Stand Establishment, Spacing and Fertilization to Maximize Pumpkin Yield

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Acreage of pumpkins has grown considerably in the United States over the past twenty years. The majority of these pumpkins are grown solely for Halloween sales and are for decoration only and not for human consumption. Americans now spend more on Halloween – 2 billion dollars – than any other holiday except Christmas. With the increase in acreage, production practices have also changed. At one time, pesticide inputs were very limited. Recent studies, however, indicate that an effective disease control program may significantly increase the yield and quality of the crop . Weekly fungicide applications alone may cost growers $300 - 500 per acre annually. In an effort to maximize profitability, growers are exploring ways to increase yield per acre in order to save on land, pesticide, fertilizer, labor, and machinery costs.

I. Stand Establishment

With the increase in hybrid seed costs, some growers have looked at transplanting single plants rather than direct seeding a high number of seeds to ensure a good stand. In addition, transplanting may aid in cucumber beetle and weed control. In 2001, a field study was conducted in Geneva and Riverhead, NY, which compared direct seeded and transplanted plots.

Table 1. 2001 Stand establishment trial parameters.

Variety	*Planting Treatments*	*Planting Date*
Magic Lantern	24 Cell - 118 cm^3	Geneva - 6/14, bare ground
	38 Cell - 76 cm^3	Riverhead – 6/25, plastic and trickle
	Direct seeded	Transplants 3-4 weeks old

- Planted on 6 foot centers with 4 feet between plants, one plant per hill
- 50 lbs/A N added at planting; 50 lbs/A N sidedressed when vines begin to run

Transplants were quick to establish compared to the directed seed plots. At Geneva, female flowers were first observed on July 6, and the first fruit set on July 13, one month after planting. Fruit in the transplanted plots were ready for harvest about two weeks before the seeded ones. At both locations, yields were significantly greater using transplants (Table 2).

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Table 2. Yield of transplanted and direct seeded pumpkins at two locations in 2001

	Riverhead, NY			Geneva, NY		
Treatment	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**
Direct Seed	1958	10.2	10.1	1771	9.0	10.4
Cell Size 24	2302	14.5	12.7	2189	12.4	11.4
Cell Size 38	2232	13.0	11.4	2347	13.7	11.7

Smaller transplants would be more economical. In 2002, a study was performed at both Geneva and Riverhead, NY, to determine the effect of planting date and variety on the yield of direct-seeded and transplanted pumpkins.

Table 3. 2002 Stand establishment trial parameters.

Variety	*Planting Treatments*	*Planting Date*
Magic Lantern	50 Cell - 66 cm^3	Geneva - 6/10, 6/24 bare ground
Gold Bullion	98 Cell - 23 cm^3	Riverhead – 6/6, 6/20, plastic and trickle
	Direct seeded	Transplants 3-4 weeks old

Table 4. Yield of transplanted and direct seeded pumpkins at two locations in 2002

	Riverhead, NY			Geneva, NY		
Treatment	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**
Direct Seed	4176	24.1	11.6	1588	6.6	8.3
Cell Size 50	5304	29.9	11.3	2070	10.0	9.3
Cell Size 98	4896	28.1	11.6	2240	10.4	9.5

Consistently, transplanted pumpkins out yield directed seeded plots. There seemed to be no advantage in using larger transplants as even the smallest ones used in this study yielded no differently than the largest. With a yield increase of 25% to 50% in tons per acre, cost of transplants should more than pay for their additional cost.

II. Plant Spacing

Grower practices vary in terms of spacing to optimize pumpkin yields. With cucumbers and watermelons, closer spacing has led to an increase in fruit per acre along with a smaller fruit size. The effect on tons/A seems to vary, resulting in either no effect or a significant increase. This trial was conducted to determine the effect of spacing on two pumpkin varieties, Howden, a large vining type, and Wizard, a semi-bush type.

Pumpkins were planted on 6 foot centers with in-row spacings of 1, 2, and 4 feet. Plants were thinned to a single plant per hill. At both locations, closer in-row spacings significantly increased the number of pumpkins/A while decreasing the average weight per fruit. At one location, despite the smaller fruit, the increase in fruit numbers resulted in a significant increase in tons/A (Table 5) while in the second location, the tons/A was not increased. Why the difference? The location in which we saw increased tons/A was irrigated while the other

location was not. Apparently, to take maximum advantage of increased plant populations, growers need to ensure that water is not limiting.

Table 5. Yield of pumpkins at 6 foot between-row spacing and three in-row spacings.

