Hello students, welcome to today's E Learning session for the course Agricultural microbiology will be seeing the module mass production of blue green algae where we will see the different methods for mass production of blue green algae or the cyanobacteria at the end of this module. You will be able to understand and explain the outlawed methods and the indoor methods for production of cyanobacterial biofertilizers are the living microorganisms when applied to the plants, especially the root , promote plant growth by regulation of hormones or by enhancing the supply of certain nutrients. Nitrogen fixation is the biological process of reduction of atmospheric nitrogen to ammonia, which can be readily utilized by the plant. This process is carried out by the diazotrophic cyanobacteria and that's why they are so important and can be used as biofertilizers. Now cyanobacteria are the oxygenic photosynthetic bacteria present in the marine. Freshwater and terrestrial environments. They were previously called as blue green algae because of the presence of chlorophyll A. They also have high quality proteins which are both necessary for photosynthesis. Photosynthesis occurs in a specialized tylakoid membrane where photosystem two as well as photosystem one are present. All cyanobacteria are photosynthetic. However, only a few can fix the atmospheric nitrogen. Anabaena and Nostoc are most widely used and provide 25 KG. Or fix nitrogen per hectare. These are examples of nitrogen fixing cyanobacteria, which can be heterocystous, non hetrocystour and even unicellular in nature for the mass production of these nitrogen fixing cyanobacteria a process called as algalization can be used. In algalization, a defined mixture of cyanobacterial species is used for inoculating soil. As biofertilizers algalization increase grain yield by 15 to 20% in field experiments. This process allows the cyanobacteria to establish themselves permanently in the soil. If inoculation is done consecutively for three to four copying seasons. And therefore for this process mass production of cyanobacteria is important and it involves various methods. The first is to prepare a starter culture. The stock culture of nitrogen fixing cyanobacteria can be maintained in soil extract medium that contains 1 gram of soil and 10 Miller Fox medium and also on Agar slants. Cyanobacteria are grown in 250ML flask containing 100 mil of Fox medium. In the light the cultures can be can be scaled up in aspirated bottles or carboys as well. Different strains are cultured and maintained separately. The pH needs to be maintained between 7 to 7.5. The cyanobacterial strain should fulfill some of the criteria such as rapid growth rate over wide temperature. Ebillity to fix nitrogen at pH 6.5 to 8.5. It should not have any adverse effect on the crop plants and it should be able to survive during storage and in the carrier material. Now let's see the open air method for mass production. This is a very rural oriented method developed by the Indian Agricultural Research Institute, New Delhi. It is very simple process and has adaptability by small and marginal farmers. In this method a mixture of cyanobacteria Anabaena, Nostoc and plectonema can be used in the open air method. Usually rough pit or field methods or even the nursery method can be involved in the draft method. Shallow trays of galvanized iron sheet or permanent tanks can be prepared and 200 grams of superphosphate is mixed. Approximately 5 to 10 centimeters of water is placed in these trays or tanks, depending upon the local conditions and the rate of evaporation. If the soil is acidic, then it can be neutralized by adding line for controlling insects, which can start to grow in. This drops carbofuran 3% granules. 25 gram poetry or other insecticide can also be used after the soil is settled. The cyanobacterial culture is inoculated on the surface of the water. These units are kept in open air and completely exposed to the sun so that the sign of bacteria can do photosynthesis and multiply in summer. The growth is very rapid and a thick mat of seven to in seven to 10 days can be formed. High rate of evaporation. Is present then more water has to be added intermittently, then the growth of cyanobacteria becomes thick.

