FAQs

- **Organic Farming**
- **Biofertilizers**

Frequently asked questions on Organic Farming

Question 1: What is Organic Farming?

Answer : In today's terminology organic farming is a method of farming system which primarily aims at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers and biopesticides) to grow and protect the crops for increased sustainable production in an eco-friendly pollution free environment.

In philosophical terms organic farming means "farming in spirits of organic relationship. In this system everything is connected with everything else. Since organic farming means placing farming on integral relationship, we should be well aware about the relationship between the soil, water and plants, between soil-soil microbes and waste products, between the vegetable kingdom and the animal kingdom of which the apex animal is the human being, between agriculture and forestry, between soil, water and atmosphere etc. It is the totality of these relationships that is the bed rock of organic farming.

Question 2: **Definitions of Organic Farming**

Answer : As per the definition of the USDA study team on organic farming "*organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection*".

In another definition FAO suggested that "*Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs*".

As per Codex definition, "*organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system*."

As per IFOAM's definition "*Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the*

use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."

Question 3: What is conventional agriculture?

Answer : Agro-practices designed based on scientific principals after research and developments (R & D) in the past about six decades are termed as conventional agriculture. It involves use of agro-chemicals such as fertilizers, synthetic pesticides and herbicides, besides (a) improved seeds – high yielding varieties (HYV), hybrids and more recently genetically modified (GM) seeds; (b) mechanization and other cultivation tools, (c) irrigation, (d) other technological outputs such as growth hormones, antibiotics (say in poultry) etc. The collective use of these has been widely referred as 'Green Revolution' or GR inputs.

Question 4: How organic Farming is different from conventional farming

Answer : Organic farming (OF) is a farming system based approach involving use of all potential 'good agricultural practices or GAP' including recycling of locally available natural resources, integration of crops and animals into the local farming system. Thus it not only promotes poly cropping on a given piece of land it also connects plants (annual and perennial), animals (fishes etc. included where relevant). In addition to other requirements of crop production to harvest high yield, a crop needs nutrients to grow and support of plant protection agents against pests. In conventional farming (CF) nutrient need is met by bag fertilizers synthesized using fossil fuels while in OF it is met by the activity of agriculturally beneficial microorganisms, available in plenty in several natural niches or can be multiplied by small bioproducts companies. Focus of research in CA is on killing the pests using synthetic pesticides while OF depends more on natural allies in managing them. Knowledge on biological aspects of insect life and behavior, and on botanicals and microbial agents with ability to suppress pests are important in OF. Over years organic farmers in India have noted local recipes and products to serve as a source of crop nutrients or crop protection and thus do not depend on market supplies for their inputs. OF practitioners in developed countries generally depend on market for biological options.

Question 5: What is natural farming

Answer : Natural farming, also known as Do-nothing farming or No-till farming was popularised by Masanobu Fukuoka, starting in the 1940s in Japan. The most essential aspect of natural farming is to let nature play a dominant role to the maximum extent possible. Hence, no-till, farm biodiversity, integration and symbiotic farm components and protection of soil cover all have a place in this method of farming. The seed ball technique for sowing has also been given importance by Fukuoka. The immense importance placed on no-tillage has led to natural farming also being referred to as No-till farming. The term 'Do

Nothing Farming' originated because the farmer is considered only to be a facilitator - the real work is done by Nature herself. Hence, while there is lots to think about and do in natural farming, actual physical work and labour has actually been seen to reduce by upto 80% compared to other agricultural systems. In Japan, Fukuoka achieved yields similar to those of chemical agriculture. His methods have also been adopted to suit European conditions and put into practice there. In India, Fukuoka is fondly-regarded and his work has found a number of practitioners who have termed their method of farming as 'Rishi Krishi or rishi kheti' literally meaning agriculture of the sages.

Question 6: Is Organic Farming non-scientific and unproven?

Answer : Many people believe that OF is non-scientific. It is incorrect. Yes, it is essentially un-explored, un-researched by the mainstream system in its totality. But it does not mean that it is non-scientific. Scientists need to research and understand the underlying principles of OF. Several aspects of OF are plausible and scientifically explicable. For most scientists the claims of high yields with OF are unproven at their research farms and unpublished in the research journal. But recent researches and long term experiment trials have proved that comparable yields are possible under organic management. Large number of practicing organic farmers, their high yields and their scientific system of farming is a proof of it and can be validated and researched by the scientists.

