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Major Constraints in Popularising Vermicompost Technology in Eastern India

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Abstract: Vermicompost technology is emerging as a simple, easily adoptable and effective biotechnology for recycling all organic wastes all over India. It can be taken up in small scales at household levels or at large scale for commercial purposes. This technology is widely spread among farmers in states like Karnataka, Tamilnadu, Maharashtra, Gujrat, etc. while opposite trend has been noticed in Odisha, West Bengal and Bihar. The major constraints related to popularisation of vermicomposting are: (1) Technical constraints which include variations in technology suggested by different researchers, lack of awareness/knowledge on advantages of vermicomposting over traditional composting and lack of proper training facility to interested individuals, (2) Economical constraints that include the lack of government support for extending financial benefits/subsidies and lack of marketing facility/infrastructure, (3) Promotional constraints which include non-availability of efficient epigeic earthworms in nearby locality, difficulty in chemical analysis of produce for maintaining quality and lack of government initiatives for encouraging organic farming, (4) Social constraints like least liking by members of family and society and (5) Psychological constraints by considering the technology as less cost effective, more labour intensive and high input oriented. If constraints are dealt (a) by arranging proper locality based suitable training among the interested farmers and unemployed youths, (b) by providing necessary financial support to them after training and (c) by creating proper marketing infrastructure to sell quality product under a dedicated Non-Government Organization using one brand name, then the technology will be popularized in Eastern India. The Organic farming as well as soil health will be improved. The technology, at present, remains as talk of the day among literates in city or in conference, but it has to be penetrated among rural masses irrespective of their literacy, financial status and demographic differences.

Key words: constraints, eastern India, popularization of technology, vermicompost, vermicomposting procedure

1. Introduction

Detrimental effects on soil health as well as sustainable crop production due to indiscriminate use of chemical fertilizers have forced mankind to concentrate more and more eco-farming adopting integrated plant nutrient system. It is a great challenge to fulfil the demand of food for ever increasing population of human being when natural resources like cultivable lands, underground water and petroleum reserve, etc are shrinking. Huge quantity of organic manure is necessary for maintenance of soil health and productivity. There is a constant increase in solid waste generation worldwide, disposal of which without creating pollution to environment is also a challenging job. In India total solid waste production has touched the level of 90 million tons per year in the form of Municipal Solid Wastes (MSW), Crop wastes, Agro-industries wastes, Animal wastes, aquatic wastes, etc. Figs. 1 and 2 showed that in just 20 years (1991 to 2011) MSW production in India jumped from 23.86 to 68.8 million tons while per capita generation increased from 0.2 to 0.5 kg/day and as projected both will increase considerably during 2030. MSW composition, determined at collection points on a wet weight basis, consists mainly of organic material (40-60%), ash and fine earth (30-40%), waste papers (3-6%), Plastics (1-6%), broken glassware (2-6%) and metals (1-3%)

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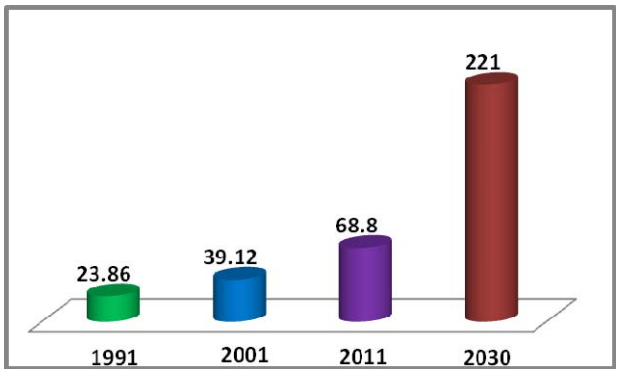

Fig. 1 MSW production (milliontons/year) in India.

