IntroductiontoAgriculture

DefinitionofAgriculture

- Agricultureisthescienceandartofcultivationofcropsandrearingoflivestock.
- Asascience,itinvolvesexperimentationandapplicationofscientific knowledgeinsuchareasas;
  - Soilanalysis,
  - Controlofpestsanddiseases,
  - Farmmachineryandstructures, Cropandlivestockbreeding.
- Asanart,itinvolvestheuseoflearnedskillsin;
  - Tillingtheland,
  - Construction,
  - Measurement,
  - Harvestingofcrops,
  - Feedingandhandlingoflivestock Marketing.

BranchesofAgriculture

CropFarming(ArableFarming)

- Thepracticeofgrowingcropsoncultivatedland. Itissubdividedinto:
- FieldcropsCultivation:
- maize,beans,potatoes,coffee,tea,cottontonamebutafew. Horticulture:
  - Itinvolvesthegrowingofperishablecropswhichhavehighvalue.
  - Itisfurthersubdividedinto:
    - Floriculture-thegrowingofflowers.
    - Olericulture-thegrowingofvegetables. Pomoculture-thegrowingoffruits.

LivestockFarming

- Thisbranchdealswiththerearingoflivestockforvariousproducts. Itisfurthersubdividedinto:
- Pastoralism:Thisistherearingofmammalianlivestocksuchascattle,sheep, goats,rabbits,pigsandcamels.
- FishFarming(Aquaculture):Thisisthepracticeofrearingfishandotheraquatic organisms,inponds.
- BeeKeeping(Apiculture):Thisinvolvestherearingofbeesinstructuresknown asbeehivesforhighyieldofhoneyandhoneyproducts.
- PoultryKeeping:Thisisthekeepingofdomesticatedbird’si.echicken,ducks, turkeysandgeese.

AgriculturalEconomics

- Itdealswiththeallocationofscarceresources(land,labour,capita)landmanagement foragriculturalproduction.Itsaimsatcreatingthegreatestoutputatlowestcost.

AgriculturalEngineering

- Thisbranchofagriculturedealswiththeuseandmaintenanceoffarmtools, machineryandstructures.Alsoreferstothestudyoftheconstructionandcareof farmmachinery,tools,buildings,watersupplysystems,irrigationsystemsand structuresusedinconservingthesoil,drainingwetlandsandsortingandprocessing farmproduce.

FarmingSystems

- Afarmingsystemistheorganizationofthevariousenterprisesinafarm.

Itisdeterminedbythefollowingfactors:

- Resourcesavailable(land,labour,capitalandmanagement).Moreresourcesonecan practicelargescalecommercialfarming
- KnowledgeandSkillsofthefarmer.Commercialfarmingrequiresmoreskillsand knowledge.
- Environmentalfactorssuchasclimate,soiltypeandtopography.Inasalslarge parcelsoflandrequiredforbeeffarming.
- Governmentpolicyongrowingofgivencrops.I.e.policyongrowingcoffeeasapure stand.
- Farmer'schoiceandpreference.
- Enterpriserequirement.Wheatfarmingiseconomicalonlargescale
- Social-culturalfactors-traditionsandvaluesieMaasaibeliefinkeepinglargeherdsof cattle.

Thefollowingaresystemsoffarming:

ExtensiveSystem:

- Itisasystemwherealargepieceoflandwithlowinvestmentofresourcesperunit areaiscarriedout.

Advantages

- Itischeap.
  - Doesnotrequirehighlevelofmanagement.
- Requireslesslabor,capitalandtechnologytooperate.
- Highprofitlevelsduetolowinputcosts.

Disadvantages

- Lowprofitperunitarea.
- Cannotbepracticedwherelandislimited.
- Lowoutputperunitarea.
  - Thelandisunder-utilized,

IntensiveFarming:

- Thissystemutilizesthefactorsofproductiontothemaximumandinvolveshighlevel ofmanagement.

Advantages

- Maximumutilizationoftheresources.
- Canbepracticedevenwherelandisalimitingfactor.
- Resultsinhighyields.

Disadvantages

- Labourintensive.

- Highcapitalinvestmentisrequired.
- Requireshighlevelofmanagement.
- Canleadtohighlosesincaseofpoormanagement.

LargeScaleFarming

- Referstothefarmingpracticeunderlargeareasoflandover20hectares.
- Itisusedmainlyforcommercialpurposes.
- Thesystemishighlymechanized.

Advantages

- Resultsinhighyields.
- Duetoeconomicsofscalehighprofitisrealized.

Disadvantages

- Lackofdiversificationmayleadtototalfailureincaseofunfavorableconditions.
- Highlevelofmanagementisrequired.
- Heavycapitalinvestment.
- Requiresskilledandqualifiedmanpower.

SmallScaleFarming

- Referstofarmingcarriedoutonasmallareaoflandlessthan5hectares.
- Familyorcasuallabourcanbeengagedduringthepeakperiods.
- MostoftheKenyanfarmersaresmallscaleduetounavailabilityoffarmland.

Advantages

- Requireslowcapitalinvestment.
- Possiblewherelandisalimitingfactor.
- Doesnotrequirehighmanagementlevelunlessunderintensivesystem.

Disadvantages

- Uneconomical10mechanizeduetosmallsize.
- Lowproduction.
- Provideslimitedemployment.
- Labourintensive.
- Difficulttospecialize.

MethodsofFarming

- Amethodoffarmingisanestablishedwayofcarryingoutfarmingactivities.
- Thefollowingarethecommonmethodsoffarming:

MixedFarming

- Itisthepracticeofgrowingcropsandkeepingoflivestockonthesameland.
- Itscommoninhighpotentialareas.

Advantages

- Mutualbenefitbetweencropsandlivestock.
- Cropssupplyfeedforanimalswhileanimalssupplymanureforcrops.
- Actsasaninsuranceagainsttotallossbythefarmer.
- Thefarmerisassuredofanincomethroughouttheyear.
- Thereismaximumutilizationoftheresources.
- Animalscanbeusedinthefarmactivitiesparticularlydraughtanimals.
- Ensuresproperutilizationoflabourandlandthroughouttheyear.

Disadvantages

- Highinitialcapital.
- Lackofspecialization.

- Landcanbealimitingfactorifbothenterprisesaretoberaised.
- Requireshighlevelofmanagementforbothenterprises.

Nomadic-Pastoralism

- Thisisthepracticeoflivestockrearingwherebyanimalsaremovedfromoneplaceto anotherinsearchofwaterandpastures.
- Itispracticedinthearidandsemi-aridareaswhereinmostcasesbeefanimalsare kept.

Nomadicpastoralismisgraduallychangingtoranchingwiththeintroductionof:

- Improvedpasturespecies,improvedlivestockbreedsandsupplementaryfeeding.
- Efficientdiseaseandparasitecontrolmeasures.
- Improvedinfra-structuresuchasroads,watersupply,cattledippingfacilities.
- Extensionservices.

Advantages

- ServesasthebackboneofbeefindustryinKenya.
- Properwayofutilizingthearidandsemiaridareas.
- Sourceofincometothepastoralcommunities.

Disadvantages

- Itencouragesthespreadoflivestockpestsanddiseasesduetocommunalwatering points,grazinganddippingfacilities.
- Thereisatendencytoincreasedsoilerosionandlanddegradation.
- Sourceofconflictsandethnictensionamongthenomadiccommunitiesforthe controlofgoodpasturesandwater.
- Difficulttocontrolbreedingandbreedingdiseases.
- Highrateofinbreedingleadingtopoorqualitylivestock.
- Lowproductionofmilk,meat,hidesandskinsduetowastageofenergyintraveling fromoneplacetoanotherinsearchofpasturesandwater.
- Highdeathratesasaresultofwalkingforlongdistances.

ShiftingCultivation

- Itisatraditionalmethodofcultivatingapieceoflanduntilthesoilisexhaustedand cropyieldsdecline.
- Thelandisabandonedandthefarmershiftstoanewfieldastheprevioustandisleft fallowtoregainitsfertility.

Advantages

- Landisallowedtorestandregainitsfertility.
- Nobuildupofpestsanddiseases.
- Soilstructureisrestored.
- Thecostofproductionislowsinceinorganicfertilizersandpesticidesarenotused.
- Cropproducearechemicalfree.

Disadvantages

- Notpracticalwherelandisalimitingfactor.
- Farmplanningandacquisitionofcreditsforlanddevelopmentis'notpossible.
- Itisacumbersomemethodduetoconstantmovement.
- Lackofsoilconservationmeasures
- Notpossibletogrowperennialcrops.
- Lowoutputperunitareaduetopoorfarmingmethods.

- Wherefireisusedtoclearthelandorganicmatterisdestroyed.

OrganicFarming

- Itisafanningmethodwherecropsaregrownandlivestockrearedwithouttheuseof agro¬chemicals.
- Itisamethodoffarmingwhichhasbeenadoptedtoreducethelongtermeffectof theagro-chemicalsoncropswhichmayeventuallyendupinmanandlivestock.
- Agro-chemicalsarealsoexpensivethusorganicfarmingreducesthecostof production.Organicallyproducedgoodsfetchhighmarketprices.

Advantages

- Cheapandcosteffective.
- Makeuseofthelocallyavailablematerials Usefulinimprovingthesoilstructures.
- Nosideeffectsfromthecropsandlivestockproducts.
- Noenvironmentalpollution.

Agro-Forestry

- Thisisthepracticeofintegratingtreesandcropsonthesamepieceofland.
- Withlandresourcesbecomingmorescarce,agroforestryisbecomingmore important.

Examplesofcommonagroforestrytreesandshrubsinclude:

- Cajanuscajan
- Grevillearobusta Sesbaniasesban
- Calliandracalothyrsus
- Casuarinaequisetifolia
- Leucaenaleucocephala

Treesselectedforagroforestryshouldhavethefollowingcharacteristics:

- Abletogrowfast.
- Deeprootstominimizecompetitionfornutrients.
- Shouldbepreferablyleguminous.

Advantages

- Treesreducesoilerosioninagivenarea.
- Leguminoustreesaddnitratesintothesoilthusimprovingthesoilfertility.
- Sometreescanbeusedaslivestockfoddertoprovideahighlevelofproteins.
- Theyareimportantsourcesofwoodfuelandtimber.
- Thereismaximumutilizationofland.

ImportanceofAgriculturetotheEconomyofKenya

- Provides**food**tothepopulationtomeetnutritionalrequirementsandtoenableman toengageinotheractivitiesoffarming.
- Provides**employment**.Thisforexamplecanbedirectasalabourerinthefarm,tea pluckerorindirectforexample,workinginagriculturalbasedindustries.
- Sourceof**rawmaterials**forindustriesforexamplecottonlintfortextileindustry.
- Provides**foreignexchange**-throughexportingagriculturalproduce.
- Provides**marketforindustrialgoods**¬agricultureisaconsumerofthefinished goodsfromagro-basedindustries.

- Sourceofincome-farmersaswellasthegovernmentgetrevenuefromthesaleof agriculturalproduceandtaxpayment.

FactorsInfluencingAgriculture

Introduction

Agriculturalproductionisinfluencedbyexternalfactors:

- Humanfactors
- Bioticfactors Climaticfactors
- Edaphicfactors.

HumanFactors

Thesearehumancharacteristicswhichaffectthewaydecisionsaremadeandoperations carriedout.

- Levelofeducationandtechnology:
  - Skills Technologicaladvancements.
- Humanhealth/HIV-AIDS:
  - Theseaffectthestrength,thevigour,visionandthedetermination towork.
  - HIV/AIDSisthebiggestthreattohumanhealthtodayandhaslong lastingeffectsonagriculture,suchas; Shortageoffarmlabour.
  - Lossoffamilysupport.
  - Lowlivingstandardsleadingtodespondencyandhopelessness.
  - Increasedcriminalactivities.
  - MoretimespentbytheGovernmentandNGO'sinCarringforthesick.
- Economy;
  - Stabilityinthecountries'economyaffectagriculturalproduction.
- GovernmentPolicy:
  - Thesearegovernmentallawswhichhavebeenenactedtoprotectfarmers,land andlivestock. Theyinclude:
  - Foodpolicy
  - Policiesoncontroloflivestockparasitesanddiseases.
- Policiesonmarketingofbothlocalandexportproductsandothers.
- Transportandcommunication:
- Foragriculturalgoodstomovefromthefarmtotheconsumers.
- Culturalpracticesandreligiousbeliefs:
  - Theseactivitieshinderimportantchangesinasocietythatmaybringagricultural development.
- Marketforces:
  - Demandandsupplyforceswhichaffectpricesofcommoditiesinafreemarket.

BioticFactors

Thesearelivingorganismswhichaffectagriculturalproduction.

- Pests-Destructiveorganismswhichdestroycrops.
- Parasites-Theseareinvertebrateswhichliveinoronotherlivingorganisms.
- Decomposers-Organismswhichactonplantsandanimaltissuestoform manure.
- Pathogens-Micro-organismswhichcausediseases.
- Predators-Animalsthatkillandfeedonotheranimals.
- Pollinators-Theytransferpollengrainsfromthestamenstothepistilofaflower.
- Nitrogenfixingbacteria-Theyaremicro-organismswhichconvertatmospheric nitrogentonitratesreadyforusebytheplants.

ClimaticFactors(weatherelements).

- Rainfall,
- Temperature,
- Wind,
- Relativehumidity
- Light.

Weather-Atmosphericconditionsofaplaceatagiventimeperiod.

Climate-weatherconditionsofaplaceobservedandrecordedforaperiodof30-40years.

Rainfall

SuppliesWater:

- Whichisnecessaryforthelifeprocessinplantsandanimals.
- Whichmakestheplantturgidhenceprovidessupport.
- Actsasasolventforplantnutrients.
- Coolstheplantduringtranspiration.
- Whichisusedasarawmaterialinphotosynthesis.

Whenplantslackenoughwatertheyrespondindifferentwaysasfollows:

- Byclosingthestomatatorestrictwaterloss.
- Hastensmaturity.
- Somewillrolltheirleaves.

Otherplantshavedevelopedpermanentadaptationtowaterstresssuchas:

- Growingneedlelikeleaves.
- Developfleshyleavesforwaterstorage. Developlongroots.
- Wiltinganddeathinextremeconditions.

ImportantAspectsofRainfall:

- Rainfallreliability; Amountofrainfall;
  - Thisisthedependencyonthetimingoftheonsetoftherains.
  - Quantityofrainthatfallsinagivenareawithinagivenyear.
- Rainfalldistribution; Thenumberofwetmonthsinayear.
- Rainfallintensity;
  - Amountofrainfallthatfallsinanareawithinaperiodof1hour.

Temperature

- Thisisthedegreeofhotnessorcoldnessofaplacemeasuredindegrees Celsius.
- Cardinalrangeoftemperature¬isthetemperaturerequiredbyplanttogrowand thrivewell.

- Optimumrangeoftemperatures-thebesttemperatureforthebestperformanceof plants.

EffectsofTemperaturesonCropProduction:

Lowtemperatures:

- Slowthegrowthrateofcropsduetoslowedphotosynthesisandrespiration.
- Highincidencesofdiseaseinfection.
- Improvesqualityofcropssuchasteaandpyrethrum.

HighTemperatures

- Increaseevaporationrateleadingto
- Wilting.
- Hastensthematurityofcrops.
- Increasediseaseandpestinfection.
- Improvesqualityofcropssuchaspineapples,orangesandpawpaws.

Wind

Windismovingair.

Goodeffectsofwindinclude:

- Seeddispersal Coolingofland
- Pollinationincrops
- Bringsrainbearingclouds

Negativeeffectsofwind:

- Increasestherateofevaporationofwater.
- Causeslodgingofcerealsanddistortsperennialcrops.
- Increasesevapo-transpiration.
- Spreadsdiseasesandpests.
- Destroysfarmstructures.

Relativehumidity

- Theamountofwatervapourintheair
- Affectstherateofevapo-transpiration.
- Formsdewwhichsuppliessoilwithmoistureunderdryconditions.
- Highhumidityinducerootingincuttings.
- Increasesdiseasemultiplicationandspread.

Light

- Provideradiantenergyharnessedbygreenplantforphotosynthesis.

Importantaspectsoflight:

- Lightintensity;
- Thestrengthwithwhichlightisharnessedbychlorophyllforphotosynthesis.
- Lightduration; Theperiodduringwhichlightisavailabletoplantsperday.

- Plantresponsetolightdurationisknownasphotoperiodism.
- Short-dayplants-requirelessthan12hoursofdaylighttoflowerandseed.
- Long-dayplants-requiremorethan12hoursofdaylighttoflowerandseed.
- Day-neutralplantsrequire12hoursofdaylighttoflowerandseed.

- Lightwavelength;
  - Thisisthedistancebetweentwo-successivecrestsofawavelength.
  - Itdictatesthedifferencebetweennaturalandartificiallight.
  - Chlorophyllabsorbscertainwavelengthsoflight.

EdaphicFactorsInfluencingAgriculture

- Thesearesoilfactors.
- Soilisthenaturalmaterialthatcoversthesurfaceoftheearth,
- Madeofweatheredrockparticlesanddecomposedanimalandplanttissues,andon whichplantsgrow.

ImportanceofSoil

- Providesanchoragetotheplantsbyholdingtheirrootsfirmly.
- Providesplantswithmineralsalts/nutrientswhicharenecessaryfortheirgrowth.
- Providetheplantswithwater.
- Containsoxygennecessaryforrespirationoftheplantsandsoilmicro-organisms.

SoilFormation:

- Soilisformedthroughweatheringprocess.
- Weatheringisthebreakdownandalterationoftheparentrocknearthesurfaceofthe earthtoastablesubstance.
- Weatheringprocessisacombinationofdisintegration(breakdown)andsynthesis (buildup)process.
- Weatheringprocessiscontinuous.

TypesofWeathering

- Physicalweathering
- Chemicalweathering
- Biologicalweathering

AgentsofWeathering

PhysicalAgentsofWeathering

- Includewind,water,movingiceandtemperature.
- Wind-carrymaterialswhichhitagainsteachothertobreakintofragments.
- Water-intensityofrainfallcausesbreakdownofrock.
- Movingice-hasgrindingeffectswhichtearoffrockparticles.
- Extremetemperaturecauserockstoexpandandcontractsuddenlypeelingofftheir surface.

ChemicalWeathering

- Affectsthechemicalcompositionandstructureoftherock.
- Involvesprocessessuchas;
  - Hydrolysis,

- Hydration,
- Carbonation Oxidation.

- Hydration;
  - Theprocessbywhichsolublemineralsintherocksabsorbwaterandexpand weakeningtherockthusleadingtodisintegration.
- Hydrolysis;
  - Theprocesswherebywaterdissolvessolublemineralsintherockweakeningit.
- Oxidation;
  - Thereactionofrockmineralswithoxygentoformoxideswhichbreakeasily.
- Carbonation;
  - Theprocesswherebycarbonicacidsformedwhenrainwaterdissolvescarbon dioxide,
  - Itreactswithcalciumcarbonatesinlimestonecausingittodisintegrate.

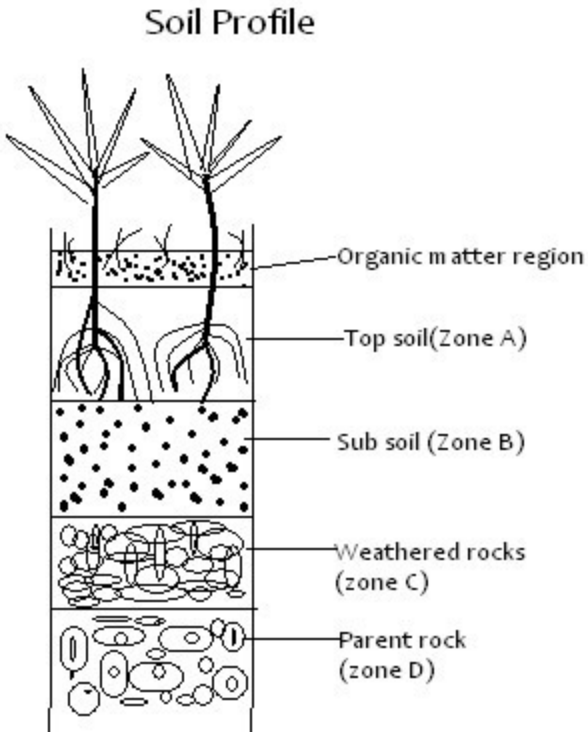
BiologicalWeathering

Thisinvolvestheactionoflivingorganisms,plantsandanimalsontherocks.

- Burrowinganimals,forexample,termitesandmolesbringsoilparticlestothe surfaceexposingthemtootheragentsofweathering.
- Biganimalslike,elephants,buffaloes,camelsandcattleexertalotofpressureon therocksastheysteponthemduetotheirheavyweightscausingtherocksto disintegrate.
- Earthwormstakepartinthedecompositionofplantmatterwiththesoilparticles.
- Man'sactivitieslike,miningandquarryingexposerockstothesurfaceduring excavation.Theseactivitiesbreakdownlargerocksintosmallerrockparticles.
- Plantrootsforcetheirwaythroughthecracksintherocksthuswideningand splittingthem.
- Humicacidsformedwhenplanttissuesdecomposereactwiththerocksweakening themfurther.
- Plantremains-decomposeaddinghumusintothesoil.

Factorsinfluencingsoilformation Climate- (rainfall,temperatureandwind) Bioticfactors-livingorganisms.

- Parentmaterial-Natureandpropertiesoftheoriginalrockfromwhichthe soilis formed. Time- lengthoftimeduringwhichthesoilformingprocesseshavetakenplace.
- Topography-influencesthemovementofdisintegratedmaterials.



- Itistheverticalarrangementofdifferentlayersofsoilfromthegroundsurfacetothe bedrock.
- Theselayersarealsoreferredtoashorizons.
- Thelayersshowdifferencesintheircontentsandphysicalpropertiessuchascolour, textureandstructure.

- Thelayersinclude:organicmatterregion,topsoil,sub-soil,weatheredrocksand parentmaterial.

OrganicMatterRegion

- Firstlayerofthesoilfoundonthesurface.
- Madeupofleavesandotherplantremainsatvariousstagesofdecomposition.
- Somesoilorganismsmayalsobefoundhere.

TopSoil

- Hasadarkcolourduetothepresenceofhumus.
- Isrichinplantnutrientsandwellaerated.
- Itisazoneofmaximumleaching(zoneofeluviations)

Sub-Soil

- Itiscompactandlessaerated.
- Itisazoneofaccumulationofleachedmaterial(zoneofaluviation)fromthetop layers.
- Deeprootedcropshavetheirrootsgrowinguptothisregion.
- Hardpansnormallyforminthislayer

WeatheredRocks

- Itisalsocalledsubstratum.
- Rocksatvariousstagesofdisintegrationarefoundinthiszone.
- Mostofthematerialsfoundinthiszoneoriginatefromtheparentrock.

ParentRock

- Itexistsasasolidmasswhichisun-weathered.
- Itisthesourceoftheinorganiccompositionofthesoil.
- Thewatertableisonthesurfaceofthisrock.

SoilsFormedinSituandSoilsDeposited

- Soilformedinthesameplaceandremainsthereissaidtobeinsitu.
- However,soilcanbeformedduetodepositionofsoilparticlescarriedfromitsoriginal siteofformationtoanotherareawhichisusuallyinthelowerareasofslopes.
- Suchsoilsaresaidtohavebeenformedthroughdeposition.

SoilFormedinSitu	SoilDeposited
l.Hasthecolouroftheparentrock	1.Hasthecharacteristicsofwhen:itcame from.
2.Shallower	2.Deeper
3.Lessrichinplantnutrients	3.Richerinplantnutrients
4.Easilyeroded	4.Noteasilyeroded
5.Lesssilty	5.Moresilty
6.Havethesamechemical composition asthatoftheunderlyingparent rock.	6.Differinchemicalcompositionfromthe underlyingparentrock.

SoilDepth

- Thisisthedistancebetweentopsoillayerandthebottomsoillayerinaprofile.
- Itdictatesrootpenetrationandgrowth
- Deepsoilsaremoresuitableforcropgrowthsincetheycontainmorenutrients.
- Havealargersurfaceareforrootexpansion.
- Deepsoilsfacilitategooddrainageandaeration.

SoilConstituents

- OrganicMatter-Deadanddecayingplantsandanimalremains
- LivingOrganisms-Soilorganismsandplantroots.
  - Micro-organisms(bacteria,protozoaandfungi) Invertebrates-termites,
  - Earthwormsandmolluscs.
  - Higheranimals-rodentsandothers.
- InorganicorMineralMatter Formedfromtheparentmaterials.
  - Supplyplantnutrients Formtheskeletonandframeworkofthesoil.
- Air
  - Foundintheporespacesofthesoil.
  - Usedforrootandorganismrespiration Usedforgerminationofseeds.
  - Helpsindecompositionoforganicmatter. Regulatessoiltemperature.
  - Regulatesthemovementofwaterthroughcapillaryaction.
- Water
  - Dissolvesmineralsalts

- Maintainturgidityinplants. Usedforgerminationofseeds
- Usedbysoilorganisms.
- Regulatesoiltemperature
- Dictatestheamountofairinthesoil.

Waterinthesoilexistsinthreeformsnamely:

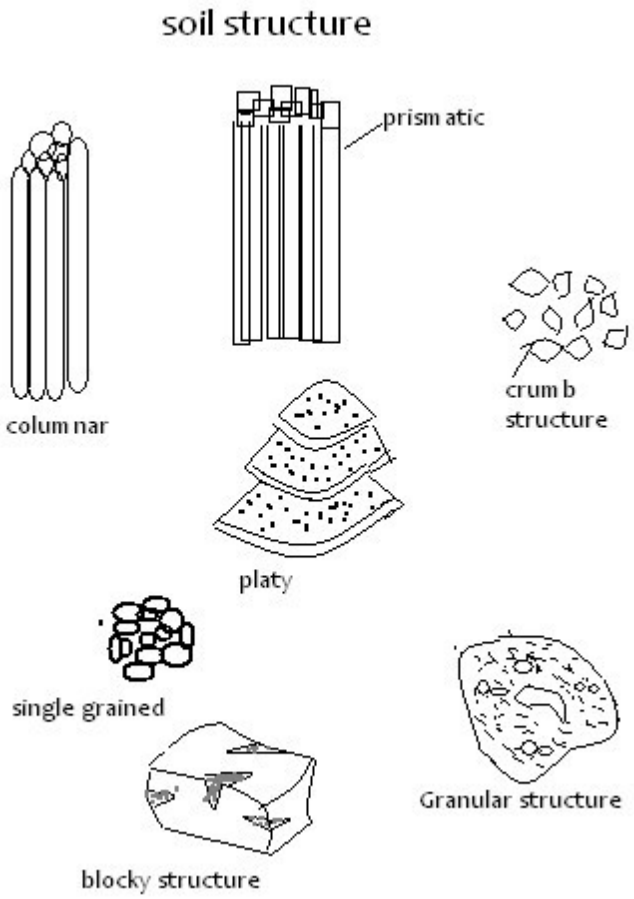
- Superfluous/GravitationalWater
  - Foundinthelargespaces(macro-pores)inthesoilparticles.
  - Heldbygravitationforces.
  - Whentheporesaresaturated,thesoilissaidtobewaterlogged.
  - Itmovesandmaycauseleaching.
- HygroscopicWater
  - Waterfoundinthinfilmsonthesoilparticles.
  - Heldbystrongadhesiveforcesbetweenwaterandsoilparticles.
  - Doesnotmoveandhencenotavailableforplantuse.
- CapillaryWater
  - Occupymicro-poresinthesoilparticles.

Heldbycohesiveforcesbetweenwatermolecules.
Movesthroughcapillaryaction Availabletoplantsforuse.

SoilStructure

Thisisthearrangementofsoilparticlesinasoilhorizon.

- TypesofSoilStructure–
  - Single-grained
  - Crumby
  - Granular
  - Prismatic
  - Columnar
  - Platy
  - Blocky



ImportanceofSoilStructureonCropProduction

SoilStructureInfluences

- Soilaeration
- Soildrainageandwaterholdingcapacity.
- Plantsrootpenetrabilityandanchorage.
- Microbialactivitiesinthesoil.
- Circulationofgasesinthesoil.

Farmingpracticeswhichimprovethesoilstructureare:

- Applicationofinorganicmanureintothesoil.
- Tillingthelandattherightmoisturecontent.
- Croprotation.
- Minimumtillage.
- Covercropping.
- Mulching.

SoilTexture ImportanceofSoilTextureonCropProduction;

- Itreferstotherelativeproportionofthevarioussizesofthemineralparticlesofsoil.
- Influencessoilfertility
- Affectstheorganicmattercontent Influencesthedrainageofthesoil.
- Influencessoilaeration.
- Influenceswaterholdingcapacity.
- Influencesthecapillarityormovementofwaterinthesoil.

SoilTexturalClasses SandySoils

- Madeuplargelyofsandparticles.
- Havelargeporespaceshencepoorinwaterretention.
- Easytotill(lightsoils).
- Freelydraining.
- Lowfertilityduetoleachingofminerals.
- Easilyerodible.

ClayeySoils

- Madeuplargelyofclayeyparticles.
- Havesmallporespaceshencegoodinmoistureretention.
- Difficulttotill(heavysoils).
- Poorly'drained.
- Expandwhenwet,crackwhendry.
- Highcapillary.
- Richinplantnutrients.

LoamSoils

- Aboutequalamountsofsandandclay.
- Moderatelygoodinbothmoistureandairretention.
- Fertilesoils. SoilColour

- Thisdependsonthe,mineralcompositionoftheparentrockandtheorganicmatter content.
- Soilscontainingalotofironarebrownish,yellowingandreddishincolour.
- Soilswithalotofsilicaarewhite.
- Soilswithalotofhumusaredarkorgrey.

SoilpH

- Thisreferstotheacidityoralkalinityofthesoilsolution/theconcentrationof hydrogenionsinthesoilsolution.

- SoilpHisdeterminedbytheconcentrationofhydrogenions(H+)orthehydroxylions (OH)inthesoilsolution.
- ApHoflessthan7meansthatthesoilisacidic.
- ApHofmorethan7meansthatthesoilisalkaline.
- Asthehydroxylions(OH)inthesoilincreasethesoilbecomesmorealkaline.

InfluenceofSoilpHCropGrowth

- Itdeterminesthetypeofcroptobegrowninaparticulararea.
- Mostcropsareaffectedbyeitherveryacidicorverybasicsoilp H.
- SoilpHaffectsthechoiceoffertilizersandtheavailabilityofnutrientstocrops.
- AtlowpHtheconcentrationofavailableironandaluminiuminthesoilsolution mayincreasetotoxiclevels,whichisharmfultoplants.
- VeryacidicorlowpHinhibittheactivityofsoilmicro-organisms.

FarmToolsandEquipment

Introduction

- Farmtoolsandequipmentperformspecificjobsinthefarm.
- Theymakeworkeasierandmoreefficient.
- Theycanbeclassifiedaccordingtotheirusesasfollows:

GardenToolsandEquipment

	Tools	Uses
1	Panga	Cuttingandshallowcultivation,makingholes.
.2	Jembe/handhoe	Cultivation,digging,shallowplantingholesandtrenches.
3 .	Forkiembe	Cultivation,diggingoutroots,harvestingofrootcrops.
4 .	Rake	Collectingtrash,breakinglargeclods,levelling,removingstones fromaseedbedandspreadingorganicmanure.
5 .	Spade	Scoopingandcarryingofsoil,sand,concretemixtureand manure.
6	Springbalance	Measuringweight.
.7	Trowel	Scoopingseedlingsduringtransplantingand.diggingplanting holesforseedlings.
8 .	Pruninghook	Bendingtallbrancheswhenpruning.
9	Secateur	Cuttingyoungstemsandpruningbranches.
.	10.Tapemeasure	Measuringdistances.
	11.Axe	Cuttingbigtreesandrootsandsplittinglogsofwood.
	12.Soilauger	Makingholesforfencingposts.
	13.mattock	Digginghardsoils
	14.sprinklers	Overheadirrigation.
	15.Wateringcan	Wateringplantsinnurserybed.
	16.Wheelbarrow	Tr ansportationofsoil,fertilizers,farmproduce,toolsandequipment
	17.Levellingboard	Forlevellinganurserybed.
	18.Pruningsaw	Cuttingoldwoodstemsandpruningbigbranches.
	19.Hosepipe	Forconveyingwaterfromataptowhereitisneed.
	20.Knapsacksprayer	Applyingagro-chemicalbyspraying.
	21.Gardenshear	Trimminghedges.
	22.Pruningknife	Removalofsmallshoots.
	23.Meterruler	Measuringdistances.
	24.Gardenfork	Shallowdigging.

LivestockProductionToolsandEquipment

	Tools	Uses
1 .	Drenchinggun	Administeringliquiddrugstoanimalsorally.
2 .	Bolusgun/ dosinggun	Administeringsoliddrugsortabletstoanimalsorally.
3	WoolShears	Cuttingoffwoolfromsheep.

7 Burdizzo .	Usedinbloodlessmethodofcastration.
8 Halter .	Ropedesignedtorestraintheanimal.
9 Trimmingknife	Cuttingshorttheovergrownhooves.
. Elastrator	Stretchingrubberringduringcastration,dehorninganddocking oflambs.
Irondehorner	Appliesheatonthehornbudtopreventgrowthofhorns.
Nosering	Fixedintothenoseofabulltorestrainit.
Stripcup	Detectingmastitisinmilkproducts.
Trocarandcannula	Relievingabloatedanimalofgasesparticularlyruminants.
Hardbroom	Forscrubbingthefloor.
Earnotcher	Makingearnotchesinlivestock.
Bucket	Forholdingmilkduringmilking.
Milkchum	Forholdingmilkaftermilking.
Milkstrainer/sieve	Removingforeignparticlesfrommilkforexamplehairsand sediments.
Rope	Tyingortetheringanimals.
Milkingstool	Usedbythemilkertositonwhilemilking.
Weighingbalance	Weighingmilkaftermilking.
Teethclipper	Removalofcanineteethofpigletssoonafterbirth.
Chaffcutter	Cuttingfodderintosmallbits.
Dehorningwire	Cuttinggrownhorns.
.4 Hypodermicsyringe .	Administeringdrugsbyinjectionforexampleinvaccination.
5 Stirrup(bucket)pump	Applicationofacaricidebyhandspraying.
.6 Thermometer	Takingbodytemperaturesoffarmanimals.

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	Tools	Uses
1	Spanner	Tighteningandlooseningnutsandbolts.
.2	Pliers	Cuttingsmallwiresandthinmetalandgrippingfirmly.
.3	Files	Sharpeningtools,smootheningorshapingedgesof
.4	Rasps	metal sSmoothen’ingandshapingofwoodenstructures.

.5	Chisels(wood)	Makinggroovesinwood.
.6	Coldchisel	Cuttingandshaping
.7	Screwdrivers	metal.
.	Saws	Drivingscrewsinoroutofwoodormetal.
8 .	Crosscutsaw	Cuttingacrossthegrainofwood.
	Ripsaw	Cuttingalongthegrainofwood.
	HacksawBowsaw	Cuttingmetals.
	Tenonlbacksaw	Cuttingbranchesof
	Copingsaw	trees Cutting Jointsonwoodandfinesawing.
	Compass/keyhole	Cuttingcurvesonthinwood.
		Cuttingeitheralongoracrossthegrainofwood espwhencuttingkecially eyholes.
9	Tinsnip	Cuttingmetalsheets.
.1 0	Bracesandbits.	Boringholesinwood.
1	Drillandbits	Boringholesinmetalworkandwoodwork.
11	Hammer	
2	Clawhammer	Drivingin,removingandstraighteningnails.
	Ballpein	Drivinginnails,rive tsandstraighteningmetal.Alsoused oncoldchisel
1	Mallet	Hammeringorhittingwoodchisel.
31	Jackplane	Finefinishingofwood.
41	Scrappers/ spokesha	Smootheningcurvedsurfacesofwoodsuchashandles
5	ve	of jembes,axes.
1	Measuring	
6	eMetrerule rquipment Trysquare	Measuringshortlength-
1	Markinggauge	Measuringlengthanglesandtoascertainsquareness. Markingparallellinestotheedgeofwood.
71	Fencingpliers	Cuttingwires,hammeringstapleswhenfencing.
81 9	Viceandclamps	Firmlyholdingpiecesofworktogether.

Tools		Uses
2 0	Spiritlevel	Measuringhorizontalorverticallevels.
2 l	Solderinggun	Meltingsolderingrodswhenrepairingorfabricatingmet al sheets.
2 2	Wirebrush	Brushingroughsurfaces.
2 3	Divider	Markingandlayingout.
2 4	Centrepunch	Markingthepointofdrilling.
2 5	Paintbrush	Applyingpaintonsurfaces.
2 6	Sledgehammer	Ramminghardware,breakingstones.

27	Wirestrainer	Tighteningwiresduringfencing.
28	Rivetingmachine	Fixrivetswhenjoiningpiecesofmetal.
29	Clawbar	Removinglongnailsfromwood,straining fencingwires and diggingfencingholes.

PlumbingandMasonryTools

	Tools	Uses
l	Pipewrench	Holding,tighteningandloosingmetallicpipes.
.2	Pipecutter	CuttingPVCpipes.
.3	Levellingrod	Levellingthefloorduringconstruction.
.4	Mason'strowel	Placingmortarbetweenconstructionstonesandbricks
.6	Mason ssquare	Ascertainverticalness.
.5	Woodfloat	Spreadingscreedoverfloorsandwalls.
.7	Plumbbob	Createalevelsurfaceonwallsandfloors.
.8	Shovel	Mixingandscoopingconcreteormortar,measuringcement

CareandMaintenanceofToolsandEquipment

ReasonsforMaintenance Toincreasedurability.
- Toincreaseefficiency.
- Reducecostsofreplacement.
- Forsafetyoftheuser/avoidaccidents.
- Avoiddamagetothetool. Methods
- Usetoolsfortherightwork.
- Properhandlingwhenusingtoolsorequipment.
- Cleanandoiltoolsafterwork.
- Keeptoolsinthererightplace.
- Replaceandrepairworn-outparts Sharpencuttingordiggingedges
- Greasemovingpartstoreducefriction
- Usesafetydevicesintheworkshoptoreduceaccidentsandbreakages

CROPPRODUCTION1
(LandPreparation)

Introduction

- Apieceoflandwhichispreparedisknownasseedbed.
- Aseedbedisapieceoflandthatispreparedreadytoreceiveplantingmaterials.

SeedbedPreparation

ReasonsforSeedbedPreparation; Toenablewatertoinfiltrate.

- To kill weeds
- To improve soil aeration.
- To destroy pests and diseases.
- To incorporate organic matter in the soil.
- For easy planting.
- To facilitate root penetration.

Operations in Land Preparation Land Clearing

- Clearing of land is necessary when:
- Opening up a virgin land.
- A stalk growing crop was previously planted.
- There is long interval between primary and secondary cultivation.
- Land was left fallow for a long time.

Procedure

- Tree felling and removal of stumps and roots.
- Burning
- Slashing
- Use of chemicals.

Note: Burning should be avoided where possible since it;

- Leads to loss of organic matter,
- Kills soil organisms
- Destroys soil structure and plant nutrients.

Primary Cultivation

- This is the initial breaking of land.
- It is done early before the onset of the rains to:
  - Give time for soil organisms to act on organic matter.
  - Allow gaseous exchange to take place, thus carbon dioxide diffuses out of the soil while oxygen enters into the soil.
  - Allow other operations to take place in time.

Reasons for primary cultivation:

- Remove weeds.
- Burry organic matter.
- Open up soil for infiltration of water and air.
- Expose pests and disease causing organisms.
- Soften the soil for easy planting.

Operations in primary cultivation

- Hand digging;

  Use of hand tools;
  - Jembes,
  - Mattocks,
  - Fork-jembes.
- Mechanical cultivation; Use of mouldboard ploughs;
  - Disc ploughs,

- Chiselploughs,
- Subsoilers Rippers.

- UseofOx-Ploughs;

Whichcanbedrawnby;

- Oxen,
- Donkeys,
- Camels

DepthofCultivation Dependson:

- Thetypeofcroptobeplanted/sizeofseed.
- Theimplementsavailable.
- Thetypeofsoil. ChoiceofImplement

Determinedby:

- Theconditionofland.
- Thetypeoftilthrequired/typeofcrop.
- Depthofcultivation.

SecondaryTillage

Thesearerefinementpracticesontheseedbedthatfollowprimarycultivation.
Itisalsoknownasharrowing. ReasonsforsecondaryTillage:

- Toremovethegerminatingweeds.
- Tobreaksoilclodstoproducerequiredtilth.
- Tolevelltheseedbedforuniformplanting.
- Toincorporateorganicmatter/manureintothesoil.

Factorsdeterminingnumberofsecondarycultivation:

- Soilmoisturecontent.
- Sizeoftheplantingmaterials.
- Conditionofthesoilafterprimarycultivation.
- Slopeoftheland.

TertiaryOperations:

- Ridging;
  - Theprocessofdiggingsoilonacontinuouslineandheapingononesideto produceafurrowandabund(ridge).
  - Itisimportantforrootcrops,toallowrootexpansionandforsoilandwater conservation.
- Rolling:
  - Itisthecompactionofthesoiltoproduceafirmsurfacewhichincreasesseed-soil contactandpreventswinderosion.

- Leveling;
  - Productionofaneven,uniformsurfacewhichpromotesuniformplanting. Sub-soiling:
- Thisisdeepcultivationintothesubsoillayertobreakupanyhardpanwhichmight havedeveloped.

Itisdoneforthefollowingreasons:
- Tofacilitatedrainage.
- Bringupleachednutrientstothesurface.
- Increaseaerationofthesoil.
- Toimproverootpenetration.
- Theimplementsusedincludechiselploughandsubsoilers.

MinimumTillage:
- Thisistheapplicationofacombinationoffarmingpracticeswiththeaimofreducing thedisturbanceofthesoil. Examplesofwhichinclude:
- Useofherbicides.
- Mulchingandcover-cropping.
- Timelyoperationstopreventweedinfestation.
- Stripcultivation.
- Uprootingandslashingofweeds. ReasonsforMinimumTillage
- Toreducecostofcultivation.
- Tocontrolsoilerosion.
- Topreservesoilmoisture.
- Topreventrootexposureanddamage.
- Toreconstructdestroyedsoilstructure.

WaterSupply,IrrigationandDrainage

Introduction

- Waterisaveryimportantnaturalresource.
- Itisnecessaryforbothcropsandlivestock.

Usesofwaterinthefarm;

- Cleaningequipment.
- Irrigationindryareas.
- Processingfarmproduce,forexample,coffee.
- Drinkingbylivestockandman.
- Mixingagro-chemicalssuchasacaricide,fungicidesandherbicides.
- Providingpowerinwatermillstogrindgraincrops.
- Coolingengines.
- Constructionwork.
- Fishrearing
- Domesticuse
- Recreationpurposesieswimming
- Usedtooperatesomemachinese.gturbines,maizemills,hydram.

Hydrologicalcycle

Itreferstotheunendingcirculationofwaterfromtheearthsurfacetotheatmosphereand backinformofprecipitation(rain,hailstonesorsnow).Watergoesbacktotheatmosphere bytheprocessofevapo-transpiration.Hygroscopicwaterheldbysoilparticleisusedby plants.

SourcesofWaterintheFarm

Threemajorsourcesofwaterinthefarm:

- Surfacewater:

Includeswaterfrom;

- Rivers,-theyoriginatefromwatercatchmentareasi.emountains,hillsandforests. Riversareeitherpermanentortemporary.
- Streams
- Lakes–arehugecollectionsofwateronlanddepressions.Arefedbyrivers streams,springsandrain.Theyareeitherfreshwaterorsalty.
- Dams-Damsandweirsareconstructedonriverstoraisewaterlevels(collectand storewater

- Groundwater:

Includeswaterfrom;

- Spring-itswherewatercomesoutoftheground(insmallorlargeamount)asa resultofanimperviouslayermeetingthegroundsurface.Waterisless contaminated.Toincreasewatervolumesconstructawallaroundthespring.
- Wells-areholesduginthegrounduntilthewatertableisreached.Itsdoneduring dryseason.Topreventaccidentsfencearoundthewallandconstructalockable reinforcedconcreteslab.
- Boreholes–aredeepholesdrilledorsunkintotheground(parentrock)bytheuse ofdrillingmachines.Wateraspumpedbyeitherelectricityorengines.Theyare commoninareaswithscarcerivers/streams.

- Rainwater:

Thisiswatertappedinvariouswayssuchas;

- Rooftops
- Rocksurface,whenitisrainingandstoredinvariousways.

CollectionandStorageofWater

- Dams:
  - Thesearestructures/barriersconstructedacrossrivers/channelsordryvalleyto collectandstorewater.Theyholdwaterandraiseitslevel.Theyareearthen.
  - Thebottompartoftheareabehindthedamhasimperviouslayer(clayorrock)to preventwaterseepage.Grass/treesplantedontheembankmentspreventsoil erosion.
  - Theyareconstructedacrosstheriverbedstoformsubsurfacereservoirsindry areas.
- Weirs:

- These are structures/barriers constructed across river to raise the water level (allow water to flow over it) for easy pumping.
- Unlike in the dam's water flows over the barrier created across the river.

- Water Tanks:
  - These are structures made of concrete, stone, rubber, metal sheets and plastics.
  - They store water from rain or that which has been pumped from other sources i.e rivers, streams, lakes, rock catchment, wells and boreholes.
  - Tanks should be covered to prevent contamination from dust and cleaned when dirt has accumulated. Runoff water should be filtered before storage,
  - Reinforce stone/concrete tanks with a wire mesh.

- Roof and rock catchment

Water storage

- Dams
- Ponds
- Tanks
- Retention ditches

Pumps and Pumping of Water

- Pumping is the lifting of water from one point to another by use of mechanical force.
- Water is pumped from the various sources and then conveyed to where it is required for use or storage.

Types of Water Pumps

Used to lift water from its source.

- Centrifugal pumps/Rotadynamic pumps- have metal discs with blades that rotate at high speed. Water is driven by a centrifugal force to the outlet. They are ideal for pumping water for irrigation (large quantities of water). Use electricity
- Piston or reciprocating pumps – they have pistons that move back and forth pushing water through the pipes. They are ideal for pumping water for domestic and livestock use. they use petrol or diesel or hand operated.
- Semi-rotary pumps- are manually operated to pump water from wells by hand for domestic and livestock use.
- Hydram – they use force of flowing water to pump water in slopy areas where water flows at high speeds.

Conveyance of Water

- This is the process of moving water from one point, usually the source or point of storage to where it will be used or stored.

Methods of conveying water

- Piping;
  - This is where water is moved through pipes. The common types of pipes include:

- Metalpipes–theycanbeeithergalvanizediron(areheavyandsuitableforpermanent installationofwatersystems)oraluminiumpipes(lightandusedforirrigationsystems).
- Plasticpipes–areinexpensiveandeasytoinstall.Aredurablehowevertheyburstunder highpressure.Theycanalsobegnawedbyrodents.
- Hosepipes–areeithermadeofrubber(expensiveanddurable)orplastic(cheap andlessdurable).Theyconveywaterfromtapstovariousareas.

- UseofContainers:
  - Inthiscasewaterisdrawnandputincontainers,drums,jerrycans,pots,gourds, tanksandbuckets.
  - Wateristhencarriedbyanimals,bicycles,humanbeingsandvehicles.
- UseofCanals:
  - Inthiscasewaterisconveyedfromahighpointtoaloweronealongagradual slopetoavoidsoilerosion.
  - Waterconveyedthroughthiswayismostlyusedforirrigationandlivestock.

WaterTreatment–Istheprocessofmakingitsafeforuseinthefarm.

- Rawwatercontainsimpurities whichmaybedissolved,floatingorsuspendedinwater. Theseimpuritiesaregroupedintothreecategories,namely:
- Physicalimpurities:thesearedissolvedimpuritiesdetectedbycolour,tasteand smell.
- Chemicalimpurities:thesearedissolvedimpuritiesdetectedbyuseofchemical analysis.
- Biologicalimpurities:thesearemicroorganismsinwatersuchasbacteria,viruses andalgae.

ImportanceofTreatingWater

- Tokilldiseasecausingmicroorganismssuchascholeraandtyphoidbacteriathat thriveindirtywater.
- Toremovechemicalimpuritiessuchasexcessfluoridewhichmaybeharmfulto humanbeings.
- Toremovesmellsandbadtaste.
- Toremovesedimentsofsolidparticlessuchassoil,sandandsticks.

ProcessofWatertreatment.

- Filtrationandwaterintake:waterfromthesourcepassthroughfinegranular materialstoremovesolidparticlesandbiologicalsubstancesbeforeenteringintake pipe.Sievesusedareofvaryingtypes.
- Softeningofwater-waterismixedwithsodaash(sodiumbicarbonate)(tosoften water)andalum(aluminiumsulphate)(tocoagulatesolidparticles)inasmalltank
- Sedimentation:thisiswherewaterisputinlargecontainerssothatsolidparticles suchassand,metalandotherscansettleatthebottom.
- Coagulation:additionofchemicalswhichprecipitateimpuritiesandhelpin softeningofhardwater.
- Filtrationpassingofwaterwithfewimpuritiesintoafiltrationtank
- Chlorination:Sterilizationtodestroydiseasecausingorganisms. Storage-waterisstoredinlargetanksbeforedistribution.

Irrigation

- Itistheartificialapplicationofwatertocropsindryareasorwherewaterisnot enough.
- Itisoneofthemethodsoflandreclamationincaseofaridandsemiaridareas.

FactorstoConsiderinIdentifyingandAssessingthePotentialofLandforIrrigation Development

- Topographyoftheland
- Soiltype
- Typeofcroptobegrown
- Wateravailability
- Humanfactorssuchasskill,capitalavailabilityandeconomicactivities.

TypesofIrrigation

- Surfaceirrigation:typeofirrigationinwhichwaterisbroughttothecropfields fromitssourcethroughcanalsorfurrows.
  - Thisincludesfloodirrigationfurrowandbasinirrigation.
  - Itisusedinflatareas.
  - Theproblemwiththismethodislossofwaterthroughseepage.
  - Italsoincreasessoilsalinity.

  Factorstoconsiderwhenchoosingfurrowirrigation
    - Topography-idealforfairlylevelland
    - Amountofwater–requiresalotofwater
    - Soiltype–soilshouldnotallowwaterseepage
  - Floodirrigation

    Itswherewaterisallowedtoflowintothefieldfromasourcesuchasariverorlake throughfurrowsandcanals.Itsidealinlevelfields.Itscheaptoestablishandmaintain .

    Twaterisunevenlydistributedhencewastage.
  - Furrowirrigation

    It’swherewaterflowsfromirrigationcanalsthroughgatesintofurrowsdugalongthe contourstoreduceerosion.Cropsaregrownonridgesofthefurrows.Repairfurrows wheneroded/wornout.Removeweedsandaccumulatedsilt.Furrowsprevent wetnessofleaveshencereducingfungaldiseases.Itscheaptoestablishand maintain.Alotofwaterislostthroughseepageandevaporation.
  - Basinirrigation

    Itswherefloodingofanareaenclosedwithembankments(dykesandlevees)with water.Levelbasinreferstolevelgroundsurroundedwithwater.Waterisallowedinvi a

    inlets.ItscommoninricefieldsieMweaTabere,Ahero,Bunyala,andWestKanoKabo nyo.Itresultsinaccumulationofsalts.Itsnotapplicableinareasthatthelandis notlevel.
  - Sub-surfaceIrrigation:
    - Thisinvolvestheuseofporouspipesorperforatedpipesundergroundtoallow watertopassoutthroughtinyholesandwetthesoilaroundtherootzones.
    - Itisusedinslopyareasandwherewaterisinadequate.

- Advantagesofsub-surfaceirrigation
  - Economizesonwaterusage
  - Minimizesoftheftofpipes
  - Reducessoilerosionasitcomesoutinsmallamounts
  - Reducesfungalinfectionbecausewaterdoesnotaccumulateonleaves
  - Noneedofconstructingdykes/levelbasins.
  - Reduceslabourrequirement(changingofwaterpipes)
- Disadvantagesofsub-surfaceirrigation
  - Pipescanbebrokenduringweedingorlandreclamation
  - Blockageofnozzles/pipeperforationsbysoil/plantrootsmakingthenineefficient
  - Expensiveiepurchaseandlayingofpipes Interfereswithfieldoperations.
- OverheadorSprinklerIrrigation:
  - Itisusedinanyareawhichisnotsteep.Wherewaterreachesthecropsinformof finedropletsfromabove.Itspracticedunderuseof(sprinklers,wateringcanand hosepipes)
- Advantagesofoverheadirrigation
  - Itiswatereconomical
  - Doesnotrequirelevelingofland
  - Doesnotencouragesoilerosion
  - Solublefertilizersandpesticidescanbemixedwiththeirrigationwater
  - CleantheplntsurfaceforeaseofphotosynthesisandgaseousexchangeSprinkleirrigationhelpstocontrolcroppestsi.eaphids
- Disadvantagesofoverheadirrigation
  - Itsexpensive
  - Encouragesfungaldiseases
  - Destroysthesoilstructurebycompaction
  - Maycausesoilerosionifpoorlymanaged
  - Requirestheestablishmentofwindbreaks DriporTrickleIrrigation:
- Itswheretheplantreceivewaterinsmallquantitiesaroundthebaseoftheplant usingbottlesorperforatedplasticpipes.
- Itisusedwherewaterislittleandinrelativelysloppyandflatareas.
- Advantagesofdripirrigation
  - Itiswatereconomical/littleamountofwaterrequired.
  - Doesnotencouragegrowthofweedsbetweentherows
  - DoesnotencouragefungaldiseasesCBDandblight
  - Doesnotencouragesoilerosion
  - Canusewaterevenunderlowpressure
  - Doesnotrequirelevelingoftheland
  - Solublefertilizersandpesticidescanbeappliedwithirrigationwater
- Advantagesofdripirrigation
  - Requiresspecialskills

- Veryexpensivetobuypipes
- Requireswaterfreefromsolidimpurities
- Requirescleanwateronlydirtywaterblockspipes

Drainage

- Thisisamethodofremovingexcesswaterorloweringthewatertablefromamarshy water-loggedland.
- Itisalsoamethodoflandreclamation.

ImportanceofDrainageasaMethodofLandReclamation

- Toincreasesoilaeration.
- Toraisesoiltemperature.
- Toincreasemicrobialactivitiesinthesoil.
- Toreducetoxicsubstancesfromthesoil.
- Toincreasesoilvolumeforexploitationbyplantroots.

MethodsofDrainage

- Useofopenditches.
- Useofundergrounddrainpipes.
- Frenchdrains.
- Camberedbeds.
- Pumpingoutwaterfromthesoil.
- Plantingtreespecieswhichabsorbalotofwaterforexampleeucalyptus.

WaterPollution

- Thisistheprocessbywhichharmfulsubstancesgetintothewater.
- Theharmfulsubstanceisreferredtoasapollutant.

Agriculturalpracticeswhichpollutewaterinclude:

- Useofinorganicfertilizers.
- Useofpesticides.
- Poorcultivationpracticessuchasovercultivation,cultivatingalongtheriverbanks.
- Overgrazingwhichleadstoerosionofsoilthuscausingsiltationinwatersources.

MethodsofPreventingWaterPollution

- Soilconservationmeasureswhichminimizesoillossesthrougherosion.
- Fencingoffthewatersources.
- Adoptingorganicfarmingpracticesforexamplecontrollingpestsandweedusingnon - chemicaltechniques.
- Plantinggrassalongriverbankstominimizesiltationinrivers.
- Properdisposalofemptychemicalcontainers.

SoilFertilityI (OrganicManures)

Introduction

- Soilfertilityistheabilityofthesoiltoprovidecropswiththerequirednutrientsintheir properproportions.

CharacteristicsofaFertileSoil

- Gooddepth-Goodsoilsgiverootsgreatervolumetoobtainplantnutrientsand providestronganchorage.
- Goodaeration-fortherespirationofplantrootsandusebysoilorganisms.
- Goodwaterholdingcapacity-ensuresprovisionofadequatewaterforplantgrowth.
- Properdrainage-ensuresprovisionofadequateairforplantgrowth.
- CorrectsoilpH-differentcropshavedifferentsoilpHrequirements.
- Adequatenutrientssupply-itshouldsupplytherequirednutrientsinthecorrect amountsandinaformavailabletoplants.
- Freefromexcessiveinfestationofsoilbornepestsanddiseases.

Howsoillosesfertility

- Leaching:verticalmovementofdissolvedmineralsfromthetoptothelowerhorizons ofthesoilprofile.
- Soilerosion-Theremovalandcarryingawayofthetopfertilesoilfromoneplaceto another.
- Monocropping-Thisisthepracticeofgrowingonetypeofcroponapiece'ofaland overalongtime.
- Continuouscropping-cropstakeawayalotofnutrientsfromthesoilwhichare neverreturned.
- Growingcropscontinuouslywithoutgivingthesoiltimetorestmakesthesoilinfertile.
- ChangeinsoilpH-changesinsoilpHaffecttheactivityofsoilmicroorganismsas wellastheavailabilityofsoilnutrients.
- Burningofvegetation-burningofvegetationcoverdestroysorganicmatter.Italso exposesthesoiltotheagentsofsoilerosion.
- Accumulationofsalts-soilswithalotofsaltsaresaidtobesaline.Stateofhaving toomuchsaltinthesoilisreferredtoassoilsalinity.
- Saltsaccumulationcausewaterdeficiencyinplants.Itmayalsoleadtochangeinsoil pH.

MaintenanceofSoilFertility

Soilfertilityismaintainedthroughthefollowingmethods:

- ControlofSoilErosion;
  - Terracing,
  - Contourcultivation,
  - Stripcropping, Cutoffdrains
  - Plantingcovercrops.
- CropRotation;
  - Practiceofgrowingdifferentcropsonthesamefieldindifferentseasonsinan orderlysequence.

- ControlofSoilpH:
  - Applicationoflimingmaterialssuchas limestone,quicklime,magnesium carbonateandslakedlimeifthesoilisacidic.
  - Applicationofacidicfertilizersifthesoilisalkaline.
  - Applicationofmanures.
- Properdrainage; Donethrough:
  - Breakinghardpan.
  - Constructionofwaterchannels. Growingcropsoncamberedbed
  - Pumpingoutwaterfromthesoil.
- Weedcontrol:
  - Useofherbicides.
  - Slashing
  - Uprooting.
  - Mulching
  - Useofproperfarmingpracticessuchasearlyplanting,correctspacingandcover crops.
- Intercropping–
  - Farmingpracticewheredifferentcropsspeciesaregrowntogetherinthefield.
- MinimumTillage;
  - Useofherbicides.
  - Uprootingofweeds.
  - Slashingweeds Mulching
  - Stripcultivation.
- UseofInorganicFertilizer;
  - Chemicalcompoundsmanufacturedtoapplyspecificplantnutrientsforexample calciumammoniumnitrate(CAN).

- UseofManure;
  - Welldecomposedmanuresreleasenutrientsintothesoilandincreaseitswater holdingcapacity.

OrganicManures

- Manuresarederivedfromplantsandanimalremains.
- Theysupplyorganicmattertothesoilwhichafterdecompositionreleasesplant nutrients.
- Theendproductofthisdecompositionisknownashumus.
- Itinfluencessoilchemicalpropertiesandsoiltemperature.
- Manuressupplyawiderangeofessentialplantnutrients.

ImportanceofOrganicMatterintheSoil

- Increasesthesoilwaterholdingcapacityofthesoilandtheinfiltrationrate(colloidal)
- Improvessoilfertilitybyreleasingawiderangeofnutrientsintothesoil.
- Providesfoodandshelterforsoilmicro-organismsresponsiblefordecomposition.
- Improvesthesoilstructure.
- BufferssoilpH/moderatessoilpH.

- Reducesthetoxicityofplantpoisonsinthesoil.
- Moderatessoiltemperaturebyitsdarkcolour.

LimitationsintheUseofManure

- Theyarebulky-lownutritivevalueperunitvolumehenceusedinlargequantities.
- Laboriousinapplicationandtransport.–theyincreaseproductioncost.
- Theyspreaddiseases,pestsandweedsiftheplantmaterialusedwasinfestedwith pestsanddiseases.
- Lossofnutrientsifpoorlystored(throughleachingandevaporation).
- Ifnotfullydecomposedcropsmaynotbenefitfromthemnutrientsreleasedcan scorchthecrops.

TypesofOrganicManures-accordingtothemethodofpreparation

- Greenmanure.
- Farmyardmanure.
- Compostmanure

GreenManure

- Madefromgreenplantswhicharegrownforthepurposeofincorporatingintothesoil toimprovesoilfertility.Mostlyleguminousplantsieclovers,Lucerne,cowpeas, groundnuts,beans,andsunhemparepreferred.Maizesorghumsunflowerandwee ds canalsobeused.

Characteristicsofplantsusedforpreparationforgreenmanure:

- Havefastgrowthrates.
- Havehighnitrogencontent.
- Capableofrottingquickly.
- Capableofgrowinginpoorconditions(hardy).

PreparationofGreenManure

- Plantthegreenmanurecropinthefield.
- Allowthecroptogrowuptofloweringstage.
- Incorporateitintothesoilthroughploughing.
- Allowthecroptodecomposefortwoweeks.
- Preparethefieldforplantingthemajorcrop.

Reasonswhygreenmanureisnotcommonlyused/limitations:

- Mostoftheplantsusedasgreenmanurearefoodcrops.
- Greenmanurecropsmayusemostofthesoilmoisture.
- Mostofthenutrientsareusedupbysoilmicro-organismsintheprocessof decomposingthegreenmanure.
- Plantingofthemajorcropisdelayed–decompositionofgreenmanuretakestime.

FarmYardManure(FYM) FactorsthatDeterminetheQualityofFYM

- Isamixtureofanimalwasteandcropresiduesusedasbeddingsinanimalhouses.
- Thetypesoftheanimal’sused-poultryandpigsabsorbfewernutrientsandgivedung withmorenutrients.Dungfromfatteninganimalshashighnutrients.
- Typesoffoodeaten–highlynutritiousfeedstuffsmakemanurewithhighnutrients
- Typesoflitterused–litterwithhighurineabsorptioncapacitysawdustandwood shavingabsorb1.5timesasmuchurineastheirweight.

