Cover crops and mulches influence weed community characteristics in strip tilled tomato (*Solanum lycopersicon* L.)

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Aim: to investigate the effects that cover crop species and their residues arranged in mulch strips may have on weed community composition in a winter cover crop-tomato sequence

MATERIALS & METHODS

Experiments were carried out at the experimental farm of Tuscia University from 2011 to 2013. The treatments consisted in:

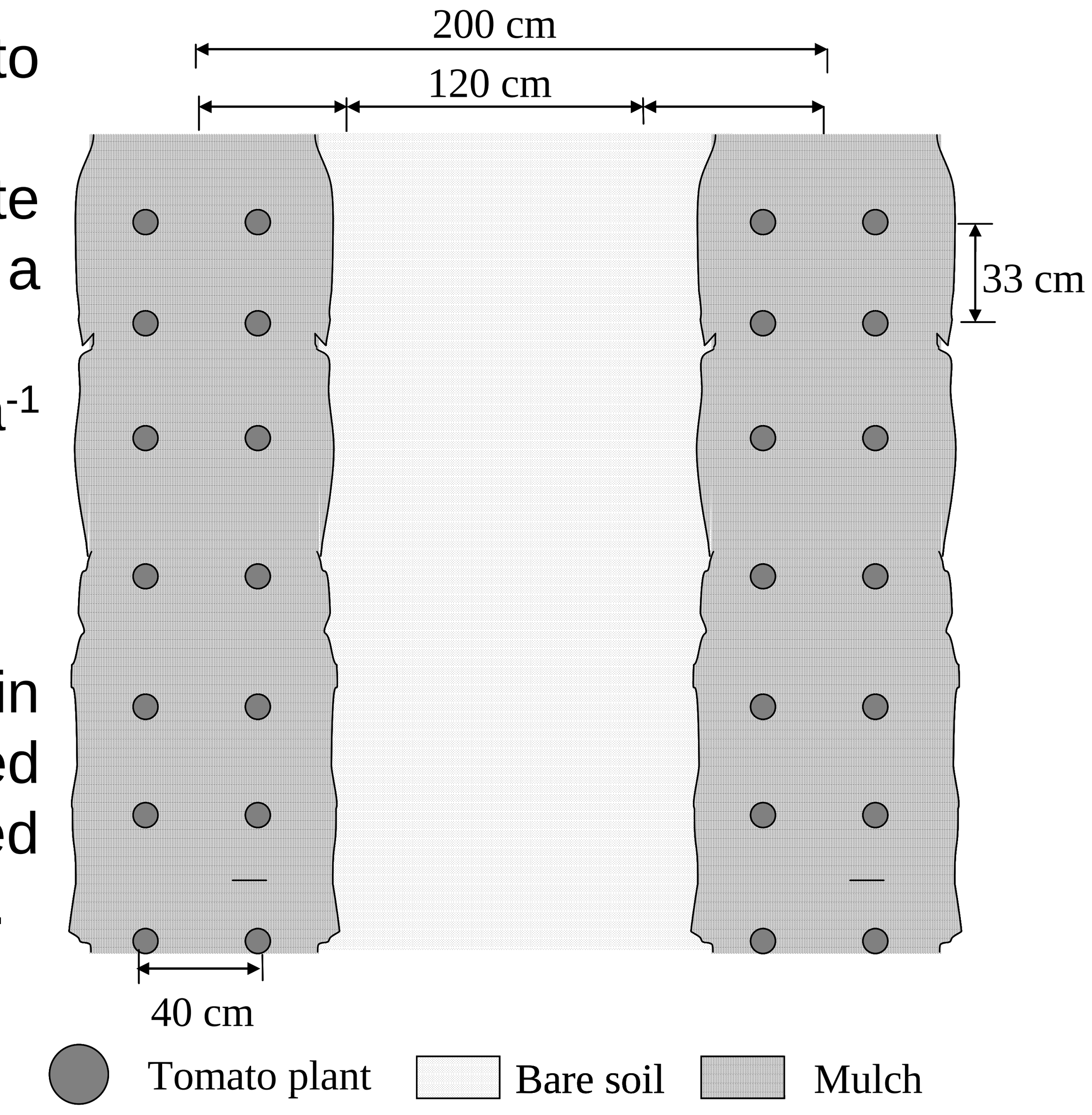
(i) 5 soil managements [three winter cover crop species (hairy vetch, phacelia, and white mustard), a winter fallow soil mulched with barley straw before tomato transplanting, and a winter fallow tilled before tomato transplanting (conventional)};

(ii) 2 levels of nitrogen fertilization applied on tomato [0 kg of N ha^{-1} (N0) and 100 kg of N ha^{-1} (N100)];

(iii) 2 levels of weed management applied on tomato [weed-free (WF) and weedy (We)].

