

EXPERIMENTAL RESULTS CONCERNING THE BEHAVIOUR OF SOME RYE CULTIVARS AND LINES, CREATED AT S.C.D.A. SUCEAVA

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Abstract

In the period 2007-2009, at S.C.D.A. Suceava there have been tested more winter cultivars and lines, from which a part of them are presented in this paper. After the three years of testing we determined that most of the verified rye cultivars and lines are valuable and have a good behavior in the vegetation and a great production capacity.

In what regards the production capacity, after the three years of testing, the Suceveana cultivar registered an average production of 5488 kg/ha, exceeding the Gloria cultivar, used as an witness, with a very significant increase of 34 %, that is 1402 kg/ha. Between the tested lines, Sv 244-05 proved to be the most valuable, exceeding the average production of Gloria cultivar with a significant distinctive increase of 19 %, that is 793 kg/ha.

The Suceveana cultivar and Sv 244-05 line had a great behavior in the vegetation, expressed by a good resistance to the winter conditions and diseases.

There have been registered differentiations under the aspect of the absolute average values and of the quantitative character variability, between the normal height cultivars and also between the short height lines. Therefore, for most of the morphoproductive elements, Suceveana cultivar presented superior values towards the other cultivars, and Sv 90-CP and Sv 244-05 lines registered higher values, than the normal height cultivars.

Until the homologation, the introduction and generalization in the production of some more valuable new cultivars of winter rye we recommend in the future the cultivation existent cultivars.

Key words: genotypes, rye, resistance, quality, production

The winter rye occupies an important place among the straw cultures from our country, as a bakery cereal after the wheat, having at the same time a special fodder importance.

Even if, globally we take part at a considerable limitation of the cultivated areas, the rye remains in culture "in the Sub-Carpathians and hilly areas, with a humid and cold climate, where are dominant the podzolic and podzolute soils, with high acidity and more reduced natural fertility, and also in the sandy soils areas, from the Southern and Western part of the country, with lacunar pluviometric regime which is divided uneven (Gaspar, 1976, Gaspar and collab., 1994; Drobotă, Zama, 2004).

Because of the genetics and amendment researches stayed behind in our country, it made that the productive potential of the rye to be lower than the wheat or barley (Gaspar, 1973, 1976; Gaspar and Reichbuch, 1978). As a result, the range of rye cultivars, from our country, remained pretty reduced in comparison to other straw cereals (Gaspar, 1984, 1989, 1989, 1997).

The need to create new cultivars, which are superior from the agronomical point of view to the cultivars cultivated along time, was imposed,

because of the level of rye productions is frequently affected by the more decreased resistance to the fall, as a result of the pretty high height of this cultivars, of the sensibility to disease attack, especially to the snow mould which represents a great danger for the cultures, in the humid and cold areas, and also by the insufficient resistance to the sprouting in the ear (Muchin and collab. 1976, Kobileanski 1982, Tarkowski, 1967, Winkel, 1982, Wolski, 1982, Gaspar, 1973, Gaspar and collab., 1996).

The researches regarding the rye amendment at S.C.D.A Suceava created four soils with improved resistance to the abscission, to diseases and to less favorable climatic conditions which are good for the culture on reduced fertility fields and after perfectible technologies but also of some new lines with dominant genetic determinism for the short size of the straw (Gaspar, 1984, 1989, 1989, Gaspar and collab. 1997, Drobotă and Zama, 2004).

This paper presents a series of experimental data regarding the physiological features, the quality features and the grain production at the rye cultivars and lines, experimented at S.C.D.A Suceava in the period 2007-2009.

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MATERIAL AND METHOD

The research material represented by four cultivars and four new lines created at S.C.D.A. Suceava beside the Dankovsje Zlote Polish cultivar, was tested at S.C.D.A. Suceava in the period 2007-2009. The experimental cultivars and lines were appreciated under the aspect of the physiological features, of the quality and production, by using the results obtained in the comparative culture of competition, during the three years of experimenting. The experimental lots were set in simple grid, with three repetitions and 7 m² croppable lot. The placement of the experiences were made two years after the mash and a year after the potato, on a levigated cernoziomoide soil, with a sandy-arigillous texture, rich in humus and total nitrogen, supplied with mobile potassium and phosphorus, without being necessary the fazial autumnal fertilization, all the more so as at the potato were applied large quantities of chemical fertilizers, and after the mash the vegetable residues were abundant. In the spring, before the plants start the vegetation stage, we administered 30-50 kg N s.a/ha as ammonium nitrate.

