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RESEARCH REGARDING THE EFFECT OF APPLYING HERBICIDES TO COMBAT WEEDS IN QUICKLY-POTATO CULTURES

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Abstract

The infields from our country have a very high degree of becoming full of weeds because its composition, the ratio of participation of various species and the degree of infestation vary and modify according to the region, vegetable crop rotation, applied combat measures and technology. The research was conducted in the vegetable region of Lunguletu, Dambovita county, with quickly-potato, 'Impala' variety, applying the herbicides Sencor 70 WG 1 kg/ha and Titus 25 DF 50g/ha, applied pre-emergent, post-emergent and combined, according to the action manner of the products, in order to establish the effectiveness of weed combat and level of damages caused by weeds. It was noticed that the best results were obtained by applying both herbicides, the degree of weed combat being 91%, compared to applying only one product, where the combat degree was 57% for Sencor 70 WG and 78 % for Titus 25 DF. The tubercle production was influenced by the degree of weed combat, the highest production being obtained for the variant that recorded the highest degree of combat, meaning the variant with both products applied.

Key words*: potato, herbicides, production.*

INTRODUCTION

Potato represents the second species within human diet after the basic cereals, because it is a complex aliment, substantial, rich in vitamins and minerals. Obtaining large potato productions involves practicing the specific culture technology, in compliance with all technological phases. Among these, a special role is played by combating weeds, which can cause serious damages by competing with the culture plants for water, air, light and nutrients. Weeds have a high reproduction capacity; their seeds have a wide lifespan and the capacity to germinate gradually for a long time, thus being able to compromise the culture when controlling them may result difficult.
In case of potatoes, after the plants have sprung up and covered the soil and the effects of herbicides applied pre-emergently, late weeds appear, which influence less the production but hinders the mechanical harvesting, increases the percentage of mechanical damaging of the tubercles and of losses, reduces the productivity of the harvesting machines (Berindei, M. 1985; Frâncu, Georgeta, 1995; 1996; 1998,; 1999). Weeds can represent bridges for the diseases and pests to be transmitted from one year to the next or from one culture to another oen, because many species of weeds represent hosts for different pests (Frâncu, Georgeta 1996 b; Ianosi, S. şi Boţoman, Gh. 2004).
The most dangerous weed, which can cause serious problems for combating, reproduce very fast, invade the potato culture and threaten the production, are called "*problem weeds*". The majority of these are perennial species that reproduce both by seeds and by vegetative reproduction, whose number and diversity across large areas increased with the unilateral use of herbicides that these species are resistant to (Berindei, M. 1985; Frâncu, Georgeta, 1987; Ianosi, S. 2002).

MATERIALS AND METHODS

The experiment was organized in Lungulețu, Dâmbovița County. The quickly-potato culture was realized on an non-evolved alluvial soil, with loamy-sandy texture, the thickness of

horizon A of 21 cm, content in humus of 1.24% (weakly ensured), content in clay of 1,02%, mobile phosphor of 21.4 mg/100 g soil, mobile potassium of 60 mg/100 g soil and pH value of 6.2.

The biological material was represented by the IMPALA soil, with a vegetation period of 80-90 days, resistant to nematodes (Ro_{1-4}) and a medium content of starch of 14 %. For weed combat, two herbicides were used: Titus 25 DF and Sencor 70 WG, applied separately and combined, according to the experimental scheme:

V1 = control 1 not worked and without herbicides.

V2 = control 2 worked both mechanically and manually and without herbicides.

V3 = SENCOR 70 WG-1,0 kg/ha applied (pre-emergent).

V4 = SENCOR 70 WG-1,0 kg/ha (pre-emergent)+TITUS 25 DF- 50 g/ha applied (post-emergent).

V5 = TITUS 25DF- 50 g/ha applied (post-emergent).

Planting density was 57.000 nests/ha (70 x 25 cm), and the density after springing up was 51.000 nests/ha. There was an agricultural basis of: N150, P150, K150 kg/ha ensured by applying 1000 kg of the chemical fertilizer Complex 15:15:15 when preparing the soil. The pre-emergent culture was autumn cabbage.

Working method, observations and measurements

a. *Mapping weeds*

The measurement of weeds was made by using a metric frame, recording the number of weeds per square meter. The result from the control 1 (V1) represents the first level of infestation, while the results from the variants V3-V5 represent the combat effects of the used herbicides.

