EFFECT OF MULCHING ON TWO VARIETIES OF POTATO

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CERTIFICATE

This is to certify that the thesis entitled **"Effect of Mulching on Two Varieties of Potato"** submitted to the Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of ***MASTER OF SCIENCE in HORTICULTURE***, embodies the result of a piece of bona fide research work carried out by **Md. Zahirul Islam**, Registration No. 07/2618 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: 30.06.2008
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DEDICATED
TO
MY BELOVED PARENTS

LIST OF ABBREVIATED TERMS

FULL NAME	ABBREVIATION
Agro-Ecological Zone	AEZ
and others	*et al.*
Bangladesh Bureau of Statistics	BBS
Centimeter	Cm
Degree Celsius	°C
Date After Planting	DAP
Etcetera	etc
Food and Agriculture Organization	FAO
Hectare	ha
Kilogram	kg
Meter	m
Millimeter	mm
Number	no.
Percent	%
Randomized Complete Block Design	RCBD
Sher-e-Bangla Agricultural University	SAU
Square meter	m^2

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The Author

EFFECT OF MULCHING ON TWO VARIETIES OF POTATO

ABSTRACT

The experiment was conducted in the Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during October 2007 to February 2008 to find out the effect of mulching on two varieties of potato. The experiment considered with two factors. Factor A: Mulching (5 types) - M_0: No mulching (Control), M_1: Black polythene, M_2: Rice straw, M_3: Saw dust and M4: Water hyacinth. Factor B: Varieties of potato (2) V_1: Lal Shil and V_2: Lal Pakri. Data on different yield contributing characters and yield were recorded and found that At 75 DAP, the maximum plant height (54.76 cm), foliage coverage(76%), number of tubers per hill (8.15), dry matter content in tuber (17.30%) and yield (13.95 t/ha) was recorded from M_1 treatment and the minimum values were observed from M_0 treatment. At 75 DAP, the maximum plant height (48.65 cm), foliage coverage (65-87%), number of tubers per hill (7.30), dry matter content in tuber (16.34%) and yield (12.96 t/ha) was recorded from Lal Shil variety and the minimum values were found from Lal Pakri variety. In case of combined effect at 75 DAP, the maximum plant height (56.16 cm), foliage coverage (80.33%), number of tubers per hill (8.80), dry matter content in tuber (18.38%) and yield (14.52 t/ha) was recorded from M_1V_1 and the minimum values were observed from M_0V_2 treatment. BCR: The highest benefit cost ratio (2.05) was recorded from M_1V_1 and the lowest (1.50) was recorded from M_0V_2 treatment. So, it may be concluded that Black polythene mulching with Lal Shil variety was found suitable.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a tuber crop belonging to the family Solanaceae. It had originated in the Peru-Bolivian region in the Andes of South America (Grewal *et al.*, 1992). The crop is grown during the winter season and it is the third most important crop of Bangladesh followed by rice and wheat (Illias, 1998). Nutritionally, the tuber is rich in carbohydrates or starch and is a good source of protein, vitamin C and B, potassium and iron. Being a carbohydrate rich crop, potato can partially substitute rice, which is our main food item. In many countries, including those of Europe, America, and Canada, potato is a staple food.

During 2-3 decades, production of potato in Bangladesh has increased with the cultivation of high yielding varieties. Most of the seed tuber, which is used by the farmer for production of potato, is not of high quality. This results in poor yield in the following growing season. Recent reports indicate that 4.16 million tons of potato was produced in this country from 302 thousand hectars of land in 2005-2006 (BBS, 2007). The average yield of potato was 14.89 t/ha in Bangladesh, which is very low in comparison to that of other leading potato growing countries of the world, such as, USA (43.49 t/ha), Denmark (39.41 t/ha) and UK (43.38 t/ha) (FAO, 2005). The reasons for low yield of potato in Bangladesh are climatic limitation, poor yielding seed tubers, pests and diseases, unscientific production practices etc.

Potato is grown during the winter season when rainfall is scarce and irrigation becomes essential for providing sufficient moisture to the growing crop. Irrigation facilities are not uniform in all the regions of Bangladesh due to costly establishment of pumps and low level of underground water. To minimize the cultivation cost mulching could be effectively used instead of irrigation. Mulch is again highly effective in checking evaporation and is therefore recommended for most crops of home garden like potato, sweet potato, carrot and ginger (Kim *et al.* 1988; Chowdhury *et al.*, 1993; Jaiswal *et al.*, 1996). Mulching also suppresses weed infestation effectively. Furthermore, it stimulates microbial activity in soil by increasing soil temperature and therefore improves agro-physical properties of soil. Different kinds of mulch play important role in conserving soil moisture. So temperature is an important factor for potato production, which is influenced by mulch. Artificial mulch such as crop residues, plant species, saw dust or polyethylene sheet is generally practiced for production of horticultural crops (Wilhoit *et al.*, 1990).

In recent years, the Tuber Crops Research Centre of BARI has collected many new varieties of potato from the International Potato Research Centre, Peru, and from other sources. These are being tested under Bangladesh field conditions, to determine whether they can be recommended for cultivation in the country. The Centre has already made good contribution towards the development of some high yielding potato varieties. Several dozens of high yielding varieties (HYV) of potato were brought to Bangladesh and tried under local conditions before recommendation for general cultivation. Though constant evaluation of the traits,

varietal performance, and considerations of other characteristics, about 10 HYV have been released for cultivation in the country. However, most of the HYV are disease and pest sensitive. On the other hand, most of our indigenous variety of potato are less disease sensitive and can be grown with minimum care and most of them are suitable for our environmental condition.

Considering the above factors, the present experiment was undertaken with the following objectives-

1. to determine a suitable mulch material for maximizing the production of potato,
2. to find out the suitable combination of potato variety and mulch material for ensuring growth and higher yield of potato.
3. to find out the suitable mulch material for specific variety from economic point of view.

CHAPTER II

REVIEW OF LITERATURE

2.1 Effect of mulching on the growth and yield of potato

Potato cultivar LuYin 1 (Shandong Academy of Agriculture, China) was tested by Zhang *et al.* (2004) under different mulching conditions: (A) no mulching (control); (B) routine mulching, using one film to cover one ridge; (C) potatoes planted in both inner sides of the ridge, using one film to cover two ridges; and (D) potatoes planted in a deep ditch on each ridge with a 7-8 cm ditch left after putting back the covering soil, using one film to cover one ridge. In treatments C and D, the ground temperature was higher than that of B and A, and the time for seedlings to come out was shortened. Treatment C showed significant increases in the height of individual plants, the stem diameter and the number of leaves. The yield of treatment C was significantly higher than that of A (increased by 55.7%) and B (increased by 14.9%).

Singh *et al.* (2004) conducted an experiment at Balipatna block of Khurda district in Orissa, India, during winter 2001-02 to study the effect of irrigation and mulching on hydrothermal state, nutrient availability, growth and tuber yield of potato. The treatments consisted of: T_1, no irrigation and no mulch; T_2, one irrigation of 30 mm given at 30 days after planting (DAP); T_3, one irrigation of 30 mm given at 60 DAP; and T_4, mulching with rice straw at 5 t/ha applied just after planting. The pattern of soil moisture depletion did not show significant differences among the treatments up to 30 DAP. T_1 showed the lowest level of

soil moisture at any given stage of the crop. The rate of depletion of soil moisture was fastest in T_2 and slowest in T_4. Soil moisture in T_3 and T_1 was intermediate between T_2 and T_4.

Uniyal and Mishra (2003) conducted an experiment with five locally available mulch materials, i.e. wheat straw, green twigs, farmyard manure (FYM), piltu (dry leaves of Pinus roxburghii) and forest litter on potato cv. Kufri Jyoti grown under mid-hill conditions of Uttaranchal, India, during summer 1998, 1999 and 2000. The mulches had significant influence on soil moisture, soil temperature, plant height, fresh shoot weight, tuber weight, number of tubers per plant, and tuber yield. Mulching with FYM was found most efficient in increasing soil moisture, soil temperature, plant height, fresh shoot weight, tuber weight, and tuber yield, followed by forest litter.

To explore the possibility of improving the yield of fall-grown potato through recycled paper mulching, the changes of soil environment and the growth and yield of potato cv. Daeji as affected by three mulching treatments of non-mulched control, recycled paper mulching (RPM), and black polyethylene film mulching (BPFM) were examined by Cui *et al.* (2002) over two fall seasons at Suwon, Korea Republic. The mulching materials were a recycled mulch paper with 110 g/m2 and a thickness of 0.1 mm, which was manufactured from old corrugated containers for this experiment and a commercial black polyethylene film with a thickness of 0.01 mm. The mulching treatments were more advantageous than the control in the conservation of soil water. Growth after emergence and yield were

significantly higher in RPM than in the control and BPFM. It was concluded that the significantly improved yield in RPM compared to that in the control was mainly due to the improvement of the sprout emergence and tuber growth accompanied by lower soil temperature and better conservation of soil water.

Momirovic (1997) conducted a field study in 1994-95 near Sisevac, Yugoslavia, with potatoes cv. Desiree which were grown with or without application of 5 t/ha of organic mulch (air-dried material from natural meadows). Mulch application resulted in a significant decrease in soil temperature in the root zone and the conservation of soil moisture. The number and weight of tubers and yield in the mulch treatment were significantly greater in both years than of without mulching.

Collins (1997) reported that transparent black polythene and polythene coated black paper mulches increased soil temperature and advanced emergence of potato. He also reported that transparent black polythene and polythene coated black paper mulches non significantly reduced the yield of potato from bare soil of 46.9 and 48.3 t/ha clear polythene mulch.

Results of 6 field trials in 1990-96 on sandy loam in the Aadorf region using differing procedures and machines are reported. Direct and indirect mulching with Phacelia, mustard or rape were compared using different cultivation and weed control by Spiess *et al.* (1997). Although green manuring and mulching had environmental benefits such as reduction in nitrate leaching, soil and ridge erosion, work peaks and soil management, and yield potential was similar to traditional cultivation methods.

Saha *et al.* (1997) carried out an experiment with four different irrigation schedules, such as an unirrigated control and irrigation at 20, 40, and 60% depletion of available soil moisture (DASM) were tested on potato (Solanum tuberosum) cv. Cardinal with or without a 15-cm thick rice straw mulch in a Plinthic Paleustult in Bangladesh. The permissible limit of available soil moisture (ASM) depletion was within 20-40% to achieve a high yield target from potatoes under the edaphic and climatic settings of the experimental area. This required 6-7 irrigations without mulch and 4-5 irrigations with mulch. Mulching increased tuber yield by 4 t/ha averaged across irrigation schedules.

Jalil (1995) conducted an experiment at the Horticulture farm, Bangladesh Agricultural University, Mymensingh in order to study effect of mulch on potato. Black polythene mulched potato took minimum time to reach 80% emergence, resulted maximum coverage of area. However, yield was higher with water hyacinth mulch.

Santosa *et al.* (1994) conducted a field trial on alluvial soil in Malang, Indonesia in 1994, potatoes cv. Granola, Temate and Herta were given 0, 5, 10 or 15 t manure/ha and mulched at a rate of 10 t rice straw/ha or not mulched. Tuber yield was 19.88, 18.55 and 16.26 t/ha in Herta, Granola and Temate.

Mulching helps checking evaporation and thus soil can retain sufficient amount of moisture. Polyethylene film mulches reduce evaporation in vegetable cultivation (Lamont, 1993). Natheny *et al.* (1992) also found that white, pale blue and

stripped straw mulch produced more than 15% marketable tubers of potato than no much (control) plots.

Khalak and Kumaraswamy (1992) conducted a field trial in 1985-1987 on red sandy soil at Bangalore, Karantakea. Potatoes cv. Kufrijyoti was irrigated with 20 or 40 mm water and the crop was given no mulch, straw mulch or polythene mulch. Tuber yield and N uptake were the highest in both years with 20mm irrigation water. Mulching with straw and polythene gave average tuber yields of 18.2 and 16.7 t/ha respectively compared with 14.3 t/ha without mulching.

Taja *et al.* (1991) reported that mulching by rice straw with optimum inorganic fertilizer application of 50 kg N/ha was good for canopy coverage of potato.

Sarker and Hossain (1989) studied the effect of weeding and mulching on potato cv. Cardinal and reported that the percentage of foliage coverage, which ranged from 40.0 to 65.0 was significantly different among the treatments, the lowest coverage being obtained from the control (no weeding) treatment. Mulching also increased growth of leaf and stem (Kim *et al.*, 1988).

