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Studies on Integrated Nutrient Management on Growth of Blackgram (*Vigna mungo* L.) in Chhattisgarh Plain

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A B S T R A C T

A field experiment was conducted at Instructional Farm, BTC College of Agriculture and Research Station, Bilaspur (C.G.). During the *Kharif* season of the year 2021 with a view to study the "Studies on integrated nutrient management on growth of black gram (*Vigna mungo L.*) in Chhattisgarh plain". The Black gram variety Indira Urad Pratham used to grown and treatment was replicated three times in Randomized block design. The soil of experimental site was alfisol belonging to textural clay loam. The investigation there were the uniform dose of 20 kg N_2, 40 kg P_2O_5 and 20 kg K_2O were applied through Urea, SSP and MOP, respectively in black gram in seven treatments *viz*., T_1: - 20:40:20 RDF, T_2: -125% RDF, T_3:- 150% RDF, T_4:- RDF + FYM@5t ha^{-1}, T_5:- 125% of RDF + FYM@5t ha^{-1}, T_6:- 150% of RDF + FYM@5t ha^{-1} and T_7: - Control. The Growth parameters *i.e.*, Initial (at 25 DAS) and final plant population (m^2) at harvest, Plant height in cm at 20, 40, 60 DAS and at harvest, Functional leaf $plant^{-1}$ at 20, 40, 60 DAS and at harvest, Number of primary branches $plant^{-1}$ at 20, 40, 60 DAS and at harvest, Root nodule $plant^{-1}$ at 40 and 60 DAS, Root nodule Weight $plant^{-1}$ at 40 and 60 DAS and Crop Growth Rate (CGR) at 0-20, 20-40, 40-60, 60 DAS – at harvest were significantly superior in the treatment T_6(150%ofRDF+FYM@5tha^{-1}). On the basis of above findings, treatment T_6(150% of RDF+FYM@5tha^{-1}) stand could be better performance first in position and T_5(125% of RDF + FYM@5t ha^{-1}) stand in second order of preference. However, treatment T_3(150% RDF) comes in next in order. Therefore, it may be concluded that treatment T_6(150%ofRDF+FYM@5tha^{-1}) may be prefer for higher growth in blackgram.

Introduction

Blackgram [*Vigna mungo* (L.) Hepper], is one of the most important pulse crops among the various grain legumes. According to Vavilov (1951) it is native to India, belongs to the family Leguminaceae. It is consumed in the form of 'dal' (whole or split, husked and un-husked) or perched. It is used as nutritive fodder especially for milch animals. It fits well in various multiple cropping and intercropping systems. After picking of pods, black gram plants may be used as green fodder for livestock or green manuring to increase fertility of soil. Besides these, the black gram crop also enriches soil by fixing the atmospheric nitrogen. Blackgram is spread in Indian subcontinent and popularly known as "Urad dal". It is cultivated in Bangladesh, Afghanistan, Myanmar and Pakistan. Most suitable climate for blackgram is 27- 30 ^{0}C, moderate rainfall and loamy soil with high water holding capability. Blackgram is third most important pulse crop grown under rain fed, rice fallow, irrigated conditions and during *kharif*, *rabi* and summer seasons, which matures in 90-100 days and it, enriches soil with nitrogen. India is major producer and consumer of blackgram (Raju, 2019). It is used for preparation of different food preparations like *Idli*, *Dosa* and non-fermented foods (Sivasubramanian *et al.*, 2015), Black gram is a self-pollinated leguminous crop which is grown during *kharif* as well as summer in seasons in arid and semi-arid regions of India. It is tolerant to drought and can be grown successfully on all types of soils. (Krishnaprabhu *et al.*, 2018).

Black gram is the most important legume crop and India alone produce more than two- third of the world's production (Saini and Jaiwal, 2002) as food, feed and industrial raw material and ranks as the third important pulse crop in India (Selvakumar *et al.*, 2012). Total black gram production was 3280 thousand tonnes; of which percentage share in 13.48% during 2017-18 (Anonymous, 2018). The total blackgram production in India was 2.89 million tonnes from an area of 3.56 million hectare (Ministry of Agriculture and Farmer's welfare annual report 2016-17). In Chhattisgarh during 2019-2020 total area has 134.13 thousand hectare and productivity of 371 kgha^{-1}. In Madhya Pradesh, total area was 9.32 lakh hectares with total production of 515 million tonnes and productivity of 553 kg ha^{-1}.

Materials and Methods

The field experiment was conducted at Instructional farm, Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (Chhattisgarh) university of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *Kharif* season 2021. The Research Farm is situated at 22.09˚N latitude, 82.15˚E longitude and at an altitude of 292.3 m above mean sea level. The region falls under the Eastern plateau and hill region (Agro-climatic zone-VII) of India. Chhattisgarh state is classified into three agro-climatic zones, in which Bilaspur falls under the Chhattisgarh plains zone of the state. The experimental field was well drained with uniform topography. The soil of experimental site was alfisol belonging to textural clay loam.

