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Mungbean and weed growth as affected by potassium and weed control methods

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Abstract
The experiment was conducted at the research plot of Sher-e-Bangla Agricultural University farm, Dhaka during the period from February, 2017 to June, 2017 to study the effect of potassium levels and weed control methods on the growth and yield of mungbean. The treatment consisted of three potassium level *viz.* K_0= Control (No Potassium), K_1 = Recommended dose of Potassium (R), K_2 = 30% increased of R and four weed control methods *viz.*, W_0 = No weeding (control), W_1 = One hand weeding at 15 days after sowing (DAS), W_2 = Two hand weeding at 15 DAS and 30 DAS, W_3 = One paraxon spray at 15 DAS. The experiment was laid out in a two factors split plot design with three replications. The seeds of BARI mung-6 variety were the test materials. The highest plant height (16.98, 27.71, 37.92, 43.35 and 45.30 cm at 15, 25, 35, 45 and 55 DAS, respectively), number of branch (4.51, 7.26, 9.48, 10.09 and 10.54 cm at 15, 25, 35, 45, and 55 DAS, respectively), number of leaflets (6.04, 11.90, 14.55, 16.00 and 17.00 at 15, 25, 35, 45, and 55 DAS, respectively) and dry weight plant^{-1} (0.75, 2.50, 5.54, 6.34 and 7.30 at 15, 25, 35, 45, and 55 DAS, respectively)was observed $K_2 \times W_2$ treatment. The lowest dry number and weight of Smooth crav grass (13.68 and 55.50 g), Purple nut sedge (25.37 and 18.77 g), Jungle rice (24.58 and 99.17 g), Bermuda grass (3.03 and 0.10 g), Indian gooes grass (0.75 and 5.85 g), Alligator weed (7.49 and 0.74 g), Green amaranth (1.43 and 0.21 g), Common purslane (0.15and 0.08 g) and Spreading dayflower (0.12 and 8.29 g) at harvest was observed in ($K_2 \times W_2$). The results in this study indicated that the plants performed better in respect of growth characters of mungbean and lowest weed growth in $K_2 \times W_2$ (30% increased of recommended dose of Potassium with two hand weeding).

Keywords: mungbean, weed, growth, potassium, weeding, weed control method

1. Introduction

Mungbean (*Vigna radiata* L.) is a vital crop belongs to the family Fabaceae (Khattak *et al.*, 2004). It is produced for both human consumption and as fodder. Its seed contains 51% carbohydrate, 26% protein, 10% moisture, 4% mineral and 3% vitamin (Afzal *et al.*, 2008). The by-product of mungbean vermicelli processing contains ll-23% crude protein, 0.4-1.8% ether extract, 13-36% crude fibre, 0.30- 0.68% calcium and 0.17-0.39 % phosphorus depending on the mungbean material (Sitthigripong *et al.*, 1998). In spite of its importance as food and feed, very little attention has been paid to its quantitative and qualitative improvement in the country. In Bangladesh, total production of pulse is only 0.65 million ton against 2.7 million ton requirement, which accounted for lower yield capacity of the crop (MoA, 2005) [11]. As resources are squeezing and population is hiking therefore crop scientists are focusing on improved management practices and advanced crop husbandry techniques (Lipton, 2001) [7]. Critical period of weed competition is the range within which a crop must be weeded to save the crop from yield loss (Islam *et al.*, l989) [5]. Mungbean is not very competitive against weed and therefore weed control is essential for mungbean production. Weed crop competition commences with germination of the crop and continues till its maturity. Several growth stages of mungbean such as emergence, flowering and pod setting are greatly hampered by weed. Weed infestation of these stages causes low pod setting and ultimately reduction in yield reduces. Weeds above critical population thresholds can significantly reduce crop yield and quality. However, the aim of weed management should be to maintain weed population at an economic threshold level. Timely control of weeds either manually or using herbicide is essential for higher yield in mungbean. Significantly more seed yields by weeding have been reported in mungbean (Hossain *et al.*, 1990; Kumar and Kiron, 1988; Musa *et al.*, 1996) [4, 6, 13].

K is essential for many physiological processes, such as photosynthesis, translocation of photosynthates into sink organs, maintenance of turgidity and activation of enzymes under stress conditions (Marschner, 2102; Mengel and Kirkby, 2001) [9, 10]. Potassium supply in high amounts can provide protection against oxidative damage caused by chilling or frost. A high K+ concentration activated the plant's antioxidant systems which are associated with cold tolerance (Devi *et al*, 2012) [3]. Higher K tissue concentrations reduced chilling damage and increased cold resistance, ultimately increasing yield production. The present study was undertaken to study the effect of potassium and weed control method on the growth of mungbean and weed.

2. Materials and methods

The experiment was conducted at the Agronomy field of Sher-e-Bangla Agricultural University, Dhaka, during the period of March 2017 to May 2017 to study the effect of potassium and weeding level on the growth of mungbean and weed. The treatment consisted of three potassium level *viz.* K_0= Control (No Potassium), K_1 = Recommended dose of Potassium (R), K_2 = 30% increased of R and four weed control methods *viz.*, W_0 = No weeding (control), W_1 = One hand weeding at 15 days after sowing (DAS), W_2 = Two hand weeding at 15 DAS and 30 DAS, W_3 = One paraxon spray at 15 DAS. The experiment was laid out in a split plot design having 3 replications. There were 36 unit plots and the unit plot size was 5.52 m^2 (2.4 m X 2.3 m). The potassium is the main plot and wedding level is sub plot.

