

INFLUENCE OF HIGH DENSITY PLANTING ON YIELD AND QUALITY OF GREEN ASPARAGUS

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ASPARAGUS GROWERS tend to seed at very high rates when they establish fields by the direct-seeding method. Many direct-seeded fields now being harvested in California had an initial plant population of over 100,000 plants per acre. In comparison, crown-planted fields are normally planted at a density of between 9,000 and 18,000 plants per acre, depending on whether single row or double row beds are used.

High density plantings are made by increasing the number of plant rows per

bed from one to as high as four, and by increasing the number of plants per ft in-row from one to as high as six. The most common practice when direct seeding is to use two rows per bed, with three inches between plants.

Long term effects

The long term effects of high density planting on total production, quality of spears, and longevity of the plantings have not been adequately determined. This report concerns part of a series of

tests to determine the influence of plant population on yield and quality of direct-seeded asparagus having a plant population of from 40,000 to 100,000 plants per acre.

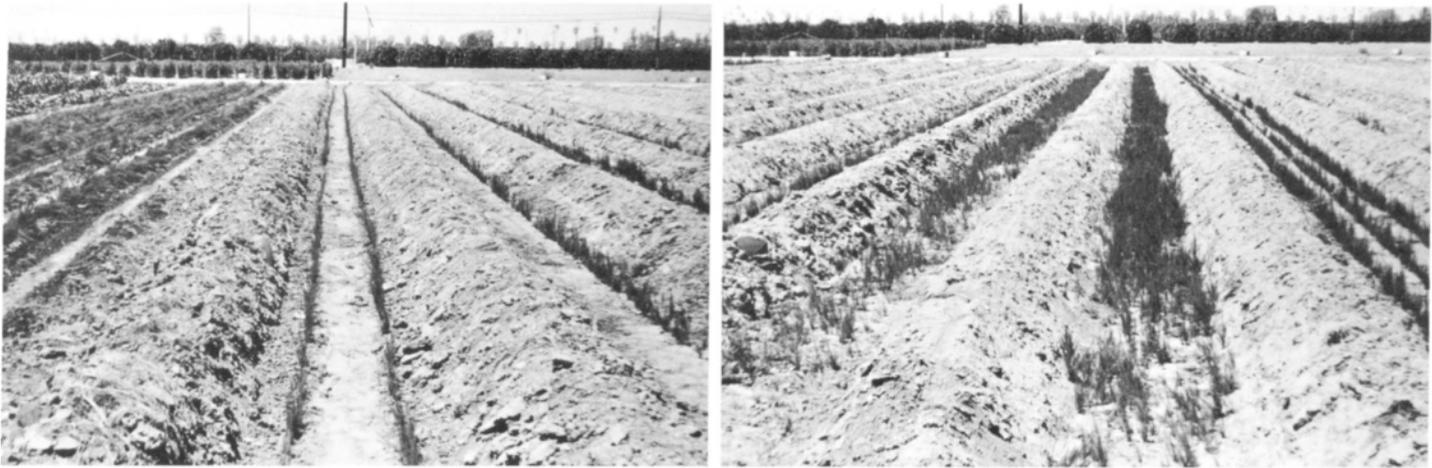
The experiment was conducted at the Citrus Research Center, Riverside, in 1966 and harvested for five years beginning in 1968. Variety U.C. 309 was direct-seeded into the bottom of preformed six-inch-deep flatbottom furrows. The four planting rates were 40,000, 80,000, 120,000 and 160,000 plants per acre,

TABLE 1. INFLUENCE OF VARIOUS PLANT DENSITIES ON TOTAL YIELD OF MARKETABLE ASPARAGUS

Year	Single row/bed 40,000 plants/acre	Double row/bed 80,000 plants/acre	Triple row/bed 120,000 plants/acre	Broadcast/bed 160,000 plants/acre
Total number of spears/acre				
1968	39,626	50,160	63,162	60,918
1969	67,305	87,592	114,603	104,905
1970	50,086	65,725	85,168	73,492
1971	110,452	137,694	154,124	142,729
1972	137,174	170,755	179,256	170,121
Total weight of spears/acre (lbs)				
1968	1632	2005	2270	2220
1969	2599	3363	4365	3886
1970	1644	2251	2810	2365
1971	4452	5570	5885	5237
1972	5972	7757	7271	6794
Average spear size (lbs)				
1968	.041	.039	.036	.028
1969	.039	.038	.037	.038
1970	.033	.034	.033	.032
1971	.040	.040	.038	.036
1972	.044	.045	.040	.040

