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VARIETAL SUSCEPTIBILITY OF WINTER FODDER PEAS TO HERBICIDES

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Abstract

Within the period 2005-2008, in the municipality of Radnevo, village of Lyubenova mahala, we made a three-factor field experiment with fodder peas based on the method of fractional plots in four repetitions in order to establish the varietal susceptibility of the crop to the herbicides imazetapir, 2,4D, propizachlor, bentazon and metribuzin. The obtained results regarding the separate indications have been processed as a two-factor complex based on the analysis of variance. It has been proven that the herbicide 2,4-D has a negative effect on the growth and the development of all three types of winter peas.

Key words: *winter fodder peas, herbicides, varietal susceptibility.*

INTRODUCTION

Peas (*Pisum sativum* L.) is one of the oldest and most significant frumentatious-leguminous plants, widely grown around the world at different ecological conditions. Despite its advantages, the average crops of the culture are blow their biological potential and the main reason for this are the weeds. According to the data from some authors, weeds have an adverse effect on the reproductive capability of the spring fodder peas and the decrease in the crop harvest is up to 53% (Mishra, J.S., Bhan, V.M., 1997; Khan, M. H. et al., 2003; Dimitrova, C., 2000). During the first days after its germination the peas develop very slowly and it is easily overgrown by the weeds. The usage of numerous herbicide preparations with multiform chemical ingredients, mechanism and sphere of activity, the changes in weed associations due to different factors, as well as the continuous selection of new varieties, necessitate the constant research on the issue connected with the susceptibility of the varieties to them. The application of suitable herbicides and herbicide mixtures in the fight with the weeds at the peas growing is a prerequisite for optimizing the biological potential of the harvest, which in combination with the proper agricultural machinery can prove to be a highly efficient and environmental activity.

MATERIALS AND METHODS

The field research wad conducted in the village of Lyubenova mahala as two three-factor trials under the method of fractional parcels with 4 repetitions and crop parcel area of 10 m². Factor A includes the peas varieties, factor B – the variants with herbicides and factor C – herbicide doses (Table 1). The variants of the factors tested are applied on one another which provides the opportunity to judge the action both of each separate factor and the interaction between them. The herbicides were dispersed by a dorsal sprayer with tank consumption of the work solution-40 l/dka. The research was done on an area without any weeds in order to avoid their influence.

Table 1. Experimental factors

Factor A *Variety*	Factor B *Herbicide*	Factor C *Doze*
A1: Vesela **A2**: No 11 **A3**: Mir	**B_1**- Pivot 100 SL *(100g/limasetapir*), 80 ml/da, soil treatment **B_2**- Basagran forte (*480 g/lbentazon + lutensol*)leaf of the weed and the culture **B_3**- Zenkor 70 VG - (*700g / kgmetribusin*), 50 g/da, 3 three-leaf of the culture (10-15 cm high) **B_4**- Pivot 100 SL (*100 g/lимаземанир*), 40 ml/da, foliar treatment **B_5**– 2,4D (*600 g/l 2,4 D–amen salt*), 67 ml/da, foliar treatment	**C1** - optimal doze **C2** - double doze

RESULTS AND DISCUSSIONS

Data about the height of the plants measured at the end of the vegetation of the winter peas were handled like two-factor complex under the method of disperse analysis. The three tested varieties are the first factor A, and the second factor B are the herbicides studied.

In Table 2 the average values of the three tested varieties are presented with regard to the height of the plant regardless of the five types of herbicides applied at single treatment doses. Based on all possible differences observed, it becomes clear that Mir variety has the biggest height and is proved to be ($P_{0.1\%}$) higher than the other two varieties. This is variety ability and the variety is suitable for foliage. The shortest plants are those of variety No 11, followed by Vesela variety which is suitable for peas.

With regard to the herbicide influence, regardless the variety studied (Table 3), the highest plants are those treated with herbicide Basagran forte ($в_2$). The differences between $в_2$ and the herbicide influence of $в_1$ (Pivot – 80 ml/da, in the soil), $в_3$ (Zenkor – 50 ml/da) and $в_4$ (Pivot – 40 ml/da, in the leaves) are insignificant. The only statistically significant difference is the extent of influence of the type with 2,4D ($в_5$). It is the same situation further to the other three herbicides.

