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Editorial

Earthworms & Vermicomposting

Since times immemorial, usefulness of earthworms has been emphasized. Earthworms have one unique habit, the habit of burrowing. Because of this quality, a Greek philosopher, Aristotle called them, "intestines of earth". The British naturalist Charles Darwin (1809-1882) began and ended his almost 45 year long career with observations, experiments and theories related to earthworms. He pointed out that earthworms by producing enormous amounts of worm-castings over the years modify the structure of the soil and help in its rapid turnover and have a good effect on soil aeration. Since then and still today the research work on different species of earthworms is being conducted all over the world. People say them as farmer's friends, soil engineers and soil conditioners etc. These are basically anecic or endogeic species of earthworms.

Epigeic earthworms are composting worms. These play significant role in transforming bio-degradable solid waste into useful vermi-manure or vermi-castings. This technique is vermicomposting. It was started in 1960 in USA for the 1st time; while Vermiculture and vermi-composting were introduced in Philippines in 1970s. **Mary Appelhof** (1936-2005) - an American Biologist and Michigan Biology teacher started Home vermicomposting using ***Eisenia fetida*** in 1972. She is known as Mother of modern day vermi-culture. Composting worms are voracious eaters, consume biodegradable matter and give out vermi-compost. The vermi-castings containing nutrients is a rich organic manure for the plants. It increases soil structure, WHC, aeration etc. Now- a- days Vermi-composting is a common practice amongst the progressive and educated farmers. They are preparing vermi-compost by using different kinds of grasses, weeds, dry garden leaves etc. as biodegradable waste. Vermicomposting is one of the best tools for environmental sustainability and safety.

Mary Appelhof

The process of vermicomposting needs certain precautions like, proper aeration, moisture, ambient temperature, shade conditions, type of the biodegradable raw material, state of the pre-decomposed cattle dung, pH and species of the composting worms etc. In this issue of the bulletin the research article entitled, "Impact of different shades on vermi-composting using ***Perionyx excavatus***" throws light on the effect of shades on the process and pace of vermicomposting. This information will ,no doubt, motivate the vermicompost producers for carrying out large scale vermicomposting.

The other article entitled,"Vermi-compost prepared from Congress grass can boost plant growth" explains that even the vermi-compost prepared from a common harmful weed, Congress grass, can boost up plant growth. This study may provide a clue to the farmers as one of the easy biological weed control strategy.

S.M. Singh

Message

Prof. K.P. Singh
Vice-Chancellor
Mahatma Jyotiba Phule
Rohilkhand University, Bareilly (UP)

Exponential increase in human population especially in Indian context is alarming and is a major threat today. The population of India is nearly 243 times more than that of Singapore, 50 times more than Australia, 36 times than Canada, 4 times than that of USA. Even the population of Uttar Pradesh state is 5.4 times more than that of Canada.

This requires more grains and vegetables to feed the mouth of the country people. Farmers are now helpless to produce more and more grains. They are bound to use chemical fertilizers and pesticides. This chemical farming system is now creating severe adverse effects on the human health. It is the peak time for all the farming communities to switch off chemical farming and opt organic farming system without any further delay.

I'm happy that the bulletin VERMECO is regularly publishing the articles on vermicomposting, organic manure, and its usages in agriculture and environmental protection. The articles published in the bulletin are worth in giving the clue to the farmers on the speedy vermicomposting process and transformation of weed into vermicompost along with the stories of two progressive farmers.

K.P. Singh

Impact of different shades on vermicomposting of grass using *Perionyx excavatus*

In large scale vermicomposting, it should be done under shade to protect tiny earthworms from direct sunlight, hot environment and rains. Shades also help to maintain the quality of vermicompost avoiding the volatilization loss of nutrients due to heating on direct sunlight and the leaching loss of nutrients due to washing with rain water but scientific information / data on influence of different shades on chemical quality of vermicompost is very meager. Keeping this in view the experiment was designed to produce vermicompost from grass in open floor covering with five easy available materials in two ways, either by making shades with bamboo structure or by using those materials as mulching.

