Revolutionizing Agriculture Through the Dissemination of EM Technology – A Practicable Model Developed in Pakistan

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Abstract

It has been long since a viable alternative to the catastrophic green revolution technologies has become available in the form of EM-Technology. Since the introduction of EM-Technology in Pakistan in 1989, experimentation is going on at research stations and farmers' fields. Further, a model was developed to launch the EM-Technology throughout the country. As a pre-requisite to this model a network of the agricultural scientists was developed. The satisfactory reports needed to launch the EM-Technology on large scale appeared in 1995 after extensive research. Under this network, along with research, other activities like seminars and meetings were held at different institutions to create general awareness among the scientists. Then according to this model, field demonstrations on large scale were carried out, information was given to the government who officially agreed to take up EM-Technology, and a public awareness campaign was initiated through press-media and mass contacts. The major steps in the dissemination of EM-Technology were taken in the beginning of 1996. These include developing methodologies for the use of EM inoculum under different agro-ecological and socio-economic conditions, publishing and distribution of literature, contacts with NGOs and government extension services, founding of Nature Farming Research & Development Foundation (NFRDF), making large infrastructure for EM inoculum preparation, and developing large scale EM supply and technology transfer system. Thus the paradigm shift that Pakistan was looking for, has come about.

Background

The interventions of the 1960s and the green revolution have had a catastrophic effect. The resource base has not been optimally managed resulting in the beneficiaries only being the large farmers. The threat that always worked was that if this model was given up then how would food security be affected?

The increase in soil productivity admittedly is one of the major factors contributing to a substantial increase in agricultural production. While the soils of Pakistan are generally low in organic matter, firstly because of arid climate resulting in rapid degradation of organic matter and secondly because very little organic matter is added to the soils. On an average, the agricultural soils from the wheat growing area of Punjab contain less than one percent organic matter (Azam 1988). Soil productivity can be enhanced through the utilization of mineral fertilizers as well as organic material (Azad and Yousaf, 1982).

Most of the research institutions too, have been investigating the deficiency of different plant nutrients in soil, and crops response to the application of major and micro-nutrients through chemical ferilizers. However, a few studies like that of Hussain et al. (1988, 1995) are in progress to emphasize the integrated use of chemical fertilizers and organic manures.

Such critical circumstances had drawn world attention to the need to explore more intensively all possibilities of increasing agricultural production with less dependency on costly off-farm inputs in an effort to make our agriculture sustainable. Now these fundamental problems have led a number of agricultural scientists to find an alternate low input technology for increasing rice and wheat production, to meet national food demand and to attain self sufficiency.

Nature farming is a system of practicing agricultural production without interrupting the natural ecosystem and without the use of chemical fertilizers and other agricultural chemicals. The aim is to utilize the natural ecosystem of the regional environment in order to ensure pollution free food products, to conserve energy, to reduce production costs, to make the use of resources and revitalize

agriculture especially on small to average farms. Research efforts have been made by different workers (Higa and Wididana 1991) to increase crop yield by enriching soil fertility through EM technology. In this nature farming technique, addition of EMs such as photosynthetic bacteria, ray fungi, filamentous fungi and yeast to the soil in order to stimulate decomposition of crop residues, manures, composts, industrial wastes and thus make the fixed nutrients available to the plants. Nature farming which is a system of organic recycling seems to have good prospects of satisfying the following.

- To avoid or largely exclude the use of synthetic agricultural chemicals, especially fertilizer and pesticide.
- To enhance environmental quality and production of the natural resources base.
- To improve the productivity and profitability of small farmers and long-term sustainability of their farming system.
- To optimize the use of on-farm resources and minimize the dependence of farmers on purchased inputs, especially fertilizers and pesticides.
- To enhance the safety and nutritional quality of food.

It has been a long time since a viable alternative has become available in the form of EM-Technology. Included in this promise is the utilization of sugar waste material estimated at nearly 2 million tons, poultry manure which is nearly half a million tons and increasing by 10 to 15 percent every year. Besides, being environment friendly it is also converting agro-residues into useful productive organic material.

The paradigm shift that Pakistan was looking for, has come about. The change would be not only in the productive sector but for an ability to think organically, and to consider this technology as a forerunner of many more such activities.

In Pakistan, the research on EM-Technology has been underway since 1990 which showed very good prospects of this technology in crop production (Rashid et al., 1994; Islam et al., 1994; Akhtar et al., 1996; Hussain et al., 1996). Encouraged from these results, it was decided in 1996 to introduce the EM-Technology among the farmers so that the country could be benefited from the need for the import of chemical fertilizers and food commodities.

