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“Agrosym 2015”**

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Jahorina, October 15-18, 2015, Bosnia and Herzegovina**

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FOREWORD

Agriculture production increased significantly in the second half of the past century as a result of intensification through increasing external inputs first of all energy and agrochemicals per unit of land. To meet the challenges of increasing food demand, ways should be found to improve the productivity, profitability and sustainability of the agricultural and forestry systems.

Industrial agricultural system has led to irretrievably changes in the landscape diversity, soil quality, environment integrity, and natural resource base. This has resulted in major questions worldwide in relation to the sustainability of agricultural production systems. At the field level, the optimization of resource use efficiency is a key to issue to achieve the different goals with respect to food supply, income and protection of the environment.

The most significant damage to natural ecosystems and the environment as a whole is caused by habitat conversion and corresponding climate change, loss of biodiversity and ecosystem functions, soil erosion and degradation, and pollution from fertilizers and pesticides.

Concepts in plant protection have changed in past decades from exclusion or destruction of pest to pest management. Serious problems with pesticides, rapid development of pest resistance, environmental effects of pesticides, and high costs led to the development of new approaches and techniques in pest management based on improved knowledge of pest dynamics and their natural enemies, and the interaction between the pest and the crop.

Many of the papers included in the present Proceedings identify a number of approaches and market-based incentives that would encourage producers to achieve entirely new levels of performance, and as a result raise the awareness of governments, and other stakeholders in the agro-food system. Some governments, too are experimenting very innovative approaches to support or encourage sustainable agriculture. One of the goals of the sustainable agriculture movement is to create farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. That aim can be realized only with adapted agricultural practices to the different agro-ecological conditions (cf. different regional characteristics, soil types, adapted cultivars for low-input or organic production). For our conditions it is important for the conservation of the ecological environment to develop organic production.

The result reported here will be also significant in the dissemination of knowledge to the wider audience about the importance of agriculture and food science, one of the most important strategic scientific areas of the European and many national research strategies.

The 6th International Scientific Agriculture Symposium “Agrosym 2015” made an important contribution to the agriculture practice in different areas. During the four-day symposium (15-18 October 2015), approximately 750 papers were presented to more than 800 participants representing more than 70 countries.

The symposium was made possible through the commitment and contributions of a wide range of partners and cosponsors. We were encouraged by symposium success.

This publication comprises an edited selection of the many papers submitted to the symposium.

It remains only for me to thank all those who have helped to make this Symposium such a great success.

Much appreciation is due to the authors and reviewers of all papers submitted and presented at the symposium, as well as to all symposium participants whose ideas and contributions ensured rich and lively discussion during the various sessions.

East Sarajevo, 03. October 2014.

Dušan Kovačević, PhD

Editor in Chief



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**PERSPECTIVITY OAT GENOTYPES AND THEIR COMPONENTS OF
PRODUCTIVITY AT THE PLOVDIV REGION (BULGARIA) AGRO-CLIMATIC
CONDITIONS**

Plamen ZOROVSKI^{1*}, Tonya GEORGIEVA¹, Todorka SAVOVA², Dragica SPASOVA³

¹Agricultural University, 4000 Plovdiv, Bulgaria

²Institute for Agriculture - Karnobat, Bulgaria

³Gotze Delchev University Shtip, Macedonia

*Corresponding author: plivz@abv.bg

Abstract

During the 2010-2013 period, in the experimental field of Crop Science Department at the Agricultural University - Plovdiv a field experiment was conducted. Randomized complete block design was displayed with three replications and size of the experimental plot 10 m². Eight new Bulgarian wintering oat lines and two varieties (Dunav 1 and Resor 1), as a standards for yield and quality in Bulgaria, were researched. Yield structural elements formation in different oat genotypes, depending on the agro-meteorological features over the years was traced. The statistical processing of the experimental data was made by SPSS V.9.0 for Microsoft Windows. The highest number of tillers in all studied wintering oat genotypes formed line №1 (4,2) and line M-K (3,6). These two genotypes formed and highest number productive tillers. From all structural elements of panicle with highest number of spikeletts per panicle proven stands line 08/Z 2 (59,3), followed by 07 / Z 1 (27,3). Line 08 / Z2 formed and the highest number of grains per panicle - 98, but with less grain weight.