Five easy available shade materials like black polythene sheet, Cement carrying bags, Rice carrying gunny bags, Used Cotton cloths and Paddy straw were collected. Fifteen Bamboo structures of size 1 meter length, 0.5 meter width and 0.3 meter height were made for covering the vermicomposting beds and each three structures were covered with above mentioned five shade materials (Fig.1). Mixed monocot grasses of the family Gramineae, Cyperaceae and Juncaceae collected from fields of establishment were used as raw material after drying for vermicomposting.

Fig. 1. Vermicompost beds covered with structured shades and as mulching

Thirty three rectangular compost beds of base size 80 cm X 40 cm were made on uncovered cemented floor by thoroughly mixing 10 kg grass each with 20 kg cow dung converted to slurry with water in first week of month. Each three beds were covered with one type of bamboo structured shades while other three beds were covered with corresponding shade material as mulching. After seven days all beds were thoroughly mixed and cover again in similar way.

After 15 days material of each bed were mixed for second time, 100 healthy adult Perionyx excavatus earthworms were released on the top of each bed and covered again in both ways i.e. bamboo structured shades and mulching. Regular monitoring was done to maintain 70 to 80 % moisture by spraying of water as and when required and to protect earthworms from predators like frogs, birds, rats and ants, etc. When the composting material became black coloured loosely granular structured material up to lower layer, as observed by physical verification once in a week, the bed material was spread under a shade for partial air drying. All earthworms were separated by hand sorting, vermicompost of each bed was sieved separately through 2 mm sieve and samples about 250 g each was collected for laboratory chemical analysis following standard procedures (Bhargava and Raghupati, 1993).

The data presented in Table- 1 showed that different type of covers played a significant role in vermicomposting of grasses. Both polythene sheet and gunny bag sheet covers took about 3 months for complete vermicomposting, cotton cloth cover 3.5 months, cement carrying bag sheet and paddy straw covers 4 months, while control (no cover no mulching) took little more time which was obvious due to less eating by earthworms during day time in presence of sunlight. Faster

Table - 1. Chemical quality of vermicomposts prepared from grass under different types of cover

Cover	Time (months)	pH (1:2)		Total Nitrogen (%)		Total Phosphorus (%)	
		C A S*	Mulching	C A S	Mulching	C A S	Mulching
Control (No Cover, no mulching)	5.0	6.22 + 0.07	6.22 + 0.07	1.14 + 0.04	1.14 + 0.04	0.61 + 0.05	0.61 + 0.05
Black Polythene sheet (BP Sheet)	3.0	6.45 + 0.05	6.48 + 0.05	1.28 + 0.04	1.24 + 0.03	0.68 + 0.07	0.62 + 0.07
Cement Bag (C Bag)	4.0	6.50 + 0.06	6.30 + 0.04	1.35 + 0.06	1.33 + 0.05	0.75 + 0.08	0.71 + 0.04
Gunny Bag (G Bag)	3.0	6.30 + 0.09	6.45 + 0.05	1.43 + 0.03	1.37 + 0.03	0.82 + 0.03	0.74 + 0.03
Cotton Cloth (C Cloth)	3.5	6.35 + 0.04	6.25 + 0.05	1.27 + 0.06	1.18 + 0.04	0.71 + 0.06	0.67 + 0.05
Paddy Straw (P Straw)	4.5	6.30 + 0.07	6.45 + 0.05	1.30 + 0.05	1.23 + 0.05	0.76 + 0.08	0.69 + 0.03