Plant Popn./A	In-Row Spacing (ft)	No./A	Tons/A	Avg. Wt. (lbs)
1815	4	1491	8.1	10.9
3630	2	2368	12.2	10.1
7260	1	3566	14.1	7.8

Growers have two options when increasing plant populations: either within-row spacings or between row spacings can be decreased. From our previous trial, we know that changing in-row spacing significantly affects yield. For pumpkin growers, a wider between-row spacing may be better, allowing for easier access to fields for the purpose of cultivation, pesticide, or fertilizer applications. A trial was conducted comparing the same plant populations on 6 and 12 foot centers. For 6 foot centers, in-row spacings of 2, 4 and 6 feet were used. For 12 foot centers, in-row spacings of 1, 2, and 3 feet were used.

For both the 6 and 12 foot centers, we saw an increase in yield as within-row spacing decreased and population increased (Table 6). Row width had little effect on any aspect of yield with the exception of the number of fruit/A. Six foot centers resulted in a significant increase in fruit numbers at both locations (Table 7). The greater number of fruit did not result in increased tons/A as the average fruit size declined slightly with the narrow spacing.

Table 6. Yield of pumpkins at 6 and 12 foot between-row spacing and three in-row spacings.

Plant Popn./A	In-Row Spacing (ft)	No./A	Tons/A	Avg. Wt. (lbs)
1210	12x3 or 6x6	1540	15.0	20.7
1815	12x2 or 6x4	2250	19.1	17.6
3630	12x1 or 6x2	2804	21.9	16.3

Table 7. Yield of pumpkins at 6 and 12 foot between-row spacing.

Between-Row Spacing (ft)	No./A	Tons/A	Avg. Wt. (lbs)
6	2440	19.7	17.4
12	1990	17.7	18.9

The data indicate that row width may become more important at higher plant populations (Table 8). The highest plant population resulted in greater fruit number and tons/A. The effect is significant, however, only when spacing between rows is narrow. The narrow row width provides each plant a more square area of land than did wider spacings at the same population. Plants are spread out more evenly in the field and may be less likely to compete in this arrangement. The effect was seen for both a large vining variety (Howden) as well as a semi-bush type (Wizard). This effect may be more pronounced when yields are maximized with optimum inputs of fertilizer, irrigation, and pesticides.

Table 8. Yield of pumpkins at 6 and 12 foot between-row spacing and three in-row spacings.

	6 Foot Between-Row		12 Foot Between-Row	
Plant Popn./A	**No./A**	**Tons/A**	**No./A**	**Tons/A**
1210	2040	18.4	2010	22.2
1815	2200	21.0	2120	22.3
3630	3350	31.2	2480	23.3

Some growers have traditionally kept two or three plants per hill in the belief that this increases yield. It is also good insurance in case a plant is lost to insect or disease. Based on previous studies, it would seem that two or more plants per hill would not increase yield. In 1997, a trial was conducted in which pumpkins were grown on six foot centers with 2, 4, or 6 foot in-row spacings. Each hill contained either one or two plants. As in the other studies, Howden and Wizard were the varieties grown.

Doubling the number of plants per hill had very little effect on yield (Table 9). At one location, there was an increase in fruit number/A and a decrease in average fruit size with two plants. Most of the significant increase in yield was all due to the closer in-row spacings which resulted in more fruit/A and more tons/A, with a typical decrease in fruit size.

Table 9. Yield of pumpkins with one or two plants per hill.

	Geneva			Albany		
Plants/Hill	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**
1	1895	13.3	14.6	2884	24.2	16.8
2	2662	14.0	10.9	3145	26.2	16.7

III. Nitrogen fertility

Trials conducted at two locations in 1995 demonstrated that there was little difference in the yield of two pumpkin varieties (Howden and Wizard) as nitrogen rates were increased from 60 to 140 lbs/A. There was a trend towards slightly larger fruit size with higher rates of N but this was not consistent (Table 10). These tests were conducted on silt loams with relatively good nutrient holding capacity so greater amounts may be useful on sandy or gravely soils. Higher amounts may lead to more foliage which could lessen fruit set. Based on these tests, 60 to 100 pounds N/A seems to be adequate.

Table 10. Yield of pumpkins with 60, 100 and 140 pounds of nitrogen.

Between-Row Spacing (ft)	**No./A**	**Tons/A**	**Avg. Wt. (lbs)**
60	2368	10.0	8.4
100	2470	11.4	9.2
140	2590	12.7	9.8