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IMPACT OF WEED CONTROL ON POTATO INFESTATION AND YIELDING

Krystyna Zarzecka[1], Feliks Ceglarek[1], Barbara Gasiorowska[1], Agata Gruzewska[2]

[1]*Department of Plant Cultivation*
[2]*Department of Agricultural Biometrics*
Podlasie University, Siedlce, Poland

ABSTRACT

The 1991-1993 research aimed at defining the applicability of mechanical treatment and some herbicides for potato weed control. Mechanical treatment, 3-time hilling plus harrowing, combined with herbicides, Bladex 50 WP 2 kg·ha^{-1} applied till emergence and post-emergence Nabu 20 EC at 2 l·ha^{-1}, showed most effective, causing a four-time reduction in weed infestation (weed dry matter) and increasing tuber yield by 47%, as compared with the control exposed to mechanical treatment, only.

Key words: potato, weed control, weeds, tuber yield

INTRODUCTION

Mechanical weed control, most frequent on potato plantations, does not completely control weeds competing with the crop [2,11,15,19]. In the years of high rainfall as well as in the highly weed-infested fields, such treatments often stimulate weed seed germination [3,7]. Chemical control with one active substance only does not always bring desired weed control; sometimes chemical control leads to species compensation [1,2,8]; thus a necessity to develop different methods of weed control with herbicide mixtures or to apply them at different dates [2,13,18]. The present research aimed at defining the impact of mechanical treatment combined with herbicide application on the number, dry matter weight and species composition of weeds and the yielding of two cultivars of table potato.

MATERIALS AND METHODS

The 1991-1993 experiment was conducted in the experimental field of the Zawady Agricultural Experiment Station of the Podlasie University on IV b class soil of pH 5.1-6.3 and average contents of available phosphorus and potassium and a low content of magnesium.

The experiment was set in a randomised sub-block design in three replications and included, as follows:

Factor I - Weed control methods (Table 1),
Factor II - Potato cultivars – 'Atol' and 'Fala,
'Atol'– mid-late, table potato cultivar, leaf-and-stem plant habit, high plants, quite high yield, a 14.1% starch content, light yellow flesh, tastes good, full consumption value till the end of the storage period. 'Fala' – mid-late table potato cultivar, stem habit, medium-height plants, a 15.8% starch content, white flesh, tastes from quite good to good, full consumption value till the end of the storage period.

Table 1. Potato weed control methods employed

Objects	Weed control treatment	
	Prior to emergence	Following emergence
1. Mechanical weed control	3-time hilling combined with harrowing (every 6-7 days)	2-time hilling (every 6-7 days)
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	3-time hilling combined with harrowing (every 6-7 days), and immediately prior to emergence, spraying with the Bladex 50 WP preparation	-
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	3-time hilling combined with harrowing (every 6-7 days), and immediately prior to emergence, spraying with the mixture of Bladex 50 WP + Dual 960 EC	-
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}	3-time hilling combined with harrowing (every 6-7 days), and immediately prior to emergence, spraying with the Bladex 50 WP preparation	Spraying with the Nabu 20 EC preparation at the potato plant height of 10-15 cm

Having harvested cereals, the forecrop, post-harvest cultivating practices were applied. Manure at 25 t·ha^{-1} was introduced with autumn ploughing, while mineral fertilisers were applied at 90 kg N, 90 kg P_2O_5 and 120 kg K_2O per ha. Phosphorus and potassium fertilisers were fed with in autumn, and nitrogen fertilisers in spring. Potatoes were planted in the third decade of April at the furrow spacing of 62.5 cm and a 40-cm distance in furrow.

Plot area for planting amounted to 18.75 sq. m and 15 sq. m for harvest. Throughout the vegetation period, every 6-7 day potato plant damage, inflicted by herbicides, was being evaluated, starting from the day the first symptoms appeared. A 9-degree EWRC scale was applied (1- no damage, 9 – complete plant damage). Weed infestation was determined with the square frame and gravimetric method before potato plant closing-up and prior to tuber harvest defining the number of weeds, species composition and weed dry matter weight. Immediately before the harvest, tubers of 10 potato plants of each plot were dug out and they were grouped into the fractions of under 30 mm, 30-40 mm, 40-50 mm, 50-60 mm and over 60 mm in diameter. Then their weight share in the total yield weight was determined as well as a mean weight of 1 tuber and the number of tubers under potato plant. The tubers more than 40 mm in diameter, compliant with the 75/R - 74450 Polish Standard, were classified as table potatoes. The harvest took place in September. The results obtained were analysed statistically and the significance of the differences obtained was verified with the Tukey test.

