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Role of *Bacillus circulans* in scaling up of productivity of vegetables pea green pods

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ABSTRACT

A field experiment was conducted during winter season (*Rabi*) 2004-05 and 2005-06 at Zonal Agricultural Research Station, Mainpuri, C.S.Azad University of Agriculture and Technology, Kanpur with the objective to workout the effective dose of *Bacillus circulans* containing bacterial fertilizer and its roles on economics in vegetable pea green pods production. Application of Vrikshamitra (PSB) @ 15 kg/ha or 1.50 lakh crore bacterium of *Bacillus circulans*/ha gave significantly higher green pod yield of vegetable pea by 79.36 q/ha over control and initial installment of Vrikshamitra. The installment of Vrikshamitra beyond 15 kg/ha confined to the further progress in green pod production of vegetable pea. The integrated use of Vrikshamitra @ 15 kg/ha and RDF also increased yield contributing parameters which culminated into increase in green pod yield. Use of 15 kg Vrikshamitra with RDF gave maximum net return of Rs. 24780/ha. The highest benefit cost ratio was also computed as 1:2.66 at RDF + 15 kg /ha Vrikshamitra. The investment of Rs. 1.00 on application of Vrikshamitra gave net response as Rs. 16.00 at 15 kg Vrikshamitra /ha after 85 days because the green pod of green vegetable pea harvested upto this period and produced was sold in the market.

Key words : *Bacillus circulans,* Bacterial fertilizer, Vrikshamitra, Culminate, Scale up

INTRODUCTION

Now-a-days, the burgeoning population pressure has forced for multiple cropping to increase the farm productivity for meeting the food requirements. The prolong and over usage of chemical fertilizers has, however, resulted in human and soil health hazards and pollution of the environment. Therefore, the current trend is to explore the possibility of supplementing chemical fertilizers with organic ones more particularly bio fertilizers of microbial origin. In soil myriads of micro-organisms are at work in fixing nitrogen, mobilizing other plant nutrients and degrading lignocelluloses waste. Very often micro-organisms are not as efficient in natural surroundings as one would expect them to be and, therefore, artificially multiplied cultures of selected micro-organisms play a part in accelerating nature's way of recycling organic resources. Recently a lignite carrier based bio-fertilizer was developed using a bacterium called *Bacillus circulans* for soil, seed and root application. It is biological plant growth enhancer and phosphate solubalizing bio-fertilizer product which increases the yield and quality of vegetable crops by stimulating plant nutrients absorption (Anonymous, 2003). Scaling up of green pod production of vegetable pea and improving the quality of green and dry kernels by use of *Bacillus circulans* culture is the subject matter of this paper.

MATERIALS AND METHODS

The experiment was laid out at Zonal Agricultural Research Station, Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur. The soil of experimental site was sandy loam in texture having pH 8.5, organic carbon 0.45% ,total nitrogen 0.04% , available phosphorus 10 kg/ha. The treatment consisted of eight levels of bacterial fertilizers *i.e.* 0, 5, 7.5, 10, 12.5, 15, 17.5 and 20 kg/ha. The experiment was laid out in three-replicated Randomized Block Design. The bacterial fertilizer supplied through Vrikshamitra. Vrikshamitra increases the yield and quality of vegetable crops by stimulating plants absorption of N, P, K, Fe, Mg, Si and Mo and it contains about 1.5 to 2.0 $x10^8$ bacterial cell of *Bacillus circulans/gram,* total nitrogen 0.42% , total phosphorus content 0.22 %, total potassium content 0.48%, organic matter content 72.36% and nitrogen fixers population (free-living) in Jensen's nitrogen-free medium $4x10^8$. The bacterial fertilizers applied in vegetable pea with seed mixing technology at the time of sowing. A recommended dose of 40 kg N+ 60 kg P_2O_5 + 40 kg K_2O/ ha was applied to vegetable pea at planting. The crop was irrigated as and when required. Vegetable pea variety Azad P_3 was planted in row 30 cm apart using 100kg kernel/ha in second week of November and green pods were plucked between 75 to 85 days in first week of February. At the time of green pods picking, the yellowish pods were separated and shelled kernel of these pods were dried for the use as vegetable after soaking in fresh water. The treatment wise cost of cultivation and gross return were computed as per prevailing market rate of inputs used. Finally net return and benefit cost ratio were calculated for each treatment.

