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Effect of phosphorus and biofertilizers on yield and economics of summer green gram (*Vigna radiata* L.) after wheat crop

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Abstract
A field study was carried out at Agronomy research Farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during *Zaid* season 2018-19 and 2019-20 to evaluate the effect of phosphorus and biofertilizers on yield and economics of summer green gram (*Vigna radiata* L.) after wheat crop. The Experiment consist of four phosphorus levels (Control, 20, 40, 60 kg P_2O_5 ha^{-1}) and three Biofertilizers (PSB, *Rhizobium*, PSB + *Rhizobium*) in 12 treatment combination *viz.*T_1- Control + PSB, T_2- Control + *Rhizobium*, T_3- Control + PSB + *Rhizobium*, T_4- 20 kg P_2O_5 + PSB, T_5- 20 kg P_2O_5 + *Rhizobium*, T_6- 20 kg P_2O_5 + PSB + *Rhizobium*, T_7- 40 kg P_2O_5 + PSB, T_8- 40 kg P_2O_5 + *Rhizobium*, T_9- 40 kg P_2O_5 + PSB + *Rhizobium*, T_{10}- 60 kg P_2O_5 + PSB, T_{11}- 60 kg P_2O_5 + *Rhizobium*, T_{12}- 60 kg P_2O_5 + PSB + *Rhizobium.*
The result revealed that when we applied 60 kg P_2O_5 ha^{-1} it gives higher yield and it is at par with 40 kg P_2O_5 ha^{-1} and in biofertilizer when PSB + *Rhizobium* is combindly used gives higher yield over other. Among all the treatment combinations, T_{12} treatment recorded maximum grain, straw, biological yield and harvest index and gave maximum values of gross return, net returns and benefit cost ratio which is closely followed by T_9.

Keywords: Yield, net return, Gross return

1. Introduction
Green gram (*Vigna radiata* L.) belongs to the family leguminoceae. In India, greengram covers 38.32 lakh ha area and production 17.84 lakh tonnes with 407 kg/ha average productivity (Anon., 2018) [2]. The cultivation of greengram is mainly confined to the states of Orissa, Maharashtra, Andhra Pradesh, Rajasthan, Madhya Pradesh, Gujarat, Bihar, Karnataka, Uttar Pradesh and Tamil Nadu. The cultivation of greengram in the Uttar Pradesh state is about 0.51 lakh hectares with the production of 0.22 lakh tonnes with 526 kg/ha average productivity (Anon., 2018) [2].
Greengram output for about 10-12% of total pulse production in the country. As per the latest available estimates, Rajasthan (26%), Maharashtra (20%) occupies the first two positions, contributing over 45%. Andhra Pradesh contribute about 10%, while Gujarat contribute about 7% of total production in the country (Anon., 2018) [2]. Greengram is the predominant in the *kharif* and summer seasons, but also cultivated from last few years in the *rabi* season in south Gujarat districts of Valsad, Navsari, Surat, Bharuch and Vadodara as a post rainy season crop. The yield level of *rabi* greengram is high as compared to *kharif*, because of minimum biotic and abiotic stresses (Anon., 2004) [1]. Fertilizers is although a costly input but essential input for securing higher yields. The prudent use of fertilizers with appropriate method and time of application are the prime importance in securing higher and economic yield. Phosphorus is the second most important nutrient next to nitrogen.
Its deficiency is usually the most important single factor which is responsible for poor yield of pulses on all soils. It is a major constituent of protein and nucleic acids. The cost of nitrogenous and phosphatic fertilizers are increasing day by day, hence, it is required to use some cheaper source of fertilizers like *Rhizobium* and phosphatic solubilizing bacteria etc. Bio-fertilizers like *Rhizobium* and phosphate solubilizing bacteria plays an important role in increasing availability of nitrogen and phosphorus through increase in biological fixation of atmospheric nitrogen and enhanced phosphorus availability to the crop, respectively. Introduction of efficient strain of *Rhizobium* in the soil poor in nitrogen may be helpful in boosting up the production through more nitrogen fixation.

