ПОЧВОЗНАНИЕ АГРОХИМИЯ И ЕКОЛОГИЯ, ГОД. XLVIII, № 3-4
SOIL SCIENCE AGROCHEMISTRY AND ECOLOGY, VOL. XLVIII, № 3-4
София. 2014. Sofia

IVAN STANKOV*, IVAN YANCHEV, TSVETANKA RAYCHEVA****
**Seedsman's House "Sadovo", Sadovo, Bulgaria*
***Agricultural University, Plovdiv, Bulgaria*

A New Stage of *Triticale* Breeding and Production in Bulgaria

Abstract

The first intensive genetic types of triticale forage grain have been obtained in results of wide breeding activities for cultivar improvement. Since 2000 the research has entered a new stage of serving the grain production in the country under the market economy conditions. The studies have been carried out in demonstration trials conducted by the first in the country private Seed House of Sadovo. Climatic changes related to the increasing frequencies of droughts in many of the grain producing areas in the world as a result of the global warming, set new challenges to the breeders and producers of triticale grain. Under the conditions of water deficit, the market demands require not only preserving, but also increasing the amount of the produced grain.

The presented results of the study carried out on the triticale cultivars Sadovets and Rozhen, refer for a five-year period in average, and, on the new genetic types Musala and Hemus – for a three-year study period in average. Sadovo 1 cultivar was used as a standard. A comparative characteristic of the productivity of triticale cultivars in different regions of the country was made. The results obtained showed the advantages of the studied new triticale cultivars of the rye type, especially concerning their productivity, which exceeded that of the standard by 118.3% for Rozhen and by 124.4% for Musala cultivar, respectively.

The high yields of the new triticale genetic types are an advantage under extreme drought conditions. Triticale cultivars exceed wheat in absolute weight but fall behind in hectoliter weight.

Key words: Triticale, selection and production

Introduction

The fist triticale cultivars for the production needs of Bulgaria were established at Dobrudja Agricultural Institute in General Toshevo, at the Institute of Genetics in Sofia, etc. The most important achievements are the cultivars Vihren, Persenk, Rakita, Zaryad, Perun, Priboy, Apogey, Kolorit, etc. The new primary amphidiploid (2n = 56) with the participation of Indian shot wheat *Triticum sphaerococcum* Perc., was synthesized for the first time at the Institute of Plant and Genetic Resources in Sadovo at the beginning of 80s of the last century in the frames of the distant hybridization programme (Popov and Stankov, 1979; 1980).

Later on, the efforts in breeding new triticale cultivars were concentrated on the establishment of secondary hexaploid genetic types, applying different hybridization schemes (Stankov, 1989). Studies were aimed at various aspects (Popov et al., 1981; Popov et al., 1982; Stankov and Stankova, 1991; Stankov and Stankova, 2001).

As a result of the vast breeding work on cultivar improvement, the first intensive triticale feed grain genetic types were obtained (Stankov et al., 1994; Stankov et al., 1995, Mangova and Stankov, 1990; 2002; Stankov, 1985; Stankova and Stankov, 2002a; Stankova and Stankov, 2002b) etc.

Since 2000 the research on triticale has entered a new stage, supporting grain production in the country. Studies have been realized under the market economy conditions and carried out at the first private Seed House in Sadovo.

Climatic changes related to the increased frequency of droughts in many grain producing areas

Table 1. Mean values of Triticale varieties (kg/ha) in 2003 – 2008 years

Varieties	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	Average	%
Sadovo 1	4040 b	5500 a	4950 a	4900 c	3410 a	4730 a	4588	100.0
Sadovest	4770 c	5800 b	4900 a	4750 b	3860 b	4820 b	4817	105.0
Rozhen	**3990** a	6360 c	5270 b	4150 a	4100 c	4990 c	**4810**	108.4
LSD 5%	*45.0*	*258.0*	*134.0*	*141.0*	*218.0*	*88.0*		

Table 2. Average yields of new Triticale genotypes in 2006 – 2008 years

Varieties	**2006**	**2007**	**2008**	Average	%
Sadovo 1	4700 c	3280 a	4720 b	4233	100.0
Musala	4350 a	4240 c	4690 a	4427	104.6
Hemus	4450 b	3780 b	4710 b	4313	101.9
LSD 5%	*95.0*	*116.0*	*16.0*		

Table 3. Average yields (kg/ha) of Triticale varieties in different regions of Bulgaria in 2007 year

№	Varieties	**Plovdiv**	**Haskovo**	**Stara Zagora**	**Sliven**	**Burgas**	**Yambol**	Average yield	%
1.	Sadovo 1 – St.	2410 a	3770 b	4850 c	3800 a	3500 a	2120 a	3408	100.0
2.	Sadovest – Triticale	3790 c	3970 c	4760 b	4400 b	4100 c	2120 a	3850	113.2
3.	Rozhen– Triticale	3790 c	4350 e	4760 b	5300 d	3800 b	2180 b	4030	118.3
4.	Hemus – Triticale	3450 b	3310 a	4640 a	4400 b	4800 d	2100 a	3780	111.0
5.	Musala– Triticale	4140 d	4260 d	5300 d	4600 c	4860 e	2270 c	4230	124.4
	LSD 5%	*114.0*	*96.0*	*55.6*	*160.0*	*48.0*	*83.0*		

