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# Sowing of Pelletized Seed: A Technique To Simplify Eucalypt Raising in Tropical Nurseries

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*The sowing of pelletized eucalyptus seeds in containers, adapting growing techniques developed in Italy, could simplify nursery operations in tropical areas. This system is more advantageous than the traditional nursery technique of broadcasting in the seedbed, then pricking out and transplanting small seedlings into pots-because it is less laborious, permits mechanical sowing, and prevents damage caused by transplanting machines and root deformations (U- or J-roots) caused by manual transplanting.* Tree Planters' Notes 45(2):58-62; 1994.

Tropical forestry plantations have been estimated at 25 million ha (61.73 million acres), with a rate of planting of about a million hectares per year. In some 90% of these plantations, fast-growing species are planted, and, among these, trees of genus *Eucalyptus* play a preponderant role (Bonner 1992).

Without any doubt, everything concerned with plantations of indigenous species deserves greater attention and study, but the fact cannot be overlooked that the great diffusion of eucalypts outside of their natural habitat has been, and still is, the result of numerous, decisive advantages that count a great deal when it comes to selecting the species for a plantation. It is up to the planter to decide which species are the most suitable ones for each environment, just as research has the possibility of contributing objective elements of judgment to ensure that such selection will be correct.

In the present context, no claim is made to analyze whether the preference for exotic trees is a positive fact or otherwise. What is proposed is a simplification of eucalypt-growing for nurseries.

## Characteristics of Eucalyptus Seed and Traditional Raising Systems in Italian Nurseries

What is commonly referred to as "eucalyptus seed" is a mixture of fertile seeds, sterile structures, unfertilized ovules, and impurities of various types, the last three components being what is known as "chaff." The various fractions are not generally separated out. Using current equipment for separation is not easy, because the size and specific gravity of fertile seeds and chaff are frequently similar. For this reason, this last component, in nursery practice, acts as inert matter that helps to distribute the fertile seeds evenly when uncleaned seeds are broadcast in seedbeds or trays.

The small size and irregular shape of fertile seeds, and the presence of chaff intimately mixed with them, make it difficult to handle the former. Generally speaking, it is practically impossible to take the fertile seeds one at a time, although in some species their volume is relatively large (*Eucalyptus globulus, E. gomphocephala, E. occidentalis,* etc.). Because of these characteristics, growing eucalypts in Italy traditionally takes place in two stages: first the seeds are broadcast in cold frames in the open air or in heated seedbeds, and then the young seedlings are pricked out and transplanted into containers, where they remain for a few months for further growth.

Transplanting, either manual or mechanized, is an effective technique provided the necessary precautions are adopted. It is of fundamental importance for the plantlets lifted from the seedbed to be of adequate size and to be in the proper physiological state to ensure a high survival rate after being transplanted into containers. The most satisfactory results are generally obtained by transplanting very small plantlets, but this requires exclusively manual operations and presents handling problems because the plantlets are very small and delicate. With manual transplanting the plantlet has to be perfectly placed in the container in order to avoid severe root deformations.

In Italy, transplanting machines are fairly widespread; however, their use may cause "strangling" in the root collar area when the pincers holding the plantlets are not perfectly regulated (figure 1). It is also very important that weather conditions are appropriate during transplanting because intense heat or strong winds can lead to seedling mortality due to excessive transpiration.

On the other hand, sowing uncleaned seed, which in general contains a high proportion of chaff, directly in containers does not permit a correct dosage of fertile seeds. There is a tendency to place a large number of

