LEAFY GREEN CULTIVAR TRIAL

for Late Spring Production

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Leafy Green Cultivar Trial for Late Spring Production

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ABSTRACT

Nine leafy greens were grown and evaluated for heat tolerance at the Mississippi Agricultural and Forestry Experiment Station's (MAFES) Truck Crops Branch in Crystal Springs, Mississippi, to identify the top-performing cultivars for late spring production. The objective was to evaluate their performance under heat stress and their response to longer days and hotter months of the year. Additionally, bitterness and visual appearance were evaluated. Plots were established on June 3, 2024, in three raised beds amended with N-P-K based on soil test recommendations. Plants were watered through drip irrigation, and temperature and rainfall data were collected. Field day attendees rated leafy greens based on appearance to gather visual preference data. In addition, a sensory panel was formed to evaluate the bitterness of each cultivar. The height and width of each lettuce head were obtained at the end of the trial. The plants were harvested on June 24, 2024, and weighed to obtain fresh weights. Cultivars Muir and Sunland germinated poorly. Muir was resown on May 13, 2024, planted on June 12, 2024, and harvested on July 15, 2024. All cultivars survived the duration of the trial period. None of the cultivars bolted—the reproductive statge of flowering and seed production—before the harvest date. The leafy greens were generally healthy throughout the trial; however, some cultivars, especially Green Saladbowl and Muir, developed stunted heads with brown spots on the lower leaves, and thrips were present. These cultivars also had the most culls. We found that cultivar significantly impacted fresh weights. Tokyo Bekana was the most vigorous and had the highest fresh weight, while Green Saladbowl had the lowest weight of the tested cultivars. Leafy green cultivars Adriana and Tokyo Bekana received the most votes for visual appeal. Tokyo Bekana, had the lowest bitterness of any cultivar tested. Starfighter was among the least bitter lettuce cultivars. Lettuce Cherokee was described as inedible and bitter by all panelists.

INTRODUCTION

Lettuce and other leafy greens are typically grown as a cool weather crop, germinating and growing best at soil temperatures under 70°F. Southern growers face many challenges growing leafy greens in warmer areas. Some of these include low germination rates due to high soil temperature, bolting in temperatures over 85°F, and tip burn. Bolting signals the change from vegetative growth to reproductive growth. Once greens bolt and enter the reproductive stage, they become bitter and tougher in texture. Factors that induce bolting, like high temperatures, would directly increase bitterness as a result. Some studies suggest that higher temperatures and longer days have an effect on bitterness by increasing the phenolic content. Heat-tolerant and bolt-resistant cultivars have been developed over time, which extend the planting window into hotter months of the year. Our aim was to evaluate and identify top-performing leafy green cultivars for late spring production in Mississippi. Nine heat-tolerant cultivars (eight lettuce cultivars and one Asian green) were grown at the MAFES Truck Crops Branch in Crystal Springs, Mississippi, to evaluate their performance under heat stress. Additionally, our aim was to evaluate bitterness and visual appeal of the tested cultivars.

MATERIALS & METHODS

Johnny's Selected Seeds supplied eight leafy green cultivars for evaluation. Bauer (Vitalis Organic Seeds) was also included in the trial. Six of the cultivars were pelleted, including Adriana, Cherokee, Salanova, Green Batavia, Muir, Starfighter, and Sunland. The other three cultivars that were not pelleted were Bauer, Green Saladbowl, and Tokyo Bekana. Germination testing by the company for Sunland and Muir was completed on August, 2023; the remaining cultivars had other germination testing dates. They were sown in 72-cell plug trays filled with Pro-Mix BX media amended with Osmocote plus (15-9-12, N-P-K). The sowing dates were determined based on the maturity dates (i.e., days to harvest [DTH]) to ensure that the cultivars would mature on June 20, 2024. (See Table 1.) Following sowing, the seedlings were grown for 4 weeks in a climate-controlled greenhouse and hardened off before transplant. Plugs were fertigated daily with weekly rotations of 150 ppm N of 20-10-20 and 150 ppm 15-5-15.

On June 3, 2024, plugs were transplanted into 8-inch-tall, raised beds containing native soil and amended with N-P-K based on soil test recommendations. Three leafy green cultivars were planted in three separate beds and consisted of 16 plants per each for cultivar, except for Muir and Sunland, which had eight plants each due to low germination rates. Subsequently, a drip irrigation system featuring emitters spaced at 12" intervals was installed to supplement rainfall. Temperature and rainfall data are collected daily with an onsite weather station.

