Evaluation of crown planting and direct seeding of asparagus after 15 years

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Asparagus growers in the desert and southern coastal areas of California have established successful asparagus fields by direct seeding in the past 6 to 7 years. Direct seeding was used in the San Joaquin Delta and Salinas areas for a few years but because of problems with weed control and small spear diameters, most growers in these areas have returned to transplanting 1-year-old crowns into production fields.

Direct seeded asparagus fields are usually high density plantings with an initial plant population in excess of 20,000 plants per acre. Short term studies have shown that (1) total production was increased with high density direct seeded plantings, (2) average spear size was smaller, and (3) initial plant populations were reduced with age.

The object of this study was to compare direct seeded and crown planted asparagus production and quality, and to study development and growth of the crown.

The experiment, conducted at the University of California Agricultural Experiment Station in Davis, was initiated in 1956 and continued for 13 harvest seasons. Crowns or seeds of the cultivar UC 309 were planted in rows 1.8 m (4 feet) apart in a Yolo fine sandy loam soil. The in-row plant spacing for the crown transplants was 30.4 cm (12 inches) and 3.8 cm (1.5 inches) for the direct seeded plants, which was 8 times the density of the crown treatment. The crowns in both planting treatments were covered during the cutting season with 20 cm (8 inches) of soil in 91 cm (3 feet) wide beds. Furrow irrigation was employed throughout the experiment.

The first 3-month harvest was made in 1958. The spears were hand harvested every second or third day depending on weather conditions. Weight and number of spears 23 cm (9 inches) in length with butt diameters over 09. cm (3/8 inch) were recorded.

Total yield over the 13 harvest seasons was 127,710 kg/ha (114,030 lb/A) for direct-seeded while crown planted plots yielded 122,692 kg/ha (109,550 lb/A). Spear totals for the 13 seasons were 4.28 million/ha (1.73 million/A) and 3.96 million/ha (1.60 million/A) for the direct seeded and crown planted plots, respectively. The 5,018 kg/ha difference in total yield was due to greater yields in the direct seeded plots during the first 6 years. No differences in yield were found during the remaining 7 seasons (figure 1A). The higher yield of the direct seeded plots was a result of increased spear production (figure 1B). The average diameter of spears in the direct seeded plantings was smaller for the first 5 harvest seasons with no differences between the two planting methods after the fifth season (figure 1C).

Plant density is believed to have been the principal factor influencing the production pattern by the two planting methods. In the first 5 years of the experiment, production was increased by virtue of the higher plant population in the direct seeded planting. Differences in production between the planting methods were negligible by the sixth year of the study because of changes in plant populations and size of crowns.

After the thirteenth cutting season one plot of each planting method was excavated and the crowns exposed in order to study their growth pattern and distribution. The fern was removed from each plot and a trench 0.5 m (20 inches) wide was dug in the furrow along each side of the bed to a depth of 1.5 m (5 feet) to accommodate the removal of soil covering the crowns and catch the washwater. The trenches were made with a tractor-mounted backhoe. The soil covering the crown was washed off with a stream of water at a pressure of 2.1 kg/cm^2 (30 psi). After the crowns were exposed they were lightly sprayed to wash off any adhering soil (figure 2).

After the soil surrounding the exposed crowns was dry, a single piece of transparent polyethylene sheeting was placed over the entire exposed plot and secured at the edges by weights and stakes. An indelible felt tipped pen was used to trace the outline of each viable crown by drawing directly over the periphery of the crown. The polyethylene sheet was removed and each of the traced crowns was cut out intact. Both the cut-out pieces and the polyethylene sheet were used for taking measurement data.

An air-flow planimeter was used to determine the area of each crown cutout. The polyethylene sheet from which the cutouts were taken was used to make a positive print of the crowns (figures 3A and 3B) by sandwiching the polyethylene sheets between a large piece of white paper and the metal window screening and painting the cutout areas with a quick drying spray paint.