The seeding of the experiments was done during the three years, in the optimal stage for the area, by insuring a density of 500 grain germs / m².

The phenological observations made during the vegetation stage on the main physiological features are presented in the paper by the grading system in FAO scale, and the interpretation of the production data and of those obtained after the biometrical analysis were made based on the analysis of variance.

The climatic conditions, appreciated as a whole, during the three years of experimentation were favorable.

The precipitation regime appreciated by the annual precipitation quantity was characterized in the three experimenting years by redundancy which vacillated from 27.9 mm in 2007 to 459.8 mm in 2008 (tab.1).

Regarding the distribution way of the precipitations during the vegetation were signaled in all these years and in different phases, some deficits of until -78.8 mm in the period of the intense vegetation, May-June from 2007, a fact which had a negative influence on the production.

The thermal regime in all the 3 years of experimenting registered average annual values above the multiannual average, a situation which brought to the prominence of some positive annual abnormalities, of over 3.2 °C, abnormalities which produced negative influences on the plants vegetation.

Table 1

The Evolution of climatic conditions in the period 2007-2009 at A.R.D.S. Suceava

The period	2006/ 2007	The abnormality	2007/ 2008	The abnormality	2008/ 2009	The abnormality	The multiannual average
THE PRECIPITATIONS (mm)							
August	211,5	+139,5	135,1	+63,1	72,3	+0,3	72,0
September-October	64,8	-15,5	154,4	+74,1	103,8	+23,5	80,3
November	9,8	-20,7	43,4	+12,9	8,0	-22,5	30,5
December-March	98,9	+3,9	79,8	-15,2	123,4	+28,4	95,0
April	32,9	-14,0	135,2	+88,3	8,4	-38,5	46,9
May – June	84,6	-78,8	190,7	+27,3	237,1	+73,7	163,4
July	105,8	+13,5	301,6	+209,3	120,8	+28,5	92,3
THE TOTAL	608,3	+27,9	1040,2	+459,8	673,8	+93,4	580,4
THE TEMPERATURE (°C)							
August	18,6	+0,6	25,3	+7,3	20,0	+2,0	18,0
September-October	24,8	+2,7	33,7	+11,6	22,7	+0,6	22,1
November	5,2	+2,5	0,9	-1,8	3,8	+1,1	2,7
December-March	11,0	+17,6	4,6	+11,2	-0,6	+6,0	-6,6
April	15,2	+7,0	9,6	+1,4	10,8	+2,6	8,2
May – June	36,2	+5,1	32,1	+1,0	32,4	+1,3	31,1
July	21,5	+2,9	19,2	+0,6	20,4	+1,8	18,6
THE TOTAL	11,0	+3,2	10,4	+2,6	9,1	+1,3	7,8

*) The normal to precipitations is calculated for 86 years

*) The normal at temperatures is calculated for 47 years.

Table 2

The grain production obtained for the rye cultivars and lines, experimented at ARDS Suceava, during 2007-2009

The current number	The genotype	The variation limits kg/ha	The average productions:			The signification
			kg/ha	%	The difference+ kg/ha	
1	Gloria-mt	2988-4731	4086	100	-	
2	Orizont	3117-4923	4292	105	206	
-3	Ergo	3202-4626	4015	98	-71	
4	Suceveana	3811-6512	5488	134	1402	xxx
5	Dankovskie zlote	2304-4805	3693	90	-393	o
6	Sv 6-99	3219-4644	4053	99	-33	
7	Sv Im-98	3314-4934	4112	101	26	
8	Sv 90-CP	3680-5227	4346	106	260	
9	Sv 244-05	3769-5935	4879	119	793	xx

RESULTS AND DISCUSSIONS

The production capacity

The rye cultivars and lines experimented during 3 years, under S.C.D.A. Suceava conditions, realized some productions ranged between 2304 kg/ha at Dankovskie zlote cultivar in 2008 and 6512 kg/ha at Suceveana cultivar in 2009 (table 2). The average production on 3 years

oscillated from 3693 kg/ha at Dankovskie zlote of until 5488 kg/ha at Suceveana cultivar.

