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Effect of plant growth regulators on yield and quality of greengram (*Vigna radiata* L. Wilczek) under graded levels of nitrogen

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Abstract : Green house experiments were conducted with greengram cv KM-2 during June 2002, to find out the effect of plant growth regulators on yield and quality of greengram under graded levels of nitrogen. The experiment was conducted in a factorial RBD with 3 replications. The treatments constituted 4 levels of N *viz.* 0, 25.0, 37.5, 50 kg ha^{-1} and growth regulators *viz.* naphthalene acetic acid (NAA), mepiquatchloride (MC) and triacontanol at recommended levels compared with water spray. The results revealed that application of 50 kg N ha^{-1} along with NAA spray excelled other treatments in increasing the growth, yield characters and protein content of greengram, followed by MC spray at 50 kg ha^{-1} of N.

Key words : Greengram, Nitrogen, Naphthalene acetic acid, Mepiquatchloride, Triacontanol.

Introduction

Pulses owe a strategic position in agricultural economy in India, being major source of protein of the country. Legumes are widely recognized to be an impressive symbol of agricultural economy, being a major source of protein in vegetarian human diet and also improving the soil fertility through their nitrogen fixing capability (Upadhyay, 2002). Among pulses, greengram is widely considered as an excellent source of high quality protein with good digestibility and also contain water soluble vitamins and minerals of dietary significance. Greengram normally produces a large number of flowers but only a few are retained and develop into pods. This crop also suffers from excessive vegetative growth due to application of nitrogenous fertilizers. Although the inflorescence is profuse, the yield is low due to poor pod setting and harvest index (Singh, 2001).

Among the various cultural factors, right time of sowing and fertilizer management appeared to have major role in determining the high grain yield of pulse crop (Singh and Singh, 2000). Recent energy crisis and consequent price hike of fertilizers coupled with the poor purchasing power of the farming community have compelled to consider the adaptation of legume-cereal cropping system. Nitrogen fertilization under optimal level increases yield, but affect the quality parameter (Kumpawat and Rathore, 2002). Application of nitrogenous fertilizers will tend to increase the vegetative growth of greengram but not having much influence on flowering and pod setting. The application of plant growth regulator regulates the excess growth and enhances the flowering and pod setting by way of transporting the photosynthates into sink. Keeping these aspects in view, the present study was undertaken to assess the influence of plant growth regulators on yield and quality of greengram under graded levels of nitrogen.

Materials and Methods

Green house experiments were conducted during 2002 at the Department of Soil Science and Agricultural Chemistry, TNAU, Coimbatore with greengram var. KM-2. The experiment was conducted in pots where rice was grown as previous crop. After the harvest of rice, greengram was sown in stubbles to represent rice fallow greengram. The experimental soil was moderately alkaline in reaction (pH 8.0) and low in soluble salt content (EC<0.45 dSm^{-1}). The experimental soil is low in available N, medium in P and K. The experiment was

able 1. Effect of plant growth regulators on plant height and yield parameters of greengram under graded levels of nitrogen

reat-ents	Plant height (cm) - Vegetative stage						No. of pods plant^{-1}					
	g_0	g_1	g_2	g_3	g_4	Mean	g_0	g_1	g_2	g_3	g_4	Mean
	9.76	11.43	12.93	12.56	11.96	11.73	5.60	6.00	7.50	7.00	6.40	6.50
	13.06	13.23	14.26	14.06	13.90	13.70	8.00	8.20	9.00	8.60	8.40	8.44
	14.43	14.60	15.33	15.00	15.10	14.89	9.50	9.90	11.00	10.60	10.20	10.24
$_3$	15.76	15.83	17.43	16.66	16.23	16.38	11.20	11.60	12.80	12.50	12.00	12.02
Mean	13.25	13.77	14.99	14.60	14.27		8.57	8.92	10.07	9.67	9.25	
	n		g		ng		n		g		ng	
SEd	0.22		0.24		0.49		0.16		0.18		0.36	
CD (P=0.05)	0.44		0.50		1.00		0.33		0.37		0.74	
	Plant height (cm) - Flowering stage						Pod length (cm)					
	25.60	27.20	30.50	29.70	28.50	28.30	3.30	4.00	4.50	4.40	4.30	4.10
	31.70	29.06	35.50	34.30	33.60	32.83	4.60	4.80	5.50	5.20	5.33	5.08
	36.20	37.60	41.90	40.60	39.50	39.16	5.70	5.90	6.50	6.30	6.00	6.08
	42.80	44.10	49.50	46.30	45.20	45.58	6.80	7.00	7.86	7.50	7.20	7.27
Mean	34.07	34.49	39.35	37.72	36.70		5.10	5.42	6.09	5.85	5.70	
	n		g		ng		n		g		ng	
SEd	0.66		0.74		1.48		0.14		0.16		0.32	
CD (P=0.05)	1.34		1.50		3.00		0.29		0.33		0.66	

$_0$ = Control; n_1 = 25.0 kg N ha^{-1};
$_2$ = 37.5 kg N ha^{-1}; n_3 = 50.0 kg N ha^{-1}

g_0 = Control; g_1 = Water spray; g_2 = NAA;
g_3 = Mepiquatchloride; g_4 = Triacontanol

conducted in FRBD with three replications. Twenty treatment combinations were tried with graded levels of N fertilizers (0,25,37.5 and 50 kg N ha^{-1}) and various growth regulators viz. control, water spray, NAA, MC and triacontanol at recommended levels. A common dose of 50 kg ha^{-1} of P as SSP was applied to all the pots irrespective of treatments. Calculated quantities of the growth regulators viz. NAA at 10 ppm, MC at 50 ppm and triacontanol at 0.5 ppm was sprayed at flowering stage of greengram as per the treatment schedule using hand sprayer. The treatment wise biometric observations, yield and yield parameters were recorded. At harvest stage seed samples were collected after threshing and analysed for N content. The protein content was determined by multiplying N content with a factor of 6.25.

