ARTICLE / INVESTIGACIÓN

The impact of different potassium concentrations on the yield of mungbean (*Vigna radiata L.*)

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Abstract: To investigate potassium's impact on mungbean yield, a field experiment was carried out in the Kut that was the Agriculture Directorate of Wasit in season 2018- 2019. This experiment compared four different potassium amounts (0, 1000, 2000 and 3000 mg.L^{-1}), symboled K0, K1, K2 and K3, respectively. The findings of this research indicated that there were significant effects on pod length, the total number of pods per plant, seeds per pod, biological yield and grain yield, with treatment K3 achieving the highest average of 10.49 cm, 35.83 pods plant^{-1}, 10.60 seeds pod^{-1}, 1.430 ton ha^{-1}, and 2.026 ton ha^{-1}, respectively. At the same time, neither the ha harvest index nor the 100-seed weight was significantly impacted.

Key words: Potassium, seed yield, biological yield, harvest index, mungbean.

Introduction

Not only does the mung bean (*Vigna radiata L.*), an essential leguminous crop with a high nutritional value, play a significant role in humans' food. They also contribute to the enhancement of soil fertility through Nitrogen fixation by the bacterial node in their roots. In comparison to other types of leguminous, its seed is more delicious, nutritious, readily digestible, and does not cause flatulence[10]. Mung bean is a type of legume that matures in a relatively short amount of time. This crop is well-known and widely grown in the south and Southeast Asia, and it is a highly significant source of protein[6].

This plant prevents soil erosion as a covering plant, enriches and fertilizes the soil through biological nitrogen fixation, and produces green feed[4].

Mung bean is one of the most extensively farmed food legumes in tropical areas worldwide. It is also one of the most popular food legumes[3].

Mung bean's growth, development, and output are significantly impacted by how fertilizers are administered, making this one of the most crucial aspects of crop production[5].

The third macronutrient is potassium, which comes after phosphorus and nitrogen, and is the macronutrient that plants need for growth and military transport. It plays an essential role as a macronutrient in plants and crop production in a sustainable way[9]. It is also currently second only to nitrogen. Regarding the importance of this crop, the root system facilitates the transport of the products of photosynthesis to the economic part of the plant, which improves yield in terms of quantity and quality[17].

Potassium plays a significant role in forming protein and deepening the root system; potassium is considered one of the most important and influential elements in harvesting productivity[13]. This is because it activates more than 75 enzymes that contribute to completing multiple critical biological activities in the plant. Additionally, potassium contributes to the process of photosynthesis, and it helps the plant complete numerous important physical activities[2].

Hussain *et al.* (2011)[7] stated that potassium displayed an unusual reaction in growth and production when they did a field experiment on mung bean crops at the Faisalabad University of Agriculture; the investigation was conducted on mung bean crops According to Salih *et al.* (2012)[15], the use of potassium fertilizer had a substantial impact on the amount of dry matter and grain produced. According to Al-Shaheen *et al.* (2016)[2], the Mung bean had a favorable response to applying potassium fertilizer.

The information presented above, This study was conducted to know the best concentration for spraying the mung crop, which achieves the highest yield and the best quality and also reduces the ground application of potassium fertilizer, reducing economic costs.

Materials and methods

Location of the experiment

The central Kut, where the experiment was carried out, is located in the Kut district of the Wasit Province. This area is located at (Longitude 32'-44o and 36'-46o East and latitudes 31o-57' and 31'-32' North). Before the planting of the crop, composite soil samples were gathered from the area being experimented. Before planting the crop, soil samples were collected from 0 to 40 cm depths and then tested using various soil analysis methods to evaluate the soil's chemical and physical characteristics. These results are found in the table (1)[14].

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Measured Character		Value	measuring unit
pH		7.9	
Electrical conductivity (EC)		1.6	$dS\ m^{-1}$
Nitrogen		31	$mg\ kg^{-1}$
Phosphorus		12	
Potassium		40	
Soil components	Sand	31	$gm\ kg^{-1}$
	Silt	26	
	Clay	43	
Soil texture		Clay	

Table 1. Chemical and physical characteristics.

Study treatments and design

A randomized complete block design was utilized in the experiment, and each plot had an area of 4 m^2, with three replications. Foliar potassium spraying at four different concentrations (K_2O 43 %), as follows: control (K0), 1000 (K1), 2000 (K2), and 3000 (K3) $Mg.L^{-1}$.

Agronomic practices

On August 9, during the 2018 growing season, mung bean seeds were planted, and there was a distance of 50 cm between rows. Phosphate fertilizer was applied all at once before planting, considering the possibility of (75 Kg. ha^{-1}). While the nitrogen fertilizer in the 40 kg ha^{-1} was added after 16 days had passed since seeding the seeds.

In contrast, the foliar fertilizer potassium spraying (K_2O 43 %) was applied when flowering first began in three separate applications of equal strength.