Methodologies of the Model

For the dissemination of EM-Technology among the farmers, action oriented strategies were planned, and then practiced under the existing infrastructure of farming and marketing in the country. Based on the experience, the successful strategies were pooled to develop a technology transfer/EM-Technology dissemination model workable in Pakistan, and perhaps anywhere else in the world with slight changes.

The pre-happening of this model was an experiment on rice-wheat production with EM under the APNAN (Asia-Pacific Natural Agriculture Network) research grant starting in 1990 for three years. This experiment created further interest among the scientists and inspired for further experimentation in Pakistan. Thus, just after one year, in 1991 the concepts and strategies were thought to develop a dissemination model for EM-Technology. The main features of this model in chronological order are as follows:

1. Preliminary Research

After two years (in 1992) by having the positive results from APNAN experiment on rice-wheat, a few other experiments were designed and conducted on the decomposition of organic materials, growing cotton-wheat and vegetables with and without EM, at University of Agriculture, Faisalabad.

2. Scientists Network

Further, in 1992 a network of scientists from all over the country was developed to conduct extensive research on EM-Technology. This was named as “Natural Agriculture Research and Development Network (NARDN)”. More than forty scientists were included in this network most of whom started doing experiments on different aspects of EM-Technology.

3. Publication and Presentation of Results

The results of preliminary studies were presented at various national and international scientific forums, and papers were also submitted for publication in scientific journals.

4. Publication of Technical Literature

To create more awareness within the scientists and technical personnels, available information on EM-Technology was complied in the form of small books/manuals/research reports. In addition, comprehensive information was also published in the form of small booklets, pamphlets, and newsletter/newspaper articles in local language (Urdu). This practice is still in progress.

5. Establishment of NFRC

During the first visit of Prof. Dr. Teruo Higa to Pakistan in 1992, a comprehensive proposal was submitted to APNAN/INFRC through him for the establishment of an autonomous type Nature Farming Research Centre (NFRC) at University of Agriculture, Faisalabad (UAF) in Pakistan. This proposal was approved, and the NFRC came into being and commenced work on July 1, 1993. Almost all the activities of EM-Technology research and development came under NFRC. Attached to NFRC, an agricultural farm was also established to conduct field experiments and demonstrations on EM-Technology.

6. Holding of Seminars

A series of national level annual seminars was started in 1993, in which scientists from all over the country present their research results of EM-Technology experiments. Proceedings of these seminars are published regularly, and distributed to many other scientists and institutions. Occasional seminars are delivered by the NFRC staff as well as Japanese counterparts at different institutions to let the participants understand the concepts and theories of EM-Technology. In addition to this, speeches are made in the farmers gatherings/meetings to teach them about the use of EM for crop and livestock production.

7. Farmers Field Demonstrations

Since 1994, on a very large scale, on-farm EM-Technology demonstrations were started at farmers fields on different crops and forest plantations like bamboo and poplar etc. This practice is still in progress in a multiple manner.

8. Inclusion in National Research Agenda

After the above mentioned preliminary achievements, the Government of Pakistan felt that EM-Technology is a viable technology and there is a need to explore its many other aspects at wider scale through further research. Therefore, upto 1995 it became a prominent feature in the research agenda of leading research institutions.

9. Government Agreement

In 1996, their Excellencies, the President, and the Prime Minister of Pakistan paid their attention for the large scale adoption of EM-Technology in the country. As a result an agreement was signed by the Government of Pakistan, and the INFRC/APNAN/EMRO, Japan to have a close cooperation for the dissemination of technology, and manufacture /supply of EM on large scale.

10. Bank Loans

In 1996, Prime Minister of Pakistan issued a special directive to Agriculture Development bank of Pakistan (ADBP) to tag the agricultural production loans with the acquisition of EM-Technology. However, this condition was relaxed by the request of NFRC as EM could not be supplied to all the farmers due to limited manufacturing facility.

11. Founding of NFRDF

In 1994, a farmers' welfare NGO named as Nature Farming Research & Development Foundation (NFRDF) was established to facilitate the relation between farmers and NFRC.

12. Technology Transfer Program

In the beginning of 1996, an extensive program was designed to cover the Province of Punjab which is the largest agricultural province in Pakistan. For this purpose Department of Agriculture (Extension) extended their cooperation for holding farmers' meetings, conduct field demonstrations and farmers' trainings. Various farmers' NGOs also got involved in this EM-Technology Transfer

program. All this activity was handled by NFRDF which employed many Technology Transfer Officers (TTO), and developed a facility for large scale production of EM in collaboration with EMRO, Japan.

13. Establishment of NFRDCs

For the large scale testing of EM-Technology under different agro-ecological conditions of the country, it has been planned to establish one Nature Farming Research & Development Centre (NFRDC) in each province. The first one is already established as NFRC in Punjab, while the second one has also been established in Sindh Agricultural University, Tando Jam, in the Sindh province, which is funded by NFRDF.

