Cropping system effects on weed biomass production and seed bank density

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Objective

To compare the effects of physical and chemical weed management tactics on weed biomass production and seed density in soil.

Experiment design

Location: Iowa State University Agricultural Engineering and Agronomy Research Farm, Boone, IA

The experiment was initiated in 2002. Plots were 18 m wide by 84 m long. Every phase of each rotation system was present every year. Plots were arranged in randomized complete blocks with four replicates.

2-year rotation: corn-soybean

3-year rotation: corn-soybean-oat/red clover

4-year rotation: corn-soybean-oat/alfalfa-alfalfa

Materials and Method

Corn and soybean main plots were split and treated with low (low) and conventional (conv) herbicide regimes. No herbicides were used for oat with red clover, oat with clover, or established alfalfa.

Measurements were made during the 2014 cropping season.

	Corn		Soybean	
	Low herbicide	Conventional herbicide	Low herbicide	Conventional herbicide
Variety	Viking 72-04N	Viking 72-04N	Latham L 2758	Latham L 2758
Herbicides applied (kg ai./ha)	tembotrione (0.049)	thiencarbazone methyl (0.037), isoxaflutole (0.092)	imazamox (0.023), lactofen (0.075)	glyphosate as isopropylamine salt (1.326), acifluorfen (0.297)
Total (kg a.i./ha)	0.049	0.129	0.098	1.623

Weed biomass data

Corn and soybean: Eight areas of 3.05 m x 0.76 m per subplot

Oat stubble and established alfalfa: Eight quadrats of 0.25 m^2 per subplot.

Weeds were classified to species, oven dried to constant weight and tallied to kilogram per hectare.

Weed seedbank data

Thirty-five cores that were 1.75 cm in diameter were taken to 20 cm depth in each subplot. Seeds were mechanically separated from soil materials with an elutriator and a floatation procedure, classified to species and tallied to counts per squared meter.

Results

The low herbicide regime used banded applications over corn and soybean rows and interrow cultivation, which reduced herbicide inputs 62% in corn and 94% in soybean.

Figure 1 – Weed biomass

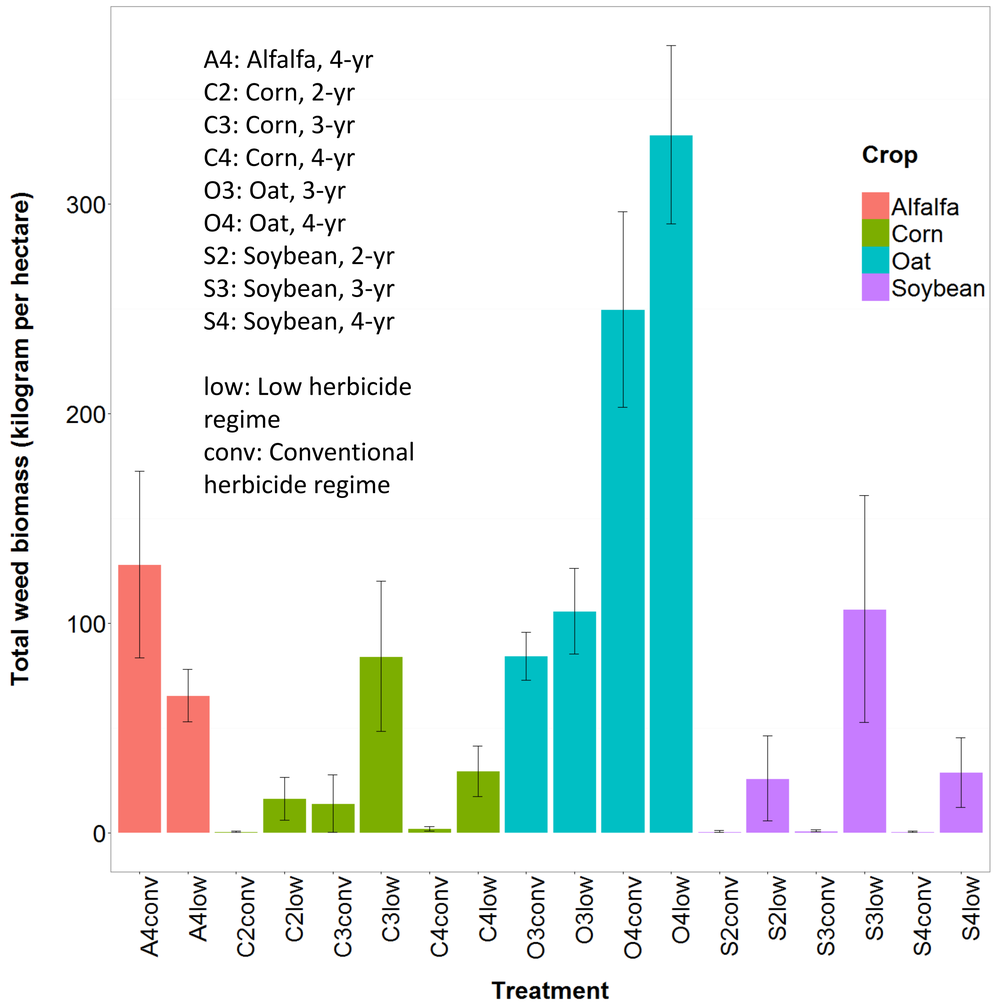

Figure 1

Total weed biomass was comparable between the 2-yr and 4-yr rotations in corn and soybean phases, regardless of herbicide regimes.

