WEED CONTROL IN SEEDLING 'GRASSLANDS MAKU' LOTUS PEDUNCALATUS

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SUMMARY

Maku lotus (*Lotus pedunculatus*) tolerated pre-plant incorporated (PPI) herbicides, dinitramine, ethofumesate, EPTC, pendimethalin and trifluralin, and post-emergence application of 2, 4-DB, dinoseb-acetate and ioxynil. The following herbicides severely retarded lotus seedling growth and are not recommended: asulam, benazolin, bentazone, chlorpropham and MCPB. A combination of a PPI herebicide (EPTC 5.0 kg/ha or trifluralin 1.0 kg/ha) with a post-emergence application of 2,4-DB (1.5 kg/ha) or 2,4-DB + ioxynil (1.5 + 0.75 kg/ha) controlled a wide spectrum of grass and broadleaf weeds without injury to seedling Maku.

INTRODUCTION

'Grasslands Maku' lotus is a legume with considerable agronomic potential on acid and low fertility soils. The control of weeds during establishment of seedling lotus crops grown for seed is important for three reasons. Lotus is slower to germinate than most other legumes particularly at lower temperatures (Charlton 1977), and is slow to establish (Lancashire *et al* 1980). Seed certification standards also require seed of a high purity.

Previous work (Brock 1972; Ivens 1975; Brock and Henderson 1976) has shown that Maku tolerates trifluralin 1.0 to 1.75 kg/ha pre-plant incorporated (PPI) and pre-emergence applications of carbetamide, dinoseb-acetate, ethofumesate, and propyzamide at rates up to 2.0, 4.5, 0.5 and 1.4 kg/ha respectively and post-emergence applications of carbetamide, dinoseb-acetate, ethofumesate, 2,4-DB and MCPB at rates up to 2.0, 3.4, 1.0—2.0, 2.2, and 2.2 kg/ha respectively. A particular problem for farmers producing lotus seed on land used extensively for wheat and barley is the control of phenoxy tolerant species including stinking mayweed (*Anthemis cotula*), cleavers (*Galium aparine*), chickweed (*Stellaria media*), and annual mouse-ear chickweed (*Cerastium glomeratum*). The objective of this study was to examine the tolerance of seedling lotus to pre- and post-emergence herbicides applied alone and in combination for the control of grass and broadleaf weeds in particular the phenoxy tolerant species.

METHODS

In three experiments in the Manawatu during 1979 herbicides were applied with a back-pack pressure sprayer in water (160-240 litres/ha) at 200 kPa. PPI herbicides were incorporated immediately after application with a rotary-hoe to a depth of 7 cm. In all experiments the dinoseb-acetate form of dinoseb was used. All visual evaluations were by two independent observers. Dry matter yields given are the lotus component of the plot yields.

Experiment 1: Five PPI herbicides (Table 1) were applied 9 March 1979 and Maku was sown in rows on the same day. Nine post-emergence herbicide treatments were applied on 12 April 1979, as a split plot treatment, with PPI herbicides as main plots. Treatments were replicated three times. Sub-plots were 2.4m^2. Soil type was a Kairanga

TABLE 1: Effect of herbicides on weed control in autumn sown Maku, Experiment 1.

Herbicides and rates (kg/ha)	Maku	Weeds (% control) **			
	Score*	Total	POa	SOn	COd
untreated	9.3	0	0	0	0
Pre-plant incorporated					
EPTC 4.8	9.5	88	98	80	53
ethofumesate 0.8	10.0	34	44	33	23
pendimethalin 2.0	10.0	50	73	16	42
EPTC 3.0 + trifluralin 1.0	10.0	53	96	77	63
dinitramine 0.75	10.0	74	83	90	61
Post-emergence					
2,4-DB 2.5	9.0	16	0	17	76
2,4-DB 2.0 + bentazone 2.0	0	11	0	33	85
2,4-DB 2.0 + dinoseb 2.0	7.5	44	0	100	92
2,4-DB 2.0 + chlorpropham 4.0	7.5	75	41	90	94
MCPB 2.0	7.5	22	0	53	98
dinoseb 2.0	9.3	41	0	100	90
asulam 2.0	5.6	55	100	0	65
propyzamide 0.6	9.7	37	52	16	50
ioxynil 0.75	9.2	28	0	100	96
Pre-emergence + post-emergence combinations					
EPTC 4.8 + 2,4-DB 2.0	8.6	94	90	90	100
EPTC 4.8 + MCPB 2.0	7.7	96	100	87	100
EPTC 4.8 + dinoseb 2.0	9.0	95	97	100	77
EPTC 4.8 + ioxynil 0.75	9.0	96	99	100	96
LSD (5%)	1.5	24	24	37	26

* Score, 0 = lotus killed by treatment, 10 = no growth reduction of lotus, August 1979, 20 weeks after establishment.

