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A Review

Waste management for sustainable agricultural production - A brief review

■ **Pallavi Talukdar, Moonty Baruah and Pinky Saikia**

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See end of the paper for authors' affiliations

Pallavi Talukdar
Department of Family Resource Management, College of Community Sciences, Assam Agricultural University, Jorhat (Assam) India

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Waste management is the collection, transport, processing, managing and monitoring of waste material which is produced by the act of human and generally carried out to reduce their detrimental effect on environment, human health and aesthetic. Waste management has been considered as one of the major problem in developing and developed country. Rapid urbanization and population growth contributes to generation of huge quantity of agricultural waste in the country, causing environmental degradation. Conversion of agricultural waste into organic resources or organic fertilizer is an effective approach to address proper waste management in urban and semi urban areas. A sustainable agricultural production in the country can be achieved either through low input sustainable agriculture or organic farming. Amongst the Asia and Pacific regions, Peoples' Republic of China produces highest quantity of agricultural waste, followed by India. It is estimated that nearly 700 million tonnes of organic waste is generated annually in India which is either burned or land filled (Mane and Smita, 2011), and nearly 700 million tonnes of annually generated organic agricultural waste can be easily converted to organic fertilizer through Vermicomposting, which in turn will promote organic farming, employment generation and decrease pollution. Organic farming by vermicompost can sequesters huge amount of atmospheric carbon and bury them back into the soil as soil organic carbon, improving soil fertility and also mitigating global warming.

Organic farming is a science of agriculture that utilizes the biological means of cultivating crops with coordination to the nature. Organic farming is considered as the backbone of sustainable agriculture. Industrial agriculture chemicals like, fertilizers, pesticides, herbicides etc. are not used or used to minimum extent necessary in this kind of farming, rather it relies on ecological processes, biodiversity and cycles adapted to the local conditions. In 1950-60, Green revolution was started where the concept of agrochemical was introduced. It boosted food productivity. It increased food production but at the same time destroyed the physical, chemical and biological properties of soil. It killed the beneficial soil organism and also impaired the power of biological resistance in crops making them more susceptible to pests and diseases. No farm land of world is free toxic pesticides today. Over the years it has worked like a slow poison for the soil and the society. According to UNEP and WHO, nearly 3 million people

suffer from acute pesticide poisoning and some 10-20 thousand people die every year from it in both developed and developing countries (UNEP report, 2001). Owing to the ill effect of the inorganic agriculture, where synthetic, chemical fertilizers, pesticides, herbicides are indiscriminately used, all the nations in the present day world opts organic farming. A quite 2nd 'Non Chemical Ever Green Revolution' is started in Asia and other countries of the world in various names like 'the Ecological Agriculture' or 'Organic Agriculture' (Lampkin, 1990). The benefits of organic farming are enormous. It is very cost effective and the cost of crop production can be reduced to the extent of 25 per cent in organic farming than the traditional farming. It sustains the health of soils, ecosystem and people. It retains the fertility of the soil for a longer period of time and thus allows the farmers to use the land for a longer period for cultivation. In addition, they also protect the soil from erosion.Organic farming may result in compatible performance as conventional agriculture and crops growth with high organic manure application could tolerate the pest and disease attack better. The nutritional benefits of food grown in organic farming are significantly superior to the crops grown by the other modern conventional methods and these foods can reduce the risks of many diseases like heart attacks, colon and breast cancer (Olesson *et al*., 2006) and even strokes.

Organic farming depends on organic recycling. Organic recyclable waste includes – crop residues, waste from the *Mandis*, farm yard waste, waste from the restaurants, poultry, cattle and pig farm litter, wastage from slaughter house, bio mass of weeds, organic wastes from fruit and vegetables production and household wastes, sugarcane trash, oilcakes, press mud and sewage wastes. Agricultural waste, which includes both natural (organic) and non-natural wastes, is a general term used to describe waste produced on a farm through various farming activities. These activities can include but are not limited to dairy farming, horticulture, seed growing, livestock breeding, grazing land, market gardens, nursery plots, and even woodlands. Agricultural and food industry residues, refuse and wastes constitute a significant proportion of world wide agricultural productivity. It has variously been estimated that these wastes can account for over 30 per cent of world wide agricultural productivity. Given agricultural wastes are not restricted to a particular location, but rather are distributed widely, their effect on natural resources such as surface and ground waters, soil and crops, as well as human health. In contrary to their harmful effect, they can be easily managed to valuable sources of plant nutrient in tropical and subtropical soils found in India.

