



Vegetative propagation of some selected horticultural crops

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ABSTRACT

Some of the horticultural crops are reproduced by asexual methods of plant propagation to regenerate clonal varieties although the sexual propagation method has also practiced for different plants. This can be done naturally for those plants which are propagating by vegetative means through specialized organs or by human intervention for targeted crops. The specialized plant organs are those plant parts which have used for storage of food reserves and propagation purposes. They reproduce by dividing and further separating the organs from their mother plants and are propagated to produce new clonal plants. Propagation by division is a form in which a group of plants or plant parts are cut which contains one or more of the underground or aerial roots or stem parts. This method is commonly used for different economically important horticultural crops viz. apple propagated by tongue grafting, grape propagated by hard wood cutting, strawberry by runner, potato by tuber, onion by bulb etc. In different field of horticultural crops propagation industry, identifying the appropriate plant parts that used for propagation and their methods of propagation are fundamental for plant propagators.

Key words: Bulb, hard wood cutting, propagation, runner, tongue grafting, tuber

INTRODUCTION

Among the plant species found on the land surface, a higher form of plant species occupy a wide variety of habitats over the others (Bhende and Kurien, 2015). This wide adaptability determines the tendency to perpetuate in to particular environment by producing their offspring's to survive. This can happen by different reproduction methods viz. by sexual reproduction which is most important method for many plants and asexual reproduction method when reproduction by seed is limited (Bryant, 1995).

A vegetative reproduction is the process of multiplication in which a portion of fragment of the plant body functions as propagates and develops into a new individual plant which involves the production of new plants without the act of fertilization or sexual union. Further can be

said that, vegetative propagation of plant is a form of plant propagation in which the new individual plant arises from any vegetative part of the parents (root, stem, leaf and other organs), and possesses exactly the same characteristics of their parent plant from which it was derived. According to Agrios (2005), clonally propagated plants are categorized as those cultivated for vegetative product and those cultivated for a fruit or reproductive product that mostly practiced in fruit trees propagation. In higher plants, any part of the structure may be capable of vegetative propagation. Many plants produce modified stems, roots, and leaves, especially for natural vegetative propagation. The most commonly known vegetative propagation of plants includes propagation by cuttings, which is obtained either from stem, leaf, root: by layering, by grafting, by modified specialized organ or by micro-propagation methods. But, In case of lower

plants, propagation occurs through binary fission, budding, fragmentation, formation of adventitious branches, gemmae, resting buds and sporadic (in lichens). All these methods of plant propagation by vegetative organ occur naturally but at the same time, man too has developed various methods of artificial vegetative propagation for many useful plants which are widely used in the horticultural industry. To do this, knowledge and skills of identification of plant organs which has to be used for plant propagation is paramount important for horticulturalists in order to multiply as per requirements. Therefore, the aim of this review paper is to discuss the propagation methods of selected horticultural crops by specialized organs.

Propagation by specialized organs

The plant is composed of four primary organs viz. roots, stems, leaves and flowers, which can be used as material for propagation. The most commonly utilized form of plant reproduction by people is seeds. But, a number of asexual methods including cutting, grafting, budding, layering, division, separation and micro-propagations are utilized when seed propagation is not feasible. Also an asexual methods of plant propagation are important to multiply cultivars with individual desirable characteristics that do not come to true from the seeds, to ensure the faster initial plant growth and higher survival rate of the plant, to produce higher yield with quality product, to reproduce plants which have a short life span and seed dormancy and to propagate a plants which are sterile to reproduce by seeds Hasan et al. (2011). Early (2008) clearly elaborated the role of vegetative propagated crops that almost all of the plants sold as perennials, bulbs, corms, trees and shrubs are vegetative propagated because most of them are hybrids which will not breed true to type from seeds. In many plant organs modifications exist to enable natural vegetative propagations. Of these, the stem is the most important one which produces a bud that completely grow to new plant with roots, stems and leaves. All daughter plants produced from these organs are identical called 'clones' of the mother plant and may serve as food stores. These stored foods enable to quickly burst