The data were recorded for Mungbean on plant height, number of branch $plant^{-1}$, number of leaflets $plant^{-1}$ and dry weight $plant^{-1}$ at 15, 25, 35, 45 and 55 DAS. Weed density weed biomass were recorded for weed parameters. The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT- C and the mean differences were adjusted by Least Significance Difference (LSD) test at 5% level of significance.

3. Result and discussion

3.1. Crop parameters

3.1.1 Plant height

Potassium showed statistically significant variation in respect of plant height. K_2 showed the highest plant height (16.61, 27.60, 36.87, 42.01 and 43.90 cm at 15, 25, 35, 45 and 55 DAS, respectively) and the lowest plant height (16.31, 26.00, 34.72, 39.63 and 41.42 cm at 15, 25, 35, 45 and 55 DAS, respectively) was observed in K_0 (Figure 1). This result is similar with the findings of Thesiya *et al.* (2013) [14] who found significant increase in plant height of blackgram due to the application of potassium. The plant height was significantly influenced by weed management at all growth stages of mungbean. At 15, 25, 35, 45 and 55 DAS, the highest plant height (16.62, 27.63, 37.43, 42.51, and 44.42 cm, respectively) was recorded in W_2 where the lowest was measured (16.62, 27.63, 37.43, 42.51, and 44.42 cm, respectively) in W_0 (Figure 2). The result under the present study was in partial agreement with the findings of Chattha *et al.* (2007) [2]. Chattha *et al.* (2007) [2] found that among different weed control methods, chemical-weeding at 2 - 3 leaf stage of Weeds + hand-weeding at 50 DAS gave maximum plant height compared to weedy check treatment. Interaction effect between different level of potassium and weeding exerted significant effect on plant height except 15 DAS. The highest plant height was observed in $K_2 \times W_2$ and the lowest was observed control $K_0 \times W_0$ (Table 1).

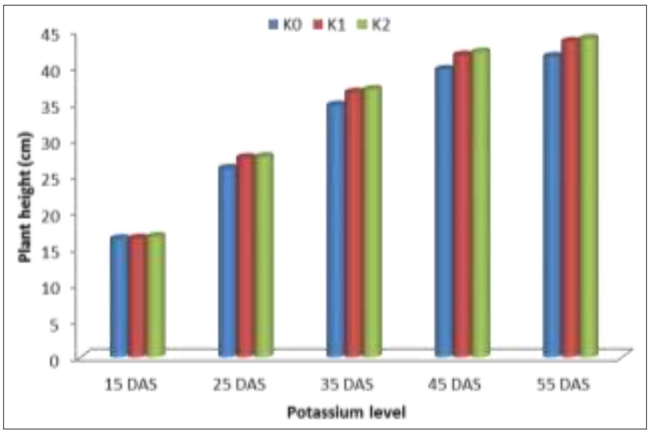

Fig 1: Effect of potassium level on plant height of mungbean at different days after sowing (DAS) [(LSD $_{(0.05)}$ 1.803, 0.261, 0.369, 0.512 and 0.532 at 15, 25, 35, 45 and 55 DAS, respectively)]

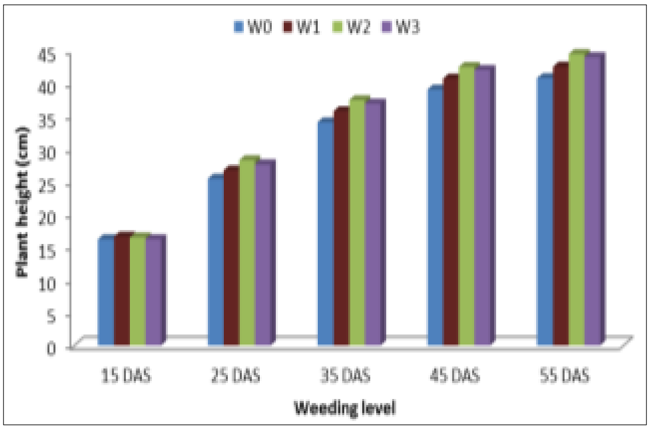

Fig 2: Effect of weeding level on plant height of mungbean at different days after sowing (DAS) [(LSD $_{(0.05)}$ 2.13,0.327, 0.436, 0.612 and 0.641 at 15, 25, 35, 45 and 55 DAS, respectively)]

Table 1: Interaction effect of potassium level and weeding on plant height of mungbean at different days after sowing (DAS)

Interaction Effect	Plant height (cm)				
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS
$K_0 \times W_0$	16.93	24.03h	32.10g	37.41h	39.09h
$K_0 \times W_1$	16.00	25.75g	34.40f	39.19g	40.96g
$K_0 \times W_2$	16.04	27.44d	36.65c	41.21c-e	43.07c-e
$K_0 \times W_3$	16.62	26.75ef	35.74de	40.72de	42.55de
$K_1 \times W_0$	16.49	26.54f	35.45e	40.40ef	42.22ef
$K_1 \times W_1$	16.89	27.20de	36.33cd	41.40c-e	43.26c-e
$K_1 \times W_2$	16.53	28.23bc	37.70ab	42.96ab	44.89ab
$K_1 \times W_3$	16.66	28.43b	37.98a	43.27ab	45.22ab
$K_2 \times W_0$	16.06	25.85g	34.53f	39.35fg	41.12fg
$K_2 \times W_1$	16.98	27.33de	36.50cd	41.59cd	43.47cd

$K_2 \times W_2$	16.03	29.03a	37.92a	43.35a	45.30a
$K_2 \times W_3$	16.21	27.71cd	37.02bc	42.18bc	44.08bc
CV (%)	5.53	4.29	6.20	4.50	7.51
$LSD_{(0.05)}$	3.691	0.566	0.755	1.055	1.11
LS	NS	**	**	*	*

Figures in a column followed by different letter(s) differs significantly from each other as adjusted by LSD.

