Different Techniques of Asexual Reproduction in Plants

Manbir kaur
Khalsa College of Pharmacy, Amritsar

Abstract: Reproduction is the important process for the continuity of the species, generation after generation. It is a biological process in which an organism gives rise to the offspring with genetic improvement. The offspring grow, mature and undergo the reproduction process to produce offspring. Hence, the cycle of birth, growth and death continue. Asexual reproduction is used in agriculture and horticulture to propagate a desirable plant whose traits would be altered by sexual reproduction, even self-pollination. Moreover, self-pollination reduces genetic variability; asexual reproduction results in genetically identical individuals because only mitotic cell divisions occur.

Keywords: Asexual reproduction, plant reproduction, plant breeding

INTRODUCTION:
In plants asexual reproduction is the process which involves single parent giving rise to offspring from a part of the plant other than the seed.

Asexual reproduction produces genetically identical plants to the parent plant as there is no mixing of male and female gametes. Traditionally, these plants survive well under stable environmental conditions when compared with plants produced from sexual reproduction because they carry genes identical to those of their parents. Asexual reproduction is further classified as vegetative reproduction and apomixis.

VEGETATIVE REPRODUCTION
Vegetatively reproducing plants have daughter plants growing around them. e.g banana, ferns. These plants have aerial portions with green leaves and they also have a thickened modified stem growing horizontally under the soil. From this underground stem new young plants grow out like the "babies of the mother plant". These young plants develop their own root system and grow independently after being separated from mother plant.

Asexual reproduction among plants is more common in areas with little margin for variation like harsh or marginal environments. There is a greater proportion of asexual plants in the arctic, for example, than in temperate regions. The asexually produced progeny are genetically identical to the parent individual.

Vegetative parts which reproduce have primary or secondary meristems, capable of active cell division, and thus can give rise to new plants. It is of two types:

1. Natural vegetative propagation
2. Artificial vegetative propagation

Many different types of roots exhibit vegetative reproduction naturally. They are described in table no. 1

<table>
<thead>
<tr>
<th>ROOTS EXHIBITING VEGETATIVE REPRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BULBS lilies</td>
</tr>
<tr>
<td>CORM gladiolus and garlic</td>
</tr>
<tr>
<td>TUNICATE BULB daffodils</td>
</tr>
<tr>
<td>STEM TUBER potato</td>
</tr>
<tr>
<td>TAPROOT parsnip</td>
</tr>
<tr>
<td>RUNNERS mint</td>
</tr>
<tr>
<td>ADVENTITIOUS ROOT ivy</td>
</tr>
<tr>
<td>SUCKERS pineapple</td>
</tr>
<tr>
<td>STOLON strawberry</td>
</tr>
</tbody>
</table>

Imperial Journal of Interdisciplinary Research (IJIR)  Page 1445
ARTIFICIAL VEGETATIVE PROPAGATION

Vegetative propagation by artificial means can be performed by following methods.

A. Layering

The development of adventitious roots is induced on the stem before it is separated from the parent plant. The lower branch is bent down and covered under a light layer of moist soil by pushing the tip into the soft ground. After some time, adventitious roots develop and on cutting the branches from the parent plant, these develop into new plants. Layering is enhanced by wounding the stem where the roots are to form. The rooting medium should always provide aeration and a constant supply of moisture. This is known as layering. Eg. lemon, rose, jasmine, strawberry, raspberry, grape-vine, etc.

Types of Layering:

1. Simple Layering

Simple layering is done by using a dormant branch (spring), or by mature branch (late summer). It can be accomplished by bending a low growing, flexible stem to the ground leaving the remaining 6 to 12 inches above the soil. The sharp bend leads to rooting. Simple layering is done on plants with low-growing branches. Examples are roses, forsythia, rhododendron etc.

2. Tip Layering

Tip layering is very much similar to simple layering. The tip of shoot is dig a hole 3 to 4 inches deep and cover it with soil. The tip grows downward first, then bends sharply and grows upward. Roots form at the bend. The re-curved tip becomes a new plant. Examples are purple and black raspberries, and trailing blackberries etc.

