Kansas Agricultural Experiment Station Research Reports

Volume 11
Issue 3 *Kansas Field Research*

Article 7

2025

Effect of Corn Row Spacing on Herbicide Effectiveness for Weed Control

Sarah H. Lancaster
Kansas State University, slancaster@ksu.edu

Eric Adee
Kansas State University, eadee@ksu.edu

Igor G. R. Lima
Kansas State University, igrezend@ksu.edu

Recommended Citation

Lancaster, Sarah H.; Adee, Eric; and Lima, Igor G. R. (2025) "Effect of Corn Row Spacing on Herbicide Effectiveness for Weed Control," *Kansas Agricultural Experiment Station Research Reports*: Vol. 11: Iss. 3. https://doi.org/10.4148/2378-5977.8699

Effect of Corn Row Spacing on Herbicide Effectiveness for Weed Control

Sarah Lancaster, Eric Adee, and Igor G. R. Lima

Summary
Cultural weed control practices, such as narrow row spacing, can be an essential component of successful weed management. In 2022 and 2023, experiments were conducted in the Kansas River Valley to evaluate the interactions of herbicide programs and corn row spacings on weed control and grain yield. There were no differences in weed control at a site with low weed density in either year. However, at a site with a greater density of Palmer amaranth, Resicore + Acuron resulted in the greatest weed control, in either 15- or 30-inch row spacing. Degree + Callisto applied in 30-inch rows provided the best performance in both locations.

Introduction
The increased prevalence of herbicide-resistant weed populations has led to the need for more complex herbicide mixtures and multiple herbicide application periods throughout the year. Herbicide resistance has also led to the need for non-chemical means of weed control. Understanding how cultural or mechanical weed management practices and herbicides interact is important for maximizing weed control.

Light interception can be an effective practice to reduce competition, especially by reducing weed seed germination. Narrow row spacing has been shown to be an effective way to help control weeds in crops such as wheat and soybeans. However, little work has been done to evaluate the influence of corn row spacing on weed control. Unlike wheat or soybeans, which can be planted in rows as narrow as 7 inches, corn is limited in terms of row spacing by the harvesting equipment available. Currently, harvesting equipment for 15-inch rows is the narrowest available for corn. In addition, seeding rates for wheat and soybeans are much higher than for corn, as the wheat and soybeans can adjust to the seeding rate. Increasing the seeding rates of wheat or soybeans in narrower rows can promote earlier canopy development. Corn normally has a narrow range of seeding rates for specific environments due to plant architecture and seed cost; therefore, significant increases in maize seeding rates are not feasible.

The objective of this project was to evaluate weed control and corn yield response to commonly used herbicide programs applied to corn planted in 15- or 30-inch rows.

Experimental Procedures
Two studies were established under dryland (Topeka) or irrigated (Rossville) crop production in Shawnee County, KS, in 2023. The experimental design was a randomized complete block with four replications. There was a two-by-six factorial arrange-

ment of treatments with two row spacings (15 or 30 inches) and five herbicide programs plus a nontreated control (Table 1). Plots were 10 by 30 feet (7 by 15-inch rows, 4 by 30-inch rows). The field at Topeka, KS, was Eudora-Kimo complex soil, which had the soybean stubble inline subsoiled in the fall, then the field was cultivated prior to planting Pioneer 1413 AM corn at 28,000 seeds per acre. Rossville was Eudora silt loam that had the soybean stubble subsoiled in the fall and was vertical tilled before planting Pioneer 1572 AM at 33,000 seeds per acre. Both studies were planted with a Kinze 3000 planter on April 24, and the herbicides at planting were applied on April 25. Herbicides were applied using a CO_2 pressurized backpack sprayer and a 5-foot hand boom equipped with XR8002 nozzles calibrated to deliver 15 gallons per acre. Just under 17 and 14 inches of rain were received at Topeka and Rossville, respectively, from April through August. The irrigated field received an extra 6.1 inches of water from June through August. Weed control was visually estimated throughout the summer until September 12. Yield data were collected from four of the middle rows in the 15-inch row spacing and the two middle rows of the 30-inch row spacing with a JD 3300 plot combine equipped with a HarvestMaster Classic Grain Gauge on September 13 and 15 (dryland and irrigated, respectively). Yields were converted to bushels per acre at 15.5% grain moisture.

Data were subjected to analysis of variance using a mixed effects model with row spacing, herbicide, and site-year as fixed effects and replication within site-year as a random effect. When appropriate, means were separated using Tukey's Honestly Significant Difference ($\alpha = 0.10$). In addition, yield response was assessed using preplanned orthogonal contrasts.

