MULTIFUNCTIONAL LIVING MULCHES FOR WEEDS CONTROL IN ORGANIC APPLE ORCHARD

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INTRODUCTION

Soil management on the tree rows in apple orchard can affect the apple trees development and yield, orchard biodiversity and the crop economic outcome. The soil in the tree rows can be managed, among others, by growing various plant species as living mulches. Multifunctional living mulch species, i.e. crop species that can provide several ecosystem services, may have an allelopathic effect on weeds or can compete with them limiting their growth and negative impact on the tree crop.

The aim of the study was to determine the suitability of living mulch species, selected for providing multifunctional ecosystem services for soil maintenance and weed control in an organic apple orchard.

MATERIAL AND METHODS

A field trial was carried out in the years of 2019-2020 in an eight-year-old organic apple orchard located in Skierniewice. A completely randomized block design (each plot was 12.5 m^2) was established with trees of cv. Gala and Golden Delicious, on M9 rootstock, spaced at 3.5 m×1.6 m (1850 trees/ha), on a loamy sandy soil (luvisol soil - sand 78% + silt 18% + clay 4%) containing 3.2% of soil organic matter and pH 6.2.

❖ **Living mulch species included:**
- ***Alchemilla vulgaris***
- ***Mentha piperita***
- ***Tropaeolum majus***
- ***Fragaria vesca***
- ***Cucurbita maxima***

❖ The perennial species grown as living mulch were planted in autumn 2018, while the annual species were sown in each year at spring time. Natural soil coverage was used as control.

❖ The assessment of soil coverage by weed species was performed using a 20 x 50 cm frame at 4 randomly selected points in the tree rows, three times during the growing season: at spring - after emergence of weeds, in the summer - during the full vegetation period and in autumn - at the end of the vegetation period.

❖ After the summer assessment, hand weeding was performed and existing weeds were removed to prevent them from producing seeds.

