NEW STRATEGIES OF CHEMICAL CONTROL OF ANNUAL WEEDS IN MAIZE

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Abstract: *At present, in Romania, chemical weed control strategies in maize suppose the application of two treatments: the first pre-emergent crop (before or right after sowing, in order to control mono- and some annual dicot species) and a second post-emergent crop (during vegetation in order to control mono- and some perennial dicot species). Taking into account the excessive sensitivity of maize to weeding, particularly during the first 4-6 weeks of vegetation, applying combined herbicides pre-emergently (that contain two to three active substances) is of particular importance. In this paper, we study the effect of simple or combined herbicides (Adengo, Akris, Merlin Duo, Merlin Expert, Successor T, Wing P, compared to the herbicide Guardian), applied at two times: pre-emergently and early post-emergently on annual weed control in maize. Research was carried out at the Didactic Station in Timişoara in 2009, on a cambic, fertile chernozem with high weeding risk. The most frequent weed species were annual monocots (74,0%), followed by annual dicots (21.0%). Compared to the standard treatment (Guardian CE), maximum efficiency in controlling annual weeds upon pre-emergent application was in the variant treated with Adengo over 91%. In general, the efficiency of combined herbicides applied early post-emergently was determined by the optimal phase of the weeds at the time of treatment, by the ratio of the two weed groups and by the amounts of rainfall after treatment application. Among herbicides, the best efficiency was again that of the herbicide Adengo (0.30-0.35 l/ha) with 96%, followed by the herbicide Merlin Duo (2 l/ha) with 89%. The species not controlled were perennial (mono- and di-cots), the annual dicot species Hibiscus trionum, as well as all the annual weed species in advanced treatment (above the optimal phase of maximum 4 leaves). Taking into account that neither of the tested herbicides controlled perennial mono- or di-cot weeds: on lands strongly infested by these weeds, we also need to apply a proper post-emergent treatment. All herbicides applied, pre-emergently and early post-emergently, were very selective for the cultivated maize hybrid DKC 5143.*

Key words: *corn crop, weeds control, herbicides, preemergent and postemergent early apply*

INTRODUCTION

At present, maize holds the most significant percentage in the structure of agricultural cultures of Romania, but despite this aspect, the obtained mean yield is low under the biological potential of the cultivated hybrids. One of the reasons concerning this situation is represented by the accentuated weed degree of this plant and the great sensibility of maize to weeds, especially in the first 5-6 weeks after sowing. Generally, the surfaces cultivated with maize present a strong infestation with mono and di-cotyledonal weeds, annual and perennial, very different in relation with the specific conditions of clime and soil, and also with the performed agrotechnics during the time in the lands. In the field of weed control, the priority objective is to limit the weed competition in the whole vegetation period by reducing the weed degree under the level of the economic damage limit.

In the course of the time, there were registered significant progresses regarding the weed control strategy in the maize cultures, determined especially by the synthesis and use of some new herbicides. Actually, in our country, this strategy relies on two treatments: the first pre-emergent (before or immediately after sowing) in order to control the mono-cotyledonal

weeds and some annual di-cotyledonal weeds, and the second post-emergent (during the vegetation phase) in order to control the mono and/or di-cotyledonal perennial species.

Relatively recent there were initialized researches regarding the usage of some new mixed herbicides (containing 2-3 active substances) with possibility to apply them at two different stages: pre-emergently and/or early post-emergently (when the maize has 2-4 leaves), in order to control the annual mono and di-cotyledonal weeds which are in incipient development phases (2-3 leaves).

The present paper intends to establish the optimal application variants of certain new mixed herbicides in two stages (pre-emergently and early post-emergently), selectively for the cultivated hybrids and in the same time with great efficacy in the control of annual weeds in the maize culture.

MATERIALS AND METHODS

Researches had been carried out in the period 2008 – 2009 at the Didactic Station of U.S.A.M.V.B. Timişoara, on a cambic chernozem.

The experiment was bi-factorial, arranged in the field following the model of the subdivided plots, in 4 replicates, the surface of each plot being by 28 m^2.

The cultivated maize hybrid was DKC 5143, sowed in the optimal stage, with a denseness by 58.000 germinant grains/ha.

There were followed the efficacy of six herbicides in the control of annual weeds of the maize culture: Adengo, Akris, Merlin Duo, Merlin Expert, Succesor T and Wing P, comparing to the standard herbicide Guardian (table 1), applied in two different stages: 1 – pre-emergently (immediately after sowing) and 2 – early post-emergently (maize at 2 – 4 leaves; weeds at 2 – 3 leaves).

In the control variant V_1 – non herbicides there was determined the initial weed degree using the quantitative numerical method, and in the rest of the variants, in the stage of 15 and respectively 30 days after the herbicides had been applied, there was determined the efficacy of the tested products in reduction of the annual weeds number, using the same method. As well, after 7, 15 and 30 days after the treatments were applied there were made observations regarding the selectivity of the used herbicides in the cultivated maize.

In the paper there are presented mean results for two research years regarding the efficacy of weed control in maize culture.

