e-GRO Edible Alert


Jonathan Karall
jaa337@cornell.edu

Neil Mattson
nsm47@cornell.edu

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Do Microgreens Respond to Fertilizer Concentration and Substrate Depth?

Microgreens are vegetable and herb seedlings harvested shortly after the emergence of the first true leaf and prior to leaf expansion/senescence of cotyledons. Microgreens represent a quick turn, potentially high value crop that consumers value for their nutrition, flavor, and aesthetic appeal. In our previous e-GRO Edible Alert e904 we addressed how microgreens respond to light and carbon dioxide. In this Alert we'll present results on how microgreens respond to fertilizer concentration and seedling depth.

Figure 1. Microgreens make a great garnish when you want to impress your guests.

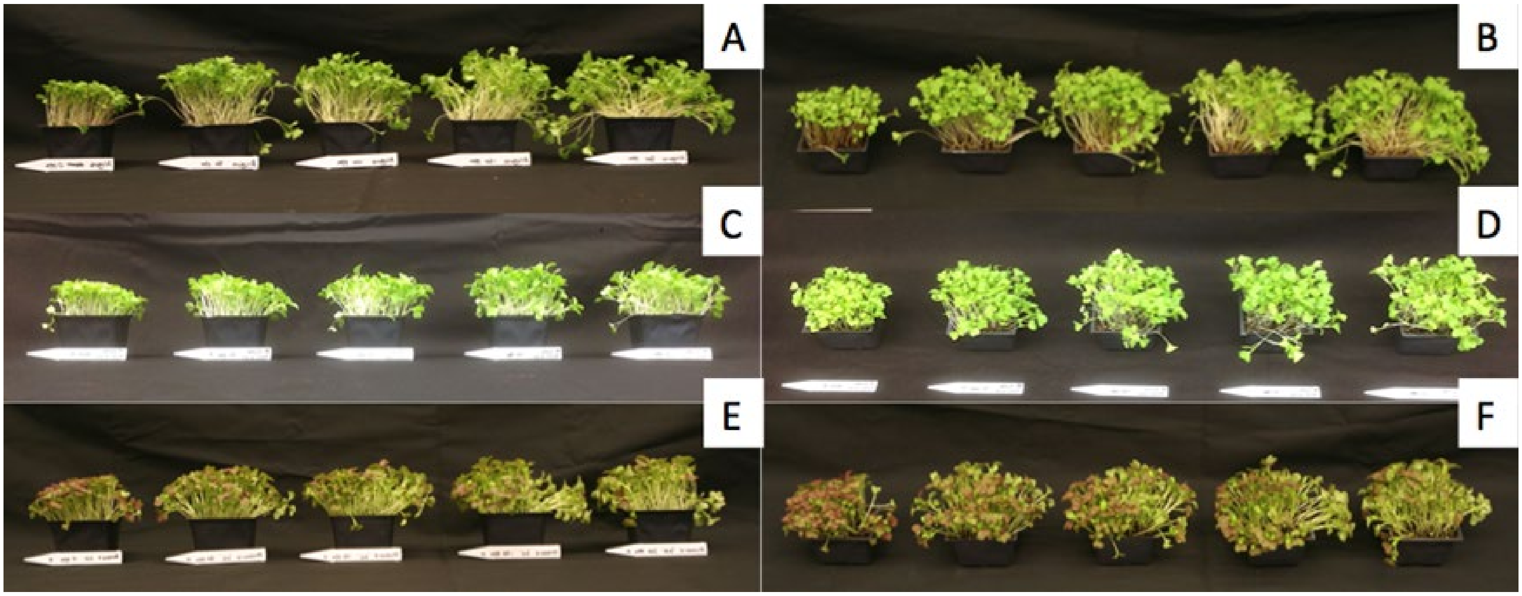

Figure 2. Images of arugula, mizuna and mustard under five fertilizer concentrations of 0, 50, 100, 150 and 200 ppm N. A-B, C-D and E-F represent arugula, mizuna and mustard, where A, C and E are in the horizontal plane and B, D and F are in the vertical plane. Within A-F, fertilizer concentrations of 0-200 ppm N are left to right. Images © by Jonathan Karall, Cornell University.