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RESULTS AND DISCUSSION

Application of Vrikshamitra @ 15 kg/ha or 1.50 lakh crore bacterium of *Bacillus circulans*/ha registered significantly higher green pod yield of vegetable pea by 79.36 q/ha over control (49.46 q/ha) and first installment of Vrikshamitra @5 kg/ha (56.58 q/ha) during both experimental seasons. The use of 15 kg Vrikshamitra in the integration of RDF produced higher green pods by a margin of 29.90, 22.78, 7.44, 5.66 and 3.11 q/ha compared with 0, 5, 7.5, 10 and 12.5 kg Vrikshamitra /ha, respectively. The installment of Vrikshamitra beyond 15 kg/ha confined to the further progress in green pod production of vegetable pea. The integrated use of Vrikshamitra @ 15 kg/ha and RDF increased filled green pods/plant, filled green pod weight/plant, kernels/plant, kernels weight/plant, kernels/pod, kernels weight/pod and 100 kernel weight, which culminated into increase in green pod yield (Table 1).

The minimum expenditure of Rs. 14000/ha was incurred with RDF+0 kg Vrikshamitra /ha while expenditure in variable dose of Vrikshamitra in integration of 40 kg N+ 60 kg P_2O_5 + 40 kg K_2O/ha (RDF) varied from Rs. 14300 in RDF + 5 kg Vrikshamitra /ha to Rs. 15200/ha in RDF +20 kg Vrikshamitra /ha (Table 2). As regard the net return, application of 15 kg Vrikshamitra in conjunction with RDF proved to be highly remunerative (Rs. 24780/ha) compared with other doses of Vrikshamitra. Similarly, the maximum benefit cost ratio was computed as 1:2.66 at RDF + 15 kg /ha Vrikshamitra. The investment of Rs. 1.00 on application of Vrikshamitra gave net response as Rs. 16.00 at 15 kg Vrikshamitra /ha after 85 days because the green pods of vegetables pea harvested upto this period and produce was sold in the market.

The dried kernels of Vrikshamitra applied plots swelled earlier when soaked with fresh water in comparison to dried kernels of control plots. The soaked kernels of Vrikshamitra plots displayed bright green colour while kernels of control plots showed dull green colour. The cooked mixed vegetable of green and soaked kernels of Vrikshamitra plots gave good taste over the mixed vegetables cooked from the kernels of control plot. These

Table 1: Yield traits and green pod yield of vegetable pea under different treatments (pooled data of 2004-05 and 2005-06)

Treatments	Filled pods/ plant	Filled pod weight/ plant (g)	Kernels /plant	Kernel weight/ plant (g)	Kernels/ pod	Kernel weight/ pod (g)	100-kernel weight (g)	Green pod yield (q/ha)		
								2004-05	2005-06	Polled
RDF + Vrikshamitra 0kg	6.22	34.48	40.77	20.21	6.22	2.95	46.90	50.02	48.91	49.46
RDF + Vrikshamitra 5kg	6.44	35.73	44.33	22.10	6.22	2.96	47.13	57.58	55.58	56.58
RDF + Vrikshamitra 7.5kg	6.77	37.53	45.33	22.60	6.44	3.06	47.23	72.70	71.14	71.92
RDF + Vrikshamitra 10kg	6.88	38.16	46.55	23.30	6.55	3.23	49.10	74.03	73.37	73.70
RDF + Vrikshamitra 12.5kg	7.11	39.40	47.55	23.73	6.66	3.26	49.40	76.48	76.03	76.25
RDF + Vrikshamitra 15kg	7.44	41.20	48.99	24.50	6.77	3.36	49.80	79.81	78.92	79.36
RDF + Vrikshamitra 17.5kg	7.11	39.46	47.44	23.66	6.66	3.26	49.36	77.14	75.81	76.47
RDF + Vrikshamitra 20 kg	7.11	39.40	47.22	23.51	6.66	3.23	49.30	76.92	75.59	76.25
S.E. ±	0.10	0.59	0.27	0.12	0.09	0.04	0.28	6.31	3.91	3.71
C.D. (P=0.05)	0.30	1.78	0.81	0.36	0.27	0.12	0.84	19.14	11.86	10.74

RDF = 40 kg N + 60kg P_2O_5 + 40 kg K_2O/ ha.

Table 2 : Cost and return of green pods production of vegetable pea under different treatments

Treatments	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs. /ha)	B:C ratio
RDF + Vrikshamitra 0kg	14000	24730	10370	1:1.76
RDF + Vrikshamitra 5kg	14300	28290	13990	1:1.97
RDF + Vrikshamitra 7.5kg	14450	35960	21510	1:2.48
RDF + Vrikshamitra 10kg	14600	36850	22250	1:2.52
RDF + Vrikshamitra 12.5kg	14750	38125	23375	1:2.58
RDF + Vrikshamitra 15kg	14900	39680	24780	1:2.66
RDF + Vrikshamitra 17.5kg	15050	38235	23185	1:2.54
RDF + Vrikshamitra 20 kg	15200	38125	22925	1:2.50

finding are in agreements with those reported by Singh (2006), Singh (2007), Singh and Katiyar (2005) and Singh *et al.* (2009).

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