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Plant Nursery Operations and Management, A Case Study of Forestry Unit, Agriculture and Natural Resources Department of Gombe Local Government, Gombe Nigeria.

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ABSTRACT

A study of plant nursery operations and management was conducted at the forestry unit, Agriculture and Natural Resources Department of Gombe Local Government, Gombe State. By way of sowing seeds either directly in the ground/in nursery beds/polythene bags or by way grafting, transplanting, cross-breeding, root-pruning etc, and follow by watering of the plants(morning and evening), application of fertilizer monthly and application of pesticides once in a while to boost the soil fertility and prevent/control any pest attack respectively. The result indicates that to produce healthy and viable plants in a nursery, some necessary conditions and requirements must be met such as; viable seeds, favorable temperature , appreciable level of moisture, a fertile and good soil with good water retention capacity. It was recommended that before the establishment of any plant nursery a study of plant characteristics must be conducted alongside climatic conditions of the area such as rainfall, humidity and temperature before choosing the type of plants to grow there for the attainment of Sustainable Development for the benefit of the present and future generations.

Keywords: Agriculture, Forestry, Natural Resources, Plant Nursery Operations and Management

HISTORY OF THE STUDY AREA

Even though their exist a body call Gombe Native Authority after the amalgamation of Nigerian Northern and Southern Protactory in 1914 for the Administration activities of the then Colonial Masters, but Gombe Local Government Area was created or become a single entity as a third tier of Government in 1976 after the Local Government reform of Alhaji Ibrahim Dasuki led committee, and the primary objectives of Local Government is the

provision of school, hospital, pipe borne water, security, and environmental sanitation. The Forestry unit of Agriculture and Natural Resources department was established in the year 1994 in an effort to address the problem of extinction of some plant species, soil erosion and desertification

INTRODUCTION TO PLANT NURSERY

A nursery is a place where plants are grown and propagated into a usable size. They include retail nurseries which are sale to the general public, wholesale nurseries; which sell only to people in nursery businesses such as other nurseries and to commercial gardens and private nurseries which supply the needs of institutions or private estates (education-portal.com/…/Plant Nursery). The range of nursery functions is far wider than that of the popular image which is that of a supplier of garden plant, and it is of vital importance to many branches of agriculture, forestry and conservatory biology. Some nurseries specialize in one phase of the following processes;

1. Propagation
2. Growing out or retail sale
3. Or in one type of plant e.g. ground covers, shade plants or garden plants.

Some produce bulk stuff, whether seedlings or grafted of particular varieties for purpose such as fruit trees, for orchards or timber trees for forestry, while some produce stock seasonally. The type of nursery I had my training was a retail nursery, where plants and flowers are sold to the general public and bulk stocks are being produced (education-portal.com/…/Plant Nursery). Presently, the need to plant trees is on the increase, it is difficult, however, to access- at the right time, in the right quantities and of high quality the trees people want to plant. In order to meet present and future demands for planting material, there is need to promote on-farm community plant nurseries. Such nurseries can be owned and managed by individual farmers, by self-help groups by schools, and by a range of other local institutions. They provide income generating opportunities, act as models for further nursery development, provide seedlings more cheaply to planters and can raise the particular species that local people are interested in (education-portal.com/…/Plant Nursery).In order for farmers and rural organizations to establish effective nurseries, it is important to provide nursery managers with the simple technical information they need for the establishment and management of the facilities.

Tools and Equipments Used in a Plant Nursery

These are the normal garden equipment's and tools used in our home gardens except for some of them which are used particularly in large nurseries. Some

gardening equipment's can be expensive, however, whatever equipment you buy be sure to look after it. Leaving spades and forks outdoors for weeks con shorten their working lives considerably, however, with a minimum of effort, most gardening equipments can see you through a lifetime`s gardening.(education-portal.com/…/Plant Nursery).

A. Protective Gardening Clothing

These are meant to protect you from injury, dirt or soil.