Table 4. Average yields (kg/ha) of Triticale varieties in different regions of Bulgaria in 2008 year

№	Varieties	**Plovdiv**	**Stara Zagora**	**Vidin 1**	**Vidin 2**	**Varna**	**Burgas**	**Pleven**	**Razgrad**	Average yield	%
1.	Sadovo 1 – St.	3720 c	5060 c	5030 b	3500 a	2980 c	5600 a	4920 a	5940 a	4590	100.0
2.	Sadovest – Triticale	2910 b	**4100** a	4800 a	4700 b	2680 b	6400 b	5100 b	7130 b	**4728**	102.0
3.	Rozhen– Triticale	2780 a	**4500** b	5050 b	4600 b	2980 c	6300 b	5880 b	7330 c	**4927**	105.6
4.	Hemus – Triticale	2930 b	4580 b	4700 a	4200 b	2920 c	6100 b	4850 a	7390 c	4710	102.5
5.	Musala– Triticale	2740 a	3080 a	4850 a	4000 b	2380 a	6200 b	6750 c	7520 d	4690	102.1
	LSD 5%	*125.0*	*164.0*	*144.0*	*350.0*	*86.0*	*430.0*	*98.0*	*120.0*		

Table 5. Absolute and hectolitre weight of Triticale genotips

Varieties	Absolute weight, g			Hectolitre weight, kg		
	2006	**2007**	**average**	**2006**	**2007**	**average**
Sadovo 1	48.6 b	40.8 a	44.7	74.7 b	75.8 b	75.3
Sadovets	50.4 b	42.9 b	46.7	66.4 a	69.7 a	68.1
Rozhen	51.7 b	41.4 a b	46.6	67.4 a	67.1 a	67.3
Hemus	44.2 a	45.7 c	45.0	64.6 a	68.1 a	66.4
Musala	50.8 b	43.4 b c	47.1	68.9 a	69.2 a	69.1
LSD 5%	*4.3*	*1.2*		*4.7*	*6.1*	

throughout the world placed new challenges to the breeders and producers of triticale grain. Under the conditions of water deficit, the market demands require not only maintaining but also increasing the amount of the grain produced.

The present paper presents the results of the studies on some new genetic types of triticale in different regions of the country with the aim of their introduction into production.

Material and Methods

Initially the triticale cultivars Sadovets (of a wheat type) and Rozhen (of a rye type), bred at the Institute of Plant Genetic Resources in Sadovo, were included in the study, and, later the new genetic types Musala (of a rye type) and Hemus (of a wheat type) were also investigated. They were all compared to the standard wheat cultivar Sadovo 1.

Results and Discussion

Six-year results of the yields of the two popular triticale cultivars Sadovets and Rozhen were presented in Table 1. The yield of Sadovets cultivar varied within 3860 – 5800 kg/ha, the average one being 4817 kg/ha (150.0%). The lowest result was reported in 2007, which was among the driest years in history of Bulgarian agriculture.

The best results were reported for Rozhen cultivar, the average yield for a five-year period being 4974 kg/ha (108.4%), varying in the separate years from 4100 to 6360 kg/ha. The lowest yield of that cultivar was also obtained in 2007. The most favorable conditions for the two triticale cultivars were established in 2004 and 2005. Rozhen cultivar was included in the varietal list of our country in 2008.

Table 2 presents the three-year results of the new genetic types of triticale Musala and Hemus. The best result was reported for Musala cultivar of the rye type: its average yield being 4427 kg/ha (104.6%) and that of Hemus cultivar – 4313 kg/ha (101.9%).

The behavior of the triticale cultivars under extreme drought stress in 2007 in different regions of South Bulgaria was presented in Table 3. Under those conditions triticale genetic types exceeded in yield the standard wheat cultivar Sadovo 1, the best results being achieved for the cultivars of the rye type: Rozhen (118.3%) and especially Musala (124.4%).

Table 4 presents the behavior of those genetic types of triticale in 8 different regions of our country in 2008, when the conditions for grain production were normal. The highest results were obtained in Chudomir village, region of Razgrad, North-Eastern Bulgaria, where the yields varied within 7130 – 7540 kg/ha. In South Bulgaria, comparatively high yields varying from 6100 to 6400 kg/ha, were obtained in the town of Aytos, Burgas region. Very good results were established in North Central Bulgaria in the town of Slavyanovo, Pleven region, the yields varying from 4850 to 6750 kg/ha, and in North Western Bulgaria in the region of the town of Vidin. The lowest yields were reported for the region of Varna and Plovdiv, where the plants did not develop enough tillers due to the late sowing date. What is more, the trial in Varna was not fertilized and weed control was not carried out.

