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Effect of nutrient and weed management on growth and yield of summer mungbean (*Vigna radiata*)

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ABSTRACT

An experiment was conducted during summer 2016 at the GBPUA&T, Pantnagar, to study the effect of nutrients and weed management on productivity and profitability of summer mungbean [*Vigna radiata* (L.) Wilczek] in *tarai* region of Uttarakhand. The experiment was laid out in split-plot design keeping nutrient management practices, viz. F_1: recommended dose of fertilizer (RDF; 18 kg N + 48 kg P_2O_5 + 24 kg K_2O/ha), F_2: half RDF + 2% urea spray at 40 days after sowing, F_3: half RDF + 2% NPK mixture (12:32:16) spray at 40 DAS, F_4: RDF + micronutrients (Zn EDTA 0.045% + boric acid 0.1% + ammonium molybdate 0.1%) spray at 20 and 40 DAS and F_5: half RDF + micronutrients (Zn EDTA 0.045% + Boric acid 0.1% + ammonium molybdate 0.1%) spray at 20 and 40 DAS in main plots, and weed management practices, viz. W_1: weedy check, W_2: imazethapyr 10% SL @ 0.075 kg/ha as post-emergence at 20 DAS, W_3: pendimethalin 30% EC @ 1 kg/ha as pre-emergence + 1 hand weeding at 30 DAS and W_4: pendimethalin 30% EC @ 1 kg/ha as PE + imazethapyr 10% SL @ 0.075 kg/ha as PoE at 20 DAS in sub plots with three replications. Significantly higher crop growth, yield attributes and grain yield (853 kg/ha) were found under F_4 treatment than others and was comparable with F_1. Similarly, highest crop growth, yield attributing characters and grain yield (1064 kg/ha) of summer mungbean was noticed with W_3 treatment.

Key words: Growth, Micronutrients, Summer Mungbean, Weeds, Yield

In India, mungbean [*Vigna radiata* (L.) Wilczek] is grown round the year in all the three distinct crop seasons, i.e. *kharif*, *rabi* and summer. In general, this crop is grown as rainfed during rainy season and on residual soil moisture in winter. In summer it can be cultivated after harvest of winter crops like, rapeseed and mustard, potato, sugarcane and wheat to utilize the 90 to 100 days left in between two main cropping seasons. The summer mungbean can only be grown under assured irrigated condition. Due to adoption of intensive cropping systems, soil faces multi-nutrients deficiencies. The potential yield in such systems is also challenged by biotic stresses like weed infestation. Balanced fertilization and effective weed management may help in realizing higher grain yield of mungbean. Basal application of recommended dose of fertilizer without keeping in account the indigenous nutrient supplying capacity of soil often remains in-sufficient to meet out the nutritional demand of the crop, especially at the later crop growth stages. Nutrient deficiency in pulses at critical growth stages can be successfully addressed through foliar application (Latha and Nadanasababady 2003). Among the micronutrients, zinc (Hafeez *et al.* 2013), boron (Ahmad *et al.* 2009) and molybdenum plays very important role in plant metabolism. In contrast a higher concentration may cause leaf injury and may damage entire plant. It is therefore, necessary to find out the optimum concentration and appropriate timing of foliar spray for increasing their efficiency. Higher weed pressure in summer mungbean severely limits its productivity. Uncontrolled weed growth on an average reduces mungbean yield by 30-50% (Kumar *et al.* 2004). Farmers often fail to follow any weed control measure which cause low yield of mungbean in the country. The timing of weeding has an important effect on the growth and yield of mungbean. Keeping this in view, the present study was undertaken in order to assess the effect of various nutrients and weed management practices on growth, yield and economics of summer mungbean.

