



## INTRODUCTION

Organic vegetable growers are interested in utilizing the ‘soil block’ method for transplant production as an alternative to plastic flats. The soil block method compresses growing media into a freestanding block in contrast to the cells of a plastic flat. Anecdotal evidence of soil block grown transplants with increased vigor and root development exists, but limited research has been conducted to evaluate these claims. Furthermore, identifying commercial growing medium appropriate for the soil block method is needed within organic transplant production. The objective of this study was to compare growth parameters and root system development of cucumber and pepper transplants grown in soil blocks and plastic flats, in combination with four commercially available certified organic media (‘Soil Blocking Mix’, Beautiful Land Products, Tipton, IA (BLP); ‘Green Potting Soil’, Cowsmo, Cochrane, WI (Cowsmo); ‘Seed Starter Mix’, Purple Cow Organics, Middleton, WI (Purple); ‘Fort Vee’, Vermont Compost Company, Montpelier, VT (Vermont)). A volume based 50% peat, 25% compost, 13.5% perlite, and 13.5% vermiculite growing medium was also evaluated. This research furthers our understanding of the soil block method and is valuable for organic transplant producers in the Midwestern US and beyond.

## MATERIALS & METHODS

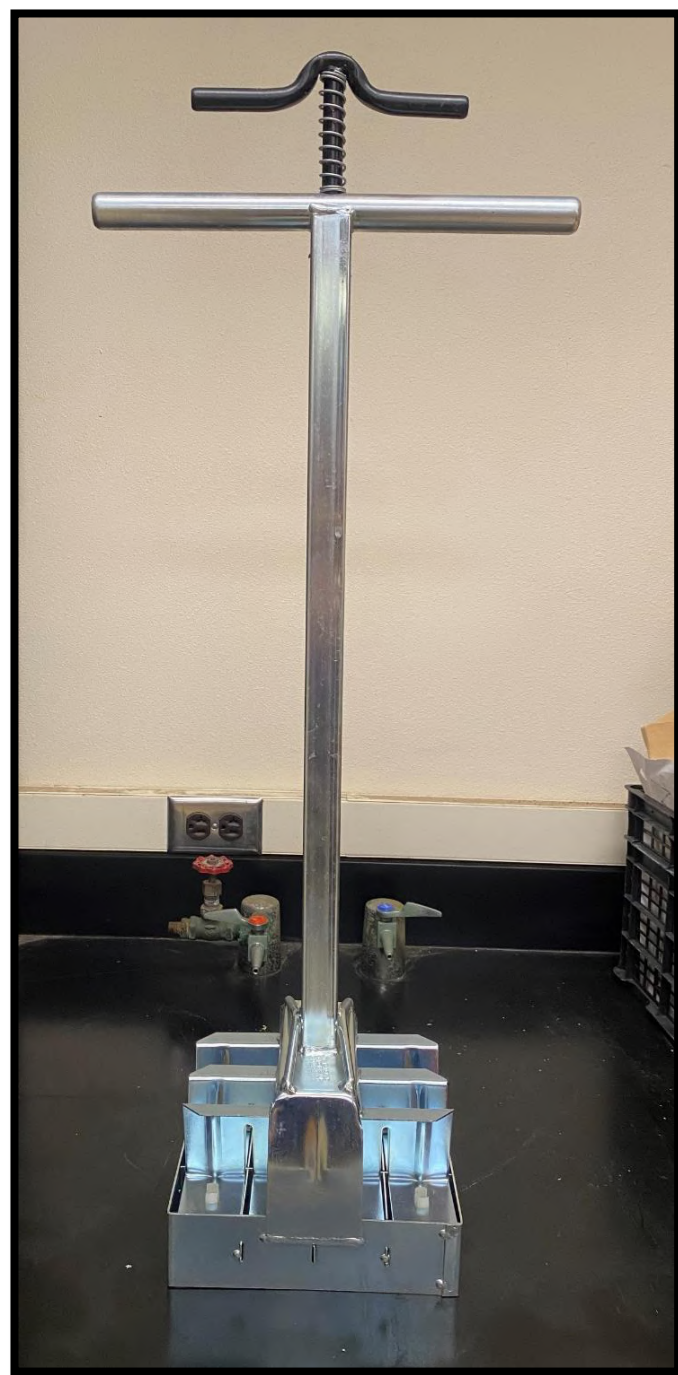


Figure 1. Stand-up 12 Soil Blocker, Johnny's Selected Seeds, Fairfield, ME.



