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Roadsides, ditch banks and many orchards in southwestern Idaho abound with volunteer asparagus. To inexperienced observers, therefore, it might appear that the crop is a 'natural' for the area and that it can be grown with only a minimum of care and attention. This does not necessarily follow since occasional volunteer plantings indicate only that there is survival under the conditions that exist in that exact spot and do not reveal certain disasters which might have overcome some of the less fortunate volunteers. One sees only the plants which have succeeded, not those that have failed. On the other hand, this does not have to be true. Using the performance of volunteers as a measure of the success of a commercial crop is many times justified.

Idaho gardeners have grown asparagus for a great many years and numerous successful commercial plantings in Idaho areas having warm weather during spring and early summer are still successful. In 1948, however, when this work began, no information was available about yields, varieties, cultural problems and quality of this crop when grown under cultivation.

This paper reports the results of studies conducted over the period 1949 to 1958; that is, the effects on yield and quality of two asparagus varieties planted at different depths. Many other factors deserve consideration in planning a commercial asparagus program; and, while many of them are of great importance, they do not come within the scope of these investigations.

If one is seriously interested in a venture into asparagus production, he should be familiar with disease problems such as crown rot, Fusarium rots, and virus disease. Insect pests are of economic importance. The use of crowns from recognized sources is to be encouraged if one does not choose to produce his own. Certainly methods of irrigation, weed control, and soil fertilization are among the important things to be considered.

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Since one needs to wait about 3 years before bringing the crop into full production after planting, he needs to give consideration to the use of a companion crop or nurse crop during the formative years of the plantation.

Disposition of the crop in the area in which these studies were made is usually through a processor who frequently is responsible for timely and adequate harvesting, but this is not always true. A study of crop histories respecting yields, prices, and net return is also needed. Even a partial answer to these questions is intended to be given here.

Materials and Methods

Seed of California "500" variety of asparagus was obtained for planting during the 1948 growing season from Dr. G. C. Hanna of the University of California at Davis where the variety was developed. The following year, 1-year-old crowns of Mary Washington, standard variety in the Northwest, were obtained from a commercial source. Selected 1-year-old crowns of both varieties were then planted in permanent plots on the Parma Branch Station. The plots were located on Greenleaf silt loam.

Plot rows were 6 feet apart, and the plants in the rows were placed 18 inches apart with 30 plants in each plot. The depths at which the crowns were planted were 6, 9, and 12 inches.

A replicated randomized block was designed for this experiment with each variety replicated 9 times and each crown depth replicated 6 times.

Asparagus spears were first harvested from the experimental plots in 1951 from April 16 to May 19. During the years 1951 to 1958, inclusive, the plots were harvested for record.

Data were recorded on the number, weight, and size of the spears from each plot as they came from the field and after they had been trimmed.

During the years of 1951 and 1952 fiber pressure readings as described by Karmer (2)* were taken on the spears at the base of the tip—which here refers to the enlarged tip as being the undeveloped terminus containing most of the true leaves or scales and which later extends and "feathers out"—and 4 inches from the terminus of the spear. In 1953, however, only the reading taken 4 inches from the terminus of the spear was obtained.

The spears from each plot were also separated into three classifications according to the size of the base. These were small or under $\frac{1}{2}$ inch in diameter, medium or from $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, and large or over $\frac{3}{4}$ inch in diameter.

In 1951, 1952, and 1953 samples of the various classifications from all the plots were frozen and held for 6 months at 0 degrees Fahrenheit for organoleptic rating by a test panel. Thereafter these ratings were not obtained.

In 1951 the organoleptic rating was done at the laboratory of the Western Utilization Research and Development Division of the United States Department of Agriculture at Albany, California. In 1952 and 1953 the representatives of commercial processors in Idaho made the rating.

Results and Discussion

Fiber Pressure Readings

During 1951 and 1952, the fiber-pressure readings taken 4 inches from the tip of the spear were higher than those taken at the base of the tip. The average fiber pressure reading for both varieties was 4.3 pounds at the base of the tip and 6.5 pounds when the reading was taken 4 inches from the end of the spear. This would seem to show only that the fiber content of the spear tissue increases as the spear ages.

The average pressure readings for the 3 years indicate no important differences in the amount of fiber between the two varieties.

No difference in the amount of fiber found in spears taken from the various depths of crown plantings appeared. However, significant decrease in the average pressure readings of the spears was recorded as the planting grew older. Pressure readings of individual spears always increased directly with the diameter of the spears being tested (table 1). This is in agreement with the findings of Kramer, et al (2).

Organoleptic Ratings

In 1951 the organoleptic rating done by the Western Utilization Research and Development Laboratory indicated that the color of the spears harvested from the 6-inch depth of planting was better than that of the spears harvested from the 9- and 12-inch depths of plantings. However, during the following 2 years, when commercial processors made this organoleptic rating, no significant differences were found between the spears from the various depth-of-planting plots. There was, however, a continuing bias against the samples from the 12-inch depth plots in that these samples continually received lower, though not significantly lower, ratings than did the samples from the other plots.

Yields

Asparagus, a perennial crop, takes several years to achieve full commercial production. Growers usually make a partial cutting the second year after planting the crowns. This partial cutting usually amounts to less than a half cutting. Another partial but heavier cut is made the third year. The fourth year after planting and harvesting the cutting is done through a full cutting season.

