Kedir, Adv Crop Sci Tech 2023, 11:2

Advances in Crop Science and Technology
ISSN: 2329-8863

Research Article Open Access

Effect of NPS Fertilizer Rates on Growth, Yield and Yield components of *Mungbean* (*Vigna radiata L.*) variety at low land of East Shawa, Ethiopia

Usman Kedir*

Adami Tulu Agricultural research center, P.O. Box 35, Ziway/Batu, Ethiopia

Abstract

Mungbean is one of the most important pulse crops for protein supplement in subtropical zones of the world. The experiment was conducted at Adami Tulu, Lume and Dugda districts during 2020 and 2021 with the objective to determine economically beneficial and optimum NPS fertilizer rates on growth and yield of mung bean. The experiment was consisted of factorial combination of three mung bean varieties (Borda, Rasa (N-26) and Shoa Robit) and six fertilizer rates of (0, 50, 100, 150, 200 and 250 kg NPS ha-1) were laid out in factorial arrangement of randomized complete block design (RCBD) with three replications. Analysis of variance revealed that the combined main effects of days to flowering (DF), days to maturity (DM), plant height (PH), pod length (PL), number of pods per plant (NPP) were significant differences among varieties and days to maturity (DM) and number of pods per plant (NPP) were observed a significant differences among the fertilizers applications. The early DF (53.31 days) from Rasa, DM (94.51 days) from Rasa, the highest PH (40.60 cm) from Shoa Robit, PL (9.86 cm) from Rasa, NPP (24.32) from Shoa Robit were recorded among varieties as well as the early DM (94.26 days) from 100 kg NPS ha^{-1} and the highest NPP (25.12) from 250 kg NPS ha^{-1} were recorded among fertilizer applications. The results of economic analysis indicated that fertilizer applications of (50 kg NPS ha^{-1} with Borda, 50 kg NPS ha^{-1} with Shoa Robit, 150 kg NPS ha^{-1} with Borda variety) was obtained the maximum net benefit of (67454.1, 74720.7 and 117381.6 ETB ha) with marginal rate of return (524, 776 and 1497%) at Adami Tulu, Dugda and Lume respectively. Therefore, application of (50, 50 and 150 kg NPS ha^{-1}) fertilizers at time of sowing with Borda, Shoa Robit and Borda variety at Adami Tulu, Dugda and Lume respectively was recommended to the mungbean growers in the study area.

Keywords: Fertilizers; Mungbean; NPS; Variety; Yield

Introduction

Mungbean (Vigna radiata (L.) Wilczek) is one of the most important pulse crops for protein supplement in subtropical zones of the world [1]. Mungbean contains 51% carbohydrate, 24-26% protein, 4% mineral, and 3% vitamins [2]. Hence, on nutritional point of view, mungbean is considered as the best of other pulse. Besides providing protein in the diet, mungbean has the remarkable quality of helping the symbiotic root rhizobia to fix atmospheric nitrogen and hence to enrich soil fertility [3]. Mungbean is an important short-duration grain legume crop with wide adaptability, low input requirements, and the ability to improve the soil by fixing atmospheric nitrogen [4]. It is an important edible bean in the human diet worldwide. It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen [5]. Mung bean is a drought-tolerant crop that rich in mineral and its sprouts contain high amounts of vitamin C and iron [6]. The crop is characterized by fast growth under warm conditions, low water requirement and excellent soil fertility enhancement via nitrogen fixation [7]. Among pulses, mung bean is the most important cash crops in the world [8, 9]. It is a vital crop in developing countries where it is consumed as dry seeds, fresh green pods or leaves due to its high protein, vitamin and mineral content. It is also consumed as forage or green pods and seeds as vegetables [10, 11]. However, its growth, development, and yield restricted or limited by insufficient or unbalanced nitrogen (N), phosphorus (P), and Sulfur (S) fertilization. Despite this, there are few studies on NPS fertilizers levels and the optimal fertilization for improving mung bean yield and quality at the study areas. Optimal fertilization measures, however, varied with variety, planting density, and soil conditions [12, 13]. So, it is very important to evaluate different varieties of mung bean and NPS fertilizer rates across locations. Therefore the study was, initiated with the following objectives.

