

COMPONENTS OF SYMPOSIUM AND NURSERY PRACTICE

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Abstract: Raising outplanting stock in a nursery is but one segment in the activity continuum designed to establish a plantation estate. All components of nursery practice, from seed pre-treatment, through sowing, nutrition, stock conditioning and lifting are interactive and influence the form and quality of stock destined for the new forest. Nurserymen need to be more aware of their major input into the success or demise of the total afforestation package. Some avenues for future investigation are noted.

THE SYMPOSIUM

Wrap-up time. The term conjures up images of gift preparation and giving, be it birthday, Yuletide, Symposia closures or whatever. The recipient generally needs to tear away a number of camouflage layers to reach the object of the search. You will find this presentation structured in a similar wrapped fashion.

The co-sponsorship of this International Nursery Symposium by Auburn and IUFRO is to be congratulated. There is usually an undersupply of information and data passing between nursery researchers, practioners and establishment personell. Symposia such as this aid greatly in the necessary multi-path transfer of knowledge. On a national level the New Zealanders have found the symposia experience worthwhile on a periodic basis. Auburn and perhaps other centres of excellence may take up the challenge of keeping such a national series alive here in the South. Be warned however, of one consequence of the New Zealand experience. The growth rate of their Forest Research Institute Nursery Symposia proceedings lies about the 0.25 kg per year level, and the inaugural Montgomery proceedings will start at a heavy base judging by the 50 odd abstracts received!

The energyflow from this Symposium over the past week could be described, with some artistic and scientific licence, by the model depicted in Figure 1. It is in fact the height growth periodicity curve for slash pine sited in South East Queensland. The first peak, corresponding to the spring flush, was the nursery inspection day when we could all escape the Maddison hotel-lobby menagerie. The second peak, corresponding to the mid-summer flush was Banquet night, and note the sharp decay response thereafter!

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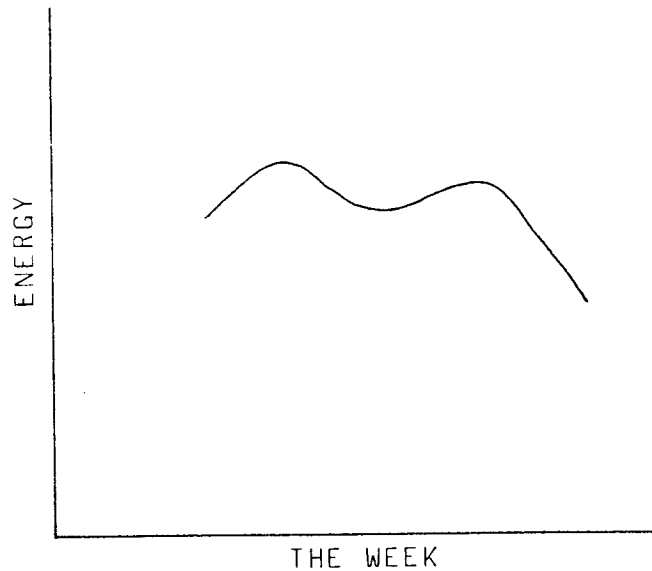


Figure 1: Energy levels of participants in the Montgomery Nursery Symposium.

The organisers can be sincerely thanked for a program that did not induce or permit an energy flow parallel with and immediately adjacent to the X-axis. Now to more serious considerations.

AN OVERVIEW OF NURSERY PRACTICE

Nursery production goals of absolute seedling numbers lifted and transferred to planting sites, achieved within budget allocations at minimum unit cost are decidedly short term in the context of a plantation establishment program. Such a program encompasses a number of discrete activities, including the nursery growing phase, stock transfer, site amelioration, planting and site tending, all tied together in a package designed to establish a new and viable forest resource. The overall success of the venture will depend in large measure on job quality within each segment. Thus nursery practice has to aim at producing high performance stock capable of surviving and growing well even under testy environmental conditions.

Is this latter mentioned goal currently being met? From data presented to this Symposium and comments made during informal discussions it is clear that it is; but only infrequently, unpredictably and characterised by favourable coincidences of technique and environment. Too frequently surveys turn up survivals in the 40 to 80 percent range. These data identify a spectacular wastage of dollars and energy.

Nurserymen need to be aware that they are an integral part of the establishment program and that their influence via the quality of planting stock produced extends beyond the seedling dispatch gate.

Just as nursery practice can be viewed as but one segment in the plantation establishment process it can itself be componentised; through seed handling, sowing, bed fertilisation, weed treatment etc. Indeed nursery practice can best be understood and manipulated when thought of as an ordered amalgamation of evolving methods and techniques all interrelated in their influence on the quality of outplanting stock offered for export.

It is important that the concept of continuous change and improvement is associated with nursery practice. Nursery manuals and prescriptions are documentation of nursery practice at one instant only along the path of change. They are but useful guides that should never be permitted to stifle investigatory trials aimed at innovation and revision.

