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Comparative characterization of cereal varieties in conditions of initial seed production

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ABSTRACT

The survey was conducted during the period 2014-2016 in IPGR Sadovo. Varieties were grown in conditions of initial seed production. The aim of the investigation was a comparative study of second year progeny and preliminary generations. For estimating the variants and for establishing the differences between varieties in the trial there were used dispersion and variance analysis. The results show that common winter wheat varieties (*Triticum aestivum* L.) Geya 1, Fermer and Tsarevets have shown higher seed yield relative to the standard Sadovo 1. A low variation in the average seed yield has been established regarding Unak variety. By this indicator it shows similarity with the standard variety. By the analysis of agro-meteorological data for the period of crop vegetation there were no registries of significant differences between the years of testing. However, we have a reason to assume that the results are based on both differences in genotype of the studied variants and on the environmental conditions.

Key words: comparative study, cereal varieties, initial seed production, seed yield

Introduction

Cereals are of paramount importance to feed the population. Typical for them are the presence arise of huge biodiversity as the result of natural factors and breeding.

The main factors for achieving effective management of agricultural systems as appropriate are the choice of crop and variety as well as guaranteed high quality of seeds used for sowing.

Of great importance for conservation of genetic characteristics of varieties is to conduct precision seed production in controlling and in compliance with accepted standards to ensure high value of germination and purity of species.

In Bulgarian legislation according to decree № 45 (State Gazette RB, 2003) requirements for certified seeds for basic category (B) are minimum germination 85% and minimum analytical purity by weight of 99%. For determination of seed certified as first and second generation (C1 and C2) should meet the minimum requirements for germination 85% and 98% of analytical quality.

The varietal purity, determined by decree № 21 (State Gazette RB, 2008), by which the Bulgarian legislation is synchronized with the EU, requires varietal purity of basic seeds – 99,9%, certified C1 – 99,7% and certified C2 – 99,0

% for oats, barley, rice, durum wheat, common winter wheat and spelt crops.

The varietal purity is established by field inspections.

For preventing of the biological contamination of the variety, resulting of crop crossing, is necessary observing the spatial isolation, that for the basic seeds (B) common winter wheat, spelt, einkorn and emmer, barley, oats, rice is 1 m, for durum wheat - 3 m, millet, varieties without hybrids of rye - 300 m, certified seeds - 250 m, triticale basic seeds - 50 m, certified - 20 m (State Gazette RB, 2008).

The success of production and formation of stable yields require maintenance of a rich set of varieties suited to the specific conditions in the regions of the country and satisfy as much as possible requirements of farmers.

The aim of this study is a comparative estimate of cereal varietal and identification of differences in terms of initial seed production.

Materials and Methods

The survey was conducted in the period 2014-2016 in the experimental fields of IPGR Sadovo.

The plants were grown at soil type leached black earth, overlapped with carbonaceous materials, and at some places encountered cinnamon forest soils. Before the sowing in March it was committed fertilization of areas under 20 kg NP and 35 kg/da ammonium nitrate.

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Table 1. Average daily temperatures during the study period

Year	IX	X	XI	XII	I	II	III	IV	V	VI	VII	Average
2013/2014	18.0	10.7	8.9	1.1	2.9	5.3	9.1	11.9	17.3	21.2	23.7	11.8
2014/2015	11.9	10.1	8.7	3.9	3.8	3.5	6.6	12.2	17.3	21.3	25.9	11.4
2015/2016	19.0	12.8	10.8	7.5	-0.8	7.5	9.6	15.3	16.1	23.1	26.0	13.4
Average for the period	16.3	11.2	9.5	4.2	2.0	5.5	8.4	13.2	16.9	21.9	25.2	12.2
Average for the period 1931 – 2000	18.9	12.6	6.9	2.1	-4.3	2.4	6.3	12.2	17.5	21.2	23.3	10.8
Deviation	-2.6	-1.4	+2.6	+2.1	+6.3	+3.1	+2.1	+1.0	-0.6	+0.7	+1.9	+1.4

Table 2. Amount rainfall by months for the period of study

Year	IX	X	XI	XII	I	II	III	IV	V	VI	VII	Total
2013/2014	8.8	26.4	51.6	9.2	25.6	6.9	94.9	91.4	58.4	104.5	77.2	554.9
2014/2015	193.0	149.0	48.5	124.9	22.4	80.0	135.4	13.0	70.3	111.5	17.5	965.5
2015/2016	109.3	62.9	50.7	1.9	190.3	26.7	35.1	42.8	130.0	32.9	13.1	695.7
Average for the period	103.7	79.4	50.3	45.3	79.4	37.9	88.5	49.1	86.2	83.0	35.9	738.7
Average for the period 1931 – 2000	34.2	37.4	47.1	49.7	39.3	30.9	39.0	42.9	56.8	58.4	46.4	482.1
Deviation	+69.5	+42.0	+3.2	- 4.4	+40.1	+7.0	+49.5	+6.2	+29.4	+24.6	-10.5	+256.6

