COMPARISON OF PREDICTED AND ACTUAL YIELDS OF ASPARAGUS

W.T. Bussell[1], P.G. Falloon[2], and E. Stevenson[3]
[1]Horticultural Research Centre, MAF, Levin
[2]Crop Research Division, DSIR, Christchurch
[3]Applied Mathematics Division, DSIR, Christchurch

ABSTRACT

Ratios of yield in the second and subsequent years to yield in the first year of harvest were calculated for three cultivars - Mary Washington 500W (MW500W), UC157 and Jersey Giant - from eight long-term cultivar evaluation trials conducted at Levin, Lincoln, Hastings and Ruakura since 1985. The ratios were lower in the open pollinated cultivar MW500W than in the hybrid cultivars UC157 and Jersey Giant. They varied within each cultivar due to both environmental (e.g. rainfall, temperature) and cultural (e.g. length of first harvest season) factors. They also differed from ratios used by New Zealand economists to calculated gross returns from an asparagus crop.

Though better models to calculate gross returns were developed from the calculations described in this paper, their accuracy will depend on environment and cultural factors.

Additional Key Words: Asparagus, open pollinated and hybrid cultivars, yield prediction models, cultural and environmental factors.

INTRODUCTION

When calculating gross returns from an asparagus crop in New Zealand, economists (e.g. Parminter 1981, Verberne 1985, McCrone 1986) have multiplied first year yield by different factors to obtain an estimate of yields in later years. These multipliers have not given an accurate prediction of gross returns in some instances.

From the many long term cultivar evaluation trials which have been undertaken since 1975 at Levin, Lincoln, Hastings and Ruakura, we have calculated ratios of yield in second and subsequent years to first year yields in three cultivars. In this paper we compare our ratios with the multipliers used by the economists and develop better models to calculate gross returns. We also consider variability in our ratios and reasons for it.

MATERIALS AND METHODS

Yields of saleable, processing grade spears (i.e. straight spears with closed tips and a basal diameter of at least 10 mm when trimmed to 180 mm long) were taken from three cultivars in two trials at Levin Horticultural Research Centre (Levin 1,2), two at Crop Research Division, Lincoln (Lincoln 1, 2) three at Hastings (Hastings 1, 2, 3) and one at Ruakura. The cultivars were Mary Washington 500W (MW500W), an open pollinated cultivar widely grown in New Zealand since about 1960 and the control cultivar in all trials, UC157 and Jersey Giant, both higher yielding single cross hybrids at present being widely planted. The design for all trials was a replicated randomised complete block. All had rows spaced 1.5 m apart but the number of replicates and plant population varied between trials (Table 1).

TABLE 1: Cultural data in long term asparagus cultivar evaluation trials, and hybrid cultivars harvested in each trial.

Trial	References[a]	Replicates	Plant pop. (000's/ha)	Hybrid Cultivars[b]
Levin 1	1	12	33	—
Levin 2	1,2	10	33	A
Lincoln 1	1,2	4	53	A
Lincoln 2	3	4	67	B
Lincoln 3	4	4	15	A,B
Hastings 1	1	1	22	A
Hastings 2		4	22	A
Hastings 3		2	22	B
Ruakura	4	4	15	A,B

a Other published data for trials available as follows:
[1]Bussell *et al.*, (1981)
[2]Bussell *et al.*, (1982)
[3]Falloon and Nikoloff (1983)
[4]Bussell *et al.*, (1985)

b Hybrid cultivars are
A Jersey Giant
B UC157

The trials were grown in silt loam soils at Levin and Lincoln and in lighter soils at Hastings and Ruakura. Further cultural details and preliminary or final results from many trials have already been published (Bussell *et al.*, 1982, 1983, 1985; Falloon and Nikoloff, 1983). The first harvest was made for a short period in the second year after transplanting in all trials. The harvest period extended

TABLE 2: Harvesting data in long term asparagus cultivar evaluation trials.

Trial	Year of 1st harv	No. of days harvested in year 1	2	3	4	5	6	7	8
Levin 1	1976	45	61	80	78	76	78	-	-
Levin 2	1977	30	64	81	76	81	79	85	80
Lincoln 1	1978	40	60	50	66	59	66	74	-
Lincoln 2	1983	40	60	70	-	-	-	-	-
Hastings 1	1977	40	80	80	80	-	-	-	-
Hastings 2	1980	25	42	56	85	86	75	-	-
Hastings 3	1979	25	43	56	71	85	86	75	-
Ruakura	1983	60	84	91	97	97	-	-	-

TABLE 3: Ratios (with standard errors) of yields in the second to sixth years of harvest to first year yields in MW500W, Jersey Giant and UC157. The number of trials that ratios were derived from are given in parenthesis.

