GROWTH AND YIELD RESPONSE OF MUNGBEAN VARIETIES UNDER DIFFERENT WEED MANAGEMENTS

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CERTIFICATE

This is to certify that the thesis entitled "**Growth and Yield Response of Mungbean Varieties Under Different Weed Managements**" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment 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 **Nurun Naher**, Registration number: **04-01442** 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 duly been acknowledged.

Dated:
Dhaka, Bangladesh

Dr. Md. Fazlul Karim
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ABSTRACT

The experiment was conducted in the Farm of Sher- e- Bangla Agricultural University during the period from August to November 2008 to study the growth and yield response of mungbean varieties under different weed managements. The experiment consisted of two factors. Factor A: Mungbean variety (2 levels): V_1= BARI Mung-5 and V_2= BARI Mung-6; Factor B: Weed management (7 levels): W_0= No weeding (Control), W_1= One weeding at 15 days after sowing (DAS), W_2= One weeding at 25 DAS, W_3= One weeding at 35 DAS, W_4= Two weedings at 15 and 35 DAS, W_5= Two weedings at 25 and 45 DAS and W_6= Weed free condition. The experiment was laid out in a factorial Randomized Complete Block Design (RCBD) with three replications. Results revealed that, the mungbean variety BARI Mung-6 stand superior than BARI Mung-5 in respect of plant height (58.45 cm and 56.14 cm), branches plant^{-1} (22.90 and 20.91), dry matter content plant^{-1} (18.10 g and 17.82 g), pods plant^{-1} (77.30 and 74.92), seeds plant^{-1} (319.24 and 300.20), seed yield (1.51 t ha^{-1} and 1.34 t ha^{-1}) and stover yield (2.29 t ha^{-1} and 2.13 t ha^{-1}), respectively. Among weed management practices, maximum pods / plant (79.32) seeds/ plant(336.17), seed yield (1.62 t ha^{-1}) & straw yield (2.53 t ha^{-1}) obtained from weed free which was at par to weeding once & two weedings. In intraction, the variety BARI Mung-6 weeded twice at 15 & 35 DAS produced maximum yield (1.75 t ha^{-1}) as well as yield attributes. This treatment showed 68.3% higher seed yield than control.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Bangladesh is a developing country. The land of our country is limited but the population is very high. More people need more food. Due to our huge population we have to produce more food in our limited land. To meet the increased demand of food, farmers are growing more cereal crops. Moreover due to the high population pressure the total cultivable lands have been decreasing day by day at a rate of one lac hectare per year for urbanization and other essentialities. The remaining land has been cultivating with irrigated *boro* rice, wheat and maize crops. Thus pulse has been shifted to marginal land to give space for the cereal crops. Pulses with poor yielding ability do not get farmers' choice in cultivating pulses on the main land.

Before present scenario, farmer grows various pulse crops. Among them grasspea, lentil, mungbean, blackgram, chickpea, field pea and cowpea are common. Pulse crop is an important food crop because it provides a cheap source of easily digestible dietary protein which complements the staple rice in the country. According to FAO (1999), per capita requirement of pulse by human should be 80 g, whereas it is only about 10.0 g in Bangladesh (BBS, 2007) thus the ideal cereal of pulse ratio (10:1) is not maintained which is now 30:1. This is fact that national production of the pulses is not adequate to meet the population demand.

Mungbean plays an important role to supplement protein in the cereal-based low-protein diet of the people of Bangladesh, but the acreage production of mungbean is gradually declining (BBS, 2007). However, it is one of the least cared crops. Mungbean is cultivated with minimum tillage, local varieties without fertilizers, pesticides and weed control measure. All these factors are responsible for low yield of mungbean which is incorporable with the yields of developed countries. At present the area under pulse crops is 0.406 million hectares with a production of 0.322 million tones where mungbean is cultivated in the area of 0.108 million hectares and the average yield is 0.69 t ha^{-1} (BBS, 2007). The variety and management of weed is the important factor that greatly affects the growth, development and yield of this crop.

Weed is one of the most important factors responsible for low yield of crops (Islam *et al.*, 1989). Mungbean is not very competitive against weed and therefore weed control is essential for mungbean production (Moody, 1978). Yield losses due to uncontrolled weed growth in mungbean ranges from 27 to 100% (Madrid and Vega, 1977; AVRDC, 1976). The rate of dry matter production in many crops is proportional to the intercepted radiation coupled with uptake of soil nutrients and moisture. 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, nutrients and moisture. The leaf area of mungbean may be reduced due to competition of weeds these radiation interception is markedly lower for dry matter production. Several authors reported that management of weeds coupled with higher yielding varieties of mungbean could be one of the solution to the back drop of mungbean cultivation. The judicial management of weed in mungbean cultivation is an important factor that greatly affects the growth, development and yield of mungbean varieties.

Hence, the present study was undertaken to maximize the seed yield of mungbean varieties with weed management practices. Considering the above circumstances, the present investigation has been undertaken with the following objectives:

i. To study the effect of variety to weed managements practices of mungbean.

ii. To determine the interaction effect of variety and weed management on the growth and yield of mungbean.

CHAPTER II

REVIEW OF LITERATURE

In Bangladesh and in many countries of the world mungbean is an important pulse crop. The crop has conventional less attention by the researchers on various aspects because normally it grows without care or management practices. Based on this a very few research work related to growth, yield and development of mungbean have been carried out in our country. However, researches are going on in home and abroad to maximize the yield of mungbean. Variety and weed managements play an important role in improving mungbean yield. But research works related to variety and weed managements on mungbean are limited in Bangladesh. However, some of the important and informative works and research findings related to the variety and weed managements so far been done at home and abroad on this crops have been reviewed in this chapter under the following headings-

2.1 Effect of variety on plant characters of mungbean

(a) Effect of fertilizer (NPK, bio-fertilizer etc) & irrigation

Chaisri *et al*. (2005) conducted a yield trial involving 6 recommended cultivars (KPS 1, KPS 2, CN 60, CN 36, CN 72 and PSU 1) and 5 elite lines (C, E, F, G, H) in Lopburi Province, Thailand, during the dry (February-May 2002), early rainy (June-September 2002) and late rainy season (October 2002-January 2003). The Line C, KPS 1, CN 60, CN 36 and CN 72 gave high yields in the early rainy season, while line H, line G, line E, KPS 1 and line C gave high yields in the late rainy session.

Two summer mungbean cultivars, i.e. Bina moog 2 and Bina moog 5, were grown during the kharif-1 season (February-May) of 2001, in Mymensingh, Bangladesh, under no irrigation or with irrigation once at 30 days after sowing (DAS), twice at 30 and 50 DAS, and thrice at 20, 30 and 50 DAS by Shamsuzzaman *et al*. (2004). The two cultivars tested were synchronous in flowering, pod maturity and leaf senescence, which were significantly delayed under different irrigated frequencies. Bina moog 2 performed slightly better than Bina moog 5 for most of the growth and yield parameters studied.

The performance of 20 mungbean cultivars were evaluated by Madriz-Isturiz and Luciani-Marcano (2004) in a field experiment conducted in Venezuela during the rainy season of 1994-95 and dry season of 1995. Significant differences in the values of the parameters measured due to cultivar were recorded. The cultivars VC 1973C, Creole VC 1973A, VC 2768A, VC 1178B and Mililiter 267 were the most promising cultivars for cultivation in the area with the average yield was 1342.58 kg/ha.

The development phases and seed yield were evaluated by Infante *et al*. (2003) in mungbean cultivars ML 267, Acriollado and VC 1973C under the agroecological conditions of Maracay, Venezuela, during May-July 1997. The differentiation of the development phases and stages, and the morphological changes of plants were studied. The variable totals of pod clusters, pods per plant, seeds per pods and pod length were also studied. The earliest cultivar was ML 267 with 34.87 days to flowering and 61.83 to maturity. There were significant differences for total pod clusters per plant and pods per plant, where ML 267 and Acriollado had the highest values. The total seeds per pod of VC 1973C and Acriollado were significantly greater than ML 267. Acriollado showed the highest yield with 1438.33 kg/ha.

(**b) Effect of seed rate and sowing date**

An experiment was conducted by Muhammad *et al*. (2006) to study the nature of association between *Rhizobium phaseoli* and mungbean. Inocula of two Rhizobium strains, Tal-169 and Tal-420 were applied to four mungbean genotypes viz., NM-92, NMC-209, NM-98 and Chakwal Mung-97. A control treatment was also included for comparison. The experiment was carried out at the University of Arid Agriculture, Rawalpindi, Pakistan, during kharif, 2003. Both the strains in association with NM-92 had higher nodule dry weight, which was 13% greater than other strains x mungbean genotypes combinations. Strain Tal-169 was specifically more effective on genotype NCM-209 and NM-98 compared with NM-92 and Chakwal Mung-97. Strain Tal-420 increased branches plant^{-1} of all the genotypes. Strain Tal-169 in association with NCM-209 produced the highest yield of 670 kg ha^{-1} which was similar (590 kg ha^{-1}) in case of NCM-209 either inoculated with strain Tal-420 or uninoculated. Variety NM-92 produced the lowest grain yield (330 kg ha^{-1}) either inoculated with strain Tal-420 or uninoculated.

Islam *et al*. (2006) carried out an experiment at the field laboratory of the Department of Crop Botany, Bangladesh Agricultural University, Mymensingh during the period from March 2002 to June 2002 to evaluate the effect of biofertilizer (*Bradyrhizobium*) and plant growth regulators (GA3 and IAA) on growth of 3 cultivars of summer mungbean (*Vigna radiata* L.). Among the mungbean varieties, Bina moog 5 performed better than that of Bina moog 2 and Bina moog 4.

Studies were conducted by Bhati *et al*. (2005) from 2000 to 2003 to evaluate the effects of cultivars and nutrient management strategies on the productivity of different kharif legumes (mungbean, mothbean and clusterbean) in the arid region of Rajasthan, India. The experiment with mungbean variety K-851 gave better yield than Asha and the local cultivar. In another experiment, mungbean cv. PDM-54 showed 56.9% higher seed yield and 13.7% higher fodder yield than the local cultivar.

A field experiment was conducted by Raj and Tripathi (2005) in Jodhpur, Rajasthan, India, during the kharif seasons, to evaluate the effects of cultivar (K-851 and RMG-62) as well as nitrogen (0 and 20 kg/ha) and phosphorus levels (0, 20 and 40 kg ha^{-1}) on the productivity of mungbean. The cultivars K-851 produced significantly higher values for seed and straw yields as well as yield attributes (plant height, pods $plant^{-1}$, seeds pod^{-1} and 1000-seed weight) compared with RMG-62. Higher net return and benefit:cost (B:C) ratio were also obtained with K-851 (Rs. 6544 ha^{-1} and 1.02, respectively) than RMG-62 (Rs. 4833 ha^{-1} and 0.76, respectively).

A field experiment was conducted by Apurv and Tewari (2004) during kharif season of 2003 in Uttaranchal, India, to investigate the effect of *Rhizobium* inoculation and fertilizer on the yield and yield components of three mungbean cultivars (Pusa 105, Pusa 9531 and Pant mung 2). The variety Pusa 9531 showed higher yield components and grain yield than Pusa 105 and Pant mung 2.

To find out the effects of *Rhizobium* inoculation on the nodulation, plant growth, yield attributes, seed and stover yields, and seed protein content of six mung bean (*Vigna radiata*) cultivars were investigated by Hossain and Solaiman (2004). The mungbean cultivars were BARI Mung-2, BARI Mung-3, BARI Mung-4, BARI Mung-5, Bina mung-2 and BU mung-1. *Rhizobium* strains TAL169 and TAL441 were used for inoculation of the seeds. Two-thirds of seeds of each cultivar were inoculated with *Rhizobium* inoculant and the remaining one-third of seeds were kept uninoculated. Among the cultivars, BARI Mung-4 performed the best in all aspects showing the highest seed yield of 1135 kg/ha. *Rhizobium* strain TAL169 did better than TAL441 in most of the studied parameters. It was concluded that BARI Mung 4 in combination with TAL169 performed the best in terms of nodulation, plant growth, seed and stover yields, and seed protein content.

Seeds of mungbean cultivars BM-4, S-8 and BM-86 were inoculated with *Rhizobium* strains M-11-85, M-6-84, GR-4 and M-6-65 before sowing in a field experiment conducted by Navgire *et al*. (2001) in Maharashtra, India during the kharif season of 1993-94 and 1995-96. S-8, BM-4 and BM-86 recorded the highest mean nodulation (16.66), plant biomass (8.29 q/ha) and grain yield (4.79 q/ha) during the experimental years. S-8, BM-4 and BM-86 recorded the highest nodulation, plant biomass and grain yield when their seeds were inoculated with *Rhizobium* strains M-6-84, M-6-65 and M-11-85, respectively.

Hamed (1998) carried out two field experiments during 1995 and 1996 in Shalakan, Egypt, to evaluate mung bean cultivars Giza 1 and Kawny 1 under 3 irrigation intervals after flowering (15, 22 and 30 days) and 4 fertilizer treatments: inoculation with *Rhizobium* (R) + Azotobacter (A) + 5 (N_1) or 10 kg N/feddan (N_2), and inoculation with R only +5 (N_3) or 10 kg N/feddan (N_4). Kawny 1 surpassed Giza 1 in pod number per plant (24.3) and seed yield (0.970 t/feddan), while Giza 1 was superior in 100-seed weight (7.02 g), biological and straw yields (5.53 and 4.61 t/feddan, respectively). While Kawny 1 surpassed Giza 1 in oil yield (35.78 kg/feddan), the latter cultivar recorded higher values of protein percentage and yield (28.22% and 264.6 kg/feddan). The seed yield of both cultivars was positively and highly significantly correlated with all involved characters, except for 100-seed weight of Giza 1 and branch number per plant of Kawny 1.

(c) Effect of weed management

Mungbean cultivars Pusa 105 and Pusa Vishal were sown at 22.5 and 30 cm spacing and supplied with 36-46 and 58-46 kg NP/ha in a field experiment conducted in Delhi, India during the kharif season of 2000. Cultivar Pusa Vishal recorded higher biological and seed yield (3.66 and 1.63 t/ha, respectively) compared to cv. Pusa 105 (Tickoo *et al*., 2006).

A field experiment was conducted by Aghaalikhani *et al*. (2006) at the Seed and Plant Improvement Institute of Karaj, Iran, in the summer of 1998, to evaluate the effects of crop densities (10, 13, 20 and 40 plants/m^2) on yield and yield components of two cultivars (Partow and Gohar) and a line of mungbean (VC-1973A), The results indicated that VC-1973A had the highest grain yield. Which was superior to the other cultivars due to its early and uniform seed maturity and easy mechanized harvest.

Rahman *et al*. (2005) conducted an experiment with mungbean in Jamalpur, Bangladesh, from February to June 1999, involving planting methods, i.e. line sowing and broadcasting; mungbean cultivars (5), namely Local, BARI Mung 2, BARI Mung 3, Bina moog 2 and Bina moog 5; and sowing dates(5), i.e. 5 February, 20 February, 5 March, 20 March and 5 April. Significantly the highest dry matter production ability was found in 4 high yielding cultivars, but dry matter partitioning was found highest in seeds of Bina moog 2 and lowest in Local. However, the local cultivar produced the maximum of dry matter in leaf and stem.

