EFFECT OF NITROGEN AND WEEDING REGIMES ON YIELD ATTRIBUTES AND YIELD OF BLACKGRAM

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Certificate

This is to certify that the thesis entitled **"Effect of Nitrogen and Weeding Regimes on Yield Attributes and Yield of Blackgram"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE** in **AGRONOMY**, embodies the result of a piece of bonafide research work carried out by **Md. Halim Ahmed**, Registration number: **00828** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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EFFECT OF NITROGEN AND WEEDING REGIMES ON YIELD ATTRIBUTES AND YIELD OF BLACKGRAM

ABSTRACT

The experiment was conducted at the Agronomy Research field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during March to May, 2007 to study the effect of nitrogen and weeding regimes on yield attributes and yield of backgram. The experiment consisted of four levels of nitrogen [N_0: 0 kg N ha^{-1}; N_{20}: 20 kg N ha^{-1} (as basal); N_{40}: 40 N kg ha^{-1} (20 kg as basal and 20 kg at 25 DAS) and N_{60}: 60 kg N ha^{-1} (20 kg as basal and 40 kg at 25 and 45 DAS)] and three weeding regimes (W_0: No weeding (control); W_1: One weeding at 25 DAS and W_2: Two weeding at 25 and 45 DAS, respectively).The blackgram variety BARImash3 was used as study material for the experiment. The experiment was laid out in a randomized complete block design (RCBD). Both nitrogen and weeding showed significant variation at 25 to 45 DAS on plant height, number of leaflet plant^{-1}, leaf dry weight, stem dry weight, reproductive dry weight, aboveground dry weight, number of pods plant^{-1}, 1000 seeds weight, seed yield kg ha^{-1} and harvest index (%). Among the four levels of nitrogen, significantly highest values of all the parameters were recorded from N_{40} while the lowest ones from N_0. The highest seed yield and harvest index were recorded as 1618.21 kg ha^{-1} and 33.80%, respectively which were obtained from $N_{40,}$ while the lowest values of the said parameter were found (1306.33 kg ha^{-1} and 31.28%) from N_0. Among the three weeding regimes, W_2 performed the best on all the parameters studied, incontrust W_0 was the worst. The highest seed yield (1748 kg ha^{-1}) and harvest index (33.76 %) were obtained from W_2 while the lowest ones 1288 kg ha^{-1} and 31.07% from W_0. Interaction effect of nitrogen and weeding regimes had significant effect for the parameters except branches plant$^{-1,}$ seed pod$^{-1,}$ 1000 seeds weight, harvest index (%) and leaves dry weight. The highest seed yield (1917.31 kg ha^{-1}) was recorded from $N_{40}W_2$ and the lowest (1046.86 kg ha^{-1}) was recorded from N_0W_0. The highest harvest index (36.18%) was also recorded from $N_{40}W_2$ and the lowest (30.36%) from N_0W_0.

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LIST OF ACRONYMS

AEZ	= Agro-Ecological Zone
BARI	= Bangladesh Agricultural Research Institute
BBS	= Bangladesh Bureau of Statistics
cm	= Centimeter
CV %	= Percentage of Co-efficient of Variance
^{0}C	= Degree Centigrade
DAS	= Days after sowing
et al.	= and others *(at el.)*
FAO	= Food and Agricultural Organization
HI	= Harvest Index
g	= gram (s)
Kg	= Kilogram
Kg ha^{-1}	= Kilogram per hectare
g	= gram (s)
LSD	= Least Significant Difference
MP	= Muriate of Potash
m	= Meter
N	= Nitrogen
NS	= Not Significant
P^{H}	= -ve Logarithm f Hydrogen ion conc.
ppm	= Parts per million
RCBD	= Randomized Complete Block Design
SAU	= Sher-e-Bangla Agricultural University
TSP	= Triple Super Phosphate
t ha^{-1}	= ton per hectare
Wt	= Weight
%	= Percent

Chapter 1

Introduction

Chapter 1
INTRODUCTION

Pulses play an important role in the daily diet of the people of Bangladesh which are also a vital source of protein, calories, minerals and some vitamins. Among the pulses grasspea, lentil, mungbean, blackgram, chickpea, fieldpea and cowpea are important. Pulse protein is rich in amino acids like isoleucine, leucine, lysine, valine etc. FAO (1999) recommends a minimum pulse intake of 80 g $head^{-1}$ day^{-1} whereas; it is only 14.19 g in Bangladesh (BBS, 2006). This is because of the fact that production of the pulses is not adequate to meet the national demand.

Among the pulse crops, blackgram (*Vigna mungo*) is one of the main edible pulse crops of Bangladesh. It ranks fourth among the pulses with an area of about 82000 ha (BBS, 2006). As an excellent source of plant protein it is cultivated extensively in the tropics and subtropics. Blackgram grain contains 59% carbohydrates, 24% protein, 10% moisture, 4% mineral and 3% vitamins (Kaul, 1982). The green plants can also be used as animal feed and its residues have manural value. The crop is potentially useful in improving cropping pattern. It plays an important role to supplement protein in the cereal-based low-protein diet of the people of Bangladesh, but the area and production of blackgram is steadily declining (BBS, 2006).

In Bangladesh, the average yield of blackgram is 1.4 – 1.5 t ha^{-1} (BARI, 2005). There are many reasons of lower yield of blackgram. Nitrogen and weed management in kharif-1 season are one of them. It can also fix atmospheric nitrogen through the symbiotic relationship between the host blackgram roots and soil bacteria and thus improves soil fertility. In general, pulses do not require to be provided with external N-application. But slow rate of dry matter accumulation during pre-flowering phase, leaf senescence during the period of pod development and low partitioning efficiency of assimilates to grain, which is identified as the main physiological constraints for increasing yield these are also attributed in blackgram for as key factors highly responsive to nitrogen. For the pulse crops, nitrogen is most useful because it is the main component of protein. The management of fertilizer greatly affects the growth, development and yield of this crop. Moreover, there is evident that application of nitrogenous fertilizers at flowering stage is helpful in increasing the yield (Patel *et al.*, 1984, Ardeshana *et al.*, 1993).

There is also report that the process of nodulation and nitrogen fixation is inhibited at higher levels of fertilizer nitrogen in the soil (Lawn and Brun, 1974). Weed is one of the most important factors responsible for low yield (Islam *et al.* 1989). Although blackgram is competitive against weed control is essential for blackgram production (Moody, 1978).

All crops have a stage during their life cycle when they are particularly sensitive to weed competition. In general, it ranges up to first 25 to 50% of the life time of crops. Critical period of weed competition is the minimum weed free period essential during the life cycle of a crop to prevent yield loss. The critical period of weed control in interference study is the period up to which the weeds would be allowed without significant yield losses of crops (Bryson, 1990). Critical time of weed competition is the range within which a crop must be weeded to save the crop from damages of weeds (Islam *et al.* 1989).

Weeds grow profusely in the rainy season due to the favorable moisture conditions and, if not timely controlled, can cause up to 90 % reduction in seed yield. Competition by weeds is influenced by the established plant density (Meylemans *et al.* 1994). Malik *et al.* (2003) reported that number of flowers plant^{-1} and pods plant^{-1} was found to be significantly higher by two times of weeding.

The rate of dry matter production in many crops is proportional to the intercepted radiation. The growth of crop is, therefore, often analyzed in term of intercepted radiation and the efficiency of conversion of solar radiation to dry weight (Gallagher and Biscoe, 1978). However such relationship may be changed for a crop which is in competition with weed for solar radiation/ the development of leaf area of blackgram may be modified by competition with weeds.

In Bangladesh limited studies have been conducted to find out the seed yield of BARImash3 (blackgram) with optimum nitrogen dose and weed management. Such studies may not be quite able to explain the weed competition under varying N-management.

Considering the above facts, the present study was undertaken with the following objectives:

i. to find out the optimum level of nitrogen for maximum yield and yield attributes of BARImash3.

ii. to determine the number and time of weeding for optimum yield and yield attributes of BARImash3.

iii. to find out the interaction effect of nitrogen and weeding regimes on yield and yield attributes of BARImash3.

Chapter 2

Review of literature

Chapter 2

REVIEW OF LITERATURE

Many studies addressed the effect of different levels of nitrogen and time of weeding on the performance of blackgram (*Vigna mungo*) and other pulse crops. Results of such studies indicate that levels of nitrogen and weed interference have profound influence on yield, yield attributes and biomass yields of crops. Some of the works that are relevant to the present study are reviewed here.

2.1 Effects of nitrogen on yield attributes and yield of blackgram

Nigamananda and Elamathi (2007) carried out a study in Uttar Pradesh, India during 2005-06 to evaluate the effect of N application time as basal and as DAP (diammonium phosphate) or urea spray and plant growth regulator (NAA at 40 ppm) on the yield and yield components of green gram. The recommended rate of N:P:K (20:50:20 kg ha^{-1}) as basal was used as a control. Treatments included: 1/2 basal N + foliar N as urea or DAP at 25 or 35 days after sowing (DAS); 1/2 basal N + 1/4 at 25 DAS + 1/4 at 35 DAS as urea or DAP; and 1/2 basal N + 1/2 foliar spraying as urea or DAP + 40 ppm NAA. Results showed that 2% foliar spray as DAP and NAA, applied at 35 DAS, resulted in the highest values for number of pods $plant^{-1}$ (38.3), seeds pod^{-1}, flower number, fertility coefficient, grain yield (9.66 q ha^{-1}).

An experiment was conducted by Tickoo *et al*. (2006) with mungbean cultivars Pusa 105 and Pusa Vishal sown at 22.5 and 30 cm spacing and supplied with 36 - 46 and 58 - 46 kg NP ha^{-1} in Delhi, India during the kharif season of 2000. Cultivar Pusa Vishal recorded higher biological and grain yield (3.66 and 1.63 t ha^{-1}, respectively) compared to cv. Pusa 105. NP rates had no significant effects on both the biological and grain yield of the crop. Row spacing at 22.5 cm resulted in higher grain yields in both crops than 30 cm.

Oad and Buriro (2005) conducted a field experiment to determine the effect of different NPK levels (0-0-0, 10-20-20, 10-30-30, 10-30-40 & 10-40-40 kg ha^{-1})

on the growth and yield of mungbean cv. AEM 96 in Tandojam, Pakistan, during the spring season of 2004. The different NPK levels significantly influenced the crop parameters. The 10-30-30 kg NPK ha^{-1} was the best treatment, recording plant height of 56.25, germination of 90.50% seed weight per plant of 10.53 g and the highest seed yield of 1205.2 kg ha^{-1}.

Nadeem *et al.* (2004) studied the response of mungbean cv. NM-98 to seed inoculation and different levels of fertilizer (0-0, 15-30, 30-60 and 45-90 kg N-P_2O_5 ha^{-1}) under field conditions. Application of fertilizer significantly increased the growth of plant and yield. The maximum seed yield was obtained when 30 kg N ha^{-1} was applied along with 60 kg P_2O_5 ha^{-1}.

Malik *et al.* (2003) conducted an experiment to determine the effect of varying levels of nitrogen (0, 25, and 50 kg ha^{-1}) and phosphorus (0, 50, 75 and 100 kg ha^{-1}) on the yield and quality of mungbean cv. NM-98 in 2001. They observed that number of flowers per plant was found to be significantly higher by 25 kg N ha^{-1}. Number of seeds per pod was significantly affected by varying levels of nitrogen and phosphorus. Growth and yield components were significantly affected by varying levels of nitrogen and phosphorus. A fertilizer combination of 25 kg N + 75 kg ha^{-1} resulted with maximum seed yield (1112.96 kg ha^{-1}).

Rajender *et al.* (2003) investigated the effects of N (0, 10, 20 and 30 kg ha^{-1}) and P (0, 20, 40 and 60 kg ha^{-1}) fertilizer rates on mungbean genotypes MH 85-111 and T44. Plant growth and grain yield increased with increasing N rates up to 20 kg ha^{-1}. Further increase in N did not affect yield.

Yakadri *et al.* (2002) studied the effect of nitrogen (40 and 60 kg ha^{-1}) on crop growth and yield of green gram (cv. ML-267). Application of nitrogen at 20 kg ha^{-1} resulted in the significant increase in leaf area ratios indicating better partitioning of leaf dry matter.

