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Research Paper

Effect of bio-fertilizers on potato tuber yield under varying fertility levels

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ABSTRACT

Seed production of potato variety kufari Pukhraj gave maximum seed tuber yield with the application of 100 per cent of NPK (150:80:100 NPK kg/ha) along with *Azotobactor* 3 kg/ha and sprayed with ethrel @ 250 ppm twice at 25 and 50 days after planting under agro-climatic region of gird region of Madhya Pradesh. Thus it is clear that yield of seed size tubers (q/ha) was the maximum under treatment combination $F_2 B_1$ due to highest weight and large number of seed size tubers per plant and lowest weight and numbers of small size tubers per plant.

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KEY WORDS : Potato, Biofertilizers, Yield, Quality

Potato is one of the most important food crops after wheat, maize and rice, historically contributing to food and nutrition security in the world. It is recognized as a nutritionally goldmine with favourable protein carbohydrate balance and high quality proteins. In Madhya Pradesh, potato is cultivated as a rabi crop. However, in some areas, it is also grown as kharif crop. The major potato producing district are Indore, Dewas, Shajapur, Chhindwara, Sagar, Ujjain and Satana. The annual production of potato in M.P. is 562400 tones from 42800 hectare with a productivity of 13.14 t/ha (Commissioner, Land Records MP 2005-06).

Potato is being vegetatively propagated by seed tubers and from true seed. Potato production from seed tubers is popular because of the ease by which tubers can be planted, the fast and vigorous growth of plant, the uniformity of harvested tubers besides its high yield potential. In spite of all these advantages, the method has presented important problem, which hampered the adoption and expansion of potato in India. The main problem is the non availability of good quality seed for planting purpose.

Under normal production technology, farmers use non-judicious chemical fertilizer to obtain the high commercial yield, which leads to more large size tubers in the produce. Which leads to the proportion of seed size (25-75g) tubers is less. Apart from this, the chemical fertilizers alone are known to deteriorate the soil health and create nutrient imbalance. At the same time, application of bio-fertilizers alone dose not produce spectacular increase in the yield due to their low nutrient status and requirement in huge quality. Hence, an effort was initiated in this investigation to study influence of chemical and bio-fertilizers on the growth and tuber yield. Bio fertilizers are eco-friendly and their use reduces the cost of chemical fertilizers. The effective use of bio-fertilizers not only provides economic benefit but improves and maintains the soil fertility and health.

RESEARCH PROCEDURE

The experiment was carried out at the Horticulture Nursery, College of Agriculture, Gwalior which is located at $26^0 13'$ N latitude $78^0 14'$ E longitude at a height of 211.5 metre above the mean sea level. The experimental field was laid out in the Split Plot Design. Main plot treatments were fertility levels whereas sub plot treatments were three bio -fertilizer treatment. Total treatments combination were eighteenth. All the treatments were replicated three times. Variety *Kufari* Pukhraj was used as seed with tuber size 40-50 g.

The treatment details given are : factor Ist (Main plot treatments) fertility levels (F): F_1- 50% of recommended dose of NPK,F_2- 100% of recommended dose of NPK (150:80:100 NPK kg/ha), factor IInd (Sub plot treatments) : Bio fertilizers (B),B_1 – *Azotobactor*, B_2 PSB and B_3 control. The haulms of the plant were killed by grammxone spray @ 3kg/ha at 80 DAP. The tubers were

harvested 15 days after haulm killing. First of all randomly selected and tagged plants were harvested and their tubers were kept separately. These tubers were graded in three categories viz. >25g, 25-75 g and > 75g. Grade wise tubers and weight was recorded. Ten plants were tagged randomly from net plot area for recording various growth and yield parameters. Grade wise tuber yield per hectare by number weight was computed by multiplying the grade wise tubers yield per plot with a multiplication factor and was expressed in quintals per hectare. Statistical analysis was carried out by adopting appropriate method of analysis of variance as described by Fisher (1958).

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been discussed in the following sub heads :

Tuber yield per hectare by weight (grade wise):

Grade < 25 g:

Minimum small size tuber yield (16.55 q/ha) was recorded when plots received 100% recommended dose of NPK and it was significantly less than 50% recommended dose of NPK (Table 1). The yield of small size tubers was maximum in control plots receiving no bio fertilizer treatment but it reduced significantly with the application of bio fertilizers, being minimum (17.49 q/ha) under inoculation with *Azotobactor* followed by PSB (19.85 q/ha) (Table 1). The difference between both the bio fertilizers was found significant. Interaction effect between fertility levels and bio fertilizers was found significant. Significantly lower small size tuber yield (13.59 q/ha) was recorded when tuber seed was inoculated with *Azotobactor* and sown with 100% recommended dose of NPK in comparison to rest of the treatment combinations (Table 2).

