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Effect of Algal Bio-fertilizer on the *Vigna radiata*: A Critical Review

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ABSTRACT
The continuous increasing demand of food crops and decrease in productivity due to continuous use of chemical fertilizer has not only resulted in decline of crop yield, loss of fertility and degradation of soil but has also led us one step back in achieving sustainable agriculture. The use of algal bio-fertilizer provides an effective, eco-friendly and non-polluting approach in improving the productivity of crop by both nitrogen fixation and photosynthesis. Algal bio-fertilizers improve soil structure and increase yield productivity even if applied in a small area. The application of algal bio-fertilizers in plants has resulted in increase in root, shoot length with number of leaves and hence overall growth of the plant has been increased. India being one of the largest producer and consumer of pulses requires abundant amount of pulse production to fulfil the demands of ever growing populations which can be achieved by using algal bio-fertilizers. This paper briefly underlines the usage of algal bio-fertilizers as an important tool for sustainability and alternative usage against the chemical fertilizers.
Keywords – Algae, bio-fertilizer, mungbean, soil fertility, pulse productivity.

I. INTRODUCTION

The overall soil health has indiscriminately resulted in bad shape due to mining activities, which has to be improved by adding suitable amendments having the power to improve soil health and genesis to support microbial growth and vegetation [1, 2, 3, 4, 5, 6].

The use of chemical fertilizers/agrochemicals has resulted in the harmful undesirable effects on both the environment as well as the human health [7]. Chemical fertilizers which are mostly used to increase the crop yield and replenish soil nutrients, gradually results in degradation of soil over the years, affects essential soil microbial communities and possess severe health and environmental hazards. They contaminate the environment and accumulate within the food-webs resulting in mortality.

The solution to these lies in the form of organic farming. Organic farming is an eco-friendly practice for sustainable agriculture which makes the ecosystem healthier [8]. It has globally emerged as an important priority area in the view of the growing demand for safe and healthy food, long term sustainability and concerns on environmental pollution associated with indiscriminate use of agrochemicals [9]. The most essential component of organic farming is bio-fertilizers.

The current demand of nutrients is much higher than the availability. It is estimated that by 2020 to achieve the targeted production of 321 million tons of food grain, the requirement of nutrient will be 28.8 million tons, while their availability will be only 21.6 million tones being a deficit of about 7.2 million tones [10]. This can be only be achieved by employing bio-fertilizers in agriculture.

Bio-fertilizers are not only the alternative to chemical fertilizers but also tend to increase the soil and plant productivity which we will further discuss in this review article. They play an important role in the nutrient mobilization and development of soil by accelerating microbial processes which supports the entire plant growth system [8].

A lot of work has been carried out on rice crops using algae as a bio-fertilizer but very few on the legumes. Thus, this review article deals with the usage of algal bio-fertilizers on pulse and its advantage.

II. AGRONOMICAL FEATURES OF MUNGBEAN

Mungbean (*Vigna radiata* L. Wilczek) also known as green gram is an important short duration grain legume crop which is one of the important pulse crops of India. It is extensively grown in tropical and subtropical Asia because of its wider range of adaptability and is not suited to the wet tropics, where the annual precipitation is above 1,000 mm. It is cultivated for its dry seeds, which are a rich source of easily digestible protein, carbohydrates, vitamin C, folic acid, thiamin, iron, zinc, potassium, magnesium, copper, manganese, phosphorus and Phytic acid (PA, myo-inositol hexakisphosphate), an anti-nutritional factor that is the main storage form of organic phosphorus [11, 12].

Mungbean is a popular cereal based diet which is easily digestible, palatable, nutritive, and non-flatulent than other pulses in the country. It is rich in digestible protein {(25 - 28%) by virtue of N_2 fixation machinery [12, 13]}, oil (1.0 - 1.5%), fiber (3.5 - 4.5%), ash (4.5 - 5.5%) and carbohydrates (62-65%) on dry weight basis. It is the third most important pulse crop in India and shares 15% (3.5 Mha) of the national pulse crop area and 8.5% (1.2 million ton) of the total pulse production. It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen [14].

2.1. Cultivation of mungbean

The best soil for cultivation of mungbean is loam soil with good drainage. However it can be cultivated in various kinds of soils including the light sandy soil (Rajasthan) to heavy black loam soil of cotton (Madhya Pradesh) and red laterite soil (Southern India). Alkaline, saline or waterlogged soils are not suited for crop growth. Seedbed prepared for germination and establishment of crop should be made clods and weeds free by 2 – 3 ploughings followed by planking. In the sandy soil where termite infestation is common Carbaryl 5% powder should be mixed in the last stage of field preparation [15].