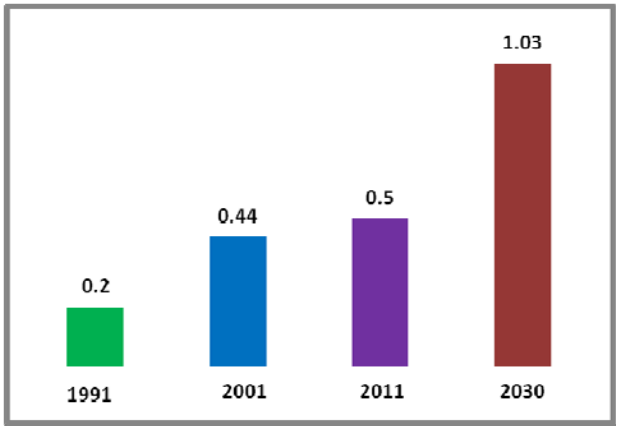

Fig. 2 Per capita generation (kg) of MSW.

[1, 2]. The percentage of paper, glass, plastics and metals in MSW are sometimes recorded low due to segregation and collection by rag pickers from collection points and disposal sites. Solid waste disposal has become Nation's great concern since after spending more than 50 percent of their budget by Municipalities, it is found that maximum about 70% of MSW can be collected and transported to disposal site leaving many parts of the municipality unclean every day and residents are not at all satisfied. The Central Pollution Control Board (CPCB) collected data from 299 cities of India on the mode of collection of MSW and found that manual collection comprised 50% while collection using trucks comprised only 49% [3]. It is very interesting to note that majority (more than 90%) of MSW are disposed by dumping in unscientific open land filling on outskirts of towns and cities while 10% of collected and 2% of uncollected MSW are burnt in open condition. Scientific technologies like controlled burning (Incineration & Pyrolysis), Waste to Energy (WtE) for Steam & Electricity production, Sanitary Landfill, Composting, Biogas production, Recycling, etc are available but Municipal authorities are still trying to follow old easy but pollution prone techniques, open dumping and open burning.

Since MSW contains 40 to 60% organic wastes many researchers [4-8] suggest for vermicomposting of MSW for its beneficial, scientific and eco-friendly disposal and for production of considerable quantity nutrient rich organic manure, vermicompost. India has an estimated potential of producing about 4.3 million tons of quality compost each year containing about 45 thousand ton N, 11 thousand ton P and 23 thousand ton K [9] by exploiting such large quantity of organic MSW, if collected from generation point before dumping in dump yard and composted following standard procedure. Traditional composting of organic waste is carried out either by Aerobic composting in perforated tank or in heap with the help of aerobic microorganisms or by Anaerobic composting inside pit or tank under partially anaerobic condition with the help of anaerobic microorganisms. Vermicomposting is, however, carried out inside aerated tanks or by making heap above surface under shade through the joint action of earthworms and aerobic microorganisms. Comparison of both types is given below in Table 1. The findings are in agreement with report of Ndegwa and Thompson [10]. It is found that the problems associated with traditional thermophilic composting are (1) long duration of the process, (2) more frequency of turning of the material, (3) more loss of nutrients during the prolonged composting process and (4) heterogeneous nature of the product. Vermicomposting technology is, on the other hand, a simple, rapid, easily adoptable and effective biotechnology for recycling various organic wastes using epigeic earthworms like *Eisenia fetida*, *Eudrillus eugeniae*, *Perionyx excavatus*, *Lampito mauritii*, *Dendrobaena veneta*, *Lumbricus rubellus*, etc. It can be carried out in small scale at house level

Table 1 Advantage of vermicomposting technology over traditional composting.

Factors	Traditional composting	Vermicomposting
Time	Long duration	Short duration
Turning	More	Less or Nil
Nutrient Status	More loss	Enriched
Initial rise in temperature	> 55°C	< 30°C
Pathogen killing	More	Less
Attention	Less	More

and also in large scale for commercial purposes and field use.

