The program and the results of pilot study on the use of bio-organic catalyst EcoSystem Plus® for treatment of agricultural plant residues at JSC Agricultural Complex "Moscowskiy"

Moscow Region, Russia

Purpose of the study: Determination of the effectiveness of bio-organic catalyst EcoSystem Plus® manufactured by Bio-Organic Catalyst, Inc. (USA) for odor removal generated due to rotting of crop residues and acceleration of composting crop residues at the JSC Agricultural Complex "Moscowskiy"(www.mosagro.ru), Moscow Region, Russia.

1. **Type of waste :** Crop residues from the growth of lettuce and arugula.

The amount of waste: Tests were carried out in two containers with 25 kg of crop waste in each container (the total weight of crop wastes and the container). Container №1 was treated by ESP. Container №2 was control, without treatment. The amounts of wastes in both containers were identical (H = 45 cm from the upper edge of the container to a waste layer).

2. **Duration of the study:** March 30, 2015 – May 10, 2015.

3. **Basic information about EcoSystem Plus®**

EcoSystem Plus® is a breakthrough bio-catalytic composition designed to increase dissolved oxygen levels in the water column and break the ester bonds of organic wastes.

EcoSystem Plus® improves the biological oxidation--reduction rates of wastewater treatment systems, the quality of discharges, and substantially reduces H2S odor levels in the air in the vicinity of treatment facilities and organic waste lagoons.

EcoSystem Plus® improves anaerobic digestion bio-methane yields and quality of bio-solids through releasing the power of bio-catalytic breaking of molecular bonds.

EcoSystem Plus® contains no bacteria or active enzymes, but stimulates the vitality of indigenous microorganisms by providing substantial improvement in oxygen availability and oxygen transfer, along with releasing the bound nutrient values in waste streams.

6. Specification of EcoSystem Plus®

EccoSystem Plus® is non-toxic, non-caustic, non-corrosive and safe to handle. The recommended shelf life is two years. The product can be stored at temperatures below 50 °C.

Ingredients: Water, bio-organic catalysts having high purity, produced from vegetable and mineral components, bio-surfactants.

Warning: Keep out of the reach of children. If the product from the package splashes into eyes, thoroughly rinse eyes with water.

7. Testing program

For testing of crop residues composting, it was recommended to use a composter, which can be either manufactured or purchased. Examples of composters are: a compost pit, a compost pile, or a compost wooden box. It is recommended that compostable waste is put in the composter with a layer no more than 15 cm deep. Too thick layer of waste will slow down the composting process and reduce the supply of oxygen into the layer of material to be treated.

For treatment of the crop remains, it was recommended to dilute ESP 50 times with water (temperature 20 - 25 ° C) immediately prior to use and to irrigate the surface of the material in the composter by abundant aerosol spray with parallel stirring to saturate the material to be treated with oxygen. The consumption rate of ESP will be determined by amounts of water required for fogging compostable material for maintaining of the moisture content of 50 - 60%.

The treatment with diluted solution of ESP (1: 50 dilution ratio) was recommended to conduct 4 - 6 times per composting cycle with stirring to ensure sufficient supply of oxygen and moisture into the layer of processed plant residues.

8. The results of the study

Container №1

The treatment was conducted with ESP solution (for the first treatment, 100 ml of ESP were dissolved in 5 liters of water).

The treatment carried out by the method of irrigation. Frequency of treatment and measurements are indicated in the table below. In case of strong odor detection by visual inspection of the container 1, it was recommended to irrigate with an additional ESP solution with the same concentration.

(See Chart Below)

	Dates of treatment and measurements			
	March 30, 2015	April 6, 2015	April 15, 2015	April 22, 2015
The presence of odor	The scent of fresh herbs	At the initial examination there was no smell	With stirring, a strong smell of hydrogen sulfide	With stirring, a strong smell of hydrogen sulfide
Visual inspection	The waste of fresh greens	Green gets yellow, has settled, and after stirring, there was a strong smell of rot. After ESP treatment, within some time, the smell had disappeared.	The liquid mass with a strong smell of hydrogen sulfide. After ESP treatment the smell completely disappeared.	The liquid mass with a strong smell of hydrogen sulfide. After ESP treatment the smell completely disappeared.
ESP concentration	100 ml of ESP in 5 liters of water (1:50 ratio).	20 ml of ESP in 1 liter of water (1:50 ratio).	20 ml of ESP in 1 liter of water (used no more than 200 ml of solution for spraying).	20 ml of ESP in 1 liter of water (used no more than 200 ml of solution for spraying).
The depth (H) from the edge of the container to compost.	H = 45 cm	H= 66 cm	Volume measurement was not conducted.	The wastes from the container have been placed on the filter material (gauze) and left for a day to determine an amount of "dry" residue. After weighing the "dry" residue, a weight was 6.5 kg. A volume was 7.3 liters.

Container №2

Control. ESP has not been applied.

	Dates of treatment and measurements			
	March 30, 2015	April 6, 2015	April 15, 2015	April 22, 2015
The presence of odor	The scent of fresh herbs	At the initial examination there was no smell	With stirring, a strong smell of hydrogen sulfide	With stirring, a strong smell of hydrogen sulfide
Visual inspection	The waste of fresh greens	Green gets yellow, has settled, and after stirring, there was a strong smell of rot.	The liquid mass with a strong smell of hydrogen sulfide.	The liquid mass with a strong smell of hydrogen sulfide.
The depth (H) from the edge of the container to compost.	H = 45 cm	H= 66 cm	Volume measurement was not conducted.	The wastes from the container have been placed on the filter material (gauze) and left for a day to determine an amount of "dry" residue. After weighing the "dry" residue, a weight was 6.3 kg. A volume was 7.0 liters.

5. Conclusions:

1. Based on the results of the study conducted, it can be stated that EcoSystem Plus® effectively eliminates odors of decay and hydrogen sulfide. From the container №2, not treated with EcoSystem Plus®, throughout the entire period of the testing came stench of hydrogen sulfide. A smell from container №1treated with EcoSystem Plus® instantly disappeared. Thus, EcoSystem Plus® performs its basic function - to combat odors.

2. When comparing the weight and the volume of "dry" residue in container numbers 1 and 2 (the volumes and weights are close in value), it can be concluded that the effect of the EcoSystem Plus® to accelerate composting and decrease the weight and volume of waste are not observed.

6. Recommendations:

EcoSystem Plus® should be used for the regular (1 to 2 times a week) treatment of waste in the pit of JSC Agricultural Complex "Moscowskiy". The treatment of compostable material is recommended with diluted solution of ESP (1: 50 dilution ratio) by the method of irrigation.

Case Study Performed By:

East Coast Distribution, Inc. (USA) - the exclusive representative of Bio-Organic Catalyst, Inc. (USA), a manufacturer of EcoSystem®, in the territory of Southern Eastern and Eastern Europe, CIS, and Republic of Georgia.