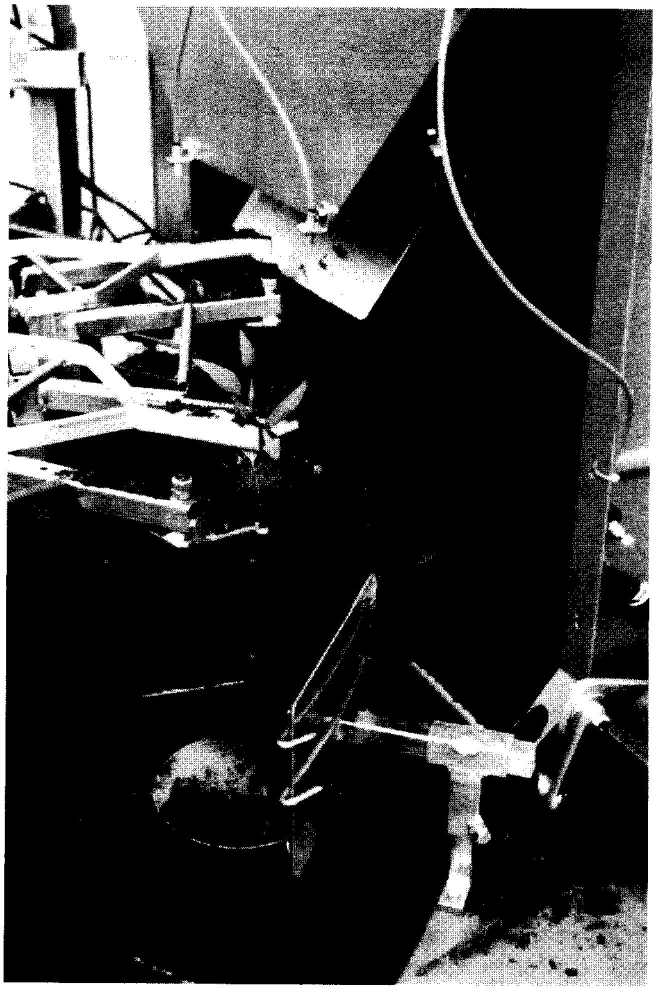

**Figure 1**—*Potting and transplanting machine (see pincers holding a seedling).*

seeds in each container, with a considerable increase in waste of seeds because of the thinning of excess seedlings that is subsequently necessary.

Considering that nurseries usually have a large number of activities to carry out, generally concentrated in limited periods of time, the need may arise for anticipating or postponing sowing and/or transplantation, so that these operations have to be performed at unfavorable moments with plantlets of not very adequate development.

## Use of Pelletized Seed for Direct Sowing in Containers

Considering the meticulous nature of the techniques involved at the various stages of the traditional seedling raising system just described (seedbed stage + transplanting in pots), the need arose in the Centro di Sperimentazione Agricola e Forestale (Società Agricola e Forestale/Ente Nazionale Cellulosa e Carta) to develop a technique that would enable work times to be reduced and survival rates in the nursery to be improved. The direct sowing of pure fertile seeds in containers could succeed in simplifying the raising process, but for this the chaff had to be wholly removed and the volume of the seed had to be increased artificially to provide easy handling. After various attempts, both aims were achieved by a Swedish firm (Hilleshbög), which pelletized the seeds. After processing, small spherical pellets were obtained, 3 mm in diameter, consisting of inert matter that disintegrated upon contact with water or moist soil. Each pellet contained one seed (figure 2).

Pellets of *E. globulus* ssp. *bicostata, E.* x *trabutti,* and *E. viminalis,* with a germinative capacity of 75, 84, and 79%, respectively, were used in Società Agricola e Forestale (SAF) nurseries situated in Italian regions with torrid summers (Campania, Calabria, Sicily, and Sardinia), to assess the practical difficulties of the new growing system. These preliminary experiments showed the need to investigate the sowing dates and materials for covering the pellets. Thus, in 1984-85, trials were carried out in SAF nurseries in Rome and at a location close to Salerno (Campania), which, in fact, provided useful information for defining the most adequate operational methods at the different raising stages. The trials carried out (Piotto 1987a) and the results obtained are described briefly below.

After sowing 2 pellets in each container (plastic bags with a volume of 760 $cm^3$ or 45.6 $in^3$), light, frequent waterings were made with fixed overhead sprinklers in order to assist the disintegration of the pellets. The containers were provided with shade until the sixth leaf appeared on the plantlets and also during the hottest part of the summer.

On the basis of a split-split-plot experimental design with six replications, an analysis was made of the influence of five sowing times (May 14 and 30, June 13 and 27, and September 3) and of three types of covering material (mixture of 50% soil and 50% peat, gelatine, and perlite) on the emergence percentage and on the development achieved by the plants at the end of the raising period.

