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Research Article

EFFECT ON GROWTH AND YIELD OF PISUM SATIVAM L. DUE TO MYCORRHIZA & RHIZOBIUM

Kanchan Lata, Tirthesh Kumar Sharma* and Sippy Dassani

Department of Botany & Industrial Microbiology, Bipin Bihari College Jhansi (U.P.), India

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ABSTRACT

A field experiment was carried out to study the effects of *Rhizobium* and mycorrhizal spores on two varieties of *Pisum sativum* (Arkel and IPFD 99-13 Vikas). Seeds of the pea varieties Arkel and IPFD 99-13 Vikas were sown in the research field of the Bipin Bihari College in Jhansi, Uttar Pradesh. *Rhizobium* and mycorrhizal spores were inoculated with the pea seeds both separately and in combination. After germination, measurements of plant height, weight, root nodule and pod numbers, chlorophyll content, leaf area, and total yield were taken. This data was measured after 30, 45, 60, 75, 90, and 120 days after sowing. These studies suggest that mycorrhiza and *Rhizobium* had a positive influence on the growth and yield of pea plants.

INTRODUCTION

Pea (*Pisum sativum* L.) is a vegetable crop. In India, it is a major crop that is typically grown for its green pods. Pea plant seeds are highly nutrient-dense and rich in protein [1]. The Mediterranean region, Afghanistan, and Abyssinia are probably the places where the pea originated. Later, pea spread to the other parts of Asia and Europe [2]. Pea was typically utilized in ancient Greece and Rome [3]. The Greeks and Romans called to the pea as "pisos" and "pisum," respectively. The plant's name changed to "peason" when it was brought to English, followed by "pease" or "peasse" and ultimately "pea." In middle and northern Europe, where the climate was favourable for its cultivation, it has become an important crop [4].

Field peas and garden peas, two varieties of cultivated peas, are occasionally considered to be different species. Since they are quite interfertile and may be crossed easily, there may not be much justification for this. It remains likely that the garden pea was developed through selection of the field pea [5]. In temperate regions of Europe, India, China, North America, and subtropical climatic regions, peas form a major component of the human diet [6]. In addition to being used as a vegetable, peas' dried split grains are frequently used as pulses. Pea straw, which is also very nutritious, is used as animal food [1]. Pea seeds have low amounts of fat, fibre, and digestible carbohydrates but high concentrations of protein and micronutrients [7].

MATERIALS AND METHODS

For this study two varieties of pea (*Pisum sativum* L.) i.e. Arkel and IPFD 99-13 (Vikas) were selected. Seeds were purchased from Agrawal Beej Bhandar Jhansi.

For giving treatment to seeds of pea, Mycorrhizal fungal spores were isolated from the rhizospheric soil samples from Babina forest of Jhansi and *Rhizobium* strain were isolated from the root nodules of *Pisum sativum* L.

Germination percentage of seeds

For germination percentage, Seeds were treated with different treatments i.e. Mycorrhiza, *Rhizobium* and Mycorrhiza+ *Rhizobium*. At room temperature (28°C), the Petri plates were placed on a laboratory table. Normal, abnormal, and diseased seeds were counted after three days. Seed germination in both varieties of pea was higher in dual inoculation of *Rhizobium*+ mycorrhiza than other treatments.

Sowing of seeds

Seeds were sown in the middle of October 2019 at the research field of Bipin Bihari College Jhansi. For each treatment 4 rows were prepared in the field. In those 4 rows seeds were sown and after 10 days of sowing, seedlings of each row were treated with different treatments such as *Rhizobium*, mycorrhiza, and dual *Rhizobium* and mycorrhiza inoculation (R+M).

Seedlings of one row were considered as controlled. Plants were observed daily and measured on 30, 45, 60, 75, 90 and 120th days after sowing.

Corresponding author:* **Tirthesh Kumar Sharma
Department of Botany & Industrial Microbiology, Bipin Bihari College Jhansi (U.P.), India

Growth parameters were plant height, plant weight, number of root nodules, number of pods, chlorophyll amount, leaf area and yield.

RESULTS AND DISCUSSIONS

In this experiment, two varieties of pea plants were inoculated with rhizosphere-isolated mycorrhizal spores and *Rhizobium*. The findings of the study have been presented in the form of tables, photos, and graphs. The parameters chosen for the experiment were plant height, plant weight, number of root nodules, number of pods, amount of chlorophyll, leaf area, and overall yield.

Data presented in Graph-01 showed that when treated with *Rhizobium* cells, mycorrhizal spores, and the two combinations, there was an increase of around 2.9% and 8.7% in variety Arkel, as well as 14.4%, 16.6%, and 25% in variety Vikas of growth in plant height at the end of the growing season.

