The experiment is displayed in plastic containers each of them contains 1 kg of soil in three repetitions. The varieties are grown in Luvic Faeozem (FAO) in 4 types of diets: $N_0P_0K_0$ (a), $N_{200}P_{200}K_{200}$ (b), $N_{400}P_{200}K_{200}$ (c) и $N_{600}P_{200}K_{200}$ (d). Nutrients were applied in soluble condition, before sowing the whole quantity of phosphorus and potassium and 200 mg of nitrogen were added per 1000 g soil. The remaining amounts of nitrogen rate were imported at the end of tillering stage. The reaction of varieties to the established conditions is studied in stages 31 (I phase), 57-59 (II phase) and 94-95 (III phase) by Zadoks (Zadoks et al, 1974). In each of these phases the plant organs are separated and analysed singly. The total amount of nitrogen (Kjeldahl), phosphorus (colorimetric by the yellow colour reaction) and potassium (flame photometry) was determined after preparing the samples for analysis. The conclusion was based on the received sample results and the NPK content in different organs and phases defined absorption of macronutrients in both separately organs and in total biomass.

**Results and discussion**

The analysis of variances shows the influence of the factors investigated on the nutrients uptake in the common wheat organs (table 1). The influence of the variety is strongest in the nitrogen uptake by the leaves (248.8$^{**}$). The influence of fertilization is strongest in the nitrogen uptake by the stems (469.1$^{**}$) and the spikes (64.9$^{**}$). Nitrogen is the most important element in plants' nutrition. Its full effect over yield and quality of production can be observed only when the other nutrients are applied optimally. Fertilization has a very strong influence over phosphorus uptake by the leaves (1139.8$^{**}$) and the stems (575.7$^{**}$). Factors Variety (431$^{**}$) and Fertilization (426.4$^{**}$) are close effect over phosphorus uptake by the spikes. The influence of fertilization is strongest concerning potassium uptake by the leaves (925.7$^{**}$), the stems (543.3$^{**}$) and the spikes (1344.6$^{**}$) of the wheat genotypes investigated. The stage of development has strongest influence over potassium uptake by the leaves (45.5$^{**}$) and the stems (28.3$^{**}$). The effect of this factor is less pronounced. Of all combined influences the most meaningful one for the assimilation of nitrogen and phosphorus by the leaves and the stems and the assimilation of the three macro elements by the spikes is AxC (Variety x Fertilization).

Table 1. Analysis of variances of factor interaction for amount of N, P, K uptake (mg/pot) by stage of development.

| Factors / Organs | | A (Variety) | B (Stage) | C (Fertilization) | AxB | AxC | BxC | AxBxC |
|---|---|---|---|---|---|---|---|---|
| Leaves | N | **248.8**$^{**}$ | 11.1$^{**}$ | 113.3$^{**}$ | 7.3$^{**}$ | **23.4**$^{**}$ | 1.4 | 2.1$^{**}$ |
| | P | 270.6$^{**}$ | 0.5 | **1139.8**$^{**}$ | 13.1$^{*}$ | **19.8**$^{*}$ | 1.2 | 2.6 |
| | K | 142.5$^{**}$ | **45.5**$^{**}$ | **925.7**$^{**}$ | 18.4$^{**}$ | 9.9$^{**}$ | 3.1$^{*}$ | 1.7$^{*}$ |
| Stems | N | 258.3$^{**}$ | 16.5$^{**}$ | **469.1**$^{**}$ | 11.83$^{**}$ | **60.9**$^{**}$ | 5.8$^{**}$ | 4.5$^{**}$ |
| | P | 381.2$^{**}$ | 6.6 | **575.7**$^{**}$ | 7.9$^{*}$ | **24.5**$^{**}$ | 1.1 | 2.2 |
| | K | 156.4$^{**}$ | **28.3**$^{**}$ | **543.3**$^{**}$ | 11.5$^{**}$ | 5.2$^{**}$ | 2.2$^{*}$ | 2.5$^{**}$ |
| Spikes | N | 46.1$^{**}$ | 2.3 | **64.9**$^{**}$ | 1.1 | **36**$^{**}$ | 0.1 | 1.1 |
| | P | **431**$^{**}$ | 4.2 | **426.4**$^{**}$ | 3.2$^{*}$ | **18.4**$^{**}$ | 1.3 | 2.0 |
| | K | 928$^{**}$ | 0.1 | **1344.6**$^{**}$ | 22.1$^{**}$ | **52.2**$^{**}$ | 0.5 | 4.8$^{**}$ |

