Evaluation of Sunflower (Helianthus annuus L.) Cultivars and Plant Spacing in East Texas

Carly Wright*, Michael A. Maurer, and Stephanie Jones
Arthur Temple College of Forestry and Agriculture
Stephen F. Austin State University, P.O. Box 13000, SFA Station, Nacogdoches, TX 75962

INTRODUCTION

Specialty cut flowers, which include sunflowers, have become an important segment in the United States cut flower industry (Bachmann, 2006). Growers in the United States, Europe, and Japan have focused on specialty products such as specialty cut flowers and seasonal products to compete with the global competition (Rabobank, 2015). Spacing of sunflowers is important for producing a successful crop. The size and quality of sunflowers can be influenced by the spacing of plants and vigor of sunflower cultivars. The grower must decide what market they are growing for to determine the optimal planting density (Mladenović et al., 2020). Sunflowers are grown both as an agronomic crop and specialty cut flower crop. Specialty cut flower growers are more interested in stems and flower sizes whereas for agronomic purposes growers are interested in seeds for the production of oil. For the production of cut flowers, growers are striving to pick a spacing that will produce marketable flowers by utilizing the available space. Sunflower growers should decide upon the optimum spacing and cultivar after considering the local market demand for the grade of stems and flowers. The purpose of this experiment was to evaluate the influence of plant spacing and sunflower cultivar on stem height, stem diameter, flower diameter, disk diameter, and days-to-harvest.

MATERIALS & METHODS

A field study was conducted at Stephen F. Austin State University and designed to evaluate sunflower cultivars and plant spacing on sunflower growth and development. Treatments consisted of four different spacings 30 × 30 cm, 23 × 23 cm, 15 × 15 cm and 8 × 15 cm and three sunflower cultivars 'Superior Gold', 'Pro Cut Gold' and 'Sunrich Lemon' (Figures 1, 2, & 3). Seeds were directly sown in the raised beds (365 × 121 × 61 cm) on May 6, 2020 (Figure 4). Two seeds at each location were sown and thinned to 1 plant. Each bed had all the four spacing treatments. The number of plants per row was 4, 5, 7 and 13 for the 30 × 30, 23 × 23, 15 × 15, and 8 × 15 cm spacing, respectively (n=64, n=80, n=112 and n=208). Raised beds were irrigated with drip irrigation every other day for the duration of the trial except for the days it rained. Sunflowers were harvested when the sunflower heads were fully developed and open (Figures 1, 2, & 3). The measurements taken for each stem harvested were stem height measured from the base of the ground, stem diameter approximately 2.5 cm below the flower, flower diameter, disk diameter and harvest date were recorded. In this experiment, the minimum standard for cut flowers used was a stem length of ≥ 60 cm, stem diameter of ≥ 5 mm, flower diameter of ≥ 8 cm and disk diameter of ≥ 3.8 cm (Wien 2016; Sloan and Harkness, 2010). Flowers were evaluated based on disk diameter to determine their dollar value per m^2. The standards based on USDA classify sunflowers based on their disk diameter. Disk diameters less than 3.8 cm were non-marketable. Flowers with disk diameters between 3.8-6 cm were worth $0.85, disk diameters of 6-8 cm were worth $1.00, and disk diameters over 8 cm were worth $1.50 (Wien, 2016). The experimental design was a randomized complete block design with four replications. The data was analyzed using SAS 9.2 with Two-Way ANOVA. A Tukey's Studentized Range Test was used to test significant differences between means with a probability level of 5%.

Figure. 1: 'Superior Gold'

Figure. 2: 'Pro Cut Gold'

Figure. 3: 'Sunrich Lemon'

