THE USE OF COMPOST, NOURISHMENT AND FEEDING

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The price of straw decides on the compost production costs. The current situation with the green energy funding indicates that for the 3-4 years to come the purchase of straw to burn together with coal will decide upon its price and at the same time the price of compost. It is hard to say what the situation will look like in the future as it will depend on new legal regulations, the reaction from the energy sector and the availability of straw, mainly its level of crop on fields.

In the new season it can be estimated that the annual average straw purchase price will not be lower. Whether it will be higher and by what amount is hard to indicate as it is difficult to determine the crop conditions writing the article now in July. Will the weather during the cropping be favourable or not and what part of the crop will be suitable for further storage.

Regardless of the current situation on the straw market, the compost is becoming a more and more significant cost in the mushroom production. It has been estimated that currently the compost involvement in the mushroom production is approaching 60%. This means that it has to be used in an even better way. A mushroom producer does everything he can, using the resources, knowledge, skills and farm equipment to the best of his abilities. Despite all of the above the diversity in the crop is significantly large. To redress the balance is an individual issue for a mushroom producer. It is estimated that currently the maximum use of fresh compost, assuming that the average yield is 32kg/m2 and compost fill within 85kg/m2 with 1% worth of protein additive amounts to 38% with the flush distribution 16 – 12 – 5kg/m2; the maximum is 48%. The phase 3 compost produced in Poland differs significantly in moisture, from the lowest in summer – around 54% to the highest in winter – around 69% also this depends on a producer. The average moisture varies around 63-64%. The compost also differs greatly in the ash content.

In the recent period one of the Dutch producers undertook action to increase the degree of using the compost to the level of 50% with the 60kg/m2 of compost. This means that in 3 flushes the proposed solution should allow for the crop to reach 30kg/m2. He is trying to reach this target using an under shelf heating and cooling system; it is a more efficient control of the compost and significant dose of protein additive for the compost. In the Polish conditions none of the solutions seems viable. High installation costs of the under shelf heating and cooling system and the efficiency of its performance is rather low. What does not help is the lack of the proportion between the crop and the additives in it. Moreover, the additives used now do not facilitate reaching this target. In the Polish conditions the great differences in the compost moisture make it difficult to determine a precise evaluation of the proposed solutions. Thus, the first step to measure the proposed changes should be to introduce indicators to show the use of fresh compost and dry compost as well as the level of organic matter.

From the Polish perspective, at the current stage of mushroom farming development it seems promising to enrich the environment the mushroom bears the fruit in substances cheaper than the compost that allow to use the environment even better. The analysis of methods of absorbing nutrients by the mushroom from the environment may facilitate to solve this problem. The absorption takes place in two different methods depending on it developmental stage. For a better understanding let me introduce and define two terms:

1. Nourishment. It is a process of absorbing nutrients from the environment (casing, compost); additionally delivered nutrients through the mushroom mycelium in the period of vegetative growth by the enzymes it possesses. The absorbed nutrients are gathered in the mushroom mycelia. After stopping the growth as a result of a shock – moving from the vegetative to the generative phase; fructification, this type of feeding fades away. The idea of using this method of feeding is used by an English company Nutrigain and the effect of research and development program is a product of a chemical synthesis trademarked Mycronutrient. It is the first feeding product used during the vegetative phase. At the moment it is mainly used to enrich the casing. The introductory tests carried out in Poland show that it can be effectively used providing that Mycronutrient is used properly in the casing and practically it can only be used in casing production companies. Further study on the use of the product will be continued. The product does not contain any animal or plant origin, which greatly increases the safety of its use. It is also a product with which mushroom diseases are unlikely to develop whether these are competitive or parasitic diseases attacking the compost for its production. It does not cause a thermal effect in the compost either – a strong increase in temperature caused by a protein additive in the phase 3 compost. The test and implementing works in Poland are carried out together with Nutrigain – the producer and recently Afirma has joined in – casing producer. The active substance in the product can be widely used also as a compost additive. However, the works are currently focused on the use in the casing. It also means that we will come back to the topic of mushroom feeding again as we get the effects of using Mycronutrient. The process of adjusting Mycronutrient to the Polish conditions must still take some time due to the fact that different types of casing are used in mushroom production in Poland and due to high amounts of water used after putting the casing.
2. Feeding is absorbing from the compost with water and additional nutrients; substances are absorbed by the mushrooms in the composting process in the cold phase; mushroom fruiting (including the introduced additive) with the microorganism coexisting with the mushrooms. The effect of feeding depends on the microorganisms’ activity in the compost, on the availability of water in the compost, on the amount and thickness of mycelia in the compost with the fruiting bodies and mushroom buds and on water evaporation from their surface. These on the other hand depend on the microclimate conditions ensuring their uninterrupted transport. This process shows that the compost activity remains in good shape. As well as hyperactivity and its lack indicates that the course of feeding process is improper. The feeding process is started by mushrooms after the end of shock and the development of buds. To increase the efficiency of feeding, protein additives are used. From the historical point of view it has been a method of increasing the use of compost for many years however recently it has been failing due to the necessity of further increase in the compost efficacy caused by the ever changing situation in the industry and on the market as well as the very nature of using the additives.