Fertilizer concentration

Because many microgreens species start with a large seed that can feed early seedling growth until harvesting it is thought by many that microgreens don't require additional fertilizer inputs. The objective of our first experiment was to determine the impact of liquid fertilizer concentration on harvestable yield of three microgreen species: arugula (Eruca sativa L.), mizuna (Brassica rapa L. var. japonica) and mustard (Brassica juncea 'Garnet Giant'). These three species were used to represent a diversity in appearance and taste but share similarity in seed size, days to harvest, and cultural requirements. The objective of this study was to determine how three species of microgreens would respond to concentration of water soluble fertilizer and substrate depth. Seeds were purchased from Johnny's Select Seeds (Winslow, Maine).

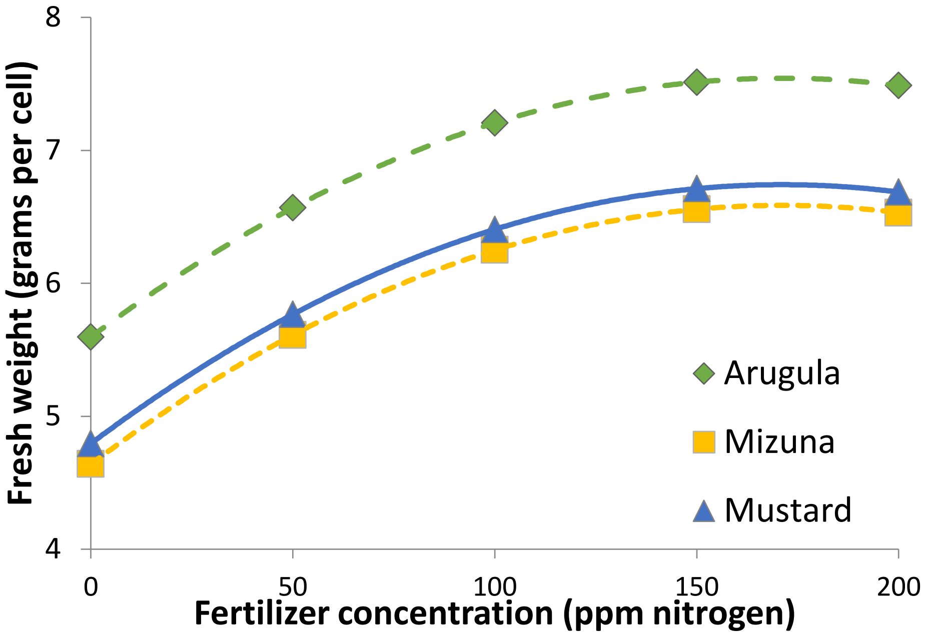

Figure 3. Fresh weight of arugula, mizuna, and mustard microgreens in response to water soluble fertilizer concentration. (Note: one 20"x10" tray = 24 cells. Thus, a fresh weight of 7 grams per cell equates to 168 grams or 6 ounces per flat.)

Seed was broadcasted over a peat/perlite potting mix (Lambert LM-111) in 10” x 20” trays containing 2401 cell inserts (i.e. 24 cells per tray) at a rate of 125 seeds per cell (equivalent to 3,000 seeds per 20”x10” flat). Trays were overhead watered and covered with a propagation dome followed by a tray placed over the top of the propagation dome to exclude light. Seeds were germinated at 68 °F for 48 hours before the dark dome was removed. The germination dome was removed 48 hours thereafter. Trays were placed into fertilizer treatments receiving either clear water (0 ppm fertilizer) or Jack’s 21-5-20 water soluble fertilizer at 50, 100, 150, and 200 ppm nitrogen. After seeding, plants were watered about every three days with their corresponding fertilizer treatment, which was applied via subirrigation by placing the tray in a container holding about 3 cm of nutrient solution for about three minutes. Microgreens were hand harvested when the average first true leaf measured a 1/2 inch in length.

Fertilizer results

Fresh weight of arugula, mizuna and mustard increased in as fertilizer concentration increased from 0 to 200 ppm N (Figure 3). Arugula showed the greatest increase in fresh weight, with more than double (106%) increase in as fertilizer increased from 0 to 200 ppm nitrogen. Mizuna had a 70% increase in fresh weight in response to fertilizer. Although fresh weight was greatest for all species at 200 ppm N, plants were more susceptible to lodging during irrigations and at harvest which resulted in entanglement and damage to the cotyledons (Figure 2).

