Effect of Foliar Application of Nutrients and Plant Growth Regulators on Growth and Profitability of Mung Bean (*Vigna radiata* L.)

Abstract

A field experiment was conducted at experimental farm, Department of Agronomy, A field experiment was conducted at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during Rabi season of 2023-24 to effect of Nutrients and Plant Growth regulators on growth and yield of Mung bean variety "SML-832" was used in this study. The result revealed that the maximum growth parameters such as plant height (51.22 cm), dry matter accumulation (24.33 g), number of primary branches per plant (8.12), number of nodulation (35.85) and yield parameter such as number of pods per plant (17.10), number of seed per pod (9.20), grain yield (10.95 q/ha), straw yield (20.02 q/ha) and biological yield (30.97 q/ha) with application of T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation. It was concluded that the treatment T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation increases growth and yield of mung bean.

Key words: -Plant growth regulators; Mung bean; Profitability & Nodulation

1. Introduction

Pulses are commonly known as food legumes which are secondary to cereals in production and consumption in India. The World Health Organization (WHO) recommends a per capita consumption of pulses at 80 gram per day and the Indian Council of Medical Research (ICMR) has recommended a minimum consumption of 47 gram. India is the largest producer and consumer of pulses in the world accounting for 32 per cent of world area and 25 per cent of production. Mung bean (*Vigna radiata* L.) contains about 25 per cent protein, this being about two third of the protein content of soybean, twice that of wheat and thrice that of rice. The protein is comparatively rich in lysine, which is deficient in cereal grains.

India is one of the important mung bean growing countries in Asia with an area 8.7 million hectares and production of 8.83 million tonnes with a productivity of 1014 kg ha^{-1} (Anonymous., 2020). Foliar feeding is often the most effective and economical way to improve plant nutrient deficiency (Dixit and Elamathi 2007). Supplemental nutrition plays a crucial role in increasing seed yield in pulses. Foliar application of nutrients is considered to be an efficient and economic method of supplementing the nutrient requirement of the crop which in turn leads to enhanced yield. The productivity of this crop is very low because of its cultivation on marginal and sub marginal lands of low soil fertility where little attention is paying to adequate fertilization. However, yield potential of summer green gram is quite high yet at farmers' field, its yield is low. In summer green gram, a high reduction in yield has been reported to occur due to non-use of fertilizers.

Foliar feeding is often the most effective and economical way to improve plant nutrient deficiency (Dixit *et al*. 2007). Supplemental nutrition plays a crucial role in increasing seed yield in pulses (Chandrashekar and Bangarusamy, 2003). Foliar application of nutrients is considered to be an efficient and economic method of supplementing the nutrient requirement of the crop which in turn leads to enhanced yield. In addition, foliar application of nutrients was found to be more advantageous than soil application with the elimination of losses through leaching and fixation. It thus increases photosynthetic rate and nutrient translocation from the leaves to the developing seeds (Manomani and Srimathi, 2009). Foliar spray of nutrients is the fastest way to boost up crop growth. Under rainfed condition when the availability of moisture becomes scarce the application of fertilizers as foliar spray resulted in efficient absorption and usage. Though foliar spray is not a substitute to soil application but it certainly be considered as a supplement to soil application. If foliar nutrition is applied it reduces the cost of cultivation which in turn reduces the amount of fertilizer thereby reducing the loss and also economizing crop production. (Amutha *et al*. 2012).

2. Materials and Methods

A field experiment was conducted during Rabi season of 2023-24 at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.32%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in randomized block design with three replications consisting of nine treatments *viz.* The experiment was laid out in randomized block design with three replications and ten treatments *i.e.* T_1-Control, T_2- Urea @ 2% spray at flower initiation, T_3-Salicylic acid @ 75 ppm at flower initiation, T_4-N: P: K (19:19:19) @ 2% at flower initiation, T_5-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation, T_6-Boron @ 250 ppm spray at flower initiation, T_7-Nitrobenzene @ 500 ppm at flower initiation, T_8-$ZnSo_4$ @ 2% spray at flowering and pod initiation and T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation. The required quantities of fertilizers as per treatments were applied. The doses of NPK were applied in the form of urea, diammonium phosphate, murate of potash respectively. The half dose of nitrogen gives basal dose and remain two split doses after irrigation and full dose of phosphorus and potassium at basal dose.

