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Double Production in Groundnut with Phosphatic Biofertilizers

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Abstract: Groundnut (Arachis hypogea L., 2n=20) is nitrogen fixing pulse crop, belong to Leguminocae family. The present study conducted on production of groundnut with phosphatic biofertilizers. The experiment was conducted at Madhav village and Sattasar village in May, 2015. The mycorrhiza solid powder dissolved with molasses + water to form organic product. The seed poured in the formulated organic product for 24 hrs. Later, the seed was placed in the prepared land. The seed emerged from the soil in 7-10 days and the flower appeared in the plant within 35 days after sowing. The healthy nodule was formed in the root organ with application mycorrhiza solid powder. The application of mycorrhiza solid powder progresses morphological growth, yield, soil property and soil biology.

Keywords: groundnut, production, biofertilizer, nodule formation

I. INTRODUCTION

Groundnut (*Arachis hypogea* L., 2n=20) is oilseed crop, commonly known as peanut, belongs to Leguminocae family. The production of groundnut of 5048 metric tonnes was estimated in the world in 2020 (USDA, 2021). In India, the production of groundnut of 101.9 lakh tonnes was recorded in groundnut in 2020 crop year (PIB, 2021). The groundnut was cultivated in India, China, Nigeria, Sudan, United States in the world. The major states of groundnut producers are Gujarat, Andhra Pradesh, Tamil Nadu, Mahrashtra, Rajasthan, Madhya Pradesh, Orissa and Uttar Pradesh. The oil content of groundnut is 48-50%, applies soap, cosmetic products, lubricants. The groundnut cake uses in making artificial fibre, groundnut shell uses in preparing coarse boards and corks. The dried groundnut plant supplies to the animal for feeding purpose.

The soil texture of Bikaner district covers with Sandy soil. The climate of the district is tropical climate. The water retention capacity and nutrient content are low in the soil. The overutilization of fertilizers disturbs the physical property and chemical property of the soil. The growth and development of the plant are retarded because of nutrient and water deficit. The application of Biofertilizers is complimentary resources for reforming soil properties and crop production. It thrives soil textures, soil colour, chemical compositions of the soil, maintains water capacity in the soil. It progresses metabolism and growth in the plant, maintains ecology and ecosystem in the plant and soil. Organic manures, valuable by-products of farming and allied industries, contribute to plant growth through their favourable effects on the physical, chemical and biological properties of soil. Organic manures also have a pronounced residual effect on the nutrient availability (Stevenson, 1994).

Groundnut and other legumes are able to fix nitrogen through symbiotic relationship with specific species of Rhizobium bacteria. Small round nodules forms on the plant's roots where colonies of bradyrhizobium and converts atmospheric N_2 into the form of nitrogen that the plant can use. “Myco” means “fungus” and “rhizae” means “root,” and so the word “mycorrhizae” means “fungal roots.” The root of the host groundnut plant provides convenient substrate for the fungus and also supplies food in the form of simple carbohydrates. The mycorrhiza incurs symbiotic association between fungi and groundnut plant roots. The fungus evolves with groundnut plants and soils for over years. Veeramani *et al*. (2012) reviewed that application of organic manure, biofertilizers and foliar nutrient spray in groundnut improves crop growth and yield.

With this background, the following objectives were taken in the open field investigation ie.,

1) To determine growth and development in the crop,
2) To determine nodule formation in the crop,
3) To determine working activity of mycorrhiza in the crop.

II. MATERIALS AND METHODS

A. Materials

Crop- Groundnut (*Arachis hypogea* L., 2n=20)
Cropping system- Monocropping
Biofertilizer- Mycorrhiza Solid powder, **(Fig. 1)**
Ingredients- Molasses, Water
Place of cultivation- Madhav Diggi village and Sattasar village, Bikaner, Rajasthan
Date of sowing- 20 May 2015 **(Fig. 2)**

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B. Methods

Pour Mycorrhiza Solid powder with diluted Molasses + water for preparing organic solution,
Mix groundnut seed in prepared organic solution for 24 hrs,
Dry organic coated mixed seeds,
Broadcast mixed seeds into the prepared land.