An investigation was conducted by Singh *et al.* (2002) to study the effect of N, P and K application on seed yield and nutrient uptake by blackgram at Central

Agricultural University, Imphal, Manipur, India during 1998 and 1999. Treatments combinations of N (0 and 15 kg ha^{-1}), P (0, 30 and 60 kg ha^{-1}) and K (0 and 20 kg ha^{-1}) were tested. The highest yield was obtained from the application of 15:60:20 kg N : P_2O_5 : K_2O ha^{-1}. The total uptake of nutrients by blackgram was associated with higher biomass production.

Mahboob and Asghar (2002) studied the effect of seed inoculation at different nitrogen levels on mungbean at the agronomic research station, Farooqabad in Pakistan. They reported that various yield components like 1000 grain weight were affected significantly with 50-50-0 kg ha^{-1} application of NPK.

Srinivas *et al.* (2002) conducted an experiment on the performance of mungbean at different levels of nitrogen and phosphorus. Different rates of N (0, 25 and 60 kg ha^{-1}) and P (0, 25, 50 and 60 kg ha^{-1}) were tested. They observed that the number of pods per plant was increased with the increasing rates of N up to 40 kg ha^{-1} followed by a decrease with further increase in N. They also observed that 1000-seed weight was increased with increasing rates of N up to 40 kg ha^{-1} .

A field experiment was carried out by Sharma and Sharma (1999) during summer seasons at Golaghat, Assam, India. Mungbean was grown using farmers practices (no fertilizer) or using a combinations of fertilizer application (30 kg N + 35 kg P_2O_5 ha^{-1}). Seed yield was 0.40 ton ha^{-1} with farmer's practices, while the highest yield was obtained by the fertilizer application (0.77 ton ha^{-1}).

Karle and Pawar (1998) examined the effect of varying levels of N and P fertilizers on summer mungbean. They reported that mungbean produced higher seed yield with the application of 15 kg N ha^{-1} and 40 kg P_2O_5 ha^{-1}.

Trivedi *et al.* (1997) carried a field experiment to study the effect of nitrogen, phosphorus and sulfur on yield and nutrient uptake of blackgram (*Vigna mungo*) at Gwalior, Madhya Pradesh during the 1990-91 kharif (monsoon) seasons. Application of 30 kg N, 60 kg P_2O_5 and 60 kg S ha^{-1} increased yield, net profit and nutrient uptake.

Trivedi (1996) conducted a field trial in the rainy seasons of 1990-91 at Gwalior, Madhya Pradesh, India with *P. mungo* (*Vigna mungo*) cv. Jawahar Urd-2 which was given 0-30 kg N, 0-60 kg P_2O_5 and 0 or 60 kg S ha^{-1}. Seed yield, net returns and N, P and S contents in seed increased with rate of N, P and S applications.

A field experiment was conducted by Satyanarayanamma *et al.* (1996). Five mungbean cultivars were sprayed with 2% urea at pre-flowering, flowering, pod development or at all the combinations or at combination of two or three growth stages. They reported that spraying urea at flowering and pod development stages produced the highest seed yield.

Kaneria and Patel (1995) conducted a field experiment on a Vertisol in Gujarat, India with mungbean cv. K 581 using 0 or 20 kg N ha^{-1} levels. They found that application of 20 kg N ha^{-1} significantly increased the seed yield (1.14 ton ha^{-1}) when compared with that of control (1.08 ton ha^{-1}).

Bhalu *et al.* (1995) conducted a field experiment during the rainy season of 1990 at Junagadh, Gujarat with blackgram (*Vigna mungo*) and seed was inoculated with *Rhizobium* or not inoculated and given 10, 20 or 30 kg N and 20, 40 or 60 kg P_2O_5 ha^{-1}. Seed inoculation increased seed yield (471 vs. 434 kg ha^{-1}). Seed yield increased with up to 20 kg N (464 kg) and 40 kg P_2O_5 (475 kg). N and P uptakes and seed protein content increased with increasing N and P rates. Net return was the highest with seed inoculation.

Ali *et al.* (1995) carried out field trials at Mianchannu in 1992 and Layyah in 1993 on sandy loam soils low in organic matter, N and P and *V. mungo* was given no fertilizers or 50 kg N, 50 kg N + 50, 75, 100 or 125 kg P_2O_5 or 50 kg N + 125 kg P_2O_5 + 50 kg K_2O ha^{-1}. NPK gave the highest number of pods $plant^{-1}$ (23.03-23.75) and seed yield (1080-1082 kg ha^{-1}) but was not significantly better than 50 kg N + 75 kg P_2O_5, which gave the highest 1000-seed weight (49.30 and 42.75 g in the 2 trials, respectively). Straw yields did not differ significantly among the treatments.

Bachchhav *et al.* (1994) conducted a field experiment during the summer season with green gram cv. Phule-M. They observed that among nitrogen fertilizers rates (0-45 kg N ha^{-1}) seed yield increased with 30 kg N ha^{-1}

Ardeshana *et al.* (1993) conducted a field experiment on clay soil during the rainy season of 1990 to study the response of mungbean to nitrogen. They observed that seed yield increased with the application of nitrogen fertilizer up to 20 kg N ha^{-1} in combination with phosphorus fertilizer up to 40 kg P_2O_5 ha^{-1}.

Singh *et al.* (1993) examined the effects of varying levels of N on mungbean cv. MH-85-61. They found that nitrogen application at the rate of 30 kg N ha^{-1} resulted the highest seed yield in mungbean.

Patel *et al.* (1992) conducted a field trial to evaluate the response of mungbean to sulphur fertilization under different levels of nitrogen and phosphorus. Greengram cv. Gujrarat 2 and K 851 were given 10 kg N + 20 kg P ha^{-1} , 20kg N + 40 kg P $ha^{1}$and 0, 10, 20 or 30 kg S ha^{-1} as gypsum and found that plant growth with highest doses. Seed yield was 1.2 and 1.24 t ha^{-1} in 20 kg N + 40 kg P ha^{-1}.

Tank *et al.* (1992) found that mungbean fertilized with 20 kg N along with level of 40 kg P_2O_5 ha^{-1} increased seed yield significantly over the unfertilized control. They also reported that mungbean fertilized with 20 kg N ha^{-1} along with 75 kg P_2O_5 ha^{-1} significantly increased the number of pods per plant.

Phimsirkul (1992) conducted a field trial on mungbean variety, U- Thong I grown in different soils under varying N levels. Results revealed that there was no effect of N fertilizer when mungbean was grown in Mab Bon soil. However, seed yield of mungbean was increased when the crop received N at 30 kg ha^{-1}.

Chowdhury and Rosario (1992) studied the effect of 0, 30, 60 or 90 kg N ha^{-1} levels on the rate of growth and yield performance of blackgram at los Banos, Philippines in 1988. They observed that N above the rate of 30 kg N ha^{-1} reduced the dry matter yield. Leelavathi *et al.* (1991) showed significant increase in seed yield of blackgram with 60 kg N ha^{-1}.

A field experiments was conducted by Sarkar and Banik (1991) to study the effect of N and P on yield of mungbean. Results showed that application of N along with P significantly increased the seed yield of mungbean. The maximum seed yield was obtained with the combination of 20 kg N and 60 kg P_2O_5 ha^{-1}.

Bali *et al.* (1991) conducted a field trail on mungbean in kharif seasons on silty clay loam soil. They revealed that 1000 seed weight increased with 40 kg N ha^{-1} and 60 kg P_2O_5 ha^{-1}.

Arya and Kalra (1988) reported that application of N at the rate of 50 kg ha^{-1} along with 50 kg P ha^{-1} increased mungbean yield. Results from field experiments conducted by Mahadkar and Saraf (1988) during summer season of mungbean showed that the application of N with P and K at 40:20:25 kg ha^{-1} gave higher seed yield.

Hamid (1988) conducted a field experiment to investigate the effect of nitrogen on the growth and yield performance of mungbean (*Vigna radiate* L. wilczek). He found that the plant height of mungbean cv. Mubarik was found was increased by nitrogen at 40 kg ha^{-1}.

Results of an experiment, conducted by Sardana and Verma (1987) in Delhi, India, revealed that application of nitrogen, phosphorus and potassium fertilizers in combination resulted in significant increase in plant height and seed yield of mungbean. They also stated that application of nitrogen, phosphorus and potassium fertilizers combinedly resulted in significant increases in 1000 seed weight.

Salimullah *et al.* (1987) reported that the yield contributing characters and yield was highest with the application of 50 kg N ha^{-1} along with 75 kg P_2O_5 ha^{-1} and 60 kg K_2O ha^{-1} in summer mungbean.

Patel and Parmer (1986) conducted an experiment on the response of green gram to varying levels of nitrogen and phosphorus. They observed that increasing N application to rainfed mungbean (cv. Gujrat-1) from 0 to 50 kg N ha^{-1} increased the number of pods per plant.

In trials, on clay soils during the summer season Patel *et al.* (1984) observed the effect of N levels (0, 10, 20 and 30 kg N ha^{-1}) and that of the P (0, 10, 20, 40, 60 and 80 kg P_2O_5 ha^{-1}) on the growth and seed yield of mungbean. In that experiment, it was found that application of 30 kg N ha^{-1} along with 40 kg P_2O_5 ha^{-1} significantly increased the number of pods per plant. They observed that application of 40 kg P_2O_5 ha^{-1} along with 20 kg N ha^{-1} significantly increased the 1000-seed weight of mungbean.

Raju and Verma (1984) carried out a field experiment during summer season of 1979 and 1980 to study the response of mungbean var. Pusa Baishaki to varying levels of nitrogen (15, 30, 45 and 60 kg N ha^{-1}) in the presence and absence of seed inoculation with *Rhizobium.* They found that maximum dry matter weight per plant was obtained by the application of 60 kg N ha^{-1} along with inoculation with *Rhizobium.*

An experiment was conducted by Trung and Yoshida (1983) using 0-100 ppm N as treatment in the form of ammonium nitrate or 10 or 100 ppm N as urea, sodium nitrate, ammonium nitrate or ammonium sulphate. They found that seed yield of mungbean increased with the increase in N up to 50 ppm.

In an experiment, Yien *et al.* (1981) applied nitrogen and phosphorus fertilizers to mungbean and reported that combined application of nitrogen and phosphorus fertilizers increased the number of pods per plant. The rate of nitrogen and phosphorus was 50 kg and 75 kg per hectare, respectively.

Combined application of nitrogen and phosphorus significantly increased the dry weight of plants. Combination with 20 kg P ha^{-1} resulted in significant increase in the seed yield.

2.2 Effect of weeding on yield attributes and yield of blackgram

Kohli *et al.* (2006) carried out a field experiment in Hisar, Haryana, India, during the 2001 summer season to determine the effect of different weed management practices on the quality and economics of mungbean cv. K-851. The treatments comprised: 0.75 kg linuron ha^{-1}; 1.0 kg linuron ha^{-1}; 0.75 kg linuron ha^{-1} + hand weeding at 35 days after sowing (DAS); 1.0 kg pendimethalin ha^{-1}; 1.25 kg pendimethalin ha^{-1}; 1.0 kg pendimethalin ha^{-1} + hand weeding at 35 DAS; 200 g thiazopyr ha^{-1}; 240 g thiazopyr ha^{-1}; 200 g thiazopyr ha^{-1} + hand weeding at 35 DAS; 0.75 kg acetachlor ha^{-1}; 1.0 kg acetachlor ha^{-1}; 0.75 kg acetachlor ha^{-1} + hand weeding at 35 DAS; hand weeding at 20 and 30 DAS; weed free; weedy control. Data were recorded for grain yield, N uptake, P uptake, protein content, net return, profit over weedy control. Pendimethalin at 1.0 kg ha^{-1} + hand weeding at 35 DAS gave the highest grain yield (15.1 q ha^{-1}). Acetachlor at 0.75 kg ha^{-1} + hand weeding at 35 DAS gave the highest P uptake (11.3 kg ha^{-1}) while hand weeding at 20 and 30 DAS gave the highest protein content (22.5).

