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A cauliflower cultivar trial was planted at the Southwest Michigan Research and Extension Center (42.081985, -86.354087, Benton Harbor, Michigan). Bejo (BJ), Clifton (CL), Sakata (SK), and Tozer (TZ) seed companies donated five cauliflower cultivars for plastic mulch-bedded hand harvest. The trial quality was good for collecting data on stressed plants and reduced population. A dry start and cabbage maggot attack reduced stand with replacement plants lagging behind, and heat around head formation created a high proportion of non-marketable heads.

Materials and Methods

On 13 Apr, five cauliflower cultivars were seeded into 72-cell trays and raised for 21 days in a greenhouse and 6 days in a shadehouse.

On 21 Apr, fertilizers were preplant incorporated to achieve 80 lb. N, 0 lb. P2O5, 60 lb. K2O, 25 lb. S, and 1 lb. B per acre (104 lb. 21-0-0-24S, 171 lb. 34-0-0, 100 lb. 0-0-60, 7 lb. 0-0-0-15B) in a field size of 0.05 acre. The soil type was a well-drained Oakville fine sand. On 5 May, black plastic mulch and drip tape was laid with 6 ft between beds. No fumigation was used.

On 11 May, cauliflower was transplanted, in a completely randomized design with four replications, two-rows per bed, 14 inches between rows, and 18 inches between holes in-row resulting in 16 plants per bed and a target plant population averaging 9,680 plants per acre. Two plants of a distinctly different variety were planted on either end of each plot to reduce picking errors between plots.

On 23 May, the fertigation schedule started, delivering an average of 24 lb. N per week per acre (13.2 gal. 18-0-0-5Ca-1.5Mg) for 9 weeks. Full season nutrient applications totaled 296 lb. N, 60 lb. K2O, 59.7 lb. Ca, 25 lb. S, 2.4 lb. B, 17.8 lb. Mg, 1.6 lb. Mn, and 3.2 lb. Zn.

No herbicides were applied. The bed-middles were rototilled and hand-hoed, and diseases were managed with a weekly rotation of standard fungicides. Thrips, aphids, and caterpillars were treated with four insecticides throughout the season.

Four reps of all cultivars were harvested and measured eight times starting 11 July (61 dap) through 28 July (78 dap). We harvested plants from each plot when the heads began reaching marketable sizes, until all heads were harvested. Heads were cut with 6-inch stems and were pregraded into No. 1, No. 2, and cull grade categories, and then measured for diameter and weighed individually. Size classes were assigned by the recorded diameters based on grower input: 16 ct (11 – 14 cm), 12 ct (15 – 18 cm), and 9 ct (19 – 20 cm). Yield data was analyzed with an analysis of variance (ANOVA) or non-parametric Kruskal-Wallis procedure followed by a Least Significant Difference (LSD) means separation.

Marketable head per plant, boxes per acre of each size class, and combined total clean yield in boxes per acre do not include culls. We determined yield per acre with the following equation.

$$\frac{1\ bx}{37.5\ lb} * \frac{1\ lb}{453.6\ g} * \frac{weight\ (g)}{plot} * \frac{1\ plot}{0.001652893\ ac} = \frac{1\ bx}{ac}$$

Results and Discussion

The season was characterized by dryness early on and cycles of heat in the mid-80's (Table 1). The dry start established aphids, and thrips as season long pests at low levels, and stressed plants initially. Our irrigation was not adequate at planting, and we replanted 7 days later. The replanted plants coincided with cabbage maggot egg-laying and the resulting stand averaged 40% less than our target population, averaging of 7,260 plants per are, with a range of 56%-90% of the intended stand across the plots. This delay resulted in only 70% of the remaining stand being harvested before other trials came on with their demands for time and labor. So, total yields are suppressed by these factors.

Total clean yield (16 ct + 12 ct + 9 ct) averaged 273.9 boxes per acre (Table 2, Figure 1). The top yielder was EZ Serenity, but there were no significant differences in yield with other cultivars. The check variety, SK Twister, was the earliest cultivar to mature, and EZ Serenity was the latest (Figure 2, Figure 3). Both BJ Alcala and EZ Serenity had a more concentrated harvest window than the other varieties.

Heads classified as No. 2 lacked togetherness in curd formation or expressed uneven bead sizes, and averaged 6.5% of the total yield across cultivars (Table 3).

Culls had more advanced symptoms of the qualities listed for No. 2 heads, and also discoloration from heat stress. Cull rates averaged 38.8% (Table 3), due to summer heat.