Mean crown area and the total area of crowns were computed from area measurements of individual crown cutouts. The percent bed coverage was calculated from the total exposed bed area (7.2 m^2 = .91 m wide × 7.9 m long) and the total crown area per plot.

Since only one plot of each treatment was excavated, the data presented here should only be regarded as representative of the exposed plots and not of

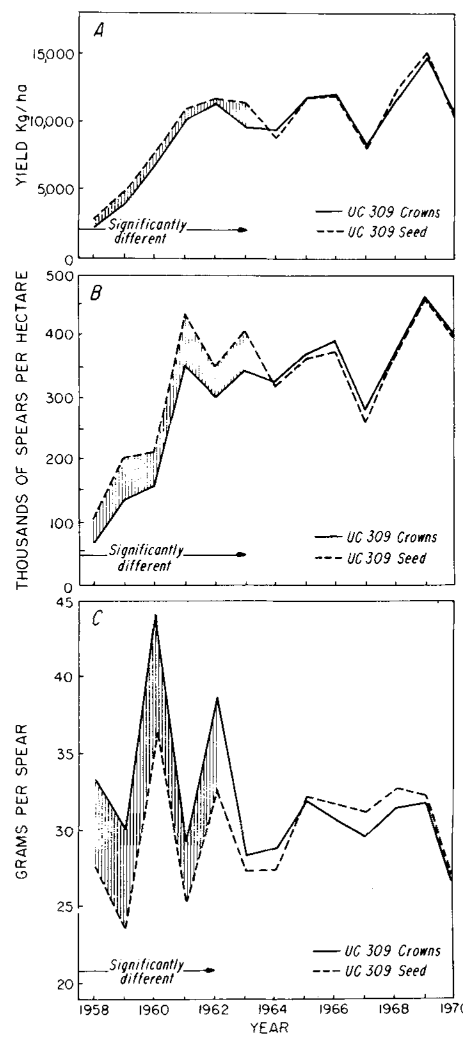

Fig. 1. Effect of direct seeding and crown planting of asparagus (var. U.C. 309) on (A) yield, (B) spears per ha. and (C) weight per spear.

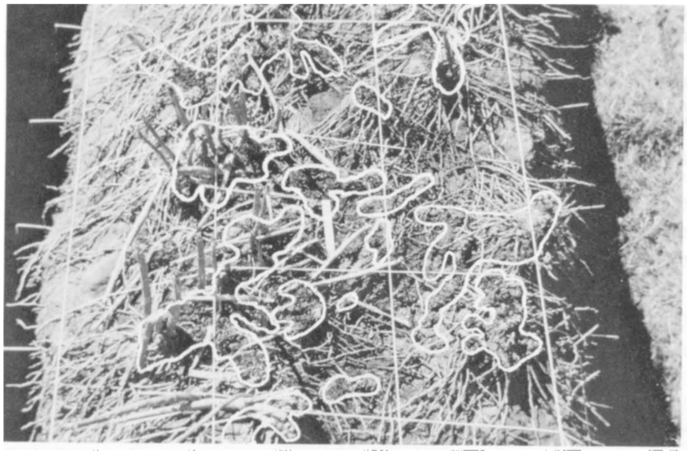

Fig. 2. Exposed asparagus bed showing crown placement and storage roots after 15 years of growth.

