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Study on the effect of different levels of potassium on growth and yield of different black gram varieties under Manipur valley sub-tropical condition

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Abstract
The aim of this research was to determine the effect of different levels of potassium on growth and yield of different blackgram varieties. A field experiment was conducted during *Kharif* 2021, at College of Agriculture, Central Agriculture University, Imphal, Manipur. The soil of experiment plot was clay in texture, nearly acidic in soil reaction (pH 5.96), medium organic carbon (0.75%), available N was low (280.39 Kg/ha), medium available P_2O_5 (188.16 Kg/ha) and available K_2O (20.67 Kg/ha). The observations of twelve treatments were replicated thrice with factors potassium levels (0, 20, 30 and 40 Kg K_2O ha^{-1}) and Varieties (*Pant U-31*, Uttara and *CAU BG-1*) in a Factorial Randomized Block Design the findings shows that growth and yield attributes *viz*. The result showed that higher plant height (38.34 cm), Maximum number of branches (6.00), Maximum fresh weight (49.10), maximum dry weight (13.13), higher pod length (4.66), highest number of pods per plant (36.01), seed yield (1125 Kg/ha) were significantly recorded with 40 Kg K_2O ha^{-1}.

Keywords: Blackgram, potassium, varieties, growth, yield

Introduction
Black gram (*Vigna mungo* L.) belongs to the family leguminosae and is one of the most important pulse crops grown in Asian countries including India. Black gram is native of India. Black gram called "Urd" in Hindi and locally known as "*Sagol hawai*" in Manipur. Black gram fix 30-40kg/ha nitrogen in the soil. Black gram contains about 24 per cent protein, 60 per cent carbohydrate, 10.9 per cent moisture, 1.4 per cent fibre, 3.2 per cent minerals and vitamins *viz*. calcium-154 mg, phosphorus-385mg, iron-9. 1 mg and small amount of vitamin B complex. Black gram production has been distributed mainly in tropical to subtropical countries. It is grown in kharif, rabi and summer season in India, Pakistan, Sri Lanka and some countries of East Asia. In India black gram is very popularly in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Punjab, Haryana, Tamil Nadu and Karnataka. Various black gram varieties are developed resistant to YMV, powdery mildew, Cercospora leaf spot etc. IPU 94-1 (Uttara) is a short duration variety developed by IIPR, Kanpur. It is a resistant variety to yellow mosaic virus. Black gram variety, Pant Urd-31 due to its durable resistance to YMV disease, photo-thermo insensitivity, short duration, dwarf type with balanced vegetative growth and higher yielding ability gained popularity among farmers across the country which is evident from the breeder seed indent received from different black gram growing states of India (Singh *et al*., 2015) [12]. To grow the crop successfully, proper supply of nutrient is very important and mainly essential macronutrient. Potassium is an essential macronutrient required for proper development of plants. In addition to activation of numerous enzymes, K plays an important role in the maintenance of electrical potential gradients across cell membranes and the generation of turgor. Potassium is one of the principal plant nutrient underlining crop yield production and quality determination. It is most abundant caption in plant, while involving in many physiological process. Potassium impact on water relations, photosynthesis, assimilate transport and enzyme activation can have direct consequences on the crop production (Pettigrew, 2008) [10].

Materials and Methods
A field experiment was carried out during *Kharif* 2021, at College of Agriculture, Central

Agriculture University, Imphal, Manipur. The experimental site is situated at a college of agriculture, C.A.U. Imphal campus. It located at latitude of $24^0 45'$ N with longitude $93^0 54'$ E and at an altitude of 774 meters above mean sea level.

Treatment combinations of

T1 = V_1 K_0 = Pant U31 x K @ 0 kg/ha.
T2 = V_1 K_1 = Pant U31 x K @ 20 kg/ha.
T3 = V_1 K_2 = Pant U31 x K @ 30 kg/ha.
T4 = V_1 K_3 = Pant U31 x K @ 40 kg/ha.
T5 = V_2 K_0 = Uttara x K @ 0 kg/ha.
T6 = V_2 K_1 = Uttara x K @ 20 kg/ha.
T7 = V_2 K_2 = Uttara x K @ 30 kg/ha.
T8 = V_2 K_3 = Uttara x K @ 40 kg/ha.
T9 = V_3 K_0 = CAU BG1 x K @ 0 kg/ha.
T10 = V_3 K_1 = CAU BG1 x K @ 20 kg/ha.
T11 = V_3 K_2 = CAU BG1 x K @ 30 kg/ha.
T12 = V_3 K_3 = CAU BG1 x K @ 40 kg/ha.

