BED DENSITY—ITS SIGNIFICANCE IN SEEDLING PRODUCTION

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The achievement of producing a consistent objective density is the single most important factor in the production of field-grown seedlings. I propose to deal with this subject under three headings:

1. Production objectives—what are you trying to do?
2. Minimising the variables—seed testing, organisation, and field factor.
3. Securing the crop—Good husbandry.

There are cultural operations that can minimise errors but in both objective and economic terms if the correct number of seedlings are not in the right place at the right time that the seeds germinate there is little that can be done to achieve the target or objective.

There is one exception: the potted seedling liner crop. These are often sown densely, pricked or potted off on germination and can be roomed out in a way similar to normal potted or container production so as to achieve the size and type of plant that is required.

PRODUCTION OBJECTIVES

We must set firm, specific objectives. Do we want: a one-year or a two-year crop, feathered or single-stemmed plants; are the plants required for potting-off or growing-on in the field; and what size, height, and girth constitutes the specifications?

There are many tables with recommended sowing density rates. Most give the maximum number that can be achieved per square metre but without considering what the plants are to be used for. This is of little value. The Forestry Commission in its *Nursery Practice Bulletin* (1) gives good recommendations for a specific crop and these provide a useful guideline when assessing bed density for forestry purposes. However, in my opinion it is better to use the simple formula as detailed on page 36 in Philip McMillan Browse's book, *Hardy Woody Plants from Seed* (2), provided always that you can decide the final plant population, as this is the vital factor in the equation.

As a general rule, when deciding plant populations the leaf size will determine the maximum number of plants. Large-leaved plants can only be grown at fairly low densities, whereas finer-leaved and needled plants can have substantially higher densities and still produce a satisfactory result. Some typical examples are shown in Table 1.

Table 1. Densities for the production of transplants as understocks

Plant		Plants per sq metre
Aesculus, Juglans, Ailanthus, Catalpa		50-180
Castanea	as a 2yr crop	80-100
Robinia, Laburnum	as a 1yr crop	100-150
Robinia, Laburnum	as a 2yr crop	150-180
Quercus	as a 2yr crop	120-150
Sorbus intermedia	as a 1yr crop	120-150
Fagus, Fraxinus, Corylus	as a 2yr crop	150-180
Crataegus, Tilia	as a 1yr crop	180-200
Betula, Alnus, Sorbus aucuparia	as a 1yr crop	200-220
Rosa spp	as a 1yr crop	250
Small conifers, *Picea* and *Pinus*	as a 1yr crop	400-600
	as a 2yr crop	250-300

The two-year crop assumes a thinning is undertaken during the dormant period after the initial undercutting.

MINIMISING THE VARIABLES

Seed testing. You must know what you have to work with. The tests that are done must be objective to enable you to calculate the bed density. Samples regularly taken and pre-germinated will give an indication of how the seed is developing and it is from this information that the calculations can be made.

Soil sterilisation (pasteurization). Partial sterilisation of the seedbed area with chemicals will eliminate many of the harmful pathogens that reduce bed densities. This operation should be carried out in the autumn when the soil is warm and in a moist condition. Covering the soil is essential to ensure thorough penetration of the fumigant released from the chemical and this also allows time for ventilation of the beds before normal sowing takes place at the turn of the year. Details of the rates of chemical to be used can be obtained from manufacturers, but on our soil type we find that 400 kg per hectare of Basamid (dazomet) incorporated to a depth of 15 cm has proven to be satisfactory.

Field factor. This is the term used to describe all those unfortunate conditions that reduce seed germination. It may be, for example, the ravages of vermin or birds. It is important to remember that the objective density, if not achieved, will change the shape and dimension of the seedling produced. Every effort should, therefore, be made to protect the crop against the ravages of such vermin. Where autumn sowing is practiced it could be the effect of rootrots during the winter. Raising beds to aid natural drainage will minimise this field factor.

Sowing. Attention to detail is vital. Care must be taken to ensure that the sowing is even, that there is no variation across the bed. Sowing in windy conditions can often lead to an uneven density. There must be irrigation backup. Remember, we are sowing an active seed that is still undergoing treatment and is in a moist condition. Drying out, particularly at sowing time, can be lethal Irrigation backup and immediate covering to minimise the field factor are part of the diligence that is necessary at the sowing operation.

SECURING THE CROP

It is reasonable to say that if all the foregoing has been carried out carefully, the growing of the crop is a comparatively routine operation. But we must ensure the best performance of our seedlings to maximise the crop.

Irrigation. Support will be necessary at all times and water should be given in frequent small doses, particularly at seed germination time where heavy doses could cause damage to the bed and encourage disease.

Feeding will be necessary to maintain the correct nutrient ratio and perhaps adjust the growth of the crop throughout the season. Normally fairly high levels of nitrogen in the early part of the year are necessary followed by increasing potash applications to mature the plants for autumn, the phosphate levels having been incorporated in a base dressing.

Pest and disease control. Regular observations will be necessary in addition to the routine prophylactic spray programme. Remember, a minor attack can soon become an epidemic where high densities of a monoculture are undertaken, and soft, young, seedlings are particularly vulnerable.

Undercutting. Root pruning to balance the growth and produce a firm, stocky seedling may be necessary during the growing season; this should be timed to coincide with cool, showery weather or, if this is not possible, be supported by a regular irrigation backup.

Thinning. This may be necessary where growth is vigorous. (This was the case in the very warm summer of 1989 with some of our seedlings). Germination always looks sparse at first and it is important to time the thinning operation so that no energy is lost from the crop. Early action will ensure that the objective size of plant is achieved. If a too dense crop is allowed to grow on, then only poor and inferior seedlings will result.

Shading. Some woodland plants that are known to grow naturally under a canopy may require shading during the middle part of the growing season.

Trimming. Some shrubby plants can be trimmed to condition them and this helps bud development on the upper parts of the stem and,

if used in conjunction with undercutting, can improve the transplantability of the crop.

Stressing. It is often necessary to stress or wrench the crop in order to help it harden-off and this is normally done toward the end of the summer. The important thing is to ensure that the crop is in good condition for lifting as early as possible. Seedlings are juvenile and tend to carry-on growing late into the season and this may cause die-back if plants are lifted before they are ripened-up, particularly where storage is used, and storage rots often occur in material that is not correctly hardened-off. Too early lifting will manifest itself in the die-back that occurs when the crop is transplanted.

CONCLUSIONS

Securing a high percentage of the objective grade with a minimal of off-grade and wastage will maximise the use of good seed and its potential and ensure that the correct size of plants for any specific operation are grown to the correct size and conditioned to give the maximum transplantability leading to a successful establishment of the final crop. This is largely a matter of achieving the correct bed density.

LITERATURE CITED

1 McMillan Browse P D A 1979 *Hardy Woody Plants from Seed* Grower Books

2 Nursery Practice Rev 1989 Forestry Comm Bull 43 J Aldous & W Mason