Results and Discussion

Effect on growth and yield attributes

Plant height (cm)

Application of graded levels of nitrogen along with plant growth regulators significantly influenced the plant height (Table 1). The plant height recorded at vegetative and flowering stage indicated that plant height increased significantly with increase in N levels. Nitrogen application at 50 kg ha^{-1} registered the highest plant height of 16.4 and 45.6 cm during vegetative and flowering stages respectively followed by N application at 37.5 kg ha^{-1}. The lowest plant height was recorded in control. Among the plant growth regulators NAA spraying recorded the highest plant height (14.9 and 39.3 cm respectively for vegetative and flowering stages). Though the N levels and plant growth regulators application was significant, their interaction failed to show significant difference in plant height.

Table 2. Effect of plant growth regulators on yield and quality of greengram under graded levels of nitrogen

Treatments	No. of seeds pod^{-1}						100 grain weight (g)					
	g_0	g_1	g_2	g_3	g_4	Mean	g_0	g_1	g_2	g_3	g_4	Mean
n_0	6.00	6.80	8.00	7.50	7.00	7.06	2.70	2.70	2.80	2.80	2.80	2.76
n_1	8.40	8.90	9.50	9.20	9.00	9.00	2.80	2.80	2.90	2.90	2.90	2.86
n_2	9.80	10.00	11.20	10.80	10.30	10.42	3.00	3.00	3.10	3.10	3.10	3.06
n_3	11.50	11.80	13.50	13.00	12.60	12.48	3.10	3.10	3.20	3.20	3.20	3.16
Mean	8.92	9.37	10.55	10.12	9.72		2.90	2.90	3.00	3.00	3.00	
	n		g		ng		n		g		ng	
SEd	0.22		0.25		0.50		0.16		NS		NS	
CD (P=0.05)	0.45		0.50		1.01		0.33		NS		NS	

	Grain yield (g pot^{-1})						Protein content (%)					
n_0	2.80	2.90	3.40	3.20	3.00	3.06	15.00	15.00	16.20	15.60	15.60	15.45
n_1	3.60	3.80	5.00	4.60	4.20	4.24	16.80	17.50	19.30	18.70	18.10	18.08
n_2	5.20	5.70	7.00	6.40	6.00	6.06	20.00	19.66	21.80	21.20	20.60	20.65
n_3	7.30	7.60	8.60	8.20	8.00	7.94	22.50	22.50	24.30	23.70	23.10	23.22
Mean	4.72	5.00	6.00	5.60	5.30		18.57	18.66	20.40	19.80	19.35	
	n		g		ng		n		g		ng	
SEd	0.22		0.24		0.49		0.24		0.27		0.54	
CD (P=0.05)	0.45		0.50		1.00		0.49		0.55		1.10	

n_0 = Control; n_1 = 25.0 kg N ha^{-1};
n_2 = 37.5 kg N ha^{-1}; n_3 = 50.0 kg N ha^{-1}

g_0 = Control; g_1 = Water spray; g_2 = NAA;
g_3 = Mepiquatchloride; g_4 = Triacontanol

Yield attributes

At harvesting stage the yield attributes *viz.* number of pods plant^{-1}, pod length (cm), number of seeds pod^{-1}, 100 grain weight (g) and grain yield pot^{-1} were recorded. The results revealed that application of N at 50 kg ha^{-1} significantly increased yield attributes *viz.* number of pods plant^{-1} (6.50 to 12.02), pod length (4.1 to 7.2 cm), number of seeds pod^{-1} (7.0 to 12.4) and 100 grain weight (2.76 to 3.16g) followed by N at 37.5 kg ha^{-1}. With respect to growth regulators, NAA spraying was found to be significant in influencing the yield attributes such as number of pods plant^{-1} (8.5 to 10.0), pod length (5.1 to 6.0 cm), number of seeds pod^{-1} (8.9 to 10.5) and 100 grain weight (2.9 to 3.0g) followed by MC at 50 ppm. Application of N at 50 kg ha^{-1} and NAA spraying registered the highest yield attributes and yield however there was no significant difference between their combinations.

Yield

The grain yield of greengram ranged from 2.80 to 8.60 g pot^{-1} due to various treatments. The highest grain yield was obtained with application of N at 50 kg ha^{-1} (7.94g pot^{-1}) followed by N at 37.5 kg ha^{-1}. NAA application registered the highest grain yield (6.0 g pot^{-1}) followed by MC (5.6 g pot^{-1}). The interaction effect between nitrogen and plant growth regulators was not significant. The increase in yield at higher levels of N (50 kg ha^{-1}) along with NAA might be due to effect of growth regulators which will make the plant photosynthetically more effective, also prevent flower shedding, improving pod setting and consequently increasing the yield. This is

concordance with the results of Bharti Bhaisare *al.* (2000) and Singh (2001).

ffect on quality

The protein content in dry mature seeds greengram is presented in Table 2. The otein content was in the range of 18.57 to 3.40 per cent. The protein content increased ith increasing N levels (15.48 to 23.22%) d the highest protein content was recorded ith NAA spraying. Though the N levels and ant growth regulators application was significant eir interaction failed to show significant difference protein content. The increase in protein content ay be due to the proper translocation and bilization of metabolites towards developing eds by the application of growth regulators. his is in agreement with the findings of Singh d Awasthi (1998).

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