Samples presenting stunting and leaf necrosis were sent to Mississippi State University's Diagnostics Lab for virus, insect, and pathogen screening. Tomato Spotted Wilt, Impatiens Necrotic Spot, and Cucumber Mosaic Viruses were included in the testing. Potyvirus testing was not available.

Attendees of the 1st Day of Summer Field Day on June 20, 2024, were given two flags each to rate the leafy green trial entries based on appearance to gather consumer preference ratings. The height and width of each lettuce head were obtained at the end of the trial. The height was measured from the soil line to the top of the lettuce, and the width was measured from the outermost leaves of the lettuce head. The plants were harvested on June 24, 2024, and weighed on June 25, 2024, to obtain fresh weights. To harvest, six heads were randomly selected from each plot and weighed. The heads were cut 1.5" above the soil line. The remaining heads were left to obtain the bolting date (DTB), which we defined as the date when elongation of the main stem became evident. A sensory panel of four participants evaluated each leafy green cultivar for bitterness after fresh weights were obtained. Texture and taste were evaluated. Bitterness was scored on a scale of 1 to 5, with 5 being the most bitter.

To determine the statistical significance of yield and size among cultivars, least squares means separation was calculated in JMP Pro, version 17.

RESULTS

Weather data

Extending the season for locally produced lettuce is important for increasing its quality during the late spring and early summer months. However, many lettuce cultivars become too bitter due to the extreme heat we experience in central Mississippi. The Truck Crops branch experienced hot temperatures during the trial, including June 10, which reached 103°F. Plants received heavy rainfall the week they were planted (over 3.4 inches), but rain amounts were much lower for the remainder of the trial. Nighttime low temperatures were in the mid- to upper-60s throughout the trial (Figure 1).

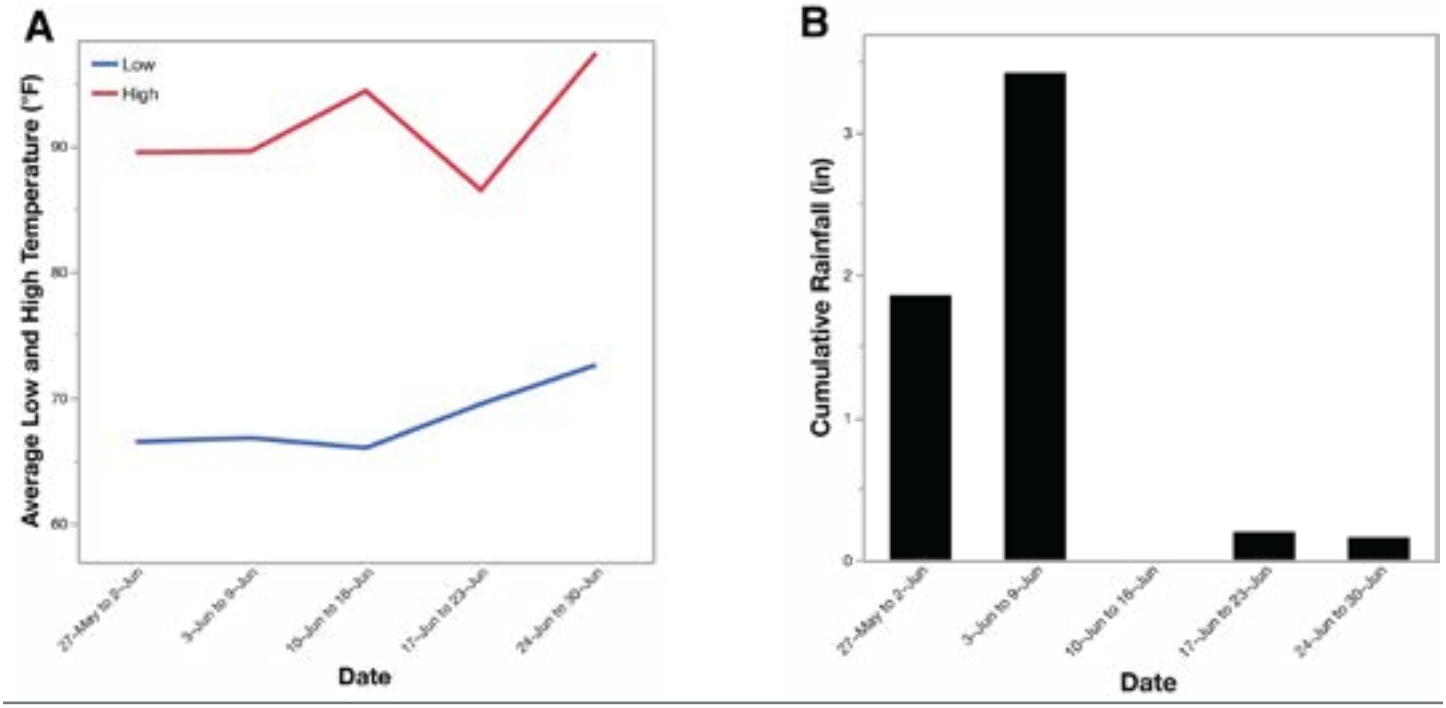

Figure 1. Truck Crops trial period weather data: A) Semi-monthly high and low mean temperature readings, B) Cumulative rainfall.

