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INTRODUCTION

- **Deficit irrigation** can be used as a valuable strategy to increase efficiency of limited water resource, in irrigation-based crop production in semiarid environments such as Western Nebraska.
- We hypothesized that corn hybrids will differ in their ability to tolerate water stress imposed by deficit irrigation. Objective of this study was to quantify **differences in irrigation water use efficiency between modern corn hybrids** under deficit irrigation

METHOD

Site description

The study was conducted at Brule, NE in 2011 and 2012 on an irrigated corn field under no-till. The soil type is Kuma silt loam with pH of 7. Corn hybrids (maturities 105 to 116) were planted in 4 row plots (3 x 10 m) at about 80,000 seeds/ha. Planting dates were May 23 and May 16 in 2011 and 2012, respectively. Nutrient and pest management was based on University of Nebraska guidelines.

Experimental design and treatments

- Split plot with 4 replications
- **Main-plot: 3 irrigation treatments: rainfed (R-0), deficit (D-50) and full irrigation (F-100).** Soil moisture monitoring and irrigation scheduling was done based on neutron probe readings. Soil water status in F-100 treatment was maintained between 50 and 90% of field capacity; D-50 treatment received 50% less irrigation water each time irrigation was initiated.
- **Sub-plot: 18 corn hybrids** (most recent releases)

Table 1. Amounts of annual rainfall and total precipitation in cm for deficit and fully irrigated treatment

Year	Rainfall	Total precipitation (cm)	
		D-50	F-100
2011	26	42	57
2012	12	42	72

Efficiency indices

1. Grain yield
2. Irrigation Water Use efficiency (IWUE)

$$IWUE = (Y_i - Y_r) / I_i$$

where, IWUE is in units of t/ha-cm, Y_i = yield (t/ha) produced at irrigated level i , Y_r = yield (t/ha) from equivalent rainfed treatment, I_i = amount of irrigation (cm) applied for irrigation level i .

3. Profit

Based on average corn prices of 250 \$/t in 2011 and 280 \$/t in 2012 and typical irrigation cost for Nebraska 9.1 \$/ha/cm

RESULTS

- Assuming that full irrigation caused no yield reduction (best-case scenario), deficit treatment (50% less irrigation):
 1. Increased corn grain yield by 77% in 2011 and 62% in 2012 compared to rainfed treatment
 2. Increased profit by 84% in 2011 and 64% in 2012 compared to rainfed treatment
 3. Increased IWUE by 0.11 t/ha-cm in 2011 and 0.04 t/ha-cm in 2012 compared to full irrigation

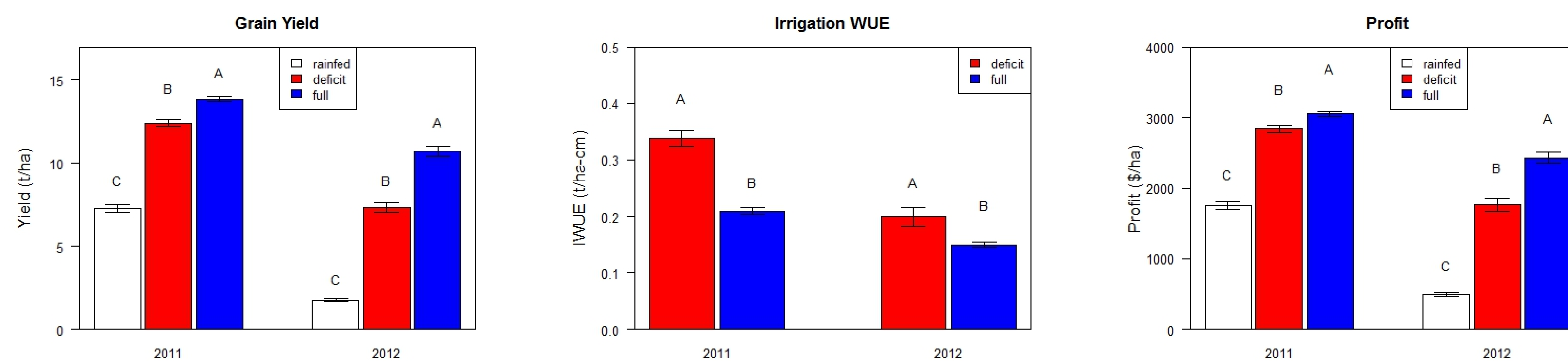


Fig 1. Average of all 18 hybrids on corn yield, irrigation WUE (IWUE) and profitability in rainfed, deficit and full irrigation treatments in 2011 and 2012

