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RESEARCH ARTICLE

THE EVALUATION OF FERTILIZER MADE FROM VEGETABLE WASTE FROM THE FOOD MARKETS IN ULAANBAATAR, MONGOLIA

Orkhontuya Puntsag, Munkhtuya Olzii and Javkhlantuya Altansuvd

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Abstract

There is a lot of organic waste from food markets that can be used to make compost. Every day, we throw away large amounts of fruit and vegetable waste, which is part of the waste from these markets. Since waste is a major issue in our country today, this research was conducted with the aim of making a significant contribution to solving this problem. As part of this work, the possibility of reusing waste from large food markets was explored. The aim was to study the effect of fertilizers made from fruit and vegetable waste on the soil. Food waste fertilizer was used for 60 days. During the composting process, the quality of the compost was checked at 21, 45, and 60 days. The processed fertilizer was tested in the soil in 3 variants and 4 repetitions. According to our research, it is possible to make compost fertilizer from vegetable waste in 1-2 months. According to the survey results, it was possible to collect 1,826.7 tons of fruit and waste per day from a large number of vegetable markets, which could be used to make 657,621.0 tons of compost per year. Intestinal bacilli were found at 21 days of composting with vegetable waste, indicating that the compost was not fully mature, and compost was fully mature at 60 days. In our country, it was possible to make compost fertilizer from food waste from food markets in 60 days and apply it to the soil at the norm of 15-20 tons.

Introduction:-

One of the major goals of the world is to provide the population with a healthy and safe living environment. In any country, the negative effects of waste are determined by how it is reduced, recycled and used, and the country's economy and development. According to foreign researchers, between 2002 and 2018, out of 447 studies on green waste, 41 detailed studies were conducted on raw materials and 32 on the quality of fertilizers (Reyes-Torres, 2018).

In our country, waste recycling is one of the reasons why people are not able to recycle waste due to their lack of knowledge on waste sorting of citizens. Especially in Ulaanbaatar, the amount of vegetable waste has increased significantly due to population growth and increased social needs. It is possible to recycle 50% of the waste generated in Mongolia, but less than 0.31% is currently recycled (Baatar, 2003).

About 80-90 percent of our food and other consumption comes from soil, but soil degradation has increased in recent years and we are more likely to have problems in the future. The study was initiated to find ways to reuse and recycle vegetable waste to improve soil fertility. Therefore, the study was based on the study of the possibility of

Corresponding Author:- Orkhontuya Puntsag

improving soil fertility with fertilizers produced from vegetable waste. Green waste is an important part of municipal solid waste. This green waste is derived from young trees, shrubs, tree bark, dead, green leaves, grass cuttings, fruits, sedges, vegetables, soil, gardens, nature reserves, and residential household waste (Bustamante, 2016).

Globally, 1/3 percent of the world's food waste, or $ 1.3 trillion, is wasted. These products use 24% of the water used in agriculture. It is estimated that 30% of grains, 20% of milk and dairy products, 45% of vegetables and fruits, and 20% of meat and meat products are spoiled and discarded. In terms of weight alone, food waste is the largest space in the world. Decomposition time also depends on the type of food from which it is derived. For example, a lemon peel lasts for six months and a banana peel for up to four weeks (Bekhtur, 1978).

Today, solid waste treatment and collection systems have expanded into large-scale industries. In Western Europe, for example, 30% of waste is disinfected and 21% is incinerated. In the United States, 14% of all solid waste is incinerated, 3% is processed, 5% is dumped under ground, 0.5% is composted, and 77.5% is dumped above ground. There are 105 incinerators in the United States, 40 in France, 12 in Italy and 25 in Switzerland. France disposes of 26 million tons of waste per year and generally recycles it into three categories for domestic, industrial and special use (Dorjgotov, 1992).

About Compost Fertilizer: Compost is a term derived from the Latin word componere compostitum, which means a compound mixture of many things. Basically, compost is an organic compound that is formed from the decomposition of a mixture of various vegetable residues, sometimes a mixture of organic minerals of animal origin with limited mineral content (Choijamts, 2000). General technical requirements for composting methods are set by MNS 6507: 2015 standard. The purpose of this standard is to determine the technical requirements, hygiene and safety of fertilizers produced from organic wastes of plant and animal origin.

Methology:-

The research was conducted in 2019-2020 with 3 variations and 4 repetitions. In order to study the amount of vegetable waste, which is the raw material for compost, the areas with the highest food waste in Ulaanbaatar were selected. During the survey, a total of 439 food market vendors were selected from the areas with large amounts of waste.

Materials mixed with fertilizers

Compost contains simple materials that we use every day. Food waste (eg, eggshells, waste of fruits and vegetables), dried leaves, sawdust, paper rags, and tea slag were periodically placed in the compost and adjusted to allow moisture and temperature to decompose according to the technology. Compost plays a role in improving soil bio-humus.