Figure 2. Experimental setup at the Iowa State University Horticulture greenhouse, Ames, IA.

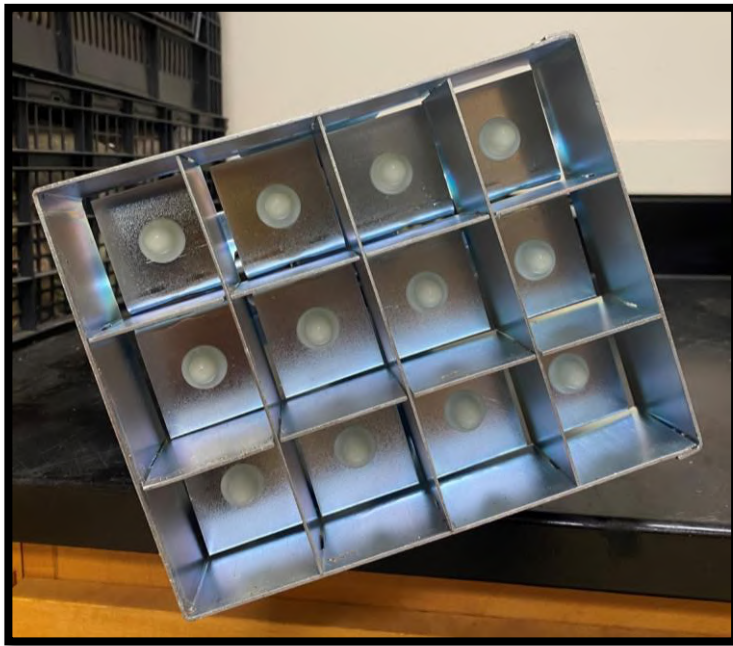


Figure 3. Block forms of Stand-up 12 Soil Blocker.

The experiment was conducted at the Iowa State University Horticulture greenhouse in Ames, IA, USA. A split plot randomized complete block design with four replications was used with growing method as the whole plot factor and media as the subplot factor. ‘Marketmore 76’ cucumbers and ‘Yankee Bell’ peppers were seeded in 50-cell flats and soil blocks made with Johnny’s Selected Seeds Stand-up 12 Soil Blocker (Fig. 1 & 3). Seedling emergence data was collected for cucumbers 10 days after seeding (DAS) and for peppers 15 DAS (Table 1 & 2). Plant count data was collected at the time of first destructive sampling of peppers (36 DAS) and cucumbers (22 DAS) (Table 1 & 2). Growth parameter data, including plant height, stem diameter, and SPAD was collected by destructively sampling cucumbers 22 DAS (Fig. 7 & 8), and peppers 36 DAS (week five), 43 DAS (week six), and 50 DAS (week seven) (Fig. 10 & 11). Root system parameters were evaluated using WinRHIZO™ at the last sampling (Fig. 13 & 14). Bulk density was collected for each growing media in soil blocks and flats (Fig. 12). The pour through method was performed weekly to evaluate the growing media pH and electrical conductivity (Table 3).



Figure 4. Soil blocks made with Stand-up 12 Soil Blocker.



Figure 5. 50-cell plastic flat.

## RESULTS

Table 1. Cucumbers emergence (10 DAS) and plant count (22 DAS) out of 25 cells or blocks.

Method	Emerg		Plant Count	
	2022	2023	2022	2023
Flat	24 a <sup>2</sup>	24	24	24
Soil Block	18 b	23	19	24

Table 2. Pepper emergence (15 DAS) and plant count (36 DAS) out of 25 cells or blocks.

Method	Emerg		Plant Count	
	2022	2023	2022	2023
Flat	23 a	23 a	24 a	24
Soil Block	20 b	16 b	22 b	23

<sup>2</sup> Means within a column with the same letters are not statistically different ( $P < 0.05$ )



Figure 6. Cucumber transplants with each growing media and method 22 DAS in 2022.

