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Soil System Effects on Lettuce Variety Performance: Research-Based Education for Agents and Volunteers

Abstract

Lettuce is widely grown for its adaptability in numerous growing systems. This project studied the effects of soil and container types on fresh weights using ‘Green Forrest’ and ‘Vulcan’ lettuce varieties. Findings in four trials revealed significant responses to soil/container combinations of lettuce grown in containers with Pro-mix soil having greater fresh weight when compared to lettuce grown in containers with Sta-Green Mix soil and lettuce grown in raised beds with a topsoil mix. Results found Green Forest to have greater fresh weights than Vulcan in all trials. Agents and volunteers can share this information with Extension clientele.

Introduction

Lettuce is a widely produced and highly consumed vegetable globally and is a staple in the human diet. It is a cool-season vegetable that grows best between a temperature range of 45 - 75°F (Sublett et al., 2018). Excessive heat can be harmful by stressing the plant and lowering its’ nutritional quality and yield (Pereira, et al., 2024). In the south, lettuce is primarily produced during the spring and fall months as preferable temperatures prevail.

Lettuce is a preferable plant due to its adaptability in different growing systems and is ideal for studying the impacts of soil types on plant growth (Dufault et al., 2009). Gardening with containers is beneficial for small spaces and limited budgets and provides mobility and control over soil quality. This study explored the effects of soil and container types on fresh weight lettuce varieties and how this information can help Extension agents and volunteers educate clientele.

Plants were grown in Pro-Mix soil, Sta-Green soil, and a raised bed in the spring and fall of 2023 and 2024. Fresh weight was collected and found significant responses to soil/container combinations. This work shows Extension agents, volunteers, and clientele easy, inexpensive methods to trial plants and products in small areas while keeping costs to a minimum.

Materials and Methods

Lettuce variety trials compared different soil and container types during the spring and fall for two years at the North Mississippi Research and Extension Center in Verona, Mississippi. *Lactuca Sativa* 'Green Forest' (GF) and 'Vulcan' (V) Lettuce seeds were purchased from Johnny's Selected Seeds (Fairfield, ME, USA). These specific varieties were selected due to known performance ability in the growing region and from previous research trials at this location (Ayankojo et. al, 2025; Adhikari, 2024). Seeds were sown into trays in a greenhouse in early March for spring trials and early September for fall trials. Seedlings were transplanted after 28 days into respective containers or raised beds.

The trial had eight City-Pickers containers with Pro-Mix Soil and eight with Sta-Green Flower & Vegetable Garden Soil (Figure 1) with six lettuces (3 GF & 3 V) per container and four containers in each block (Figure 2).

Figure 1. Soil brands used in containers.

Figure 2. Lettuce growing in City-Pickers Containers.

There was also a pre-existing raised bed equivalent to 16 City-Pickers containers containing 70% ground pine bark, 20% red sand, and 10% topsoil mix. It was planted alternately with both lettuce varieties, six GF and six V in each block. Beds had previously been used for plant trials but had been unused and unfertilized 12 months before the study began.

Plots were fertilized at planting with a slow-release Osmocote Vegetable Food (14-14-14) at a rate of 1.9 ounces per container or per 4 square feet of raised bed area. Plots were treated and maintained equally, with the only difference being soil type or having a container. Irrigation was equal for all plots and was provided with an oscillating sprinkler as needed. Plants were harvested around 35 days after transplanting. Fresh mass (FM) (Figure 3) and dry mass (DM) data were recorded across treatments with only fresh mass data being reported here.

Figure 3. Lettuce weighed for fresh mass.

Extension agents, volunteers, and the public were invited to view the trial at various field days and educational events during the two-year process.

Statistical analysis was performed using SAS (version 9.4; SAS Institute, Cary, NC). Data was analyzed using PROC GLIMMIX analysis of variance (two-way ANOVA) followed by mean separation. The standard errors were based on the pooled error term from the ANOVA table. Tukey's test ($p \leq 0.05$) was used to differentiate between genotype classifications and treatment. Year was analyzed separately due to significance $p < 0.001$.

Results

Data from all four seasons indicated Green Forest lettuce fresh weight to be significantly greater than Vulcan lettuce fresh weight (Table 1). This is likely due to the Green Forest variety naturally producing a larger amount of foliage (fresh weight), per the seed supplier description (Johnny's, 2023).

Table 1. Mean Fresh Weight in Ounces by lettuce variety, year, and season.

Variety	Spr '23	Spr '24	Fall '23	Fall '24
GF	**7.19**	**4.20**	**2.45**	**8.23**
V	4.75	2.89	1.96	5.57
P-Value	0.0001	0.0001	0.0005	0.0001

GF=Green Forest, V=Vulcan

Results from all four trials indicated lettuce grown in containers having Pro-Mix soil had a fresh weight that was significantly greater ($P < 0.0001$) than lettuce grown in Sta-Green soil and lettuce grown in raised beds. Lettuce fresh weight was also significantly greater ($P < 0.0001$) in three of four trials when grown in Sta-Green soil as compared to lettuce grown in a raised bed (Table 2). Pro-Mix soil contained no additional fertilizers while Sta-Green soil contained trace amounts of N 0.05, P 0.04, and K 0.03. The Sta-Green soil was purchased 15 months prior to the trial, and it is unlikely this fertilizer amount influenced results. Results could be different if freshly purchased soil containing fertilizer was utilized.

