EFFCT OF NUTRIENT CONCENTRATION AND CHLOROPHYLL CONTENT OF BLACKGRAM USING TWO DIFFERENT MANURES UNDER DROUGHT STRESS

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Abstract

This study was conducted to evaluate the performance of black gram (*Vigna mungo.L*) grown under drought stress using coir waste manure and cow dung manure. Two varieties of black gram-ATD mash 3 and ATD mash 1 were the treatment variables. A best fit positive relationship existed between leaf chlorophyll and leaf nitrogen content with two organic manures. N, P and K accumulation in the two varieties was affected significantly. However there was increasing tendency of N, P and K levels using coir waste manure. This is due to water holding capacity and drought resistance activity of coir waste. Among the two varieties ATD mash 3 showed better performances than ATD mash1.

Keywords : Nitrogen level, Black gram, Chlorophyll, Plant samples, P analysis.

I. INTRODUCTION

A large number of pulses are grown in India. The main are lathyrus, lentil, chickpea, blackgram and mungbean. Among the pulses blackgram (Vigna mungo L.) is one of the main edible pulse crop of Bangladesh. It ranks fourth among the pulses with an area of about 70,000 hectare (BBS, 2000). Nitrogen is an essential element and important determinant of growth and development of crop plant (Tanaka et al., 1984). The important plant parameters proposed for estimating nitrogen stress are leaf nitrogen, dry weight, leaf elongation, leaf area and carbon dioxide rate (Green, 1976). Soils of India are mostly deficient in nitrogen. As soils of N deficiency is common in tropics and subtropics (Dakora and Keya, 1997), N supply and N management will continue to be important factors in crop production in this region. Another factor of concern is the significant environmental decline already associated with the injudicious use of the fertilizer nitrogen (Vitousek et al., 1997). It has been observed that photosynthesis rate decreases after flowering. The leaf nitrogen and chlorophy 11 content also showed a similar decline (Rao and Ghildiyal, 1985). It was suggested that decrease in photosynthesis rate after flowering was due to the mobilization and translocation of nitrogen from leaves to seeds, owing to higher nitrogen requirement of pulse crop for seed development (Ghildiy1 and Sirohi, 1986). This was further substantiated by the observation that in deflowered plants where pods were not allowed to developed, retained higher rate of photosynthesis, chlorophy11 and leaf nitrogen content (Mitra and Ghildiyal, 1988). Mitra et al. (1988) observed that urea application retarded leaf senescence as judged by the retention of chlorophy11 and leaf nitrogen. It should be possible to increase N_2 fixation by legumes through genetic improvement and management practices (Hardarson and Atkins, 2003). Since the process of nodulation and nitrogen fixation is inhibited at higher levels of fertilizer nitrogen in the soil (Lawn and Brun, 1974) and there is a high demand of nitrogen of the crop is at post flowering period, it is necessary to have clear understanding on nitrogen use efficiency of legume crop. Foliar application of N is reported to have beneficial effect on mungbean (Hamid, 1991). This study was therefore undertaken to find out the role of organic manures on the leaf chlorophy11 content, nutrient content and nutrient uptake pattern of blackgram under drought stress conditions.

II. MATERIALS AND METHODS

A field experiment was conducted at the fields of sevalpatti, Virudhunagar District, Tamilnadu (from March to June 2008). The soil of the experimental field was silty clay with PH 6.5. The experimental soil contains 0.159% total N, 0.619% organic carbon, 0.312 meq exchangeable P/100g soil, 0.38 meq exchangeable K/100 g soil and CEC 22.54 meq/100 g soil. The experimental site is situated in a drought stress during March to June. The experiment was laid out in a factorial RCBD with 3 replications.

Treatment Combinations: Two varieties of black gram with two different organic manures constituted the following combinations. A1 NO: ATD mash-3 with 0 kg ha^{-1} level of nitrogen fertilizer; A1N20: ATD mash-3 with 20kg ha^{-1} level of cow dung manure. A1 N60: ATD mash-3 with 60kg ha^{-1} level of nitrogen fertilizer: B1 N80: ATD mash 3 with 80kg ha^{-1} level of nitrogen fertilizer; A1 N100: ATD mash-3 with 100kg ha^{-1} level of nitrogen fertilizer; A2 NO: ATD mash-1 with 0kg ha^{-1} level of nitrogen fertilizer; A2 N20:ATD mash -1 with 20kg ha^{-1} level of nitrogen fertilizer, A2 N40: ATD mash-1 with 40kg ha^{-1} level of nitrogen fertilizer;A2N60: ATD mash 1 with 60 kg ha^{-1} level of nitrogen fertilizer; A2 N80: ATD mash-1 with 80 kg ha^{-1} level of nitrogen fertilizer; A2 N100: ATD mash-1 with 100kg ha^{-1} level of nitrogen fertilizer. The above procedure was followed for coir waste manure. The well prepared

soil was fertilized at the rate of 50 and 36 kg P and K per hac. Organic Nitrogen is six levels of 0, 20, 40, 60, 80, 100 kg $ha^{-1.}$ Half dose of N and full dose of P and K were applied as basal at the time of seed sowing. Seeds were sown on 9 March, 2008 with 10x30 cm2 spacing; light irrigation was given to establish the seedlings properly. Excess seedlings were removed on March 20 to retain one seeding per hill. The crop was top-dressed with rest half of N on April 6, 2008.