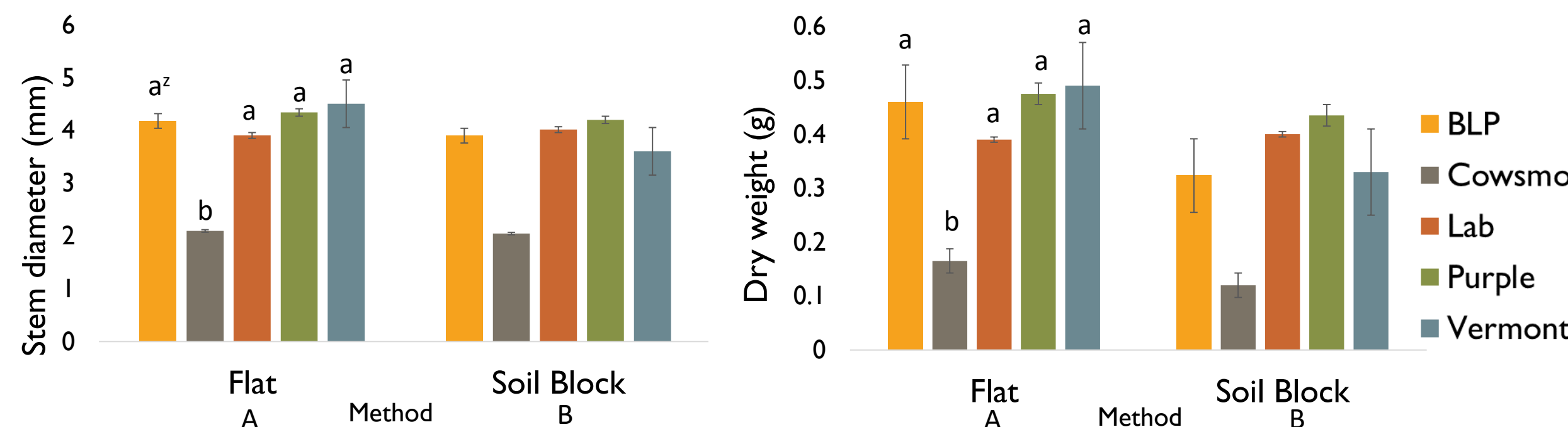


Figure 7. Cucumber stem diameter and plant dry weight 22 DAS in 2022 by method and by growing media.

<sup>2</sup> Means with the same letters are not statistically different ( $P < 0.05$ )

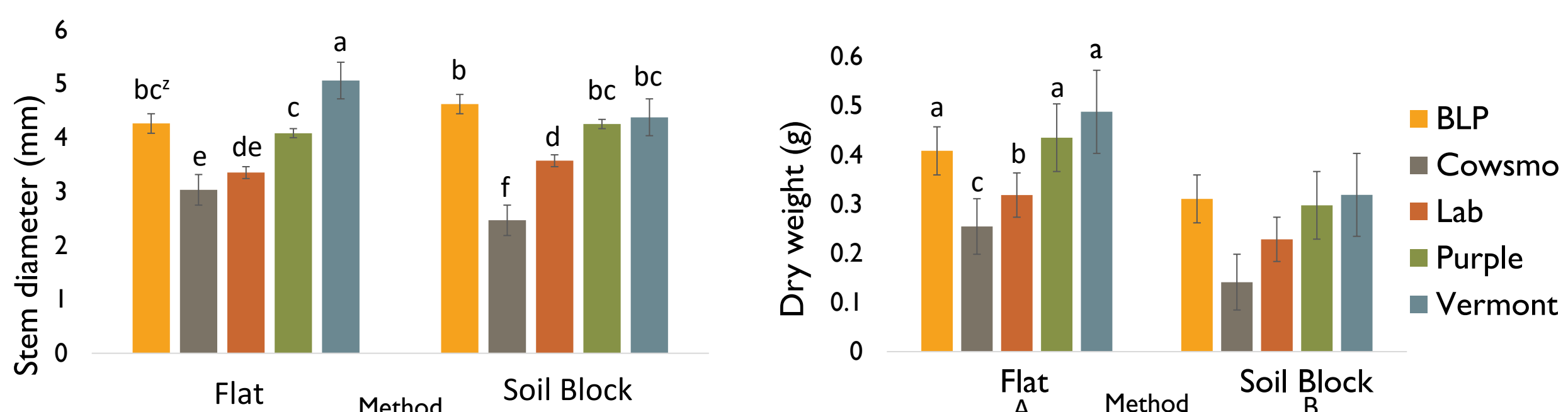


Figure 8. Cucumber stem diameter and plant dry weight 22 DAS in 2023 by method and by growing media.

