

Vermicomposting for Sustainable Agricultural Development - A Case Study of Khagaria District

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Abstract :

Vermicomposting is used to convert organic materials into humus. Nutrient profile in the vermicompost is generally higher than tradition compost. Through vermicompost, we can enhance soil fertility, physically, chemically and biologically. Vermicompost treated as 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. The enhancement of plant growth could not be satisfactorily without 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 of the uses of organic fertilizers in agriculture sector were also examined.

Keywords : Vermicompost, Sustainable agriculture development, Nutritive value, Cropped area, Land use planning.

Introduction :

The population of India is increasing at the alarming rate. The population of India is expected to increase the world largest in 2027, an increase of 36 percent in twenty five years at 1.2 percent annually. According to the 2011 census Khagaria district has a population of 1657,599, roughly equal to the nation of Guinea - Bissau or the US state of Idaho. Therefore, 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 :

Khagaria district is located on the northern bank of the Ganga River. The total population of Khagaria district is 1657599 (2011) showing 29.46% increase over the population of the district in 2001. Khagaria district has a density of 1116 persons per square km. this density is very high compared to the national and states average density of population. The level of Literacy (68.86%) in the district is also very low. The area under agricultural land use accounts to 108398.70 hectares that stands for 72.96% of the total geographical area of the district. Agriculture is the backbone of Khagaria is economy 77% of workforce engaged in agriculture.

Objectives :

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

Land use pattern (Khagaria) :

Block wise land use of the total reported Area (in hectares) 2012-13

Table - 1
Land Use Pattern (Khagaria)

Block Wise Land Use Of The Total Reported Area (in Hectares) 2012-13.

Sl. No.	Name of C.B.D.	Net Sown Area	Current Fallow Land	Old fallow Land	Orchards Groves	Unculturable Land	Culturable waste land	Area not available for cultivation	Pasture and grazing land	Forest	Block Total
1	Alauli	15739.27	1983.77	642.83	913.35	770.82	1198.41	2856.40	1233.31	2108.85	27447.00
2	Khagaria	14739.27	3306.26	399.61	2307.25	1241.63	637.47	123.69	1070.37	2235.89	26236.00
3	Mansi	3895.96	488.46	198.48	203.02	348.20	194.70	40.76	125.90	1066.52	7001.00
4	Chauthn	8547.33	1467.94	1030.57	541.84	660.48	423.21	906.62	734.85	2084.15	16397.00
5	Beldaur	12861.75	1169.25	2093.06	190.56	1704.33	1022.90	1304.93	1303.38	1205.84	22356.00
6	Gogri	13111.58	2867.27	1092.09	1910.07	2403.90	700.50	1144.30	820.15	981.14	25031.00

Source: - Dist. Statistical Office , Khagaria , 2012-2013

Agricultural land use:

The area under agricultural land use accounts to 108398.70 hectares that stands for 72.96% of the total geographical area of the district. It includes net sown area, current fallow land, other(Old) fallow and orchards & groves. the total area the district of Khagaria under net sown area in 2011-12 was 81512.22 hec. that stands for 54.86% of the total geographical area of the district. The area under current fallow land is 13517.39 hec. That stands for 9.10% of the total geographical area of the district. Other (old) fallow land covers 6295.46 hec. That stands for 4.24% of the total geographical area of the district. Again, Orchards and groves cover 7073.63 hec. of land that stands for 4.76% of the total geographical area of the district.

Total Non-Ag.Land Use: The total area of non-agricultural use consists unculturable waste land, culturable waste land, area not available for cultivation, pasture and grazing land and forest. All these sub-categories jointly

covers 27.04% of the total geographical area of the district while culturable waste land covers 3.39% area not available for cultivation covers 5.30% pasture and grazing land covers 4.13% and forest covers 8.08% of the geographical area of the district.

Agriculture is possible only in net sown area. This is the only resource on which man lives on directly or indirectly. The area under net sown area ranged from 55% to 65% of the total geographical area of the district between 1990-91 to 2010-11 as is shown in the above mentioned table. In 1990-91, the total area under net sown area was 82101.09 hect. that stands for 55.26% of the total geographical area of the district while in 2000-01, it increased to 60.24% and in 2010-11 net sown area increased to 63.76% of the total geographical area of the district. During the period of twenty years, the average percentage of net sown during the period of twenty years, the average percentage of net sown area remained 59.75% of the total geographical area of the district.

Table -2
District:- Khagaria : LANDUSE CATEGORIES
(Average of 1990-91,2000-01 & 2010-12) (Hect.)