The weather conditions throughout the 3-year research varied. 1991 was chilly and semi-dry; all the vegetation period months, except for September, remained dry and semi-dry. 1992 and 1993 were humid (the Sielianinov hydrothermic coefficient for the vegetation period amounted to 1.4 and 1.1, respectively), while in 1992 the rainfall distribution was uneven. The weather conditions most favourable for plant development and yielding were observed in 1993; the hydrothermic coefficient calculated for the summer months (June - August) critical for tuber accumulation, ranged from 0.9 to 1.1.

RESULTS

1. Reaction of potato plants to herbicides

Bladex 50 WP applied at 2 kg·ha^{-1} in both cultivars caused plant damage in the form of distortion and leaf-blade joint (Table 2). Similarly the mixture of Bladex 50 WP + Dual 960 EC distorted leaf blades as well as caused a yellowing and leaf-edge withering. After spraying with the Bladex 50 WP followed by Nabu 20 EC, joints and leaf-blade distortion were most numerous and 7 days after spraying scored 4.2, according to the 9-degree scale being applied, yet after 21 days the value dropped to 2.7. With the vegetation period coming to an end, the damage symptoms observed for all the variants of chemical weed control were getting less and less visible.

Table 2. Phytotoxic effect of herbicides on the over-the-ground potato parts defined with the EWRC evaluation method (mean for 1991-1993)

Weed control method	7 days after spraying		14 days after spraying		21 days after spraying		Mean		
	Atol	Fala	Atol	Fala	Atol	Fala	Atol	Fala	Mean
1. Mechanical weed control	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	3.5	4.0	3.0	3.0	2.0	2.0	2.8	3.0	2.9
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	3.5	4.0	3.0	3.5	2.5	2.5	3.0	3.3	3.2
4. Mechanical Weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}	4.0	4.3	3.5	3.8	2.5	2.9	3.3	3.7	3.5
Mean	3.0	3.3	2.6	2.8	2.0	2.1	2.5	2.8	-

1 – no damage, 9 – complete damage

Out of the cultivars researched, a stronger negative reaction to herbicides was noted for ‘Fala’ (by an average of 2.8 points) than for ‘Atol’ (by an average of 2.5 points according to the 1-9 scale).

2. Weed infestation

Weed infestation determined prior to potato plant row closing-up showed a total of 19 species, including 17 dicotyledonous (Table 3). The monocotyledonous weeds were represented by 2 species only, yet they were observed only in big numbers in the objects sprayed with Bladex 50 WP (13.2 items/sq. m amounting for 80.0%) and with the mixture of Bladex 50 WP + Dual 960 EC (9.9 items/sq. m accounting for 66%). The species most represented were *Chenopodium album, Elymus repens, Echinochloa crus-galli, Raphanus raphanistrum* and *Polygonum convolvulus* which amounted to, on average, 81.6% of the total weed number per 1 sq. m.

Analysing the impact of weed control methods on the number of weeds, it was noted that the highest percentage of plant damage (63.8%, as compared with the control) was obtained for the object exposed to mechanical and chemical control with the Bladex 50 WP and Nabu 20 EC herbicides - object 4. There were also observed significant differences in weed infestation of the cultivars researched (Table 4). A considerably fewer dicotyledonous species were found in the fields with ‘Atol’ than with ‘Fala’.

