EFFECT OF SOIL MANAGEMENT PRACTICES ON YIELDS OF ASPARAGUS — INTERIM RESULTS

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SUMMARY

In the first full harvest season, 3 years after planting crowns of asparagus (*Asparagus officinalis* cv. "NZ Beacon") first-grade yields were 1.9 t/ha at Flock House, 1.4 t/ha at Takapau and 0.9 t/ha at both Hastings and Levin. Crowns were set at a depth of 200 mm in ridged or flat beds. Beds were cultivated or not cultivated. Ridging was advantageous at all sites except Takapau, where the winter was extremely dry; and cultivation improved yield at Flock House only. Weeds at all four sites were managed successfully with appropriate herbicide programmes over all management treatments.

INTRODUCTION

The expansion of asparagus production in New Zealand since 1977-1978 has been accompanied by the need for information on suitable cultural practices for different soil types in various parts of the country. In the early 1970s in the traditional centre of commercial production in Hawkes Bay, flat beds rather than ridged rows were generally favoured for best yields except on cold, wet soils (Anon. 1973). Although both soil cultivation and herbicides were recommended for weed control, few herbicides were registered for use in the crop and chemical weed control programmes were seldom adequate. Weed control improved with more herbicide information and experience (Cox *et al* 1978; Franklin *et al* 1980) but there was a grower reaction against certain residual herbicides which, along with disease build-up and other factors, were suspected of contributing to declining yields in many established beds.

Management practices may have a large effect on crop vigour and longevity, and agronomic needs may vary with district and soil type. Trials were established on four representative sites in the southern region of the North Island to measure the effect of soil contour and cultivation on asparagus. After two seasons significant production began in 1984. This paper describes the soil management regimes applied and the results so far obtained.

METHODS

Experiments were laid down on MAF research areas in August and September 1981 using cv. "NZ Beacon" grown at Levin HRC. Locations and soil types are detailed in Table 1.

TABLE 1:

Experiment site	Soil type	Soil Texture			
		% organic carbon	% sand	% silt	% clay
Flock House Research Area, Bulls	Alluvial Sandy loam	3.0	31	48	21
Hastings Horticultural Research Station	Clay loam	2.1	17	46	37
Takapau Research Area	Silt loam	5.2	36	46	18
Levin Horticultural Research Centre	Silt loam	3.2	23	62	16

Proc. 38th N.Z. Weed and Pest Control Conf.

The four treatments are illustrated in Figure 1. The asparagus 'crowns' were planted either in ridges, raised by machine 300 mm above the tractor wheel track, or on the flat, but always covered with 200 mm of soil. Subsequent management was either with or without cultivation but in either case herbicides were used as needed. As the experiment aimed to compare treatments which differed in soil management but which all resulted in effective weed control, appropriate cultivation or herbicide treatments were applied according to the particular circumstances of the trial.

Fig. 1: Treatment details.

Plants were placed 450 mm apart in the row in plots of three rows 1.5 m apart, 20 m long which was large enough for realistic tractor operations. There were six replicates. Each site received fertiliser, usually potassic superphosphate and lime to consistently maintain a pH of 6.0 to 6.5, according to soil tests.

In 1981-82, the first growing season, weed control was achieved by a pre-emergence herbicide mixture of methabenzthiazuron (Tribunil WP) 0.8 kg ai/ha plus diuron (Karmex WP) 0.5 kg ai/ha, or in the case of Levin and Takapau, plus metribuzin (Sencor WP) 0.3 kg ai/ha. Spot applications of glyphosate (Roundup AC), sethoxydim (Alloxol S EC) or asulam (Asulox AC) were made as needed. During the winter, treatments 1 and 3 were cultivated. In 1982-83 the pre-emergence herbicide mixture was changed to simazine (Simazine FP) 0.6 plus bromacil (Hyvar X WP) 0.6 kg ai/ha and MCPA (MCPA AC), fluazifop-butyl (Fusilade EC) and dicamba (Dicamba AC) were used as needed for spot application to particular weeds.

In 1983-84 and 1984-85 asparagus spears were harvested, thus allowing an additional 'closing up' herbicide application and, where appropriate, cultivation. In most cases the spring pre-emergence herbicides were mixtures of metribuzin 0.3 plus either simazine 0.7 or diuron 1.0 kg ai/ha and the 'closing up' treatments were bromacil 1.2 or hexazinone (Velpar AC) 1.5 kg ai/ha. Glyphosate or clopyralid (Versatill AC) were used as necessary.

As far as possible the cultivation treatment applied before emergence and at the end of harvest was similar on each site. Usually the same machine was used at the same settings. Two passes were made of either asparagus discs or a spinning cultivator, set to throw soil away from the row then back again on the second pass.

The second season consisted of 30 picks over a period of 10 weeks from mid-September until late November at all locations except Takapau where the season was approximately 3 weeks later. Numbers and weights of spears were recorded in three quality grades. First grade is defined as spears trimmed to 180 mm length, at least 10 mm diameter with tight heads and no physical defects or damage. Results are not given for second grade (defective) or third grade (too thin) spears.

