STRATEGIES OF CHEMICAL CONTROL IN THE SPECIES *XANTHIUM STRUMARIUM* L. IN MAIZE CROPS

STRATEGII DE COMBATERE CHIMICĂ A SPECIEI *XANTHIUM STRUMARIUM* L. DIN CULTURILE DE PORUMB

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Abstract. *Maize, the most widespread tillage crop in Romania, is known as being very sensible to weeding, particularly during the first stages of vegetation. A problem-weed in maize crops is the species Xanhium strumarium L., popularly called mouse ear or thistle. In this paper we aim at establishing some of the most efficient pre-emergent herbicides in the control of this species in the grain maize crops. Research was carried out during the years 2005 and 2006, at the Didactic Station of the Agricultural and Veterinary University of the Banat in Timişoara (România) on a cambic chernozem. The trial was mono-factorial with four replications. The best results in the control of the species Xanhium strumarium L. were ensured by the herbicide Cambio-2.5 l/ha (96.80% in 2005 and 95.20% in 2006), closely followed by the herbicide Premiant-1l/ha. None of the tested products resulted in phyto-toxicity symptoms in the cultivated maize hybrid, Florencia (P_{3573}). Grain maize yields were visibly influenced on one hand by some of the performances of the herbicides in the control of the mouse ear and on the other hand by the climate conditions of the two years, the year 2006 being more favourable for maize crop.*

Rezumat. *Porumbul, cea mai răspândită cultură prăşitoare din România, este cunoscută ca fiind foarte sensibilă la îmburuienare, mai cu seamă în primele faze de vegetaţie. O buruiană problemă pentru porumb o reprezintă specia Xanhium strumarium L., denumită popular cornuţi sau scaiete. Lucrarea de faţă urmăreşte să stabilească unele dintre cele mai eficiente erbicide postemergente în combaterea acestei specii din cultura de porumb boabe. Cercetările s-au desfăşurat pe parcursul anilor 2005 şi 2006 la Staţiunea Didactică a USAMVB Timişoara, pe un sol de tip cernoziom cambic. Experienţa a fost monofactorială, în patru repetiţii. Cele mai bune rezultate în controlul speciei Xanhium strumarium L., au fost asigurate de erbicidul Cambio-2,5 l/ha (96,8 % în anul 2005 şi 95,2% în anul 2006), urmat îndeproape de erbicidul Premiant-1l/ha. Niciunul dintre produsele testate nu a determinat simptome de fitotoxicitate la hibridul de porumb cultivat, Florencia (P3573). Producţiile de porumb boabe au fost influenţate vizibil, pe de o parte de performanţele erbicidelor în combaterea cornuţilor, iar pe de altă parte, de condiţiile climatice ale celor doi ani, anul 2006 fiind mai favorabil pentru cultura porumbului.*

Key words*: maize, weeds, Xanhium strumarium L., control, herbicide, and crop.*
Cuvinte cheie*: porumb, buruieni, Xanhium strumarium L., combatere, erbicide, recoltă.*

INTRODUCTION

The presence of weeds is a natural thing in all the crops where there is no control measure at all. Weeds are unwanted on agricultural lands because of the inconveniences they cause to the crops and, indirectly, to humans.

Maize, the main tillage crop in Romania, is invaded by numerous weed species that are particularly dangerous, called "problem-weeds"; *Xanhium strumarium* L., popularly called mouse year, ranges in this category. The weed causes significant damage from several reasons: it sprouts together with the maize plantlets, it has a long vegetation period, and it is tall (Berca, 2004).

Thistle is, at the same time, toxic for both domestic and wild animals. Ingesting an amount of seeds equal to 30% of the animal body's weight will result in its death (Parson, 1973).