2. Vermicomposting Technology

Vermicomposting is the aerobic, non-thermal organic waste decomposition process where earthworms fragment the half decomposed organic material, mix and promote microbial activity. Earthworm utilizes a small portion (5-10%) of its food for their body synthesis but excrete a large part of these consumed wastes as vermicompost. The action of earthworm is both mechanical and biochemical. Mechanical participation in degrading organic materials results in fragmentation, thereby increasing the surface area of action, turnover and aeration. Biochemical changes are carried out through enzymatic digestion, nutrient enrichment and transport of organic and inorganic materials. Even though Aristotle at about 330 BC first pointed out the beneficial role of earthworm in soil genesis by calling them as “Intestines of the Earth” and “Farmer’s friend” and then Charles Darwin in 1881 mentioned that “All the fertile areas of this planet have at least once passed through the bodies of earthworms....., research studies on Indian earthworms was actually started in 1948 by Dr. A K Dutta, in 1952 by Dr. S. D. Nijhawan and Dr. J. S. Kanwar and in 1957 by Dr. S. R. Khambata and Dr. J. V. Bhat for finding out earthworm’s role on soil aggregation, soil productivity and intestinal microflora. The research on vermicomposting technology in India was, however, started during nineteen seventies by Dr. Radha D Kale at University of Agricultural Science, Bangalore and by Dr. Madhab Chandra Dash at Sambalpur University, Orissa. Several factors like food, temperature, habitat conditions, species and life cycle pattern were found influencing the growth and activity of earthworms.

2.1 Procedure

Following process [11] is followed for successful vermicomposting of biodegradable wastes which must be shredded first into small pieces. Aerobic/heap compost beds (Length — as convenient, width 1m and height more than 1m) will be prepared on the cemented surface by mixing biodegradable wastes and cow dung in 4:1 ratio (weight wise) (Fig. 3). Beds should be moistened properly and covered with black polythene sheets. Materials will be mixed two times at 15 days interval and covered again with same polythene sheets. Bottom-up turning of the waste materials accelerates composting process by exposing the lower layer of the waste materials to the aerobic zone. Vermicompost beds (length 5 m or as convenient, width 1m and height 0.45 to 0.60 m) will be prepared using these partially decomposed materials of aerobic compost beds on the floor under the shade (Fig. 4). Epigeic earthworms (*Eisenia fetida*/*Perionyx excavatus* species) at the rate of 10 to 15 worms per kg of decomposed materials will be added in the top of each bed and beds will be covered with moist Hessian cloths or gunny bags. Watering will be done on each bed periodically using sprayer to keep bed moist (70 to 80% moisture) only.

When vermicompost will be ready for collection, top layer appears somewhat dark brown, granular as if, used dry tea leaves have been spread over the layer. Watering should be stopped for three days and vermicompost will be harvested from top layers. Remaining portion will be kept undisturbed after covering with Hessian cloths and sprinkling water. The harvested vermicompost will be stored at one place as heap and all adult earthworms will move to

Fig. 3 Aerobic composting on the surface in open place.

Fig. 4 Vermicomposting on the floor under shade in windrows pattern.

the lower layer of heap within 2 hours. Top portion of vermicompost heap should be taken out and spread under shade for partial air drying to bring moisture at about 30 percent. Earthworms present in lower part of vermicompost heap can be separated then by hand screening and released back in vermicomposting beds. Partially dried vermicompost has to be sieved through 2 mm wire mess/sand sieving net and stored in Plastic bucket or Plastic/Nylon bags for use as good organic manure.

Before final harvesting from beds arranged in windrows pattern, new beds should be made with partially decomposed materials in between rows and watering will be stopped in old beds. Eighty to ninety percent earthworms will migrate to new beds in the night. Remaining earthworms can be collected manually from harvested vermicomposts as mentioned above and released in new beds. Shade is necessary to protect earthworm from sunlight and rain during vermicomposting. Initial decomposition of wastes develops temperature up to 60°C. It is always better to go for initial decomposition of wastes following aerobic composting (heap method) in the open place and then vermicomposting under shade using earthworm. The temperature inside the heap during initial decomposition depends on the height of heap and nature of wastes. Bed height during aerobic composting must be one meter or more for getting temperature more than 55°C initially for at least one week to kill all pathogens/harmful microorganisms. During vermicomposting the bed height should not be more than 60 cm otherwise composting will be delayed due to creation of anaerobic environment in lower side of the bed. Optimum temperature range for vermicomposting is around 25°C to 35°C. Rate of composting becomes slower under low temperature levels. Daily attention is very essential to maintain moisture in the beds and to protect earthworms from predator like frog, ant, rat, etc. More moisture creates anaerobic condition and delays composting. Earthworms try to come out of beds if beds start drying or remain under waterlogged condition. The two stage composting technique suggested here also confirms the earlier findings of shortening of stabilization time and improvement of the products quality by meeting the pathogen reduction requirements in combined traditional composting and vermicomposting process [10, 12].

