

**Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh**

**THESIS**

Submitted to the  
Babasaheb Bhimrao Ambedkar University, Lucknow  
(A Central University)  
Lucknow

**BABASAHEB  
BHIMRAO  
AMBEDKAR  
UNIVERSITY**



• LUCKNOW •  
प्रज्ञा शील करुणा  
ESTABLISHED 1996

For the Degree of

**DOCTOR OF PHILOSOPHY**

*in*

**HORTICULTURE**

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2021

## CERTIFICATE

This is to certify that the thesis entitled "Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh" submitted by Mr. Neeraj Kumar Verma, Enrolment No. 775/06 is an original research work and has not been previously submitted in part or full for the award of any other degree or diploma to this or any other University.

The thesis submitted to Babasaheb Bhimrao Ambedkar University Lucknow satisfies all the requirements as stipulated in the Doctor of Philosophy (Ph.D.) Regulations, 1999 as amended in 2008/2010/2013 and it is fit for submission and evaluation for the award of the degree of Doctor of Philosophy of the University.

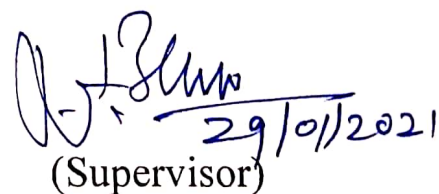
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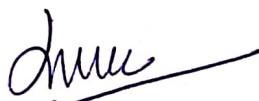
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## DECLARATION

I, **Neeraj Kumar Verma**, Enrolment No. 775/06, hereby declare that, I am a candidate for the Degree of **Doctor of Philosophy in Horticulture**, Department of Applied Plant Science (Horticulture), School for Biosciences and Biotechnology, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow-226025 (U.P.), India and have carried out my research work entitled “**Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh**”. The thesis has been submitted for the award of the degree of Doctor of Philosophy in Horticulture and is my original research work.

I do also hereby undertake that the thesis is essentially free from any kinds of plagiarism.

Date: 29/01/2021

Place: Lucknow

  
(Neeraj Kumar Verma)

Research Scholar

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## ACKNOWLEDGEMENT

*There are some special and auspicious moments come in our life, where we get a chance to express our gratitude and sincere emotions to our near and dears without whom I can't make my dream come true. It is not easy to reveal the heartiest veneration and heartfelt thank you to all who made me to help in achieving this destination.*

*I owe my sincere gratitude with heartfelt thanks to my mentor **Prof. R. B. Ram**, Professor, Department of Horticulture under the School for Biosciences and Biotechnology Technology, Babasaheb Bhimrao Ambedkar University, Lucknow, for her inspiring guidance, valuable suggestion, untiring supervision, prosperous motivation, unending enthusiasm, devoted encouragement, unconditional affection and care and the continuous support during the period of my research.*

*I am heartily thankful to you for being a great supervisor in building up my understanding of the research area and gave me the opportunity to pursue the research ideas.*

*I feel immense pleasure to owe my deep sense of gratitude to **Hon'ble Vice Chancellor, Prof Sanjay Singh**, Babasaheb Bhimrao Ambedkar University, Lucknow for providing all sort of facilities to carry out the presence investigation.*

*I am extremely grateful to **Dr. D. K. Sharma**, Ex. Director, Central Soil Salinity Research Centre, Karnal (Haryana) for getting permission to pursuing Ph.D with study leave and inspiring guidance, generous suggestions, exclusive and constructive approach for providing all facilities needed for completion of the research work.*

*I am extremely grateful to **Dr. P. C. Sharma**, Director, Central Soil Salinity Research Centre, Karnal (Haryana) for getting permission to pursuing Ph.D with study leave and inspiring guidance, generous suggestions, exclusive and constructive approach for providing all facilities needed for completion of the research work.*

*I am extremely grateful to **Dr. V. K. Mishra**, Head, Central Soil Salinity Research Centre, Regional Research Station, Lucknow for getting permission to pursuing Ph.D*

*with study leave and inspiring guidance, generous suggestions, exclusive and constructive approach for providing all facilities needed for completion of the research work.*

*I would like to pay my heartiest gratitude to **Dr. T. Damodaran** (Principal Scientist), for his devoted encouragement, knowledgeable discussions, uses his scientific laboratory and precious feedback during the entire phase of my research.*

*I would like to profess my sincere gratitude and venerable thanks to **Prof Sanjay kumar**, Head, Department of Horticulture, School for Biosciences and Biotechnology Technology, Babasaheb Bhimrao Ambedkar University, Lucknow for his valuable guidance, critical appraisal and unflinching interest in my work.*

*I would like to pay my heartiest gratitude to **Dr. Atul Kumar Singh** Principal Scientist, for his devoted encouragement, knowledgeable discussions, uses his scientific laboratory and precious feedback during the entire phase of my research.*

*I emphatically my heart full and sincere gratitude, appreciation and venerable thanks **Dr. Sanjay Arora**, Principal Scientist, Central Soil Salinity Research Centre, Regional Research Station, Lucknow for his invaluable guidance, critical appraisal and unflinching interest.*

*I am immensely thankful and sincere gratitude, and venerable thanks **Dr Y. P. Singh** Principal Scientist **Dr. S. K. Jha** Principal Scientist and **Dr. C. L. Verma** Principal Scientist Central Soil Salinity Research Centre, Regional Research Station, Lucknow for his valuable guidance, critical appraisal and unflinching interest.*

*I would like to thanks my friends especially **Mr. Tarun Kumar**, **Mr. Manish Panday**, **Mr. Sailendra Verma**, **Dr. Shyamji Mishra**, **Mr. Himansu Dixt**, **Dr. Ram Gopal**, **Ms. Kavita**, **Mr. Santosh Kumar**, **Mr. Ashish yadav**, **Mr. Yogesh kumar** and staff CSSRI, RSS, Lucknow and others for their constant encouragement, moral support and cooperation in preparation of this thesis. They were kind of companion during tough times.*

*I would like to pay my heartiest gratitude to **Prof. D. H. Duivedi** professor, for his devoted encouragement, knowledgeable discussions and precious feedback during the entire phase of my research.*

*I am immensely thankful and indebted to **Dr. M.L. Meena**, Assistant professor, Department of Applied Plant Science (Horticulture), School for Biosciences and Biotechnology Technology, Babasaheb Bhimrao Ambedkar University, Lucknow for her valuable suggestion and constant encouragement.*

*I emphatically my heart full and sincere gratitude, appreciation and venerable thanks **Dr. Sutanu Maji**, Assistant professor, Department of Applied Plant Science (Horticulture) under the School for Biosciences and Biotechnology Ttechnology, Babasaheb Bhimrao Ambedkar University, Lucknow for his invaluable guidance, critical appraisal and unflinching interest.*

*I am immensely thankful and sincere gratitude, and venerable thanks **Dr. Ravi Shankar Verma**, and **Dr. Ruby Lata**, Assistant Professor, Department of Applied Plant Science (Horticulture) under the School for Biosciences and Biotechnology Technology, Babasaheb Bhimrao Ambedkar University, Lucknow for his valuable guidance, critical appraisal and unflinching interest.*

*I wish to record my sincere thanks to my seniors especially **Dr. Sachin Kishor**, and also to my colleagues **Mr. Prem kumar** for helping me during my experimental trial in the field and laboratory as well as encouraging me throughout my research work.*

*I would like to thanks my juniors **Mr. Mata Prasad**, **Mr. Maya Ram**, **Mr. Sutranjay yadav**, **Mr. Rajmani**, **Mr. Shivendra kumar** for helping me during my experimental trial in the field and laboratory as well as encouraging me throughout my research work.*

*This acknowledgement would be incomplete without expressing my heartiest thanks to my parents for their unconditional love, affection, help, and moral support. This achievement is impossible without the blessings of my mother who is far away from me somewhere in the stars yet most near and close to me.*

*“Next to God, thy parents” all that I am hoping to be I owe my father **Sri. Nokhey Lal Verma**, mother **Smt. Sonkali** and grandparents with heartiest reverence. I admire confidence bestowed on me by my parents. The untiring pains taking dedicated help, affection, silent wishes and blessings received from them to bring me to this level to do good deeds. It is beyond my capacity to express in words.*

*I also wish to convey my thanks to my wife **Ms. Preeti Verma** for her everlasting love, support and encouragement during the course of this study.*

*I am heartily thankful to brother’s **Mr. Nitesh Kumar Verma and Naveen Kumar Verma** and my lovely & cute son **Mr. Arth Verma** for their affection, care and support at every step of this entire journey.*

*I, also pay my thanks to **Ms. Anita Tiwari, Mr. Vinay Kumar, Smt. Munni Devi** and **Mr. Anilesh Singh** (Office staff) and **Mr. Rajendra kumar, Rinku** (field staff) and all other faculty members of department, and also to each and every one who helped me during my research.*

*I proffer my sincere thanks from the core of my heart to CSSRI for providing Study leave for pursuing ph.D programme (Hort.).*

*Last but not the least, I record my sincere thanks to all beloved and respected people who helped me and could not find separate mention, I still solicit their benediction to proceed at every step of a perfectly destined life.*

*Date*

*Place: BBAU, Lucknow*

***Neeraj Kumar Verma***

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## **List of Abbreviations**

cm	:	Centimeter
CD	:	Critical Difference
R.B.D.	:	Randomized Block Design
cv.	:	Cultivar
d.f.	:	Degree of Freedom
<i>et al.</i>	:	( <i>et albeit</i> ) and elsewhere
g	:	Gram
Kg	:	Kilogram
MT	:	Metrication
ha	:	Hectare
<i>i.e.</i>	:	( <i>Id est.</i> ) That is
ml	:	Millilitre
μ	:	Micron
pH	:	Puissance de Hydrogen
R H	:	Relative Humidity
S.Em.	:	Standard error of mean
SS	:	Sum of Square
<i>Viz</i>	:	( <i>Videlicet</i> ) Namely
%	:	Percent
CV	:	Coefficient of variation
m	:	Metre
No.	:	Number
ppm	:	Parts per million
NS	:	Non-significant
Max	:	Maximum
Min	:	Minimum
M.S.S.	:	Mean sum of square
Fig.	:	Figure
DAP	:	Days after planting

### INTRODUCTION

The cultivated strawberry (*Fragaria × ananassa* Duch.) belonging to the family Rosaceae and it was arisen in Europe in the 18<sup>th</sup> century (1714 and 1759) as a chance cross between two American native diploid species viz., *Fragaria chilioensis* Duch. and *Fragaria virginiana* Duch. (Singh *et al.*, 2015; Beer *et al.*, 2017). All the cultivated cultivars of strawberry are octaploid ( $2n = 8x = 56$ ) in nature (Anonymous, 1956) yet Indian strawberry (*Fragaria × vesca* Duch.) is diploid ( $2n=28$ ) in nature and it is the most widely cultivated strawberry. Two other species namely *F. vesca* Duch. ( $2n=14$ ) and *F. moschata* Duch. ( $2n=42$ ) are also grown commercially but on a much smaller scale (Graham *et al.*, 1996). In India, strawberry was first introduced by the ICAR-NBPGR, Regional Research Station, Shimla (H.P.) in early sixties, but the early effort was made to popularize its cultivation in Himachal Pradesh and Uttar Pradesh. Cultivars like sweet Charlie, Chandler, Belrubi, Pusa Early Dwarf, Fern, Selva, Pajaro, Winter Dawn, Camarosa, Red Coat, Addie, Swiss, Gorella, Jucunda, Sweet Heart, Mecharenj, Red Gro Florida-90, Elsanta, Brighton, Dilpans, Florida Go are the common cultivars being grown in tropical and sub-tropical northern India. However, some cultivars like Sweet Charlie, Chandler and Selva have shown the promising results under Lucknow conditions too.

The name ‘strawberry’, that it holds is derived from a farmer’s practice of mulching the plant with straw. This might have led to the development of the word strawberry from the two words, ‘strewn’ and ‘berries’. Strawberries strewn among fallen leaves were a common sight in olden days. The fully mature ripe strawberry fruits have attaining attractive red colour, sweet-sour taste and a pleasant aroma (Mitra, 1991).

As far as global scenario is concerned the Europe produces about 1/3<sup>rd</sup> of the total production of strawberries in the world. Among different countries like Spain, Poland, Germany and France are the major producers in the world. The USA, Mexico, Egypt, Japan, Italy, and Russian Federal are also producers of a sizable quantity of strawberries. However, being tremendous demand of farmers and consumers of the modern techniques to be adopted for its cultivation and standardized agro techniques. Due to introduction of

day- neutral varieties under protected cultivation, both area and production in India have increased extensively during the past few years (**Sharma, 2002**).

The flowers of most strawberry cultivars are hermaphroditic and self-pollinating in nature. The resulting seeds are the achenes and form the true fruits, while the fruit receptacle constitutes the strawberry flesh. The receptacle is composed of an epidermal layer, a cortex and pith. The latter two layers are separated by vascular bundles that supply nutrients to the developing embryos (**Hancock, 1999**).

Now, it is being cultivated in about 75 countries of the world in plain as well as in the hilly areas up to distance from the ground of 3000m from MSL in humid or dry cold regions with assured irrigation facility (**Singh et al., 2008**). In India, strawberry covers about 1000 hectares area and production is about 5000MT (**NHB database 2017-18**). Strawberries are grown throughout the year in Europe, United States, Canada and as well as in South America. Initially grown in a temperate zone in the country but its cultivation has now become likely in the tropical and sub-tropical zones as well with the introduction of day neutral cultivar *viz.*, Chandler (**Asrey and Singh, 2004**). It is herbaceous with prostrate growth habit, which behaves as an annual in sub-tropical region and perennial in temperate region (**Singh et al., 2017**). In India, it is generally cultivated on the hills (Nainital and Dehradun districts of Uttarakhand, Kashmir valley, Himachal Pradesh and Nilgiri hills), plateau like West Bengal (Kalimpong) and to some extent in the plains areas like Uttar Pradesh, Maharashtra (Mahabaleshwar), Karnataka (Bangalore), Delhi, Haryana, and Punjab. In recent years, strawberry is being cultivated productively in plains around Pune, Nasik and Sangali towns of Maharashtra.

It is a valuable food in diet of millions people around the globe. It is worthy to note that among all the fruits, it gives high returns in a short time of period. Fruits are good-looking with distinct pleasant aroma, flavour, sweet taste, lusciousness, softness and rich source of vitamins, minerals and nutrients with ellagic acid which have anti cancerous property (**Sharma and Sharma, 2003**). The taste of fruit mainly depends on three different compounds *viz.*, sugars, acids and aromatic compounds. Fruit contains 0.55% of total sugars and 0.90% to 1.85% acidity the prominent being maleic and citric acid. As reported by (**Singh et al., 2017**) per 100g fresh fruit is edible portion (96%), moisture (87.8%), protein (0.7%), fat (0.2%), fibre (1.1%), carbohydrate (9.8%), minerals

(0.4%), vitamin A (30 IU/100g), thiamine (0.03 mg/100g), riboflavin (0.07 mg/100g), nicotinic acid (0.2 mg/100g), ascorbic acid (55 mg/100g) and calories (44/100g).

The fruits also contain niacin 0.06 mg, ascorbic acid 59 mg, calcium 21 mg, phosphorous 21 mg, iron 1 g, potassium 164 mg and sodium 1 mg. **Mussinán and Walradt (1975)** identified 13 organic acids in fresh California strawberry fruits. **Stohr and Herrmann (1975)** found 10-70 mg catechin, 10 mg epicatechin, 10mg caffeic, 10 to 15mg P-coumaric acid, 10 to 35mg 4-hydroxybenzoic acid, 5 mg protocatechuic acid, and 10 to 40mg Gallic acid/100g of fresh fruit. Ethyl esters are the major volatile compounds responsible for the flavour of fruits. Strawberry fruits represent the most competitive sink in the plant and accumulate 20 - 40% of the total plant dry weight (**Hancock, 1999**).

Fruits are consumed as a dessert and also have a special demand in fruit processing industries for preparation of canned strawberries, jam, jelly, ice-cream and many attractiveness products (**Hughes et al., 1969**). Cultivation of good quality strawberry cultivation is affected by many factors like type of soil, soil pH, climate, irrigation, nutrition, mulching, growth regulators etc.

Soil is an important factor for good quality fruits. Plants performed better and produced good quality fruits on well-drained sandy-loam soil with pH 5.5 to 6.5 (**Chindlers et al., 1995**). Its successful cultivation requires an optimum temperature of 22 to 23°C and night temperature 7 to 13°C for the maximum growth and development of crop (**Shoe Maker, 1954**). No floral induction under short days in plant of strawberry held at 26/22°C and 30/26°C day and night temperature regimes. In warm climates, high air temperature probably play an important role in restricting growth and fruit development by reducing photosynthetic activity and increasing respiration rate (**Larson, 1994**). Albinism is a physiological disorder which is caused by certain climatic condition and extremities in nutrition which affects yield and berries quality. Frost as well as winter injury seriously reduces yield of berries. Strawberry runners require a number of minerals/ nutrients for proper growth and development. However, there are contradictory reports on the role of fertilizers in strawberry as their effects vary with regions, soils, years and many other factors. Strawberry plant is a surface feeder therefore; soil fertility,

moisture, drainage and microbial status of the upper layer of soil have great impact on growth, development, fruit yield, fruit quality and production of runners also.

The application of chemical fertilizers have improved fruit yield per unit area but these fertilizers are costly and hamper the environmental balance of the soil. Excessive and unbalanced use of chemical fertilizers leads to degradation of physico-chemical properties and microbial status of the soil. The balanced use of organic manures or bio-fertilizers and inorganic fertilizers will enable higher production, improved berries quality and runners count. Therefore, an alternate source of nutrition is needed to sustain production and productivity of soil (**Beer *et al.*, 2017**). It is an important fruit crop whose cultivation has plenty of scope near the metropolitan cities.

Organic fertilizers are improving soil fertility by modifying soil structure, pH, biophysical conditions and availability of essential nutrients (**Atiyeh *et al.*, 2002**). Considering the future prospects of organic agriculture, the balanced application of organic manures or bio-fertilizers integrated with inorganic fertilizers to get higher production. Bio-fertilizers are the organisms that supplement the nutrient status of soil. Plants have a number of advantageous relationships with such organisms. Nutrient eminence of the soil is most important factor to affect the productivity of strawberry crop. The beneficial micro-organisms used as bio-fertilizers to increase the growth of plants, either by enhancing the availability of nutrients or by releasing plant growth stimulating hormones. Bio-fertilizers are getting hold of increased attention to improve soil fertility and production quality of horticultural crops, due to hike in prices of chemical fertilizers and to minimize environmental pollution (**Sindhu *et al.*, 2010**).

Modern day intensive crop cultivation results in the huge application of chemical fertilizers which are not only in short supply but also costly and they pollutes the soil and water respectively. Therefore, the current emphasis has been given to explore the possibilities of supplementing the chemical fertilizers with organic fertilizers particularly bio-fertilizers of microbial origin *viz.* *Azotobacter*, phosphate solubilizing bacteria (PSB) and *Azospirillum* that help in fixing atmospheric nitrogen and solubilizing phosphorus to enhance fertility of soil as well as soil bio-chemical activities. Bio-fertilizers are the derived product of living microorganism that are capable to fixing atmospheric nitrogen and also convert insoluble form of phosphorus to soluble form for the uptake of plants.

Bio-fertilizers consist mainly of beneficial micro-organisms they can release nutrients from raw materials and plant residues in the soil and make them available commercially, where specific strains are used. Recently, they become positive alternatives to chemical fertilizers because they help in bringing down the costs of chemical fertilizers, especially N and P and they improve soil fertility of the soil by maintaining the physico-chemical properties. They may help in getting better crop productivity and quality by increasing the biological N fixation, the availability and uptake of nutrients and stimulating the natural hormones.

They are safe for humans, animals and environment and using them helps in reducing the environment pollution (**Walid *et al.*, 2014**). Farmyard manure (FYM) is being used from ancient times as a supplement of nutrition which improves physical conditions of soil. Farmyard manure contains a lot of useful living micro and macro organisms like bacteria, fungi earthworm etc. These organisms are directly involved in several oxidation-reduction reactions and release several useful nutrients and stimulate the production of hormones and enzymes which are required for growth and development of the plants. Farmyard manure has also been the sources of various soil borne pathogens and weed infestation, hence influences cost of cultivation of the crop.

To protect the environment from further degradation and to maintain the purity of air, water and food, we have to opt for judicious use of chemicals and shift from chemical ecological agriculture for building up strong organic base to fertilize the fields (**Chandra, 2005**). The use of organics such as farmyard manure (FYM), vermicompost, poultry manure, crop residues, spent wash, municipal solid waste compost (MSWC) etc. are put forth for nourishment of soil fertility and productivity at a satisfactory level (**Musa *et al.*, 2015**). Also plant growth promoting bio- inoculants are known to enhance growth and yield of crops in eco-friendly manner. Management of municipal solid waste is one of the major challenges particularly in urban areas. It is expected that by year 2025, municipal solid waste production in the world may reach about 2.2 billion tonnes year<sup>-1</sup> (**Hoornweg and Bhada, 2012**).

India produces 12.74 million tons municipal solid waste (MSW) per day (**CPCB, 2012**). In India, it is generally produced from commercial complexes, household kitchen, hospitals, industries and agriculture. The amount of municipal solid waste generated per

capita is estimated to increase at a rate of 1–1.33% annually (**Pappu et al., 2007; Shekdar, 1999; Bhide and Shekdar, 1998**). Rapid industrialization and urbanization are increasing the amount of municipal solid waste day by day. Municipal bodies/ urban local bodies (ULB) in various cities collect the municipal solid waste, transport it to the dump yards and dispose it off in open ground dumping or non-sanitary landfill. These landfill sites are an ecological hazard – emanating methane causing greenhouse effect, smell and dirt causing health problems, and leachate contaminating the ground water etc. (**Singh et al., 2017**). Disposal of huge quantities of municipal solid wastes generated is becoming a problem. Municipal solid waste compost (MSWC), with high content of organic matter and low concentration of inorganic and organic pollutants allow an improvement of soil physical, chemical, biochemical and microbial characteristics and constitute low cost soil recovery (**Walter et al., 2006**). It could accelerate salt leaching; decrease both the exchangeable sodium percentage (ESP) and electrical conductivity (EC), and increase water infiltration, water holding capacity and aggregate stability (**Tajada et al., 2006; Singh et al., 2018** ). Furthermore, municipal solid waste compost (MSWC) represents a source of nutrients that can improve soil fertility, may contribute in restoring the productivity of salt affected soils (**Lakhdar et al., 2008**).

Municipal solid waste compost (MSWC) is ever more generated from kitchen and garden sources in urban areas worldwide, and presents an opportunity for application to arable soils in order to benefit a physical condition of soils, temperature relations and water regime. Where compost is added as mulch and incorporated in the topsoil to increase retention of soil water is readily established under both field and glasshouse conditions for both cropped and bare soils (**Naeinia and Cook, 2000**).

The effects of bio-inoculant in legumes, cereals and oilseed crops have been well established (**Rao, 2008**). However, meagre information is available on strawberry cultivation, especially under partial reclaimed alkali soil conditions.

Among various production practices, mulching is considered as an important cultural practice as it plays an important role in soil moisture conservation, weed control, regulation of soil-hydrothermal regime, besides keeping the fine fruit neat and cleans (**Gupta and Acharya, 1993; Hancock, 1999; Tarara, 2000**). Mulching is a practice, which helps in proper growth and development of the plant by modifying soil

temperature, providing better nutrient availability and better in-situ moisture conservation (**Kher *et al.*, 2010**). Mulching has strong influence on yield, quality and duration of harvesting, which is primarily due to better soil and moisture conservation, changes in soil temperature, improved nutrient accessibility, and suppression in number and growth of weeds, protection from frost injury and decrease in number of dirty and diseased berries (**Bakshi *et al.*, 2014; Sharma, 2002**).

Keeping this in view the above facts in mind the present study was proposed to assess the efficacy of integrated use of organics, bio-inoculants along with mulching on the performance of strawberry grown on partially reclaimed alkali soil.

In view of the importance of this crop, the present investigation entitled “**Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh**” was under taken with the following objectives:

1. To find out the efficacy of organics, bio-inoculant and mulching on the vegetative growth, yield and quality attributes of strawberry.
2. To investigate the changes in soil characteristics as influenced by application of organics, bio-inoculant and mulching.
3. To work out the cost economics of different organic amendments used in strawberry.

### REVIEW OF LITERATURE

An organic fertilizers bio-inoculants and mulching are enriching the nutrient quality of soil and plants have a number of positive relationships with such organisms. They are supposed to be very helpful, means for improving the plant growth characters, floral characters, yield and quality parameters of the crop. Organics manures (*viz.* farmyard manure, vermicompost, town-compost or municipal solid waste compost, neem-cake and poultry manure provide large particulate surface area that enhance microbial activities and also for strong retention of nutrients.

This chapter deals with the earlier research work done related to NPK, organics, mulching and bio-inoculant application in strawberry crop. Supporting evidences from other crops have also been incorporated for making interpretation of the results easier and broad based.

Keeping these facts in mind, the present investigation entitled “**Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh**” was carried out under field conditions. A brief review of the available research findings on nutrient management in different crops with special emphasis on fruit crops is being presented here.

#### **2.1 Efficacy of organics, bio-inoculant and mulching on the growth and floral attributes.**

In an experiment conducted by **Wange (1996)**, it was found that the application of *Azospirillum* in strawberry crop increased the number of buds, number of leaves, number of fruits per plant and they also reported that an inoculation of PSB in strawberry cv. Chandler also increased plant height, number of buds, number of flowers and number of leaves.

**Chol *et al.* (2000)** observed that the nitrogen uptake increased in the fresh weight of leaf and also recommended 80-110 mg/litre of nitrogen concentration to attain maximum vegetative growth in cv. 'Nyoho' of strawberry.

In an experiment conducted by **Simonne *et al.* (2001)**, it was found that the significant effect on fruit weight of cv. 'Camarosa' and 'Sweet Charlie' of strawberry with N rate (0.57 to 1.14 kg ha<sup>-1</sup>) interaction with varying response per day of both cultivars in throughout of the season.

An experiment carried out by **Gaur and Deepak (2003)**, an application of 200 kg N ha<sup>-1</sup> in strawberry crop and found that the maximum plant height (19.90 cm), number of leaves per plant (23.15), average number of flowers (3.95) per plant, percentage of fruit set (68.35%), fruit length (2.56 cm), fruit width (2.04 cm), number of fruits per plant (16.7) and average fruit weight (7.90 g), respectively.

**Asrey and Singh (2004)** revealed that an assessment of strawberry varieties under semi arid irrigated region of Punjab and get highest (14.4 cm) plants spread and number of leaves plant<sup>-1</sup> (6.63) were recorded in cv. Gorella at an early stage of the crop, while lowest (8.83 cm) plant spread and number of leaves plant<sup>-1</sup> (3.33) were recorded in cv. Dana. Maximum number of fruits plant<sup>-1</sup> (40.66) was in cv. Seasap, while minimum (25.33) was recorded in cv. Gorella, respectively.

**Patil *et al.* (2004)** observed the effect of organic and inorganic fertilizers on tomato and reported that maximum plant height (120.70 cm) and number of leaves plant<sup>-1</sup> (118.10) were recorded with 50% RDF (NPK 100:50:50 kg ha<sup>-1</sup>) + 50% FYM.

An experiment conducted by **Nam *et al.* (2006)**, and it was observed that plant height, number of flowers and number of runners plant<sup>-1</sup> were influenced by N, P, K and Ca application.

Field research was conducted by **Nazir *et al.* (2006)**, to find out the effect of various organic nutrients combinations on growth attributes and yield of strawberry cv. Senga Sengana. The experiment was comprised five organic nutrients combinations

along with control with RDF of N, P and K through inorganic fertilizers. Poultry manure + *Azotobacter* + wood ash + PSB + oil cake gave the maximum plant height (23.39 cm), plant spread (24.21 cm), and number of runners plant<sup>-1</sup> (13.03).

Similarly, in an experiment conducted by **Zargar *et al.* (2008)**, it was observed that maximum number of primary flowers plant<sup>-1</sup> (8.00), number of secondary flower plant<sup>-1</sup> (10.00), total number of flowers plant<sup>-1</sup> (18.00), number of primary fruits plant<sup>-1</sup> (7.00), number of secondary fruits plant<sup>-1</sup> (10.0), total number of fruits plant<sup>-1</sup> (17.00) and phosphorus content in leaf (0.30%) and available phosphorus (11 kg ha<sup>-1</sup>) were recorded under the treatment where N (225 kg ha<sup>-1</sup>) + P (150 kg ha<sup>-1</sup>) + PSB were applied.

**Ingle *et al.* (2008)** reported that the vegetative parameters of okra *viz.*, plant height, number of leaves, number of internodes and number of branches were found to increase significantly in treatment of 100% NPK + *Azotobacter* + PSB.

**Huil *et al.* (2008)** discussed the effect of bio-fertilizer on growth, yield and fruit quality of replanted strawberry. The results indicated that the bio-fertilizer could significantly result in improvement on vegetative growth, yield and fruit quality of successive strawberry crop. The yield and fruit quality attributes like sugar: acid ratio, total soluble solids and ascorbic acid were found enhanced 11.5, 20.0, 17.2 and 30.2 %, respectively with 37.5 kg ha<sup>-1</sup> bio-fertilizer in all the treatments over control.

**Bairwa *et al.* (2009)** conducted a field trial and studied the effect of INM on okra *cv.* Arka Anamika and reported that, maximum number of fruits plant<sup>-1</sup> (18.36) was recorded in treatment neem-cake @ 6 q ha<sup>-1</sup> + vermicompost 10 q ha<sup>-1</sup> + *Azotobacter* + PSB + 60 % of NPK through inorganic fertilizer. They further reported that application of 60% recommended dose of NPK through inorganic fertilizer + neem-cake @ 0.6 t ha<sup>-1</sup> + vermicompost at 1.0 t ha<sup>-1</sup> + *Azotobacter* + PSB significantly resulted the maximum (77.80 cm) plant height at 90 DAP, stem base diameter (2.25 cm), total fruit bearing nodes plant<sup>-1</sup> (19.18), number of fruits plant<sup>-1</sup> (18.36), fruit weight (17.65 g), fruit length (12.26 cm) and fruit yield increases upto 29.30% along with maximum (3.19) B:C ratio.

An experiment carried out by **Iqbal *et al.* (2009)**, it was found that the strawberry runners attained the plant height of (21.24 cm), plant spread (28.16 cm), leaf area (74.95 cm<sup>2</sup>), size of fruit (37.62 x 28.01 mm) and fruit weight (15.87 g) with application of 25% nitrogen through farm yard manure amplified with *Azotobacter* and at par with the plants supplied with cent percent nitrogen in the form of urea with combination of *Azotobacter*.

**Santos *et al.* (2009)** carried out an experiment and found that the first set of studies consists of two trials were conducted during 2005-06 and 2006-07. N rates were 0.5, 0.7 and 0.9 kg ha<sup>-1</sup> per day and 75, 105, 135 kg ha<sup>-1</sup> per season. In first set of study the canopies of cv. “Strawberry Festival” were 30% and 10% wider than “Winter Dawn” at 6 and 12 weeks, whereas N rates linearly increased canopy diameter of both cultivars.

The positive effect of an organics, FYM and integration with urea and *Azotobacter* on the strawberry cv. Chandler was determined by **Umar *et al.* (2009)**. They reported that maximum plant height (21.24 cm), plant spread (28.16 cm), leaf area (74.9 cm<sup>2</sup>) was found in treatment 100% N (Urea) + *Azotobacter* treated plants of strawberry.

**Verma *et al.* (2009)**, observed that the effect of organic manure and FYM on apple tree, they found that maximum terminal shoot growth (45.1 and 41.8 cm), plant height (6.0 and 5.8 m) and plant spread (5.6 and 5.0 m N-S, 5.8 and 5.5 m E-W) were recorded in treatment organic manure @ 5 kg tree<sup>-1</sup>.

**Smitha *et al.* (2010)** reported that maximum plant height (129.27 cm), number of leaves (969.87) and leaf area plant<sup>-1</sup> (10,668.55 cm<sup>2</sup>) at the time of harvesting stage in *Solanum nigrum* when 75% RDF through inorganic fertilizers + 25% RDF through poultry manure were applied to plants.

**Umar *et al.* (2010)** claimed that the application of 25% nitrogen through subabul + 75% nitrogen through urea augmented with bio-fertilizer and resulted in the maximum plant height (20.9 cm), plant spread (27.8 cm) and leaf area (70 cm<sup>2</sup>) in strawberry cv. Chandler.

An experiment conducted by **Demirsoy *et al.* (2012)** to determine the effects of organic and conventional growing systems in contents with some nutrient elements *viz.* nitrogen (N), phosphorous (P), potassium (K), iron (Fe), and manganese (Mn) effect on yield and growth parameters *viz.*, leaf area, length of petiole, petiole diameter, crown number, crown diameter, leaf, root dry weight in cultivars ‘Sweet Charlie’ and ‘Camarosa’ of strawberry.

**Gupta and Tripathi (2012)** reported that application of *Azotobacter* @ 7 kg ha<sup>-1</sup> along with vermicompost @ 30 t ha<sup>-1</sup> resulted in maximum number of runners plant<sup>-1</sup> (4.32 and 5.34). The maximum runners plant<sup>-1</sup> (7.45) was also obtained with the application of FYM @ 10 t ha<sup>-1</sup> + *Azotobacter* + PSB + AMF (**Singh *et al.*, 2012**).

**Mishra *et al.* (2012)** found that the effect of two levels of each *Azotobacter* and PSB on vegetative characters like growth, flowering, quality attributes and yield of strawberry cv. Chandler. The pooled data revealed that the combined application of *Azotobacter* and PSB are significantly increased the plant height (19.29 cm), number of flowers plant<sup>-1</sup> (67.27) number of fruits set plant<sup>-1</sup> (37.88), number of crowns plant<sup>-1</sup> (7.17) and number of runners plant<sup>-1</sup> (5.26).

An experiment was conducted by **Singh *et al.* (2012)** to determine the effect of integrated nutrient management on strawberry and they reported that maximum plant height (22.60 cm) was recorded with 100% NPK (80:17.6:33.2 NPK kg ha<sup>-1</sup>) fertilized plants.

**Kumar *et al.* (2013)** studied the influence of application of different doses of farmyard manure, poultry manure and vermicompost in combination with inorganic fertilizers along with seed treatment with bio-fertilizers (*Azotobacter* & PSB) on growth and productivity of potato on rainfed condition. The best treatment combination was found 50% RDF of NPK through inorganic fertilizers and 50% RDN through poultry manure along with combination of *Azotobacter* + PSB.

Field research was conducted by **Mal *et al.* (2013)**, on okra and reported that maximum plant height (148.97 cm) and leaf area plant<sup>-1</sup> (434.99 cm<sup>2</sup>) were recorded

with application of FYM @ 10 t ha<sup>-1</sup> + 100% NPK + vermicompost @ 5 t ha<sup>-1</sup> along with bio-fertilizers.

An experiment conducted by **Lata et al. (2013)**, revealed that the maximum plant height (5.83, 8.31, 12.61, 14.83, 17.44 and 19.25 cm), length of leaves (6.34, 6.96, 7.32, 8.00, 8.32 and 8.80 cm), width of leaves (5.16, 6.58, 7.86, 8.93, 10.20 and 10.94 cm) and number of leaves plant<sup>-1</sup> (5.81, 10.27, 13.66, 16.86, 18.04 and 18.80) at different DAP were recorded in the treatment T<sub>12</sub> - *Azotobacter* (50 %) + *Azospirillum* (50 %) + NPK (50 %) + FYM.

**Khalid et al. (2013)** studied during 2011-12 using six organic amendments on strawberry cv. Chandler which included T<sub>1</sub>- planting media (soil + silt + FYM), T<sub>2</sub> - planting media + 400 mgL<sup>-1</sup> humic acid, T<sub>3</sub>- planting media + 200 g kg<sup>-1</sup> leaf manure, T<sub>4</sub>- planting media + 200 g kg<sup>-1</sup> vermicompost, T<sub>5</sub>- planting media + 200 g kg<sup>-1</sup> plant fertilizer and T<sub>6</sub> planting media + 200 g kg<sup>-1</sup> bio-compost. Treatment T<sub>1</sub> (soil + silt + FYM) induced positive influence on plant height (15.21 cm), canopy spread (20.37 cm), number of flowers (58), number of fruits (42), fruit size (3.04 cm), fruit weight (8.82 g), crown diameter (1.47 cm), fresh weight of plant (10.71 g), number of runners plant<sup>-1</sup> (2), while T<sub>2</sub> (soil + silt + 4200 g kg<sup>-1</sup> vermicompost) improved fresh leaf weight (0.92 g), number of leaves (6.67), leaf area (43.07 cm<sup>2</sup>) and days taken to first bloom (96.67). Leaf manure based treatment (T) enhanced root length (20.11 cm), T<sub>3</sub>, T<sub>4</sub> improved total soluble solid (8.88<sup>0</sup>Brix) and ascorbic acid (64 mg/100 g).

An experiment was conducted by **Rayees et al. (2015)**, they observed that the different growth attributes at 30, 45, 60, 90, 105, 120 DAP, yield and quality attributes of fruit clearly indicate that the application of integrated sources of nutrients which significantly affect the vegetative, reproductive and yield characteristics of strawberry.

Field research was conducted by **Singh and Varu (2013)** on papaya and applied the half dose of RDF (100:100:125 NPK g plant<sup>-1</sup>) + *Azotobacter* @ 50g plant<sup>-1</sup>+ PSB @ 2.5 g/m<sup>2</sup> in papaya and found highest number of leaves plant<sup>-1</sup> (24) up to harvesting.

**Verma and Rao (2013)** conducted an experiment to see the effect on the integrated nutrient management (INM) on the performance of growth and yield of strawberry cv. Chandler and nutrient status of soil under mid hill conditions of Uttarakhand with twelve treatment combinations viz. inorganic fertilizers (NPK), bio-fertilizers (*Azotobacter* and PSB) and organic manures (FYM and vermicompost), replicated thrice with randomized block design (RBD) 20 plants each replication. Treatment *Azotobacter* + PSB + vermicompost + 50% RDF of NPK are receiving the maximum plant height, plant spread, and leaf area. And treatment *Azotobacter* + PSB + vermicompost + 50% RDF registered that an earliest flowering, fruit maturity, maximum number of flowers plant<sup>-1</sup> and duration of flowering.

An experiment conducted by **Wani et al. (2013)**, on strawberry cv. Sweet Charley. Data were recorded on growth parameters at 30, 45, 60, 90, 105, 120 different days after planting (DAP) and yield parameters at 45, 60, 90, 120, 135, and 150 DAP. In spite of, the manure and fertilizer combination (75% organic fertilizers + 25% inorganic fertilizers) was found prominent treatment with regard to integrated and combined application of nutrient of strawberry crop.

**Bakshi et al. (2014)** examined that the effect of different types of mulches like paddy straw, wheat straw, dry grass, transparent polyethylene, black polyethylene and no mulch (control). All the treatments improved the vegetative growth, yield and quality attributes of strawberry, but black polythene mulch gave best results in terms of reducing the weed population (1.00/m<sup>2</sup>), increasing in terms of plant height (21.67 cm), plant spread (31.24 cm), number of leaves plant<sup>-1</sup> (18.33), number of flowers plant<sup>-1</sup> (28.33) and number of fruits plant<sup>-1</sup> (12.12).

Field research was carried out by **Kumar et al. (2014)**, and claimed that maximum plant height, number of leaves, plant spread, number of flowers plant<sup>-1</sup>, length:diameter ratio of fruits and average number of fruits plant<sup>-1</sup> was noted in treatment of 100 kg N ha<sup>-1</sup> of strawberry.

An experiment conducted by **Meena et al. (2014)**, with application of different doses of organic manure *i.e.* FYM (100% and 50%), vermicompost (100% and 50%) and neem-cake (100 % and 50%) along with bio-fertilizers *i.e.* PSB and *Azospirillum*. They found that maximum plant height (39.50 cm) was noted in treatment PSB @ 2 kg ha<sup>-1</sup> and maximum number of branches plant<sup>-1</sup> (6.93), maximum number of cluster plant<sup>-1</sup> (9.83) were noted under *Azospirillum* 2@ kg ha<sup>-1</sup>. While all growth parameters were noted minimum in control.

**Singh et al. (2015)** conducted a field experiment with application of vermicompost + *Azotobacter* + PSB + AM found maximum plant height (20.26 cm), plant spread (25.64 cm), number of leaves (54.30) and leaf area (97.87 cm<sup>2</sup>) plant<sup>-1</sup>, while all growth characters were found minimum in control, while earliest flowering (50.39 days) and maximum number of runners (7.12) plant<sup>-1</sup> were found in vermicompost + AM, while minimum runners (3.27) was recorded in vermicompost alone. Duration of harvesting (66.80 days) was recorded in vermicompost + PSB + AM, while maximum number of flowers (64.23) and percentage of fruit setting (50.63) plant<sup>-1</sup> were recorded in vermicompost + *Azotobacter* + PSB + AM. A minimum day taken to first fruit set (6.30 days) was found in vermicompost + *Azotobacter*; all the characters were found minimum under control. Maximum yield (311.26 g) plant<sup>-1</sup> was recorded in treatment vermicompost + *Azotobacter* + PSB + AM, and minimum in control (136.59 g).

An experiment conducted by **Husam et al. (2015)**, it was recorded the maximum plant height (9.17 cm), maximum number of leaves plant<sup>-1</sup> (9.53), and number of flowers plant<sup>-1</sup> (2.20) was recorded in treatment T<sub>12</sub> (NPK 40:40:40).

**Kumar et al. (2015)** found that the maximum plant height (23.95cm), number of leaves plant<sup>-1</sup> (12.67), primary branches plant<sup>-1</sup> (10.50), secondary branches plant<sup>-1</sup> (27.35), days to first flowering (61.06 days), number of flowers plant<sup>-1</sup> (15.33), days to first fruit set (72.80 days) and number of fruits plant<sup>-1</sup> (8.33) were recorded by the application of 100 percent vermicompost + PSB (T<sub>5</sub>) followed by treatments comprising of vermicompost + *Azospirillum* (T<sub>6</sub>) where plant attained height (23.50 cm), number of leaves plant<sup>-1</sup> (11.67), primary branches plant<sup>-1</sup> (10.25), secondary branches plant<sup>-1</sup>

(26.95), first flowering (63.06 days), number of flowers plant<sup>-1</sup> (14.67), days taken to first fruit set (73.50 days) and number of fruits plant<sup>-1</sup>(7.67).

**Afroz *et al.* (2016)** examined that the maximum plant height (25.60 cm), number of leaves (21.66), number of flowers (125.33), number of fruits (12.35), number of destroyed fruits (11), fruit weight plant<sup>-1</sup> (215.10 g) and fruit length (4.16 cm), fruit diameter (3.41cm), individual fruit weight (17.85 g) and fruit yield (11.50 t ha<sup>-1</sup>) were found in treatment of 115:40:110 and 25 kg ha<sup>-1</sup> N:P:K:S, respectively. Among the fertilizers, the solo effect of N (115 kg ha<sup>-1</sup>), P (40 kg ha<sup>-1</sup>), K (110 kg ha<sup>-1</sup>) and S (25kg ha<sup>-1</sup>) gave maximum growth and yield of strawberry. The highest concentration of NPK and S were found in shoot and fruit of strawberry when fertilizers doses are used 140:60:135 and 35 kg ha<sup>-1</sup>, respectively.

## **2.2 Efficacy of organics, bio-inoculant and mulching on the physical and yield parameters.**

In an experiment conducted by **Pandey and Mishra (1983)**, it was recorded that N<sub>2</sub> 75-100 kg, P<sub>2</sub>O<sub>5</sub> 80-120 kg and K<sub>2</sub>O 50-75 kg ha<sup>-1</sup> resulted in maximum growth, fruit yield and better quality fruit in strawberry.

**Locascio and Martin (1985)** found that 100 percent N applications through urea at the time of runners planting of strawberry significantly increased the marketable fruits and fruit weight also.

Field research was conducted by **Joolka *et al.* (1986)**, they recommended that dose of inorganic fertilizer N 150 kg<sup>-1</sup> with P<sub>2</sub>O<sub>5</sub> 75 kg ha<sup>-1</sup> observed higher yield of strawberry.

**Dar *et al.* (2000)** conducted a field experiment to study the effect of various organic fertilizer combinations on growth, yield and quality attributes of strawberry (*Fragaria × ananassa* Duch) cv. Sweet Charlie comprising eight inorganic fertilizer treatment combinations together with control. The treatment N 100 kg + K 80 kg ha<sup>-1</sup> was maximum plant spread recorded (27.52 cm), plant height (11.50 cm), number of leaves

(8.34), length of petiole (6.14 cm), number of flowers plant<sup>-1</sup> (4.45), fruit length (1.40 cm), specific gravity (1.20), vitamin C (55.85 mg/100 g), pH of fruit juice (3.15) and yield plant<sup>-1</sup> (367.60 g).

From a trial conducted by **Gariglio *et al.* (2000)**, it observed that N treatments significantly increases yield of strawberry over their control. Yield increased with increasing N rates from 0 to 53 kg ha<sup>-1</sup>. This resulted in an increase in the number of fruits but not in fruit weight.

**Turemis (2000)** carried out an experiment to find out the effect of various plant compost and manure on yield and quality attributes of strawberry cv. Dorit. And reported that maximum yield (595.4 g plant<sup>-1</sup>) with vermicompost treatment and followed by wheat straw + poultry manure with (490.2 g plant<sup>-1</sup>), tobacco + poultry manure (464.6 g plant<sup>-1</sup>), banana leaf + FYM (456.9 g plant<sup>-1</sup>) and poultry manure only (436.6 g plant<sup>-1</sup>).

**Pathak *et al.* (2002)** carried out an integration of 75 percent nutrient supply through inorganic fertilizers and 25 percent through organic sources in maize-wheat cropping system and yield obtained equal to that with application of cent percent nitrogen, phosphorus and potassium. The subsistence to positive nutritional environment under the influence of bio-fertilizers, FYM and inorganic fertilizers had a positive influence on vegetative and reproductive phase and to get higher yield in maize (*Zea mays*) – wheat (*Triticum aestivum*) cropping system.

