

by L.W. Smith⁺1. INTRODUCTION.

Weeds are a problem at two stages in the life of a lucerne stand. Firstly, during the establishment stage, when annual broadleaved weeds are the prevailing type, and secondly, in the mature lucerne stage, when the stand is liable to invasion by grasses and perennial weeds.

Numerous chemicals have been used for weed control in seedling lucerne, the most promising being D.N.B.P. (2,4-dinitro-6-secondary butyl phenol) and 2,4-DB (4-(2,4-dichlorophenoxy) butyric acid). (Ormrod 1953; Santelman et al 1956; Meeklah 1957; Ball and Soundy 1958; Rocco 1958). Other chemicals have also been used with success in mature lucerne, such as C.I.P.C. (isopropyl-N-(3-chlorophenyl) carbamate), dalapon (2,2-dichloropropionic acid), T.C.A. (trichloroacetic acid) and 2,4-DB. (Spencer 1954; Green, Evans and Elliot 1956; McLeod 1957; McCarthy and Sand 1958; Meeklah 1960).

All these chemicals are either selective on grasses or on broadleaved weeds, but in many cases the weeds occurring in lucerne will be mixtures of these two weed types. There was an obvious need for further local information regarding the effects of dalapon (selective on grasses) and 2,4-DB (selective on broadleaved weeds) alone and mixtures. Trials on these lines were therefore planned, and this paper deals with the results of these experiments, which were carried out in the Lachlan Valley, N.S.W., during the 1959 season.

The main weeds occurring on the trial areas were:-

(a) Seedling lucerne

fat hen	(<u>Chenopodium album</u>).
skeleton weed	(<u>Chondrilla juncea</u>).
wireweed	(<u>Polygonum aviculare</u>).
barley grass	(<u>Hordeum leporinum</u>).
variegated thistle	(<u>Silybum marianum</u>).
stinging nettle	(<u>Urtica urens</u>).
prairie grass	(<u>Bromus cartharticus</u>).

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(b) Mature lucerne

barley grass	
wimmera ryegrass	(<u>Lolium rigidum</u>).
prairie grass	
variegated thistle	
chickweed	(<u>Stellaria media</u>).
soft brome	(<u>Bromus mollis</u>).

The effects of growth stage on spraying with 2,4-DB was also studied in seedling lucerne at Merrindale.

2. TRIALS ON SEEDLING LUCERNE.

Two experiments were conducted at Cowra, N.S.W., using 2,4-DB and dalapon alone and in mixtures. The lucerne was sprayed in the 4-6 leaf stage of growth. The trials were designed as 4 replicate randomised blocks and gave the following results:

(a) Effects on lucerne.

All the mixtures of 2,4-DB and dalapon above $\frac{1}{2}$ lb/ac 2,4-DB plus 1 lb/ac dalapon injured the lucerne stand. Applications of 1 lb/ac 2,4-DB alone or 1 lb/ac dalapon alone, however, did not damage the lucerne, but rates of 2 and 4 lb/ac dalapon gave severe injury to the seedling lucerne.

(b) Effects on weeds.

Fat hen was controlled by $\frac{1}{2}$ lb/ac 2,4-DB, while other weeds such as variegated thistle and stinging nettle, needed 1 lb/ac for control. Wireweed received only a temporary check at the 1 lb/ac rate and then recovered, a similar result occurred with skeleton weed. Seedling grasses controlled by the 1 lb/ac dalapon rate were Poa annua, barley grass and soft brome, but not prairie grass, which required 2-4 lb/ac for effective control. It must be noted that these trials suffered from drought conditions for 2-3 weeks after spraying, and due to the subsequent poor growth of lucerne no yield data was obtained from the plots. Other weeds not occurring uniformly on the plots but controlled by 1 lb/ac 2,4-DB were spear thistle, (Cirsium vulgare); seedling docks (Rumex spp.); hedge mustard, (Sisymbrium officinale); and common fumitory, (Fumaria officinalis).

3. TRIALS ON MATURE LUCERNE.

A mature lucerne stand in the Cowra district was treated with 2,4-DB, dalapon and mixtures of these chemicals.

The trial was designed as a 6 replicate randomised block and the yields of lucerne, grass and weeds at the first cut are set out in Table 1.

Table 1.

Treatment	Rate lb/ac.	Dry Weight Lucerne lb/ac.	Green Weight	
			Grass lb/ac	Weeds lb/ac
2,4-DB	$\frac{1}{2}$	970	4132	400
2,4-DB	1	945	4668	488
2,4-DB + dalapon	$\frac{1}{2}+1$	1120	1264 ⁺	1188
2,4-DB + dalapon	$\frac{3}{4}+2$	1170	128 ⁺	1004
dalapon	1	1400 ⁺	432 ⁺	1484 ⁺⁺
dalapon	2	1535 ⁺	200 ⁺	1200 ⁺⁺
dalapon	4	1445 ⁺	40 ⁺	1468 ⁺⁺
untreated	-	1005	5060	964
L.S.D. at P = 0.05		395	860	692

N.B. The low yields of lucerne are due to the drought conditions and the poor stand due to grass invasion.

+ Significantly different from untreated and 2,4-DB plots at 5%.

++ Significantly different from 2,4-DB plots at 5%.