Laboratory analysis of plant samples

Leaf chlorophy ll content: Leaf chlorophy11 content of two black gram varieties were measured at pre-flowering and pod filling stage. For this reason the top most leaf was collected and leaf chlorophy11 was determined in the lab by utilizing acetone method. Oven dried plant materials (leaves+stem+petiole+grain) at final harvest were ground for the estimation of different mineral icons.

Total N analysis: Estimation of total nitrogen was done by colorimetric method flowing Linder (1944). Plant sample was digested in Kjeldahl digestion flask with salicylic sulfuric acid and digestion catalyst. After digestion, color of the solution was developed with four different reagents (reagent B I mL, 7-10 drop of A, 5 mL of solution C and 5 mL of solution D). Then absorbance of the solution was measured at 625 nm wavelength with Double Beam Spectrophotometer (Model 200-20 Hitachi)

Total P analysis: Total P was determined by nitric-perchloric acid digestion method as described by Yamakawa (192). The absorbance was measured at 40nm with Double Beam Spectrophotometer (Model 200-20 Hitachi).

K analysis:

K was determined following Hitachi Ltd. (1986). During K analysis dry plant sample was digested with nitric-perchloric acid solution. After digestion the sample was diluted with distilled water. Then the absorbance of that respective ion was measured with atomic absorption spectrophotometer (Model 41170-30 Hitachi).

Statistical Analysis:

The data recorded on different plant characters were statistically analyzed with the help of MSTAT program. The differences between the treatment means were compared by Least significant Difference (LSD) test (Gomez and Gomez, 1983)

III. RESTULTS AND DISCUSSION

Table 1. Coir Waste effect on N, P and K contents in plant of two black gram varieties at harvest

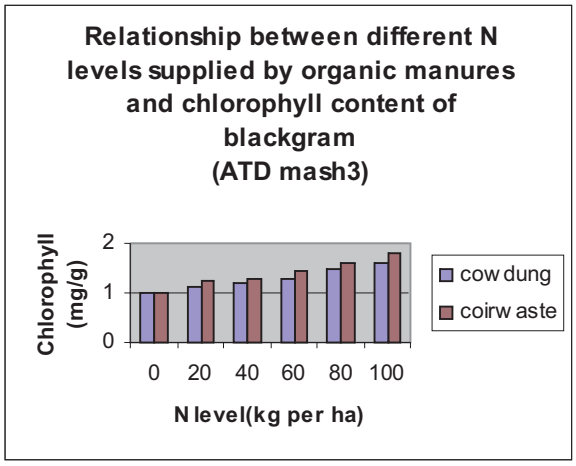
Variety	Organic N (kg ha^{-1})	Nutrient concentration (%) in total plant at harvest stage		
		N	P	K
ATD mash3	0	1.43	0.14	1.01
	20	1.47	0.15	1.01
	40	1.48	0.16	1.02
	60	1.57	0.18	1.24
	80	1.52	0.17	1.20
	100	1.49	0.16	1.16
ATD mash1	0	1.35	0.12	0.93
	20	1.37	0.14	0.95
	40	1.38	0.15	0.97
	60	1.57	0.16	1.10
	80	1.47	0.15	1.01
	100	1.38	0.14	0.98
LSD(0.05)		NS	NS	NS
CV (%)		8.94	15.85	12.78

Table 2. Effect on N, P and K contents in seed of two black grams Varieties at harvest using coir waste manure

Variety	Organic N (kg ha^{-1})	Nutrient concentration (%) in total plant at harvest stage		
		N	P	K
ATD mash3	0	2.19	0.18	0.84
	20	2.24	0.18	0.85
	40	2.25	0.19	0.86
	60	2.35	0.22	0.92
	80	2.29	0.19	0.89
	100	2.25	0.19	0.87
ATD mash1	0	2.00	0.13	0.78
	20	2.08	0.14	0.80
	40	2.14	0.16	0.82
	60	2.33	0.18	0.90
	80	2.22	0.17	0.87
	100	2.20	0.15	0.86
LSD(0.05)		NS	NS	NS
CV (%)		8.03	6.15	2.12