The full dose of fertilizers was applied according to the treatments by manually in previously open furrows before sowing the seeds. The uniform dose of 20 kg N_2, 40 kg P_2O_5 and 20 kg K_2O were applied through Urea, SSP and MOP, respectively in all the treatments. These were drilled by hand in the open furrows during sowing of seed in all the treatments. FYM dose was applied as per the treatment. Five plants of each plot were randomly selected and tagged for recording the observations at different stages of growth. The observations on growth parameters were recorded at an interval of 20, 40, 60 DAS and at harvest.

Results and Discussion

Data pertaining to growth of blackgram attributes influenced by various treatments has been given in table 1.1, 1.2, 1.3 & 1.4 and fig 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7.

Initial (at 25 DAS) and final plant population (m^{-2}) at harvest, clearly shows that, non-significant effect of highest initial (at 25 DAS) plant population (m^{-2}) (32.00) was noted in treatment T_6(150% of RDF + FYM@5t ha^{-1}). And lowest initial (at 25 DAS) plant population (m^{-2}) (28.00) was noted in treatment T_7(Control). The highest final plant population (m^{-2}) at harvest (31.00) was noted in treatment T_6(150% of RDF+FYM@5tha^{-1}). And lowest final plant population (m^{-2}) at harvest (25.00) was noted in treatment T_7(Control).

The plant height at 20 days after sowing, was noted significant highest (12.00 cm) in treatment

T_6(150%of RDF+FYM@5tha^{-1}), while significant lowest plant height in cm (7.00) was noted in treatment T_7 (Control). At 40 days after sowing, significant highest plant height in cm (20.00) was noted in treatment T_6(150% of RDF+FYM@5tha^{-1}), Significant lowest plant height in cm (11.00) was noted in treatment T_7 (Control). At 60 days after sowing, significant highest plant height in cm (35.00) was noted in treatment T_6(150% of RDF+FYM@5tha^{-1}, Significant lowest plant height in cm (25.00) was noted in treatment T_7 (Control). At harvest significant highest plant height in cm (46.00) was noted in treatment T_6(150% of RDF + FYM@5t ha^{-1}), while significant lowest plant height in cm (30.17) was noted in treatment T_7(Control). The results obtained in the present study are supported by the works of Meena and Ram (2016) studied the effect of integrated nutrient management on productivity of blackgram and revealed that application 17.2 kg P ha^{-1} along with PSB and 5t FYM ha^{-1} has recorded significantly higher plant height (44.5 cm) over control (30.2cm).

Functional leaf plant^{-1} at 20 days after sowing, significant highest (10.00) was noted in treatment T_6 (150% of RDF+FYM@5tha^{-1}), Significant lowest functional leaf plant^{-1} (7.00) was noted in treatment T_7 (Control). At 40 days after sowing, significant highest functional leaf plant^{-1} (12.00) was noted in treatment T_6 (150% of RDF+FYM@5tha^{-1}), Significant lowest functional leaf plant^{-1} (8.00) was noted in treatment T_7 (Control).

At 60 days after sowing, significant highest functional leaf plant^{-1} (26.00) was noted in treatment T_6(150% of RDF+FYM@5tha^{-1}), Significant lowest functional leaf plant^{-1} (20.00) was noted in treatment T_7 (Control).

At harvest significant highest functional leaf plant^{-1} (22.00) was noted in treatment T_6 (150% of RDF+ FYM@5tha^{-1}), while significant lowest functional leaf plant^{-1} (16.00) was noted in treatment T_7 (Control). Also similar results were reported by Rathore *et al.,* (2010); Tiwari *et al.,* (2011) and Mir *et al.,* (2012).

Number of primary branches plant^{-1} at 20 days after sowing, was noted significant highest (2.90) in treatment T_6(150% of RDF + FYM@5t ha^{-1}), Significant lowest number of primary branches plant^{-1}(1.40) was noted in treatment T_7(Control).

At 40 days after sowing, significant highest number of primary branches plant^{-1}(3.60) was noted in treatment T_6(150% of RDF + FYM@5t ha^{-1}), Significant lowest number of primary branches plant^{-1}(2.50) was noted in treatment T_7(Control).

At 60 days after sowing, significant highest number of primary branches plant^{-1}(5.60) was noted in treatment T_6(150% of RDF + FYM@5t ha^{-1}), Significant lowest number of primary branches plant^{-1}(4.10) was noted in treatment T_7(Control). At harvest significant highest number of primary branches plant^{-1} (9.00) was noted in treatment T_6(150% of RDF+FYM@5tha^{-1}), while significant lowest number of primary branches plant^{-1} (6.00) was noted in treatment T_7(Control). The result obtained in the present study is in accordance with the results of Shashikumar *et al.,* (2013); Kumawat *et al.,* (2013) and Masu *et al.,* (2019).

Root nodule plant^{-1}, clearly show that, at 40 DAS significant highest root nodule plant^{-1} (18.00) was noted in treatment T_6 (150%ofRDF+FYM@5tha^{-1}), while significant lowest root nodule plant^{-1} (8.00) was noted in treatment T_7 (Control). At 60 days after sowing, significant highest root nodule plant^{-1} (25.00) was noted in treatment T_6 (150% of RDF+FYM@5tha^{-1}), while significant lowest root nodule plant^{-1} (13.00) was noted in treatment T_7 (Control). The results obtained in the present study are supported by the works of Ghanshyam *et al.,* (2010) and Rajkhowa *et al.,* (2003).