growth of plants in the spring, e.g. iris rhizomes (Henry, 2005). According to McKey et al. (2010) and Stewart and Globig (2011), clonally propagated food crops encompass a huge range of phylogenetic, morphological and ecological diversity. Different parts of clonally propagated plants have been selected to provide food and clonal propagates such as stems, roots, leaves, fruits, under or sub-aerial specialized storage organs and even seeds. The specialized vegetative structures includes runners, suckers, crown, offsets, bulbs, corms, tubers, tuberous roots, rhizomes and pseudo-bulbs are used primarily for the storage of foods, nutrients and water during adverse environmental conditions and for germplasm propagules. Plants possessing these modified plant parts are generally herbaceous perennials, in which the shoots die down at the end of a growing season but the fleshy vegetative structure usually do not die and remains viable in the soil, which put forth new vegetative growth in the next season (McKey et al., 2010). Plants that survive as underground storage organs are called genotypes that can withstand period of adverse growing conditions in their regular growth cycles and used as propagules. For instance, potato tubers are modified stems that store starch in swollen underground structures known as tubers which serve as a seed for raising commercial potato crops. Different horticultural crops propagated by specialized organs either dividing them or separating from their mother plants in order to get smaller planting materials.

Propagation by division

Propagation by division is a form in which a group of plants or plant parts are cut or torn apart and each part of the divided plant contains one or more of the roots of the plant and a part of the stem of one or more stems. Division is probably the simplest form of plant propagation which is suitable for most clumps and rosette forming perennials (Henry, 2005).

Most of the perennial plants benefited from division as they get older and begin to lose their vigor. It involves little more than breaking up established clumps in to a number of smaller pieces. The only

complications come in knowing just when to divide and establishing a minimum size for the divisions. The success rate of plant rose from division is very high compared to the other propagation methods. Plants that have fibrous, rhizomatous roots, and form clumps or crowns, are typically split up for propagation in to new plants. The dividing line between fibrous rooted perennials, crown rhizome perennials and rhizomes are somewhat indistinct. Rhizomes are purely underground stems and separated from the crown of roots around the base of the plant (Henry, 2005). He also suggested that, plants suitable for division can be put in to three categories. Firstly, plants that form clumps of rosettes or of sets which can simply be cut up or broken apart in to rooted pieces and immediately regarded as new plants. This sort of division can in most cases be done any time of the year. Many of these types of plants will also produce runners or offsets which can be separated from the parent plants. Likewise any plants which produce suckers can be propagated by removing the rooted suckers and growing them on it. Secondly, there are plants that have distinct foliage clusters but fibrous crown, these plants will usually require careful cutting up and many in some cases have only a few roots per division. This can necessitate planting in some sort of nursery bed until establishment, although in most cases they will survive if planted out straight away. This division can undertake when the plant are not growing too actively and the weather is not too warm. Thirdly, those plants which fleshy crowns with foliage emerging at many points. Tese will require careful cutting and many in some case have distinct growth points. Each division will need at least one growth point if it is to strike. This sort of division is best done just as the plants are emerging from dormancy. The line between division and natural layering is overlapped. Many perennials and shrubs, particularly ground covers will strike roots wherever they come in contact with in the ground. If cut at the appropriate point these aerial roots will then develop as normal subterranean roots. Different horticultural crops can be propagated by different specialized organs i.e. 'propagation by division' (Henry, 2005).

Propagation by tongue grafting

Apple is king of temperate fruit, symbol of health and premier fruit of the world. Tongue grafting is the most successful method in apple propagation. In tongue grafting, a 5 mm slanting cut is made tapering into the bark on the lower end in the scion- wood, in the middle if this slanting cut, another cut is made upward to form a tongue. A similar slanting cut of identical length is made on the rootstock pointing upward. Then a similar tongue is also made in the rootstock, corresponding to the exact location if the tongue made in the scion wood. The scion tongue is inserted into rootstock tongue in a way that the two cuts fit each other firmly. If the thickness in the scion-wood is different to the rootstock, the tongue should be cut in a way that in inserting it in the rootstock, the cambium layer of both the rootstock and scion make as much contact as possible. After the scion wood is interlocked with rootstock, is tied with a thread and waxed or wrapped with an alkathene strip so as to make it airtight the height if the scion graft on stock should normally be 15 cm above the ground. The month of February to March is the best time for tongue grafting in apple (Sharma and Rana, 2015; Muthukumar and Selvakumar, 2013).