Under the aspect of the production capacity were remarked the Suceveana cultivar and the line Sv 244-05 which realized average productions of 5488 kg/ha and respectively of 4879 kg/ha exceeding the production of 4086 kg/ha of Gloria cultivar, used as a witness, with gains insured statistically of 1402 kg/ha and respectively 793 kg/ha, what in relative values represents 34% and respectively 19%.

Table 3

The main physiological features of the cultivars and winter rye lines, tested at ARDS Suceava in the period 2007-2009

The current number	The genotype	The resistance to hibernation-foliar massdestroyed (grades)	The resistance to diseases			The resistance to abscission	The precocity (± days towards the witness at	
			To snow mold	To mildew	To brown rust		The earing	Maturity
1	Gloria-mt	3	4	4	5	5	0 (223 zile)	0 (265 zile)
2	Orizont	4	5	5	5	5	+2	+2
3	Ergo	3	5	5	5	5	+2	+2
4	Suceveana	2	3	3	4	4	-1	-1
5	Dankovskie zlote	4	7	6	6	8	+1	+1
6	Sv 6-99	4	4	3	5	5	+2	0
7	Sv Im -98	3	3	4	4	3	+5	+3
8	Sv 90 - CP	3	4	4	4	3	+6	+3
9	Sv 244-05	2	3	2	4	2	+6	+3

All the other tested cultivars and lines, excepting the Dankovskie zlote cultivar realized productions on the level of the witness cultivar. The Dankovskie zlote cultivar, in the three experimenting years realized a production significantly smaller than the Gloria witness cultivar.

The level of the production potential of the tested cultivars and lines found itself in relationship with the value of the physiological

features and the useful agronomical characters presented hereinafter, in the sense that the productive genotypes are supported in most cases by the improved resistance to diseases and abscission and also to the superiority of some quantitative characters.

Physiological features

The observations made on the physiological features underlined some differences of the

cultivars and lines experimented in the period 2007-2009 (table 3).

The resistance to hibernation, appreciated at the beginning of spring, when the vegetation comes to life, after the degree of the destroyed foliar mass, underlined a behavior relatively similar to the cultivars and lines in this concern, being registered as resistant (grade 2-4).

The resistance to diseases

The rainy and colder weather, specific for the area where is A.R.D.S. Suceava located creates very favorable conditions for the emergence and evolution of diseases.

The snow mold attacked the rye cultures in all the experimenting years but with a smaller intensity, creating damages by reducing the plants density and also the short size lines, Sv-Im-98 and Sv 244-05 (grade 3). The averages of resistance were registered: Orizont and Ergo cultivars (grade 5) and moderate sensible proved to be the high Dankovskie zlote cultivar (grade 7).

The mildew attack manifested even from the early vegetation phases at all the experimented genotypes. In this matter, except for the Orizont, Ergo and Dankovskie zlote cultivars who proved as average resistant (grade 5-6), all the other genotypes manifested a good resistance (grade 2-4).

The brown rust attacked frequently and intensively the rye cultures from the northern part of the country. They behaved as resistant: Suceveana cultivar and the short size lines, Sv-Im-98 and Sv 90 (grade 5-6).

Referring to the disease resistance of the short sized rye forms it must be imposed the almost unanimously opinion of the researchers, that the short forms are usually more sensible to the disease attack than the taller forms. In this case, the lines Sv Im-98, Sv 90-CP and Sv 244-05 with a good resistance to the main foliar diseases, proved during the experimentation from the period 2007-2009, gets a special significance and as a source of resistance genes to the snow mold, mildew and brown rust.

The resistance to abscission is registered as a major importance objective for rye, depending in a bigger proportion of the plant's size than of the straw resistance. The pretty tall size of the rye makes the resistance to abscission to be lower and the level of productions to be frequently diminished. Thus, there have been created new rye lines with shorter size of great productivity and resistance to the increasing abscission. Among the experimented cultivars and lines, Suceveana cultivar and short straw lines, Sv-Im 98, Sv 90-CP and Sv 244-05 succeeded to remark by a good

resistance (grade 2-4), the semi-tall size genotypes, Gloria, Ergo and Sv 6-99 had an average resistance (grade 5). While the tall Dankovskie zlote cultivar proved to be sensible to abscission (grade 8).