RESULTS

Weed Control

At Flock House winter growth of couch (*Elytrigia repens*) was satisfactorily controlled with an application of glyphosate 1.5 kg ai/ha. At closing-up a second application of glyphosate, followed by hexazinone 1.5 kg ai/ha, suppressed further couch growth, Californian thistle (*Cirsium arvense*) and prostrate amaranth (*Amaranthus deflexus*). Special efforts were taken to control Californian thistle at Hastings, using glyphosate, and other weeds were controlled with the regime of residual herbicides. At Takapau, during an unusually dry winter, yarrow (*Achillea millefolium*) grew strongly and was treated with dicamba. At closing-up this weed and Californian thistle were controlled with glyphosate, clopyralid and hexazinone. At Levin, Californian thistle and creeping buttercup (*Ranunculus repens*) were treated with glyphosate followed by residual herbicides.

Yields of spears

The first harvest season was short — 12 picks over 4 weeks — and yields are not presented.

In 1984 the highest yield, 1.9 t/ha of first grade, was obtained from the Flock House site. The corresponding yield from Takapau was 1.4 t/ha and that from both Hastings and Levin was 0.9 t/ha.

TABLE 2: First Grade Yields of Asparagus at Four Sites, 1984 Season.

	Number of Spears Per Crown			Weight of Spears, Trimmed to 180 mm t/ha		
	Ridge	Flat	Mean	Ridge	Flat	Mean
Flock House						
Cult	5.57	5.07	5.32	2.09	2.02	2.05
No-cult	5.79	4.20	5.00	1.96	1.70	1.83
Mean	5.68	4.63		2.03	1.86	
MSD 5% between means	0.77			0.24		
within table	1.09			0.34		
Hastings						
Cult	3.59	2.99	3.29	0.88	0.84	0.86
No-cult	4.13	2.89	3.51	1.11	0.79	0.95
Mean	3.86	2.94		1.00	0.81	
MSD 5% between means	0.56			0.16		
within table	0.79			0.23		
Takapau						
Cult	3.72	4.20	3.96	1.31	1.53	1.42
No-cult	3.85	4.02	3.93	1.29	1.46	1.38
Mean	3.78	4.11		1.30	1.50	
MSD 5% between means	0.34			0.14		
within table	0.48			0.20		
Levin						
Cult	3.33	2.31	2.82	1.01	0.78	0.90
No-cult	2.99	2.37	2.68	0.99	0.78	0.88
Mean	3.16	2.34		1.00	0.78	
MSD 5% between means	0.57			0.17		
within table	0.81			0.29		

Numbers and weights of first grade spears from each treatment are presented in Table 2. At Flock House the flat, no-cultivation treatment produced significantly lower numbers and weights of spears than the ridged treatments. This treatment at Hastings also resulted in low yields, especially if compared with the ridged no-cultivation treatment which gave about 40% greater numbers and weights of spears. At Takapau, ridging was not beneficial — the flat, cultivated treatment gave significantly higher

weights than either ridged treatment. At Levin ridging resulted in generally higher yields than flat treatments. Overall, ridging resulted in higher numbers of first grade spears, except at Takapau; higher weights at Hastings and Levin with a similar trend at Flock House, but significantly lower weights at Takapau. Cultivation generally had little effect on yield.

DISCUSSION

Weeds were controlled in all treatments by the use of safe and previously tested herbicides.

Differences in soil contour (ridged or flat) and condition (cultivated or not) could be expected to affect the efficiency of herbicide action, and this may vary according to local soil type and climate. It was noted, for example, that a better result was sometimes obtained from a residual herbicide applied to recently cultivated soil. All herbicide treatments, however, were at least adequate and usually very effective. Thus, it can be assumed that yield differences between ridge or cultivation treatments resulted from effects on the soil environment around the asparagus crowns, and not from weed competition or herbicide damage. Ridged rows led to better yields at three sites. At the remaining site, Takapau, soil conditions were very dry (the lowest winter rainfall this century) and the ridged crop probably suffered more from moisture stress. It will be interesting to experience a wetter season here, or even apply irrigation, to see if the suggested explanation of a drought effect can be substantiated. On all sites it was noted that spears emerged a few days earlier in the season on ridged rather than flat beds, probably because of a soil temperature advantage.

The benefit of cultivation on flat beds at Flock House is consistent with the general observation that this alluvial soil is especially prone to 'packing' by rainfall with consequent structural deterioration. Further yield data as these crops develop should confirm the trends emerging at each site. Where cultivation continues to have no effect on the crop, it obviously provides a useful weed control option in conjunction with a range of herbicides.

ACKNOWLEDGEMENTS

The support of K.G. Tate with planning and technical assistance from H. Dick, A. Slegers, M.W. Slay and W. Stiefel is acknowledged with thanks.

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