Keywords: *winter oat, genotypes, elements of the yield*

Introduction

The changes in the weather conditions significantly affect the development and thus determine the regions that are favourable for growing different varieties of crops, including grain crops (Kuzmova, 2009). Oats are a crop which prefers moist and cool weather, which is the reason why it is grown in these regions of the country (Dimitrova – Doneva, M., D. Tanchev, 1999). The changes in the climate necessitate creating new varieties that are more adaptable to the changing conditions. The high and the low temperatures of the air, the uneven distribution of the rainfall throughout the year, especially during the periods that are critical for the growth of the oats, significantly affect the development of the plants and thus the formation of the structural elements of the yield (Valchev, Dr., T. Savova, 1995; Savova, T., 1996). The shortening of the stages of development is caused by the high temperatures of the air and also by the lack of moisture in the soil (Palfner, 1991). The rise of the air temperature and the lack of sufficient rainfall during the spring-summer period shorten the period of ear formation, tasseling and ripening (Savova, T. 2002; Larson, 1988). The high temperatures and the lack of moisture from the end of the tillering period to the beginning of the stem elongation cause the growth of shorter panicles with fewer ears on them. The stem elongation is considered to be the most critical period of the development of the winter grain crops regarding the moisture in the soil. The conditions in which the tasseling takes place are also very important. The lack of moisture and the high temperatures during the formation of the grain lead to the growth of small and shrivelled grains. This adversely affects the yield and the quality of grain. The studying and the creation of high-yielding genotypes of winter oats adaptable to the certain agro-climatic conditions is the main purpose of this survey.

Materials and Methods

The field experiment was conducted within the period 2011-2013 in the experimental field of the Department for Plant Production at the Agricultural University – Plovdiv on the soil order Mollic Fluvisols based on FAO (Popova R., and Sevov, A., 2010).

8 winter lines of oats were included in the survey: № 1, 07/ Z1, 08/ Z2, M-K (selection of the Agricultural University-Plovdiv, Bulgaria), Radolishta, Kucevishte (selection from the town of Štip, the Republic of Macedonia), Kt 651, Kt 718 (selection of the Agricultural Institute – Karnobat, Bulgaria) and 2 winter cultivars – Dunav 1 and Resor 1 which are said to be yield and quality standards in Bulgaria.

The sowing was performed in mid October based on a block method in three repetitions, over an area of 10,5m² and a sowing rate of 500 k.s./ m². The land had previously been planted with sunflower. The used fertilization rate was N₆P₈K₈.

The statistical processing of the experimental data was performed using SPSS V.9.0 for Microsoft Windows.

Results and Discussion

The weather conditions during the period of growth of the crop are the main factor determining the development of the plants and the formation of the structural elements of the yield.

Within the period of the survey, the vegetation year 2010-2011 was characterized as being favourable for the growth of oats.

The frequent and heavy rainfall in October delayed the sowing and as a result it was conducted in late November and the presence of low average temperatures of 10,8 °C (which is 1,8 °C below the norm) delayed the growth of the plants.

The period of panicle emergence, blossoming and grain formation was accompanied by heavy precipitations and the quantity of rainfall in May and June was above the norm while the temperatures were close to the long-term ones. The wax ripeness and the overall ripeness take place under temperatures that are 1,5 to 2,2°C above the norm (June-July) as well rainfall that is 5,5 mm above the norm (June). The combination of these conditions during the period of formation and ripening of the grains has a positive influence on the nutrition and some of the quality indicators of the grain. (Table 1 and Table 2).

Table 1. Average diurnal temperature in periods of ten days (°C), 2010 – 2011.

Months	X	XI	XII	I	II	III	IV	V	VI	VII
Periods of ten days										
I	11,6	12,7	7	0,2	4,5	0,7	13	13,6	22,3	24
II	13,2	11,8	-1,8	4,6	2,9	9,2	10,2	17	22,5	26,7
III	7,8	9,5	2	-0,6	0,5	10,8	12,2	20,6	22,3	25,5
Average monthly temperature t° C	10,8	11,3	2,4	1,4	2,7	6,9	11,8	17,1	22,4	25,4
Average for the period 1965- 1995	12,6	7,4	2,2	-0,4	2,2	6	12,2	17,2	20,9	23,2

Table 2. Amount of the rainfall during the vegetation period (mm), 2010- 2011

Months Periods of ten days	X	XI	XII	I	II	III	IV	V	VI	VII
I	27,9	-	4,4	2,7	-	9,9	2	31,3	8,6	6,6
II	48,7	11	14,4	4,4	28,1	57,8	16,8	8,4	28,6	7,3
III	42,5	4,4	10,2	17,5	24	6,7	-	1,1	4,3	0,7
Monthly amounts	119,1	15,4	28,7	24,6	52,1	74,4	18,8	40,8	41,5	14,6
Average for the period 1965- 1995	47	35	36	40	48	44	39	32	36	42

The vegetation year 2011-2012 was not very favourable for the growth of the winter oats (Table 3 and Table 4).