- Methodofstorage–shouldbestoredinconcretefloorandleakfreerooftoprevent lossofnutrients. Ageoffarmyardmanure– wellrottedmanureisrichinnutrientsandits easiertomixwiththesoil
- Ageoftheanimalsused. PreparationofFYM
- Providebeddingsinthehousesoffarmanimals(grass,woodshavings,orsawdust).
- Animalsdeposittheirdroppingsandurineonthebeddings.
- Animalsmixthemthroughtrampling.
- Thebeddingstogetherwithdungareremovedandheapedundershedtodecompose.
- Aftersometime,thematerialsdecomposeandFYMisformed.
- Itcanthenbeusedinthefarm

CompostManure

Ismanurepreparedfromheaped(composted)organicmaterials(plantresiduesand animalwasteorplantmaterialsonly).Avoidsyntheticandinfestedplant/weeds.

Factorstoconsiderinselectingsiteformakingcompostmanure:

- Awelldrainedplace–toavoidwaterloggingthatmaycauseleaching
- Directionoftheprevailingwind–toavoidbadodourfrombeingblowntothe homestead.
- Sizeofthefarm–centrallyplacedtowherethemanureistobeused
- Accessibility–toeasetransportationofneededmaterials

PreparationofCompostManure Twomethods:

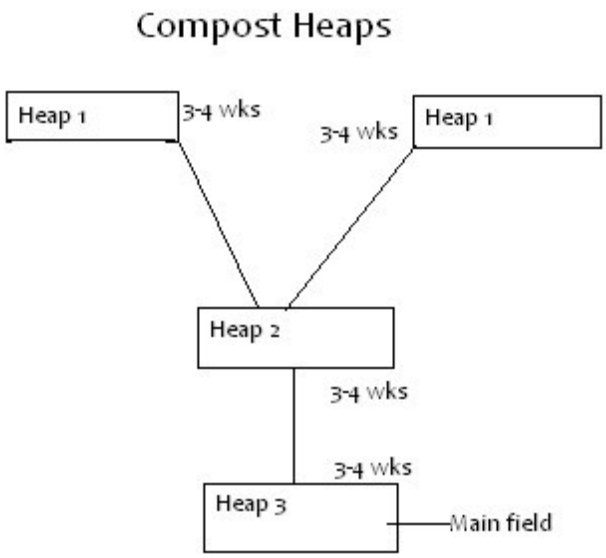
- Fourheapsmethod
- IndoreMethod(PitMethod)

IndoreMethod(PitMethod)

Procedure;-itwasdevisedinindiaatindore

- Selectashelteredplacewithashadeandnearthefield.
- Digapitwiththedimension1.2mx1.2mx1.2m.
- Placethematerialsinthefollowingorder:
- Hedgecuttingsormaizestalkstoadepthof30cmasafoundation
- Alayerofgrass,greenweedsorleavesandkitchenwastesto30cm.
- Awellrottenmanure/poultrydroppings.
- Woodash(toimprovethelevelofphosphorusandpotassium)andphosphatic fertilizers.
- Alayeroftopsoiltointroducemicro¬organismforthedecompositionoforganic remains.Repeatthesequenceuntilthepitisfull.
- Note:Somewatershouldbesprinkledtothematerialstoinitiatethedecomposition processandregulatetemperatures.Useyoungvegetativematerial.Toincreaseair circulationavoidcompacting.

Fourheapsmethod:



Compositionoftheheap

- Cropresidue
- Animalwaste
- Oldfarmyardorcompostmanure
- Inorganicfertilizerandtopsoil

Procedure

- Clearthesitetoremovesurfacevegetationandtopsoil.
- Levelthesite
- Fourposts2mhigharefixed1.2mapartfromfourcornersoftheheap.
- Fixwoodplanksonthesides.
- Materialsareplacedintwoheaps(labeled1)asinthepitmethod,
- Thetwoheapsmakeupheap1.
- After3-4weeks,thedecomposedmaterialfromheap1istransferredtoheapII.
- Afteranother3-4weeksthematerialistransferredtoheapIII.
- After3-4weeksitisreadyforuseinthefarm.
- Turnthematerialheapoccasionally(every3months)tofacilitatecirculationofairand forproperdecomposition.
- Longsharppointedstickisdrivenintothepileatanangletocheck temperatures withintheheap.Hightemperatureiscorrectedbyaddingwater.

Indicatorsofwelldecomposedmanure

- Absenceofbadodour.
- Materialsarelighter.
- Manureisbrownincolour.

AdvantagesofCompostManure

- Onedoesnothavetoownlivestockinordertoprepareit.
- Alotofmanurecanbeproducedwithinashorttime.
- Avarietyofmaterialscanbeusedinitspreparation.
- Useslocallyavailablematerialsthuscheaperthantheartificialfertilizers.
- Improvesthesoilstructure.

LimitationsofCompostManure

- Itreleasesnutrientsslowlyintothesoil.
- Largequantitiesofcompostmanurearerequiredtosupplyenoughplantnutrients.
- Itspreparationislabourintensive.
- Itmayinducesoil-bornepestsanddiseases.

LivestockProduction:

(CommonBreeds)

Introduction

- Thetermlivestockisusedtorefertoalldomesticatedanimalsonthefarmformans benefit.
- Theseanimalsincludecattle,sheep,goats,poultry,pigs,rabbits,camels,bees,fish anddonkeys.

Theimportanceofkeepinglivestock:

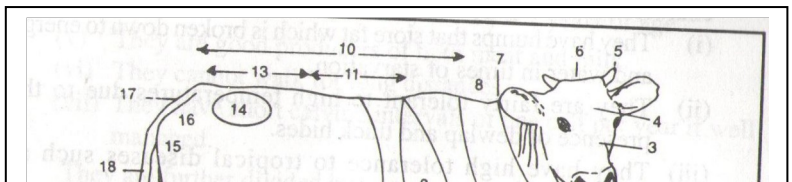
- Sourceoffood–animalproductsusedasfoodinclude;meat,milk, eggs,honeyandblood.Theyprovideproteinandenergy.
- Sourceofincome–animalproductissoldtoearnincomeforthe farmer.Theyareexportedforforeignexchange.
- Culturalvalues-areusedasastatussymbol(wealthyifyouowna largeherdofcattle,sheep,goatsorcamels).Itsusedasamedium ofexchangeinbartertrade.Itsusedforsocialceremoniesie marriagefuneralsassacrifices.Itsalsousedforrecreationpurposes iebullandcockfighting,ostrich,camel,donkeyandhorseraces.
- Sourceofanimalpower–theyprovidedraughtpowerforpullingcartsandploughs.
- Provisionofrawmaterialsforindustriesietextileindustries(wool,fur,mohair,hides andskins)animalwasteisusedinagriculturalindustrytoproducebiogasandmaintai n soilfertility.
- Farmyardmanurefromtheanimalsisusedinmaintainingsoilfertility.
- Cattledungisusedintheproductionofbiogas. Commonlivestockbreeds

Breedreferstoagroupofanimalshavingthesamecharacteristicsandacommonorigin. Livestocktyperefertothepurposeforwhichtheanimaliskept.Livestockarerearedfor differenttypeandbreed.

CattleBreeds

Definitionofterms

Bull	maturemalecattle
Bullock	maturecastratedmalecattle
Steer	youngcastratedmalecattle



Heifer youngfemalecattlebetweenwiningandfirstcalving
Cow maturefemalecattle
Calf youngoneofacattle Cattlecanbeclassifiedintotwogroupsbasedontheirorigin. Theseare;

- Indigenouscattle.
- Exoticcattle.

IndigenousCattle(nativesoriginiswithinthetropics)–Bosindicus

Havevariedcharacteristicsduetouncontrolledbreeding

Characteristicsofindigenouscattle

- Havehumpsthatstorefatwhichisbrokendowntoenergyandwaterduringstarvation.
- Havefairlytoleranttohightemperaturebecauseofthedewlapandthickhides
- Hightolerancetotropicaldiseasesietrypanosomiasis
- Slowgrowthratehencelatematurity.Heifersareservedat2-3yrs.
- Lowproductionofmilkandmeat.
- Walkforlongdistancesinsearchoffoodandwater
- Longcalvingintervalsmorethanoneyear.
- Zebus–
  Theyaresmallinsizeandwithadistincthumpandinclude:
  - Nandi,
  - Bukedi
  - Maasaicattle.
- TheBorana
  - Thesearethecattlekeptintheorthernpartsof Kenya.
  - Theyarelargerthantheebus.
- Indigenouscattlearehardyhenceabletotoleratetheharshenvironmentalconditions inthetropics.
- Theyarethemajorsuppliersofbeefin Kenya.Longrumpthat’swideanddropping
- Growsslowlyandmatureslate Haslargehumpanddewlap.Cowweighs400-450kgandbull550-650kgs

ExoticCattle

- Foreigncattlefromthetemperateregions.
- Theyhavedistinctbreedcharacteristicsandareclassifiedintovariousbreeds.

Generalcharacteristics:

- Theyhavenohumps.
- Theyhavelowtolerancetohightemperatureshencepopularincoolclimatesofthe Kenyahighlands.
- Theyarehighlysusceptibletotropicaldiseases.
- Theyhavefastgrowthratesleadingtoearlymaturity.
- Theyaregoodproducersofbothmeatandmilk.
- Theycannotwalkforlongdistances.
- Areservedbetween1.5yrsto2yrs

- Theyhaveshortcalvingintervalsofonecalfperyearifwellmanaged.

Exoticcattlebreedsfallunderthefollowinggroups:
- Dairycattlebreeds.
- Beefcattlebreeds.
- Dualpurposebreeds.

DairyCattleBreeds

- Theyinclude;
- Friesian,
- Ayrshire,
- Guernsey Jersey.

CharacteristicsofDairyCattle

- Wedgeortriangularinshape.
- Largestomachforheavyfeedinghencehighmilkproduction.
- Docilewithmildtemperament.
- Large,wellsuspendeduddersandteats.
- Leanbodieswithlittleflesh. Straighttopline
- Leanandsmoothneck.
- Largeandlongmammarymilkwellsandveins.
- Cylindrical;uniformandwellspacedteats.
- Wideandwellsethindquarterstoaccommodatetheudder.

Friesian-Holstein(largestofalldairybreeds)

- Origin:Hollandanddistributedallovertheworld.
- Colour:Blackandwhite.Haveawhiteswitch,foreheadpatchandlegpartsbelowthe knees.
- Size:it’sthelargestofthedairybreeds.Cowweighs550-680kgsBullweighs950kg calveshaveabirthweightof35-40kgs.
- Milkproduction:Highestmilkproducersofalldairybreedsabout9150kgper lactationof305bdays.Themilkhastheleastbutterfatcontent;3.5%.heifersare servedat21monthsandcalveat30months.Aregoodfeedersandrequirelarge quantitiesoffodder.

Ayrshire

- Origin:Scotland
- Colour:Whitewithbrownmarkingsorred/darkredwithwhitemarkings.
- Size:Cowweighs360-590kgsBullsweighs500-720kg.

Conformation:
- Straighttoplines,hornsarelongandfaceupwards.
- MilkproductionissecondtoFriesianabout5,185kgperlactationof305days.the buttercontentofabout4%.Heifersservedat21mothsandcalvedownat30months. Theyarehardyfeeding0npoorpastures.

Guernseyorchannelislandbreed.

- Origin:GuernseyIslandoffthecoastofFranceintheEnglishchannel.
- Colour:Yellowishbrowntoredwithwhitelegs,switchandgirth..
- Size:Bulls540-770kg.Cowweighs450-500kgs.Calvesweigh25-30kgsatbirth.

Conformation:

- Uddersarelesssymmetrical.
- Averagemilkproductionisabout6100kgperlactationof305dayswithbutterfat contentof4.5%-5.0%hencetheyellowcolourofmilk.Heifersserveat21monthsand calvedownat30months.

Jersey(smallestofallthedairybreeds)

- Origin:EnglandatJerseyIslandintheEnglishChannel.Channelislandbreed.
- Colour:Yellowbrownwithblackmuzzleandtailsswitch.
- Size:Bullsweigh540-700kg.Cowweighs350-450kgs.calvesweigh20-25kgsatbirth.

Conformation:

- Dishedforehead,havestraighttop-lineandlevelrumpswithsharpwithers.
- Haveprotrudingblackeyes.
- Averagemilkproduction4270kgperlactationof305days.Theyhavebutterfatcontent of5%-5.3%.
- Theytoleratehightemperatures.Heifersservedat15-18monthsandcalvedownat 24-27months.Havelittlepasturerequirements.Feedsonpoorpastures.

BeefCattle

Examples:

- AberdeenAngus,
- Hereford,
- Shorthorns,
- Galloway,
- AmericanBrahman,
- charolais SantaGetrudis.

CharacteristicsofBeefCattle

- Blockyorsquareconformationtheyappearsquareorrectangularwithcompact bodies.
- Havethickmusclesorarewellfleshed.
- Earlymaturing-growsfaster.
- Deepchestandgirthandshortlegs.
- Straighttopandlowerlines.
- Efficientconvertersoffoodintomeatandfats
- Goodforagershavereducedselectivegrazing.
- Breedregularly
- Moreresistanttodiseases
- Abletomaintaingoodweightevenduringadverseconditions.

AberdeenAngus

- Origin:NorthEastScotlandinthecountryofaberdeen.
- Colour:Blackwithalongsmoothcoatofhair

- Shape:Cylindrical,compactanddeep;Itispolled.Itmaturesearlyandcowshavea goodmotheringability.

Size:

- Maturebullsweigh900kg.
- Maturecowsweigh72s0kgs.
- ItisfoundinTimauareaofKenya

Hereford

- Origin:England.
- Colour:Deepredandwhite-faced.
- Size:Averageweightofbullsis1000kg.
- Cowsweigh840kgs.
- ItisfoundinareassuchasNaivasha.

Shorthorn

- Origin:England.
- Haseasyfleshingability
- Colour:Red,Roanorwhite
- Shape:Cylindrical,compactanddeep.
- Itispolled.

Size:

- Bullsweigh700-900kg,
- cowsweigh545-630kgs.

Galloway

- Origin:Scotland.
- Colour:Black
- KeptinthehighlandareaslikeMoloinKenya.

Charolais

- Origin:France.
- Colour:Creamywhite.
- Size:Bullsweigh1200kg,cowsweigh1000kgs.
- ItisfoundinranchesinLaikipiaDistrict.

DualPurposeBreeds

E

xamples:Sahiwal,RedPollandSimmental.

Sahiwal

- Origin:IndiaandPakistan..
- Colour:reddishbrown.
- Size:Bullsweigh650kg,andcows400kg.
- Milkproductionaverages2700-3000perlactationwithabutterfatcontentof3.7%.
- Ithasapendulousudderswhichdoesnotletdownmilkeasily.
- Itisthereforesaidtobeadifficultmilker.
- Itiskeptinsemi-aridareassuchasNaivasha.

RedPoll

- Origin:England.
- Colour:Deepredwithawhitenose.
- Conformation:Polled-deepgirthandshortlegs.
- Keptinsemi-aridareassuchasNakuru,Mogotio.

Simmental

- Origin:Switzerland.

- Colour:Lightredandwhitepatchesonthehead.

Conformation:

- Ithasbroadandstraightback,withwell-sprungribsanddeepgirth.
- Itiswellfleshedatrearquarters,wellsuspendeduddersandlargeteats.

SheepBreeds:

PurposeofKeepingSheep;

- Meat(mutton).
- Woolproduction.

ExoticSheep

- Woolbreeds-forexamplemerino.
- Dualpurpose-forexampleCorriedale,Romneymarsh.
- Muttonbreeds-forexampleHampshireDown,Dorpers.

Merino

- Origin:Spain

Characteristics:

- Ithaswhitefaceanditslipsandnostrilsarepinkincolour.
- Ramshavehornswhicharespiralinshape.
- Itissusceptibletofootrot,wormandrespiratorydiseases.

Corriedaledual

- Origin:NewZealand.
- Size:Rams85-90kg.Ewes60--85kg.fleeceweigh5-5.5kg.
- Thisisadual-purposebreedwithwhiteopenfaceandwhitespotsonthelegs.
- Itishornlessandhardy.
- Hashighqualitywoolandmeat
- Moderatelylonglegscoveredwithwool.
- Woolisofgoodlengthandlowshrinkage.
- It'sacrossbreedbetweenmerinoandLincoln.

RomneyMarshdual

- Origin:England.
- Size:Rams102-115kg.
- Ewes84-100kg
- Itisadual-purposebreedwhichshornlesswithwidepollandblacknostrilsandlips.
- Itisaverageinprolificacy.
- Suitableforhighaltitude
- Hasblackhooves
- Itisresistanttofootrotdiseasesandworminfestation.
- Producesmediumlengthwool.3.6-4.1kgs

HampshireDowndual

- Origin:England.
- Size:Rams125kg.
- Ewes80-100kg
- Itisamuttonbreedwhichisearlymaturing,hardyandprolific.
- Fleeceisofpoorqualitybecauseoftheblackfibres.
- Lambingpercentageis125-140.

Dorper

- IsacrossbreedofDorsethornandblackheadPersiansheep.

Itismuttonbreed.

DorsetHorn

- Dualpurposebreedofsheep.
- IndigenousBreedsofSheep
- Theirbodiesarecoveredwithhair.
- Theirclassificationisbasedontheirtailsandtheirnamesvaryaccordingtodifferent tribes.

Characteristics;

- ThintailedsheepfoundinWestAfrica.
- FattailedsuchasMaasaisheep.
- Fatrumpedsheep.

MaasaiSheep

- FoundinSouthWesternKenyaandNorthernTanzania.Itsanindigenousbreed
- Ithasanabilityofutilizingpoorpastures.
- Size:Ram38kg, Ewe20-30kg.
- Colour:Redandbrown.
- Thesareearlymaturingwithlonglegsandsmallpointedhorns.

BlackHeadPersianSheep

- Origin:Arabianowinnorthernkenya–itsindigenousbreed
- Colour:Whitewithblackheadandneck.
- Itispolledwithabigdewlap,fatrumpandacurvedtail.
- Itstoleranttoharshconditions.
- Hasafattailandprolificwithlonglegs.
- Weighs50kgswhenmature.

Goats

BillyorBuck–maturemalegoat
Nanny/Doe–maturefemalegoat
Kid–youngoneofagoat

Goatswelladaptedtoawiderangeofenvironmentalconditionsbecauseofthefollowing characteristics:

- Theyfeedonawiderangeofvegetation.
- Theyrequireverylittleamountofwater.
- Theyaretoleranttohightemperatures.
- Theyarefairlyresistanttodiseases.
- Theycanwalklongdistanceswithoutlosingweight.

Goatbreeds

Classifiedinto

- Dairygoats(temperate/exoticandtropical/indigenousdairygoats)
- Meatgoats
- Hairgoats
- Indigenous
- Exotic

IndigenousGoatBreeds

- Galla(whiteincolour).Adultfemalecanweigh25kg.
- Somali(Boran):FoundinNorthernKenya(whiteincolour).
- Turkana/Samburu:(Longhairandbearded.
- Mubende:(Black)(40-45kg).Thesearesmallandhardyandarekeptformeatand milkedbythepastoralists.
- Hasgoodqualitymeat.

ExoticBreeds

Boergoatmeatgoat

- Origin:SouthAfrica
- Colour:White
- Haslongearsandlonghairontheirbodies.
- Hasanabilitytotwinandtriplet
- Hasarapidbodygrowthandweightgain

Anglo-Nubian-tropicaldairygoat

- Origin:NorthEastAfrica
- Colour:RoanandWhite
- Thesehavelonglegs,loppedorfloppingearsandarepolled.
- Theyproduce1-2litersofmilkper day.

Jumnapari–tropicaldairygoat

- CrossbreedbetweenIndianjamnapariandEgyptianNubian.
- Origin:India
- Colour:White,blackandfrawn. Theyarehorned,havelargeloppedears
- Produce1-1.5_litresofmilkperday.
- Adultfemaleweigh45-60kgs

Toggenburgdairygoat

- Origin:Switzerland
- Colour:Whitepatchesonthebody,whitestripesonthefaceandneck.
- Erectforwardpointingearsandpolled.
- Canproduce2-3ofmilkperday.

Saanendairygoat

- Origin:Switzerland.
- Colour:White
- Theyhaveerect,forwardpointingearsandpolled.
- Canproduce3-3.5litresofmilkperday.Has3.5butterfatpercentage

Britishalpinedairygoat

- Origin Britain
- DistributionwidelydistributedinKenya
- Lowerthansaanenandtoggenberg

Angorahairgoat

- Origin:AngorainAsia.
- Colour:White

- Itiskeptforwoo/hair(mohair)production.
- Itsvulnerabletointernalparasites Frenchalpine.Pigs

Characteristics:

- Theyaresparselyhairedandthereforecannotwithstandcold.
- Pigswallowwhenitishotduetoabsenceofsweatglands.
- Theybreathefastwhenitishot.
- Theyhavebristlesinsteadofhair.

Breeds

LargeWhite

- Origin:Britain
- _Keptforbaconandporkproduction.
- Long,largeandwhiteincolour.
- Earsstraightanderect.
- Hasdishedfaceandsnout.
- Mostprolificandwithgoodmotheringability.
- Fairlyhardy. Landrace

- Origin:Denmark
- Whiteandlongerthanlargewhite._ Earsdrooping.
- Goodforbaconproduction.
- Veryprolificwithgoodmotheringability._ Requireshighlevelofmanagement.

WessexSaddle

- BackOrigin:England
- Colour:Blackwithwhiteforelegsandshoulders.
- Straightsnoutanddroopingears._ Goodforbaconandpork.
- Goodforkeepingoutdoors.
- Excellentmotheringinstincts.

Otherpigbreedsinclude:

- Berkshire,
- Middle-white
- DurocJerseypig.

Pigscanbecrossedtoobtainhybridsorcrosses.

AdvantagesofCrosses

- Increasedlittersize._
- Earlymaturing.
- _Increaseinbodylength.
- _Highproportionofleanmeattofat.

PoultryBreeds

Therearethreetypesofchickenbreeds:

- Thelightbreedskeptforeggproduction.
- Theheavybreedskeptformeatproduction.
- Dualpurposebreeds-keptforbotheggsandmeatproduction.

CharacteristicsofLightBreeds

- Nevergobroodyhencepoorsitters.
- Excellentlayers(over220eggsperyear).
- Poormeatproducers(henscanattain2kg;cocks3kgs)
- Verynervousandexhibithighdegreeofcannibalism.
- Hen'scombislargeandbentoveroneeyeandcock'scombislargewith5-6 serrations.

Examples:

- Leghorns,
- Anconas,
- Silkies, Minorcas.

CharacteristicsofHeavyBreeds

- Canlayfeweggsandprovidegoodmeatasbroilers.
- Cangobroody.
- Heavierandbiggerinsize.
- Growfast. Examples:
- LightSussex,
- CornishDark White.

CharacteristicsofDual-PurposeBreeds

- Gobroody.
- Havegoodmeat.
- Diseaseresistant(donotrequirehighstandardofmanagement).

Rarelyexhibitcannibalism. Examples:RhodeIslandRed.

Hybrids

- Thesearedevelopedbycrossingtwodifferentbreeds.
- Theyaresuperiorinperformance.
- Canattain2kgin56daysforbroilersandlayover200eggsperyearforlayers.

Examples:

- Shavers,
- Thombers Isabrown.

Rabbits

Kindlingyoungoneofarabbit

Doematurefemalerabbit

Buckmaturemalerabbit

Theydowellinnearlyalltheenvironmentalconditions
Theylowfoodandspacerequirement.
Keptforthefollowingreasons: Toprovidemeat,fur,hairorwool.

- Toprovideskinforleather.
- Toprovidemanureformaintainingsoilfertility.
- Aspetanimals.

- Usedforresearchpurposes. Breeds
- Californianwhite:white,veryprolificblackears,paws,tail,noseandfeet).
- NewZealandwhite/Kenyawhite:(whitewithpinkeyes-goodformeat).Weighs 4-5.0kgsatmaturity.
- Flemishgiant(darkgrey-goodformeat).
- Angorarabbit(white,keptforwoolproduction).
- Chinchillah(greyish,keptforitsfurandmeatproduction).
- Earlops(whitewithdroopyears).
- Kenyawhite(white,smallestofbreeds).
- Earlopshasdroppingearsandwhiteincolor.

Camels

Keptinaridandsemiaridareasfor;

- Animalpower-Transportation,
- Racing,
- Toprovidemilk(9lperdayperlactationof300days)milkcontain4%butterfat,meat andwool.
- Productionofhidesforthetextileindustry Therearetwospeciesofcamels.

Dromedary(Camelusdromedarius)

- Origin:ArabiaandSyria Aresinglehumped,havelightbody
- Goodforracingandrapidtransport.

Bacterian(Camelusbacterianus)

- Origin:CentralAsia
- Hasdoublehumps,heavierandhasshorterlegs.
- Itssmallerthandromedary
- Canliveincoldregionshenceitsthickandlongcoat/furactsasinsulation. Yields5-12kgoffurpershearingseason Capableofsheddingthecoatduringspring.

Donkey

Keptfor

Provisionofanimalpoweri.ecarryingofloads,pullingofcartsandploughs.

Termsusedtodescribelivestockindifferentage,sexanduse.

Livestock		Adult	Rep lacementStock		Young	Users)
Species	Male	Female	Male	Female	One	
Cattle	Bull	Cow	Bullock	Heifer	Calf	Dairy-milk Beef-meat
Sheep	Ram	Ewe	Ram	Hogget	Lamb	Mutton-meat Woolsheep-wool
Goat	Buckor	Doeor	Buck Billy	Doe Nanny	Kid	Dairy-milk Mutton-meat

Pigs	Boar	Sow	Boar	Gilt	Piglet	Pork-meat Bacon-cured
Poultry	Cock	Hen	Cockerel	Pullet	Chick	Broilers-meat Layers-eggs
Rabbits	Buck	Doe	Buck	Doe	Ki ndling	Meat
Camel	Bull	Cow	Bull	Heifer	Calf	Pack,trainedfor riding,racingmilk, meat,fur

AgriculturalEconomicsI (BasicConceptsandFarmRecords)

Introduction

- Economicsisthestudyofhowmanandsocietychoosestoallocatescarce prod uctiveresourcestoproducevariouscommodities,overtime,anddistributethem amongvariousconsumersinsociety.
- It'salsoanappliedsciencethataimsatmaximizingoutputwhileminimizingcosts,by combiningthelimitedsuppliesofland,capital,labourandmanagementtoproduce goodsandservicesforusebythesocietyoveraperiodoftime.
- Itattemptstoexplainhowmancanbestusethelimitedresourcestoproducegoods andserviceswhichsatisfieshisneedswithminimumwastageorlossofthese resources

Example;

- food,
- clothing
- shelter

- Agriculturaleconomicsisthereforedefinedasasciencethataimsatmaximizing outputwhileminimizingcostsbycombiningthelimitedsuppliesofgoodsand servicesforusebythesocietyoveracertainperiodoftime.
- Theseare;
  - land,
  - capital,
  - labour
  - management

BasiceconomicPrinciples Scarcity

- Economicscarcitymeansresourcesarelimitedinsupplyrelativetodemand.
- Thisprincipleimpliesthatthereisnotimethatmancanhaveenoughresourcesto satisfyallhisneedordesires

Choice/Preference

- Humanwantsaremanyandvariedandmeansofsatisfyingthemarelimited.
- Therefore,manhastomakeachoiceamongthealternativesinordertousethe resourcesavailable. Mandoesthisbysatisfyingthemostpressingneedsfirst. Thisiscalled scaleofpreference. OpportunityCost

- Opportunity cost is the revenue forgone from the best alternative.
- It exists only where there are alternatives.
- Where there are no alternatives the opportunity cost is equal to zero.
- Opportunity cost helps in decision making.

Farm Records

- Farm records are documents kept in the farm
- They show farm activities carried out over a long period of time
- Or information kept in the farm in written form, about the farm and all activities in it.

Uses of Farm Records

- Show the history of the farm
- Show whether the farm is making a profit or loss.
- Show all the assets and liabilities of the farm which can be used to value the farm.
- Help in supporting insurance claims on death, theft, fire or loss of farm assets.
- Help in tax assessment to avoid over taxation.
- Used as a guide in planning and budgeting.
- Helps to detect losses or theft in the farm.
- Make it easy to share profits or losses in partnerships.
- Help in settling disputes among heirs to estate if the farmer dies without a will.
- Provide labour information on terminal benefits for a worker.

Type of Farm Records

- **Production Records** - Show the total yield and yield per unit of each enterprise.
- **Inventory Records** - A record of all permanent and consumable goods in the farm.

Consumable Goods Inventory

Date	Commodity Item	Quantity	Date	Issued to	Quantity	balallce Stock

- **Field Operation Records** - Show in details all field practices carried out together with the input used for all the crop enterprises.
- **Breeding Records** –
  - Show all the breeding activities in the farm.
  - From these records it is possible to select the prolific animals and cull the infertile ones.
- **Feeding Records** – A record of the types of feeds used in the farm and their quantities.
- **Health Records** –
  - Indicates the health conditions of the animals in the farm.

  From these records it is possible to:

  Select and cull animals on health grounds.
  - Know the course of action to be taken in the event of a disease and maintenance of good health.
  - Know the prevalent diseases.
  - Calculate the cost of treatment.
- **Marketing Records** show commodities sold, quantities and value of all the sales.

LabourRecords-showlabourutilizationandlabourcosts.

SoilFertilityII

(InorganicFertilizers)

Introduction

- Plantnutrientsoccurinthesoilinformofsolublesubstances.Othersoccurintheatm
- Thesesubstancesaretakeninbytheplantsindifferentquantitiesdependingontheir rolesintheplanttissues.

EssentialElements

- Thesearenutrientsneededbyplantsforvarioususes.
- Theyaredividedintotwobroadcategoriesnamely: Macronutrients
  - micronutrients.

Macro-nutrients

- Thesearealsoreferredtoasmajornutrients.
- Theyarerequiredbytheplantinlargequantities.

Theyinclude;

- carbon,
- hydrogen,
- oxygen,
- nitrogen,
- phophorus,
- potassium,
- sulphur,
- calcium
  magnesium.

- Nitrogen,phosphorusandpotassiumarereferredtoas**fertilizerelements,**
- Calcium,magnesiumandsulphur,arereferredtoas**limingelements.**

RoleofMacronutrientsinPlants

Nitrogen(NO_3,$NH4^{++}$) Sources:

- Artificialfertilizers
- Organicmatter
- Atmosphericfixationbylightning Nitrogenfixingbacteria.

RoleofNitrogeninPlants

- Vegetativegrowth
- Chlorophyllformation Buildupofprotoplasm.

- Improvesleafqualityinleafycropssuchasteaandcabbages.

DeficiencySymptoms

- Yellowingoftheleaves/chlorosis.
- Stuntedgrowth.
- Prematureripening.
- Prematuresheddingoftheleaves.
- Lightseeds.

EffectofExcessNitrogen

- Scorchingoftheleaves.
- Delayedmaturity.

LossofNitrogenFromtheSoil:

- Soilerosion.
- Leaching.
- Volatilization.
- Cropremoval.
- Usedbymicroorganisms.

Phosphorus(H_2P0_4,$HPO^{2-}_4$$P_2O_5$)

Sources:

- Organicmanures
- Commercialfertilizers
- Phosphaterocks

RoleofPhosphorus

- Encouragesfastgrowthoftheroots.
- Improvesthequalityoftheplant.
- Hastensmaturityofthecrops.
- Influencescelldivision.
- Stimulatesnoduleformationinlegumes.

Deficiencysymptoms

- Growthoftheplantisslow.
- Maturityisdelayed.
- Leavesbecomegrey,purpleincolour.
- Yieldofgrains,fruitsandseedislowered.

LossofPhosphorusFromtheSoil

- Soilerosion.
- Leaching
- Cropremoval
- Fixationbyironandaluminiumoxide.

Potasium(K^+,K_2O) Sources;

- Cropresidueandorganicmanures.
- Commercialfertilizers
- Potassiumbearingmineralse.g.feldsparandmica.

RoleofPotassiuminPlants

- Increasesplantvigouranddiseaseresistance.
- Increasesthesizeofgrainsandseeds.

- Reducestheill-effectsduetoexcessnitrogen.
- Preventstoorapidmaturationduetophosphorus.

DeficiencySymptoms

- Plantshaveshortjointsandpoorgrowth. Plantslodgebeforematuring.
- Leavesdevelopaburntappearanceonthemargin.
- Leavesatthelowerendoftheplantbecomemottled,spottedorstreaked.
- Inmaize,grainsandgrassesfiringstartsatthetipoftheleafandproceedsfromthe edgeusuallyleavingthemidribgreen.

LossofPotassiumFromtheSoil

- Cropremoval.
- Leaching.
- Soilerosion.
- Fixationinthesoil. Calcium($Ca^{2}+$)

Source:

- Cropresiduesandorganicmanures.
- Commercialfertilizers. weatheringofsoilminerals.
- Agriculturallimesforexampledolomite,limestone.

RoleofCalciuminPlants

- Improvesthevigourandstiffnessofstraw.
- Neutralizesthepoisonoussecretionsoftheplants.
- Helpsingrainandseedformation.
- Improvesthesoilstructure.
- Promotesbacterialactivityinthesoil.
- Correctsthesoilacidity. Deficiencysymptoms

Youngleavesremainclosed.

- Therearelightgreenbandsalongthemarginsoftheleaves.
- Leavesintheterminalbudbecomehookedinappearancethereisadie-¬backatthe tipandalongthemargins. LossofCalcium
- Cropremoval
- Leaching
- Soilerosion Magnesium(Mg2+)

Sources:

- Cropresiduesandorganicmanures
- Commercialfertilizers
- Weatheringofsoilminerals. Agriculturallimes.

RoleofMagnesiuminPlants

- Formspartofchlorophyll.
- Promotesthegrowthofthesoilbacteriaandenhancesthenitrogenfixingpowerof thelegumes.
- Activatestheproductionandtransportofcarbohydratesandproteinsinthegrowing plant.

Deficiencysymptoms

- Lossingreencolourwhichstartsfromthebottomleavesandgraduallymoves upwards.
- Theveinsremaingreen.
- Leavescurveupwardsalongthemargins.
- Stalksbecomeweakandtheplantdevelopslongbranchedroots.
- Theleavesbecomestreaked. Sulphur($S0_4^{2-}$,SO_2)

Sources:

- Commercialfertilizers.
- Soilmineralcontainingsulphides
- Atmosphericsulphurfromindustries.
- Rainwater

RoleofSulphurinPlants

- Formationandactivationofcoenzyme-A.
- Sulphurisaconstituentofaminoacids.
- Influenceplantphysiologicalprocesses.

DeficiencySymptoms

- Smallplants/stuntedgrowth.
- Poornodulationinlegumes.
- Lightgreentoyellowishleaves/chlorosis.
- Delayedmaturity. Micro-nutrients
- Alsoreferredtoastraceorminornutrients.
- Theyarerequiredinsmallquantities/traces.
- Theyareessentialforpropergrowthanddevelopmentofplants.

Theyinclude;

- Iron,
- Manganese,
- Copper,
- Boron,
- Molybdenum Chlorine.

RoleofMicronutrientsandTheirDeficiencySymptoms

- Copper
  - Roleinoxidation-reductionreactions.
  - Respirationandutilizationofiron Deficiencysymptoms-yellowingofyoungleaves.
- Iron
  - Synthesisofproteins.
  - Takespartinoxidation-¬reductionreactions.
  - Deficiencysymptoms-leafchlorosis
- Molybdenum
  - Nitrogentransformationinplants.

- Metabolizationofnitratestoaminoacidsandproteins - Deficiencysymptoms-leafcurlandscathing.
- Manganese-Sameasmolybdenum.
- Zinc
  - Formationofgrowthhormone.
  - Reproductionprocess
  - Deficiencysymptoms-whitebudformation.
- Boron–
  - Absorptionofwater.
  - Translocationofsugar

InorganicFertilizers

- Thesearechemicallyproducedsubstancesaddedtothesoiltoimprovefertility.

ClassificationAccordingto:

- Nutrientscontained
  - Straight-containonlyoneprimarymacronutrient.Ienitrogen, phosphorous,orpotassium.Fertilizersnamedbasedonthenutrients containedin;
  - Nitrogenousfertilizers-theprimarymacronutrientisnitrogenieCAN,ASN, UREAandSA(sulphateofammonia
  - Phosphaticfertilizerscontainphosphorusasamacronutrient.IeSSP.DSP. TSP
  - Potassicfertilizers–theycontainpotassiumasamacronutrientiemuriate ofpotashkclandpotassiumsulphateorsulphateofpotashK2SO4
  - Compound/Mixed/Complexfertilizers-containmorethanone macronutrient.Itcaneitherbeacompleteorincompletefertilizer
    - Completecompoundfertilizer-isonethatcontainsallthethreeprimary macronutrientsie20-10-10,25-55-5,17-17-170r15-15-15
    - Incompletecompoundfertilizer–isonethatcontainsonlytwoofthe primarymacronutrientsieDAP18-46-0
- Timeofapplication
  - Someappliedwhenplanting.
  - Topdressingaftercropemergence - Effectsonthesoilp H.
    - Acidicfertilizers.
    - Neutralfertilizers.
    - Basicfertilizers.

PropertiesandIdentificationofFertilizers

Fertilizershaveuniquepropertiesthataidintheiridentification.

NitrogenousFertilizers Characteristics

- Highlysolubleinsoilwater.
- Highlymobileinthesoilhenceitisappliedasatopdress.

- Easily leached because of the high solubility hence does not have residual effect on the soil.
- Have short residual effect therefore applied frequently.
-
- Has scorching effect on young crops during wet seasons.
- Easy to volatilize during hot season.
- They have a tendency to cake under moist conditions.
- They are hygroscopic (they absorb moisture hence form cakes hence should be stored in dry conditions.

Examples:

- Sulphate of Ammonia $(NH_4)2SO_4$.
  Physical appearance: white crystals,
  Has acidic effect, Contains 20% N.
- Ammonium Sulphate Nitrate $[(NH_4)_2SO_4 + NH_4NO_3]$
  Colour: granules which appear yellow orange,
  less acidic,
  contains 26% N.
- Calcium Ammonium Nitrate (CAN)
  Colour: greyish granules,
  neutral in nature, contains 21% N.
- Urea
  Colour: small whitish granules
  Easily leached or volatilized, contains 45-46% N.

Phosphate Fertilizers

- Has low solubility and immobile.
- Non-scorching.
- Has a high residual effect hence benefit the next season's crop.
- Easy to store because they are not hygroscopic.

Examples;

- Single super-phosphate
  Appearance: whitish, creamy white granules,
  contains 20-21% P_2O_5
- Double super-phosphate Contains 40-42% P_2O_5 Triple super-phosphate Contain 44-48% P2O5

  Appearance: dark greyish granules,
  Appearance: small greyish granules,

Potassic Fertilizers

Characteristics:

- Has moderate scorching effect.
- Moderately soluble in water.
- Most Kenyan soils have sufficient potassium.

Examples;

- MuriateofPotash(KCl)
  - Contain60-62%K_2O
  - Slightlyhygroscopic. Appearanceamorphouswhite.
- SulphateofPotash(50%K_2O)

CompoundorMixedFertilizers

- Thesearefertilizerswhichsupply2ormoreofthemacronutrients.Ntrientcontentis expressedintwoways
- Fertilizergrade:indicatingaguaranteeofminimumcontentasapercentageof N:P2O5:K2Oie14-46-0
- Fertilizerratio-whereretherelativepercentageisexpressedasaratioofNPKpresent. Ie10-20-0as1:2:0

Examplesofcompoundfertilisers;
- MonoammoniumphosphateMAP. Moderatelyacidic.Containsbothnitrogenandphosphorus.Appliedduring planting.
- Di-ammoniumphosphateDAP Moderatelyacidic.Containsbothnitrogenandphosphorus.Appliedduring planting.Gradeis18-46-0
- Nitrophos-20:20:0,-Moderatelyacidic.Containsbothnitrogenand phosphorus.Appliedduringplanting.

Advantagesofapplicationofcompoundfertilizers

- Savestimeandmoney.
- Mixturegivesimprovedstoragepropertiesandbetterhandling.

Disadvantagesofcompoundfertilizersapplication

- Expensive.
- Wasteful.
- Mixingmaynotbethorough.
- Incompatibilityoftheindividualfertilizers.

Methodsoffertilizerapplication

- Broadcasting-randomscatteringofthefertilizersontheground.Forpotassicand nitrogenousfertilizers.Itsdonewhenthesoilismoist.Shallowlydigthefertilizerinto thesoiltopreventvolatilization.
- Placementmethod-applicationoffertilizersintheplantingholesordrills. Thoroughlymixthefertilizerwiththesoilbeforeseedplacement.Idealforphosphati c fertilizers.
- Sidedressing-fertilizerisplacedatthesideoftheplantwithintherootzone,in bandsorspot-rings.Idealfornitrogenousfertilizers.Itsachievedthroughring applicationplacementaroundanindividualcropbeneaththecanopy)orband application(inbetweenrowsofcropsinaband)
- Foliarspraying-speciallyformulatedfertilizersolutionappliedonthefoliagein sprayform.Fertilizerisdirectlyabsorbedbyleaves.Preferredduringprolongeddry seasonortopdressingcloselyspacedcropsiewheat.

- Dripmethod-appliedthroughirrigationwater.Itsappliedthroughperforatedpipes orbottles.Commonlyusedinhorticulturalcropfields.

DeterminationofFertilizerRates

Contentsoffertilizersareexpressedasfertilizergradeorfertilizeranalysis.

- Fertilizergradeindicatetheguaranteedminimumoftheactiveingredients(N,P_2O_5,K_2O)inthemixtureoramountofeachnutrientcontainedinafertilizer.Itscalculatedby findingoutchemicallythepercentageofeachnutrientpresentinafertilizer

  Percentageofnutrient=nutrientcontent/totalweightofthefertilizer.Itsintermsof thethreemacronutrientsNPK.10-10-10gradecontains10kgN10kgofP2O5and 10kgsofK2O.30kgsformsactiveelementswith70kgsfillermaterial.
- Fertilizerratio-givesrelativeproportionofthethreeprimarymacronutrients.A 10:10:10hasN:P2O5:K2Ointheratioof1:1:1
- Theamountoffertilizerornutrientrequiredperunitarea-itdependsontheamountof nutrientsneededandfertilizergrade.
- Itisexpressedasapercentageonaweighttoweightbasisorpercentagebyweight

  Example10:20:0meansforevery10kgofthemixturethereare10kgofnitrogen,20kgof P_2O_5and0kgofK_2O.

  Amountoffertilizerappliedinthefieldisdeterminedbytheamountofplantnutrients available.

Example

Afarmerwasaskedtoapplyfertilizersasfollows:

- 60kg/hanitrogen(topdressing)
- 60kg/haP_2O_5(inplantinghole).
- 60kg/haK_2O.

Howmuchsulphateofammonia(20%)wouldberequiredperhectare?

Howmuchdoublesuper-phosphate(40%)P_2O_5wouldberequiredperhectare?

Howmuchmuriateofpotash(50%K_2O)wouldberequiredperhectare?

Answer/Solution

- Sulphateofammonia(SA)whichgives60kg/haN

  $=\frac{60}{20}x100=300kgSA$
- Doublesuperphosphate(40%P_2O_5)whichgives60kg/haP_2O_5

  $\frac{60}{40}x100=150kgDSP$
- Muriateofpotash(60%K_2O)whichgives60kg/hK_2O

  $=\frac{60}{60}x100=100kgmuriateofpotash$

Example

Afarmerwasaskedtoapplyfertilizersasfollows:

- 200kg/haofDSP(40%P_2O_5
- 150kg/haofmuriateofpotash(60%K_2O)
- 150kg/haofsulphateofammonia(20%N)

HowmuchP2O5didthefarmerapplyperacre?

HowmuchK₂Odidthefarmerapplyperhectare?
HowmuchNdidthefarmerapplyperhectare?

Solution/Answer

- P_2O_5appliedperhectarefrom200kgofDSP

$$\frac{40}{100} \times 200 = 80\text{kg/ha}P_2O_5$$

- K_2O_5appliedperhectarefrom150kgofmuriateofpotash

$$\frac{60}{100} \times 150 = 90\text{kg/ha}K_2O$$

- Nappliedperhectarefrom150kg/hasulphateofammonia

$$\frac{20}{100} \times 150 = 30\text{kg/ha}N$$

Carboncycle

Carboncyclereferstoaseriesofchangeswhich,carbonundergoesintheatmosphere, watersoilandleavingorganisms.

Occursinformofcarbondioxideandforms0.03%byvolume.Plantsacquirecarboninform ofcarbondioxide.

Waysinwhichcarbonisremovedfromtheatmosphere

i) Photosynthesis-carbondioxidecombineswithwaterinpresenceofsunlightto formcarbohydratesingreenplants.Oxygenisgivenoutasabyproduct

ii) 6CO2+6H2O……C6H12O6+6O2

iii) Itdissolvesinrainwaterformingcarbonicacidthatgetsintothesoilleadingto weathering.

Waysinwhichcarbonisreturnedintotheatmosphere

i) Respiration-carbondioxideisgivenoffduringaerobicrespirationinlivingcells ii) Combustion-burningofcarboncontainingmaterialreleasescarbondioxideinto theatmosphere.

iii) Decomposition-whenplantsandanimalsdecay

Importanceofthecarboncycle

- Maintainsthevolumeofcarbondioxideintheatmosphere
- Ensuresconstantsupplyofcarbondioxideforplantuser
- Ensuresbalancebetweencarbondioxideandoxygentopreventthebuildupofcarbon dioxidetoatoxiclevel.

Nitrogencycle

Referstoaseriesofchangeswhichnitrogenundergoesbetweentheatmosphere,water,so il
andlivingorganisms.Nitrogenoccursnaturallyinformofnitrogenforming78%byvolume.

Waysinwhichnitrogenisremovedfromtheatmosphere

i) Nitrogenfixationbylighting-itinvolvesnitrogencombiningwithoxygentoform nitricoxide.Theoxideisoxidizedtonitrogendioxidethatdissolvesformingnitric acid

N2+O2--------2NO

NO+O2--------NO2

NO2+H20-------H2NO2+H2NO3

Nitricacidionizestoformnitrateionsreadilyavailabletoplants. ii) Nitrogenfixationbynitrogenfixingbacteria

Itinvolvesbothsymbioticandnonsymbioticnitrogenfixation.

Symbioticnitrogenfixationinvolvesrhizobiumbacteriainrootnodulesof leguminousplants

Non-symbiotic-involvesfixationbyfreelivingbacteriafoundinthesoilie azotobacterandclostridium

iii) Nitrification-theprocessbywhichammoniumcompoundsareconvertedinto nitratesandnitritesbynitrobacterandnitrosomonasbacteria.

iv) TheHarber–Boschprocessisaprocessthatresultsinformationofammonia

N2+3H2……2NH3

AmoniaformedisusedtoprepareSAandCAN

Waysinwhichnitrogenisreturnedintotheatmosphere

i)Denitrification

Istheconversionofnitratesintoammoniagasandammoniumionsthatescapesinto theatmosphere.itscommoninwaterloggedandcompactedareas.

ii)Combustion

Somenitrogeneouscompoundsareconvertedintoammoniaandnitrogenoxidew hen vegetationisburned. iii)Volatilization

Someammoniumcompoundssublimeformingammoniagasthatescapesintothe atmosphere.

Importanceofnitrogencycle

i. Ensuresavailabilityofnitrogeneouscompoundsinthesoilforplantuse
ii. Ensuressurvivalofanaerobicmicroorganismsieclostridium.

SoilSampling

- Referstotheprocessofobtainingofsmallquantityofsoilfromthefieldtobea representativeinallaspectsoftheentirefarm.Itsdonetotestforsoilnutrientsand soilPH.Italsogivesinformationaboutsoilstatus.

SoilSamplingProcedures

Itvariesbasedonthelocalsituations.

- Clearthevegetationoverthesite.
- Digoutsoilatdepthsof15-25cmforcroplandand5cmforpastureland.

- Placethedugoutsoil(usingsoilauger)inacleancontainer.
- Repeattheprocedurein15-20spots
- Mixthoroughlythesoilinthecontainer.
- TakeasampleandsendittoNationalAgriculturalLaboratoryforanalysis.
- Thecontainercarryingthesub-sampleorcompositesampleshouldbeproperly labeledasfollows:
  - Nameofthefarmer,
  - Location,
  - District
  - Addressofthefarmer.
  - Fieldnumber
  - Dateofsampling

SitestoAvoid–thisareasgivemisleadinginformation

- Deadfurrows,ditches.
- Swamps
- Nearmanureheaps.
- Recentlyfertilizedfields
- Anthills.
- Underbigtrees.
- Nearfencelinesorfootpaths.
- Donotputthemincontainerswhicharecontaminatedwithfertilizersorother chemicalcontainers.

MethodsOfSoilSampling:

- Zigzagmethod–locationsfortakingsoilsamplesarearrangedinazigzagway.
- Traversemethod–determinethefourcornersofafieldandtakesamplesdiagonally

SoilTesting

- It’stheprocessofanalyzingsoilsamplestodeterminetheabilitytosupplythe essentialelementsortheanalyzingofthesoilsampletodeterminecertainqualitieso f thesoil.

ImportanceofSoiltesting:

- Todeterminethevalueofthesoilhencedeterminethecroptogrow.
- Todeterminethenutrientcontenthencefindoutthetypeandamountoffertilizerto apply.
- Todeterminewhetheritisnecessarytomodifythesoilp Hforacrop.
- Helpstodiagnosethecauseoflowcropyields.

SoilPH

Referstothepotentialhydrogenorhydrogenionsconcentrationinasoilsolution.It’sa measureoftheacidity(H^+)oralkalinity(OH^-)ofthesoilsolution.It’sthenegativeofthe logarithmtobase10ofthehydrogenionconcentration.PH=-log[H^+]For[H^+]=10^{-6}PHis6.

HowSoilpHaffectsCropProduction

- Influencesthephysicalandchemicalpropertiesofthesoil.
- Affectstheavailabilityofnutrients.

- Influencestheincidencesofsoilbornediseases.
- Determinethetypeofcroptobegrownatagivenarea.

MethodsofpHTesting

- Universalindicatorsolution(colourindicatordyes)-it’sacommonlyused method
- pHmeter–onlyusedinresearchinstitutes,colleges,universitiesandsome collegetraininginstitutes.

ProceduresofdeterminingsoilPHusingcolourindicator

i.BDHuniversalindicatormethod

- Placesmallquantityofsoilonaporcelainplateandadd1-2cm3oftheindicator
- Washthesoilwiththeindicatorandallowtheindicatortodrainawayintoaclean partoftheporcelain.
- Observethecolourofthesolutionagainstthe PHcolourchart.
- Estimatetheacidityoralkalinityofthesolution.

ii.Soiltestwithuniversalindicatorpapers

- Addasmallamountofsoilsampletocm3of25boileddistilledwater
- Shakethemixturethoroughlyanddeepapieceofthe PHpaper.
- Checkthecolourofthe PHpaperagainstthecolourcharttofindoutthe PHvalue.

iii.Fieldtestusingprintedcolourstandards

- Fillthetesttubeswithbariumsulphatetoa3cmdepth(forfinesoilusemore bariumsulphatelessforcoursesoils)toensureflocculationandprecipitationof colloidalclay,
- Addsoiltoadepthof55cmineachtesttube
- Addboileddistilledwateruptotheuppermark
- Add8dropsofBDHsoilindicatortooneofthetesttubeandleavetheothers without
- Shakethetesttubeforoneminuteandallowittosettle
- Holdthetesttubessidebysideandviewthecolouronthechartthroughtheblank tubes.
- Slidethechartalonguntiltheprintedcolourviewedthroughtheblanktube

matchesthecolourofsuspensioncontainingindicator

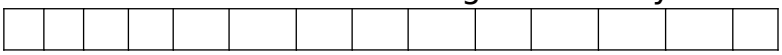
NBredcolourindicateacidicwhileblueindicatealkalineorbasic

iv.Usingcommercialsoiltestingkit

- Adddistilledwatertoasmallsoilsampletomakesoilsolution
- Addafewdropsofcolourindicator
- Comparethecolourofthesoilsolutiontothatonthechart

ThePHscale

It’sascaleusedtoestimatethedegreeofacidityoralkalinityofasolution.



Itrunsfrom1-14.PH7representsneutral.PHvaluebelow7indicatesacidic conditionwhileabove7alkalineconditions.SoilPHinfluencesavailabilityofvarious nutrientsinthesoil.
Mostnutrientsarereadilyavailableatneutrality.Phosphates(6-57-5)
AtPH8.5–potassium,manganese,boron,ironandzincareunavailable
LowPH–lowersavailabilityofphosphorous

HowsoilPHaffectscropproduction

- Influencesthephysicalandchemicalpropertiesofthesoil
- Affectsavailabilityofnutrients
- Influencesincidencesofsoilbornediseases
- Determinethetypeofcroptobegrownatagivenarea

ImportanceofsoilPHtocrops

- Itdeterminepresenceorabsenceofnutrients
- Itcontrolstheactivitiesofsoilmicroorganism-lowPHinhibitssoilmicroorganism activityienitrogenfixationhencelownutrientlevels.OptimumPHformicrobial activityis5.5-7.8
- SoilPHmaydeterminethesurvivalofpestsienematodesseriouslydamageplantsin acidicsoils.LowPHlowersplantresistancetopests
- Determinesthetypeofcroptobegrown-differentcropsspeciesreactdifferentlyto soilPH.barleyisaffectedbylowPH.TeadoswellatlowPHoatsdoeswellatboth lowandhighPH.

Importanceofsoiltesting

- Todeterminethenutrientcontenthencefindoutthetypeoffertilizertoapply
- Todeterminewhetheritisnecessarytomodifythesoil PHforacrop
- Todeterminethevalueofthesoilhencedeterminethecroptogrow

CropproductionII(Planting)

- Plantingistheplacementoftheplantingmaterialinthesoilforthepurposeofregenerationinordertoproduce moreoftheplantspecies.

Typesofplantingmaterials

i)Seeds

- Seedsareproducedbyfloweringafterpollinationandfertilization.Theycontainthepartoftheplant thatgerminatesandsubsequentlygrowsintonewplants.

Advantagesofusingseedsasplantingmaterials.

- Seedsareeasilytreatedagainstsoilbornepestsanddiseases.
- Theyarenotbulkythereforestorageiseasy.
- Theyareeasytohandleduringplantingmakingoperationeasy.
- Whenplantingseeds,itiseasytousemachineslikeseedplantersanddrillers.
- Itiseasytoapplymanuresandfertilizerstogetherwithseedsduringplanting.
- Fertilizersandmanuresapplicationcanbeeasilymechanized.
- Itispossibletodevelopnewcropvarietiesduetocrosspollination.

Disadvantagesofusingseedsasplantingmaterials.

- Someseedshavelongdormancyandtheymayneedspecialtreatmentinordertogerminate.
- Plantsraisedfromseedshavevariationsfromthemotherplantduetocrosspollination,Thismay introduceundesirablecharacteristics.
- Soilbornepestsmaydamageseedsifleftforsometimeinthesoilbeforerainfalls.

  Someseedsmayloseviability ifstoredforalongtime.Thisleadstogapsinthefarm.

ii)Vegetativematerials.

Theseareplantpartswhichhavetheabilitytoproduceroots,theygrowanddevelopintonewplants.
Theyincludeleaves,roots,orstems.Theyareusedalongastheyarecapableofrooting.

Advantagesofusingvegetativematerialsforplanting.

- Cropsoriginatingfromvegetativematerialsmaturesfasterthanthosefromseeds.
- Thecropsshowsuniformityinsuchqualitiesasdiseaseresistance,seedsize,colour,keepingor storingqualityandchemicalcomposition.
- Itispossibletoproducemanyvarietiesofcompatiblecropsonthesamerootstock.

- Useofthevegetativematerialsiseasierandfaster,especiallywhereseedsshowprolongeddormancy.
- Theresultingplanthasdesiredshapeandsizeforeaseofharvestingandspraying.
- Itfacilitatesthepropagationofcropswhichareseedlessorthosethatproduceseedswhicharenot viableorhavealongdormancyperiod.Suchcropsincludesugar-cane,bananas,Napiergrassand others.

Disadvantages.

- Vegetativepropagationdoesnotresultinnewcropvarieties.
- Keepingthematerialsfreeofdiseasesisdifficult.
- Materialscannotbestoredforlong.
- Thematerialsarebulkyandthereforedifficulttostoreandtransport.

Plantpartsusedforvegetativepropagation.

i) Bulbils.

- Thesearetinysisalplantsproducedintheinflorescencealmostattheendoftheplantgrowth cycle.
- Theyresemblethemotherplantexceptthattheyaresmallerinsize.
- Theyareproducedbythebranchesofthesisalpole.
- Whenmanuretheymaturetheydeveloprudimentaryrootsandfallofftothegroundjustbelowth e pole.
- Theyarethencollectedandraisedinthenurseriesbeforetheyaretransplantedt\othemainfield.
- Onesisalpolemayproduceasmanyas3,000bulbils.Theyareusually10cmlong.Theymakegoodplanting materialsandarebetterthansuckers

ii) Splits

- Theseareplantletsdividedfromtheexistingmotherplantwithcompletewithcompleteleaves androotingsystem.
- Theyareusedtopropagatemostpasturegrassesandpyrethrum.
- Pyrethrumsplitsareraisedfirstinnurseryandthentransplantedtothefield.

iii) Crownsandslips

- Thesearematerialsusedtopropagatepineapples
- Crownsarebornontopofthefruitsandarebrokenoffandpreparedforplanting.
- Theyaremorepreferredtosuckersbecausetheygiveuniformgrowthandtaketwoyearstoreach maturity.
- Slipsarebornetothebaseofthepineapplefruits.

- Theyarecutandpreparedforplantings.
- Theirgrowthrateisfasterthanforcrownsgivingaverageuniformity.
- Theytake22monthsfromplantingtomaturity.
- Crownsandslipsareplantedinthenurseriesfirstbeforetransplantingtothemainseedbed.

iv) Suckers

- Thesearesmallplantsthatgrowfromthebaseofthemainstem.
- Theyhaveadventitiousrootswhichgrowquicklywhenplantedtoformanewplant.
- Theyareusedtopropagatebananas,sisal,andpineapples.
- Whenplanted,suckersgiveunevengrowthleadingtomaturityatdifferenttimes.Theyshouldbe plantedwhentheyareyoung.

v) Tubers

- Theseareundergroundfoodstorageorganswhichareshortandthick.
- Theyareusedasvegetativepropagationmaterialsbecausetheysproutandproducerootsfor growth.
- Therearemainlytwotypesoftubers,thestemandroottubers.
- Roottubersdevelopfromthethickeningoftheadventitiousroots.
- Roottubersarenotcommonlyusedforpropagationsincetheyproduceweakstems.
- Agoodexampleofaroottuberisthesweetpotato.
- Ontheotherhandstemtubershavesomeauxiliarybudswhicharesometimesreferredtoas‘eyes’.
- Theseeyessprouttoproducestemswhichgrowintoplants.Stemtubersarethereforeswollen stemswithscalesleaves.
- AgoodexampleofastemtuberisIrishpotato.

vi) Vines.

- Thesearesoftwoodcuttingswhichproducerootseasilyuponplantingtogiverisetonewplants.
- Theyarecutfromthemotherplantsandplanteddirectlyintothefield.
- Softwoodcuttings(vines)aretakenfromrapidlygrowingshoots.
- Thesoftupperpartsoftheshootsarepreferred.
- Whenpreparingthecuttings,someleavesandnodesareincluded.
- Rootsareproducedfromthenodes.

vii) Cuttingsandsetts

- Cuttingsareportionofplantspartswhicharecutandthenplanted. o

  Theymaybefromstems,rootsorleaves. o

  Astemcuttingmusthaveabudwhichdevelopsintoshoot. o

  Therootcuttingmusthaveaneye.Cuttingmusthaveaneye. o

  Cuttingsmustproduceleavesassoonaspossiblesothattheycanstartmakingtheirownfood. o

  Sometimescuttingsareinducedtoproducerootsbyuseofrootinghormones. o

  Oncethecuttingshavedevelopedroots,theygiverisetonewplants.

- Insomecrops,thecuttingsarebigenoughtobeplanteddirectlytothemainseedbedwhereas therearesomeplantswhosecuttingsarefirstraisedinspecialnurseriesbeforetheyare transplantedtotheseedbed.

- ThecuttingsofNapiergrassandsugar-caneareplanteddirectlyontheseedbedbutthoseoftea; havetoberaisedinspecialnurserybeforetheyaretransferredtotheseedbed.

- Examplesofcropswhicharepropagatedbyuseofstemcuttingsinclude:tea,cassava,andsugar -caneandNapiergrass.

- Thestemcuttingsusedtopropagatesugar-caneareknownas‘setts’.Settsarestemcuttings whichhave3-5nodesareusually30-45cmlong.

Factorsaffectingrootingofcuttings.

 Temperature:forthecuttingstoproducerootswarmtemperaturesarerequiredaroundthe rootzonewhilecooltemperaturesareimportantfortheaerialpartofthecuttings.Formost speciesoptimumdayandlighttemperaturesforrootingare22-27°cand15-21°crespectively.

a)Relativehumidity:Properrootingofcuttingsrequireshighhumiditywhichlowerthe transpirationrate.Italsoincreasesandmaintainsleafturgidityallthetime.Assuch,cuttings shouldberootedingreenhousesorundershadyconditions,whererelativehumiditycanbe regulated.Sometimesthepropagationareacanbesprayedwithwatertokeepitmoist.

b)Lightintensity:softwoodcuttingsneedhighintensitylighttoproduceroots.Thisisbecause lightpromotestheproductionofrootssinceitaffectstherateofphotosynthesis.Hardwood cuttingsdowellindarkconditionssincetheyhavehighamountofstoredcarbohydratesand thereforerootingisexcellentindarkness.

c)Oxygensupply:plentifulsupplyofoxygenisrequiredforrootformation.Therootingmedium usedmustthereforebecapableofallowingproperaeration.

d)Chemicaltreatment:therootinghormoneswhichpromotetheproductionofrootsin cuttings.ThecommononesincludeIAA (Indoleaceticacid).

e)Leafarea:Softwoodscuttingsrequirealotofleavesforphotosynthesiswhilehardwood cuttingswillproducerootsbetterwithoutleaves.

Selectionofplantingmaterials

Whenselectingmaterialsforplantingthefollowingfactorsmustbeconsidered:

- Suitabilitytotheecologicalconditions–theselectedplantingmaterialsshouldbewelladaptedtothe soilconditions,temperaturesandamountofrainfallinthearea.Therearemanyvarietiesofmaize,for example,whicharesuitabletodifferentecologicalconditions.Hybrid622forexampleismainlyforthe highaltitudesareasofKenya513forthemediumaltitudesandtheKatumanicompositesforthelow rainfallareaswhilethecoastcompositesaresuitableforthecoastalconditionseach varietywill growwellandproducehighyieldsifgrownunderthecorrectconditions

- Purityofthematerials-plantingmaterialsshouldbepureandnotmixedwithotherofftypesthe percentagepurityofplantingmaterialswillaffecttheseedwhilehigherseedsratesareusedforimpure seeds.

