



Studies on Indigenous Microorganisms (IMOs) increasing Growth of Leaves Germination, Chlorophyll content and Differentiation between IMOs and Chemical Fertilizers in various crop plants.

M.Soma Sekhar and Prof.D.V.R.Sai Gopal

Dept. of Virology,
S.V.U.College of Sciences,
S.V .University,
Tirupati, AP -517502
INDIA

Abstract: *The most important thing in soil is the primitive diversity and power of indigenous microorganisms. The Indigenous Microorganisms or IMO s, are tiny colonies of life that are found and propagated from the immediate vicinity of the growing location supplies readily available nutrients directly to the soil-rhizosphere system. In the present study the impact of Indigenous microorganisms (IMOs) and chemical fertilizers on soil fertility, plant growth and nodule formation were assessed. Various concentrations of IMOs and Chemical fertilizers were applied to the seeds as well as soil and their effect on plants such as Okra, cowpea and bajra were monitored for period of 45 days. Germination started as early as second day in all seeds treated with IMOs, whereas only few seeds treated with chemical fertilizers showed germination. Germination was not observed in control seeds (seeds neither treated with IMOs nor treated with chemical fertilizers). On third day good germination was noticed with seeds treated with IMOs, whereas average germination was observed with chemical fertilizers treated seeds. 50% of control seeds started germination on third day. Maximum height and chlorophyll content were obtained in IMOs treated plants when compared to chemical fertilizers treated plants and control plants in a period of 45 days. The number of root nodules, size of root nodules of the selected plants was maximum in IMOs treated plants compared to chemical fertilizers treated seeds and control seeds. Increase in seed yield was observed in IMOs treated plants when compared to chemical fertilizers treated plants and control plants. In conclusion, indigenous microorganisms at a concentration of 50 mg/kg soil resulted in increased plant/ leaf growth, earlier germination, increased seed yield and increased chlorophyll contents respectively*

Keywords: *Indigenous microorganisms, soil fertility, chemical fertilizers, chlorophyll content.*

I. Introduction

Microorganisms play an important role in making soil good for growing plants. These microorganisms can also be collected and cultured .Natural Farming promotes the use of Indigenous .Microorganisms (IMOs). The microorganisms that have been living in the local area for a long time are best for farming because they are very powerful and effective. They have survived and can survive the extreme climatic conditions of the local environment much better than artificially produced microorganisms. it is important to recognize that the best soil and crop management practices to achieve a more sustainable agriculture will also enhance the growth, numbers and activities of beneficial soil microorganisms that, in turn, can improve the growth, yield and quality of crops. In essence, soil quality is the very foundation of a more sustainable agriculture. (National Academy of Sciences, 1989; Hornick, 1992; Parr *et al.*,(1992). The insurmountable rising cost of inorganic fertilizers is inevitably uncontrollable in the coming production years. Looking into this perspective the farmers have to look for an alternative measures to sustain his farming business profitability. Natural farming system connects seed to an in alienating part of the microbial world of nature. Very life on earth is said to be of microbial ministration and to think of life without microbes is next to impossible. So is the case in terms of the earth's bio-diversity of species whether seed or breed can co-exist in the midst of teaming microbial millions. Natural farming technologies emphasizing on IMO's multiplication in various ways. The technologies are relevant to preserve the native varieties and bio diversity by farming community. (Cho Han kyu 2012). Natural farming is a culture where plants are grown in 100% natural environment with the least human interference and no harmful chemicals or synthetic products used. It is practically leaving the crops grow and produce in their natural environment, and man comes enhances the natural conditions to improve productivity.

II. Materials and Methods

Collecting indigenous microorganisms from the environment:

The IMO's can be collected by various methods. It can be collected from hills and mountains using steamed rice with low moisture (hard-boiled), decomposed leaves and bamboo stumps. It is possible to collect, to a certain extent, particular types of microorganisms. The collection process takes approximately 4-5 days in cooler temperature (about 68°F, 20°C) and 3-4 days under warmer conditions (<68°F, 30°C). Indigenous Microorganisms are highly concentrated under undisturbed conditions or places or areas. Combining Indigenous Microorganisms collect from multiple sites. The Indigenous Microorganisms (IMO) cultured at any time of the year. Avoid wet, rainy seasons. Excessive moisture in the environment promotes growth of bacteria, fungi that are less desirable for the intended uses.

Procedure to cultivate the Indigenous Microorganisms:

Take a square shape (L1.5xW1xH1) wooden box, fill with 75% cooked Rice and tie with string. Bury the box into the soil leaf mold deeply. Cover it with plastic sheet to prevent from rain. Temperature base after 3 to 5 days, when open the box it looks like white layer, includes fungus, bacteria forms. It's called as cultivation of Indigenous microorganisms. (IMO step -1). Mix jaggery into the IMO-1 equal ratio (1:1) and took in cool place within the jar. (IMO step-2) Cultured IMO-2 placed in cool and dried place within the jar. IMO-2 (2:1000) ratio apply on the rice bran and mix equally, along with FPJ&FFJ same ratio. It is called as IMO step-3. IMO-3 mixed in the soil called as IMO-4, cultured microorganisms are starts working.

