EFFECT OF CRITICAL AGROTECHNICAL FACTORS ON THE YIELD OF SUNFLOWER HYBRIDS

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Abstract

Today, cropyears with extreme weather conditions are becoming more and more frequent and increase the risk of sunflower production. The objective of researches into plant production is to minimize these effects as much as possible. In this sense, the optimization of agrotechnological factors is of high importance. Therefore, appropriate cropping technologies (sowing time, crop density) and optimized, rational crop protection are highly important especially in highly sensitive sunflower cultures. The treatments of hybrids oil content and the yield had a significant influence in many cases.

Key words: sunflower, plant density, yield, genotypes, high oleic acid sunflower.

INTRODUCTION

Domestic agriculture, including the structure of plant production – based on ecological and agrotechnical conditions, and the type of processing of the produced plant –, is focused on wheat production. This characteristic has a number of advantages, but has several disadvantages as well. One of the most important principals of sustainable plant production is creating a differentiated production structure. In this complex crop rotation, oil plants have determinative importance. Among oil plants, in our country, due to the wide range of usability, role of sunflower production is undisputed. In the past decades, sunflower production became a determining sector of domestic plant production. In the middle of the ’90s – exploiting the booming of domestic and foreign markets – the area sown with sunflower was over 500000 ha^{-1}, which was seriously threatening of the effectiveness of its production. Since that time, its sown area has been decreasing. According to our professional knowledge, a sown area of 300000-500000 ha^{-1} is safely predictable, which provides partly the domestic supply and partly helps to take the opportunities on foreign markets.

Sunflower is the most important oil crop and is planted on the biggest acreage in Hungary. It has a significant role in Hungary’s crop oil production and became one of the major crops in the Hungarian crop production sector. During the last 30 years, the cultivation area increased from 9.2 million ha to 23 million ha. Sunflower is a typical commercial cash crop, which fits well in the structure of arable farming. Because in terms of acreage the most significant crops are corn and cereals, the partial

monoculture cultivation cannot be avoided. Sunflower production is a way to eliminate this problem, therefore it has an important role both in planting and ecological points of view. Sunflower well adapts to Hungary's climatic conditions and sunflower production is easily practicable in our country (Pepó et al., 2002).

According to Szendrő (1980), for growing sunflower with shorter growing season a stand density of 50000-55000 plant ha^{-1}, and with an average growing season a stand density of 45000-50000 plant ha^{-1} is recommended. Besides the number of plants, for the yield, it is also important to uniformly distribute the plants within a row. Even with an appropriate number of plants, irregular distribution can cause decrease of the yield.

According to Gaev et al. (1996), in point of yield, the most favourable stand density is 55000 plant ha^{-1}.

According to Szekrényes (2000), to reach more than 2 t ha^{-1} average yields, genetic background is provided. In the future, hybrids with good resistance to pathogens together with chemical control can result in the best yields. The differences in yields between sunflower hybrids are caused by the yield potential and different yield stability. Agricultural, climatic and soil factors (e.g. number of plants, sowing-time) given in different crop years have a significant effect on yield stability of sunflower hybrids. (Borbélyné Hunyadi, Lesznyákné, 2007; Zsombik, 2006; Sándor et al., 2007).

MATERIALS AND METHODS

The experiment was carried out at the Látókép Experimental Station of the University of Debrecen, Centre for Agricultural Sciences and Engineering, Farm and Regional Research Institute in the Hajdúság in 2013. The experimental plots were set up in a randomized block design in four repetitions. In the experiment, we tested 6 modern sunflower hybrids. Four different plant densities were applied (35000-65000 plants ha^{-1}) increasing in 10000 plants ha^{-1} steps. Fungicide treatment was applied in the 8-leaf and in the flowering stages on plots where fungicide treatment was applied twice. The yields were standardized for a moisture content of 8%.