To determine optimum NPS fertilizer rates with variety on growth and yield of mung bean;

To identify economically feasible rates of NPS fertilizer in the study area

Materials and Method

Description of the study area

The field experiment was conducted at Adami Tulu, Dugda and Lume site from July to November of 2020 and 2021 years under rain fed conditions at each location.

Experimental material

The treatments was consisted of factorial combination of three mung bean varieties (Borda, Rasa (N-26) and Shoa Robit) and six fertilizer rates of (0, 50, 100, 150, 200 and 250 kg NPS ha^{-1}) were tested as the experimental materials. The NPS (19% N, 38% P_2O_5 and 7% S) contents from 100 kg were used as sources of fertilizers. Three mung bean varieties that adapted to the study area were used.

Soil sampling and analysis

One representative soil sample was taken at a depth of 0-30 cm from five randomly selected spots diagonally across the experimental

***Corresponding author:** Usman Kedir, Adami Tulu Agricultural research center, P.O. Box 35, Ziway/Batu, Ethiopia, E-mail: usmankedir2007@gmail.com

Received: 30-Dec-2022, Manuscript No: acst-23-85101; **Editor assigned:** 05-Jan-2023, PreQC No: acst-23-85101 (PQ); **Reviewed:** 27-Jan-2023, QC No: acst-23-85101; **Revised:** 17-Feb-2023, Manuscript No: acst-23-85101 (R); **Published:** 28-Feb-2023, DOI: 10.4172/2329-8863.1000558

Citation: Kedir U (2023) Effect of NPS Fertilizer Rates on Growth, Yield and Yield com*ponents of Mungbean* (*Vigna radiata L.*) variety at low land of East Shawa, Ethiopia. Adv Crop Sci Tech 11: 558.

field using auger before planting. The sample was analyzed for selected physico-chemical properties, namely organic carbon, texture, soil pH, cation exchange capacity (CEC), total N, available P and S.

Treatment and Experimental design

The treatments were consisted of factorial combination of three mung bean varieties (Borda, Rasa (N-26) and Shoa Robit) and six NPS fertilizer rates of (0, 50, 100, 150, 200 and 250 kg ha^{-1}) were used. The experiment was arranged in a randomized complete block design (RCBD) with three replications in factorial arrangement of 3 x 6 = 18 treatment combinations.

Experimental procedure

The study was conducted under rain fed for two consecutive years. The experimental plot was laid out in Randomized Complete Block Design (RCBD) with three replications. The plot size was 2 m x 3.0 m = 6 m^2. The spacing between rows, plants, plots and blocks was 0.30, 0.10, 0.5 and 1 m, respectively.

Data collected

Days to flowering

Number of days taken for 50% flowering from five randomly selected plants per plot was recorded by visual observation.

Days to maturity

Number of days taken from planting to physiological maturity per plot was recorded.

Plant height (cm)

The height of five randomly selected of plants in the central two of plot was measured from ground surface to apex leaf and then average was taken.

Pod length (cm)

Length of pod in cm of sampled plants was recorded from base of pod to the tip with the help of meter scale and then averaged.

Number of pods per plant

Number of pods in sampled five plants was counted. The average number were computed and expressed as number of pods per plant.

Number of seeds per pod

The number of grains in pods of observational plants was counted. The average number were computed and expressed as number of grains per pod.

Grain yield (q ha^{-1})

Weight of grains obtained after threshing, cleaning and sun drying was taken and finally recorded in quintal per hectare.

Straw yield (q ha^{-1})

After picking the pods, the remaining portion of the plant was harvested. The straw yield was calculated after the plant was completely dried. Then yield was converted into quintal per hectare.

Harvest index (%)

The harvest index was calculated as the ratio of economic yield (grain) and biological yield. Its value was expressed in percentage, using the following formula.

$$HI\ (\%) = \frac{\text{Grain Yield (q ha}^{-1})}{\text{Biological yield (q ha}^{-1})} \times 100$$

Data analysis

Data was analyzed using GenSTAT statistical software package and mean values or Least Significant Differences (LSD) was compared using the procedures of Duncan's at the 5% level of significance.