K_0= Control (No Potassium), K_1 = Recommended dose of Potassium (R), K_2 = 30% increased of Recommended dose of Potassium, W_0 = No weeding (control), W_1 = One hand weeding at 15 days after sowing (DAS), W_2 = Two hand weeding at 15 DAS and 30 DAS, W_3 = One paraxon spray at 15 DAS

3.1.2 Number of branch Plant^{-1}

Branches plant^{-1} was significantly influenced by potassium, weeding level and its interaction effect at all growth stages of mungbean. K_2 treatment, showed the highest number of branches plant^{-1} (4.28, 6.90, 36.87, 9.22, 9.81 and 10.25 cm at 15, 25, 35, 45 and 55 DAS, respectively) and the lowest number of branches plant^{-1} (4.05, 6.52, 8.70, 9.26 and 9.68 cm at 15, 25, 35, 45 and 55 DAS, respectively) was found in K_0 (Figure 3). Optimum fertilizer level might be increased the vegetative growth of mungbean that lead to the highest number of branch per plant. Biswash *et al.* (2014) [1] showed that increasing potassium levels have significant effect on number of branches plant^{-1}of mungbean. At 15, 25, 35, 45 and 55 DAS, the highest number of branches plant^{-1} (4.38, 7.06, 9.36, 9.96 and 10.40 respectively) was recorded in W_2 and the lowest was achieved with W_0 (3.97, 6.39, 8.54, 9.08 and 9.49 respectively) (Figure 4). Muhammad *et al.* (2004) [12] reported that weeding were applied twice, i.e. at 10 and 35 days after sowing significantly affected number of branches plant^{-1}. The highest plant height (4.51, 7.26, 9.48, 10.09 and 10.54 cm at 15, 25, 35, 45, and 55 DAS, respectively) was observed in $K_2 \times W_2$ and the lowest plant height (3.77, 6.08, 8.12, 8.64 and 9.02 at 15, 25, 35, 45, and 55 DAS, respectively) was observed $K_0 \times W_0$.

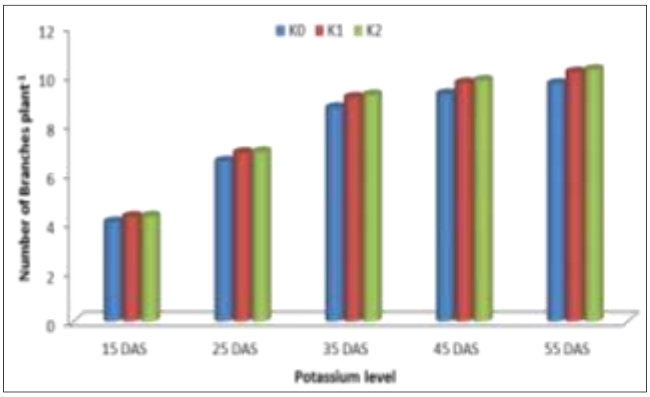

Fig 3: Effect of weeding level on number of branches plant^{-1} of mungbean at different days after sowing (DAS) [($LSD_{(0.05)}$ 0.062, 0.020, 0.080, 0.113 and 0.118 at 15, 25, 35, 45 and 55 DAS, respectively)].

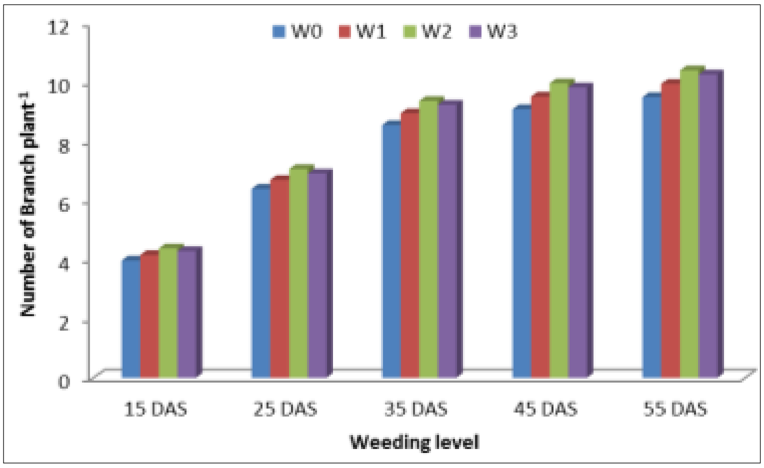

Fig 4: Effect of weeding level on number of branches plant^{-1} of mungbean at different days after sowing (DAS) [($LSD_{(0.05)}$ 0.554, 0.093, 0.129, 0.132 and 0.143 at 15, 25, 35, 45 and 55 DAS, respectively)].