Question 7: Does practicing organic farming (OF) means reduced yield

Answer : It is widely believed that when crops are grown without synthetic fertilizers and pesticides crop yields reduce. But this is not true. Various long term experiments conducted in various countries, including India (at ICRISAT and ICAR) have proved beyond doubt that once the soil health is restored, comparable yields can be harvested with most of the crops. During conversion period when soils are not fit for organic yields may decline, but with appropriate planning and crop selection it can be contained.

One can meet and verify several OF practicing farmers claiming their yield at par or better than their neighbour conventional farmers. Reduced yield in the initial years when a field is converted from conventional system to organic, is a widely observed phenomenon and OF cannot be quoted as low-yielder on this basis. The initial one to three year period is needed to build the agriculturally beneficial microorganisms in soil that have been adversely affected by use of agro-chemicals in CA. With scientific understanding of this soil-life building process it should be possible to reduce this period to less than one year.

Question 8: Why were crop yields low before invention of Agro-chemicals

Answer : Yes, crop yields were low before the use of agro-chemicals started in India in the 1960's. The plausible reasons can be traced to the interventions (rules and regulations) by the ruling Governments before independence. Historical evidences (see website www.dharampal.net and www.cpsindia.org/tav.html)

suggest that crop yields were comparable to what are harvested today. For example the average yield of rice [from over 1000 localities in each of the two independent records/studies one from writing on palm-leaf in Tamilnadu (still available) and survey report of Thomas Bernard of East India Company] was around 3 t ha^{-1}, and mean paddy yield of well performing localities was over 6 t ha^{-1} in one and over 9 t ha^{-1} in the other study. These evidences suggest that an opportunity is available to think and explore why high yields could be harvested without agro-chemicals and develop those technologies for wider use to meet the to-day's requirements in at least less endowed rain-fed areas..

Question 9: What are strengths and weaknesses of CA?

Answer : Use of external inputs and knowledge generated boosted yield of almost every crop and animal production and helped many countries such as India to come out of starvation situation of the 1940's to 60's to a situation of self-sufficiency and even export. But there was a price paid for this and which is still being paid and will have to be paid continuously even in the future (unless changed). These are widely referred as 'fall-outs of the GR' and involve (a) pesticide residues in the food chain and in bodies of practicing farmers, (b) spoilage of large chunks of land due to inappropriate use of fertilizers and water, (c) declining water table, (d) pollution of aquifers and above surface water bodies, (e) disregard of locally available natural resources of crop nutrients and crop protection, (f) increased cost of production each year without a corresponding increase in production, (g) agro-technologies that make farmers dependant on market for inputs.

The fall-outs became more apparent after about 30-years of their use and scientists are addressing it by involving stronger use of natural resources. Use of farm-yard manure (FYM), Vermicompost and biopesticides (botanicals and microbial agents) are now widely recommended by research institutes (both national and international). More recently, balanced use of both fertilizers and compost etc widely termed as 'integrated nutrient management or INM' is being promoted on large scale. Practices of balanced use of biopesticides and synthetic chemicals are relatively a recent suggestion and are widely referred to as 'integrated pest management or IPM'.

Question 10: What are the strengths and weaknesses of OF?

Answer : Organic farming is a knowledge intensive system and has been developed by practitioners themselves over the years. There is essentially very little external input and therefore it is a low-cost system. But in the absence of research support, farmers are not able to access the desired information needed for crating appropriate management protocol. Fear of losing productivity during conversion period is a major deterrent in its wide scale adoption.

Question 11: Where is the large quantity of compost for OF?

Answer : A crop does not differentiate whether a nutrient molecule is offered from chemical fertilizer or from compost prepared by the farmer. Most of us believe that one would need large quantity of farm-yard manure (FYM) or compost for growing crops, if we are not using chemical fertilizers. This belief is due to the fact that we measure value of the FYM or compost as a source of nutrients (NPK) a crop needs. This is mis-leading because this perspective ignores the fact that there are different types of agriculturally beneficial microorganisms in nature (available in plenty in compost) with ability to facilitate crop nutrition and even protection. To harness this gift of nature, one needs to understand and provide food for these microorganisms while they function on the root rhizosphere of a given crop. Plant biomass, raw or processed (i.e. FYM) is a good food for microorganisms. Thus an OF practitioner does not need many cattle for every ha area for making compost. Plant biomass can be strategically produced in large quantities on the same field growing crops that can serve as food for microorganisms, and small quantities of cow-dung or its ferments can serve as source of beneficial microorganisms. Thus there is no need of large quantities of compost for organic farming. Recycling of all locally available natural resources (plant biomass in particular) is extremely important.

