CropSeed Confidential Report No. 46

Environmental influences on asparagus production and quality

Progress report 1992

A report prepared for
New Zealand Asparagus Council
Research Committee

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1 EXECUTIVE SUMMARY

1 This is the fourth report on this trial which was planted in 1987. A range of irrigation treatments was applied to define the best summer irrigation regime for optimum spear yield and quality in the following spring.

2 The number of irrigations applied in 1992 ranged from none to three; large differences in soil moisture deficits resulted. No water was applied to two treatments because there was enough rainfall to prevent the target soil moisture deficit being reached. Irrigations were stopped in late March.

3 Irrigation requirements of asparagus seem to be fairly light: the crop appears able to cope well with a soil moisture deficit of 160-200 mm. Export yields of UC157 were highest without irrigation and lowest with frequent irrigations. Jersey Giant was not as greatly affected but the highest export yields were obtained from less frequent irrigations. Yields were reduced without any irrigation but are also beginning to show a detrimental effect of frequent watering.

2 INTRODUCTION

Water availability during asparagus fern growth may affect the yield of asparagus during the following spring because spear production is very dependent on the amount of assimilate accumulated in the storage root system during the preceding summer-autumn fern growth period. There have, however, been no previous studies reported in New Zealand to define the water requirements or yield responses to irrigation of an established asparagus crop. Preliminary studies have shown that irrigation during the two establishment years increases the yield of asparagus grown on sandy soils by between 35 and 72% (Bussell et al., 1987).

A field trial was begun at Lincoln in 1987 to define the best irrigation management to use during fern growth in order to obtain optimum spear yield and quality during the following spring harvest. During each fern growth season, the amounts and timings of irrigation applied to three cultivars were varied, and the results used to determine the conditions required to produce optimum spear yield and quality during the following spring. The irrigation treatments in the trial were selected on the basis of trigger soil moisture deficits so that the results can be applied anywhere in New Zealand. The treatments allow fluctuations in summer rainfall and differences in water-use rates between locations to be accounted for.

In this report we present yield results from the fifth harvest season (1992). Results from the second and third seasons, presented in previous reports (Falloon et al., 1989, 1990), indicated that the best yields were obtained from treatments in which irrigations were triggered at relatively high soil moisture deficits. The report of the fourth season (Fraser-Kevern et al., 1991) shows a similar result but noted a significant decline in the yield of UC157 under frequent irrigation. This decline was not evident in Jersey Giant.

3 MATERIALS AND METHODS

The trial was established at Lincoln in 1987 using seedling transplants. Two cultivars (UC157 and Jersey Giant) were planted in single rows 1.5 m apart. All plots were spray irrigated during the first year to ensure good crop establishment. In the second summer of fern growth (1988/89) five irrigation treatments were started, and have continued during each summer since then:

I_0 - no irrigation
I_1 - irrigated when the soil moisture deficit = 210 mm
I_2 - irrigated when the soil moisture deficit = 160 mm
I_3 - irrigated when the soil moisture deficit = 110 mm
I_4 - irrigated when the soil moisture deficit = 60 mm

Water was applied to each plot using trickle irrigation when the trigger soil moisture deficit in the top 1.1 m of soil was reached. Each irrigation consisted of 50 mm of water. The soil moisture deficits were determined by measuring soil moisture contents weekly. A neutron probe was used to take readings at intervals of 0.2 m from 0.3 m to 1.1 m, and gravimetric analyses were done in the top 0.2 m of soil.

As in the previous years the trial was sprayed before harvest with metalaxyl (Ridomil MZ72) to control Phytophthora rot. The plots were harvested from 7 October to 7 December 1992 (62 days). Spears were trimmed to 23 cm long, graded and weighed into saleable and reject spears. Rejects included those spears with diameters <6 mm or >25 mm, and those which were frosted, diseased, deformed or with open bracts.

4 RESULTS

Weather during the 1991/92 season was drier then average in Canterbury. A total of 276 mm of rain fell during the six month period from 1 November 1991 to 30 April 1992 while potential evapotranspiration (PET) during the same period was 786 mm. Thus the PET - rainfall deficit was 510 mm. Long term mean rainfall and PET values for the period are 320 and 630 mm respectively (i.e. 310 mm deficit).

The number of irrigations required to maintain soil moisture deficits above the target levels varied from 0 to 3, with the earliest irrigation in treatment I_4 applied on 18 February 1992 and the latest applied to I_2, I_3 and I_4 on 19 March. I_3 and I_4 were also irrigated on 25 February. No irrigation was applied to treatment I_1 as there was enough rainfall to prevent the target deficit being reached. The irrigation treatments caused a wide range in soil moisture deficits (Figure 1). Even before any irrigation was applied in the 1991/92 summer there were differences which had clearly carried through from previous irrigation seasons.

While total yields were similar to the 1991 harvest, export yields were only 73% of 1991. This high reject rate can be attributed mainly to the warm November which resulted in a lot of open bracts.

Jersey Giant produced the highest total spear yield (Table 1). Its mean yield was 30% higher than that of UC157. However, yields of export grade spears were higher in UC157 than Jersey Giant, so the proportion of reject grade spears was much greater for Jersey Giant (66% compared with 50% for UC157).

Jersey Giant yields were highest in the I_1 and I_2 treatments, i.e. with little irrigation. There was a slight yield decline when irrigation was applied more frequently. Both the I_0 and I_4 treatments produced export yields significantly less than I_2. UC157 export yields were significantly higher in I_1 than in I_2, I_3 or I_4. The yield decline with frequent irrigation was most marked, export yields of I_4 being only 53% of that in I_1.

5 DISCUSSION

Only in the first season of irrigation treatments, 1988/89, was water applied to I_1 but I_1 yields have tended to become increasingly higher than I_0 in subsequent seasons, indicating a long term effect of irrigation. Irrigation treatments have had a much greater effect on UC157 than Jersey Giant and the effect of the apparent 'over-watering' of I_4 has been increasing. It is becoming clear that UC157 needs little irrigation and has its yields seriously reduced by high rates of irrigation. By contrast, Jersey Giant does need some water but is beginning to show a decline in yield with the I_4 treatment this season.

This trial will continue for at least one more season, but with changes in the irrigation management in the 1992/93 summer. Only 25 mm of water will be applied when each deficit is reached instead of the 50 mm applied in previous years. This will have the effect of increasing the discrimination among treatments.

In conclusion, irrigation requirements of asparagus seem to be fairly light: the crop appears able to cope well with a soil moisture deficit of 160-200mm. Irrigation at this point is essential, however, to maintain production, but applying water at a very low SMD to a cultivar like UC157 will cause a greater yield decline than no water application.

6 REFERENCES

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Table 1. Effects of the irrigation treatments on the total and export yields (t/ha) of the two cultivars.

Treatment	Total			Export		
	Jersey Giant	UC157	Mean	Jersey Giant	UC157	Mean
I_0	11.10	10.07	10.58	3.47	4.98	4.23
I_1	11.90	10.69	11.30	4.26	5.52	4.89
I_2	12.21	8.68	10.44	4.29	4.30	4.30
I_3	10.55	7.59	9.07	3.66	3.96	3.81
I_4	10.51	6.21	8.36	3.33	2.94	3.13
Mean	11.25	8.65	9.95	3.80	4.34	4.07
$LSD_{(0.05)}$			1.67			0.80

Fig 1: Effect of Irrigation & Rainfall on Soil Moisture Deficits (SMD)