Year	Cultivar MW500W	Jersey Giant	UC157
2:1	1.44 ± 0.23 (8)	1.59 ± 0.09 (5)	1.24 ± 0.34 (4)
3:1	2.16 ± 0.46 (8)	2.56 ± 0.61 (5)	2.30 ± 0.77 (4)
4:1	2.36 ± 0.59 (7)	3.31 ± 1.18 (4)	3.43 ± 1.45 (3)
5:1	3.14 ± 0.61 (6)	4.57 ± 1.09 (3)	5.46 ± 3.20 (3)
6:1	2.62 ± 0.48 (5)	5.08 ± 1.57 (2)	3.53 ± 1.83 (2)

to the full season in either the third or the fourth year after transplanting. Details of length of harvest in each trial are given in Table 2.

Ratios of yield in the second to sixth years to yield in the first harvest year were calculated from all eight trials for MW500W, from five trials for Jersey Giant and four trials for UC157. They were used to calculate models for use in determining gross returns from the three cultivars. The possible effects of rainfall, mean air temperature, wind run obtained from meterological data from Levin HRC, Lincoln, Havelock North and Hamilton Airport), and length of the first harvest season on variability of the ratios were investigated.

RESULTS AND DISCUSSION

The ratios of the second to sixth year yields to yields in the first year in MW500W, Jersey Giant and UC157 are given in Table 3. The economists' multipliers (Table 4) are generally much higher than the ratios we obtained, especially in earlier years. Only the multipliers of Parminter (1981) for Limbras and of McCrone (1986) came close to our ratios for Jersey Giant and UC157 for the same period.

TABLE 4: Economists' multipliers used in calculating grosss returns.

	Year of Harvest 2	3	4+
Parminter (1981) for Limbras	2	2.5	2.5
Parminter (1981) for MW500W	2	3.75	3.75
Verberne (1983)	3	7.5	10
McCrone (1986)	2	2.5	2.5

Our ratios show that yield plateaus by the Fourth harvest year in MW500W. The multipliers of Verberne (1983) account adequately for this result, even though his multipliers are too high. Yield plateaus later than the fourth harvest year in the hybrid cultivars Jersey Giant and UC157. None of the economists' models adequately account for the actual yields we obtained in these two cultivars.

Our results indicate that multipliers for the lower yielding, open pollinated cultivar MW500W are not the same as for higher yielding hybrid cultivars. They further indicate that multipliers for individual hybrid cultivars are initially likely to be different. For MW500W, first year yield should be multiplied by 1.4 to obtain an estimate of second year yield, by approximately 2.0 for yield in the third year and by 2.5 for yield in later years. These multipliers may be appropriate for other lower yeilding cultivars also. For Jersey Giant, first year yield should be multiplied by 1.6 and 2.6 to obtain an estimate of yield in the second and third years respectively, and by approximately 4.0 for yield in later years. The appropriate multipliers for UC157 are 1.2 and 2.3 for yield in the second and third years respectively, and by approximately 4.0 for yield in later years.

The ratios for each cultivar varied considerably (Table 3). Variability in the ratios both between trials and within a trial appear to be due to both environmental and cultural factors. Ratios in MW500W varied from year to year at Levin HRC and Lincoln (Table 5), due possibly in part to extremes of weather. Rainfall 40% above average between the summer of 1978-79 and spring 1980 would have contributed to the low yields and hence low ratios in 1979 and 1980 at Levin HRC. The windier and cooler 'El Nino'

TABLE 5: Effects of season on ratios of yields in the second and subsequent years of harvest to yields in the first harves season for MW500W at Levin and Lincoln.

Trial	Year						
	1977	1978	1979	1980	1981	1982	1983
Levin 1	2.62	3.14	1.40	1.20	1.44	-	-
Levin 2	-	2.14	1.34	1.16	2.75	3.27	1.32
Lincoln 1	-	-	1.07	1.28	2.42	3.43	2.37
Mean	2.62	2.64	1.27	1.21	2.20	3.35	1.85

TABLE 6: Effect of either harvesting one year after transplanting (Lincoln 3, 4) or a long first harvest season (Levin 3) o ratios of yields in the second to seventh harvest season to yields in the first harvest season.

Trial	Cultivar	Harvest Season					
		2	3	4	5	6	7
Lincoln 3	MW500W	2.51	6.22	5.41	7.03	11.89	14.89
Lincoln 3	J. Giant	3.34	9.02	10.49	11.22	18.29	25.12
Lincoln 4	MW500W	6.89	5.04	7.74	8.70	16.48	
Levin 3	MWW500W	0.86	0.91	1.03	0.80	1.01	

summer of 1982-83 may have caused the lower yields in 1983 at both sites. The effect on the ratios of other environmental factors known to affect yield, e.g. soil type (Bussell *et al.,* 1985), could not be assessed due to insufficient data. Other trials at Lincoln (Lincoln 3, 4; Table 6) have demonstrated that a short harvest season in the first year after transplanting can give a low base yield and high ratios. A long harvest season for the first harvest can give a high base yield and low ratios. At Levin, for example, a trial harvested for 73 days in its first harvest season (Levin 3, Table 6) has ratios ranging from 0.86 to 1.03 in later years.

The analysis of data from cultivar evaluation trials carried out at four sites throughout New Zealand has enabled us to develop better models to calculate gross returns for asparagus. However, their accuracy will always be dependent on environmental and cultural factors.

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