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Sustainable Agricultural System

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Abstract

Algae are wide and versatile class of microorganisms which can perform photosynthesis because these absorb energy of the sunlight. In agriculture, algae play a key role, where they can be used as bio-fertilizers and stabilizers of the soil. Algae, marine algae, are being employed as fertilizers, which results in lesser phosphorous and nitrogen runoff through use of manure from livestock's. This raises water quality and flows into oceans and rivers. Such species grow globally and used as dietary additives for human use. They can also provide a healthy and carbon-neutral fuel, which expand on barren fields which arid desert fields with limited freshwater demands. Seaweeds provide a major source for iodine. Iodine concentrations of milk rely on the fed to cow that delivered milk. As per the Fuzhou Wonderful Biological Science, providing milk cattle with seaweed will increase amount of iodine of the milk. Algae feed supplements also raise egg-laying levels in hen. In this article they spoke to all those who work in this field on the important facets of algae and also its agricultural usage. Algae are the Earth's most prominent photosynthesizing species. These absorb more energy from the sun and generate higher amount of oxygen than any plant combined. These form the base of most systems of marine resources, which sustain an array of animals. In a number of forms algae are of commercial significance. The chemical material could be used as a food supply, a bait, and as a fertilizer in aquaculture. It also plays a vital role in the reclaiming of alkalines, could be used as a soil binding agent and used in a number of consumer products.

Keywords: Algae, Agriculture, Bio-fertilizer, Carbon-neutral fuel photosynthesis, Sea weeds, stabilizers of Soil.

Introduction

Assortment of the plants similar types that were communally referred to algae involves an enormously variety abundance of organism. Algaes can vary for size from one molecules small micrometer to massive seaweeds which can develop to more than fifty meters. Most of the singular groups are mobile, all of them contain protozoa. Algae omnipresent; exist in nearly each ecosystem on the earth, in wetlands, hot springs, frozen glaciers, snowy fields, and cold and hot desert. Biologically and Biochemically, algae close in certain ways to other plants[1]–[9]. These share same essential biochemical pathway; both contain chlorophyll and starch, proteins and product similar to that of bigger plants. In fact, algae are main primary sources of compounds that are organic; and they plays a crucial role in marine environments as basis for both food chain.

This study aims to strengthen the notion of algae being essential component of semi-arid and arid ecosystem. The distribution and status can also be representative of the environmental health. In fact, the existence of algae helps in decreased erosion through controlling movement of water to the soils. They play a very important role in fertility of soil, land reclamation, bio-control of farm pest, microbiological surface formating, industrial wastewater collection, and processed water reclamation. Human society depends for its life upon agriculture. Agricultural output also relies on the soil's productivity level. Like other species, algae present in different forms of soil can help soil enhance it properties such as content of carbon, hardness, ventilation and nitrogen fixation. Extent of the changes has strongly function on soil physical and chemical properties, which influence algal community composition[1], [4], [8].

Man applications of the algae, especially aquatic algae, much complex and crucial financially commonly understood. They are used in form of human food, in agricultural production (compost, fertilizer, fisheries and fodder), pharmaceuticals, leather goods, paint and paper industry, chemical products by larger aquatic algae (such as carrageenan or agar) are being employed for manufacturing of the industry of food, and diatomaceous earth is extensively used for filtering and scrubbing material. Also, algae's are essential ground-binding agent that minimize erosion which is used to treat wastewater.

Fig. 1: 3D. Blue Green Algae Genus

Cyanobacteria is a group of diverse prokaryotes as illustrated in Fig. 1. A normal characteristic is oxygenic photosynthesis, close to observed in the algae and plants more up. They produce oxygen in the atmosphere, since sunlight is supply of water and energy. Energy and photosynthesis-generated reducing agents are typically use in reducing CO_2. Such micro-organisms spread around the world and promote plant growth and production where they can share environment, as these:

1) Add to the soil's fertility in several ecosystems;

2) Contain a number of bioactive substance;

3) Have greater efficiency of heavy metal bio-sorption.

Diazotrophic cyanobacteria need sunlight as its primary source of energy for carbon and nitrogen fixation. As bio-fertilizers, they thus have tremendous potential and their use would decrease the need for fuel in fertilizer production. There has long been awareness of the agronomic ability of hetero-cyst cyanobacteria, living freely or in symbiotic association having water Azolla. As recorded in Egypt, China, India and Philippines, this contributed to production of smaller level biotechnology that involved the usage of paddy soil having suitable cyano-bacterial strain as bio-fertilizers in fields of rice.

Cyanobacteria are friendly bio-fertilizers for grain-based crop systems, the key components of wetland rice habitats that are readily accessible and are the cheapest available bio-fertilizer sources. Whereas introduction of gene into grain plant by the use of modern genetic techniques and tissue culture remains a research objective, the usage of cyano-bacterial diazo-trophic technology of rice production provides effective and even longer term substitute for artificial N fertilizers, especially in the developing countries.

