DEDICATION

The indebtedness to the parents can not be repaid in even hundreds of years for the difficulties faced by the parents in bringing up the children. That is why, one should try to please one's parents and teachers also, because when these three are pleased, one's penance becomes fulfilled.

Hence this research work is affectionately dedicated to my parents Aai and Nana with due respect.

...Mohan...

"EFFECT OF *DIFFERENT* MULCHES ON YIELD, QUALITY AND STORAGE OF ONION BULBS IN *KHARIF* SEASON (CV. PHULE SAMARTH)"

By

NAIKWADI MOHAN BABURAO

(Reg. No. 04/098)

A Thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH,

RAHURI – 413 722 DIST. AHMEDNAGAR,

MAHARASHTRA (INDIA)

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

HORTICULTURE

DEPARTMENT OF HORTICULTURE

POST GRADUATE INSTITUTE,
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI – 413 722, DIST. AHMEDNAGAR (M.S.) INDIA

2006

"EFFECT OF DIFFERENT MULCHES ON YIELD, QUALITY AND STORAGE OF ONION BULBS IN *KHARIF* SEASON (CV. PHULE SAMARTH)"

By

NAIKWADI MOHAN BABURAO
(Reg. No. 04/098)

A thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI – 413 722, DIST. AHMEDNAGAR,
MAHARASHTRA (INDIA).

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

HORTICULTURE

Approved by

Dr. S.D. Masalkar
(Chairman and Research Guide)

Dr. R.S. Patil
(Committee member)

Dr. U.T. Desai
(Committee member)

Dr. A.S. Patil
(Committee member)

DEPARTMENT OF HORTICULTURE
POST GRADUATE INSTITUTE,
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI – 413 722, DIST. AHMEDNAGAR (M.S.) INDIA
2006

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part there of

has not been submitted by me or any other

person to any other University

or Institute for Degree

or Diploma

Place : M.P.K.V.

Date : 31/05/2006

(Naikwadi.)

(M.B. Naikwadi)

Dr. S.D. Masalkar
Associate Professor,
Department of Horticulture,
Mahatma Phule Krishi Vidyapeeth,
Rahuri – 413 722, Dist. Ahmednagar,
Maharashtra State (India).

CERTIFICATE

This is to certify that the thesis entitled, **"EFFECT OF DIFFERENT MULCHES ON YIELD, QUALITY AND STORAGE OF ONION BULBS IN *KHARIF* SEASON (CV. PHULE SAMARTH)"**, submitted to the faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra State) in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **HORTICULTURE**, embodies the results of a piece of bona fide research carried out by **Mr. NAIKWADI MOHAN BABURAO,** under my guidance and supervision and that no part of this thesis has been submitted for any other degree, diploma or publication in other form.

The assistance and help received during the course of this investigation and sources of reference have been duly acknowledged.

Place : M.P.K.V., Rahuri
Date : 31 / 05 /2006

(S.D. Masalkar)
Research Guide

Dr. A.S. Jadhav,
Associate Dean,
Post Graduate Institute,
Mahatma Phule Krishi Vidyapeeth,
Rahuri – 413 722, Dist. Ahmednagar,
Maharashtra State (India).

CERTIFICATE

This is to certify that the thesis entitled, **"EFFECT OF DIFFERENT MULCHES ON YIELD, QUALITY AND STORAGE OF ONION BULBS IN *KHARIF* SEASON (CV. PHULE SAMARTH)"**, submitted to the faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra State) in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **HORTICULTURE**, embodies the results of a piece of bona fide research carried out by **Mr. NAIKWADI MOHAN BABURAO,** under the guidance and supervision of **Dr. S.D. Masalkar**, Associate Professor, Department of Horticulture, M.P.K.V., Rahuri and that no part of this thesis has been submitted to any other University for degree or diploma.

Place : M.P.K.V., Rahuri

Date : / /2006

(A.S. Jadhav)

ACKNOWLEDGEMENTS

With limites humility, I would like to thank God, the Almighty, prostating at his lotus feet who bestowed me with healthy, confidence and courage enough to go through this crucial justure. Though formal and dead words can not carry the fragrance of emotions with them, still they are the sole available way of expressing emotions in such formal acknowledgements.

I have immense please in expressing my deepest sense of gratitude and profound thanks towards my research guide, Dr. S.D. Masalkar, Associate Professor of Department of Horticulture, Post Graduate Institute, Rahuri, for constant inspiration, valuable guidance, keen interest, constructive criticism and constant encouragement during course of manuscript of this dissertation and P.G. life.

I record my deep sense of gratitude towards my advisory committee members, Dr. U.T. Desai, Head, Department of Horticulture, PGI, M.P.K.V., Rahuri, Dr. R.S. Patil, Professor, Department of Horticulture and Dr. A.S. Patil, Ex. Professor, Department of Agril. Chemistry and Soil Science, PGI, M.P.K.V., Rahuri for making helpful comments and valuable suggestions during the investigation and examining the manuscript critically.

Words are too meager to express my indebtedness and heartful gratitude towards Shri. Uday Shinde (SRA), Shri. Shinde S.J. (Agril. Asstt.) for their valuable cooperation during entire period of investigation.

I am indeed grateful to Dr. A.R. Karale, Associate Professor of Horticulture, Dr. M.N. Bhalekar, Office Incharge, Tomato Improvement Scheme, Prof. S.N. Gohil, Associate Professor of Horticulture, Prof. A.M. Musmade, Associate Professor of Horticulture, Prof. A.B. Kamble, Office Incharge, C.S. and P.G. Lab., Shri. S.N.

Shelke, and all staff members, Department of Horticulture, PGI, M.P.K.V., Rahuri.

It is most rightful time to express my special thanks to my joyous friends Nilesh, Vikas, Yogesh, Sandeep, Sachin, Chetan, Santosh, Pramod, Avinash, Akshay, Suhas, Vitthal, Navanath, Bruhspati, Manoj, Prashant, Raju, Kailas, Jaydeep, Kiran, my sister-cum friends Priyanka and Sarika; Seniors Sachin, Sandeep, Sanjay, Umesh, Chandu, Rahul, Kiran, Bharat and all excellents for their continuous support during the work. I must thank to all my department colleagues Shri. V.S. Bharmal, Kaushal, Mahendra, Santosh, Rahul, Yuvraj, Deepak, Anil, Arinjay, Swati, Vaijanta, Pallavi and Aparna for their kind cooperation.

It seems one used choicest of words to measure the boundless love and unlimited and unfold sacrifices of someone very close. However, I find no such measures adequate to quantify all that my parents have done for me. I will forever remain indebted to my beloved 'Aai' and 'Nana', my brother Mahesh and Vahini, sister Pushpanjali and Daji, Grand mother and Grand father, Dada and Bai, Rambha tai and Fatangare Sir for the sacrifice made by them to shape my career and whose long cherished dreams are turning into reality in the form of this dissertation.

I am deeply obliged to all the authors and research scholars, past and present whose literature has been cited in this dissertation.

My sincere thanks are also due to Shri. Dhanraj Patole, Pragati Computers for type setting of this manuscript in descent manner.

At last but not the least, all my owe goes to them all.

Place : M.P.K.V., Rahuri

Naikwadi

Date : 31/ 05 /2006 **(Naikwadi Mohan B.)**

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

@	:	At the rate
B.P.	:	Black polyethylene
CD	:	Critical difference
cm	:	Centimeter (s)
°C	:	Degree celcius
cv.	:	Cultivar
DAT	:	Days after transplanting
et al.	:	et alli (and others)
expt	:	Experiment
Fig.	:	Figure
FYM	:	Farmyard manure
g	:	Gram (s)
ha	:	Hectare
i.e.	:	id est (that is)
K	:	Potassium
Kg	:	Kilogram (s)
m	:	Meter (s)
Max.	:	Maximum
Min.	:	Minimum
N	:	Nitrogen
No.	:	Number (s)
NS	:	Non-significant
P	:	Phosphorus
PLW	:	Physiological loss in weight
S.Em±	:	Standard error of means
Sig.	:	Significant
T.S.S.	:	Total soluble salts
t	:	tonne (s)
viz.,	:	Namely
W.P.	:	White polyethylene
wt.	:	Weight
%	:	Per cent
/	:	per

ABSTRACT

"EFFECT OF DIFFERENT MULCHES ON YIELD, QUALITY AND STORAGE OF ONION BULBS IN *KHARIF* SEASON (CV. PHULE SAMARTH)"

by

NAIKWADI MOHAN BABURAO

A Candidate for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

In

HORTICULTURE

2006

Research Guide	:	Dr. S.D. Masalkar
Department	:	Horticulture

The present investigation was conducted at 'Scheme for Research on Onion storage', Department of Horticulture, M.P.K.V., Rahuri during year 2005-06 on newly recommended onion cv. Phule Samarth. The experiment was laid out in Randomized Block Design with 4 replications consisting of 7 treatments, viz., Black polyethylene sheet mulch, white polyethylene sheet mulch, black polyethylene strip mulch, white polyethylene strip mulch, wheat straw mulch, sugarcane trash mulch and control.

The results indicated that the maximum plant height was reported in sugarcane trash mulch (68.7 cm) which was at par with black polyethylene sheet mulch (67.42 cm). Maximum number of leaves were observed in black polyethylene sheet mulch (10.65) while the lowest plant height and number of leaves were reported in control.

Minimum premature bolting was recorded in control (1.87%), while maximum premature bolting was observed in black polyethylene sheet mulch (4.95 %) and sugarcane trash mulch (4.87 %). Maturity of onion crop was prolonged due to black polyethylene sheet mulch (117.25 days), while early maturity was reported in control (87 days). The lowest neck thickness (0.95 cm), the lowest equatorial diameter (4.82 cm) and the lowest polar diameter (5.15 cm) was observed in control plot. The highest neck thickness (1.16 cm) and the highest polar diameter (5.91 cm) was reported in black polyethylene sheet mulch, while highest equatorial diameter (6.55 cm) was reported in sugarcane trash mulch.

The highest marketable bulb yield (28.69 t/ha) and total bulb yield (33.45 t/ha) was reported in sugarcane trash mulch which was at par with black polyethylene sheet mulch.

Biochemical parameters, except T.S.S. of onion bulbs were not influenced due to various mulches. The highest T.S.S. was recorded in black polyethylene sheet mulch.

Abstract contd..... *Naikwadi M.B.*

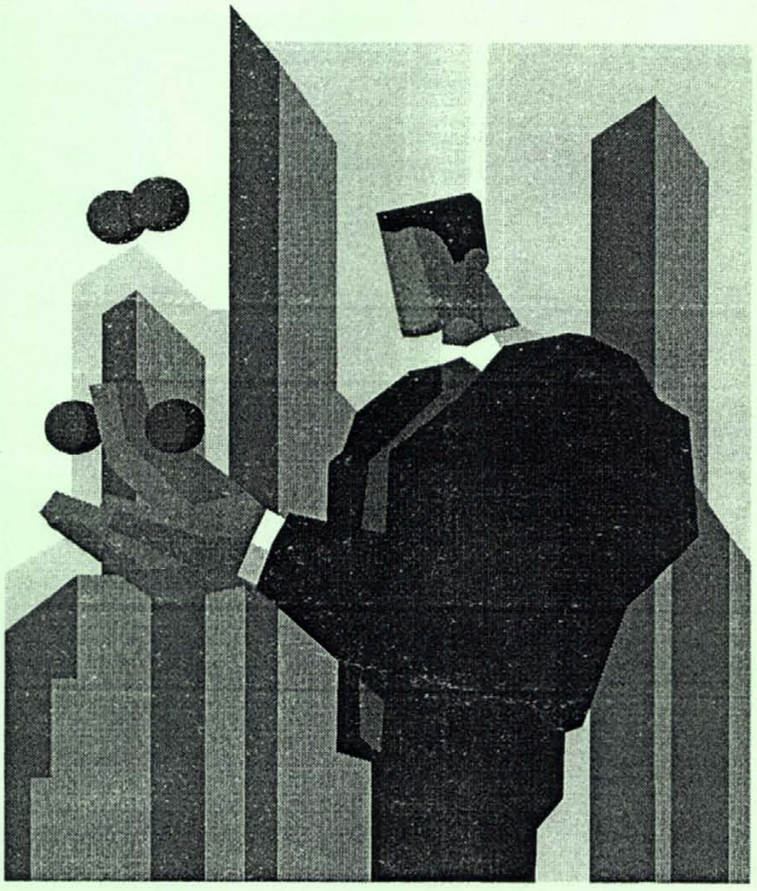
PLW losses and rotting losses were not affected significantly due to different mulches. Minimum sprouting losses were recorded in white polyethylene strip mulch (1.44 %) and the highest in white polyethylene sheet mulch (6.56 %). The lowest total losses (14.87 %) were recorded in control which was at par with sugarcane trash mulch (15.62 %), while maximum total losses (21.75 %) were recorded in black polyethylene sheet mulch.

Nutrient status of soil was not influenced significantly due to various mulches. The soil temperature was significantly increased under black polyethylene sheet mulch (38.93°C) than control (35.91°C).

Weed intensity was effectively decreased in black polyethylene sheet mulch while white polyethylene sheet mulch failed to control weeds.

The highest net profit (Rs. 1,34,735 / ha) and the highest Cost : benefit ratio (6.63) was obtained in sugarcane trash mulch, while the lowest net protit (Rs. 70135 / ha) and the lowest Cost : benefit ratio (1.16) was recorded in white polyethylene sheet mulch.

Page No 1 to 83



INTRODUCTION

1. INTRODUCTION

The *Allium cepa* belonging to family Aliaceae, has been under cultivation for over 5000 years. It is thought to have been first domesticated in mountainous regions of Turkmenistan, Uzbekistan, North Iran and Afghanistan (Vavilov, 1951).

Onions are consumed in rather small quantities by most families. Onions can be eaten raw or cooked. They are also used as a seasoning for a wide variety of dishes and chosen for salads. It is used in processed forms, such as flakes, powder. Nadkarni (1927) reported many medicinal properties of onion. Onions are diuretic, applied on bruises, boils and wounds, relieves heat sensation etc. Researchers also suggested that onions in the diet may play a part in preventing heart disease and other ailments (Hanley and Fenwick, 1985; Augusti, 1990).

Onion has high nutritive value. Composition of onion bulb is given below.

Table 1. Composition of onion bulb* (per 100 g of edible portion)

Moisture – 86.4 g	Vit. C – 11 mg
Carbohydrates – 11.09 g	Calcium – 180 mg
Protein – 1.2 g	Phosphours – 50 mg
Fibre – 0.6 g	Iron – 0.7 mg
Mineral – 0.4 g	Nicotinic acid – 0.4 mg
Thiamine – 0.08 mg	Riboflavin – 0.01 mg

* Aykroyd (1963)

Onion is one of the most important vegetable crop grown in India. India ranks second after China, in area and production of onion. India is having 5.30 lakh hectares of land under onion crop with production of 55 lakh tonnes of bulbs for local as well as export purpose (Anonymous 2006). Maharasthra is the leading state for onion production with 75.5 thousand hectare area and 1535 thousand tonnes of production followed by Karnataka (Anonymous 2005). Inspite of large production, the productivity of onion in India is only 10.5 to 11.5 t/ha, which is very low when compared with the world.

Onion is a photothermosensitive crop and requires specific temperature and day length for vegetative growth and bulb development. In Maharashtra, onion can be taken in *rabi, kharif* and late *kharif* season. In *kharif* season, there are heavy rains and weather is cloudy which favours weed growth, attack of pest and diseases like thrips and purple blotch, respectively. Other problems are poor keeping quality, rotting and sprouting losses in storage.

Phule Samarth, a new onion cultivar has early maturity and natural top fall is suited for *kharif* season having productivity 28.16 t/ha.

There appears a great scope for improvement in present soil and water management practices to increase yield along with quality parameter. Mulches are covering material to soil surface. The use of mulch in onion is an accepted practice in Western countries. It conserves soil moisture, suppresses the weed growth, regulates the soil

temperature, improves the soil structure and checks the soil erosion. Mulching also helps in establishment of seedling and plant growth. Benefits of plastic mulch are probably associated with better diurnal pattern of soil temperature and wider canopy-air temperature (Pandey and Singh 1998). Plastic mulch reduces weed infestation and ultimately the cost of weeding (Wivutvongvana *et al.*, 1998).

Theoretically any type of material can be used as a mulch, but in practice, only a few are more admirably suited for horticultural crops. There is amazing variety in the materials employed. They being as varied as plant residues which include dry leaves, corn-stalks, saw dust, grain straw, hay, Pine needles, cane trash, wood-wool and materials like asphalt paper, glass-wool, Al-foil, bituminous emulsions, polyethylene plastic etc. Choice of mulching material would, however, depend upon it's easy availability, suitability, efficiency and economy. In present investigation, the synthetic mulches, such as white polyethylene, black polyethlene and organic mulches such as sugarcane trash, straw mulch will be used. The relative efficiency of these mulches for weed control, yield, quality of crop need to be studied.

Hence, the present investigation is undertaken with the following objectives

1. To study the effect of different mulches on yield and quality of onion bulbs.
2. To study the effect of different mulches on storage of onion bulbs.
3. To standardize the suitable mulch for *kharif* onion.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The literature related to the present investigation entitled, "Effect of different mulches on yield, quality and storage of onion bulbs in *kharif* season (cv. Phule Samarth)" has been referred from available resources. The references of relevant crop has been also collected and systematically presented in respective headings.

2.1 Plant growth parameters

Kirti Singh and Sethi (1966) reported that organic mulches caused earlier maturity in potato as compared to polyethylene mulch and control, whereas polyethylene mulch had an adverse effect on crop maturity and seemed to enhance the time taken for maturity of the crop.

Kashyap *et al.* (1967) revealed that the growth of the plants such as height, number of leaves and girth of plants showed significant differences due to different kinds of mulches. Bumper growth was observed under paddy husk, while sawdust reduced all growth characters of the plant.

Cho *et al.* (1982) reported that a 0.03 mm polyethylene mulch increased plant height, number of leaves, fresh and dry weights of whole plants and fresh bulb weight compared with unmulched control. Later, the mulch was removed, which increased bolting.

Chung (1987) found that mulching with polyethylene film gave highest bulb yield and caused faster maturity of plants, high growth rate, increased bulb weight and number of cloves per bulb and increased rate of secondary growth.

Suh and Kim (1991) applied transparent polyethylene film mulches and black polyethylene film mulches to onion crop on 3 dates (30^{th} Oct., 25^{th} Nov. and 20^{th} Dec.) and revealed that plant growth was improved by mulching and the earliest mulching date was more effective than later ones. Only the transparent polyethylene film applied on 30 October increased the level of bolting.

Adetunjii (1994) compared the soil solarization with transparent polyethylene film with organic mulches and with a no mulch treatment and reported that, except sawdust mulch, mulching significantly enhanced vegetative growth and bulb yield.

