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Studies On Use Of Biofertilizers In Agricultural Production

Vandna Chhabra

Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara (Punjab) India- 144411

email: vandna.21027@lpu.co.in

ABSTRACT: India had to reconstruct its economy after 1947 when more than three-quarters of the population relied on farming. There were several issues faced by agriculture in India like very small grain productivity due to lack of irrigation and other infrastructure as farming still dependent on monsoons. The Green Revolution began in 1965 with the first implementation of High Yielding Variety (HYV) seeds in Indian agriculture. This has been combined with better and more effective irrigation and proper fertilizer use to increase the crop yields. The Green Revolution ultimately resulted in India becoming self-sufficient. Presently, to get more production from the shrinking resources like land and water is the huge challenge. Biofertilizers, are regarded as profitable, environmental friendly and limitless resources of crop nutrients or microbial inoculants and economical transporters for adding and mobilizing nutrients in soil.

Key words: Agriculture; biofertilizers;India

1. INTRODUCTION

It is evident that, there is a well-established contribution of chemical fertilizers to enhanced agricultural output. National fertilizer consumption was about 1 million tonnes at the start of the green revolution in 1966. Since then, fertilizer demand has risen exponentially and India is now the world's second-largest fertilizer consumer with an estimated consumption of 28.1 million tonnes. According to FAI, 2012, India accounted for almost 16% of nitrogen, 20% of phosphatic and 13% of potashic fertilizers during 2008 out of worldwide consumption (ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Naik, M., & Kumar, P. (2020); Kumar, P., & Naik, M. (2020); Kumar, P., & Dwivedi, P. (2020). Urea is however the most frequently used fertilizer together with other nitrogen containing fertilizers like ammonium sulphate, ammonium chloride, accounted for more than 60% of complete market share in India. Complex NP / NPK fertilizers (excluding DAP) are the second biggest products with a market share of approximately 14% (FAI 2014). The continuous increase in fertilizer use intensity over the past 3-4 decades is evident in all areas (FAI 2012).

Rice was the biggest fertilizer consumer followed in 2006-2007 by wheat. The combination of fruits, vegetables and sugar cane represents an additional 11% of fertilizer use. Cotton accounts for about 5.6% of complete consumption. The Committee, citing information from the start of the Green Revolution, noted that the decadal growth rate in agriculture dropped considerably from 8.37% in 1960-70 to 2.61% in 2000-2010. The present pace of development will not be able to feed the population of the country by 2025. Against its present 253 mmt production, the nation requires to generate 300 million metric tons (mmt) of

grains. The Committee, in its study, highlighted the unequal use of fertilizers and pesticides in various areas and blamed it for reducing soil fertility. Farmers were quoted as lack of consciousness as the reason for this imbalance (Devi, P., & Kumar, P. (2020); Kumari, P., & Kumar, P. (2020); Kaur, S., & Kumar, P. (2020); Devi, P., & Kumar, P. (2020); Sharma, K., & Kumar, P. (2020); Kumar, S. B. P. (2020); Devi, P., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020).

Inspite of outsized use of fertilizers, the trend of yield went down due to less soil fertility and reducing soil flora and fauna (Mahajan and Gupta, 2009; Khare and Arora, 2015;Gupta and Singh, 2008). There are also reports that nutrients applied through chemical fertilizers may be unutilized or underutilized by plants (Bhardwaj *et al.*, 2014; Mahdi *et al.*, 2010) thus causing wastage, increase cost of cultivation and environmental pollution. In that situation, use of bio-fertilizers can be better alternative for sustainability of agriculture (Pindi and Satyanarayana, 2012; Borkar, 2015).

Biofertilizers are environment friendly and hold immense prospective in providing plant nutrients. The microorganisms in biofertilizers reestablish natural nutrient cycle, maintain optimum nutrient level in soil and also increase soil organic matter content alongwith healthy plants, sustainability and fertility of the soil (Singh *et al*., 2011; Sinha *et al*., 2014; Shelat *et al*., 2017; Kumar, P. (2019); Kumar, D., Rameshwar, S. D., & Kumar, P. (2019); Dey, S. R., & Kumar, P. (2019); Kumar et al. (2019); Dey, S. R., & Kumar, P. (2019); Kumar, P., & Pathak, S. (2018); Kumar, P., & Dwivedi, P. (2018); Kumar, P., & Pathak, S. (2018).

Biofertilizers can fix atmospheric nitrogen (BNF) and helps in formation of growth enhancing substances in plants by increasing solubility of phosphates and potash (Wani *et al*., 2013; Borkar, 2015). N-fixing biofertilizers like rhizobium, are used to add soil nutrients and it is a crop specific inoculants (Table 1).

Table1. Nitrogen fixing rhizobium for different crops

N-fixing Rhizobium	**Crops**
R. trifoli	Berseem
R. melilotti	*Leucerne*
R.phaseoli	Green gram and Black gram
R. lupini	Chickpea

Mazid *et al*., 2011 demonstrated beneficial effects of azotobacter on crop yields upto 10-35% by using the suitable strain. Increase in yield due to Azotobacter reported in many crops cereals, millets and pulses etc.

Azospirillium is also N-fixing microorganism, beneficial for nonleguminous plantsand they also produce growth regulating substances. Azospirillum proved appreciably advantageous in improving yield and yield attributing components and is mainly recommended for crops like for maize, sorghum ,sugarcane, pearl millet etc. Plunging the roots of rice seedlings in 2% Azospirillum inoculants suspension increased the yield by 100 kg/ha (Kennedy *et al*., 2004). Herbspirillum is responsible for fixation of atmospheric N in sugarcane and increasing N availability and the uptake of nitrate, potash, phosphate (Khan *et al*., 2011; Kumar et al.,2018; Kumar, P., & Hemantaranjan, A. (2017); Dwivedi, P., & Prasann, K. (2016). Kumar, P. (2014); Kumar, P. (2013); Kumar et al. (2013); Prasann, K. (2012); Kumar et al. (2011); Kumar et al. (2014).

Acetobacter can fix N and act as plant growth hormones for increasing germination and development of roots in sugarcane. Azolla have ability to fix Nitrogen upto 55 kg per hectare so yield of flooded paddy can be increased by 10-20%. Azolla has symbiotic relationship with blue green algae and can benefir rice (Ghosh, 2004). The PSB (Phosphate

Solublizing Bacteria) can help in improving phosphate uptake by plants and having potential for utilization of deposited rock phosphates. *Bacillus subtilis* and *Thiobacillus thioxidans* can be used as biofertilizers for increasing the availability of zinc in soils as justified by Samoon *et al*., 2010.

Although state and central governments are promoting the use of biofertilizers, there are certain limitations in their use like 1**.**Unawareness of farmer's 2.Marketing constraints 3. Limited resources for synthesis of biofertilzers 4. Seasonal need 5. Inadequate knowledge of staff 6. Lack of stanadrized techniques.

2. CONCLUSION

Sustainable agriculture development is a great challenge for world as it needs increasing productivity with negligible disturbance to ecosystem. Plant growth and development is affected by abiotic and as well as biotic agents. Various activities of microorganisms have the potential to stand against biotic and abiotic stress, while impact depends upon plant species, type of stress, microbes used and their interaction with plant. Bio-fertilizers are the tools and gift to agriculture can act as substitute to conventional fertilizers and part and parcel of organic farming.

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