CONTROL OF *LAMIUM PURPUREUM* AND *RANUNCULUS REPENS* SPECIES IN PEAR ORCHARD

Laura VORNICU[1], T. H. RUS[1], A. PISTOL[1], Ramona ȘTEF[1*], A. CĂRĂBEȚ[1*]

[1] University of Life Sciences "King Mihai I" from Timisoara, Romania
Corresponding author:chirita_ramona@yahoo.com; alin70599@yahoo.co.uk

Abstract. *In the last 30 years, the area occupied by pearorchards, in Romania, is decreasing from 9974 ha to 4827.05 ha. Favorable conditions for pear cultivation can be found in 14 counties. Orchards are annually infested with weeds that compete with fruit trees for nutrients, space, water, light and reduce growth, vigor, flowering, production and fruit quality. Herbicides are an effective, easy and relatively cheap method of weed control. The effectiveness of herbicides against weeds is different for each species. The aim of this study was to reduce populations of Lamium purpureum and Ranunculus repens by using MCPA and Fluroxypyr-methyl. The testing of herbicides against the two weed species (Ranunculus repens and Lamium purpureum, was carried out in the Orchards Experimental Research Station - Lugoj Herindești (Timiș county). The experimental field included 5 variants: three treated with the hormonal herbicide MCPA 50% DMA (0.9 l/ha, 1.2 l/ha, 1.5 l/ha), one in which the herbicide Cerlit was applied (1.0 l/ha) and a control untreated variant. These herbicides were applied post-emergence (21.04.2022). The impact of MCPA and fluroxypyr, in the control of Ranunculus repens and Lamium purpureum species, was determined 10-38 days after application. 10 days after applying the treatments, the species Lamium purpureum was reduced by 70-75%, regarding the species Ranunculus repens it was observed that the product MCPA 50% DMA 1.5 l/ha managed to reduce the population in percentage of 80%. At 38 days after application, an increase in the effectiveness of herbicides in the control of segetal species was observed.*

Keywords*: Ranunculus repens, Lamium purpureum, control, efficacy, MCPA*

INTRODUCTION

In Romania, in 2014, the total area of orchards represented 1% of the country's agricultural area (158,609.74 ha) (COMAN et al., 2014). In the last 32 years, the fruit-growing sector has been in a constant decline, with negative consequences not only on the economic development of the rural environment, but also on the quality of life of the communities in the traditional fruit-growing areas (COMAN et al., 2014). In the period 1990-2022, the area occupied by orchards decreased by approximately 50%, reaching 136,000 ha (I.N.S., 2023).

The main fruit tree species cultivated in Romania are: apple, pear, plum, cherry, sour cherry, apricot, peach, nectarine, walnut, hazelnut, almond, shrubs. The total area occupied by pear orchards in Romania is 4,827.05 ha (COMAN et al., 2014).

Weed control in fruit orchards is of crucial importance in reducing the competition for water and nutrients during the critical phase of tree growth and to increase the productivity of fruit trees (GRANATSTEIN and SÁNCHEZ 2008, MIA et al., 2020, SCEDEI et al., 2022). In addition, the appropriate approach to weed control in orchards can play an important role in the operation of their specific uses, reducing habitats for pests (such as field mouse populations) and bringing economic benefits through the production of high-quality fruit (HAMMERMEISTER 2016; MIA et al., 2020). A serious challenge for fruit producers is managing weeds in the tree row zone, where they can compete strongly with fruit trees for water and nutrients because of the low density of tree roots compared to weeds (MERWIN 2003; LISEK 2014).

Weeds can cause significant damage to fruit producers by competing with trees, sometimes leading to losses of up to 60% (MARIN et al., 2022). In addition, weeds also serve as

a source of infection for disease and an intermediate host for insects (JOHNSON et al., 1993; FITZGERALD and SOLOMON, 2004). Applying herbicides to control weeds can help avoid these threats. However, the excessive application of herbicides brings a series of adverse effects (water or soil pollution and the development of weed resistance to herbicides) (ZHANG et al., 2005; PARK et al., 2014). Therefore, it is necessary to investigate the weed species present and select effective herbicides or management methods accordingly.