Method of composting with fruit and vegetable waste

Composting is done during the summer. Fertilizer raw materials and vegetable wastes were collected from sources or markets. When composting, the selected area was first leveled with a 15-30 cm thick layer of wood, fruit and vegetable waste was spread 15-30 cm thick, and covered with 15 cm thick manure and 5 cm thick soil to form a stockpile. To shorten the preparation time, spray the stockpile lightly once a week. well mixed and made of plastic film and other materials. The components of the stockpile rotted well and were processed to the same color composition.

Fig 1:- Stages of composting.

The compost fertilizer was tested for 30-60 days, and the moisture content of the fertilizer was monitored until the component become same color, and samples were collected on the 21st, 45th, and 60th days, with 3 times of repetitions. The collected samples were analyzed chemical, physical, chemical and hygienic properties of fertilizer quality (Figure 1).

Standard methods used in the study Individual and group interview methods, statistical processing methods, laboratory analysis methods MNS6051: 2009, MNS (ISO) 4834: 1999 MNS (ISO) 4835: 1999, MNS (ISO) 4837: 1999, MNS (ISO) 4891: 1999 used.

Result And Discussion:-

Results of food waste survey from markets

Fig 2:- The average annual amount of waste generated in the surveyed markets.

From the above graph, it can be seen that the annual amount of waste generated in the surveyed markets is 4.2 tons of food waste per year from 6.26 tons of food in 6 markets. The surveyed traders dump 3-5 kg of food waste per day. The graph above shows that one vegetable trader throws 15-20 kg of waste per day (Figure 2).

Determining the quality of compost fertilizer

Food waste of fruit and vegetables was collected from 6 food markets and fertilized in 30-60 days. Fertilizer samples were taken on the 21st, 45th, and 60th days of composting.

Table 1:- Fertilizer nutritional value.

№	Nutritional value	21st day	45th day	60th day	Reference value
1	Temperature ^{0}C	60	62	53	
2	Moisture %	59	62	48	46.1-67.9
3	pH	9.16	8.82	7.65	6.9-8.2
4	EC	8.6	5.6	5.0	1.51-3
5	Organic C %	16.9	15.9	42.2	41-56
6	Organic element%	29.2	46.9	71.16	64.6-98.9
7	Movable N	1.63	1.68	0.45	-
8	P %	1.65	1.85	0.36	0.14-0.38
9	K %	0.51	0.33	0.27	0.58-1.56
10	Na %	0.32	0.17	0.13	1.06-3
11	Ca %	0.78	0.71	0.72	1.06-3
12	Mg %	0.39	0.37	0.21	0.38-.07

Table 1 shows that in the 21st, 45th, and 60th day samples of fertilizers, moisture, temperature, humidity, pH, electrical conductivity, organic carbon, organic materials, moveable nitrates, phosphorus, potassium, sodium, and calcium and magnesium were compared with the reference values. From the graph above, the nutrient content was within acceptable levels. The pH, compost, movable nitrate, and phosphorus of the compost were slightly higher than the allowable levels, while the organic carbon and material were slightly lower.

Table 2:- Specification of microelements of compost fertilizers.

Microelements and units	21st day	45th day	60th day	Reference value
Copper /ppm	1.30	1.24	3.00	1.60-3.80
Zinc /ppm	4.70	5.50	5.10	3.95-8.70
Iron g/Kg	189	453	459	182.3-670
Manganese /ppm	4.0	4.0	27.4	6.6-13.1
Lead / ppm	1.8	1.4	2.8	1.65-2.79
Chrome / ppm	4.3	3.4	29.0	16.4-27.9
Nickel /ppm	1.8	1.7	1.1	2.21-6.30

During 30-60 days of composting, the samples taken on days 21, 45 and 60 were compared with the reference levels of 7 microelements: copper, zinc, iron, manganese, lead, chromium and nickel. Table 2 shows that the compost values matured on days 21, 45, and 60 were within acceptable levels (Table 2).

Fig 3:- Comparison of compost quality with Mongolian standard of compost fertilizer MNS 2015.

Three versions of laboratory-developed fertilizers, such as 21st, 45th, and 60th day samples, compared the 8 parameters of nutrients such as moisture, pH, electrical conductivity, organic carbon, mobile nitrate, phosphorus, potassium, and sodium with the standard compost fertilizer. The nutrient quality was within the standard range (Figure 2).

Table 3:- Hygiene characteristics of compost fertilizers.

№	Sampled day	Color	Smell	E. coli in 1 g	Salmonella in 1 g
1	21	Dark	Odorless	Undetected	Detected
2	45	Dark	Odorless	Undetected	Detected
3	60	Dark	Odorless	Undetected	Detected

In Table 3, hygienic analysis was performed on compost prepared in 30-60 days. Hygiene tests revealed Escherichia coli and Salmonella. No Escherichia coli was detected in 21, 45, or 60 days of compost samples. On the 21st day of composting, Salmonella, an intestinal pathogen, was detected.

