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Influence on Plant Growth Regulators and Micro Nutrients in Growth and Yield of Blackgram (*Vigna Mungo L.*)

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Abstract

A field experiment was conducted during Rabi season 2019-2020 at Krishna College of Agriculture and Technology, Affiliated to Tamil Nadu Agricultural University, Coimbatore-3, Tamilnadu, India. To study the influences on plant growth regulators and micronutrients on growth and yield of blackgram (*Vigna mungo* L.). The experiment was laid out in RBD design with four replications. Five different treatments are consisted of plant growth regulators and micro nutrients, T_1-RDF alone without any spray, T_2-RDF + NAA @ 40ppm,T_3-RDF + Gibberlic acid @ 50ppm, T_4-RDF + DAP @ 2%, T5 -RDF + Commercial micronutrient (0.5%). The results of the experiment revealed that application of RDF + DAP @ 2%, (T_4) was recorded the highest growth and yield parameters, plant height (58.33cm), no of branches plant-1(6.83), no of pod plant-1(18.50), no of seed pod-1(6.50), grain yield (916kg/ha), haulm yield(1527kg/ha) and harvest index(37.49) percentage.

Keywords: Vigna mungo; Plant growth regulators; Micronutrients, Growth and Yield.

Introduction

Blackgram (*Vigna mungo* L.) occupies an important place among the premier pulse crops in India. Blackgram is an extensively grown grain legume and belongs to Fabaceae family and got noticeable significance from the point of food and nutritional security in the world [1]. It is an N-fixing legume that improves soil fertility and soil physical properties. *Vigna mungo* is responsive to P (40kg/ha) and K (30kg/ha) and only needs rough tillage and one or two weeding's [2]. Many *Vigna mungo* cultivars exist, each one adapted to specific environmental conditions. Early maturing, disease resistant and easily cultivated cultivars have been obtained.

Pulses are the cheapest source of quality protein and they provide the protein Component for a balanced diet of the people [3]. The per capita consumption of pulses in our country is just 40g which is lower than the recommendation of the Indian Council of Medical Research (ICMR) and World Health Organization (WHO) which is 45g and 80g respectively. Thus, the requirement of pulses as per the recommendations of ICMR and WHO for billion people would be 17.15 million tonnes 56 and 29.2 million tonnes respectively [4].

Blackgram is a perfect combination of all nutrients, which include 20 to 25 % proteins, 40 to 47 % starch, ash fats, carbohydrates and essential vitamins [5]. *Vigna mungo* resembles green

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gram (*Vigna radiata* L.) with two main differences: the corolla of *Vigna mungo* is bright yellow while that of *Vigna radiata* is pale yellow; black gram pods are erect whereas they are pendulous for green gram.

It is generally found in lowlands but can grow up to 1800m above sea level provided there is neither frost nor prolonged cloudiness. Optimal growth conditions are average day temperatures ranging from 25°C to 35°C and annual rainfall of 600-1000 mm. It has poor tolerance of wet tropical climates but in high rainfall areas it can be grown during the dry period on residual moisture. It grows better on rich black vertisols or loamy soils, well-drained soils with a pH 6-7 [2].

The main producer of blackgram is India, which produces about 1.5 million t of seeds annually [6].

India consumes its entire production. The other main producers (Myanmar and Thailand) are the major exporters. Plant growth regulators are chemicals, which provide optimum vegetative growth and increased source partitioning in the reproductive organs so that the yield is sufficiently increased by regulating plant growth and architecture [7]. *Vigna mungo* seeds are mainly a staple food and the dehulled and split seeds (*dhal* in Hindi) are a common dish in South Asia. They can be ground into flour and used for making papadum, typical Indian flat bread. The seeds are normally too expensive to be used as a feed, even in areas of primary production.

