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# Fall-Planted Cover Crops for Weed Suppression in Western Kansas

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# Fall-Planted Cover Crops for Weed Suppression in Western Kansas


## Abstract

The widespread evolution of herbicide-resistant (HR) kochia and Palmer amaranth warrants the use of alternative ecological-based strategies for weed management in no-tillage (NT) dryland cropping systems in western Kansas. A field study was established in the fall of 2020 at Kansas State University Agricultural Research Center near Hays, KS, to determine the impact of fall-planted cover crop (CC) mixture on 1) kochia and Palmer amaranth suppression (density and biomass reduction), and 2) Palmer amaranth emergence dynamics in subsequent grain sorghum. A CC mixture of winter triticale, winter pea, radish, and rapeseed was planted in wheat stubble in the fall of 2020. The CC mixture was terminated at triticale heading stage on May 26, 2021 by using 1) Roundup PowerMax (glyphosate) at 32 fl oz/a, and 2) Roundup PowerMax at 32 fl oz/a + Degree Xtra (premix of acetochlor + atrazine) at 2.2 quart/a. A chemical fallow treatment (without CC) was included for comparison. The study site was planted with grain sorghum hybrid 'DKS 38-16' on June 10, 2021. The CC mixture produced an average of 1360 lb/a aboveground biomass at the time of termination. The CC terminated with Roundup PowerMax + Degree Xtra had 98 and 95% less total weed density at 0 and 30 days after termination (DAT), respectively, compared to chemical fallow. No difference in weed density was observed at later evaluations. At grain sorghum harvest, CC terminated with Roundup PowerMax and Roundup PowerMax + Degree Xtra reduced total weed biomass by 61% and 73%, respectively, compared to chemical fallow. The time taken to reach 10, 50, and 90% cumulative emergence of Palmer amaranth was delayed by 9, 15, and 21 days, respectively, in CC terminated with Roundup PowerMax and 11, 39, and 128 days, respectively, in CC terminated with Roundup PowerMax + Degree Xtra when compared with chemical fallow. Grain sorghum yield did not differ between CC and chemical fallow treatments. These results suggest that a fall-planted CC mixture can play an important role for kochia and Palmer amaranth suppression in NT dryland crop production in western Kansas.



## Keywords

cover crop, dry land, kochia, Palmer amaranth, suppression





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# Fall-Planted Cover Crops for Weed Suppression in Western Kansas

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## Summary

The widespread evolution of herbicide-resistant (HR) kochia and Palmer amaranth warrants the use of alternative ecological-based strategies for weed management in no-tillage (NT) dryland cropping systems in western Kansas. A field study was established in the fall of 2020 at Kansas State University Agricultural Research Center near Hays, KS, to determine the impact of fall-planted cover crop (CC) mixture on 1) kochia and Palmer amaranth suppression (density and biomass reduction), and 2) Palmer amaranth emergence dynamics in subsequent grain sorghum. A CC mixture of winter triticale, winter pea, radish, and rapeseed was planted in wheat stubble in the fall of 2020. The CC mixture was terminated at triticale heading stage on May 26, 2021 by using 1) Roundup PowerMax (glyphosate) at 32 fl oz/a, and 2) Roundup PowerMax at 32 fl oz/a + Degree Xtra (premix of acetochlor + atrazine) at 2.2 quart/a. A chemical fallow treatment (without CC) was included for comparison. The study site was planted with grain sorghum hybrid 'DKS 38-16' on June 10, 2021. The CC mixture produced an average of 1360 lb/a aboveground biomass at the time of termination. The CC terminated with Roundup PowerMax + Degree Xtra had 98 and 95% less total weed density at 0 and 30 days after termination (DAT), respectively, compared to chemical fallow. No difference in weed density was observed at later evaluations. At grain sorghum harvest, CC terminated with Roundup PowerMax and Roundup PowerMax + Degree Xtra reduced total weed biomass by 61% and 73%, respectively, compared to chemical fallow. The time taken to reach 10, 50, and 90% cumulative emergence of Palmer amaranth was delayed by 9, 15, and 21 days, respectively, in CC terminated with Roundup PowerMax and 11, 39, and 128 days, respectively, in CC terminated with Roundup PowerMax + Degree Xtra when compared with chemical fallow. Grain sorghum yield did not differ between CC and chemical fallow treatments. These results suggest that a fall-planted CC mixture can play an important role for kochia and Palmer amaranth suppression in NT dryland crop production in western Kansas.