In order to evaluate the degree of weed infestation and effectiveness of control methods, the following evaluation methods were used:

- covering degree *(G. a. %) = (no. of weeds per variant / no. of weeds for control 1) x 100.*
- combat degree *(G. c. %) = 100 - G. a.*
- participation degree (*G. p. %*) *= (no. of weeds per species / total no. of weeds per variant) x 100.*

b. *Production analysis*

At the final harvest (20 June) the total production, the consumption fraction (tubercles over 30 mm diameter) and the under STAS fraction (tubercles under 30 mm diameter) were measured.

The estimation of damages produced to the culture by weeds was made based on the mathematical relations used in plant protection, proposed by Rotaru, V; Mihăiță, A; Alexandri, Al. (1999), by using the following formulae:

$P = (1 - q_0 / q_1) \times 100$ where:

P = damage (%),

q_0 = average production for the variant with weeds (t/ha),

q_1 = average production for the variant without weeds – control 2 (t/ha)

RESULTS AND DISCUSSIONS

a. *Number of weeds measured for the control 1 – not worked and without herbicides*

The number of per species and per group (plants/m^2), as well as the participation ratio (%) to the infestation degree for the control 1 variant is different depending on the weed species. Among annual weeds, the largest numbers of plants for one species were recorded for bristle grass (*Setaria glauca*) 31 plants/m^2, for amaranth (*Amaranthus retroflexus*) 12 plants/m^2; for orache (*Chenopodium album*) 11 plants/m^2 (Table 1). Among the perennial dicotyledonous species, the following numbers were recorded: 6 plants/m^2 for pelamid (*Cirsium arvense*); 5 plants/m^2 for bindweed (*Convolvulus arvensis*); 5 plants/m^2 for sow thistle (*Sonchus arvensis*); for the perennial monocotyledonous the largest number was recorded for cane (*Sorghum halepense*) 4 plants/m^2.

Among the species with large number of plants, the bristle grass (*Setaria glauca*) participates to the infestation degree by an average of 34 % the amaranth (*Amaranthus retroflexus*) by 13 %, the orache(*Chenopodium album*) by 12 %, the pelamid (*Cirsium arvense*) by 8 % and the bindweed (*Convolvulus arvensis*) by 5%.

b. *Number of weeds per species for the variants with herbicides*

The herbicides used (V3-V5) totally combated (table 2) the annual monocotyledonous weeds. The perennial monocotyledonous weeds,

represented by cane (*Sorghum halepense*) were combated for the variant with SENCOR 70WG 1 kg/ha applied pre-emergently and TITUS 25DF 50 g/ha applied post-emergently (V4), but remained partially combated for the variants with only one herbicide SENCOR 70WG 1 kg/ha applied pre-emergently (V3) and TITUS 25DF 50 g/ha post-emergently (V5). Regarding the combating of dicotyledonous weeds, it could be observed that, except for the V3 were weeds were not combated, for the majority of variants the results were good. The major problem is represented by *Convolvulus arvensis* (bindweed) that was not combated in any of the variants. However, it could be observed that for the variant V4 the rest of the weeds were successfully combated by applying herbicides both pre-emergence and post-emergence.

Table 1. Number of weeds measured for the control 1 – not worked and without herbicides

Group of plants/species	Nr./m^2	G. p. %
Annual monocotyledonous		
Setaria glauca	31	34
Total annual monocotyledonous	*31*	*34*
Perennial monocotyledonous		
Sorghum halepense	4	4
Total perennial monocotyledonous	*4*	*4*
Total monocotyledonous	*35*	*38*
Annual dicotyledonous		
Amaranthus retroflexus	12	13
Brassica rapa	7	8
Chenopodium album	11	12
Galinsoga parviflora	7	8
Polygonum persicaria	3	3
Total annual dicotyledonous	*40,0*	*44*
Perennial dicotyledonous		
Cirsium arvense	6	8
Convolvulus arvensis	5	5
Sonchus arvensis	5	5
Total perennial dicotyledonous	*16*	*18*
Total dicotyledonous	*56*	*62*
TOTAL weeds (nr./m^2)	91	100

For V3, the pre-emergent application of SENCOR 70WG led to the combat of annual monocotyledonous weeds (*Setaria glauca*) and of several annual dicotyledonous weeds. The perennial dicotyledonous weeds were not combated. As a result of applying this herbicide, the covering degree was 43% and the combat degree was 57%.