** Visual evaluation, May 1979, 10 weeks after pre-emergence treatments applied (POa = poa annua, SOn = black nightshade COd = twin cress, (*Coronopus didymus*).

silt loam.

At post-emergence spraying Maku was 5 cm tall with 5-7 trifoliolate leaves, black nightshade (*Solanum nigrum*) 3-4 cm tall and poa annua (*Poa annua*) 1-4 tillers.

Conditions at the time of application were, pre-emergence: soil surface dry with adequate soil moisture at 25 mm, air temperature 27°C, rainfall for the 7 days before and after spraying, 0 and 26 mm respectively; post-emergence: air temperature 16°C, rainfall for the 7 days before and after spraying 46, and 0 mm respectively.

Experiment 2: Four post-emergence herbicides (Table 2) were applied 12 June 1979 to Maku sown in 50 cm rows on 14 April 1979. Treatments were replicated four times in a randomized block design. Plots were 7.5 m². Soil type was an Opiki peaty silt loam.

At spraying Maku was 2 cm tall with 3 trifoliolate leaves, stinking mayweed had rosettes 5-8 cm diameter with 6 leaves; cleavers had 3-5 stems/plant with stems 5-8 cm long and chickweed, 3-7 stems/plant with stems 3-10 cm long.

Conditions at time of application were a moist soil surface, with rainfall of 10 and 16 mm, 1 and 7 days after spraying respectively, air temperature 11°C.

Experiment 3: EPTC and trifluralin PPI at 3 rates (Table 3) were applied on 6 November 1979 and Maku was sown in 50 cm rows two days later. On 8 January 1980, four post-emergence herbicide treatments were applied to plots that had had EPTC 5.0

TABLE 2: Effects of herbicides on Maku injury, yield, and control of phenoxy tolerant broadleaved weeds in autumn sown Maku, Experiment 2.

Herbicide and rates	(kg/ha)	Maku		Weeds (% control)*				
		Injury* (%)	Yield** (kg/ha)	ANc	GAa	CEg	STm	PIe
untreated	0	0	3110	0	0	0	0	0
benazolin	0.75	20	2670	40	0	55	30	72
benazolin	1.5	80	580	85	10	98	58	70
dinoseb	1.0	0	3510	20	18	36	13	8
dinoseb	2.0	5	3180	29	25	68	69	30
ioxynil	0.8	5	2990	84	60	58	61	69
ioxynil	1.6	15	3060	97	88	98	96	92
asulam	1.5	32	3170	57	0	0	20	0
LSD (5%)		26	1150	33	42	27	35	42

* Visual evaluation, September 1979, 14 weeks after application (ANc = stinking mayweed, GAa = cleavers, CEg = annual mouse-ear chickweed, STm = chickweed, PIe = oxtongue, (*Picris echiodies*).

** dry matter yield, 30 April, 1980.

kg/ha pre-emergence (Table 3). Treatments were replicated four times in a randomized block design. Plots were 7.5 m². Soil type was a Te Arakura silt loam.

Growth stages at post-emergence spraying were Maku 10-15 cm tall; black nightshade up to 20 cm tall, fathen (*Chenopodium album*) up to 30 cm tall, Scotch thistle (*Cirsium vulgare*) rosettes up to 20 cm diameter and broadleaved dock (*Rumex obtusifolius*) rosettes up to 20 cm diameter.

Conditions at the time of application were, pre-emergence: dry soil surface with adequate soil moisture for germination at 25 mm, air temperature 18°C, rainfall for 7 days before and after spraying 9 and 6 mm respectively; post-emergence: air temperature 20°C, rainfall of 0 and 36 mm, 1 and 7 days after spraying, respectively.

RESULTS AND DISCUSSION

Maku tolerance

In the three trials (Tables 1,2,3) Maku tolerated PPI treatments of EPTC (7 kg/ha), trifluralin (2.25 kg/ha), pendimethalin (2.0 kg/ha), ethofumesate (0.8 kg/ha) and dinitramine (0.75 kg/ha). These were the highest rates tested. Trifluralin injury reported on a Manawatu fine sandy loam by Brock (1972) at 2.0 kg/ha did not occur (Table 3). In an earlier trial Brock (1972) reported trifluralin injury to Maku at 2.0 kg/ha on a Manawatu fine sandy loam, while Ivens (1975) reported no injury at 1.7 kg/ha on a Tokomaru silt loam. These observations suggest that Maku tolerates trifluralin at rates up to 1.0 kg/ha on light soils, and 1.7 to 2.25 kg/ha on heavier soils.