III. Results and Discussions:

Various concentrations of IMOs and Chemical fertilizers were applied to the seeds as well as soil and their effect on plants such as Okra, cowpea and bajra were monitored for period of 45 days. Germination started as early as second day in all seeds treated with IMOs, whereas only few seeds treated with chemical fertilizers showed germination. Germination was not observed in control seeds (seeds neither treated with IMOs nor treated with chemical fertilizers). On third day good germination was noticed with seeds treated with IMOs, whereas average germination was observed with chemical fertilizers treated seeds. 50% of control seeds started germination on third day. Maximum height and chlorophyll content were obtained in IMOs treated plants when compared to chemical fertilizers treated plants and control plants in a period of 45 days. The number of root nodules, size of root nodules of the selected plants was maximum in IMOs treated plants compared to chemical fertilizers treated seeds and control seeds. Increase in seed yield was observed in IMOs treated plants when compared to chemical fertilizers treated plants and control plants. In conclusion, indigenous microorganisms at a concentration of 50 mg/kg soil resulted in increased plant/ leaf growth, earlier germination, increased seed yield and increased chlorophyll contents respectively.

A. Growth

Weighing Plants: Fresh vs. Dry Weight

Measuring Fresh Weight: technically measure the fresh weight of plants without harming them, the simple act of removing a plant from its growing "medium" can cause trauma and affect the on going growth rate of experiment. Measuring the fresh weight of plants is tricky and should probably be saved as a final measure of growth at the end of the experiment. Here is the process for measuring fresh weight:

1. Remove plants from soil and wash off any loose soil.
2. Blot plants gently with soft paper towel to remove any free surface moisture.
3. Weigh immediately (plants have a high composition of water, so waiting to weigh them may lead to some drying and therefore produce inaccurate data).

Measuring dry weight: Since plants have a high composition of water and the level of water in a plant will depend on the amount of water in its environment (which is very difficult to control), using dry weight as a

measure of plant growth tends to be more reliable. You can only capture this data once as a final measure at the conclusion of your experiment.

4. Remove the plants from the soil and wash off any loose soil.
5. Blot the plants removing any free surface moisture.
6. Dry the plants in an oven set to low heat (100° F) overnight.
7. Let the plants cool in a dry environment (a Ziploc bag will keep moisture out) - in a humid environment the plant tissue will take up water. Once the plants have cooled weigh them on a scale.
8. Plants contain mostly water, so make sure you have a scale that goes down to milligrams since a dry plant will not weight very much. (Wood, A.J. and Roper, J. (2000, March))

The IMO treated plants increased the growth of leaves and yield. Fresh weight of leaves and dry weight of leaves are calculated. **(Table-1)**

- a. **Leaf fresh weight:** fresh leaves were collected from the IMO treated plants and control plants. The fresh weight of these leaves was taken and the leaves were taken and the leaves were preserved in polythene bags at room temperature.
- b. **Leaf dry weight:** The preserved leaves were dried under room temperature and the weights of the leaves were noted.

B. Effect of indigenous microorganisms and chemical fertilizers on crop plants. (Table-2)

Various concentrations of IMOs and Chemical fertilizers were applied to the seeds as well as soil and their effect on plants such as Okra, cowpea and bajra were monitored for period of 45 days. Germination started as early as second day in all seeds treated with IMOs, whereas only few seeds treated with chemical fertilizers showed germination. Germination was not observed in control seeds (seeds neither treated with IMOs nor treated with chemical fertilizers). On third day good germination was noticed with seeds treated with IMOs, whereas average germination was observed with chemical fertilizers treated seeds. 50% of control seeds started germination on third day. Maximum height and chlorophyll content were obtained in IMOs treated plants when compared to chemical fertilizers treated plants and control plants in a period of 60 days and root nodules formation also observed finally.

C. Estimation of Chlorophyll in IMO Treated and Control (Arnon Method): Table - 3

Take the young leaves of IMO treated and control plant leaves. 1 gram of both IMO treated and control plant leaves were separately, washed in tap water and followed by distilled water and cut into small pieces. The samples are macerated in cold 80% acetone and centrifuged at 3000 rpm for 15 minutes. The pellets were thoroughly washed thrice with 80% acetone and the supernatants were pooled. The pellets were discarded and pooled; supernatants were made up to 25ml with acetone.