Sutater (1987) found an increase in plant height and the number of potato leaf with different mulching treatments. Mangaser *et al.* (1986) stated that mulch in potato improved yield and proportion of marketable size tubers compared to no mulch plants. They also reported that potato planting with mulch should be done from the last week of November up to second week of December to obtain the

best yield. Mulching conserved the soil moisture better in potato cultivation (Prihar, 1986).

Manrique and Mcyer (1984) found in a study of black and white plastic and various qualities of barley straw as mulches for non heat-tolerant potato variety at Manila Agricultural Experiment Station, Lima, Peru, that during winter, soil temperature in plastic mulched plots ranged from 18 to 26°C. The condition gave relatively higher tuber yield in most of the varieties.

Rashid *et al.* (1981) conducted a trial at Joydeppur, Dhaka on potato cv. Cardinal cultivated with or without ridges, without mulching or mulching with water hyacinth, rice straw, or spikelets (Chitta). Tuber yield was the highest (17.6 t/ha) when the plants were ridged and mulched with water hyacinth. Emergence in no mulched plots was significantly lower than that of mulched plots.

Challaiah and Kulkani (1979) conducted an experiment in potato with irrigation at 13 to 15 days interval in combination with polythene mulch. Polythene mulch gave higher yield (30.64 t/ha). Bhattacharjee *et al.* (1979) demonstrated that potato yields were higher with straw mulch than that of without mulch on coarse textural soil in Patna, India.

Black polythene, sawdust and dried grass mulch in potato production improved soil moisture retention but black polythene mulch had the best result (Patil and Basad, 1972). In a separate experiment, Bieoral (1970) found that polythene sheets caused a 2% increase in the moisture content of the top 30cm of the soil.

2.2 Effect of variety on the growth and yield of potato

Luthra *et al.* (2006) reported that Kufri Arun is a medium maturing, main season, high yielding table potato variety suitable for cultivation in north Indian plains. It is a clonal selection from the cross between Kufri Lalima and MS/82-797. Its plants are tall and vigorous with field resistance to late blight. Its tubers are red, oval with shallow to medium eyes and creamy-light yellow flesh, and having good keeping quality. It is fertilizer responsive and capable of yielding 350-400 q/ha under optimum agronomical practices.

Pandey *et al.* (2006) reported that Kufri Chipsona-3 is a medium maturing, late blight resistant potato variety with oval tubers, white smooth skin and cream/pale yellow flesh. The variety is meant for processing, especially chip making, and is an improvement over the existing varieties Kufri Chipsona-1 and Kufri Chipsona-2. The total and process grade tuber yields of Kufri Chipsona-3 are higher than those of Kufri Chipsona-1 and Kufri Chipsona-2. The total tuber yields are higher than even the popular table variety Kufri Bahar. Kufri Chipsona-3 yields excellent defect free tubers. The physiical maturity of its tubers occurs at 110 days.

Qingshu 1 is a mid-late-maturing variety, derived from the cross Kexin 2 x 86-6-3 that was examined and approved in November 2004 by the Crop Variety Evaluation Committee of Gansu Province, China. Its characteristics include suitable growth period, desirable agronomic traits, fine tuber quality, strong resistance to multiple diseases, and high tuber yield.

The evaluation of nine potato cultivars (Diamant, Desiree, 9511, 9620, 9619, 384093, Hateema, Adora and Draga) was done by Abbasi *et al.* (2004) in Faisalabad, Pakistan on the basis of different plant growth and yield parameters. The emergence percentage of all the cultivars showed non-significant difference except Draga, which gave the lowest percentage of emergence. Maximum numbers of plants were observed in Hateema, Desiree, Diamant and Adora. The cultivar 9619 gave maximum number of stems per plant. The highest number of large tubers per plot (66.75) was produced by 9620 and Draga gave minimum number of large tubers per plot (7.75) while maximum weight of large tubers per plot (6.09 kg/plot) was given by the variety 9620. The highest number of medium tubers per plot was produced by variety 9619 with 195.3 followed by Diamant with 168.3 number of medium tubers per plot, while Adora gave lowest number of medium tubers per plot (93.00). The maximum number of total tubers per plot (1343) was produced by 9619 followed by Diamant (1247.50). The maximum weight (54.11 kg/plot) of tubers was found in 9619 while the lowest weight (25.30 kg/plot) of tubers was given by Draga.

A field experiment was conducted by Ray *et al.* (2004) in West Bengal, India during 1999-2000 and 2000-01 to study tuber yield, dry matter content and storage life of potato tubers under room temperature using newly released indigenous processing cultivars viz. Kufri Chipsona-1 and Kufri Chipsona-2 and six Dutch potato cultivars viz. Cardinal, Diamant, Ajax, Fresco, Marfona and Sante. The cultivar Kufri Jyoti was used as control. Among the nine cultivars, Cardinal recorded the maximum tuber yield (30.53 t/ha) followed by Diamant

(29.76 t/ha), K. Chipsona-1 (26.53 t/ha), K. Jyoti (25.39 t/ha) and K. Chipsona-2 (24.07 t/ha). Only three cultivars viz. K. Chipsona-1 (21.98%), K. Chipsona-2 (20.85%) and Diamant (19.18%) recorded higher dry matter content than that of K. Jyoti (18.87%).

Seven table potato varieties were tested by Haase (2002) on heavy soils during 1999-2001 at Frankenhausen near Kassel, Germany, on an organic research station (converted in 1998). Average yields were 46 t/ha in 1999, 34 t/ha in 2000, and 44 t/ha in 2001. Highest marketable yields were obtained with Agria (40 t/ha), while lowest were obtained with Laura and Delikat (32 t/ha).

Gregoriou and Onoufriou (2002) conducted an experiment on farmers fields in the main potato growing area of Cyprus (Kokkinochoria area). Emphasis was given to yield and earliness, and to tuber quality characters (keeping quality, size and shape, cooking, colour of skin and flesh, dry matter, appearance, physiological disorders, etc.). Considering the continuously changing production and marketing requirements and the fact that selection of a potato variety is a compromise among various factors, the varieties: Superstar, Burren, Ditta, Arinta, Cynthia, Filea, Othello, Armada, Akira, Fabula and Vivaldi were recommended for commercial production.

Five potato cultivars of Dutch origin were compared in trials by Ghimbasan (1997) in Romania in 1993 on humus-semiclayey and sandy (stony) soils. Doritta, Aminca, Sante, Carlita and Novita produced 46.91, 50.95, 45.00, 41.47 and 27.90 t/ha on the humus-semiclayey soil and 42.94, 35.71, 36.67, 35.32 and 22.22 t/ha

on the sandy soil. The tuber yields of Doritta and Aminca were not significantly different from the standard variety Sante, whereas Novita produced significantly lower yield than Sante on both types of soil.

The results of field trials are summarized by Guarda *et al.* (1997) at 8 sites throughout Italy in 1997 to gather data on the morphological, production, phytopathological and food processing characteristics of 35 potato cultivars. A method is outlined which uses the data gathered to calculate a general varietal index. This index can be used to describe the relative merits of each variety, and hence to decide which varieties are best cultivated under different conditions and for different purposes.

Wu *et al.* (1997) conducted an experiment with potato variety Yushu 1 that was selected from the progeny of the cross Gaoyuan 7 x 762-93. Yushu 1 has early maturity, high yield, is resistant to disease and deterioration. It can be harvested 65 days after planting. Tuber yield is 33.7 t/ha in spring and 22.5 t/ha in autumn. The tubers have good quality and are suitable for export and processing. Yushu 1 can be grown on the plains as part of a double cropping system or by single cropping in mountainous districts.

A brief report is given by Kuznetsova (1997) of small-scale Russian tests over 12 years involving at least 3-4 varieties each year. Among the most promising varieties were Bronnitskii and the German variety Adretta. In tests of 5 varieties during 1995-96 (2 from the Netherlands and 3 from Russia), the highest yielding was Radja from the Netherlands (over 2 kg/plant). Promising also was the Russian

variety Effekt, which responded well to cultural conditions. The best for flavour were those from the Netherlands.

Yield formation was studied by Reust (1997) in mid-early varieties Agria and Matilda, and mid-late Panda, grown during 1992-95. Tuber bulking rate was largely influenced by growing conditions. Mean daily yield increases varied from 500 to 1000 kg/ha, and high yielding variety Agria showed the highest rate of daily increase. Early in the season, starch content increased in proportion to the tuber bulking rate.

Brief descriptions are given by Glukhov (1994) of 2 varieties bred, tested and multiplied by scientists of the All-Russian Institute of Potato Farming at their base at Belousovskoe Experimental Farm in the Kaluga province of European Russia. The former is able to give yields of 15 t/ha within 60 days of planting. The midlate Belousovskii produces 18-20 tubers/cluster. The tubers are white, spherical to oval, with small eyes. The flesh is white. The marketable tubers weigh 50-120 g and contain 25-26% dry matter and up to 20% starch.

2.3 Combined effect of mulch and variety on the growth and yield of potato

Jalil *et al.* (2004) conducted an experiment in Mymensingh, Bangladesh from December 1994 to March 1995 to examine the effects of different mulch materials on potato yield. The mulching treatments were: no mulch with no irrigation (control), no mulch with irrigation, natural mulch with irrigation, and mulching with rice straw, water hyacinth, black polythene or white polythene. The mulching treatments were applied on the potato cultivars Lal Pakri and Cardinal. The black polythene mulch took the minimum time (12 days) to reach 80% emergence. Lal Pakri took a longer time (97.33 days) to attain maturity than Cardinal (87.91 days). White polythene mulch enhanced early maturity (89.17 days), while natural mulch+irrigation treatment took a longer time (96.33 days). The maximum yields for Cardinal and Lal Pakri were obtained from water hyacinth mulching (47.70 and 28.4 t ha^{-1}, respectively) and the lowest yields were recorded for the control (38.54 and 19.79 t ha^{-1}, respectively). Water hyacinth mulch was found to be economically best mulching treatment.

Bhuyan (2003) conducted a field experiment at the Horticulture Farm of Bangladesh Agricultural Univertsity, Mymensingh during the period from November 2002 to March 2003 to investigate the effect of mulching, variety and crop management practices on growth and yield of potato. The experiment was conducted with four mulching treatments, (no mulch no irrigation, irrigation, saw dust and straw mulch); two varieties (Diamant' and 'Cardinal') and use of organic manure without pesticides application). Mulching treatments showed significant effect on most of the yield and yield components. The highest yield (21.31 t/ha)

was obtained from straw mulch followed by sawdust (19047 t/ha), irrigation treatment (19.06 t/ha) and no mulch no irrigation treatment (15.29 t/ha). The variety also caused significant variations on most of the parameters. The variety Diamant gave the higher yields (19.07 t/ha) followed by Cardinal (18.51 t/ha) yield.

A field experiment was conducted by Chowdhury *et al.* (2000) in the rabi (dry) season of 1997-98 on a clay terrace soil in Salna, Gazipur, Bangladesh, to study the effects of rice straw mulching and irrigation on the yield, total water use, and water use efficiency of an indigenous low yielding cultivar of potato, Lal pakri. The experiment was executed in a split plot design comprising the combination of the two mulching conditions (no mulching or covering the soil surface with 12- to 15-cm thick rice straw) as a main plot and five frequencies of irrigation distributed as a subplot. Rice straw mulch conserved soil moisture and maintained a higher moisture regime in each irrigation level throughout the cropping period. The treatments of rice straw mulching and the single irrigation 30 days after sowing were the best combination with a satisfactory high yield of 7.9 Mg ha^{-1} in the 1997-98 rabi season having a good amount and distribution of rain.

A field experiment was conducted by Jaiswal (1995) during 3 consecutive years (1990-92) to develop agronomic practices for raising early crop of potato (*Solanum tuberosum*) in warm-temperature condition. The crop planted on 25 September gave 27 and 19% more yield than the crop planted on 5 and 15 September respectively. All cultivars ('Kufri Chandramukhi', 'Kufri Jyoti' and 'JH

222') gave the highest tuber yield when planted on 25 September. Among the cultivars, 'Kufri Chandramukhi' gave the highest yield, followed by 'Kufri Jyoti'. On an average, mulching increased the tuber yield by 25% over no mulch; however, the increases due to mulching were 58 and 46% in crop planted on 5 and 15 September respectively. Mulching reduced daily maximum soil temperature at 15 cm depth by 1.5-4.5 degrees C, resulting in faster emergence, early canopy development and higher tuber yield. Mulching also effectively controlled the weed growth. Weed dry weight was reduced substantially with delayed planting.