Substrate depth

Root-zone height and volume impacts both physical properties (moisture holding capacity and air porosity) as well as total nutrient availability. As a quick turn crop (often 10-12 days) microgreens producers can go through a lot of potting mix/substrate in a year. In commercial microgreens production, growers commonly use trays with a shallow layer of substrate with the goal of reducing media cost. However, this could reduce media air porosity and require more frequent need for watering/fertilization. Four substrate depths of 0.7, 1.3, 1.7 and 2.3 in/tray (where the tallest substrate height refers to filling a tray to the top with substrate) were tested. In this experiment, we used Jack’s 21-5-20 at 150 ppm as our fertilizer. Other methods were the same as above (fertilizer concentration).

Substrate results

The fresh weight for arugula, mizuna and mustard increased by 41, 45 and 40%, respectively, as substrate depth increased from 0.7 to 2.3 inches (Figure 5). Depending on substrate height treatment we observed a deficiency or excess of moisture. For example, cells at a substrate height of 0.7 inches dried out more frequently and needed more frequent irrigation than the 2.3 inch treatment which exhibited excess moisture and increased disease occurrence (especially in arugula). This suggests a media height of 1.7 inches may be an appropriate balance between holding moisture and not being too wet. Alternatively, growers would need to adjust timing of irrigation to match their substrate and substrate depth. Plant responses to substrate depth are shown in Figure 4.

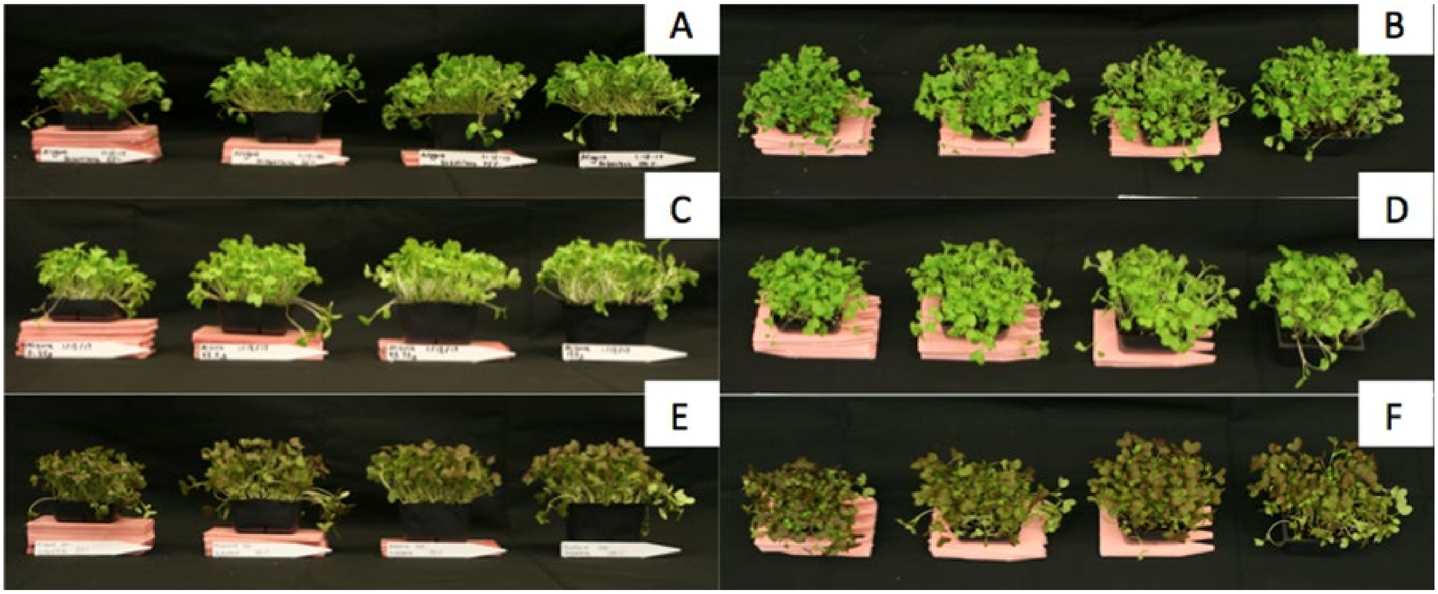

Figure 3. Images of arugula, mizuna and mustard under four substrate depths of 0.7, 1.3, 1.7 and 2.3 in/tray. A-B, C-D and E-F represent arugula, mizuna and mustard, where A, C and E are in the horizontal plane and B, D and F are in the vertical plane. Within A-F, substrate depths of 0.7 to 2.3 in/tray are left to right. Images © by Jonathan Karall, Cornell University.

