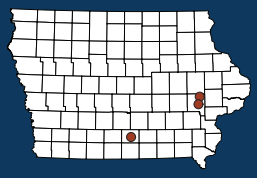
PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

RESEARCH REPORT Pelleted Seed and Covered Trays for Summer Lettuce Germination



2018

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Cooperators

Jill Beebout – Chariton
Carmen Black – Solon
Kate Edwards – Iowa City

Funding

Ceres Trust

In a Nutshell:

- Farmers were interested in better germination and quality of lettuce seedlings during hot summer months.
- Three farmers completed experimental trials to evaluate the effects of pelletized seed and a wetted sheet covering seedling trays during germination on germination rates and seedling quality (number of leaves, height, compactness).

Key findings

- Effects of the two treatments differed by farm, and by succession.
- While Jill Beebout recorded slightly more leaves on uncovered trays, Kate Edwards recorded better germination and more compact plants in covered trays during her first succession, but saw no effect of either treatment during her second succession. Carmen Black, meanwhile, saw mixed effects of the treatments, with unpelleted seed providing the most compact seedlings and more leaves per plant. Within her pelleted trays, the uncovered trays were more compact than covered trays.

BACKGROUND

During the 2017 Summer Lettuce Variety Trial, several farmers noticed the uneven germination of the pelleted lettuce seed being used for the trial.[1] They were curious if this was because of the pelleting or because of the heat, and if there was a better way to germinate seeds for summer lettuce transplants. This project compares pelleted and unpelleted lettuce seed in a split-plot, randomized replicated design that also explores the effect of a wetted sheet on the seed trays. The lettuce variety Magenta was used, as it was the favored variety of the growers from the 2017 trial.

Carmen Black, who participated in the 2017 variety trial, said, "We wondered if using pelleted seed contributed to the poor germination, so this year we want to directly compare the germination of pelleted and unpelleted seed. I feel committed to growing lettuce through the hot part of the summer for both the CSA and restaurant sales, and poor germination was unexpectedly one of my biggest challenges to growing an adequate amount last summer. Having better germination will help us grow summer lettuce more efficiently and economically."

Objective: Determine if pelletized seed or covering seedlings with a wetted sheet during germination effected germination rates or lettuce seedling quality during summer months.

METHODS

This project was conducted at three Iowa farms: Jill Beebout (Blue Gate Farm in Chariton), Carmen Black (Sundog Farm in Solon), Kate Edwards (Wild Woods Farm in Iowa City). All farmers germinated head lettuce (Magenta) in experiments using a randomized complete block design with a split-plot arrangement. At each farm, six seedling trays (main plots) were divided in half (sub-plots), with one side seeded to pelleted seeds, the other to unpelleted seeds. Three of the trays were covered with a moistened sheet during germination, the other three were left uncovered. A schematic of the trial setup is shown in **Figure 1**. Production practices for lettuce germination including tray types and planting media for each farm are detailed in **Table 1**. Seeds for the trials were provided by Johnny's Seeds (Winslow, ME).

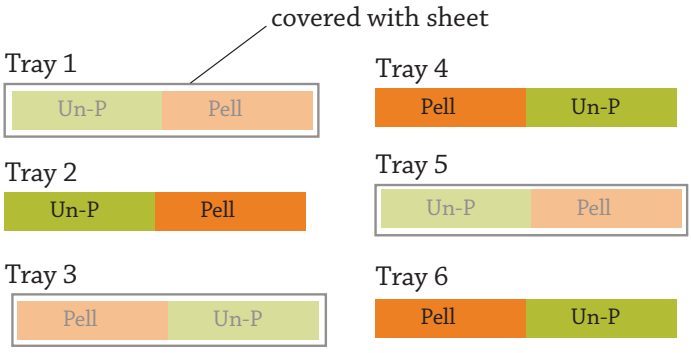

FIGURE 1. Experimental design.

Germination trial setup with covered and uncovered soil blocks in Carmen Black's high tunnel.

Magenta lettuce seedlings are evaluated at Kate Edwards' farm before being transplanted to the field.

TABLE 1. Seedling and trial set-up.

