

Response of chickpea cultivars and pea to irrigation and planting rates.

Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425;
Perry Miller, Dept. of Land Resources and Environmental Science and John Riesselmann, Dept.
of Plant Sciences and Plant Pathology, Bozeman, MT 59717.

Executive Summary

We found that cultivars of dezi, small kabuli, and large kabuli chickpea will respond to irrigation in the absence of *Ascochyta* blight. Seed yields of about 2000 lbs/acre of kabuli chickpea and 3000 lbs/acre of dezi and small kabuli chickpea can be achieved with adequate precipitation or irrigation water; however, at the higher irrigation rates, maturity is delayed substantially. In addition we found seed yields were similar from planting rates of four and eight (three and six for large kabuli) pure live seeds (pls) per square foot.

Introduction

Chickpea offer an ideal rotation crop for many producers who produce barley or wheat continuously. The crop fits into the small grain cropping system with little or no change in machinery with obvious pest control advantages of a broadleaf crop such as different weed herbicides. Chickpea offers a growth pattern that is later than barley or wheat limiting irrigation water demand conflicts between the two crops. In addition, little or no planting or harvest conflicts exist with small grain production. However irrigation and water use information is lacking; consequently, the objective(s) of the research is to study the response of chickpea to differential irrigation water application and planting rates.

Materials and Methods

Three chickpea cultivars and one pea cultivar were planted into fallow (into barley stubble, no-till in 2003 and 2004) with a six-row, 12 inch spaced, double disk, planter. Planting dates were May 15, 2002, May 14, 2003, and May 4, 2004. Sixty lbs/acre of monoammonium phosphate was seed placed, and 30 lbs/acre of KCl was broadcast while planting (6-30-24). Plot size was 6 x 17 feet with four replicates. The following planting rates were used: kabuli chickpea (cultivar – Dwelly, (Yuma in 2003 and 2004) – 3 and 6 pls/ft², desi and small kabuli chickpea (cultivars- Miles and Amit, respectively), and dry pea (cultivar- Espace) – 4 and 8 pls/ft². Both species were inoculated with appropriate *Rhizobium* inoculant. Irrigation was supplied with a line source through the center of the plot with water levels decreasing as distance from the source increased. Three irrigation water regimes, low, moderate, and high, were established as well as rainfed. Plots were direct cut with a Hege plot combine. The dryland moisture regime peas were harvested on 8/29/02 and the dryland moisture regime of chickpea was harvested on 9/26/02. The remaining moisture regimes were harvested on 10/7/02. Harvest dates in 2003 were as follows: dryland pea - August 4, dryland chickpea and low moisture regime pea- August 26, low and medium moisture regime chickpea and remaining pea-September 3, and high moisture regime chickpea-September 18. Harvest dates in 2004 were as follows: dryland pea - August 2, dryland chickpea and low moisture regime pea- August 30, low and medium moisture regime chickpea and remaining pea-September 9, and high moisture regime chickpea-October 13. Precipitation and applied irrigation water data are summarized in Table 1. Pre-plant and post-harvest soil water was determined gravimetrically. Initially, the plot area, soil water content was characterized by eight samples four feet deep, and after harvest, each plot was sampled to determine soil water content. Soil water use (in inches) was calculated in each foot of soil by subtracting post-harvest water content from pre-plant and multiplying by 12. Plant water use was determined by adding soil water use, precipitation, and irrigation water applied.

Results and Discussion

2002

The data are summarized in Table 2. Pea yields were affected by hail (about 30 to 50 % loss) after the initial harvest date for the dryland moisture regime, under the high moisture regime, pea yields would have approached 6000 lbs/acre. Chickpea were unaffected by the hail. The dezi and small kabuli chickpea were eventually infected with *Ascochyta* after the August 15 disease ratings were made. Seed yields of all chickpea cultivars declined with increasing irrigation water, but the affect was most pronounced with the kabuli cultivar, Dwelly. Planting rate did not affect seed yield. Plant water use was not determined because of the severe disease infection and pea hail damage.

