

EXECUTIVE SUMMARY

1. While the use of chemical has led to a considerable increase in agricultural productivity, it is also a cause of major drain on India's foreign exchange. For example more than 50% of phosphatic fertilizer production in India is based on imported phosphoric acid. India's dependence on imported rock phosphate is even higher, about 95% of the rock phosphate used by fertilizer industry is imported. The use of chemical fertilizers is also a cause of soil deterioration and water pollution.
2. In view of the disadvantages associated with the use of chemical fertilizers, it is important to use alternative sources, which are environment friendly plant nutrients. Biofertilizers, most of which are nitrogen fixing microorganisms, are considered to be suitable alternative source of plant nutrition.
3. Biofertilizers have been focus of increasing attention in recent years. This report deals with the status of technology and production capabilities in the case of following biofertilizers:
 - I) Rhizobium
 - II) Azotobacter
 - III) Azospirillum
 - IV) Blue green algae (BGA)
 - V) Azolla
4. While a number of research centers, agricultural departments and industrial producers have taken interest in biofertilizers, their use in India continues to be limited. Efforts to promote the use of these substances in the past have been hampered by poor and uneven quality. Survey of farmers show that poor quality of biofertilizers is largely responsible for the poor acceptance by users.
5. The poor performance of biofertilizers can be attributed to a) stains which do not survive well in adverse climatic and soil conditions; b) inefficient production technologies resulting in the production of contaminated product with poor nitrogen fixing ability; c) the use of inappropriate carriers, and storage and transport facilities which reduce the shelf life and d) lack of knowledge and understanding among the farmers of the correct procedures for the storage and application of biofertilizers.
6. Gaps exist between India and some of the leading countries in all

areas of biofertilizer production and application technology. These gaps are particularly important in the field of strains, techniques used for sterilization, fermentation, and carriers. The effect of these are aggravated further by poor quality control maintained by most producers. In the circumstance, a significant increase in the level of penetration and demand of biofertilizers is possible only if these gaps are reduced and strict quality control is maintained.

Recommendations

1. There is a considerable amount of duplication in the efforts of various research centres. Better coordination and monitoring of research efforts is necessary to ensure that resources are concentrated on important problems. Systematic evaluation of the performance data on all India basis may be carried out to identify the suitable biofertilizers on which research and production efforts may be concentrated.
2. A number of agricultural departments and universities are engaged in the production of small amounts of biofertilizers. As the resources devoted to these efforts are sub-optimal, they do not result in significant improvement in technology. These activities should be concentrated in a few selected research institutes where adequate resources could be provided.
3. Strains with improved nitrogen fixation capability in Indian environment need to be identified and maintained. Research efforts using genetic manipulation techniques, which can make a significant contribution to the development of such strains needs to be increased.
4. There is a need to identify and develop superior strains. At present only single strains of rhizobium, azotobacter and azospirillum are used. It is necessary that composite strains of these biofertilizers are produced and used.
5. The quality and shelf life of biofertilizers suffer from the use of inappropriate carriers. Research efforts aimed at the development of carriers which are effective and abundant in the country needs to be increased.
6. While a number of research centres are engaged in research on biofertilizers, technologies suitable for large scale production of biofertilizers are yet to be perfected and diffused. Efforts in the direction needs to be accelerated. Production of high quality biofertilizers requires the use of advance sterilization and process engineering techniques and sophisticated controls and equipment.

The high-tech nature of biofertilizer production needs to be fully appreciated. Only then the quality of production can be achieved and maintained.

7. The unsuitable storage and transportation methods used at present are responsible for poor performance of biofertilizers in many instances. As the expenditure required for the setting up and maintenance of these facilities require large capital, the individual producers are unlikely to invest in them. The government may consider setting up these facilities at district level to ensure that the quality of biofertilizer does not deteriorate during storage and transportation.
8. While promotional efforts are important, the success of these efforts will depend on the availability of biofertilizers of high and consistent quality. A system by which the quality is monitored by the central and state level authorities may be devised and enforced.