Deka and Shadeque (1994) conducted experiment to find out the effect of various mulching materials as well as different clove sizes on growth and yield of garlic and revealed that the effect of mulching on plant height and number of leaves was statistically significant at all stages of observation with highest plant height of 43.0 cm and number of leaves (7.4) was recorded in paddy straw mulch 120 DAS.

Baten *et al.* (1995) evaluated different mulches for their effects on growth and yield of late planted garlic and reported that plants treated with any of the mulches showed significant increase in

plant height, number of leaves per plant, length of leaf, length of pseudostem etc.

Chhangani (1998) reported that the number of leaves per plant was significantly reduced with groundnut shell and saw dust mulches while length of leaf was maximum with polyethylene mulch and minimum with sawdust.

Rahman and Khan (2001) studied the effect of mulches on morpho-physiclogical attributes of onion and reported that the dry matter accumulation, leaf area index, plant height and root length were significantly influenced by mulches. Ash mulch induced early flowering than other mulches.

2.2 Bulb observations

Sumi *et al.* (1986) reported that the mulching gave a maximum yield of 10.13 t ha^{-1} with an average bulb size of 31.22 g compared with 6.06 t ha^{-1} and 19.01 g,respectively for unmulched plot.

Chung (1987) reported that the mulching with polyethylene film gave the highest yield, it increases the bulb weight of garlic, however the number of shortened or abnormal flower stalk and the proportion of cracked bulbs were also higher in mulched crops than in those grown in bare ground.

Asandhi *et al.* (1989) mulched the garlic Cv. Lumbu Hijau with rice straw, transparent plastic and black plastic and cabbage residue was incorporated into soil at 50g /50g soil and revealed that

mulching with rice straw gave the maximum bulb yield (2.81 cm in diameter) and maximum number of cloves /bulb (12.75).

Abdel (1990) studied the influence of mulching on irrigated and non-irrigated yellow onion cultivar and reported that the mulching treatment with furrow irrigation gave the maximum bulb length and bulb diameter.

Vidyasagar and Monica (1993) observed that in general, bulb yield significantly and positively associated with bulb size, equatorial and polar diameter, plant height, leaf breadth and neck thickness.

Baten *et al.* (1995) reported that different mulches caused significant increase in bulb and neck diameter in garlic compared with control. Bulb length, bulb diameter, clove length, clove diameter, clove number were also significantly higher in mulched plot.

Chen and Chen (1997) found that the plastic film mulching increased plant height, leaf area index, dry matter accumulation and tuber yield of potatoes. The percentages of large and medium sized tubers were also increased.

Chhangani (1998) revealed that the highest polar length of bulb (5.59 cm) and the bulb diameter (7.58 cm) were obtained with polyethylene mulch followed by millet chaff mulch, groundnut shell, and the lowest values were noticed under saw dust including control.

2.3 Yield observations

Menezes *et al.* (1974) reported increased bulb yield at all spacing in mulched field of garlic.

Suh (1991) reported that the total bulb yield was highest with transparent polyethylene mulch (9198.2 kg/ha) as compared with control (5433.9 kg/ha), but yield with black polyethylene mulch was also significantly higher than that of control.

Khalak and Kumarswami (1992) conducted a trial on potato Cv. Kufri Jyoti and given three treatments (I) Non mulch (II) straw mulch (III) polyethylene mulch. Mulching with straw and polyethylene gave average yield of 18.2 and 16.7 tonnes ha^{-1}, respectively compared with 14.2 t ha^{-1} without mulching.

Vinay Singh *et al.* (1997) revealed that the mulching at 30 DAT gave maximum bulb yield (263.34 q/ha) followed by three hand weedings at 30, 60 and 90 DAT.

Rekowska (1997) found that the mulches generally had a positive effect on yield and crop quality. The black plastic film mulch produced the largest and the heaviest bulbs and also gave the highest average marketable yield of 13.3 t ha^{-1} compared with 10.15 t ha^{-1} in unmulched control.

Rekowska and Fiedorow (1998) reported that the garlic crop mulched with transparent and black plastic film, rye straw, saw dust or peat increased the bulb yield, with the highest marketable yield

in transparent and black plastic mulch (5.74 and 5.58 t ha^{-1}, respectively) and the highest bulb quality.

Sarma *et al* (1999) revealed that the potato Cv. Kufri Megha mulched with black plastic film increased the tuber yield significantly over normal planting methods. Plastic film conserved soil moisture and helped in better crop growth and tuber yield.

Aggarwal *et al* (2002) reported that among the mulches in garlic, the best performance was obtained with FYM. Organic mulches were superior over synthetic mulches and of the synthetic mulches, black polyethylene gave better performance over transparent polyethylene mulch and control interms of yield and cost benefit ratio.

Sahoo *et al.* (2002) conducted a experiment to study the effect of plastic film mulching on potato and revealed that mulching increased the tuber yield by 19.5 and 29.5 qt ha^{-1} over unmulched condition during the 2 years, respectively. The plant height, number of tubers per hill and weight of tubers (g) per hill were more in mulched treatments than unmulched treatment.

El-Shanawani *et al.* (2003) mulched the irrigated onion field with transparent polyethylene film and found significant increase in growth, yield and quality of onion plants grown in mulched plots over other plots. Bulb yield increase over that of shaded ones was 97.05 per cent and 18.03 per cent for mulched and unmulched plots, respectively.

2.4 Bio-chemical analysis

Kirti Singh and Sethi (1966) reported that mulching treatment had no effect on moisture content of potato, however all mulches except polyethylene caused increase in starch content. Straw mulching markedly increased the starch content and decreased protein and sugar content of the tuber.

Cho *et al.* (1982) reported that the polyethylene mulch increased the fresh and dry weight of whole plants and fresh bulb weights compared with unmulched control.

Vani *et al.* (1989) reported the highest TSS (11.44 %) of muskmelon grown under transparent polyethylene mulch, followed by yellow polyethylene mulch (9.39 %), control (9.20 %) and straw mulch (7.86 %).

Abdel (1990) revealed that irrigation and clear polyethylene mulch treatment with furrow cultivation gave the highest values for percentage dry weight.

Dixit and Mujumdar (1995) revealed that all the mulches (rice husk, paddy straw, saw dust, transparent polyethlene),except black polyethylene and earthened up plots significantly increased the starch content of tubers as compared to control. Paddy straw and rice husk mulches significantly decreased the protein content of tubers while control recorded higher protein content of tubers.

Rekowska (1997) reported the highest bulb quality of garlic with transparent or black plastic mulch.

Rahman and Khan (2001) reported that the dry matter accumulation was affected by different mulches in onion.

Kolhe (2003) reported that yield and quality of musk melon fruit is different under different mulches. TSS was the highest (9.89° Brix) under grass mulch than other mulch treatments.

2.5 Storage studies

Sumiati (1989) conducted a experiment to study the effect of mulch on fruit quality in tomato. The plants were mulched with rice straw or black plastic. He revealed that, after storage, the fruit quality indices were best in variants mulched with plastic.

Lang- *et al.* (2001) conducted experiment to study the effect of mulches on storage quality of apple and revealed that the mulches increased the concentration of Ca, K and Mg in the soil and soils CEC. These below ground changes were reflected in increase in leaf potassium and calcium and severity of calcium related bitter peat was significantly reduced.

Martins *et al.* (2001) revealed that peach fruits harvested from orchards with mulching presented a firmer texture than those harvested from orchards without mulching. The sensorial analysis showed that at the end of the storage period, the fruits harvested from orchards with soil management consisting of mulching had better

appearance, marketing quality and taste than those harvested from orchards without mulching.

2.6 Nutrient status of soil

Kashyap *et al.* (1967) revealed that differences in chemical composition of soil due to different mulches were not significant, however the treatment (saw dust) which indicated higher available nitrogen content in soil had indicated lower available phosphorus in soil.

Adetunjii (1994) compared the soil solarization with transparent polyethylene film with organic mulches and no mulch treatment and reported that solarization conserved more soil moisture and doubled the concentration of NH_4^+-N and NO_3-N in soil as compared with other mulches and control.

Baker *et al.* (1998) studied the interaction of poultry litter, polythene mulch and floating raw covers on triploid watermelon and revealed that the polyethylene mulch significantly increased the post-harvest soil-NO_3 and leaf – N concentration and increased yield and yield components.

Xia *et al.* (1986) conducted experiment to study the effect of film mulching for increasing hardiness of loquat and revealed that available soil N, P and K increased by 23.3-28 per cent, 46-54.8 per cent and 200 per cent, respectively compared with that at start of mulching.

Muralidhava and Raghuramulu (1997) concluded that mulching increased the growth and yield of crop and improved the soil nutrient status.

Neilsen *et al.* (2004) conducted a trial to study the use of organic application to increase productivity of high density apple orchard and revealed that the surface mulching improved soil nutrient status and biological activity and buffered tree against moisture stress.

2.7 Soil temperature

Yamashita and Takase (1987) reported that the black polyethylene film used for mulching onion sets, raised the soil temperature, excessively. Use of polyethylene film coloured white on the upper side and black below gave lower soil temperature than black or silvered films and better leaf growth and bulb yields.

Cunha *et al.* (1993) reported that the transparent sheets resulted in a greater increase in soil temperature followed by black sheets, while white sheets resulted in the same temperature as in control plots of garlic.

Rao and Pathak (1998) reported that mulching with black polythene showed maximum soil temperature throughout the expt. in Aonla, while sugarcane trash maintained minimum temperature followed by grass, paddy straw and rice husk.

Harender Raj and Bhardwaj (2000) reported that mulching with transparent polyethylene resulted in increase in temperature of soil. The average soil temperature was highest at 8 cm soil depth in

solarization treatment. The temperature was 4°C higher in solarized beds than unsolarized plots.

Hoda-Ahmed *et al.* (2000) reported that mulching moist soil with transparent polyethylene for 15 and 30 days increased maximum soil temperature by 9.5 and 9.8°C, compared to non solarized soil at 10 cm depth. Mulching with black polyethylene increased maximum temperature by 15.2 and 14.7°C.

Hwang *et al.* (2000) reported that mulching influenced soil temperature with the daily average soil temperature in the clear PE film mulching treatment 4°C higher than in straw mulching treatment.

El-Shanawany *et al.* (2003) mulched the irrigated onion field with transparent polyethylene sheet and revealed that mulching increased soil temperature by 10 to 6.35° over unmulched one at 5 and 20 cm depth, respectively.

2.8 Weed intensity

Devochkin (1971) revealed that the best treatment in carrot was mulching with peat preem and spraying the peat with prometryne at 5 kg per ha to control the weeds. Plots were almost weed free throughout the growing season.

Katan *et al.* (1980) reported that mulching with transparent polyethylene significantly reduced the weed population in onion.

Durante and Cuocolo (1989) reported that both, straw mulching and selective herbicide gave useful weed control in autumn planted onion.

Ram and Singh (1992) revealed that the highest weed control efficiency was recorded in black polyethylene mulch and the lowest in white polyethylene mulch. The maximum weed population was observed in controlled plots.

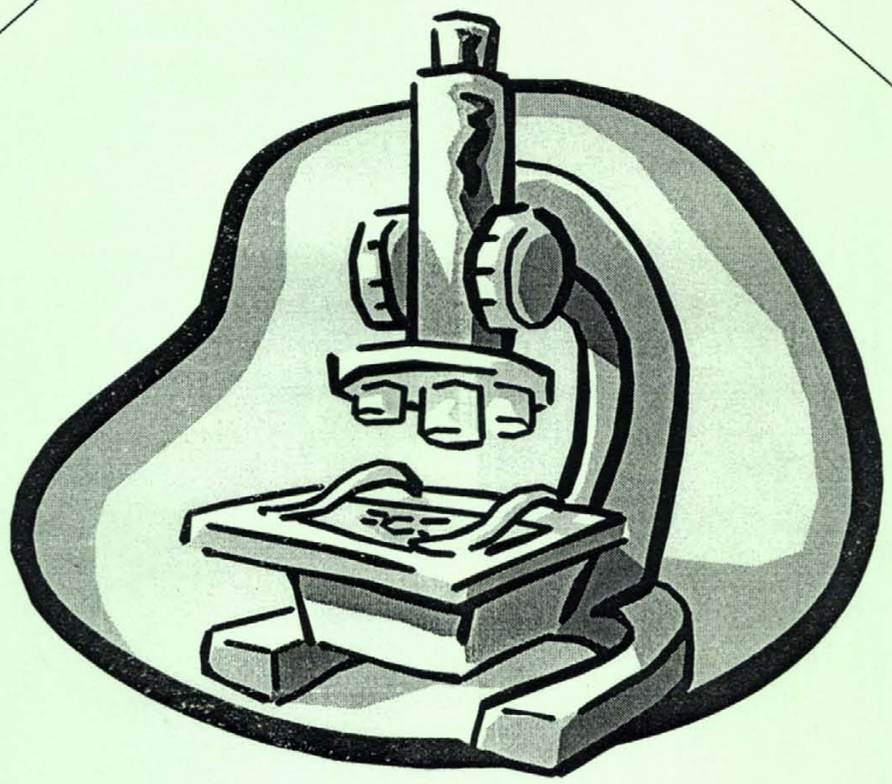
Rao and Pathak (1998) reported that rice husk mulching in tree basin of aonla was ineffective in controlling the weed growth, while mulching with black polyethylene showed minimum weed count followed by grass, sugarcane trash and paddy straw.

Cui *et al.* (2001) revealed that recycled paper mulch and black polyethlene film mulch resulted in effective control of weeds in potato by obstructing light transmission onto soil surface but transparent polyethylene film had no control on weeds.

Shirgure *et al.* (2003) studied the effect of black and white polyethylene mulch, straw mulch, paddy straw and local grass on weed reduction. The significant weed reduction was achieved with black polyethylene of 100 μ and grass mulching @ 3 tonnes / ha.

2.9 Economics

Dixit and Mujumdar (1995) reported that among organic mulches and plastic mulches in potato, paddy straw mulching was most profitable. It recorded the highest cost : benefit ratio (1:2.59) followed by control (1:2.04) while lower cost : benefit ratio was noticed under polyethylene mulches because of higher cost of polyethylene.



MATERIAL AND METHODS

PLATE NO. 1. General view of Experimental Plot.

PLATE NO. 2. Onion cultivar - Phule Samarth.

3. MATERIALS AND METHODS

The present investigation entitled, "Effect of different mulches on yield, quality and storage of onion bulbs in *kharif* season (Cv. Phule Samarth)" was carried out at the "Scheme for Research on Onion Storage", Department of Horticulture, M.P.K.V., Rahuri, Dist. Ahmednagar during June 2005 to February 2006.

Geographically, the central campus of M.P.K.V., Rahuri comprise semi arid plain zone of Maharashtra state and situated in sub-tropic. It lies on 19°24^{1} N latitude and 27°31^{1} E longitude. It is 657 m above the mean sea level. The average rainfall is 560 mm. The annual mean maximum and minimum temperature are 37.9°C and 17.0°C, respectively.

The average daily maximum temperature recorded during the period of investigation was 30.31°C ,while the average daily minimum temperature was recorded as 21.03°C. The mean maximum and minimum humidity was within the range of 90.18 % and 48.9 %, respectively. The total rainfall received during the period of investigation was 524.49 mm.

3.1 Material

3.1.1 Mulching of the beds

Black polyethylene film (300 μ), white polyethylene film (100 μ), wheat straw, sugarcane trash are used as a mulch material.

3.1.2 Selection of variety

The variety of onion grown was Phule Samarth, which is recently developed by M.P.K.V., Rahuri. It is a *kharif* season variety. It has early maturity and natural top fall. The average yield is 28.16 t ha^{-1}.

3.1.3 Nursery details

Raised beds are prepared and provided with 15 to 20 kg of well rotted and powdered FYM. Onion seeds of variety Phule Samarth were sown in 3rd week of June, on raised beds, at the rate of 10 kg ha^{-1}. Regular watering was carried out to obtain healthy and uniform seedling. The seedlings were ready for transplanting within one and half month.

3.1.4 Planting details

Eight weeks old, medium tall and uniformly vigourous seedlings were dipped in insecticide and fungicidal solution and were transplanted after clipping the leaves on 18 Aug. The FYM (20 tonnes/ha) was thoroughly incroporated into the soil at the time of transplanting. Mulching of beds was also carried out simultaneously with transplanting as per experimental layout.

The fertilizer dose was applied at the rate of 100 kg N + 50 kg P_2O_5 + 50 kg K_2O /ha, ½ dose of N and complete dose of P and K was applied as a basal dose and remaining ½ dose of N was applied at 30 days after planting. Other cultural operations like weeding and irrigation were followed as and when required.

3.1.5 Harvesting, sampling and method of storage

The bulbs were harvested when the leaves turned yellow and at 50 per cent top fall. The bulbs were cured for 5 to 6 days in the field by windrow method. Then the bulbs were cured in shade for 15 days and tops were cut keeping 4 cm neck. The bulbs were graded and uniform sample of 10 kg of medium sized bulbs from each plot was kept in iron cage. These cages were kept for 2 months under the well ventilated roof structure of "Scheme for storage of onion, Department of Horticulture, M.P.K.V., Rahuri" at ambient temperature. The stored bulbs were observed at 15 days interval for recording storage losses due to sprouting, rotting and PLW.