Table 3. Impact of potato weed control methods on the number and species composition of weeds per sq.m before potato row closing-up (mean for cultivars and the years 1991-1993)

Weed species	Mechanical weed control	Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	Mechanical weed control + Bladex 50WP 2 kg·ha^{-1}+ Dual 960 EC 1.5 l·ha^{-1}	Mechanical weed control + Bladex 50WP 2 kg·ha^{-1}+ Nabu 20EC 2 l·ha^{-1}	Mean	Percentage of species
I. Total of monocotyledonous	1.7	13.2	9.9	1.9	6.7	38.5
1. *Elymus repens*	0.7	6.2	8.5	1.5	4.2	24.1
2. *Echinochloa crus-galli*	1.0	7.0	1.4	0.4	2.5	14.4
II. Total of dicotyledonous	25.9	3.6	5.2	8.1	10.7	61.5
1. *Chenopodium album*	16.5	2.0	2.1	3.0	5.9	33.9
2. *Polygonum convolvulus*	2.0	0.1	0.2	0.7	0.8	4.6
3. *Polygonum nodosum*	1.5	0.1	0.4	0.6	0.7	4.0
4. *Stellaria media*	1.4	0.2	0.3	0.8	0.7	4.0
5. *Raphanus raphanistrum*	1.3	0.5	0.6	1.0	0.8	4.6
6. *Capsella bursa-pastoris*	0.7	-	0.3	0.1	0.3	1.8
7. *Viola arvensis*	0.7	0.2	0.2	0.2	0.3	1.7
8. *Matricaria inodora*	0.4	0.2	0.3	0.6	0.3	1.7
9. *Galeopsis tetrahit*	0.4	0.1	0.6	0.4	0.4	2.3
Other species (12 -19)	1.0	0.2	0.2	0.7	0.5	2.9
Total number of weeds	27.6	16.8	15.1	10.0	17.4	-
$LSD_{0,05}$ for methods of weed control:		for the monocotyledonous 2.1 for the dicotyledonous 3.8				

Table 4. Number and weed species composition per sq. m before potato row closing-up, depending on weed control methods and cultivars (mean for 1991-1993)

Weed control method	Monocotyledonous			Dicotyledonous		
	Atol	Fala	Mean	Atol	Fala	Mean
1. Mechanical weed control	1.4	1.9	1.7	20.6	31.1	25.9
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	12.4	13.9	13.2	2.2	4.9	3.6
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	9.4	10.4	9.9	2.4	8.0	5.2
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}+ Nabu 20 EC 2 l·ha^{-1}	1.8	2.0	1.9	7.0	9.1	8.1
Mean	6.3	7.1	-	8.1	13.3	-
$LSD_{0.05}$ for weed control methods for cultivars			2.1 2.4			3.8 1.8

Prior to the potato tuber harvest, the number of weed species dropped to 17; similarly their number per area unit decreased. The smallest number of monocotyledonous weeds (1.4 items/sq. m) was observed in plots sprayed with Bladex 50 WP and Nabu 20 EC, while the greatest numbers in plots where only Bladex 50 WP (10.4 items/sq. m) was applied (Table 5). However dicotyledonous weeds were controlled most effectively with Bladex 50 WP (object 2) and Bladex 50 WP with Nabu 20 EC (object 4). A total number of mono- and dicotyledonous weeds was lowest in object 4 and, as compared with the mechanical control, decreased 3-fold (Table 6). The results presented in Table 7 show that weeds in the 'Fala' field produced significantly more dry matter than in the 'Atol' field, both at the beginning of the vegetation period and prior to the tuber harvest. The

highest effectiveness in weed control was observed for the treatment applied for object 4, which was prior-to-the-emergence sprayed with Bladex 50 WP, and after potato emergence with Nabu 20 EC. Weed control effectiveness here amounted to, prior to row closing-up, an average of 78.8%, and prior to tuber harvest - 76.5%.

Table 5. Impact of potato weed control methods on the number and species composition of weeds per sq. m before tuber harvest (mean for cultivars and the years 1991-1993)

