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From the desk of Chief Editor.....

National Centre of Organic Farming, Ghaziabad and its six Regional Centres at Bangalore, Bhubaneshwar, Panchkula, Imphal, Jabalpur and Nagpur are presently playing major role in implementing the objectives of National Project on Organic Farming in India. As the present Indian agriculture production is declining due to non judicious use of synthetic fertilizers and chemicals. The soil organic carbon content of soil has reached critically low level in Indian soil. It is essential to improve the organic matter content in soil to improve soil carbon contents and other minerals required for high crop production. The organic farming restricts the use of synthetic chemicals and fertilizers for crop production. Thus use of organic products like biofertiliser, farm yard manure, compost, vemicompost and other organic input application to soil are recommended. Increasing soil organic carbon and soil fertility is primary concern. Application of biofertiliser like nitrogen fixing organisms, phosphorus solubilizing bacteria, potassium mobilizers, sulphur mobilizers and waste decomposers is not only increase soil health, fertility status but also promote crop growth by suppressing disease pathogens. Biofertiliser have a great potential in improving soil health conditions and sustainable agricultural production. Presently in the market solid and liquid carrier based different biofertlizer formulation products are available. The biofertiliser may consist of individual or consortia based formulations. The solid carrier based biofertilisers formulations are produced by using peat, lignite, charcoal etc., The greatest constraint of solid carrier based biofertiliser is short shelf life of microbial inoculums. Presently the liquid formulations of biofertiliser have been developed by various institute and organizations are gaining more importance due to long shelf life and high population. Increase in crop growth and production is observed when applied these biofertiliser through seed or irrigation or soil application. It has been scientifically proven application of biofertiliser to soil has a beneficial to both crop plants and soil. Thus understanding the beneficial effects of biofertiliser microbial inoculants on different crops, identification of new fast growing strains, formulations of novel biofertiliser, and its application is subject of curiosity around the world. The total production of biofertiliser in India is reached upto 46836.82MT in 2012-13, which cover around 10% of land. Thus government of India is making serious efforts to fill this gap by introducing new schemes and policies. Thus in this biofertiliser news letter issue NCOF, Ghaziabad put effort to give details of various government supporting schemes and ongoing research in the field of biofertiliser. I wish this edition will helpful to the researcher, scientists, administrators, farmers, industrialist and other publics to understand the importance of biofertiliser agriculture and efficient utilization of government supported schemes for strengthening biofertiliser production, its application and promote sustainable agriculture production.

Dr. Krishan Chandra

Letters to the Editor

Welcome readers –now you have opportunity to participate and be interactive with this publication.

All the times the readers are made to read whatever is published and there is no way to understand the level of satisfaction the readers come to attain after going through its contents on publication of an issue. We think that reader's views are quite important to consider. The news / information being disseminated through this publication should have a reflection from the readers to complete the process of communication and to enable the readers to communicate if they expect any special reference or material. The choice of the readers should always be kept in mind while making efforts to give latest news / information on the subject. Thus to make it interactive, more informative and readers friendly we think that creating this column is quite important.

We welcome the communication from our valued readers for this column. The communication may contain views of readers on importance of material published and its extent of advantages to them beside the material they think to be given consideration for publication in the issue. The feedback so received from the readers would not only be accommodated in this column but also it would be considered to assess it if found significant to further improve the quality of material to be published. The communication may also be information about a particular event, news or literature on biofertiliser in the locality of the readers which could turn advantageous to other readers. Thus an interaction could be established among the readers through this publication. This would also inspire the others readers to be interactive and share their views / information and news which we think would ultimately benefit the all the stake holders including farmers.

With this we again welcome the letters from the readers addressed to the editor. The readers must write their complete name and communication address, mobile no. and e-mail IDs while making communication with us for this column.

Promotion of Organic Farming through New Organic Inputs

National Centre of Organic Farming (NCOF) involved in promotion of organic farming through technical capacity building of stakeholders, technology development, transfer of technology, promotion & production of quality organic and biological inputs, awareness creation & publicity, quality control requirements of bio-fertilizers & organic fertilizers including revision of standards & testing protocols, organic input resource management and market development. The farmer's producer companies may be set up to grow organic products. These farmers can come from a group of villages, preferably contiguous, forming a cluster and should be supported to achieve organic certification over a period of three years. These producer companies should be given financial support as per provisions for FPOs and subsidies for eligible components, under National Mission on Sustainable Agriculture (NMSA) for marketing of the organic product so that it fetches better prices and encourages others to take up organic farming. Marketing Federations existing at the state level should enter into agreement with the producer companies to market their organic product in the niche markets.

The various Components under the Integrated Nutrient Management & Organic Farming are listed below:

1. Setting up of mechanized fruit / vegetable market waste / agro waste compost production unit.
2. Setting up of State of art liquid / carrier based biofertiliser / biopesticide units
3. Setting up of bio-fertilizer and organic fertilizer testing quality control laboratory (BOQCL)
4. Strengthening of existing biofertiliser and organic fertilizer testing / quality Control laboratory (BOQCL) under Fertlizer Control Order (FCO)
5. Promotion of organic inputs on farmer's field (Manure, Vermi-compost, Bio-Fertilizers Liquid / solid, Waste compost, Herbal extracts etc.)
6. Adoption of organic farming through cluster approach under Participatory Guarantee System (PGS) certification.
7. Support to PGS system for on-line data management and residue analysis
8. Organic Village adoption for manure management and biological nitrogen harvesting
9. Support to research for development of organic package of practices specific to state and cropping system
10. Setting up of separate organic agriculture research and teaching department
11. Supporting NCOF in discharging of its functions

Project Sanctioning System

The State Governments will prepare proposals related to Soil Health Management (SHM) Intervention and furnish to Integrated Nutrient management (INM), Division of Department of Agriculture & Cooperation, Government of India. A project Sanctioning Committee(PSC) chaired by Joint Secretary (INM), with representation from ICAR, NCOF, CFQTI, IFD , NRM and Crops Division will analyze and approve projects so received.