Table 2. Mean Fresh Weight in Ounces by soil type, year, and season.

Soil Type	Spring '23		Spring '24		Fall '23		Fall '24	
P	**7.51**	**A**	**4.96**	**A**	**3.62**	**A**	**9.89**	**A**
S	5.97	B	3.42	B	2.48	B	7.83	B
RB	5.91	B	2.25	C	0.53	C	2.97	C

P = Pro-Mix, S = Sta-Green Mix, RB = Raised Beds

Soil by variety was not significantly different in spring 2023 ($P = 0.12$) or spring 2024 ($P = 0.08$). Soil by variety was significant in fall 2023 ($P < 0.0002$) and fall 2024 ($P < 0.0001$) (Table 3). Green Forest outperformed the Vulcan lettuce in the Pro-Mix and Sta-Green soils both years, and in the raised bed one year. As stated earlier, Green Forest produces a larger plant than Vulcan and therefore a greater fresh weight naturally. Vulcan lettuce did outperform Green Forest in the raised bed in the first fall trial.

Table 3. Mean Fresh Weight in Ounces by lettuce variety, soil, and year.

Year	Variety	Soil	Mean Fresh Weight	
2023 Fall	**GF**	**Pro-Mix**	**4.10**	**A**
	V	Pro-Mix	3.10	B
	GF	Sta-Green	2.82	B
	V	Sta-Green	2.11	C
	V	Raised Bed	0.65	D
	GF	Raised Bed	0.41	D
2024 Fall	**GF**	**Pro-Mix**	**11.50**	**A**
	GF	Sta-Green	10.02	B
	V	Pro-Mix	8.29	C
	V	Sta-Green	5.66	D
	GF	Raised Bed	3.17	E
	V	Raised Bed	2.77	E

GF=Green Forest, V=Vulcan

Both Green Forrest (GF) Lettuce (Figure 5) and Vulcan (V) Lettuce (Figure 6) performed best in containers with Pro-Mix soil.

Figure 5. Green Forest in Pro-Mix

Figure 6. Vulcan in Pro-Mix.

A total of four educational events were held across both years where over 200 participants including Extension agents, volunteers, and home gardeners learned about container vegetable production and how they can implement the results in home landscapes.

Conclusions

Growing lettuce and other crops in containers are known to be an effective production method. Both Green Forest and Vulcan lettuce varieties grown in containers produced more fresh weight than lettuces grown in raised beds. Using Pro-mix soil over the Sta-Green soil mix also provided greater fresh weight when both were used as container media. Green Forest had greater fresh weights across the trials but naturally produces a larger plant.

Using a quick-release or water-soluble fertilizer could potentially produce enough growth to reach harvest sooner hopefully without compromising total fresh weight. Future testing will compare more soil types along with other crops. Trials of this nature could be performed by Extension agents or volunteers in any geographic location and with numerous crops to determine the best local production methods. This knowledge could then be beneficial to hobby farmers, homeowners, and volunteers.

Literature Cited

Ayankojo, I.T., Horgan, T., and Wilson, J**.** (2025) Effects of Supplemental Lighting on Lettuce Growth, Yield, and Water Use During Winter Season in North Mississippi. *Agronomy*, July, 15(7), 1635, https://doi.org/10.3390/agronomy15071635.

Bikash Adhikari, Omolayo J. Olorunwa, Thomas Horgan, Jeff C. Wilson, Casey Barickman, Tongyin Li, and Raju Bheemanahalli.(2024) Seed priming attenuates the effect of salt stress and improves the yield performance of Lettuce. *Journal of Agriculture and Food Research,* March, Vol 15, https://doi.org/10.1016/j.jafr.2023.100947.

Dufault, R. J., Ward, B., & Hassell, R. L. (2009). Dynamic relationships between field temperatures and romaine lettuce yield and head quality. *Scientia Horticulturae*, *120*(4), 452–459. https://doi.org/10.1016/j.scienta.2009.01.002.

Johnny's Select Seeds, 2023.

Pereira, M.C., N. O. S. Souza, W. M. Nascimento, G. O. da Silva, C. R. da Silva, and F. A. Suinaga. (2024) Stability Evaluation for Heat Tolerance in Lettuce: Implications and Recommendations, *Plants*, 13(11), 1546, https://doi.org/10.3390/PLANTS13111546.

Sublett, W.L., T. C. Barickman, and C. E. Sams. (2018) The Effect of Environment and Nutrients on Hydroponic Lettuce Yield, Quality, and Phytonutrients. *Horticulturae*, 4(4), 48, https://doi.org/10.3390/HORTICULTURAE4040048.