Studies on the efficacy of biofertilizers on growth, yield and quality traits of French bean (*Phaseolus vulgaris* L.) Cultivars

SUMMARY

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Supervisor:
Prof. R. B. Ram

Submitted By:
Jiterndra Kumar Meena

DEPARTMENT OF APPLIED PLANT SCIENCE (HORTICULTURE)
SCHOOL FOR BIOSCIENCES AND BIOTECHNOLOGY
BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)
VIDYA VIHAR, RAE BARELI ROAD, LUCKNOW-226 025 (U.P.), INDIA

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Summary

The salient findings emanating from the present investigation entitled "**Studies on the efficacy of biofertilizers on growth, yield and quality traits of French bean (*Phaseolus vulgaris* L.) Cultivars**" was conducted at the Horticulture research farm-II of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, (A Central University), Lucknow during 2014-15 to 2015-16.

Field experiment with soil application of biofertilizers was conducted in Factorial randomized block design. Observations were documented on growth, yield and quality traits. The experimental findings of the study are summarized as blow.

The experimental data clearly indicated that the significant variation is observed in germination, of cultivars maximum in V_1 (PDR-14) in 2014-15 and 2015-16. However, the minimum was recorded in V_2 while the optimum germination was obtained in V_3 (IPR-98-3-1) both the year of experimentation.

Maximum plant height was observed in V_1 (PDR-14) while minimum plant height was found in V_2 (EC-400445) in both the consecutive years.

The data of plant height at 60 DAS showed significant difference due to bio-fertilizers, varieties and their interaction. V_1 (PDR-14) were recorded the maximum plant height among varieties which was significantly superior to other varieties. Maximum plant height was recorded in the treatment B_3followed by $B_2$was recorded. The minimum plant height recorded in B0 (control).

Highest plant height in B_3 followed by $B_2$was recorded. The lowest plant heights in control (B_0). Among the different cultivars, PDR-14 recorded significantly the highest plant height followed by IPR-98-3-1, while the minimum plant height was recorded EC-400445at maturity.

The combination effect, PDR-14 recorded the highest plant height grown with Rhizobium (B_3) inoculation treatment (V_1B_3).V_3B_0were recorded the lowest plant height without biofertilizers inoculation treatment.

The treatment of Rhizobium (B_3) has recorded maximum number of secondary branches per plant followed by (B_2) and the least was recorded in (B_4), while the Treatment B_3 was significantly superior to all other treatments.

V_3B_3 registered maximum number of primary branches per plant was significantly superior to all other treatment combinations followed by V_1B_3 and V_3B_1 and least interaction effect was recorded in V_1B_0 in both year (2014-15 and 2015-16) of research work.

The application of Rhizobium (B_3) was recorded maximum number of secondary branches per plant is followed by (B_2) and the least was recorded in (B_4).Treatment B_3 was significantly superior to all other treatments.

V_1 (PDR-14) recorded maximum number of leaves among varieties which was significantly superior to other varieties. Maximum number of leaves was recorded in the treatment B_3, followed by B_2 was recorded. The minimum number of leaves was recorded in B_0.

The data on number of leaves at 60 DAS showed significant difference due to biofertilizers and cultivars. Maximum number of leaves was recorded in the treatment B_3 and followed by B_2 were recorded. The minimum number of leaves recorded in B_0in control.

The interaction effect of cultivars and biofertilizers was no significant in relation to number of leaves at 60 days both year (2014-15 and 2015-16) and pooled value of data was no significant.

V_1 (PDR-14) was recorded maximum number leaves among varieties at 90 DAS which was significantly superior to other varieties. Maximum number leaves was recorded in the treatment B_2 followed by B_3 was recorded. The minimum number leaves recorded in B_0 (control).

The interaction effect of cultivars and biofertilizers was significantly found in relation to number leaves at 90 days both years (2014-15 and2015-16) and pooled value of data was significant in V_1B_2.while least value was found in V_3B_0.

V_1 (PDR-14) recorded maximum number of secondary branches per plant which was significantly superior to V_3 (IPR-98-3-1) and V_2 (EC-400445) respectively in 2014-15 and 2015-16.

Vesicular Arbuscular Mycorrhizae (B_5) was recorded maximum leaf length followed by (B_4) control (B_0) and the least was recorded in Azotobacter (B_1). Treatment B_5 was significantly superior to all other treatments.