Results and Discussion

Weed control

Weed control 5 WAP (weeks after planting) in Rossville during 2022 was similar for all treatments and ranged from 24 to 68% (Figure 1). However, at harvest, Palmer amaranth control in 15-inch rows was 67% compared to 50% in 30-inch rows (Figure 2). During 2023, weed control 5 WAP differed among herbicide treatments included in the study. Control by Degree Xtra plus Callisto was greatest at 94% and was statistically comparable to all treatments except Harness Xtra and Bicep, which had 74% and 26% control, respectively (Figure 3). By 8 WAP, there was an interaction of herbicide and row spacing, with control ranging from 99% for Degree Xtra plus Callisto in 15-inch rows to 76% for Bicep in 30-inch rows (Figure 4 and 5). Weed control was not evaluated at harvest during 2023.

In Topeka during 2022, all treatments resulted in 100% weed control 5 WAP (Figure 6). Similarly, weed control at harvest (Figure 7) was statistically similar by all treatments, but ranged from 98% (Harness Xtra, 30-inch) to 65% (Bicep, 15-inch). At 5 WAP in 2023, weed control was affected by the interaction of herbicide and row spacing (Figure 8). Weed control in all treatments was 97% or greater, except Harness Xtra in 15-inch rows, which was 63%. By 8 WAP, there were no statistical differences among any treatments (Figure 9), with control ranging from 70% by Bicep in 15-inch rows to 99% for DegreeXtra plus Callisto in 15-inch rows, HarnessXtra in 15-inch rows, Acuron plus Resicore in 30-inch rows, Bicep plus Callisto in 30-inch rows, and DegreeXtra plus Callisto in 30-inch rows.

Weed populations at Topeka were less dense and more variable than populations at Rossville, which resulted in fewer statistical differences being detected. At Topeka, henbit was the dominant weed species early in the growing season; however, a mixture of species that included marestail, dandelion, prickly sida, hophornbeam copperleaf, and green foxtail was present at harvest. At Rossville, the dominant weed species was Palmer amaranth.

Yield

During 2022, yields were similar between locations, despite the availability of irrigation at Rossville. This suggests that the Palmer amaranth infestation at Rossville may have resulted in yield loss that could not be overcome by irrigation. Yields were statistically similar across all herbicide treatments and both row spacings (Figures 10 and 12). The greatest yield was obtained in plots treated with DegreeXtra plus Callisto, which yielded 199 bushels per acre, and the lowest yield was 175 bushels per acre in the Bicep plus Callisto treatment. During 2023, yield was similar at both locations and was not influenced by herbicide or row spacing (Figures 11 and 13). The greatest yield of 203 bushels per acre was observed in the DegreeXtra plus Callisto treatment at Rossville. This yield was similar to the same treatment at Topeka, Acuron plus Resicore at Rossville and Topeka, Bicep plus Callisto at Rossville and Topeka, Harness Xtra plus Callisto at Rossville, and Bicep at Rossville. The lowest yield of 115 bushels per acre was from the nontreated check at Rossville.

Conclusion

In conclusion, this study investigated the interplay between herbicide programs, corn row spacings, weed control, and grain yield. While Resicore + Acuron consistently provided effective weed control, corn row spacing did not significantly influence weed management outcomes. However, site-specific factors such as weed species composition and density significantly impacted weed control efficacy. Notably, Palmer amaranth infestations required distinct management strategies compared to sites with lower weed densities. Additionally, herbicides applied at lower weed densities inadvertently affected corn yields due to plant injury. Certain herbicide treatments, particularly DegreeXtra plus Callisto, consistently produced higher corn yields across both years and locations, underscoring the importance of tailored weed management approaches for agricultural productivity.

Table 1. Herbicides and rates applied to corn planted in 15- and 30-inch rows at Rossville and Topeka, KS on April 25, 2023.

Treatment	Herbicides	Active Ingredients	Rate/a	Cost ($/unit)
1	Bicep II Magnum	atrazine + *S*-metolochlor	2.1 qt	48.10/gal
	Callisto	mesotrione	6 fl oz	2.50/fl oz
2	Degree Xtra	acetochlor	3 qt	51.10/gal
	Aatrex	atrazine	0.5 qt	60.00/gal
	Callisto	mesotrione	6 fl oz	2.50/fl oz
3	Harness Xtra	acetochlor	1.9 qt	57.35/gal
	Aatrex	atrazine	0.7 qt	60.00/gal
4	Acuron	*S*-metolachlor + atrazine + mesotrione + bicyclopyrone	1.5 pt	79.65/gal
	Bicep II Magnum	*S*-metolachlor + atrazine	1 pt	48.10/gal
5	Resicore	acetochlor + clopyralid + mesotrione	1.5 qt	72.65/gal
	Aatrex	atrazine	1 pt	60.00/gal