The yield of cut asparagus obtained from the planting during this initial period is small compared to what will be obtained from the mature planting. In order that the performance of a mature

planting in the area would be more nearly approximated, the yields of cut spears obtained during the period of immaturity were not included in the analysis of data with yields obtained after the fourth year. This paper then is based upon the yields obtained during the years 1951-1953 are included in the following table as a matter of information. That these yields cannot be compared to those used in the following years must be stressed, for these represent total weights while those for later years represent culled and trimmed weights.

Total Yields from the Immature Asparagus Planting

in Tons/Acre

Year	Mary Washington	California "500"
1951	1.4	1.75
1952	1.46	1.81
1952	1.6	1.9

Analysis of the data collected during any single year seldom showed proven differences between varieties or between treatments during the course of this experiment. Statistically significant differences found in any single year were not the same as those found for all the years. However, regardless of the size of the differences, they were in the same direction and examination of the tabulated data for the 8 years shows definite trends. A combined analysis of the data obtained during the course of this experiment showed that these trends amounted to real differences. This combined analysis showed that all of the main effects—variety, years, replications and crown depth—were highly significantly different from most of the classifications of data. However, none of the interactions showed differences in the way varieties and crown depths reacted to the different years and conditions. There were no significant interactions between main effects.

Examination of the data concerned with the yielding ability of the varieties Mary Washington and California "500" shows that the variety California "500" outyielded the variety Mary Washington consistently and that over the period of this experiment the difference in yields was considerable. In every classification of the data obtained except in number of spears over ¾ inch in diameter, California "500" outyielded Mary Washington.

The effect on yields of the individual years during which this experiment took place was also significant. This effect was anticipated since the maturing and enlarging of the crown with time would increase their yielding ability, and the data were collected from this asparagus bed during the time in which it was maturing. Furthermore, the length of the cutting season was changed by the weather differences between the seasons and by the human judgment necessary in the decision to cease cutting.

Responses to crown depth, the effect with which this experiment was most concerned, were also consistently different in all

TABLE 1—Fiber Pressure Readings on Asparagus taken in 1951, 1952, and 1953 four inches from the tip of the spear.

	Pressure readings in pounds per square inch											
	1951			1952			1953			Average of 3 years		
Stem Diameter[1]	Mary Washington	No. 500	Size ave.	Mary Washington[3]	No. 500[3]	Size ave.	Mary Washington	No. 500	Size ave.	Mary Washington[1]	No. 500[1]	Size ave.[1]
Small	4.0	4.7	4.4	4.5	4.5	4.5	3.5	3.6	3.6	4.0	4.3	4.2
Medium	7.2	6.8	7.0	6.3	5.3	5.8	5.5	5.4	5.5	6.3	5.8	6.1
Large	9.4	9.9	9.7	7.7	7.2	7.5	7.3	7.7	7.5	8.1	8.3	8.2
L.S.D. 5%			.5			.4			.3			.4
L.S.D. 1%			.7			.5			.4			.5
Variety Average	6.9	7.1		6.2	5.7		5.4	5.6		6.1	6.1	
Year Average (2)	7.0			6.0			5.5					

1. No significant difference between varieties or variety x size for the 3-year average.

2. Between years L.S.D. 5%— .4
   1%— .5

3. No. 500 had a significantly lower pressure reading than Mary Washington at the 5% level.

classifications of the measurements taken with the exception of the classifications concerned with the production of asparagus spears larger than ¾ inch in diameter. In these classifications, no differences could be demonstrated.

The 6-inch crown depth yielded the most spears, and the number of harvested spears decreased directly as the depth of planting increased to 9 and 12 inches. (Table 2.)

The yield of marketable asparagus—culled and trimmed weight—as an average of the last 5 years of the experiment amounted to 1.45 tons per year per acre. This average yield is taken from the data for the 6-inch depth of planting plots. These were the highest yielding plots in the experiment and most nearly represent what can be expected from a commercial planting. These yields compare favorably with the national average. (1)

Dates of First and Last Harvests

Dates of first and last harvest varied greatly. The earliest date of first harvest was April 10 in 1957, and the latest date of first harvest was April 30 in 1955. The median date of first harvest was April 19.

The date of last harvest varied even more widely, but June 20 was the last date on which asparagus was harvested in any year.

TABLE 2—Effect of Depth of Planting on the Number of Asparagus Spears Produced.

Depth of Planting in inches	Years			
	1955	1956	1957	1958
6	3182(1)	4946	2872	5303
9	2670	4370	2601	5029
12	2642	4244	2222	4664

Literature Cited

1. Knott, J. E. 1956 HANDBOOK FOR VEGETABLE GROWERS. John Wiley & Sons, Inc., New York.

2. Kramer, Amihud, et al, 1949. Objective methods for measuring quality factors of raw, canned, and frozen asparagus. Proc. Amer. Soc. Hort. Sci. 53: 411-425.

Conclusions

Eight years of cultural studies in southwestern Idaho on asparagus varieties and best planting depths for asparagus crowns have yielded the following information:

Quality of the asparagus grown on the experimental plots was completely satisfactory for either fresh use or for processing.

California "500" proved to be superior to the Mary Washington variety in yielding ability, but there was no difference in their qualities.

The yield of these varieties, while satisfactory, can best be described as average.

The best yield of asparagus spears came from crowns planted at the shallowest depth or 6 inches below the soil surface.

It can then be concluded that:

Asparagus may prove a satisfactory crop for commercial planting in southwestern Idaho.

California "500" is to be preferred over the standard variety Mary Washington for future planting in the area.

Shallow planting of asparagus crowns is best on the silt-loam soil types of the area.

Asparagus growers in the area could expect yields comparable to those obtained in most areas where asparagus is grown commercially.