The earliness

Under this aspect, all the cultivars and Sv 6-99 line behaved almost very alike to the witness cultivar Gloria, by manifesting an abnormality of 1-2 days towards this one, while the short height cultivars, Sv Im-98, Sv 90-CP and Sv 244-05 proved to be more late with 5-6 days to the earing than the Gloria cultivar, a delay which diminished to 3 days in the maturity stage.

Morphological-productive features

The statistical analysis of the morphological-productive elements, under the aspect of absolute average values and of the variability of the respective features, underlined some differences, between the normal size cultivars and also between these and the short size lines.

Therefore, Suceveana cultivar presented superior values towards the other cultivars regarding the length of the main ear (11.6 cm), the number of ears in the ear (41.4), the number of grains in the ear (56.1), the weight of the grains in the ear (2.7 g), the number of grains at the plant (202.7) and the weight of the grains at the plant (8.8 g) excepting the twinning capacity, the fertility of the main ear and MMB which registered average values slightly reduced (table 4). A disadvantage of Suceveana cultivar is the tall size of the plants which had an average value in the three years of experimenting of 155.8 cm.

Related to the variability of the quantitative characters at tall cultivars, the biometric analysis showed a tight dispersion of the values, attesting therefore a reduced variability for the characters regarding the plants height and the number of ears in the ear. At these characters, the variation coefficients of the cultivars registered small values, from 4.4% until 5.4 for the plants' height and from 4.6% until 13.8% at the number of ears in the ear. The others elements of the productivity characterized by value dispersion a lot more larger, registering variation coefficients of until 40.1% at the twinning capacity and of 37.1% for the weight of the grains at the plant.

In terms of height, the lines Sv6-99, Sv Im-98, Sv 90-CP and Sv 244-05 have characterized by a shorter size of 32.1 in comparison with the tall cultivars, with a lower resistance to abscission, a fact which underlines the existence of the correlation between the smaller size of the plants and the better resistance to abscission (table 5).

Table 4

The variability of the quantitative characters at the cultivars of rye of normal height, created at ARDS Suceava and tested in the period 2007-2009

The current number	Quantitative characters	The parameters of the variation at the cultivars:							
		GLORIA		ORIZONT		ERGO		SUCEVEANA	
		$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %
1.	The plants' size(height) –cm	143,2+1,6	5,1	152,1+ 1,4	4,7	138,4+1,7	5,4	155,8+ 1,2	4,4
2.	Number of fertile siblings/plant	3,2+ 0,1	21,4	2,8+0,3	40,1	3,0+0,3	20,5	2,7+0,2	38,2
3	The main ear's length –cm	9,0+0,3	9,8	9,4+0,4	15,6	10,1+0,3	11,1	11,6+0,6	19,5
4	The number of ears in the ear	35,2+ 0,3	4,6	36,0+0,8	12,4	38,0+0,7	8,7	41,4+1,2	13,8
5	Number of grains in the ear	55,3+ 1,5	15,4	51,5+1,3	13,4	53,5+1,7	16,2	56,1+1,9	22,6
6	The weight of the grains at the ear- g	2,4+ 0,2	29,7	2,4+0,1	24,5	2,1+0,4	33,5	2,7+0,2	31,4
7	The main ear's fertility - %	76,4+ 2,8	19,1	72,6+2,2	16,7	74,9+2,6	17,2	74,7+2,5	20,8
8	The number of the grains at the plant	191,1+ 12,6	21,3	192,0+12,3	18,6	185,8+14,2	28,2	202,7+13,6	25,8
9	The weight of the grains at the plant	7,9+ 0,5	25,6	8,6+0,8	35,8	7,5+0,6	37,1	8,8+0,8	34,2
10	The mass of 1000 beans	38,8+ 0,6	15,9	41,4+1,0	12,5	37,7+0,7	22,4	40,1+0,5	18,4

An important feature of the above-mentioned lines is constituted by the negative correlation between the straw's length and the dimensions of the main morpho-productive characters as: the ear's length, the number and height of the grains, on the ear and on the plant also.