Pictures

Pictures were taken at the peak harvest for each respective cultivar, and arranged in that order in Figure 4. Each box represents a combination of heads from multiple replicate plots.

Acknowledgements

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Table 1. Weather data summarized by weeks between 11 May and 26 July at the Southwest Michigan Research and Extension Center in 2023. Temperatures are the maximum reached for the week, and precipitation is total number of inches received for that week. *Week is reported as week of the year (week of the trial).

Week*	Daytime High (F)	Nighttime High (F)	Precipitation (inches)
19 (1)	81.4	63.3	0.1
20 (2)	74.1	50.9	0.1
21 (3)	82.8	55.8	0.0
22 (4)	90.6	66.2	0.0
23 (5)	83.9	56.1	0.0
24 (6)	83.4	54.2	0.7
25 (7)	89.8	65.7	0.3
26 (8)	86.5	68.9	1.6
27 (9)	89.4	67.8	1.2
28 (10)	86.6	67.2	1.1
29 (11)	84.3	61.6	0.0
Mean	84.8	61.6	0.5

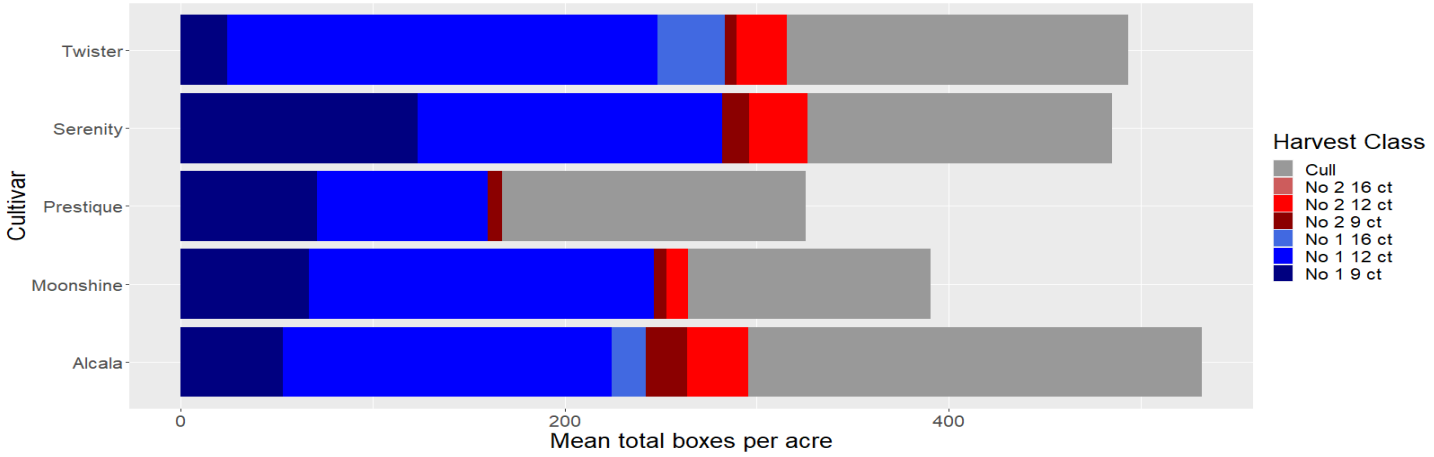

Figure 1. Mean total boxes per acre of cauliflower with each harvest class stacked to show their distribution within the total yield. Heat-related culls were prevalent, and only 70% of the total number of plants were picked due to other trials competing for time and labor.