To effectively manage weeds, it is essential to know: their biology, the composition of herbicides, how they act on weeds and the interactions between herbicides, soil and physico-chemical characteristics, as well as the interaction with fruit trees (GHINEA et al., 2004 quoted by MARIN et al., 2022).

Studies by HWANG and PARK (2016) highlight the diversity and abundance of weeds in fruit orchards. They reported identifying 64 weed species belonging to 27 families, 39 annuals and 25 perennials, in plantations in Chungnam Province (HWANG and PARK, 2016). In Romania, MARIN et al. (2022) reported 36 weed species in the apple orchard, in Argeș County. SCEDEI et al. (2022) identified 14 weed species in the peach orchard in Timiș County. The most common weed species in fruit orchards in Romania are *Convolvulus arvensis, Veronica hederifolia, Amaranthus retroflexus, Chenopodium album, Polygonum aviculare, Stellaria media, Lamium purpureum, Ranunculus repens, Polygonum convolvulus, Cirsium arvense, Sonchus arvensis, Elymus repens, Cynodon dactylon, Echinochloa crus-galli, Digitaria sanguinalis, Setaria viridis, Setaria glauca* etc. In the fruit plantations, in the western part of Romania, the species *Sorghum halepense* was also reported, a weed frequently found in agroecosystems in Romania and very difficult to control (CHIRIȚĂ and al., 2004; CHIRIȚĂ and al., 2008 ; CHIFAN and al. 2019).

Due to the diversity of weeds, it is more effective to use integrated methods of their management than a single control method (RIFAI et al., 2002). The correct selection of the weed management method is crucial, as it can have significant effects on tree yield and fruit quality (GUERRA, STEENWERTH 2012; VAN HUYSSTEEN, WEBER 1980), as well as on orchard biodiversity. A sustainable orchard soil management system depends on the three pillars of: economics, ecology and equity. They indicate that an orchard must be managed in a way that is economically viable, ecologically responsible and socially acceptable (GRANATSTEIN, KUPFERMAN 2008).

The objective of the current study was to control the population of two "target" species (*Lamium purpureum, Ranunculus repens*) from the hair plantation located in Western Romania.

MATERIAL AND METHODS

The research was carried out at the Orchard and Experimental Station - Lugoj Herindești (Timiș county). The investigated crop was the hair plantation. The field of experience included 5 variants in 4 replicates.

The substances used were MCPA 500 g/ha and Cerlit (Fluroxipir-meptil 250 g/ha) and were applied post-emergence, during the vegetation of the crop. The application of herbicides was carried out on April 21, 2022. The variants differed in terms of the active substance and the dose applied.

After the application of the herbicides, observations were made regarding their effectiveness agaunst the two target species, *Lamium purpureum* and *Ranunculus repens*, the assessment was made according to the EWRS scale. The effectiveness of the products was evaluated at 10 days (05/05/2022) and 38 days (05/29/2022).

Variant/herbicide	a.i. content g/l-g/ha	Applied dose l/ha
V_1 –Untreated	-	
V_2 – MCPA 500 g/l	MCPA 500 g/l	1.5 l/ha
V_3 – MCPA 500 g/l	MCPA 500 g/l	1.2 l/ha
V_4 – MCPA 500 g/l	MCPA 500 g/l	0.9 l/ha
V_5- Cerlit	fluroxipir-meptil 250 g/ha	1 l/ha

Trial setup (poze Ștef R., 2022)

Analysis of variance was used for the statistical interpretation of the results.