3.2 Experimental details

Experiment was carried out during June 2005 to Feb. 2006 having following details.

a. Treatment details

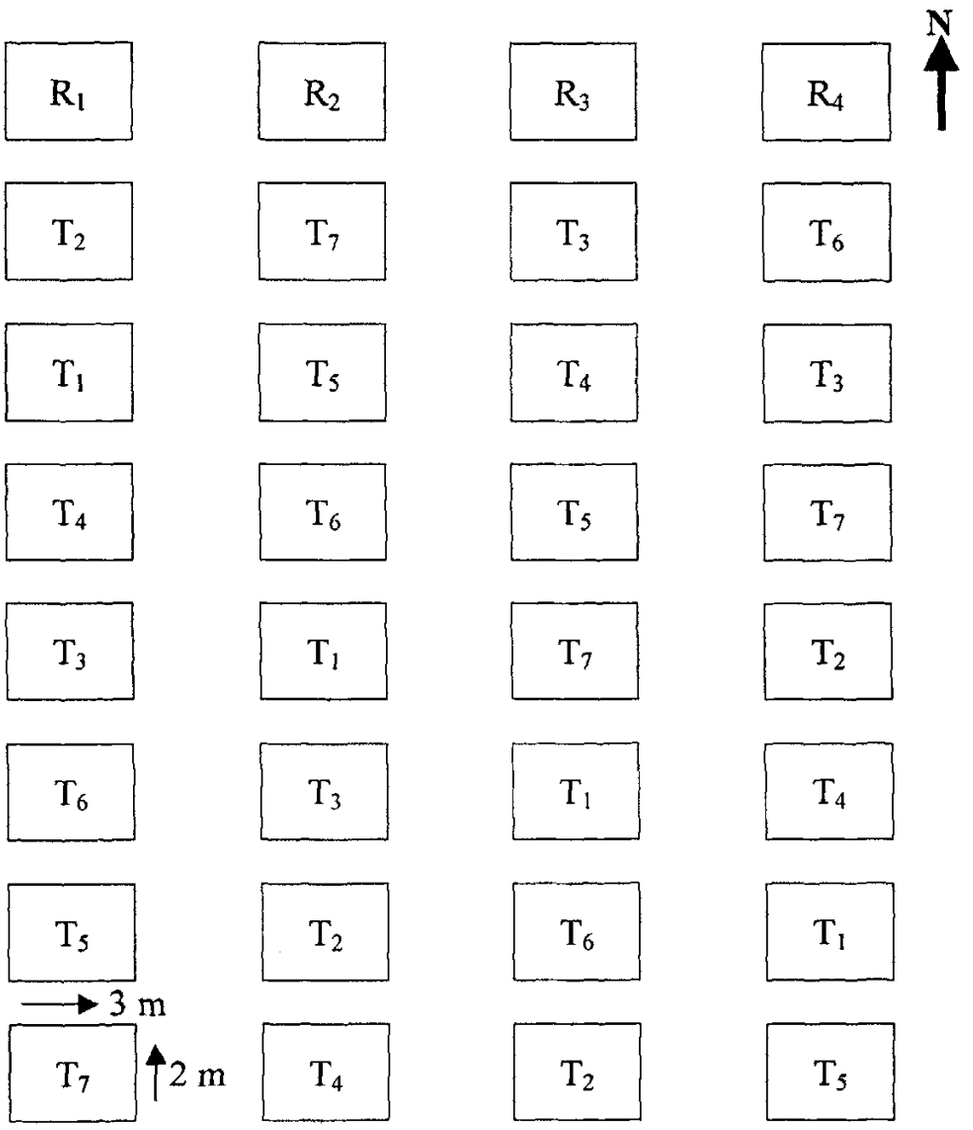
There are 7 treatments as follows (size/wt.)

i..	Black polyethylene paper sheet (300 μ)	-	3.30 x 2.30 m
ii.	White polyethylene paper sheet (100μ)	-	3.30 x 2.30 m
iii.	Black polyethylene paper strip (300μ)	-	2.30 x 0.14 m (20 strips
iv.	White polyethylene paper strip (100μ)	-	2.30 x 0.14 m (20 strips
v.	Wheat straw	-	1.8-2 kg/bed
vi.	Sugarcane trash	-	1.8-2 kg/bed
vii.	Control	-	3 hand weeding at 20, 45 and 75 DAT stages

b.	Number of replication	:	4
c.	Design	:	Randomized Block Design
d.	Season	:	*Kharif*
e.	Time of seed sowing	:	20 June
f.	Method of planting	:	Transplanting in flat bed
g.	Time of transplanting	:	16 August
h.	Spacing	-	15 x 10 cm
i.	Plot size		
	Gross	:	3.0 m x 2.0 m
	Net	:	2.8 m x 1.8 m
j.	Variety	-	Phule Samarth

3.3 Methods

To study the effect of different mulches on yield, quality and storage, various biometric observations were recorded. Ten plants



Plot size : Gross : 3.0 x 2.0 m

: Net : 2.8 x 1.8 m

Fig. 1: Lay-out plan

PLATE NO. 3. T_1 - Black polyethylene sheet mulch plot.

PLATE NO. 4. T_2 - White polyethylene sheet mulch plot.

PLATE NO. 5. T_3 - Black polyethylene strip mulch plot.

PLATE NO.6. T_4 - White polyethylene strip mulch plot.

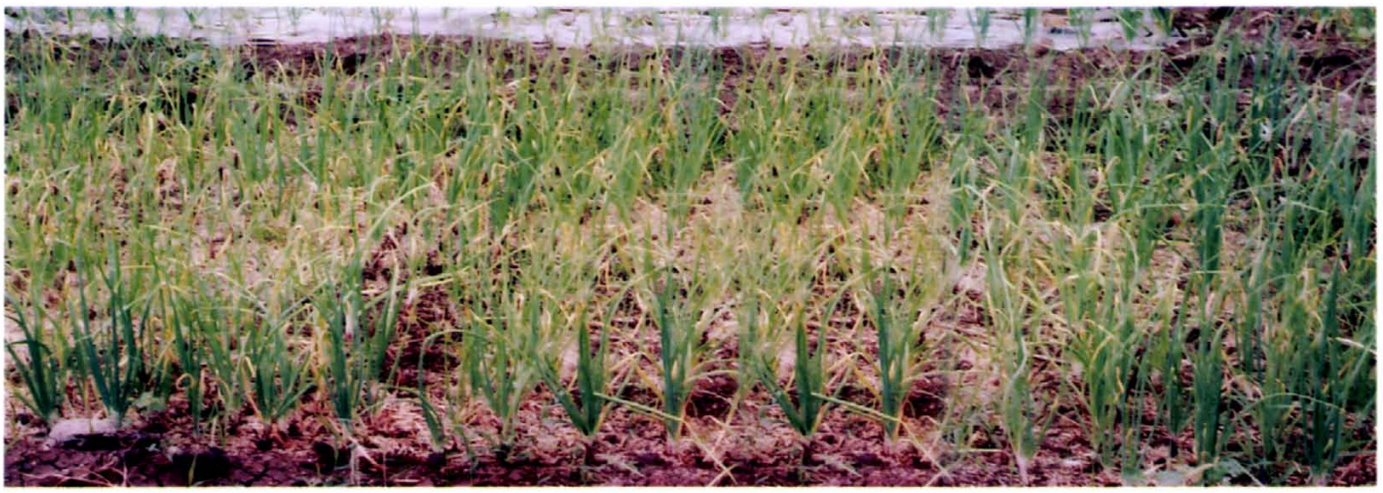


PLATE NO. 7. T_5 - Wheat straw mulch plot.

PLATE NO. 8. T_6 - Sugarcane trash mulch plot.

PLATE NO. 9. T_7 - Control plot.

from each plot were selected at random and marked with pegs for recording observations.

3.3.1 Plant growth parameters

3.3.1.1 Height of plant (cm)

The height of plant was recorded for randomly selected 10 plants from each plot at 30 days interval from transplanting. The height was recorded from ground level to tip of the highest leaf in centimeter.

3.3.1.2 Number of leaves per plant

The number of leaves were recorded from 10 randomly selected plants from each plot at 30 days interval from transplanting. The same plants for which height observations were recorded, were also used for recording this observations. The green and dried leaves were also counted. From this the mean number of leaves per plant was calculated as under,

$$M = \frac{\sum X}{N}$$

Where,

X = Number of leaves

n = Number of plants

$\sum$ = Summation

3.3.1.3 Premature bolting (%)

The number of bolted plants was counted from each plot and the premature bolting (%) was calculated using following formula

$$\text{Premature bolting (\%)} = \frac{\text{Number of bolted plants / plot}}{\text{Number of bulbs per plot}} \times 100$$

3.3.1.4 Days required for 50 % foliage top fall

The days required for 50 per cent foliage top fall from transplanting were considered for maturity and recorded in each treatments.

3.3.2 Bulb observations

3.3.2.1 Neck thickness (cm)

This was measured by Vernier calliper in cm from randomly selected 10 bulbs.

3.3.2.2 Polar diameter of bulbs (cm)

It was measured by Vernier calliper in cm from junction of root plate to top of the bulb from same bulbs which were used for recording neck thickness and mean polar diameter was worked out.

3.3.2.3 Equatorial diameter of bulbs (cm)

It was measured by Vernier calliper in cm and it is the maximum distance between opposite sides at right angles to the polar

diameter. Same ten randomly selected bulbs were used for recording polar diameter and mean equatorial diameter was worked out.

3.3.3 Yield observations

The bulbs were sorted out as marketable, non-marketable *viz.,* small size, bolted, and twin bulbs. Then their weights from each plot was recorded in Kg and total yield in tonnes per hectare was calculated.

Following yield observations were recorded.

a. Marketable bulb yield

b. Non-marketable bulb yield

   i. Small size bulb yield

   ii. Bolted bulb yield

   iii. Twin bulb : yield

c. Total bulb yield

3.3.4 Biochemical analysis

The analysis for biochemical constituents such as TSS, dry matter, reducing sugars, non-reducing sugars, total sugars was carried out after harvesting.

3.3.4.1 Total soluble solids (TSS %)

For this purpose, five bulbs from each treatment were randomly selected and juice was extracted with the help of juicer. The mean TSS was determined with the help of hand refractometer.

3.3.4.2 Reducing sugars (%)

Reducing sugar (%) of onion bulbs was determined by the method of Lane and Eynon (1923) on fresh weight basis, as juice of bulbs was taken for analysis.

3.3.4.3 Non-reducing sugars (%)

Non reducing sugars (%) were calculated by substracting the reducing sugars from total sugars.

3.3.4.4 Total sugars (%)

Total sugars (%) were estimated after acid hydrolysis by the method of Lane and Eynon (1923).

3.3.4.5 Dry matter (%)

The bulbs were randomly selected from each treatment and cut into small pieces with the help of stainless steel knife and weighed. The prepared sample of 100 g was then kept in hot air oven at 60°C temperature, till the constant weight was observed. From this, dry matter (%) was calculated.

3.3.5 Storage studies

The uniform samples of 10 kg of harvested, cleaned and cured bulbs of each plot was kept for storage studies. Observations were recorded for two months period at fortnightly interval for storage losses, due to rotting, sprouting, PLW and total losses. At each observation, rotted and sprouted bulbs were discarded after recording the weight.

3.3.5.1 Rotting losses (%)

The rotted bulbs were separated and weighed and percent loss due to rotting was determined.

3.3.5.2 Sprouting losses (%)

Sprouted bulbs were separated and weighed and percent loss due to sprouting was determined.

3.3.5.3 PLW losses (%)

The percent loss in weight, both due to rotting and sprouting was subtracted from total loss in weight and thus loss due to PLW was worked out.

3.3.5.4 Total losses (%)

The weight of only healthy bulbs was recorded which was subtracted from initial weight of sample to get the total losses.

3.3.6 Nutrient status of soil

3.3.6.1 Availability of N : P : K in soil (kg/ha) at initial stage was determined by soil testing

3.3.6.2 Availability of N:P:K in soil (kg/ha) from each treatment after harvest was determined by soil testing.

3.3.7 Soil temperature

Soil temperature was recorded for each treatment in °C using soil thermometer at weekly interval from planting to harvesting.

3.3.8 Weed count (per m^2)

Weed count was done by calculating the number of weeds per meter square in each plot at every 30 days interval.

3.3.9 Economics

3.3.9.1 Gross monetary return

Gross monetary returns per hectare were worked out by considering the marketable and non-marketable bulb yield from different treatments and prevailing market prices of commodities.

3.3.9.2 Input cost net return

Input cost (cost – A) was worked out by considering the amount required for the purchase of input like seeds, fertilizers, pesticides, irrigation charges etc. and amount spent on the labour charges and bullock charges required for all the operations.

The net return were worked out by subtracting the total input cost of cultivation from the gross returns of the corresponding treatments.

3.3.9.3 Cost : benefit ratio

The Cost : benefit ratio was worked out by considering per hectare values of net profit and input cost of cultivation.

3.3.10 Statistical analysis

A standard method of statistical analysis suggested by Panse and Sukhatme (1985) was adopted for analysis of data recorded for various characters under study.

EXPERIMENTAL RESULTS

4. EXPERIMENTAL RESULTS

An experiment entitled "Effect of different mulches on yield, quality and storage on onion bulbs in *kharif* season (Cv. Phule Samarth)" was conducted during the period of June 2005 to Feb 2006 at "Scheme for Research on Onion Storage", Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist– Ahmednagar. The present investigation studies dealth with different aspects viz., effect of different mulches on yield, quality and storage of onion bulbs.

The results obtained during the course of investigation regarding plant growth, bulb dimension, yield, quality, storageability, nutrient status of soil, weed control and soil temperature are systematically given under the appropriate headings and sub-headings.

4.1 Plant growth parameters

Observations on plant growth attributes viz., plant height, number of leaves were recorded periodically during crop growth, while the number of days required for 50 per cent natural foliage top fall and premature bolting percentage were recorded at the time of bulb harvesting.

4.1.1 Plant height (cm)

Data pertaining to mean plant height as influenced periodically by different treatments are presented in Table 2 and graphically depicted in Fig. 4.2.

4.1.1.1 At 30 DAT

Data on the mean plant height at 30 DAT presented in Table 2 revealed no significant differences due to various treatments. However, maximum plant height (37.85 cm) was recorded in T_6 (sugarcane trash mulch) while minimum plant height (28.95 cm) was recorded in T_7 (Control).

4.1.1.2 At 60 DAT

Data on the mean plant height at 60 DAT presented in Table 2 revealed that there was significant differences due to various treatments. The maximum mean plant height was recorded (60 cm) in treatment T_6 (Sugarcane trash). It was significantly higher than all other treatments, except T_1 (B.P. sheet mulch), to which it was at par. The minimum plant height (46.325 cm) was recorded in treatment T_7 (Control) which was at par with treatment T_3 and T_4.

4.1.1.3 At 90 DAT

Data on the mean plant height at 90 DAT presented in Table 2 revealed significant differences due to various treatment. The maximum

mean plant height (68.675 cm) was recorded in treatment T_6 (Sugarcane trash) ,which was at par with treatment T_1 (B.P. sheet mulch). The minimum plant height (54.15 cm) was recorded in treatment T_7 (Control). It was significantly lower than all treatments,except T_4 (W.P. strip mulch) to which it was at par.

4.1.2 Number of leaves

The data pertaining to the number of leaves per plant as influenced by various treatments presented in Table 2.

4.1.2.1 At 30 DAT

Data on the number of leaves per plant at 30 DAT presented in Table 2 revealed no significant differences due to various treatments. However, higher number of leaves (5.1) were recorded in T_6 (sugarcane trash mulch) and minimum number of leaves (4.3) were recorded in T_7 (control).

4.1.2.2 At 60 DAT

Data on the number of leaves per plant at 60 DAT presented in Table 2 revealed that there was significant effect of treatments. The maximum number of leaves per plant (7.25) was obtained in treatment T_1 (B.P. sheet mulch). It was significantly higher than all treatments,except T_2 (W.P. sheet mulch) and T_6 (sugarcane trash) to which it was at par. The

Table 2. Periodical observation for plant growth characters

Sr. No.	Treatment	Plant height (cm)			Number of leaves		
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
1.	T_1 B.P. sheet mulch	36.45	58.02	67.42	4.90	7.25	10.65
2.	T_2 W.P. sheet mulch	31.40	54.95	62.42	4.70	6.62	10.25
3.	T_3 B.P. strip mulch	29.97	50.63	59.07	4.50	6.05	10.35
4.	T_4 W.P. strip mulch	29.52	49.02	57.42	4.37	6.35	9.62
5.	T_5 Wheat straw	32.40	52.60	61.17	4.72	5.97	9.82
6.	T_6 Sugarcane trash	37.85	60.00	68.67	5.10	6.72	10.60
7.	T_7 Control	28.95	46.32	54.15	4.30	5.77	9.30
8.	'F' test	N.S	Sig.	Sig.	N.S.	Sig.	Sig.
9.	S. Em±	1.837	1.667	1.56	0.171	0.211	0.125
10.	C.D. at 5 %	--	4.951	4.632	--	0.627	0.372

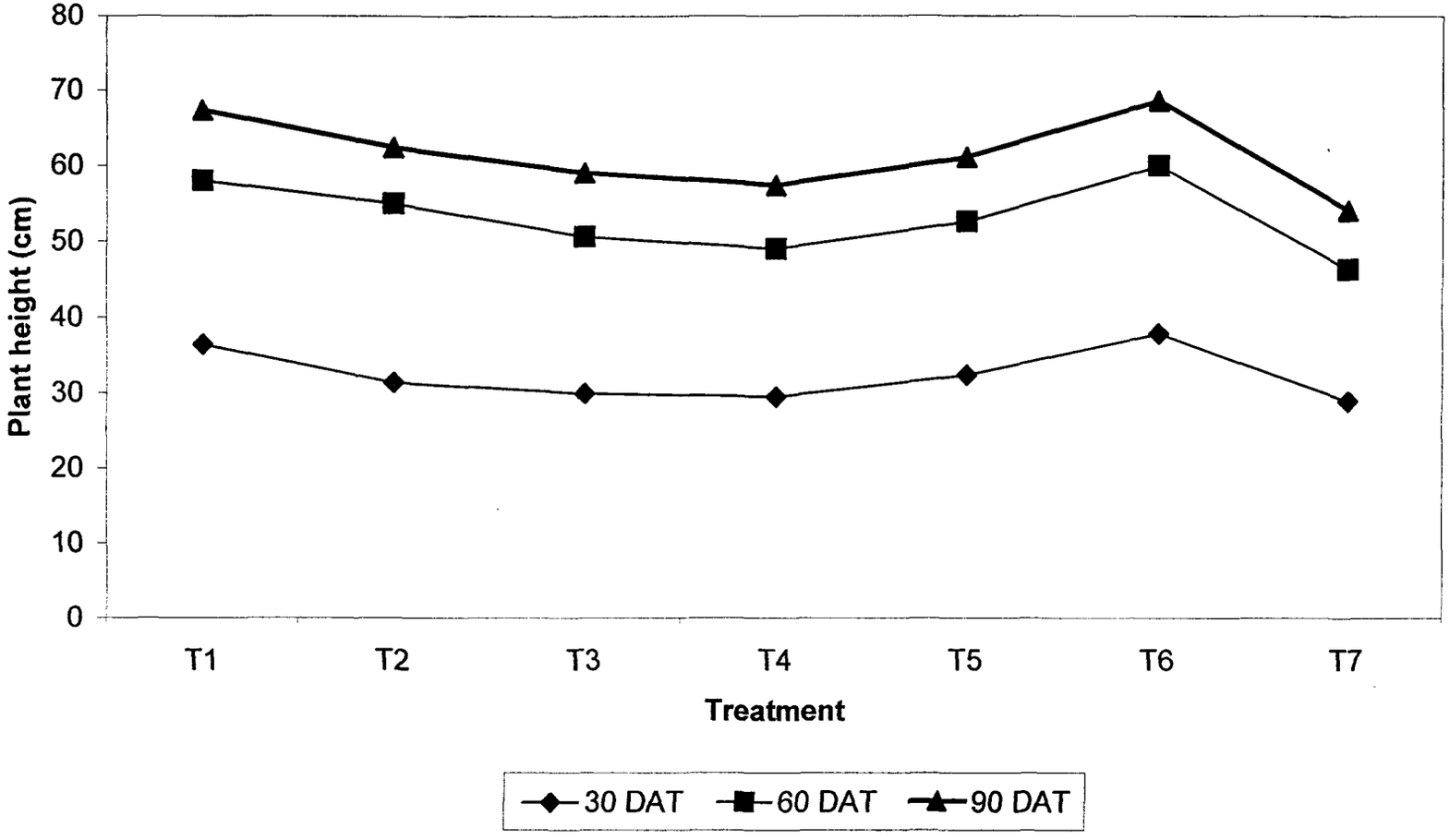


Fig. 4.2 Mean plant height (cm) as influenced periodically due to various mulches

minimum number of leaves per plant (5.775) was recorded in treatment T_7 (control) which was at par with T_3, T_4 and T_5.