When perlite was used to cover the pellets, the highest number of seedlings were produced (figure 3). Gelatine, on the contrary, led to a very limited number of emergences, whereas the soil-peat mixture gave intermediate results. From the standpoint of survival and development of the material obtained, sowing at

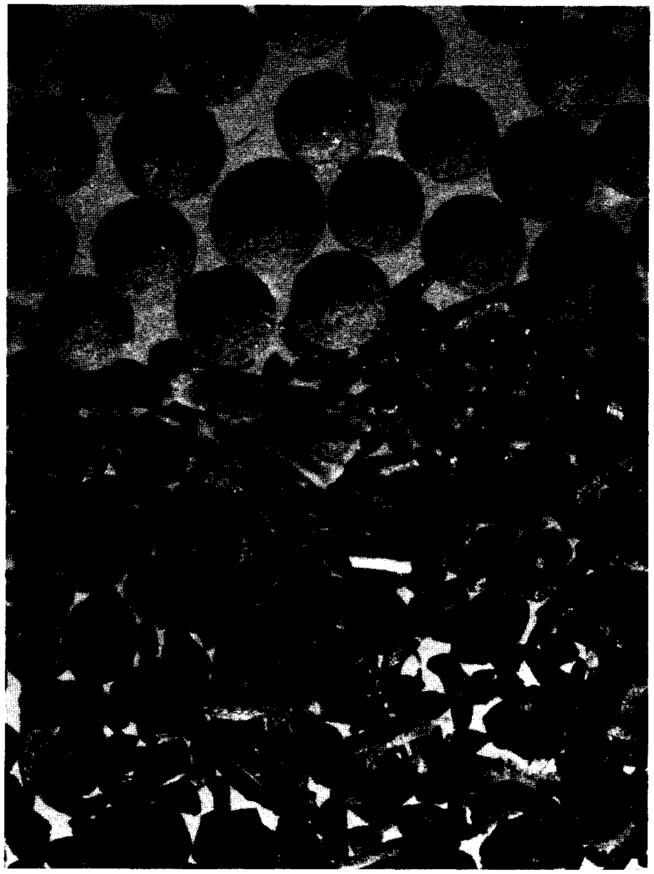

**Figure 2**—*Pelletized and nonpelletized* Eucalyptus viminalis *seed (notice the chaff in the latter).*

**Figure 3**—*Eucalypt seedling emergence in containers covered with perlite.*

the end of June proved most advantageous in Rome and at the end of May in Salerno, especially when perlite was used to cover the pellets. For the best combination of factors studied, the percentage of empty containers at the end of the emergence period varied between 3 and 10%, according to the species and the nursery.

Further research was necessary to understand the problem of the disintegration of the thicker pellets (3.25 to 3.75 mm), which had been prepared to contain larger seeds (*E. gomphocephala).* During the standard germination tests to determine the germinative capacity, it had been observed that these pellets offered some degree of resistance to disintegration, and this raised doubts as to their nursery performance. The germination of pelletized seed and that of decoated seed were then compared by removing the inert material forming the pellet, both in a laboratory-controlled environment and in an open-air nursery (Piotto 1987b).

At the end of 1 week, the percentage of pelletized seed that had germinated in the cabinet-type germinators (at conditions of alternate cyles of 16 hours at 20 /C and 8 hours at 30 /C, without light) amounted to 35%, while the level reached by the decoated seed was 74% (figure 4). In the nursery, at the end of 7 days, the emergence of both was about the same: 42 and 47%, respectively. After 1 month, the emergence in the nursery was 80% for pelletized seed and 76% for the decoated seed, which means that their performances were very similar. In the laboratory, on the other hand, the initial differences continued,