2.2 Nutritional Status (Quality) of Vermicomposts

Vermicomposts prepared by this technique from various wastes were found mainly neutral in pH (6.1 to 8.8) and rich in plant nutrients (0.7-2.3% total N, 0.1-1.0% total P and 0.4-2.9% total K) (Table 2), even though nutrient contents of vermicompost depends on nutrient contents of substrates (resource materials) from which it is made.

3. Acceptance of Technology by Indian Farmers

In India, a large number of vermicomposting units

Table 2 Quality of vermicomposts prepared from different wastes.

Wastes	pH (2:1)	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Agricultural wastes	6.4-8.8	0.8-2.3	0.4-1.0	1.2-2.9
Aquatic plants	6.1-7.5	0.7-1.4	0.4-0.7	0.9-1.4
Office wastes	6.8-7.1	1.1-1.2	0.1-0.3	0.4-0.6
Kitchen wastes	7.2-7.7	1.2-1.7	0.7-1.0	1.4-2.0
Residential wastes	7.3-8.0	0.7-1.2	0.6-0.7	1.0-1.6

established by various government and non-governmental organizations provide vermicompost to numerous entrepreneurs, especially in the states of Karnataka, Tamil Nadu, Kerala, Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, etc. Since vermicomposting activity affords part time employment to the family members, it is gaining strong foothold among the farmers of Karnataka. Besides being an eco-friendly activity, vermicompost can contribute enormously to farm production and economic conditions of rural people, many government organizations, private organizations and other agencies have been showing keen interest in undertaking vermicompost production in Karnataka [13]. In Tamil Nadu women from Keezhamathur village near Madurai city, have started production of vermicompost under the guidance of NABARD (National Bank for Agriculture and Rural Development) and a local NGO, Sarojini Naidu Rural Welfare and Education Trust [14]. In Kerala the KrishiVigyan Kendra (KVK) at Thelliyoor, near Thiruvalla, had identified banana waste as a potential source of compost material and had popularised vermicompost among the farmers in the rural areas. The vermicompost units were set up mostly in homesteads and produced around 2,000 kg of organic manure per unit on an annual basis [15]. In Maharashtra different groups led by Mr U. Bhawalkar in Pune, Mrs Asha S Bhise in Latur andNiklangMandal, a community based organization (CBO) of Borivali had popularised vermicomposting among masses. Various reports are also available on farm women participation in vermicompost production in various parts of Gujarat [16-18]. Varalakshmi et al. [19] also reported about acceptance of vermicompost as a micro-enterprise for improving the economic status of self-help group (SHG) women in Guntur district of Andhra Pradesh.

Even though several attempts were taken by various government and non-government organizations to popularize vermicomposting technology among farmers in all states of India, technology has been widely accepted by many vermicompost producers in South India and West India but failed to become popular among masses in Eastern India i.e. in Bihar, Odisha and West Bengal. Attempt has been made in this article to find out various constrained faced by vermicompost producers in Eastern India which made them least interested to expand this technology among grass root level.

4. Major Constraints to Popularize Vermicomposting Technology

Vermicomposting of organic wastes, as mentioned earlier, started in India in nineteen seventies and presently almost all Agricultural Universities, many environment conscious government and non government organizations have started training on vermicomposting with a purpose to generate more and more employment and income avenue, but still majority of Indian population especially farmers are not aware about the role of tiny earthworms as well as the vermicomposting technology in beneficial management of organic wastes [2]. During discussion with different vermicompost producers, small and medium farmers, NGOs advocating vermicomposting and author's own experience as trainer, various problems/constraints which act against popularizing vermicomposting technology in village level can be divided into five groups such as (1) Technical Constraints, (2) Economical constraints, (3) Psychological constraints, (4) Promotional constraints

and (5) Social constraints. All these factors are discussed below in details.