The large quantity of the rainfall in October 2012 (70,4 l/m²) again delayed the sowing of the winter genotypes of oats. This increased the likelihood of freezing of the plants. The positive temperatures in the winter months prevented the plants from freezing, owing to which the lines Radolishta and Kucevishte developed successfully. The spring months (March – April 2012) were characterized by favourable temperatures and rainfall, which determined the formation of panicles with more ears on them.

The period of grain formation and ripening (May-June) was characterized by temperatures close to and a little above the norm for the long-term period and also by heavy precipitations in May and quantity of the rainfall above the norm in June. This combination of weather conditions was favourable for the formation and the nutrition of the already existing grains on the spikelet, which is a prerequisite for a relatively high weight of the grains in the panicle.

Table 3. Average diurnal temperature in periods of ten days (°C), 2011- 2012

Months Periods of ten days	X	XI	XII	I	II	III	IV	V	VI	VII
I	15,3	7,3	3,4	-0,2	- 4,5	4,1	11,2	19,6	21,3	25,9
II	10,6	1,8	5,1	1,5	-3,1	8,1	14,3	16,5	24,6	27,5
III	8,7	2,4	-1,6	-3,0	3,5	13,2	17,7	16,6	24,9	27,5
Average monthly temperature t° C	11,6	3,8	2,3	-0,6	-1,4	8,4	14,4	17,6	23,6	27,0
Average for the period 1965- 1995	12,6	7,4	2,2	-0,4	2,2	6	12,2	17,2	20,9	23,2

Table 4. Amount of the rainfall during the vegetation period (mm), 2011- 2012

Months Periods of ten days	X	XI	XII	I	II	III	IV	V	VI	VII
I	22,8	0,0	0,4	65,6	47,2	2,0	13,5	37,3	40,1	0,0
II	38,3	0,8	12,6	0,0	2,6	2,7	8,2	73,7	0,0	2,0
III	9,3	0,1	25,8	54,6	7,0	0,2	0,5	49,8	2,3	0,4
Monthly amounts	70,4	0,9	38,8	120,2	56,8	4,9	22,2	160,8	42,4	2,4
Average for the period 1965- 1995	47	35	36	40	48	44	39	32	36	42

The third vegetation year 2012-2013 was characterized by high temperatures and rainfall unevenly distributed during the months (Tables 5 and 6). The high temperatures in October and the rainfall above the norm allowed the fast and simultaneous germination of the crops. This guaranteed the normal duration of the period of development, the occurrence of the third-leaf phenophase and the initiation of the tillering stage before the drop of the temperatures. During the winter months, positive temperatures above the norm were registered, which contributed to the successful wintering of the plants. However, the small quantity of the rainfall in that period reduced the moisture of the soil which is necessary in the spring. In February and March, when the spring vegetation starts, the rainfall is below the norm, which shortens the duration of the tillering stage. This has a negative effect on the formation of the overall and the productive tillering of the plants.

Table 5. Average diurnal temperature in periods of ten days (°C), 2012- 2013

Months Periods of ten days	X	XI	XII	I	II	III	IV	V	VI	VII
I	17,4	11,4	3,4	1,4	4,5	7,0	11,1	19,4	18,6	21,8
II	16,2	7,9	-0,2	2,0	3,8	8,0	13,2	20,7	23,3	23,2
III	12,7	6,8	-0,3	2,0	5,5	7,2	17,8	20,0	23,1	25,1
Average monthly temperature t° C	15,6	8,7	0,97	1,8	4,6	7,4	14,03	20,03	21,67	23,37
Average for the period 1965- 1995	12,6	7,4	2,2	-0,4	2,2	6	12,2	17,2	20,9	23,2

Table 6. Amount of the rainfall during the vegetation period (mm), 2012- 2013

Months Periods of ten days	X	XI	XII	I	II	III	IV	V	VI	VII
I	0,3	0,3	40,6	2,8	8,5	0,2	74,9	1,3	33,7	53,4
II	2,0	1,7	58,0	4,4	19,1	3,9	9,7	0,1	28,1	1,6
III	37,1	8,7	0,1	30,1	17,5	29,8	0,0	2,0	47,7	8,3
Monthly amounts	39,4	10,7	98,7	37,3	45,1	33,9	84,6	3,4	109,5	63,3
Average for the period 1965- 1995	47	35	36	40	48	44	39	32	36	42

In May, when the plants are in their tasseling and milky ripeness stages, minimum quantity of the rainfall of 3,4mm/m² was registered, considering the fact that the norm for the long-term period is 32mm/m². These conditions and temperatures 2,8° C above the norm provide prerequisites for the abnormal pollination of the blossoms of the panicle and the growth of a smaller number of grains. This disrupts the normal formation of the grains.