Figure. 4: Raised beds

RESULTS

All three cultivars showed similar trends with stem height increasing as spacing increased (Figure 5). However only the 8×15 cm spacing was significantly shorter than the other spacings for the 'Superior Gold' and 'Sunrich Lemon' cultivars. The 'Superior Gold' cultivar resulted in significantly greater stem height compared to the 'Pro Cut Gold' and 'Sunrich Lemon' cultivars. However, all three cultivars produced marketable stem height for all four spacing treatments. There was a significant trend with stem diameter increasing as spacing increased between all four spacings (Figure 6). The 30×30 cm (9.8 mm) spacing had the largest stem diameter followed by the 23×23 (8.6 mm), 15×15 (7.0 mm), and 8×15 cm (5.6 mm) spacings, respectively. However, all three cultivars produced marketable stem diameters (≥ 5 mm) at all four spacings. Flower diameter showed a similar trend for all three cultivars, with flower diameter increasing as spacing increased (Figure 7). All three cultivars had a significantly smaller flower diameter for the 8×15 cm spacing compared to the other spacings. The 'Superior Gold' cultivar had a significantly larger flower diameter (17.2 cm) compared to the 'Pro Cut Gold' (14.0 cm), and 'Sunrich Lemon' (11.9 cm). However, all three cultivars produced marketable flower diameters (≥8 cm) at all four spacings. A similar trend of increasing disk diameter as spacing increased was observed for all three cultivars (Figure 8). Cultivars 'Pro Cut Gold' and 'Sunrich Lemon' showed significantly smaller disk diameters for the 8×15 and 15×15 cm spacings compared to the other spacings. Disk diameter increased with increasing vigor of the sunflowers with 'Superior Gold' producing the largest disk diameter (7.5 cm) followed by 'Pro Cut Gold' (5.9 cm) and 'Sunrich Lemon' (5.8 cm). All three cultivars produced marketable flowers based on disk diameter (≥3.8 cm) at all four spacings. Spacing had minimal effects on days-to-harvest, but there was a significant difference in cultivars days-to-harvest which would be attributed to genetic difference between cultivars (Figure 9). All three cultivars had a significant difference between the 8×15 cm spacing compared to the other three spacings. For the sunflower growth parameters, the largest sunflowers were associated with the most vigorous cultivar 'Superior Gold' and largest spacing (30×30 cm). However, when evaluating profits the greatest profit per m^2 was associated with the combination of the smallest spacing (8×15 cm) and the most vigorous cultivar (Figure 10). 'Superior Gold' declined in profits as spacing increased with 8×15 cm spacing producing $73.43 and 30×30 cm spacing producing $15.73 per m^2. The same trend occurred for both the 'Pro Cut Gold' and 'Sunrich Lemon' sunflower cultivars.

CONCLUSIONS

The initial results of this experiments indicate that marketable sunflowers can be produced at all four spacings and cultivar combinations. Stem height, stem diameter, flower diameter, and disk diameter for all three cultivars resulted in similar trends with increased sunflower growth and size with increased spacing. Conversely days-to-harvest decreased with increased spacing by approximately 2 days for each cultivar. Profits substantially increased with the combination of the most vigorous cultivar ('Superior Gold') and the smallest spacing (8×15 cm), while the least profit was the combination of least vigorous cultivar ('Sunrich Lemon') and the largest spacing (30×30 cm). This indicates that the increase in number of sunflower per m^2 in combination with increased sunflower size results in the greatest profit per m^2.

