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Present status of biofertilizers and Future prospects

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ARTICLE ID: 073

Abstract:-

Biofertilizers is a product that contains living microorganisms, which exert direct or indirect beneficial effects on plant growth and crop yield through nutrients present in the rhizosphere. They are the living things that nourish the crop. Various biofertilizers are available in market nowadays such as potassium solubilizing, phosphate solubilizing and nitrogen fixing. These biofertilizers are prepared by using a synthetic medium. Increasing human population in the world raising a big ultimatum to the security of food of each people as the land for agriculture is limited and even getting reduced with time, bioferetilizers are available in a solid form by using carriers that may affect the survival rate of microorganisms. They have low quality bacterial count/ survival rate and also bulky in nature. Exploitation of microbes as biofertilizers is considered to some extent an alternative to chemical fertililizers in the agriculture sector. Biofertilizers are increasing production costs and not up to mark of customer satisfaction as there is no checking quality about their performance, and therefore they don't meet the higher demand of consumers satisfication. Agriculture productivity is very essential to be enhanced vitally within the upcoming few decades to meet the large demand of food by population emerged. Maximum dependence on chemical fertilizers for more crop production automatically damages both human health with great severity and environmental ecology. There is a need to formulate biofertilizers those can be used as all in one with their additional properties as organic phosphorus solubilization by Phytase.

Keywords:- Biofertilizers, Solubilization, Microorganisms, Agriculture, Population , Chemical fertilizers.

Introduction:-

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Plants are the primary producers of the environment and perform ecological food chain directly or indirectly. Maximum percentage of human and animals are depend on the nutrition of plants. Since 1960 the world's population has doubled to six billion people and it is projected to increase to 8-9 billion people by coming year future in 2040 *(Vance et al.2003).* the modern agriculture played a vital role in meeting the food demands for a burgeoging human population, which has also led to an escalating reliance on synthetic agrochemicals like fertilizers and pesticides *(Santos et al.2012).* Dense or jungly growing human population increasing demand for food to survive on earth. Biofertilizers are specific beneficial microorganisms that promote the growth of plant crops. Ecofriendly converting the unavailable form of the nutrients into available form. They applied through soil or seed that help crop plants to uptake of nutrients by their interactions in the rhizosphere. Biological fertilizers enriches the soil of agricultural field with micro-nutrients and macro nutrients via nitrogen fixation and phosphorus and potash solubilization or mineralization and enhance plant growth- regulating or growth-promoting substances, biodegration of organic matter (OM) in the soil and production of antibiotics *(Sinhaet al.2014). Motsara et al (1995)* had stated that biofertilizers are solid and liquid based preparations which contains microorganisms in a sufficient number which is beneficted for growth and nutrition of the plant. These are used in various form like single super potashphate, urea and different names of potash such as in Rahtriya Chemicals and Fertilizers (RCF), Indian Farmers Fertiliser Cooperation Limited (IFFCO), Mahadhan, Koromandal, Sardar and Shreeram. Biofertilizers like Rhizobium, Azotobacte, and blue green algae (BGA) are in use since very long. These microorganisms fix atmospheric nitrogen and supply it to plants. Hence, biofertilizers to some extent. The bacterial biofertilizers contribute 20-30 kg N/ha/season. Rhizobium inoculants is used for leguminous crops. Azotobacter can be used with crops like wheat , maize, millets , maize, sugarcane and wheat. Blue green algae belonging to genera Nostoc, Anabaena, tolypothrix and Aulosira fix atmospheric nitrogen and are used as inoculants for paddy crop grown both under upland and low land conditions. However, the inoculants are most effective under low land rice cultivation and contribute 20-30 kg N per ha per season with better quality of grains. Anabaena in association with water fern contributes nitrogen upto 60 kg/ ha / season and also enriches soils with organic matter *Adesemoye and Kloepper (2009)* also observed that fertilizers are not completely absorbed by the plant but also remain

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accumulated in the soil which causes soil and water pollution. In the previous last five decades, the use of NPK fertilizer has drastically increased. The International Fertilizer Industry Association reported that in 2006 the use of NPK fertilizers in China, India, and USA, consuming 50.15, 21.65, and 20.83 million tons, respectively, compared with consumption in 1961 of 1.01, 0.42, and 7.88 million tons. An eco-friendly and effective remedy for Plant Growth Promoting Rhizobacteria (PGPR) are the supplements to chemical fertilizers and also observed that these beneficial bacteria can exert a plant growth positively by direct mechanisms such as nitrogen fixation, solublization of nutrients, production of growth regulators, etc., or by indirect mechanisms such as stimulation of mycorrhizae development, competitive exclusion of pathogens or the removal of phytotoxic substances *(Lugtenberg and Kamilova, 2009)*. Synthetic fertilizers are manufactured substances in industries composed of known quantities of macronutrient example as Nitrogen (N),

Phosphorus (P) and Potassium (K), etc. and micronutrients such as boron (B), zinc (Z), Iron (Fe), Sulphur (S) etc. and with their indiscriminate and imbalance use causes ground, air and water pollution by nitrate (NO_3) leaching and surface water bodies pollution through eutrophication *(Youssef and Eissa, 2014)*. The massive application of fertilizers cause leaching, accumulation and run-off of nutrients especially Nitrogen and Phosphorus, leading to degradation of the environment *(Gyaneshwar et al., 2002)*. The consumption of biofertilizers is looking forward to increased in copious coming era. It is very necessary to increase the production of biofertilizers by lost-cost method. Use of biofertilizers is being emphazied along with chemical fertilizers and organic manure and this makes Integrated Nutrient Management (INM). Hence, biofertilizers are live products and require care in storage , transport , application and maintaining field condition. They are not replacement of fertilizers but can supplement their requirement. For best results use both nitrogenous and phosphatic biofertilizers. State agriculture Universities, Government and non- government organizations are engaging in the mass production of biofertilizers. Recently many small and medium sectors are manufacturing biofertilizers.