However, one of shortcomings in the technology is the heavy implementation of many poisonous agro-chemicals, particularly herbicides, which are documented as cyano-bacterial diazo-trophic development inhibitors in most instances, and certain cases mutagenic ones. Good biotechnology therefore needs collection of appropriate diazo-trophic strains as bio-fertilizers which could withstand herbicide concentrations in field doses.

Enhancing Fertility of Soil:

Any cyanobacteria can convert atmospheric N to ammonia, a mechanism in which O_2 formed in same cell by photosynthetic activity is counterproductive to fixation of nitrogen. Techniques for preventing oxygen vary from

temporary differentiation of fixation of nitrogen and oxygen development (in more than one single celled non-hetero-cyst strain) for spatial differentiation and cell segregation into hetero-cyst fixing nitrogen cysts.

Hetero-cysts are differentiated terminally cells with internal part is anaerobic, primarily due to result of respiration, helping oxygen based fixation of N cycle for begin. This regulating of the N_2 fixing in the hetero-cyst mechanism has been extensively studied[10]–[19]. Diazotrophic cyano-bacteria need sunlight as their primary source of energy for carbon and nitrogen fixation. As bio-fertilizers, they thus have tremendous potential and their use would decrease the need for fuel in production of fertilizer. The agronomic ability hetero-cyst cyanobacteria has long been recognized, whether freely existing or in association with water fern Azolla.

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Uptake of Phosphorus and Nitrogen:

Cyanobacteria have some types that solubilize soil phosphate. Phosphorus (P) is second essential nutrient in plant, micro-organisms after nitrogen. Most marine environments are resource constrained, where the main limiting nutrients are mostly P and N. A predator must be capable in sustain natural population rise at various resource level which is less the needed by species in order to ensure survival.

Algae are specifically modified by environmental changes, packaging or improved productivity of resource use to scavenge their habitats for food. Internal algal modifications require metabolic and physiological changes, although they may also excrete compounds to increase the supply of nutrients. Algae secrete extracellular phosphatases at the start of P minimal conditions nearly immediately. Algae may also secrete other chemicals and alter their surrounding pH, that in turn may allow usable adsorbed P. Additionally, algae can hold resources such as P above their basic needs.

Cyano-bacterial fertilization on rice and lettuce seedlings has been correlated with inorganic fertilization. Bio-fertilizers are expected to acquire greater importance as a replacement and alternative to chemical fertilizers in increasing nutrient deliveries to grain crops due to the high nutrient depletion in the network of grain production, absurdly high fertilizer costs and enhanced understanding of environmental conservation.

N-Fixation:

Nitrogen fixing is considered to be a wide range of cyano-bacterial species, and its significance in increasing fertility of the soil for agriculture which is sustainable is well recognized in irrigated and submerged cultivation of rice. The usage of cyanobacteria as bio-fertilizer of rice paddies is promising but has limits because of variations in the quantity and nature of inoculum in different agro-ecological regions and its physiological attributes. The productivity of the use of fixed N by plants of rice is always poor, thus, attempts are expanded to remove appropriate strain cyanobacteria which will be abundant in fixation of atmospheric N but in constantly excretions of it, rendering it accessible to growth grain plants.

Cyano-bacteria are commonly used in rice paddies of Asia, in which improvement of crop production by biological fixation of nitrogen instead of Nitrogen rich fertilizer isn't limited to their beneficial effects. The tolypothrix tenuis cyanobacterium is cultivated in wheat, and applied to paddy fields.

Sources of the Organic Matter:

Even algaes are a major source of organic matter in soil (Ibraheem, 2007). The organic matter produced from decay death of algae can be mixed in soil and this mucilage act as a agent for binding the texture of the soil, thus increasing quality of humus which will make it more suitable for plants after a few years. Moisture preservation also essential for humus accumulation.

Reclamation of Soil:

The land reclamation problems in semi-arid and arid regions that are mainly salinity requirements of the larger surface area. A lot of research have been performed on the impact of salinity on plant and algae production, metabolism, and yields have been used to enhance the plants' salt resistance.

Through such economic perspective, regulators for growth are inefficient and, when implemented in significant quantities, are extremely non-practical. Algae plays an important role in reclamation of soil which enhances fertility of soil and under certain environmental condition improves plant conditions.

Growth Substance for Plants:

When researching on Indian paddy field algae, Lata and Gupta (1964) found cyanobacteria stimulated germination of seed and promoted seedlings growth. Additionally, they have found protein content increased both the yield and the consistency of the grains. It seems quite likely that the algae's advantageous impact on rice crop won't be limited to ability of fixing atmospheric N only, but these do have other advantageous functions, like producing biologically active substance. Pathways used by microbes to promote crop production include bio-fertilization (improving plant's intake of nutrients of mineral), biological regulation (eradication of plant threats having microbial pests, worms and weed), and control growth of plant by supplying hormones of plant growth. Bio-fertilization strategies that use cyanobacteria are suggested for growing the germination of seed pace and other plant growth requirements (Strick et al., 1997).