<sup>2</sup> Means with the same letters are not statistically different ( $P < 0.05$ )

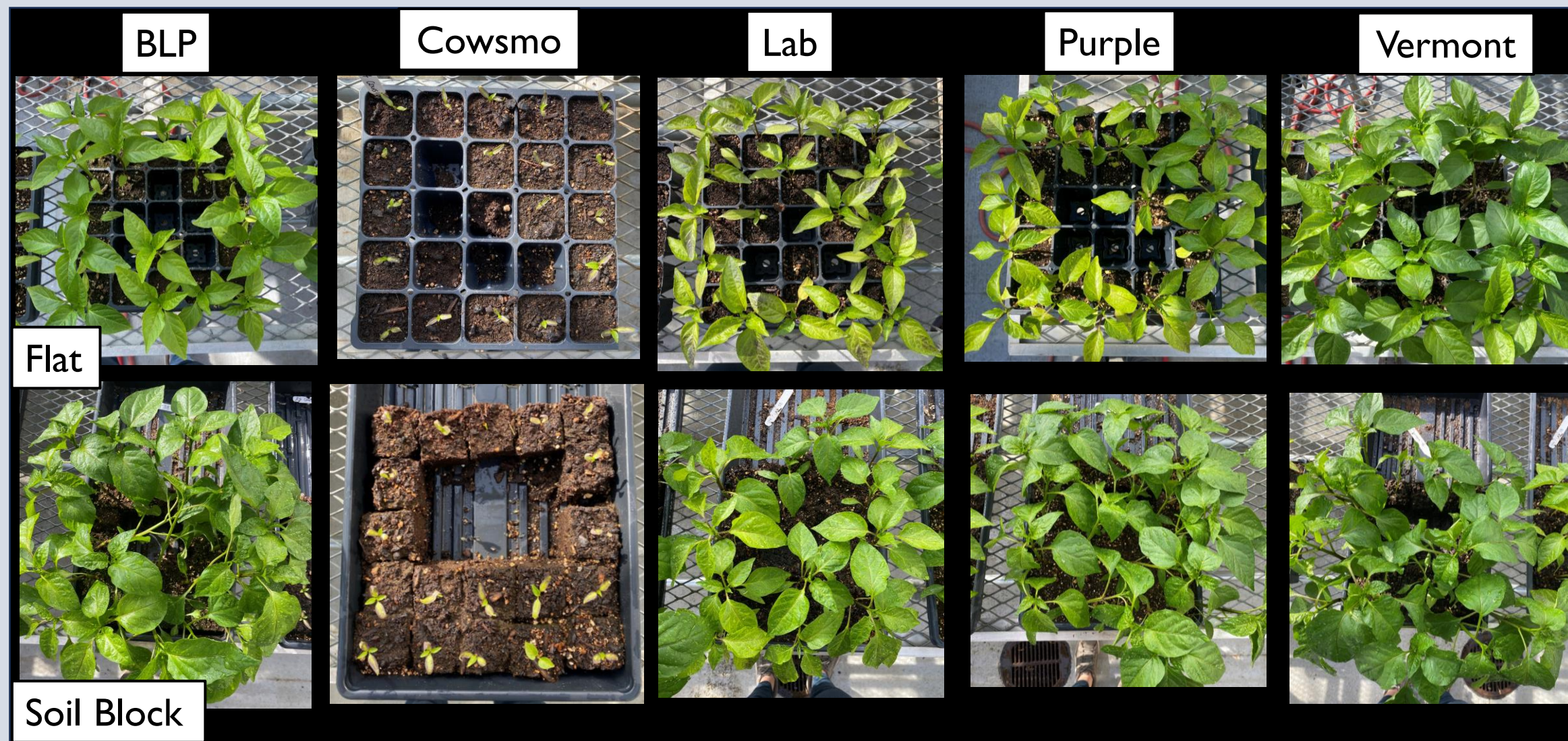


Figure 9. Pepper transplants with each growing media and method 50 DAS in 2022.