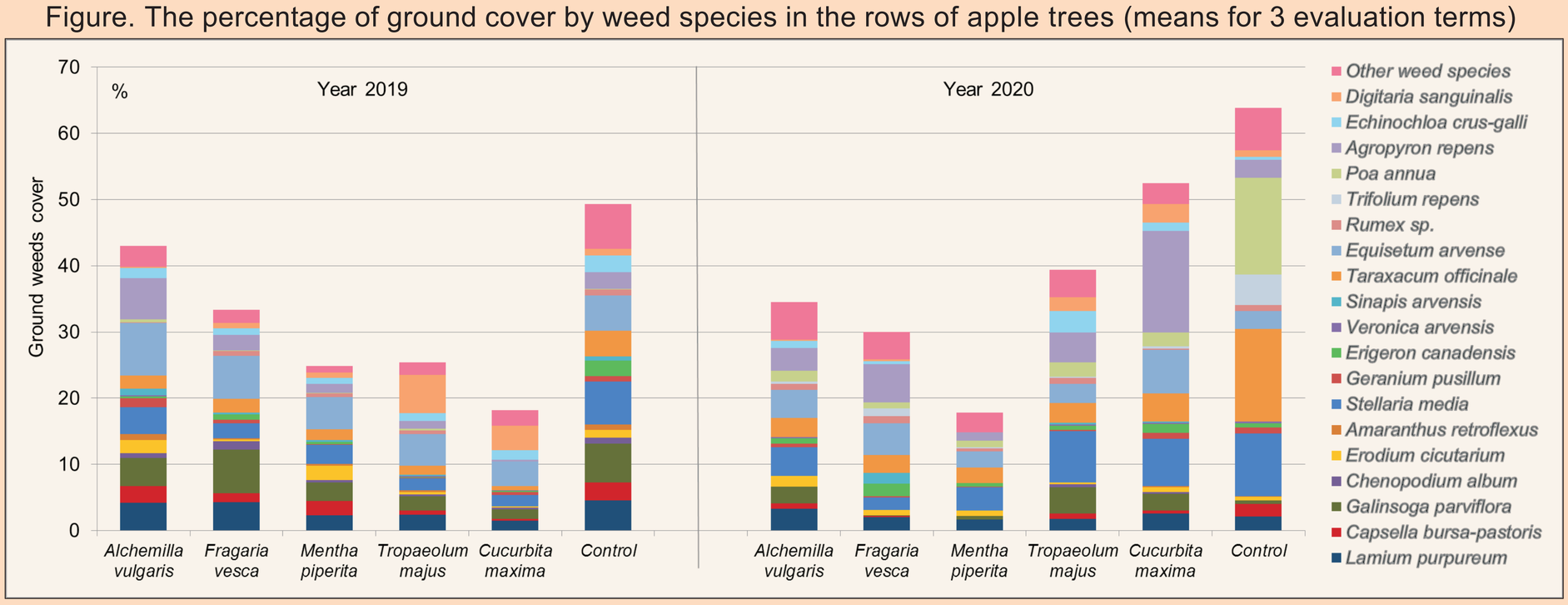
RESULTS

Table. The weed species found in the rows of apple trees with living mulches

	Weed species	Living mulches					
		Alchemilla vulgaris	*Fragaria vesca*	*Mentha piperita*	*Tropaeolum majus*	*Cucurbita maxima*	Control
Dicotyledonous	*Capsella bursa-pastoris*	+++	+++	+++	+++	+++	+++
	Lamium purpureum	+++	+++	+++	+++	+++	+++
	Galinsoga parviflora	+++	+++	+++	+++	+++	+++
	Stellaria media	+++	+++	+++	+++	+++	+++
	Chenopodium album	+++	+++	++	++	++	++
	Taraxacum officinale	+++	+++	+++	+++	+++	+++
	Amaranthus retroflexus	++	++	+++	+	-	+++
	Rumex acetosella	+++	++	++	-	-	++
	Spergula arvensis	++	+++	++	+	+	-
	Geranium pusillum	+++	+++	++	+	++	+++
	Polygonum aviculare	+	+++	+	+	++	+++
	Erodium cicutarium	++	++	+++	+	+++	+++
	Trifolium repens	+	++	++	-	+	++
	Erigeron canadensis	-	++	+	+++	+	++
	Arnoseris minima	++	++	++	+++	++	+++
	Hypochaeris radicata	++	+++	+++	++	+++	+++
	Erophila verna	++	+	+	+	+	+
	Veronica arvensis	++	++	+	+++	+++	+++
	Viola arvensis	+++	++	+	-	-	+++
	Raphanus raphanistrum	+	+	+	-	-	+
	Fallopia convolvulus	+	+	+	-	+	-
	Matricaria maritima subsp. inodora	-	-	-	+	+	-
	Cirsium arvense	+	+	-	-	-	-
	Polygonum persicaria	+	+	-	+	-	-
	Galeopsis tetrahit	-	+	-	+	-	+
Monocotyledonous	*Echinochloa crus-galli*	++	+++	++	+++	++	+++
	Bromus mollis	+++	+++	++	+++	+++	+++
	Agropyron repens	++	+++	+++	+++	+++	++
	Poa annua	+++	+++	+++	+++	+++	+++
	Setaria sp.	++	+	+	+	++	++
	Digitaria sanguinalis	+	++	++	++	++	++
	Equisetum arvense	+++	+++	+++	+++	+++	+++

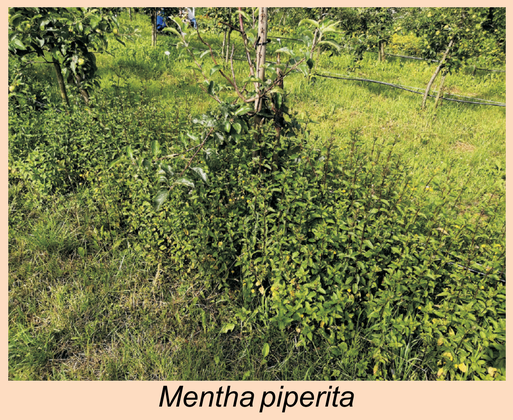
The period of weeds occurrence spring (+); summer (+); autumn (+).
32 weed species were recorded in the apple orchard throughout the study period: 75% annuals and the rest biennial (3%) perennial (22%).

Figure. The percentage of ground cover by weed species in the rows of apple trees (means for 3 evaluation terms)



Mentha piperita strongly reduced soil cover by weeds and an increasing trend of coverage was also recorded for *Alchemilla vulgaris* and *Fragaria vesca* in the second year.


Alchemilla vulgaris


Mentha piperita


Tropaeolum majus


Fragaria vesca


Control

CONCLUSIONS

1. All plant species used as mulches in apple tree rows reduced weeds compared to control, but *Alchemilla vulgaris* and *Fragaria vesca* required more time to fully establish.
2. *Mentha piperita* and *Tropaeolum majus* strongly reduced the growth of both annual and perennial weeds from the first season.
3. A correct selection of multifunctional living mulch species could support the weed control in organic orchards.

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