

Effect of Integrated Kochia (*Kochia scoparia*) Management in a Four Year Rotation Study

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Introduction

- Combinations of cultural, mechanical, and chemical practices are often recommended in agronomic settings in order to combat the buildup of various pests, including weeds (Swanton & Murphy 1996).
- Kochia (*Kochia scoparia*) has become one of western United States most problematic weeds, in part, because of evolved resistance to many common herbicides (Mengistu & Messersmith 2002; Schwinghamer & Van Acker 2008).
- In Wyoming, Nebraska, and Montana, kochia has developed resistance to four different herbicide SOA:
 - ALS-inhibitors
 - Photosystem II inhibitors
 - EPSP synthase inhibitors
 - Synthetic auxins (Heap 2017)
- It is critical to find alternative, sustainable methods to control herbicide-resistant kochia.

OBJECTIVE:

- Quantify the combined impacts of crop rotation, tillage, and herbicide use on kochia populations through time.

Methods

- Field studies were initiated in 2014 and continued through 2017 in Lingle, WY.
- Kochia seed with known ALS R:S ratio (5:95%) was spread at 2,000 g/ha spring, 2014.
- **Split-split-plot RCBD**
 - 4 blocks per site
- **Whole-plot: TILLAGE**
 - Annual intensive tillage
 - Minimum tillage
- **Split-plot: CROP ROTATION**
 - Continuous corn
 - Corn-sugarbeet
 - Corn-bean-corn-sugarbeet
 - Corn-bean-wheat-sugarbeet
- **Split-split-plot: HERBICIDE**
 - Complete reliance on ALS-inhibitors
 - Mixtures including ALS-inhibitors
 - Annual rotation between ALS herbicides and non-ALS herbicides
- Kochia densities were estimated in summer of all four years of the study.
- Statistical Data Analysis: Generalized linear model

