

# Artificial seed / synthetic seed production

Large scale production of somatic embryos and their encapsulation is referred to as Artificial or synthetic seed production. It is an alternative to traditional micro propagation for production and delivery of cloned plantlets. Artificial or synthetic seed is a bead of gel containing somatic embryo or shoot bud and the nutrients, growth regulators. Pesticides, antibiotics etc needed for the development of a complete plantlet from the enclosed somatic embryos or shoot bud.

Artificial seeds may be produced by one of the two following ways:

- A. Dessicated
- B. Hydrated systems

In the **desiccated system** the somatic embryos are first hardened to withstand desiccation and then are encapsulated in a suitable coating material to yield desiccated artificial seeds. Somatic embryo may be hardened either by treating or coating mature somatic embryos with a suitable polymer followed by drying or treating them with ABA during their maturation phase. ABA treatment also improves germination of somatic embryos.

In the **hydrated systems**, somatic embryos are enclosed in gels which remain hydrated. Of the many gels evaluated “calcium alginate is the most suitable.

Artificial seeds can be made easily as follows. A 2% solution of Sodium alginate is filled in a burette and allowed to drip drop by drop into a 100 millimolar  $\text{CaCl}_2$  solution. As the sodium alginate bead or drop forms at the tip of the burette, a somatic embryo is inserted into it with the help of a spatula before the drop falls into the  $\text{CaCl}_2$  solution. The beads become hardened as calcium alginate is formed. After about 20-30 min the artificial seeds are removed, washed with water and used for planting.

Hydrated seeds are sticky and difficult to handle on a large scale, dry rapidly in the open air and they have to be planted soon after they are produced. These problems can be resolved by providing a waxy coating over the beads. Alternatively, a desiccated system may be used to produce synthetic seeds. However, it is not possible to store, except at low temperature and for a limited period.

# Applications

- 1) seed propagation of sterile plants
- 2) High efficiency in multiplication
- 3) Fixation of hybrid vigour, eliminate the need of inbred lines to produce F1 hybrids.
- 4) Elimination of the need of edible seeds or tubers for propagation

- 5) Multiplication of Genetically engineered individuals, which may be sterile and unstable during sexual production
- 6) production of virus and disease free plants
- 7) protection of seedlings by incorporating useful chemicals in the encapsulation material
- 8) provide the advantages of true seed (case of handling and transportation) for vegetative propagation.

# Limitations

- 1) Large scale production of high quality somatic embryos is a costly affair
- 2) poor germination of synthetic seeds due to lack of supply of nutrients, sufficient oxygen, microbe invasion and mechanical damage of somatic embryos
- 3) Occurrence of somaclonal variation.
- 4) Special skills are required to carry out the work

# Problems

1. Artificial seeds that are stable for several months requires the procedures for making the embryos quiescent
2. Artificial seeds need to be protected against desiccation
3. Recovery of plants from artificial seeds is often very low due to incomplete embryo formation or difficulties in creating an artificial endosperm.
4. The embryo must be protected against microorganisms