

## Synthetic Seeds

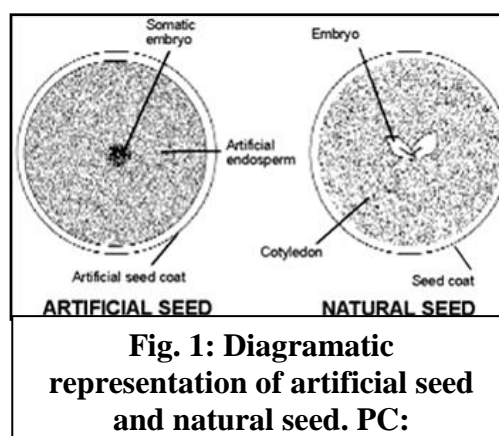
**V. Satya Srii\* and Nethra Nagarajappa**

All India Coordinated Research Project on Seed (Crops), Seed Technology Research Unit, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences Bangalore, Bengaluru-560065.

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### Introduction

Synthetic seeds are artificially encapsulated plant propagation material. This material could be somatic embryos, shoot buds, cell aggregates, or any other tissue that we can use as a seed for propagation. Synthetic seed technology primarily involves encapsulating somatic embryos in a protective coating. These seeds have the potential to develop into a whole plant in vitro as well as under ex vitro conditions. They retain this potential even after storage.



### Why synthetic seeds?

One of the reasons is that this technology can help in improving characteristics in the new embryos and hence can be beneficial for longer duration storage. For instance, these embryos and plant propagules are prone to weed infestations as well as pathogen infections that can affect their ability to survive. Therefore, adding herbicides or biological pesticides along with nutritive material provides resistance against weeds and even pests for the initial growth phase. Thus, facilitating better growth and development. Another important reason is to prevent the desiccation of somatic embryos or plant propagules in the natural environment. Hence, to prevent these outcomes, protective coatings are suggested for somatic embryos or propagules. They are also important for some seedless plant species or varieties, for instance, grapes where it is hard to have successful propagation via seeds.

### Types of synthetic seeds

#### 1. Desiccated synthetic seeds

These seeds are produced by encapsulating multiple somatic embryos along with the process of desiccation. The process of desiccation involves completely removing the moisture

content from these seeds. To form the protective coating on somatic embryos or propagules, we use **polyoxyethylene (Polyox)** as encapsulating material. This material prevents the growth of microorganisms and is non-toxic to embryos.

The process of desiccation either takes place slowly over a period of 1 to 2 weeks in decreasing humidity environment or by simply leaving them on the bench overnight to dry. However, desiccated seeds are beneficial only for those plant species where somatic embryos are tolerant to desiccation.

## 2. Hydrated synthetic seeds

These seeds are produced by encapsulating the somatic embryos in hydrogel capsules. They are more suitable for plant species where somatic embryos are recalcitrant and show sensitivity to desiccation. The most common method to form hydrated seeds is by using **calcium-alginate** encapsulation.

### Production of synthetic seeds

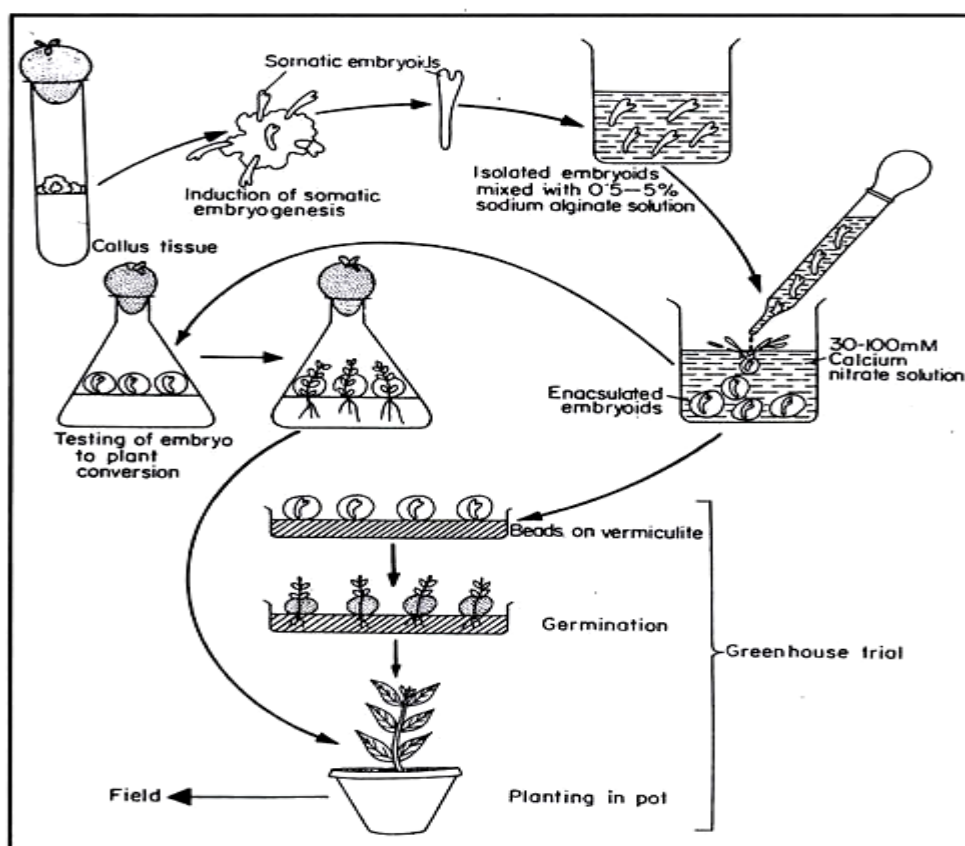


Fig. 2: Diagram showing the production of artificial seed. PC: biotecharticles.net



### **Advantages of synthetic seeds**

- This method is for large scale productions.
- It maintains genetic uniformity for a high number of generations. Most plant tissue culture methods fail to maintain genetic uniformity for longer durations.
- According to literature, the costs of producing a plant using this technology is low.
- It facilitates rapid multiplication of plants.
- One of the biggest merit of this method is direct delivery of plant parts (protected with viable coating) to the field.
- These seeds have potential for short and medium term storage without losing viability.
- As compared to plantlets, it is easy to handle and transport synthetic seeds.

### **Disadvantages of synthetic seeds**

- Somatic embryos have low survival rates for most plant species, which also limits the value of synthetic seeds.
- There are not many protocols available to produce propagules from different plant parts using plant tissue culture methods. Hence less useful material is available for producing synthetic seeds.
- In some cases, inefficient maturation of somatic embryos leads to poor germination and hence poor growth and development.
- According to scientists, somatic embryos from some plant species are not capable of germinating out of the capsule or coating. Hence, they are not able to form normal plants rapidly.
- The concentration of coating material is also a limiting factor for producing synthetic seeds. It should have nutrient supplementing materials for facilitating germination and growth.
- When the shape of synthetic seeds is not matching the farm machinery then it is hard to use them for transplantation. Hence, seeds should be transplantable.
- One of the major problems these seeds face is quick drying out of capsules. We need to store them in a humid environment and coat them with hydrophobic materials to prevent drying.

### **Conclusion**



Synthetic seeds have promising applications. Intensive research and development is going on around the world for producing such seeds, especially for important crops. They can be transported easily from one country to another without any quarantine obligations. Hence, these seeds can definitely be an innovative way to increase global food production in the coming years.

### References

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