An experiment was conducted by Abid *et al*. (2004) in Peshawar, Pakistan, during the 2002 summer season to study the effect of sowing dates (15 April, 15 May, 15 June, 15 July and 15 August) on the agronomic traits and yield of mungbean cultivars NM-92 and M-1. Sowing on 15 April took more number of days to emergence but showed maximum plant height. The highest emergence/m^2 was recorded in 15 June-sown plants. Sowing on 15 August gave the highest number of days to 50% flowering and to physiological maturity, while 15 April-sown plants gave the highest mean grain yield. NM-92 gave higher mean grain yield than M-1. The highest seed yield was observed in 15 April-sown with cultivar M-1 plants.

The effect of seeding rates (15, 20 and 25 kg seed ha^{-1}) on the growth and yield of mungbean cultivars NM-92, NARC mung-1 and NM-98 was investigated in Faisalabad, Pakistan during 2002-03 by Riaz *et al*. (2004). The cultivar NM-98 produced the maximum pod number of 17.30, grain yield of 983.75 kg/ha and harvest index (24.91%) where cultivar NM-92 produced the highest seed protein content of 24.64%.

Taj *et al*. (2003) carried out an experiment to find out the effects of seeding rates (10, 20, 30 and 40 kg seed/ha) on the performance of 5 mungbean cultivars (NM-92, NM 19-19, NM 121-125, N/41 and a local cultivar) were studied in Ahmadwala, Pakistan, during the summer season of 1998. Among the cultivars, NM 121-125 recorded the highest average pods per plant (18.18), seed per pod (9.79), 1000-seed weight (28.09 g) and seed yield (1446.07 kg ha^{-1}).

(d) Effect of seed treatment

The study was carried out in the Field Laboratory of the Department of Crop Botany, Bangladesh Agricultural University, Mymensingh during the period from

October 2000 to February 2001 by Quaderi *et al*. (2006) to evaluate the influence of seed treatment with Indole Acetic Acid (IAA) at a concentration of 50 ppm, 100 ppm and 200 ppm on the growth, yield and yield contributing characters of two modern mungbean (*Vigna radiata* L.) varieties viz. BARI Mung 4 and BARI Mung 5. Among the mungbean varieties, BARI moog 5 performed better than that of BARI Mung 4.

2.2 Time of weed control on plant characters of mungbean

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, 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 seed yield of mungbean when weeded at 10 DAE.

A field study was conducted by Chattha *et al*. (2007) in Islamabad, Pakistan, during 2003-04 to determine the effect of different weed control methods on the yield and yield components of mungbean. In this study different weed control methods (chemical, mechanical, hand weeding and their integration) were compared for their efficiency to control various weed species under rainfed conditions of Pakistan. Among different weed control methods, use of herbicide tribunal 70 WP (methabenzthiazuron) at 2 kg ha^{-1} at 2-3 leaf stage of weeds + hand weeding at 50 DAS gave promising results in terms of weed reduction. This was closely followed by mechanical weeding after 20 days of crop sowing with a follow-up hand weeding after 50 days of crop sowing and/or two hand weeding after 20 and 40 days of crop sowing. Maximum reduction in density and biomass of the weeds was observed by chemical weeding at 2-3 leaf stage of weeds + hand weeding at 50 DAS. There was a significant increase (50%) in grain yield of mungbean due to chemical weeding at 2-3 leaf stage of weeds + hand weeding at 50 DAS. Similarly, this treatment out yielded other treatments in terms of number of pods per plant, number of seeds per pod, 1000 grain weight, grain yield and net benefits. The economic analysis of these weed control methods also showed better performance of chemical weeding at 2-3 leaf stage of weeds + hand weeding at 50 DAS as compared to rest of the treatments.

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 yield. The treatments comprised: 0.75 kg linuron/ha; 1.0 kg linuron/ha; 0.75 kg linuron/ha + hand weeding at 35 days after sowing (DAS); 1.0 kg pendimethalin/ha; 1.25 kg pendimethalin/ha; 1.0 kg pendimethalin/ha + hand weeding at 35 DAS; 200 g thiazopyr/ha; 240 g thiazopyr/ha; 200 g thiazopyr/ha + hand weeding at 35 DAS; 0.75 kg acetachlor/ha; 1.0 kg acetachlor/ha; 0.75 kg acetachlor/ha + 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 + hand weeding at 35 DAS gave the highest seed yield (15.1 q/ha). Acetachlor at 0.75 kg/ha + hand weeding at 35 DAS gave the highest P uptake (11.3 kg/ha) while hand weeding at 20 and 30 DAS gave the highest protein content (22.5%).

Different weed control methods (chemical, mechanical, hand weeding and their integration) under various cropping patterns (wheat-fallow; wheat-maize-fallow;

and wheat-legume-fallow) were compared for their efficiency to control various weed species in wheat in Islamabad, Pakistan, during 2002-03 and 2003-04 by Riaz *et al*. (2007). Avena fatua, Fumaria indica, Euphorbia helioscopia, Melilotus indica, Chenopodium album, Medicago polymorpha and Convolvulus arvensis were the main weed species found in the field. Among the different weed control methods, the integrated weeding, i.e. chemical weeding (recommended dose of isoproturon) at 2-3 leaf stage of weeds with a follow-up hand weeding after 50 days of crop sowing (WC6) under wheat-mungbean-fallow cropping pattern, gave promising results. This was closely followed by mechanical weeding after 20 days of crop sowing with a follow-up hand weeding after 50 days of crop sowing (WC5) and/or two hand weedings after 20 and 40 days of crop sowing (WC2). These weed control methods significantly affected the yield and yield components of wheat during both years. The economic analysis of these weed control methods also showed better performance of WC6 compared to the rest of the treatments under all cropping patterns.

An experiment was conducted by Muhammad *et al*. (2004) in Pakistan during 2003 to investigate the efficacy of various weed management strategies in mungbean (cv. NIAB MUNG 98). Water extracts of sorghum, eucalyptus (*Eucalyptus camaldulensis*) and acacia (*Acacia nilotica*) were used in comparison with hand weeding and a pre-emergence herbicide (pendimethalin, Stomp 330 EC). The water extracts were prepared by soaking the chaffed herbage of sorghum, ground leaves of eucalyptus and pods of acacia in distilled water in 1:5 ratio for 72 h. The water extracts and hand weeding were applied twice, i.e. at 10 and 35 days after sowing. All the treatments significantly affected number of branches plant^{-1}, number of pods plant^{-1}, 1000-grain weight and grain yield. The water extract of acacia recorded the highest yield and almost all the yield components followed by the two hand weedings+pre-emergence herbicide treatment.

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, fluazifop-P-butyl [fluazifop-P] (Fusilade) at 2.0 l/feddan, bentazone (Basagran) at 0.75 l/feddan, butralin at 1.875 l/feddan+one hand hoeing (HH), fluazifop-P-butyl at 1.5 l/feddan+one HH, bentazone at 0.56 l/feddan+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 mung bean weeds compared to the unweeded treatment. The most effective treatments for weed control in mung bean 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 greengram (*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 seed yield were significantly influenced by weed management practices in both years. However, yield attributes and grain yield were unaffected by phosphorus. The highest cost : benefit ratio was obtained with a weed free treatment followed by one hand weeding..

Every crop has a stage during its life cycle when it is particularly sensitive to weed competition (Islam *et al*., 1989). 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. 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).

Sarker and Mondal (1993) observed that weeding at different dates after sowing affected some yield contributing characters and yield of mungbean. Seed yield was by 49 to 55% when weeds were not removed at all. Variable number of weedings in mungbean have been suggested viz., one weeding at 2 weeks after emergence, two weedings during early growth stage (Madrid and Vega, 1984), and three weedings during the first 3 weeks after sowing (Enyi, 1984) for optimum yield.

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

Panwar and Singh (1980) reported that weeding of mungbean at 20 DAE could effectively produce yields twice than that of unweeded plots. The knowledge of critical period of weed competition is a pre-requisite for a good harvest.

Mungbean is not very competitive against weeds and, therefore, weed control is essential for mungbean production (Moody, 1978). Yield losses due to uncontrolled weed growth in mungbean range from 27 to 100% (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.

Enyi (1984) reported that weeding up to 8weeks after sowing is reported for optimum yield of mungbean. He also reported that weed competition causes reduction in the number of pods/plant. The yield loss of mungbean was 95% during dry season in Philippines (Madrid and Vega, 1977).

Madrid and Vega (1977) reported that mungbean needs to be weeded for the first 5 weeks during wet season and only for 3 weeks in the dry season. Weed is one of the major constraints to high production of this crop during the kharif season.

From the above review, it could be summarized that the backdrop of mungbean cultivation may overcome with yield improvement through use of high yielding mungbean varieties coupled with optimum weed control management in its life cycle.

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted during the period from August to November 2008 to study the growth and yield response of mungbean varieties under different weed managements practics. The details materials and methods of this experiment are presented below under the following headings:

3.1 Experimental site

The experiment was conducted at the Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh. The experimental site is situated between $23^{0}74^{/}$N latitude and $90^{0}35^{/}$E longitude (Anon., 1989).

3.2 Soil

The soil of the experimental field belongs to the Tejgaon series under the Agroecological Zone, Madhupur Tract (AEZ- 28) and the General Soil Type is Deep Red Brown Terrace Soils. A composite sample was made by collecting soil from several spots of the field at a depth of 0-15 cm before the initiation of the experiment. The collected soil was air-dried, ground and passed through 2 mm sieve and analyzed for some important physical and chemical properties. The initial physical and chemical characteristics of the experimental soil are presented in Appendix I.

3.3 Climate

The climate of experimental site is subtropical, characterized by three distinct seasons, the monsoon from November to February and the pre-monsoon period or hot season from March to April and the monsoon period from May to October (Edris *et al.*, 1979). Meteorological data related to the temperature, relative humidity and rainfalls during the period of the experiment was collected from the Bangladesh Meteorological Department (Climate Division), Sher-e-Bangla Nagar where it showed that heavy rainfall (163 mm) occurrence during August & no rainfall in September & November (Appendix II).

3.4 Planting material

The variety BARI Mung-5 and BARI Mung-6 was used as the test crops. The seeds were collected from the Pulse Seed Division of Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. The variety BARI Mung-5 and BARI Mung-6 are the released varieties of mungbean, which grow both in *Kharif* and *Rabi* season. Life cycle of this variety ranges from 60-65 days. Maximum seed yield is 1.1-1.5 t/ha.

3.5 Land preparation

The land was irrigated before ploughing. After having ‘zoe’ condition the land was first opened with the tractor drawn disc plough. Ploughed soil was brought into desirable fine tilth by 4 ploughing and cross-ploughing, harrowing and laddering. The stubble and weeds were removed. The first ploughing and the final land preparation were done on 18 and 25 August 2008, respectively. Experimental land was divided into unit plots following the design of experiment.

3.6 Fertilizer application

Urea, Triple super phosphate (TSP) and Muriate of potash (MoP) were used as a source of nitrogen, phosphorous and potassium, respectively. Urea, T.S.P. and Fertilizer were used at the rate of 40, 40 and 50 kg N, P, K per hectare, respectively (FRG/2005). All of the fertilizers were applied during final land preparation.

3.7 Treatments of the experiment

The experiment consists of two factors:

Factor A: Mungbean variety

i) V_1= BARI Mung-5

ii) V_2= BARI Mung-6

Factor B: Weed management (7 levels)

i) W_0= No weeding (Control)

ii) W_1= One weeding at 15 days after sowing (DAS)

iii) W_2= One weeding at 25 days after sowing (DAS)

iv) W_3= One weeding at 35 days after sowing (DAS)

v) W_4= Two weeding at 15 and 35 days after sowing (DAS)

vi) W_5= Two weeding at 25 and 45 days after sowing (DAS)

vii) W_6= Weed free conditio

There were in total 14 treatment combinations such as V_1W_0, V_1W_1, V_1W_2, V_1W_3, V_1W_4, V_1W_5, V_1W_6, V_2W_0, V_2W_1, V_2W_2, V_2W_3, V_2W_4, V_2W_5 and V_2W_6.

3.8 Experimental design and layout

The two factors experiment was laid out in factorial Randomized Complete Block Design (RCBD) with three replications. Each block was divided into 14 plots where 14 treatment combinations were allotted at random. There were 3 replications. The unit plot size was 3.6 m × 2.5 m. The space between two blocks and two plots were 1.5 m and 0.75 m, respectively. The layout of the experiment is shown in Appendix III.

3.9 Sowing of seeds in the field

The seeds of mungbean were sown on August 26, 2008. Before sowing seeds were treated with Bavistin to control the seed borne disease. The seeds were sown in solid rows in the furrows having a depth of 2-3 cm. Row to row distance was 30 cm.

3.10 Intercultural operations

3.10.1 Thinning

Seeds started germination of four days after sowing (DAS). Thinning was done two times; first thinning was done at 8 DAS and second was done at 15 DAS to maintain optimum plant population in each plot (333333ha^{-1}).

3.10.2 Irrigation and weeding

1^{st} & 2^{nd} irrigation were given at 15 & 30 DAS. The crop field was weeded as per treatment. The plot was weeded 6 times for keeping the plot continuous free as per treatment W_6.

3.10.3 Protection against insect and pest

At early stage of growth few worms (*Agrotis ipsilon*) and virus vectors (jassid) infested the young plants and at later stage of growth pod borer (*Maruca testulalis*) attacked the plant. Dimacron 50EC was sprayed at the rate of 1 litre/ha to control the pest.

3.11 Crop sampling and data collection

Ten plants from each treatment were randomly selected and marked with sample tag . Plant height and branches plant^{-1} were recorded from selected plants at an interval of 10 days started from 20 DAS at harvest.

3.12 Harvest and post harvest operations

Harvesting was done when 90% of the pods became brown to black in color**.** The matured pods were collected by hand picking from a pre demarcated area of three linear meter at the center of each plot.

3.13 Data collection

The following data were recorded

i. Plant height (cm)
ii. Branches plant^{-1} (no.)
iii. Above ground dry matter plant^{-1} (g)
iv. Days to 1st flowering (no.)
v. Days to 80% pod maturity (no.)
vi. Pods plant^{-1} (no.)
vii. Seeds plant^{-1} (no.)

viii. Pod length (cm)

ix. Weight of 1000 seeds (g)

x. Seed yield (t ha^{-1})

xi. Stover yield (t ha^{-1})

xii. Harvest index (%)

3.14 Procedure of data collection

3.14.1 Plant height (cm)

The height of plants were measured with a meter scale from the ground level to the top of the plants and the mean height was expressed in cm.

3.14.2 Branches $plant^{-1}$ (no.)

The number of branches $plant^{-1}$ was counted from selected plants. The average number of branches per plant was determined.

3.14.3 Above ground dry matter $plant^{-1}$ (g)

Collected plants including roots, stem (with pods) and leaves was oven dried at 70^0C for 72 hours then transferred into desiceator and allowed to cool down to the room temperature and final weight was taken and converted into dry matter content per plant.

3.14.4 Days to 1st flowering (no.)

Days to 1st flowering were measured by counting the number of days required to start flower initiation in each plot.

