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EFFICIENCY OF THE APPLICATION OF AN INCREASING HYDROGEL DOSE IN CULTIVAR MUSHROOMS (AGARICUS BISPORUS)

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ABSTRACT

The economical efficiency of the application of an increasing hydrogel dose in cultivar mushrooms *(Agaricus bisporus (Lange) Sing. Imbach)* has been experimented in controlled weather conditions. It was found that the application of a 50g·m^{-2} hydrogel dose is not economically proved due to the lack of yield significant increase. In the cultivation of this particular variety of mushrooms, the optimal hydrogel dose shouldn't be low than 100 g·m^{2}.

Key words: Production efficiency, hydrogel, cultivar mushroom.

INTRODUCTION

In the production of mushrooms, one keeps being in search of new methods of improving the cultivation efficiency. Reaching the target is possible through the maximisation of the production volume or the minimisation of expenses connected with the production. To realise that, substances having positive influence on the production volume are used, as well as on the quality improvement, morbidity limitation and other product features. The principle of a rationalised cultivation is to refund the entire expenses. It is nonsense to make extra expenses if in the end, there is not benefice and even expenses refund. That is why, the introduction of new technologies and means of production should precisely be analysed in terms of expenses and benefice.

The majority of substances used in the production of mushrooms provide a hormetic effect, what means that, an optimal dose exceeding of this substance causes a decrease in the volume of production and a deterioration of the quality. Establishing the right hormetic dose for this cultivation is possible only by applying the marginal account. The given accounting method was created basing on the rule of soil decreasing productivity, which derives as proved, from the hormetic effect [7].

There is no doubt that the cultivation of mushrooms is tightly connected with the amount of water available. Unfortunately, during the vegetative season, there are periods of water excess and those of water deficit. A water supply on regular basis during the whole vegetative season can improve the quality of the harvest and what is more, significantly increases the cultivation efficiency. That assumption led to the introduction and application of hydro gels (sorbing agents) to the production of mushrooms.

The application of hydro gels has an influence on the subsoil by increasing the specific surface and the sorptive volume of the soil, which increases the possibility of detaining water. [3,4] Note that, the above process leads to a change in the structure of the detained water. The amount of adsorptive water become limited and is not available for plants, but on the other hand, the global amount of water available for plants increases. The results of the analysis also show that, sorbing agents stop the filtration process and water evaporation from the subsoil [2,6] The insertion the hydrogel of cations from different metals and non metals make them a potential source of feeding components for plants [1].

Nowadays, there is still a limited number of experiment results related to the application of hydro gels in the mushroom cultivation. The available data allows us to attest the protecting role of hydro gels for mushrooms against the water problem caused by the periods of lack in the subsoil. What more, they improve the cover structure and its aeration, as well as the reduction in the frequency of watering [8].

THE AIM, MATERIALS AND METHODS OF THE EXPERIMENT

The aim was to evaluate the economic efficiency of application of the polyamide hydrogel increasing doses in the cultivation of cultivar mushrooms *(Agaricus bisporus (Lange) Sing. Imbach)* in controlled weather conditions.

The materials of the experiment consisted of the results of 2 experiments carried out in 2003 and 2004 in mushrooms production site (glasshouse) located in the Siedlce District. The experiments were carried out in the third area. The hydrogel doses below were applied:

H_c – Reference cultivation without hydrogel
H_1 – 50 $g \cdot m^{-2}$
H_2 – 100 $g \cdot m^{-2}$
H_3 – 150 $g \cdot m^{-2}$

The volume commercialisable yield ($kg \cdot m^{-2}$) was determined for each experiment. The efficiency of sorbing agents' application was determined applying the marginal account. The expenses related to the use of hydro gels ($euro \cdot m^{-1}$) were evaluated as well as the added value of production from 1 m^2 with the application of an extra hydrogel dose. The currency rate of 1euro on the 30.06.2005 was quoted to 4.0122 zł according to the NBP (Polish National Bank). The average selling price of mushrooms as basic reference was 0.997 $euro \cdot kg^{-1}$. The price of the hydrogel used in experiments was 7.48 $euro \cdot kg^{-1}$.

A Standard Deviation, a Coefficient of Variation and an average value were determined due to the diversification in volume of yielding. It has been accepted that, the diversification of results is little if the CV value is less than 10%, average if between 10 and 60%, high if above 60% [5].