## Introduction

Weed management is crucial during fallow periods in NT dryland wheat-sorghum-fallow (WSF) rotations in western Kansas. Fallow periods in this 3-year crop rotation stretch from wheat harvest to sorghum planting and from sorghum harvest to wheat planting. Evolution of HR weed species such as kochia [*Bassia scoparia* (L.) A. J. Scot] and Palmer amaranth (*Amaranthus palmeri* S. Watson) further poses a serious challenge for weed management (Heap 2022). This shows the need for developing alternative, ecological-based weed management strategies. Cover crop use is being widely

promoted primarily because of several benefits, including weed suppression, improved soil health, and enhanced precipitation use efficiency (Kumar et al., 2020). However, in the semiarid environments such as western Kansas, soil moisture is the most limiting factor and growing CC under such conditions is questionable (Holman et al., 2018, 2021). To explore alternative uses of CC for weed suppression in dryland conditions, a CC study was established in the fall of 2020 at Kansas State University Agricultural Research Center near Hays, KS. The main objectives of this study were to determine the impact of fall-planted CC mixture replacing fallow period after wheat harvest in WSF rotation terminated with Roundup PowerMax (glyphosate) or Roundup PowerMax + Degree Xtra (commercial premix of acetochlor + atrazine) on (1) weed density and biomass suppression, and (2) Palmer amaranth emergence dynamics in grain sorghum.

## Procedures

The study site was under WSF rotation for >10 years and had a natural seedbank of Palmer amaranth and glyphosate-and dicamba-resistant kochia. A CC mixture (60 lb/a) of winter triticale (60%) + winter peas (30%) + radish (5%) + rapeseed (5%) was planted in wheat stubble on September 20, 2020. The study was set up in a randomized complete block design with three treatments and four replications. The plots were 145-ft by 43-ft in size. The treatments consisted of chemical fallow (without CC and weeds were controlled with herbicides), CC terminated with Roundup PowerMax (32 fl oz/a), and CC terminated with Roundup PowerMax (32 fl oz/a) + Degree Xtra (2.2 quart/a). The CC was terminated at triticale heading stage on May 26, 2021, using Roundup PowerMax alone and Roundup PowerMax + Degree Xtra. Chemical fallow plot was cleaned with Gramoxone (32 fl oz/a) + Degree Xtra (2.2 quart/a) at the time of sorghum planting. Sorghum hybrid 'DKS 38-16' was planted on June 10, 2021, at 43,500 plants/a. Urea ammonium nitrate (UAN) was applied at planting at 20 gal/a. Total weed density and biomass were recorded at 0, 30, 60, 80, and 140 days after CC termination (DAT) using two quadrats (10 $ft^2$ each) randomly placed in the center of each plot. Palmer amaranth emergence was monitored at weekly intervals by counting and removing emerged seedlings using two permanent quadrats (10 $ft^2$ each) from each plot. Sorghum was harvested on November 4, 2021 and grain yield was recorded. Data were subjected to ANOVA using PROC mixed in SAS v. 9.3 software (SAS Inst. Inc., Cary, NC). Means were separated using Fisher's protected LSD test at $P < 0.05$. Cumulative emergence of Palmer amaranth was fitted using the drc package in R software using the following equation (Knezevic et al., 2007):

$$Y = \{100/1 + \exp [b(\log X + \log T_{50})]\}$$

where, Y refers to the percent cumulative emergence, X is the number of days, $T_{50}$ is the days required to reach 50% cumulative emergence, and b is the slope of each curve.

