REVIEW OF RESEARCH

SYNTHESIS OF BIO-FERTILIZERS, CONTAINING NUTRIENTS (NPK) FROM ORGANIC MATTERS FOR AGRICULTURAL PURPOSE

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ABSTRACT:

New inventions in the field of agriculture for improving the methodologies have been doing and still being invented. For agricultural purpose, many chemical composition fertilizers and pesticides along with other drugs and manure are being used widely. Uses of the chemical fertilizers are being inserted in many indirect ways to our pure ecosystem and is responsible for many creating harmful effects.In our environment organic matters are present those can fulfil this deficiency, without affecting much to the elements of ecosystem as compare to pure chemical substances. These organic matters can be useful with having eco-friendly advantages. Bio fertilizer, which is a best alternative, is a synthesized organic matters which contains living micro-organisms. Bio-fertilizers when subjected to seed, plant surfaces, or soil promotes and improves the growth rate by increasing the availability of nutrients to the plant. There are many ways to synthesize a bio-fertilizer from the natural by-products and organic matters those are easily available. Composting, Landfilling and various other techniques have already been in vogue to make bio-fertilizer and green manure. This bio-fertilizers are known as cost-effective, cheap and recyclable/renewable source to replace the chemical fertilizers. Liquid bio fertilizer have the capability to provide a better alternative to the traditional chemical fertilizer and carrier based bio fertilizer can also play an important role in restoring soil health.

KEYWORDS: *NPK (Nitrogen, Phosphorus, Potassium), Bio-fertilizers synthesis.*

INTRODICTION:

India has been a country where almost 50% employment is on agriculture and its allied sectors. The traditional method of doing agriculture those have been prescribed and suggested by sages since Vedic era, are still in prevalence nowadays. In current period, which is a modern and scientific age, new invention in every field is common. Due to this trend, chemical aspect of science is not an exception and evolving with the time. In this context, new inventions in the field of agriculture for improving the methodology also have been done and still being invented. For agricultural purpose, many chemical composition fertilizers and pesticides along with other drugs and manure are being used widely. According to plant science (Botany) plants are less dependent on external chemical drugs (fertilizers etc.) for their physical activity and growth, which is around 2% in amount and for rest of the 98%, they depends on ambience. Air and water are the main source for Hydrogen, Carbon, and Oxygen along with soil and fertilizers for macro and micro nutrients. Chemical fertilizers are being inserted in many indirect ways to our pure ecosystem, which is immediately affecting the food chain in small scale and can be

seen in the form of many disorders or disease in animals and humans. Studies claim pesticides are one of the reasons for climate change and global warming. Thus the question arises, is there any need to supply more chemical fertilizers for just 2%?In our environment organic matters are present those can fulfil this deficiency, without affecting much to the elements of ecosystem as compare to pure chemical substances. These organic matters can be useful with having eco-friendly advantages.

Crop or plants are made-up of organic matters like other living organisms. The inner and outer structures of a plant formed by many different processes, those processes need nutrients from environment.

PLANT NUTRIENTS

Plants absorb and use inorganic minerals for nutrition which are present in the soil or subjected/injected to the plants. Inorganic minerals is formed by many complex interactions such as weathering of rock minerals, decaying organic matter, animals, and microbes in soil. Mineral nutrients are absorbed by plant roots as ions in soil water. Many factors could influence nutrient uptake for plants. Ions can be readily available to roots or could be "tied up" by other elements or the soil itself. Soil quality also affects the absorbing quality of these minerals, for instance too high in pH (alkaline) or too low (acid) makes minerals unavailable to plants.

FERTILITY OR NUTRITION

The term "fertility" refers to the inherent capacity of a soil to supply nutrients to plants in adequate amounts and in suitable proportions. The term "nutrition" refers to the interrelated steps by which a living organism assimilates food and uses it for growth and replacement of tissue. Previously, plant growth was thought of in terms of soil fertility or how much fertilizer should be added to increase soil levels of mineral elements. Most fertilizers were formulated to account for deficiencies of mineral elements in the soil. The use of soilless mixes and increased research in nutrient cultures and hydroponics as well as advances in plant tissue analysis have led to a broader understanding of plant nutrition.

Plant nutrition is a term that takes into account the interrelationships of mineral elements in the soil or soilless solution as well as their role in plant growth. This interrelationship involves a complex balance of mineral elements essential and beneficial for optimum plant growth.

ESSENTIAL VS BENEFICIAL NUTRIENTS

The term essential mineral element (or mineral nutrient) was proposed by Arnon and Stout (1939). They concluded three criteria must be met for an element to be considered essential. These criteria are:

- A plant must be unable to complete its life cycle in the absence of the mineral element.
- The function of the element must not be replaceable by another mineral element.
- The element must be directly involved in plant metabolism.