The phosphorus solubilizing bacteria as inoculants in the root zone of crop plants partially solubilize the insoluble phosphate and improve the phosphorus use efficiency and the productivity. Mineral nutrition plays a vital role not only in exploiting the realizable potential of the crop, but also to maintain the sustainability of soil for agricultural production. Due emphasis on nutritional part is very essential. Fertilizer and its management is one of the important cost effective agronomic factors to augment the production. The degree of response of the crop to fertilizer application depends on fertility status of the soil. Inadequate or excess supply of any plant nutrient limits the crop production.

Materials and Methods

A field experiment was conducted at Agronomy Research farm of A.N.D. University of Agriculture and Technology Kumarganj Ayodhya, UP to evaluate the effect of phosphorus and biofertilizers on yield and economics of summer green gram (*Vigna radiata* L.) after wheat crop. The experiment consist of 12 treatment combination with some phosphorus levels (Control, 20, 40, 60 kg P_2O_5 ha^{-1}) and biofertilizer (PSB, *Rhizobium*, PSB + *Rhizobium*) which were laid out in factorial randomized block design with four replication. There are 12 treatment *viz.* T_1- Control + PSB, T_2- Control + *Rhizobium*, T_3- Control + PSB + *Rhizobium*, T_4- 20 kg P_2O_5 + PSB, T_5- 20 kg P_2O_5 + *Rhizobium*, T_6- 20 kg P_2O_5 + PSB + *Rhizobium*, T_7- 40 kg P_2O_5 + PSB, T_8- 40 kg P_2O_5 + *Rhizobium*, T_9- 40 kg P_2O_5 + PSB + *Rhizobium*, T_{10}- 60 kg P_2O_5 + PSB, T_{11}- 60 kg P_2O_5 + *Rhizobium*, T_{12}- 60 kg P_2O_5 + PSB + *Rhizobium*. The total biomass of each plot was threshed and cleaned, the seeds obtained were weighed and converted into q ha^{-1}**,** straw yield was also recorded from each plot by subtraction the grain yield from the total biological yield and expressed in q ha^{-1}. The economics of various treatments was calculated by converting the total yield (grain + straw) into money value. The cost of cultivation was computed on the prevailing market of expenditure. Net income was calculated by the following formulae: Net income (Rs. ha^{-1}) = Gross income (Rs. ha^{-1}) - cost of cultivation (Rs.ha^{-1}). Benefit cost ratio was calculated by dividing net return to the cost of cultivation of the individual treatment combination.

$$\text{BCR} = \frac{\text{Net return (Rs.)}}{\text{Cost of cultivation (Rs.)}}$$

The data recorded on various parameters were subjected to statistical analysis following analysis of variance technique and were tested at 5% level of significance to interpret the significant differences.

Result and Discussion

Grain and straw yield and harvest index

The data with respect to grain yield, straw yield and harvest index as influenced by various treatments have been presented in (Table-1). The maximum grain yield, straw yield and harvest index were recorded with the application of 60 kg P_2O_5 ha^{-1} individual which was at par with 40 kg P_2O_5 ha^{-1} and in biofertilizer PSB + *Rhizobium* have got maximum and in treatment combination T_{12}- 60 kg P_2O_5 + PSB + *Rhizobium* which was statistically at par with T_9- 40 kg P_2O_5 + PSB + *Rhizobium* and significantly superior over rest of the treatments. The minimum grain yield, straw yield and harvest index were recorded with the phosphorus level zero and biofertilizer PSB and in treatment combination T_1 (control + PSB). Grain yield, straw yield and biological yield are the resultant of coordinated inter-play of growth and yield contributing character. The grain yield, straw yield and biological yield increased significantly with increasing levels of phosphorus up to 60 kg P_2O_5 ha^{-1} which was at par with 40 kg P_2O_5 ha^{-1} and superior over rest of the doses of phosphorus (Table-1) during both of the year 2018-19 and 2019-20. The increase in grain yield with phosphorus application was due to increase in source capacity like plant height, number of branches $plant^{-1}$ and leaf area index as well as sink capacity like number of pods $plant^{-1}$, number of grains pod^{-1}, test weight and also better utilization of photosynthates towards sink due to increase in translocation from source to sink. These results are in agreement with the findings of earlier research workers, Mohammad *et al.* (2017) [7], Chaudhari *et al.* (2016) [4], Bairwa *et al.* (2012) [3], Singh and Sharma (2011) [8] and Mir *et al.* (2009) [6], they also reported the increase in yield with increasing doses of applied phosphorus of up to 40 to 60 kg P_2O_5 ha^{-1}.