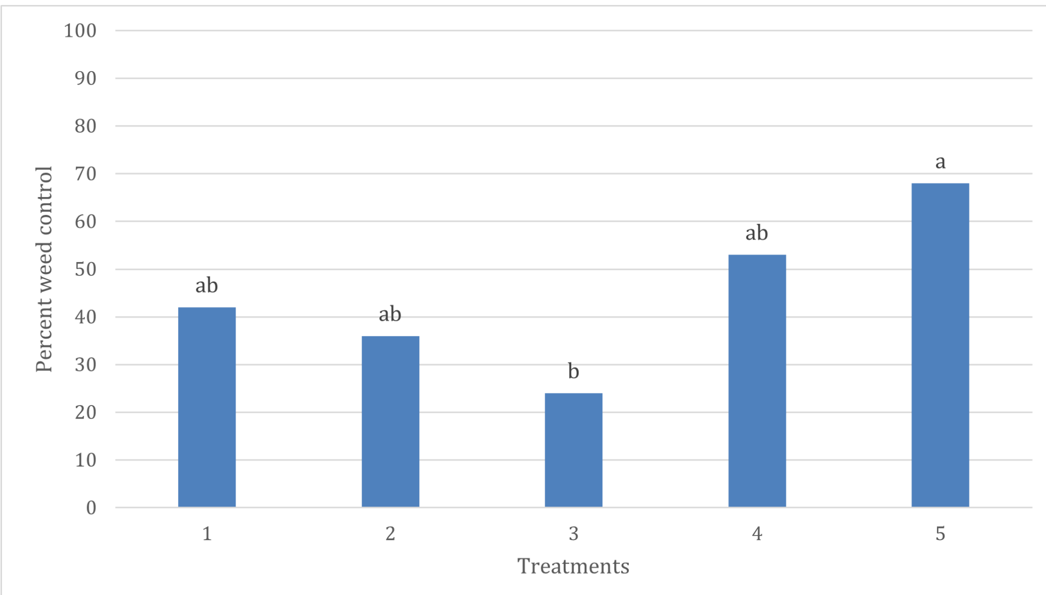

Figure 1. Weed control 5 weeks after corn planting at Rossville in 2022. Bars with similar letters are similar (α = 0.1). Treatments correspond with information presented in Table 1.

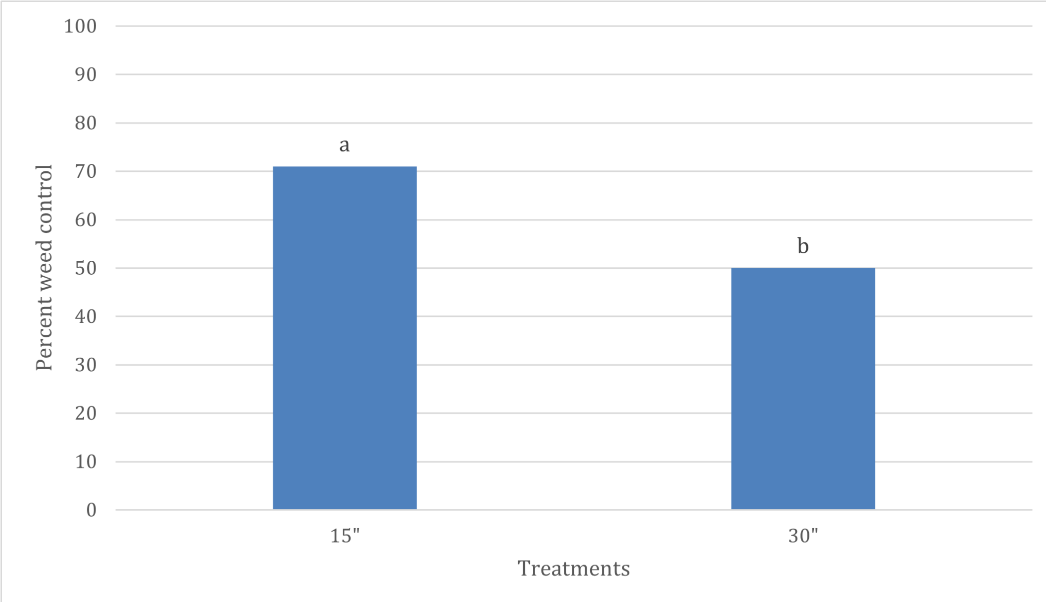

Figure 2. Weed control at corn harvest in Rossville in 2022. Bars with similar letters are similar ($\alpha = 0.1$).