- Germinationpercentage-Thisisameasureofthegerminationpotentialofseedsitisexpressedasa percentageforexampleagerminationpercentageof80meansthatforevery10seedsplanted80of themareexpectedtogerminate.Germinationpercentagehelpstodeterminetheseedratesofcrops lowerseedratesareusedforcropswithhighergerminationpercentagewhilehigherseedratesare usedforthosewithlowergerminationpercentage.

- Certifiedseeds-Thesearеseedswhichhavebeentestedandproventohave100germination potentialandfreefromdiseasesandpeststheygivehighyieldsafterthefirstplantingbutthe subsequentyieldsdeclineifreplacedthereforeinthiscaseitisalwaysadvisabletobuynewseeds whicharecertifiedeverytimeplantingisdone

  InKenyacertifiedseedsareproducedbytheKenyaseedcompany(KSC)anddistributedbyKenya FarmersAssociation(KFA)andotheragents.

PREPARATIONOFPLANTINGMATERIALS.

Aftertheplantingmaterialsareselectedtheyarepreparedindifferentwaysbeforetheyareplanted. Someofthemethodsusedtoprepareplantingmaterialsincludethefollowing:

(a)Breakingtheseeddormancy.

Someseedsundergoadormancyperiodbetweenmaturityandthetimetheysprout.Thedormanc y periodisthestage wherebyaseedcannotgerminate,thestageofinhibitedgrowthofseed.It shouldbebrokenbeforetheseedisplanted.

Methodsofbreakingseeddormancy.

Thefollowingmethodsareusedtobreakseeddormancy:

(I)Mechanicalmethod:Thisisamethodwhichaimsatscratchingtheseedcoattomakeitpermeableto water.Scarificationisdonebyrubbingsmallsizedseedsagainsthardsurfacesuchassandpaper,while fillingornickingtheseedcoatwithaknifeisdonetolargesizedseedssuchascrotonseeds.

(ii)Heattreatment:thisinvolvestheuseofhotwaterorburningtheseedslightly.Itsoftenstheseedcoat makingitpermeabletowaterandthusisabletogerminate.Theseedsaresoakedinhotwaterabout80’c for3-4minutesafterwhichthewaterisallowedtodrainoff.Exampleofseedstreatedinthiswayinclude: leucean$7a^2+3^2=2^2$calliadraandacacia.

Lightburningalsoservesthesamepurposeashotwatertreatment.Inthiscasetrashisspreadoverthe seedswhicharealreadycoveredwithathinlayerofsoil.Thetrashisburned,afterwhichtheseedsare retrievedandplanted.Examplesincludeacaciaandwattletreeseeds.Overheatingshouldbeavoidedas thiswillcooktheseeds.

(iii)Chemicaltreatment:seedsaredippedinspecificchemicalssuchasconcentratedsulphuricacid,fortwo minutesandthenremoved.Thechemicalwearsofftheseedcoatmakingitpermeabletowater.Careshouldbe takennottoleavetheseedsinthechemicalsfortoolongasthiswillkilltheembryo.Cottonseedsarenormally treatedwithchemicalstoremovethelintorfibres.

iv)Soakinginwater:seedsaresoakedinwaterforaperiodofbetween24–48hoursuntiltheyswell.Theyare thenremovedandplantedimmediately.Theseedstreatedthusgerminateveryfast.Pre-germinatedseedsare usedwhenraisingriceinthenurseries. b)Seeddressing

Thisisthecoatingofseedswithfungicidesoraninsecticideoracombinationofthetwochemicals.Thisis particularlycommonwithcereals,sugar-caneandlegumes.

Thechemicalsprotecttheseedlingsfromsoil-bornediseasesandpests.Certifiedseedswhicharesoldbyseed merchantsinKenyahavebeendressedwiththesechemicals.Farmerscanalsobuythechemicalsanddress theirownseeds. C)Seedinoculation

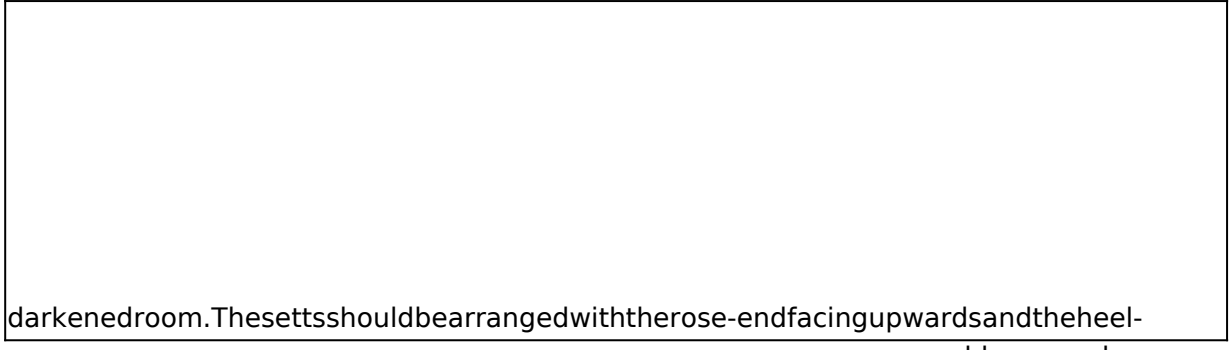
Inareaswheresoilsaredeficientinnitrogen,legumessuchasbeans,cloversandpeasshouldbecoatedwith aninoculant.Aninnoculantisapreparationwhichcontainstherightstrainof Rhizobiumdependingonthetype oflegumeandencouragesnodulation,hencenitrogenfixation.Belowisatableshowingdifferentlegumecrop s andtheirrightstrainofRhizobium.

Cropinoculationgroup	RhizobiumSpecies
Lucerne	R.melioti
Clover	R.trifoli
Pea	R.leguminosarum
Bean	R.phaseoli
Lupin	R.lupine
Soyabean	R.japonicum

Whenhandlinginoculatedseeds,careshouldbetakentopreventthemfromcomingincontactwithchemical s. Thismeansthatinoculatedseedsshouldnotbedressedwithchemicalsasthesewillkillthebacterium.They shouldalsobeplantedwhenthesoilismoisttoavoiddehydrationwhichkillsthebacterium.

d)Chitting

Thispracticeisalsoreferredtoassprouting.Theselectedseedpotatoes‘setts’whichareusedasplanting materialsaresproutedbeforeplantingtobreaktheirdormancy.Thesettsofabout3-6cmindiameterare arrangedinlayersof2or3tubersdeepinapartially



darkenedroom.Thesettsshouldbearrangedwiththerose-endfacingupwardsandtheheel-enddownwards.
Diffusedlightencouragestheproductionofshort,greenandhealthysprouts.IfChittingisdoneincomplete darkness,long,palethinsproutsdevelopwhichbreakeasilyduringplanting.DuringChittingpotatoaphidsand tubermonthsshouldbecontrolledbydustingorsprayingthesettwithdimethoate.Sometimesachemical knownasRenditeisusedtobreakdormancy,thusinducingsprouting.Chittingisdonemainlytomakesurethat growthcommencesimmediatelytheseedisplantedsoastomakemaximumuseofrainsforhighyields.

Timeofplanting

Thetimingofplantingorsowingisinfluencedbythetypeofcroptobeplantedandtheenvironmental conditionsofthearea.

Factorstoconsiderintimingplanting.

- Therainfallpattern/moistureconditionofthesoil.
- Typeofcroptobeplanted.
- Soiltype.
- Marketdemand.
- Prevalenceofpestsanddiseases.
- Weedcontrol.

Timelyplantingisnecessaryandshouldbedoneattheonsetofrains.Insomeareaswhererainfallisscaredry plantingisrecommended.

Advantagesoftimelyplanting.

- Cropsmakemaximumuseofrainfallandsuitablesoiltemperature,leadingtovigorousgrowth.
- Cropsusuallyescapeseriouspestsanddiseasesattack.
- Cropsbenefitfromnitrogenflushwhichisavailableatthebeginningoftherain.
- Forhorticulturalcrops,propertimingensuresthattheproduceismarketedwhenpricesarehigh.
- Cropsestablishearlierthantheweeds,hencesmotheringthem.

Methodsofplanting.

Therearetwomainmethodsofplanting:

Broadcasting.

- Rowplanting.

Broadcasting.

Thismethodinvolvesscatteringtheseedsalloverthefieldinarandommanner.Itiscommonlyadaptedfor lighttinyseedssuchasthoseofpasturegrasses.Itiseasier,quickerandcheaperthanrowplanting.However, itusesmoreseedsthanrowplantingandtheseedsarespreadunevenlyleadingtocrowdingofplantsinsome

places.Thisresultsinpoorperformanceduetocompetition.Broadcastinggivesagoodgroundcover,but weedingcannotbemechanized.Forgoodresults,theseedbedshouldbeweed-free,firmandhaveafinetilth.

Rowplanting.

Theseedsorotherplantingmaterialsareplacedinholes,drillsorfurrowsinrows.Thedistancebetweenone rowtotheotherandfromoneholetotheotherisknown.InKenya,bothlargeandsmall–scalefarmers practicerowplanting.Itispracticedwhenplantingmanytypesofcrops,especiallyperennial,annualandroot crops.

Advantagesofrowplanting.

- Machinescanbeusedeasilybetweentherows.
- Itiseasytoestablishthecorrectplantpopulation.
- Lowerseedrateisusedthanifbroadcastingisadopted.
- Itiseasytocarryoutculturalpracticessuchasweeding,sprayingandharvesting.

Disadvantagesofrowplanting.

- Itdoesnotprovideanamplefoliagecover.Thusthesoilisliabletobeingerodedbywindandwater.
- Itismoreexpensivethanbroadcastingbecauseofconsumingalotoflabourandtime.
- Itrequiressomeskillinmeasuringthedistancesbetweenandwithintherows.

Seedscanalsobeplantedbydibblingwheretheplantingholesaredugbyuseofpangasorjembe,orbya dibblingstick(dibbler).Mostofthedibblingisdonerandomlyalthoughrowscanalsobeusedwhenusinga plantingline.Randomdibblingisnotpopularincommercialfarmingduetolowlevelsofproduction.Itisonly commonamongconservativefarmersinplantingoflegumessuchasbeans,pigeonpeasandcowpeas.

Over-sowing.

Thisistheintroductionofapasturelegumesuchasdesmodiuminanexistinggrasspasture.Someformof growthsuppressionofexistinggrasssuchasburning,slashingorhardgrazingplusslightsoildisturbanceis recommendedbeforeoversowing.Aheavydoseofsuperphosphate,preferablysinglesupersatarateof2004 00kg/haisapplied.Thegrassmustbekeptshortuntilthelegumeisfullyestablished.Regardlessofthe methodofestablishment,thepasturesandfodderstandsshouldbereadyforlightgrazing4-5monthsafter plantingifrainfallandsoilfertilityarenotlimiting.

Under-sowing.

Thisreferstotheestablishmentofpastureunderacovercrop,usuallymaize.Maizeisplantedas recommendedandweeded2-
3weeksaftertheonsetofrains.Pastureseedsarethenbroadcastedwithhalfthe recommendedbasalfertilizer.Nofurtherweedingshouldbedoneandmaizeshouldbeharvestedearlyto exposetheyoungpastureseedlingstosunlight.Thebenefitsofundersowingincludefacilitatingmoreintensi ve landutilizationandencouraginganearlyestablishmentofpastures.

Foddercropsandvegetetivelypropagatedpasturespeciesmayalsobeundersownaslongasrainfallis adequatefortheirestablishment.Timingisnotverycrucialinthiscaseandplantingcanbedoneaslateas6-8 weeksaftertheonsetofrains.

Plantpopulation

Thisreferstotheidealnumberofplantsthatcanbecomfortablyaccommodatedinanygivenarea,without overcrowdingortoofewtowastespace.Agriculturalresearchhasarrivedattheoptimumnumberofvarious

cropplantstoberecommendedtofarmers.Plantpopulationisdeterminedbydividingtheplantingareaby spacingofthecrop.Thismaybesimplifiedthus:

$$\text{Plantpopulation} = \frac{\text{Areaofland}}{\text{Pacingofcrop}}$$

Example

Giventhatmaizeisplantedataspacingof75x25cm,calculatetheplantpopulationinaplotofland measuring4x3m.

Working

$$\text{Plantpopulation} = \frac{\text{Areaofland}}{\text{Pacingofcrop}}$$

Areaofland =400cmx300cm

Spacingofmaize =75cmx25cm

$$\text{Therefore,plantpopulation} = \frac{400\text{cm} \times 300\text{cm}}{75\text{cm} \times 25\text{cm}}$$

=64plants.

Spacing

Itisthedistanceofplantsbetweenandwithintherows.Correctspacingforeachcrophasbeenestablishedas shownintablebelow.

Crop	Spacing
Maize (Kitale) Hybrids	75–90cmx23–30cm
Coffee (Arabica)tallvarieties	2.75cmx2.75m
Tea	1.5mby0.75m
Beans(erecttype)	45-60mby25cm
Bananas	3.6–6.0mby3.6–4.5m
Coconut	9mx9m
Tomatoes(Moneymaker)	100x50cm
Kales	60x60cm

Spacingdeterminesplantpopulationandthemainaimofcorrectspacingistoobtainmaximumnumberof plantsperunitareawhichwillmakemaximumuseofenvironmentalfactors.Widerspacingleadstoareduced plantpopulationwhichmeansloweryields,whereascloserspacingcouldleadtoovercrowdingofplantsand competitionfornutrientsandotherresourceswouldoccur.Correctlyspacedcropsproduceyieldofhighqualit y thatareacceptableinthemarket.

Spacingisdeterminedbythefollowingfactors:

- Thetypeofmachinerytobeused. Thespacebetweentherowsshouldallowfreepassageofthemachinerywhichcanbeusedinthefield. Forexample,thespacingbetweenrowsofcoffeeissupposedtoallowmovementoftractordrawn implements.
- Soilfertility

Afertilesoilcansupporthighplantpopulation.Thereforecloserspacingispossible.

- Thesizeofplant
  Tallcropvarietiesrequirewiderspacingwhileshortvarietiesrequirecloserspacing,forexample,Kitale hybridmaizeiswidelyspacedthanKatumanimaize.
- Moistureavailability.
  Areaswithhigherrainfallarecapableofsupportingalargenumberofplantshencecloserspacingthan areasoflowrainfall.
- Useofcrop.
  Cropgrownforthesupplyofforageorsilagematerialisplantedatacloserspacingthanforgrain production.
- Pestanddiseasescontrol.
  Whencropsareproperlyspaced,pestsmightfinditdifficulttomovefromoneplacetotheother,for example,aphidsingroundnuts.
- Growthhabit.
  Spreadingandtilleringcropvarietiesrequirewiderspacingthanerecttype.

Seedrate.

Seedrateistheamountofseedstobeplantedinagivenunitareagovernedbyultimatecropstandwhichis desired.Theobjectiveofcorrectspacingofcropistoobtainthemaximumyieldsfromaunitareawithout sacrificingquality.Mostcropsareseededatlighterratesunderdrierconditionsthanunderwetorirrigated conditions.Seedswithlowgerminationpercentageareplantedathigherratesthanthosewhichhaveabout 100%germinationpercentage.Thereisanoptimalseedrateforvariouscrops.Forexample,theseedratefor maizeis22kgperhectare,wheatis110kgperhectareandcottonisbetween17to45kgperhectare.

Factorstoconsiderinchoosingseedrates.

- Seedpurity.
  Whenplantingseedwhichispureorwithahighgerminationpercentage,lessseedisrequired.Onthe contrary,moreseedsarerequiredwhenusingimpureormixedseeds.
- Germinationpercentage.
  Lessseedisusedwhenitsgerminationpercentageishigher.Seedoflowergerminationpercentageis requiredinlargeamounts.
- Spacing.
  Atcloserspacing,moreseedsareusedthaninawiderspacing.
- Numberofseedsperhole.
  Whentwoormoreseedsareplantedperhole,higherseedrateisrequiredthanwhenonlyoneseedis plantedperhole.
- Thepurposeofthecrop.
  Acroptobeusedforsilagemakingisspacedmorecloselythanonemeantforgrainproduction.This wouldrequireuseofmoreseeds.Maizetobeusedforsilagemaking,forexample,requiresmoreseeds thanthatmeantforproductionofgrain.

Depthofplanting.

Thisisthedistancefromthesoilsurfacetowheretheseedisplaced.Thecorrectdepthofplantingis determinedby:

- Soiltype:seedswillemergefromgraterdepthsinsandysoilthatarelighterthaninclaysoils.
- Soilmoisturecontent:Itisrecommendedthatoneplantsdeepindrysoilsinordertoplacetheseeds inazonewithmoistsoil.
- Sizeoftheseed:Largerseedsareplanteddeeperinthesoilbecausetheyhaveenoughfoodreserves tomakethemshootandemergethroughthesoiltothesurface.
- Typeofgermination:seedswithepigealtypeofgermination(carrycotyledonsabovethesoilsurface) suchasbeans,shouldbeplantedshallowerthanthosewithhypogealtypeofgermination(leave cotyledonsunderthesoil)suchasmaize.

SuggestedActivities.

1. Learnerstocarryoutplantingusingbroadcastingmethodandplantingrows.
2. Learnerstoidentifydifferentvegetativepropagationmaterialsdisplayedbytheteacher.
3. Learnerstodeterminethecorrectplantpopulationforagivenareabymathematicalcalculations.
4. Learnerstocollectsamplesofdifferenttreeseedsandpreparethemforplantingbyvarious methodsofbreakingseeddormancy.
5. Learnerstodeterminethegerminationpercentageofdifferentsamplesofcerealsandlegume seeds.

CropProductionIII

(NurseryPractices)

Introduction

- Plantingmaterialsareeitherplanteddirectlyinaseedbedorindirectlythrougha nurserybed.
- Aseedbedisapieceoflandwhichcouldbesmallorlargeandpreparedtoreceive plantingmaterials.
- Anurserybedontheotherhandisasmallplotoflandspeciallypreparedforraising seedlingsorplantingmaterialsbeforetransplanting.
- Itisusually1mwideandanyconvenientlengthdependingonthequantityofseedlings toberaised.
- Aseedlingbedisaspecialtypeofnurserybedusedforraisingseedlingsprickedout fromthenurserybedduetoovercrowdingbeforetheyarereadyfortransplanting.
- Prickingoutreferstotheremovalofseedlingsfromanurserybedtoaseedlingbed.
- Nurserypracticesrefertoalltheactivitiescarriedoutthroughoutanurserylifetoraise seedlings..

ImportanceofNurseryBedinCropProduction

- Tofacilitatetheproductionofmanyseedlingsinasmallarea.
- Itiseasytocarryoutmanagementpracticesinanurserythanintheseedbed.
- Itfacilitatestheplantingofsmallseedswhichdevelopintostrongseedlingsthatare easilytransplanted.
- Itensurestransplantingofonlyhealthyandvigorousgrowingseedlings.
- Itreducestheperiodtakenbythecropinthefield.
- Excessseedlingsfromthenurserymaybesoldtoearnincome.

SelectionofaNurserySite

Factorstoconsider;

- Nearnesstothewatersource.
- Typeofsoil.-shouldbewelldrained,deepandfertile,preferablyloamsoil.
- Topography.-itshouldbesituatedonagentleslopetopreventfloodinganderosion throughsurfacerun-off.

- Previouscropping.-toavoidbuildupofpestsanddiseasesassociated withparticularplantfamilies,considertheprecedingcrops.
- Security.-selectasitethatisprotectedfromtheftanddestructionby animals.
- Protectionagainststrongwindsandheatofthesun.-selectashelteredplace.i.e.to avoidexcessiveevapo-transpirationanduprootingseedlings.

TypesofNurseries

Categoriesofnurseries:

- VegetableNursery:
  - Theyareusedforraisingtheseedlingsofvegetablecrops.
  - Tomatoes,cabbages,kale,onions,brinjalsandpeppers.
- VegetablePropagationNurseries:
  - Theyareusedforinducingrootproductionincuttingsbeforetheyaretransplanted,
  - Thecuttingscanbeplanteddirectlyinthesoilandhencecalled bareroot nurseries.
  - Orplantedintocontainerssuchaspots,polythenebagsandothers,hencecalled containerizednurseries.
- TreeNurseries:
  - Theseareusedforraisingtreeseedlings.
  - Theseedlingscanberaisedinbarerootnurseriesorincontainerizednurseries.

Erectwoodenhoopsoverthesleevedcuttings

Placeapolythenesheetonthehoops.Burrythesheetintothegroundattheedges.

Waterthesleevesonceper3weeks.

NurseryManagementPractices:

- Thesearethepracticescarriedoutinthenurserywhiletheplantingmaterialsare growing. Theyinclude:

- Mulching.–lightmulchshouldbeappliedonthenurserybed.Itbeshouldberemoved onthe4th daywhenseedlingsstarttoemerge.Itpreventsexcessiveevaporationalso moderatessoiltemperature.
- Weedcontrol–removeweedsbyuprooting.
- Shading.–NBdarkconditionsmakeseedlingstobeetiolatedandpale
- Prickingout-involvesremovingovercrowdedseedlingsandplantingtheminasecond nurseryataspacingof3-4cmapart.Itsdonetoavoidcompetitionandallowseedlings togrowstrongandhealthy.
- Pestsanddiseasecontrol-beginswhenthesoilissterilizedthroughheat treatmentoruseofchemicalsi.efuradanduringnurseryestablishment.
- Hardeningoff–it’sapracticeofpreparingseedlingstoadapttothe ecologicalconditionsprevailingintheseedbed.Involvesreducingthe shadeandwatering1-2weeksbeforetransplanting. Watering– doneregularlyinthemorningandevenings.

Preparationofvegetativematerialsforplanting:

- Grafting–
  - Itisthepracticeofunitingtwoseparatewoodystems.Onepartprovidesthebase andhasarootingsystem.Theotherpartisobtainedfromanotherplant.
  - Thepartbearingtherootsisreferredtoasrootstockwhilethepartwhichis graftedontotherootstockisknownasscion.
  - Thescionhasbudswhichdevelopintothefutureplant.
  - Theabilityoftherootstockandthesciontoformasuccessfulunionistermedas compatibility. MethodsofGrafting - Whiportonguegrafting:
  - Inthiscasethediameteroftherootstockandthescionarethesame.Makea slantingcutusingasterilizedknifeonthescionandtopofthestock.
  - Itiscarriedoutwhenthediameterofthescionandtherootstockis'pencil'thick. Fittogetherthetwoseparatepartsandwrapwithagraftingtapeorpolythenestrip.

- Sidegrafting:Inthiscasethediameteroftherootstockisbiggerthanthat ofthescion.Scionisinsertedintothesideofthestock.

Othertypesofgraftinginclude;

- Approachgrafting,
- Notchgrafting

Barkgrafting.

Budding:

- Itisthepracticeofunitingavegetativebud(scion)toaseedlingofanotherplant.
- Thescionhasonlyonebudandsomebarkwithorwithoutwood.
- Thebudisinsertedinaslitmadeonthebarkofthestock.
- Itisheldtightlyonthestockbytyingwithabuddingtapeuntilitproducesashoot.

MethodsofBudding:

- T-budding–preparedbymakingaTshapedincision15-20cm abovethegroundthroughthebarkdowntothewood.Asharp knifeknownasbuddingknifeisused.Barkisraisedandbudslided downwardsthroughtheraisedbarkuntilitliesbetweentheedges ofthebark.Budisfirmlytiedusingeitheradhesivetapesor polythenepapers.Removethewrappingafter2weekstoinspect thebud.Thegreenbuddevelopstoproduceashoot.Thestockis thencutafewcmfromthescion.At25cmtheshootistiedtoa staketopreventitfrombeingblownbywind.
- Topbudding–involvesbuddingyoungorsmalltreesbyinsertingthebudatdesired locations.Itallowsforproductionofdifferentfruitsonthesamerootstock.
- Patchbudding-itswhereabudfromthescionstemisremovedandinsertedintoa patchwherethebarkhasbeenremovedfromtherootstock.

ImportanceofBuddingandGrafting:

- Plants withdesirablerootcharacteristicsbutwithundesirableproductsmaybe usedtoproducedesirableproductsforexamplelemon¬-orangegraft.
- Theyfacilitatethechangingofthetopofthetreefrombeingundesirabletodesirable
- Theymakeitpossibletogrowmorethanonetypeoffruitorfloweronthesameplant.
- Theyhelptopropagateclonesthatcannotbepropagatedinanyotherway.
- Theyhelptoshortenthematurityperiod.Iegraftedmangoestake3.5yrstomature non-graftedtakes7yrstomature.
- Graftinghelpstorepairdamagedtrees.

Layering

- Itistheprocessbywhichapartofaplantisinducedtoproducerootswhilestill attachedtothemotherplant.
- Oncetherootshavebeenproduced,thestemisthencutoffandplanted.

Typesoflayering;

- Marcottingoraeriallayering–usedonhardwoodplantswherethestemcant bebendeasily.Itinvolvesheapingmoistrootingmediaaroundasectionofa branchwhosebarkandcambiumlayerhavebeenremoved.Wraptherooting mediawithpolythenesheettomaintainitmoist.Auxinsaccumulateinducing rootdevelopment.
- Trenchlayering-itinvolvesbendingastemandlayingitinatrench.Holdit usingpegs.Coveritwithmoistsoil.Rootsdevelopatthebaseandthebuds developintoshootscutoff.Theshootisthencutfromthemotherplant.
- Tiplayering.-itinvolvesbendingtheterminalbudbearingshoottothegroundand coveringwithalayerofmoistsoil.Itisheldinpositionusingapeg.Afterrootingthe shootiscutfromthemotherplantandtransplanted.
- Compoundorserpentine–involvesbendingabranchseveraltimesandholditin positionwithpegstoproduceseveralnewrootedplantingmaterial.

TissueCultureforCropPropagation

- Tissueculture is a biotechnology used in cloning vegetatively propagated plants.
- It is based on the ability of plant tissue (or cells) to regenerate other parts of the plant. Tissues are also known as propagules or explants.
- The tissues are derived from shoot tips where cells are undergoing rapid cell division and are not differentiated.
- The cells are then provided with the right conditions which enable them to multiply and develop roots.

The Right Conditions for tissue culture:

- Culture medium containing correct nutrients and growth regulators
- Correct temperature.
- Correct light intensity and - Correct relative humidity.

Stages in plant tissue culture propagation.

Stage 1- aseptic culture is established and a propagule developed by enhancing cell division and enlargement. Void contamination using disinfectants (alcohol, calcium or sodium

hypochlorite,mercurychlorideandantibiotics).Sterilizealltools.Culturemediumismade of
inorganicminerals,carbonandenergysource(sugar)vitamins.Organicsupplimentsand growthregulators.
Stage2-subculturetorapidlymultiplythepropagulesthroughsomaticdevelopmentof embryostoproduceauxillarybudsandadventitiousroots.Theculturemediumisenriched withsubstancesthatenhanceplantorgandevelopment.

Stage3-involvespreparationofthepropaguleforestablishmentinthesoil.Itincludes:

i) Rootingoftheregeneratedplantlets

ii) Hardeningtheplantletsbyimpartingtolerancetomoisturestressandattackby pathogens.Occursduetochangeinphysicalenvironmentsieincreasingthe temperaturesandlightintensityandexposingplantletstoconditionssimilarto thoseinthefield.

iii) Convertingtheplantletsfromheterotrophicmodeofnutritiontoautotrophicmod e
ofnutrition.Rootingispromotedbyleavingoutthegrowthhormoneinthemediu m orsupplementingthemediumwithauxins.

ImportanceofTissueCultureinCropPropagation

- Itisusedtorecoverandestablishpathogen-freeplantsespeciallyinthecontrolof viraldiseases.
- Itisusedinmassproductionofplantletsorpropagules.
- Itisfastandrequireslessspacethantheculturalmethodsofusingcuttingwhich requiresabiggerspace.

Tissueculturerequireshighlyskilledmanpowerandspecialstructureswhere temperatureandhumidityarecontrolled.

TransplantingSeedlings

- Vegetableseedlingsarereadyfortransplantingwhentheyareonemontholdorhave 4-6leavesorareabout10-15cminheight.
- Beforetransplanting,thenurserybedisadequatelywatered3-4hoursbeforelifting theseedling.
- Thisensurestheseedlingsareliftedeasilywithaballofeartharoundtherootsto minimizerootdamage.
- Healthyandvigorousseedlingsareliftedusingagardentrowel.
- Transplantingisdonewhentheweatheriscoolpreferablymorningorevening.
- Seedlingisplantedatthesamedepthitwasinthenursery.Lowerleavesshouldnot touchthesoil. Applyalittlemulchandwatertheseedlingregularly.

Transplantingtreeseedlings.

- Theytakealittlelongertoreachtransplantingagecomparedtovegetableseedlings.
- Digtheholesforseedlinglongbeforetransplanting.Topsoiliskeptforrefilling.

- Transplantingshouldbedoneattheonsetofthelongrainstogivetheyoungtreesa goodstart.
- Watertheseedlingswelladaybeforetransplantingtomakesoiltostickaroundroots.
- Removepolythenesleeves
- Therootsaretrimmedbeforeliftingtheseedlingsforthoseraisedinthenurserybed.
- Placetheseedlingsatthecentreofthehole.Useasharpknifetocutandremove polythenesleeves.
- Addmoresoiluntiltheholeisfull.Plantttheseedlingatthesamedepthitwasinthe nursery.
- Waterandmulchtheseedlingsaftertransplanting.Provideatemporaryshadeto conservemoisture.
- Aftertransplantingtheyoungtreesshouldbeprotectedfromdamagebyanimalsfor a periodofaboutoneyear.
- Treeseedlingstakealittlelongertoreachtransplantingagecomparedtovegetable cropseedlings.

CropproductionIV(FieldPracticesI)

Introduction

- Fieldpracticesareactivitiescarriedoutonthefieldtofacilitatepropergrowthand maximumyieldofthevariouscropsgrown. Theyincludethefollowing:
- CropRotation
- Mulching
- R0utinefieldpractices
- Cropprotection
- Harvesting

CropRotation

- Thisisthegrowingofdifferenttypesonthesamepieceoflandindifferentseasons, inanorderlysequence.

ImportanceofCropRotation

- Maximizesuseofnutrientsandmoisture.
- Breaksthelifecycleofpestsanddiseaseagents.
- Maintainsgoodsoilstructure.
- Reducessoilerosionduetoadequatesoilcover.
- Controlsweedsthatarespecifictocertaincropse.g.strigaoncereals
- Improvessoilfertilitywhenlegumesareincludedincroprotation.

FactorsInfluencingRotationalProgramme

- Growthhabitsandnutrientrequirements.

- Liabilitytosoilerosion.
- Cropsattackedbythesamepestsanddiseasesshouldnotfollowoneanotherinthe programme.
- Availabilityofcapitalandmarketforexamplebeansorpeasinlegumes.

Rotationalprogramme

Adecisionismadeonwhichcropstobeincludedinarotationsystem.Thesequencein whichtheyfolloweachotherisestablished.Toarriveatthesequenceconsider:

Heavyfeedercrops

Lightfeedercrops

Deeprootedcrops
Legumecrops

Devoteequalhectaragetoeachcourse.Allfieldsshouldbesimilarinsize.Includeawhole fieldateachstageintherotation.

Forafour–itinvolvesplantingoffourcropsfromdifferentfamiliesinarotationprogramme. Itworkswellifthefarmisdividedintoone,two,orfourfieldsinaneightfield’sfarmsystem

Examples

i) Fourcourserotation(a)

1st year yams

2nd year groundnuts

3ryear maizeoranyothercereal

4th year cassava

ii) Fourcourserotation(b)

1st year irishpotatoes

2nd year beans 3rd year maize

4th year sweetpotatoes

iii) Threecourserotation

Firstyear peas

2nd year sorghurm

3rd year cassava

Termsusedincropproduction

Monocropping/monoculture

It’sthepracticeofgrowingonetypeofcropinafarmoronepieceofland.Thecropsuses onlythenutrientsitneedswhileothersremainunusedhenceleadingtotheirdeficiency.

It leadstobuildupofpestsanddiseasesifonecropIgrowncontinuously.

Intercropping

It’sthepracticeofgrowingoftwoormorecropsinthesamefieldatthesametime.The cropstakealongtimegrowingtogetheralthoughmaynotbeharvestedtogether.Example s: maize/beans,beans/potatoes,bananas/coffee.Ithelpsincontrollingsoilerosion.

Mixedcropping

It’sthepracticeofgrowingtwoormorecropsinthesamefieldinspecificsectionsatthe sametime.

Mulching

- Thisistheplacementofmaterialssuchasbananaleavesorpolythenesheetsonthe groundnexttothegrowingcrop.
- Thesematerialsshouldnotcomeintocontactwiththebaseofthecropastheymay encouragepestattack.

ImportanceofMulching

It’sanimportantandpopularpracticeespeciallydryareas

- Reductionofevaporationrate.
- Smothersweeds.
- Moderationofsoiltemperature.
- Reductionofspeedofrunoffs.

TypesofMulchingMaterials

- Organicmulchingmaterialssuchas;
  - Sawdust,woodshavings,coffeepulps,ricehusks,
  - Drygrass,bananaleaves,drymaizestalk,napiergrass.
- Inorganicorsyntheticmaterialscommonlyusedareeitherblackortransparent polythenesheets.Theyareusedinhighlyprofitablecropsiepineappleproduction.

AdvantagesofMulching

- Preventswaterevaporationthusmaintainingmoistureinthesoilforcropuse.
- Actsasaninsulatorthusmodifyingorregulatingthesoiltemperature.
- Ithelpstocontrolsoilerosionbyreducingthespeedofrunningwater,intercepting raindropsandincreasinginfiltration.
- Itcontrolsweedsbysuppressingthem.
- Afterdecompositionorganicmulchaddnutrientstothesoilthusimprovingitsfertility.
- Humus producedafterthedecompositionoforganicmulchimprovessoil structureandthewaterholdingcapacityofthesoil.

DisadvantagesofMulching

- Itisafirerisk.
- Providesabreedinggroundaswellasahidingplaceforpeststhatfinally mayattackthecrops.
- Trapsthelightshowersofrainfallthusloweringthechancesofraindropsreaching thesoil.
- Itisexpensivetoacquire,transportandapply.

RoutineFieldPractices Thinning

- It’stheuprootingorRemovalofexcess,weak,damagedordiseasedseedlingsto allowspacefortheremainingseedlings.

- Allowstheremainingseedlingstogetenoughnutrientsandmoisture.
- Itisaimedatobtainingoptimumplantpopulation.It’sdonewhenthesoiliswetto preventdestructionofrootsoftheremainingseedlings.

Gapping

- It’sthereplacementorFillingupofgaps(deadseedings)soastomaintainproper plantpopulation.
- Gapsoccurasaresultoffailureofseedstogerminate(duetopoorviability)ordying ofseedlings.

- Itshouldbedoneearlyenoughfortheseedlingstocatchupwiththeotherplantsand toavoidshadingofnewlyplantedseedlings.Itensuresoptimumplantpopulation.

Rogueing

- Thisistheremovalanddestructionofadiseasedpartofaplantorthewholeplant.
- Thedestructioncanbeachievedthroughburningoftheuprootedplant.It’sdoneto preventspreadofpestsanddiseases.It’susedtocontrolpestsiemaizestalkborer andbeanfly.Diseasesieamillariarootrotintea.

Pruning

- It’stheremovalofextraunwantedpartsoftheplant.Itcanbeunwanteddueto overcrowding,breakage,diseaseattackorunproductive. Reasonsforpruningare:
- Totraintheplantsothatitcanhavetherequiredshape–formativepruningintea restrictsupwardgrowthencouraginglateralgrowth.Multiplestempruningthe seedlingiscappedat38cminthenurserytoencouragegrowthofsuckers.
- Toremoveold,unproductiveordiseased,damagedpartsoftheplant–ieextra suckers,leaves,branches,flowersorevenstems.
- Totrainplantstotakeadesirableshapeforexampleformativepruningintea.
- Tocontrolcropleaveratiohenceavoidingoverbearing.
- Tocontroldiseasesandpestsforexampleantestiabugsincoffeeandcoffeeberry disease.–itdiscouragesbreedingandspreadingofdiseasesthatthrivewellinhumid conditions.
- Tofacilitateotheroperationssuchasspraying,pickingandseeding-teaandcoffee bushesareprunedtomaintainlowpluckingtableandbearingheadrespectively.It ensuresthatthespraypenetratesintothebush.
- Toreducewastageofchemicalsappliedonthecrop.
- Toremovebranchesthatinterfereswithtraffic,telephonelinesandview.
- Openuptheplanttoallowfreeaircirculationandexposureofleavestosunlight.

Not e:Toolsusedaresecateur,pruningsawpruningshearsandpruningknife.

Methodsofpruning

Theyinclude:

Pinchingout:

Istheremovalofterminalbuds.Intomatoestheterminalbudispinchedoutataheightof 1.6-1.8cm.influe-curedtobaccoit’sdoneafterbearing16-20leaves.Thepracticeisknown ascapping.

Annualpruning:

It’stheremovalofbranchesthathavebornetwocropswithundesirablegrowth characteristics.Dry,diseased,brokenbranchesarealsoremoved

Coppicingorpollarding:

It’scarriedoutintreecrops.Itinvolvescuttingbranchesatspecifiedpointstoachievea desiredshape.

N/Bensurestheplantisnotinjuredbecauseitlowersproductionduetohealing.Protectthe cutsurfacesbyapplyingpaintorStockholmtartopreventtheentryofdiseasecausing organisms.Thiskeepsoffvectorsieaphids.

Toolsusedinpruning

Pruningsaw-usedforcuttinghardbranchesandstemsincoffeeandcitrus.

Pruningknife-usedforcuttingorpruningteabyuseofstrokes

Pruningshear-usedfortrimminghedges Secateurs– usedforpruningorcuttingsoftbranchesincoffeeandcitrus.

Tea

It’sprunedtoconvertitintoalowspreadingbush.Pruningencouragesvigorousvegetat ive growthmaintainingaconvenientpluckingtable. Pluckingtableformation

Thisinvolvesformationofaframe(widepluckingtable)byencouragingdevelopmentof lateralbranches.

Methodsofframeformation

i) Formativepruning
ii) Pegging

Formativepruningmethod

Theplantiscappedatdifferentheightstodiscourageverticalgrowthandencouragelateral growth.Themethodisnotcommonbecauseittakeslongtobringteaintobearing.

Pegging

Itswhereayoungteaplantgrowsforayeartoaheightof25-30cmandcutat15cmabove thegroundlevel.Morebranchesdevelopandgrowto60-75cmhigh.Thebranchesarethen forcedtogrowatanangleof30-45^{0}byuseofpegsandtipsnippedoff.Dormantbudsgrow intoshoots.

Peggingiscarriedoutusing:

- Individualhookedpegs
- Ringsandpegs

Parallelsticksandpegs Useofindividualhookedpegs

It’swhereeachbranchishelddownbya50cmlongwoodenormetallicpeg.

Useofringsandpegs

It’swherea30cmdiameter,stickorwireringisplacedonbranchesthatareforcedtobend sidewaysatanangleof30-45^0.Itsheldusingthreepegs.Shoottipsarethennippedto encouragegrowthofmoreshoots.

Usingparallelsticks(“fitos”)andpegs

Thisiswheretwoparallelstraightlightfitosareplacedoneithersideofarowofteabushes. 45cmlightsticksarethenplacedundertheparallelstickstoholdinpositionanybranch betweenthefitos.Fitosarehelddownusingpegs. Tipping

It’sthecuttingbackofshootstothedesiredtableheight(20cmabovethepeggingheight).I t isdonethreemonthsaftertableformationorlastcutting.Threeleavesandabudare removedaboveeachshoottoacquirerequiredheight.Itsdoneatanintervalof2-3weeks.It

encouragesformationofuniformpluckingtable.Forauniformpluckingtabletwo2mY shapedareused.Astraightpruningstickisthenplacedonthe Yshapedsticksthattouch thegroundandleaves/budstippedoff. Maintenanceofpluckingtable

Maintenancepruningiscarriedouttopreventriseofthepluckingtable.Itinvolvescutting backtheteabushto5cmabovethelastpruningheightafter2-5yrs.Itsfollowedwithtipping after3months.

Rehabilitationitisthecuttingbackofthebushto45cmabovethegroundafter40-50yrs.

Pruningmaturetree

Itinvolvescuttingallbranchestoaspecificheightabovethegroundlevel.

Observethefollowing:

i) Don’tcutsidebranchesgrowingbelowthepruningheightbecauseitreduces spreadingofthebushandtheyield.

ii) Outsideedgeofthebushshouldnotbecutatahigherlevelthanthecentre.Also avoiddiscshapedframe.

iii) Prunethebushparallelwiththeslopeoftheground

iv) Cutthebranchesacrosstominimizetheareaofthewoundslongsloppingcuts increasediebackandinfection

v) Removesmallbranchesandtwigswiththehand-avoidcleaningupusingtheknife. vi) Leaveallbranchesonthegroundtoactasmulchandtorotandreleasenutrients.

vii) Afterseveralpruningcutbacktheteabushestotheoriginaltabletochangethe cycle.

viii) Placeaprotectivecupofseveralbranchesontopoftheframeforprotection duringdryareasinplacesieMeruandwestofriftvalley.

ix) Prunetheteabushesbackto5cmabovethepreviouspruninglevelafterevery threeyears.Thispracticepreventsdevelopmentofthecallustissue.

Coffee

It’sprunedtoregulatethequalityandquantityofcoffeeBerries.

Reasonsforpruning:

i)Toregulatebearingii)Toremoveoldandunproductivebranches

iii)Toregulatetheheightoftreeshencemakingharvestingeasy.

iv)Toopenupthebushhenceallowingaircirculation

v)Tofacilitatepenetrationofsprays/chemicals

Systemsofpruning

a)Singlestempruning

b)Multiplestempruning.

Singlestempruning

Thisiswhereonepermanentstemisestablishedwithastrongframeworkofprimary branches.It’sdonebycappingthemainstematvariousheights(at53cm,114cmand 168cm).Thebestgrowingsuckerisallowedtogrowupwardsateachcapping.Cappings encouragedevelopmentofstrongprimarybranches.

Theheightofasinglestemisbetween1.5-1.8m.Cropsareborneonprimarybraches whenyoungandlateronsecondariesandtertiaries.Annualpruningiscarriedout(after harvesting)toremovesuckers,dead,branchestouchingtheground,brancheswith undesirablegrowthhabits(thosegrowinginwards,outwards,crossingandtouchingea ch other)anddamagedbranches.Removalofsuckersisdonethroughout.

Singlestempruning:

Advantages

i) Allowseasysprayingandpicking ii)

Minimizesbreakage

Disadvantages

i) Requiresskilledlabourtoestablish ii)

Ittakestimetobringbushestobearing

NBToavoidscorchingtopbranchesandfruitsshadethetrees.

Multiplestempruning

Itinvolvesestablishingtwoorthreemainuprightstemswithlateralstobearthecrop.

Typesofmultiplestempruning:

Cappedmultiplestempruning

Non-cappedmultiplestempruning

Cappedmultiplestempruninginvolvescappingat38cm,andallowingtwoorthree shootstogrowtoaheightof1.5-1.8m.

Non-cappedinvolvescappingmainstemat38cmandthenallowingsuckers2-3togrow. Thecrop/berriesisborneonthelaterals.Thestemsgrowtallandbendoutwardsdueto theweightoftheberries

After4-6yrsthestemsareremovedandnewonesareallowedtogrow

Referredtoasthechangeofcycle(prunetheinnerlateralstoallowlighttopenetrateand encouragegrowthofnewsuckerstoreplaceoldstems)

Advantagesofnon-capped

i)Itrequireslessskillstoestablish ii)It’seasytoprune

iii)Itdoesnotallowaccumulationofcoffeeberrydiseasebecauseoldstemsare removed.

Disadvantages

i)Breakingofstemsandbranchesiscommon

ii)Difficultytogatherberriesfromtoppoints

iii)Difficulttospraythetallbranches iv)Stumpsrotwithage.

Annualpruning

Itinvolvestheremovaloflateralsthathavebornetwocropsthosethataretooclose,dry, brokenandthosethatarewithundesirablegrowthcharacteristics

Capping

Thisistheprocessofcuttingthemainstemataheightof53cmwhentheyoungcoffeeplant is69cmtall.Secondcappingat114ccmisdonewhenthestemif130cmandthirdcappingat 168cmwhenitsataheightof183cm.oneuprightbranchisallowedtodevelopaftereach capping.

De-suckering

Thisistheremovalofsuckersfromcoffeebushesanditsdonethroughouttheyearas suckersappear

Changingthecycle

It’sthereplacementofoldbearingstemsbysuckers.Itschangedafter4-6yrs.

Bananastoolmanagement.

Doneasfollows

- Removeextrasuckersinthestool.
- Leave3-6stemsperstooldependingonthearea.
- Thesuckersleftshouldbeindifferentstagesofdevelopmentie i)1startingtogrow ii)1bearing iii)1halfgrown
- ToremovesuckersCutthesuckersdeeplyattheroot
- Removedrydiseasedleavesusingsickleorapangatoopenupthestool.

Cuttingupinpyrethrum.

Thisistheremovalofoldpyrethrumstemsdowntothelevelofoliageattheendofthedry season

Thisreducesbuddisease

Itincreasesyield,preventsdecliningyieldinthefollowingseason.

Training

It’sthepracticeofmanipulatingplantstogrowinadesigneddirectionandshapethrough staking,propping,andtrelishing.

Staking-it’sthesupportingofplantswithweakstemsietomatoes,gardenpeasandsome beanvarietieswiththinstrongsticks.

Propping–it’sthepracticeofprovidingsupporttotallbananavarietiesandthosewithheavy buncheswithaforkedstake.

Trelishing-it’sthepracticeofprovidingsupporttocropswithvinesusingwireorsisal strings.Wiresandstringsareheldbypostsatdefinitespacing.

Earthing-up

- Thisistheplacementofsoilinformofaheparoundthebaseoftheplant.
- Itismostlycarriedoutintubercropssuchasirishandsweetpotatoestoimprove tuberformation.
- Itisalsocarriedoutingroundnutsandmaizeduringfirstweeding.
- Ingroundnutsitpromotesproductionofpodswhileinmaizeitprovidessupportto preventlodging.
- Toolsusedinclude:forkedjembe,jembe,orahoe.

CropProtection WeedControl

- Weedsareplantsgrowingwheretheyarenotwanted,thatisaplantoutofplace.

- Suchplantsincludeblackjack,couchgrass,Sodomapple,thornappleandMcDonald's eyewanderingjew.
- Suchplantsshouldbeeradicatedorcontrolledusingrecommendedmethods.

PestControl

- Croppestsarelivingorganismsthatareharmfultothecrops.
- Theyinclude;insects,nematodes,rodents,thripsandmites.
- Theycausegreatdamagetocropsinthefieldandstoredproduce.Theyreducecrop productqualityandquantity.

ControlofCropDiseases

- Adiseaseisanyalterationinthestateofanorganismandfunctionsofaplantorits parts.
- Diseasecausingorganismsareknownaspathogens.
- Theyincludefungi,virusesandbacteria.
- Diseasescausedbyfungiarereferredtoasfungaldiseasesi.eCBDincoffee,rustin maize,smutinsorghum,armilariarootrotintea,whilethosecausedbyvirusesand bacteriaarereferredtoasvirali.eratoonstandinginsugarcane,andbacteriali.e bacteriawiltintomatoes,blackrotincabbages,andblackarmofcottonrespectively.
- Diseasescanalsobecausedby:nutritionalimbalancesandphysiologicaldisorders.

Harvesting

- Itisthegatheringoroftheharvestproduceaftermaturity.It'sthefinaloperationincrop production.Precedingoperationsdeterminetheamountofharvest.Harvestingat wrongstagecauseslossinquantityandquality

Stagingandtimingofharvesting

Timeofharvestingdepends0n

- Thepurposeofthecroportheuseforwhichthecropwasintended.-
  Maizeforsilage-plantsharvestedbeforeflowering
  Maizeforgrain-plantsharvestedwhenthegrainsmature
- Concentrationoftherequiredchemicalsinthepatbeingharvestediecaffeinein coffee,andsucroseinsugarcane.
- Stageofmaturityofthecrops.
- Marketdemand/Tastesandpreferencesofconsumers.Thisdependsonconsumer preferenceeggreenordrymaize
- Prevailingmarketpricesandprofitmargins-Harvestingisdelayedforhighermarket prices
- Weatherconditions,henceliabilitytospoilage-harvestmostcropsduringdryseason. Synchronizationofplantingandharvestinginvolvestimingofplantingsothatthecro p maturesattherighttime.
- Moisture.

Methodsofharvestingisdeterminedby:

- Scaleoffarmingforexamplelargescalefarmingmachinesareusedandmanual harvestingforsmallscalefarmers..
- Typeofcropforexamplepyrethrum,spinachandkalesareharvestedbyhand.
- Uniformityinripeningofthecropforexamplewheatisharvestedbyuseofcombined harvesterwhilecoffeeisharvestedbyhand.

- Uniformityinheightofthecropandsizeofseed,fruitsandflowers.
- Financialstatusofthefarmer.
- Partoftheplanttobeharvested.

Methodsofharvesting

Crop	Methodofharvesting
Coffee	pickingtheripecherriesforpulpinginthefactory
Tea	pickingtwoleavesandaterminalbud
Irishpotato	liftingtuberswithsticks,panga,orforkedjembe
Beans	pickinggreenpodsdependingonthemarket.Dry beansthewholeplantisuprootedafterdrying,spreadonmatstodryfollowedbythreshing.

Precautionsduringharvesting

Theproduceshouldnotbeaffectedbothinqualityandquantity.
Harvestattherightstagedependingonintendeduse.
Ensurerighttimingwhentheweatherconditionsaredry
Avoiddelayedharvestingtopreventspoilage.
Makethestorereadytoreceivetheproduce.

Post-HarvestPractices

- Thesearethepreparationscarriedoutoncropproducebeforeitgetstotheconsumer. Theyinclude;
- Threshing/shelling–it'stheremovalofmaizegrainsfrommaizecobs, beansfrompodsandsorghumfromheads.It'sthefirstoperation afterharvest.
- Drying–drythegrainstoattaincorrectmoisturecontentforstorageto preventrottingandfungalattack.Formaizedryto13%moisture content.
- Cleaning–itinvolveswinnowingincerealstoremovechafffromgrains.
- Sortingandgrading–theproduceissortedandgradedaccordingto thequalityiegrade1(bigandwellripened)gradeII(under-ripe, diseasedandsmall)forcoffee
- Dusting-it'stheapplicationofchemicalpowdersonseedstoprevent attackbystoragepests.
- Processing–it'sthetransformationofrawmaterialintoafinalproduct.Theproduce isprocessedinorderto
  - -Improvetheflavorietobaccoandtea
  - -Improvethekeepingqualityasinfruitswhencannedormadeintojuicesor sauces
  - -Reducebulkinesshenceloweringtransportationandstoragecostsie sugarcane.
- Packaging–istheplacementofproduceintocontainersforstorage,saleor transportation.Itreducesdamagingtotheproduce.Itmakesiteasierforthefarmert o quantifytheproduceandsetprices.

Storage

Purposeofstorageisto;

- Preventspoilage.
- Maketheproduceavailableforfutureuse.
- Toawaitgoodmarketprices.

Requirementsforproperstoreare:

- Itshouldbeclean.
- Itshouldbewellventilated.
- Itshouldberaisedfromthegroundtopreventdampconditions.
- Itshouldbedry.
- Itshouldbestrongtoholdcropproduce.
- Itshouldbeeasytoclean.
- Itshouldbevermin-proof.
- Itshouldbesecurefromtheft.
- Itshouldbetreatedagainstpestssuchasweevils.

TypesofStorage

- Traditionalstoragestructures.

  Itincludes

  i) Puttingshelledgrainsinpotsandgourdstoredinsideoroutsidethe house.

  ii) Storingintraditionalgranariesthatwereelevatedfromthegroundwith posts.Theyweremadeofwoodentwigswoventogetherandroofed withthatchingmaterialsiegrass,reedsorplantleaves.

  Disadvantagesoftraditionalstorage

  i) Foodispronetoratandweevilsattack ii) Rottingofgrainiscommon iii) Limitedinsize

- Modernstoragestructures.

  Theyarecharacterizedbyimprovedstorageconditionsofproducetoprevent losses.Grainsarethreshed,driedanddusted.Theyarethenbaggedandstack instoresordirectly.

PreparationoftheStore

- Cleaningthestoretoremovedebrisofthepreviouscropthatmightbeharboring storagepests.
- Maintenance–itinvolvesrepairorreplacingofbrokenandwornoutparts.Replacethe thatchorotherroofingmaterials.
- Dustingthestorewithappropriatechemicalstocontrolstoragepests.
- Clearingthevegetationaroundthestoretokeepoffvermin.

CropProductionV:(Vegetables)

Introduction

- Avegetableisanycropthatisgrownandeatenfresh.Theyarehorticulturalcrops. Theyarepopularbecausetheymatureearlyhencequickreturns.

- Vegetablesareimportantbothfornutritionalandcommercialreasons.Theygrown bothforforeignandlocalconsumption.
- Theyarecategorizedonthebasisofthepartusedasfood. Suchpartsinclude;
  - Leaves,
  - Stems,
  - Roots,
  - Fruits,
  - Flowers,
  - Pods
  - Bulbs. Importanceofvegetablecrops

a)Nutritionalimportance

Aresourcesofvitaminandmineralshencetheyareprotectivefoods.Theycontain vitaminsA,B,andC.deficiencyofthesevitaminsmayleadtodiseasesi.enight blindness,scurvyandberiberi.Mineralsinvegetablesinclude:ironphosphorus,and calcium.

b)Commercialimportance

Vegetablesprocessedintosauces,juices,andjamsaresoldtoearnincomeregularly.

Vegetablesaregrowneitherforhomeuseorcommercialpurposes.Vegetablescan begrownduringrainyseasonbutfetchlowpricesbecausetheyareinplenty,those grownunderirrigationsystemindryseasonfetchhighpricesduetoscarcity.

Typesofvegetables

Vegetablesaregroupedintothefollowingcategories:

- Leafvegetablesforexamplekales,spinach,amaranthus,cowpeasandcabbages. Theyareusedasfoodandrequirealotofnitrogentostimulatevegetativegrowth.
- Rootvegetablesforexamplecarrots,beets,radishesandtulips. Theyareusedasfood.
- Fruitvegetablesforexamplecucumbers,tomatoes,melons,brinjals,pumpkins, squashesandpepper,theyareusedasfood.
- Stemvegetablesforexampleasparagus,leeksandspringonions.Theyareusedas food.
- Bulbvegetablesforexamplebulbedonionsandgarlic.Theyareusedasfood.
- Podvegetables–exampleslegumesFrenchbeanspigeonpeas.Theycanbeeaten whilegreen.

Tomatoes(Lycopersiconesculentum)

- ItoriginatedfromtheslopesofAndesMountainsinSouthAmerica.Developmentof varietieswasdoneinEuropespreadingworldwide.Tomatoesarefruitvegetables widelygrowninKenya.

- Theripefruitmaybeeatenrawcookedorprocessedtomaketomatosauces,juices andpastes.TomatofruitsarerichinvitaminsA,BandC

EcologicalRequirements

- Warmclimate.
- Altitude:0-2100mabovesealevel.
- Rainfall:760-1300mmperannum.Itcantolerateupto2300mm.rainshouldbe welldistributedoverthegrowingperiod.
- Soils:deep,fertileandwelldrained.

Varieties

- Freshmarketvarieties:-arefleshy,roundinappearance,withsmoothskinsand withapoorkeepingquality.
  - Moneymaker,-it’sthemostpopular,fastgrowingandhighyielding.
  - Marglobe,hundredfold,
  - Beeeater,
  - Ailsacraig
  - Hotset, Supermarmande
  - Ponderosa.
- Processingvarieties:Areelongatedorovalshaped.Havegoodkeepingquality andplum.
  - CalJ
  - Kenyabeauty,
  - San-marzano,
  - Roma,
  - Heinz13S0,
  - Primabel,
  - Rutgershybrid
  - 10XHYBRID

NurseryPractices(establishmentandmanagement)

- It’sestablishedinafinetilth.
- ChooseasitewhichhasnotbeengrownSolanaceae(brinjals,pepers,tobacco,& gooseberry)cropinthelastthreeyears.
- Nurserybedsareraisedabout15cmabovethegroundlevel,onagentlysloping ground.
- Makethenurserybedfineandlevel.
- Makedrillsof20cmapartand1cmdeepdrilldropintheseedssinglyandcoverthe seeds.
- Morethan1cmlowersgerminationpercentage.
- Provideshadeormulchmaterial.Avoiddarkanddampconditionsfortheycause seedlingstogrowthin,tallandunhealthy.
- Watertwiceaday.
- Applyphosphaticfertilizersduringplanting.

- Hardentheseedlings2-3weeksbeforetransplanting.
- Transplantseedlingsat10cmheight.Or4-5trueleaves.

Seedbed/landPreparation

- Thelandshouldbedugdeeplytocontrolweeds(perennial)
- Dighalls15cmdeepataspacingof90cmx60cmor100x50cm.

Transplanting

- Seedlingsarereadyfortransplantingwhentheyare10-15cmhighafteraboutone month.
- Holesaremadeataspacingof90cmx60cm.
- Apply20gmofDSPorahandfulofwellrottenmanureintheplantinghole.Thoroughly mixwiththetopsoil.
- Waterthenurserybeforeliftingoftheseedlingstoensurethattheyareliftedwitha lampofsoil.
- Transplantwithaballofsoilaroundtheroots.Oneseedlingperhole.
- Applymulcharoundeachseedling.
- Transplantingisnormallyintheeveningoronacloudyday. FieldMaintenance
- Gapping–replaceseedlingsthatdryup.Itsdonetomaintaincorrectplantpopulation.
- Weeding-Earlycontrolofweedsisnecessarytoreducecompetitionfornutrients,and chancesofdiseases/pestsspreading.Whenhandcultivatingavoidstem/rootinjury. Toomuchfruitshakingcauseimmaturefruitfall.
- Topdressing-itisdoneaftercropestablishesataheightof25-30cm.useCAN 100KG/Ha(20kgofnitrogen/Ha).Applyoneteaspoonfulperplant.Toomuchfertilize r causes
  - -Prolongedmaturity
  - -Crackingoffruitsbeforematurity -Blossomendrot
  - -Toomuchvegetativegrowthhinderingfruitformation.
- Pruning-stheremovalofthemanytomatoshootstoremainwith1-3mainshootsper plantforgoodyields.Removeleavesnearthegroundtoreducechancesofblight attack.Abushyplantusesnutrientsforvegetativegrowthandnotfruitdevelopment.
- Staking-stakingisdonetotraintheplantstogrowvertically.Dwarfvarietiescan supportthemselvesbuttallvarietiesaresupportedwithsticksabout2mhighfirmly fixedtotheground.Useasisalstring,orbananafibretotietheplantsat20cm intervals.

  Reasonsforstaking
  - -Productionofcleanfruits
  - -Facilitatessprayingandharvestingofthecrop -
    Controlsincidencesofdiseaseoutbreaks -
    Preventsinfestationbysoilbornepests.

PestsControls AmericanBollworm(Heliothisamigera)

- Larvastageofamoth.Itsbrown,green,orpinkincolor.Itsdestructiveattacking fruitsietomatoes,citrus,cotton,andmaize,beans,andsorghumstems.
- Natureofdamage:boringholesonthefruits.Theyfeedwithheadinsidethe tomatofruitandrestofthebodyoutside.

- Control:sprayinginsecticides.

- Cutworms,redspider,mitesandnematodesareminortomatopests
- Control
- Usecroprotationapplysuitablepesticides
- TobaccoWhiteFly
  - Natureofdamage:suckplantsapfromtheundersideoftheleaf,hencemay transmitviraldiseases.
  - Control:Destroyinfectedplantandsprayinsecticides. DiseaseControl
- TomatoLateBlight
  - Cause:Fungusphytophthorainfestans.
  - Symptoms:
    -drybrownpatches/lesionsontheleaves,stemsandfruits.
    -RottingandPrematurefallingofaffectedfruits
  - It’scommonduringwetandcoldweather.Fungalsporesgerminateandspreadon moistleaves.
  - Control:useoffungicides,croprotationanddestructionofaffectedmaterials.
- Bacterialwilt
  - Cause–bacteria(pseudomonasSolanacearum)
  - Tomatoplantsdryandwithereveninwetconditions
  - Nochemicalcontrol.Uprootandburninfectedplants.
  - Controlbyuseofcertifiedseedsandcroprotation.
- Blossom-endRot
- It’saphysiologicaldisease

Causedby;

- Toomuchnitrogeninearlystages.
- Irregularorinfrequentwatering.
- Calciumdeficiencyinyoungfruits.
- Control: oApplycalciumammoniumnitrateandcorrectionoftheaboveproblems.
  oRegularwatering
  oApplicationofcalciumcompounds Harvesting

- Forcanning,fruitsshouldbefullyripebeforeharvesting.
- Forfreshmarket,fruitsshouldbepartiallyripeandpackedincratestoavoiddamage.
- Transportusinglargewoodencrates.Fruitsshouldbelevelwiththetopofrhecrateto allowpilingofcratesontopofeachothertoavoidsquashingfruits.
- Thefruitsshouldbegradedaccordingto;
  - Size,
  - Colour,
  - Ripeness
  - Freedomfromblemishes.

Cabbage(Brassicaspp)

- ItoriginatedfromEuropeandhasspreadtomostpartsoftheworld.Theleavesare richinvitaminAandDandmineralsieironpotassium,phosphorusandcalcium.
- Hasahighnutritionvaluewheneatenfresh.
- Itisaleafvegetablecloselyrelatedtootherbrassicacropssuchaskales,cauliflower, Chinesecabbage,cerelycabbageandBrusselssprouts.Thisvegetableshavesimila r managementpractices.
- Cabbageleavesmaybeeatenrawinsalads,steamed,boiledorcookedinavarietyof ways.
- Leavesaretightlycompactedtoformovoidorsphericalhead.
- Theleavescanalsobefedtolivestock.