The observations *viz.* plant height (cm), No. of branches/plant, plant fresh weight (g/plant), plant dry weight (g/plant), Pod length (cm), no. of pods/plant, test weight (g), seed yield (Kg/ha) and stover yield (Kg/ha) were recorded with standard process of observations. The data was statistically process in Factorial Randomized Block Design, analysis of variance ANOVA is used.

Result and Discussion

A. Growth attributes

I) Plant height

The data regarding plant height shows that at harvest significantly higher plant height (38.34 cm) with treatment 40 Kg K_2O ha^{-1}, whereas treatments with 30 Kg K_2O ha^{-1} and 20 Kg K_2O ha^{-1} was recorded statistically on par with absolute control. Plant height was influenced by application of both potassium levels and varieties. This findings supported by Abraham *et al*., (2021) [1] in blackgram where 30 Kg K ha^{-1} reported maximum height among plant height. Varietal difference among different treatments might be due to genetical make up.

II) Number of branches per plant

Significant influenced of potassium levels and varieties on number of branches per plant. 40 Kg K_2O ha^{-1} recorded maximum growth among different levels and varieties 6.00 (*Pant U-31*), 5.32 in Uttara and *CAU BG-1* followed by in 30 Kg K_2O ha^{-1} and 20 Kg K_2O ha^{-1}. Similar results was observed in Buriro *et al*., (2015) [4] in Mungbean.

III) Plant fresh weight (g/plant)

The result with application of potassium levels and different varieties showed significant different in plant fresh weight. Maximum fresh weight recorded in plants with 40 Kg K_2O ha^{-1} 49.10 g/plant (Uttara), 45.54 g/plant (Pant U-31) and 41.58 g/plant (*CAU BG-1*).
Which was on par with 30 Kg K_2O ha^{-1} and 20 Kg K_2O ha^{-1}. Increased fresh weight of plant with application of potassium levels noticed in cowpea by Ayub *et al*., (2012) [3]. Difference plant growing habit between varieties might due to difference in local landraces, pedigree method Pyngrope *et al*., (2015) [11].

IV) Plant dry weight (g/plant)

Plant dry wt. was significantly influenced by potassium levels & varieties at harvest stage. 40 Kg K_2O ha^{-1} applied crops maximum dry weight with 13.47 g/plant (Uttara), 11.23 g/plant (*Pant U-31*) and 11.12 g/plant (*CAU BG-1*) followed by 30 Kg K_2O ha^{-1}. Similar increased in dry wt. was found in Abraham *et al*., (2021) [1].

Yield attributes and yields

V) Pod length (cm)

Application of potassium & varieties affect positively on pod length. Effect of different potassium levels & varieties was found significant on length of pods. Highest length at 40 Kg K_2O ha^{-1} 4.66 (Pant U-31) followed by 4.40 (Uttara) and 4.23 (CAU BG-1) which was on par with 30 Kg K_2O ha^{-1}. Significant Increased in length of pod with application potassium similar to results was found in experiment Thesiya *et al*. (2013) [14]. Variation among the individual genotypes might be due to the genotypes in the study which were developed by different breeding institutes using different breeding methods. Pyngrope *et al.* (2015) [11].

VI) Number of pods/plant

Potassium levels effect significantly on number of pods/plant, Highest number of pods recorded at 40 Kg K_2O ha^{-1} applied crops 36.01(*Pant U-31*) followed by 31.17(Uttara) and 27.09 (*CAU BG-1*) which was on par with 30 Kg K_2O ha^{-1}. Findings directly line with Kalaichelvi and Chinnusamy (2005) [8] experiment in blackgram soil application of 40 kg/ha potassium humate to the previous cotton increased the yield attributes parameter like number of pods/plant (19.3). Among varieties, similar results was reported on number of pods/plant in different trials (Annual report, Mungbean and urdbean, 2020-2021, AICRP on MULLaRP).