Results and Achievements

As a result of above enlisted activities, there has been a significant positive response from the farmers towards the acceptance of EM-Technology. Further, the scientists from the disciplines of agriculture, livestock production, and environment have become more attracted towards this technology. A brief description of the outcome of the activities of above mentioned model follows;

Government Agencies Involved

In the research and extension work of EM-Technology, the following eighteen government agencies were associated.

- Nature Farming Research Centre (NFRC), University of Agriculture, Faisalabad.
- Nature Farming Research and Development Foundation (NFRDF), Faisalabad.
- Ayub Agricultural Research Institute (AARI), Faisalabad
- Punjab University, Lahore.
- Rice Research Institute, Kala Shah Kaku
- Cotton Research Institute (CRI), Multan
- National Agricultural Research Centre (NARC), Islamabad.
- University of Arid Agriculture, Ravalpindi
- Department of Agriculture (Extension, Adaptive Research), Punjab
- Department of Agriculture (Water Management), Punjab
- Department of Agriculture (Plant Protection), Punjab
- Nature Farming Research and Development Centre, Sindh Agricultural University, Tandojam (Sindh)
- Agriculture Research Institue, Tandojam (Sindh)
- Rice Research Institute, Dokari, Karkana (Sindh)
- Quaid-e-Awam Agriculture Research Institute, Karkana (Sindh)
- NWFP Agricultural University, Peshawar (NWFP)
- Agriculture College Rawalkot, Muzaffarabad (AJK)
- Agricultural Research Centre, Seriab, Quetta

Involvement of NGOs

On volunteer basis, fifteen farmers' NGOs identified below are working for the dissemination of EM-Technology in their respective regions.

Punjab

- Pakistan Organic Farmers Association (POFA), Lahore.
- Kissan Board Pakistan, Lahore
- Bamboo Growers Association, Lahore
- Jadeed Ziraat Society of Pakistan, Lahore
- Farmers Associate Pakistan (FAP), Lahore
- Caritas Pakistan, Faisalabad
- Church of Pakistan, Faisalabad
- Punjab Cooperative Fruit Development Board, Faisalabad
- Village Friends Organization, Mian Channu

- Pakistan Farmers Forum, Main Channu
- Potato, Vegetables & Fruit Growers Cooperative Society, Okara
- Universal Associates, Layyah

Sindh

- Pakistan Horticultural Society, Karachi
- Orangi Pilot Project, Karachi
- Sindh Rural Women Uplift Group, Hyderabad

Large-scale Production of EM

By keeping in view the increased demand of the farmers for EM, the NFRDF, Pakistan with the help of INFRC/APNAN/EMRO, Japan developed the facility for a monthly production of about 1.0 million tons of EM inoculum which would be sufficient to be applied over about 0.5 million acres of cropping on regular basis.

Development of Technical Information

The following books/research reports were published during the period. In addition, a number of research papers were published, and booklets on use of EM-Technology in Urdu language were developed for the farmers.

- Principles of Nature Farming with Effective Microorganisms
- EM-Technology : Ecological Concepts and practices in nature Farming
- Applied EM-Technology
- Proceedings of First National Seminar on Nature Farming
- Proceedings of Second National Seminar on Nature Farming
- Sustainable Rice-Wheat Production through Organic Amendments and Effective Microorganisms (EM)
- Integration of Organic and Mineral Sources of Nutrients along with EM Inoculum for Sustainable Rice Wheat Production

Developments in EM Application Methodologies

Based on the requirement of agro-ecological conditions in various regions of Pakistan, some new methodologies were designed for EM application to the crops. This includes :

- Making extended (20 times) EM by the farmers
- Making EM compost (Bokashi) and its application methods
- Spraying crops with EM
- Drip and Sprinkler irrigation with EM water
- Seed treatment with EM
- Cattle-shed-manure treatment with EM
- Designing of EM-Fermenter for higher efficiency of organic amendments and EM inoculum. The design of a simple EM fermenter and a super fermenter is available

Area Covered

At present, out of 34 districts of Punjab province, in 16 districts the arrangements for the supply of EM to the farmers' had been made. In five districts, the Technology Transfer Officers (TTs) have also been appointed to provide the farmers' technical guidance for the use of EM on crops and in livestock. Currently, about 30,000 acres are being cultivated by using EM-Technology, and a number of poultry and dairy farmers are also using EM. In addition many large scale farmers in Sindh province are using EM-Technology.

The following sketch shows the EM-Technology dissemination program in the Punjab province to be covered in three phases. Until now the first two phases have been covered, and in the third phase area, still the progress is in the preliminary stage, and expected to be covered fully within next one year.

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