EFFECT OF 2,4-D ON SOME TROPICAL PASTURE LEGUMES

The use of 2,4-D to control broad-leaved weeds during the establishment of improved tropical pastures has been regarded as unsatisfactory because of the damaging effect of 2,4-D on tropical pasture legumes. In view of this, an indicator pot experiment was established in December 1962 to obtain quantitative information on the effect of 2,4-D on five tropical pasture legume species, which are listed in Table 1.

The herbicide used was a concentrated emulsifiable solution containing 50 per cent. w/v 2,4-dichlorophenoxyacetic acid present as the dimethylamine salt.

The design was a randomized block layout of five replications. There was an untreated control and a sprayed plot of each legume. Free-draining 2¾-in. dia. wax paper cups of approximately 220-ml capacity were used. One plot consisted of two separate cups. Each cup was filled with screened red-brown sandy clay loam of basaltic origin.

All seed was pregerminated and inoculated with the appropriate Rhizobium strain prior to planting on December 14, 1962. Two plants were grown in each cup. In some instances there were fewer than four established plants in each plot at the time of spraying (see Table 1).

TABLE 1

RESULTS OF INDICATOR POT EXPERIMENT, 1962-63

Species	Mean No. of Trifoliate Leaves/ Plant at Time of Spraying	Untreated. Mean No. of Living Plants/Plot		2,4–D. Mean No. of Living Plants/Plot		Untreated. Mean D.M. Yield/Plot (g)	2,4–D. Mean D.M. Yield/Plot (g)
		At Time of Spraying	At Time of Harvest	At Time of Spraying	At Time of Harvest		
Centrosema pubescens Benth. (commercial)	1·0	4·0	4·0	4·0	3·4	0·42	0·26
Centrosema pubescens Benth. (mixed strains, C.P.I. 23086 and C.P.I. 25355)	1·1	3·6	3·6	4·0	3·4	0·36	0·27
Pueraria phaseoloides Benth. (Q 367)	1·5	4·0	4·0	3·8	2·8	0·30	0·14
Stylosanthes gracilis H.B.K. (Q 2289)	1·9	3·8	3·8	3·8	3·8	0·04	0·03
Calopogonium mucunoides Desv. (Q 5647)	1·7	4·0	4·0	4·0	4·0	0·30	0·19
Phaseolus atropurpureus (cross of two strains—siratro) ..	2·0	4·0	4·0	4·0	0·0	0·28	0·00
Necessary differences for significance { 5%						0·06	
1%						0·07	

Differences within species: untreated dry-matter yield significantly greater than 2,4-D dry-matter yield at 1% level for all species except *Stylosanthes gracilis*

The herbicide was applied on January 3, 1963, 20 days after planting, at 4 oz of acid equivalent per ac. The herbicide concentrate was mixed with water and applied with an Oxford Precision Sprayer at 20 gal per ac and 30 lb per sq. in. through flat fan nozzles. All cups which were to be sprayed were stood on the ground at random in a 30 ft x 5 ft 8 in. plot and sprayed simultaneously with one traverse of the sprayer boom. Spraying was carried out in the shelter of a building to minimize spray drift.

The cups were kept under cover in a lath-house and watered daily by sprinkling with tap-water. Surviving plants were harvested (roots and tops) on January 16, 1963, oven-dried at approximately 95°C and weighed. The results are presented in Table 1.

Under the trial conditions, *Stylosanthes gracilis* (stylo) and *Calopogonium mucunoides* (calopo) survived 2-4-D, whereas *Phaseolus atropurpureus* (siratro) was completely killed. *Centrosema pubescens* (centro) and *Pueraria phaseoloides* (puero) partially survived the spray treatment. Apart from stylo, all species were significantly reduced in dry-matter yield as a result of spraying with 2,4-D.

It was decided to test the findings from the pot experiment further in a small plot field trial in February 1963 at the Queensland Department of Primary Industries Sub-station at Utchee Creek, near South Johnstone.

The four tropical pasture legume species tested are shown in Table 2. The herbicide used was the same as that used in the indicator pot experiment. The field layout was a randomized block of four replications. There was an untreated control and sprayed plot of each legume. The plot size was 12 ft x 7 ft with 1-ft guard strip between plots. Three rows were planted at approximately 2 ft. 4 in. centres down the length of each plot. The plots were planted on February 13, 1963, with seed which had been inoculated with the appropriate Rhizobium strain and were thinned on March 15, 1963, to give a plant stand

Fig. 1.—*Centrosema pubescens.* Left, untreated; right, sprayed with 2,4-D.

as near as possible to 147 plants per plot. The trial was sited on a red-brown sandy clay loam of basaltic origin which is deficient in available phosphate. No fertilizer was applied to the trial.