Economics

Data (Table-2) revealed that maximum cost of cultivation (Rs. 35146.44 and 36321.06 ha^{-1} during 2018-19 and 2019-20, respectively) was incurred in the treatment T_{12}- 60 kg P_2O_5 ha^{-1} with PSB + *Rhizobium*, while the lowest cost of cultivation of system (Rs. 33300.53 and 34594.34 ha^{-1} during 2018-19 and 2019-20, respectively) was associated with T_1- Control + PSB. The maximum gross return was calculated in (Rs. 135434.2 and 156836.2 ha^{-1} during 2018-19 and 2019-20 respectively) T_{12}- 60 kg P_2O_5 ha^{-1} with PSB + *Rhizobium* followed by T_9 - 40 kg P_2O_5 ha^{-1} with PSB + *Rhizobium*. The highest net income of (Rs. 100287.8 during 2018-19 and Rs. 120515.1 ha^{-1} during 2019-20) was noted under T_{12}- 60 kg P_2O_5 ha^{-1} with PSB + *Rhizobium* might be due to the highest grain yield of green gram. Similarly, maximum benefit cost ratio was also observed with T_{12} (2.85 and 3.31) followed by T_9 (2.78 and 3.23) during both the years of 2018-19 and 2019-20, respectively. The minimum (0.45 and 0.62) benefit cost ratio was recorded in T_1 during 2018-19 and 2019-20, respectively. The results showed that combined use 60 kg P_2O_5 ha^{-1} + PSB + *Rhizobium* to be more profitable in green gram cultivation. Ghosh and Joseph (2006) [5] observed that the net returns and benefit cost ratio were higher when seed was inoculated with PSB + *Rhizobium* over control.

Table 1: Grain yield (q ha^{-1}), straw yield (q ha^{-1}), biological yield (q ha^{-1}) and harvest index as affected by phosphorus levels and bio-fertilizers at successive stage of crop growth

S.N.	Treatments	Grain yield		Straw yield		Total biological yield		Harvest index	
		2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
a.	**Phosphorus levels (kg ha^{-1})**								
1.	Control	6.80	7.05	16.70	17.46	23.50	24.51	28.95	28.76
2.	20	8.60	8.92	19.80	20.70	28.40	29.62	30.28	30.12
3.	40	11.20	11.59	25.40	26.53	36.60	38.12	30.60	30.40
4.	60	11.40	11.84	26.50	27.72	37.90	39.56	30.08	29.93
	SEm±	0.172	0.211	0.530	0.478	0.474	0.533	0.004	0.033
	C.D. (P=0.05)	0.495	0.608	1.526	1.376	1.369	1.539	0.012	0.106
b.	**Bio-fertilizer**								
1.	PSB	6.90	7.15	18.30	19.13	25.20	26.28	27.38	27.21
2.	*Rhizobium*	10.00	10.37	22.60	23.62	32.60	33.99	30.67	30.51
3.	PSB + *Rhizobium*	11.60	12.03	25.40	26.55	37.00	38.58	31.35	31.18
	SEm±	0.149	0.183	0.459	0.414	0.410	0.461	0.008	0.004
	C.D. (P=0.05)	0.428	0.527	1.322	1.192	1.185	1.333	0.029	0.014