By **Turemis (2002)**, evaluated that the effect of various plant composts and manures on cv. Dorit-216 of strawberry and reported that maximum yield (595.4g plant<sup>-1</sup>) was found in treatment banana compost, followed by 490.2 g plant<sup>-1</sup> in wheat straw (WS) + poultry manure (PM), (464.6 g plant<sup>-1</sup>) in tobacco + poultry manure (PM) and 456.9 g plant<sup>-1</sup> in banana compost + farm yard manure (FYM).

Field research was conducted by **Wang and Lin (2002)**, with various soil mediums and they reported that compost significantly increased plant growth, yield and fruit quality of fruit when it used as soil supplement. If adding half dose (50% fertilizer) of Peter nutrient solution to a mixture of 50% soil + 50% compost was reported to be

very effective in significantly increasing leaf chlorophyll content, plant dry weight, fruit yield (>70%) and fruit size (>15%) of strawberry which increasing an approximately doubles than control.

It was reported by **Hammam (2003)**, that application of PSB in Banana cv. William banana resulted in increased bunch weight (33 kg), number of fingers (19) and average finger weight (114 g).

**El-araby et al. (2003)** conducted a field experiment during the summer seasons of 1999-2000 and 2000-2001 of strawberry plants cv. “Camarosa”. In this study responses to different levels of nitrogen (0, 200, 300 and 400 kg N fed.<sup>-1</sup>), organic manure (0, 15, 20 and 25 m<sup>3</sup> fed.<sup>-1</sup>) and bio-fertilizer treatments with or without inoculation by “Halex-2” as well as their interactions had influenced yield and fruit quality of strawberry.

**Nestby et al. (2004)** observed that the proper nutrition, cultivar specificities, cultural practices, weather conditions and irrigation have a quick effect on strawberry crop. Chemical fertilizers are also increased strawberry yield, as they ensure optimal nutritional status in plants.

Field research was conducted by **Patil et al. (2004)**, and examined that the effect of organic and inorganic fertilizers on tomato crop and they reported that maximum yield plant<sup>-1</sup> (2.34 kg) was found in treatment 50% RDF (NPK 100:50:50 kg ha<sup>-1</sup>) + 50% nutrients from FYM.

An experiment conducted by **El – Humid et al. (2006)**, they found that an application of PSB (5kg ha<sup>-1</sup>) in strawberry crop resulted that increased size, firmness and yield of fruit (252 g plant<sup>-1</sup>).

**Nowsheen et al. (2006)** reported that the application of PSB (5 kg ha<sup>-1</sup>) in strawberry cv. Senga Sengana and resulted that highest yield (230.95 g plant<sup>-1</sup>). They further reported that an application of *Azotobacter* (4 kg ha<sup>-1</sup>) in cv. Senga Sengana of strawberry got maximum yield (235.90 g plant<sup>-1</sup>).

An experiment conducted by **Kadlage *et al.* (2007)**, it was reported that an application of recommended dose of fertilizer (RDF) + phosphate solubilizing bacteria (PSB) produced highest fruit yield (35.85 t ha<sup>-1</sup>) in tomato crop.

**Marathe and Bharambe (2007)** reported that an application of 25 percent N through FYM + 50 percent RDF + *Azotobacter* + phosphate solubilizing bacteria (PSB) showed that maximum fruit length (74.0 mm) and fruit width (76.7 mm) while maximum fruit weight (188.4g) was found in 50% N through FYM + 50% RDF in tomato crop.

An experiment conducted by **Ghaderi and Talaie (2008)**, it showed that an application of manure along with urea had a significant effect on the fruit yield, prevention of fruit decay as well as leaf specific mass and fruit quality is a combination of appearance, flavour, texture and nutritional value of fruit.

**Atif Yasseen Mahadeen (2009)** concluded that an application on strawberry crop of NPK (inorganic fertilizer) combination with organic fertilizer tended to increase fruit yield in comparison with their use alone. The maximum fruit yield (27.62 t ha<sup>-1</sup>) with 40 t of organic fertilizer along with 60 kg each of NPK ha<sup>-1</sup>, while the minimum yield (21.76 t ha<sup>-1</sup>) recorded under control. It was clearly evident that all treatments that received organic fertilizer recorded higher yield of strawberry when compared with untreated plots with organic fertilizer, which indicated the importance of organic fertilizer. Number of fruits plant<sup>-1</sup> was significantly decreased by adding organic fertilizer (40 t ha<sup>-1</sup>) even with mixture of chemical fertilizer

Field research was conducted by **Bairwa *et al.* (2009)**, on cv. Arka Anamika of okra and fruit yield was reported that (182.50 g plant<sup>-1</sup>) in treatment @ 6 q ha<sup>-1</sup> neem-cake + 10 q ha<sup>-1</sup> vermicompost + *Azotobacter* + PSB + 60 percent of NPK through inorganic fertilizers.

**Gunes *et al.* (2009)** from a field trial reported that PSB and fungi can increase soil phosphorus availability, potentially enhancing crop yield when phosphorus is limiting. They studied that effectiveness of *Bacillus* FS-3 and *Aspergillus* FS 9 to enhancing strawberry (*Fragaria* × *ananasa* Duch.) cv. Fern yield, mineral content in leaves and

fruits on a phosphorus deficient calcareous arid soil in Eastern Anatolia, Turkey. Strawberry yield increased with P addition (quadratic function) reaching the maximum of 94 g pot<sup>-1</sup> at 200 kg P ha<sup>-1</sup> in the absence of phosphorus solubilizing micro-organisms. At this yield level, *Bacillus* FS-3 and *Aspergillus* FS 9 inoculation resulted in phosphorus fertilizer savings of 149 kg P ha<sup>-1</sup> and 102 kg P ha<sup>-1</sup>, respectively. Both micro-organisms increased yields beyond the maximum achievable yield with sole phosphorus fertilizer addition. Micro-organism inoculation increased fruit and leaf nutrient concentrations like N, P, K, Ca, and Fe with the largest increases upon addition of *Bacillus* FS-3.

**Lutfi and Murat (2009)** conducted an experiment with view to the generative potential and results suggested that yield of strawberry per plant was affected by the application of bio-fertilizers and the chemical fertilizer and also found that a significantly yield increase in cv. 'Selva' of strawberry with the use of PGPR (foliar + root application).

**Chelpinski et al. (2010)** carried out an experiment in 2006-2007 of different fertilizers influence on yield and quality parameters of cv. Kent of strawberry. Two combinations were tested of each consisting of three types of fertilizers. In both combinations, two types of multi-component fertilizers were used (5% N, 5% P<sub>2</sub>O<sub>5</sub>, 15% K<sub>2</sub>O and O 10% N, 5% P<sub>2</sub>O<sub>5</sub>, 10% K<sub>2</sub>O) and ammonium nitrate of 50 kg N ha<sup>-1</sup> in the first combination and 70 kg N ha<sup>-1</sup> in the second treatment. The usage of multi-component fertilizers, especially O type resulted in an increase yield in cv. Kent of strawberry.

Field research was conducted by **Umar et al. (2010)**, and observed that significantly increasing in fruit size (28.9 mm), fruit weight (19.6 g) and fruit yield (385.2 q ha<sup>-1</sup>) with the application of 25% nitrogen through subabul + 75% nitrogen through urea in strawberry cv. Chandler.

An experiment conducted by **Ahmad and Mohammad (2012)**, on the influence of different organic nutrient combinations on strawberry and reported that the maximum fruit diameter (3.11 cm), length of fruit (3.95 cm), volume of fruit (20.397 cc) and fruit

weight (11.11 g) were found in 75% RDF of NPK through inorganic fertilizers + 25% FYM.

**Devi *et al.* (2012)** conducted an experiment on *cv.* Sardar of guava and reported that maximum fruit weight (230.5 g) was found in treatment of neem-cake (9 kg/plant/year) along with vermicompost (19 kg/plant/year) + *Azotobacter* + phosphate solubilising bacteria (PSB) + potash mobilizers each at 100 g/plant/year. Further, they are reported that, the maximum number of fruits/plant (626.3) was found with FYM (26 kg/plant/year) + *Azotobacter* + phosphate solubilising bacteria (PSB) + potash mobilizers @ 100 g/plant/year each.

Field research was conducted by **Akash *et al.* (2013)**, and studied that integrated nutrient management (INM) in guava and they reported that the maximum (41.14 kg) fruit yield plant<sup>-1</sup> in treatment 25% N tree<sup>-1</sup> through FYM + 75% N tree<sup>-1</sup> through inorganic fertilizer.

An experiment conducted by **Pesakovic *et al.* (2013)**, and opinion that where *cv.* Senga Sengana of strawberry plants was treated with liquid inoculums of di-azotrophic bacteria *Klebsiella planticola* and they produced significantly maximum (0.52 kg) yield plant<sup>-1</sup>.

**Singh and Varu (2013)** reported that maximum fruit length (30cm), fruit girth (22cm), fruit weight (16.70g) and number of fruits plant<sup>-1</sup> (45.33) in RDF (100:100:125 NPK g plant<sup>-1</sup>) + *Azotobacter* at 50 g plant<sup>-1</sup> + PSB @ 2.5 g/m<sup>2</sup> treated plants.

**Verma and Rao (2013)** found that the maximum fruit weight, number of fruits/plant, yield plant<sup>-1</sup> (181.84 g), marketable yield plant<sup>-1</sup> (145.47 g) and yield ha<sup>-1</sup>. (101.02q) were recorded in the treatment *Azotobacter* + PSB + vermicompost + 50 % RDF followed by *Azotobacter* + PSB + FYM + 50 % RDF treatment. The application of *Azotobacter* + PSB + vermicompost + 50 % RDF was found more effective in decreasing the electrical conductivity (0.02 dS m<sup>-1</sup>) and soil pH (6.27). The organic carbon (1.95%), available nitrogen (314.64 kg ha<sup>-1</sup>), phosphorous (17.56 kg ha<sup>-1</sup>) and potassium (306.33

kg ha<sup>-1</sup>) were recorded significantly higher in soil after harvest of crop in treatment receiving *Azotobacter* + PSB + vermicompost + 50% RDF.

**Lata et al. (2016)**, was conducted a field experiment on strawberry cv. Chandler as affected by the biological, organic and inorganic nutrient substrates under sub-tropical conditions. Integrated application of strawberry runners with bio-fertilizers, farmyard manure and NPK significantly influenced the yield and yield attributing characters, sensory attributes and benefit: cost ratio of strawberry grown under saline soils of sub-tropical conditions of Uttar Pradesh. Treatment T<sub>8</sub> [*Azotobacter* (50%) + *Azospirillum* (50%) + NPK (50%)] was most effective for commercial cultivation with higher yield (287.0 g/plant), better fruit quality, overall acceptability by the consumers and remunerative (B:C, 4.78:1.00) to the farmers compared to control (141.57 g/plant).

On the basis of results obtained by **Kushwah et al. (2018)**, in the treatment T<sub>5</sub> (75 percent RDF + 25 percent vermicompost + *Azotobacter* @ 5 kg ha<sup>-1</sup> + PSB @ 5 kg ha<sup>-1</sup>) was found beneficial in terms of maximum yield (24.87 t ha<sup>-1</sup>) and quality attributes of strawberry with net return of Rs. 19, 86, 880.00 ha<sup>-1</sup> and maximum cost: benefit ratio (1: 4.97).

### **2.3 Efficacy of organics, bio-inoculant and mulching on the bio - chemical parameters.**

An experiment conducted by **Haynes and Goh (1987)**, and opined that the application of nitrogenous fertilizers are adversely affect on titratable acidity and sugar content in strawberry fruits are inconsistent and vary from year to year.

**Badiyala and Bhutani (1990)** had assessed that total soluble solids (8.13 °Brix) and minimum acidity percent with the fertilizer schedule consisting of 150 kg N, 75 kg P and 50 kg ha<sup>-1</sup> in cv. Tioga of strawberry in mild hilly areas (Palampur) of Himanchal Pradesh.

Field research was conducted by **Kopanski and Kawecki (1994)**, and recorded that application of 90 kg N ha<sup>-1</sup> increased the ascorbic acid content in ‘Dukat’ and ‘Senga Sengana’ cultivars of strawberry.

**Lacertosa et al. (1999)** assured that ascorbic acid and sugars concentrations were inversely correlated with the content of nitrogen in the fruits and also clearly indicating that, appropriate N fertilizer application could be effective in improving fruit quality of strawberry.

**Giusti and Wrolstad (2001)** studied that anthocyanin pigment has a significant role in colour quality of many fresh & processed fruits and vegetables. Thus, accurate amount of anthocyanin, along with their degradation indices, are very helpful to food technologists and horticulturists to assessing the quality of raw and processed foods. Since many natural food colorants are anthocyanin derived (eg. grape-skin extract, red-cabbage extract, purple-carrot extract etc.), the same measurements can be used to assess the colour quality of these food ingredients. In addition to the intense interest of anthocyanin content of foods and nutraceuticals values because of health benefits such as reduction of coronary heart diseases.

An experiment conducted by **Makkun et al. (2001)**, and found that 225 kg ha<sup>-1</sup> of N rate improved fruit firmness during storage, compared to lower N rates such as 150 kg ha<sup>-1</sup>. Higher N rates increased also acidity and reduced sugar content in strawberry fruits.

Field research was conducted by **Leskinen et al. (2002)**, and recorded that the strawberry crop grown with organic fertilizers found more sugar content than traditionally grown.

An experiment conducted by **Yoshida et al. (2002)**, it was recorded that anthocyanin synthesis may be decreasing with N deficiency in strawberry fruits.

**Ali et al. (2003)** reported that the combined application of nitrogen (150 kg ha<sup>-1</sup>), Phosphorus (100 kg) and FYM 20 t ha<sup>-1</sup> and found the maximum total soluble solids and ascorbic acid content.

An experiment conducted by **Patil *et al.* (2004)**, revealed that maximum total soluble solids (6.08<sup>0</sup>Brix) and vitamin C (26.76 mg/100g of fresh weight) were recorded with application of 50% RDF (NPK 100:50:50 kg ha<sup>-1</sup>) + 50% FYM in tomato crop.

**Atif Yasseen Mahadeen (2009)** evaluated that ascorbic acid content of strawberry fruits are showed a significantly increased with application of organic fertilizer when compared with untreated plots with organic fertilizer. Application of 40 t ha<sup>-1</sup> organic fertilizer with or without chemical fertilizer resulted in increased ascorbic acid content of strawberry fruit which was about two times when compared with untreated plots with organic fertilizer.

**Umar *et al.* (2009)** conducted an experiment on *cv.* Chandler of strawberry and they reported that the application of 25 percent N through subabul with 75 percent N through urea with bio-fertilizer exhibited the maximum fruit size (38.4 × 28.9 mm), fruit weight (16.9 g), TSS (6.83<sup>0</sup>Brix), and total sugars (4.85%)

**Ertuk *et al.* (2010)** conducted a trail on strawberry during 2006 and 2007 to observe the effect of inoculation of plant growth promoter rhizo-bacteria (PGPR) on phonological data, total yield and fruit quality characteristics in *cv.* ‘Fern’ of strawberry (*Fragaria x ananassa* Duch). All bacterial root inoculations are significantly increased yield plant<sup>-1</sup> (1.98 – 20.85%), average fruit weight (3.05 –19.26%) and fruit quality ratio (10.30 – 32.05%) as compare to control, whereas the bacterial inoculations did not affect leaf area, date of first flowering and date of harvesting of fruits in strawberry in same cultivar. The bacteria also increased total soluble solid values varied between 10.16% (control) and 12.83% (RC01) and vitamin C ranged from 47.41 mg 100g<sup>-1</sup> (control) to 53.88 mg 100 g<sup>-1</sup> (RC05) in strawberry *cv.* ‘Fern’.

An experiment conducted by **Umar *et al.* (2010)** observed that the application of 25 percent nitrogen through subabul + 75% nitrogen through urea (inorganic fertilizer) augmented with bio-fertilizer resulted in maximum total soluble solids (6.84<sup>0</sup>Brix), total sugars (4.85%) in strawberry *cv.* Chandler.

**Verma and Sharma (2010)** investigated that the influence of FYM and organic manure on apple and maximum titratable acidity (0.29%) was found that in organic manure @ 5 kg tree<sup>-1</sup> with organic manure @ 10 kg tree<sup>-1</sup>. They further reported the maximum total soluble solids (13.3 and 13.5 °Brix) and total sugars (18.8 and 10.0%) were recorded in organic manure @ 10 kg tree<sup>-1</sup> in two years of experiment.

**Yadav et al. (2010)** observed that maximum quantity of ascorbic acid (57.55 mg/100g fresh edible fruit) content was recorded in plants fertilized with *Azotobacter* + PSB (6 kg ha<sup>-1</sup> each), closely followed (56.47 mg/100g edible fruit) with *Azotobacter* 6 kg ha<sup>-1</sup>+ PSB 5 kg ha<sup>-1</sup>. Whereas, the minimum quantity of ascorbic acid content (47.64 mg/100g fresh fruit weight) was recorded under control in strawberry.

**Livia et al. (2011)** reported that quality and antioxidant attributes of ‘Osogrande’ and ‘Camino Real’ strawberries at different ripening stages. The maximum total soluble solids content in pink (7.58 °Brix) and ripe (7.98 °Brix) stages of ‘Osogrande’ strawberry. At pink stage, this cultivar showed higher amounts of total phenolics (2909.48 mg kg<sup>-1</sup> fresh fruit weight) and total ellagic acid content (45.16 mg kg<sup>-1</sup> fresh fruit weight.) of ‘Camino Real’ strawberry exhibited the maximum content of vitamin C (52.55 mg kg<sup>-1</sup> fresh fruit weight).

An experiment conducted by **Shehata et al. (2011)**, showed that using of compost then total soluble solids and anthocyanin content in strawberry fruit have increased in greater extent with respect to chemical fertilizers.

**Tripathi et al. (2011)** conducted a field trial and they observed that the maximum duration of fruit harvesting (70.90 days) and the minimum number of days taken to emergence first flower (56.69 days) and fruit set (6.12 days) with significantly more yield (322.17 g plant<sup>-1</sup>) were also found in *Azotobacter* and PSB (6 kg ha<sup>-1</sup> each) fertilized plants. So far as the quality parameters of berries are concerned, plants fertilized with *Azotobacter* and PSB (6 kg ha<sup>-1</sup> each) also produced berries with the maximum fruit length (4.63 cm), width (2.64 cm), weight (8.48 g), volume (6.14 cc), TSS (10.30 °Brix),

total sugars (9.54%), ascorbic acid (57.55 mg/100g fresh fruit) with minimum titratable acidity (0.548%) with comparison to control under plains of central Uttar Pradesh (India).

**Ahmad et al. (2012)** reported that fruits quality of strawberry in terms of yield plant<sup>-1</sup> (238.95 g), total soluble solids (9.01<sup>0</sup>Brix), total sugars (7.95%) and acidity (0.85%) are significantly increased with application of manure + *Azotobacter* + woodash + phosphate solubilizing bacteria (PSB) + oil cake and similarly in *Azotobacter* (6 kg ha<sup>-1</sup>) with PSB (6 kg ha<sup>-1</sup>) is significantly increased the yield of strawberry fruits (**Mishra and Tripathi 2012**).

**Andersson et al. (2012)**, conducted an experiment on strawberry results showed that strawberries are better pollinated in organic than in conventional farms. Effects on total soluble solids and sugars were also earlier reported. The glucose, sucrose and malic acid content of the strawberry were in the same range as earlier.

**Devi et al. (2012)** conducted an experiment on cv. Sardar of guava and they reported that application of poultry manure @ 10 kg/plant/year + *Azospirillum* + phosphorous solubilizers (PSB) + potash mobilizes each @ 100 g/plant/year was effective for enrichment of total soluble solids (12.00<sup>0</sup>Brix) and total sugars content (6.67%) in fruit whereas, the ascorbic acid content (172.6 mg/100g fruit pulp) was recorded the maximum in treatment of neem-cake @ 9 kg/plant/year alone.

**Singh and Saravanan (2012)** recorded that the maximum number of fruits plant<sup>-1</sup> (29.13), fruit yield plant<sup>-1</sup> (417.73g), fruit yield ha<sup>-1</sup> (37.59 t), length of fruit (3.94 cm), diameter of fruit (3.12cm), specific gravity (1.380), TSS (7.36<sup>0</sup>Brix), juice content (92.34%), titratable acidity (0.876%) and ascorbic acid (59.12 mg/100 g) were recorded in T<sub>7</sub>-VAM @ 12 kg ha<sup>-1</sup>+*Azotobacter* @ 10 kg ha<sup>-1</sup> in the cv. Chandler of strawberry.

**Singh et al. (2012)** reported that the maximum titratable acidity (0.84%) was recorded under control and total sugar (7.80%) was recorded the maximum in vermicompost 5 t ha<sup>-1</sup> + *Azotobacter* + phosphate solubilizing bacteria (PSB) + arbuscular mycorrhizal (AM) fungi treated plants of strawberry. The maximum TSS

(10.30 °Brix), ascorbic acid (57.55 mg/100 g) and total sugars (9.54%) were found in *Azotobacter* along with PSB (Mishra and Tripathi 2012).

An experiment conducted by Lal *et al.* (2014), observed that the effect of integrated nutrient management (INM) on acid lime and reported that the maximum TSS (10.42 °Brix), ascorbic acid (46.33 mg/100g fruit juice) and the minimum acidity (6.06%) were found in treatment 50% RDF through NPK and remaining 50% by goat manure.

Hassan *et al.* (2015) observed that using of 100% of RDF of N, P and K as mineral fertilizers and compost significantly affected most of plant growth characters, yield and bio-chemical attributes. It was clearly evident that all treatments that received 100% of recommended dose (organic sources or inorganic fertilizers) recorded maximum values in all studied measured like plant and fruit attributes, as compared with compost rate of 50% of recommended dose. Results also indicated that, bio-fertilizers increased plant growth characters, bio-chemical composition *viz.* total fruit yield and its components like physical quality and chemical constituents of fruit, *i.e.*, TSS °Brix, ascorbic acid, titratable acidity, anthocyanin content and total sugars. On the other hand, chemical composition (NPK) of plant foliage, physical fruit quality as well as average length, fruit diameter and fruit weight was not statistically affected by bio-fertilization.

Kumar *et al.* (2015) laid out an experiment in randomized block design (RBD) and 12 treatments with thrice replications on different levels of N, P, K and farmyard manure (FYM). The results revealed that maximum TSS (9.91°Brix), specific gravity (1.71), ascorbic acid (54.39 mg/100g of fruit pulp) and minimum acidity (0.51%) and pH (3.50) were recorded in T<sub>7</sub> (N: P: K), respectively 150:75:60 kg ha<sup>-1</sup> + 20 t ha<sup>-1</sup> FYM) followed by T<sub>10</sub>. The least values were recorded in control.

Newsheen *et al.* (2015) carried out an experiment comprised with five organic nutrient treatments and different combinations of FYM, *Azotobacter*, PSB, mustard oil cake, poultry manure, wood ash and *Azospirillum* with recommended doses of N P K through chemical fertilizer as control. The maximum plant height (23.39 cm), plant spread (24.21 cm) and runners plant<sup>-1</sup> (13.03) were found in treatment poultry manure +

*Azotobacter* + wood ash + phosphate solubilizing bacteria (PSB) + mustard oil cake along with maximum yield (238.95 g plant<sup>-1</sup>) and different physical characters of fruits like length (3.95 cm), diameter (3.11 cm), volume (20.39 cc), weight (11.11 g) and chemical characters viz. total sugars (7.95%), total soluble solids (9.01<sup>0</sup>Brix), acidity (0.857%) and TSS: acid ratio (11.12).

**Miner et al. (2016)** revealed that market yield maximized with total 120 N kg ha<sup>-1</sup> with one-half banded in the fall and the remaining applied with drip irrigation in the spring season. Fruit firmness decreased with increasing N rate. Fruit pH and concentrations of total acids, total soluble solids and crown number were not affected by N treatments, but soluble solids increased at the time of harvesting, but crown yield increased with N rate similar to market yield. There was no response of K with drip irrigation in any variable in either year.

**Jain et al. (2016)** conducted an experiment during 2013-14 and 2014-15 with 21 treatments including combinations of organic and microbial sources of nutrients (Compost, Poultry manure, vermicompost, FYM, *Azotobacter* and PSB. In different combinations organic manure and bio-fertilizers treatment T<sub>15</sub> (vermicompost + Poultry manure +PSB +*Azotobacter*) was recorded maximum plant height (16.19 cm), plant spread (24.68 cm), number of leaves plant<sup>-1</sup> (15.79), leaf area index (77.26 cm<sup>2</sup>), earliest flowering (40.68 days), maximum number of flowers plant<sup>-1</sup> (13.42), maximum fruit weight (12.86 g), number of fruits plant<sup>-1</sup> (11.78), TSS (7.05<sup>0</sup>Brix) and ascorbic acid (53.42 mg/100 g) and yield (112.63 g plant<sup>-1</sup>).

## **2.4 Efficacy of organics, bio-inoculant and mulching on the soil parameters.**

An experiment conducted by **Derevyanchuk (1977)**, and confirmed that strawberry grown on dark gray forest soil and application of urea (N) gave the maximum yield compared with several other N forms.

**Shinde et al. (1995)** conducted an experiment on a medium texture calcareous soil to assess the effect of vermicompost and FYM or the yield uptake N, Fe, Mn and Cu

by strawberry and revealed that application of FYM @ 20 t ha<sup>-1</sup> was found beneficial for strawberry crop due to yield and uptake of N, Fe, Mn, and Cu are increased.

**Naeini and Cook (2008)** reported that the Municipal Waste Compost was added to soils in the glasshouse and field to assess its impact upon soil physical properties. Application use by mulch and incorporation, and the amelioration of temperature, soil water content, unsaturated hydraulic conductivity and evaporation were investigated. Incorporation in the glasshouse pot experiments increased early season evaporation, while compost applied by either means raised soil temperature. In later stages of drying, the presence of compost reduced the evaporation rate. In the field, compost addition to trials of maize (*Zea mays*) improved retention of soil water during a normally wet summer, but not during a very dry summer. Furthermore, soil temperature tended to be reduced by mulching. It is concluded that compost application is beneficial to soil water retention and its subsequent utilization by a crop in conditions of normal rainfall under a temperate climate. Furthermore, it is concluded that the common practice of extrapolating glasshouse-derived information to field conditions creates serious problems, at least in soil physical experimentation.

**Niskanen and Dris (2002)** conducted nutritional status study on strawberries grown on coarse textured and medium to high humus content soil having normal fertility which was good for soil pH, P, B and Cu and satisfactory for K, Ca, Mg and Mn. They reported that mean nutrient concentration as N 19.1, P 2.8, K 15.0, Ca 9.3 Mg 2.7 and B 0.05 g/kg of dry matter.

**Greer (2002)** reported that excessive use of fertilizer in strawberry results reduced yield, excessive vigour, softness of fruit, poor colour development and potential contamination of ground and surface water. He also estimated that nitrogen use efficiency (NUE) by the strawberry plants is 8-20% of the applied nitrogen fertilizers.

**Sharma and Adholeya (2004)** carried out an experiment on strawberry (*Fragaria ×ananassa* Duch.) grown in alfisols of semi arid areas in India and results in suboptimal yields. Low organic carbon and low phosphorus (P<sub>2</sub>O<sub>5</sub>) availability, in addition to high

P<sub>2</sub>O<sub>5</sub> fixation affects the P<sub>2</sub>O<sub>5</sub> availability drastically, even when it is applied externally. AM response was evaluated at four doses of P<sub>2</sub>O<sub>5</sub> (50, 100, 150, and 200 kg ha<sup>-1</sup>) in a high P<sub>2</sub>O<sub>5</sub>-fixing capacity and P<sub>2</sub>O<sub>5</sub>-deficient alfisols. At the time of harvesting of all inoculated plants, except those at the maximum level of applied P<sub>2</sub>O<sub>5</sub> (200 kg ha<sup>-1</sup>), had maximum fruit yields per plant, unit mass, number of runners, maximum plant dry matter, and P<sub>2</sub>O<sub>5</sub> content in plant. However, the AM response as calculated by yield varied with P<sub>2</sub>O<sub>5</sub> concentration. Inoculated plants had a significantly better fruit yield when grown at 150 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, and the yield was comparable with un inoculated plants which grown at 200 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. The external P<sub>2</sub>O<sub>5</sub> requirements were 71 kg ha<sup>-1</sup> for mycorrhizal and 106 kg ha<sup>-1</sup> for non mycorrhizal strawberry plants to obtain 90% of the higher fruit yield. In terms of P<sub>2</sub>O<sub>5</sub> fertilization, this corresponds to a savings of 35 kg ha<sup>-1</sup>. The percent of mycorrhizal root length and colonization both in inoculated and non inoculated plants was not found to vary significantly with P<sub>2</sub>O<sub>5</sub> application.

**Elisa *et al.* (2008)** conducted an experiment and found that in early spring growth of perennial strawberry (*Fragaria × ananassa* Duch.) plants are supported by the carbohydrate (CHO) and nitrogen (N) reserves accumulated from the previous growing season. The limitations of these reserves on the initial spring growth and yield of perennial strawberries have not been studied in detail, particularly the influence of N reserves. Differential N fertigation (0 to 20 mm) was applied to potted strawberries during the growing season and a supplemental foliar urea application was applied to a portion of the plants in the fall to modify reserve N during dormancy. Plant N content and spring vegetative growth the year after fertigation increased nearly twofold with increasing N fertigation. Photosynthesis per unit leaf area also increased up to 10 mm of fertilizer N and then stabilized through 20 mm. Foliar urea application in fall further increased total plant N content and size, decreased carbohydrate (CHO) concentration, and also decreased yield in plants with the most total N.

**Haynes *et al.* (2008)** investigated in a field trial to determine the effects of increasing doses of N (urea) and K on vegetative growth, nutrients uptake, yield and fruit quality characters of strawberry. In the first and second seasons there were small increases in plant growth and yield with the low rate of N but higher rates caused marked

reductions in both growth and yield. With the high N rates accumulation of high levels of ammonium and total soluble solids in the soil during spring of the first season was thought to have initially inhibited plant growth. Following nitrification of the accumulated ammonium, soil acidification occurred and consequently toxicities of Al and Mn limited strawberry growth at high N rates. In the second and third seasons there was a positive growth and yield response to the addition of K in the no-N and low-N treatments although rate of K had no influence. Increasing rates of K generally increased concentrations of leaf K and decreased those of Mg and Ca. Additions of K had no effect on chemical parameters of fruit quality. However, increasing rates of N raised concentrations of amino acid-N and applied N tended to raise concentrations of polyphenols and reduce those of ascorbic acid. Applications of N had variable effects on titratable acidity and sugar contents of fruit and year-to-year differences in quality parameters were generally greater than those caused by N additions.

**Dar et al. (2013)** carried out the experiment on strawberry at Research Farm, Horticulture Department, AAIDU, Allahabad (India) during winter season 2006 - 07. To investigate the impact of macro nutrients like N, P and K on plant height, plant spread, number of leaves, petiole length and fruit yield of strawberry cv. Sweet Charlie. The application of 100 kg N + 80 kg K ha<sup>-1</sup> and resulted that the maximum growth and yield improvement in strawberry is followed by in treatment 100 kg N: 80 kg P: 80 kg K ha<sup>-1</sup>. The study revealed that strawberry crop requires optimum NPK doses to harness the maximum yield.

Field research was conducted by **Derkowska et al. (2015)**, effects and recorded data on plant height, leaf surface area, fresh and dry weight of leaf, the degree of mycorrhizal colonization in the roots and on the number of spores of arbuscular mycorrhizal fungi in the rhizosphere zone of strawberry plant roots.

**Malusa et al. (2016)** revealed that different kinds of soil micro-organisms which belonging to several taxa like bacteria, fungi, and possibly protozoa kingdoms, colonizing the rhizosphere or the plant tissues and promoting plant growth (PGPM) can be utilized

for the production of microbial based fertilizers (bio-fertilizers). However, their application in agricultural practice is still hindered by several factors.

**Singh *et al.* (2018)** conducted a field experiment during 2015 to 2016 at Shivri farm, Lucknow on highly sodic soil with combined use of municipal solid waste compost (MSWC) with chemical amendments can provide a practical solution for ameliorating sodic soils and sustaining crop productivity. To evaluate the influence of organic and inorganic amendments on amelioration of sodic soils and sustaining crop productivity of rice (*Oryza sativa* L.)- wheat (*Triticum aestivum* L.) cropping system. The results indicated that, application of reduced dose (25% of GR) of gypsum (T<sub>3</sub>) in combination with on-farm MSWC@10 t ha<sup>-1</sup> reduced about 14% ESP and increased 11% soil bulk density, 54% infiltration rate, 10% soil organic carbon content, and 13% available N over the recommended practice (T<sub>1</sub>). Productivity of rice and wheat crops enhanced 4 and 12%, respectively.

### MATERIALS AND METHODS

The present investigation entitled “**Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh**” was carried out at the Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow (UP), India during the winter season of 2017-18 and 2018-2019 year. The details of methodology adapted in this experiment have been presented under here.

#### **Location and site of experiment**

This experiment was conducted at the Horticultural Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli road, Lucknow. The experimental plot located approximately 10 km from Charbagh railway station nearby Railway line of Alambagh Utratia railway line 200 mile distance towards south of the Lucknow. The farm is situated at an elevation of 129 meters above the mean sea level (MSL). Lucknow is geographically situated in the subtropical tract of Central U.P. at 26° 46' North latitude and 80° 55 ' East longitudes.

#### **Topography, climate and weather condition**

The climate of this region is subtropical with temperature maximum ranging from 29.3 to 46 °C in the peak summer season and minimum ranging from 3.5 to 12 °C in peak winter. The relative humidity (RH) is vary from 50 -77% in different seasons of round the year with hot or summer and cold winter. The average rainfall is 700-800 mm, most of which is received from July to September from S-W monsoon ,distributed over a period of about 100 days, with the peak period between July to August. Scattered showers also occur during the winter months from western disturbance. In general, the temperature ranges from 5 to 42 °C. The coldest month of the year is January, while the maximum temperature is recorded during the May and June respectively. The soil of experimental farm was partially reclaimed alkali soil with pH 8.06; electrical conductivity is about 0.312 dS m<sup>-1</sup> and sodium exchangeable percentage approx. 15.0. During the experiment,

meteorological observations were recorded from ICAR-Indian Institute of Sugarcane Research, Lucknow and presented in table 3.1 and 3.2, respectively.

### Experimental material

The runners of cv. Chandler of strawberry were brought from ICAR-Central Institute of Temperate Horticulture, Srinagar (J&K) in both the years. The runners were kept for two days in shade net for hardening before planting in well- prepared beds under open field condition which were distributed randomly in three replications with twelve treatments. Standard cultural practices were followed manually during the experiment to avoid the biotic and a biotic hazard /stress for maintaining the quality and yield.

**Table 3.1. Weekly meteorological observations recorded during the experimental period of the crop (2017-18)**

Week No.	Month & Date	Mean Temp. (°C)		Relative humidity (%)		Wind Velocity (Km/hr)	Total Rainfall (mm)	Suns hine hours	Evapo ration rate
		Max	Mini	Max.	Mini				
1	5Nov - 11	29.7	14.0	97	47	0.7	0.0	3.0	1.7
2	12 - 18	29.5	12.7	97	43	0.8	0.0	5.2	1.7
3	19 - 25	26.5	9.6	83	35	2.5	0.0	8.4	2.7
4	26 -02 Dec	26.3	7.0	96	34	1.3	0.0	8.1	1.8
5	03 - 09	25.9	10.3	90	38	1.8	0.0	6.1	1.9
6	10 - 16	25.8	9.9	94	33	1.6	0.0	4.7	1.4
7	17 - 23	23.7	7.8	94	47	2.2	0.0	3.9	1.4
8	24 - 31	21.8	7.9	98	59	1.5	0.0	2.3	0.9
9	Jan 01 - 07	16.6	6.0	96	65	1.0	0.0	0.6	0.7
10	08 - 14	18.0	4.7	99	60	1.2	0.0	4.4	0.7
11	15 - 21	23.5	4.9	96	40	2.3	0.0	7.3	1.7
12	22 - 28	22.1	5.7	97	50	2.0	0.0	6.3	1.8
13	29 -04 Feb	26.1	8.2	88	34	3.6	0.0	8.2	2.6
14	05 - 11	24.8	8.2	86	38	3.6	0.0	6.7	3.0
15	12 - 18	24.4	10.4	89	46	3.7	0.0	5.8	2.3
16	19 - 25	30.0	11.7	92	36	2.0	0.0	8.4	3.2
17	26 -04 Mar	31.3	14.7	84	33	4.2	0.0	8.5	4.6
18	05 - 11	31.5	13.9	74	27	5.0	0.0	9.7	5.5
19	12 - 18	33.5	15.5	75	24	4.0	0.0	8.5	5.4
20	19 - 25	33.4	16.5	72	22	3.9	0.0	9.2	6.2
21	26 -01 Apr	35.8	17.0	68	23	4.2	0.0	9.3	7.0
22	02 - 08	35.7	19.8	70	33	2.5	1.1	8.4	5.3
23	09 - 15	35.2	19.6	71	26	3.3	0.0	8.6	5.5
24	16 - 22	39.5	21.8	47	17	4.8	0.0	9.4	8.9
25	23 - 29	37.7	18.2	54	25	3.8	0.0	9.4	8.0

**Table 3.2. Weekly meteorological observations recorded during the experimental period of the crop (2018- 19)**

Week No.	Month & Date	Mean Temp. (°C)		Relative humidity (%)		Wind Velocity (Km/hr)	Total Rainfall (mm)	Sunsh ine hours	Evapo ration rate
		Max	Mini.	Max.	Mini.				
1	5Nov - 11	28.5	11.0	92	36	1.5	0.0	6.8	2.2
2	12 - 18	29.1	12.7	90	36	1.9	0.0	7.4	2.6
3	19 - 25	28.1	10.3	92	37	1.6	0.0	7.9	2.0
4	26- 02 Dec	26.9	9.8	97	44	1.0	0.0	6.3	1.9
5	03 - 09	25.1	6.7	97	42	1.1	0.0	6.0	1.5
6	10 - 16	23.9	7.0	95	44	1.6	0.0	3.8	1.1
7	17 - 23	23.5	3.4	95	35	1.2	0.0	5.0	1.3
8	24 - 31	21.8	2.5	93	31	2.1	0.0	7.1	1.6
9	01-Jan 07	22.7	4.9	97	45	1.5	0.0	5.3	1.3
10	08 - 14	22.6	5.8	93	37	1.8	0.0	6.3	1.6
11	15 - 21	22.9	4.5	96	40	2.3	0.0	7.7	1.8
12	22 - 28	21.8	10.3	90	65	2.0	5.0	3.8	1.6
13	29 -Feb 04	22.3	7.0	94	45	2.7	0.0	8.1	1.9
14	05 - 11	22.5	9.5	97	58	2.5	2.6	5.3	1.9
15	12 - 18	23.6	10.4	94	53	2.3	0.2	5.5	1.4
16	19 - 25	26.4	11.3	93	42	3.6	0.0	7.1	2.7
17	26- 04 Mar	23.6	9.5	91	51	2.9	0.8	7.0	2.2
18	05 - 11	27.5	10.9	88	38	4.4	0.0	9.7	3.4
19	12 - 18	30.5	13.1	78	30	4.1	0.0	9.0	3.9
20	19 - 25	32.1	15.0	71	27	5.5	0.0	9.8	5.8
21	26- 01 Apr	34.7	17.0	75	27	3.9	0.0	9.5	5.5
22	02 - 08	35.6	18.3	77	32	3.0	0.2	9.7	5.1
23	09 - 15	38.1	21.4	71	25	3.2	0.0	9.4	5.7
24	16 - 22	34.3	18.7	65	34	4.7	0.0	7.9	6.4
25	23 - 29	40.0	23.9	57	21	3.1	0.0	9.4	7.7

**Soil status of experimental area**

The soil samples from the experimental plot were collected from a depth of 15 cm before planting of the runners and the sample were thoroughly mixed and to get the composite sample which were subjected to physical and chemical analysis. The results of the initial soil analysis are given below.

**Properties of soil of experimental field**

S.No.	Component	Amount	Method of determination
1.	Available N <sub>2</sub> (kg/ha)	81.24	Kjeldahl's method (Subbiah and Asija, 1956)
2.	Available P <sub>2</sub> O <sub>5</sub> (kg/ha)	13.35	Olsen's method (Jackson, 1973)
3.	Available K <sub>2</sub> O (kg/ha)	133.80	Flame photometer (Jackson, 1973)
4.	Organic carbon (%)	0.21	Rapid titration method (Jackson, 1973)
5.	pH	8.06	Glass electrode, pH meter (Jackson, 1973)
6.	EC (dS m <sup>-1</sup> )	0.312	Conductivity meter (Jackson, 1973)

### **Preparation of experimental field**

The experimental field was two times ploughed up to depth 30 cm with the help of tractor. The field was kept open to sun for at least 10 days for killing the weeds, eggs and larva of insect pest and repeated ploughing and followed by planking to obtain fine tilth. Required area was marked and prepared lay out according to the plan. A total 36 plots were made with a size 1.50 x 1.05 m<sup>2</sup> of each plot. 1.0 m wide drainage channel were made in between two replications.

### **Treatment of runners**

Runners were inoculated with bio-inoculant (PSB) prior to planting. Inoculation was prepared by thoroughly mixing of bio-inoculant with jaggery and water in bucket and placed at a cool place for a whole night for multiplications of microbes. Roots of runner were dipped in this mixture for 45 - 60 minutes so as roots get inoculated. The treated runners were then transplanted in the field.

### **Application of fertilizers**

DAP (Di-ammonium phosphate), urea and MOP (muriate of potash) were used in the experimental field to fulfil the recommended dose (100:120:80 kg ha<sup>-1</sup>) of NPK were applied according to treatment in each plot. Full dose of DAP (Di-ammonium phosphate) and MOP (Muriate of potash) and half dose of nitrogen were applied at basal dose or at the time of planting and remaining nitrogen was uses in two equal split doses as a top dressing after one month of planting and remaining dose after two months of planting.

### **Application of organics**

The recommended dose of organic fertilizers like farmyard manure (FYM) and municipals solid waste compost (MSWC) were applied before fifteen days of runners planting. As per treatment combinations, the calculated quantities of organics were applied in the experimental plots.

### **Planting of runners**

The strawberry runners were planted in evening on 10<sup>th</sup> November 2017-18 and 2018-19, respectively. Each plot contains five rows (rows were raised 15 cm from the ground level) and runners were planted at distance of 30 x 15 cm (4 runners in each row), accommodated 20 runners in each plot. After this, water can run in either direction in the



**Fig. Showing the preparation of research field (2017)**



**Fig. Showing the preparation of research field (2018)**

**Plate 1: General view of field preparation (2017-18 and 2018-19)**

furrows between the beds. The remaining solutions of bio-inoculant were mixed with irrigation water according to various treatments combinations.

### **Irrigation**

The first irrigation was applied immediately after planting the runners and the subsequent irrigations were given at an interval of 7-10 days during winter season and 4-5 days during summer season and optimum soil moisture was maintained in the field trial throughout the raising of experiment.

### **Intercultural operation**

The regular weeding and hoeing were done to keep clean of beds. It was done after light irrigation in order to loosen the soil which facilitates weeding and hoeing. Manually weeding and hoeing were done with the help of hand hoe and khurpi. Generally four to five weeding and hoeing were done during the experiment.

### **Mulching**

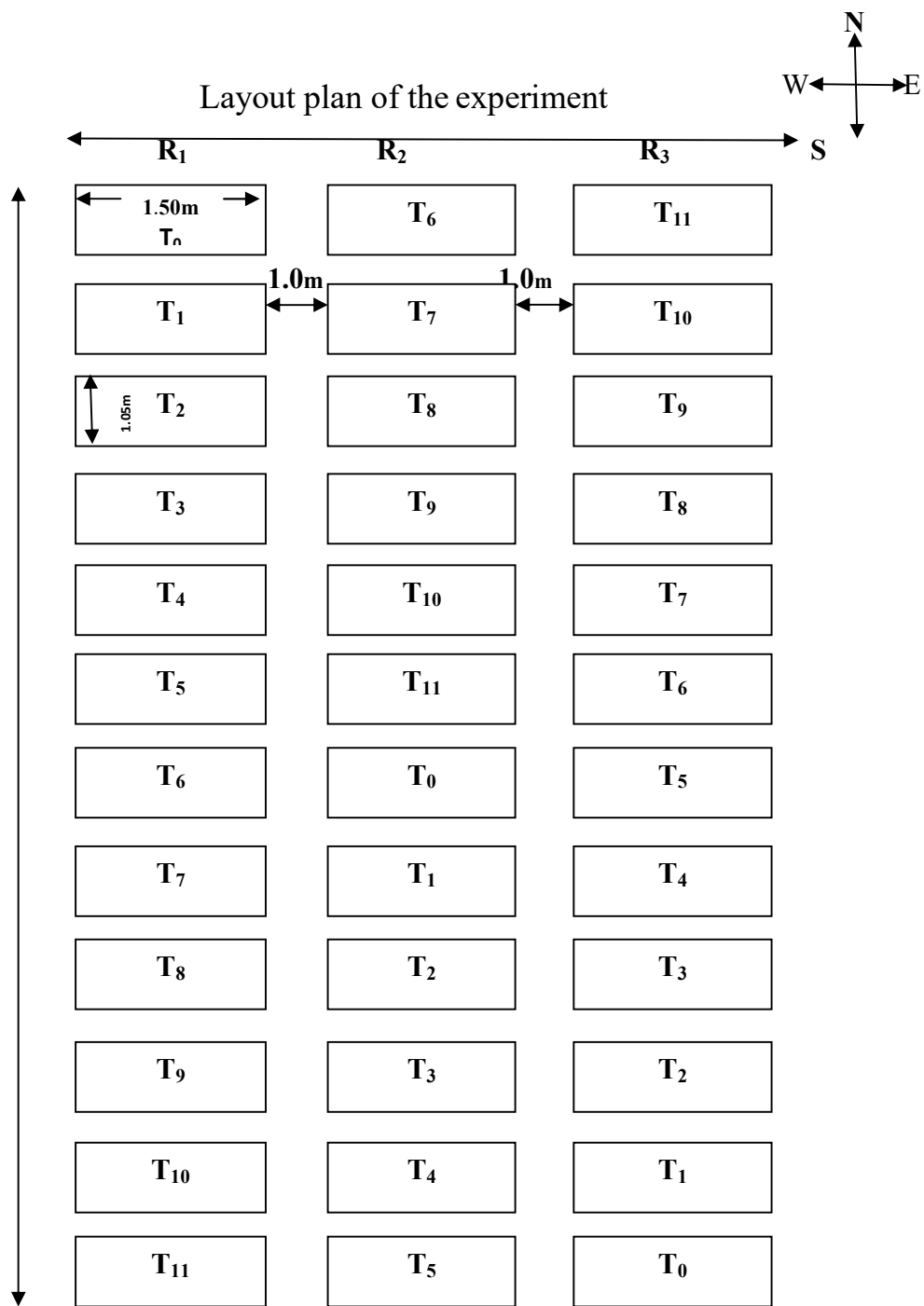
Mulching with paddy straw was done to conserve the soil moisture, maintain soil temperature during peak winter, prevent fruits rotting, prevent weed infestation and obtain better quality of fruits.