Malik *et al.* (2003) conducted an experiment to determine the effect of varying levels of weeding (0, 1 and 2 weeding) on the yield and quality of blackgram. They observed that number of flowers $plant^{-1}$ and pods $plant^{-1}$ was found to be significantly higher by two times of weeding.

Two field experiments were conducted in Kalubia Governorate, Egypt, in 1999 and 2000 summer seasons by El-Metwally and Ahmed (2001) to investigate the effects on some weed control treatments, i.e. butralin (Amex-820) at 2.5 l $feddan^{-1}$, fluazifop-P-butyl [fluazifop-P] (Fusilade) at 2.0 $feddan^{-1}$, bentazone (Basagran) at 0.75 l $feddan^{-1}$, butralin at 1.875 l $feddan^{-1}$ + one hand hoeing (HH), fluazifop-P-butyl at 1.5 l $feddan^{-1}$ + one HH, bentazone at 0.56 l feddan^{-1}+one HH, one HH, 2 HHs at 2 and 4 weeks after sowing, and unweeded control, on the growth, yield and yield components as well as chemical composition of mung bean cv. Kawmy-1. The common weeds in both growing seasons were *Amaranthus caudatus*, *Convolvulus arvensis*, *Xanthium spinosum*, *Cyperus rotundus* and *Cynodon dactylon.* All the weed control treatments decreased significantly fresh and dry weights of mungbean weeds compared to the unweeded treatment. The most effective treatments for weed control in mungbean were the 2 HHs, bentazone + one hand hoeing, bentazone and butralin+one HH. The 2 HHs treatments recorded the highest values of total carbohydrates and protein percentage, followed by the bentazone + one HH and butralin + one HH treatments. Application of bentazone + one HH and 2 HHs significantly increased the fresh and dry weights of plants and leaves, plant height, stem diameter, number of branches per plant, number of pods per plant, weight of pods per plant, number of seeds per pod, weight of 100-seed, biological yield per plant, seed yield per plant and per feddan compared with other treatments.

Bayan and Saharia (1996) conducted an experiment to study the effect of weed management and phosphorus on green gram (*Vigna radiata*) during the kharif seasons of 1994-95 in Biswanath Chariali, Assam, India. The results indicated that effective weed management could be achieved with one hand weeding at 20 days after seeding (DAS). Weed-free and hand weeding at 20 DAS resulted in a significant increase in plant dry matter compared with no weeding. Branches per plant, pods per plant and grain yield were significantly influenced by weed management practices in both years. However, yield attributes and grain yield were unaffected by phosphorus. The highest benefit: cost ratio was obtained with a weed free treatment followed by one hand weeding.

Weeds remain one of the most significant agronomic problems associated with organic arable crop production. It is recognized that a low weed population can be beneficial to the crop as it provides food and habitat for a range of beneficial organisms (Aebischer and Fuller, 1997).

Ahmed *et al.* (1992) found that one hand weeding at 10 or 20 DAE produced higher yield than unweeded plots in mungbean during early kharif. They also observed highest grain yield of mungbean when weeded at 10 DAE.

Bulb yield losses of about 79 - 89% due to weed infestation have been reported by Ahmed, 1991. Weeds can significantly reduce crop yield and quality in conventional and organic (Bulson, 1991) crops. Maximum seed yield was obtained when weeds were removed 20 days after sowing. In competition study, 20 % yield reduction in soybean occurred if weed control measure was not taken prior to 5weeks after emergence (Crook and Renner, 1990; Marwat and Nafziger, 1990).

The critical period of crop/weed competition was determined in mungbean (Kumar and Kairon, 1990; in cotton (Bryson, 1990); in wheat (Islam *et al.* 1989) and in mustard (Dashora *et al.* 1990).

Critical period of weed competition is the minimum weed free period essential during the life cycle of a crop to prevent yield loss. The critical period of weed control in interference study is the period up to which the weeds would be allowed without significant yield losses of crops (Bryson, 1990).

Islam *et al.* 1989 stated that every crop has a stage during its life cycle when it is particularly sensitive to weed competition. Kumar and Kairon (1988) found that weed biomass increased and mungbean yield decreased with delay in weeding. However, delay in weeding did not affect the number of seeds pod^{-1}.

Higher yield of mungbean was observed in the early-weeded plots compared to late/unweeded plots (Singh *et al.* 1988). Pascua (1988) determined the critical period of weed control and competition on mungbean yield. The treatments that gave lower fresh weight of weed had higher number of seeds pod^{-1}. Higher percent yield reduction was recorded when the mungbean plants were exposed to longer weed competition. Maximum dry matter content was recorded under weed free condition followed by weed removal at 30 and 40 days after sowing (Kumar and Kairon, 1988).

Karim *et al.* (1986), found that critical period of weed competition was in between 20 and 30 days after sowing in jute. The critical period of crop/weed competition was determined in direct seeded Aus rice (Mamun *et al.* 1986) and also in transplanted Aus rice (Ahmed *et al.* 1986).

Sarker and Mondal (1985) observed that weeding at different dates after sowing affected some yield contributing characters and yield of mungbean. Grain yield was by 49 to 55% when weeds were not removed at all. Variable number of weeding in mungbean have been suggested viz., one weeding at 2 weeks after emergence, two weeding during early growth stage (Madrid and Vega, 1984), and three weeding during the first 3 weeks after sowing (Enyi, 1984) for optimum yield.

Removal of weeds at 10, 20 or 30 days after sowing produced higher yields of mungbean than weedy check (Yadav *et al.* 1983). The harmful effect of weed infestation did not begin just after emergence of seedling, rather the competition between the weeds and crop was found to be the most severe at a particular stage of crop growth which was known as critical period of crop-weed competition (Shahota and Govinda krisnan, 1982).

Soybean seed weight, seeds pod^{-1}, pods plant^{-1} were reduced due to long duration of wild oat competition (Rathmann and Miller, 1981). The knowledge of critical period of weed competition is a pre-requisite for a good harvest. Panwar and Singh (1980) reported that weeding of mungbean at 20 DAE could effectively produce yields twice than that of unweeded plots.

Mungbean is not very competitive against weeds and, therefore, weed control is essential for mungbean production (Moody, 1978). The yield loss of barley grain due to weed infestation ranges from 10 - 35% (Gupta and Lamb, 1978). It may even range upto 100% (Mann and Barnes, 1977).

Yield losses due to uncontrolled weed growth in mungbean range from 27% to 100% (AVRDC, 1976; Vats and Sidhu, 1976; Madrid and Manimtim, 1977). Vats and Sidhu (1977) reported that weeding in greengram two weeks after sowing was significantly superior to weeding four or eight weeks after sowing.

The magnitude of yield loss due to weed depends on environmental condition and weed growth. Yield loss was 60% during spring and 27% during the summer in Taiwan (AVRDC, 1976).

Enyi (1973) reported that weeding up to 8 weeks after sowing was appropriate for optimum yield of mungbean. He also reported that weed competition caused reduction in the number of pods $plant^{-1}$.

Chapter 3

Materials and Methods

Chapter 3

MATERIALS AND METHODS

In this chapter, the details of different materials used and methodology followed during the experimentation are described.

3.1 Experimental site

The research work was carried out at the experimental field of Sher-e-Bangla Agricultural University, Dhaka during kharif-1 season (March-May, 2007). The field was located at the southeast part of the main academic building. The soil of the experimental plot belongs to the agro ecological zone of Madhupur Tract (AEZ-28).

3.2 Soil

A soil sample from 0 -15 cm depth was collected from experimental field. The physio-chemical properties of the soil are presented in Appendix I.

3.3 Climate

The experimental area is under the subtropical climate. Usually the rainfall was heavy during Kharif-1 season and scanty in Rabi season. The atmospheric temperature increased as the growing period proceeded towards Kharif-1 season. The weather conditions of crop growth period such as monthly mean rainfall (mm), mean temperature (^{o}C), sunshine hours and humidity (%) are presented in Appendix II.

3.4 Planting material

The variety of blackgram used for the present study was BARImash3 (**Hemanta**). The seeds of this variety were collected from the Pulse Research Sub-centre of Bangladesh Agricultural Research Institute (BARI), Gazipur.

Before sowing, the seeds were tested for germination in the laboratory and the percentage of germination was found to be over 90%. The important characteristics of the variety is mentioned below:

3.4.1 BARImash3 (Hemanta)

BARImash3 (**Hemanta**) has an erect growth habit and attains a height of 45 - 60 cm. Leaves are darker green. The variety is moderately resistant to yellow mosaic virus and *Cercospora* leaf spot (CLS). BARImash3 (**Hemanta**) produces a mean seed yield of 1800 kg ha ha^{-1}, compared with 1200 kg ha^{-1}, for BARImash-1.The duration of this crop is 70-75 days. The color of the seed is blackish brown. Seeds contain 23.9 % protein and 46.8 % carbohydrate. The variety was introduced in our country in 1996.

3.5 Land preparation

The land was first opened with the tractor drawn disc plough. Ploughed soil was then brought into desirable tilth by 4 operations of ploughing and harrowing with country plough and ladder. The stubble and weeds were removed. The first ploughing and the final land preparation were done on 7 March and 14 March, 2007, respectively. Experimental land was divided into unit plots following the design of experiment. The plots were spaded one day before planting and the basal doses of fertilizers were incorporated thoroughly before planting.

3.6 Fertilizer application

Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MP) were used as a source of nitrogen, phosphorous, and potassium respectively. Nitrogen was applied in the experiment as per treatments. P_2O_5 and K_2O were applied as basal dose at the rate of 48 and 33 kg per hectare, respectively following BARI recommendation.

3.7 Treatments of the experiment

The experiment was two factorials with four levels of nitrogen and three weeding regimes.

Factor A: Nitrogen (N) - 4

The following nitrogen levels were applied in the experiment

i	No nitrogen	(N_0)
ii.	20 kg N ha^{-1} as basal	(N_{20})
iii.	40 kg N ha^{-1}; 20 kg as basal and 20 kg at 25 DAS	(N_{40})
iv.	60 kg N ha^{-1}; 20 kg as basal and 40 kg at 25 DAS and 45 DAS respectively.	(N_{60})

Factor B: Weeding regimes (W) - 3

The following weeding regimes were imposed in the experiment;

i.	No weeding	(W_0)
ii.	One weeding at 25 DAS	(W_1)
iii.	Two weeding at 25 DAS and 45 DAS	(W_2)

Combining two factors, 12 treatment combinations were obtained-as follows:

N_0W_0 = No nitrogen + No weeding (Control)

$N_{20}W_0$ = Basal nitrogen 20 kg ha^{-1} + No weeding

$N_{40}W_0$ = Basal nitrogen 20 kg ha^{-1} + split nitrogen 20 kg ha^{-1} + No weeding

$N_{60}W_0$= Basal nitrogen 20 kg ha^{-1} + split nitrogen 40 kg ha^{-1} + No weeding

N_0W_1 = No nitrogen + One weeding at 25 days after sowing

$N_{20}W_1$ = Basal nitrogen 20 kg ha^{-1} + One weeding at 25 days after sowing

$N_{40}W_1$ = Basal nitrogen 20 kg ha^{-1} + split nitrogen 20 kg ha^{-1} + One weeding at 25 days after sowing

$N_{60}W_1$ = Basal nitrogen 20 kg ha^{-1} + split nitrogen 40 kg ha^{-1} + One weeding at 25 days after sowing

N_0W_2 = No nitrogen + Two weeding at 25 days after sowing and 45 days after sowing

$N_{20}W_2$ = Basal nitrogen 20 kg ha^{-1} + Two weeding at 25 days after sowing and 45 days after sowing

$N_{40}W_2$ = Basal nitrogen 20 kg ha^{-1} + split nitrogen 20 kg ha^{-1} + Two weeding at 25 days after sowing and 45 days after sowing

$N_{60}W_2$ = Basal nitrogen 20 kg ha^{-1} + split nitrogen 40 kg ha^{-1} + Two weeding at 25 days after sowing and 45 days after sowing

3.8 Experimental design and layout

The experiment was laid out in a Randomized Complete Block Design (RCBD) with factorial arrangement. Each treatment was replicated three times. The size of unit plot was 4 m x 3 m. The distance between two adjacent replications (block) was 1m and plot to plot distance was 0.75 m. The inter block and inter plot spaces were used as footpath and irrigation/drainage channels.

