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The Comparison of Mungbean (*vigna radiata* L.) Cultivars in the Presence of Various Potassium Applications

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ABSTRACT

Potassium (K) comes under a category of major plant nutrients and is essentially required for plant to complete its life cycle. It is involved in promoting the growth yield and quality of most crops. There are confusions regarding applying accurate potassium dose and investigating the performance of two mungbean cultivars under potassium applications, an experimental trial was laid down at the research area of Pulse Research Sub-Station, Tandojam to determine the performance of two mungbean (AEM-96 and C-23) cultivars in the presence of five potassium applications i.e., 00, 20, 30, 40, and 50 kg K ha^{-1}. The outcomes from the study showed that each trait was significantly improved by increasing the applications of potassium. A significant ($P \leq 0.05$) improvement in the growth parameters (Plant height and branches per plant), yield attributes (pods per plant, seeds per pod, seed weight per plant and 1000-seed weight) and yield traits (seed yield and biological yield) was observed in both cultivars under the application of 50 kg K ha^{-1}. While both cultivars showed similar lower performance in accordance with control (00 kg K ha^{-1}) plots. From cultivars, AEM-96 produced best results as compared to C-23 for each trait on each potassium level. In this regard, mungbean cultivar AEM-96 with 50 kg K ha^{-1} was recommended for cultivation to obtain good growth and yield performance.

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INTRODUCTION

Mungbean or Green Gram (*Vigna radiata* L.) is the member of Fabaceae family. It is considered as the cash crop of most countries because of its early maturing and drought resistant nature. It has significant value among field crops due to its short-season. Mungbean is the chief malnutrition source for the people of most countries. Mostly, the mungbean crop is grown for edible purpose of human beings. But in some countries, it is also grown for the purpose of fodder, green manuring and cover crop. Mungbean bears small seeds which provide high nutrition and protein content. It has been reported that mungbean seeds contain 51 % carbohydrates, 25 % protein, 4% minerals, 3 % vitamins and 1.3 % fats (Kaul, 1982). Due to high protein content, mungbean can fulfil the protein requirements of those people who doesn't or couldn't use meat in their daily diets. There are numerous benefits of mungbean crop such as better taste, easily digestible, good market rates. Not only this, this crop has ability to fix biological nitrogen fixation for future use (Mandal *et al*., 2009). Mung bean benefits from biological nitrogen fixation (BNF) through association with native rhizobia (Herridge *et al*., 2005), but overall, mungbean crop is known for their low symbiotic specificity with soil rhizobia (Zhang *et al*., 2008). So, the seeds of this crop are inoculated with efficient elite strains to get maximum nodulation which in results fix more biological nitrogen (Delić *et al*., 2011). Despite having many benefits, it is a fact that the yield production of mungbean crop is decreasing day by day. In Pakistan, the production of mungbean crop was decreased up to 3.4 % in 2019 as compared to the production of 2018 (GOP, 2019). There are many reasons behind the low crop yield, productivity and profitability. Among that, the correct fertilizer and its proportion is of main concern for availing higher growth and maximum yield of most crops (Chaudhary and Sarwar, 1999). So, the application of fertilizers with their appropriate doses should be the priority of mungbean growers to get high yield and profitability.

Fertilizer management has significant importance in the crop production sector and can affect the production of all crops (Asaduzzaman *et al*., 2008). Potassium is a macro nutrient essentially required for the growth and yield of many crop plants (Baligar *et al*., 2001: Abbas *et al*., 2011). Potassium plays its role in increasing photosynthesis rate and water relations of most crop plants (Garg *et al*., 2005) and in results it maximizes the yield of most pulse crops. Potassium is responsible for cell expansion as it helps in maintaining the turgor pressure of cells. The osmotic regulation and opening and closing of stomata are also driven by this element (Yang *et al*., 2004). It is reported that potassium triggers at least 60 enzymes which are important to plant's life (Ahmad *et al*., 2011) and it is also important in protein synthesis. One of the main functions of potassium is to produce resistance mechanism in crop plants against various insect pests and diseases and as a result it increases the growth and yield performance of field crop (Arif *et al*., 2008). Potassium is essentially required at flowering and pod setting stage of most legume crops (Zahran, 1998). Potassium fertilization is necessary for mungbean cultivation as like nitrogen and phosphorus but unfortunately, it has been ignored by most of the farmers of Indo-Pak region. The yield of mungbean cultivars was maximized when 90 kg potassium was added per hectare (Hussain *et al*., 2011). Laghari *et al*. (2016) observed an increasing seed yield with each increasing level of potassium. It has been reported in previous studies that potassium is the factor for increased development and yield of mungbean crop (Chanda *et al*., 2002; Fadhel *et al*., 2011).