In India, there is general deficiency of organic carbon and plant nutrients in soil due to rapid loss of these components by bio- degradation. In order to compensate these losses, extensive utilization of organic residues in agriculture is essential.

It has been estimated that organic resources available in the country alone can produce not less than 20 million tonnes of plant nutrients, N, P and K (Anonymous, 2008). Vermicomposting is the best technology for disposal of biodegradable agricultural waste and to make it a better source for maintaining soil health. Vermicomposting is the microbial composting of organic waste through the act of earthworms to form organic fertilizer which contains higher level of major plant nutrients (N,P and K) and micronutrients. Vermicompost technology has promising potential to meet the organic manure requirement in both irrigated and rain fed areas. Vermicomposting and vermifiltration are natural waste management processes relying on the use of worms to convert organic wastes to stable soil enriching compounds. Both activities of on-site wastewater management and domestic organic waste management can be accommodated through these processes in a sustainable manner. Sustainability can be achieved through the accelerated cycling of nutrients though a closed cycle whereby waste products are put to productive end use. It has been reported that in India, there is a general potential for utilization of crop residues/ straw of major crops. About 141.2 MT. straws available and from agricultural fields can contribute about 0.7, 0.84, and 2.1 MT. N.P.K, respectively (Anonymous, 2011). Considering, if 50 per cent of crop residue is utilized as animal feed, the rest can recycled to produce vermicompost. Crop residue has wide C: N ratio due to this, immobilization nutrients. Sugarcane trash is one of the major sources of agricultural waste in the country. In India, per hectare availability of sugarcane trash is about 6- 8 (over all country about 19 – 38 million tonnes). Fresh sugarcane trash contains 0.36 per cent N with a wide C:N ratio of 122:1. The composted trash contains – higher content of N (1.09) with reduced C:N ratio (20.1) (Anonymous, 2011). Organic manures from animal wastes are very important nutrient sources in building up soil fertility. In India, estimated production of dung and urine is about 1002 and 658 million tonnes,

respectively. They contribute about 5.7 million tonnes of N, P and K with proper utilization. It is reported that about 75 per cent of household waste can be converted into excellent vermicompost (Lisa Dorward, 2012). Small scale system of Vermicomposting for the disposal of household waste have been extensively used in homes and schools in the United states, Canada and other developed countries. Production of vermicompost occurs in the range of small containers with perforated lids for proper aeration, to large sophisticated tanks. These systems of disposal of household organic waste to turn into production of organic manure have earn the interest of urban waste authorities and these authorities used to encourage the home owners to use them. They even supply these free of cost to those who do not put the food waste into garbage. In Australia, a very successful Vermicomposting toilet has been designed to use them in the state parks.

Agriculture is also responsible for huge emission of green house gases and induction of global warming. Of the increase of atmospheric carbon over the last 50 years, about a third (33.3%) is thought to have come from agriculture (Robbins,2004). Chemical agriculture has further augmented green house gases emission. From their production in factories to their transport, and use in farms, agrochemical generates huge toxic wastes, pollution and green house gases. Aggressive tillage of compacted soils (due to the use of agrochemicals) depletes the soil organic carbon and emits large volume of carbon dioxide. Chemical nitrogen from the soil is oxidised as Nitrogen dioxide which is 312 times more powerful green house gases than carbon dioxide. Organic farming by vermicompost sequesters huge amount of atmospheric carbon and bury them back into the soil as soil organic carbon, improving soil fertility and also mitigating global warming. Soils amended with vermicompost have significant greater soil bulk density and hence become porous, lighter and low tillage. Production of vermicompost diverts huge amount of wastes from landfill which emit large amount of powerful green house gases Methane, Nitrogen dioxide along with carbon dioxide. Every 1 kg of waste diverted from landfill prevents 1 kg of green house gases emission (Sinha *et al*., 2011). It is like a win - win situation for the nation, farmers, environment and the society.

Conversion of agricultural wastes, particularly from the urban and semi-urban areas, is an effective approach to address proper waste management in cities. It will not only deal with prevention of associated health risks, but also will provide important resources for agricultural production. At the same time, this may help in generating employment opportunities. A favourable attitude should be developed towards the use of organic waste to convert into vermicompost by educating all the actors involved in the society. Recycling of waste in urban and semi-urban areas should be treated as integral part of management of urban environment. Moreover the participation of women is fundamental since they are motivated for protection of human health, preservation of environment and land for future generations.

Authors' affiliations:
Moonty Baruah and Pinky Saikia, Department of Family Resource Management, College of Community Sciences, Assam Agricultural University, Jorhat (Assam) India

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