Table 1

Experimental variants

Variant	Active substance	Dose L, kg /ha	Application stage
V_1 – Non treated (MH_1)	-	-	-
V_2 – Duardian (std)	acetochlor	2,25 2,25	pre-emergently early post-emergently
Adengo	thiencarbazone 90 g /l + isoxaflutole 225 g /l + cyprosulfamide 150 g /l	0,4 0,35	pre-emergently early post-emergently
Akrus	dimethenamid 280 g /l + terbutilazin 250 g /l	3,5 3,5	pre-emergently early post-emergently
Merlin Duo	isoxaflutole 37,5 g /l + terbutilazin 375 g /l	2,5 2,5	pre-emergently early post-emergently
Merlin Expert	isoxaflutole 480 g /l	0,2 0,2	pre-emergently early post-emergently
Succesor T	petoxamid 300 ml /l + terbutilazin 250 g /l	3,5 3,0	pre-emergently early post-emergently
Wing P	dimethenamid 212,5 g /l + pendimethalin 250 g /l	2,5 2,5	pre-emergently early post-emergently

RESULTS AND DISCUSSION

Mapping the weeds in the control variant (V_1 – non herbicides) there were determined for two years a mean weeding degree by 461 weeds /m^2, belonging to 13 different species. Among these, the greatest percentage by 74% was reached by the annual mono-cotyledonal weeds: *Setaria glauca* (51,7%), *Sorghum halepense* from seeds (14,0%) and *Echinochloa cruss-galli* (8,3%). The di-cotyledonal annual weeds reached a percentage by 21%, more frequent being *Chenopodium album* (6%) and *Amaranthus retroflexus* (5,2%). The perennial species *Sorghum halepense* (from rhizomes), *Cirsium arvense* and *Convolvulus arvensis* totalized a participation percent by 5% (table 2).

In the specified weeding conditions and satisfying humidity degree, after the treatment with the new mixed herbicides pre-emergently applied, there were registered great efficacies regarding the weed control in maize culture (figure 1).

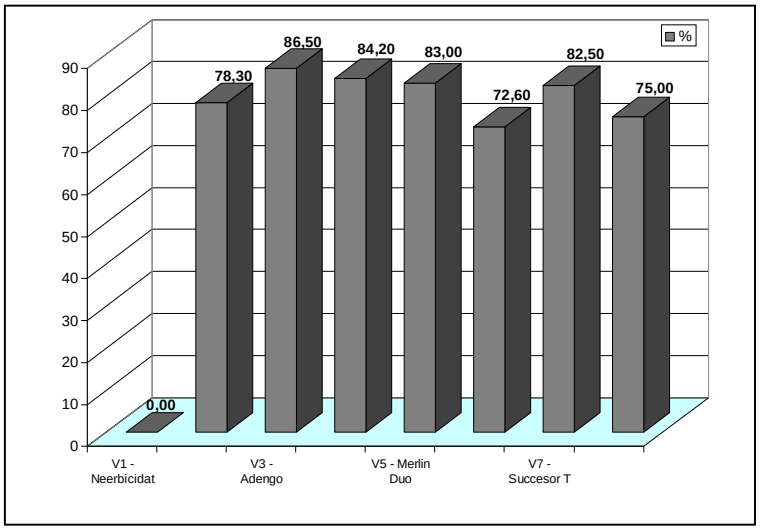

Figure 1. Efficacy (%) of the new mixed herbicides pre-emergently applied in weed controlling from maize crop, during 2008 – 2009

Thus, related to the control variant V_2 – Guardian CE 2,25 l/ha, which assured the decreasing of weed number with 78,3%, the most efficient were proven the herbicides: Adengo (86,5%), Akris (84,2%), Merlin Duo (83,0%) and Succesor T (82,5%), while the herbicides Wing P and Merlin Expert there were situated under the mean of the control variant (75%, respectively 72,6%).

It must be noticed that not even one pre-emergently applied herbicide controlled the existing perennial weeds and some annual di-cotyledonal species considered as resistant: *Xanthium strumarium, Hibiscus trionum, Solanum nigrum* and *Sinapis arvensis*.

After early post-emergently appliance of the new herbicide combinations, generally there was observed an increasing of their efficacy (exception the control variant V_2 – Guardian CE and variant V_6 – Merlin Expert).

The superior effect of the tested herbicides early post-emergently applied (maize at 2 – 4 leaves and weeds at 2 – 3 leaves) is explained by the extension of the controlling spectrum upon certain some annual species considered as resistant.