### **Plant protection measures**

The experimental field was infested with white ants and termites. For its controlling application of chlorpyrifos 20% EC at the time of irrigation to control effectively from pest. Carbaryl @ 0.15% was foliar spray to control strawberry caterpillars. The diseases symptoms show of wilting and drying of whole plant within 45 days after planting from near the rhizospheric soil. Blitox @ 0.25% and bavistin @ 0.2% were also sprayed alternatively at the initial stages of growth to protect from fungal diseases.

### **Lay out of an experiment**

Research field was divided into 36 plots having the gross plot size of 1.5 m x 1.05m and arranged in the three replications of 12 plots. The experiment was laid out in randomized block design than 12 treatments as depicted in Fig.3.1.



### Location of an experiment

Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow-226025.

### Programme of work

The details of materials were used and procedures followed during the course of investigation are mentioned below:

**Variety used:** Chandler

**Source of NPK:** (Urea, DAP and MOP) from local market

**Source of bio-inoculant and organics:** Phosphate solubilizing bacteria (PSB) ICAR-CSSRI, Regional Research Station, Lucknow, U.P., India.

**Strawberry Runners:** ICAR-CITH, Srinagar (J&K)

Components	Treatments	Doses
Inorganic manures	Nitrogen	100 % of RDF*
		75 % of RDF
		50 % of RDF
	Phosphorus	100 % of RDF
		75 % of RDF
		50 % of RDF
	Potash	100 % of RDF
		75 % of RDF
		50 % of RDF
Organic manures/ Organics	Farmyard manure (FYM)	20 t/ha
	Municipal solid waste compost (MSWC)	10 t/ha
Bio-inoculant	Phosphate solubilizing bacteria (PSB)	Runners dip( $10^9$ cfu/ml)**

\***RDF:** Recommended dose fertilizers

\*\***cfu:** colony forming unit/ml

### **Details of treatments combination**

**T<sub>0</sub>** : Control (Without fertilizers, Organics, Bio-inoculant and mulching)

**T<sub>1</sub>** : 100% NPK + Mulch (Paddy straw)

**T<sub>2</sub>**: 75% NPK + Mulch (Paddy straw)

**T<sub>3</sub>** : 50% NPK + Mulch (Paddy straw)

**T<sub>4</sub>** : 75% NPK + FYM + Mulch (Paddy straw)

**T<sub>5</sub>** : 75% NPK + MSWC + Mulch (Paddy straw)

**T<sub>6</sub>** : 50% NPK + FYM + Mulch (Paddy straw)

**T<sub>7</sub>** : 50% NPK + MSWC + Mulch (Paddy straw)

**T<sub>8</sub>** : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant

**T<sub>9</sub>** : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant

**T<sub>10</sub>** : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant

**T<sub>11</sub>** : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant

### **Details of Experiment layout:**

Number of treatments	:	12
Replication	:	3
Total plots	:	36
Net plot size	:	1.20 m X 0.60 m
Gross plot size	:	1.50 m X 1.05 m
Row to Row distance	:	30 cm
Plant to plant distance	:	15 cm
Number of plants per row	:	4
Number of row per plot	:	5
Number of plants per plot	:	20
Total plants required for entire field	:	720
Recommended dose of fertilizers (N: P: K)	:	75-100: 80-120: 50-80 kg/ha
Design:	:	Randomized Block Design

## **Observations recorded during the experimentation.**

The following observations recorded up to last fruit picking from the respective plants under respective treatments replications wise.

### **A. Growth attributes**

#### **1. Height of plant (cm)**

Plant height of the five representative plants were recorded from ground level to terminal end of leaf with a measuring scale at 30, 45, 60, 75, 90, 105 and 120 DAP. The average height of the plants was calculated and subjected to statistical analysis and expressed in centimetre.

#### **2. Spread of plant (cm)**

The spreading of plant was observed in both directions North – South, East – West with the help of measuring scale at 30, 45, 60, 75, 90, 105 and 120 DAP and expressed in centimetre.

#### **3. Length of leaf (cm)**

The length of plant of five representative plants were recorded with the help of measuring scale and expressed in centimetre.

#### **4. Width of leaf (cm)**

The width of leaf of five representative plants were recorded with the help of measuring scale and expressed in centimetre.

#### **5. Leaf area (cm<sup>2</sup>)**

Five leaves from selected plant were taken and their area was measured with the leaf area meter. An average value leaf area of a single leaf is expressed in cm<sup>2</sup>.

#### **6. Length of petiole (cm)**

The length of petiole of five representative plants were recorded with the help of measuring scale and expressed in centimetre. The average was calculated and subjected to statistical analysis.

#### **7. Number of leaves per plant**

The number of fully opened leaves was counted from the five representative plants at each successive stage of growth *i.e.* 30, 45, 60, 75, 90, 105 and 120 DAP. The average was calculated and subjected to statistical analysis.

### **8. Days taken to first flowering**

The duration between the date of planting and the date of first flower opening was recorded for calculating the number of days to first flower.

### **9. Number of flowers per plant**

To determine the number of flowers/plant, total number of flowers at 10 days interval was recorded and average number of flowers/plant was calculated.

### **10. Length of pedicel (cm)**

The length of pedicel of five representative plants were recorded with the help of measuring scale and expressed in centimetre. The average was calculated and subjected to statistical analysis.

### **11. Days taken to first fruit set**

Number of days taken for first fruit set was calculated from date of flower opening till fruit was set from ten randomly selected plants. The average was worked out and denotes in days.

### **12. Number of fruits per plant**

To determine the number of fruits/plant, total numbers of fruits were recorded at 10 days interval and average number of fruits was calculated.

### **13. Percentage fruit setting/plant**

To determine the percent fruit setting, total numbers of flowers set divided by total numbers of fruits set at 10 days interval and average number of fruit setting/plant was denoted.

### **14. Duration of fruit harvesting**

The date of flower opening and picking of fruit was recorded and duration between the dates of flower opening and picking of fruit was worked out and expressed in days.

### **15. No. of runners/plant.**

The number of runners from five randomly selected plants was recorded of each treatment, after harvesting last flush of fruit and denotes as average number of runners/plant.



**Flowering and fruiting view of research field (2017-18)**



**Flowering and fruiting view of research field (2018-19)**

**Plate 2: An over view of flowering and fruiting stages of crop (2017-18 and 2018-19)**

## **B. Physical and yield parameters**

### **1. Length of fruits (cm)**

The length of fruit was also measured with the help of digital vernier callipers and reading denotes in centimetre.

### **2. Diameter of fruits (cm)**

The diameter of fruit measured with the help of digital vernier callipers and reading denotes in centimetre.

### **3. Size of fruit (cm<sup>2</sup>)**

For measuring of fruit size, five fruits from each treatment were randomly selected and their length and diameter were multiplied and expressed in cm<sup>2</sup>.

### **4. Volume of fruit (ml)**

Fruit volume was measured by displacement water method with the help of measuring cylinder and expressed in cubic centimeter (cc).

### **5. Specific gravity of fruit**

It was determined by water displacement method as given below.

Specific gravity of fruit = Weight of fruit (g)/ Volume of displaced water by fruit (ml).

### **6. Fresh fruit weight (g)**

To know the fruit weight, the above selected ten fruits were weighed and the average weight of fruit was calculated and denoted in grams (g).

### **7. Dry fruit weight (g)**

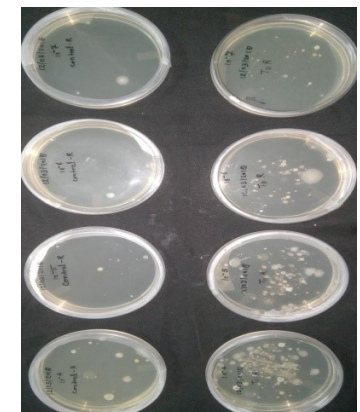
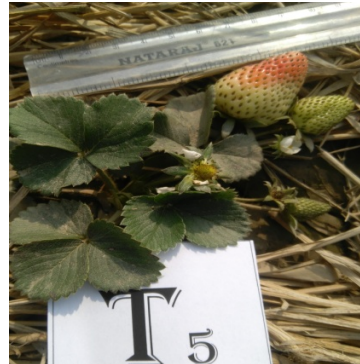
To know the dry weight fruit, ten fruits were weighed and the average fresh weight of fruits are store in oven for few days then after weight of dry fruit was calculated and expressed in grams (g).

### **8. Fruit yield per plant (g)**

The total amount of fruits produced per plant from respective treatment was weighed and recorded at the time of each harvesting and expressed as yield of fruits plant<sup>-1</sup> in grams (g).

### **9. Fruit yield plot<sup>-1</sup> (kg)**

The total amount of fruits produced per treatment in a plot was weighed and recorded at the time of each harvesting and denoted yield of fruits plot<sup>-1</sup> in kilograms (kg).



**Plate 3: Observations recorded on various parameters during the course of investigation**

## 10. Fruit yield ha<sup>-1</sup> (q)

The total amount of fruits produced from the area of the crop raising was weighed and recorded at the time of each harvesting. It was multiplied by the area of per ha in quintal (q).

### C. Bio-chemical parameters

#### 1. pH determination of fruit juice

The pH of the each fruit sample was measured with a digital pH meter. The pH meter was standardized against standard buffer solution before use. Fruit juice of each sample was taken in a clean beaker and its pH was recorded at room temperature.

#### 2. Total soluble solids (TSS °Brix).

The total soluble solids (TSS) were determined by using a digital refractometer. Before use, the refractometer was set at zero with distilled water. Pulp of five fruits were randomly selected and prepared composite sample and crushed for extracting the juice. The refractometer was wiped clear with a moist muslin cloth. A drop of fruit juice of crushed pulp was taken on prism of refractometer and the value was read against light. Values thus, obtained were expressed in degree brix (°Brix) (Saini *et al.*, 2001).

#### 3. Titratable acidity (%).

Titrate acidity (%) was determined by titration in terms of citric acid with NaOH 0.1 N where 10 ml of the sample was taken and dissolved to make up the volume to 100 ml with distilled water and filtered through muslin cloth. Taken 10 ml of this aliquot was titrated against 0.1 N NaOH using few drops of 1% phenolphthalein as indicator till the pink colour was appeared. Result was calculated as percent anhydrous citric acid as per formula given below.

$$\% \text{ acidity as anhydrous citric acid} = \frac{\text{Titre value} \times 0.0064 \times \text{volume made}}{\text{Aliquot taken (5ml)} \times \text{Weight of sample (10g)}}$$

#### 4. TSS/Acid ratio

TSS/acid ratio was calculated by dividing total soluble solids (TSS °Brix) by acidity.

#### 5. Ascorbic acid /vitamin C (mg/100g fresh fruit weight)

Taken 10 ml of fruit juice was made up to 100 ml with 3% HPO<sub>3</sub> and filtered. 10 ml aliquot was titrated against standard dye (2, 4- Dichlorophenol indophenols) to obtain

a pink colour was observed which persisted for at least 15 seconds. Ascorbic acid content was calculated by using following formula.

$$\text{Ascorbic (mg/100g)} = \frac{\text{Titer value X dye factor X volume made up}}{\text{Volume of extract X weight or volume of sample taken for estimation}} \times 100$$

### **6. Total Sugars (%)**

Twenty gram of fresh fruit pulp was thoroughly homogenized with distilled water in warring blender and volume was making 250 ml. To this solution, 5 ml of 10 percent sodium oxalate was added to precipitate the excess of lead acetate and filtered, 50 ml of the filtrate was taken and hydrolyzed by adding concentrated HCl and it was allowed to put overnight. The excess of HCl was neutralized with saturated NaOH solution. The hydrolyzed aliquot was taken in a burette and titrated against boiling solution containing 5 ml each of Fehling 'A' and Fehling 'B' using methyl blue as an indicator (A.O.A.C., 1980). The end point was indicated with the appearance of brick red colour and the total sugars (glucose equivalent) were worked out as grams of fresh weight of fruit pulp.

### **7. Reducing sugar (%)**

To determine the reducing sugar, taken 10 g of fresh fruit pulp was crushed with distilled water and filtered with muslin cloth and volume was make up 100 ml. From it 05 ml aliquot was taken with 5 ml Fehling solution 'A' and 'B' in 100 ml conical flask and was titrated against 1 % of glucose solution, while boiling by using methyl blue as indicator. The end point was marked by the appearance of brick red colour.

### **8. Non-reducing sugar (%)**

Non-reducing sugar was estimated by deducting of the quantity of reducing sugar from total invert sugar and multiplied by factor 0.95. The results were denoted as per cent for non-reducing sugar.

$$\text{Non-reducing sugar (\%)} = \text{Total sugars (\%)} - \text{reducing sugar (\%)} \times 0.95$$

### **9. Anthocyanin (mg/ 100 g)**

**Resents used:** 0.1NHCL

The anthocyanin was determined by the method as suggested by Rangana (1997). Dilute 10 ml of juice to 50 ml, with 0.1N HCl and allow equilibrating in the dark for one hour. Record the absorbance (O.D.) at 510 nm.



**Plate 4: An overall view of fruits of various treatments**

Total O.D./100ml = O.D. X Volume made up X 100 / ml of juice taken

Total anthocyanin (mg /100 ml) = Total O.D./100ml /87.3

#### **D. Soil parameters/properties**

The rhizospheric and non-rhizospheric soil samples up to 15 cm depth were composed from healthy strawberry plants in sterilized polythene bags with help of manually auger were taken to the laboratory for further studies. The samples were mixed uniformly and processed for the study of microbial population and analysis of physico-chemical properties.

##### **Analysis of soil samples**

The physico-chemical parameters of soil samples were analyzed at Central Laboratory, ICAR-Central Soil Salinity Research Institute, Regional Research Station, Lucknow.

##### **1. Soil moisture content (%)**

The soil moisture content was determined by drying the soil up to constant weight, at 105°C. Moisture content was calculated by using the below mentioned formula

$$\text{Moisture content (\%)} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Dry weight}} \times 100$$

##### **2. Temperature (°C)**

Soil temperature was measured with the help of soil thermometer from each plot during the experimental period.

##### **3. Soil pH**

Soil pH represents the acidity and alkalinity of the soil that influences the plant growth. For estimation of soil pH, the dried and sieved soil sample was taken. Soil: water suspension was made by taking 20 g of soil sample mixed with 40ml of distilled water and stirred for 30 min and thereafter the pH was measured with digital soil pH meter using glass electrode and the reading was recorded.

##### **Interpretation of soil pH**

<4.5	Very strongly acidic
4.5 – 5.5	Strongly acidic
5.5 – 6.5	Slightly acidic

7.0	Neutral
7.1 – 8.5	Slightly alkaline
8.5 – 10.0	Strongly alkaline
>10.0	Very strongly alkaline

#### 4. Electrical conductivity ( $\text{dS m}^{-1}$ )

The Electrical Conductivity (EC) of a solution is the measure the ability of the solution to conduct electricity. The electrical conductivity of soil was determined soil-water suspension by using digital EC meter. The clear supernatant of soil – water suspension of 1:2 (w/v) was used in electrical conductivity (EC) determination (**Jackson, 1973**). The EC is denoted in either milli-mhos per centimetre or equivalent deci-Siemens per meter.

#### 5. Organic carbon content (%)

Organic carbon content was determined by **Walkley and Black (1934)**. Taking 0.5g of soil sample in 500 ml capacity conical flask, 10 ml of 1N  $\text{K}_2\text{Cr}_2\text{O}_7$  was pipetted and slightly swirled the flask to disperse the soil, then 20 ml of concentrated  $\text{H}_2\text{SO}_4$  was added in the flask and it was swirled again for few minutes until the soil and the reagents were mixed absolutely. The flask was allowed to stand on insulating asbestos sheet for 30 minutes and then de-ionized water (200 ml) was added in the flask and followed by 3-4 drops of di-phenyl amine indicator and titrated with 0.5 N ferrous ammonium sulphate (FAS) solution  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$  till colour changes from blue-violet to green at end point. A blank was also run in the same manner without soil to standardize with  $\text{K}_2\text{Cr}_2\text{O}_7$ . Organic carbon content in soil was calculated using the following equation.

Organic carbon (%) =  $\frac{\text{ml (blank)} - \text{ml (sample)}}{\text{Normality of FAS} (0.03)} \times \text{wt. of dry soil}$

Where FAS = Normality of Ferrous Ammonium Sulphate

#### 6. Microbial properties (population)

Population of soil bacteria from respective experimental plots were estimated from rhizospheric zone soil of strawberry plants as described by Aneja (2007). The fresh soil samples were collected by fine brushing in sterile Petri dish. Soils sample from rhizosphere of plants (10 g) were thoroughly mixed in 90 ml of autoclaved distilled water

to make suspension. Soil suspension was kept for 30-60 min with periodic shaking. 1 ml of this suspension was added to 10 ml dilution vial and shaken. Serial dilution technique was performed up to  $10^{-7}$  dilution. An aliquot of this suspension was spread on nutrient agar (NA) plate and incubated for 24-48 h at 28-30°C for observing colonies developed on it.

### **Standard plate counting method**

To enumerate the bacterial population, standard plate count method was used. The number of viable bacterial cells per unit volume of a sample using agar plate media was enumerated. The inoculum sample was spread across the plate and the colonies that were formed after incubation were counted. The colonies are referred to as colony forming units (CFU). Once the CFUs are counted on the plate, they were divided by the volume plated to determine the concentration of cells in the sample.

## **7. Available N, P, K content (kg ha<sup>-1</sup>)**

### **7.1 Estimation of nitrogen content (kg ha<sup>-1</sup>)**

The available nitrogen content in soil was determined by the alkaline permanganate method (Subbiah and Asija, 1956). The 20 g of soil sample was taken into in 800 ml Kjeldahl flask and moistened with around 10 ml of distilled water. To this 100 ml of 0.32% KMnO<sub>4</sub> solution was added. To this 2 to 3 ml of paraffin liquid was added (avoid contact with upper part of neck of the flask). 20 ml of 2.5% boric acid containing mixed indicator was measured in a 250 ml conical flask and placed under the receiver tube. The end of the receiver tube was dipped in boric acid. 2.5% of 100 ml NaOH solution was added. Switched the heaters on and continue distillation until 100 ml of distillate is collected. The distillate was titrated against 0.01 N H<sub>2</sub>SO<sub>4</sub> until light red colour appeared. Blank was also run without soil following the same procedure.

$$\text{Available nitrogen (kg ha}^{-1}\text{)} = \frac{\text{Volume of blank} - \text{volume of titrate} \times 0.02 \times 1 \times 0.014 \times 2.24 \times 10^6}{2}$$

### **Soil rating of available N (kg ha<sup>-1</sup>)**

Low	< 280
Medium	280 – 560
High	> 560

## 7.2 Estimation of available phosphorus (kg ha<sup>-1</sup>)

Available P content in the soil was estimated following the using Olsen's extractant (0.5M NaHCO<sub>3</sub> of pH 8.5)

### Procedure of estimation

Two gram of soil sample was weighed into a 150 ml conical flask. To this added 40 ml of Olsen's extractant and a pinch of charcoal. The contents were shaken for 30 min and then filtered through Whatman No. 42 filter paper. Five ml of extract was pipette into 25 ml volumetric flask and a drop of P nitro phenol was added. The content was acidified with 2.5 M H<sub>2</sub>SO<sub>4</sub> and then 4 ml of ascorbic acid reagent was added and volume was made to 25ml with distilled water. The content was shaken properly and the intensity of its blue colour (absorbance) with spectrophotometer after 10 minutes at 680 nm wave length. Incorporated the absorbance value in the standard graph and obtain the concentration of P in the coloured solution.

Available phosphorus (kg ha<sup>-1</sup>) =  $\mu\text{g P in the aliquot} / \text{vol. of aliquot} + 1 / \text{wt. of soil taken}$

### Soil ratings for available phosphorus (kg ha<sup>-1</sup>)

Low	< 10
Medium	10 – 19
High	> 20

## 7.3 Estimation of available potassium (kg ha<sup>-1</sup>)

Five gram soil sample was shaken properly for 30 min with 25 ml of 1N ammonium acetate and then immediately filtered through filter paper. Potassium concentration in the extract was determined with flame photometer. The calibration was done by solution of different concentration (10, 15 and 40 ppm) of potassium.

Available potassium (kg ha<sup>-1</sup>) =  $X \text{ ppm} \times \text{vol. of the extract} / \text{wt. of soil taken} + 2.24 \times 10^6 / 10^6$

X ppm = Concentrations of K in the soil extract

Volume of the extract = 25ml

Weight of soil = 5g

### Soil ratings for available potassium (kg ha<sup>-1</sup>)

Low	< 108,	Medium	108-280,	High	> 280
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### Statistical analysis

The data collected on various parameters of the crops during two consecutive years during the course of investigation were subjected that to statistical analysis as described by **Panse and Sukhatme (1985)**. The significant effect of treatment was judged with the help of 'F' (variance ratio) table. The significant differences between the means were tested against the critical difference at 5% probability level.

### Analysis of variance (ANOVA)

Analysis of variance for all the treatments in Randomized Block Design (RBD) was carried out. For testing the hypothesis the following ANOVA table 3.3 was used.

Source of Variation	d. f.	S.S.	M.S.S.	F (value)	
				F. cal	F. tab at 5%
Due to replication	(r-1)	SSR	SSR /SSR(r-1)	MSSR/ MESS	F(r-1)
Due to treatments	(t-1)	SSTr	MSSTr/ SSTr (t-1)	MSSTr/ MESS	F (t-1)
Due to error	(r-1) (t-1)	SSE	MESS / SSE (r-1) (t-1)	MESS	F(t-1) (r-1)
Total	(rt-1)	TSS	-	-	-

Where,

**d.f.** = Degrees of freedom

**t** = Number of treatments

**SSR** = Sum of squares due to replications

**SST** = Sum of squares due to treatments

**MSSR** = Mean sum of squares due to replications

**MSSTr** = Mean sum of squares due to treatment

**C.D. (5%)** = SE (d) ×  $t_{0.05}$  error d.f.

**r** = Number of replication

**SS** = Sum of squares

**ESS** = Error sum of squares

**TSS** = Total sum of squares

**SE (m)**  $\pm = \sqrt{M_e / r}$

**SE (d)**  $\pm = \sqrt{2M_e / r}$

The significance and non-significance treatment effect was judged with the help of 'F' variance ratio test. 'F' calculated value was compared with the table value of 'F' at 5% levels of significance. If calculated value exceeds from the table value, the effect was considered to be significant. The significance difference between the means was tested critical difference (CD) at 5% level of significance.

### EXPERIMENTAL FINDINGS

The present investigation entitled “Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh” was carried out during 2017-18 and 2018-19. The experiment was conducted at the Horticulture Research Farm of the Department of Horticulture, School of Agriculture Science and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow (UP), India. The observations of vegetative growth, flowering, fruit yield, fruit quality parameters and soil parameters/properties of strawberry were analyzed statistically and presented in this chapter under following headings and subheadings. Each character of strawberry was described in light of data presented in Tables and graphically illustrated.

#### 4.1 Growth and floral characters

##### 4.1.1 Plant height (cm) at 30 DAP

Plant height at 30 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.1 and graphically illustrated in fig. 4.1.1.

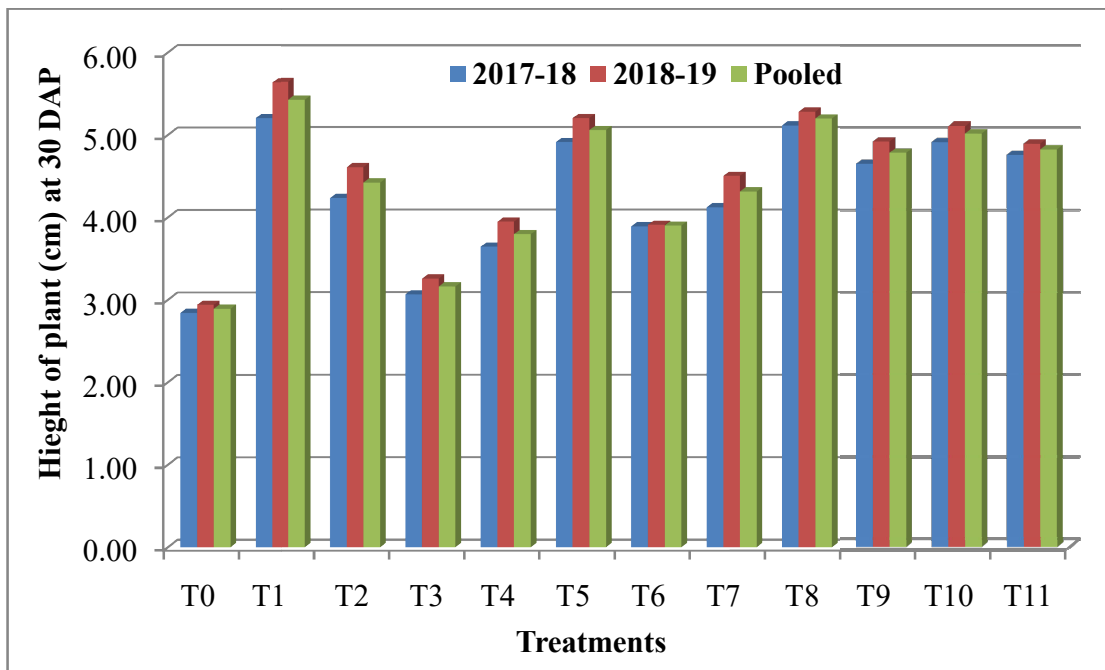
During 2017-18, maximum plant height (5.21 cm) was recorded with T<sub>1</sub> and followed by T<sub>8</sub> (5.11 cm), T<sub>5</sub> and T<sub>10</sub> (4.91 cm). However, T<sub>1</sub> and T<sub>8</sub> were found statistically at par with each other. Lowest plant height (2.84 cm) was recorded under T<sub>0</sub> (control).

During 2018-19, maximum plant height (5.64 cm) was recorded with T<sub>1</sub> and followed by T<sub>8</sub> (5.28 cm) and T<sub>2</sub> (5.20 cm). Also of, T<sub>1</sub> was found statistically at par with T<sub>8</sub>. Minimum (2.94 cm) plant height was noted in T<sub>0</sub> (control).

As far as the plant height pooled data values are significantly observed to be the highest (5.42 cm) in T<sub>1</sub> as compared to other treatments except T<sub>8</sub> (5.28 cm) and minimum plant height (2.89 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.1. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 30 DAP in strawberry.**

Treatments	Year		Pooled
	2017 -18	2018-19	
T <sub>0</sub> :Control	2.84	2.94	2.89
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	5.21	5.64	5.42
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	4.23	4.60	4.42
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	3.06	3.26	3.16
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	3.64	3.95	3.79
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	4.91	5.20	5.06
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	3.89	3.91	3.90
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	4.12	4.50	4.31
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	5.11	5.28	5.19
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	4.65	4.91	4.78
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	4.91	5.11	5.01
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	4.75	4.89	4.82
CD at 5%	0.801	0.700	0.750
SEm±	0.271	0.237	0.254



**Fig. 4.1.1. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 30 DAP in strawberry.**

#### **4.1.2 Plant height (cm) at 45 DAP**

Plant height at 45 DAP of both years and pooled as subjective by different treatments combinations have been presented in table 4.1.2 and graphically illustrated in fig. 4.1.2.

In the year 2017-18, T<sub>1</sub> produced maximum (6.11 cm) plant height followed by T<sub>9</sub> (6.02 cm) and T<sub>11</sub> (5.99 cm). However, T<sub>9</sub> and T<sub>11</sub> were found statistically at par with each other. The lowest plant height (3.70 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, the highest (6.57) plant height was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (6.44 cm), and T<sub>11</sub> (6.23 cm). Notwithstanding of, T<sub>9</sub> was found statistically at par with T<sub>1</sub>. Minimum (3.87 cm) plant height was noted in T<sub>0</sub> (control).

Similar trend as the year 2018-19 was observed in pooled data regarding this character.

#### **4.1.3 Plant height (cm) at 60 DAP**

Data pertaining to the plant height at 60 DAP of both the years and pooled as prejudiced by different treatments combinations have been depicted in table 4.1.3 and graphically illustrated in fig. 4.1.3.

During the year 2017-18, the maximum plant height (7.34 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (6.46 cm), and T<sub>8</sub> (6.16 cm). However, T<sub>8</sub> was found statistically at par with T<sub>4</sub> (6.13 cm). The lowest plant height (4.07 cm) was recorded in T<sub>0</sub> (control).

Similar trend was also observed during 2018-19, maximum plant height (7.79 cm) was recorded again in T<sub>1</sub> and followed by T<sub>9</sub> (6.79 cm), and T<sub>4</sub> (6.46 cm). In spite of, T<sub>9</sub> was found statistically at par with T<sub>4</sub>. Minimum plant height (4.28 cm) was distinguished in T<sub>0</sub> (control).

Similar trend as the year 2018-19 was observed in pooled data regarding this character and presented in table 4.1.3.

**Table 4.1.2. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 45 DAP in strawberry.**

Treatments	Year		Pooled
	2017 - 18	2018 - 19	
T <sub>0</sub> :Control	3.70	3.87	3.78
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	6.11	6.44	6.27
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.29	5.46	5.38
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.98	5.31	5.14
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.30	5.64	5.47
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.79	6.08	5.93
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	4.91	5.34	5.12
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	4.90	5.56	5.23
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	5.89	6.22	6.05
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	6.02	6.57	6.29
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	5.81	6.14	5.98
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	5.99	6.23	6.11
CD at 5%	0.974	0.722	0.848
SEm±	0.330	0.244	0.287

**Table 4.1.3. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 60 DAP in strawberry.**

Treatments	Year		Pooled
	2017 -18	2018 -19	
T <sub>0</sub> :Control	4.07	4.28	4.18
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	7.34	7.79	7.57
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.55	5.66	5.61
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.86	5.03	4.94
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	6.13	6.46	6.30
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.87	6.20	6.03
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.88	6.22	6.05
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.67	5.84	5.76
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.16	6.39	6.27
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	6.46	6.79	6.63
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	5.88	6.15	6.01
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	6.03	6.33	6.18
CD at 5%	0.828	0.576	0.702
SEm±	0.281	0.195	0.238

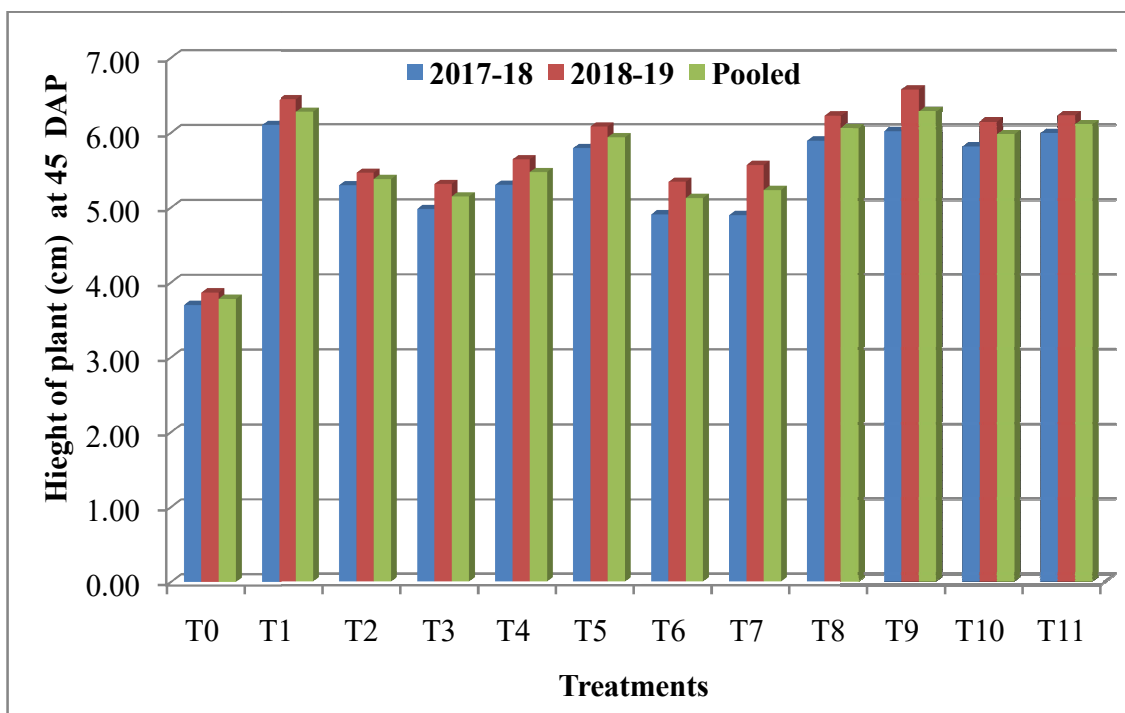


Fig. 4.1.2. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 45 DAP in strawberry.

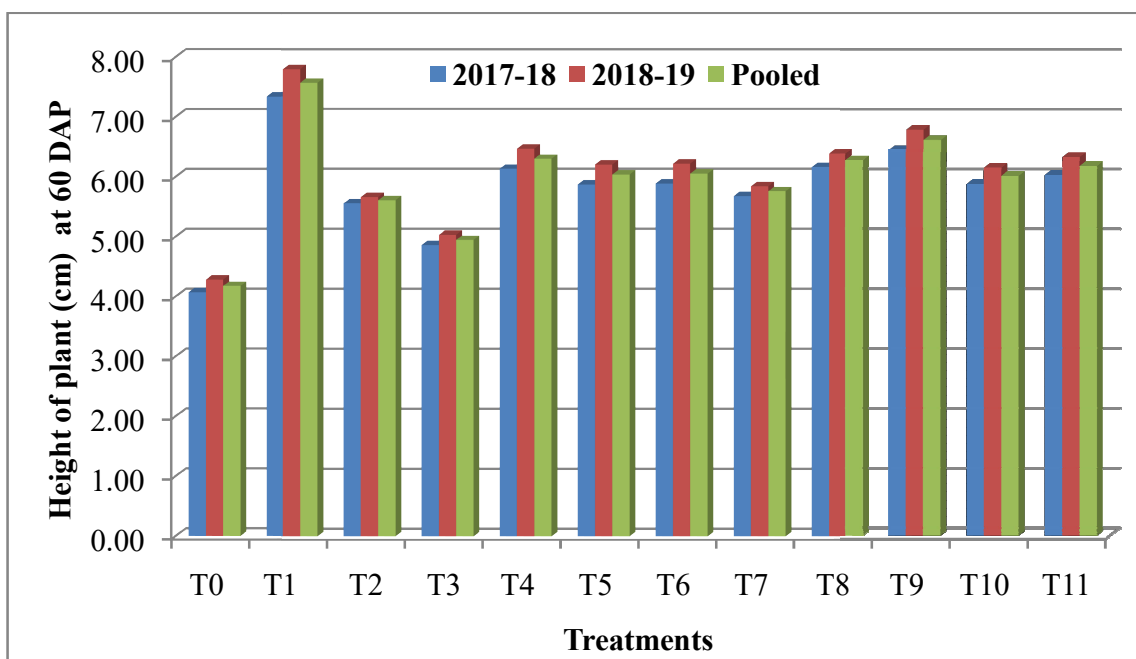


Fig. 4.1.3. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 60 DAP in strawberry.

#### **4.1.4 Plant height (cm) at 75 DAP**

Data pertaining to the plant heights at 75 DAP of both the years and pooled as prejudiced by different treatments combinations have been presented in table 4.1.4 and graphically illustrated in fig. 4.1.4.

In the year 2017-18, significantly the highest (8.09 cm) plant height was noted in T<sub>1</sub> and followed by T<sub>9</sub> (7.19 cm), and T<sub>2</sub> (7.06 cm). However, lowest plant height (4.84 cm) was recorded in T<sub>0</sub> (control).

Similar trend was observed in pooled data regarding this character and presented in table 4.1.4.

As far as the plant height pooled data values are significantly observed that the highest (8.36 cm) noted in T<sub>1</sub> and followed by T<sub>9</sub> (7.42 cm) as compared to other treatments and minimum plant height (4.95 cm) was recorded in T<sub>0</sub> (control).

#### **4.1.5 Plant height (cm) at 90 DAP**

Plant heights at 90 DAP of both years and pooled as subjective by different treatments combinations have been presented in table 4.1.5 and graphically illustrated in fig. 4.1.5.

In the year 2017-18, maximum plant height (9.08 cm) was recorded with T<sub>1</sub> and followed by T<sub>2</sub> (8.23 cm) and T<sub>9</sub> (7.37 cm). However, lowest plant height (5.54 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest plant height (10.08 cm) was recorded with T<sub>1</sub> and followed by T<sub>2</sub> (9.00 cm), and T<sub>4</sub> (8.36 cm). Minimum plant height (6.21 cm) was noted in T<sub>0</sub> (control).

As far as the pooled data of plant height values are significantly observed that the maximum noted in T<sub>1</sub> (9.58 cm) as compared to other treatments and the minimum (5.88 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.4. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 75 DAP in strawberry.**

Treatments	Year		Pooled
	2017 -18	2018 -19	
T <sub>0</sub> :Control	4.84	5.06	4.95
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	8.09	8.64	8.36
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.06	7.44	7.25
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	5.92	6.02	5.97
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	6.20	6.46	6.33
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.89	6.05	5.97
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.74	6.14	5.94
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.76	5.99	5.88
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.22	6.78	6.50
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	7.19	7.66	7.42
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	6.11	6.43	6.27
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	6.43	6.79	6.61
CD at 5%	0.970	0.366	0.668
SEm±	0.329	0.124	0.226

**Table 4.1.5. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 90 DAP in strawberry**

Treatments	Year		Pooled
	2017 -18	2018 -19	
T <sub>0</sub> :Control	5.54	6.21	5.88
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.08	10.08	9.58
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.23	9.00	8.62
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	6.18	7.51	6.84
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.18	8.36	7.77
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	6.10	7.27	6.69
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	6.32	7.37	6.84
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	6.27	6.94	6.61
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.34	7.73	7.04
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	7.37	8.23	7.80
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	6.49	7.49	6.99
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	6.86	7.26	7.06
CD at 5%	1.139	0.944	1.041
SEm±	0.386	0.320	0.353

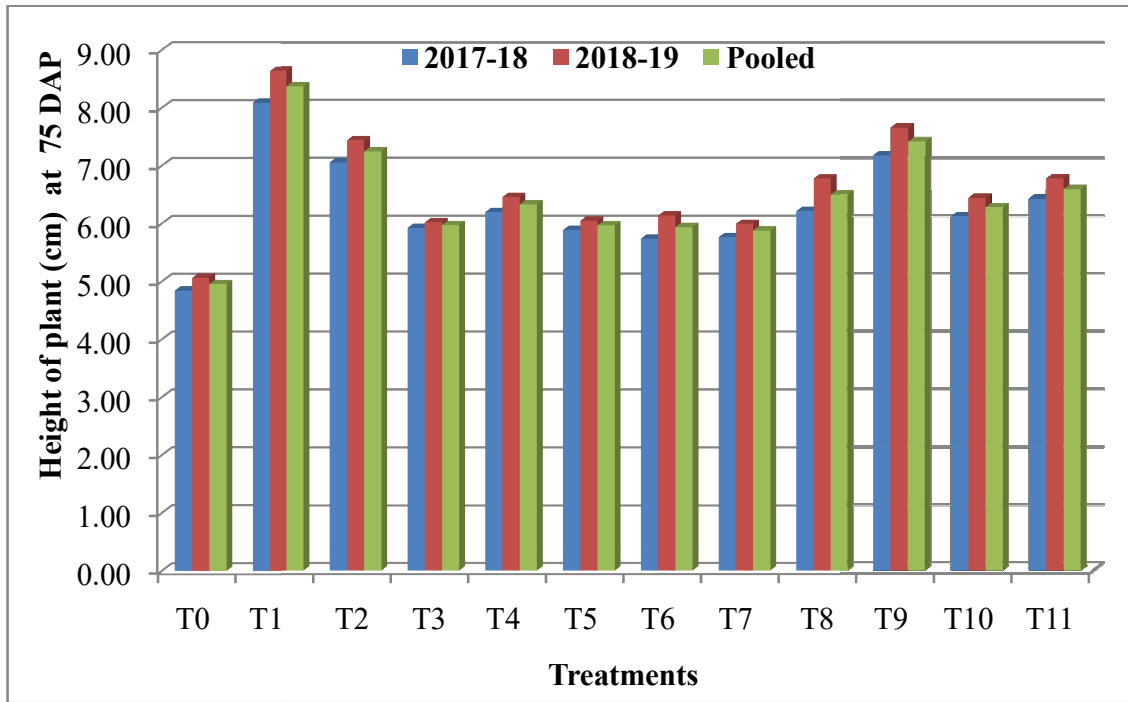


Fig. 4.1.4. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 75 DAP in strawberry.

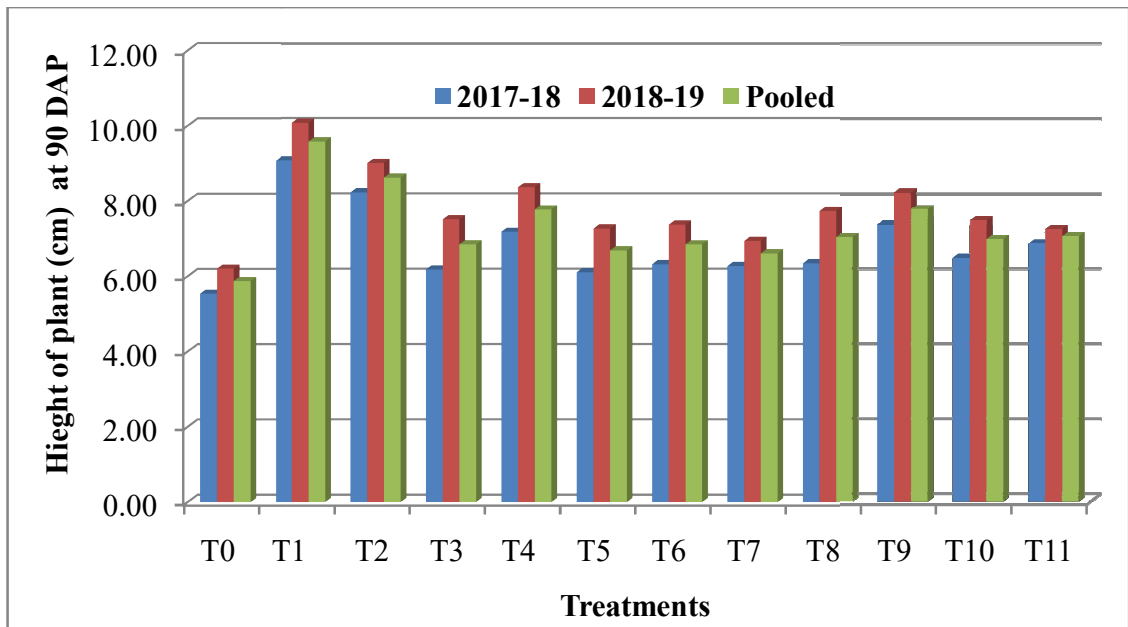


Fig. 4.1.5. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 90 DAP in strawberry.

#### **4.1.6 Plant height (cm) at 105 DAP**

Data pertaining to the plant heights at 105 DAP of both the years and pooled as prejudiced by different treatments combinations have been presented in table 4.1.6 and graphically illustrated in fig. 4.1.6.

During the year 2017-18, significantly the maximum plant height (10.08 cm) was noted in T<sub>1</sub> and followed by T<sub>9</sub> (10.07 cm), and T<sub>4</sub> (9.32 cm). However, lowest plant height (6.45 cm) was recorded in T<sub>0</sub> (control).

During the year 2018-19, significantly the maximum plant height (11.24 cm) was noted in T<sub>1</sub> and followed by T<sub>4</sub> (10.32 cm), and T<sub>9</sub> (10.11 cm). However, lowest plant height (7.15 cm) was recorded in T<sub>0</sub> (control).

Similar trend as the year 2018-19 was repeated in pooled data regarding this character and presented in table 4.1.6.

#### **4.1.7 Plant height (cm) at 120 DAP**

Data pertaining to the plant heights at 120 DAP of both the years and pooled as prejudiced by different treatments combinations have been presented in table 4.1.7 and graphically illustrated in fig. 4.1.7.

During the year 2017-18, significantly the highest plant height (11.52 cm) was noted in T<sub>1</sub> and followed by T<sub>9</sub> (10.77 cm), and T<sub>11</sub> (10.43 cm). Notwithstanding of T<sub>11</sub> was found statistically at par with T<sub>4</sub> (10.41 cm) and T<sub>10</sub> (10.20 cm). Lowest plant height (6.79 cm) was recorded in T<sub>0</sub> (control).

Similar trend was also observed during the year of 2018-19 regarding this character and presented in table 4.1.7.