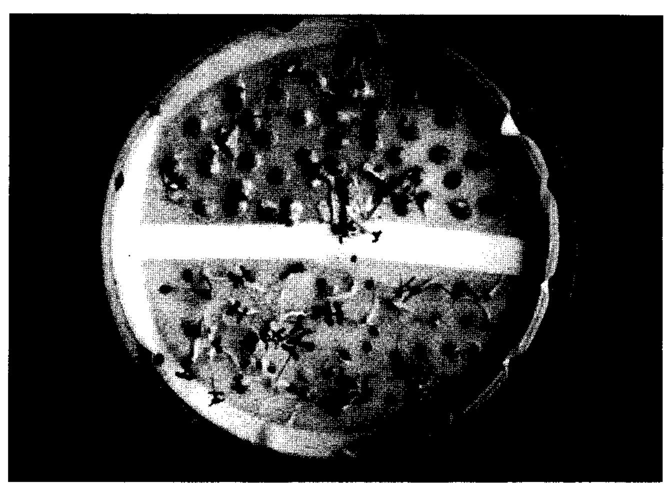

*Figure 4—Germination of pelletized seeds of Eucalyptus gomphocephala* **(top)** *and of decoated seeds* **(bottom)** *after 1 week in cabinet germinators.*

although in less accentuated form: the pelletized seed germinated less (69%) than the decoated seed (84%). The conclusion was thus reached that pelletized seed sown in open-air nurseries did not find coating a limiting factor, even when this was of relatively large size, because its breakdown was appreciably facilitated by the mechanical action of the irrigation water, something that did not occur in the laboratory, where the environment is normally moist but static. Subsequent trials have shown that the results obtained in the experiment described are always reliable when a high-quality coating technology is applied, that is to say, only if the preparation of the pellet and the materials used to make it ensure its rapid disintegration in contact with water. If, on the contrary, the coating material is not sufficiently crumbly, it gives rise to delays in emergence. It is therefore essential to deal with commercial companies with extensive experience in seed processing that are capable of preparing a product having the requisites imposed by conditions in open-air nurseries. Many years have elapsed since the first pelletization (1983), and pellets prepared by various companies Hilleshög Asgrow, and Royal Sluis) have been available for several years. No connection has been found between the date that the pellet was prepared and the field germinability of the enclosed seed, at least within certain time limits. That is to say, no aging of the material has been noted able to severely limit germination. Fortunately, the initial qualitative characteristics of the pellet as regards coating material remain. There are, however, other aspects of nursery growing that are far more decisive for the success of plant production, namely:

- Choosing a sowing date to ensure the maximum emergence of plantlets and adequate development of plants at the end of their period in the nursery.
- Sowing at the proper depth (3 to 5 mm).
- Using a light and friable covering material (e.g., perlite) that creates no obstacles to germination of the tiny eucalyptus plantlets.
- Placing a nonwoven cloth over the containers for a few (3 to 6) days after sowing to prevent the wind from blowing the perlite or other light covering material away.
- Watering with overhead sprinklers that produce very small droplets, because these must not cause the seeds to move or the covering material to be shifted; the first waterings should be abundant to hasten the breakup of the pellets and to maintain a good level of moisture in the superficial part of the potting mix until the radicle penetrates the growing medium.
- Shading, above all in the initial stage, and always when required by strong insolation.

Some of our results were valid only for the specific site where the trials were carried out (sowing dates, for example). However, in general, the subsequent application of the technique of direct sowing of pellets for the commercial production of some millions of eucalyptus seedlings in areas of Italy with very hot summers has demonstrated the feasibility of the proposed method for growing on a vast scale over the course of several years. The direct sowing of pelletized seed therefore proves to be an efficient alternative to the traditional system of seedbed sowing with subsequent transplanting into containers in that it offers the following advantages (Piotto and Rossi Marcelli 1993):

- It is less laborious.
- It avoids the damage usually caused by transplanting machines when the plantlet is grasped by the collar during transplanting operations.
- It avoids the typical root deformations that are fairly frequently observed after manual transplanting (J- or U-shaped roots).
- It makes mechanized precision sowing possible because pellets are uniform in size and shape.

The author has first-hand experience of tropical nurseries within the framework of an international watershed management project in Honduras (Bauer 1980), and this experience makes her feel fully in agreement with those who claim that there is no abrupt difference between plantation management in temperate areas and in tropical ones (Ladrach 1992). In any case, the basic principles discussed here can be adapted to situations in tropical nurseries. The use of pelletized eucalyptus seed, adapting the idea developed in Italy, could be an example.

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