Research Report

NODDING THISTLE

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Summary

A series of six trials with light rates of sodium salts of MCPB and 2,4-DB were carried out in lucerne crops infested with nodding thistle (*Carduus nutans*). Results are discussed. A description is given of preliminary work on the spread of nodding thistle seed by wind.

INTRODUCTION

AN EARLIER PAPER to this Conference (Delahunty, 1960) showed that nodding thistle (*Carduus nutans*) could be controlled in pastures by the application of light rates (less than 1 lb a.i. per acre) of the potassium salt of MCPA, the sodium salt of MCPB and the amine salt of 2,4-D in autumn (April-May) or spring (September). Control with the sodium salt of 2,4-DB at 0.75 lb and 1.5 lb a.i. per acre was shown in one trial to be reasonably effective.

The effect of hormone weedkillers on lucerne has been the subject of several papers at N.Z. Weed Control Conferences. McLeod (1957) reported that on mature lucerne the potassium salt of MCPA at 1 lb (quantities throughout this paper are in terms of active ingredient per acre) caused 80 to 100% severe distortion and wilting, usually within 24 hours. After 4 to 6 weeks, 90 to 100% of lucerne had been killed in all trials. When the sodium salt of MCPB was applied at 0.5 lb and 1 lb, 25 to 80% of the plants became distorted and wilted within 1 to 2 weeks. Symptoms were less severe in June and in one May treatment, but, despite the severity of early symptoms, the lucerne made a good recovery in all plots. At 2 lb the lucerne plants collapsed rapidly and a 25 to 30% thinning out of the stand resulted. The sodium salt of 2,4-DB at ½ lb and 1 lb caused slight distortion only. McLeod (1957) also reported that sodium salt of MCPB and the sodium salt of 2,4-DB at 1½ lb and 1 lb to young lucerne stands did no permanent damage.

Meeklah (1960) reported a series of trials with 2,4-DB at rates up to 3 lb on mature lucerne. Most of his work concerned spring applications of various formulations of 2,4-DB but in the one trial in which an application of the sodium salt of 2,4-DB at 1½ lb was made in autumn (April) there was no significant depression of lucerne in the spring cut. The most severe depressions from autumn application ranged up to 15%.

1958 TRIAL

In July, 1958, an established lucerne stand on light land was located in which there was a strike of nodding thistles just occurring. On June 30 seven spray treatments (in four replications) were applied: the potassium salt of MCPA at ¼ lb and ½ lb, the sodium salt of 2,4-DB at ¼ lb, ½ lb and 1 lb, the sodium salt of MCPB at ¼ lb and ½ lb. Within a few days it was noticed that the lucerne was distorting and twisting, the distortion being most severe with

½ lb MCPA and least with ¼ lb of 2,4-DB. The seedling thistles were killed but another, heavier strike of seeds occurred soon after spraying.

On November 4 all plots were cut with the results shown in Table 1.

TABLE 1: DRY MATTER, PER ACRE, 1958 TRIAL

Treatment	lb D.M. per ac.	5%	1%
MCPA at ¼ lb	3,060	a	A
MCPA at ½ lb	2,270	b	B
2,4-DB at ¼ lb	2,500	b	AB
2,4-DB at ½ lb	2,370	b	AB
2,4-DB at 1 lb	2,260	b	B
MCPB at ¼ lb	2,780	ab	AB
MCPB at ½ lb	2,500	b	AB
Control	2,320	b	B

There were no surviving thistles in any plot. The apparently severe MCPA treatments outyielded the controls!

1959 TRIAL

A young, weak stand of lucerne that had been sown with turnips in February, 1959, was the site of the next trial. Four spray treatments (½ lb of the potassium salt of MCPA, ½ lb of the sodium salt of MCPB, ½ lb and 1 lb of the sodium salt of 2,4-DB) in four replications were applied on August 18 to thistles in all stages up to 6 in. rosettes.

A prolonged period of dry weather followed with a resultant very slow growth. The trial was eventually grazed in early December as there was insufficient growth for mowing.