Chlorophyll and Leaf Nitrogen Content: Chlorophyll and leaf Nitrogen content of two blackgram varieties were measured at pre-flowering and pod titling stage. There is a positive best fit linear functional relationship existed between leaf chlorophyll and leaf nitrogen content with different manures. The functional relationship indicated

that with the increasing levels leaf chlorophyll and nitrogen content increased linearly. Irrespective of varieties and N levels both leaf chlorophyll and nitrogen content showed higher values at mature stage(Fig.1 and 2). This finding is consistent with the findings of Mitra et al. (1988).The chlorophyll and leaf nitrogen content were found to be slightly higher in coirwaste manuring plants than cowdung manuring plants. It was concluded that organic manure as an exogenous source of nitrogen was used to test the model that increased nitrogen supply during flowering and pod filling stage would retard leaf senescence and improve photosynthate and nitrogen availability for seed biomass and drought stress tolerance.



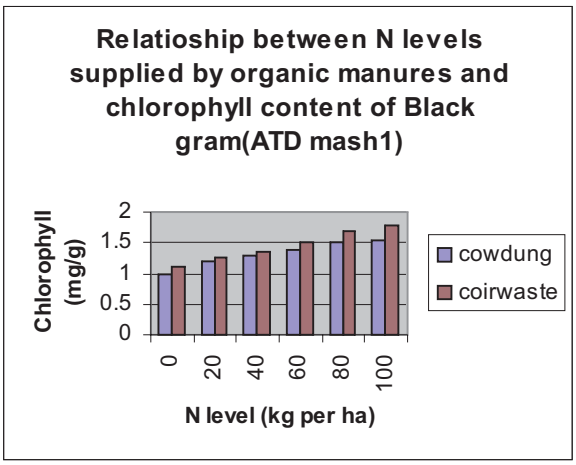


Fig. 1

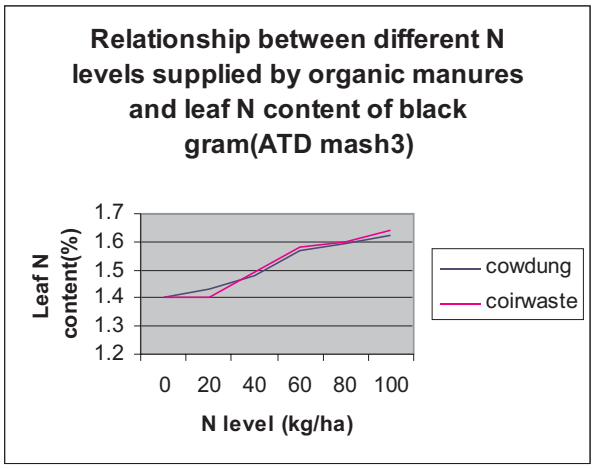


Fig.2

Fig.1. and Fig. 2. shows the functional relationship between different N levels and chlorophyll content of two black gram varieties at harvesting stage.

Nutrient content and uptake Nutrient concentration (N, P and K) in plants: Nitrogen is one of the important key factors in regulating the growth and yield of crops. N concentration in plant components often been used as an index of crops N requirement. Plants N content was determined at maturity stage. The levels of applied organic fertilizer influenced the tissue N content. N content in plant parts increased in N levels up to 60kg ha^{-1} and it helped to sustain high concentration of N. An increase in N levels increased N content significantly at all the growth stages, highest N content was observed at active tillering stage with higher N level (100kg $ha^{-1)}$ and lower at harvest without using manure (Quayum et al., 1994). Plants grown without manure had tissue N concentration of 1.43% at harvest whereas plants treated with coirwaste of 60kg ha^{-1} had 1.58%. N content in plant tissue irrespective of varieties was highest at the same level of N treatment. Similar trend in pea was obtained by Verma et al. (1998). Irrespective of N levels ATD mash 3 always contain higher tissue N concentration that ATD mash1 (Table 1). The increase in N content in blackgram at this level may be due to the accelerated metabolic activity of the fertilized plants resulting increased absorbing power of root system.

