

ASPARAGUS AS A SUSTAINABLE CROP FOR SUBTROPICAL Agriculture

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Abstract

Asparagus (*Asparagus officinalis* L.) is a perennial vegetable that shows promise as a diversified crop for Hawaiian agriculture. It has many cropping advantages, is easily marketed locally and has potential as an export product. Asparagus is resistant to nematodes that are limiting to many vegetable crops in tropical environments and is also resistant to many other diseases and pests. Once established, an asparagus field may remain productive for over ten years without replanting. In Hawaii, asparagus can be harvested every six to eight months and the harvest dates can be scheduled at any time of year. Asparagus is also known to be somewhat tolerant of brackish water and thus may be planted in many Hawaiian locations where other crops will not grow.

The research reported here had as its main purpose the development of a new crop and its adaptation to the subtropical growing conditions existing over much of the arable land in the state. The yield data for the eight cultivars tested are presented for each of the four harvests that took place. During the three-year project, the asparagus production from the test plots continued to increase. Biennial harvesting is expected to be sustainable in Hawaii. Production costs are expected to remain low enough for the crop to be profitable. Asparagus requires little maintenance, needing only irrigation and fertilization which may be applied through drip tubing. The California cultivars out-yielded New Jersey cultivars in Hawaii in terms of total weight of spears harvested. However, one of the New Jersey cultivars, Jersey Giant, consistently produced the largest number of small size spears, which usually bring a higher price. The winter harvest was smaller than summer harvest but, since prices are higher in winter, this may help to offset the lower yields.

INTRODUCTION

Over the last ten years the two major Hawaiian export crops, sugarcane and pineapple, have seen significant reduction in acreage. This has opened up land for other diversified crops that offer opportunities for Hawaiian farmers. Asparagus shows promise for a growing local market and possibly as an export crop. A trial was installed in cooperation with a local grower to evaluate growing practices, cultivars, and the suitability of the crop for Hawaii in terms of disease and pest control and sustainable harvesting for a number of years.

Asparagus has a number of advantages. It is a perennial plant that produces an extensive root system (Thompson, 1942) with stems and leaves developing from the rootstock or crown. Some of the commercial cultivars are male hybrids that do not produce female flowers and thus do not expend energy on fruit production (Rick and Hanna, 1943; Snee, 1953; Wolyn and Feng, 1993). The expected production life of a field is 10 to 20 years. Asparagus is tolerant of nematodes and sustains little damage from them (Dudash and Barker, 1992). After initial crop establishment, asparagus requires little maintenance. Although asparagus is considered a temperate crop, it has proven to be well adapted to a year-round growing season.

Harvesting can be scheduled at any time of year in Hawaii and farm section harvesting can be staggered so that the local market can be steadily supplied throughout the year. Conversely, harvests can be scheduled during times when there is a low supply of asparagus on the world market and the price is high. The information generated in these trials has contributed to an increase in the acreage planted in asparagus in Hawaii. Many local consumers and retailers have expressed a preference for fresh, locally grown spears over imported asparagus. The authors estimate that approximately 400 to 500 acres can satisfy local demand with yields of about 3000 lb/acre fresh weight of spears per year (Maynard and Hochmuth, 1997). In addition to supplying local needs, a potential export market exists in Japan and possibly elsewhere. Asparagus for the Japanese market is mainly produced during the summer months (U.S. Agriculture Trade Office, 1995), but Hawaii can supply asparagus during fall months when production in Japan and mainland USA is lowest.

MATERIALS AND METHODS

Eight asparagus cultivars were included in the trial: three New Jersey cultivars, Jersey Gem, Jersey General, and Jersey Giant; and five California cultivars, Atlas, Apollo, Purple Passion, Grande, and UC 157. Plants were seeded in flats and transplanted to the field after three months. The plot layout was a randomized complete block with 12 replicate plots per cultivar. Each replicate plot had four ten-foot lines, but only the second line was harvested for data records. The rest of the lines were harvested by the farmer for sale. Plant to plant spacing was 12 inches and the lines were four feet apart. The crop growth and health were observed over the next 14 months until the first harvest took place. Harvest data were recorded as number and total weight of spears in each of three size categories per harvest date. The small size included spears with a diameter at the base of 1/4 to 3/8 in. Spears smaller than 1/4 in were discarded. Medium spears were 3/8 to 5/8 in and jumbo spears were over 5/8 in. Harvests lasted from the time the first spears appeared until they became too small and spindly for commercial sale. The first harvest lasted one week and harvests increased in duration until the fourth which lasted three weeks. The total yields also increased correspondingly.