The heavy rainfall in June - 109,5mm/m² contributed only to the nutrition of the grains already formed in the panicle. Under these conditions, we have well-nurtured but fewer grains on the panicle.

The tillering of the studied genotypes varied widely over the years depending on the agro-climatic conditions (Table 7). For the Macedonian genotypes Radolishta and Kucevishte, this indicator has not been registered during two of the years of the experiment because of the large percentage of freezing of the plants.

The largest number of tillers was registered for line No. 1 – 4,2 tillers, followed by line M-K – 3,6 tillers. These two lines have the largest number of productive tillers between 2,2 and 2,4. The lowest overall tillering was registered for line 08/Z2 – 2,1 tillers. Of all the studied

genotypes, the least productive tillers on average for the entire period of survey were registered for the cultivars Resor 1.

Table 7. Overall and productive tillering (number of tillers/ plant), 2011 – 2013.

Genotypes	Overall tillering				Productive tillering			
	2011	2012	2013	Average	2011	2012	2013	Average
№ 1	4,2	4,0	4,4	4,2	2,4	3,7	1,1	2,4
07/ Z 1	2,8	2,6	3,0	2,8	2,0	1,6	1,2	1,6
Dunav 1 - st	3,6	3,1	3,5	3,4	1,9	2,7	1,1	1,9
08/ Z 2	2,3	1,5	2,5	2,1	1,7	2,0	1,7	1,8
M-K	3,8	3,7	3,3	3,6	2,2	2,1	2,3	2,2
Kt 651	2,4	3,6	4,2	3,4	1,4	2,5	2,4	2,1
Resor 1 - st	3,4	1,8	2,0	2,4	2,1	1,1	1,0	1,4
Kt 718	3,6	3,0	3,6	3,4	2,0	1,8	2,2	2,0
Radolista	-	2,1	-	2,1	-	1,9	-	1,9
Cuceviste	-	2,2	-	2,2	-	2,0	-	2,0

Regarding the length of the panicle, table 8 shows that there are great differences between the winter genotypes of oats included in the experiment. The shortest panicle is that of line 07/Z1, reaching 16,8 cm and the longest one is that of line 08/Z2 – 20,8 cm. These two lines are distinguished from all the rest for having the largest number of spikelets, the largest number of grains on the panicle and, respectively, the highest weight of the grains on the panicle. The panicle with the largest number of ears (59,3) and the largest number of grains (98) is that of line 08/Z2. Regarding these indicators, it surpasses all the other genotypes included in the survey but is inferior in terms of size of the grain (with the exception of lines Radolishta and Kucevishte) and hectoliter weight (Zorovski, P et al, 2014).

Table 8. Structural elements of the panicle at wintering oat genotypes, average for the period of study 2011-2013.

Genotypes	Panicle length (cm)	Spikelets per panicle (number)	Grains per panicle (number)	Grain weight per panicle (g)
№ 1	20,0 a	24,2 c	47,2 b	1,06 a
07/ Z 1	16,8 b	27,3 c	54,6 b	1,60 a
Dunav 1 - st	20,4 a	24,5 c	44,2 b	1,23 a
08/ Z 2	20,8 a	59,3 a	98,0 a	2,00 a
M-K	19,7 a	24,0 c	40,4 bc	1,13 a
Kt 651	18,9 a	21,9 c	42,2 b	1,01 a
Resor 1 - st	19,7 a	31,6 b	56,6 b	1,21 a
Kt 718	16,3 b	26,0 b	40,1 bc	1,33 a
Radolista	17,9 b	19,2 d	40,0 bc	0,98 b
Kuceviste	18,2 b	21,0 c	43,1 b	1,21 a

Conclusions

The conditions throughout the year largely affect the degree of tillering of the studied winter genotypes of oats. The largest overall and productive tillering was registered for line No. 1, followed by line M-K. Of all the studied genotypes, the largest number of spikelets on a panicle was registered for line 08/Z2 (59,3), followed by line 07/Z1 (27,3). These two genotypes also have the largest number of grains on the panicle and the largest weight of the grains on the panicle. They prove to be the most suitable to be grown in the respective agro-climatic region.

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