PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

EXPERIMENT

2024

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Drip Irrigation for Potatoes

In a Nutshell:

- Irrigation can increase potato yield and quality, with effects depending on rainfall and soil conditions.
- The benefits of irrigation are balanced against the cost of setting up and running irrigation systems.
- In this trial, Lee Matteson set out to evaluate how much increase one might expect to see in potato yields with irrigation, to inform his ROI calculations for the cost of the irrigation system.

Key Findings:

- A wet year made irrigation redundant such that it had no significant effect on yield.
- Matteson plans to continue this investigation in the future, when drier weather might limit potato productivity.

Cooperators

Lee Matteson, Lee's Greens - Nevada, IA

Funding

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BACKGROUND

Increased water availability enables plant stomata to stay open longer, enabling more efficient photosynthesis and more carbon fixation. More available carbon leads to higher starch content. Research shows that irrigation increases potato specific density, a measure of starchiness and standard quality measurement of potatoes [1], [2]. Thus, especially in the dryer, western potato producing regions of Idaho and Washington, irrigation delivers greater yields and higher quality. In the rainier, eastern potato-growing regions of Maine, most farmers do not irrigate, or else they lay out drip irrigation tape only as needed [3].

The climate of Iowa is variable, so strategies to optimize potato growing conditions vary from year to year. After several recent hot, dry summers in central Iowa, Lee Matteson wanted to test the effects of drip irrigation on the yield of red and white potato varieties. He hypothesized that drip irrigation could boost plant productivity enough to offset the cost, as well as ensuring the success of the crop against drought conditions.

Lee Matteson holding a case of Red Pontiac Potatoes, Nevada IA, 2024.

METHODS

Design

Matteson tested the effect of irrigation on both a red and a white potato variety, for a total of four treatments:

- Irrigated Red Pontiac
- Irrigated Kennebec
- Non-irrigated Red Pontiac
- Non-irrigated Kennebec

Each irrigation treatment ran an entire row, with the two halves of each row randomly assigned to the two varieties. Thus, four rows were irrigated and four were not. The design of the experiment can be seen in **Figure A1**.

Drip tape was laid out on June 6, 2024. Matteson used 20-20-20 fertilizer in this trial, in line with his standard potato-growing practices. For the irrigated plants, the fertilizer was dissolved in the irrigation solution and dispensed when the irrigation system was run for 60 minutes on June 10 and again on July 6. Granular 20-20-20 fertilizer was dispensed to the non-irrigated plants on

the same days that the irrigation was run. The irrigation system was only run on the two days that it was used to disperse fertilizer. Because of the wet prevailing conditions, soil moisture levels never fell to a level where irrigation was required.

Measurements

Yield was measured as the total fresh weight of all marketable potatoes harvested from each plot.

Data analysis

We ran a 2-way Analysis of Variance (ANOVA). We then used Tukey's Honest Statistical Difference (HSD) at a 95% confidence level to determine whether there were significant differences between treatments. Because there were two independent variables (variety and treatment) in this trial, HSD is a better tool for determining whether the differences are significant than other possible tests.

HSD gives information on whether two groups are significantly different from one another. All groups' means which do not differ by more than the HSD are not significantly different and are given the same letter. The highest are all given the label 'a' (**Figure 1**). The next highest group or set of groups which is significantly different from 'a' would be labeled 'b'. We can perform this analysis because the trial had a completely randomized and replicated experimental design (**Figure A1**).

RESULTS AND DISCUSSION

There were no significant differences among the treatments (**Figure 1**). The weather was wet (**Figure A2**), which reduced the effect of, or need for, irrigation. Weather and field conditions affected the results. Weed pressure was high (see photo above) despite pre-emergence spraying and hand weeding in mid-June. Pest pressure from potato beetles (*Leptinotarsa decemlineata*) was also very high, despite a stepped-up insecticide regime. The combined pressure of heavy rainfall throughout the growing season and pests contributed to early die off and lower yields than Matteson expected. Matteson usually harvests potatoes in late August or September, but harvested on Aug. 20 this year because all the plants' vegetative matter had died off.

Matteson noted that he would like to continue this trial for a couple more years, to get more complete results over a wider array of weather conditions. This experiment was designed after a string of drier-than-usual summers to quantify the increase in yields that could be had through irrigation, and "The weather has a lot to do with overall results and it was interesting to see the difference between this year's results and what I have witnessed in past years."

CONCLUSIONS AND NEXT STEPS

Matteson hoped that this trial would give him data to inform a return on investment (ROI) calculation for setting up irrigation systems. Matteson said: "If I see a result that increases yields, I will more likely implement these changes as long as it doesn't increase costs beyond the return on investment." Unfortunately, the wet weather made irrigation redundant.

Going forward, Matteson plans to repeat the experiment. If the weather is dryer, he expects to see an improvement to the yield of the irrigated plants. He hopes that future results "will hopefully help other farms make more informed decisions on their own farms when using similar practices".

Drip irrigation setup (green hose) in young potatoes, Nevada IA, June 2024.

TABLE 1. Planting and management details at Lee Matteson's in 2024.