1. Foot wear: this includes a pair of heavy duty shoes or boots which help prevent you from getting dirty or damage, and also protect you from stones, falling items or tools.
2. Gardening Aprons: these protect your clothes from getting dirty and also functional with additional pockets which can hold things, from seed packets to hand tools. They also come in handy for your mobile phones or keys.
3. Gardening Gloves: help keep your hands protected from cuts and abrasions. There are many varieties available, from light-weight cotton gloves to thick waterproof heavy duty gloves.

B. Garden Tools

1. Cultivator: this is along handled tool with three angled prongs used to break down large earth when preparing garden beds. If you have a large garden, then it may be worth investing in a mechanical cultivator.
2. Draw Hoe: this is a long handled tool used for weeding, using a chopping action and for drawing up soil around plants called "Earthing-up".
3. Garden Fork: this is a long handled fork which has 4-5 rounded prongs used in digging soil in situations where using spade may be difficult and also for turning the soil over to make more workable.
4. Rake: this is a long handled tool used to create a fine tilt for a seed bed, to level it out and to gather up surface stones.
5. Spade: a long handled tool traditionally used for digging, shoveling soil and compost. They are available in various sizes and can often be bought as a set with a garden fork.

C. Gardening Equipments

1- Basket: used for tools and harvested crops around the garden.
2- Containers: they come in different sizes, shapes and materials used for growing a wide variety of crops.
3- Dibbers: they are used for creating planting holes or seed drills and is available in plastic wood or metal.

4- Kneeling Pads: used to protect your knees while kneeling in the garden.
5- Line and Pin set: used for sowing or planting in a straight line. Available in wood, plastic or metal.
6- Loppers: used for taking smaller branches off trees.
7- Measuring Rules: used for measuring plots and beds for accurate plant spacing.
8- Nets/Netting: used to protect plants from birds, lizards and others. Usually plastic coated.
9- Plant ties: used for tying stems of plants for support.
10-Pruners: used for making sharp clean cuts on plant stems.
11- Polythene Bags: used for sowing seeds prior to planting out.
12-Sieves: used for removing small stones from soil.
13-Sprayers: used for spraying plant with water or chemicals.
14-Watering Cans: used for watering smaller areas and containers.
15-Wooden Stakes: used for supporting young fruits trees.

Establishment of a Plant Nursery

A significant amount of study should be undertaken before any actual planting of a commercial or wholesale nursery is undertaken. Travel to visit nurseries of the type envisioned is critical to knowing the opportunities and pitfalls of the different types of nurseries. Before you plant a anything, you must have a marketing plans, a study of the land resources is always the first order of priority. These include:

A. Factors that Influence Location

Where to site a nursery is an important issue to consider before starting, because it influences the factors that will be required to maintain it, the way in which it will be managed and the ease of access to users. Some of these factors include:

- There should be reliable supply of water, ideally being near a river or pond or where a water tank or where a drum is available to store the water is available.
- The site should be accessible all year round, so that customers are able to get seedlings easily, and so that the nursery staff manage plants and transport mature seedlings to planting sites or markets.
- Good soils and other planting materials should be available easily.
- The sites should be protected from strong winds and from livestock, should receive sun, and should be a gentle slope to allow drainage.

B. Factors that Influence Size

How big a nursery is depends on many different factors, of which these are the most important:

- The space available for establishing the nursery: the land available in farms may be only small area, but more space may be available in public land like yards.
- Whether you will grow the seedlings in pots or in beds, and whether they will be raised from seedlings or from grafts, or from bare rooted cuttings, etc. this will influence the amount of space each plant needs. Remember that an additional space is required for keeping collected soil, sand and manure, and for mixing these materials.
- The numbers of seedlings to be raised for personal use and sale. When considering the size of the market for seedlings, it is better to by being conservative in estimating how your market will be.
- The amount of water that is available to maintain the seedlings.

C. Facilities and Resources

When establishing a nursery, it is important to have somewhere to keep nursery tools safely and in a favorable condition. This does not have to be in the nursery itself, but could be in the house, school or any other locations. The basic tools needed for a nursery includes shovels, empty tins with small holes in the bottom (substitute for a watering can), and kitchen knives for root-pruning. If resources allow, then proper watering cans then wheelbarrows, pruning knives, knife sharpeners, soil sieves and shovels are also all useful (education-portal.com/…/Plant Nursery).