Propagation by hard wood cutting

Among the fruits, grapes occupy more than 10 million ha. area with annual global production of US \$ 2 billion (Rao, 2005). It is propagated commercially by hard wood cutting (4 inches length and 8-10 mm diameter and 25-30 cm length) and can be prepared from the pruned wood. Growth regulators which are commercially used for cuttings is 1BA 2000 PPM in 10 second (Fig. 1 and 2)

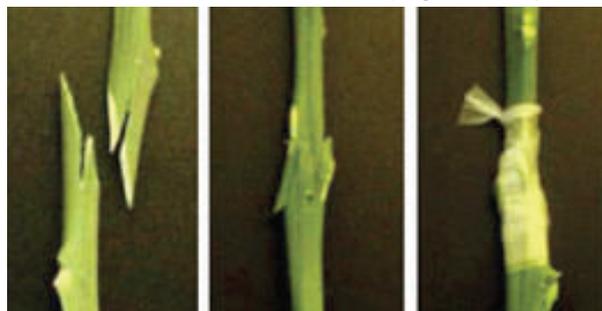


Fig. 1. Propagation by hard wood cutting

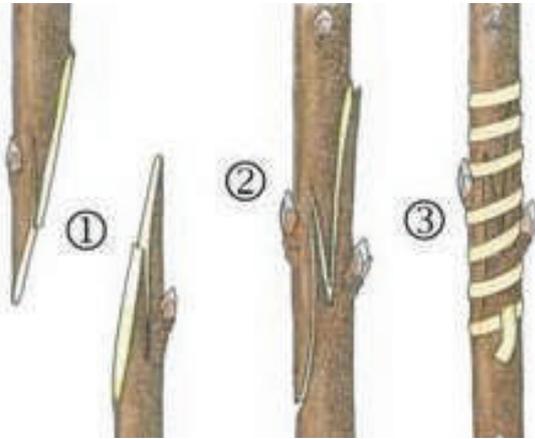


Fig. 2. Demo on propagation by hard wood cutting

Propagation by runner

Strawberry is one of the most important fruit crops which is regenerated by specialized stems called runner which grows horizontally along the ground and forms a new plant at one of the nodes. One plant may have several runners and one runner may grow several nodes. The long and flexible runners facilitate to bend and positioned according to

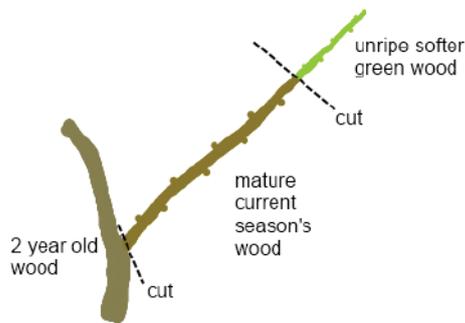


Fig. 3. a, b Propagation by runner



Fig. 4. a, b Propagation by runner

the desire of the person cloning them. When runner separated from the mother plant with intact roots, it serves as a propagule (Fig. 3 and 4). Growing strawberry plants from a runner is one of the easiest and quickest ways of propagating methods. According to Hasan et al., strawberry runners have been affected by photo period, as the day length has increased from 15 to 17 h, the number and length of strawberry runners also increased proportionately. So it is important to produce runners under a long period of light to get higher and vigor propagules (Ud-Deen, 2008).

Propagation by tuber

Potato is propagated vegetatively by 'division' of tubers. Tubers are divided into sections, each containing one or more eyes. Tubers are thickened underground stems that serve as storage organs. Tubers have no basal plate since