III. BIO-FERTILIZERS

Bio-fertilizers are the organic products containing living or latent cells of efficient strain of different types of microorganisms that have the ability to mobilize nutritionally important elements forms through biological stress [16]. They generally colonize in the rhizosphere or the interior of the plant and improve plant growth and yield.

Bio-fertilizers contains bacterial, fungal or algal strains and enhance the productivity of the soil by fixing atmospheric nitrogen [17] or by solubilizing soil phosphate or by stimulating plant growth for synthesis of growth promoting substances by increasing the availability of primary nutrients. They play main role in selective adsorption of immobile (P, Zn, Cu) and mobile (C, S, Ca, K, Mn, Cl, Br, and N) elements to plants [18].

Bio-fertilizers can be applied to seeds, soil, plant surfaces or composting areas with the objective of accelerating microbial processes which augment the availability of nutrients that can be easily absorbed by plants, harvesting the naturally available biological system of nutrient mobilization [19].

Bio-fertilizers can add 20-200 kg N ha^{-1} (by fixation) and increase crop yield by 10-50% [20]. The total production of bio-fertilizers in the country is 10,000 mt/annum and the production capacity is 18,000 mt/annum. The total Average annual consumption of bio-fertilizers in the country is around 64g/ha [16].

They include: Symbiotic Nitrogen Fixers (Rhizobium spp.), Asymbiotic free Nitrogen Fixers, (Azotobacter, Azospirillum, etc.), algal bio-fertilizers (blue green algae or BGA in association with Azolla), phosphate solubilising bacteria, mycorrhizae, organic fertilizers and NPK (nitrogen, phosphorous and potassium) from organic sources, such as FYM (farm yard manure) can be used as a sole source or as a substitute for inorganic fertilizers [21].

3.1. Classification of bio-fertilizers

Bio-fertilizers are broadly classified into 3 categories as shown in Fig. 1.

a. Nitrogenous bio-fertilizers
b. Phosphatic bio-fertilizers
c. Organic matter decomposers

Nitrogen fixers such as *Rhizobium* - requires symbiotic association with the root nodules of legumes to fix nitrogen while others (*Azospirillum, Azotobacter, BGA*) can independently fix nitrogen independently. Phosphate solubilising micro-organisms such as *Bacillus, Pseudomonas, Aspergillus* etc. secrete organic acids which enhance the uptake of phosphorus by plants by dissolving rock phosphate. Some others are phosphate mobilizers and Zinc Solubilizers [22]. But their effectiveness varies greatly, depending largely on soil condition, temperature and farming practices.

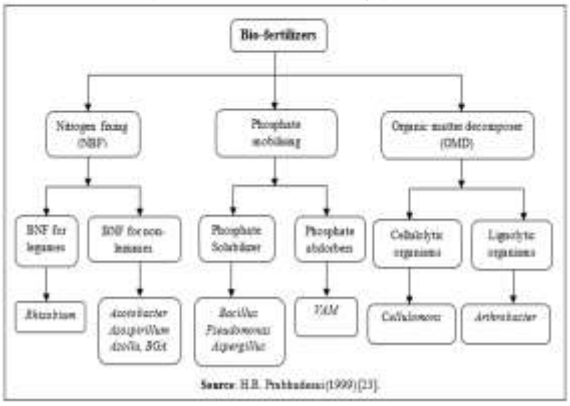

Figure 1 Classification of bio-fertilizers

3.2. Methods of Bio-fertilizer application

Bio-fertilizers can be applied via four methods [23].

a. Seed treatment
b. Soil treatment
c. Seedling treatment
d. Set treatment

3.2.1. Seed Treatment

Used for inoculation of cereals like rice, wheat, sorghum, maize etc. and oilseeds like groundnut, sunflower, mustard, safflower, pulses like cowpea, green gram, blackgram, soyabean etc. One packet

(200g) is sufficient to treat 10-12 kg seed. On this basis the dose of bio-fertilizer per acre can be worked out, based on the seed rate. This is done as follows:

- Keep the seeds required for sowing one acre in a hep on a clean cemented floor or gunny bag.
- Prepare culture suspension by mixing 1 packet (200g) bio-fertilizer in approx. 400 ml of water (1:2).
- Sprinkle the culture suspension on the heap of the seeds and mix by hand so that thin coating is uniformly applied to the seeds.
- Spread the seeds under shade for drying and then sow.
- In place of water, rice glue (Kanji) can also be used for better results.