Question 12 : Does the soil fertility decline when fertilizers are not used?

Answer : It may sound logical that fields not receiving fertilizers (urea, diammonium phosphate or DAP and single super phosphate or SSP) should have low fertility than those receiving alternative inputs (FYM, biomass etc.) and practicing OF. But it is scientifically untrue and large number of long term studies have concluded that , on the contrary organic management systems improve soil fertility and long term sustainability.

Question 13: Scientifically, where crop nutrients come from in OF?

Answer : Any given part of a plant is composed of about 30 different elements. It means all these elements or nutrients are needed and are taken-up by the plants during its growth process. A plant can access majority of them from water and air(C, H, O, N) or soil and assimilate them through biochemical processes going on in its body during the growth process. Only rest of the <10% of its body weight is accessed exclusively from soil. It is hypothesized that in organic farming plants are accessing much of the major elements (including nitrogen) from air. Not only that polycrops are key requirement in OF, there is integration of annual-perennial plants trees and animals on a given piece of land. Trees are the only agency in nature that accesses potential crop nutrients from meters down (while crop plants such as wheat and pulses draw nutrients from top 30 cm to 60 cm soil profile) in the soil and offer us on the soil surface in the form of fallen leaves and lopped branches. In conventional agro practices importance of this plant biomass (fallen leaves or lopped branches of trees) that can be harnessed by recycling, is not honored/recognized. Plant

biomass is an important asset in OF and practitioners use it for crop production in various ways e.g. composting or surface mulch.

Question 14: How are crops protected in OF?

Answer : Only environment friendly options of crop protection are used in OF. These include cultural practices, poly crops, trap crops, plants and microorganism with bio-factors to kill or suppress insect pests. Tropical countries are rich in tens or perhaps hundreds of plants (botanicals) with ability to help manage crop pests (both diseases and insect-pests). Also, Microorganisms with ability to kill/suppress crop pests occur in nature and some are available commercially. In addition, each insect-pest has its own natural enemies generally referred as 'beneficial insects'. For example, as per a published report, the most obnoxious insect-pest *Helicoverpa armigera* (also called legume pod-bored or cotton boll-worm) has over 200 natural enemies.

Question 15: Why restrict pesticides when India is a low user?

Answer : Yes, if calculated on the basis of quantity of pesticide use per unit area India is one of the low users. But if calculated on the basis of quantity of pesticide used in a given crop such as vegetables, it may even be more than the high use countries. It means the rate of use for a given crop and niche, it is not low. Higher chemical residues in many food items is an indication.

Question 16: Where are the evidences that high yields are possible in OF?

Answer : Indeed it is difficult to believe for most of us that high yields are possible without synthetic agro-chemicals. But recent research studies have indicated that high or comparable yields are possible in organic farming. Large numbers of practicing organic farmers are live examples of this possibility.

Question 17: Do OF practitioners need organic seeds/planting materials

Answer : As per the dictates of certification system, it is true that once a field has been fully converted and certified as organic, it should use the seeds of the different crops that are produced on a certified field only. But during conversion period chemically untreated seeds can be used. Under non-certified system seeds not treated with chemicals are ideal option.

Question 18: Are OF products more nutritious?

Answer : Organic products are invariably free from chemical residues and are rich in some nutrients. There are enough indications that organically grown products are rich in vitamin-C and some minerals. Although, there may be dispute that how much superior and whether this quantity will have some significant impact on overall health scenario or not, but trends indicate their superiority over conventional products.

Recently under Network Project on Organic Farming, initial studies indicate improvement in some of the quality parameters of ginger (oleoresin and oil content), turmeric (oil, oleoresin, starch and curcumin content), black pepper (oleoresin content), chillies (ascorbic acid content), cotton (ginning percentage), and vegetables (iron, manganese, zinc and copper content in tomato, French bean, cabbage, cauliflower, pea and garlic).

Question 19: Is OF labor intensive?

Answer : In the absence of mechanization, several protocols of organic farming can be labour intensive. But this fact should go in favour of countries and situations where labour is cheap and plenty e.g. India.