PDR-14 (V_1) recorded maximum leaf width which was significantly superior to V_3 (IPR-98-3-1) and V_2 (EC-400445) respectively in 2014-15 and 2015-16.

Maximum leaf width recorded in Rhizobium (B_3) followed by Azotobacter (B_1) and control (B_0) and the least was recorded in (B_4). Treatment B_3 was significantly superior to all other treatments.

Interaction effect of cultivars and biofertilizers revealed that V_1B_3 registered maximum leaf width and was significantly superior to all other treatment combinations followed by V_1B_5 and V_3B_5. Least interaction effect was recorded in V_1B_0 in both years (2014-15 and 2015-16) of research work.

Cultivar PDR-14 had recorded first flowering. It was followed by EC-400445 and IPR-98-3-1 with significant increase in days to first flowering. Application of biofertilizers caused significant effect on days to first flowering. Minimum number of days for first flowering were taken under (B_3) Rhizobium. Maximum days to first flowering under (B_0) control. combination effect of cultivars and biofertilizers had significantly on days taken to first flowering in French bean.

Variety PDR-14 noted earliest 50% flowering. It was chased by EC400445 and IPR-98-3-1. The difference b/w PDR-14 and EC400445 was no significant but both were significant effect earlier for 50% flowering as compared to IPR-98-3-1.

Maximum days for 50% flowering were taken with control which was significantly higher than other biofertilizers. Minimum days to 50% flowering observed in B_3 followed by B_2 and B_5. The result was significantly found in 2014-15 and 2015-16.The interaction effect of cultivars and biofertilizers on days to 50%

flowering was found significant. Minimum days to 50% flowering taken with treatments V_1B_5 and maximum days to 50% flowering found in V_3B_0 in both years.

V_1 (PDR-14) recorded maximum number of pods per plant which was significantly superior to V_3 (Selection-9) and V_2 (EC-400445) respectively in 2014-15 and 2015-16. Maximum number of pods per plant was recorded in 2014-15 and 2015-16 with (B_3) Rhizobium which was significantly superior to B_2, B_0 (control) and B_1 in both years. Interaction between cultivars and biofertilizers revealed that V_1B_3 recorded maximum number of pods which was superior to all other treatment combinations. Significantly lowest number of pods per plant was recorded in V_3B_0 in 2014-15 and 2015-16.

The variety V_1 (PDR-14) was showed maximum number of grain per pod followed by V_3 (IPR-98-3-1) and V_2 (EC-400445). Variety V_1 PDR-14 was significantly superior to other varieties.

Biofertilizers B_2 (Phosphate Solubilizing Bacteria) recorded maximum number of grains per pod which was superior to B_3 (Rhizobium), control (B_0) and interaction effect between two factors (cultivars and biofertilizers) V_1B_2 had shown significantly higher number of grains per pod which was superior to all other treatments. Least interaction effect was found in V_1B_0 in both years.

Cultivar, V_3 (IPR-98-3-1) recorded maximum pod length and least pod length was recorded in V_1 in 2014-15. The treatment of B_3 was recorded maximum pod length which was significantly higher than other treatments. Least pod length was observed in B_0. Regarding interaction effect, V_3B_3 recorded maximum pod length of and lowest was registered in V_1B_0 in both year of research work.

Cultivar, V_1 recorded maximum pod width and least pod width was recorded in V_2 in 2014-15 and 2015-16. B_4 recorded maximum pod width which was higher than other treatments. Least pod width was observed in B_0.

Cultivar V_3 recorded maximum pod breadth and least pod width was recorded in $V_1$and V_3 in 2014-15 and 2015-16. Among different biofertilizers, application of B_3 recorded maximum pod breadth which was significantly higher than other treatments. Least pod width was observed in B_0.

Regarding interaction effect, V_2B_3 recorded maximum pod width and lowest was registered in V_1B_0 in both year of research work. The data was found significant in 2015-16 and pooled value of both years.

The highest Single pod weight was noted in V_1 (PDR-14) while lowest Single pod weight was found in V_2 (EC-400445) in both the years, respectively.

Combined effect of cultivar and biofertilizers also had a marked effect on the Single pod weight. Treatment combination (V_1B_3 and V_1B_2) had maximum Single pod weight in both the consecutive years respectively. Minimum Single pod weight was found in V_2B_0 in both the years, respectively.