RESULTS

The experiments carried out showed that the application of hydro gels in the mushrooms cultivation leads to the increase of yield on a m^2. The experimental mushroom yield, without hydrogel application was evaluated to 27.85 $kg \cdot m^{-2}$ (table 1,). A 50 $g \cdot m^{-2}$ application of hydrogel in the 2 experiments caused a 0.5 kg increase of the average volume of yield.

A 100 $g \cdot m^{-2}$ application of hydrogel in the 4 experiments caused a 2.1 $kg \cdot m^{-2}$ increase of the volume of yield, where as a 150 $g \cdot m^{-2}$ application of hydrogel caused a 3.25 $kg \cdot m^{-2}$ increase of the volume of yield. During the experiments carried out, there was an low yield diversification as the CV value for the 2 experiments was 5.08%.

Analysing the experiments in detail, a non regular yield increase was noticeable when increasing the use of hydrogel on the subsoil. On the experiments, an increase of the yield was noticed even until the H_3 dose of hydrogel.

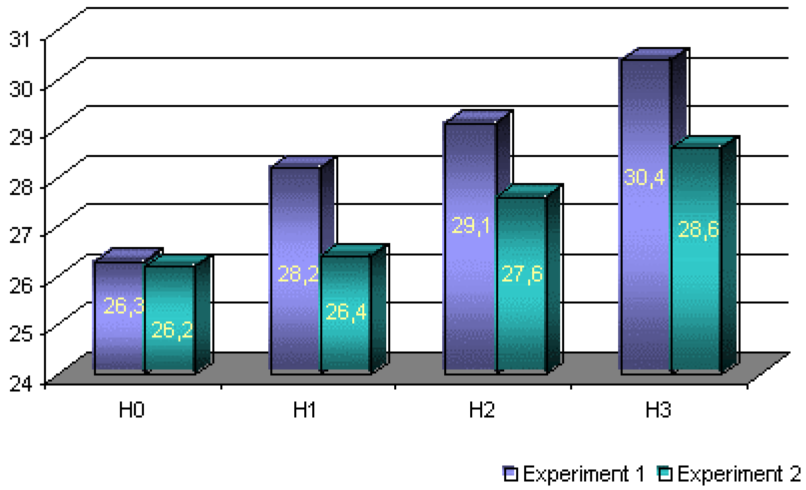
Comparing with the reference cultivation without hydrogel, the yield increase (H_3- H_0) caused by the hydrogel doses in the experiment nr 1 was evaluated to about 1.7 $kg \cdot m^{-2}$. On the experiments 2 was evaluated 1.12 $kg \cdot m^{-2}$ (table 1, figure 1).

Table 1. Mushrooms yield during the experiments 1-2 ($kg \cdot m^{-2}$)

Flush	Hydrogel dose				Average	SD	CV(%)
	H_0	H_1	H_2	H_3			
Experiment 1							
I	11.90	13.20	12.70	13.60	12.85	0.73	5.70
II	11.00	11.70	12.40	12.40	11.88	0.67	5.64
III	3.40	3.30	4.00	4.40	3.78	0.52	13.74
Σ	26.30	28.20	29.10	30.40	28.50	1.72	6.04
Experiment 2							
I	13.50	13.30	14.30	14.20	13.83	0.50	3.61
II	10.60	10.50	10.50	11.60	10.80	0.54	4.96
III	2.10	2.60	2.80	2.80	2.58	0.33	12.83
Σ	26.20	26.40	27.60	28.60	27.20	1.12	4.12
Average E_1-E_2	26.25	27.30	28.35	29.50	27.85	1.42	5.08

Source: Self elaboration based on experiments results.

Figure 1. Average volume of mushrooms yield in different experiments (kg·m-2)



Source: Self elaboration.

Taking in consideration that the price per kilogram of mushrooms was 0.997 euro, the cost of production on a metre square of surface was at the same level as the cultivation. The phenomenon can be observed on table 2, which allows avoiding detailed analysis.

Table 2. Value of mushroom yield in experiments 1-2 (euro·m-2)

Flush	Hydrogel dose			
	H_0	H_1	H_2	H_3
Experiment 1				
I	11.86	13.16	12.66	13.56
II	10.97	11.66	12.36	12.36
III	3.39	3.29	3.99	4.39
Σ	26.22	28.12	29.01	30.31
Experiment 2				
I	13.46	13.26	14.26	14.16
II	10.57	10.47	10.47	11.57
III	2.09	2.59	2.79	2.79
Σ	26.12	26.32	27.52	28.51
Average E_1-E_2	26.17	27.22	28.26	29.41

Source: Self elaboration based on experiments results.