4.1.2.3 At 90 DAT

Data on the number of leaves per plant at 90 DAT presented in Table 2 revealed significant effects due to various treatments. The maximum number of leaves per plant (10.65) was obtained in treatment T_1 (B.P. sheet mulch). It was significantly superior than all treatments,except T_3 (B.P. strip mulch) and T_6 (sugarcane trash) to which it was at par. Minimum number of leaves (9.3) per plant was recorded in treatment T_7 (control), which at par with treatment T_4 (W.P. strip mulch).

4.1.3 Premature bolting percentage

From Table 3, it is revealed that significant differences were observed due to various treatments and it is graphically depicted in Fig. 4.3. The minimum percentage of bolting (1.875) was observed in treatment T_7 i.e. control, which was at par with T_2, T_3, T_4 and T_5. The maximum percentage of bolting (4.95 %) was observed in treatment T_1 (B.P. sheet mulch) which was significantly higher than all treatments, except T_6 (sugarcane trash) to which it was at par. It was interesting to note that these two treatments (T_1 and T_6) showed rapid plant growth,displayed higher percentage of premature bolting .

4.1.4 Days required for 50 per cent top fall

From Table 3, it is revealed that significant differences were observed due to various treatments and it is graphically depicted in Fig. 4.4. Minimum number of days required for 50 per cent top fall were recorded in treatment T_7 i.e. control (87 days), which was significantly earlier than all other treatments. While, maximum number of days (117.25 days) were recorded in treatment T_1 (B.P. sheet mulch) which was at par with treatment T_2. However, it was important to note that all treatments showed fifty percent top fall as a salient feature of Cv. Phule Samarth, but vigorous plant growth matured late than controlled growth.

4.2 Bulb observations

Observations on bulb attributes viz., neck thickness, equatorial diameter and polar diameter were recorded after harvesting and curing of the onion bulbs.

4.2.1 Neck thickness (cm)

The data regarding the neck diameter are presented in Table 3. The data revealed that significant differences were observed due to various treatments. The minimum neck diameter (0.953 cm) was observed in treatment T_7 (control). It was significantly superior than all other treatments, except T_2 (W.P. sheet mulch) and T_5 (wheat straw) to which it was at par. The maximum neck thickness (1.168 cm) was observed in treatment T_1 (B.P. sheet mulch).

4.2.2 Equatorial diameter (cm)

The data presented in Table 3 shows that there was significant effect of treatments. The maximum equatorial diameter (6.54 cm) was observed in treatment T_6 (sugarcane trash), which was at par with treatments T_1, T_2, T_3 and T_5. The minimum equatorial diameter (4.81 cm) was observed in treatment T_7 (control). It was significantly lower than all treatments,except T_4 (W.P. strip mulch) to which it was at par.

4.2.3 Polar diameter

The data presented in Table 3 revealed significant differences due to various treatments. Maximum mean polar diameter (5.91 cm) was observed in treatment T_1 (B.P. sheet mulch) which was at par with the treatments T_2 and T_6. The minimum polar diameter (5.153 cm) was recorded in treatment T_7 (control) which was significantly lower than other treatments.

4.3 Yield observations

Data pertaining to the different components of yield of onion bulbs viz., marketable yield, non-marketable yield viz., small size bulb yield, bolted bulb yield, twin bulb yield and total bulb yield is presented in Table 3.

Table 3. Bulb characteristics at the time of harvesting

Sr. No.	Treatment	% premature bolting	Days to 50 % NTF*	Bulb neck thickness (cm)	Bulb Diameter (cm)		Bulb yield (t/ha)				Total bulb yield (t/ha)
					Equa-torial	Polar	Marketable bulb yield	Non marketable bulb yield			
								Twin	Bolted	Small size	
1.	T_1	4.95	117.25	1.16	6.34	5.91	28.48 (85.29%)	0.556 (1.66%)	1.371 (4.11%)	2.98 (8.92%)	33.39
2.	T_2	2.62	116.25	1.05	6.30	5.65	23.96 (85.26%)	0.345 (1.22%)	0.756 (2.70%)	3.037 (10.8%)	28.10
3.	T_3	2.40	109.75	1.13	6.30	5.47	26.125 (85.51%)	0.513 (1.67%)	0.820 (2.68%)	3.09 (10.14%)	30.55
4.	T_4	2.10	109.75	1.08	5.53	5.49	24.001 (82.99%)	0.582 (2.01%)	0.641 (2.216%)	3.798 (13.13%)	28.92
5.	T_5	3.00	108.50	0.96	5.71	5.54	23.655 (81.01%)	0.755 (2.56%)	0.988 (3.38%)	3.813 (13.05%)	29.2
6.	T_6	4.87	113.25	1.16	6.55	5.67	28.690 (85.76%)	0.606 (1.82%)	1.113 (3.72%)	3.04 (9.1%)	33.45
7.	T_7	1.87	87.00	0.95	4.82	5.15	20.390 (79.32%)	0.389 (1.51%)	0.529 (2.05%)	4.395 (17.09%)	25.705
8.	'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	N.S.	Sig.	N.S.	Sig.
9.	S. Em±	0.538	0.415	0.035	0.283	0.102	0.653	0.167	0.150	0.343	0.827
10.	C.D. at 5 %	1.397	1.231	0.105	0.841	0.302	1.939	--	0.444	--	2.457

* NTF – Natural top fall as a sign of physiological maturity

* Figures in parenthesis are expressed as a percent yield on weight basis

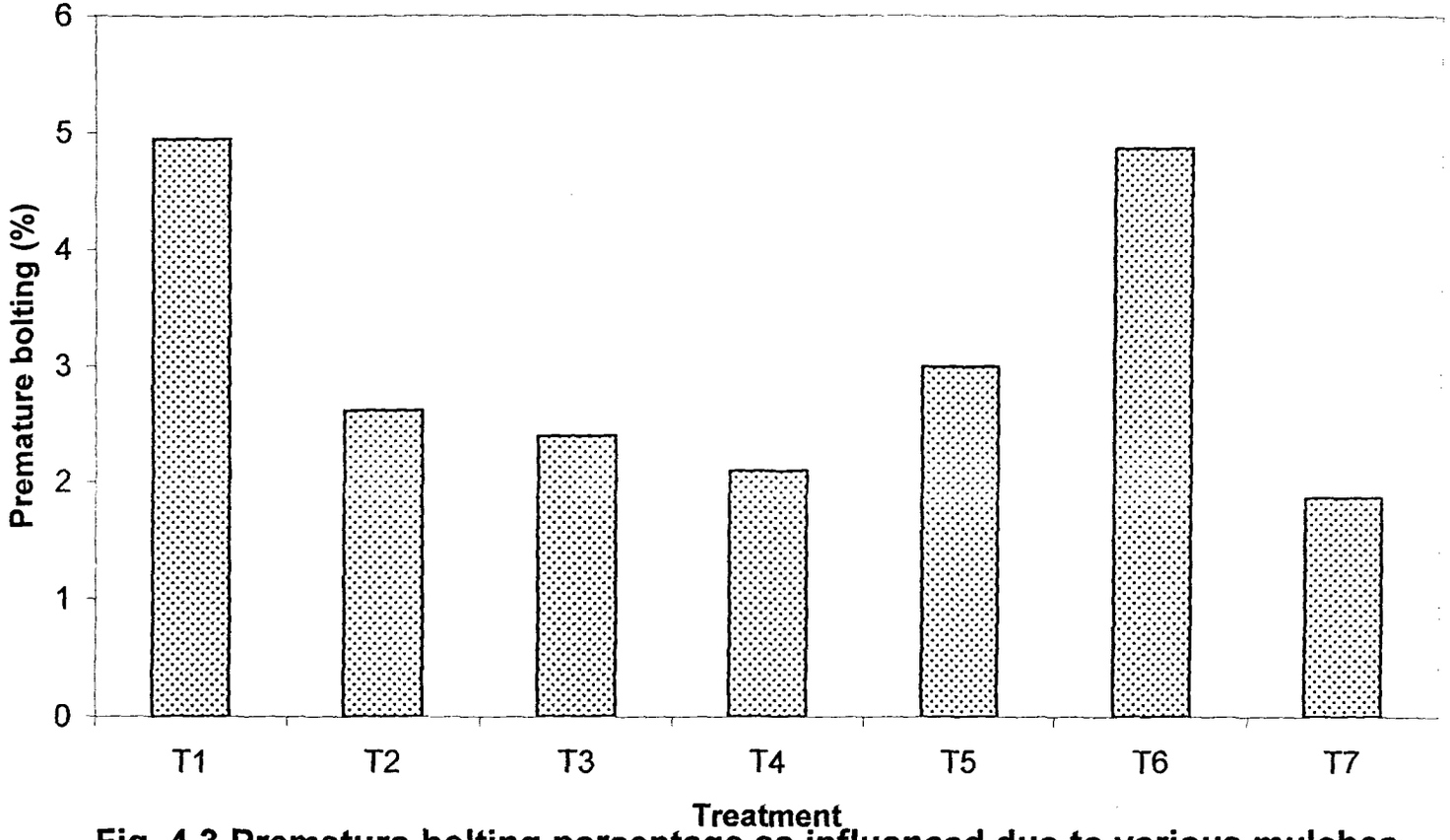


Fig. 4.3 Premature bolting percentage as influenced due to various mulches

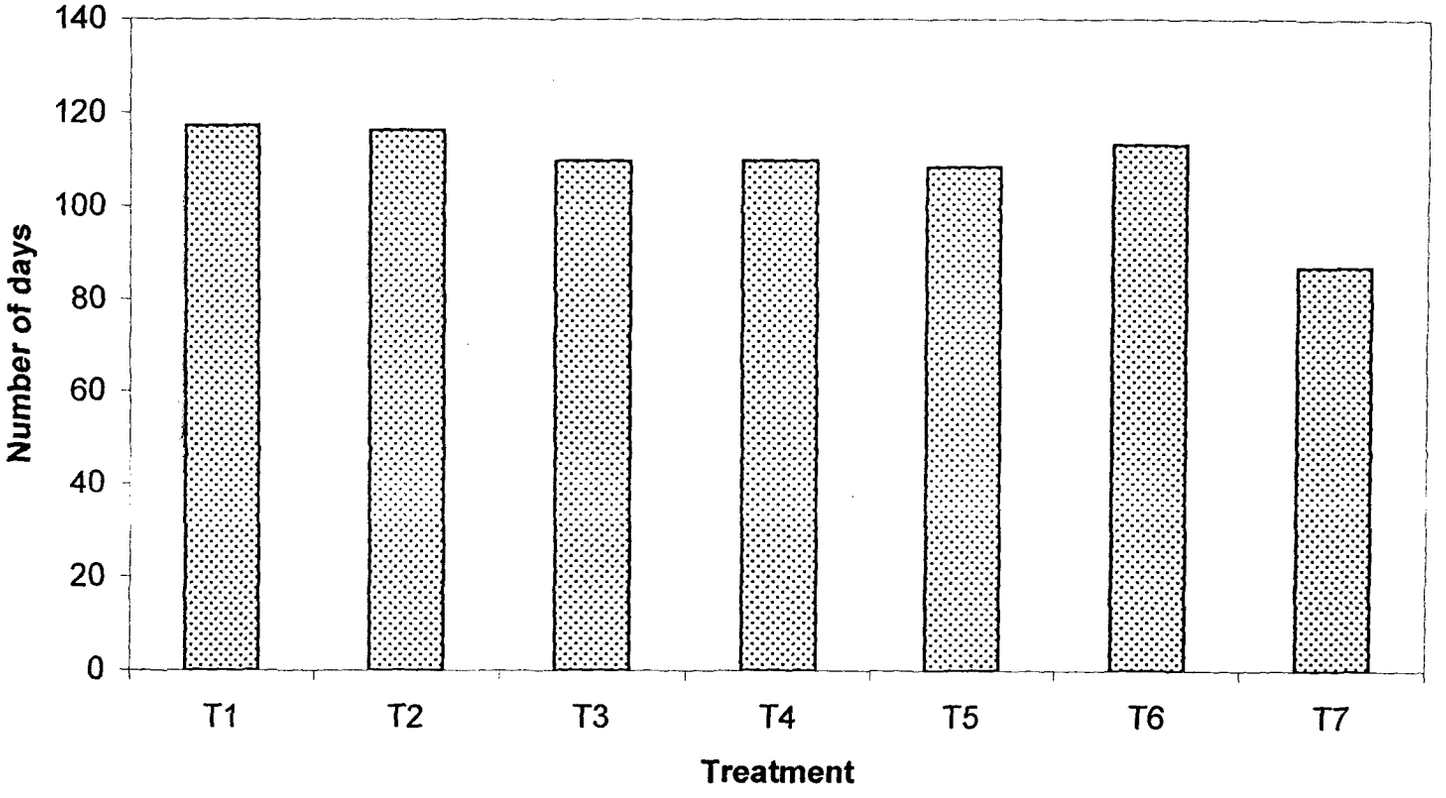


Fig. 4.4 Number of days required for 50 % natural top fall as influenced due to various mulches

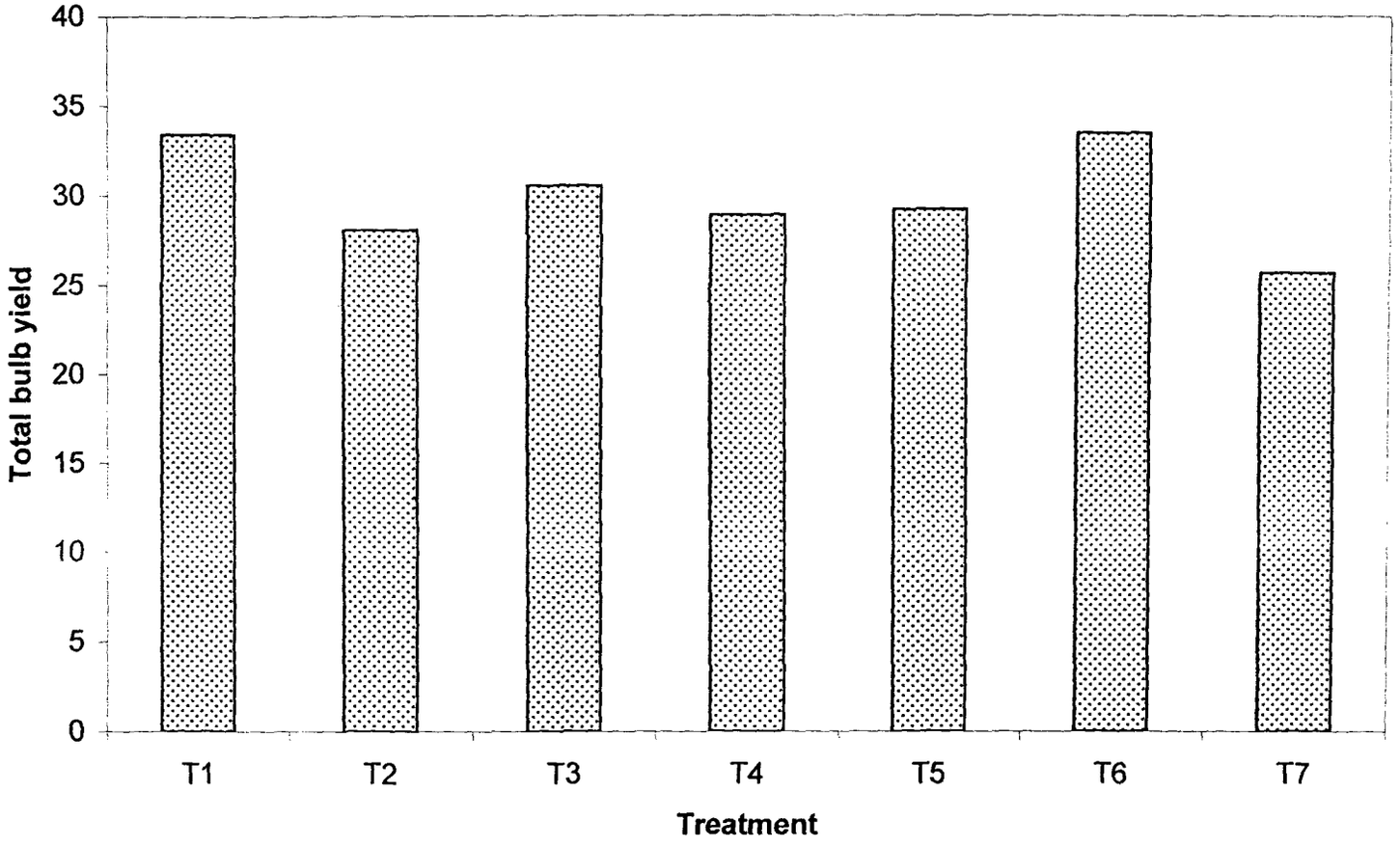


Fig. 4.5 Total bulb yield of onion as influenced due to various mulches

4.3.1 Marketable bulbs yield (t/ha)

From Table 3, it is revealed that there was significant differences due to various treatments. Maximum mean marketable bulb yield (28.48 t/ha) was recorded in treatment T_1 (B.P. sheet mulch) which was significantly higher than all other treatments,except T_6 (sugarcane trash) to which it was at par. Minimum marketable bulbs yield (20.39 t/ha) was recorded in treatment T_7 (control).

4.3.2 Non marketable bulbs yield (t/ha)

4.3.2.1 Small size bulbs yield (t/ha)

Farm Table 3, it is revealed that there was no significant differences in small size bulbs yield due to various treatments. However, maximum small size bulb yield was obtained in control (4.395 t/ha) and minimum small size bulb yield was obtained in black polyethylene sheet mulch (2.98 t/ha).

4.3.2.2 Bolted bulbs yield (t/ha)

Data pertaining to the bolted bulbs yield as influenced due to various treatments is presented in Table 3.

Data revealed significant differences due to various treatments. Minimum bolted bulb yield (0.529 t/ha) was recorded in treatment T_7,which was significantly superior than all treatment,except T_2,

T_3 and T_4 to which it was at par. Maximum bolted bulbs yield (1.371 t/ha) was recorded in treatment T_1, which was at par with treatments T_5 and T_6.