Siddique and Rashid (1990) conducted experiments for 3 seasons (1987/88) to study the effect of irrigation and mulching on the yield of 3 varieties of potato (Challisha, Lalpakri and Pakri Lalita). Water hyacinth was used for mulching. From the results they found that the varieties responded very well to both irrigation and mulching.

CHAPTER III

MATERIALS AND METHODS

3.1 Experimental Site

The present experiment was carried out in the Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during October 2007 to February 2008. The location of the experimental site is $23^0 74^/N$ latitude and $90^0 35^/E$ longitude and at an elevation of 8.2 m from sea level (Anon., 1989).

3.2 Characteristics of Soil

The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) under AEZ No. 28. It had shallow red brown terrace soil. The selected plot was medium high land and the soil series was Tejgaon (FAO, 1988). The characteristics of the soil under the experimental plot were analyzed in the Soil Testing Laboratory, SRDI, Farmgate, Dhaka and details of the recorded soil characteristics were presented in Appendix I.

3.3 Weather Condition of the Experimental Site

The climate of experimental site was under the subtropical climate, characterized by three distinct seasons, the monsoon or the winter season from November to February and the pre-monsoon or hot season from March to April and the monsoon during May to October (Edris *et al.*, 1979). Details of the meteorological data during the period of the experiment was collected from the Bangladesh Meteorological Department, Agargoan, Dhaka and presented in Appendix II.

3.4 Planting Material

Potato tubers of Lal Shil and Lal Pakri were used in the experiment as planting material. The potato tubers were collected from Dhaka Seed store, Siddique Bazar, Dhaka.

3.5 Treatment of the Experiment

The experiment was carried out to find out the effects of mulching on two varieties of potato. The experiment had two factors.

Factor A: Five Mulch materials;

i. M_0: No mulching (Control)
ii. M_1: Black polythene
iii. M_2: Rice straw
iv. M_3: Saw dust
v. M_4: Water hyacinth

Factor B: Two varieties of potato;

i. V_1: Lal Shil
ii. V_2: Lal Pakri

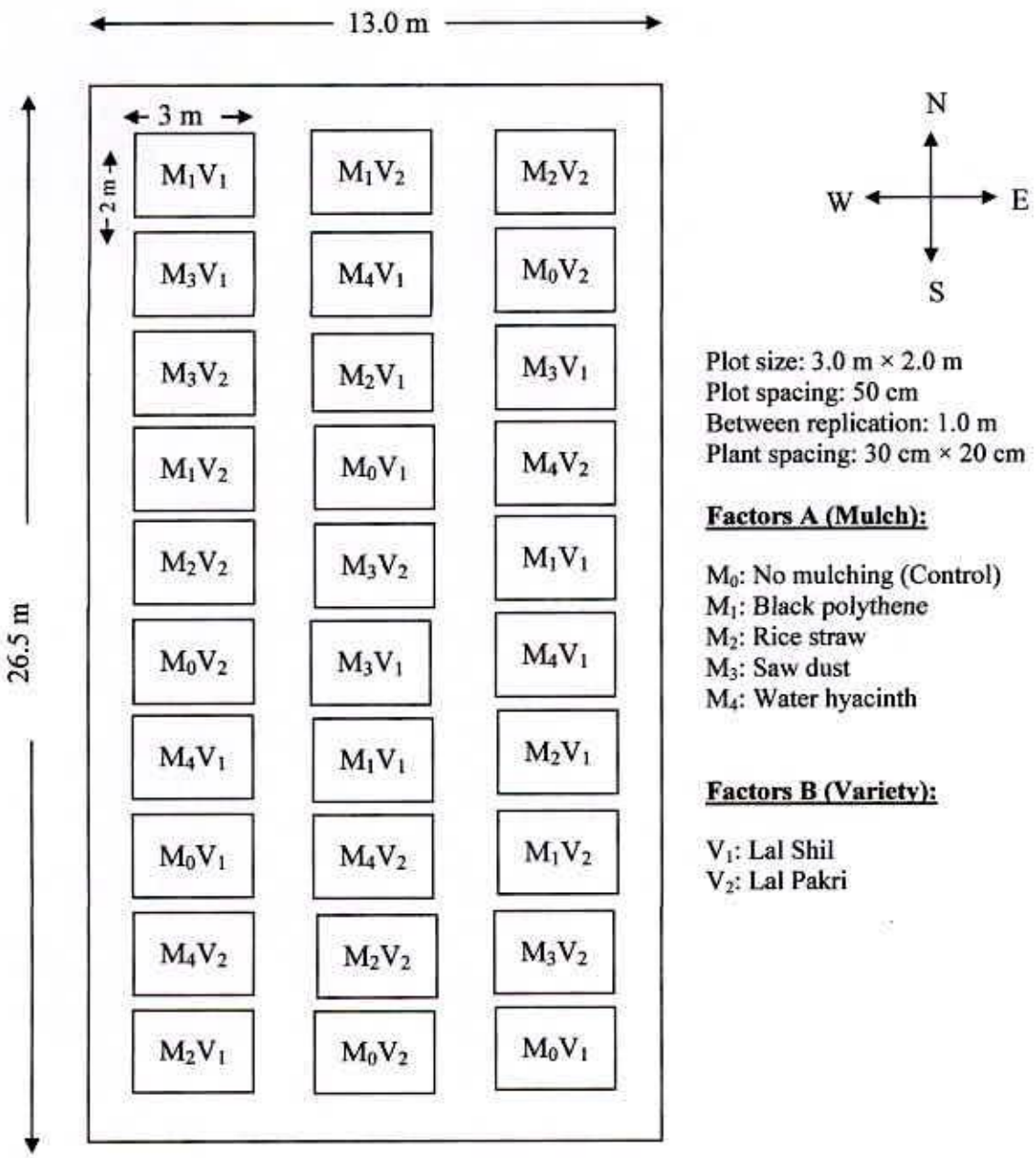
There were the 10 treatment combinations such as M_0V_1, M_0V_2, M_1V_1, M_1V_2, M_2V_1, M_2V_2, M_3V_1, M_3V_2, M_4V_1 and M_4V_2.

3.6 Experimental design and layout

The two factors experiment was laid out following Randomized Complete Block Design (RCBD) with three replications. An area of 30.5 m × 12.0 m was divided into three equal blocks. Each block was divided into 10 plots where 10 treatment combinations were allotted at random. There were 30 unit plots and the size of the each unit plot was 3.0 m × 2.0 m. The distance maintained between two blocks and two plots were 1.0 m and 0.5 m respectively. The potato tubers were sown with row to row distance 30 cm and plant to plant 20 cm. The layout of the experiment is shown in Figure 1.

3.7 Preparation of the main field

The selected experimental plot was opened in the second week of October 2007 with a power tiller and was exposed to the sun for a week. After one week the land was harrowed, ploughed and cross-ploughed several times followed by laddering to obtain a good tilth. Weeds and stubbles were removed to obtain a desirable tilth of soil for planting of potato tubers. The experimental plot was partitioned into the unit plots in accordance with the experimental design. Mulching and variety as per treatments were applied as per unit plot. The soil was treated with fungicide Theovit against the fungal attack.



Plot size: 3.0 m × 2.0 m
Plot spacing: 50 cm
Between replication: 1.0 m
Plant spacing: 30 cm × 20 cm

Factors A (Mulch):

M_0: No mulching (Control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

Factors B (Variety):

V_1: Lal Shil
V_2: Lal Pakri

Figure 1. Field layout of the experiment

3.8 Application of manure and fertilizers

Nitrogen, phosphorus and potash were applied in the form of urea, TSP and MP. Well-rotten cow dung, TSP and MP was applied during final land preparation. Urea was applied in three equal installments at 15, 30 and 45 days after tuber planting. The following manures and fertilizers were used as recommended by Rashid (1993).

Table 1. Dose and method of application of fertilizers in potato field

Fertilizers	Dose/ha	Application (%)			
		Basal	15 DAT	30 DAT	45 DAT
Cowdung	10 tons	100	--	--	--
Urea	250 kg	--	33.33	33.33	33.33
TSP	150 kg	100	--	--	--
MP	250 kg	100	--	--	--

3.9 Application of mulch treatment

Mulches of black polythene sheet, rice straw, saw dust and water hyacinth were applied immediately after planting of potato tubers while small holes were made on black polythene sheet for proper emergence of seedlings.

3.10 Planting of potato tubers

Healthy and uniform sized potato tubers with emerged eyed of the variety Lal Shil and Lal Pakri were planted in the row of the main field on November 25, 2007. Maintaining at a spacing of 30 cm × 20 cm between row to row and plant to plant were made during planting of tuber. Tubers were planted below 2.5 cm from surface soil and after planting tubers were covered with loose and fertile soil.

3.11 After care

When the seedlings started to emerge in the beds mulch materials were removed for easy growth and development of potato seedlings. The crop was always kept under careful observation. After emergence of seedlings, various intercultural operations were accomplished for better growth and development of the potato seedlings.

3.11.1 Weeding

Weeding was done in control plot to keep the plots free from weeds, easy aeration of soil, which ultimately ensured better growth and development.

3.11.2 Plant Protection

Furadan 5G @ 20 kg/ha was applied during final preparation of the main field to prevent the crop and tubers from the attack of soil insects. Ridomil Gold 0.2% was sprayed at an interval of 10 days, commencing at 40 days after seed sowing in the experimental plots, as a preventive measure against late blight disease.

3.12 Harvesting

The crop was harvested depending upon the maturity of each variety. Harvesting was done manually, with the help of a spade. Enough care was taken to avoid injury of tubers during harvesting period.

3.13 Data collection

Data were recorded on different parameters from the sample plants during the course of experiment. Ten plants were randomly selected from each unit plot for

the collection of data. The plants in the outer rows and the extreme end of the middle rows were excluded from the random selection to avoid the border effect.

3.13.1 Plant height

The height of plant was recorded in centimeter (cm) at 15, 30, 45, 60, 75 and 90 DAP in the experimental plots. Data were recorded as the average of 10 plants selected at random from the inner rows of each unit plot. The height was measured from the ground level to the tip of the growing point.

3.13.2 Foliage coverage

The foliage coverage was recorded by visual estimation of land area of the plot covered by the foliage at 15, 30, 45, 60, 75 and 90 days after planting of tubers.

3.13.3 Number of main stem per plant

Total number of main stem at harvest was recorded as the average of 10 plants selected at random from each unit plot. The total stems were recorded by counting the entire main stem per hill.

3.13.4 Fresh weight of stem per plant

The fresh weight of stem at harvest was recorded as the average of 10 plants selected at random from each unit plot. The weight of the stems was recorded immediately after harvest.

3.13.5 Dry matter content of stem per plant

After recording the fresh weight of the stems, the stems were chopped and dried well in sun. The sun-dried stems were then dried in an oven at 65^0C for 72 hours, until a constant weight was achieved.

The day weight of the sample was recorded in percent and the mean value was calculated. Then the dry matter of stem per plant was calculated by using formula:

$$\% \text{ Dry matter of stem} = \frac{\text{Dry weight of stem}}{\text{Fresh weight of head}} \times 100$$

3.13.6 Number of tubers per hill

Total number of potato at harvest was recorded as the average of 10 plants selected at random from each unit plot. The total number of tubers was recorded by counting the entire potato per hill.

3.13.7 Dry matter content of tubers

After recording the fresh weight of the tubes, the tubers were chopped and dried well in sun. The sun-dried stems were then dried in an oven at 65^0C for 72 hours, until a constant weight was achieved. Percent dry matter was calculated by using formula:

$$\% \text{ Dry matter of} = \frac{\text{Dry weight of tuber}}{\text{Fresh weight of tuber}} \times 100$$

3.13.8 Weight of tubers per hill

Ten hills from middle row ware selected from each unit plot, and the yield of potato tubers were obtained.

3.13.9 Yield per hectare

Yield per hectare of potato was calculated by converting the weight of plot yield to hectare and was expressed in ton.