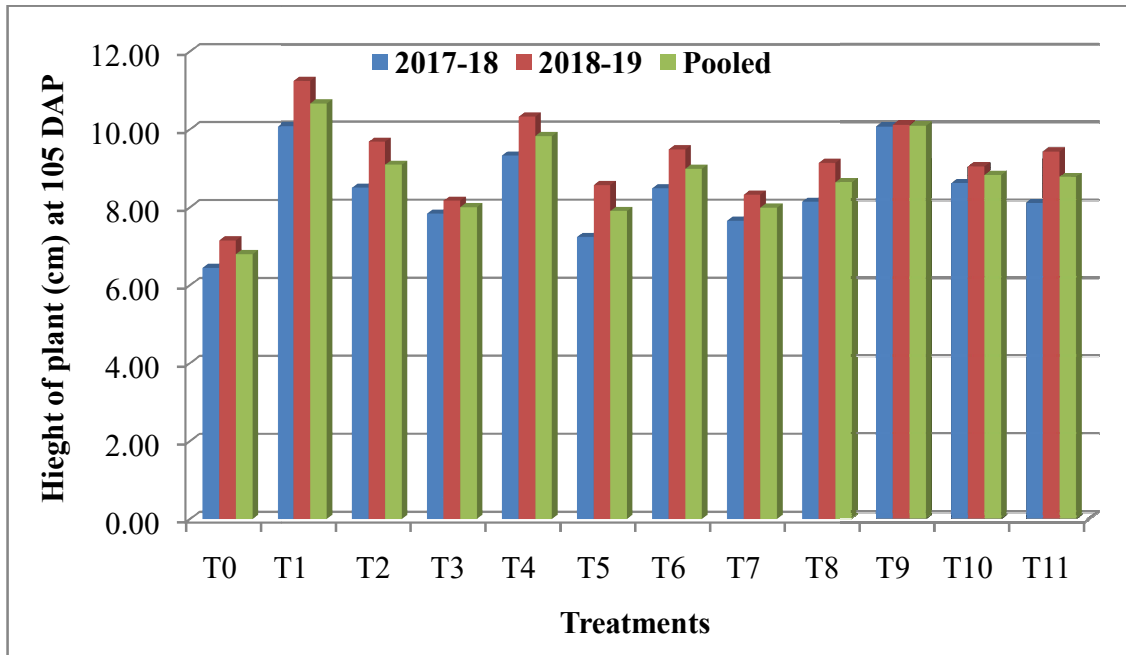
Similar trend was also repeated in pooled data regarding this character presented in table 4.1.7.

**Table 4.1.6. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 105 DAP in strawberry.**

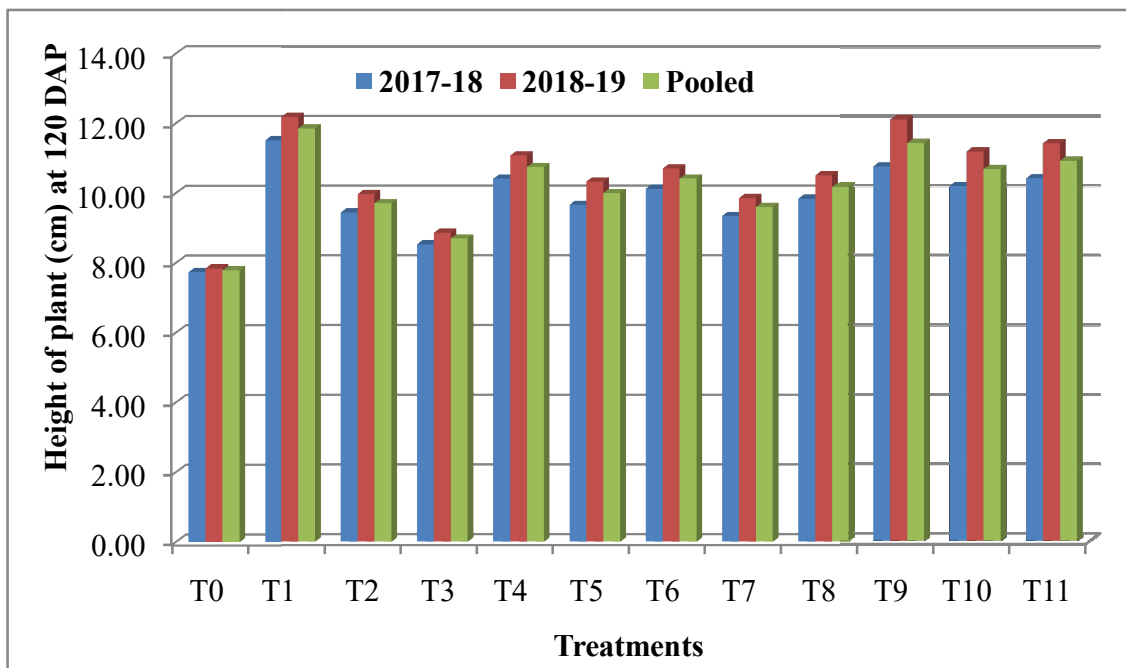
Treatments	Year		Pooled
	2017 -18	2018 -19	
T <sub>0</sub> :Control	6.45	7.15	6.80
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	10.08	11.24	10.66
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.50	9.68	9.09
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	7.83	8.17	8.00
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	9.32	10.32	9.82
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.23	8.57	7.90
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	8.48	9.48	8.98
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	7.65	8.32	7.99
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	8.14	9.14	8.64
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	10.07	10.11	10.09
T <sub>10</sub> : 50% NPK+ FYM + Mulch(Paddy straw) + Bio-inoculant	8.61	9.04	8.83
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	8.11	9.44	8.77
CD at 5%	1.783	1.494	1.638
SEm±	0.604	0.506	0.555

**Table 4.1.7. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 120 DAP in strawberry.**

Treatments	Year		Pooled
	2017 -18	2018 -19	
T <sub>0</sub> :Control	7.74	7.85	7.80
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	11.52	12.19	11.86
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	9.45	9.97	9.71
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	8.53	8.87	8.70
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	10.41	11.08	10.75
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.67	10.33	10.00
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	10.13	10.71	10.42
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	9.34	9.86	9.60
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	9.84	10.51	10.18
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	10.77	12.10	11.44
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	10.20	11.20	10.70
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	10.43	11.43	10.93
CD at 5%	1.408	0.825	1.116
SEm±	0.477	0.280	0.378



**Fig. 4.1.6. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 105 DAP in strawberry.**



**Fig. 4.1.7. Efficacy of organics, bio-inoculant and mulching on plant height (cm) at 120 DAP in strawberry.**

#### **4.1.8 Plant spread E-W (cm) at 30 DAP**

Plant spread at 30 days after planting (DAP) of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.8 and graphically illustrated in fig. 4.1.8.

During 2017-18, maximum plant spread (10.68 cm) was recorded with T<sub>1</sub> and it was significantly superior to other treatments like T<sub>6</sub> (10.31 cm), and T<sub>11</sub> (10.09 cm). Further it was found that T<sub>9</sub> (9.62 cm) was statistically at par with T<sub>4</sub> (9.58 cm) and T<sub>2</sub> (9.50 cm). Lowest (7.71 cm) plant spread was recorded under T<sub>0</sub> (control).

During 2018-19, maximum plant spread (10.66 cm) was recorded with T<sub>1</sub> and followed by T<sub>5</sub> (9.89 cm), and T<sub>10</sub> (9.86 cm). Minimum (7.98 cm) plant spread was noted in T<sub>0</sub> (control).

Similar trend as the year 2017-18 was observed in pooled data regarding this character and presented in table 4.1.8.

#### **4.1.9 Plant spread N-S (cm) at 30 DAP**

Plant spread at 30 days after planting (DAP) during both years and pooled as influenced by different treatments combinations have been presented in table 4.1.9 and graphically illustrated in fig. 4.1.9.

During 2017-18, maximum plant spread (10.34 cm) was recorded with T<sub>4</sub> and followed by T<sub>9</sub> (10.29 cm), and T<sub>1</sub> (10.23 cm). Further it was found that T<sub>1</sub> (10.23 cm) was statistically at par with T<sub>11</sub> (10.04 cm) and T<sub>8</sub> (9.49 cm). Lowest plant spread (7.67 cm) was recorded under T<sub>0</sub> (control).

During 2018-19, maximum plant spread (10.49 cm) was recorded with T<sub>1</sub> and followed by T<sub>4</sub> (10.17 cm), and T<sub>8</sub> (9.82 cm). Minimum plant spread (7.75 cm) was noted in T<sub>0</sub> (control).

Pooled data clearly show that maximum plant spread (10.36 cm) noted in T<sub>1</sub> and followed by T<sub>4</sub> (10.25 cm), and T<sub>9</sub> (9.95 cm). Further T<sub>9</sub> (9.95 cm) was found statistically at par with T<sub>11</sub> (9.89 cm), T<sub>8</sub> (9.65 cm) and T<sub>10</sub> (9.41 cm) and minimum plant spread (7.71 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.8. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 30 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	7.71	7.98	7.85
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	10.68	10.66	10.67
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	9.50	9.33	9.42
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.38	9.53	9.46
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	9.58	9.55	9.57
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.14	9.89	9.52
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	10.31	9.57	9.94
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.73	9.53	9.13
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	9.43	9.69	9.56
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	9.62	9.52	9.57
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	9.17	9.86	9.51
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	10.09	9.50	9.79
CD at 5%	0.721	0.687	0.704
SEm±	0.244	0.233	0.238

**Table 4.1.9. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 30 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	7.67	7.75	7.71
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	10.23	10.49	10.36
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	9.12	9.18	9.15
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	8.78	8.58	8.68
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	10.34	10.17	10.25
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.14	8.92	9.03
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	8.98	9.52	9.25
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.20	5.87	7.03
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	9.49	9.82	9.65
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	10.29	9.62	9.95
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	9.14	9.69	9.41
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	10.04	9.74	9.89
CD at 5%	0.512	1.342	0.927
SEm±	0.173	0.455	0.314

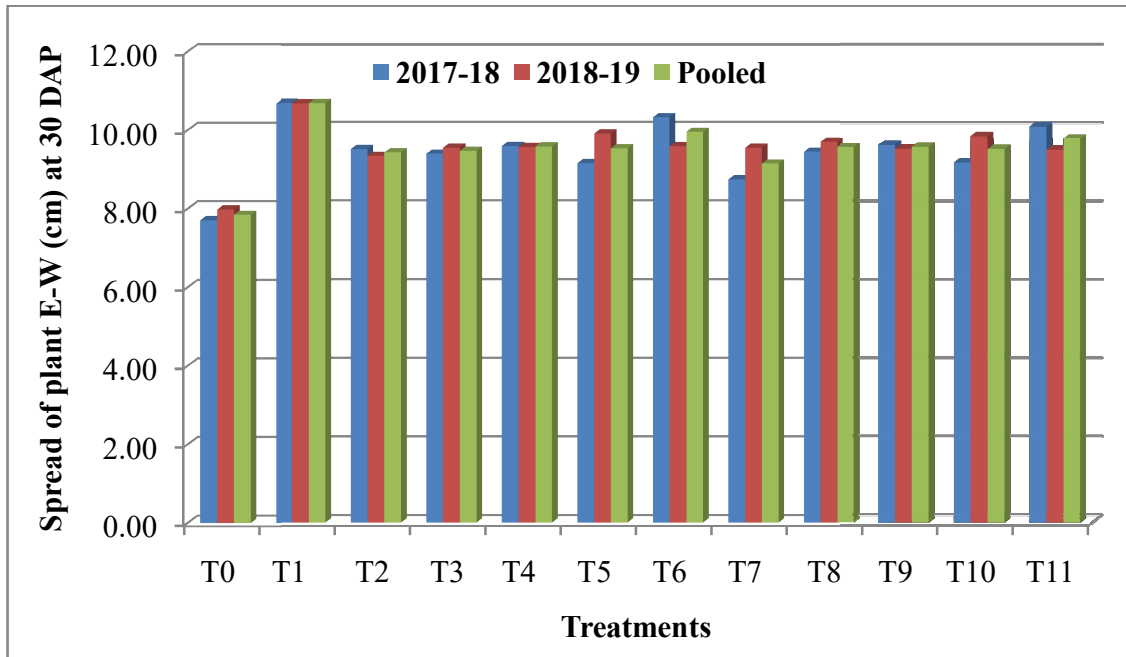


Fig. 4.1.8. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 30 DAP in strawberry.

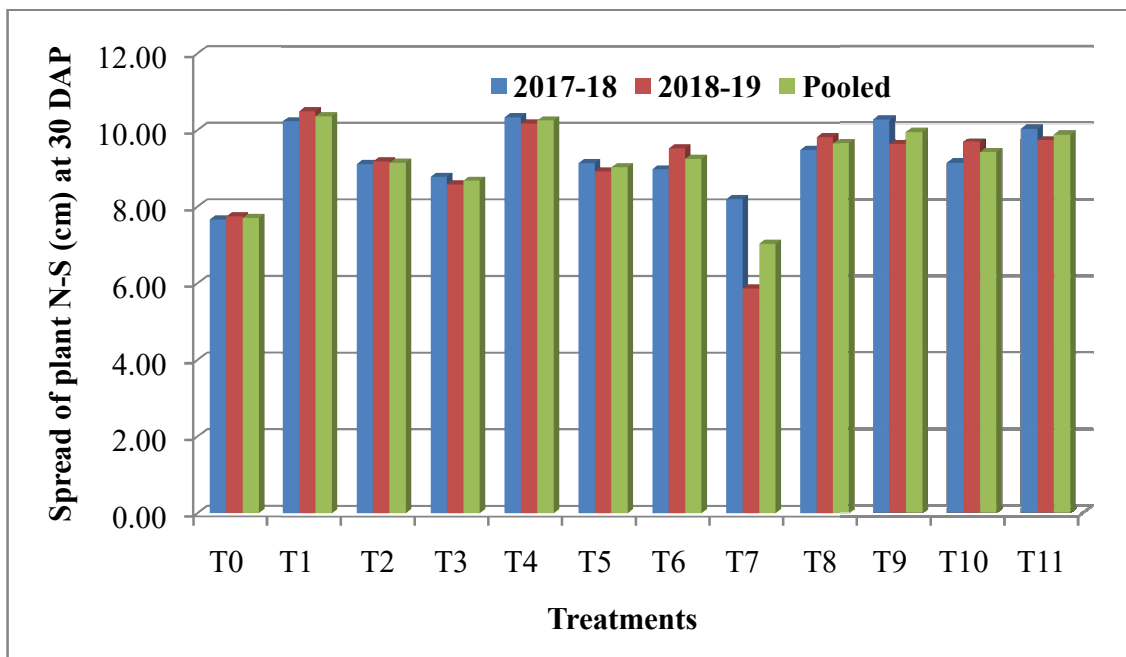


Fig. 4.1.9. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 30 DAP in strawberry.

#### **4.1.10 Plant spread E-W (cm) at 45 DAP**

Plant spread at 45 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.10 and graphically illustrated in fig. 4.1.10.

During 2017-18, maximum plant spread (11.77 cm) was recorded with T<sub>1</sub> and followed by T<sub>4</sub> (11.12 cm), and T<sub>6</sub> & T<sub>9</sub> (10.95 cm). Lowest plant spread (9.65 cm) was recorded under T<sub>0</sub>.

During 2018-19, maximum plant spread (12.80 cm) was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (12.53 cm), and T<sub>10</sub> (12.49 cm). Minimum (9.02 cm) plant spread was noted in T<sub>0</sub>.

Pooled data clearly show that maximum plant spread (12.15 cm) noted in T<sub>1</sub> and followed by T<sub>9</sub> (11.88 cm), and T<sub>4</sub> (11.54 cm). Further T<sub>9</sub> (9.95 cm) was found statistically at par with T<sub>11</sub> (11.50 cm), T<sub>7</sub> (11.20 cm) and T<sub>2</sub> (11.14 cm) and minimum plant spread (9.33 cm) was recorded in T<sub>0</sub>.

#### **4.1.11 Plant spread N-S (cm) at 45 DAP**

Plant spread at 45 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.11 and graphically illustrated in fig. 4.1.11.

During 2017-18, maximum plant spread (12.03 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (11.76 cm), and T<sub>7</sub> (11.57 cm). Lowest (8.09 cm) plant spread was recorded under T<sub>0</sub>(control).

During 2018-19, maximum plant spread (12.91 cm) was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (12.53 cm), and T<sub>5</sub> (12.25 cm). Minimum (8.93 cm) plant spread was noted in T<sub>0</sub>(control).

Pooled data clearly show that maximum plant spread (12.34 cm) noted in T<sub>9</sub> and followed by T<sub>1</sub> (12.28 cm), and T<sub>8</sub> (11.79 cm). Further T<sub>8</sub> (11.79 cm) was found statistically at par with T<sub>5</sub> (11.78 cm), T<sub>2</sub> (11.68 cm) and T<sub>7</sub> (11.79 cm) and minimum plant spread (8.92 cm) was recorded under T<sub>0</sub>(control).

**Table 4.1.10. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 45 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	9.65	9.02	9.33
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	11.77	12.53	12.15
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	10.46	11.82	11.14
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	10.94	10.00	10.47
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.12	11.96	11.54
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.73	10.68	10.20
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	10.95	10.32	10.63
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	10.90	11.51	11.20
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	9.39	12.38	10.89
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	10.95	12.80	11.88
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	9.39	12.49	10.94
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	10.70	12.30	11.50
CD at 5%	1.245	1.007	1.126
SEm±	0.422	0.341	0.381

**Table 4.1.11. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 45 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	8.90	8.93	8.92
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	12.03	12.53	12.28
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	11.54	11.82	11.68
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.55	9.54	9.54
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.52	11.79	11.66
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	11.30	12.25	11.78
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	9.72	10.32	10.02
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	11.57	11.51	11.54
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	11.42	12.15	11.79
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	11.76	12.91	12.34
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	10.65	11.10	10.87
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	11.32	11.46	11.39
CD at 5%	0.525	0.597	0.561
SEm±	0.178	0.202	0.190

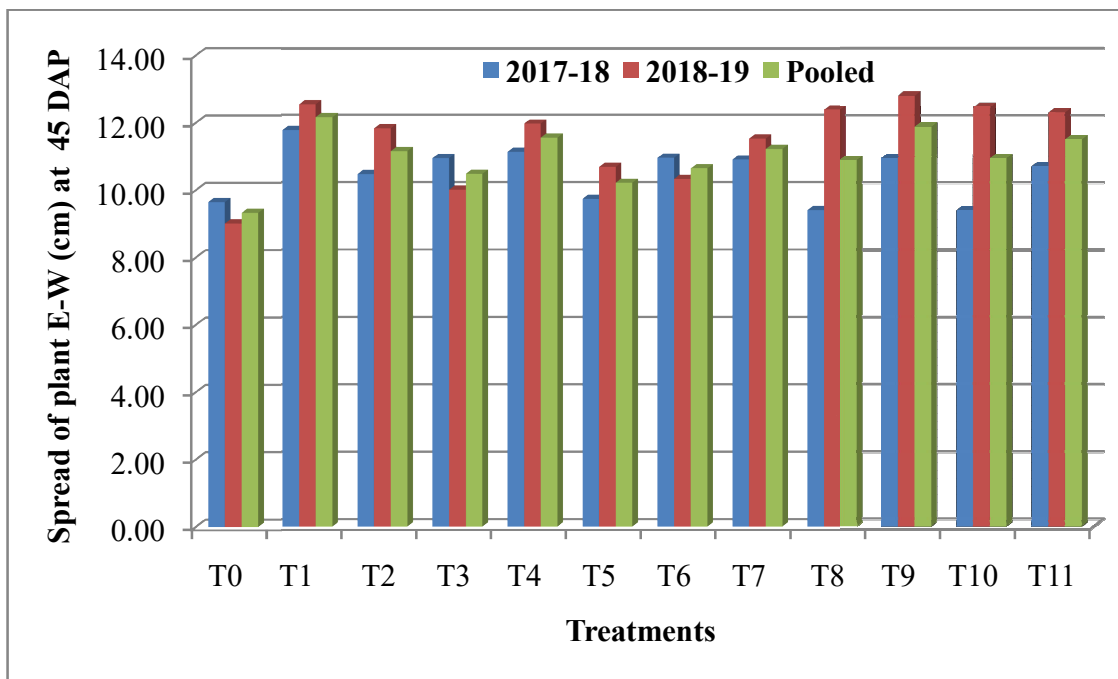


Fig. 4.1.10. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 45 DAP in strawberry.

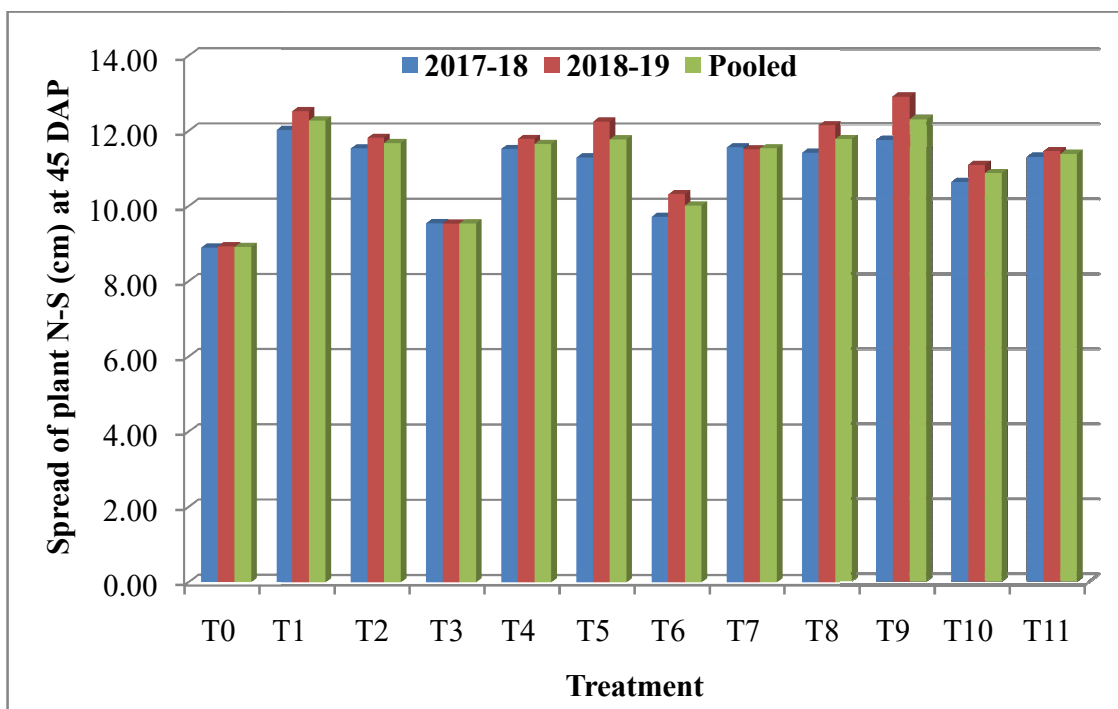


Fig. 4.1.11. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 45 DAP in strawberry.

#### **4.1.12 Plant spread E-W (cm) at 60 DAP**

Plant spread at 60 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.12 and graphically illustrated in fig. 4.1.12.

In the year 2017-18, highest plant spread (12.49 cm) was recorded with T<sub>1</sub> and followed by T<sub>7</sub> (12.44 cm) and T<sub>8</sub> (12.44 cm). Notwithstanding, T<sub>2</sub> was found statistically at par with T<sub>10</sub>, T<sub>5</sub> and T<sub>11</sub>. Lowest plant spread (9.67 cm) was recorded under T<sub>0</sub> (control).

In the year 2018-19, highest plant spread (13.55 cm) was recorded with T<sub>9</sub> and followed by T<sub>7</sub> (13.24 cm), and T<sub>1</sub> (13.15 cm). Notwithstanding, T<sub>5</sub> was found statistically at par with T<sub>6</sub>, T<sub>8</sub>, T<sub>10</sub> and T<sub>11</sub>. Minimum (9.81 cm) plant spread was noted in T<sub>0</sub> (control).

Pooled data clearly show that highest (12.84 cm) noted in T<sub>7</sub> and followed by T<sub>1</sub> (12.82 cm), and T<sub>9</sub> (12.68 cm). Further T<sub>8</sub> (12.35 cm) was found statistically at par with T<sub>5</sub> (12.24 cm), T<sub>10</sub> (12.09 cm) and T<sub>11</sub> (11.82 cm) and minimum plant spread (9.74 cm) was recorded in T<sub>0</sub> (control)

#### **4.1.13 Plant spread N-S (cm) at 60 DAP**

Plant spread at 60 DAP of both years are pooled as influenced by different treatments combinations. The data have been presented in table 4.1.13 and graphically illustrated in fig. 4.1.13.

In the year 2017-18, maximum (12.53 cm) plant spread was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (12.39 cm), and T<sub>8</sub> (12.18 cm). Notwithstanding, T<sub>7</sub> was found statistically at par with T<sub>10</sub>, T<sub>5</sub> and T<sub>11</sub>. Lowest (9.59 cm) plant spread was recorded under T<sub>0</sub> (control).

In the year 2018-19, highest (13.49 cm) plant spread was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (13.15 cm), and T<sub>5</sub> (12.69 cm). Also T<sub>8</sub> was found statistically at par with T<sub>7</sub>, T<sub>10</sub>, T<sub>11</sub> and T<sub>4</sub>. Minimum (9.18 cm) plant spread was noted in T<sub>0</sub> (control).

Similar trend as the year 2017-18 was observed in pooled data regarding this character.

**Table 4.1.12. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 60 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	9.67	9.81	9.74
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	12.49	13.15	12.82
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	12.17	11.79	11.98
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	11.06	10.80	10.93
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.26	11.95	11.61
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	11.78	12.69	12.24
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	11.12	12.29	11.71
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	12.44	13.24	12.84
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.44	12.25	12.35
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	11.80	13.55	12.68
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.97	12.21	12.09
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	11.47	12.16	11.82
CD at 5%	0.948	0.957	0.952
SEm±	0.321	0.324	0.322

**Table 4.1.13. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 60 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	9.59	9.18	9.38
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	12.39	13.15	12.77
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	11.26	11.40	11.33
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	10.10	10.35	10.23
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.50	11.96	11.73
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	11.82	12.69	12.25
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	10.70	11.17	10.94
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	12.13	12.42	12.27
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.18	12.67	12.43
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	12.53	13.49	13.01
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.94	12.19	12.06
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	11.65	12.07	11.86
CD at 5%	0.474	0.479	0.476
SEm±	0.161	0.162	0.161

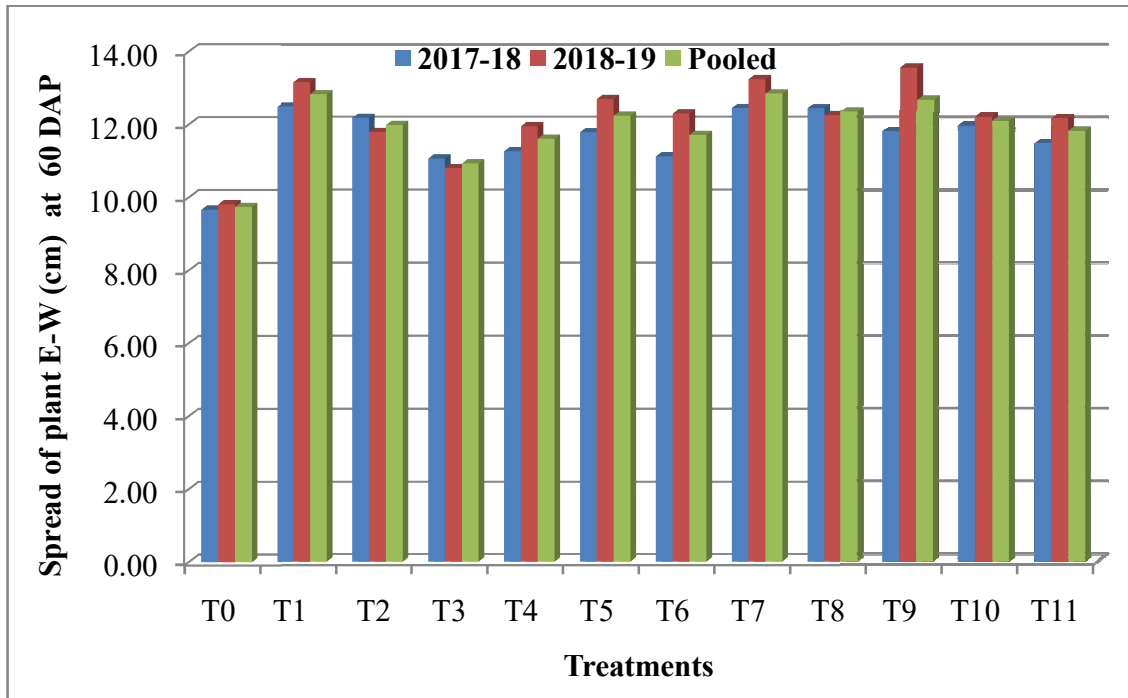


Fig. 4.1.12. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 60 DAP in strawberry.

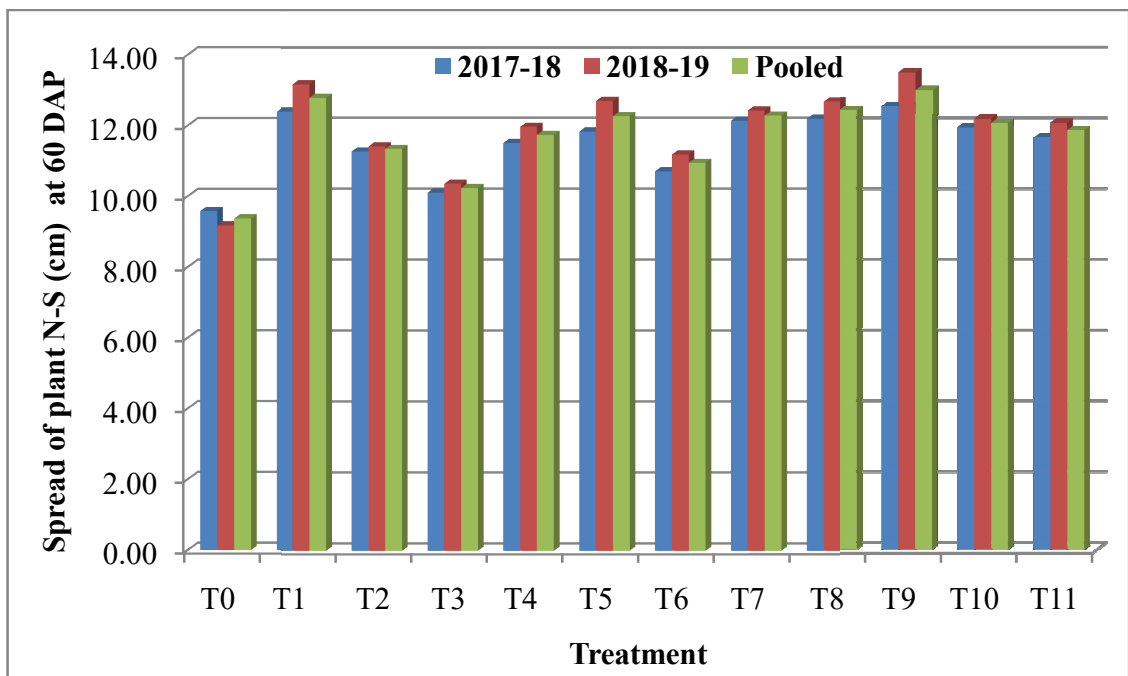


Fig. 4.1.13. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 60 DAP in strawberry.

#### **4.1.14 Plant spread E-W (cm) at 75 DAP**

Plant spread at 75 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.14 and graphically illustrated in fig. 4.1.14.

During 2017-18, maximum (13.69 cm) plant spread was recorded with T<sub>1</sub> and followed by T<sub>4</sub> (13.35 cm), and T<sub>5</sub> (13.15 cm). Lowest (10.23 cm) plant spread was recorded under T<sub>0</sub>(control).

During 2018-19, maximum (13.84 cm) plant spread was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (13.83 cm), and T<sub>6</sub> (13.26 cm). Minimum (9.71 cm) plant spread was noted in T<sub>0</sub>(control).

Pooled data showed that maximum (13.77 cm) was noted in T<sub>1</sub> and followed by T<sub>8</sub> (13.41 cm), and T<sub>5</sub> (13.13 cm). T<sub>6</sub> (13.03 cm) was found statistically at par with T<sub>11</sub> (12.91 cm), T<sub>4</sub> (12.90 cm) and T<sub>9</sub> (12.85 cm) and minimum plant spread (9.97 cm) was recorded in T<sub>0</sub>(control).

#### **4.1.15 Plant spread N-S (cm) at 75 DAP**

Plant spread at 75 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.15 and graphically illustrated in fig. 4.1.15.

During 2017-18, maximum plant spread (13.81 cm) was recorded with T<sub>4</sub> and followed by T<sub>8</sub> (13.66 cm), and T<sub>9</sub> (13.61 cm). Notwithstanding, T<sub>1</sub> was found statistically at par with T<sub>11</sub>, T<sub>5</sub> and T<sub>6</sub>. Lowest plant spread (9.87 cm) was recorded under T<sub>0</sub>(control).

During 2018-19, maximum plant spread (13.80 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (13.64 cm), and T<sub>7</sub> (13.64 cm). Notwithstanding, T<sub>4</sub> was found statistically at par with T<sub>8</sub>, T<sub>6</sub> and T<sub>11</sub>. Minimum (9.60 cm) plant spread was noted in T<sub>0</sub> (control).

Pooled data clearly that maximum (13.72 cm) noted in T<sub>4</sub> and followed by T<sub>1</sub> (13.66 cm), and T<sub>9</sub> (13.63 cm). T<sub>8</sub> (13.57 cm) was found statistically at par with T<sub>11</sub> (12.96 cm), T<sub>6</sub> (12.94 cm) and T<sub>7</sub> (12.88 cm) and minimum plant spread (9.73 cm) was recorded in T<sub>0</sub>(control).

**Table 4.1.14. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 75 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	10.23	9.71	9.97
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	13.69	13.84	13.77
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	11.76	12.08	11.92
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	12.23	12.41	12.32
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	13.35	12.46	12.90
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	13.15	13.12	13.13
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	12.79	13.26	13.03
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	12.94	12.92	12.93
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.99	13.83	13.41
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	12.86	12.83	12.85
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	12.94	12.53	12.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	12.64	13.17	12.91
CD at 5%	1.253	1.027	1.140
SEm±	0.425	0.348	0.386

**Table 4.1.15. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 75 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	9.87	9.60	9.73
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	13.52	13.80	13.66
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	11.56	12.08	11.82
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	10.42	10.75	10.58
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	13.81	13.63	13.72
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	12.50	11.46	11.98
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	12.49	13.38	12.94
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	12.12	13.64	12.88
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	13.66	13.48	13.57
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	13.61	13.64	13.63
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	12.04	12.46	12.25
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	12.66	13.27	12.96
CD at 5%	0.728	0.717	0.722
SEm±	0.247	0.243	0.245

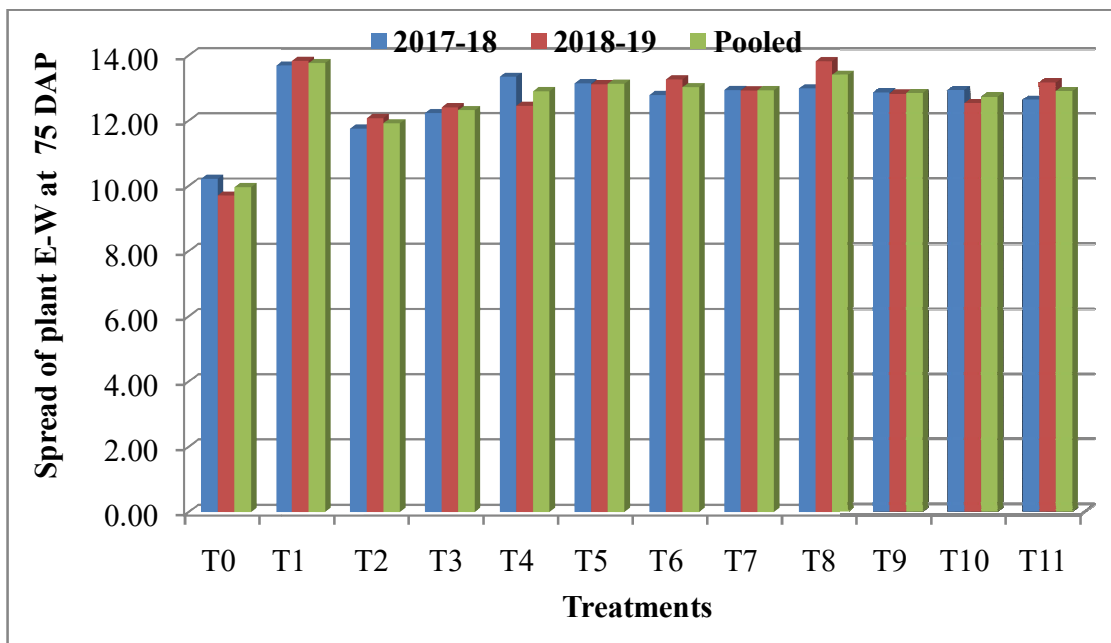


Fig. 4.1.14. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 75 DAP in strawberry.

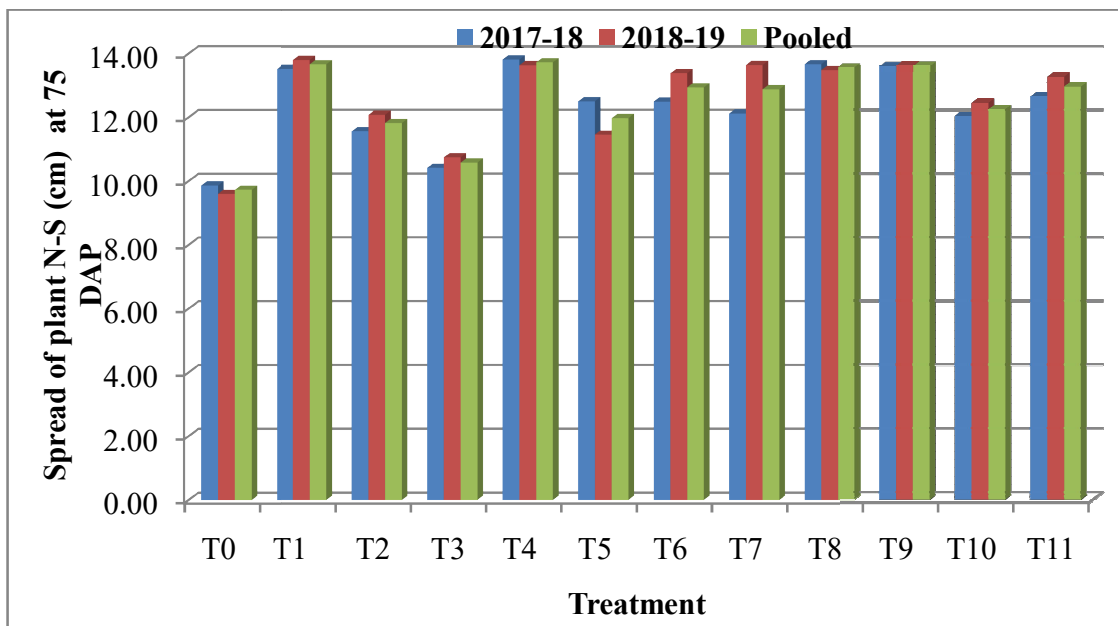


Fig. 4.1.15. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 75 DAP in strawberry.

#### **4.1.16 Plant spread E-W (cm) at 90 DAP**

Plant spread at 90 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.16 and graphically illustrated in fig. 4.1.16.

During 2017-18, highest (14.70 cm) plant spread was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (14.25 cm), and T<sub>11</sub> (14.25 cm). Notwithstanding, T<sub>7</sub> was found statistically at par with T<sub>10</sub>, T<sub>8</sub> and T<sub>4</sub>. Lowest (10.80 cm) plant spread was recorded under T<sub>0</sub> (control).

During 2018-19, maximum (15.10 cm) plant spread was recorded with T<sub>9</sub> and followed by T<sub>10</sub> (14.84 cm), and T<sub>6</sub> (14.79 cm). Notwithstanding, T<sub>11</sub> was found statistically at par with T<sub>4</sub>, T<sub>8</sub> and T<sub>7</sub>. Minimum (10.20 cm) plant spread was noted in T<sub>0</sub> (control).

Pooled data clearly that maximum (14.90 cm) noted in T<sub>9</sub> and followed by T<sub>10</sub> (14.52 cm), and T<sub>11</sub> (14.48 cm). T<sub>8</sub> & T<sub>7</sub> (14.40 cm) were found statistically at par with T<sub>1</sub> (14.36 cm), T<sub>6</sub> (14.10 cm) and T<sub>3</sub> (13.73 cm) and minimum plant spread (10.50 cm) was recorded in T<sub>0</sub> (control).

#### **4.1.17 Plant spread N-S (cm) at 90 DAP**

Plant spread at 90 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.17 and graphically illustrated in fig. 4.1.17.

In the year 2017-18, maximum plant spread (14.70 cm) was recorded with T<sub>9</sub> and followed by T<sub>1</sub> and T<sub>11</sub> (14.25 cm). Minimum plant spread (10.67 cm) was noted in T<sub>0</sub> (control).

In the year 2018-19, maximum plant spread (15.10 cm) was recorded with T<sub>9</sub> and followed by T<sub>8</sub> (14.96 cm), and T<sub>11</sub> (14.70 cm). Notwithstanding, T<sub>4</sub> was found statistically at par with T<sub>10</sub>, T<sub>1</sub> and T<sub>7</sub>. Minimum plant spread (10.07 cm) was noted in T<sub>0</sub> (control).

Similar trend was observed in pooled data regarding this character which presented in table 4.1.17

**Table 4.1.16. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 90 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	10.80	10.20	10.50
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	14.25	14.47	14.36
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	13.31	14.14	13.72
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	13.30	14.16	13.73
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	13.88	14.68	14.28
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	13.72	14.01	13.86
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	13.41	14.79	14.10
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.23	14.57	14.40
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	14.18	14.63	14.40
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	14.70	15.10	14.90
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	14.19	14.84	14.52
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	14.25	14.71	14.48
CD at 5%	0.843	1.388	1.115
SEm±	0.286	0.470	0.378

**Table 4.1.17. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 90 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	10.67	10.07	10.37
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	14.25	14.34	14.29
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	12.77	13.19	12.98
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	11.84	12.25	12.05
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	14.14	14.52	14.33
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	12.70	12.74	12.72
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	13.41	13.54	13.47
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.23	14.32	14.28
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	14.18	14.96	14.57
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	14.70	15.10	14.90
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	14.19	14.44	14.32
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	14.25	14.70	14.48
CD at 5%	0.795	0.679	0.737
SEm±	0.269	0.230	0.249

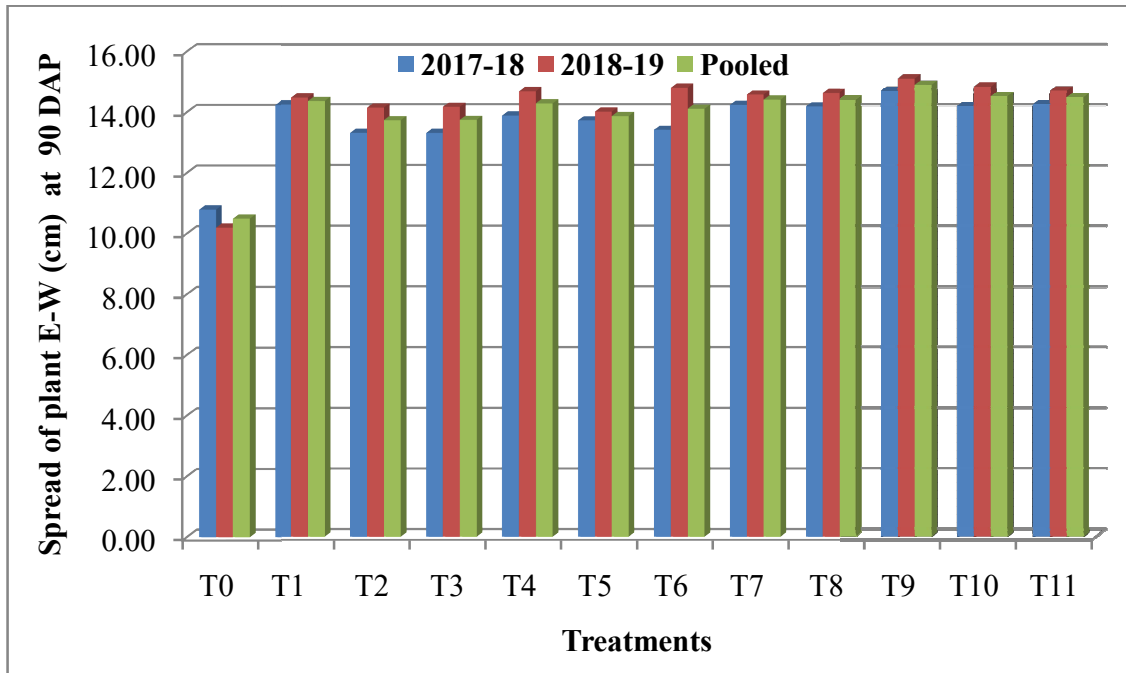


Fig. 4.1.16. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 90 DAP in strawberry.

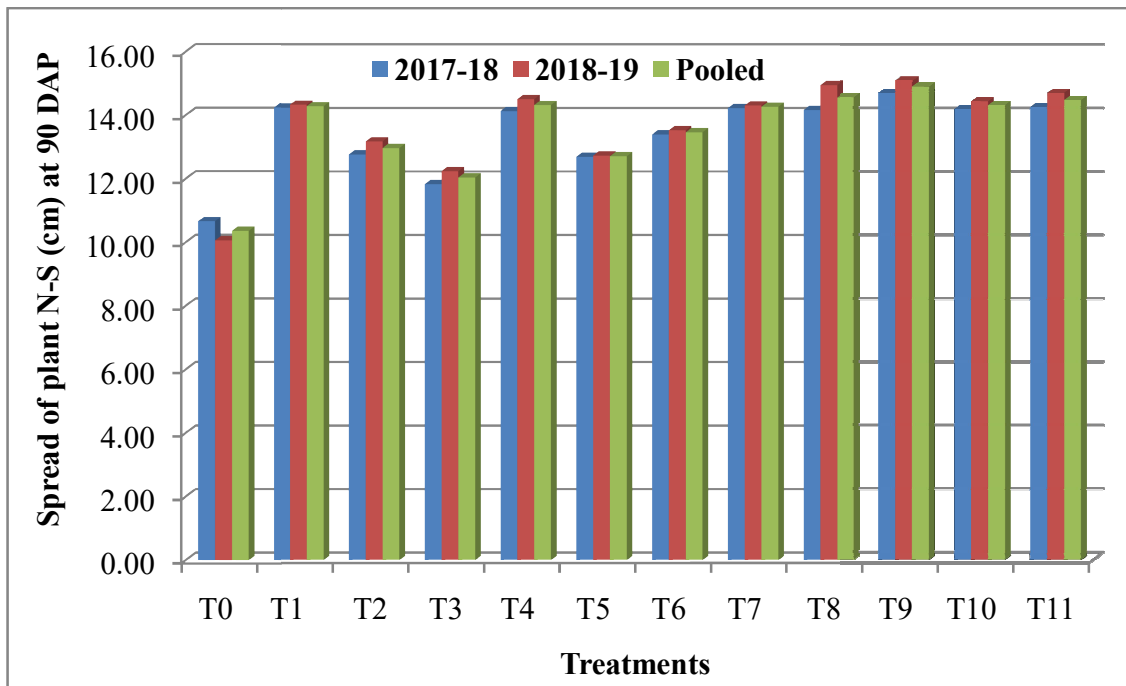


Fig. 4.1.17. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 90 DAP in strawberry.

