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The Significance of Bokashi Compost Obtained from Beneficial Microorganisms on Sustainability and Waste Disposal

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ABSTRACT

It is known that the use of chemicals is one of the leading factors that cause soil pollution. Studies are carried out to developed new methods for reducing the damage caused by chemical inputs that continue to increase and to ensure the sustainability of wastes by creating awareness of nature protection in product cultivation and consumption. In addition, the irregular storage of household waste has become a serious problem in our country. This problem greatly affects climate change by causing environmental pollution. In order to reduce or even eliminate these effects, bokashi compost, which is obtained from organic wastes, has been produced for many years in the world with the aim of improving the physical and chemical properties of soils, increasing productivity and sustainability. The aim of this study is to determine the importance of bokashi compost, which is produced with the help of beneficial microorganisms, which is an effective soil conditioner to maintain the existence of our natural ecosystem that does not cause environmental damage, in terms of sustainability.

1. Introduction

Our country comprises a geography that has hosted the biodiversity of different cultures for centuries, where a wide range of agricultural activities are carried out until today and which has the most suitable climatic conditions in the world in terms of agricultural production. We owe it to the very fertile soil structure entrusted to us in order to bequeath a legacy to future generations and the existence of our unique ecosystem in order to carry out a wide variety of polyculture agricultural production in our lands. This will be possible by protecting our rich wealth and applying correct and programmed agricultural techniques by preserving soil fertility and quality for the sustainability of agricultural production. Accordingly, increasing the amount of organic matter in the soils is the first step to be taken. Since the past, the need for organic matter of the soils has been ignored and the chemical pollution experienced in our soils has caused serious problems due to the chemical inputs applied incorrectly and continuously with the idea of increasing the product yield.

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Although the fact that we have insufficient raw materials of fertilizer in our country causes us to be economically dependent on foreign countries, we are faced with a great loss within the scope of sustainability when we evaluate the income we will obtain in the short term in the long term by weakening and barren our highly fertile lands. In addition, human, animal, plant presents significant threats in terms of environmental health. When all these reasons are evaluated, the significance of environmentally friendly smart agricultural practices has increased in order to ensure the sustainability of organic wastes aimed at increasing the productivity of our heritage soils (Bellitürk and Goldmann, 2020; Çelik and Kılıç, 2020). Although the controlled disposal of organic wastes is more of a problem in developed countries compared to the population, both environmental and domestic wastes have reached serious dimensions in our country by drawing attention to the increasing consumption due to the rapidly rising population density in recent years (Kılbacak, Bellitürk and Çelik, 2021). Uncontrolled storage of waste plays an important role on the climate change in addition to revealing environmental problems. At this point, our duty is to separate all kinds of organic wastes, process them with completely natural methods and convert them into organic fertilizers that are both suitable for the balance of nature and have economic added value and ensure their sustainability.

In this direction, the importance of compost and biogas production facilities is increasing with the aim of recycling which has gained momentum in recent years and studies are carried out in accordance with the 100% natural ecosystem.

Bokashi compost

As seen in the world, bokashi compost obtained from organic wastes is produced in order to increase the fertility of the soils that have gained importance in recent years in our country and to improve the physical and chemical properties of the soil with the aim of sustainability.

Bokashi is a Japanese term for organic matter that has been fermented. Although there are many types of composting activities, the easiest and cheapest method is known as bokashi compost. In general sense, bokashi compost, which was developed in later periods by taking the old Japanese culture as an example, emerged as a result of the activities of EM (Active Microorganism) created by anaerobic conditions.

It has gained importance in recent years in the world and is widely used and produced although it displays differences according to countries. In bokashi compost, which is created from domestic organic wastes in Europe and the USA, the bokashi bran is obtained with EM first which is known as beneficial microorganisms. The resulting bokashi bran is added the organic parts of the kitchen wastes after separation and left to fermentation for about 21 days in the buckets that do not take air with the mouth closed. During fermentation, the drainage of the leachate accumulated at the bottom ensures the continuity of beneficial microorganism activities (Alattar and Popa, 2016). The production of bokashi compost is mainly to impregnate beneficial microorganisms in a dry dandruff and then dry them to preserve them under suitable conditions and store them for use. Unlike other composting processes, bokashi is similar to pickling made in homes. Since it can be easily made in a bucket that does not take air with its mouth closed, we can obtain bokashi compost even in our homes. Since EM completely undertakes composting, it does not require processes such as mixing, ventilation and turning as in other compost types. Citrus, animal products such as meat and dairy products and similar wastes, in short, materials that cannot be used in other composting processes, undergo a rapid fermentation and break down in bokashi. It is possible to produce at home lactic acid bacteria, which are necessary for the construction of bokashi compost and carry out the main decay process. Active microorganisms are organisms that were discovered and developed in the early 1980s by Dr. Teruo Higa.

The theory of Dr. Higa is presented that there are three kinds of microorganisms in any system such as the atmosphere, soil, and water: positive microorganisms, negative microorganisms, and opportunistic microorganisms. Regardless of the system, the healthy development of a formation depends on the equal and balanced harmony of positive and negative microorganisms in the environment. They are opportunistic microorganisms that change places depending on the multiplicity of other microorganisms in the environment. In the system, if negative microorganisms are in the majority, they are on their side, and if positive microorganisms are in the majority, they are on the positive side. The main goal of active microorganisms is to increase the presence of positive microorganisms in the system and to attract the attention of opportunistic microorganisms and to get their support.