Apart from the above mentioned criteria beneficial elements are those that can compensate for toxic effects of other elements or may replace mineral nutrients in some other less specific function such as the maintenance of osmotic pressure. The omission of beneficial nutrients in commercial production could mean that plants are not being grown to their optimum genetic potential but are merely produced at a subsistence level.

MATERIALS AND METHODS

Carrot grass

Partheniumhysterophorus is a species of flowering plant in the aster family, Asteraceae. It is native to the American tropics. In India, it is locally known as carrot grass, congress grass or GajarGhans. This present in a huge quantity in Achanakmar Tiger reserve, which is near to Bilaspur.

Partheniumhysterophorus invades disturbed land, including roadsides. It infests pastures and farmland, causing often disastrous loss of yield, as reflected in common names such as famine weed]. In

some areas, heavy outbreaks have been ubiquitous, affecting livestock and crop production, and human health. As an invader it first appeared as a contaminant in imported wheat.

The plant produces allelopathy chemicals that suppress crop and pasture plants, and allergens that affect humans and livestock. It also frequently causes pollen allergies.

It is being investigated as a means of removing heavy metals and dyes from the environment, control of aquatic weeds, commercial enzyme production, an additive in manure for biogas production, as a bio pesticide, and as green manure and compost.

Contact with the plant causes dermatitis and respiratory malfunction in humans, and dermatitis in cattle and domestic animals. The main substance responsible is parthenin, which is dangerously toxic.It also is responsible for bitter milk disease in livestock when their fodder is polluted with Parthenium leaves.

Among other allelopathic effects of the species, the presence of Parthenium pollen grains inhibits fruit set in tomato, brinjal, beans, and a number of other crop plants.

Figure : A carrot grass plant

Figure: A mature carrot grass plan

According to the chemical composition of carrot grass, amino acids containing Nitrogen are present in a rich amount.

Oil cakes

Oil cakes are the dry contents remains after the extraction of oils from seeds. Even after the oil extraction the chemical composition of this dry matters remain intact except few. The table below is shown to show N-P-K contents for few oil cakes.

Table: Oil cakes content

Oil cakes	Nitrogen (N) (%)	Phosphorus (P)(%)	Potassium (K)(%)
(a) Non edible cakes			
Castor cake	5.5-5.8	1.8-1.9	1.0-1.1
Mahua cake	2.5-2.6	0.1-0.9	1.8-1.9
Karanj cake	3.9-4.0	0.9-1.0	1.3-1.4
Neem cake	5.2-5.3	1.0-1.1	1.4-1.5
Safflower cake	4.8-4.9	1.4-1.5	1.2-1.3
(b) Edible cakes			

Coconut cake	3.0-3.2	1.8-1.9	1.6-1.7
Cotton seed	6.4-6.5	2.8-2.9	2.1-2.2
Groundnut cake	7.0-7.2	1.5-1.6	1.3-1.4
Linseed	5.5-5.6	1.4-1.5	1.2-1.3
Sesamum cake	6.2-6.3	2.0-2.1	1.2-1.3

Figure :Soyabean oil cakes

Figure : Mustard oil cakes

Amla

Phyllanthusemblica, also known as emblic, emblicmyrobalan, myrobalan, Indian gooseberry Malacca tree, or amla from Sanskrit amalaki is a deciduous tree of the family Phyllanthaceae. It has edible fruit, referred to by the same name. Amla leaves are a good source of P, K, Mn.

Figure :Amla fruits and leaves

Termite Mounds

Phosphorus did not differ among mound sections, but it was the nutrient that most differed between the termite mound and the adjacent soil, with higher values in the mound than in the soil. Although there was no significant difference, the P values at the distance of 0.50 m were almost the double of the values at 1.50 m from the mound, which indicates the influence of the mound on its adjacent soil. quantified and systematized phosphorus forms in different sections of termite mounds (exterior wall, internal wall, and center) of different trophic guilds and soils in seven Brazilian ecosystems and concluded that termite activity results in a gross enrichment of phosphorus in labile form in nets, and the composition of P in termite constructions is reflected in their diet. According to Oliveira et al. (2012), the higher amount of P in termite mounds than in the adjacent soil is related to the amount of clay used in their construction, which hinders the loss of P available.

Figure : A termite mound

Banana

The result of mineral content analysis shows the concentration of potassium to be highest (78.10mg/g). The concentration (mg/100g) of calcium, sodium, iron, and manganese were 19.20, 24.30, 0.61 and 76.20 respectively. Phosphorus also present in a good amount in the pulp but less as compare to other abovementioned elements.

Cow dung

Cow dung is high in organic materials and rich in nutrients. It contains about 3 percent nitrogen, 2 percent phosphorus, and 1 percent potassium (3-2-1 NPK). In addition, cow manure contains high levels of ammonia and potentially dangerous pathogens.