4.1 Technical Constraints

Vermicomposting looks like very simple process, but working with tiny earthworms requires some knowledge and expertise. It has been seen that majority of trainees in eastern India did not start vermicomposting work and majority of vermicompost workers are not at all trained. They have joined on the influence of friends or relatives only. Lack of seriousness or less dedication to hard work of vermicompost producers sometimes leads to failure and financial loss. Educated youths generally do not take up this activity, only illiterate or low educated people are engaged. In Eastern India about 80 percent workers engaged in vermicomposting have low level of knowledge whereas in case of Gujarat among vermicompost making farmers 84 percent and 94 percent farmers have medium to high level of knowledge in Banaskantha [18] and Anand districts [20], respectively. The study in Barmer district of Rajasthan also revealed that 84% farmers had medium level of knowledge and only 5.33% farmers had low level of knowledge [21].

Vermicomposting can be carried out in wooden boxes, cemented tanks, cemented rings, cemented floor, plastic covered floor surface, plastic bins, earthen pots, earthen pits lined with either stones or plastics (Fig. 5). Sizes of containers varied depending on the availability of wastes [2]. Some trainers including the author suggest for heap method while Agriculture departments of state governments in Eastern India advocate for tank method. Similarly different researchers suggest different species of epigeic earthworms (*Eisenia fetida, Eudrillus eugeniae, Perionyx excavatus, Lampito mauritii, Dendrobaena veneta, Lumbricus rubellus,* etc.) based on climatic conditions. All these generally confuse the untrained vermicompost producers and wrong selections of earthworm species as well as vermicomposting techniques bring failures and considerable financial loss to them. Formal training to the vermicompost producer is, therefore, very essential to bring success. In Dharwad district of Karnataka 70 percent vermicompost producers follow heap method while remaining 30 percent producers follow trench method, i.e., inside tanks or pits [13].

Fig. 5 Vermicomposting carried out in different techniques.

Common technical problems usually faced by untrained or new vermicompost producers are: (1) Drainage problems in pits/tanks, (2) Moisture and pH of bedding materials, (3) Size of raw materials, (4) Temperature rising inside the bed, (5) Smelling of beds, (6) Disturbance of beds, (7) Declining in worm population in bed and (8) Separation of earthworms during harvesting, etc. Earthworms, being very sensitive to moisture contents of bedding materials and sunshine, need proper care in their maintenance. Since direct sunlight dries the compost beds quickly, earthworms remain inside compost bed if direct sunshine comes and earthworms come out of too wet beds with development of anaerobic situation if rain drops fall on beds, vermicomposting is usually carried out under the shade/cover. Worms breathe through their skin which needs to be moist for better breathing. But if the beds become too dry, worms being not only dehydrating but also suffocating, will try to go away from the bed. Addition of excess water in vermicompost beds made in pits or tanks creates anaerobic condition due to less airflow and beds become sour and stinky, not favourable for worm health. Addition of more food than the consumption capacity of earthworms present in bed (overfeeding) will lead to rotting food and rancid smells. Feeding with greasy, smelly and animal products to earthworms should be avoided for avoiding rotten smells of compost. Temperature rise in feed stock due to thermophilic reaction during initial bacterial decomposition of feed stock may kill the earthworms which can be avoided by adopting two stage aerobic composting-vermicomposting technique as suggested above. Earthworms have a large amount of predators which include birds, fowl, rodents, frogs, toads, snakes, ants, leeches and flat worms. Declining of earthworm population in bed may be due to either eating by predators or deserting worms themselves for unfavourable living conditions. Many researchers [13, 20, 22] also reported earlier about some of these technical constraints faced by farmers in different parts of India during production of vermicompost. Jangid et al. [23] mentioned that educational constraints especially “lack of skill about improved methods of compost makings” was perceived as the major constraints in adoption of organic farming practices in Jaipur district of Rajasthan. In fact in eastern India there is no systematic training plan for popularizing vermicomposting with proper follow up interaction with trained farmers. Some conduct training due to their own interest, satisfaction or as partial fulfilment of their project works.

