

PLANTING DENSITY AFFECTS PUMPKIN SIZE AND WEIGHT BUT NOT YIELD

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ABSTRACT: Pumpkin cultivars Aspen and Howden Biggie were planted at the North Mississippi Research & Extension Center in Verona during the summer of 2001 to investigate the effect of plant density on yield and size. Four densities of 'Aspen' were tested: 3068, 2045, 1361 and 908 plants/ac. These densities are equivalent to 14, 21, 32, and 48 ft²/plant, respectively. In a separate experiment, four densities of 'Howden Biggie' were tested: 2045, 1361, 908 and 605 plants/ac. These densities are equivalent to 21, 32, 48, and 72 ft²/plant, respectively. 'Howden Biggie' produces a more vigorous vine than 'Aspen' and therefore plant densities were adjusted accordingly. Plant density did not influence yield (lb/ac or pumpkins/ac) for either cultivar. However, there was a significantly linear relationship for each cultivar between increasing plant density and decreasing size (lb/ pumpkin or in³/pumpkin). These results indicate that pumpkin yield was surprisingly stable over a wide range of plant densities, from 908 to 3068 plants per acre for 'Aspen' and from 605 to 2045 plants per acre for 'Howden Biggie.' These results also indicate that pumpkin size was clearly affected by plant density, with greater densities producing smaller pumpkins. The greatest influence of plant density, however, was on pumpkins per plant. Increasing plant density resulted in decreasing pumpkins per plant for both cultivars. These results indicate that plant productivity was least at the greatest density. At 3068 and 2045 plants/ac, 10 % of the 'Aspen' and 30 % of the 'Howden Biggie' plants, respectively, did not produce pumpkins. At all other plant densities, every plant produced one or more pumpkins. This study was conducted last year with similar results, except the weather was unusually hot and sunny in 2000.

CITATION: Cushman K.E., T.E. Horgan, D.H. Nagel, and P.D. Gerard. 2002. Planting density affects pumpkin size and weight but not yield. Annual Report of the North Mississippi Research & Extension Center, Miss. Agric. & For. Expt. Sta. Info. Bull. 386. pp. 282-283.

KEY WORDS: Pumpkin, *Cucurbita spp.*, plant density, population, spacing, Aspen, Howden Biggie.

MATERIALS AND METHODS: Pumpkin cultivars 'Aspen' and 'Howden Biggie' were planted at the North Mississippi Research & Extension Center in Verona during the summer of 2001 to investigate the effect of plant population on yield and size. Four 'Aspen' planting densities were tested: 908, 1361, 2045, and 3068 plants/ac. These planting densities are equivalent to approximately 48, 32, 21, and 14 ft²/plant, respectively. In a separate experiment, four 'Howden Biggie' planting densities were tested: 605, 908, 1361, and 2045 plants/ac. These planting densities are equivalent to approximately 72, 48, 32, and 21 ft²/plant, respectively. 'Howden Biggie' produces a larger, more vigorous plant than 'Aspen' and therefore planting densities were adjusted accordingly. This was the second year of a two-year study, and only results from 2001 are presented in this report.

Plant beds were formed six inches high and 30 in across the top with a press-pan-type bed shaper. Beds were spaced 8.0 ft apart, center-to-center, with a 20-ft wide drive row located between each set of four rows. Preplant fertilizer was placed in the bed during bed formation at the rate of 50 lb N, 100 lb P₂O₅, and 200 lb of K₂O per acre. Drip irrigation tubing, rated at 0.3 gal/min/100 ft at 10 psi, was installed 1 to 2 in deep off center in the top of each bed.