The published proceedings of this Symposium will be a ready reference book on southern pine nursery practice and current research aimed at its enhancement. No useful purpose can be served by offering this audience an abstract of the abstracts or a precis of the presentations. Rather it may be more informative to briefly review a short list of those components of 1-0 nursery practice that appear, from the discussions this past week, in need of some comment or further examination and test.

SOME COMPONENTS OF NURSERY PRACTICE

Seed Pre-Sowing Treatment

The common message is to extract and treat seed in delicate fashion. There is no consensus on the best procedure of pre-sowing treatment though a significant proportion of organisations present utilise a moist cold storage (MCS) treatment. Data for slash pine seed grown and nursery sown in Queensland (Figure 2) show that MCS both speeds up and facilitates even germination.

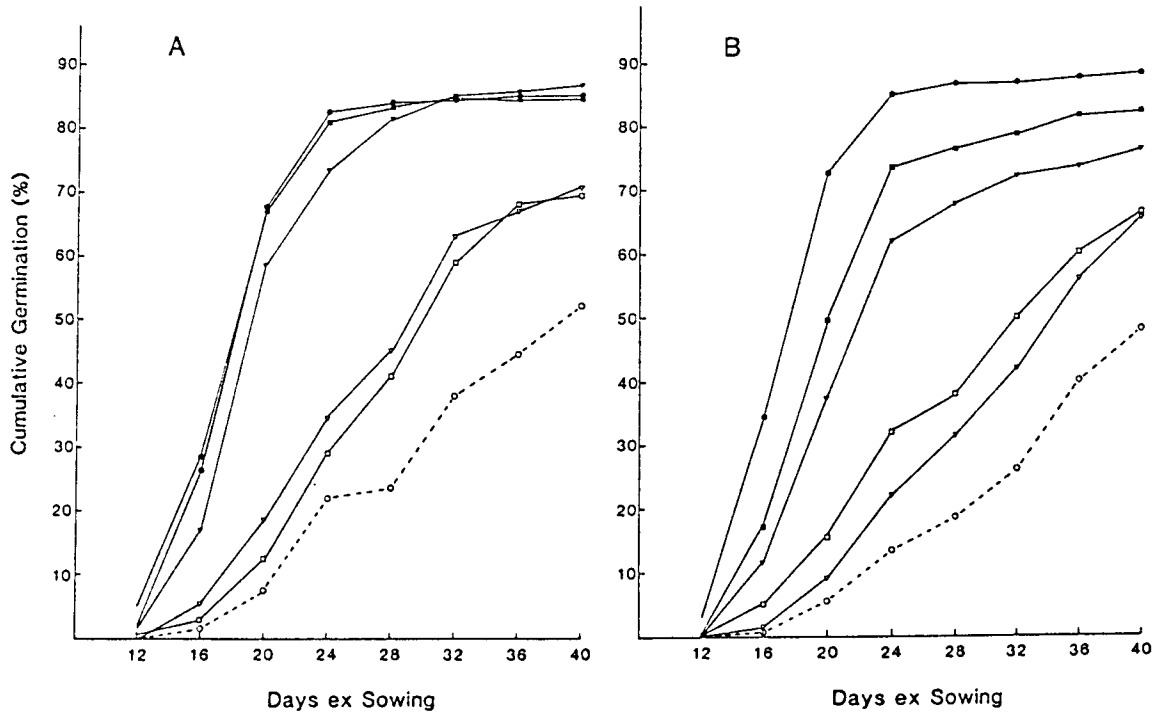


Figure 2: Influence of seed age and pre-sowing treatments on slash pine germination in the nursery. Treatments represented include: (●) MCS 6 weeks, (■) MCS 3 weeks, (▼) Water soak 16 hrs plus MCS 15 days, (□) Water soak 48 hrs, (▽) Water soak 60 hrs, (○) Untreated control. Seed stored 5 months (A) and 17 months (B) at 3°C.

Fumigation

Fumigation practice is restricted wholly to the United States and here there is no consensus on its use. The only rationale for fumigation is in pathogen control since weed crops can be more efficiently controlled by weedicides. The extent to which fumigation is viewed as an insurance premium is a moot point and ought to be examined rationally together with alternative nursery hygiene practices.

Sowing

The vacuum drum precision seeder is undoubtedly the preferred method of sowing. The importance of maximising individual seedling space within any sowing density regime was well documented particularly by the New Zealand authors. The challenge with nursery bed density is to maximise the output of plantable grade seedlings from the smallest nursery bed area. If the objective is to produce a cull free (say < 5% culls) crop then southern pine need to be raised in the range 160-200 plants m^{-2} . There is no doubt that plantable grade stock with acceptable field performance can be grown at high densities (Table 1) but the cull rate increases dramatically. The opportunity cost forgone through wastage of orchard quality seed needs to be included in any economic analyses of bed stocking rates. A trade-off between reduced bed stocking and reduced nursery cover crop rotations seems feasible.

Table 1: The effect of bed stocking on the relationship between field survival (%) and root collar diameter, and the incidence of cull grade stock in 1-0 slash pine.