There was a patchy control of thistles with the best kill being obtained with MCPA, the 1 lb rate of 2,4-DB was next best, then MCPB and the ½ lb rate of 2,4-DB. The lucerne was thinned out by the MCPA but little difference could be seen between other treatments.

1960 TRIALS

Nodding thistles strike in lucerne at two main periods, the autumn and the spring. The spring strike usually appears from late July onwards. The strike can be heavy but, provided the stand is shut for hay, the seedling thistles are usually smothered by the rapidly growing lucerne; grazing of the stand allows the thistles to establish. The autumn strike has little or no competition from the lucerne and, by spring, is a well-rooted plant that can compete with the lucerne.

It was then decided to carry out trials with autumn spraying and two sites were located. Site A was in a vigorous, grass-free stand heavily infested with nodding thistles up to 6 in. in diameter; Site B was in a much weaker, browntop (*Agrostis tenuis* var. *stolonifera*), creeping bent (*Agrostis stolonifera*) infested stand in which many seedling thistles (up to 1 in. in diameter) had recently struck.

It had been intended to spray both areas on the same day but, owing to troubles with the sprayer, site B was not sprayed until one day later than site A.

The treatments (applied in late April) were the sodium salt of MCPB at ½ lb and 1 lb, and the sodium salt of 2,4-DB at ½ lb, 1 lb, and 2 lb. Site B was grazed continually from spraying through the winter; site A was not grazed.

The effect of the weedkiller in the two trials differed greatly. In site B there was an early kill of thistles which, however, was not complete; the heavier rates of both weedicides had killed more thistles by August than the lighter rates. With a growthy spring, the stand was shut for hay and the smothering effect of the rapidly

growing lucerne completed the kill; in November all treated plots were free of thistles.

In trials at site A the August inspection showed disappointing results with very poor control by all treatments. The stand was shut for hay, and, when re-inspected in November, the results were much better. Although all thistles had not been killed in any plot, numbers had been considerably reduced.

The best control was achieved with 1 lb of MCPB, with 2 lb 2,4-DB almost as good. Similarly $\frac{1}{2}$ lb MCPB was slightly better than 1 lb 2,4-DB.

In both trials the lucerne, throughout the winter months, appeared to be severely affected by 1 lb MCPB with much less noticeable effects from other treatments. By November the effect had worn off and there was no visible suppression from any treatment.

1961 TRIALS

Two further trials were laid down in early May, 1961, with similar treatments except that the $\frac{1}{2}$ lb rate of the sodium salt of 2,4-DB was omitted. In both sites there were flowering or regrowth thistles with mainly rosettes of up to 12 in. diameter.

As in the 1960 trials, one site was very dirty with grassy weeds and the other was practically free of grass. Once again the purer sward showed much more apparent symptoms of lucerne depression but these again disappeared in spring.

In neither trial was a complete control of thistles achieved. 2 lb of 2,4-DB was slightly better than 1 lb of MCPB and both were superior to 1 lb of 2,4-DB and $\frac{1}{2}$ lb of MCPB.

DISCUSSION

It seems that complete freedom from nodding thistles cannot be obtained in infested lucerne stands by the use of even moderate rates of the present hormone weedkillers. With the likely thinning out of the stand that occurs with MCPA, there are only the less reliable MCPB and 2,4-DB from which to choose. Equivalent results can be achieved with half the quantity of MCPB (when compared with 2,4-DB) and, because of the lower cost, MCPB is to be preferred.

DISTRIBUTION OF SEED BY WIND

Among the many agencies of dispersal of the fruits of nodding thistle, the wind is most commonly blamed for the spread of this weed. A. J. Healy (pers. comm.) has stated that, while a proportion of the fruits might be carried for some distance, a significantly larger proportion would normally be dropped within a relatively short distance of the parent plants. He based his statement on observations in the field that, in the main, the "down" carried no fruit whereas examination of the ground around thistle plants showed a large amount of fruit in the vicinity of parent plants.