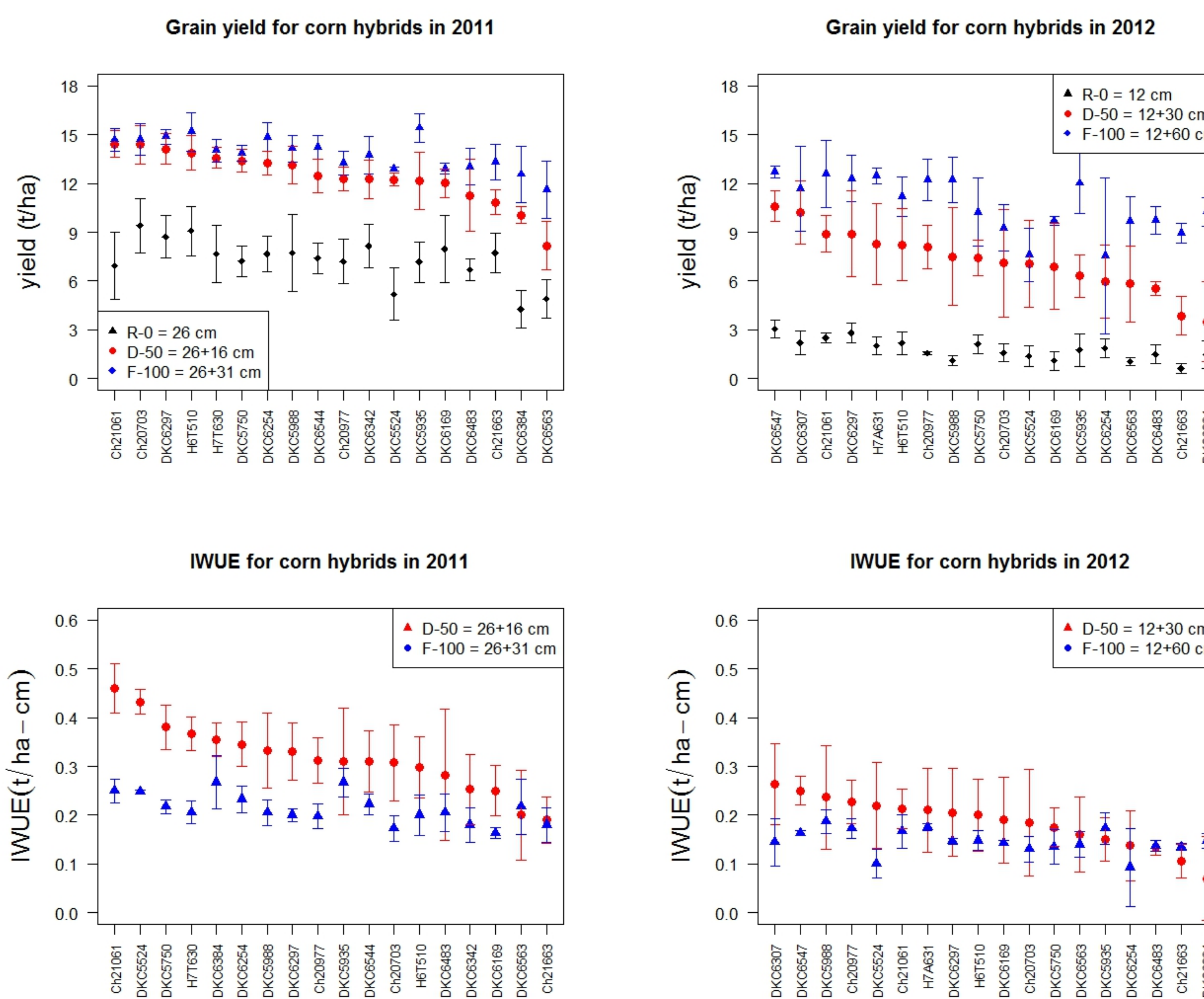


Fig 2. Mean grain yield and Irrigation water use efficiency (IWUE) with 95% confidence intervals for 18 corn hybrids under rainfed, deficit and full irrigation treatment in 2011 and 2012; hybrids are ranked by best performing hybrid under deficit irrigation

- Some corn hybrids yielded similarly under deficit and full irrigation.
- Increase in total precipitation decreased the variability in grain yield suggesting that differences in soil environment and/or agronomic practices (e.g. residue cover) can have an impact on water availability to corn under deficit irrigation.
- All hybrids had similar IWUE under full irrigation. IWUE ranged from 0.2 to 0.3 t/ha-cm in 2011 and from 0.1 to 0.2 t/ha-cm in 2012
- Hybrid IWUE varied under deficit irrigation. In 2011, up to 0.25 t/ha-cm differences between hybrid IWUE; while up to 1.8 t/ha-cm differences between hybrid IWUE is observed in 2012.

CONCLUSIONS

- Deficit irrigation showed to be a good strategy to increase crop water productivity, in semi arid regions.
- Ranking of hybrids in their IWUE changes across years. Farmers with irrigation water allocations, light textured soils and low capacity wells should carefully select their corn hybrids as substantial differences in irrigation WUE between hybrids under deficit irrigation were observed.
- For best results, integrate deficit irrigation with hybrid selection and other farm management practices such as seasonal soil-moisture monitoring, no-till, optimal planting densities, row spacing, etc.

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