Influence of Planting Depth and Interval to Initial Harvest on Yield and Plant Response of Asparagus

Dale T. Lindgren
University of Nebraska - Lincoln, dlindgren1@unl.edu

HortScience 25(7):754–756. 1990.

Influence of Planting Depth and Interval to Initial Harvest on Yield and Plant Response of Asparagus

Dale T. Lindgren[1]
University of Nebraska–Lincoln West Central Research and Extension Center, Route 4, Box 46A, North Platte, NE 69101

Additional index words. survival, emergence, harvest date, frost tolerance, crown depth, *Asparagus officinalis,* yield components

Abstract. **Four planting depths and two time intervals (1 or 2 years) between transplanting and initial year of harvest of asparagus (*Asparagus officinalis* L.) yield were compared for 4 years. Spear emergence and initial spring harvest date were delayed and susceptibility to spring frost injury was decreased with increasing planting depth (from 5.0 to 20.0 cm). Over years, crown depth increased for the shallowest planting and decreased for the deepest planting. Harvesting after 1 year vs. 2 years from planting reduced yield. There were no significant interactions between year of initial harvest and depth of planting.**

Researchers have discussed the effect of the interval between planting and initial harvesting on asparagus production (Benson and Motes, 1982; Haber, 1935; Jones and Robbins, 1926; Lewis, 1934; Shelton and Lacy, 1980) and the effect of planting depth on production (Hanna, 1935; Young, 1940), but have not related the two factors. The objectives of this study were to 1) determine if there was an interaction between year of initial harvest and planting depth on asparagus production in central Nebraska, 2) see what effect planting depth has on various growth characteristics, and 3) compare the effect of making the initial harvest 1 year after setting crowns rather than after 2 years.

Seed of 'Mary Washington' asparagus was field-sown in June 1979 at the Univ. of Nebraska West Central Research and Extension Center near North Platte, Neb. The site is located in the semi-arid plains, with an elevation of 860 m and an average growing season of 150 days. The soil is Cozad silt loam (Typic Haplustoll). Crowns from the seedlings were transplanted in Apr. 1980 to plots with rows 2.1 m apart and 45 cm between plants within rows. These 1-year-old crowns were planted at one of four depths (5, 10, 15, or 20 cm) in single-row plots. Sixteen plants were planted at each depth in a randomized complete-block design with five replications. Eight of the 16 plants of each replicate of each planting depth were harvested for 2 weeks beginning in 1981, and the remaining eight plants were initially harvested in 1982. Spears were harvested at an average height of 18 cm. Harvest continued until spear diameter decreased to 8 or 9 mm. Plot yields are expressed as spear fresh weight (in grams) per 3.6 m of row length. Plots were fertilized annually with N at the rate of 80 $kg \cdot ha^{-1}$ (34N–0P–0K), mechanically weeded between rows, hand-weeded within rows, and sprinkler irrigated as needed. Fusarium and rust diseases were more prevalent beginning in 1983, and there was a rapid and sharp temperature drop in Nov. 1983 that may have resulted in crown injury.

Average date of emergence and average date of first harvest were recorded as the number of days past 1 Apr. Spring frost injury to emerging spears, which occurred only in 1983 and 1984, was recorded as percentage of live plants with frost injury. Weight

Received for publication 15 May 1989. Published as Paper no. 8918. Journal Series, Agricultural Research Division, Univ. of Nebraska, Lincoln. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.
[1]Associate Professor.

Table 1. Average emergence, average initial harvest date, frost injury, and crown depth for four planting depths of asparagus.

Planting depth (cm)	Average[z] emergence (days after 1 Apr.)	Average[z] initial harvest (days after 1 Apr.)	Plants with frost injury (%) 1983	1984	Crown depth (after 6 yr) (cm)[y]
5	21.0	24.6	31	19	11.2
10	23.1	28.0	3.0	0.0	13.2
15	25.5	29.6	5.0	3.0	15.2
20	26.8	29.8	0	5.0	17.5
Depth (D)	**	**	*	*	**
Replicate (R)	*	NS	NS	NS	NS
Harvest (H)	NS	NS			NS
D × R	NS	NS			*
D × H	NS	NS			NS

[z]Average over 4 years, 1982–85.
[y]Depth of crown 6 years after transplanting to field plots.
NS,*,**Not significant or significant at $P = 0.05$ or 0.01, respectively.

Table 2. Summary of significance from general linear model procedure for survival, total yield, and yield components and contrasts for depth of planting over 4 years, 1982–85.

Factor	Plant survival	Total wt/plot (g)	Spears/plot	Spears/plant	Wt/spear	Wt/plant
Depth	NS	NS	**	**	*	NS
Harvest	*	*	**	**	NS	NS
Replicate	**	**	**	**	*	*
Contrast[z]						
Depth L	NS	NS	*	*	*	NS
Depth Q	NS	NS	NS	*	NS	*
Depth C	NS	NS	NS	NS	NS	NS

[z]L = linear, Q = quadratic, C = cubic.
NS,*,**Not significant or significant at $P = 0.05$ and 0.01, respectively.

Table 3. Effect of planting depth on average annual yield averaged over 4 years, 1982–85.

Planting depth (cm)	Total wt/plot (g)	Spears/plot	Spears/plant[z]	Wt/spear (g)	Wt/plant (g)[y]
5.0	1076	72.3	12.2	13.3	179
10.0	962	59.6	9.6	13.7	153
15.0	756	48.9	8.8	14.2	133
20.0	821	47.4	9.0	16.6	155
Significance	NS	**	**	*	NS

[z]Average number of spears produced per live plant per year.
[y]Average weight for yield of each live plant.
NS,*,**Not significant or significant at $P = 0.05$ or 0.01, respectively.

