

## ASSESSMENT OF THE QUANTITATIVE AND QUALITATIVE YIELD OF THE WINTER WHEAT VARIETY „SELECT” IN POLYFACTORIAL FIELD EXPERIMENTS

Victor STARODUB, Ruslan TABACARI

State Agrarian University of Moldova, 44 Mircesti Street, MD-2049, Chişinău,  
Republic of Moldova

Corresponding authors emails: stejar45@gmail.com; ruslan.tabacari@cstsp.md

### Abstract

*Investigating the productive potential of the variety „Select” under the action of three technological factors with different graduations it was proved the priority of the forerunner peas due to the nitrogen-fixing bacteria. The forerunner spring vetch is less ensured with nitrogen because a part of biological nitrogen is used by the oat plants. Yield increase, provided statistically by a significantly positive record, was obtained as a result of sowing on the recommended and admissible planting dates and constituted respectively 133.3 and 41.6 kg/ha. The limit difference was of 68.2 kg. At the same time, the yield level was higher on the recommended planting date reaching the following values: 5016.6 kg/ha at the seed density of 4 million germinating seeds per hectare, 5100.0 kg/ha at 5 million germinating seeds per hectare, and 5233.3 kg/ha at 6.0 million germinating seeds per hectare. The average yield of the variety „Select” sowed after the forerunner spring vetch was lower by 648.7 kg/ha compared to the yield obtained after the forerunner peas.*

*Analyzing the factors that induce fluctuations in the protein content of wheat kernels it was established that the most important one is the planting date when the protein surplus, after the forerunner peas, constituted +1.84 % and +2.05 % provided statistically by a positive record compared to the control variant, the LD being 0.73%. High protein content with difference provided statistically by a significantly positive record was obtained after the forerunner peas + 0.73% compared to the spring vetch, the limit difference being of 0.58%. Sowing the variety „Select” on admissible and late planting dates in terms of the crop year 2014/2015 provided a higher content of protein substances with difference provided statistically by a significantly positive record after both forerunner plants, however the values of this indicator were higher after the forerunner peas. Seed density did not influence kernel quality.*

**Key words:** *Triticum aestivum, density, common winter wheat, yield, proteins, forerunner plants, gluten.*

### INTRODUCTION

*Triticum aestivum* (winter wheat) is one of the most important cultivated plant species. Its value is not limited only to the fact that it is the main source of food, but it also consists in the importance of including wheat in the crop rotation system, thus improving soil structure, monitoring weed control as well as reducing the number of pathogens that attack other varieties included in the crop rotation system. Thus, *Triticum aestivum* is an important partner in the crop rotation sequence increasing its productivity.

The major problems regarding *Triticum aestivum* cultivation are connected with autumn droughts, cold winters and arid conditions during the growing season (summer), factors limiting quantitative and qualitative yield in the Republic of Moldova.

Therefore, in order to cultivate wheat it is important to adapt the cultivation technology to real conditions. Among the basic elements of advanced technology we could mention the planting date, seed density in the seminal track and the forerunner plant.

The importance of these elements consists also in the fact that as a result of climate change in the optimal planting date of winter wheat (second decade of October), often the soil is still very dry and later planting date reduces the jointing of plants and their resistance to wintering, diseases and pests.

Based on the above-mentioned facts, we planned to study the influence of planting date, seed density on the seminal track and forerunner plants on some quality indicators of the common winter wheat variety „Select” in polyfactorial field experiments.

## MATERIALS AND METHODS

The method of experiment establishment is a systematic one as it was performed in four repetitions (3 repetitions to determine the yield and the 4<sup>th</sup> repetition was destined to observations and measurements). Plot area was of 50 m<sup>2</sup>. During the growing season, there were made phenological observations and biometric measurements according to the experimental technique regarding the number of ears/m<sup>2</sup>, plant height, number of kernels per ear, mass of kernels/spike etc. Statistical interpretation of obtained results was done using the dispersion analysis method.

### The factors included in the study:

- Factor A – forerunner plants with graduations:
  - Peas (**Mt**);
  - Spring vetch.
- Factor B - planting dates with graduations:
  - September 27 (**Mt-recommended**);
  - October 22 (**admissible**);
  - November 12 (**late**).
- Factor C – seed density with graduations:
  - 4 million of viable seeds per ha;
  - 5 million of viable seeds per ha (**Mt**);
  - 6 million of viable seeds per ha.