Table 2: Interaction effect of potassium level and weeding on number of branches plant^{-1} of mungbean at different days after sowing (DAS)

Interaction effect	Number of branch plant^{-1}				
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS
$K_0 \times W_0$	3.77h	6.08h	8.12f	8.64g	9.02f
$K_0 \times W_1$	4.00g	6.44g	8.60e	9.15f	9.56e
$K_0 \times W_2$	4.26d	6.86de	9.16bc	9.75cd	10.19bc
$K_0 \times W_3$	4.15ef	6.69 ef	8.94cd	9.51de	9.93cd
$K_1 \times W_0$	4.12f	6.64 f	8.86d	9.43e	9.85d
$K_1 \times W_1$	4.22de	6.80 d-f	9.08b-d	9.66c-e	10.10b-d
$K_1 \times W_2$	4.38bc	7.06bc	9.43a	10.03ab	10.48a
$K_1 \times W_3$	4.41ab	7.11ab	9.49a	10.10a	10.56a
$K_2 \times W_0$	4.01g	6.46g	8.63e	9.19f	9.60e
$K_2 \times W_1$	4.24de	6.83de	9.13bc	9.71cd	10.15bc
$K_2 \times W_2$	4.51a	7.26a	9.48a	10.09ab	10.54a

$K_2 \times W_3$	4.30cd	6.93cd	9.25ab	9.85bc	10.29ab
CV (%)	4.41	3.44	7.43	6.42	5.43
$LSD_{(0.05)}$	0.093	0.162	0.223	0.230	0.248

Figures in a column followed by different letter(s) differs significantly whereas figures having common letter(s) do not differ significantly from each other as adjusted by LSD.

K_0= Control (No Potassium), K_1 = Recommended dose of Potassium (R), K_2 = 30% increased of Recommended dose of Potassium, W_0 = No weeding (control), W_1 = One hand weeding at 15 days after sowing (DAS), W_2 = Two hand weeding at 15 DAS and 30 DAS, W_3 = One paraxon spray at 15 DAS

3.1.3 Number of leaflets Plant^{-1}

Significant effect observed on number of leaflets plant^{-1} by potassium and weeding level at all growth stages of mungbean. K_2 treatment, showed the highest number of leaflets plant^{-1} (5.72, 11.31, 13.96, 15.41 and 16.41 at 15, 25, 35, 45 and 55 DAS, respectively) (Figure 5). Biswash *et al.* (2014) [1] showed that increasing potassium levels have significant effect on number of leaves of mungbean. At 15, 25, 35, 45 and 55 DAS the highest number of leaflets plant^{-1} (5.87, 11.57, 14.22, 15.67 and 16.67 respectively) was recorded in W_2 (Figure 6). Interaction effect between different level of potassium and weeding exerted significant effect on number of branch plant^{-1} at all DAS except 15 DAS (Table 3). The highest number of leaflets plant^{-1} (6.04, 11.90, 14.55, 16.00 and 17.00 at 15, 25, 35, 45, and 55 DAS, respectively) was observed in $K_2 \times W_2$.

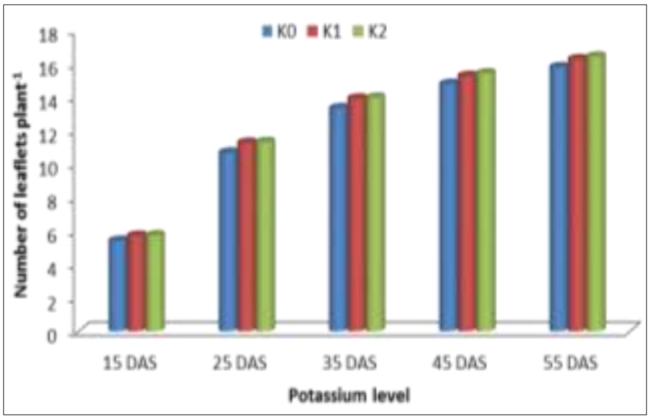

Fig 5: Effect of weeding level on number of leaflets plant^{-1} of mungbean at different DAS [(LSD $_{(0.05)}$ 0.062, 0.013, 0.321, 0.045 and 0.342 at 15, 25, 35, 45 and 55 DAS, respectively)].

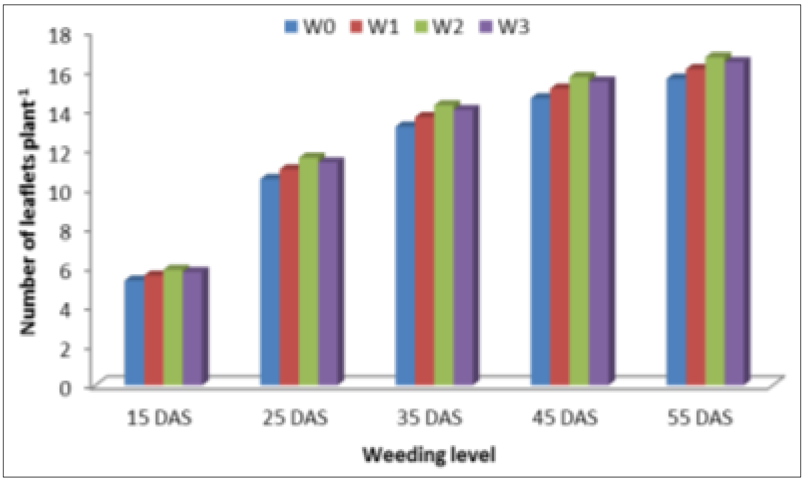

Fig 6: Effect of weeding level on number of leaflets plant^{-1} of mungbean at different DAS