RESULTS AND DISCUSSION

Long-term profitable sunflower production can be carried out by increasing yield, yield quality and stability. The last two can be achieved by applying and adjusting agricultural methods and factors that are best for the given hybrids. When creating production models, the effects of crop years that have been becoming more and more extreme in the past years should be

considered. To compensate those effects, agricultural management should be adapted to the climatic and soil conditions of the given area. Contrary to other arable crops, for sunflower, average and droughty crop years are more favourable, which is due to its strong root going into deeper layers of the soil. In rainy crop years decrease of yield is expected, as many pathogens harmful for sunflower can cause considerable damage in cultivations in those crop years, which can be countervailed only, but not fully, by increase of production costs. Based on the above mentioned characteristics it can be concluded that in sunflower production, among agricultural factors, the role of plant protection and seeding technology is outstanding, which has also been proved by our experiments. Data gained from the investigation reflects the specific features of sunflower. In the control treatment (without fungicides), yield results of the tested sunflower hybrids were worse than that of the stands that were treated twice, in the higher plant density levels. In the average of the hybrids and number of plants, decrease of yield was only slight.

Fungicide treatments have a strong influence on how the number of plants can be increased. In the control treatment, maximum yield was obtained with a plant density of 55000 plant ha^{-1}, with most and also in the average of the hybrids. Increasing the number of plants above that quantity decreased yield even in crop years favourable for sunflower. In stands treated twice the best yield was obtained in the 55000 plant ha^{-1} density level as well. There were significant differences between the investigated hybrids in yield potential, resistance to pathogens and the extent to which the number of plants could be increased. Yield potential of hybrids Performa and Paraiso 102 was the highest, in the control treatment and in stands treated twice, and also at every plant density. In the control treatment, the difference in yield between the lowest and the optimum density went above 1000 kg ha^{-1} in case of the most hybrids. Due to treating them twice with fungicide and the increasing number of plants per hectare, increase of yield was more than 1000 kg ha^{-1} (1207-1148 kg ha^{-1}) only in case of one hybrid (P64LC09) (Table 1-2).

We evaluated our data separately for groups of hybrids with average and with high oleic acid content as well. Results showed that in the investigated cropyear, region and agricultural conditions, yield potential of HO hybrids was lower than that of the average hybrids (Figure 1-2).

Table 1

Yields of sunflower hybrids according to different plant density levels in control fungicide treatment (Debrecen-Látókép, 2013)

Plant dens.	ES Amis	Paraiso 1000	Paraiso 102	ES Performa	P64LC09	ES Tectonic	Average
	Yield (kg ha^{-1})						
35000	4271	4663	4403	4949	4532	4181	4500
45000	5048	5069	5476	5740	4950	4848	5189
55000	5346	5179	5614	5902	5515	4690	5374
65000	4240	4064	5036	4862	3865	3640	4285
Average	4726	4744	5132	5363	4716	4340	4837
$LSD_{5\%}$	402						

Table 2

The Yields of sunflower hybrids according to different plant density levels in twice applied fungicide treatment (Debrecen-Látókép, 2013)

Plant dens.	ES Amis	Paraiso 1000	Paraiso 102	ES Performa	P64LC09	ES Tectonic	Average
	Yield (kg ha^{-1})						
35000	4641	4292	4917	4732	4480	4402	4577
45000	5279	4851	5301	5413	4987	4982	5136
55000	5110	4795	5824	5653	5696	5162	5373
65000	3810	3852	4212	4707	4480	4661	4287
Average	4710	4448	5064	5126	4911	4802	4843
$LSD_{5\%}$	476						