Partial budget analysis

The partial budget analysis was done based on the formula developed by CIMMYT (1988). All costs and benefits were calculated on hectare basis in Birr. The dominance analysis shows non-profitable treatments or negativity and is dominated treatment (marked as "**D**"). The net benefit (NB) and% marginal rate of return (MRR) was calculated using the formula:

NB= GFB -TVC

Where, GFB = Gross Field Benefit, TVC = Total Variable Cost

$$MRR\ (\%) = \frac{NB\ (NBb - NBa)}{TCV\ (TVCb - TVCa)} \times 100$$

Where, NBa = NB with the immediate lower TCV, NBb = NB with the next higher TCV, TVCa = the immediate lower TVC and TVCb = the next highest TCV.

Results and Discussion

Soil Physico-chemical properties of the experimental site

According to the laboratory analysis, the soil texture of the experimental area is loam across three locations of two years except Dugda in 2020 is clay loam. Mung bean is highly sensitive to water logging and weeds effects; it needs a well drained soil and good management options [14-19]. The soil fertility status of the study area was not such good and improving with recommended fertilizer rate is important. However, the low level of organic matter and Nitrogen content of the soil across locations could influence the availability of nutrients for the later season unless it could be properly amended by nitrogen fixing legumes, cover crops and by leftover of such crops (Table 1).

Days to flowering

The combined analysis of variance revealed that a significant difference ($P < 0.05$) with variety on days to flowering but not significant with NPS fertilizer rates. The early days to flowering of variety (53.31 days) was observed from Rasa (N-26) variety, while the late flowering (54.26 days) was observed from Borda variety (Table 3). The early days to flowering (53.65 days) was observed in response to 50 and 150 kg NPS ha^{-1} fertilizers applications. However, the late flowering (54.26 days) was observed from control (Table 3). This may due to the reason of NPS fertilizer enable plants to more active shoot growth and to synthesize hormones for more flower initiations [19].

Days to maturity

The combined main effect of variety and fertilizers were highly significant at ($P < 0.001$). The interaction effect of variety and fertilizers rates had also highly significant at ($P < 0.001$). The early maturity days of (94.51) was observed with Rasa (N-26) variety and the late maturity days of (95.90) observed with Borda variety. In case of fertilizer the

Table 1: Selected physico-chemical properties of the soil of the experimental site before sowing.

No	Soil characters	Values of soil samples						Source
		Adami Tulu		Dugda		Lume		
1	Soil texture ₰	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**	
	Sand (%)	48.00	38.71	32.87	47.62	36.02	46.16	
	Clay (%)	19.76	19.02	32.51	23.05	25.59	21.53	
	Silt (%)	32.24	42.27	34.61	29.33	38.39	32.30	
	Texture Class	Loam	Loam	Clay Loam	Loam	Loam	Loam	
2	pH-Water (H_2O) ₩	7.79 Mildly alkaline	8.05 Moderately alkaline	6.88 Neutral	8.64 Strongly alkaline	6.95 Neutral	8.49 Strongly alkaline	[14]
3	EC(mS/cm) ₵	0.25 Non-saline	0.75 Non-saline	0.16 Non-saline	0.26 Non-saline	0.09 Non-saline	0.12 Non-saline	[15]
4	CEC(meq/100 gm soil) ₶	31.60 high	38.94 High	31.85 high	36.36 high	33.71 high	35.86 high	[15]
5	Organic carbon (OC) (%) ₺	0.58 Low	1.66 Low	1.04 Low	1.22 Low	0.76 Low	0.69 Low	[16]
6	Total Nitrogen (N) (%) ₮	0.07 Poor	0.09 Poor	0.13 Moderate	0.07 Poor	0.04 Very Low	0.04 Very Low	[17]
7	Available phosphorus(P) (mg P_2O_5/kg soil) ₯	44.83 Very high	19.44 High	46.09 Very high	30.34 Very high	9.60 Medium	12.05 High	[18]
8	Available sulfur (S) (mg/kg soil) ₴	117.76 Very high	95.70 High	114.59 Very high	13.89 Low	21.17 Optimum	7.11 Low	[16]

Table 2: The combined means square values of ANOVA for Mung-bean varieties and fertilizers at Adami Tulu, Dugda and Lume districts tested for two years.