Root nodule weight plant^{-1} (mg), clearly show that, at 40 DAS significant highest root nodule weight plant^{-1} (39.00) was noted in treatment T_6 (150% of RDF + FYM@5t ha^{-1}), while significant lowest root nodule weight plant^{-1} (mg) (17.00) was noted in treatment T_7(Control).

Table.1 Effect of integrated nutrient management on Initial and final plant population (m^{-2}) and Plant height in cm.

Tr. No.	Treatment details	Initial (at 25 DAS) and final plant population (m^{-2}) at harvest		Plant height in cm			
		Initial	Final	20 DAS	40 DAS	60 DAS	At harvest
T1	20:40:20 RDF	30.00	28.00	9.00	15.00	29.00	35.02
T2	125%RDF	30.30	28.90	9.47	16.00	30.50	37.00
T3	150% RDF	31.10	30.10	11.00	18.00	33.00	42.07
T4	RDF + FYM@5t ha^{-1}	30.80	29.60	10.30	17.00	32.30	40.00
T5	125% of RDF + FYM@5t ha^{-1}	31.60	30.60	11.50	19.00	34.00	44.10
T6	150% of RDF + FYM@5t ha^{-1}	32.00	31.00	12.00	20.00	35.00	46.00
T7	Control	28.00	25.00	7.00	11.00	25.00	30.17
	SEm (±)	**0.67**	**1.18**	**0.93**	**1.41**	**1.89**	**2.93**
	CD (P=0.05)	**NS**	**NS**	**2.87**	**4.34**	**5.82**	**9.03**
	CV (%)	**3.81**	**7.05**	**16.05**	**14.70**	**10.47**	**12.96**

Table.2 Effect of integrated nutrient management on Functional leaf $plant^{-1}$ and Number of primary branches $plant^{-1}$

Tr. No.	Treatment details	Functional leaf $plant^{-1}$				Number of primary branches $plant^{-1}$			
		20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40 DAS	60 DAS	At harvest
T1	20:40:20 RDF	8.00	10.00	23.00	19.00	1.90	2.80	4.60	7.00
T2	125%RDF	8.70	10.50	23.50	20.00	2.05	2.95	4.80	7.40
T3	150% RDF	9.30	11.30	25.00	21.00	2.60	3.30	5.20	8.20
T4	RDF + FYM@5t ha^{-1}	9.00	11.00	24.00	20.50	2.40	3.10	5.00	7.80
T5	125% of RDF + FYM@5t ha^{-1}	9.60	11.60	25.50	21.50	2.80	3.50	5.40	8.75
T6	150% of RDF + FYM@5t ha^{-1}	10.00	12.00	26.00	22.00	2.90	3.60	5.60	9.00
T7	Control	7.00	8.00	20.00	16.00	1.40	2.50	4.10	6.00
	SEm (±)	**0.55**	**0.74**	**1.09**	**1.10**	**0.22**	**0.17**	**0.25**	**0.58**
	CD (P=0.05)	**1.71**	**2.28**	**3.37**	**3.41**	**0.68**	**0.55**	**0.77**	**1.79**
	CV (%)	**10.90**	**12.06**	**7.95**	**9.57**	**16.61**	**9.92**	**8.73**	**12.98**

Table.3 Effect of integrated nutrient management on root nodule plant^{-1}at 40 and 60 DAS

Tr. No.	Treatment details	Root nodule plant^{-1} at 40 and 60 DAS		Root nodule weight plant^{-1} (mg) at 40 and 60 DAS	
		40 DAS	**60 DAS**	**40 DAS**	**60 DAS**
T1	20:40:20 RDF	12.00	18.00	27.00	35.00
T2	125%RDF	14.00	20.00	29.00	40.00
T3	150% RDF	16.00	23.00	33.00	52.00
T4	RDF + FYM@5t ha^{-1}	15.00	22.00	31.00	46.00
T5	125% of RDF + FYM@5t ha^{-1}	17.00	24.00	36.00	59.00
T6	150% of RDF + FYM@5t ha^{-1}	18.00	25.00	39.00	62.00
T7	Control	8.00	13.00	17.00	23.00
	SEm (±)	**1.00**	**1.56**	**2.22**	**2.96**
	CD (P=0.05)	**3.08**	**4.83**	**6.84**	**9.12**
	CV (%)	**12.12**	**13.09**	**12.70**	**11.33**

Table.4 Effect of integrated nutrient management on Crop Growth Rate (CGR) (g day^{-1} plant^{-1}) at 0-20, 20-40, 40-60, 60 DAS - at harvest