3.2.2. Set Treatment

This method is generally recommended for treating the sets of sugarcane, cut pieces of potato and the base of banana suckers. This is done as follows:

- Prepare culture suspension by mixing 1 kg (5 packets) of bio-fertilizer in 40-50 litres of water.
- The cut pieces of planting material required for sowing one acre are kept immersed in the suspension for 30 minutes.
- The cut pieces are then dried in shade for some time before planting.
- The field is irrigated within 24 hours after planting.

For set treatment, the ratio of bio-fertilizer to water is approximately 1:50.

3.2.3. Seedling Treatment

This method is recommended for crops like paddy, tobacco-tomato, chilly, onion, cabbage, cauliflower, etc. This is done as follows:

- Prepare the suspension by mixing 1 kg (5 packets) bio-fertilizer culture in 10-15 litres of water.
- Make small bundles of seedlings required for one acre.
- Dip the root portion of these seedlings in this suspension for 15-30 minutes and transplant immediately.
- Generally, the ratio of inoculants and water is 1:10 (approx.) i.e. 1 kg bio-fertilizer in 10 litres of water.
- For vegetables like chilly, tomato, cabbage, cauliflower, 1 packet of bio-fertilizer is sufficient for 0.1 ha land.

3.2.4. Soil Application

This method varies crop to crop depending on its duration.

For a short duration (less than 6 months) crop, 10-15 packets (each of 200g) are mixed with 40-60 kg of well decomposed cattle manure or with 40-60 kg soil for one acre of land. The mixture of bio-fertilizer and cattle manure/soil sprinkled with water is then broadcasted into soil at the time of sowing or at the time of irrigation in standing crop. For long duration crop (perennial crop) 20 -30 packets of bio-fertilizer (each containing 200 g) are mixed with 80-120 kg cattle manure or soil per acre.

3.3. Different bio-fertilizer used in India

The some of the commonly used bio-fertilizers in India are described in Table 1.

Table 1 Common bio-fertilizer used in India

Name	Crops Suited	Benefits Usually Seen	Remarks
Rhizobium strains	Legumes like pulses, groundnut and soya bean.	10-35 % yield increase, 50-200 kg N/ha	Fodders give better results. Leaves residual N in the soil.
Azotobacter	Soil treatment for non-legume crops including dry land crops.	10-15 % yield increase – adds 20-25 kg N/ha	Also controls certain diseases.
Azospirillum	Non-legumes like maize, barley, oats, sorghum, millet, sugarcane, rice etc.	10-20 % yield increase	Fodders give higher/ enriches fodder response. Produce growth promoting substances, it can be applied to legumes as co-inoculant.
Phosphate Solubilizers (*there are two bacterial and two fungal species in this group**)**	Soil application for all crops.	5-30 % yield increase	Can be mixed with rock phosphate.
BGA and Azolla	Rice/wet lands	20-30 kg N/ha. Azolla can give biomass up to 40-50 tons can fix 30-100 kg N/ha.	Reduce soil alkalinity, can be used for fishes as feed. They have growth hormonal effects. TNAU has developed high yielding Azolla hybrids.
Mycorrhizae (VAM)	Many trees, some crops, and some ornamental plants.	30-50 % yield increase enhances uptake of P, Zn, and Water.	Usually inoculated to seedlings.

Source: Marichamy and Aananthi, 2014 [24].

IV. ALGAE AS A BIO-FERTILIZER

Algae constitutes a polyphyletic group of photosynthetic organisms that include both prokaryotic cyanobacteria and eukaryotic organisms with wide morphological and biochemical diversity. They are green cell factories that convert light, CO_2, and nutrients (both organic and inorganic) into myriad molecules of high economic value [25, 26, 27, 28, 29, 30, 31, 32, 33]**.** Further, algae have high solar conversion (photosynthetic) and carbon dioxide-capturing efficiency compared to terrestrial plants, leading to a higher surface area productivity in terms of biomass and metabolites. The main industrial attractions of algae are their ability to grow with minimum freshwater inputs and utilize lands that are otherwise agriculturally non-productive. The ability to survive in polluted wastewaters containing high quantities of nutrients such as nitrogen, phosphorous, and heavy metals [34]. They are helpful in water purification to some extent [33, 35, 36, 37, 38, 39].