$^{**}$ Significance at the 0.01 level,, $^{*}$ Significance at the 0.05 level

Depending on the stage of development and the fertilization rate, the varieties grown under controlled conditions show considerable differences in relation to yield from separate organs and from the total biomass. Similar results are received by Nankova et al (1999). At the end of tillering and the beginning of booting stage (31 according to Zadoks) the differences among the investigated varieties in the uptake of nitrogen, phosphorus and potassium of the total biomass are insignificant. In the variants without mineral fertilization $N_0P_0K_0$ investigated varieties assimilate similar quantities of all elements. After fertilization the differences between the separate genotypes in nutrients uptake increase. The accumulated nitrogen, phosphorus and potassium increase parallelly with the increase of the fertilization rate. In these conditions the varieties Sadovo 1, Aglika, Bolyarka and Karat distinguish with increased nutrients uptake. At the stage of heading (57-59 according to Zadoks) greater differences in the assimilation of macro elements by the total biomass in comparison with the previous stage are found out. In the variants without mineral fertilization $N_0P_0K_0$ the variation in the values between the extracted quantities of nutrients is not very significant. With mineral fertilization genotypes investigated reach their maximum in nitrogen, phosphorus and potassium uptake when different fertilization rate are applied. The varieties Sadovo 1, Aglika, Iveta and Bolyarka distinguish with the greatest quantities of accumulated macro elements. At the full maturity stage (94-95 according to Zadoks) the differences between the investigated varieties in the nutrients uptake are the strongest. This peculiarity is extremely expressed at nitrogen uptake by the total biomass (figure 1). The quantity of the assimilated nitrogen by the leaves and the stems is decreases sharply, but its quantity in the spikes and in the total biomass increases. The trend for increasing the quantity of assimilated nitrogen by the spikes in similar experiments is found by Nankova (1994). The varieties differentiate in the accumulated quantities of nitrogen at the different fertilization rates. Among the variants without mineral fertilization $N_0P_0K_0$ (a) the differences between the genotypes are not very important. When using mineral fertilization these differences become deeper. This means that the genotypes researched can be divided into a few groups. The varieties Aglika, Iveta, Bolyarka and Slaveya accumulate higher than average quantities when balanced mineral fertilization $N_{200}P_{200}K_{200}$ (b) applied, and Milena, Enola, Pryaspa and Todora when fertilized with $N_{400}P_{200}K_{200}$ (c). The increasing nitrogen fertilization leads to increase of the assimilated quantities of nitrogen above the average for the standard sort Sadovo 1 and Kristi, and with Karat and Pobeda this suppresses the assimilation. The varieties Sadovo 1, Milena and Slaveya extract the greatest quantities nitrogen with the three fertilizer rates researched.