3. Results and Discussion

3.1 Growth attributes

The data are presented regarding to plant height are presenting in Table 1.0. The data revealed that the maximum plant height at 20 DAS was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (13.88 cm). The minimum plant population at 20 DAS was recorded with T_1-Control (10.85 cm). The data revealed that the maximum plant height at 60 DAS was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (49.80 cm). The minimum plant population at 60 DAS was recorded with T_1-Control (43.52 cm). The data revealed that the maximum plant height at harvest was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (51.22 cm). The minimum plant population at harvest was recorded with T_1-Control (45.25 cm). Similar result also reported by Deshmukh *et al.* (2008), Ganapathy *et al.* (2008), Verma *et al.* (2009) and Gupta *et al.* (2010).

The data are presented regarding to dry matter accumulation are presenting in Table 2.0. The data revealed that the maximum dry matter accumulation per plant at 35 DAS was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (6.20 g). The minimum dry matter accumulation per plant at 35 DAS was recorded with T_1-Control (4.45 g). The data revealed that the maximum dry matter accumulation per plant at 50 DAS was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (13.25 g). The minimum dry matter accumulation per plant at 50 DAS was recorded with T_1-Control (9.22 g). The data revealed that the maximum dry matter accumulation per plant at harvest was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (24.33 cm). The minimum dry matter accumulation per plant at harvest was recorded with T_1-

Control (19.25 g). Similar concluded also observed by Ali and Mahmoud (2013), Doss *et al*. (2013) and Shashi *et al*. (2013).

The data are presented regarding too number of primary branches per plant and number of nodules per plant are presenting in Table 2.0. The data revealed that the maximum number of primary branches per plant was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (8.12). The minimum number of primary branches per plant was recorded with T_1-Control (6.02). The data revealed that the maximum number of nodules per plant was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (35.85). The minimum number of nodules per plant was recorded with T_1-Control (29.30). same findings also noticed by Rahman *et al.* (2014), Kumar (2015), Naidu *et al.* (2015) and Karthikeyan *et al.* (2020).

3.2 Yield attributes and yield

The data are presented regarding to yield attributes are presenting in Table 3.0. The data revealed that the maximum number of pods per plant was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (17.10). The minimum number of pods per plant was recorded with T_1-Control (13.25). The data revealed that the maximum number of seed per pod was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (9.20). The minimum number of seed per pod was recorded with T_1-Control (7.15). Similar result also confirmed by Sritharan *et al*. (2005), Chaudhary and Yadav (2011), Venkatesh *et al.* (2012) and Beg *et al*. (2013).

The data are presented regarding to yields are presenting in Table 3.0. and depicted in Figure 1.0. The data revealed that the maximum grain yield was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (10.95 q/ha). The minimum grain yield was recorded with T_1-Control (8.05 q/ha). The data revealed that the maximum straw yield was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (20.02 q/ha). The minimum straw yield was recorded with T_1-Control (15.65 q/ha). The data revealed that the maximum biological yield was obtained with T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation (30.97 q/ha). The minimum biological yield was recorded with T_1-Control (23.70 q/ha). The data also supported by Gowda *et al.* (2014), Rahman *et al.* (2014), Siva *et al.* (2017), Thakur *et al.* (2020) and Kushwah *et al.* (2023).

Conclusion

On the basis of one-year experimentation it was concluded that the treatment T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation increases growth and yield of mung bean. So, it was concluded that the treatment Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation superior among all treatments for better yield and profitability.