Data in Table 5 show that Triticale genetic types exceeded in absolute grain weight the standard Sadovo 1, but significantly dropped behind it in hectoliter grain weight.

Conclusions

The many-year experimental results show that the studied genetic types of Triticale demonstrate an explicit advantage in productivity compared to the standard wheat cultivar Sadovo 1. It was most obviously expressed under extreme drought conditions, especially by the rye type triticale cultivars.

Triticale cultivars have an advantage over wheat ones in absolute grain weight but step behind in hectoliter weight.

References

Mangova, M. and Stankov, I. 1990. Study on the technological properties of grain at heksaploid forms *Triticale*. *Plant Science*, 27(5), 21-24 (BG)

Mangova, M. and Stankov, I. 2002. Quality traits in *Triticale* heksaploid genotypes. Anniversary Scientific Session, Sadovo, Bulgaria, 262-264

Popov, P. and Stankov, I. 1979. A new amphidiploids obtained with the participation of *Triticum sphaerococcum* and *Secale sereale* (2n = 14). Bulgarian Academy of Sciences, 32(1), 119-122

Popov, P. and Stankov, I. 1980. A new amphidiploid (2n = 56) with the participacion of *Triticum sphaerococcum* and *Secale sereale. Hodowla Roslin Klimatizacija i Nasiennictwo*, 24, 5, 551-557

Popov, P., Kostov, K., Stankov, I., Stankova, P. 1981. Possibilities to use triticale as a source of vegetable protein in livestock. *Plant Science*, 18, № 7, 103-107 (BG)

Popov, P., Stankova, P. and Stankov, I. 1982. Photosynthesizing area and clean productivity of photosynthesis in hexaploid forms of triticale. *Plant Science*, 19, № 3, 83-87 (BG)

Stankov, I. 1985. Main directions and aspects in *Triticale* breeding. Eucarpia meeting, Clermon Ferrand, France, INRA, Paris, 389-397

Stankov, I. 1989. Studies on some biological and economic qualities of new *Triticale* varieties. *Plant Science*, 15(10), 36-41 (BG)

Stankov, I., Stankova, P. and Tsvetanov, S. 1994. Analysis of some structural elements of yield on new varieties and *Triticale* heksaploid lines. *Plant Science*, 32(6), 100-101 (BG)

Stankov, I., Stankova, P. and Tsvetanov, S. 1995. Biological and economic properties of new hexaploid *Triticale* cultivars and lines. Eucarpia ITA, International Triticale Syposium, volume of Abstracts, F 25, Lisbon, Portugal.

Stankov, I. and Stankova, P. 1991. New results in the breeding of hexaploid *Triticale*. Second International Triticale Symposium, Passo Fundo, Brazil, 583-585

Stankova, P. and Stankov, I. 2001. Correlation between economic and biological yield some cereals in terms of soil drought. Anniversary Scientific Session, General Toshevo, Dobrich district, Bulgaria, 168-175

Stankova, P. and Stankov, I. 2002a. Selection of new *Triticale* genotypes with improved tolerance to drought. Anniversary Scientific Session, Sadovo, Bulgaria, 13-16

Stankov, I. and Stankova, P. 2002b. State of a selection of *Triticale* field of feed grain. Anniversary Scientific Session, Sadovo, Bulgaria, 24-28

Нов етап в селекцията и производството на Triticale в България

И. Станков*, И. Янчев**, Ц. Райчева**

**Семенарска къща „Садово", Садово*
***Аграрен университет, Пловдив*

Резюме

В резултат на широка селекционно-подобрителната работа са получени първите интензивни генотипове тритикале с направление за фуражно зърно. След 2000 г. изследователската работа навлезе в нов етап, обслужващ зърненото производство в страната, който се осъществява в условията на пазарно стопанство. Проучванията са проведени в демонстративни опити на първата в страната частна Семенарска къща „Садово". Промяната на климата, свързана със зачестяване и засилване на засушаванията в много зърнопроизводителни райони на света, като резултат от глобалното затопляне, поставя нови предизвикателства пред селекционерите и производителите на зърно от тритикале. В условията на воден дефицит нуждите на пазара налагат не само запазване, но и повишаване количеството произведено зърно.

Представени са резултатите от проучванията върху изпитани сортове тритикале Садовец и Рожен – средно от пет години на изследване и техни нови генотипове – Мусала и Хемус, средно от три години на изследване. За стандарт е ползвана пшеница сорт Садово 1.

Извършена е сравнителна характеристика на продуктивността на сортовете тритикале в различни региони на страната. Получените резултати представят предимството на изпитаните нови генотипове тритикале от ръжен тип по отношение на продуктивността им, която превишава тази на стандарта, съответно 118,3% (Рожен) и 124,4% (Мусала).

Високите добиви от новите генотипове тритикале имат предимство при екстремни стресови условия на суша. Сортовете тритикале превъзхождат пшениците по абсолютна маса, но й отстъпват по хектолитрова маса.