EcologicalRequirements

- Altitude:highaltitudes
  - Thosewithsmallheads:900-1500mabovesealevel
  - ThosewithLargeheads:1800-2900mabovesealevel.
- Temperature:requirecoolcondition.
- Rainfall:
  - 750-2000mmperannum.
  - Shouldbewelldistributedthroughoutthegrowingperiod.
- Soils:
  - Deep,
  - Fertileorrich
  - Welldrained.
  - SlightlyacidicPHof6.5

Varieties

Earlymaturing:

Brunswick,

Sugarloaf,

Earlyjersey,

Copenhagenmarket,

Chinesecabbage,

Celerycabbage,

Cafesplitskool

Gloria,mukuki, Goldenacre.

Latematuring:

Drumhead,

Savoy, Perfection,

Winningstadt.

NurseryPractices(establishmentandmanagement)

Establishinanareawherebrassicafamilycropshavenotbeengrownforthelast3yrs. Preparethenurserytoafinetilthbyremovingallroots,stonesandperennialweeds.

Thebedsshouldberaised,dimension1mwideandanyconvenientlength(usually2-3min length).

Makedrillsof10-20cmapart.

Sowseedsbydrillingandcovertoadepthof1cm.

Provideshadeormulchmaterial.Mulchmaterialisremovedattheemergenceofseedlings.

Applyphosphaticfertilizersandmixthoroughlywithsoilduringplanting.

Watertwiceaday.

Hardenofftwoweeksbeforeplanting.

Seedbed/LandPreparation

Cultivation(ploughingandharrowing)shouldbedoneduringthedryseasonsothatallthe weedsarekilled.Thisgivesseedlingstimetogrowbeforeweedscomeup.

Digholesatthespacingof60cmx60cmor90cmx60cmdependingonthevariety.

Incorporatewellrottenfarmyardmanureinthesoil.

Transplanting

Watertheseedlingsbeforeuprooting.

Seedlingsarereadyfortransplantingafteronemonththatiswhentheyare1O-15cmin height.

Selecthealthyandvigorousseedlings.

Transplanttheseedlingswithballsofsoiltopreventrootdamage.

Planttothesamedepthastheywereinthenursery.Itsdoneintheeveningorduringcloudy day.

FieldMaintenance/managementpractices.

Topdressing-it’sdoneat20-25cmheight.ApplyatablespoonfullofCANorSA.Repeat3-4 weeksafterfirsttreatment.

Weeding-Controlweedstoreducecompetition.It’sdonebyhand.Careshouldbetakennot tobreakleavestheyaffectheadformation.

Cabbagepestsandtheircontrol

PestControl Aphids

Affectscabbageheadsduringdryseason.

Theyarerareinwetconditions.

Irrigatetocontrolduringdryseason.

DiamondBlackMoth

Damage:Eatstheundersideoftheleafmakingwindowsorholesintheleaf.

Control:Sprayrecommendedinsecticides.

Sawfly-controlusecroprotationandinsecticides

Cutworms–larvastageofamoththatstayshiddeninsoilormoistrubbish.It’sfoundcurled inthesoil.

Damage:Attacksthestematthegroundlevelcausingheplanttofall.

Control
:Sprayrecommendedinsecticides.Mixappropriateinsecticidepowderwiththesoilin eachsoilholeduringtransplanting.

DiseaseControl

BlackRot

Cause:BacteriaofBrassicas

Symptoms:Leavesturnyellowandrottingofthestem(atthepithwherethebacteria destroysthetissue)givinganoffensiveodour,

Control:Closedseason,croprotation,usecertifiedseedsandspray appropriatechemicals.

Dampingoff

Cause–fungus.Attackscabbageseedlingsinthenurseryinheavilywateredandshaded nurserybeds.

Symptoms-cobweb–likeblackmassoffungiformsaringonthestembaseabovethesoil. Witheringanddeathofseedlings.

control-removeshade,thinningofovercrowdedseedlings,useoflesswater,applycopper fungicides.

Downymildew

Cause-fungusinareaswhereheavymistsarefrequent

Control–
uprootandburnaffectedplants,practicecroprotationandnurseryhygiene.Apply
fungicidesincaseofheavyinfection.

BlackLeg
Cause:Fungus

Symptoms:Browntoblackspotsonseedlingsanddarkcankeronthestem.

Control:croprotation,destroyinfectedmaterials.

Harvesting

Cabbagesarereadyforharvesting3-4monthsaftertransplanting.

Theheadsarecutwhentheyaresolidandcompact.

Harvestedcabbagesaresoldimmediately.

Duringrainyseasonheadscrackandstartrotting.

Flowersmaygrowfromsplitheadstoformseeds.

Theyaresoldmostlyinurbanareaseitheronwholesaleinbagsorsinglyinretail

Carrots(Daucuscarota)

It’sahardybiennalrootvegetablethatoriginatedfromEuropeandspreadtomanypartsof
theworld.

ItisarootvegetablegrowninthecoolareasofKenya.Containscarotenethatisnecessary
formanufactureofvitaminA.

Itiscommonlyeatenrawinsaladsbutcanalsobecooked.

EcologicalRequirements

Altitude:0-2,900mabovesealevel.

Rainfall:

750-1,000mm.

Welldistributedthroughoutthegrowingperiod.

Soils:

Itrequiresdeep,

Finetilth

Welldrainedsoilsthatarefreefromobstaclestoallowforrootexpansion.

Temperatures
:itrequirescooltowarmtemperaturesasveryhightemperaturesresultinthe productionofpaleandshortroots.

Varieties

FreshmarketvarietiesforexampleChantenayandNantes.

CanningvarietiesforexampleNantes

Foddervarieties(livestockfeed)forexampleOxhast.

LandPreparation

Thefieldshouldbewelldugtoadepthofabout20cm.

Thesoilclodsshouldbebrokentogiveafinetilthbeforeplanting.

Manureshouldnotbeappliedasitinducesforkingwhichreducesthecropquality.

Planting

Carrotsareplanteddirectlyintothemainseedbed.

Seedsaredrilledintorowsmade20-30cmapart.

Theseedsarethencoveredlightlyandthesoilpresseddown.

90kg/haofDSPshouldbeappliedatplantingtimeinthedrills.

Itshouldbemixedwellwiththesoilsbeforeplacingtheseeds.

FieldmanagementPractice

Thinning--itisdone2weeksaftergermination.

Weedcontrol-thefieldshouldbekeptweedfree.

Earthingupshouldbedonewhileweedingtoencouragerootexpansion..

Topdressing:afterweeding60kgofnitrogenperhectareshouldbeappliedastopdress.

Irrigation-thisshouldbecarriedoutwhereorwhenthereisnotenoughrainfall.

PestControl

Carrotsdonothavemanyfieldpestsexceptthegreenaphids.

Thesecanbecontrolledbyuseoftheappropriatepesticides.

DiseaseControl

Occasionallyattachedbythemildewsespeciallyinwetandhumidenvironment.

Thinningcanbedonetoreducehumidconditions.

HarvestingandMarketing

Carrotsarereadyforharvesting3-5monthsafterplantingdependingonthevariety.

Theyareliftedfromthesoilandsoldfreshorcanned.

Onions(Alliumcepa)

Origin-
MediterraneanregionofsouthEastAsiaspreadingtomanyotherparts.It’sabiennial crop.

Onionsarebulbvegetablesgrowninthewarmareasof Kenya.

Theyareusedasavegetableinsaladsandforflavouringfoods,soupsandstews.

EcologicalRequirements

Altitude:0-2,100mabovesealevel.

Rainfall:

1,000mmofrainperyear Irrigationindryareas.

Soils:

Requireswelldrainedfertilesoils pHof6.0-7.0.

Temperatures:

Onionsareawarmclimatecrops.

However,somevarietiesprefercoolconditions.

Theyrequireafairlylongdryperiodforripening.

Varieties

Redcreole,

Tropicanahybrid

Whitecreole.

LandPreparation

Thelandshouldbewellpreparedleavingafinetilth.

Farmyardmanureat40-50tonnesperhectareshouldbeappliedandmixedwellwiththe soil.

Planting

Direct:Seedsaredrilledinrows30cmapartand8cmwithintherows.20kg/haofDSP fertilizerisused.

Indirect:Seedsareestablishedinthenurseriesbeforetransplantingtheminrows30cmapa rt and8cmwithintherows.

Shallowplantingisrecommendedforbulbexpansion.

FieldManagementPractices

Thinning

Itiscarriedoutonlyinthecropthathasbeendirectlyplantedsoastoachievespacingof 8cmbetweentwoplantswithintherow.

Thethinnedplantsreferredtoasspringonionsareusedasvegetablesinsalads.

Topdressing

Calciumammoniumnitrateattherateof250kgperhectareisrecommendedfortopdressin g onions.

Thisisdone3monthsafterplanting.

PestControl

OnionThrips:

Thesecausesilveringandwitheringofleavesfromthetipsdownwards.

Theyarecontrolledbysprayingwithappropriateinsecticidessuchas Diazinonorfenthion.

DiseaseControl

PurpleBlotchandDowneyMildew

Purpleblotch;

Characterizedbyovalgreyishlesionswithpurplecentresonleaves.

Thiscausesleafcurlinganddieback.

Downeymildew;

Characterizedbybrownsporescoveringtheleavesleadingtodeathofthewholeplant.

Thetwodiseasesareeffectivelycontrolledbycroprotationandapplicationofappropriate fungicides.

HarvestingandMarketing

Onionsarereadyforharvesting5monthsafterplanting.

Whenleavesstartdryingthetopsarebrokenorbentattheneck.

Thishastensthewitheringofthestems.

Thebulbsarethendugoutandlefttodryinashadeforafewdays.

Onionsaregradedaccordingtosizeandmarketedinnetsofabout14-16kgs.

LivestockHealthI

(IntroductiontoLivestockHealth)

Introduction

- Healthisthestateofthebodyinwhichalltheorgansandsystemsarenormaland functioningnormally.
- Diseaseisanydeviationoralterationfromthenormalhealthoftheanimalorstateof thebodyoftheanimal.
- Profitableanimalproductionrequires:goodhusbandryofhealthyanimals,correct feeding,grazingcontrol,adequatewatersuppliesandproperbreedingprogramme.

ImportanceofKeepingLivestockHealthy:

- Healthyanimalsgivehighincomeduetolowtreatmentcosts.
- Animalsgrowwellandreachmaturityquickly.
- Theeconomicandproductivelifespanofahealthyanimalislonger. Highproduction– theygivemaximumproductionorperformance.
- Healthyanimalsgivegoodqualityproductsandconsequently commandhighmarketvalue.
- Healthyanimalscanmultiplyregularly.
- Healthyanimalsareeconomicalandeasytokeepbecausethefarmerspendslesson diseasetreatment.
- Healthyanimalsdonotspreaddiseasestoeitherotheranimalsorhumanbeings.
- Safetyofconsumersoflivestockproducts.

Signsofgoodhealthyinlivestock.

Goodhealthrequiresconstantobservations.Signsofgoodhealtharecategorizedintothre e:

- Physicalappearance.

Itsexaminedinthefollowingterms

- Behavioroftheanimal-healthyanimalsaregentle/docile.Excitementand aggressivenessisasignofillhealth Generalappearanceoftheanimal-healthyanimalisalert,brightinmannerand carriesitsbodyweightevenly.Dullnessandrestlenessisasignofillheath.
- Movementoftheanimal-theyhavenormalgaitmovingwithaalotofeas. Limpingorstrainingisasignofillhealth.
- Poster-theyhavenormalposterwhilestandingandlyingdown.

Physiologicalbodyfunctions.

Itsexaminedunderthefollowing:

- Appetiteandfeeding-appetiteisthedesiretheanimalshaveforfood.They havegoodappetiteeatingtosatisfactionifgivenfoodoftherightcolor,taste andsmell.Theyeatanddrinkwellandregularly.Excessiveoflackofappetite aresignsofillhealth.
- Defecation-theydefecatenormallyandregularly.Inconsistenceintexture,color, smellandfrequencyofdefecationindicatesillhealth.Dungwithbloodstains, parasitelarvaeshowsillhealth.
- Urination-theyurinateregularlyandnormallypale–strawurineincolor. Difficultiesinurinating,redorheavyyellowurineareasignofillhealth.
- Bodytemperature-theyhaveabodytemperaturewithinanormalrange.Body temperatureismeasurebyaclinicalorvetinarythermometerbyinsertinginth e rectumorunderthewingsinbirds.Atemperatureaboveorbelowthenormis asignofillhealth
- Respiratoryrate-theyhavenormalrespiratoryrateperminute.Itsmeasured witharespirometer.

Animal	Temperature	pulserate	Respiration
Cattle	38.5-39.5	50-70	10-30
Sheep	38.5-40.5	70-80	12-20
Goat	38.5-40.5	70-80	10-20
Chicken	40.4-43.0	200-400	15-30
Pig	38.0-39.0	60-80	8-18
Horse/Donkey	37.5-38.5	28-40	8-16

Respirationrateinvolvestherhythmicinspirationandexpiration.Itvariesfrom speciestospeciesasshownabove.

Factorsinfluencingrespirationrate

i)Theboysizeoftheanimal
ii)Theamountofexercisedonebytheanimal iii)Thedegreeofexcitement

iv)Theambientorenvironmentaltemperature

Difficultorfastbreathingrateshowsillhealth.

- Productionlevel-theyhavesteadyyieldofmilk,eggs,andotherproducts. Reducedproductionorweightlossisasignofillhealth.

- Pulserate-theyhaveanormalpulserate(waveofbloodpassingthroughthe arterialbloodstream,correspondingtothebeatsoftheheart.Itsmeasuredby placingthefingerorthumbontheartery underthetailorloweredgeofthejaw oftheanimal.Itvariesfromspecietospecies.

Factorsinfluencingthepulserate

i)Thedegreeofexcitement ii)Ageoftheanimal

iii)Sexoftheanimal

iv)Physiologicalstatusoftheanimaliepregnancyorillhealth.

- Morphologicalconditionsofthebody.

Theyareobservedinthefollowingareas:

- Thevisiblemucousmembranes-theyhaveapink,moist,softandelastic, smoothandwelllubricatedmucousmembrane.Brightred,paleandanaemic, yellowishorbluishmucousmembraneisasignofillhealth.

- Theskinandanimal’scoat-theyhave;warmsmooth,soft,pliableandmoist skin.Extremedryhair,staringcoatwherethehairsticksup,excessivesweating, lossofhair,abnormaloutgrowthsorswellingsontheskinofanimalsaresigns ofillhealth.

PredisposingFactorstoLivestockDiseases

- Thesearecondition swithinoraroundtheanimalthatmakeiteasyforananimalto contractadisease. They include:

- Animalfactorssuchas;
  - Species-speciestypedeterminesthetypeofdiseaselikelytoaffectthespecies.ieswinefever affectsonlypigs,newcastleaffectsonlypoultry.

  - Breedoftheanimal-itinfluencesthekindofdiseaseinfluencingabreediecancer oftheeyeforHereford

- Age-somediseasesareassociatedwithanimalsofagivenagegrouponlyiepiglet anaemia,lambdysentry,andcalfpneumonia.
- sex–omediseasesonlyaffectcertainsexduetothearrangementoforgansie mastitis,vaginitisforfemaleandorchitisformale colouroftheanimal-heatstresslikelyaffectanimalswithblackskincolorand photosensitizationforlightpigmentedanimals.

- Environmentalfactorssuchas;
  - Chilling,
  - Beingrainedon,
  - Exposuretohotsun Dampness.
- Managementfactorssuchas;
  - poorfeeding,
  - housing,
  - handling
  - hygiene, overcrowding.

SignsofILL-HealthinLivestock

- Abnormalbehaviorforexampleseparationfromtherestoftheherdandrestlessness.
- Abnormalposturefor example limpingandlameness.
- Alimentarycanaldisfunctionsuchasbloodstainedfaecesandabnormaldefecation, diarrhoeaanddysentery.
- Urination:highfrequencyortoolowandhavingstrangecolour.
- Skin:roughwithscalyskin,blistersontheskinandhairloss.

CausesofDiseases

- Pathogeniccauses/infectiosdiseasecausingorganisms;
  - Viruses-areextremelysmallorganisms.Theycontainanucleicacidcoreina proteincoat.Notseenusingordinarymicroscopeinsteadanelectronic microscope.Theygrowandmultiplyinlivingcells.Theyleadtocelldeathdueto tissuedamageanddisfunction.Theyaffectonlycertaintissuesandonehostonly. Viralconditionsareinfectiousandcontagious.Examplesofviraldiseases:

Disease	Causalorganism/Vector	Animalaffected
Rinderpest	Virusattackingmainlyth e mucousmembraneofth e alimentarytract.	Cattle
Footandmouth	Virusattacksthemucous membranesofthemouth andcoronet.	Cattle,sheep,goatsand pigs
Swinefever	Virus	Pigs
Newcastle	Virus	Poultry
Marek’sdisease(fowl paralysis	Virus	Poultry
Gumborodiseaseof poultry	Virus	Chicks

- Bacteria–areunicecullarmicro-organismsofdiverseshapes;cocci/spherical, bacilli/cylindrical,spirilla/spiralandvibrio/commashaped.Theyarefoundinsoil, air,food,andwater.Somearepathogenicwhileothersarenon-pathogeniciethose intheruminantdigestcellulose.Theycausethelargestnumberofdiseases (pathogenic).Examplesofbacterialdiseases.

Disease	Causalorganism/Vector	Animalaffected
Anthrax	Bacillusanthracis	Cattlesheep,goatsand pigs
Blackquater	Clostridiumsspp	Cattle,sheep,goats
Brucellosis(contagious abortion)	Brucellaabortus	Cattle,goats
Calfpneumonia	Pasteurellaspp	Calves
footrot	Spherophorus necrophorus Staphylococcusspp	Cattle,goats
Fowltyphoid	Salmonellagallinarum	Domesticfowls
Mastitis	Streptococcusspp Staphylococcusspp	Cattlegoats
Enterotoxemia(pulpy kidney)	Clostridiumwelchii	Sheep
Pullorumdiseasesof poultry/Bacillarywhite diarrhea	Salmonellapullorum	Poultry
Lambdysentery	Clostridiumwelchii	Younglambs

- protozoa–aremicroscopicsingle–celledorganisms.Somearepathogenicand parasitic.Arespreadbyarthropodvectorsieticks,tsetseflyiesandmosquitoes. Theyalsoproducetoxicdiseasecausingsubstances.Commondiseaseinclude:

Disease	Causalorganism	Vector	Animalaffected
Eastcoastfever	Theileraparva	Brownticks	Cattle
Redwater (Babesiosis)	Babesiaspp	Blueand brownear ticks	Cattleandsheep
Anaplasmosis(gall –sickness)	Anaplasmamarginal e	Blueticks	Cattle,sheepand goats
Heartwater	Cowdriaruminantiu m (rickettsia)	Bonttick	Cattlesheepand goats
Trypanosomiasis	Trypanosomespp	Tsetseflies	Mostanimals
Coccidiosis	Eimeriaspp	Coccidian	Poultryandyoung animals

- parasiticorganisms-theysuckbloodandtransmitotherorganismsthatcause diseases.Canblockinternalorgansintheanimalcausinginjuriestothebody organs.Theyaredividedintoexternalparasites(ticks,fleas,lice,keds,tsetseflies andbitingflies)andinternalparasites(roundworms,tapeworms,andflukes).
- fungi.
- rickettsia,

- Physicalcauses;

- Physicalinjuriestothebodyorpartsietraumaticinjuryduetosuddenandviolent physicalforce.Pressureonaparticularpartofthebodyierobecausesphysical injury.Excessiveheatcausesblistersorburns.
- Fracturesandtearingoftheskin.
- Dislocation, Sprains.

- Nutritional/metabolicdisordersforexamplemilkfever-arisefrombodymalfunctions, ormineraldeficiencyinthedietormineralimbalances.Itscommoninrapidlygrowing animals.Itmayresultin:
  - -Pigletanaemiaduetolackofiron.
  - -Curledtoeparalysisinpoultryduetolackofcalciumandphosphorus.
  - -Milkfever9parturientparesis)duetolackofcalcium.
  - -Goiterinyoungcalvesduetolackofiodine.
  - -Bovineketosisoracetonaemiaduetoimpairedmetabolismofcarbohydrates andvolatilefattyacids. -
    Enzooticataxiaorswaybackinlambsduetolackofcopper.
  - -Osteomalaciaduetolackofphosphorus.
- Chemicalcausesforexamplepoisoningbyagrochemicals.Chemicalsieacids, alkalis,insecticidesandherbicidescausespoisoning.Apoisonisanysubstance whichwillinterferewiththenormalstructureorphysiologicalmechanismofan animal'sbodyoncomingincontactwithinternalorexternalbodyorgans.Chemicals causeirritation,corrosionandburningoftissues.Mostarepoisonous.Others interferewithmembranepermeability.Weedsi eDaturastramonium(thornapple)are poisonoustoanimals.
- Livingorganisms-arethemostcommoncauses.Theyincludeparasitesandthose livingcreaturesthatinvadeanimal'sbody.Examplesbacteria,virus,protozoa,wor ms, insectsandarthropods.Pathogensaredividedintoinfectiousandthosethatare typicallyparasiticinnature.
- Amountoffoodeatenbyananimal-excessiveintakeoflushpasturecausebloator ruminaltympany.Resultsduetoproductionofexcessmethaneintherumenduring fermentation.Animalsbecomeemaciatedwhentheylack:proteins,carbohydrates, mineralsandvitamins.feedswithaflatoxincauseill-healthordeath.

CategoriesofDiseases

- Notifiablediseases;
  - Thesearediseaseswhichcausehigheconomiclosses.
  - Anycase/ outbreak,shouldbereportedtothegovernmentauthorityieChiefs,D.O.s, veterinaryofficersorthepolice.
- Tick-bornediseases-Transmittedbyticks.
- Breedingdiseases-Transmittedthroughmating.
- Nutritionaldiseasesforexamplemilkfeverandbloat.
- Parasiticdiseasesforexampleascariosis.

GeneralMethodsofDiseaseControl

Thisinvolvesbothroutinemanagementpracticesandpreventivemeasures;

PREVENTIVEMEASURES

- Quarantine-istherestrictionofmovementofanimalsandtheirproductsfrom andintotheaffectedareasintheeventofanoutbreakofanotifiabledisease.It's basedontheprincipalofenclosureinwhichaffectedanimalsareisolatedand theirmovementrestricted.
- Vaccination-vaccinesareweakenedformsofdiseasecausingorganismsinjectedin theanimal'sbloodstream.Itstimulatesproductionofantibodiesinanimals. Examplesvaccinesagainst;footandmouth,Newcastle,rinderpest,rabiesandfowl pox,anthrax,fowltyphoidandblackwater.
- Controlofvectorsbyuseofacaricidesandrotationalgrazing–avectorisan organismthattransmitsadiseasefromaninfectedanimaltoahealthyoneieticks, tsetseflies,kedsandmites.
- Disinfectingtheequipmentandbuildingsusingantisepticsanddisinfectantsdisinfe ctantsareusedtokillbacteriainbuildings,troughsandpigstyfloors. Antisepticsarepreparationsofmildantibacterialdrugsforuseontheskinorwounds increamorliquidform.
- Useofprophylacticandtreatmentmeasures/preventivedrugs-itinvolves
  - Useofprophylacticdrugs-ieprovidingcoccidiodantsinwaterorfood tocontrolcoccidiosis,drenchinganimalswithantihelminthesagainst internalparasitesinsheep,useoflongactingdrugsiesulphanomides tocontroltrypasonomiasis.
- Slaughteringtheaffectedanimalsforhighlycontagiousandinfectious diseasesierinderpest,footandmouthdisease,Newcastle,swinefeverand brucellosisisolateandslaughtertheinfectedanimals.Itpreventsanyfurther spread.Burrydeeplyorburntheircarcasses
- Isolatingsickanimals-it'stheseparationorconfinementofasickanimal fromhealthyoneswhenitssickorsuspectedtohavecontractedadisease. It'sdonetoavoidfurtherspreadingofhighlyinfectiousandcontagious diseases.

ROUTINEMANAGEMENTPRACTICES

- Properfeedingoflivestock-donetoavoiddeficiencydiseasesandtomake animalsstrong.Giveabalancedration,dietsthatareadequateinquantity andquality.Wellbalancedrationactasameasureofpreventingnutritional ormetabolicdisorders.
- Cullingoftheanimalswhicharecarriers/slaughteringtheaffectedanimals.
- Useofartificialinseminationtocontrolbreedingdiseases.
- Properselectionandbreedingofanimals–healthanimalsfreefromdiseaseare selectedforbreeding.Susceptibleanimalstodiseasesareculled.Toavoid transmissionofcongenitalldiseasesappropriatebreedingpoliciesareneeded
- Properhousingandhygiene-
  housesforrabbits,calves,poultry,pigs,zerograzingandyoungstockshouldmeetth efollowingrequirements: -Wellventilatedbutfreefromdroughtandcoldwinds,
  - Leakproof
  - Welllitandeasytoclean
  - Allowproperdrainage
  - Haveadequatespaceforthenumberofanimalshoused.

Properhousinghelpstocontroldiseasesiemastitis,scoursinyounganimals andparasitesiemites.Highleveloffarmhygienecontrolsmanydiseases. Placeafootbathmadeof2%coppersulphatesolutionattheentrance.5-10% cuso4isusedtocontroldiseaseiefootrot.

AppropriateMethodsofHandlingLivestock

Handleanimalsinahumaneandtechnicalway

Animalsarehandledforthefollowingreasons:

- Wheninspectingtheanimaltoascertainanyabnormalityorsignsofdiseases.
- Whenadministeringanyformoftreatmentsuchasdrenching,injectionandmastitis control.
- Whensprayingorhanddressingtheanimalwithchemicalstocontrolexternal parasites.
- Whenmilkingtheanimal.
- Whenperformingsomeofthemanagementpracticessuchasdehorning,disbudding, castration,hooftrimming.

W

hencarryingouttheseactivitiesanimalsshouldberestrainedinacrushorwithhalters

. Othermethodsofrestraininganimalsincludetheuseof;

- halters,
- ropes, bullring
- leadstick.
- Useofaheadyoke.

Activitiesthatnecessitatehandlingoftheanimal

- Drenching-oraladministrationofdrugstotheanimal.Itsdineusingadrenchinggun. Animalisrestrained.thehedisheldclosetothestocksmanunderthelefthandarm pit.Mouthisopenedwiththelefthand.mouthisopenedwiththelefthandanddrugs pushedin.
- Injection-intra-muscularinjectiondoneintothemusclesorintravenousintoveins.
- Mastitiscontrol-restrainanimalinthecrush.Completemilkingandtheninfuse antibiotisintotheteats.
- Handspaying-animalisrestrainedinacrush.Useastiruppumporknapsacksprayer. Sprayallsidespreferredbyticks.

LivestockHealthII(Parasites)

Introduction

- Aparasiteisanorganismwhichobtainsitslivelihoodfromanotherorganism(host) whichsuffersdamage.
- Parasitismistheassociationbetweenaparasiteandahost.
-

Theeffectsofparasiteonthehostanimalare:

- Depriving the host of its food - internal parasites compete with the host for nutrient leading to loss of wt, emaciation and low production.
- Sucking blood hence causing anaemic condition that might result in death.
- Damaging the organs and tissues of the host - internal parasites i.e roundworms, liver flukes migrate from place to place injuring tissues.
- Cause irritation on the skin of the host - parasites biting effect makes the animal to rub itself against solid objects destroying skin, furor wool.
- Destruction of hides and skins.
- Transmission of diseases.
- Cause obstruction in body passages leading to malfunctioning of affected organs.

GeneralSymptomsofParasitesInfestation:

- Emaciation.
- Potbellied condition.
- Swellings in the jaw or other areas.
- Rough hair or rough coat.
- Anaemia.
- Diarrhoea.
- Presence of worm segments and blood stains in the defecation.

TypesofParasites

There are two types of parasites:

- External (ecto-parasites)
- Internal (endo-parasites)

External parasites are;

- ticks,
- tsetse flies,
- mites,
- lice,
- fleas
- keds
- They found outside of the body of the host organism. They attack the skin of livestock. They live on or under the skin.
  They belong to phylum athropoda

Classesofparasites

- Class insect - flies, keds, mosquitoes, flies, lice, and fleas.
  - Tsetse fly (Glossina spp)
    - It’s a large fly that bites during the day. Has many species in different habitats. Feeds on wild and domestic animals blood. It undergoes complete metamorphosis (develops from eggs - larvae - pupa - adult stage)
  - Harmful effects of tsetse flies
- Transmit trypanosomiasis through trypanosome protozoan parasite in the saliva.
- Sucks large volumes of blood from the animal causing anaemia in small animals.

- Damagestheskinsnandhidesofanimalsthewoundsformedactasroutesfor secondaryinfectionbypathogens. Controloftsetseflies
- Bushclearingtodestroybreedingplacesoftheflies.
- Sprayingbreedingplaceswithsuitableinsecticidesregularlytokilladultflies.
- Useflytrapswithimpregnatednets.
- Useofsterilizingagentsieradioisotopesonmalefliesandreleasingthem.
    - oKeds(melophagusovinus)

Commonlyknownassheepticks.Arehairyandwinglessbloodsuckingfliesthatattack sheep.

Harmfuleffects

- Retardationofgrowthinlambs.
- Animalsbecomeanaemic
- Irritation,animalsscratchesandbitesitselfhencedamagingthewool.
- Considerablewheninfectionisheavy.
- Arachnida–consistsofticks,mitesandspiders

LifeCycleofticks

- Eggsarelaidincracksontheground.
- Theyhatchin4-6weeksintolarvaewhichclimbonthegrasswaitingforapassing animal.

One-HostTick

- Thisrequiresonehosttocompleteitslifecycle.
- Example:bluetick(Boophilusdecoloratus).
- Preferredsites:face,neck,dewlapandsideofthebody.
- Diseasetransmitted:Redwaterandanaplasmosis.

Two-HostTick

- Thisrequirestwodifferenthoststocompleteitslifecycle.
- Example:Theredleggedtick(Rhipicephaluseverts)
- Preferredsites:Ears,anus,udderandthetail.
- Diseasetransmitted:Redwaterandeastcoastfever.
- Example:Bontleggedtick(amblyommaspp.)
- Preferredsites:Udder,scrotumandtailswitch.
- Diseasetransmitted:Sweatingsickness.

Three-HostTick

- Thisrequiresthreehoststocompleteitslifecycle.
-

Example:Thebrowneartick(Rhipicephalusappendiculatus)

- Preferredsites:Ears,tailswitchandaroundtheeyes.
- Diseasetransmitted:Eastcoastfeverandredwater.
- Bontticktransmitheartwater(amblyommaspp.)

ControlofTicks

- Dipping/spraying/handdressingwithacaricides.

- Rotationalgrazing.
- Ploughingthelandtobreakthelifecycle.
- Handpickingandkilling.
- Fencingofthegrazingfieldstokeepoffotheranimalsincludingwildgame.
- Burningofgrasstokilltheminvariousstages.

Endo-parasites(internalParasites)

- Endoparasitesarehelminths.

Theycanbedividedinto:

- Platyhelminthes/flatwormswhichinclude; Trematodes(flukes)
  - Cestodes(tapeworms).
- Nemato-helminthes/nematodes.E.gRoundworms.

GeneralSymptomsofHelminthiasis

- Diarrhoeawhichfoultheanalandtailregion.
- Dullness.
- Anaemia.
- Bigstomach(potbelliedcondition).
- Presenceofwormsegmentsinfaeces.
- Coughing.

Trematodes(LiverFluke)

- Therearetwospeciesofflukes: Fasciolagigantica
  - Fasciolahepatica.
- Fasciolahepaticaismorecommon.
- Itiscommonlyfoundintheliverandbileductofcattle,sheepandgoats.
- Liverflukeisaprobleminmarshyandlowlyingwetareas.

LifeCycleoftheLiverFluke

- Adultflukeintheliveroftheprimaryhostlayseggs.
- Eggspassthroughthebileductintothesmallintestinesandarepassedoutinfaeces ontothepasture.
- Undermoistconditions,theyhatchintoamiracidiumlarvawhichswimsaboutin searchofasecondaryhost(freshwatersnails).
- Inthesnail,itdevelopsthroughsporocyst,rediaandcercaria.
- Whenitleavesthesnail,thecercariagetsencystedonvegetationandbecomes metacercaria.
- Thisisswallowedbytheprimaryhostwithgrass.
- Theyoungflukemigratesintotheliverthroughbloodvesselswhenitmatures.

ControlofLiverFluke

- Keeplivestockoffmarshyareasneartherivers/streams/lakesanddams.
- Drenchaffectedanimals.
- Drainageofswampyareas.
- Eradicatetheintermediatehostbyuseofmolluscicides.
- Providewatertolivestockinelevatedtroughs.

Tapeworms

- There are many species of tapeworms

Eexample;

- Taenia solium
- Taenia saginata.

The adults live in the small intestines of man (the primary host).

- The intermediate host of Taenia solium is pig.
- The intermediate host of Taenia saginata is cattle.

Life Cycle of Tapeworm

- Adult tapeworms live in man's intestines where it lays eggs.
- Eggs are passed out with faeces,
- Then they develop an outer covering known as onchosphere.
- The eggs are swallowed by intermediate host.
- The outer covering is digested and the young worm emerges.
- This bores into the blood vessels and is carried to specific muscles such as the tongue, heart, thigh muscles.
- It develops into an encysted form called bladder-worm.
- When the animal is killed and meat is eaten raw or in an inadequately cooked form, man gets infected by the bladder¬-worm.
- In man, the bladder-worm evaginates and attaches itself onto the intestinal wall where it develops into an adult.

Control of Tapeworms

- Meat should be well cooked before eating.
- Use of drugs in primary host.
- Meat inspection by meat inspectors/veterinary officers.
- Use of pit latrines by man.

Nematodes (Roundworms)

Common one sare;

- Ascaris suum (pig roundworms),
- Ascaris lumbricoides found in man and sheep
- Haemonchus contortus found in sheep, cattle and goats.
- Roundworms are common in warm areas especially in areas where the standards of hygiene and sanitation are low.

Nature of Damage

- Damage is done to the liver and lung tissues as they migrate in the body.
- Suck out blood.
- Deprive the host of food.

Control of Roundworms

- Use of drugs.
- Rotational grazing.
- Use of proper stocking rates to avoid overgrazing.
- Practicing high standards of cleanliness and hygiene such as use of latrines.

LivestockProductionII(Nutrition)

Introduction

- Animalsarefedforthepurposeofproductionandbodymaintenance.
- Theediblematerialgiventoanimalsiscalledfood.
- Itisdigested,absorbedand utilizedinthebody.
- Nutrientsareorganicandinorganicsubstancescontainedinthefoodmaterials.

ComponentsofFoodmaterial

- water,
- protein,
- carbohydrates,
- fatsandoils, vitamins
- mineralsalts.

Water

Sources

- Freewater(throughdrinking)
- Boundwater(containedinfeeds).
- Metabolicwater(obtainedfromoxidationoffood). Functions
- Regulatesbodytemperature.
- Transportagentinthebody.
- Universalsolventinthebody.
- Givesshapetothecells(turgidity).
- Actsasalubricant.
- Actsasconstituentofbodyfluids.

FactorsDeterminingtheRequirementsofWaterbyLivestock

- Productionlevel.
- Amountofdrymattereaten.
- Temperatureofthesurroundingarea.
- Typeofanimal.
- Typeoffoodeaten.

Protein Sources:

- Groundnutcakes,
- cottonseedcakes,
- fishmeal, meatmeal.

Functions:

- Growthofnewtissues.
- Repairofwornouttissues(bodybuilding).
- Synthesisofantibodies.
- Synthesisofhormonesandenzymes.

- Productionofenergyduringstarvation.

DigestionofProteins

In non-ruminants, protein digestion takes place in the stomach.

- Food is subjected to mechanical breakdown through chewing into small particles.
- Protein is acted on by enzymes to turn into amino acid which is assimilated into the bloodstream.

In ruminants, protein digestion initially takes place in the rumen.

- Food is acted on by micro-organisms into microbial protein.
- Later, enzymatic action takes place in the "true stomach" or abomasum where proteins are broken down into amino acids which are then assimilated into the bloodstream.

Carbohydrates Sources:

- Cereals,
- tubers
- commercially mixed feeds.

Functions:

- Supply energy and heat to the body.
- Excess is stored in form of fat for insulation of the body.

DigestionofCarbohydrates

- In non-ruminants;
  - carbohydrate feeds are broken down by chewing into small particles.
  - The enzymatic action further breaks down carbohydrates into glucose, fructose and galactose which are then assimilated into the bloodstream.
- In ruminants;
  - mechanical breakdown of carbohydrate feeds is followed by microbial activities which breakdown cellulose into volatile fatty acids.
  - These are absorbed through the rumen walls.
  - Some carbohydrates are broken down by enzymatic action in the "true stomach" or abomasum.

FatsandOils Sources:

- Cotton seeds, soya beans
- groundnuts.

Functions:

- Supply energy and heat to the body.
- Excess is stored as fat adipose tissues.
- Source of metabolic water in the body.
- Required for the development of neural system.
- Insulator in the body.

DigestionoflipidsinRuminants

- Fats are hydrolysed in the rumen into fatty acids and glycerol.
- Others are fermented into propionic acid,
- The shorter chains are passed to the true stomach where enzymatic action takes place.

Vitamins Sources:

- Greenmaterials, driedgrass
- fishliveroil.

Functions:

- Protectsthebodyagainstdiseases.
- Regulatethefunctionsofallpartsofthebody.
- Itactsasaco-enzymeinthebody. Examples:
  - VitaminA,
  - vitaminB2 vitaminC,
  - vitaminE vitaminK.

Minerals Sources:

- Saltlicks,
- bonemeal, legumes
- cereals.

Functions:

- Formpartofthetissuessuchasbonesandteeth.
- Worktogetherwiththeenzymes.
- Actasacid-basebalances.
- Actaselectrolyteinthebody.
- Regulateosmoticbalanceinthebody. Examples:
  - Calcium,
  - phosphorus,
  - magnesium,
  - iron,
  - iodine, sodium
  - chlorine.

- CalciumandphosphorusNeededforteethandboneformation.
  - Lackofthesemineralsleadstorickets,osteomalacia.
- Lackofironleadstoanaemia.

ClassificationofAnimalFeeds

Thisisbasedonnutrientcomposition:

- Roughages.
- Concentrates.
- Feedadditives.

Roughages

- Arefeedsoflowavailablenutrientsperunitweightandhighfibrecontent.

Examples:

- Dryroughages,
- succulentroughages,
- residuesfromagriculturalbyproductsandconservedmaterials. Characteristics

- Lowlevelofavailablenutrients.
- Havehighlevelofcalciumespeciallylegumes.
- GoodsourceofvitaminA.
- Havehighfibrecontent.

Concentrates

- Arefeedsofhighavailablenutrientsperunitweight.

Examples:

- Maizegermandbran,
- maltextract,
- milkproducts,
- soyabeans,
- oilseedcakes,
- meatmeal, bonemeal
- bloodmeal.

Characteristics

- Lowfibrecontent.
- Feedcontentisconsistentlyhigh.
- Highdigestibilityofthefeed.
- Highinnutrientcontent.

FeedAdditives

Thesearesubstancesaddedtothefeedtoincrease;

- palatability,
- medication
- orhormonestomakeanimalsproducemore. Therearetwotypes:
- Nutritiveadditives,suchasmineralslicks(maclick).
- Non-nutritiveadditives,suchas;
  - medicants(coccidiostats), Stilboestrol(usedinbeefanimals)
  - oxytocin(toincreasemilkletdown).

Functions

- Stimulategrowthandproduction.
- Improvefeedefficiency.
- Preventdiseasecausingorganisms.

CompoundedFeeds

- Thesearethefeedspreparedandmixedbyuseofmachines.
- Thesefeedscanberound,pelleted,pencils,cubesormash.

Poultryfeedscanbecategorizedas:

- Chickmashhaving20%D.C.P.giventochicks.
- Growersmashhaving16%D.C.P.giventogrowers. Layersmashhaving12-15%D.C.P.giventolayers.

Meaningoftermsusedtoexpressfeedvalues

- Nutritiveratio(NR):
  - Istheproportionofproteintocarbohydratesandfats. Inyounganimals1:3:6
  - Inoldanimals1:8.
- Crudeprotein(C.P):Isthetotalamountofproteincontainedinafeed.
- DigestibleCrudeProtein(D.C.P):Istheportionofcrudeproteinwhichananimal iscapableofdigesting.
- CrudeFibre(C.F.):

- Isthetotalamountoffibrecontainedinafeed.
- Itismainlyligninandcellulose.

- DigestibleFibre(D.F.):Istheportionofthetotalfibrecontainedinafeedwhichan animaliscapableofdigesting.
- DryMatter(D.M.):Isthematerialleftinafeedafterwaterhasbeenremoved.
- Starchequivalent(S.E.):Istheamountofpurestarchwhichhasthesameenergy as100kgofthatfeed.
- TotalDigestibleNutrients(T.D.N.):Isthesumofallthedigestibleorganic nutrientssuchasfats,proteins,carbohydratesandfibre.

ComputationofLivestockRations

- Ration:
  - Istheamountoffoodthatwillprovideessentialnutrientstoananimalina24hour period
  - toenablethatanimaltomeetitsmaintenanceandproductionrequirements.
- Balancedration:
  - Istherationthatcontainsalltheessentialnutrientsinrequiredamountsandin therightproportion.
- Maintenanceration:
  - istheportionofafeedrequiredbyananimaltocontinuewiththevitalbody processeswithnolossorgaininweight.
- Productionration:
  - Isthefeedrequiredbyanimalsoverandabovemaintenanceration toenablethe animaltoproduce;
  - forexample;milk,eggs,wool,growinsize,performwork,reproduceandfatten.

Stepsinrationformulation

- Findingouttheanimal'sfeedrequirementbasedonbodyweight.
- Listalltheavailablefeeds,withtheirnutrientcompositionandtheirprices.
- Calculatetheamountofingredientsrequiredintherationtomeettheanimalsneeds.

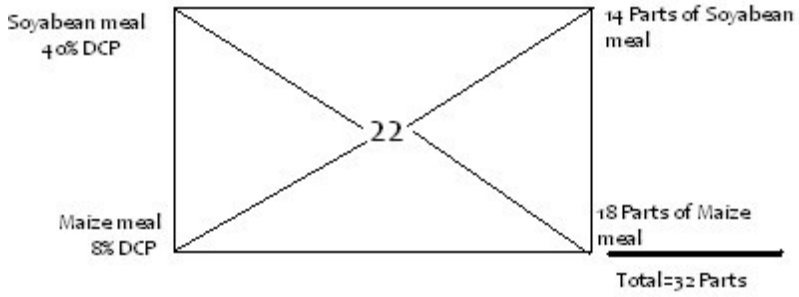
Methodsusedinrationformulation

- Trialanderrormethod
- Pearson’ssquaremethod
- Graphicalmethod
- Linearprogramming(useofcomputers)

Examples;

MixaPigsration22%proteinusingsoyabeanmeal40%DCPandmaizemealcontaining 8%DCP.

Pearson's square method



Soyabeanmeal(14*100)=43.75kg

32 Maizemeal(18*100=56.25kg

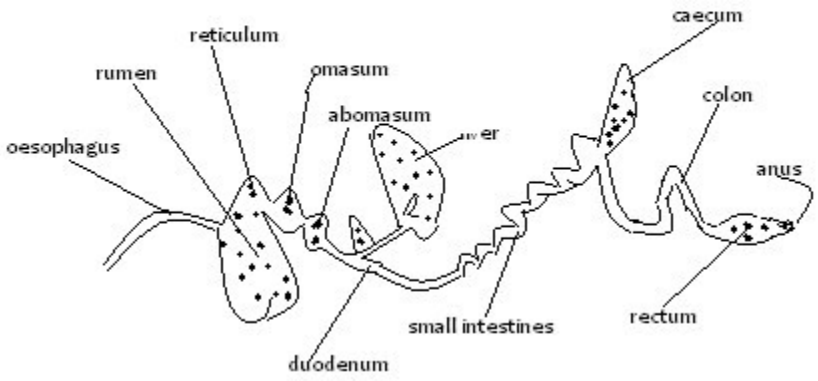
32 Digestionanddigestivesystems

- Digestionistheprocessthroughwhichfoodisbrokendownintosmallparticlesinthe alimentarycanalreadyforabsorptionintothebloodstream.

Digestionoffoodinlivestocktakesplaceinthreestages;

- Mechanicalbreakdownandchewing
- Microbialbreakdownbybacteriaandprotozoaintherumenofruminants
- Chemicalbreakdownbyenzymes.

Digestive system of a Ruminant



Rumen-

- Breakdownoffoodbymicro-organismsandalsostoresfood.
- SynthesisofvitaminB-complex.
- Synthesisofaminoacidsfromammoniagas.
- Proteinsarebrokentopeptidesandaminoacids.
- Carbohydratesarebrokentovolatilefattyacids. Reticulum:

Separateslargefoodparticlesfromthesmallparticles.
Retainsforeignmaterialssuchasstones,hardwoodandsand.

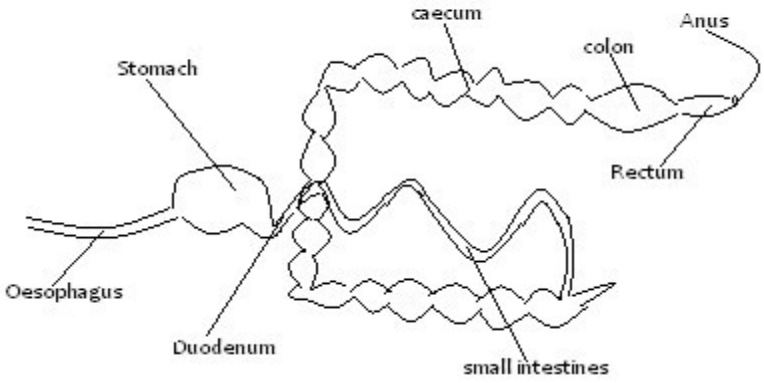
Omasum:

Breaksupfoodbygrinding. Reductionofwatercontentfromthefeedstuff.

Abomasum:

Enzymaticdigestiontakesplacehere..
Containssomemicrobeswhichdigestcellulose.
Breaksupfoodbygrinding.
Itisalsofoundinnon¬-ruminants.

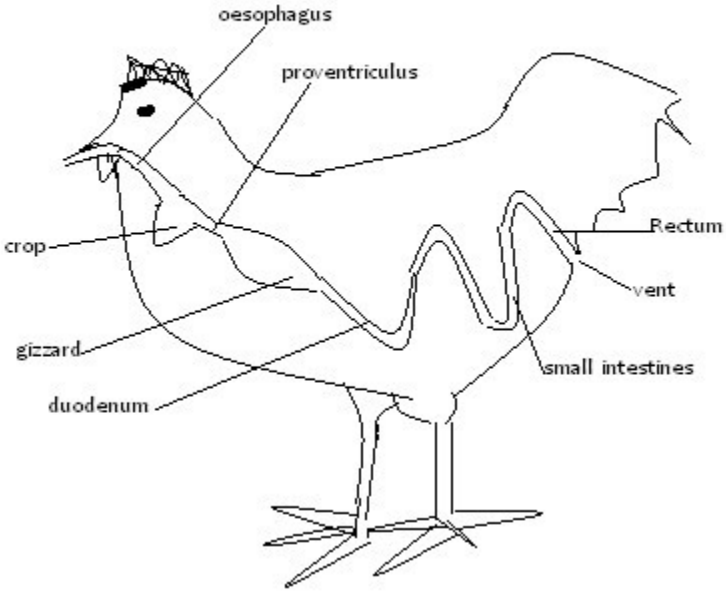
Digestive system of a non-ruminant e.g pig



ComparisonBetweenDigestioninRuminantandNonruminants

Ruminants	Non-ruminants
. • Chewthecud.	. • Donotchewthecud.
• Havefourstomachchambers-thus polygastric.	• Haveonestomachchamber - thusmonogastric.
• Regurgitatefood.	• Cannotregurgitatefoodonce swallowed.
• Candigestcellulose.Have micro-organismsintherumen that digestcellulose.	• Havenomicro-organisms inthestomachhencecannot digestcelluloseexceptthose
5.HavenoPtyalininsalivahence noenzymaticdigestioninthe 6 mouthMostdigestionan. dabsorptiontakes placeintherumen.	• animalswithmicro-organisms inthecaecum.
.7 Havealkalinesalivaduetopresence ofammonia.	• HavePtyalininthesalivahence enzymaticdigestionstartsinthe m outhMostdigestionandabsorption inthesm takesplacaellintestines.
	ThesalivaisneutralpH.

Differences



FunctionsofthePartsofPoultry

- Crop:
  - Storageoffood.
  - Softeningoffoodbysecretionsfromsmallglandsinthewalls.
- Proventriculus:Enzymesstartthebreakdownoffood.
- Gizzard:-Crushesandgrindsthecoarsefood(hassmallgritandgravel).

ComparisonBetweenDigestionInRuminantsandNon-Ruminants

SimilaritiesBetweenDigestionInRuminantsandNon-Ruminants

- Digestioninyoungruminantsissimilartothatinnon-ruminantsastheydonothavea developedrumen-reticulumcomplex.
- Finalproteindigestiontakesplaceinthesmallintestinesinbothcases.
- Waterabsorptiontakesplaceinthecoloninbothruminantsandnon¬ruminants

LivestockProductionIII… (SelectionandBreeding)

Introduction

- Thebreedingofanimalsisunderhumancontrol,andthebreedersdecidewhich individualsshallproducethenextgeneration.
- Thebreedermakesachoice.
- Thebreedingofanimalsisbaseduponthefactthatcertainqualitiesaregenetic ,hencev aluablequalitiesarepassedonfromparentstooff-springs.
- Thequalitiescanbemaintainedorimprovedinthenextgeneration.

Theperformanceofananimalisinfluencedbytwomajorfactors;

- Geneticpotential
- Theenvironment,whichincludes:
  - Feeding,
  - Health,
  - Care
  - Theecologicalconditions.
- Thegeneticpotentialofananimalisinheritedfromitsparents.
- Inselectionandbreedinganimalswithsuperiorcharacteristicsareselectedand allowedtomate.
- Intheprocesstheytransmitthesuperiorcharacteristicstotheiroffspring.
- Whenthisisdoneoveralongperiodoftime,itresultsinlivestockimprovement.

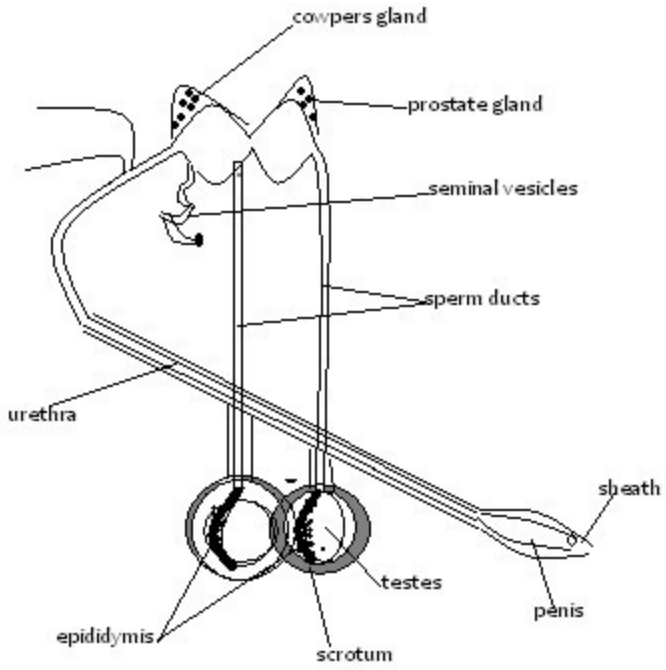
ReproductionandReproductiveSystems

- Reproductionistheprocessbywhichoff-springsareproduced.
- Allfarmanimalsmultiplybymeansofsexualreproduction.
- Itbeginswithfertilizationwhichisthefusionofmaleandfemalegametestoforma zygote.
- Fertilizationtakesplaceinternallyinthebodyofthefemale.
- Theembryo(zygote)formeddevelopsinsidebodyofmother,fedandprotecteduntil endofgestationperiod.
- Inpoultry,theprocessisdifferentinthateggsarefertilizedinternallybutlaidand developmentofthechicktakesplaceoutsideduringincubation.
- Inbothmaleandfemale,certainorgansarespecializedfortheprocessof reproduction.
- Someoftheseorganssecretfluidswhicharenecessaryforthemovementand survivalofthegametes(reproductivecells.)

ReproductioninCattle

- Themalereproductiveorgansproducethemalegametes,thespermatozoans.
- Theseareintroducedintofemalereproductivesystem,wheretheyfusewiththe spermtoformzygote.

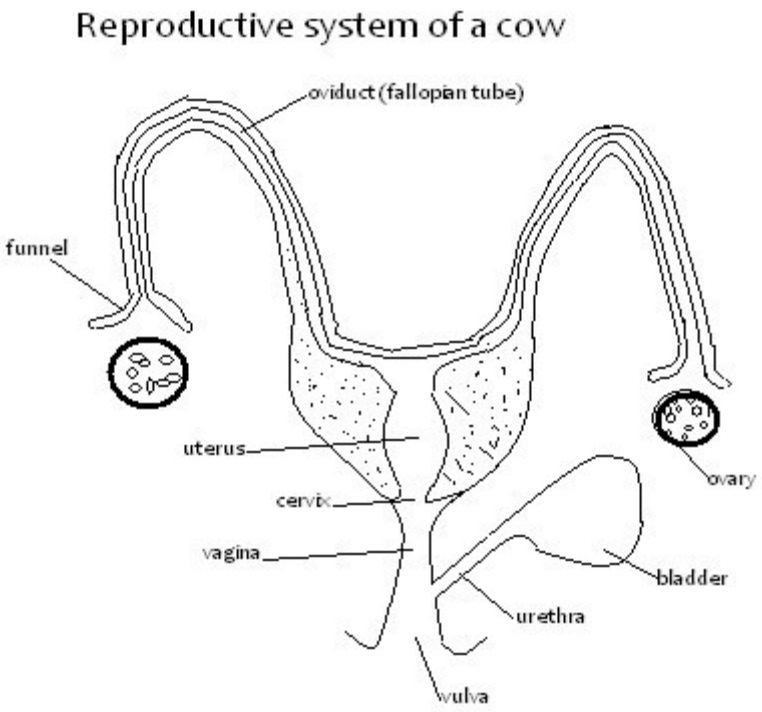
Reproductive system of a bull



- Thetestis:
  - Therearetwotesteshanginglooselybetweenhindlegs.
  - Enclosedbylooseskin(scrotum)scrotumregulatetemperatureoftestisfor optimumproductionofsperms.
  - Producespermatozoa(sperms)whicharestoredincoiledtubecalledepididymis.
- Epididymis:Storageofspermatozoa.
- Spermducts:
  - Conveysspermfromthetestisandurinethroughthepenis.
  - sphinctermusclescontracttoalloweachtopassseparetly.
- Seminalvesiclesproducefluidcalledsemem.
- semencarriesspermsoutofpenisinfluidform.

- Prostategland-producefluidthatneutralizetheacidiceffectsofurineinthe urethrapreventingdeathofsperms.
- Accessoryglands:Includeseminalvesiclescowpersglandandprostategland.
- Urethra:Conveysurineandsemen.
- Penis:
  - Surroundedbyasheathwhichisanextensionofskin.
  - Itintroducesspermsintothevaginaofacowthroughthevulvaduringmating.

- Itisacopulatoryorgan,alsousedforurination.



Ovariesandfallopiantubes(oviduct)

- Twoovarieslocatedinabdomen,leftandright.
- Produceova/eggsandhormoneswhichcontrolsexualcycle.
- Oestrogenproducedbygraafianfollicleinsideovaryinducesoestrus
- ie.Heatperiodsothatthecowshowssignsofheat
- Afterevery21daystheovaryreleasesamatureovumandthecowcomesonheat.
- Theovumtravelsthroughthefallopiantubestotheuterus.
- Thereleaseandmovementoftheovumdowntotheuterusiscalled**ovulation.**
- Ifmatingisdoneatthistime,fertilizationwilltakeplace.
- Thefertilizedeggimplantsitselfontotheendometrium(wallsofuterus)anddevelops intofoetus.

Fallopiantubes:

- Fertilizationtakesplacehere.
- Alsoapassagefortheeggfromtheovarytotheuterus.

Theuterus:

- Embryodevelopshere. - Thecervix:Closestheuterus.

ThevaginaandVulva:

- Vulvaistheexternalopeningoffemalereproductivesystem.
- Itallowsmatingtotakeplacesothatspermsaredepositedintothevagina.
- Thefoetusandurineareremovedthroughthevulva.

Pregnancy

- Isperiodbetweenfertilizationofovaandtheexpulsionofthefoetusthroughthevulva.
- Alsocalled**gestationperiod.** - Incattlegestationperiodis270-285days.
- Endswiththebirthofacalf.

- Thereproductivetractundergoesaperiodofrestduringwhichitisrepairedand returnstonormal.
- Duringpregnancy,hormonecalled**progesterone**isproducedbytheplacentato maintainthefoetusintheuterus.

Parturition(givingbirth)

- Actofgivingbirthcalledparturition.
- Thistimethefoetusexpelledthroughthebirthcanal.

Whenananimalisabouttogivebirth,itshows**signs;-**

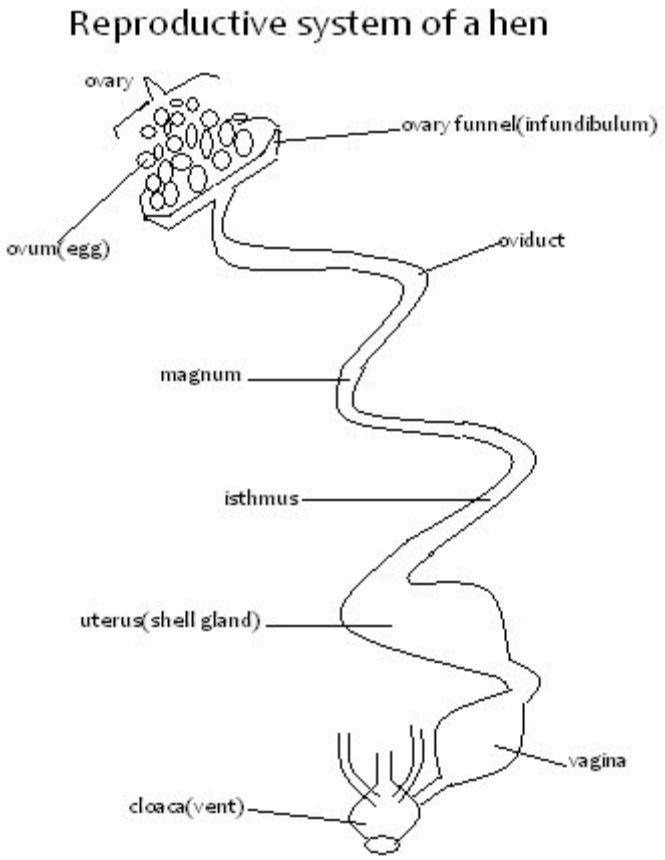
- Distendedudderwhichproducesthickmilkyfluidcalledcolostrums.
- Swollenvulvaproducingthickmucus.
- Looseandslackenedpelvicgirdle.
- Visiblepinbones.
- Generalrestlessness.

- Animalparturateswithin2-3hoursafterthissigns.
- Thecorrectpresentationiswiththefrontfeetfirst,andtheheadoutstretchedand restinginbetweenthefee.
- Anyotherpresentationcalled**mal-presentationorbreechpresentation**and requiresassistance.

ReproductioninPoultry

- Thecockhasnopenisbutasmallopeningneartheventthroughwhichspermsare emitted.
- Cockhastesteswithinthebody.
- Thehenhaselongatedoviductforformationofanegg.
- Fertilizationoccursinternally.
- Duringmatingthecloacaofthehenandtheventofthecockfitintoeachotherand thensemenispouredintothecloaca,thensuckedtotheoviducts.

TheReproductiveSystemofaHen



Ovary

- Henhastwoovariesbutonefunctional.
- Ovaformedinovaries.
- 3500-4000ovapresentinsideovaryheldbyfollicle.
- Matureovumreleasedviaraptureoffollicle.

Itmovesintooviductreceivedbythefunnel.

Funnel(infundibulum)

- Fertilizationoccurshere.
- Chalazaealsoaddedtoyolk.
- Timehereis15minutes.
- Itis11.6cmlong.

Magnum

- Thickalbumenisadded.
- Staysfor3hrs.its33cmlong.

Isthmus

- Its10.6cmlong.
- Shellmembranesadded.
- Determinesshapeofegg.
- Water,mineralsaltsandvitaminsadded.
- Takes15minutes.

Uterus(shellgland)

- Calciumdeposited9ie.shelladdedaroundtheegg.
- Pigmentsadded.

- Additionofalbuminfinished. Vagina- Staysherefor18-22hours.
- Short,6.9cmlong.
- Fortemporalstorageofeggbeforelaying Cloaca
- Eggmovesoutofcloacathroughthevent.
- Thecloacaextentsouttopreventtheeggfrombreaking.

NB;

- Eggformationnotdependedonfertilization.
- Eggformationtakes24-26hours.
- Thecomponentsofeggareobtainedfrombodyreservesofthehensbody.

SelectionofaBreedingStock

- Selectionisusedasatoolforlivestockimprovement.
- Abreedingstockisagroupofmalesandfemaleswhichactasparentsoffuture generations.
- Selectionistheprocessofallowingcertainanimalstobeparentsoffuture generationswhilecullingothers.
- Cullingistheremovalofanimalswhichdonotperformtothedesiredlevel,fromthe herd.
- Theanimalsretainedhavecertaindesirablecharacteristicswhichmakethemproduce more.
- Selectedanimalsmakeupthebreedingstock.
- Thebreedingstockshouldpassthegoodqualitiestotheiroffspringsforbetter performance,toimprovethelivestock.
- Selectionprocessrepeatedformanygenerationsincreaseschancesofformationof desirablequalitiesinananimal.
- Geneticallytermedasgenefrequency(occurrenceofthegenesthatcarrydesirable characteristics.)
- Selectionincreasesoccurrenceofdesirablegenesanddecreasesoccuranceof undesirablegenes.
  - Duringselection,thecharacteristicstobeselectedforarefirststudiedcloselyto ascertainthatitisnotinfluencedbytheenvironment,butmainlybythegeneticmake up.
- Selectionhelpsimprovecharacteristicswhicharehighlyheritable.
- Heritabilitymeansthelikelihoodofaparticulartraittobetransmittedtotheoffspring andtheyarestronglyinherited.
- Acharacterlikemilkyieldislowlyheritable,i.e.itisweaklyinheritedandabigger percentageofthecharacterisaffectedbytheenvironment.

Thedegreetowhichselectionaffectsacharacterdependsonthefollowing factors;

- Theheritabilityofthecharacter
- Theintensitywithwhichtheselectionisdone

- Theintervalbetweengenerationsandkindofselectionbeingpracticed.

