ABSTRACT

Keywords - winter wheat, varieties, fertilization, quality.

Wheat is among the oldest cultivated plants, with highest importance in human nutrition.

For more than half of the world population, wheat bread is basic nutrition, with high-energy and special cooking properties, making it the main cereal grain for all countries with advanced agriculture.

Wheat grains are processed into flour used as raw feedstock in the manufacture of pasta, semolina, biscuits, starch, glucose, dextrin, confectionery and bakery.

Doctoral thesis comprises seven chapters with 279 pages, 140 tables and 70 figures. The thesis has two distinct parts: first part - which is a synthesis of literature on doctoral thesis, and also here being included all references. This part contains 56 pages, 7 tables and 7 figures. In the second part of the thesis is natural frame, climatic conditions in years of experimentation, research material and methods and the results of own research on the thesis topic. This one has 200 pages, 63 figures and 133 tables.

Location test was settled up at Pruteț Farm from Agricultural Society Moldova Țigănaşi. The farm is located on the territory of Probota village in the East part of Lower Jijia Plain and on plain and terraces of Prut River. The research was conducted over three agricultural years (2004-2007) their climatic conditions are very different. Crop years 2004-2005 and 2005-2006 were good years for winter wheat crop in terms of rainfall, while the agricultural year 2006-2007 was a dry year. Tests were made on an aluvisol weak gleyed, with pH 7.4, humus 2.24%, 0.69% total nitrogen, phosphorus 49 ppm and 291 ppm mobile potassium.

Experiments aim was to improve wheat cultivation technology in Lower Jijia Plain, with the objectives: the most favourable periods for sowing wheat, quantifying the effect of nitrogen and phosphorus fertilizers on production and its quality in some wheat varieties recently introduced into culture; caryopses influencing production, using wheat varieties more suited to conditions in the area, finding the best interactions between fertilization, sowing period and varieties with positive impacts on main biomass quantity and bakery quality.

To achieve the aims, at Pruteț Farm, was held a poly-factorial experience 2A x 4B x 5C type, in the agricultural years 2004-2007.

Experimental factors were:

- **Factor A** – Sowing époque with two graduations:

  a_1 – sowing in optimal époque (7^{th} of October)

a_2 – late sowing (after 14 days – 21st of October)

- **Factor B** – Fertilization with four graduations:

b_1 – N_0P_0

b_2 – $N_{54}P_{54}$ (N_{27}+N_{27})

b_3 – $N_{108}P_{54}$ (N_{27}+N_{54}+N_{27})

b_4 – $N_{162}P_{54}$ (N_{27}+N_{108}+N_{27})

- **Factor C** – Varieties with five graduations:

c_1 – Eliana

c_2 – Arieşan

c_3 – Dropia

c_4 – Rapid

c_5 – Flamura 85

Method of experience settlement was in subdivided plots. In order to make statistical interpretation of results, all variants of experience were arranged in four repetitions. During the vegetation, phenologic observations were made in accordance with biometric measurements and experimental techniques regarding number of spikes/m^2, plant height, number of grains in spike, grain weight/spike etc.

Statistical interpretation of results was done by variance analysis method. Results were centralized in tables and graphs were drawn. In agricultural year 2004-2005 sowing in first époque (7th of October) resulted in a greater number of spikes/m^2 (357.6 ears/m^2) than the time of delayed sowing (21st of October), when were obtained 343.9 spikes/m^2. From varieties revealed Arieşan, which exceeded the control variety Eliana with 9.9% in the first époque of sowing and with 7.1% in the second époque of sowing. Fertilization had influence the number of spikes on m^2 realizing with 28.2% more spikes at variant $N_{108}P_{54}K_0$ face to $N_0P_0K_0$ in first époque and with 8.93% in second époque of sowing. In agricultural year 2005-2006 the number of spikes/m^2 was higher than the previous year, achieving the greatest number of spikes/m^2 at variety Eliana - 508.2 in the first époque of sowing and 488.5 in the second époque of sowing. Fertilization realized also in this year an increase of spikes per m^2 at variant $N_{108}P_{54}K_0$ both at first and second époque of sowing.