2003

Seed yield data are summarized in Table 2, and water use data are shown in Figures 1-3. Chickpea data were affected by early and differential infection of *Ascochyta* that gradually disappeared due to the hot and dry weather that dominated the region for about 10 weeks starting about June 20. Also pea yields were reduced by extensive shatter. Generally both pea and chickpea responded to higher irrigation levels. However this year chickpea had higher yields than pea probably due to the excessive shattering of pea (pea data not shown graphically). Also differences in seed yield due to planting rate were non-significant. Water use efficiency was about 225, 175, and 140 lbs/inch of water for Amit, Miles, and Yuma chickpea, respectively and was unrelated to planting rate.

2004

Seed yield data are summarized in Table 2, and water use data are shown in Figures 4-6. Pea yields were reduced by extensive shatter and are not presented graphically. Generally pea and chickpea responded to increasing irrigation levels. No *Ascochyta* blight was noted this year, and there was no seed yield response to planting rate. Water use efficiency (WUE) averaged about 225, 175, and 140 lbs/inch of water for Miles, Amit, and Yuma, respectively and was unrelated to planting rate.

Conclusions

Seed yields ranged from 1100 to 3400 lbs/acre for Amit, 1000 to 3000 lbs/acre for Miles, and 1300 to 2400 lbs/acre for Yuma chickpea. Yields were essentially the same for planting rates of 4 (3 for Yuma) pls/ft² and 8 pls/ft² (6 for Yuma). In the absence of *Ascochyta* blight, highest yields occurred with the high water regime. Chickpea responded to additional water in terms of both seed yield increases and delayed maturity. With adequate water, chickpea will bloom and set seed until a killing frost terminates plant growth. In general WUE was highest for the dryland water regime and the cultivars Amit and Miles. Water use efficiency did not significantly increase with irrigation level and was unrelated to planting rate.

Table 1. Precipitation and Applied Water (inches). Western Triangle Ag. Research Center, Conrad, MT. 2002-2004.

Water Level	Total Irrigation Water			Total Precipitation			Total Water		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
Low	2.4	2.3	4.1	13.6	9.6	7.3	16.0	11.9	11.4
Moderate	7.0	7.4	6.5	13.6	9.6	7.7	20.6	17.0	14.2
High	8.5	8.7	7.0	13.6	10.4	8.4	22.1	19.1	15.4
Dryland Pea	0	0.6	3.0	10.2	9.4	5.4	10.2	10.0	8.4
Dryland Chickpea	0	0.6	3.0	13.2	9.5	7.3	13.2	10.1	10.3

Table 2. Effect of irrigation, planting rate, and cultivar on seed yield and *Ascochyta* infection of chickpea and pea. Western Triangle Ag. Research Center, Conrad, MT. 2002-2004.

Cultivar ¹	Seeding Rate ²	Irrigation Level	Seed yield (lb/a)			Disease Rating (1-9) ³ (2002)
			2002	2003	2004	
Amit	4	Dryland	2586.1	1672.7	1702.0	1
Amit	4	Low	1390.0	1483.5	1385.7	1
Amit	4	Moderate	149.3	3062.4	2307.4	1
Amit	4	High	136.4	3446.6	2853.7	1
Amit	8	Dryland	2545.0	1941.4	1108.4	1
Amit	8	Low	1604.2	2474.3	1604.5	1
Amit	8	Moderate	232.2	3419.8	2236.9	1
Amit	8	High	163.5	3372.0	3115.0	1
Espace	4	Dryland	3170.2	1521.2	1592.3	
Espace	4	Low	2045.1	1981.8	1595.6	
Espace	4	Moderate	2932.7	1487.3	1333.2	
Espace	4	High	3155.5	2866.8	1336.1	
Espace	8	Dryland	3934.3	1504.4	1444.3	
Espace	8	Low	2130.7	1488.7	1652.9	
Espace	8	Moderate	3273.2	2118.6	1179.4	
Espace	8	High	2993.2	2049.0	1478.0	
Myles	4	Dryland	2819.5	999.0	1000.1	1
Myles	4	Low	1388.2	1563.0	2086.5	1
Myles	4	Moderate	269.6	2582.2	3075.1	1
Myles	4	High	458.5	2752.3	2994.5	1
Myles	8	Dryland	2427.1	1279.7	1608.5	1
Myles	8	Low	1827.0	1368.4	2022.0	1
Myles	8	Moderate	233.8	3112.9	2745.6	1
Myles	8	High	252.0	2642.8	3332.3	1.3
Yuma	3	Dryland	1349.1	1714.4	1328.3	1.8
Yuma	3	Low	182.6	1087.2	1197.6	3.5
Yuma	3	Moderate	25.2	1891.0	1964.6	3.5
Yuma	3	High	19.4	2115.6	2136.3	4
Yuma	6	Dryland	1663.6	1190.8	1449.2	2.3
Yuma	6	Low	188.8	1224.8	1313.3	3.8
Yuma	6	Moderate	14.3	2016.3	2043.0	5.3
Yuma	6	High	237.0	2429.9	2273.7	4.8

