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RESEARCH PAPER

Effect of plant growth regulators 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 (374.95 q/ha) net monetary return (Rs. 297254/ ha) and B:C ratio (4.83) with the application of 100 per cent of NPK (150:80:100 NPK kg/ha) along with Azotobacter 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 $F_2B_1G_2$ due to highest weight and large number of seed size tubers per plant and lowest weight and numbers of small size tubers per plant.

Key Words **:** Potato, PGR, Yield, Quality

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INTRODUCTION

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 of 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 vegetativelly 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. Many research workers reported that plant growth could be altered by the use of growth regulars. It is a well-known fact that is a balance between the growth of tubers and plant. Anything which favours the growth of one will retard the growth of others. Plant growth regulators play an important role in increasing the tuber yield by 10-15 per cent by increasing the size of the tuber. (Shen *et al.,* 1996, Javed and Arshad, 1998, Ghosh *et al.,* 2000).

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Nursery, College of Agriculture, Gwalior is located at 26°13' N latitude 78 °14' E longitudinal at a height of 211.5 metre above the mean sea level in Gird belt. The experimental field was laid out in the split plot design. Main plot treatment fertility levels were sub plot treatment, plant growth regulators are were three. Total treatments combination was eighteenth. All the treatments were replicated three times. variety kufari pukhraj used of seed tuber size was 40-50 gram.

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The treatment details were factor I[st] (Main plot treatments) fertility levels (F): F_1- 50 per cent of recommended dose of NPK,F_2- 100 per cent of recommended dose of NPK (150:80:100 NPK kg/ha), Factor II[nd] plant growth regulators (G).G_1- GA_3- 100 ppm (sprayed at 25and 50 DAP),G_2- Ethel (Ethephone) -250 ppm (sprayed at 25 and 50 DAP). G_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 by adopting appropriate method of analysis of variance as described by Fisher (1958).

RESULTS AND DISCUSSION

The results obtained from the present investigation have been duscussed below:

Tuber yield per hectare by weight (gradewise):

Grade < 25 g:

Minimum small size tuber yield (16.55 q/ha) was recorded when plots received 100 per cent recommended dose of NPK and it was significantly less than 50 per cent recommended dose of NPK (Table 1). The application of GA_3 100 ppm significantly reduced the yield of small size tubers over ethrel 250 ppm and control. Moreover, ethrel 250 ppm also reduced the yield of small size tubers significantly over control (Table 1). 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 *Azotobacter* and sown with 100 per cent recommended dose of NPK in comparison to rest of the treatment combinations (Table 2).

Grade 25-75 g:

Application of 100 per cent recommended dose of NPK resulted in significantly the highest yield of seed size tubers (206.54 q/ha) as compared to 50 per cent of recommended dose of NPK (Table 1). Application of GA_3 100ppm resulted in significantly highest seed size tuber yield (218.30 q/ha) over ethrel 250ppm (200.35 q/ha) and control (173.15 q/ha) which also significantly differed between them selves.

Grade>75g:

Fertility levels caused a marked variation in the yield of large size tubers. Application of 100 per cent of recommended dose of NPK resulted in significantly highest yield of large tubers over 50 per cent 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 *Azotobacter* 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.

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 per cent recommended dose of NPK wherever the number of seed size tubers (grade 25-75 g) increased correspondingly with 100 per cent of recommended dose of NPK as compared to plots receiving 50 per cent 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)

Table 1 : Effect of fertility levels bio fertilizers and plant growth regulators 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
C.D. (P=0.05)	0.90	3.75	3.45
Plant growth regulator			
G_1	16.41	218.30	98.88
G_2	20.83	200.35	92.25
G_3	22.33.	173.15	79.85
S.E. (m) ±	0.26	1.21	0.88
C.D. (P=0.05)	0.77	3.54	2.56

Table 2 : Interactive effects of bio- fertilizers and plant growth regulators on tuber yield by weight (< 25g) (q/ha)

Bio fertilizers	Plant growth regulator		
	G_1	G_2	G_3
B_1	15.12	18.25	19.00
B_2	16.34	20.78	22.44
B_3	17.76	23.45	25.45
	G within B	B within G	
S.E. (m) t ±	0.46	0.41	
C.D. (P=0.05)	1.33	1.21	

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

Bio fertilizers	Fertility levels	
	F_1	F_2
G_1	207.39	229.21
G_2	185.76	214.93
G^3	170.83	175.47
	G Within F	F Within G
S.E. (m) t ±	1.71	1.53
C.D. (P=0.05)	5.01	5.25

reported that 100 per cent NPK significantly increased the marketable yield (grade >30g) over 50 per cent NPK.

Application of GA_3 100 ppm was found more beneficial in comparison to ethrel 250 ppm. The increase in number of tubers per plant could be due to increased utilization of substances such as photosynthetic and nutrient for tuber development as a result of reduction in dry matter production of haulm. The increase in yield of seed size tubers by the application of GA_3 100 ppm and ethrel 250 ppm was probably due to increased number of tubers per plant. Similar response of plant growth regulators GA_3 and ethrel on seed size tuber yield was reported by Pandita *et al.* (1981) and Singh *et al.* (1993).

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