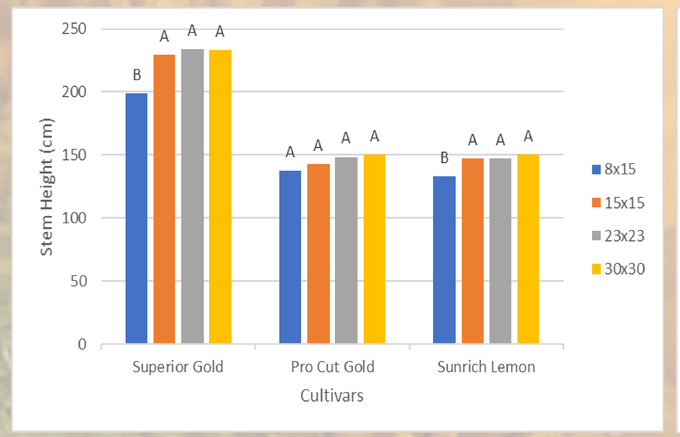

Figure 5: Effect of spacing and cultivar on stem height

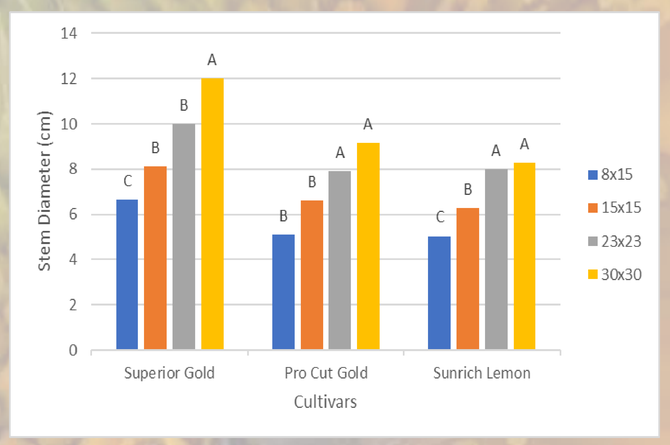

Figure 6: Effect of spacing and cultivar on stem diameter

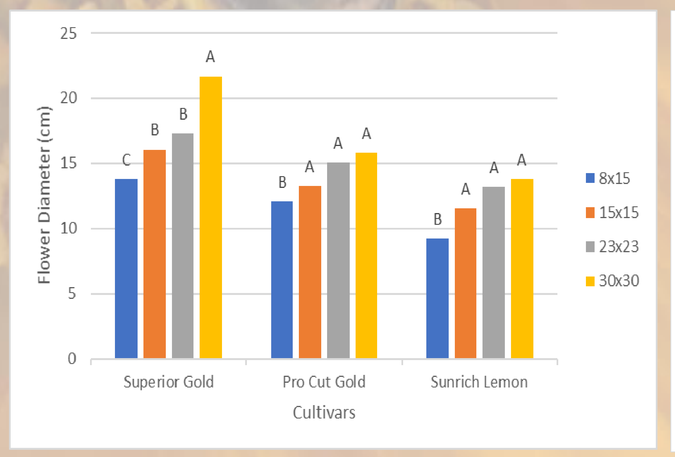

Figure 7: Effect of spacing and cultivar on flower diameter

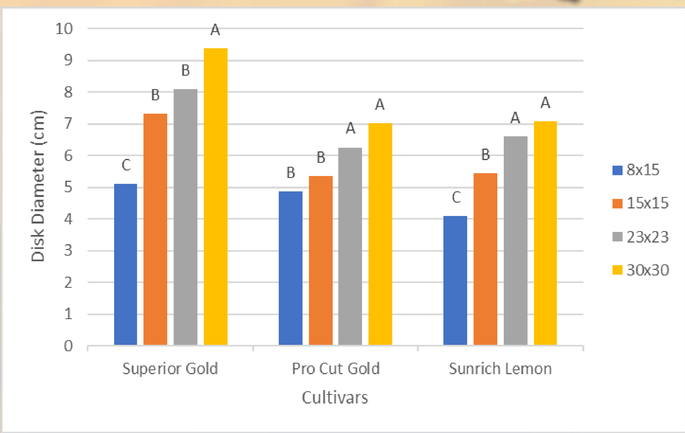

Figure 8: Effect of spacing and cultivar on disk diameter

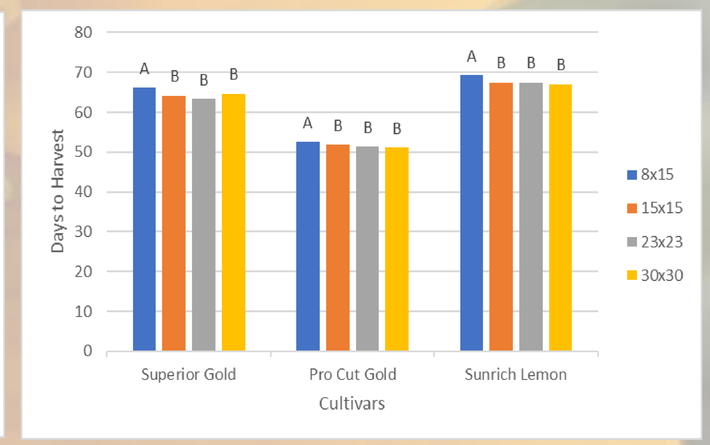

Figure 9: Effect of spacing and cultivar on days-to-harvest

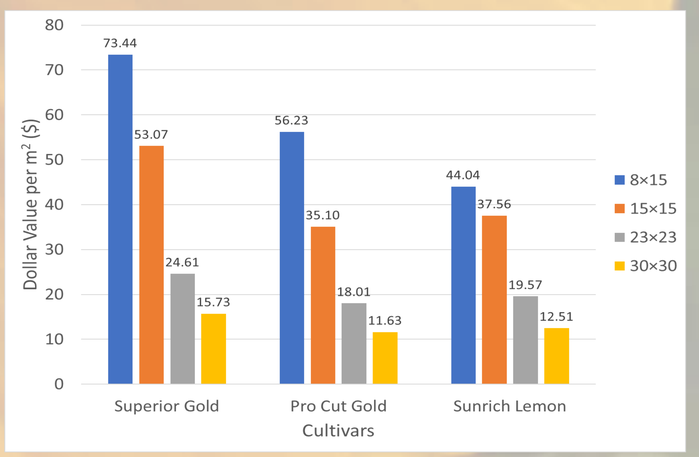

Figure 10: Effect of spacing and cultivar on profit

REFERENCES

Bachmann, J. 2006. Specialty Cut Flower Production and Marketing. NCAT, ATTRA.
Mladenović, E., S. Cvejić, S. Jocić, N. Ćuk, J. Čukanović, M. Jocković, and A. M. Jeromela. 2020. Effect of plant density on stem and flower quality of single-stem ornamental sunflower genotypes. Horticultural science (Praha), 47(1): 45-52. doi:10.17221/10/2019-HORTSCI
Rabobank. World Floriculture Map 2015. 2015. Rabobank Industry Note. 475.
Schoellhorn, R., E. Emino, and E. Alvaraz. 2003. Specialty Cut Flower Production Guides for Florida: Sunflower. University of Florida, Feb. 2003.
Sloan, R. C., and S. S. Harkness. 2010. Planting date and pinch treatments affect the growth of field-grown, cut-flower sunflower cultivars.
Wien, H. C. 2016. Pinching Sunflower Produces More Stems-What about Profits? The Cut Flower Quarterly , 14-15.