The following formula were used for

Total chlorophyll, chlorophyll-A and chlorophyll-B

Total chlorophyll: $[(20.2 \times O.D_{645}) + (8.02 \times O.D_{663})] \text{ df}$

Chlorophyll A : $[(12.7 \times O.D_{663}) - (2.69 \times O.D_{645})] \text{ df}$

Chlorophyll B : $[(22.9 \times O.D_{645}) - (4.68 \times O.D_{663})] \text{ df}$

.D – Optical density ; df – dilution factor

The IMO treated plants increased the growth of leaves and yield. Fresh weight of leaves and dry weight of leaves are calculated(Table-1)

s.no	Sources	Fresh leaves weight (Initial weights)	Dry leaves weight	
			After 15 days	After 30 days
1.	Low IMO treated (100 g / 1kg)	10 mg	7.6 mg	5.2 mg
2.	Medium IMO treated (250 g / 1 kg)	10 mg	8.5 mg	6.9 mg
3.	High IMO treated (500 g / 1 kg)	10 mg	6.9 mg	5.9 mg
4.	Control plants (without IMO)	10 mg	5.8 mg	4.2 mg

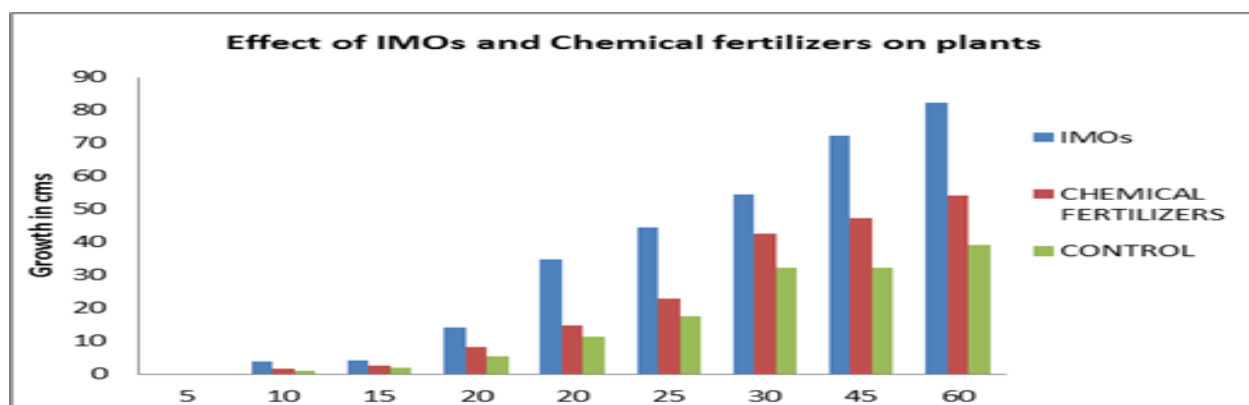


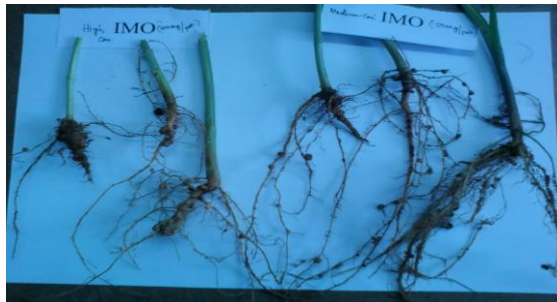
Table -2 Effects of indigenous microorganisms and chemical fertilizers on crop plants. (Table-2)

s.no	Indigenous microorganisms(IMO)	Chemical/organic fertilizers	Control
1.	<u>Germination:</u> Day-1: No Day-2: Occur in all seeds Day-3: Good germination, growth in all seeds.	No Germination occurs in some seeds only. Average germination, crop plants are smaller than IMO	No No Germination occur in 50%Of seeds
2.	<u>Growth</u> Day-4: Height of the crop plants are average 3.5to3.9 Day-5: Height – 3.6cms to 4.2cms Leaf Colour – Dark green Day-10 : Height – 8.2 to 14.2 Leaf Colour – Dark green Day -20 : Height – 34.7 to 44.3 Leaf Colour – Dark green Day-30: Height – 54.4 to 72.3 Leaf Colour – Dark green Day-60: Height – 82.3 to 64.4 Leaf Colour – Dark green	Height of the crop plants are average 0.7 to1.6 1.5 to 2.5 Normal green 5.2 to 8.3 Leaf Colour-Normal green Height – 14.8 to 22.8 Leaf Colour – green Height – 42.6 to 47.4 Leaf Colour – green Height – 48.2 to 54.1 Leaf Colour– Normal green	Height of the crop plants are average 0.5 to1.2 1.0 to 2.1 Light green 4.5 to5.6 Leaf Colour-Normal green Height –11.5to 17.7 Leaf Colour – green Height – 32.4 to 34.6 Leaf Colour – green Height – 35.3 to 39.2 Leaf Colour – pale green

Total chlorophyll, Chlorophyll A & Chlorophyll B ratio in IMO Treated and Control plants (Table -3)

Chlorophyll mg/ g fresh leaves				
Sample	Total Chlorophyll	Chlorophyll-A	Chlorophyll – B	Chlorophyll A/B Ratio
1. IMO treated Low (100 g / 1L)	0.9821	0.6681	0.4124	1.6200
2. Medium (250 g / 1 L)	1.7311	0.4846	0.0986	4.9148
3. High (500 g / 1 L)	1.2101	0.3254	0.4506	0.7221
Control (without IMO)	0.5831	0.9982	0.7429	1.3436

Research Work Images



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