## Results

The CC at termination had an average biomass of 1360 lb/a. Results suggested that CC treatments significantly reduced total weed density compared to chemical fallow at 0 and 30 DAT; however, no differences were observed at later sampling times (Figure 1). The CC terminated with Roundup PowerMax and Roundup PowerMax + Degree Xtra had 50 and 65% lesser weed biomass at 80 DAT, respectively, compared to chemical fallow (Figure 2 and 3). At sorghum harvest, weed biomass was 61 and 73% less in CC treatments terminated with Roundup PowerMax and Roundup PowerMax + Degree

Xtra, respectively, compared to chemical fallow. The time taken to reach 10, 50, and 90% cumulative emergence of Palmer amaranth was delayed by 9, 15, and 21 days, respectively, in CC terminated with Roundup PowerMax and 11, 39, and 128 days, respectively, in CC terminated with Roundup PowerMax + Degree Xtra as compared to chemical fallow (Figure 4). Sorghum grain yield did not differ among treatments with an average yield of 27 bu/a, most likely due to limited growing season precipitation.

### *Conclusions*

Results indicate that replacing fallow period with fall-planted CC mixture and terminated with combination of Roundup PowerMax and residual herbicides can provide effective weed suppression (density, biomass) in subsequent NT dryland grain sorghum.

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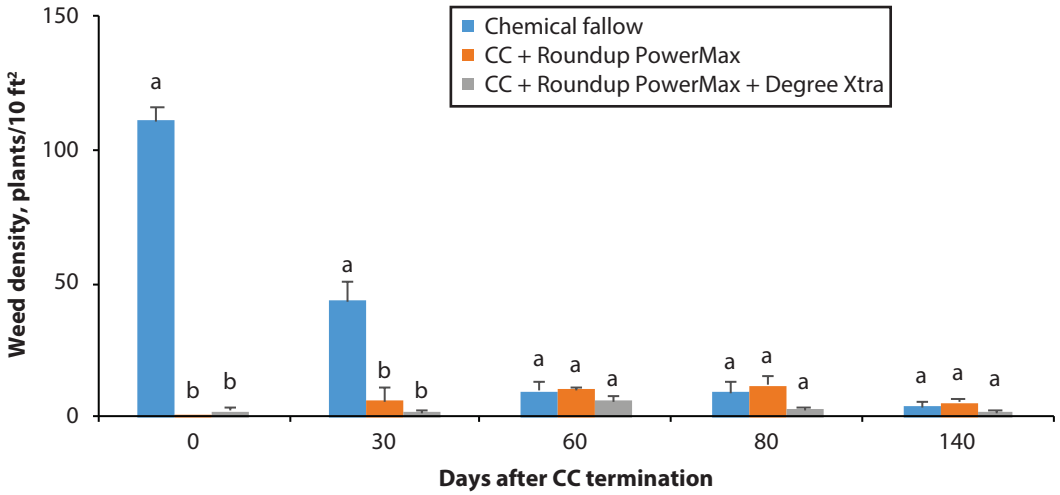


**Figure 1. Total weed density among treatments. Means with the same letter are not significantly different ($P < 0.05$) among treatments within days after cover crop (CC) termination.**