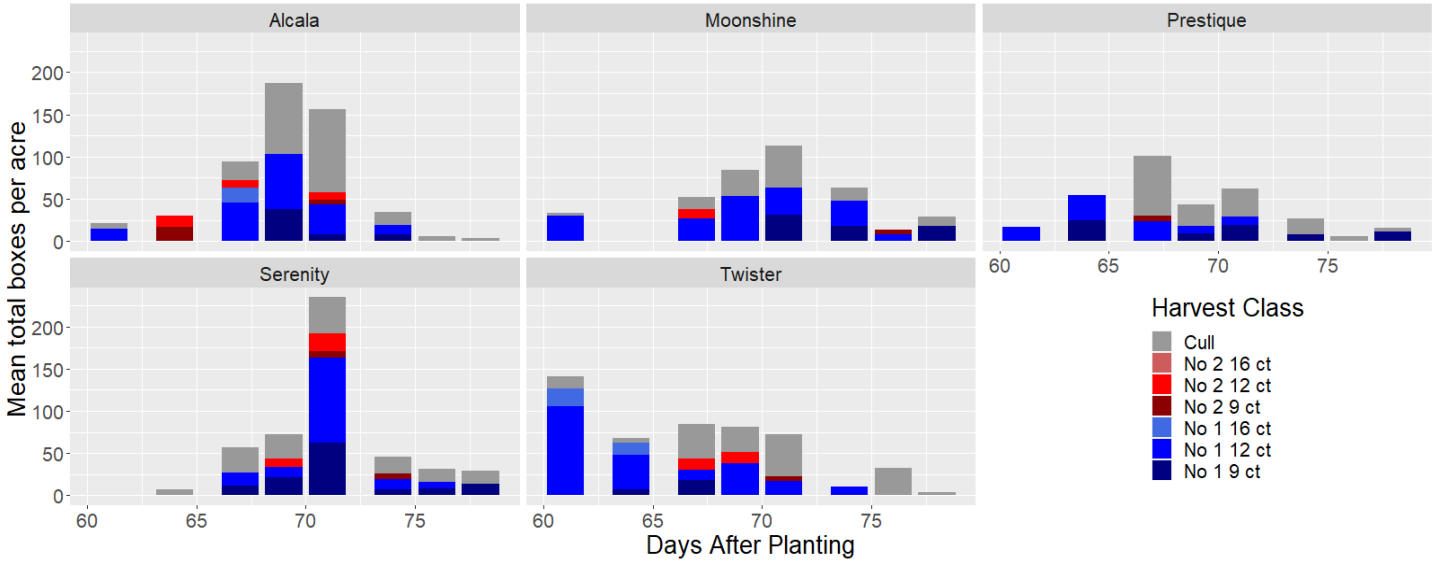

Figure 2. Mean total boxes per acre of cauliflower at each harvest, with harvest class stacked to show their distribution within the total yield on each picking date. This graph makes it easy to see where harvests were concentrated through the picking window for each cultivar, and the pack out for each pick. Eight harvests occurred from 11 July (61 dap) through 28 July (78 dap). Heat-related culls were prevalent, and only 70% of the total number of plants were picked due to other trials competing for time and labor.