Nursery Operations

Nurseries are places where seedlings are raised for planting purposes. In the nursery, the young seedlings are tended from sowing to develop in such a way as to be able to endure hard field conditions. Whether local or introduced specie, nursery seedlings are found to have a better survival than seedlings sown directly in the field or through natural regeneration. So, nursery seedlings become the planting material for plantations, whether these plantations are for production, protection or amenity(www.careerzone.org/majors/…/01.060...).

Nurseries are of two types:

Temporary Nurseries: These are established in or near the planting site, once the seedlings are raised, the nursery becomes part of the planted site. They are sometimes called "flying nurseries".

Permanent Nurseries: These can be large or small depending on the objective and the number of seedlings raised annually. Permanent nurseries must be well designed, properly sited and with adequate water supply.

Seedling production is a major expense of a forestation and every effort should be made to produce good quality at a reasonable cost. Mastering the technique of nursery operations is necessary.

Collection, Handling, Storage and Pre-Treatment of Seeds

A. Seed Quality

Seeds are either collected by the forester or obtained from a known seed source in the country or abroad. In the latter case, the seed must be of good qualities:

- It must be clean from dirt and debris.
- It must be free from pests and pathogens.
- It must have a high percentage of germination.
- It must be accompanied by a note, carrying the scientific name of the species, place of collection, date, number of seeds, unit weight, and whether any treatment has been applied.

B. Seed Collection

To ensure seed quality, fruit collection must be made from trees having the desirable characters. Such trees are labeled and their locality recorded.
The phonologies of these trees should be observed as to when they would flower, set fruit, and have mature fruits. Does fruiting take place every year, every two years? Are there any factors affecting fruit production? For example drought, and defoliation by insects etc.

- Nature of fruit(dehiscent or intact)
- Hazards to the fruits: collected by humans, animals, insects, pathogens, blown by wind?
- Collection time and method: well developed and mature fruits contain good seeds. So, the collection time is when the fruits are fully matured.

Fruits are either collected from the tree by beating the tree with a stick, or shaking the crown with a long hook or by climbing. Some fruits fall to the ground and they are collected. In such a case the place of their collection is cleaned beforehand.

- Treatment of fruits: collected fruits are cleaned, sprayed against insects and spread on a clean sheet to dry.

C. Seed Extraction

This is the process of separating the seeds from the fruit. Therefore, the method of extraction varies with the type of fruit.

D. Seed Drying

Once seeds are extracted, they are cleaned of chaff and dirt, and they are dried in the sun or in an oven. If seeds are stored wet, moulds and pathogens may spoil them.

E. Seed Storage

Seeds whether bought or collected, must be stored in a proper way until needed. Dry seeds can be safely stored in air-tight polythene bags at room temperature. When seeds are stored, they are normally labeled, given a number and placed in an air-tight polythene bag and kept in a closed tin. A single tin may contain several bags and a car register system is used to indicate in a register system in which the seeds are stored and how much is left after using a given quantity. (education-portal.com/…/Plant Nursery).

F. Seed Viability

Some seeds lose their viability in a short period; therefore, it is important to test seeds which are stored to determine their germination percentage and it is useless to store any seed that fall below 40% germination unless they are very rare or very expensive.

Seedling Production

There are many operations involved in seedling production, the most important ones are described below:

Nursery Soil Mixtures

Nursery soil mixtures should have the following characteristics:

- It must be light
- It must be cohesive
- It must have a good water holding capacity
- It must have high organic matter.
- It must be fairly fertile or made so by the addition of fertilizer.

Nursery Soil Treatment

Potting soil must be acidic, if it happens to be alkaline, it can be treated by a solution of 2% sulfuric acid. Sometimes, nursery soil have to be sterilized against pathogens by use of 40% solution of formaldehyde applied to the soil 7-

10 days before sowing the seeds. Soil fumigation is also a treatment against fungi by methyl bromide gas.(education-portal.com/…/PlantNursery).