3.14.5 Days to 80% pod maturity (no.)

Days to 80% pod maturity were measured by counting the number of days required to attain maturity of 80% pods. Maturity was measured on the basis of brown colour of leaves and stem and dark grey colour of pods.

3.14.6 Pods plant^{-1} (no.)

Numbers of total pods of selected plants from each plot were counted and the mean numbers were expressed as per plant basis. Data were recorded as the average of 10 plants selected at random from the inner rows of each plot.

3.14.7 Seeds plant^{-1} (no.)

The number of seeds per plant was recorded randomly from selected plants at the time of harvest. Data were recorded as the average of 10 plants selected at random from the inner rows of each plot.

3.14.8 Pod length (cm)

Pod length was taken of randomly selected twenty pods and the mean length was expressed on per pod basis.

3.14.9 Weight of 1000 seeds (g)

One thousand cleaned, dried seeds were counted randomly from each harvest sample and weighed by using a digital electric balance and weight was expressed in gram (g).

3.14.10 Seed yield (t ha^{-1})

The seeds collected from 3 linear meter of each plot were sun dried properly. The weight of seeds was taken and converted the yield in t ha^{-1}.

3.14.11 Stover yield (t ha^{-1})

The stover collected from 6 linear meter of each plot was sun dried properly. The weight of stover was taken and converted the yield in t ha^{-1}.

3.14.12 Harvest index

Harvest index was calculated from the seed and stover yield of mungbean and expressed in percentage.

$$\text{HI (\%)} = \frac{\text{Economic yield (seed weight)}}{\text{Biological yield (Total dry weight)}} \times 100$$

3.15 Estimated growth parameter

Using the data on the leaf area and dry matter, the following growth parameters were derived (Hunt, 1978):

Crop Growth Rate (CGR)

Crop growth rate was calculated using the following formula:

$$\text{CGR} = \frac{1}{GA} \times \frac{W_2 - W_1}{T_2 - T_1} \quad \text{g m}^{-2}\,\text{day}^{-1}$$

Where,

GA = Ground area (m^2)

W_1 = Total dry weight at previous sampling date

W_2 = Total dry weight at current sampling date

T_1 = Date of previous sampling

T_2 = Date of current sampling

Relative Growth Rate (RGR)

Relative growth rate was calculated using the following formula:

$$RGR = \frac{LnW_2 - LnW_1}{T_2 - T_1} \quad g\ g^{-1}\ day^{-1}$$

Where,

W_1 = Total dry weight at previous sampling date

W_2 = Total dry weight at current sampling date

T_1 = Date of previous sampling

T_2 = Date of current sampling

Ln = Natural logarithm

3.16 Statistical analysis

The data obtained for different parameters were statistically analyzed to find out the significant difference of different mungbean variety and weed managements on yield and yield contributing characters of mungbean. The mean values of all the characters were calculated and analysis of variance was performed by the 'F' (variance ratio) test. The significance of the difference among the treatment means was estimated by the Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

The experiment was conducted to study the growth and yield response of mungbean varieties under different weed managements. Data on different yield contributing characters and yield were recorded. The analyses of variance (ANOVA) of the data on different parameters are presented in Appendix IV-IX. The results have been presented with the help of table and graphs and possible interpretations given under the following headings:

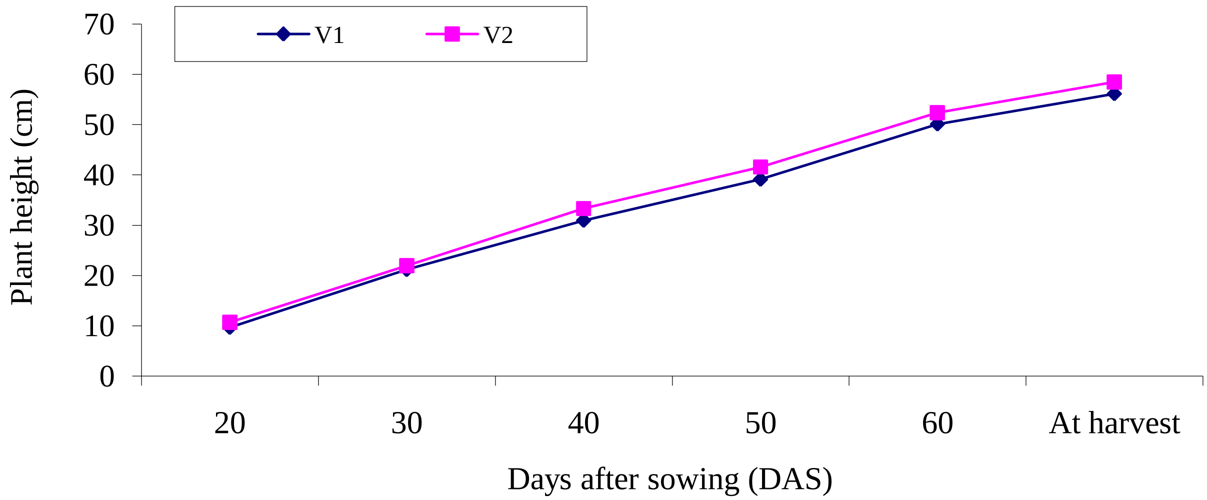
4.1 Plant height

Effect of variety

Plant height varied significantly at 20, 30, 40, 50, 60 DAS and at harvest for BARI Mung-5 and BARI Mung-6 (Figure 1). The tallest plant (10.68 cm, 21.94 cm, 33.30 cm, 41.55 cm, 52.35 cm and 58.45 cm, respectively) was recorded from V_2 (BARI Mung-6), and the shortest plant (9.65 cm, 21.15 cm, 30.95 cm, 39.11 cm, 50.12 cm and 56.14 cm) from V_1 (BARI Mung-5) at different DAS & harvest. The plant height depends of their varietal characters. Raj and Tripathi (2005) reported that cultivar K-851 gave significantly higher values for plant height compared with RMG-62.

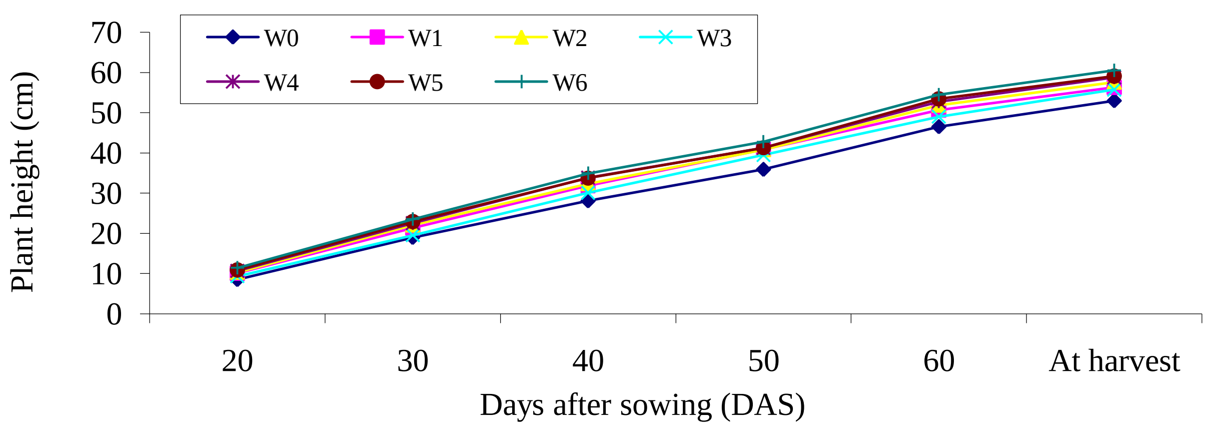
Effect of weed management

Different weed managements showed significant differences on plant height at 20, 30, 40, 50, 60 DAS and harvest (Figure 2). The tallest plant (11.41 cm, 23.52 cm, 34.92 cm, 42.79 cm, 54.45 cm and 60.54 cm, respectively) was observed from W_6



V_1= BARI mung-5 V_2= BARI mung-6

Figure 1. Effect of variety on plant height of mungbean at different days (SE ± = 0.281, 0.251, 0.586, 0.711, 0.447 and 0.415 at 20 DAS, 30 DAS, 40 DAS, 50 DAS, 60 DAS and at harvest, respectively)



W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weeding at 15 and 35 DAS W_5= Two weeding at 25 and 45 DAS
W_6= Weed free condition

Figure 2. Effect of weed management on plant height of mungbean at different days (SE ± = 0.526, 0.470, 1.096, 1.331, 0.837 and 0.776 at 20 DAS, 30 DAS, 40 DAS, 50 DAS, 60 DAS and at harvest, respectively)

(weed free condition), which was similar to W_5 (two weedings at 25 and 45 DAS) and W_4 (two weedings at 15 and 35 DAS), while the shortest (8.47 cm, 18.94 cm, 28.05 cm, 35.87 cm, 46.49 cm and 52.95 cm) from W_0 (no weeding) followed (9.34 cm, 19.51 cm, 30.09 cm, 39.47 cm, 48.99 cm and 55.73 cm) by W_3 (one weeding at 35 DAS).

Interaction effect of variety and weed managements

Interaction effect of mungbean variety and weed managements showed significant differences on plant height at 20, 30, 40, 50, 60 DAS and harvest (Table 1). At 20 DAS, maximum plant height (12.06 cm) was noted from V_1W_6 (BARI Mung-5 + weed free condition) and it was at par with V_2W_4 (BARI Mung -6 + two weedings at 15 and 35 DAS) (11.51 cm), V_1W_5 (BARI m Mung-5 + two weedings at 25 and 45 DAS) (11.37 cm), V_2W_6 (BARI Mung-6 + weed free condition) (10.75 cm),V_2W_2 (BARI Mung-6 + one weeding at 25 DAS) (10.68 cm), V_2W_3 (BARI Mung-6 + one weeding at 35 DAS) (10.45 cm), V_2W_5 (BARI Mung-6 + two weedings at 25 and 45 DAS) (10.40 cm), V_2W_0 (BARI Mung-6 + no weeding) (10.23 cm), V_1W_2 (BARI Mung-5 + one weeding at 25 DAS) (9.91 cm), V_1W_4 (BARI Mung-5 + two weedings at 15 and 35 DAS) (9.79 cm). On the other hand the lowest plant height (6.71 cm) was recorded in V_1W_0 (BARI Mung-5 + no weeding) which was statistically similar with V_1W_3 (BARI Mung-5 + one weeding at 35 DAS) (8.22 cm). At 30 DAS, the highest plant height (24.18 cm) was noted from V_1W_6 and it was at par with V_2W_4 (24.01 cm), V_1W_5 (23.44 cm), V_2W_6

Table 1. Interaction effect of variety and weed managements on plant height of mungbean at different days

Treatments	Plant height (cm)					
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	At harvest
V_1W_0	6.71 d	18.03 f	24.00 e	32.27 e	42.06 f	49.20 d
V_1W_1	9.49 bc	20.81 c-e	32.60 a-c	40.23 a-d	49.24 de	55.86 bc
V_1W_2	9.91 a-c	21.46 b-d	31.45 bc	39.20 b-d	50.02 c-e	56.64 bc
V_1W_3	8.22 cd	19.12 ef	26.40 de	35.57 de	47.24 e	54.76 c
V_1W_4	9.79 a-c	21.02 c-e	30.42 cd	38.00 c-e	51.80 b-d	56.64 bc
V_1W_5	11.37 ab	23.44 ab	35.60 a-c	42.88 a-c	54.33 ab	59.31 ab
V_1W_6	12.06 a	24.18 a	37.28 a	45.63 a	56.13 a	60.55 a
V_2W_0	10.23 a-c	19.86 d-f	32.11 bc	39.47 a-d	50.92 b-e	56.70 bc
V_2W_1	10.72 a-c	21.80 b-d	31.16 bc	41.50 a-d	52.08 b-d	56.81 bc
V_2W_2	10.68 a-c	22.65 a-c	33.26 a-c	42.44 a-c	53.75 a-c	58.58 ab
V_2W_3	10.45 a-c	19.90 d-f	33.78 a-c	43.37 a-c	50.73 b-e	56.70 bc
V_2W_4	11.51 ab	24.01 a	36.18 ab	44.46 ab	53.72 a-c	60.96 a
V_2W_5	10.40 a-c	22.47 a-c	31.84 bc	39.66 a-d	52.51 a-d	58.85 ab
V_2W_6	10.75 ab	22.87 a-c	33.66 a-c	39.95 a-d	52.76 a-d	60.53 a
SE	0.744	0.665	1.550	1.882	1.184	1.098
Significance level	0.05	0.05	0.01	0.01	0.01	0.01
CV(%)	12.68	5.35	8.36	8.08	7.00	5.32

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS

W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS

W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS

W_6= Weed free condition

(22.87 cm), V_2W_2 (22.65 cm), V_2W_5 (22.47 cm), V_2W_1 (21.80 cm), V_1W_2 (21.46 cm), V_1W_4 (21.02 cm), V_1W_1 (20.81 cm). On the other hand the lowest plant height (18.03 cm) was recorded in V_1W_0 which was statistically similar toV_1W_3 (19.12 cm). At 40 DAS, the highest plant height (37.28 cm) was noted from V_1W_6 and it was at par with V_2W_4 (36.18 cm), V_1W_5 (35.60 cm), V_2W_6 (33.66 cm), V_2W_2 (33.26 cm), V_2W_5 (31.84 cm), V_2W_1 (31.16 cm), V_1W_2 (31.45 cm), V_1W_4 (30.42 cm), V_1W_1 (32.60 cm). On the other hand the lowest plant height (24.00 cm) was recorded in V_1W_0 which was statistically similar to V_1W_3 (26.40 cm). At 50 DAS, highest plant height (45.63 cm) was noted from V_1W_6 and it was at par with V_2W_4 (44.46 cm), V_1W_5 (42.88 cm), V_2W_6 (39.95 cm), V_2W_2 (42.44 cm), V_2W_3 (43.37 cm), V_2W_5 (39.66 cm), V_2W_0 (39.47 cm), V_1W_2 (39.20 cm), V_1W_4 (38.00 cm). On the other hand the lowest plant height (32.27 cm) was recorded in V_1W_0 which was statistically similar to V_1W_3 (35.57 cm). At 60 DAS, the highest plant height (56.13 cm) was noted from V_1W_6 and it was at par with V_2W_4 (53.72 cm), V_1W_5) (54.33 cm), V_2W_6 (52.76 cm), V_2W_2 (53.75 cm), V_2W_3 (50.73 cm), V_2W_5 (52.51 cm), V_2W_0 (50.92 cm), V_1W_2 (50.02 cm), V_1W_4 (51.80 cm). On the other hand the lowest plant height (42.06 cm) was recorded in V_1W_0 which was statistically similar to V_1W_3 (50.02 cm). At harvest, the highest plant height (60.96 cm) was noted from V_2W_4 and it was at par with V_1W_6 (60.55 cm), V_1W_5 (59.31 cm), V_2W_6 (60.53 cm), V_2W_2 (58.58 cm), V_2W_3 (56.70 cm), V_2W_5 (58.85 cm), V_2W_0 (56.70 cm), V_1W_2 (56.64 cm), V_1W_4 (56.64 cm). On the other hand the lowest plant height (49.20 cm) was recorded in V_1W_0 which was statistically similar to V_1W_3 (54.76 cm).