3.14 Statistical Analysis

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

3.15 Economic analysis

The cost of production was analyzed in order to find out the most economic treatment of mulch material and variety. All input cost included the cost for lease of land and interests on running capital in computing the cost of production. The interests were calculated @ 13% in simple rate. Analyses were done according to the procedure of Alam *et al.* (1989). The benefit cost ratio (BCR) was calculated as follows:

$$\text{Benefit cost ratio} = \frac{\text{Gross return per hectare (Tk.)}}{\text{Total cost of production per hectare (Tk.)}}$$

CHAPTER IV

RESULTS AND DISCUSSION

The present experiment was conducted to determine the effect of different mulching on two varieties of potato. Data on different yield contributing characters and yield at different days after planting (DAP) were recorded to find out the suitable mulch material for specific variety. The analysis of variance (ANOVA) of the data on different yield components and yield are given in Appendix III-V. The results have been presented and discussed, and possible interpretations given under the following headings-

4.1 Plant height

Statistically significant difference was recorded due to different mulch materials on plant height of potato at 15, 30, 45, 60, 75 and 90 DAP (Appendix III). At 15 DAP, the longest (9.50 cm) plant was recorded from MI (black polythene) which was closely followed (8.62 cm, 8.32 cm and 7.89 cm) by M_3 (saw dust), M_4 (water hyacinth) and M_2 (rice straw), respectively and the shortest (6.82 cm) plant was found from M_O (no mulch). The longest (21.55 cm) plant was recorded from M_1 which was closely followed (18.71 cm, 18.53 cm and 16.97 cm) by M_3, M_4 and M_2, respectively, while the shortest (14.95 cm) plant was found from MO at 30 DAP. At 45 DAP, the longest (33.53 cm) plant was recorded from MI which was closely followed (30.72 cm, 30.47 cm and 28.65 cm) by M_3, M4 and M_2, respectively and the shortest (21.48 cm) plant was observed from M_O The longest (47.73 cm) plant was recorded from MI which was statistically identical (44.77

Table 2. Combined effect of mulch materials and varieties of potato

Treatment combination	Plant height (cm) at					
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
M_0V_1	7.18 de	15.57 de	22.36 d	35.10 de	41.20 ef	35.47 ef
M_0V_2	6.45 e	14.32 e	20.60 d	31.12 e	38.94 f	32.81 f
M_1V_1	9.94 a	22.65 a	35.85 a	49.92 a	56.16 a	51.77 a
M_1V_2	9.05 ab	20.45 ab	31.20 b	45.54 ab	53.36 ab	47.91 ab
M_2V_1	8.04 bcd	17.36 cd	29.84 bc	42.30 bc	45.82 cde	41.33 cd
M_2V_2	7.73 cd	16.58 cde	27.45 c	39.22 cd	43.55 def	38.49 de
M_3V_1	8.92 abc	19.22 bc	32.40 b	46.34 ab	50.10 bc	46.31 bc
M_3V_2	8.33 bcd	18.20 bcd	29.04 bc	43.20 bc	47.25 cd	43.12 bcd
M_4V_1	8.50 bc	18.94 bc	32.00 b	46.05 ab	49.95 bc	45.07 bc
M_4V_2	8.13 bcd	18.12 bcd	28.94 bc	43.00 bc	46.82cd	41.31 cd
$LSD_{(0.05)}$	1.113	2.575	3.180	4.252	4.543	4.755
Significance level	0.05	0.05	0.01	0.05	0.01	0.01
CV(%)	7.89	8.27	6.40	5.88	7.60	6.54

DAP: Days after planting
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

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

cm) with M_3 and closely followed (44.53 cm) by M_4, while the shortest (33.11 cm) plant was found from M_0 at 60 DAP. At 75 DAP, the longest (54.76 cm) plant was recorded from M_1 which was closely followed (48.67 cm and 48.39 cm) by MS and M4, respectively and the shortest (40.07 cm) plant was observed from M_0. The longest (49.84 cm) plant was recorded from MI which was closely followed (44.71 cm) by M_3 and the shortest (34.14 cm) plant was recorded from M_0 at 90 DAP (Figure 2). Mulch materials create favorable condition for the growth of plant such response was possibly due to the physiochemical and

biological improvement occurred in the soil including favorable temperature and moisture regimes, nutrient availability and microbial activity that mulching might have" provided. Among the different mulch materials black polythene was more effective. Probably, black polythene was more suitable for ensuring soil moisture that is why black polythene treated plot preserved maximum level of moisture. Similar results also reported by Uniyal and Mishra (2003), Manrique (1995) Santosa *et al.* (1994).

Plant height varied significantly due to different variety of potato at 15, 30, 45, 60, 75 and 90 DAP (Appendix III). The tallest plant (8.52 cm, 18.75 cm, 30.49 cm, 43.94 cm, 48.65 cm and 43.99 cm) was recorded from Lal Shil variety at 15, 30, 45, 60, 75 and 90 DAP. On the other handle shortest (7.94 cm, 17.53 cm, 27.45 cm, 40.42 cm, 45.98 cm and 49.07 cm) plant was recorded from Lal Pakri variety 15, 30, 45, 60, 75 and 90 DAP (Figure 3). Plant height varied for variety to variety. (Mainly it is gene governed characteristics but management practices influence it very little)

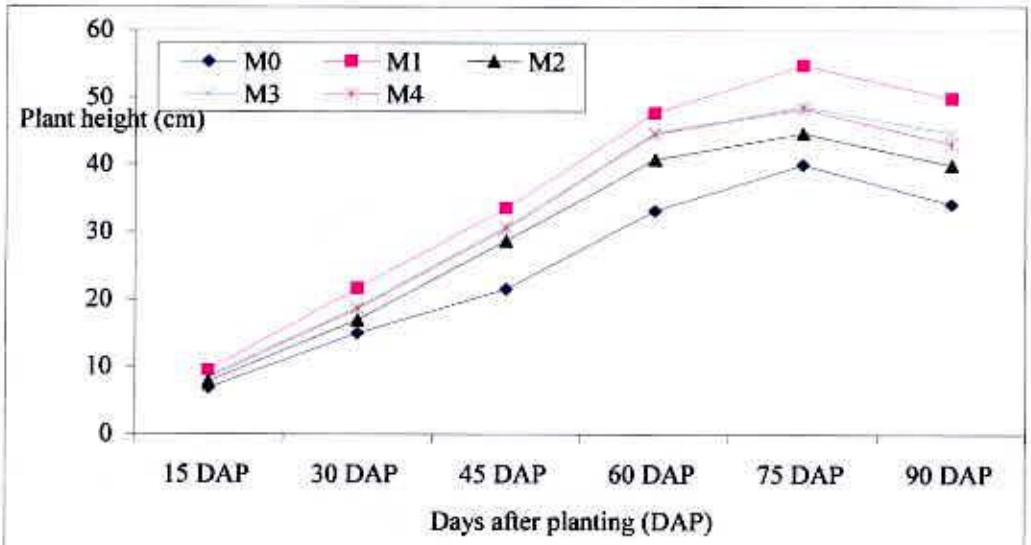


Figure 2. Effect of mulch materials on plant height of potato
Horizontal lines represent at 0.05 level of probabiltiy

M_0: No mulching
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_3: Water hyacinth

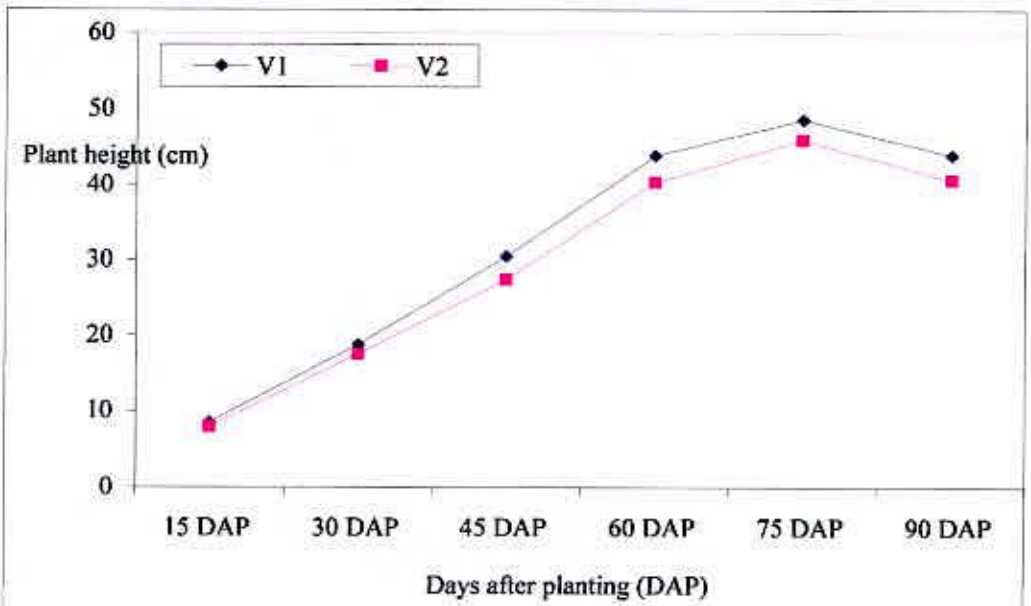


Figure 3. Effect of variety on plant height of potato
Horizontal lines represent at 0.05 level of probabiltiy

V_1: Lal Shil
V_2: Lal Pakri

Statistically significant variation was recorded due to combined effect of different mulch materials and varieties on plant height at 15, 30, 45, 60, 75 and 90 DAP (Appendix III). At 15 DAP, the longest (9.94 cm) plant was found from M_1V_1 (black polythene + Lal Shil) and the shortest (6.45 cm) plant was found from M_0V_2 (no mulch + Lal Pakri). The longest (22.65 cm) plant was recorded from M_1V_1 and the shortest (14.32 cm) plant was observed from M_0V_2 at 30 DAP. At 45 DAP, the longest (35.85 cm) plant was recorded from M_1V_1 and the shortest (20.60 cm) plant was found from M_0V_2. The longest (49.92 cm) plant was recorded from M_1V_1 and the shortest (31.12 cm) plant was observed from MoV_2 at 60 DAP. At 75 DAP, the longest (56.16 cm) plant was recorded from M_1V_1 and the shortest (38.94 cm) plant was found from M_0V_2. The longest (51.77 cm) plant was observed from M_1V_1 and the shortest (32.81 cm) plant was observed from M_0V_2 at 90 DAP (Table 2).

4.2 Foliage coverage

Different mulch materials showed a statistically significant difference on foliage coverage of potato at 15, 30, 45, 60, 75 and 90 DAP (Appendix IV). At 15 DAP, the maximum (16.50%) foliage coverage was found from M_1 (black polythene) which was closely followed (14.17% and 13.50%) by M_3 (saw dust) and M_4 (water hyacinth), respectively and the minimum (10.50%) foliage coverage was found from M_0 (no mulch). The maximum (33.50%) foliage coverage was observed from M_1 which was closely followed (29.00% and 27.67%) by M_3 and M_4, respectively whereas the minimum (21.83%) foliage coverage was recorded from M_0 at 30 DAP. At 45 DAP, the maximum (53.67%) foliage coverage was

recorded from M_1 which was closely followed (49.50% and 49.17%) by M_3 and MI, respectively and the minimum (34.17%) foliage coverage was observed from MO- The maximum (66.33%) foliage coverage was recorded from MI which was closely followed (62.00% and 61.17%) by M_3 and M4, while the minimum (39.33%) foliage coverage was recorded from MO at 60 DAP. At 75 DAP, the maximum (76.00%) foliage coverage was found from MI which was closely followed (68.50% and 67.67%) by M_3 and M_4, respectively and the minimum (44.83%) foliage coverage was observed from M_0. The maximum (64.17%) foliage coverage was recorded from M_1 which was closely followed (57.50% and 55.67%) by M_3 and M4, while the minimum (33.67%) foliage coverage was recorded from M_0 at 90 DAP (Figure 4). Mulch materials created favorable condition for the growth of plant Such response was objective due to the physiochemical and biological improvement occurred in the soil including favorable temperature and moisture regimes, nutrient availability and microbial v/ activity of mulching Among the different mulch materials black polythene was more effective. which ensured maximum vegetative growth with maximum foliage coverage. Jalil (1995) reported that black polythene mulched potato took minimum time to reach 80% emergence, resulted maximum coverage of area. Taja *et al.* (1991) reported that mulching by rice straw with optimum inorganic fertilizer application of 50 kg N/ha were good for canopy coverage of potato.