¹ Chickpea: Desi -Amit and Myles; Kabuli -Dwelly in 2002 and Yuma in 2003, 2004.

Dry pea = Espace

² Planting Rate: pls/ft² = pure live seed per square foot

³ Disease Rating is 1 - 9, 1 is a healthy plant and 9 is a dead plant. Disease notes taken 8-15. As the data indicate, *Ascochyta* infection exploded after the August 15 evaluation.

Figure 1. Effect of planting rate and water use on the yield of Amit chickpea. 2003.

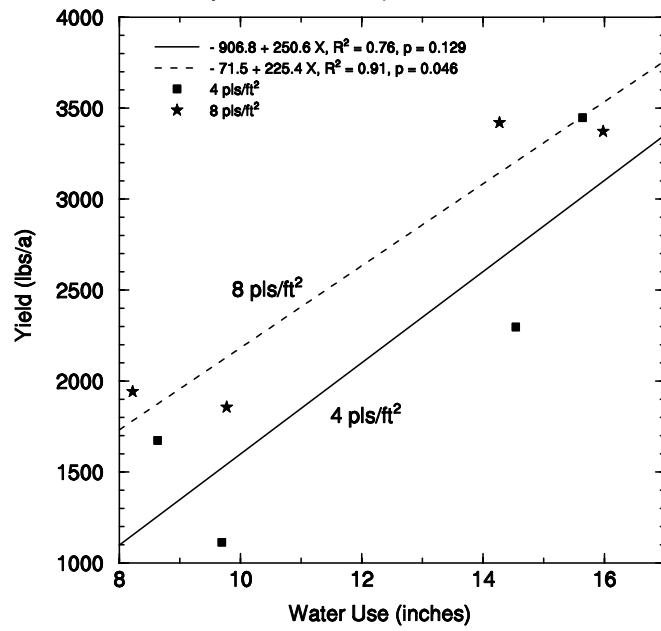


Figure 2. Effect of planting rate and water use on the yield of Myles chickpea. 2003.

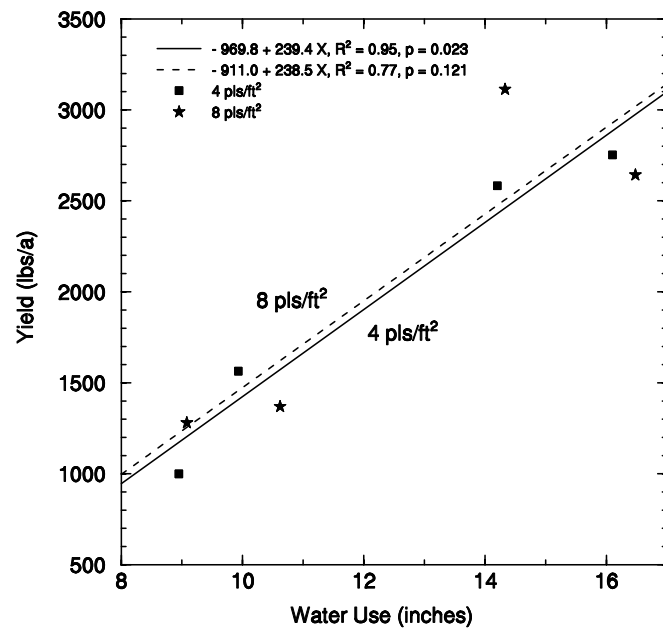


Figure 3. Effect of planting rate and water use on the yield of Yuma chickpea. 2003.