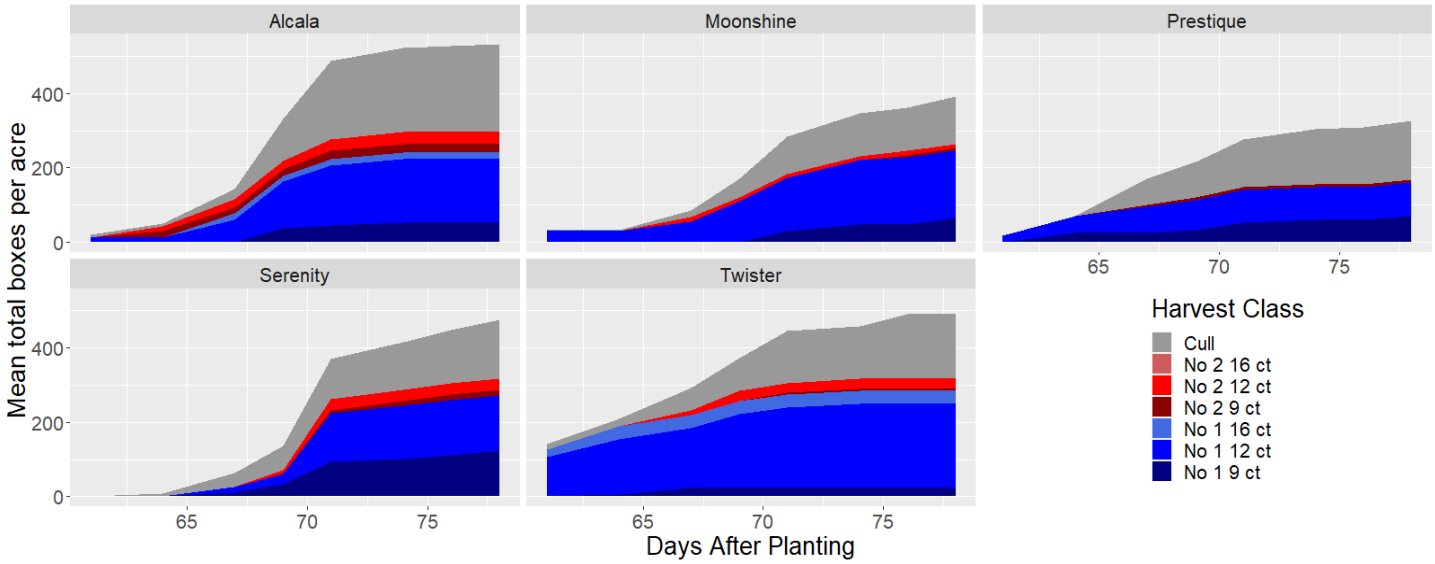

Figure 3. An accumulation graph showing mean total boxes per acre of cauliflower at each harvest, compounding throughout the picking window. This graph makes it easy to see how quickly the cultivar produces its total pack out and can be used to determine when it makes sense to stop picking based on total yield and breakeven. Eight harvests occurred from 11 July (61 dap) through 28 July (78 dap). Heat-related culls were prevalent, and only 70% of the total number of plants were picked due to other trials competing for time and labor.

Table 2. Mean yield data of five cauliflower cultivars at the Southwest Michigan Research and Extension Center in 2023. Data in these tables are arranged in order of largest mean total yield in clean boxes per acre (16 ct + 21 ct + 9 ct), with a box representing 37.5 lb. of cauliflower. There were no significant differences in yield.

Company and Cultivar	Clean Total	No. 1 16 ct	No. 1 12 ct	No. 1 9 ct	No. 2 16 ct	No. 2 12 ct	No. 2 9 ct	Culls	Marketable Pieces per Plant	Plants per Acre
EZ Serenity	326.5	123.5	158.5	0.0	14.3	30.1	0.0	158.8	4840.0	7713.7
CHECK SK Twister	316.0	24.3	224.2	35.1	5.8	26.6	0.0	177.6	3630.0	7562.5
BJ Alcala	295.5	53.6	171.2	17.4	21.9	31.5	0.0	236.4	4537.5	8772.5
EZ Moonshine	264.3	66.8	179.9	0.0	6.2	11.4	0.0	126.2	3932.5	6806.2
EZ Prestique	167.3	70.9	89.1	0.0	7.3	0.0	0.0	158.1	2571.2	5445.0
Std.Dev	64.2	36.1	48.9	15.7	7.0	13.7	0.0	40.7	884.5	1233.4
Mean	273.9	67.8	164.6	10.5	11.1	19.9	0.0	171.4	3902.2	7260.0
CV	23.4	53.2	29.7	149.4	62.7	68.8	NA	23.8	22.7	17.0
Test stat (4, 15)	H=3.2571	F=2.723	H=1.5294	H=3.1711	H=1.5091	F=1.027	NA	F=0.92	H=4.2508	F=2.558
P-value	0.516	0.069	0.821	0.530	0.825	0.425	NA	0.478	0.373	0.082
LSD (α=0.05)	ns	ns	ns	ns	ns	ns	NA	ns	ns	ns

Table 3. Percentage of yields for each harvest class. The order of the cultivars is a continuation of Table 2.

Company and Cultivar	No. 1 16 ct	No. 1 12 ct	No. 1 9 ct	No. 2 16 ct	No. 2 12 ct	No. 2 9 ct	Culls	No. 2	No. 1
EZ Serenity	25.5%	32.7%	0.0%	2.9%	6.2%	0.0%	32.7%	9.2%	58.1%
CHECK SK Twister	4.9%	45.4%	7.1%	1.2%	5.4%	0.0%	36.0%	6.6%	57.4%
BJ Alcala	10.1%	32.2%	3.3%	4.1%	5.9%	0.0%	44.4%	10.0%	45.5%
EZ Moonshine	17.1%	46.1%	0.0%	1.6%	2.9%	0.0%	32.3%	4.5%	63.2%
EZ Prestique	21.8%	27.4%	0.0%	2.2%	0.0%	0.0%	48.6%	2.2%	49.2%
Mean	15.9%	36.7%	2.1%	2.4%	4.1%	0.0%	38.8%	6.5%	54.7%

Figure 4. Pictures were taken at the peak harvest for each respective cultivar, and arranged in that order here. Each box represents a combination of heads from multiple replicate plots.
Top row left to right: CHECK SK Twister on 11 July, EZ Prestique on 17 July, BJ Alcala on 19 July.
Bottom row left to right: EZ Moonshine on 19 July, EZ Serenity on 27 July.