TOLERANCE OF LENTILS TO PRE-EMERGENCE HERBICIDES

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SUMMARY

Four experiments investigated the tolerance of winter and spring sown lentils to pre-emergence applied herbicides. Lentils tolerated cyanazine 1.5 kg ai/ha, metribuzin 0.35 kg ai/ha, pendimethalin 1.0 kg ai/ha, atrazine 0.75 kg ai/ha and terbuthylazine 1.0 kg ai/ha. Herbicides were also applied at two or three times these rates. Lentil plant numbers were not reduced with higher rates of cyanazine but other herbicides either reduced plant numbers, and/or decreased yield. Cyanazine (less than 3.0 kg ai/ha) should remain the basis of pre-emergence weed control but terbuthylazine or atrazine are alternatives. Metribuzin at less than 0.35 kg ai/ha may be mixed with cyanazine.

INTRODUCTION

Lentils are the fifth most important pulse crop on a world production basis. The plant is a short, fine-leaved, semi-erect annual legume bearing many small pods with 1-2 seeds/pod. Since 1981, lentil production in New Zealand has increased from trial plantings to approximately 1600 ha in 1986/87, and is expected to increase to a maximum of 10,000 ha within 3 years (W.A. Jermyn *pers com*). As with many new crops, weed control is a major component of successful husbandry. Information collected and reported by Butler and Jermyn (1981) for a limited experimental area is no longer adequate for the area of commercial production. Farmers are using increasing rates of cyanazine for control of weeds such as field pansy (*Viola arvensis*) and the lack of good tolerance information on cyanazine and other pre-emergence herbicide treatments prompted the trials reported below.

METHODS

Four tolerance trials, at sites in Mid and Central Canterbury, were laid down in 1986. Weed-free sites were not selected as it was anticipated that the herbicide treatments would control any weeds present in treated plots, and that untreated plots would be hand-weeded.

Lentil seed was sown at 70-100 kg/ha with a commercial hoe coulter drill on farmers properties (Sites 1,3,4), or with a precision cone seeder drill at Lincoln. (Site 2). A randomised block design with four replicates and a plot size of 2 x 7 m was used at all sites. The treatments and other relevant details are set out in Tables 1 and 2. Herbicides were applied with a modified Oxford precision sprayer fitted with fan nozzles (Teejet 8002) operated at 200 kPa to apply 200 litres/ha. Two or three hand-weeded plots per replicate were included in all trials.

Plants were counted in three 0.25m² quadrats per plot. Plants were visually assessed by two independent observers for damage and vigour 8 weeks after spraying. Four areas of 1.2 m² per plot at Sites 1,3,4 or a single 5.4 m² area at Site 2, were sampled by hand pulling plants which were then threshed in a stationary threshing machine. A subsample was counted and weighed for seed weight. Data were analysed three ways using analysis of variance: analysis as a randomised block with all treatments included; analysis as a factorial with data from the five herbicides by three rates; and analysis of the interaction of two rates of both cyanazine and metribuzin.

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RESULTS AND DISCUSSION

Analysis of the data from the four sites did not indicate any site by herbicide interaction, so the data were pooled and the combined analysis is presented in Table 2. Plant numbers were highest at Site 2, as were yields (Table 1). Visual damage was closely related to plant counts at 6-8 weeks so data is not presented. Lentil seed weight was not affected by treatment, but at Site 2 the weight was 7% lower than at Sites 3 and

TABLE 1: Experimental details of lentil trials in 1986/1987, and untreated plot results.

Details	Site 1	Site 2	Site 3	Site 4
Location	Dorie	Lincoln	Methven	Highbank
Soil type ¹	Templeton	Wakanui	Lyndhurst	Lyndhurst
Sowing date	29.6.86	29.7.86	11.9.86	23.9.86
Cultivar	Olympic	Invincible	Olympic	Invincible
Spraying date	23.7.86	21.8.86	22.9.86	24.9.86
Plant count (1)	3.9.86	9.9.86	15.10.86	15.10.86
Plant count (2)	22.9.86	13.10.86	17.11.86	17.11.86
Visual score	22.9.86	13.10.86	21.11.86	21.11.86
Plant count (3)	16.10.86			
Harvest date	20.1.87	14.1.87	22.1.87	21.1.87
Hand weeded plots				
Plants/m ² (1)	144	246	155	108
Plants/m ² (2)	147	255	158	94
Seed weight (g)	—	50.5	54.0	55.0
Yield (t/ha)	—	2.8	2.2	1.2

¹All soils were silt loam soils.

TABLE 2: Total plant counts at 4 weeks after emergence, and at 6-8 weeks after emergence, and total yield of lentils from four sites, expressed as a percentage of that in hand weeded plots at each site.

