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VERMICOMPOSTING AS A TOOL OF SUSTAINABLE AGRICULTURAL DEVELOPMENT: A CASE STUDY OF VAISHALI DISTRICT

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Vermicomposting as a Tool of Sustainable Agricultural Development: A Case Study of Vaishali District

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Abstract – Vermicomposting is a process in which earth worms are used to convert organic materials into humus - like material known as vermicompost. Nutrient profile in the vermicompost is generally higher than tradition compost. In fact, vermicompost can enhance soil fertility, physically, chemically and biologically. Physically, vermicompost treated soil has better aeration, porosity, bulk density and water retention. The chemical properties such as pH, electrical conductivity and organic matter content are also improved for better crop yield. Nevertheless, the enhanced plant growth could not be satisfactorily explained by improvements in the nutrient content of the soil, which means that other plant growth influencing materials are available in the vermicomposts. Although vermicompost have been shown to improve plant growth significantly, the application of vermicomposts could impede the growth due to the high concentrations of soluble salts available in the vremicomposts. Therefore, vermicomposts should be applied at moderate concentration in order to obtain maximum plant yield. This review paper discussed in detail the effects of vermicompost in soil fertility physically, chemically and biologically. Future prospects and economy on the use of organic fertilizers in agriculture sector were also examined.

Keywords : Vermicompost, Sustainable Agriculture Development, Nutritive Value, Cropped Area, Land Use Planning.

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INTRODUCATION

To feed this fast growing population sustainable development of agriculture of the district is urgently needed. Agricultural scientists, planners, geographers, politicians and administrators must think seriously for third green revolution.

STUDY AREA

Vaishali district is located on global map between 25°41' and 25°68' North latitude and 85°13' and 85°22' East longitude. The district occupies an area of 2,036 square kilometers. The rank of the district in comparaison to other districts of Bihar in terms of area is 25th. The district is surrounded by Muzaffarpur district in the north, Ganga River and Patna District in the south, Samastipur district in the east, Gandak River and Saran district in the west.

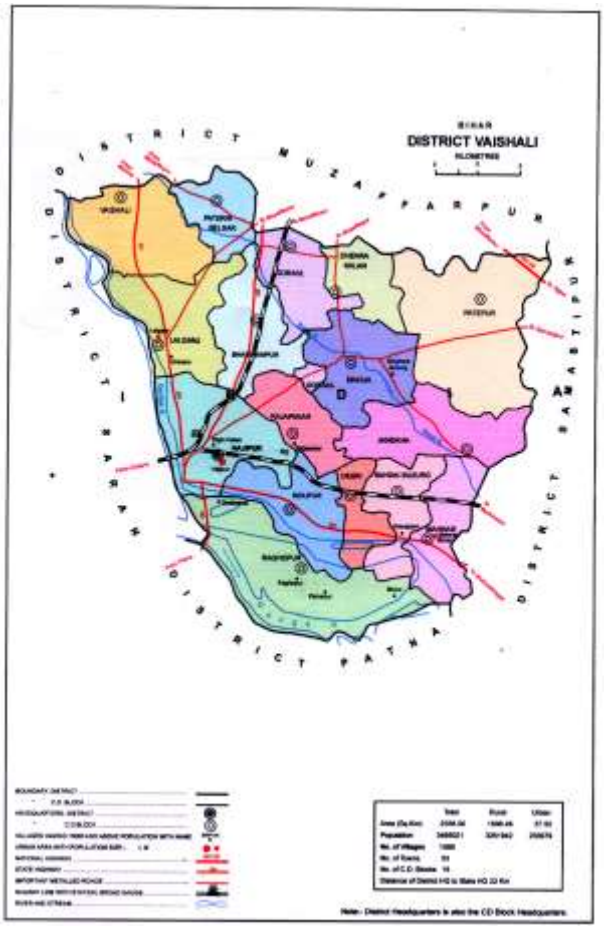
NATURAL DIVISIONS

The district of Vaishali comprises an extensive plain formed by the alluvium brought by the Ganga, the Gandak and other rivers which flow through it. It lies on the south of the Burhi Gandak and is bounded by the Ganges on the South and the Gandak on the sout-west. It is a plain with very few waterlogged or low-lying tracts, highly fertile and well-suited for both food and cash crops. The morphology of the area has been shaped mainly by Gandak River which originates in the Himalayas in Nepal. Morphologically it can be classified into three broad categories.

1) Hazipur Surface: It is the oldest morpho-unit of the area comprising yellow-brown to brownish-grey compact clay.

2) Vaishali Surface: It overlies the Hazipur surface. This surface comprises ash-grey-silt/silt- clay/clayeysilt and has been found development on the eroded and very gently sloping Hazipur surface.

