PRODUCTIVITY OF VARIOUS VARIETIES OF SPRING DURUM WHEAT IN THE CONDITIONS OF THE CENTRAL ZONE OF ORENBURG REGION

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Abstract. Spring wheat is one of the most important food grain crops. Hard spring wheat is used to produce cereals, pasta and vermicelli. The grain of this crop contains a lot of protein (14-16% soft, 15-18% hard) and gluten-28-40%.

This crop is grown mainly in the following regions: the Volga region, the Southern Urals, Western and Eastern Siberia. Average yields are obtained here due to lack of moisture, but the grain contains a lot of protein and gluten. When growing it in the Non-Chernozem zone, higher yields are obtained, but the quantity and quality of gluten is usually lower. In those regions (the North Caucasus, the Central Asian Republic) where winter wheat yields higher yields, spring wheat is considered one of the insurance products in case of its re-sowing in case of poor wintering.

Keywords: spring wheat, cultivation technology, sod podzolic soils, drought-resistant crops.

1. Scheme of experiment and research methodology

Research work was carried out at the department of agrotechnologies, botany and plant breeding in 2019 in the conditions of educational and experimental field of the Orenburg State Agrarian University [1, 2-7, 10]. A single-factor experiment with different varieties of spring durum wheat was laid. Scheme of the experiment:

1. Tverdynya (control);
2. Rusticano;
3. Golden;
4. Bezenchukskaya 210.

The experiment was conducted in triple replication, the accounting plot area was 60 sq. m. Soil of the research site was southern chernozem, medium-power, carbonate, heavy loamy with humus content of 4.4%, labile phosphorus - 4.5%, nitrate nitrogen - 1.35, exchangeable potassium - 35 mg per 100 g of soil. The reaction of the soil solution is slightly alkaline (pH=7.8).

1. Weight seeding rates were calculated taking into account the sowing qualities of seeds taken from the certificate of seed condition. The numerical rate index was adopted as 4.0 million germinating seeds per hectare. Calculation of the seeding rate is carried out according to the formula:

\[ NW = \frac{A \times M_{1000} \times 100}{1000} \]

where

- \( NW \) is the number of seeds per hectare;
- \( A \) is the area of the plot in hectares;
- \( M_{1000} \) is the weight of 1000 seeds in grams.
NW – weight norm of seed sowing, kg/ha;
A - index of numerical rate, millions of germinating seeds per 1 hectare;
M_{1000} – mass of 1000 grains, grams;
SC – sowing capacity, %.

SC = \frac{P \times G}{100},

where:
P – seed purity, %;
G – seed germination, %.

In 2018, seeds of spring wheat variety Rusticano had 99% purity, germination - 96%, weight of 1000 seeds 35.8 g. The sowing capacity was 95%.

The weight rate of seeding at 4.5 m/ha was 160 kg/ha.

2. The following phenological phases of development were noted in the experiment: shoots, tillering, emerging into the tube, earing, flowering, milky ripeness, waxy ripeness, and full ripeness. The beginning of the phase was the date when 10% of the plants had signs of this phase, and the full onset was not less than 75% [5-9].

3. Field germination was calculated by dividing the number of sprouted plants per square meter by the number of sown germinated seeds and expressed as a percentage.

4. Before harvesting by counting and dividing the number of surviving plants per 1 sq. m. by the number of emerged seedlings was determined.

5. Biological yield and yield structure were determined by selecting, counting and analyzing plants from 1 square meter taken before harvesting [10-14].

6. Determination of gluten, its quantity and quality. Gluten is a protein substance of wheat grain, which is obtained by washing the dough in water. The optimum ratio of gluten in the grain gives good bread. Gluten consists of two forms of proteins: gliadin and glutenin. To determine the quantity and quality of gluten, you need to take 30 grams of grain, pass them through a mill, that is prepared from the grain meal, from which weighed 25 grams, add them 14 ml of water having a room temperature of 18 - 20 °C. Then they knead the dough, roll it into a ball and put it to stand for 20 minutes. After twenty minutes, begin to wash away the gluten in the water. The process is continued until it stops clouding the water and separating the shells. The washed gluten is then determined as a percentage of the total weight of the sample, this is the amount of gluten. Then they begin to determine the quality of gluten: weighed 4 grams from the total gluten, rolled into a ball and put in water for 15 minutes to stand. After 15 minutes determine the quality of gluten on the device PEC-ZA and record the deviation of the pointer [15-19, 21-25].