Fund Flow Mechanism:

Consequent to approval of project, funds will be released to State Designated Agency notified by the State. State Level Implementing Agency would ensure implementation in a time bound manner. Funds will be released based on progress report, submission of utilization certificates of earlier sanctioned projects, specific emergent need etc.

Monitoring and Evaluation

1. At State level, process of implementation will be monitored by State Standing Technical Committee (SSTC) and State Mission for Sustainable Agriculture (SMSA) / State Level Committee (SLC). At National level, Intervention on SHM will be monitored by INM division. Web-based monitoring, video conferencing, desk reviews, field visits, and evaluation of programme implementation will be followed for effective monitoring. State Government may also undertake concurrent evaluation during implementation period to facilitate mid course corrections, if, any.
2. States will ensure submission of detailed Quarterly Progress Reports (QPR) by 10th of first month of next quarter. Similarly, detailed Annual Progress Report (APR) should be sent to Department of Agriculture & Cooperation, Ministry of Agriculture within three months, after closure of financial year.
3. At field or village level, Panchayats will be involved in overseeing day to day process of implementation. At district level, monitoring will be undertaken by Joint Director / Deputy Director Agriculture in collaboration with respective Zilla Panchayat Raj Institutions.
4. At cluster / village level, details of approved programme, all activities undertaken, name of beneficiaries, expenditure incurred etc. may be displayed at the Panchayat Bhavan / prominent public place in the locality.

Human resource development through trainings by NCOF and its Six RCOFs

1. **International Trainers' training / cooperation and liaison with international bodies:**

This being an exclusively new field with practically little expertise in the country, training of officers from DAC, NCOF, State agencies (involved with organic agriculture implementation programme), certification agencies and scientists from ICAR and SAUs (working for development of organic package of practices since last 3 years) are required to be given and international exposure. This also includes the need based visit of foreign experts to India and Indian executive officers/technical experts to different countries to create awareness about Indian organic produce, attend seminar/conferences, participate in exhibitions and develop liaison with international bodies on organic agriculture. Visit by select group of officers from DAC and NCOF to BioFach, Nuremberg and other such events, can also be useful in learning international trends in organic agriculture.

2. Certificate Courses

a. **Certificate Course on organic farming:** To create first generation organic agriculture extension workers and field workers in the field of organic farming and to create a rural force of soil testing entrepreneurs through rapid soil testing kits it is propose to conduct one month certificate courses on organic production practices, on farm input management, certification process (third party and PGS both), documentation, post harvest processing, storage and marketing. The course will be open for rural youth having Degree/Diploma in agriculture/Science with Biology, SAUs / Educational institutes can also sponsor their undergraduate students for such courses. Ten such courses (2 per year) will be organized at NCOF, Ghaziabad.

b. **Training / Refresher course on production and quality control of organic inputs:** To update the analytical skills, sample collection and handling requirements of State Government officers/personnel from organic inputs production units on quality analysis requirement as pr FCO for biofertiliser and organic fertilizers and to transfer appropriate production technology to personals associated with the production of organic and biological inputs, **10 days** training/refresher courses are proposed.

c. **Trainers trainings:** To create a cadre of organic agriculture trainers it is propose to organize **five days** customized trainers training courses for Fertilizer

inspectors, Senior level extension officers, KVK trainers, NGO trainers, PGS Regional Council members and technical staff of production and quality control units etc. on FCO, certification systems, PGS operational strategy, organic management, production and quality control of organic inputs.

d. **Training of Field Functionaries/ Extension Officers on Organic Farming, PGS-India programme, soil health management and for input dealers on quality control**: As organic farming and sustainable soil health management practices are primarily on-farm management practices, to disseminate appropriate management protocols to field functionaries and extension officers, working in both Government and NGO sector, two days training courses are proposed.

Components to be implemented by NABARD : Support and Encourage production and use of organic inputs for nutrient mobilization and plant protection through Capital Investment Subsidy for Setting up of Commercial Input Production Units.

1. **Setting up of mechanized Fruit/Vegetable Market/Agro Waste Compost production unit (100 TPD capacity) –** For establishment of large mechanized compost plants by State Government/APMCs/ Municipalies /other public sector enterprise / fertilizer companies / private industries / private entrepreneur / individual etc. for fruit and vegetable waste/agro waste compost unit under PPP or otherwise mode. Model project outlay of each unit is proposed for Rs.190.00 lakh. 100% assistance will be provided to State Govt / Govt Agencies upto a maximum limit of Rs 190 lakh / unit and for individuals /private agencies in the form of Capital Investment Subsidy @ 33% of total financial outlay (TFO) limited to Rs.63 lakh as Credit linked back ended subsidy through NABARD. Details in respects of Model financial Outlay are given at Annexure-IV.

2. **Setting up of State of art liquid/carrier based Bio-fertilizer / Biopesticide Production Units (200 TPA Capacity)** – For establishment of state of the art sterile liquid/carrier based 200 TPA biofertiliser and microbial Biopesticides production units by State Government/APMCs/Municipalities/other public sector enterprise/fertilizer companies/private industries/private entrepreneur/individual etc. under PPP or otherwise mode. Model project outlay of each unit is proposed for Rs.175.00 lakh. 100% Assistance will be provided to State Govt. / Govt Agencies upto a maximum limit of Rs 160 lakh / unit and for individuals / private agencies in the form of Capital Investment Subsidy @ 25% of total financial outlay (TFO) or Rs.40 lakh whichever is less as credit linked back ended subsidy through NABARD.

3. Setting up of mechanized Fruit/Vegetable Market/Agro Waste Compost production unit (100 TPD capacity).

4. Setting up of State of art liquid / carrier based Bio-fertilizer / Biopesticide Production Units (200 TPA Capacity).

Components to be implemented by State Govts. / ICAR / SAUs etc.