Increased plant height also results in increased fresh and dried weight. After being treated with *Rhizobium*, mycorrhiza, and *Rhizobium* + mycorrhiza, the plant mass increased by 2.5%, 6.1%, and 17.5% in the variety Arkel and 3.1%, 8.2%, and 15.9% in the variety Vikas, according to the results shown in Graph-02.

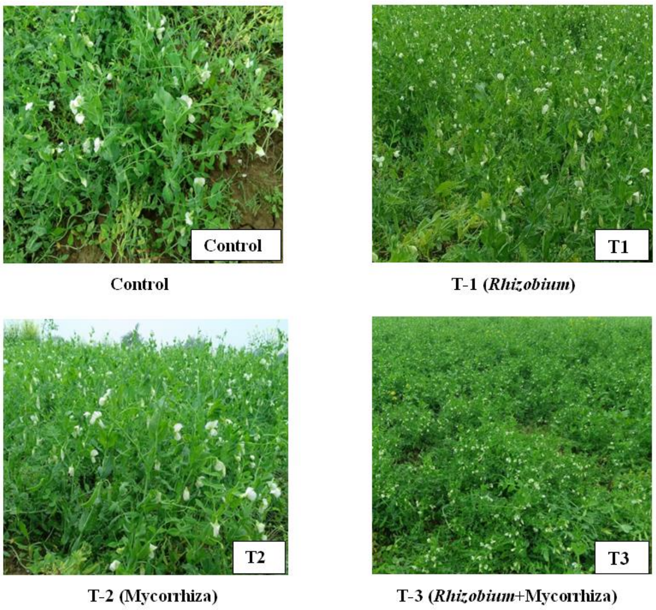
The ability of the *Pisum sativum* plant to nodulate under different treatments is affected by the effect of plant growth (height and weight). The data shown in Graph-03 revealed an increase in the nodulation of the crop under study. When seeds were treated with *Rhizobium* and Mycorrhiza spores separately and in combination, the growth rates at the end of plant growth were 21.8%, 6.2%, and 25% in variety Arkel and 19.3%, 3.2%, and 35.4% in variety Vikas, respectively, when compared to control crops.

It has been found that increases in plant weight, height, and nodule number also result in increases in leaf area. When the leaves are chemically analysed for amounts of chlorophyll in treated plants, the results shown in Graph-04 reveal an increase in leaf area of 13.5%, 14.8%, and 33% in the variety Vikas when compared with control plants in various treatments. Graph-05 clearly shows that at the end of the growing season, the amount of chlorophyll in variety Arkel has increased by 33.4%, 43.8%, and 78.6%, whereas it has decreased by 29.0%, 40.8%, and 68.3% in variety Vikas.

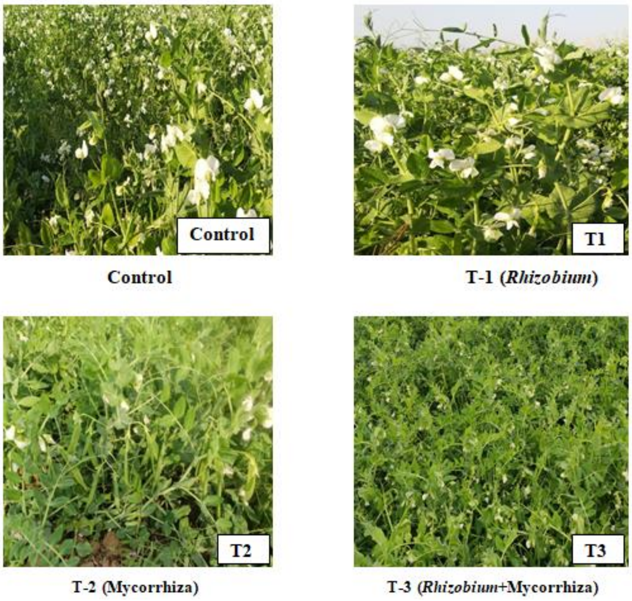
Plant yield is affected by how spore treatments affect vegetative parameters. The plant's yield is measured in terms of the number of pods and total yield (weight of 100 seeds). The results shown in Graph-06 showed that after treatment with *Rhizobium* and mycorrhizal spores separately and together, the number of pods increased by 17.2%, 31.0%, and 46% in the variety Arkel and by 10%, 13.3%, and 30% in the variety Vikas when compared to the number of pods in control plants. The total yield of the crop plant rises as the number of pods increases as well. The crop treated with *Rhizobium*, mycorrhiza, and *Rhizobium*+ mycorrhiza showed increases in variety Vikas of 10.7%, 11.3%, and 21.4%. (Graph-07).