3.9 Germination test

Germination test was performed before sowing the seeds in the field using petridishes. Three layers of filter paper were placed on petridishes and the filter papers were softened with water. Seeds were distributed at random in four petridishes. Each petridish contained 100 seeds. Germination percentage was calculated by using the following formula:

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Number of seeds set for germination}} \times 100$$

3.10 Sowing of seeds in the field

The seeds of were sown in rows made by hand plough on March 15, 2007. The seeds were sown in solid rows in the furrows having a depth of 2-3 cm from the soil surface. Row to row distance was 30 cm and plant to plant distance was 10 cm.

3.11 Intercultural operations

3.11.1 Weeding

The crop field was weeded or not weeded according to the treatment. First weeding was done at 25 DAS (Days after sowing) and second weeding at 45 DAS (Days after sowing). Three weeding regimes were done during the experiment according to the treatment of the design; (i) no weeding, (ii) one weeding and (iii) two weedings. Demarcation boundaries and drainage channels were also kept weed free.

3.11.2 Thinning

Thinning was done in all the unit plots with care so as to maintain the plant spacing as per treatment in each plot. Thinning was done at 25 DAS.

3.11.3 Irrigation

Pre sowing irrigation was done to maintain equal germination. After sowing two irrigations were done during the life cycle. First irrigation and second irrigation were done at 15 DAS and 30 DAS respectively.

3.11.4 Protection against insect and pest

At early stage of growth, few worms (*Agrotis ipsylon*) and virus vectors (Jassid) attacked the young plants. To control these pests, Dimacron 50 EC was sprayed at the rate of 1litre ha^{-1}. Spraying was done in the afternoon while the pollinating bees were away from the field.

3.12 Harvesting and threshing

Harvesting was done when leaves and stem of blackgram became yellowish in color and 90% of the pods became brown to black in color. The matured pods were collected by hand picking from a pre demarcated area of 1 m^2 at the centre of each plot. The harvested plants were tied into bundles and carried to the threshing floor. The crops were sun dried by spreading on the threshing floor. The seeds were separated from the pods by beating with bamboo sticks and later were cleaned, dried and weighed. The weights of the dry straw were also taken.

3.13 Crop sampling and data collection

At each harvest, ten plants were selected randomly from each plot. The selected plants of each plot were cut carefully at the soil surface level. The heights, number of leaves, pods and number of seeds pod^{-1} were recorded separately. The components were oven dried at 70°C for 72 hours to record constant dry weights. Total dry matter was determined by recording the dry weight of each portion of the plants.

3.14 Data collection

The data on the following parameters of ten plants were recorded at each harvest. The following data were recorded

i) Plant height (cm)

ii) Number of leaflets $plant^{-1}$

iii) Number of branches $plant^{-1}$

IV) Leaves dry weight (g)

v) Stem dry weight (g)

v) Reproductive dry weight (g)

vii) Aboveground dry weight (g)

viii) Number of pods $plant^{-1}$

ix) Wt. of 1000 seeds (g)

x) Number of seeds pod^{-1}

xi) Pod length (cm)

xii) Seed yield (kg ha^{-1})

xiii) Harvest index (%)

3.15 Procedure of data collection

3.15.1 Plant height (cm)

The height of the selected plant was measured from the ground level to the top of the plants and the mean height was expressed in cm.

3.15.2 Number of leaflets plant^{-1}

The leaflets were counted from ten sample plants. The average number of leaflets plant^{-1} was determined.

3.15.3 Number of branches plant^{-1}

The branches were counted from ten plants. The average number of branches plant^{-1} was determined.

3.15.4 Leaf dry weight

Ten plants were randomly selected from each treatment and leaves are separated from each plant then leaves were dried separately in an oven for 72 hours at 70^{0}C and weight was taken carefully. This procedure was done from 25 DAS to 75 DAS at 20 days interval.

3.15.5 Stem dry weight

Stems were separated from ten plants of each treatment. These stems were dried separately in oven for 72 hours dry was taken carefully. This procedure was done from 25 DAS to 75 DAS at 20 days interval.

3.15.6 Reproductive parts dry weight

Reproductive parts (flowers and pods) dry weight of ten plants of the each treatment was measured from 40 DAS to 75 DAS.

3.15.7 Aboveground plant parts dry weight

The sum of the plant parts (leaves dry weight, stem dry weight and reproductive parts dry weight) constituted the above ground dry weight.

3.15.8 Number of pods plant^{-1}

The number of pod from ten randomly selected plants from each plot was determined at the time of harvest to find out the number of pods plant^{-1}.

3.15.9 Number of seeds pod^{-1}

Twenty pods were taken randomly from each treatment and the seeds were separated and counted. Then the average seed number pod^{-1} was calculated.

3.15.10 Weight of 1000 seeds (g)

Weight of 1000 seeds was counted from each plot and weight was taken using an electrical balance and data were recorded.

3.15.11 Seed yield (kg ha^{-1})

Plants of selected 0.9 m^2 from each plot were harvested at complete maturity. The seeds of each pod were separated from the plants manually and were dried in the sun to a constant weight. Seed weight was recorded plot wise and yield were then converted to kg ha^{-1} basis.

3.15.12 Harvest index (%)

Harvest index was calculated with the following formula. It was calculated by using the following formula (Gardner *et al.*, 1985).

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (grain weight)}}{\text{Biological yield (Grain + Stover dry weight)}} \times 100$$

3.15.13 Analysis of data

The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT-C. The means were separated following least significance deference (LSD) test at 0.05 level of significance (Gomez and Gomez, 1984).

Chapter 4

Results and Discussion

Chapter 4

RESULTS AND DISCUSSION

The results regarding the effect of nitrogen and weeding regimes and their interactions on different growth and yield parameters of BARImash3 (blackgram) are presented and discussed in this chapter.

4.1 Plant height

4.1.1 Effect of nitrogen

Nitrogen application significantly increased the plant height of BARImash3 (Figure 1). The maximum plant height (64.74 cm) was observed from 60 kg N ha^{-1}. Plant height was progressively increased with the increase of nitrogen. The maximum plant height (64.74 cm) was recorded from 60 kg N ha^{-1} and second highest plant height (63.35 cm) with 40 kg N ha^{-1}. The increment of plant height with increased nitrogen might be due to high rate of cell division or cell elongation of blackgram plants. Saini and Thakur (1996) found similar results and Yein *et al.* (1981) found increased plant height of blackgram with nitrogen application.

4.1.2 Effect of weeding regimes

The result showed that the effect of weeding regimes on plant height was significant at 25 and 45 DAS (Figure 1). It was observed that two times weeding resulted with the highest plant height (63.69 cm) and no weeding showed the lowest plant height (56.62 cm). One weeding showed the medium result. Probably, weeding facilitated the plants to have more resources which rendered the increased plant height in this experiment. Similar result was obtained by Mahla *et al.* (1999) who observed that plant height of blackgram increased with increasing the weeding regimes.

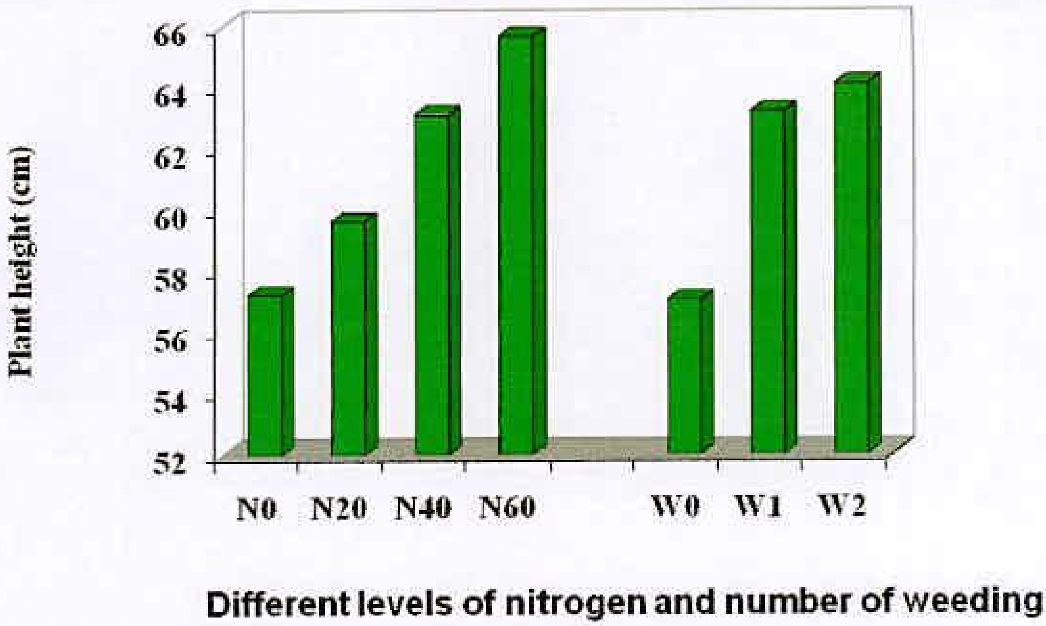

Figure 1. Effect of nitrogen and weeding regimes on plant height of BARImash3 ($LSD_{0.05}$=2.705 and 2.343, respectively)

N_0 = No nitrogen
N_{20} = 20 kg N ha^{-1}
N_{40} = 40 kg N ha^{-1}
N_{60} = 60 kg N ha^{-1}

W_0 = No weeding
W_1= One weeding at 25 DAS
W_2 = Two weeding at 25 DAS and 45 DAS

4.1.3 Interaction effect of nitrogen and weeding regimes

Interaction of nitrogen and weeding regimes also had significant affect the plant height of blackgram. Maximum plant height (66.52 cm) was found in treatment $N_{60}W_2$. On the contrary, the lowest plant height (52.20 cm) was found from the interaction of no nitrogen and no weeding (control).

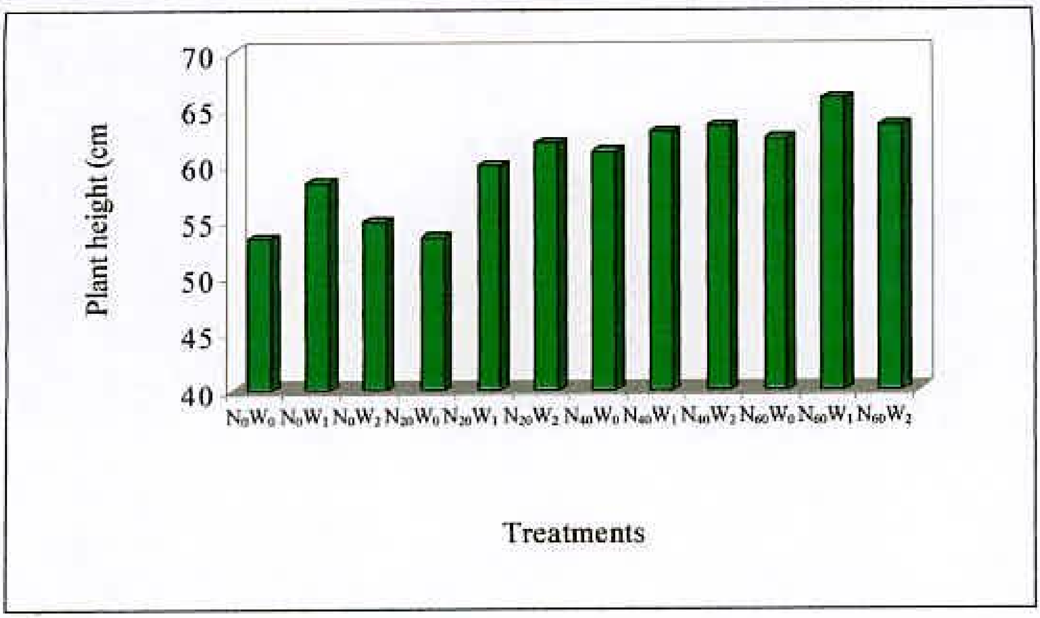

Figure 2. Interaction effect of nitrogen and weeding regimes on plant height of BARImash3 ($LSD_{0.05}$ = 4.686)

N_0 = No nitrogen	W_0 = No weeding
N_{20} = 20 kg N ha^{-1}	W_1 = One weeding at 25 DAS
N_{40} = 40 kg N ha^{-1}	W_2 = Two weeding at 25 DAS and 45 DAS
N_{60} = 60 kg N ha^{-1}	

4.2 Number of branches plant^{-1}

4.2.1 Effect of nitrogen

Effect of nitrogen on the number of branches plant^{-1} has been presented in figure 3. The figure shows that number of branches plant^{-1} increased progressively with the advances of growth stages and the highest number (6.38) was found at N_{40}. The lowest number of branches (5.34) plant^{-1} was found with control. Although, the maximum nitrogen doses (60 kg ha^{-1}) increased plant height but it did not increase in number of branches plant^{-1} compared to N_{40}. Ferdous (2001) noticed similar results in bushbean. Wein *et al.* (1997) also obtained the similar result in fieldpea.