Cover crop residues were arranged in strips and tomato seedlings were transplanted in paired rows into the mulch strips (Fig. 1). In the weedy treatments the weeds were controlled with a rotary hoe only between the tomato paired rows. Weed species density and weed aboveground biomass were determined at cover crop suppression and at tomato harvesting.

Figure 1. Plan of the tomato plants transplanted onto mulch strips in paired rows.



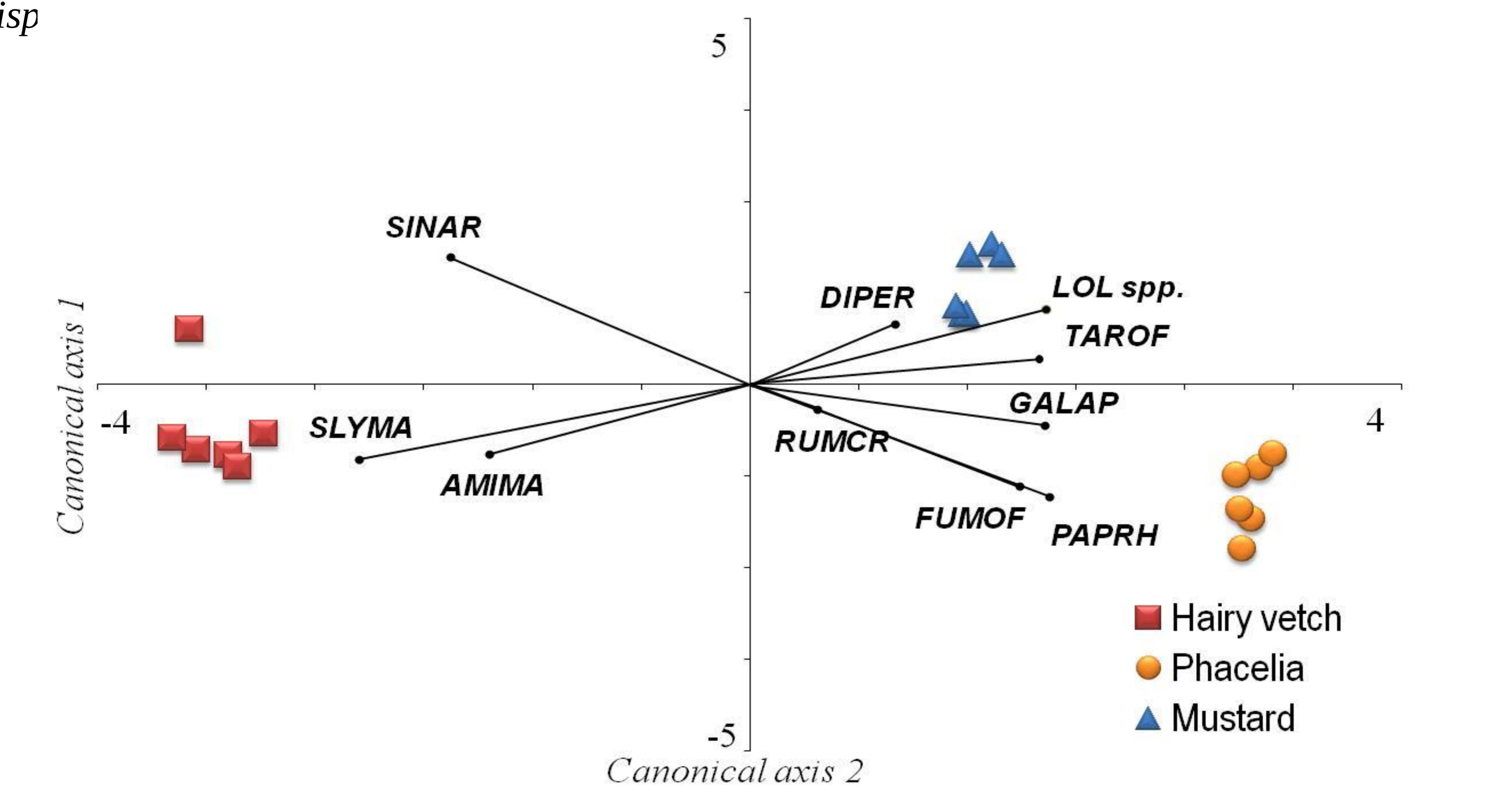
RESULTS & DISCUSSION

Cover crop aboveground biomass ranged from 634 g m^{-2} in hairy vetch to 375 g m^{-2} in mustard. Hairy vetch was the most weed-suppressive species compared to mustard and phacelia (Table 1). The weeds associated with hairy vetch were generally of the nitrophilous species which may have been favored by the large amount of nitrogen released from the legume (Fig. 2).

Table 1. The interaction effects of year x soil management on the weed density and weed aboveground biomass at cover crop suppression and at tomato harvesting and soil management x nitrogen fertilization at tomato harvesting. Values belonging to the same