1. Setting up of Biofertiliser and Organic Fertilizer Testing/Quality Control Laboratory (BOQCL) under FCO
2. Strengthening of existing Biofertiliser and Organic Fertilizer Testing/Quality Control Laboratory (BOQCL) under FCO
3. Support to PGS system for on-line data management an residue
4. Organic Village adoption for manure management and biological nitrogen harvesting
5. Support to research for development of organic package of practices specific to state and cropping system
6. Setting up of separate Organic Agriculture Research and Teaching Department

7. Promotion of Organic Inputs on farmer's field (Manure, Vermi-compost, Bio-Fertilizers Liquid / solid, Waste compost, Herbal extracts etc.)
8. Adoption of organic farming through cluster approach under Participatory Guarantee System (PGS) certification
9. Field demonstrations-cum field days.
10. Capacity building and operationalization of PGS-India programme
11. Training / Refresher Course on Production and Quality Control of Organic Inputs.
12. Training for field functionaries and extension staff.

List of various schemes and pattern of assistance under Organic & INM of SHM under NMSA

Sl. No.	Component	Pattern of assistance
1	Setting up of mechanized Fruit/Vegetable market waste/ Agro waste compost production unit.	100% Assistance to State Govt/Govt. Agencies upto a maximum limit of Rs. 190.00 lakh /unit and 33% of cost limited to Rs. 63 lakh/unit for individuals/ private agencies through NABARD as capital investment for 3000 TPA production capacity
2	Setting up of State of art liquid/ carrier based Biofertiliser/ Biopesticide units	100% Assistance to State Govt/Govt. Agencies upto a maximum limit of Rs. 160.00 lakh /unit and 25% of cost limited to Rs. 40 lakh/unit for individuals/ private agencies through NABARD as capital investment of 200 TPA production capacity
3	Setting up of Bio-fertilizer and Organic fertilizer testing Quality Control Laboratory (BOQCL) or Strengthening of existing Laboratory under FCO.	Assistance up to maximum limit of Rs. 85 lakh for new laboratory and up to a maximum limit of Rs. 45 lakh for strengthening of existing infrastructure to State Government Laboratory under Agriculture or Horticulture Department.
4	Promotion of Organic Inputs on farmer's field (Manure, Vermi-compost, Bio-Fertilizers Liquid / solid, Waste compost, Herbal extracts etc.)	50 % of cost subject to a limit of Rs. 5000/- per ha and Rs. 10,000 per beneficiary. Propose to cover 1 million ha area.
5	Adoption of organic farming through cluster approach under Participatory Guarantee System (PGS) certification.	Rs. 20,000/- per ha subject to maximum of Rs. 40,000/- per beneficiary for 3 year term.
6	Support to PGS system for on-line data management and residue analysis	Rs. 200 per farmer subject to maximum of Rs. 5000/- per group/year restricted to Rs. 1.00 lakh per Regional Council. Up to Rs. 10, 000/- per sample for residue testing (Residue analysis to be done in NABL Labs).
7	Organic Village adoption for manure management and biological nitrogen harvesting	Rs. 10 lakhs/village for adoption of integrated manure management, planting of fertilizer trees on bunds and promotion of legume intercropping through groups/ SHGs etc. (Maximum 10 village per annum/State will be supported).

8	Training and demonstration on Organic Farming	Capacity building of stakeholders on organic farming, Participatory Guarantee System (PGS), quality control of organic input etc. Rs. 20,000/- per demonstration for a group of 50 participants or more
9	Support to research for development of organic package of practices specific to state and cropping system	Against specific proposal
10	Setting up of separate Organic Agriculture Research and Teaching Department	Against specific proposal

List of Equipments and Plant and Machinery for Setting up New Biofertiliser and organic fertilizer (organic manures) Quality Control Laboratory for Capacity of 1000 samples / year (Essential equipments, for strain maintenance and quality control glassware, plastic ware etc (Rs. lakh)

Sl. No.	Item	Quantity required (No)	Rate (Lakh Rs.)	Amount (Lakh Rs.)
1	Vertical Autoclave 600x350 mm	2	0.8	1.600
2	Hot air Oven 24x24x24”	2	0.6	1.200
3	Refrigerator 300 lit	1	0.3	0.300
4	BOD Incubator 290 lit	2	1.2	2.400
5	Laminar air flow work station , working table size 3' x 2'	2	1.5	3.000
6	Rotary shaker (capable of holding 25no., flasks of 100-500 ml capacity)	2	1.25	2.500
7	Binocular research microscope with phase contrast attachment (MOST IMPORTANT) having turret condenser and matching phase objectives of 10x, 40x and 100x magnification, 10x wide field eye pieces and telescopic centering eyepiece.	1	2.20	2.200
8	pH Meter(Micro Processor based) and conductivity meter	1 each	0.3	0.600
9	Small oil free air compressor	2	0.5	1.000
10	Airconditioners 1.5 ton split type	4	0.3	1.200
11	Miscelleneousequipments and tools such as colony counter, balances, microliter pipettes/Deionizer etc	-	LS	4.000
12	Glassware and plastic ware aids	-	LS	2.500
13	Centrifuge 15,000 rpm	1	1.50	1.50
14	ICP	1	30	30.00
15	Auto N-Analyzer	1	10	10.00
16	Moisture analyzer	1	2.0	2.0
17.	Chemicals etc	LS	-	2.50
18	Assistance for hired manpower on contract	LS	-	10.00
19	Computer with appropriate software	1	1.50	1.500
20	Contigencies	LS	-	5.000
	Total for A			**85.00**

For strengthening of existing BOQCL assistance shall be limited to Rs. 45.00 lakh. Any of the equipments mentioned above shall be the admissible items for strengthening.

