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ORIGINAL ARTICLE

Agricultural wastes in climate change mitigation

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ABSTRACT

Today, among the wastes that harm the environment, there are many wastes such as cleaning agent wastes and expired drugs. In addition to these wastes, agricultural wastes are an important issue. The vast majority of agricultural wastes are wastes containing high cellulose. Agricultural wastes include tobacco plant waste, vineyard and fruit tree pruning residues, wheat straw, cob, cotton stalk, mushroom compost residues, corn stalk, husk, rice bran, pulp, lentil waste, wood shavings, bean straw, leather waste, soybean straw, wastes consisting of a dysfunctional irrigation system and plastic mulches. Gases especially causing greenhouse gas effect (carbon dioxide, methane, nitrous oxide and other) which are released by the destruction of agricultural and other wastes by burning, accumulate in the atmosphere, causing global warming and negatively affecting the climate. The study has been compiled with the aim of revealing solutions for the use or recycling of agricultural wastes that cause greenhouse gases when destroyed by incineration.

Keywords: Climate change, agricultural waste, environment, greenhouse gases, evaluation

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1. INTRODUCTION

In case of unconscious burning of agricultural wastes, gases such as carbon dioxide can accumulate in the atmosphere. These gases, which accumulate in the atmosphere and keep the rays reflected from the earth to the atmosphere and warm our world, are called greenhouse gases. If these greenhouse gases accumulate in the atmosphere in excessive amounts as a result of burning garbage and agricultural wastes from various sources other than natural ways, the amount of radiation they hold increases. In this case, global warming, which is an important climate problem, occurs due to the increase in gases that cause the greenhouse effect.

One of the important issues that should be prevented in agricultural areas is stubble burning. Burning stubble increases the emission of gases that cause greenhouse effect in the atmosphere and global warming. In addition, beneficial insects and organisms in the soil die by burning the stubble. Stubbles can be evaluated by mixing the stubble with the soil or using it as straw.

According to the type of agricultural waste, agricultural wastes can be reused today in packaging, biochar production, composting, fertilizer production and similar ways. Agricultural wastes such as animal manure, straw, fruit and vegetable wastes, waste paper can also be used in the production of vermicompost, which is an important fertilizer, in addition to compost. Plastic products such as pesticide packaging, irrigation system residues, and plastic mulches can be reused instead of incineration. Vegetable and animal wastes can be used as organic fertilizer and soil improver.

There are different methods in the evaluation of agricultural wastes in different agricultural products. In a study (Elbasiouny et al. 2020) about the administration of agricultural wastes for the reduction of climate change, mentioned that agricultural wastes increase due to population growth and that these wastes are disposed of with incineration or inappropriate methods. They stated that this situation harms the atmosphere in terms of wasting valuable resources as well as increasing greenhouse gas emissions. In their studies, they mentioned the importance of using these wastes as animal feeding, composting, bioenergy sources, bioplastics and building materials in order to prevent greenhouse gases and climate change. However, they mentioned that rice, corn, wheat or barley, cotton, sugar beet crops are the agricultural wastes in the highest amount.

Çolakoğlu, B. (2018), divided agricultural wastes into wastes that occur during or after animal production, wastes that occur during or after plant production and wastes that occur during or after the production of agricultural products. It was mentioned that agricultural wastes can be evaluated as renewable energy source (biomass, biogas fuels), compost, particle board, biodegradable plastic production, mulch, mushroom production, paper production, insulation construction material, heavy metal removal.

In another study (Doğan, N., 2005), cotton stalk and apricot kernel used as biosorbent in order to absorb copper (Cu) and lead (Pb) heavy metal ions from liquid solutions. It was determined that cotton stalk was more effective in removing both heavy metals than apricot kernels. In addition, it was observed that agricultural wastes remove Pb ions more effectively than Cu ions. It was found that the harmful effects of heavy metals on P. aeruginosa soil bacteria were reduced with the help of agricultural wastes. The aim of the study is to eliminate the lack of knowledge about the damages caused by the incineration of agricultural wastes to the environment and climate. In addition, contribute to eliminating the lack of knowledge about how these wastes can be used and to improve people's perspective on this issue.

2. PRODUCTION OF ORNAMENTAL PLANTS BY USE OF AGRICULTURAL WASTES

The evaluation of agricultural wastes in producing of ornamental plants is another issue. Ornamental plants are usually produced in pots, so a growing medium is needed.