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MATERIALS AND METHODS

The field experiment was conducted during summer 2016 in Pulses Agronomy Block of N. E. Borlaug Crop Research Centre at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The soil of the experimental site was sandy loam, high in organic carbon (0.86%) and available nitrogen (322 kg/ha), medium in phosphorus (P_2O_5) (28 kg/ha) and potassium (K_2O) (220 kg/ha), having near neutral *p*H (7.2). The experiment was conducted in split-plot design with 3 replications. The experiment comprised of 5 treatments in main plots, viz. F_1: RDF (18 kg N + 48 kg P_2O_5 + 24 kg K_2O/ha), F_2: half RDF + 2% urea spray at 40 DAS, F_3: half RDF + 2% NPK mixture (12:32:16) spray at 40 DAS, F_4: RDF + micronutrients (Zn EDTA @ 0.045% + boric acid @ 0.1% + ammonium molybdate @ 0.1%) spray at 20 and 40 DAS, and F_5: half RDF + micronutrients (Zn EDTA 0.045% + boric acid 0.1% + ammonium molybdate 0.1%) spray at 20 and 40 DAS, and 4 treatments such as W_1: Weedy check, W_2: imazethapyr 10% SL @ 0.075 kg/ha PoE at 20 DAS, W_3: pendimethalin 30% EC @ 1 kg/ha PE + HW at 30 DAS and W_4: pendimethalin 30% EC @ 1 kg/ha PE + imazethapyr 10% SL @ 0.075 kg/ha PoE at 20 DAS in sub plots. NPK mixture of 12:32:16 grade @ 150 kg/ha was applied as basal at the time of sowing. Pant Mung 5 @ 25 kg seed/ha was used for sowing and furrows were opened manually at a distance of 30 cm apart with the help of furrow opener to a depth of 6-7 cm. Hand weeding operation as per treatment, was carried out using *khurpi* at 30 DAS. The plant height (cm), number of trifoliate leaf, number of branches and dry matter accumulation/plant were recorded during the year of experiment and expressed in standard units. The weight of plant was expressed as g/m^2 and grain yield from each net plot area was recorded in kilogram and then converted into kilogram/hectare by multiplying with conversion factor based on net plot size.

RESULTS AND DISCUSSION

The data on plant height (cm) at various crop growth stages have been presented in Table 1. The plant height (cm) differed significantly due to various fertility levels and weed management practices at all growth stages. In general, plant height increased continuously with the advancement of crop age. Amongst the fertility levels the maximum plant height was recorded with the application of F_4 treatment as compared to other treatments but difference was at par with F_1at all the growth stages of crop i.e. 30, 45, 60 DAS and at harvest. The application of F_4 ensured a proper supply of macro and micronutrients and their uptake by plants resulted in higher plant height at 30, 45, 60 DAS and at harvest stage as compared to rest of the treatments. Similar results reported by Malik *et al*. (2015) that application of foliar spray of 2% urea showed maximum growth and yield parameters in mungbean.

Among different weed management practices, W_1 recorded maximum plant height at 30, 45, 60 DAS and at harvest stage which was statistically at par with W_2 and significantly higher thanW_4 and W_3. This result may be due to more crop weed competition receiving more sunlight to their survival. Among the fertility levels, maximum number of trifoliate leaves/plant was recorded with the application of F_4 over other treatment except F_1 at 30, 45 DAS and F_2 which did not influenced significantly at 45 DAS. Among the different weed management practices, the maximum number of trifoliate leaves/plant was recorded with W_3 at 30, 45, 60 DAS and harvest stages which were at par with

Table 1 Effect of nutrient and weed management practices on growth parameters of summer mungbean