Filling the Pots/ Pot Size

Polythene pots of different sizes are now used for raising nursery plants. This does not preclude the use of other containers like boxes, half tins, and earth pots etc. The pots are filled with nursery soil, taking care of to have no voids by shaking and knocking regularly. The pots are filled, leaving small space at the top and stacked side by side on nursery beds. It is very important to determine the pot size because: large pots require more soil, take a lot of labor to fill and transport them; they occupy a large nursery space and require more water in contrast to small pots. But they produce large plants in a short time. The general rule is that "the larger the planting site, the larger the pot should be".(education-portal.com/…/PlantNursery).

Pre-Treatment of Seeds

Some trees and shrubs needs are ready for sowing as soon as they are collected; others pass through a dormant stage during which the embryo completes its development. Often, a pre-treatment is used to hasten germination. The methods of pre-treatment vary with different types of dormancy of trees and shrubs seeds. The main types of dormancy are: exogenous, endogenous and combined exogenous and endogenous dormancy. (education-portal.com/…/PlantNursery).

Sowing of Seeds

Having determined the soil mixture, kind and size of the container, one would to sow the seeds.

- Type of sowing: when the containers are beds or boxes, seeds can be sown by broadcasting or in lines. When the containers are pots, then it is pit sowing.
- Depth of sowing: seeds are sown at a depth of 1-3 times their diameter. When seeds are sown at this depth, adequate moisture and optimum temperature will hasten their germination. Excessively deep sowing will impair seedling emergence.
- Ideal sowing time: this is determined by the period to raise plant able seedlings of the desired size.

Watering Plants in the Nursery

After sowing, seed beds should be watered using a fine nozzle spray, producing almost a mist. This will guard against removing and washing away of fine seeds.

Hand watering whether by a container or with a hose, is the best method of watering. Watering is done frequently until seeds germinate.

Care of Nursery Stock

The production of good quality seedlings will depend on how well the following activities have been executed:

- Weeding
- Damping-off
- Hardening-off

Vegetative Propagation

Not all trees and shrubs used in planting programme are produced from seeds, species whose propagation by seed is difficult can often be produced by vegetative propagation. Nursery stock that is obtained by vegetative propagation includes; stumps, cuttings and sets. Encyclopedia 2013. 03/10/2014. 3:30pm

- Stump: this is a term applied to nursery stock of broad leaves specie which has been subjected to drastic pruning of both the roots and the shoots. Stumps are normally covered with wet sacks or layers of leaves during the transit to the planting site.
- Cuttings and sets are also commonly used as a planting stock. A "cutting" is a short length cut from a young living stem or branch for propagating; a cutting produces a whole plant when planted in the field. A rooted cutting is one that has been rooted in the nursery, prior to field planting. Sets are long, relatively thin, stem cutting or whole branches.

Size and Quality of Planting Stock

There is a considerable range in what is considered to be the desired size of tree and shrub seedlings for planting. The optimum size varies, depending on whether the seedlings are bare rooted or containerized, on the tree or shrub specie to be planted, and on the characteristics of the planting site. Experiences indicate that medium sized stock between 15 and 40 centimeters, with a woody root collar, have a better survival rate than smaller plants. The maximum size for planting potted stock is largely determined by the size of the container. The larger the container, the larger the plant that can be grown in it; but the period of growth is limited to that which is free of harmful root restriction. Excessively tall plants can be lessened in the ground or blown over, and root development might be restricted or inadequate to cope with the high transpiration demand of the large top Encyclopedia 2013. 03/10/2014. 3:30pm

Preparation of Seedlings for the Planting Site

Seedlings of planting size are first graded. Grading of planting stocks depends, to a large extent, on the local experiences and the establishment of local standards. The main objectives of a grading system for a large stock are:

- To eliminate culls, seedlings with damaged or diseased tops or roots.
- To eliminate seedlings below minimum standards of size and root development.
- To segregate seedlings that exceeds the minimum standards into two or more quality classes.

Transport of Seedlings to the Planting Site

Packing of container raised plants for transport present few problems. They are put in trays and loaded into vehicles. The tins which have been used for seedling trays can be used, but these are heavy. Often plants are damaged transport to the planting site. Therefore, adequate care must be taken to avoid mishandling of plants during loading and unloading from vehicles http://www.fao.org/docrep/T012ze05.htm).