FactorsToConsiderWhenSelectingABreedingStock.

- Age
- Levelofperformance
- PhysicalFitness
- Health
- BodyConformation
- TemperamentorBehaviour
- Qualityofproducts
- MotheringAbility
- Adaptability
- Proliferation

Age

- Younganimals,
- Thosethathavenotparturatedformorethan3-times,shouldbeselected.
- Theyhavealongerproductivelife.
- Oldanimalsarepoorbreedersandlowproducers.

Productionandbreedingefficiencydeclinewithage.

Levelofperformance

- Animalswithhighestproductionlevelselected.
- Performancebestindicatedbyrecords.

Goodperformanceofanimalindicatedby;

- Highmilk,woolandeggproduction,
- Goodmotheringability
- Highprepotencywhichistheabilityofaparenttopassgoodqualitiestotheir offsprings.
- Theanimalswithpoorperformanceshouldbeculled.
- Goodrecordskeptandusedbythefarmerforthispurpose.

PhysicalFitness

Animalsselectedshouldbefreefromanyphysicaldefect
e.g.

- mono-eyed,
- limping,
- irregularnumberofteats,
- scrotalhernia,
- defectiveandweakbackline

Health

- Sickanimalsdonotbreedwellandareexpensivetokeep.
- Animalsthatareresistanttodiseasespassthesecharacteristicstotheir offsprings

BodyConformation

- Animalsforbreedingtobeselectedaccordingtoproperbody conformation.
- Adairycowshouldbewedge-shapedwithalargeudder,thinlegs, longneck.

- TemperamentorBehaviour
  - Animalswithbadbehaviorsshouldbeculled.eg
  - Cannibalism,eggeating,aggressiveness,kicking

- Qualityofproducts
  - Selectanimalsthatgiveproductsofhighquality.
- MotheringAbility
  - Animalsselectedshouldhaveagoodmotheringability,
  - Thatisanimalswithgoodnaturalinstincttowardstheiryoung ones.
  - Thiswillenablethemtoreartheyoungonesuptoweaning.

- Adaptability
  - Animalsselectedshouldbewelladaptedtotheprevailingclimatic conditionintheare a.
- Prolificacy
  - Animalsselectedshouldbehighlyprolific.
  - Thatis,animalswiththeabilitytogivebirthtomanyoffspringsata time(largerlitter).
  - Thisisaqualitythatshouldbeconsideredwhenselectingpigsand rabbits.

Selectionincattle,andsheep,

Selectionincattle

Considerthefollowing;

- LevelOfPerformanceWhichInclude; MilkYieldButerContent.
  - LengthOfLactationPeriod.
  - CalvingIntervals.
- AgeOfTheAnimal,
- Fertility,
- PhysicalFitness,
- HealthOfTheAnimal,
- BodyConformation,
- SuitabilityOfTheEnterprise-MilkOrBeef

Selectioninsheep

Considerthefollowing;

- Levelofperformancewhichincludes;
  - Motheringability
  - Growthrate
  - Woolquality
  - Carcassquality

- Twiningrate
- Age
- Suitabilitytotheenterprise-woolormutton
- Flockinginstinct
- Healthoftheanimal
- Physicalfitness
- Inheritabledefects
- Fertility
- Inheritabledefects. Fertility.

SelectioninGoats Considerthefollowing:

- Fertility.
- Motheringability.
- Growthrate. Twiningrate
- Carcassquality/dressingpercentage.
- Growthrate.
- Suitabilitytotheenterprise-milkormutton. Healthoftheanimal.
- Age.

SelectioninPigs

- Considerthefollowing:
- Carcassquality/dressingpercentage.
- Suitabilitytotheenterprise(baconorpork) Growthrate.
- Healthoftheanimal.
- Motheringability.
- Prolificacy.
- Numberofteats.
- Temperament.
- Bodyformation.
- Age.
- Hereditydefects

SelectioninCamels

- Healthoftheanimal.
- Age.
- Temperament.
- Foragingability.
- Fertility.
- Levelofperformance-milk,meat,furandtransport. MethodofSelection

Theseinclude:

- Massselection-Animalswithsuperiorcharacteristicsareselectedfromaherdand thenallowedtomateamongeachother.
- Progenytesting-assessingonthebreedingvalueofananimalonthebasisof performanceofitsoffsprings.

- Contemporarycomparison¬-comparisonofperformancebetweenheifersofthe sameageandsexualmaturity.

Breeding

- Processofmatingselectedmalesandfemalestoproduceoffspringwiththedesired characteristics.

Reasons:

- Toexpandtheinheritedpotentialoftheanimal.
- Toimproveproduction.
- Toovercomeproductionproblemscreatedbytheenvironment.
- Tosatisfyconsumerstaste.
- Foreconomicreasons.

TermsUsedinBreeding Inheritance

- Genetictransmissionofcharacteristicsfromparentstooffsprings.
- Themechanismofinheritanceiscarriedbythesexcells(gametes)andiscontrolled bygenesfoundinthechromosomes.
- Genesareverytinyunitsofinheritancecarryingparticularcharacteristics,suchas colour,bodyshapeandamountofmilkproduction.
- Chromosomesaregeneticmaterialswhichcarrygenes.
- Theyexistinpairspaternalandmaternal)inthenucleusfthebodycells.
- Theyarealwaysconstantinnumber.

DominantandRecessiveCharacteristics

- Adominantgeneisonethatsuppressestheother.
- Itproducesadominantcharacteristic.
- Arecessivegeneisonethatissuppressedbytheother.
- Itproducesarecessivecharacteristic. HybridandHybridVigour
- Ahybridisananimalwhichistheproductofcrossinganimalsoftwodifferent breeds.
- Hybridvigourorheterosisisincreasedvigourandperformanceresultingfrom crossingtwosuperiorbreeds.

Epistasis

- Thisisthemaskingoftheeffectofonegenebyanothergenewhichisnon-allelic,that issituatedondifferentlocus.

BreedingSystems

Inbreeding

- Matingofanimalswhicharerelated.Reasons:
- Toincreasegeneticuniformityinaherd.
- Usedtofixtherequiredcharacteristicsinnewbreeds.
- Toincreasephenotypicuniformity.
- Togetprovensires. Limitations
- Itcanbringaboutlossofhybridvigour.
- Itmayleadtodeclineinfertility. Itmayleadtohighrateofpre-natalmortality.

SystemsofInbreeding

- CloseBreeding:matingbetweenverycloselyrelatedanimals,forexamplesibmating andparentssib-mating.
- LineBreeding:matingofdistantlyrelatedanimalsthathadacommonancestorfor examplecousins. Outbreeding
- Matingofanimalswhicharenotrelated.

Reasons:

- Tointroducenewgenesinanexistingbreedingherd.
- Toexploitheterosisresultingfromacrossbetweentwobreeds.
- Todevelopanewbreedoragradeanimal. Limitations
- Lackofuniformityinanimalsthatresultfromoutbreeding.
- Desirablecharacteristicsmaybelostduetovariation.

SystemsofOutbreeding

- Cross-breeding
  Matingofanimalsfromtwodifferentpurebreeds.
- Out-Crossing
  Matingofunrelatedanimalsfromthesamebreed.
- Upgrading/Gradingup
  Matingwherethefemaleofacowgradestock(locals)ismatedwithapurebreed sire.
  Theresultantanimalisreferredtoasahighgrade.

MatinginLivestock

MatinginCattle

- Heatsignsoccurevery21days.
- Theheatperiodlastfor18-30hours¬onaverage24hours.
- Cowshouldbeserved12-18hoursaftershowingthefirstheatsigns.

HeatSigns - Restlessness.

- Mountingonothersandwhenmountedonshestandsstill.
- Riseinbodytemperature.
- Dropinmilkproductioninlactatingcows.
- Vulvaswellsandbecomesreddish.
- Clearorslimymucusfromthevulva.
- Bellowingormooingfrequently.

MatinginPigs

- Heatsignsinpigsoccurafterevery21days.
- Theheatlastsabout72hours.

- Sowsorgiltsshouldbeservedin18-36hoursoftheheatperiod.

SignsofHeat

- Restlessness.
- Frequenturination.
- Swellingandreddeningofthevulva.
- Clearorslimydischargefromthevulva.
- Frequentmountingonothers.
- Itrespondsverywelltothe'ridingtest'.

MatinginRabbits

- Doesarereadyformating6-7monthsofage.
- Heatsignsoccurevery14days.
- Thedoeshouldbetakentothebuckandnotviceversa.

SignsofHeat

- Restlessness.
- Frequenturination.
- Swollenvulva.
- Thedoethrowsherselfontheside.
- Thedoerubsherselfagainstthewalloranyothersolidobject.
- Thedoetriestocontactotherrabbitsinthenexthutchbypeeping.

MethodsofServiceinLivestock

NaturalMating Advantages:

- Itismoreaccurate.
- Itislesslaborious.
- Usefulwhenheatsignsoffemalescannotbeeasilydetected.

Disadvantages

- Inbreedingisnoteasilycontrolled.
- Transmissionofbreedingdiseases.
- Extrafeedforthemaleisrequired.
- Largemalescaninjuresmallfemales.
- Wastageofsemen.
- Itiscumbersomeandexpensivetotransportabulltoremoteareas.

Artificialinsemination

- Introductionofsemenintothefemalereproductivetractbyartificialmeans.

Advantages

- Thereiseconomicaluseofsemen.
- Itcontrolstransmissionofbreedingdiseases.
- Siresthatareunabletoservecowsduetoheavyweightorinjurycanproducesemen toservecows.
- Itpreventslargebullsfrominjuringsmallcows.
- Itreducestheexpensesofkeepingamaleanimal.
- Asmallscalefarmerwhocannotaffordtobuyasuperiorbullcanhavethecows servedatalowcost.

- Semencanbestoredforlong.
- Ithelpstocontrolinbreeding.
- Iteliminatesthethreatofkeepingdangerousbullsfromthefarm.
- Itmakesresearchworkeasier.

Disadvantages

- Harmfulcharacteristicscanbespreadquicklybyonebulltotheoffsprings.
- Itrequiresskilledlabour.
- Lowchanceofconceptionduetodeathofsemenduringstorage.
- Itislaborious:

EmbryoTransplant

- Itistheimplantationofanembryo(fertilizedova)fromahighqualityfemale(donor) intheuterusofalowgradefemale(recipient).

Advantages

- Fastermultiplicationofananimalwithsuperiorcharacteristics.
- Itiseasiertotransportembryosthanthewholeanimal.
- Embryoscanbestoredforalongperiodawaitingtheavailabilitybyrecipientfemales.
- Itstimulatesmilkproductioninafemale(recipient)thatwasnotreadytoproducemilk.
- Lowgradeanimalscanbeusedinproductionandrearingofhighqualityanimals.
- Offspringsofasuperiorfemalecanspreadquicklyinanarea.

Disadvantages

- Itisexpensive.
- Itrequiresskilledpersonnel.
- Itrequiresspecialequipmentforfertilizationandstorageofembryos.

SignsofParturitioninLivestock

- Parturitionistheactofgivingbirthinfemaleanimals.

ParturitioninCattle

- Thegestationperiodincattleis270-285daysaveraging280days.

SignsofParturition

- Restlessness
- Enlargedorswollenvulva.
- Clearmucusdischargefromthevulva.
- Slackeningofthepelvicmuscles.
- Fullanddistendedudder.
- Thickmilkyfluidfromtheteats.
- Awaterbagappearsandburstsjustbeforecalving.

ParturitioninPigs

- Thegestationperiodinpigsisabout4monthsor3months,3weeksand3days.

SignsofParturition

- Restlessness.
- Thevulvaturnsredandswells.
- Theudderbecomesfullwithamilkyfluidthesowstartstoprepareanestby collectingsomebeddingsatonecomerofthepen.

ParturitioninRabbits

- Thegestationperiodinrabbitsis28-32days.

SignsofParturition

- Preparinganestbypluckingoffhairfromherbelly.
- Goesofffeeding

- Restlessness.
- Theudderdistends.

LivestockProductionIV

(LivestockRearingPractice)

Introduction

- Inthemanagementoflivestocktherearemanyactivitiesthatarecarriedouton animalstoenhanceproduction.
- Theyrequirecareinfeeding,health,breeding.
- Specificmanagementalsoimportantinbeeandfishfarming.

Routinglivestockrearingpractices.

- Aroutineisafixed/regularwayofdoingsomething.
- donerepeatedlyafteracertainperiodoftime

FeedingPractice

- Animalsarefedtocaterforbothmaintenanceandproductionrequirements.
- Thesearespecialtypesoffeedingcarriedoutoncertainanimalstocaterforspecific needs. Theseinclude: Flushing
- Thepracticeofgivingextraqualityfeedtoananimalaroundservicetime.
- Insheepitisdone2-3weeksbeforetuppingand3weeksaftertupping.
- Inpigsitisdone3-4weeksbeforeservice. ImportanceofFlushing
- Itincreasesconceptionrates.
- Itenhancesimplantationofthezygote.
- Insheepitincreasestwinningpercentageby15-20%.

SteamingUp

- Givingextraqualityfeedtoananimalduringthelastweeksofgestation.
- Incattleitisdone6-8weeksbeforecalving.

ImportanceSteamingUp

- Itprovidesnutrientsformaximumfoetalgrowth.
- Ithelpsinthebuildupofenergyforparturition. Itensuresthebirthofahealthyanimal.
- Itpromotesgoodhealthofthemother.
- Itincreasesandmaintainshighmilkyieldafterbirth.

CreepFeeding

- Feedingofyounganimalsfrombirthtoweaning. Piglets
- 10daysold-introducedtocreeppellets.
- 5weeksold-creeppelletsmixedwithsowandweanermeals. 8weeksold-weaning.

Lambs

- Runwiththeirmothersfornaturalsuckling.

- Bucks-introducedtosucculentfeedsandconcentrates. Kids
- Meatgoatskidssucklenaturally.
- Dairygoats,fedonmilkartificially, Given0.5-1.25litresuptothethirdweek.
- Introducedtoconcentratesat3-4months. Weanedat6-8weeksofage.

ParasiteandDiseaseControlPractices Vaccination

- Introducingactivediseaseorgansmswhicharereducedinstrengthorvirulentintothe animals'bodytoinduceimmunity.

AdministrationofVaccinationdonethrough:

- Byinjection.
- Orallythroughthemouth.
- Byinhalationthroughthenose.
- Eyedrops.

Deworming

- Practiceofkilling/removinginternalparasitesbyadministeringdrugsknownas dewormers/antihelmitics.

HoofTrimming

- Cuttingbackovergrownhooveswiththehelpofahooftrimmingknife,ahoofcutteror ahoofrasp. Importance
- Facilitateeasymovement.
- Controloffootrotdisease.
- Facilitatemating-preventtheramfrominjuringtheeweduringtupping.

Docking/tailing

- Thisistheremoval(cuttingoft)oftailsinsheepduringthefirstweekafterbirth.

Importance

- Evendistributionofbodyfat.
- Facilitateeasymatinginadultlife.
- Minimisefoulingofthewoolwithfaeces. Reduceincidencesofblowflyinfestation.

MethodsofDocking/tailing

- Cuttingwithsharpknifeorscalpel.
- Useofelastratorandrubberring. DippingandSpraying

Thesearemethodsofapplyingacaricidesontheanimalstocontrolexternalparasites.

Dusting

- Itistheapplicationofchemicalpowdersontheanimalbodyoronthewallsofthe animalhousetocontrolexternalparasites.
- Itisusedtocontrolstick-fastparasitesandfleasinpoultry.

BreedingPractices

Thesearepracticescarriedouttoenhancesuccessfulbreeding.

- CrutchingandRinging
  - Crutching-cuttingofwoolaroundtheexternalreproductiveorgansoffemale sheep.
  - Ringing-trimmingwoolaroundthesheathofthepenisoftheramstofacilitate mating.

- TuppingandServing
  - Tuppingreferstomatinginsheepandgoats.
  - Servingreferstomatingincattleandpigs.
- Raddling
  - Thisisthepracticeoffittingtheramswithbreedingchuteswhicharepaintedin differentcoloursduringmating
  - toidentifymatedewesandtoindicatetheactiveramshencehelpincullingof theweakrams.

Identification

Thepracticeofputtingidentificationmarksonanimal.

- Branding-burningmarksontheanimalsskin.
- Eartagging-placingmarkedplasticormetallictagsontheanimalsears.
- Earnotching-cuttingdifferentshapesbearingdifferentvaluesontheearlobes.
- Tattooing-useofpermanentinkordyetomarkanimalswithlightskin.
- Neckstraporchain-Fixingoftagsroundtheanimalsneckwithachainorastrap.

Importance/purposeofIdentification

- recordkeeping
- Settingdisputesincaseanimalsgetmixedupinthepasture.

Debeaking

- Cuttingabout1/3oftheupperbeakwithaknife,scissorsorhotiron.

- Importance Controleggeating.
- Controlcannibalism.

ToothClipping

- Theremoval(clipping)oftheneedle(canine)teethinpiglets24hoursafterbirth.

Culling

- Removalofundesirableanimalsfromaherd. Dehorning
- Removalofhornsorhornbudsfromananimal. Importance
- Itpreventsanimalsfrominjuringeachother.
- Itmakestheanimaldocileandthereforeeasytohandle.
- Foreasytransportationandfeeding.
- Preventsdestructionoffarmstructures.

Shearing

- Thepracticeofcuttingwoolfromalloverthebodyofasheep.
- Itstartsattheageof8monthsandthendoneonceayear.
- Shouldbedoneduringthedryseason.
- Toolsused:woolshears.
- Caremustbetakennottocuttheskin,testicles,udder,vulvaandpenis. Castration
- Itistherenderingunserviceablethetesticlesofamaleanimal.

Importance

- To control breeding diseases.
- To control breeding.
- For faster growth rates.
- Increase quality of meat by removing unpleasant smell especially in goats.

Methods Used:

Closed/bloodless method

- involves use of burdizzo or rubber ring and elastrator.
- Animals do not bleed but may not be 100% effective.

Open method

- A surgical method used for castrating cocks, piglets and rabbits whose testes are internal.
- Also used for lambs, kids and calves.
- Animals bleed a lot.
- However, it is 100% effective.
- It is not recommended for mature adults.

Caponisation

- It is the practice of making male birds lose their male characteristics by use of hormones.
- Hormones used include stilboestrol which is injected into the birds when they are one day old and female hormones implanted beneath the skin at the neck.
- Birds which have lost their male characteristics in this way are referred to as capons.

Management During Parturition

- Parturition is the act of giving birth to fully grown foetus.

Parturition in Cattle

- It is referred to as calving.
- Gestation period lasts 270-285 days after conception.
- When the signs of parturition are observed the cow should be separated from the rest of the herd.
- Normal calving should take 2 hours and the normal presentation is the muzzle, face or forehead on top of the fore legs first.
- In case of other presentations the mother should be assisted.
- Provide the mother with plenty of water and feed after parturition.
- If the afterbirth does not come out within 48 hours a veterinarian should be called to remove it.

Parturition in Sheep

- It is referred to as lambing.
- Gestation lasts 21 weeks (150 days) after conception.
- The ewe lamb naturally without any problem.
- If complications arise the ewes should be assisted.

Signs of Parturition in Sheep

- Udder becomes full.

- Teatsarebrightredincolour.
- Restlessnessandbleating.
- Slackeningofthehipmuscles.

Afterthesesigns'areseentheewesshouldbeseparatedfromtheothers.

- Thenormalpresentationisforelegsandheadfirst.
- Afterbiththemothershouldbeallowedtolickthelambtoensurethecoatisdry.

ParturitioninGoats

- Itisreferredtoaskidding.
- Ittakesplace150daysafterconception.
- Nanniescarryingtwins,kidafewdaysearlier.
- Kiddingnanniesshouldbekeptinacleandryplacewhichshouldbewellsheltered.
- Signsofparturitionaresimilartothoseofewes.
- Kiddingnanniesshouldbekeptwithanotherfemaleforcompany.

ParturitioninPigs

- Itisreferredtoasfarrowing.
- Gestationperiod113-117days(4months).

SignsofFarrowing

- Thesowbecomesrestless.
- Thereisenlargementofthevulva.
- Musclesoneachsideofthetailslacken.
- Thereislossofappetite.
- Theudderandtheteatsbecomeenlarged.
- Thesowcollectsbeddingmaterialinonecomertobuildanest.
- Milkpresentintheteats24hoursbeforefarrowing.

Afterthesignsareseen;

- Farrowingtakesabout2-6hoursundernormalcondition.
- Anattendantshouldbetheretoassistthemotherandpiglets.
- Ensuretheremovaloftheafterbirthtopreventthesowfromeatingit.
- Thesowshouldbefedwellandgivenplentyofcleanwater.

ParturitioninRabbits

- Itisreferredtoaskindling.
- Ittakesplace28-32daysafterconception.
- Provideanestingboxandplentyofdrysoftbeddingsinthehutchtowardsthefourth weekofgestation.

SignsofParturition

- Thedoeplucksoffthefurfromherbody.
- Usesthefurtobuildanestabout3-10daysearlier.

BeeKeeping(Apiculture)

- Beesareinsectswhichliveinverywellorganisedcolonies.

Eachcolonyconsistsof:

- Queens-fertilefemalesthatbreedtoensurethecontinuityofthespecies.

- Drones-fertilemalesthatmatewiththequeenforreproductionprocess.
- Workers-non-fertileorsterilefemalesthatmaintainthecolony. DutiesofWorkers
  - Theyrearandnursethebrood(eggs,larvaeandpupae),queenanddrones.
  - Theycollectnectarandmakehoney.
  - Theymakethehoneycombs.
  - Theyprotectthehives. Theycleanthehive.

ImportanceofBees

- Collectnectarfromflowers.
- Makehoney-anutritiousproductusedbymanasfood.
- Helpsincropspollinationofplants.
- Beesproducewaxusedtomakecandles.
- Theymakepropolis-abeeproductwhichismedicinal. RoutineManagement

Siting/locatingofanApiary

Factorstoconsider;

- Nearnessoraccessibilitytonectarorflower-producingvegetation.
- Areaswithshade.Beesaresensitivetothesun'sheatandrequiresomeshadeto protectthem.
- Safedistancefromhumanresidenceandotherlivestock.
- Beesarestinginginsectsandcanbeahazardtohumansorotheranimals.
- Nearnesstoasourceofwaterforuseintheirnutrition.
- Agooddistancefromsourceofnoiseandotherdisturbances.
- Safetyfrompredatorsforexamplehoneybadgers,ants(safariants),birdsandother parasitessuchaswaxmoths.

Feeding

- Normallybeesareself-sufficientinprovidingtheirfoodfromthehoneytheymake.
- However,duringthedryseason,theirfeedingshouldbesupplementedbyprovidinga solution(syrup)ofsugarwaterorgivingmolasses.
- Thisshouldbeplacedstrategicallysothatitiseasilyaccessibletothebees.

Parasites

- Ants Waxmoths
- Beelouse
- Honeybadger ControlofParasites
- Useofphysicalbarrierssuchas Vaseline/greasetocontrolants.
- Smokethehivetocontrolbeelouse.
- Suspendthehivetocontrolhoneybadgers.
- Burninfectedcombstocontrolwaxmoths.

DiseasesandControl

- Africanbeesareseldomattackedbydiseases. HarvestingHoney

Factorstoconsider;

- Stageofripening:Honeymustbeharvestedwhenitisfullymature.
- Seasonoftheyear:Harvestedattheendoftherainyseason. Procedure
- Blowlightsmokethroughthehole.
- Thismakesbeessuckhoneyandbecomeengorgedanddocile.

- Lowerthehivetotheground.
- Openthehivetoexposehoneycombs.
- Brushthebeesoffthehoneycombs.
- Cutthehoneycombs,leavingasmallmarginonthebarsandkeepthemina closed container.

HoneyProcessing

- Usingheatinawaterbathtomeltthehoney.
- Crushingandstraining.
- Usingacentrifugalextractor.

PrecautionsWhenHandlingBees

- Avoidexcessivesmoking.
- Thiskillsthebroodandlowersqualityofthehoney.
- Useprotectiveclothingtoavoidsting.
- Protectthehivefromrainwater.
- Usecleanequipmentandcontainerstoavoidcontaminationofthehoney.
- Userecommendedmethodofextractinghoney.
- Userecommendedtypeofhivesuchas Kenyatopbarhive.

FishKeeping(Aquaculture) Introduction

- Therearingorkeepingoffishiscalledfishfarmingandisnormallycarriedoutin speciallypreparedponds.

Agoodfish-pondshouldhavethefollowingfeatures:

- Siteshouldbeonafairlylevelgroundwithapermanentsupplyorsourceofwater.
- Theareashouldhaveclayeysoiltoavoidlossofwaterthroughseepage.
- Watermustbefreefromanypollutantssuchaschemicalsandotherwastes.

Constructionshouldprovidefor:

- aninletforfreshsupplyofwater,
- aspill¬waychanneltotakeoffoverfloworexcesswater,
- anoutlettodrainoffthewaterwhenitisnecessarytoreplacepondwater,
- afencetokeepoffpredatorsandotherintruders.

FeedingFish

- Fishnaturallyfeedonworms,insectsandalgaeintheponds.

Thesesourcesoffoodmustbesupplementedbythrowinginthepond;

- kitchenwastes,
- choppedvegetablematerialssuchascabbageleaves,
- cerealbrans brewers'grain.

ManagementPracticestoEnsureMaximumHarvestofFish

- Controlofstockingrate,thatisto,havetherecommendedpopulationoffishinapond atanyonetime.
- Harvestatthecorrectmaturitystage.
- Thisisdonebyusingthefishingnetwithcorrectmeshsizestoavoidcatchingthe fingerlings.
- Avoidwaterpollutioninthepondswhichmaypoisonfish.
- Ensureadequatesupplyoffoodinthepond.
- Waterinthepondsshouldbekeptinmotiontofacilitateaeration.
- Maintainappropriatedepth(level)ofwater.

- Controlpredatorsand/orthieves.
- Drainandrefillpondswithfreshwaterasnecessary.

HarvestingFish

- Harvestingorextractingfishfromthefish¬pondsforconsumption

Twomainmethods:

- Hook-and-linemethod:
  - Thisisslow,injuressmallfishandisinefficient.
  - Itisonlysuitableforsmall-scalefishing.
- Useoffishingnets:
  - Thisisthemostefficientmethodaslongasanetwiththecorrectmeshsizesis used.
  - Harvestingmaybedone6-8monthsaftertheintroductionoffingerlingsintothe fishpond.

MaintenanceoftheFishPond

- Repairingthedykeoranystructureonit.
- Cleaningthepondandremovingforeignmaterials.
- Plantinggrasswherenecessary.
- Removingundesirablevegetation.
- Removingthesilt. FishPreservation

Practicesbeforepreservation:

- Cleanthefishtoremovemudandanyworms.
- Removingscalesandslime.
- Openingthefishonthesidetoremovethegutandtheintestinesreferredtoas gutting. .
- Cleaningtheabdominalcavitythoroughly.
- Keepingfishinopencontainers.

MethodsofPreservation

- Freezing
- Salting
- Sundrying
- Smoking

AppropriateHandlingofLivestockDuringManagement

- Physicalbeatingshouldbeavoided.
- Structureswhichhelpinrestraininganimalsshouldbeusedwheneverapplicable.
- Thecorrectmethodsofsecuringandcastinganimalsshouldbeused.
- Useaslittleforceaspossible.
- Equipmentsuchasropes,halters,leadstickandbullringsareusedtohandleanimals appropriately.

FarmStructures

Introduction

- Farmstructuresarephysicalconstructionsonthefarmusedtoincreaseefficiencyin production.

ConstructionofFarmStructures

Involves:

Planningforfarmstructures;

Consider;

- Farmactivities.
- Sizeoftheenterprise.
- Futureoftheenterprise.
- Accessibility. Soiltype.

Sitingfarmstructures;

Consider:

- Thelocationofthehomestead.
- Accessibility.
- Security.
- Drainage/topography.
- Winddirection.
- Relationshipbetweenthestructures.
- Proximitytosocialamenities.
- Farmer'stasteandpreference.

MaterialsforConstruction

StructuralMaterialsandUse

Factorswhichdeterminethetypeofmaterialstouseare;

- durability,
- strength,
- labour,
- availability,
- workability,
- serviceability,
- cost
- sanitation.

StonesandBricks

Advantages

- Stonesandbricksaredurable,easytodisinfect,resistanttoweatherandinsects decayandareeasilyavailable.

Disadvantages

- Theyarebulkyandrequireskilledlabourtomakethem.

PlasticandSyntheticMaterials

Theseinclude;

- glass, asbestosfibre
- polythenematerials.

Advantages

- Light,
- cheepdependingonquality,
- easytodisinfect,
- canbemouldedintoanyshape,
- aredurable,
- cannotbedestroyedbyinsectsandfungus
- arewater-proof.

Disadvantages

- Areeasilydestroyed,
- fragile,
- veryexpensive
- requireskilledlabour.

Wood(Timber)

Advantages

- Theyareworkable,
- cheap,
- canbere-used
- arefairlystrong. Disadvantages
- Theycancatchfireeasily,
- decayifexposedtowater
- areaffectedbyfungusandinsects.

Concrete

- Isamixtureofcement,sand,aggregateandwater
- e.g.inmakingblockstheratiois1:2:3;onepartcement,twopartssandandthree partsaggregate.

Uses

- Makingpostsforfencing.
- Makingwallsandfloorofbuildings.
- Makinggabionsandwaterchannelstopreventerosion. Makingwatertroughs.

Advantages

Thesematerialsare;

- durable,workable,
- easytodisinfect,

- cheaptomaintain,
- fireresistant

Disadvantages

- Thesematerialsare;
- expensive,
- requireskilledlabour,
- bulky,
- cannotbereused

Animalhandlingstructures

- Thecrush–usedwhendoingfollowingactivities;
  - Sprayinglivestocktocontrolticks,
  - milking,
  - examiningsickanimals,
  - artificialinsemination,
  - treatinganimals,egdrenching,vaccination,
  - dongroutinejobssuchasdehorning,identificationmarks,
- Thesprayrace-usedinthecontrolofticksbysprayinglivestockwithacaricides
- Thedip-machakostype,andthepludgedip.Thisisusedinthecontrolofticksby dippinglivestock

FarmBuildings

Factorstobeconsideredinsiteselection;

- Security
- Nearnesstoasourceofwater
- Topography
- Directionoftheprevailingwind
- Directionofthesun
- Personalwhims/tastesandpreference Nearnesstomeansofcommunication.

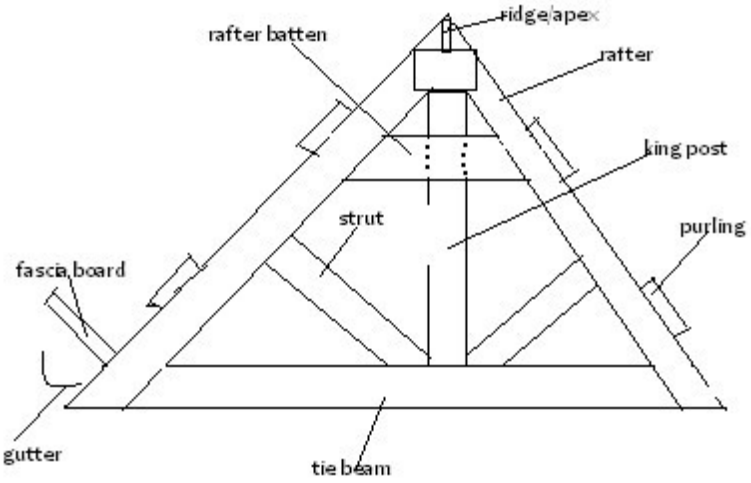
Typesoffarmbuildings

- Housesforfarmanimals.
- Storesforfarmproduce.
- Storesforequipment,toolsandsupplies.
- Buildingsforgrowingcropse.ggreenhouse.
- Buildingforprocessingplante.gmilkplant.

Partsofabuilding Thefoundation,

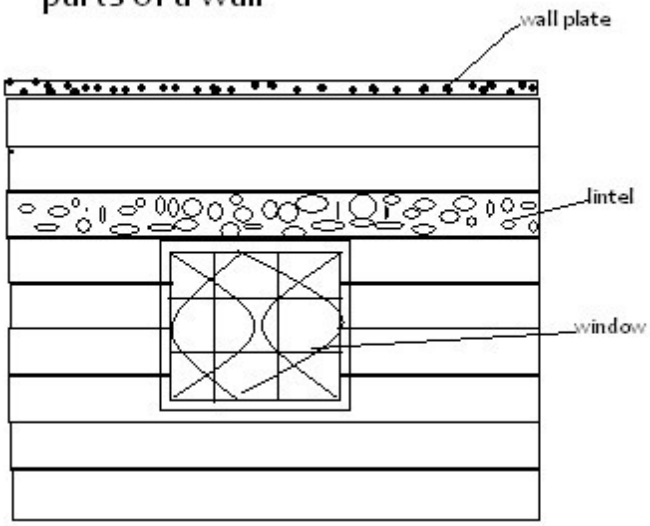
- Thewalls,
- Theroof

Parts of a Roof

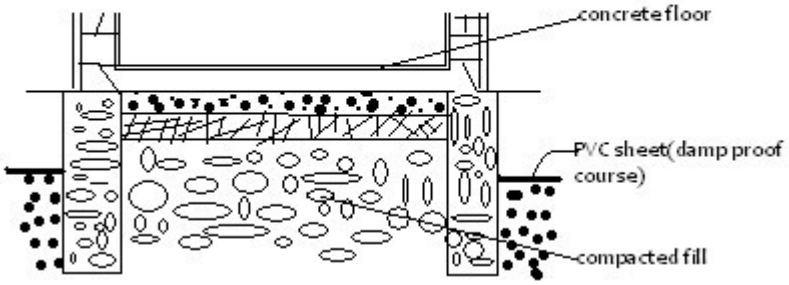


Include; kingpost,
rafters,
struts,
tiebeam,
rafterbatten

parts of a wall



Parts of the foundation



Include;

- concretefloor,
- foundationwall,
- PVCsheet(damp-proofcourse) thecompactedfill(hardcore).

Fences

- ImportanceofFenceinaFarm Keepoutintruderstothefarm,
- Definetheboundarylinesofthefarm.
- Paddockingoffieldstomakerotationalgrazingpossible.
- Livefencesserveaswindbreaks.
- Fencesareusedinmixedfarmingtoprotectcropsfrom damagebylivestock.
- Fencesaddaestheticvaluestothefarm.
- Itiseasytocontrolbreeding.
- Itiseasytoisolatesickanimalsfromtherestoftheherd.

TypesofFences Deadfences.

- Barbedwirefences.
- Electricfence.
- Concretefence.
- Chickenwirefence(meshwirefence).
- Wovenwirefence(chainlink).
- Woodenfence.

FencingPractice

- Materialsinclude;
  - wires,
  - staples,
  - nails,
  - posts,
  - droppers
  - concretematerials.
- Sizeofposts:
  - Generalpurpose2.5mby25cmindiameter
  - Straineunitsandcornerposts3mby30cmindiameter:
- Distancebetweentheposts:
  - 3mbetweenposts,10mifdroppersaretobeused.
  - 200mbetweenstrainerunits.
- Depthofholes-60cm.

GatePosts,GatesandStrainerUnits

- Gatesshouldbehungonpostsseparatefromthefence.
- Mechanicalimplementsforexampletractorsrequire4.0-4.5mwidthofgate.
- Entrancegatesforpedestrianscanbeaccommodatedwithinthefence.

StepsinFencing Locatethecorners

- Clearthefencingarea.
- Markgates,strainers,passplacesandstandardsbypegging.
- Digholestoproperdepths.

- Fixthestandardposts.
- Firmaroundpostsorapplyconcrete.
- Fixwiresonposts.
- Fixthedroppers.

AgriculturalEconomicsII (LandTenureandLandReforms)

Introduction

- Landisanimportantfactorofproduction.
- Withoutlanditisimpossibletopracticetheagriculturalbusiness.
- Howevertheefficiencyofutilizationoflandisinfluencedtoalargeextentbythe conditionofholdingtheland.

LandTenure

- Landtenureisdefinedasthepossessionofthelegalrightstotheuseofland.
- Variouskindsofrightstotheuseoflandgiverisetodifferenttenuresystems.

LandTenureSystem

- Alllandtenuresystemsfallintotwomajorclasses,namely:

CollectiveTenureSystems Thisincludes:

CommunalTenureSystems

- Thisinvolvesthepossessionofrightsoverlandbythewholecommunity.
- Itworksquitewellunderconditionsofunlimited,landresources.

AdvantagesofCommunalTenure

- Landlessproblemdoesnotexist.
- Landisnotfragmented.
- Allowsforfreemovementofanimalsinsearchofbetterpasturesandwater.

D

- isPromotescommunityspiritamongthemembersadvantagesofCommunalTenure .
- Noincentiveamongtheuserstoconservethelandresources.
- Everybodystrivestomaximizereturnsfromthelandwithoutthedrivetoinvest,for example,intermsofsoilconservationandmaintenanceofsoilfertility.
- Thereisatendencyofoverstockingandcontinuouscropping;whichleadstosoilerosion andlossoflandproductivity.
- Asaresultofcommunalgrazingoflivestock,itisimpossibletoimprovelivestock through;
  - controlledbreeding,
  - properfeeding,
  - diseaseandparasitecontrol.
- Sincethereisnotitledeed,(certificateofownership)itisvirtuallyimpossibletosecure loanstodeveloptheland.

Co-operativeTenureSystem

- Thiscategoryincludesvariouscollectivearrangementsunderthegovernmentorother authorities.
- Farmersvoluntarilygrouptogetherandbuylandwhichtheysubsequentlyoperateonco operativebasis.
- Examplesareco-operativeranches.

AdvantagesofCo-operativeTenure

- Nolanddisputes.
- Labouriswellutilized.
- Profitisdistributedaccordingtothenumberofshares.
- Resourceuseisenhancedforhighproduction.

Disadvantagesofco-operativetenure.

- Incaseofpoormanagementeverybodywillloose.
- Noindividualtitledeedhencecannotsecureloans.

Stateownership

- Landisownedbythewholestateandisreferedtoasgovernmentland.

ExamplesinKenya;

- Areasnotallocatedtoindividuals
- Landunderlocalcountycouncils/citiesandtowns
- Landunderforest,gamereserveandparks,landforinfra-structureandpublicutility

Advantagesofstateownership

- Generationofincomeforthestate
- Allthecitizensbenefitfromwhatevercomesoutoftheland.

Disadvantages

- Non-competitiveintermsofproduction
- Noindividualmotivationwhenworkingontheland.

IndividualTenuresystem

Thevariousformsofindividuallandtenureare;

- Owneroperator,
- PlantationandConcestion,
- Land-lordism/Tenancy

Owneroperator

- Thiscategoryincludesallpersonswhooperateonlandtowhichtheyhaveabsolute individualrights.
  - Examplesarethemajorityofindividuallandownersinareaswheredemarcationand registrationoflandhastakenplaceandtitledeedsissued.

Advantages

- Theownerisfreetomakepermanentproductionplans.
- Theownercanpledgethelandtitledeedtosecureloans(credit)fromlendingagencies forfurtherdevelopment
- Anindividualismotivatedtoworkharderthanwhenundercommunalarrangement
- Managerialfailuresusuallyaffectsmallunitsofproductionandarethereforenegligible.
- Itiseasyfortheownertogetagriculturaladvice.

Disadvantages

- Costsuchasmachineryforprocessingmaybetoohighfortheindividualowner
- Innovationmaybeinadequateduetolowlevelsofeducation. Lackofcapitaltoinvest.

Plantationandconcession

- Inthisformoflandtenure,theindividualisusuallyacompanyoracorporation.
- Mostofthemengageintheproductionofonlyonecommodity
- Theyarerigidintheirproductionplansandinmostcaseslabourishiredonwagebasis.
- Examplearecoffee,tea,sugarcane,sisalestatesinKenya.

Advantages

- Highproductionfromthelandhencehigheconomicgains
- Allowsforeignerstouseanddevelopland
- Nolanddisputes
- Createemploymentforthelocalpeople
- Generategovernmentrevenuethroughtaxation.

Disadvantages

- Individualsownlargepiecesoflandwhileothersarelandless
- Largeareasoflandmaybeleftunderdeveloped.
- Foreignersmayrepatriateprofittotheircountries.
-

Landlordismandtenancy

- Thearrangementhereinvolvestheownershipoflandbyoneindividualorgroupof individuals(landlord)wholeaseittoanotherindividual(tenant).
- Alegalleasespecifiesthelengthoftimeduringwhichthetenureisoperative; andthatservesasasecurityoftenuretothetenant.
- Theefficiencyofproductioninthisarrangementisgreatlyaffectedbythelengthof lease,itslegalbackingandrentpayable.

Advantages

- Apersonwithoutlandcangetachancetouseland.
- Alandlordwhocannotoperatetheland,foranyreason,canstillearnincomeby leasingittoaneedytenant.
- Itisaflexiblearrangement;thatis,itallowsroomforchangeofproductionplans shouldneedarise.
- Securityoftenuregivesthetenantincentivetoinvestdependingonthelengthof tenure.

Disadvantages

- Poorlanduseandlowproductionifthetenantdoesnothaveenoughfundstoimprove onland.

- Tenantscannotproducelongtermcrops,
- Landlordscanexploitthetenantsbyovercharging.
- Lackofincentivestoimprovelandbythetenantssinceitdoesnotbelongtothem.

LandReforms Definition

- Landreformisanyorganizedactiondesignedtoimprovethestructureoflandtenure andlanduse.

FormsofLandReform LandConsolidation

- Thismeansbringingorputtingtogether,intoonepiece;fragmentedparcelsorpieces oflandscatteredoveralargearea.

Theobjectiveoflandconsolidationare:

- Tosaveontimespentwhilemovingfromonepieceoflandtoanother.
- Tofacilitateeffectiveandefficientfarmplanning.
- Tocreateanincentiveamonglandoperatorstoinvestonanddevelopland.
- Tofacilitatemechanizationandimproveproductionthroughefficiency.
- Toimprovelevelofproductionthrougheffectivesupervisionofthelabourforceand soundfarmingmethods,

LandFragmentationandSub-division

- Thisisthesubdividingofa(large)pieceoflandintosmallerportions.
- Sometimesitbecomesnecessarytosub-dividelandforthefollowingreasons:
  - Tosellpartoftheland.
  - Theparentmaywishtosubdivideanddistributehislandamongthesons,daughters andotherdependants.
  - Thegovernmentmaydecidetosubdividelargefarmsinordertosettlelandless citizens.

LandAdjudicationandRegistration

- Landadjudicationinvolves;
  - Establishingthelegitimateownership,
  - Measurements(tomakepermanentboundaries)
  - Recordingoflanddetails.
- Oncelandhasbeenadjudicated,andanydisputesconcerningthesamelandaresettled,
- Itisthenregisteredinthe"RegisterofLand".
- Andtheownerisissuedwithalandtitledeedorcertificateoflegalownership.

Importanceoflandtitledeed

- Thelegalownerofthelandhassecurityoftenureandhenceanincentivetoinvestand improveproductivity.
- Afarmercanmortgagethelandbyofferinglandtitlecertificateasasecuritytoloaning agenciestosecurecapitaltofinancedevelopmentprojects.
- Ifafarmerwhocannotoperatethefarm,hecanstillearnincomefromitbyleasingit.
- Disputesconcerninglandboundariesand/orlandownershipnolongerarise.

LandSettlementandResettlement

Definition

- Landsettlementmeanstheoccupationoflandwhichwaspreviouslyuninhabited.
- Landresettlement,ontheotherhand,isthetransferofpeoplefromanalreadydensely populatedareatoasparselypopulatedone. Objectives
- Tosettlethelandlesscitizens.
- Torelievepopulationpressureindenselypopulatedareas.
- Toincreaseorpromoteagriculturalproductivitybyfarmingonlandthatwaspreviously unusedorlyingidle.
- Tocreateself-employmentthusimprovingthelivingstandards.
- Landreclamation,especiallybycreatingtsetsefly-barriers.

SoilandWaterConservation

Introduction

- Soilandwateraretwoveryimportantnaturalresourcesinfarming.
- Theyshouldthereforebewellmaintainedandusedwithoutwastagetosustain continuousproduction.
- Waterlossduringtherainyseasonshouldbepreventedandexcesswaterconserved foruseduringscarcity.
- Soilerosionmustbecontrolledatwhatevercostifsoilistobeconserved.

SoilErosion

- Itistheremovalandcarryingawayofthetopsoilbytheactionofwaterorwind.

FactorsInfluencingSoilErosion

- Amountandintensityofrainfall.
  - Thesteeperthelandthehigherthevelocityofsurfacerunoff.
  - Thehigherthevelocityofsurfacerunoffthegreaterisitserosivepower/effect.
- Typeofsoilforexamplesandysoilsaremoreeasilydetachedandcarriedaway thanclayeysoils.
- Soildepth;
  - Thedeeperthesoil,thelongerittakestobesaturatedwithwater.
- Landuse:
  - Overstockingleadstobarenessofthelandandloosenessofthesoil.

- Deforestation-indiscriminateremovaloftreesleadstoexposureofsoilto heavyrainfallandhightemperatures.
- Indiscriminateburningofvegetationexposesthesoiltoerosiveagents.
- Cleanweedingleavesthesoilbare.
- Ploughingalongtheslope. Monocultureorcontinuouscultivation.

Groundcover

- Treesactaswindbreakers.
- Rootsofvegetationcoverholdthesoilparticlestogether.
- Leaffallactasmulchwhichreduceserosion.
- Leavesofvegetationcoverinterceptsraindropsreducingtheirerosivepower.

AgentsofErosion

- Water-movingwaterhaserosivepower.
- Wind-windcarriesawaysoil.
- Humanbeings-throughman'sactivitiessuchascultivationandmining.
- Animals-throughovergrazingandcreatingfootpathswheresoilerosiontakesplace.

TypesofErosion

- Raindrop(splash)-displacementofthesoilcausedbyraindrops. Sheet-uniformremovalofsoilinthinlayersfromflatorgentlyslopingareas.
- Rill-removalofsoilfromsmallburwelldefinedchannelsorrills.
- Gulley-removalofsoilfromchannelswhichbecomeprogressivelydeeperandwider.
- RiverbankErosion-removalofsoilalongriverbanksbytheriverwater.
- Solifluction-gravitationalflowofsoilsaturatedwithwater.
- Landslides-massmovementofrockdebrisandsoildownaslope, Forexample;
  - Slipmovementofearthorrockmassesforashortdistance.
  - Debrisslide-materialsmoveatagreaterspeed.
  - Debrisfall-movementofmaterials/debrisalongverticalcliff.
  - Rockfall-movementofrockdownaverysteepslope.
  - Rockslides-massofrockmaterialsthatslidealongabeddingplate,ajointor afaultface.

SoilErosionControlMeasures

Soilconservationmeasurescanbeclassifiedinto:

- Biologicalorculturalcontrol
- Physicalorstructuralcontrol

BiologicalorCulturalControlMeasures

Thesemeasuresareapplicablewherelandslopeisbetween2-12%.

- Grassstrips/filterstrips;
  - Thesearenarrowuncultivatedstripsalongthecontourleftbetweencultivated strips.
- Covercropping;
  - Theestablishmentofacropthatspreadsoutoverthesurfaceofthesoiltoprovide itwithacover.

- Contourfarming;
  - Carryingoutallandoperationsalongthecontour.
- Mulching;
  - Coveringofthesoilwitheitherorganicorsyntheticmaterials.
- Propercroppingsystemssuchas:
  - Croprotation
  - Correctspacing Inter-cropping
  - Ridging/furrowing Stripcropping
- Controlledgrazing; Properstockingrate,rotationalgrazing.
- Stripcropping;
  - Growingcropswhichgivelittlegroundcoverinalternatestripswithcropssuchas beanswhichhaveagoodgroundcover. Afforestation/re-afforestation.
  - Afforestation-growingoftreeswherenon-existed.
  - Re-afforestation-growingoftreeswheretheyhavebeencutdown.
  - Agroforestry-landusethatinvolvesthegrowingoftreesincombination with cropsandpasturesonthesamepieceofland.

PhysicalorStructuralControlMeasures

- Thesearesoilandwaterconservationmeasureswhichinvolvemechanical constructionsontheearth.
- Theyareusedinareasofmoderateslopebetween13-55%. Theyinclude:
- Trashorstonelines;
  - Thesearerowsofheapedcrop'residuesorstonesmadealongthecontours.
- Filterstrips;
  - Itinvolvesthegrowingofanopencropintheuppersideoftheslopefollowedbya densecroptoreducespeedofwater. Thisincreasesinfiltration.
- Terraces;
  - Arestructuresconstructedacrossaslopetoreducethelengthofaslopethus reducingrun-off.
- Benchterraces;
  - Areconstructedwheretheslopeis35-55%. Treecropsaresuitableforsuchareas.

ImportanceofaBenchTerrace:-

- Reducesslopeoftheland.
- Conservessoilmoisture. Betterretentionofsoilfertility.
- Narrowbasedterraces–Cannotallowcultivationbymachines.
- Broadbasedterraces-Iswideenoughtoallowcultivationbymachines.
- Gradedterraces:
  - Haveadrainagechanneltoleadoffexcesswatertoavegetatedplace.
  - Theyshouldbeabout100minlength.
- Levelterraces:
  - Havenooutletchannels,
  - Theaimistohavewaterinfiltrating,
  - Hencenowatercanflowfromtheendsoftheterrace.
- Fanyajuu:

- A ridge made by digging a channel and throwing the soil uphill.
- Fanya chini:
  - In this case the soil is heaped on the lower side of the channel.
- Bunds: heaps of soil (earth) made along the contour.
- Cut off drains:
  - An open trench with a embankment on the lower side into which water from the farm drains.

  Water from the trench should be discharged into;
  - Natural waterways,
  - Artificial waterways,
  - Rocky ground
  - Grass land
- Gabion/Porous dams:
  - Galvanized wire mesh boxes filled with stones which are built across slopes and gullies.
- Dams and reservoirs;
  - Dams- barriers built across river/waterway to hold and store water. It reduces speed of runoff. - Reservoirs- these are large storage tanks.
- Ridging- heaps of soil to reduce the speed of water,

  They retain the water for sometime.

Water Harvesting Methods

- Water harvesting and storage should be done during the rainy season to avoid wastage.

This should be done using the following methods:

- Roof catchment- trapping and collection of rain water from rooftops.
- Rock catchment- water is harvested by constructing a barrier on the lower side of a large impervious rock to trap surface runoff from the rock.
- Weirs and dams.
- Dam- a barrier constructed across a river or a dry valley so that it can hold water.
- Weirs- barriers constructed across a river or a stream to raise the water level and still allow water to flow over it. - Ponds- water retention excavations made to hold excess surface water.
- Retention ditches/level terraces.- These are terraces constructed with blocked ends to retain water. Micro-Catchments
- A system of harvesting limited rainfall and storing the water in the ground for use by the planted crops.

Types of Microcatchments;

- Triangular/V-shaped/Negarims;
  - V¬-shaped bunds measuring 25cm
  - Are built with soil from the excavated planting holes to direct runoff water towards the basin area around the base of each plant

- Semi-circularbunds;
  - Formedaroundthegrowingplanttoholdwateraroundtheplant.
- Trapezoidalbunds;
  - Trapezoidalshapedbunds,whichencloseslargeareawherethecropsaregrown.
- Contourbunds/furrows;
  - Thesearefurrowsmadealongthecontoursbetweentherowsofcropswhere agro¬forestrytreesareintercroppedwithannualcrops.
- Plantingholes/pits;
  - Theseareextralargeplantingholesmadeandfilledwithdryplantmaterials beforefillinginwithsoil.

UseofMicro-Catchments

- Slowdownthespeedofsurfacerunoff.
- Usedduringlandscapingofthecompound,parksandroadsidenestareas.
- Reclamationoflandforfoodcropindryareas.
- Watercollectedandstoredcanbeusedforirrigation
- Afforestationindryareas.

WeedsandWeedControl

Introduction

- Weedscauseheavycroplossesifnotcontrolled.
- Theircontrolisimportantsoastomaintainhighqualityandquantityproduce.

Definition:

- Aweedisanyplantgrowingwhereitisnotrequired.
- Andwhoseeconomicdisadvantagesoutweightheadvantages.

HarmfulEffectsofWeeds

- Weedscompetewithcropsfornutrients,space,lightandsoilmoisture.
- Someweeds,forexample,Strigaspparesparasitictocultivatedcropssuchasmaize.
- Someweedslowerthequalityofagriculturalproduceforexample:
  - Mexicanmarigoldgivesundesirableflavourtomilkifdairycowsfeedonit.
  - Devilshorsewhip,blackjack,bristlyfox-tailandothersgetattachedtosheepwool thusloweringitsquality.
- Someweedsarepoisonoustohumanbeingsandlivestockforexample:
  - Thornapple(Daturastramonium)
  - Sodomapple(Solanumincanum)
- Someweedshaveallelopathiceffectstocultivatedcrops.
- Waterweedsblockirrigationchannels.
- AquaticweedssuchasSalviniainLakeNaivashaandwaterhyacinthinLakeVictoria affectfishing.
- Someweedsarealternatehostsforinsects,pestsanddiseasecausingorganismsfor example:
  - Wildoat(avenafatua)isanalternatehostforrusts.
  - Mallow(malvaverticillata)isanalternatehostforcottonstainers.
- Weedslowerthequalityofpastureforexample:

- Tickberry(Lantanacamara)
- Nutgrass(Cyperusrotundus),
- Manyattagrass(Eleusinejaegeri)

- Someweedsirritateworkersthusreducingtheefficiencyinwhichtheyarecontrolled forexample:
  - Doublethorn(Oxygonumsinuatum),
  - Stingingnettle(Urticamassaica), Devil'shorsewhip(Achyranthesaspera).

FactorsContributingtotheCompetitiveAbilityofWeeds

- Theyproducelargequantitiesofseedsforexamplepigweedandblackjack.
- Theirseedsremainviableinthesoilforalongtimeawaitingconducivegermination conditions.
- Theyhaveeffectiveseeddispersalmechanisms.
- Someweedspropagatebymeansofelaborateundergroundstoragestructures.
- Theyareefficientinutilizinglittlemoisture,nutrientsandsunlight.
- Somehaveshortlifecycles.
- Theyhaveelaboraterootsystemsforsupportingtheplantandabsorbingnutrients andwater.

WeedClassification

Itisbasedon:

- Lifecyclesforexample:
  - Annuals-completetheirlifecycleinonlyoneseason.
  - Biennuals-completetheirlifecyclesintwoseasonsonly.
  - Perennials-completetheirlifecycleinmorethantwoseasons.
- Morphology-leafformationsuchassize,shapeandvenation.
  - Broadleavedweedsforexampleblackjack,lantana,pigweed,oxalisandothers.
  - Narrowleavedweedsforexamplecouchgrass,setaria,nut-grass,manyattagrass andothers.
- Habitat-someweedsareterrestrial(growonland)whileothersareaquatic(grow onaquatic/marineconditions).

WeedIdentification

- Weedsareidentifiedbytheircommon(individual)namesandbotanicalnames.
- Theyarenamedaccordingtospecificfeaturesoraccordingtopersonwhoidentified them.

CommonName	BotanicalName
BlackJack	Bidenspilosa
Mexicanmarigold	Tagetesminuta
0xalislsorrel	Oxalisspp.
Doublethorn	Oxygonumsinuatum
Thornapple	Daturastramonium
Couchgrass	Digitariascalarum
Nutgrass	Cyperusrotundus
WanderingJew	Commelinabengalensis

- Sowthistle.....Sonchusoleraceus
- Devil'shorsewhip.....Achyranthesaspera
- Macdonald'seye/Gallantsoldier.Gallinsogaparviflora
- Sodomapple.....Solanumincanum
- Blacknightshade.....Solanumnigrum
- Chineselantern.....Nicandraphysalodes
- Brackenfern.....Pteridiumaquillium
- Lovegrass/Bristlyfoxtail.....Setariaverticillata
- Cleavers.....Galliumspurium
- StingingNettle.....Urticamassaica
- Fathen/Goosefoot.....Chenopodiumspp.
- Rapeweed.....Brassicanapus
- Wildoats.....Avenafatua
- Lantana/Tickberry.....Lantanacamara
- Waterhyacinth.....Eichhorniacrassipes
- Striga/Witchweed.....Strigahermontheca
- Creepingindigo.....Indigoferaspicata

WeedControlMethods

Themethodsofweedcontroldeterminedby:

- Theweedbeingcontrolled.
- Weatherconditions.
- Capitalavailability.
- Effectonenvironment.

METHODSOFWEEDCONTROLINCLUDE:

ChemicalWeedControl–

- Theuseofchemicalsknownasherbicidestocontrolweeds.

ClassificationofHerbicides

Basedon:

- Formulation-thephysicalformoftheherbicidesforexample:
  - Liquids
  - Wettablepowders
  - Emulsion
  - Dust
- TimeofApplication
  - Pre-emergence-appliedbeforetheplantedcropgerminates.
  - Postemergence-appliedaftertheplantedcropgerminates.
- Selectivity Selective.
  - Nonselective.
- ModeofAction
  - Contact-herbicidesthatkillonlythepartsoftheplantwhichitcomesinto contact.

- Translocatedsystemicherbicidesthatwillkillthewholeplantevenifitcomes intocontactwithonlyasmallpartofit.

MethodsofHerbicideApplication

- Spraying-applicationofsolutions.
- Dusting-applicationofdusts.
- Fumigation-applicationoffumigantsintothesoil.

SafetyMeasuresintheUseofChemicals

- Readmanufacturer'sinstructionsandfollowthem.
- Wearprotectiveclothingsuchasoveralls,breathingmask,glovesandboots.
- Avoidinhalingtheherbicides.
- Washthoroughlyafterhandlingchemicals.
- Donotbloworsuchblockednozzles.
- Avoidherbicidedrifttounintendedcropsandotherplants.
- Avoidherbicidedrifttolivestockfeedandwater.
- Avoidspillingherbicidesinpasturesandfoddercrops.
- Disposeofftheemptycontainersproperlyforexampleburyingtheminthesoil.
- Donotwashsprayingequipmentinwatersourcesusedbyanimalsandhumanbeings.
- Storechemicalsinasafeplace.
- Washthesprayingequipmentthoroughly.
- Sinkleftoverchemicalsintothesoilaftertheday'swork.

AdvantagesofChemicalWeedControl

- Itislesslaborious.
- Effectiveinthecontrolofdifficultweedssuchascouchgrassandsedges.
- Itdoesnotdisturbcroprootsandotherundergroundstructures.
- Itmakesthecontrolofweedsincertaincropeasier.
- Itisefficientinbothwetanddryconditions.
- Itdoesnotdestroysoilstructure.
- Cheaperinlargescaleproductionthantheuseofmanualormechanicalcultivation.

DisadvantagesofChemicalWeedControl

- Itrequiresskilledlabourinmixingandapplication.
- Causeenvironmentalpollution.
- Herbicideshavelongresidualeffectswhichmayinterferewithfuturecrops.
- Itisveryexpensive.

MechanicalWeedControl

- Itinvolvesthefollowingoperations: Tillage/Cultivation
- Thisistheopeningandlooseningupofthesoil.
- Itcanbedonebyhandtoolsortractordrawnimplements.

Advantages

- Cheapinsmallscaleproduction.
- Increaseswaterandairinfiltrationintothesoil.
- Incorporatescropsresiduesintothesoil.

- Theearthing-updoneduringtillageencouragesrootgrowth.

Disadvantages

- Ifdonerepeatedlyitdestroyssoilstructure.
- Itislaboriousandexpensiveinlargescaleproduction.
- Itmaynoteffectivelycontrolweeds.
- Itmayleadtosoilerosionandlossofsoilmoisture.
- Damagecroproots.

Slashing/Mowing–

- Mechanicalremovalofshootsfromweeds.
- Itiseffectiveinthecontrolofannualweeds.

Uprooting

- Itisdonewhenthecropsaretooclose
- Toallowmechanicalcultivationorwhereweedsarescattered.

CulturalWeedControl

Itinvolvesthefollowingpractices:

- Mulching.
- Covercropping.
- Croprotation.
- Timelyplanting.
- Useofcleanseed/plantingmaterials.
- Properspacing.
- Properseedbedpreparation.
- Flooding.

BiologicalWeedControl

- Theuseoflivingorganismstocontrolweeds.

Examplesare:

- Useoflivestocktograzeandcontrolgrowthofweedsespeciallyinplantations.
- Useofweedeatingfishtocontrolaquaticweeds. Useofmothstocontrolcactus.
- Limitations:themethodisnotreliable.

LegislativeWeedControl/Quarantine

- Itinvolvesgovernmentlawsandregulationswhichpreventtheintroductionand spreadofforeignweedsinacountryoranarea.DonebyKEPHIS.
- Limitations:Onlysamplesarecheckedwhilethebulkofthematerialsmayhave someweedseeds.

CropPestsandDiseases

Introduction

- Croppestsanddiseasesleadtohighlossesincropproductionhenceefficientcontrol measuresareneeded.
- Propercontrolmeasuresrequirethefarmerstobeableto;
  - Identifytheseorganisms,
  - Knowtheirlifecycles,feedinghabits
  - Thedamagetheycausetocrops.

CropPests

DefinitionofaPest:

- Itisalivingorganismthatdestroyscrops/treeseitherdirectlyorindirectlyby introducingpathogens(diseasecausinggerms).

ClassificationofPests

Pestsareclassifiedaccordingtothefollowing:

- ModeofFeeding
  - Pestswithbitingandchewingmouthparts-theycausephysicaldamageand reducethephotosyntheticareaoftheplant.
    - Pestswithpiercingandsuckingmouthparts-theysuckoutthenutritiousplant sapandintheprocessmayintroducediseasecausingorganisms.
- CropsAttacked
  - Somecroppestsattackspecificcropsforexample,stemborersprefercereal crops.
- StageofGrowthofCropsAttacked
  - Therearepestsofseedlingsattackwhenthecropisyoung,forexamplecutworms.
  - Pestsoffruits-attackthecropsatfruitingstage.
  - Pestsofgrainsattackthecropswhenthegrainsareformed.
- FieldandStoragePests
  - Somepestsattackthecropswhileinthefield.
  - Otherpestsattacktheproduceafterithasbeenharvestedandstored.