FARM	JILL BEEBOUT	CARMEN BLACK	KATE EDWARDS
Seeding date(s)	June 29	July 1	July 10; Aug. 17
Number of plants per plot	36	60	60
Soil block/cell size (in. x in.)	72-ct flats (1.5 x 1.5)	120 soil blocks	120 soil blocks
Transplant media	Rainbow Gardens Organic Mix	Beautiful Lands Products C3	Beautiful Lands Products C3
Watering method	Wand	Wand	Wand
Transplant date(s)	July 26	Aug. 8	Aug. 26; Oct. 4

Farmers recorded the germination rate by counting the soil blocks/cells in each tray that did not germinate. They recorded the emergence rate by counting the number of days to the first true leaves on 10 plants in each tray. They also recorded evenness of germination by measuring the height and leaf number of 10 plants in each tray when the seedlings were ready to transplant. Compactness was calculated by dividing number of leaves by seedling height.

Data were analyzed using JMP Pro 13 (SAS Institute Inc., Cary, NC) statistical software. Means separation among varieties by succession at each farm was determined using Tukey's least significant difference (LSD). Statistical significance is reported at the 90% confidence level.

RESULTS AND DISCUSSION

Beebout, Chariton

Beebout seeded flats on June 29 and measured seedlings prior to transplanting on July 26 (27 days). Seedling quality indicators and germination rates are shown in **Table 2**. At transplant, seedlings from uncovered trays had statistically more leaves (6.3 leaves/seedling) than seedlings from covered trays (5.6 leaves/seedling). Though not statistically significant, uncovered trays tended to have taller and less compact seedlings than covered trays. Pelleted seeds did not show any significant difference in seedling quality from unpelleted seeds. All treatments showed very strong germination rates, ranging from 97% to 99%.

Black, Solon

Black seeded into soil blocks on July 1 and measured seedlings prior to transplanting on Aug. 8 (38 days). Seedlings grown from unpelleted seed were more compact (1.01) than those grown from pelleted seed (0.79).

TABLE 2. Emergence and seedling quality indicators at Jill Beebout's.

TREATMENT (SHORTHAND)	GERMINATION RATE (%)	NUMBER OF LEAVES	SEEDLING HEIGHT (IN.)	COMPACTNESS (LEAVES/ HEIGHT)	DAYS TO TRUE LEAF EMERGENCE
Covered, Pelleted (C, P)	99	5.6 ab	2.1	2.78	5.0
Covered, Unpelleted (C, UP)	99	5.5 b	2.2	2.75	6.3
Uncovered, Pelleted (UC, P)	99	6.1 ab	2.8	2.14	5.0
Uncovered, Unpelleted (UC, UP)	97	6.4 a	3.0	2.19	5.3
LSD	*3*	*0.8*	*1.2*	*1.32*	*1.5*

By quality indicator (column), only values that differ by more than the least significant difference (LSD) are followed by different letters and are considered statistically different with 90% certainty.

TABLE 3. Emergence and seedling quality indicators at Carmen Black's.

TREATMENT (SHORTHAND)	GERMINATION RATE (%)	NUMBER OF LEAVES	SEEDLING HEIGHT (IN.)	COMPACTNESS (LEAVES/ HEIGHT)
Covered, Pelleted (C, P)	98	4.6 b	6.4 a	0.71 c
Covered, Unpelleted (C, UP)	97	5.8 a	5.6 b	1.03 a
Uncovered, Pelleted (UC, P)	95	5.3 ab	6.2 ab	0.87 b
Uncovered, Unpelleted (UC, UP)	91	5.7 a	5.8 ab	0.99 a
LSD	*7*	*1.1*	*0.8*	*0.10*

By quality indicator (column), only values that differ by more than the least significant difference (LSD) are followed by different letters and are considered statistically different with 90% certainty.

Tallest seedlings resulted from the covered trays with pelleted seed. This treatment combination also produced the least number of leaves. Germination rate was similar across all treatments. Results are shown in **Table 3**.

Edwards, Iowa City

Edwards did two successions of the trial, which were seeded into soil blocks on July 10 and Aug. 17 and transplanted to the field on Aug. 26 and Oct. 4 (47 and 48 days to transplant). During succession 1, seedlings grown from covered trays had higher germination rates (98%) and more compact seedlings (1.17), as shown in **Table 4**. Uncovered trays produced taller seedlings, but Edwards, and most farmers, value a compact plant over tall plant, which can be leggy and struggle during transplant. Pelleting did not have an impact on seedling quality.