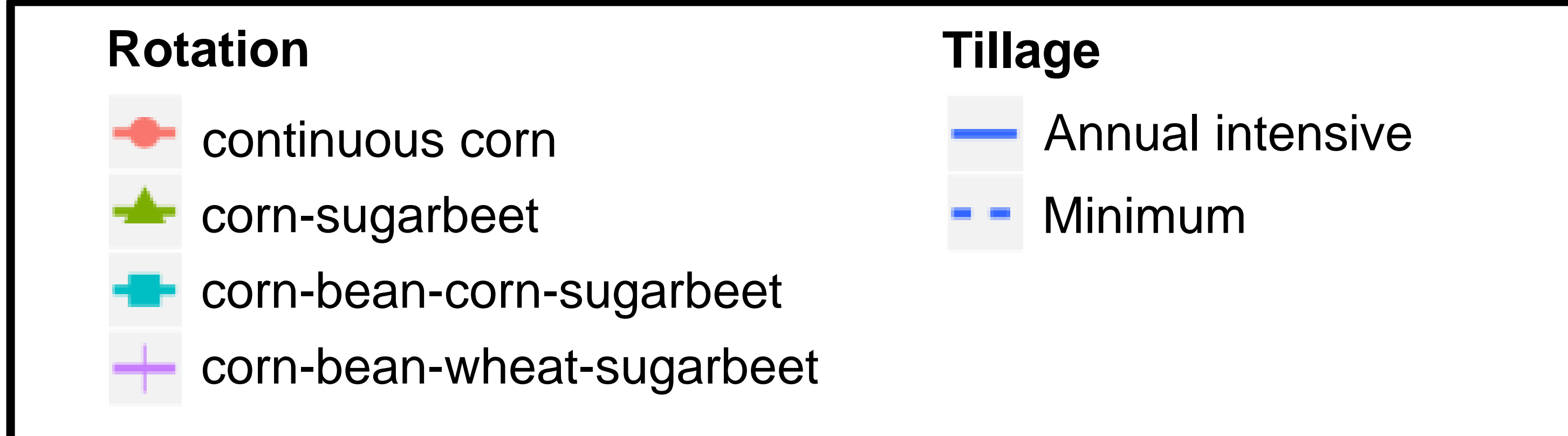
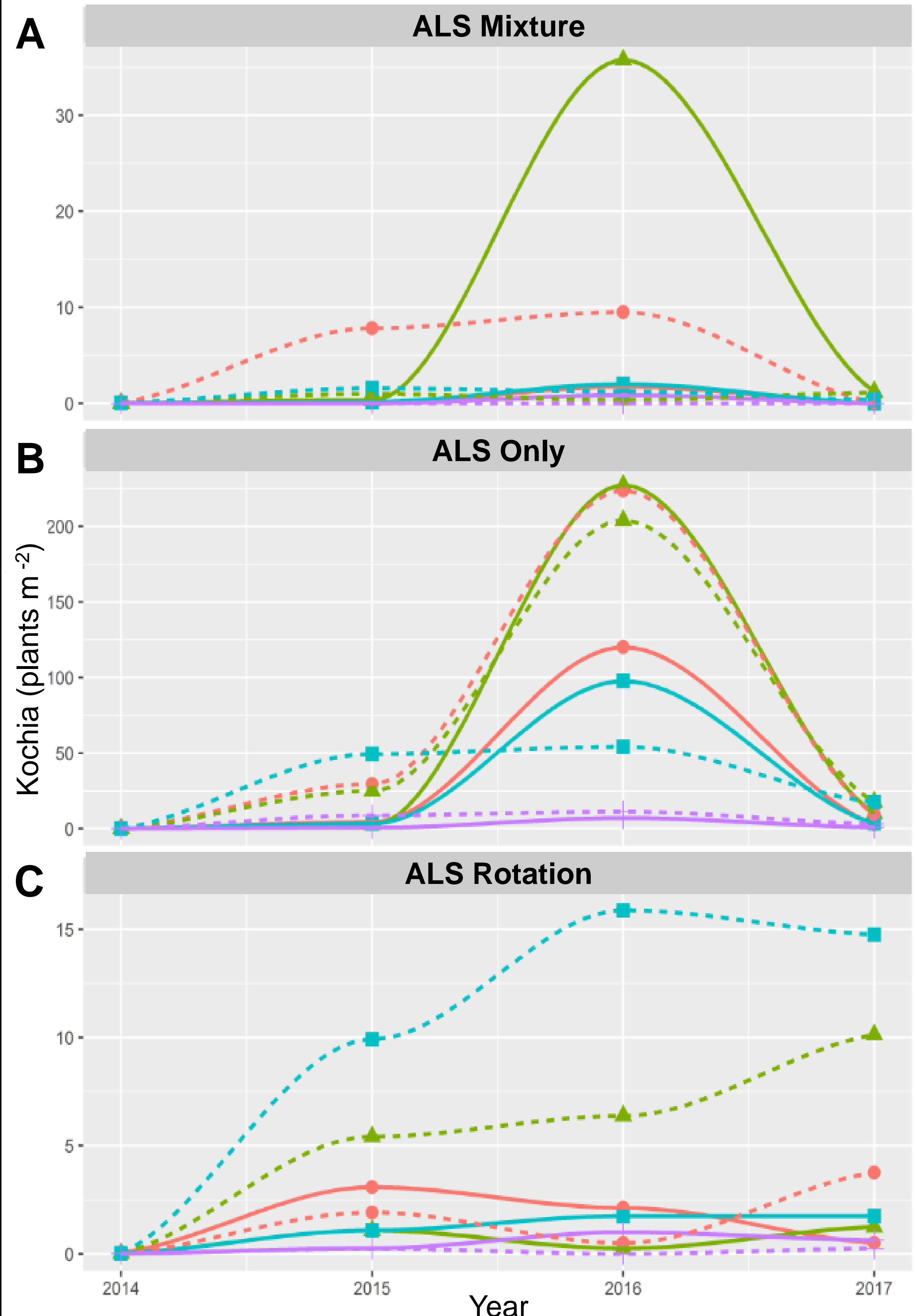


Figure 1. Average number of kochia per m² for plots treated with mixtures including ALS inhibitors and another effective mode of action (A), complete reliance on ALS inhibitor herbicides (B), or an annual rotation between ALS herbicides and non-ALS herbicides (C).

Results & Discussion

- Low kochia densities were observed in 2014 (the initial year of the study) for all weed management programs.
- Kochia density increased steadily through 2016, predominantly in plots which were treated with ALS inhibitors only, contained less diverse crop rotations, and were minimally tilled.
- A severe hail storm in 2016 reduced kochia densities dramatically in 2017 for all management programs.
- Throughout all four years of the study, lowest kochia densities were found in plots which were treated with either a mixture including ALS inhibitors or an ALS rotation, contained the most diversified crop rotations, and were intensively tilled.
- Our data shows that integrating cultural and mechanical practices has the ability to suppress herbicide resistant weed populations at a manageable level just as effectively, if not better, than the best chemical weed management program alone.

Future research

R:S ratio of seedbank and surviving plants are currently being quantified for the study. Combined data will be used to model the long term effects of crop rotation diversity, tillage, and herbicide application on kochia populations in the High Plains region.

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