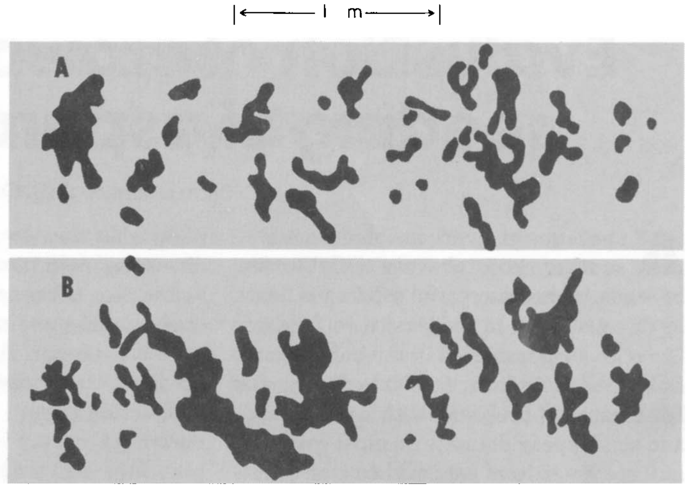

Fig. 3. Configurations of viable crown material from (A) crown planted and (B) direct seeded asparagus after 15 years of growth. Notice the size and segmentation of the crowns.

the entire experiment.

The exposed direct seeded plot contained 59 crowns which had a total crown area of 16,963 cm^2 (18.26 $feet^2$) and a mean crown area of 287 cm^2 (44.5 $inches^2$). The crown planted plot contained 76 crowns with a mean crown area of 148 cm^2 (22.9 $inches^2$) and a total crown area of 11,278 cm^2 (12.14 $feet^2$). The amount of bed covered by viable crowns was 23.5 percent and 15.6 percent for the direct seeded and crown planted plots, respectively.

A representative portion of the print made from the polyethylene sheeting is presented to demonstrate the differences observed (figure 3). The original location of plants in each plot is obscured due to the growth and segmentation that occurred over the 15 years. The number of crowns changed dramatically from the initial population. The direct seeded plots' initial population of 216 plants was reduced to 49, a loss of 157 plants. In contrast, the crown planted plot increased by 49 plants to a plant population of 76. The change in crown numbers is thought to be due to two main factors. The reduction of plants in the direct seeded plot was probably due to high plant competition; the increase of plants in the crown planted plot was due to segmentation, a possible result of *Fusarium* sp. infestation.

The larger crown area found in the direct-seeded plot is believed to be related to better adapted plants remaining intact over the 15 year period. The crown planted plot probably had some of the better adapted plants but since the direct seeded plot contained 8 times the initial population of the crowns planted, chances of having more plants that were better adapted to the conditions present during the experiment were greater.

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Response of corn to fertilizer, plant population, and planting date

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Corn for grain in California has increased steadily in acreage and yield over the past 20 years. In 1960, corn was grown on 130,000 acres with an average yield of 4032 pounds per acre. By 1975 the crop was grown on 290,000 acres averaging 6160 pounds per acre. This 52 percent yield increase in 15 years (about 3.5 percent annually) can be attributed to improved hybrids and cultural practices.

Fertilizer rates, planting dates, and number of plants per acre all are known to influence corn yields. Previous studies considered these factors singly. An experiment at the Davis Campus of the University of California considered all three factors simultaneously.

Two planting dates were used, May 9 and 30. Nitrogen fertilization was at three rates: 0 (unfertilized check), 200, and 400 pounds per acre of actual nitrogen applied as ammonium sulfate with 21 percent nitrogen. The plant populations were 18,000, 26,000, and 34,000 per acre, respectively, giving plant spacing within the 30-inch rows of 6, 8, and 12 inches. Plots were hand thinned 20 days after planting to provide required plant population. The nitrogen levels as well as the plant populations represent values used in commercial corn production, with the middle values near those used by many growers. The two planting dates are somewhat later than the average for commercial plantings in the Davis area. Other cultural practices were designed to achieve a high level of production. The experiment was planted with DeKalb XL361, a three-way cross hybrid. Most of the currently grown hybrids are single-crosses. All yields reported here are in pounds per acre at 15.5 percent moisture. Grain protein percentages are reported on a 100 percent drymatter basis.

The mean yields of all populations and nitrogen fertilizer rate are summarized in table 1. Corn planted on May 9 averaged 12,180 pounds per acre, and the May 30 planting averaged 10,990 pounds, a reduction of 1,190 pounds per acre (significant at the 10 percent probability level). The higher yield from the earlier planting confirms the experience of corn growers in California.

Nitrogen fertilization at 200 pounds