The right proportion of essential macro elements is compulsory to get higher yield, development and growth of various field crops (Cisse and Amar, 2000). Studies focusing the influence of potassium on mungbean crop have made some confusions about finding the accurate quantity of potassium to be applied. Due to this, we designed the present study to find out optimum potassium application to obtain maximum growth and output yield of mungbean. We also focused to select the most responsive mungbean cultivar in relations to growth and seed output against various potassium applications.

MATERIALS AND METHODS

Site Selection and Plant Material

The field trial was conducted at the experimental area of Pulse Research Sub-Station, Tandojam, Sindh, Pakistan with latitude 68.33° and longitude 25.25°. Two mungbean cultivars i.e., AEM-96 and C-23 were examined against five potassium applications. The growth and yield performance of AEM-96 cultivar was highest among other cultivars (Jamro *et al*., 2018). However, the same cultivar performed poorly in antioxidant potential in another study (Zia-Ul-Haq *et al*., 2013). The C-23 was newly experimented variety which was not used in any research experiment before. The whole experiment was replicated thrice and was organized in split plot arrangements of Randomized Complete Block Design (RCBD). The size of net plot was managed as 20 m^2. The seeds of both cultivars were obtained from Pulse Research Sub-Station, Tandojam, Sindh, Pakistan. The seed were sown by drilling method by using single coulter hand drill. The 25 kg seed rate per hectare was used as per the recommendations of agriculture research wing, Sindh. Whereas 30 and 75 cm distances were kept among plants and rows, respectively. The sowing was done before 15th July, 2020 and harvesting was completed in the month of October, 2020.

Soil Analysis

The Bouyoucos Hydrometer method (Kanwar and Chopra, 1959) was followed for the determination of soil texture. The Electrical Conductivity (EC) and pH of soil extracts was measured using Rowell's method (Rowell, 1994). Electric conductivity of soil was checked by using

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conductivity meter (model-8733, Germany), and the pH was determined with the help of digital pH meter (Orion (ISE) Model-SA-720, USA). The certified standards were used for the determination of EC and pH according to the protocol. The percentage of Organic matter (OM) in soil measured by following the method of Walkely-Black (Jackson, 1958a). Kjeldahl's method (Jackson, 1958b) was used in the experiment for measuring soil nitrogen (%). The Spectrophotometer (model-Specord-200 PC, Germany) was used to quantify the amount of AB-DTPA phosphorous (mg kg^{-1}) and the flame photometer model No. (PFP-7, UK) was used to measure extractable potassium (mg kg^{-1}). The methods described by Soltanpour and Schwab, (1977) were followed to determine the quantity of phosphorus and potassium.

Chemical and Physical Properties of Soil

The soil was tested before conducting the experiment. Following properties of soil were obtained:

Table 1. The chemical and physical properties of experimental soil.

Properties	Value
Soil Type	Clay loam
Sand	25 %
Silt	35 %
Clay	45 %
pH	7.76 (alkaline)
EC	0.46 dSm^{-1}
Organic matter	0.71 %
N	0.03 %
P	8.18 mg kg^{-1}
K	76.0 mg kg^{-1}

Potassium treatment and Nutrition Management

The mungbean crop was fertilized with five different application rates of potassium fertilizer i.e., 00 (control), 20, 30, 40, and 50 kg K ha^{-1}. The control plots were remained unfertilized, only the recommended doses (75-60 kg ha^{-1}) of nitrogen (N) and Phosphorus (P) were applied, respectively by Urea and Single Super Phosphate (SSP). The various applications of K were supplied through the fertilizer namely Muriate of Potash (MOP). Total P and K and half of N were given as basal dose. The remaining amount of N was supplied to the crop in equal splits at first and second irrigation.

Land Preparation and Agronomic Management

Initially the soil was ploughed with disc plough followed by levelling of the land and goble plough. A soaking dose was given to the soil. The seedbed was prepared with the help of rotavator and cultivar. Clods were crushed completely through clod crusher followed by planking. All the weeds and stubbles were removed before sowing the seeds and Interculturing practices were performed time to time during the whole period. Monitoring of crop against insect pests and disease was performed everyday morning and if found any problem, recommended measures were taken. The crop was irrigated three times from sowing up to harvesting. Harvesting and threshing were performed manually when the crop came to its full maturity.