Table 1.0 Effect of foliar application of nutrient and plant growth regulators on plant height of mung bean

Treatments	Plant height (cm)		
	20 DAS	60 DAS	At harvest
T_1-Control	10.85	43.52	45.25
T_2- Urea @ 2% spray at flower initiation	13.12	48.08	49.58
T_3-Salicylic acid @ 75 ppm at flower initiation	12.55	45.45	46.96
T_4-N: P: K (19:19:19) @ 2% at flower initiation	12.85	45.85	47.15
T_5-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation	13.35	48.36	49.85
T_6-Boron @ 250 ppm spray at flower initiation	12.05	45.00	46.25
T_7-Nitrobenzene @ 500 ppm at flower initiation	13.02	46.25	47.63
T_8-$ZnSo_4$ @ 2% spray at flowering and pod initiation	12.32	45.15	46.45
T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation	13.88	49.80	51.22
S. Em. ±	0.25	0.59	0.88
CD at 5%	0.76	1.75	2.64

Table 2.0 Effect of foliar application of nutrient and plant growth regulators on dry matter accumulation, number of primary branches per plant and number of nodules per plant of mung bean

Treatments	Dry matter accumulation per plant (g)			Number of primary branches per plant	Number of nodules per plant at 40 DAS
	35 DAS	50 DAS	At harvest		
T_1-Control	4.45	9.22	19.25	6.02	29.30
T_2- Urea @ 2% spray at flower initiation	5.55	12.33	23.00	7.52	31.12
T_3-Salicylic acid @ 75 ppm at flower initiation	5.12	11.85	20.10	7.65	32.20
T_4-N: P: K (19:19:19) @ 2% at flower initiation	5.35	12.00	20.35	7.85	35.12
T_5-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation	5.95	12.80	23.12	7.90	33.63
T_6-Boron @ 250 ppm spray at flower initiation	5.00	11.80	19.85	7.60	33.02
T_7-Nitrobenzene @ 500 ppm at flower initiation	5.45	12.20	20.32	7.82	33.45
T_8-$ZnSo_4$ @ 2% spray at flowering and pod initiation	5.05	11.90	20.25	7.88	33.00
T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation	6.20	13.25	24.33	8.12	35.85
S. Em. ±	0.22	0.31	0.45	0.09	0.75
CD at 5%	0.66	0.92	1.35	0.27	2.24

Table 3.0 Effect of foliar application of nutrient and plant growth regulators on yield attributes and yield of mung bean

Treatments	Number of pods per plant	Number of seed per plant	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)
T_1-Control	13.25	7.15	8.05	15.65	23.70
T_2- Urea @ 2% spray at flower initiation	16.20	8.45	9.75	18.15	27.90
T_3-Salicylic acid @ 75 ppm at flower initiation	16.00	8.40	9.70	17.35	27.05
T_4-N: P: K (19:19:19) @ 2% at flower initiation	16.55	8.70	10.15	17.45	27.60
T_5-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation	16.70	8.95	10.45	19.52	29.97
T_6-Boron @ 250 ppm spray at flower initiation	15.80	8.10	9.50	17.00	26.50
T_7-Nitrobenzene @ 500 ppm at flower initiation	16.20	8.30	9.80	17.52	27.32
T_8-$ZnSo_4$ @ 2% spray at flowering and pod initiation	15.90	8.30	9.60	17.20	26.80
T_9-Urea @ 2% + Salicylic acid @ 75 ppm spray at flower initiation + Nitrobenzene @ 500 ppm at flower initiation	17.10	9.20	10.95	20.02	30.97
S. Em. ±	0.19	0.17	0.27	0.63	1.03
CD at 5%	0.57	0.50	0.82	1.89	3.08