Xanhium strumarium L. is a dicotyledonate, annual, summer weed. Its stem is straight, rigid, coarse, frequently ramified, and it forms a bush 20 to 150 cm tall. The leaves are large, broad, triangular, and covered in short, rigid hairs. It has small, green, unisexuate flowers grouped separately at the end of each branch and of the main stem. The fruits, 10 to 15 mm long, with shorter or longer thorns, contain each two seeds. Seeds keep their germinating ability for 6 to 7 years (Weaver & Lechowicz, 1983; Ciocârlan et al., 2004).

Xanhium strumarium L. is widely spread in the world, and it can be met mainly in temperate areas. It is a serious problem mainly in Australia, America, Europe, India, and South Africa. The first description made in Europe says it is original from California. It seems that the most abundant sub-species of the ear mouse in North America came from Central America (Love & Dansereau, 1959).

Mouse ear is met on numerous soil types and in a wide variety of habitats. It is frequent in tillage crops, along the roads, along the railroads, along the rivers, etc. It hates shadow, but it tolerates flooding in all its development stages (Barkley, 1983).

MATERIALS AND METHODS

Research was carried out during two years, 2005 and 2006, at the Didactic Station of the Agricultural and Veterinary University of the Banat in Timişoara, on a cambic chernozem. We aimed at identifying the most efficient post-emergent herbicides in the control of the species *Xanhium strumarium* L. in grain maize crops.

The trials were monofactorial, and set after the randomised block method, with four repetitions. The experimental variants were as follows:

V_1 – not treated (Control)

V_2 – Basis 75 DF (rimsulfuron 50% + tifensulfuron-methyil 25%) – 0.2 kg/ha.

V_3 – Buctril Universal (bromoxinil 280 g/l + acid 2,4 D 280 g/l) – 0.8-1l/ha.

V_4 – Callisto (mesotrine 480 g/l) – 0.2-0.35 l/ha.

V_5 – Cambio (bentazon 320 g/l + dicamba 90 g/l) 2-2.5 l/ha.

V_6 – Maister (foramsulfuron 30% + iodosulfuron 1% + Safner 30%) – 1.50-1.75 g/ha.

V_7 – Peak 75 WG (prosulfuron 75%) 20-40 g/ha.

V_8 – Premiant (acid 2,4 D 300 g/l., + dicamba 100 g/l) – 1l/ha.

Taking into account the fact that maize is very sensitive to weeding right after sprouting and in order to point out the performances of each post-emergent herbicide tested in the control of the species *Xanhium strumarium* L., in all the variants but the control one, we applied the pre-emergent herbicide Furore 900 EC (dimethenamide 900 g/l) at a rate of 1.5 l/ha; this product controls annual monocotyledonate weeds and some annual dicotyledonate weeds, but not the species under study.

The maize hybrid we cultivated was Florencia (Pioneer 3573), a semi-late hybrid of the FAO 450-550 group.

The initial state of weeding was determined through the quantitative-numerical method in the control variant. Fifteen days after applying the post-emergent herbicides we measured, through the same method, their effect on weeds, and particularly on the species *Xanhium strumarium* L. We also made repeated observations on the phyto-toxic effects on maize plants.

Finally, we assessed results in each experimental plot yield, and we later processed them through the variance analysis method.

RESULTS AND DISCUSSIONS

In the conditions of modern agriculture, integrated weed control studies should be based on a complex programme of herbicide use combined, at the same time, with preventive and agrotechnical methods specific to each crop, depending on the type of weed infestation. The goal of integrating different methods is to control weeds reasonably, without any secondary negative aspects.

In the climate and soil conditions specific to the Didactic Station of the Agricultural and Veterinary University of the Banat in Timişoara, we recorded initially in the maize crop, a number of 31.40 plants per m^2 of *Xanhium strumarium* L., in 2005, and a number of 36.20 plants per m^2 in 2006, which indicates a strong weeding of the maize crop by this species. Taking into account that most pre-emergent herbicides do not control mouse year, it is necessary to apply during vegetation some post-emergent herbicides.