Trait Measurement

Five random plants were chosen and tagged from each treatment of every replication. The data was collected for Plant height (cm), Twigs $plant^{-1}$, Pods $plant^{-1}$, Seeds $plant^{-1}$ and Seed weight $plant^{-1}$ (g) from that randomly selected plants and average of five plants was obtained for each treatment. After getting average of plants, the average of each treatment from all three replications was obtained and used for statistical purpose. The whole mungbean plants of each treatment were harvested with their straw and weighed to get biological yield (kg $plot^{-1}$) and after it was changed to biological yield (kg ha^{-1}) by using the following formula:

$$Biological\ yield\ (kg\ per\ ha) = \frac{Biological\ yield\ per\ plot\ (kg)}{Plot\ Size\ (m^2)} \times 10000$$

Similarly, Seeds were threshed manually and weighed. Seed yield (kg $plot^{-1}$) was obtained from each treatment and converted from seed yield (kg $plot^{-1}$) to seed yield (kg ha^{-1}) through following formula:

$$Seed\ yield\ (kg\ per\ ha) = \frac{Seed\ yield\ per\ plot\ (kg)}{Plot\ Size\ (m^2)} \times 10000$$

Statistical Analysis

The collected replication wise data was analysed through

STATISTIX-8.1 (www.statistix.com) software. The Analysis of Variance (ANOVA) and Least Significant Difference (LSD) were obtained to testify the significant different among treatment at probability level ($P \leq 0.05$). The graphs were made through GraphPad Prism software (Swift, 1997) version 6.01.

RESULTS AND DISCUSSION

Plant Height (cm)

The applications of different levels of potassium exhibited a significant ($P \leq 0.05$, Fig.1, Table. 2) positive effect on plant height (cm) of two mungbean (AEM-96 and C-23) cultivars. It was observed that the height of plants in both cultivars was improved with every increased potassium application. However, the highest plant height was noticed in plots which were applied with 50 kg potassium per hectare, followed by 40, 30 and 20 kg. The smallest height was seen in those plots where no potassium fertilizer was supplied. Comparing the performance of both cultivars, it was observed that AEM-26 plants were longer as compared to C-23 in each potassium level except the control plots where statistically both cultivars showed similar plant height. The results obtained by us are in conformity with Kumar *et al*. (2018) where they informed that highest plant height of mungbean cultivars was achieved when crop was fertilized with 90 kg K/ha. Potassium at 45 kg ha^{-1} application without any water stress conditions can produce long mungbean plants up to the height of 22 cm (Sadaf and Tahir, 2017). In the experiment conducted by Biswash *et al*. (2014) on different potassium and vermicompost levels to check the growth and nutrition content of mungbean, they reported that 20 kg Muriate of Potash (MOP) with either 6 or 8 kg vermicompost per hectare can increase the height of plants up to marked level.

Branches plant^{-1}

Increasing the level of K from 00 to 50 kg ha^{-1} significantly enhanced ($P \leq 0.05$, Table. 2) branches plant^{-1} in AEM-96 and C-23 cultivars. The mungbean crop given 50 kg potassium per hectare produced additional branches plant^{-1} while the control plants produced less branches plant^{-1} in each cultivar (Fig.2). Assuming the performance of both cultivars, it was observed that AEM-96 was more productive in relation to branches plant^{-1} as compared to C-23 in either 20, 30, 40 or 50 kg potassium applications. Interestingly, control plants of both cultivars exhibited no significant difference for branches plant^{-1}. Both cultivars produced similar number of branches plant^{-1} in the absence of potassium application. More number of branches plant^{-1} were achieved when the mungbean crop received either with 80 or 100 kg potassium in a hectare (Kumar *et al*. 2014). Thalooth *et al*. (2006) fertilized mungbean crop with zinc, potassium and magnesium. They reported that an efficient branching system was achieved when 2.0 % KNO_3 was sprayed on mungbean plants in comparison of zinc and magnesium.