The results of this study showed that mycorrhizal spore inoculation and *Rhizobium* as a biofertilizer significantly affected the root and shoot lengths, plant weight, number of nodules and pods, leaf area, amount of chlorophyll, and germination. Similar results were also reported by [8, 9, 10, 11]. The combined effects of mycorrhizal spores and *Rhizobium* were found to have the greatest impact on *Pisum sativum* growth and yield. It was observed during the research that variety Vikas is more affected than variety Arkel. Similar reports were cited by [9, 12, 13].

It has been observed that combining the inoculation of several crops with Rhizobia and VAM-fungi will boost growth and yield, including soybean [14]. Similar beneficial effects of mycorrhiza and *Rhizobium* on *Vigna radiata* growth have been reported [15].

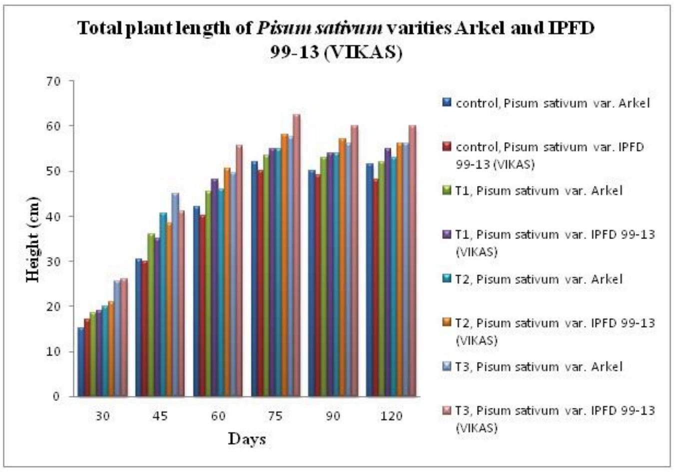


Pisum sativum variety Arkel treated with *Rhizobium*, mycorrhiza and dual inoculation of *Rhizobium* and mycorrhiza

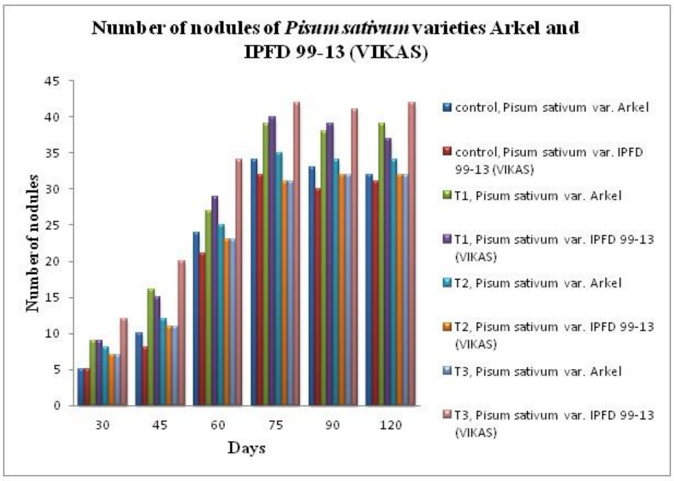


Pisum sativum variety IPFD 99- 13 Vikas treated with *Rhizobium*, mycorrhiza and dual inoculation of *Rhizobium* and mycorrhiza

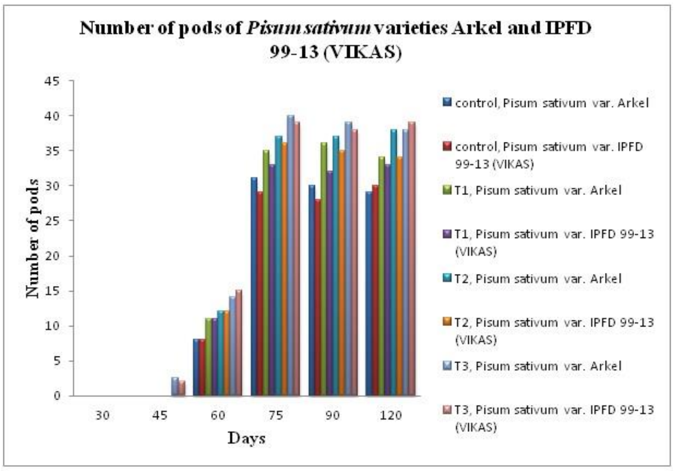
Comparative Graphs of Growth Parameters of Pisum sativum L. Varieties