Table 3: Interaction effect of potassium level and weeding on number of leaflets plant of mungbean at different DAS

Interaction effect	Number of leaflets				
	15 DAS	**25 DAS**	**35 DAS**	**45 DAS**	**55 DAS**
$K_0 \times W_0$	5.06	9.96h	12.61h	14.06h	15.06h
$K_0 \times W_1$	5.36	10.56g	13.21g	14.66g	15.66g
$K_0 \times W_2$	5.71	11.25de	13.90d	15.35c-e	16.35de
$K_0 \times W_3$	5.57	10.97ef	13.62ef	15.07ef	16.07ef
$K_1 \times W_0$	5.52	10.88f	13.53f	14.98fg	15.98f
$K_1 \times W_1$	5.66	11.15d-f	13.80de	15.25d-f	16.25de
$K_1 \times W_2$	5.87	11.57bc	14.22bc	15.67a-c	16.67bc
$K_1 \times W_3$	5.92	11.65ab	14.30ab	15.75ab	16.75ab
$K_2 \times W_0$	5.38	10.60g	13.25g	14.70g	15.70g
$K_2 \times W_1$	5.69	11.20de	13.85de	15.30d-f	16.30de
$K_2 \times W_2$	6.04	11.90a	14.55a	16.00a	17.00a
$K_2 \times W_3$	5.76	11.36cd	14.01cb	15.46b-d	16.46cd
CV (%)	6.56	5.67	6.56	3.45	7.23
$LSD_{(0.05)}$	-	0.271	0.248	0.330	0.260

Figures in a column followed by different letter(s) differs significantly from each other as adjusted by LSD.

3.1.4 Dry weight plant^{-1}

Significant variation was observed in dry weight plant^{-1} on potassium, weeding level and their interaction all DAS except 15 DAS (Figure 7). K_2 treatment, showed the highest dry weight plant^{-1} and the lowest dry weight plant^{-1} was observed with K_0 at 15, 25, 35, 45 and 55 DAS (Figure 7). At 15, 25, 35, 45 and 55 DAS, the maximum dry weight plant^{-1} (1.13, 3.31, 9.19, 11.69 and 13.37 g, respectively) was recorded in W_2 (Figure 8). The result under the present study agreed with the findings of Kumar and Kairon (1988) [6] and Malik *et al.* (2000) [8]. Kumar and Kairon (1988) [6] found that weed biomass increased and mungbean yield decreased with delay in weeding. They also reported that weed removal at 30 and 40 days after sowing showed high yield. In interaction effect, the highest dry weight plant^{-1} (0.75, 2.50, 5.54, 6.34 and 7.30 at 15, 25, 35, 45, and 55 DAS, respectively) was observed in $K_2 \times W_2$ and the lowest dry weight plant^{-1} was observed in $K_0 \times W_0$ (Table 4).

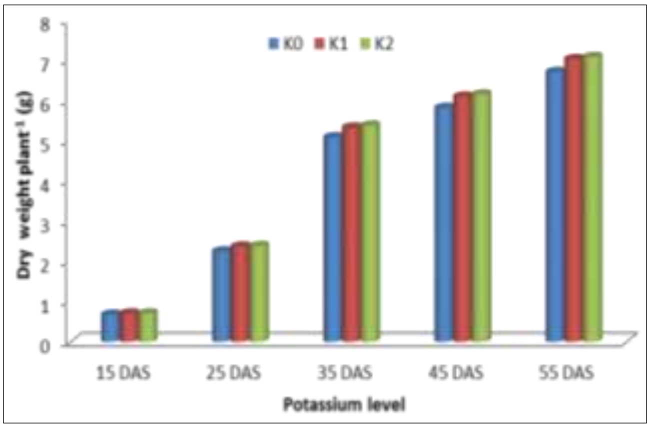

Fig 7: Effect of potassium level on dry weight plant^{-1} of mungbean at different days after sowing

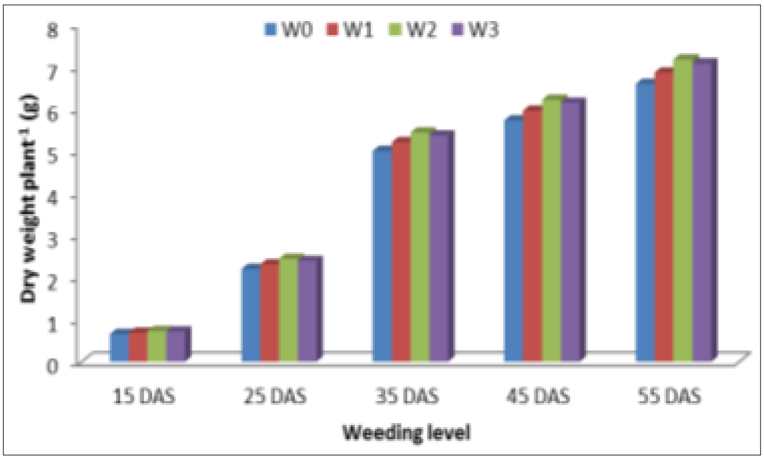

Fig 8: Effect of weeding level on dry weight plant^{-1} of mungbean at different days after sowing (DAS)