Survival and marketable yield percentages

All cultivars survived the intense heat of the late spring trialing period. Generally, the lettuce grew rapidly after transplant. Cultivars Muir and Sunland displayed poor germination. Less vigor in lettuce head formation was observed in cultivars Green Saladbowl and Salanova Green Batavia. Asian green Tokyo Bekana was observed to be the most vigorous cultivar. Tokyo Bekana also held the highest percentage of marketable yield (93.7%) with a 100% survival rate. Adriana and Bauer were not far behind in marketable yield with 93.7%. Muir had the lowest marketable yield with 62.5% and the highest culls at 37.5%. Muir also held one of the lowest survival ratings along with Bauer at 87.5%. Muir and Sunland had poor germination and had to be resown on May 13, 2024 (Table 1 and Figure 2).

RESULTS

Figure 2. Leafy green trial plots. Photos taken June 24, 2024.

Table 1. Leafy green yield quality and survival.

Cultivar	Marketable yield (%)	Cull yield (%)	Survival rate (%)
Adriana	93.7	6.3	100
Bauer	93.7	6.3	87.5
Cherokee	81.2	18.8	93.8
Salanova Green Batavia	81.2	18.8	100
Green Saladbowl	68.7	31.3	93.8
Muir	62.5	37.5	87.5
Starfighter	81.2	18.8	100
Sunland	87.5	12.5	100
Tokyo Bekana	100	0	100

RESULTS

Bolting dates

None of the cultivars bolted before the harvest date. Muir and Sunland had the shortest juvenile period with just, 59 days. While cultivars Bauer and Salanova Green Batavia had the longest juvenile periods of 79 and 76 days, respectively (Table 2).

Table 2. Sowing dates for leafy greens, harvest date (DTH), and bolt date (DTB).

Type	Cultivar	DTH	DTB	Sowing Date	Harvest Date
Butterhead	Adriana	48	69	5/3/2024	06/24/2024
Oakleaf	Bauer Green	58	79	4/23/2024	06/24/2024
Summer Crisp	Cherokee	48	69	5/3/2024	06/24/2024
Batavia	Salanova Green Batavia	55	76	4/26/2024	06/24/2024
Oakleaf	Green Saladbowl	49	70	5/2/2024	06/24/2024
Summer Crisp	Muir*	50	59	5/1/2024	07/15/2024
Leaf Lettuce	Starfighter	52	73	4/29/2024	06/24/2024
Romaine	Sunland*	56	59	4/25/2024	06/24/2024
Asian Green	Tokyo Bekana	45	66	5/6/2024	06/24/2024

*Muir and Sunland were resown on 5/13/2024 due to poor germination; however, Sunland continued to germinate poorly. As a result, only eight plants were available and used, instead of the intended 16.

Disease and insect results

The leafy greens were generally healthy throughout the trial; however, some cultivars developed stunted heads with brown spots on the lower leaves. The samples were evaluated for plant pathogens and insects, but only thrips could be found. Thrip damage was heaviest on cultivars Green Saladbowl and Muir. They tested negative for viral infection. Potyvirus testing was not conducted, so it cannot, therefore, be ruled out.

Leafy green yields

Cultivar significantly impacted fresh weights (Figure 2 & 3). Tokyo Bekana was the most vigorous and had the highest fresh weight. Green Saladbowl was less vigorous and has the lowest fresh weight of the tested cultivars. Starfighter and Sunland had notably higher fresh weights than the remaining cultivars.