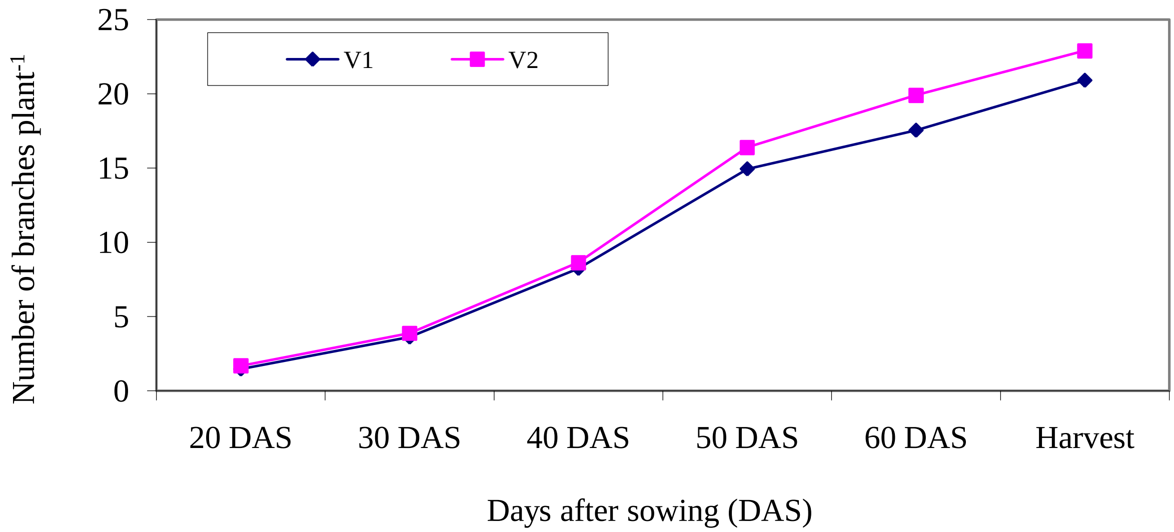
4.2 Branches plant^{-1}

Effect of variety

Significant variation was recorded for number of branches plant^{-1} at 20, 30, 40, 50, 60 DAS and harvest for BARI Mung-5 and BARI Mung-6 under the present trial (Figure 3). The maximum number of branches plant^{-1} (1.68, 3.87, 8.63, 16.39, 19.90 and 22.90) was found from V_2 (BARI Mung-6) and the minimum number of branches plant^{-1} (1.48, 3.63, 8.25, 14.95, 17.55 and 20.91) from V_1 (BARI Mung-5). The variety produced different number of branches plant^{-1} on the basis of their varietal characters and that was governed by genetical factor. Previous findings suggested that management practices influences the number of branches plant^{-1} but variety itself manipulated the number of branches hill^{-1}. Aghaalikhani *et al*. (2006) reported with two cultivars (Partow and Gohar) and a line of mungbean (VC-1973A) where line was superior to the other cultivars due to its number of branches per plant of mungbean.

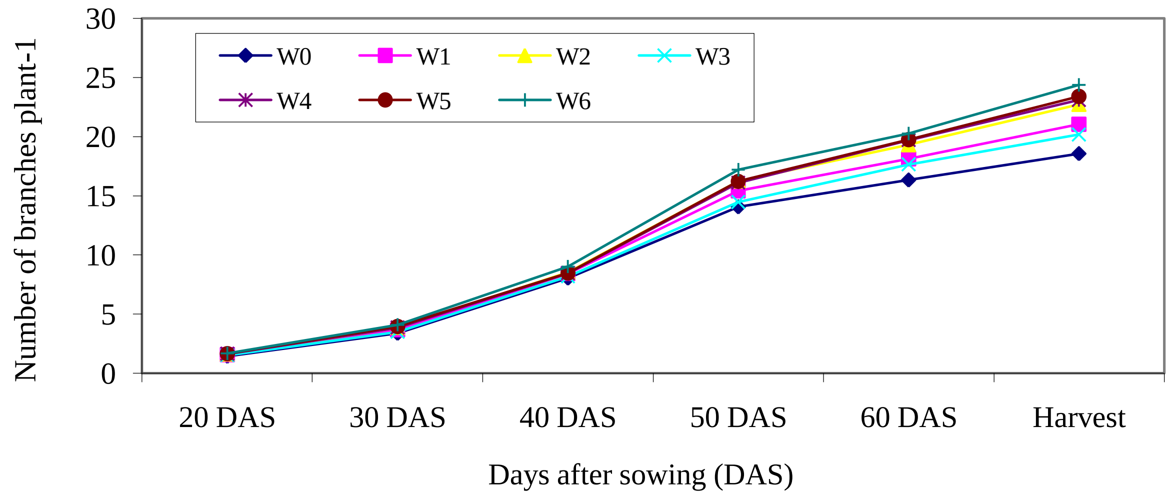
Effect of weed management

Number of branches plant^{-1} showed significant variation for different weed managements at 20, 30, 40, 50, 60 DAS and at harvest (Figure 4). The maximum number of branches plant^{-1} (1.68, 4.10, 9.02, 17.20, 20.25 and 24.37) was recorded from W_6 (weed free condition), which was statistically similar (1.65, 3.95, 8.47, 16.22, 19.75 and 23.40) to W_5 (two weedings at 25 and 45 DAS), while the minimum number of branches plant^{-1} (1.43, 3.37, 8.03, 14.05, 16.32 and 18.55) from W_0 (no weeding) followed (1.52, 3.50, 8.18, 14.47, 17.65 and 20.18)



V_1: BARI Mung-5 V_2: BARI Mung-6

Figure 3. Effect of variety on branches plant^{-1}of mungbean at different days (SE ± = 0.022, 0.051, 0.086, 0.259, 0.281 and 0.291 at 20 DAS, 30 DAS, 40 DAS, 50 DAS, 60 DAS and at harvest, respectively)



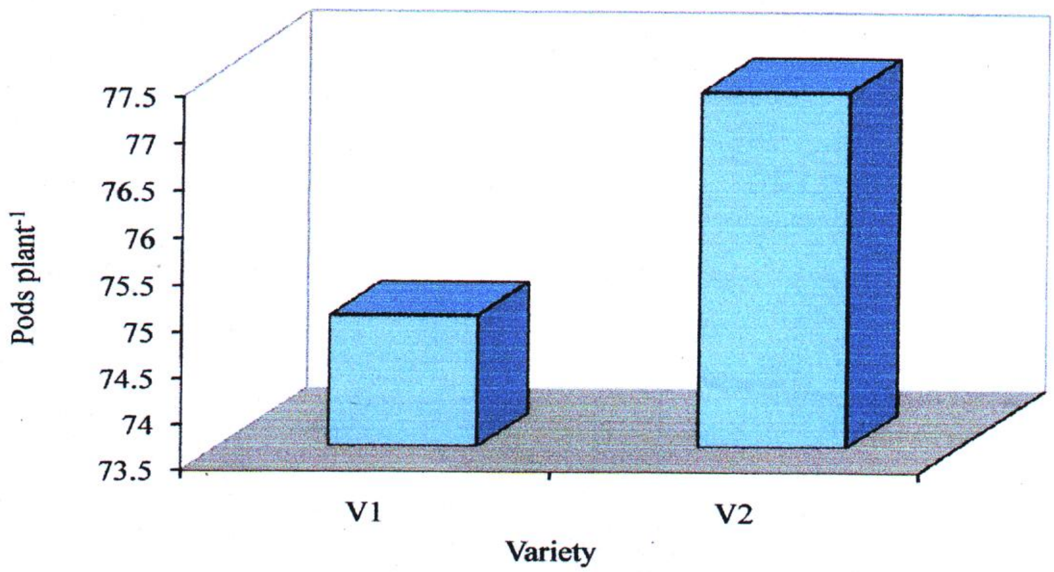
W_0: No weeding (Control)
W_1: One weeding at 15 DAS
W_2: One weeding at 25 DAS
W_3: One weeding at 35 DAS
W_4: Two weeding at 15 and 35 DAS
W_5: Two weeding at 25 and 45 DAS
W_6: Weed free condition

Figure 4. Effect of weed management on branches plant^{-1}of mungbean at different days (SE ± = 0.022, 0.051, 0.086, 0.259, 0.281 and 0.291 at 20 DAS, 30 DAS, 40 DAS, 50 DAS, 60 DAS and at

by W_3 (one weeding at 35 DAS). Branches plant^{-1} varied for different weed management practices based upon the growth and net assimilation rate. Muhammad *et al*. (2004) reported that weeding were applied twice, i.e. at 10 and 35 days after sowing significantly affected number of branches plant^{-1}.

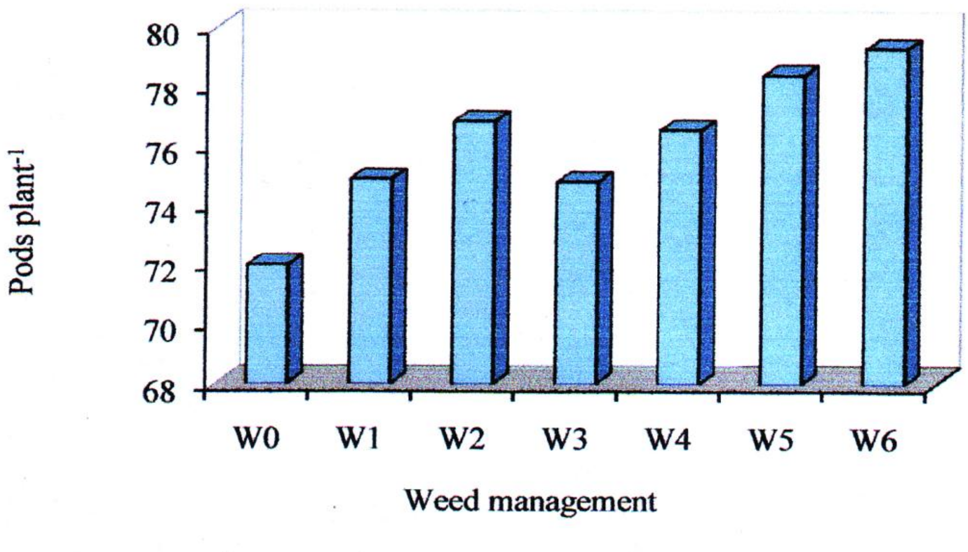
Interaction effect of variety and weed managements

Interaction effect on number of branches plant^{-1} at 20, 30, 40, 50, 60 DAS and harvest was found significant (Table 2). At 20 DAS, the highest branches plant^{-1} (1.80) was noted from V_2W_4 (BARI Mung-6 + two weedings at 15 and 35 DAS) and it was at par with V_2W_6 (BARI Mung-6 + weed free condition) (1.73), V_2W_2 (BARI Mung-6 + one weeding at 25 DAS) (1.70), V_2W_3 (BARI Mung-6 + one weeding at 35 DAS) (1.63), V_2W_5 (BARI Mung-6 + two weedings at 25 and 45 DAS) (1.67), V_1W_5 (BARI Mung-5 + two weedings at 25 and 45 DAS) (1.63), V_1W_6 (BARI Mung-5 + weed free condition) (1.63), V_2W_0 (BARI Mung-6 + no weeding)



V_1= BARI mung-5 V_2= BARI mung-6

Figure 5. Effect of variety on pods plant^{-1} of mungbean (SE ± = 0.614)



W_0= No weeding (Control)
W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS
W_3= One weeding at 35 DAS
W_4= Two weeding at 15 and 35 DAS
W_5= Two weeding at 25 and 45 DAS
W_6= Weed free condition

Figure 6. Effect of weed management on pods plant^{-1} of mungbean (SE ± = 1.150)

Table 2. Interaction effect of variety and weed management on branches plant^{-1} at different days

Treatments	Branches plant^{-1}					
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	At harvest
V_1W_0	1.27 f	3.07 d	7.07 g	11.47 d	13.73 e	15.87 f
V_1W_1	1.50 c-e	3.70 bc	8.30 c-f	15.47 a-c	17.97 bc	21.30 c-e
V_1W_2	1.50 c-e	3.70 bc	8.23 d-f	15.90 ab	18.23 bc	21.10 de
V_1W_3	1.37 ef	3.17 d	7.93 ef	13.43 cd	15.60 de	17.87 f
V_1W_4	1.47 de	3.60 c	7.63 fg	14.53 bc	17.27 cd	21.27 c-e
V_1W_5	1.63 a-d	4.00 a-c	9.03 a-c	16.60 ab	19.70 bc	23.73 a-c
V_1W_6	1.63 a-d	4.20 a	9.53 a	17.23 a	20.37 ab	25.27 a
V_2W_0	1.60 b-d	3.67 bc	9.00 a-c	16.63 ab	18.90 bc	21.23 c-e
V_2W_1	1.60 b-d	3.60 c	8.53 c-e	15.37 a-c	18.27 bc	20.80 e
V_2W_2	1.70 ab	4.00 a-c	8.80 b-d	16.57 ab	20.37 ab	24.33 ab
V_2W_3	1.67 a-c	3.83 a-c	8.43 c-e	15.50 a-c	19.70 bc	22.50 b-e
V_2W_4	1.80 a	4.10 ab	9.27 ab	17.67 a	22.23 a	25.53 a
V_2W_5	1.67 a-c	3.90 a-c	7.90 ef	15.83 ab	19.70 bc	22.47 b-e
V_2W_6	1.73 ab	4.00 a-c	8.50 c-e	17.17 a	20.13 ab	23.47 a-d
SE	0.059	0.136	0.227	0.684	0.743	0.770
Significance level	0.05	0.01	0.01	0.01	0.01	0.01
CV(%)	6.41	6.28	9.65	7.56	6.87	6.09

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

(1.60), V_1W_2 (BARI Mung-5 + one weeding at 25 DAS) (1.50), V_1W_4 (BARI Mung-5 + two weedings at 15 and 35 DAS) (1.47). On the other hand the lowest branches plant^{-1} (1.27) was recorded in V_1W_0 (BARI Mung-5 + no weeding) which was statistically similar with V_1W_3 (BARI Mung-5 + one weeding at 35 DAS) (1.37). At 30 DAS, the highest branches plant^{-1} (4.20) was noted from V_1W_6 and it was at par with V_2W_4 (4.10), V_2W_2 (4.00), V_1W_5 (4.00), V_2W_5 (3.90), V_2W_3 (3.83), V_1W_2 (3.70), V_2W_0 (3.67), V_1W_4 (3.60). On the other hand the lowest branches plant^{-1} (3.07) was recorded in V_1W_0 which was statistically similar with V_1W_3 (3.17). At 40 DAS, the highest branches plant^{-1} (9.53) was noted from V_1W_6 and it was at par with V_2W_4 (9.27), V_1W_5 (9.03), V_2W_0 (9.00), V_2W_2 (8.80), V_2W_5 (8.50), V_2W_3 (8.43), V_1W_2 (8.23), V_1W_4 (7.63). On the other hand the lowest branches plant^{-1} (7.07) was recorded in V_1W_0 which was statistically similar to V_1W_4 (7.63). At 50 DAS, the highest branches plant^{-1} (17.67) was noted from V_2W_4 and it was at par with V_1W_6 (17.23), V_2W_6 (17.17), V_2W_0 (16.63), V_1W_5 (16.60), V_2W_2 (16.57), V_1W_2 (15.90), V_2W_5 (15.83), V_2W_3 (15.50), V_1W_4 (14.53). On the other hand the lowest branches plant^{-1} (11.47) was recorded in V_1W_0 which was statistically similar with V_1W_3 (13.43). At 60 DAS, the highest branches plant^{-1} (22.23) was noted from V_2W_4 and it was at par with V_1W_6 (20.37), V_2W_2 (20.37), V_2W_6 (20.13), V_2W_3 (19.70), V_2W_5 (19.70), V_1W_5 (19.70), V_2W_0 (18.90), V_1W_2 (18.23), V_1W_4 (17.27). On the other hand the lowest branches plant^{-1} (13.73) was recorded in V_1W_0 which was statistically similar with V_1W_3 (15.60). At harvest, the highest branches plant^{-1} (25.53) was noted from V_2W_4 and it was at par with V_1W_6 (25.27), V_2W_2 (24.33), V_1W_5 (23.73), V_2W_6

(23.47), V_2W_3 (22.50), V_2W_5 (22.47), V_1W_4 (21.27), V_2W_0 (21.23), V_1W_2 (21.10). On the other hand the lowest branches plant^{-1} (15.87) was recorded in V_1W_0 which was statistically similar with V_1W_3 (17.87).