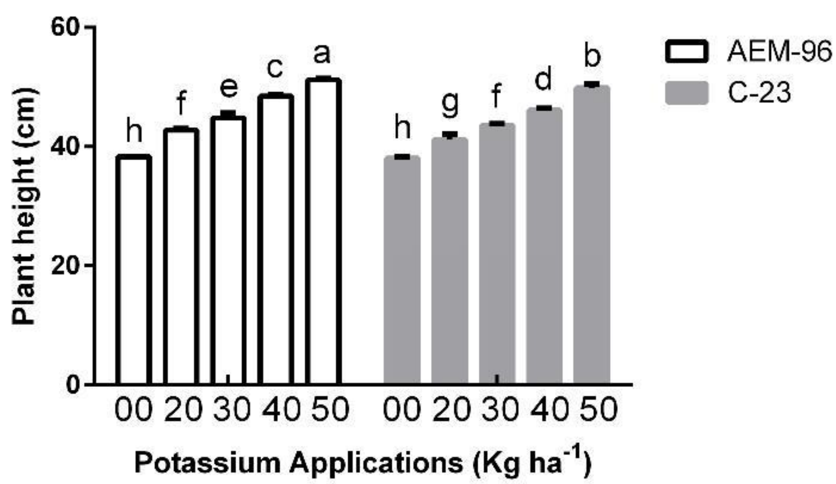

Figure 1. The comparison of two mungbean cultivars for plant height (cm) in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

Table 2. Two-way ANOVA comparing the performance of Mung bean cultivars under the impact of different potassium levels (00, 20, 30, 40, 50 kg K ha^{-1}) for plant height, branches plant^{-1}, pods plant^{-1}, seeds pod^{-1}, seed weight plant^{-1}, 1000-seed weight, biological yield and seed yield.

Indicators	F-value (Sources of variation for 2-way ANOVA)		
	Cultivars	**K levels**	**Cultivar x K levels**
Plant height (cm)	8786.80**	462.74**	2.95*
Branches plant^{-1}	26.17*	462.44**	5.52**
Pods plant^{-1}	82.59**	476.80**	3.22*
Seeds pod^{-1}	104.38**	256.74**	6.46**
Seed weight plant^{-1} (g)	20.87*	322.68**	2.27^{ns}
1000-seed weight (g)	104.13**	428.41**	5.10**
Biological yield (kg ha^{-1})	391.39**	2321.41**	11.72**
Seed yield (kg ha^{-1})	111.40**	863.10**	6.40**

F-values are shown; **significant difference at P = 0.01, *significant difference at P = 0.05, and ns = non-significant.

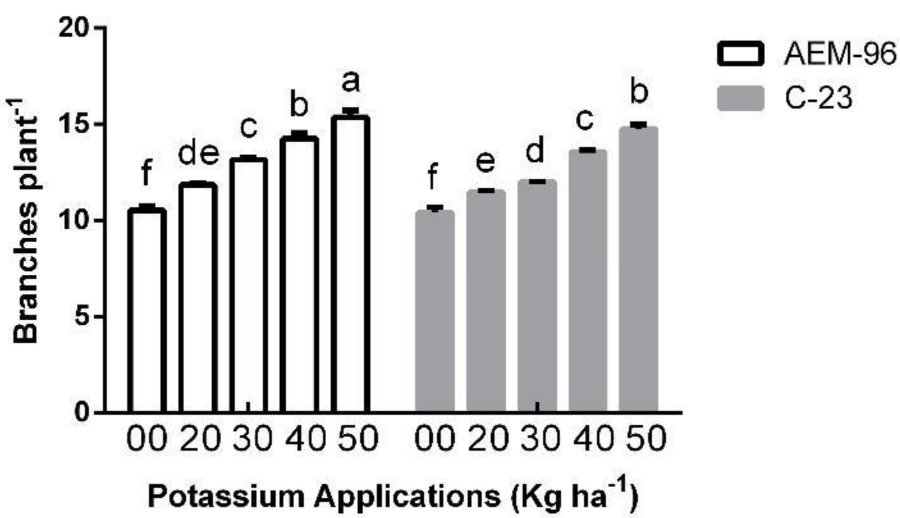

Figure 2. The comparison of two mungbean cultivars for branches plant^{-1} in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P\leq0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

Pods plant^{-1}

The results showed that the pods plant^{-1} in mungbean cultivars were significantly maximized ($P\leq0.05$, Table. 2) with enhancing potassium application rates. The cultivar AEM-96 produced the greatest number of pods plant^{-1} in each K level. However, the other cultivar (C-23) was ranked 2nd in producing maximum pods plant^{-1} (Fig.3). In the situation of K levels, it was noted that highest (50 kg) K level gave more pods plant^{-1} in both cultivars. However, it was observed that each decrease in the amount of K slightly decreased the quantity of pods plant^{-1} in both cultivars. The lowest 00 kilogram potassium per hectare showed lesser performance in producing maximum quantity of pods plant^{-1}. This trait is closely correlated with the increase in seed yield. Higher number of pods plant^{-1} were obtained at 90 kilogram potassium per hectare (Hussain *et al.* 2011). However, they reported that the cultivar Chakwal Mung-06 produced more pods plant^{-1} as compared to NIAB Mung-92. But the results reported by Buriro *et al.* (2015) specified that NIAB Mung-92 showed a higher potassium response when compared with Chakwal Mung-06 for producing maximum quantity of pods plant^{-1}. Varieties respond differently in different environments. So, these differences can be due to soil or environmental conditions because both the experiments were conducted in different provinces of Pakistan.