III. RESULTS AND DISCUSSION

A. Determination of Growth and Development in the Crop

1) *Germination of Groundnut:* The treated seed was placed in the prepared land on 20 May 2015. The seed germinated in 7-10 days. The cotyledons stored proteins and carbohydrates while the tap root penetrates deep in the sandy soil. The leave grows upward, unfurl and capture light in order to create food. With ample sunlight and water, the plants grow rapidly as the root obtains nutrient from the soil and the leaves manufactures starch sugar with help of photosynthesis.
2) *Formation Of Flowers In The Crop Within 35 Days:* The proper sunlight, nutrients, and water were emerged flower within 35 days after planting.. The pollinated flower forms a gynophores, or peg. After pollination, the flower's pedicel forms a peg (gynophores) due to cell division beneath the ovary. The peg quickly grows downward where it digs into the soil because positively geotropism movement. The peg contains growing embryos of the plant. A cap of cells forms next to the withered style, to protect the ovary as it pushes through the soil. Once the soil, the peg orients horizontally and forms a single shell containing 1-3 seeds. More flowers and pegs grow daily until the plant dies within 120-140 days. The total pegs may range from 50-60 pegs **(Fig. 3).**
3) *Formation Of Root In The Crop With Powder & Granular Inoculants:* The commercial mycorrhizal inoculants are not limited to seed treatment or to the crop planting process. The seed of groundnut was treated with powered inoculants and Molasses before planting. In these situations, the method employed is to make a hole in soil by dipstick & fill granular inoculants in the soil. The roots become colonized when they eventually enter the treated soil. This kind of application is not common among groundnut crops. Treating established crops is particularly worthwhile; a one-time inoculation will continue to deliver benefits over 4 months. The amount of inoculants used to treat such a crop is greater but the advantage applies to multiple harvests. The treated seed will quickly colonize and spread fungi to surrounding roots Zalate *et al*. (2009) reported that seed inoculation with biofertilizers significantly increased the pod, haulm and biological yields, shelling percentage, oil yield and protein content of groundnut crop. Pravin *et al*. (2018) resulted that application of Biofertilizers significantly increased the growth attributes viz., plant height, primary branches plant and secondary branches plant and yield.

B. Determination of Nodule Formation in the Crop

Benefits are maximized when the mycorrhizal fungus colonizes the roots of groundnut early in the groundnut. The seed has germinated and begun to sprout. The active components in the inoculum are mycorrhizal fungi propagules in the form of spores and colonized root fragments. When one of these colonizing units touches or comes into very close proximity of living root tissue of groundnut. They are activated by minute amounts of specialized root exudates and begin the mycorrhizal colonization process.

The newly colonized root cells begin to send hyphal threads from the young groundnut plant's roots. The hyphal begins absorbing moisture and nutrients from the surrounding soil while warding off root disease pathogens via production of antagonistic exudates. These processes results greatly improve chances for survival compared to non mycorrhizal groundnut plants. Almost immediately, the colonized sprout develops special tools to secure adequate moisture, nutrients and defence against fungal root diseases. The hyphae quickly grow and spread throughout the surrounding soil, penetrating the tiny spaces between soil particles. As they encounter more roots, these also become colonized. Then, each of these root produces more hyphal which in turn colonize even more roots until a massive hyphal network has pervaded the expanded rhizosphere. Clearly, inoculating seeds with mycorrhiza is an effective way to go. The benefits are the greatest and the cost is minimal, since treating, a seed usually takes less inoculum than is required to colonize larger root system of a more developed ground nut plant. Panwar *et al.* (2002) described that application phosphatic biofertilizers produces nodule in the root organ through metabolic activity, transport nutrient in the plant.

C. Determination of Working Activity of Mycorrhiza In The Crop

First of all, as in trialing any change in program, be sure to leave a part of your crop untreated as a control. Often the effects of mycorrhizal colonization will be obvious in early growth. The groundnut plants may be taller, have more foliage and larger root systems.

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If water is scarce, you may note less moisture stress compared to control crop. Sometimes the visual difference between the treated and the control crop is less obvious but the yields are significantly better in the treated crops. And occasionally, there will be no discernible difference at all. In this last circumstance, it may be that the benefits lie entirely in savings via reduced inputs to get the same yields as without treatment. Capitalizing on this may take some experimenting over several seasons **(Fig. 4).** Michael *et al.* (2020) identified the activity of the mycorrhiza in the groundnut crop.

IV. CONCLUSION

The powdered or liquid mycorrhizal inoculants are best accomplished in crop growth and yield. The inoculum adheres directly to the surface of the seed. Powdered inoculants work well with hairy textured seeds such as ground nut seeds. Seed adhesion is important not only to insure inoculum proximity to the germinating seed. A liquid inoculum is often preferred for groundnut and similar smooth-surfaced seeds because it will adhere well. A "sticker" or tackifier Molasses product is necessary to apply powdered inoculants to these types of seeds to keep the powder attached to the seed surface.

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Fig. 1: Mycorrhizal Granular prepared in field. Sample holding by Dr.Ram Bajaj