4.3 Above ground dry matter plant^{-1} (g)

Effect of variety

Above ground dry matter plant^{-1} showed non-significant variation at 20, 30, 40, 50 and 60 DAS for BARI Mung-5 and BARI Mung-6 (Table 3). There was trend to increase dry matter / plant with the advancement of days but definite trend was not followed in variety. Rahman *et al*. (2005) reported that the highest dry matter production ability was found in high yieldings mungbean cultivars, and dry matter partitioning was found highest in seeds of Bina moog 2 and lowest in local.

Table 3. Effect of variety and weed managements on above ground dry matter plant^{-1} at different days

Treatments	Above ground dry matter plant^{-1} (g)				
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS
Variety					
V_1	7.65	9.99	12.88	15.14	17.82
V_2	7.75	9.83	12.59	14.91	18.10
SE	0.149	0.148	0.204	0.221	0.213
Significance level	NS	NS	NS	NS	NS
Weed Management					
W_0	7.07 c	9.32 c	11.71 c	13.75 c	16.39 c
W_1	7.29 bc	9.65 bc	12.21 c	14.80 bc	17.47 bc
W_2	7.28 bc	9.70 bc	12.48 bc	14.98 bc	18.22 ab
W_3	7.26 bc	9.54 c	12.19 c	14.12 c	17.77 b
W_4	8.06 ab	10.10 a-c	12.59 bc	15.07 bc	18.11 ab
W_5	8.29 a	10.44 ab	13.56 ab	15.94 ab	18.63 ab
W_6	8.66 a	10.63 a	14.43 a	16.52 a	19.12 a
SE	0.279	0.277	0.382	0.414	0.399
Significance level	0.01	0.01	0.01	0.01	0.01
CV(%)	8.86	6.84	7.35	6.75	5.44

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

Effect of weed management

Above ground dry matter plant^{-1} showed significant variation at 20, 30, 40, 50 and 60 DAS for different weed management (Table 3). At 20 DAS, above ground dry matter plant^{-1} was maximum (8.66 g) in W_6 (weed free condition) but statistically similar with W_5 (two weedings at 25 and 45 DAS) (8.29 g) and W_4 (two weedings at 15 and 35 DAS) (8.06 g). Treatment W_0 (no weeding) gave minimum dry matter (7.07 g) and followed by W_3 (one weeding at 35 DAS) (7.26 g), W_2 (one weeding at 25 DAS) (7.28 g) and W_1 (one weeding at 15 DAS) (7.29 g). At 30 DAS, above ground dry matter plant^{-1} showed similar trend as in 20 DAS. At 40 DAS, above ground dry matter plant^{-1} was maximum (14.43 g) in W_6 that statistically similar with W_5 (13.56 g) and W_4 (12.59 g). Treatment W_0 gave minimum dry matter (11.71 g) and followed by W_3 (12.19 g), W_1 (12.21 g) and W_2 (12.48 g). At 50 DAS, above ground dry matter plant^{-1} was almost similar trend as in 40 DAS. At 60 DAS, above ground dry matter plant^{-1} was maximum (19.12 g) in W_6 which was similar with W_5 (18.63 g) and W_4 (18.11 g). Treatment W_0 gave minimum dry matter (16.39 g) and followed by W_3 (17.77 g), W_1 (17.47 g) and W_2 (18.22 g). Kumar and Kairon (1988) found that weed biomass increased and mungbean yield decreased with delay in weeding. They also reported that weed removal at 30 and 40 days after sowing showed high yield.

Interaction effect of variety and weed managements

Interaction effect of mungbean variety and weed managements on above ground dry matter plant^{-1} at 20, 30, 40, 50, 60 DAS and harvest was significantly affects by variety & weed management (Table 4). At 20 DAS, the highest above ground dry matter plant^{-1} (8.95 g) was noted from V_1W_6 and it was at par with V_1W_5 (8.89 g), V_2W_4 (8.39 g), V_2W_6 (8.37 g), V_2W_0 (7.92 g), V_1W_4 (7.73 g), V_2W_5 (7.70 g), V_1W_2 (7.45 g). On the other hand the lowest branches plant^{-1} (6.23 g) was recorded in V_1W_0 which was statistically similar with V_1W_3 (6.98 g). At 30 DAS, the highest above ground dry matter plant^{-1} (11.08 g) was noted from V_1W_6 and it was at par with V_1W_5 (10.91 g), V_2W_4 (9.83 g), V_2W_6 (10.17 g), V_2W_0 (10.64 g), V_1W_4 (10.37 g), V_2W_5 (9.97 g), V_1W_2 (10.09 g). On the other hand the lowest branches plant^{-1} (8.01 g) was recorded in V_1W_0 which was statistically similar with V_2W_2 (9.30 g). At 40 DAS, the highest above ground dry matter plant^{-1} (15.39 g) was noted from V_1W_6 which was statistically similar with V_1W_5 (14.40 g) and the lowest branches plant^{-1} (10.41 g) was recorded in V_1W_0. At 50 DAS, the highest above ground dry matter plant^{-1} (17.50 g) was noted from V_1W_6 which was statistically similar with V_1W_5(16.79 g) and the lowest branches plant^{-1} (12.70 g) was recorded in V_1W_0. At 60 DAS, the highest above ground dry matter plant^{-1} (20.28 g) was noted from V_1W_6 which was statistically similar with V_1W_5 (19.63 g) and the lowest branches plant^{-1} (14.89 g) was recorded in V_1W_0.

Table 4. Interaction effect of variety and weed management on above ground dry matter plant^{-1} at different days

Treatments	Above ground dry matter plant^{-1} (g)				
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS
V_1W_0	6.23 d	8.01 d	10.41 d	12.70 d	14.89 g
V_1W_1	7.34 b-d	9.94 a-c	12.30 c	14.92 bc	16.96 f
V_1W_2	7.45 b-d	10.09 a-c	12.79 bc	15.41 bc	19.20 a-c
V_1W_3	6.98 cd	9.54 bc	12.23 c	13.97 cd	16.65 f
V_1W_4	7.73 a-c	10.37 a-c	12.65 bc	14.70 c	17.10 ef
V_1W_5	8.89 a	10.91 a	14.40 ab	16.79 ab	19.63 ab
V_1W_6	8.95 a	11.08 a	15.39 a	17.50 a	20.28 a
V_2W_0	7.92 a-c	10.64 ab	13.00 bc	14.80 c	17.90 b-f
V_2W_1	7.25 b-d	9.36 bc	12.12 c	14.67 c	17.98 b-f
V_2W_2	7.12 b-d	9.30 c	12.16 c	14.55 c	17.25 d-f
V_2W_3	7.53 b-d	9.53 bc	12.16 c	14.27 cd	18.88 a-e
V_2W_4	8.39 ab	9.83 a-c	12.53 c	15.44 bc	19.11 a-d
V_2W_5	7.70 a-c	9.97 a-c	12.72 bc	15.09 bc	17.63 c-f
V_2W_6	8.37 ab	10.17 a-c	13.48 bc	15.53 bc	17.95 b-f
SE	0.394	0.391	0.541	0.586	0.564
Significance level	0.05	0.01	0.01	0.05	0.01
CV(%)	8.86	6.84	7.35	6.75	5.44

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

4.4. Days to 1st flowering

Effect of variety

BARI Mung-5 and BARI Mung-6 showed significant differences for days to 1st flowering (Table 5). The maximum days to 1st flowering (36.38) was found from BARI Mung-5, again the minimum days to 1st flowering (34.76) from BARI Mung-6. Days to 1st flowering varied for different varieties might be due to genetical and environmental influences as well as management practices. Shamsuzzaman *et al*. (2004) reported Bina moog 2 performed slightly better than Bina moog 5 for synchronous in flowering.

Effect of weed management

Days to 1st flowering differed significantly for different weed managements (Table 5). The maximum days to 1st flowering was recorded from W_0 (no weeding) (37.50), which was statistically similar with W_1 (37.17), W_3 (36.67) and W_4 (35.50). On the other hand, the minimum from W_6 (33.67) which was statistically similar with W_2 (33.83) and W_5 (34.67).

Interaction effect of variety and weed managements

Variety and weed managements showed significant variation on days to 1st flowering due to the interaction effect (Table 6). The maximum days to 1st flowering was observed from V_1W_0 (BARI Mung-5 + no weeding) (41.33) and it was at par with V_1W_1 (BARI Mung-5 + one weeding at 15 DAS) (37.67), V_1W_3

Table 5. Effect of variety and weed management on days to 1st flowering and days to 80% maturity of mungbean

Treatments	Days to 1st flowering	Days to 80% pod maturity
Variety		
V_1	36 a	69 b
V_2	34 b	70 a
SE	0.371	0.541
Significance level	0.01	0.01
Weed Management		
W_0	37 a	73 a
W_1	37 a	71 a
W_2	33 c	67 b
W_3	36 ab	72 a
W_4	35 a-c	67 b
W_5	34 bc	67 b
W_6	33 c	66 b
SE	0.693	1.012
Significance level	0.01	0.01
CV(%)	4.77	5.57

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

Table 6. Interaction effect of variety and weed management on days to 1st flowering and days to 80% maturity of mungbean

Treatments	Days to 1st flowering	Days to 80% pod maturity
V_1W_0	41 a	75 a
V_1W_1	37 b	71 a-c
V_1W_2	36 bc	67 cd
V_1W_3	37 b	73 a
V_1W_4	36 bc	67 cd
V_1W_5	34 cd	64 d
V_1W_6	31 d	64 d
V_2W_0	33 cd	71 a-c
V_2W_1	36 bc	71 a-c
V_2W_2	31 d	68 b-d
V_2W_3	35 bc	72 ab
V_2W_4	35 bc	67 cd
V_2W_5	35 bc	71 a-c
V_2W_6	35 bc	67 cd
SE	0.980	1.431
Significance level	0.01	0.05
CV(%)	4.77	5.57

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

(BARI Mung-5 + one weeding at 35 DAS) (37.67), V_2W_1 (BARI Mung-6 + one weeding at 15 DAS) (36.67), V_1W_4 (BARI Mung-5 + two weedings at 15 and 35 DAS) (36.00), V_2W_3 (BARI Mung-6 + one weeding at 35 DAS) (35.67), V_2W_6 (BARI Mung-6 + weed free condition) (35.67), V_2W_4 (BARI Mung-6 + two weedings at 15 and 35 DAS) (35.00), V_2W_5 (BARI Mung-6 + two weedings at 25 and 45 DAS) (35.00), again the minimum days (31. 33) from V_1W_6 (BARI Mung-5 + weed free condition) which was statistically similar with V_2W_2 (BARI Mung-6 + one weeding at 25 DAS) (31.37).

4.5 Days to 80% pod maturity

Effect of variety

Days to 80% pod maturity showed statistically in significant variation among the varieties (Table 5). The maximum days to 80% pod maturity (70) was observed from BARI Mung-6, while the minimum days to 80% pod maturity (69.00) from BARI Mung-5. Aghaalikhani *et al*. (2006) reported that VC-1973A was superior to cultivars Partow and Gohar due to its early and uniform seed maturity

Effect of weed management

Different weed managements showed significant differences on days to 80% pod maturity (Table 5). The maximum days to 80% pod maturity was observed from no weeding (73.67), which was statistically similar with one weeding at 35 DAS (72.83) and one weeding at 15 DAS (71.33), while the minimum days to 80% pod maturity from weed free condition (66.00) which was statistically similar with two weedings at 15 and 35 DAS (67.17), one weeding at 25 DAS (67.50) and two weedings at 25 and 45 DAS (67.67).

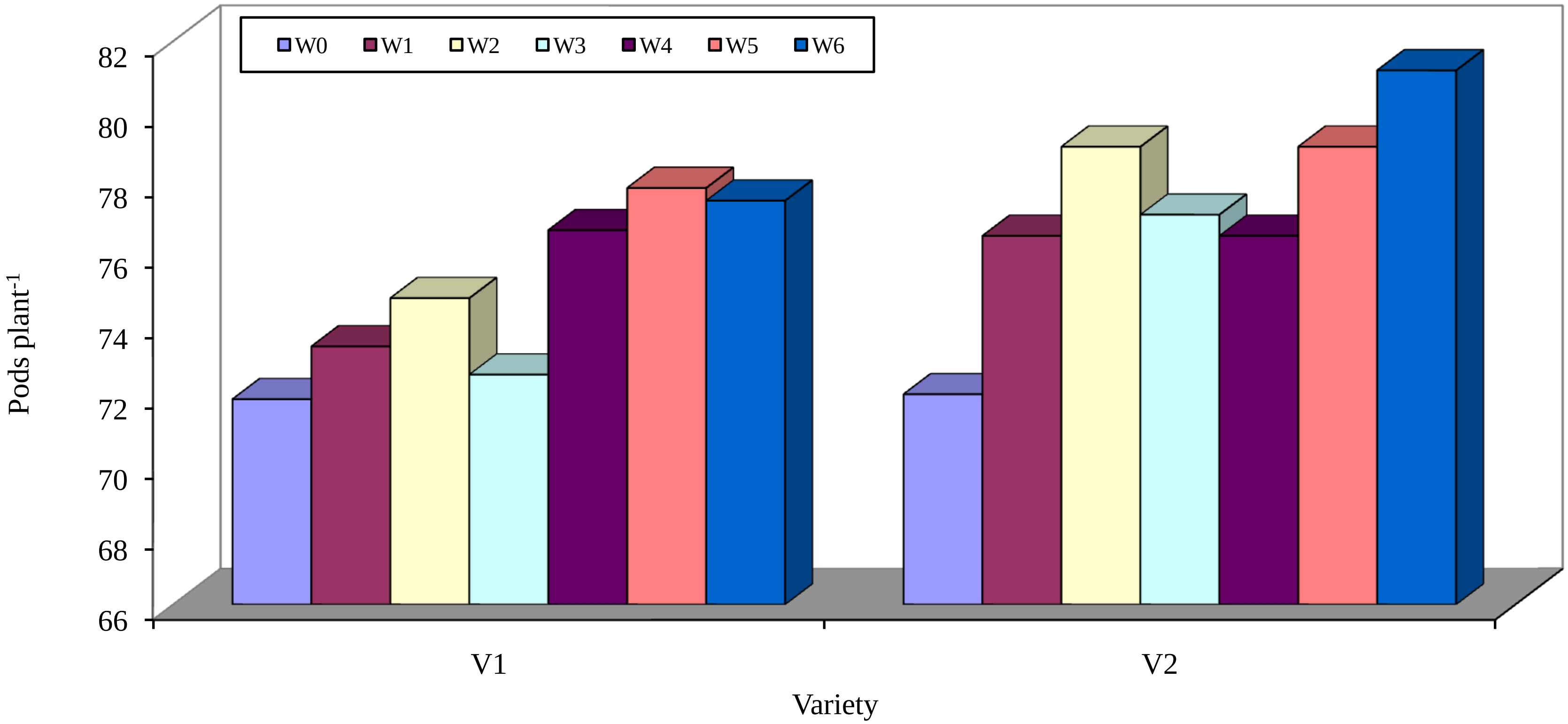
Interaction effect of variety and weed managements

Interaction effect of mungbean variety and weed managements showed significant variation for days to 80% pod maturity (Table 6). The maximum days to 80% pod maturity (76) was found from no weeding with BARI Mung-5 and it was at par with one weeding at 35 DAS (73.33) of same variety closely followed by one hand weeding at 35, 15 DAS of BARI Mung-6 and one weeding at 15 DAS of BARI Mung-5. The minimum days (64) required in continuous weeding of BARI Mung-5 which was statistically similar to same variety with two weedings at 25 and 45 DAS (65).

