SEED TREATMENT - AN AID TO PASTURE ESTABLISHMENT

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Seed treatments can assist establishment of pasture species during germination, emergence and seedling growth.

TREATMENTS TO REDUCE SEED THEFT

Ants commonly take seeds sown by aircraft (Campbell 1966; Campbell and Gilmour 1979) or direct drilling; occasionally they take seeds (e.g. carrot, sorghum) from prepared seedbeds. As a normal seeding rate of pasture seed (10 kg/ha) has 5 million seeds and there are approximately 10 million seed-harvesting ants/ha the need to treat seeds before sowing becomes evident.

Seed harvesting ants are widespread in Australia; the most numerous, *Pheidole* spp, are small, 3 mm long with a liveweight of 0.5 mg. Worker ants can carry clover seeds 17 times their own weight but generally prefer smaller seeds. When grass seeds are taken the seed coat is stripped off and thrown out of the nest. Legume seeds are often placed near the nest entrance so that weathering breaks the seed coat and allows ants access to the seed. Thus nests of seed-harvesting ants can be identified by seeds or seed refuse near the nest entrance.

Coating seeds with insecticide prior to sowing (Campbell 1985*a*) reduces the number of seeds taken by ants (table 1). The insecticide (0.2 kg bendiocarb, Ficam^{R}, or 0.5 kg permethrin, Coopex^{R}) should be mixed with 2 L of water and applied to 100 kg seed. For fluffy seeds, such as cocksfoot, use 4 L of water. These insecticides can be mixed with the inoculum and glue when lime-pelleting legume seed without harming the rhizobia.

TABLE 1. Effect of permethrin and bendiocarb on the rate of removal of phalaris seeds by ants (Campbell and Gilmour 1979).

Insecticide	Rate (kg a.i./100 kg seed)	Number of seeds taken/nest/day: Days after sowing 1	2-7	8-14	Total in 14 days
Permethrin	0.15	4	2	8	72
Bendiocarb	0.15	5	3	8	79
Nil	-	>150	>150	>150	>2100

Losses due to birds can be reduced by treating seeds with methiocarb (e.g. Mesurol 75^{R}) at 0.45% of weight of seed. For example, only 1% of treated pea seed was taken by birds (when sown in a prepared seedbed) compared to 65% of untreated seed (Porter 1977). Colouring seeds with bright dyes can also reduce seed theft by birds.

PELLETING (SEED COATING) TO IMPROVE GERMINATION AND EARLY ESTABLISHMENT

In New Zealand, Vartha and Clifford (1973) found, for surface-sowing, higher establishment of pelleted than unpelleted grass seed. However other New Zealand and Australian workers (Scott 1975; Dowling 1978) found the benefits of pelleting to be small or non-existent. The effects

of pelleting are mainly concerned with: better imbibition; faster germination rate; and higher total germination.

Pelleting gives little protection to the radicle (first root) tip during entry into the soil. The radicle tends to grow away from the seed and pelleting material when searching for entry. If the radicle tip becomes exposed and dries out then the seedling will die.

Gelatinous pelleting materials had no advantage over non-gelatinous materials (e.g. reverted superphosphate, lime, talc) in assisting establishment (Scott 1975). Neither did new materials with specialised moisture holding characteristics (e.g.Terra sorb^{R}, a blend of starch and acrylic polymers) improve establishment above that of unpelleted seeds (Campbell 1985*b*). At present the variability of results makes it difficult to prepare general recommendations for the use of pelleted seed in farming practice (Scott 1975) - further research is needed.

PELLETING (SEED COATING) TO SUPPLY NUTRIENTS TO THE ESTABLISHING SEEDS

Seedlings exhaust their food reserve in the 7 to 21 days after germination, thus it is essential that fertilizers be applied *with* the seed. As germinating pasture seeds can take up applied nutrients as early as four days after imbibition (McWilliam *et al.* 1970) pelleting appears an attractive way to apply the nutrients. However as many concentrated salt fertiliser coatings depress germination, addition of nutrients to seeds is generally restricted to cases where small amounts (1 to 10 kg/ha) assist establishment. For example, treatment of legume seed with molybdenum and coating buffel grass seed with monosodium phosphate at 10 mg/seed pod (Silcock and Smith 1982) assisted establishment of each. Molybdenum trioxide should be applied to legume seed, not sodium molybdate, as the latter kills rhizobia (Gartrell 1969). To incorporate molybdenum trioxide (83 g on the amount of seed sown/ha) in the lime pellet, increase the glue by 5% and add the molybdenum after the first coating of the inoculant/glue mixture and thoroughly mix before applying the lime. Larger amounts of these nutrients distributed over the whole sown area will be needed to allow the sown species to spread and produce over time.