The herbicide was applied to the sprayed plots on April 4, 1963, 50 days after planting, at 1 lb of acid equivalent per ac. The herbicide concentrate was mixed with water and applied with an Oxford Precision Sprayer at 20 gal per ac and 30 lb per sq. in. through flat fan nozzles.

Sufficient rain fell throughout the course of the trial for normal plant growth. All plots were kept as free as possible of broad-leaved weeds by periodic hand weeding to minimize weed competition in the untreated control plots.

The surviving legume in a 9 ft x 7 ft quadrat in each plot was cut to ground level and weighed on May 30, 56 days after spraying. Legume samples of 300 g were taken at harvest time from each treatment and dried at approximately 95°C. The dry-matter yields are shown in Table 2.

TABLE 2

RESULTS OF FIELD TRIAL, UTCHEE CREEK, 1963

Species	No. of Trifoliate Leaves/Plant at Time of Spraying	Untreated. Mean D.M. Yield/Plot (lb/7 sq. yd.)	2,4-D. Mean D.M. Yield/Plot (lb/7 sq. yd.)
Centrosema pubescens Benth. (commercial)	5–11	1·38	0·25
Stylosanthes gracilis H.B.K. (Q 2289)	17–23	0·66	0·67
Calopogonium mucunoides Desv. (Q 5646)	7–16	2·45	0·80
Phaseolus atropurpureus (cross of two strains—siratro)	5–20	1·44	0·09
Necessary differences for significance 5%		0·77	
1%		1·05	

Differences within species: untreated dry-matter yield significantly greater than 2,4-D dry-matter yield at 1% level for all species except *Stylosanthes gracilis*

Fig. 2.—*Stylosanthes gracilis.* Left, untreated; right, sprayed with 2,4-D.

Fig. 3.—*Calopogonium mucunoides.* Left, untreated; right, sprayed with 2,4-D.

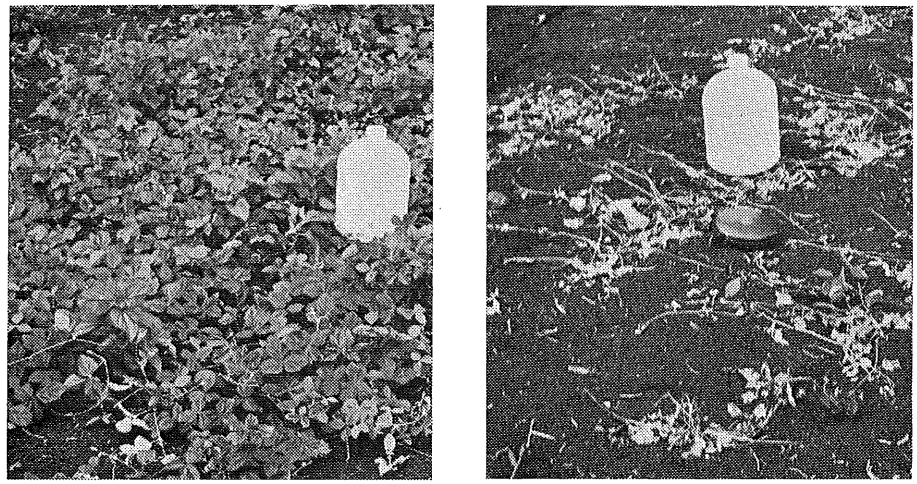

Fig. 4.—Siratro. Left, untreated; right, sprayed with 2,4-D.

Apart from stylo, all species were significantly reduced in dry-matter yield as a result of spraying with 2,4-D. Inspection of the plots the day after spraying showed that all sprayed plots had drooped. Fifteen days after spraying, Siratro appeared almost completely dead, centro and calopo were severely damaged, but stylo had recovered and was little affected.

Figures 1–8 illustrate the effect of 2,4-D on the four tropical legume species tested in the field trial. All photographs were taken on May 1, 77 days after planting and 27 days after applying the spray treatments. The polythene bottle is standing in each plot.

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