It has been estimated that about 200,000-800,000 species exist on earth, of which about 35,000 species are already described in literature [40]. *Cyanobacteria/BGA (Chrococcus, Phormidium, Anabaena, Aphanocapra, Oscillatoria), Azolla, Chlorella, Chlamydomonas* are prominent ones.

Nitrogen fixing BGA includes filamentous BGA such as *Nostoc*, *Anabaena*, etc., and non-filamentous BGA include *Chrococcus*. Filamentous BGA N_2-fixing occurs in heterocyst, which are morphologically distinct, functionally specialized cells.

The technological principle of BGA as bio-fertilizer is based on nitrogen fixation of filamentous BGA, in which inorganic nitrogen (N_2) from the air can be converted into organic nitrogen which can be utilized by higher plants. In addition, photosynthesis of micro-algae can use carbon dioxide and water to generate monosaccharides and oxygen in the chloroplasts.

Based on the growth habit of BGA, they are used either as air dried or dried method to save BGA. The wet BGA were dried in oven 35-40 ^{0}C. This method is not only easy to operate and also ensure a high germination rate [40].

Dry algae acts as an organic material so it can hold nutrient inside it and supply it to plants by capillary action for a longer duration whereas most chemical fertilizer dissolve in water and settle down deep in earth due to which nutrient get unavailable to plants after a certain time period, it increases the water holding capacity of soil and increase the inter molecular space between soil molecule due to which proper aeration is supplied to root system [41].

BGA (also called cyanobacteria) are an ancient group of unique prokaryotic organisms with the ability to perform mutually compatible functions like nitrogen fixation and photosynthesis. They play an important role in maintenance and build-up of soil fertility. BGA are the diverse group of photosynthetic prokaryotes growing frequently in rice fields, which are known to fix atmospheric nitrogen and convert insoluble phosphorus into soluble form [42].

They comprise of about 150 genera and more than 2000 species. A substantial number of cyanobacteria are terrestrial. Species of cyanobacteria (Cyanophyceae) representing 38 genera have been reported to be soil inhabitants. They are often the dominant microalgae in soils. Many cyanobacteria carry out photosynthesis and can grow only in the presence of light (obligate photoautotrophs) but some species can grow on certain substrates in darkness (facultative heterotrophs) [43].

Cyanobacteria have been reported to play an important role in improving soil aggregation in paddy fields. A number of studies establish the potential of cyanobacteria for bioamelioration of soils and enhancing crop yield [41]. In a study it was observed that soils with Cyanobacterial cover produces organic matter, which increases soil TOC along with producing more water stable soil aggregates. Better soil aggregation in bio-fertilizer treated soils may be attributed to polysaccharides produced by the algae. Diazotrophic cyanobacteria which are photoautotrophic and N_2 fixing microorganisms improve crop production by acting as natural fertilizers as they increase both carbon and nitrogen status of soils [44].

Azolla-Anabaena can be utilized as a bio-fertilizer on rice and many other crops, an animal feed, a human food, a medicine, and a water purifier. It may also be used for the production of hydrogen fuel, the production of biogas, the control of weeds, the control of mosquitoes, and the reduction of ammonia volatilization that accompanies the application of chemical nitrogen fertilizer [45].

V. ALGAL BIO-FERTILIZER AS A SOIL CONDITIONER

5.1. As a source of organic matter

Algae also act as an important source of organic matter in soil. The organic matter formed from the death and decay of algae may get mixed in the soil and mucilage acts as binding agent for soil texture, thereby increasing the humus content and making it more habitable for other plants after some years. Humus accumulation is also important for moisture retention [46].

5.2. In uptake of P and N

Cyanobacteria also consist of some soil phosphate solubilizing species. Phosphorus is the second important nutrient after nitrogen for plants and microorganisms. Algae immediately excrete the extracellular phosphatases under the P limited conditions. They can also excrete other compounds and change the pH of their surroundings, which in turn can render adsorbed P available. In addition, algae can store resources like P in excess of their immediate needs [46].

5.3. Production of extracellular substances

They benefit plants by producing growth-promoting regulators (the nature of which is said to resemble gibberellin and auxin), vitamins, amino acids, polypeptides, antibacterial and antifungal substances that exert phyto-pathogen biocontrol and improve soil structure and exo-enzyme activity [46].

