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# EFFECT OF 2,4,5-T PREPLANT SOIL SPRAYING ON THE ESTABLISHMENT OF STYLOSANTHES GRACILIS

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The use of 2,4,5-T as a post-emergence "blanket" spray to control timber regrowth during the establishment of improved grass/legume pastures in the wet tropics is regarded as unsatisfactory on account of the high probability of severe herbicide damage to young pasture legume plants.

In order to provide factual data on this matter, the two preliminary pot trials reported here were established at the Queensland Department of Primary Industries' Tropical Agriculture Research Station at South Johnstone, in North Queensland. The trials were designed to obtain some information on the effect of 2,4,5-T soil spraying on the establishment of the tropical pasture legume stylo (*Stylosanthes gracilis* H.B.K.) sown after spraying.

The herbicide used was a concentrated emulsifiable solution containing 40 per cent. w/v 2,4,5-trichlorophenoxyacetic acid present as the butyl ester. The seed was *Stylosanthes gracilis* H.B.K.-Q2289, which had been dehulled and scarified with sandpaper.

## Trial 1

A 2 x 5 factorial design of four replicates of one pot per plot was employed in the first trial. Factors tested were:

(*a*) Sprays—P0, no spray; P1, 2,4,5-T at 1 lb acid-equivalent per ac.

(*b*) Planting times—Q0, immediately after spraying; Q1, 7 days after spraying; Q2, 14 days after spraying; Q3, 21 days after spraying; Q4, 28 days after spraying.

The bases of free-draining 8½-in. diam. plastic pots were filled with 2–3 in. of crushed metal and 10 lb of air-dry soil which had passed a ⅜-in. mesh sieve was then added. Soil had been taken from approximately the 0–6-in. layer in standing coastal forest and was a dark-grey, coarse sandy loam of granitic origin.

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The day before spraying the pots were surface-watered with an excess of tap water and allowed to drain. Sprays were applied through a 18·0 "Monarch"-type hollow-cone nozzle with a hand-operated knapsack sprayer. The pots were stood at random in a row and sprayed with a single traverse of the nozzle. Spray concentrate had been mixed in water and was applied at 32 gal per ac.

Fifty stylo seeds which had been inoculated with the appropriate *Rhizobium* strain were planted at $\frac{1}{2}$ in. x 1 in. spacings at a depth of $\frac{3}{4}$ in. Soil over each seed was returned by pressing with the edge of a block of wood. Ten randomly selected plants were retained in each pot for harvesting and all other seedlings which emerged removed. In many instances fewer than 10 plants survived in each pot until harvest (Table 1). Pots were sheltered in a lath-house and surface-watered with tap water.

**TABLE 1**

RESULTS OF TRIAL 1

| Planting Time | Mean No. of Plants per Pot at Harvest | | Dry-matter Yield per Pot (g) | | | Total No. of Seedlings Emerging up to Harvest* | | |
|---|---|---|---|---|---|---|---|---|
| | P0 | P1 | P0 | P1 | Mean | P0 | P1 | Mean |
| Q0 .. | 8·00 | 8·00 | 0·64 | 0·69 | 0·66 | 39·7 | 35·7 | 37·7 |
| Q1 .. | 9·25 | 8·25 | 1·03 | 0·69 | 0·86 | 40·0 | 38·5 | 39·2 |
| Q2 .. | 9·00 | 9·00 | 0·70 | 0·72 | 0·71 | 40·5 | 38·1 | 39·3 |
| Q3 .. | 8·75 | 8·25 | 0·46 | 0·39 | 0·43 | 42·5 | 40·0 | 41·2 |
| Q4 .. | 9·50 | 7·75 | 0·38 | 0·34 | 0·36 | 40·5 | 42·2 | 41·3 |
| | Mean .. .. | | 0·64 | 0·57 | 0·60 | 40·6 | 38·9 | 39·7 |
| | | | Yields | | | Seedling Emergence | | |
| | Significant differences | | Q0 > Q4<br>Q1 ⩾ Q3, Q4<br>Q2 ⩾ Q4<br>Q2 > Q3 | | | Q3 > Q0<br>Q4 > Q0 | | |

* Square root transformation used for analysis.

Living stylo top growth was harvested to ground level 104 days after spraying, dried at 95°C and weighed.

Table 1 shows that, regardless of planting time, spraying with 2-4,5-T prior to planting stylo seed below the soil surface had no detectable adverse effect on plant yields or on the number of seedlings emerging. The yields from the early-planted treatments significantly outyielded the late-planted. The numbers of seedlings emerging in the plantings made 3 and 4 weeks after spraying were significantly greater than the number in the planting immediately after spraying. No clear explanation can be offered for these differences in seedling emergence.

## Trial 2

A 2 x 3 x 5 factorial design of four replicates was used in Trial 2. Factors tested were:

(*a*) Soils—A0, red-brown, sandy clay loam of basaltic origin, carrying tropical rain-forest; A1, dark-grey, coarse sandy loam of granitic origin, carrying coastal forest (as for Trial 1); A2, dark-grey, coarse sandy loam of granitic origin, carrying *Melaleuca viridiflora,* a paper-bark tea-tree.