PELLETING TO IMPROVE BALLISTICS ?

When pasture seed is aerially distributed with fertilizer, seed and fertiliser frequently segregate in bands (Scott 1965). For example, white clover and cocksfoot seed were displaced 5 and 9 m respectively from the centre of the fertiliser strip. Scott (1965) recommended pelleting cocksfoot to ensure that it would fall in the same areas as white clover when they were aerially distributed with fertiliser. This problem can be overcome in another way: i.e. by spreading seed alone from an aircraft fitted with a venturi or wing pods and flying at right angles to the wind direction. In a light cross breeze (2.4 km/hr) most seeds have a swath width of between 15 and 25 m but in a moderate cross breeze (8 km/hr) the swath width increases to between 23 to 45 m; the lighter seeds having the widest swath (Atkinson *et al.* 1968).

INOCULATING AND LIME PELLETING LEGUME SEEDS

Rhizobia (bacteria) form nodules on the roots of legumes and supply nitrogen to the plant. Thus most legumes should be inoculated with rhizobia when they are sown into a new area. To protect the rhizobia from acid fertiliser or soil, the seed plus rhizobia is coated with fine lime. The method described by Roughly and McDonald (1987) follows: prepare a 1.5% methyl cellulose glue (15 g methyl cellulose to 1 L water); add 250 g inoculant and mix; pour over

25 kg of white clover/lucerne seed or 50 kg of subterranean clover seed and mix until the seed is coated; add 12.5 kg of fine lime (Microfine^{R} or Omyacarb 5^{R}) or plasterer's whiting and rotate seed for 1 to 3 minutes; overspray coated seed with 1:1 polyvinyl acetate glue and water until the surface is damp then continue rolling until the lime coat is firm. Inoculated and pelleted seed can be purchased from commercial firms but care should be taken to ensure that the correct group of viable rhizobia is used and the inoculated seed is kept out of sunlight, not subject to temperatures over 15°C and sown as soon as possible after delivery.

In problem country (acid soil) improved nodulation has been achieved by increasing the inoculation level to 5 times normal (Lowther and McDonald 1973). In very acid soil establishment of legumes can only be achieved by sowing inoculated and lime pelleted seed in bands of 50:50 lime - Mo super-phosphate. To allow the legumes to spread from these bands it may be necessary to work 0.5 to 1 tonne of lime into the seedbed at least 6 weeks before sowing.

SEED TREATMENT TO REDUCE WEED COMPETITION

By applying herbicides to seeds, control of some weeds can be achieved during early establishment. For example, application of EPTC to lucerne seed reduced competition from rats tail fescue and increased the number of lucerne seedlings to establish (Scott and Blair 1985). As EPTC is toxic to phalaris, an antidote had to be applied to the seed to protect the seedling. These are new techniques still under investigation.

PROTECTION OF THE ESTABLISHING SEEDLING

Damping-off fungi (*Pythium* spp) have restricted establishment of lucerne and clovers on the south coast of NSW. By dusting with metalaxyl (Apron$^{(R)}$) at 0.2 kg/100 kg seed establishment of lucerne was improved from 27% (untreated) to 54% (Stovold *et al.* 1980).

Earth mites (*Penthaleus major* and *Halotydeus destructor*) can reduce the establishment of surface-sown legumes (Table 2). White clover seedlings are most susceptible to damage because they have the smallest cotyledons and leaves; in this experiment phalaris was resistant (Campbell and Vere 1983).

TABLE 2. Effect of earth mites on establishment of surface-sown pasture species after herbicide treatment prior to sowing.

	Plants/m^2 present 9 weeks after sowing			
Insecticide treatment	White clover	Lucerne	Red clover	Phalaris
+ insecticide - few mites	15	39	18	14
- insecticide - many mites	1	5	4	17

Damage by earth mites can be reduced by treating seeds with dimethoate (400 ml of 40% a.i. in 2 L of water/100 kg of seed) or omethoate (620 ml of 58% a.i. in 2.5 L water/100 kg seed). The effectiveness of this treatment is reduced by heavy rain after sowing but before emergence, or inadequate weed control. Both the above insecticides are toxic to legume rhizobia. For heavy infestations of mites insecticides should also be applied to the whole paddock.

Other pests that attack establishing seedlings (cockchafers (scarabs), slugs, crickets) cannot be controlled by seed treatment but close observation at frequent intervals during early establishment and subsequent treatment would increase establishment successes.

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