Organization of Seedling Production

Seedling production must be organized in such a way that plant able seedlings of good quality are produced in time. As time of planting is critical especially in arid areas, except when irrigation is applied, the organization becomes vary important. All the processes which have been described earlier must be done perfectly and in time. Administration is also important in a nursery work to ensure that:

a- Nursery activities (jobs) are done correctly;
b- These activities are done in time
c- Labor requirement is available for performing the work and
d- Materials/tools and equipments required to do the work are suitable.

This requires a nurseryman having a fair knowledge of labor productivity, nursery technique and prices of materials. Records of nursery seedling production as well as cost of materials and labor are kept to show the economics of nursery work. Labor and material requirement depend on the size of the nursery.

Forms showing costs of tasks, for example seed collection, filling of pores with soil, sieving, mixing and preparing nursery soil, should be designed and filled in regularly.

Nursery Pest Management

A pest is a plant or animal detrimental to humans or human concerns (as agriculture or livestock production), they can also be referred to as organisms that cause nuisance and epidemic disease associated with high mortality rate. A pest can also be defined as a competitor of humanity; it is any organism which is invasive or prolific, detrimental, troublesome, noxious or destructive. It is also possible for an organism to be a pest in but beneficial, domesticated or acceptable in another. Examples of pests include; rodents, insects, mammals, bacteria, fungi among others (http://www.fao.org/docrep/T012ze05.htm).

Pest management is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economical, health and environmental risks. Pest management using biological method of control requires knowledge of pest life cycles and threshold levels and modification of spray programs to avoid any of the bio-control agent. The reward of using biological control is better pest inventories, reduced environmental hazards and happier employees.

Physical method of control involves the use of traps, nets, fences, scare-crows among others, to prevent the pest attacks. This method is usually used to control animal pests such as; rats lizards, rabbits, birds, monkeys etc. http://www.fao.org/docrep/T012ze05.htm).

The Use of Insecticides in Pest Control (Chemical Method of Pest Control)

Regardless of the pesticide or mixture of pesticides used, it is strongly recommended that the effects be evaluated on a few plants under your particular conditions, before treating all plants. An insecticide is a chemical compound that is absorbed by the host plant, translocate through its tissues and makes the host toxic to certain insect and mite pests. Several systematic insecticide are taken up throughout the plant up to the leaves, others can be absorbed by the plant foliage or bark with spray applications. Insecticides have been effective primarily in controlling small sucking pests including aphids, whiteflies, scales, mealy bugs, lace bugs and spider mites http://www.fao.org/docrep/T012ze05.htm).

Methods of Pesticide Application

a- Granular Application: this is used to control soil dwelling insects using a sprayer. Granular products often need to be watered into the soil to prevent binding with plant material and to move insecticides from the carrier into the soil.

b- Spray Application: these are often done using flow able, emulsify able concentrates and other insecticide formulations, spray equipment varies from handheld and back-pack sprayers to high pressure hydraulic sprayers. Through coverage of the leaves and branches, it is important to gain adequate control of insect pest.
c- Drench Application: this method may be useful against root-feeders, wood borers or sap-feeders. The is sprayed or poured within the plant`s drip-line and the plant root system takes it up.

CONCLUSION AND RECOMMENDATIONS

A study on the plant nursery operations and management was carried out at the forestry unit, agriculture and natural resources department of Gombe local government. It was recommended that before the establishment of any plant nursery a study of plant characteristics must be conducted alongside climatic conditions of the area such as rainfall, humidity and temperature before choosing the type of plants to be planted there for the attainment of Sustainable Development for the benefit of the present and future generations. The research recommend that government should embark on rigorous tree planting campaign, and at the same time they should given out free seedlings to the entire members of the public in an effort to reduce desertification and sequester green house gases in the atmosphere in order to reduce the effect of climate change. The study also recommend that government should be sending Plant Nursery Managers to local, national and international conferences and seminars to avail themselves the opportunity of knowing the international best practices of Plant Nursery management. It was further recommended that Plant Nursery Managers should encourage their staff to acquire more literal knowledge (so that they will be able to read and write), and they should also provide them with technical knowledge (by teaching them what they learn at various conference/seminars they attended).

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