USE OF SOIL BACTERIUM PREPARATION IN THE SPRING BARLEY PRODUCTION

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Abstract: *We examined the effect of fertilization and soil bacterium preparation on the yield and protein content of spring barley varieties in 2011. The experiment was set in three repetitions, random blocks. The soil of the experiment was calcareous meadow chernozem. During the experiment we applied seven different fertilizer bacteria treatments, which we supplemented with a control plot. The year 2011 was unfavourable for spring barley production. In 2011 the amount of precipitation in the vegetation period of spring barley was lower than the average of 30 by 39.7 mm. As a result, relatively low yields formed. The control plots had the lowest average yield, 2.2-2.42 t/ha. We can claim that improving the nutrient supply the crop results were higher. Without the bacteria treatment the yields were between 3.12 and 4.42 t/ha, the protein contents were 8.94-12.41%. The most favourable yield results occurred in case of N 80 kg/ha+PK and N 120kg/ha+PK treatments. Under the influence of soil bacteria treatments the average yields were better in many cases, as well as that of the protein content, which obviously proves the nutrient transformation ability of the bacteria.*

Key words*: spring barley, nutrient supply, yield, fertilization, soil bacterium preparation, protein content*

INTRODUCTION

The ecological conditions of Hungary are favourable for cereals production. Spring barley is a plant produced for the brewing industry and for animal feeding purposes. Unlike other spring crops it shows unusual temperature needs and more moderate water requirements (ca. 225-250 mm in the vegetation period), but it is sensitive to the distribution of precipitation (KISMÁNYOKI, 2005).

The yield of arable crops is influenced by many factors, among them the nutrients play a determinative role in intensive field crop production (PEPÓ, 2007; PETRÓCZI, 2008).

To provide the required amount of supplementary nutrients, it is necessary to determine the suitable NPK nutrient rate for the plants. Nitrogen can be absorbed only in the presence of the necessary phosphorus and potassium supplies, and large dose of nitrogen alone induces crop depression (SÁRVÁRI, 2006).

The short-term breeding spring barley has poorly developed roots, and therefore it needs a lot of nutrients it can take up easily. To provide the high yield and good quality it is very important to ensure the optimal amount and ratio of nutrients, suitable for production purposes. The nutrient supply, the ratio and the quantities of nutrients (NPK) have fundamental influence on the yield and quality (RADICS, 1994).

The microbial vaccines mainly provide nutrients supply and plant growth-promoting hormones as well as breaking down raw materials. In addition, they have an activity against soil and seed-derived microbes (ÁRVAY, 2004).

One factor, which prevents the use of vaccines is that the effect of microbicide vaccines is less spectacular, especially compared with the results of the use of fertilizers. In many cases, the products affect only the following six crops, e.g. improve the soil structure, or the residual effects of nutrients (BIRÓ, 2004).

The use of soil bacteria preparations has several advantages. Some of the bacteria they contain bind the nitrogen in the air, while others explore phosphorus and potassium contents that plants cannot take up .This results in significant fertilizer-cost savings. Other bacteria reduce agents in the soil, thereby increasing the resistance of plants and reduce the number of fungicide preventions. As a result, less pesticides and fungicides will be necessary. They improve the soil structure, thereby improving physical and chemical properties of the soil. The lighter soils can take the precipitation better, reducing the risk of developing inland waters. On the other hand, a higher moisture content of the soil in this area would reduce drought sensitivity. The soils treated with soil bacteria preparation, due to its improving soil structure, have lower resistance to the tillage tool, which reduces the amount of fuel used for tillage. They are capable of producing plant hormones and as a result they contribute to the improved drought tolerance of plants as well. The above advantages of the soil bacterial products are justified in any field crop production. (AGRO.BIO HUNGARY KFT, 2013).

MATHERIAL AND METHODS

Soil properties of the experimental field. We set the experiment on the area next to the Mezőtúr Industrial Park in 2011. The soil was calcareous meadow chernozem, the reaction of which was nearly neutral (pH_{KCL} 6,72). Before setting the experiment the soil analysis data showed that it had proper nitrogen, poor phosphor and good potassium content. The soil was hard to cultivate, with slow transformation of phosphor and potassium.

Table 1

Main properties of the experimental field area

pH (H_2O)	$CaCO_3$	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (Ka)
6.72	0.7	64	433	3.07	57

Weather in the experimental year. The year 2011 was unfavourable for spring barley production. In 2011 the amount of precipitation in the vegetation period of spring barley was lower than the average of 30 by 39,7 mm. Particularly April and May were extremely dry when only 11.2 mm and 33.3 mm rain fell. Totally, we can say, the deficient precipitation had a negative effect on the development of spring barley, which resulted in low yields in 2011

Table 2

The distribution of precipitation in the vegetative period of spring barley in 2011

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
March	25.8	33	-7.2
Ápril	11.2	46	-34.8
May	33.3	56	-22.7
June	56.6	59	-2.4
July	77.4	50	27.4
Total amount of rainfall (mm)	**204.3**	**244**	**-39.7**

Main features of the agrotechnique applied. Our small-scaled plough experiment was set in three replications, organised as a random block in 2011. We applied seven different fertilizer bacteria treatments, which we supplemented with a control plot. The amount of nitrogen was applied in autumn and spring in 50-50 %; the total amount of phosphorus and potassium was applied in autumn in one dosage. The soil bacterium preparation was applied in spring. The fore-crop was maize. Fall tillage involved deep ploughing at 28-32 cm depth in the experimental years. The spring barley varieties in the experiment were Pasadena, KH Lédi, KH Szofi, and Mauritia.