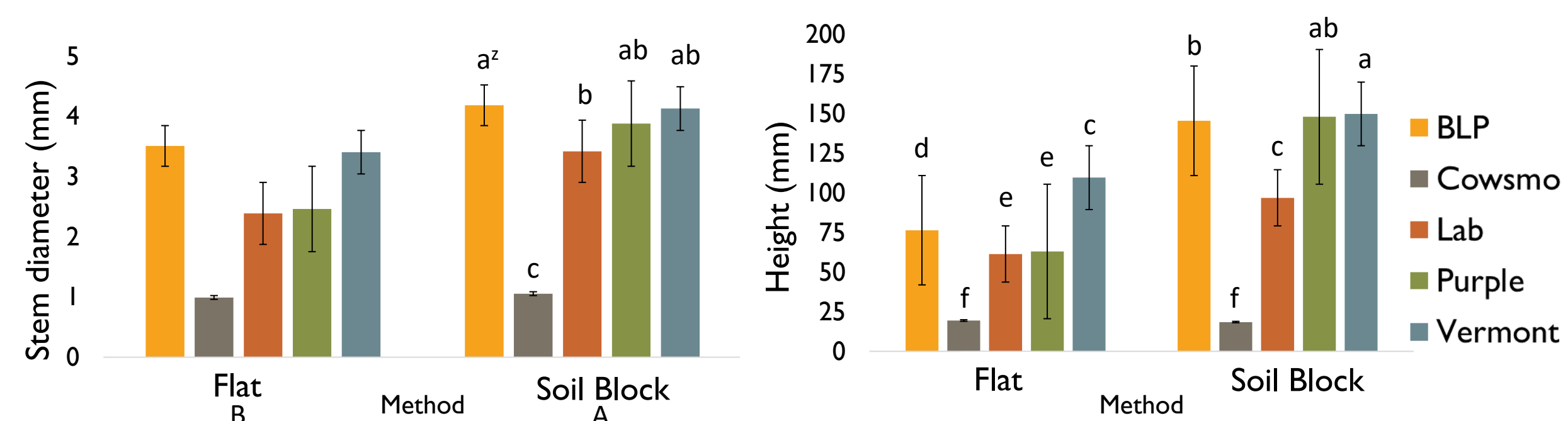


Figure 10. Pepper stem diameter and plant height 50 DAS in 2022 by method and by growing media.

<sup>2</sup> Means with the same letters are not statistically different ( $P < 0.05$ )

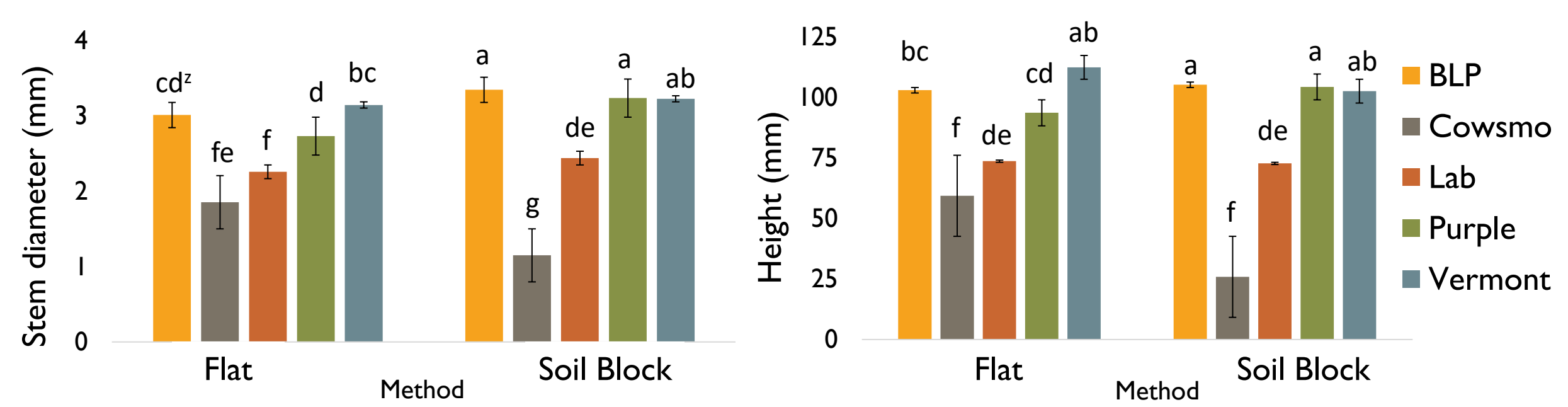


Figure 11. Pepper stem diameter and plant height 50 DAS in 2023 by method and by growing media.

<sup>2</sup> Means with the same letters are not statistically different ( $P < 0.05$ )