The watering is stopped and the sign of bacterial mat is allowed to dry into flakes. The flakes from the trace are collected and stored in bags for using field. The trust can be filled again with water and the dry cyanobacterial flakes that were harvested can be used as a inoculum. The process is continued and once the soil and the truth is exhausted after a harvest of three to four. It is replaced with fresh soil mixture and superphosphate and the process is continued all over again with a single harvest from one trust about 1.5 to 2 kilograms of dry cyanobacterial flakes can be obtained. The next method is a pit method where shallow pits are dug in the ground and layered with a thick polythene sheet to hold water. The rest of the procedure is same as described in the draft method beginning with the starter culture. Addition of Soil and superphosphate inoculation, allowing the multiplication of cyanobacteria and harvest. The pit method is easy and less expensive, expensive to operate by small farmers in the field method which produces material on a commercial scale about 40 meters square area as demarcated in a field for production of cyanobacteria. After crop harvest, the stubbles are removed and the soil is loamy. It is puddled to facilitate the water logging, which is required for growing the cyanobacteria. The area can be bonded with strong Earth bunds and flooded with water to a depth of 2.5 centimeters. Flooding is repeatedly needed in the fields to keep the water standing superphosphate at 12 KG every 40 meters. Square is applied if the field was used for growing cyanobacteria or has received the sign of bacteria before for two consecutive cropping season. No fresh cyanobacterial application is required because the cells of sign of bacteria. Will be present in the soil and they will start to grow once the condition becomes conducive. Carbofuran can be applied at the rate of 250 grams every 40 meter square clay soils,sunny weather are good for the growth of cyanobacteria in about 2 weeks. There is a very luxuriant growth of cyanobacteria case of loamy soils. It takes about three to four weeks. The floating mats of cyanobacteria are allowed to dry in the sun in the field, and the flakes are stored for further use. The cyanobacteria are harvested continuously by re flooding the plot and applying superphosphate and pesticides. The addition of sign of bacterial inoculum for subsequent production may not be necessary during April to June.

The average yield of the harvest ranges from 16 to 30 kilograms of cyanobacterial flakes from 40 meters square of land now. The nursery production of cyanobacteria involves the production, along with seedlings, in their nurseries, 320 meters square of land is used to prepare a nursery plus an additional 40 meter alongside for the production of cyanobacteria, 15 to 20 K of cyanobacteria will be available and is sufficient to inoculate about 1 1/2 hectares of land during the transplantation, especially or Paddy the mixture of Anabaena Nostoc is prepared in the field for application by first growing them in the flask containing sterile medium and then they are transferred to larger glass bowls under non sterile conditions. This slide shows the open point design for mass cultivation of cyanobacteria. the mixture of anabaena nostoc is grown in flask and transferred to glass flask. The nursery plots with six to 7 centimeter of water require 150 gram of sign of bacteria per meter square. In about 7 days, 502 thousand grand per meter square of cyanobacterial biomass can be harvested. The nursery plots can be covered with a transparent plastic sheet for protection from low temperatures for field inoculation. About 750 gram per hectare or 7.5 tons per hector can be obtained in 10 to 15 days in the open air method. The disadvantages include that the sign of bacteria can be produced only for a limited period in a year.

The production stops during rainy day or during the winter. Reason there can be a high level of contamination. The production rate can be slow with the low population density of the cells. And they can be a need for heavy inoculum for Hector to overcome some of these problems. The indoor production of cyanobacteria can be used where the design of bacteria or the blue green algae are grown in a Poly

house or a glass house made up of RCC, brick, mortar or even polyethylene line pits. I know bacteria are grown individually in separate tanks as pure cultures. The culture is harvested and mixed with a carrier material, pre soak overnight in water and Multani mitti in a ratio of one is to one and then sun dried. The dried material is ground and packed in polythene bags, sealed and stored. The final product should contain about 10,000 to one Lac units of propagules per gram of the carrier material. 1000 gram material of this is sufficient to inoculate one hectare of rice growing area. Some problems associated with the use of cyanobacteria as biofertilizer include the competition from the flora when the nitrogen content is low with nitrogen fertilizer, is used as when the green algae dominate the soil flora. Most cyanobacteria inoculated in this soil failed to dominate over the indigenous soil flora. These are some of the references which you can refer to. Thank you.