List of Equipments and project outlay for 200 MT / annum or 50,000 Liters Per Annum (LPA) production capacity bio-fertilizer/ bio-pesticide units (Rs. lakh)

Sl. No.	Item	Quantity required (No)	Rate (Lakh Rs.)	Amount (Lakh Rs.)
1	Vertical Autoclave 600x350 mm	2	0.8	1.600
2	Hot air Oven 24x24x24”	1	0.3	0.300
3	Refrigerator 300 lit	2	0.3	0.600
4	BOD Incubator 290 lit	2	1.2	2.400
5	Laminar air flow work station , working table size 3' x 2'	2	1.5	3.000
6	Rotary shaker (capable of holding 25no., flasks of 100-500 ml capacity)	2	1.25	2.500
7	Binocular research microscope with phase contrast attachment (MOST IMPORTANT) having turret condenser and matching phase objectives of 10x, 40x and 100x magnification, 10x wide field eye pieces and telescopic centering eyepiece.	1	2	2.000
8	pH Meter(Micro Processor based)	1	0.3	0.300
9	Small oil free air compressor	2	0.5	1.000
10	Airconditioners 1.5 ton split type	4	0.3	1.200
11	Miscelleneousequipments and tools such as colony counter, balances, microliter pipettes etc	-	LS	2.500
12	Glassware and plastic ware aids	-	LS	2.200
13	Centrifuge	1	0.5	0.50
14	Deep Freeze – 300 lit capacity (For culture storage or culture Bank)	1	0.4	0.400
			Total for A	**21.00**
B. Fermentation and biomass up-scaling equipments and machines				
1	Mother culture glass vessels/ fermenters 1-2 lit cap.	30	0.05	1.500
2	Stainless steel seed fermenters 50 lit cap., aerated, stirred type with auto pH, aeration and temperature control	4	4.0	16.000
3	Stainless steel fermenters, aerated, stirred type, with auto pH, aeration and temperature control. Total vessel cap 750 lit and working cap. 500 lit.	3	10.0	30.000
4	Air compressor oil free type, 2,000 lit air/min cap with moisture cum oil trap and filters	2	2.0	4.000
5	Chiller 1 ton cap	2	2.0	4.000
6	Automatic steam generator 100 kg cap.	1	6.5	6.500
7	Fittings, pipe lines, filters, miscellaneous items		LS	3.000
	Total for B			**65.000**
C. Product handling, packaging equipments and machines and storage equipments				
1	Autoclave Horizontal 2x2x4 ft chamber size	1	6.0	6.00
2	Automatic bottle filling machine with necessary conveyor system and laminar air-flow provision at filling chamber	1	13.5	13.500
3	Capping and labeling machines and miscellaneous items	1	5.0	5.000
4	Miscellaneous fittings, electrical installation, other tools and equipments		LS	3.000
5	Air conditioners for storage	4	0.5	2.000
6	Peddal Mixer or Ribbon Blender	1	0.5	0.500
7	Generator (DG Set of 65 KVA)	1	4.0	9.000
			Total for C	**39.00**
			Grand total for A+B+C	**125.00**
Grant in aid for 200MT/annum production capacity 176.00 lakh				

Project Outlay – Model Project on 200 TPA / Shift Bio-fertiliser Unit. (Rs.lakh)

Sl. No.	Particulars	Quantity	Rate (Lakh Rs.)	Amount (Lakh Rs.)
Land and Building				
1	Cost of Land	2000 sq.mt.	0	0
2	Land Levelling	Lumpsum	Lumpsum	1.000
3	Fencing and Compound Wall and Gates	Lumpsum	Lumpsum	5.000
4	Civil Structure	5,000 sqft	600/sqft	30.000
	Sub Total			**36.000**
Plant, Machinery and Equipments				
5	**As per Annexure I**			**125.00**
Other expenses capitalised				
6	Interest during gestation/ construction period and first year expenses capitalised		Lumpsum	5.0
14	Margin money for working capital			5.0
15	Preliminary and Pre-op. Expenses		Lumpsum	5.0
16	Total Project outlay			176.00
Say				**176.00**

Brief communication

Screening of Efficient Nitrogen Fixing Organisms

Krishan Chandra, Srinivasamurthy R and Majumdar, P
National Centre of Organic Farming

Presently different strains of biofertiliser formulations are available in the market. Production of quality of biofertiliser and its efficacy depends on the type of microbial strain used. Several research institutes and companies are utilizing their own strains in the preparation of biofertiliser and marketing technology in their own brand name. Many small scale industries who were not having R&D facility obtain microbial strain from research institutes / microbial collection centers for formulations of biofertiliser. Many times in industry due to contamination often they tend to lose original / pure strains. They procure pure strains form its original source or microbial collection centers. National Centre of Organic Farming (NCOF) is one of the major nationally recognized institute, which play important role in promoting organic production in the country. The institute is a nodal agency for quality control of biofertiliser, maintenance of organic strain collection Bank and including new biofertiliser strains in strain collection Bank. A total of 625 microbial strain distributed in the year 2012-13. The centre is having laboratory facility for quality testing of biofertiliser and other organic inputs. The efficiency of biofertiliser strains to form nodules and nitrogen fixation is also a routinely evaluated at NCOF.

The chickpea (*Cicer arietinum*) is one of the most cultivated leguminous pulse crop in India. The largest consumer and producer of chickpea in the world is India and it accounts for 64% global chickpea production. The highest production of chickpea was recorded 8567.8 thousand tones in the year 2012-13. chickpea is a leguminous crop and harvest atmospheric nitrogen through root nodules. The nodules of the crop is formed by infection of specific group of *Rhzobium* spp (Gaur and Sen,1979). Chikpea is infected by unique specific group of nodules forming rhziobial strains and fix atmospheric nitrogen. (Gaur and Sen, 1979). The cultivation of chickpea has beneficial effect on soil fertility. Incorporation of plant biomass to soil enriches nitrogen content of soil. The Rhizobium strains depending upon the growth time mainly grouped as fast grower strains, *R. loti* (Crow et al., 1981), moderate grower *Mesorhizobium* spp (Javris et al, 1997) and slow grower *Bradyrhizobium* spp (Jordon., 1982, 1984). The major two types of chickpea infecting rhizobial strains are *Rhizobium ciceri and Rhizobium mediterraneum,* classified based on generation times of bacteria, which were later transferred to the *Mesorhizobium* genus (Jarvis et al., 1997). Even through it has been described unique groups of bacteria infect the chickpea, However, there are many reports of heterogeneity on rhizobial isolates of chickpea. Matalaah et al 2002 reported different types of molecular phenotypic diversity of chickpea and also chickpea can also be nodulated by Rhizobium of the Sinorhizobium genus. The interaction of bacteria is highly crop specific. Thus selection of highly efficient nodulating bacteria of specific strain is most important. The yield of crop varies depending on the level of nitrogen fixation by inoculates and its competence. The rhizobium strains differ in their nitrogen fixing ability and capacity to infect the individual crop plants. The efficiency of strain infection also affect by host cultivar. Most of research worker have reported the role of slow growing rhizobium association with chickpea and its abundance in soil. Whereas in India, study on fast growing rhizobial strains association with chickpea is limited. Thus, it requires more attention to find fast growing rhizobial strain for improving crop growth and yield of chickpea. Fast growing efficient rhizobial strains are more preferable commercial production of biofertiliser.