Question 20: What is homa farming

Answer : Homa farming has its origin from Vedas and is based on the principle that “you heal the atmosphere and the healed atmosphere will heal you” The practitioners and propagators of homa farming call it a "revealed science". It is an entirely spiritual practice that dates from the Vedic period. The basic aspect of homa farming is the chanting of Sanskrit mantras (Agnihotra puja) at specific times in the day before a holy fire. While there is no specific agricultural practice associated with homa farming, it is believed that, the farm and household it is practiced in, is energised and "awakened". The ash that results from the puja is used to energise composts, plants, animals, etc. Homa Organic Farming is holistic healing for agriculture and can be used in conjunction with any good organic farming system.

Question 21: What is Netueco culture farming

Answer : The Natueco farming system follows the principles of eco-system networking of nature. It is beyond the broader concepts of organic or natural farming in both philosophy and practice. It offers an alternative to the commercial and heavily chemical techniques of modern farming. Instead, the emphasis is on the simple harvest of sunlight through the critical application of scientific examination, experiments, and methods that are rooted in the neighborhood resources. It depends on developing a thorough understanding of plant physiology, geometry of growth, fertility, and biochemistry.

Question 22: What is Biodynamic Farming

Answer : Biodynamic agriculture/ farming is a method of farming that aims to treat the farm as a living system which interacts the environment, to build healthy, living soil and to produce food that nourishes and vitalizes and helps to develop mankind. The underlying principle of biodynamics is making life-giving compost out of dead material. The methods are derived from the teachings of Rudolf Stainer and subsequent practitioners. The important components of biodynamic farming are as follows:

a. Turning in plant materials such as green crops and straw
b. Not using chemical fertilizers and pesticides
c. Avoiding soil compaction by machinery or animals, particularly in wet weather
d. Keeping soil covered by pasture, crops or mulch not destroying the soil structure by poor farming practices such as excessive use of rotary hoe or cultivation in unsuitable weather (too wet or too dry)
e. Fallowing the land by planting deep-rooting permanent pasture species or using green crops
f. Use of preparations BD-500 and BD-501
g. Compost made with preparations BD-502 – BD-507
h. Liquid manure made with preparations BD-502 – BD-507
i. Cowpat pit manure made with preparations BD-502 – BD-507

These biodynamic preparations named BD-500 to BD-507 are not food for the plants, but they facilitate the effective functioning of etheric forces. They are also not the usual compost starters, but can stimulate compost organisms in various ways. In short they are biologically active dynamic preparations which help in harvesting the potential of astral and etheral powers for the benefit of the soil and various biological cycles in the soil.

Frequently Asked Questions on Biofertilizers

Question 1: What is biofertiliser?

Answer : Biofertilisers are carrier based (powder or liquid) preparations containing effective strains of some microorganisms like bacteria, fungi and algae alone or in combination in sufficient count. On being applied on seed, seedling roots or in soil fix atmospheric nitrogen or solubilize insoluble phosphate in soil and making them available to the crop plants. The biofertilizers are also called as bioinoculants/culture, microbial inoculants or teeka.

As per the definition given in Fertilizer Control Order "Biofertilizers means the product containing carrier based (solid or liquid) living microorganisms which are agriculturally useful in terms of nitrogen fixation, phosphorus solubilization or nutrient mobilization, to increase the productivity of the soil and/or crop".

Question 2: Whether biofertilisers are available for all primary nutrients?

Answer : Although at present, biofertilisers are available for nitrogen and phosphorus only but efforts are on to identify the organisms which can solubilize or mobilize other minerals or nutrients. Recently K-biofertilizer and Zn-biofertilizers have also been developed but these products are yet to be commercialized.

Question 3: Can one biofertiliser supply two major plant nutrients?

Answer : `No'. One biofertiliser can supply/made available mainly one major nutrient.

Question 4: What nutrient is supplied by the algal group?

Answer : The algal group supplies only nitrogen.

Question 5: What nutrient is supplied by the fungal group?

Answer : The fungal group solubilises insoluble forms of phosphate present in the Soil and make it available to the crop plants.

Question 6: What nutrient is supplied by the bacterial group?

Answer : The bacterial organisms present in the biofertiliser either fix atmospheric nitrogen or solubilise insoluble forms of soil phosphate.

Question 7: Which is the most important source of N in nature?