#### **4.1.18 Plant spread E-W (cm) at 105 DAP**

Plant spread at 105 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.18 and graphically illustrated in fig. 4.1.18.

In the year 2017-18, highest plant spread (16.25 cm) was recorded with T<sub>6</sub> and followed by T<sub>9</sub> (16.00 cm), and T<sub>4</sub> (15.73 cm). However, T<sub>6</sub> was also found statistically at par with T<sub>9</sub> lowest plant spread (11.35 cm) was recorded under T<sub>0</sub> (control).

In the year 2018-19, highest plant spread (16.29 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (15.70 cm), and T<sub>8</sub> (15.59 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remains are statistically significant over other treatments. Minimum (10.94 cm) plant spread was noted in T<sub>0</sub> (control).

As far as pooled data of both the years are concerned the maximum plant spread (15.88 cm) in T<sub>6</sub> followed by T<sub>9</sub> (15.85 cm) and T<sub>1</sub> (15.78 cm) which was significantly higher as compare to rest of the treatments. Minimum plant spread (11.15 cm) was recorded in T<sub>0</sub> (control).

#### **4.1.19 Plant spread N-S (cm) at 105 DAP**

Plant spread at 105 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.19 and graphically illustrated in fig. 4.1.19.

In the year 2017-18, highest plant spread (16.00 cm) was recorded with T<sub>9</sub> and followed by T<sub>6</sub> (15.93 cm), and T<sub>8</sub> (15.90 cm). However, T<sub>9</sub> was also found statistically at par with T<sub>6</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum plant spread (11.14 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest plant spread (16.29 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (15.70 cm), and T<sub>8</sub> (15.59 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. Minimum (10.67 cm) plant spread was recorded in T<sub>0</sub> (control).

As far as pooled data of both the years are concerned the highest plant spread (15.85 cm) in T<sub>9</sub> followed by T<sub>8</sub> (15.74 cm) and T<sub>6</sub> (15.64 cm) which was significantly higher as compare to rest of the treatments. Minimum plant spread (10.90 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.18. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 105 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	11.35	10.94	11.15
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	15.27	16.29	15.78
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	14.70	14.08	14.39
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	13.93	13.33	13.63
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	15.73	15.29	15.51
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	14.50	14.03	14.26
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	16.25	15.51	15.88
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.96	14.69	14.83
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	14.91	15.59	15.25
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	16.00	15.70	15.85
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	14.90	14.56	14.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	14.91	14.70	14.80
CD at 5%	1.595	0.804	1.199
SEm±	0.540	0.273	0.406

**Table 4.1.19. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 105 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	11.14	10.67	10.90
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	14.60	16.29	15.45
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	13.73	14.08	13.91
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	12.80	13.33	13.07
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	14.62	14.69	14.66
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	13.50	13.58	13.54
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	15.93	15.36	15.64
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.89	14.86	14.88
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	15.90	15.59	15.74
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	16.00	15.70	15.85
T <sub>10</sub> : 50% NPK+ FYM+ Mulch (Paddy straw) + Bio-inoculant	14.90	14.56	14.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	14.38	14.70	14.54
CD at 5%	0.998	0.649	0.823
SEm±	0.338	0.220	0.279

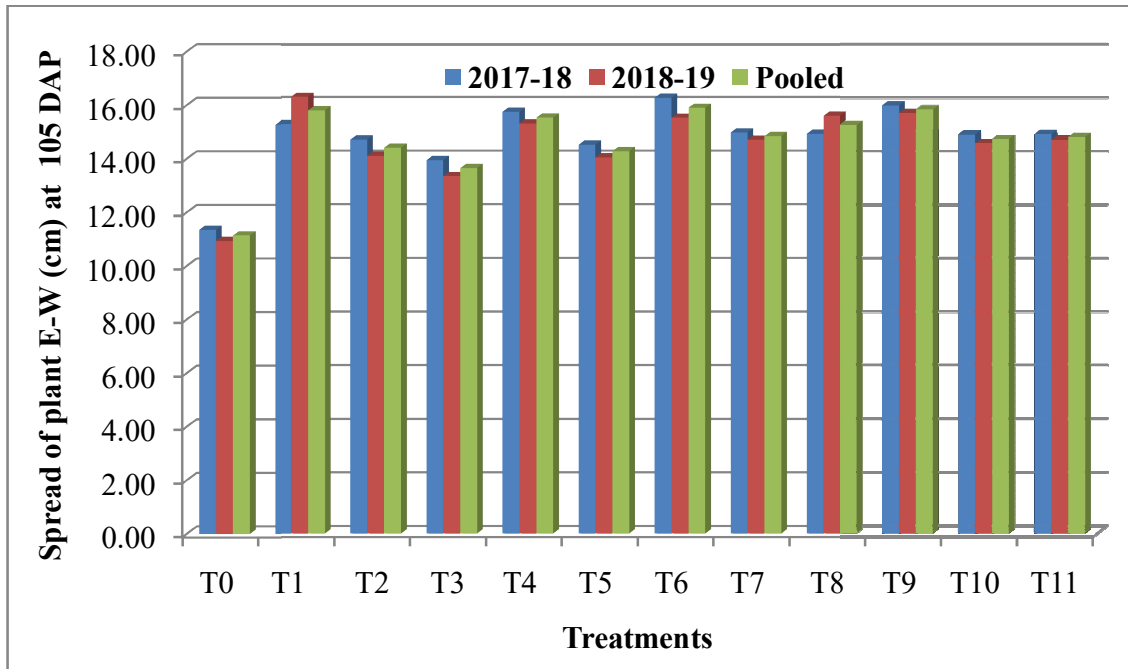


Fig. 4.1.18. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 105 DAP in strawberry.

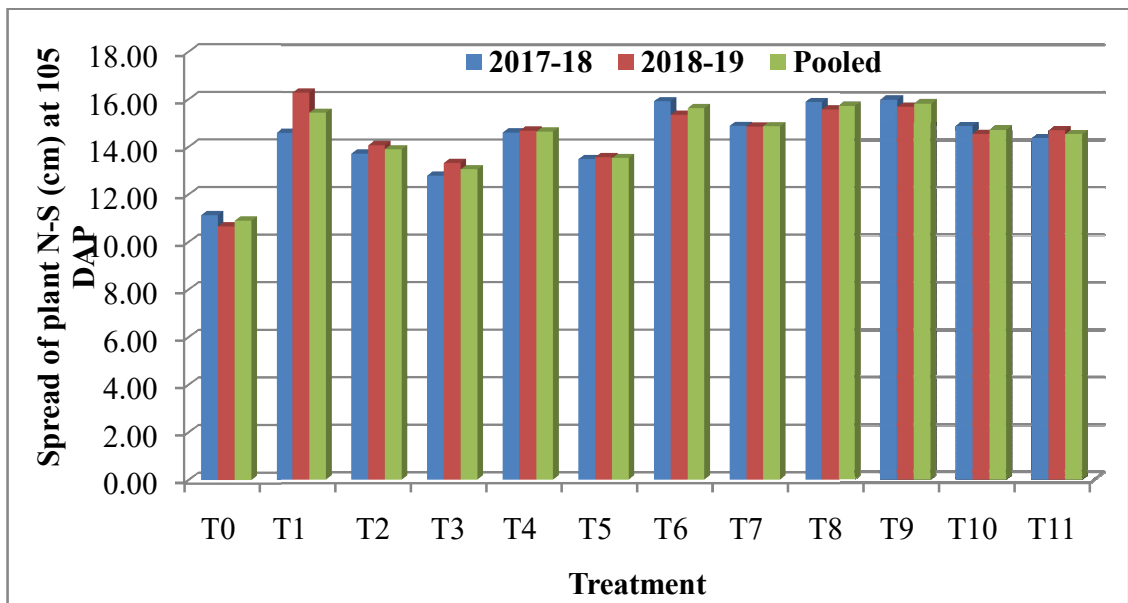


Fig. 4.1.19. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 105 DAP in strawberry.

#### **4.1.20 Plant spread E-W (cm) at 120 DAP**

Plant spread at 120 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.20 and graphically illustrated in fig. 4.1.20.

During the year 2017-18, maximum plant spread (17.78 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (16.67 cm), and T<sub>11</sub> (16.52 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>11</sub>. But remained statistically significant over other treatments. Minimum (12.04 cm) plant spread was recorded in T<sub>0</sub> (control).

During the year 2018-19, maximum plant spread (17.58 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (16.29 cm), and T<sub>6</sub> (16.17 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>6</sub>. But remained are statistically significant over other treatments. Minimum (11.96 cm) plant spread was recorded in T<sub>0</sub> (control).

Similar trend was observed in pooled data regarding this character which presented in table 4.1.20.

#### **4.1.21 Plant spread N-S (cm) at 120 DAP**

Plant spread at 120 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.21 and graphically illustrated in fig. 4.1.21.

During the year 2017-18, maximum plant spread (17.43 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (16.48 cm), and T<sub>8</sub> (16.36 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained are statistically significant over other treatments. Minimum (11.90 cm) plant spread was recorded under T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.1.21.

Similar trend was also observed in pooled data regarding this character which presented in table 4.1.21.

**Table 4.1.20. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 120 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	12.04	11.96	12.00
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	17.78	17.58	17.68
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	15.70	15.78	15.74
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	15.32	14.64	14.98
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	16.47	15.59	16.03
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	15.65	14.79	15.22
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	16.45	16.17	16.31
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.98	14.79	14.89
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	16.36	15.15	15.76
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	16.67	16.29	16.48
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	15.77	15.42	15.59
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	16.52	14.97	15.74
CD at 5%	1.491	0.931	1.211
SEm±	0.505	0.315	0.410

**Table 4.1.21. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 120 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	11.90	11.93	11.91
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	17.43	17.58	17.51
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	15.32	15.52	15.42
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	13.63	14.14	13.89
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	16.16	15.59	15.88
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	14.77	14.79	14.78
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	15.83	16.17	16.00
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	14.98	14.91	14.95
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	16.36	16.21	16.28
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	16.48	16.62	16.55
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	15.32	15.24	15.28
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	15.58	15.31	15.44
CD at 5%	0.776	0.597	0.686
SEm±	0.263	0.202	0.232

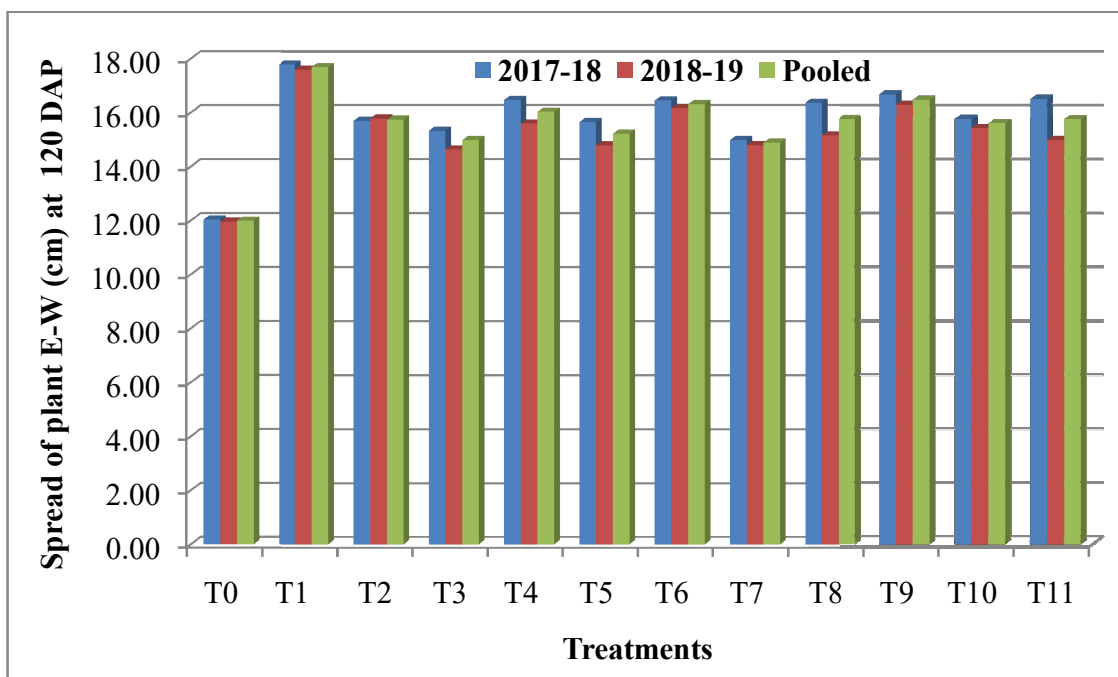


Fig. 4.1.20. Efficacy of organics, bio-inoculant and mulching on plant spread E-W (cm) at 120 DAP in strawberry.

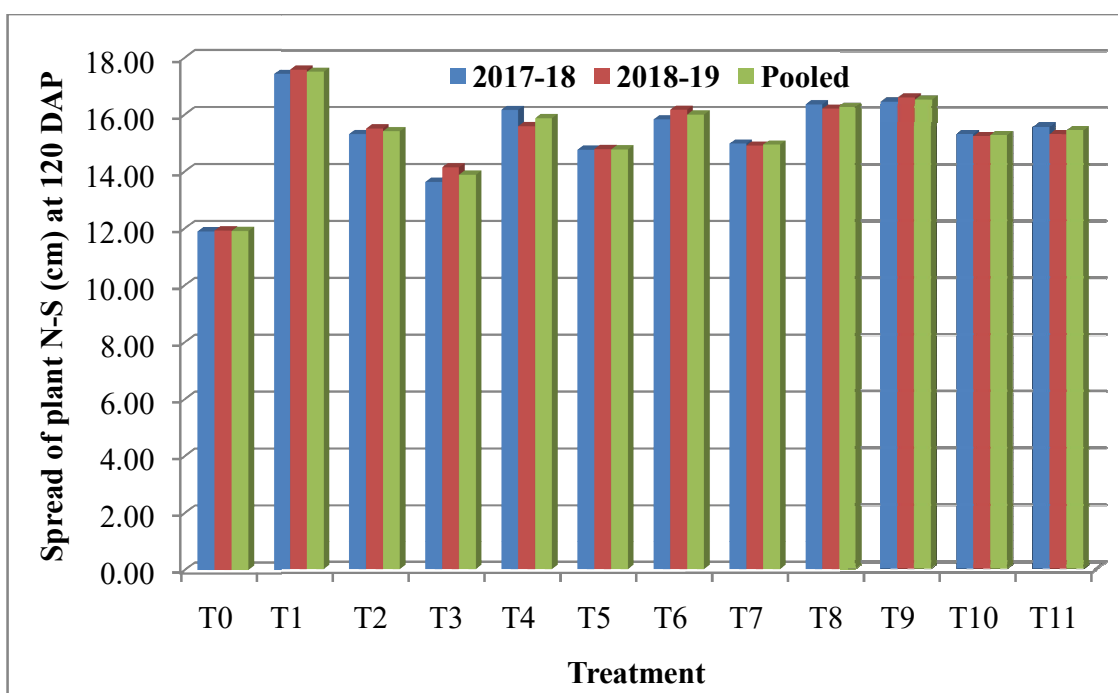


Fig. 4.1.21. Efficacy of organics, bio-inoculant and mulching on plant spread N-S (cm) at 120 DAP in strawberry.

#### **4.1.22 Length of leaf (cm)**

Leaf length of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.22 and graphically illustrated in fig. 4.1.22.

In the year 2017-18, maximum leaf length (6.85 cm) was noted with T<sub>1</sub> and followed by T<sub>9</sub> (6.33 cm), and T<sub>11</sub> (6.07 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>11</sub>. But remains are statistically significant over other treatments. Minimum leaf length (3.96 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest leaf length (7.26 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (6.99 cm), and T<sub>8</sub> (6.69 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. However, remained are statistically significant over other treatments. Minimum leaf length (3.99 cm) was recorded in T<sub>0</sub> (control).

Similar trend as the year 2017-18 was observed in pooled data regarding this character which presented in table 4.1.22.

#### **4.1.23 Width of leaf (cm)**

Width of leaf of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.23 and graphically illustrated in fig. 4.1.23.

During the year 2017-18, highest width of leaf (8.12 cm) was noted with T<sub>1</sub> and followed by T<sub>9</sub> (6.79 cm), and T<sub>8</sub> (6.54 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. However, remained are statistically significant over other treatments. Minimum width of leaf (4.22 cm) was recorded under T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.1.23.

Similar trend was also observed in pooled data regarding this character which presented in table 4.1.23.

**Table 4.1.22. Efficacy of organics, bio-inoculant and mulching on length of leaf (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	3.96	3.99	3.98
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	6.85	7.26	7.06
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.01	6.37	5.69
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.50	4.54	4.52
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.42	5.70	5.56
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	4.97	5.20	5.09
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	4.66	4.40	4.53
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	4.64	5.13	4.89
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	4.84	6.69	5.77
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	6.33	6.99	6.66
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	4.79	4.66	4.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	6.07	5.71	5.89
CD at 5%	0.982	0.420	0.701
SEm±	0.333	0.142	0.237

**Table 4.1.23. Efficacy of organics, bio-inoculant and mulching on width of leaf (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	4.22	4.28	4.25
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	8.12	8.25	8.19
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	6.30	6.92	6.61
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	5.05	4.89	4.97
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.58	6.05	5.81
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.22	5.86	5.54
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.26	4.45	4.86
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.11	5.72	5.42
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.54	7.07	6.80
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	6.79	7.62	7.20
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	4.90	4.91	4.90
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	6.09	5.86	5.98
CD at 5%	0.970	0.610	0.790
SEm±	0.328	0.207	0.267

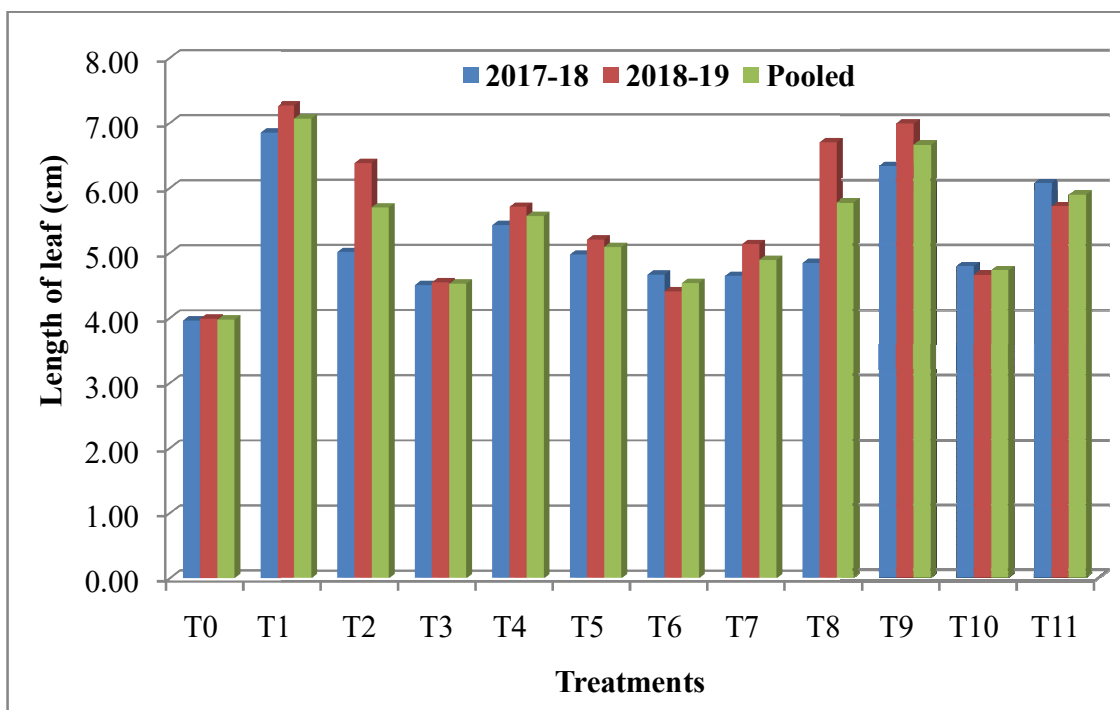


Fig. 4.1.22. Efficacy of organics, bio-inoculant and mulching on length of leaf (cm) in strawberry.

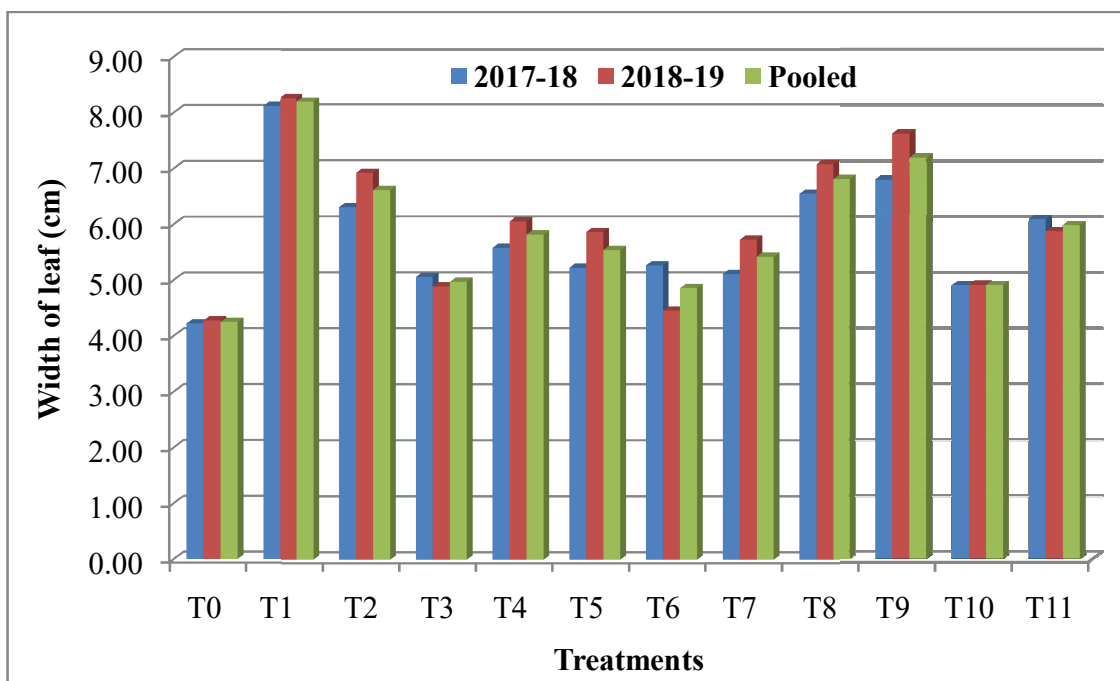


Fig. 4.1.23. Efficacy of organics, bio-inoculant and mulching on width of leaf (cm) in strawberry.

#### **4.1.24 Leaf area (cm<sup>2</sup>)**

Leaf area of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.24 and graphically illustrated in fig. 4.1.24.

In the year 2017-18, maximum leaf area (29.50 cm<sup>2</sup>) was noted with T<sub>9</sub> and followed by T<sub>1</sub> (26.87 cm<sup>2</sup>), and T<sub>8</sub> (25.23 cm<sup>2</sup>). However, T<sub>9</sub> was also found statistically at par with T<sub>1</sub> and T<sub>8</sub>. Minimum leaf area (13.89 cm<sup>2</sup>) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest leaf area (29.58 cm<sup>2</sup>) was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (26.59 cm<sup>2</sup>), and T<sub>11</sub> (26.17 cm<sup>2</sup>). However, T<sub>9</sub> was also found statistically at par with T<sub>1</sub> and T<sub>11</sub>. However, remained are statistically significant over other treatments. Minimum leaf area (14.10 cm<sup>2</sup>) was recorded in T<sub>0</sub> (control).

Similar trend as the year 2017-18 was observed in pooled data regarding this character which presented in table 4.1.24.

#### **4.1.25 Length of petiole (cm)**

Length of petiole of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.25 and graphically illustrated in fig. 4.1.25.

In the year 2017-18, maximum length of petiole (5.33 cm) was recorded with T<sub>7</sub> and followed by T<sub>1</sub> (5.13 cm), and T<sub>11</sub> (5.11 cm). However, T<sub>7</sub> was also found statistically at par with T<sub>11</sub> and T<sub>9</sub>. However, remained are statistically significant over other treatments. Minimum length of petiole (3.47 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest length of petiole (5.20 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (5.11 cm), and T<sub>4</sub> (5.00 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>4</sub>. Minimum length of petiole (3.85 cm) was recorded in T<sub>0</sub> (control).

As far as pooled data of both the years are concerned the highest length of petiole (5.17 cm) in T<sub>1</sub> followed by T<sub>7</sub> (5.15 cm) and T<sub>9</sub> (5.08 cm) which was significantly higher as compare to rest of the treatments. Minimum length of petiole (3.66 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.24. Efficacy of organics, bio-inoculant and mulching on leaf area (cm<sup>2</sup>) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	13.89	14.10	14.00
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	26.87	26.59	26.73
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	23.31	23.55	23.43
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	18.08	20.80	19.44
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	20.98	21.64	21.31
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	21.25	21.23	21.24
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	19.94	19.62	19.78
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	21.72	22.24	21.98
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	25.23	25.80	25.52
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	29.50	29.58	29.54
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	23.18	24.02	23.60
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	23.25	26.17	24.71
CD at 5%	6.835	5.419	6.127
SEm±	2.315	1.836	2.075

**Table 4.1.25. Efficacy of organics, bio-inoculant and mulching on length of petiole (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	3.47	3.85	3.66
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	5.13	5.20	5.17
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	4.82	4.83	4.83
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.18	4.42	4.30
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.00	5.00	5.00
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	4.54	4.67	4.61
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	4.83	4.67	4.75
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.33	4.96	5.15
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	4.55	4.62	4.59
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	5.06	5.11	5.08
T <sub>10</sub> : 50% NPK+ FYM+ Mulch (Paddy straw) + Bio-inoculant	4.93	4.62	4.78
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw)+ Bio-inoculant	5.11	4.95	5.03
CD at 5%	0.833	0.651	0.742
SEm±	0.282	0.221	0.251

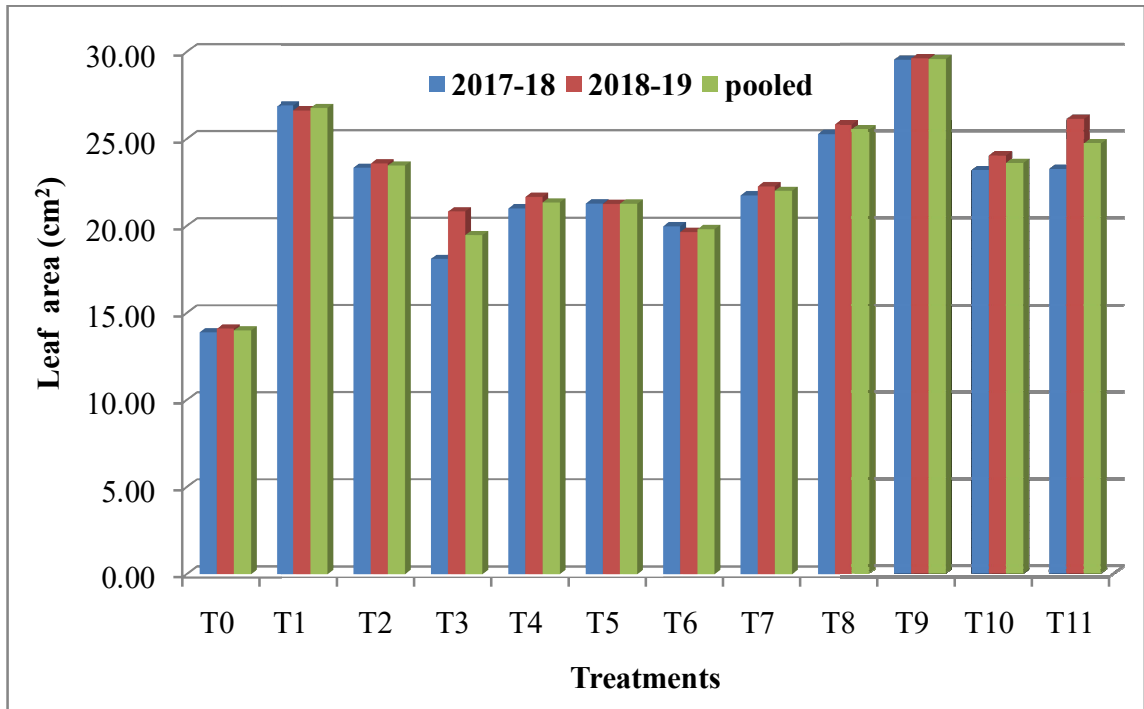


Fig. 4.1.24. Efficacy of organics, bio-inoculant and mulching on leaf area (cm<sup>2</sup>) in strawberry.

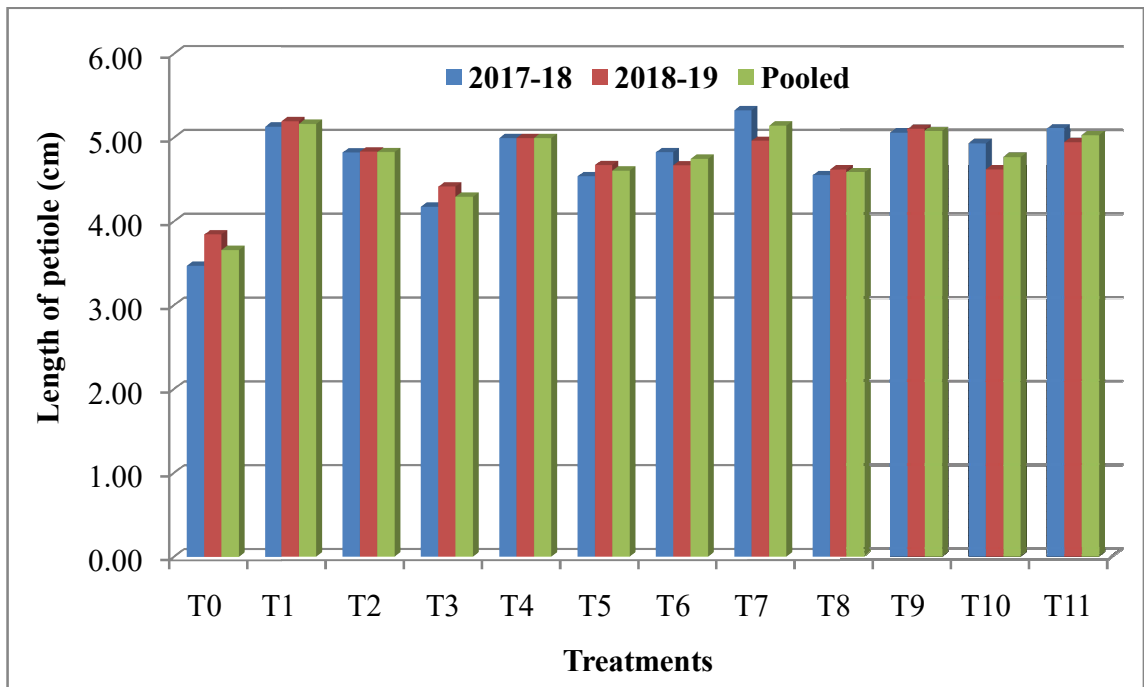


Fig. 4.1.25. Efficacy of organics, bio-inoculant and mulching on length of petiole (cm) in strawberry.

#### **4.1.26 Number of leaves per plant at 30 DAP**

Number of leaves per plant at 30 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.26 and graphically illustrated in fig. 4.1.26.

In the year 2017-18, T<sub>11</sub> produced maximum number of leaves (5.89) was recorded and followed by T<sub>1</sub> (5.78), T<sub>5</sub> (5.78) and T<sub>9</sub> (5.78). Minimum number of leaves (3.70) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest number of leaves (6.21) was recorded with T<sub>1</sub> & T<sub>9</sub> and followed by T<sub>5</sub> (5.91) and T<sub>8</sub> (5.88). Minimum number of leaves (3.99) was recorded in T<sub>0</sub> (control).

As far as pooled data of both the years are concerned the maximum number of leaves (6.00) in T<sub>1</sub> and T<sub>9</sub> followed by T<sub>5</sub> (5.84) which was significantly higher as compare to rest of the treatments. Minimum number of leaves (3.84) was recorded in T<sub>0</sub> (control).

#### **4.1.27 Number of leaves per plant at 45 DAP**

Number of leaves per plant at 45 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.27 and graphically illustrated in fig. 4.1.27.

In the year 2017-18, maximum number of leaves (7.88) was produced in T<sub>9</sub> and followed by T<sub>8</sub> (7.55), T<sub>1</sub> (7.49) and T<sub>2</sub> (6.48). However, T<sub>9</sub> was also found statistically at par with T<sub>8</sub> and T<sub>1</sub>. Minimum number of leaves (4.97) was recorded in T<sub>0</sub> (control).

In the year 2018-19, maximum number of leaves (8.12) was produced in T<sub>1</sub> and followed by T<sub>9</sub> (7.75) and T<sub>8</sub> (7.55). Minimum number of leaves (4.97) was recorded in T<sub>0</sub> (control).

Similar trend was also observed regarding this character in pooled data which presented in Table 4.1.27.

**Table 4.1.26. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 30 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	3.70	3.99	3.84
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	5.78	6.21	6.00
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.00	5.33	5.17
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.56	4.90	4.73
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.44	5.19	5.32
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.78	5.91	5.84
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.56	4.93	5.24
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.67	5.25	5.46
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	5.67	5.88	5.78
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	5.78	6.21	6.00
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	5.56	5.19	5.37
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	5.89	5.75	5.82
CD at 5%	0.807	0.814	0.810
SEm±	0.273	0.276	0.274

**Table 4.1.27. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 45 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> :Control	4.97	4.70	4.83
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	7.49	8.12	7.81
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	6.48	6.23	6.36
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	5.89	5.52	5.71
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	6.00	6.54	6.27
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.97	6.07	6.02
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.35	5.19	5.27
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.77	5.51	5.64
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	7.55	7.55	7.55
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	7.88	7.75	7.81
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	5.36	5.34	5.35
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	5.84	5.87	5.85
CD at 5%	1.046	1.101	1.073
SEm±	0.354	0.373	0.363

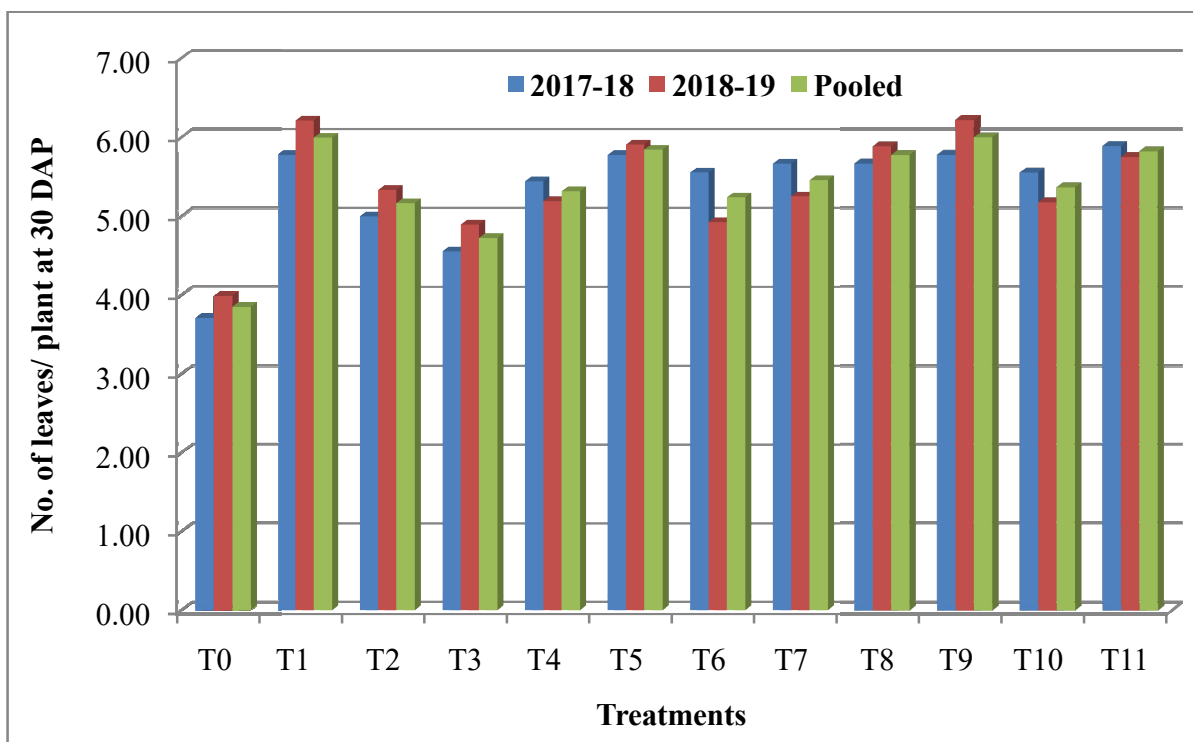


Fig. 4.1.26. Efficacy of organics, bio-inoculant and mulching on Number of leaves / plant at 30 DAP in strawberry.

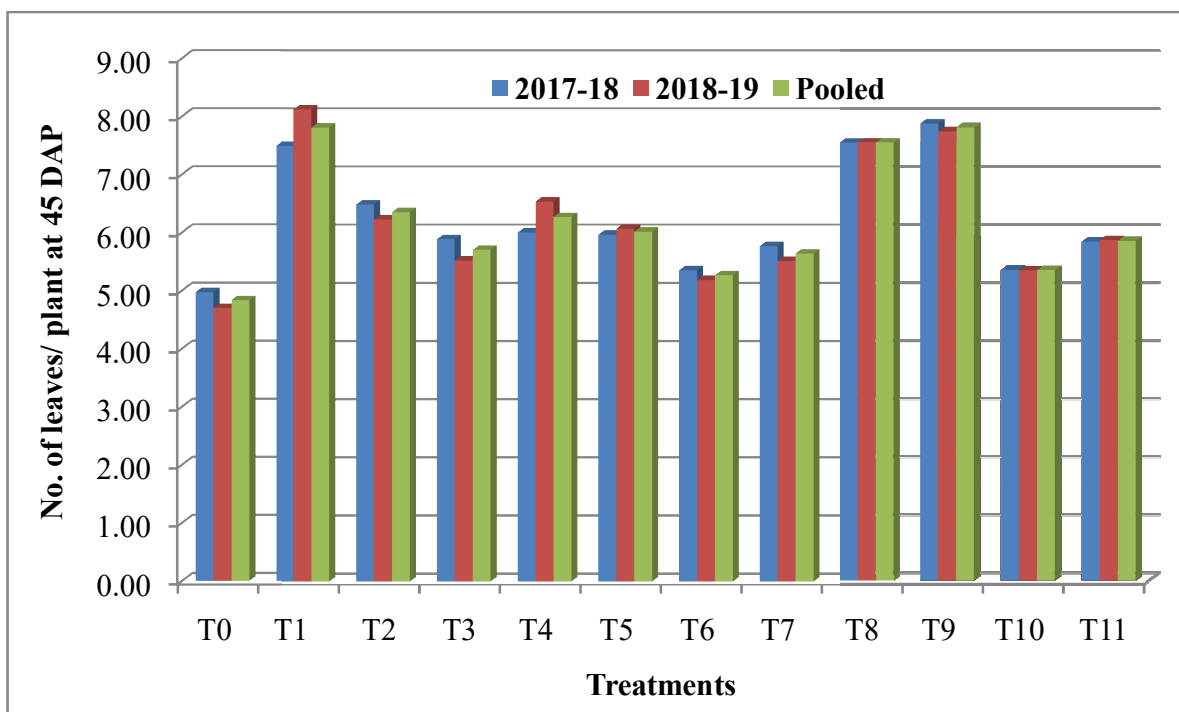


Fig. 4.1.27. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 45 DAP in strawberry.

#### **4.1.28 Number of leaves per plant at 60 DAP**

Number of leaves per plant at 60 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.28 and graphically illustrated in fig. 4.1.28

In the year 2017-18, maximum number of leaves (8.56) was produced in T<sub>1</sub> and followed by T<sub>9</sub> (8.37) and T<sub>8</sub> (7.48). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained are statistically significant over other treatments. Minimum (6.77) number of leaves was recorded in T<sub>0</sub> (control).

Similar trend was observed for number of leaves per plant during the year 2018-19.

Similar trend was also observed regarding this character in pooled data.

#### **4.1.29 Number of leaves per plant at 75 DAP**

Number of leaves per plant at 75 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.29 and graphically illustrated in fig. 4.1.29.

In the year 2017-18, T<sub>1</sub> was produced maximum number of leaves (10.79) and followed by T<sub>9</sub> (9.92) and T<sub>8</sub> (9.90). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained are statistically significant over other treatments. Minimum (7.78) number of leaves was recorded in T<sub>0</sub> (control).

Similar trend was observed for number of leaves per plant during the year 2018-19.

Similar trend was also observed regarding this character of strawberry in pooled data.

**Table 4.1.28. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 60 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	6.77	6.55	6.66
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	8.56	9.81	9.19
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.44	7.67	7.56
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	7.19	6.30	6.74
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.22	6.42	6.82
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	6.63	6.85	6.74
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	6.56	6.16	6.36
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	6.85	6.43	6.64
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	7.48	8.44	7.96
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	8.37	8.86	8.62
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	7.04	7.10	7.07
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	7.63	7.07	7.35
CD at 5%	1.180	0.951	1.065
SEm±	0.400	0.322	0.361

**Table 4.1.29. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 75 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	7.78	7.84	7.81
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	10.79	10.76	10.77
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.85	9.15	9.00
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	8.45	8.52	8.48
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	9.16	9.23	9.20
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.95	8.04	8.00
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	7.37	7.44	7.41
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	7.64	7.88	7.76
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	9.90	9.97	9.93
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	9.92	10.10	10.01
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	8.54	8.65	8.60
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	9.52	9.45	9.49
CD at 5%	0.843	0.810	0.826
SEm±	0.286	0.274	0.280

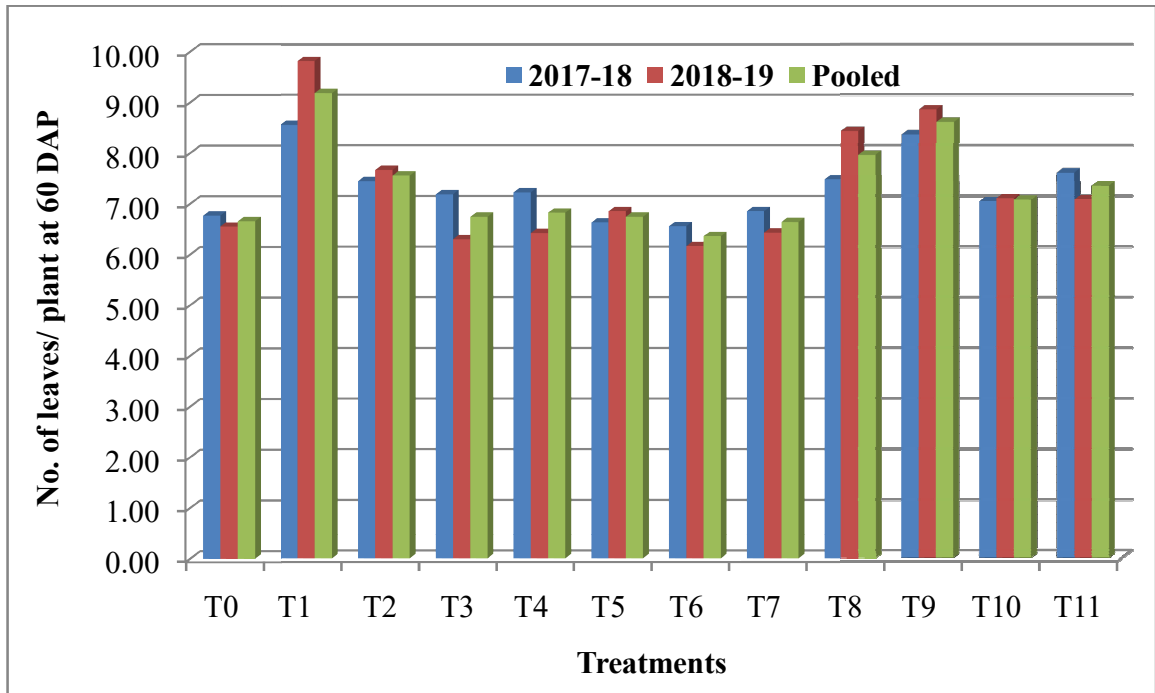


Fig. 4.1.28. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 60 DAP in strawberry.