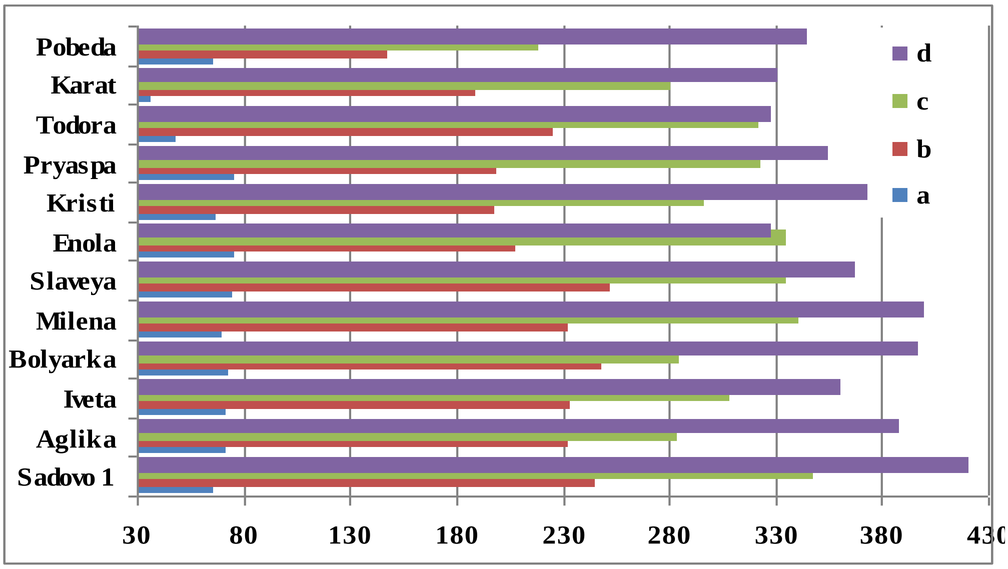


Figure 1. Utilization of nitrogen (mg/pot) of the total biomass in the phase of full maturity - $N_0P_0K_0$ (a), $N_{200}P_{200}K_{200}$ (b), $N_{400}P_{200}K_{200}$ (c) и $N_{600}P_{200}K_{200}$ (d).

In phosphorus uptake by the total biomass the differences between the varieties are clear still with the variants without mineral fertilization $N_0P_0K_0$ (a) (figure 2). The greater part of the genotypes investigated assimilate maximal quantities when balanced mineral fertilization $N_{200}P_{200}K_{200}$ (b) used – Sadovo 1, Aglika, Iveta, Bolyarka and Milena. The further increase of the nitrogen fertilization rate does not lead to increased phosphorus uptake. According to the quantity of uptake of this macro element, the investigated genotypes can be divided into two groups. Sadovo 1, Aglika, Iveta, Bolyarka and Milena that assimilate higher than average quantities of phosphorus with all fertilizer rates belong to the first group. When fertilizing with $N_{400}P_{200}K_{200}$ (c) the varieties Sadovo 1, Iveta and Bolyarka accumulate less phosphorus in comparison with the accumulated quantities in the variants with zero fertilization (a). Slaveya, Enola, Kristi, Pryaspa, Todora, Karat and Pobeda belong to the second group. With all researched fertilizing rates these genotypes accumulate less than the average quantities of phosphorus. The varieties Sadovo 1, Aglika, Iveta, Bolyarka and Milena extract the greatest quantity phosphorus with the three fertilizer rates investigated.