Answer : It is available in the atmosphere. The atmospheric air contains about 79% nitrogen in gaseous form. One hectare area column of atmospheric air contains approx. 80,000 T of nitrogen. This form of nitrogen (N_2) from air cannot be utilized by plants as such.

Question 8: What is symbiotic association?

Answer : Certain bacteria like Rhizobium live inside the root nodules of leguminous plants. These nodules are bacterial houses. While living inside the root nodules, the bacteria get shelter and food material from the plant and fix atmospheric nitrogen which is used by the plants. The plants and bacteria both are mutually benefited and hence it is called symbiotic association.

Question 9: What is Rhizobium?

Answer : Nitrogen is available to the leguminous plants mainly through biological nitrogen fixation by the root nodule bacteria called Rhizobium. These bacteria are symbiotic in nature and host specific. Higher yields in legumes can be obtained by exploiting this system.

Question 10: Can one Rhizobium strain be used for all leguminous crops?

Answer : No. Rhizobium strains are host specific and strain meant for one crop plant can not be used for other crop plant. Therefore, it is necessary to apply only the specific strain, which is recommended for that crop.

Question 11: What is Acetobacter?

Answer : *Acetobacter* is symbiotic bacteria capable of fixing atmospheric nitrogen by living within the sugar plant. The organism is found in all parts of plant body. The *Acetobacter* is suitable for sugarcane cultivation.

Question 12: What is an Associative Symbiotic Bacteria?

Answer : This bacterial group live partly within the root and partly outside. There is a fair degree of symbiosis between the host and the bacteria. Hence, they are called as Associative Symbiotic bacteria. Azospirillum is an important bacterium in this group, recommended for millets, grass, wheat, maize, sorghum, rice etc.

Question 13: What is non-symbiotic bacteria?

Answer : Certain bacteria live independent of root system of plant capable of fixing nitrogen or solubilising soil phosphate without any symbiotic association and hence they are called non-symbiotic bacteria or free-living.

Question 14: What is Azotobacter?

Answer : It is a non-symbiotic nitrogen fixing bacteria, aerobic in nature, recommended for non-leguminous crops like paddy, millets, cotton, tomato, cabbage and other monocotyledonous crops. Azotobacter also produces growth promoting. Substances like IAA, Gibberellic acid, Cytokinin, Vitamins and certain chelating agent and polysaccharides as reducing and binding agents. Azotobacter performs well, if the soil organic matter content is high.

Question 15: What is Azolla?

Answer : *Azolla* is an aquatic floating fern, found in temperate climate suitable for paddy cultivation. The fern appears as a green mat over water, which becomes reddish due to excess anthocyanin pigmentation. The BGA cyanobacteria (*Anabaena azollae*) present as symbiont with this fern in the lower cavities actually fixes atmospheric nitrogen. The rate of nitrogen fixed is around 25 kg/ha.

Question 16: What is the dose of Azolla required for one acre paddy crop?

Answer : *Azolla* application can be done in two ways:

One - As green manure, where *Azolla* is grown alone (for two to three weeks) in flooded fields Once a thick mat is formed, water is drained and *Azolla* fern is incorporated (10 Mt material) in the field before transplanting paddy. By this method 25-30 kg of biologically fixed nitrogen cn be provided to the paddy crop.

In second method 4-5 Q of fresh *Azolla* is applied in standing water one week after transplanting of paddy. Within 2-3 weeks it will cover the entire water surface and continues to grow along with paddy as dual crop. When plants grow, it dies due to shading and release fixed nitrogen. By this method 25-30 kg of biologically fixed N can be provided to the paddy crop.

Question 17: Name four phosphate solubilising microorganisms?

Answer :

1. *Pseudomonas striata*,
2. *Bacillus Polymyxa/megaterium*,
3. *Aspergillus awamori*,
4. *Penicillium digitatum*.

Question 18: What is Blue green algae?

Answer : The blue green algae are also called as cyanobacteria. This Chlorophyll containing algal organism fixes atmospheric nitrogen. Application of BGA (10 kg/ha) is recommended for flooded paddy as it can survive and multiply easily in standing water. Single application of BGA can provide 15-20 kg of biologically fixed N to the crop.

Question 19: How the phosphate solubiliser is functioning in the soil?

Answer : The phosphate solubilisers produces organic acids like tartaric, fumeric, malic, succinic and acetic acid etc. which solubilise insoluble forms of phosphate present in the soil and make it available to crop plants.