Among the herbicides we tested in the first year, the most efficient control of the species *Xanhium strumarium* L. was ensured by Cambio – 2.5 l/ha (96.80%), Maister – 175 g/ha (93.70%), and Premiant – 1 l/ha (91.30%). Unsatisfactory results were recorded on plots treated with Peak 75 WG – 40 g/ha (64.30%) and Callisto – 0.35 l/ha (62.10%). (Table 1)

Table 1

Experimental results concerning the control of the species *Xanhium strumarium* L. in 2005

Variant	Rate	Weed control (%)	Weed control (EWRS scale)	Controlled weeds (per m^2)	Significance of the difference
V_1 – Untreated (Control)	-	0.0	9	Ct	-
V_2 –Basis 75 DF	0.2 kg/ha	86.7	5	27.23	xxx
V_3 – Buctril Universal	1 l/ha	68.5	7	21.51	xxx
V_4 – Callisto	0.35 l/ha	62.1	7	19.50	xxx
V_5 – Cambio	2.5 l/ha	96.8	3	30.40	xxx
V_6 – Maister	1.75 g/ha	93.7	4	29.43	xxx
V_7 – Peak 75 WG	40 g/ha	64.3	7	20.19	xxx
V_8 – Premiant	1l/ha	91.3	4	28.67	xxx

$DL_{5\%}$ = 1.98 weeds/m^2
$DL_{1\%}$= 2.69 weeds/m^2
$DL_{0.1\%}$ = 3.63 weeds/m^2

In 2006, experimental results concerning the control of the species under study point out the performances of the herbicides Cambio – 2.5 l/ha and Premiant – 1 l/ha, with a control percentage of 95.20% and 94.30%, respectively. Satisfactory results were also recorded in the variants treated with Basis 75 D – 0.20 kg/ha or Maister 175 g/ha, i.e. 89.70% and 86.70% respectively. The other three products controlled mouse ear in lower percentages, i.e. between 61.00% and 57.10% respectively. (Table 2)

None of the herbicides applied during vegetation produced visible phyto-toxicity symptoms in maize plants: we can therefore consider them as very selective for the cultivated maize cultivar, Florencia.

Grain maize yields, in general, correlated positively with the results of the post-emergent herbicides in the control of the species *Xanhium strumarium* L. but they were

strongly influenced by climate conditions during the two experimental years. Thus, the year 2005 was less favourable to maize crops, the maximum yield in the variant treated with Cambio – 2.5 l/ha was 61.47 q/ha. A good yield of 59.25 q/ha was also in the variant treated with Premiant – 1 l/ha; the average of the field was 47.45 q/ha, while the plots treated with the herbicides Peak 75 WG – 40 g/ha, Callisto 0.35 l/ha, or the untreated variant (the control) yielded below the value of 47.45 q/ha. (Table 3)

Table 2

Experimental results concerning the control of the species *Xanhium strumarium* L. in 2006

Variant	Rate	Weed control (%)	Weed control (EWRS scale)	Controlled weeds (per m^2)	Significance of the difference
V_1 – Untreated (Control)	-	0.0	9	Ct	-
V_2 –Basis 75 DF	0.2 kg/ha	89.7	5	32.48	xxx
V_3 – Buctril Universal	1 l/ha	61.0	7	22.09	xxx
V_4 – Callisto	0.35 l/ha	57.1	7	20.67	xxx
V_5 – Cambio	2.5 l/ha	95.2	3	34.47	xxx
V_6 – Maister	1.75 g/ha	86.7	5	31.30	xxx
V_7 – Peak 75 WG	40 g/ha	60.5	7	21.91	xxx
V_8 – Premiant	1l/ha	94.3	4	34.14	xxx

$DL_{5\%}$ = 2.62 weeds/m^2
$DL_{1\%}$= 3.57 weeds/m^2
$DL_{0.1\%}$ = 4.82 weeds/m^2

Table 3

Experimental results concerning the impact of applying herbicides on grain maize crops in 2005