IdentificationofCommonPests

NameofPest	CropAttacked	DamageDone	ControlMeasures
Armyworms (Spodoptera exempta)	(i) Cereal crops (ii) Sugarcane (iii)Grasses	Defoliatethe wholeplant	(i)Earlyplanting (ii)Useofeffectiveinsecticides
Cutworms (AgrotisSpp.)	Young seedlings	Cuttheseedlingsatthestembase	(i)Earlyplanting (ii)Useofsoilapplied insec(futicmiidegsants) (iii)Flood/irrigation
Bollworms (Heliathismigera)	Cotton, tomatoescitrus,ma,ize, beans,millet, othelegumesr	Eatand destroy thefruitsand seeds	(i)Croprotation (ii)Fieldhygiene (iii)Sprayingwith i(nivs)eearlcticyidplesanting
Maizestalkborer (Busseolafusca) and (Chilopartellus)	Maizesorghum	Destructionofthe stemandyoung growingtissues	(i)Earlyplanting (ii)Fieldhygiene (iii)Croprotation (iv)Useofstalkborerdust
Loopers (Ascotisselena ria)	Coffee	Makewindowsincropleaves	(i)Useofeffective in(iisec)Ustiecofidespa.rasitic wasps, birdandchams eleons
LeafMiner (Leucoptera meyrickiandL. caffeina)	Coffee	Makeminesintheleaves reducing photosynthetic area.	(i) Useofparasiticwasps (naturenaelmies) (ii)Useofeffective insecticides.
Stainers (Dysdercusspp.)	Cotton	Stainthecotton lintreducing quality	(i) Useofparasitictachinid fS (i) pliesrayingwithinsecticides. (i) Controlalternatehosts. (Croprotation
Aphids (Aphisspp.)	Severalcrops suchascitrus, maizecotton,,beans. cabbagesand others	(i)Transmit viraldiseases. (ii)Suckout sapleading tostunted growth.	(i) Naturalenemiesfor (i) exampladybirldes, (ii)Overheadirrigation (iii)Useofinsecticides

OtherCropPestsInclude:

- Mealybugs-coffee
- Thrips-coffee
- Beetles-fieldandstoragepests.
- Birds-fieldpests-cerealsandfruits.
- Rodents-fieldandstoragepests,cerealsandtubers.
- Nematodes-soilbornepests-tomatoes,potatoes,sunflower,beans.

HarmfulEffectsofCropPests

- Pestssuchassquirrelsandrodents,unearthplantedseeds,resultinginpoor germination.
- Somepestslikenematodes,termitesandmolesdamagecroprootscausingwilting anddeathofthecrops.
- Theylowerthequalityandquantityoffarmproduce.
- Theyincreasethecostofproductionsincefarmerswillincurexpensesinpurchasing chemicalstocontrolthem.
- Theytransmitdiseasestocropsforexample,aphidstransmitstreakvirusdiseasein maize.
- Chemicalsusedtocontrolthepestscausepollutiontotheenvironment.
- Theyexterminatethecropbyfeedingonthemforexampleeatingembryooftheseed.

ControlofPests

- Ifpestpopulationcausesdamagebeyondtolerancethenitissaidtohavereached economicinjurylevel(EIL)hencecontrolmeasuresshouldbeeffectedbeforethis level.

Beforeanycontrolmeasureiseffected,thefollowingshouldbeconsidered:

- Knowthelifecycleofthepest.
- Correctidentificationofthepest.
- Correctassessmentofthedamage.
- Theweatherconditions.
- Thevalueofthecropinquestion.
- Thecostfactorofthecontrolmethod.

MethodsofControllingthePests

- Culturalmethods.
- Physical/mechanicalmeasures
- Biologicalmethods.
- Chemicalmethods.
- Integratedpestmanagement.

CulturalMethods:

- Thesearefarmingpracticeswhichaimatreducingthepestpopulationbydestroying thelifecycleofthepestseitherbyexposingthemtoadverseconditionsordenying themfood. Theseinclude:
- Timelyplantingtoescapepestattack.
- Timelyharvesting.
- Propertillage.
- Closeseason:thisistheperiodwhenasusceptiblecropisnotgrowninorderto controlacertainpest.

- Trapcropping:Thesearecropswhichattractpestsdivertingthemfromthemain crop.Thetrapcropisgrowntogetherwiththemaincrop.
- Croprotation:Itbreaksthelifecycleofthepest.
- Plantingresistantvarieties:Theseareplantswithnaturalprotectivemechanisms againstpestforexamplehairycottonagainstjassidbugs,gooseneckedsorghum againstbirds,hightilleringinsorghumagainstshootfly.
- Fieldhygiene:Thisincludesrogueingandremovalofcropresidueswhichharbour pestsfromfield.
- Alterationsofenvironmentalconditions,suchas,creatingamicro¬climate whichisnotconducivetopestsforexampleopenpruningincoffee.
- Cropnutrition:applicationoffertilizersandmanurestomakethecropstrongand abletoescapepestattacks.
- Destructionofalternatehosts,forexample,weedslikemallowwhichharbour cottonstainers.
- Useofcleanplantingmaterials.Thishelpstopreventintroductionofcroppests.
- Properspacing:ifwellspacedsomepestsfinditdifficulttomovefromoneplantto another.
- Useoforganicmanure,forexample,farmyardmanurediscourageseelworms (nematodes).

ChemicalControl

- Chemicalsusedtocontrolpestsareknownaspesticides.
- Pesticidesareadministeredthroughdusting,sprayingorfumigating.

ClassificationofPesticides: Pesticidesareclassifiedonthebasisof:

ModeofEntry

- Stomach-ingestedbythepesttogetherwiththecropmaterials.
- Contact-absorbedthroughthebodytissues.
- Fumigants-throughthebreathingmechanism.
- Systemic-translocatedtoallparts.

ModeofAction

- Respiratorypoisons-interferewithbreathingmechanisms.
- Coagulants-causethebloodofthepesttocoagulate. Neurotoxins-actonthenervoussystem.
- Protoplasmicpoisons-causethecellstodisintegrate.

TargetPests

- Insecticides-killinsectpests Molluscicides-killsnailsandslugs.
- Rodenticides-killrodents.
- Nematocides-killnematodes.

Formulation.

- Dusts,granulesandpowders Emulsifiableconcentrates.
- Miscibleliquids.
- Wettablepowders.
- Fumigants.

FactorsThatAffecttheEfficiencyofPesticides

- Concentrationofthepesticides.
- Weatherconditionsatthetimeofapplication.
- Timingofapplication-efficiencyishighifappliedwhenthepestismostsusceptible.
- Persistenceofthepesticidehavinglongresidualeffectinthesoil.
- Resistanceofthepests.

AdvantagesofChemicalPestControl

- Faster
- Immediateresultsareachieved.
- Lowlabourrequirements.

DisadvantagesofChemicalPestControl

- Expensivetobuy.
- Causepollutiontotheenvironment.
- Requireskilledlabourtoapply.
- Somepesticidesmaykillbeneficialorganismsandpredators.
- Sometargetpestsmaybuildupresistance.

MechanicalPestControl/Physical

- Thisinvolvesthekillingofthepestsusingphysicalmethods.
- Orcreatingphysicalbarrierstopreventpestsfromgettingintocontactwiththecrops.

Example:

- Flooding/irrigation;forexample,molesaresuffocatedthroughflooding.
- Useoflethaltemperatures:eithertoocoldortoohot.
- Suffocation;commonlyusedingrainstoragebinsbybeingmadeairtight.
- Trappingandkilling,forexample,rats.
- Creationofphysicalbarriers,suchas,ratbafflers,stickymaterialsontreetrunks.
- Properdrying:thismakesthemtoohardtobedestroyedbypests.
- Scaringdevicesespeciallyinriceplantationstocontrolbirds.
- Useofexplosivesthrownatbreedingplacesofbirdstokillorscarethemaway.

BiologicalPestControl

- Itinvolvestheuseoflivingorganismstoreducethepestpopulation.

Predator	TargetPest
Parasiticwasp	Whiteflyincitrus,bollworms,stalkborers
Birds	Crickets,locusts,caterpillarllars.
LadyBird	Aphids
Trachnidflies	cottonstainer
Prayingmantis	giantloppers
Majimotoants	scales
Cats	moles,rats,mice
Brachonidwasps	mealybugs
Chicken	cottonstainer,larvaeofbeetles,grasshoppers,crickets

Advantages

- Cheap
- Noenvironmentalpollution
- Savesonlabour.

Disadvantages

- Takestoolongtogetthecorrectagent - Difficulttocontrolthepesteffectively.

IntegratedPestManagement

- Itisanewmethodwhichinvolvesthecombinationofthemethodsmentionedabove.
- Theaimistohaveleasthazardstotheuserandtotheenvironment.
- Example,attractant-pheromonesareusedtoattractpeststooneplacewheretheyare sprayedanderadicated.

LegislativeMethod/Quarantine CropDiseaseAndTheirControl

- LegislativemearsuresofpestcontrolareeffectedbytheKenyaPlantHealth InspectorateService(KEPHIS)throughseedinspection.
- Adiseaseisanydeviationfromthenormalperformanceorfunctions.
- Aplantdiseaseisanyharmfulphysiologicaldisorderinaplantcausedbypathogenic agentssuchasvirus,bacteria,fungi.
- Thestudyofplantdiseaseiscalledplantpathology.

Economicimportanceofcropdiseases

- Theylowercropyield
- Theyreducethequalityoftheproducethusreducingtheirmarketvalue
- Theycausefoodpoisoning.E.gergotinwheat,afflatoxiningraincropsbyfungus.
- Theyreducephotosyntheticareaoftheplant.

Classificationandidentificationofplantdisease

- Plantdiseaseareclassifiedaccordingtotheircausalagents; Fungaldiseases;
- Fungiarenon-greenplant-like.
- Someareparasiticandothersaresaprophytic.

Parasiticfungidividedinto;

- Obligateparasites-thosethatdependonotherlivingorganismsforfood.
- Falcultativeparasites-thosethatareabletoliveonboththelivinganddead tissues.

Examplesoffungaldisease

- Panamadisease(Fusariumoxysperium—bananas)
- Cigar-endrot(Verticiliumtheobromae)-bananas
- Dieback–attackthetipsofshootsandroots
- Mildews-foliardiseaseofseveralcrops
- Armillariarootrot(Armillariamellea)-coffeeandtea
- Dampingoff-diseaseofseedlingsinthenursery
- Anthracnose(Colletotrichumspp)-coffee,beans,tomatoes.
- Fungusalsocausedamagetostoredgrainswhicharenotproperlydriedorifthestore isdamp.
- Funguscausefoodpoisoningandlowerseedviabilityforexample*Aspergillusflavus* whichproducesahighlytoxiccompoundcalled afflatoxin.

Examplesoffungaldisease

Disease/cause	Cropsattacked	Symptomsofattack	Controlmeasures
Lateblight	Membersof	Drypatchesonthe	-Croprotation

(Phytopthora infestans)	Solanaceae family (potatoes, tomatos)	leavesandfruits (necroticlesions)	-effectivefungicides -treatedseeds -resistantvarieties
Rusts (Puciniaspp)	Rice,wheat, sorghum,maize	Redandbrown pistulesonthe leaves,shriveled grains	-resistantvarieties -Recommended fungicides - Earlyplanting
Smuts (Ustilag ospp)	Wheat,maize, sugarcane	Blackpowdermass onthespikesandthe ear	-Fieldhygiene, -certifiedseeds, -resistantvarieties, -croprotation
Blasts(Piricul ariaoryzae)	Rice	-Smallbluesportson leaveswithgrey centre.	-Seeddressing -Resistantvarietieseg sindano
		- Attackinflorescence tocause‘’empty heads’’	- Destructionofaffected plants -fungicides
CoffeeBerry Disease(CBD) (Colletotrich u mcoffeanum)	Coffee	-Darkblotchesspots ontheflowers -Brownconcentric ringsontheleaves -Darksunken woundsonthe berries.	-Resistantvarietieseg Ruiru11 -Properpruning -Effectivefungicides -strippung

BacterialDiseases

- Bacteriaaremicroscopicsingle-celledorganismswhichreproducebybinaryfission
- Transmission;Throughirrigationwater,seeds,fertilizers,manures,wind,
- raindropsplash,insects,soilandmechanicalmeans.

SymptomsofBacterialDiseases

- Wilting
- Cankers(necrotictissues)localizednecrosis Gallformationininfectedtissues.

Examplesofbacterialdiseases

Disease/Cause	Crackedtt Symptomsofattack	ControlMeasures
Haloblight (Pseudomon ii.Yellowband	Beans i.Irregulardarklesionson leavesandpods. roundthe lesionscalled"halo". iii.Watersoakedlesions	1Useofresistant .varieties forexampleWairimu. , apshaseolicola) ii.Effectivefungicide. iii.Croprotation
FusariumwiltTomatoes (Fusarium oxysporum)	i.Stuntedgrowth. ii.Yellowingandshedding ofleaves. iii.Wiltingoftheplant.	i.Useofresistantvarieties.
Blackarm malvacearum	Cotton i.Smallroundspotsonthe cotyledonsofyoung seedlings.	ii.Useofcertifiedseeds. i.Fieldhygiene. (Anthomonas

)

ii.Thespotselongateto formblacklesionsonthe stem.

BacterialwiltTomatoes Uniform.wiltingofthewholei.Useofcertifiedseeds.

(Pseudomon[and]potatoes plantevenwithenough ii.Croprotation.

asoslanacearu water. m)

ViralDiseases

- Virusesaresmalllivingorganismswhichcanonlybeseenunderaverypowerful electronicmicroscope.
- Virusesinterferewithphotosynthesis,respiration,transpirationandnitrogenutilization

SymptomsofViralInfection

- Leafchlorosis.
- Leafcurling.
- Mosaic(lightgreenoryellowpatches).
- Malformation(distortion)ofplantparts.
- Rosettes;Developmentofabnormallyshortinternode.

Transmission

- Throughtheuseofinfectedvegetativematerialsandinsectvectorslikeaphids, mealybugsandleafhoppers.

Viraldiseases

Disease/Cause	crops Attacked	SymptomsofAttack	ControlMeasures
Ratton stunting	Sugarcane	Reddiscolorationonthe vascularbundles.	IUseofcleanmaterials .1Treatmentofseed canes.
Maizestreak	Maize	Yellowstripesalternatingwith green,paralleltothemidrib.	iControlleafhopper. .ii.Useifcertifiedseeds. iii.Fieldsanitation.
Greening disease	Citrus	i.Yellowmottlingoftheleaves. iDieback. iii.Prematureleaffall.	i,Useofcleantoolswhen budding. 1Controlofinsect
Leafmosaic	Suzgarcane, cassava. potatoes.	i.Yellowmottling. INecrosisofstem.	1ivectorsControlofaphids. . .ii.Useofcleanmaterials. iSeedtreatment.
Tristeza	Citrus	IDwarfingof .iplantsDieback..	i i.Strippingaffectedfruits. ii.Useofcleanequipment ofbudding.

OtherCausesofCropDiseases

- Floodingformingammoniawhichispoisonoustothecropscausingaburningeffect onleaves.
- Chemicals:somemaybetoxic.

- Poorweather:Extremesofdayandnighttemperatures.
- Stress:suchasirregularwateringasintomatoblossomendrot.

ControlofCropDiseases

- Culturalmethod:Thisinvolvesuseof Healthyplantingmaterials.
- Practicingfieldhygiene.
- Properseedbedpreparation.
- Properspacing.
- Heattreatmentoftheplantingmaterialsforexamplesugarcane.
- Properdryingofcerealsandpulsesto13%M.C.
- Growingdiseaseresistantvarieties.

LegislativeMethod

- Involvestheimposingofregulationsandlawsespeciallyincaseofdiseaseoutbreaks topreventtheintroductionandspreadofdiseases.

ChemicalControl

- Usedasalastresort.

Chemicalcontrolmeasuresinclude:

- Seeddressingbeforeplanting.
- Soilfumigationtocontrolsoilbornediseases.
- Spraying:applicationoffungicides.

CropProductionVI

(FieldPracticesII)

Introduction

- Therearemanycropscultivatedin Kenya.
- Thesecropsaregrownforvarioususesandrequiredifferentecologicalconditions.

Definitions:

- Hybrids-Thesearecropvarietiesdevelopedbycrossingtwopurelines.
- Composites-Thesearecropvarietiesdevelopedthroughrepeated massselection.
- Cultivars-thesearevarietiesofcropswhicharecultivatedinagivenarea.

Maize EcologicalRequirements

- Maingrowingareas:Trans-Nzoia,Nakuru,UasinGishu,Laikipiadistrictsandothers.
  - Altitude:Upto2000mabovesealevel.
  - Temperature:About25°C
  - Soils:Freelydraining,fertileloamsoils.
  - Rainfall:750-12S0rnmcriticalatsilkingandpollinationstage.
- Varieties
  - Highaltitudeareas:Hybrids611,613and614C.
  - Mediumaltitudeareas:511,512,622and632.

- Marginalrainfallareas:KatumanicompositeandMakuenicomposite.
- Coastregions:CoastcompositeandKatumanicomposite.

SeedbedPreparation

- Ploughingshouldbedeepanddoneduringthedryseasontoeradicateweeds.
- Requiremediumtilth.
- Plantspacing75-90cmx20-30cm.
- Plantingdoneattheonsetoftherains.Thishelpstoreducepestattack.
- Dryplantinginareaswithinadequaterainfallisnecessary.

FieldMaintenance:

- Applyphosphaticfertilizerduringplantingatarateof120kg/haP2O5
- Alsonitrogenousfertilizersastopdressattherateof200kgofASNorCAN.
- Controlweedsbycultivation,useofappropriateherbicides,uprooting,slashingand mulching.

PestControl MaizeStalkBorer:

- Natureofdamage:Boringtheleavescausingwindowingeffect,boringthestems andcobs.
- Control:Destructionofpreviousyearscropresidue,closedseasonandapply chemicals

MaizeWeevils:

- itisastoragepest.
- Damage:Boresholesintothemaizegrains,eatingthecontents.
- Control:Properhygieneandsanitationinthestores.
- UseofchemicalssuchasActellicSuper. DiseaseControl:

Rust

- Cause:Fungus.
- Symptoms:Redorbrownpustulesonthe.leaves.
- Control:Plantresistantvarietiesandcroprotation.

Smuts

- Cause:Fungus
- Symptoms:Blacksootymassofsporesonmaizeheadsorcobs(ear).
- Control:Croprotation,growingresistantvarietiesanddestructionofaffectedpla nt parts.

MaizeStreakVirus

- Cause:Virus
- Symptoms:Yellowlongitudinalstripesparalleltothemidrib.
- Control:Certifiedseed,earlyplantingandrogueing.

Harvesting

- Harvestthecrop3-9monthsafterplantingdependingonvariety.
- Maizestalksarecutandstockedinthefield.
- Cobsremovedbyhand.
- Forlargescaleharvesting,combinedharvestersareused.
- Yieldsabout3,OOOkgand4500kg/ha.

BulrushMillet

Areaswheregrown:

- LowerareasofKirinyaga,
- Embu,
- Meru, PartsofMachakos
- KerioValley.

EcologicalRequirements

- Altitude:Doeswellinareasbelow1200m.
- Rainfall:500-600mrnperannum.
- Soils:Lightsandysoils.
- Varieties:Serere2A,3A,6A,17,16/9

SeedBedPreparations

- Ploughingoflandduringthedryseason.
- Soilshouldbeoffinetilthsincetheseedsaresmall.

Planting:

- Doneattheonsetoftherains.
- Plantedbybroadcastingandrowplantingataspacingof60cmx15cm.

FieldMaintenance:

- Weedingisdoneuntiltillering.
- Top-dressingisdonebyuseofsulphateofammonia.

PestControl Birds

- NatureofDamage:Eatstheseedsatmilkystage.
- Control:Birdscaringdevices.

DiseaseControl

Ergot

- Cause:Fungus.
- Symptoms:Headsbecomesticky.
- Control:Useofcertifiedseeds,croprotationanddestructionofaffectedcrops.

DownyMildew

- Cause:Fungus.
- Symptoms:Long,whitishlinesontheleaves.
- Control:Croprotationandfieldhygiene.

Harvesting

- Donebycuttingofftheheads.
- Dryingoftheheads.
- Threshingandwinnowingofthegrains.
- Storedunderwellventilateddryconditions.

- Yieldsabout1000kg/hawithgoodmanagement.

FingerMillet - Areaswheregrown:WesternKenyaandUganda.

EcologicalRequirements

- Altitude:0-2400mabovesealevel.
- Rainfall:900mm,droughtresistantintheearlystages.
- Soils:Freedrainingfertilesoils.

Varieties:

- SererevarietiesdevelopedatSerereinUganda.
- Ultralupin - 5.18oats.

LandPreparations

- Theseedbedshouldbethoroughlypreparedtoafinetilthduetothesmallsizeofthe seeds.
- Italsohelpstocontrolweeds.

FieldOperations Planting

- Fingermilletshouldbeplantedasearlyaspossibleintheseason.
- Itisusuallybroadcastedbyhand.
- Ifplantedinrows,thefurrowsshouldbe30-33cmapartandtheplantsshouldbe thinnedto5cmapartwithintherows.

FertilizerApplication

- Sulphateofammoniaattherateof125kg/haisrecommendedfortopdressingfinger millet.

WeedControl

- Cleanseedbedpreparation
- Uprooting

PestControl:

- Birdsarecontrolledthroughscaring.

DiseaseControl

Headblast:

- Cause:Fungus
- Symptoms:Brownspotswithgreycentresontheleavesandstemsbelowthe inflorescence.
- Control:Useofresistantvarieties.

Harvesting

- Individualheadsarecutwithknives.
- Headsaredried,threshedandwinnowed.
- Yields1650kg/hawithgoodmanagement.

Sorghum

- ItisgrowninWestern,northern,RiftValley,EasternandsomepartsofCentral Province.

EcologicalRequirements

- Altitude:0-1500mabovesealevel.
- Rainfall:420-630mm.Itisdroughtresistant.
- Soils:Fairlyfertileandwelldrainedsoils.

Varieties

- Dobbsvariety.
- Serenavariety.

FieldOperations Planting

- Broadcastingtheseedsonthefirmlypreparedseedbed.
- Intercroppedwithothercropsespeciallymaizeandbeans.
- Canbeplantedinpurestandsataspacingof60cmx15cm

FertilizerApplication

- Respondswelltofarmyardmanure(FYM).
- Inorganicfertilizersarenotcommonlyusedingrowingsorghum.

PestControl

- Birdpests:Theyarethemostcommonsorghumpests.
- Theyinclude
  - quelea,
  - aethiopica(SudanDioch),
  - weaverbirds,
  - starlingbird bishop'sbird.
- Theyarecontrolledthrough;
  - killingthemusingexplosives,
  - poisonsprayingintheirbreedingplaces
  - useofflamethrowers.
- Sorghumshoot-flycontrolledbyearlyplanting,closedseasonandapplicationof insecticides.
- Stemborer-controlbyuseofinsecticidesandfieldhygiene.

DiseaseControl

Commonsorghumdiseasesinclude:

- Leafblight
- Anthracnose. Sootystripe.
- Loosesmut
- Headsmut

Smutsarecontrolledbyseeddressing-whiletheotherdiseasesarecontrolledby growingresistantvarieties.

Harvesting

- Sorghumisreadyforharvesting3-4monthsafterplanting.
- Headsarecutoffusingasharpknifeafterwhichtheyaresun-dried,threshed, winnowedandstored.
- Upto3000kg/hectarecanbeobtainedwithgoodmanagement.

Beans

- Growninallprovinceswheremaizeisgrown.

EcologicalRequirements

- Altitude:10.00-2100metresabovesealevel.
- Rainfall:Averageof62Smmperannum.
- Soils:Welldrainedloamysoilsrichinorganicmatter.

Varieties

Varietiesfordrybeans:

- RoseCoco,
- MweziMoja,
- CanadianWonder,
- Wairimu, Haricot,
- Mwitemania.

Varietyforcanning:Mexican142.

VarietiesforFrenchBeans:

- Primeur,
- LongTom,
- Saza,
- MasterPiece Monel.

SeedbedPreparation

- Landshouldbepreparedearly.
- Primaryandsecondarycultivationdonetocontrolperennialweeds.

SeedSelectionandTreatment

- Selectwholesomeseedsfreefromdamageandwrinkles.
- Seedsaredressedagainstbeanfly.
- Seedsshouldbeinoculatedwithappropriatebacteria(nonedressedseeds)

Planting

- Plantedattheonsetoftherains.
- Spacing30-45cmx15cm.
- Applyphosphaticfertilizerduringplantingtime.
- Plant2-4seedsperhole.

FieldMaintenance

- Providesticksfortheclimbingvarieties.
- Controlofweedsthroughshallowcultivation.
- Top-dresswithnitrogenousfertilizerforexampleCAN.

PestControl Bean-Fly

- Natureofdamage:Feedsonthestemscausingswellingattheroots.
- Thisresultsinwiltinganddeath.
- Control:Dressingofseeds,earlyplantingandspraying withinsecticides.

BeanBruchid(StoragePest)

- Natureofdamage:Makedarkcircularwindowsonthegrains.
- Control:Cleanstores,fumigation,andseeddressing.

DiseasesControl BeanAnthracnose

- Cause'Fungus
- Symptoms:Brownorblacklesionsontheundersideoftheleaves,podsandstems.
- Control:Growingresistantvarieties,croprotation,destructionofcropresiduesa nd sprayingwithfungicides.

BeanRust

- Cause:Fungus
- Symptoms:Redbrownpustulesontheleaves.
- Control:Plantingresistantvarietiesandsprayingcopperfungicides.

Harvesting

- Doneduringthedryseasonfordrybeansandwhenthepodsaredry.
- Threshingandwinnowingdone.
- Sortingofrotten,offtypesanddamagedones.
- SoldtoNationalCerealsandProduceBoardwhendry.
- ForFrenchbeans,pickthepodswhensoftandgreen.
- Marketimmediatelytoavoidshrivelling.

RiceProduction

Areaswheregrown;

- MweaTabereIrrigationScheme AheroPilotSchemeinKanoplains.
- BunyalainBusia.
- BurainTanaRiver. LandPreparation
- Plotsof0.4hectarearemadewithbundsconstructedaroundthem.
- Plotsarefloodedforfourdays.
- Rotavators/jembesareusedtoworkthefloodedfieldsonthefifthday.
- Thelandisthenlevelledandallowedtodrain.

WaterControl

- Duringlandpreparation,waterlevelshouldbeabout7.5-10cm.
- Duringlevellingwaterlevelshouldbe5cm
- Waterisdrainedoffcompletelyfordirectsowing.
- Fortransplantedrice,waterlevelshouldbe5cmattransplanting.
- Waterlevelshouldbemaintainedat1/3theheightofplantuntilmaturity.
- Watershouldbeallowedtoflowslowlythroughthefields.
- Oldwatershouldbechangedevery2-3weeksiftheflowofwaterisnotpossible.
- Waterintroducedshouldalwaysbewarmtoensurepollination.

FertilizerApplication S.Aappliedinthenursery.

- Rateof25kgSAforeverynurseryunitof18.5mx18.5m.
- Phosphaticfertilizersbroadcastedinthefield.
- Rateof120kghaDSPbeforeplanting.
- S.Aappliedinthefieldintwosplitsbeforeandaftertransplantingatarateof 250kg/ha

FloodinginRice

Floodwaterinriceproductionisimportantforthefollowingreasons;

- Itprovidesgoodconditionsforgrowthsuchashighhumidity.
- Killssoilorganisms.
- Preventsdenitrification.

WeedControl

- Controlledthroughflooding.
- Appropriateherbicidessuchaspropanilandbutachlorarealsoused.

HarvestingofIndustrialCrops

- cotton,pyrethrum,sugarcane,coffeeandtea.

HarvestingofCotton

Stageofharvesting

- Takes4monthstomature.
- Harvestwhenbollsaredryandfullyopened.

MethodandProcedure

- InKenyacottonispickedmanually.
- SortoutgradeAR(safi)fromgradeBR
- (fifi)intoseparatecontainers. Precautions
- Harvestduringdryconditionstopreventdirtifyingthelint.
- Avoiduseofgunnybagstopreventcontamination.
- Avoidpickingleaves.
- Harvestonweeklybasis. HarvestingofPyrethrum

Stageofharvesting

- Takes3-4monthstomature.
- Harvesttheflowerswithdiscfloretswhichhaveassumedahorizontalposition.

MethodsandProcedure

- Pyrethrumispickedmanually.
- Flowersarepickedbytwistingtheheadssothatnostemisattached. Precaution
- Cleanharvestingshouldbedone.
- Avoidpickingleaves.
- Flowersareplacedinwovenbaskets.
- Overblownflowersarepickedandthrownoff.
- Picktheflowerswhenthedewisdry.
- Harvestedflowersshouldbetakentothefactorythesameday.
- Avoidcompactionofflowersinthebasket.
- Harvestinginterval,onceintwoweeksduringthewetseasonandonceinamonth

duringthedryseason. HarvestingSugarcane

Stageofharvesting;

- Take14-20monthsfortheplantcroptomatureand12-16monthsfortheratooncrop.

- Samplingofcaneisdonebeforeharvestingtoascertainthecorrectsugarcontent.

MethodsandProcedures

- Cutthecaneatthegroundleveltoavoidyieldloss.
- Thegreentopsareremovedfromthecanes.
- Harvestingmatchetisusedforcuttingthecane. Precaution
- Caneshouldbeharvestedimmediatelyatmaturitytoavoidloweringquality.
- Thegreentopsshouldberemovedimmediatelyaftercuttingtoavoidreductionof sugarcontentbyenzymeinvertase.
- Burntcaneshouldbeharvestedimmediatelyafterburningtopreventrapidinversion tomonosaccharides.
- Thecaneshouldbeprocessedwithin48hours. HarvestingofCoffee

Stageofharvesting;

- Takes2-4yearsdependingonthepruningsystem. Harvestonlyripeberries.

MethodsandProcedures;

- Handpickingisdonesothatripeberriescanbeselected.
- Duringpickinghookedstickscanbeusedtobendthetalltrees. Precautions
- Onlytheuniformlyripeberriesshouldbepicked.
- Over-ripeandunder-ripeberriesshouldbedriedandsoldasbuni.
- Ripecherriesshouldbeprocessedonthesamedaytheyarepicked. HarvestingTea

Stageofharvesting

- Ittakes2-4yearsforteatomaturedependingonthemethodofbringingyoungtea intobearing.

MethodandProcedures

- Teaharvestingisknownasplucking.
- Fineplucking-2leavesandabudareremoved.
- Coarseplucking-3leavesandabudareremoved.
- Astraightfitto(straightstick)isusedtoguidethepluckerontheplu ckingtable.
- Tippingisdonebycuttingoffshootsthatappearabovethefitto. Precautions
- Pluckedteaisplacedinwoven(wellventilated)basketstopreventfermentingbefore itreachesthefactory.
- Thepluckedteashouldbekeptinacoolplaceawaitingtransport.
- Itshouldbeprocessedwithinthesamedayofharvesting.
- Harvestingisdoneonaweeklybasisunderwetconditionsandonceaftereverytwo weeksunderdryconditions.

ForageCrops

Introduction

- Theseareplantswhicheithergrownaturallyorarecultivatedbymantobeusedfor feedinglivestock.
- Thetermforagecropsincludepastureandfoddercrops.
- Foddercropsarepurposelygrownforfeedinglivestock.

- Theyarecutoruprootedwhenready
- Pastureisagroundcoverofgrassoramixtureofgrassandlegumesgrazeddirectly orcutandfedtolivestock.

ClassificationofPastures

- Accordingtotypeofstand.
  - Eitherpure Mixedstands.
- Accordingtoecologicalzones.
  - Lowaltitude,
  - Mediumaltitude,
  - Highaltitudepastures
- Accordingtotheestablishment.
  - Natural

ExampleslesArtificialpasturesofgrasses.

- Napier,
- Rhodes, Setaria,
- Molasses,
- Congosignal,
- kikuyu,
- star,
- Guatemala,
- Sudan

ExamplesofGuineaLegumes;

- Lucern, Clover,
- Desmodium,
- Glycine, Stylo,
- Centrio,

PastureEstablishment

SeedbedPreparation

- Thisinvolvesclearingtheland,primaryandsecondarycultivationtoafinetilth becausetheseedsaresmall.
- Thisisdoneduringthedryseason.

Selectionofplantingmaterials

- Selectseedsofhighgerminationpercentage,
- Freefromimpuritiesorbuycertifiedseeds.
- Ifvegetativematerialsareused,selectfromhighyielding,vigorous-growingand healthyplants.

Treatmentoflegumeseeds

- Legumeseedsareinoculatedwiththecorrectstrainofbacteriawhichfixnitrogenfor thecrop.

Planting

MethodsofsowingareThisisdoneatthebeginningoftherains;

- Directsowing, Undersowing,
- Over-sowing

Oversowing

Thisisintroductionofapasturelegumeinanexistinggrasspasture. Undersowing Theestablishmentofapastureinanalreadyexistingcropwhichactsasacovercrop.

Seedsratedepend;

- Onpurityofseeds,
- Pasturespecies
- Whetherpureormixedstand.

Applyphosphaticfertilizerwhenplantingandlatertop-dresswithnitrogenousfertilizer.

Pasturemanagement

- Re-seedingorgapping;Re-seedingisdoneifthegrassiscompletelydenudated.
- Butifpartially,gappingcanbedone
- Controlofweedsbyslashing,uprootingandmowing
- Fertilizationofpastures-donebyuseofmanuresandnitrogenousfertilizer.
- Topping;Thisistheremovalofstemmyfibrousmaterialleftbehindaftergrazing.It allowsnewgrowthaftertherains
- Controlofpests-donebytrappingofmoles,useofpesticidesandbiologicalmeans.

PastureUtilization

- Pasturesshouldbeutilizedatmaturitywhennutritivevalueishigh.

Itisutilizedthroughthefollowingmethods:

- Directgrazing-thiscanbedonethroughrotationalgrazingorherding.
- Zerograzing-thisiswherethepastureiscutandfedtotheanimalsinthestalls.

CommonfodderCrops EdibleCana

- Altitude:1500-2000mabovesealevel.
- Establishment:Youngtubersorbulbsareused.
- Spacing:1mx1m.
- Management:Doeswellwithapplicationoffarmyardmanureandrequiresfertileland.
- Utilization:Topsandtubersareslicedandfedtolivestock.
- Conservation:Bulbsortubersareslicedandstored.

NapierGrass

- Altitude:0-2000mabovesealevel.
- Establishment:Stemcuttingsorsplits. Spacing:1mx50cm.

Management:

- Applyphosphaticfertilizersduringplantingtime.
- Top-dresswithnitrogenousfertilizersinsplitapplication.
- Cleanweedingwhenyoung.
- Cutwhen6-8weeksor1m-1.5minheight.
- Utilization:Cutstemisfedtolivestock. Conservation:Ensiledwheninplenty.

TypesofNapierGrass:

- Banagrass(broad-leavedwithhairyleaves) Clone(thin-stemmedandhairless)
- FrenchCameroon(thin-stemmedandnothairy).
- Pakistanhybrid(thin-leavedwithhairyleaves).

- Used for silage making.

Lucerne

- Altitude: 1500-2500m above sea level.
- Soil: Deep red soil are ideal.
- Establishment: Inoculated seeds are planted 30-50cm apart in the rows.
- Management: Weeding and fertilizer application.
- Utilization: Cut wilted and fed to livestock before flowering stage.
- Conservation: Hay, silage, dried materials such as cubes or pencils.

Mangolds

- Is a root crop.
- Root is utilized as livestock feed.
- Ripe ones are used.

Kales

- Leaves used as livestock feeds.

Guatemala Grass

- Leaves and stems used as livestock feed.

Sorghum Grass

Two varieties:

- Columbus grass
- Sudan grass.

- Established from seeds which are drilled or broadcasted.
- Columbus grass should be dried before feeding to animals to avoid hydrocyanic and prussic acid poisoning.

Desmodium (Desmodium spp)

Two varieties;

- Greenleaf
- Silverleaf.

- Established from seeds on thoroughly prepared clean beds.
- Can also be inter-planted with Napier grass.
- Cut and wilted before feeding to livestock.

Agroforestry, trees used as fodder crops include:

- Leucaenia
- Calliandra
- Atriplex
- Sesbania.

Forage Conservation

Forage can be conserved as;

- Hay,
- Silage
- Standing forage.

Importance of forage conservation:

- To reserve excess forage for use during time of shortage.
- To avoid unnecessary wastage of forage.
- Conserved forage can be sold.
- To have sustained supply of feed for livestock throughout the year.

Methods

HayMaking

- Thisisthedehydrationofgreenpasturestoamoisturecontentof16-20percent.

Stepsinhaymaking:

- Cutthecropwhenthesunisshining.
- Drythematerialsfor1-2days.
- Windrowthedrymaterialtoallowforfurtherdrying.
- Balethedrymaterialsforstorage. Storeundershedorshelter.

FactorsDeterminingQualityofHay

- Stageofgrowthatwhichforageisharvested.
- Leafcontentoftheforagematerial.
- Methodofhandlingandcuringthehay.
- Forminwhichmaterialisfedtolivestock.
- Speciesofforageused.
- Amountofforeignmaterialsinforage.

SilageMaking

- Thisisafeedproducedbyconservingforageinsucculentformthroughtheprocess offermentationbyanaerobicbacteria.

Stepsinsilagemaking:

- Cutthecropandtransportittothesilo,
- Materialwithahighmoisturecontentiswiltedinthesunfor4-48hoursbefore ensiling.
- Materialischoppedtoreasonablesizepiecesbeforefillinginthesilo.
- Spreadthechoppedmaterialevenly.
- Checktemperatureifbelow31°C,needsfurtherfilling;ifabove31°Ccompactionis necessary.
- Fillingshouldbecompletebytheendofthethirdorfourthday.
- Thesiloiscoveredwith15cmofstraw,sawdustthen15cmofsoiltomakeitairand watertight.
- Atrenchisdugroundthesilotokeepoffsurfacewater.

FactorsAffectingtheQualityofSilage

- Maturitystageofthecropwhencut.
- Typeofcrop.
- Moisturecontentofthematerial Additivessuchasmolasses.
- Degreeofcompaction.
- Sizeofpiecesensiled.
- Amountofforeignmaterialsincludedinthesilage.
- Amountofleafoftheensiledmaterial.

StandingForage

- Thisisforageleftinthefieldtobeusedduringthedryseason.

LivestockHealthIII:(Diseases)

Introduction

L
ivestockdiseasesareclassifiedaccordingtocausativeagentsasfollows:

- Protozoandiseases-causedbyprotozoans.
- Bacterialdiseases-causedbybacteria:
- VIraldiseases-causebyvirus.
- Nutritionaldiseases-broughtaboutbynutritionaldisorders.

ProtozoanDiseases

- EastcoastFever(ECF).
- Anaplasmosis(gallsickness)
- Coccidiosis
- Trypanosomiasis(Nagana)

EastcoastFever

- Animalsattacked:Cattle
- Cause:Protozoan.(Theileriaparva)
- Itisatick-bornediseasetransmittedbyred-¬leggedtickandbrowneartick.

Symptoms

- Riseinbodytemperature.
- Swellingoflymphglandsbelowtheear.
- Difficultiesinbreathing. Dullness.

ControlandPrevention

- Controlofvectorsthroughdippingandfencing.
- Treatmentbyuseofclexonintheearlystages. Anaplasmosis(gallsickness)

Animalsattacked:

- Cattlebetween2monthsand2years.
- Poultry.
- Lambsandkids. Rabbits.

Cause:Protozoan(Anaplasmamarginale)

- Transmittedbythebluetick
- contaminatedsurgicalinstrumentsandhypodermicneedles.

Symptoms

- Fever/riseinbodytemperature.
- Constipationorharddung.
- Palenessinthegums,eyesandlips.
- Dropinmilkproduction. Control
- Tickcontrol.
- Intramuscularinjectionofantibioticsandirongivinginjections.
- Coccidiosis

CoccidiosisofPoultry

- Cause:Protozoan(Eimeriaspp.) Symptoms

- Suddendeathofchicks.
- Whitish,yellowandbloodstaineddiarrhoea.
- Ruffledfeathers.
- Chicksbecomeparalysedbeforedying.
- Chicksbecomeanaemicanddull. Control
- Disinfectionofchickhouse.
- Preventionofcontaminationoffoodandwaterwithdroppings.
- Useofprophylaticdrugsforexample,Coccidiostats.

Trypanosomiasis(Nagana)

- Animalsattacked:cattle,sheepandgoats.
- Cause:Protozoanofthetrypanosomespecies,
- Vector-tsetseflies.

Symptoms
- Fever.
- Dullness.
- Anorexia/lossofappetite.
- Lossofbodycondition/emaciation.
- Swollenlymphnodes.
- Lachrimationwhichleadstoblindness.
- Diarrhoea
- Roughcoatandsometimeswithouthairandmaybecracked.
- Swellinginpartsofthebelly.
- DrLosopisofhairattailendnmilkproduction/'.inlactatingcows.
- Anaemia.
- Abortionmayoccurinpregnantfemales. Control
- Treatinganimalswithtrypanocidaldrugs.
- Effectivevector(Tsetseflies)control
- Confinementofwildanimalsingameparks.

BacterialDiseases

- Fowltyphoid
- Footrot.
- Contagiousabortion.
- Scours.
- Blackquarter.
- Mastitis.
- Anthrax.
- Pneumonia.

FowlTyphoid

- Animalsattacked:Alldomesticbirdswhichincludechicken,turkeyandducks.
- Causes:Bacteria(Salmonellagallinarum}

Symptoms
- Depression/appearingverysick.
- Respiratorydistress.
- Dullness.
- Droopingwings.

- Sleepyeyes.
- Anaemiaresultinginpaleandshrunken combsandwattles.
- Greenishyellowdiarrhoea. Control
- Killingallaffectedbirdsandproperdisposalofthecarcasses.
- Maintaininghygieneinthepoultryhouse.
- Ensuringthatthehouseisdryandwellventilated.
- Obtainingchicksfromreliablesources.
- Treatmentusingsulphurdrugswhicharemixedindrinkingwaterormash.
- Forexample:applicationofFurazolidone(Furazol)attherateof0.04%inmashfor10 continuousdaystreatsthediseaseeffectively.

FootRot

- Itisalsoreferredtoasfoul-in-thefoot.
- Animalsattacked:cattle,sheepandgoats.
- However,itismostseriousinsheep.
- Cause:Bacteria(FusiformisnecrophorusandFusiformisnodosus).

Symptoms

- Animal'sfootbecomesswollen.
- Lamenessisobserved.
- Pusandrottensmellcomeoutofthehoof.
- Sheeparefoundkneelingwhilegrazingwhenthefrontfeetareaffected.
- Animalsspendmostoftheirtimelyingdownwhenthehindfeetareaffected.
- Emaciationduetolackoffeeding.

Control

- Hygieneinthelivingplaces.
- Regularfootexaminationandhooftrimming.
- Useofafootbathofcoppersulphatesolutionat5-10%solutionorformalinat2-5% solution.
- Treatingwoundsonthefeetwithantiseptics.
- Affectedanimalsshouldbegivenantibioticinjections.
- Isolationofsickanimalsfromhealthyones.
- Avoiddampnessandmuddyconditions.

ContagiousAbortion(Brucellosis/Bang'sDisease)

- Animalsattacked:cattle,sheep,goatsandpigs. o Italsoaffectsman.
- Cause:Bacteria oBrucellaabortusincattle, oBrucellasuisinpigs oBrucellamalitensisingoatsandsheep.

Symptoms

- Spontaneousabortionorprematurebirth.
- Retainedplacentaifabortionoccursduringthelaterstagesofpregnancy.
- Infertilityincowswhilebullshavelowlibidoandinflamedtestisalsoknownasorchitis.
- Ayellowishbrown,slimy,odourlessdischargefromthevulvamayoccurafterthe abortion. Control
- Useofartificialinsemination.

- Slaughteringaffectedanimalsfollowedbyproperdisposaloftheircarcasses.
- Theattendanttotheanimalsshouldavoidcontactwiththeabortedfoetus.
- Abloodtestshouldbecarriedoutforallbreedinganimalstodetecttheinfectedones.
- Hygieneintheanimals'houses. Scours(whiteScours)
- Animalsatacked:calves,piglets,lambsandkids.
- Cause:Abacteriumwhichattacksyounganimalsinthefirstweekoflife. Symptoms
- Whiteoryellowishdiarrhoea.
- Pungentsmellingfaeces.
- Fever.
- Anorexia/lossofappetite.
- Listlessness. Sunkeneyes.
- Undigestedmilkandmucuswithbloodspotsobservedinthefaeces.
- Faecalmatterstickstothehindquarters. Suddendeathifnotreatmentisgiven.

Control

- Maintainighygieneintheyounganimalhousingunits.
- Avoidingdampnessonthefloorofthehouse.
- Fingersoftheattendanttrainingcalvestodrinkmilkfromabucketmustbe disinfected.
- Calvingshouldbecarriedoutinacleanarea.
- Haveseparateattendantsfortheinfectedcalvestopreventdiseasespread.
- Replacingmilkwithwarmwatermixture.
- Treatingaffectedanimalswithantibiotics.

BlackQuarter

- Itisalsoknownasblackleg.
- Animalsattacked:Allruminantsagedbetween8-18months.
- Cause:Bacteria(ClostridiumchauveiandChauveisepticum)

Symptoms

- Lameness.
- Fever.
- Fastandheavybreathing.
- Crackingontheswollenpartsiftouched.
- Swellingoftheaffectedpartsusuallythehindquarters,shouldersandchestorback.
- Dullness.
- Anorexia.
- Gruntingandgrindingofteeth.
- Animalstopschewingcud. Control
- Treating withrecommendedantibiotics.
- Vaccinatingusingblackquartervaccineknownasblanthax.
- Buryingthecarcassdeeporburningitcompletely. Mastitis
- Isaninflammationoftheudder.
- Animalsattacked:Goats,cows,pigsandhumanbeings.
- Cause:Bacteria(Streptococcusspp.orStaphylococcusspp.) Pre-disposingFactors:
- Incompletemilking.

- Injuriesontheudderandteats.
- Weaksphinctermusclesoftheteatsallowingfreeflowofmilk.

Symptoms

- Milkiswatery,bloodstainedorclotted.
- Swollenudder Control

- Propermilkingtechniques.

- Treatmentbyuseofantibiotics.
- Cullingofanimalswhichareoftenattacked.

Anthrax

- Attacksalldomesticanimals.
- Cause:Bacteria(Bacillusanthracis)

Symptoms - Suddendeath.

- Highfever.
- Grindingoftheteeth.

Pneumonia

- Itisaninflammationofthelungs.
- Animalsattacked:Calves,kids,lambs,pigletsandpoultry.

Cause:

- Bacteria(Mycoplasmamycoides)
- dust
- wormsinthelungs.

Symptoms

- Dullness.
- Anorexia/lossofappetite.
- Staringcoat.
- Emaciation.
- Breathingrapidly.
- Abnormallungsoundswhenbreathing.
- Coughingifthechestispressed.
- Fluctuatingbodytemperature. - Nasaldischarge.

Control

- Keepingyounganimalsinwarmpens.
- Propersanitation.
- Isolationoftheaffectedanimals.
- Treatingusingantibiotics.

ViralDiseases

- Rinderpest.
- Footandmouthdisease(FMD).
- NewCastle
- Fowlpox
- Gumboro

- Africanswinefever Rinderpest
- Animalattacked:Cattleandwildgame.

Cause:virus. Symptoms

- Harshstaringcoat.
- Riseintemperature. Eyedischarge(Lachrimation)
- Diarrhoeaanddysentery. Ulcersinthemouth.

FootandMouthDisease

- Animalsattacked:Cattle,sheep,goatsandpigs.

Cause:Virus. Symptoms

- Sharpriseintemperature.
- Blistersinthemouth,hooves,udderandteats.

Lossofappetite. Control

- Vaccination.
- Quarantine
- nursingwoundswithdisinfectant.

NewCastle

- Animalsattacked:Poultry.

Cause:Virus. Symptoms

- Difficultiesinbreathing.
- Beaksremainwideopenandnecksarestrained.
- Birdsbecomedull.
- Thebirdsstandwitheyesclosedallthetime.
- Anorexia/lossofappetite.
- Nasaldischargeswhichforcethebirdstoshaketheirheadstoclearit.
- Birdswalkwithastaggeringmotion.
- Paralysisofwingsandlegsmayoccur.
- Birdshavetheirbeaksandwingsdown.
- Birdsproducewaterygreenishdiarrhoea.

Birdslaysoftshelledeggs. Control

- Killingallbirdsandburningthemfollowedbycleaninganddisinfectingthehouses beforebringinginnewstock.
- Vaccinationshouldbedoneduringthefirst6weeksandthen2-3monthslater.

Quarantine. FowlPox

- Animalsaffected:Poultry.
- Cause:Avirusknownasavianfox.

Symptoms

Twotypesoffowlpoxwithdifferentsymptoms.

- Cutaneoustype
- Diptheritictype

Thecutaneoustypeaffectstheskinandhasthefollowingsigns:

- Injuriesonthecombsandwattles,legs,ventandunderthewings.
- Lossappetite.

Thediptheritictypeaffectsinternalmembranesandhasthefollowingsymptoms:
- Injuriesintheinsideofthethroatandmouthmembranesresultingindifficult breathingandswallowing.
- Eyesandnoseproducesawateryliquid.
- Lossofappetite.
- Dullness.
- Emaciation. Control
- Killingallaffectedbirdsfollowedbyproperdisposaloftheircarcasses.
- Vaccinatingremaininghealthybirds.

Gumboro

- Itisalsoreferredtoaspoultry AIDS.
- Animalsattacked:Poultry.
- Cause:AvirusknownasBirmavirus. Symptoms
- Theglandsabovethevent(bursa)becomeswollen.
- Dropineggproduction.
- Birdsdevelop respiratorydistress.
- Lossofappetite.
- Lowwaterintakebybirds.
- Lossofimmunitymakingthebirdsmoresusceptibletoopportunisticdiseases.

Control
- Vaccination.
- AdministeringvitaminsandespeciallyB12.

AfricanSwineFever

- Animalsattacked:Alldomesticatedpigs.
- Cause:AvirusknownasIridovirus.

Symptoms

- Fever.
- Lossofappetite.
- Depression/dullness.
- Emaciation.
- Coughing.
- Nasaldischarge.
- Diarrhoeainseriousconditions.

Control
- Vaccination.
- Quarantine.
- Killingallaffectedanimalsandproperdisposaloftheircarcasses.
- Doublefencingtokeepwildanimalsaway.

NutritionalDiseases/Disorders

MilkFever

- Itisanon-infectiousdiseasebroughtaboutbycalciumdeficiencyinanimalswhich haverecentlygivenbirth.
- Animalsattacked:Cows,goatsandpigsthathaverecentlygivenbirth.

Causes:
- Duetolowcalciumlevelsintheblood.
- Whichleadstoanincreaseinthemagnesiumandsugarlevelintheblood.

- Mostlyoccursinhighproducingcowsinthefirstfewmonthsoflactation.
- Thisisbecausetheseanimalsloosemorecalciumthroughmilksecretionthanthey aregettingfromthediet.

Symptoms
- Dullness.
- Musculartwitchingcausingtheanimaltotremble.
- Staggeringastheanimalsmove.
- Animalfallsdownandsbecomesunconscious.
- Theanimalliesdownonitssideandthewholebodystiffens.
- Bodyfunctionssuchasurination,defecationandmilksecretionstops.
- Stomachcontentsaredrawnintothemouthwhichlatercauselungfeverwhen breathingin.
- Lossofappetite.

Treatment
- Intravenousinjectionofsolublecalciumsaltinformofcalciumboro- gluconate ,60gmsdissolvedin500ccofwater.
- Keepingtheanimalinacomfortablepositiononitssternum.
- Givingfreshwater.

Note:Theanimalssufferingfrommilkfevershouldnotbegivenmedicineorallyforthe followingreasons:
- Itwillnotbeabletoswallowmedicine.
- Themedicinemaygetintothelungstherebypromotinglungfever.

Control
- Partialmilkingforthefirst10days.
- Highyieldingcowsshouldbegivenrationscontainingphosphorusandcalcium.
- GivinghighdosesofVitaminD.

Bloat
- Animalsattacked:Cattleandsheep.
- Cause:Accumulationofgasesasaresultoffermentationintherumen.

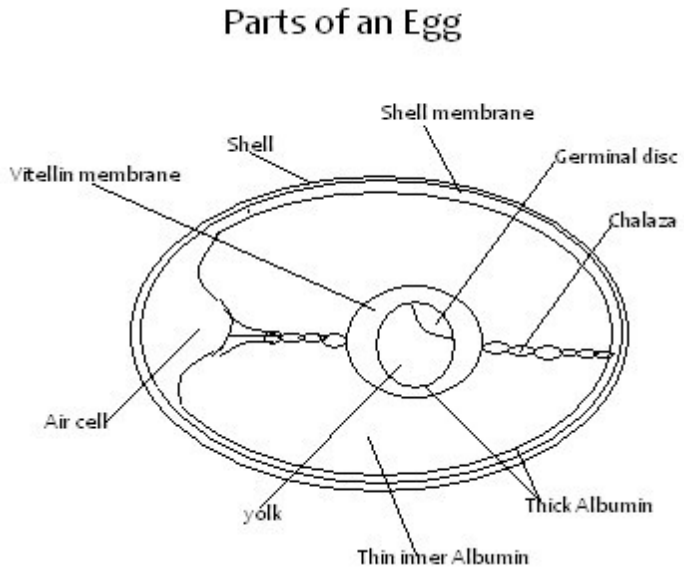
Symptoms
- Theleftsideisblownup.
- Suddendeath.

Control
- Relievebyuseoftrocarandcannula.
- Chasingtheanimalaroundifnoticedearly.
- Drenchingbyuseofstopbloat.
- Feedingruminantswithdryroughagesduringthewetseasonbeforegrazingonlush pastures.

LivestockProductionV(Poultry)

Introduction
- PoultryindustryinKenyahasdevelopedtremendouslyduetotheuseofartificial i ncubationandbroodingandeasyavailabilityofhybridbirds,botheggersandbroilers .

- Poultryproductionhasbecomeaneasysourceofincomeandfoodfortheruralas wellastheurbancommunities.
- Thetermpoultryincludesdomesticbirdssuchasturkeys,ducks,geese,pheasants, dovesandpigeons.
- Oflateostrichfarminghasbecomealucrativeactivity.
- Poultryproductionstartswithincubationofeggs.



PartsofanEgg

- Shell
  - Forms10-12%ofthewholeeggcontent.
  - Madeofcalciumandphosphorus. Protectstheinnereggcontents.
- Shellmembrane
  - Madeofinnerandoutermembranes.
  - Liningoftheeggshell.
  - Constitutes1%ofthetotaleggcontent.
- Albumen(eggwhite)
  - About55-60%ofthetotaleggcontent.
  - Itisdividedintochalaza,thickandthinalbumen.
  - Chalazaholdstheeggyolkinposition. Albumenservesasfoodforthechick.
- Yolk
  - 30-33%ofthetotaleggcontent.
  - Supplyembryowithnutrients.
- Germinaldisc-Theembryowhichdevelopsintoachickiffertilized.
- Vitellinemembrane-Givestheyolkitsroundshape.
- Airsac
  - Keepstheeggfreshbyallowinggaseousexchange.
  - Providesoxygenfortheembryo

EggCandling:

- Thisisthepracticeofdeterminingtheinternalqualitiesofaneggbyexaminingit againstalightsource.

Procedure

- Theeggisplacedonaholemadeona cardboardbox.

- Thisiscalledacandlingbox.
- Asourceoflightisplacedintheboxdirectlyundertheegg.
- Theobserverthenlooksthroughtheeggagainstthesourceoflightbelow.
- Abnormalitiesonandwithintheeggcanbeseenthroughthetranslucentshell.

Incubation

- Involvestheprovisionoffertileeggswiththeproperconditionforembryonic development.

SelectionofEggsforIncubation

- Shouldbefertile.
- Shouldbeofmediumsizeabout55-60gmsinweight.
- Shouldhavesmoothshell.
- Shouldbeovalshaped.
- Shouldnotbecracked.
- Eggsshouldbecleantoensurethatporesareopen.
- Shouldnothaveabnormalitiessuchasbloodspots,meatspotsanddoubleyolk..
- Eggsshouldnotbemorethan5daysold.
- Eggsshouldbefreshthatiscollectedwithinoneweek.

Internaleg
ggqualitiescanbedeterminedthroughtheeggcandlingprocess.

MethodsofIncubation

NaturalIncubation

- Thisinvolvestheuseofabroodyhenwhichsitsontheeggstoprovidethemwith conditionsnecessaryforhatching.
- Takes20-21days.
- Thehenisgivenabout10-15eggs. Signs ofBroodinessinPoultry
- Tendencytositonaneggafterlaying.
- Moultingofthehen.
- Makingsomenoiseatthelayingnests. Feathersareraised.
- Itbecomesaggressivewhendisturbed. Itstopslaying.

PreparationandManagementofNaturalIncubation

- Thehenisgiven"Chinaeggs"tositontoinducebroodiness.
- Whenbroodythehenshouldbeprovidedwithanestingnestorasaucer¬shapednest scoopedontheground.
- Thenestshallbelinedwithsoftbeddingandfertileeggsprovided.
- Theeggsaresetintheeveningornight.
- Thebirdisdustedtocontrolexternalparasites.
- Thehenisallowedthouroutsidetofeedandexerciseeveryday.
- Brokeneggsshouldberemovedimmediately. Thehenshouldnotbedisturbed.

AdvantagesofNaturalIncubation

- Itischeap.
- Highhatchability.

- Lowriskinvolved.
- Usefulinsmallscaleproduction.
- Lessskillisrequired. Lesslaborious.

DisadvantagesofNaturalIncubation

- Eggproductionislowbecausethehenwillnotlayeggsduringincubation.
- Itisnotpossibletoplanwhentoincubate.
- Ifthehendiestheeggswillbedestroyed.
- Ifthehendesertstheeggsorrefusestositonthemthefarmerwillincurlosses.
- Onlyfewchickscanbehatchedatatimebyonehen.
- Diseasesandparasitescouldeasilybetransmittedtothechicks.

ArtificialIncubation

- Thisistheuseofartificialdeviceknownasanincubatorforhatchingeggs.

ConditionsNecessaryforArtificialHatchingofEggs

- Temperature-maintainat37.5°C-39.4°Cthroughouttocontroltherateofembryonic developmentofthechick.Highorlowtemperaturesarelethal.
- Ventilation-Goodaircirculation.
- Carbondioxide:oxygenratiomaintainedat0.03%:21%. Relativehumidity-Maintainedat60%.
  - Highhumidityleadstomarshychicks
  - lowhumiditythechickmaysticktotheshell.
- TurningofEggs–
  - Done3-4timesadaytofacilitateuniformdistributionofheatforuniform developmentofchick.
  - Turnslowly180°clockwisealongtheaxistoavoidbreakingthebloodvessels.
  - Someincubatorshaveautomaticturningmechanism.
- Cleanliness-cleaninganddisinfectingtheincubatorwithformaldehydesolution.

AdvantagesofArtificialIncubation

- Itfacilitateslargescaleproductionofchicks.
- Incubatorsarealwaysreadywhenneeded.
- Artificialincubationleadstohighereggproductionbecausebroodinessinthehensis notrequired,sothereismoretimeforlayingeggs.

DisadvantagesofArtificialIncubation

- Highinitialcapitalinbuyinganincubator.
- Highlevelofmanagementandattentionisrequired.
- Itisnoteconomicalforonlyasmallnumberofeggs.
- Highrisksinvolvedinturningtheeggs.

BroodingandRearingofChicks

- Broodingistherearingofdayoldchicksupto8weeksoldforthelayerchicksand2 weeksforthebroilerchicks.
- Forsuccessfulbroodingthesourceofthechicksshouldbeconsidered.

SourcesofChicks

Thefollowingfactorsshouldbeconsidered:

- Thereputationofthesupplier(hatchery).
- Timetakenbythechicksintransit. - Propersexingandbreedidentification.

Brooding

NaturalBrooding

- Ahenisallowedtotakecareofthechicks.
- Sheprovidesthemwithwarmthandsecurity.
- Shestayswiththechicksfor8weeksandthenrejectsthem.

Advantages - Itischeap.

- Lesslabourisneeded.
- Suitableforsmallscale.

DisadvantagesofNaturalBrooding

- Notpossibletoproducelargenumbersofchicks.
- Thehengoesofflayingduringbroodingtime.
- Onlypossiblewhenabroodyhenisavailable.

ArtificialBrooding

- Thechicksareraisedartificiallyinastructureknownasabrooderuntiltheyare8 weeksold.

BrooderRequirements

- Temperature-shouldbeabout35°Cinthe15thweekandreducedto21°Cbythe8th week.
- Litter-woodshavingswhicharecapableofabsorbing60%moisturewithoutshowing wetnessshouldbeused.
- Spaceconfinement-Donebyuseofhardboardswhichareabout25cmhighandform acircularspace.Aspaceof1m^{2}for25chicksisrequired.
- Feedersandwaterers-shouldbeenoughforthechicksandevenlydistributedinthe brooder.
- Ventilators-windowsshouldbeenoughtoallowproperaircirculationbutdirect draughtshouldbeavoided.

TypesofHeatersintheBrooder

- Electricheaters-oneordinarybulb100wattscanraise30chicks.
- Oneinfra¬redbulb240wattscanraise100chicks.
- Keroseneburners-Hurricanelampscanraise100chicks.
- Charcoalburners-thesearespeciallymadejikoswithheatdeflectors.

BrooderManagement

PreparationBeforeChicksArrive

- Start2-3daysbeforearrival.
- Thebrooderhouseshouldbecleanedtoremoveoldlitterandthendisinfected.
- Newlitters5-1Ocmhighshouldbeputinandcoveredwithabsorbentmaterials/news papers.
- Equipmentshouldbecleaned,disinfectedandtestedtomakesurethattheyare working.
- Thebrooderislitabout6hoursbeforethechicksarrive.
- Feedandwatershouldbeplacedintoshallowcontainers.
- Brooderspaceshouldbeconfinedwithahardboardtopreventchicksstrayingfar fromthesourceofheat.

ManagementAfterArrivaloftheChicks

- Chicksareplacedinthebrooderduringthedaytofamiliarizewiththebrooder.
- Ifchicksarrivestressedandweaktheyshouldbegivenglucosesolutioninthe waterers.
- Incasetheheatsourceischarcoalburnerstheyshouldbecoveredwithwiremesh.
- Feedchickswithchickmashwhichislatermixedwithgrowersmashasthechicks grow.
- Cleanwatershouldbeprovidedandchangedregularly.