In routine screening, fast growing efficient Rhizobium strains nodulating chickpea has

been isolated at NCOF. Presently these strains were under evaluation for efficient nodulation and nitrogen fixation under *in vitro* pot culture assay.

Jamila Maatallah, El Bekkay Berrho*, Juan Sanjuan, Carmen Lluch, Phenotypic characterization of rhizobia isolated from chickpea (*Cicer arietinum*) growing in Moroccan soils, Agronomie 22 (2002) 321–329

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Current Research and Developments in Biofertiliser

INFLUENCE OF PHOSPHATE SOLUBILIZING AND POTASSIUM MOBILIZING STRAINS ON GROWTH AND YIELD OF TOMATO.

Agriculture is main occupation in Mayanmar. The poor farm management and use of non judicious synthetic chemical fertilizer has deteriorated soil health condition. Soil is not able to support for better crop growth and production. To overcome these problems in Mandalay Technological University, Myanmar a study was conducted to use microbial agents as an alternative for chemical fertilizer. Tin et al., (2013) screened few microbial strains for efficient phosphate solubilizing and potassium decomposing microbial agents. The phosphorus solubilizing agents identified as a *Bacillus spp* and Potassium decomposing as a *Pseudomonas* spp. It is reported phosphorus solubilization ranging from 192 to 386ppm under *in vitro* conditions. The strain designated as Ps recorded high phosphate solubilizing ability (386ppm). Potassium mobilizing activity was range from 1.12 to 8.45 ppm. The high (8.45ppm) potassium decomposing activity was reported by strain Y. These strains were evaluated for its influence on growth and yield of tomato crop plants. Among the different treatment studied, treatment inoculated with consortia of microbial strain consisting of phosphorus solubilization and potassium decomposing strains shown highest total tomato yield (48.95 Kg) at 120 days after sowing. While application of chemical fertilizer alone recorded 35.47 kg tomato total yield. The experiment clearly indicated that application of biological inputs to soil has increased crop yield than application of chemical fertilizer.
(Source: International Journal of Innovation and Applied Studies. 3(4): 959-966, 2013.)

INFLUENCE OF PHOSPHATE DISSOLVING MICROORGANISMS ON YIELD AND P UPTAKE IN CROP PLANTS.

Phosphorus present in soil as both organic and inorganic form. Most of the phosphorus is in the insoluble inorganic from. The phosphorus solubilizing microorganisms bring solubilization of insoluble inorganic phosphate to water soluble inorganic phosphates which are available to plant. There are different types of microorganisms show phosphate solubilization by different mechanisms. It is essential to understand the ecology of microorganisms in the specific area and crop to select and isolate strong efficient strain, which upon inoculation increase crop growth and yield. Pingale and Virkar (2013) isolated bacteria (*Pseudomonas* spp, *Bacillus* spp) and Fungi (*Penicillium lilacium*) having phosphate solubilizng capacity. *Penicillium lilacium* has shown highest percent phosphorus solubilization (39.2 %) under *In vitro* conditions. The fungi strains may seem to be promising isolates and can be explored in future as a biofertiliser agent after conducting more field studies.
(Source: European journal of Experimental Biology, 2013 3 (2): 191-193)

SCREENING OF PHOSPHATE AND POTASSIUM SOLUBILIZING BACTERIA FROM WEATHERED ROCKS AT VIETNAM.

In Vietnam about 35% of the Mekong Delta region is consists of alluvial soil and covers about 1.1 million ha along the river, which is abundance of acid sulphate clay soil. In alluvial soil phosphorus reacts with Al and Fe becomes insoluble P compounds. The scarcity of potassium mineral source is also reported in Vietnam, thus there is great dependency on the imported potassium fertilizers. Phosphate and potassium are two major important element required for plant growth and development. Supplementing these mineral nutrients is essential to achieve good crop growth and production. Thus under this situation, complex source of mineral nutrients present in soil should be utilized. Microorganisms

capable of solubilizing / mobilizing phosphorus and potassium can be utilized as alternative for chemical fertilizer under such situation. In view of this, Dipe and Hieu (2013) in isolated P and K solubilizing bacteria from weathered materials of denatured rock mountain, Ha Tien, Kien Giang Province, Vietnam. Among the isolated 25 strains, eleven strains was reported to be efficient potassium (Kaolinite) solubilizers under *in vitro* conditions. These strains can also solubilize insoluble phosphorus. The potassium and phosphorus solubilization range from 61.20 to 76.78 mg k L^{-1} and 4.19 to 17.46 mg Po_4^{3-} L^{-1}. The isolated organisms belong to Microbacterium *hominis, Flectobacillus spp, Agrobacterium tumefaciaens, Bacillus cereus, Bacillus coagulans, Bacillus cereus, Bacillus subtillis, Bacillus megaterium* and *Bacillus coagulans* was identified based on 16S DNA sequence. Still the further study needs to be conducted to understand the mechanisms involved in potassium solubilization and evaluation of these strains under field conditions.
(Source: American Journal of Life Sciences: 1(3): 88-92, 2013)

EVALUATION OF EFFICIENCY PARAMETERS OF PHOSPHOROUS-SOLUBILIZING AND N-FIXING BACTERIA INOCULATIONS IN WHEAT (*TRITICUM AESTIVUM* L.)