Both cultivars were direct seeded by hand 27 July 2001. Each "hill" was planted with 2 or 3 seeds. Germination was good to excellent, and hills were thinned by hand to one plant per hill 2 weeks after emergence. At this time, a few missing plants were replanted. This resulted in an excellent plant stand for both cultivars in all plots. Clomazone herbicide (2.5 pt/ac Command 4EC) was applied immediately after seeding. Within one week of application, ¼ in precipitation effectively incorporated the herbicide. Effects of the herbicide were evident on many of the young pumpkin plants. Many plants exhibited white, bleached leaves. All plants, however, eventually grew out of the Command injury and produced green, healthy plants. Row middles were mechanically cultivated by hand or with a tractor-mounted rototiller one month after planting. Asana XL (esfenvalerate), Pounce 3.2EC (permethrin), Thiodan

EC (endosulfan), or Sevin 80WSP (carbaryl) were mixed with Bravo WS (chlorothalanyl) or Quadris (azoxystrobin) and sprayed on a 7 to 10 day schedule for insect and disease control. Irrigation was applied through the drip tape to supply at least 1.0 acre-in per week. Soluble fertilizer was applied by injecting a concentrated solution of ammonium nitrate (NH₄NO₃) when vines began to “run.” Soluble fertilizer supplied an additional 50 lb N per acre. Two active and healthy bee colonies were located on experiment station property within ¼ mile of the pumpkin research plots.

‘Aspen’ was harvested Oct. 18 and ‘Howden Biggie’ Oct. 25. Due to a late planting date, many pumpkins were not fully colored at harvest. Each pumpkin was weighed and measured for height and width. There were very few unmarketable pumpkins due to factors other than color. For both cultivars, only pumpkins greater than 5 lb were included in the analyses. The experimental design was a randomized complete block with four replications. Cultivar (i.e. Aspen and Howden Biggie) was not part of the experimental design. Each plot consisted of groups of four rows, but only 400 ft² (20 ft wide by 20 ft long) was harvested from the center of each plot to minimize the influence of an ‘edge effect.’ Volume of each pumpkin was calculated as a cylinder: (height)(π)(radius)². Regression analysis was performed with SAS. The Mixed procedure was used to analyze size data (lb and in³ per pumpkin) and the General Linear Model procedure was used to analyze yield data (lb and pumpkins per acre and pumpkins per plant).

RESULTS AND DISCUSSION: Plant density did not influence yield (lb and pumpkins per acre) for either cultivar (Tables 1 and 2). However, there was a significantly linear relationship between increasing plant density and decreasing size (lb and in³ per pumpkin) and this relationship occurred for each cultivar (Tables 1 and 2). These results indicate that pumpkin yield was surprisingly stable over a wide range of plant densities, from 908 to 3068 plants per acre for ‘Aspen’ and from 605 to 2045 plants per acre for ‘Howden Biggie.’ These results also indicate that pumpkin size was clearly affected by plant density, with greater densities producing smaller pumpkins.

The greatest influence of plant density, however, was on plant productivity. Increasing plant density resulted in decreasing pumpkins per plant (Tables 1 and 2). In other words, increasing plant density resulted in decreasing plant productivity. For example, at the greatest plant densities, 10 % of the ‘Aspen’ and 30 % of the ‘Howden Biggie’ plants did not produce pumpkins. At all other plant densities, every plant produced one or more pumpkins.

Table 1. ‘Aspen’ marketable yield and size

Plant population		Marketable yield			Average size	
(plants/acre)	(ft ² /plant)	(lb/acre)	(pumpkins/acre)	(pumpkins/plant)	(lb/pumpkin)	(in ³ /pumpkin)
908	48.0	48,000	2,670	2.9	18.0	920
1361	32.0	47,400	3,080	2.3	15.4	750
2045	21.3	50,000	3,190	1.6	15.7	750
3068	14.2	41,500	2,830	0.9	14.7	710
Significance ¹		0.3742	0.3511	<0.0001	0.0004	0.0002

¹ Significance of linear regression model. Quadratic regressions were not significant.

Table 2. ‘Howden Biggie’ marketable yield and size

Plant population		Marketable yield			Average size	
(plants/acre)	(ft ² /plant)	(lb/acre)	(pumpkins/acre)	(pumpkins/plant)	(lb/pumpkin)	(in ³ /pumpkin)
605	72.0	41,700	1610	2.7	26.0	1480
908	48.0	39,700	1550	1.7	25.6	1370
1361	32.0	34,900	1630	1.2	21.4	1150
2045	21.3	36,100	1530	0.7	23.7	1300
Significance ¹		0.0852	0.7999	<0.0001	0.0442	0.0355

¹ Significance of linear regression model. Quadratic regressions were not significant.