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PUSA Decomposer – A Technique to Combat Stubble Burning in India

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Recently, the scientists have developed a bio-decomposer technique called 'PUSA Decomposers' for converting crop stubble into compost. Delhi and many other North Indian States are covered with smoke during winters due to stubble burning in the neighboring States by the farmers. Stubble burning depletes the soil's fertility and eliminates the soil's beneficial bacteria and fungi, in addition to harming the environment. Pusa Decomposer is a fungi-based liquid that softens stiff stubble to the point that it may be easily mixed with soil in the field and used as compost.

Introduction

PUSA Decomposer, is a recently developed microbial spray by the Division of Microbiology of the Indian Agriculture Research Institute (IARI), New Delhi, is a ray of hope for an end to paddy residue burning, which has been on the rise in the paddy fields of Punjab, Haryana, and Uttar Pradesh, as well as in the areas surrounding Delhi, for the past half-decade. The intervention takes its name from the IARI's Pusa campus in Delhi. The decomposers are capsules made by extracting fungi strains that aid in the decomposition of paddy straw at a much faster rate than usual. Fungi aid in the production of enzymes required for the degradation process.

It is thought to be a cost-effective method of addressing air pollution produced by crop stubble burning. The fungus grow in temperatures between 30 and 32 degrees Celsius, which is the temperature when paddy is harvested and wheat is planted. Waste decomposer is an alternative to all chemical fertilizers; in fact, it traps them. PUSA Decomposer is a liquid formulation made of decomposer capsules and easily available ingredients that is fermented over time. By decomposing the plant/crop, waste decomposers aid in the growth of soil microorganisms and provide a conducive environment for the release of nutrients. IARI may try to introduce Pusa Decomposer in areas of Northeast India where 'slash and burn' (locally known as 'jhum') is still practiced (for example, in Tripura, Arunachal Pradesh, and Meghalaya).

Stubble burning has been identified as one of the most significant sources of air pollution, particularly in South Asia. It is a major producer of gaseous pollutants such as carbon dioxide (CO2), carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and methane (CH4), as well as particulate matter (PM10 and PM2.5), all of which have important health and environmental consequences.

According to reports, burning 63 million tons of crop stubble releases 3.4 million tons of CO, 0.1 million tons of NOx, 91 million tons of CO2, 0.6 million tons of CH4, and 1.2 million tons of PM into the environment. Due to the extensive rice-wheat rotation system in India, which generates a big amount of stubble, the situation is more dire. In India, it is estimated that 352 Mt of stubble is generated each year, with wheat and rice stubble accounting for 22 and 34 percent, respectively. Each year, approximately 84 Mt (23.86%) of the stubble is burned on the field shortly after harvest. The terrible haze seen over India during the winter season has been related to stubble burning because it occurs during the burning season (October-November).

Figure. 1. Tablets of PUSA Decomposer

The number of field fires in Punjab, Haryana, and Uttar Pradesh increased five-fold in the first six days of October compared to the same period last year, according to satellite data from the Indian Agriculture Research Institute (IARI). The hunt for a solution to the northern states' crop fires began in 2009-2010, when paddy production was moved from May to July to coincide with the monsoon because the intensive use of water for irrigating paddy was quickly depleting groundwater. Farmers chose the shortest way to clear their fields for the winter sowing of wheat, which resulted in an eruption of farm fires. The Punjab government announced a USD 1 million award for technologies for in situ crop residue management, in addition to offering a plethora of subsidized machines to help farmers clear fields without burning paddy straw.

Impacts of Stuble Burnining

- Stubble burning has a negative externality in the form of emissions, which has ramifications for climate change and health expenditures for people in impacted areas, as well as economic disruptions (flight cancellations/delays, sluggish vehicle traffic, and accidents).
- Fine particulate matter (PM2.5) is emitted by stubble burning and is a health hazard when levels in the air are high; the particles can become lodged inside the lungs and raise the risk of lung cancer by 36%.
- In India, the cost of air pollution caused by stubble burning is estimated to exceed $30 billion per year.
- When 1 tonne of rice is burned, the soil loses 5.5 kilograms of nitrogen, 2.3 kg of phosphorus, 25 kg of potassium, and 1.2 kg of sulfur.
- Besides organic carbon, the heat from burning agricultural debris kills important bacterial and fungal organisms in the soil.
- Stubble burning depletes the soil's fertility and eliminates the soil's beneficial bacteria and fungi, in addition to harming the environment.

PUSA Decomposer Mixture

Pusa Decomposer is a fungi-based liquid that softens stiff stubble to the point that it may be easily mixed with soil in the field and used as compost. It's a blend of seven fungus that create enzymes that help paddy straw digest cellulose, lignin, and pectin. It entails creating a liquid formulation containing decomposer capsules (a set of four tablets created by extracting

fungi) and fermenting it for 8-10 days before spraying the mixture on crop stubble areas to ensure rapid bio-decomposition. With four capsules, jaggery, and chickpea flour, farmers can make a 25-litre liquid mixture. A hectare of land can be covered using the mixture.

Figure 2 Spray preparation of PUSA Decomposer

Process of spray preparation of PUSA Decomposer

The PUSA Decomposer spray is prepared by eliminating the dirt from 150 grams of jaggery or gur that has been boiled in water. Water is added to the jaggery solution once it has cooled. The solution is then combined with 50 grams of gram flour and four capsules, and the jar is kept in a warm area for five days. It's necessary to mix in the layer that freezes on the water's surface. Enough for a hectare is a 25 litre solution packed with enzymes that breakdown stubble.

Field application of PUSA Decomposer

The technology is a microbial-based strategy (liquid formulation & capsules) for degrading garbage (pit or windrows) and converting it into nutrient-rich compost. The IARI solution, which is available in the form of four capsules for Rs 5 apiece or Rs 20 for a packet of four capsules, is so inexpensive and quickly decomposes stubble that it may be used by any farmer without fear of incurring additional costs or depleting the soil's nutrients through fire. A hectare of farm waste can be converted into useable compost with just four capsules. The overall cost per acre is around Rs 300, which includes the cost of preparing the jaggery-gram mixture, blending the capsules in large containers of water, and the cost of labor for spraying. The fields retain some moisture and the soil is enhanced as the farm waste decomposes, decreasing the need for fertilizers.

The method entails creating a liquid formulation containing decomposer capsules and readily available inputs, fermenting it for 8-10 days, and then spraying the mixture on crop stubble areas to assure rapid bio-decomposition. The pills should be combined with jaggery and chickpea flour, as well as enough water. The PUSA Decomposer is a collection of four tablets created from fungi strains that assist paddy straw degrade at a considerably faster rate than usual, allowing farmers to shred the straw, spray it with a solution containing the fungal strains, and mix it with the soil for decomposition. The degrading process takes around 20 days to complete. Decomposition of shredded and moistened paddy straw mixed with soil takes at least 45 days under normal conditions.

Figure 4 Liquid Formulation of PUSA Decomposer

Figure 3 Liquid Formulation of PUSA Decomposer

Advantages

- ✓ PUSA Decomposer is a low-cost, effective method of dealing with the problem of stubble burning known as bio-decomposer spraying.
- ✓ This enhances the soil's fertility and productivity because the stubble acts as manure and compost for the crops, requiring less fertilizer in the future. Laste decomposer can be utilized in a variety of ways in addition to decomposing bio-waste.
- ✓ It will also improve the Air Quality Index (AQI) in the area, as well as manage all forms of pathogens, foliar diseases, insects, and pests.
- ✓ It is a cost-effective, feasible, and realistic strategy for preventing stubble burning.
- ✓ It is an environmentally benign and beneficial technology that will aid in the achievement of the Swachh Bharat Mission.

Conclusions

The PUSA Decomposer is an innovative approach being tested by the Union government in 2020. It was created at the Pusa campus of the Indian Agricultural Research Institute. The PUSA Decomposer is a collection of four pills created from fungal strains that aid in the rapid decomposition of paddy straw. To decompose the straw, farmers might shred it, spray it with a solution containing the fungal strains, and mix it in with the soil. If these strategies are successful, it will usher in a new era of farming. This has the potential to minimize pollutants while also improving soil fertility.

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