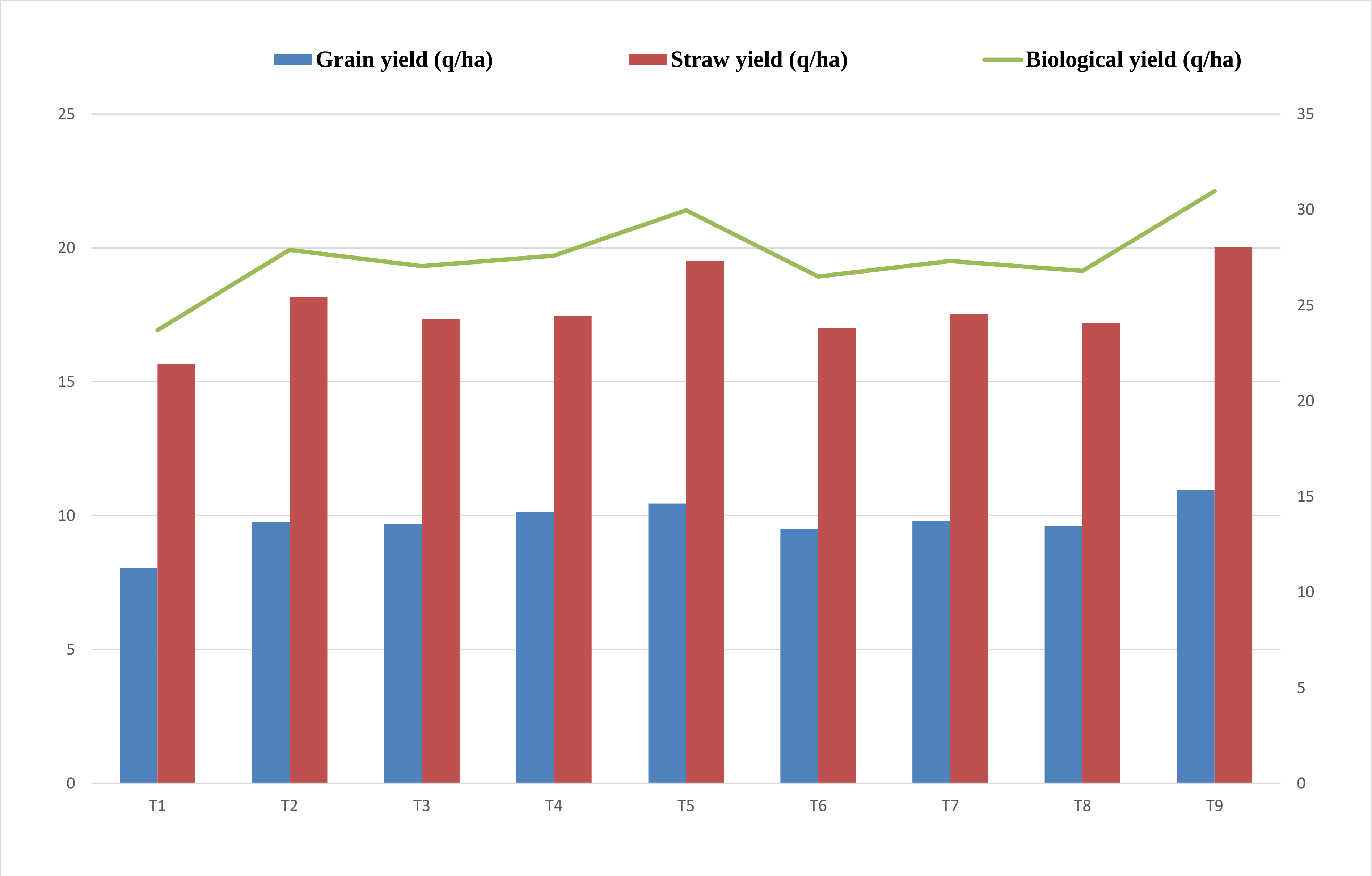

Figure 1.0 Effect of foliar application of nutrient and plant growth regulators on yields of mung bean

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