Treatment	Plant height (cm)				No of trifoliate leaves/plant				No of branches /plant				Dry matter accumulation (g/plant)			
	30 DAS	45 DAS	60 DAS	Harvest	30 DAS	45 DAS	60 DAS	Harvest	30 DAS	45 DAS	60 DAS	Harvest	30 DAS	45 DAS	60 DAS	Harvest
Fertility levels (F)																
F_1	8.4	18.5	25.9	28.9	3.3	6.3	7.0	5.3	2.1	4.3	5.5	6.1	2.5	4.9	7.7	11.3
F_2	7.9	17.2	24.0	27.6	2.9	5.9	6.7	5.0	1.8	3.9	5.1	5.7	2.4	4.8	7.5	10.9
F_3	7.3	16.3	22.2	26.8	2.7	5.6	6.4	4.3	1.7	3.6	4.8	5.4	2.4	4.7	7.3	10.7
F_4	8.9	19.6	27.0	30.0	3.7	6.6	7.4	5.7	2.4	4.8	6.0	6.9	2.7	5.0	8.6	11.8
F_5	7.2	15.9	21.6	25.9	2.4	5.2	6.2	4.1	1.6	3.4	4.6	4.5	2.4	4.6	7.2	10.6
SEm±	0.2	0.5	0.5	0.7	0.2	0.2	0.3	0.3	0.1	0.3	0.1	0.3	0.02	0.06	0.20	0.20
LSD (P=0.05)	0.7	1.7	1.6	2.3	0.6	0.8	NS	1.1	0.5	NS	0.4	0.9	0.06	0.20	0.80	0.80
Weed management practices (W)																
W_1	8.7	18.8	25.8	29.5	2.3	5.0	6.0	4.0	1.5	3.2	4.5	5.2	2.4	4.6	6.5	9.3
W_2	8.1	17.8	24.3	28.0	2.8	5.7	6.5	4.6	1.8	3.8	5.0	5.7	2.4	4.7	7.7	11.0
W_3	7.3	16.1	23.0	26.4	3.6	6.9	7.4	5.7	2.4	4.6	5.8	6.1	2.6	4.9	8.6	12.7
W_4	7.7	17.2	23.4	27.2	3.2	6.3	7.0	5.2	2.1	4.3	5.4	5.9	2.5	4.8	7.9	11.2
SEm±	0.3	0.5	0.5	0.5	0.1	0.25	0.3	0.3	0.1	0.2	0.2	0.3	0.01	0.04	0.10	0.30
LSD (P=0.05)	0.9	1.4	1.6	1.5	0.5	0.72	0.9	0.8	0.4	0.6	0.7	NS	0.04	0.10	0.30	0.80

NS, non-significant; RDF, recommended dose of fertilizer; DAS, days after sowing; PoE, post-emergence; PE, pre-emergence; HW, hand weeding.

W_4 but significantly higher than remaining treatments. The lowest number of trifoliate leaves per plant was recorded in W_1 treatment which remained at par with W_2. Fertility levels significantly influenced the number of branches/plant at 30, 60 DAS and at harvest stages while weed management practices significantly influenced the number of branches/plant at 30, 45 and 60 DAS. Among the fertility levels, higher number of branches/plant was recorded with the application of F_4 which was at par with F_1 at 30 DAS and at harvest, and significantly superior over the remaining treatments in rest of the growth stages. The lowest number of branches/plant was recorded in F_5. In case of weed management practices, the maximum number of branches/plant was recorded with the application of W_3 at 30, 45 and 60 DAS as compared to other treatments but difference was non-significant with W_4. The lowest number of branches/plant was recorded in W_1 which remained at par with W_2. More number of branches under W_3 at 30 may be due to less weed density, which provided sufficient space for horizontal spread of the crop. Similar finding were also recorded by Wagner and Nadassay (2006). In general, dry matter accumulation/plant increased continuously with the advancement of crop age and reached its maximum at harvest. Fertility levels and weed management practices significantly influenced the dry matter accumulation/plant at all crop growth stages. In fertility levels, dry matter accumulation/plant was recorded significantly maximum with the application of F_4 over the other treatments except F_1 at 45 DAS and at harvest which did not influenced significantly. Among the different weed management practices, maximum dry matter accumulation/plant was recorded with W_3 which was significantly higher than other treatment in all crop growth stages. Lowest dry matter accumulation/plant was recorded in weedy check which remained at par with W_2 at 30 and 45 DAS. This was because of phototoxic effect of imazethapyr on crop plant.

Data pertaining to yield attributing characters and yield of mungbean has been given in Table 2. The result revealed that the maximum length of pod (6.6 cm), number grains/pod (6.9), 1000 grain weight (40.9 g) and yield (853 kg/ha) were recorded with F_4. With respect to grain yield, F_1 (843 kg/ha) was at par with F_4. Other yield attributing characters like number of pods/plant (10.6) and grain weight (4.2 g)/plant were non-significant with respect to different fertility levels. The yield increased because of increased plant height, number of leaves, number of branches, number of pods, grain yield/plant and also increases the number of grain/pod, 1000 grain weight in same treatments. Similarly, Patra and Bhattacharya (2009) have reported that combined application of 0.05% solution of ammonium molybdate and 0.2% solution of borax resulted in 78.4% (726.7 kg/ha) increase in seed yield compared to control treatment and also reported by Biswas *et al*. (2009) by spraying of ammonium molybdate to increase the *Rhizobium* activity and also increases the biological nitrogen fixation. Similar results were reported by Pal *et al*. (2009) who opined that phosphorus level of 35 kg/ha produced the maximum grain yield. The highest seed yield (957 kg/ha) in case of 75 kg/ha phosphorus can be attributed to more number of pod/plant and test weight as also mentioned by Jain *et al.* (2007) and Malik *et al*. (2003).