Source of variation	df	GY (q/ha)	DF	DM	PH	PL	NPP	NSPP	HI	ADB	SY
Rep	2	49.64ns	17.694ns	94.172ns	149.98ns	1.524ns	79.57ns	4.438ns	111.85ns	82.76ns	16.77ns
Var	2	68.91**	26.090***	53.716***	423.98***	104.553***	271.13***	6.889***	72.77ns	150.82ns	10.47ns
Locations	2	2104.44***	430.965***	315.306***	5305.66***	8.226***	193.98**	136.347***	70.11ns	10583.38***	3159.42***
Fr	5	29.43ns	4.503ns	39.954***	75.46ns	1.774ns	118.80ns	1.519ns	40.06ns	82.25ns	32.82ns
Var. Locations	4	28.97ns	1.021ns	2.619ns	65.03ns	4.409***	33.72ns	1.894ns	104.10**	54.71ns	61.38ns
Var.Fr	10	22.92ns	3.506ns	14.817***	51.36ns	1.093ns	50.63ns	1.137ns	61.80ns	120.00ns	70.51ns
Locations.Fr	10	20.96ns	0.845ns	2.438ns	16.36ns	0.559ns	10.11ns	1.002ns	42.16ns	120.79ns	63.14ns
Var.Loc.Fr	20	15.76ns	0.462ns	2.825ns	32.76ns	0.295ns	12.26ns	1.058ns	53.81ns	76.78ns	38.59ns

early maturity days (94.26) recorded with 100 kg ha^{-1} NPS fertilizer rates. The late maturity days of (96.49) observed with 250 kg ha^{-1} NPS fertilizer rates (Table 2). This may be due the combined elements of NPS fertilizer is better for growth and developments of the crop. [20] reported that application of biofertilizer with urea performed better in growth and development than single application of biofertilizer or urea.

Plant height (cm)

The combined main effect of variety were highly significant at ($P < 0.001$) difference but not with NPS fertilizer rates. The highest plant height (40.60 cm) was recorded with Shoa Robit variety. While, the lowest Plant height of (36.66 cm) was recorded from Rasa (N-26). In case of fertilizer, the highest plant height (39.89 cm) was recorded from 250 kg NPS ha^{-1} and the minimum plant height of (36.67 cm) was observed from control (Table 3). The response of NPS fertilizers uptake for mungbean on plant height vary from variety to variety. This may be due to the uptake capacity of variety for nutrient genetically limited. [21] reported that the maximum numbers of seeds pod^{-1} were recorded at the rate of 90-120 kg N-P_2O_5 ha^{-1}. [22] concluded that application of 60 kg P_2O_5 ha^{-1} significantly increased leaf area index, chlorophyll content at flower initiation and plant height, dry matter accumulation at harvest, higher number of seeds per pod, test weight, higher seed and stalk yield over other lower levels (0, 20 and 40 kg P_2O_5 ha^{-1}).

Pod length (cm)

The combined main effect of variety were highly significant at ($P < 0.001$) difference but not with NPS fertilizer rates. The highest pod length for variety (9.86 cm) was observed from Rasa (N-26) variety and the minimum pod length (7.93 cm) was observed from Borda variety (Table 3). The highest pod length of (9.01 cm) was recorded from 150 kg NPS ha^{-1} and the lowest (8.56 cm) were recorded from control. The highest pod length recorded from one variety at all locations, this may be due to the genetic makeup of variety. [23] reported that the longest (14.72 cm) pod length was recorded at 162 kg NPS ha^{-1} fertilizer rate while the shortest from the control treatments.