Fig. 2: Photo shows the actual healthier groundnut standing crops at field

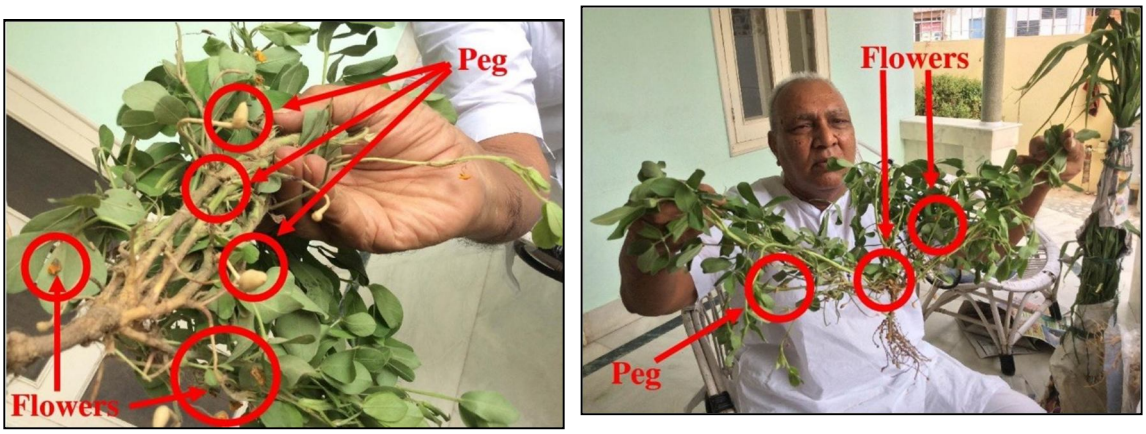

Fig. 3: Encouraging mycorrhizae fungi in nursery will reduce Nil fertilizer requirements & grow healthier groundnut plants – Photo by Dr.Ram Bajaj

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Fig. 4: Arbusculer are found inside root & arbuscular mycorrhizae inoculum contains spores & colonized root fragments – Photo Dr.Ram Bajaj

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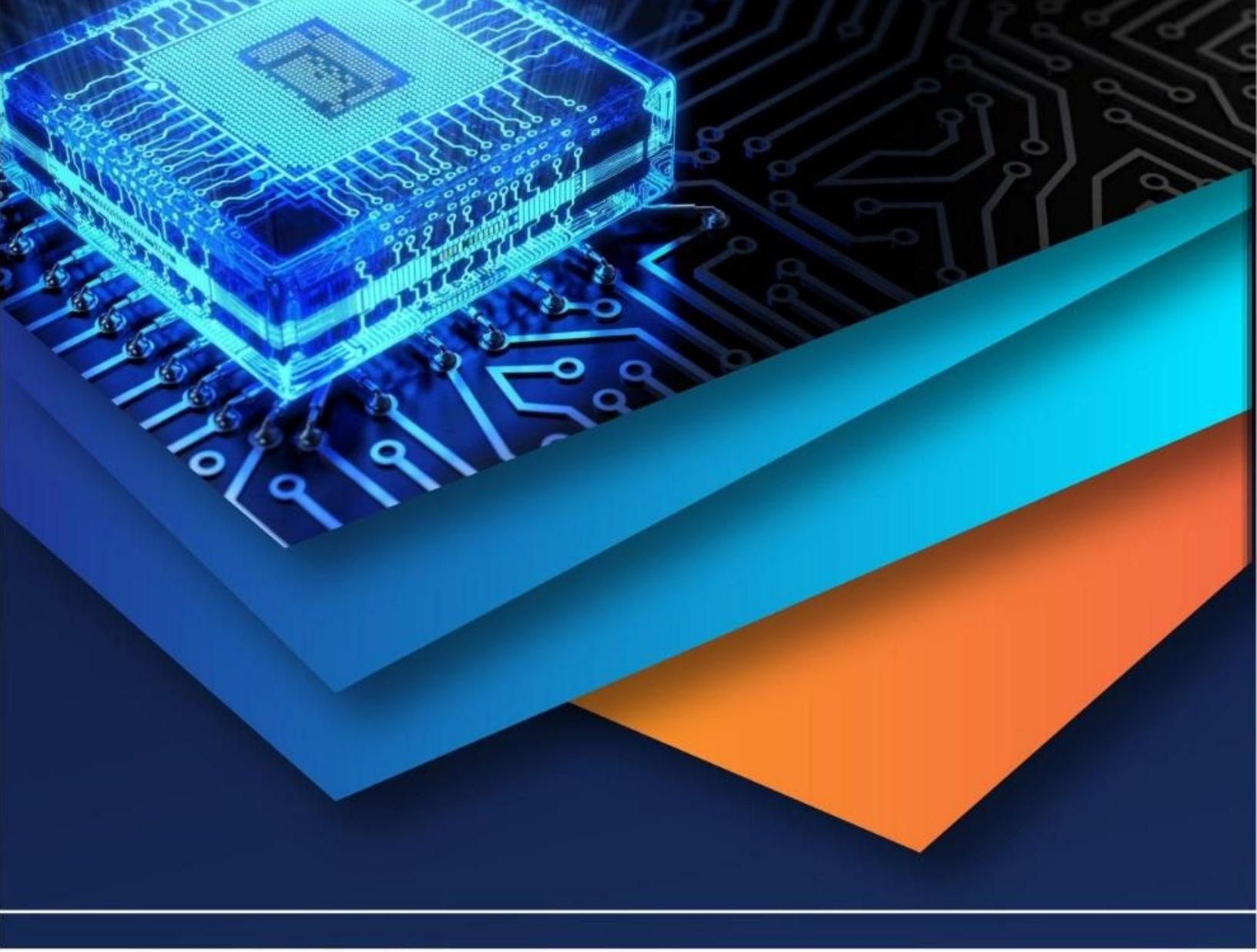

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