We processed the obtained data by single factor variant analysis (SVÁB, 1981).

RESEARCH RESULTS

Without any fertilizers the yield of the examined varieties was ranging between 2.2-2.42 t/ha. The KH Szofi had the best ability to absorb and utilize nutrients. It obtained a yield of 2.42 t/ha without any fertilizers. The yield of varieties was ranging between 3.12-4.42 t/ha in the consequence of fertilization. By assessing the varieties we can conclude, that the KH Szofi reached the highest yield with 4.42 t/ha in N 120+PK treatment. The economical and reliable yield increase was achieved by N 40+PK and N 80+PK treatments. Under the influence of soil bacteria treatments the average yields were better, which obviously proves the nutrient transformation ability of the bacteria. With bacteria treatments the result was 3.37 –4.5 t/ha, so owing to this we registered 0.1 – 0.44 t/ha extra yield

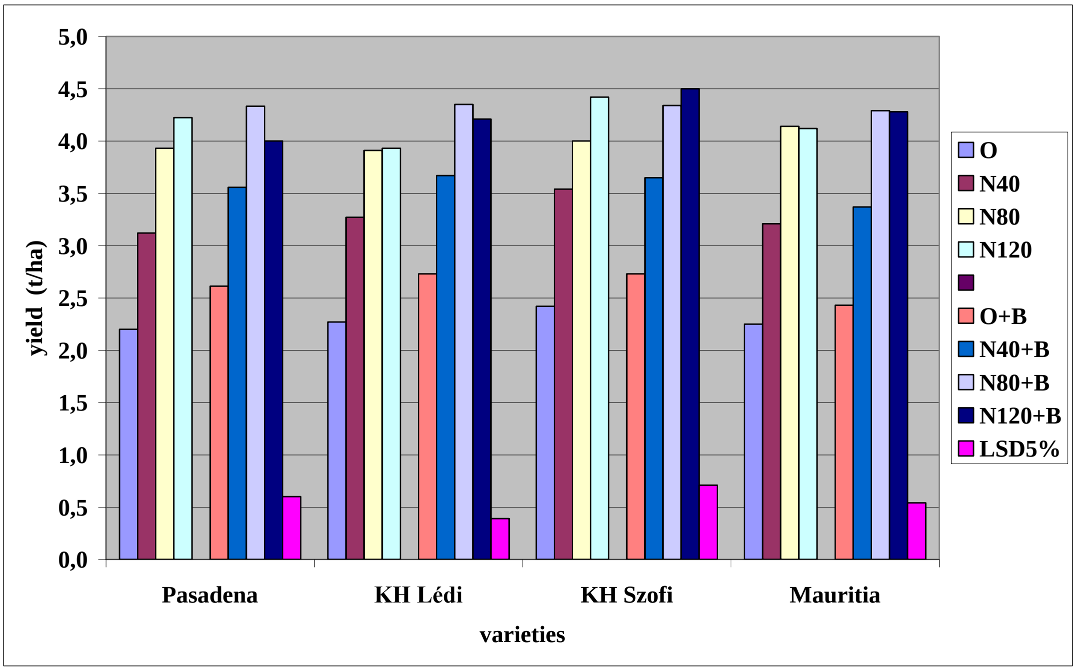

Figure 1 The yield of spring barley varieties on different nutrient levels

The protein content of the Pasadena type in control (without fertilization) treatment was 8.95%, while in the highest dose N 120 treatment it was 11.47%. Together with the nutrient-supply improvement the protein content also increased. In some cases, there were significant differences between the values of the treatments. If the fertilizer treatments were also supplemented with soil bacteria treatment protein content increased, which can be attributed to the nutrient uptake ability of the bacteria. The differences between the treatments were not statistically significant.

The protein content of KH Lédi type was 9.42% in control treatment. Together with the nutrient-supply improvement the protein content also increased. Compared to the protein content of the control and N 40 treatments, the values measured in N 80 and N 120 treatments were statistically higher. If the fertilizer treatments were also supplemented with soil bacteria treatment protein content increased, which can be attributed to the nutrient uptake ability of the bacteria. In the soil bacteria treatments it can also be observed that compared to the values of the O+B and N 40+B treatments the protein content values of N80 and the N + B 120 + B treatments were significantly higher.

The protein content in both types did not exceed 12.5% of the beer industry criteria, not even in the highest dose N 120, N 120 +B treatments.

Table 1

The protein content of the examined varieties

Treatments	varieties	
	Pasadena	**KH Lédi**
Ø	8,95	9,42
N40	9,71	9,85
N80	10,55	11,40
N120	11,47	12,42
Ø+B	10,14	10,27
N40+B	10,29	10,78
N80+B	10,67	11,89
N120+B	11,43	12,37
LSD 5%	1,38	1,04

CONCLUSIONS

Under the influence of soil bacteria treatments the yield and protein content was better, which obviously proves the nutrient transformation ability of the bacteria. Proper conclusion can be drawn only from the results of several years this making further examinations is essential.

We carried out our research from the conviction that the results obtained should be utilized on the geographical areas with similar ecological character, furthermore, newer information shall be obtained that help in the elaboration and specification of technologies for each variety, respectively.

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