

2017

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Recommended Citation

Delate, Kathleen; Johnson, Rebecca; and Rees, Myron (2017) "Evaluation of Organic Soybean Varieties and Organic Popcorn Varieties and Fertilization," *Farm Progress Reports*: Vol. 2016 : Iss. 1 , Article 140.

DOI: <https://doi.org/10.31274/farmprogressreports-180814-1705>

Available at: <https://lib.dr.iastate.edu/farmprogressreports/vol2016/iss1/140>

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Evaluation of Organic Soybean Varieties and Organic Popcorn Varieties and Fertilization

RFR-A1698

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Introduction

According to the USDA National Organic Program, certified organic farmers must source organic seed (seed from organically raised crops). The organic seed industry is currently growing in Iowa and the Midwest, and with this growth, organic growers are looking for University-based recommendations on organic varieties to use in Iowa. The Organic Agriculture Program at Iowa State University has been using organic seed at the Southeast Research Farm, Crawfordsville, Iowa, for 15 years with excellent results. In addition, a new organic fertilizer (Biotic Organic™ 4-4-4, Perfect Blend, Bellevue, WA) was tested beginning in 2013, and continued in 2016, for its effect on organic popcorn production.

Materials and Methods

Organic soybean variety trial. There were four soybean varieties selected for the 2016 organic variety trial. These included the following varieties: Viking 0.2399AT12N and 0.2265 (Albert Lea Seed, Albert Lea, MN), IA2104RA12 (ISU, Ames, IA); and BR 27C5 (Blue River Hybrids, Ames, IA). Plots measuring 20 ft x 380 ft were laid out in a randomized complete block design with four replications of each variety. The field was chisel-plowed April 14 and field-cultivated May 9 and 23 to prepare for planting. Soybeans were planted at a 1.5-in. depth at 149,000 seeds/acre May 23. Weed

management included rotary hoeing June 6 and 10, and row cultivation June 14 and 24. Plant and weed stands were counted July 6. Soybeans were harvested October 13.

Popcorn. The fourth year of the organic popcorn trial followed a conventional soybean field. Plots measuring 10 ft x 100 ft were laid out in a randomized complete block design of two varieties (AP2204 and N15262) and two fertilizer treatments, i.e. with organic fertilizer and control (no fertilizer). There were four replications of each treatment. On May 27, 60 lb/plot of Perfect Blend™ organic 4-4-4 fertilizer was applied to supply 100 lb N/acre. Plots were field cultivated May 23 and 27 and popcorn seeds were planted at 32,000 plants/acre the same day. Plots were rotary hoed June 6 and 10 and row cultivated June 14. Plant and weed stands were counted July 6. Height of popcorn plants and sampling for stalk nitrate occurred September 22. Popcorn harvest occurred October 12.

Results and Discussion

Despite the challenging weather in 2016, organic soybean emergence and performance was very good in southeast Iowa. Soybean plant populations averaged 90,167 plants/acre, but there were some differences between varieties. The Viking 0.2399AT12N, IA 2104RA12, and BR 27C5 had similar populations, at 92,833 plants/acre, although plots where the variety Viking 0.2265 was planted experienced a lower population, averaging 82,167 plants/acre (Table 1). Weed management was excellent in 2016, and on July 6 there was no difference among varieties in weed populations, averaging one grass and one broadleaf weed/ft² (Table 1). Organic soybean yields were excellent in 2016, given the challenging weather,

averaging 52 bushels/acre (Table 2). There were some differences between varieties, however, with the IA2014RA12 variety yielding lower (48.4 bu/acre) than the Viking 0.2399AT12N and BR 27C5, which averaged 54.9 bushels/acre together. Viking 0.2265 was intermediate, at 50.4 bushels/acre. Yield in the aphid-resistant variety, IA2014RA12, was lower than the other aphid-resistant variety, Viking 0.2399AT12N, which had the highest numerical yield, at 55.5 bushels/acre. The lower plant population of the Viking 0.2265 soybeans did not significantly affect yield. The higher plant population of the IA2104RA12 was not associated with a higher yield. Soybean yield results were similar to 2013 results (last time soybeans were grown in the rotation), when they averaged 51 bushels/acre. These results show great promise for organic soybean seed.