RESULTS AND DISCUSSIONS

On the day of application, the population density of *Lamium purpureum* and *Ranunculus repens* was established by establishing the number of plants per m^2 (24.75 pl/m^2 *Lamium purpureum* and 7.75 plants/m^2 *Ranunculus repens* respectively). The treatments, used in the experience, reduced the population of *Lamium purpureum* by 70-75% (figure 1.). The herbicide MCPA, applied in three doses (1.5 l/ha; 1.2 l/ha; 0.9 l/ha) controlled the purple dead-nettle population by 70-75%, the absolute differences of (-1, 67) and (-5.0) were not significant compared to the Cerlit herbicide (the reference product).

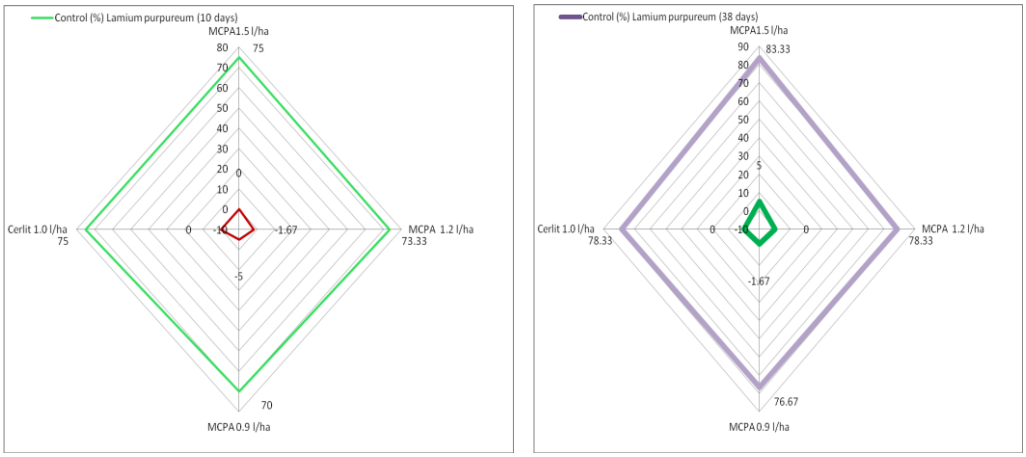

Figure 1. The effectiveness of the herbicide MCPA 500g/l against the *Lamium purpureum* species and the differences recorded compared to the reference herbicide Cerlit
(10 days – left figure and 38 days – right figure)

The population of *Lamium purpureum*, 38 days after the application of herbicides, was reduced by 76.67 – 83.33%. From the data presented, an increase in the effectiveness of MCPA 500 g/l and Cerlit herbicides in controlling purple dead-nettle is observed.

Comparing the effectiveness recorded in the variant treated with MCPA 500 g/l (1.5 l/ha) with that obtained in the control variant (treated with the product Cerlit 1 l/ha), a significant reduction of the *Lamium purpureum* species was observed (figure 1). By decreasing the herbicide dose (MCPA 500 g/l) no more statistical differences were obtained compared to the reference herbicide.