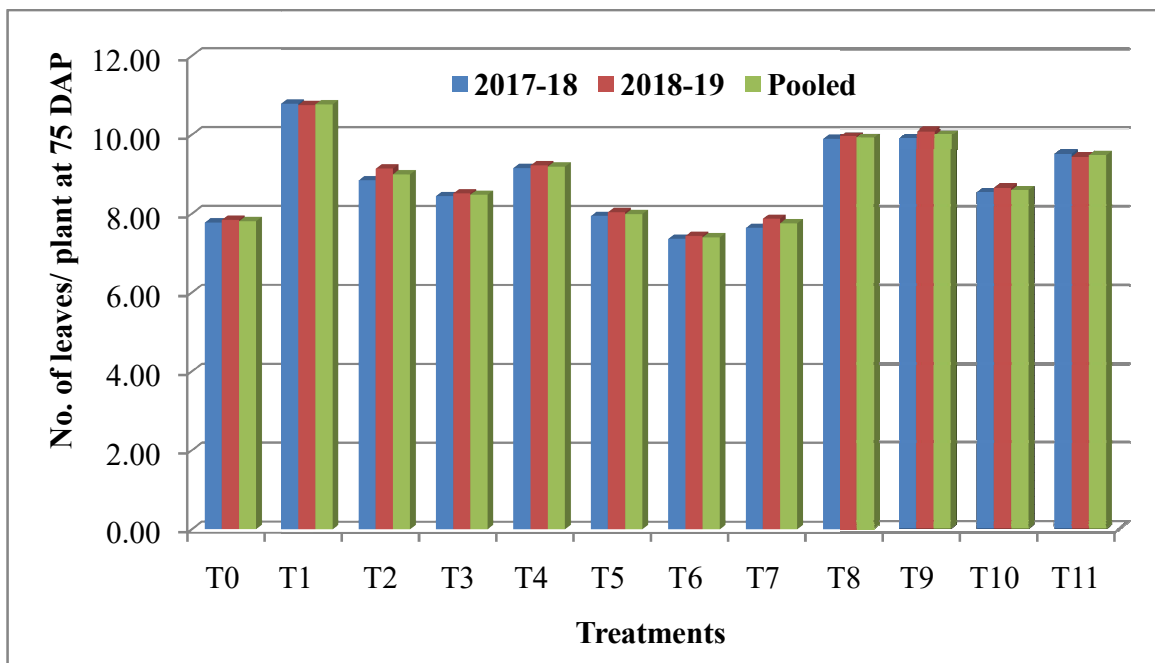


Fig. 4.1.29. Efficacy of organics, bio-inoculant and mulching on number of leaves / plant at 75 DAP in strawberry.

#### **4.1.30 Number of leaves per plant at 90 DAP**

Number of leaves per plant at 90 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.30 and graphically illustrated in fig. 4.1.30.

In the year 2017-18, T<sub>1</sub> was produced maximum number of leaves (11.9) and followed by T<sub>9</sub> (10.64) and T<sub>8</sub> (10.45). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained are statistically significant over other treatments. Minimum number of leaves (8.47) was recorded under control (T<sub>0</sub>).

Similar trend was observed for number of leaves per plant during the year 2018-19.

Similar trend was also observed regarding this character in pooled data.

#### **4.1.31 Number of leaves per plant at 105 DAP**

Number of leaves per plant at 105 DAP of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.31 and graphically illustrated in fig. 4.1.31.

In the year 2017-18, maximum number of leaves (13.23) was recorded with T<sub>1</sub> and followed by T<sub>2</sub> (12.06), T<sub>4</sub> (11.57) and T<sub>11</sub> (11.53). However, T<sub>1</sub> was also found statistically at par with T<sub>2</sub> and T<sub>4</sub>. But remained statistically significant over other treatments. Minimum number of leaves (8.87) was recorded under control (T<sub>0</sub>).

In the year 2018-19, highest number of leaves (15.47) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (14.91) and T<sub>8</sub> (13.29). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Lowest number of leaves (9.80) was recorded control (T<sub>0</sub>).

On the basis of pooled data of both the years, it was found that maximum number of leaves (14.35) in T<sub>1</sub> and followed by T<sub>9</sub> (13.16) which were significantly higher as compare to rest of the treatments. Minimum (9.33) number of leaves was recorded T<sub>0</sub> (control).

**Table 4.1.30. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 90 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	8.47	8.93	8.70
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	11.97	12.26	12.11
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	10.21	10.39	10.30
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.51	9.61	9.56
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	9.88	10.38	10.13
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.87	10.21	10.04
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	8.62	8.97	8.80
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.57	9.10	8.83
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	10.45	10.96	10.71
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	10.64	10.82	10.73
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	9.16	9.64	9.40
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	9.98	10.01	10.00
CD at 5%	1.091	1.208	1.149
SEm±	0.370	0.409	0.389

**Table 4.1.31. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 105 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	8.87	9.80	9.33
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	13.23	15.47	14.35
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	12.06	13.20	12.63
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.88	10.32	10.10
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.57	12.45	12.01
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	10.74	11.09	10.92
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	10.68	11.01	10.85
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	10.73	11.06	10.89
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	10.97	13.29	12.13
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	11.42	14.91	13.16
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.39	11.61	11.50
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	11.53	11.85	11.69
CD at 5%	1.755	1.675	1.715
SEm±	0.595	0.568	0.581

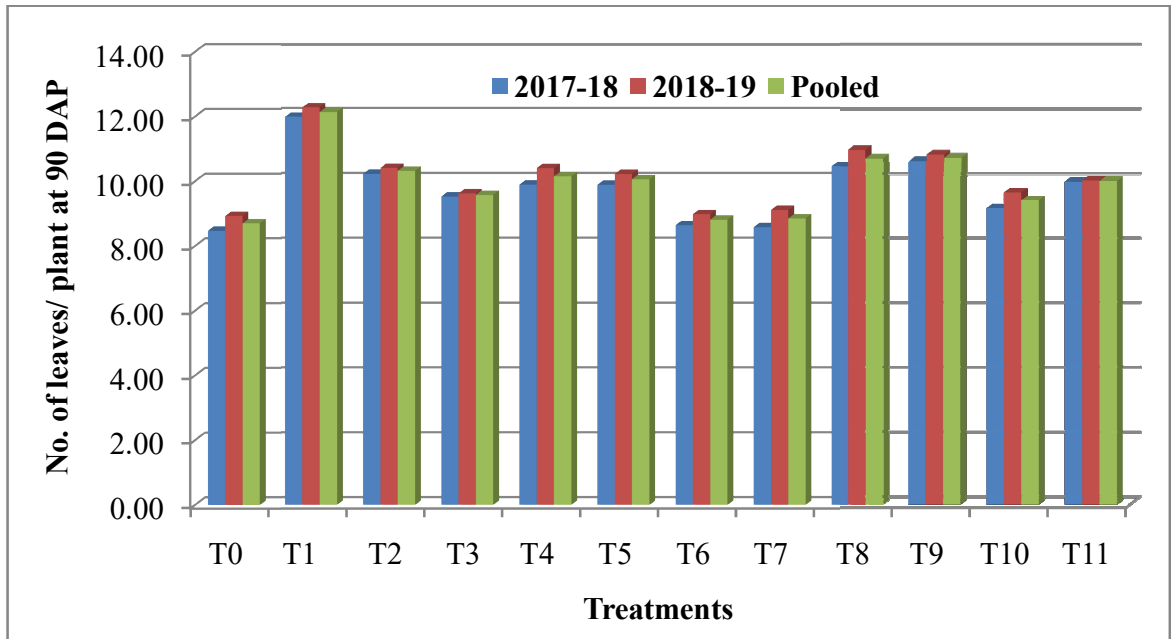


Fig. 4.1.30. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 90 DAP in strawberry.

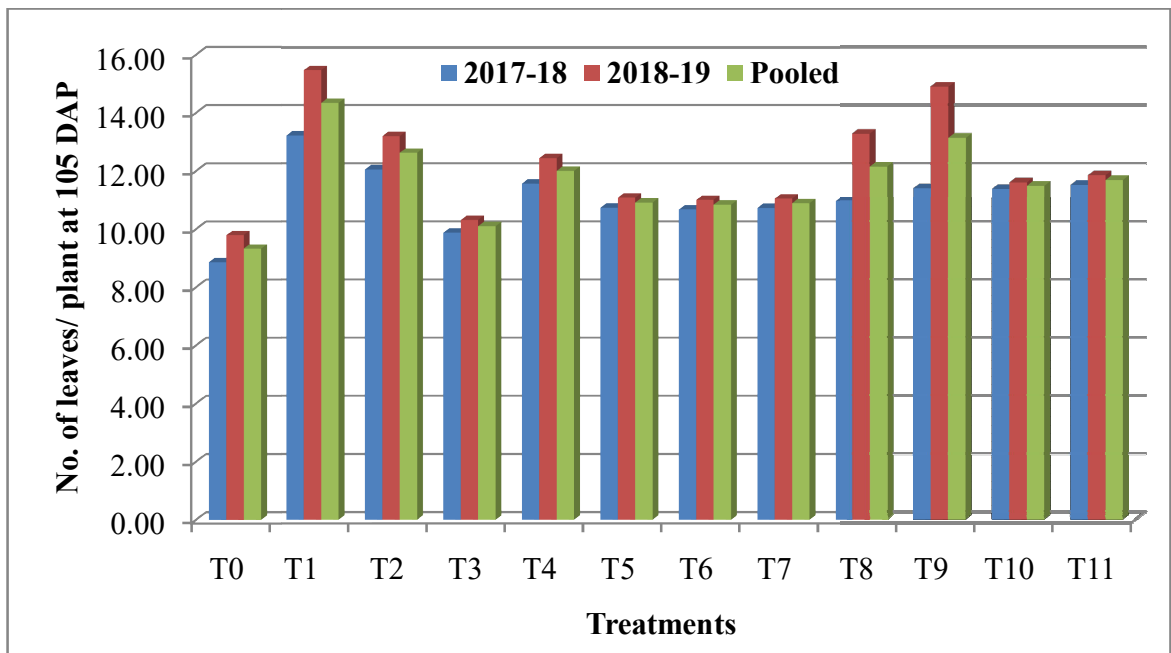


Fig. 4.1.31. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 105 DAP in strawberry.

#### **4.1.32 Number of leaves per plant at 120 DAP**

Number of leaves per plant at 120 DAP of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.32 and graphically illustrated in fig. 4.1.32.

During the year 2017-18, T<sub>1</sub> was produced maximum number of leaves (21.36) per plant followed by T<sub>4</sub> (17.55) and T<sub>9</sub> (17.41). However, T<sub>1</sub> was also found statistically at par with T<sub>4</sub> and T<sub>9</sub>. But remained statistically significant over other treatments. Minimum number of leaves per plant (10.36) was recorded under control (T<sub>0</sub>).

Similar trend was observed for number of leaves per plant during the year 2018-19.

Similar trend was also observed regarding this character in pooled data.

#### **4.1.33 Days taken to first flowering**

Data on days taken to first flowering as influenced by different treatment combinations are presented in table 4.1.33 and illustrated graphically in fig. 4.1.33.

During the year 2017-18, significantly minimum days taken (46.74) to first flowering was noted in T<sub>9</sub> and followed by T<sub>11</sub> (47.24), T<sub>8</sub> (48.05) and T<sub>10</sub> (48.85). However, T<sub>9</sub> was statistically at par with T<sub>11</sub>, T<sub>8</sub> and T<sub>10</sub>. Maximum (57.60) period of days taken to first flower recorded under control (T<sub>0</sub>).

Similar trend was observed during the year 2018-19 regarding this character.

Similar trend was also observed regarding this character in pooled data.

**Table 4.1.32. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 120 DAP in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	10.36	11.46	10.91
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	21.36	21.56	21.46
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	16.01	17.83	16.92
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	11.95	14.35	13.15
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	17.55	18.54	18.05
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	16.28	17.07	16.67
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	14.24	14.42	14.33
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	13.43	13.57	13.50
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.20	17.56	17.38
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	17.41	18.59	18.00
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	14.77	16.02	15.39
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	16.46	16.60	16.53
CD at 5%	1.617	1.903	1.760
SEm±	0.548	0.645	0.596

**Table 4.1.33. Efficacy of organics, bio-inoculant and mulching on days taken to first flowering in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	57.60	58.34	57.97
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	50.17	50.62	50.40
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	54.10	53.64	53.87
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	52.98	54.20	53.59
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	51.68	50.50	51.09
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	51.02	51.32	51.17
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	54.19	52.43	53.31
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	51.64	50.13	50.88
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	48.05	48.85	48.45
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	46.74	47.08	46.91
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	48.85	49.38	49.11
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	47.24	47.47	47.35
CD at 5%	5.359	2.043	3.701
SEm±	1.816	0.692	1.254

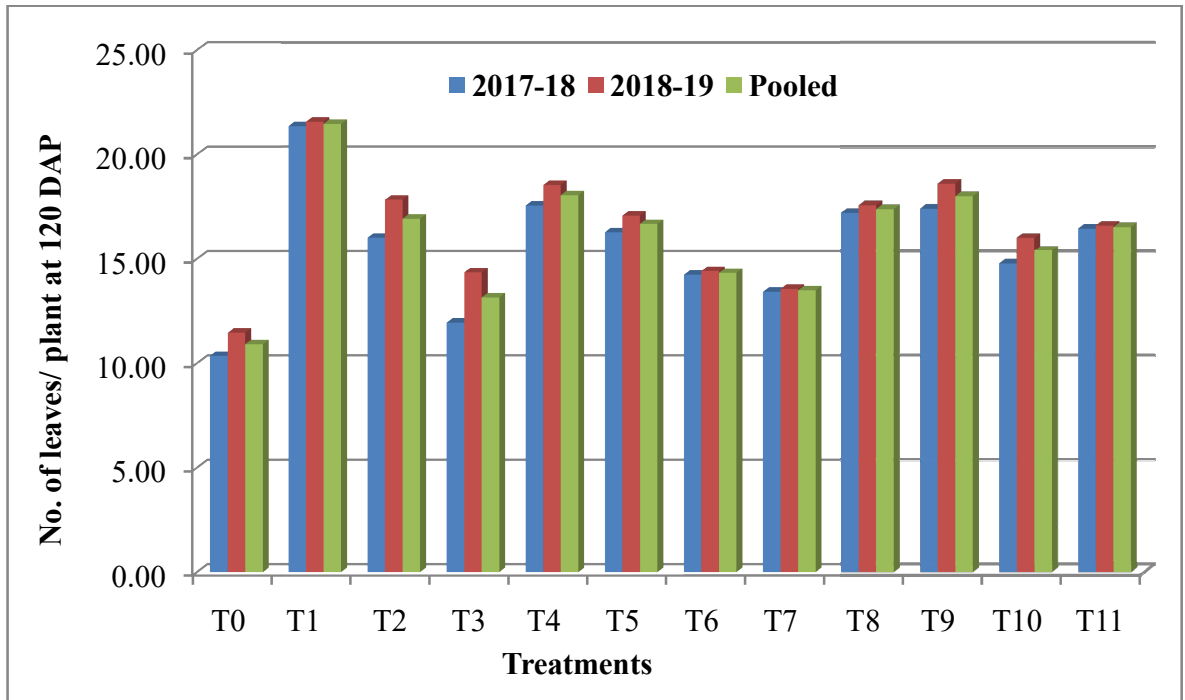


Fig. 4.1.32. Efficacy of organics, bio-inoculant and mulching on number of leaves per plant at 120 DAP in strawberry.

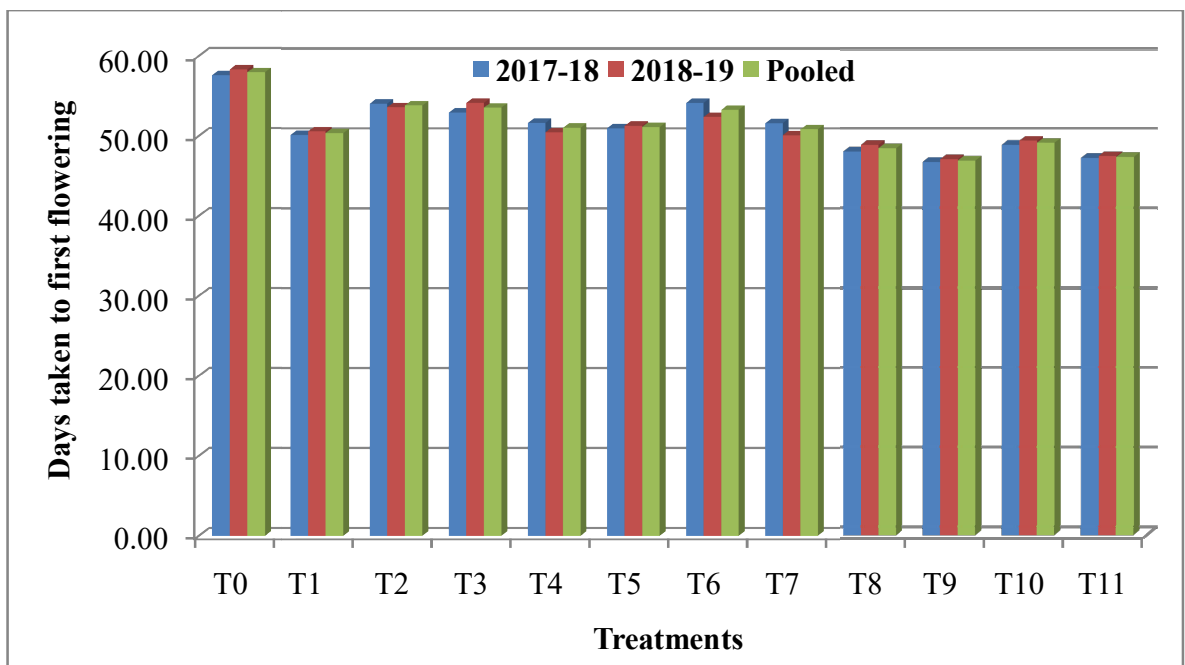


Fig. 4.1.33. Efficacy of organics, bio-inoculant and mulching on days taken to first flowering in strawberry.

#### **4.1.34 Number of flowers per plant**

Number of flowers per plant of both years and pooled as influenced by different treatments combinations have been presented in table 4.1.34 and graphically illustrated in fig. 4.1.34.

In the year 2017-18, maximum number of flowers (12.49) was recorded with T<sub>9</sub> and followed by T<sub>8</sub> (12.05), T<sub>11</sub> (11.90) and T<sub>4</sub> (11.68). However, T<sub>9</sub> was also found statistically at par with T<sub>8</sub> and T<sub>11</sub>. But remained statistically significant over other treatments. Minimum number of flowers (8.60) was recorded in T<sub>0</sub> (control).

In the year 2018-19, maximum number of flowers (12.08) was recorded with T<sub>9</sub> and followed by T<sub>4</sub> (11.54) and T<sub>5</sub> (11.43). However, T<sub>9</sub> was also found statistically at par with T<sub>4</sub> and T<sub>5</sub>. Minimum number of flowers (8.66) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum number of flowers (12.29) in T<sub>9</sub> and followed by T<sub>8</sub> (11.76) which was significantly higher as compare to rest of the treatments. Minimum number of flowers (8.63) was recorded under control (T<sub>0</sub>).

#### **4.1.35 Length of pedicel (cm)**

Length of pedicel of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.35 and graphically illustrated in fig. 4.1.35.

During the year 2017-18, T<sub>1</sub> produced maximum length of pedicel (8.47 cm) and followed by T<sub>11</sub> (8.47 cm) and T<sub>2</sub> (7.82 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>11</sub> and T<sub>2</sub>. Minimum length of pedicel (5.14 cm) was recorded in T<sub>0</sub> (control).

In the year 2018-19, maximum length of pedicel (8.88 cm) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (8.07 cm) and T<sub>8</sub> (7.67 cm). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. Minimum length of pedicel (5.12 cm) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum length of pedicel (8.67 cm) in T<sub>1</sub> and followed by T<sub>9</sub> (7.90 cm) which was significantly higher as compare to rest of the treatments. Minimum length of pedicel (5.13 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.34. Efficacy of organics, bio-inoculant and mulching on number of flowers per plant in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	8.60	8.66	8.63
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	11.17	11.26	11.22
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	10.10	10.21	10.15
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	8.65	8.73	8.69
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	11.68	11.54	11.61
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	11.35	11.43	11.39
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	11.19	11.34	11.27
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	11.64	10.99	11.32
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.05	11.47	11.76
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	12.49	12.08	12.29
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.52	11.19	11.35
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	11.90	10.97	11.44
CD at 5%	1.089	1.125	1.107
SEm±	0.369	0.381	0.375

**Table 4.1.35. Efficacy of organics, bio-inoculant and mulching on length of pedicel (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	5.14	5.12	5.13
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	8.47	8.88	8.67
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.82	7.63	7.73
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	6.80	6.94	6.87
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.13	7.44	7.28
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.54	7.55	7.54
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	6.79	6.50	6.64
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	6.62	6.39	6.51
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	7.55	7.67	7.61
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	7.72	8.07	7.90
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	7.27	6.89	7.08
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	8.11	7.19	7.65
CD at 5%	1.498	0.740	1.119
SEm±	0.507	0.251	0.379

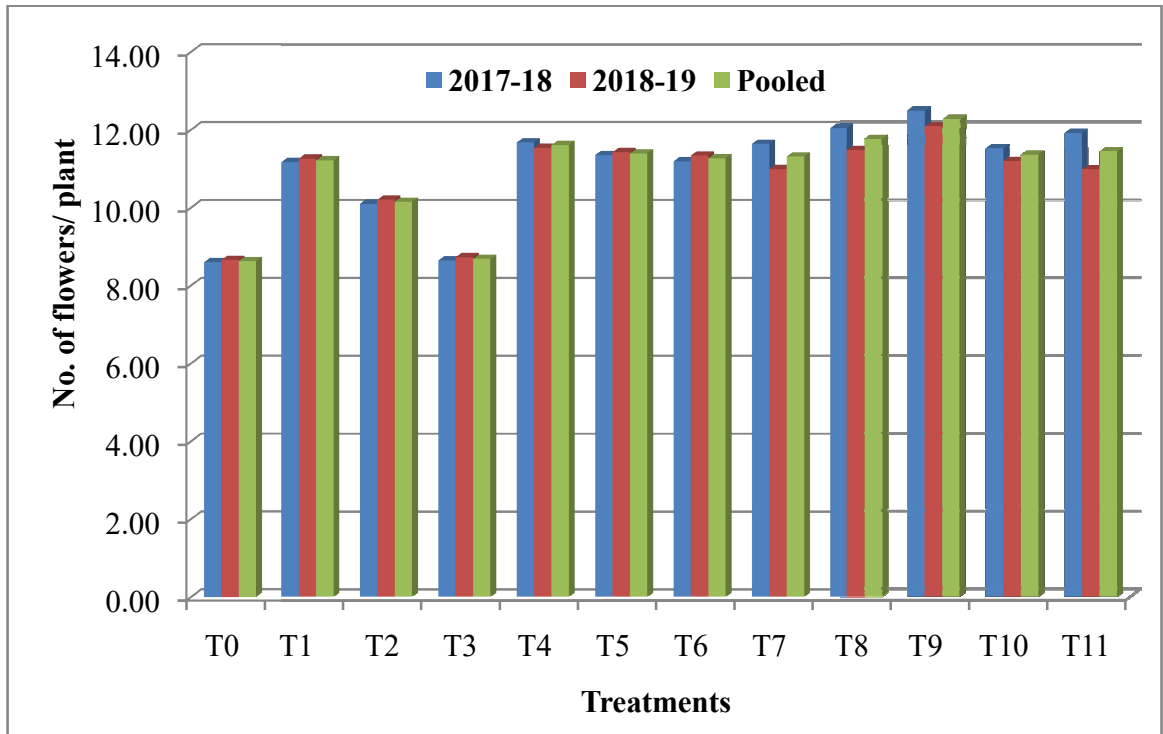


Fig. 4.1.34. Efficacy of organics, bio-inoculant and mulching on number of flowers / plant in strawberry.

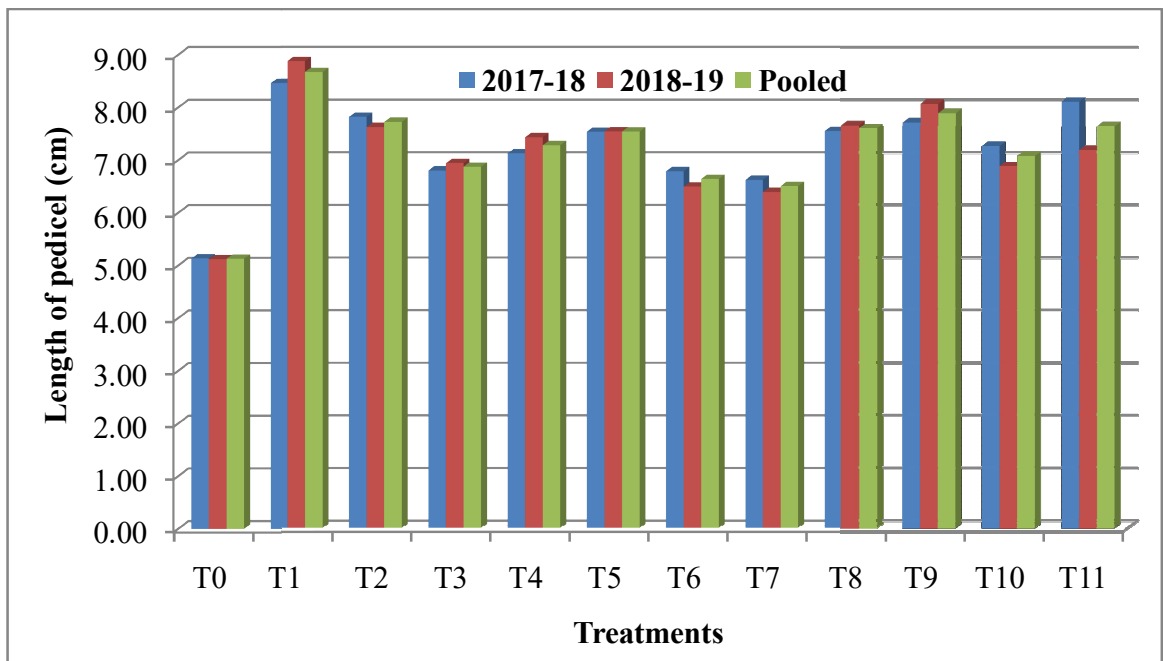


Fig. 4.1.35. Efficacy of organics, bio-inoculant and mulching on length of pedicel (cm) in strawberry.

#### **4.1.36 Days taken to first fruit set**

The relevant data pertaining to days to first fruit set as affected by different treatment combinations are presented in table 4.1.36 and depicted in fig. 4.1.36.

During the year 2017-18, significantly minimum days taken to first fruit set (6.07) was recorded in T<sub>9</sub> and followed by T<sub>11</sub> (6.57) and T<sub>8</sub> (6.83). A maximum day taken to first fruit set (10.06) was recorded under control (T<sub>0</sub>).

Similar trend was observed during the year 2018-19 regarding this character.

Similar trend was also observed regarding this character in pooled data.

#### **4.1.37 Number of fruits plant<sup>-1</sup>**

Number of fruits per plant of both years and pooled as influenced by different treatments combinations have been depicted in table 4.1.37 and graphically illustrated in fig. 4.1.37.

In the year 2017-18, T<sub>9</sub> produced maximum number of fruits plant<sup>-1</sup> (10.18) and followed by T<sub>8</sub> (10.02) and T<sub>11</sub> (9.83). However, T<sub>9</sub> was also found statistically at par with T<sub>8</sub> and T<sub>11</sub>. But remained statistically significant over other treatments. Minimum number of fruits plant<sup>-1</sup> (6.10) was recorded T<sub>0</sub> (control).

In the year 2018-19, maximum number of fruits plant<sup>-1</sup> (10.01) was recorded with T<sub>9</sub> and followed by T<sub>11</sub> (9.94) and T<sub>5</sub> (9.89). However, T<sub>9</sub> was also found statistically at par with T<sub>11</sub> and T<sub>5</sub>. Minimum number of fruits plant<sup>-1</sup> (5.93) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum number of fruits plant<sup>-1</sup> (10.10) in T<sub>9</sub> and followed by T<sub>8</sub> (9.94) which were significantly higher as compare to rest of the treatments. Minimum number of fruits plant<sup>-1</sup> (6.01) was recorded in T<sub>0</sub> (control).

**Table 4.1.36. Efficacy of organics, bio-inoculant and mulching on days taken to first fruit set in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	10.06	9.92	9.99
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.08	8.50	8.79
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.19	8.79	7.99
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.26	9.62	9.44
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	8.34	8.25	8.30
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.68	7.14	7.41
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	7.56	8.81	8.18
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.97	8.88	8.93
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.83	6.93	6.88
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	6.07	6.10	6.09
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	7.85	7.61	7.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	6.57	6.59	6.58
CD at 5%	2.054	0.507	1.280
SEm±	0.696	0.172	0.434

**Table 4.1.37. Efficacy of organics, bio-inoculant and mulching on number of fruits plant<sup>-1</sup> in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	6.10	5.93	6.01
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.19	9.21	9.20
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.67	8.45	8.56
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	7.20	7.20	7.20
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	9.75	9.65	9.70
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	9.77	9.89	9.83
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	8.77	8.89	8.83
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	9.32	9.68	9.50
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	10.02	9.87	9.94
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	10.18	10.01	10.10
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	9.76	9.71	9.74
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	9.83	9.94	9.89
CD at 5%	1.206	1.310	1.258
SEm±	0.408	0.444	0.426

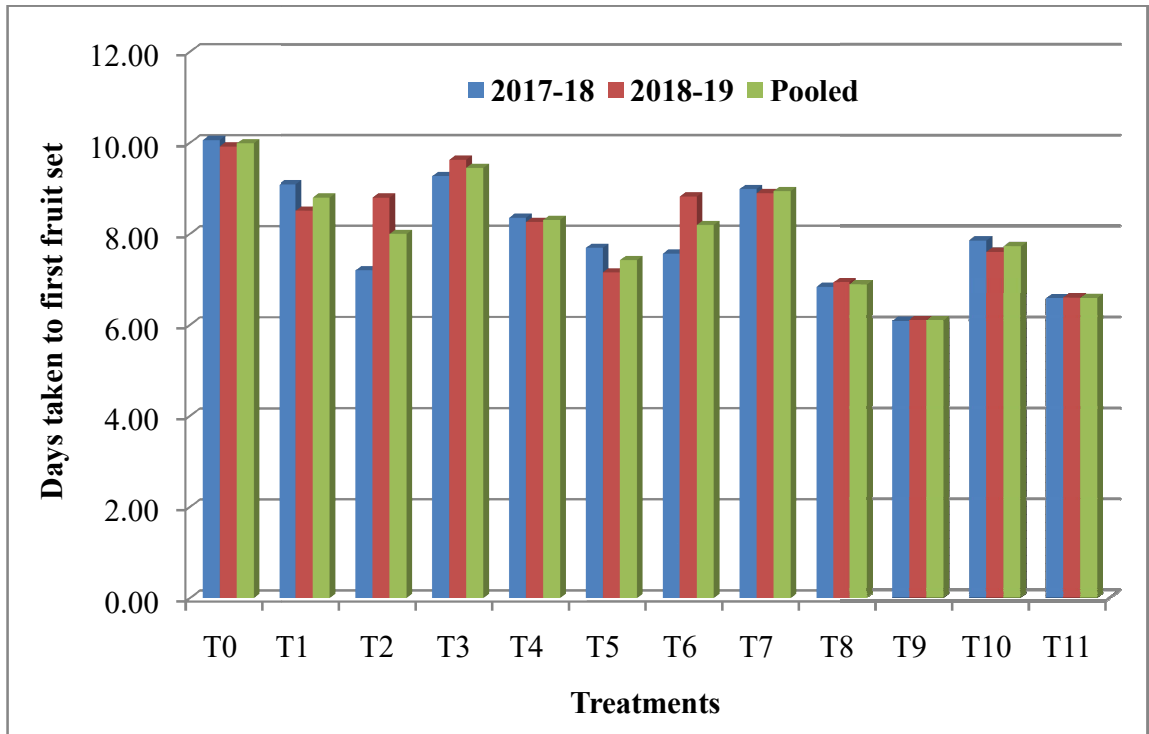


Fig. 4.1.36. Efficacy of organics, bio-inoculant and mulching on days taken to first fruit set in strawberry.

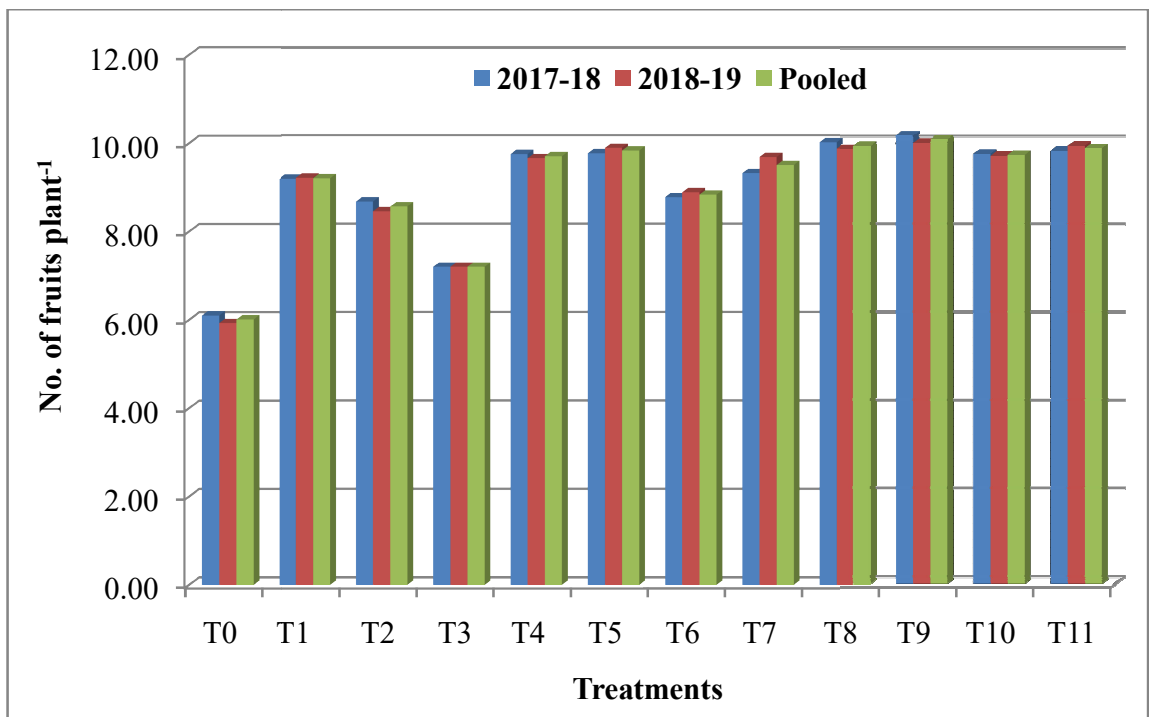


Fig. 4.1.37. Efficacy of organics, bio-inoculant and mulching on number of fruits plant<sup>-1</sup> in strawberry.

#### **4.1.38. Percentage of fruit setting plant<sup>-1</sup>**

Pooled data pertaining to percentage of fruit setting plant<sup>-1</sup> for two years and pooled as affected by application of different treatments combinations are presented in table 4.1.38 and graphically depicted in fig. 4.1.38.

In the year 2017-18, maximum percentage of fruits setting plant<sup>-1</sup> (84.90%) was noted with T<sub>9</sub> which was followed by T<sub>8</sub> (83.40%), T<sub>10</sub> (82.86%) and T<sub>11</sub> (82.79%). Minimum percentage of fruit setting plant<sup>-1</sup> (70.76%) was recorded in T<sub>0</sub> (control).

In the year 2018-19, maximum percentage of fruits setting plant<sup>-1</sup> (86.15%) was noted with T<sub>9</sub> which was followed by T<sub>11</sub> (85.40%) and T<sub>4</sub> (83.48%) however, T<sub>11</sub> was found statistically at par with T<sub>7</sub> and T<sub>10</sub>. Minimum percentage of fruit setting plant<sup>-1</sup> (68.73%) was recorded in T<sub>0</sub>.

As far as pooled data of both the years, on percentage of fruit setting plant<sup>-1</sup> are concerned it was found that T<sub>9</sub> had maximum fruit setting plant<sup>-1</sup> (85.53%). It was followed by T<sub>11</sub> (84.09%) and T<sub>8</sub> (83.11%). Minimum percentage of fruit setting plant<sup>-1</sup> (69.75%) was recorded in T<sub>0</sub> (control)

#### **4.1.39. Duration of fruit harvesting (days)**

The relevant data pertaining to duration of harvesting as affected by different treatment combinations are presented in table 4.1.39 and depicted in fig. 4.1.39.

During the year 2017-18, significantly maximum days taken to fruit harvesting (62.17) was recorded in T<sub>1</sub> and followed by T<sub>9</sub> (61.74) and T<sub>8</sub> (57.71). A minimum day taken to fruit harvesting (47.93) was recorded in T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character.

Similar trend was also observed regarding this character in pooled data.

**Table 4.1.38. Efficacy of organics, bio-inoculant and mulching on percentage of fruit setting plant<sup>-1</sup> in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	70.76	68.73	69.75
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	71.90	71.81	71.85
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	75.65	72.72	74.19
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	76.66	82.53	79.59
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	80.52	83.48	82.00
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	82.65	83.16	82.90
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	78.38	78.32	78.35
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	80.17	81.47	80.82
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	83.40	82.82	83.11
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	84.90	86.15	85.53
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	82.86	81.07	81.96
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	82.79	85.40	84.09
CD at 5%	8.903	8.950	8.926
SEm±	3.016	3.032	3.024

**Table 4.1.39. Efficacy of organics, bio-inoculant and mulching on duration of fruit harvesting (days) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	47.93	48.61	48.27
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	62.17	62.71	62.44
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	55.10	57.75	56.42
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	50.65	51.14	50.89
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	55.01	56.20	55.60
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	54.35	58.41	56.38
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	50.86	49.92	50.39
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	51.64	50.92	51.28
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	57.71	58.94	58.32
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	61.74	61.78	61.76
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	48.85	48.67	48.76
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	50.90	50.24	50.57
CD at 5%	6.681	2.603	4.642
SEm±	2.263	0.882	1.572

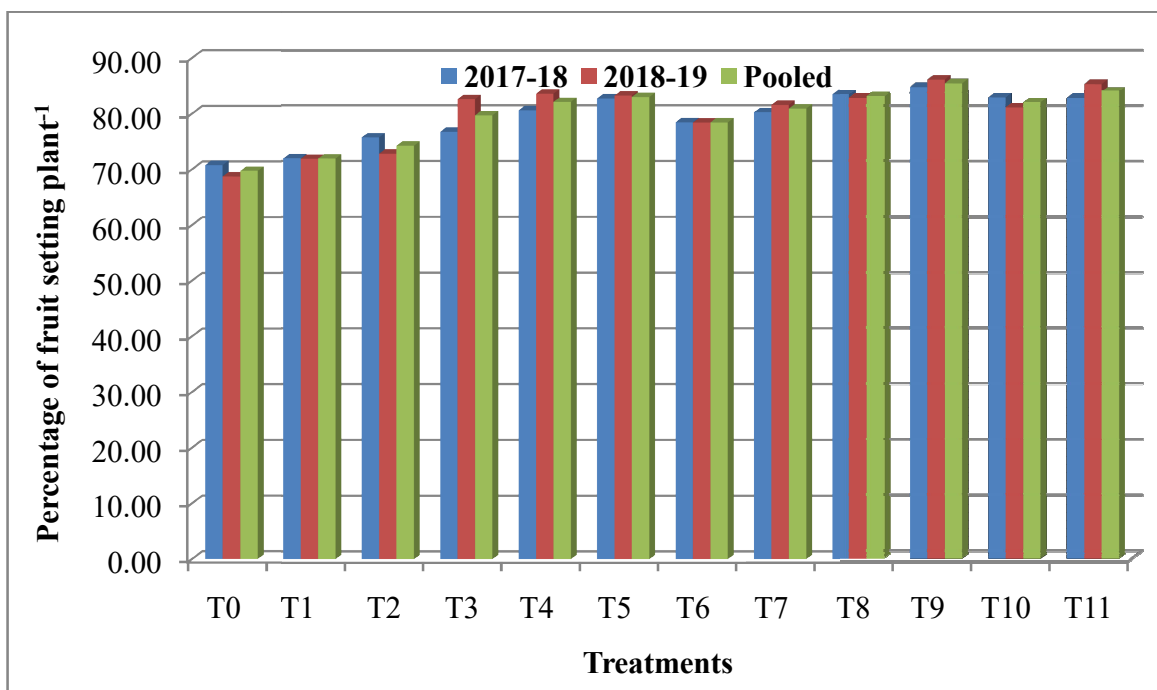


Fig.4.1.38. Efficacy of organics, bio-inoculant and mulching on percentage of fruit setting/plant in strawberry.

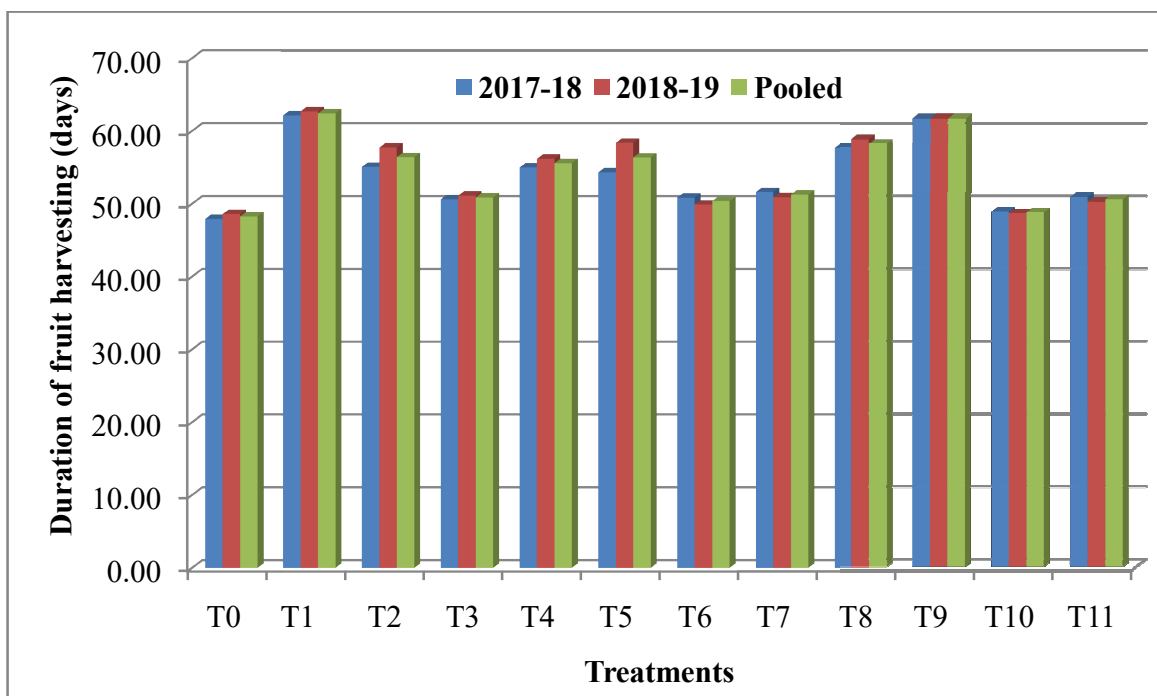


Fig. 4.1.39 Efficacy of organics, bio-inoculant and mulching on duration of fruit harvesting (days) in strawberry.

#### **4.1.40 Number of runners plant<sup>-1</sup>**

The relevant data pertaining to number of runner's plant<sup>-1</sup> as affected by different treatment combinations are depicted in table 4.1.40 and depicted in fig. 4.1.40.

During the year 2017-18, significantly maximum number of runners plant<sup>-1</sup> (6.84) was recorded in T<sub>8</sub> and followed by T<sub>1</sub> (6.52) and T<sub>9</sub> (6.33). However, T<sub>8</sub> was found statistically at par with T<sub>1</sub> and T<sub>9</sub>. Minimum number of runners plant<sup>-1</sup> (3.30) was recorded in T<sub>0</sub> (control).

In the year 2018-19, maximum number of runners plant<sup>-1</sup> (7.26) was noted with T<sub>1</sub> which was followed by T<sub>9</sub> (7.02), T<sub>8</sub> (6.69) and T<sub>2</sub> (5.76). However, T<sub>1</sub> was found statistically at par with T<sub>9</sub> and T<sub>8</sub>. Minimum number of runner's plant<sup>-1</sup> (3.66) was recorded in T<sub>0</sub> (control).

As far as pooled data of both the years, on number of runner's plant<sup>-1</sup> are concerned it was found maximum (6.89) in T<sub>1</sub>. It was followed by T<sub>8</sub> (6.77) and T<sub>9</sub> (6.68). Minimum number of runner's plant<sup>-1</sup> (3.48) was recorded in T<sub>0</sub> (control).

### **4.2 Physical and yield parameters**

#### **4.2.1 Length of fruit (cm)**

Length of fruit of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.1 and graphically illustrated in fig. 4.2.1.

During the year 2017-18, T<sub>9</sub> produced maximum length of fruit (3.77 cm) and followed by T<sub>2</sub> (3.60 cm) and T<sub>8</sub> (3.56 cm). However, T<sub>9</sub> was also found statistically at par with T<sub>2</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum length of fruit (2.29 cm) was recorded in T<sub>0</sub> (control).

During the year 2018-19, maximum length of fruit (3.83 cm) was recorded with T<sub>9</sub> and followed by T<sub>1</sub> (3.70 cm) and T<sub>8</sub> (3.59 cm). However, T<sub>9</sub> was also found statistically at par with T<sub>1</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum length of fruit was (2.18 cm) recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum length of fruit (3.80 cm) in T<sub>9</sub> and followed by T<sub>8</sub> (3.57 cm) which was significantly higher as compare to rest of the treatments. Minimum length of fruit (2.23 cm) was recorded in T<sub>0</sub> (control).