In crop year 2006-2007 the highest number of spikes was obtained from variety Dropia, 7.2% higher than the control variety Eliana in the first époque of sowing. At sowing in delayed époque variety Eliana came in first place with a number of 430.2 spikes/m^2. Fertilization increased the number of spikes per m^2 to 23.5% at variant $N_{108}P_{54}K_0$ sowed in the first époque and to 7.4% at variant $N_{162}P_{54}K_0$ when sowing was made in the second époque.

In average over the three years of experimentation sowing in the first époque led to a greater number of spikes per m^2 with 4.77 compared with second époque of seeding, fertilization with $N_{162}P_{54}K_0$ led to an increase with 11.18% more ears that at variant $N_0P_0K_0$, and Dropia variety realised the biggest average number of spikes in m^2 (442.7). Influence of interaction between sowing époque x cultivars x agro-fond on the density of spikes/m^2, the average value in the years 2004-2007, put in light the Arieşan variety x first époque of sowing x agro-fond $N_{162}P_{54}K_0$ with a number of 489.7 spikes/m^2, being with 30.0% higher than control version.

In the three agricultural years (2004-2007) application of chemical fertilizers produced significant increases in wheat plants' height. The highest variety of five experiments was Arieşan variety with 94.4 cm in crop year 2004-2005 first époque of sowing and Rapid variety was the shortest with 72.2 cm in the second époque of sowing. Plants' height recorded the highest value in first époque of sowing in 2004-2005 and 2005-2006 crop years when climatic conditions were favourable for winter wheat crop of and the lowest in 2006-2007, a driest year.

Chemical fertilization of winter wheat produced very significant increases of the yields in each of the three years of field experiments, but averaged over the whole period. Grain production was influenced by climatic conditions of each year, but also by technological factors and varieties. In the 2004-2005 crop year was remarked Flamura 85 variety with a production averaged at 6550.5 kg/ha, very close to the control (Eliana variety with 6517.1 kg/ha).

$N_{162}P_{54}K_0$ fertilization achieved an average production of 6851.2 kg/ha, 23.0% higher than the production of control variant $N_0P_0K_0$, achieving 5.94 kg grain for 1 kg active fertilizer substance. Sowing in the second époque of sowing realised an average production of 6640.4 kg/ha with 11.20% higher than the average production in the first époque of sowing.

Interaction between the investigated factors determine the highest yield at interaction second époque of sowing x $N_{162}P_{54}K_0$ x Flamura 85 with 7681.8 kg/ha, 49.09% higher than in control variant (first époque x $N_0P_0K_0$ x Eliana).

In the 2005-2006 crop year was also remarked Flamura 85 variety with the greatest production of 5347.7 kg/ha, 6.55% higher than the control variety Eliana and fertilization with $N_{162}P_{54}K_0$ increased the production with 29.53% face to control variant ($N_0P_0K_0$). Also in his agricultural year sowing in the second époque determined the highest average production (5188.83 kg/ha). Interaction between factors led that grain production to swing between 6224 kg/ha at interaction second époque of sowing x Flamura 85 x $N_{162}P_{54}K_0$ and 4333.3 kg/ha to control interaction first époque x Eliana x $N_0P_0K_0$ difference between the productions of the two alternatives being 43.63% for the first interaction.

In the 2006-2007 crop year, agricultural year drought in the second part of his, Dropia variety with the greatest grain production (3588.8 kg/ha) proved to be more resistant to drought, making a greater production than Eliana with 45.18%. Flamura 85 variety ranked second with 3345.1 kg/ha. $N_{162}P_{54}K_0$ fertilization resulted in a production of 3633.9 kg/ha with 59.44% higher than in variant $N_0P_0K_0$. Second époque of sowing determined a production of 3150 kg/ha, 11.58% higher than the average of the first époque.

