

The Concept of Herbal Biofertilizer to Eliminate Adverse Effects of Chemical Fertilizers and Pesticides

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Food waste, particularly the house-hold wastes, includes uneaten food and food preparation left over from residences, commercial establishments such as restaurants, institutional sources like school cafeterias and industrial sources like factory lunch-rooms, and is the single-largest component of the municipal solid waste stream by weight [1]. The components of kitchen waste include spoilt vegetables, peelings and trimmings, fruit skins, spoilt fruit, cooked and uncooked meat, bones, fats, egg-shells, used teabags, coffee grounds, bread and pastries, cooked food waste, tissue papers, packing materials, plastics, glass and water, etc. [2]. Due to relatively high moisture content of kitchen waste, bioconversion technologies such as anaerobic decomposition has been suggested to be a better option.

Every house-hold generates approximately 1.5 to 2.0 kg of solid waste which comes to 168.13 tonnes per day on 8.0 lac of urban population [3], [4]. The urban residents dispose the wastes on the roads or in dust-bins either packed in polythene bags or loose. The wandering ruminant cattle or animals like dogs ingest their desired materials and in so doing scatter the matter in wider areas which becomes the den of several disease-causing microorganisms and, at times, results into the outbreak of cholera and other infectious diseases. About 72% of the total solid wastes are biodegradable which may be transformed into biofertilizer. The biodegradable materials, by undergoing the process of decomposition using microbial consortia and composting, are transformed into high quality biofertilizer [5]. The present investigations have distinctly indicated that such biofertilizers have been found to be better on all parameters tested (Percentage of seed germination, Root-shoot ratio in plantlets, Chlorophyll contents in early leaves, Nitrate Reductase activity, Better development and early initiation of flowering / grain

formation) and a better nutrient supplier than the traditional commercial biofertilizers [6].

The pesticides

The term pesticide covers a wide range of chemical compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators and others. The production of pesticides started in India in 1952 with the establishment of a plant for the production of BHC near Calcutta, and India is now the second largest manufacturer of pesticides in Asia after China and ranks twelfth globally. There has been a steady growth in the production of technical grade pesticides in India, from 5,000 metric tons in 1958 to 102,240 metric tons in 1998. In 1996–97 the demand for pesticides in terms of value was estimated to be around Rs. 22 billion (US\$ 0.5 billion), which is about 2% of the total world market. Tremendous benefits have been derived from the use of pesticides in forestry, public health and the domestic sphere – and, of course, in agriculture, a sector upon which the Indian economy is largely dependent. Food grain production, which stood at a mere 50 million tons in 1948–49, had increased almost fourfold to 198 million tons by the end of 1996–97 from an estimated 169 million hectares of permanently cropped land. If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment. There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment. The country, at present, is not in a position to completely eliminate the use of chemical fertilizers and pesticides. However, it would not be difficult and unrealistic to phase out the use of these chemicals systematically. For this, the doses of chemical fertilizer and pesticides need to be gradually reduced and be balanced by increasing the use of optimum quantity of biofertilizers and organic pesticides.

The combination of biofertilizer and medicinal plants (The Herbal Biofertilizers)

A new concept of the preparation of herbal biofertilizer has been visualized to have a combined effect of good quality biofertilizer together with an effective bio-pesticide. For this the biofertilizer prepared using the kitchen biodegradable

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wastes has been mixed thoroughly, in a ratio of 5:1 with the dried and finely powdered leaves of *Lawsonia inermis*, *Boerhaavia diffusa*, *Cordia myxa*, *Flacourtia jungomas* and *Terminalia arjuna* (Fig 1).

