

THE EFFECT OF CROP DENSITY ON YIELD COMPONENTS ENHANCING FOOD PRODUCTION EFFICIENCY

István KRISTÓ¹ – István Mihály PETRÓCZI² – Kálmán GYURIS² –
Mária TORMA¹

¹University of Szeged, College of Agriculture, Hódmezővásárhely

²Cereal Research Non Profit Co., Szeged

Introduction

The determination of optimal quantity of seeds is a highly important task, not only from agro-technical, but also from economic point view, after all it basically determines the cost of growing. We have to take into consideration the habitat, the nutritive supply, the quality of seed-bed and seeds, the way and quality of sowing and the needs of breed for the determination of seed quantity.

Regarding the work of Ragasits (1998), there is a relation between the density of plants, the formation of shoots and the development of spikes in the case of cereals. The competition between plants leads to self-regulation in dense sowing circumstances, which involves the reduction of side-shoots and the number of grain per spikes in the time of spike formation, and it finally leads to the reduction of crops, regarding to Ragasits (1998). By contrast, Pékáry (1971) pointed out that the increase of seed quantity did not affect the crop size of wheat as a conclusion of the research, which was done with 3 breeds on two different habitats. Kuti at al. (1971) draw the conclusion from the examination of wheat breed called Bezosztaja 1, that crop yield was decreasing while the quantity of seeds was increasing in average sowing time. Despite this fact, they had different results when examining the effect of different seed quantities in the same sowing time: under the early sowing circumstances the big amount of seeds was disadvantageous, but in last sowing the disadvantage was not presented. Kuti at al. (1985) researches show that the examined winter wheat breeds gave different crop yield sowing different seed quantity, respectively, the crop yield was affected not only by the properties of breeds, but by the age-group and by sowing date as well. The authors could not find significant differences regarding the effect of the number of germs on the crop yield in the average of years, breeds and sowing dates. By contrast, a research of Szalai (1985) shows, that the number germs is an important crop-assign agro technical factor. The author revealed that less than 300 seeds m⁻² cause important loss in the crop yield, up to 600 seeds m⁻² the yield is increasing, but above 600 seeds m⁻² the yield is not changing on its merits, although it shows a decreasing tendency.

Examining the elements of crops he pointed out, that the number of hibernated plants and the number of mature spikes increased while the number of seeds increased, but the estimated crop-improving effect of the higher number of spikes was degraded by the less grain yield of spikes. Anderson at al. (1992) experienced in a three years research, that the number of spikes decreased by the increase of the density of sowing. Tóthné (1999) examined the elements of the props, and showed that in the case of loose stand the number of grains per spikes was significantly increasing. Pan et al. (1994) examining the effects of the seed density and sowing time concluded, that the negative effects of delay sowing can be corrected by increasing the number of germs, respectively bigger seed density causes the number of plants and spikes per area unit.

Materials and methods

The research was established in two breeding period (2003/2004, 2004/2005), with 4 breeds of winter wheat (GK Garaboly, GK Kalász, GK Petur, GK Holló), in 4 repeats, on 10 square

meter random layout plot in the research farm of the Cereal Research Non Profit Co. in Szeged-óthalom. The experiment was done in deep salty meadow chernozem soil, which can be characterized with average N, good P_2O_5 and K_2O provider ability, the plasticity value is 40-44, humus content 2.8-3.2 %, PH value 7.6-7.9. The sowing was done by means of a Wintersteiger plot seedling-machine on the 14th of October, with 2 different amounts of seeds (300 and 500 seeds m^{-2}). 60+60+60 kg ha^{-1} NPK active agent was emitted as autumn basic fertilizer, and after 60 kg ha^{-1} N as top-dressing in springtime. The examined plants were chosen from a unit area (0.25 running metre) for the project. Number of plants in the sample area, number of shoots and spikes, the number and weight of spikelets and seeds were examined, and the weight of straw and spikes was measured. Wintersteiger LD 180 ST 4 threshing-machine was used for threshing the spikes and Numigral seed-counter was used for finding out the number of grains.

Results and discussion

The aim of the research was to discover how the amount of sowing seeds affects the crop yield and the different crop elements of winter wheat.

Table 1. Crop yield of winter wheat at different number of seeded germs.