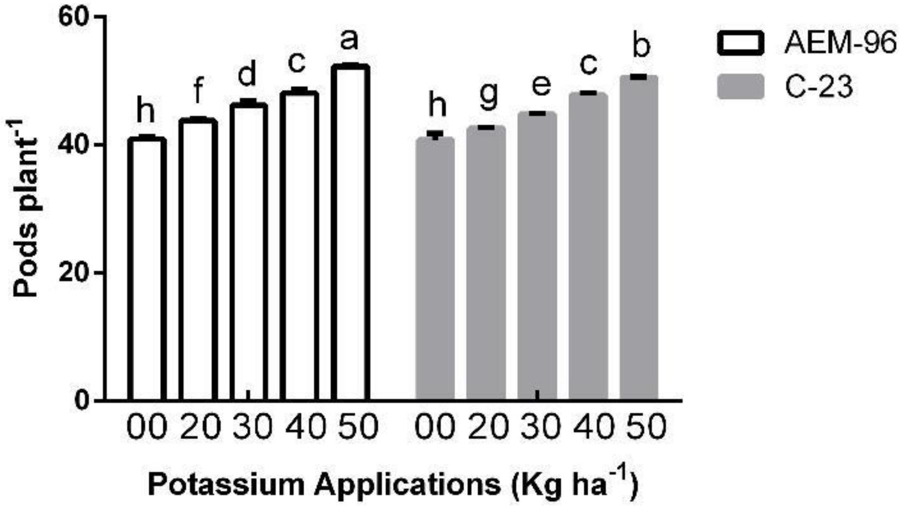

Figure 3. The comparison of two mungbean cultivars for pods plant^{-1} in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P≤0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

Seeds plant^{-1}

The results concerning the quantity of seeds plant^{-1} showed a significant ($P≤0.05$, Table. 2) effect of increasing K applications on mungbean cultivars. Seeds plant^{-1} in the cultivars of mungbean crop were enhanced with the dosage of 50 kilograms (Fig.4). However, the quantity of seeds in one plant was decreased when the supply of K ha^{-1} was reduced. The mungbean crop which received no potassium fertilizer produced less quantity of seeds plant^{-1} in both cultivars. In the situation of cultivars, AEM-96 produced highest while C-23 produced lowest seeds plant^{-1} in every K level except 00 kg K ha^{-1} which was statistically similar in both cultivars. Our results support the finding of previous research where Biswash *et al*. (2014) observed maximum 315.99 seeds plant^{-1} when they treated mungbean crop with 20 kilogram potassium per hectare. Maximum values of seeds plant^{-1} were detected when different mungbean varieties were treated with 125 kg potassium ha^{-1} (Buriro *et al*. 2015).

Seed weight plant^{-1} (g)

Increasing level of K meaningfully ($P≤0.05$, Table. 2) increased the seed weight plant^{-1} (g) of AEM-96 and C-23 cultivars of mungbean. The crop provided with K at the rate of 50 kg ha^{-1} produced greatest seed weight plant^{-1}, the ordinary seed weight plant^{-1} was noted in the crop given K at 40 and 30 kilogram in a hectare. Whereas the lowermost weight of seeds plant^{-1} was obtained in control treatments (Fig.5). The AEM-96 cultivar was more responsive in terms of producing seed weight plant^{-1} than C-23 in every K application level. Our findings agree with the previous research conducted by Thalooth *et al*. (2006), where they confirmed that the maximum 11.84 (g) seed weight plant^{-1} can be achieved when potassium is applied at mungbean fields under regular irrigation. The potassium fertilization to mungbean crop can considerably enhance the weight of seeds plant^{-1} (Kataria *et al*. 2014).