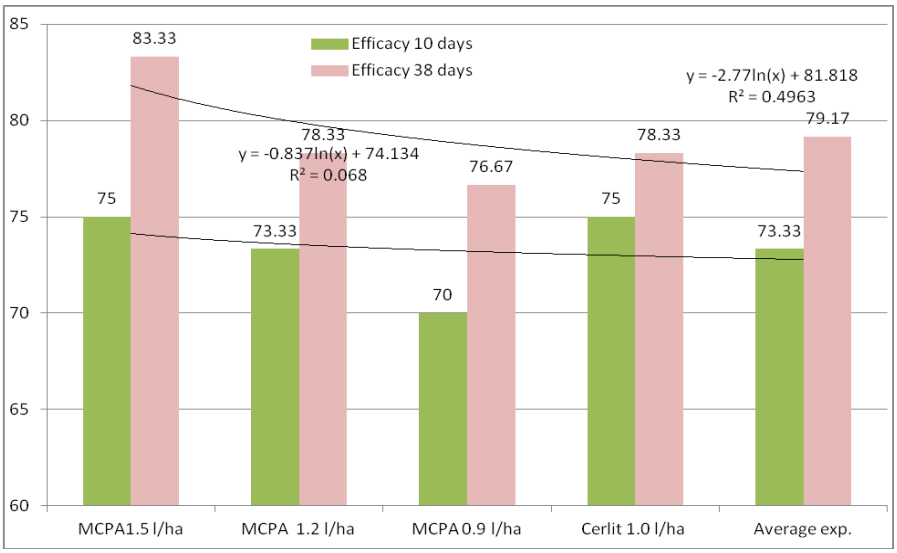

Figure 2 Graphic representation of the results regarding the control of the *Lamium purpureum* species in the pear orchard (at 10 and 38 days respectively after applying the treatments)

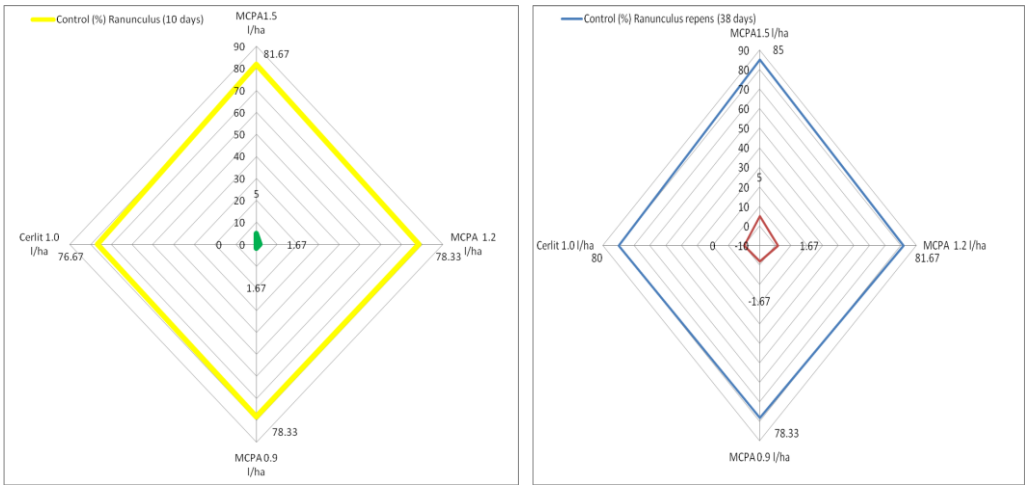

Figure 3 The effectiveness of the herbicide MCPA 500g/l in the control of the *Ranunculus repens* species and the differences recorded compared to the reference herbicide Cerlit
(10 days – left figure and 38 – days right figure)

During 2022, the maximum efficiency in combating the species Ranunculus repens, from the hair plantation (Herindești - Timiș) was recorded in the plots where the herbicide

MCPA 500 g/l 1.5 l/ha was applied (81.67%). The herbicide Cerlit, 10 days after application, failed to control more than 76.67% of the population of Ranunculus repens (figure 3).

At 38 days after the application of herbicides, the perennial species *Ranunculus repens* was controlled in a percentage of 78.33 - 85%. (Figure 3). The application at the dose of 1.5 l/ha of MCPA 500 g/l, led to a greater remanence of the herbicide, its effectiveness being at highest, 38 days after application, and the percentages obtained being distinctly significant compared to the effectiveness of the product reference (figures 3). The doses of 1.2 l/ha and 0.9 l/ha determined absolute differences of (-1.67) and (1.67), but statistically insignificant. The Cerlit product had an effectiveness of 80% in combating the perennial species *Ranunculus repens* (Figure 4).

