SOIL MANAGEMENT PRACTICES FOR ASPARAGUS PRODUCTION

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SUMMARY

Crowns of asparagus (*Asparagus officinalis* c.v. "NZ Beacon") were planted 200 mm below the soil surface in beds ridged or flat, cultivated or not, at four sites. After 3 years, marketable yields were considerably higher at Flock House than at Hastings, Takapau or Levin sites. Ridging was initially advantageous except at Takapau in 1984. After crops had become established, ridging improved yield only at Hastings and, in 1986, depressed yield at Flock House. Cultivation had little effect on yields in 5 years. Incidence of volunteer asparagus seedlings was higher on cultivated plots. Herbicide programmes designed for the varying weed populations at each site were successful.

INTRODUCTION

During the past decade the area of asparagus production in New Zealand has increased from 815 ha (Anon. 1977) to 2669 ha (Anon. 1987). The crop is generally grown in rows 1.5 m apart but there is considerable variation in management practices according to soil type, climate and weed infestation. Earlier, flat beds rather than ridged rows were favoured in Hawkes Bay, the original centre of asparagus production, except on cold, wet soils. During recent years there has been a substantial increase in use of herbicides usually accompanied by a decrease in cultivation.

In 1981 a series of trials was established at four sites in the southern region of the North Island to measure the effects of soil contour and cultivation on asparagus growth and yield. The trials were located as follows:—

Flock House Research Area, Bulls — alluvial sandy loam

Hastings Horticultural Research Station — clay loam

Takapau Research Area — silt loam

Levin Horticultural Research Centre — silt loam

After the first full harvest season in 1984, interim results of this work were reported (Cox and Ingle 1985). At this stage of the asparagus crop development, ridging had been shown to be worthwhile at all sites except Takapau but cultivation had improved yield only at Flock House. The present paper describes the further development of these trials and reports final results after taking 1985 and 1986 yields.

METHODS

Asparagus crowns cv "NZ Beacon" grown at Levin Horticultural Research Centre were transplanted in early spring 1981 on the Flock House, Hastings, Takapau and Levin sites. The crowns were planted 450 mm apart in rows spaced at 1.5 m, either in ridges raised 300 mm above the wheel track or on the flat, but in each case covered with 200 mm of soil.

Each experiment was laid out in six replicates. Fertiliser and lime were applied according to need, as determined by soil tests. Details of establishment and maintenance of the experiments have been reported previously (Cox and Ingle 1985).

Cultivation treatments were applied to half the total number of flat and ridged plots. Treatments were thus:—

1. Flat, Cultivation.	3. Ridge, Cultivation.
2. Flat, No Cultivation	4. Ridge, No Cultivation

The cultivation treatment, which was applied before emergence and at the end of harvest, was similar at each site. Usually the same machine, asparagus discs or spinning

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cultivator, was used at the same settings. Two passes were made on each occasion, first directing soil away from the row then back again on the second pass. A graduated metal probe was used to record depth of soil cover above the crowns.

The first harvest of twelve picks was taken in 1983. In 1984, 1985 and 1986 the full harvest season consisted of thirty picks, three per week. In 1986 yields were not recorded at Hastings and Takapau results are not presented as the crop was only recorded weekly. Weights and numbers of untrimmed, trimmed and first grade spears were recorded. First grade is defined as spears trimmed to 180 mm length, at least 10 mm diameter, straight, with tight heads and no physical defects or damage.

In April 1987, on the Levin site, depth of soil cover was measured above the asparagus crowns which were originally planted in 1981 at a depth of 200mm.

At each site weed emergence was monitored regularly by counts and observations to provide a basis for determining herbicide treatments. Table 1 summarises the herbicide programmes used.

TABLE 1: Herbicide programmes used at four sites (all herbicide rates are kg ai/ha).