7. Determination of the natural mass. Grain is poured into the cylinder, from the ladle in an even stream, without shocks, up to the line inside the cylinder, indicating the capacity of the filler. The knife is quickly, without shaking the device, removed from the slot and after the load and grain fall into the measure, the knife is again inserted into the slot with the same precautions. Separate grains, which at the end of the knife movement will fall between the blade of the knife and the edges of the slit are cut with the knife. The measure together with the filler is removed from the nest, overturned, holding the knife and filler, and the excess grain remaining on the knife is poured. Remove the filler, remove the grains lingering on the knife and take the knife out of the slot. The measure with the grain is weighed and the natural mass is set. Weighing of grain when determining the natural weight on the liter purke is made with an accuracy of 0.5 g. [20, 24-32].

8. Mathematical processing of the results was carried out by method of analysis of variance according to B.A. Dospekhov on a PC.

In the autumn period, moldboard tillage was carried out to a depth of 25-27 cm. In the third decade of April, when the physical ripeness of the soil approached, the moisture was covered in two trails with harrows BZSS - 1.0. Presowing cultivation was carried out on May 21 with a KPS - 4 cultivator to a depth of 5 - 6 cm.
In 2019, sowing was carried out on 21 May with a seeding rate of 4.5 million germinated seeds per hectare at a depth of 5 - 6 cm, the Austrian Wintersteiger seeder. Harvesting was carried out by Terrion 2010 combine in the phase of full grain ripeness on September 5, 2019. In 2019, during the sowing-sprouting period, favorable weather conditions were formed for swelling and germination of seeds. Therefore, the field germination of spring wheat seeds was high and amounted to 90.8% (Table 1).

Table 1. Field germination, safety and overall survival of spring durum wheat in 2019

| Sorts          | Number of sown germinating seeds pcs. / 1 sq. m | Number of emerged plants per square meter | Number of plants saved for harvesting pcs./ per 1 sq. m | Field germination, % | Preservation of plants, % | Overall survival rate, % |
|---------------|-----------------------------------------------|------------------------------------------|--------------------------------------------------------|-----------------------|----------------------------|--------------------------|
| Tverdynya (c) | 450                                           | 410                                      | 340                                                   | 91.1                  | 82.9                       | 75.6                     |
| Rusticano     | 450                                           | 400                                      | 384                                                   | 88.9                  | 96.0                       | 85.3                     |
| Golden        | 450                                           | 400                                      | 354                                                   | 88.9                  | 88.5                       | 78.7                     |
| Bezenchukskaya 210 | 450                                           | 425                                      | 374                                                   | 94.4                  | 88.0                       | 83.1                     |

Field germination of spring wheat varieties was different. The lowest it was in varieties Rusticano and Golden and amounted to 88.9%. The highest field germination of 94.4% was observed in the variety Bezenchukskaya 210, which is 3.3% more than in the control variety Tverdynya.

The highest number of surviving 384 pcs/m² was noted in the variety Rusticano, then the variety Bezenchukskaya 210 - 374 pcs/m². The least number of plants for harvesting was retained in the variety Tverdynya - 340 pcs/m². In this regard, the preservation of plants varied in the context of varieties as well. The highest it was in the variety Rusticano - 96.0%, and the lowest - 82.9% - in the variety Tverdynya.

Productive bushiness is one of the main elements of the yield structure. Productive bushiness on average in the experiment was 0.85 units and was quite low even for our arid region (Table 2).

If the total number of stems was the highest in the variety Rusticano, the number of productive stems was the smallest - 169 pcs./m². At the same time, the number of productive stems was 333 and 347 pcs./m², respectively, in the varieties Tverdynya and Golden. The highest number of productive stems 367 pcs./m² was formed the variety Bezenchukskaya 210. Therefore, the lowest productive bushiness 0.44 units, marked in the variety Rusticano, and in other studied varieties - 0.98 units. This indicates that the Italian Rusticano variety is not well suited for our harsh natural and climatic conditions.

Table 2. Total and productive bushiness of spring wheat in 2019.

| Sorts          | Number of plants saved for harvesting, pcs./m² | Total number of stems, pcs./m² | Number of productive stems, pcs./m² | Overall bushiness | Productive bushiness |
|---------------|-----------------------------------------------|--------------------------------|--------------------------------------|-------------------|----------------------|
| Tverdynya (c) | 340                                           | 340                            | 333                                  | 1.0               | 0.98                 |
| Rusticano     | 384                                           | 384                            | 169                                  | 1.0               | 0.44                 |
| Golden        | 354                                           | 354                            | 347                                  | 1.0               | 0.98                 |
| Bezenchukskaya 210 | 374                                           | 374                            | 367                                  | 1.0               | 0.98                 |

The value of total bushiness in all studied variants was 1.0 units.
The lowest biological yield of 0.15 c/ha was obtained in the variety Rusticano. The lowest yield was obtained due to the lowest number of productive stems 169 pcs/m2, the number of grains in the ear 1 pc. and the mass of 1000 grains 8.9 grams. For example, the biological yield of the varieties Tverdynya and Golden was 4.7 and 7.1 c/ha.