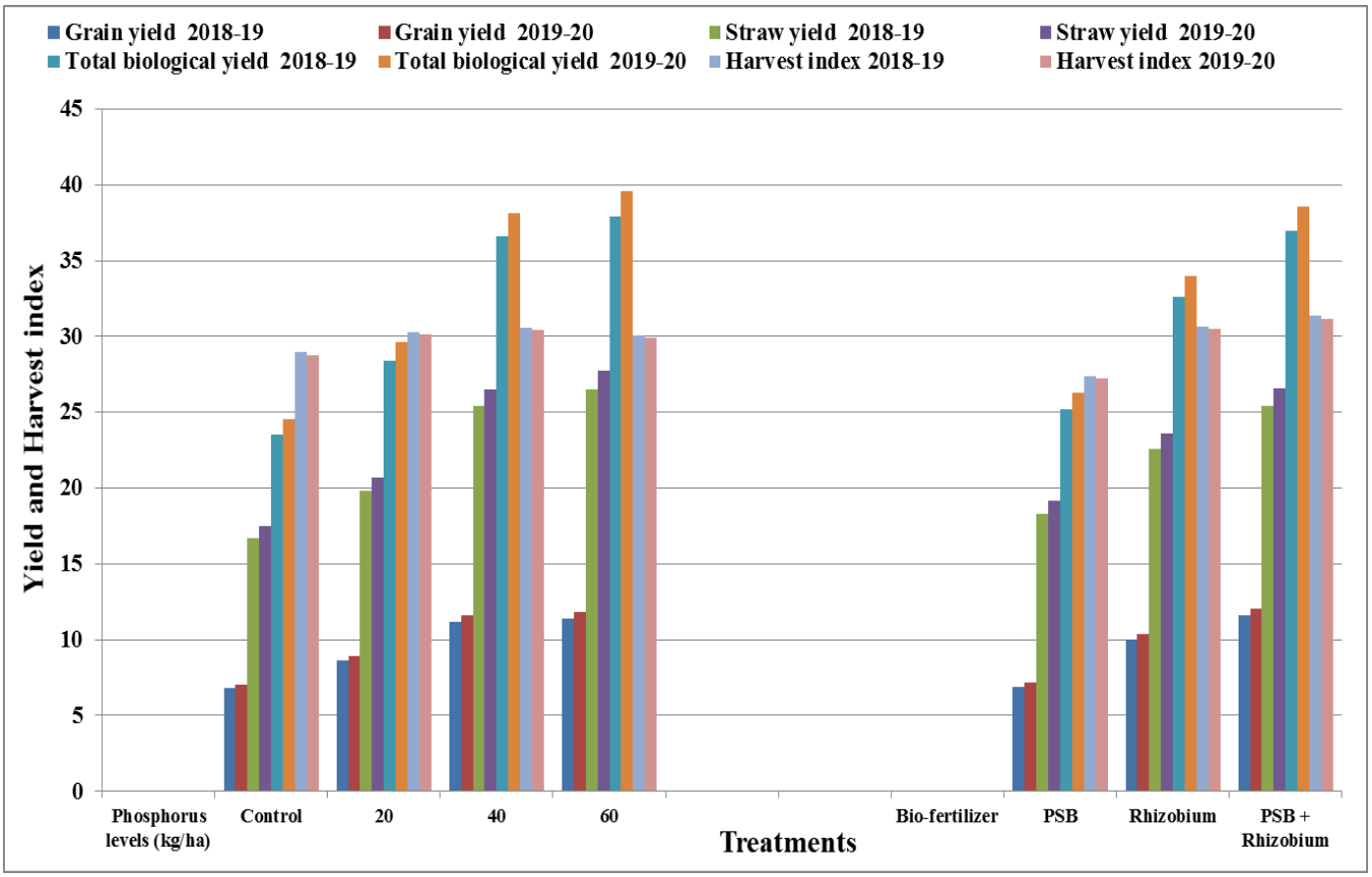

Fig 1: Grain yield (q ha^{-1}), straw yield (q ha^{-1}), biological yield (q ha^{-1}) and harvest index as affected by phosphorus levels and bio-fertilizers at successive stage of crop growth