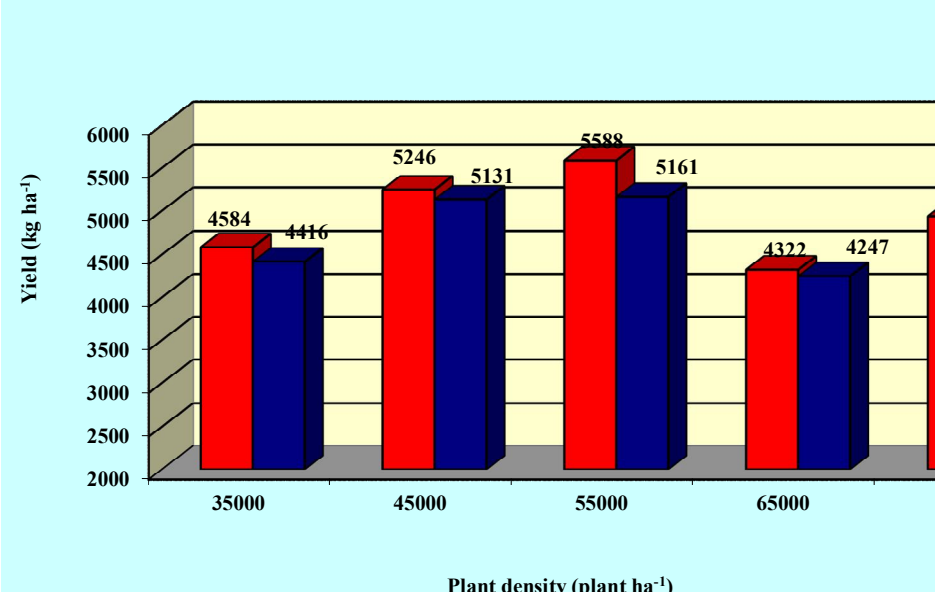

Fig. 1. Yields of LO and HO sunflower hybrids according to different plant density levels in control fungicide treatment in the average of hybrids (Debrecen-Látókép, 2013)

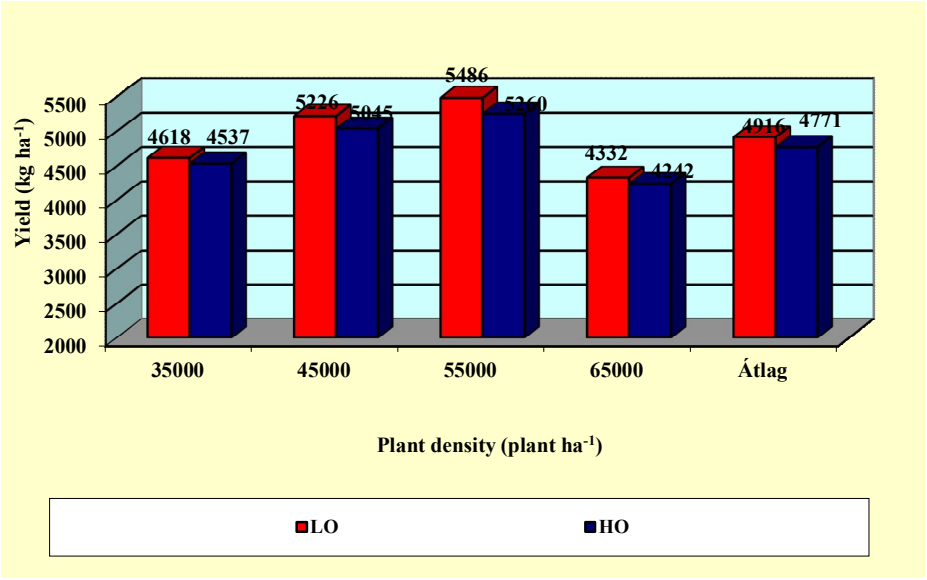

Fig. 2. Yields of LO and HO sunflower hybrids according to different plant density levels in a twice applied fungicide treatment in the average of hybrids (Debrecen-Látókép, 2013)

CONCLUSIONS

Nowadays there are more and more crop years with extreme climatic conditions, which increase the risk of sunflower production. Plant production researches aim to reduce as much as possible the number of these risk factors in sunflower production. From this perspective, optimization of agricultural factors plays a very significant role. In the production of sunflower, which is a sensitive crop from plant protection point of view, it is essential to apply the appropriate seeding technology (date of sowing, number of plants) and the optimized reasonable plant protection methods.

Experimental data assume that with chemical control of fungal diseases, yield and yield stability can effectively be increased as well as number of plants can be increased without difficulties, even in average or droughty crop years. Results showed significant differences in yield potential, resistance to pathogens and the extent to which the number of plants can be increased. Data proved that with the conditions provided by the investigated crop year, place of production and agricultural factors, yield potential of HO hybrids was lower than that of the average hybrids.

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