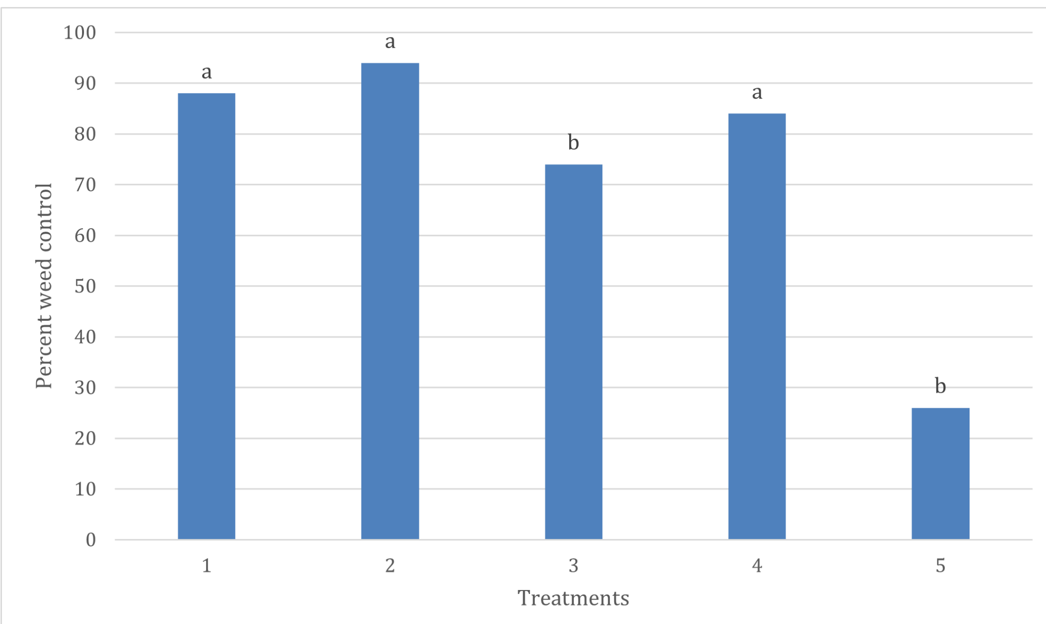

Figure 3. Weed control 5 weeks after corn planting at Rossville in 2023. Bars with similar letters are similar ($\alpha = 0.1$). Treatments correspond with information presented in Table 1.

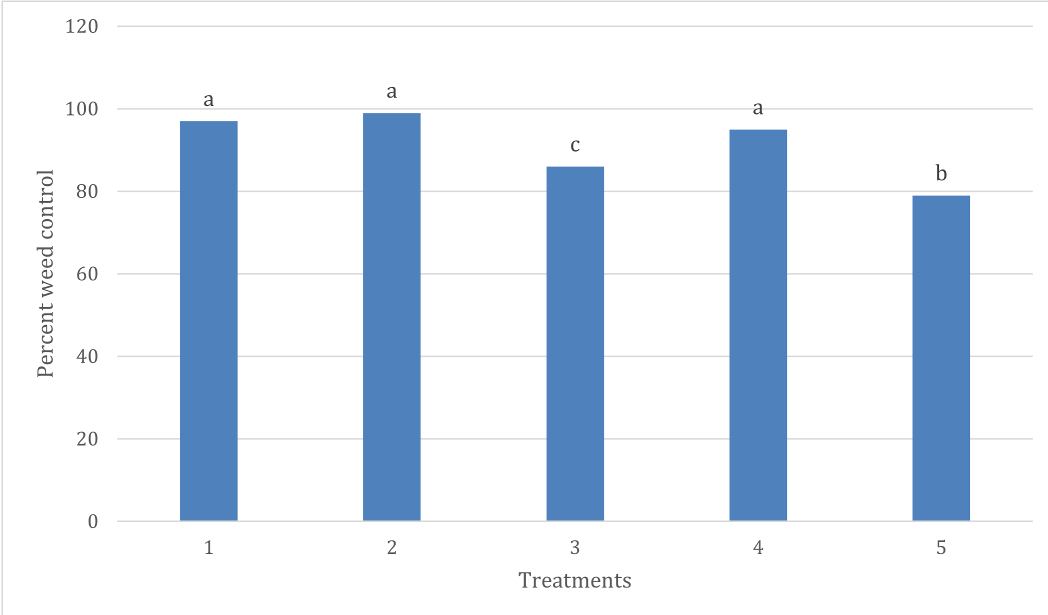

Figure 4. Weed control at corn harvest in Rossville during 2023. Bars with similar letters are similar ($\alpha = 0.1$). Treatments correspond with information presented in Table 1.