For V4, the combination between the two herbicides, SENCOR 70WG and TITUS 25DF, ensured a culture with very few weeds, resulting a covering degree of 9% and a combat degree of 91%.

For V5, the variant only with post-emergence TITUS 25DF, the results were good, the herbicide having proper effects both on monocotyledonous and dicotyledonous weeds. For this variant, with 20 plants/m^2 not combated, the covering degree was 22% and the combat degree was 78%.

Table 2. Number of weeds per species for the variants with herbicides

Group of plants/species	V1 Mt.1	V 3	V 4	V 5
Annual monocotyledonous				
Setaria glauca	31	0	0	0
Total annual monocotyledonous	*31*	*0*	*0*	*0*
Perennial monocotyledonous				
Sorghum halepense	4	3	0	2
Total perennial monocotyledonous	*4*	*3*	*0*	*2*
Total monocotyledonous	*35*	*3*	*0*	*2*
Annual dicotyledonous				
Amaranthus retroflexus	12	10	3	1
Brassica rapa	7	0	0	2
Chenopodium album	11	8	0	2
Galinsoga parviflora	7	0	0	0
Hibiscus trionum	-	-	-	-
Polygonium persicaria	3	2	0	0
Sonchus oleraceus	-	-	-	-
Total annual dicotyledonous	*40*	*20*	*3*	*5*
Perennial dicotyledonous				
Cirsium arvense	6	6	0	2
Convolvulus arvensis	5	5	5	5
Sonchus arvensis	5	5	0	2
Total perennial dicotyledonous	*16*	*16*	*5*	*9*
Total dicotyledonous	*56*	*36*	*8*	*18*
TOTAL weeds	91	39	8	20
covering degree *G.a. %)*	100	43	9	22
combat degree (*G.c. (%)*	*0*	*57*	*91*	*78*

The economic analysis of the efficiency of weed combat in quickly-potato culture was performed according to the obtained

productions and their value for the studied variants. These results are presented in figure 1, where it can be noted that for the control variant 2 (V2-worked manually and mechanically), which recorded the highest cost (500 lei/ha), the combat degree was rather high (91 %).

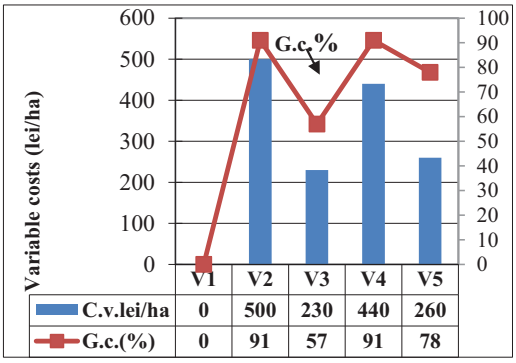

Figure 1. Treatment cost and combat degrees per variant

The variant with pre-emergence herbicide recorded the lowest costs, meaning V3 only with SENCOR 70Wg 1 kg/ha applied, the cost level was 230 lei/ha and the combat degree was 57 %. For V4, where both herbicides were applied, SENCOR 70WG - 1 kg/ha and TITUS 25DF – 50g/ha, the cost was 440 lei/ha, but with a combat degree of 91 %. For the variant only with TITUS 25DF -50 g/ha applied (V5), the cost was 260 lei/ha for a combat degree of 78%. The total tubercle production, per consumption fraction and under STAS fraction (fig. 2) and the percentage allocation (table 3) was influenced by the application of herbicides.

Table 3. Percentage allocation of the production of tubercles for consumption and under STAS from the total production

Variant	% of production	
	consumption	under STAS
V1 (control 1 not worked)	89.8	10.2
V2 (control 2 worked)	95.0	5.0
V3 (Sencor 70WG)	91.8	8.2
V4 (Sencor 70WG+Titus 25DF)	92.5	7.5
V5 (Titus 25DF)	91.4	8.6
Average	92.1	7.9

Regarding the total production, it was noted that for the variant where pre-emergent SENCOR was used, the obtained production was of 28.2 t/ha, while for the variant where post-emergent TITUS 25DF was used the production obtained was 30.3 t/ha. For the V4 variant, where two herbicides were applied, the production was 36 t/ha. The additional post-emergent herbicide with TITUS 25DF influenced the total tubercle production due to the wider span of weeds combated by that particular herbicide.