Take home message

Based on our studies with arugula, mizuna, and mustard microgreens, it is important to fertilizer microgreens for optimal yield. We found 150 ppm N with a complete water-soluble fertilizer worked best (good yield and less lodging). Regarding substrate depth, unfortunately trying to cut costs by using a shallow layer of substrate reduces yield. With the peat-based potting mix in our trial a substrate depth of 1.7 inches performed well. Overall, a relatively small increase in input costs by using fertilizer and a reasonable substrate depth can reap large returns in microgreens yield. Growers should always trial new inputs/practices on a small scale in their own facility before adopting widespread changes.

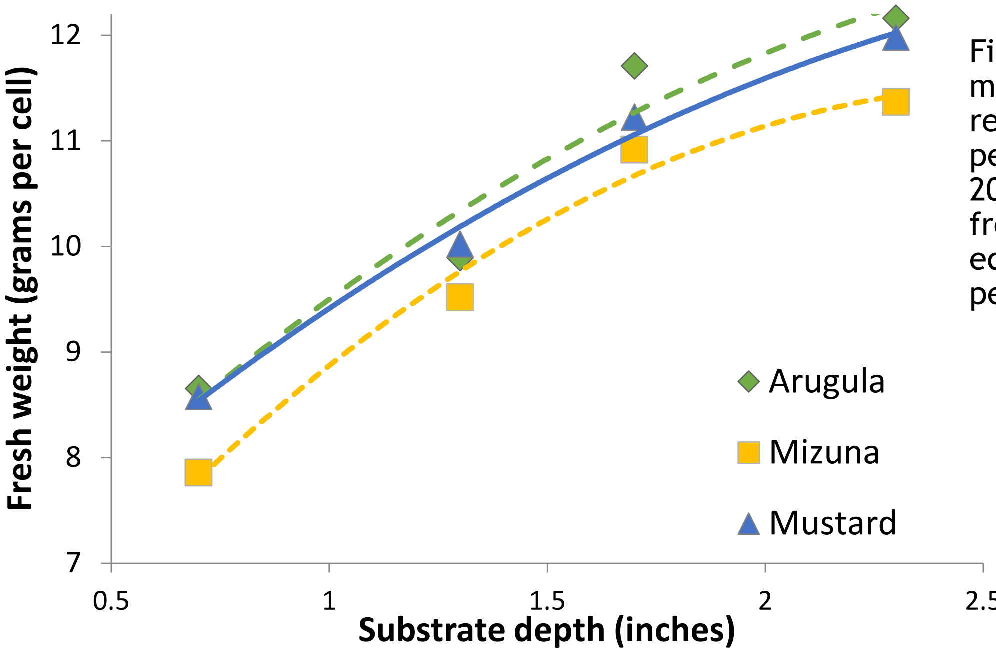

Figure 5. Fresh weight of arugula, mizuna, and mustard microgreens in response to substrate depth of the peat:perlite potting mix. (Note: one 20”x10” tray = 24 cells. Thus, a fresh weight of 7 grams per cell equates to 168 grams or 6 ounces per flat.)

Citations

Allred, J. 2017. Environmental and cultural practices to optimize the growth and development of three microgreen species. M.S. Thesis. Cornell University. 78pp. Available online.

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CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Greenhouse Horticulture and
Controlled-Environment Agriculture
University of Arkansas
ryand@uark.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Chieri Kubota
Controlled Environments Agriculture
The Ohio State University
kubota.10@osu.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Sustainable Greenhouse & Nursery
Systems Extension & Research
The Ohio State University
owen.367@osu.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Alicia Rihn
Agricultural & Resource Economics
University of Tennessee-Knoxville
arihn@utk.edu

Dr. Debalina Saha
Horticulture Weed Science
Michigan State University
sahadeb2@msu.edu

Dr. Beth Scheckelhoff
Extension Educator – Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Ornamental Extension Plant Pathologist
University of Georgia
jwoodwar@uga.edu

Cooperating Universities

Cornell CALS – College of Agriculture and Life Sciences

Cornell Cooperative Extension Suffolk County

UTIA Institute of Agriculture – The University of Tennessee

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