Micro scale structure and physical, hydro physical designation of organic wastes of hazelnut husk, corn straw, pine bark, tea waste, wood chips, rice husk, waste mushroom compost,

household waste compost were determined in a study (Öztekin, H. Ö., 2018) regarding the use of organic wastes in growing ornamental plants and in the result of study, domestic waste compost, waste mushroom compost, hazelnut husk, wood shavings were found suitable for use as growing media. In addition, it has been stated that corn straw, pine bark, tea waste and rice husk media can be used by adding certain amounts to the growing media.

In study made by Zulfiqar et al. (2019) by using *Dracaena deremensis* ornamental plant, growing environments were created by replacing mown grass, leaves and wheat straw biochar materials with 10% peat. They determined that the addition of biochar and compost materials to the peat/perlite medium increased the growth in vegetative part (height of plant, leaf number, area of leaf, fresh biomass) of *Dracaena deremensis* by 10-30% compared to the peat/perlite medium.

A study carried out by Jayasinghe et al. (2010) on using of substrates obtained from animal manure compost and synthetic aggregates in ornamental plant production as an alternative to peat. In their study, they determined that animal compost and synthetic aggregate based media were more effective on plant growth than control (peat) media in French marigold (*Tagetes patula*). They determined that the highest length of plant, number of flowers in per plant, shoot fresh weight, shoot dry weight, root length, root dry weight, root fresh weight values were obtained from animal manure compost and synthetic aggregate medium at the rates of 40% and 60%. They determined that the mentioned parameters in this medium (40% animal manure compost, 60% synthetic aggregate) had higher values, respectively, 27.01%, 42.86%, 37.09%, 67.29%, 5.14%, 45.58%, 34.26% compared to the control medium.

3. USE OF MUSHROOM COMPOST WASTE IN AGRICULTURAL PRODUCTION AND USE OF AGRICULTURAL WASTE IN MUSHROOM PRODUCTION

Baran et al. (1995) conducted a study to determine the physical and chemical features of agricultural wastes from tobacco dust, grape pomace and mushroom compost. They determined that the physical properties of agricultural wastes in their study were insufficient, however, their nutrient content was at a very high level. In addition, the organic matter contents of all agricultural wastes they used in their study were found to be high, grape pomace had the highest organic matter content. However, they determined that the aeration capacity of agricultural wastes consisting of tobacco dust, grape pomace and mushroom compost was insufficient and it was stated that these agricultural wastes could be mixed with environments with high aeration capacities such as peat and perlite and their aeration capacity could reach the desired level. In terms of salt content, they mentioned that tobacco dust and mushroom compost have high values.

Polat et al. (2004) conducted a study on the effects of using waste mushroom compost in lettuce cultivation on yield and quality. In their study, synthetic mushroom compost waste, which was kept in the open field for two years, was used in lettuce cultivation at doses of 1, 2, 4 tons/da. The authors determined that waste mushroom compost applications gave higher results in terms of average head weight, average marketable head weight, and total marketable product, compared to the control application.

Another issue is the usability of agricultural wastes in mushroom production. Fungi take in oxygen and give off carbon dioxide, that is, they breathe. More research is needed to determine whether the use of agricultural wastes in mushroom production instead of burning has a positive effect on the atmospheric greenhouse effect. However, when a material is burned, a large amount of carbon dioxide is suddenly released into the air. In mushroom production, there may be a slower release of carbon dioxide. Pasteurized, rotten or waste organic materials of vegetable and animal origin can be used in mushroom production. *Pleurotus spp*. production can be done using freshly cut logs as well as different composts. In this way, instead of using logs as wood, that is, as fuel, it is possible to evaluate them in a way that can contribute more economically. Another important issue here is how much efficiency will be obtained from which waste.

A large number of agricultural wastes can be used in mushroom cultivation.

In the study (Akyüz and Kırbağ, 2009), agricultural wastes consisting of wheat straw, cotton stalk, corn stalk, rice bran, lentil waste, bean stalk, soybean stalk, and leather waste were used for the production of *Pleurotus spp*, it was found that wastes from agriculture and industry were easily used in the production of *Pleurotus spp.* Within the scope of their study, the lowest yield (in 100 g compost containing 70% moisture) was 15 g and obtained from *P. eryngii'*s wheat straw + 5% leather waste, and the highest yield was 22 g and obtained *P. eryngii's* wheat straw-bean stalk (1 :1) + 5% rice bran.