Virgin soils were taken from approximately the 0–6-in. layer at each site.

(*b*) Sprays—B0, no spray; B1, 2,4,5-T at 1·7 lb acid-equivalent per ac.

(*c*) Planting times—C0, 1 day after spraying; C1, 5 days after spraying; C2, 9 days after spraying; C3, 17 days after spraying; C4, 33 days after spraying.

Wax paper cups 2¾ in. in diameter were filled with approximately ½ lb of air-dry soil which had passed a ⅜-in. mesh sieve. The cup sides were punctured with twenty ⅛-in. diam. holes. About an hour before spraying the cups were immersed in water to the level of the soil surface and then allowed to drain. Cups were stood at random side by side in a measured area and sprayed with a hand-operated atomizer. Spray concentrate had been mixed in water and was applied at 125 gal per ac.

The cups were sub-irrigated through a wooden box (3 ft x 3 ft x 1 ft) which had been lined with polythene sheeting and partly filled with river sand. At each watering, tap water was run onto the sand at the edges of the box until the soil in each cup was visibly damp on the surface. Watering was carried out daily, although occasionally at weekends one or two days elapsed between waterings. A sloping hinged lid of reinforced transparent plastic was fitted to the box and according to weather conditions it was either left shut or propped open; it was, however, always closed at nights and at weekends.

Fifty seeds were sprinkled onto the soil surface of each pre-selected cup at planting time. From time to time germinated seed was removed and each plant classified as "normal" (apparently healthy) or "abnormal" according to appearance.

This method of classification was satisfactory when spray damage was marked but was less reliable at the threshold level for damage. Final observations were made 20 weeks after spraying

The percentage of normal seedlings recorded in the unsprayed cups was significantly greater than that in the sprayed (Table 2). There was, however, no difference in the percentage of total seed germinating in the sprayed and the unsprayed cups, suggesting that 2,4,5-T soil residues had no inhibitory effect on stylo germination.

**TABLE 2**

EFFECT OF SPRAYS ON STYLO ESTABLISHMENT : TRIAL 2

Figures as percentages

| Seedling Classification | Spray | | Significant Differences* |
|---|---|---|---|
| | B0 | B1 | |
| Normal .. .. .. | 55·9 | 29·1 | B0 ⩾ B1 |
| Abnormal .. .. .. | 24·4 | 47·6 | B1 ⩾ B0 |
| Total† .. .. .. | 81·4 | 79·9 | N.S. |

* Inverse sine transformation for all Trial 2 analyses.

† Normal + Abnormal.

The soil/spray interaction is given in Table 3. For the percentage of normal seedlings recorded the interaction was not significant, showing that for normal seedlings, at least, the soil types tested did not play a major role in determining spray damage. There was, however, a highly significant soil/spray interaction for abnormal seedling percentages. This result indicates that for stylo establishment 2,4,5-T spraying had a more detrimental effect when used on the rain-forest and coastal forest soils than on the tea-tree soil.

**TABLE 3**

SOIL/SPRAY INTERACTION : TRIAL 2

Figures as percentages

| Seedling Classification | Spray | Soil A0 | Soil A1 | Soil A2 | Interaction |
|---|---|---|---|---|---|
| Normal .. | B0 | 61·9 | 51·1 | 54·6 | N.S. |
| | B1 | 29·4 | 26·9 | 31·0 | |
| Abnormal .. | B0 | 19·5 | 28·0 | 25·9 | Highly |
| | B1 | 49·7 | 51·8 | 41·2 | significant |
| Total .. | B0 | 82·3 | 80·4 | 81·3 | N.S. |
| | B1 | 82·9 | 80·8 | 75·7 | |

**TABLE 4**

PLANTING TIME/SPRAY INTERACTION : TRIAL 2

Figures as percentages

| Seedling Classification | Spray | Planting Time | | | | | Interaction |
|---|---|---|---|---|---|---|---|
| | | C0 | C1 | C2 | C3 | C4 | |
| Normal .. .. .. | B0 | 46·6 | 49·8 | 54·3 | 60·7 | 67·7 | Highly |
| | B1 | 11·0 | 19·9 | 22·7 | 37·2 | 60·7 | significant |
| Abnormal .. .. .. | B0 | 29·2 | 28·7 | 27·1 | 24·0 | 14·1 | Highly |
| | B1 | 63·8 | 59·3 | 55·3 | 46·6 | 15·9 | significant |
| Total .. .. .. | B0 | 76·9 | 79·0 | 82·4 | 85·3 | 82·7 | N.S. |
| | B1 | 75·3 | 81·6 | 79·1 | 84·9 | 77·8 | |

The planting time/spray interaction was highly significant for both normal and abnormal seedling percentages (Table 4). In the C4 planting there were no significant differences between the sprayed and the unsprayed cups for either normal or abnormal seedling percentages. This shows that the toxic effect of 2,4,5-T had been reduced sufficiently by 33 days to allow safe surface broadcasting.

## Conclusion

Results from these two trials suggest that the position and method of stylo seed placement at sowing after 2,4,5-T spraying could be a major factor in determining the extent of seedling damage.

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