Using a basin irrigation approach, plots were irrigated simultaneously right after planting using the same irrigation schedule. The plants' needs and the environment's characteristics were considered while determining the length of time between irrigations. Hoeing was used to keep the field free of weeds so we could plant. At harvest time (the last week of October 2019), plants were counted in each net experimental unit. In addition, five plants were randomly selected from each experimental unit to conduct further research. The following information was kept in the log: length of the pod (cm), number of pods per plant (pod $plant^{-1}$), number of seeds per pod (seed pod^{-1}), 100-grain weight (g), grain yield (ton h^{-1}), biological yield (ton h^{-1}), and harvest index.

Statistical analysis

The data were analyzed using GenStat, and the means were compared using the LSD test at 0.05 probability levels[16].

Results

K3 treatment supplied the highest average of the pod length (10.49 cm), and the treatment K0 resulted in the lowest average (8.85 cm). These results go along with what is shown in (Table 2), which demonstrates that there is a significant relationship between potassium levels and pod length[13]. who stated the effect of positive potassium in raising the pod length might be related to the relevance of concentration nutrients processed during photosynthesis, which resulted in higher division and elongation of the pod cells.

Significant impacts on the number of plant pods were observed when potassium levels were varied (Table 2). When administered at a concentration of 3000 mg/L, potassium produced the most significant number of pods per plant (35.83). The control treatment required a minimum number of pods, which was 29.25. These findings are consistent with (8) as well as (9). The number of pods can be attributed to the element potassium in the composition of many plant compounds. Potassium is one of the components of proteins, enzymes, and chlorophyll; as such, it is incorporated into all biological processes, including enzymatic reactions and photosynthesis[13].

There was a substantial correlation between the different potassium concentrations and the number of seeds produced by each pod (Table 2). When sprayed at a level of 3000 $mg.L^{-1}$, potassium gave the highest quantity of seeds per pod, which came out to be 10.60. In plots where potassium was not given to the soil, the lowest number of seeds per pod (9.0 seeds per pod-1) was achieved. These results are consistent with (9), (11), respectively[13]. In addition to the increase in the availability of other nutrients, the K treatment also facilitated the movement of photosynthates; the primary reason for the rise in the number of seeds may be because protein synthesis from source to sink was increased. The seeds number per pod was significantly altered after potassium was administered to the plants[7].

When varied amounts of potassium were used, the potassium levels in 100 seeds' worth of mung bean did not significantly differ. (Table 2).

The results are shown in (Table 3) that there is a significant relationship between the potassium fertilizer concentrations and the seed yield. The K3 treatment produced the highest rate of seed yield (1.430 tons ha-1), while treatment K0 gave the lowest rate of seed yield (1.127 tons ha-1). The results of (9), (11) and (13) led to the same conclusion[13]. This may be owing to the high nutrient content of the leaves, which has enhanced the effectiveness of photosynthesis and raised the quantity of glucose needed to create the protein and fat stored in the seeds, hence increasing seed production[12].

Significant influence on the biological yield caused by potassium concentrations of 3000 mg L^{-1}. The highest possible biological yield (2.026 ton ha^{-1}) was achieved with an application of potassium at a concentration of 3000 mg L^{-1} (Table 3)

Control treatment had the lowest overall biological yield (1.673 ton ha^{-1}) of all the effects. These results were in agreement with those of (1), who observed the positive role of potassium levels in the provision of sufficient quantities of photosynthesis products, their transfer and collection within the plant, which exploits its high efficiency in the production of dry matter, which led to an increase in biological yield. Potassium levels were found to play a role in providing sufficient quantities of photosynthesis products. This is indicated by (17), who confirmed that increasing potassium levels increase grain yield and biological yield, transfer, and collection within the plant. There was not a significant difference in the harvest index of mung bean between different K Concentrations. (Table 3).

Treatments	Pod length (cm)	No. of pods	No. of seed	100 seed weight (gm)	
K_0	8.85	29.25	9.00	7.61	
K_1	9.27	31.67	9.50	7.98	
K_2	10.37	35.40	10.57	8.07	
K_3	10.49	35.83	10.60	8.26	
LSD (0.05)	0.541	0.630	0.750	N.S	**K =**

Table 2. Effect of fertilizer potassium on Pod length, number of pods, seeds number and 100 seed weight of mung bean (Season 2018-2019).

Treatments	Seed yield (ton ha^{-1})	Biological yield (ton ha^{-1})	Harvest index	
K_0	1.127	1.673	67.38	
K_1	1.324	1.894	70.01	
K_2	1.418	2.022	70.12	
K_3	1.430	2.026	70.62	
LSD (0.05)	0.051	0.079	N.S	**K =**

Table 3. Effect of fertilizer potassium on Seed yield, Biological yield and Harvest index of mung bean (Season 2018-2019).

Conclusions

Among different potassium Concentrations, the application of potassium is 2000 and 3000 mg. L^{-1} was found to be the most effective, which exhibited significant yield attributes and productivity in terms of grain, and biological yield.

Using potassium fertilizer resulted in a favorable response from the mung bean plant. We have concluded that, compared to the other macronutrients, potassium (K) is of comparable importance and should be added to the mungbean crop. The experiment demonstrated a reaction in terms of yield due to potassium administration levels of 2000 and 3000 mg. L^{-1}.

Concentrations of K, which are based on one season experiment, influenced the parameters mentioned above of mung bean; additional tests may be required to evaluate the product's effectiveness in various environmental conditions and types of soil.

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