In Turkey, it was noted that, soil health condition is affected with no judicious application of synthetic fertilizer and improper farm management. The application of biofertiliser to soil improves soil health and conditions which support crop growth and development is well established. Thus to improve the soil health and sustain the agricultural production, a study on microbial biofertiliser application was under taken by Sancar BULUT in Erciyes University, Kayseri, Turkey. An experiment conducted to know the effects of single, dual, and triple combinations of phosphorus-solubilizing [*Bacillus megaterium* var. *phosphaticum*] and nitrogen-fixing bacteria [*Stenotrophomonas maltophilia* and *Ralstonia pickettii*] inoculated treatments were compared with chemical fertilizer and absolute control treatments with regard to wheat efficiency parameters. The results indicated that, application of consortia of strains including *Bacillus megaterium* var. *phosphaticum, Stenotrophomonas maltophilia and Ralstonia pickettii shown* up to 94.3% of the nitrogen uptake efficiency, 94.1% of the nitrogen translocation efficiency, 85.9% of the nitrogen use efficiency, 91.9% of the agronomic efficiency and 91.7% of the water use efficiency. These results are very close to treatment applied only with chemical fertilizer. Thus application biological inputs found to be highly suitable in reclamation soil health condition and increase crop yield.
(Source: Turkish Journal of Agriculture and Forestry, 37: 734-743, 2013)

INFLUENCE OF ORGANIC ACIDS AND POTENTIAL PHOSPHATE-SOLUBILIZING BACTERIA IN AEROBIC RICE

Solubilization of phosphorus by microorganisms through production of organic acids, change in pH, production of chelators, enzymes and other mechanisms are well reported. The complete mechanisms involved in phosphorus solubilisation not yet completely understood. The direct effect of organic acid influence on solubilisation was also studied less. In this regard Panhwar et al., (2013) conducted an experiment to study the direct effect of organic acids and phosphorus solubilizing bacteria and its influence on aerobic rice cultivation. Different concentration of organic acids (0, 10, 20 and 30 mM) supplied with PSB strain (*Bacillus* spp) was inoculated to rice crop. It was reported that, inoculation of *Bacillus* spp along with oxalic acid at 20mM found to be more effective than malic acid. They also recorded significantly increased soluble soil P (28.39mg kg−1), plant P uptake (0.78 P pot−1), and plant biomass (33.26mg) at 40 days after growth of rice crop plants under growth chamber. However oxalic acid synthetic chemical and had adverse effects on human beings. Thus it still needs more study before its utilization.
(Source: The Scientific World Journal, http://dx.doi.org/10.1155/2013/272409, 2013)

OIs Under FCO 1985

A letter No. 2-2/2013 Fert.Law has been issued to all state government for maintaining the status-co in regard to the selection of Sea weed extract, Humic Acid, Amino Acid, PGPs , Digested proteins etc. Mean while Ministry is also considering to examine the matter with consultation with ICAR, Fertilizer industry and other stake holders. The letter is reproduced below.

F. NO. 2-2/2013 Fert. Law
Department of Agriculture & Cooperation
Ministry of Agriculture

Krishi Bhawan, New Delhi
Dated the 9/2,2013

To

Secretary (Agriculture),
All State Governments

Subjects: Notification of General Specifications of Organic Manure in the Fertiliser (Control) Order, 1985.

Sir,

I am directed to say that this Ministry vide Notification S.O.No. 2475(E) dated 16th August, 2013 notified the General Specifications of Organic Manure in the Fertiliser Control Order, 1985. Subsequently, Fertiliser Industry, have represented to this Ministry raising concern in respect of adhering to some of the general specifications as notified in case of Sea weed extract, Humic Acid, Amino Acid, PGRs, Digested Protein etc.and thus, requested this Ministry to reconsider the matter. It has been decided by this Ministry to examine the matter in consultation with the ICAR, Fertiliser Industry, and others. Till such time, state Governments may kindly maintain the status quo in regard to sea weed extract, humic acid, amino acid, PGRs, Digested Protein as prevalent before issue of said notification.

Shukla
Deputy Secretary (INM)

Copy to

1. Director Agriculture-ALL State Governments
2. Director, NCOF
3. DG, FAI

Status of Biofertilisers and Organic Fertilisers under FCO, 1985

In order to ensure adequate availability of right quality of fertilizers to the farmers at reasonable price, Government of India has declared fertilizer as an essential commodity under Essential Commodities Act, 1955 and enacted Fertilizer Control Order (FCO), 1985 to regulate the trade, price, quality and distribution of fertilizers in the country. The State Governments are the enforcement agencies and are adequately empowered to take appropriate administrative and legal action against those who indulge in production and sale of fertilizers which do not meet the specifications prescribed in the FCO, 1985.

Biofertiliser and Organic Fertiliser have been included in the FCO, 1985. Bio-fertilizers are classified under Schedule–III Part-A of the FCO, 1985. Presently, Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Micro-organism (PSM), and Mycorrhizal Bio-fertilizer are included. Organic fertilizers are specified in Schedule-IV Part-A of FCO, 1985. Presently, city waste compost, vermi-compost, de-oiled castor cake and Phosphate rich Organic manure (PROM) manure are notified.

As a number of products under the umbrella of organic are flourishing in the market, it is essential to demark their identity in terms of Fertilizer Control Order 1985. Policy framers are serious on this issue and have been trying to solve the core issues on quality control of organic inputs by bringing them under FCO 1985 from time to time. For first time organic inputs were brought under FCO purview in the year 2006. Since then the FCO 1985 has been amended four times bringing some more organic inputs under FCO purview. Recently the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture included the new organic inputs in the FCO. Their parameters and standards fixed are depicted here under beside a communication issued by DAC to all states Secretaries of Agriculture to implement the up to date amendments of FCO 1985 on organic inputs.

Newly Notified Organic Inputs under Fertilizer Control Order (FCO) 1985:

With the steep rise in production and use of organic inputs their quality has become a focal point in the eyes of policy framers to ensure their desired effect in the fields. The details of newly organic inputs included under FCO are listed below.

1. Potassium Mobilizing Bacteria (KMB)

Sl. No	Particulars	Specifications
1	Base	Carrier based in the form of powder or granules or liquid based
2	Viable Cell Count	$5x10^7$ CFUs /g of powder/granules or $1x10^8$ CFUs /ml
3	Contamination	Nil at 10^{-5} serial dilution
4	pH	6.5 – 7.5 for powder/granules and 5.0 – 7.5 for liquid based
5	Particle size in powder based	Should pass through 0.15 – 0.212 mm IS sieve
6	Moisture % by weight in powder based	30 – 40
7	Efficiency Character	Miniumum 10 mm solublization zone in prescribed media having at least 3 mm thickness.

