



## The Influence of Some Herbicides on the Structural Elements of the Yield of Winter Oilseed Rape

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### Abstract

In the period 2011-2013 in the experimental field of the Agricultural University, Plovdiv, were conducted field experiments using some herbicides *Teridox* (500 g/1 *dimetochor*), *Butizan S* (500 g/1 *metazachlor*), *Modaon 4F* (48 g/1 *bifenox*) on winter oilseed rape. The experiments were based on the block method over an area of 25 m<sup>2</sup> in 4 repetitions. It has been established that they demonstrate excellent selectivity for this crop and by eliminating the competition of the weeds, they increase the components of the yield and have a positive effect on the growth and the development of rape. The obtained data has been statistically processed based on the *Student* method.

**Key words:** winter rape, herbicides, yield

### Introduction

Rape is a major oilseed crop in more than 32 countries in the world and ranks second only to soybeans. Not only in Europe but also in Bulgaria it has a fast rate of increase in land under this crop.

Weed control is one of the important moments in the agrotechnics of rape. It must be scientifically sound and based on a thorough study on the species composition and their density. The production of high-quality yield depends largely on the properly selected means of weed control (Dimitrova et al., 2008; Frizen et al., 2003; Harker et al., 2003, Tityanov M. et al., 2009; Tonev et al., 2012). Data from experiments showed that the rape is most sensitive to weeds by the emergence of 4-5 real leaves, i.e. 17-38 days after the germination of the crop (Martin S., 2001; Loid M., 2003). This is the stage in which weeds have much higher sensitivity to all of the herbicides selective for the crop (Adamczewski et al., 1988, 1998). If the crops are significantly overgrown with weeds, the yield can be reduced by over 50% and it is often necessary to plough the crops in autumn or early spring (Tonev et al., 2013). The results of the experiments show that the highest yield of rape seeds is obtained after treatment with the soil herbicides *Sultan* and *Butizan SC* in doses of 350 ml/da, which exceeded the control sample by

41 and 39%, respectively (Dimitrova et al., 2008; Ivanova, R et al., 2005). Other authors added that with *Butizan* and *Teridox* excellent results are obtained in the fight against the main broadleaf weeds, except for the cruciferous species *Sinapis arvensis L.* and *Raphanus raphanistrum L.*, and also some grain weeds (Matuszak and Wodarczyk, 2011). Good selectivity of *Modaon 4 F* to the crops and high efficiency (over 75-80%) against *Sinapis arvensis L.* and *Raphanus raphanistrum L.* was reported by Senior and Dale (2002).

Herbicides increase the seed yield in oilseed rape, but there is little research on their impact on the structural elements of the production, which defines the goal of our research.

### Materials and Methods

In the experimental field of the Agricultural University, Plovdiv during the period 2011-2013, we conducted a field experiment with herbicides applied to the soil after sowing and before the germination of the crops and also to the leaves during the vegetation period of the oilseed rape, the *Xenon* hybrid, grown on a piece of land previously planted with wheat. The experiment was made using the block method, with an area of 25 m<sup>2</sup> of the experimental field, in 4 repetitions (table 1).

**Table 1.** Variants of experiment

Variants	Active substance	Dose, ml/ha
Zero control	-	-
Modaon 4Φ	48 g/l <i>bifenox</i>	1000
Teridox	500 g/l <i>dimethachlor</i>	2000
Butizan S (soil application)	500 g/l <i>metazachlor</i>	2000
Butizan S (on the leaves)	500 g/l <i>metazachlor</i>	2000

The agrotechnical activities were conducted in accordance with the common technology for growing oilseed rape (processing of the soil, fertilization, sowing, rolling).

The results obtained were statistically processed based on the *Student* method. A summarized dispersion analysis was carried out and the years of the experiment were used as repetitions.

The experimental year 2011 was characterized by a warm and humid autumn. The rainfall within the period September – November was 74,7 mm but it was unevenly distributed (70,4 mm of the rainfall was in October).

The average monthly temperatures in the early months (I and II) of 2012 were below normal by -0.6°C and -1.4°C, respectively. This period was also characterized by significant rainfall (177,0 l/m<sup>2</sup>). The total rainfall for March and April was only 27,1 l/m<sup>2</sup>, but in May the heavy rainfall (160,8 l/m<sup>2</sup>) caused the emergence of secondary weeds in the experimental area.

The period from October 2012 to February 2013 was favourable for the development and the successful overwintering of the plants. The average monthly temperatures had values a little above the allowed the successful wintering of the plants, although the amount of rainfall for this period was below the average. The temperature values, registered by the end of the vegetation period, were above the average, and in combination with the rainfall, which was unevenly distributed per months, secured the needs of the plants. The autumn of 2013 was characterized as being cool and humid. average for October and December for the long-term period, except for in December 2012, when the temperatures were with 1,28°C below the average ones. The combination of these temperatures with the rainfall for the same period.

Biometric measurements were made on 30 plants per each variant regarding the following indicators: number of pods from one plant; number of seeds per 1 pod; weight of the pod of 1 plant; weight of the seeds of 1 plant; length of the

pod; number of branches of 1 plant and the weight of the pods of 1 plant.