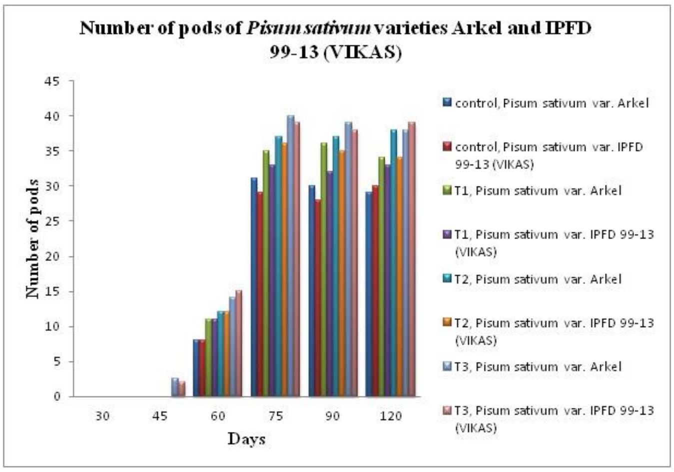
Graph 1



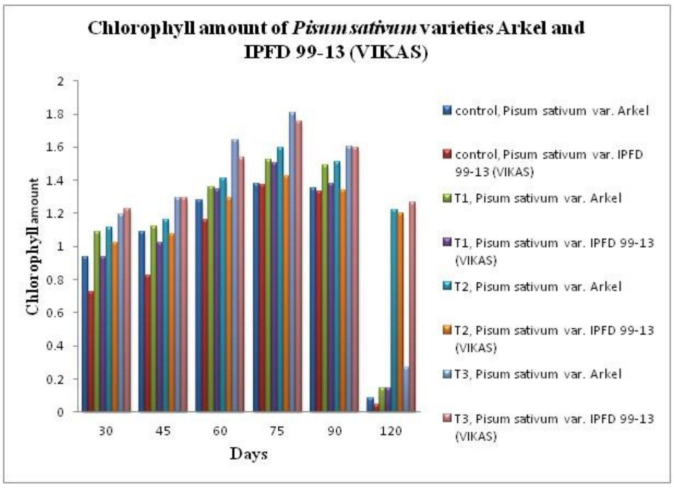
Graph 2



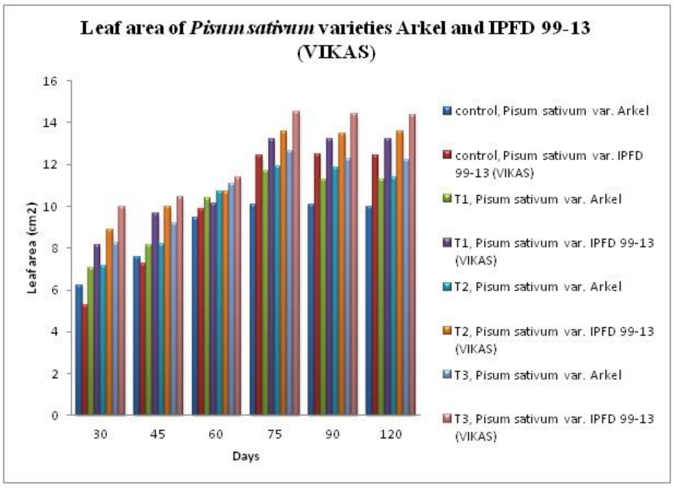
Graph 3



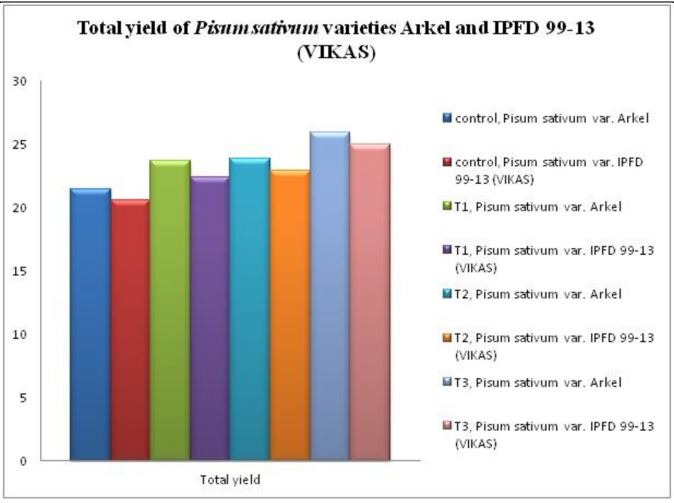
Graph 4



Graph 5



Graph 6



Graph 7

CONCLUSION

For this study two varieties of pea (*Pisum sativum* L.) i.e. Arkel and IPFD 99-13 (Vikas) were selected. Pea seed were treated with mycorrhizal spores, *Rhizobium* and dual inoculation of mycorrhizal spores and *Rhizobium*. When the effect of each treatment in various treatments were compared in both varieties, it has been found that mycorrhizal spores and *Rhizobium* spores together have been found be most effective on morphological and yield parameters.

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