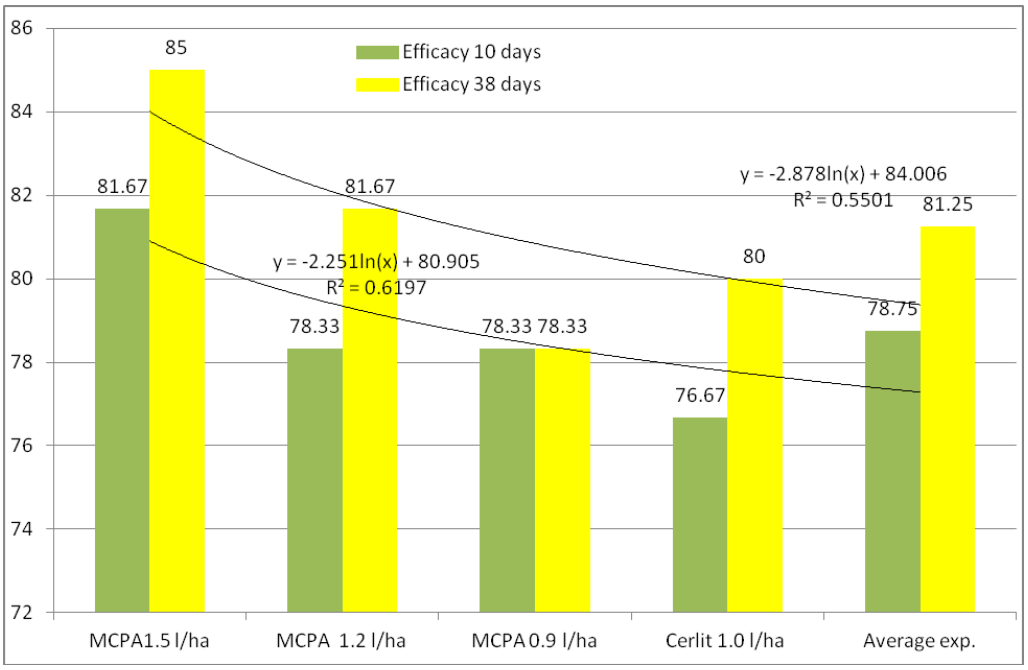

Figure 4 Graphic representation of the results regarding the control of the *Lamium purpureum* species in the pear orchard (10 and 38 DAT)

The reference herbicide, Cerlit 1l/ha, better controlled the population *of Ranunculus repens* compared to that of *Lamium purpureum*.

CONCLUSIONS

The effectiveness of the herbicides used in the experiment was influenced by the treatment, the dose and the days after their application.

The herbicide MCPA 500 g/l applied at a dose of 1.5 l/ha best controlled the ephemeral species (*Lamium purpureum*) and the perennial species (*Ranunculus repens*). Superiority was statistically evident 38 days after application.

The efficacy of the herbicides, in combating the two target weeds, recorded 10 days after application, was lower compared to that recorded at 38 days.

The application of the dose of 0.9 l/ha MCPA 500 g/l determined a percentage of control lower than that recorded in the plots treated with the reference product Cerlit.

BIBLIOGRAPHY

CHIFAN RAUL, ȘTEF RAMONA, GROZEA IOANA, 2019 - The cyclohexanediones effect on the *Sorghum halepense* control in the sunflower agroecosystem,

CHIRITA, R., LAUER, K. F., SARPE, N., 2004 - Control of Johnson grass in maize with new broad-spectrum herbicides in Western Romania, Zeitschrift fur pflanzenkrankheiten und pflanzenschutz-Journal of Plant Diseases and Protection, Special Issue, 19, 725-731

CHIRITA, RAMONA, GROZEA IOANA, SARPE NICOLAE, LAUER KARL FRITZ, 2008 - Control of *Sorghum halepense* (L.) species in western part of Romania., Communications in agricultural and applied biological sciences, ISSN:1379-1176, Volume:73 Issue: 1, 2008

COMAN MIHAIL, CHIȚU EMIL et al., 2014 - Zonarea speciilor pomicole în funcție de condițiile pedoclimatice și socio-economice ale României, Editura Invel Multimedia, București

DAVID M GRANATSTEIN, EUGENE KUPFERMAN, 2008 - Sustainable Horticulture in Fruit Production, Acta Horticulturae

FITZGERALD J. D., M. G. SOLOMON, 2004 - Can flowering plants enhance numbers of beneficial arthropods in UK apple and pear orchards. Biocontrol Sci. Techn., 14: 291–300 Ha S. and D. Chung 2012 Agricultural Status and Soils

GRANATSTEIN D., KUPFERMAN E., 2008 - Sustainable horticulture in fruit production. International Society for Horticultural Science (ISHS), 767: 295–308.