Among the weed management practices, significantly higher number of pods/plant (11.0), length of pod (6.2 cm), number of grain/pod (6.7), 1000 grain weight (39.89), grain weight/plant (4.6 g) and yield (1064 kg/ha) were noticed by spray of W_3 treatment over W_1 and remained at par with treatment of W_2 and W_4 with respect to number of

Table 2 Effect of nutrient and weed management practices on yield attributes, yield and economics in mungbean

Treatment	Pods/ plant	Pod length (cm)	Grains/ pod	1000-grain weight (g)	Grain weight (g/plant)	Grain yield (kg/ha)	Cost of cultivation (₹/ha)	Net returns (₹/ha)	B:C ratio
Fertility levels (F)									
F_1	9.9	5.9	6.1	39.1	3.9	843	25080	30973	1.23
F_2	9.7	5.6	5.9	38.2	3.8	672	24062	21146	0.87
F_3	9.3	5.3	5.6	37.8	3.7	594	24240	15585	0.64
F_4	10.6	6.6	6.9	40.9	4.2	853	28459	27391	0.96
F_5	8.9	5.1	5.5	37.0	3.5	546	26864	9961	0.37
SEm±	0.5	0.15	0.3	0.3	0.14	38	-	-	-
LSD (P=0.05)	NS	0.5	0.9	0.9	NS	127	-	-	-
Weed management practices (W)									
W_1	6.5	4.8	5.0	36.2	2.5	431	21290	8901	0.41
W_2	10.3	5.7	6.1	38.3	3.9	492	23057	10789	0.46
W_3	11.0	6.2	6.7	39.8	4.6	1064	25955	42665	1.64
W_4	10.9	6.0	6.4	39.6	4.2	821	25222	29204	1.15
SEm±	0.3	0.09	0.3	0.2	0.11	31	-	-	-
LSD (P=0.05)	0.8	0.3	0.9	0.5	0.3	91	-	-	-

NS, non-significant; RDF, recommended dose of fertilizer; DAS, days after sowing; PoE, post-emergence; PE, pre-emergence; HW, hand weeding.

pod/plant, length of pod and number of grain/pod. Similar finding have been reported by Choudhary *et al*. (2012) and Bhowmick *et al*. (2015). The minimum grain yield was obtained in weedy check due to severe-weed competition faced by the crop. Similar finding has been reported by Bhandari *et al*. (2004).

The data pertaining to cost of cultivation, net returns and B: C ratio recorded under different treatment (Table 2). Among the fertility levels, higher net return and B: C ratio was obtained with the RDF (18 kg N + 48 kg P_2O_5 + 24 kg K_2O/ha) followed by RDF + micronutrients (Zn EDTA 0.045% + boric acid 0.1% + ammonium molybdate 0.1%) spray at 20 and 40 DAS. This was because of higher grain yield resulted in higher value of net return (₹ 30973) and B:C ratio (1.23) in above treatments. The minimum value of B:C ratio was computed in case of half RDF + micronutrients (Zn EDTA 0.045% + boric acid 0.1% + ammonium molybdate 0.1%) spray at 20 and 40 DAS. Among the weed management practices, the highest net returns (₹ 42,665) and B:C ratio (1.64) was obtained with the application of pendimethalin 30% EC @ 1 kg/ha PE + HW, 30 DAS followed by pendimethalin 30% EC @ 1 kg/ha PE + imazethapyr 10% SL @ 0.075 kg/ha PoE at 20 DAS. The maximum net returns and B:C ratio in this treatment was because of higher grain and straw yield. Similar finding have been reported by Komal *et al*. (2015) and Singh *et al*. (2015).

Application of recommended dose of fertilizer (18 kg N + 48 kg P_2O_5 + 24 kg K_2O/ha) along with pre-emergence application of pendimethalin (1 kg/ha) followed by one hand weeding at 30 DAS in mungbean resulted in higher crop growth with enhanced productivity and profitability. This combination may further be recommended for better nutrient and weed management in mungbean in similar agro-climatic zones and other summer pulse crops like urdbean for higher productivity and profitability.

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