Tr. No.	Treatment details	Crop Growth Rate (CGR)(g day^{-1} plant^{-1})			
		0-20	**20-40**	**40-60**	**60-at harvest**
T1	20:40:20 RDF	5.00	9.00	15.00	**5.50**
T2	125%RDF	5.30	11.00	15.50	**6.00**
T3	150% RDF	6.00	13.00	17.00	**7.00**
T4	RDF + FYM@5t ha^{-1}	5.60	12.00	16.00	**6.50**
T5	125% of RDF + FYM@5t ha^{-1}	6.25	14.00	17.50	**7.50**
T6	150% of RDF + FYM@5t ha^{-1}	6.50	15.00	18.00	**8.00**
T7	Control	4.30	3.00	10.00	**2.00**

Fig.1 Initial (at 25 DAS) and final plant Population (m^{-2}) at harvest

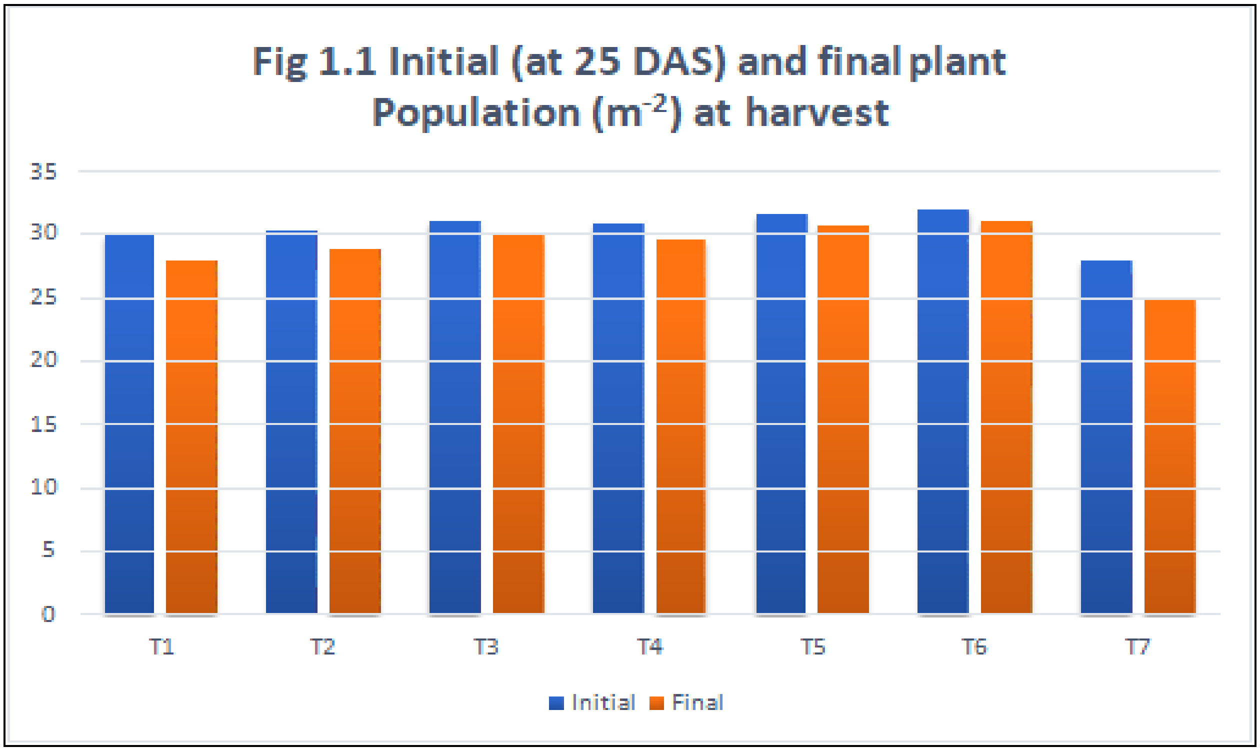


Fig.2 Plant height in cm at 20, 40, 60 DAS and at harvest

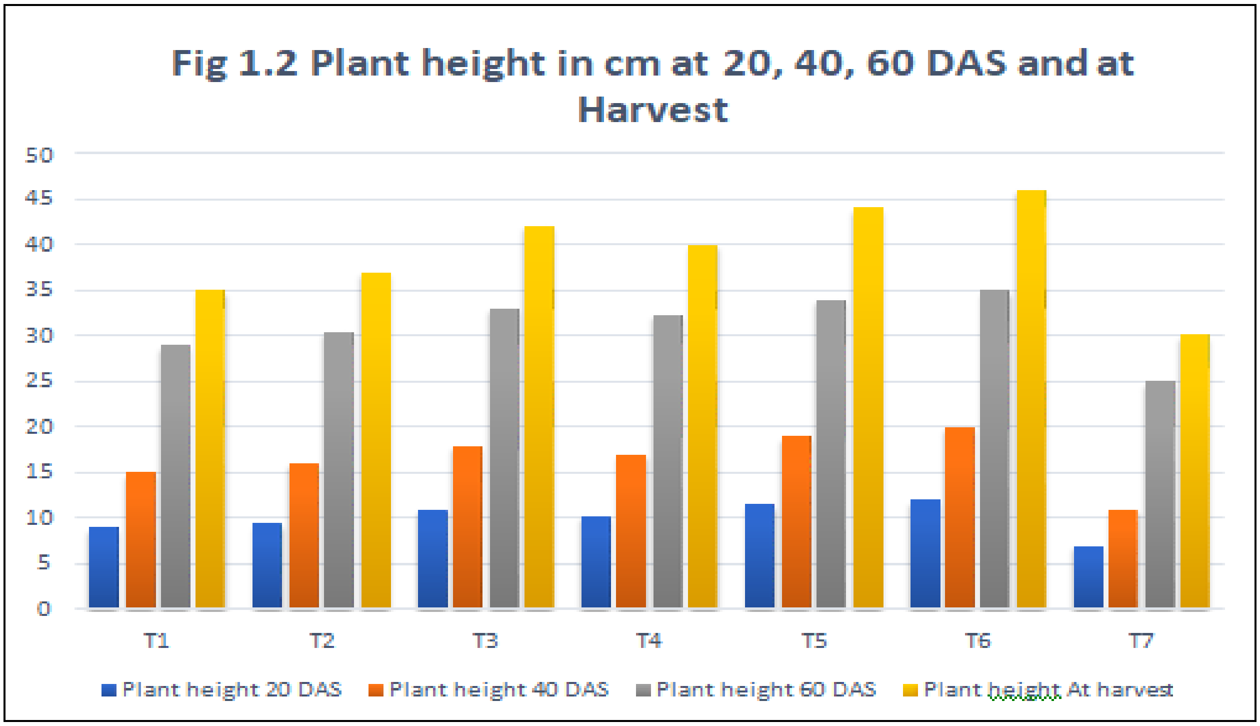


Fig.3 Functional leaf plant^{-1}

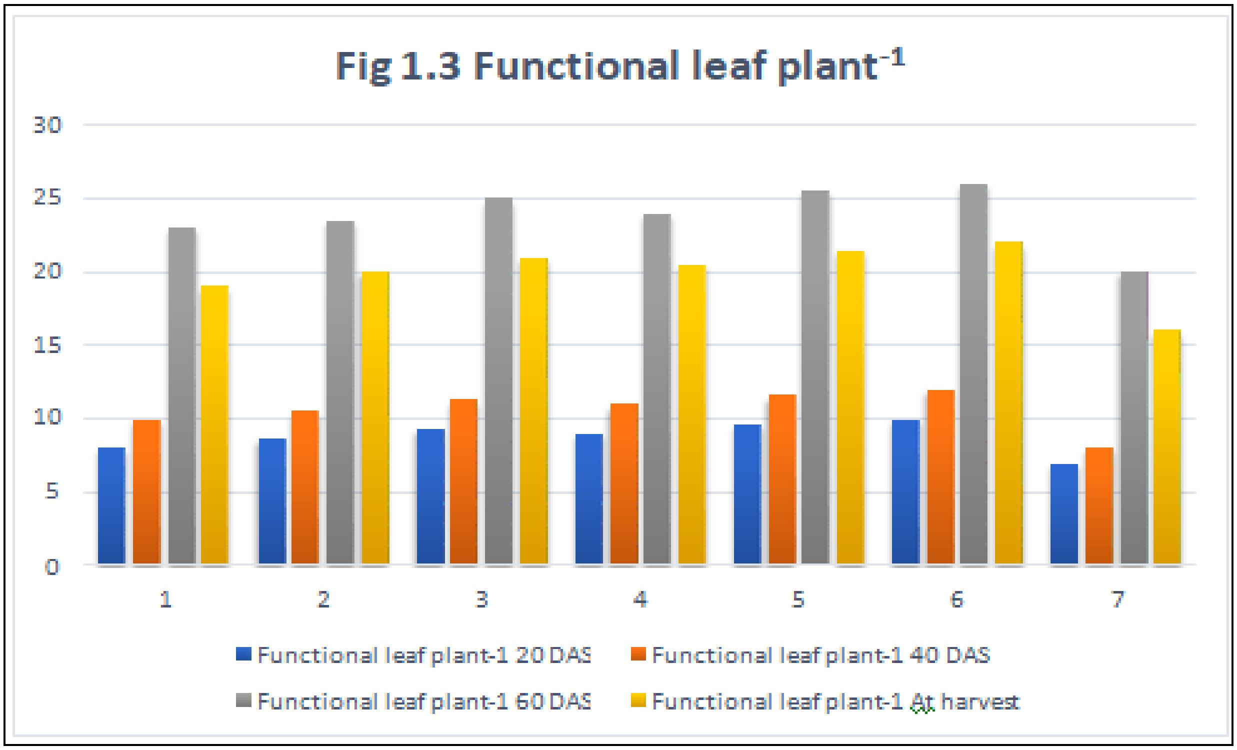


Fig.4 Number of primary branches plant^{-1}