For that matter, the productive superiority of the line Sv 244-05, is especially justified by the higher values than those registered at normal size cultivars, by the twinning capacity (3.7 fertile siblings/plant), by the length of the main ear (11.8 cm) the number of the grains in the ear (62.4), the main ear's fertility (78.6%), the number of the grains at the plant (246.6) and the weight of the grains at the plant (9.6 g).

The larger variability of the characters regarding the main ear's length and fertility, signaled at the rye with short straw, offers real possibilities of selection in order to obtain some new populations of rye with short size and superior values for these quantitative characters.

Quality features

Under the aspect of the physical and chemical features of the production, it has been discovered that the experimented cultivars and lines in the period 2007-2009 showed different values.

The hl mass registered, in relation to the climatic and culture conditions, high average values, from 68.7 kg at Dankovskie zlote cultivar to 73.2 kg at Ergo cultivar, and the mass of 1000

grains oscillated between 37.4 kg for Sv 6-99 line and 41.4 kg at Orizont cultivar.

The experimented cultivars and lines differentiated also regarding the chemical features which registered values at the protein ranged between 11.7% at Sv 6-99 line and 13.4% at Suceveana cultivar, and at the farina-starch between 60.0% at Dankovskie zlote cultivar and 64.3% at Sv 244-05 line.

CONCLUSIONS

The experimental data from the 3 years of testing show that most of the rye cultivars and lines which were verified are valuable have a good behavior in the vegetation and a great capacity of production.

Among the cultivars stood up Suceveana which distinguished itself by a high stability of the crops and a good behavior in the vegetation, due especially to hibernation and diseases resistance, differently from the snow mold and also a good resistance to abscission.

Among the experimented lines, the most valuable one proved to be Sv 244-05 line which realized a higher average production in comparison with the witness cultivar, concretized by a significant distinct gain of 19% (793 kg/ha).

Until the homologation, the introduction and generalization in the production of some new more valuable autumn rye cultivars, we recommend continuing the culture of Suceveana cultivar.

Table 5

The quality features of the production at the rye cultivars and lines, tested at ARDS Suceava, in the period 2007-2009

The current number	Quantitative characters	The parameters of the variation at the lines							
		Sv 6-99		Sv 1m-98		Sv 90 - CP		Sv 244-05	
		$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %	$\bar{x} + S \bar{x}$	S %
1	The plants' size(height) –cm	132,2+1,9	6,7	128,1+ 1,8	7,3	127,0+1,7	8,3	123,7+ 2,3	8,6
2	Number of fertile siblings/plant	2,8+ 0,1	14,7	3,4+0,2	16,5	3,2+0,2	21,4	3,7+0,2	18,7
3	The main ear's length –cm	11,5+ 0,5	14,4	10,2+0,2	7,8	12,3+0,6	29,8	11,8+0,5	25,4
4	The number of ears in the ear	39,4+ 0,4	5,7	40,9+0,9	12,5	40,4+0,7	8,6	41,3+1,1	15,2
5	Number of grains in the ear	52,7+ 1,8	12,7	60,3+1,8	14,2	55,6+1,7	13,1	62,4+1,9	17,9
6	The weight of the grains at the ear- g	2,0+ 0,3	21,5	2,0+0,1	16,1	2,3+0,5	34,3	2,5+0,4	30,1
7	The main ear's fertility - %	77,5+ 1,9	14,0	72,1+2,1	18,3	75,4+2,7	27,2	78,6+2,5	21,4
8	The number of the grains at the plant	197,9+15,1	25,3	231,1+12,3	19,1	217,3+14,1	18,6	246,6+13,2	24,7
9	The weight of the grains at the plant	8,1+ 0,5	35,3	7,6+0,4	22,9	8,5+0,9	24,2	9,6+0,5	32,1
10	The mass of 1000 beans	37,4+ 0,9	21,0	37,6+0,6	16,3	38,7+0,9	18,4	41,0+1,2	23,7

*The grading was made in FAO scale: 1-very resistant, 9- very sensible

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