3) Diara Surface: It is the lowest and youngest geomorphic unit which emerges from river bed. The diara surface has come into existence after the main channel has migrated. They are the old river beds.



Rivers

The main river of the district is the Ganga, the Gandak and the Burhi Gandak. Besides the large rivers such as the Ganges, the Gandak, the district has a few streams also. The most important river is the Ganga which touches the district at Teraharasia in Raghopur block, where it is joined by the Gandak. The river is about 1.6 kms. wide though in the rainy season it becomes much wider. Large stretches of sand may be seen in the river-bed except in the rainy season. The Ganga is navigable throughout the year. Country boats ply regularly between Hajipur and Patna. The Gandak, which is also locally known as the Narayani or Saligrami, joins the main stream of the Ganga opposite Patna. The river has vast irrigation and power potentialities and the Gandak Project has been implemented for harnessing its resources.

Climatic conditions

In summer the climate of the district is hot and dry but winter months are quite cool and pleasant. Winter comes towards he middle of October after the rains are over. The temperature begins falling and January is the coldest month of the year with mercury falling to about 5ºC. The blowing of westerly wind accompanied by dust storms about the middle of March marks the beginning of hot weather. The mercury starts shooting upward 26 and May is the hottest month of the year when the maximum temperature goes up to 42ºC. The summer continues till the end of June when the onset of rains brings the much awaited relief and the temperature falls, though the humidity is still high the rise in humidity often makes the heat only more oppressive during the rainy season which lasts till the end of September. From November to February the district has a pleasant climate.

Rainfall

As per the data available with the Directorate of Statistics and Evaluation of the State, the average annual rainfall in the district varies between 747.5 and 1,737.7 mm during 2006-09. Maximum rainfall occurs during the month of June to September when the district receives almost 85 percent of its average total rainfall. The district receives minimum rainfall during the month of December. Weather conditions become hot and humid during the rainy season. The average number of rainy days in district varies between 38 and 57 during 2006-09. Actual Rainfall and Average No. of Rainy Days figures are as follows:- Source- Directorate of Statistics and Evaluation, Bihar orah and dhamin. Crocodiles are occasionally seen in the Gandak and the Ganga.

Land use Pattern

Agriculture is the main occupation of the people of the district and also the main source of livelihood of the people. Rainfall still controls the agricultural economy of Vaishali district. Conditions have, however, improved to some extent to meet the situation caused by the failure of monsoon. The soil of the district is highly calcareous. The different varieties of soil found in the district are sandy, loamy, light clayey and usar. Paddy is grown mostly on clayey soil which is known locally as mathivari. Sandy loam which is known as balsundari, is particularly suited for rabi cultivation. Rice, maize and wheat are the main crops of the district. Sugar-cane tobacco, potato are the cash crops grown in the district. The district headquarters Hajipur is famous for the very good varieties of banana produced here. It is exported to other places also. In Hajipur area the cultivation of vegetables and fruits is now being done on scientific lines and their production has gone up considerably. Introduction of good grafts had helped the growers in producing better varieties of fruits and this has augmented the earning of the cultivators considerably.

As pr Village Directory data of 2011-Census, land use pattern figures are as follows:-

ANNUAL AVERAGE RAINY DAYS AND ACTUAL RAINFALL IN M.M

2006		2007		2008		2009	
Average No. of Rainy Days	Actual Rainfall	Average No. of Rainy Days	Actual Rainfall	Average No. of Rainy Days	Actual Rainfall	Average No. of Rainy Days	Actual Rainfall
1	2	3	4	5	6	7	8
40.8	1,196.1	56.3	1,737.7	52.1	1,479.3	37.8	747.5

Source- Directorate of Statistics and Evaluation, Bihar

Irrigational facilities

The soil of the district is capable of retaining moisture. It is considered to be one of the fertile districts in Bihar. Formerly, the cultivators did not find it necessary to obtain water for the fields from large irrigation work. But on account of falling production of food crops, deficit in food grains and the increasing pressure of population the need for assured irrigation has been keenly felt. After independence, considerable attention has been paid to implementation of various irrigational projects. A number of Medium Irrigation schemes, Minor Irrigation schemes, Open borings, irrigation wells and tube wells have been introduced in the district during the different plan periods. Cattle shows are sometimes organized and prizes in cash or kind are awarded with a view to encouraging the local breeders.