4.2 Economical Constraints

In India, organic farming has started simultaneously by the commercial growers of spices, tea, basmati rice and cotton for getting premium prices in export market and also by resource-poor farmers in rainfed marginal lands as alternative cultivation approach. Few states like Uttarakhand, Mizoram, Sikkim, Nagaland, etc. have already declared to go totally organic. With continuous increasing demand of organic food, organic farming is also gaining importance but its success depends on sufficient availability of vermicompost, bio-fertilizers and other organic manures. Trainers generally try to convince farmers by mentioning huge requirement of vermicompost either for self use in crop cultivation or for sale to earn extra income. But in India no marketing facility/infrastructure has been created by either Government or Public Sector for selling vermicompost. Interested unemployed youths or housewives face financial problem for starting vermicomposting due to lack of any formal Government support. While 63 percent of vermicompost producing farmers of Dharwad district in Karnataka stated about fund shortage for taking up improved methods of vermicompost production, 95 percent producers reported difficulty in selling vermicompost due to lack of market information [13]. In eastern India also there is no organized structure of vermicompost marketing due to which Banks are not

showing much interest to give loan without becoming sure about returns and individuals after training are also not becoming interested to take risk on initial investment. Indian government give subsidy for reducing the cost of chemical fertilizers which become cheaper as compare to cost of vermicompost for giving same amount nutrient contents. Larger producer sometimes get some market to sell vermicompost but the smaller growers remain helpless. These economical constraints confirm the earlier report of Jadav & Gorfad [24], Sourabh & Ojha [22] and Vaidya et al. [20].

4.3 Psychological Constraints

Since training on vermicomposting is simple and suitable for all irrespective of trainee's age, educational qualification, employment status, economic condition or gender, people generally take it very lightly and do not consider vermicomposting as an important or essential activity for generating Employment and Income. Some farmers feel training or research on vermicomposting is not at all required. Many youths feel shy/hatred to work with earthworms since they often think that "Waste handling" is untouchable's work or low dignified work. Some people even think that disposal of wastes through vermicomposting is complex procedure in comparison to burning and vermicomposting activity is more laborious with respect to income generation. All these are psychological constraints prevalent more in Eastern India. Importance of psychological constraints in low popularization of vermicomposting technique among farmers was also expressed earlier by Sourabh and Ojha in Bihar [22]. In a study on Integrated Nutrient Management Practices in irrigated rice cultivation at Kurnool district of Andhra Pradesh Ramanaiah et al. [25] observed that the major constraints for low adoption of vermicomposting technique were "cumbersome process" and "requirement of skills" as expressed by 64 percent and 76 percent farmers, respectively.

4.4 Promotional Constraints

As mentioned earlier that no systematic training system is followed in India for popularizing vermicomposting technique among farmers and there is also no inter connection/collaboration among different training groups of India. There is no systematic promotional approach from government or NGO side. Many times it has been seen that trained farmers are facing difficulty to start vermicomposting due to non-availability of suitable earthworms for procurement in nearby locality and not getting sufficient cow dung as both cows and bullocks are reduced considerably in village level. Problem of non-availability of earthworms for procurement was also reported earlier by Shivakumar et al. [13] and Vaidya et al. [20]. Vermicomposting technology is labour intensive and day by day increased labour cost prevents farmers to take up this activity. Quality of vermicompost depends on the quality of resource materials from which it is made and considerable variations in nutrient status of vermicomposts are observed batch to batch with change in substrate composition. Sometimes people mix dry cow dung powder or dry mud of ponds during selling for getting more profit. With increase in consciousness farmers want quality vermicompost certified by some notable agency. But Laboratory facility for chemical analysis of processed vermicompost as well as Quality Certified Agency in rural India are lacking. Even no-single window facility is available to look after vermicomposting activity throughout India. Like "AMUL" for selling dairy milk, no vermicompost producer's society has been created so far. All these come under promotional constraints which play significant role in hindering the popularization activity among farmers.