4.6 Pods plant^{-1} (No.)

Effect of variety

Significant variation was recorded for BARI Mung-5 and BARI Mung-6 in the content of pods plant^{-1} (Figure 5). The higher number of pods plant^{-1} (77.30) was recorded from BARI Mung-6, whereas the lower number of pods plant^{-1} (74.92) from BARI Mung-5. Different varieties responded differently due to genetical characters and the prevailing environment during the growing season. Raj and Tripathi (2005) reported that cultivar K-851 gave significantly higher values for pods per plant compared with RMG-62.



V_1= BARI Mung-5
V_2= BARI Mung-6

W_0= No weeding (Control)
W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS
W_3= One weeding at 35 DAS
W_4= Two weeding at 15 and 35 DAS
W_5= Two weeding at 25 and 45 DAS
W_6= Weed free condition

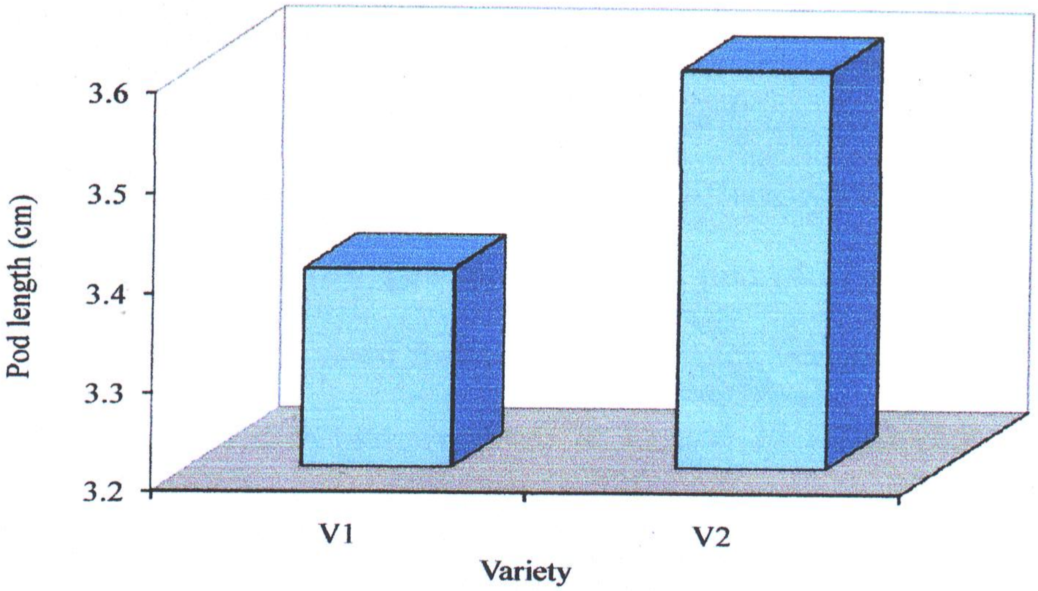
Figure 7. Interaction effect of variety and weed management on pods plant^{-1} of mungbean (SE ± = 1.626)

Effect of weed management

Number of pods plant^{-1} varied significantly for different weed managements (Figure 6). The highest number of pods plant^{-1} (79.32) was found from W_6 (weed free condition), which was statistically similar (78.42, 76.85 and 76.55) with W_5 W_2 and W_4 , respectively, while, the lowest number (71.97) from no weeding which was statistically similar (74.80 and 74.90) with one weeding at 35 DAS and one weeding at 15 DAS, respectively.

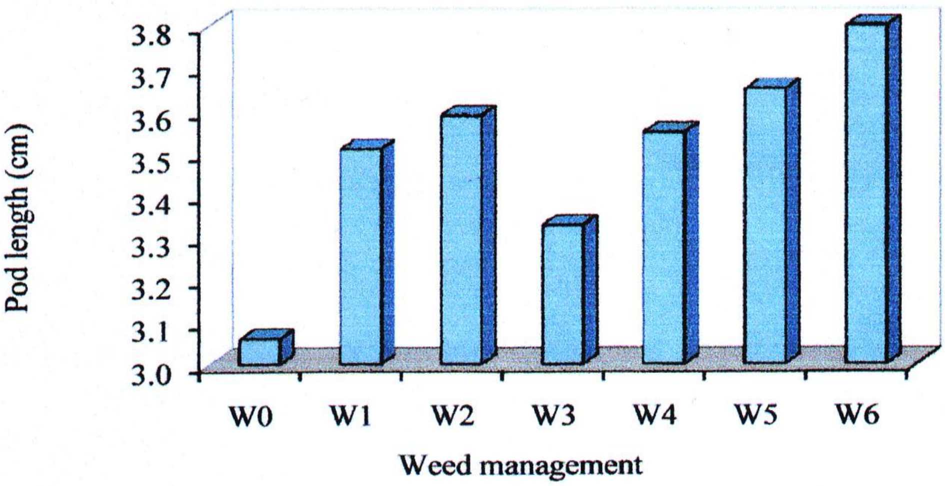
Interaction effect of variety and weed managements

Statistically significant variation was recorded due to the interaction effect of mungbean variety and weed managements on number of pods plant^{-1} (Figure 7). The highest number of pods plant^{-1} (81.17) was recorded from continuous weeding with BARI Mung 6and it was at par to same variety with one weeding at 35 DAS) (79.00), followed by two weedings at 25 and 45 DAS (77) of BARI Mung-5. Control (no weeding) treatment showed lowest pods / plant which was at par to one weeding at 25 & 15 DAS with BARI Mung-5.



V_1= BARI mung-5 V_2= BARI mung-6

Figure 8. Effect of variety on pod length of mungbean
(SE ± = 0.056)



W_0= No weeding (Control)
W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS
W_3= One weeding at 35 DAS
W_4= Two weeding at 15 and 35 DAS
W_5= Two weeding at 25 and 45 DAS
W_6= Weed free condition

Figure 9. Effect of weed management on pod length of mungbean
(SE ± = 0.105)

4.7 Seeds plant^{-1} (No.)

Effect of variety

Number of seeds plant^{-1} varied significantly by the results (Table 7). The highest number of seeds plant^{-1} (319.24) was found from V_2 (BARI Mung-6), which lower number of seeds plant^{-1} (300.20) from V_1 (BARI Mung-5).

Effect of weed management

Significant variation was recorded for different weed managements on number of seeds plant^{-1} (Table 7). The maximum number of seeds plant^{-1} (336.17) was obtained from W_6 (weed free condition), which was statistically similar (321.23, 315.75 and 313.82) with $W_{5,}$ W_2 and $W_{4,}$ respectively. On the other hand, the lowest number of seeds plant^{-1} (281.97) from W_0 which was statistically similar (298.23 and 300.88) with W_3 and W_1, respectively.

Interaction effect of variety and weed managements

Interaction effect of mungbean variety and weed managements varied significantly on number of seeds plant^{-1} (Table 8). The highest number of seeds plant^{-1} (356.73) was recorded from weed free condition with variety BARI Mung-5 and it was at par with two weedings at 15 and 35 DAS (347.87) and one weeding at 25 DAS (329.77) and 35 DAS (326.93) of variety BARI Mung-6, V_2W_0 (BARI Mung-6 + no weeding) (318.97), V_1W_5 (BARI Mung-5 + two weedings at 25 and 45 DAS) (334.73), V_1W_1 (BARI Mung-5 + one weed 15 DAS) (313.93), V_2W_5 (BARI Mung-6 + two weedings at 25 and 45 DAS) (307.73), while the lowest number of seeds plant^{-1} (244.97) from V_1W_0 (BARI

Mung-5 + no weeding) which was statistically similar with V_1W_3 (BARI Mung-5 + one weed 15 DAS) (269.53).

4.8 Pod length (cm)

Effect of variety

Significant variation was recorded for pod length in to varieties (Figure 8). The longest pod (3.60 cm) was recorded from V_2 (BARI Mung-6), whereas the shortest pod (3.40 cm) from V_1 (BARI Mung-5).

Effect of weed management

Different weed managements showed significant variation on pod length (Figure 9). The longest pod (3.80 cm) was found from W_6 (weed free condition), which was statistically similar (3.65 cm, 3.59 cm, 3.55 cm and 3.51 cm) with W_5, W_2, W_4 and W_1, respectively and the shortest pod (3.06 cm) from W_0 (no weeding) which was statistically similar (3.33 cm) with W_3 (one weeding at 35 DAS), respectively.

Interaction effect of variety and weed managements

Variety and weed managements showed significant differences on pod length due to interaction effect (Figure 10). The longest pod (4.17 cm) was attained from V_1W_6 (BARI Mung-5 + weed free condition), which was statistically similar with two weedings at 15 and 35 DAS (3.93 cm) and two weedings at 25 and 45 DAS (3.91 cm) of BARI Mung-5 and BARI Mung-6, while the shortest pod (2.50 cm) from no weeding with BARI Mung-5

4.9 Weight of 1000 seeds (g)

Effect of variety

The variety did not influence significantly the weight of 1000 seeds (Table 7). The highest weight of 1000 seeds (21.67 g) was observed from V_1 (BARI Mung-5) and the lowest weight (21.24 g) from V_2 (BARI Mung-6). Raj and Tripathi (2005) reported that cultivar K-851 gave significantly higher values for 1000-seed weight compared with RMG-62.

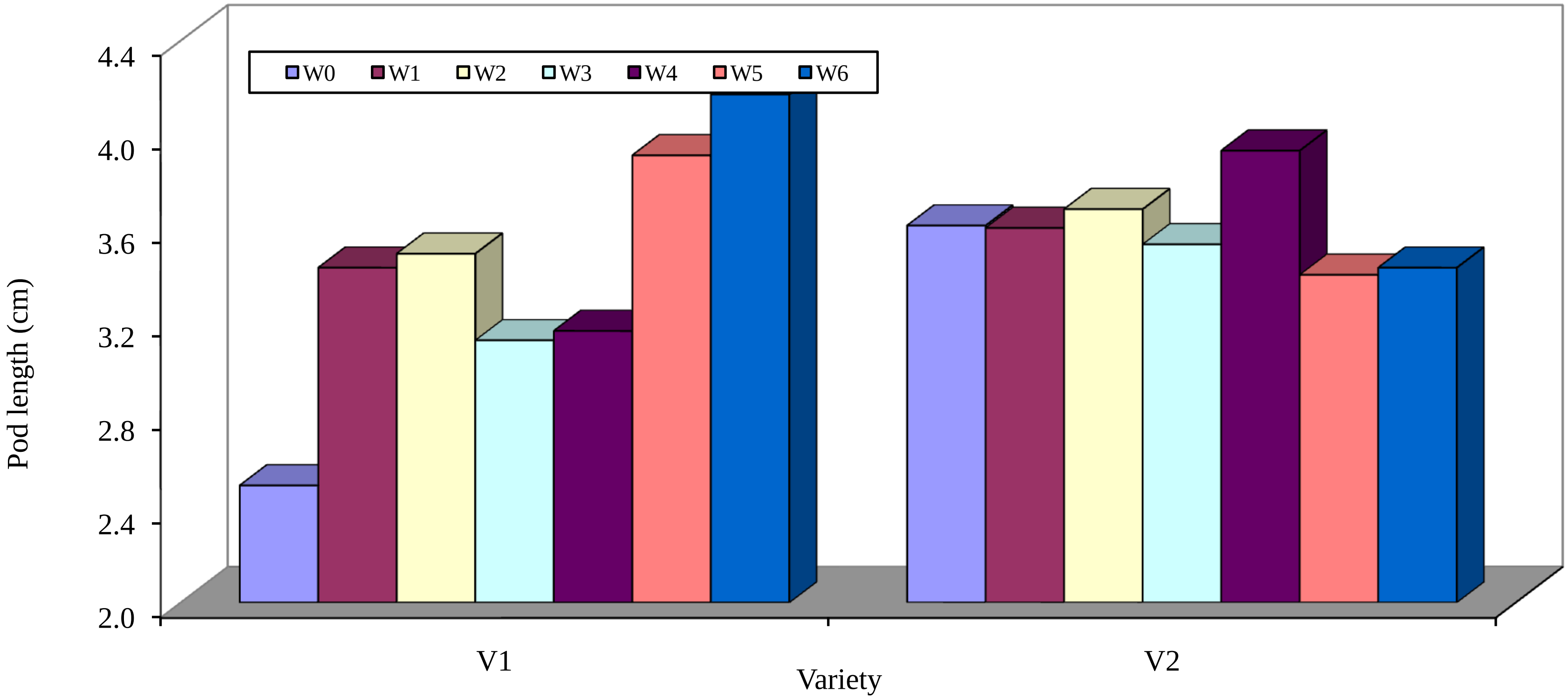
Effect of weed management

Statistically significant variation was observed on weight of 1000 seeds due to different weed managements (Table 7). The highest weight of 1000 seeds (22.74 g) was recorded from weed free condition, which was statistically identical (22.45 g, 22.02 g, 21.99 g and 21.12 g) with two weedings at 25 and 45 DAS, at 15 and 35 DAS, one weeding at 25 DAS and 15 DAS, respectively and the lowest weight of 1000 seeds (19.59 g) from W_0 which was statistically similar (20.27 g) with

W_3. Muhammad *et al*. (2004) reported that weeding at 10 and 35 days after sowing significantly affected 1000-grain weight.

Interaction effect of variety and weed managements

Weight of 1000 seeds showed significant differences due to interaction effect of mungbean variety and weed managements (Table 8). The highest weight of 1000 seeds (23.67 g) was found from V_1W_6 (BARI Mung-5 + weed free condition), which was statistically similar with V_1W_5 (BARI Mung-5 + two weedings at 25 and 45 DAS) (23.59 g), while the lowest weight of 1000 seeds (18.15 g) from V_1W_0 (BARI Mung-5 + no weeding).