characteristic and treatment with different letters in rows for year or nitrogen fertilization effects (upper case letter), and in columns for soil management effect (lower case letter) are statistically different according to LSD (0.05).

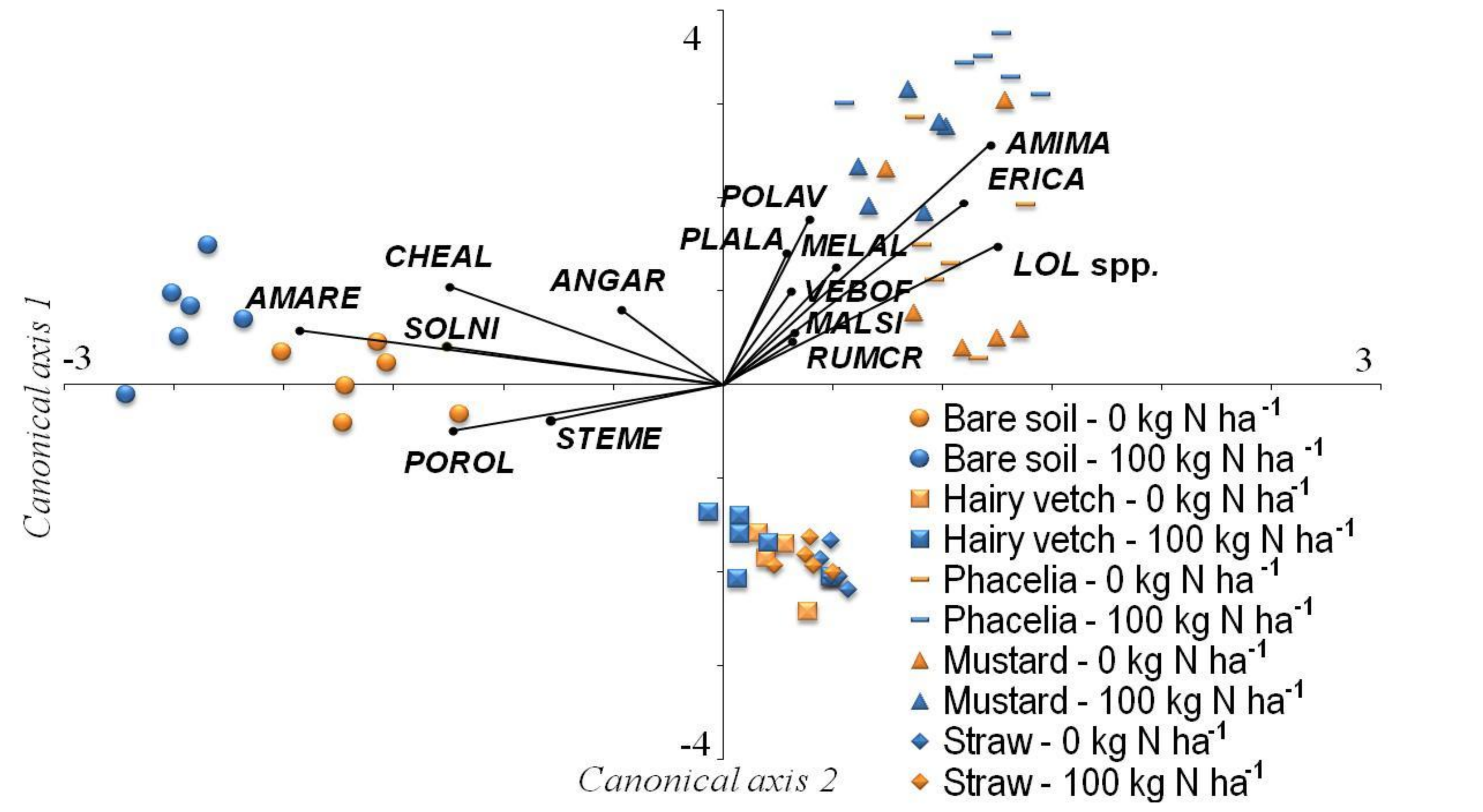
	At cover crop Suppression				At tomato harvesting							
Soil management	Weed density (plants m^{-2})											
	2012		2013		2012		2013		0 kg N ha^{-1}		100 kg N ha^{-1}	
Hairy vetch	27.5	bA	15.3	bB	13.2	bA	11.6	cA	8.1	cA	16.7	cA
Straw	---		---		3.2	bA	7.8	cA	3.1	cA	7.9	cA
Mustard	51.7	aA	47.2	aB	90.3	aA	68.2	bB	66.8	bB	91.8	bA
Phacelia	---		---		90.7	aA	66.4	bB	59.6	bB	97.5	abA
Bare soil	46.5	aA	36.2	aB	102.0	aA	95.9	aA	85.0	aB	112.9	aA
	Weed aboveground biomass (g m^{-2} of DM)											
	2012		2013		2012		2013		0 kg N ha^{-1}		100 kg N ha^{-1}	
Hairy vetch	119.8	bA	81.8	bA	45.1	bA	61.6	cA	33.2	cA	73.4	cA
Straw	---		---		17.3	bA	43.0	cA	13.3	cA	47.0	cA
Mustard	437.0	aA	351.0	aB	392.2	aA	346.6	bA	286.5	bB	452.2	bA
Phacelia	---		---		424.7	aA	327.7	bB	283.2	bB	469.3	bA
Bare soil	343.3	aA	280.3	aB	438.2	aA	488.9	aA	359.5	aB	567.6	aA