**Biological material – the variety „Select”** – was created at the Research Institute of Field Crops of the Republic of Moldova by the repeated individual selection method of the elite plant out of the hybrid population. The variety belongs to *ferrugineum* variety. Average plant size was of 73-90 cm and it possesses the resistance to lodging. It is characterized by high resistance to powdery mildew, brown rust and *Ustilago tritici*. The ear is dense with about 25-40 kernels. 1000 kernel weight was about 35-43 grams. The average yield of variety during the test years constituted 4430 kg/ha.

## RESULTS AND DISCUSSIONS

The crop year 2014 - 2015 was a favorable year for the common winter wheat growth and development. In terms of the thermal regime, the deviation from the annual average was of +2°C. In terms of rainfall, this year was

characterized by an increase of +86 mm compared with the annual average (492 mm).

The weather in June, when the development and filling of common winter wheat grains take place, was warmer by 1.4°C and the rainfall amount constituted 69.0 mm, which was by 2.9 mm less than the norm.

The main indicator that reflects the results of our experiments is the yield, which largely depends on the weather conditions and quality of implemented technological elements. Testing the productive potential of the variety „Select” (Table 1) under the action of three technological factors with different graduations, it was confirmed the priority of peas as a forerunner plant due to nitrogen-fixing bacteria. Spring vetch used as a forerunner plant is less ensured with nitrogen because a part of biological nitrogen is used by the oat plants. Yield increase provided statistically by a significantly positive record was obtained as a result of sowing on the recommended and admissible planting dates and constituted 133.3 and 41.6 kg/ha respectively.

The limit difference was of 68.2 kg. At the same time, the yield level was higher in the case of recommended planting date reaching the values of 5016.6 kg/ha at the seed density of 4 million viable seeds per hectare, 5100.0 kg/ha at 5 million and 5233.3 kg/ha at 6.0 million of germinating seeds per hectare. The average yield of variety „Select” sowed after the forerunner spring vetch was lower by 648.7 kg/ha compared to the yield obtained after the forerunner peas.

In our polyfactorial field experiments the values of quality characteristics are strongly influenced by the applied technology. Analyzing the factors that induce fluctuations in the protein content of wheat kernels (Table 2), it was established that the first place is occupied by the planting date when the surplus of protein after the forerunner peas constituted +1.84 % and +2.05 % provided statistically as positive compared to the control variant, LD being of 0.73%.

High protein content with difference provided statistically by a significantly positive record was obtained after the forerunner peas + 0.73% compared to the spring vetch, the limit difference being of 0.58.

Table 1. The yield of winter wheat variety „Select”, kg/ha

| Seed density, million/ha<br>Factor „C” | Forerunner plant – Factor „A” |            |         |                  | Spring vetch                |         |                  |        | Average of the Factor „C”, D <sub>05</sub> = 68.2 kg | ± Compared to the control variant |
|--|-------------------------------|------------|---------|------------------|-----------------------------|---------|------------------|--------|--|-----------------------------------|
|  | Peas (Mt)                     |            |         |                  | Planting dates – Factor „B” |         |                  |        |  |                                   |
|  | Recommended (Mt)              | Admissible | Late    | Recommended (Mt) | Admissible                  | Late    | Recommended (Mt) | Late   |  |                                   |
| 4                                      | 5016.6                        | 3850.0     | 3056.6  | 4408.3           | 3375.0                      | 2658.3  | 3727.4           | 3727.4 | - 68.0   |                                   |
| 5 (Mt)                                 | 5100.0                        | 4141.6     | 3082.3  | 4375.0           | 3508.3                      | 2566.6  | 3795.6           | 3795.6 | -  |                                   |
| 6                                      | 5233.3                        | 4300.0     | 3375.0  | 4416.6           | 3541.6                      | 2475.0  | 3890.2           | 3890.2 | +94.6  |                                   |
| Average of the Factor „A”              | 4128.3                        |            |         | 3480.5           |                             |         |                  |        |  |                                   |
| LD <sub>05</sub> A = 55.6 kg           | -                             | 647.8      |         |                  |                             |         |                  |        |  |                                   |
| Average of the Factor „B”              | 5116.4                        | 4097.2     | 3771.3  | 4401.7           | 3474.9                      | 2566.6  |                  |        |  |                                   |
| LD <sub>05</sub> B = 68.2 kg           | -                             | -1019.2    | -1345.1 |                  | -926.8                      | -1835.1 |                  |        |  |                                   |
| LD <sub>05</sub> of the experiment, kg | 167.0                         |            |         |                  |                             |         |                  |        |  |                                   |

