

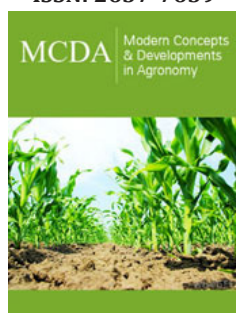
Vermicomposting in Pakistan: Current Scenario and Future Prospectives

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Abstract

Crop residues and waste management are serious issues in Pakistan. Burning of crops residue leads to environmental pollution such as smog. Vermicomposting is the best technique to manage wastes and crop residues and convert them into nutrient-rich organic fertilizer. Vermicompost contains macro & micro-nutrients, growth regulators and microbes that help in the solubilization of zinc and phosphorus. Future perspective of vermicomposting in Pakistan is the production of vermicompost, less reliant on chemical fertilizers and moving towards organic farming.

Introduction

Agriculture is a backbone of Pakistan's economy. Total geographical area of Pakistan is 79.61 million hectares. Out of this, 22 million hectares is under cropped area. Agriculture accounts for 24% of growth domestic product (GDP) of Pakistan. It employs 48% of labour force and bestows 60% to foreign export earnings. Pakistan's current population is almost 210 million which is increasing @ 2.4% annually. About 67% of country population lives in the rural areas that depends primarily on agriculture. To meet the needs of human and livestock, crop intensification is being practiced in the country. This resulted into production of more crop residues. Management of crop residues are serious problem in Pakistan. Pakistan is generating 69.5 million tons crop residues per year. It is common practice to burn crop residues especially in Asia [1,2]. Burning causes serious problem to environment by worsening of soil fertility and harms the agricultural land biodiversity [3]. The major adversative effect is greenhouse gases emission that resulted into global warming. So, vermicomposting of crop residues e.g. rice straw, wheat straw protects the environment along with the production of organic fertilizer (vermicompost). This vermicompost improves the soil biodiversity and nutrient status. The consumption of chemical fertilizers in Pakistan is more but yield is considerably low than the developed countries. The overuse of chemical fertilizers leads to increase the environmental pollution through the accumulation of nitrate in drinking water, agricultural products and cadmium accumulation. So, it is need of hours to adopt sustainable agriculture. Vermicomposting is the best alternative to chemical fertilizers. With rise in population, waste management is becoming a serious problem for the community. Pakistan generates 48.5 million tons solid waste per year, which is increasing @ 2% annually. The composition of solid waste comprises of paper, plastic, rubber, textile waste, animal wastes, leaves, fodder, grass and straws. Mostly, this waste is burned and buried on open lots, threatening the human health and air quality very badly.

Due to lack of waste management infrastructure like other developing countries, it is creating severe environmental problems e.g. smog. Different methods of solid wastes disposal are in use, but these are time consuming and are costly. Therefore, it is the need of hours to adopt cost effective and alternative method of managing solid wastes. In this regard, vermicomposting seems to be a feasible and cost-effective technique for effective management of organic solid wastes [4,5]. Many studies showed the ability of earthworms to consume several types of wastes e.g. animal dung, crop residues, sewage sludge and industrial wastes [6,7]. Earthworms split the waste substrate and enhance the decomposition of organic wastes.

Vermicomposting is bio-oxidative process that leads to the conversion of organic waste to nutrients rich organic fertilizer (vermicompost) through the interaction of earthworms with micro-organisms. Vermicomposting significantly alters the physical, chemical and biological properties of wastes. In vermicomposting, only epigeic earthworms can be used. Among these, *Eisenia fetida* is commonly used in vermicomposting. Vermicompost, the final product of vermicomposting, is nutritious organic fertilizer comprised of nitrogen (2-3%), potassium (1.85-2.25%) and phosphorus (1.55-2.25%), microorganism (nitrogen fixing bacteria, mycorrhizal fungi, zinc and phosphorus solubilizing bacteria and fungi etc.) and marvel growth protectors and promoters [8]. Vermicompost also contains calcium, zinc and manganese along with enzymes such as cellulase, lipase, chitinase and amylase that break down soil organic matter even after excretion from earthworm [9-11] (Table 1).

Table 1: Nutrients composition of cow dung, sheep manure and kitchen waste solid vermicompost [1].

Nutrient Elements	Cow Dung Vermicompost	Sheep Manure Vermicompost	Kitchen Waste Vermicompost
Nitrogen (%)	1.75	1.6	1.95
Phosphorus (%)	1.01	0.41	1.73
Potassium (%)	0.74	0.37	1.32
Calcium (%)	2.8	2.18	2.35
Magnesium (%)	0.98	1.06	0.62
Zinc (%)	0.04	0.04	0.045
Organic matter (%)	51	43	41
EC (dS/m)	6.45	-	8.46

Current scenario of vermicomposting in Pakistan

“Lahore Composting Facility” project is the 1st of its type in Pakistan. It is transferring the composting technology to the country as there are no landfills sites and exposed dumping of waste is practiced. This is first public-private partnership project in Pakistan in area of Municipal Solid Waste Management (MSWM). However, no more research on vermicomposting was conducted in Pakistan. National Agriculture Research Centre (NARC), Islamabad conducted a few studies on vermicomposting. Up till now, no vermicomposting commercial unit was working in the country. Currently, a “Vermicompost Center” has been developed at University of Agriculture Faisalabad, Pakistan by the cooperation of Higher Education Commission of Pakistan (HEC) and researchers from Turkey [12]. This center is working with the objectives of solution-oriented research on vermicomposting, to provide nutritive, cost-effective vermicompost, training of students and farmers to prepare their own vermicompost on their farms.

Future prospective of vermicomposting in Pakistan

A. Evaluation of vermicompost sector in Pakistan.

B. Provision and production of vermicompost (organic fertilizer) at farmer's own farm.

C. Reduction the dependency on chemical fertilizers and step towards sustainable agriculture for better soil health and productivity.

D. Managing the crop residues effectively and converting them to vermicompost instead of burning that causes smog. So, it is environmentally safe technology.

E. Managing wastes by converting it into organic fertilizer.

F. Bringing more land under cultivation by reducing heavy metals load through vermicomposting.

G. Improving the financial condition of farmers by providing cheap source of fertilizer.

H. Saving capital by reduction of chemical fertilizer imports.

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