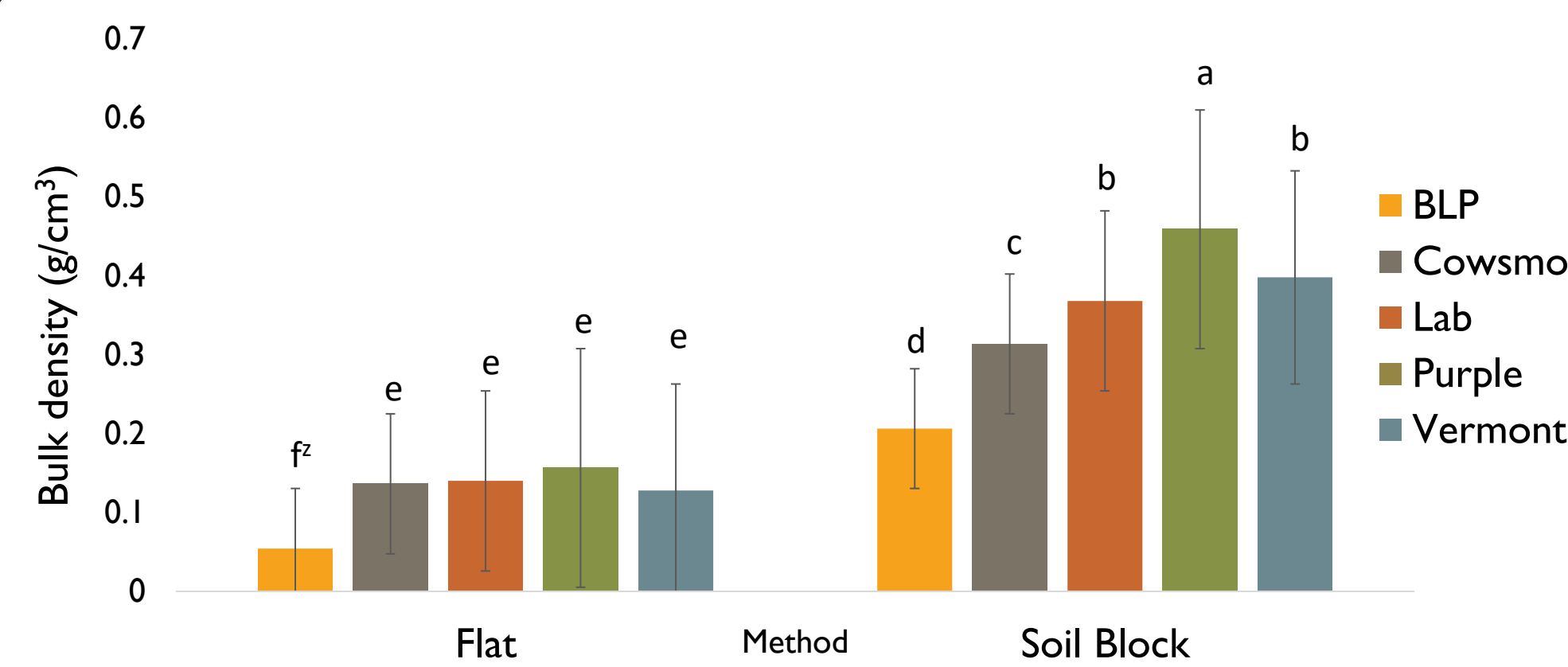


Figure 12. Bulk density of growing media by method in 2023.

<sup>2</sup> Means with the same letters are not statistically different ( $P < 0.05$ )

Table 3. pH and electrical conductivity (EC) of five growing media in 2022 and 2023 by pour through extraction.

Media	pH						EC (ds/mm)					
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
BLP	5.73 b	5.88 b		5.90 a	6.00 b	6.10 c	6.29 b	4.29 b	2.84 b	2.21 b	1.41 bc	1.04
Cowsmo	6.78 a	6.95 a		7.33 a	7.25 a	7.35 a	4.77 c	3.44 c	2.77 b	2.18 b	1.93 b	1.40
Lab	6.78 a	6.90 a		7.20 a	7.25 a	7.23 a	6.48 b	4.62 b	2.94 b	2.19 b	1.88 b	1.24
Purple	5.18 c	5.38 c		6.08 b	6.08 b	6.50 b	5.65 bc	2.94 c	1.64 c	1.47 c	1.16 c	0.98
Vermont	5.08 c	5.30 c		5.60 c	5.98 b	6.13 c	7.82 a	6.66 a	5.16 a	3.87 a	2.69 a	1.18
BLP	5.55 c	5.68 d	5.43 d	5.55 d	5.65 d	6.18 e	6.36 b	5.23 b	4.75 c	2.98	2.20 c	1.78 d
Cowsmo	6.36 b	6.70 b	6.78 b	6.90 b	7.00 b	7.18 c	6.31 b	5.18 b	4.79 bc	3.74	3.91 a	3.19 a
Lab	6.75 a	6.98 a	7.10 a	7.33 a	7.53 a	7.65 a	6.15 b	5.05 b	4.34 c	2.89	2.83 b	1.96 b
Purple	6.40 b	6.53 c	6.65 b	6.90 b	7.13 b	7.38 b	7.55 a	6.50 a	5.82 a	3.73	3.21 b	1.64 bc
Vermont	5.45 c	5.63 d	5.73 c	6.20 c	6.40 c	6.83 d	7.39 a	6.38 a	5.55 ab	3.13	2.75 bc	1.40 cd