Cover	Total Potassium (%)		Total Calcium (%)		Total Sulfur (%)		Total Sodium (%)	
	C A S	Mulching	C A S	Mulching	C A S	Mulching	C A S	Mulching
No Cover	2.22 + 0.05	2.22 + 0.05	0.98 + 0.04	0.98 + 0.04	0.65+ 0.03	0.65 + 0.03	1.83 + 0.05	1.83 + 0.05
B P Sheet	2.51 + 0.08	2.39 + 0.07	1.10 + 0.05	1.04 + 0.06	0.81 + 0.06	0.74 + 0.08	2.01 + 0.07	1.93 + 0.07
C Bag	2.59 + 0.06	2.46 + 0.08	1.33 + 0.03	1.18 + 0.08	0.96 + 0.05	0.87 + 0.08	2.04 + 0.09	1.98 + 0.08
G Bag	2.61 + 0.05	2.55 + 0.06	1.34 + 0.06	1.27 + 0.03	1.01 + 0.04	0.97 + 0.04	2.23 + 0.04	2.11 + 0.05
C Cloth	2.34 + 0.04	2.29 + 0.03	1.14 + 0.03	1.07 + 0.04	0.85 + 0.03	0.81 + 0.06	1.96 + 0.03	1.86 + 0.06
P Straw	2.57 + 0.07	2.23 + 0.05	1.23 + 0.05	1.01 + 0.03	0.89 + 0.04	0.77 + 0.03	1.97 + 0.08	1.87 + 0.06

*C A S = Cover as structured shade

drying of top layer was also hindered the rate of decomposition. However, no significant difference in time of vermicomposting was noticed in treatments covered with structured shade and mulching and hence one data for time is only placed here for each shade materials.

The pH of vermicomposts varied from 6.22 to 6.50, slightly more under cover than no cover treatment. There was no remarkable difference in pH values under cover or mulching system and even among different shading materials. But in case of different nutrient contents comparable differences were noticed between shading materials and structured cover always gave little higher nutrient status than mulching with corresponding shade materials. This might be due to availability of better airy and moist environment for growth and feeding of earthworms under structured shades than their counter parts under mulching. Total nitrogen varied from 1.14 to 1.43 %, showing slight higher result in case of Gunny bag followed by cement carrying bag shades while little less nitrogen recorded in shades of cotton cloth and polythene sheet. Though nitrogen content was little less under mulching but the trend was found same. Total phosphorus varied from 0.61 to 0.82 %, potassium from 2.22 to 2.61 %, calcium from 0.98 to 1.34 %, sulfur from 0.65 to 1.01 % and sodium ranged between 1.83 to 2.23, higher results were, however, obtained from vermicomposts prepared under gunny bag cover followed by cement carrying bag while lowest result was recorded from vermicomposts prepared under no cover, no mulching treatments followed by polythene sheet cover.

It was found that structured shades of any materials was always better in rapid vermicomposting as well as nutrient status of vermicompost than no cover treatment since it provided better airy and moist environment essential for growth and optimum feeding of earthworms. Even mulching also helped in quicker vermicomposting and better nutrient contents in comparison to no cover (control) situation. Similar to raw material, quantity of cow dung and earthworm species, cover / shade is also an important factor in rapid vermicomposting technique.

The experiment, therefore, shows that vermicomposting should be carried out under shade, either under airy structured cover or even at least under mulching condition. As a shade material gunny bag sheet or hessian cloth is better followed by cement carrying bag sheet, black polythene sheet, used cotton cloth and even paddy straw. This information will no doubt motivate the vermicompost producers for carrying out large scale vermicomposting work under any shade instead of open places.

A. K. Sannigrahi- Former Scientist 'F', Proof & Experimental Establishment, DRDO, Chandipur, Balasore, Odisha- 756025

General Article

Vermicompost prepared from Congress grass can boost plant growth

Congress grass ***(Parthenium hysterophorus)*** is one of the common major annual, persistent, prolific, allergic, asthmatic and harmful weeds effectively competing with the crop plants.

Fresh weed was collected from nearby University campus area, shade dried and chopped into small pieces of ± 2 cm size and mixed it with pre-decomposed cattle dung in 1:3, 1:1 and 3:1 ratios, in triplicate, with 4 kg total weight of each. After 15 days of pre-decomposition, 10 g matured worms, ***Eisenia fetida*** were introduced into each rectangular plastic tubs (size 43 x 32 x 14 cm). These experiments were carried out at room temperature 20-25^{0}C and till the transformation of weed into vermicompost. Such experiments were repeated five times.