Question 20: Whether phosphate solubilisers are crop specific?

Answer : No. They can be applied to and recommended for all crops.

Question 21: What is VAM?

Answer : The VAM is Vesicular Arbuscular Mycorrhizal fungi - which possess special structures known as vesicles and arbuscules. VAM is an intercellular, obligate endosymbiont and on establishment on the root system act as extended root system. Besides harvesting moisture from deeper and faraway nitches in the soil they also harvest various micronutrients and provide to the host plants.

Question 22: Does VAM act as phosphate mobiliser?

Answer : Yes. Mycorrhizae help in mobilizing insoluble soil phosphates. They further help increasing nutrient uptake (phosphorus as well as zinc).

Question 23: Why biofertilisers are environmental friendly?

Answer : Biofertilizers are preparations made from nature born beneficial microorganisms. They are safe for all plants, animals and human beings. Being beneficial to crops and natural nutrient cycles they are not only environment friendly but also help in saving of chemical inputs.

Question 24: What are the main advantages of biofertilisers?

Answer : Nitrogen fixing biofertilizers fix atmospheric nitrogen equivalent to the application of 15-35 kg of chemical N, while phosphate solubilizing biofertilizers help crops in taking 15-20 kg of phosphorus/ ha from soil's insoluble phosphorus pool.

Question 25: Describe the method of Biofertiliser applications.

Answer : Biofertilizers can be applied to different crops and plants by three different ways.:

a. **Seed treatment** Suspend 200 gm each of nitrogen fixing and PSB in 300-400 ml of water and mix thoroughly. Pour this slurry on 10 to 12 kg of seed and mix by hands, till all the seeds are uniformly coated. Dry the treated seeds in shade and sow immediately. For acidic and alkaline soils

it is always advisable to use 1 kg of slacked lime or gypsum powder respectively for coating the wet biofertilizer treated seeds.

b. **Seedling root dip treatment: -** Suspend 1 to 2 kg each of nitrogen fixing (*Azotobacter*/*Azospirillum*) and PSB into just sufficient quantity of water (5-10 lit depending upon the quantity of seedlings required to be planted in one acre). Dip the roots of seedlings in this suspension for 20-30 min before transplanting. In case of paddy make a sufficient size bed (2mt x 1.5mt x 0.15mt) in the field, fill it with 5 cm of water and suspend 2 kg each of *Azospirillum* and PSB and mix thoroughly. Now dip the roots of seedlings in this bed for 8-12 hours (overnight) and then transplant.

c. **Soil treatment: -** For soil treatment depending upon the total number of plants per acre 2-4 kg of *Azotobacter*/*Azospirillum* and 2-4 kg of PSB are required for one acre. Mix two types of biofertilizer in 2-4 liters of water separately and sprinkle this suspension on two separate heaps of 50-100 kg of compost. Mix the two heaps separately and leave for incubation overnight. After 12 hours, mix the two heaps together. For acidic soils mix 25 kg lime with this mixture. In plantation crops apply this mixture at the root zones by dibbling. In some field crops the mixture is broadcast evenly in the moist field and mixed with soil just before sowing. In sugarcane the biofertilizer manure is to be applied in furrows near the root zone, after 30-40 days of planting and covered with soil. In potato it is to be applied after 20 days of planting or at the time of earthing-up operations. In case of sugarcane and potato, if setts/tubers are not treated with plant protection chemicals then biofertilizer compost mixture can be applied in furrows immediately before plantingSeed/Seedling/Tuber/ sets treatment - most effective, failing which soil inoculation better than nothing. Application dose: -200 gm BF (one packet) for 10-12 kg seeds, treatment, for one hectare 5-10 kg BF+50-60 Kg soil/ compost (soil application) for one hectare 10 kg BGA (wet land paddy) for one hectare10 Q Azolla (wet land paddy) for one hectare.

Question 26: What is seed treatment and how it should be done with BF?

Answer : Coating the seed with bio-inoculants is generally known as seed-treatment or bacterisation. It ensures quick germination, fast growth of crop plants, increased yield and better product. It can be done either by dry mix/wet coat or palletizing process. Suspend 200 gm each of nitrogen fixing and PSB in 300-400 ml of water and mix thoroughly. Pour this slurry on 10 to 12 kg of seed and mix by hands, till all the seeds are uniformly coated.