Number of pods per plant

The combined main effect of variety was highly significant at ($P < 0.001$) and the significant ($P < 0.05$) data was recorded for fertilizers. The highest Number of pods per plant (24.32) was recorded from Shoa Robit variety and the minimum Number of pods per plant (21.27) was recorded from Rasa (N-26) variety (Table 3). In case of fertilizer, the highest number pods per plant (25.12) recorded at 250 kg NPS ha^{-} fertilizer level while the lowest (21.04) was from control. This may be due to the early application of NPS fertilizer develop vegetative growth and produce maximum number of pods per plant. With high rate of P nutrient in the soil (Table 1) and NPS fertilizer additions soil sites are satisfied and P level increase to sufficiency for crop production. This is particular importance because of; the role of P in plant nutrition; enhancing nitrogen absorption, influencing pod and seed formation in legumes and contributing significantly in plant energy processes [24]. [25] reported that (30.80) maximum number of pods per plant. [26]

Table 3: The combined main effects of varieties and fertilizer on Mung bean tested at Adami Tulu, Dugda and Lume districts for two year.

Treatments	Parameters									
Varieties	**GY (q/ha)**	**DF**	**DM**	**PH**	**PL**	**NPP**	**NSPP**	**HI**	**ADB**	**SY**
Borda	17.85	54.26 b	95.90 b	38.29 a	7.93 a	23.56 b	10.94	41.37a	43.16	25.31
Rasa (N-26)	16.32	53.31 a	94.51 a	36.66 a	9.86 c	21.27 a	11.38	39.74a	41.13	25.12
Shoa Robit	17.46	54.02 b	95.42 b	40.60 b	8.57 b	24.32 b	10.96	40.66a	43.19	25.73
LSD (0.05)	NS	0.6***	0.7***	2.30***	0.26***	1.69***	NS	NS	NS	NS
NPS (kgha^{-1})										
0	16.39	54.26	96.01cd	36.67	8.56	21.04 a	10.89	39.81	41.18	24.78
50	17.24	53.65	94.88 ab	37.91	8.58	22.38 ab	11.23	39.94	43.46	26.23
100	17.23	53.72	94.26 a	39.52	8.79	22.34 ab	11.16	40.75	42.13	25.13
150	18.29	53.65	94.59 ab	38.96	9.01	24.37 bc	11.30	41.34	44.40	26.50
200	17.71	54.21	95.44 bc	38.15	8.89	23.03abc	11.06	41.83	42.37	24.66
250	16.41	53.70	96.49 d	39.89	8.89	25.12 c	10.92	39.86	41.41	25.00
LSD (0.05)	NS	NS	1.0***	NS	NS	2.38**	NS	NS	NS	NS
CV (%)	23.5	3.0	2.3	16.4	12.9	33.7	11.3	15.7	20.9	26.0

observed that nitrogen (20 kgha^{-1}) and phosphorus (60 kgha^{-1}) application resulted in significant differences in leaf area ratios indicating better dry matter partitioning, increased number of pods and seed yield. Maximum number of pods per plant was 26.71 obtained when potash applied at 90 kg ha^{-1} and Minimum number of pods per plant was 21.34 obtained in plots with a control [27].

Number of seeds per pod

The analysis variance reveled that the combined main effect of variety and fertilizer was not significant. The highest number of seeds pods per pod (11.38) was recorded from Rasa (N-26) variety and the lowest number of seeds pods per pod (10.94) was recorded from Borda variety (Table 3). In case of fertilizer, the highest number of seeds pods per pod (11.30) recorded at 150 kg NPS ha^{-1} fertilizer level, while the lowest (10.89) was from control. The result showed that as the amount of Phosphorus in the NPS fertilizer increases the number of seed set per pod. This may be due to early application and the optimum content of P is required for mungbean to set seeds per pod. Similar studies reports that yield, pods per plant, seeds per pod, and 100-seed weight of mung bean are significantly affected by the application of N, P, and K fertilizers [28]. P deficiency suppresses growth and lowers yield, whereas, excessive amounts of P delays maturation and seed set [29]. As the levels of P fertilizer increased, the seeds per pod sharply increased then gradually decreased [30]. [31] reported significantly higher number of pods per plant, number of seeds per pod, test weight and seed yield with 45 kg P_2O_5 ha^{-1} than all the lower levels of phosphorus. [32] reported that the application of nitrogen at the rate of 40 kg ha^{-1} produced significantly higher number of seeds per pod (10.80) than all other treatments. [25] reported that (12.48) maximum number of seeds per pod.