Weed species	Mechanical weed control	Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	Mechanical weed control + Bladex 50WP 2 kg·ha^{-1} + Nabu 20EC 2 l·ha^{-1}	Mean	Percentage of species
I. Total of mono-cotyledonous	8.2	10.4	4.8	1.4	6.2	43.7
1. *Elymus repens*	1.0	3.2	4.0	1.0	2.3	16.1
2. *Echinochloa crus-galli*	7.2	7.2	0.8	0.2	3.9	27.6
II. Total of dicoty -ledonous	13.9	5.6	6.5	5.9	8.0	56.3
1. *Chenopodium album*	7.7	1.9	2.5	2.2	3.7	26.2
2. *Polygonum convolvulus*	1.1	1.9	1.3	1.0	1.1	7.7
3. *Polygonum nodosum*	0.7	0.5	0.4	0.3	0.5	3.5
4 *Stellaria media*	0.6	0.5	0.7	0.7	0.6	4.2
5. *Raphanus raphanistrum*	0.6	0.2	1.0	1.0	0.7	4.9
6. *Capsella bursa-pastoris*	0.4	-	-	-	0.1	0.7
7. *Viola arvensis*	0.2	0.2	0.1	0.1	0.3	2.1
8. *Matricaria inodora*	1.4	0.3	0.2	0.2	0.5	3.5
9. *Galeopsis tetrahit*	0.6	-	0.1	0.1	0.2	1.4
Other species (12 -19)	0.6	0.1	0.2	0.3	0.3	2.1
Total number of weeds	22.1	16.0	11.3	7.3	14.2	-
$LSD_{0,05}$ for weed control methods for monocotyledonous			1.7			
for dicotyledonous			2.2			

Table 6. Number and species composition of weeds per sq. m before potato harvest, depending on weed control methods and cultivars (mean for 1991-1993)

Weed control method	Monocotyledonous			Dicotyledonous		
	Atol	Fala	Mean	Atol	Fala	Mean
1. Mechanical weed control	6.1	10.2	8.2	12.1	15.6	13.9
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	6.3	14.5	10.4	3.0	8.2	5.6
3. 3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}+ Dual 960 EC 1.5 l·ha^{-1}	4.4	5.1	4.8	5.3	7.6	6.5
4. Mechanical weed control + Bladex 50 WP 2 kg/ha + Nabu 20 EC 2 l·ha^{-1}	1.0	1.7	1.4	5.3	6.5	5.9
Mean	5.5	7.9	-	6.4	9.5	-
$LSD_{0,05}$ for weed control methods			1.7			2.2
for cultivars			1.4			1.5

Table 7. Impact of weed control methods and cultivars on the dry matter of weeds (g) per sq. m (mean for 1991-1993)

Weed control method	Prior to row closing-up				Before tuber harvest			
	Atol	Fala	Mean	Effectiveness (%)	Atol	Fala	Mean	Effectiveness (%)
1. Mechanical weed control	51.6	58.6	55.1	-	233.0	278.2	255.6	-
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	36.2	40.4	38.3	30.5	146.3	203.6	175.0	31.5
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	20.5	24.4	22.5	59.2	96.8	112.7	104.8	59.0
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}	10.0	13.3	11.7	78.8	57.1	63.1	60.1	76.5
Mean	30.7	34.1	-	-	133.3	164.4	-	-
$LSD_{0,05}$ for weed control methods			3.6				7.4	
$LSD_{0,05}$ for cultivars			3.1				6.3	

3. Potato yielding

Weed control methods showed a significant impact on yielding of potato cultivars (Table 8). The plots treated with herbicides gave an increase in tuber yield as compared with the variant exposed to mechanical control by an average ranging from 2.5 to 8.7 t·ha^{-1} (by 13 – 47%). The highest yields were obtained from the object least weed-infested due to chemical treatment applied prior to emergence with Bladex 50 WP and post emergence with Nabu 20 EC (object 4). Mean potato tuber yield increases ranged, depending on the cultivar, from 8.3 to 9.2 t·ha^{-1} (47%).

The herbicide weed-control effectiveness was also well-reflected in the mean weight of 1 tuber as well as the number of tubers per 1 potato plant. The highest mean tuber weight and the greatest number of tubers per one plant were obtained from object 4 with the lowest weed-infestation. The values defined for the cultivars researched differed significantly. 'Atol' produced more robust tubers than 'Fala'; similarly the number of tubers per 1 plant was higher.