Table 2. The content of protein substances in the kernels of common winter wheat variety „Select” in polyfactorial field experiments, %

| Seed density, million / ha<br>Factor „C” | Forerunner plant – Factor „A” |            |       |                  | Spring vetch                |       |                  |      | Average of the Factor „C”, LD <sub>05</sub> = 0.73 % | ± Compared to the control variant |
|--|-------------------------------|------------|-------|------------------|-----------------------------|-------|------------------|------|--|-----------------------------------|
|  | Peas (Mt)                     |            |       |                  | Planting dates – Factor „B” |       |                  |      |  |                                   |
|  | Recommended (Mt)              | Admissible | Late  | Recommended (Mt) | Admissible                  | Late  | Recommended (Mt) | Late |  |                                   |
| 4  | 2.03                          | 4.12       | 4.64  | 1.87             | 2.76                        | 4.65  | 3.35             | 3.35 | 0.05   |                                   |
| 5 (Mt)                                   | 2.84                          | 4.48       | 4.10  | 1.80             | 2.79                        | 4.39  | 3.40             | 3.40 |  |                                   |
| 6  | 2.34                          | 4.20       | 4.60  | 1.50             | 2.83                        | 4.14  | 3.27             | 3.27 | 0.13   |                                   |
| Average of the Factor „A”                | 13.70                         |            |       | 12.97            |                             |       |                  |      |  |                                   |
| LD <sub>05</sub> A = 0.58%               | -0.73                         |            |       |                  |                             |       |                  |      |  |                                   |
| Average of the Factor „B”                | 12.40                         | 14.24      | 14.45 | 11.72            | 12.79                       | 14.39 |                  |      |  |                                   |
| LD <sub>05</sub> B = 0.73%               | -                             | +1.84      | +2.05 | -                | +1.07                       | +2.67 |                  |      |  |                                   |
| LD <sub>05</sub> of the Experiment, %    | 1.75                          |            |       |                  |                             |       |                  |      |  |                                   |

Table 3. Gluten content in the kernels of common winter wheat variety „Select” in polyfactorial field experiments, %

| Seed density, million / ha<br>Factor „C”      | Forerunner plant – Factor „A” |            |       |                  |            |       | Average of the Factor „C” LD <sub>05</sub> , % = 0.76 | ± Compare d to the control variant |
|---|-------------------------------|------------|-------|------------------|------------|-------|---|------------------------------------|
|   | Planting dates – Factor „B”   |            |       | Spring vetch     |            |       |   |                                    |
|   | Recommended (Mt)              | Admissible | Late  | Recommended (Mt) | Admissible | Late  |   |                                    |
|   |                               |            |       |                  |            |       |   |                                    |
| 4   | 25.50                         | 29.93      | 31.03 | 25.16            | 27.05      | 31.05 | 28.30   | -0.10                              |
| 5 (Mt)  | 27.22                         | 30.69      | 29.89 | 25.05            | 27.11      | 30.50 | 28.40   | -                                  |
| 6   | 26.16                         | 30.10      | 30.95 | 24.38            | 27.19      | 29.79 | 28.13   | -0.27                              |
| Average of the Factor „A”                     | 29.05                         |            |       | 27.49            |            |       |   |                                    |
| LD <sub>05</sub> A, % = 0.62                  |                               |            |       |                  |            |       |   |                                    |
| Average of the Factor „B”                     | 26.29                         | 30.25      | 30.62 | 24.85            | 27.12      | 30.50 |   |                                    |
| LD <sub>05</sub> B, % = 0.76                  | -                             | +3.96      | +4.33 | -                | +2.27      | 5.65  |   |                                    |
| LD <sub>05</sub> of the General Experiment, % | 1.9                           |            |       |                  |            |       |   |                                    |

