Knowledge Consortium of Gujarat
Department of Higher Education - Government of Gujarat
Journal of Science
ISSN: 2320 - 0006

Continuous Issue-1 | October - November 2012

EFFECT OF PHOSPHATE SOLUBILIZING BACTERIA VERMI COMPOST ON SOIL FERTILITY

Abstract

Since last many years we find soil fertility decreasing to great extent. There is extensive use of chemical fertilizers to increase the productivity. Excessive use of such fertilizers deteriorates the fertility of soil. We have developed a vermicompost which results to give better crop quality with higher yield and increases nutrients in the soil.Modified vermicompost obtained from agro waste, cow dung along with Azobacter, Azospirillium and phosphate solubilizing bacteria with help of Esienia Fetida worms under control condition is noticed to be a very good soil conditioner. This vermicompost organic fertilizer analyzed for N, P, K content. Percentage of total Nitrogen (N) and total Phosphate(asP2O5) found as per FCO specification. Effect of domestic waste was alsostudied.

[1] Introduction :

Environmental degradation is a major threat and rampant use of chemical fertilizers contributes largely to deterioration of the environment. Imbalanced use of fertilizers have adversely impacted agricultural productivity and soil fertility. Majority of soils are deficient in all plant nutrients. Further, disposal of million tons of industrial organic waste, human household and human sewage is a critical problem and expensive. Most of these organics are burned currently or used as land fillings. Since last many years earthworms are used to convert organic waste material into humus like material known as vermicompost. There are around 3600 types of earthworms in the world. Non-burrowing type warms convert the organic waste into vermicompost faster than the burrowing type earthworms and hence they are preferred most. Earthworm passes a mixture of organic and inorganic matter through their guts and assimilate 5 – 10% of ingested material. The rest is excreted out as granular cast coated with mucous. Vermicompost contains all useful nutrients, vitamins and hormones required by plants and bacteria including N-fixing , P- solubilizing , fungi etc. The manurial quality of vermicompost depends on composition of the input used.

Readily available vermicompost hardly match norms setup by FCO. It has been noticed that many supplier use chemical fertilizer like Urea and DAP to increase N, P , K percentage of vermicompost. Hence we have used Nitrogen fixing and Phosphate solubilizing bacteria, which is being used as biofertilizer during vermicomposting along with seeding material and worms, to increase Nitrogen and Phosphate content.

Bio-chemical composition of activated sludge and vermicompost is similar. Vermicompost is used successfully for secondary (biological) treatment in effluent treatment plant to reduce BOD & COD. It also maintains required nutrient level for bacterial growth and helps in sludge precipitation. The application of biotechnology to environmental problem using different microbes proved to be the best way in degrading some of the most complex pollutants as well as in prevention of pollution through waste treatment.
In our present study, we also tried to convert industrial solid organic waste into vermicompost and use this vermicompost in greenbelt.

[2] Experimental :

Dung received as such with little part of grass and soil was heaped after mixing tree leaves and maize straw and watered regularly for 20 days to complete methnation and for natural biodegradation. Heat evolved during decomposition was subsided.

3 kg of municipal waste , 3 kg of dung and 2.5 gm. each of Azobacter , Azospirillium and Phosphate culture manufactured by GSFC were mixed . Mixing of bidding and culture was done by hand with pitchfork. Municipal waste was cleaned first to remove stone, glass, plastic and other hard material .This mixture was heaped in an open earthen pot , which was sheltered by green net to control temperature. 80 *Esienia Fetida* worms weighed 60 gms. was released in the pot. Watering was done regularly for 5 days until excess water came out from the drainage hole just provided above the bottom. Within 5 days the bed got compact and watering was done alternate day to maintain required moisture level and temperature around 20 – 25 oC. Fine dry granules on the surface indicates complete decomposition and harvesting was done step wise after 30 days horizontally from the surface. Gradually lower portion was also harvested and within 40 days total mass was decomposed and converted in to compost. Total 95 no of worms weighted 73 grams were screened out. Vermicompost thus obtained was tested for primary nutrients and results were found as under :

Sr. No.	TEST	UNIT	RESULT
01	Moisture content	%by Wt.	25.5%
02	Bulk Density (ARB)	gm/cc	0.61
03	Total Nitrogen as N	% by Wt.	1.2%
04	Total Phosphate as P2O5	% by Wt.	1.05%
05	Total Potash as K2O	% by Wt.	0.60%

In another experiment 30% of industrial organic solid waste was mixed with cow dung and agro waste. Total 5 kg of mixture was heaped with 80 (80grams) California Golden Giant earthworms (known as super worms) and were treated as above. After 40 days completely decomposed cast was tested for toxicity. All primary nutrients were found without any toxicants.

[3] Conclusion :

It has been observed that due to the addition of trio culture ,nutrient content in the vermicompost has been increased and is very much close to the standard given by FCO, specially in terms of Total Nitrogen and Phosphate, which is not possible by the conventional method of vermicomposting. In addition to that microbiological count of Azobacter , Azospirillium and PSB is also very high in the range of 104 no. of bacteria per gram. So this vermicompost can fix higher percentage of atmospheric Nitrogen and increases the level of available P_2O_5 in the soil. Phosphorous solubilizing bacteria Psudomonas are very effective to increase available Phosphate in soil as well as growth of crops. So exploitation of PSB through vermicompost has enormous potential for making use of fixed phosphate in soil. This can reduce required quantity of chemical fertilizer. Antifungal activities can also be improved which control fungal diseases. Much higher yield can be achieved with this compost.

Compost obtained with industrial organic waste and cow dung are enriched with all nutrients and have no toxicants. This encourage researcher to develop better condition with different feed stock and variety of worms to convert maximum quantity of industrial solid waste in to wealth there by reducing enormous expense incurred their disposal. Nearly all biological waste can be used as feed stock for earthworms and it means that very few substances remains leftover for incinerate.

In a separate experiment , waste land charged with vermicompost containing cocoons and warms, was cultivated with karnal grass and irrigated with effluent water having 300 COD and 100 BOD. Irrigation rate was controlled and kept less compared to Eva transpiration rate, preventing contamination of ground water. It was observed that after 20 days noticeable growth of grass was achieved and all organic contaminant residue left in the soil was consumed by earthworms. Large quantity of compost is produced in-situ. Na , Cl and SO_4 salts absorbed in the soil though the soil does not get saline due to living soil and presence of earth warms.

Acknowledgement

We acknowledge the kind support of Yuvraj Manvedrasingji Gohil, Rajpipla for providing information and worms. We greatly appreciate Dr. N.M.Patel, Principal Shri J P Arts and Science College, Bharuch for providing us facility to carry out the experiments.

REFERENCES :

1. Afzal , A. and A.Bano 2008, Phosphate solubilizing bacteria improve the yield and phosphorous uptake in wheat. Int.J.Agri.Biol. 10:85-88
2. Banik S and B K Dey .1982, Available phosphate content of an alluvial soil as influenced by inoculation of some isolated phosphate solubilizing microorganisms. Plant .Soil 69:353-364.

****

AUTHOR INFORMATION :

Pratesh J. Shah
Department Of Chemistry,
Shree Jayendrapuri Arts & Science College,
Bharuch,
Gujarat

Pragna S. Modi
Department Of Chemistry,
Shree Jayendrapuri Arts & Science College,
Bharuch,
Gujarat

Nitinkumar B. Patel
Department Of Chemistry,
Shree Jayendrapuri Arts & Science College,
Bharuch,
Gujarat