Above ground dry biomass (q ha^{-1})

The analysis of variance indicated that variety and fertilizers on above ground dry biomass was not significant. The highest (43.19 q ha^{-1}) from Shoa Robit variety and the lowest (32.26 q ha^{-1}) above ground dry biomass were recorded from (Rasa (N-26) variety. In case of fertilizers, the highest above ground dry biomass of (44.40 q ha^{-1}) from 150 kg NPS ha^{-1} and the lowest (41.18 kg NPS ha^{-1}) recorded from control. [33] reported that maximum (37.11 q ha^{-1}) biological yield was recorded in plots treated with 60 kg P ha^{-1} followed by 40 kg P ha^{-1} application.

Grain yield (q ha^{-1})

The combined main effect of variety and fertilizer was not significant on grain yield statistically. However, the highest grain yields of (17.85 q ha^{-1}) were recorded from Borda variety and the lowest (16.32 q ha^{-1}) were recorded from Rasa (N-26) variety. In case of fertilizer, the highest grain yield of (18.29 q ha^{-1}) was recorded from 150 kg NPS ha^{-1} fertilizer applications, while the lowest (16.39 q ha^{-1}) recorded from control (Table 3). NPS fertilizers perform a significant role in mung bean grain yield as due to the P element in NPS fertilizer has ability to nodulate legumes in low Nitrogen soils. Phosphorus element is important for nodule increase implying more nitrogen fixation then finally the main mechanisms for yield increments. It might also due to; Phosphorus has the role of structural, energy transfer and improvement of root growth and also adjusts the effect of extra nitrogen in maturity delay [34]. Nodules are strong sink for P, reaching concentrations three fold higher than in other organs [35]. It may also be due to the early application of N feed as NPS improve vegetative development and increases rhizobia activities to produce high yields. Lowering the application of N fertilizer for mung bean after the branches developed may helps rhizobia to freely fix atmospheric Nitrogen. During the early growth stages before the branches develop, mung bean cannot efficiently fix atmospheric N because it has few or no rhizobia, observed that application of 12.5 kg N ha^{-1}along with 20 kg P_2O_5 ha^{-1} produced significantly higher seed yield over control.

Straw yield (q ha^{-1})

The combined main effect of variety and fertilizer was not significant on straw yield on mung bean. The highest (25.73 q ha^{-1}) straw yield was recorded from Shoa Robit variety while the lowest (25.12 q ha^{-1}) recorded from Rasa (N-26) variety (Table 3). In case of fertilizers, The highest (26.50 q ha^{-1}) straw yield was recorded from 150 kg NPS ha^{-1}, while the lowest (24.66 q ha^{-1}) recorded from 200 kg NPS ha^{-1} followed by control (Table 3).

Harvest index (%)

The combined main effect of variety and fertilizer was not significant difference at harvest index. The highest (41.37%) harvest index recorded from Borda variety and the lowest (39.74%) was recorded from Rasa (N-26) variety. In case of fertilizer, the highest (41.83%) harvest index was recorded from 200 kg NPS ha^{-1} and the lowest (39.81%) was recorded from control (Table 3).

Partial budget analysis

The results of the partial budget analysis of the experiment showed that maximum returns over cost of the treatments. Combined mean of adjusted yields are downward by 10% less than that of the actual research results. The maximum net benefit of Ethiopian birr (ETB) 67454.1 ha^{-1}, 74720.7 ha^{-1} and 117381.6 ha^{-1} with an acceptable marginal rate of return (MRR) (>100%) of (524, 776 and 1497%) was obtained from Borda variety with 50 kg NPS ha^{-1}, Shoa Robit variety with 50 kg NPS ha^{-1} and Borda variety with 150 kg NPS ha^{-1} at Adami Tulu, Dugda and Lume respectively (Table 3). The economical NPS fertilizer rate with the same variety was highest at Lume as compered to Adami Tulu. It could be due the very low amount of (0.04%) Nitrogen content results of the soil laboratory analysis at Lume (Table1). At Adami Tulu the Shoa Robit variety with 100 kg NPS ha^{-1} gave maximum net benefit of (70924.5 ETB ha^{-1}) but with un-acceptable range of the marginal rate of return less than hundred percent of (7%). In case of Dugda, the lowest MRR (776%) from Shoa Robit variety with 50 kg NPS ha^{-1} gave with about (2453.4 ETB ha^{-1}) net benefit increment advantage than the highest MRR (985%) at Borda variety with 150 kg NPS ha^{-1} because higher yields do not necessarily mean that high net benefits (Table 3). Therefore, Borda variety with 50 kg NPS ha^{-1}, Shoa Robit variety with 50 kg NPS ha^{-1} and again Borda variety with 150 kg NPS ha^{-1} at Adami Tulu, Dugda and Lume respectively were economical and recommended for mung bean production in study area.