- Constantattentionshouldbegiventothechicksforthefirst2weeks.
- Anyvicesshouldbecheckedandcontrolled.
- Anydeadchicksshouldberemovedassoonasseen.
- Ventilationshouldbeusedtocontrolthetemperatureandhumidityinthebrooder.
- Constantdisinfectionisrequiredattheentrancetoavoiddiseases.
- Brooderspaceshouldbeincreasedasthechicksgrow.
- Debeakingshouldbedoneat10daysold.
- Vaccinationagainstdiseasessuchas Gumboroafter 2weeks, NewCastleat 3-4 weeksandfowltyphoidat 7weeks.
- Dustingtocontrolexternalparasites.
- Growers'mashshouldbeintroducedgraduallyat 7weeksold.
- Chicksareremovedfromthebrooderwhentheyare 8weeksold.
- Onaveragethechickusesabout 1.5kg-2.2kgofchickmashbythetimeitis 8weeks old.

TemperatureControlintheBrooder

Ifthebroodertemperaturesarelowthefollowingshouldbedone:

- Brooderspaceisreduced.
- Heatersareincreased. Ventilatorsareclosed.

Ifthebroodertemperaturesaretoohighthefollowingshouldbedone:

- Brooderspaceisincreased.
- Heatersshouldbereduced.
- Ventilatorsshouldbeopened.

ManagementoftheGrowers

- Thegrowersarebirdsattheageof 9weekstothepointoflaythatisat 18weeks.
- Growersshouldbefedongrowers'mash.
- Bythistimethegrowersshouldbeoccupyingthemainpoultryhouse.
- Sickbirdsshouldbeisolatedandtreated.
- Afootbathforconstantdisinfectionshouldbeplacedattheentrance.
- Eachbirdisfed 115gmsperdayofgrowers'mash.
- Greensandsolublegritshouldalsobeprovided.
- Cleanwatershouldbeprovidedallthetime(adilibitum).
- Drenchingagainstinternalparasitesshouldbedonebyaddingadewormerintothe water.
- Verminsshouldbecontrolled.
- Littershouldbekeptdrybyturning.
- Vaccinationshouldbedoneasrequired.
- Layerpulletsrequiredimlylithouse.

ManagementoftheLayers

- Layers'mashshouldbeintroducedat 18weeksandincreasedgradually.

- Thebirdsstartlayingat18-21weeks.
- ThebirdsshouldbevaccinatedagainstNewCastleandfowltyphoid.
- Enoughfloorspaceroosts,feedersandwaterersshouldbeprovided.
- Eachhenshouldbegiven120gmsperdayoflayers'mash.
- Cleanwatershouldbeprovidedadlibitum.
- Eggsshouldbecollectedtwiceadayatnoonandintheevening.
- Greenleavesshouldbeprovidedtokeepthebirdsbusythuspreventingcannibalism andimprovetheyellowcolouroftheyolk.
- Grainsshouldbegiveninadditiontothelayers'mashattherateof65gmsperbirdper day.
- Solublegritoroystershellsshouldbeprovidedatalltimesforefficientdigestionand strongshelledeggs.
- Layersshouldbefedaccordingtotheirbodyweightandtherateofeggproductionfor examplea70kgbagshouldfeed100layersfor4-5days.
- Enoughlayingnestsshouldbeprovidedatleast1per5layers.
- Thelayingboxesshouldbedimlylittoreduceeggeating.
- Debeakingshouldbedonewhennecessary.
- Brokeneggsanddeadbirdsshouldbedisposedoffproperly.
- Thenon-layersandcannibalsshouldbeculled.

ManagementofBroilers

- Broilersaretablebirdskeptformeatproduction.
- Theyhavehighgrowthratesorhighfeedconversionratio.
- Theobjectiveistoproduceakilogramofqualitypoultrymeatfromlessthantwokgof broilerfeed.
- Thebroilerchickrequiresspecialbroilerfeedfromdayoldto4weeksofage.
- Broilerstarters'mashorcrumbsshouldbefed.
- Thiscontainscoccidiostat,highlevelofprotein,vitaminsandtraceelementsforearly growth.
- From4weeksto8weekstheyaregivenbroilerfollow-onmashorpellets.
- Thisfeedcontainshighlevelofmetabolisableenergytoensureagoodcoverof subcutaneousfatinthefinishedbroiler.
- From8weeksuntilslaughterfinisherpelletsshouldbegiventoincreasethesize.
- Adequatecleanwatershouldbeprovidedatalltimes(adlibitum).
- Highlevelofhygieneshouldbemaintainedtoreducemortalityrate.
- Birdsshouldbedustedwithappropriatepesticidestocontrolexternalparasites.
- Dewormingshouldbedoneroutinely.
- Vaccinationagainstcommondiseasesshouldbedone.
- Deadbirdsshouldbedisposedoffproperly.
- Broilersshouldbekeptunderdeeplittersystem,thehouseshouldbewellventilated andwelllit.

PoultryRearingSystems

- extensive, semiintensive
- intensivesystems.

TheExtensiveSystems

FreeRange

- Birdsaresetfreethroughoutthedaytofendforthemselves.
- Birdsareconfinedinnightsheltersforthenight. Thereisnosupplementation.

Advantages

- Birdseatinsectsandgreenleavesthereforelessfeedisrequired.
- Cheapmethod.
- Cannibalismandeggeatingarereducedsincethebirdsarenotcrowded.
- Manureisevenlyspreadintheruns.
- Lowlabourrequirement.
- Birdsgetplentyofexercisesthushelpingtokeepingoodhealth.
- Noneedtoprovidegritasbirdspickitfromthesoil. Disadvantages
- Morelandisrequiredifafarmerwantstorearmanybirds.
- Birdscanbestolenoreatenbypredators.
- Eggsgetlostinthevegetationorstolen.
- Eggsgetdirty.
- Difficulttodeterminelayersfromnon-¬layers.
- Birdsgeteasilyinfectedwithdiseasesandparasitesofthearea.
- Breedingprogrammeisnoteasytofollow.
- Birdscandestroycropswhereperimeterfencingisnotconstructed.
- Lowproductivityperunitarea.

Semi-Intensive

FoldSystem

- Birdsareconfinedinsmallportablestructurescalledfolds.
- Afoldmeasures3.5mlong,1.5mwideand1.5mheight.
- 1/3ofthefoldisroofedwhiletherestisenclosedwithwiremesh.
- Birdsgetplentyofsunlight.
- Birdsgetfreshgrassasthefoldismovedtonewgrounds. Advantages
- Manureisevenlyspreadinthefield.
- Lessfeedisusedbecausebirdseatgrass.
- Reducesbuildupofparasitesanddiseasessincethefoldismovedoften.
- Birdsareprotectedfrompredators. Disadvantages
- Fewbirdsarekeptperfold.
- Itislaborioussincethefoldsaremovedfromoneplacetotheother.
- Individualeggproductionrecordisdifficulttokeep.
  - Thefolddoesnotlastlongbecauseof
- highfrequencyofhandling.
- Thereturnperunitareaoflandislow.

IntensiveSystem

DeepLitterSystem

- Birdsareconfinedinahousethroughouttheirlife.
- Thefloorofthehouseismadeupoflitterwhichaccumulatesovertime.

- Enoughfeeders,waterersandlayingboxesareprovideddependingonthenumberof birdsandspaceavailable.

Movableroostsandperchesmadeoftimberframesshouldbeprovidedinthehouse.
Stressandvicesshouldbewatchedcloselyandcontrolled.
Eggsshouldbecollectedasfrequentlyaspossibletopreventdirtandeggeating.
Thehouseshouldbedimlylit.
Thefloorspacerequirementshouldbe1m^{2}per2-3birds. Advantages

Highstockingrateperunitareaofland.
Lowlabourrequirement.
Fastaccumulationofmanure.
Thereiscontroloffeeding,eggproductionandmovementofbirds.
Safetyofthebirdsisguaranteedfrompredators.
Nolossofeggs.
Usefulmethodwhenrearingbreedingstock.
Regularcleaningofthehouseisnotnecessarysincethelitterabsorbsthedroppings.
Easycollectionofeggs.

Disadvantages

Highincidenceofcannibalismlikeeggeating,featherpluckingandtoepecking.
Pestsanddiseasecausingorganismsaccumulateinthelitter.
Individualrecordsofthebirdsarenotpossible. Maybedifficulttofindlitter.
Eggsbecomedirtyiflaidonthefloor.
Feedersandwaterersmaybecontaminatedbythelitter.
Thesystemencouragesbroodinessinhens.
Highinfestationofdiseasesifthemanagementisbelowstandard.
Ifthereisadiseaseoutbreak,itcanspreadveryquicklythroughoutthehousedueto thecommunalhousing.
Highcostofbuildingdeeplitterhouse. BatteryCageSystem
Birdsareconfinedincageswhicharepl acedinthepoultryhouse.
Thecagesaremadeofwiremesh Eachcagecontains1-3birds.
Waterandfeedtroughstogetherwitheggstraysarefittedalongthefrontsideofthe cages.
Thefloorofthecagesshouldbeslantingtoallowtheeggstorolloutofthecages.
Droppingsfromthecagesfallfrombehindforeasycleaning.

Advantages

Recordsareeasilykeptthereforecullingiseasy.
Birdsdonotbecomebroody.
Moreeggsarecollecteddduetorestrictedmovementofthehensandcompletecontrol ofeggeating.
Tendermeatisobtainedfromthecullsbecausethemuscleshavenotbeen toughenedmuch.
Handlingiseasierthanintheothersystemsandindividualattentiontohensisgiven.
Stockingrateisveryhigh.
Vicesaregreatlyreduced.
Eggsarecleanbecausehensdonotsteponthem.
Thesystemcaneasilybemechanised.

- Birdsdonotcontaminatethefoodandwater.
- Sickbirdscanbedetectedeasilyandisolatedfortreatment.
- Wirefloorspreventre-infestationofparasiticwormsandcoccidiosis.
- Nobullyingduringfeeding. Lowlabourrequirement.

Disadvantages

- Initialcostsforcages,equipmentandhouseareexcessivelyhigh.
- Requireshighlevelofmanagement.
- Highermaintenancecostswhereautomationisused.
- Birdsmaygetfatigueduetolackofexercisesthusloweringproductivity.
- Incaseofdiseaseoutbreak,spreadingisveryfast.
- Birdsdevelopbruisesoncombs,breastsandtoesastheysticktheirnecksout-tofeed andwalkinthecages.
- Notusefulwhenrearingbreedingstockandtherearingofbroilers.
- Cannotbeusedforbroodingyoungchicks.

StressandVicesinChicken

- Stressisaconditionimposedonthebirdsmakingthemdisturbedanduncomfortable.
- Stressreducesproductionandbringsaboutpoorperformance.
- Vicesarehabitsdevelopedbyanimals.
- Theseaffectproductionandhealthofthebirds.
- Usuallytheyarebadhabits.

CauseofStressinPoultry

- Suddenchangesinroutinemanagement.
- Presenceofstrangersinthepoultryhouse.
- Presenceofanimalsandvermins.
- Toomuchnoise.
- Constantandpoorhandling.
- Suddenweatherchanges.
- Disturbanceofthepeckingorder.
- Overcrowding
- Poorhygiene.
- Diseaseandpestattack.
- Lackoffoodandwater.

ControlofStress

- Poultryhouseshouldbekeptquietandconstructedawayfromnoise.
- Poultryhouseshouldbeinsulatedtomaintainconstanttemperatures.
- Parasitesanddiseasesshouldbecontrolled.
- Changeinroutinemanagementshouldbegradual.
- Enoughfeedandwatershouldbeprovided.

Vices

- Featherpecking.
- Cannibalism(toeandventpecking).
- Eggeating.

PeckingandCannibalism

- Situationwherebirdspeckateachotherresultingindeathorinjury.

Effects:

- Featherandbodygrowthrate ISreduced.

- Lossofbirdsduetodeathmayresultfromcannibalism.
- Cullingrateisincreased(economicloss).
- Theappearanceofthecarcassisspoiledtherebyreducingitsmarketvalue.

CausesofCannibalism

- Overcrowdinginthehouse.
- Hightemperaturesinthepoultryhousemakingthebirdsuncomfortable.
- Toobrightlight.
- Externalparasiteinfestation.
- Inadequateandincorrectfeeding.
- Idlenessofthebirds.
- Greedinessofthebirds.
- Disturbancesofthepeckingorder.
- Prolapsesoftherectumwhichoccursonceinawhile.
- Brightlightinthelyingboxes.

PreventiveMeasures

- Amplespacingshouldbeprovidedonthefloor,feeders,waterersandlayingboxes.
- Overheatingshouldbeavoidedduringbrooding.
- Thehouseshouldbedimlylitforthelayers.
- Layingnestsshouldbedarkenedandabovetheground.
- Dustingshouldbedonetocontrolexternalparasites.
- Provideenoughbalancedration.
- Birdsshouldbekeptbusy.
- New/strangebirdsshouldnotbeallowedinthehouse.

EggEating

Aviceinfluencedbythefollowing:

- Presenceofbrokenorsoftshelledeggs.
- Idlenessofthebirds.
- Inadequatelayingnests.
- Mineraldeficiencies.
- Brightlightinthelayingnests.
- Greedinessofthebirds.

PreventiveMeasures

- Eggsshouldbecollectedregularly.
- Layingboxesraisedabovetheground.
- Layingboxesshouldbedarkened.
- Birdsshouldbegivenbalancedration.
- Debeakingshouldbedoneasneedbe.
- Birdsshouldbekeptbusywithgreens.
- Birdsshouldbekeptaccordingtoagegroups.
- Injuredbirdsshouldbeisolatedandtreated.

MarketingofPoultryProducts

- Poultryproductsincludeeggsandmeat.

MarketingofEggs

- Eggsaredelicateandperishablefoodsandhavethehighestvaluewhenfresh.

Thefactorsconsideredwhensortingoutandgradingeggsforthemarketinclude:

- Size/weightoftheegg-largeeggsfetchhighpricesthansmallones.Theaverage weightshouldbeabout57gms.
- Shapeoftheegg-Thenormaleggshapeisoval,withabroadendandanarrowend.
- Cleanliness-Consumersprefercleaneggs.

- Colouroftheshell-Browneggsarepopularwiththeconsumers.
- Candlingqualities-candlingisdonetodeterminefreshnessoftheeggsandpresence ofanyothereggabnormalities.
- Shelltexture-shouldbesmoothandwithoutcracks.

PoultryMeat

- Broilersareslaughteredattheageof1-2.5monthsoldwithalifeweightof1.5-2kgs.
- Thebirdsarekilledanddressedinacleanwaybeforebeingwrappedincleanbags readyforsale.
- Themeatissoldinhotelsandrestaurants.
- Wholebirdscanbesoldliveinlocalmarkets.

LivestockProductionVI(Cattle)

Introduction

- Cattleproductionisawidelydistributedenterprisein Kenya.
- Mostfarmingcommunitieschoosebetweentheexoticandthe'localbreedsortheir crossesdependingontheenvironmentalconditions.
- Whereasthebackboneofbeefindustryin Kenyaismadeupoftheindigenous animalsandtheircrosses,andbasedinthesomewhatdrierareas,the-dairyindustryis mainlybasedontheexoticbreedsandtheircrossesandcommoninthewetter regionsof Kenya.
- Whateverproductionundertaken,thereturnsdependmostlyonthemanagement levelsprovidedtotheseanimals.
- Aproductiveherdstartswithgoodmanagementoftheyoungstock.

RaisingofYoung·Stock.

- Theyoungoneofcattleisknownasacalf.

FeedingDairyCalves

- Newborncalvesshouldbegivencolostrumswithinthefirst3-5daysoftheirlife.
- Colostrumisimportantforthefollowingreasons:
  - Itishighlydigestible.
  - Itcontainsantibiotics.
  - Itishighlynutritious.
  - Itservesasalaxative.
  - Itishighlypalatable.
- Calvescanbefedusingnaturalmethod(directsuckling)orartificially/bucketfeeding.

NaturalMethod

- Inthismethod,calvessucklethemotherdirectly.

Advantages

- Thecalftakesmilkatbodytemperature.
- Themilkisfreefromcontaminants.
- Lessproblemsofscouring.

Disadvantages

- Underfeedingofthecalfmayresult.
- Cowsmaynotletdownmilkincasethecalfdies.
- Difficulttokeepaccurateproductionrecords.

Artificial/BucketFeeding

- Thecalfistrainedtofeedfromthebucketimmediatelyafterbirth.

Thecalfistrainedasfollows:

- Wellmeasuredmilkisputinacleanbucket.
- Indexfingerisinsertedintothemouthofthecalf.
- Theheadofthecalfisloweredslowlyintothebucketuntilthecalfstartstodrinkthe milk.
- Thefingeriswithdrawnslowlyasthecalfcontinuestodrinkfromthebucket.
- Theprocedureisrepeateduntilthecalfgetsusedtotheprocess.

Advantages

- Easytokeepaccurateproductionrecord/milkyieldsofthecow.
- Possibletoregulatetheamountofmilkgiventothecalf
- Thecowdoesnotneedthepresenceofthecalfinordertoletdownmilk
- Easytomaintainhighhygienestandards.

Disadvantages

- Laborious
- Calfmaybegivencoldmilk
- Equipmentusedandthestockmanmaybedirtyleadingtoscours

Preparationofartificialcolostrums Ingredientsused

- Afresheggwhippedin0.86litresofwarmwater
- Litreofwarmwater
- Oneteaspoonfulofcodliveroil
- Onetablespoonfulofcastoroil
- Note;colostrumsisfedtothecalvesthreetimesadayforthefirst4daysoflifeand thereaftertwiceaday.

Weaningofcalves Earlyweaning

- Calfisfedonwholemilkuptothetenthweekthenitisweaned
- Calfisgivenmilkequalto10%ofitsbodyweightuptothe8thweek
- After8thweek,milkisreducedgraduallyby1kguntilweaning
- Calfisgivenearlyweaningconcentratesandsoftforage

EarlyWeaningGuide

Agein weeks	Whole milk(kg/day)	Concentrates(kg/day)
1	Colostrumsad libitum	-
2-3	5	-
4-5	6	0.25kg/day
6-7	6	0.5kg/day

8-9	5	0.75kg/day
10-11	4	1.00kg/day
12-3	-	1.50kg/day
14-15	-	2.ookg/day
16	-	2.ookg/day

Lateweaning

- Calfisfedonwholemilkuptothe3rdweek,whenmilkisreplacedgraduallywithskim milk.
- Attheageof3weeksthecalfisintroducedtocalfpelletsorpencilsandgreenfodder.
- Thecalfisgivenplentyofcleanwater.
- Thecalfcontinuestobegivenadditionalskimmilkuptotheageof14weekswhen maximumamountofmilkisgiven.
- Skimmilkisreducedfrom14weeksto16weekswhenweaningisdone.

Lateweaningguide

Agein weeks	Wholemilk (kg/day)	Concentrates (kg/day)	Skim milk (kg/day)
1	Colostrumsad libitum	-	-
2	3.5	-	-
3	4	-	-
4	4.5	0.25kg/ day	1
5	4.0	0.5kg/day	3
6	3.0	0.75kg/ day	5
7	-	1.00kg/ day	7
8-14	-	2.00kg/ day	8
15	-	2.00kg/ day	4
16	-	2.00kg/ day	4

Rearingofreplacementstock

- Thereplacementstockincludesyoungheifersandbullswhichhavebeenselectedfor breedingtoreplacetheoldstock.

ManagementPractice

- Parasitecontrol-Sprayingagainstexternalparasitesanddewormingagainst internalparasites.

- Diseasecontrol-Calvesarevaccinatedroutinelyagainstdiseasessuchas;
  - Blackquater-at4monthsold. AnthraxandBlackquaterat6monthsold
  - Brucellosis-3-8monthsold(heifers).
- Castration-formalecalvesnotselectedforbreeding.
- Identification-Suitablemethodsareused.Itallowsproperrecordkeeping.
- RemovalofExtraTeats;
  - Theseteatsareknownassupernumeraryteatswhichmakemilkingofthe animaldifficult. Theyareclippedoffwithteatclippers.
- Dehorning/Disbudding-Theremovalofhornbudsusingsuitablemethods.

CalfHousing

RequirementofaCalfPen;

- Shouldbecleanandeasytoclean.
- Bewarmanddry.
- Haveadequatespacetoallowexerciseandfeeding.
- Shouldbeproperlylitandallowsunlightfor VitaminD.
- Haveproperdrainagetoavoiddampness.
- Draughtfreetopreventchilling.
- Bewellventilatedtoallowfreshair.

TypesofPens

Thesecanbe;

- permanent mobile/movable.

PermanentPens

- Haveasolidfloorraisedabovetheground. Thefloorshouldbeslantedfordrainage.
- Constructednearthemilkingparlour.

Mobile/MovablePens

- Haveanopenfloortoallowgrassintothepen.
- Easilymovedfromoneplacetoanothertoavoidsoiling.
- Keptoutdoorsinthepasturestoallowthecalftonibbleonpastures.

SingleHousing

- Calvesshouldbehousedsinglyuptotheageof3weeks,whentheyareputingroup pens.
- Thisistoavoidthemlickingeachotherandswallowinghairswhichformindigestible balls.

MilkandMilking

- Milkisthewhitelactealsubstancesecretedbythemammaryglandsofthefemale mammals.

CompositionofMilk

- Protein-Caseinandwhey.
- Fat-Butterfat.
- Carbohydrates-Lactose
- Minerals-mainlycalciumandphosphorus.
- Water

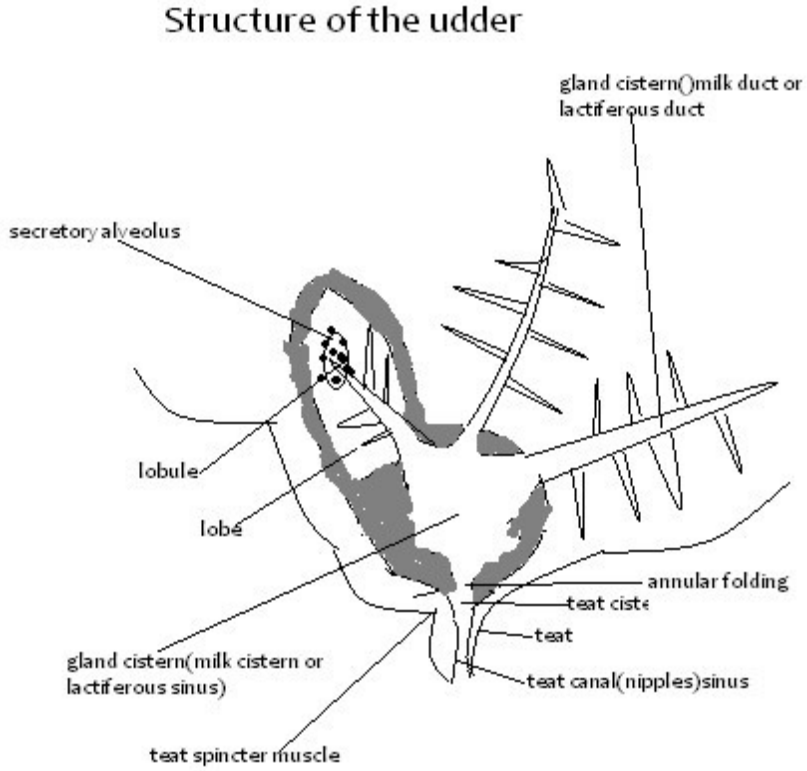
FactorsAffectingMilkComposition

- Ageoftheanimal.

- Conditionsoftheanimal.
- Stageoflactationandpregnancy.
- Completenessofmilking.
- Typeofbreed.
- Seasonoftheyear.
- Typeoffoodeaten.
- Physiologicalconditionssuchasdiseases.

MilkSecretionandMilkLet-down

- Milkissecretedbythemammaryglandswhichisanaccessoryglandofthe reproductivesystem.
- Themammaryglandofacowisknownasanudder.



StructureoftheUdder

Theudderiscomposedofthefollowingparts:

- Alveoluscells-synthesizeandsecretemilk.
- Lobule-agroupofalveoluscells.
- Lobe-Severallobulesgroupedtogetheranddrainedbylactiferousducts.
- Glandcistern-spacewheremilkcollectsfromthelobes.
- Teatcistern-Aspacewheremilkcollectsbeforeemission.
- Teat-Anorganwhichdrainseachquarteroftheudder.

MilkSecretion

- Theprocessofmilksecretionisknownas lactogenesis.
- Thedigestedfoodistakentotheudderviabloodvessels.
- Intheudderthenutrientsarecarriedintothealveolicellswheremetabolicreactions takeplacetobuildupthesenutrientsintomilk.

- A hormone prolactine is secreted by pituitary gland which brings about lactogenesis.
- The milk secreted is then stored in the upper part of the udder waiting to be released.

Milk Let-Down

- The process of milk let-down occurs naturally when the animal is stimulated.
- Milk secreted moves from alveolar region through the ducts to the gland cistern.
- Oxytocin, a hormone secreted by the pituitary gland causes the contraction of the udder muscles forcing the milk down the teats.
- Oxytocin hormone lasts 7-10 minutes in the bloodstream hence fast milking is important to withdraw the milk.
- Milk is withdrawn from the teats by gently squeezing them.

Factors Influencing Milk Let-Down

- Presence of the calf.
- Presence of the milkman/milker.
- Rattling of the milk equipment.
- Site of the food/feeding the animal.
- Massaging or washing the udder.
- Sight of the milk parlour.

Factors Inhibiting Milk Let-Down

- Beating the animal/inflicting pain to the animal.
- Presence of strangers and animals for example dogs.
- Poor milking techniques.
- Absence of the calf (in case the cow is used to it).

Clean Milk Production

The following factors are essential for clean milk production:

- A healthy lactating cow.
- A healthy and clean milker.
- Clean and properly constructed milking parlour.
- Clean and disinfected milking equipment.
- Proper handling of the milk after milking.

Milking Procedure

- The animals are brought near the milking parlour 15-20 minutes before milking to get into the mood of being milked.
- Milking materials such as equipment, feeds, ropes, stools and salve are collected and placed near the milking parlour.
- The animals are allowed into the milking stall one by one as the milking proceeds as follows:
  - The animal is restrained in the stall.
  - Feed is weighed and placed into the feed trough.
  - The udder is thoroughly washed, disinfected and dried with a clean cloth.
  - A strip cup is used to test for mastitis on each quarter.
  - Milking proceeds by squeezing the teats with the full hand. If machine milking the teat cups are placed on the teats.
  - For hand milking start with the hind quarters and finish with the forequarters.
  - Fast milking should take about 8 minutes then end with stripping the udder.

- Themilkisweighedandrecorded.
- Theanimalisthenreleased.

DryCowTherapy

- Thisistheinfusionofantibioticsintotheteatcanalofacowthatispreparingfor dryingoff.
- Itpreventsbacterialinfectionwhichleadstomastitis.

MilkProducts

- Pasteurizedmilk-milkthatisheatedandcooledimmediately.
- UltraHeatTreated(UHT)-milkheatedtoatemperatureof130-135C,packedandthen cooled.
- Butter-Milkbutterfatseparatedbyaprocessknownaschurning. Cream-Alayerofis:thatcollectsatthetopofthemilkwhenlefttostand.
- Cheese-Milkproteinswhichhavebeencompressed.
- Ghee-Milkfatmadefromheatingcreamorbutter.
- Skimmilk-Milkwithoutbutterfat.

MarketingofMilk

- TheKenyaDairyBoardregulatestheproductionandsaleofmilkandmilkproducts throughvariousDairyCo-operativeSocieties.
- Processorsanddistributorsofmilkandmilkproductsinclude; oKCC,
  - oBrooksideDairies,
  - oTuzo,
  - oDelamereDairies oLimuruDairies.

MarketingofBeef

Donebythefollowing:

- Individualfannersthroughthelocalslaughterhouse.
- Livestockmarketingdivision.
- KenyaMeatCommission. Farmer'sChoice.

FarmPowerandMachinery

Introduction

- Farmpowerisanyformofenergyusedinthefarmtodowork..

SourcesofFarmPower

HumanPower

- Performslighttasks.
- Qualityofworkproducedisvariable.
- Takesalongtimetocompleteatask.

AnimalPower

- Donebydraughtanimalssuchascamels,donkeys,horsesandelephants. Usedinlandpreparationandtransportation.

Disadvantages

- Slow.
- Animalsareliabletosicknessandgettired.
- Needenoughfood. WindPower

- Topumpwaterfromboreholes.
- Towinnowcropssuchasbeans,fingermilletandrice. Generateelectricity. Disadvantages
- Noteasytocontrolandmaynotbeavailablewhenneeded.

WaterPower

- Irrigation.
- Grindingmills(togrindmaizegrains).

Disadvantages

- Difficulttouseinthefarmbecauseitisnoteasytocontrol.

Biomas

Thisincludes:

woodorcharcoal

biogaspower.

Charcoal/WoodFuelEnergy

Uses

- Providesheatforboilingwaterandcooking.
- Dehydratingofsomecrops. Curingoftobacco.

Disadvantages

- Exhaustible.
- Itcannotbeuseddirectlyinsomefarmoperations. Largequantitiesarerequired.
- Theyarebulkyhencedifficulttotransport.

Biogas Uses

- Providesheatandlightforcooking,boilingwaterandlighting.
- Produceselectricity. Disadvantages
- Onlypossiblewheretherearean imalsunderzerograzingunit.
- Itislabour-consuming.
- Largequantitiesofdungarerequired.
- Cannotbeuseddirectlyinsomefarmoperations.

FossilFuels

Theseinclude:

- coal,
- petroleumoils naturalgas.

Uses

- Petrolordieselisburnedininternalcombustionenginestoproducepower.
- Keroseneisthemainsourceofpowertolightruralhomes.
- Naturalgasisusedforcooking,heatingandlighting.

ElectricalPower

Itincludes:

- hydro-electricalpower(HEP),
- geothermal,
- nuclear

- powerstoredinbatteries.
- Nuclearenergyisapotentialsourceofpowerwhichhasnotyetbeenusedinthefarms.

UsesofElectricalPower

- Ru nsstationarymachinessuchasmillingmachines,grindingmills,coolingmachinesandwaterpumps.
- Suppliesheatandlightforoperationsofbrooders.

Disadvantages

- Cannotbeuseddirectlyinsomefarmoperations.
- Lackofelectricityintheruralareas.
- Powerfailurescanleadtohighlosses.
- Itiscostlytoinstallandmaintain.

SolarEnergy

Energyobtainedfromthesun.

Uses

- Providesheatandlight.
- Usedbyalltheplantsinphotosynthesis.
- Dehydratingcropssuchasvegetables,maizegrains,beansandhay.
- Boilswaterwhichdrivesturbinestoproducepowerforminoruses.

Disadvantage

- Lowconcentrationofenergyoncloudydays.
- ExpensiveIncollectingandconcentratingequipment.
- Cannotbeuseddirectlyinsomefarmoperations.
- Requiresskilledlabourtoinstallandmaintain.

Tractor

- Thetractorhasaninternalcombustionenginewhichburnspetrolordieseltoproducepower.
- Thispoweristhenpassedtothegearboxfromwhereitistransmittedinvariousways.
- Thecommontractorengineisafourstrokecycleengine.

Thefourstrokesare:

- Inductionstroke.
- Compressionstroke.
- Powerstroke.
- Exhauststroke.

InductionStroke

- Pistonmovesdown.
- Inletvalveopens.
- Fuelandairgetintothecylinder. CompressionStroke

- Inletvalveisclosed.
- Pistonmovesupthecylinder.
- Fuel-airmixtureiscompressed.

PowerStroke

- Asparkisproducedatsparkplug,ignitingthefuel-airmixture.
- Theincreasedpressureforcesthepistondownthecylinder.

ExhaustStroke–

- Exhaustvalveopens.
- Pistonmovesupthecylinder.

- Burnedfuel-airmixtureexpelled.

AdvantagesoftheFourStrokeEngines

- Producehighpowerwhichcandoheavyfarmwork.
- Haveefficientfuelandoilutilization.
- Performawiderangeoffarmoperations.
- Areeffectivelycooledwithwaterthusallowingtheproductionoflargeenginesize.
- Exhaustgassesareeffectivelyexpelledfromthecylinders.

Disadvantages

- Areexpensivetobuyandmaintain
- Theiruseislimitedinsomeareas;
- Tractorcanonlybeusedonflatorgentlyslopingareas
- Requireskilledpersonnelandsupportservices

TheTwoStrokeEngines

- Foundinsmallmachinessuchasmowers,motorbikes,andwaterpumpswhichdolightjobsinthe farm.
- Allthecyclesarecompletedintwostrokesofthepiston. Thesestrokesare;

Inductionandcompressionstroke

- Thepistonisatthebottom
- Pistonmovesupuncoveringtheinletport
- Fuel-airmixtureisdrawnin
- Ignitionoccurswhenthepistonreachesthetop
- Pistonisforceddownwardcompressingthemixtureinthecrank.

Powerandexhauststroke

- Thepistonisatthetop
- Ignitedgasesproducepressurewhichforcethepistondownwards
- Thepistoncoverstheinletportandtrapsfreshfuel-airmixtureinthecrankcase
- Pistonmovesfurtherdowntouncovertheexhaustport
- Fuel-airmixturetransferredfromthecrankcasetothecombustionchamber.

WhatAdvantagesoftwostrokeengine?

- Cheaptobuyandeasytomaintain
- Economicalinfuelconsumption
- Canbeusedinawiderangeoffarmland,includinghillyareas
- Candosmalltasksinthefarmwhichwouldbeun-economicaltodousingthefourstrokeengine.

Whatdisadvantagesoftwostrokeengine?

- Theyproducelesspowerhencecannotbeusedforheavyduties.
- Theyareinefficientinburningfueltoproducepower.
- Theyareaircooledthuslimitingthesizeoftheengine.

SystemsofaTractor

Themoderntractorhasthefollowingsystems:

- Thefuelsystem.
- Electricalsystem
- Ignitionsystem
- Coolingsystem
- Powertransmissionsystem.

TheFuelSystem

Suppliesfueltotheengine.
Categorizedintotwotypesdependingonthefuelused.
Theseare:

- Thepetrolfuelsystem.
- Thedieselfuelsystem ThePetrolFuelSystem

Consistsof:

- Fueltank-storageoffuel.
- Fuelfilter-removesforeignparticlesfromthefuel.
- Carburettor–
  - atomisesfuelintospray.
  - introducesfuel-airmixtureintotheengines.
  - Regulatesfuel-airintosuitableproportions.
- Fuelpump-forcesfuelintothecarburettor.
- Deliverypipe-connectsallthedevices.

Maintenance

- Cleaningthecarburettorregularly.
- Cleaningthefuelfilterinpetrol.
- Cleaningtheholeinthefueltankcap.

TheDieselFuelSystem Consistsof:

- Fueltank-storageoffuel.
- Fuelinjectionpump-pumpsdieselthroughinjectionnozzlesandbreaksintofinespray.
- Fuelfilters-removeforeignparticlesfromthefuel.
- Deliverypipes-connectthevariousdevices.

Maintenance

- Replacingthefuelfilter.
- Bleedingincaseairistrappedinthesystem.
- Cleaningthesedimentbowlregularly.

StructuralandFunctionalDifferencesBetweenPetrolandDieselEngines

Petrolengine	DieselEngine
Ithasacarburettor.	Ithasaninjectionpump.
Fuelandairaremixedinthecarburettor beforeitgetsintotheengine.	Thefuelandairaremixedwithinthe cylinder.
Fuelisignitedbyanelectricspark.	Fuelisignitedbycompressionofairand fuelmixtureinthecylinder.
Itproduceslittlesmokebecause	Itproducesalotofsmokesincethediesel

o□etroliscompletelyburnt.	□ isnotcompletelyburnt.
□ □Petrolengineislightinweightand . suitedforlightduties□ .	□□ Itisrelativelyheavyinweightandsuited . □ forheavyduties.

ElectricalSystem

Consistsofthefollowing:

- □Battery
  - ➢ Convertschemicalenergyintoelectricalenergy.
  - ➢ Storeselectricalenergyproducedbytherunning
- Ignitioncircuit-providetheelectricalrequiredbythesparkplugs. currentthatproducesasparkintheengine.
- Generatorcircuit-providetheelectricalcurrentthatstartstheengine.
- Lightingcircuit-supplytheelectricalcurrentrequiredforthelightingsystem.

□Startermotorcircuit-startstheengine.

CareandMaintenanceofaTractorBattery

- Thelevelofelectrolyteshouldbekeptjustabovetheplatebytoppingwithdistilledwater.
- Corrodedterminalsshouldbescrappedcleanandsmearedwithgrease.
- Thebatteryshouldbetightlyfixedinaboxtoavoidspillageanddamage.
- Thebatteryshouldbefittedcorrectlyonthetractor.
- Thebatteryshouldbechargedregularlyandperiodically.
- Incaseoflongstoragethebatterycontentsshouldbekeptupsidedown.
- Thegeneratorfanbeltshouldalwaysbefunctionaltoensurethebatteryisalwayscharged.

IgnitionSystem

Consistsof:

- Ignition-changethelowvoltagefromthebatterytohighvoltagecurrentrequiredbythesparkplugs.
- □ Condenser-absorbstheself-inducedcurrentintheprimarycircuit.
  - ➢ storescurrentforashorttime.
  - ➢ passeselectriccurrenttothedistributor.
- Distributor-distributesthehighvoltagecurrenttothesparkplugs.
- Contactbreaker-Interruptsthenormalflowofcurrentintheprimarycircuit.

StatetheMaintenancepracticescarriedontheIgnitionSystem

□Thecarbondepositsonthesparkplugelectrodesshouldberemoved.

- Thesparkplugswhoseelectrodesarewornoutshouldbereplaced.
- Thecontactbreakerpointsshouldbecleaned.
- Thebreakerpointsshouldbeadjustedsothattheyliebetween0.30mmand0.50mm.
- Thecondensershouldbereplacedregularly.
- Theignitionsystemsshouldalwaysbekeptdry.
- Ignitionwireswithpoorinsulationshouldbereplaced.

CoolingSystem

- Thecoolingsystemaimsatpreventingtheenginefromoverheatingwhichwouldcausepistonzeisure inthecylinder.
- Sometractorenginesarecooledbyairwhileothersarecooledbywater.

StatetheCharacteristicsofAirCooledEngines

- Theyaresimpleinconstruction.
- Theyhavefinsandafanbladewhichassiststhecirculation.
- Theyarelightinweightfortheyhavenoradiatorsandwaterjackets.

Limitations

- Theygethotquicklyanduseheavylubricatingoil.
- Thecoolingisnotadequateunderallconditionsespeciallywhencarryingheavyloads.

WaterCooledSystems

- Itconsistsoftheradiator,waterjackets,waterhoses,waterpump,thermostatandafanning mechanism.
- Waterisusedtoabsorbheatfromtheengineblockatareasonablerate.

CareandMaintenanceofWaterCoolingsystem

- Thewaterpumpsshouldbelubricatedregularly.
- Cleanwatershouldbeusedintheradiatorandtrashremovedfromthefins. Allpipesshouldbefittedtightlytoavoidblockage.
- Theradiatorshouldbefilledwithcleanwaterbeforestartingtheday'swork.
- Fanbelttensionshouldbecheckedregularlyandiftootightortoolooseshouldbeadjusted accordingly.

LubricationSystem

- Thissystemisaimedatsupplyingoiltoallpartsoftheenginewherefrictionislikelytooccur.

ImportanceofLubricationsystem

- Ithelpstoincreasetheefficiencyofthemachineandreducestherateofwearandtearofmovingparts. Itreducestheheatcreatedbytherubbingsurfacesandactsasasealbetweenthem.
- Itactsasacleaningagentbecauseitwashesoffallthedust,dirt,sootandmetalchippingsfromtheoil pathstothesump.

TypesofLubricationSystems;

- Splashfeedtype
- Forcefeedtype
- Oilmisttype

TypesofLubricants

- SAE10-Thisisthinengineoilwhichgiveslittleprotectionwhenheated.

- SAE50-Thisisthickerengineoilwhichisrecommendedforprotectingthebearings.
- SAE90-100-Thesearetransmissionoilswhicharerecommendedforclutch,gearbox,wheel lubricationandballbearings.

Note:SAE-SocietyofAutomobileEngines.

CareandMaintenanceofLubricationSystems

- Oldorcontaminatedoilshouldnotbeusedforlubrication.
- Oilshouldbedrainedwhenstillhottoavoidstickingonthewallsofthesump.
- Theoilfiltersshouldbereplacedwhennecessary.
- Thecorrecttypeofoilshouldbeusedasperthemanufacturers'instructions.

PowerTransmissionSystem

- Thefunctionofthissystemistotransferpowerfromthetractorenginetothedriveshaft,thewheel axle,thepowertakeoffshaftandthehydraulicsystem.
- Thesystemconsistsoftheclutch,gearbox,differentialandthefinaldrive.

Thepowertransmittedfromtheengineismadeavailableforusethroughthefollowing:

- Thepropellershaft-itconnectsthegearboxtothedifferential.
- Thepowertakeoffshaft(PTOshaft)¬-Itislocatedattherearpartofthetractorandrotatesatthe samespeedasthecrankshaftoftheengine.

- Hydraulicsystem-itisoperatedbytheuseofalevernearthedriversseat.
- Itisconnectedtothe3-pointlinkageandhelpstolowerorraiseimplementsmountedonthe3-point linkagessuchasploughs,mowers,plantersandsprayers.

Drawbar–

- Itisaone-pointlinkageattherearpartofthetractor.
- Itservesfortheattachmentoftrailedimplementsthatcanbeusedduringharrowing, transportationorrolling.

TractorServicing

- Theaimoftractorservicingistokeepthetractoringoodandefficientworkingconditions. Tractorservicingiseither;

  short

  longterm.

ListtheShortTermTractorServicing

Itincludes:

- Checkingtheengineoildailybyuseofadipstick.
- Iftheoillevelislow,itshouldbeadded.
- Thefuellevelshouldbecheckedatthestartofeveryday'sworkandaddedifnecessary.
- Waterlevelintheradiatorshouldbecheckedandifpossibletoppedup.
- Thelevelofthe electrolyteshouldbecheckeddailyandtoppedupwithdistilledwateraccordingly.
- Nutsandboltsshouldbetightenedeveryday.
- Lostnutsandboltsshouldbereplacedbeforetheday'swork.
- Greaseshouldbeappliedbyuseofgreasegunthroughthenipples.
- Largesedimentsfromthesedimentsbowlshouldberemoved.
- Thetyrepressureshouldbecheckeddailybeforetheday'swork.
- Thefanbelttensionshouldbecheckedtoensurethatitdeflectsbetween1.9cmand2.5cmwhen pushed.
- Thebrakeshaftbearingshouldbegreased.
- Thebrakefluidlevelismaintainedattherecommendedlevel.

LongTermServices

- Theengineoilshouldbedrainedcompletelyfromtheoilsumpandreplacedwithnewoil.
- Thegearboxoilshouldbecheckedandrefilledasrecommended.
- Theoilinthedifferentialshouldbereplacedasrecommended.
- Thelinkageandthepulleyattachmentshouldbegreased.
- Thepulleyoillevelshouldbecheckedandaddedifneedbe.
- Thedirtyoilshouldberemovedandreplacedwithcleanone.

FarmMachinery

TractorDrawnImplements

- Theseareimplementswhichareattachedtothetractorduringoperation.

  Statethetwocategories.TractorDrawnImplements

- One-pointhitchimplements;
  - Areattachedtothetractoratonlyonepointthatis,thedrawbar.
  - Theyincludealltrailedimplementssuchasthetrailers,heavyharrows,plantersandrollers.
- Threepointhitchimplements;
  - Areimplementsattachedtothetractoratthreepointsthatis,thetoplinkagepointandtwolower linkagepoints.
  - Theyareoperatedbythehydraulicsystem.
  - Theyi ncludeploughs,mostharrows,sub¬soiler,planters,mower,ridgers,sprayersandrotavators.

Trailers

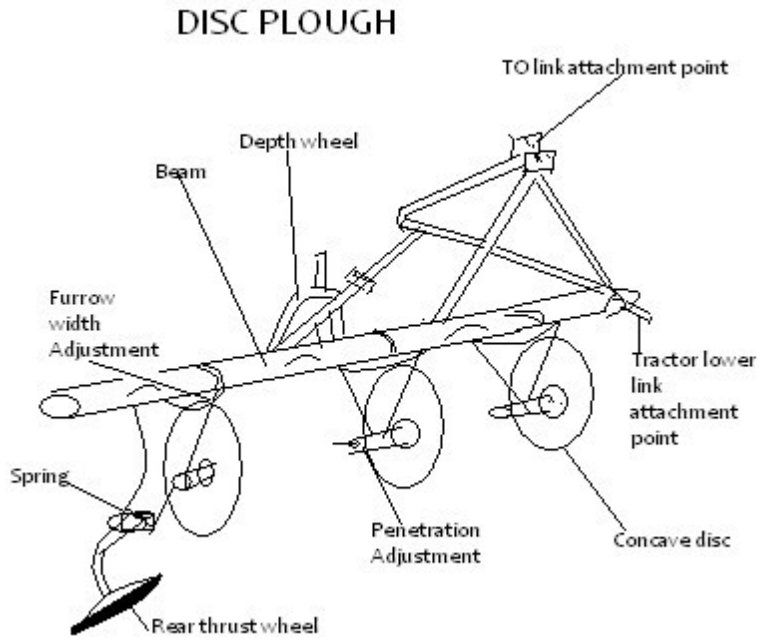
- Theyareone-pointhitchimplements.
- Theyareusedfortransportationofgoods.
- Smalloneshavetwowheelswhilebigoneshavefourwheels. Maintenance
- Allthemovingpartsshouldbelubricated.
- Tyrepressureshouldbeadjustedtothecorrectpressure.
- Wornouttyresshouldbereplaced.
- Loosenutsandboltsshouldbetightened,worn-outonesshouldbereplaced.
  Theimplementsshouldbekeptunderashedduringlongstorage.

Ploughs

- Theyareprimarytillageimplements.
- Thecommontypeofploughsinclude:
  - Discploughs.
  - Mouldboardploughs.

Discploughs

Itismadeupofheavysteelconcavediscsof60-70cmdiameter.



PartsandFunctionsofadiscplough Thehitchmast:

- Isanattachmentforthethreepointhitch.
- Madeupoftwosidelinksandatoplink.
- Thesearepartsconnectedtohydraulicsystemofatractorforliftingandpulling.

- Thebeam:Supportsallotherparts.Italsoaddsweightforbetterpenetration.
- Depthwheel:
  - Usedwhendrivingonhighway, italsocontrolsthedepthofploughing.
  - Maynotbepresentinalldiscploughs.
- Thestandardorleg:Connectsthediscstothebeam.
- Thehub:Allowsthediscstorotatesmoothlyhencedoesthecuttingoffurrowslices.
  Thescrapers:Removethetrashandmudorsoilwhichclingtothediscs,
  Discblades:Cutandinvertthefurrowslices.
- Rearfurrowwheel:Controlsthedepthofdiggingandstabilisesthediscs.

Adjustment .

- Thecuttingangleshouldbeadjustedat35°-50°fromthelineoftravel. Achievedbypivotingthebeamorthestandard.

Depthofdigging:Thisiscorrectedbychangingtheheightofdepthwheeloradjustinghydraulicsystem andaddingweights.

CareandMaintenanceofDiscPlough

- Checkforloosenutsandboltsandreplacethem.
- Sharpenthediscbladesifblunt.
- Lubricatetherotatingpartsbyuseofoil/greasetoreducefriction.
- Painttheexposedpartsforexamplethebeam/framework.
- Cleantheimplementattheendofeachday'sworkbeforestorage.
- Storetheimplementsinashed.
- Theunpaintedpartsshouldbecoatedwitholdengineoiltopreventrust.

UsesofaDiscPlough

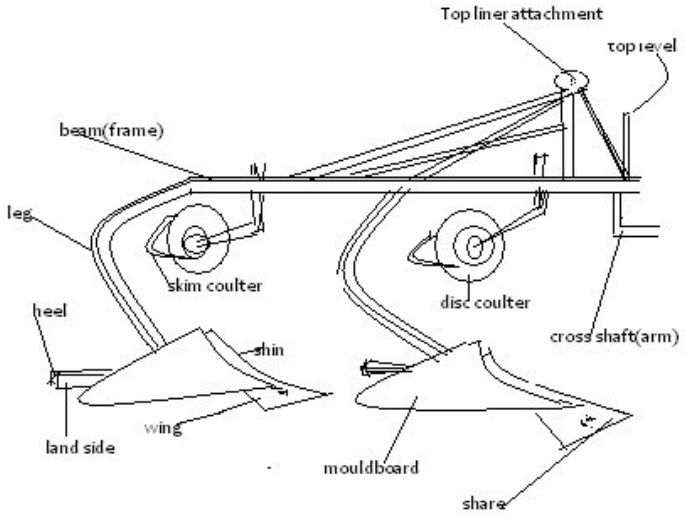
Usedinareaswiththefollowingconditions:

- Virginlandwithmanyobstacles.
- Landwithtoomuchtrashortallvegetation.
- Openinguppastureland.

Mouldboardploughs

- Thisprimarytillageimplementissuitedinareaswithoutobstaclessuchasstones,treestumps,and roots.
- Itgivesauniformdepthofploughing.

MOULDBOARD PLOUGH



PartsandFunctionsMouldboardploughs

- Share:Thismakesthehorizontalcutandstartstheturningofthefurrowslices.
- Mouldboard:Continuestheturningofthefurrowslicesandpulverizesthesoil.
- Disccoulter:Makesaverticalcutinthesoiltoseparatethefurrowslicefromtheun-ploughedland.
- Skimcoulter:Removesanytrashfrombetweenthefurrowslices.

Frog:Itisthepartwheretheshare,mouldboardandthelandsideareattached.

- Landside:Stabilizestheploughandabsorbsthesideforcescreatedwhenfurrowisturned.

- Shin:Leadingedgeofamouldboard.
- Knifecoulter:Isaverticalknifewhichcutstrashandearthaheadoftheshare.

CareandMaintenance

- Lubricatetherollingpartsforexamplewheelbearingsanddisccoulterbearings.
- Paintscratchedpartsoftheplough.
- Sharpentheshareorreplaceifwornout.
- Checkallloosenutsandboltsandreplacewherenecessary.
- Cleantheimplementaftereachday'sworktoremovesoil,mudandtrash.
- Forlongstorage,keepunderashedandapplylubricants.

Adjustment

- Depth:
  - Controlledbyraisingorloweringthedepthwheel.
  - Controlledbyhydraulicontrolleversetting.
- Pitch:controlledbyalteringthelengthofthetoplink.
- Frontfurrowwidth:Controlledbycrossshaftadjustmentleverorbyrotatingthecrossshaftcrank.
- Laterallevelling:Controlledbytractorliftrod.

Operationaldifferencesbetweenadiscandamouldboard

Doesnotinvertthefurrowslices completely.	Invertsthefurrowslicescompletely.
Moresecondaryoperationsare necessaryafterithasbeenused.	Fewersecondaryoperationsare needed.
Cutsatvaryingpoints.	Operatesatuniformdepth.
Noteasilybrokenbyobstacles.	Caneasilybebrokenbyobstacles.
Requireslesspowertooperate.	Requiresmorepowertooperate.

DiscPlough	MouldboardPlough
Suitableonfieldwithstones, rootsandstumps.	Cannotbeusedonfieldswithstone, rootsorstumps.

- Checkforloosenutsandboltsdaily.
- Lubricatetheshaftsandbearings.
- Cleanandoilbeforestorage.

SpringTineHarrow

- Ismadeupofflatandcurvedtineswhichactassprings.

Uses

- Levelsandsmoothenstheseedbed.
- Breaksthesoilclods.
- Mixestrashandsoilthuspreventingwinderosion.
- Aeratesthesoil.

Adjustments

- Depthiscontrolledbythehorizontalconnectinglinkanddepthwheel.
- Forindividualtine,usecrossbarandlooseningthescrews.

CareandMaintenance

- Checkforloosenutsandboltsandtightenthemifnecessary.
- Cleanafteruse.
- Oilthelevermechanism.

SpikeToothHarrows

- Consistsofametalframeworkwithrigidmetalspikeswhichbreakupthesoilbyvigorouslyhitting largelumpsofsoilsasitispulledthroughthesoil.

Uses

- Itsmoothensandcompactsthesoil.
- Itbreaksbiglumpsofsoilintosmallparticles.
- Canbeusedforcultivatingsmallcropsifwellset.

Subsoilers

- Heavyandrequirehighhorsepowertopull.
- Ploughingdepthof51-90cm.

Functions

- Breakupcompactedsoil.
- Breakupthehardpan.

CareandMaintenance

- Cleanitafteruse
- Checkthepointandifwornout,replaceit.
- Oilwhennotinuse. Ridger

Itisdoublemouldboardploughusedtomakeridgesandfurrows.

Itisusedtopreventwaterlogginganddrainingthroughfurrowsforeasyharvestingofrootcrops.

Rollers

- Thisisanequipmentusedtocompactthesoilgentlyespeciallywheretinyseedsaretobeplanted.

Rotavators:(Rotarycultivators)

- Workontheprinciplesofhighspeedofrevolvingflailbladeswhichbeatandcutthesoiltogetherwith trash.
- Itisanequipmentforbothprimaryandsecondarytillageoperations.
- ItisdrivenbytheP.T.O.shaftofatractor.

Uses

- Breaksuplargesoilparticlesintosmallones.

- Mixesthevegetationandthesoil.
- Achievestwooperationsinonepass.

Adjustments

- Forwardspeedofthetractorgivesafinetilthoftheseedbeddonethroughthegearbox.
- Depthofworkdonebycontrolofdepthwheel.
- Slipclutchmaybreakincasetheknivescomeacrossobstructions

Mowers

Uses

- Cuttinggrassforhayorsilagemaking, cuttingovergrowngrass clearingthefield.

ReciprocatingMower

PartsandFunctions

- Swathstick:Keepsthecutcropfallingcorrectly. Swathboard:Toremovethecutcrop.
- Shoe:Hasarunnertoabsorbtheweightandwear.
- Cutterbar:Isaflatbarwhichguidesthefingers.

Wearplate:Counteractsdownwardforceandholdstheknives.

Adjustments

- Toadjustkniferegisterbymovingthewholebarawayortowardstheyoke.
- Knifelead:Theoutershoeshouldbeadjustedtobeouterthantheinnershoeby4cm. Maintenance
- Checkforloosenutsandboltsandtightenwherenecessary.
- Keepknifesectionsharp.
- Lubricatetheknifeparts.
- Checkknifetoledgerplatecupforbestcutting.
- Keepallthepartstight.

RotaryMowers

- Cuttingedgeconsistsoftwobladesfittedoppositetoeachotheronhorizontaldisc.
- Thecuttingbladesswingroundathighspeedhorizontallytothegroundhencecuttingiseffected.

AdjustmentandMaintenance

- Bladesshouldbesharp.
- Guardstobefittedaroundthebladestoprotecttheoperatorfromflyingobjects.
- LubricatetheP.T.O.shafts.
- Checkthegear-boxoilregularlyandfilltotherightlevelifnecessary. Planters

Theyaremachinesusedforsowingseeds.

- Therearetwotypes:
  - Rowcropplanters. Seeddrills.

FunctionsofthePlanters

- Metertheseedandfertilizersfromseedandfertilizerhopper.
- Opentheseedfurrow.
- Depositttheseedinthefurrowthroughthedeliverytubes.
- Covertheseed

FunctionsofPartsofaSeedPlate

- Fillerplate:givesproperseeddepth.
- Falsering:allowstheseedtofallfromtheseedplateintotheboot.
- Knockoutpawl:pushestheseedsoutofthecellbytherolleraction.
- Cut-offpawl:preventsmorethanoneseedremaininginaplatecell.
- Cells:shapedholestoholdtheseed.

Adjustments

- Adjustthecoultersdepthfortherightcrop.
- Fixtherightseedplate.
- Placetheplanterinthelevelposition.
- Alltheshaftsshouldbefreetoturn.

CareandMaintenance

- Checkallloosenuts,boltsandtightenthem.
- Cleanandoiltheplanterafteruse.
- Greasethedrivesprocketsregularly.

Seeders

- Thegraindrillsowsgrainsofwheat,barley,oats,peas,beansandalfalfaseeds.

Partsthatcanbeadjustedtochangethesowingrate;

- Selectthesideofthefeedwheelrecommendedonthedrillchartsfortheseed-rate.
- Changethespeedofthewheelsbychangingthegearsorsprocketsorboth.
- Changethepositionofthefeedgateinthecup.
- Usereducersbelowthefeedwheel. CareandMaintenance
- Keepseedandfertilizerhoppersdryandcleanaftereachday'swork.
- Checkthedriveshaftandlubricatethem.
- Paintthepartsforexamplefertilizer
- hoppertobeshiny

CombineHarvester

Use

Harvestingcerealcropsforexamplemaize,wheatandbarley.
Itisdesignedtodothefollowing:

- Cutting Threshing.
- Winnowing
- Bagging

PartsofaCombineHarvester

- Cutterbar-cutsthegrainhead.
- Pickupreel-directcropintothecutterbar,
- Elevator-channelsthecutgraintothethreshingdrum.
- Winnowingran-fanstrashupontoastrawwalkeranddirectsitoutofthecombineharvester.
- Deliverytube-deliverstheclean.grainsintoacollectingtankfromwhereitisbagged.

MaintenanceofaCombineHarvester

- Loosenutsandboltsshouldbetightened.
- Removeallforeignmaterialsstuckinthemachineattheendoftheday'swork.

Ridgers

- Theyareusedforharvestingtubercropsandformakingfurrowsorridges.

Maintenance

- Lubricatethemovingparts.
- Cleantheimplementafteruse.
- Storeunderashed.
- Repairorreplaceworn-outorbrokenparts.
- Loosenutsandboltsshouldbetightened. Unpaintedpartsshouldbeoiledduringlongstorage.
- Sharesshouldbesharpenedifblunt.

Foragers

- Theyaretractormountedandoperatedbypowerfromthe P.T.O.shaft.
- UsedforharvestingforagecropssuchasNapiergrass,sorghumandmaize.

Maintenance

- Tightenloosenutsandbolts.
- Lubricatemovingparts.
- Storeinashed.
- Cleanaftertheday'swork.
- Repair/replacewornoutorbrokenparts.
- Unpaintedpartsshouldbeoiledtopreventrust.

MaizeShellers

- Thesearestationaryimplementswhichareeitherhandortractordriven.
- Theyconsistof a rotatingdiscwhichshellmaizegrainsfromcobs.

Maintenance

- Greasingmovingparts.
- Removinganystuckmaizecobs.

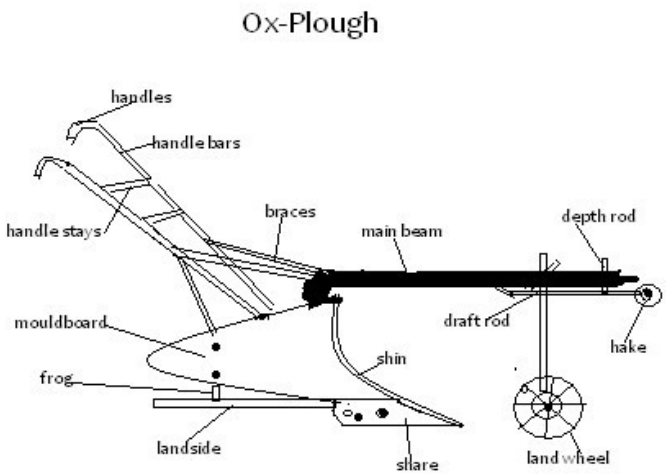
Repairorreplacewornoutorbrokenparts.

- Storeinashed.

AnimalDrawnImplements

OxPlough

- Ox-ploughisasimpletypeofamouldboardploughwhichispulledbyapairofoxen,donkeysorcamels.



Explainthefunctionsofthefollowingpartsofanox-plough

- Mainbeam-Itisthemaincomponentontowhichalltheotherpartsareattached.
- Mouldboard-Itinvertsthecutfurrowsliceupsidedown.
- Ploughshare-Itcutsthefurrowslices.
- Landwheel-Itregulatesthedepthofplough.
- Draftrod-Itisonthisrodthatachainisconnectedonwhichayokeislinked.
- Itformsthedraughtmechanismoftheplough.

WhataretheAdvantagesofanOx-PloughOverTractor¬DrawnPlough?

- Lessskillisrequiredtooperateit.
- Usefulwheretractorscannotbeusedforexamplesteepslopes.
- Cheaptobuyandmaintain.

WhatarethedisadvantagesofanOx-PloughOverTractor¬DrawnPlough?

- Muchtimeiswastedintrainingoxen.
- Tediousandlaborioustothedriveroftheanimalsandthecontrolleroftheimplement.
- Animalscanbesickorinpoorphysicalstate.
- Extralandisrequiredasgrazingfieldsfortheoxen.

Adjustments

- Depthofploughiscontrolledbythelandwheelanddraftrod

CareandMaintenance

- Sharpenorreplacingofthewornoutshare Replacementofwornoutpartssuchashooksanddrawbarassembly. Oilingtheshinypartse.gmouldboard Washoffthesoilafteruse.
- Paintthehandles,beamandbracestopreventrusting.

Ox-DrawnCart

- Thesearesmallcarriagesharnessedtotheanimalsbyayoke Thesmallcartshaveonlytwowheelsbiggeroneshavefour. Theyarepulledbyanimalsinsinglesorinpairs Cartsareusedfortransport.

Maintenance

- Movingpartsshouldbeoiled
- Theyokeshouldberepairedwhenwornoutorreplacedifnotrepaired Tyrepressureshouldbecheckedandadjustedaccordingly Repairotherdamagesonthecart.

AgriculturalEconomicsIII:

(ProductionEconomics)

Introduction

Theagriculturalsectorisakeyplayerintheeconomyofourcountry.

Itisamajoremployerandbringsalotofnationalincomethroughforeignexchange.

NationalIncome

Thesearethetotalearningsfromgoodsandservicesproducedbyacountryina periodofoneyear.

RelationshipBetweenFirmandHousehold

AhouseholdisconsideredtobeaunitcomprisingafarmerandfamilymembersIt producesrawmaterialsandconsumesmanufacturedgoods.

Afirmontheotherhand,isanymanufacturingorprocessingunitwhichconsumes rawmaterialsandproducesmanufacturedgoods.

Bothhouseholdandfirmgenerateincome,whichinturn,isusedto:

Improvethestandardoflivingofthehouseholdmembersbypayingforessential goodsandservices.

Thefirmsbuildmoreindustriestocreatemoreemploymentandrevenuethrough

salariesandwages.

- Financegovernmentprojectsthroughtaxesandhencefurthernational development.

GrossDomesticProduct(G.D.P.)

- Thisisthesumtotalofallgoodsandservicesproducedinacountryinaperiodofone year.