Stage of crop development	Spring*	Summer**
1981-82 Season of planting	methabenzthiazuron 0.8 + diuron 0.5 <i>or</i> methabenzthiazuron 0.8 + metribuzin 0.3 + diuron 0.5	spot treatments of glyphosate, sethoxydim, asulam as required, linuron 0.5
1982-83 Establishment	simazine 0.6 + bromacil 0.6	spot treatments of MCPA, fluazifop-butyl, dicamba as required
1983-84 First harvest season	glyphosate 2.0 then metribuzin 0.3 + simazine 0.7 <i>or</i> metribuzin 0.3 + atrazine 0.7	bromacil 1.0 <i>or</i> bromacil 1.2 + glyphosate 1.5 <i>or</i> bromacil 0.6 + hexazinone 0.6 <i>or</i> bromacil 1.0 + diuron 0.4
1984-85 Second harvest season	glyphosate 2.0 then diuron 1.0 + metribuzin 0.3-0.5	glyphosate 2.0 then bromacil 1.2 <i>or</i> hexazinone 1.5 <i>or</i> bromacil 0.5 + hexazinone 0.5, spot treatments of glyphosate, clopyralid as required
1985-86 Third harvest season	metribuzin 0.3 + diuron 0.5 + simazine 0.5	metribuzin 0.5 + hexazinone 1.0 <i>or</i> metribuzin 0.5 + terbutometon/terbuthylazine 1.0 <i>or</i> bromacil 0.5 + hexazinone 0.7 + MCPA 1.6
1986-87 Fourth harvest season	metribuzin 0.4 + diuron 0.4 + simazine 0.4 <i>or</i> bromacil 1.0 + hexazinone 1.0	bromacil 0.7 + hexazinone 0.7

* before crop emergence in September

** in 1983 overall residual treatments were applied at the end of October in 1984 and succeeding years most applications were at 'closing up' in December.

Note:

herbicides used are identified by product as follows:—

asulam (Asulox AC), atrazine (Gesaprim FP), bromacil (Hyvar X WP), clopyralid (Versatill AC), dicamba (Dicamba AC), diuron (Karmex WP), fluazifop-butyl (Fusilade EC), glyphosate (Roundup AC), hexazinone (Velpar WSP), methabenzthiazuron (Tribunil WP), metribuzin (Sencor WP), sethoxydim (Alloxol S EC), simazine (Gesatop WP), terbutometon/terbuthylazine (Caragard FP).

RESULTS

Weed control

On all four sites weed problems were greatest in the first season and gradually lessened as the overall herbicide programme took effect. Couch (*Elytrigia repens*), especially at Flock House, was well controlled by glyphosate and fluazifop-butyl. Californian thistle (*Cirsium arvense*) was reduced by clopyralid, glyphosate and amitrole T but it persisted in patches on all sites. Prostrate amaranth (*Amaranthus deflexus*) at Flock House was controlled by glyphosate and hexazinone. Yarrow (*Achillea millefolium*) at Takapau was controlled by glyphosate, metribuzin and dicamba. Tall willow herb (*Epilobium ciliatum*) at Levin was controlled by diuron.

Self-sown asparagus seedlings were controlled at all sites by glyphosate, hexazinone and MCPA. Assessments of the incidence of asparagus seedlings showed that their establishment was usually assisted by cultivation. Where seed was shed on to uncultivated soil much less germination occurred. At Levin, just before 'closing up' in late November 1984 percentage ground cover of asparagus seedlings on cultivated beds was 11-13% higher than on uncultivated beds (Table 2). One year later the population had increased considerably and was controlled by an overall application of MCPA 1.6 kg ai/ha at 'closing up'.

TABLE 2: Incidence of volunteer asparagus seedlings according to treatment, Levin site.

	% total ground cover			
	1984		1985	
	Cultivation	No cultivation	Cultivation	No cultivation
Flat	12	1	43	16
Ridge	14	1	34	12

Yields of spears

Number and weight of first grade spears are given in Table 3.

If the cumulative totals of the first 3 years are considered (as means of ridged and flat treatments), the production of first grade spears from the Flock House site was 5.39 t/ha. The Takapau and Hastings trials produced 3.46 and 3.10 t/ha respectively and production from the Levin trial was 2.34 t/ha.

Comparing the most productive with the least productive site, the 1986 yields were little different from the previous year at Flock House but considerably higher at Levin.