**Table 4.1.40. Efficacy of organics, bio-inoculant and mulching on number of runners plant<sup>-1</sup> in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	3.30	3.66	3.48
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	6.52	7.26	6.89
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.02	5.76	5.39
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	4.67	4.68	4.68
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	5.42	5.70	5.56
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	5.64	5.42	5.53
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	6.00	5.53	5.76
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.31	5.13	5.22
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	6.84	6.69	6.77
T <sub>9</sub> : 75% NPK+MSWC+ Mulch (Paddy straw)+ Bio-inoculant	6.33	7.02	6.68
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	4.79	4.66	4.73
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw) + Bio-inoculant	6.07	5.71	5.89
CD at 5%	0.935	1.023	0.979
SEm±	0.317	0.346	0.331

**Table 4.2.1.Efficacy of organics, bio-inoculant and mulching on length of fruit (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	2.29	2.18	2.23
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	3.40	3.70	3.55
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	3.60	3.39	3.50
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	2.98	3.04	3.01
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	3.14	3.22	3.18
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	3.22	3.23	3.22
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	2.92	2.94	2.93
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	2.90	2.94	2.92
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	3.56	3.59	3.57
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	3.77	3.83	3.80
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	3.22	3.33	3.28
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	3.42	3.44	3.43
CD at 5%	0.659	0.701	0.680
SEm±	0.223	0.238	0.230

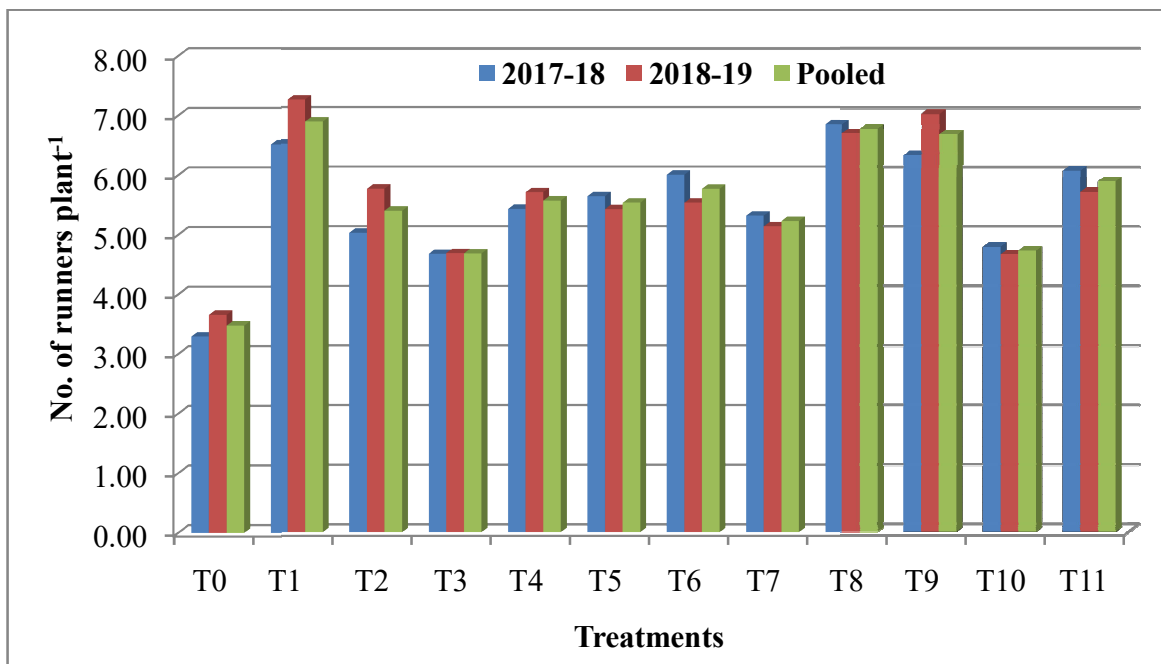


Fig. 4.1.40. Efficacy of organics, bio-inoculant and mulching on number of runners plant<sup>-1</sup> in strawberry.

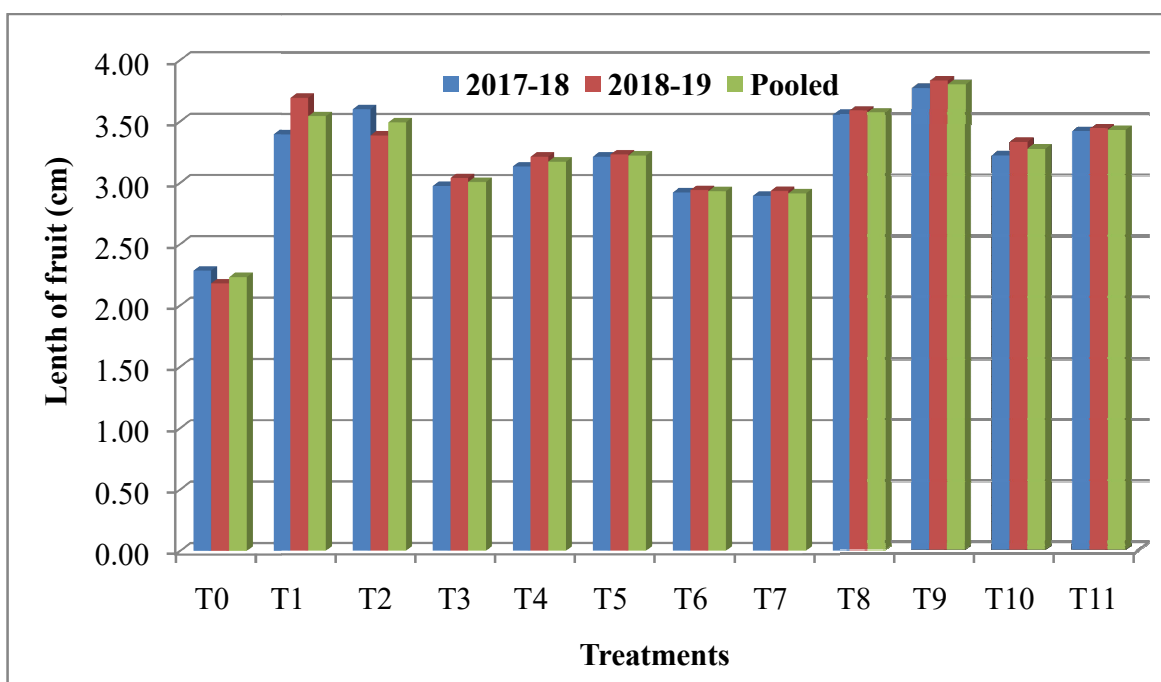


Fig. 4.2.1. Efficacy of organics, bio-inoculant and mulching on length of fruit (cm) in strawberry.

#### 4.2.2. Diameter of fruit (cm)

Diameter of fruit of both years and pooled as influenced by different treatments combinations have been presented in table 4.2.2 and graphically illustrated in fig. 4.2.2.

During the year 2017-18, T<sub>9</sub> produced maximum diameter of fruit (2.63 cm) and followed by T<sub>1</sub> (2.53 cm) and T<sub>8</sub> (2.49 cm). However, T<sub>9</sub> was also found statistically at par with T<sub>1</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum diameter of fruit (1.45 cm) was recorded in T<sub>0</sub> (control).

During the year 2018-19, maximum diameter of fruit (2.81 cm) was recorded with T<sub>9</sub> and followed by T<sub>8</sub> (2.74 cm) and T<sub>1</sub> (2.54 cm). However, T<sub>9</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum diameter of fruit (1.46 cm) was recorded in T<sub>0</sub> (control).

In pooled data similar trend was observed as year 2018-19 regarding this character.

#### 4.2.3. Size of fruit (cm<sup>2</sup>)

Fruit size of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.3 and graphically illustrated in fig. 4.2.3.

In the year 2017-18, maximum fruit size (9.81 cm<sup>2</sup>) was noted with T<sub>9</sub> and followed by T<sub>8</sub> (8.79 cm<sup>2</sup>), and T<sub>1</sub> (8.68 cm<sup>2</sup>). However, T<sub>9</sub> was also found statistically at par with T<sub>8</sub> and T<sub>1</sub>. Minimum fruit size (3.32 cm<sup>2</sup>) was recorded in T<sub>0</sub> (control).

In the year 2018-19, highest fruit size (9.65 cm<sup>2</sup>) was recorded with T<sub>1</sub> and followed by T<sub>9</sub> (9.55 cm<sup>2</sup>), and T<sub>8</sub> (8.78 cm<sup>2</sup>). However, T<sub>1</sub> was also found statistically at par with T<sub>9</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Minimum fruit size (3.18 cm<sup>2</sup>) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum fruit size (9.68 cm<sup>2</sup>) in T<sub>9</sub> and followed by T<sub>1</sub> (9.16 cm<sup>2</sup>) which was significantly higher as compare to rest of the treatments. Minimum fruit size (3.25 cm<sup>2</sup>) was recorded in T<sub>0</sub> (control).

**Table 4.2.2. Efficacy of organics, bio-inoculant and mulching on diameter of fruit (cm) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	1.45	1.46	1.46
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	2.53	2.54	2.53
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	2.06	1.92	1.99
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	1.90	1.84	1.87
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	2.30	2.24	2.27
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	2.37	2.35	2.36
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	2.21	2.22	2.21
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	1.83	1.88	1.85
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	2.49	2.74	2.62
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	2.63	2.81	2.72
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	2.15	2.25	2.20
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	2.03	2.16	2.09
CD at 5%	0.633	0.604	0.618
SEm±	0.215	0.205	0.210

**Table 4.2.3. Efficacy of organics, bio-inoculant and mulching on size of fruit (cm<sup>2</sup>) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	3.32	3.18	3.25
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	8.68	9.65	9.16
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.48	6.96	7.22
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	5.58	5.70	5.64
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.20	7.22	7.21
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.61	7.56	7.59
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	6.42	6.49	6.46
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.42	5.60	5.51
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	8.79	8.78	8.79
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	9.81	9.55	9.68
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	6.92	7.50	7.21
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	6.94	7.41	7.17
CD at 5%	2.559	2.832	2.695
SEm±	0.867	0.959	0.913

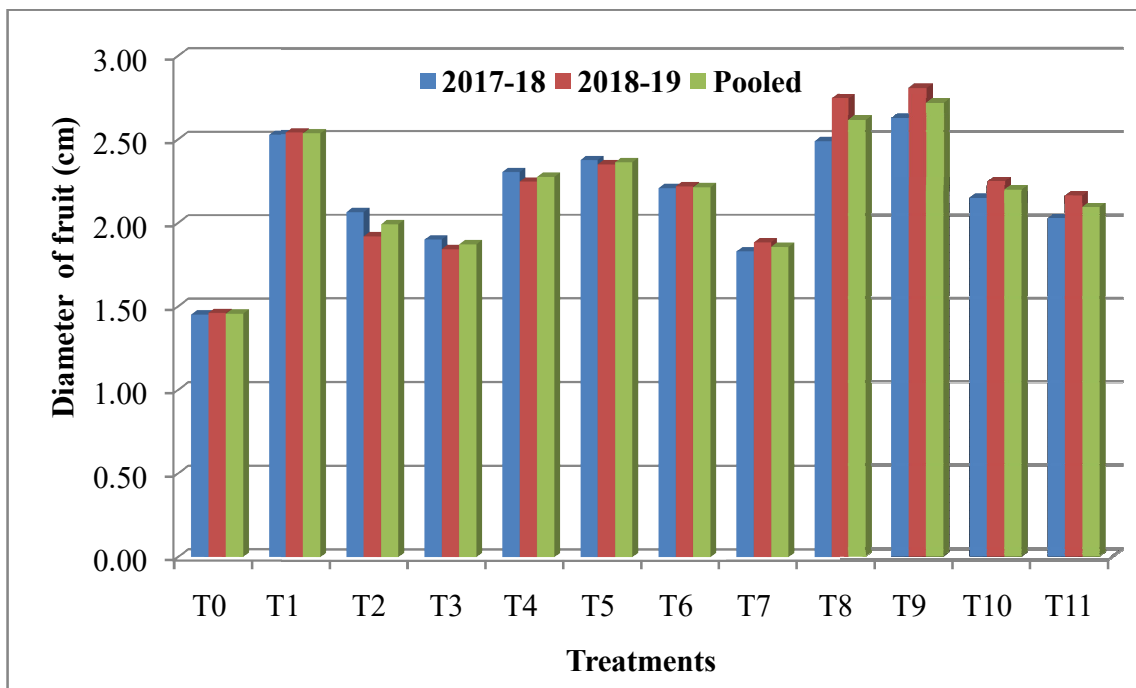


Fig. 4.2.2. Efficacy of organics, bio-inoculant and mulching on diameter of fruit (cm) in strawberry.

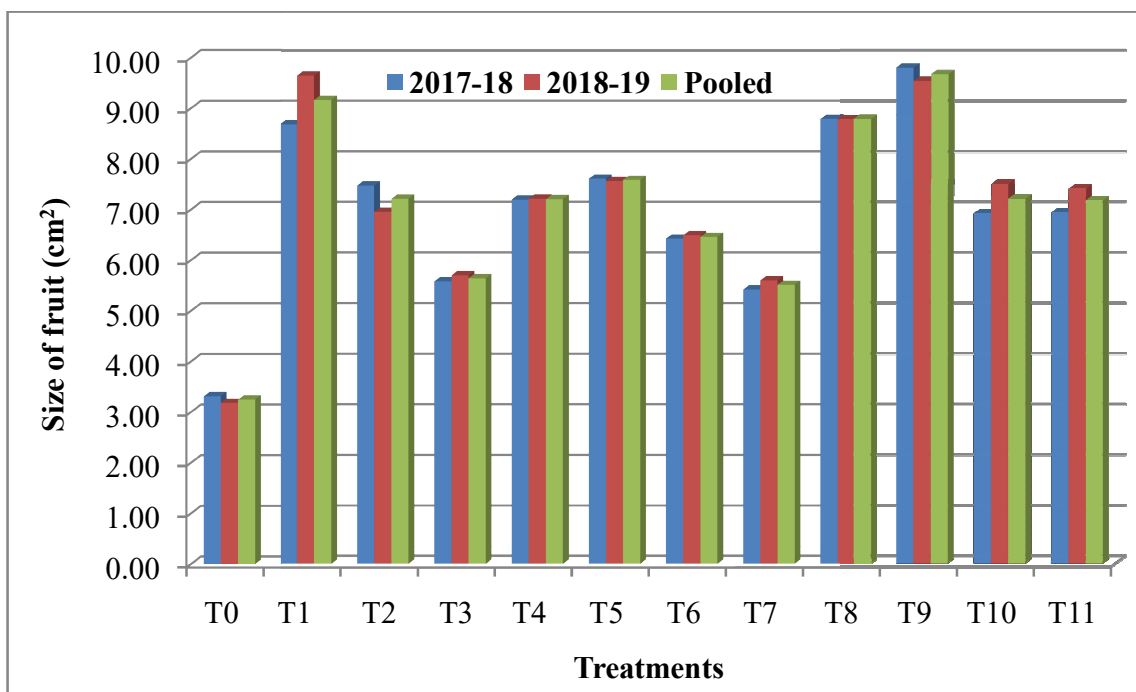


Fig. 4.2.3. Efficacy of organics, bio-inoculant and mulching on size of fruit (cm<sup>2</sup>) in strawberry.

#### **4.2.4 Fresh fruit weight (g)**

Data on fruit weight of both years and pooled as influenced by different treatments combinations have been presented in table 4.2.4 and depicted in fig. 4.2.4.

During the year 2017-18, maximum fruit weight (12.95 g) was found in T<sub>9</sub>. It was followed by T<sub>8</sub> (12.56 g), T<sub>11</sub> (12.40 g) and T<sub>10</sub> (11.89 g). Minimum fruit weight (5.85 g) was noted in T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.4.

Similar trend was also observed regarding this character in pooled data which presented in table 4.2.4.

#### **4.2.5. Volume of fruit (ml)**

Data on fruit volume of both years and pooled as influenced by different treatments combinations have been presented in table 4.2.5 and depicted in fig. 4.2.5.

During the year 2017-18, maximum fruit volume was (12.66 ml) found in T<sub>9</sub>. It was followed by T<sub>8</sub> (12.27 ml), T<sub>11</sub> (11.97 ml) and T<sub>10</sub> (11.64 ml). Minimum fruit volume (6.18 ml) was noted in T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.5.

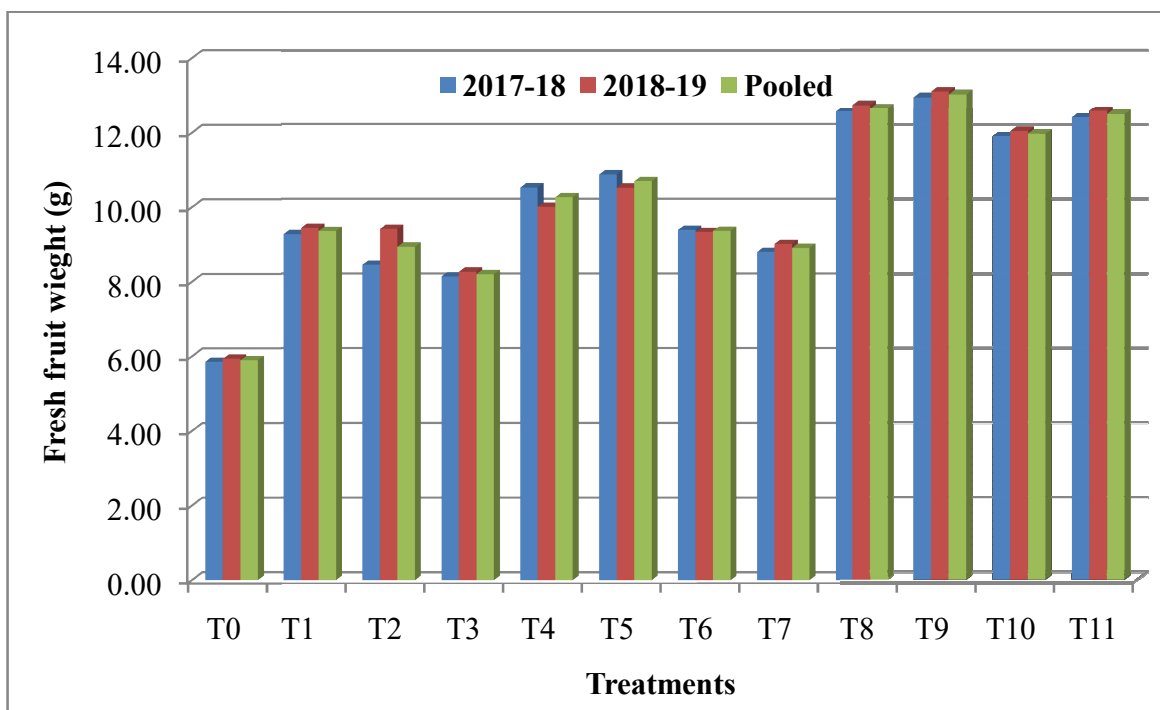
Similar trend was also observed regarding this character in pooled data which presented in table 4.2.5.

**Table 4.2.4. Efficacy of organics, bio-inoculant and mulching on fresh fruit weight (g) in strawberry.**

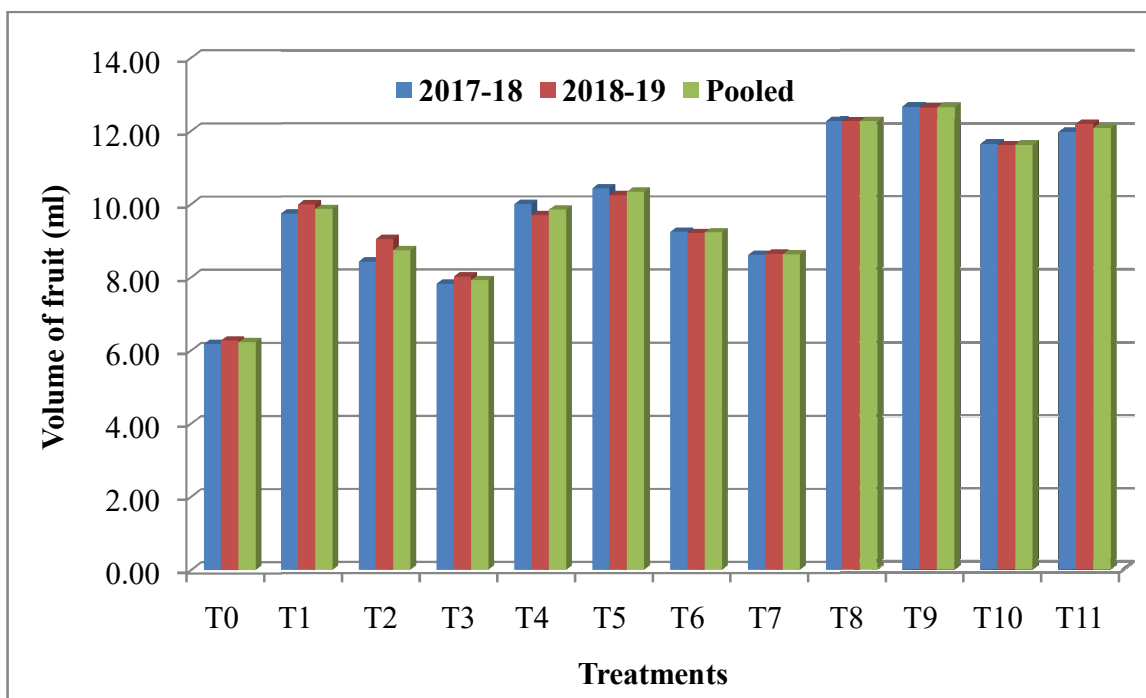
Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	5.85	5.94	5.90
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.26	9.43	9.35
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.44	9.40	8.92
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	8.13	8.26	8.19
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	10.51	9.99	10.25
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	10.86	10.50	10.68
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	9.38	9.32	9.35
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.79	9.00	8.89
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.56	12.74	12.65
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	12.95	13.10	13.03
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.89	12.03	11.96
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	12.40	12.58	12.49
CD at 5%	1.921	1.947	1.934
SEm±	0.651	0.660	0.656

**Table 4.2.5. Efficacy of organics, bio-inoculant and mulching on volume of fruit (ml) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	6.18	6.28	6.23
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.74	10.00	9.87
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	8.43	9.05	8.74
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	7.82	8.02	7.92
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	10.01	9.70	9.85
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	10.43	10.25	10.34
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	9.25	9.21	9.23
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	8.62	8.65	8.63
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.27	12.26	12.27
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	12.66	12.64	12.65
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	11.64	11.60	11.62
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	11.97	12.19	12.08
CD at 5%	1.833	1.865	1.849
SEm±	0.621	0.632	0.626



**Fig. 4.2.4. Efficacy of organics, bio-inoculant and mulching on fresh fruit weight (g) in strawberry.**



**Fig. 4.2.5. Efficacy of organics, bio-inoculant and mulching on volume of fruit (ml) in strawberry.**

#### **4.2.6. Specific gravity**

Specific gravity of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.6 and graphically illustrated in fig. 4.2.6.

During the year 2017-18, maximum specific gravity (1.050) was noted with T<sub>4</sub> and followed by T<sub>5</sub> (1.041), and T<sub>3</sub> (1.037). In spite of, T<sub>4</sub> was also found statistically at par with T<sub>5</sub> and T<sub>3</sub>. Minimum specific gravity (0.947) was recorded in T<sub>0</sub> (control).

During the year 2018-19, highest specific gravity (1.041) was recorded with T<sub>7</sub> and followed by T<sub>2</sub> (1.039), and T<sub>8</sub> (1.039). In spite of, T<sub>7</sub> was also found statistically at par with T<sub>2</sub> and T<sub>8</sub>. But remained statistically significant over other treatments. Lowest (0.946) specific gravity was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum specific gravity (1.040) in T<sub>4</sub> and followed by T<sub>3</sub> & T<sub>11</sub> (1.034) which was significantly higher as compare to rest of the treatments. Minimum specific gravity (0.946) was recorded in T<sub>0</sub> (control).

#### **4.2.7. Dry fruit weight (g)**

Data on dry fruit weight of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.7 and graphically illustrated in fig. 4.2.7.

During the year 2017-18, maximum dry fruit weight (1.23 g) was found in T<sub>9</sub>. It was followed by T<sub>8</sub> (1.20 g), T<sub>11</sub> (1.18 g) and T<sub>10</sub> (1.14 g). Minimum dry fruit weight (0.56 g) was noted in T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.7.

Similar trend was also observed regarding this character in pooled data which presented in table 4.2.7.

**Table 4.2.6. Efficacy of organics, bio-inoculant and mulching on specific gravity in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.947	0.946	0.946
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	0.952	0.943	0.948
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	1.002	1.039	1.020
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	1.037	1.030	1.034
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	1.050	1.031	1.040
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	1.041	1.024	1.033
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	1.015	1.011	1.013
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	1.020	1.041	1.030
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	1.023	1.039	1.031
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	1.024	1.036	1.030
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	1.022	1.036	1.029
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	1.036	1.032	1.034
CD at 5%	0.026	0.026	0.026
SEm±	0.009	0.009	0.009

**Table 4.2.7. Efficacy of organics, bio-inoculant and mulching on dry fruit weight (g) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.56	0.57	0.56
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	0.88	0.90	0.89
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	0.80	0.90	0.85
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	0.78	0.79	0.78
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	1.01	0.95	0.98
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	1.04	1.00	1.02
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	0.90	0.89	0.90
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	0.84	0.86	0.85
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	1.20	1.21	1.21
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	1.23	1.25	1.24
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	1.14	1.15	1.14
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	1.18	1.20	1.19
CD at 5%	0.191	0.187	0.189
SEm±	0.065	0.063	0.064

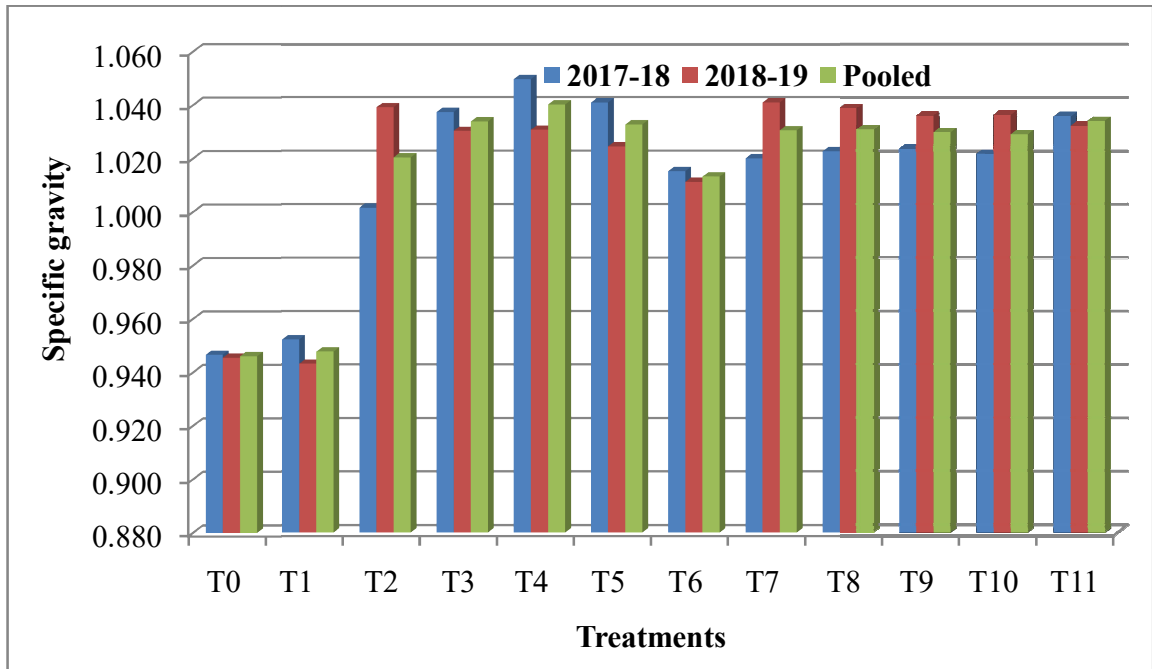


Fig. 4.2.6. Efficacy of organics, bio-inoculant and mulching on specific gravity in strawberry.

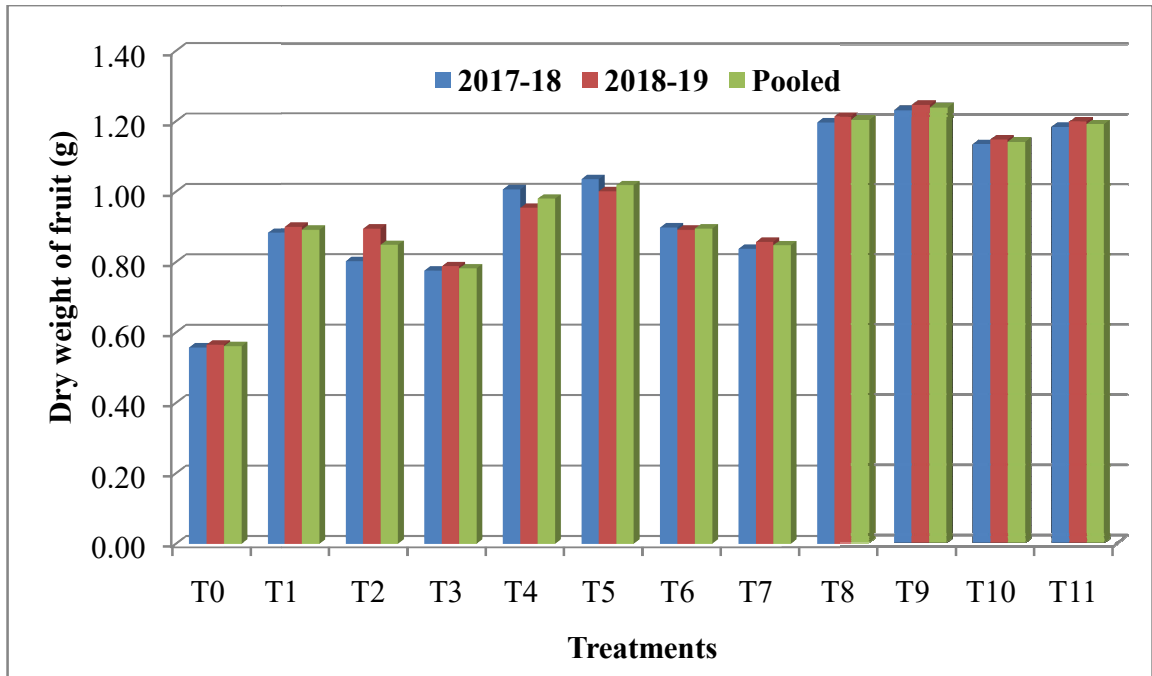


Fig. 4.2.7. Efficacy of organics, bio-inoculant and mulching on dry fruit weight (g) in strawberry.

#### **4.2.8. Fruit yield per plant (g)**

Data on fruit yield per plant of both years and pooled as influenced by different treatments combinations have been presented in table 4.2.8 and graphically illustrated in fig. 4.2.8.

During the year 2017-18, maximum fruit yield plant<sup>-1</sup> (131.93 g) was found in T<sub>9</sub>. It was followed by T<sub>8</sub> (125.76 g), T<sub>11</sub> (121.74g) and T<sub>10</sub> (116.32 g). Whereas Minimum (35.67 g) fruit yield plant<sup>-1</sup> was noted inT<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.8.

Similar trend was also observed regarding this character in pooled data which presented in table 4.2.8.

#### **4.2.9. Fruit yield plot<sup>-1</sup> (kg)**

Data on fruit yield/plot of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.9 and graphically illustrated in fig. 4.2.9.

In the year 2017-18, maximum fruit yield plot<sup>-1</sup> (2.64 kg) was found in T<sub>9</sub>. It was followed by T<sub>8</sub> (2.52 kg), T<sub>11</sub> (2.43 kg) and T<sub>10</sub> (2.33 kg). Minimum fruit yield plot<sup>-1</sup> (0.71 kg) was noted inT<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.9.

Similar trend was also observed regarding this character in pooled data which presented in table 4.2.9.

**Table 4.2.8. Efficacy of organics, bio-inoculant and mulching on fruit yield plant<sup>-1</sup> (g) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	35.67	35.14	35.40
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	85.14	86.96	86.05
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	74.22	81.22	77.72
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	57.95	59.10	58.53
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	101.61	95.50	98.56
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	106.01	103.64	104.83
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	82.82	82.93	82.87
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	81.92	87.14	84.53
T <sub>8</sub> : 75% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	125.76	125.54	125.65
T <sub>9</sub> : 75% NPK+MSWC+Mulch (Paddy straw)+ Bio-inoculant	131.93	131.06	131.49
T <sub>10</sub> : 50% NPK+ FYM+ Mulch(Paddy straw) + Bio-inoculant	116.32	116.37	116.35
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw)+ Bio-inoculant	121.74	125.10	123.42
CD at 5%	20.627	20.677	20.652
SEm±	6.988	7.005	6.996

**Table 4.2.9. Efficacy of organics, bio-inoculant and mulching on fruit yield plot<sup>-1</sup> (kg) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.71	0.70	0.71
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	1.70	1.74	1.72
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	1.48	1.62	1.55
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	1.16	1.18	1.17
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	2.03	1.91	1.97
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	2.12	2.07	2.10
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	1.66	1.66	1.66
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	1.64	1.74	1.69
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	2.52	2.51	2.51
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	2.64	2.62	2.63
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	2.33	2.33	2.33
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	2.43	2.50	2.47
CD at 5%	0.412	0.412	0.412
SEm±	0.140	0.140	0.140

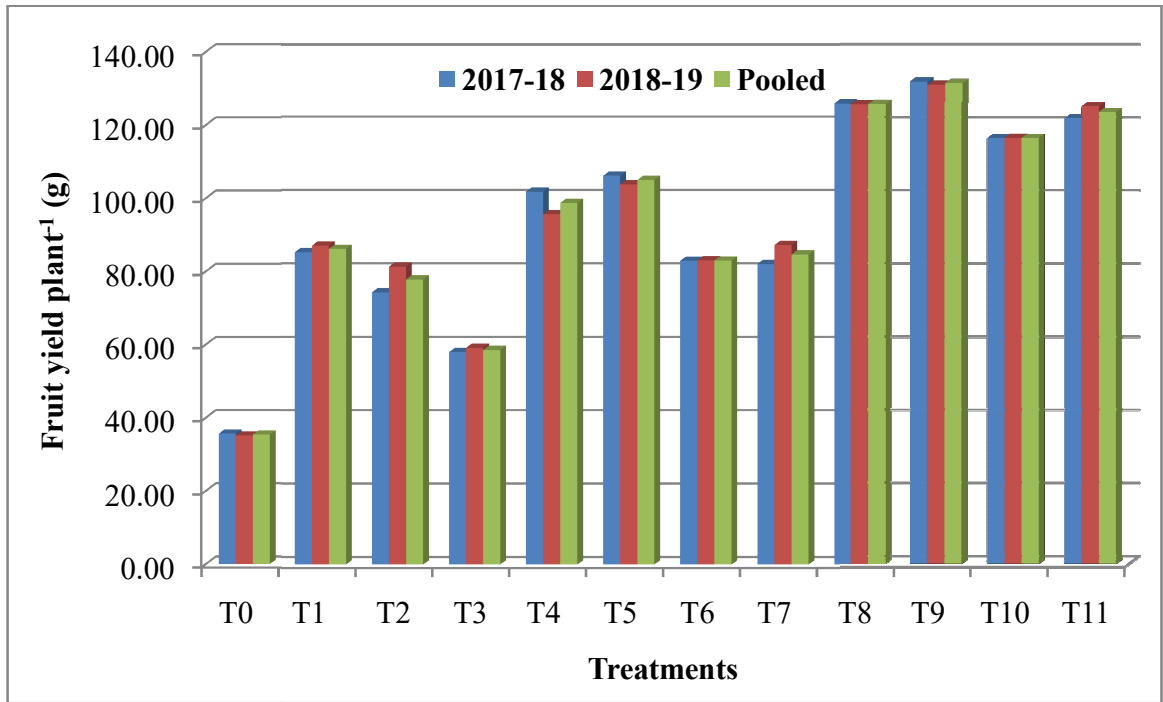


Fig. 4.2.8. Efficacy of organics, bio-inoculant and mulching on fruit yield plant<sup>-1</sup> (g) in strawberry.

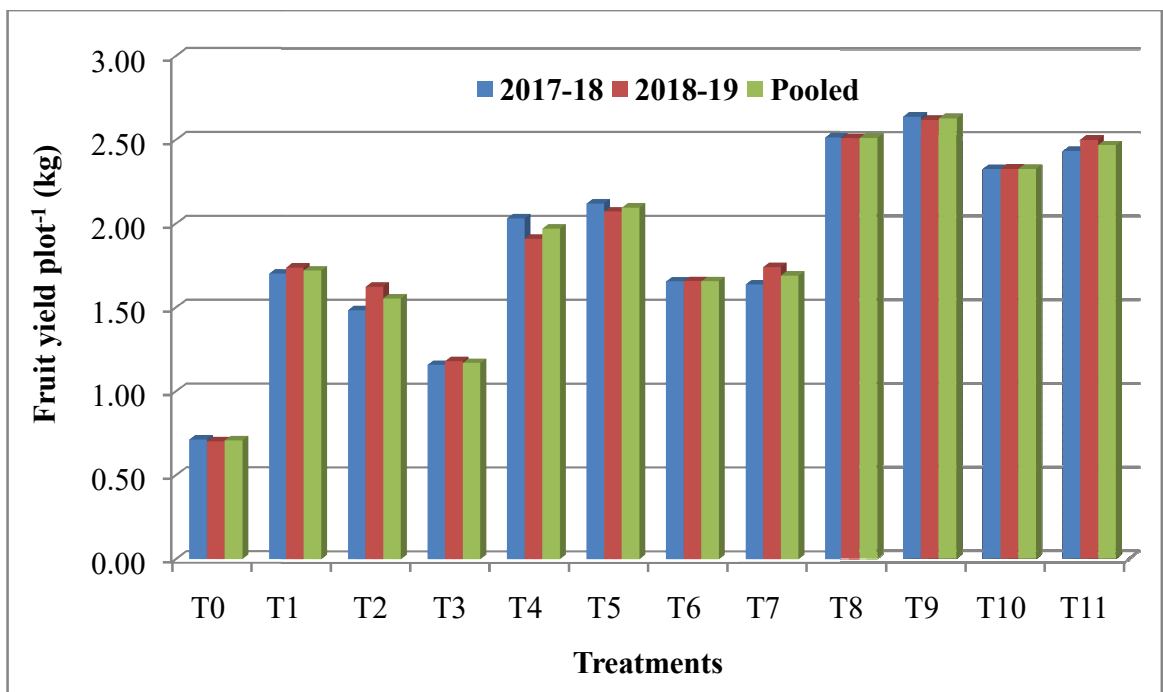


Fig. 4.2.9. Efficacy of organics, bio-inoculant and mulching on fruit yield plot<sup>-1</sup> (kg) in strawberry.

#### **4.2.10. Fruit yield ha<sup>-1</sup> (q)**

Data on fruit yield ha<sup>-1</sup> of both years and pooled as influenced by different treatments combinations have been depicted in table 4.2.10 and graphically illustrated in fig. 4.2.10.

In the year 2017-18, maximum fruit yield ha<sup>-1</sup> (195.45 q) was found in T<sub>9</sub>. It was followed by T<sub>8</sub> (186.32 q), T<sub>11</sub> (180.36 q) and T<sub>10</sub> (172.33 q). Minimum fruit yield ha<sup>-1</sup> (52.84 q) was noted in T<sub>0</sub> (control).

Similar trend was observed during the year 2018-19 regarding this character which presented in table 4.2.10.

. Similar trend was also observed regarding this character in pooled data which presented in table 4.2.10.

### **4.3 Bio-chemical parameters**

#### **4.3.1 pH determination of fruit juice**

Data on pH content of fruit juice of both years and pooled as influenced by different treatments combinations have been depicted in table 4.3.1 and graphically illustrated in fig. 4.3.1.

During the year 2017-18, highest pH content of fruit juice (4.98) was found in T<sub>8</sub> and followed by T<sub>9</sub> (4.52), T<sub>10</sub> (4.45) and T<sub>4</sub> (4.52). Lowest pH content of fruit juice (3.81) was noted in T<sub>0</sub> (control).

During the year 2018-19, highest pH content of fruit juice (4.90) was found in T<sub>10</sub> and followed by T<sub>8</sub> (4.89), T<sub>9</sub> (4.86) and T<sub>11</sub> (4.73). Minimum pH content of fruit juice (3.86) was noted in T<sub>0</sub> (control).

In pooled data similar trend was observed as the year 2017-18 of regarding this character which presented in table 4.3.1.

**Table 4.2.10. Efficacy of organics, bio-inoculant and mulching on fruit yield ha<sup>-1</sup> (q) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	52.84	52.06	52.45
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	126.13	128.83	127.48
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	109.95	120.32	115.14
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	85.86	87.55	86.71
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	150.53	141.49	146.01
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	157.05	153.55	155.30
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	122.69	122.86	122.78
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	121.36	129.09	125.23
T <sub>8</sub> : 75% NPK + FYM+ Mulch (Paddy straw) + Bio-inoculant	186.32	185.99	186.15
T <sub>9</sub> : 75% NPK+MSWC+Mulch (Paddy straw)+ Bio-inoculant	195.45	194.16	194.81
T <sub>10</sub> : 50% NPK+ FYM+Mulch (Paddy straw) + Bio-inoculant	172.33	172.40	172.37
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw)+ Bio-inoculant	180.36	185.33	182.84
CD at 5%	30.561	30.632	30.596
SEm±	10.353	10.377	10.365

**Table 4.3.1. Efficacy of organics, bio-inoculant and mulching on pH determination of fruit juice in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	3.81	3.86	3.83
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	4.21	4.26	4.24
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	4.00	4.13	4.07
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	3.85	4.15	4.00
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	4.28	4.73	4.51
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	4.19	4.46	4.32
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	3.87	4.19	4.03
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	3.96	4.27	4.12
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	4.98	4.89	4.93
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	4.52	4.86	4.69
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	4.45	4.90	4.67
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	4.27	4.73	4.50
CD at 5%	0.524	0.407	0.465
SEm±	0.177	0.138	0.157

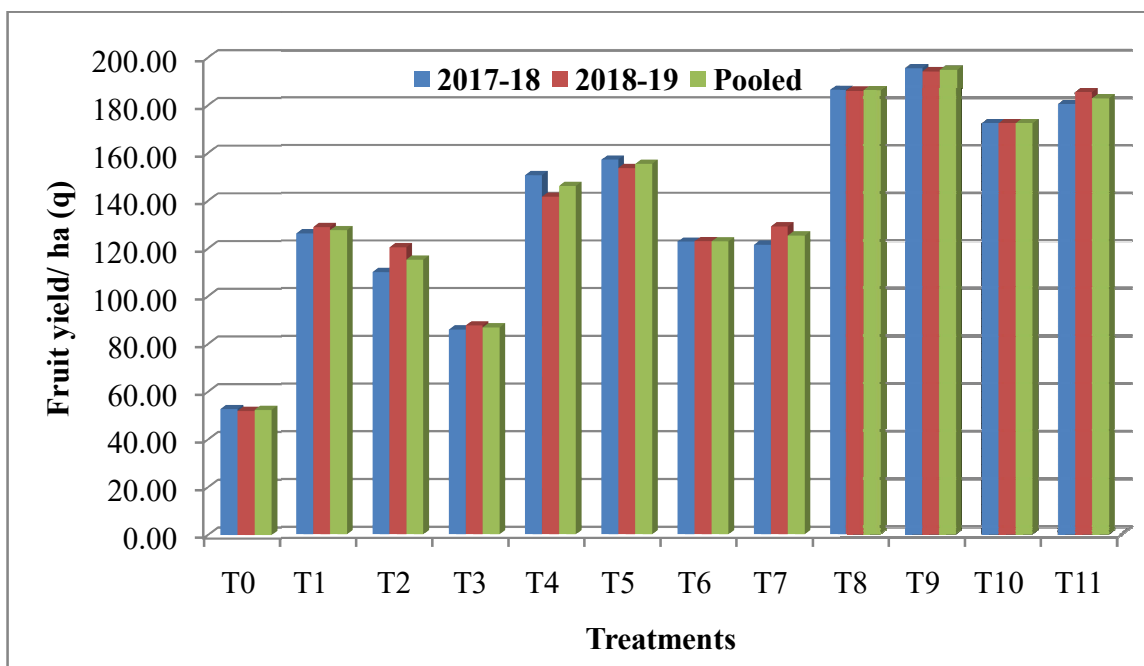


Fig. 4.2.10. Efficacy of organics, bio-inoculant and mulching on fruit yield ha<sup>-1</sup> (q) in strawberry.

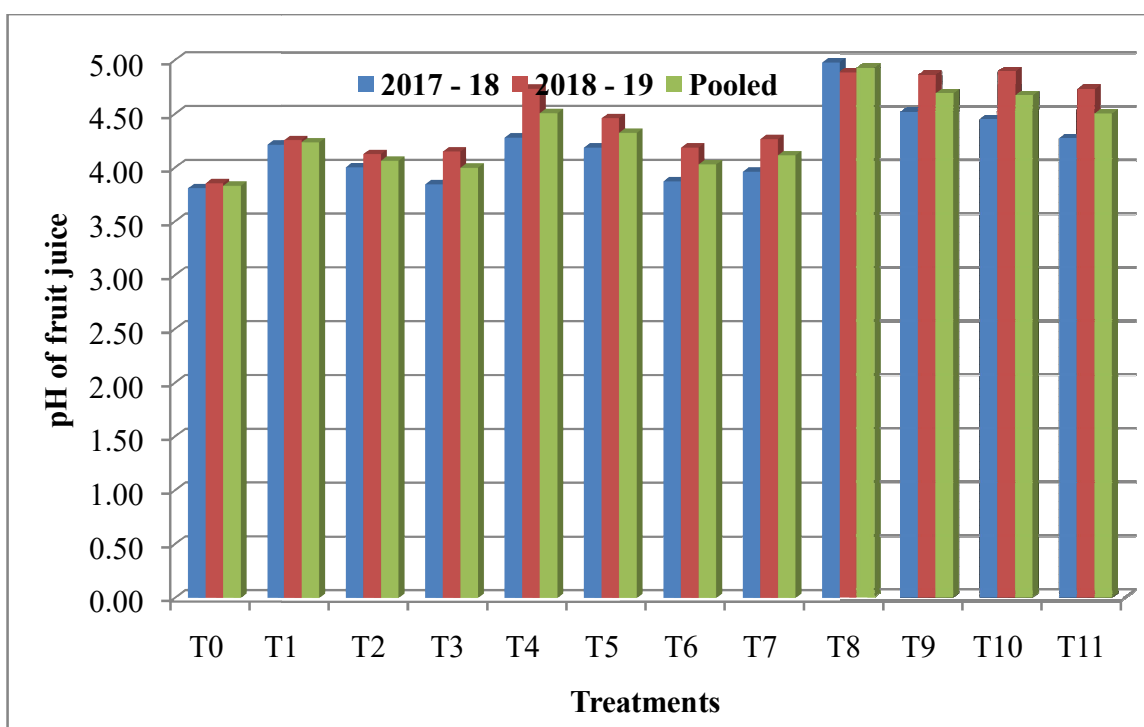


Fig. 4.3.1. Efficacy of organics, bio-inoculant and mulching on pH determination of fruit juice in strawberry.