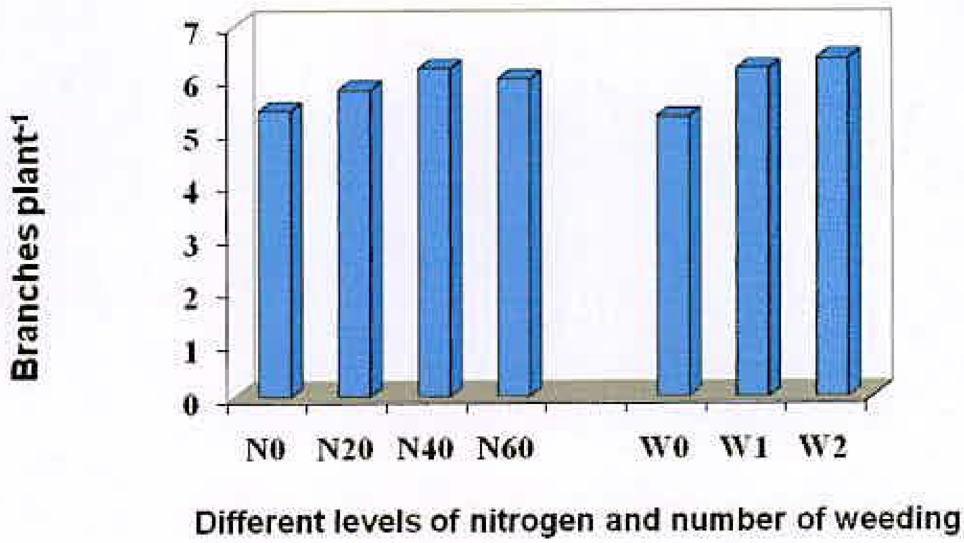

Figure 3. Effect of nitrogen and weeding regimes of branches plant^{-1} of BARImash3 ($LSD_{0.05}$ = 0.278 and 0.241, respectively)

N_0 = No nitrogen

N_{20} = 20 kg N ha^{-1}

N_{40} = 40 kg N ha^{-1}

N_{60} = 60 kg N ha^{-1}

W_0 = No weeding

W_1= One weeding at 25 DAS

W_2 = Two weeding at 25 DAS and 45 DAS

4.2.2 Effect of weeding regimes

Weeding regimes had a significant effect on number of branches plant^{-1} at different growth stages of BARImash (Figure 3). The result showed that two times of weeding (W_2) gave the highest number of branches (6.54) plant^{-1} whereas no weeding showed the lowest number of branches (5.23) plant^{-1}. One weeding (W_1) gave intermediate result at all growth stages which was significantly different from both no weeding (W_0) and two weedings (W_2). The result corroborates with the findings of Mahla *et al.* (1999) who observed that number of branches plant^{-1} of blackgram increased with increasing the number of weeding.

4.2.3 Interaction effect of nitrogen and weeding regimes

Interaction affect of Nitrogen and weeding regimes was affected by the number of branches plant^{-1} of BARImash. Maximum number of branches plant^{-1} (7.03) was found in treatment $N_{60}W_1$ (Figure 4). While, the lowest number of branches plant^{-1} (4.59) was found from treatment (N_0W_0).

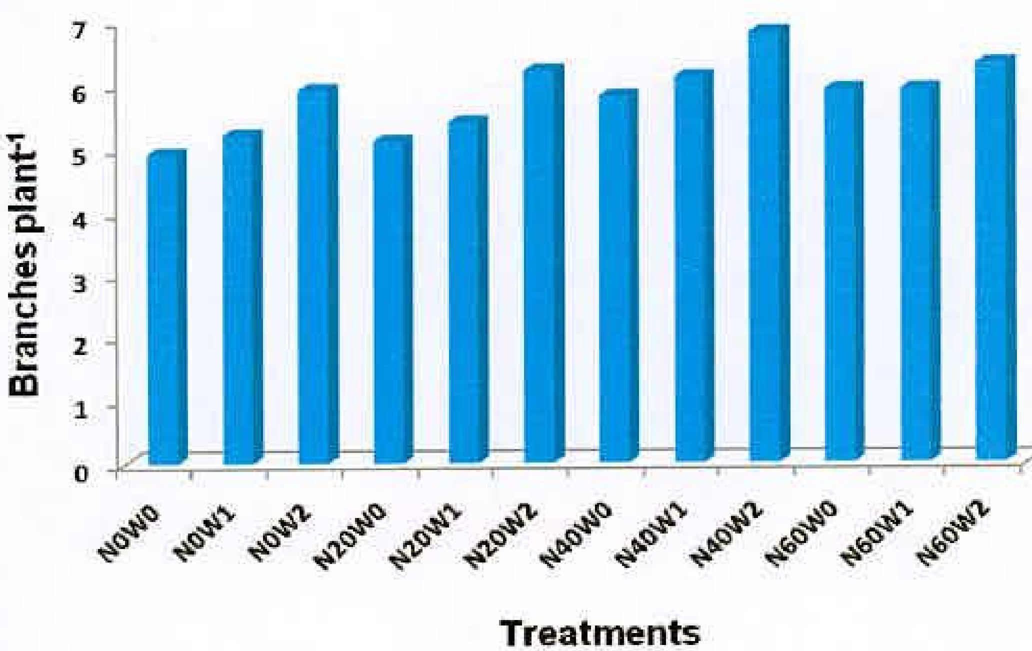

Figure 4. Interaction effect of nitrogen and weeding regimrs on the number of branches plant^{-1} of BARImash3) ($LSD_{0.05}$ = 0.481)

N_0 = No nitrogen

N_{20} = 20 kg N ha^{-1}

N_{40} = 40 kg N ha^{-1}

N_{60} = 60 kg N ha^{-1}

W_0 = No weeding

W_1 = One weeding at 25 DAS

W_2 = Two weeding at 25 DAS and 45 DAS

4.3 Number of leaflets plant^{-1}

4.3.1 Effect of nitrogen

Effect of nitrogen on the number of leaflets plant^{-1} has been presented in Figure 5. It appeared from the table that leaflets plant^{-1} showed an increasing trend with increases of growth stages. The 40 kg N ha^{-1} (N_{40}) showed highest number of leaflets (115.74) $plant^{-1}$ at all growth stages. Conversely N_0 gave the lowest number of leaflets (107.18) $plant^{-1}$. Srivastava and Verma (1982) showed that N application at a rate of 15 kg ha^{-1} increased the number of green leaflets, in blackgram plant.

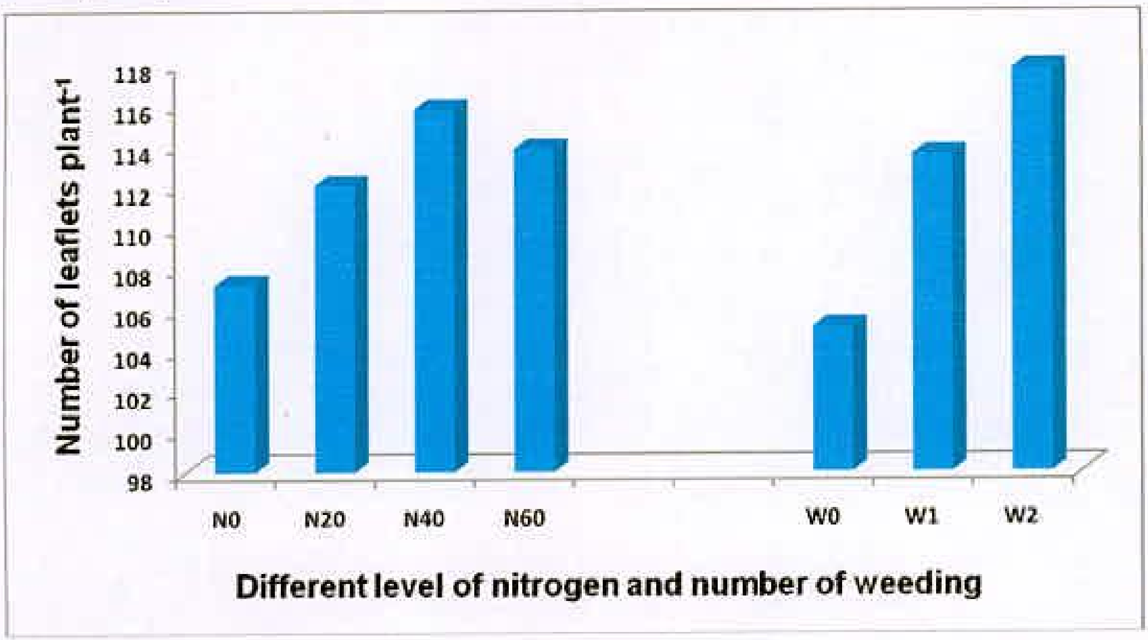

Figure 5. Effect of nitrogen and weeding regimes on number of leaflets $plant^{-1}$ of BARImash3 ($LSD_{0.05}$ = 5.14 and 4.452, respectively)

N_0 = No nitrogen

N_{20} = 20 kg N ha^{-1}

N_{40} = 40 kg N ha^{-1}

N_{60} = 60 kg N ha^{-1}

W_0 = No weeding

W_1 = One weeding at 25 DAS

W_2 = Two weeding at 25 DAS and 45 DAS

4.3.2 Effect of weeding regimes

Significant variation was found in total number of leaflets $plant^{-1}$ with different weeding regimes at all growth stages (Figure 5). The figure shows that number of leaflets increased with increased frequency of weeding regimes. The number of leaflets $plant^{-1}$ was much higher form 45 to 65 DAS than earlier stage. For all growth stages two weedings treatments (W_2) showed highest leaflets (117.70) plant^{-1} than no or one weeding treatment. The lowest number of leaflets (105.10) plant^{-1} was obtained from no weeding treatment (W_0)

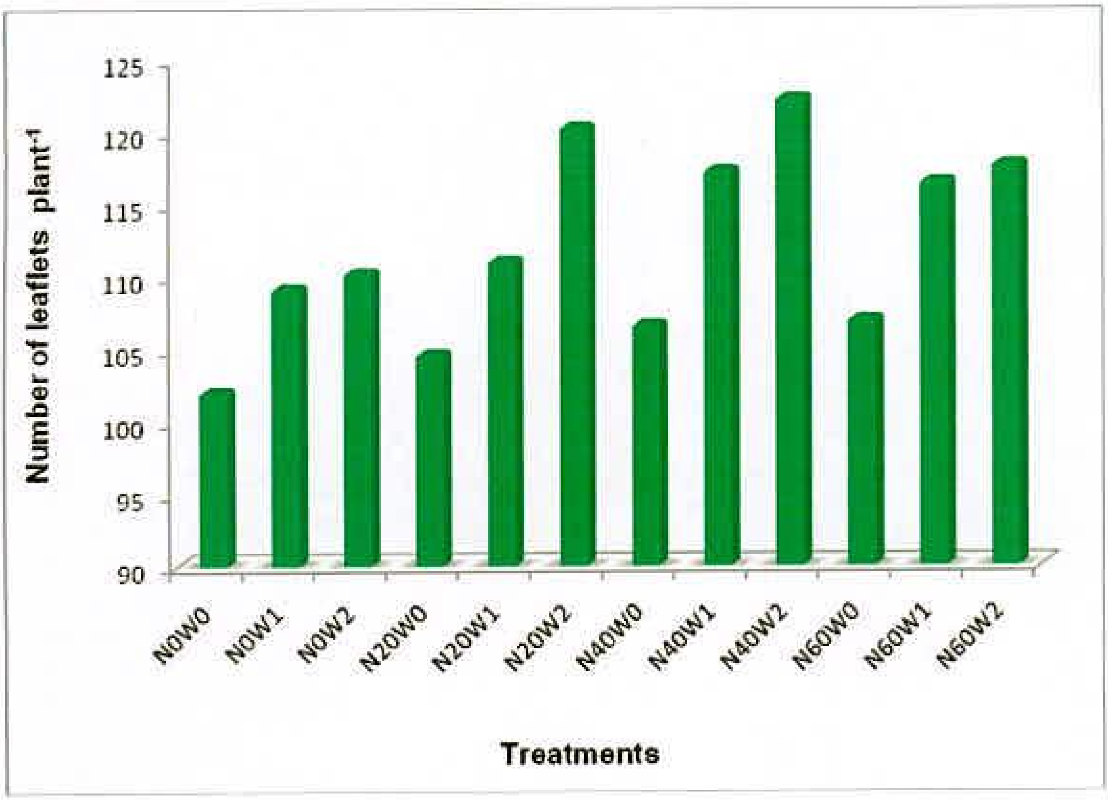

Figure 6. Interaction effect of nitrogen and weeding regimes on number of leaflets plant^{-1} of BARImash3 ($LSD_{0.05}$ = 8.90)