Irrigation practices

The economy of the district mainly depends upon agriculture. The major crops of the district are Paddy (Basmati Rice), Mustard, Sugarcane, Jute, Lentis and Vegetables. The irrigation in the district is mostly influenced by the presence of canal system in the northern and eastern parts. This has greatly improved the irrigation facilities in the district. Irrigation through lifting of water by means of swing buckets, by constructing bunds on the river and distribution of the water by means of 'Pynes'. Other irrigation means are shallow tube wells, tanks and wells. Gross irrigated area reported from the district is 183000 hectares of land with Net irrigated area of 141000 hectares of land. Along with this, total cropped area is 390473 hectares and net sown area is 304875 hectares of land.

OBJECTIVES:

(i) An attempt has been made to suggest an alternative measures to increase crop production in the study by using vermitechnology.

(ii) This research paper discussed in detail the effects of vermicompost on soil fertility physically, chemically and biologically.

(iii) Future prospects and economy on the use of organic fertilizers in agriculture sector were also examined.

METHODOLOGY:

The present research work based on the observational description and observational rational methods in order to decipher the theme of the research. Various statistical and cartographic methods has applied where ever needed. The present research study based on both primary and secondary data. The primary data collected through personal observation, interview, questionnaires schedule etc. while the secondary data collected from concerned district or block headquarters. Map and diagrams, graphs etc. have been widely used in this research papers.

DISCUSSION:

Agricultural scientists, planners, geographer, politicians and administrators must think seriously for second green revolution. At present formers of the districts in order to get high yield are using chemical fertilizers at the ratio of 13:3:1 (Nitrogen, Phosphorous, Potassium) than the prescribed stand ratio of 4:2:1 in a haphazard way, resulting in soil pollution, depleting soil micro-nutrients and affecting soil chemistry. The soil of the area is becoming barren and yield of the crop is either stagnant and decreasing.

It has been observed that a middle class former family with 2-3 animals and 2 to 2.50 acres of land can support his 5-7 members family well by adopting this technology and will be able to sell food grains in the market to meet out other expenditure of his family. It has been empirically observed that there is very poor adoption of this technology in the rural areas of the district while, there is immense benefit from it. The lack of propogation illiteracy of the farmers and harassment of the Government officials and local leaders are some causes of poor adoption. Vermitechnology is less costly, less prone to soil erosion, less moisture loss, pollution free, eco-friendly and almost doubles the crop yields. In vermitechnology earthworms of special species Rs. 500-600 per 5 kg. from Khagaria, are used to prepare, vermicompost manure/against the traditional animal dung compost. These earthworms make use of plant residues organic waste, animal urine and dung. These earthworms by virtue of their feeding and general behavioural activities like burrowing, leading to micronising, digesting, excreting and decomposing of complex waste matters into simple forms. Thus play vital role in increasing soil fertility. They also mix the different layers of soil 1 mm to 5 mm thick surface every year and turnover soil from 2 to 250 tonnes per hectares yearly, depending on the species of earthworms and soil characteristics (physical and chemical both). Thus they bring various complex organic nutrients closer to plant roots for absorption. The capacity of these earthworms to break up complex organic matters into compost form in 2 to 5 times faster than conventional method, in conventional composting, generally it takes 6 months while these special earthworms convert 1 tonne per month in a 5 meter pit linked with animal's urine track. These earthworm's activities promote hasten and enable humification process and provide 15% to 30% more phosphorous and 6% more nitrogen to the soil. Besides it, some other plant nutrients like Calcium, Magnesium, Potassium, Phosphorous and Molybdenum are more available to plants through warm cast than surrounding soil, it has been observed periodic turnover and mixing of organic matters in traditional compost pit is labour intensive

process. While in vermitechnology composting and all process related to aeraction (i.e. turning, mixing and bringing various plant nutrient to the roots of plants) is done by earthworm.

Table - 1

AGRICULTURAL AREA

S.N.	Crop	Category Crops	Area devoted in Hect	%age
1	Cereal crops	Rice, Wheat, Maize, Barley	91321.3	73.38
2	Food cash crop	Sugarcane, Potato, Vegetable, Fruits, Spices, Oil seeds	14325.4	11.51
3	Pulses	Gra,. Arhar, Mung, Urad, Peas, Khesari etc.	3894.97	3.13
4	Millets	Marua, Kodo, Sawan, Jowar, Bajra, Kauni etc.	3145.45	2.53
5	Fodders	Oat, jenera, Napier etc.	2834.39	2.28
6	Fibers	Sanai, Pat Jute etc.	5647.95	4.54
7	Non-food cash crops	Tobacco, Betel leaf etc.	1814.67	1.46
8	Other crops	Kerao, Bokla, Suthani Lulthi etc.	1472.57	1.18
Total			124457	100.00