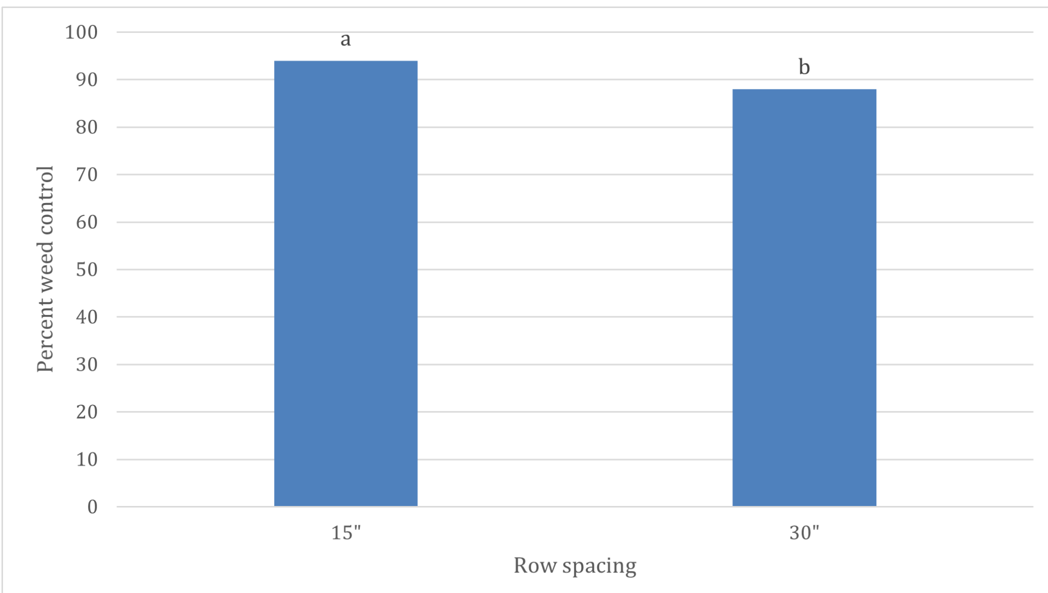

Figure 5. Weed control at corn harvest in Rossville during 2023. Bars with similar letters are similar ($\alpha = 0.1$).

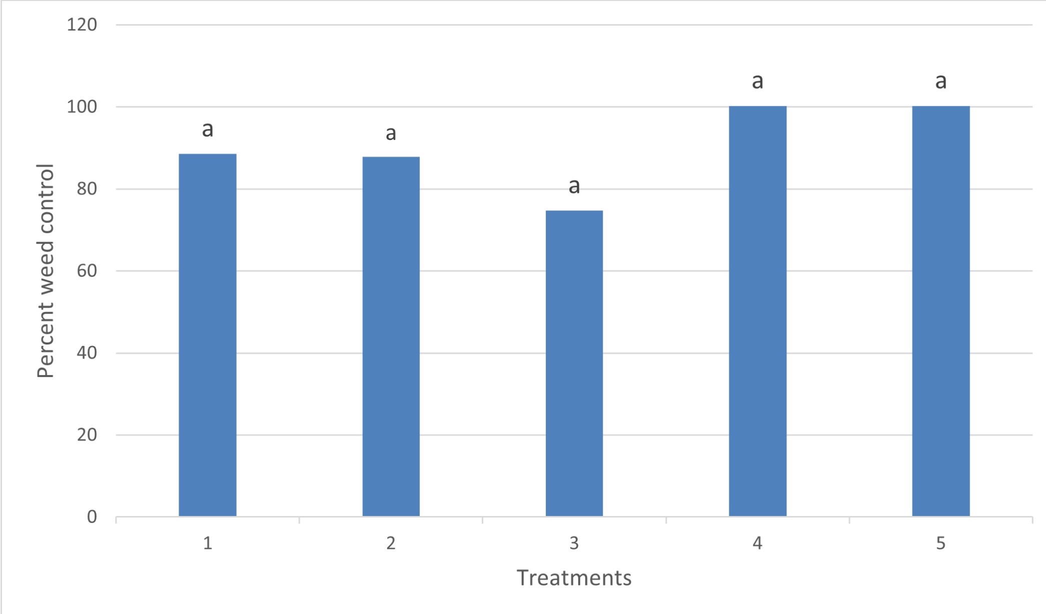

Figure 6. Weed control five weeks after corn planting at Topeka in 2022. Bars with similar letters are similar (α = 0.1). Treatments correspond with information presented in Table 1.