RESULTS

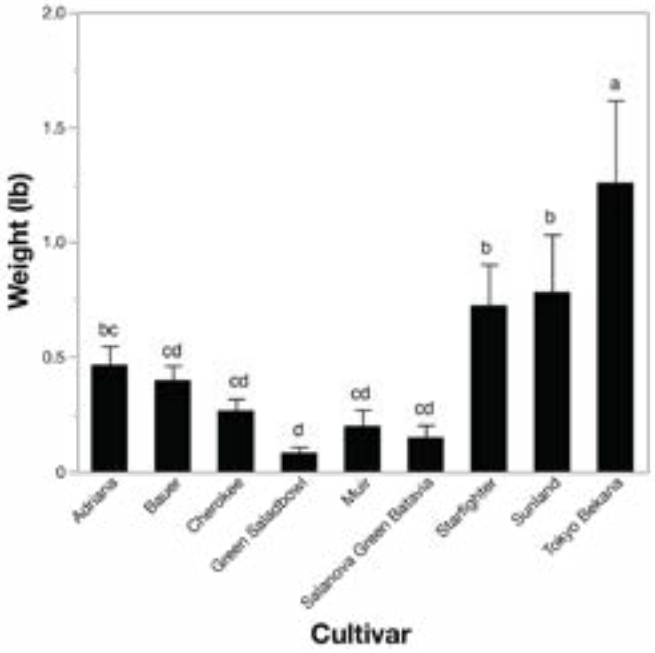

Figure 3. Leafy green fresh weights. Muir was not weighed due to delayed germination and poor vigor. Cultivars sharing the same letters are not statistically significant.

Consumer visual preference data

Leafy green cultivars Adriana and Tokyo Bekana received the most visual appeal votes, both receiving 18 each. Several cultivars received no votes or just one vote due to the lack of visual appeal (Table 3).

Table 3. Consumer preference ratings of leafy greens.

Type	Cultivar	Votes
Lettuce	Adriana	18
Lettuce	Bauer	0
Lettuce	Cherokee	11
Lettuce	Salanova Green Batavia	0
Lettuce	Green Saladbowl	1
Lettuce	Muir	0
Lettuce	Starfighter	11
Lettuce	Sunland	1
Asian Green	Tokyo Bekana	18

RESULTS

Sensory evaluation

Every leafy green cultivar produced crisp, tender leaves and would be suitable for culinary use in terms of their textural appeal. While no cultivars exhibited bolting characteristics at harvest and tasting, many cultivars were found to be bitter. Asian green and Tokyo Bekana had the lowest bitterness of any cultivar tested. The panel described the leaves as peppery and flavorful. Starfighter and Bauer were found to be the least bitter lettuce cultivars. Some panelists described their flavors as mild with some bitterness that a dressing could mask. Adriana was found to be slightly more bitter than Starfigher and Bauer. Lettuce Cherokee scored a unanimous rating of 5 and was described as inedible and bitter by all panelists (Figure 4).

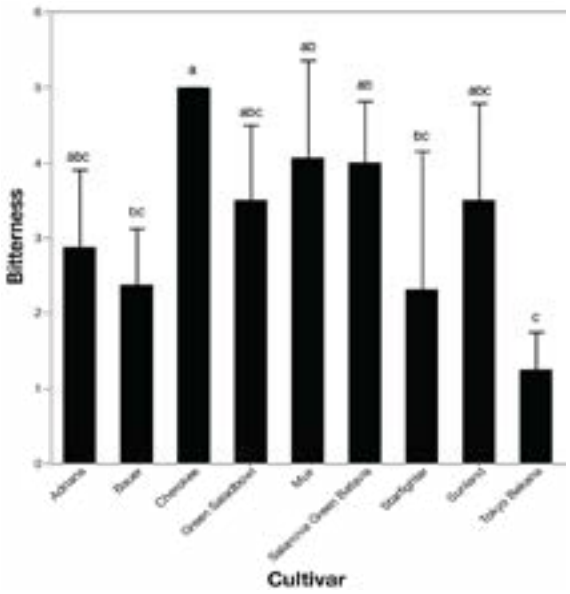

Figure 4. Leafy green bitterness sensory panel evaluation. Bitterness was based on a scale of 1 to 5, with 1 being the least bitter and 5 being the most bitter. Cultivars sharing the same letters are not statistically significant.

CONCLUSION

All cultivars survived the late spring trialing period, although they varied in performance due to the intense heat and insect pressure from thrips. Based on our findings Asian Green, Tokyo Bekana, was the overall best cultivar evaluated. With a 100% survival rate with 0% culls, it also received the highest visual appearance rating as well as being the most preferred cultivar in terms of taste. Other top-performing cultivars were Adriana, Bauer, and Sunland. All producing high marketable yield percentages and a less bitter taste. Although Bauer did not perform as well as other cultivars in vigor, survival rate, and visual appearance. Salanova Green Batavia, Muir, and Cherokee had the lowest fresh weights and were the most bitter. Green Saladbowl and Muir suffered the greatest amount of thrips damage, impacting their overall performance. Although the cultivar Cherokee was found to be visually appealing to some consumers, cooler temperatures may result in higher sensory panel scores.

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