1000-seed weight (g)

The mungbean crop showed a consecutive improvement in 1000-seed weight (g) with each increment in potassium level. The crop fertilized with potassium at 50 kg K ha^{-1} significantly ($P≤0.05$, Fig.6, Table. 2) caused the uppermost 1000-seed weight (g), although the lowermost 1000-seed weight (g) was noticed in in control treatment. The results about the mungbean cultivars suggest that the maximum values of 1000-seed weight (g) were found in the cultivar AEM-96 and the minimum values of 1000-seed weight (g) were produced by the cultivar C-23. According to statistics, no significant difference was found in 1000-seed weight of both cultivars in control plots. A number of studies have shown that 1000-seed weight is increased when the potassium was applied either foliar or in soil. Our results agree with these previous researches where they stated the potassium fertilizer has potential to increase 1000-seed weight of mungbean crop (Fooladivanda *et al*. 2014; Mazed *et al*. 2015; Yin *et al*. 2018; Yin *et al*. 2019).

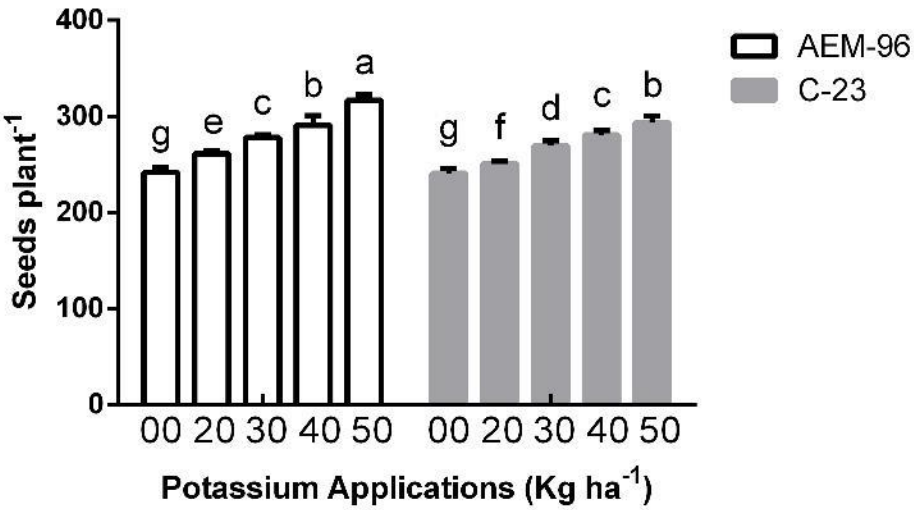

Figure 4. The comparison of two mungbean cultivars for seeds plant^{-1} in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

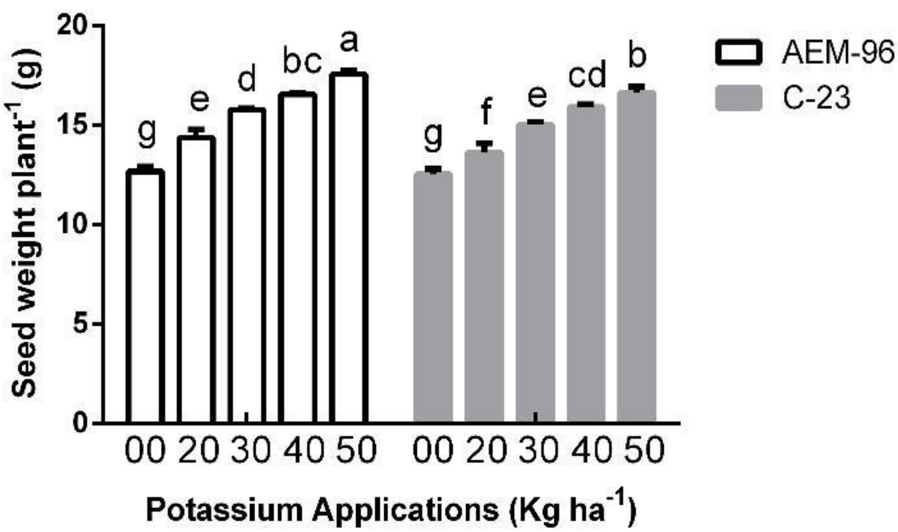

Figure 5. The comparison of two mungbean cultivars for seed weight plant^{-1} in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