Variant	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of the difference
V_5 – Cambio 2.5 l/ha	61.47	129.55	+ 14.02	xxx
V_8 – Premiant 1 l/ha	59.25	124.87	+ 11.80	xxx
V_6 – Maister 175 g/ha	56.90	119.92	+ 9.45	xxx
V_2 – Basis 75 DF 0.2 kg/ha	53.58	112.92	+ 6.13	xxx
V_3 – Buctril Universal 1 l/ha	51.63	108.81	+ 4.18	xx
Medium	47.45	100.00	Ct	-
V_7 – Peak 75 WG 40 g/ha	44.70	96.32	- 2.75	0
V_4 – Callisto 0.35 l/ha	43.31	91.28	- 4.14	00
V_1 – Untreated	8.75	18.44	- 38.70	000

$DL_{5\%}$ = 2.65 q/ha
$DL_{1\%}$= 3.60 q/ha
$DL_{0.1\%}$ = 4.86 q/ha

The year 2006 had better condition for the maize crop to develop, so that the general level of the crops was higher, with an average of 55.78 q/ha. The highest yields, over 70.00 q/ha, ensured by the herbicide Premiant – 1 l/ha and Cambio – 2.5 l/ha respectively, were higher compared to the precedent year. Three of the tested herbicides (Bucril Universal – 1 l/ha, Callisto – 0.35 l/ha, and Peak 75 WG – 40 g/ha) resulted in lower yields compared to the field average. (Table 4)

Table 4

Experimental results concerning the impact of applying herbicides on grain maize crops in 2006

Variant	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of the difference
V_8 – Premiant 1 l/ha	74.30	133.21	+ 18.52	xxx
V_5 – Cambio 2.5 l/ha	72.45	129.89	+ 16.67	xxx
V_2 – Basis 75 DF 0.2 kg/ha	69.19	124.04	+ 13.41	xxx
V_6 – Maister 175 g/ha	63.75	114.29	+ 7.97	xxx
Medium	55.78	100.00	Ct	-
V_3 – Buctril Universal 1 l/ha	52.21	93.60	- 3.57	0
V_4 – Callisto 0.35 l/ha	51.54	92.40	- 4.24	00
V_7 – Peak 75 WG 40 g/ha	49.16	88.14	- 6.62	000
V_1 – Untreated	13.60	24.39	- 42.18	000

$DL_{5\%}$ = 3.02 q/ha
$DL_{1\%}$= 4.11 q/ha
$DL_{0.1\%}$ = 5.54 q/ha

CONCLUSIONS AND RECOMMENDATIONS

1. *Xanhium strumarium* L. is tall and has a long vegetation period and, because it shoots at the same time as maize, it is a particularly damaging weed for this crop.
2. Weeding by this species of the experimental field was very strong, i.e. 31.40 plants per m^2 in 2005 and 36.20 plants per m^2 in 2006.
3. The most efficient herbicides in the control of the species *Xanhium strumarium* L. in maize were Cambio – 2.5 l/ha (96.80% in 2005 and 95.20% in 2006) and Premiant – 1 l/ha (91.30% in 2005 and 94.30% in 2006).
4. As a result of applying the seven herbicides post-emergently there were no visible symptoms of phyto-toxicity in maize, these herbicides proving to be very selective for the maize hybrid we cultivated, Florencia.
5. Grain maize yields from the experimental plots generally correlated positively with the performances of the tested herbicides in the control of the species *Xanhium strumarium* L.
6. The year 2006 had more favourable climate conditions for the maize compared to the precedent year, which also led to higher average yields in this year (55.78 q/ha) compared to the year 2005 (47.45 q/ha).
7. In order to control efficiently and sustainably “problem-weeds” it is necessary to develop and implement a programme for the integrated control which, besides the use of herbicides (the use of herbicides associated to broaden the control spectrum, the rotation of herbicides on the same plot, etc.) also include agro-technical methods (particularly crop rotation and systems of soil work) as well as measures for the prevention of weeding.

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