The most significant feature of this trial was the big reduction in grasses by the application of low rates of dalapon. The main grass was barley grass; this grass together with soft brome and prairie grass was controlled by 2 lb/ac of dalapon, however wimmera rye required 4 lbs for control. It must be noted that this decrease in grass species was associated with a corresponding increase in other weeds such as chickweed and variegated thistles. However, a significant increase in lucerne yield over the untreated plots was also obtained. This no doubt being due

to the increased water and nutrients available to the lucerne after the grasses were removed. (N.B. This trial also suffered severely due to drought.) It is felt that the density and fertility of the lucerne stand is most important and it is recommended that before a stand is treated with dalapon to remove grasses a fertility check should be made to see that fertility is not a limiting factor causing grasses to invade the stand.

2,4-DB had very little effect on mature lucerne at 1 lb/ac; only odd deformed leaves being noticed. Mixtures of 2,4-DB and dalapon were not as effective as either used alone at equivalent rates.

4. THE EFFECTS OF SPRAYING AT VARIOUS STAGES OF LUCERNE GROWTH.

(a) Seedling lucerne.

Seedling lucerne at various growth stages as measured by the number of leaves at spraying, was treated at Merrindale Research Station with 2,4-DB at $\frac{1}{2}$, $\frac{3}{4}$ and 1 lb/ac. The experiments were carried out on seedling lucerne grown in boxes ($8\frac{1}{2}$ " x $8\frac{1}{2}$ ") 12 plants per box, on a four replicated randomised block design. The plants were harvested and measured 6 weeks after treatment and the results are shown in Table 2.

These results show that seedling lucerne is very susceptible to 2,4-DB at the 1 to 2 leaf stage of growth, but not at the 4 to 5 or 6 to 7 leaf growth stage, however, the plants became susceptible again in the 8 to 9 leaf growth stage. Thus spraying should be carried out after the 2 leaf stage of growth and before the 8 leaf stage of growth is reached.

(b) Mature lucerne.

The application of dalapon and 2,4-DB to mature stands of lucerne should be carried out in the early spring, just as the lucerne starts making active growth. Application in August is to be preferred although it can be left till mid September in the more temperate areas. A grazing before spraying removes excess vegetation and a minimum of lucerne leaf is exposed to the spray although lucerne up to 6 inches high was sprayed on some plots with no apparent damage. This is in accordance with recent New Zealand work (Meeklah 1959) where lucerne 6 inches high tolerated 5 lb/ac dalapon.

Growth Stage at Spraying	Treatment	Average No. Leaves per Plant	Average Height per Plant in Cm.	Average Dry Weight of 12 Plants in Gm.
1-2 leaves	2,4-DB $\frac{1}{2}$ lb/ac	2.9 ⁺⁺	6.3 ⁺⁺	0.23 ⁺⁺
	2,4-DB $\frac{1}{4}$ lb/ac	2.8 ⁺⁺	6.1 ⁺⁺	0.22 ⁺⁺
	2,4-DB 1 lb/ac	3.1 ⁺⁺	6.4 ⁺⁺	0.24 ⁺⁺
	No treatment	4.2	10.0	0.42
4-5 leaves	2,4-DB $\frac{1}{2}$ lb/ac	9.3	14.5	0.94
	2,4-DB $\frac{1}{4}$ lb/ac	9.8	14.2	0.99
	2,4-DB 1 lb/ac	9.6	14.4	0.93
	No treatment	10.2	14.7	1.03
6-7 leaves	2,4-DB $\frac{1}{2}$ lb/ac	16.6	19.8	1.76
	2,4-DB $\frac{1}{4}$ lb/ac	14.2	18.1	1.67
	2,4-DB 1 lb/ac	15.0	19.6	1.73
	No treatment	16.7	17.6	1.70
8-9 leaves	2,4-DB $\frac{1}{2}$ lb/ac	23.4	25.9	3.09
	2,4-DB $\frac{1}{4}$ lb/ac	14.6 ⁺	23.3	2.13 ⁺
	2,4-DB 1 lb/ac	17.8 ⁺	21.8 ⁺	2.78 ⁺
	No treatment	26.2	25.6	3.13
25-30 leaves	2,4-DB $\frac{1}{2}$ lb/ac	34.5	26.5	4.29
	2,4-DB $\frac{1}{4}$ lb/ac	34.7	26.7	4.45
	2,4-DB 1 lb/ac	32.2	27.1	4.22
	No treatment	38.0	24.1	5.32

Significantly different from untreated - at 5% +
at 1%⁺⁺.

5. CONCLUSION.

Dalapon is highly effective for removing grasses, particularly barley grass from mature lucerne stands. Mature lucerne will tolerate over 4 lb/ac dalapon, but seedling lucerne will only tolerate 1 lb/ac.

2,4-DB will control certain weeds in seedling and mature lucerne stands at rates of 1 lb/ac. The stage of growth at spraying is most important in seedling lucerne. Mixtures of 2,4-DB and dalapon above $\frac{1}{2}$ lb/ac 2,4-DB plus 1 lb/ac dalapon should not be recommended in seedling lucerne without further work, however they can be used in mature stands where susceptible weeds occur together, but with reduced effectiveness compared to each applied separately.

6. REFERENCES.

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