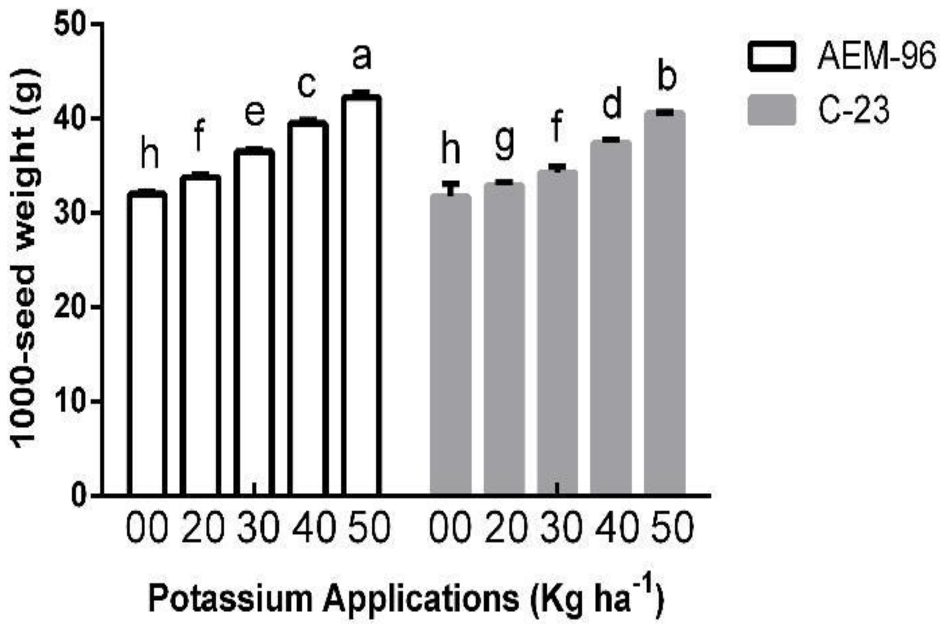

Figure 6. The comparison of two mungbean cultivars for 1000-seed weight in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

Biological yield (kg ha^{-1})

The data in relation to the biological yield (kg ha^{-1}) exhibited a significant ($P \leq 0.05$, Table. 2) positive influence of K applications upon two mungbean cultivars. Both cultivars of mungbean crop demonstrated maximum biological yield when they were exposed to 50 kg application of potassium (Fig.7). The other K treatments such as 40, 30 and 20 produced lower biological yields. The poorer biological yield (kg ha^{-1}) was observed in those plants which received no potassium. The mungbean cultivar AEM-96 produced huge amount of biological material (kg ha^{-1}) in each K level as compared to C-23. In an experiment on Grass Pea, Ali *et al*. (2021) evaluated that highest biomass yield (kg ha^{-1}) was acquired, when they treated their crop with 20 kilogram potassium dose. Potassium application at 45 kg K ha^{-1} with regular irrigation can significantly increase the biological yield up to 4729.63 kilograms in hectare (Sadaf and Tahir, 2017). Fooladivanda *et al*. (2014) reported that the variety VC-6172 of mungbean given 180 kilogram K produced more biological yield than variety Indian.

Seed yield (kg ha^{-1})

The seed yield (kg ha^{-1}) of two mungbean cultivars (AEM-96 and C-23) was analysed to check the impact of potassium applications. The results showed that seed yield (kg ha^{-1}) of the mungbean cultivars was significantly ($P \leq 0.05$, Table. 2) enhanced with increasing the level of potassium fertilizers. The supreme yield of seed acquired in plots where 50 kg potassium per hectare was applied followed by 40, 30 and 20 kilogram of potassium (Fig.8). Whereas control plants indicated lowest seed yield in every cultivar. In situation of the cultivars, it was detected that AEM-96 produced highest seed yield under each K level and C-23 cultivar was ranked 2nd. However, the statistical results presented that there was not any significant difference between the seed yield produced by both cultivars under 00 kg K ha^{-1} application level of potassium. The results shows that potassium was the reason behind the increase of seed yield of both mungbean cultivars because in control both cultivars were similar in producing seed yield. Our findings agree with the findings of many of previous research workers such as Theoneste *et al*. (2018), who conducted pot experiment on different potassium levels and concluded that 0.5 K_2O g/pot was enough for achieving highest seed yield of mungbean crop. Hussain *et al*. (2011) and Buriro *et al*. (2015) reported that potassium at 90 and 125 kilogram K hectare, respectively can enhance the seed yield of various cultivars.