4.3.2.3 Twin bulbs yield (t/ha)

From Table 3 it is revealed that there was no significant differences in twin bulbs yield as influenced due to various treatments. However, numerically higher twin bulbs yield was recorded in wheat straw (0.755 t/ha) and minimum twin bulbs yield was recorded in white polyethylene sheet mulch (0.345 t/ha).

4.3.3 Total bulbs yield

Data pertaining to the total bulbs yield as influenced due to various treatment is presented in Table 3 and graphically depicted in Fig. 4.5.

Data revealed that there was significant differences due to various treatments. The highest bulb yield (33.45 t/ha) was recorded in treatment T_6 (sugarcane trash) which was at par with treatment T_1 i.e. B.P. sheet mulch (33.39 t/ha). Minimum yield was recorded in treatment T_7 i.e. control (25.70 t/ha) which was significantly lower than all other treatments, except T_2 to which it was at par. Thus, it showed promise of sugarcane trash mulch and black polyethylene sheet mulch on improvement of onion yield potential.

4.4 Biochemical analysis

Data pertaining to the biochemical composition of onion bulbs viz., T.S.S., reducing sugars, non reducing sugars, total sugars and dry matter is presented in Table 4.

4.4.1 T.S.S. (%)

Data is respect of the T.S.S. of onion bulbs as influenced due to various treatment is presented in Table 4.

Data revealed that there was significant differences in T.S.S. of onion bulbs due to various treatments. The highest T.S.S. (12.45) was recorded in T_1 (B.P. sheet mulch) which was at par with treatments T_2, T_3, T_4, T_5 and T_6. Minimum T.S.S. (11.27 %) was recorded in treatment T_7 (control) which was significantly lower than all other treatments.

4.4.2 Reducing sugars

From Table 4, it is revealed that there was no significant differences due to various treatments. However, maximum reducing sugars (3.63 %) were recorded in T_7 (control) and minimum reducing sugars (2.97%) were recorded in T_4 (W.P. strip mulch).

4.4.3 Non-reducing sugars

From Table 4, it is revealed that there was no significant differences in non-reducing sugars of bulbs as influenced due to various treatments. However, maximum non-reducing sugars (4.96 %) were

Table 4. Biochemical content of freshly harvested onion bulbs

Sr. No.	Treatment	% Dry matter	% T.S.S.	% sugars		
				Total sugars	Reducing sugars	Non-reducing sugars
1.	T_1 B.P. sheet mulch	10.46	12.45	7.98	3.04	4.94
2.	T_2 W.P. sheet mulch	10.85	12.25	8.01	3.22	4.79
3.	T_3 B.P. strip mulch	10.75	12.27	8.03	3.10	4.93
4.	T_4 W.P. strip mulch	10.76	12.30	7.89	2.97	4.91
5.	T_5 Wheat straw	11.47	12.27	7.99	3.17	4.82
6.	T_6 Sugarcane trash	11.25	12.25	7.99	3.02	4.96
7.	T_7 Control	11.55	11.21	8.54	3.63	4.91
8.	'F' test	N.S.	Sig.	N.S.	N.S.	N.S.
9.	S. Em±	0.331	0.171	0.164	0.155	0.192
10.	C.D. at 5 %	--	0.509	--	--	--

recorded in T_6 (sugarcane trash) and minimum non-reducing sugars (4.79%) were recorded in T_2 (W.P. sheet mulch).

4.4.4 Total sugars

Data regarding total sugars in onion bulbs as influenced due to various treatment is presented in Table 4. Data revealed no significant differences due to various treatments. However numerically higher total sugars (8.54%) were recorded in T_7 (control) and minimum total sugars (7.89%) were recorded in T_4 (W.P. strip mulch).

4.4.5 Dry matter (%)

From Table 4, it is revealed that there was no significant differences in dry matter content of onion bulbs as influenced due to various treatments. However, higher dry matter (11.55%) was recorded in T_7 (control) and minimum dry matter (10.46%) was recorded in T_1 (B.P. sheet mulch).

4.5 Storage studies

Observations were recorded periodically on various components of storage loss of onion bulbs viz., physiological loss in weight (%),sprouting loss (%), rotting loss (%) and total loss (%).

4.5.1 Physiological loss in weight (%)

Data pertaining to mean physiological loss in weight as influenced periodically by different treatments are presented in Table 5.

4.5.1.1 After 15 days of storage

Data revealed that PLW losses were not significantly affected by different treatments after 15 days at storage. However, it was ranged from 2.26% in T_6 (sugarcane trash) to 3.55% in T_2 (W.P. sheet mulch).

4.5.1.2 After 30 days of storage

Data revealed that PLW losses were not affected significantly due to effect of various treatments after 30 days of storage. However, it was ranged from 4.56% in T_6 (sugarcane trash) to 6.75% in T_5 (wheat straw mulch).

4.5.1.3 After 45 days of storage

Data revealed that PLW losses were not affected significantly due to effect of various treatments after 45 days of storage. However it was ranged from 7.69% in T_6 (sugarcane trash) to 11.52% in T_5 (wheat straw mulch).

4.5.1.4 After 60 days of storage

From Table 5, it is revealed that the PLW losses due to various treatments were not significantly affected, after 60 days of storage. However higher PLW losses (16.162 %) were recorded in treatment T_1 (B.P. sheet mulch) and lowest PLW losses (11.7 %) were recorded in treatment T_6 (sugarcane trash) followed by T_3 (12.625 %), T_7 (12.863 %),

T_2 (14.388 %) and T_4 (14.963 %). Thus, various mulching treatments showed non significant effect in PLW losses during storage.

4.5.2 Sprouting loss (%)

Data pertaining to mean sprouting loss as influenced periodically by various treatments are presented in Table 5 and graphically depicted in Fig. 4.6.

4.5.2.1 After 15 days of storage

Data revealed that sprouting losses were not affected significantly due to various treatments after 15 days of storage. It was ranged from 0 % in T_1 (B.P. sheet mulch) and T_3 (B.P. strip mulch) to 0.49% in sugarcane trash.

4.5.2.2 After 30 days of storage

Data revealed that the sprouting losses were not affected significantly due to various treatments after 30 days of storage. It was ranged from 0.17% in T_1 (B.P. sheet mulch) to 1.08% in T_6 (sugarcane trash).

4.5.2.3 After 45 days of storage

Data revealed that, the sprouting losses were not affected significantly due to various treatments after 45 days of storage. It was ranged from 1.35 % in T_3 (B.P. strip mulch) to 4.44% in T_2 (W.P. sheet mulch).

4.5.2.4 After 60 days of storage

From Table 5, it is revealed that the sprouting losses were significantly affected due to various treatments after 60 days of storage. The minimum sprouting losses were recorded in treatment T_4 (1.438 %) followed by T_7 (1.662 %), T_5 (2.940 %), T_6 (2.992 %) and T_3 (3.762 %). The maximum sprouting losses were recorded in treatment T_2 (W.P. sheet mulch). It was significantly higher than all the treatments.except T_1 (B.P. sheet mulch) to which it was at par.

4.5.3 Rotting loss

Data pertaining to mean rotting loss (%) as influenced periodically by various treatments are presented in Table 5.

4.5.3.1 After 15 days to storage

There were no rotting losses after 15 days of storage due to various treatments.

4.5.3.2 After 30 days of storage

Data pertaining to mean rotting loss (%) due to various treatments is presented in Table 5. Data revealed that there was no significant differences due to various treatments. The treatments T_1, T_4 and T_5 recorded 0 % rotting loss.

Table 5. Cumulative storage losses for 2 months storage period

Sr. No.	Treat ments	PLW (%)				sprouting losses (%)				rotting losses (%)				Total losses (%)			
		15 days	30 days	45 days	60 days	15 days	30 days	45 days	60 days	15 days	30 days	45 days	60 days	15 days	30 days	45 days	60 days
1.	T_1	3.25	6.7	10.81	16.16	--	0.17	1.6	5.59	--	--	--	--	3.25	6.87	12.41	21.75
2.	T_2	3.55	5.86	10.89	14.39	0.075	0.26	4.44	6.56	--	0.12	0.42	0.67	3.625	6.24	15.75	21.62
3.	T_3	3.37	6.36	10.24	12.62	--	0.57	2.77	3.76	--	0.06	0.24	0.24	3.37	7.0	13.25	16.62
4.	T_4	3.14	6.51	10.15	14.96	0.11	0.49	1.35	1.44	--	--	--	0.10	3.25	7.0	11.50	16.5
5.	T_5	3.24	6.75	11.52	15.18	0.14	0.57	1.85	2.94	--	--	--	--	3.38	7.32	13.37	18.12
6.	T_6	2.26	4.56	7.69	11.7	0.49	1.08	2.48	2.99	--	0.36	0.58	0.93	2.75	6.0	10.75	15.62
7.	T_7	2.54	5.42	9.15	12.86	0.09	0.37	1.42	1.66	--	0.20	0.30	0.350	2.63	6.0	10.87	14.87
8.	'F' test	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S	Sig.	--	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Sig.
9.	S. Em±	0.098	0.665	0.810	0.979	0.175	0.271	0.663	0.722	--	0.15	0.192	0.225	0.476	0.764	1.640	1.042
10.	C.D. at 5 %	--	--	--	--	--	--	--	2.145	--	--	--	--	--	--	--	3.096

* Percentage storage losses were worked on weight basis

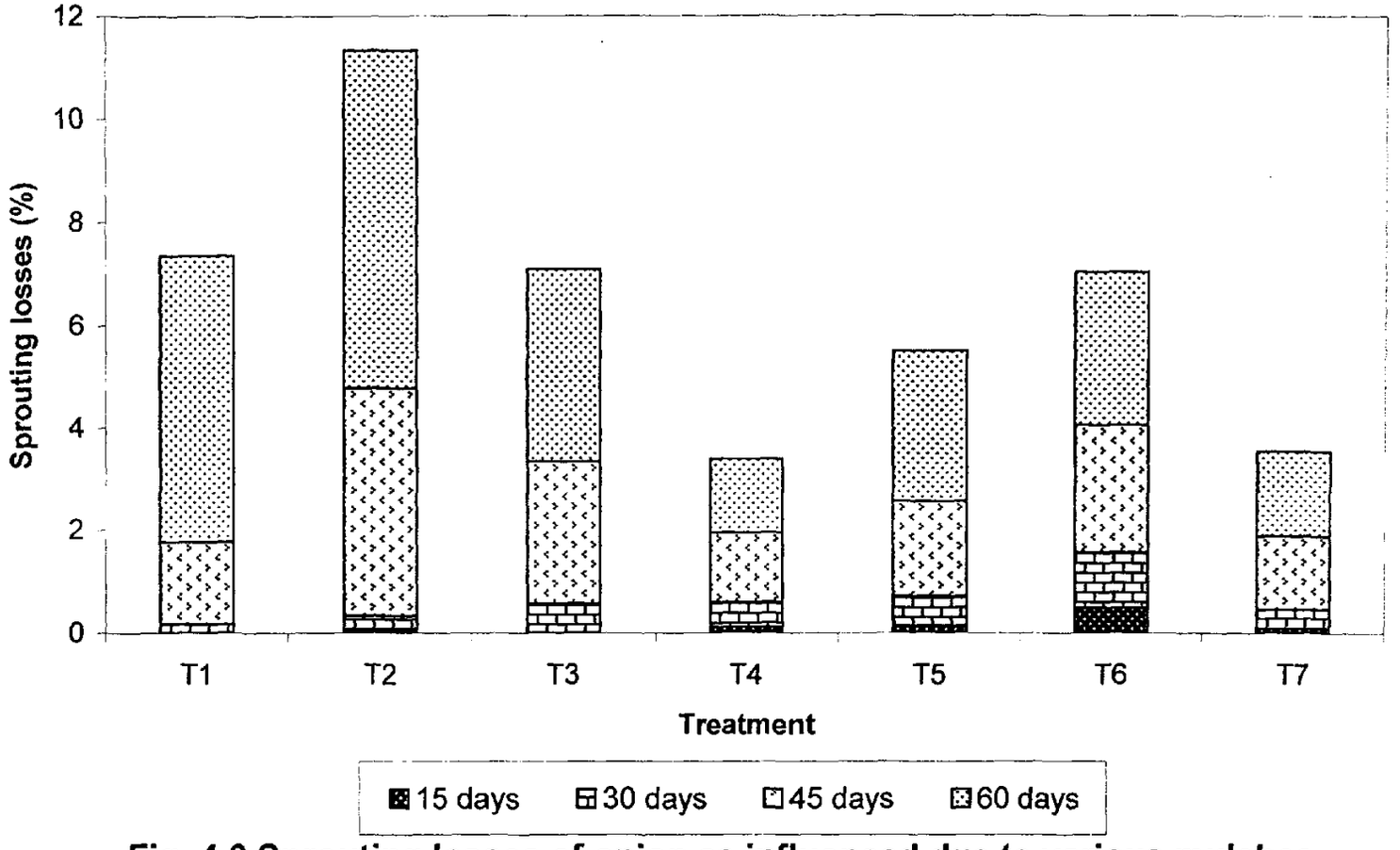


Fig. 4.6 Sprouting losses of onion as influenced due to various mulches

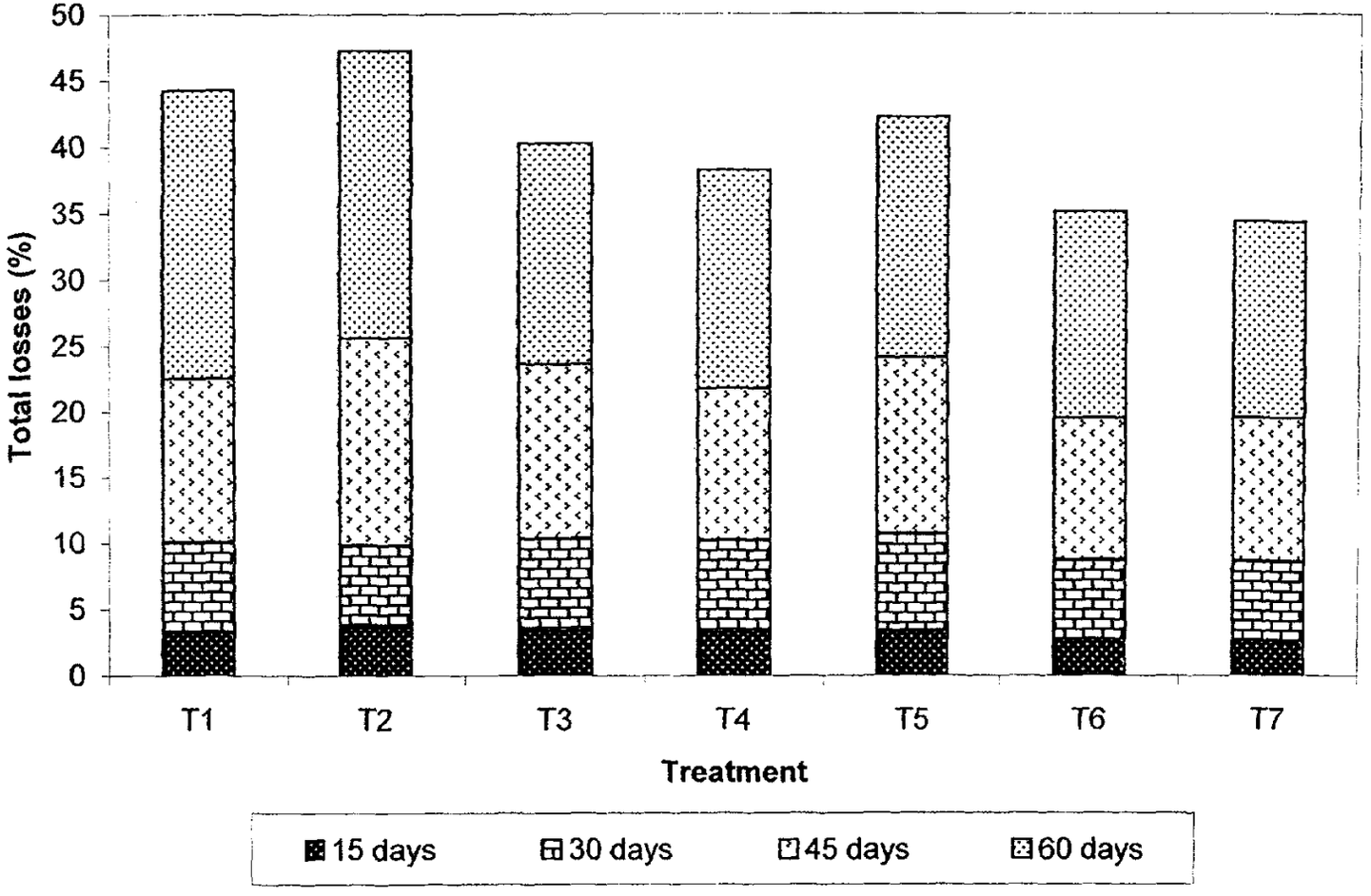


Fig. 4.7 Total losses of onion as influenced due to various mulches

4.5.3.3 After 45 days at storage

Data pertaining to the effect of various treatments are presented in Table 5. Data revealed that rotting losses were not significantly affected due to various treatments after 45 days of storage. However, treatments T_1, T_4 and T_5 recorded 0 % rotting loss.

4.5.3.4 After 60 days of storage

From Table 5, it is revealed that the rotting losses were not significantly affected due to various treatments after 60 days of storage. However numerically the highest rotting loss (0.932 %) was observed in treatment T_6 (sugarcane trash) followed by T_2 (W.P. sheet mulch) and T_7 (control). It once again indicated that mulching treatment did not influence onion storage particularly rotting losses.

4.5.4 Total loss (%)

Data regarding the mean total loss (%) as influenced by various treatments are presented in Table 5 and graphically depicted in Fig. 4.7.

4.5.4.1 After 15 days of storage

Farm Table 5, it is revealed that the total losses (%) were not significantly affected due to various treatments after 15 days of storage. However, it was ranged from 2.63% in T_7 (control) to 3.62% in T_2 (W.P. sheet mulch).

4.5.4.2 After 30 days of storage

From Table 5, it is revealed that the total losses (%) were not significantly affected due to various treatments after 30 days of storage. However, it was ranged from 6% in T_6 (Sugarcane trash) and T_7 (control) to 7.32% in T_5 (wheat straw mulch).

4.5.4.3 After 45 days of storage

Data pertaining to the effect of various treatments are presented in Table 5.

Data revealed that total losses (%) were not significantly affected due to various treatments after 45 days of storage. However, it was ranged from 10.75% in T_6 (sugarcane trash) to 15.75% in T_2 (W.P. sheet mulch).

4.5.4.4 After 60 days of storage

Data regarding the effect of various treatments are presented in Table 5.

Data revealed that the percent total losses were significantly affected due to various treatments after 60 days of storage. The minimum total losses (14.875) were recorded in treatment T_7 i.e. control. It was significantly superior than all treatments except T_3, T_4 and T_6 to which it was at par. The maximum total losses (21.75 %) were recorded in treatment T_1 followed by T_2 (21.625 %) and T_5 (18.12 %).