GUERRA B., K. STEENWERTH, 2012 - Influence of Floor Management Technique on Grapevine Growth, Disease Pressure, and Juice and Wine Composition: A Review, Agricultural and Food Sciences/American Journal of Enology and Viticulture, pp149-163

HAMMERMEISTER A.M., 2016 - Organic weed management in perennial fruits. Scientia Horticulturae, 208: 28–42.

HWANG K. S. AND K. W. PARK, 2016 - A Survey of Weed Occurrence and Management on Apple Orchard Fields in Chungnam Province in Korea. Weed Turf. Sci., 5: 5–9

JOHNSON K. B., V. O. STOCKWELL, R. J. MCLAUGHLIN, D. SUGAR, J. E. LOPER AND R. G. ROBERTS, 1993 - Effect of antagonistic bacteria on establishment of honey bee–dispersed Erwinia amylovora in pear blossoms and on fire blight control. Phytopathology– New York and Baltimore then stpaul, 83: 995

LISEK JERZY, 2014, Possibilities and limitations of weed management in fruit crops of the temperate climate zone, Journal Of Plant Protection Research Vol. 54, No. 4 (2014)

MARIN FLORIN-CRISTIAN, CALINESCU MIRELA, SUMEDREA MIHAELA, 2022. Researches on use of SOME post-emergent herbicides to control weeds in the bearing apples orchards, Fruit Growing Research, Vol. XXXVIII pp. 157-167

MERWIN I.A., 2003 - Orchard Floor Management Systems. p. 303−318. In: "Apples: Botany, Production and Uses" (D.C. Ferree, I. Warrington, eds.). CABI Publ., Wallingford, UK, 660 pp

MIA M.J., MASSETANI F., MURRI G., NERI D., 2020 - Sustainable alternatives to chemicals for weed control in the orchard – a Review. Hort. Sci. (Prague), 47: 00–00.

PARK T. S., K. Y. SEONG, H. S. CHO, M. C. SEO, H. W. KANG, K. W. PARK, 2014 - Current status, mechanism and control of herbicide resistant weeds in rice fields of Korea. CNU J. Agric. Sci., 41: 85–99

RIFAI M.N., ASTATKIE T., LACKO-BARTOSOVA M., GADUS J., 2002 - Effect of two different thermal units and three types of mulch on weeds in apple orchards. J. Environ. Eng. Sci. 1 (5): 1−16

SCEDEI DANIELA NICOLETA, FLORIN FIRU, CORINA CONSTANȚA SÎRBU, OLIMPIA ALINA IORDĂNESCU, ANIȘOARA DUMA-COPCEA, CASIANA MIHUȚ, RAMONA ȘTEF, ALIN CĂRĂBEȚ, CARMEN BEINȘAN, SIMION ALDA, 2022 - Degree of control of weeds under the influence of agro-technical measures and herbicides in a peach plantation (*Prunus persica* L.), Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 1, 2022

VAN HUYSSTEEN L., WEBER H.W., 1980 - The effect of selected minimum and conventional tillage practices in vineyard cultivation on vine performance. South African Journal for Enology and Viticulture, 1: 77–83.

ZHANG H. J., X. LIU, B. G. GU, 2005 - The identification and management of herbicide resistance weeds. Pestic. Sci. Admi., 26: 27–33

*** I.N.S., 2023 - https://insse.ro/cms/sites/default/files/com_presa/com_pdf/ Research Journal of Agricultural, ISSN - 2066-1843, Science, 51 (4), 2019, https://www.cabdirect.org