The project area was irrigated for two to three hours every other day. This was sufficient for optimal growth in this location. During the first year of the project, two different fertilizer rates were tested. The yield results showed that there was no difference between the two so after the first harvest, the entire project area received the

lower rate. Fertilizer applied was 11-37-0 and urea for a total rate per crop of 81 lb/acre phosphorus and 80 lb/acre nitrogen. Since Hawaii does not have a cold period to induce dormancy, the irrigation was stopped for one month allowing the ferns to die back and rest. Upon renewing the irrigation and fertilization, spears again sprouted and were harvested. After the first harvest, the field was again allowed to grow to ferns and was watered and fertilized as before. The second, third, and fourth harvests took place at six month intervals.

RESULTS

The asparagus seedlings were planted at a density of one plant per foot in lines four feet apart. As the ferns grew, the canopy closed in sufficiently to shade out weeds. Asparagus produces an extensive root mass that continues to spread and remains productive for years. During the first year of growth there was one *Cercospora* fungus blight outbreak requiring fungicide treatment, but no other problems were encountered during the rest of the project. It may be that in more humid areas of the state more severe fungal infections would occur. Weeds must be controlled during the period between transplanting and closing over of the ferns, but after that there is little weed pressure for the life of the field.

The irrigation and fertilization practices followed in the trial proved to be suitable for asparagus production in Hawaii's subtropical environment. In temperate regions, asparagus ferns die back each winter and the regrowth in the spring provides the single harvest for the year. It is now evident that with sufficient irrigation and fertilization, two harvests per year are sustainable in Hawaii and these can be scheduled as desired to take advantage of market prices. By drying out different sections of a farm at successive intervals, continual production can be maintained.

The planting density in our trial gave good yields, however it is probable that a number of different planting densities would yield well. The yields in each size category were summarized for each cultivar and each harvest and are shown in Tables 1 through 5. Grande, Jersey Giant, UC 157, Atlas, and Apollo all yielded greater than the U.S. national average of 3000 lb/acre (Maynard and Hochmuth, 1997). The California cultivars Atlas and Apollo gave the greatest overall yields in this project. It is likely that cultivars bred in California are better suited to the warm Hawaii climate than are the New Jersey cultivars. The yields as presented in the attached tables show that Atlas and Apollo out-yielded the other cultivars in almost every case in the medium and jumbo size categories and in total weight of spears. Jersey Giant consistently produced the greatest weight of small size spears. The small spears are preferred by many hotel and restaurant chefs who are willing to pay a higher price for them. Purple Passion asparagus produced purple color spears that were unusual and attractive. This cultivar produced a large number of jumbo size spears, but spears were often deformed. Although this cultivar might be enjoyable for a home gardener, it is not recommended for commercial producers.

DISCUSSION

The acreage planted with asparagus in Hawaii has increased over the last five years. The local markets for fresh Hawaii asparagus are only just beginning to be developed. Hotel and restaurant chefs, small fresh produce outlets as well as large supermarkets have shown an interest in the product. So far, asparagus producers are unable to supply all the potential local markets on a continual basis and it seems apparent that a much larger local market can be developed than currently exists. Eventually, Hawaii asparagus could become an export crop, possibly to Japan. In addition, asparagus would be a good crop for organic farming in that it requires little or no pest or disease control and fertilizer can be provided as organic manure.

Many agricultural workers in Hawaii who were previously employed in the sugarcane and pineapple industries have started small farming operations of their own and are in need of information and assistance in developing new crops and markets for their produce. This project was undertaken to educate and inform Hawaii farmers about asparagus as an alternative crop for diversified agriculture.

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Table 1. Asparagus yield first harvest December, 1997 at 14 months after planting. Results shown as average weight of spears in lb/acre in three size categories.

Cultivar	Small ¹	Cultivar	Medium
Purple Passion	110 a	Jersey Gem	105 a
Jersey General	180 b	Jersey General	120 a
Grande	250 cd	Purple Passion	120 a
Apollo	265 cd	Grande	160 a
Jersey Gem	265 cd	Jersey Giant	165 a
Atlas	275 cd	UC 157	240 b
UC 157	300 cd	Atlas	245 b
Jersey Giant	330 d	Apollo	260 b
Cultivar	Jumbo	Cultivar	Total, all sizes
Jersey Gem	15 a	Jersey General	315 a
Jersey General	20 a	Purple Passion	315 a
Jersey Giant	25 a	Jersey Gem	385 ab
Purple Passion	90 ab	Grande	505 abc
Grande	100 ab	Jersey Giant	525 bc
UC 157	125 ab	UC 157	665 cd
Atlas	190 b	Atlas	715 d
Apollo	225 b	Apollo	750 d

¹ Means within the same size category followed by the same letter are not significantly different by Duncan's Multiple Range test, ($P = 0.05$).