4.5 Social Constraints

All human activities lead towards generation of wastes. Nobody has time to think for its disposal. Common people feel that wastes can be thrown out

being nobody's property. In fact "Waste Management Rules" are there in India but none is serious about it. Vermicomposting is need of the day not only for disposal of organic wastes but also for generating good quality organic manure, essential input for organic farming. Due to psychological problems as mentioned above vermicomposting is least liked by members of the family as well as society. Even Municipalities or Village Panchayets are not ready to provide suitable place/space for vermicomposting both in urban and rural areas. Organic part of Municipal Solid Wastes can easily be converted to good quality vermicompost if wastes are segregated at source. Segregation by municipal workers at dumping site or in dustbin is inhuman activity and not advisable since the poor workers suffer leg and hand injury due to different sharpen wastes present in MSW and infect themselves with many dreaded diseases like eczema, intermycosis, hepatitis, tuberculosis, dysentery, typhoid, cholera, hookworm, roundworm, yellow fever, etc. But due to lack of seriousness majority of citizens are not cooperating in segregation of MSW at source. Even though women in south and west India participates largely in vermicomposting [14, 16, 17, 19], but women in Eastern India are not encouraged for participating in vermicomposting activity due to fear of un-touchability, disease spreading and foul smelling in vermicomposting sheds.

5. Solutions to Tackle Different Constraints

Earthworms favour partly decomposed food, hence balanced feeding and proper care will help in "no escaping" of earthworms, avoiding foul smell and quick composting, etc. Technical constraints can be overcome by arranging proper training to farmers and interested youths, regular follow up (continuous guidance) by experts and encouragement in vermicomposting work by adapting integrated Aerobic composting -Vermicomposting approach. Both Central and State Governments have to be serious on proper disposal of solid wastes. Incentives/subsidy should be given to vermicompost producers by Government for a) helping in clean India campaign, b) reducing CO_2 production c) maintaining Nutrient balance in soil and d) making pollution free environment. Economical constraints can be tackled if Government (Central as well as State) creates for producers a single window avenue with the help of Agriculture, Horticulture, Animal Husbandry and Dairy departments for getting suitable earthworms, developing vermicompost sheds, better marketing facility to sell their vermicompost and subsidies on selling price of vermicompost to make it cheaper and comparable with chemical fertilizers.

More awareness programs in both Rural and Urban India with the help of Multi-Media as well as systematic Vermicomposting Training/Earthworm demonstration in block levels will help to remove psychological blocks from the minds of farmers. Arrangement of speech, debate, Essay competition, Poster making and Drawing competition in school level every year will create a long lasting impact. Organizing every year the State level Vermicompost Producer's Meet as well as Lady Farmer's Meet and announcing "Best Vermicompost Producer" Award with financial benefits in both District and State Level will create enthusiasm among farmers and help vermicomposting technology to spread in grass root level. "Vermicomposting Cooperative Society" should be made by compulsory membership of all vermicompost producers in India for creation of marketing facility, maintenance of standard quality of vermicompost and for removal of socio-psycho-economical constraints. Some of the measures mentioned here were also suggested by farmers of Anand district of Gujarat for popularizing vermicomposting [20].

6. Conclusion

"Waste Management" is not at all a less dignified work. Paradigm shift is the need of present time to look wastes as valuable Resource materials for

production of vermicompost, biogas, renewable energy and recycling of metals. Door to Door Collection of wastes must be made mandatory for all municipalities and village panchayets, Flat Societies, etc. Special care must be taken in segregation of wastes and handing over to respective collectors instead of throwing which should be declared as punishable offence. Each and every people as well as Government machinery in India have to be serious to remove constraints mentioned above and to spread Vermicomposting Technology at grass root level. Discussion in Seminars or conferences without proper follow up is found generally fruitless. An "Association of Earthworm lovers" should be created immediately in Eastern India for encouraging people to save and rear earthworms and also to popularise vermicomposting under one brand name.

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