The highest Green pod yield per plant (g) was noted in V_1 (PDR-14) closely followed by V_3 (IPR-98-3-1) during 2014-15 and 2015-16, respectively. However lowest value was recorded in treatment V_2 (EC-400445).

Application of B_3 recorded the highest Green pod yield per plant (g) which was significantly higher than other treatments. Least Green pod yield per plant (g) was observed in B_0.

The combination effect of cultivars and biofertilizers significantly observed in treatment combination V_1B_3 followed by V_3B_3 respectively. Least Green pod yield per plant (g) was recorded in control V_2B_0 in both the year of work.

The highest Green pod yield per plot (kg) noted in V_1 (PDR-14) closely followed by V_3 (IPR-98-3-1during 2014-15 and 2015-16, respectively. However lowest value were recorded in treatment V_2 (EC-400445). Application of B_3 recorded the highest Green pod yield per plot (kg) which was significantly higher than other treatments. Least Green pod yield / plot (kg) was observed in B_0.

The combination effect of cultivars and biofertilizers significantly found in treatment combination V_1B_3 followed by V_3B_3 respectively. Least Green pod yield per plot (kg) was recorded in control V_2B_0 in both the year of work.

The highest Green pod yield per ha (q) were noted in V_1 (PDR-14) closely followed by V_3 (IPR-98-3-1) during 2014-15 and 2015-16, respectively. However lowest green pod yield per hectare were recorded in treatment V_2 (EC-

400445).Application of B_3 recorded the highest Green pod yield per ha (q) which was significantly higher than other treatments. Least Green pod yield per ha (q) was observed in B_0.

Combination effect of cultivars and biofertilizers are significantly found in this parameter of experiment. The highest Green pod yield / ha (q) observed in treatment combination V_1B_3 followed by V_1B_5 respectively. Least Green pod yield per ha (q) was recorded in control V_2B_0 in both the year of work.

The highest 100 seeds weight (g) were noted in V_1 (PDR-14) closely followed by V_3 (IPR-98-3-1) during 2014-15 and 2015-16, respectively. However lowest value recorded in treatment V_2 (EC-400445). Application of B_3 recorded the 100 seeds weight (g) which was significantly higher than other treatments. Least100 seeds weight (g) was observed in B_0.

The highest 100 seeds weight (g) observed in treatment combination V_1B_3 followed by V_1B_2respectively. Least 100 seeds weight (g) was recorded in control V_2B_0 in 2014-15 and pooled value of both years.

The maximum moisture (%) was recorded in V_1 (PDR-14) followed by V_2 (EC-400445). while minimum in V_3 (IPR-98-3-1) in both years of experiment. Effect of biofertilizers on Moisture (%) in French bean was recorded. Control (B_0) registered the maximum Moisture (%) followed by B_4. while minimum Moisture (%) recorded in B_3 for both year of experiment. Combination effect of cultivars and different biofertilizers has no significant effect noticed on the moisture (%) in 2014-15 and 2015-16 and pooled value of both year.

Total sugars (%) were recorded maximum in V_1 (PDR-14) followed by V_3 (IPR-98-3-1). V_1 is significantly superior to V_3 and V_2 varieties in both years of experiment. Effect of biofertilizers on Total sugars (%) in French bean was recorded. Rhizobium (B_3) inoculation registered the maximum total sugars (%) followed by B_2. While minimum total sugars (%) recorded in B_0 (control) for both year significantly influenced the total sugars (%).

Interaction effect of cultivars and biofertilizers has no significant effect noticed on the total sugars (%) in both the years of experiment.

Maximum protein content was recorded in V_1 (PDR-14) followed by V_3 (IPR-98-3-1). V_1 (PDR-14) is significantly superior to V_3 (IPR-98-3-1) and V_2 (EC-400445) varieties in both years of experiment. Effect of biofertilizers on protein content in French bean was recorded. Rhizobium (B_3) inoculation registered the maximum protein (%) followed byB_2.while minimum protein (%) recorded in B_0 control for both years significantly influenced the protein content

Interaction effect between cultivars and biofertilizers (VxB) significant found in V_1B_3 (PDR-14 + Rhizobium) registered maximum protein content in both year of research work. While minimum protein content was at V_2B_0.