Table 4. Protein content, variety „Select”, in polyfactorial field experiments, kg/ha

| Seed density, million / ha<br>Factor „C” | Forerunner plant – Factor „A” |            |         |                  |            |        | Average of the Factor „C” LD <sub>05</sub> , kg = 68.2 | ± Compare d to the control variant |
|--|-------------------------------|------------|---------|------------------|------------|--------|--|------------------------------------|
|  | Planting dates – Factor „B”   |            |         | Spring vetch     |            |        |  |                                    |
|  | Recommended (Mt)              | Admissible | Late    | Recommended (Mt) | Admissible | Late   |  |                                    |
|  |                               |            |         |                  |            |        |  |                                    |
| 4  | 520.30                        | 467.51     | 384.84  | 601.65           | 341.33     | 334.92 | 443.26   | -9.29                              |
| 5 (Mt)                                   | 563.16                        | 515.74     | 347.25  | 443.98           | 416.06     | 317.63 | 433.97   | -                                  |
| 6  | 533.38                        | 525.12     | 452.12  | 436.80           | 451.69     | 300.97 | 453.35   | +19.38                             |
| Average of the Factor „A”                | 481.05                        |            |         | 405.00           |            |        |  |                                    |
| +76.05                                   |                               |            |         |                  |            |        |  |                                    |
| Average of the Factor „B”                | 545.61                        | 502.79     | 394.74  | 494.14           | 403.03     | 317.84 |  |                                    |
| ± compared to the control variant        | -                             | -42.82     | -150.87 | -                | -91.11     | -176.3 |  |                                    |

The sowing of variety „Select” on admissible and late planting dates under the conditions of the crop year 2012/2013 provided a higher content of protein substances with difference provided statistically by a significantly positive record after both forerunner plants, however the values of this indicator were higher after the forerunner peas. Seed density did not influence kernel quality.

The data presented in Table 3 show an increased gluten content in the kernels of common winter wheat variety „Select” sowed after the forerunner peas +1.56 % compared to the forerunner spring vetch, provided statistically by a significantly positive record, the LD being of 0.62%. The sowing performed on admissible and late planting dates provided an increase of gluten with statistically significant positive values of 3.96% and 4.33% compared to the control LD, which was of 0.76%. Seed density did not influence gluten content. Taking into account quality indicators of the variety „Select” in polyfactorial field experiments we can confirm that this variety belongs to the first quality group „B” – valuable and excellent for bakery.

Wheat is among the major components of mixed fodder recipes. The nutritional value of wheat is determined primarily by the high content of accumulated starch (up to 65%), also proteins (10-15% and up to 26% in the best varieties), fats (2%), mineral salts, vitamins of the groups B and PP, which supplement energy needs.

Protein amount obtained from the kernel yield of variety „Select” (Table 4) reflects the superiority of the forerunner peas compared to spring vetch, the values of this indicator constituting 481.05 kg/ha or by 76.05 kg per ha more. The sowing of seeds on admissible and late planting dates didn't increase protein amount per hectare. Seed density of 600 viable

seeds per m<sup>2</sup> provided by 19.38 kg/ha more compared to the control variant of 500 seeds per m<sup>2</sup>. Extensive use of new technologies and farming practices could increase protein amount up to 50%.

## CONCLUSIONS

Analyzing the obtained data, we can conclude that common winter wheat variety „Select” ensures increased yields provided statistically by a significantly positive record after the forerunner peas sowed on the recommended planting date at the density of 6.0 million viable seeds per hectare.

The values of protein and gluten content reached by the variety „Select” proves the fact that it belongs to the high-quality class of valuable wheat, especially for the baking industry.

## RECOMMENDATIONS

Common winter wheat variety „Select” sowing after the forerunner peas on the recommended planting date at seed density of 6.0 million viable seeds per hectare is better provided with symbiotic nitrogen compared the forerunner spring vetch.

## REFERENCES

- Boincean B.P. et al., 2013. Tehnologii alternative de cultivare a grâului de toamnă în Republica Moldova. (Îndrumar). Chișinău, 47 p.
- Lăzureanu A., Alda S., Cărciu Gh., 2009. Variația producției și a unor indici calitativi la două soiuri de grâu de toamnă zonate în partea de vest a țării. Buletinul AGIR, nr.1-2, p. 186- 190.
- Starodub V., Gheorghiev N., Burdujan V., Rurac M., Angela Melnic, 2011. Tehnologia de cultivare a cerealelor de toamnă (Recomandări practice). Chișinău, Centrul de Edit. UASM, 34 p.