Table 2. Proved difference between the varieties with regard to the plant height, treated with single dose

Variety	ẋ	Different with		
		a_1	a_3	a_2
a_1	115	-	+++	+++
a_3	89.20		-	+++
a_2	78.13			-

$gDp_{5\%} = 4.41$; $gDp_{1\%} = 5.94$; $gDp_{0.1\%} = 7.87$

Table 3. Proved difference between the herbicides with regard to the plant height, treated with single dose

Herbicides	ẋ	Different with				
		$в_2$	$в_1$	$в_3$	$в_4$	$в_5$
$в_2$	95.889	-	ns	ns	ns	+
$в_1$	95.778		-	ns	ns	+
$в_3$	94.778			-	ns	+
$в_4$	94.000				-	ns
$в_5$	90.111					-

$gDp_{5\%} = 4.41$; $gDp_{1\%} = 5.94$; $gDp_{0.1\%} = 7.87$

Comparative analysis between the combinations of the two factors is presented in Table 4. Following the logic of the two previous tables, the combination of Mir variety treated with Basagran ($a_1в_2$) has the highest average value – 116.33 cm, followed by the same variety treated with Zenkor, Pivot and 2,4D respectively. The values of these variants (combination variety – herbicide) are proved to be higher than the others. However, there is not any significant difference between them, which means that the herbicides do not have a negative influence on the growth of the peas.

In the hierarchical order with regard to the average values, the variants of combinations between Vesela variety treated with the respective herbicides follow in approximately same order. The proven difference is defined at Vesela variety treated with Pivot, Basagran, Zenkor and the herbicide 2,4D respectively. Similar dependency is detected with the other combinations between variety No 11 and the herbicides studied.

The combination between variety No 11 and $в_5$ (herbicides 2,4-D, at dose 67 ml/da) is distinguished by the lowest value of the indication studied.

It was proved that the combination between the three varieties with herbicide $в_5$, i.e. 2,4-D at double dose led to withering of the plants. Therefore, the values are 0.

The average values with regard to the number of the peas on one plant of the three varieties winter peas tested with the five herbicides applied at single treatment dose are presented in the next three tables.

Table 5 shows that there are no proved differences between the varieties tested with regard to the indicator number of peas. The values of this indication are within the limits between the average 12,667 for Mir variety (a_1) and 12,133 for variety No 11 (a_2).

With regard to the herbicide influence, regardless of the variety tested (Table 6), the number of the peas per plant is the biggest for the plants treated with herbicide 2,4D ($в_5$) – 13,222. This indicator is proved to be larger than the number of peas detected after treatment with herbicides Pivot ($в_1$) and Zenkor ($в_3$). On the second place with regard to the number of peas is the variant treated with Pivot ($в_4$) – 13,000. They have proved bigger value

than the variant with B_3 (Zenkor). For it, the number of peas detected was the smallest - 11,333.

Table 4. Proved difference between the varieties with regard to the indicator number of peas per plant, treated with single dose

Variety	ẋ	Different with		
		a_1	a_3	a_2
a_1	12.667	-	ns	ns
a_3	12.200		-	ns
a_2	12.133			-

$gDp_{5\%} = 1.16$; $gDp_{1\%} = 2.64$; $gDp_{0.1\%} = 3.50$

Table 5. Proved difference between the herbicides with regard to the indicator number of peas per plant, treated with single dose

herbicides	ẋ	Different with				
		B_5	B_4	B_2	B_1	B_3
B_5	13.222	-	ns	ns	+	+
B_4	13.000		-	ns	ns	+
B_2	12.111			-	ns	ns
B_1	12.000				-	ns
B_3	11.333					-

$gDp_{5\%} = 1.16$; $gDp_{1\%} = 2.64$; $gDp_{0.1\%} = 3.50$

Table 6. Proved difference between the varieties with regard to the indicator weight of the seeds per plant, treated with single dose

Variety	ẋ	Different with		
		a_1	a_3	a_2
a_1	12.733	-	ns	ns
a_3	12.600		-	ns
a_2	12.267			-

$gDp_{5\%} = 1.03$; $gDp_{1\%} = 1.72$; $gDp_{0.1\%} = 2.61$
$gDp_{5\%} = 1.03$; $gDp_{1\%} = 1.72$; $gDp_{0.1\%} = 2.61$

The competitive analysis between the combinations of the two factors – variety-herbicide is presented in Table 7. The plants of variety No 11, treated with herbicide Pivot (B_4) – 14,330 have the highest average value of this indicator. For the three varieties combined with herbicides B_4 and B_5 the values were close to each other and vary from 14,330 to 13,333 pcs.
Variety No 11, treated with B_4 herbicide (Pivot, veget.) has proved higher value than the other 12 combinations.
The lowest value of the indicator was detected for Vesela variety treated with herbicide Zenkor (B_3) – 11,000, that proved to have the weakest influence as shown in Table 7. For the three varieties combined with herbicide 2,4D at double dose, all the plants withered.