Materials and methods

Field experiment was conducted during 2019-2020 at Krishna College of Agriculture and Technology, usilampatti. The experimental field was red loamy soil with pH 6.5, available nitrogen (231kg ha^{-1}), available phosphorus (16kg ha^{-1}) and available potassium (293kg ha^{-1}). The experimental farm located at 9° 58' N latitude, 77° 48' E longitudes at an altitude of 218m above mean sea level. The experiment was laid out in RBD design with four replications. The data obtained on various parameters were tabulated and subjected to statistical analysis by the method suggested by Snedecor and Cochran [8]. The influence of treatment was tested with F‟ test wherever" F‟ test shown their significance. The levels of treatment were compared by critical difference at 5% level of probability. Five different treatments consisted of foliar nutrition and growth regulators *viz*, T_1-RDF alone without any spray, T_2-RDF + NAA @ 40ppm, T_3-RDF + Gibberlic acid @ 50ppm, T_4-RDF + DAP @ 2%, T_5-RDF + Commercial micronutrient (0.5%). The sowing of VPN 8 Black gram variety was done at 30 x 10 cm spacing. The recommended dose of 25kg N, 50kg P_2O_5 and 25kg K_2O was applied along with Farmyard Manure (FYM) at12.5tha^{-1}. The whole quantity of P_2O_5, FYM and half dose of nitrogen and potassium were applied at the time of field preparation. Remaining half dose of N and K_2O was applied at 25 and 45 DAS. The foliar nutrients and growth regulators were sprayed by using knapsack sprayer fitted with flood jet nozzle as per the treatments. Observations recorded on plant height (cm), no of branches plant^{-1}, no of pod plant^{-1}, no of seed pod^{-1}, grain yield, haulm yield and harvest index were recorded. Marimuthu and Surendran [9]. Found that more number of pods plant^{-1} was recorded in blackgram when 2 per cent DAP was sprayed along with soil application of potassium. Anandhi and Ramanujam [10] conducted the field experiments and the results revealed that the foliar spray of 1% Urea or 2% DAP at 35 and 55 DAS can be recommended to increase the productivity of black gram.

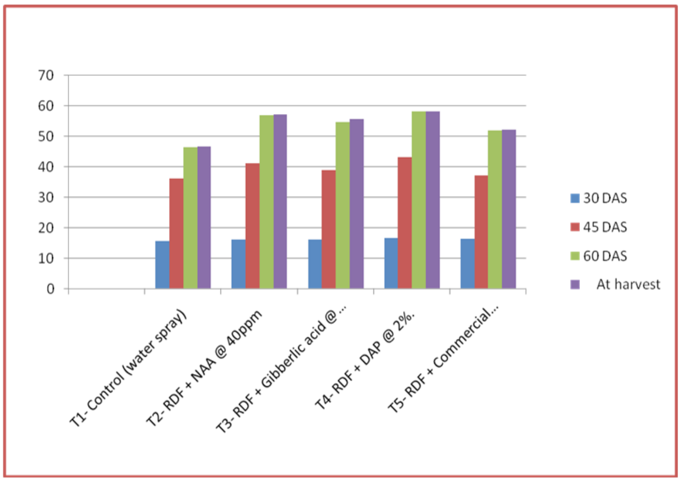

Figure 1: Effect of different treatments on Plant heights (cm) per plant.

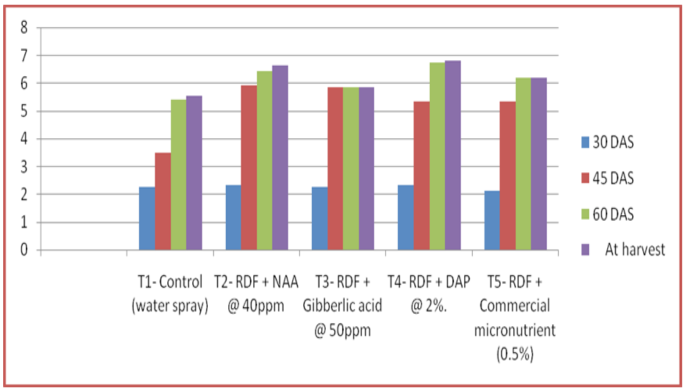

Figure 2: Effect of different treatments on no of branches per plant.

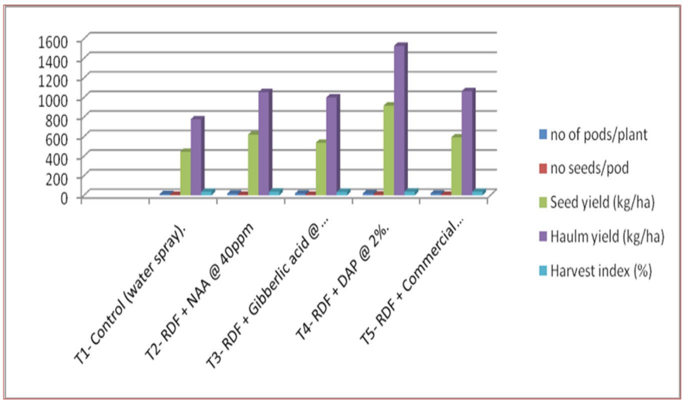

Figure 3: Effect of different treatments on yield attributes, pods plant-1, seeds pod-1, seed & haulm yield (kg ha-1) and harvest index percentage.

Table 1: Effect of different treatments on Plant heights (cm) per plant.