The construction of the complete thistle fruit — *i.e.*, pappus and fruit — is also a factor of importance. It is not an organic whole; the pappus can and does separate from the fruit proper as a function of maturity, climatic conditions, and physical contact. The pappus hairs are arranged and attached basally to a thickened collar or ring which fits on an apical flange of the fruit; in the centre of this flange is a small knob or protuberance which projects up through the centre of the basal collar of the pappus. The pappus is firmly attached to the apex of the fruit up to maturity, but with the drying of the fruit, and some degree of spreading of the phyllaries or bracts of the thistle heads, this union of pappus and fruit becomes much less permanent. Often the physical contact between the pappus and fruit as the wind withdraws it from the involucre and brushes or

TABLE 2: DISTRIBUTION OF SEED BY WIND

Dis- tance	Date	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Down Seed	Total
1 ft	April 2	38	17	17	11	—	—	—	13	7	20	13	9	5	9	5	0	3	106	61
	April 12	57	21	23	13	—	—	—	15	3	27	16	8	4	15	7	5	3	151	68
2 ft	April 2	18	10	6	3	1	2	14	14	7	12	7	16	9	4	3	0	2	62	42
	April 12	31	14	17	5	5	0	23	14	14	14	7	26	10	5	3	3	3	124	55
4 ft	April 2	12	10	3	3	0	0	8	3	3	7	5	8	5	4	3	3	1	45	30
	April 12	24	15	10	4	4	0	12	7	12	12	5	13	5	9	3	6	3	90	42
8 ft	April 2	5	3	1	0	4	0	0	0	0	2	1	1	1	2	1	0	0	17	9
	April 12	8	4	7	3	5	3	0	0	0	5	2	3	2	4	1	3	2	35	17
16 ft	April 2	1	0	1	0	0	0	1	1	1	1	0	2	1	1	0	0	0	7	2
	April 12	0	0	2	1	1	0	1	1	1	4	1	5	2	0	0	1	0	14	5
32 ft	April 2	0	0	0	0	1	0	0	0	0	1	0	3	1	0	0	0	0	5	1
	April 12	0	0	1	0	2	0	0	0	0	1	0	3	1	1	0	3	0	11	1
64 ft	April 2	—	—	—	—	0	0	0	0	0	0	0	—	—	—	—	—	—	0	0
	April 12	—	—	—	—	0	0	1	1	0	0	0	—	—	—	—	—	—	1	0

jolts it against the phyllaries is sufficient to cause the fruit to drop very soon, while the pappus continues on. With higher humidity or moisture the pappus appears to adhere more permanently to the fruit, but, on the other hand, moisture makes the pappus less efficient as a distributing aid.

To verify these observations some preliminary work has been done during this last season. Vaseline was tried as an adhesive in small (2 in. diameter) containers but seed collection was too erratic to enable definite conclusions to be drawn.

Late in March a new site was located. A strip along the border of a lucerne paddock had been fenced off by a farmer for a shelterbelt. The trees had died but nodding thistles had established and were shedding seed when eight lines of catchers were laid out on the south-west side at right-angles to the strip. A new adhesive, a non-drying resin, was used. Seven days later, after a period of mild weather with light north-east breezes, the tins were inspected. A further ten days later, after light rain, they were re-inspected. The results are shown in Table 2.

By the time of the last inspection the resin had become gelatinous with rain; many insects had been caught, thus reducing the effective catching area. There was no thistle alongside the place where the catcher should have been placed in line 3.

DISCUSSION

While the conditions of this experiment were practically ideal, with light winds along the line of catching tins, the results show that seed is dropped very close to the parent plant.

Further trials will be carried out next season.

GERMINATION OF NODDING THISTLE SEED

Tests were carried out in Copenhagen tanks at the Seed Testing Station, Palmerston North, on seed of nodding thistles, and are as follows:

(1)	18–30° C		63% in 12 days.
(2)	18–30° C substratum soaked
in 0.2% KNO ₃		69% in 12 days.
(3)	Prechilled 4 days at 5° C then
as (1)		49% in 8 days + 4 days prechilling.
(4)	Prechilled 4 days then as (2)		73% in 8 days + 4 days prechilling.

The seed germinated fairly quickly. The remainder at the end of the tests appeared to be mostly dead and mouldy.

Similar results had been obtained in earlier tests.

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