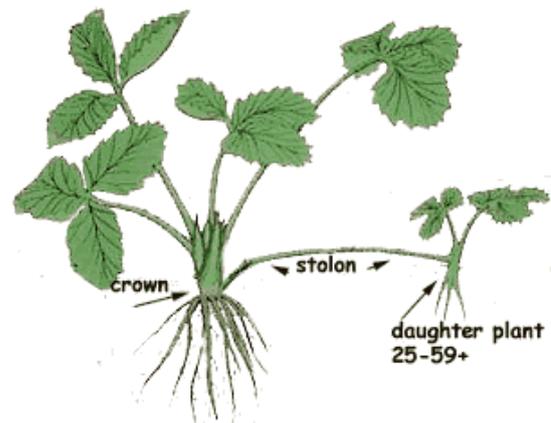


Fig. 5. Propagation by tuber

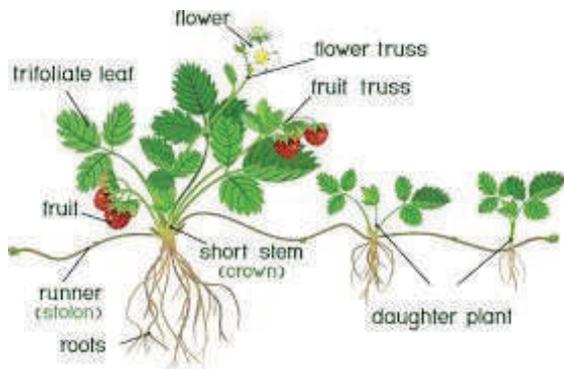


Fig. 6. Propagation by tuber having nodes

they do not originate from the base of a stem (Fig. 5). In potato (*Solanum tuberosum* L.) and many other tuberous plants, many tubers may raise from a single plant. Tubers are anatomically the same as stems having internodes and nodes from which eyes develop containing one or more shoot buds (Fig. 6). The tubers serve as an overwintering storage site producing new roots and shoots during the following season. The new shoots use the reserves from the tuber for initial growth and produce new tubers for the following season. Potato can be planted directly as whole or divided to smaller parts of tuber which have a bud at the node for shoot development. Planting different size of potato tubers has a direct effect on potato yields (Shrestha, 2007), the larger size and whole/half cut of potato tuber produces the higher tuber yields and are less susceptible to late blight potato disease as compared to the smaller size of the tubers.

Propagation by bulbs

Onion (*Allium cepa* L.) is an important vegetable crop that is grown worldwide. It is propagated either by seed or bulb (Smith et al., 2001)

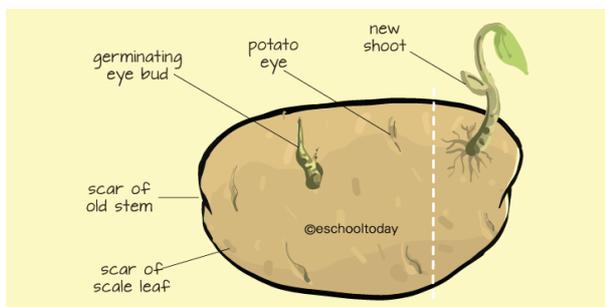


Fig. 7. Propagation by bulbs

Bulbs are a specialized modified underground organ consists of short, fleshy, usually vertical stem axis and enclosed by thick scales (Fig. 7). There are two kinds of bulbs; tunicate and non-tunicate,. the tunicate bulbs have outer modified leaves, which are dry and papery thin and non-tunicate or scaly bulbs lack this protective (papery) covering and are easily damaged. Meristems (lateral buds) develop between the scales and stem axis to form bulblets, known as offsets, when grown to mature size. The bulb size of onion has a direct effect on onion yield production. Some times when onion has propagated by bulb (Fig. 8), the upper portion of the bulb is removed in order to facilitate rapid initial growth of the bulb (Toogood and Anderson, 1999).

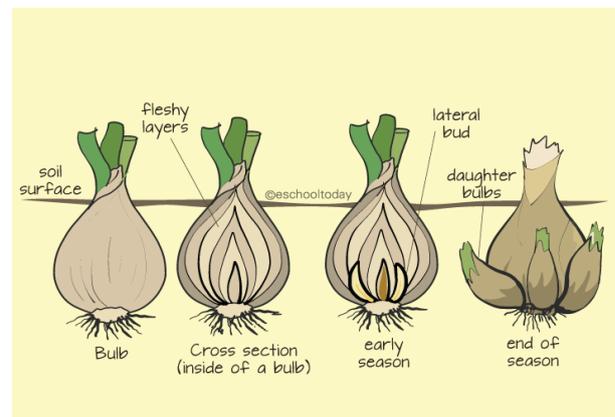


Fig. 8. Onion propagation by bulbs

CONCLUSION

Almost all of the breathing creatures on this planet has directly or indirectly dependent on the plant products either for food or other purposes. Generally, plants can be reproducing sexually by seed and asexually by different plant organs which the propagules possesses an identical genetic feature of the original parent plants. Different horticultural plants propagated differently by their specialized organs either by separating or dividing of their organ to produce a copy of the parent plants. Crops like apple, grape and straw berry fruits and potato and onion vegetables are reproduced by these specialized organs. Knowing and applying of this propagation methods are of paramount importance for plant propagators in order to increase production and yield of respective crops.

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