5.4. Nitrogen fixation

Cyanobacteria are widely used in rice fields throughout the Asia, where their enhancement of soil fertility occurs by means of biological nitrogen fixation (which is called as Algalization [47]) in place of N-rich fertilizers.

The action of algae as a bio-fertilizer includes:

a. Increase in soil pores with having filamentous structure and production of adhesive substances [48].
b. BGA produce Auxin, Indole acetic acid and Gibberellic acid, vitamins, amino acids [49] and are able to fix 20-30 kg N/ha in submerged rice fields, as they are abundant in paddy, therefore, also referred as "paddy organisms" [10].
c. They contribute significant amounts of P, K, S (sulphur), Zn (zinc), Fe (Iron), Mb (molybdenum) and other micronutrient to the soil [10].
d. Increase in water holding capacity through their jelly structure [47].
e. Increase in soil biomass after their death and decomposition [50].
f. Decrease in soil salinity [50].
g. Preventing weeds growth [50].
h. Increase in soil phosphate by excretion of organic acids [48].

VI. ALGAL BIO-FERTILIZER FOR MEASUREMENT IN GROWTH, BIOMASS, CROP YIELD AND PRODUCTION

The beneficial effects of use of cyanobacterial inoculation as a bio-fertilizer is reported on a number of crops such as barley, oats, tomato, radish, cotton, sugarcane, maize, chili and lettuce, wheat [48] .

But the majority of research of algae as a fertilizer is been done in the rice crops.

6.1. Paddy

The Field experiments put into practice over the last two decades under the all India Coordinated research trials, using rural oriented BGA bio-fertilizer developed at Indian. Agricultural Research Institute (IARI), New Delhi, have shown that BGA can provide 25-30 kg N/ha/season and an increase of up to 30% of the paddy crop yield [51].

The treatment of paddy crops with bio-fertilizer (Azolla and BGA) resulted in highest plant height 91.8 cm at 105 days, number of grain average value 893 grain and increase percentage yield 14.77% of bio-fertilizer treated plant over the control whereas the Chemical fertilizer treated plant resulted in plant height of 84.7 cm at 105 days, number of grain average value 610 grain and increase yield percentage 7.98% over the control. The number of grains present on a single plant was the highest for treatment with Bio fertilizer compared to Chemical fertilizer treatment. The final plants height, numbers of grain value average and increase yield percentage were lowest in chemical fertilizer treated plants [52].

Upon introduction of Azolla in paddy field, it resulted in increase of yield of paddy from 21% to 34% due to green manuring and 15% to 23% increase due to dual cropping [16].

6.2. Maize

The effect of three species of red marine algae (*Laurencia obtusa*, *Corallina elongata* and *Jania rubens*) was evaluated as bio-fertilizer to enhance growth of Maize (*Zea mays* L.) plants. After 60 days it was observed that the application of *Laurencia obtusa* + *Jania rubens* caused 48.21% increase in plant length, 61.84% increase in potassium content and increase in leaves number in comparison to other treatments. Application of *Laurencia obtusa* + *Corallina elongata* caused 90.86% increase in plant fresh weight. Application of algae mixture resulted in 72.41% increase in plant dry weight and 73.97% increase in phosphorus content. However, application of *Jania rubens* alone caused 129.23% increase in the plants nitrogen content compared with control [53].

6.3. Black Gram

When Vigna mungo (L.) Hepper commonly known as black gram seeds were treated with bio-fertilizer, Azotobacter sp., it showed better and significant result compared to untreated control in terms of both morphological (such as number of leaves, breadth of leaves, total length of plant, shoot and root length) and biological parameters including chlorophyll content, carbohydrate content, protein content [54].

6.4. Soil Conditioner

Giant Kelp (an algal species) is also used as a fertilizer with a combination of other fertilizer which provides high value of nutrients needed by the plants. This is commonly practiced in pacific coast of North America. Kelp fertilizer comes in liquid, soluble powder and solid forms. It provides all the major nutrients including 2.5 lbs. of potassium which is a major plant nutrient. BGA also increases the yield, weight and oil content and inducing resistance to *Tikka* disease in ground nut plant. Dry algae is an organic material which act as humus for the soil which helps in binding the soil, hold nutrient inside it and supply to plants by capillary action for a longer duration, increases the water holding capacity of soil and increase the inter molecular space between soil molecule due to which proper aeration is supplied to root system and hence makes it more beneficial to use as bio fertilizer in comparison to chemical fertilizers [41].