Figure 2 – Proportional weed biomass

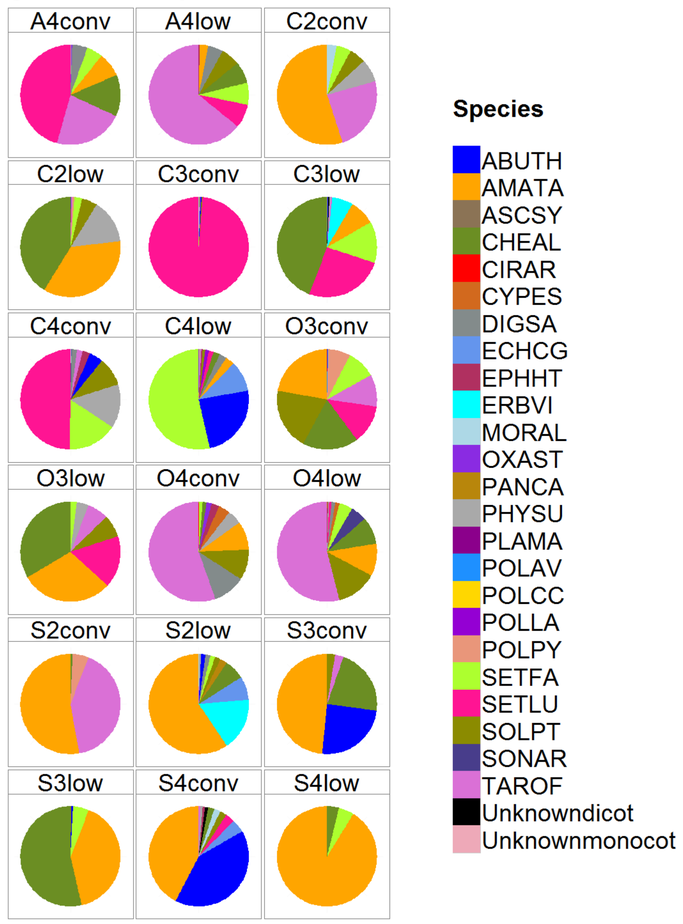

Figure 2

7 monocot and 17 dicot weed species and genera were found. The most prevalent were giant foxtail (*Setaria faberi*), yellow foxtail (*S. glauca*), woolly cup grass (*Eriochloa villosa*), common water hemp (*Amaranthus rudis*), common lambsquarters (*Chenopodium album*), and dandelion (*Taraxacum officinale*).

Figure 3 – Weed seed density

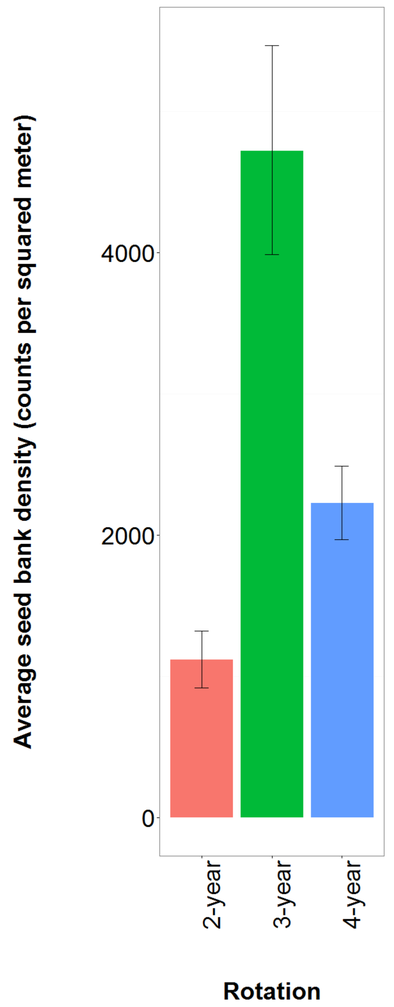

Figure 3

Averaged over all crop phases of each rotation system, weed seed bank population density in the soil was unaffected by herbicide regime (p=0.65), but strongly influenced by rotation system (p=0.0002).

Conclusions

Integration of physical and chemical tactics provided effective weed control in corn and soybean in the 2-yr and 4-yr rotation systems, which had a greater impact on weed suppression (less total weed biomass, smaller seedbank density) than the 3-yr rotation. Oat and forage crops that were not cultivated or sprayed had greater weed infestation than corn and soybean.

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