Irrigation Water Amount and Delivery Method Effect on Garden Bean Production Under Conventional and Strip Tillage Systems

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INTRODUCTION

Idaho ranks 1st in garden bean production in the U.S. Most of the garden beans are produced in the Magic (8,000 ac) and Treasure Valley (>1,500 ac) regions of Idaho. Beans are a valuable rotational crop in Idaho and they are an excellent crop to plant in years where water inputs will be limited. Interest in garden beans is increasing among Idaho growers. In cooperation with the Idaho Bean Commission, plant and soil scientists and water management engineers at the University of Idaho will conduct two field experiments to develop sustainable water and soil conservation strategies for garden bean production.

OBJECTIVES

The study is focus on the effects of water management using subsurface drip irrigation versus furrow irrigation in two tillage systems: conventional and strip tillage.

MATERIALS AND METHODS

The experiment has been conducted at two locations: one - in SW Idaho, at the University of Idaho Parma Research and Extension Center, and the other in SC Idaho - at the University of Idaho Kimberly Research and Extension Center. The experiments are set up in a split block randomized complete block design. Each treatment is replicated four times. The experiment is comprised of eight irrigation x tillage treatment combinations, including surface and subsurface drip irrigation in a conventional vs strip till. The following agronomic, cultural and environmental parameters are being assessed: biomass (stand emergence and establishment, plant height, weight, overall plant health and vigor - NDVI), environmental (estimated evapotranspiration and amount of irrigation water actually applied, and soil moisture levels), and bean yield and quality.

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PRELIMINARY RESULTS

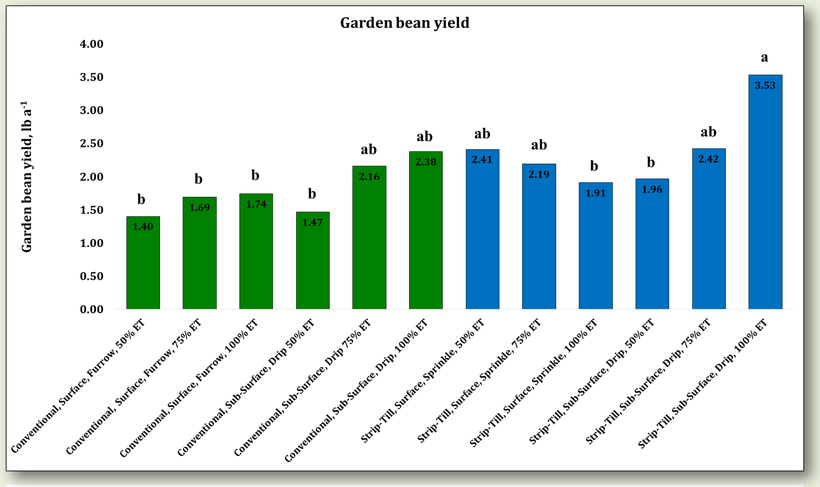


Figure 1. Garden bean by-plot yield as affected by the water amount and delivery method under conventional and strip tillage, Parma, ID, 2016.

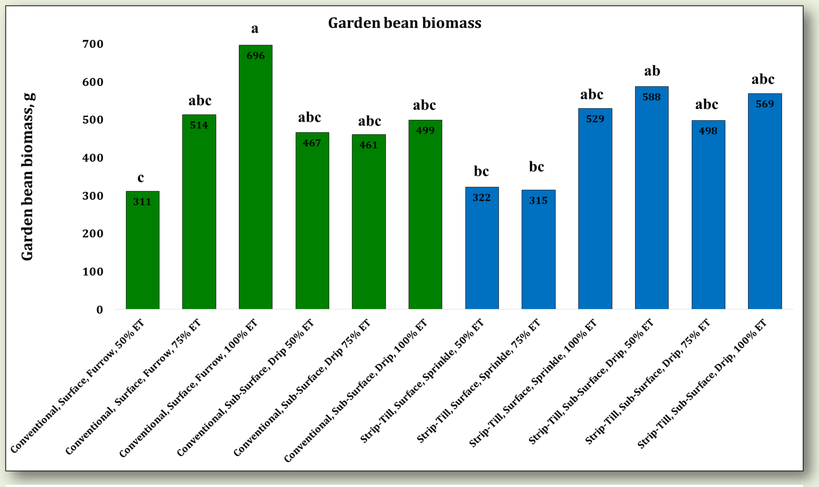


Figure 2. Garden bean above ground biomass weight as affected by the water amount and delivery method under conventional and strip tillage, Parma, ID, 2016.

