University of California
Agriculture and Natural Resources
Intermountain Research & Extension Center

RESEARCH REPORT

Number 191, 2018

Weed Management Strategies for Nightshade and Summer Annual Weeds in Garbanzo Beans (chickpea) grown in the Tulelake Basin

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The combination of poor cereal grain prices and high demand for chickpea from NW milling has increased the interest in growing garbanzo beans in Tulelake. In 2017, the Intermountain Research and Extension Center planted a trial to evaluate garbanzo bean development, yield and quality. The results were quite promising with yield averaging 2,500 lbs per acre and excellent bean quality for milling. We had no signs of insect or disease. Weeds, on the other hand, were a terrible problem. The plots required hand-weeding to prevent excessive competition, and cost-effective weed control strategies are needed for large scale production.

Weeds are a significant challenge to successful garbanzo bean production as garbanzo beans are a weak competitor with most weeds including hairy nightshade, cutleaf nightshade, pigweed, common lambsquarters, and prickly lettuce. Previous studies showed herbicides and proper crop rotation are critical to successful weed management in garbanzo beans. Pre-irrigation and tillage are other weed control options, but Tulelake's limited growing season makes pre-irrigation and tillage before planting impractical. Several studies documented herbicide efficacy in garbanzo beans, but little research and information is available that is relevant to irrigated production in Tulelake. Tulelake's soil, climate, and production practices are quite unique compared to other production regions. The soils and climate are very different from the rest of California, and Tulelake's irrigation production practices are different from Idaho and Washington where garbanzo beans are grown without irrigation.

Objectives: Evaluate herbicide efficacy and crop safety for garbanzo beans grown under irrigation in Tulelake.

- Compare the efficacy of currently registered herbicides applied at recommended timings
- Determine the weed control benefits and crop safety of herbicide tank-mixes
- Evaluate the potential of using pyroxasulfone (Zidua) and dimethenamid-P (Outlook) as a preemergence herbicides

Procedures: The experiment was conducted at the UC Intermountain Research and Extension Center in Tulelake CA. Garbanzo beans were spring seeded and grown under solid-set irrigation. Garbanzo beans were planted using a 10 inch row spacing at 4.5 seeds/ft^2. Plots were 6ft by 20 ft with 4 replications. Yield was determined by direct combining using a research grain combine. Data included % weed control, weed density for all weed species, % visual crop injury, crop stand, and crop yield/quality.

Herbicide Treatment List

1. Untreated Control
2. Hand-weeded Control
3. Prowl H2O at 2.0 pt/A preplant incorporated shortly before planting
4. Prowl H20 at 2.0 pt/A preplant surface applied (no-till and reduced till option)
5 . Prowl H20 at 2.0 pt/A post plant pre-emergence (within a 2 days of planting)
6. Sharpen at 2 oz/A + MSO at 1% post plant preemergence
7. Prowl H20 at 2.0 pt/A preplant surface applied and Sharpen at 2 oz/A + MSO 1% post-plant pre-emergence
8. Prowl H20 at 2.0 pt/A + Sharpen at 2 oz/A + MSO 1% post-plant pre-emergence
9. Prowl H20 at 2.0 pt/A + Goal 2xL at 8 fl. oz/A + Sharpen at 2 oz/A + MSO 1% post plant preemergence
10. Prowl H20 at 2.0 pt/A + Chateau at 1.5 oz/A + Sharpen at 2 oz/A + MSO 1% post plant preemergence
11. Zidua at 2.5 oz/A preplant incorporated
12. Zidua at 2.5 oz/A post plant preemergence

Results: See table for a complete review of results. None of the herbicide treatments caused a reduction in crop stand or early season crop injury. All Sharpen treatments provided excellent control of pigweed and hairy nightshade. Combining other herbicides with Sharpen did not improve weed control compared to Sharpen alone for the limited weed spectrum in the trial. Prowl H20 at most application timings numerically reduced weed density compared to the control. Zidua reduced nightshade density and numerically reduced pigweed density compared to the untreated control. Preplant incorporated treatments of Prowl H20 and Zidua consistently had lower weed density compared to post plant preemergence applications. The untreated control had the lowest chickpea yield due to weed competition (Table). Chickpea yield did not differ among herbicide treatments. Sharpen at 2 oz/A post-plant preemergence had the highest yield in the trial and was only treatment statistically different from the control.

Table. Influence of Herbicides on Weeds and Garbanzo Bean (Chickpea) Establishment and Yield.

Herbicide Treatments	Early season crop injury	Crop stand	Early season crop height	Pigweed	Hairy nightshade	Total weeds	Chickpea yield	Chickpea yield per plant
	0-10 rating	# plants/plot	cm	# weeds/plot			tons/A	grams
1. Untreated Control	1 a	271 a	28 a	32 a	9 a	48 a	1.07 b	7.75 b
2. Hand-weeded Control	0.75 a	238 a	25 a	11* ab	10* a	23* ab	1.34 ab	11.39 a
3. Prowl H2O at 2.0 pt/A preplant incorporated shortly before planting	1 a	290 a	26 a	14 ab	3 ab	18 ab	1.26 ab	8.76 ab
4. Prowl H20 at 2.0 pt/A preplant surface applied	1.25 a	255 a	25 a	17 ab	6 ab	23 ab	1.13 ab	9.1 ab
5 . Prowl H20 at 2.0 pt/A post-plant preemergence (within a 2 days of planting)	0.75 a	275 a	27 a	29 ab	4 ab	33 ab	1.17 ab	8.49 ab
6. Sharpen at 2 oz/A + MSO at 1% post-plant preemergence	0.75 a	269 a	26 a	0 b	0 b	0 b	1.52 a	11.18 ab
7. Prowl H20 at 2.0 pt/A preplant surface applied & Sharpen at 2 oz/A post-plant preemergence	0.75 a	249 a	26 a	0 b	0 b	2 b	1.43 ab	11.5 a
8. Prowl H20 at 2.0 pt/A + Sharpen at 2 oz/A post-plant preemergence	0 a	266 a	27 a	0 b	0 b	0 b	1.49 a	10.5 ab
9. Prowl H20 at 2.0 pt/A + Goal 2XL at 8 fl. oz/A + Sharpen at 2 oz/A post-plant preemergence	0.5 a	252 a	27 a	0 b	0 b	0 b	1.41 ab	10.9 ab
10. Prowl H20 at 2.0 pt/A + Chateau at 1.5 oz/A + Sharpen at 2 oz/A post-plant preemergence	0.75 a	262 a	27 a	0 b	0 b	0 b	1.37 ab	10.2 ab
11. Zidua at 2.5 oz/A preplant incorporated	0.5 a	247 a	25 a	6 ab	1 b	7 b	1.36 ab	10.95 ab
12. Zidua at 2.5 oz/A post plant preemergence	1 a	249 a	26 a	16 ab	6 ab	23 ab	1.28 ab	10 ab

Letters next to means represent significant difference. Treatments with different letters are statistically different using Tukey's HSD test.

**Reflects weeds that emerged after 1st weeding event. All weeds were removed from the hand-weeded plot after weed density measurements.*