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INVESTIGATION OF SOYBEAN PRODUCTION WITH MICROBIOLOGICAL PREPARATION ON THE SOIL, IN WEST HUNGARIAN REGION

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Abstract. *More and more research is conducted, how to reduce nitrogen, phosphorus and potassium fertilizer use in crop production. Application of soil replacement products are becoming too often in Hungary. In the experiment, we get a nearer view of a neutral microbial soil preparation in soybean production and the development of nitrogen-fixing nodule, the content of chlorophyll and after harvest the plants yield and contents. The soil suspension composition may exert both positive and negative effects, which depends on what has been combined with bacterial strains of soybean seed. We searched for the operating trial to answer to how changes in the treated soil the soybean production relative to the control.*

Keywords: soybean, microbiological preparation, nitrogen-fixing, nodule

1. Introduction

The agricultural aid due increased to the soybean area in Hungary, between in 2015-2016. In order ensure a higher level of production, more and more company will hold to the farmer's soybean roadshow, which demonstrate the characteristics of the varieties and the minimum agronomic conditions. More and more farmers are using a variety of additional bacteria manure in crop production, in hopes to grow the yield (M. Miransari, 2015). The foliage manure or manure on soil bacteria is not an increase in the yield, but speed the plough the stress tolerance of plants to changing climate conditions. Number of studies demonstrate that foliage manure or soil bacteria manure will be reduced to drought stress and torridity days when using the plants (J. G. Streeter,2002, D. B Lobell et al., 2007, J.H.G. Stephens et al.,2000). However, most of the enterprise purpose is not the protection, but also to increase the yield. In the field trial experiment, we tried modeling the farmers thought, to see how we could even help the better yield (E. A. Ampofo et al.,2016, E. L. Piper et al., 1999).

2. Material and Methods

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The field trial experiment was in Mosonudvar, Győr-Moson-Sopron county, Hungary. The soil is sandy-loam region, good water management, nitrogen and phosphorus content was medium, and low potassium levels, pH is 7,55, humus content 1,62. Nutrient supply was 300 kg/ha 7-20-30 npk fertilizer and the experimental area of 20 hectares. After selecting the experimental area, determined by dividing the border and outwork the soil bacteria is one of the five-acre parcel (Figure 1). The field trial applied a very early and high yield as well as protein content soybean variety. We examined based on the BBCH Scale in the following phases: 21-23 (two times),51-59, 70-79. The development of nodules in appreciable soybean growing therefore we measured all the four phases of the treated and untreated surfaces. The SPAD values amply demonstrated the activity of nodules, because the SPAD values were higher, though this was not accompanied by a high nodules numbers. We investigated number of nodules and SPAD value addition to the yield and composition content (humidity, protein- and oil content).

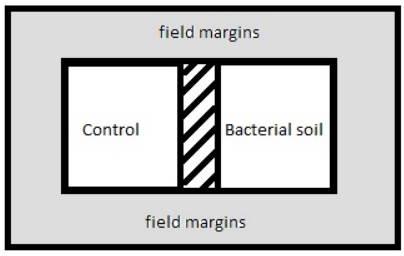

Fig. 1. **field trial in Mosonudvar, 2016.**

Chlorophyll Meter SPAD-502Plus:

The SPAD-502Plus enables quick, easy measurement of the chlorophyll content of plant leaves without damaging the leaf. Chlorophyll content is one indicator of plant health, and can be used to optimize the timing and quantity of applying additional fertilizer to provide larger crop yields of higher quality with lower environmental load.

Mininfra smart:

Mininfra instruments are scanning spectrophotometers operating in the Near Infrared (NIR) wavelength range. Mininfra grain analysers are transmission mode (NIT – Near Infrared Transmission) instruments that apply light of 780-1064nm wavelength for the measurement because grains and flour transmit this type of light in a measurable extent. The instrument trans-illuminates the material to be

analysed and measures the intensity (spectrum) of the transmitted light at several wavelengths. The measurement of the spectrum is done at some selected wavelengths: the light of these wavelengths are produced by a so called grating monochromator.

Statistical analysis:

The statistical analysis of variance analysis (SPSS) was used and accepted as significant difference in P levels in case of 0.05 met.

Results:

In the first survey has measured the nodules number (phase 21-23) (Table 1) the control field was higher than on the treated soil. We dug 10 plants per field trial, after that cleaned and counted in the lab the nodules. The treated soil does not always occur immediately positive effect, hence the importance of continuous monitoring.

Table 1) First nodule survey in field trial, Mosonudvar, 2016.