Treatment	Rate kg ai/ha	Counts 1 plants/m ²	Counts 2 plants/m ²	Grain yield*
hand weeded		100	100	100
cyanazine	1.5	94	96	128
cyanazine	3.0	96	97	129
cyanazine	4.5	94	85	121
metribuzin	0.35	97	87	117
metribuzin	0.7	96	64	88
metribuzin	1.05	89	32	52
pendimethalin	1.0	91	93	104
pendimethalin	2.0	89	82	97
pendimethalin	3.0	90	84	88
terbuthylazine	1.0	96	86	129
terbuthylazine	2.0	84	71	113
terbuthylazine	3.0	93	41	89
atrazine	0.75	90	89	110
atrazine	1.5	94	71	112
atrazine	2.25	89	41	84
cyanazine/metribuzin	1.5/0.35	85	80	120
cyanazine/metribuzin	1.5/0.7	97	32	81
cyanazine/metribuzin	3.0/0.35	97	66	110
cyanazine/metribuzin	3.0/0.7	98	22	58
LSD (5%)		11.6	16.9	27.5
CV%		8.8	17	16

* Site 1 excluded from analysis.

4 (Table 1). Weed control was complete at all rates and, at the two higher rates, plots were free of all annual weeds until harvest. At Lincoln, one patch of Californian thistle (*Cirsium arvensis*) infested two plots, but the experimental area was weed free at all other sites. Cultivar differences did not appear to be important. Cv. Titore has been shown to be more sensitive to metribuzin (Butler and Jermyn 1981) but these cultivars, Invincible and Olympic, did not react differently to the herbicides tested.

Plant Counts

Herbicides had not reduced lentil plant numbers at 4 weeks, but had by 6 to 8 weeks after emergence. Some herbicides halved plant numbers. Lentils did not tolerate cinnemethalin (Cinch) 1.0 kg ai/ha at Sites 1 and 2, and so was not included at Sites 3 and 4. Diflufenican 0.075 plus isoproturon (HR1288) 0.375 kg ai/ha mixture reduced plant numbers by 18%, and, at twice the rate, reduced plant numbers by 48%. It was also not included in further trials.

Cyanazine (Bladex) and pendimethalin (Stomp) were the only herbicides which did not significantly reduce plant numbers at 2X or 3X rate, although pendimethalin-treated plants were chlorotic and ill-thrifty at these higher rates. Cyanazine 4.5 kg ai/ha did not reduce plant numbers, although plants showed triazine damage for about 8 weeks. Plant numbers counted at 12 weeks at Site 1 were similar to the 8 week counts.

Lentil Yield

Flooding on part of Site 1 precluded its incorporation in the combined data analysis. Yields in hand-weeded plots ranged from 1.2 to 2.8 t/ha. Despite three weedings of untreated plots, herbicide treatment at the lowest rate out-yielded untreated plots. Yields of plots were correlated ($R^2 = 0.72$) with plant numbers surviving herbicide treatment. Increasing rates of cyanazine did not reduce yields, whereas increasing the rate of other herbicides did. Atrazine (Actazine 50) at 0.75 kg ai/ha controlled weeds including field pansy, but tolerance to higher rates was poor and at the highest rate yield was reduced. Atrazine should only be used with caution. Likewise terbuthylazine (Gardoprim) damaged lentils at the standard rate, with increasing damage at higher rates. Despite reduced plant numbers after terbuthylazine application, yield was high, possibly because damage to the young plants made them branch more and set more seeds. Whether this effect would be the same in an adverse growing season is questionable. Metribuzin (Sencor) was effective, but lentils did not tolerate rates higher than 0.35 kg ai/ha. Metribuzin 0.35 kg ai/ha will provide good short term control, but will not provide season-long weed control such as that provided by cyanazine at 3.0 kg ai/ha. Metribuzin would be useful in combination with either cyanazine or atrazine, at low rates, to control specific weeds.

CONCLUSION

Cyanazine should remain the basis of weed control in lentils, and the rate could be increased to 3 kg ai/ha without major risk of crop injury. Weed control lasts for more than 12 weeks at this rate. Other herbicides such as metribuzin 0.35 kg ai/ha may be used to improve weed control. No adverse interaction between cyanazine and metribuzin was detected but the rate of metribuzin used in a mixture is more important for crop safety than the rate of cyanazine. Atrazine is a low cost herbicide, but rates above 0.75 kg ai/ha are not tolerated. Pendimethalin reduces vigour and yields and its use in lentils cannot be recommended. Terbuthylazine may be useful although lentils cannot tolerate 2X rates. Recovery from terbuthylazine damage was adequate.

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