Congress Grass

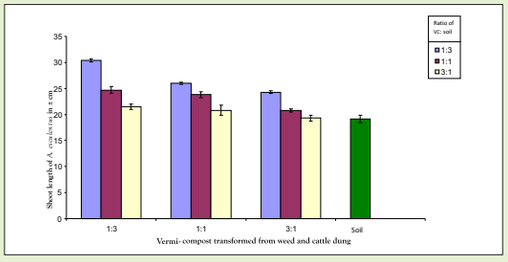

Fig.1. Growth of shoot length of Lady's finger ***(A. esculentus)*** in Congress grass ***(P. hysterophorus)*** transformed vermi-compost after 40 days (SE= 3),VC=Vermicompost

Impact of vermicompost prepared from different ratios of weed and dung on the shoot length of lady's finger ***(Abelmoschus esculentus)*** was assessed by mixing it with the local soil in the ratio of 1:3, 1:1 and 3:1 using earthen pots with surface diameter 11.6 cm in triplicate. Three healthy seeds of lady's finger were sown in each pot at the depth of 1 cm from the surface. Moisture of pots was maintained by sprinkling appropriate amount of water alternatively. Shoot length of the grown plants was measured after 40 days and the data were compared with plants grown in the plane soil only.

Results showed that the shoot length of lady's finger was the maximum when vermicompost transformed from 1:3 ratio of weed: dung when mixed with the soil in 1:3 ratio and least when vermicompost prepared from 3:1 was used with the soil in the ratio of 3:1. It was also noted that in the first 20 days, increase in the shoot length of the plants was the maximum. More growth of plants in the pots having vermicompost transformed from 1:3 weed-dung medium might be due to high level of microbial population in it. These findings indicate that the vermicomposting technique could be one of the easiest biological ways in permanent eradication of weeds.

S.M.Singh- Professor Department of Animal Science, Mahatma Jyotiba Phule Rohilkhand University, Bareilly-243006 (India)

Success Stories of Farmers
Practicing Organic Farming

Organic farming is a technique of cultivating plants and rearing animals in natural ways. Our farmers were practicing traditionally this from time immemorial until few decades ago, but demand for food has increased due population explosion that has led to development of new high yielding/hybrid varieties and use of chemicals to feed the mass. Later, the ill effects of such molecules and practices on human health and environment was realized and now practices are being developed involving the use of biological materials and avoiding synthetic substances to maintain soil fertility and ecological balance. In western Uttar Pradesh, organic farming is adopted by the majority of farmers now. The brief story of two of farmers of Bareilly district, practicing organic farming from the last 4-5 years showed their success. They found organic farming sustainable, remunerative and a source of self-employment.

Balvir Sahay Gangwar
(Contact No.: 9258276126)

Balvir Sahay Gangwar (65) is from village-Badhepura, Tehsil- Nawabganj, District-Bareilly after retiring from the job focused on organic farming. He is associated with Krishi Vigyan Kendra, Bareilly since after his retirement. He is cultivating different crops adopting organic practices. Major crops cultivated by him includes sugarcane, paddy, wheatand mustard. This year he has cultivated black wheat organically under the guidance of SMS (Agronomy) using waste decomposer, jeevamrit, organic plant protection materials and got excellent results.The grains of black wheat were quite bold and productivity of wheat was 1.6 tons/ha.

Sarvesh Kumar
(Contact no.8057238501)

Mr. Sarvesh Kumar (25) is from village-Grem, Block- Nawabganj, District Bareilly (Uttar Pradesh). He is an educated youth from an agrarian family, was searching a job and during this he came in contact with KVK-IVRI, Izatnagar, Bareilly and attended trainings on mushroom production, vermicomposting, fruit and vegetable production and implemented the practices in his agricultural land (0.50 ha). To maximize the economic output and to earn more K.V.K's specialists suggested him to adopt vegetable as an intercrop in the main crop and suggested to go for organic certification of his agricultural products.