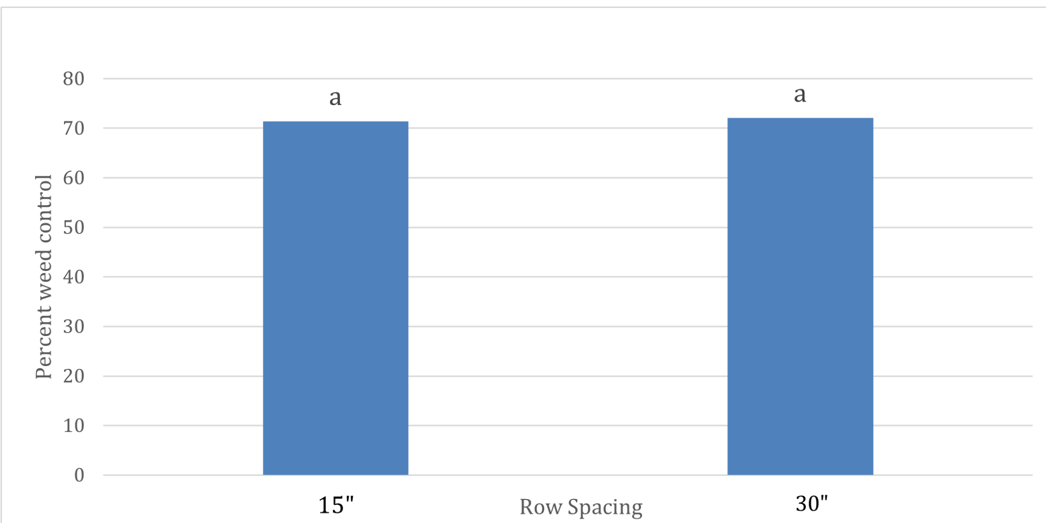

Figure 7. Weed control at corn harvest in Topeka during 2022. Bars with similar letters are similar (α = 0.1).

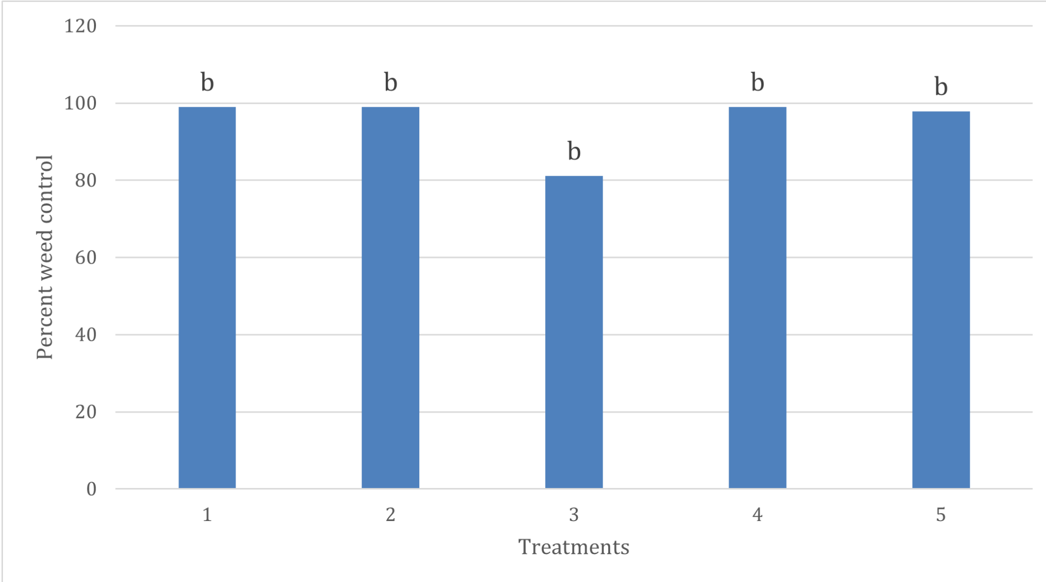

Figure 8. Weed control five weeks after corn planting at Topeka in 2023. Bars with similar letters are similar ($\alpha = 0.1$). Treatments correspond with information presented in Table 1.

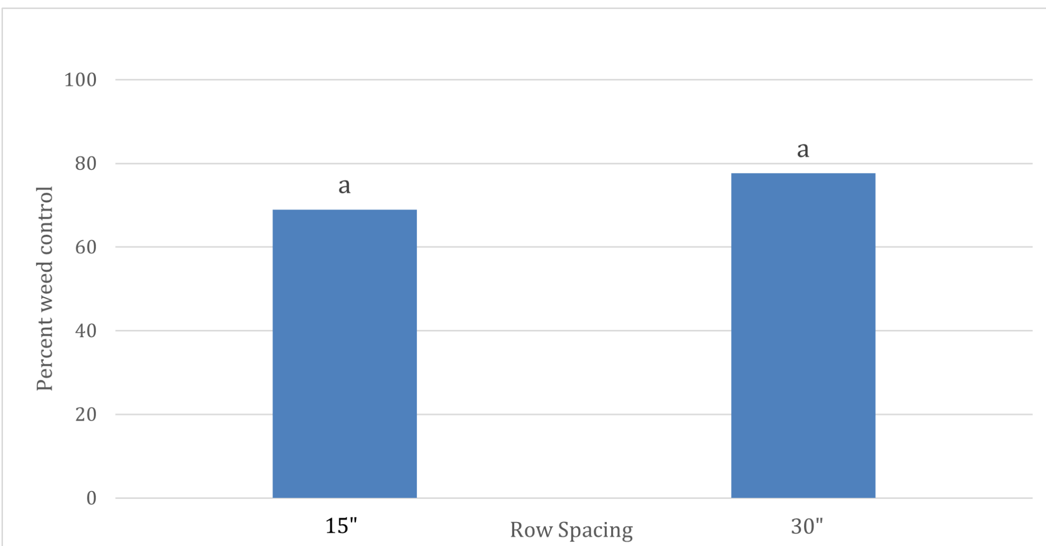

Figure 9. Weed control at corn harvest in Topeka during 2023. Bars with similar letters are similar ($\alpha = 0.1$).