4.6 Nutrient status

4.6.1 Availability of N:P:K in soil (kg/ha) at initial stage

The data pertaining to initial availability of N:P:K in soil is presented in Table 6. Data revealed that soil contained N-191.29 kg/ha, P_2O_5-39.75 kg/ha and K_2O-616 kg/ha.

4.6.2 Availability of N:P:K in soil (kg/ha) after harvest

The data pertaining to the availability of N:P:K in soil is presented in Table 6.

Data revealed that there was no significant differences due to various treatments. However, available N:P:K was slightly reduced as compared to the initial available N:P:K in soil.

The highest reduction in available soil Nitrogen was recorded in treatment T_2 i.e. white polyethylene sheet mulch (11.50 kg /ha) while minimum reduction was observed in T_1 i.e. black polyethylene sheet mulch (7.05 kg/ha).

The highest reduction in available soil P_2O_5 was recorded in black polyethylene strip mulch (7.04 kg/ha) while minimum reduction in soil P_2O_5 was recorded in control (5.77 kg/ha).

The highest reduction in available soil K_2O was recorded in T_4 (-14.15 kg/ha) followed by T_2 (14 kg/ha) while minimum reduction in soil K_2O was recorded in T_5 and T_7 (2.8 kg/ha).

Table 6. Soil nutrient status upon onion crop harvesting

Sr. No.	Treatment	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potash (kg/ha)
1.	T_1 B.P. sheet mulch	184.235 (-7.055)	32.755 (-6.995)	607.6 (-8.4)
2.	T_2 W.P. sheet mulch	179.73 (-11.50)	33.5 (-6.25)	602.0 (-14)
3.	T_3 B.P. strip mulch	181.59 (-9.7)	32.705 (-7.045)	607.6 (-8.4)
4.	T_4 W.P. strip mulch	180.66 (-10.63)	33.255 (-6.495)	601.85 (-14.15)
5.	T_5 Wheat straw	188.943 (-2.347)	33.688 (-6.062)	613.2 (-2.8)
6.	T_6 Sugarcane trash	182.227 (-9.063)	33.588 (-6.162)	610.4 (-5.6)
7.	T_7 Control	183.158 (-8.132)	33.975 (-5.775)	613.2 (-2.8)
8.	'F' test	N.S.	N.S.	N.S.
9.	S. Em±	2.957	1.039	4.243
10.	C.D. at 5 %	--	--	

* Values in parenthesis showed difference in nutrient status from initial availability of NPK in soil

* Note : Initial nutrient status of soil before planting of onion crop was as follows

Nitrogen : 191.29 kg/ha, Phosphorus : 39.75 kg/ha and Potash : 616 kg/ha

4.7 Soil temperature

The data pertaining to the mean soil temperature as influenced by various treatment is presented in Table 7.

The data revealed that there was significant differences in soil temperature due to various treatments. The mean maximum temperature was recorded in treatment T_1 (B.P. sheet mulch). It was significantly superior than all treatments except T_2 (W.P. sheet mulch) to which it was at par. The minimum soil temperature (35.91°C) was recorded in treatment T_7 (control). It was significantly lower than other treatments.

4.8 Weed count (per m^2)

Data pertaining to the weed count as influenced periodically by various treatment is presented in Table 7 and graphically depicted in Fig. 4.8.

4.8.1 At 30 DAT

Data regarding the mean weed count as influenced due to various treatment is given in Table 7.

Data revealed significant differences due to various treatments. The minimum weed count was recorded in treatment T_1 (B.P. sheet mulch) which was significantly lower than all treatments except T_6 (sugarcane trash) and T_7 (control) to which it was at par. The maximum

Table 7. Periodical weed count per unit area and mean soil temperature affected by different mulching material

Sr. No.	Treatment	Weed count per m^2 area*			Soil temperature
		30 DAT	60 DAT	90 DAT	
1.	T_1	12.25	10.5	9.75	38.93
2.	T_2	33.25	50.25	62.5	38.64
3.	T_3	25.25	20.75	20.00	38.26
4.	T_4	29.25	31.75	35.25	38.12
5.	T_5	24.50	46.75	60.50	37.23
6.	T_6	14.75	15.75	17.75	37.04
7.	T_7	15.25	13.5	14.25	35.91
8.	'F' test	Sig.	Sig.	Sig.	Sig.
9.	S. Em±	1.101	3.515	2.58	0.154
10.	C.D. at 5 %	3.271	10.438	7.662	0.458

* Weed count was calculated on number of weed plants per m^2 area

Note : In control, hand weeding was done at 20, 45 and 75 DAT stages and then weed intensity was worked out

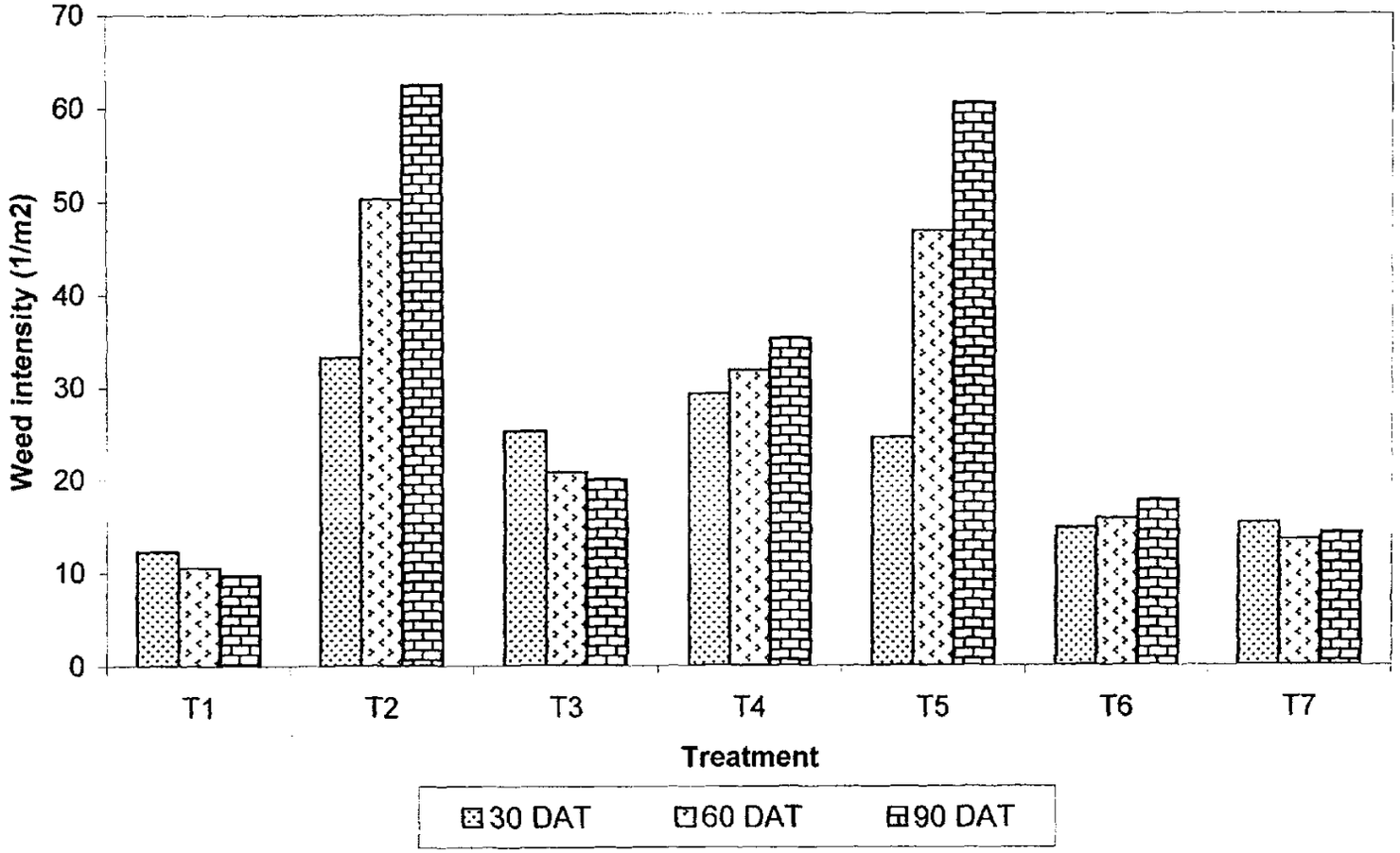


Fig. 4.8 Weed intensity (1/m2) as influenced periodically by various mulches

weed intensity was recorded in treatment T_2 (W.P. sheet mulch) which was significantly higher than all treatments.

4.8.2 At 60 DAT

Data presented in Table 7 revealed that there was significant effect of various treatments. The minimum weed intensity (10.5) was recorded in treatment T_1 (B.P. sheet mulch) followed by T_7 (13.5) and T_6 (15.75). The maximum weed intensity (50.25) was recorded in treatment T_2 (W.P. sheet mulch) followed by T_5 (46.75).

4.8.3 At 90 DAT

Data presented in Table 7 revealed that there was significant effect of various treatments. The minimum weed intensity was recorded in T_1 (9.75) which was significantly higher than all treatments,except T_7 to which it was at par. Maximum weed intensity was recorded in treatment T_2 (62.5) followed by T_5 (60.5). Thus, more or less similar trend was observed as that of 30 DAT and 60 DAT crop stages.

4.9 Economics of different mulching treatment

The data in respect of economics of different mulching treatments in *kharif* onion is presented in Table 8. It was revealed that the net returns obtained from sugarcane trash mulch (T_6) was highest i.e. Rs. 1,34,735. Sequentially it was reduced in different treatments viz., wheat straw mulch (T_5),black polyethylene sheet mulch (T_1), control (T_7) black

polyethylene strip mulch (T_3), white polyethylene strip mulch (T_4) and white polyethylene sheet mulch were in order of Rs. 1,10,472.00, Rs. 94670.00, Rs. 93122.00, Rs. 88472, Rs. 78688 and Rs. 70135 per hectare, respectively. The cost : benefit ratio was maximum (6.63) in sugarcane trash mulch (T_6), followed by T_5 and T_7. Thus, mulching treatment especially with sugarcane trash and wheat straw showed higher cost : benefit ratio than control and hence showed initial promise for using as a potential mulch material for onion cultivation. However, effect of polyethylene mulch need to be reinvestigates for its feasibility.

Table 8. Benefit : Cost ratio

Sr. No.	Treatment	Cost of cultivation (Rs.)					Bulb yield (t/ha)		Income				Cost : benefit ratio (A/B)
		Common expenditure (Rs.)	Cost of mulching material (Rs.)	Cost of application of mulch (Rs.)	Cost of hand weeding (Rs.)	Total cost (B) (Rs)	Marketable bulb yield (t/ha)	Non-marketable bulb yield (t/ha)	Marketable bulb (Rs.)	Non-marketable bulb (Rs.)	Total (Rs.)	Net profit (A) (Rs.)	
1.	T_1	17615	41640	750	--	60005	28.48	4.91	142400	12275	154675	94670	1.57
2.	T_2	17615	41650	750	--	60015	23.96	4.14	119800	10350	130150	70135	1.16
3.	T_3	17615	35000	600	--	53215	26.125	4.425	130625	11062	141687	88472	1.66
4.	T_4	17615	35400	600	--	53615	24.001	4.920	120005	12298	132303	78688	1.46
5.	T_5	17615	3750	300	--	21665	23.655	5.545	118275	13862	132137	110472	5.09
6.	T_6	17615	2500	500	--	20615	28.69	4.76	143450	11900	155350	134735	6.63
7.	T_7	17615	--	--	4500	22115	20.39	5.315	101950	13287	115237	93122	4.21

- Onion cost of cultivation is based on cost of crop cultivation scheme (Govt. of Maharashtra)
- Quantity of black polyethylene sheet (T_1) required = 1041 kg/ha @ Rs. 40 /kg
- Quantity of black polyethylene sheet (T_3) required = 875 kg/ha @ Rs. 40 /kg
- Quantity of white polyethylene sheet (T_2) required = 833 kg/ha @ Rs. 50 /kg
- Quantity of white polyethylene sheet (T_4) required = 708 kg/ha @ Rs. 50 /kg
- Quantity of wheat straw (T_5) required = 5000 kg/ha @ Rs. 0.75 /kg
- Quantity of sugarcane trash (T_6) required = 5000 kg/ha @ Rs. 0.50 /kg
- Rate of marketable bulb = Rs. 5 /kg
- Rate of non-marketable bulb = Rs. 2.5 /kg

DISCUSSION

5. DISCUSSION

The present investigation entitled "Effect of different mulches on yield, quality and storage of onion bulbs in *kharif* season" (cv. Phule Samarth) was carried out at "Scheme for Research on Onion Storage", Department of Horticulture, M.P.K.V., Rahuri during June 2005 to February 2006. The results obtained have been presented in previous chapter and are discussed here under the appropriate headings and subheadings.

5.1 Growth observations

Growth attributes viz., plant height, leaf number, bolting percentage and days required for 50 per cent neck top fall was significantly influenced due to various mulches. It was presented in results.

5.1.1 Plant height (cm)

The plant height increased progressively with advancement of crop growth.

Mean plant height recorded periodically during crop growth did not differ significantly due to various mulches at 30 DAT, however it was significantly superior at 60 DAT, 90 DAT as compared to control. At 60 DAT and 90 DAT, highest plant height of 60 cm and 68.675 cm, respectively was obtained under sugarcane trash which was at par with

black polyethylene sheet mulch. Minimum plant height of 46.325 cm and 54.15 cm was observed in control at 60 DAT and 90 DAT, respectively. The positive response of mulches on plant height might be due to improved micro-climate developed in the rhizosphere of the crop.

These findings were in confirmity with the results of Kirti Singh and Sethi (1966), Baten *et al.* (1995) and Rahman and Khan (2001) who reported significant increase in plant growth parameter under mulched conditions.

5.1.2 Leaf number

Similar trend of increase of plant height was observed in leaf number. At 30 DAT, mulch did not have any significant effect on leaf number. However at 60 DAT and 90 DAT, leaf number was significantly superior than control. At 60 DAT and 90 DAT the highest leaf number 7.250 and 10.650, respectively was recorded in black polyethylene sheet mulch which was at par with sugarcane trash mulch. Minimum leaf number was recorded in control.

Increased leaf number in mulches may be due to congenial atmosphere and increased soil moisture in rhizosphere of the crop.

These results are similar to those obtained by Kashyap *et al.* (1967), Baten *et al.* (1992).

5.1.3 Premature bolting percentage

Premature emergence of seed stock in bulb crop is known as premature bolting. Premature bolting may be due to heredity, differences in variety, extreme changes in temperature, relative length of day and night, poor seed quality, poor soil (Pandey and Singh, 1993).

Various mulches significantly affect the bolting percentage. The minimum bolting was recorded in control plot. While maximum bolting was observed in black polyethylene sheet mulch (4.95 %) which was at par with sugarcane trash mulch (4.87 %). Generally under high temperature condition, bolting remains low. But in present investigation contrary results were obtained. It may be probably due to more fluctuation between environmental and soil temperature. Hence further precise study need to be undertaken. However, Suh and Kim (1991) reported increased level of bolting in transparent polyethylene mulch than black polyethylene mulch.

5.1.4 Days required for 50 per cent foliage top fall

50 per cent foliage top fall is a sign of physiological maturity of crop. Days required for 50 per cent top fall was significantly different under different mulches. Minimum number of days were recorded under control plot (87 days). While maximum number of days were recorded in black polyethylene sheet mulch (117.25 days) which was at par with white polyethylene sheet mulch. The increased number of days for 50 per cent

top fall might be due to more vigorous and prolonged vegetative growth under these mulches because of improved soil temperature and moisture conditions.

5.2 Bulb observation

The bulb attributes viz., neck thickness, equatorial diameter and polar diameter was significantly influenced due to various mulches. It was presented in results.

5.2.1 Neck thickness (cm)

Various mulch treatments significantly increased the bulb neck thickness while minimum neck thickness was recorded in control (0.953 cm). The increased bulb neck in various mulching treatment may be due to more vigorous plant and bulb growth.

5.2.2 Equatorial diameter (cm)

Equatorial diameter was significantly affected due to various mulches. Highest equatorial diameter (6.54 cm) was recorded in sugarcane trash mulch which was at par with treatments T_1, T_2, T_3 and T_5. Increased equatorial diameter may be due to enhancement of early vegetative growth which helped in better bulb development.

Chhangani (1998) reported the similar results.

5.2.3 Polar diameter (cm)

Polar diameter was significantly influenced due to various treatments. Highest polar diameter (5.19 cm) was observed under black polyethylene sheet mulch which was closely followed by white polyethylene sheet mulch and sugarcane trash mulch. While minimum bulb diameter was recorded under control condition.

Yamaguchi *et al.* (1975) reported that higher the soil temperature, more elongated the bulbs. So that increased soil temperature may be one reason for higher polar diameter under these mulches.

These results are more or less similar to those obtained by Baten *et al* (1995) and Chhangani (1998).

5.3 Yield observation

It is known that yield is related to vegetative growth up to a limit. In this experiment also, mulches have significant effect on growth as well as yield of onion bulbs.

5.3.1 Marketable bulb yield

Marketable bulb yield was significantly influenced due to various mulches. Highest marketable bulb yield was obtained under sugarcane trash mulch (28.69 t/ha) which was closely followed by black polyethylene sheet mulch, while minimum marketable bulb yield was recorded under control plot. Increased marketable yield may be due to

excellent bulb development under black polyethylene sheet mulch and sugarcane trash mulch.

These results are in confirmity with the results of Rekowska (1997) who recorded highest average marketable yield under black polyethylene mulch.

5.3.2 Non marketable bulbs yields

It includes small size bulbs, twin bulb and bolted bulb yield. Small size bulb yield and twin bulb yield was not affected due to various mulches.

However, the bolted bulb yield was significantly affected due to various mulches. The lowest bolted bulb yield (0.529 t/ha) was obtained under control plot, while highest bolted bulb yield was recorded under black polyethylene sheet mulch (1.371 t/ha) and sugarcane trash mulch (1.113 t/ha).

5.3.3 Total yield

Total yield was significantly influenced due to various mulch treatment. The highest total bulb yield (33.45 t/ha) was obtained under sugarcane trash mulch which was closely followed by black polyethylene sheet mulch (33.39 t/ha) while minimum total yield was obtained in control plot (25.705 t/ha). Vidyasagar and Monica (1993) reported that bulb yield positively associated with bulb size, equatorial and polar diameter, plant

excellent bulb development under black polyethylene sheet mulch and sugarcane trash mulch.

These results are in confirmity with the results of Rekowska (1997) who recorded highest average marketable yield under black polyethylene mulch.

5.3.2 Non marketable bulbs yields

It includes small size bulbs, twin bulb and bolted bulb yield. Small size bulb yield and twin bulb yield was not affected due to various mulches.