Popcorn. Popcorn plant populations were similar between varieties and between fertilizer treatments, averaging 32,486 plants/acre (Table 3). Grass and broadleaf weeds also were similar between treatments, averaging one weed/ft² for both grass and broadleaf weeds (Table 3). The excellent weed management was due to timely rotary hoeing

and row cultivation after rotary hoeing. Organic popcorn yields, with the use of the Perfect Blend™ organic fertilizer, were statistically higher at 3,760 lb/acre compared with 2,462 lb/acre for the control with no fertilizer (Table 4). Yields were similar to 2013 yields of 3,298 and 2,996 lb/acre, for the fertilized and control plots, respectively. The N15262 and AP2204 variety yields were similar at 3,111 lb/acre averaged over both treatments (Table 4). Plant height was greater in the AP2204 variety, averaging 229 cm, compared with 198 cm in the N15262 variety (Table 4). The organic fertilizer led to an increase in plant height of 10 cm in the AP2204 variety, but not in the N15262 variety. We will repeat this trial in 2017.

Acknowledgements

We would like to thank the Leopold Center for Sustainable Agriculture for their support of this project. Thanks also go to Chad Hesseltine, Cody Schneider, and Bob Turnbull for their help in production, data collection, and analytical aspects of this project. We also thank The Grain Place, Marquette, NE; Albert Lea Seed; and Blue River Hybrids for their seed support.

Table 1. Soybean and weed populations in the soybean variety trial experiment, ISU Southeast Farm, Crawfordsville, IA, 7/6/16.

Variety	Plant population (plants/ac)	Grass weeds/ft²	Broadleaf weeds/ft²
IA 2104RA12	94,833a ^x	0.80	1.00
VIKING 0.2399AT12N	93,167a	0.70	1.10
VIKING 0.2265	82,167b	0.40	0.90
BR 27C5	90,500a	0.80	0.70
LSD _{0.05}	5960	NS	NS
P value ($\alpha=0.05$)	0.0022	0.4307	0.6986

^xMeans followed by the same letter in a column are not significantly different at $P \leq 0.05$ or not significant (NS) (Fisher's Protected LSD Test).

Table 2. Soybean yield in the soybean variety trial experiment, ISU Southeast Farm, Crawfordsville, IA.

Variety	Yield (bu/ac)
IA 2104RA12	48.4c ^x
VIKING 0.2399AT12N	55.5a
VIKING 0.2265	50.4bc
BR 27C5	54.2ab
LSD _{0.05}	0.4839
P value ($\alpha=0.05$)	0.0113

^xMeans followed by the same letter in a column are not significantly different at $P \leq 0.05$ or not significant (NS) (Fisher's Protected LSD Test).

Table 3. Popcorn and weed populations in the organic popcorn fertilization experiment, ISU Southeast Farm, Crawfordsville, IA, 7/6/16.

Variety	Compost	Plant population (plants/ac)	Grass weeds/ft²	Broadleaf weeds/ft²
NI5262	No compost	30,444	0.22	0.67
NI5262	Compost	33,166	0.58	0.58
AP2204	No compost	33,000	0.67	0.33
AP2204	Compost	33,333	1.00	0.92
LSD _{0.05}		NS ^x	NS	NS
P value ($\alpha=0.05$)		0.3589	0.9353	0.1063

^xMeans followed by the same letter in a column are not significantly different at $P \leq 0.05$ or not significant (NS) (Fisher's Protected LSD Test).

Table 4. Popcorn height and yield in the organic popcorn fertilization experiment, ISU Southeast Farm, Crawfordsville, IA, 9/22/16.

Variety	Compost	Height (cm)	Yield (lb/ac)
NI5262	No compost	198.6c ^x	2,465b
NI5262	Compost	197.4c	3,739a
AP2204	No compost	223.3b	2,458b
AP2204	Compost	233.6a	3,781a
LSD _{0.05}		4.86	732
P value ($\alpha=0.05$)		<.0001	0.0002

^xMeans followed by the same letter in a column are not significantly different at $P \leq 0.05$ or not significant (NS) (Fisher's Protected LSD Test).