While micro-algae and cyano-bacteria are principal soil photosynthetic microbial agents, their ecological function is not yet completely established. Moreover, some of their favorable characteristics and positive effects are naturally affecting plant / soil processes. Two significant possible applications of soil microalgae are as bio-fertilizers or soil conditioners in crop production.

An anti-microbial- and PGR-compounds (Plant Growth Regulator) have been showing growing concern recently. The impact of algae development of large quantities of extracellular compounds, including cyanobacteria, plays useful role of water environments, valuable role in boosting germination and development of high plants. For the same cause, algae of cyanobacteria were proposed as bio fertilizer due to release from their assimilation of nitrogen outside their cells of a very big portion of the biologically active substance.

Dust Control and Soil Consolidation:

- *Formation of Crust:*

Soil microorganism typically accumulate soil particle in forming crusts of biological soil, in particular in hard environment in which the distribution of vascular plants is spotty and groundwater is restricted. In environments where groundwater and nutrient were scarce and plant cover which is vascular is not continued, crusts of biological comprising of cyanobacteria, algae, lichens, micro-fungi, bacterium, and moss were common. Crusts change soil conditions, including water quality, nutritional content and vulnerability to degradation, and are therefore likely to influence plants directly and indirectly.

By linking smaller particles together into bigger particles, cyano-bacteria and other crust species maintain the earth. The binding is accomplished by many processes, having: physical attachment of particles of soil through intertwined filament, adhesive to gelatinous substance sheath or layers of slime secreted through cyano-bacterial trichome, and binding of particle for locations within cyano-bacterial cell wall. This binding will enhance crust's matter composition which is organic in nature, thereby increasing resistance of the soil to both water and wind degradation.

Crusts are created by the interference of thalli and soil particles with algae filaments and cyanobacteria, moss and lichen (Chartres, 1992). Along with the living organisms themselves, polysaccharides that are excreted by cyanobacteria and filamentous algae attach particles of soil into one, compact sheet to create a crust of first cms of soil's surface. Significance of the production of crust of soil in environmental functions is well known in semi-arid and arid regions. Soil crusts are popular in China's arid desert regions until the moving sand dunes have stabilized. Micro-biotic crust organisms exist across arid and semi-arid regions in the world, and increasing

of physiological, taxonomic and ecological studies have contributed to interest in the role in cycle of nutrients and the discovery of rich micro-fauna as well as micro-flora (Lewis and Flechtner, 2002). With Cameron, Drouet and Shields, and Friedmann et al., the first study of micro-biotic crust species to include algae started in the 1960's.

- *Soil aggregate Stabilization:*

In the United States, mucilaginous (palmelloid) green microalgae are very small in size as soil conditioning agents. Preparation of soil is process or commodity which not only enhances soil physics properties for agriculture as well as composition through genesis and soil aggregate stabilizing. The creation of aggregates is dynamic and poorly known. Nonetheless, aggregate freezing is considered to be mainly due to the adsorption and attachment of particulates by polysaccharides or microbial sources by living microbial filaments along with the atmosphere (Burns and Davies, 1986).

The mass-cultured Asterococcus and Chlamydomonas species have shown towards dramatically increase stability of aggregates of soil in wind's face disturbance and slake of water when inoculated on sandy soils which are irrigated by middle sprinklers pivot (Hawkes and Flechlner, 2002).

CONCLUSION

In this study, as regards the interaction between algae and crop plants, an effort was made to light on various advantageous functions of algae in the agriculture. Algae is an integral component of arid and semi-arid environments. In fact, their spread can be representative of environmental quality. In recent times, attention has been given to the idea of using algae as biological conditioners rather than either chemical or organic conditioner, where use decreases associated soil and plant emissions together, additionally to potential for enhancing plant and soil properties.

Algae, particularly cyanobacteria and microalgae, are present everywhere in soils around world. While these are soil's principal photosynthetic agents for microbial, their environmental role is yet not clearly established. In the research, focus was placed on function of algae crop reclamation and production, in particular microalgae, and many of their merits properties and positive effects affect system of plant or the soil.

- Organic acid excretion that enhances P-uptake and P-availability.
- Enhanced soil organic matter.
- Formation of Crust.
- Presence of concentrated metal ions in the environment.
- Biological N2-fixation.
- Generation and emergence of extracellular biologically active substances which may affect the development and growth of plants. They have been documented as plant growth regulators (PGRs), amino acids, vitamins, and polypeptides, antifungal or antibacterial substances exercising bio control of phytopathogen and polymer, exopolysaccharides, improving structure of soil and exoenzyme production.
- Stabilized aggregation of soil by the help of the extracellular polysaccharides.
- This study has also strengthened the algae's position in wastewater treatment and farm recycling. Complete wastewater treatment from multiple source systems helps to remove ammonia, nitrate, phosphate and some toxic substances.

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