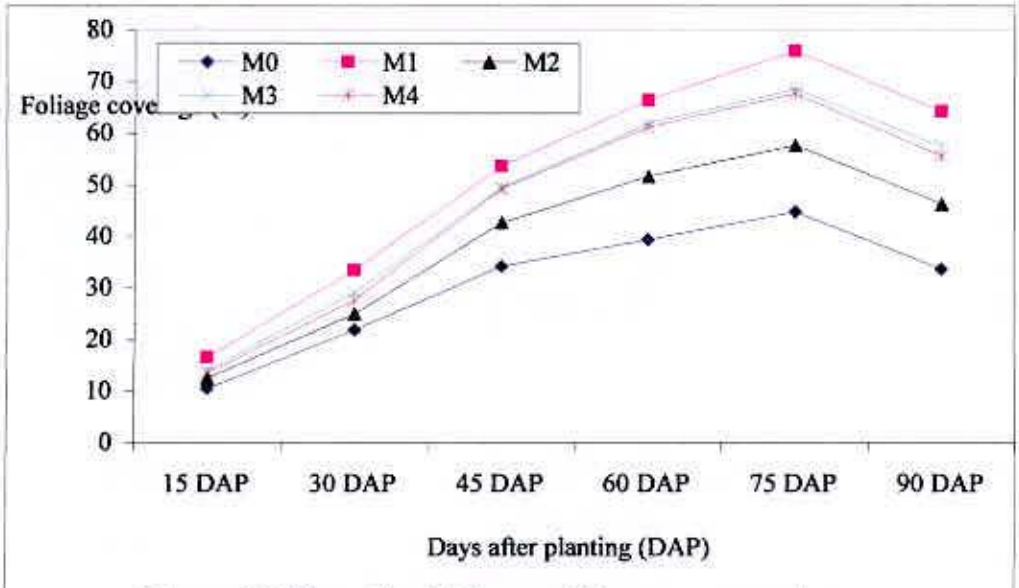


Figure 4. Effect of mulching on foliage coverage of potato
Horizontal lines represent at 0.05 level of probabiltiy

M_0: No mulching
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_3: Water hyacinth

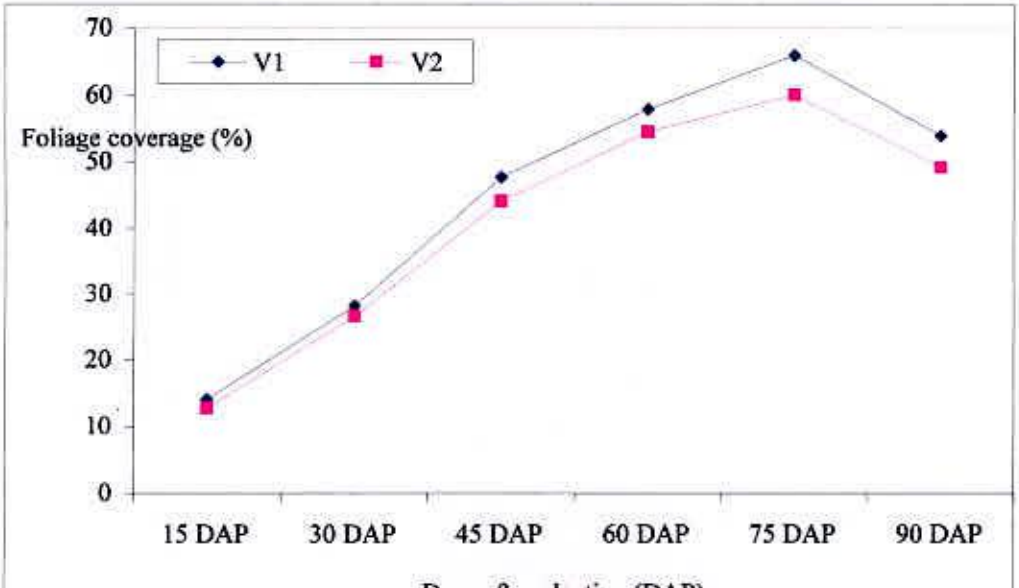


Figure 5. Effect of variety on foliage coverage of potato
Horizontal lines represent at 0.05 level of probabiltiy

V_1: Lal Shil
V_2: Lal Pakri

Foliage coverage differ of significantly due to different variety of potato at 15, 30, 45, 60, 75 and 90 DAP (Appendix IV). The maximum foliage coverage (14.13%, 28.20%, 47.67%, 57.80%, 65.87% and 53.67%) was observed from Lal Shil variety at 15, 30, 45, 60, 75 and 90 DAP. On the other hand the minimum (12.73%, 26.60%, 44.00%, 54.40%, 60.00% and 49.07%) foliage coverage was recorded from Lal Pakri variety 15, 30, 45, 60, 75 and 90 DAP (Figure 5).

A statistically significant variation was recorded due to the combined effect of h different mulch materials and varieties on foliage coverage at 15, 30, 45, 60, 75 and 90 DAP (Appendix IV). At 15 DAP, the maximum (17.67%) foliage coverage was recorded from MiVi (black polythene + Lal Shil) and the minimum (10.33%) foliage coverage was recorded from M_0V_2 (no mulch + Lal Pakri). The maximum (35.33%) foliage coverage was found from M_1V_2 and the minimum (21.33%) foliage coverage was observed from M_0V_2 at 30 DAP. At 45 DAP, the maximum (55.67%) foliage coverage was recorded from M_1V_1 and the minimum (33.00%) foliage coverage was found from M_0V_2. The maximum (68.33%) foliage coverage was recorded from M_1V_1 and the minimum (37.67%) foliage coverage was observed from M_0V_2 at 60 DAP. At 75 DAP, the maximum (80.33%) foliage coverage was recorded from M_1V_1 and the minimum (42.33%) foliage coverage was found from M_0V_2. The maximum (67.33%) foliage coverage was recorded from M_1V_1 and the minimum (31.67%) foliage coverage was observed from M_0V_2 at 90 DAP (Table 3).

Table 3. Combined effect of mulch materials and varieties of potato.

Treatment(S)	Foliage coverage (%) at					
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
M_0V_1	10.67 d	22.33 ef	35.33 f	41.00 e	47.33 e	35.67 e
M_0V_2	10.33 d	21.33 f	33.00 f	37.67 e	42.33 e	31.67 e
M_1V_1	17.67 a	35.33 a	55.67 a	68.33 a	80.33 a	67.33 a
M_1V_2	15.33 b	31.67 b	51.67 ab	64.33 ab	71.67 b	61.00 ab
M_2V_1	13.00 c	25.00 de	44.00 de	54.33 c	60.33 cd	47.67 cd
M_2V_2	12.00 cd	25.00 de	41.33 e	49.00 d	55.00 d	45.00 d
M_3V_1	15.33 b	30.33 bc	51.33 abc	63.33 ab	71.00 b	60.67 ab
M_3V_2	13.00 c	27.67 cd	47.67 bcd	60.67 b	66.00 bc	54.33 bc
M_4V_1	14.00 bc	28.00 cd	52.00 ab	62.00 b	70.33 b	58.00 b
M_4V_2	13.00 c	27.33 cd	46.33 cde	60.33 b	65.00 bc	53.33 bc
$LSD_{(0.05)}$	1.951	3.216	4.815	5.147	6.210	7.278
Significance level	0.05	0.01	0.05	0.01	0.01	0.01
CV(%)	8.46	6.84	7.12	5.35	9.75	11.24

DAP: Days after planting
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

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

4.3 Number of main stem per hill

A statistically significant difference was recorded due to different mulch materials on number of main stem per hill of potato (Appendix V). The maximum (5.67) number of main stem per hill was observed from M_1 (black polythene mulch) which was closely followed (5.00 and 4.67) by M_3 (saw dust) and MLt (water hyacinth), respectively and the minimum (2.83) number of main stem per hill was found from M_0 (no mulch) (Figure 6). Mulch materials created favorable condition for the growth of plant which lead to The production of maximum number of main stem per hill.

Number of main stem per hill varied significantly due to different variety of potato (Appendix V). The maximum (4.73) number of main stem per hill was recorded from Lal Shil variety and the minimum (3.87) number of main stem per hill was recorded from Lal Pakri variety (Figure 7).

Combined effect of different mulch materials and varieties on number of main stem per hill showed statistically significant difference (Appendix V). The maximum (6.00) number of main stem per hill was recorded from the treatment combination of M_1V_1 (black polythene mulch + Lal Shil) and the minimum (2.33) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5).

4.4 Weight of stem per plant

Statistically significant difference was recorded due to different mulch materials on weight of stem per plant of potato (Appendix V). The maximum (91.68 g) weight of stem per plant was recorded from M_1 (black polythene mulch) which was

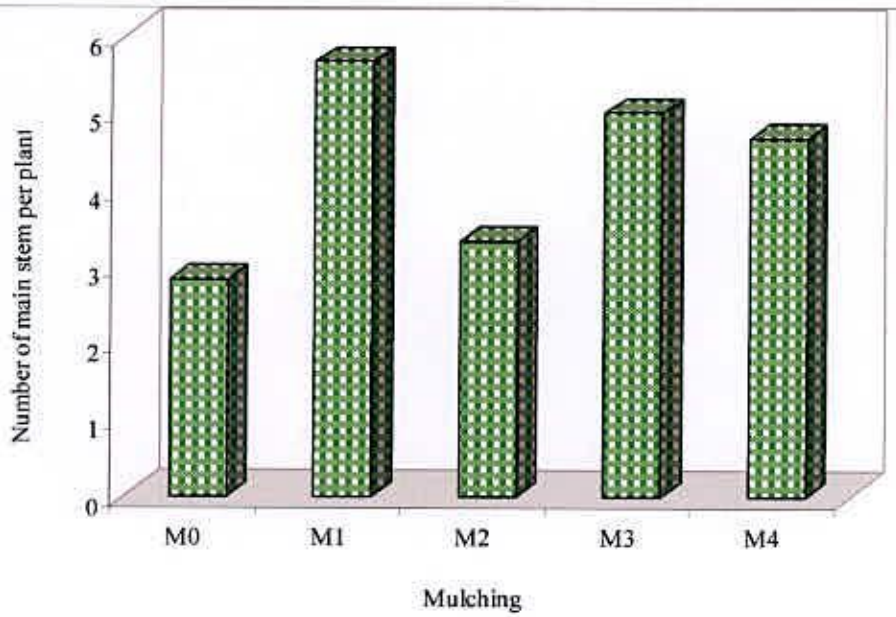


Figure 6. Effect of mulching on number of main stem per plant of potato vertical bars represent at 0.05 level of probability.

M_0: No mulching
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_3: Water hyacinth

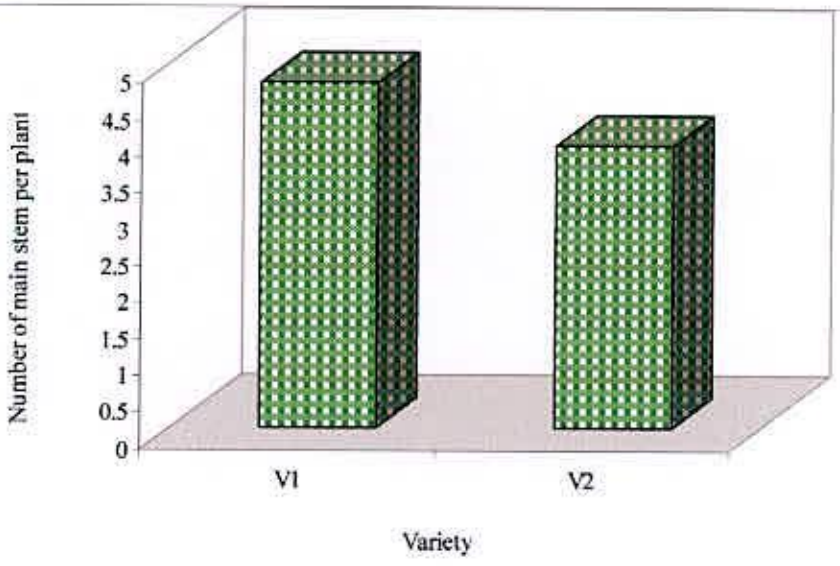


Figure 7. Effect of mulching on number of main stem per plant of potato vertical bars represent at 0.05 level of probability.

V_1: Lal Shil
V_2: Lal Pakri

closely followed (80.1 1 g and 79.20 g) by M_3 (saw dust) and M_4 (water hyacinth), respectively and the minimum (47.70 g) weight of stem per plant was found from

(no mulch) (Table 4). Mulch materials created favorable condition for the growth of plant which leady to production of maximum weight of stem per plant.

Weight of stem per plant varied significantly due to different varicty of potato (Appendix V). The maximum (77.55 g) weight of stem per plant was observed from Lal Shil variety and the minimum (70.40 g) weight of stem per plant was recorded from Lal Pakri variety (Table 4).

Statistically significant difference was recorded due to the combined effect of different mulch materials and varieties on weight of stem per plant (Appendix V). The maximum (95.24 g) weight of stem per plant was found from M_1V_1 (black polythene + Lal Shil) and the minimum (44.25 g) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5).