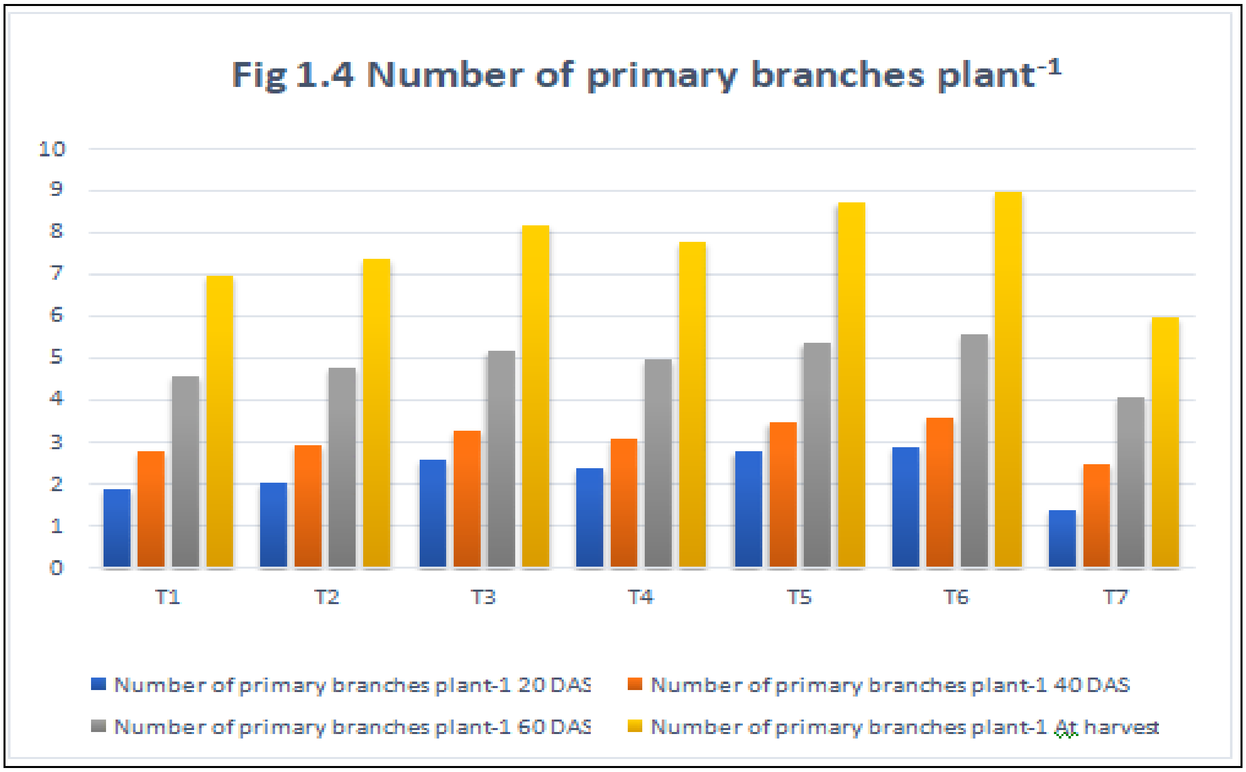


Fig.5 Root nodule plant^{-1} at 40 and 60 DAS

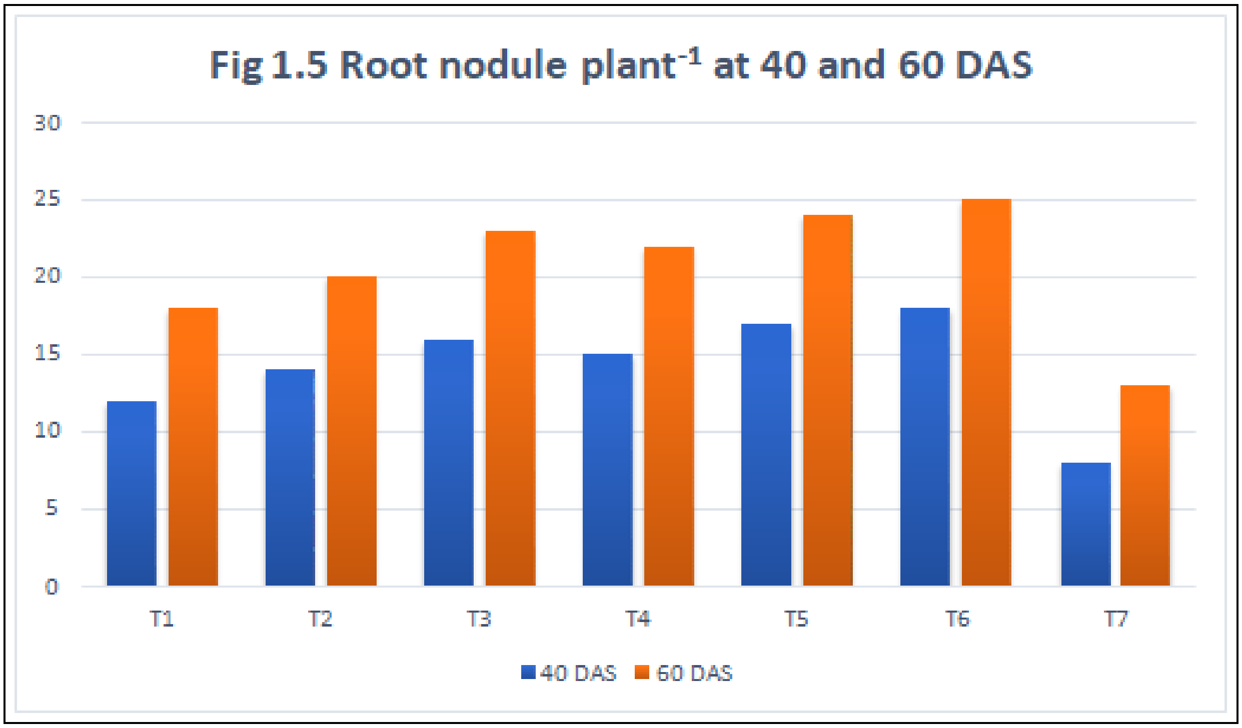


Fig.6 Root nodule weight plant^{-1} (mg) at 40 and 60 DAS

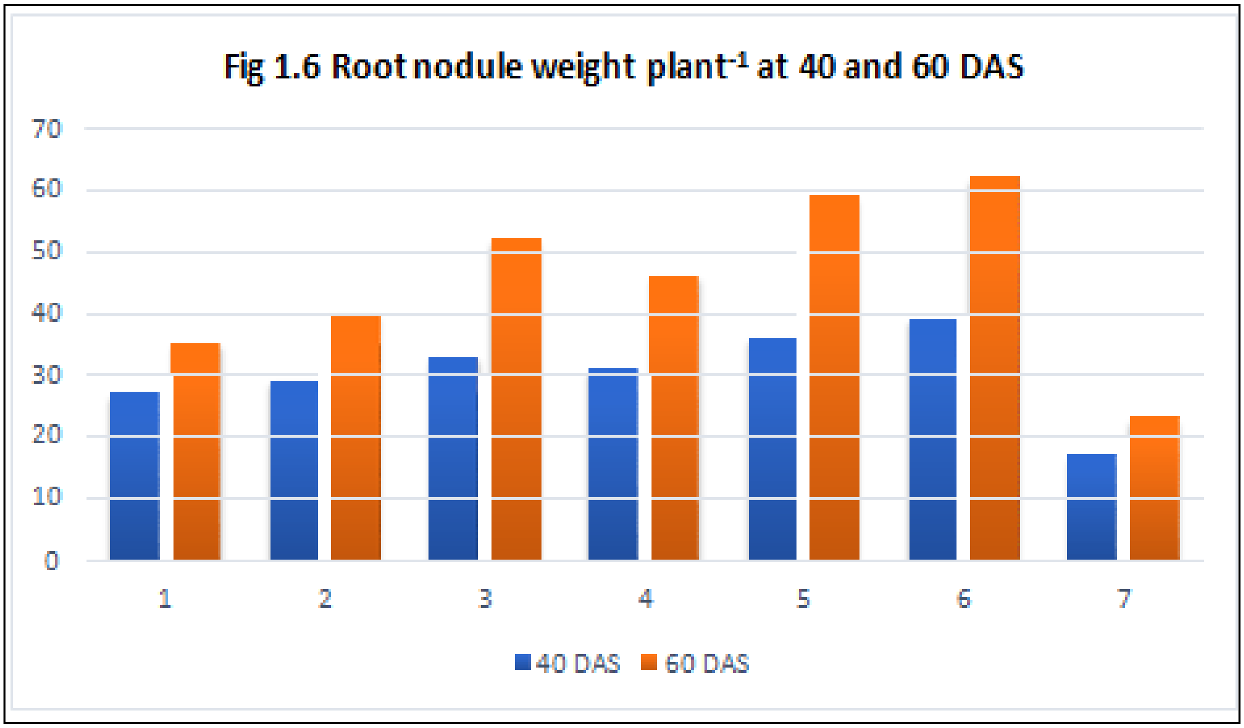
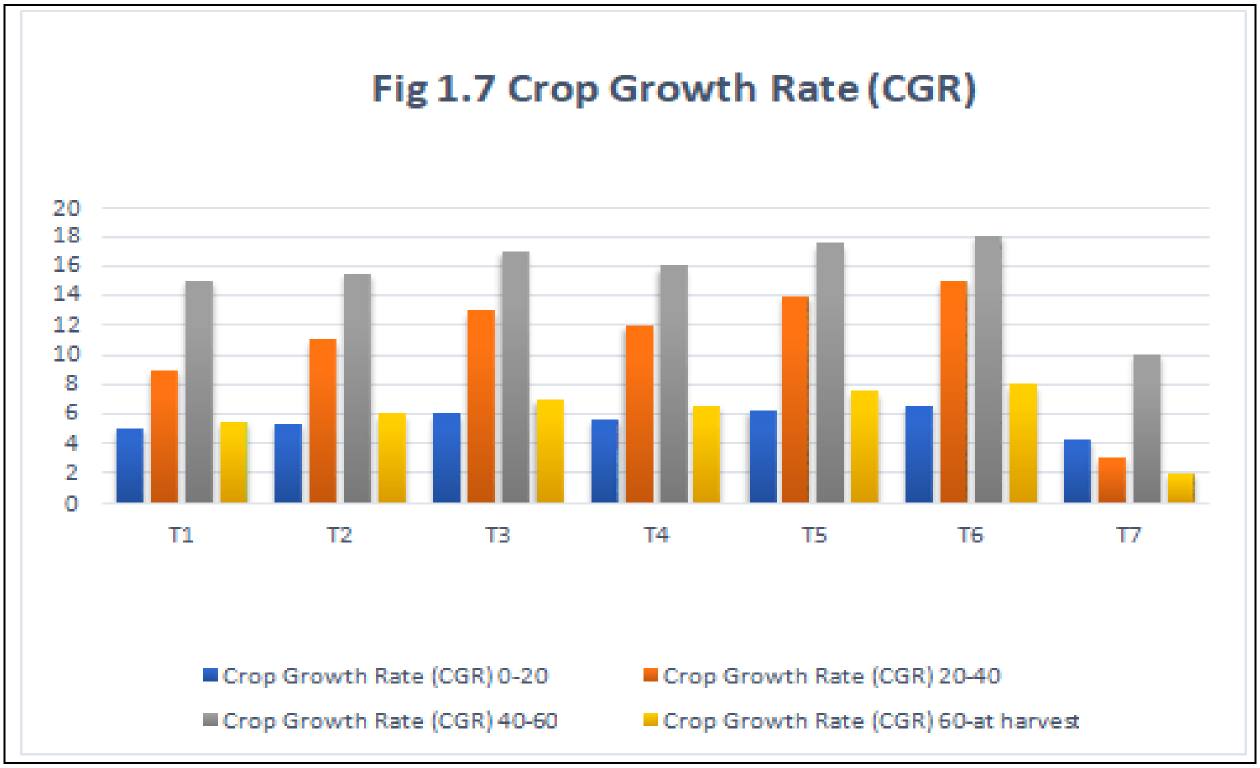


