

EFFECT OF WEED COMPETITION ON NEWLY ESTABLISHED ASPARAGUS

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SUMMARY

The effects of weed competition during the establishment phase of newly transplanted asparagus (*Asparagus officinalis* cv. UC72) were studied over four growing seasons. Treatments included 2, 4, 6, 8, 10 or 12 weeks of weed competition in spring/early summer or 4, 8 or 12 weeks of competition during late summer/autumn. Weed competition for 6 or more weeks in the spring reduced the fern growth, spear numbers and spear yields significantly and these effects persisted in subsequent seasons, although some compensatory growth appeared to slowly minimise the results of that stress. Weed competition during the late summer/autumn, which comprised mostly grass weeds and was not severe, had no significant effect on spear production in the subsequent seasons.

INTRODUCTION

In perennial crops such as asparagus, weeds present during the growing season not only reduce the yield for the current season by limiting the availability of moisture and nutrients, but also restrict replenishment of carbohydrate reserves in the crop for the next season's growth. The critical period of weed competition in most vegetable crops, including asparagus, is during the establishment phase (Welker and Brogdon 1972, Zimdahl 1980). Once the asparagus fern is established and has formed a canopy, competition by weeds is reduced. Weeds can, however, still interfere with the crop and the effects of competition may not be apparent until the next season's growth starts.

With the large number of pre-emergence herbicides available for use in asparagus crops (Franklin *et al* 1980; Rahman *et al* 1981), the grower is faced with several options of using a long or a short term herbicide, or a combination of these chemicals. To make the decision wisely one must have a good perception of what competition from weeds can do in the early stages of crop growth and in the later part of the growing season between January and April. This information would also help in making a correct decision as to whether or not a post-emergence herbicide is economical if weeds become a problem later in the season.

MATERIALS AND METHODS

The trial was located near Hamilton on a Horotiu sandy loam soil with an organic carbon content of 9.8%. One year old crowns of cv. UC72 were transplanted on 18.8.82 at spacings of 1 m between rows and 35 cm apart within the rows. Trial design was systematic with two replications and the treatments were blocked so that the spring and autumn treatments were considered separately for statistical analyses. Individual plots were 60 m long and consisted of a single row for spring treatments and two rows for the autumn treatments.

The treatments included no weed competition; 2, 4, 6, 8, 10 or 12 weeks of weed competition after spear emergence in the spring/early summer period; and 4, 8 or 12 weeks of weed competition in late summer/autumn. The no weed competition treatment was achieved by two applications of diuron (Karmex), at 2 kg ai/ha (in September and December) and spot treatment of difficult to kill weeds when required.

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For the spring/early summer treatments weeds were removed at the required time by hand weeding. This was followed by a directed spray of bromacil (Hyvar X) at 1.6 kg ai/ha to achieve the long term weed control for the rest of the growing season, except for the 12 week treatment which was treated with diuron at 2 kg ai/ha. For the late summer/autumn treatments, plots were treated with 1 kg ai/ha bromacil in September and weeds were removed by hand hoeing when necessary up to 4 weeks before the start of the treatment. Several rows of asparagus were also treated with 1.6 kg ai/ha bromacil in September to compare this herbicide with the diuron treatment which has been demonstrated a safe chemical on asparagus (Rahman *et al* 1981). All herbicides were applied in 350 litres/ha water at 200 kPa.

The above treatments were repeated in the 1983-84 growing season.

For the 1984-85 and 1985-86 seasons bromacil at 1.6 kg ai/ha was applied in early September to all treatments, except for the no weed competition treatment which received two applications of diuron as before. Thus the effects of treatments applied over the first two years were measured for a further two years to determine the 'carry over' effects.

The data collected from the trial included weed dry matter and fern height at the time of weed removal; weight of asparagus ferns at the end of each growing season; the number of spears (1983-85) and weight of spears in the last two seasons. The spear harvest season lasted 41 days in 1984 (8/9 to 19/10) and 77 days in 1985 (11/9 to 20/11) during which time spears 180 mm or more in length were harvested at ground level every Monday, Wednesday and Friday.

RESULTS AND DISCUSSION

The extent of competition offered by weeds can be seen from the data in Table 1. Within 10 weeks of spear emergence, weeds had outgrown the asparagus plants. The main weeds present during the first 4 weeks were willow weed (*Polygonum persicaria*), black nightshade (*Solanum nigrum*), and narrow-leaved plantain (*Plantago lanceolata*) with occasional plants of chickweed (*Stellaria media*), annual poa (*Poa annua*), and white clover (*Trifolium repens*). With time, willow weed became the dominant weed and was the only species present in the 10 and 12 weeks spring/early summer treatments.

TABLE 1: Weed competition during asparagus establishment in 1982 — spring/early summer period.