4.5 Dry matter content in stem

Mulch materials showed statistically significant variation on dry matter content in stem of potato (Appendix V). The maximum (12.33%) dry matter content in stem was observed from MI (black polythene) which was statistically identical (12.08% and 11.62%) with M_3 (saw dust) and M_4 (water hyacinth), respectively and the minimum (1 1.51%) dry matter content in stem was recorded from M_0 (no mulch) (Table 4).

Table 4. Main effect of mulch materials and varieties of potato contributing characters.

Treatment(S)	Weight of stem per plant (g)	Dry matter content in stem (%)	Number of tubers per hill	Dry matter content in tubers (%)	Weight of tubers per hill (g)
Mulching					
M_0	47.70 d	11.51 ab	5.50 d	13.10 c	108.50 d
M_1	91.68 a	12.33 a	8.15 a	17.30 a	230.00 a
M_2	71.18 c	10.88 b	6.45 c	15.47 b	189.50 c
M_3	80.11 b	12.08 a	7.05 b	16.25 ab	215.00 b
M_4	79.20 b	11.62 ab	7.20 b	15.91 b	210.50 b
$LSD_{(0.05)}$	3.563	0.871	0.493	1.245	8.412
Significance level	0.01	0.05	0.01	0.01	0.01
Variety					
V_1	77.55 a	12.02 a	7.30 a	16.34 a	206.40 a
V_2	70.40 b	11.35 b	6.44 b	14.88 b	175.00 b
$LSD_{(0.05)}$	2.253	0.551	0-312	0-788	5.320
Significance level	0.01	0.05	0.01	0.01	0.01
CV(%)	8.97	6.15	5.92	10.58	7.64

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

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

Table 5. Combined effect of mulch materials and varieties of potato yield contributing characters.

Treatment(S)	Number of main stem per hill	Weight of stem per plant (g)	Dry matter content in stem (%)	Number of tubers per hill	Dry matter content in tubers (%)	Weight of tubers per hill (g)	Yield (t/ha)
M_0V_1	3.33 cd	51.15 e	12.96 a	5.80 ef	13.75 de	112.00 g	10.14 e
M_0V_2	2.33 d	44.25 f	10.05 d	5.20 f	12.45 e	105.00 g	9.45 e
M_1V_1	6.00 a	95.24 a	12.48 ab	8.80 a	18.38 a	250.00 a	14.52 a
M_1V_2	5.33 ab	88.12 b	12.18 abc	7.50 bc	16.22 bc	210.00 c	13.38 b
M_2V_1	3.33 cd	74.00 c	10.92 cd	6.80 cd	16.10 bc	204.00 cd	12.84 bc
M_2V_2	3.33 cd	68.36 d	10.84 cd	6.10 de	14.84 cd	175.00 f	11.20 d
M_3V_1	5.67 a	84.22 b	12.16 abc	7.50 bc	16.96 ab	235.00 b	13.74 ab
M_3V_2	4.33 bc	76.00 c	12.00 abc	6.60 d	15.54 bcd	195.00 de	12.05 cd
M_4V_1	5.33 ab	83.15 b	11.56 bc	7.60 b	16.50 bc	231.00 b	13.55 ab
M_4V_2	4.00 c	75.25 c	11.68abc	6.80 cd	15.33 bcd	190.00 e	11.84 cd
$LSD_{(0.05)}$	1.049	5.039	1.232	0.697	1.761	11.90	0.981
Significance level	0.01	0.01	0.05	0.01	0.01	0.01	0.01
Cv(%)	14.22	8.97	6.15	5.92	10.58	7.64	9.66

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

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

Dry matter content in stem varied significantly due to different variety of potato (Appendix V). The maximum (12.02%) dry matter content in stem was found from Lal Shil variety and the minimum (11.35%) recorded from Lal Pakri variety (Table 4).

Statistically significant difference was recorded due to combined effect of different mulch materials and varieties on dry matter content in stem (Appendix V). The maximum (12.48%) dry matter content in stem was observed from M_1V_1) (black polythene + Lal Shil) and the minimum (10.05%) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5).

4.6 Number of tubers per hill

Statistically significant difference was recorded due to different mulch materials on number of tubers per hill of potato (Appendix V). The maximum (8.15) number of tubers per hill was found from M_1 (black polythene) which was closely followed (7.20 and 7.05) by M_4 (water hyacinth) and Ma (saw dust), respectively and the minimum (5.50) number of tubers per hill was found from MO (no mulch) (Table 4). Mulch materials created favorable condition for the growth of plant which lead to the production of maximum vegetative growth with maximum number of tubers per hill. Burger and reported that mulching by straw produced 30% more tubers than me no mulch potato crops.

Number of tubers per hill varied significantly due to different variety of potato (Appendix V). The maximum (7.30) number of tubers per hill was found from

Lal Shil variety and the minimum (6.44) from Lal Pakri variety (Table 4).

Statistically significant difference was recorded due to the combined effect of different mulch materials and varieties on number of tubers per hill (Appendix V). The maximum (8.80) number of tubers per hill was observed from M_1V_1 (black polythene + Lal Shil) and the minimum (5.20) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5).

4.7 Dry matter content in tubers

Statistically significant difference was recorded due to different mulch materials on dry matter content in tuber of potato (Appendix V). The maximum (17.30%) dry matter content in tuber was observed from M_1 (black polythene) which was statistically identical (16.25%) with Ma (saw dust) and the minimum (13.10%) dry matter content in tuber was found from M_0 (no mulch) (Table 4).

Dry matter content in tuber varied significantly due to different variety of potato (Appendix V). The maximum (16.34%) dry matter content in tuber was recorded from Laf Shil variety and the minimum (14.88%) dry matter content in tuber was found from Lal Pakri variety (Table 4).

Statistically significant difference was recorded due to the combined effect of h-different mulch materials and varieties on dry matter content in tuber (Appendix V). The maximum (18.38%) dry matter content in tuber was recorded from M_1V_1

(black polythene + Lal Shil) and the minimum (12.45%) was from (no mulch + Lal Pakri) (Table 5).

4.8 Weight of tubers per hill

Statistically significant difference was recorded due to different mulch materials on weight of tubers per hill of potato (Appendix V). The maximum (230.00 g) weight of tubers per hill was recorded from M_1 (black polythene) which was closely followed (215.00 g and 210. 50 g) by M_3 (saw dust) and M_4 (water hyacinth), respectively and the minimum (108.50 g) weight of tubers per hill was found from MO (no mulch) (Table 4). Mulch materials created favorable condition for the growth of plant which lead to production of maximum weight of tubers per hill. Bhattacharjee *et al* (1979) demonstrated that potato yields were higher/ with straw mulch than that of without mulch on coarse textural soilin Patna, India.

Weight of tubers per hill varied significantly due to different variety of potato (Appendix V). The maximum (206.40 g) weight of tubers per hill was recorded from Lal Shil variety and the minimum (175.00 g) weight was recorded from Lal Pakri variety (Table 4).

Statistically significant difference was recorded due to combined effect of different mulch materials and varieties on weight of tubers per hill (Appendix V). The maximum (250.00 g) weight of tubers per hill was recorded from M_1V_1 (black polythene + Lal Shil) and the minimum (105.00 g) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5). (black polythene + Lal Shil) and the minimum (12.45%) was roumHTom (no mulch + Lal Pakri) (Table 5).

4.9 Yield per hectare

Mulch materials showed statistically significant difference on yield per hectare of potato (Appendix V). The maximum (13.95 ton) yield per hectare was recorded from M_1 (black polythene) which was closely followed (12.90 ton and 12.70 ton) by M_3 (saw dust) and M_4 (water hyacinth), respectively and the minimum (9.80 ton) yield per hectare was observed from M_0 (no mulch) (Figure 8). Mulch materials created favorable condition for the growth of plant which lead to i production of maximum yield per hectare. Momirovic (1997) also reported that mulch application resulted in a significant decrease in soil temperature in the root zone and the conservation of soil moisture. The number and weight of tubers and tuber yield in the mulch treatment were significantly greater than on plots without mulching.

Yield per hectare differed significantly due to different variety of potato (Appendix V). The maximum (12.96 ton) yield per hectare was recorded from Lal Shil variety and the minimum (11.58 ton) yield per hectare was obtained from Lal Pakri variety (Figure 9). Jalil *et al.* (2004) reported that the maximum yields for Cardinal and Lal Pakri were obtained from water hyacinth mulching (47.70 and 28.4 t ha^{-1}, respectively) and the lowest yields were recorded for the control (38.54 and 19.79 t ha^{-1}, respectively). Water hyacinth mulch was found to be economically the best mulching treatment.

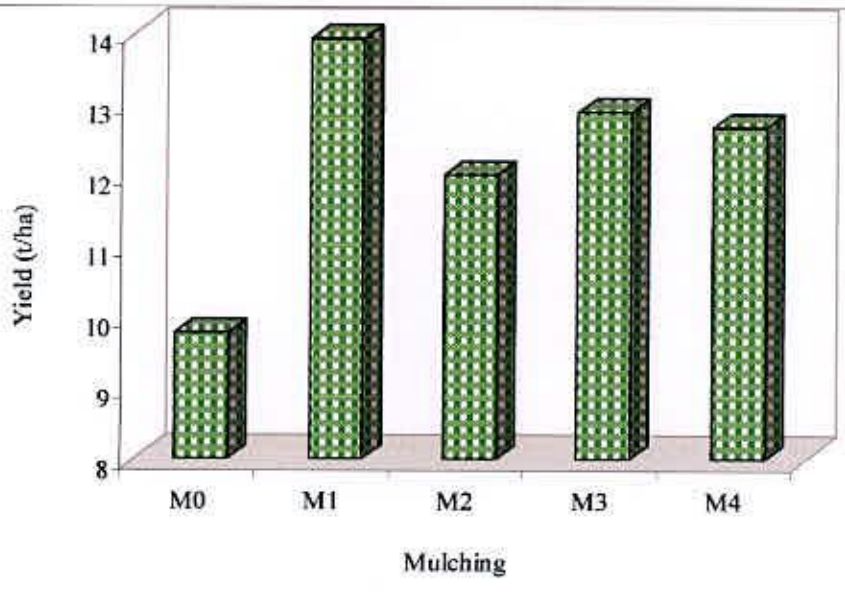


Figure 8. Effect of mulching on number of main stem per plant of potato vertical bars represent at 0.05 level of probability.

M_0: No mulching M_1: Black polythene
M_2: Rice straw M_3: Saw dust
M_3: Water hyacinth

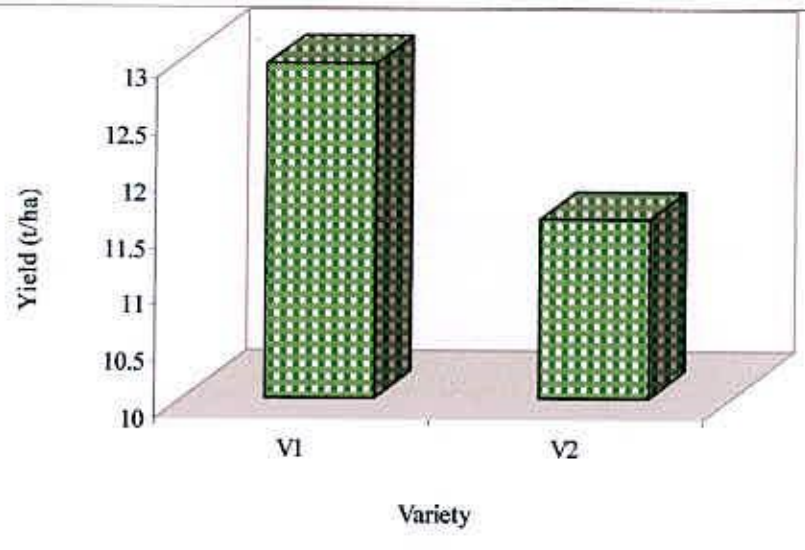


Figure 9. Effect of mulching on number of main stem per plant of potato vertical bars represent at 0.05 level of probability.

V_1: Lal Shil V_2: Lal Pakri

Statistically significant difference was recorded due to combined effect of different mulch materials and varieties on yield per hectare (Appendix V). The maximum (14.52 ton) yield per hectare was recorded from M_1V_1 (black polythene + Lal Shil) and the minimum (9.45 ton) was found from M_0V_2 (no mulch + Lal Pakri) (Table 5).