Fig.7 Crop Growth Rate (CGR)



At 60 DAS significant highest root nodule weight plant^{-1} (mg) (62.00) was noted in treatment T_6(150% of RDF + FYM@5t ha^{-1}), Significant lowest root nodule weight plant^{-1}(23.00) was noted in treatment T_7 (Control). Similar results were also observed by Rajkhowa *et al.*, (2003) and Mahetele *et al.*, (2011).

Significant highest crop growth rate (CGR) (g day^{-1} plant^{-1}) at 0-20 days after sowing, was noted (6.50) in treatment T_6 (150% of RDF + FYM@5t ha^{-1}), Significant lowest crop growth rate (CGR) (gday^{-1}plant^{-1}) (4.30) was noted in treatment T_7(Control). At 20-40 DAS significant highest crop growth rate (CGR) (g day^{-1} plant^{-1}) (15.00) was noted in treatment T_6 (150% of RDF + FYM@5t ha^{-1}), significant lowest crop growth rate (CGR) (g day^{-1}plant^{-1}) (3.00) was noted in treatment T_7(Control). At 40-60 DAS significant highest crop growth rate (CGR) (g day^{-1} plant^{-1}) (18.00) was noted in treatment T_6 (150% of RDF + FYM@5t ha^{-1}), Significant lowest crop growth rate (CGR) (g day^{-1}plant^{-1}) (10.00) was noted in treatment T_7(Control). At60DAS-at harvest significant highest crop growth rate (CGR) (gday^{-1}plant^{-1}) (8.00) was noted in treatment T_6 (150% of RDF + FYM@5t ha^{-1}), Significant lowest crop growth rate (CGR) (gday^{-1}plant^{-1}) (2.00) was noted in treatment T_7 (Control). Also, similar results were reported by Geetha and Velayutham (2009) observed that basal application of N and P fertilizers 12.5:25 kg ha^{-1} to blackgram significantly increased crop growth rate and relative growth rate over control.

The growth parameters pre-harvest observations parameters like initial (at 25 DAS) and final plant population (m^{-2}) at harvest, plant height in cm at 20, 40, 60 DAS and at harvest, functional leaf plant^{-1} at 20, 40, 60 DAS and at harvest, number of primary branches plant^{-1} at 20, 40, 60 DAS and at harvest, root nodule plant^{-1} at 40 and 60 DAS, root nodule weight plant^{-1} (mg) at 40 and 60 DAS, and Crop Growth Rate (CGR) g day^{-1} plant^{-1} at 0-20, 20-40, 40-60,60 DAS and at harvest were significantly superior in the treatment T_6 (150% of RDF + FYM@5t ha^{-1}), and similar trend find with treatment T_5(125% of RDF + FYM@5t ha^{-1}) and T3 (150%

RDF). It could be concluded from the present investigation that effect of integrated nutrient management on growth and yield attributes of blackgram from the overall performance and association studies of all parameters stand could be better performance in first in position T_6 (150% of RDF + FYM@5t ha^{-1}) and T_5 (125% of RDF + FYM@5t ha^{-1}) stand in second order of preference.

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