Table 4: Interaction effect of potassium level and weeding on dry weight plant^{-1} of mungbean at different days after sowing (DAS)

Interaction effect	Dry weight plant^{-1} (g)				
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS
$K_0 \times W_0$	0.63	2.08g	4.80g	5.49g	6.33g
$K_0 \times W_1$	0.67	2.22f	5.03f	5.75f	6.63f
$K_0 \times W_2$	0.71	2.37c-e	5.29c-e	6.05c-e	6.98c-e
$K_0 \times W_3$	0.69	2.31de	5.21de	5.96de	6.87de
$K_1 \times W_0$	0.69	2.29e	5.17e	5.92e	6.82e
$K_1 \times W_1$	0.70	2.35c-e	5.29c-e	6.05c-e	6.98c-e
$K_1 \times W_2$	0.73	2.44ab	5.48ab	6.27ab	7.22ab
$K_1 \times W_3$	0.74	2.45ab	5.52a	6.31ab	7.27a
$K_2 \times W_0$	0.67	2.23f	5.05f	5.77f	6.66f
$K_2 \times W_1$	0.71	2.36cd	5.32cd	6.08cd	7.01cd
$K_2 \times W_2$	0.75	2.50a	5.54a	6.34a	7.30a
$K_2 \times W_3$	0.72	2.39bc	5.38bc	6.16bc	7.10bc
CV (%)	6.27	4.89	5.22	4.35	7.34
$LSD_{(0.05)}$	-	0.019	0.121	0.143	0.153

Figures in a column followed by different letter(s) differs significantly from each other as adjusted by LSD.

3.2. Number of dry weight of narrow leaved weeds

3.2.1 Smooth crav grass (*Digitaria ischaemum*)

The effects of potassium, weeding and their interaction have been shown significant on number and dry weight of smooth crav grass (Table 5). K_0 treatment gave the highest number and dry weight of smooth crav grass (22.57 and 94.35 g) and the lowest (17.25 and 71.31 g) was observed with K_2. The maximum number and weight (24.93 and 103.55 g) was recorded in W_0 and the minimum number and weight (17.29 and 72.17 g) was achieved by W_2 treatment. The highest number and dry weight of crav grass (27.35 and 113.60 g) was observed in $K_0 \times W_0$ and the lowest (13.68 and 55.50 g) was observed in $K_2 \times W_2$.

3.2.2 Purple nut sedge (*Cyperus rotundus*)

The effects of potassium, weeding and weeding and their interaction were found significant on number and dry weight of Purple nut sedge (Table 5). It was apparent that K_0 gave the highest number and dry weight (42.00 and 31.08 g) and the lowest (31.98 and 23.67 g) was observed with K_2. In case of weeding, the highest number and weight (34.20 and 47.79 g) was found from W_0 and the lowest number and weight (32.26 and 23.88 g) was observed with W_2. The highest number and weight of Purple nut sedge (50.71 and 37.52 g) was observed in $K_0 \times W_0$ and the lowest (25.37 and 18.77 g) was observed in $K_2 \times W_2$.

Table 5: Effect of potassium on number and dry weight of narrow leaves weed in mungbean fled at harvest

	Smooth crav grass (*Digitaria ischaemum*)		Purple nut sedge (*Cyperus rotundus*)		Jungle rice (*Echinochloa colona*)		Bermuda grass (*Cynodon dactylon*)		Indian gooes grass (*Eleusine indica*)	
	Number m^{-2}	Weight (g)	Number m^{-2}	Weight (g)	Number m^{-2}	Weight (g)	Number m^{-2}	Weight (g)	Number m^{-2}	Weight (g)
Potassium level										
K_0	22.57a	94.35a	42.00a	31.08a	43.26a	164.60a	5.16a	0.16a	1.24a	9.81a
K_1	20.92b	86.89b	38.78b	28.70b	39.77b	151.89b	4.77b	0.14a	1.14b	9.03b
K_2	17.25c	71.31c	31.98c	23.67c	32.65c	125.26c	3.93c	0.12b	0.94c	7.45c
$LSD_{(0.05)}$	0.850	1.87	0.376	1.041	1.039	3.793	0.251	0.011	0.05	0.277
LS	**	**	**	*	**	**	**	*	**	**
Weeding level										
W_0	24.93a	103.55a	46.22a	34.20a	47.79a	181.13a	5.72a	0.17a	1.36a	10.79a
W_1	20.39b	84.71b	37.81b	27.98b	39.09b	148.16b	4.68b	0.14b	1.11b	8.83b
W_2	17.29d	72.17d	32.26d	23.88d	32.14d	126.25d	3.87d	0.12c	0.95d	7.48d
W_3	18.37c	76.31c	34.06c	25.20c	35.22c	133.47c	4.22c	0.13c	1.00c	7.95c
$LSD_{(0.05)}$	0.641	2.719	1.275	0.94	1.336	4.703	0.144	0.009	0.044	0.288
Interaction										
$K_0 \times W_0$	27.35a	113.60a	50.71a	37.52a	52.43a	198.71a	6.27a	0.18a	1.49a	11.84a
$K_0 \times W_1$	22.42c	93.13c	41.57c	30.76c	42.98c	162.89c	5.14c	0.16b	1.22c	9.71c
$K_0 \times W_2$	19.70de	84.21de	37.14de	27.48de	37.74de	145.56de	4.43e	0.14c-e	1.10ef	8.67de
$K_0 \times W_3$	20.82d	86.48d	38.60d	28.56d	39.91d	151.26d	4.78d	0.14b-e	1.14de	9.01d
$K_1 \times W_0$	25.33b	105.21b	46.96b	34.75b	48.56b	184.02b	5.81b	0.18a	1.38b	10.97b
$K_1 \times W_1$	20.69d	85.96d	38.37d	28.39d	39.67d	150.35d	4.75d	0.15b-d	1.13de	8.96d
$K_1 \times W_2$	18.49f	76.81f	34.28f	25.37f	34.12g	134.01f	4.14fg	0.13e	1.01g	7.90f
$K_1 \times W_3$	19.16ef	79.58ef	35.52ef	26.28ef	36.72ef	139.19ef	4.40ef	0.13de	1.04fg	8.29ef
$K_2 \times W_0$	22.11c	91.85c	41.00c	30.34c	42.39c	160.65c	5.07c	0.15bc	1.21cd	9.57c
$K_2 \times W_1$	18.07f	75.04f	33.50f	24.79f	34.63fg	131.25f	4.14g	0.13e	0.99g	7.82f
$K_2 \times W_2$	13.68h	55.50h	25.37h	18.77h	24.58i	99.17h	3.03i	0.10f	0.75i	5.85h
$K_2 \times W_3$	15.13g	62.87g	28.06g	20.76g	29.01h	109.96g	3.47h	0.10f	0.83h	6.55g
CV (%)	4.99	3.98	5.98	5.99	5.19	3.91	5.02	4.00	4.33	4.93
$LSD_{(0.05)}$	1.10	4.709	2.209	1.643	2.314	8.146	0.2486	0.017	0.076	0.500