V_1= BARI mung-5

V_2= BARI Mung-6

W_0= No weeding (Control)
W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS
W_3= One weeding at 35 DAS
W_4= Two weeding at 15 and 35 DAS
W_5= Two weeding at 25 and 45 DAS
W_6= Weed free condition

Figure 10. Interaction effect of variety and weed management on pod length of mungbean (SE ± = 0.148)

4.10 Seed yield (t ha^{-1})

Effect of variety

Significant variation was recorded for seed yield of mungbean in BARI Mung-5 and BARI Mung-6 under the present trial (Table 7). The higher seed yield (1.51 t ha^{-1}) was observed from BARI Mung-6, whereas the lower seed yield (1.34 t ha^{-1}) from BARI Mung-5 which was 12.7% lower than former one. The variety BARI Mung-6 showed higher seed yield due to higher yield attributes. Besides seed yield varied for different varieties might be due to genetical and environmental influences as well as management practices. Quaderi *et al*. (2006) reported that mungbean varieties, Bina moog-5 performed better than that of Bina moog-4 in context of yield. Tickoo *et al*. (2006) recorded that the cultivar Pusa Vishal recorded higher grain yield (1.63 t/ha) compared to cv. Pusa 105. Bhati *et al*. (2005) showed that K-851 gave better yield than Asha and the local cultivar

Effect of weed management

Different weed managements showed significant variation on seed yield of mungbean (Table 7). The higher seed yield (1.62 t ha^{-1}) was obtained from weed free condition, which was statistically similar (1.58 t ha^{-1}, 1.51 t ha^{-1}, 1.44 t ha^{-1} and 1.42 t ha^{-1}) with two weedings at 25 and 45 DAS, two weedings at 15 and 35 DAS, one weeding at 15 DAS and one weeding at 25 DAS, respectively, whereas the lowest seed yield (1.13 t ha^{-1}) from no weeding which was statistically similar (1.29 t ha^{-1}) with one weeding at 35 DAS, respectively. Yield losses due to uncontrolled weed growth in mungbean ranges from 27 to 100% (AVRDC, 1976).

Muhammad *et al*. (2004) reported that weeding at 10 and 35 days after sowing significantly affected grain yield.

Interaction effect of variety and weed managements

Interaction effect of mungbean variety and weed managements showed significant differences on seed yield of mungbean (Table 8). The maximum seed yield (1.75 t ha^{-1}) was recorded from two weedings at 15 and 35 DAS with variety BARI Mung-6 which was statistically similar with same treatment of BARI Mung-5. The lowest seed yield from no weeding with variety BARI Mung-5 (1.04 t ha^{-1}) followed by same variety with one weeding at 35 DAS.

4.11 Stover yield (t ha^{-1})

Effect of variety

Statistically significant variation was recorded for stover yield of BARI Mung-5 and BARI Mung-6 (Table 7). The higher stover yield (2.29 t ha^{-1}) was recorded from V_2 (BARI Mung-6), and the lower stover yield (2.13 t ha^{-1}) from V_1 (BARI Mung-5). Bhati *et al*. (2005) reported that mungbean cv. PDM-54 showed 13.7% higher fodder yield than the local cultivar.

Effect of weed management

Stover yield of mungbean varied significantly for different weed managements (Table 7). The highest stover yield (2.53 t ha^{-1}) was observed from W_6 (weed free condition), which was statistically similar (2.36 t ha^{-1} and 2.33 t ha^{-1}) with W_4 (two weedings at 15 and 35 DAS) and W_5 (two weedings at 25 and 45 DAS), respectively while the lowest stover yield (1.78 t ha^{-1}) from W_0 (no weeding) which was statistically similar (2.09 t ha^{-1}, 2.15 t ha^{-1} and 2.22 t ha^{-1}) with one hand weeding at 35, 15 & 25 DAS, respectably.

Interaction effect of variety and weed managements

Variety and weed managements showed significant differences on stover yield of mungbean due to interaction effect (Table 8). The highest stover yield (2.72 t ha^{-1}) was observed from V_1W_6 (BARI Mung-5 + weed free condition) and it was at par with V_1W_4 (BARI Mung-5 + two weedings at 15 and 35 DAS) (2.52 t ha^{-1}), V_2W_3 (BARI Mung-6 + one weeding at 35 DAS) (2.49 t ha^{-1}), V_2W_2 (BARI Mung-6 + one weeding at 25 DAS) (2.44 t ha^{-1}), whereas the lowest stover yield from V_1W_0 (BARI Mung-5 + no weeding) (1.36 t ha^{-1}) which was similar with V_1W_3 (BARI Mung-5 + one weeding at 35 DAS) (1.75 t ha^{-1}).

4.12 Harvest index (%)

Effect of variety

Significant variation was not recorded for harvest index of both the varieties (Table 7). The numeric maximum harvest index (39.71%) was recorded from BARI Mung-6 and which the minimum (38.97%) from BARI Mung-5.

Effect of weed management

Harvest index of mungbean varied in-significantly for different weed managements (Table 7). The maximum harvest index (40.56%) was observed from two weedings at 25 and 45 DAS, while the minimum (38.47%) from two weedings at 15 and 35 DAS.

Interaction effect of variety and weed managements

Interaction between Variety and weed managements showed in-significant on harvest index of mungbean (Table 8). The mximum harvest index (43.36%) was observed from V_1W_0 (BARI Mung-5 + no weeding), whereas the minimum harvest index from V_1W_4 (BARI Mung-5 + two weedings at 15 and 35 DAS) (35.47%).

Table 7. Effect of variety and weed management on yield contributing characters and yield of mungbean

Treatments	Seeds plant^{-1} (No.)	Weight of 1000 seeds (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Harvest index (%)
Variety					
V_1	300.20 b	21.67	1.34 b	2.13 b	38.97
V_2	319.24 a	21.24	1.51 a	2.29 a	39.71
SE	5.567	0.295	0.040	0.053	0.301
Significance level	0.05	NS	0.01	0.05	NS
Weed Management					
W_0	281.97 c	19.59 b	1.13 c	1.78 c	39.52
W_1	300.88 bc	21.12 ab	1.44 ab	2.15 b	40.06
W_2	315.75 ab	21.99 a	1.42 ab	2.22 b	39.14
W_3	298.23 bc	20.27 b	1.29 bc	2.09 b	38.49
W_4	313.82 a-c	22.02 a	1.51 ab	2.36 ab	38.47
W_5	321.23 ab	22.45 a	1.58 a	2.33 ab	40.56
W_6	336.17 a	22.74 a	1.62 a	2.53 a	39.14
SE	10.41	0.552	0.074	0.098	0.523
Significance level	0.05	0.01	0.01	0.01	NS
CV(%)	8.24	6.30	12.69	10.89	11.12

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS

W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS

W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS

W_6= Weed free condition

Table 8. Interaction effect of variety and weed management on yield contributing characters and yield of mungbean

Treatments	Seeds $plant^{-1}$ (No.)	Weight of 1000 seeds (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Harvest index (%)
V_1W_0	244.97 f	18.15 c	1.04 e	1.36 e	43.36
V_1W_1	313.93 a-e	22.01 ab	1.47 a-d	2.29 a-c	38.99
V_1W_2	301.73 b-e	22.26 ab	1.31 b-e	2.01 cd	39.40
V_1W_3	269.53 ef	20.30 bc	1.04 e	1.75 de	38.36
V_1W_4	279.77 d-f	21.69 ab	1.27 c-e	2.24 bc	35.47
V_1W_5	334.73 a-c	23.59 a	1.64 ab	2.52 ab	39.53
V_1W_6	356.73 a	23.67 a	1.64 ab	2.72 a	37.68
V_2W_0	318.97 a-d	21.03 ab	1.21 de	2.20 bc	35.69
V_2W_1	287.83 c-f	20.23 bc	1.41 a-d	2.00 cd	41.12
V_2W_2	329.77 a-c	21.72 ab	1.54 a-d	2.42 a-c	38.89
V_2W_3	326.93 a-d	20.24 bc	1.53 a-d	2.44 a-c	38.62
V_2W_4	347.87 ab	22.36 ab	1.75 a	2.49 ab	41.48
V_2W_5	307.73 a-e	21.30 ab	1.53 a-d	2.14 b-d	41.59
V_2W_6	315.60 a-e	21.81 ab	1.60 a-c	2.34 a-c	40.61
SE	14.73	0.781	0.105	0.139	0.854
Significance level	0.01	0.05	0.05	0.01	NS
CV(%)	8.24	6.30	12.69	10.89	11.12

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS

W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS

W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS

W_6= Weed free condition

4.13 Crop Growth Rate

Effect of variety

Crop Growth Rate (CGR) of mungbean did not vary significantly by variety at different growth stages. There was trend to increase CGR with advancement of days where as maximum at 50-60 DAS. The variety BARI Mung-5 showed high values in three stages but lower at 50-60 DAS.

Effect of weed management

Significant variation was not recorded for CGR due to weed management all the stages except 30-40 DAS (Table 9). At 30-40 DAS, the maximum (6.34 g $m^{-2}day^{-1}$) CGR was recorded from W_6 (weed free condition) followed by W_5 while the minimum (3.98 g $m^{-2}day^{-1}$) in W_0 (no weeding).

Table 9. Effect of variety and weed management on Crop Growth Rate (CGR) and Relative Growth Rate (RGR) of mungbean

Treatments	Crop Growth Rate (g $m^{-2}day^{-1}$) at				Relative growth rate (g g^{-1} day^{-1}) at			
	20.-30 DAS	30.-40 DAS	40.-50 DAS	50.-60 DAS	20.-30 DAS	30.-40 DAS	40.-50 DAS	50.-60 DAS
Variety								
V_1	3.90	4.82	3.85	4.56	0.027	0.025	0.016	0.017
V_2	3.46	4.61	3.84	5.32	0.024	0.024	0.017	0.019
SE	0.240	0.274	0.371	0.288	0.002	0.001	0.002	0.001
Significance level	NS	NS	NS	NS	NS	NS	NS	NS
Weed Management								
W_0	3.75	3.98 b	3.40	4.41	0.027	0.023	0.017	0.017
W_1	3.93	4.27 b	4.58	4.80	0.028	0.023	0.019	0.018
W_2	4.02	4.63 b	4.17	5.41	0.029	0.025	0.018	0.020
W_3	3.80	4.43 b	3.21	6.09	0.027	0.025	0.015	0.023
W_4	3.40	4.15 b	4.14	5.06	0.022	0.022	0.018	0.019
W_5	3.58	5.19 ab	3.97	4.48	0.023	0.026	0.016	0.016
W_6	3.28	6.34 a	3.48	4.33	0.021	0.030	0.014	0.015
SE	0.449	0.513	0.695	0.538	0.003	0.003	0.003	0.002
Significance level	NS	0.05	NS	NS	NS	NS	NS	NS
CV(%)	19.86	16.68	14.21	12.69	10.44	15.60	44.83	26.99

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS
W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS
W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS
W_6= Weed free condition

Interaction effect of variety and weed managements

Interaction effect of variety and weed management showed non significant variation for CGR at 20-30, 30-40, 40-50 and 50-60 DAS (Table 10). But there was trend to increase CGR up to 50-60 DAS in all the treatment. The variety BARI Mung-6 with one hand weeding at 35 DAS showed higher values at 50-60 DAS.

4.14 Relative Growth Rate

Effect of variety

Non-significant differences was obtained for relative growth rate (RGR) for BARI Mung-5 and BARI Mung-6 at 20-30, 30-40, 40-50 and 50-60 DAS (Table 9). There was no definite trend was followed by two variety in all stages.

Effect of weed management

RGR for different weed management at 20-30, 30-40, 40-50 and 50-60 DAS was found in significant (Table 9). At 20-30 DAS, the maximum (0.029 g g^{-1} day^{-1}) RGR was observed from W_2 (one weeding at 25 DAS), again the minimum (0.021 g g^{-1} day^{-1}) from W_6 (weed free condition). At 30-40 DAS, the maximum (0.030 g g^{-1} day^{-1}) RGR was recorded from W_6, while the minimum (0.022 g g^{-1} day^{-1}) from W_4. At 40-50 DAS, the maximum (0.019 g g^{-1} day^{-1}) RGR was observed from W_1 (one weeding at 15 DAS), whereas the minimum (0.014 g g^{-1} day^{-1}) from W_6. At 50-60 DAS, the maximum (0.023 g g^{-1} day^{-1}) RGR from W_3 (one weeding at 35 DAS) and the minimum (0.015 g g^{-1} day^{-1}) from W_6.

Table 10. Interaction effect of variety and weed management on Crop Growth Rate (CGR) and Relative Growth Rate (RGR) of mungbean

Treatments	Crop Growth Rate (g $m^{-2}day^{-1}$) at				Relative growth rate (g g^{-1} day^{-1}) at			
	20.-30 DAS	30.-40 DAS	40.-50 DAS	50.-60 DAS	20.-30 DAS	30.-40 DAS	40.-50 DAS	50.-60 DAS
V_1W_0	2.96	4.01	3.81	3.65	0.025	0.026	0.020	0.016
V_1W_1	4.34	3.94	4.92	4.08	0.030	0.021	0.019	0.016
V_1W_2	4.41	4.50	4.35	6.32	0.030	0.024	0.019	0.022
V_1W_3	4.28	4.48	2.89	4.48	0.031	0.025	0.013	0.018
V_1W_4	4.40	3.80	3.42	4.00	0.029	0.020	0.014	0.016
V_1W_5	3.38	5.81	3.98	4.73	0.021	0.028	0.015	0.016
V_1W_6	3.55	7.18	3.53	4.62	0.021	0.033	0.013	0.015
V_2W_0	4.53	3.94	3.00	5.17	0.029	0.019	0.012	0.019
V_2W_1	3.52	4.60	4.24	5.51	0.026	0.026	0.019	0.020
V_2W_2	3.64	4.77	3.98	4.50	0.027	0.027	0.018	0.017
V_2W_3	3.33	4.38	3.52	7.69	0.023	0.024	0.016	0.028
V_2W_4	2.39	4.50	4.85	6.12	0.016	0.024	0.021	0.021
V_2W_5	3.79	4.57	3.96	4.23	0.026	0.024	0.017	0.016
V_2W_6	3.01	5.50	3.43	4.03	0.021	0.028	0.015	0.014
SE	0.635	0.726	0.982	0.761	0.005	0.004	0.004	0.003
Significance level	NS	NS	NS	NS	NS	NS	NS	NS
CV(%)	19.86	16.68	14.21	12.69	10.44	15.60	44.83	26.99

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

V_1= BARI Mung-5 V_2= BARI Mung-6

W_0= No weeding (Control) W_1= One weeding at 15 DAS

W_2= One weeding at 25 DAS W_3= One weeding at 35 DAS

W_4= Two weedings at 15 and 35 DAS W_5= Two weedings at 25 and 45 DAS

W_6= Weed free condition

Interaction effect of variety and weed managements

Interaction effect of variety and weed management differ non-significantly for RGR at 20-30, 30-40, 40-50 and 50-60 DAS (Table 10). At 20-30 DAS, the maximum (0.031 g g^{-1} day^{-1}) RGR was found from V_1W_3 (BARI Mung-5 and one weeding at 35 DAS), whereas the minimum (0.016 g g^{-1} day^{-1}) from V_2W_4 (BARI Mung-6 and two weedings at 15 and 35 DAS). At 30-40 DAS, the maximum (0.033 g g^{-1} day^{-1}) RGR from V_1W_6 (BARI Mung-5 and weed free condition), while the minimum (0.019 g g^{-1} day^{-1}) from V_2W_0 (BARI Mung-6 and no weeding). At 40-50 DAS, the maximum (0.021 g g^{-1} day^{-1}) RGR was obtained from V_2W_3 (BARI Mung-6 and one weeding at 35 DAS) and the minimum (0.012 g g^{-1} day^{-1}) from V_2W_0. At 50-60 DAS, the maximum (0.028 g g^{-1} day^{-1}) RGR was found from V_2W_3 (BARI Mung-6 and one weeding at 35 DAS), whereas the minimum (0.014 g g^{-1} day^{-1}) from V_2W_6 (BARI Mung-6 and weed free condition).