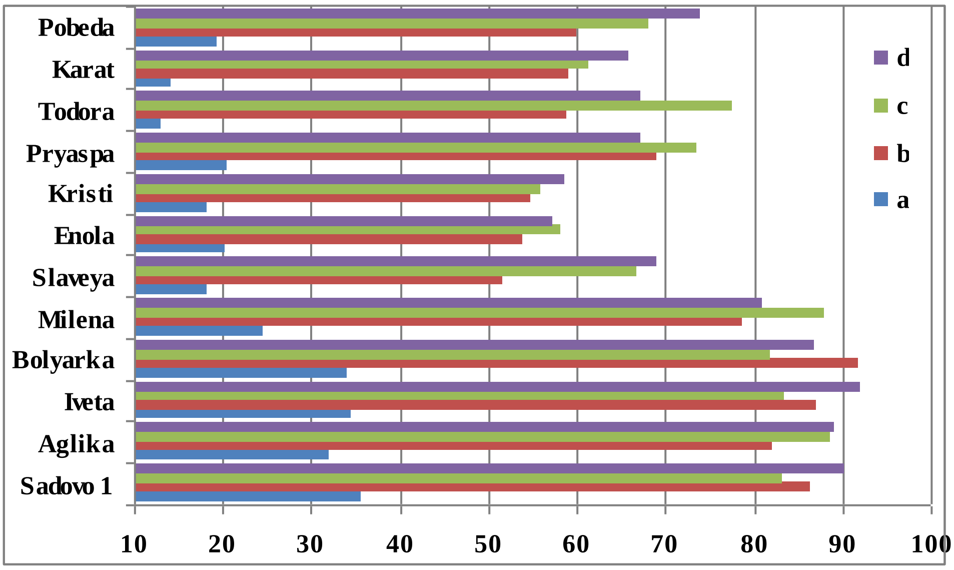


Figure 2. Utilization of phosphorus (mg/pot) from the total biomass in the phase of full maturity - $N_0P_0K_0$ (a), $N_{200}P_{200}K_{200}$ (b), $N_{400}P_{200}K_{200}$ (c) и $N_{600}P_{200}K_{200}$ (d).

At the full maturity stage the genotype specificity in the potassium uptake is not very outstanding (figure 3). With the variants without mineral fertilization $N_0P_0K_0$ (a) there are not meaningful differences between the varieties in the uptake of this macro element. At these conditions of nutrient poor regime only Sadovo 1 standard is distinguished with fewest quantities of potassium in their biomass above the ground. When fertilizing no meaningful differences between the genotypes are found out independently of the fertilizer rate. Increasing nitrogen fertilization leads to parallel increase of the values of the extracted quantities of this nutrient. Here the varieties can also be divided into a few groups. Milena, Slaveya and Pryaspa that accumulate the largest quantities of potassium compared to the average quantities when $N_{400}P_{200}K_{200}$ (c) used, belong to the first group. Aglika, Iveta, Bolyarka, Todora and Karat belong to the second group. In this group the increasing nitrogen fertilization leads to increase of the assimilated quantities of potassium above the average and reaching the maximum at the last stage of fertilization with $N_{600}P_{200}K_{200}$ (d). Sadovo 1, Enola, Kristi and Pobeda belong to the third group. These varieties extract close quantities of potassium independently of the fertilization rate applied. The varieties Aglika, Iveta and Bolyarka extract the greatest quantity potassium with the three fertilizer rates investigated. Among the variants without mineral fertilization $N_0P_0K_0$ (a) the varieties Aglika, Iveta and Bolyarka distinguished with the greatest quantities of assimilated nutrients at this final stage of their individual development. Among the variants with mineral fertilization these are the varieties Aglika, Iveta, Bolyarka, Milena and Slaveya. The increasing nitrogen fertilization influences strongly nitrogen uptake in grain of the investigated varieties (table 2). Previous research show that the increase of the nitrogen fertilization rate influences productivity and the assimilated quantities of nitrogen in the grain (Kostov et al, 1999; Nankova et al, 1999). The varieties Enola (62.7 mg/pot) and Pryaspa (63.4 mg/pot) accumulate the largest quantities of nitrogen in the control variants without fertilization $N_0P_0K_0$ (a). Fertilization with $N_{400}P_{200}K_{200}$ (c) leads to increase of nitrogen in the grain compared to the balanced proportion $N_{200}P_{200}K_{200}$ (b). Further increase of the nitrogen proportion leads to increase of the positive effect, i.e. increases the addition of accumulated nitrogen in the grain compared to the previous fertilizer rate. This trend concerns all varieties except for Enola which shows certain decrease of the quantity of nitrogen uptake in the grain. The varieties Slaveya and Milena distinguish with highest quantities of nitrogen uptake and Pobeda with lowest at all three levels of investigated nitrogen fertilization. The average increase in comparison to control samples that are not fertilized (a) is with 319,4% (b), 407,7% (c) and 366,7% (d) correspondingly. Fertilization in proportion N:P:K=2:1:1 (c) leads to accumulation of nitrogen in the grain 27,7% more than the balanced proportion (b).