VII) Test wt. (g)

Effect of potassium levels on test weight was significant crops applied 40 Kg K_2O ha^{-1} observed maximum test weight 44.20 g (*CAU BG-1*), 43.10 g (Uttara) and 41.85 g (*Pant U-31*) which was on par with 30 Kg K_2O ha^{-1} and 20 Kg K_2O ha^{-1}. Test weight was significant between varieties, different trials on varieties has showed similar test weight perfomances in (AICRP on MULLRaP, annual report, Mungbean and Urdbean, 2020-2021).

VIII) Seed yield (Kg/ha)

Significant effect of different potassium levels & varieties observed on grain yield (Kg/ha) where crops with 40 Kg K_2O ha^{-1} recorded maximum grain yield 1125.67 Kg/ha (*Pant U-31*) followed by 1079 Kg/ha (Uttara) and 973 Kg/ha (*CAU BG-1*) in all varieties taken into consideration which was on par with 30 Kg K_2O ha^{-1}. Potassium increased carbohydrates synthesis and translocation of photosynthesis leads to attributes the better yield reported by Chaudhari *et al*. (2018) [6]. Enzyme responsible for synthesis of starch is activated by K under high K levels, starch is efficiently moved from sites of production to storage organs. (Patil *et al*., 2011) [9]

IX) Stover yield (Kg/ha)

Potassium showed significant on stover yield of crops at different potassium levels and varieties. Highest stover yield recorded on 40 Kg K_2O ha^{-1} with 2410 Kg/ha (Uttara)

followed by 2199 Kg/ha (*Pant U-31*) and 1910 Kg/ha (*CAU BG-1*) which was on par with 30 Kg K_2O ha^{-1}. Potassium plays a major role in growth as it is involved in assimilation, transport and storage tissue development (Chakmak, 2010) [5]. Similar results reported by Thakare (2016) [13]. Among varieties, significant difference recorded on stover yield findings supported by Gangwar *et al.*, (2012) [7] influenced of different sowing dates on different varieties carried out.

Table 1: Effect of levels of potassium and different varieties on growth parameters

Sl. No.	Treatments	Plant Height (cm)	No. of branches	Plant fresh wt. (g/plant)	Plant dry wt. (g/plant)
1.	T1	24.30	3.10	30.98	7.95
2.	T2	25.40	5.20	34.29	9.94
3.	T3	27.02	5.69	42.74	10.93
4.	T4	28.67	6.00	45.54	11.23
5.	T5	25.80	3.04	31.67	7.95
6.	T6	32.52	4.28	39.94	10.02
7.	T7	35.02	5.10	44.71	11.30
8.	T8	38.34	5.32	49.10	13.47
9.	T9	25.13	2.74	31.39	7.17
10.	T10	29.73	4.10	36.88	8.92
11.	T11	31.18	4.99	40.41	10.00
12.	T12	33.85	5.08	41.58	11.12
13.	S.E(d)(±)	1.55	0.34	1.69	0.48
14.	C.D	3.22	0.71	3.51	0.99

Table 2: Effect of levels of potassium and different varieties on growth parameters

Sl. No.	Treatments	Pod length (cm)	No. of pods/plant (cm)	Test wt. (g)	Seed yield (Kg/ha)	Stover yield (Kg/ha)
1.	T1	4.16	14.12	37.03	585.00	1530.00
2.	T2	4.28	25.66	37.55	1032.67	2130.00
3.	T3	4.32	28.85	39.27	1082.00	2152.00
4.	T4	4.66	36.01	41.85	1125.67	2199.00
5.	T5	3.79	13.46	37.07	566.00	1744.00
6.	T6	4.00	22.56	37.43	997.67	2342.00
7.	T7	4.31	26.19	38.63	1035.33	2386.00
8.	T8	4.40	31.17	43.10	1078.67	2410.00
9.	T9	3.94	12.17	37.43	606.33	1500.00
10.	T10	4.00	17.89	40.17	900.67	1830.00
11.	T11	4.17	22.27	41.85	945.67	1880.00
12.	T12	4.23	27.09	44.20	973.33	1910.00
13.	S.E(d)(±)	0.22	2.31	1.80	22.29	144.12
14.	C.D	NS	4.79	3.73	46.22	298.91

(NS-Non-significant)

Conclusion

From the experimental results, it can be concluded that application of potassium significantly influenced on growth and yield of different blackgram varieties. Where application of K @ 40 Kg K_2O ha^{-1} improved growth and yield significantly in all of three varieties taken into consideration. Maximum increased in yield with application of potassium was recorded in *Pant U-31* followed by Uttara and CAU BG-1.

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