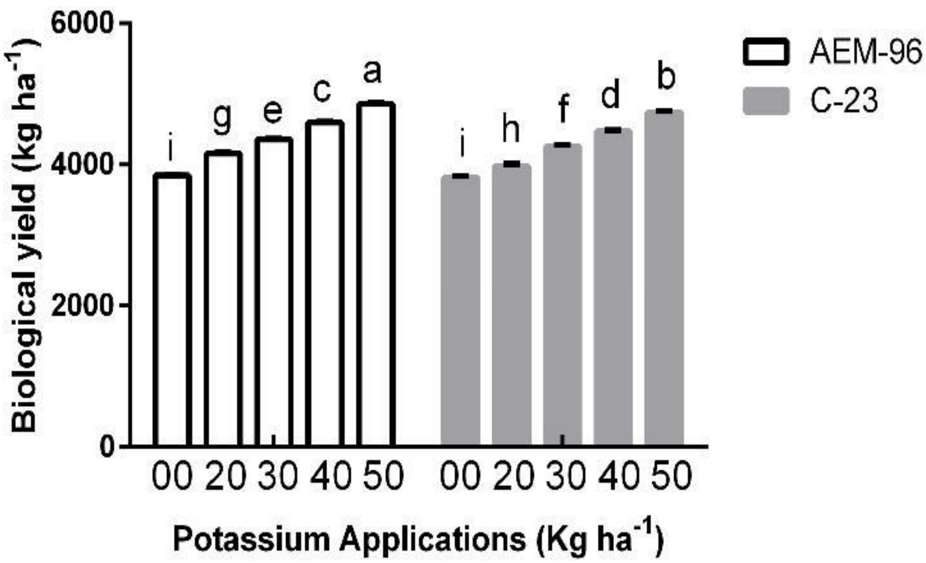

Figure 7. The comparison of two mungbean cultivars for biological yield in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

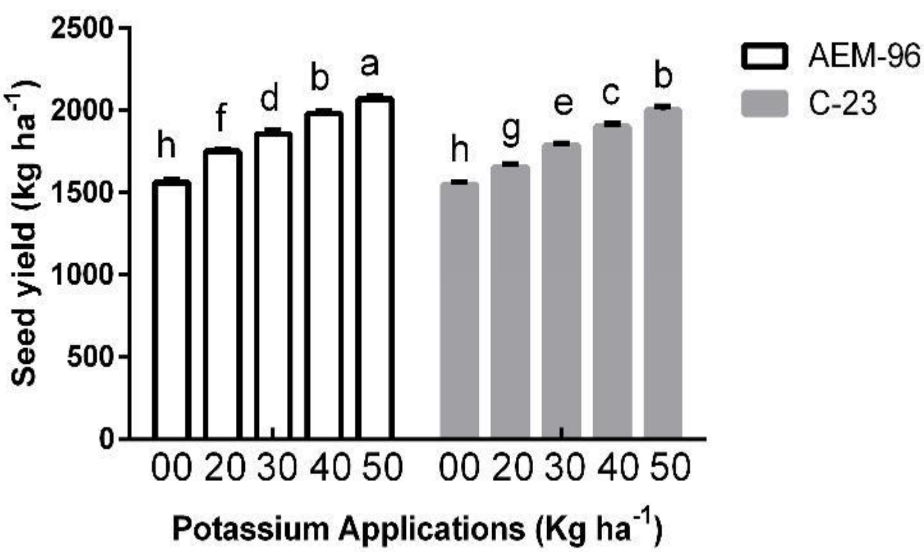

Figure 8. The comparison of two mungbean cultivars for seed yield in the presence of various potassium applications i.e., 00, 20, 30, 40, and 50-kilogram K ha^{-1}. The various letters indicate a significant difference ($P \leq 0.05$) among K treatments and both cultivars. White bars showing the performance of mungbean cultivar AEM-96 and grey bars showing the performance of C-23 cultivar. All the results are exposed as mean ± standard deviation. The Mean values are results of three biological replications.

CONCLUSION

Two mungbean (*Vigna radiata* L.) cultivars namely AEM-96 and C-23 were evaluated on the basis of their performance against different potassium applications such as 00 (control), 20, 30, 40 and 50 kg K ha^{-1}. It was concluded that potassium application at the rate of 50 kg ha^{-1} increased plant height, branches $plant^{-1}$, pods $plant^{-1}$, seeds pod^{-1}, seed weight $plant^{-1}$, 1000-seed weight, biological yield and seed yield of both cultivars. Both the cultivars performed similar in the absence of potassium (control plots) for every trait. Hence, it was proved that potassium was the reason behind the increased performance of every trait of mungbean cultivars. In comparison of two mungbean cultivars, it was observed that AEM-96 was more responsive as compared to C-23 against various potassium applications. However, the mungbean cultivar AEM-96 was recommended for cultivation against 50 kg potassium at locality. The nutrient status varies in relation to region and soil type. These recommendations show about the locality of Tandojam area. The other research experiments can be carried out in different regions of the country to explore the actual potassium application rate for mungbean crop.

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CONFLICT OF INTEREST

The authors declares that they have no conflict of interest.

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