2. Zinc Solubilizing Bacteria (ZSB)

Sl. No	Particulars	Specifications
1	Base	Carrier based in the form of powder or granules or liquid based
2	Viable Cell Count	$5x10^7$ CFUs /g of powder/granules or $1x10^8$ CFUs /ml
3	Contamination	Nil at 10^{-5} serial dilution
4	pH	6.5 – 7.5 for powder/granules and 5.0 – 7.5 for liquid based
5	Particle size in powder based	Should pass through 0.15 – 0.212 mm IS sieve
6	Moisture % by weight in powder based	30 – 40
7	Efficiency Character	Miniumum 10 mm solublization zone in prescribed media having at least 3 mm thickness.

3. Phosphate Rich Organic Manure (PROM)

Sl. No	Particulars	Specifications
1	Moisture per cent by weight, maximum	15.-25.0
2	Particle size –	minimum 90% material should pass through 4.0 mm IS sieve
3	Bulk density (g/cm^3)	<1.6
4	Total organic carbon per cent by weight, minimum	7.9
5	Total nitrogen (as N) per cent by weight, minimum	0.4
6	Total phosphates (as P_2O_5) per cent by weight, minimum	10.4
7	Total potash (as K_2O) per cent by weight, minimum	-
8	C:N ratio	<20:1
9	pH (1:5 solution) maximum	6.7
10	Conductivity (as dSm^{-1}) not more than	8.2
11	Heavy metal content (as mg/kg), maximum : Arsenic (as As_2O_3) Cadmium (as Cd) Chromum (as Cr) Copper (as Cu) Mercurry (as Hg) Nickel (as Ni) Lead (as Pb) Zink (as Zn)	 10.0 5.0 50.0 300.0 0.15 50.0 100.0 1000.0

"Promotion of Liquid Biofertiliser" – Thirty Days Training Programme

Presently in the market solid and liquid carrier based different biofertlizer formulation products are available. The total production of biofertiliser reached upto 46836 MT in 2012-13, which about 10% of land covers. The biofertiliser may consist of individual or consortia based microbial formulations. The solid carrier based biofertilisers formulations are produced by using peat, lignite, charcoal etc., The greatest constraint of solid carrier based biofertiliser is short shelf life of microbial inoculums. Presently the liquid formulations of biofertiliser have been developed by various institute and organizations are gaining more importance due to long shelf life and high population. It is easy produce handle and application. The effectiveness of these biofertiliser depends on the pure microbial culture present in the formulations. The quality is most important for achieving positive impact on crop production. Many of the biofertiliser manufacturing units do not have skilled persons in their production units, not following strictly microbiological protocols, do not know how to identify and handle microbial cultures, do not know FCO quality control parameters of biofertilisers. So it is necessary to train the persons involved in biofertiliser production units for quality maintenance.

As human resource development through trainings is one of the components of NCOF and its Six RCOFs and Keeping in view of above constrains a 30 days training programme was conducted on "Promotion of liquid Biofertiliser" at NCOF Ghaziabad from 5th November to 4th December, 2013.The programme is Initiated by Integrated Nutrient management (INM) Division, Department of Agriculture and Cooperation, Ministry of Agriculture, India. The main objective of training is to update the analytical skills, sample collection and quality analysis requirement as per FCO for biofertiliser and organic fertilizers.

The training comprised of lectures by experts in biofertiliser technology from various Central, State Government and biofertiliser manufacturing Industries and laboratory exercises. The training involves both theory and practical aspects of biofertiliser production and its quality control. A total of thirty one participants from different biofertiliser manufacturing units from different states viz., Uttarakhand, Utter Pradesh, Madya Pradesh, Himachal Pradesh, Haryana, Kolkata, Punjab, Chhattisgarh, Gujarat, Karnataka, Kerala, Tamil Nadu and Maharashtra were participated in the training.

In the 30 days training several important topics on biofertiliser and organic inputs production and its importance were discussed in twenty four lectures with power point presentations made by several scientist / experts and entrepreneurs. The important topics covered are listed below :

1. Biofertiliser: an overview & Types of biofertiliser
2. The world of microorganisms, Handling of microorganisms in laboratory-Basic protocols
3. Cultivation of microorganisms, media Types their preparation and slant / plating protocols
4. Introduction to soil & biofertiliser
5. Salient features of Fertilizer Control Order (FCO) 1985
6. *Rhizobium* as a biofertiliser
7. Nutrient management in organic farming
8. Impact of biosolubilisers on Indian economy
9. Phosphate solublization through microorganisms
10. Development and promotion of liquid biofertiliser

11. Liquid biofertiliser for plants & agriculture
12. Mycorrhizae for agriculture
13. New initiative & recent techniques in biofertiliser
14. Capital investment subsidy scheme under NPOF
15. Recent advances in biofertiliser technology & constraints
16. Future trends in biofertilisers
17. Production of biofertiliser- Carrier based technology
18. Liquid biofertiliser – An overview, Comparison of carrier based and liquid biofertiliser
19. Azotobacter: an important biofertiliser
20. Microbial solutions for sustainability
21. Introduction to integrated pest management / biocontrol agents
22. Plant growth promoting rhizobacteria

The practical classes covered the basic microbial laboratory techniques and quality control aspects of biofertiliser of FCO, 1985. Hands on training were given to trainees to learn and develop laboratory skills in biofertiliser formulations and maintain quality parameters. In the practical classes trainees were thought about the topics listed below:

- General laboratory safety, precautions, rules and procedures to be followed in microbiological laboratories
- Maintenance of aseptic laboratory conditions for microbiological experiments
- Instruments / equipments used in the laboratory and its working principle
- Sterilization Methods
- Measurement of moisture content of carrier used in biofertiliser formulations
- Study of microscope
- Media and its preparation
- Isolation of microorganisms by serial dilution pour plate technique
- Isolation of microorganisms-spread plate technique
- Purification of microorganism-Four way streaking method
- Study of Morphological characters of Bacteria
- Preservation of microorganisms
- Study of staining techniques- simple staining
- Identification of bacteria -Gram staining technique
- Isolation of phosphate solubilising bacteria.
- Isolation of potassium Mobilizing bacteria
- Study of compatibility between microorganisms-Dual inoculation technique
- Testing root nodulation efficiency of *Rhizobium* Spp,
- Methods of analysis of *Azotobacter* biofertiliser
- Test for Nitrogen fixation in pure cultures
- Method of Analysis of *Azospirillum* biofertilisers
- Methods of analysis for mycorrhizal biofertiliser
- Quantification of phosphate solubilizing efficiency of bacteria
- Quality parameters of FCO1985.