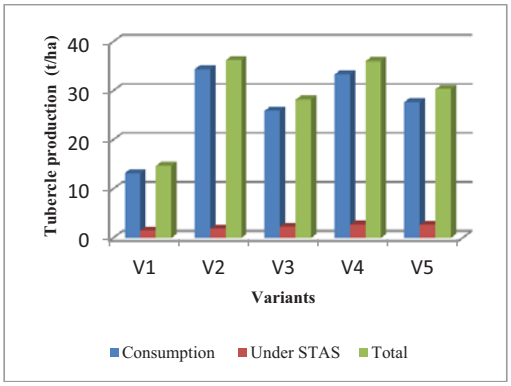

Figure 2. Tubercle production, total and per fractions (t/ha)

The production of tubercle for consumption was only of 13.2 t/ha for the control variant 1 (V1), while for the control variant 2 (V2) the production was of 34.4 t/ha; 21.2 t/ha larger due to combating the weeds and soil loosening. As in the case of total production, the production of tubercles for consumption for the control variant 1 (13.2 t/ha) was lower than for the other variants, while the production for the control variant 2 (34.4 t/ha) was higher than for the variants with herbicides, except for the one with both herbicides - SENCOR 70WG and TITUS 25DF (V4).

For the variant with SENCOR 70WG, the production of tubercles for consumption was of 25.9 t/ha, for the variant with TITUS 25DF the production was of 27.7 t/ha, and for the variant with both of them (V4) the production was of 33.3 t/ha.

The production of tubercles under STAS (with diameter under 30 mm) generally represent 10-15 % from the total tubercle production; in this case it represents 7.8 %.

The damages caused by weeds to the total tubercle production (table 4) are serious for the variants without combat measures, 59 % for

V1, compared to 0,5 % for the combined application of the herbicides Sencor and Titus and 0 % for soil maintenance.

Table 4. Damage caused by weeds to total production and to the production for consumption

Variant	Total production		Production for consumption	
	Prod. t/ha	Damage %	Prod. t/ha	Damage %
V1 (control 1 not worked)	14.7	59	13.2	61
V2 (control 2 worked)	36.2	0	34.4	0
V3 (Sencor 70WG 1 kg/ha)	28.2	22	25.9	25
V4 (Sencor + Titus)	36.0	0,5	33.3	3
V5 (Titus 25DF 50g/ha)	30.3	16	27.7	19
Average per variant	29.08	24.3	26.9	27.0

CONCLUSIONS

The highest level of weeds was produces by the annual dicotyledonous and monocotyledonous species (80 %), which must be taken into consideration when choosing herbicides, because these species can be combated relatively easy and cheaper by applying herbicides pre-emergently

The analysis of weed combat effectiveness, for the herbicides applied pre-emergently to the quickly-potato from Lunguleţu, showed that for the variant with pre-emergent application of the herbicide SENCOR 70WG the combat degree was 57 %, for the variant with post-emergent application of TITUS 25DF the degree was 78 %, and for the double herbicide variant, with pre-emergent SENCOR and post-emergent TITUS, the combat degree was 91%

The economic study related to costs and combat degree conducted on the variants showed that for the control 2 (V2 worked), for which he highest cost of 500 lei/ha was recorded, the combat degree was 91 %. The variant with only pre-emergent herbicide recorded the lowest cost, thus for SENCOR 70WG a cost of 230 lei/ha and combat degree of 57 %, while for the variant with only post-emergent the cost was 260 lei/ha and the combat degree of 78%. The pre-emergent application of SENCOR 70WG and post-emergent application of TITUS 25DF, led to a cost of 440 lei/ha and a combat degree of 91%, the same result as for variant 2.

Among the weed combat variants for the quickly-potato cultivated in Lunguleţu, the lowest productions were obtained from control 1, while the highest were obtained from the control 2 and the variants with herbicides. The productions obtained from variant 2 or the variant with both herbicides were significantly higher than the other variants with herbicides applied. The degree of weed infestation strongly influenced the level of tubercle production.

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