Table 3. Comparative assessment of average seed yield of cereal crops

Crops	Variety	2014	2015	2016	\bar{x}	St.dev.	CV%	$\bar{x} \pm S_x$	$S_x \%$
Wheat	1 Sadovo 1 St	236	170	222	210	34.78	16.56	20.08	9.56
	2 Tsarevets	264	288	362	304	51.08	16.80	29.49	9.70
	3 Boryana	287	289	207	261	46.78	17.92	27.01	10.35
	4 Yunak	312	280	240	277	36.07	13.01	20.83	7.51
	5 Victory	154	242	200	199	44.02	22.16	25.41	12.79
	6 Diamond	313	298	216	275	52.21	18.99	30.15	10.96
	7 Sadovo 772	169	244	300	237	65.73	27.73	37.95	16.01
	8 Geya 1	256	299	356	304	50.16	16.52	28.96	9.54
	9 KM 135	319	231	222	258	53.59	20.77	30.94	11.99
	10 Farmer	389	255	370	338	72.51	21.45	41.86	12.38
	11 Denitsa	261	185	250	232	41.07	17.70	23.71	10.22
	12 Murgavets	208	231	250	230	21.03	9.16	12.14	5.29
Total for wheat		264	251	266	260	59.53	22.86	19.30	3.86
Rye	Millennium	185	231	250	222	33.42	15.05	43.97	8.69
Triticale	Rozhen	329	185	300	271	76.16	28.07	26.16	16.21
Oat	Kaloyan	77	150	160	129	45.31	35.12	42.94	20.28
Barley	Potok	236	93	200	176	74.38	42.18	9.67	24.35
Crops	Total	250	230	257	245	67.02	27.33	43.97	3.94

In the study were included varieties of *Triticum aestivum* L. - Sadovo 1, Tsarevets, Boryana, Yunak, Diamant, Pobeda, Sadovo 772, Geya 1, KM 135, Farmer, characterized by a beard with awns, and were set in comparative testing for II year offspring at 11 m² plots (Figure 1).

Variety ordinary winter wheat Murgavetz (*Triticum aestivum* L.), variety durum wheat Denitsa (*Triticum durum*

L.), variety rye Millennium (*Secale cereale* L.), triticale variety Rozhen (*Triticosecale*), double-row winter barley variety Potok (*Hordeum vulgare* L.) and weeding oats variety Kaloyan (*Avena sativa* L.) were studied as preliminary generations by 2,5 da by cultivar (Figure 2).

For conducting the experience, the principles of spatial isolation of crops were kept (MAFI, 1977).



Figure 1. General view of sowing of ordinary winter wheat (IPGR Sadovo).



Figure 2. Cereal crops - preliminary generations (IPGR Sadovo).

The harvesting is done with the plot combine HEGE 160, according to the methodology. The discarded offspring are excluded from the formation of the seed yield. The seeds are cleaned of PETKUS FORTSCHRITT K 541 SUPER. Broken fractions, shriveled grains, damaged by pests and foreign impurities are separated as a breeze and not included in the yield (EC, 2000). The studied genotypes were evaluated comprehensively by parameters of seed yield and stability. The repeats were representing by years of reporting. For processing of the data from evaluation package for mathematical and statistical analysis SPSS 19 were used. For evaluating the variants by standard variety Sadovo 1 and for establishing the differences between varieties in the trial were used dispersion and variance analysis (Dimova & Marinkov, 1999).

Results

In the analysis of agro-meteorological data for the period of crop vegetation there were no significant differences between years of the study (Tables 1, 2). The period of investigation is characterized by a significantly higher temperatures and rainfall of the characteristic for the region. The spring growing and the period of filling and ripening of the grain at crops were leaked at higher temperatures than usual near the town of Sadovo. A comparative assessment of the cereal varieties, included in the study was presented in Table 3.

From all tested genotypes the wheat variety Murgavetz features the lowest coefficient of variation (9.16%), followed by Unak (13.01%), which is a reason to accept their seed yield like a stable throughout the study period.

Variety Geya 1 shows the trend of increased seed yield in the tested three years period and it is characterized by an average variation in the trait.

The standard variety Sadovo 1 has the highest seed yield in 2014 (236 kg/da) and the lowest in 2015 (170 kg/da). It shows an average variation in the feature (16.56%). Variety Farmer is characterized by the highest seed yield (338 kg/da) average for the period in terms of the city of Sadovo.

In the group of other cereals is observed high variability in seed yield (over 20%). The exception is rye variety Millennium, which is characterized by a mean stability for the trait. The results of dispersion analysis of the survey data of wheat genotypes indicate that variety Farmer shows very well provided evidence of a difference than the standard variety (Table 4). For Tsarevets and Geya 1 the results were recorded higher yield of seeds, and the differences compared Sadovo 1 have been established in GD 5%. Discussing the results of the survey and analysis of agro-meteorological data give a reason to assume that the results are based on both differences in genotype of the studied variants and on the environmental conditions.

Table 4. Differences to standard regarding seed yield in wheat varieties.

Variety	Yield of seeds (kg/da)	Difference	Prove
Sadovo 1 <i>St</i>	210	0	n.s
Tsarevets	304	96	*
Boryana	261	52	n.s.
Unak	277	68	n.s.
Victory	199	-11	n.s.
Diamant	275	66	n.s.
Sadovo 772	237	28	n.s.
Geya 1	304	94	*
KM 135	258	48	n.s.
Farmer	338	128	**
	GD	5.0 %	93
		1.0 %	128
		0.1 %	174

Conclusions

Variety Farmer has proven higher yield than cultivar Sadovo 1, but showed high variability of the trait during the study period.

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Variety Unak is characterized with lower and within the average variation of seed yield in the years. By the trait the cultivar gives similar yield of seeds with standard Sadovo 1 and could be used equally with him for seed production.

The varieties Tsarevets and Geya 1 are characterized by higher yield of seeds as compared with the standard, such as exhibited similar stability to the Sadovo 1 with respect to the variation of the trait over the three years.

Rye variety Millennium exhibits an average yield stability in terms yield of seeds.

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