Present status of biofertilizers:-

Afterthe introduction of chemical fertilizers in the lastcentury, the farmers were glad of getting increased yield in the agriculture in the beginning. But slowly chemical fertilizers

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started displaying their ill-effects such as leaching out, and polluting water basins, destroying micro-organisms and friendly insects , making the crop more susceptible to the attack of diseases, reducing the soil fertility and thus causing irresparable damage to the overall system. *Conway(2012)* reported that at present, there are 7 billion approximately living in the world and this number is undoubtedly expected to rise to approximately 8 billion around 2020. *Sujanya and Chandra (2011)* observed that regardless, the enormous use of chemical fertilizers in agriculture making the country self- dependent in providing large amount of food supply but concurrently damages the environment to a great extent and causes harmful impacts on human or living beings. Hazardous chemical fertilizers cannot be taken up by the plants, they start accumulating in the ground water and some these chemicals are also responsible for causing eutrophication of water bodies and the indiscriminate uses of chemical fertilizers shows great threat to nature by polluting water, air and soil. Chemical are adversely affect soil in terms of depletion of water soil fertility, water holding capacity, increased salinity and disparity in nutrients of soil *(Savci,2012).* Using diversified organisms ,

crop productivity had increased to an appreciable measure (ICAR report, 2006-2007). Several Plant Growth Promoting Rhizobacteria (PGPR) have been studied which can replace chemical fertilizers. This includes a handful genera such as *Bacillus, Clostridium, Arthrobacter, Azotobacter, Hydrogenophga, Enterobacter, Azospirillium, Serratia, Burkholderia, etc. (Lugtenberg and Kamilova, 2009).* Biofertilizers are promoted to harvest available biological system of nutrient mobilization naturally which enormously increases the fertility of the soil and crop yield ultimately *(Pandey and Singh 2012).* Prolongly, all the adverse effective use of chemical fertilizers, organic farming has emerged as a potent alternative area in terms of the growing demand of healthy supply of food , long term sustainability, and concerns regarding environmental pollution *(Reddy, 2013).* Considering, recent efforts have been focused towards the production of "nutrient-rich high-quality food" to ensure biosafety *(Bhardwaj et al.2014; Buragohain et al.2017).* The additional advantages of biofertilizers include longer shelf life of microbial cells causing no adverse effect to the ecosystem *(Sahoo et al.,2014).* A biofertilizer is a substance which contains microorganisms which when applied to seeds , plants, or soil, colonizes the rhizosphere and promotes plant growth by increasing the supply of nutrients to the plant (*Vessey 2003; Bardi and Malusa,2012; MalsuasndVassilev 2014*). Biofertilizers improve soil fertility by fixing the

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atmospheric nitrogen and solubilizing insoluble phosphates and produce plant growth – promoting substances in the soil *(Mazid and Khan, 2015).* Phosphorus is an essential plant nutrient that limits agricultural production on a global scale.

Role of Phytase:-

The utility of the phosphorus in plants from low phytase containing media or phosphate and from the soil is improved when soil media are inoculated with living microorganisms that possess the ability to exude phytase, or when phytase a purified form is added. Soil is rich in both organic and inorganic source of phosphate, organic phosphate such as phytae chelates other other trace minerals and make it unavailable to the plant growth. In our research we screened organic and in-organic P-solubilizer strain for its application in the agriculture field. Approximately 30-80% of the total phosphorus in the soils is bound inorganic form *(Harrison, 1987).* Phosphorus is the key of nutrients for plant growth.

Need of formulation of biofertilizers for sustainable farming:-

Biofertilizers are low-cost benefits with high benefits in agriculture. *(Fages 1992),* the success of inoculation technology depends on two factors such as the microbial strain and inoculants formulation. In practical terms, the formulation determines potential success of inoculants. Inoculants is a synonym for biofertilizer is prepared containing beneficial microorganisms which enhance plant growth. As strains of same microbial species share many physiological properties, the technological process thus developed for a particular strain is readily adaptable to another strain of some species with only minor modifications *(Bashan, 1998).* Most important constraints for adoption of biofertilization in India have been attributed to poor quality of inoculants produced, lack of knowledge about inoculation technology for extension personnel and farmers, effective inoculants delivery/supply system, and lack of committed policy to exploit biofertilizers successfully *(Wani and Lee, 1991; Bodake et al .2009; Jangid et al. 2012).*

Conclusion:-

Biofertilizers have a great role in increasing the crop production. They improves the soil health status and cost is lower than other fertilizers. Relatively more effective than chemical

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fertilizers and has significant effect in biomass production and grain productivity. Phosphorus is very important nutrient of plants as it required in large quantity. Cost is lower of biofertilizers than the other fertilizers. They improves the soil texture and do not allow the pathogens to flourish. Farmers can prepare the inoculum themselves. Biofertilizers are effective under semi-arid condition. This concluded that biofertilizers are growth promoting biochemicals. Hence, biofertilizers are non- polluting and provides sustainability to soil.

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