Varieties	Red Pontiac and Kennebec
Treatment 1: Control	Not irrigated
Treatment 2: Irrigation	Irrigated for 60 minutes on June 10 & July 6
Replicates	4
Plot length × width (ft)	57 x 3
In-row spacing (in.)	6-8
Field preparation	Tilled 4-6 in. deep three times before planting
Fertilization	Granular 20-20-20 fertilizer applied on June 10 & July 6
Weed control	Apr. 20: Preemergence spray June 15: Hand weeding
Harvest	Aug. 20 and 21

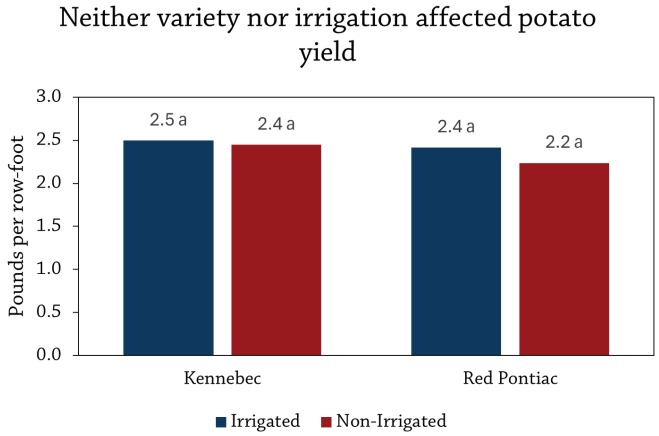

FIGURE 1. Yield of all marketable potatoes at Lee Matteson's in 2024. Because no two treatments' means differed by more than the honest significant difference (HSD = 0.22 lb/row-ft), none of the treatments had a statistically significant effect. All treatment means are followed by the same letter 'a' to indicate that none are significantly different from any other.

APPENDIX – TRIAL DESIGN AND WEATHER CONDITIONS

REP 1	Irrigated row	Red Pontiac	Kennebec
	Not irrigated row	Red Pontiac	Kennebec
REP 2	Irrigated row	Kennebec	Red Pontiac
	Not irrigated row	Red Pontiac	Kennebec
REP 3	Not irrigated row	Kennebec	Red Pontiac
	Irrigated row	Kennebec	Red Pontiac
REP 4	Irrigated row	Red Pontiac	Kennebec
	Not irrigated row	Red Pontiac	Kennebec

FIGURE A1. Experimental design used by Matteson.

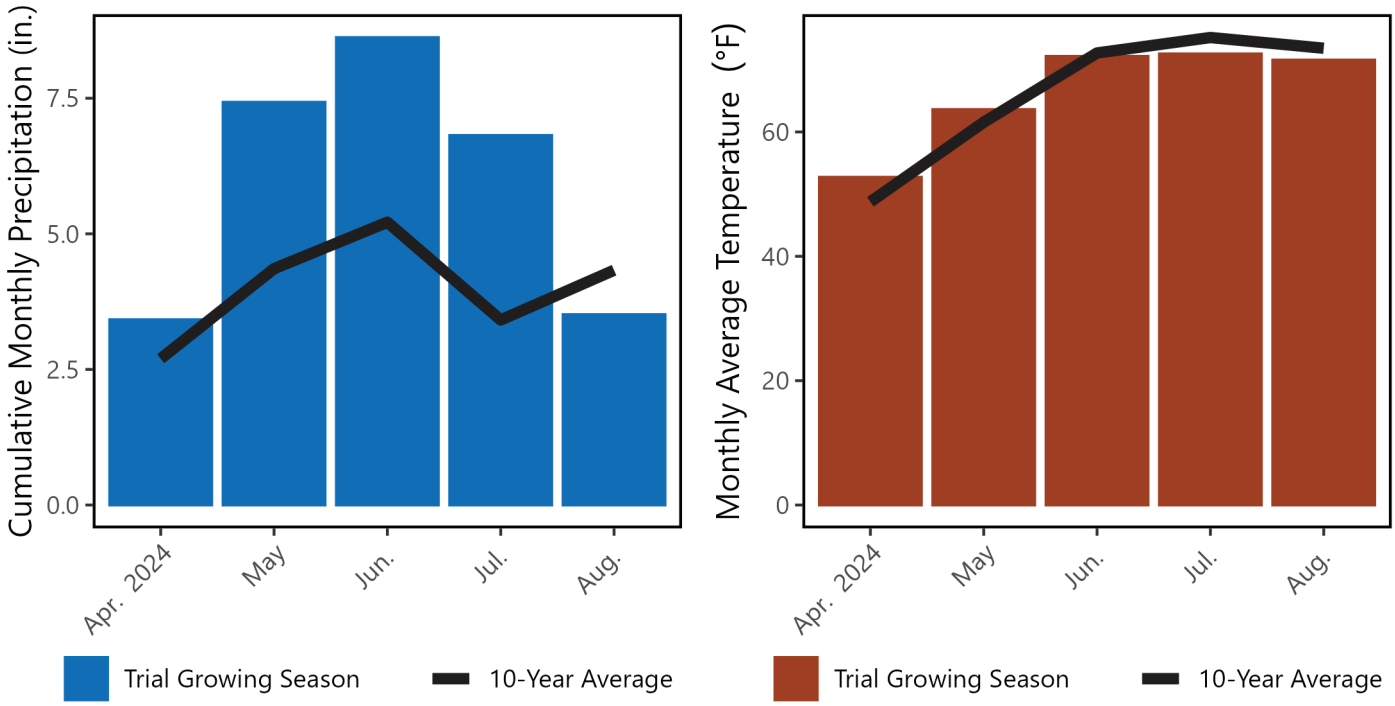

FIGURE A2. Cumulative monthly precipitation and mean monthly temperature in 2024 (columns) and 10-year averages (lines)for Nevada IA [4], [5]. It was abnormally wet throughout the growing season.

REFERENCES

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PRACTICAL FARMERS of Iowa

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