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Growth and yield of banana *Musa* (AAA group) 'Barjahaji' as Affected by Split Application of Potassium

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A B S T R A C T

The study indicated that growth characters were significantly influenced by different dose and time of application of potassium. Among the growth parameters the highest pseudostem girth (67.50 cm) and the highest leaf area index (LAI) of 4.71 was recorded under T_4 [200g K_2O + 100g K_2O/plant (2+2 splits: 75th, 165th, 255th and 300th day after planting)]. The highest number of hands per bunch (7.67), bunch weight (17.63 kg) and yield (53.73t/ha) was also obtained under T_4 indicating the contribution of the pseudostem girth and LAI towards the yield of banana.

Introduction

Among the commercial cultivars of Assam 'Barjahaji' (AAA group) is one of the most promising cultivars of Assam with a wide consumer acceptance. In spite of being a popular fruit in Assam the yield of banana is much lower than the national average.

The possible reasons may be poor management practices adopted by the farmers, in general, and improper nutrient management in particular. Banana requires high amount of mineral nutrients for proper growth and production. The K demand of banana is invariably high. A note worthy feature of potash nutrition in banana is that the uptake pattern of K is continuous throughout the plant life (Balakrishnan, 1980). Potassium stimulates early shooting and significantly shortens the time required for fruit maturity. It improves bunch grade and size of fingers.

Higher economic yield by split application of potassium though obtained, however, no attempt has yet been made to study the response of application of potassium in 4 split doses up to 300 days after planting in banana *Musa* (AAA group) 'Barjahaji'. Therefore an attempt has been made in the present study to find out the effect of 4 split application of potassium upto 300 days after planting on growth and yield of banana *Musa* (AAA group) 'Barjahaji'.

Materials and Methods

The present investigation was conducted in the Demonstration Farm of Krishi Vigyan Kendra, Goalpara, Assam during the year 2019-20. A plot having good slope and satisfactory drainage was selected for the experiment. The experiment was laid out in Randomised Block Design with three replications consisting of seven treatments. The total experimental area was 945.76 m^2 with an individual plot size of 38.88m^2. There were 12 plants in each plot with a spacing of 1.8 x 1.8m. The following are the treatments formulated for the experiment.

Symbol	Treatments
T_1	100g K_2O/plant (4 splits: 75th, 165th, 255th and 300th day after planting)
T_2	200g K_2O/plant (2 splits: 75th and 165th day after planting)
T_3	0 + 200g K_2O/plant (2 splits: 255th and 300th day after planting)
T_4	200g K_2O + 100g K_2O/plant (2+2 splits: 75th, 165th, 255th and 300th day after planting)
T_5	100g K_2O + 200g K_2O/plant (2+2 splits: 75th, 165th, 255th and 300th day after planting)
T_6	200g K_2O + 200g K_2O/plant (2+2 splits: 75th, 165th, 255th and 300th day after planting)
T_7	500g K_2O/plant (3 splits: 90th, 150th and 210th day)

Potassium in the form of muriate of potash was applied as per treatments at their respective days after planting. A constant dose of 200g N as Urea and 35 g P_2O_5 as SSP was applied per plant in all the treatments. Nitrogen was applied in two equal splits at 3rd and 5th month after planting. The data on plant growth (height of pseudostem, girth, number of leaves, functional leaves, LAI), days to shooting, days to harvesting, yield were recorded.

Results and Discussion

Growth Parameters

Vegetative growth of plants in terms of pseudostem height, pseudostem girth, total leaf production, number of functional leaves and leaf area index had significant difference among treatments (Table 1 and 2). The pseudostem height increased with increasing levels of potassium at all stages of growth. This result is in conformity with the result obtained by Baruah and Mohan, 1985 in cv.'Jahaji'. Oubahov and Dafri, 1987 found positive correlation between potassium and the productivity index (pseudostem circumference). In the present investigation, with the increasing levels of potassium, the pseudostem girth was found to increase significantly in all the three stages of observation i.e. third month after planting, fifth month after planting and shooting stage. However, at fifth month after planting a significant difference was noticed between T_4 and T_5 at equal level of potassium (300g). This may be due to the fact that there is good response of higher dose in T_4 (200g) in the first two splits as compared to the lower dose (100g) in T_5. At shooting stage the increase in pseudostem girth in T_4 as compared to T_7 may be due to the better uptake of potassium in four splits application in T_4 as compared to 3 splits in T_7.

The total number of leaves, total number of functional leaves and leaf area index were significantly influenced by different levels of potassium (Table 2). Prior to emergence of inflorescence a banana plant produces a constant number of leaves (Champion, 1963), which may vary due to climatic, nutritional and genetic differences. In the present investigation the total number of leaves produced was found to be higher with higher levels of potassium with respect to the stages i.e. 3rd month, fifth month after planting and shooting stage. The result obtained is in conformity with the works of Mustaffa, (1988); Parida *et al.*, 1994) and Agrawal *et al.*, (1998).

The higher production of leaves with increasing levels of potassium application may be due to its regulatory effect on carbon assimilation that may determine the production of leaves. The number of functional leaves increased with the increase in applied potassium at fifth month after planting and shooting stage.