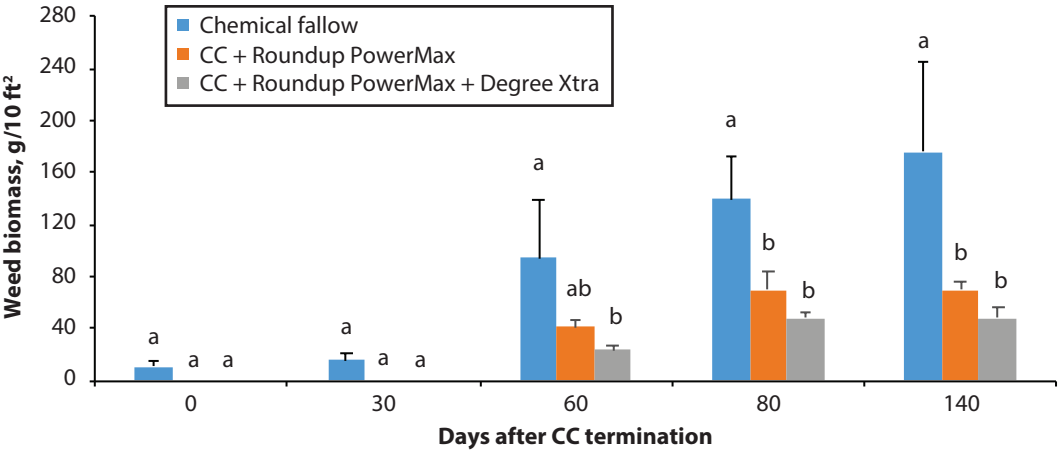


**Figure 2. Total weed biomass among treatments. Means with the same letter are not significantly different ($P < 0.05$) among treatments within days after cover crop (CC) termination.**