4.10 Economic analysis

Input costs for land preparation, seed cost, mulching cost, manure cost, thinning, irrigation and man power required for all the operations from planting to harvesting of potato were recorded for unit plot and converted into cost per hectare. Prices of potato were considered in market of Agargoan, Dhaka rate basis. The economic analysis was presented under the following headings-

4.10.1 Gross return

In the combination of mulch materials and variety showed different gross return under the trial (Table 6). The highest gross return (Tk. 174,24/ha) per hectare was recorded from MiVi (black polythene mulch + Lal Shil variety) and the second highest gross return (Tk. 164,88/ha) was recorded from M_3V_1 (saw dust mulch + Lal Shil variety). The lowest gross return (Tk. 113,40/ha) was recorded from M_0V_2 (no mulch + Lal Pakri variety).

4.10.2 Net return

Different treatment combination showed different amount of

net return. The highest net return (Tk. 89,367/ha) was recorded from M_1V_1 and

Table . 6 Cost and return of potato cultivation as influenced by mulching and variety

Treatment Combination	Cost of production (Tk./ha)	Yield of Chinese cabbage	Gross return (Tk./ha)	Net return (Tk./ha)	Benefit cost ratio
M_0V_1	75594	10.14	121680	46086	1.61
M_0V_2	75594	9.45	113400	37806	1.50
M_1V_1	84873	14.52	174240	89367	2.05
M_1V_2	84873	13.38	160560	75687	1.89
M_2V_1	81052	12.84	154080	73028	1.90
M_2V_2	81052	11.20	134400	53348	1.66
M_3V_1	81052	13.74	164880	83828	2.03
M_3V_2	81052	12.05	144600	63548	1.78
M_4V_1	79960	13.55	162600	82640	2.03
M_4V_2	79960	11.84	142080	62120	1.78

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

Market price of Potato @ Tk. 12,000/t

the second highest net return (Tk. 83,828/ha) was recorded from M_3V_1. The lowest net return (Tk. 37,806/ha) was recorded from MoV_2 (Table 6).

4.10.3 Benefit cost ratio

The combination of mulch material and organic manure was different for treatment combination (Table 6). The highest (2.05) benefit cost ratio was recorded from M_1V_1 and the second highest benefit cost ratio (2.03) was recorded from M_0V_2. The lowest benefit cost ratio (1.50) was recorded from M_1V_2. From economic point of view, it was apparent from the above results that the treatment combination of M_1V_1 was more profitable a compared to other treatments.

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted in the farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from October 2007 to February 2008 to find out the effect of mulching on two varieties of potato. The experiment considered two factors. Factor A: Mulching (5 types)- M_0: No mulching (Control); M_1: Black polythene; M_2: Rice straw; M_3: Saw dust and M_4: Water hyacinth; Factor B: Varieties of potato (2 varieties)- V_1: Lal Shil and V_2: Lal Pakri. Data on different yield contributing characters and yield were recorded.

At 75 DAP, the longest (54.76 cm) plant was recorded from M_1 and the shortest (40.07 cm) was observed from M_0. At 75 DAP, the maximum (76.00%) foliage coverage was found from M_1 and the minimum (44.83%) was observed from M_0. The maximum (5.67) number of main stem per hill was observed from M_1 and the minimum (2.83) was found from M_0. The maximum (91.68 g) weight of stem per plant was recorded from M_1 and the minimum (47.70 g) was found from M_0. The maximum (12.33%) dry matter content in stem was observed from M_1 and the minimum (11.51%) was recorded from M_0. The maximum (8.15) number of tubers per hill was found from M_1 and the minimum (5.50) was found from M_0. The maximum (17.30%) dry matter content in tuber was observed from M_1 and the minimum (13.10%) was found from M_0. The maximum (230.00 g) weight of tubers per hill was recorded from M_1 and the minimum (108.50 g) was found

from M_0. The maximum (13.95 ton) yield per hectare was recorded from M_1 and the minimum (9.80 ton) was observed from M_0.

The tallest plant (48.65 cm) was recorded from Lal Shil variety and the shortest (45.98 cm) was recorded from Lal Pakri variety at 75 DAP. The maximum foliage coverage (65.87%) was observed from Lal Shil variety and the minimum (60.00%) was recorded from Lal Pakri variety at 75 DAP. The maximum (4.73) number of main stem per hill was recorded from Lal Shil variety and the minimum (3.87) was recorded from Lal Pakri variety. The maximum (77.55 g) weight of stem per plant was observed from Lal Shil variety and the minimum (70.40 g) was recorded from Lal Pakri variety. The maximum (12.02%) dry matter content in stem was found from Lal Shil variety and the minimum (11.35%) was recorded from Lal Pakri variety. The maximum (7.30) number of tubers per hill was found from Lal Shil variety and the minimum (6.44) was recorded from Lal Pakri variety. The maximum (16.34%) dry matter content in tuber was recorded from Lal Shil variety and the minimum (14.88%) was found from Lal Pakri variety. The maximum (206.40 g) weight of tubers per hill was recorded from Lal Shil variety and the minimum (175.00 g) was recorded from Lal Pakri variety. The maximum (12.96 ton) yield per hectare was recorded from Lal Shil variety and the minimum (11.58 ton) was obtained from Lal Pakri variety.

At 75 DAP, the longest (56.16 cm) plant was recorded from M_1V_1 and the shortest (38.94 cm) was found from M_0V_2. At 75 DAP, the maximum (80.33%) foliage

coverage was recorded from M_1V_1 and the minimum (42.33%) was found from M_0V_2. The maximum (6.00) number of main stem per hill was recorded from M_1V_1 and the minimum (2.33) was found from M_0V_2. The maximum (95.24 g) weight of stem per plant was found from M_1V_1 and the minimum (44.25 g) was found from M_0V_2. The maximum (12.48%) dry matter content in stem was observed from M_1V_1 and the minimum (10.05%) was found from M_0V_2. The maximum (8.80) number of tubers per hill was observed from M_1V_1 and the minimum (5.20) was found from M_0V_2. The maximum (18.38%) dry matter content in tuber was recorded from M_1V_1 and the minimum (12.45%) was found from M_0V_2. The maximum (250.00 g) weight of tubers per hill was recorded from M_1V_1 and the minimum (105.00 g) was found from M_0V_2. The maximum (14.52 ton) yield per hectare was recorded from M_1V_1 and the minimum (9.45 ton) was found from M_0V_2. The highest (2.05) benefit cost ratio was recorded from M_1V_1 and the lowest benefit cost ratio (1.50) was recorded from M_0V_2. From economic point of view, it was apparent from the above results that the treatment combination of M_1V_1 was more profitable compare to other treatments.

Considering the results of the present experiment, further studies in the following areas may be suggested:

1. Such study is needed in different agro-ecological zones (AEZ) of Bangladesh for regional adaptability and other performance.
2. Another mulch material may be included for drawing conclusion.
3. Available other indigenous variety may be used for further study.

REFERENCES

Abbasi, N. A., Hafiz, I. A. and Bilal, F. 2004. Evaluation of exotic potato varieties in ecological conditions of Islamabad during autumn season. *International Journal of Agriculture and Biology*. **6**(3): 479-482.

Alam, M. S., Iqbal, T. M. T., Amin, M. and Gaffar, M. A. 1989. Krishitattic Fasaler Utpadan O Unnayan (in Bengali). T. M. Jubair Bin Iqbal, Sirajgonj. pp. 231-239.

Anonymous. 1989. Annual Report 1987-88. Bangladesh Agricultural Research Institute. Joydebpur, Gazipur. p. 133.

BBS, 2007. Monthly Statistical Bulletin of Bangladesh. 2007. Bangladesh Bureau of Statistics Division, Ministry of Planning, Govt. of the Peoples Republic of Bangladesh. June, Pp.106-107.

Bhattacharjee, A. K. Singh, K and Singh, K. K. 1979. Water management of the soils in the northern plains. Of Bihar (India): *J. Indian Potato Assoc.*, **6**. (2): 95-98.

Bhuyun, H. A. M. 2003. Effect of mulch and crop management practices on growth and yield of potato. MS thesis, Dept. of Hort, BAU, Mymensingh.

Bieloral, H. 1970. Water preservation by small-scale hydrological circulation in plastic tunnel. Hassadeh. **50**(80): 987-989.

Burger, M. S. and P. C. 1984. Potato irrigation scheduling and straw mulching *South Africa J. Plant Soil*. **1**(4): 111-116.

Challaiah and Kulkarni, G. N. 1979. Studies on the response of potato (*Solanum tuberosum L.)* to various soil moisture levels and mulches and its economics in relation to tuber yield. *Mysore J. Agril. Sci.* **13**(1): 35-40.

Choudhury, M. S. H., M. A. Siddique and M. G. Rabbani. 1993. Irrigation and mulching effect on sweet potato yield. *Bangladesh Hort.*, **21**(1): 43-47.

Chowdhury, M. M. H. Karim, A. J. M. S. Hossain, M.M. and Egashira, K. 2000. Yield and water requirement of indigenous potato grown on a clay terrace soil of Bangladesh. *J. Agril. Unive*. **45**(2); 621-629.

Chowdhury, M. M. H., Karim, A. J. M. S., Hossain, M. M. and Egashira, K. 2000. Yield and water requirement of indigenous potato grown on a clay terrace soil of Bangladesh. *Journal of the Faculty of Agriculture*. **45**(2): 621-629.

Collins, W. B. 1997. Effect of mulch on emergence and yield of potatoes. *Can. J. Plant Sci*. **56**:877-880.

Cui, R., Lee, S. and Lee, B. W. 2002. Effect of recycled paper mulch on yield of fall-grown potato. *Korean Journal of Crop Science*. **47**(1): 68-73.

Edris, K. M., Islam, A. T. M. T., Chowdhury, M. S. and Haque, A. K. M. M. 1979. Detailed Soil Survey of Bangladesh Agricultural University Farm, Mymensingh, Dept. Soil Survey, Govt. People's Republic of Bangladesh. 118 p.

FAO. 1988. Production Year Book. Food and Agricultural of the United Nations. Rome, Italy. 42: 190-193.

FAO. 2005. Production Year Book. Food and Agricultural Organization of the United Nations, Rome. p.340.

Ghimbasan, R. 1997. Potato cultivation (growing) conditions, varieties and productions (crops). Bulletin-of-the-Transilvania-University-of-Brasov,-New-Series-Series-A. 1997; 4(39): 31-34

Glukhov, A. P. 1994. Potato varieties of the Belousovskoe Experimental Farm. *Kartofel I Ovoshchi*. (3): 23

Gomez, K. H. and A. A. Gomez. 1984. Statistical Procedures for Agricultural Research. Second Edn. Wiley- Inter Science publication, JohnWiley and Sono, New York. p.680.

Gregoriou, S. and Onoufriou, N. 2002. Evaluation of potato varieties in Cyprus. Miscellaneous Reports Agricultural Research Institute, Ministry of Agriculture, Natural Resources and the Environment. (81): 30.

Grewal, J. S., Sharma, R. C. and Saini, S. S. 1992. Agrotechniques for Intensive Potato Cultivation in India. Publications and Information Division, Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, New Delhi. 126 p.

Guarda, G., Colauzzi, M., Tassoni, F., Zuffellato, F. and Bellato, S. 1997. Varietal results for potato. *Informatore Agrario*. **53**(49): 45-53.

Haase, T., Schuler, C., Kolsch, E., Hess, J. and Volkel, G. 2002. Organic table potato production: results of three years of variety trials. *Kartoffelbau*. **53**(4): 136-139.

Illias, M. K. 1998. Potato production in Bangladesh. *Crop Science*. **39** (4): 145-149.

Jaiswal, J. P., P. P. Subedi and H. M. Gurung. 1996. Fertilizer trail on carrot connected at outreach research sites for off-season production working paper. Lumle. Res. Centre, Kaksi, Nepal. **24**: 96-103.

Jaiswal, V. P. 1995. Response of potato (*Solanum tuberosum*) cultivars to date of planting and mulching under warm-temperature condition. Indian Journal of Agronomy. **40**(4): 660-664.

Jalil, M. A. 1995. Effect of different mulches on the growth and yield of potato (*Solanum tuberosum)*. M S thesis, Dept. of Hort, BAU, Mymensingh.

Jalil, M. A., Azad, M. A. K. and Farooque, A. M. 2004. Effect of different mulches on the growth and yield of two potato varieties. *Journal of Biological Sciences*. **4**(3): 331-333.

Khalak D. and Kumaraswamy, A. S. 1992. Effect of irrigation of schedule and mulch on growth attributes and dry matter accumulation of potato. *Indian J. Agron*. **37**(3): 510-513.

