



EFFECT OF BIO-FERTILIZERS ON YIELD AND ECONOMIC TRAITS OF POTATO AT TWO FERTILITY LEVELS

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ABSTRACT: A field experiment was conducted for two consecutive years to assess the efficiency of bio-fertilizers at two fertility levels on yield and economy of potato crop. Results revealed that application 100% recommended dose of nitrogen and phosphorus + *Azotobacter* and *Phosphobacteria* gave the maximum tuber yield which was closely followed by application of 75% recommended dose of nitrogen and phosphorus + *Azotobacter* and *Phosphobacteria*. However, both the treatments gave considerable net return indicating 25% saving of nitrogen and phosphorus fertilizers. Among both the inoculants *Bacillus cereus* was found better than *Bacillus subtilis* in potato yield.

Keywords: Potato, biofertilizer, inorganic fertilizer, tuber yield, economy.

To enhance the quick source of food production and productivity to provide stable food for increasing population of world, the potato is a best suited crop. It is cultivated in the world in an area of 18.64 million hectares with annual production of 321.0 million tones. India stands fourth in area (1.3 million hectares) and third (23.6 million tones) in world production. Potato is a low caloric, wholesome food and richest source of energy and other essential elements (Shekhawat and Dahiya, 7). It is short duration crop and more chemically expensive crop. Due to increase cost of inorganic fertilizer and their detrimental effects on soil fertility and tuber quality, supplementing the nutrients through organic sources i.e. bio-fertilizers have become imperative to sustain production (Sunaina *et al.*, 10).

MATERIALS AND METHODS

The experiment was conducted during rabi season of 2005-06 and 2006-07 at experimental field of L B S Krishi Vigyan Kendra, Gopalgram, Gonda (U.P.) with potato cv. Kufri Ashoka. The trial was laid out in randomized block design with four replications. The treatments comprising of seed tuber without any treatment (T₁), seed inoculation with *Azotobacter* and *Phosphobacteria* (T₂), inoculation with *Bacillus cereus* (T₃) and *Bacillus subtilis* (T₄) were tested at two fertility

levels i.e. F₁-100% and F₂- 75% of recommended dose of nitrogen and phosphorus with 100 kg K₂O. The recommended dose of nitrogen, phosphorus and potash for potato was 150:80:100 kg/ha (RDF). Nitrogen, phosphorus and potash were applied through urea, single super phosphate and muriate of potash, respectively. Half of nitrogen and full dose of phosphorus and potash were applied as basal dose, one day before planting in row, and rest of nitrogen was top dressed after one month of planting at the time of earthing up. The recommended cultural operations and plant protection measures were followed throughout the experiment.

Inoculation of potato tuber cv. Kufri Ashoka was done with *Azotobacter* and *Phosphobacteria*. For inoculation 200 g inoculants of each of *Azotobacter* and *Phosphobacteria* were mixed in 1ltr of 10% jaggery solution to make a slurry of biofertilizer. This slurry of biofertilizer was poured on the tubers and mixed thoroughly in order to form uniform coating of biofertilizer on the tubers. Treated tubers were air dried in shade and sown on the same day. Inoculation with *Bacillus cereus* and *Bacillus subtilis* was done by suspending the dried inoculants separately in 40 ltrs of water containing 2 kg jaggery followed by dipping the tubers in this suspension for 30 minutes. The seed tubers were planted on raised beds at a spacing of 60 x 20 cm with a seed rate of 26q/ha. Harvested tubers were

classified in A, B, C and D grade tubers according to their diameter. Average data was analysed statistically.