Source: Zinsbar Report, District Statistical Offices, 2011-12

The above mentioned table shows the land devoted to different crops in the district. Out of the total agricultural area 73.38% (91321.3 hec.) land is devoted to the cereal crop that comprises rice, wheat, maize, Barley etc. Food cash crops cover 11.51% (14325.4 hec) cultivable land in the district which consists sugarcane, potato, vegetables, fruits, spice, oilseeds etc. Pluses, gram, arhar, mung, urad, peas, khesari etc. are grown, Mallets that includes marua, kodo, sawan, jowar, Bajra, Kauni etc. covers 2.53% cultivable lands comprising 3145.45 hec. Fodders includes oat, jenera, napier etc, These crops are grown on 2834.39 hec. of cultivable land and it covers 2.28% of the total agricultural area.

Fibers crops include Sanai, Pat, Jute etc. 4.45% (5647.95hec) of the total agricultural area. A Non-food cash crop that includes tobacco, betel leaf etc. covers 1814.67 hec. Cultivable land that stands for 1.46% of the total cultivable land. Only 1.18% cultivable land is devoted to other crops kerao, bokla, suthn, lulthi, etc.

According to Prof. S. Jasraj Puri from earthworms bodies medicines are prepared through unanipathy for the treatment of wounds, piles, arthirities, jaundice, gallbladder stone, hernia, Asthma and sexual impotency.

Thus, the whole process done by these special earthworms is known as vermitechnology or vermicomposting. These earthworms have maintained C/N ratio (Carbon-Nitrogen) and C/P relationship (Carbon-Phosphorous), brought down to 20:1 and made Nitrogen available to plants.

Nutritive Value of Vermicompost in Vaishali District

It has been observed that some minerals like Copper, Magnesium, Cobalt which are useful to increase crop yield are decreasing due to excessive use of pesticides like thylate, phiolone and chlorophyriphos to kill termites (in potato crops) has made the soil poisonous.

Table - 3

Nutritive Value of Vermicompost

Sr. No.	Nutrients	Value	% or ppm
1	Organic carbon	9.15	18.52%
2	Nitrogen	0.52	1.63%
3	Phosphorous	0.15	0.36%
4	Potassium	0.26	0.62%
5	Sodium	0.08	0.40%
6	Copper	2.00	9.35 ppm
7	Iron	5.80	11.23 ppm
8	Zinc	5.80	11.23 ppm
9	Sulphur	1.30	556 ppm

In the study area Vaishali district application of vermicompost is encouraging author in Bahadurpur village adopted by Shri Ramlal Mahto, a middle class progressive farmer cum service man in following three cereal crop like wheat, rice and maize and in the cultivation of some vegetables like potato, tomato, cauliflower, cabbage, raddish, elephant foot (suran), stripped pear gourds (parwal), bottle gourd (lauki, ghiya), pumpkin (kaddu). For the onion, garlic and one horticulture crop banana the result is encouraging and the maximum yield of wheat increased from 22-25 qtl. per hectare to 40-48 qtl. per hectare. The soil scientists of Bangalore Agriculture University in a village Nagsandra, 40 km away from Bangalore have tapped maize yield 83 qtl. per acre is increases of 27 qtl. per acre more by applying new technology (use of urine). The growth of banana is robust and vegetables yield almost has doubled.

Table - 2

Estimated Production of Various Crops (2021 A.D.) After Use of Vermicompost

Sr. No.	Crops	Total cropped area (in ha)	Production (in mt. tonne)	Average production (qtl./ha)	Expected production (in lakh mt. tonne)
1	Wheat	73276	251687	34.35	5.3
2	Rice	17534	56533	26.54	9.3
3	Maize	51219	101789	19.83	2.0
4	Pulses	7755	7508	9.68	0.15
5	Oilseeds	15119	16857	11.15	0.33
6	Potato	40518	845165	208.59	16.9

The cost of chemical fertilizers (Nitrogen) at present is Rs. 5-6/kg., while the cost of vermicompost is only Rs. 4-6/kg., which includes packaging also. It has been suggested that the middle class family with 5-7 members having 2.00-2.5 Acre of land with 2 or 3 cattles can support his family well and will have excess foodgrains to sell in the market. It has been observed that there is very poor adoption of this technology in the district inspite of its immense benefit. It has been suggested that the officials of agricultural department must take serious interest in propagating its benefits in demonstrating and providing training to 5 young educated, energetic, unemployed and progressive

young farmers from each gram panchayat for training at block headquarter in the initial stage. Government must provide some incentive for its propagation among the masses. The feedback of this project must be evaluated periodically. Carrot and stick policy must be adopted seriously to check the corrupt official, otherwise fate of this development technology will fade like other government development projects.

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