## Results and Discussion

The data obtained from the dispersion analysis on the influence of the studied herbicides on the structural elements of the yield of the winter oilseed rape, hybrid Xenon, are listed in tables 2-5. They are unidirectional in terms of various indicators during the separate experimental years, and are therefore presented in the summary tables, on average for the period of survey. The herbicides Butizan S applied in a dose of 200 ml/dka (in the soil and on the leaves), Teridox - 200 ml/dka (soil) and Modaon 4F applied in a dose of 100 ml/dka to the leaves have been proven to increase the average performance of all tested indicators compared with the zero control sample. Destroying the existing weeds in the experimental areas, their application leads to increased growth of rape and the structural elements of the yield and that was statistically proven for the reporting period.

In the data analysis of the impact of the studied herbicides, it can be seen that they have a significant influence on the major structural elements of the yield of winter oilseed rape, hybrid Xenon.

In Tables 2 to 5, the results of the conducted dispersion analysis of the summarized data from the years of survey are presented for each feature separately as well as the proven differences compared to the zero control sample.

**Table 2.** Significance of differences compared with the zero control sample over the number of branches of 1 plant

Variants	Number of branches of 1 plant		
	$\bar{x}$	D	Significance
3	2,945	0,89	+++
5	2,915	0,86	++
4	2,465	0,41	+
2	2,410	0,35	+
1	2,055		
gD <sub>5%</sub> = 0,36 gD <sub>1%</sub> = 0,56 gD <sub>0,1%</sub> = 0,89			

**Table 3.** Significance of differences compared with the zero control sample over the number of seeds per 1 pod and weight of the pod of 1 plant

Number of seeds per 1 pod				Weight of the pod of 1 plant			
Variants	$\bar{x}$	D	Significance	Variants	$\bar{x}$	D	Significance
5	26,81	5,46	++	3	10,41	3,54	+++
3	26,68	5,33	++	5	9,67	2,80	++
2	25,44	4,09	+	4	8,94	2,07	+
4	25,02	3,67	+	2	8,37	1,50	+
1	21,35			1	6,87		
gD <sub>5%</sub> = 2,85 gD <sub>1%</sub> = 4,43 gD <sub>0,1%</sub> = 7,53				gD <sub>5%</sub> = 1,47 gD <sub>1%</sub> = 2,45 gD <sub>0,1%</sub> = 3,47			

**Table 4.** Significance of differences compared with the zero control sample over the number of pods from one plant and length of the pod

Number of pods from one plant				Length of the pod			
Variants	$\bar{x}$	D	Significance	Variants	$\bar{x}$	D	Significance
5	60,975	25,03	+++	3	6,23	0,88	++
3	49,415	13,47	++	4	6,13	0,78	++
4	48,890	12,94	++	5	6,12	0,77	+
2	44,325	8,38	+	2	5,77	0,42	+
1	35,945			1	5,35		
gD <sub>5%</sub> = 8,23 gD <sub>1%</sub> = 12,89 gD <sub>0,1%</sub> = 21,92				gD <sub>5%</sub> = 0,40 gD <sub>1%</sub> = 0,75 gD <sub>0,1%</sub> = 1,28			

**Table 5.** Significance of differences compared with the zero control sample over weight of the seeds of 1 plant and the weight of the pods of 1 plant

Weight of the seeds of 1 plant				Weight of the pods of 1 plant.			
Variants	$\bar{x}$	D	Significance	Variants	$\bar{x}$	D	Significance
3	6,86	3,33	++	5	5,23	1,65	++
5	6,82	3,29	++	3	4,36	0,78	ns
4	5,39	1,86	+	4	4,10	0,52	ns
2	5,08	1,55	+	2	4,05	0,47	ns
1	3,53			1	3,58		
gD <sub>5%</sub> = 1,54 gD <sub>1%</sub> = 2,74 gD <sub>0,1%</sub> = 4,65				gD <sub>5%</sub> = 1,03 gD <sub>1%</sub> = 1,61 gD <sub>0,1%</sub> = 2,74			

For the formation of the features regarding the number of seeds in one fruit, the number of fruits per plant and pod weight of 1 plant, the most favourable influence was that of the preparation Butizan S applied in a dose of 200 g/dka (on the leaves).

Regarding the other features - number of branches per 1 plant, fruit weight from 1 plant, fruit length and weight of seeds of 1 plant, the highest average values were obtained from the plants treated with the herbicide Teridox 200 ml/dka (in the soil).

The lowest values for the features were recorded in the untreated (zero) control sample. The differences compared with it are statistically significant, though at different levels (P<sub>5%</sub>, P<sub>1%</sub> and P<sub>0,1%</sub>). The number of weeds in the zero control sample over the years ranged from 123 to 138 of weeds per m<sup>2</sup> and they have a significant negative impact on the structural elements of the yield.

Regarding the feature weight of the pods, only the difference in the sample treated with Butizan S in a dose of 200 g/dka applied to the

leaves, was statistically significant (P<sub>1%</sub>). Regarding the impact of the other herbicides, there are differences but they are insignificant. Perhaps, this is due to the influence of climatic conditions during the years of survey.

#### Conclusion

Eliminating the competition of weeds in the initial stage of the development of winter oilseed rape, hybrid Xenon, the studied herbicides *dimethachlor*, *metazachlor* and *bifenoxy* have a positive influence on the major structural elements of the yield. The results of the conducted dispersion analysis for each separate feature prove statistically the differences from the zero control sample.

The most favourable impact on the individual features was exercised by the preparations Butizan S applied on the leaves in a dose of 200 g/dka and Teridox 200 ml/dka, applied in the soil.

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