Figures in a column followed by different letter(s) differs significantly from each other as adjusted by LSD.

3.2.3 Jungle rice (*Echinochloa colona*)

Number and dry weight of jungle rice was significantly influenced by potassium, weeding level and their interaction (Table 5). K_0 gave the highest number and weight (43.26 and 164.60 g) and the lowest (32.65 and 125.26 g) was observed with K_2. The highest number and weight (47.79 and 181.13 g) was found from W_0 and the lowest (32.14 and 126.25 g) was observed with W_2. In interaction effect, the highest number and weight of Jungle rice (52.43 and 198.71 g) at harvest was observed in $K_0 \times W_0$ and the lowest (24.58 and 99.17 g) was observed in $K_2 \times W_2$.

3.2.4. Bermuda grass (*Cynodon dactylon*)

Different level of potassium, weeding and their interaction showed significant variations in respect of number and weight of Bermuda grass. K_0 showed the highest number and weight (26.84 and 111.50 g) and the lowest (26.84 and 111.50 g) was observed with K_2 treatment. The maximum number and weight (5.72 and 0.17 g) was recorded in W_0 and the minimum (3.87 and 0.13 g) was achieved by W_2. The highest number and weight of Bermuda grass (6.27 and 0.18 g) at harvest was observed in $K_0 \times W_0$ and the lowest (3.03 and 0.10 g) was observed in $K_2 \times W_2$.

3.2.5. Indian gooes grass (*Eleusine indica*)

The effects of different levels of potassium, weeding and their interaction have been shown significant on number and weight of Indian gooes grass at harvest (Table 5). K_0 treatment gave the highest number and weight and the lowest number and weight was observed with K_2. Result showed that the increasing number of weeding significantly decreased number and weight of Indian gooes grass. The highest number and weight of Indian gooes grass (1.49 and 11.84 g) at harvest was observed in $K_0 \times W_0$ and the lowest (0.75 and 5.85 g) at harvest was observed in $K_2 \times W_2$.

3.3. Number of dry weight of broad leaved weeds

3.3.1. Alligator weed (*Alternanthera philoxeroides*)

Different level of potassium, weeding and their interaction showed significant variations in respect of number and weight of Alligator weed (Table 6). K_0 showed the highest number and weight (12.41 and 1.20 g) and the lowest number and weight (9.45 and 0.91 g) was observed with K_2 treatment. The highest number and weight (13.65 and 1.32 g) was recorded in W_0 and the lowest number and weight was achieved by W_2 (9.53 and 0.92 g). The highest number and weight of Alligator weed (14.98 and 1.44 g) at harvest was observed in $K_0 \times W_0$ and the lowest (7.49 and 0.74 g) was observed in $K_2 \times W_2$.

3.3.2. Green amaranth (*Amaranthus viridis*)

The effects of different levels of potassium, weeding and their interaction have shown significant on number and weight of Green amaranth (Table 6). Treatment gave the highest number and weight (2.36 and 0.35 g) and the lowest number and weight (1.80 and 0.27 g) was observed with K_2. The maximum number and weight (2.60 and 0.39 g) was recorded in W_0 and the minimum number and weight (1.82 and 0.27 g) was achieved by

W_2. The highest number and weight of Green amaranth (2.85 and 0.43 g) at harvest was observed $K_0 \times W_0$ and the lowest (1.43 and 0.21 g) was observed in $K_2 \times W_2$.