Brock and Henderson (1976) reported that Maku was injured by ethofumesate pre-emergence applied at 1.0 kg/ha but was tolerant at 0.5 kg/ha. In this trial Maku was tolerant to 0.8 kg/ha of ethofumesate (Table 1). There was post-emergence tolerance to 2,4-DB (3.0 kg/ha), dinoseb (2.0 kg/ha), ioxynil (1.6 kg/ha), and propyzamide (0.6 kg/ha). Both dinoseb and ioxynil have contact activity on plants, and caused a burning on leaf margins especially with the summer application (Experiment 3) which was visible for several weeks after treatment. High rates of dinoseb and ioxynil in summer reduced dry matter yield in autumn, but did not appear to have any long term effect (Table 3).

In experiment 1 growth of lotus was retarded by asulam (2.0 kg/ha), MCPB (2.0 kg/ha) and chlorpropham (4.0 kg/ha), and in experiment 2, by

Seed Production

TABLE 3: Effects of herbicides on Maku injury, yield in autumn, stand score the following spring, and weed control in spring sown Maku, Experiment 3.

Herbicides and rates (kg/ha)		Lotus			Weeds** (% control)			
		Injury (%) 15 Jan. 1980	Yield (kg/ha) 16 April 1980	Stand Score* 22 Sept. 1980	RUo	SOn	CIv	CHa
untreated		0	910	7.3	0	0	0	0
EPTC	3.0	9	1620	7.0	28	38	0	25
EPTC	5.0	2	1530	9.5	15	29	15	22
EPTC	7.0	3	2420	10.0	60	45	48	72
trifluralin	0.75	3	900	9.3	46	25	35	46
trifluralin	1.5	3	920	9.3	82	38	15	75
trifluralin	2.25	14	1550	10.0	98	35	3	91
*Post-emergence****								
2,4-DB	1.5	9	1910	10.0	100	98	100	100
2,4-DB	3.0	10	2170	10.0	97	99	100	100
ioxynil	1.0	52	1410	10.0	88	79	90	100
ioxynil	2.0	43	980	10.0	95	99	95	98
2,4-DB 1.5 + ioxynil	1.0	45	1740	10.0	99	98	100	100
2,4-DB 3.0 + ioxynil	1.0	44	1460	10.0	100	99	100	100
dinoseb	1.5	56	1950	10.0	68	48	42	48
dinoseb	3.0	66	1180	10.0	70	55	70	93
LSD (5%)		16	760		28	32	30	36

* Score, see Table 1.

** Visual evaluation, February 1980, 18 weeks after sowing (RUo = broadleaf dock, SOn = black nightshade, CIv = Scotch thistle, CHa = fathen). Weed cover in control = 82%.

*** All post-emergence plots received EPTC 5.0 kg/ha pre-emergence.

asulam at 1.5 kg/ha. The use of these three herbicides is not recommended in seedling lotus. Bentazone and benazolin, two herbicides used on white clover, severely reduced the growth of, or killed, Maku (Table 1 and 2).

The combination of EPTC with a post-emergence herbicide (2,4-DB, dinoseb, ioxynil) had no detrimental effects on Maku (Table 1,3). The other PPI treatments in combination with 2,4-DB, dinoseb and ioxynil (Experiment 1) are not presented, but were similar to EPTC.

Weed control

Phenoxy tolerant broadleaved weeds were controlled by ioxynil (Table 2) despite the advanced growth stage of the seedlings. Control at lower rates could be expected with smaller seedlings. Other broadleaved weeds were controlled by 2,4-DB and ioxynil, or the 2,4-DB + ioxynil mixture (Table 1 and 3). Dinoseb is used overseas for broadleaved weed control in *Lotus corniculatus* (Linscott and Hagin 1978), but in this study, dinoseb was equal to ioxynil for weed control in only one (Experiment 1) of the three experiments.

Both grasses and broadleaved species are problems in seedling lotus. A combination of a PPI herbicides that controls grasses (EPTC at 5.0 kg/ha or trifluralin) with a post-emergence herbicide to control broadleaved weeds (2,4-DB at 1.5 kg/ha or 2,4-DB + ioxynil at 1.5 + 0.75 kg/ha) should give nearly complete weed control (Table 1 and 3).

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