Seedling quality indicators in succession 2 did not follow the patterns of succession 1. Seedling quality indicators were not statistically different based on treatments.

CONCLUSIONS AND NEXT STEPS

The effects of pelleting and wetted sheets covering germination trays differed by farm. While Beebout recorded slightly more leaves on uncovered trays, Edwards recorded better germination and more compact plants in covered trays during her first succession, but saw no effect of either treatment during her second succession. Black, meanwhile, saw mixed effects of the treatments, with unpelleted seed providing the most compact seedlings and more leaves per plant. Within her pelleted trays, the uncovered trays were more compact than covered trays.

All farmers were interested in repeating this trial for another year after making refinements to the protocol to better capture the most extreme weather conditions for starting lettuce seed (hot, sunny). They wondered if the difference in their results was due, in part, to specific weather conditions following seeding, such as a cool, cloudy day versus a hot, sunny day. Kate Edwards said, "My main take-way from this trial is that when it gets hot, I'm going to put a wet sheet over my germination trays." Beebout had similar conclusions: "After struggling with summer lettuce germination in the past, this trial really helped me overcome my frustration with it. I never thought I could use the high tunnel for starting summer lettuce, but this opened up some options for me."

Black removed the covers to evaluate germination lettuce seeds in the soil blocks on July 4.

TABLE 4. Emergence and seedling quality indicators at Kate Edwards'.

SUCCESSION (SEEDING DATE)	TREATMENT (SHORTHAND)	GERMINATION RATE (%)	NUMBER OF LEAVES	SEEDLING HEIGHT (IN.)	COMPACTNESS (LEAVES/ HEIGHT)
1 (July 10)	Covered, Pelleted (C, P)	98 a	4.8	4.2 b	1.17 a
	Covered, Unpelleted (C, UP)	98 a	4.5	3.9 b	1.17 a
	Uncovered, Pelleted (UC, P)	93 b	5.0	4.9 a	1.02 b
	Uncovered, Unpelleted (UC, UP)	86 b	5.0	4.9 a	1.02 b
	LSD	*11*	*0.7*	*0.4*	*0.17*
2 (Aug. 17)	Covered, Pelleted (C, P)	94	4.7	8.6	0.54
	Covered, Unpelleted (C, UP)	93	4.4	8.2	0.5
	Uncovered, Pelleted (UC, P)	94	5.5	8.4	0.66
	Uncovered, Unpelleted (UC, UP)	97	5.0	8.1	0.62
	LSD	*8*	*1.1*	*1.2*	*0.22*

By succession and quality indicator (column), only values with different letters are statistically different with 90% certainty.

Pelleted and unpelleted seed appeared to germinate at different rates at Edwards' farm, but pelleting did not have lasting effects on seedling quality indicators.

APPENDIX – WEATHER CONDITIONS

TABLE A1. Weather data for 2018 and historical averages.

	BEEBOUT: CHARITON				BLACK, EDWARDS: IOWA CITY			
	GROWING DEGREE DAYS (BASE 50 °F)		DAILY HIGH TEMP °F		GROWING DEGREE DAYS (BASE 50 °F)		DAILY HIGH TEMP °F	
MONTH	2018	AVG.	2018	AVG.	2018	AVG	2018	AVG
June	686	589	85	81	677	646	84	83
July	678	716	86	86	682	756	85	86
August	680	668	86	84	686	706	84	84
September	503	467	77	77	485	489	77	77

Monthly growing degree days and monthly high temperatures for the current year and historical averages are reported from the nearest weather station. Climate data were accessed from Chariton and Iowa City weather stations. Historical data include years 1980-2018.[2]

REFERENCES

1. Kolbe, L., C. Black, R. Faux, A. McGary, J. Scheibel and K. Edwards. 2017. Summer Lettuce Variety Trial. Practical Farmers of Iowa Cooperators' Program. https://practicalfarmers.org/research/summer-lettuce-variety-trial/ (accessed April 2019).

2. Iowa Environmental Mesonet. 2019. Iowa Environmental Mesonet. Iowa State University Department of Agronomy. http://mesonet.agron.iastate.edu/ (accessed March 2019).

PFI COOPERATORS' PROGRAM

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs. If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan@practicalfarmers.org.