



## Seed Pelleting: A Smart Technology for Better Crop Establishment

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Seeds are the starting point of agriculture, and their quality directly determines crop productivity. For many crops, particularly vegetables, pulses, and flowers, ensuring good germination and uniform crop stand is often a challenge. Tiny and irregular seeds such as those of onion, carrot, tomato, or chillies are difficult to sow evenly, while nutrient deficiency or disease attack in the early stages can further reduce crop establishment. To address these problems, a simple yet highly effective method known as \*seed pelleting\* has been developed. Seed pelleting is a technique in seed enhancement where seeds are coated with inert materials to increase their size, shape, and weight for easier handling and precise sowing. Since many crop seeds (like tobacco, onion, carrot, tomato, and several flower crops) are very small, irregularly shaped, and light in weight, direct sowing often results in uneven seed distribution, poor plant population, and difficulties in mechanical sowing.

Pelleting involves applying layers of coating material (such as clay, lime, gypsum, or polymer-based substances) around the seed until it becomes round and uniform in size. Apart from inert fillers, nutrients, pesticides, fungicides, biofertilizers, and growth stimulants may also be incorporated into the pellet to improve seed germination, seedling vigor, and protection against pests and diseases. Seed pelleting involves coating individual seeds with a layer of inert or active materials, often using an adhesive, so that their size, shape, and weight are improved. The final product is usually spherical or oval in shape, which makes the seeds easier to handle, particularly when mechanical seed drills are used. While seed coating only adds a thin film of material, pelleting significantly increases the volume and weight of the seed (ISTA, 2020). Depending on the objective, the pelleting material may simply be inert powders such as clay, lime, gypsum, or talc, or it may be enriched with nutrients, protectants, or biofertilizers to provide additional benefits to the emerging seedling.

### Importance of Seed Pelleting

The importance of seed pelleting lies in its ability to solve multiple problems faced by farmers. In crops with small seeds like onion or carrot, direct sowing in the field often results in uneven spacing and poor germination. Pelleting increases the seed size and makes sowing more accurate, which saves both labour and seed (Rai & Verma, 2017). The uniformity in germination and seedling emergence results in a better crop stand and higher productivity. In addition, pelleted seeds can carry beneficial materials such as micronutrients, fungicides, insecticides, or microbial inoculants. This not only enhances early seedling vigour but also protects plants from soil-borne pests and diseases (Singh & Agarwal, 2015). Thus, pelleting is not just about improving the seed's physical appearance but about giving it a head start in life.

### Types of Seed Pelleting

- Inert pelleting uses fillers like clay, lime, gypsum, or charcoal, mainly to increase seed size and improve handling.

- Nutrient pelleting involves coating seeds with essential nutrients such as molybdenum for pulses, zinc for cereals, or boron for vegetables. These nutrients are made available to the young seedlings at the time of germination, ensuring strong early growth
- Protective pelleting uses chemical or biological agents to safeguard the seed from diseases and insect pests; for instance, fungicides like carbendazim or bioagents such as *Trichoderma* are often used in pulses (Singh & Agarwal, 2015).
- Biofertilizer pelleting with microbes like *Rhizobium* or *Azospirillum* enhances nitrogen fixation and plant nutrition. More recently, \*polymer pelleting\* has gained attention, where polymer materials are used as binders, allowing for controlled release of active ingredients.

### Method of Seed Pelleting

The method of seed pelleting is relatively simple and can be performed both at farm level and in seed industries. The first step is the selection of good quality seeds. These seeds are then slightly moistened with an adhesive solution, such as gum arabic or jaggery water, which helps the pelleting material stick to the seed surface. Once the seeds are coated with the adhesive, the chosen filler material—be it clay, lime, or nutrient powder—is gradually dusted over them while continuously stirring or rolling. This process is often carried out in a rotating drum, but small quantities can even be done manually using trays or bowls. The seeds are coated until the desired thickness is achieved, after which they are dried in shade to ensure that the coating remains firm and the seed viability is maintained (Copeland & McDonald, 2012). Proper drying is critical, as improperly dried pelleted seeds may lose vigour or be prone to fungal infection.

### Applications of Seed Pelleting in Agriculture

Seed pelleting has wide applications in agriculture, particularly for crops with small, light, or irregularly shaped seeds such as tobacco, onion, carrot, tomato, and various flower crops. By increasing seed size and making them round and uniform, pelleting facilitates precision sowing and makes the seeds suitable for mechanical planters and seed drills, thereby improving sowing efficiency and reducing labor costs. Pelleted seeds establish better in the field as the coating can regulate water absorption, create a favorable microenvironment, and sometimes supply nutrients or growth-promoting substances. In addition, seed pellets can act as carriers of agrochemicals such as fungicides, insecticides, biofertilizers, and micronutrients, offering protection against pests and diseases while also nourishing the seedlings. This reduces the need for multiple field applications and ensures healthy crop establishment. The practice also minimizes seed wastage, which is especially important for expensive or hybrid seeds, and ensures uniform germination in nursery trays, making transplanting easier and more effective. Thus, seed pelleting plays an important role in modern agriculture by improving seed handling, protecting seedlings, and enhancing crop productivity.

### Advantages of Seed Pelleting

Improved seed size and shape – Small, irregular seeds become larger, round, and uniform, making them easier to handle.

Facilitates precision sowing – Ensures proper spacing, depth, and even distribution of seeds, suitable for both manual and mechanical planting.

Better germination and establishment – Coating materials help regulate water absorption and provide a favorable microenvironment for seedlings.

Carrier for inputs – Pellets can deliver fungicides, insecticides, biofertilizers, and micronutrients directly with the seed, reducing the need for later applications.

Reduced seed wastage – Particularly useful for costly and hybrid seeds, as each pellet contains a single seed, minimizing losses.

Nursery and transplanting efficiency – Provides uniform seedling growth, making nursery management and transplanting easier.

### Limitations of Seed Pelleting

Costly process – Requires additional materials, equipment, and labor, increasing the overall seed cost.

Special storage conditions – Pelleted seeds may have reduced shelf life and require careful handling to prevent damage or moisture absorption.

Delay in germination – If the pellet coating is too thick or not properly prepared, it can slow down water uptake and seed emergence.

Not suitable for all crops – Mainly used for small-seeded crops; large-seeded crops often do not need pelleting.

Dependence on precision – Improper pelleting techniques can damage seeds or lead to uneven germination.

### Future Prospects

The future of seed pelleting appears very bright in the context of precision agriculture and sustainable farming. Researchers are developing eco-friendly pelleting materials that make use of biodegradable polymers, natural adhesives, and bio-based protectants. The integration of nanotechnology into pelleting—such as nano-fertilizers or nano-pesticides—is expected to revolutionize seed enhancement (Singh & Agarwal, 2015). Furthermore, combining pelleting with other seed enhancement techniques like priming and film coating may result in multifunctional seed technologies that improve both productivity and environmental safety.

### Conclusion

Seed pelleting is a small but powerful innovation that can significantly influence agricultural productivity. By improving seed handling, enhancing germination, protecting seedlings, and delivering nutrients, pelleting provides a comprehensive solution to many challenges faced in crop establishment. For crops with small seeds or specific nutrient requirements, it is almost indispensable. As agriculture moves towards greater efficiency and sustainability, seed pelleting will continue to play a key role in ensuring food security and farm profitability.