He planted sugarcane in 0.5 ha area by trench method and took a row of okra, black toria, coriander in the mid of two sugarcane rows and then calculated benefit and cost ratio which were around 2.08:1.0 in sugarcane (0.5ha), 2.39:1.0 in pea (0.35ha), 1.82:1.0 in coriander (0.15ha), 1.48:1.0 in okra (0.15ha). He did not use any fertiliser instead; he incorporated 15.50 tons of FYM in his field while he planted sugarcane. He treated sugarcane cuttings and vegetable seeds with cow urine and ***Trichoderma***, respectively. Napier cuttings was planted for fodder at the boundary of his fields to meet the round the year green fodder requirement of dairy animals. He also got organic certificate for his agricultural products and is now enthusiastically pursuing organic agriculture practices in his village.

Courtesy: Dr. R K Singh & Vanee Yadav- Krishi Vigyan Kendra Bareilly, ICAR-IVRI, Izatnagar, Bareilly

Indian Earthworm Biologist-17
Dr. Madhuri Dabral (b.1978)

Dr. Madhuri Dabral did Graduation (1999) and Post Graduation (2002) from Hemvati Nandan Bahuguna University, Garhwal and Ph.D. in Environmental Sciences (2009) from Gurukul Kangri University, Hardwar. She did research on commercial production and manufacturing of bio-insecticide, bio-pesticide, bio-herbicide, bio-fungicide etc. through vermiwash.

She has completed many research projects funded from DST, Uttarakhand Council of Science & Technology (UCOST), Uttarakhand State Biotechnology Department, Dehradun (USBD) as women young scientist. She guided and helped to establish vermicomposting units at BEL and Nagar palika Kotdwar to manage their organic waste. She has also worked on eradication and management of toxic weeds as Congress grass, Lantana camara and Pine and published 7 research articles. She participated in 8 National Seminars too.

Dr. Madhuri Dabral headed the Department of Environment Science at Graphic Era University, Dehradun (October 2011-October2012). Dr. Dabral has served as In charge "Parvatiya Krishi Vikas Kendra" (HILL AGRO), Village-Haldukhata, Tehsil-Kotdwar, Distt.-Pauri Garhwal from July 2007 to July 2009 and also worked in the remote areas of District Pauri Garhwal on Hi-tech Organic Farming and Vermi-culture, during Integrated Watershed Development Project (IWDP) in the year 2005-06 and in the villages of District Chamoli during the Integrated Horticulture Development Scheme (IHDS) in the year 2005-07.

She has been crowned with Rashtriya Nirman Ratan Award by "All India Business Development Association" in 2019 at New Delhi and Research Performance Award in 2012 (Research day) at Graphic Era University, Dehradun.

Dr. Dabral is Life member of Indian Academy of Environmental Sciences, Haridwar, Uttarakhand; Annual member of International Research Journal of Environment and Chemistry and the Society for Ethanopharmocology, Kolkata.

She is truly devoted in Organic Waste Management since last 15 years and has established a Vermicomposting and vermiwash production unit at Haldukhata, Kotdwar, Uttarakhand and started to spread awareness about organic compost and helped more than 600 farmers in and outside Uttarakhand to establish their own vermi-culture, vermi-composting and vermi-wash units.

Dr. Dabral is involved in the production of vermicompost at very large scale to fulfill the demand of hundreds of farmers. She is providing training and awareness drives in schools, colleges and nearby villages. Her Company provides earthworms to the needy peoples on reasonable rates and sometimes free, depending on the economic status of the interested groups. The company is focused and dedicated towards making Uttarakhand and India chemical free.

Presently Dr. Dabral is Director of Charekha India (opc) Private Limited-is a startup recognized company and involved in the production and marketing of vermicompost, vermiwash and compost tea. She is working as consultant in the NGO, "Society for Harmonizing Agriculture, people and Environment" (SHAPE), village -Haldukhata, Tehsil Kotdwar, District Pauri Garhwal from June 2002 to till date.

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