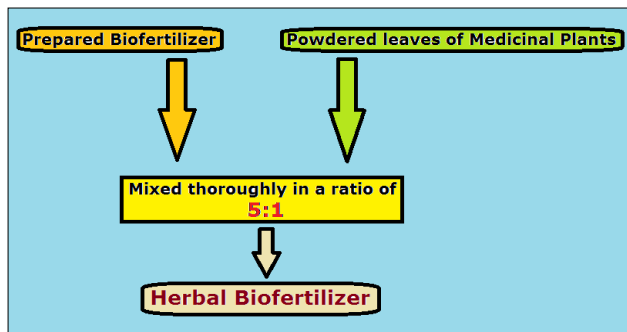


Fig 1 Preparation of herbal biofertilizer

During the present investigations, an attempt has been made to study the quality of the prepared herbal biofertilizer. The results indicated that the experimental plants which were grown using the herbal biofertilizer, excelled on all the parameters tested (chlorophyll contents in leaves and nitrate reductase activity) in comparison to the normal biofertilizer used as control. Furthermore, following addition of mixture of fungal and bacterial soil-borne plant pathogens to the control and experimental pots, the plants showed diseased symptoms that appeared after 15 – 20 days of incubation period in the control plants whereas the experimental plants remained healthy as before [7].

It appeared likely that the addition of dried and finely powdered leaves of *Lawsonia inermis*, *Boerhaavia diffusa*, *Cordia myxa*, *Flacourtia jungomas* and *Terminalia arjuna* to the prepared biofertilizer has played a crucial role to have supplied antifungal and antibacterial biochemicals to the crop plants via soil and made them disease-free. An important point to note is that the intensity of immunity of the plants may vary with the change in medicinal plants added to the Herbal Biofertilizer. However, further detailed studies on the role of secondary metabolites of these medicinal plants in controlling the pathogenic nature of the plant pathogen will be required.

Are chemical fertilizer and pesticides really good for the field?

Pathogen free soil is a big task for farmers, to make crops and vegetables grow well, the soil needs to be rich in nutrients and water. That's because plants get nutrients and water for growth from the soil through their roots. Healthy soil is formed of clods. Air and water flow between them. The texture of the soil is usually soft. Many good bacteria present in the soil remain active and suppress harmful bacteria that

cause plants to develop diseases. But, due to adverse climatic conditions a number of pathogenic microbes become active and cause big loss and damage to crops. To cope with this problem an effective soil treatment is required; for this purpose, growers use treatment with chemical fertilizers and pesticides or sometimes they burn the infected crops in the fields, but in such practices good microbes also get killed together with plant pathogenic microbes.

Why herbal biofertilizer is important for soil than chemical fertilizer and pesticides?

The herbal biofertilizer is a good nutrient supplier to the plants rather better than the normal Biofertilizer and friendly to the good bacteria present in the soil. Furthermore, it eliminates the possibility of any soil-borne plant pathogenic microbes and therefore, the use of any chemical pesticide is not required.

Due to overuse of chemical fertilizers and chemical pesticides (fungicides and bactericides) the soil becomes nutrient deficient and fails to provide proper nutrition to the crops (due to killing of good bacteria like nitrogen-fixing bacteria by chemical pesticides) together with toxic residual effect of pesticides on crops directly affecting the consumers. In contrast, the Herbal Biofertilizer has been better nutrient provider to the crops and keeps the soil healthy by eliminating the soil-borne plant pathogens (fungi and bacteria); and is soil-friendly. The initial results obtained during the present work are very encouraging [8] (Richa *et al.*, 2017 b) and has a long way to move forward in future. Such investigations will definitely pave way to replacing gradually the chemical fertilizers and chemical pesticides by the herbal biofertilizers in one stroke.

SUMMARY

A new concept of the preparation of herbal biofertilizer has been visualized to have a combined effect of good quality biofertilizer together with an effective bio-pesticide. For this the biofertilizer prepared using the kitchen biodegradable wastes has been mixed thoroughly, in a ratio of 5:1 with the dried and finely powdered leaves of *Lawsonia inermis*, *Boerhaavia diffusa*, *Cordia myxa*, *Flacourtia jungomas* and *Terminalia arjuna*. The herbal biofertilizer is a good nutrient supplier to the plants rather better than the normal biofertilizer and friendly to the good bacteria present in the soil; with pathogen resistance against soil-borne plant pathogens eliminating the use of chemical pesticides. The combination of medicinal plants may vary to have variable results and furthermore, the use of Herbal Biofertilizer would be a boon to gradually replace the enormous use of chemical fertilizers and chemical pesticides.

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