Root Collar Diam. (mm)	Bed Stocking (plants m^{-2})			
	130	250	320	450
2	-	-	0.0	33.3
3	66.7	64.4	47.4	48.3
5	68.3	75.3	75.2	59.4
6	87.4	82.4	85.3	88.2
8	96.5	95.8	97.8	100.0
Overall	91.2	81.3	69.3	57.9
Cull (%) ^{/1}	3.0	11.8	31.5	42.0

^{/1} Stock < 4 mm diameter are cull grade.

Weed Control

All nurseries appear to possess a satisfactory suite of pre - and post - emergent weedicides. It is readily apparent that all weedicides need to be rigorously tested under local conditions before routine adoption. Duplication of reported results cannot be guaranteed. Continuous testing and updating of new products is required to provide more efficient primary applications and also to give reliable back-up for the unexpected failure, build-up of resistant weed populations or deregistration.

Nutrition

There is a glaring inadequacy in the extent of quantitative monitoring of nutrient level inputs and outputs generally achieved in southern pine nurseries. The concept of nursery crop logging is strongly recommended. This approach to soil and plant nutrition sees the development of an organic and inorganic fertiliser schedule based on replacing the nutrients removed in the pine seedling crop plus an allowance for leaching or fixation in the soil and to allow for a gradual build-up of soil fertility. Both soil and foliage analyses are required in this balance sheet system.

Stock Conditioning

Intensive undercutting and root wrenching techniques were developed in New Zealand and Australia for the express aim of conditioning 1-0 P.radiata and P.caribaea stock ready for outplanting. It is well to remember that both these species, in contrast to P.taeda, P.elliottii et al, do not enter a truly dormant phase in winter. There is some evidence to suggest that the requirement for stock conditioning prior to lifting in continuously flushing species can be regarded as indispensable to satisfactory post-plant survival while simply being an enhancement to survival potential in dormant lifted stock. This may be one reason for the more conservative treatments observed in US nurseries, viz., longer root wrenching periodicity and deeper root severance.

The consensus view from this weeks discussion is that undercutting ought to be carried out at a shallower depth (10-12 cm) than subsequent root wrenching (maximum 15 cm deep). The wrenching schedule adopted needs to be tailored to each species and its local nursery culture. In particular the conditioning x bed density treatment interaction requires study in both hemispheres.

Physiological investigations are needed both to help explain the conditioning phenomenon itself and to provide nurserymen with reliable and simple techniques to monitor the process. Induced plant water stress has been implicated in the process and this parameter can be readily measured in a variety of ways.

Seedling Quality

While no one morphological or physiological seedling parameter is universally used as a predictor of outplanting performances i.e. of seedling quality, most nurserymen have a favoured index or indices based on local empirical evidence. Root collar diameter, shoot maturation and root growth capacity feature regularly in any listing of reliable indices. It is problematic that any one definitive measure of seedling quality will be found given the full effort expended in the long search to date. Nevertheless local trials keeping records of heat/chill sums and/or accumulated plant water deficits might help refine the use of existing indices.

I view the objective of all enquiry into seedling quality as ultimately a means of updating nursery cultural practices towards the production of cull free, high field-performance stock.

Lifting and Handling

One of the most vital components of the nursery management package. The message we all must carry, even preach, is that planting stock must be treated with respect during and after removal from the relative safety of the nursery bed.

Of immediate concern is the maintenance of the root system itself. The advent of mechanical lifters has not overcome the damage caused by heavy handed (booted!) manual lifting practice. Mechanical fails often seems designed specifically to remove bifurcate 2^o and 3^o roots. Mechanical belts often ring-bark seedlings and tear roots. There is much mechanical design work still to be carried out in this area.

Next comes the difficult task of avoiding root desiccation. In Queensland we have successfully relied on a clay slurry root dip applied immediately after hand lifting to minimise the adverse effects of subsequent exposure; Note that the clay slurry must be at least of a creamy consistency to effect a significant positive response (Table 2). Exposure is minimised by short haul transport and short-term storage in shaded and wind excluded units, reducing the need for bench-top culling and maximising the opportunities for planting by machine.

Table 2: Field survival (%) of 1-0 slash pine related to clay slurry strength of the root dip treatment.

	Clay Slurry Strength		
	Thin 0.5 kg l ⁻¹	Cream 1.0 kg l ⁻¹	Thick 1.5 kg l ⁻¹
May Planting	65.2	96.1	98.0
June Planting	98.1	98.6	99.0
July Planting	86.3	92.3	94.2
Mean	83.2	95.7	97.1

Often seedling care through the lifting - transport - planting period is not what it should be because of a temporary loss of seedling ownership. Ownership or responsibility is handed from the nursery supervisor to the regeneration or establishment supervisor at some agreed stage; ensure that both parties do not shrink back from the agreed handover.

FINALE

My concern that nurserymen generally take too blinkered a view of the total afforestation project and do not appreciate the significant influence that they hold on that projects viability must be evident. This Symposium, drawing as it has a representative cross section of individuals involved in discrete parts of the first establishment venture is an appropriate venue to raise this issue of perspective. Give it a little thought.

My thanks to our gracious hosts. They have contributed much in both the planning and doing functions to make this meeting a most rewarding professional experience.