Weeks of competition	Clean-up dates	Weeds		
		Dry matter (kg/ha)	Height (cm)	Fern height (cm)
2	29.09.82	52	4	60
4	13.10.82	255	10	75
6	26.10.82	985	18	80
8	11.11.82	2620	50	80
10	24.11.82	5380	120	90
12	8.12.82	10990	140	100

By contrast, the extent of weed competition was much lower in the late summer/autumn treatments. Weeds consisted mainly of paspalum (*Paspalum dilatatum*) and summer grass (*Digitaria sanguinalis*), with a few broadleaf weeds viz. narrow-leaved plantain, dandelion (*Taraxacum officinale*) and mouse-ear chickweed (*Cerastium fontanum* ssp. *triviale*) in the 4 week treatment. At the end of the growing season the 4 week treatment had 1 paspalum (4 tillers/plant on average) and 10 summer grass plants/m² while the 12 week treatment had 13 paspalum (25 tillers) and 10 summer grass plants/m².

Competition by weeds for 6 weeks or more in the spring/early summer resulted in a significant reduction in the weight of asparagus ferns produced during the growing season (Table 2). The effects were more pronounced in the first year of establishment

TABLE 2: Effect of weed competition on weight of asparagus ferns at the end of season.

Treatment		Weight of ferns (t/ha)		
		July 1983	June 1984	June 1985
No weed competition*	—	1.09	5.03	6.52
Spring/ early summer	2 weeks	1.06	5.20	6.57
	4 weeks	1.14	5.47	6.79
	6 weeks	0.77	4.13	5.52
	8 weeks	0.66	4.03	5.15
	10 weeks	0.42	3.03	4.37
	12 weeks	0.30	2.50	3.04
SED		0.07	0.61	0.82
CV%		7.1	10.6	11.1
Autumn/ late summer**	4 weeks	0.86	4.27	6.71
	8 weeks	1.00	4.23	6.04
	12 weeks	0.86	4.06	5.98
bromacil 1.6 kg ai/ha	—	1.05	4.47	7.40

*Achieved by two applications of diuron 2 kg ai/ha

**There were no significant differences between the autumn/late summer treatments ($P < 0.05$).

but the reductions were still significant in the second and third growing seasons. Competition by weeds during the late summer/autumn months did not result in significant reductions in the weight of ferns. The bromacil treatment produced fern weights similar to the no weed competition treatment.

Data on the number of spears counted on 9.9.83 (the second year of treatment application) were similar to the results obtained with fern weights, in that weed competition for 6 or more weeks in spring/early summer significantly reduced the spear number (Table 3).

TABLE 3: Effect of weed competition on the number and yield of asparagus spears.

Treatment		No. of spears ('000/ha)			Spear yield (t/ha)	
		1983	1984	1985	1984	1985
No weed competition*	—	47.0	85.9	210.5	2.58	4.78
Spring/ early summer	2 weeks	43.3	81.8	201.6	2.71	4.76
	4 weeks	45.7	88.0	227.4	2.76	5.19
	6 weeks	27.8	68.6	167.0	2.21	4.31
	8 weeks	33.7	74.7	185.3	2.31	4.35
	10 weeks	26.4	59.8	162.6	1.79	3.96
	12 weeks	23.7	64.1	169.2	1.59	3.70
SED		6.6	7.9	13.7	0.36	0.27
CV%		13.3	11.0	7.4	16.4	6.3
Autumn/ late summer**	4 weeks	46.2	84.2	224.6	2.85	5.52
	8 weeks	45.9	86.5	214.0	2.65	5.37
	12 weeks	42.7	85.4	221.0	2.32	5.21
bromacil 1.6 kg ai/ha	—	44.7	84.7	216.6	2.45	4.96

*Achieved by two applications of diuron 2 kg ai/ha

**There were no significant differences between the autumn/late summer treatments ($P < 0.05$)

The effects of weed competition treatments applied in 1982-83 and 1983-84 seasons were also measured in the 1984 and 1985 harvesting seasons. Results in Table 3 show that significant reductions in both number and weight of spears were only noted in the

10 and 12 week competition treatments, although there was a trend for lower number and yield of spears in the 6 and 8 week competition treatments. The yield reduction was less in 1985 than in 1984 indicating that some compensatory growth was taking place in plots initially affected by weed competition. As was the case with fern weights, weed competition from the autumn treatments did not have any significant effect on the number or yield of spears in the following two years. The weed spectrum in the autumn included mainly grass weeds, as mentioned earlier, and the numbers were much smaller compared to spring treatments. In most asparagus crops competition from grass weeds would be expected after the activity of residual herbicides begins to dissipate in the late summer/autumn.

Asparagus production depends upon the reserves of the root system produced the previous year plus the growing conditions during the current season (Welker and Brogdon 1972). The results presented above clearly show that the effects of weed competition for 6 weeks or more in spring/early summer became evident in the first season of growth and continued to affect both the fern and spear production in subsequent years. Annual applications of 1.6 kg ai/ha bromacil resulted in crop growth and spear yields similar to a no weed competition treatment. Weed competition in the autumn, which was not severe in this trial, did not reduce either the fern or spear production.

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