Table.1 Experimental results of pseudostem height and pseudostem girth of banana 'Barjahaji' (*Musa* AAA group)

Treatments	Pseudostem height (cm)			Pseudostem girth (cm)		
	3rd month	5th month	Shooting	3rd month	5th month	**Shooting**
T_1	82.33	116.00	207.33	32.17	42.50	**60.67**
T_2	83.33	124.33	208.50	34.33	48.67	**62.67**
T_3	81.33	105.33	183.50	30.50	40.67	**59.50**
T_4	85.33	128.17	209.83	34.83	49.17	**67.50**
T_5	85.67	126.50	210.83	33.33	44.67	**65.17**
T_6	86.33	130.17	212.83	34.83	48.83	**67.33**
T_7	88.33	133.67	218.67	34.50	48.33	**66.50**
S. Ed.±	0.47	0.37	0.48	0.39	0.46	**0.42**
C.D. at 5%	**0.98**	**0.76**	**0.99**	**0.82**	**0.96**	**0.87**

Table.2 Experimental results of total leaf production, number of functional leaves, leaf area index (LAI), days to shooting and days to harvesting of banana 'Barjahaji' (*Musa* AAA group)

Treatments	Total Leaf production	Number of Functional Leaves	Leaf Area Index	Days to shooting	Days to harvesting
T_1	32.17	8.67	3.46	340.67	**450.33**
T_2	31.50	8.83	3.81	344.33	**442.33**
T_3	30.50	8.33	2.71	347.67	**443.67**
T_4	34.17	9.67	4.71	333.33	**429.33**
T_5	34.00	9.33	4.38	333.67	**431.67**
T_6	34.67	9.83	4.64	332.33	**433.67**
T_7	34.83	10.17	4.61	332.67	**435.33**
S. Ed.±	0.42	0.36	0.03	0.64	**0.71**
C.D. at 5%	**0.87**	**0.74**	**0.06**	**1.33**	**1.48**

Table.3 Experimental results of yield and yield attributing characters of banana 'Barjahaji' (*Musa* AAA group)

Treatments	Number of hands per bunch	Number of fingers per bunch	Bunch weight (kg/plant)	Yield (t/ha)
T_1	6.67	95.67	11.60	**35.83**
T_2	6.33	96.67	12.40	**38.60**
T_3	5.33	86.33	10.23	**31.76**
T_4	7.67	123.00	17.63	**53.73**
T_5	7.00	119.33	15.73	**48.69**
T_6	7.33	124.67	16.87	**52.05**
T_7	7.17	126.33	16.53	**51.30**
S. Ed.±	0.51	0.61	0.21	**0.59**
C.D. at 5%	**1.06**	**1.28**	**0.44**	**1.23**

The leaf area index (LAI) is determined using the number of functional leaves present at each stage. In the present investigation with the increasing levels of potassium along with the corresponding number of functional leaves at the stage accounted for higher leaf area index (LAI). The higher leaf area index (LAI) with increasing levels of potassium is in support of the findings of El-Khoreiby, (1991) and Chakravarty *et al.,* (1996).

Shooting, harvesting and yield

The effect of treatments on the days taken for shooting and harvesting was found to be highly significant (Table 2). The longest duration taken for shooting was recorded under T_3 (347.67 days) and the shortest duration was recorded under T_6 (332.33 days). The highest duration of harvesting was recorded in T_1 (450.33 days) and the lowest was recorded under T_4 (429.33 days). The early shooting in T_6 may be due to the production of higher number of leaves at floral initiation stage. On the other hand the days taken to harvesting was less in T_4 than other treatments due to more availability of potassium during the later part of the vegetative growth which hastened the maturity of the bunch. On the other hand higher doses tend to increase the days to harvest. This is in tune with the results obtained by Obeifuna (1995) that optimal dose of 300g potassium per plant when applied to plantains at about 19th to 20th leaf stage reduced the time of harvest from planting.

In the present study it was revealed that the plants that recorded significantly higher pseudostem girth produced correspondingly higher number of hands per bunch. This result was in support of Oubahov and Dafiri (1987) who found a positive correlation between potassium and the productivity index (pseudostem circumference) and yield components (number of hands and number of fingers). The highest number of hands per bunch (7.67) was recorded under T_4 (Table 3). The number of fingers per bunch showed an increasing trend with the increasing levels of potassium applied, with the exception of T_3 and T_5. This could be due to poor vegetative growth due to less application of potassium during the vegetative phase in comparison to T_2 and T_4 respectively. The highest number of fingers per bunch (126.33) was recorded under T_7. The increase in number of fingers per bunch could be due to efficient utilization of potassium in the formation of fingers with increased levels of potash. The rapid production of leaves under such situation had increased the leaf area enabling production of relatively large amounts of assimilates for unimpaired partitioning among various organs of the plants. This result

got ample support from the experiments of Chakravarty *et al.*, (1996) and Hasan *et al.*, (1999).

In the present investigation, the yield of plants from K_2O application @ 200g per plant was very low and it sharply increased from application of K_2O @ 300g per plant (in 4 splits) and again declined from K_2O application @ 400g per plant. This might be due to fixation of the initial doses of potassium applied @ 200g per plant; hence subsequent doses might have contributed to the increase in yield. Decrease in yield from application @ 400g K_2O per plant and 500 g K_2O per plant might be due to other nutritional imbalance, more particularly for nitrogen and phosphorus as these were applied at fixed doses and the amount might have been more than sufficient in boosting yield of banana 'Barjahaji'.

From the present investigation, it can be concluded that T_4 (200g K_2O + 100g K_2O; 2+2 splits) was found to be the best in terms of growth and yield of banana cv. 'Barjahaji'

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