Table 2. Asparagus yield second harvest August 1998. Results shown as average weight of spears in lb/acre in three size categories.

Cultivar	Small ¹	Cultivar	Medium
Purple Passion	215 a	Purple Passion	730 a
Jersey General	450 b	Jersey General	835 ab
Grande	450 b	Jersey Gem	1015 bc
Atlas	460 bc	Grande	1075 bcd
Apollo	540 bcd	UC 157	1210 cd
UC 157	595 cd	Jersey Giant	1220 cd
Jersey Gem	600 cd	Atlas	1280 d
Jersey Giant	650 d	Apollo	1320 d
Cultivar	Jumbo	Cultivar	Total, all sizes
Jersey Gem	200 a	Jersey General	1575 a
Jersey Giant	210 ab	Purple Passion	1675 ab
Jersey General	280 ab	Jersey Gem	1800 abc
UC 157	415 abc	Grande	1975 abcd
Grande	450 bc	Jersey Giant	2080 bcd
Atlas	600 cd	UC 157	2225 cd
Purple Passion	725 de	Atlas	2340 de
Apollo	865 e	Apollo	2725 e

¹ Means within the same size category followed by the same letter are not significantly different by the Least Significant Difference (LSD) test. ($P = 0.05$).

Table 3. Asparagus yield third harvest January 1999. Results shown as average weight of spears in lb/acre in three size categories.

Cultivar	Small ¹	Cultivar	Medium
Purple Passion	130 a	Purple Passion	230 a
Jersey General	340 b	Jersey General	425 b
Atlas	405 bc	Grande	505 b
Grande	445 bcd	Jersey Gem	545 bc
Jersey Gem	460 cd	Jersey Giant	595 bc
Apollo	475 cd	UC 157	605 bc
UC 157	545 d	Atlas	720 cd
Jersey Giant	555 d	Apollo	815 cd
Cultivar	Jumbo	Cultivar	Total, all sizes
UC 157	85 a	Purple Passion	570 a
Jersey Giant	95 ab	Jersey General	890 b
Jersey Gem	100 ab	Grande	1055 bc
Grande	150 abc	Jersey Gem	1065 bc
Jersey General	185 abc	UC 157	1080 bc
Purple Passion	220 abc	Jersey Giant	1210 bc
Atlas	255 bc	Atlas	1340 cd
Apollo	270 c	Apollo	1540 d

¹ Means within the same size category followed by the same letter are not significantly different by the Least Significant Difference (LSD) test, ($P = 0.05$).

Table 4. Asparagus yield fourth harvest September, 1999. Results shown as average weight of spears in lb/acre in three size categories.

Cultivar	Small ¹	Cultivar	Medium
Purple Passion	160 a	Purple Passion	1108 a
Atlas	361 b	Jersey General	1653 b
Jersey General	361 b	Jersey Giant	1894 b
Grande	421 bc	Jersey Gem	1898 b
Jersey Gem	477 bc	UC 157	1953 b
UC 157	492 c	Grande	2009 b
Apollo	503 c	Atlas	2114 bc
Jersey Giant	531 c	Apollo	2556 c
Cultivar	Jumbo	Cultivar	Total, all sizes
Jersey Giant	28 a	Purple Passion	1988 a
Jersey Gem	29 a	Jersey General	2115 a
UC 157	85 a	Jersey Gem	2398 ab
Jersey General	100 a	Jersey Giant	2453 ab
Grande	185 ab	UC 157	2511 ab
Atlas	470 bc	Grande	2620 ab
Apollo	471 bc	Atlas	3001 bc
Purple Passion	714 c	Apollo	3514 c

¹ Means within the same size category followed by the same letter are not significantly different by the Least Significant Difference (LSD) test, ($P = 0.05$).

Table 5. Summary of total yields of asparagus for four harvests over a two-year period. Results shown as average weight of spears in lb/acre.

Cultivar	Dec. 1997	Aug. 1998	Jan. 1999	Sep. 1999	Total
Jersey General	315	1575	890	2115	4895
Purple Passion	315	1675	570	1988	4548
Jersey Gem	385	1800	1065	2398	5648
Grande	505	1975	1055	2620	6155
Jersey Giant	525	2080	1210	2453	6268
UC 157	665	2225	1080	2511	6481
Atlas	715	2340	1340	3001	7396
Apollo	750	2725	1540	3514	8529