2013

Influence of Land Rolling on Soybean Production and Associated Weeds

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Abstract
Land rolling soybean has become a common practice in some areas of northern Iowa. Land rolling pushes rocks and corn root balls down to the soil surface, improving combine harvest operations. However, land rolling field pea, barley, and summer fallow in eastern Montana essentially doubled density of several troublesome broadleaf weeds, including horseweed (also called marestail), kochia, Russian thistle, tumble mustard, prickly lettuce, and redroot pigweed. Iowa has different weed community and environments from Montana, and little is known how, or if, land rolling might influence weed community in Iowa. We conducted a replicated study on eleven Iowa farms on the influence of land rolling on soybean stand density, yield, and early-season weed density.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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RFR-A1257

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Introduction

Land rolling soybean has become a common practice in some areas of northern Iowa. Land rolling pushes rocks and corn root balls down to the soil surface, improving combine harvest operations. However, land rolling field pea, barley, and summer fallow in eastern Montana essentially doubled density of several troublesome broadleaf weeds, including horseweed (also called marestail), kochia, Russian thistle, tumble mustard, prickly lettuce, and redroot pigweed. Iowa has different weed community and environments from Montana, and little is known how, or if, land rolling might influence weed community in Iowa. We conducted a replicated study on eleven Iowa farms on the influence of land rolling on soybean stand density, yield, and early-season weed density.

Materials and Methods

All farming operations were done by cooperating farmers, including tillage, soybean variety selection, planting date and rate, herbicide applications, and harvest. Treatment on each farm was land rolling or no land rolling. Replication number within farms ranged from three to eight. Individual plot size varied by farm, ranging from 30 ft to 48 ft in width; plot lengths were as great as one half-mile. Row spacing was 30 in. for all fields. Most cooperators used a preplant herbicide tank mix with residual activity as part of their weed management. Soybean stand density was determined by counting the number of plants from four 1-m of row in each plot at about growth stage V2. Weed density was determined in each plot by counting by species present in ten 0.1 m^2 circular quadrats at about V2 growth stage, prior to the first in-crop herbicide application. Soybean yield data were collected by producer yield monitors or by determining weight and area of a single combine pass for each plot with seed weighed on a portable scale. Statistical analyses were done with the PROC MIXED procedure (SAS, v.9) with farm and land rolling as fixed effects. Replication was considered a random effect. Treatment effects were considered significant at $P = 0.05$. Mean separations were done with the least square means procedure at $P = 0.05$.

Results and Discussion

Soybean stand density differed by farm, however, the effects of land rolling and farm by land rolling were not significant (Table 1). Stand densities were typical for Iowa soybean production systems. Soybean yields varied for farm and farm by land rolling (Table 1). Eight of the ten farms with yield results did not show a significant influence of land rolling. However, for the two farms where land rolling did influence yield, treatment effect was not consistent. One farm had greater yield for soybean that was not rolled while one other farm had greater yield for soybean that was land rolled. The effects of farm and farm by land rolling were significant for total weed density (Table 1). Total weed density was similar between rolled and not-rolled treatments on 9 of 10 farms, however, land rolling resulted in a significantly greater weed density compared with soybeans that were not

land rolled. Weed community was not particularly diverse in this study, with only 13 species identified. Weed species encountered included the annuals volunteer corn, velvetleaf, tall waterhemp, yellow foxtail, redroot pigweed, horseweed, black nightshade, common lambsquarters, purslane, Venice mallow, and woolly cupgrass (results not presented). The only perennial found was dandelion, and due to the surmised lack of influence of land rolling on previously established weeds, this species was not included in the calculation of total weed density. Most soybean fields had received a preplant herbicide application with residual activity, likely resulting in our generally low weed densities. Land rolling rarely influenced weed community, soybean stand density, or soybean yield.

Table 1. Influence of land rolling and farm on soybean stand density, yield, and weed density.

Treatment	Stand[1]			Yield[1]			Total weeds[1]		
	Not rolled	Rolled	P > F	Not rolled	Rolled	P > F	Not rolled	Rolled	P > F
Farm	plants/acre			bushels/acre			No./m^2		
Barnett	-	-	-	42.9	44.2	0.3204	1.3	4.7	0.7109
Blomgren	112,000	116,000	0.4782	75.4	75.2	0.8722	3.3	10.3	0.4142
Dordt	115,200	120,600	0.4632	63.4	64.3	0.5372	7.0	13.3	0.5214
Hustoft	140,000	137,100	0.6600	55.5	54.5	0.4411	0.3	0.8	0.9532
MBS Family	-	-	-	38.4	38.9	0.5980	9.1	2.0	0.2726
Metzger	126,600	113,100	0.0516	53.7 b	57.0 a	0.0317	35.7 b	61.0 a	0.0146
Rietema	133,000	132,100	0.8886	46.3	48.2	0.2060	0.1	2.3	0.8127
Schwab	111,200	111,500	0.9594	41.4 a	34.1 b	0.0002	0.7	1.0	0.9730
Treis till	126,300	122,600	0.5770	56.0	54.8	0.4120	1.0	0.1	0.9191
Treis no-till	130,900	124,300	0.3156	57.0	56.2	0.5830	0.3	0.1	0.9730
Mean	124,400	122,200		53.0	52.7		10.6	10.4	
P > F									
Farm (F)	0.0003			0.0001			0.0001		
Land rolling (L)	0.3458			0.5371			0.9636		
F × L	0.5419			0.0093			0.0165		

[1]Means within farm and parameter followed by different letters differ significantly.