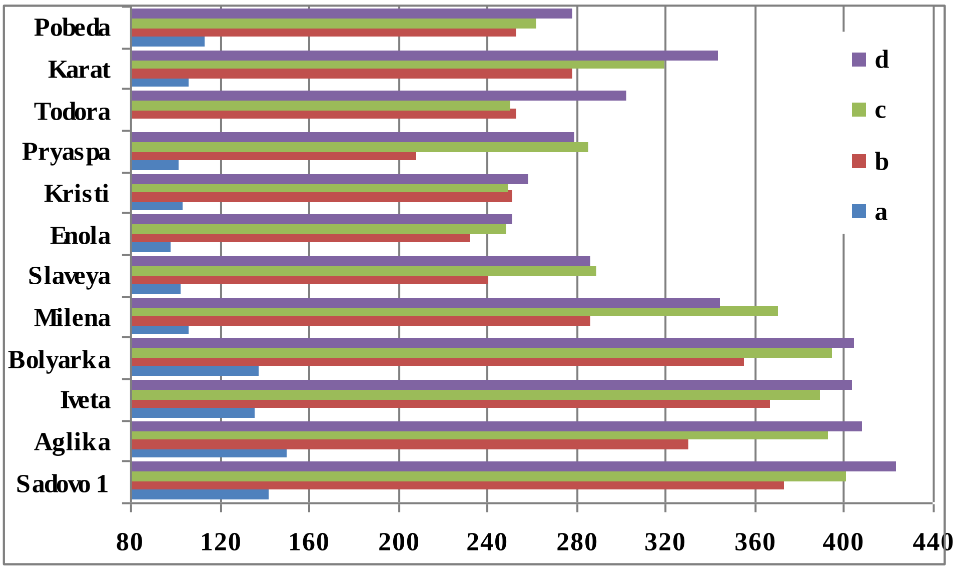


Figure 3. Utilization of potassium (mg/pot) from the total biomass in the phase of full maturity - $N_0P_0K_0$ (a), $N_{200}P_{200}K_{200}$ (b), $N_{400}P_{200}K_{200}$ (c) и $N_{600}P_{200}K_{200}$ (d).

Table 2. Nitrogen uptake in grain

| Varieties | Fertilization rate – mg/1000 g soil | | | |
|---|---|---|---|---|
| | NoPoKo - a | $N_{200}P_{200}K_{200}$ - b | $N_{400}P_{200}K_{200}$ - c | $N_{600}P_{200}K_{200}$- d |
| Sadovo 1 – St. | 52,335 | 186,633 | 205,884 | 239,677 |
| Aglika | 57,459 | 174,012 | 187,833 | 230,524 |
| Iveta | 60,092 | 185,061 | 176,085 | 222,804 |
| Bolyarka | 58,953 | 191,618 | 193,972 | 237,561 |
| Milena | 58,114 | 183,260 | **220,909** | **281,064** |
| Slaveya | 60,142 | 207,879 * | **269,388** * | **286,004** * |
| Enola | **62,727** | 170,145 * | 247,046 | 244,099 |
| Kristi | 54,472 | 160,524 * | 233,631 | 277,524 |
| Pryaspa | **63,390** | 163,971 * | 248,570 | 256,479 |
| Todora | 30,590 * | 162,549 * | 218,621 | 248,553 |
| Karat | 28,081 * | 145,894 ** | 220,587 | 239,302 |
| Pobeda | 51,027 | 103,965 ** | 175,817 | 210,777 |
| *Average* | *53,115* | *169,626* | *216,528* | *247,864* |

** Significance at the 0.01 level, * Significance at the 0.05 level

**Conclusions**

The different diets lead to the expression of specific characteristics in terms of their ability to absorb nutrients through vegetation process. The factors "genotype" and "fertilization" have stronger influence on the absorption of nutrients compared to the phase development. In the initial phase of wheat development (end of tillering-beginning of spindling), the differences in the absorption of macronutrients are larger among the varieties than between different levels of fertilization. The genotypic specificity in the nutrients absorption is most pronounced in phase ripe. This feature is well expressed in the accumulation of nitrogen and phosphorus from total biomass and less from the potassium extraction. Except the variety Enola all other reach a maximum absorbed nitrogen in grain at fertilization ratio of N:P:K=3:1:1. The varieties Slaveya and Milena have the largest amount of nitrogen absorbed in their grains.

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