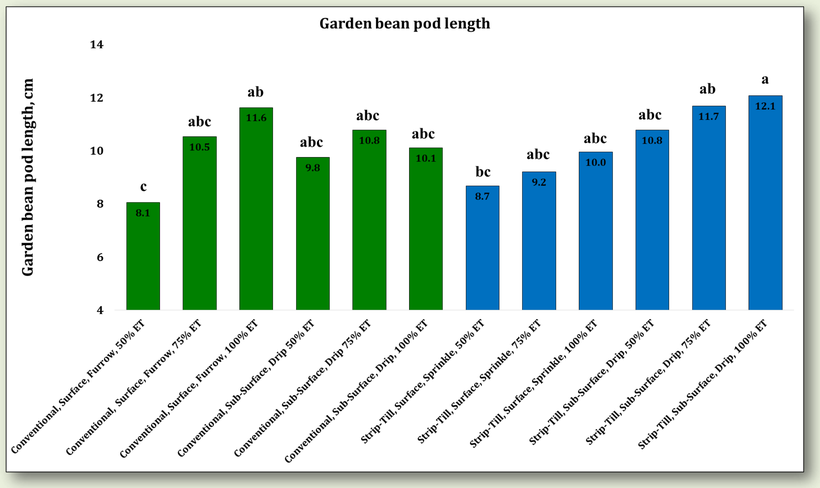


Figure 3. Garden bean pod length as affected by the water amount and delivery method under conventional and strip tillage, Parma, ID, 2016.

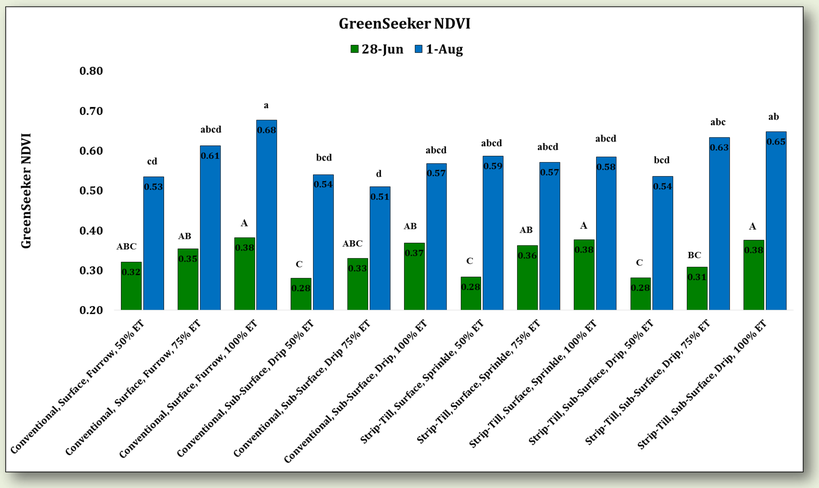
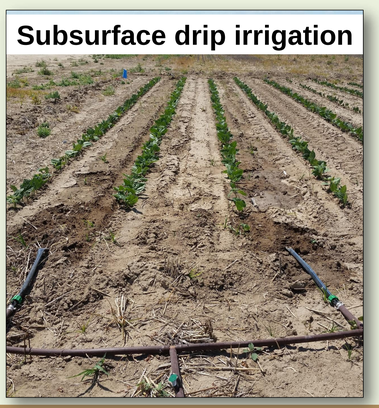


Figure 4. Garden bean GreenSeeker NDVI as affected by the water amount and delivery method under conventional and strip tillage, Parma, ID, 2016.

DISCUSSION

- ✓ In general, higher yields were observed under strip-till compared to conventional tillage. Highest yield was obtained with strip-tillage under drip irrigation at 100% ET, whereas conventional, tillage coupled with furrow irrigation resulted in the lowest yields. Yield of strip-tilled plots under drop irrigation at 75% ET was slightly higher that in conventionally tilled plots under drip irrigation applied at 100% ET. Notably, strip-tilled plots under drip irrigation at 50% ET had higher yield, than any plots under the conventionally tilled plots under furrow irrigation. In sprinkle-irrigated treatments, bean yield decreased as the amount of water increased (**Figure 1**).
- ✓ Highest above-ground biomass was obtained with conventional tillage under furrow irrigation applied at 100% ET. A noted stepwise increase in biomass production was observed from 50 to 75 to 100% ET. For other tillage x irrigation methods, no obvious trends were noted in biomass production associated with the amount of irrigated water applied (**Figure 2**).
- ✓ Strip-till and drip irrigation combination has resulted in the longest bean pods. The longest pods were observed with strip-till under drip irrigation at 100% ET. There was a stepwise increase in bean pod length for conventionally-tilled plots under furrow irrigation from 50 to 75 to 100% ET. The shortest bean pods were noted for the conventionally-tilled plots furrow irrigated at 50% ET. In general, sprinkle-irrigated plots had lower pod length compared to all other treatments (**Figure 3**).
- ✓ The GreenSeeker sensor NDVI measurements were able to pick up differences in water application levels – a stepwise increase in NDVI was observed with greater water amounts applied. Highest NDVI was noted for plots under conventional tillage, furrow irrigated at 100% ET. Equivalent NDVI was measured for strip-tilled plots under drip irrigation at 100% ET. For sprinkle-irrigated plots, a stepwise increase in NDVI was observed for early-season measurements, with almost no differences among treatments at a later-season crop sensing date (**Figure 4**).

PRELIMINARY CONCLUSION: Strip-tillage utilized in combination with subsurface drip irrigation, has potential for improving garden bean production in the Idaho Treasure Valley area by promoting soil health and allowing to conserve soil moisture and enabling growers to apply less irrigation water throughout the growing season.



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