Stage 5 Agricultural Technology: Plant nursery production

Propagation of plants

Read the following passage and complete the questions.

Plants have evolved a fascinating array of reproductive strategies in order to survive and increase, and to colonize new ground. They have adapted to a wide range of adverse habitats, such as deserts, high altitudes where winds damage foliage and discourage pollinating insects; and even water, where problems are completely different. Since the dawn of civilization, the farmer and gardener have used their observations of plant reproduction in the wild to develop propagation methods in cultivation. All plant reproduction is by seeds (sexual reproduction) or by vegetative (asexual) methods.

Reproduction from seeds

Sexual reproduction remains the most important method of increase for many plants. Genetic material from a male and female parent of one species (preferably on different plants) unites in the seed or spore. The seed embryo forms a new plant that often looks the same as the parents, but has a different genetic make-up to either.

This capacity for evolution enables plants to adapt over a period of time to environmental changes or to colonize areas originally hostile to the species. Another advantage of producing seeds is that the plant embryos are able to lie dormant in hostile conditions, such as drought or a severe winter, delaying the next stage of reproduction until more favourable conditions occur.

Sexual reproduction can give rise to botanical subspecies or varieties, whose characteristics deviate to some degree from the parent species. This is most marked in mountainous areas where some plants become isolated on a valley floor or alpine peak from the more widespread species. The potential for variation is more dramatic where plants are isolated by water, creating colonies on separate islands. Geographical isolation can also result in endemism: a species limited to one locality.

In contrast, where two species from the same genus grow in the same area, they may cross-breed to produce natural hybrids. *Arbutus x andrachnoides* grows wild in Greece and is a hybrid of two species, *Arbutus andrachne* and *A. unedo*. In the wild, plants disperse hundreds or even millions of seeds in order that a few seedlings might survive to maturity. In cultivation, a high yield of good quality seedlings may be obtained more quickly by providing them with as ideal an environment as possible.

Humankind has also benefited from the genetic diversity of seeds, selecting forms that may have died out in the wild and developing from them plants with immense value in cultivation. Seeds offer the potential to introduce an exciting range of plants, with new forms of flower and leaf, hardiness, habit, adaptability for specific conditions, and resistance to pests and diseases.

However, seedlings may not be as suited to local conditions in the wild, or as garden-worthy in cultivation, as the parents. This risk can be reduced by the gardener, to some extent, by using seeds from known sources, where good-quality parents are selected and grown away from possible pollen contamination from inferior plants. Some seeds have a deep seated or complex dormancy as in *Davidia involucrata,* where seeds do not always germinate in any quantity in one season or may take several years to reproduce. Other species may fail to produce seeds at all or yield seeds with low viability, such as *Acer griseum*.

Vegetative reproduction

Nature has overcome the limitations of seeds by adopting asexual reproduction also, producing offspring (clones) that are genetically identical to the parent. Plants have many ways of increasing vegetatively from modified roots or stems. The simplest is by forming a closely knit mass, or crown of shoots and buds, each being a separate plant.

Some plants can regenerate shoots or roots from growth tissue to produce new plants (runners or layers). Others form specialized organs, including stem tubers (potato), corms (crocus) and pseudobulbs (cymbidium orchids), that store food. This enables a plant to survive unfavourable conditions and save energy for reproduction when favourable conditions occur.

Vegetative reproduction allows some plants to colonize an area more rapidly than by seeds, as any gardener who has encountered couch or witch grass *(Agropyron repens)* knows. It is also useful to plants at the fringes of their natural habitat, where flowering and seed production are difficult. Blackberries *(Rubus fruticosus)* rarely flower in dappled woodland, but spread rapidly by tip layering.

Gardeners have adapted natural vegetative, or clonal, reproduction to obtain plants that are always *true* to the parent. Methods such as division of herbaceous plants are even more reliable than seeds. Artificial ways of increase, such as by cuttings or air layering, have also been developed by exploiting plants' regenerative abilities.

Clonal propagation carries dangers, however. Genetically identical plants carry the same susceptibility to disease. The large UK population of English elms *(Ulmus procera)* was destroyed in the 1960-70s by Dutch elm disease. The trees usually reproduce by root suckers so were represented by just a few genetically different clones. If the elms had increased by seeds, they may have varied enough genetically for resistant trees to have occurred.

Learning from nature

Most plants have the capacity to increase sexually and asexually, which avoids disasters similar to that suffered by the English elm. This benefits gardeners, who can choose a propagation method to suit their needs and the capacity of each plant to reproduce in the local conditions. The plant family can be a useful guide: plants in the same family often reproduce similarly. For example, most plants in the Gesneriaceae, such as African violets *(Saintpaulia), Columnea, Ramonda* and *Streptocarpus* readily regenerate from leaf tissue. The Labiatae, including coleus *(Solenostemon),* sage *(Salvia), Lamium* and rosemary, root easily from stem cuttings — in the wild, stems close to moist soil produce roots. Another factor is the plant's natural limit of distribution; often reproductive ability declines outside this area. This may be countered by providing controlled conditions.

(From Toogood, Alan (ed.) (1999) *Propagating Plants*, Dorling & Kindersley, London.)

Questions

1. The two main methods in which plants can naturally reproduce are…
2. Briefly describe the process of sexual reproduction in plants.
3. Describe three reasons why sexual propagation is important in plants.
4. How are these natural advantages (from question 3) often a disadvantage to a gardener?
5. How are plants reproduced by vegetative means similar to their parent plant?
6. In natural systems plants can propagate by vegetative means in a number of methods, list some of these.
7. What are the risks a gardener faces if plants are propagated by vegetative methods?