Table 4. Effect of interval between setting of crowns and first harvest on components of yield for 1982 through 1985.

Interval (no. years)	Total wt (g)[z]	Spears/plot	Spears/plant[y]	Wt/spear (g)	Wt/plant (g)[x]
1[w]	782	49	8.9	14.3	141
2	1025	65	10.8	14.6	169
Significance	*	**	**	NS	NS

[z]Weight per 3.6 m of row.
[y]Average number of spears produced per live plant.
[x]Average weight of each live plant.
[w]An average of 313 g/plot harvested in 1981, first year of harvest.
NS,*,**Not significant or significant at $P = 0.05$ and 0.01, respectively.

per plot, number of spears per live plant, spears per plot, weight per spear, and weight per live plant were recorded for each treatment. The last harvest season was 1985. In Apr. 1986, crowns of all live plants were excavated and average depth of the crowns measured. Crown weight was not recorded. Data were analyzed statistically for the combined years using general linear model procedures and planned comparisons.

Average emergence and the date of initial harvest were earliest at the shallowest planting depth (Table 1). However, plantings at this depth were more susceptible to injury by early spring frost than deeper plantings because of earlier emergence. Crown depths after 6 years had increased by ≈6 and 3 cm for the 5- and 10-cm planting depths, respectively, while the depth of crowns planted at 20 cm decreased by ≈2.5 cm. Differences in planting depth (D) were significant for all traits.

Table 2 summarizes the results of a general linear model procedure analyzing plant survival, yield, and yield components averaged over 1982–85. There were significant replicate (R) differences for all traits measured, and some of the traits were significantly different for D and for year of initial harvest (H). All interactions, including D × H, were nonsignificant. In general, linear contrasts for depth had a better fit than quadratic or cubic contrasts.

Number of spears per plot and spears per plant were greater at the shallow planting, while individual spear weight was highest at the deepest planting averaged over the four years of 1982 to 1985 (Table 3). Although the total weight per plot did not differ significantly among planting depths, the yield of shallow-planted plants tended to be higher (Table 3).

The effect of harvesting the first year vs. the 2nd year after setting crowns averaged over treatments and years is compared in Table 4. There were significant differences for total production, spears per plot, and spears per plant between the two initial harvest intervals. Averaged annually over 1982 to 1985, the delayed harvest (L) resulted in 31% more weight than the earlier one.

Delayed emergence and a later date of first spring harvest for the deep plantings (Table 1) would be expected because of delayed warming of the crowns to stimulate growth and the greater distances the spears had to grow to emerge. However, early emergence of shallow plants makes them more susceptible to injury from spring freezes. Individual weight per spear increased with planting depth (Table 3), a finding that agrees with Young (1940) in North Dakota. There were no significant interactions between R × D or D × H, suggesting that these factors act independently. Analysis indicated that there was a significant replication effect. This effect could be related to soil type, moisture, temperature, and/or fertility. Morse (1919) pointed out a similar type of replication or location effect on asparagus production over relatively short distances.

Crown depth changed and equalized over time. Shallow crowns tended to move deeper, and deep crowns tended to become shallower, which is in agreement with the findings of Young (1940). Yeager and Scott (1939) in North Dakota reported that, in a 35-year-old asparagus bed, crown depth averaged ≈13 cm. However, no initial planting depth was provided in the North Dakota study.

This trial also suggested that harvesting spears 1 year after setting crowns reduced asparagus yield, compared to harvesting spears 2 years after setting crowns. This finding is in agreement with those of Haber (1935) in Iowa, Lewis (1934) in Illinois, and Shelton and Lacy (1980) in Michigan, but not with Benson and Motes (1982) in California and Oklahoma and Jones and Robbins (1926) in California. The studies that indicated a reduced yield from harvesting 1 year after setting crowns were all from more-northern states with short growing seasons; studies that did not show a reduced effect on yield with early harvest occurred in areas with long growing seasons. Crops respond differently to different situations, and recommendations may need to be different for various regions. Benson and Motes (1982) pointed out that it is possible that, in locations where plants are growing under more adverse conditions, plants may have increased difficulty in surviving when stressed. Lewis (1934) suggested that cutting in Illinois for even a short period the first year following crown planting decreases yield, unless the plants make a vigorous growth after cutting. Delaying harvest until the 2nd year after setting crowns may be beneficial in plantings that undergo stress or have short growing seasons to permit build-up of carbohydrate reserves.

Literature Cited

Benson, B.L. and J.E. Motes. 1982. Influence of harvesting asparagus the year following planting on subsequent spear yield and quality. HortScience 17(5):744–745.

Haber, E.S. 1935. Effect of harvesting, spacing and age of plants on yields of asparagus. Iowa Agr. Expt. Sta. Bul. 339. p. 3–16.

Hanna, G.C. 1935. Asparagus production in California. California Agr. Ext. Serv. Circ. 91.

Jones, H.A. and W.W. Robbins. 1926. Influence of cutting asparagus the year after planting on production the following year. Proc. Amer. Soc. Hort. Sci. 23:23–25.

Lewis, E.P. 1934. Asparagus yields as affected by severity of cutting. Illinois Agr. Expt. Sta. Bul. 401:25–36.

Morse, F.W. 1919. A fertilizer experiment with asparagus. Massachusetts Agr. Expt. Sta. Bul. 194:231–257.