3.3.3. Common purslane (*Portulaca oleracea*)

Potassium and weeding level have been shown significant on number and weight of Common purslane. K_0 treatment gave the highest number and weight (0.24 and 0.13 g) and the lowest number and weight (0.18 and 0.10 g) was observed with K_2 (Table 6). The highest number and weight (0.26 and 0.14 g) was recorded in W_3 and the lowest number and weight (0.19 and 0.11 g) was achieved by W_2. Interaction effect between different level of potassium and weeding observed non-significant effect on number and weight of common purslane at harvest (Table 6).

3.3.4. Spreading dayflower (*Cyanotis axillaris*)

Potassium and weeding level showed significant variations in respect of number and weight of Spreading dayflower. K_0 treatment showed the highest number and weight (0.18 and 12.41 g) and the lowest (0.13 and 9.38 g) was observed with K_2 treatment (Table 6). It is mentioned from the present study that the increasing number of weeding significantly decreased number and weight of Spreading dayflower. The maximum number and weight (0.19 and 13.65 g) was recorded in W_3 and the minimum number and weight (0.14 and 9.34 g) was achieved by W_2. Interaction effect between potassium and weeding level not significant effect on number and but significant effect on weight of Spreading dayflower at harvest.

Table 6: Effect of potassium level on number and dry weight of broad leaves weed in mungbean field at harvest

	Alligator weed (*Alternanthera philoxeroides*)		Green amaranth (*Amaranthus viridis*)		Common purslane (*Portulaca oleracea*)		Spreading dayflower (*Cyanotis axillaris*)	
	Number (m^{-2})	Weight (g)	Number (m^{-2})	Weight (g)	Number (m^{-2})	Weight (g)	Number (m^{-2})	Weight (g)
Potassium effect								
K_0	12.41a	1.20a	2.36a	0.35a	0.24a	0.13a	0.18a	12.41a
K_1	11.45b	1.11b	2.18b	0.32b	0.22b	0.12b	0.16b	11.37b
K_2	9.45c	0.91c	1.80c	0.27c	0.18c	0.10c	0.13c	9.38c
CV (%)	3.98	8.77	4.46	4.34	4.35	5.16	4.65	7.03
$LSD_{(0.05)}$	0.433	0.354	0.873	0.016	0.013	0.011	0.011	0.446
Weeding level effect								
W_0	13.65	1.32	2.60	0.39a	0.26a	0.14a	0.19a	13.65a
W_1	11.17	1.07	2.13	0.32b	0.21b	0.11b	0.16b	11.17b
W_2	9.53	0.92	1.82	0.27c	0.18c	0.10c	0.14c	9.34d
W_3	10.06	0.97	1.92	0.29bc	0.19c	0.11bc	0.14c	10.06c
CV (%)	3.98	8.77	4.46	4.34	4.35	5.16	4.65	7.03
$LSD_{(0.05)}$	0.381	0.313	0.071	0.044	0.012	0.009	0.008	0.408
Interaction effect								
$K_0 \times W_0$	14.98a	1.44a	2.85a	0.43a	0.28	0.15	0.21	14.98a
$K_0 \times W_1$	12.28c	1.18c	2.34c	0.35a-c	0.24	0.13	0.18	12.28c
$K_0 \times W_2$	10.97de	1.06de	2.09de	0.31b-d	0.21	0.13	0.16	10.97ef
$K_0 \times W_3$	11.40d	1.10d	2.17d	0.32bc	0.22	0.12	0.16	11.40de
$K_1 \times W_0$	13.87b	1.34b	2.64b	0.39ab	0.27	0.14	0.20	13.87b
$K_1 \times W_1$	11.33d	1.09d	2.16d	0.32bc	0.22	0.12	0.16	11.33de
$K_1 \times W_2$	10.12f	0.98fg	1.93f	0.28c-e	0.19	0.11	0.15	9.79g
$K_1 \times W_3$	10.49e	1.01ef	2.00ef	0.30cd	0.20	0.11	0.15	10.49fg
$K_2 \times W_0$	12.11c	1.17c	2.30c	0.34bc	0.23	0.12	0.17	12.11cd
$K_2 \times W_1$	9.89f	0.95g	1.89f	0.28c-e	0.19	0.10	0.14	9.89g
$K_2 \times W_2$	7.49h	0.74i	1.43h	0.21e	0.15	0.08	0.11	7.25i
$K_2 \times W_3$	8.29g	0.80h	1.58g	0.23de	0.16	0.09	0.12	8.29h
CV (%)	3.98	8.77	4.46	4.34	4.35	5.16	4.65	7.03
$LSD_{(0.05)}$	0.659	0.054	0.121	0.076	-	-	-	0.767

Figures in a column followed by different letter(s) differs significantly from each other as adjusted by LSD.

K_0= Control (No Potassium), K_1 = Recommended dose of Potassium (R), K_2 = 30% increased of Recommended dose of Potassium, W_0 = No weeding (control), W_1 = One hand weeding at 15 days after sowing (DAS), W_2 = Two hand weeding at 15 DAS and 30 DAS, W_3 = One paraxon spray at 15 DAS

4. Conclusion

In conclusion we can say that the mungbean performed better in respect of growth characters in $K_2 \times W_2$ (30% increased of recommended dose of potassium with two hand weeding at 15 DAS and 30 DAS) compare to other treatment combinations and also weed growth minimum in this treatment.

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