The main issues connected with the use of protein additives are:

1. The limitations in the amount of dosage. The amount of 2% cannot be exceeded because it is becoming harder and harder to control the thermal effect, decreasing selectiveness of the compost and the difficulties in mixing big amounts of the additive with the compost in particular when it is too dry or too moist. Uneven mixing with larger and larger amounts of the additives leads to the compost and mycelium deterioration as the compost returns to the hot phase of composting. The dosage can be increased with the moist compost at hand (67-69%) mixing it well with the additive whilst filling on a shelf, choosing the additive that results in a minimum thermal effect such as ProMycel Gold and it increases cooling capabilities of the compost.
2. The lack of mechanism for setting dosage in relation to the compost quality. In principle the dosage of the additive is set freely with the assumption that it is better to add something than nothing. There is no mechanism for setting the dosage in relation to the compost quality. The application of NRI (spectroscopy) has not brought the desired objective - to analyse the compost. It turns out that this method is only faster than the traditional methods without any extra benefits in relation to the navigation of the production process and the additive dosage settlement. The factor that disrupts the relation between the amount of the substances available for the mushrooms and the amounts actually used by them is the crop conditions, which frequently makes it hard or even impossible to establish the quality of compost and the amount of dosage used. There is no information on the amount of cropping achieved by the mushroom producers in relation to the use of the compost. The producers often use different amounts of compost for an area unit.
3. The increasing price for soya results in the additive price rise in relation to the expected effect, in particular larger amounts of additives to be used. It is additionally complicated by the genetically modified soya and ethics; soya is food for people.
4. The soya price rise results in the increase in the competition among its providers. It leads to the elimination of soya in the additives. It is illustrated by the reluctance to reveal the additives’ composition. This is to prevent the possibility to establish an actual price unit of protein in the offered additives, and I hope, to end the attempts to introduce additives with animal origin. It results from the fact that the producers when buying additives are often led by the price not the quality of the additives. It is to some extent understandable when facing issues with the dosage.
5. There is no liability put in place for a delivery of defective additives with improper composition, e.g. containing animal additive. Who is responsible for a possible loss: the compost plant or the mushroom producer that accepts the offered additive?
6. There is no Polish additive producer. It is additionally complicated by the confusion on the market. It is difficult to enter the market as the producer has to compete with large fodder companies - specialised providers of additives strongly bound by contracts with compost plants.

The confusion around the use of compost and the application of additives is intensified by some compost plants’ attempts to introduce a substitute for a crop straw such as corn straw, hay and rape straw. In my opinion these attempts have no future as the prices of all raw materials of plant origin that can be used for burning are similar and the introduction of a good compost production technology from other raw materials to gain big cropping is rather problematic. It may turn out that the patient died before an equally effective medicine was invented (*Polish saying*).

The search for new ideas to combine mushroom nourishment and feeding as well as to strengthen mycelium.

At the moment tests can be carried out to examine the application of feeding substances (Mycronutrient) in order to:

1. Strengthen the compost designed for CACing through mixing the feeding substance (Mycronutrient) with the overgrown compost and leaving for further growth; mycelium regeneration for 2 or 4 days. Next, the fragmentation of the regenerated compost and using it as CACing. The stronger mycelium should allow for its more aggressive behaviour in casing in particular in a heavy casing. And then a better transport of the nutrients.
2. Nourish compost surface at about 2-3cm in particular phase 2 in order to improve its shape. It is to ensure a better connection of the compost with the casing and the fruiting bodies. The top surface is watered with the solution containing the nutrients and is left for 2 days and then it is sprayed and covered with nutrients (Mycronutrient).
3. Improve the degree of compost overgrowth through the introduction in phase 2 a feeding substance in a form of granules. This is to allow the mycelium to spread on the compost, to shorten the time the compost may be affected by competitors and to penetrate the hyphae with a nourished mycelium.

For the compost in phase 2 and 3 some tests may be carried out to examine models to improve the use of compost, basing on the substances for nourishment and feeding already at hand and searching for new solutions in the future.

Phase 2 compost

1. Compost overgrowth with the feeding additive as a solid substance.
2. Preparation of CACing with the feeding additive.
3. Preparation of the compost surface with a dose of the feeding additive.
4. Placing the casing with the feeding substance and the prepared CACing.

Phase 3 compost

1. Compost overgrowth with the feeding substances (Mycronutrient).
2. Placing the casing with the feeding substance.
3. Using ½ dose of the protein additive designed for phase 2 to strengthen the mushroom cropping in the second and third flush. ProMycel Platinium for example.
4. Decrease in the compost amount to 60-70 kg/m2.

Other suggestions to increase the use of compost.

When analysing the mushrooms feeding methods, new ideas can be put forward which can improve the degree of the compost use:

1. The production of protein additives containing microflora improving the compost decomposition process in the symbiosis with the mushrooms.
2. The compost aeration in the period of mushroom cropping in order to improve the cold composting process.

The search for new solutions involves scientific study. Currently there are no connections between the industry and science. The very industry does not invest in the future. The development expenses are treated as production costs. The same is for consulting. The producers do not consider the loss due to getting no benefits through consultation.

The very compost potential does not ensure expected compost. What is necessary is properly laid out and equipped mushroom farms. Even now better a production performance can be noted in newly built premises equipped with state of the art controllers filling loose compost using modern combines with heavy casing and the technology for its processing on the shelf.

The key person to achieve a high compost use is a process engineer that has a specialist knowledge and motivation to do this task.

The problem can be reversed and we can ask ourselves a question – what can we do to yield 40kg/m2 , as it was described in grzyby.grzybnia.pl, not doing anything to enrich the environment the mushrooms grow in!

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