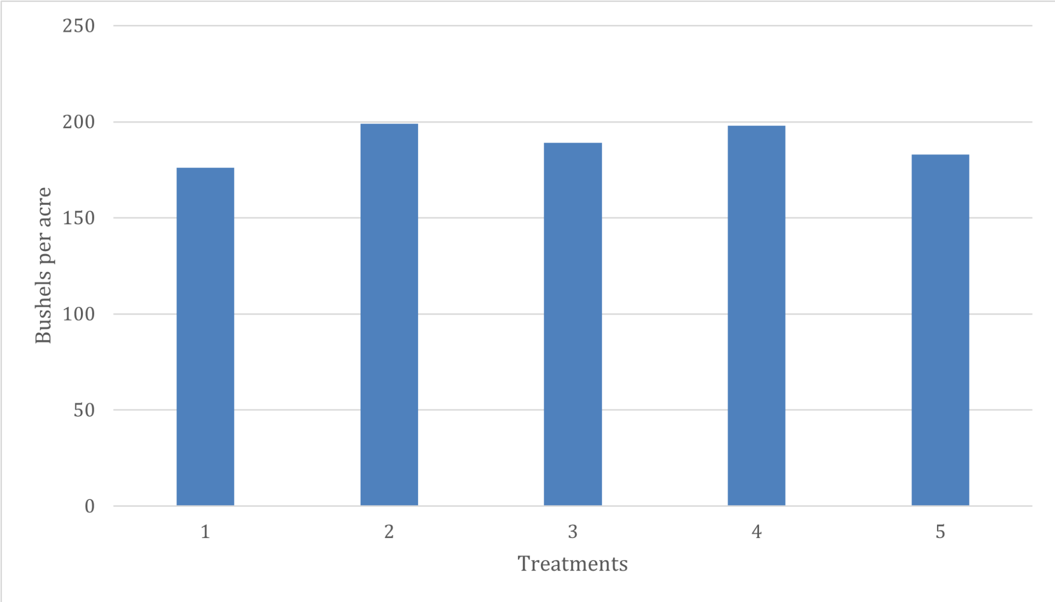

Figure 10. Corn grain yield (adjusted to 15.5% moisture) at Rossville in 2022. No statistical differences were observed among herbicides or row spacings. Treatments correspond with information presented in Table 1.

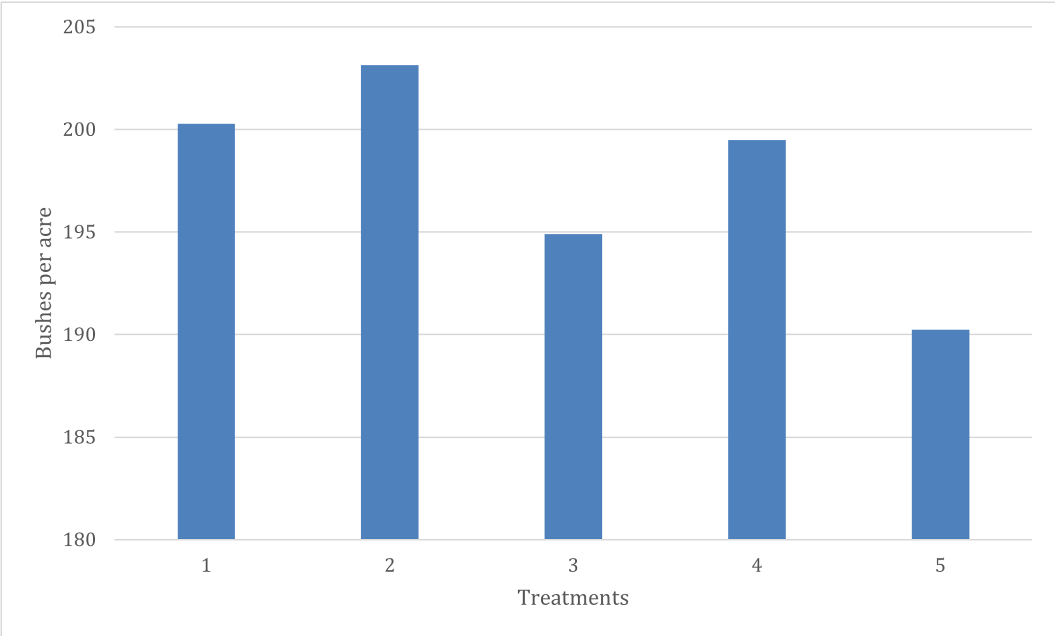

Figure 11. Corn grain yield (adjusted to 15.5% moisture) at Rossville in 2023. No statistical differences were observed among herbicides and row spacings. Treatments correspond with information presented in Table 1.