In a study by (Kurt, Ş., 2008) vine pruning residue, wheat straw, rice straw, sesame stalk, 2 sawdust+bran, 2 vine pruning residue+bran, 2wheat straw+bran, 2 rice straw+bran, 2 sesame stalk+bran media were used in the cultivation of *Pleurotus ostreatus*, *Pleurotus sajor-caju* mushroom species and the fastest mycelial growth in *Pleurotus ostreatus* species was obtained from wheat straw (22.83 days), vine pruning residue (23.67 days), sesame stalk (26.22 days) media, and in *Pleurotus sajor-caju* species from wheat straw media. In addition the highest total yield and biological efficiency rate in both species were obtained from 2 wheat straw + bran medium and the lowest yield was determined in wheat straw medium in both species. Besides it was informed that the easy availability of these wastes according to the regions is important for the continuous production of mushrooms.

4. OTHER STUDIES ON THE USE OF AGRICULTURAL WASTES

Kara et al. (2021), examined the impacts of organic mulch practice using wheat straw on the physical properties of the soil. As a result of their study, they determined that 600 kg/da and 900 kg/da wheat straw practices increase the organic matter in the soil and increase the yield and quality in plant production.

Another agricultural waste obtained in significant quantities is obtained as a result of tobacco farming. Çerçioğlu, M., (2011) mentioned that agro-industrial wastes can be used instead of inorganic fertilizers and that the use of tobacco waste in sustainable agriculture can be an alternative to inorganic fertilizers. Within the scope of study, it was emphasized that importance of using tobacco waste as fertilizer in order to prevent the damage caused by the burning and disposal of tobacco plants and fabrication wastes, which are rich in organic matter. However, it was stated that tobacco dust should be used by composting in order to reduce the amount of nicotine. In addition, it has been mentioned in the study that the use of tobacco waste in the improvement of the physical and chemical structures of alkaline soils can be beneficial in terms of agriculture and the environment.

In addition, agricultural wastes can also be used in the production of chips, fiber and yarn. In a study (Arslan et al., 2007), it was mentioned that panels produced in different thicknesses and densities by gluing chips and fibers produced from agricultural wastes using various glues and boards obtained at different press temperatures can be alternatives to panel materials produced using wood chips and fibers. However, it has been mentioned that the high costs in the collection, transportation and storage of agricultural wastes prevent the use of agricultural wastes. Kalayci et al. (2016) mentioned that tons of pineapple leaf fibers, which is an important agricultural waste, appear as agricultural waste every year. Within the scope of their study, they stated that pineapple leaf fibers are an important textile material because the cellulose ratio is quite high. They mentioned that pineapple leaf fibers can be obtained by mechanical methods as well as biological methods and can be used in yarn production. They explained that the use of these fibers in the textile sector will contribute to sustainable agriculture.

Agricultural wastes can also be used as biofuels. Sumer et al. (2016) evaluated agricultural and animal wastes in terms of the potential for conversion to biochar in Türkiye. They determined that this potential is 3942654 tons in terms of agricultural and animal origin wastes. They stated that 77% animal, 22.5% garden and vineyard pruning wastes and 0.6% field agriculture wastes take place in the formation of biochar

potential. Dayıoğlu, M. A., (2013) stated that biorefineries are facilities that have the necessary biomass conversion stages to produce different types of fuels, electricity and chemicals and it was stated that the fuels obtained by mixing certain amounts of biofuels with fossil fuels provide a neutral carbon dioxide cycle in terms of greenhouse balance. Additionally the biomass raw materials were stated as starch (corn, wheat, barley, rye, oat, potato), sugar (beet, sugarcane, sweet sorghum, cassava root), oil (sunflower, rapeseed, soybean, safflower, cotton, palm, peanut, jojoba, maize), lignocellulose (branched millet, flax, hemp, sorghum, poplar, willow, eucalyptus, miscanthus, woody plants, straw, stalk, cob, table, bark, husk, kernel, branch, pulp, wood shavings).

5. CONCLUSION

Prevention of stubble burning, utilization of agricultural wastes in the form of growing ornamental plants, improvement of alkaline soils of tobacco waste, use of agricultural wastes as biochar and biofuel are some of the stages of evaluation of agricultural wastes. In addition, it is seen that agricultural wastes are in a wide variety of numbers. Considering the multitude ways of utilization of agricultural wastes and the diversity of agricultural wastes, it seems possible that prevent excessive increase of greenhouse gases by evaluating these wastes with different methods instead of incineration. However, it is necessary to investigate how these wastes can be evaluated in which products. However, it should not be forgotten that the usage dose of these wastes differs in terms of the agricultural area to be used or the product to be produced. Producers need to be guided correctly in using a wide variety of agricultural wastes.

Compliance with Ethical Standards

Ethical approval:

For this type of study, formal consent is not required.

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