RESULTS AND DISCUSSION

The results (Table 1) revealed that tuber treatment with *Azotobacter* + *Phosphobacteria* along with 100% RDF (F₁T₂) resulted in significantly the maximum tuber yield per hill (617.33 g), number of tubers per plot (850), tuber yield per plot (35.38 q) and total tuber yield (314.0 q/ha) which was 32.18% higher than F₂ T₁ and 26.97 higher than F₁T₁ i.e. control. Inoculation with *Bacillus cereus* and *Bacillus subtilis* were comparable to tuber treatment with *Azotobacter* + *Phosphobacteria* at both the fertility levels. The increase in yield attributes could be because of secretion of certain growth promoting substances by the microbial inoculants, which in turn plant nutrient uptake and thereby enhanced growth attributes in F₁ T₂ treatment as compared to the other treatments. The results are in agreement with Singh and Raghav (9) and Pandey and Kumar (5) who also reported that secretion of plant growth promoting substances like IAA, gibberellins, cytokinin etc. by *Azotobacter* in addition to the fixation atmospheric nitrogen resulted in promotion of growth of plant and tuber.

It is evident from the data (Table 1) that all the

bio-fertilizer treatments gave more yields at higher fertility level than at low fertility level. The grade wise number and yield of tubers were significantly affected by the seed tuber treatment with *Azotobacter* + *Phosphobacteria*. Maximum number of 'A' and 'B' grade tubers per hill and per plot were obtained by seed tuber treatment with *Azotobacter* + *Phosphobacteria*. Treatment of tubers with *Bacillus cereus* gave significantly higher number of yield of 'C' grade tubers per hill and per plot. Number and yield of 'D' grade tubers per plot was significantly higher in control treatment. Above findings clearly showed that number and mean weight of tubers of different grade may be dependent of effect of biofertilizer treatment. The supply of nitrogen and phosphorus with *Azotobacter* + *Phosphobacteria* increased the size as well as number of tubers significantly. These results are in close conformity with the finding of Frommel *et al.* (1), Hooda and Pandita (3) and Singh (8).

The increase in total yield may be due to appropriate supply of nutrients i.e. 100 per cent nitrogen and phosphorus and additional supply by *Azotobacter* + *Phosphobacteria*. Improved vegetative growth of potato and higher emergence per cent resulted in maximum photosynthesis and better translocation of photosynthates to tubers. The results are inconsonance with findings reported

Table 1 : Effect of bio-fertilizers on yield and economic attributes of potato at two fertility levels (Pooled means of two years).

Treatment	No. of tubers/hill	Tuber yield /hill (g)	No. of tubers/plot	Tuber yield/ plot (kg)	Tuber yield/ha (q)	Cost of cultivation (Rs.)	Net Return (Rs.)	B : C Ratio
F ₁ T ₁	8.005	417.61	706.5	32.02	247.23	46230.14	58930.25	1.27
F ₁ T ₂	10.40	617.33	850.0	40.67	313.99	46530.14	87151.11	1.87
F ₁ T ₃	10.48	514.53	823.0	38.74	299.07	46560.14	80695.11	1.73
F ₁ T ₄	9.52	515.80	755.0	33.66	259.85	46560.14	67352.61	1.44
F ₂ T ₁	8.43	408.07	687.5	30.76	237.50	45243.97	57155.53	1.25
F ₂ T ₂	10.37	557.18	790.0	40.07	309.38	45543.97	86197.78	1.89
F ₂ T ₃	9.86	482.23	721.0	33.45	258.23	45573.97	64355.28	1.40
F ₂ T ₄	8.37	440.80	744.0	32.02	247.11	45573.97	59558.03	1.31
CD (P=0.05)	0.52	1.98	5.31	1.20	9.25			

by Ghosh and Das (2), Mahendran and Kumar (4), Sunaina *et al.* (10) and Saikai and Deka (6).

The cost of cultivation increased with increasing fertility levels and bio-fertilizer treatment which is directly associated with the cost of fertilizer and bio fertilizer treatments. Treatment with 100 per cent nitrogen and phosphorus along with *Azotobacter* + *Phosphobacteria* (F₁T₂) gave higher net return by 81 per cent over other treatments. Whereas, 75 per cent nitrogen and phosphorus along with tuber treatment with *Azotobacter* + *Phosphobacteria* exhibited the maximum B:C ratio and it was found more economical and remunerative for potato cultivation. Similar results have also been reported by Singh (8) and Yadav *et al.* (11).

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