Does Introduction of Technology Lead to a Reduction in Water Pumping Using Center Pivot Irrigation Systems in Central Nebraska

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Introduction

In irrigation dependent states, the need for finding ways to reduce water use is extremely important because as the population grows, stress on freshwater sources will also increase. Focusing on agricultural water savings is critical because common ways of reducing water like citizens' responsibility to turn off the tap as soon as possible are not viable anymore (Ruiz et al. 2020).

Up to 90% of water used in these regions can be from irrigation alone (Richter et al. 2017). Since legislative action may be slow on water conservation efforts, more timely action may be lead by farmers and citizens to address growing and unsustainable water use.

Purpose

This research determined if a reduction of water pumping due to technology has occurred in the Central Nebraska Irrigation Project (CNIP). We hypothesized that if technology is introduced then there will be less applied irrigation while not affecting crop yield.

Background

Central Nebraska Irrigation Project (CNIP)

- 50 Participant: 15 Control
- Central Nebraska
- Taught and train to use technology
- 2018, 2019, and 2020

Similar Projects:

- PepsiCo
- Western Nebraska Irrigation Project
- McKinley Project

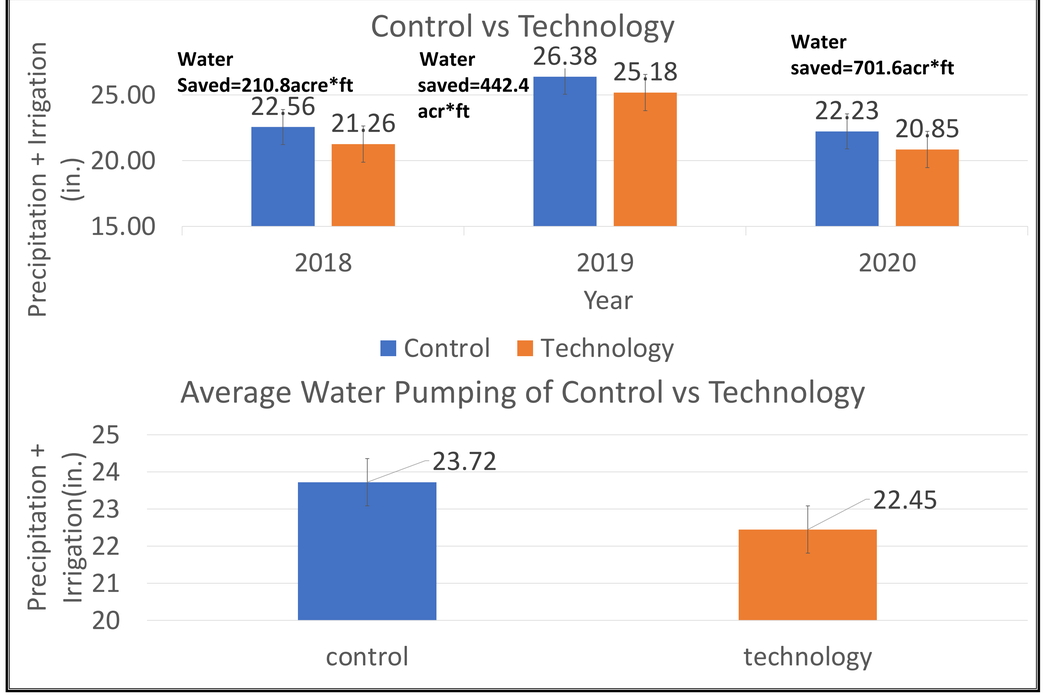
Technology Introduced

- Center pivot telemetry
- Soil moisture probes
- Flow meters
- Arable Mark II Weather Station

Methods

All data used was from the results of the Central Nebraska Irrigation Project reports provided by The Nature Conservancy and the Central Platte NRD. Irrigation plus precipitation for 2018, 2019, and 2020 as well as for the combined data was analyzed using an unpaired t-test assuming unequal variance. Average water used for participants was put into a bar graph vs the average water used for control fields. Power analysis for sample size done in R studio.

Results



Results

```
> pwr.t2n.test(n1=15, n2= NULL, d=.8, sig.level=0.05, power=.8, alternative= c("two.sided"))

     t test power calculation

             n1 = 15
             n2 = 76.21513
              d = 0.8
      sig.level = 0.05
          power = 0.8
    alternative = two.sided
```

Results

- In 2018, 2019, and 2020 there were 210.8 acre*ft, 442.4 acre*ft, and 701.6 acre*ft of water pumping reduction, respectively. (p=.19 for 2018). (p=.27 for 2019). (p=.22 for 2020). (p= .07 for all three years combined).
- Average 1.3 inches of water pumping reduction for each year
- Approximately 76 participants needed
- No Reports of lost yield.

Conclusion

- While the p-value of the water savings was not significant, there would likely be significant results had funding allowed for a larger sample size.
- The power analysis for sample size has shown that approximately 76 participants would have been needed to lead to significant results.
- There was also likely a behavioral lag in the participant section for the technology use.

Future Research

- There is a need for continuing this project at least one more growing season.
- Investigating whether a consistent 1.3 inches of water savings would be seen in similar sized fields in eastern Nebraska.

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