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted in the Farm of Sher- e- Bangla Agricultural University during the period from August to November 2008 to study the growth and yield response of mungbean varieties under different weed managements. The experiment consists of two factors. Factor A: Mungbean variety (2 levels): V_1= BARI mung-5 and V_2= BARI mung-6; Factor B: Weed management (7 levels): W_0= No weeding (Control), W_1= One weeding at 15 DAS, W_2= One weeding at 25 DAS, W_3= One weeding at 35 DAS, W_4= Two weedings at 15 and 35 DAS, W_5= Two weedings at 25 and 45 DAS and W_6= Weed free condition. There were in total 14 treatment combinations. The two factors experiment was laid out in Randomized Complete Block Design (RCBD) (factorial) with three replications. Data on different growth, yield contributing characters and yield were recorded.

At 20, 30, 40, 50, 60 DAS and at harvest the taller plant (10.68 cm, 21.94 cm, 33.30 cm, 41.55 cm, 52.35 cm and 58.45 cm) and maximum number of branches plant^{-1} (1.68, 3.87, 8.63, 16.39, 19.90 and 22.90) were recorded from V_2, whereas the shorter plant (9.65 cm, 21.15 cm, 30.95 cm, 39.11 cm, 50.12 cm and 56.14 cm) and minimum number of branches plant^{-1} (1.48, 3.63, 8.25, 14.95, 17.55 and 20.91, respectively) from V_1. At 20 and 60 DAS the higher dry matter content plant^{-1} (7.75 g and 18.10 g, respectively) was obtained from V_2 and at 30, 40 and 50 DAS (9.99 g, 12.88 g and 15.14 g) from V_1. The maximum days to 1st flowering (36.38) and days to 80% maturity (69.90) was found from V_1 and the minimum days 34.76 and 69.00, respectively were from V_2. The higher pods plant^{-1} (77.30), seeds plant^{-1} (319.24), maximum weight of 1000 seeds (21.67 g) was recorded from V_2, whereas the lower 74.92, 300.20, 3.40 cm, 21.24 g, respectively from V_1. The higher seed yield (1.51 tha^{-1}) and stover yield (2.29 tha^{-1}) was observed from V_2, whereas the lower 1.34 tha^{-1}, 2.13 tha^{-1}, respectively from V_1. Crop Growth Rate (CGR) and relative growth rate (RGR) did not vary significantly for variety. Over all the variety BARI Mung-6 showed higher seed yield due to higher yield contribution characters. Results indicated that weed management with W_6 (Weed free condition) gave maximum plant height at 20, 30, 40, 50, 60 DAS & harvest were 11.41 cm, 23.52 cm, 34.92 cm, 42.79 cm, 54.45 cm & 60.54 cm, respectively and at per with W_5 (Two weedings at 25 and 45 DAS) and W_4 (Two weedings at 15 and 35 DAS). Similar trend was observer incase of branches per plant; 1.68, 4.10, 9.02, 17.20, 20.25, 24.37 and above ground dry matter per plant; 8.66 g, 10.63 g, 14.43 g, 16.62 g, 19.12 g, respectively.

The day to 1st flowering and 80 % pod maturity were minimum incase of W_6 weed management.

The higher number of pods per plant (79.32), sees per plant (336.17), pod length (3.80 cm), 1000 seed wt (22.74 g), seed yield (1.62 t ha^{-1}) and stover yield (2.53 t ha^{-1}) was recorded from the management W_6 when W_5 and W_4 were showing the similar values. In all cases plants gave minimum growth, yield attributes and yield values with on weeding treatment.

BARI Mung-5 along with weed free condition (V_1W_6) gave maximum plant heights 12.06 cm, 24.18 cm, 37.28 cm, 45.63 cm, 56.13 cm and 60.55 cm at 20,30,40,50,60 DAS and harvest, respectively which was followed by V_2W_4 (BARI Mung-6 + 2 weeding at 15 and 35 DAS). Almost similar trend was noticed with V_1W_6 (BARI Mung-5 along with weed free condition) and V_2W_4 (BARI Mung-6 + 2 weeding at 15 and 35 DAS) in the production of branches per plant and above ground dry matter per plant. Yield contributing characters like pods per plant (81.17), seed per plant (356.73), pod length (4.17 cm), 1000seed wt (23.67 g) were maximum as recorded from V_2W_6. Statistically at per values of pods per plant and pod length were observed by V_2W_4. The highest seed yield (1.75 t ha^{-1}) and stover yield (2.72 t ha^{-1}) were achieved. Almost all these parameters were lower in values when BARI Mung-5 grown with out any weed management.

Conclusion

The maximum seed yield (1.75 t ha^{-1}) could be obtained from BARI Mung-6 when weed management was given at 15 and 35 DAS which was 68.3% higher than control. It is noted that continuous weeding show higher yield than two weedings at 15 & 35 DAS of both varieties. One weeding at 25 or 35 DAS also showed reasonable seed yield. Over all it is suggested that at lest weed should be controlled up to 35 DAS with one or two hand weeding.

Recommendations

Considering above finding of the of the present experiment, further studies in this aspect may be conducted or adaptive trial is needed in different agro-ecological zones (AEZ) of Bangladesh with one or two weedings versus control.

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APPENDICES

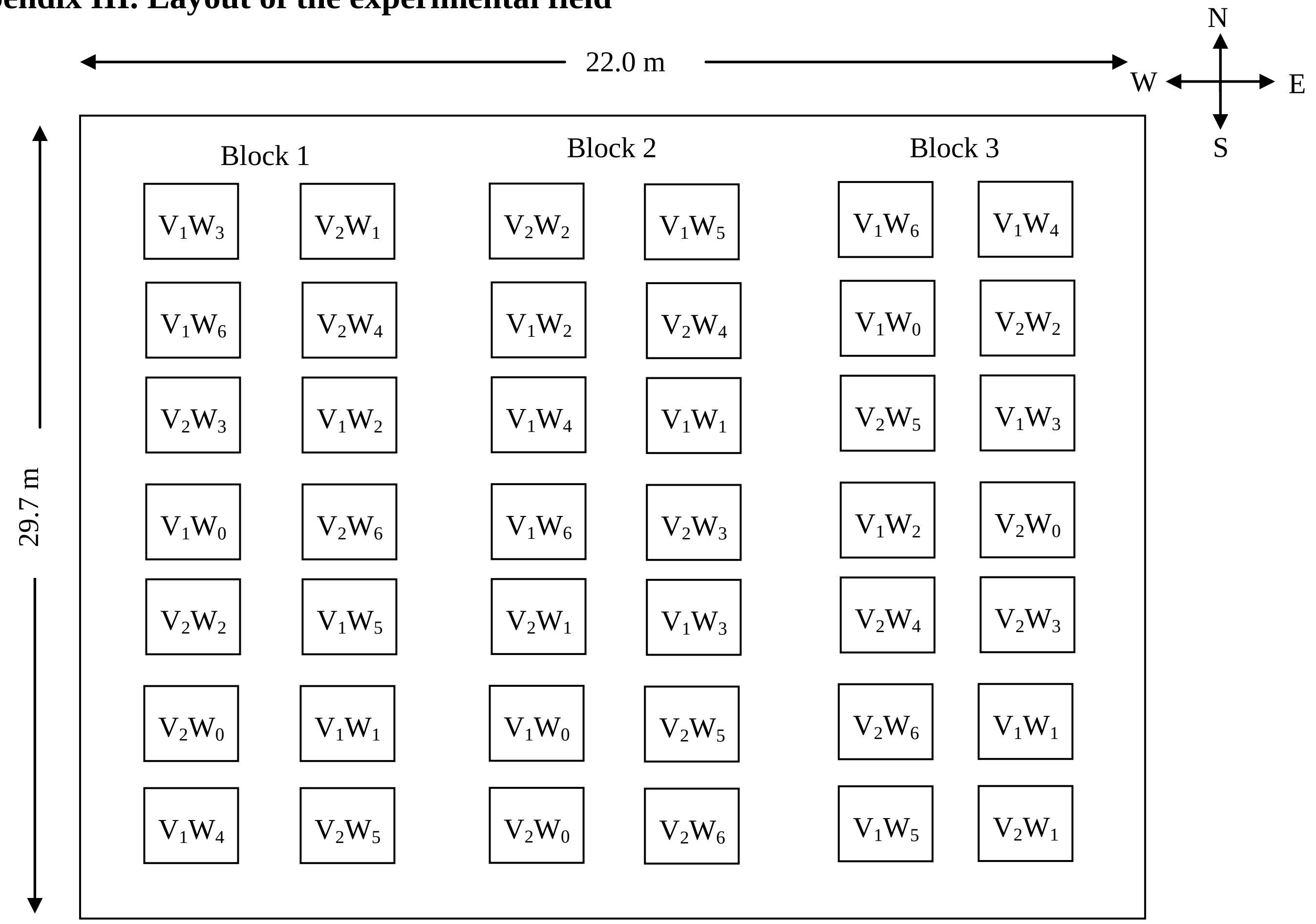
Appendix I. Physical and chemical characteristics of the experimental soil

1. pH		6.0
2. Particle-size analysis of soil	Sand	29.04
	Silt	41.80
	Clay	29.16
3. Textural Class		Silty Clay
4. Organic matter (%)		0.840
5. Total N (%)		0.067
6. Phosphorous (ppm)		8.333
7. Potassium (ppm)		25.00

Appendix II. Monthly record of air temperature, relative humidity and rainfall of the experimental site during the period from August to November 2008

Month	Air temperature (^{0}C)		Relative humidity (%)	Rainfall (mm)
	Maximum	Minimum		
August	33.6	23.6	69	163
September	22.4	13.5	74	00
October	29.18	18.26	81	39
November	25.82	16.04	78	00

Appendix III. Layout of the experimental field



Plot size = 3.6 m × 2.5 m

Plot spacing = 0.5 m

Between replication= 1.0 m

<u>Factor A:</u> Mungbean variety

V_1= BARI Mung-5

V_2= BARI Mung-6

<u>Factor B:</u> Weed management

W_0= No weeding (Control)

W_1= One weeding at 15 DAS

W_2= One weeding at 25 DAS

W_3= One weeding at 35 DAS

W_4= Two weeding at 15 and 35 DAS

W_5= Two weeding at 25 and 45 DAS

W_6= Weed free condition

Appendix IV. Analysis of variance of the data on plant height of mungbean as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square					
		Plant height (cm) at					
		20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Harvest
Replication	2	1.153	0.153	2.203	0.817	5.374	0.654
Factor A (Variety)	1	11.060*	6.456*	58.012**	62.306*	52.468**	56.214**
Factor B (Weed management)	6	5.868**	18.076**	34.171**	28.904*	45.735**	38.351**
Interaction (A×B)	6	4.420*	3.412*	38.620**	41.888**	24.030**	11.502*
Error	26	1.661	1.327	7.204	10.622	4.203	3.615

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix V. Analysis of variance of the data on branches plant^{-1} of mungbean as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square					
		Branches plant^{-1}					
		20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	Harvest
Replication	2	0.003	0.021	0.016	1.422	0.722	0.096
Factor A (Variety)	1	0.421**	0.594**	1.566**	21.859**	57.869**	41.601**
Factor B (Weed management)	6	0.045**	0.402**	0.571**	7.279**	11.983**	25.333**
Interaction (A×B)	6	0.023*	0.202**	2.088**	6.814**	8.572**	14.072**
Error	26	0.010	0.055	0.154	1.403	1.656	1.781

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VI. Analysis of variance of the data on above ground dry matter plant^{-1} of mungbean plant as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square				
		Above ground dry matter plant^{-1} (g) at				
		20 DAS	30 DAS	40 DAS	50 DAS	60 DAS
Replication	2	0.390	0.524	0.556	0.956	0.943
Factor A (Variety)	1	0.111	0.278	0.865	0.579	0.846
Factor B (Weed management)	6	2.329**	1.432*	5.267**	5.576**	4.603**
Interaction (A×B)	6	1.348*	2.421**	3.263**	3.055**	7.935**
Error	26	0.466	0.459	0.877	1.029	0.954

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VII. Analysis of variance of the data on yield contributing characters and yield of mungbean as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square								
		Days to 1st flowering	Days to 80% pod maturity	Number of pods plant^{-1}	Number of seeds plant^{-1}	Pod length (cm)	Weight of 1000 seeds (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	Harvest index (%)
Replication	2	0.857	2.167	2.779	123.624	0.004	2.507	0.001	0.009	2.979
Factor A (Variety)	1	27.524**	8.595	59.524**	3807.62*	0.420*	1.907	0.286**	0.282*	5.821
Factor B (Weed management)	6	14.937**	56.873**	36.692**	1865.40*	0.349**	8.247**	0.178**	0.345**	3.591
Interaction (A×B)	6	20.413**	16.095*	6.064*	3689.50**	0.647**	4.910*	0.098*	0.395**	27.158
Error	26	2.883	6.141	7.928	650.714	0.066	1.827	0.033	0.058	19.134

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VIII. Analysis of variance of the data on crop growth rate (CGR) of mungbean plant as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square			
		Crop Growth Rate (CGR) at			
		20-30 DAS	30-40 DAS	40-50 DAS	50-60 DAS
Replication	2	0.620	0.436	2.680	0.505
Factor A (Variety)	1	2.055	0.451	0.001	6.173
Factor B (Weed management)	6	0.450	4.026*	1.488	2.440
Interaction (A×B)	6	1.933	1.258	0.925	4.748
Error	26	1.208	1.580	2.895	1.737

*: Significant at 0.05 level of significance

Appendix IX. Analysis of variance of the data on relative growth rate (RGR) of mungbean plant as influenced by variety and weed management

Source of variation	Degrees of freedom	Mean square			
		Relative Growth Rate (RGR) at			
		20-30 DAS	30-40 DAS	40-50 DAS	50-60 DAS
Replication	2	0.0001	0.0001	0.0001	0.0001
Factor A (Variety)	1	0.0001	0.0001	0.0001	0.0001
Factor B (Weed management)	6	0.0001	0.0001	0.0001	0.0001
Interaction (A×B)	6	0.0001	0.0001	0.0001	0.0001
Error	26	0.0001	0.0001	0.0001	0.0001