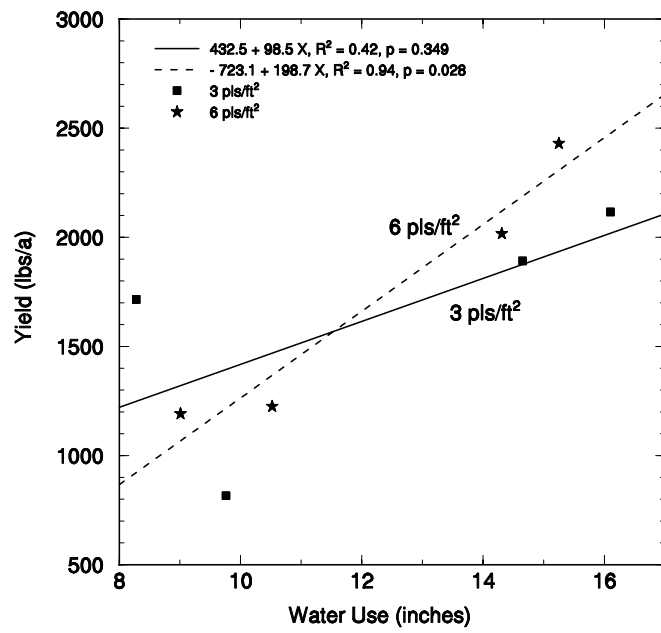


Figure 4. Effect of planting rate and water use on the yield of Amit Chickpea. 2004.

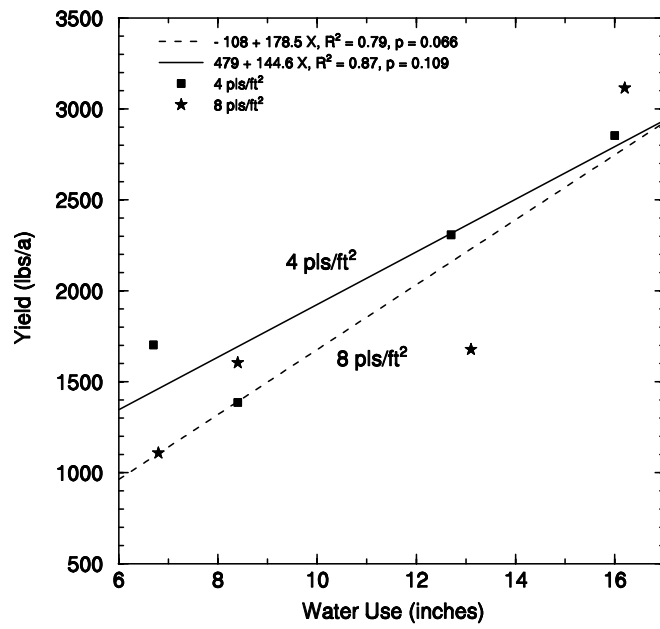


Figure 5. Effect of planting rate and water use on the yield of Myles Chickpea. 2004.

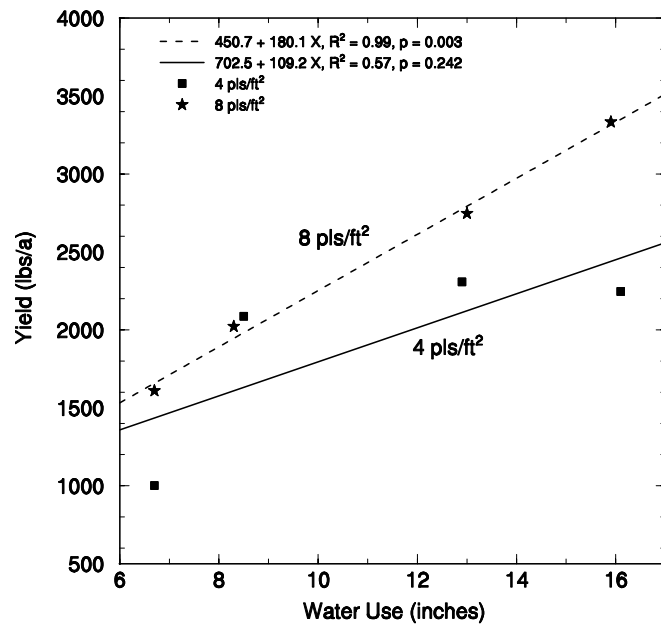


Figure 6. Effect of planting rate and water use on the yield of Yuma Chickpea. 2004.