N_0 = No nitrogen	W_0 = No weeding
N_{20} = 20 kg N ha^{-1}	W_1= One weeding at 25 DAS
N_{40} = 40 kg N ha^{-1}	W_2 = Two weeding at 25 DAS and 45 DAS
N_{60} = 60 kg N ha^{-1}	

4.3.3 Interaction effect of nitrogen and weeding regimes

Nitrogen and weeding interaction affected the number of leaflets plant^{-1} of BARImash3 (Figure 6). Maximum number of leaflets (122.32) plant^{-1} was found in treatment $N_{60}W_1$ which was statistically similar with treatment $N_{40}W_2$

and $N_{20}W_1$. The lowest number of leaflets plant^{-1} (102.07) was found from treatment N_0W_0. Asheesh and Elamathi (2007) also found the similar results in case of experiment with mungbean.

4.4 Leaf dry matter (LDM) (g)

4.4.1 Effect of nitrogen

Doses of nitrogen have a significant effect on leaf dry matter production of BARImash3 (Table 1). The pattern of leaves dry matter production shoulded an increasing trend with the increasing of growth stages. The N_{40} treatment showed the highest (6.40 g) leaf dry matter production. The treatment N_0 showed the lowest leaf dry matter wt. (5.43 g) at all growth stages. However, the plants grown without fertilizer had minimum leaf dry weight at each growth stage. The intermediate levels of dry matter (6.18 g) production were obtained with the 20 kg N ha^{-1} as basal doses. Leelavathi *et al.* (1991) reported that also levels of nitrogen showed significantly increased dry matter production of blackgram up to 60 kg N ha^{-1}.

4.4.2 Effect of weeding regimes

Significant variation was found in leaf dry matter production with different weeding regimes at all the growth stages of BARImash3 (Table 2). It was observed that leaf dry matter production was increased with each increment of weeding regimes. It was also observed that two weedings at 25 days after sowing and 45 days after sowing respectively (W_2) produced the highest leaf dry matter (6.78 g) production and the lowest leaves dry matter (5.26 g) were achieved with no weeding. Mahla *et al.* (1999) obtained the similar result and reported that dry matter production plant^{-1} of blackgram increased with increasing weeding.

4.4.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding regimes affected the leaf dry matter production of BARImash3 (Table 3). Maximum leaves dry matter (7.47 g) production of BARImash3 was found in treatment ($N_{40}W_2$). The second height leaves dry matter (7.19 g) production in BARImash3 was found in treatment ($N_{20}W_2$). The lowest leaves dry matter (4.90 g) production in BARImash3 was found from treatment (N_0W_0).

4.5 Stem dry matter (SDM) (g)

4.5.1 Effect of nitrogen

Different doses of nitrogen have a significant effect on stem dry matter production of BARImash3 (Table 1). The pattern of stem dry matter production shoulded an increasing trend with the increasing of growth stages. The treatment (N_{40}) showed the highest stem dry matter (6.67 g) production than treatment (N_0). The zero dose of nitrogen (0 kg ha^{-1}) showed lowest stem dry matter (6.17 g) production for all growth stages of BARImash3 because plants grown without fertilizer had minimum stem dry matter at each growth stage. The intermediate stem dry matter (6.53 g) production was obtained with the treatment (N_{40}) as basal doses. Leelavathi *et al.* (1991) reported that different levels of nitrogen showed significantly increased dry matter production of blackgram up to 60 kg N ha^{-1}.

4.5.2. Effect of weeding regimes

Significant variation was found in stem dry matter production with different weeding regimes at all growth stages of BARImash3 (Table 2). It was observed that stem dry matter production was increased with each increment of weeding regimes. It was also observed that two weeding at 25 days after sowing and 45 days after sowing respectively produce the highest stem dry matter (6.78 g) the treatment (W_2) and the lowest stem dry matter (6.08 g) production were achieved from treatment (W_0). Mahla *et al.* (1999) obtained the similar result that dry matter production $plant^{-1}$ of blackgram increased with increasing weeding.

4.5.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding regimes affected the stem dry matter production of BARImash3 (Table 3). Maximum stem dry matter (7.10 g) production of BARImash3 was found in treatment ($N_{40}W_2$). The second height stem dry matter (6.75 g) production of BARImash3 was found in treatment ($N_{20}W_2$). The lowest stem dry matter (5.77 g) production in BARImash3 was found from treatment (N_0W_0).

4.6 Reproductive dry matter (RDM) (g)

4.6.1 Effect of nitrogen

Different doses of nitrogen have a significant effect on reproductive dry matter production of BARImash3 (Table 1). The pattern of reproductive dry matter production should an increasing trend with the increasing of growth stages. Treatment (N_{40}) showed the highest reproductive dry matter (6.04 g) production than treatment (N_{20}). The lowest doses of nitrogen (0 kg ha^{-1}) showed lowest reproductive dry matter (4.97 g) production for all growth stages of BARImash3. Because plants grown without fertilizer had minimum reproductive dry matter at each growth stage. The intermediate reproductive dry matter (5.90 g) production was obtained with the treatment (N_{20}). Leelavathi *et al.* (1991) reported that different levels of nitrogen showed significantly increased dry matter production of blackgram up to 60 kg N ha^{-1}.

4.6.2. Effect of weeding regimes

Significant variation was found in reproductive dry matter production with different weeding regimes at all growth stages of BARImash3 (Table 2). It was observed that reproductive dry matter production was increased with each increment of weeding regimes. It was also observed that two weeding at 25 days after sowing and 45 days after sowing respectively produce the highest reproductive dry matter (6.48 g) and the lowest reproductive dry matter (4.59 g) production were achieved with no weeding. Mahla *et al.* (1999) obtained the similar result that dry matter production $plant^{-1}$ of BARImash3 increased with increasing weeding regimes.

4.6.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding regimes affected the reproductive dry matter production of BARImash3 (Table 3). Maximum reproductive dry matter (7.16 g) production of BARImash3 was found in treatment ($N_{40}W_2$). The second height reproductive dry matter (6.56 g) production in BARImash3 was found in treatment ($N_{20}W_2$). The lowest reproductive dry matter (3.85 g) production in BARImash3 was found from treatment (N_0W_0).

4.7 Aboveground dry matter (AGDM) (g)

4.7.1 Effect of nitrogen

Different doses of nitrogen have a significant effect on aboveground dry matter production of BARImash3 (Table 1). The pattern of aboveground dry matter production showed an increasing trend with the increasing of growth stages. Treatment (N_{40}) showed the highest aboveground dry matter (19.11 g) production than treatment (N_0). The treatment (N_0) showed lowest aboveground dry matter (16.58 g) production for all growth stages of BARImash3. Because plants grown without fertilizer had minimum aboveground dry matter at each growth stage. The intermediate aboveground dry matter (18.26 g) production was obtained with the treatment (N_{20}). Lower dry weight in control plot might be due to internal nutrient and moisture stresses of plant, which caused reduction in both cell division and cell elongation and reduced carbohydrate synthesis and hence the growth was minimum (Kurmer and Karion, 1988). Leelavathi *et al.* (1991) reported that different levels of nitrogen showed significantly increased dry matter production of blackgram up to 60 kg N ha^{-1}.

4.7.2 Effect of weeding regimes

Significant variation was found in aboveground dry matter production with different weeding regimes at all growth stages of BARImash3 (Table 2). It was observed that reproductive dry matter production was increased with each increment of weeding regimes. It was also observed that two weeding at 25 days after sowing and 45 days after sowing respectively produce the highest aboveground dry matter (20.04 g) production and the lowest aboveground dry matter (15.94 g) production were achieved with no weeding. Mahla *et al.* (1999) obtained the similar result that dry matter production plant^{-1} of BARImash3 increased with increasing weeding regimes.

4.7.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding regimes affected the aboveground dry matter production of BARImash3 (Table 3). Maximum aboveground dry matter (21.73 g) production of BARImash3 was found in treatment ($N_{40}W_2$). The second height aboveground dry matter (20.51 g) production in BARImash3 was found in treatment ($N_{20}W_2$). The lowest aboveground dry matter (14.52 g) production in BARImash3 was found from treatment (N_0W_0).

Table 1. Dry matter production in different plant parts of BARImash3 as affected by nitrogen

Nitrogen	LDM (g)	SDM (g)	RDM (g)	AGDM (g)
N_0	5.43	6.17	4.97	16.57
N_{20}	6.18	6.46	5.62	18.26
N_{40}	6.40	6.67	6.04	19.11
N_{60}	6.17	6.53	5.90	18.60
LSD (0.05)	**0.48**	**0.29**	**0.23**	**0.62**
CV%	**7.99**	**4.55**	**4.23**	**3.50**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}
LDM = Leaves dry matter, SDM = Stems dry matter, RDM = Reproductive dry matter, AGDM = Aboveground dry matter

Table 2. Dry matter production in different plant parts of BARImash3 as affected by weeding regimes

Weeding	LDM (g)	SDM (g)	RDM (g)	AGDM (g)
W_0	5.26	6.09	4.59	15.94
W_1	6.10	6.53	5.85	18.48
W_2	6.78	6.78	6.48	20.04
LSD (0.05)	**0.41**	**0.25**	**0.21**	**0.54**
CV%	**7.99**	**4.55**	**4.23**	**3.50**

W_0 = No weeding; W_1= One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

LDM = Leaves dry matter, SDM = Stems dry matter, RDM = Reproductive dry matter, AGDM = Aboveground dry matter

Table 3. Dry matter production in different plant parts of BARImash3 as affected by the interaction effect of nitrogen and weeding regimes

Treatments	LDM (g)	SDM (g)	RDM (g)	AGDM (g)
N_0W_0	4.90	5.77	3.85	14.52
N_0W_1	5.63	6.28	5.27	17.19
N_0W_2	5.75	6.48	5.79	18.02
$N_{20}W_0$	5.16	6.07	4.49	15.73
$N_{20}W_1$	6.20	6.55	5.82	18.57
$N_{20}W_2$	7.19	6.75	6.56	20.51
$N_{40}W_0$	5.40	6.23	4.78	16.40
$N_{40}W_1$	6.33	6.65	6.18	19.16
$N_{40}W_2$	7.47	7.10	7.16	21.73
$N_{60}W_0$	5.56	6.26	5.23	17.06
$N_{60}W_1$	6.26	6.60	6.12	18.89
$N_{60}W_2$	6.70	6.74	6.36	19.64
LSD (0.05)	**0.81**	**0.50**	**0.40**	**1.07**
CV%	**7.99**	**4.55**	**4.23**	**3.50**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}

W_0 = No weeding; W_1 = One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

LDM = Leaves dry matter, SDM = Stems dry matter, RDM = Reproductive dry matter, AGDM = Aboveground dry matter

4.8 Pod length (cm)

4.8.1 Effect of nitrogen

Nitrogen levels had significant effect on the length of pod of BARImash3 (Table 4). The maximum length of pod (4.67 cm) was found form N_{60}. The second highest length of pod (4.66 cm) was observed with the treatment N_{40} which was identical with N_{60}. The control plot without any nitrogen produced the minimum length of pod in this study. Nitrogen induced increase in pod length which was also reported in BARImash3 and green gram (Singh *et al.* 1993).

