EFFECT OF SOWING DATE AND SEEDING RATE ON DIFFERENT WINTER WHEAT CULTIVARS

VETÉSIDŐ ÉS CSÍRASZÁM HATÁSA KÜLÖNBÖZŐ ŐSZI BÚZA GENOTÍPUSOKRA

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Abstract: *In this paper the effect of two different sowing dates (middle of October and beginning of November), as well as two different seeding rates (300 and 600 seeds/m^2) on five different winter wheat breeds have been investigated. We evaluated our results with variance analysis according to the different sowing dates and seeding rates.*

Összefoglalás: *Publikációnkban két vetésidő és két vetési sűrűség hatását tanulmányoztuk öt őszi búza genotípus terméshozamára. Eredményeinket a vetésidők és a csíraszámok szerint külön-külön varianciaanalízissel elemeztük és értékeltük.*

Key words**:** *winter wheat, cultivar, genotype, breed, yield, sowing date, seeding rate*
Kulcsszavak: *őszi búza, genotípus, fajta, terméshozam, vetésidő, vetéssűrűség*

INTRODUCTION

Winter wheat production is performed on 20-25% of the arable area of Hungary. The last years' economical, climatic and cultivar changes gave new jobs to agrotechnical researches in Central Europe. According to Ágoston and Pepó (2005), the agricultural and physiological speciality of the winter wheat cultivars have more important effect on grain yield than the pathology factors. We can ensure or even develop the profitability of winter wheat with changes made in agrotechnical factors (sowing date), with the selection of breed suitable for the area and with the right farming practices (seeding rate). Regarding the work of Ragasits (1998), at too dense wheat population not only the fungous diseases increase, but the competition between plants due to that induces self-regulation, which finally leads to decrease of the yield. On the other hand, Pekáry (1971) got the result that the increase of quantity of seeds did not influence the yield of winter wheat. Researches of Kuti and Szőke (1985), Szalai (1985) show that the breeds gave different crop yield by sowing different seed quantity, however the growing season and the sowing date caused significant changes in the yield. Pan et al. (1994) stated that the increase of seeding rate at early and optimal sowing time is unfavourable, but the negative effect of late sowing may be compensated by the increase of seed quantity. Anderson and Olsen (1992) experienced that the length of straw and percentage of lurch are increased, and beside diseases winter-kill harmed plants that Ragasits (1998) and Ogiuchi et al. (2004) confirmed as well. Pepó et al. (2006) emphasize particular function of breeds in landscape production. The author revealed that the environmental circumstances are determinative factors in the productivity and yield safety of winter wheat cultivars. Moreover, Pepó (1995) and Baniuniene et al. (2005) regard the cultivar-growing season relation as of high importance. It is important to improve newer and newer breeds, and to define the optimal sowing date and seeding rate of winter wheat breeds, due to the climate-change of habitats, not only from agrotechnical, but also from economic point of view. In our investigation we were looking for the answer, whether the sowing date and seeding rate had any effects on the yield of the different winter wheat cultivars.

MATERIAL AND METHODS

The experiment was set up in the growing season of 2005/2006, with 5 winter wheat cultivars (GK Élet, GK Garaboly, GK Kalász, GK Petur, GK Holló), in 4 replications, on 10m^2 plots in randomized block design, on the research farm of the Cereal Research Non Profit Co. in Szeged-Öthalom. The experiment was established in deep salty meadow chernozem soil, of average N, good P_2O_5 and K_2O providing ability. The plasticity value is 40-44, humus content 2.8-3.2 %, pH value 7.6-7.9. As autumn basic fertilizer, 60+60+60 kg ha^{-1} NPK active agent was dispersed, followed by 60 kg ha^{-1} N as top-dressing in springtime.

The sowing was performed by Wintersteiger plot seeding-machine on the 14th of October and 6th of November, with 2 different seeding rates (300 and 600 seeds m^{-2}). The examined plots received the same pest control. The harvest was done by a Wintersteiger plot harvester at the beginning of July, when the wheat was mature.

RESULTS AND DISCUSSION

Effect of the seeding rate on the productivity of winter wheat:

At October seeding date the yield of parcels with different seeding rates differed by the genotypes (Table 1.). The denser stock produced 0.15 t/ha less than the 300 seeds m^{-2} parcels in the GK Élet breed. However at GK Garaboly breed we harvested higher yield in the more dense stock contrary to stock with 300 seeds m^{-2} density. At GK Kalász breed no remarkable difference was found in the yield of stocks with different seeding rates. The seed quantity reduction caused 3% less yield at GK Petur, and 9% extra yield at GK Holló breed with good tillering ability. Regarding the averages of seeding rates of October seeding date, we found difference between the genotypes, which was proved at 5% significance level. We recorded the highest yield at October seeding date at GK Élet (8.19 t/ha) and the lowest at GK Holló (7.17t/ha). In the average of breeds at middle October seeding date, 0.11 t/ha extra yield was recorded in favour of more sparse plant stock, but no significant difference was found between the seeding rates.