However, the bolted bulb yield was significantly affected due to various mulches. The lowest bolted bulb yield (0.529 t/ha) was obtained under control plot, while highest bolted bulb yield was recorded under black polyethylene sheet mulch (1.371 t/ha) and sugarcane trash mulch (1.113 t/ha).

5.3.3 Total yield

Total yield was significantly influenced due to various mulch treatment. The highest total bulb yield (33.45 t/ha) was obtained under sugarcane trash mulch which was closely followed by black polyethylene sheet mulch (33.39 t/ha) while minimum total yield was obtained in control plot (25.705 t/ha). Vidyasagar and Monica (1993) reported that bulb yield positively associated with bulb size, equatorial and polar diameter, plant

height etc. Increased bulb yield may be due to increased bulb dimensions in these mulches.

These results are in confirmity with the results of Menezes *et al.* (1974), Suh (1991), El Shanawani *et al.* (2003) who reported increased yield under mulched conditions.

5.4 Biochemical analysis

Biochemical composition of onion bulb was not influenced due to various mulches except T.S.S. It was presented in results.

5.4.1 T.S.S.

T.S.S. was significantly influenced due to various mulches. The highest TSS was reported under black polyethylene mulch while lower value for T.S.S was reported under control plot. These findings are in accordance with the results of Vani *et al.* (1989) and Kolhe (2003) who reported increased T.S.S. in muskmelon due to various mulches as compared to control.

5.4.2 Reducing sugars

Reducing sugars in onion bulbs were not significantly influenced due to various mulches. It was in the range at 3.63 per cent in control to 2.97 per cent in black polyethylene strip mulch.

5.4.3 Non-reducing sugars

Various mulches did not affect the non reducing sugars in onion bulb significantly. However numerically higher non reducing sugar was recorded in sugarcane trash mulch (4.96 %) and that of minimum in white polyethylene sheet mulch (4.79 %).

5.4.4 Total sugars

Total sugars were not affected significantly due to various mulch treatment. It was in the range of 8.54 per cent in control to 7.89 per cent in black polyethylene strip mulch.

5.4.5 Dry matter

Dry matter content in onion bulb due to various treatments were not significantly influenced. However, Rahman and Khan (2001) reported that the dry matter accumulation was affected due to different mulches. Dry matter content was in the range of 11.55 per cent in control to 10.46 per cent in black polyethylene strip mulch. Dry matter content is positively correlated with storage life.

5.5 Storage studies

Onions are stored, because demand for the product varies little throughout the year. Onion cultivars vary considerably in their suitability for storage. Genetically controlled factors which may influence storage performance include dry matter and pungency, skin colour, skin number

and quality; and the length of natural dormancy of particular onion varieties.

Various components of storage losses viz., PLW losses, sprouting losses, rotting losses and total losses were influenced due to various mulches.

5.5.1 Physiological loss in weight (%)

PLW losses increased with increase in storage period. The maximum storage losses was due to PLW losses, however it was not significantly influenced due to various mulches during the storage period of two months. However numerically highest PLW losses were recorded in black polyethylene sheet mulch (16.16 %) and minimum losses was recorded in sugarcane trash mulch (11.7 %). It means that mulching of onion did not have noticeable effect on PLW losses during onion storage.

5.5.2 Sprouting loss (%)

Sprouting losses were increased continuously with the storage period. However, various mulching treatments did not show any prominent effect on sprouting losses during storage as upto 45 days results were non-significant and at 60 days storage, even if significant differences were observed among various treatments, it did not display clear-cut effect of mulching over control.

5.5.3 Rotting loss

Rotting losses were not significantly affected during 2 months storage period and they were less than 1 per cent in all treatments. Thus it is concluded that mulching has no effect on onion storage particularly when rotting losses are concerned.

5.5.4 Total loss

Total losses increased progressively with increase in storage period. Even though mulching treatment did not show significant effect on onion storage during initial stages (i.e. upto 45 days) but after 60 days, more storage losses were recorded in mulching treatment. However, exception was mulching with sugarcane trash, where total losses (15.62 %) were at par with control (14.87 %). Thus by considering higher yield potential and good storage quality, sugarcane trash mulching showed high promise for *kharif* onion cultivation.

5.6 Nutrient status of soil

The nutrient status of soil was not affected significantly due to various mulches. But there was slight reduction in available N:P:K in soil after harvesting as compared to the initial availability.

Highest reduction in available soil nitrogen was reported in white polyethylene sheet mulch. In this plot, weed intensity was so high

that it had uplifted the polyethylene sheet, so reduction in soil nitrogen might be due to increased weed population in this mulch.

While highest reduction in available soil P_2O_5 was reported in black polyethylene strip mulch it may be correlated with increased plant growth and increased yield.

Higher reduction in available K_2O was reported in white polyethylene strip mulch. It might be due to increased yield and high weed population in this mulch. Kashyap (1967) revealed that chemical composition of soil due to various mulch were not significant. Present result supported the findings.

5.7 Soil temperature (°C)

Soil temperature was significantly influenced due to various mulches. Each mulch created its own unique soil-temperature regime. However, in plastic mulches the soil temperature was in the range of 38°C to 39°C, while in organic mulches it was 37.04°C and 37.23°C in sugarcane trash and wheat straw mulch, respectively. The increase in soil temperature due to various mulches was within a range of 2 to 3°C.

These findings are in confirmity with the findings of Cunha *et al.* (1993) and Hwang-Jaemoon *et al.* (2000) who reported increased temperature under plastic mulches.

5.8 Weed intensity

Weed intensity was significantly influenced due to various treatments at 30 DAT, 60 DAT and 90 DAT. Highest weed intensity was observed under white polyethylene sheet mulch at all stages of crop growth. Lowest weed intensity was observed under black polyethylene sheet mulch at all stages of crop growth. Lowest and decreased weed intensity in black polyethylene may be due to shading effect and prevention of light causing etiolation and death of weeds. White polyethylene because of its transparent nature, could not prevent light transmission and thus failed to produce etiolation and death of weeds.

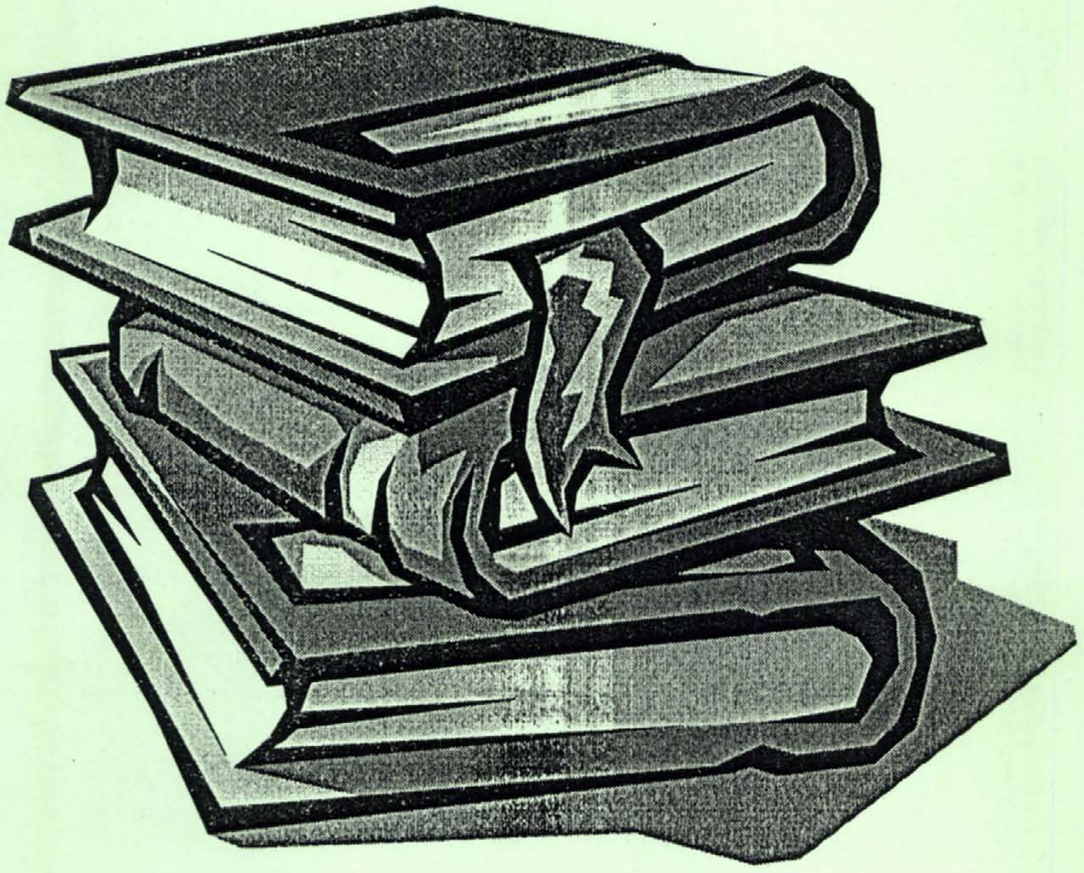
Above results are in confirmity with the results of Ram and Singh (1992). However, Katan *et al.* (1980) reported reduced weed population under transparent polyethylene mulch.

5.9 Economics of different mulching treatments

A general economic analysis was made in relation to the all mulches in which total cost of cultivation under different mulches was worked out as depicted in results.

The sugarcane trash mulch was found to be the most profitable mulch as it recorded highest net profit (Rs. 1,34,735) and highest cost benefit ratio (6.63). The lowest net profit and lowest Cost : benefit ratio was reported in white polyethylene sheet mulch. All plastic mulches reported relatively less Cost : benefit ratio on account of higher prices of

mulching material and also they were not durable and could be used for only one season. Thus, by considering the highest net profit and the highest cost benefit ratio, sugarcane trash mulch showed higher promise for *kharif* onion cultivation.



SUMMARY AND CONCLUSIONS

6. SUMMARY AND CONCLUSION

The present investigation entitled, "Effect of different mulches on yield, quality and storage of onion bulbs in *kharif* season (Cv. Phule Samarth)" was carried out at 'Scheme for Research on Onion Storage', Department of Horticulture, M.P.K.V., Rahuri, during June 2005 to February 2006. The experiment was laid out in Randomized Block Design with 7 treatments, replicated four times.

6.1 Summary

The important findings as regards to growth, yield contributing characters, yield, quality parameters and storageability of onion bulbs in *kharif* season are summarized here.

Maximum growth in respect of plant height was observed in sugarcane trash mulch (68.67 cm) which was closely followed by black polyethylene sheet mulch (67.42) after 90 DAT. Minimum plant height was observed in control (54.17) at 90 DAT.

Maximum number of leaves were observed in black polyethylene sheet mulch (10.65) at 90 DAT. While minimum number of leaves were observed in control (9.30).

Minimum percentage of bolting was observed in control (1.87%), while maximum percentage of bolting was observed in black polyethylene sheet mulch (4.95 %) and sugarcane trash mulch (4.87 %).

Maximum number of days required for 50 per cent natural top fall was recorded under black polyethylene sheet mulch (117.25 days) minimum number of days was recorded in control plot (87 days).

Minimum neck thickness was recorded under control (0.95 cm), while maximum neck thickness was recorded under black polyethylene sheet mulch (1.16 cm).

Highest equatorial diameter was recorded in sugarcane trash much (6.55). Minimum equatorial diameter was recorded in control (4.82 cm).

Highest polar diameter was recorded in black polyethylene sheet mulch (5.91 cm) while that of minimum polar diameter was observed in control plot (5.15 cm).

The highest marketable bulb yield was recorded in sugarcane trash mulch (28.69 t/ha) while was closely followed by black polyethylene sheet mulch (28.48 t/ha). Minimum marketable bulb yield was recorded in control (20.39 t/ha).

Twin bulb yield and small size bulb yield was not influenced significantly due to various treatments.

The lowest bolted bulb yield was recorded in control (0.529 t/ha), while maximum bolted bulb yield was recorded in black polyethylene sheet mulch (1.371 t/ha).

The highest total bulb yield was observed in sugarcane trash mulch (33.45 t/ha) and black polyethylene sheet mulch (33.39 t/ha). Minimum total yield was recorded in control (25.705 t/ha).

Highest T.S.S. in onion bulb was observed in black polyethylene sheet mulch (12.45 %) while minimum T.S.S. was recorded in control (11.21).

While per cent dry matter, reducing sugars, non-reducing sugars and total sugars were not influenced significantly due to various treatments.

PLW losses were not influenced significantly due to different mulches. However numerically highest PLW losses were recorded in black polyethylene sheet (16.16 %) mulch and minimum PLW losses were recorded in sugarcane trash mulch (11.7 %) after 60 days of storage.

Minimum sprouting losses were recorded in white polyethylene strip mulch (1.44 %) while highest sprouting losses were recorded in white polyethylene sheet mulch, after 60 days of storage.

Rotting losses were not affected due to various treatments and they are less than 1 per cent in all mulches including control after 60 days of storage.

The lowest total losses was recorded in control plot (14.81 %) which was closely followed by sugarcane trash mulch (15.62 %). While highest total losses (21.75 %) were recorded in black polyethylene sheet mulch, which was at par with white polyethylene sheet mulch.

There was no significant differences due to various treatments. However, available N:P:K was slightly reduced as compared to initial available N:P:K in soil.

Maximum soil temperature was recorded in black polyethylene sheet mulch (38.93°C) while minimum soil temperature was recorded in control plot (35.91°C).

The lowest weed intensity was observed under black polyethylene sheet mulch, while the highest weed population was observed in white polyethylene sheet mulch at 30, 60 and 90 DAT.

The highest net profit (Rs. 1,34,735) and the highest Cost : benefit ratio (6.63) was obtained in sugarcane trash mulch while the lowest net profit (Rs. 70135) and the lowest Cost : benefit ratio was recorded in white polyethylene sheet mulch.

6.2 CONCLUSION

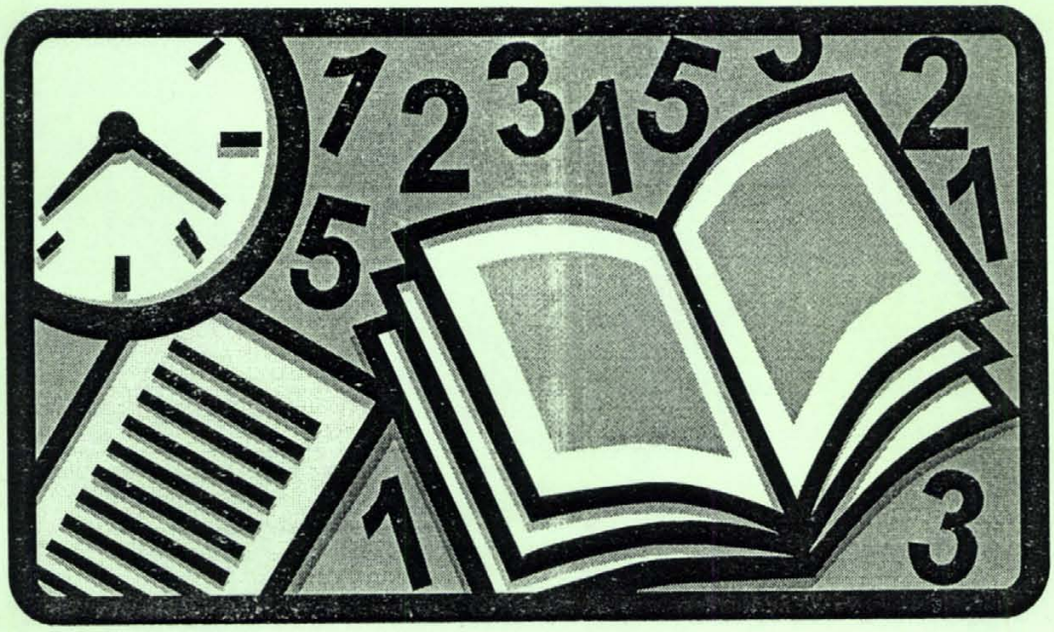
From the present investigation, it may be concluded that mulching in onion had significant response on growth, yield, quality and storage attributes.

Among the mulches sugarcane trash mulch and black polyethylene sheet mulch showed overall excellent performance in respect of growth characters and yield.

More storage losses were recorded in mulching treatment after 60 days of storage, however exception was mulching with sugarcane trash, where total losses (15.62 %) were at par with control (14.87 %).

Black polyethylene sheet mulch influenced the soil temperature significantly as compared to control and also showed excellent weed control. The highest net profit and the highest cost-benefit ratio was observed in sugarcane trash and wheat straw mulch respectively. Thus on account of higher yield potential, good storage quality and higher cost : benefit ratio, sugarcane mulching showed higher promise for *kharif* onion cultivation.

The above findings are based on one year data and it seems worth while to continue exploration in this field in future for confirmation of the above findings.



LITERATURE CITED

7. LITERATURE CITED

Abdel, C.G. 1990. The influence of mulching on irrigated and non-irrigated onion cultivations. *Mesopotamia J. of Agric.* 22 (4) : 25-33.

Adetunjii, I.A. 1994. Response of onion to soil solarization and organic mulching in semi-arid tropics. *Scientia-Horticulture* 60 (1-2) : 161-166.

Aggarwal, Sonia, Korla, B.N., Sharma, Veena. 2002. Effect of dates of planting and mulch materials on growth and yield of Ginger (*Zingiber officinale*) *Haryana J. Hort. Sci.* 31 (1&2) : 108-110.

Anonymous 2005. National Agricultural Co-operative Marketing Federation India Ltd., Report.

Anonymous, 2006. FAO quarterly bulletin of statistics. Vol. 19 (3/4) : 48.

Asandhi, A.A., Djatnika, I., Pasetriyani, Mulyaningsih, F. 1989. Effect of several types of mulch and cabbage waste on garlic. Buletin – Penelitian – Hortikultura. 18 (1) : 11-16.

Augusti, K.T. 1990. Therapeutic and medicinal values of onion and garlic. In : Onion and allied crops. Vol. III. Boca raton, Florida, CRC Press. pp. 93-108.

Aykroyd, W.R. 1963. ICMR special report. Series No. 42.

Baker, J.T., Earhart, D.R., Baker, M.L., Dainello, F.J., Haby, V.A. 1998. Interactions of poultry litter, polyethylene mulch and floating row covers on Triploid Watermelon. *Hort. Sci.* 33 (5) : 810-813.

Baten, M.A., Nahar, B.S., Sarker, S.C., Khan, M.A.H. 1995. Effect of different mulches on growth and yield of late planted garlic (*Allium sativum*) *Pakistan J. Scientific Indus. Res.* 38 (3-4) : 138-141.

Chattopadhyay, P.K. and Patra, S.C. 1997. Effect of mulches on soil moisture and temperature in pomegranate. *Indian J. Hort.* 54 (4) : 280-282.