Table 1 : Effect of fertility levels and bio fertilizers on tuber yield per hectare by weight (grade wise) (q/ha)

Fertility level	<25g	25-75g	>75g
F_1	23.17	188.00	87.67
F_2	16.55	206.54	92.95
S.E. (m) +	0.15	0.62	0.57
CD (P=0.05)	0.90	3.75	3.45
Bio fertilizer			
B_1	17.49	215.24	98.75
B_2	19.85	202.21	89.35
B_3	22.22	174.34	82.88
S.E. (m) ±	0.16	1.22	0.73
CD (P=0.05)	0.52	3.99	2.38

Table 2 : Interactive effect of fertility levels and bio fertilizers on tuber yield per hectare by weight (<25g) (q/ha)

Bio fertilizers	Fertility levels	
	F_1	F_2
B_1	19.23	13.59
B_2	24.25	17.40
B_3	26.02	18.65
	B within F	F within B
S.E. (m) ±	0.23	0.24
CD (P=0.05)	0.74	1.03

Grade 25-75 g:

Application of 100% recommended dose of NPK resulted in significantly the highest yield of seed size tubers (206.54 q/ha) as compared to 50% of recommended dose of NPK (Table 1). Application of *Azotobactor* and PSB as seed treatment gave significantly higher yield of seed size tuber (215.24 and 202.21 q/ha, respectively) over control. Between both the bio fertilizers. *Azotobactor* was found significantly better than PSB in respect of increasing seed size tuber yield (Table 2).

Grade>75g:

Fertility levels caused a marked variation in the yield of large size tubers. Application of 100% of recommended dose of NPK resulted in significantly highest yield of large tubers over 50% of recommended dose of NPK (Table 1).The yield of large size tubers varied due to inoculation of seed tubers with bio fertilizers. Inoculation with *Azotobactor* resulted in significantly highest yield of large size tubers over PSB and control. Inoculation with PSB also produced more yield of large size tuber significantly over control (Table 1).

The fertility levels caused significant improvement only in the number of large size tubers per plant and the highest was found in plots receiving 100% recommended dose of NPK wherever the number of seed size tubers (grade 25-75 g) increased correspondingly with 100% of recommended dose of NPK as compared to plots receiving

Table 3 : Interactive effects of fertility levels and bio fertilizers on tuber per hectare by weight (25-75g) (q/ha)

Bio fertilizers	Fertility levels	
	F_1	F_2
B_1	207.29	223.20
B_2	196.67	207.76
B_3	160.03	188.65
	B within F	F within B
S.E. (m) ±	1.73	1.54
CD (P=0.05)	5.64	5.73

50% of recommended dose of NPK, but variation in the number of seed tubers per plant between both fertility levels did not touch the level of significance. In case of number of small size tubers (grade <25 g) per plant, increasingly levels of fertility from 50 to 100 per cent of recommended dose of NPK reduced the number of small size tubers per plant without significant margin. This is mainly due to more bulking rate of tubers. These results are in line with the findings of Sharma and Singh (1988) who reported progressive increase in the seed size tuber yield with the application of NPK fertilizers at the higher rates to potato seed crop. Indiresh *et al.* (2003) reported that 100% NPK significantly increased the marketable yield (grade >30g) over 50% NPK.

Seed inoculation with *Azotobactor* and PSB alone might have increased nutrient (specially N and P) availability in soil and thereby enhanced nutrient uptake and ultimately the yield. *Azotobactor* passessed several useful traits like nitrogen fixation ammonia excretion and production of plant promoting substances. Besides this *Azotobactor* has also been found to synthesize antibiotic like metabolites (Meshram, 1984). Thus, *Azotobactor* plays nutritional stimulatory and therapeutic role for the benefit of crop, which make it a potential bio-fertilizer for potato. Similarly PSB solubilizers phosphorus from soil source and makes it available to plant. Many worker's like Singh (2002 a) also recorded significant increases in yield of large size tubers due to seed inoculation with PSB. Singh (2001) and Singh (2002b) also recorded significant increase in yield of large size tuber due to seed inoculation with bio-fertilizer.

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