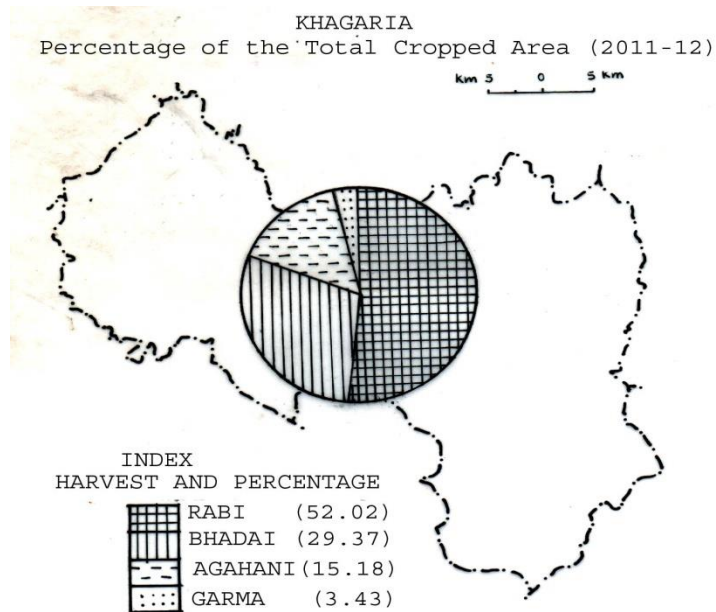
S.No.	Lu Categories	1990-91	2001-01	2010-11	Average
1	Net Sown Area	82101.09	89499.99	94729.74	88776.94
2	Current Fallow Land	11306.36	8364.62	4427.46	8032.81
3	Old Fallow Land	8379.48	6953.19	4397.74	6576.80
4	Orchards and Groves	2926.88	1248.01	936.01	7003.63
A	Agricultural Land Use	104713.80	106065.81	104490.94	105090.18
5	Unculturable Land	10920.07	8498.34	6715.47	8711.29
6	Culturable Waste Land	9270.92	6522.33	19626.41	11806.55
7	Area Not Available For Cultivation	4397.74	9107.49	8929.20	7478.18
8	Pasture And Grazing Land	2154.30	4694.89	3149.73	3332.97
9	Forest	17115.14	13683.51	5660.61	12153.22
B	Non-Agricultural Land Use	43858.56	42506.55	44081.42	43482.18
Total		148572.36	148572.36	148572.36	148572.36

Source: District Statistical Office, Khagaria, 2011-12.

Table - 3
District:- Khagaria
(Total Cropped Area 2011-2012)

S.No.	Harvests	% age to the total cropped area
1	Rabi	52.02
2	Bhadai	29.37
3	Agahani	15.18
4	Garma	3.44
	Total	100.00

Source :- Zinsbar Report , Dist. Statistical Office , 2011-2012

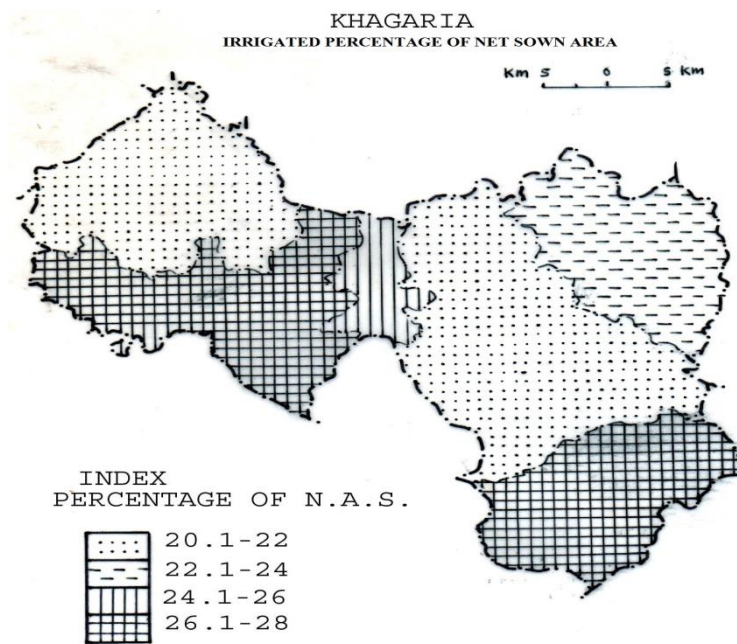


Vermitechnology is less costly, less prone to soil erosion, less moisture loss, pollution free, eco-friendly and almost doubles the crop yields. In vermitechnology earthworms of special species Rs. 500-600 per 5 kg. from Khagaria, are used to prepare, vermicompost manure/against the traditional animal 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 aeration (i.e. turning, mixing and bringing various plant nutrient to the roots of plants) is done by earthworm.

Table - 4
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 vermitechology 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 Khagaria 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 - 5
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 Khagaria 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 - 6
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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