Table 2

Weed degree of the maize culture in the non-herbicide variant at S.D. Timişoara during 2008 – 2009

Crt. no.	Species	Weed umber/m^2	% of participation
1.	*Setaria glauca*	238,3	51,7
2.	*Sorghum halepense* (seeds)	64,5	14,0
3.	*Echinochloa crus – galli*	38,3	8,3
4.	*Chenopodium album*	27,7	6,0
5.	*Amaranthus retroflexus*	24,0	5,2
6.	*Sorghum halepense* (rhizomes)	17,0	3,7
7.	*Hibiscus trionum*	14,3	3,1
8.	*Polygonum convolvulus*	10,6	2,3
9.	*Xanthium strumarium*	9,7	2,1
10.	*Solanum nigrum*	9,2	2,0
11.	*Convolvulus arvensis*	3,7	0,8
12.	*Cirsium arvense*	2,3	0,5
13.	*Sinapis arvensis*	1,4	0,3
TOTAL		**461,0**	**100,0**

Generally, the efficacy of the mixed herbicide applied in this stage had been determined in great measure by respecting the development phase of the weeds at the moment of treatment, by the precipitation quantity fallen after the herbicide appliance, and also by the percentage of the different weed species.

Among the experimental variants, the greatest variants had been recorded in the variant V_3 – Adengo (93,6%), V_5 – Merlin Duo (90,5%), V_4 – Akris (88,0%) and V_7 – Succesor T (85,7%) (figure 2).

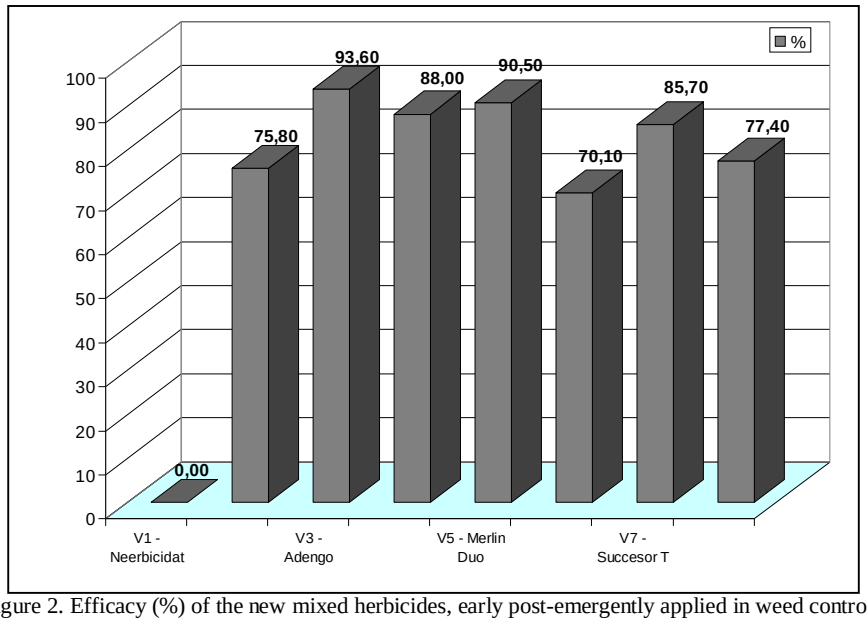

Figure 2. Efficacy (%) of the new mixed herbicides, early post-emergently applied in weed controlling from maize crop, during 2008 – 2009

The weeds unsatisfactory controlled were those perennial mono and di-cotyledonal, the annual di-cotyledonal *Hibiscus trionum*, and also all annual weeds in an advanced development phase at the treatment (more than 4 leaves).

As a result of the repeated observations made after the pre-emergently and early post-emergently appliance of the tested herbicides in the maize experiment at Didactic Station Timişoara there were not registered phytotoxicity symptoms at the cultivated hybrid DKC 5143.

CONCLUSIONS

1. The maize culture were strongly affected by weeds (461 weeds/m^2, as a mean for two research years), the dominant species being those annual mono and di-cotyledonal species.

2. As a consequence of the pre-emergent appliance of the new mixed herbicides, the weeds had been satisfactory controlled, the most efficient being the herbicides Adengo – 86,5%; Akris – 84,2% and Merlin Duo – 83,0%.

3. At the early post-emergent appliance of the tested herbicides in the optimal phase (maize 2 – 4 leaves; annual weeds: 2 – 3 leaves) these generally manifest an increasing efficacy (because of the expansion of the controlling spectrum upon some annual weed species considered as resistant). As well, in this case the greatest results regarding the weed control had been assured in the variants: V_3 – Adengo (93,6%); V_5 – Merlin Duo (90,5%) and V_4 – Akris (88,0%).

4. The uncontrolled weed species for the both appliance phases were those perennial. At the pre-emergent appliance there were not satisfactory controlled some annual di-cotyledonal species (*Solanum nigrum, Hibiscus trionum, Sinapis arvensis*) and at the early post-emergent appliance the species *Hibiscus trionum* and all the weeds in advanced vegetation phase at the moment of herbicide treatments.

5. The efficacy of the tested herbicides was determined by the weed degree, the percentage of different weed species, the application stage and the used dose, the climatic conditions and the respecting of the optimal phase of weed development (at the early post-emergent application).

6. All the tested herbicides in the two application stages were very selective for the cultivated maize hybrid DKC 5143, not being noticed phytotoxicity symptoms.

7. In the maize cultivated lands strongly weeded with perennial mono or di-cotyledonal species there is imposed at least once at few years the applications of the herbicides during the vegetation phases in order to control these weeds.

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