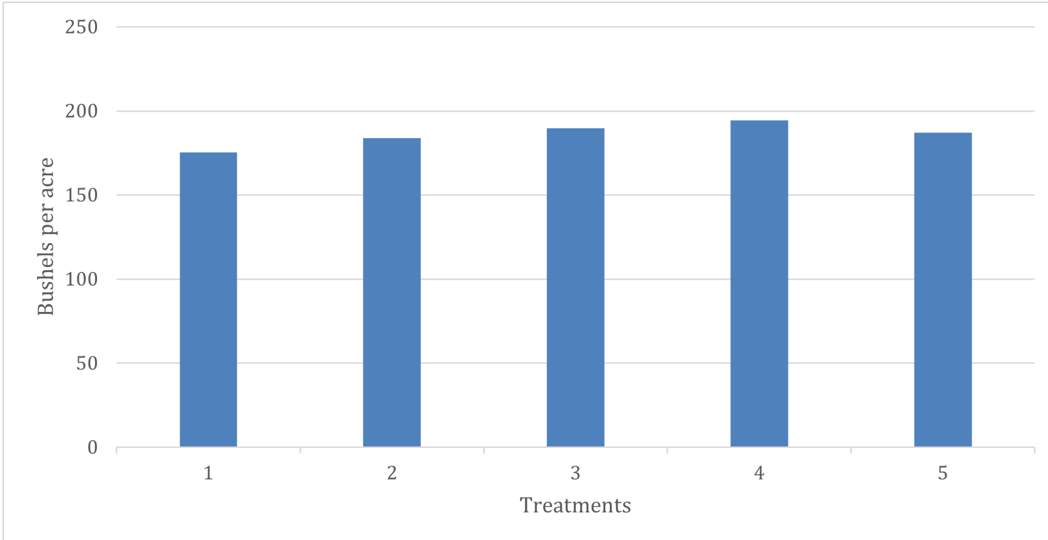

Figure 12. Corn grain yield (adjusted to 15.5% moisture) at Topeka in 2022. No statistical differences were observed among herbicides and row spacings. Treatments correspond with information presented in Table 1.

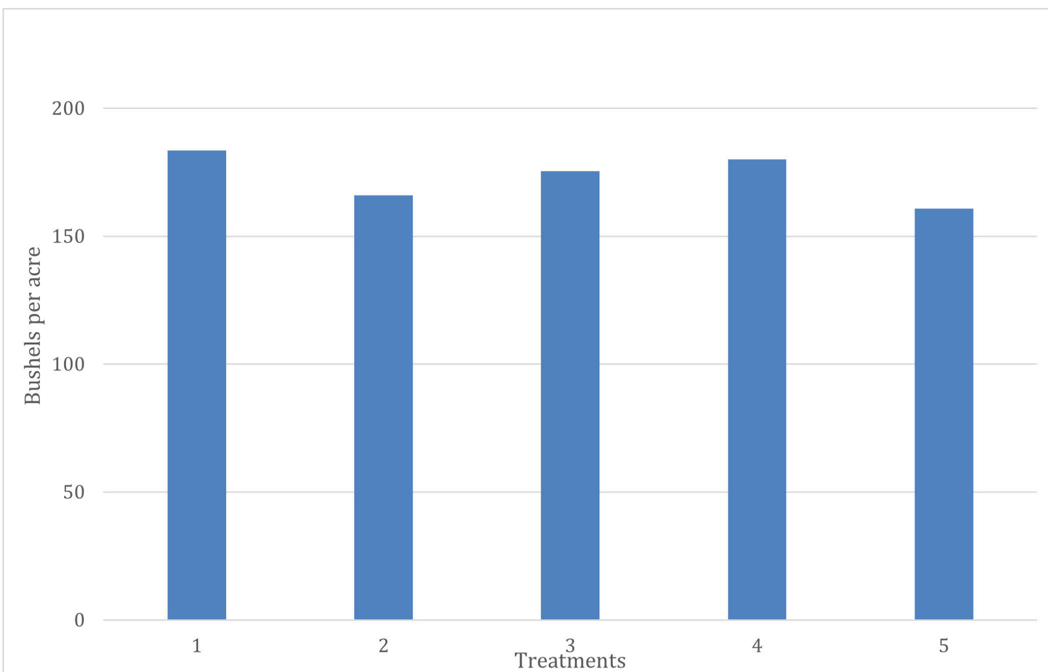

Figure 13. Corn grain yield (adjusted to 15.5% moisture) at Topeka in 2023. No statistical differences were observed among herbicides and row spacings. Treatments correspond with information presented in Table 1.