Combined application of cow dung and NPK fertilizer significantly ($P < 0.05$) increased organic matter, available P, exchangeable K and Effective Cation Exchange Capacity compared to the control in both locations. Uptake of N, K, Ca and Mg were higher with treatments in which cow dung was combined with NPK fertilizer compared to the control at both locations. Also, combined application of cow dung and NPK fertilizer significantly ($P < 0.05$) increased sweet potato vine length, number of branches and tuber yield relative to the control. From the results obtained, application of 1.9 t/ha cow dung + 200 kg/ha NPK fertilizer is recommended for sweet potato production in Umudike while application of 0.9 t/ha cow dung + 300 kg/ha NPK fertilizer is recommended in Uturu.

Bael

Aeglemarmelos L., commonly known as bael or golden apple,(Japanese bitter orange, stone apple or wood apple) is a species of tree native to the Indian subcontinent and Southeast Asia.

The bael fruit typically has a diameter of between 5 and 12 cm. It is globose or slightly pear-shaped with a thick, hard rind and does not split upon ripening. The woody shell is smooth and green, gray until it is fully ripe when it turns yellow. Inside are 8 to 15 or 20 sections filled with aromatic orange pulp, each section with 6 (8) to 10 (15) flattened-oblong seeds each about 1 cm long, bearing woolly hairs and each enclosed in a sac of adhesive, transparent mucilage that solidifies on drying. The exact number of seeds varies in different publications.

It takes about 11 months to ripen on the tree and can reach the size of a large grapefruit or pomelo, and some are even larger. The shell is so hard it must be cracked with a hammer or machete. The fibrous yellow pulp is very aromatic. It has been described as tasting of marmalade and smelling of roses. Boning (2006) indicates that the flavor is "sweet, aromatic and pleasant, although tangy and slightly astringent in some varieties. It resembles a marmalade made, in part, with citrus and, in part, with tamarind."[10] Numerous hairy seeds are encapsulated in a slimy mucilage. The values for various minerals found in bael fruit pulp as P, K, Ca, Mg, Fe, Cu and Zn were 51.6, 603, 78, 4.0. 0.55. 0.19, 0.28 mg per 100g respectively.

Figure :A bael pulp and opened fruit

Jaggery

A product of sugarcane, is such a product which is rich in important minerals (viz Calcium-40-100 mg, Magnesium-70-90 mg, Potassium-1056 mg, Phosphorus-20-90 mg, Sodium-19-30 mg, Iron-10-13 mg, Manganese-0.2-0.5 mg, Zinc-0.2-0.4 mg, Copper-0.1-0.9 mg, and Chloride-5.3 mg per 100 g of jaggery), and vitamins (viz Vitamin A-3.8 mg, Vitamin B1-0.01 mg, Vitamin B2- 0.06 mg, Vitamin B5-0.01 mg, Vitamin B6-0.01 mg, Vitamin C-7.00 mg, Vitamin D2-6.50 mg, Vitamin E-111.30 mg, Vitamin PP-7.00 mg, and protein-280 mg per 100 g of jaggery).

Different plant seeds

- Narrow leaf plant seeds: Rice, wheat, corn etc.
- Pulses seeds: Gram, peas etc.
- Oil crop seeds: Soya, sunflower, peanuts etc.
- Fruit seeds: papaya, guava, orange etc.
- Vegetable seeds: pumpkin, ladyfingers etc.
- Flower seeds: marigold, rose etc.

Different plant seeds can serve the purpose of supplying micronutrients if mixed with bio-fertilizer raw matters. The different plant seeds have different ration of nutrients available, so there is a possibility that the above mentioned group can supply all the micronutrients.

RESULT AND DISCUSSION:

This bio fertilizers have been developed and experimented in different crops like soyabean, rice, chickpeas and wheat for year 2018-2019. First it has been tested for a small area and found useful. In the year 2018-2019 it applied for a large scale and 20-30% production volume increment have been observed. One table corresponding to the results, mentioned here:

Table: Growth rate impact due to catalyst solution with NPK solution

Crop	Area	Improvement in the growth	Plant height and growth	Increment in the production volume
Chickpeas	5-6 Acre	4-5 days early flowering	1-2 cm more height	1-2 quintal per acre
Wheat	5-6 Acre	-	2-3 cm more height	2-3 quintal per acre
Rice	20-25 Acre	More grains per plant	1-2 cm more height	5-6 quintal per acre
Soya bean	2-3 Acre	-	-	2-3 quintal per acre

CONCLUSION

This proposed catalyst solution is a new approach to enhance the absorbing capability of a plant while using the liquid bio-fertilizers. A small scale experiment has been done for different crops and the expected outcomes have likely observed. A large scale approach is being experimented on different crops. This catalyst solution is useful when bio-fertilizers are being used for a large scale crops, because proposed catalyst solution makes those bio-fertilizers solution very effective even if it is supplied in small quantity.

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