Table 8. Impact of weed control methods on yield, mean tuber weight and number of tubers per plant of potato cultivars (mean for 1991-1993)

Weed control method	Cultivar	Yield of tubers		Mean weight of tuber (g)	No of tubers per plant
		t·ha^{-1}	%		
1. Mechanical weed control	Atol	19.5	100	77.1	12.0
	Fala	17.6	100	64.0	10.8
	Mean	18.6	100		
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}	Atol	22.3	114	82.5	12.6
	Fala	19.9	113	71.5	11.1
	Mean	21.1	113		
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}	Atol	25.0	128	90.3	12.7
	Fala	21.5	122	78.3	12.0
	Mean	23.3	125		
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}	Atol	28.7	147	116.1	13.7
	Fala	25.9	147	91.1	11.8
	Mean	27.3	147		
Mean	Atol	23.9		91.5	12.6
	Fala	21.2		76.2	11.4
$LSD_{0,05}$ for weed control methods		1.0		8.1	-
$LSD_{0,05}$ for cultivars		1.1		4.0	1.1
$LSD_{0,05}$ for interaction of weed control methods x cultivars		0.8		14.0	-

The fraction weight results show that reducing potato plantation weed infestation with herbicides increased the table potato tuber weight (fraction over 40 mm in diameter) as compared with the results obtained for the mechanical control (Table 9). The highest mean small tuber fraction (to 30 mm and 30-40 mm in diameter) was noted for the most-highly weed-infested object exposed to a traditional mechanical weed control. Out of all the cultivars investigated, in 'Atol' the share of table potato tubers was significantly higher than in 'Fala' which had a significantly higher share of tubers of 30 mm and 30-40 mm in diameter.

Table 9. Impact of potato weed control methods on the percentage of the weight of fraction tubers in the yield of potato cultivars (mean for 1991-1993)

Weed control method	Cultivar	Tuber fraction in mm					
		to 30	30 - 40	40 – 50	50 – 60	over 60	from 40 to over 60 mm
1. Mechanical weed control	Atol	1.4	21.5	21.9	38.1	17.1	77.1
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}		1.5	18.2	20.6	40.6	19.1	80.3
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}		1.5	14.9	24.1	41.6	17.9	83.6
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}		1.4	12.1	21.0	44.4	21.1	86.5
Mean		1.5	16.6	21.9	41.2	18.8	81.9
1. Mechanical weed control	Fala	11.0	37.0	26.0	22.0	4.0	52.0
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}		10.3	29.2	32.6	21.6	6.3	60.5
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}		9.8	27.9	30.0	25.8	6.5	62.3
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}		5.0	23.8	34.1	30.1	7.0	71.2
Mean		9.0	29.5	30.6	24.9	6.0	61.5
1. Mechanical weed control	Mean	6.2	29.3	24.0	30.1	10.5	64.6
2. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1}		5.9	23.7	26.6	31.1	12.7	70.4
3. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Dual 960 EC 1.5 l·ha^{-1}		5.7	21.4	27.1	33.7	12.2	73.0
4. Mechanical weed control + Bladex 50 WP 2 kg·ha^{-1} + Nabu 20 EC 2 l·ha^{-1}		3.2	18.0	27.6	37.3	14.0	78.9
$LSD_{0.05}$ for weed control methods		0.1	0.3	-	0.2	0.3	0.9
for cultivars		0.4	0.3	0.2	0.3	0.4	1.7

DISCUSSION

Potato in its initial vegetation period is not a highly competitive crop to weeds and requires a continuos weed control [16]. Adamiak et al. [3] observed that if a regular and careful mechanical potato weed control is possible, then the use of herbicides remains unnecessary. However according to Pawinska [14] and Kowanski [10], mechanical control protects the plantation against 'unwanted competitors' at the beginning of the vegetation period only without inhibiting the weed development in the height of summer, which was confirmed by the results obtained on both the number as well as the dry matter weight of weeds. Out of all the weed control methods researched, the mechanical and chemical method, the Bladex 50 WP and Nabu 20 EC, showed most effective. The herbicides caused a 3-fold decrease in the weed number, and an over-4-fold decrease in dry matter