Ridging was generally beneficial during the earlier years at all sites except Takapau where yields were significantly less from the ridged treatment in 1984, a very dry season. By 1986 there was little difference between ridged and flat rows in the Levin trial. On this site, in April 1987 the mean depth of soil above the crowns was 142 mm on flat and 119 mm on ridged treatments (MSD 5% = 7 mm).

Separate results for cultivated and uncultivated treatments are not presented as only small differences occurred.

DISCUSSION

This series of four trials used the same plant material and made the same basic treatment comparisons but, individually, the trials developed differently. The need for different herbicides, according to weed species present, was successfully catered for by the existing range of 'safe' herbicides. It was intended that differential weed competition should not be a factor in this investigation and this aim was successfully achieved, albeit by somewhat complex herbicide programmes.

The superimposed cultivation treatments, carried out twice a year, before crop emergence and at the end of harvest, generally did not affect the crop. However, the operations were not drastic and were not primarily needed for weed removal. A more intensive, or less skillfully applied, regime would have been much more likely to harm the crop either directly, by mechanical damage, or indirectly by causing moisture loss or structural deterioration. In one instance, at Flock House in 1984, it was considered that the soil environment was improved by cultivation (see Cox and Ingle 1985).

TABLE 3: First grade yields of asparagus at four sites 1983-1986.

	Number of spears per crown			Weight of spears trimmed to 180 mm, t/ha		
	Ridge	Flat	MSD 5%	Ridge	Flat	MSD 5%
Flock House						
1983	1.43	1.03	0.22	0.45	0.31	0.09
1984	5.68	4.63	0.77	2.03	1.86	n.s.
1985	8.15	7.86	n.s.	2.94	3.19	n.s.
Total 1983-85	15.26	13.52	1.51	5.42	5.36	n.s.
1986	8.45	9.19	n.s.	2.75	3.21	0.24
Total 1983-86	23.71	22.71	n.s.	8.17	8.57	n.s.
Hastings						
1983	2.28	1.39	0.18	0.61	0.39	0.08
1984	3.86	2.94	0.56	1.00	0.81	0.16
1985	7.82	6.16	0.90	1.85	1.55	0.25
Total 1983-85	13.96	10.49	1.47	3.46	2.75	0.42
Takapau						
1983	2.02	1.83	n.s.	0.48	0.46	n.s.
1984	3.78	4.11	n.s.	1.29	1.46	0.14
1985	4.62	4.80	n.s.	1.53	1.71	n.s.
Total 1983-85	10.42	10.74	n.s.	3.30	3.63	n.s.
Levin						
1983	0.83	0.41	0.23	0.27	0.12	0.07
1984	3.16	2.34	0.57	1.00	0.78	0.17
1985	3.75	3.50	n.s.	1.22	1.29	n.s.
Total 1983-85	7.74	6.25	1.39	2.49	2.19	n.s.
1986	8.56	7.79	n.s.	2.68	2.69	n.s.
Total 1983-86	16.30	14.04	n.s.	5.17	4.88	n.s.

The deleterious effect of ridging in 1984 at Takapau was attributed to dry soil conditions. Subsequently there was no significant difference between ridged and flat rows so it seems that the crop could be grown either way in this district.

The highest yielding crop of cv. "NZ Beacon" was at Flock House. As 1985 and 1986 yields were similar here, it also seems likely that the crop matured more quickly than, for example, at Levin where annual yields were still increasing in 1986.

With the availability of a choice of herbicides, and the option to use a reasonable intensity of cultivation if required, it seems that a ridge contour is generally suited to asparagus production. This was especially apparent under the heavier soil conditions of the Hastings clay loam where ridging maintained an advantage. As the plant matures new crown growth arises from the upper surface and over the years, if there is no cultivation, the soil depth in ridges will probably decrease but this is easily rectified if considered necessary.

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REFERENCES

- Anon, 1977. New Zealand Horticultural Statistics. Economics Division, MAF, Wellington.
- Anon, 1987. Spearhead. New Zealand Asparagus Council Newsletter, May 1987.
- Cox, T.I. and Ingle, A., 1985. Effect of soil management practices on yields of asparagus — interim results. *Proc. 38th N.Z. Weed and Pest Control Conf.* 150-153.