Conclusions and Recommendation

The influence of different fertilizer levels on the growth and productivity of three mungbean cultivars across three locations was evaluated for two years. NPS fertilizers are an essential at sowing time and play important roles on growth, development, high yield and significantly affect mung bean varieties. The 50, 50 and 150 kg NPS ha^{-1} fertilizer rates are optimum at sowing time with Borda, Shoa Robit and Borda variety gives an important growth and productivity across Adami Tulu, Dugda and Lume respectively was economically beneficial and suggested for mung bean production in study area.

References

1. Mondal M MA, Puteh AB, Malek MA, Ismail MR, Rafii MY et al. (2012) Seed yield of Mungbean (Vigna radiata (L.)Wilczek) in relation to growth and developmental aspects. The scientific world J 5: 1-7.
2. https://www.ijsrp.org/print-journal/ijsrp-jun-2019-print.pdf
3. Anjum M S, Ahmed Z I, Rauf C A (2006) Effect of Rhizobium inoculation and nitrogen fertilizer on yield and yield components of mungbean. Int J Agriculture Bio 8(2):238-240.
4. Khattak G S S, Haq MA, Ashraf M, McNeilly T (2001) Genetic basis of variation of yield, and yield components in mungbean (Vignu rudiutu (L.) Wilczek). Hereditas 134: 211-217.
5. Nadeem M Ather, Ahmad R, Ahmad MS (2004) Effect of seed inoculation and different fertilizer levels on the growth and yield of mungbean (Vigna radiata L.). J Agron 3: 40-42.
6. Keatinge JDH, Easdown WJ, Yang RY, Chada ML, Shanmegasundaram S (2011) Overcoming chronic malnutrition in future warming world: the key important of mungbean and vegetable soybean. Euphytica 180(1): 129-141.
7. Yagoob H, Yagoob M (2014) The effects of water deficit stress on protein yield of mungbean genotypes. Peak J Agricultural Sci 2(3): 30-35.
8. Somta P, Srinives P (2007) Genome research in mung bean (Vignaradiata L.) Wilczek) and black gram (V mungo L.) Hepper). Science Asia 33: 69-74.
9. Pandey A, Kumar A, Ramya P (2011) Genetic diversity in green gram accessions as revealed by STMS markers. African J of Biotech 10(75):17081-17087.
10. Tang D, Dong Y, Ren H, He C (2014) A review of photochemistry metabolite changes and medicinal uses of the common food mungbean and its' sprouts (Vignaradiata). Chem Central J 8:4.
11. Das S, Shekhar UD, Ghosh P (2014) Assessment of molecular genetic diversity in some green gram cultivars as revealed by ISSR analysis. Advances in Applied Sci Res 5(2): 93-97.
12. Guo ZX, Wang MH, Bao S, Xu N, Wang GF, et al. (2010) A preliminary research on the optimum application rate of npk for mung bean and adzuki bean. J Jilin Agri Sci 35(2): 24-26.
13. Zeng LL, Cui XH, Li QQ, Liu F, Wang C, et al. (2010) Studies on the effects of application ratios of nitrogen, phosphorus and potassium on yield of mung bean. Heilongjiang Agri Sci 7:48-51.
14. https://www.semanticscholar.org/paper/Acidic-soils-in-Kenya%3A-Constraints-and-remedial-Kanyanjua-Ireri/92b007a073e72e70ba3d53ce2c81f6a9620f3d48
