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Artificial Seed

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SUMMARY

Plant propagation using artificial or synthetic seeds developed from somatic and not zygotic embryos opens up new vistas in agriculture. Artificial seeds make a promising technique for propagation of transgenic plants, non-seed producing plants, polyploids with elite traits and plant lines with problems in seed propagation. Being clonal in nature the technique cuts short laborious selection procedure of the conventional recombination breeding and can bring the advancements of biotechnology to the doorsteps of the farmer in a cost-effective manner.

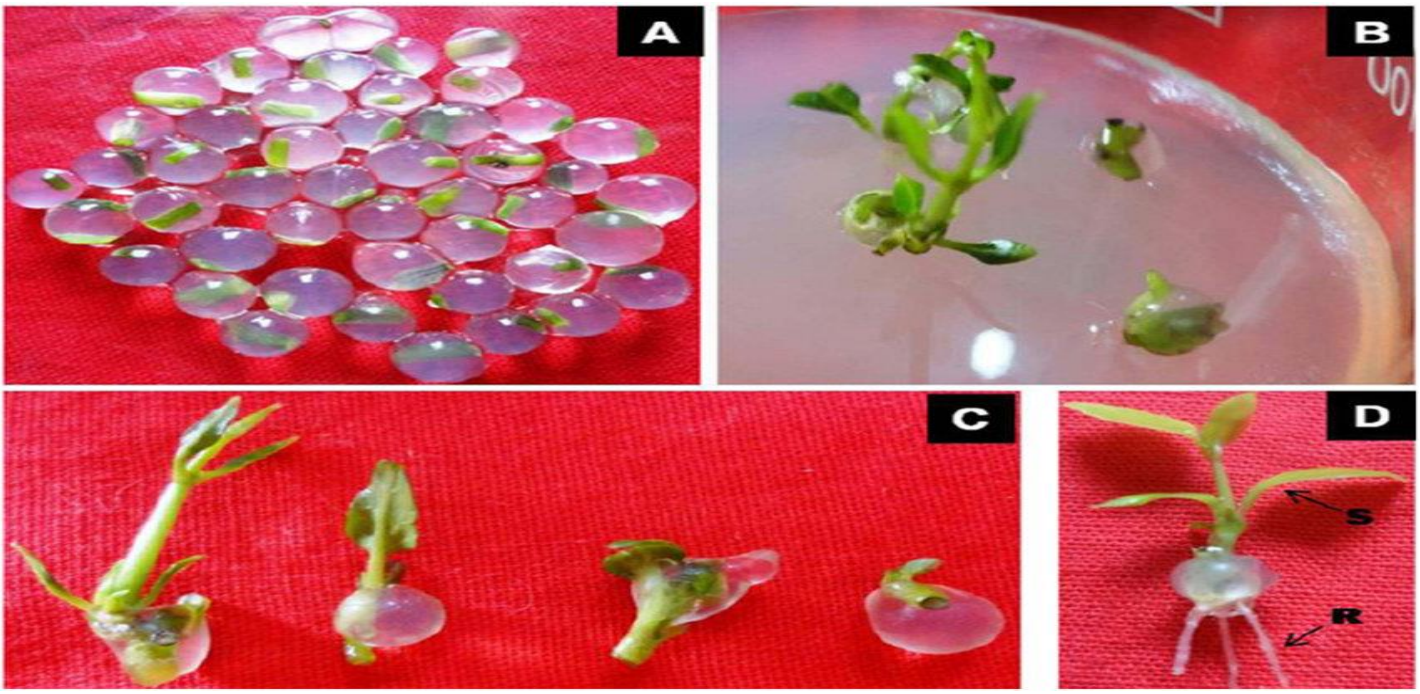
INTRODUCTION

Synthetic seeds are defined as artificially encapsulated somatic embryos, shoot buds, cell aggregates, or any other tissue that can be used for sowing as a seed and that possess the ability to convert into a plant under in vitro or ex vitro conditions and that retain this potential also after storage. In simple words synthetic seed contains an embryo produced by somatic embryogenesis enclosed within an artificial medium that supplies nutrients and is encased in an artificial seed covering. The technology designed to combine the advantages of clonal propagation with those of seed propagation and storage. Also be as channel for new plant lines produced through biotechnology advances. The first synthetic seeds were produced by Kitto and Janick in 1982 using carrot.

Types of Artificial Seed:

1) Hydrated Artificial Seed:

Somatic embryos induced in appropriate nutrient medium is mixed with sodium alginate (0.5-5%). Then embryo loaded sodium alginate is dropped in to a solution of calcium chloride (30-100 min) drop by drop. Each droplets form calcium alginate capsule around each embryo within 10-60 min .Excess calcium ions removed by rinsing of water.



2) Desiccated Artificial Seed :

Desiccated synthetic seed are coated with a water soluble resin polyethylene oxide S E suspension is mixed with equal volumes of 5% solutions of polyethylene oxide, with subsequently dried from polyembryonic desiccated wafers. The survival of the encapsulated embryos was further achieved by embryo hardening treatment with 12% Sucrose followed by chilling at inoculums density.