3. Compound (serpentine) Layering

Several layers can result from a single stem in Compound (serpentine) layering. Bend the stem to the rooting medium as for simple layering, but alternately cover and expose sections of the stem. Each section should have at least one bud exposed and one bud covered with soil. This method works well for plants producing vine-like growth. Examples are pothos, wisteria, clematis, and grapes etc.

4. Mound Layering

It is also known as stool layering. Mound layering is resourceful with heavy-stemmed, closely branched shrubs and rootstocks of tree fruits. In this the plant back is cut down to 1 inch above the soil surface in the dormant season. Dormant buds will produce new shoots in the spring. Mount soil over the new shoots as they grow. Roots will develop at the bases of the young shoots. Remove the layers in the dormant season. Examples are apple rootstocks, daphne, magnolia, and cotoneaster.
5. Air layering

Air layering is also known as marcotting and gootee. It is a vegetative method of plant propagation which involves the rooting of aerial stems while attached to the parent plant. This method applies to many trees, shrubs, bamboo and herbaceous plants like rubber plant, croton, magnolia, oleander. Air layering differs, depending on whether the plant is a monocot or a dicot. For monocots, make an upward 1- to 1 1/2-inch cut about one-third through the stem. The cut is held open with a toothpick and surround the wound with moist, unmilled sphagnum moss that has been soaked in water and afterwards remove excess moisture. Wrap the moss with plastic and hold in place with twist ties or electrician’s tape. No moss should extend beyond the ends of the plastic. Fasten each end of the plastic securely, to retain moisture and to prevent water from entering. If exposed to the sun, the plastic should be covered. Aluminum foil can also be used, as it does not require twist ties or tape to hold it in place. The process for dicots is similar, except a 1-inch ring of bark is removed from the stem. With a sharp knife, make two parallel cuts about an inch apart around the stem and through the bark and cambium layer. After the rooting medium is filled with roots, sever the stem below the medium and pot the layer. The new plant will usually require some pampering until the root system becomes more developed. Provide shade and adequate moisture until the plant is well established.

Figure 5. Air Layering

B. Cutting

Cutting consists of a vegetative part of a plant which is rooted to form a new plant. A portion of stem with leaves is cut from the parent and placed in a suitable rooting medium for that particular species of plant. The media include moisture containing sand, a mixture of peat moss and soil, or water. The cutting is transplanted to soil after root has developed. The use of cuttings allows the production of clones or plants which are considered “duplicates” of the parent plants genotypically. Several plants like sugarcane, rose, Coleus and China-rose, etc., are grown by stem-cutting.

It is beneficial where a plant cutting may consist of segments of the root or whole leaves or portions of leaves, or segments of stems which are used as starter planting materials. Depending on the plant part used, these propagules are called by special terms such as root cuttings, leaf cuttings, leaf-bud cuttings or stem cuttings. In sugarcane, the stem cutting is called cane cutting while in bamboo, it is culm cutting.

GRAFTING

Plant grafting is a procedure in a small branch of a plant is inserted into the stem of a rooted plant of the same or allied species. As a result of insertion, organic union or fusion of tissues takes place and both of them grow as one A grafted plant, therefore, is a composite of parts derived from two or more plants. Grafting generally applies to the dicots and to the gymnosperms because of the presence of a continuous vascular cambium between the xylem and the phloem. But in the monocots that have no vascular cambium, successful grafts are rare and difficult.

The scion is a shoot, 4 -12 inches in length. It’s all the buds are kept intact while all the buds of the stock are removed. The graft is placed on the stock and the joining portion is covered with a layer of wax or clay in order to prevent the evaporation of water and the entry of injurious bacteria. After some time the tissues of the scion and the stock become united. Grafting is of two types

(a) Splice grafting

In splice grafting, both graft and stock are cut across obliquely at about the same angle and then firmly tied together

(b) Whip grafting

In whip grafting, both graft and stock are cut diagonally. A vertical notch is made in the stock and the graft is cut at one end to make a chisel-shaped structure or tongue. The tongue of the graft is inserted into the notch of the stock and the two are bound.