Treatments	Plant height (cm)				Branches plant^{-1}			
	30 DAS	45 DAS	60 DAS	At harvest	30 DAS	45 DAS	60 DAS	At harvest
T_1-Control (water spray)	15.83	36.17	46.50	46.67	2.27	3.50	5.40	5.53
T_2-RDF + NAA @ 40ppm	16.23	41.17	57.00	57.17	2.33	5.93	6.43	6.63
T_3-RDF + Gibberlic acid @ 50ppm	16.30	39.00	54.83	55.67	2.27	5.83	5.83	5.83
T_4-RDF + DAP @ 2%.	16.73	43.17	58.33	58.33	2.33	5.33	6.73	6.80
T_5-RDF + Commercial micronutrient (0.5%)	16.50	37.17	52.00	52.17	2.13	5.33	6.20	6.20
S.Ed	0.61	0.63	0.84	0.71	0.144	0.224	0.075	0.083
C.D at 5%	1.34	1.90	2.52	2.13	0.36	0.67	0.23	0.25

Table 2: Effect of different treatments on yield attributes, pods plant-1, seeds pod-1, seed & haulm yield (kg ha-1) and harvest index percentage.

Treatments	Yield attributing characters				
	No of pods /plant	No of Seeds /pod	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
T_1-Control (water spray).	11.17	5.60	444.0	777.0	36.36
T_2-RDF + NAA @ 40ppm	17.83	6.23	620.0	1055.0	37.00
T_3-RDF + Gibberlic acid @ 50ppm.	17.67	5.97	537	999.0	34.96
T_4-RDF + DAP @ 2%.	18.50	6.50	916.0	1527.0	37.49
T_5-RDF + Commercial micronutrient (0.5%).	17.83	6.17	592.0	1064.0	35.74
S.Ed	0.235	0.22	41.0	83.0	0.24
C.D at 5%	0.7	0.65	83.0	166.0	0.49

Results & discussion

Effect of growth attributes

Plant height is an important character of the vegetative phase and indirectly influences the yield components (Table 1). Plant height as a measure of crop growth was recorded at successive stages of crop growth and no of branches i.e. 30, 45, 60 DAS and at harvest. The analyzed data is presented in Table1. Foliar application of nutrients influenced plant height of blackgram significantly over control. All the treatments were significantly superior to untreated control. Nitrogen has been widely accepted as dominant growth promoter. The significant increase of plant height was due to the internodes elongation and the vigorous root growth. The highest plant height was recorded at harvest (58.33cm) in respect of foliar application of T_4-RDF + DAP @ 2%. This result was in close conformity with the findings of Brunes et al. [11]. In soybean and also similar results were reported by Jadhav and Bhamburdekar [12], in groundnut cultivars.

The highest no of branches was recorded at harvest (6.83) in respect of T_4 -RDF + DAP @ 2%. The increase in branches per plant due to the twice application of DAP, which helped in acceleration of various metabolic process *viz*. photosynthesis, energy transfer reaction and symbiotic biological N- fixation process. The results are conformity with the branches per plant of combination of DAP, Brassinolide combined with micronutrient might have favored better translocation of assimilates to sink resulted in improvement in growth and yield parameters. Foliar application of BR and SA might have enhanced the CO_2 fixation, induced activity of carbohydrate synthesizing enzymes coupled with effective partitioning of dry matters into reproductive sink as reported earlier [13].

Effect of yield attributes

The number of pods per plant was recorded from randomly selected five plants of each plot just before the harvesting. The analyzed data is presented in Table 2. The pods were picked up from randomly selected five plants of each plot, threshed carefully by hand and counted the average number of seeds per pod. The recorded highest Number of pods plant^{-1} (18.50) seeds pod^{-1}(6.50), seed yield and haulm yield (916.00 and 1527.00 kg/ha) in respect of Foliar spray of T_4-RDF + DAP @ 2% twice at flowering and pod formation stages. This might be due to beneficial effect of nutrients in combination with growth regulators applied at proper time and stage, which resulted in higher yield as reported by Kumaran and Subramanian [14]. Followed by T_2-RDF + NAA @ 40ppm recorded of Number of pods plant^{-1} (17.83) seeds pod^{-1}(6.23), seed yield and haulm yield (620.00 and 1055.00 kg/ha) respectively. This might be due to better absorption of nutrients applied through foliage leading to better activity of functional root nodules resulting in more uptakes of nutrients. Marimuthu and Surendran [9]. Conformity with effects of growth regulators on grain yield and haulm yield of black gram were significantly improved by the application of nutrients and plant growth regulators.

Harvest index

The analysis of variance for harvest index reveals that the effect of foliar application of nutrients on harvest index was found significant. The maximum harvest index was recorded (37.49%) with the foliar application of T_4-RDF + DAP @ 2% twice at flower initiation and pod formation.

Conclusion

From this study, it is concluded that different treatments has positive effect on yield, and growth of black gram. Application of DAP 2% spray at flowering and 15 days later recorded highest grain yield (916kg/ha), while application of DAP 2 % spray at flowering and 15 days later recorded highest straw yield (1527kg/ha) and harvest index (37.49%). The minimum seed yield (444kg/ha) was recorded in control treatment (T_1).

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