Table 7 proved difference between the combinations variety – herbicide with regard to the indicator number of peas per plant, treated with single dose
The average values with regard to the indicator weight of the seeds per plant for the three varieties of winter peas tested regardless of the five herbicides applied at single dose are shown in Tables 8, 9 and 10.
Table 8 shows that there are not any differences between the varieties tested with regard to the indicator observed – weight of the seeds per plant. The values of this indicator are between the limits of the average 12,733 for Mir variety (a_1) and 12,267 for variety No 11 (a_2).
Further to the influence of the herbicides, with no regard to the variety tested (Table 9) the weight of the seeds per plant is the heaviest for the plants treated with herbicide Basagran (B_2) – 13,22, followed by the variant treated with Zenkor (B_3) – 12,89. The lowest weight proved to be for the variant with herbicide B_5 (2,4D) – 11.33.
The competitive analysis between the combinations of the two factors – variety-herbicide is shown in Table 10. The highest equal average value of this indicator have the plants of variety No 11 and Vesela variety treated with herbicide Basagran (B_2) – 13.33. The indicator weight of the seeds for the three varieties treated with herbicide Zenkor and Pivot respectively, has the same values – 13.00.
The lowest value of the indicator weight of the seeds per plant was detected for the variety No11, treated with 2,4D (B_5) – 10.33. All the other combinations between the varieties and herbicides tested proved higher values compared to those of variety No 11 and herbicide 2,4D.
The combination with 2,4D at double dose had a lethal effect on the plants.
All the other varieties have proved, though at different grade, heavier weight of the seeds compared to those treated with 2,4D at single dose for varieties No 11 and Vesela.
Table 10. Proved difference between the combinations variety – herbicide with regard to the indicator weight of the seeds per plant, treated with single dose.

Table 7. Proved difference between the combinations variety – herbicide with regard to the plant height, treated with single dose

Combination	ẋ	Different with														
		a_1B_2	a_1B_3	a_1B_1	a_1B_4	a_1B_5	a_3B_1	a_3B_2	a_3B_4	a_3B_3	a_3B_5	a_2B_1	a_2B_2	a_2B_3	a_2B_4	a_2B_5
a_1B_2	116.33	-	ns	ns	ns	ns	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
a_1B_3	116.00		-	ns	ns	ns	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
a_1B_1	115.33			-	ns	ns	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
a_1B_4	114.67				-	ns	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
a_1B_5	112.67					-	++	+++	+++	+++	+++	+++	+++	+++	+++	+++
a_3B_1	91.33						-	ns	ns	ns	+	+++	+++	+++	+++	+++
a_3B_2	90.67							-	ns	ns	+	+++	+++	+++	+++	+++
a_3B_4	89.33								-	ns	+	+++	+++	+++	+++	+++
a_3B_3	89.00									-	ns	+++	+++	+++	+++	+++
a_3B_5	85.67										-	+	+	++	++	+++
a_2B_1	80.67											-	ns	ns	ns	+++
a_2B_2	80.67												-	ns	ns	+++
a_2B_3	79.33													-	ns	++
a_2B_4	78.00														-	++
a_2B_5	72.00															-

$gDp_{5\%} = 4.41$; $gDp_{1\%} = 5.94$; $gDp_{0.1\%} = 7.87$

Table 8. Proved difference between the combinations variety – herbicide with regard to the indicator number of peas per plant, treated with single dose