On the basis of method of uniting two parts, grafting can be of following types:

(i) Tongue grafting:

In this case the stock and scion have almost same diameter. They are given oblique or sloping cuts. A small notch is given to ensure perfect fixing of scion into stock groove.

(ii) Wedge grafting

In this case also, the stock and scion have same diameter. But a ‘V’ shaped notch is given the stock while scion is cut like a wedge.
(iii) Crown grafting:
In this case stock has a larger diameter than scion. Many scions are selected and all of them are grafted on a single stock.

(iv) Side grafting:
In this case, lateral or side cuts are made in stock. One scion is fitted in each lateral cut of stock.

Budding, often called bud grafting, is an artificial method of asexual or vegetative propagation in plants. Like grafting, this method is employed to convert one plant (the rootstock) into another plant type with desirable characteristics. Similarly, the resulting plants in general have shortened stature and maturity as compared to plants propagated from seed. This method of plant propagation has the advantage of producing numerous clones from a single piece of stem having node

Asexual Reproduction results in genetically identical individuals because only mitotic cell divisions occur. In the absence of meiosis, individuals that are highly adapted to a relatively unchanging environment persist for the same reasons that self-pollination is favored. Should conditions change dramatically, there will be less variation in the population for natural selection to act upon and the species may be less likely to survive. Most roses and potatoes for example, are vegetatively propagated. Vegetative Reproduction
In a very common form of asexual reproduction called vegetative reproduction, new plant individuals are simply cloned from parts of adults. Some plants reproduce by means of runners, or stolons—long, slender stems that grow along the surface of the soil. In the cultivated strawberry, for example, leaves, flowers, and roots are produced at every other node on the runner. This thickened portion first produces adventitious roots and then a new shoot that continues the runner. Underground stems, or rhizomes, are also important reproductive structures, particularly in grasses and sedges. Rhizomes give rise to a new flowering shoot. The noxious character of many weeds results from this type of growth pattern, and many garden plants, such as irises, are propagated almost entirely from rhizomes. Corms, bulbs, and tubers are rhizomes specialized for storage and reproduction. The roots of some plants—for example, cherry, apple, raspberry, and blackberry—produce “suckers” or sprouts, which give rise to new plants. Moreover some grasses (such as Kentucky bluegrass), and dandelions, the embryos in the seeds may be produced asexually from the parent plant. The plants that can produce seeds without fertilization either the ovule or part of the ovary, which is diploid in nature, gives rise to a new seed, is known as apomixis. The seeds produced in this way give rise to individuals that are genetically identical to their parents. Thus, although these plants reproduce asexually by cloning diploid cells in the ovule, they also gain the advantage of seed dispersal, an adaptation usually associated with sexual reproduction. In general, vegetative reproduction, apomixis, and other forms of asexual reproduction promote the exact reproduction of individuals that are particularly well suited to a certain environment or habitat.

ADVANTAGES:
Asexual reproduction produces individuals that are genetically identical to the parent plant.

• Advantages of asexual reproduction include an increased rate of maturity and a sturdier adult plant.
• Asexual reproduction can take place by natural or artificial means.
• The plants that cannot produce viable seeds such as banana, sugarcane, seedless grapes can be easily grown by vegetative propagation.
• It is easier, less expensive and a rapid method of propagation.
• Superior quality fruits or flowers can be produced by the method of grafting.
• Preservation of desirable characteristics due to no genetic recombination.
• By tissue culture, a large number of disease free identical plants can be grown in very short time.

DISADVANTAGES OF VEGETATIVE PROPAGATION
1. Unwanted characters cannot be eliminated from plants.
2. When plants grown repeatedly they may lose vigor
3. May become susceptible to diseases.
4. Vegetative parts such as root, stem leaves, bulbil etc can not be preserved for longer periods as they easily attacked by pathogens.

REFERENCES: