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Effect of organic manures on growth of benefit crop production, environment, human health in India

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Abstract
India with a population of 1.20 billion out of which, 74%, i.e., 800 million, population derive sustenance from agriculture, with about 40 % population in India below poverty line with limited resources to provide input-urea, Di-ammonium phosphate and potash. Obviously for rural population, a bio-fertilizer based on farm yard manure, solid waste, and agricultural waste material available in plenty could be considered a potential resource for rural India. Today increasing cost of chemical fertilizers along with declining yield are responsible for decreased fertility with a degradation of soil. Bio-fertilizers a viable and safe resource for farmers provides a lot of scope for local employment through decentralized rural infrastructure, more skills and capacities to address technology and production capacities of soils. Bio-fertilizer renovation was started from July, 2009 by Discovery Park Project at Rajiv Gandhi Institute of Information Technology,a campus of Indian Institute of Information Technology, Allahabad. The four blocks- Bhader, Bhetua, Amethi and Sangrampur with total population of 1120691 for four blocks combined together, were selected for this work, 25 thousands families in each block in the district, use bio-fertilizers out of 63 thousand families of the entire blocks. The application of bio-fertilizer as *Nadap*, Vermi-compost and Horn compost significantly improve yield and economics of various agricultural crops. On an average, compost contains 0.5-1.2 percent N, 0.2-0.5 percent P_2O_5 and 0.5-0.8 percent K_2O. Based on this analysis an average dressing of 25 tons per hectare of compost supplies 112 kg of N, 56 kg of P_2O_5 and 112 kg of K_2O. These quantities are not fully available to the crops in the year of application. Nitrogen is very slow acting and less than 30 percent of it is generally available to the first crop. About 60 to 70 percent of the phosphate and about 75 percent of the potash become available to the immediate crop. However, organic manures combination with 50% recommended dose of NPK significantly increased crop yield.

Keywords: bio-fertilizers, organic manure, bio-innovation, bio-culture, organic fertilizers

Introduction
With the increasing demand in agriculture it has become important for us to increase the productivity by using various fertilizers, insecticide and pesticide but with the tremendous use of these products the soil has been affected badly because of the depletion in the essential minerals of the soil. To overcome this problem, it has become important for all of us to use a different remedy for the production of various biofertilizer. Biofertilizers provide an economically viable support to small and marginal farmers for realizing the ultimate goal of increasing productivity. Biofertilizer are low cost effective and renewable source of plant nutrients to supplement chemical fertilizers. Sustainable crop production depends much on good soil health. Discovery park pursuing three types of biofertilizer as NADEP, Vermi and Horn composting. Composting is a process of essential meant to utilize soil waste of animal plant origin.

Vermi-compost
Vermi compost play an important role in the organic farming. It is one of the important methods of compost preparation. Vermicomposting utilizes earthworms for the purpose of producing value added manure. Moreover, earthworms ingest litter, dung and other organic matter and grind it in to fine particles, thereby increasing the surface area and promoting faster decomposition. The material passes through the body of the earthworm to produce vermicast. Soil with vermicasts has roughly 100 times more bacteria than soil without worms. Moreover plant growth promoting substances have been reported to be present in vermicast (Ismail, 2002). It has been found that vermicompost has nitrogen content of 2.12% phosphorus of 2.01%, potassium of 2.27% and organic carbon of 27.38% (Perumal, 2002).In study, vermicompost had a pH of 6.6 and EC 0.04% was recorded.
Vermi-compost

Fig 1: Vermi-compost

Methods
In general, there are two methods of vermin composting under field conditions-
1. Vermicomposting of wastes in field pits.
2. Vermicomposting of wastes on ground heaps

Vermi composting of Wastes in Field Pits
- It is preferable to go for optimum sized ground pits of 20

feet length 3 feet width 2 feet deep for effective vermicomposting bed.
- Series of such beds are to be prepare at one place.

Vermi composting of wastes on Ground Heaps
- Instead of open pits, vermicomposting can be taken up in ground heaps
- Dome shaped beds (with organic wastes) are prepared and vermicomposting is taken up.
- Optimum size of ground heaps may be 10 feet length x 3 feet width x 2 feet high.

Materials Required for Vermi composting
- Farm wastes (straw from wheat, soybean, chickpea, mustard etc.) were used for vermicomposting.
- Fresh dung.
- Wastes: dung ratio (1:1 on dry weight basis).
- Earthworm: 1000-1200 adult worms (about 1 kg per quintal of waste material).
- Water: 3-5 liters in every week per heap or pit.

Vermi comopost Preparation by Pit and Heap Methods

Open permanent pits of 10 feet length 3 feet width 2 feet deep were constructed under the tree shade, which was about 2 feet above ground to avoid entry of rainwater into the pits Brick walls were constructed above the pit floor and perforated into 10 cm diameter 5-6 holes in the pit wall for aeration. The holes in the wall were blocked with nylon screen (100 mesh) so that earthworms may not escape from the pits. Partially decomposed dung (dung about 2 month old) was spread on the bottom of the pits to a thickness of about 3-4cm. This was followed by addition of layer of litter/residue and dung in the ratio of 1:1 (w/w). A second layer of dung was then applied followed by another layer of litter/crop residue in the same ratio up to a height of 2 feet. Two species of epigeic earthworm's viz., Eisenia foetida and Perionyx excavatus were inoculated in the pit. Moisture content was maintained at 60-70% throughout the decomposition period. Jute bags (gunny bags) were spread uniformly on the surface of the materials to facilitate maintenance of suitable moisture regime and temperature conditions. Watering by sprinkler was often done. The material was allowed to decompose for 15-20 days to stabilize the temperature because to reach the mesophilic stage, the process has to pass the thermophilic stage, which comes in about 3 weeks. Earthworms were inoculated in the pit or heap with 10 adult earthworms (1.160.3 g each) per kg of waste material and a total of 500 worms were added to each pit or heap. The materials were allowed to decompose for 110 days. The forest litter was decomposed much earlier (75 to 85 days) than farm residue (110-115 days).

In the heap method the waste materials and partially decomposed dung (1:1 w/w) are made in heaps of dimension; 10 feet length x 3 feet width x 2 feet high and during inoculation channels are made by hand and earthworm @ 1 kg per quintal of waste are inoculated and then watering is done by sprinkler method. Jute cloth pieces are used as covering material.

NADEP compost

NADEP preparation is made from agricultural waste, cow dung dried soil, water, etc. Decomposition processes follows through aerobic method and it requires about 90 to 120 days for obtaining the finished products. The main advantage is to improve the physical, chemical and biological condition of the soil. It also supplies the major and micronutrients to the plant growth. NADEP manure has nitrogen content of 1.38%, phosphorus of 0.92%, potassium 2.50% and organic carbon of 30.35% *(Perumal*, 2002). In our study the NADEP, pH of 6.7 and EC 0.05% was recorded. NADEP analyzed for the presence of growth hormones such as IAA 21.4 mg /Kg, kinetin 5.4 mg /Kg and absence of ABA and GA_3 was recorded.

Fig 2: NADEP compost

Description

The recommended size of the NADEP tank is 10 fit (length) X 3 fit (width) X10 fit (height). All four walls of NADEP tank are provided 6 inch vents by removing every alternate brick after the height of 1 fit from bottom for aeration.

Raw material required for filling NADEP tank:

Agricultural waste: (dry & green): 1530-1400 kg, Cattle dung: 90-100kg, Fine sieved soil: 1675 kg, Water: 1350-1400 liters,

NADEP method

The NADEP method of composting is the latest and widely acclaimed method. It has been developed by Sri N.D. Panaripane at Dr Kumarappa Gowardhan Kendnl, Pusaad (Maharashtta). The method has been proved to be highly economical and technically feasible at the village level. This method involves following steps.

Construction of tank

In this method, a rectangular tank is constructed on the floor with the help of bricks and puddled mud. The floor is cemented with bricks. The walls of the tank are 9 inches thick. The inside measurements of the tank are kept as 10ft length and 6 ft width. The height of the tank is kept at 3 ft and 3 inches. The tank of this size provides 200 cu ft area.

To ensure proper aeration inside the tank, two-brick-sized holes are provided in each third row of bricks of the length-side-walls. In the width -side walls, one hole in each third row of bricks is open. Care should be taken that the holes do not fall in the same vertical line. The tank has the storage capacity of 3.5 tonnes and the economic life is expected to be 10 years. The minimum of 10 tanks are desirable for economizing the production of compost

Materials required

Following materials are required to fill a tank:

a. Vegetative wastes, amounting to 1300 to 1400 kg. Polythenes, stones and glass pieces should be sorted out

from the material. "

b. About 100 kg of cattle dung is required. If bio-gas slurry is used then 200 kg. of material is necessary.
c. Nearly 1000 to 2000 litres of water is required. In rainy season water requirement is less.

Depending on the requirement and availability of materials, ratio of the materials kept can be altered. For example, to collect 100 tonnes material one can take 2.5 tonnes of dung, 47.5 tonnes of agro- wastes and 50 tonnes of waste clay.

Filling the tank

Follow the steps given below in sequence. Care should be taken that the tank is filled within 48 hours of starting or the quality of product will deteriorate.

a. Spray cow dung slurry over the inner side of the wall of the tank..
b. Spread 6" thick layer of agro-waste. In this first layer, coarsest material available should be spread. This will accommodate 100 to 110 kg of agro-waste.
c. Mix 4 kg of dung in l00-125 litres of water and spread it over agro-waste layer.
d. Spread 50 to 60 kg sieved, dry clay soil evenly over the layer. Sprinkle water over it.

All the subsequent layers should be laid in the same sequence. Avoid pressing the layers too much. Fill the tank up to 1.5 ft above the mouth of pit. The top most layer of the tanks assumes a shape of curve being highest in the centre. Generally, 11-121ayersareenough to fill the tank to a required height Plaster the top of the tank using 400 -500 kg moist clay soil. This forms approximately 3 inch thick layer of clay soil. If the clay layer cracks, fill the cracks with dung paste.

After 15-20 days of filling the tank, contents are shrunk to about 8-9 inches below the tank mouth. Again fill the tank by laying layers of residues in the same manner as described before. Bring the height of the tank material up to the original level i.e. 1.5 ft above the mouth of the tank. It takes 90-120 days from first filling for the material to compost adequately. Meantime, light sprinkling of water from time to time and patching up of cracks if formed, should be done to obtain a good quality compost Thatching the tank in too dry or too rainy weather is useful. Check the pit material after 110 days of the first filling. Material will give an earthy smell. When it is granular, dark grey in appearance, take out the pit material till the l20th day. If some undecomposed residues are still left, sort them out and put them back in tank for further composting.

The same pit can be used three times in a year. One tank at one time gives about 3.5 tonnes of compost. That is way one tank can produce 10.5 tonnes of compost in a year. The toil in turning, as is needed in other methods, is also avoided in this method of composting.

Horn Compost

It is made from fresh lactating cow dung packed into cow horns, buried over the winter for fermentation in the earth land deep. Chemically it was found that an increase of nitrate nitrogen from 0.06% to 1.7 %. i.e. about 28.31 times of original content (Pfeiffer, 1958). BD 500 is unique formulation activates regulates the soil by increasing its humus and bacterial content. BD 500 also encourages earthworm activity and allows for better nourishment of the plants (*Purple Hills 2003). T*he important effect of BD 500 is stimulation of root growth, particularly fine hair roots. In our study the BD 500 had a pH(The power of hydrogen) of 7.2 and E.C. (Electrical Conductivity) 0.17 %. It was found that it has the phosphorus content of 1.10 %, Potassium of 2.50 % and organic carbon of 24.50 %

Fig 3: Horn Compost

Table 1: *Nutrient properties of these bio-fertilizers*

Treatment	pH	EC (%)	Nitrogen (N) %	Phosphorus (P) %	Potassium (K) %	Organic Carbon (OC) %
Horn compost	7.2	0.17	1.62	1.10	2.50	24.50
Vermi-compost	6.6	0.04	2.12	2.01	2.27	27.38
NADEP	3.7	0.05	1.38	0.92	2.50	30.35

Besharam, Behaya (Ipomoea fistulosa Linn.)

Besharam, Behaya (Ipomoea fistulosa Linn.) shrub 1-5 m high, cultivated and occasionally naturalized near sea level; stems hollow; petiole 2.5-15 cm long; leaf blades ovate to lanceolate, 10-25 cm long, truncate to shallowly cordate at base, long-acuminate; sepals suborbicular, 5-6 mm long; corolla 5-9 cm long, finely tomentose without, rich pink, deeper pink to purple at base, the limb spreading to 11 cm in diameter; filaments unequal, dilated and pilose at base; fruit ovoid to subglobose, 1.5-2 cm long, the seeds covered with long, woolly, brown trichomes."

The plant Ipomoea fistulosa Linn (Besharam, Behaya) is a large, diffuse or straggling shrub with milky juice, leaf ovate chordate, entire, acuminate, flower large campanulate,pale rose, pink or light violet in lax, dichotomously branched auxiliary and terminal, pedunculate cymes; Fruitsglabrous capsule; Seed silky, belonging to family Convolvulaceae. It is well distributed in India and found particularly in Chhattisgarh and Madhya Pradesh. The plant is commonly known as Besharam, Behaya (Ipomoea fistulosa Linn.) and used for skin troubles successfully. The milky juice of Beshram is used for the treatment of Safed Dag (Leucoderma). The juice is collected and applied externally on affected parts, anti-inflammatory. It is used to decrease the teratogenic effect

resulting from cyclophosphamide. Aqueous extract of Ipomoea fistulosa shows neuromuscular blocking activity. It used as aphrodisiac, purgative and cathartic.

The leaves of Ipomoea fistulosa contain 1-3 flavonol glycosides and Ergine (D-Lysergic acid amide). Polyhydroxylated alkaloids were isolated from the leaves, flowers and seeds.12 Chromatographic separation of the leaf extract resulted in the isolation of swainsonine, 2-epilentiginosine, calystegines B (1), B (2), B (3) and C (1) and N-methyl-trans-4-hydroxy-l-proline and beta sitosterol.13-15 After exhaustive literature survey it was aimed to screen the anti-inflammatory activity of the leaves of Ipomoea fistulosa Linn. Behaya are responsible for poor productivity soil and on their some could be used for bio fertilizer.

The above practices have been followed in 1120691 families at four blocks of district Chhtrapati Shahuji Maharaj Nagar (CSM Nagar), UP, India all three vermi-compost, NADAP, Cow-dung (FYM-farm yard manure) are very popular among rural population and same should be propagated in rural area across the country. It should be appreciated that appellation of bio fertilizer not only increases the productivity but also saves the environment from degradation due to chemical fertilizer-urea, DI-ammonium Phosphate (DAP) and Muriate of Potash (MOP) as well as save foreign exchange with reduction in DI-Ammonium Phosphate (DAP) and Potash.

Results and Discussion

Biofertilizer composting is normally ready in 120 days. When the heap has cooled down and the height of the pile has fallen to about 70 cm. by analysis result if may be confirmd that the biofertilizer contain all essential nutrients which are required for plant/ crop growth. This shows that microorganism totally brake down complex organic material waste into simple organic material. It further indicates that we successfully prepared the biofertilizer from the field waste using cow dung solution. Biofertilizer enhance the nutrient availability to crop plants (By processes like fixing atmosphere N or P present in the soil); and impart better health to crop or plants and soil thereby enhancing crop yield in a moderate way. It is a natural method without any problems like salinity and alkalinity, soil erosion etc. In the vast areas of low input agriculture and oil seed production, as also in crops as wheat, maize and vegetables etc. these products will be of much use to give sustainability to production in view of the priority for the promotion of organic farming and reduction of chemical residues in the environment, special focus has to be given for the production of bifertilizer.

Conclusion

In all the four blocks- Bhader, Bhetua, Amethi and Sangrampur with total families 63180 Discovery Park empowers all four blocks familyies on the above mention items. 26650 families prepared biofertilizer by waste and obnoxious weeds as behya, parthenium and water hyacinth (jalkumbhi), Biofertilizer use effectively increases the yield of Vegetables- Potato, Tomato, Brinjal, Chilli, Cauliflower, Cabbage, Carrot, Radish, Cucumber, Bottlegourd, Bittergourd, Squash, Spongigourd, Redigegourd, Okra, Garlic, Onion, Beans, Peas, Cowpea, Spinach, Pumpkin, Watermelon, Amaranths, Sugerbeet, Corinder, Colocasia, Pointed gourd, Broccoli, Summer onion, Shimla Mirch, Cumin, Methi, Rajma, Babycorn etc., fruits- Papaya, Banana, Sapota, Grapefruit, Litchi, Loquat, Pomegranate, Grape, Citrus, Phalsa, Sweetorange, Mandarin, Strawberry, Mango, Guava, Aonla, Bale, Jamun, Mahua, Karonda, Jackfruit (Kathal), etc., have been extensively used with enthusiasm in each block. It is interesting that the growth of Rajma, broccoli, banana have received great enthusiasm, because earlier there was feeling in the area that such vegetables and fruits cannot be grown there. The compost material used was of the size of 1.25 to 3.75 from this we conclude that hard woody material used in the compost should be crushed with the help microorganism to compost material rapidly. The material used in the pile should have equal volume of green plant material with equal volume of naturally dry plant material to yields such a ratio. A temporary shed may be constructed over pit to protect the compost to avoid direct contact of environmental heat during summer. The pit should have sloping walls and floor with 90 cm slops to prevent water logging. Before making first pile in the pit base of the pit should be sprinkled with water so that it will help in maintaining optimum temperature for the growth of micro organism. Biofertilizer preparation helps to increase the number of beneficial microorganism in the soil, microbial health and promotes a healthy environment for plants.

(Key words): Bio-fertilizers, Organic manure, Bio-innovation, Bio-culture, Organic fertilizers

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