Chen, Goling and Chen, G.L. 1997. Effect of plastic film mulching on increasing potato yield. *Acta-Agriculture – Zhejiangensis* 9 (2) : 83-86.

Chhangani, S. 1998. Effect of mulching on water conservation, growth and bulb yield of onion. *Haryana J. Hort. Sci.* 27 (2) : 122-125.

Cho, J.T., Choung, T.W., Song, Y.J., Youn, K.B. 1982. The effect of a polyethylene film mulch and the time of its' removal on the growth and yield of garlic. Research Reports, Office of Rural Development, S. Korea. Horticulture. 24 (12) : 123-128.

Chung, H.D. 1987. Effect of polyethylene film mulching, sulphur application and different levels of N and K on growth, flower

stalk elongation, bulbing and leaf tip yellowing of garlic (*Allium sativum* Cv. Euisung). *J. Korean Soc. Hort. Sci.* 28 (1) : 1-8.

Cui-Rixian, Lee-Bynuwoo, Lee-Haclae: Cui-RX; Lee, B.W., Lee, H.L., Growth and yield of spring grown potato under recycled paper mulching. *Korean J. Crop Sci.* 46 (2) : 150-156.

Cunha, M.G., Zambolim, L., Vale, FXR-do, Chaves, G.M.; Akves, H Do-Vate-FXR. 1993. Evaluation of soil solarization using transparent, black or white polyethylene sheets for control of garlic white rot (*Sclerotium cepivorum*). *Fito Patologla-Brasileira* 18 (2) : 199-205.

Deka, B.C. and Shadeque. 1994. Effect of mulching and clove size on growth and yield of garlic (*Allium sativum* L.) *Veg. Sci.* 21 (2) : 93-96.

Devochkin, F.A. 1971. Mulching and herbicide treatment in crops of carrot and onion grown for sets. *Izvestiya-Timiryazevskoi-Sel Skokhozyaistvenna Akademil* 6 : 135-144.

Dixit, C.K. and Mujumdar, A.M. 1995. Effect of mulching on water use efficiency, yield and quality of potato (*Solanum tuberosum* L.). *Haryana J. Hort. Sci.* 24 (3-4) : 286-291.

Durante, A., Cuocolo, L. 1989. Chemical weed control and mulching in onion and garlic. *Adv. Hortic. Sci.* 1 : 17-112.

El-Shanawany, A.A., El-Sheikh, H.H., Bashandy, A.A. 2003. Effect of solar heating of soil on downy mildew disease, growth and quality of Egyption Onion. *African J. Mycol. Biotech.* 11 (3) : 25-38.

Hanley, A.B. and Fenwick, G.R. 1985. *J. pl. foods*, 6 : 221-238.

Harender Raj and Bhardwaj, M.L. 2000. Soil Solarization for controlling soil born pathogens in vegetable crops. *Indian J. Agric. Sci.* 70 (5) : 305-307.

Hoda-Ahmed, A.M., El-Moneem, K.M.H.A., Allam, A.D., Fahmy, F.G.M., 2000. *Assiut. J. Agric. Sci.* 31 (2) : 249-267.

Hwang-JaeMoon, Tae-Gun Sik, Hwang, J.M., Tae, G.S. 2000. Changes of micro-climates and garlic growth in outdoor by mulching and tunnel treatments. *Korean J. Soc. Hort. Sci.* 41 (1) : 27-30.

Kashyap, R., Jyotishi, R.P., S.R. Shrivastava. 1967. Effect of various kinds of mulches on the growth and yield of onion (*Allium cepa* L.) and on the Physico-chemical condition of soil. *Punjab Hort. J.* 7 (3-4) : 119-127.

Katan, J., Rotem, I., Finkel, Y., Daniel, J. 1980. Solar heating of the soil for the control of pink root and other soil borne diseases in onions. *Phytoparasitica* 8 (1) : 39-50.

Khalak, A. and Kumarswami, A.S. 1992. Nutrient uptake and tuber yield as influenced by irrigation and mulching scare water alfisols. *J. Indian Potato Assoc.* 19 (1-2) : 35-39.

Kirti Singh and Sethi, K.S. 1966. Effect of different mulching material on various response of potato (*Solanum tuberosum* L.). Punjab Hort. J. 6 (3-4) : 169-176.

Kolhe, C.D. 2003. Effect of different mulches and growing condition in Muskmelon (*Cucumis melo* L.). M.Sc. (Ag.) Thesis. M.P.K.V., Rahuri.

Kudo, K. 1996. Bulletin of the faculty of Agriculture, Meiji University No. 109 : 13-21.

Lane, J.H. and Eynon, L. 1923. Determination of reducing sugar by means of fehling's solution with methylene blue as internal indicator. *J. Soc. Chem. Indus.* 22 : 32.

Lang, A., Behboudian, M.H., Kidd, J., Brown, H., Palmer, J.W. Wunsche, J.N. 2001. Mulch enhance apple fruit storage quality. *Hort Res.* 557 : 443-439.

Martins, C.R., Cantillano, R.F.E., Delgado, R.M.-da-F, Treptow, R., Rombaldi, C.V. da.-F-Delgado, R.M. 2001. Soil management effects on the storage post harvest quality of peache (*Prunus persica*) Cv. Chimavvita. *Revista-Brasileira-de-Fruit Cultura* 23 (1) : 55-58.

Menezes, Sobrinho, J.A.-de, Navais, R.I-de, Sontos, H.L.-dos, Sans, L.M.A. 1974. The effect of nitrogen fertilization, plant spacing and mulching on the yield of garlic cultivar. *Amarante Revista-Ceres*. 21 (115) : 203-212.

Muralidhara, H.R., Raghuramulu, Y. 1997. A review on mulching practices in coffee plantation. *Indian Coffee* 61 (9) : 10-13.

Nadkarni, K.M. 1927. Indian Material Media, Nadkarni and Co. Bombay.

Neilsen, G.H., Hogue, E.T., Neilsen, D., Forge, T. 2004. Use of organic application to increase productivity of high density apple orchards. *Acta Hort.* 635 : 347-356.

Pande, U.C. and Singh, J. 1993. Agrotechniques for onion and garlic. *Advances in Hort.* Vol. 5- Veg. Crops Part – I (1993) Malhotra Publ. House, New Delhi – 110064, India, pp-433-481.

Pandey, A.K. and Singh, K.P. 1998. Vegetable production technology towards productivity enhancement, I.S.V.S. Souvenir, Silver Jubilee National Symponium, Varanasi, U.P., India. Dec. 12-14, 1998 pp. 76-84.

Panse, V.G. and Sukhatme, P.V. 1985. Statistical methods for agricultural workers, 4th Edition, ICAR Publication, New Delhi, pp. 85-105.

Rahman, M.S., Khan, M.A.H. 2001. Mulching – induced alteration of micro-climatic parameters on the morpho-physiological

attributes of onion (*Allium cepa* L.).*Plant- Prod. Sci.* 26 : 241-248.

Ram, B. and Singh, V.P. 1992. Evaluation of mulch materials for potato under low hill valley conditions of Uttar Pradesh. *Veg. Sci.* 19 (2) : 126-131.

Rao, V.K. and Pathak, R.K. 1998. Effect of mulches on Aonla (*Emblica officinalis*) orchard in sodic soil. *Indian J. Hort.* 55 (1) : 27-32.

Rekowska, E. 1997. Effect of soil mulching on the yield and quality of garlic developing inflorescence stalks. *Folia-Horticulture* 9 (1) : 59-65.

Rekowska, E., Fiedorow, Z. 1998. Effect of different methods of soil mulching on quality and yield of garlic. *Ekologiczne Aspekty Produkcji Ogrodnictwo.* 27 : 251-256.

Sahoo, R.C., Mohapatra, B.K., Khanda, C.M., Satapathy, M.R., Lenka, D. 2002. Water use efficiency and yield of potato as influenced by plastic mulching. *Crop Res. Hisar* 24 (2) : 338-342.

Sarma, A. Dutta, T.C., Sarma, A. 1999. Effect of mulching technique with black plastic film (25 μ) on potato crop under rainfed condition. *Crop Res. Hisar* 18 (3) : 383-386.

Shirgure, P.S., Sonkar, R.K., Shyam Singh and Panigrahi, P. 2003. Effect of different mulches on soil moisture conservation, weed

reduction and yield of drip irrigated Nagpur mandarin (Citrus reticulata). *Indian J. Agric. Sci.* 73 (3) : 148-152.

Suh, J.K., Kim, Y.B. 1991. Study of improvement of mulching culture method in onion (*Allium cepa* L.). Research Reports of the Rural Development Administration. *Horticulture* 33 (2) : 31-36.

Sumi, S., Castellane, P., Bellingieri, D., Churata, Masca, MGC. 1986. Mulching and rates of simple superphosphate in a garlic crop. *Horticultura-Brasileira.* 4 (1) : 32-34.

Sumiati, E. 1989. Effect of mulch, shade and plant growth regulator on fruit quality in the tomato cultivar Berlian. *Bulletin Penelitian Hortikultura.* 18 (1) : 94-100.

Vani, S., Varma, A., More, T.A. and Srivastava, K.P. 1989. Use of mulches for the management of mosaic disease in Muskmelon. *Indian Phytopath.* 42 (2) : 227-235.

Vavilov, N.I. 1951. Chronica Botanica, 13, Wal ham, Mass.

Vidyasagar and Monika, 1993. Inter relationship of yield components in onion (*Allium cepa* L.). *South Indian Hort.* 41 (4) : 201-203.

Vinay-Singh, Singh, J., Bisen, R.K., Agrawal, H.P., Singh, V. 1997. A note on weed management in onion. *Veg. Sci.* 24 (2) : 157-158.

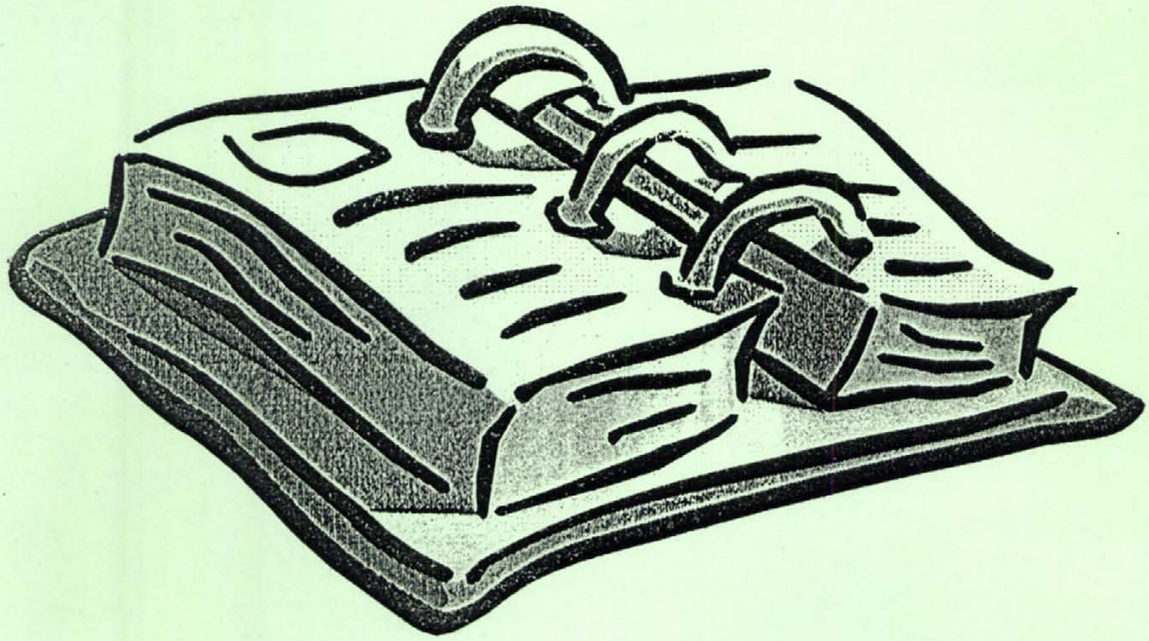
Wivutvongvana, P., Ekasingh, M.., Paungmanee, J., Koldpeng, T., Nikornpum, M. and Lumyong, P. 1998. The use of fertilizer,

mulching and irrigation for vegetable production. Extension Bull. *ASPAC Food and Fertilizer Technology*, 334 : 1-9.

Xia, Q.Z., Sun, T.L., Chen, Q.T., Zeng, F.C. Zhao, X.Q., He, F.Q., Zha, B.K. 1986. Film mulching for increasing hardiness of loquat. *Zhejiang Agricultural Science* 3 : 136-138.

Yamaguchi, M., Paulson, K.N., Krusella, M.N. and Bernhard, R.A. 1975. Effect of soil temperature on growth and quality of onion bulbs (*Allium cepa* L.) used for dehydration. *J. Am. Soc. Hort. Sci.* 100 : 415-419.

Yamashita, F., Takase, N. 1987. Studies on the culture of onion sets-II, Improvement of growing methods by use of a film mulch which modifies the rise in soil temperature. *Research Bulletin of the Aichi-Ken Agril. Res. Centre-Japan.* 19 : 148-155.



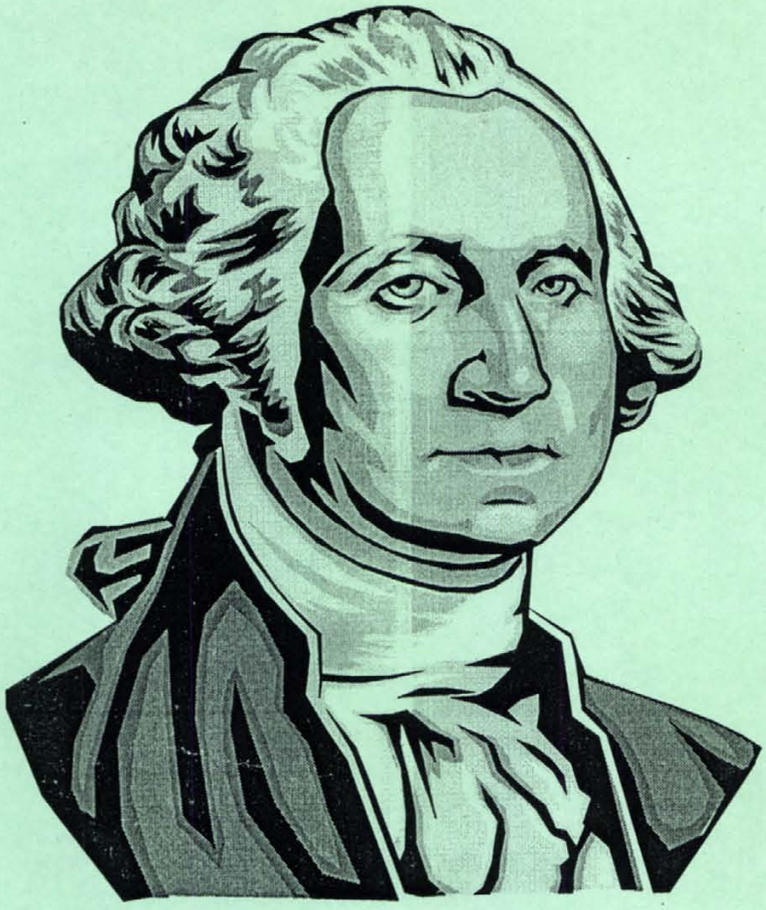
APPENDICES

8. APPENDICES

Meteorological data recorded during period of investigation

Meteorological week	Date	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
		Min.	Max.	Morning	Evening	
25	June-05 18-24	26.2	35.7	87	54	000.0
26	25-1	24.3	31.1	91	64	006.5
27	July-05 2-8	23.7	31.7	94	57.1	000.0
28	9-15	23.7	32.2	93	49	005.3
29	16-22	24.3	32.7	94	61	112.7
30	23-29	23.9	27.7	93	74	033.1
31	30 July – 5 August	23.5	28.0	93	76	036.7
32	August-05 6-12	23.8	28.7	92	66	012.9
33	13-19	23.9	29.4	93	63	004.0
34	20-26	23.8	30.5	91	59	003.1
35	27 Aug-2 Sept.	24.7	32.0	92	56	019.4
36	Sept.-05 3-9	25.3	30.0	96	74	142.3
37	10-16	24.2	29.0	92	71	018.5
38	17-23	23.6	29.0	91	69	047.6
39	24-30	23.7	29.2	92	64	001.5
40	Oct-05 1-7	23.1	30.2	88	55	009.4
41	8-14	21.4	32.6	88	48	000.0
42	15-21	23.6	28.9	95	64	068.9

Meteorological week	Date	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
		Min.	Max.	Morning	Evening	
43	Oct.-05 22-28	23.2	30.1	92	56	000.0
44	29 Oct- 4 Nov.	20.4	30.5	87	38	000.0
45	5 Nov.-11 Nov.	18.1	29.2	86	35	000.0
46	12-18	18.8	29.8	77	37	000.0
47	19-25	19.9	30.2	82	39	000.0
48	26 Nov-2 Dec.	20.5	29.7	86	44	000.0
49	Dec. 05 3-9	20.7	29.6	89	44	000.0
50	10-16	18.2	28.2	86	36	000.0
51	17-23	17.4	28.0	91	33	000.0
52	24-31	17.7	27.7	90	35	000.0
01	Jan-06 1-7	17.9	28.6	90	35	000.0
02	8-14	18.9	29.9	92	33	000.0
03	15-21	19.6	31.6	90	31	000.0
04	22-26	16.2	27.5	89	28	000.0
05	29 Jan- 4 Feb.	18.8	30.4	88	30	000.0
06	Feb-06 5-11	18.9	30.8	90	29	000.0
07	12-18	20.3	32.4	89	31	000.0
08	19-25	21.5	34.6	88	29	000.0
09	26 Feb – 4 March	20.5	34.4	80	28	002.5



VITA

9. VITA

NAIKWADI MOHAN BABURAO

A candidate for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

HORTICULTURE

Title of thesis	:	"Effect of Different Mulches on Yield, Quality and Storage of Onion Bulbs in *Kharif* Season (Cv. Phule Samarth)".
Major field	:	Horticulture
Biographical information		
Personal	:	Born on 2nd Jan. 1982 at Rajuri, Tal. Junnar, Dist- Pune, Son of Sau Kusum Baburao Naikwadi and Baburao Laxman Naikwadi.
Educational	:	➢ Passed S.S.C. Examination from Vidya Vikas Mandiv, Rajuri, Dist.- Pune in First Class with Distinction (87.86 %) ➢ Passed H.S.C. Examination from B.G.P. Sahyadri Junior College, Sangamner, Dist. A.Nagar, in First Class with Distinction (78 %) ➢ Completed B.Sc. (Agri.) from College of Agriculture, Dhule in First Class with Distinction (86.66 %)
Address	:	'Lakshaganga' At/Post Rajuri, Tal. Junnar, Dist- Pune, Pin – 412 411, Phone : (02132) 235413, (02488) 282138