Combination	ẋ	Different with														
		a_2B_4	a_3B_5	a_1B_5	a_3B_4	a_2B_5	a_2B_2	a_1B_1	a_2B_1	a_3B_2	a_1B_2	a_2B_3	a_1B_4	a_1B_3	a_3B_1	a_3B_3
a_2B_4	14.330	-	ns	ns	+	+	+	+	+	+	++	++	++	++	++	++
a_3B_5	13.667		-	ns	ns	ns	ns	ns	+	+	+	+	+	+	+	++
a_1B_5	13.333			-	ns	ns	ns	ns	+	+	+	+	+	+	+	+
a_3B_4	13.000				-	ns	ns	ns	ns	ns	+	+	+	+	+	+
a_2B_5	12.667					-	ns	ns	ns	ns	ns	ns	ns	+	+	+
a_2B_2	12.667						-	ns	ns	ns	ns	ns	ns	+	+	+
a_1B_1	12.667							-	ns	ns	ns	ns	ns	+	+	+
a_2B_1	12.000								-	ns	ns	ns	ns	ns	ns	ns
a_3B_2	12.000									-	ns	ns	ns	ns	ns	ns
a_1B_2	11.667										-	ns	ns	ns	ns	ns
a_2B_3	11.667											-	ns	ns	ns	ns
a_1B_4	11.667												-	ns	ns	ns
a_1B_3	11.333													-	ns	ns
a_3B_1	11.333														-	ns
a_3B_3	11.000															-

$gDp_{5\%} = 1.16$; $gDp_{1\%} = 2.64$; $gDp_{0.1\%} = 3.50$

Table 9. Proved difference between the combinations variety – herbicide with regard to the indicator weight of the seeds per plant, treated with single dose

Combination	ẋ	Different with														
		a_2B_2	a_3B_2	a_1B_2	a_1B_3	a_3B_3	a_3B_4	a_1B_4	a_2B_3	a_2B_4	a_3B_1	a_1B_1	a_2B_1	a_1B_5	a_3B_5	a_2B_5
a_2B_2	13.33	-	0	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	+	+	+++
a_3B_2	13.33		-	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	+	+++	+++
a_1B_2	13.00			-	0	0	0	ns	ns	ns	ns	ns	ns	ns	+	+++
a_1B_3	13.00				-	0	0	ns	ns	ns	ns	ns	ns	ns	+	+++
a_3B_3	13.00					-	0	ns	ns	ns	ns	ns	ns	ns	+	+++
a_3B_4	13.00						-	ns	ns	ns	ns	ns	ns	ns	+	+++
a_1B_4	12.67							-	ns	ns	ns	ns	ns	ns	ns	++
a_2B_3	12.66								-	ns	ns	ns	ns	ns	ns	++
a_2B_4	12.65									-	ns	ns	ns	ns	ns	++
a_3B_1	12,64										-	ns	ns	ns	ns	++
a_1B_1	12.33											-	ns	ns	ns	++
a_2B_1	12.32												-	ns	ns	++
a_1B_5	12.00													-	ns	+
a_3B_5	11.66														-	+
a_2B_5	10.33															-

$GDP_{5\%} = 1.03$; $GDP_{1\%} = 1.72$; $GDP_{0.1\%} = 2.61$

CONCLUSIONS

Out of the varieties tested, Mir is the highest. This is variety ability and the variety is suitable for foliage. The shortest plants are those of variety No 11, followed by Vesela variety which is suitable for peas.

Further to the influence of the herbicides, with no regard to the variety tested, the plants treated with herbicide Basagran forte - 150 ml/da are the highest, and the shortest are the plants at the variant with 2,4-D - 67 ml/da.

The highest average value under the indicator weight of the seeds have the plants of variety № 11 and variety Vesela, treated with herbicide Basagran forte – 13.33 g, and the lowest value was measured for variety No 11, treated with 2,4D ($в_5$) - 67 ml/da.

There are no differences proved between the varieties tested with regard to the indicator weight of the seeds of 1 plant and number of peas per 1 plant.

The combination between the varieties and herbicide 2,4D – 133 ml/da (double dose) has a lethal effect on the pea's plants.

REFERENCES

.Angelova S., Guteva J., 1995. Biological and economic characteristic of local and introduced peas varieties, Plant Science, XXXII, 1-2, p. 149-151.

Dimitrova Ts., 2000**.** Biological testing on herbicides used to fight the weeds of spring fodder peas. Plant Science, 37, p. 328-331.

Khan M.H., Hasan G., Marwat K.B., Shah N.H, 2003. Effect of different herbicides on controlling weeds and their effect on yield and yield components of edible pea (*Pisum sativum* L.). Pakistan Journal of Weed Science Research, p. 81-87.

Mishra J.S., Bhan V.M., 1997. Effect of cultivar and weed control on weed growth and yield of pea (*Pisum sativum*), Indian Journal of Agronomy, p. 316-319.