The highest yield of 15.2 c/ha was obtained in the variety Bezenchukskaya 210. The highest yield was obtained due to the highest number of productive stems 367 pcs/m2, the highest number of grains in the ear 14 pc. and the highest mass of 1000 grains 29.6 gr.

Economic yield similar to the biological yield also varied depending on the studied wheat varieties. It was highest in the variety Bezenchukskaya 210 and lowest in the variety Rusticano.

In 2019, spring durum wheat produced a high amount of crude gluten, which averaged 38.4% (Table 3). The highest amount of gluten 41.2% was formed in the variety Tverdynya, while the varieties Golden and Bezenchukskaya 210 formed 35.6 and 38.4%, respectively. It should be noted that in the variety Rusticano the amount of gluten was not determined, because the necessary amount of grain for its determination was not collected.

In our studies, in all variants of experience, spring durum wheat formed gluten of the second group of quality.

### Table 3. Quality indicators of spring wheat grain

| Sorts               | Crude gluten | Natura, g/l |
|---------------------|--------------|-------------|
|                     | amount, %    | quality group |          |
| Tverdynya (c)       | 41,2         | II          | 704       |
| Rusticano           | -            | -           | -         |
| Golden              | 35,6         | II          | 645       |
| Bezenchukskaya 210  | 38,4         | II          | 723       |

The full-scale mass of the grain did not meet the requirements of high quality wheat and was below 750 g / l. The full-scale mass of grain of the Bezenchukskaya 210 variety entered the restrictive conditions, because it was higher than 710 g / l, so its grain went according to the fourth class, and in other varieties - according to the fifth class.

The analysis of table 3 shows that since the production costs were the highest on the Bezenchukskaya 210 variety, the production cost per 1 hectare was the highest 6321.06 rubles. And since the highest yield of 10.5 c / ha was obtained on this variety, the cost of production per 1 ha was the least 602.01 rubles. On this option, the highest profit was obtained per 1 hectare - 5228.94 rubles, for 1 centner - 497.99 rubles, the level of profitability is 82.7% and cost recovery products 1.83 rubles.

### Table 4. Economic efficiency of spring durum wheat cultivation in the Uchkhoz OGAU in 2019

| Indicator                        | Experiment variants |
|----------------------------------|---------------------|
|                                  | Tverdynya (c)       |
|                                  | Rusticano           |
|                                  | Golden              |
|                                  | Bezenchukskaya 210  |
| Yield, c/ha                      | 2,8                 | 0,1             | 4,0         | 10,5       |
| Labor costs for the production of products, people. - hours. per 1 hectare | 0,93                | 0,87            | 0,96        | 1,12       |
|                                  | 0,33                | 8,67            | 0,24        | 0,11       |
| Production costs per: 1 ha, rubles. 1 cwt, rubles. | 6091,68            | 6011,25         | 6127,43     | 6321,06    |
|                                  | 60112,51           | 1531,86         | 602,01      |
|                                  | 2175,6             |                 |             |            |
Thus, as studies have shown, in the current climatic conditions, it is most expedient to cultivate the Bezenchukskaya 210 spring durum wheat variety.

2. Conclusions
The scientific research conducted in 2019 under the conditions of educational and experimental farm of OGAU allowed us to make the following preliminary conclusions and recommendations.

Field germination of spring durum wheat was high and averaged 90.8%. It was lowest in the varieties Rusticano and Golden and amounted to 88.9%, and the highest - 94.4% in the variety Bezenchukskaya 210. The highest number of surviving 384 pcs/m² was observed in the variety Rusticano, and the variety Bezenchukskaya 210 - 374 pcs/m².

Productive bushiness was quite low and on average for the experiment was 0.85 units. The lowest productive bushiness 0.44 units. was noted in the variety Rusticano, and the other varieties studied - 0.98 units.

Structural indicators such as the number of grains in the ear, grain mass per ear, mass of 1000 grains were also the highest in the variety Bezenchukskaya 210.

The highest amount of gluten 41.2% was formed in the variety Tverdynya, while the varieties Golden and Bezenchukskaya 210 - 35.6 and 38.4%, respectively. The group of gluten quality in all variants of the experiment was the second. The full-scale grain mass on all variants did not meet the requirements of high-quality wheat and was below 750 g/l. Profit was obtained only on the variety Bezenchukskaya 210, which amounted to 522893.94 rubles.

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