Interaction between those three factors highlighted in this crop year, with 4564.3 kg/ha, interaction second époque x Flamura 85 x $N_{162}P_{54}K_0$ that carried with 121.4% more than control interaction first époque x Eliana x $N_0P_0K_0$. Averaged over three agricultural years, winter wheat reacted very statistically significant to application of chemical fertilizers obtained yields varying between 6156.7 kg/ha on $N_{162}P_{54}K_0$ agro-fond and 4080.9 kg/ha on $N_0P_0K_0$ agro-fond, with a difference of 1312.1 kg/ha very significant.

Analyzing the influence of variety on winter wheat yield, average of years 2004-2007 highlights Flamura 85 variety with a production of 5081.1 kg/ha, difference very significant face to control Eliana, being 411.7 kg/ha. Influence of sowing époque on wheat yield highlights the second époque of sowing with a production difference distinct significant of 389.9 kg/ha face to average yield when sowing was realised in the first époque.

Regarding the interaction between sowing époque and fertilizer rates (average of agricultural years 2004-2007), is highlighted second époque of sowing II x Flamura 85 x $N_{162}P_{54}K_0$ agro-fond at which the difference face to first époque of sowing and agro-fond $N_0P_0K_0$ was 1940.4 kg/ha very significant. Averaged over three years, very significant yields were obtained in both sowing époques on agro-fond $N_{54}P_{54}K_0$, $N_{108}P_{54}K_0$ and $N_{162}P_{54}K_0$.

Watching the interaction between sowing époque and varieties (average of years 2004-2007), is remarked Flamura 85 variety, second époque of sowing with a very significant difference of 775.3 kg/ha face to control first époque x Eliana variety. On the interaction of three factors (époque of sowing x variety x agro-fond) is highlighted Falmura 85 variety, agro-fond $N_{162}P_{54}K_0$, the second époque of sowing, with a difference of 2306.7 kg/ha to control Eliana x $N_0P_0K_0$ x first époque of sowing, very significant. **Hectolitre mass** is a quality assessment, a higher hectolitre mass representing a quality raw material, even in terms of protein content and wet gluten as shown by some authors. Influence of variety on hectolitre mass, shows Dropia variety with value of 78.4 kg/hl in 2004-2005 crop year and the lowest hectolitre mass of 71.6 kg/hl was obtained by Arieşan variety in the crop year 2005-2006.

Watching the interaction between sowing époque and fertilizer rate highlighted the second sowing époque, agro-fond $N_{162}P_{54}K_0$ with a value of hectolitre mass 78.4 kg/hl in the

2004-2005 crop year. Interaction between sowing époque and varieties highlights Flamura 85 variety x first époque of sowing and Rapid variety x second époque of sowing with a value of 74 kg/hl in crop year 2005-2006.

As regards the interaction between fertilization rates and varieties, the higher value of hectolitre mass was conducted on agro-fond $N_{162}P_{54}K_0$ by Flamura 85 variety in the three years of research. On the interaction between sowing époque x agro-fond x varieties highlights Dropia variety, second époque of sowing agro-fond $N_{162}P_{54}K_0$, in crop year 2004-2005, with 79.2 kg/hl, with 3.53% higher than the control interaction (first époque x Eliana x $N_{162}P_{54}K_0$).

In the 2005-2006 crop year was the best interaction at first époque x Rapid variety x $N_{54}P_{54}K_0$ with 74.9 kg/hl, 4.3 kg/hl less than the higher hectolitre mass of crop year 2004-2005.

Crop year 2006-2007, with a second driest part of wheat growing season hectolitre mass was at quit high levels. The best interaction was second époque x Dropia x $N_{162}P_{54}K_0$, with 79.9 kg/hl, almost like the crop year 2004-2005. **Mass of a thousand-grain** is one of the important and stable components of wheat production, a synthetic indicator of general adaptability to local conditions and an important factor of flour output, together with hectolitre mass.

