

COVER CROP SPECIES AND PLANTING METHOD EFFECT ON WEEDS AT A MAIZE MONOCULTURE FIELD

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Introduction

The use of legume cover crops (CC) to replace fallow during the winter intercrop period of maize monoculture allows to reduce nitrogen fertilizer without yield penalties. Cover crops can also affect the weed flora because of its competitive effect and/or allelopathic effects. We studied the effect of the species and seed rate of legume cover crops and the planting method on the weed density of the subsequent maize crop in a sprinkler irrigated field located in the middle Ebro valley (Spain).

Materials and Methods

The experiment was carried out in a 2 ha field irrigated with a solid-set sprinkler system at Zaragoza (41°43'N, 0°48'W, 225 m altitude). The climate is Mediterranean semiarid with long-term annual averages of 14.1 °C for air temperature, 300 mm for precipitation, and 1240 mm for ETo. The soil is a sandy loam (Typic Xerofluvent). Three CC species (winter peas, common vetch and hairy vetch) at two seeding rates (normal and reduced by 25%) and a control (without cover crop) were tested using two planting methods (conventional with tillage and no tillage). The experiment started in October 2018 after a maize crop. Maize was grown with conventional practices (tillage and herbicides). Weed density was measured on September of 2019, before maize harvest. Weed density was also measured after the following CC season on May 2020 in early stages of the maize crop in a part of the field where no pre-emergence herbicide was applied.

Results

Main weeds at maize harvest were *Diptotaxis erucoides*, *Poa annua*, *Sonchus oleraceus* and *Stellaria media*. Common vetch increased the density of *S. oleraceus* (Table 1). No tillage planting of CC decreased the density of *D. erucoides* and *P. annua* to a third compared to conventional planting, and *S. media* was almost suppressed, but duplicated the density of *Cynodon dactylon* (Table 1). Main weeds at the early stage of the following maize crop season were *Abutilon theophrasti*, *Chenopodium album*, *C. dactylon*, *Cyperus rotundus*, *S. oleraceus* and *Xanthium strumarium*. No effect of the CC species on weed density was found. Compared to conventional planting of CC, no tillage planting suppressed *A. theophrasti*, decreased to a third the density of *C. album* and *C. rotundus*, and to 17% the density of *X. strumarium*, but increased the density of *C. dactylon* six times (Table 2). In both measurement dates, the total density of dicot and monocot weeds was reduced when the CC were planted without tillage. The effect of the CC species and seeding rate on weed density was minor but the experiment just started and will continue during two more years.

Table 1. Weed density at maize harvest in 2019 as affected by tillage for cover crop (CC) planting and CC seed rate. ANOVA after transformation of weed density ($\sqrt{(x+0.5)}$). The interaction of the two factors was not significant.

Factor	Cynodon dactylon	Diptotaxis erucoides	Poa annua	Sonchus oleraceus	Stellaria media
	Plants m ⁻²				
Tillage	S	S	S	NS	S
Conventional	4.05 b	19.44 a	88.89 a	13.65	127.06 a
No tillage	8.33 a	6.90 b	28.57 b	11.59	2.14 b
CC and seed rate	NS	NS	NS	S	NS
Control (without CC)	7.22	6.11	81.39	6.94 c	78.06
Winter peas-normal rate	16.39	8.33	29.72	13.06 bc	61.67
Winter peas-low rate	3.89	13.06	31.39	13.33 bc	59.44
Common vetch-normal rate	5.00	16.11	58.33	21.11 a	60.28
Common vetch-low rate	1.94	7.50	35.56	14.72 ab	79.72
Hairy vetch-normal rate	4.44	19.44	79.52	8.61 bc	53.61
Hairy vetch-low rate	4.44	21.67	95.00	10.56 bc	59.44

NS: not significant. S: significant
For each weed species and factor, the values followed by different letters are significantly different according to a Fisher Protected LSD test 0.05 level.

Table 2. Weed density at early stage of maize in 2020 as affected by tillage for cover crop (CC) planting and CC seed rate. ANOVA after transformation of weed density ($\sqrt{(x+0.5)}$). The interaction of the two factors was not significant.

Factor	Abutilon theophrasti	Chenop. album	Cynodon dactylon	Cyperus rotundus	Xanthium strumarium
	Plants m ⁻²				
Tillage	S	S	S	S	S
Conventional	6.31 a	25.36 a	3.09 b	17.38 a	26.91 a
No tillage	0.36 b	8.33 b	19.52 a	5.71 b	4.64 b
CC and seed rate	NS	NS	NS	NS	NS
Control (without CC)	0.42	16.25	18.75	7.92	35.42
Winter peas-normal rate	2.5	27.08	19.17	25.83	12.08
Winter peas-low rate	3.33	20.00	17.50	7.92	20.42
Common vetch-normal rate	6.25	11.67	7.08	2.92	9.58
Common vetch-low rate	5.42	14.58	7.50	6.25	15.83
Hairy vetch-normal rate	1.67	13.33	5.42	21.25	7.92
Hairy vetch-low rate	3.75	15.00	3.75	8.75	9.17

NS: not significant. S: significant
For each weed species and factor, the values followed by different letters are significantly different according to a Fisher Protected LSD test 0.05 level.