15. https://www.semanticscholar.org/paper/Booker-Tropical-Soil-Manual%3A-A-Handbook-for-Soil-in-Landon/3ea6cc951c36cc55fee3efa36d69018a5ae8393d
16. https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=2935166
17. https://agris.fao.org/agris-search/search.do?recordID=QT2016105951
18. https://www.google.com/books?hl=en&lr=&id=doaM88x5agC&oi=fnd&pg=PA3&dq=18.%09Olsen,+S.+R.,+Cole,+C.+V.,+Watanabe,+F.+S.,+and+Dean,+L.+A.+1954.+Estimation+of+available+phosphorus+in+soils+by+extraction+with+sodium+bicarbonate.+Circular,+Vol+939+(p.+19).+Washington,+DC:+US+Department+of+Agriculture.++&ots=zZ0iZBmU0F&sig=rorWrB8xX_TJUQMBKe_eJt6aymc
19. http://45.113.122.54/pdfs/ijfh/v7-i1/2.pdf
20. https://pas.cseas.kyotou.ac.jp/activity/HP_SPIRITS/Brahmaputra/data/JAE_ALL/ASFBpdf/8.AFSB4(2)pdf/23.%20Mollah-1.pdf
21. https://www.researchgate.net/profile/OmidSadeghipour/publication/49584228_Production_of_Mungbean_Vigna_radiata_L_as_Affected_by_Nitrogen_and_Phosphorus_Fertilizer_Application/links/55ef4b4508aedecb68fda6c4/Production-of-Mungbean-Vigna-radiata-L-as-Affected-by-Nitrogen-and-Phosphorus-Fertilizer-Application.pdf
22. http://archive.saulibrary.edu.bd:8080/xmlui/handle/123456789/2326
23. https://www.semanticscholar.org/paper/Growth%2C-nodulation-and-yield-response-of-green-bean-Shanko-Gedebo/cc1437625cc52637a264f0bea29fd46a0e1719ab
24. Anetor MO, Akinrinde EA (2006) Differences in the liming potential of some fertilizer materials in a tropical acid alfisol. J Applied Sci 6: 1686-1691.
25. Salah Uddin Md, Ruhul Amin AKM, Jafar Ullah Md, Asaduzzman Md (2009) Interaction effect of variety and different fertilizers on the growth and yield of Summer Mungbean. American-Eurasian J of Agronomy 2 (3): 180-184.
26. https://www.semanticscholar.org/paper/EFFECT-OF-NITROGEN-AND-PHOSPHORUS-ON-GROWTH-AND-OF-Yakadri-Thatikunta/c9918c34539669cb482274c234f61ac1f2d70166
27. https://www.semanticscholar.org/paper/Growth-and-yield-response-of-mungbean-(Vigna-L.)-to-Hussain-Baloch/8d9b1e6ed806e2543de88f17a750761d93ed840b
28. Zhao CH, Kong QQ, He XY, Duan Y (2013) Mung bean field best dosage and balanced NPK fertilization technology research. J Inner Mongolia agricultural sci technology 5: 60-89.
29. https://jglobal.jst.go.jp/en/detail?JGLOBAL_ID=201602252238616307
30. https://www.semanticscholar.org/paper/Nitrogen%2C-phosphorus%2C-and-potassium-fertilization-Yin-Guo/caeca2406c8ec29e09ed6cc38b85e57785da6bf8
31. https://worldveg.tind.io/record/33290/
32. https://agris.fao.org/agris-search/search.do?recordID=PK2001001097
33. https://www.tandfonline.com/doi/full/10.1080/23311932.2016.1151982
34. https://www.researchgate.net/profile/MehdiHosseinifarahi/publication/332728137_Evaluation_the_Effects_of_Different_Levels_of_Phosphorous_on_Yield_and_Yield_Components_of_Coriander_Coriandrum_sativum_L/links/60b0a0b2a6fdcc647ee373ba/Evaluation-the-Effects-of-Different-Levels-of-Phosphorous-on-Yield-and-Yield-Components-of-Coriander-Coriandrum-sativum-L.pdf
35. https://link.springer.com/article/10.1023/A:1003512519558