

ESTABLISHMENT, MANAGEMENT AND PROTECTION

NURSERY AND PLANTING TECHNIQUES

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SUMMARY

The Introduction gives a few instances of direct sowing carried out in the rather low region of the Cantabrique mountains in Spain, and in Western Australia. This kind of reforestation can only be envisaged under special climatic conditions and when seeds can be easily obtained at a reasonable cost.

Eucalyptus plantations have also been made in Portugal by natural regeneration of some forests.

In both cases, sowing was done in small areas and outside natural Eucalypt forests; it is therefore only of interest to study the plantations made from seedlings grown in nurseries, as a means of artificial reforestation.

Reference is made to the difficulties of seed collection, which are due to the large dimensions of the cultivated species, and to the fact that only trees which are isolated give abundant fruit and have low branches. Thus, in addition to being costly, in general only 10 to 15% of the seeds are fertile. Nevertheless, in practice 15,000 to 25,000 plants per kg. can be obtained from seeds of good germinating capacity.

The season for collecting seeds of the species mainly used in the Mediterranean region is between the end of the winter and mid-spring. The fruit ripens 10 to 12 months after blossoming.

Trees intended for seed production must be carefully chosen and submitted to various tests in order to establish a strict selection of "seed-producing trees". For selection purposes germination tests should be carried out and parent trees investigated. The capsules should not be gathered from trees less than 10 years old, nor from mixed stands. Although Eucalyptus seeds retain a high germinating capacity over a number of years, it is not advisable to use them after two years.

Nurseries require abundant water of good quality. 1 m<sup>3</sup> per day is needed for watering 10,000 plants. The ground should be level, protected against winds (either naturally or by shelterbelts), and preferably sandy. Nurseries should be situated near the plantations, should have similar ecological conditions, and good transport facilities are essential. In a nursery one hectare usually produces annually 400,000 to 500,000 Eucalypts with bare roots and 300,000 to 400,000 with ball roots. One square meter of a seed-bed produces an average of 1,000 to 1,500 plants, corresponding to a transplanted area with:

15 to 22 m<sup>2</sup> Eucalypts with bare roots  
10 to 15 m<sup>2</sup> Eucalypts with compact ball roots  
20 to 30 m<sup>2</sup> Eucalypts in pots.

Permanent nurseries or those intended to produce large quantities of plants should be surrounded by a practicable road; another main road should cross the nursery lengthwise, with narrower pathways cutting across it. The beds should be arranged inside this accessible network and separated by small walls of 25 to 50 cm. wide. Transplanting beds should be rectangular and not larger than 30 x 2 m. Beds for pots should be between 1 to 1.20 m. in size, so that the number of pots can remain always the same, preferably 1,000 or 2,000.

The seed-beds should be 1 to 1.5 m. wide and not more than 3 m. long. Watering should be done by spraying with sprays or rotary hoses. In the case of small nurseries where it is not possible to install a system of artificial rain, small reservoirs should be set up at a distance of 30 m. from one another and a watering sprinkler used.

In sub-tropical and Mediterranean climates, Eucalypts need to be covered, preferably with lattice-work, at least at the time of sowing or when transplanting seedlings, and during the hottest days of the dry season. It is also advisable to cover the plants in regions which are subject to frost.

Eucalypt reforestation can be carried out with plants with bare roots or with earth balls, according to the climate. In the case of Eucalypts grown in pots or earth balls, these pots or balls should be as small as possible to limit transportation costs, but care should be taken to avoid damaging the plants. In Portugal the following sized pots have been found suitable:

Diameter - 12 cm. at the top, 6 cm. at the bottom, height 12 cm.

In French Morocco pots of 9 x 4.5 x 9 cm. are used.

A small hand machine which makes compact balls ("paulist balls") in which Eucalypts are planted out is widely used, especially in Brazil, Portugal and Portuguese West Africa. The machine used in Brazil and in Portuguese West Africa makes seven balls at a time and has a daily output of 2,500, whereas the one mostly used in Portugal produces only one ball at a time but has an output of 2,000 to 3,000 per day. This latter machine is more practical and less tiring.

The sowing season varies according to climate, and to some extent, to the species. Even in Portugal there is some fluctuation. Thus in the north, where the summer is cooler, sowing is carried out in March/April, while in the south where it is warmer, it is done in May/June. Sowing is done 5 to 6 months before planting so that the plants reach a height of 25 to 30 cm. by that time. This period may be as long as 10 months if planting is done at the beginning of spring.

Sowing may be done in beds, the seedlings being transplanted when they reach 3-5 cm., in compact balls, pots, or planting beds. The seeds can also be put straight into the pots or balls, in which case only the most vigorous plants are kept.

50 grams of seeds per m<sup>2</sup> are used for sowing in beds; however, for species with larger seeds (E. calophylla, E. ficifolia, E. macrocarpa, E. globulus, E. maculata, E. citriodora, etc.) it is advisable to use a larger quantity, from 70 to 100 grams. The soil in the beds should be moderately fertile, preferably humo-siliceous, and adequately manured. Once the soil is well prepared it must be watered generously, almost flooded, and sown broadcast. A fine layer of soil, sand or mould, not exceeding 0.5 cm. is then spread over the seeds. The beds must then be covered until germination. The ground should be kept moist by one or two waterings a day, according to the climate and the season.

When the Eucalypts reach a height of 3-5 cm., one or two months after sowing, they must be transplanted. During the first ten days at least, the transplanted seedlings must be sheltered from the sun and wind under a trellis or some other cover. They must then be put under a looser trellis, or even completely uncovered, according to the climate.

The planting season varies a great deal from one region to another and according to the species used, as they do not all have the same resistance to frost, drought, etc. In regions which are subject to severe frosts, planting is done at the beginning of the rainy season (with frost-resistant species), i.e. at the beginning of spring. Where there is no danger of frost it is advisable to plant when the autumn rains begin. On the basis of observations made in Portugal during the past few years the various species tried out for their resistance to frost have been divided into four groups. It must be noted that certain species which are sufficiently resistant when young become less resistant later on than other species which are more susceptible when young.

A fundamental requirement for a good Eucalyptus plantation is that the soil be made as fertile as possible, and all natural vegetation removed during the first two years. There are various methods of planting, in rows, in squares, in isosceles and equilateral triangles, etc., but square plantations are most frequent.

Spacing between the Eucalypts varies considerably according to the fertility and humidity of the soil, and also the species and type of cultivation used - coppice, coppice with standards, high forest, etc. In general, spacing increases progressively with the dryness of the climate and the poverty of the soil. Thus in regions with an Atlantic climate and a rainfall of about 1,500 mm., or in sub-tropical climates with summer rains (i.e. Sao Paulo, Brazil) the best spacing is 2 x 2 m.

In the Mediterranean region spacing increases in proportion as the Atlantic influence gives way to the Mediterranean or Continental influence. Thus in Portugal the following spacings are used:

north littoral	2 x 2 m. and 2.5 x 2.5 m.
center and south	3 x 3 m.
south, inland	3.5 x 3.5 and 4 x 4 m.

In French Morocco, in the region of Rharb, with a semi-arid climate and sandy soil, the best spacing is 3 x 3 m. and 4 x 2 m.

In arid zones spacing is 6 x 6 m. and, in extreme cases, 8 x 8 m.