<sup>2</sup> Means within a column with the same letters are not statistically different ( $P < 0.05$ )

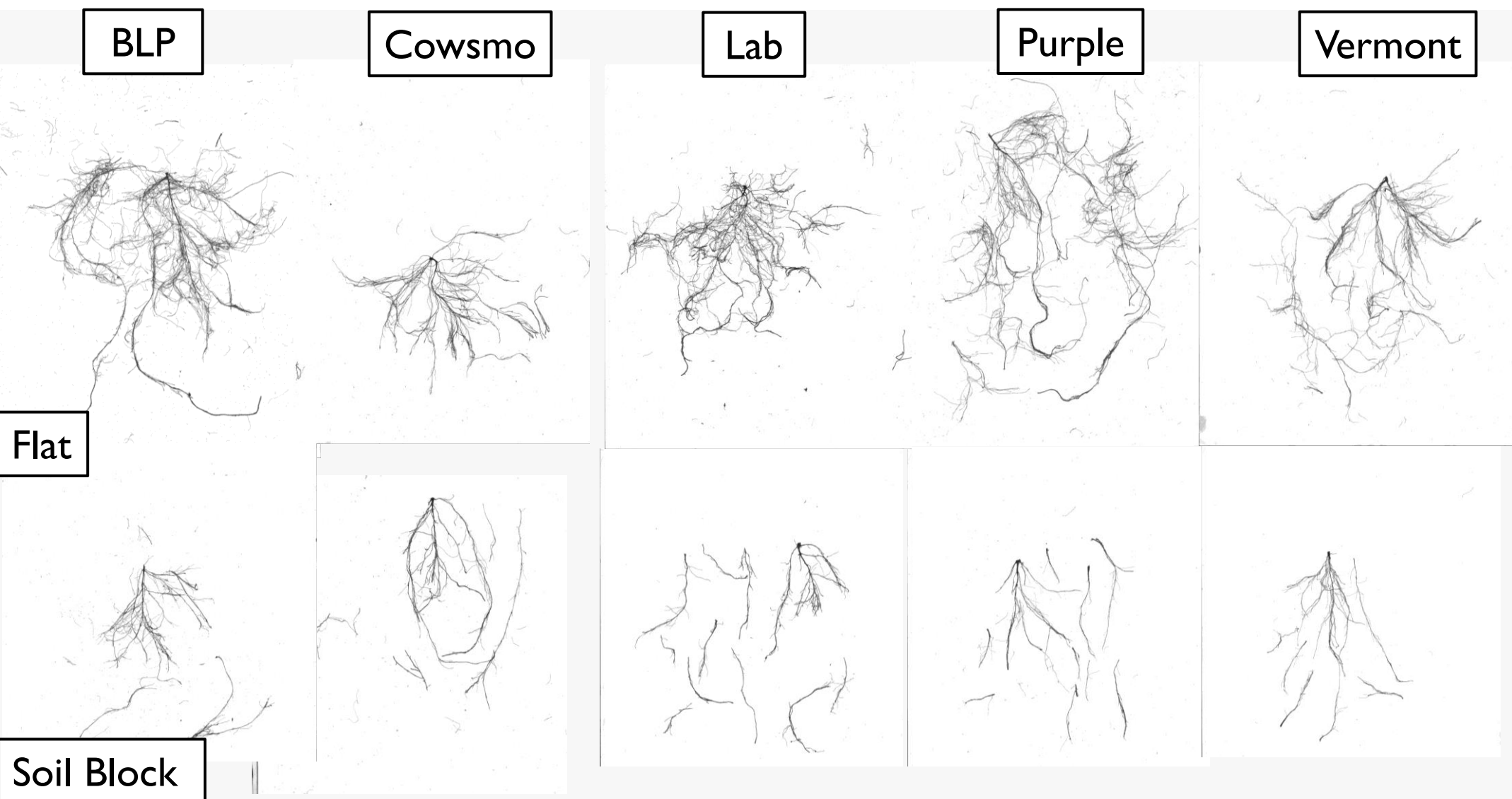


Figure 13. Cucumber root system 22 DAS in 2022 by method and media.

