

PCP 201: PRINCIPLES OF CROP PRODUCTION 1

LECTURE NOTE ON PLANT PROPAGATION

By

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To propagate means to multiply. Crop propagation means to increase or multiply crop plants. This can be done either through the use of seed or other plant parts (stem, root, leaves).

Propagation through the use of seed (**Sexual Propagation**)

In sexual propagation seeds are planted. In order to properly comprehend why multiplication of crop plants through the use of seed is termed sexual propagation a review of how seeds are formed is important.

Seed formation in flowering plants

At a stage during the development of a plant flowering plants move from the vegetative to the reproductive phase. During this time flowers are produced. A typical flower consists of both the male reproductive part known as the **stamen** and it is made up of the anther and the filament. The female reproductive part consist the stigma, style and the ovary and they are collectively known as **pistil**. In the ovary are found several ovules. Through the process of pollination pollen grains are transferred from the anther to the stigma. **One pollen grain fertilizes one ovule**. After successful fertilization, **the ovules develop to form the seeds while the ovary becomes the fruit**. Seeds that are produced thus possess genes obtained from both the male and the female parents.

Some plants produce flowers in which the male part matures first, produce and shed pollen grains before the stigma becomes receptive; such plants are known as **protandrous plants**.

On the other hand the female reproductive parts in some flower mature earlier and are withered before the pollens are shed and they are known as **protogynous plants**. Conditions mentioned above favour cross pollination in crop plants and they are important considerations in merits and demerits of sexual propagation.

Advantages of propagation by seed

- Seeds can easily be transported compared with materials used for asexual propagation
- Seeds can remain viable at least till the subsequent growing season when properly stored

- Transfer of diseases and disease causing agents to subsequent generation is milder in seed compared than in vegetative propagation

Disadvantages of propagation by seed

- Raising plants from seeds may not result in the same plant like the parent plant, for example maleness in pawpaw.
- Propagation from seeds may result in non uniform field.
- Propagation by seed might result in production of off-type due to genetic reconstitution.
- Fruit production is delayed in fruit trees when propagated from seed compared to asexual propagation.
- Tuber crops like cassava will not produce economic yield in the first year if propagated from seed rather than from stem cutting.
- There are plants that do not produce seeds at all or in situation where the seeds are produced, they are not viable.

The above constraints to sexual propagation leave us with the option of vegetative propagation.

Asexual or Vegetative Propagation

Asexual propagation is a way of multiplying plants using other plant parts other than seeds.

Asexual propagation has a number of advantages which include the following:

- Plants that are propagated vegetatively mature early and fruit trees propagated vegetatively produce fruits earlier than when propagated from seeds.
- Offspring of plants propagated asexually are exactly like the mother plant genetically. This could help in predicting the characteristics of the offspring ahead of time.
- Vegetative propagation gives a more uniform field of crops relative to sexual propagation, this is important in calibration of machines in mechanization; crop management can also be synchronized.

- Qualities of fruits like flavour and sometimes sizes have been improved upon where grafting or budding was involved.

Asexual propagation has some demerits which include

- Diseases can easily be spread from the parent plant to the offspring in vegetative propagation.
- The field stands the danger of being completely wiped out in case of disease incidence as all the population will be susceptible.
- Vegetative propagation requires more skill and equipment than sexual propagation which makes it more costly.
- Transporting materials used for vegetative propagation are bulky and transporting them is not easy compared to seeds used for sexual propagation.
- Preserving materials used for vegetative propagation is more demanding than preservation of seeds.

Types of vegetative propagation

1. Use of specialized food storing plant part

Certain plants have some adaptive features that make them survive adverse environmental conditions such as drought or cold. Such plants produce leaves and have vigorous growth under favourable environmental conditions. When the conditions become adverse the above ground plant part dries up while the plant remain alive but in a dormant form in the soil. This is possible as food is stored in the below ground part; this dormant form also posses bud from which new growth commences when favourable conditions resumes depending on the stored food.

Examples in this category are:

- Bulb for example onion and garlic



Fig: Onion bulb

Bulbs are globular in shape and consist mainly of fleshy food storing leaves. Onion production starts by planting the seeds in the nursery, the seedlings generated with their little bulbs are later transplanted out on the field.

Garlic is also another kind of bulbs. In garlic however, new plants are generated by separating the different cloves that form the bulb and planting them out.

- Corm for example cocoyam



Fig: Corm of cocoyam

Corms are propagated by planting whole small corms or by dividing larger corms into segments each with three or more buds.

- Tubers for example Irish potato and yam
Some plants have underground stems which are enlarged and are used to store food examples are yam and Irish potatoes. Such enlarged stems have spirally arranged nodes with buds which develop into new plants. Yam can be propagated by planting small tubers known as mini sets or by planting fragments of cut large tubers.
- Tuberous root for example sweet potato
Roots of some plants serve as storage organs examples are cassava and sweet potato. While sweet potato produces root tubers with active buds which can be as propagating material, tuberous root of cassava are not suitable as propagating material; however the conventional method of propagating sweet potato is by using the stem cuttings. When the stems are not available stems can be generated from the root tubers by planting the tubers in well aerated and well watered (preferable sandy) soil. When the shoots are well formed they are severed and used as stem cuttings.
- **Suckers** for example banana and plantain
Suckers are new plants developed attached to the stem of the mother plant; they may have their own roots right in the soil. Such plants can be cut off from the main stem and planted elsewhere to commence independent life example include pineapple. Four types of suckers are identified in plantain and banana these are peepers, water suckers, sword suckers and maiden suckers. Sword and maiden

suckers are suitable as propagating materials. In the actual sense however, the stem of plantain and banana can best be describe as a corm.

- **Rhizomes** are stems which grow horizontally underground. They posses nodes internodes and axillary buds which can generate a new plant when severed from the main stem. Examples of plants propagated by rhizomes include ginger, sugar cane, bamboo.
- **Runners** these are plants with stems that grow horizontally above the soil. They posses nodes, internodes, and axillary bud. Roots and new plants are produced where the nodes touch the soil, thus the plant can be severed at such points to commence independent life for example sweet potato. In sweet potato the stems are cut into fractions with at least four nodes. Planting of the stem cutting is done by inserting the stem into the soil two nodes deep.



Figure: Runners of sweet potato

2. Layering:

This involves causing a branch of a plant to produce roots while still attached to the main stem; after such plant is detach and planted out to commence an independent life. Examples of plants propagated in this way include tomato, guava, and mango.

3. Grafting and budding

Layering and budding are also means of propagating plant vegetatively. In **grafting** parts of two individual plants are taken and are joined to form a single plant. One of the two plants will supply the root and it is also known as the **stock**, **root stock** or **under stock** in the union, the other part supplies the stem and is known as the **scion** example citrus. **Budding** is similar to grafting the difference however is that while the scion consist of several bud in grafting, the scion is usually consist of a single bud in budding.

4. Cutting

Some plants are also propagated by cuttings. Stem, root, or leaves of certain plants are used to regenerate them. Whole plants develop by production of either roots, shoots or both root and shoot from stem cutting, root cutting or leaf cutting respectively. Example is in cassava, rose and sweet potato



Fig: Sweet potato stem cutting- note the projection at the nodes and the internodes



Fig: Cassava stem cuttings- note the active buds at the nodes

The above is a summary of the most common methods of crop propagation, additional information will be given during the course of the lectures and practical.