In crop year 2005-2006 wheat sowed in the second époque had the mass of a thousand-grain less with 1.2 g than the one sowed in first époque (51.1 g). The highest mass of a thousand-grain was of 50.8 g at Arieşan variety in agricultural year 2005-2006 and the lowest mass of a thousand-grain 49.9 g was carried out by the Rapid variety. Values greater than 50 g were obtained also by varieties Eliana, Dropia and Flamura 85. Values of the mass of a thousand-grain were influenced by fertilization, with values ranging from 50.6 on agro-fond $N_{108}P_{54}K_0$ to 48.7 g on agro-fond $N_0P_0K_0$ in crop year 2005-2006. Interaction of the investigated factors showed in crop year 2005-2006, with 52 g mass of a thousand-grain, the following interactions: first époque x Arieşan x $N_{108}P_{54}K_0$; first époque x Flamura 85 x $N_{108}P_{54}K_0$; second époque x Eliana x $N_{108}P_{54}K_0$; second époque x Arieşan x $N_0P_0K_0$. The smallest mass of a thousand-grain was obtained at control, having a value of 47 g.

In crop year 2006-2007 sowing in second époque conducted a mass of a thousand-grain of 42.84 g, 4.7% higher than sowing in first époque (7^{th} of October). Arieşan variety recorded highest mass of a thousand-grain 43.6 g and the smallest value was obtained by Eliana variety, with 41.1 g. Interaction of three factors caused the biggest mass of a thousand-grain, with 46.5 g at interactions: second époque x Eliana x $N_{108}P_{54}K_0$ and second époque x Arieşan x $N_{108}P_{54}K_0$. In this agricultural year the mass of a thousand-grain was lower than in the 2005-2006 crop year.

Analyzing protein content, averaged over the three years of experimentation, it was found that at sowing in the first époque (7^{th} of October) the content ranged from 12.16% at Rapid

variety x $N_0P_0K_0$ to 15.23% at Flamura 85 variety x $N_{162}P_{54}K_0$ and at sowing in the second époque (21st of October), varied between 12.20% at Eliana variety x $N_0P_0K_0$ and 14.96% at Flamura 85 x $N_{162}P_{54}K_0$.

Averaged over three years, at sowing in the first époque Dropia variety realised 14.07% protein, followed by variety Flamura 85 with 14.05%, with significant distinct differences face to control variant (Eliana). Fertilization has contributed to increasing the protein content from 12.6% at $N_0P_0K_0$ variant to 13.88% at variant $N_{162}P_{54}K_0$ with a very significant difference of 1.28 percentage points.

At sowing in the second époque, averaged over three years Dropia variety ranked first with 13.92% protein, followed by Flamura 85 variety with 13.89% protein, and $N_{162}P_{54}K_0$ fertilizer rate made 14.58% protein, with 2.13 percentage points more than control variant $N_0P_0K_0$. Analyzing baking qualities of wheat obtained under the influence of inquiry factors we found that on average of three years, at sowing in the first époque (7th of October) wet gluten content was 27.88% and at sowing in the second époque (21st of October) content was 29.11% fits in high quality. Fertilization with higher rates of nitrogen and phosphorus increased the wet gluten in wheat grains. Economic efficiency of fertilization was relatively good, averaged over three years, due to the efficiency of crop years 2004-2005 and 2005-2006, crop year 2006-2007 having also inefficient variants due to the climatic conditions.

From fertilized variants the highest rate of net profit achieved in $N_{108}P_{54}K_0$ fertilization in both sowing époques, with 42.66% at first époque and 48.79% at second époque of sowing, which is more efficient due to higher yields obtained per unit area. Conclusions and proposals showed that the most suitable varieties for the tested area are Flamura 85 and Dropia, or $N_{108}P_{54}K_0$ $N_{162}P_{54}K_0$ fertilization formula and the second sowing époque (21st of September).

Wet gluten had very good values, except for Flamura 85 varieties, agro-fond $N_0P_0K_0$, first époque of sowing in agricultural year 2004-2005, Dropia on $N_0P_0K_0$ agro-fond, second époque of sowing in crop year 2005-2006 and Eliana on agro-fond $N_{108}P_{54}K_0$ and Flamura 85 on agro-fond $N_0P_0K_0$ in the agricultural year 2006-2007. **Deformation index** had very good values for most varieties. **Falling number** had good values in the conditions of agricultural year 2005-2006 and satisfactory ones in the conditions of crop year 2006-2007.