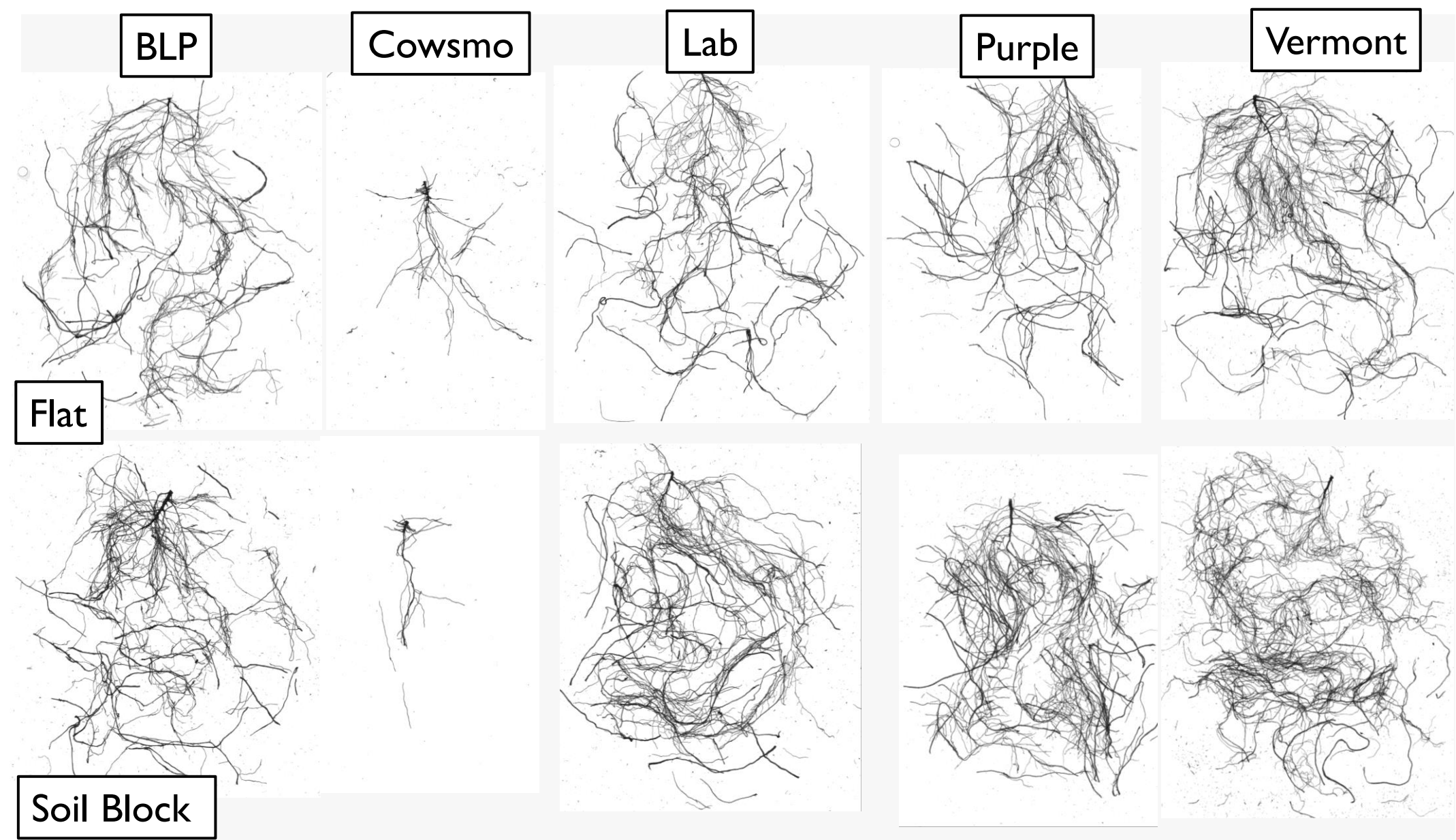


Figure 14. Pepper root system 50 DAS in 2022 by method and media.

## DISCUSSION & CONCLUSION

- Soil blocks tended to delay emergence of seedlings due to higher bulk density and lower medium temperature.
- Cowsmo exhibited a high pH and low nitrogen concentration, resulting in stunted transplants.
- Pepper transplants grown with BLP, Purple, and Lab displayed a greater plant height, stem diameter, SPAD, and dry weight in soil blocks than in flats, while peppers grown in Vermont performed similarly in flats and soil blocks across many metrics.
- Cucumber transplants had a lower dry weight in soil blocks.
- In soil blocks, transplant roots had a tendency to grow into neighboring blocks due to the lack of a physical barrier.

## ACKNOWLEDGEMENTS

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