Phase: 21-23 *Nodules numbers pro plants*		
date	*Control*	*Treated soil*
06.06.2016.	11	4
	18	3
	9	8
	4	4
	11	3
	5	3
	2	3
	11	2
	11	4
	7	5
Average	**9 ***	**4**

remarks: * significant difference p<0,05

The second survey has been seen the beneficial influence bacteria manure. We dug out 10 plants pro area again, thereupon cleaning and calculated the nodules in the lab (Table 2). The treated area was more crops with nodules, such as control area, but no significant differences can be found between the two treatments. Therefore, we started to measure the SPAD value and we trust that found of difference between the treated and untreated areas. The third survey has marked the 10 selected samples, measured the SPAD value, and then dug up the plants

and counted the nodules in the laboratory (Table 3-4). We were found significant differences between the control and the treated area in phase 51-59. Higher nodules number and SPAD value get by treated area. It is clear, that the preparation of the soil began take to the effect and help the crop to the yield increase in July. The last measurement was the beginning of maturation (phase 70-79). The plants began to air dry, so it was even more interesting to examine the content of chlorophyll. We found high nodules numbers and get by higher the SPAD value in the treatment area, in the control nodules started to die away and the chlorophyll content was less well (Table 5-6). The harvest already knew that bacteria in the manure area to receive a higher yield than the control because previous studies support this. The spectacular difference behindhand by the yield. The experiment proved that the use of bacteria in large quantities of manure does not increase the yield (Table 7). The moisture and protein content of the treated soil was favorable. The protein was significantly higher compared in the treated soil than the control, which is important component for the processing industry.

Table 2) Second nodule survey in field trial, Mosonudvar, 2016.

Phase: 21-23 *Nodules numbers*		
date	*Control*	*Treated soil*
24.06.2016.	1	7
	0	4
	0	5
	0	8
	0	1
	1	3
	2	2
	5	4
	2	2
	2	1
Average	**1**	**4**

Table 3) Third nodule survey in field trial, Mosonudvar, 2016.

Phase: 51-59 *Nodules numbers*		
date	*Control*	*Treated soil*
21.07.2016.	1	23
	1	2
	0	5
	0	12
	0	0
	4	22
	4	7
	4	4
	5	4
	0	18
Average	**2**	**10 ***

remarks: * significant difference p<0,05

Table 4) SPAD-value at the end of flowering, Mosonudvar, 2016.

Phase: 51-59 *SPAD value*		
date	*Control*	*Treated soil*
21.07.2016.	51.92	50.72
	51.01	51.07
	46.67	49.3
	49.88	51.49
	47.61	48.85
	42.87	50.28
	45.03	52.87
	46.79	51.9
	43.98	51.91
	48.38	48.95
Average	**47.41**	**50.73 ***

remarks: * significant difference p<0.05

Table 5) Fourth nodule survey in field trial, Mosonudvar, 2016.

Phase: 70-79 *Nodules numbers*		
date	*Control*	*Treated soil*
23.08.2016.	31	11
	21	22
	14	18
	0	19
	0	15
	2	9
	2	11
	17	12
	9	16
	12	30
Average	**11**	**16 ***

remarks: * significant difference p<0.05

Table 6) SPAD -value at early ripening, Mosonudvar, 2016.

Phase: 70-79 *SPAD value*		
date	*Control*	*Treated soil*
23.08.2016.	12.5	30.53
	14.89	30.96
	42.18	37.96
	39.42	42.66
	16.06	44.39
	29.03	35.94
	32.87	38.99
	31.39	34.89
	34.14	31.0
	31.04	37.43
Average	**28.35**	**36.48 ***

remarks: * significant difference p<0.05

Table 7) Values measured after harvest (yield, moisture, protein, oil content), Mosonudvar, 2016.

	Yield (t/ha)	*Moisture (%)*	*Protein content (%)*	*Oil content (%)*
Control	4.29	12.05	33.65	19.10
Treated soil	4.11	11.25	35.63*	18.23

remarks: * significant difference $p<0.05$

Conclusions

The area was good to the soybean product in 2016. Right time, sufficient rainfall fell (575 mm), which has been good for the ripening. Average crop yield of 3.5-4 t/ha was in 2016. We measured on the heat days the chlorophyll content and thanks to microbiological preparation the values were better than control field. The area with microbial preparation can be said that a nitrogen-fixing bacteria to a slow start at the cross-contamination, but then continuously has been increased the numbers of nodules. The control area of the plants can be said that highly variable was the number of nodules and even during maturation, we found the plant that was not nodules. It is apparent that the bacteria manure do not cause the increased yield but improves at harvest the moisture content and the protein content. Most inoculum on the market has a reliable number of bacteria, which helps the formation of nodules in the main roots. The experiment based on better help the soybeans of the soil bacterial manure during the growing season, which is the future of the yield and content also seen. In order to achieve safe yield of the seed put out fungicidal necessary, but important for the green crops and the corresponding nutrient supply as well.

R E F E R E N C E S

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