Figure 2. Biplot from canonical discriminant analysis (CDA) of the weed species in the cover crop species at cover crop suppression. Data was combined for 2012 and 2013 growing seasons. SLYMA=*Silybum marianum*; SINAR=*Sinapis arvensis*; PAPRH=*Papaver rhoeas*; TAROF=*Taraxacum officinale*; DIPER=Diplotaxis *erucoides*; FUMOF=*Fumaria officinalis*; GALAP=*Galium aparine*; AMIMA=*Ammi majus*; LOL spp.=*Lolium* spp.; RUMCR=Rumex *crisp*



At tomato harvesting, hairy vetch and barley straw showed a low level of weed infestation (Table 1). The increase in weed density in phacelia and mustard was determined mainly by surface-germinating perennial weed species. Although, the conventional treatment showed similar weed density values to those observed in phacelia and mustard, the weed flora was mainly composed of annual photoblastic weeds. The administration of nitrogen to the tomato increased the density and aboveground biomass of the nitrophiluos weed species (Fig. 3).

Figure 3. Biplot from canonical discriminant analysis (CDA) of the weed species in the tomato crop at tomato harvesting . Data was combined for 2012 and 2013 growing seasons. AMARE=*Amaranthus retroflexus*, CHEAL=*Chenopodium album*; POLAV=*Polygonum aviculare*; ERICA=*Conyza canadensis*; AMIMA=*Ammi majus*; MALSI=*Malva sylvestris*; MELAL=*Silene latifolia* subsp. *alba*; POROL=*Portulaca oleracea*; SOLNI=*Solanum nigrum*; RUMCR=*Rumex crispus*; VEBOF=*Verbena officinalis*; LOL spp.=*Lolium* spp.; PLALA=*Plantago lanceolata*; ANGAR=*Anagallis arvensis*; STEME=*Stellaria media*.



CONCLUSIONS

The amount of cover crop biomass and its characteristics appear to be key factors for reducing weed density and weed aboveground biomass both in cover crops and the subsequent tomato crop. The use of crop residues determined a change in weed species composition which was mainly composed of perennial weeds, while annual photoblastic weeds were the most abundant species of weed flora in conventional tilled soil.