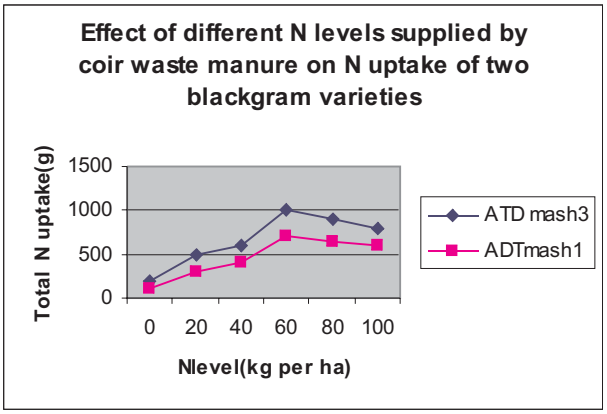
N supply through manure application also influenced P and K content in the plant tissue, but differences was not as conspicuous as was observed in case of N content(Table 1). P and K content in all plant organs increased up to 60kg ha^{-1} and then further increases in nitrogen caused reduction in P and K content. From the table it is clear that total N, P and K content (%) in both the black gram varieties increased up to 60 kg N ha^{-1} then decreased. But these nutrients are always higher in ATD

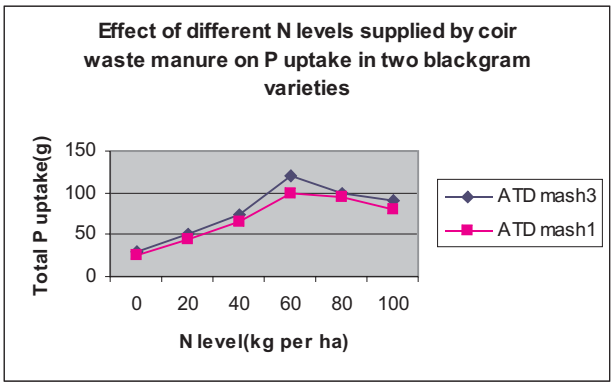
mash 3 than ATD mash 1 at all levels of N. After 60 kg $ha^{-1,}$ further increase in nitrogen caused reduction of P content also observed in pea (Verma and Bhandari, 1998)

Nutrient Concentration (N.P. and K) in grains: N concentration in the grains increased progressively with the increasing levels in both the black gram varieties (Table 2). Irrespective of varieties and N levels, seed N content increased with the increases of N levels up to 60 kg $ha^{-1.}$ Further increased in N levels, N content in seed decreased gradually. Among the varieties ATD mash 3 showed that N uptake in grain increased with increase in N levels of coirwaste manuring plants than cowdung manuring plants. Nitrogen up take in rice straw also followed a similar trend as that in grain. Sing et al. (1992) reported, response of N of field pea up to 30kg ha-1 whereas Negi (1992) up to 20kg ha-1 only.

P and K content in seed also increased with the increased of N levels (Table 2) but the effect were not so conspicuous like as N content. Maximum P and K content in seed were observed in plant treated with 60 kg ha-1. Further increase of N levels decreased, P and K content in seed. From this table it clear that N levels influence seed N, P and K content up to 60 kg ha-1. But the effect was more pronounced on N content than P and K content in seed. Among the varieties, ATD mash 3 always contained higher percent of N, P and K compared to ATD mash 1 using coir waste manuring. N, P and K content in seed always lower in 0 kg N ha-1 treated plants.

Nutrient uptake (N, P and K): Uptake of nutrient elements (N, P and K) by the plant was estimated as the dry matter multiplied by their respective concentration (%).The total uptake of N, P and K by the black gram varieties as influenced by applied N organic fertilizer is presented in Fig 3. As the total dry matter increased over time, N, P and K uptake also increased. Response of N,P and K uptake to the applied N fertilizer paralleled the response of plant nutrient concentration (%). Total uptake of N, P and K varied due to nitrogen treatment variations. Plants treated with 60kg N ha^{-1} had the highest N, P and K uptake irrespective of both the varieties. Up to 60kg N ha-1 all the nutrient uptake increased, but further increase of organic fertilizer decreased the N, P and K uptake gradually.





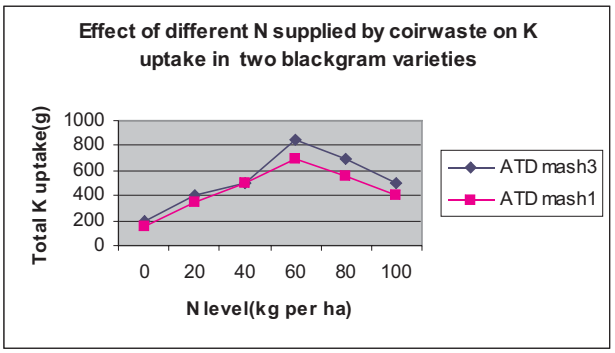


Fig.3

Among the varieties ATD mash 3 always showed better uptake of these nutrients compared to ATD mash 1. This might be due to greater dry matter production by this variety. Nutrient uptake at 0 kg N ha^{-1} was lowest in both the varieties. Similar results also were obtained by Bahl et al. (1996) in pea and Ferdous (2001) in edible podded pea. Irrespective of Nitrogen levels and varieties, N uptake was always higher than P and K uptake (Fig.3).

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