Kim, S. Y., O. H. Ryu and B. H. Hahm. 1988. The effect of transparent polythene film mulch on the soil temperature, potato growth and yield of the spring crop. Reports of Rural Development Administration Horticulture, Korea Republic, 30: 292-298. [Cited from Field *Crop Abstr*., **42** (10): 8125, 1989].

Kuznetsova, T. N. 1997. Testing potato varieties. *Kartofel I Ovoshchi*. (4): 22.

Lamont, W .J. 1993. Plastic mulches for the production of vegetables crops. *Hort. Tech*. **3**(10): 35-39 [Cited from Hort Abstr, 64(3): 1997]

Lang, H. 1984. Use of polythene film in early potato growing for reliability, yield and quality. *Kartoffelbau*. **35**(2): 65-69. [Cited from Potato Abs. 10(2): 137, 1985.]

Lei, Y., Qiao, H., Lei, R. X. and Wang, G. 2005. Selection of a new fine quality, high-yielding and disease-resistant potato variety Qingshu No. 1. *Chinese Potato Journal*. **19**(6): 384-385.

Luthra, S. K., Pande, P. C., Singh, S. V., Pandey, S. K., Khurana, S. M. P., Khan, I. A., Singh, B. P. 2006. Kufri Arun: a new red skin potato variety. *Potato Journal*. **33**(1/2): 20-25.

Mangaser, V. T. Caccam, M. C. and Menguita, M. C. 1986. Planting dates and mulching effects on potato variety Cosima. *Philipine J. Crop Sci*. **11**:12-15.

Manrique, L. A. 1995. Mulching in potato systems in the tropics. Journal of Plant Nutrition. **18**(4): 593-616.

Manrique, L. A. and Meyer, R. 1984. Effect of soil mulches on soil temperature, plant growth and potato yield in acridic isothermic environment in Peru. *Turrialba*, **34**(4): 413-419 [Cited from Potato Abstr. 10(11); 1649.

Momirovic, N. M., Misovic, M. M. and Brocic, Z. A. 1997. Effect of organic mulch application on the yield of potato seed crop. *Acta Horticulturae*. (462): 291-296.

Natheny, T. A, Hunt, P. G. and Kasperbauer, M. J. 1992. Potato tuber production in response to reflected light from different colored mulches. *Crop Sci*. **32**(4): 1021-1024.

Pandey, S. K. Singh, S. V. Dinesh, K., Manivel, P., Marwaha, R. S., Parveen, K. and Singh, B. P. 2006. Kufri Chipsona-3: a high yielding potato variety for chipping with defect free tubers. *Potato Journal*. **33**(1/2): 26-34.

Patil, A. V. and Basad, A. D. 1972. Effect of different mulching treatments on soil properties growth and yield of tomato (Var. Sioux). *Indian J. Hort*. **29**(2): 175-205.

Prihar, S. S. 1986. Fertilizer and water use efficiency in relation to mulching. *Indian J. Agron*. **32**(4): 452-454.

Rashid, A. Ahmad, K. U. and Habib, A. K. M. A. 1981. Effect of artificial mulching on the performance of potato. *Bangladesh Hort*. **9**(1/2): 24-27.

Rashid. M. M. 1993. Shabji Chash. Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. Pp. 254.

Ray, D., and Mukhopadhyay, S. K. 2004. Tuber yield, dry matter content and storage life of some potato processing varieties under alluvial zone of West Bengal. *Indian Agriculturist*. **48**(1/2): 113-117.

Reust, W. 1997. Yield formation and quality aspects of three potato varieties. Revue Suisse Agriculture. **29**(5): 217-220.

Saha, U. K., Hye, M. A., Haider, J. and Saha, R. R. 1997. Effect of rice straw mulch on the water use and tuber yield of potato grown under different irrigation schedules. *Japanese Journal of Tropical Agriculture*. **41**(3): 168-176

Santosa, M., Prabowo, A. M. And Kustiono, D. 1994. Growth of potato (*Solanum tuberosum* L.) cultivars given farmyard manure and mulched at medium

altitude. *Agrivita*. 17(2): 48-54.

Sarker, M. H. and Hossain, A. K. M. A. 1989. Effect of weeding and mulching on the growth and yield of potato (*Solnuum tuberosum L.). Bangladesh J. Agric*. **14**(2): 105-112.

Siddique, M. A. and Rashid, M. M. 1990. Scope for increasing indigenous potato varieties of Bangladesh. In Seed Potato in Bangladesh. Proceedings of the international seminar on seed potato. Bangladesh Agricultural Development Croporation. Dhaka. January. 8-10, 1990. pp. 166-167.

Singh, R., Chowdhury, S. R., Kundu, D. K. and Kannan, K. 2004. Effects of paddy straw mulch on hydrothermal state, nutrient availability, growth and tuber yield of potato (*Ipomoea batatas* L.). *Advances in Horticultural Science*. **18**(1): 15-20

Spiess, E., Heusser, J., Ammon, H. U. and Scherrer, C. 1997. Mulching procedures and techniques in potato growing. *FAT Berichte*. **(495)**: 20.

Sutater, T. 1987. Shading and mulching effect on potato yield. Bull. Penelitian-Hortikultura. **15**(2): 191-198. [Cited from Field Crop Abstr. **15**(3): 775, 1990].

Taja, H, and Vander-Zaag, P. 1991. Organic residue management in the hot tropics: influence on the growth and yield of solanum potato and maize. *Tropical Agric*. **68**(2): 111-118.

UNDP. 1988. Land Resource Apprisal of Bangladesh for Agricultural Development Report 2: Agro-ecological Regions of Bangladesh, FAO, Rome, Italy, pp. 577.

Uniyal, S. P. and Mishra, A. C. 2003. Response of potato to soil moisture and temperature as affected by different mulches. *Journal of the Indian Potato Association*. **30**(3/4): 315-318.

Wilhoit, J. H. Morse, R. D. and Vaughan, K. 1990. Strip tillage production summer cabbage using high residue levels. *Agric. Res*. **5**(4): 338-342.

Wu, H. Z., Cui, X. C., Jin, F. 1997. Selection of 'Yushu No. 1' potato - a new variety with disease resistance, high yield and good quality. *China Vegetables*. (3): 23-25.

Zhang, Y., Cui, Z. and Zhang, Z. X. 2004. Effect of different plastic film mulching patterns on yield of spring potato. *China Vegetables*. (2): 36-37.

APPENDICES

Appendix I. Characteristics of Horticulture Farm soil as analyzed by Soil Resources Development Institute (SRDI), Khamarbari, Farmgate, Dhaka

A. Morphological characteristics of the experimental field

Morphological features	Characteristics
Location	Horticulture Garden , SAU, Dhaka
AEZ	Madhupur Tract (28)
General Soil Type	Shallow red brown terrace soil
Land type	Silty Clay
Soil series	Tejgaon
Topography	Fairly leveled
Flood level	Above flood level
Drainage	Well drained

B. Physical and chemical properties of the initial soil

Characteristics	Value
% Sand	27
% Silt	43
% clay	30
Textural class	silty-clay
pH	5.6
Organic carbon (%)	0.45
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20.00
Exchangeable K (me/100 g soil)	0.10
Available S (ppm)	45

* **Source**: SRDI

Appendix II. Monthly record of air temperature, rainfall, relative humidity, soil temperature and Sunshine of the experimental site during the period from October 2007 to February 2008

Month	*Air temperature (°c)		*Relative humidity (%)	*Rain fall (mm) (total)
	Maximum0	Minimum		
October, 2007	29.18	18.26	81	39
November, 2007	25.82	16.04	78	00
December, 2007	22.4	13.5	74	00
January, 2008	24.5	12.4	68	00
February, 2008	27.1	16.7	67	30

* Monthly average,

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

Appendix III. Analysis of variance of the data on plant height of potato as influenced by mulching and variety

Source of variation	Degrees of freedom	Mean square					
		Plant height (cm) at					
		15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
Replication	2	0.067	2.862	0.006	0.119	0.053	1.990
Mulching (A)	4	5.830**	35.523**	123.399**	190.936**	176.744**	203.576**
Variety (B)	1	2.494*	11.053*	69.494**	93.245**	53.147**	79.968**
Interaction (A×B)	4	0.089*	0.508*	1.783**	0.566*	0.221**	0.430**
Error	8	0.421	2.253	3.437	6.144	7.013	7.684

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

Appendix IV. Analysis of variance of the data on foliage coverage of potato as influenced by mulching and variety

Source of variation	Degrees of freedom	Mean square					
		Foliage coverage (%) at					
		15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
Replication	2	3.033	0.700	3.433	1.300	1.033	3.333
Mulching (A)	4	29.133**	114.883**	348.083**	698.967**	869.217**	837.783**
Variety (B)	1	14.700**	19.200*	100.833**	86.700**	258.133**	172.800**
Interaction (A×B)	4	1.200*	3.450**	2.583*	2.867**	3.717**	3.717**
Error	8	1.293	3.515	7.878	9.004	13.107	18.000

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

Appendix V. Analysis of variance of the data on yield contributing characters and yield of potato as influenced by mulching and variety

Source of variation	Degrees of freedom	Mean square						
		No. of main stem per hill	Weight of stem (g)	Dry matter content in stem (%)	No. of tuber per hill	Dry matter content in tuber (%)	Weight of tubers per hill (g)	Yield (t/ha)
Replication	2	0.300	31.471	0.497	0.361	3.819	12.100	0.296
Mulching (A)	4	8.367**	1614.890**	1.885*	5.750**	14.514**	13927.95**	14.373**
Variety (B)	1	5.633**	384.063**	3.327*	5.547**	16.016**	7394.700**	14.159**
Interaction (A×B)	4	0.467**	1.519**	2.395*	0.110**	0.241**	315.450**	0.302**
Error	8	0.374	8.628	0.516	0.165	1.054	48.100	0.327

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

Appendix VI. Per hectare potato production cost

A. Input cost

Treatment Combination	Labour cost	Ploughing cost	Seed Cost	Mulch Materials	Manure and fertilizers				Insecticide/ pesticides	Sub Total (A)
					Cowdung	Urea	TSP	MP		
M_0V_1	5000.00	4000.00	5000.00	0.00	5000.00	3000.00	2700.00	4500.00	2000.00	31200.00
M_0V_2	5000.00	4000.00	5000.00	0.00	5000.00	3000.00	2700.00	4500.00	2000.00	31200.00
M_1V_1	5000.00	4000.00	5000.00	8500.00	5000.00	3000.00	2700.00	4500.00	2000.00	39700.00
M_1V_2	5000.00	4000.00	5000.00	8500.00	5000.00	3000.00	2700.00	4500.00	2000.00	39700.00
M_2V_1	5000.00	4000.00	5000.00	5000.00	5000.00	3000.00	2700.00	4500.00	2000.00	36200.00
M_2V_2	5000.00	4000.00	5000.00	5000.00	5000.00	3000.00	2700.00	4500.00	2000.00	36200.00
M_3V_1	5000.00	4000.00	5000.00	5000.00	5000.00	3000.00	2700.00	4500.00	2000.00	36200.00
M_3V_2	5000.00	4000.00	5000.00	5000.00	5000.00	3000.00	2700.00	4500.00	2000.00	36200.00
M_4V_1	5000.00	4000.00	5000.00	4000.00	5000.00	3000.00	2700.00	4500.00	2000.00	35200.00
M_4V_2	5000.00	4000.00	5000.00	4000.00	5000.00	3000.00	2700.00	4500.00	2000.00	35200.00

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri

Appendix VI. Contd.

B. Overhead cost (Tk./ha)

Treatment Combination	Cost of lease of land for 6 months (13% of value of land Tk. 6,00000/year	Miscellaneous cost (Tk. 5% of the input cost	Interest on running capital for 6 months (Tk. 13% of cost/year	Sub total (Tk) (B)	Total cost of production (Tk./ha) [Input cost (A)+ overhead cost (B)]
M_0V_1	39000	780	4614	44394	75594
M_0V_2	39000	780	4614	44394	75594
M_1V_1	39000	993	5180	45173	84873
M_1V_2	39000	993	5180	45173	84873
M_2V_1	39000	905	4947	44852	81052
M_2V_2	39000	905	4947	44852	81052
M_3V_1	39000	905	4947	44852	81052
M_3V_2	39000	905	4947	44852	81052
M_4V_1	39000	880	4880	44760	79960
M_4V_2	39000	880	4880	44760	79960

M_0: No mulching (control)
M_1: Black polythene
M_2: Rice straw
M_3: Saw dust
M_4: Water hyacinth

V_1: Lal Shil
V_2: Lal Pakri