Bokashi compost production activities constitute areas to maintain the process in the world effectively and continuously. However, it is still not a widely applied compost variety in Turkey. This leads to the fact that the exact method of composting cannot be determined. In recent years, research has been initiated and trials have been conducted. The positive effect of bokashi compost on the physical and chemical properties of the soil and its yield-increasing effects on plant growth have been stated as a result of the studies conducted worldwide.

Bokashi compost is a material that is considered as a soil conditioner and used as an organic fertilizer containing humus with a very high content of organic matter (Tanuğur, 2009).

In a pot trial in which they conducted (Guzman-Holst, Zaneva, Chessell, Creswell, and Bowes, 2022), they aimed to determine the effects of EM-bokashi, which is applied in different amounts during the development of radish (Raphanus sativus). As a result of the study, EM-bokashi treatment increased the average lump diameter, length and weight significantly. It has been observed that bokashi compost which was produced by using different organic wastes increases the chlorophyll levels and dry biomass values of cucumber (Cucumis sativus) and cabbage (Brassica napus subsp. pabularia) seedlings (Abo-Sido, Goss, Griffith, and Klepac-Ceraj, 2021). In an incubation study with bokashi compost was added to organic waste, chemical properties of the soil, nitrogen concentration and nitrogen mineralization were increased in the soil (Augusto, Luiz, and Beatriz, 2018). It was also found out that bokashi compost has an effect on the evaporation of water from the soil and a decrease in soil temperature (Lasmini, Nasir, Hayati, and Edy, 2018). In a study (Christel, 2017), the researcher thermophilic compost and vermicompost, respectively to the soil where spinach (Spinacia oleracea L.) is grown with bokashi. As a result, they observed that the application of bokashi improved the yield and quality of the plant and the application provided plants longer- lasting and accessible inorganic N support than vermicompost.

Bokashi application increased the nutritional

quality of spinach by increasing the concentrations of K, Fe, Mg and Zn in spinach leaves compared to other applications.

In addition, the second harvest showed a higher N content in the spinach leaf texture compared to the others. In a study (Erdoğdu, 2020) the effects of bokashi compost with beneficial microorganisms on yield and yield characteristics of silage corn was investigated. It was observed that the organic matter content increased in the soils where bokashi was applied, and the raw ash and cellulose content increased in the raw materials chopped with silage. In a 11-year study (Hu and Qi,2013), it was found out that the nitrogen and phosphorus ratio contained in the leaves was higher as a result of dry matter analysis the effects of bokashi compost and traditional compost application examined on wheat yield. According to the results of the research, it was reported that the positive effects of beneficial microorganism activities on the increase in yield in wheat were reflected due to the stimulating effects on nutrient mineralization.

2. Conclusion

Lack of organic matter which has an extremely important place in agricultural production activities is the main determining factor affecting the quality and yield of the product. Continuous and uncontrolled chemical fertilizer applications without providing organic matter supply to the soils increase the yield during the harvest period and causes mistakes and ignore the negativities they create in the soils in the name of sustainability of agricultural production in the long term. Chemical inputs used in agricultural activities carried out by traditional methods are applied unconsciously and in large quantities, affecting the natural balance of our soils completely negatively and accelerating the process of inefficiency. For this reason, it is inevitable to use bokashi compost in the name of sustainable agricultural production, especially in traditional and all agricultural productions, respecting the natural environment to protect the ecosystem, as well as considering soil and plant health, and evaluating all kinds of animal and vegetable organic wastes**.** The realization of all natural and organic fertilizers obtained from organic wastes with a sustainable agriculture in the cultivation of plant products in terms of human health should now be undertaken as a universal duty. It should become our main duty to organize and carry out sustainable agricultural techniques with supra-state agricultural policies on behalf of the generations that reproduce without disease without disturbing the biological balance of our soils, and to project and support them. In addition, unsupervised storage and uncontrolled disposal of household wastes has become a major problem in Turkey. Based on this problem, it was decided to establish and implement decisive criteria for the regular storage of domestic solid wastes in our country (T. Ç. M. Odası, "Hava kirliliği raporu,2018). In the declaration published after the 'Zero Food Waste Leaders' Network' meeting held in Ankara on 10 October 2018, it was announced that the average food waste in our country was 26 million tons and the idea of taking the necessary steps to reduce these wastes to the lowest levels was defended (Kılınç Şahin,2016). On average, the amount of organic waste in the USA annually is 30 million tons. Based on the announced figures, studies continue to be carried out to ensure the evaluation and recycling of organic wastes worldwide. With this goal, the United Nations General Assembly has decided to reduce the food and organic wastes sent to the burial disposal facility by half until 2030 within the scope of the 2030 Sustainable Development Goals (Lan, Sun, and Fan,2020).

If all these developments are taken into consideration, bokashi compost can be one of the effective methods that can be applied in solving the problems related to the storage of organic wastes and the recovery of the nutrient element in the content of foodborne wastes to the soil.

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