4.8.2 Effect of weeding regimes

Weeding regimes also had a significant role in the elongation of pod (Table 5). In this study, the maximum length (4.84 cm) was observed form two weeding treatment (W_2) where no weeding treatment produced the minimum pod length (4.33 cm). One weeding produced the second highest length of pod (4.55 cm) which was statistically different from others.

4.8.3 Interaction effect of nitrogen and weeding regimes

Interaction of nitrogen and weeding affected the pod length of BARImash3 (Table 6). Maximum pod length (4.95 cm) of BARImash3 was found in treatment ($N_{40}W_2$) which was statistically significant. The second highest pod length (4.93 cm) was found in treatment ($N_{20}W_2$). The lowest pod length (4.21 cm) was found from treatment (N_0W_0).

4.9 Number of pods plant^{-1}

4.9.1 Effect of nitrogen

Greater photosynthesis enhanced more nutrient uptake that helps to initiate more flowering buds, which ultimately develops as pods. Nitrogen requirement of a plant depends on its demand and is controlled genetically or by the nutrient status present in the soil. The number of pods plant^{-1} significantly increased with the increasing levels of nitrogen (Table 4). Plants treated with 40 kg N ha^{-1} showed highest number of pods (22.63) plant^{-1} for all growth stages. The second highest number of pods (21.97) plant^{-1}and lowest number of pods (19.45) plant^{-1} was recorded form the plants treated with 20 kg N ha^{-1} (N_{20}) and 0 kg N ha^{-1} (N_0) respectively. Application of N above 40 kg ha^{-1} did not show any advantage in relation to pod setting. This result was similar to those reported by Ferdous (2001). Probably optimum nitrogen and soil moisture restricted flower and pod dropping which might have contributed to more pods per plant as reported by Biswas (2001) in fieldbean.

4.9.2 Effect of weeding regimes

Weeding treatment exerted as significant effect on number of pods plant^{-1} in BARImash3 (Table 5). Number of pods plant^{-1} increased significantly with the increased the weeding regimes. Two weeding at 25 and 45 days after sowing (W_2), produced the highest number of Pods (23.45) plant^{-1} than lessen number of weeding. It appeared from the result that two weeding at 25 and 45 days after sowing showed higher pods plant^{-1} than single or no weeding treatment. The second highest number of pods (21.35) plant^{-1} was found from one weeding treatment (W_1). Pascua (1988) determined the critical period of weed control and competition on mungbean yield. He stated that the pods plant^{-1} the treatments that gave lower fresh weight of weed had higher number of seeds pod^{-1}, which supports this result. Kalita *et al.* (1995) obtained the similar result stating that times of weeding (2 or 3 times) resulted the greatest seed yield which were associated with a greater number of pods plant^{-1} and seeds pod^{-1}

4.9.3 Interaction effect of nitrogen and weeding regimes

Interaction of nitrogen and weeding regimes affected the number of pods plant^{-1} of BARImash3 (Table 6). Maximum number of pods (24.96) plant^{-1} of BARImash3 was found in treatment ($N_{40}W_2$) (Table 6) which was statistically higher. The second greatest number of pods (23.98) plant^{-1} in BARImash3 was found in treatment ($N_{20}W_2$). The lowest number of pods (19.15) plant^{-1} in BARImash3 was found from treatment (N_0W_0).

4.10 Number of seeds pod^{-1}

4.10.1 Effect of nitrogen

Effect of nitrogen on the number of seeds pod^{-1} was found highly significant in this experiment (Table 4). The maximum number of seeds (6.70) pod^{-1} was found form the treatment of N_{40}. The second highest number of seeds (6.55) pod^{-1} that was observed with the treatment of (N_{60}). The control plot without any nitrogen produced the minimum number of seeds (5.81) pod^{-1}. This finding was partly supported by Singh *et al.* (1993) who stated that application of nitrogen increased the number of seeds per pod.

4.10.2 Effect of weeding regimes

Effect of weeding regimes on the number of seeds pod^{-1} was found highly significant in this experiment (Table 6). The results showed that two times of weeding gave the highest number of seeds pod^{-1} (7.10) which was then followed by one weeding (6.81) (W_1). No weeding gave the lowest number of seeds (5.18) pod^{-1}. Kalita *et al.* (1995) obtained similar result who stated that times of weeding (2 or 3 times) resulted the greatest seed yield which were associated with a greater number of pods plant^{-1} and seeds pod^{-1}.

4.10.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding affected the number of seeds pod^{-1} of BARImash3 (Table 6). Maximum number of seeds (7.47) pod of BARImash3 was found in treatment ($N_{40}W_2$) which was statistically significant. The second highest number of seeds (7.30) pod^{-1} was found in treatment ($N_{20}W_2$). In the contrary, the lowest number of seeds (4.91) pod^{-1} was found from treatment (N_0W_0).

4.11 Weight of 1000 seeds (g)

4.11.1 Effect of nitrogen

Effect of nitrogen on the 1000 seeds weight (g) was found significant effect in this experiment. The 1000 seeds weight (g) varied from 35.41g to 38.34 g (Table 4). The maximum 1000 seeds weight (37.21g) was found form the treatment (N_{40}) and the second highest (36.88 g) was observed from treatment (N_{20}). The control plot without any nitrogen produced the minimum 1000 seeds weight (35.71 g). Singh *et al.* (1993) in blackgram and greengram Roy *et al.* (1995) in sesame also got the highest seed weight with moderate nitrogen level.

4.11.2 Effect of weeding regimes

Weight of 1000 seeds (g) was significantly affected by weeding treatment (Table 5). Results showed that 1000 seeds weight (g) increased gradually with the increases of weeding regimes. Two weeding treatments at 25 and 45 days after sowing showed the highest value (37.42 g) of 1000 seeds weight which was 1.84% and 0.98% higher than W_0 and single weeding (W_1) treatments. Patel *et al.* (1984) observed similar result expressing that two of weeding significantly increased 1000 seed weight of mungbean compared to control treatment.

4.11.3 Interaction effect of nitrogen and weeding regimes

No significant interaction effect of nitrogen and weeding regimes was found responsive to 1000 seeds weight (g) of BARImash3 (Table 6). Maximum 1000 seeds weight (38.34 g) was found in the treatment ($N_{40}W_2$). The second highest 1000 seeds weight (38.14 g) was found in treatment ($N_{20}W_2$). The lowest 1000 seeds weight (35.41 g) was found from treatment (N_0W_0).

Table 4. Yield contributing characters of BARImash3 as affected by nitrogen

Nitrogen	Pod length (cm)	Number of pods plant^{-1}	Number of seeds pod^{-1}	Wt. of 1000 seeds (g)
N_0	4.39	19.45	5.81	35.71
N_{20}	4.58	21.97	6.40	36.88
N_{40}	4.66	22.63	6.70	37.21
N_{60}	4.67	20.85	6.55	36.81
LSD (0.05)	**0.19**	**1.28**	**0.26**	**0.93**
CV (%)	**4.22**	**6.18**	**4.13**	**2.59**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}

Table 5. Yield contributing characters of BARImash3 as affected by weeding regimes

Weeding	Pod length (cm)	Number of pod plant^{-1}	Number of seeds pod^{-1}	Wt. of 1000 seeds (g)
W_0	4.332	18.85	5.182	35.74
W_1	4.553	21.35	6.818	36.81
W_2	4.841	23.45	7.102	37.42
LSD	**0.163**	**1.11**	**0.224**	**0.81**
CV (%)	**4.22**	**6.18**	**4.13**	**2.59**

W_0 = No weeding; W_1= One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

Table 6. Yield contributing characters of BARImash3 as affected by the interaction effect of nitrogen and weeding regimes

Treatments	Pod length (cm)	Number of pods $plant^{-1}$	Number of Seeds pod^{-1}	Wt. of 1000 seeds (g)
N_0W_0	4.21	19.16	4.91	35.41
N_0W_1	4.39	20.71	6.19	36.09
N_0W_2	4.56	20.75	6.34	35.62
$N_{20}W_0$	4.24	19.85	5.05	35.70
$N_{20}W_1$	4.56	22.21	6.85	36.78
$N_{20}W_2$	4.93	23.98	7.30	38.14
$N_{40}W_0$	4.40	20.96	5.38	35.82
$N_{40}W_1$	4.63	23.07	7.24	37.48
$N_{40}W_2$	4.95	24.96	7.47	38.34
$N_{60}W_0$	4.46	18.78	5.38	36.00
$N_{60}W_1$	4.62	21.06	6.99	36.88
$N_{60}W_2$	4.91	21.81	7.28	37.57
LSD (0.05)	**0.32**	**2.29**	**0.44**	**1.61**
CV (%)	**4.22**	**6.18**	**4.13**	**2.59**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}

W_0 = No weeding; W_1= One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

4.12 Seed yield (kg ha^{-1})

4.12.1 Effect of nitrogen

Seed yield kg ha^{-1} was significantly affected by nitrogen (Table 7). The highest seed yield (1618.21kg ha^{-1}) was observed in the treatment (N_{40}) which was statistically similar to treatment (N_{20}) and treatment (N_{60}). The lowest yield (1306.33 kg ha^{-1}) was observed from the control treatment (N_0). Treatment of (N_{40}) probably influenced plant to have good production of dry matter in early stage and that eventually raised and partitioned to the reproductive units. These findings agreed well with Bachchhav *et al.* (1994) who found that application of 40 kg N ha^{-1} resulted with highest seed yield. Similar result was also found in bushbean (Ahlawat and Sharma, 1998) and in pea (Ferdous, 2001). The report of Singh *et al.* (1993) revealed that the higher grain yield of blackgram was mainly owing to significantly superior yield attributes like effective number of pods plant^{-1} and 1000-seeds weight.

4.12.2 Effect of weeding regimes

Grain yield (kg ha^{-1}) was significantly affected at different weeding regimes of BARImash3 (Table 8). The results showed that two times weeding gave the highest grain yield (1748 kg ha^{-1}) and no weeding showed the lowest grain yield (1248 kg ha^{-1}). One weeding gave the medium result (1509 kg ha^{-1}). Similar result was found in mungbean by Singh *et al.* (1988) and Yadav *et al.* (1983) that weeded plants showed higher yield compared to unwedded (control).

4.12.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding affected the grain yield of BARImash3 (Table 9). Maximum grain yield (1917.31 kg ha^{-1}) of BARImash3 was found in treatment ($N_{40}W_2$). The second height grain yield (1831.06 kg ha^{-1}) in BARImash3 was found in treatment ($N_{20}W_2$). The lowest grain yield (1046.86 kg ha^{-1}) in BARImash3 was found from treatment (N_0W_0).

4.13 Harvest index (%)

4.13.1 Effect of nitrogen

Nitrogen effect on harvest index was highly significant (Table 7). Higher HI might be beneficial in obtaining higher economic yield. A significant increase in HI was found in BARImash3 due to application of nitrogen. The highest HI of 33.80 % was observed in treatment (N_{40}). It was due to the increased dry matter accumulation, better root development resulting from higher partitioning of dry matter towards the production of economic yield. The lowest HI (31.28 %) was observed at control treatment (N_0). Similar results were recorded in bushbean (Islam, 2001) in mungbean (Akhtaruzzaman, 1998) and in sesame (Roy *et al.* 1995).

4.13.2 Effect of weeding regimes

Harvest index was significantly affected by weeding regimes of BARImash3 (Table 8). The results showed that two times weeding at 25 days after sowing and 45 days after sowing respectively gave the highest harvest index (33.76 %) and no weeding showed the lowest harvest index (31.07 %). One weeding gave the medium result (33.08 %).