Test results to determine the dosage of compost fertilizer for soil

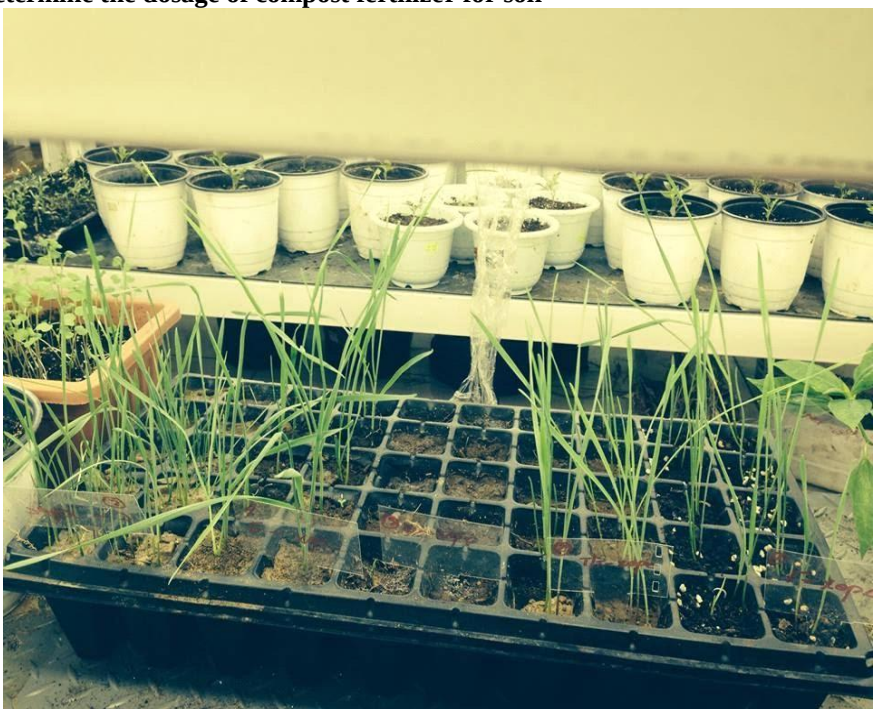

Fig 4:- Tests for compost dosage under laboratory conditions.

During the research period from April 2019 to March 2020, compost fertilizer was processed in 30-60 days from the waste collected from the source of fruit and food waste. Laboratory tests were performed in 3 versions with 4 repetitions. The test version was calculated on 15, 20, 25 tons for spinach cultivation. According to the results of the experiment, the yield was increased by calculating the norm of 25 tons per hectare of fertilizer made from fruit and vegetable waste in the field (Figure 3).

Fig 5:- Nutrient comparison.

The nutrient content of compost fertilizer processed in 30-60 days was compared with control and manure. As shown in Figure 4, nitrogen content and electrical conductivity of compost compost were relatively higher than control and manure. The high nitrogen content of compost means that the nutrient content is 0.6%. However, due to composting, the electrical conductivity is 0.6% higher than that of control and manure.

Discussion:-

In the experiment, samples were collected on the 21st, 45th, and 60th days of composting for 60 days, or 3 repetitions. The collected samples were chemically, physically, heavy metals and hygienically analyzed for compost quality. Nutrient, microelement, and nutrient quality indicators of compost compost were acceptable.

According to the results of our research, it was possible to make fully mature compost in 60 days by testing compost fertilizers with vegetable waste for 1-2 months. The main nutrients are nitrogen (0.5-1.5%), phosphorus (0.1-0.2%),

potassium (0.4-0.8%), indicate similarity. This result was consistent with the results of other studies (Murugesan, 2020).

The use of soil to support the decomposition process of organic waste decomposes faster than 1-2 weeks without the decomposer version. No unpleasant odor during composting. Compost fertilizer can be used to fertilize lawns, to fertilize flowering areas, to fertilize trees and shrubs, to fertilize areas for biological rehabilitation, to fertilize areas for hay and fodder crops, to fertilize forest rehabilitation areas, and to increase yields (Choijamts, 2000).

India produces 1,57,478 tons of vegetable waste and other wastes per day (Kumar, 2017). Our country produces 1,826.7 tons of organic and other waste per day. According to some researchers, aerobic fertilizers containing more than 80 percent organic waste support bacterial activity and pH = 6.8 or a neutral environment has been observed to separate food waste from its source (Murugesan, 2020).

Compared to European countries, our country is lagging behind in recycling, and in the last 5 years, waste recycling technology has been introduced, but there is a lack of research on food waste.

Conclution:-

According to the survey results, it was possible to collect 1,826.7 tons of fruit and waste per day from a large number of vegetable markets, which could be used to make 657,621.0 tons of compost per year.

Intestinal bacilli were found at 21 days of composting with vegetable waste, indicating that the compost was not fully mature, and compost was fully mature at 60 days.

In our country, it was possible to make compost fertilizer from food waste from food markets in 60 days and apply it to the soil at the norm of 15-20 tons.

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