Table 1

Effect of breed and seeding rate on the yield of winter wheat at October sowing date

Seeding rate (seed m^{-2})	Breeds					
	GK Élet	GK Garaboly	GK Kalász	GK Petur	GK Holló	Average
300	8,26	7,88	7,84	8,05	7,50	7,91
600	8,11	7,92	7,82	8,29	6,84	7,80
Average	8,19	7,90	7,83	8,17	7,17	7,85

Between breeds: $SzD_{5\%}$=0.30
Between seeding rates: $SzD_{5\%}$=0.19
Between interactions of breeds and seeding rates: $SzD_{5\%}$=0.43

In all genotypes sown at middle November, there was a clear increase in the yields due to higher seeding rate compared with 300 seeds m^{-2} density (Table 2.). In the average of seeding rates at November seeding date the lowest yield was recorded for GK Élet, while GK Garaboly reached the highest yield. Between genotypes at late sowing date we got significant differences. At November seeding date, in the average of the five genotypes the yield was 7.03 t/ha at 300 seeds m^{-2} density, and the yield of plots with higher seeding rate was 7.83 t/ha. The sowing at middle November with higher seeding rate resulted in higher yield, than the sparser stock. The effect of seeding rate on the yield of winter wheat at 5% significance level at November seeding date was proved.

Table 2

Effect of breed and seeding rate on the yield of winter wheat in November seeding

Seeding rate (seed m^{-2})	Breeds					
	GK Élet	GK Garaboly	GK Kalász	GK Petur	GK Holló	Average
300	6,93	7,33	7,11	6,84	6,94	7,03
600	7,53	8,24	7,82	7,73	7,86	7,83
Average	7,23	7,79	7,46	7,28	7,40	7,43

Between breeds: $SzD_{5\%}$=0.24
Between seeding rates: $SzD_{5\%}$=0.15
Between interactions of breeds and seeding rates: $SzD_{5\%}$=0.34

Effect of sowing date on the productivity of winter wheat:

At 300 seeds m^{-2} density the yield of late seeding decreased at the GK Élet with 16%, at GK Garaboly with 7%, at GK Kalász with 9%, at GK Petur 15% and at GK Holló with 7%, compared with October seeding date (Table 3.). So at 300 seeds m^{-2} density the GK Élet and the GK Petur breeds responded with higher yield loss, higher than the other breeds. On the plots with lower seeding rate the genotypes according to the averages of sowing dates had different yields, however no significant difference was found between the breeds. At 300 seeds m^{-2} density, the winter wheat produced high yield (7.91 t/ha) at optimal October seeding date, but on the contrary at late seeding we got 880 kg/ha less yield. In the case of low seeding rates, significant difference was found for the yield of plots with different seeding time at 5% significance level.

Table 3

Effect of breed and sowing date on the yield of winter wheat at 300 seeds m^{-2} seeding rate

Sowing dates	Breeds					
	GK Élet	GK Garaboly	GK Kalász	GK Petur	GK Holló	Average
October	8,26	7,88	7,84	8,05	7,50	7,91
November	6,93	7,33	7,11	6,84	6,94	7,03
Average	7,60	7,61	7,47	7,45	7,22	7,47

Between breeds: $SzD_{5\%}$=0.31
Between sowing dates: $SzD_{5\%}$=0.20
Between interactions of breeds and sowing dates: $SzD_{5\%}$=0.44

By the investigation of the yield of breeds at 600 seeds m^{-2} seeding rate we found, that not only the changes in yield, but the trend of changes was different, either (Table 4.). We found that at October seeding date, 7% extra yield was produced compared to later seeding date at GK Élet and GK Petur breeds. The GK Kalász breed produced 7.82 t/ha extra yield both at early and late seeding, either. Therefore GK Kalász can be sown even at high seeding rate in wide interval without changes in the amount of yield. This seed density issued in 4% and 15% extra yield at GK Garaboly and GK Holló breeds at November seeding date compared to October seeding date. In the average of sowing dates the GK Garaboly and GK Petur cropped more than 8 t/ha yield, too. The GK Holló produced the lowest yield of 7.35 t/ha. We found significant differences between the five genotypes at 5% significance level. In the studied winter wheat breeds at 600 seeds m^{-2}, there was a slight difference only between different sowing times, so we found significant differences neither.

Table 4

Effect of breed and sowing date on the yield of winter wheat at 600 seeds m^{-2} seeding rate

Sowing dates	Breeds					
	GK Élet	GK Garaboly	GK Kalász	GK Petur	GK Holló	Average
October	8,11	7,92	7,82	8,29	6,84	7,80
November	7,53	8,24	7,82	7,73	7,86	7,83
Average	7,82	8,08	7,82	8,01	7,35	7,82

Between breeds: $SzD_{5\%}$=0.22
Between sowing dates: $SzD_{5\%}$=0.14
Between interactions of breeds and sowing dates: $SzD_{5\%}$=0.32

CONCLUSIONS

Our results show, that winter wheat has good adaptability, as it has cropped a certain amount of yield in each treatment, but the effect of treatments caused remarkable differences in the level of production. Winter wheat grown under more favourable conditions (October sowing date, 600 seeds m^{-2} seeding rate) responded to the treatments more even, compared to those grown under unfavourable conditions (November sowing date, 300 seeds m^{-2} seeding rate).In the case of October seeding, 3 out of the examined 5 cultivars gave better yield if sown at lower seeding rate. Negative effects caused by late sowing could be compensated by increased amounts of seeds at each cultivar. Each breed, as well as their average gave higher grain yield at sparser seeding rate. In the case of 600 seeds m^{-2} seeding rate, GK Élet and GK Petur were more productive if sown in October, while GK Garaboly and GK Holló proved to be better if sown in November.

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