The marginal account was carried out for the evaluation of the economical efficiency of the increasing hydrogel dose application (table 3). If the ratio ΔK/ΔP < 0, then the application of additional inputs is efficient. In that case, expenses on hydro gels are inferior to the value of the mushrooms yield. But if ΔK/ΔP > 0 or negative, then the application of additional inputs is inefficient.

Table 3. Marginal increases due to the application of sorbing agents' dose (euro·m-2) as well as the ratio between extra expenses on hydro gels (ΔK=0.374 euro) and extra profit from their application (ΔP).

Flush	Marginal increases – ΔP			ΔK/ΔP Ratio		
	Hydrogel dose					
	H_1	H_2	H_3	H_1	H_2	H_3
Experiment 1						
I	1.30	-0.50	0.90	0.29	-0.75	0.42
II	0.70	0.70	0.00	0.54	0.54	0.00
III	-0.10	0.70	0.40	-3.75	0.54	0.94
Σ	1.89	0.90	1.30	0.20	0.42	0.29
Experiment 2						
I	-0.20	1.00	-0.10	-1.88	0.38	-3.75
II	-0.10	0.00	1.10	-3.75	0.00	0.34
III	0.50	0.20	0.00	0.75	1.88	0.00
Σ	-0.15	0.50	0.50	-2.50	0.75	1.00
Average E_1-E_2	0.87	0.70	0.90	-1.15	0.59	0.65

Source: Self elaboration based on experiments results.

The 50 $g \cdot m^{-2}$ hydrogel application is inefficient as the ratio ΔK/ΔP is -1.15. Neither the 100 $g \cdot m^{-2}$ hydrogel application is efficient as the ratio ΔK/ΔP is 0.59. The 150 $g \cdot m^{-2}$ as its ratio is positive, and was evaluated 0.65.

The results of experiments allow attesting that, to make the hydrogel application economical, it shouldn't exceed 50 $g \cdot m^{-2}$. In this case, the optimal dose is 100 $g \cdot m^{-2}$.

REFERENCES

1. Bres W., Łukasz P. 1996: Ocena własciwosci hydrożelu alcosorb (AS 400) oraz badanie możliwosci jego stosowania jako komponentu podłoży. [Properties evaluation of alcosorb (AS 400) hydrogel as well as analysis of possibilities of its application as a subsoil component. Zesz. Probl. Post. Nauk Roln. nr 429, page 65-68 [in Polish].
2. Hajnos M., Sokołowska Z., Stawiński J. 1994: Wpływ sorbenta poliamidowego na opór penetracji i porowatosc gleb. [The influence of the polyamide sorbing agent on the penetration resistance and the porosity of the soil.] . Zesz. Probl. Post. Nauk Roln. nr 407, page 21-24 [in Polish].
3. Hetman J., Martyn W. 1996: Oddziaływanie hydrożeli na własciwosci wodne podłoży ogrodniczych. [The impact of hydro gels on water properties of garden subsoil]. Zesz. Probl. Post. Nauk Roln. nr 429, page 133-135 [in Polish].
4. Martyn W., Onuch J., Amborska J. 1998: Ocena tempa wysychania podłoży ogrodniczych w zależno□ci od udziału w nich hydrożeli. [The evaluation of frequency of garden subsoil drying up in dependence on the application of hydro gels]. Zesz. Probl. Post. Nauk Roln. nr 461, page 291-298 [in Polish].
5. Rószkiewicz M. 2002: Narzędzia statystyczne w analizach marketingowych [Statistic tools in marketing analysis]. C.H. Beck, Warsaw page 7 [in Polish]
6. Sokołowska Z., Hajnos M., Gliński J., Wolski T. 1994: Retencja wody w glebie gliniastej i piaszczystej modyfikowanej dodatkiem sorbenta poliamidowego. [Water retention in clay soil and in sand modified by the polyamide sorbing agent]. Record Zesz. Probl. Post. Nauk Roln. nr 407, page 51-55 [in Polish].
7. Szarek S. 2005: Use theory of hormesis to explain of law diminishing returns. EJPAU, Volume 8, Issue 4.
8. Szyduga K. 2002: Uprawa pieczarki. [Mushrooms cultivation]. Hortpress, Warsaw [in Polish].

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