weight, as compared with the effectiveness of mechanical control. Similar results on weed control with herbicides were reported by Kowanski [10], Rymaszewski et al. [18] and Zarzecka [19]. The present results also show significant differences in the weed infestation of the cultivars investigated. Both at the beginning and at the end of the vegetation period, higher infestation was observed in the plots with 'Fala' which has fewer leaves – than 'Atol'. The latter competed more effectively with weeds due to its more abundant over-the-ground mass, observed for all the control methods and also confirmed by other authors [15,19], which shows that rich-in-foliage cultivars inhibit weed development in the field to a greater extent than the stem-habit cultivars. The present research showed a correlation between the weed control methods and the conditions in research years. In the dry year 1991, weed weight was highest and the segetal plant control less effective than in humid periods. The most effective control was observed in humid 1993 with its even rainfall distribution, confirmed by the results reported by Adamiak et al. [3], Kowanski [10], Zarzecka [19], who, due to a water deficit, did not obtain a satisfactory reduction in potato weed infestation with herbicides.

Mechanical and chemical weed control (objects 2-4) reducing weed infestation, affected potato tuber yields considerably. The highest mean tuber yield was obtained from object 4, 3-time hilled combined with harrowing-up till emergence and, immediately prior to emergence, sprayed with Bladex 50 WP, and, after emergence, with the Nabu 20 EC herbicide; the yield was higher than the one obtained for mechanical control by 47%. Similar yield increases for objects treated with herbicides were reported by Kowanski [10,11], Palys [13], Zarzecka [19], while Pawlowski and Pomykalska [15] and Rymaszewski et al. [18] did not obtain a significant yield increase, which they relate to a relatively low weed infestation of the field. In the present research similarly, from least-infected objects the highest number of tubers per plant, mean weight of one tuber as well as the highest number of table potato tubers were obtained, which is confirmed by other authors [13,16,19].

Potato yielding depended also on weather conditions, which was confirmed by the correlation between weed control methods with the conditions in research years. 1993, with its even rainfall and temperature distribution, turned out most favourable for plant growth and yielding, while 1991, with its dry vegetation period, appeared least favourable.

A positive impact of herbicides employed in agriculture can be defined with yield increases [1]. According to Chotkowski and Rembeza [6] as well as Lapinska [12], obtaining higher yields requires higher costs to be borne, yet the extra costs are fully compensated with an increase in produce value. The value of the tuber yield increase obtained in the present research exceeded almost 4-folds the costs of herbicides and prior-to-potato-emergence spraying (objects 2 and 3) and over 7-fold the costs of prior-to-and-post-potato-plant-emergence chemical control (object 4). Similarly the results reported by Chotkowski [5] show that the value of the yield increase was also a few times higher than the costs of herbicides and treatment services. All the above suggests that potato plantation weed control with herbicides is economically justifiable.

CONCLUSIONS

1. Herbicides applied for potato weed control caused a leaf damage which decreased with time and did not bring a decrease in tuber yield.
2. The greatest weed control effectiveness was observed for the mechanical-and-chemical method with the application of Bladex 50 WP and Nabu 20 EC, which reduced the number of weeds, as compared with the number obtained for mechanical control, by about 3-fold and the weed mass by 78.8% at the beginning of the vegetation and by 76.5% prior to tuber harvest.
3. There was observed a significant impact of potato cultivar plant morphological traits on weed infestation. Richer-in-foliage plants of 'Atol' covered the land more and inhibited the development of segetal flora to a greater extent than the plants of 'Fala' with its plant stem-habit.
4. Potato weed control with herbicides gave a higher tuber yield than the yield obtained with the mechanical method by an average of 15-47%, an increase in mean tuber weight as well as the number of tubers per plant and a greater share of table tubers over 40 mm in diameter.
5. There was noted an interaction of the weed control methods and the conditions in research years. The greatest effectiveness in weed control and the highest tuber yield were obtained in humid and warm 1993.
6. The increase in potato tuber yield fully justifies the application of chemical weed control as the value of the increase in yield 4-to-7-fold exceeded the money invested into herbicides and spraying services.

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Submited:

Krystyna Zarzecka[1], Feliks Ceglarek[1], Barbara Gasiorowska[1], Agata Gruzewska[2]
[1]Department of Plant Cultivation
[2]Department of Agricultural Biometrics
Podlasie University
14 Prusa, 08-110 Siedlce, Poland