4.13.3 Interaction effect of nitrogen and weeding regimes

Interaction effect of nitrogen and weeding affected by harvest index of BARImash3 (Table 9). Maximum harvest index (36.18 %) of the crop was found in treatment ($N_{40}W_2$). The second height harvest index (34.32 %) of BARImash3 was found in treatment ($N_{20}W_2$). The lowest harvest index (30.36 %) of BARImash3 was found from treatment (N_0W_0).

Table 7. Yield ha^{-1} and harvest index (%) of BARImash3 as affected by nitrogen

Nitrogen	Yield (kg ha^{-1})	Harvest Index (%)
N_0	1306.33	31.28
N_{20}	1558.80	32.91
N_{40}	1618.21	33.80
N_{60}	1576.37	32.56
LSD	**53.21**	**1.12**
CV%	**5.89**	**3.51**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}

Table 8. Yield ha^{-1} and harvest index (%) of BARImash3 as affected by weeding regimes

No. of weeding	Yield (kg ha^{-1})	Harvest Index (%)
W_0	1288	31.07
W_1	1509	33.08
W_2	1748	33.76
LSD	**46.08**	**0.97**
CV%	**5.89**	**3.51**

W_0 = No weeding; W_1 = One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

Table 9. Yield ha^{-1} and harvest index (%) of BARImash3 as affected by interaction effect of nitrogen and weeding regimes

Treatments	Yield (kg ha^{-1})	Harvest Index (%)
N_0W_0	1046.86	30.36
N_0W_1	1433.58	31.58
N_0W_2	1438.56	31.89
$N_{20}W_0$	1358.77	30.95
$N_{20}W_1$	1486.59	33.46
$N_{20}W_2$	1831.06	34.32
$N_{40}W_0$	1363.42	31.41
$N_{40}W_1$	1573.91	33.77
$N_{40}W_2$	1917.31	36.18
$N_{60}W_0$	1383.63	31.56
$N_{60}W_1$	1541.05	33.49
$N_{60}W_2$	1804.42	32.63
LSD	**92.16**	**1.94**
CV%	**5.89**	**3.51**

N_0 = No nitrogen; N_{20} = 20 kg N ha^{-1}; N_{40} = 40 kg N ha^{-1}; N_{60} = 60 kg N ha^{-1}

W_0 = No weeding; W_1= One weeding at 25 DAS; W_2 = Two weeding at 25 and 45 DAS

Chapter 5

Summary and Conclusion

Chapter 5

SUMMERY AND CONCLUSION

The experiment was conducted at the research field of Sher-e-Bangla Agricultural University (SAU) during the period from March to May, 2007 to study the effect of nitrogen and weeding regimes on yield attributes and yield of blackgram. The variety BARImash3 of blackgram was used as study material. The experiment was conducted with two factors in four levels of nitrogen and three weeding regimes. Factor A: Nitrogen (N) – 4; four levels were used in the experiment such as No nitrogen (N_0); 20 kg N ha^{-1} as basal dose (N_{20}); 40 kg N ha^{-1} (N_{40}) and 60 kg N ha^{-1} (N_{60}). Factor B: Weeding regimes (W)- weeding regimes was imposed in the experiment was; No weeding (W_0); One weeding at 25 DAS (W_1) and Two weeding at 25 and 45 DAS (W_2). Combining two factors, 12 treatment combinations were obtained. The experiment was conducted in a randomized complete block design (RCBD) with three replications.

Significant variation was found in plant height for different nitrogen levels. The tallest plant height (64.74 cm) was found the plots treated with 60 kg N ha^{-1} and 0 kg N ha^{-1} resulted with the shortest plant height among the treatments. Significant variation was found in plant height for different weeding regimes. The treatment two weeding gave the tallest plant (63.69 cm). Maximum plant height (66.52 cm) was found from the combination ($N_{60}W_2$) treatment. Dry weight was greatly influenced by weeding. The control treatment (no weeding) produced the lowest dry weight $plant^{-1}$ for all growth stages. Among nitrogen doses treatment N_{40} produced the highest dry weight. Two weeding produced the highest dry weight at all growth stages. The interaction of two weeding with 40 kg N ha^{-1} showed maximum dry weight and that of the lowest was observed from the interaction of no weeding with 0 kg N ha^{-1} at the time of harvest.

The highest (6.38) and the lowest (5.34) number of branches $plant^{-1}$ were observed from N_{40} and N_0, respectively. Two weeding produced the highest number (6.54) of branches $plant^{-1}$ and that was minimum (5.23) in the control. On the other hand, interaction of two weeding with 40 kg N ha^{-1} produced the highest number of branches $plant^{-1}$ (7.03) under the study. Among nitrogen levels 40 kg N ha^{-1} produced the highest (22.63) and 0 kg N ha^{-1} produced the lowest (19.45) pod $plant^{-1}$. Number of pods $plant^{-1}$ was highest (23.45) with two weeding and that of the lowest with zero weeding (18.85). Two weeding with 40 kg N ha^{-1} interaction produced the highest number of pod $plant^{-1}$ (24.96) and no weeding with no nitrogen interaction produced the lowest number of pod $plant^{-1}$ (19.15).

Number of seeds pod^{-1} was significantly affected by weeding, nitrogen and their interaction. Two weeding produced the highest number of seeds pod^{-1} (7.47) whereas control produced the lowest (4.91). However, no significant effect was found in the combined effect of seeds pod^{-1} and 1000 seeds weight. Treatment combination of two weeding with 40 kg N ha^{-1} and one weeding with 40 kg N ha^{-1} produced the highest number of seeds pod^{-1} (7.47 and 7.24, respectively) and two weeding with 20 kg N ha^{-1} gave similar result (7.30). No weeding with 0 kg N ha^{-1} showed lowest seeds pod^{-1} (4.91). Interaction effect of treatments on thousand seed weight was non-significant but two weeding produced the highest thousand seed weight (37.42), whereas no weeding produced the lowest 1000 seeds weight. Interaction of two weeding with 40 kg N ha^{-1} produced the highest weight of 1000 seeds (38.34 g) and no weeding with 0 kg N ha^{-1} produced the lowest 1000 seeds weight (35.41 g).

Seed yield (kg ha^{-1}) varied significantly among the weeding regimes, nitrogen doses and their interaction. Two weeding produced the highest seed yield (1748 kg ha^{-1}) whereas control treatment produced the lowest seed yield (1288 kg ha^{-1}). The treatment 40 kg N ha^{-1} and 0 kg N ha^{-1} produced the highest and the lowest seed yield, respectively. Interaction of two weeding with 40 kg N ha^{-1} produced the highest seed yield (1917.31 kg ha^{-1}) which was 83.15% higher than that of the lowest yield (1046.86 kg ha^{-1}) by no weeding with 0 kg N ha^{-1}. Among different nitrogen levels 40 kg N ha^{-1} produced the highest harvest index (33.80%) with the three weeding regimes; two weeding gave the highest harvest index (33.76%). Interaction of two weeding with 40 kg N ha^{-1} produced the highest harvest index (36.18%) in this study. From the present study, it might be concluded that weeding regimes influenced the growth, yield and yield components of BARImash3 (blackgram). Weeding (at 25 and 45 DAS), 40 kg N ha^{-1} and the interaction between two weeding with 40 kg N ha^{-1} were found as most promising in terms of yield and yield attributes of the blackgram variety BARImash3.

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Appendices

APPENDICES

Appendix I. Physical characteristics and chemical composition of soil of the experimental plot

Soil Characteristics	Analytical results
Agro-ecological Zone	Madhupur Tract
P^H	5.46 – 5.61
Organic matter	0.80
Total N (%)	0.41
Available phosphorous	21 ppm
Exchangeable K	0.42 meq / 100 g soil

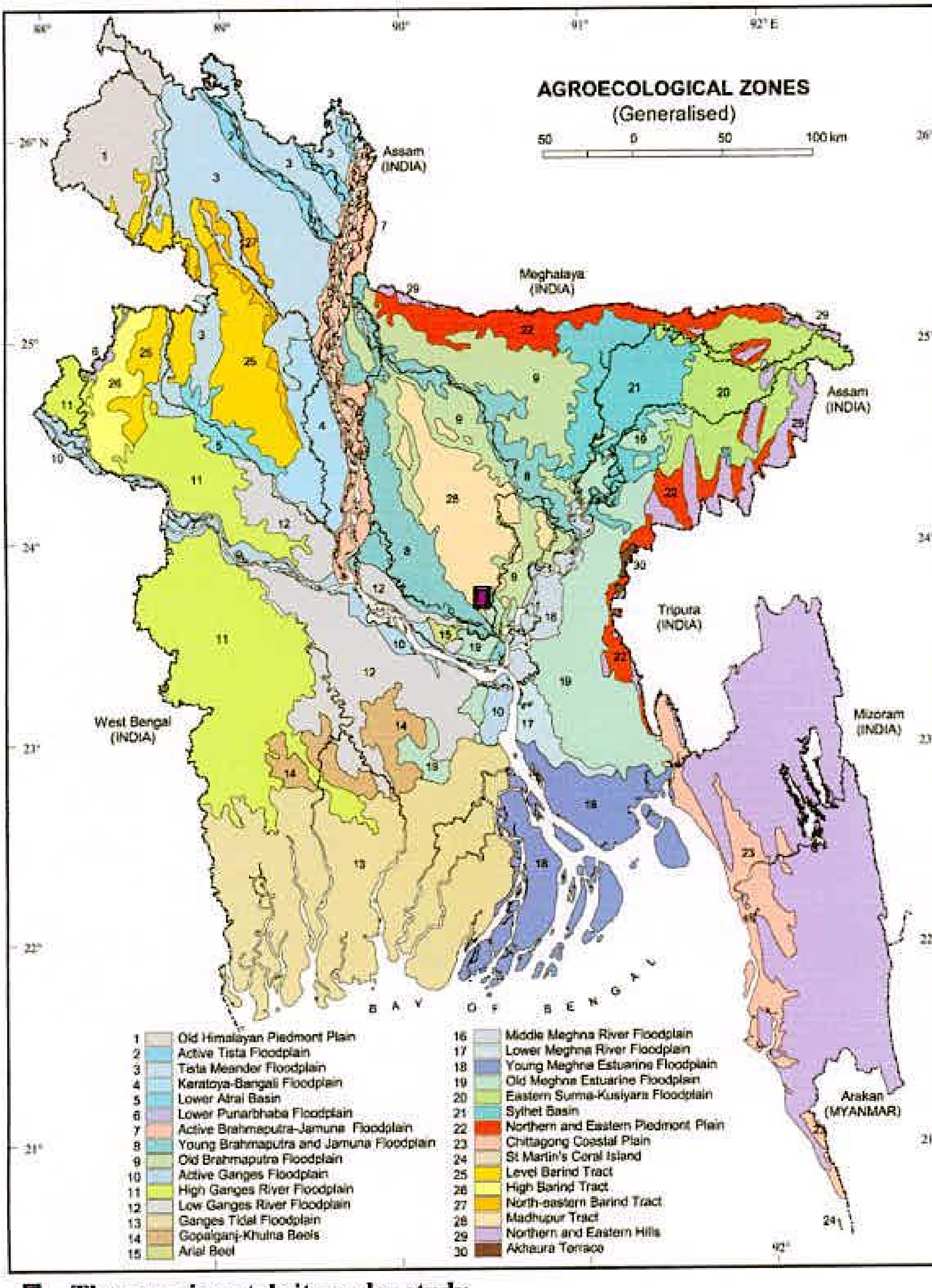
Source: Soil Resources Development Institute (SRDI)

Appendix II. Monthly average air temperature, rainfall, relative humidity, soil temperature and Sunshine of the experimental site during February to May, 2007

	Month	*Air temperature (°c)		*Relative humidity (%)	*Rain fall (mm) (total)	*Sunshine (hr)
		Maximum	Minimum			
2007	February	28.29	17.26	48	8	7.58
	March	31.4	19.6	54	11	8.2
	April	33.6	23.6	69	163	6.4
	May	34.7	25.9	70	185	7.8

* Monthly average,
* Source: Bangladesh Meteorological Department (Climate and weather division) Agargoan, Dhaka - 1212

Appendix III. Experimental location on the map of Agro-ecological Zones of Bangladesh



■ **The experimental site under study**