VII. FUTURE SCOPE

Bio-fertilizers have shown great potential as supplementary, renewable and environmental friendly sources of plant nutrients and are an important component of Integrated Nutrient Management (INM) and Integrated Plant Nutrition System (IPNS). The use of algae as bio-fertilizer is based on renewable source of energy which does not pollute the environment and increases the crop yield in comparison to the agrochemicals.

Besides this, algae also acts as an important tool for mitigation of greenhouse gas by amplifying CO_2 sequestration in rice field and keeping the organic carbon in soil for a long time to achieve carbon emission reduction, thus acting as a biological source for sequestration of CO_2, bio-indicator of pollution.

Algae also acts as a potential source of biofuel production. Bio fuel currently make up 3.1% of the total road transport fuel in the U.K. or 1,440 million liter. Conventional Bio fuel are likely to produce between 3.7 and 6.6% of the energy needed in road and rail transport, while advanced biofuel could meet up to 4.3% the U.K's renewable transport fuel target by 2020 [55]. Hence algal biofuel can replace the need of fossil fuel and arise as a renewable source of energy.

Hence more research is needed to be done in use of algae as a bio-fertilizer, biofuel and pollution mitigation tool.

VIII. CONSTRAINTS

- Unavailability of appropriate, efficient strains and suitable carrier [40, 56].
- Inadequate and inexperienced staff and lack of awareness of farmers [56, 57].
- Seasonal and unassured demand [56, 57].
- Resource constraint.
- Limited resource generation for bio-fertilizer production.
- Unavailability of suitable carrier resource constraint [57].
- Lack of quality assurance and limited resource generation for bio-fertilizer production [56].
- Soil and climatic factors and inadequate experienced staff [56, 57].
- Native microbial population, faulty inoculation techniques and mutation during fermentation [56, 58].
- Higher implementation costs [58].
- Extensive and long term application may result in accumulation of salts, nutrients, and heavy metals that could cause adverse effects on plant growth, development of organisms of the soil, water quality, and human health [58].
- Large volumes are required for land application due to low contents of nutrients, in comparison with chemical fertilizers [58].
- Nutritional deficiencies could exist, caused by the low transfer of micro and macronutrients [58].

IX. ECONOMICS

The growth of algae largely depends on the temperature and pH of it's surrounding since the biological activity ceases after the optimum temperature is reached. Abundant algal growth can be observed during the post-monsoon period whereas minimal growth is observed during the summer or pre-monsoon season [31]. Excess of nutrients, more than that what is required for algal growth can result in algal blooms which can be toxic. So while using along with NPK special care has to be taken of concentration of phosphates otherwise instead as acting as a bio-fertilizer algae may act as an environmental pollutant.

Algal inoculation in small quantity requires culturing in a growth media in laboratory but for large scale commercial requirement it may be little expensive. For requirement in paddy fields no additional inoculation is required since once applied in paddy field it replicates in its own. A recent study showed that Cyanobacteria can compensate about 50 % of recommended doses of N, P, and K [59].

The current demand of sustainable agriculture has paved the way for bio-fertilizers usage and its advantage over the chemical fertilizers has raised the awareness among the farmers (though it still has to make progress) which is resulting in the commercial production of bio-fertilizers by Govt. of India due to less consumption of energy needs for plant setup [60].

Nationalized banks have started their Hi-Tech agricultural programme providing loan to entrepreneurs to start their own production unit. This low cost technology has also been encouraged by the government of India by providing a subsidy of upto 20 lakh rupees to setup the production unit of 150 metric tons per annum capacity. The success of the project entirely depends on the economic viability.

X. CONCLUSION

Algal bio-fertilizers employ natural process for adding nutrients into the soil and thus has led to the decrease in the pollution and soil contamination. So this bio fertilizer can be regarded as the new alternative renewable energy source for coming generations, substituting the needs of chemical fertilizers and promoting sustainable agriculture. Algal bio-fertilizers not only provide nutrients to the plants but in fact also help in increasing plant growth and soil fertility. Algal bio-fertilizers play a major role in organic farming with no prerequisite requirement of large land.

In spite of having numerous advantages by its credit, bio-fertilizer application still experiences lags in India. These lags in India may arise by various reasons major among them is lack of awareness and knowledge in the farmers (who play major role in this regard). Also, the production of algal bio-fertilizer at present is confined only at the local level with very low production rate. Only developing, creating and inventing new techniques and methods doesn't imply their advantage or disadvantages, but information about its effective application and knowledge in masses creates a huge impact in success of that technique.

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