GrossNationalProduct(G.N.P.)

- IsthesumtotalofG.D.P.andthedifferencebetweenincomeinflow(revenue comingintothecountryfromoutside)andincomeoutflow(moneygoingoutof thecountrybyforeigninvestors).
- Itrepresentsthetotalincomeearnedwithinthecountryandfromabroad.

PerCapitaIncome

- IstheGrossNationalIncome(intermsofrevenue)dividedbythenumberofpeople livinginthecountry.
- Itisnotagoodmeasureoftheeconomicwell-beingofthepeoplebecauseofthe unevendistributionofincomeamongthem.

ContributionofAgriculturetoNationalDevelopment

- Theinteractionbetweenhouseholdandthefirmgenerateincomewhichisused tofinancefurtherexpansionofthefirms.
- Thiscreatesmoreemploymentandrevenue.
- Thegovernmenttaxestheincometofinancenationaldevelopmentprogramm es suchas; health, education, water,energy communication.

FactorsofProduction

- Afactorofproductionisanythingthatcontributesdirectlytooutput,thatis,itisa productiveresource.
  - Productiveresourcesusuallyemployedintheproductionofgoodsandservices.

Include:

- Land
- Labour
- Capital
- Management

Land

- Asafactorofproduction,referstothenaturalcharacteristicsandpropertiesofa givenareaofland.
- Thekeyfactorhereisproductivityforexamplesoilfertility,presenceofwaterand mineralsandisalwaysfixedandhasnogeographicalmobility.

Labor

- Besidesbeingaconsumer,humanbeingsarealsoafactorofproduction.
- Theyprovidethelabourforce(humanpower)requiredintheproductionprocess.
- Labourisassessedintermsofproductivityandnotmerenumbersofworkersor labourers.
- Labourismeasuredintermsofmanhours,mandaysormanmonths.

Thelabourer'sproductivecapacitydependsonsuchfactorsas;

- age,
- health, stateofnutrition
- levelofeducation.

- Theamountofworkandtheefficiencywithwhichitisperformeddeterminesthe qualityoflabour.

Capital

- Capitalreferstoallman-madeassetsthathelplandandlabourtoproduce.
- Itiscategorizedinto: Fixed/durable;
  - Workingcapital Liquidcapital

Fixed/durable;

Capitalforexample

- machinery,
- buildings
- permanentimprovementsonlandlikefences,
- roads,
- irrigationfacilities
- water¬supplysystem.

Workingcapital;

Whichincludeconsumergoodssuchas;

- fertilizers,
- livestockfeeds, fuelinstore,
- pesticides.

Liquidcapital;

Forexample; readymoney,

- bankdeposits,
- sharesinfinancialinstitutions.

Management;

- Itisaprocessofdecisionmakinginthefarm.
- Managersusetheirknowledgeandjudgmenttodecidehowtocombinetheother threeproductiveresourcesinthebestwaypossible.
- Theymakeplans,executethemandbeartherisksorconsequenceswhichsuchplans entail.

ProductionFunction

Definition

- Productionfunctionisaphysicalrelationshipbetweeninputsandoutputsina productionprocess.
- Ittellsthequantityofoutput(product)thatmaybeexpectedfromagiven combinationofinputs.
- Productionfunctionmaybeexpressedintableformorgraphicallyasacurve.

Examples:

Feedingpigsforporkproductionatvaryinglevelsofconcentratefeed.

1.

Unitoffeed	Bodywt. Gains(kg)	Marginal products (kg)
0	212	-
10	222	10
20	238	16
30	251	13
30	261	10
50	269	8
60	275	6
70	280	5
80	283	3
90	285	2
100	286	1

TypesofProductionFunctions

- Aproductionfunctionassumesthreeformswhichmaybetreatedasdifferenttypes:
  - IncreasingReturns
  - ConstantReturns
  - Decreasing(Diminishing)Returns

IncreasingReturns

- Inthistype,eachadditionalunitofinputresultsinalargerincreaseinoutputthanthe precedingunit. Thisshowsthatresourcesareunderutilized.

ConstantReturns

- Theamountoftheproductincreasesbythesameamountforeachadditionalinput; thatisconstantreturnstoinputfactor.
- Againhereresourcesareunderutilized.

Decreasing(Diminishing)Returns

- Here,eachadditionalunitofinputresultsinasmallerincreaseinoutputthanthe precedingunit.
- Resourceuseisstretchedtothemaximum.
- Itisthemostcommonlyencounteredforminagriculturalenterprises;
- ItgivesrisetothelawofDiminishingReturns.

Examples:

- Feedingdairycowsformilkproductionwithvaryingamountsoffeed.
- Cropresponsestoapplicationofvaryingamountsoffertilizers.
- Useofvaryingunitsoflabouronfixedunitofland.

EconomicLawsandPrinciples

TheLawofDiminishingReturns

- Thelawofdiminishingreturnsstatesthat;
  ''ifsuccessiveunitsofoneinputareaddedtofixedquantitiesofotherinputsapointis eventuallyreachedwhereadditionalproduct(output)peradditionalunitofinput declines.''
- Thislawisencounteredpracticallyinallformsofagriculturalproduction.
- Itisusefulindeterminingthemostrationalandprofitablelevelofproduction.

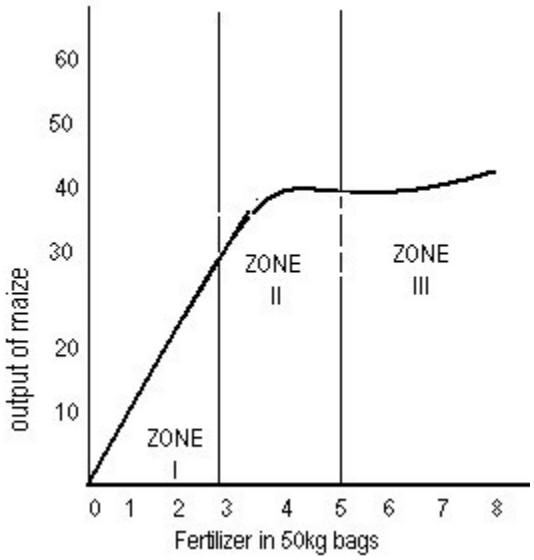
Example:

Productionofmaizeatvaryinglevelsof N.P.K. fertilizerapplicationonafixedareaofland.

UnitofNPK Fertilizer (bags)	Total PrYield souct	Marginal Products (bags)

30	10	-
60	27	17
90	42	15
120	56	14
150	63	7
180	65	3
210	65	0
240	60	-5
270	52	-8
300	42	-10

Zonesofaproductionfunctioncurves



Zonesofaproductionfunctioncurvestheseare:

- IrrationalzoneorZoneI.
- RationalzoneorZoneII
- IrrationalzoneorZoneIII.

- Thethreezonesarearrivedatbydrawingtwoperpendicularlinesthroughthe productionfunctioncurve,oneatMP=APandanotheratMP=O.
- InZoneIresourcesarenotfullyutilizedwhileinZoneIII,excessiveapplicationof resourcesleadstoproductiondeclineorloss.
- Itisnoteconomicaltoproduceattheselevels.
- InZoneIIresourcesaremaximallyutilizedresultinginmaximumproduction.
- Itisthereforeeconomical(orwise)toproduceatthislevel.

PrincipleofSubstitution

States
-’’iftheoutputinaproductionprocessisconstant,itisprofitabletosubstituteone inputfactorforanother,aslongasitischeaperthanitsnextalternative.’’

- Thisprincipleisapplicableinasituationwheremorethanonevariableinputfactors areused.
  - Forexamplefeedinghayandconcentratesformilkproduction,farmyardmanurean d phosphaticfertilizersintheproductionofmaize.
- Thebasicproblemthattheproducerwishestosolvewhentwoinputfactorsareused incombinationisinwhatproportionsmustthevariableinputsbecombinedinorderto produceataminimumcostandhenceattainmaximumprofit.
- Tosolvetheaboveproblem,theproducermustdeterminetheleastcostcombination ofinputsused.
- Theleastcostcombinationisattainedatapointwheretheˆ†Rateof Substitution(MRS)equalstheinverseofpriceratiooftheˆ†factorsinvolved.

Thatis: $x_2 = PX_1$ △

$X_1 = PX_2$ △

X_1-firstinputfactor
X_2-secondinputfactor

- △ change(increaseordecrease)

P-price(costofinputfators)

Examples:

- Producing20bagsofmaizeusingvaryingcombinationsoffarmyardmanureand phosphatefertilizers.
- Priceoffarmyardmanure(FYM)isKShs10/-perunitandthatofphosphatefertilizer isKshs50/-perunit

		△	X_1(P-fert) x_2(N-fert) $\underline{X}\underline{X}_{21}$(MRS)
	100kgunits	△ 100kg	
	I	units9.00	-
	2	4.00	5.1
	3	2.80	1.20
	4	2.40	0.40
	5	2.00	0.40
	6	1.80	0.20
	7	1.65	015
	8	155	0.10
	9	1.45	0.10
	10	1.45	0.05

Intheaboveexample,thefollowingassumptionsaremade:

- Afixedquantityofoutputistobeproduced.
- Inputfactorsincombinationsubstituteforoneanotheratvaryingrates.
- Relativepricesofinputfactorsdonotchangedrasticallyduringtheperiodof production.

NOTE

:oneinputfactorsubstitutesfortheotheratdiminishingvaryingmarginalrateofsubstitution.

PrincipleofEquimarginalReturns

- Thisprinciplestates;’’Thatthelastunitofaninputfactorspentinoneenterprise y ieldsamarginalreturnexactlyequaltothemarginalreturnearnedfromthelastunit investedineachoftheotherenterprises.’'

Example

- Ifthelastshs.100/-spentbuyingcattlefeedwillreturnmorethanshs.100/ =spenton buyingfertilizerforgrowingmaize,thenitisadvisabletopurchasemorefeeduptoa pointwherethelastshs.lOO/- spentonitwillreturnexactlythesameasthelast shs.100/- spentonfertilizers.
- Thisconceptisonlyrelevantinasituationwherefarmersdonothaveadequate

capitaltoemployinputsuptothelevelwheremarginalrevenueequalsthe marginal cost.

TheprincipalofProfitMaximization

- Theprofitisdefinedasthedifference,inmonetaryterms,betweenthetotal returns (income)andtotalcosts(expenses)inaproductionprocess.
- Profitmaximisationaimsatobtainingthehighestreturnsataminimumcost perunit ofinputfactorused.

Thiscanbedonebyconsideringtwoconcepts.

MarginalConcept

- Profitismaximisedwhenthemarginal(additionalorextra)revenue(MR)is equalto, orslightlyhigherthan,themarginalcost(Mc).
- Atthispointeveryaddedinputfactorbringsinhigherreturnsthantheexpenses incurredininvestingit.

NetRevenueConcepts

- ProfitissaidtobemaximizedinaproductionprocesswhentheNetRevenue (differencesbetweentotalrevenueandtotalcosts)isthehighestthatis; NR=TR-TC.
- Thisisarrivedatbyanalyzingthetotalcostandtotalrevenueearnedfroma particular enterpriseandthensubtractingtheformerfromthelatter.

Whencalculatingtheprofitusingwhateverconcept,thefollowing assumptionsaremade:

- Costofinputs(suchasfertilizers,labour)remainsconstantduringtheperiod of production.

Priceoftheproduce(product)remainsunchanged.

- Fixedcostsareignoredthatisonlyvaryingcostsdirectlyinvolvedareconsidered.

FarmPlanning

- Planningistheprocessofestablishingtheorganizationalobjectivesanddefiningthe meansofachievingthem.

Factorstoconsiderindrawingafarmplan.

Sizeofthefarm.

- Environmentalfactors.
- Thecurrenttrendsinlabourmarkets.
- Farmer'sobjectivesandpreferences.
- Possibleproductionenterprises.
- Existingmarketconditionsandpricetrends.
- Availabilityandcostoffarminputs.
- Governmentregulations/policy.
- Security.
- Communicationandtransportfacilities

FarmBudgeting

- Farmbudgetingistheprocessofestimatingthefutureoutcomesofaproposedfarm plan,
- Thatis;thefutureincomesandexpensesofafarmplan.

ImportanceofFarmBudgeting

- Ithelpsthefarmindecisionmaking.
- Ithelpsthefarmertopredictfuture
- returnsthatisplanningahead.
- Ithelpsthefarmertoavoidincurringlossesbyinvestinginlessprofitableenterprises.
- Ithelpsthefarmertosecureloansfromfinancialinstitutionssuchas Agricultural FinanceCorporationandcommercialbanks.
- Itensuresaperiodicanalysisofthefarmbusiness.
- Itactsasarecordwhichcanbeusedforfuturereference.
- Itpinpointsstrengthsorweaknessesinfarmoperations.

TypesofBudgets

PartialBudget

- Itrepresentsfinancialeffectsonminorchangesinafarmorganisation.
- Itisnecessarywhenafarmerwantstoreplaceorreduceenterprise.

CompleteBudget

- Acompletebudgetisnecessarywhenthefarmerwantstostartanewbusiness whereboththeVariablecostsandthefixedcostsarelikelytobeaffected.
- Itinvolvesamajorchangeorreorganizationinthefarmbusiness.

AgriculturalServicesAvailabletotheFarmer:

- Agriculturalproductionefficiencyisgreatlyincreasedbyservicesrendered tothe farmingcommunitiesby;
  - Governmentinstitutions
  - Non-governmentalorganizations.

Someoftheseservicesare:

- ExtensionandTraining:
- BankingServices:
- Credit:

ExtensionandTraining:

- Inthefieldandinfarmer'strainingcentres.

BankingServices:

- Theseenablesthefarmerstosavesomeoftheirfarmincomeandinvestthemin futureprojects.

Credit:

- Creditisafinancialassistanceadvancedtoagriculturalfarmerstofinancetheirfarm projectsandrepayitwithinterest.
- Itisaborrowedresource.

TypesofCredit

- Creditiscategorisedaccordingto;
  - Timeofrepayment
  - Thetypesofprojectstobefinanced.

Examplesare:

Short-termCredit

- Repayablewithinoneyearandisadvancedforthepurchaseof;
  - seeds,
  - fertilizers,
  - animalfeeds.

Medium-termCredit

- Repayablewithin2-5yearsandisusedtofinanceprojectssuchas;
  - fencingmaterials,
  - purchaseoflivestock,
- lightfarmequipment.

Long-termCredit

- Repayableperiodisupto15yearsandevenmore.
- Itisgivenforthelong-termordurableprojectssuchas;
    - purchaseofland,
    - constructionofsoilandwaterconservationstructures,
    - farmbuildings,
    - irrigationprojectsforperennialcashcropsforexample;
        - coffee,
- farmmachinery
- implements.

SourcesofCredit

- Co-operativesocietiesandunions.
- Cropboards.
- Commercialbanks.
- AgriculturalFinanceCorporation.
- Insurancecompanies.
- Individualmoneylenders.
- Settlementfundtrustee.

ArtificialInseminationServices:

- Providesfarmerswithsemenfromimprovedorsuperiorbullstoimproveth eir livestockherdsthroughcontrolledbreeding.

AgriculturalResearchOrganization

- Thesedevelopandpassontofarmers,improvedproductiontechniquesas wellas cropandlivestockspecieswithbetterperformanceindifferentecologicalz ones.

MarketingOutlets

- Theseareagenciesthatensureeffectiveandefficientconveyanceoffarm produceto pointsofprocessingandconsumption.
- Theyarelargelycropmarketingboardsorcorporationsandcooperativesocie ties.

VeterinaryServices

- Inthefieldareveterinaryofficerswhohelpthefarmerintreatingandcontrol ling livestockdiseasesandparasites.

FarmInputSupplies

- Farmersareabletoobtaintheirfarminputsfromorganizationssuchasco-operatives andprivatecompanies.

- Theseorganizationsbringinputsclosertothefarmersforexample KenyaFarmers Associationandprivateagro¬vets.

TractorHireServices

- Thisinvolveshiringoftractorsandmachineryatacostbyfarmerswhoarenot privilegedtoowntheirown.

Sources

- MinistryofAgriculture
- Privatecontractors.
- Individualfarmers.
- Otherserviceproviders.

RisksandUncertaintiesinFarming

- Uncertainty-isthestateofnotknowingaboutfutureeventsoroutcomes.
- Risks-isthedifference(divergence)betweentheexpectedandtheactual outcome.

TypesofRisksandUncertainties

- Fluctuationofcommodityprices.
- Physicalyielduncertainty.
- Ownershipuncertainty.
- Outbreakofpestsanddiseases.
- Sicknessandinjury.
- Newproductiontechnique.
- Obsolescenceforexamplemachinerymaybecomeoutdatedorobsolete within a shorttime.
- Deathofeitherfarmerorlivestock.
- Naturalcatastrophiessuchas;
  - floods,
  - drought,
  - earthquakes,
  - stormandstrongwindswhichmaydestroycropsorkilltheanimals.

WaysinWhichFarmersAdjusttoRisksandUncertainties

- Diversification.
- Selectingmorecertainenterprises.
- Contracting.
- Insurance.
- Inputrationing.
- Flexibilityinproductionmethods.
- Adoptingmodernmethodsofproduction.

AgriculturalEconomicsIV:

(FarmAccounts)

Introduction

- Farmingisabusinesshencefinancialrecordsareimportant.
- Financialandphysicalrecordsifaccuratelykeptinthefarmserveasveryimportant toolsindecision-making.

Importanceofkeepingfarmaccounts:

i. Tosecureloans– financialrecordsareconsideredbycreditorstodeterminewhethera farmiscreditworthyornot. ii. Tomakesoundmanagementdecisions- therecordsprovidedatathathelpthefarmto planandmakedecisions. iii. Todeterminewhetherthefarmismakingprofit– theyindicatewhetherthefarmis runningataprofitorloss

iv. Topreparefarmbudgets- ithelpsthefarmertodrawestimatesforfutureincomeand expenditure(inpreparingpartialbudget.

v. Evaluatingassetsandliabilities.- ithelpsinassessingthefarmsabilitytopaywhatit owesothers.

vi. Assessingthetaxchargeable- ithelpsthefarmertoestimatetheamountoftaxthat canbechargedforfairtaxing.

- Thefinancialrecordsarekeptinseveralbooksandstatementsasfollows:

FinancialDocuments

Theyinclude:

- Invoices.
- Receipts.
- Deliverynotes
- Purchaserecords.

1.AnInvoice

- Commonlyusedwhengoodsaredeliveredoncredit.
- Thisisadocumentissuedbythesellertothebuyerforgoodstakenoncredit, and paymenttobedonelater.
- Theoriginalisgiventothebuyeranddu plicateretainedbysellerforbothparties to havedetailsofthetransactions.
- Itspecifiestheperiodwithinwhichpaymentshouldbemadeandlistsanytrade discountsallowed.
- It’sthefirstaccountingdocumentinacredittransaction.

- Invoicescanbepreprintedboundtogethertoformabook

Theinvoiceshowsthefollowingdetails:

- Thebuyerandseller(peopleinvolvedinthetransaction).
- Dateoftransaction.
- Amountinvolved(typeandquantitiesofgoodsdelivered.)
- Priceperunitofthegoods.
- Amountofmoneyinvolved
- Invoiceserialnumber.
- Termsofpayments.

2.AReceipt

- Thisisadocumentissuedbythesellertothebuyerwhencashpaymentforgoods deliveredismade.
- Theyarepre-printedandwritteninduplicateortriplicate.Areceiptshouldbestamped withtheofficialrubberstampofthefirm. Itshowsthefollowing:
- Thebuyerandtheseller.
- Dateoftransaction.
- Amountinvolved.
- Serialnumber
- Goodsorservicesbeingpaidfor
- Signatureofthepersonacceptingthereceipt.
- Theforminwhichpaymentismadeiechequeorcash.

3.DeliveryNote

- Itisadocumentwhichshowsthatthegoodshavebeendelivered.
- Thereceiververifiesthegoodsandthensignsonthedeliverynote.
- Deliverynotesmaybepre-printedandwritteninduplicateortriplicatedependingon thenatureofthebusiness.
- Itservesasevidencethatgoodshavebeenphysicallydelivered.

Features:

Thedeliverynoteshowsthefollowing:

- Goodsdeliveredasperorder.
- Qualityorconditioninwhichthegoodsarereceived.
- Peopleinvolvedinthetransaction.
- Dateofdelivery.
- Mannerormethodofdelivery.
- Referencenumberofthepurchaseorder
- Quantityandtypeofgoodsdelivered.
- Signatureofthepersonreceiving

4.Purchaseorder

- Itisarequesttoatraderorbusinessfirmtosupplygoodsoncredit.Itmaybe acceptedorrejectedbythesupplier.

- It’sabindingcontractdocumentbetweenbuyerandsupplier.
- Itmaybeinpre-printedformorordinarybusinessletter.
- CommonlyusedpurchaseorderistheLPOLocalpurchaseorder.
- Localpurchaseordernumberisquotedwhenpreparinganinvoiceormayattacha copyoftheLPO.

Featuresofapurchaseorder

- Thefirmorpersonrequestingforgoods
- Thepersonorfirmfromwherethegoodsarebeingrequested
- Quantity,qualityandtypeofgoodsbeingrequested.
- Thepersonwhoauthorizedtheordertomakeitvalidandtocontrolexpenditure. Purchaseorderserialnumber.

5.Statements

- Referstoasummaryofallinvoicesofvariouscustomerssenttothecustomersfor paymentattheendofthemonth.
- It’sasummaryoftransactionswithinagivenperiod.
- Therearetwotypesofstatementsi)statementofaccountandii)bankstatement
- Bankstatementifafinancialdocumentsentbythebanktothefarmeronmonthly basistoshowthepositionofthebankaccountbytheendofthemonth.
- Statementofaccountisadocumentsenttothebuyerbythesellerasareminderto informhim/herwhathe/sheowestheseller.

Features

- Dateoftheinvoices
- Thenumberofthevoices
- Theamountundertheheadingdebit

Ifduringthemonthanypaymentismade,itsaccountedforunderheadingcredit.The differencebetweendebitandcreditisenteredunderheadingbalance.

Booksofaccount

Thisarebooksthatdealwithspecificareasofaccount.Theyinclude:

- Ledger
- Inventory
- Cashbook
- Journal

Ledger:

- It’sthemainbookusedtokeepfinancialrecords.Itcontainsdetailsofallthethingsin thebusinessownedbythefarmer.
- Itisaprinciplebookofaccountsinwhichentriescontainedinalltheotherbooksare entered.

- Isabookwhichcontainsindividualaccounts.Anaccountisapageorasectioninthe ledgergiventoaperson/firmandonwhichallthebusinesstransactionsrelatingto thatperson/firmareentered.
- Itisastorehouseofallthetransactions.
- Aledgerindicatesdetailsofwhatthefarmerorthebusinessfirmowns.It alsoindicateswhatthebusinesshastopayouttootherbusiness establishmentsandtheexpectedreceiptstothebusinessfromother businessestablishments.
- Aledgerindicatesdetailsofwhatthefarmerorthebusinessfirmowns.It alsoindicateswhatthebusinesshastopayouttootherbusiness establishmentsandtheexpectedreceiptstothebusinessfromother businessestablishments.
- Eachpageisnumberedandverticallydividedintotwoequalpartsdrawnintheshape ofletterT:namelycreditanddebit.Thetitleoftheaccountisindicatedatthetop.Ie Poultry-Commerciallayers.Debitsarewrittenonthelefthandsidewhilecreditonthe righthandside.
- Eachpartisfurthersub-dividedintofoursections.Datecolumn,particularscolumn, foliocolumnandamountreceivedorspendout.

Ledgercolumns

Datecolumn

It’swherethedateofthetransactionisrecorded.Itcontainstwosub-columns. Thefirstisforthemonthandthesecondforthedate/dayofthemonth. Accountingyeariswrittenatthetopofthedatecolumn.

Particularscolumn

Itcontainsthedescriptionofthetransactions(what’spurchasedandwhatissold) forbothcreditanddebitcolumns.ieboughtlayersmash5bagsorsold30 traysofeggs.

Foliocolumn

Afolioisapageinbookkeeping.Eachpageintheledgerisnumbered,andsoeach accountisonitsownnumberedpage(folio).Enterthenumberofthepageon theaccountinthefoliocolumn.Folionumbershelpsintrackingtheentries.

Entriesinafolio.

Debit(DR)–thefollowingdetailsareenteredinthedebitcolumn

- Dateoftransaction
- Theitemintheparticulars
- Folionumberintheaccountfoliocolumn.
- Theamountofmoneyintheamountcolumn.

Credit(CR)-thefollowingdetailsareenteredinthecreditcolumn

- Dateoftransaction
- Theitemintheparticulars
- Folionumberintheaccountfoliocolumn
- Theamountofmoneyreceivedintheamountscolumn.

- Cashathandintheparticularscolumn.

NB:Balancesofthedebtorandcreditorsaccountscanbeusedtodeterminehow muchthebusinessowestoitscreditorsforgoodboughtoncredit.Accounting balanceisthemathematicaldifferencebetweenthetotalsofthedebitand creditsidesofanaccount.Ifthedebitsidetotalismorethanthecreditside thetotaldifferenceisknownasdebitdifferenceandcreditdifferenceifcredit sidetotalexceedsdebittotals.
Togetaccountingbalancesubtractthetotalofthesmallersidefromthetotal ofthebiggerside.Insertthefigureonthesidewiththesmallertotalasa balancecarrieddown.Thismakesthetwosidesequal.Belowthetotalswrite theaccountbalanceontheoppositesideasbalancebroughtdown.

CashBook:

- Itisabookwheretransactionsinvolvingcashorchequepaymentsare recorded.
- Cashincludesallformsofmoney,cheques,moneyorders,andbankdrafts. ItinvolvescashorChequepaymentsandreceipts.
- Itisdividedintotwoparts-debitandcreditside.
- AllthereceiptsofcashorChequearerecordedonthedebit(assalesand receipts)andallpaymentsarerecordedonthecreditside(aspurchasesand expenses).
- Cashbookisaformofledgeraccountoraportionofledgerbounddifferently whereallreceiptandpaymentsofmoneyarerecorded.
- Thetwomajorcolumnsarefurthersubdividedsubcolumns;dateofpayment, particulars/details,amount(Shs/CentsorCash/Bank).

Typesofcashbooks

- Singlecolumncashbook- ithasonlyonecolumnforamount.Ithascashaccountand bankaccountondifferentpages.
- Two-columncashbook- hasgottwocolumnsfortheamountssideonbothdebitand credit.Columnforcashandthatofbank
- Threecolumncashbook– hasgotthreecolumnsfortheamountonbothdebitand credit:discountreceivedorallowed,cashandbank
- Pettycashbook
- Analysiscashbook.

Example:Enterthefollowingentriesinthecashbook.

- 1.7.05-Receivedshs.2,000fromNdetebycheque.
- 2.7.05-BoughtD.A.P.fertilizerandpaidchequeofshs.5,000.
- 3.7.05-Receivedshs.5,000cashfromNgala.
- 4.7.05-PaidwaterbillforShs.400incash.
- 9.7.05-Paidtelephonebillof1,500bycheque. 11.7.05-Depositedshs.2,000inthebank.
- 20.7.05-Withdrewshs.2,000fromthebankforhomeuse.

CashBookrecord

SalesAndReceipts2005				Purchasesadandexpense2005			
Date	Details	Cash	Bank	Date	Details	Cash	Bank
1.7.05 3.7.05 11.7.05	R eceivedfromNdete Rec eivedfromNgala Cash	 5,00 0 2,00 0	2,000	2 .7.05 4 .7.05 9.7.0 5 20. 7.0	D.A.P Waterbill Telephonebill Cash	 400 500	5,000 2,000

5

Inventory

- It’sabookwhichcontainsalltheentriesofwhatthebusinessfirmorthefarm owns (assets).
  - Assetsquantitiesandconditionsarerecorded.
  - Assetsarevaluedatthebeginningorattheendoftheaccountingperiod.
  - Inventoriesaredrawnattheendoratthebeginningoftheaccountingperio d.
- Itprovidesinformationusedduringvaluationordrawingupofthebalances heetand profitandlossaccount.
- Assetseitherappreciateordepreciateinvaluethereforemakinginformati oninthe inventorytochange.
- Appreciationistheincreaseinvalueduetobirthofyoungstock,orpurchase ofnew items
- Depreciationisthedecreaseinvalueduetoplantdeath,animallossorwear andtear ofmachineriesandtools/equipment/farmbuildings.
- Writtenoffitemsaredeletedintheinventory.
- Inputsstoredarerecordedinastore’sinventoryinordertocontroltheissui ngoutof stock.
- Therearedifferentinventoriesiecrops,livestock.Farmmachineryandequip ment

Purposesoftheinventory

- Ithelpsindrawingupabalancesheet
- Helpsinpreparingaprofitandlossaccount
- Providesinformationforvaluationofthebusiness

Categoriesofinventories

i. Consumablesgoodsinventory-iepesticides,animalfeeds,fertilizers,drugs andconstructionmaterials.Havetwomaincolumnsreceiptsandissues
ii. Permanentgoodsinventory-iemachinery,tools&equipment.

Informationmustbeenteredinaninventorybookwheneveritemsarereceivedor issued.

Journals

- It’sabookwhereallunclassifiedtransactionsareentered.
- It’salsoadiary/ logbookthatcontainsdailyrecordingofalltransactionsinthefarm.
- Italsocontainsmiscellaneoustransactionsthatcannotbeenteredinbook sie purchasebooksandreturnbooksconsideredtobesubsidiarybooks.

Informationrecordedinthejournal

- Purchaseoncreditofcapitalequipment- thingsboughtforusenottoresale
- Thesaleoncreditofcapitalequipment
- Rectificationoferrorsinbooks,newentries,correctionorcancellingold entries madeinjournals.
- Transfersfromoneaccounttoanotherintheledger.Informationonthe purchases, salesreturns,stocksandothersinthejournalispostedintheledgerand usedto drawthetradingaccount.Informationonthedepreciationofassetsistr ansferred fromthejournaltotheprofitandlossaccount.Theseentriesareknowna sclosing entries.
- Openingentriesinnewbooks.Balancesarejournalizedfirst,hencerefe rredtoas openingentries.
- Initialentryforthetransactioninvolvingtheissuesofsharesinpartners hip,orjoint stockownership,oracceptanceofnewpartnersorthewindingupofthe partnership.

Informationonthejournalpage

- Dateoftransaction
- Nameoftheaccounttobedebited
- Nameoftheaccounttobecredited
- Amountofmoneytransacted
- Details/ abriefdescriptionofthetransactione.g.dateandnatureoftransaction

Stepsinenteringtheinformationinthejournal

- Entertheaccounttodebited,first
- Entertheinformationinthefoliocolumnafterthetransactionispostedtoth ejournal e.g.1.1–thefolionumberrelatingtothepostedentry.1.2- folionumbershowingthat theentryhasbeenpostedtoavoiddoubleposting.
- Thecolumns(DR)and(CR)shouldbeinthejournalasamatterofprocedure.

Fi
n anc Thetransactionsshouldhavevouchersorsupportingdocuments ial Statement
s .

1. Cash Account Sheet/Analysis

- It'stheprocedureofkeepinganaccountbookinwhichalltheindividualtransactions arerecordedandanalyzed.
- Itinvolvestherecordingofsalesandreceipts,purchasesandexpense.Itshastwo columns:salesandreceiptsandpurchasesandexpenses.
- Itresemblescashbookintermsoftheentriesofthereceiptsandpaymentshowever thedifferenceisthatincashanalysistheanalysiscolumnsareincluded.
- Eachsaleorpurchaseisenteredtwice,onceinthetotalcolumnandonceinthe analysiscolumn.
- Thesumofalltheentriesinthetotalcolumnshouldalwaysequalthesumoftheentriesinalltheothercolumns.
- Thecashanalysisaccountsheetisgivenbelow.

2. The Balance Sheet

- Itisafinancialstatementofassetsandliabilitiesrecordedonagivendate.
- Itshowsthefinancialpositionofafarmbusinessataglance(snapshot).It'sa statementshowingwhatthefarmbusinessisworth.Itspreparedattheendofthe tradingperiodoraccountingperiod,normallyoneyear.
- Itcontainstwomaincolumns:assetsandliabilities.Assetsarerecordedon oneside andliabilitiesontheotherside.
- Thetotalsofthetwosidesofthebalancesheetmustalwaysbeequal.Totalofassets mustbeequaltothetotaloffliabilities.Thebottomlinefigures(grandtotal) mustbe onthesamelevelandhaveadoubleunderline.

Abalancesheetshouldhavethefollowingdetails

- NameofthebusinessieMukumufarmenterprise
- NameofthestatementieBalancesheet
- Dateatwhichitispreparedie31st December2004.Dateisimportantbecause assets,capitalandliabilitieskeeponchangingastransactionstakeplaceandsoa balancesheetcanonlybetrueataspecifictime.

NB:

- Abusinessissolventwhentheassetsaremorethanliabilities.Itsinsolvent when liabilitiesaremorethanassets.
- Itemsofthebalancesheet(assetsandliabilities)arearrangedstartingwiththe mostliquid(current)tothemostpermanent.
  (orderofpermanencyvsorderof liquidity)

Assetsareitemsownedbythefarmer,

Theseinclude:

- Property(money,goodsandbuildings).
- Debtsreceivablefromotherpeople.
- Goodsandservicespaidforinadvance.

Assetscanbedividedintotwo:

- Fixedassets:assetsofpermanentnatureandnoteasilyconvertedintocash.Ieland, buildingsandmachinery.
- Currentassets:assetswhichcanbeeasilyconvertedintocash.Theyarelesspermanentproperty.iecropsinstoreandcashinbank.

- Liabilitiesareclaimstothefarmer'spropertysuchasbankoverdraftand debtspayable.

Theyaredividedinto:

- Currentliabilities-debtswhichmustbepaidwithinashorttime.
- Longtermliabilities-debtswhicharepayableovermanyyearsoroveralongperiod.

3.ProfitandLossAccount/Tradingaccount

- It’safinancialstatementshowingwhetherthebusinessmadeaprofitoraloss.
- Preparedattheendofacalendaryear.
- Ithastwomainsides:income(salesmade)andexpenditureside(expensesincurred).
- Itisafinalaccountwhichsummarizesthesaleandreceipts(incomeflowinginthe business)andthepurchasesandexpenses(flowingoutofthebusiness).
- Italsoshowstheopeningandclosingvaluations,debtspayableandreceivable.
    - oIncomeside

- Containsthefollowingdetails:

- Closingvaluation-alltheassetsinthefarm/ businessbytheendofthefinancial year,thisgivesthetotalvalueofthefarmorthebusiness.
- Salesandreceipts- alltheproduceitemssoldfromthefarmorbusinessand anydebtsreceivablebytheendofthefinancialyear.

- oTheexpenditureside

- Itcontainsthefollowingdetails
  - oOpeningvaluation-allassetsinthefirm/businessbythebeginningofa financial year.Itgivesthevalueofthefarmatthebeginningoftheyear.It’sthecap ital availableforinvestmentinthefollowingyear.
  - oPurchasesandexpenses- includeitemsboughtanddebtspayabletothe firm/businessforthefinancialyear.

- Theexpenses,purchase,debtspayableandopeningvaluationsareentere dontheleft handsideofthepageoftheaccountcolumnswhileallsales,receipts,closin g valuationsanddebtsreceivableareenteredontherighthandsideofthepa geofthe accountcolumns.

- Theclosingvaluationofthepreviousaccountingperiodbecomestheopeni ng valuationforthecurrentaccountingperiod.

- Whenthetotalsoftheopeningvaluation,purchasesandexpensesincludin gdebts payableisgreaterthanthesumoftheclosingvaluation,salesandreceiptsa nddebts receivablethenthebusinesshasmadeaLoss.

- Ifthetotalsofthe,openingvaluation,purchases,expenses,anddebtspaya bleisless thantheclosingvaluationsalesandreceiptsanddebtsreceivable,thebusi nesshas madeaProfit.

- Netprofit=(closingvaluation+salesandreceipts)- (openingvaluation+purchases andexpenses)

- Tocalculateprofitorloss,account,valuationisdonebyhavinganinventory ofallthe assets.

- Valuationoftheassetsisdeterminedbymarketpriceandcostofproductio nfor machineryandbuildingsasdepreciationfactor,isattached.

Formatofabalancesheet

BalancesheetofKatiloschoolas31-12-2009

Assets	Shs..	Cts	Liabilities	Shs.	Cts.
FixedAssets			Long-termLiabilities		
Land			Long-termloanforland		

Buildings F encesandotherstructures CurrentAssets Livestock Debtsreceivable Cashinbank Cashinhand Sub-total			d Loanspaya evelopment bleover15 years CurrentLiabilities- -Debtspayable -Creditsfromfriends -Short-termloans Sub-total		
Total			Total		

Format

ProfitandLossAccountofKithekoFarmat31-12-2009

SalesandReceipts	Shs.	Cts.	Purchase&Expenses	Shs.	Cts
I.Incomeduringthe 2. year Debtsreceivable 3.Closingvaluation Balance(beingaloss)			I. 2. Openingvaluation Expen ditureduringtheyear 3. DebtspayableBalance (being farmaprofitornetincome)		
TOTAL			TOTAL		

AgriculturalEconomicsV (AgriculturalMarketingandOrganizations)

Introduction

- Agriculturalmarketingisaneconomicactivitywhichinvolvesthedistributionoffarm producefromthefarmtotheconsumer.

MarketandMarketing

- Marketisaninstitutionfortheexchangeofgoodsandservicesoraplacewhere sellingandbuyingofgoodstakesplace.
- Marketingreferstotheflowofgoodsandservicesfromtheproducertotheconsumers.

MarketingFunctions

- Transportation-Movementofgoodsfromproductioncentre’stotheconsumption centre’s.

- Buying and selling- Purchase of goods from the producer to be sold to the consumer.
- Storage- Agricultural products are seasonal hence storage is necessary.
- Processing- Changing of raw form into utilisable form.
- Grading and standardization- Sorting into uniform lots of certain qualities.
- Assembling- Collecting the farm produce from the farm to the market centres.
- Collecting market information– To know the prices, supply and demand of certain commodities.
- Advertising- Making the consumers aware of the produce.
- Bearing of risks- Such as fire risk, price fluctuation.
- Financing or expenditure on other processes.
- Packaging or putting into small packs and labeling.
- Packing or putting produce In containers such as bags.

Marketing Agencies and Institutions

- Middlemen (itinerant trader)- are the people who buy from the producer and sell to other agencies.
- Wholesalers- Buy in bulk and sell to the retailers.
- Retailers- Buy from the wholesalers and sell in small units to the consumers.

Problems in Marketing Agricultural Produce

- Farm produce are bulky, that is weight and volume are high but low in monetary value thus difficult to transport.
- Most of the agricultural products are perishable for example milk, vegetables and fruits.
- Storage problems (since they are bulky they require a lot of space).
- Lack of proper transport systems since agricultural products are in the rural areas and the market are situated in urban centres.
- Lack of market information hence farmers are exploited by middlemen.

Price Theory

- Price is the amount of money paid in exchange for goods or services.
- Price theory is concerned with the determination of price of any commodity.
- Price is determined where demand for and supply of any commodity are equal to each other.

Demand

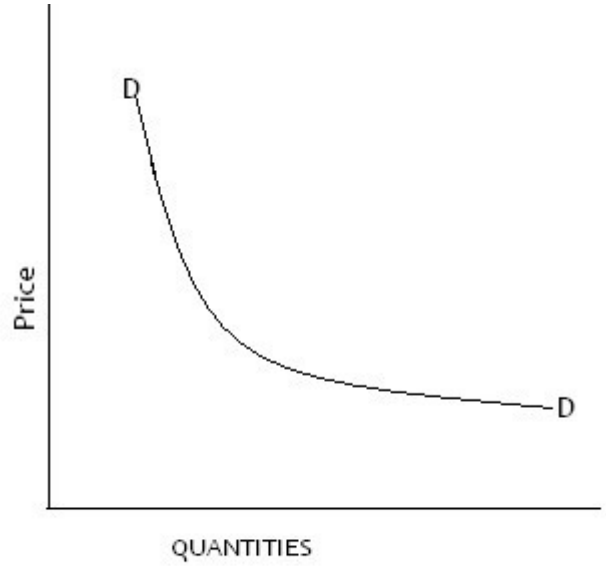
- It is the quantity of any commodity which is purchased at any price within a given time.

Thelawofdemandstatesthatquantitydemandedchangesinverselywiththe price.

DemandCurve

- Thecurveslopesfromlefttorightdownwards.
- Thismeanspeoplebuymoreatlowerpricesandviceversa.

DemandCurve



DEMAND CURVE

FactorsAffectingtheDemandofaCommodity

- Population
- Incomeoftheconsumer.
- Newinventions.
- Tasteandpreferenceoftheindividual.
- Priceofthesubstitutecommodities.
- Priceexpectations.
- Advertisement.
- Cultureandsocialvaluesoftheconsumers.
- Priceofcommoditieshavingjointdemandforexampletractorsanddiesel.

ElasticityofDemand

- Itistheresponsivenessofdemandtoachangeinprice.
- Elasticityofdemand=Percentagechangeinquantitydemanded

Percentagechangeinprice

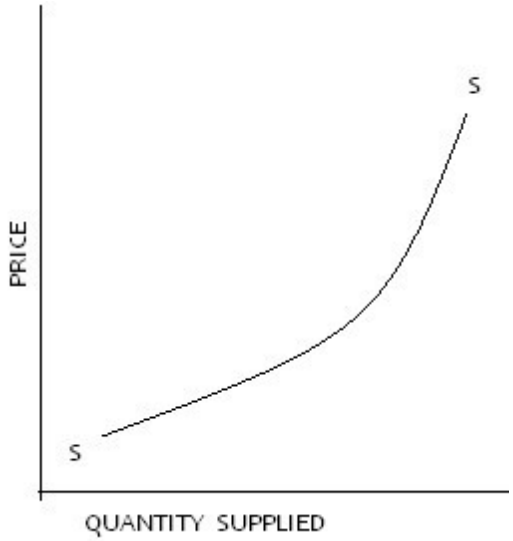
TypesofElasticityofDemand

- Elasticdemandisonewheretheratioismorethan1.
- Unitaryelasticityisonewheretheratioisequalto1.
- Inelasticdemandisonewheretheratioislessthan1.

Supply

- Supplyisthequantityofanycommoditywhichisofferedforsaleatanyprice ata giventime.
- Thelawofsupplystatesthatwhenpricerises,quantitysuppliedincreasesa ndwhen pricefallsquantitysupplieddecreases(otherfactorsheldconstant).
- Thecurverisesfromlefttorightupwards.
- Thismeansthatpeoplearewillingtooffermoreforsaleathigherprices.

SUPPLYCURVE



SUPPLYCURVE

FactorsAffectingSupplyofaCommodity

- Numberofsellers
- Priceofsubstitutecommodities.
- Newtechnology.
- Priceexpectation.
- Peaceandsecurity.
- Weatherconditions.
- Policyofthegovernment.
- Costofproductionofthecommodities.

ElasticityofSupply

Thi sreferstotherateatwhichquantitysuppliedchangesduetoachangeinpricelevel .

..ElasticityofSupply=PercePenrtcaengetagcheangcheiangenPricinequantitysupplied

TypeofElasticityofSupply

- Elasticsupplyonewheretheratioismorethan1.
- Unitaryelasticityofsupplyisonewheretheratioisequalto1.
- Inelasticsupplyisonewheretheratioislessthan1.

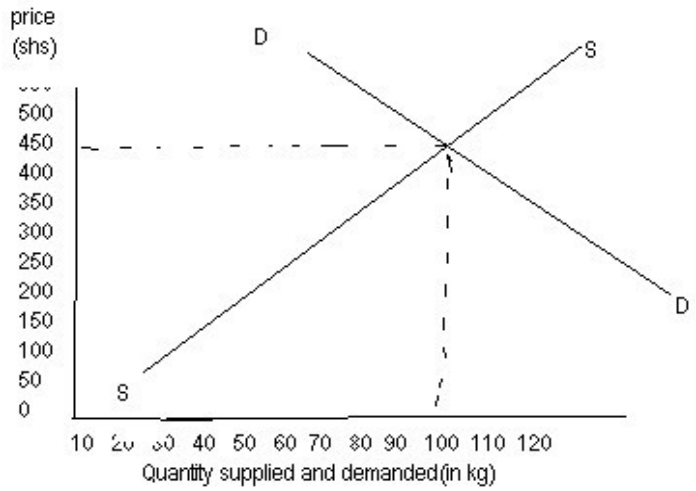
- Oneoftheproblemsofagriculturalproduceisthatsupplydoesnotreadilyadjustto pricechanges.

EquilibriumPrice

- Isthepriceatwhichdemandandsupplyareequal.
- Thatmeanswhateverisofferedforsaleatthemarketisbought.
- Inthegraphbelow,thequantitysuppliedanddemandedareequalatapriceofShs.300andquantityof80kg.

- Atthispointthepriceishigherthanshs.300thenthesupplywillbegreaterthan demandandtherewillbesurplushencepricewillfall.

- If,ontheotherhand,thepriceislessthanshs.300demandwillbegreaterthansupply
  henceshortageandriseinprice.



AgriculturalOrganization

- Agriculturalorganizationsareagencieswhich,throughtheiractivities,promote agriculturaldevelopment.
- Theseorganizationsareco-operativesandstatutoryboards.

Co-operatives

- Aco-operativeisanorganisationofpeoplewithacommonaimofpoolingtheir

resourcestoachievetheirobjectives.

FunctionsofCo-operatives

Aco-operativesocietycarriesoutthefollowingfunctions:

- Collectingandassemblingmembers'produce.
- Processingthefarmproduceaftercollection.
- Transportationofmembers'producetomarketpoints.
- Negotiationoffairpriceswiththepurchasingagenciesforthemembers'produce.
- Purchaseanddistributiontomembersoffarminputs.
- Storageofmembers'producebeforetransmissiontomarketpoints.
- Provisionofcreditfacilitiestomembersoneasyterms.
- Trainingandeducationofmembersonimprovedfarmingtechniques.
- Offeringfarmmachineryservicestotheirmembersonhiretermsforfarmoperations.
- Co-operativesmayinvestinotherviableventuresandtheprofitsrealisedaresharedamongmembersinformofdividendsorbonuses.

FormationandStructureofCo-operatives

Theformationofaco-operativetakesthefollowingstages:

- Individualswithcommoninterestcollecttogethertoformaprimaryco-operative society
- Atleastten(10)membersqualifyforregistration.
- Eachprimaryco-operativesocietyelecttheirofficebearersconsistingofchairman, secretaryandtreasurer.
- Severalprimaryco-operativesocietiesareusuallyamalgamatedtoformadistrictcooperative union.
- Tertiaryco-operativeunionsarenation¬wideorganizationstowhichthesecondaryco-operativeunionsareaffiliated.
- ExamplesareKenyaPlantersCo-operativeUnion,KenyaFarmersUnion,KenyaCooperativeCreameries,Co-operativeBankofKenya,etc.
- Apexorganizations.ThisisrepresentedinKenyabyKenyaNationalFederationofCooperativeswhichisanaffiliateoftheInternationalCo-operativeAlliance.

ProblemsFacingCo-operatives

Co-operativesencounterthefollowingproblemsintheiroperations:

- Managerialproblemsarisingfrom:

- Financialmismanagementduetopooraccounting.
  - Corruptionandmisappropriationofco¬operativeresourcesbythepersonnelinthe system.
  - Lackofadvisoryservicesontechnicaloperations.
  - Inabilitytomeetthesetobligationsofprovidingcreditfacilitiesdueto malpractices.
- Thenatureofagriculturalproductsandassociatedproblems.
  - Bulkinesshencedifficultiesintransportationandstorage.
  - Perishabilityofproducehencedifficulttosustainquality.
- Inadequatecapitaltoinvestintheco¬operativeundertakings.
- Transportproblemsduetopoorroads.
  - Thishampersthepproducegettingtothemarketpointsintime.

StatutoryBoards

- AstatutoryboardisanorganizationestablishedbyanActofParliamentandcharged withtherunningormanagingofacertainindustrywithinthegovernmentsector.

MarketingBoards

- Someofthestatutoryboardsarechargedwiththemarketingofcertainfarmproduce andarethuscalledmarketingboards.
- ExamplesaretheCoffeeBoard,PyrethrumBoard,CottonSeedandLintMarketing Boa rd,TeaBoards,NationalCerealsandProduceBoard,KenyaMeatCommission,the DairyBoardofKenyaandothers.
- Theirmarketingfunctionsaretolookformarketandbetterprices.

ResearchOrganization

- Thesearereasearchcentreswhichamongotherthings,carryoutresearchandtrialson:
- Developmentofnewvarietiesandcultivarsofcrops.
- Breedingdiseaseandpestresistantvarietiesofcropsandtypesofanimals.
- Adaptationsofcropandlivestockspeciestoecologicalconditionsofcertainareas.
- Useoffertilizersandpesticidesoncropsinspecificareas.
- Developmentofearlymaturingandhighyieldingspecies.
- Soiltestingandcropanalysis.Advisoryservicesofagro-economicaspects.

OtherOrganizations

KenyaNationalFarmers'Unionnegotiatesfor:

- Reasonableandaffordablepricesoffarminputs.

- Betterpricesforfarmproduce.
- Bettercreditfacilities.
- Bettercontrolofdiseasesandpest.

AgriculturalSocietyofKenya

- Organizesagriculturalshowsinthecountry.
- Encouragesimprovementoflivestockthroughexhibitionsandeducatingfarmers
- Organizestherunningofyoungfarmers'clubs.
- Organizesandfinancestheploughingcontestsduringwhichfarmerslearn the moderntechniquesofseedbedpreparation.
- Publish"KenyaFarmers"magazines.

YoungFarmersand4-KClubs.

Thesearestudentorganizationswhoseobjectivesare:

- Toexposetheyoungstudentsandencouragethemtoappreciateagriculturea sa professionintheircareer.
- Toencouragetheyouthtodevelopleadershipqualitiesthroughassignment ofsmall farmingprojects.
- Organizingstudentsexchangeprogrammeswithotherclubmembersboth locallyand abroad.
- Todevelopbetterfarmingskillsthroughjudgingcompetitions,annualrallies and camps.

AgriculturalBasedWomenGroups

- Thesareself-helpgroupswhoseobjectiveistoupliftheeconomicstatusoftheir membersbycarryingoutagriculturalrelatedactivities.

Theirsuccessdependsonthefollowingfactors:

- Commitmentoftheirleaders.
- Motivationofthemembers.
- Sacrificeforeachother.

Agroforestry

Introduction

InKenyalanduseischangingfromextensivemethodsoffarmingtomoreproductive andsustainableintensivemethods.
Agroforestryisamethodoffarmingwhichhasbecomeincreasinglyimportant.

Definition

Thisisthepracticeofintegratingavarietyoflanduse
Itcombinestreegrowing,pastureandcropproductionpracticeonthesamepieceof landtoimprovetheoutputoftheland.

FormsofAgroforestry

Agroforestry;

Itisacombinationoftrees/shrubsandcropsinagriculturalproduction.

Silvopastoral:

Itisacombinationofgrowingtree/shrubs,pastoralandkeepingoflivestock.

Agrosilvopastoral:

Itisacombinationofgrowingtrees/shrubs,animals,pastures,andcrops.

ImportanceofAgroforestry

Environmentalprotection.
Sourceofincome.
Afforestationfortimberproduction.
Maintenanceofsoilfertility.
Aestheticvalue.
Laboursavinginfirewoodcollection.
Sourceoffoodandfeed.
Sourceoffuelwood.

ImportantTreesandShrubsforParticularPurposes

EucalyptusSpp;

Timber,
Beeforage,
Fuelwood,
Medicinal,
Productionofessentialoils.

AcaciaSpp;

Leavesandpodseatenbyanimals,
Provisionofshade.

Cajanuscajan(pigeonpeas);

Proteinousfeedforhuman, Usedasfodder
Firewood.

- Crotonmegalocarpus(croton);
  - Fuelwoodtimberforpoles
  - Handlesforhandtools.
- Erythrinaabyssinica(flametree);
  - Woodcarvings,
  - Beeforage,
  - Nitrogenfixation
  - Medicinal.
- Markhamialutea(markhamiatree)¬;
  - Timberforconstruction,
  - Shade,
  - Soilprotection,
  - Beeforage.
- Grevillearobusta(silkyoak.)
  - Timber,
  - Fuelwood,
  - Fodder,
  - Beeforage,
  - Soilprotection,
  - Windbreaker
  - Shade.
- Sesbaniasesban(sesbania);
  - Fodder,
  - Nitrogenfixation,
  - Shade,
  - Fuelwood.
- Calliandracalothyrsus(calliandra);
  - Fuelwood,
  - Fodder,
  - Nitrogenfixation,
  - Shade,
  - Beeforage.
- Perseaamerican(avocado);
  - Fodder,
  - Fruitproduction,
  - Shade,
  - Fuelwood.
- Mangiferaindica(mango);
  - Fruitproduction,
  - Shadetrees,
  - Windbreak,
  - Soilprotection,
  - Fuelwood.

CharacteristicsofAgroforestryTreeSpecies:

- Fastgrowthrate.
- Deeprooted.
- Nitrogenfixationability.
- By-productproductionability.
- Bemultipurposeinnature.
- Shouldnotpossesscompetitiveabilitywithmaincrop..
- Havecoppicingandloppingability.
- Haveappropriatecanopy-shouldnotshadeothers.
- Nutritiousandpalatable.

TreesandShrubstoAvoidatCertainSitesandReasons

- EucalyptusSpp.-
  shouldnotbeplantednearwatersourcesbecauseitwouldabsorb thewater.
- EucalyptusSpp.-
  shouldnotbeplantedonthearablelandastherootshave allelophathiceffectsonothervegetationincludingcrops.
- Talltreesshouldnotbeplantednearfarmbuildingsbecausetheymayfall and damagingthebuildings,theirrootswillbreakthebuildingstonesgradually .
- Bushytreesorshrubsshouldnotbenearfarmbuildingsastheymayha rbour predators.
- Talltreesplantedwithmaincropofalowercanopyinterceptttherainf all, affectingthegrowthofthemaincrop.
- Cypresstreeshaveleaveswhichproduceacidityinthesoilpreventingu ndergrowth beneaththetree.
- Thesetreesshouldnotbeplantedwithinthefarmbutattheperiphery.

TreeNursery

- Treenurseriesarestructuresusedtoraisetreeseedlingsuntiltheyarereadyfor transplanting. Thereare2maintypes: Barerootnurseries: Thesearealsoknowna s'Swaziland'bedswheretheseedlingsareraiseddirectlyintothe soil.

Advantages

- Cheapandlesstimeconsuming.
- Requirelesslabour
- Occupyasmallspace.

- Manyseedlingsareraisedinasmallspace.
- Transportationofseedlingsiseasy.

Disadvantages

- Rootdamagewhenuprootingtheseedlings.
- Difficulttotransport.
- Lowersurvivalrateaftertransplanting.

Containerizednursery:

- Theseedlingsinthistypeofnurseryareraisedincontainerssuchaspots,polythene bagsortubesandtins.

Advantages

- Highersurvivalrateaftertransplanting.
- Norootdamage.
- Successfulinaridareas.

Disadvantages

- Labourintensive.
- Difficulttogetcontainers.
- Sometimesitmaybedifficulttogettherighttypeofsoiltouseinthe containers.

SeedCollectionandPreparation

SeedCollection

Seedsshouldbecollectedfrom;

- Adaptabletrees,
- Highyielding,
- Healthy
- Resistanttopests/diseases.
- Themotherplantshouldbeidentifiedfirst.

Thefollowingmethodsusedtocollectseeds.

- Shakingthetree.
- Gatheringfromunderthetree.
- Loppingofthetree.
- Climbingonthetrees.
- Hookingmethod.

SeedPreparation

- Thisdonewhenseedsarecollectedfromafreshfruit,theyshouldbesoakedin water, thenwashedanddried.
- Cleaningandsorting:donetoremoveimmatureseeds,rottenseeds,broken or damagedseeds.
- Drying:Donebysun-dryingorovendrying.

- Seedtesting:thisdetermines;
  - Seedqualityforpercentagepurity,
  - Seedweight,
  - Moisturecontent,
  - Germinationpercentage.
- Seedsshouldbestoredindrycontainersatroomtemperature.
-
  Seedtreatment:seedsaretreatedfirsttobreaktheseeddormancyandensurerapid germination;
  -
    Hotwatertreatment:usedtosoftentheseedcoattomakeitmorepermeableto water.
  -
    Examplesofseedswhichrequirethistreatmentareleucaenia,calliandraand acacia.
  -
    Mechanicalbreaking:donebynickingtheseedcoatwithaknifeforeasyentrance ofwaterforexampleseedsofcrotontrees.
  - Lightburning:appliedtothewattletreeseeds.

NurseryManagement

Thefollowingarethepracticescarriedoutinthenurserywhentheseedlingsaregrowing:

- Mulching:
  - Aimistoreduceexcessiveevaporation,
  - Moderatesthesoiltemperature,
  - Whenitdecaysitimprovesthesoilstructure,
  - Reducestheimpactoftheraindrops.
- Weeding:
  -
    Donetoreducecompetitionforgrowthfactorsbyuprootingtheweeds, Useasharppointedstick. Watering:
  - Donebyuseofawateringcan
  - Donetwiceadayinthemorningandintheevening.
- Prickingout:
  -
    Itistheremovalofseedlingsinanovercrowdedareatoanothernurserybed, Thisallowstheseedlingstogrowstrongandhealthy.
- Rootpruning:
  - Itisthecuttingoftherootslongerthanthepots.

    Rootpruningisdoneforthefollowingreasons;
  - Makeliftingeasier
  - Encouragefastestablishment.

- Reducedamagetotheseedlings.
- Encouragedevelopmentofashortdenseandstrongrootingsystem.

- Shading:
  - Donetoreducetheintensityofsunlight.
- Darkconditionsshouldbeavoided.
- Pestanddiseasecontrol:
  - Useofappropriatechemicals,
  - Sterilizationofsoilthroughheattreatment,
  - Fencingtoprotectseedlingsagainstanimaldamage.
- Hardeningoff:
  - Itisthepracticeofpreparingseedlingstoadapttotheecologicalconditions prevailingintheseedbed.
  - Itinvolvesgradualreductionofshadeandwatering1-2weeksbeforetransplanting.
- Transplanting:
  - Thepracticeoftransferringseedlingsfromthenurserybedtothemainfieldwhere theygrowtomaturity.

ProcedureofTransplanting

- Holesaredugearlybeforetransplanting.
- Topsoilismixedwithcompostmanure.
- Theseedlingsarewateredwelladaybeforetransplanting.
- Theseedlingsareremovedfromthenurseriescarefullywithaballofsoilforthebare rootseedlingsandrootstrimmedforthecontainerizedseedlings.
- Theseedlingisplacedintheholeatthesameheightitwasinthenursery.
- Thecontainerisremovedcarefully.
- Thesoilisreturnedintotheholeandfirmedaroundtheseedling.
- Theseedlingiswateredandmulched.

CareandManagementofTrees

- Protection:
  - Fromdamagebyanimalssuchasgoatsandcattlebyeatingtheleaves.
  - Itisdonebyfencingthefieldsorusingsmallpolesaroundeachseedling withor withoutwirenettings,canbedoneforindividualtreesoranentirefield.
- Pruningandtrimming:
  - Pruningistheremovalofextraorunwantedpartsofaplant.
  - Theunwantedpartmaybeduetobreakage,overcrowding,pestsordisease attacksandoverproduction.
  - Pruninginitiatesgrowthofshootsandtrainsthetreetohavetherequired shape.

- Regularcuttingbackofthetreesisknownascoppicing,
  - Itisdoneatthebeginningofeachcroppingseasontoreducecompetitionfor water,minerals,nutrientsandsunlightwithcrops.

Thematerialsprunedorcoppicedareusedasfuelwoodorforfoddercrops.

- Graftingoldtrees:
- Thisisthepracticeofunitingtwoseparatewoodystems.
  - Thepartwiththerootingsystemisknownasrootstock(base)
  - Thepartwhichisgraftedontotherootstockiscalledascionwhichhasbuds thatdevelopintothefutureplant.
  - Theabilityofthescionandtherootstocktoformasuccessfulunionisknown ascompatibility.
  - Methodsofgraftingincludewhiportonguegrafting,sidegraftinganda approachgrafting.

AgroforestryPractices

- AlleyCropping/HedgerowInter¬cropping:
- Thegrowingofmultipurposetreesandshrubstogetherwithcrops.

Benefits

- Improvesoilfertilitythroughnitrogenfixationandorganicmatter.
- Provisionofgreenmanure.
- Usedasfenceandmarkboundaries.
- Actsaswindbreaks.
- Suppressweeds.
- Sourceoftimberandfuelwood.

- Multi-storeycropping;
  - Thisisthegrowingtogetheroftreesofdifferentheights.
  - Thesystemisbasedoncropswhichcantoleratеshading.
  - Thetreesandcropsformdifferentlevelsofcanopywhichlooklikestorey.

Benefits

- Increaseswaterconservationforpastures.
- Noneofthecropsortreesincludedwillbeshaded.
- Actaswindbreakforcrops.
- Createssuitablemicro-climateinthearea.
- Treesareusedfortimber,fuelwoodandforage.

- Woodlots(farmforests)
  - Theseareplotsoflandsetasidefortreesonly.

- Theyareestablishedinthehillyandlessproductivepartsofthefarm.
- FastgrowingtreespeciessuchasEucalyptusspp.shouldbegrown.

SitesforAgroforestry:

- Farmboundaries-providelivefences.
- Riverbanks-protectwatercatchmentareas. Homesteads-provisionofshadeandwindbreak Terraces-forsoilconservation.
- Steepslopes-ascontourhedgestoencouragewaterseepage.

TreeHarvestingMethods

- Pollarding;
  - Thisistheextensivecuttingbackofthecrownofthetreeabout2-3metersabove thegroundleveltoharvestallthesidebranches.
  - Itstimulatesthedevelopmentofanewcrownandbranches.
- Coppicing;
  - Cuttingthemainstemofthetreecompletelyataheightof10-50cmabovethe ground. Thetreeshouldbecutinaslantingangle.
- Loppingorsidepruning;
  - Theremovalofselectedbranchesofthetree
- Donetoproducefuelwoodandfodder.
- Shakingofthetree;
  - Thisisamethodofharvestingpodsandseedsfromtreeswithoutcuttingthetree.
- Cuttingback;
  - Thetreeiscutfromthebasetoallownewgrowthasdoneincoffeewhen changingthecycle.
- Thinning;
  - Theremovalofsomeofthetreesgrowinginlinestogivetheremainingtrees enoughspacetogrow.