Table 2: Economics of various treatment combinations

Treatments	Cost of cultivation		Gross income		Net return		Benefit cost ratio	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
P_0B_1 (T_1)	33300.53	34594.34	48599.08	56268.07	15298.55	21673.73	0.459409	0.626511
P_0B_2 (T_2)	33370.53	34676.34	69544.4	80463.77	36173.87	45787.43	1.084006	1.320423
P_0B_3 (T_3)	33440.53	34758.34	80486.52	93112.39	47045.99	58354.05	1.406855	1.67885
P_1B_1 (T_4)	33936.27	35121.67	61135.48	70762.51	27199.21	35640.84	0.801479	1.014782
P_1B_2 (T_5)	34040.27	35186.67	87548.07	101269	53507.8	66082.28	1.571897	1.878049
P_1B_3 (T_6)	34110.27	35268.67	101336.4	117204.5	67226.17	81935.86	1.970848	2.323191
P_2B_1 (T_7)	34430.86	35592.52	80779.78	93297.03	46348.92	57704.51	1.346145	1.621254
P_2B_2 (T_8)	34490.86	35642.52	113657.4	131271.6	79166.57	95629.08	2.295291	2.683006
P_2B_3 (T_9)	34580.86	35712.52	130822.8	151110.7	96241.94	115398.2	2.783098	3.231309
P_3B_1 (T_{10})	35010.44	36134.06	79845.66	92620.09	44835.22	56486.03	1.280624	1.563235
P_3B_2 (T_{11})	35120.44	36222.06	116370.1	134804.2	81249.66	98582.13	2.313458	2.721605
P_3B_3 (T_{12})	35146.44	36321.06	135434.2	156836.2	100287.8	120515.1	2.853427	3.31805

Conclusion

On the basis of above discussion it may concluded that the application of 60 kg P_2O_5 ha^{-1} and PSB + *Rhizobium* individual and in treatment combination 60 kg P_2O_5 ha^{-1} + PSB + *Rhizobium* (T_{12}) have recorded maximum grain yield, straw yield, biological yield and harvest index and gave maximum values of gross return, net return and benefit cost ratio which is closely followed by T_9, hence this treatment can be recommended for higher yield and may be opted for getting higher benefit cost ratio.

References

1. Anonymous. Directorate ofeconomics and statistics, statistics Division 2004.
2. Anonymous. Directorate ofeconomics and statistics, statistics Division 2018.
3. Bairwa RK, Nepalia V, Balai CM, Chauhan GS, Ram B. Effect of phosphorus and sulphur on growth and yield of summer mungbean. Journal ofFood Legumes 2012;25(3):211-214.
4. Chaudhari SN, Thanki JD, Chaudhari VD, Verma C. Yield Attributes, Yield and Quality of Greengram (*Vigna Radiata* L.) As Influenced By Organic Manures, Biofertilizer And Phosphorus Fertilization. The bioscan 2016;11(1):431-433.
5. Ghosh MK, Joseph SA. Productivity and economics of summer green gram (*Vigna radiata)* influenced by bio-fertilizers, phosphorus and sulphur application. Agronomy Digest 2006;6(7):19-20.
6. Mir AH, Bhat Jam, Lai SB. Effect of phosphorus, sulphur and PSB on black gram *(Phaseolusmungo)* and its redidual effect on mustard *(Brassica juncia*) and soil properties. Environment and Ecology 2009*;*27(3A):1365-1368.
7. Mohammad I, Yadav BL, Ahmad A. Effect of phosphorus and bioorganics on yield and soil fertility status of Mungbean (*Vigna radiate* L.Wilczek) under semi arid condition of Rajasthan, India. International Journal of Current Microbiology and Applied Sciences 2017;6(3):1545-1553.
8. Singh TP, Sharma A. Effect of sources of phosphorus and microbial inoculation on productivity, nutrient availability in soil and uptake of nutrients by chickpea (*Cicer arietinum*) grown on sandy loam soil. Indian Journal of Agriculture Sciences 2011;81:834-837