TABLE 2. EFFECT OF PLANT DENSITY ON NUMBER AND PERCENTAGE OF MARKETABLE SPEARS ACCORDING TO SIZE

Treatment	Spears per acre						
	Large	%	Medium	%	Small	%	
1968	1 row/bed	3537	8.9	18229	46.0	17860	45.1
	2 row/bed	3854	7.7	22110	44.1	24196	48.2
	3 row/bed	3524	5.6	24274	38.4	35364	56.0
	broadcast/bed	3762	6.2	23377	38.4	33779	55.4
1969	1	3710	5.5	25555	38.0	37963	56.5
	2	5830	6.6	34003	38.8	47678	54.5
	3	6625	5.8	41923	36.5	66316	57.7
	4	5353	5.1	36960	35.4	62198	59.5
1970	1	1574	3.1	19548	39.0	28979	57.8
	2	2615	4.0	28054	42.7	35039	53.3
	3	3740	4.3	32968	37.8	50361	57.8
	4	2245	3.1	28092	38.1	43245	58.8
1971	1	8084	7.3	57219	51.9	44856	40.7
	2	10514	7.7	72382	52.7	54313	39.6
	3	9352	6.1	75816	49.4	68420	44.5
	4	6816	4.8	68050	47.8	67363	47.4
1972	1	17477	12.7	69801	50.9	49896	36.4
	2	21806	12.8	88387	51.8	60562	35.4
	3	16474	9.2	85905	47.9	76877	42.9
	4	15100	8.9	77299	45.4	77722	45.7



Asparagus planted in double-row and single-row beds (left photo); Asparagus planted by broadcast method and in triple-row beds (right photo).

using single, double, and triple row beds and a 12-inch-wide broadcast planting respectively, on five-ft centers. The in-row plant spacing was approximately two inches.

General observations

The overall appearance and growth of the plants throughout the seven-year test period appeared normal for the area. The photo shows the initial stand of the various treatments. During the second growing season a noticeable loss in plant stand in the center area of the bed occurred in the triple row and broadcast plantings. The plant stand in the center area of the beds decreased gradually but continuously for the next two seasons. After the second harvest season, all the plantings except the single row plantings appeared similar to the double row plantings because of the loss of plants in the center area of the triple row and broadcast plantings.

It is believed that the loss in stand in the center of the beds was caused by the crowding effects associated with high density plantings, especially shading during the fern stage of plant growth. Also, it was difficult to maintain adequate soil moisture in the center of these beds, which were five ft apart, because of the poor lateral movement of water in this soil. In 1970 a surface drip irrigation system was installed to alleviate the moisture stress in the center of the beds.

Yield

Yield was measured by the number and weight of the marketable spears produced each season. All spears measuring

less than $\frac{1}{4}$ inch in diameter were discarded as culls.

A significantly greater number of marketable spears was obtained each season in the double row, triple row, and broadcast plantings than in the single row planting. As shown in table 1, the triple row planting produced the highest number of marketable spears each year. There was also a reduction in yield in the broadcast planting, which had the highest initial plant density.

With respect to weight of marketable spears, there was no significant difference between the double row and triple row plantings, for the first four harvest seasons, because of the larger average size of spears in the double row plantings, as shown in table 1. In the fifth season the weight was greater in the double row planting.

Quality

The spears were sized into three grades: large (.75 in +), medium (.50-.75 in), and small (.25-.50 in), as a measure of quality. All the spears smaller than $\frac{1}{4}$ inch were discarded. Each season the single row and double row plantings produced spears with the largest average spear size. Statistically the difference between these two treatments was nonsignificant. The average spear size in the triple row and the broadcast plantings was smaller than in the lower density plantings.

There was no significant difference in the percentage of large spears produced in the single row and double row plantings for the first four harvest seasons, but the double row beds produced

more because of higher plant density. This same trend was also reflected in the medium and small grades. Except for the first harvest season, the double row planting produced the lowest percentage of small spears.

The same general trends were observed when the yield and grades were calculated by weight of production.

Spear size

The data show that the average spear size was reduced in plantings with densities above 80,000 plants per acre, or more than two rows per bed. Although there was little or no difference in the percentage of large and medium grade spears between the single and double row plantings, the total volume of production was increased considerably in the double row planting.

Plant population determinations are difficult to make in direct seeded fields. Observation indicated that there was a continual loss of plants throughout the test period, especially in the centers of the two highest density plantings. In 1972, when the test was terminated, the stand appeared excellent in all treatments, with no indications that the longevity of this planting would be adversely affected.

Further studies are in progress at plant densities between 16,000 and 80,000 plants per acre, which should yield more information on the effects of plant density and quality of direct-seeded plantings.

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