List of Industrialist / Entrepreneurs of 30 days training programme on Promotion of Liquid Biofertilisers during 05 November 2013 to 04 December 2013 at National Centre of Organic Farming, Ghaziabad

Sl. No	Name of Participants	Organization	Phone no / Email address
1.	Dr. NITA J NAIK	Bio Fert plant, KRIBHCO, SURAT.	09909037299 njnnayak@yahoo.co.in nita.njn@gmail.com
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5.	Mr. RUPINDER SINGH	Maxgrow Biotech (p) Ltd Sco-2 Model Town Ext. Ludhiana Panjab	09463603245
6.	KM. NEVEDITA TANDI	C G Rajya Beej Evam Krishi Vikas Nigam Ltd, H O Beej Bhavan, Ravigram, Telibandha, G E Road, Raipur	9179114567 0771-4212216
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9.	MR AAKASH SHAH	Prabhat Fertilizer & Chemical Works, Village Kurali,Indri Road Karnal-132001(Haryana) India	prabhat343@sify.com 8529020925 9416000343 Ph.+91-0184-2389444,2389666 Fax.+91-0184-2389400
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12.	Mr. AVINASH KUKKAR	International Biotech Panjab	09988176000
13.	Mr. BANSI LAL	Amar Biotech Bhatinda	09872679227
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15.	Mr.R GAURAV KUMAR	Y S Sons Agrotech	info@yssonsagrotech. com 8930793793

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19.	Mr. PANJAB PISE	Shakti Agrobiotechindia Pvt. Ltd.	shakti.agrobiotech@gmail.com, 08888129863
20.	Mr. PREM NARAYAN SINGH	International Biotech Panjab	08054581505
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23.	Mr. VIPIN KUMAR	Sri Ram Solvent, Jaspur, UK	9568511272
24.	Mr. CHETAN SHINDE	INORA, Pune , Maharastra	chetanshindein@gmail.com 09970000780
25.	Mr. MANOJ KUMAR	Y S Sons Agrotech	manoj@yssonsagrotech.com 09218514001
26.	Mr. N.C. RABEESH KUMAR	ABTEC, Agro-biotech R&D center, Poovantharuhu (P.O.), Kottagam, Kerela	rabee.nc@gmail.com 09496339172
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Book Reviews

Biofertiliser Technology. Edited by Dr. S. Kannaiyan, Dr. K. Kumar and Dr. K. Govindarajan, Print 2013, Scientific Publishers, Jodhpur – The book is the proceedings of National workshop on "Recent Developments in Biofertilisers for rice based cropping system" held at Tamil Nadu Agricultural University, Coimbatore during August 16-18, 2001 to develop a strong, workable and compatible package of nutrient management through organic and inorganic sources exclusively for rice based cropping system. The book consists of 56 chapters containing the research work/ presentations/ discussions that are deliberated by leading scientists and experts from different parts of India working on basic and applied aspects of various biofertilisers used in rice based cropping system.

The book is first of its kind in focusing the application of biofertilisers technology in rice based cropping system. It enables the use of living organisms for the nourishment of plants either by fixation of atmospheric nitrogen through the process of biological nitrogen fixation or by solubilizatiion of mineral nutrients like phosphorous. It is clearly described about different biofertilisers that are associated with rice based cropping system. The book is completely confined to rice based cropping system as it is the major cropping system practiced in India which includes the rotation of crops involving rice, pulses, oil seeds, cotton, sugar cane, green manures etc. Rice-rice v/s most dominant cropping system under irrigated conditions in south and eastern India, while rice-wheat, rice-groundnut, rice-legumes, rice-mustard and rice-potato are some of the predominant rice based cropping systems with 200 percent cropping intensity in different North Indian States.

The lucid way of presentation of the research articles helps even the young researchers to understand them completely. The quality of work done by the authors enhanced the standards of the book to multifold. Almost all the articles reflects the research background and command over the subject of the authors. The editors have taken every care that was ought to be taken for the compilation of articles and especially the suggestions of articles into respective section of biofertiliser (*Cynobacterial, Azolla, Azospirillum, Rhizobium*, Endophytic Diazotroph, Microbial solubilization & mobilizing biofertilisers, Other bio-inoculants and quality control of biofertilisers) is really helpful for the reader to look into the area of interest and further saves the time of reader in bringing and out the book in a befitting manner. The publisher as well took interest to bring out the book with good get up and further has taken all care to avoid typographical errors. Infact, editors made emphasis on almost all the biofertilisers (*Cynobacterial, Azolla, Azospirillum, Rhizobium*, Endophytic Diazotroph, Microbial solubilization & mobilizing biofertilisers, Other bio-inoculants and quality control of biofertilisers) that are related/ associated with enhancement of growth and yield of paddy along with crops associated with rice cropping system and integrated plant nutrient supply approach (IPNS) models, package and soil health management through IPNS. Due to massive information it is worthy to be called as a master piece of the book. The book has not only started with a best article, but has also finished with certain good articles that covered the quality control aspects of biofertilisers along with molecular techniques required for checking the genetic purity of different strains, alongwith many more standard articles that fell in between. The entire book is worth reading, the massive information is bounded in 450 pages would really satisfy the thirst for knowledge in the respective field on the whole the book will be a very good resources material for people in different walks of life viz. agricultural policy makers, crop management scientists, researchers, students, extension workers and literate farmers.