Procedure for Artificial Seed:

The somatic embryos foe synthetic seeds are produced in the lab through culturing of somatic cells and treating with different hormones to produce root and shoot. The following are the different steps involved in artificial seeds production;

1.Establish somatic embryogenesis
2.Mature somatic embryos
3.Synchronize and singulate somatic embryos
4.Mass production of embryos
5.Encapsulation of matured somatic embryos
6.Desiccation
7.Field planting

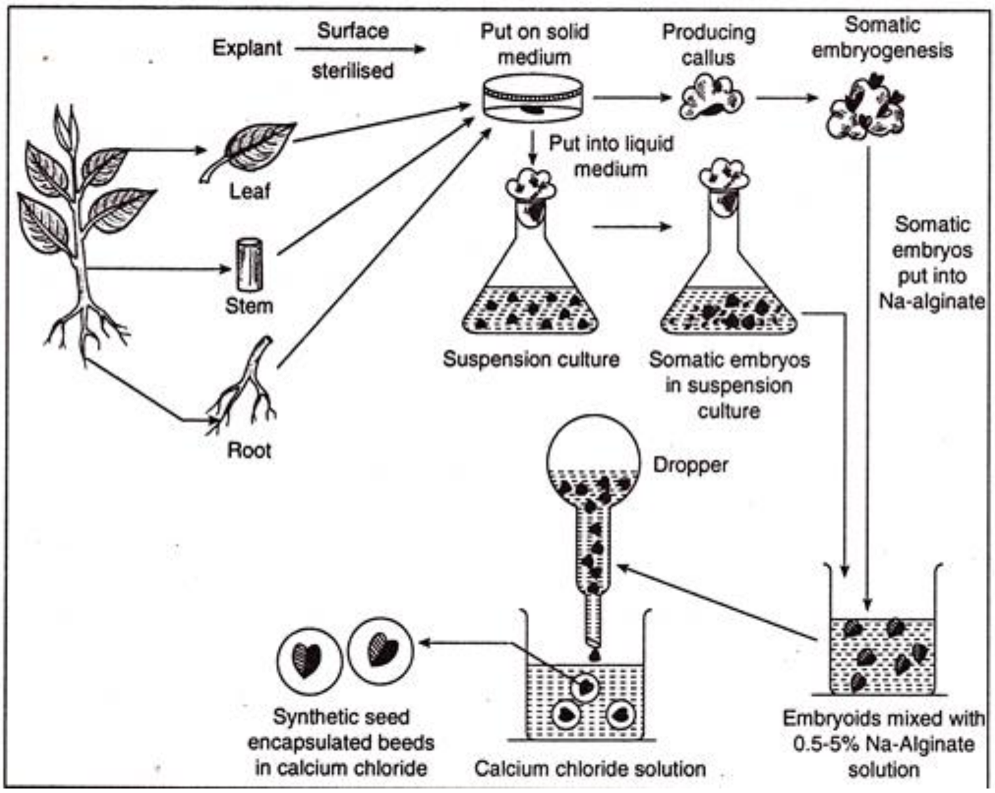


Fig: 01 Steps for making artificial seed

Importance of Artificial seed:

- Easy handling and Inexpensive transport: As the synthetic seeds are small in size hence it is easier to store, transport and planting.
- Storage life: Synthetic seeds posses' long storage life and also the seed viability remains good for longer period of time.
- Product uniformity: As somatic embryos are used for the production of artificial seeds hence most of the seeds are identical in there uniformity.
- To avoid extinction of endangered species and seed less plants: The most important advantages of synthetic seed are such as it helps in conservation of endangered species e. g. in hedgehog cacti (Echinocereus sp.) and seedless varieties e.g. grapes.

- Large scale propagation: After the standardization of protocol it is very much suitable for large scale monoculture.
- Germplasm conservation: A synthetic seed plays an important role in germplasm conservation.
- Elite plant genotypes: artificial seed technology preserves, protects and permits economical mass propagation of elite plant genotypes such as orchids.
- Independent of environmental conditions: The technologies of synthetic seeds production are not a season dependent as these are prepared inside the laboratory.
- Permits direct field use: For tissue culture raised plants rooting, hardening is necessary but in case of synthetic seeds direct field sowing can give good yield.
- Facilitates study: basic steps involved in the synthetic seed technology involves seed coat formation, function of endosperm in embryo development and seed germination, somaclonal variation provides wide open facility for study.
- Supply of beneficial adjuvants: beneficial adjuvants like plant nutrients, plant growth regulators, microorganisms, fungicides, mycorrhizae, antibiotics can be made available to the developing plant embryo as per the requirement as these can be added in to the matrix.
- Hybrid production: synthetic seed production technology can be used for production of hybrids which have unstable genotypes or show seed sterility such as not susceptible towards infection. It can be used in combination with embryo rescue technique. The rescued embryo can be encapsulated with this technique to form synthetic seeds.
- In self-pollinated crops that currently have good seed production systems, synthetic seeds will not have any practical applications, but in cross pollinating species, especially those where seed production is difficult and expensive, synthetic seeds offer many advantages and opportunities.

Limitations -

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

Problems

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

CONCLUSION

Artificial seeds were produced successfully from encapsulated plant propagules in different plant species. Procedures were optimized and proper plantlets were obtained. This technique has great advantages such as: a cost-effective delivery system, minimization of the cost of plantlets, simple methodology with high potential for mass production, a promising technique for the direct use of artificial seedlings in vivo, and a high storage capacity. The advances of this technique depend on the plant species in the first step. During the last fifteen years, considerable improvement is seen in the case of artificial seed production but several problems remain associated with the commercialization of synthetic seed. The most important requirement about the practical application of artificial seed is the production of high quality micropropagules and large-scale production of seeds. Among tree species, regeneration of viable plantlets from somatic embryos is a frequently encountered problem, including germination, maturation, rooting of shoots or acclimatization and shoot apex elongation. The production of synthetic seed must either reduce production cost or increase crop value. Improvement in the practices related to sorting of matured embryos, harvesting, encapsulation and germination can give higher yield and improvement of the quality of synthetic seed. However further study and research related to the improvement of technology can help in the global acceptance of synthetic seeds.

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