Breeds	Crop yield (t ha ⁻¹)						Average of breed
	300 seeds m ⁻²			500 seeds m ⁻²			
	2004	2005	Average of treatments	2004	2005	Average of treatments	
GK Garaboly	8,84	6,47	7,66	9,09	7,08	8,09	7,88
GK Kalász	8,75	7,98	8,37	9,13	7,97	8,55	8,46
GK Petur	8,49	6,97	7,73	8,80	7,69	8,25	7,99
GK Holló	8,69	6,20	7,45	8,91	6,48	7,70	7,58
Average	8,69	6,91	7,80	8,98	7,31	8,15	7,98

Comparing the crop results of 2004 with those of 2005 we experienced that the weather in 2004 was more advantageous for winter wheat, which could be seen in both germs-treatment (Table 1.) Examine the affectation of the seeds number to the crop yield of winter wheat, can be concluded that every breeds reacted in the same way, the wheat with low density produced less crop, than the other with 500 seeds m^{-2} . This fact can be seen in the average of treatment as well, the stock of 500 seeds m^{-2} produced 8.15 t ha^{-1} , while the stock of 300 seeds m^{-2} produced 350 kg less, only 7.8 t ha^{-1} . We were curious how the crop yield change affects the crop determinant elements. That is way we compared the yield components of 500 seeds m^{-2} stock with the 300 seeds m^{-2} stock regarding the examined years and to the average of breeds (Figure 1).

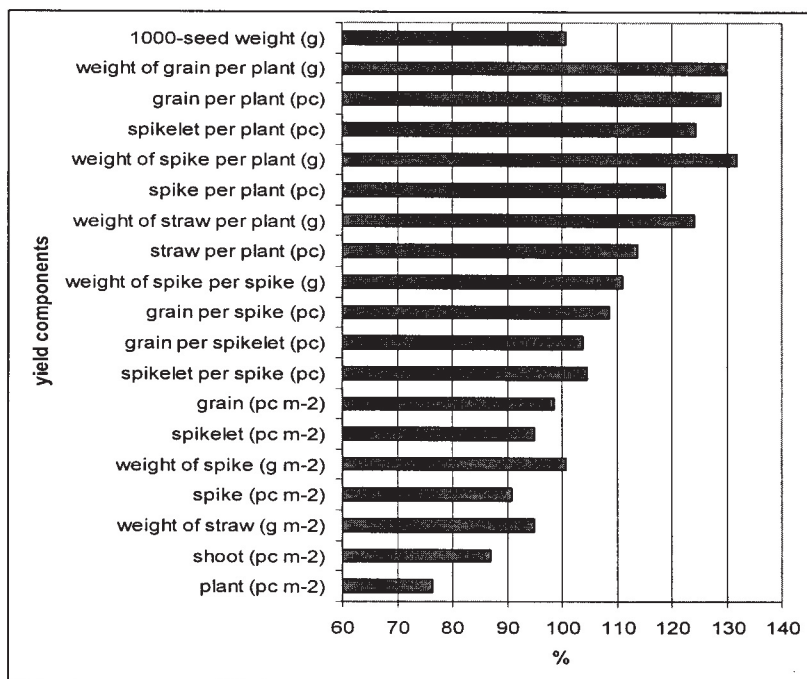


Figure 1. Yield components of the low density winter wheat in the percentage of the yield components of 500 seeds m⁻² stock.

There was a 24% loss in the number of plants per area unit, a 13% loss in the number of shoots, a 5% loss in the weight of straw, a 9% in the number of spikes, a 5% in the number of spikelets, a 1% in the number of seeds at the 300 seeds m⁻² stock, compared to the 500 seeds m⁻². From the yield components of the lower density stock increased the weight of spike (1%). It probably happened because of the increasing spike-weight (+11%), which can be caused by the increase in the number of spikelets per spikes, number of seeds per spikelets and thousand seed weight. In the stock of 300 seeds m⁻² the individual plants had bigger living space; the productivity of plants was bigger, so the tiller-producing ability was better. In the stock of 300 seeds m⁻² the shoot number of plans increased by 24%, weight of spikes by 24%. It does not mean, that only the unproductive shoot number had been increased, because the 19% increase of spikes number shows the increase of productive shoots as well. Besides this the number of spikelets per plants increased by 24%, and the seed number increased by 29% in the stock of 300 seeds m⁻², which caused a 32% increase in the spike weight, compared to the stock of 500 seeds m⁻².

Conclusion

We discovered that the stock with 300 seeds m⁻² density had less crop yield, than the stock with 500 seeds m⁻² in the case of every breed. In the stock of lower density the plants had better circumstances, because of the bigger living space, so the tiller-producing ability was better, the number of productive shoots, the number of spikelets per spikes, the grain number per spikes and their weight increased. The improvement of these yield components could not

compensate the plant number reduction per area unit of the 300 seeds m⁻² stock, which is the most important reason of the crop yield reduction.

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