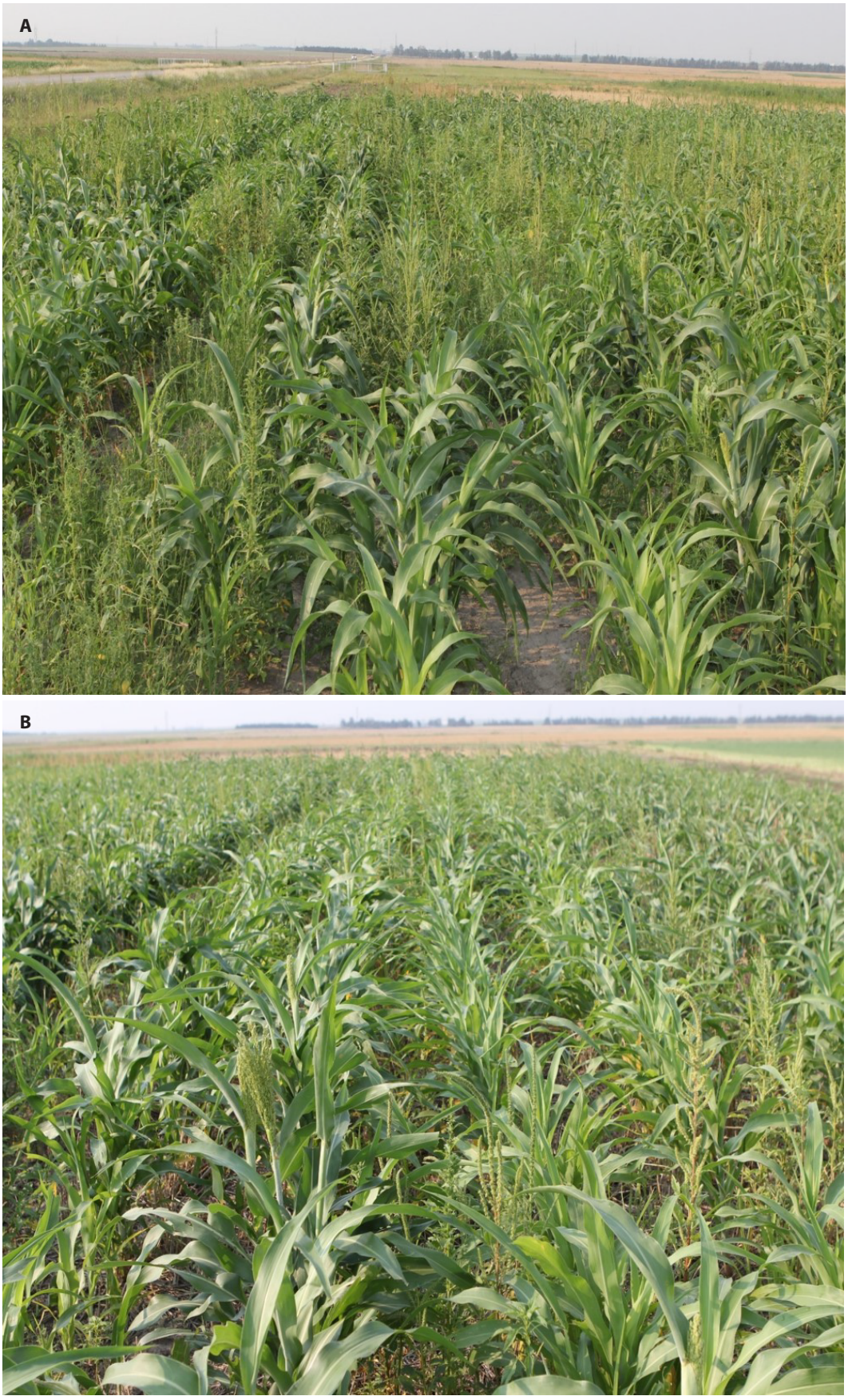


**Figure 3. Weed suppression in sorghum at 80 days after cover crop (CC) termination in (A) chemical fallow, and (B) CC terminated with Roundup PowerMax + Degree Xtra.**

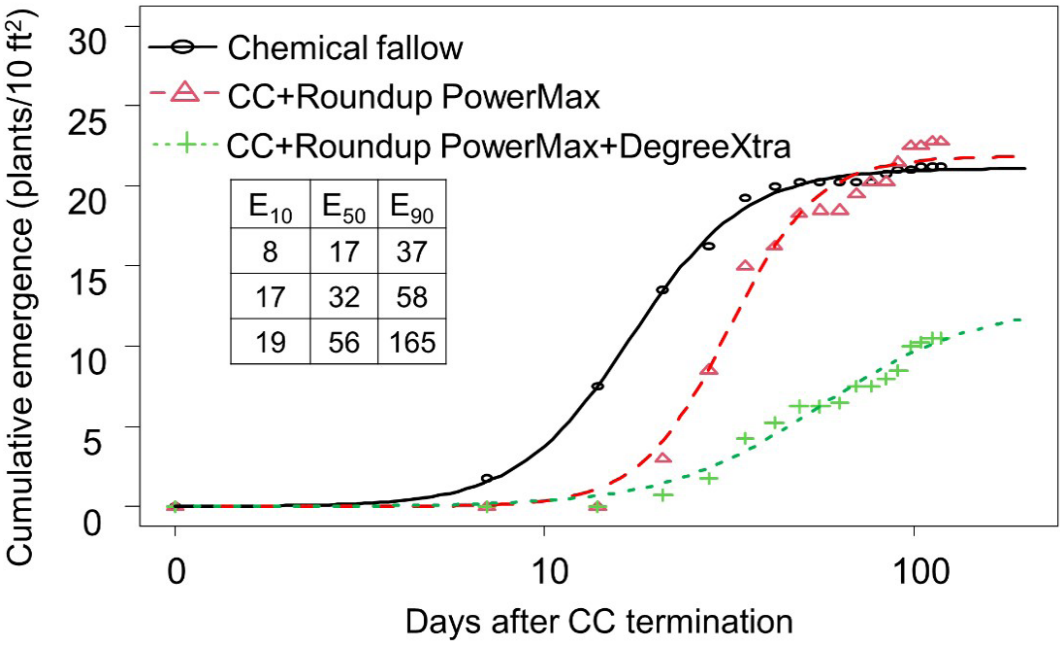


**Figure 4. Cumulative emergence of Palmer amaranth among treatments. $E_{10}$, $E_{50}$, and $E_{90}$ indicate the days required for 10, 50, and 90% cumulative emergence of Palmer amaranth, respectively.**