#### **4.3.2. Total soluble solids (TSS °Brix)**

Data on total soluble solids (TSS °Brix) of both years and pooled as influenced by different treatments combinations have been presented in table 4.3.2 and graphically illustrated in fig. 4.3.2.

In the year 2017-18, a maximum total soluble solid (12.14 °Brix) was found under T<sub>8</sub>. It was followed by T<sub>9</sub> (11.21 °Brix), T<sub>10</sub> (10.76 °Brix) and T<sub>5</sub> (10.39 °Brix). A minimum (7.77 °Brix) total soluble solid was noted in T<sub>0</sub> (control).

Similar trend was observed in the year 2018-19 regarding this character which presented in table 4.3.2.

. Similar trend was also observed regarding this character in pooled data which presented in table 4.3.2.

#### **4.3.3. Titratable acidity (%)**

Titratable acidity of both years and pooled as influenced by different treatments combinations have been depicted in table 4.3.3 and graphically illustrated in fig. 4.3.3.

During the year 2017-18, minimum titratable acidity (0.66%) was noted with T<sub>9</sub> and followed by T<sub>8</sub> (0.67%), and T<sub>4</sub> (0.67%). Maximum titratable acidity (0.83%) was recorded in T<sub>0</sub> (control).

During the year 2018-19, lowest titratable acidity (0.63%) was recorded with T<sub>8</sub> and followed by T<sub>9</sub> (0.65%), and T<sub>4</sub> (0.67%). Maximum titratable acidity (0.82%) was recorded under T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that minimum titratable acidity (0.65%) in T<sub>8</sub> and followed by T<sub>9</sub> (0.66%) and T<sub>4</sub> (0.67%). Minimum titratable acidity (0.94%) was recorded under T<sub>0</sub> (control).

**Table 4.3.2. Efficacy of organics, bio-inoculant and mulching on total soluble solids (<sup>0</sup>Brix) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	7.77	8.29	8.03
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	9.71	9.85	9.78
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	9.69	9.79	9.74
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	9.48	9.57	9.53
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	10.01	10.22	10.12
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	10.39	10.54	10.47
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	9.15	9.38	9.26
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	9.33	9.37	9.35
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	12.14	12.28	12.21
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	11.21	12.05	11.63
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	10.76	11.53	11.15
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	10.37	10.47	10.42
CD at 5%	1.284	1.015	1.149
SEm±	0.435	0.344	0.389

**Table 4.3.3. Efficacy of organics, bio-inoculant and mulching on titratable acidity (%) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.83	0.82	0.82
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	0.77	0.78	0.77
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	0.78	0.76	0.77
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	0.79	0.79	0.79
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	0.67	0.67	0.67
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	0.73	0.71	0.72
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	0.78	0.78	0.78
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	0.75	0.79	0.77
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	0.67	0.63	0.65
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	0.66	0.65	0.66
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	0.72	0.66	0.69
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	0.73	0.74	0.74
CD at 5%	0.039	0.025	0.032
SEm±	0.013	0.008	0.010

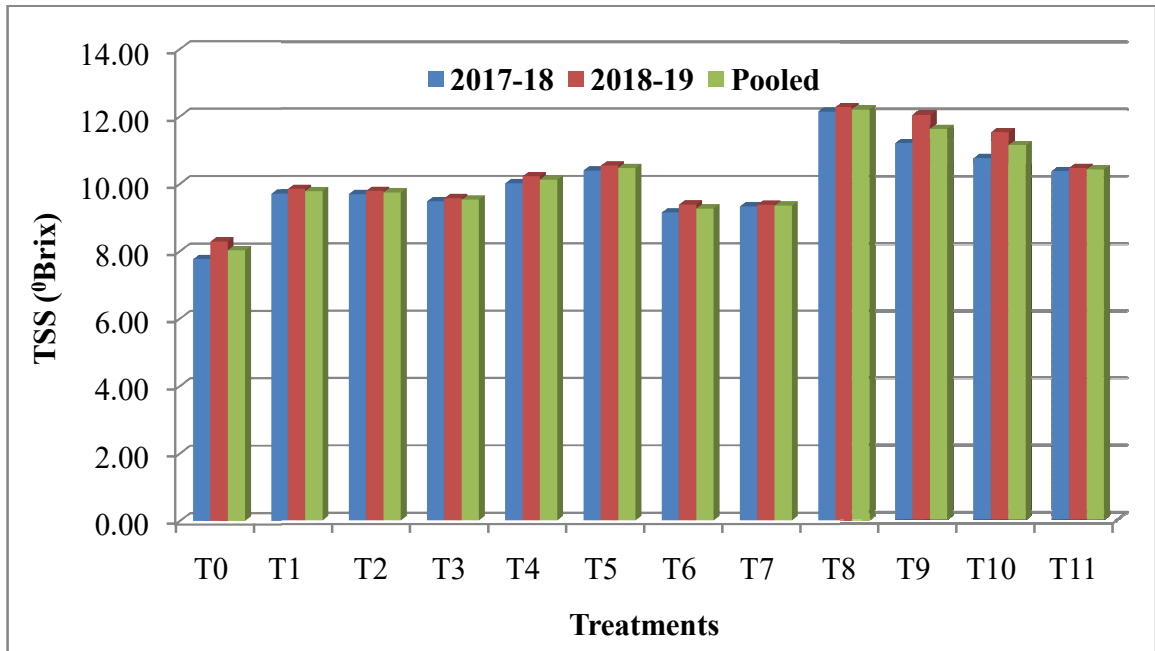


Fig. 4.3.2. Efficacy of organics, bio-inoculant and mulching on total soluble solids ( $^{\circ}$ Brix) in strawberry.

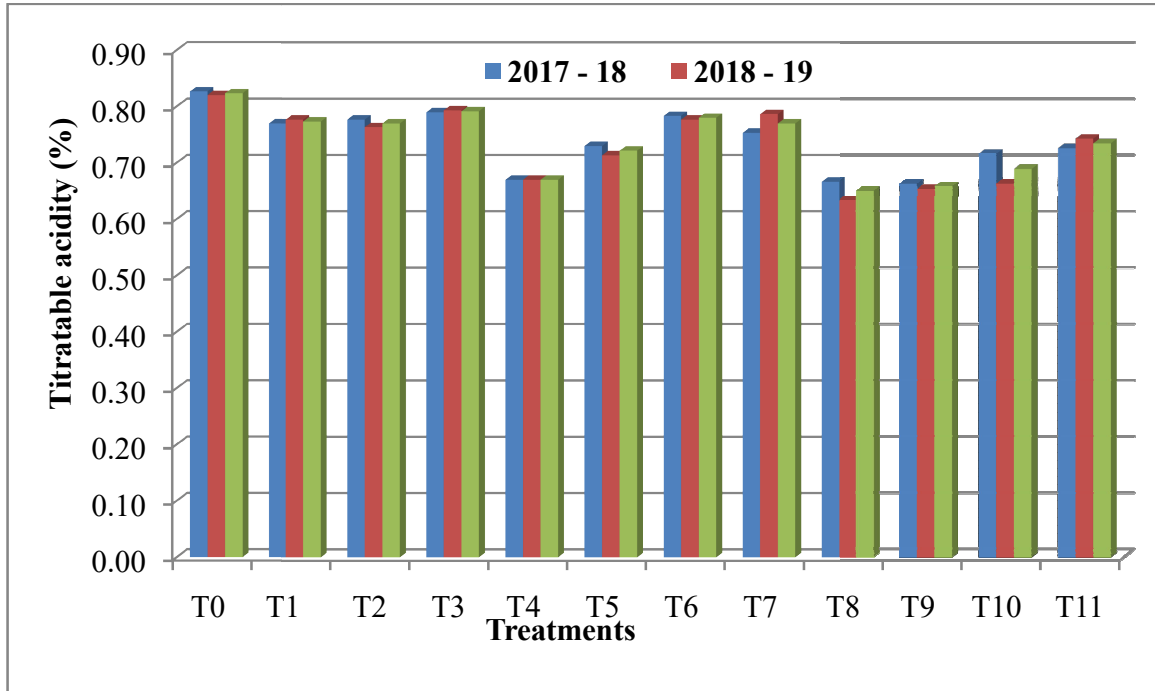


Fig. 4.3.3. Efficacy of organics, bio-inoculant and mulching on titratable acidity (%) in strawberry.

#### **4.3.4. TSS/Acid ratio**

Data on TSS/Acid ratio of both years and pooled as influenced by different treatments combinations have been depicted in table 4.3.4 and graphically illustrated in fig. 4.3.4.

In the year 2017-18, maximum TSS/Acid ratio (18.25) was found in treatment T<sub>8</sub>. It was followed by T<sub>9</sub> (16.90), T<sub>10</sub> (15.02) and T<sub>4</sub> (14.93). Minimum TSS/Acid ratio (7.50) was noted under T<sub>0</sub> (control).

Similar trend was observed in the year 2018-19 regarding this character which presented in table 4.3.4.

Similar trend was also observed regarding this character in pooled data which presented in table 4.3.4.

#### **4.3.5. Ascorbic acid /vitamin C (mg/100g fruit pulp)**

Data on vitamin C of both years and pooled as influenced by different treatments combinations have been presented in table 4.3.5 and graphically illustrated in fig. 4.3.5.

In the year 2017-18, highest vitamin C (69.60 mg/100 g fruit pulp) was found in T<sub>0</sub>. It was followed by T<sub>1</sub> (68.57 mg/100 g fruit pulp), T<sub>6</sub> (65.37 mg/100 g fruit pulp) and T<sub>3</sub> (65.03 mg/100 g fruit pulp). Lowest vitamin C (54.31 mg/100 g of fruit pulp) was noted under T<sub>8</sub>.

Similar trend was observed in the year 2018-19 regarding this character which presented in table 4.3.5.

Similar trend was also observed regarding this character in pooled data which presented in table 4.3.5.

**Table 4.3.4. Efficacy of organics, bio-inoculant and mulching on TSS/Acid ratio in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	7.50	7.67	7.59
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	12.62	12.68	12.65
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	12.52	12.84	12.68
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	12.00	12.07	12.03
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	14.93	15.25	15.09
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	14.23	14.78	14.50
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	11.68	12.08	11.88
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	12.42	11.92	12.17
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.25	19.39	18.82
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	16.90	18.45	17.67
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	15.02	17.41	16.21
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	14.30	14.09	14.19
CD at 5%	1.954	1.475	1.714
SEm±	0.662	0.500	0.581

**Table 4.3.5. Efficacy of organics, bio-inoculant and mulching on ascorbic acid /vitamin C (mg/100 g fruit pulp) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	69.60	69.51	69.56
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	68.57	68.16	68.37
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	64.55	64.80	64.67
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	65.03	65.09	65.06
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	58.16	57.93	58.04
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	59.74	59.85	59.80
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	65.37	65.49	65.43
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	63.24	63.26	63.25
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	54.31	54.41	54.36
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	56.21	55.96	56.09
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	54.87	55.06	54.96
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	58.32	58.65	58.49
CD at 5%	3.322	3.418	3.370
SEm±	1.125	1.158	1.141

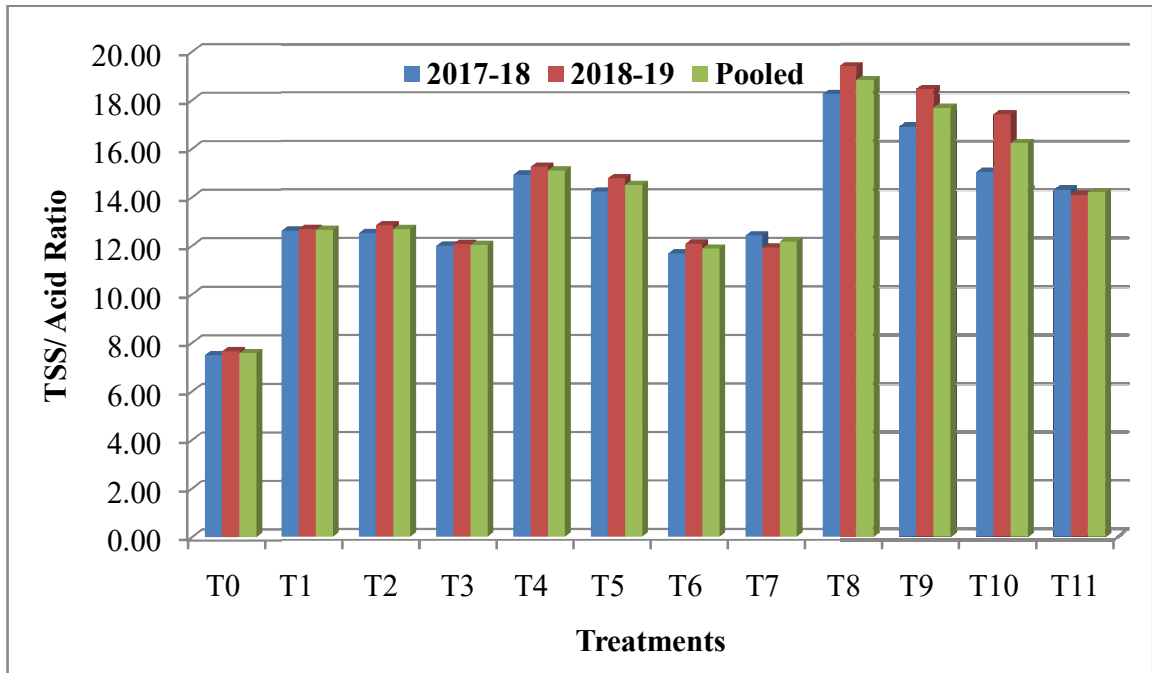


Fig. 4.3.4. Efficacy of organics, bio-inoculant and mulching on TSS/Acid ratio in strawberry.

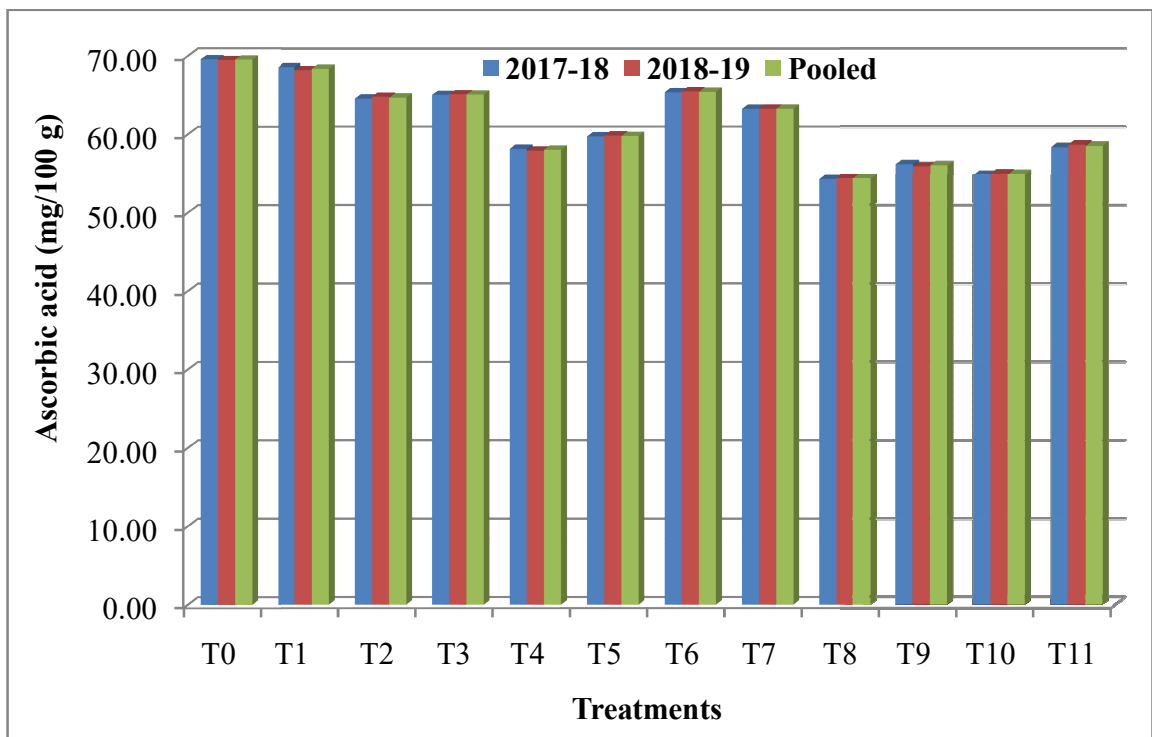


Fig. 4.3.5. Efficacy of organics, bio-inoculant and mulching on ascorbic acid /vitamin C (mg/100 g fruit pulp) in strawberry.

#### **4.3.6. Total sugars (%)**

Data on total sugars of both years and pooled as influenced by different treatments combinations have been depicted in table 4.3.6 and graphically illustrated in fig. 4.3.6.

During the year 2017-18, a highest total sugar (8.28%) was found in T<sub>8</sub>. It was followed by T<sub>9</sub> (7.41%), T<sub>4</sub> (7.11%) and T<sub>10</sub> (7.09%). A lowest total sugar (4.62%) was noted in T<sub>0</sub> (control).

During the year 2018-19, a maximum total sugar (8.26%) was found under T<sub>8</sub>. It was followed by T<sub>9</sub> (7.44%), T<sub>10</sub> (7.20%) and T<sub>4</sub> (7.19%). A lowest total sugar (4.59%) was noted in T<sub>0</sub> (control).

Similar trend was also observed regarding this character in pooled data.

#### **4.3.7. Reducing sugar (%)**

Data on reducing sugar of both years and pooled as influenced by different treatments combinations have been presented in table 4.3.7 and graphically illustrated in fig. 4.3.7.

In the year 2017-18, highest reducing sugar (4.69%) was found in T<sub>8</sub>. It was followed by T<sub>5</sub> (4.56%) and T<sub>9</sub> (4.19%). Lowest (2.49%) reducing sugar was noted under T<sub>0</sub> (control).

Similar trend was observed in the year 2018-19 regarding this character which presented in table 4.3.7.

Similar trend was also observed regarding this character in pooled data which presented in table 4.3.7.

**Table 4.3.6. Efficacy of organics, bio-inoculant and mulching on total sugars (%) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	4.62	4.59	4.61
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	5.03	5.12	5.07
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	5.27	5.29	5.28
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	5.25	5.41	5.33
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.11	7.19	7.15
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	6.79	6.85	6.82
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	5.12	5.16	5.14
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	5.14	5.20	5.17
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	8.28	8.26	8.27
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	7.41	7.44	7.42
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	7.09	7.20	7.15
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	6.98	7.05	7.01
CD at 5%	0.533	0.553	0.543
SEm±	0.181	0.187	0.184

**Table 4.3.7. Efficacy of organics, bio-inoculant and mulching on reducing sugar (%) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	2.49	2.52	2.50
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	2.81	2.87	2.84
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	3.13	3.15	3.14
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	3.20	3.24	3.22
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	4.00	4.03	4.02
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	4.56	4.60	4.58
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	2.99	3.03	3.01
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	2.80	2.82	2.81
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	4.69	4.70	4.70
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	4.19	4.18	4.19
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	3.98	4.04	4.01
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	3.89	3.90	3.90
CD at 5%	0.426	0.425	0.425
SEm±	0.144	0.144	0.144

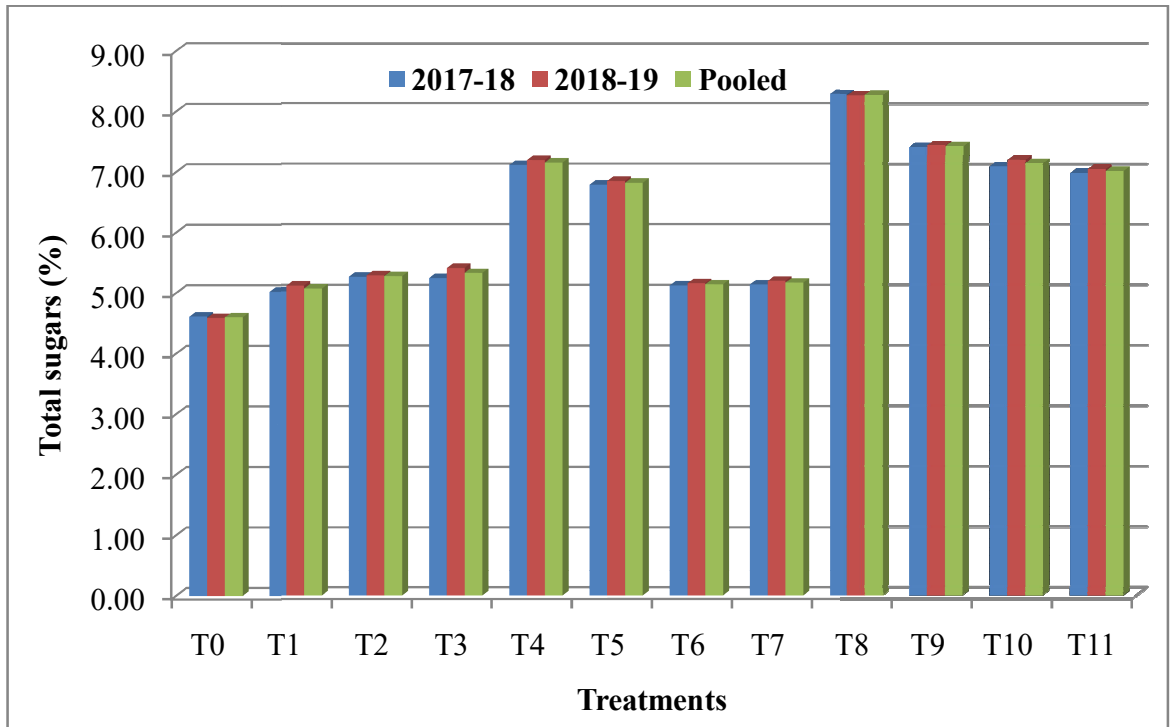


Fig. 4.3.6. Efficacy of organics, bio-inoculant and mulching on total sugars (%) in strawberry.

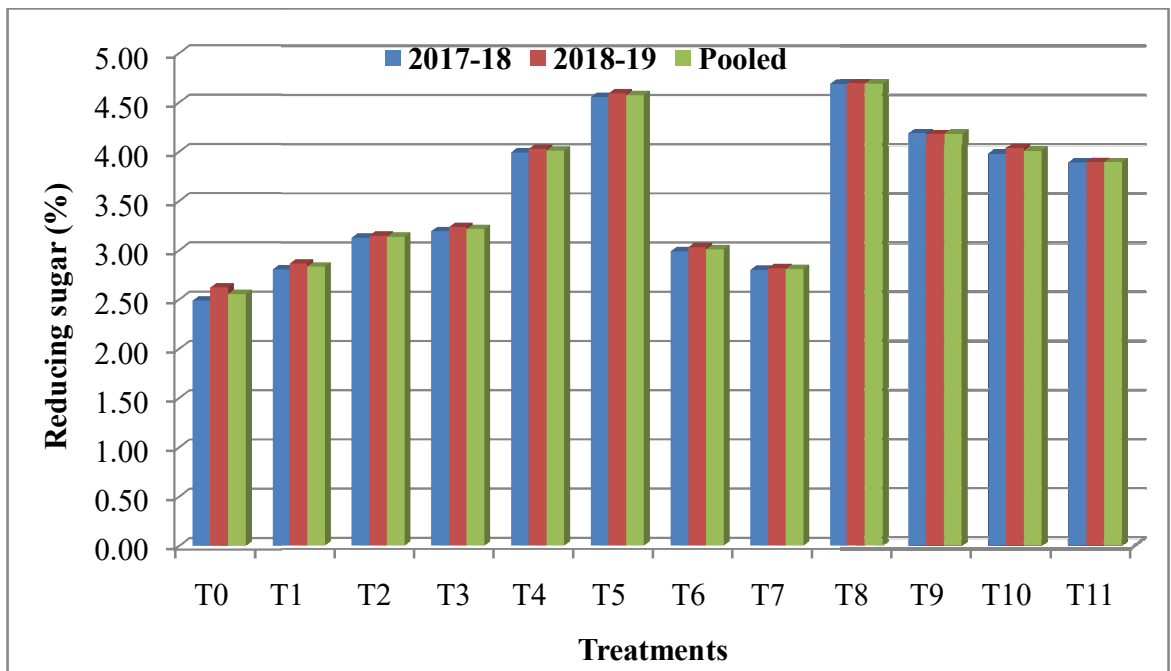


Fig. 4.3.7. Efficacy of organics, bio-inoculant and mulching on reducing sugar (%) in strawberry.

#### **4.3.8. Non-reducing sugar (%)**

Data on non-reducing sugar of both years and pooled as influenced by different treatments combinations have been presented in table 4.3.8 and graphically illustrated in fig. 4.3.8.

In the year 2017-18, maximum non-reducing sugar (3.59%) was found in T<sub>8</sub>. It was followed by T<sub>9</sub> (3.22%) and T<sub>4</sub> (3.11%). Lowest non-reducing sugar (2.13%) was noted under T<sub>0</sub> (control).

Similar trend was observed in the year 2018-19 regarding this character.

Similar trend was also observed regarding this character in pooled data.

#### **4.3.9. Anthocyanin (mg/100 g)**

Anthocyanin of both years and pooled as influenced by different treatments combinations have been depicted in table 4.3.9 and graphically illustrated in fig. 4.3.9.

During the year 2017-18, maximum anthocyanin content (45.66 mg /100 g) was noted with T<sub>5</sub> and followed by T<sub>8</sub> (42.65 mg /100 g) T<sub>4</sub> (41.44 mg /100 g) and T<sub>9</sub> (41.24 mg /100 g). Minimum anthocyanin (31.26 mg /100 g) was recorded in T<sub>0</sub> (control).

During the year 2018-19, greatest anthocyanin (46.06 mg /100 g) was recorded with T<sub>5</sub> and followed by T<sub>9</sub> (43.70 mg /100 g), T<sub>8</sub> (43.23 mg /100 g) and T<sub>4</sub> (41.43 mg /100 g). Lowest (30.79 mg /100 g) was recorded under T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum (45.86 mg /100 g) anthocyanin in T<sub>5</sub> and followed by T<sub>8</sub> (42.94 mg /100 g), T<sub>9</sub> (42.47 mg /100 g) and T<sub>4</sub> (41.43 mg /100 g). Minimum (31.02 mg /100 g) was recorded under T<sub>0</sub> (control).

**Table 4.3.8. Efficacy of organics, bio-inoculant and mulching on non-reducing sugar (%) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	2.13	2.13	2.13
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	2.22	2.25	2.24
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	2.14	2.14	2.14
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	2.05	2.17	2.11
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	3.11	3.16	3.14
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	2.23	2.25	2.24
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	2.13	2.13	2.13
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	2.34	2.38	2.36
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	3.59	3.56	3.58
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	3.22	3.26	3.24
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	3.11	3.16	3.13
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	3.09	3.15	3.12
CD at 5%	0.185	0.184	0.184
SEm±	0.063	0.062	0.062

**Table 4.3.9. Efficacy of organics, bio-inoculant and mulching on anthocyanin (mg/100g) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	31.26	30.79	31.02
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	34.74	34.92	34.83
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	35.94	35.16	35.55
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	32.45	31.22	31.83
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	41.44	41.43	41.43
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	45.66	46.06	45.86
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	36.13	36.15	36.14
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	36.28	36.55	36.41
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	42.65	43.23	42.94
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	41.24	43.70	42.47
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	41.00	41.08	41.04
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	39.01	38.75	38.88
CD at 5%	2.669	2.956	2.812
SEm±	0.904	1.001	0.952

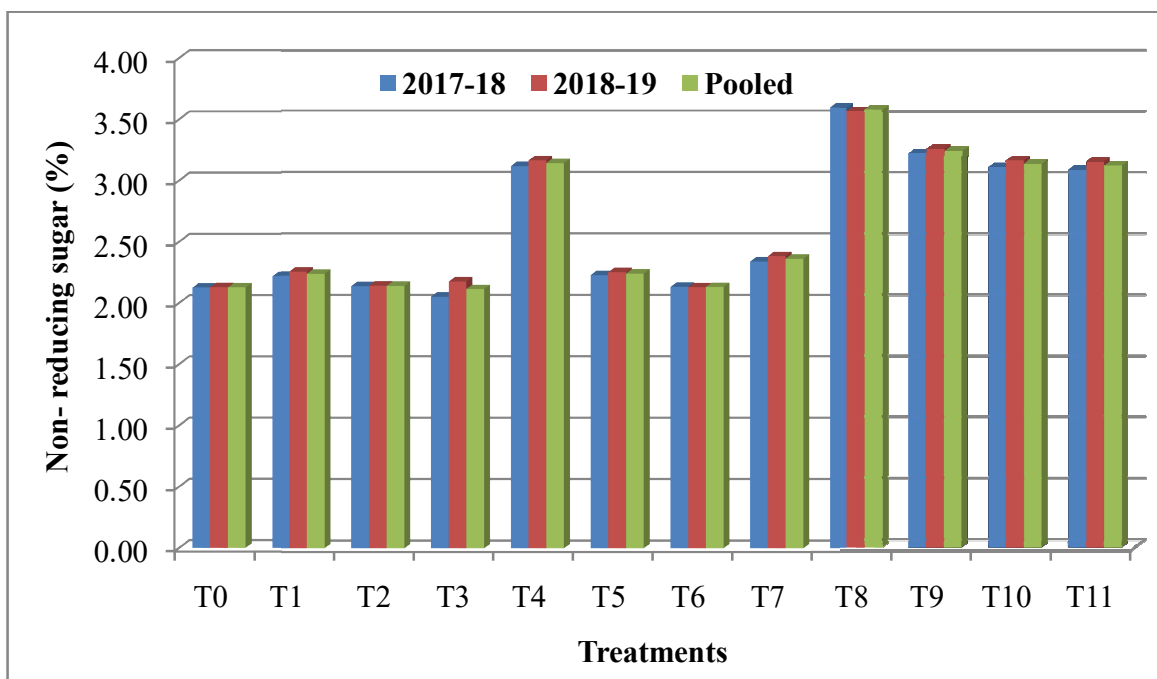


Fig. 4.3.8. Efficacy of organics, bio-inoculant and mulching on non-reducing sugar (%) in strawberry.

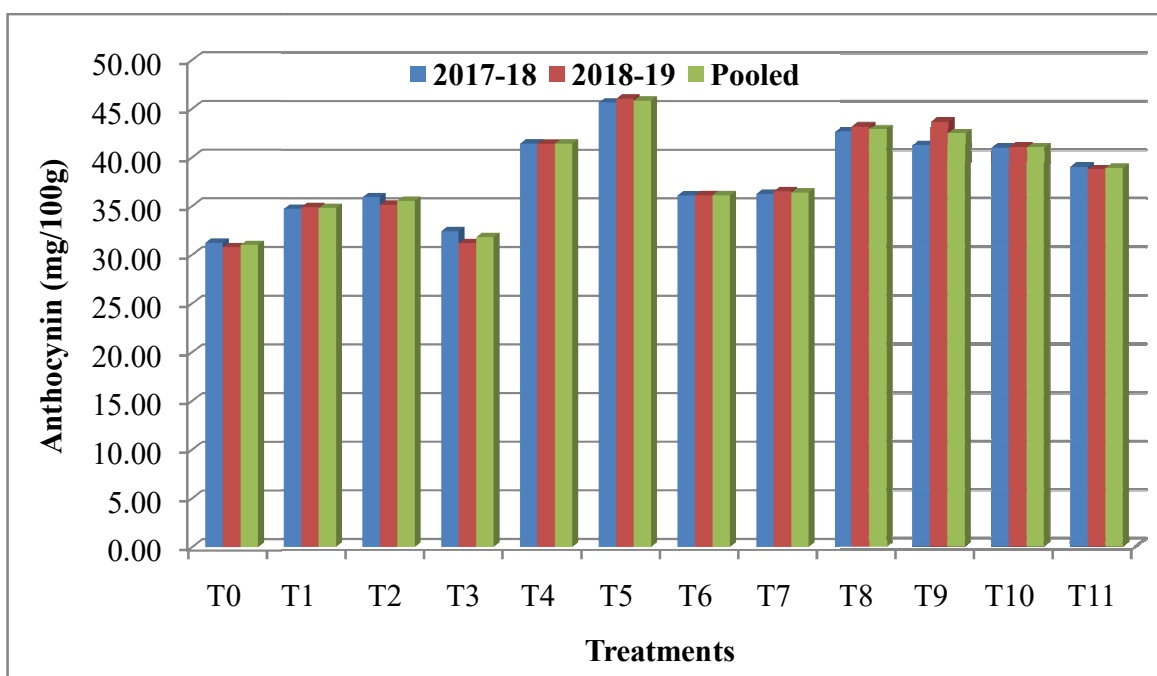


Fig. 4.3.9. Efficacy of organics, bio-inoculant and mulching on anthocyanin (mg/ 100 g) in strawberry.

## 4.4 Soil parameters

### 4.4.1 Soil moisture (%)

Soil moisture during 2017-18 as influenced by different treatment combinations have been presented in table 4.4.1.1 and graphically illustrated in fig. 4.4.1.1.

During the year 2017-18, maximum soil moisture *i.e.* 19.63, 19.09, 19.42, 20.21, 18.89, 15.42 and 14.84% were noted with T<sub>8</sub>, T<sub>2</sub>, T<sub>4</sub>, T<sub>6</sub>, T<sub>9</sub>, T<sub>8</sub> and T<sub>6</sub> at 30, 45, 60, 75, 90, 105 and 120 DAP, respectively. Minimum values were recorded under T<sub>0</sub> at different days after planting.

**Table – 4.4.1.1. Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry during 2017-18.**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	16.35	16.77	17.07	16.97	13.91	11.88	11.15
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	17.73	18.04	17.94	19.88	17.39	13.78	12.44
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	18.53	19.09	18.04	19.53	18.33	13.90	12.57
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	17.41	18.15	18.15	19.88	18.37	14.29	13.62
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	17.90	17.97	19.42	20.09	18.18	14.42	14.16
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	17.30	18.04	17.94	19.31	18.62	14.19	14.19
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	18.96	19.00	18.15	20.21	17.98	15.18	14.84
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	17.90	18.23	19.42	19.42	18.72	15.21	14.21
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	19.63	17.99	18.49	19.53	17.85	15.42	14.75
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	18.76	18.26	18.15	19.31	18.89	15.30	14.63
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.63	18.04	19.42	18.42	17.25	15.13	14.13
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	18.54	18.40	18.89	18.53	18.19	15.11	13.11
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	1.282	1.697
SEm±	1.043	1.440	1.091	0.855	1.658	0.434	0.575

Soil moisture during 2018-19 as influenced by different treatment combinations have been presented in table 4.4.1.2 and graphically illustrated in fig. 4.4.1.2.

During the year 2018-19, maximum soil moisture *i.e.* 19.53, 18.23, 18.72, 18.76, 17.94, 15.48 and 14.04% were noted with T<sub>2</sub>, T<sub>7</sub>, T<sub>7</sub>, T<sub>10</sub>, T<sub>10</sub>, T<sub>6</sub> and T<sub>9</sub> at 30, 45, 60, 75, 90, 105 and 120 DAP, respectively. Minimum values were recorded under T<sub>0</sub> (control) at different days after planting.

**Table – 4.4.1.2. Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry during 2018-19.**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	16.34	16.06	17.15	17.11	13.49	11.88	11.45
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	19.53	17.67	18.23	18.23	16.04	14.25	12.72
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	18.04	17.67	17.00	18.15	17.57	14.46	13.61
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	19.04	18.15	17.33	18.69	16.67	14.43	13.04
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	18.00	17.67	18.23	18.15	17.04	14.90	13.49
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	19.04	17.67	17.94	17.89	17.02	14.96	13.52
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	17.59	17.67	18.23	18.15	17.94	15.48	13.17
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	19.38	18.23	18.72	18.23	17.02	15.45	13.39
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.04	18.15	18.61	17.65	17.38	15.18	13.82
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.67	17.18	18.23	18.02	17.06	15.12	14.04
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.11	18.15	18.22	18.76	17.94	14.23	13.43
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	18.05	16.18	17.26	18.15	17.52	14.91	13.55
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	1.258	N.S.
SEm±	0.936	1.328	1.480	1.492	1.317	0.426	0.733

Soil moisture of pooled as influenced by different treatment combinations have been presented in table 4.4.1.3 and graphically illustrated in fig. 4.4.1.3.

On the basis of pooled data of both the years, maximum soil moisture *i.e.* 18.84, 18.38, 19.07, 19.28, 17.98, 15.33 and 14.34% were noted with T<sub>8</sub>, T<sub>2</sub>, T<sub>7</sub>, T<sub>3</sub>, T<sub>9</sub>, T<sub>6</sub> and T<sub>9</sub> at 30, 45, 60, 75, 90, 105 and 120 DAP, respectively. Minimum values were recorded under T<sub>0</sub> (control) at different days after planting.

**Table – 4.4.1.3. Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry (pooled).**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	16.35	16.42	17.11	17.04	13.70	11.88	11.30
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	18.63	17.86	18.09	19.06	16.72	14.02	12.58
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	18.29	18.38	17.52	18.84	17.95	14.18	13.09
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	18.23	18.15	17.74	19.28	17.52	14.36	13.33
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	17.95	17.82	18.83	19.12	17.61	14.66	13.83
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	18.17	17.86	17.94	18.60	17.82	14.58	13.86
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	18.28	18.33	18.19	19.18	17.96	15.33	14.01
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	18.64	18.23	19.07	18.83	17.87	15.33	13.80
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.84	18.07	18.55	18.59	17.61	15.30	14.29
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	18.22	17.72	18.19	18.67	17.98	15.21	14.34
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	18.37	18.10	18.82	18.59	17.59	14.68	13.78
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	18.30	17.29	18.08	18.34	17.85	15.01	13.33
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	1.270	0.848
SEm±	0.990	1.384	1.286	1.174	1.488	0.430	0.654

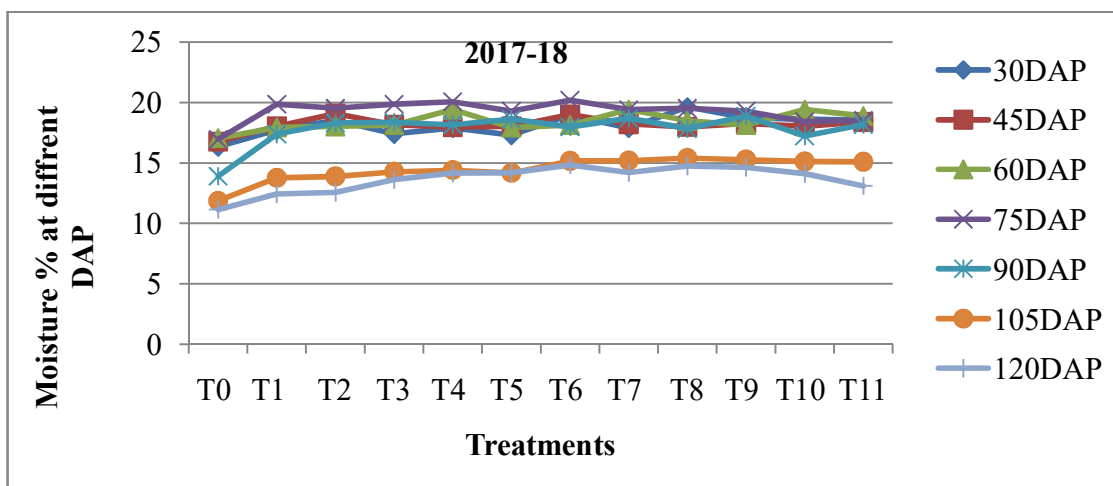


Fig. 4.4.1.1 Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry during 2017-18.

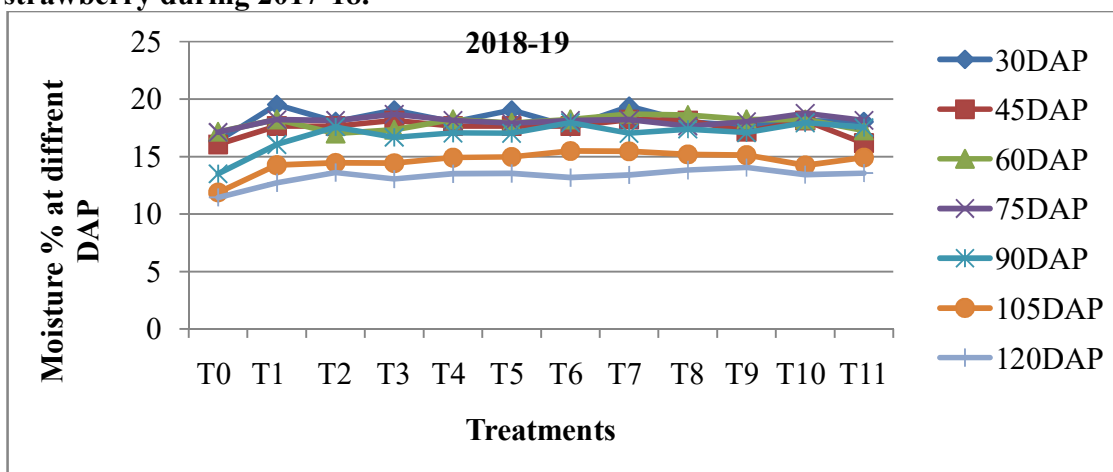


Fig. 4.4.1.2 Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry during 2018-19.

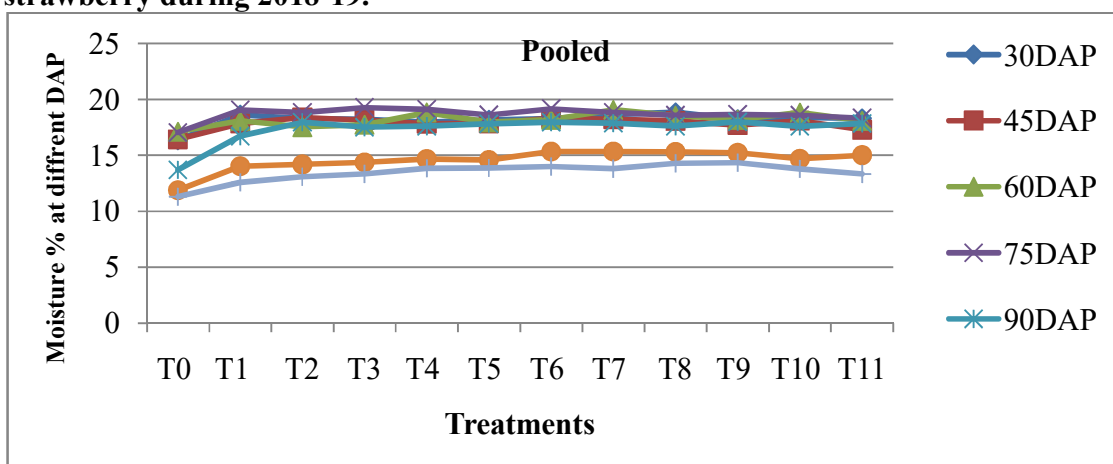


Fig. 4.4.1.3 Efficacy of organics, bio-inoculant and mulching on soil moisture in strawberry (pooled).

#### 4.4.2. Soil temperature (°C)

Soil temperature during 2017-18as influenced by different treatment combinations have been presented in table 4.4.2.1 graphically illustrated in fig. 4.4.2.1.

During the year 2017-18, maximum soil temperature *i.e.* 19.2, 18.2, 20.2, 20.6 and 26. 4°C were noted under control at 30, 45, 90, 105 and 120 DAP respectively, but 18.0 and 18.1 °C were maximum at 60 DAP and 75 DAP, respectively under T<sub>4</sub>. Minimum values 16.7, 17.4, 17.6, 17.6, 19.7, 20.0 and 26. 1°C were recorded under T<sub>2</sub>, T<sub>10</sub>, T<sub>10</sub>, T<sub>9</sub>, T<sub>4</sub> and T<sub>8</sub>&T<sub>10</sub> at different days after planting, respectively.

**Table 4.4.2.1. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry during 2017-18.**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	19.2	18.2	17.9	18.0	20.2	20.6	26.4
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	18.8	18.0	17.8	17.9	20.0	20.4	26.3
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	16.7	17.8	17.8	17.7	19.8	19.8	26.3
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	18.8	17.9	17.6	17.8	20.1	20.1	26.2
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	18.7	17.8	18.0	18.1	19.8	20.0	26.2
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	17.2	18.0	17.8	17.7	20.0	20.0	26.1
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	16.8	17.9	17.9	17.8	19.9	19.8	26.4
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	18.7	18.1	17.7	17.9	19.8	20.1	26.2
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	16.9	17.4	17.9	18.0	20.1	20.3	26.1
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.8	18.0	17.8	17.7	19.7	20.2	26.3
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.7	17.4	17.6	17.6	19.8	20.3	26.1
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	16.9	17.9	18.0	17.7	19.9	20.1	26.3

Soil temperature during 2018-19 as influenced by different treatment combinations have been presented in table 4.4.2.2 graphically illustrated in fig. 4.4.2.2.

During the year 2018-19, maximum soil temperature *i.e.* 17.8, 18.0, 20.2, 18.0 and 26.4 °C were noted under control at 30, 75, 90, 105 and 120 DAP, respectively, but 18.1 and 18.0 °C were maximum at 45 DAP and 60 DAP, respectively under T<sub>7</sub> and T<sub>11</sub>. Minimum values 17.2, 17.0, 17.0, 17.0, 19.7, 17.4 and 19.7 °C were recorded under T<sub>2</sub>, T<sub>9</sub>, T<sub>4</sub>, T<sub>2</sub>, T<sub>9</sub>, T<sub>6</sub> and T<sub>9</sub> at different days after planting, respectively.

**Table 4.4.2.2. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry during 2018-19.**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	17.8	17.6	17.2	18.0	20.2	18.0	20.6
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	17.6	17.0	17.1	17.6	20.0	17.6	20.4
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	17.2	17.8	17.2	17.0	19.8	17.8	19.8
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	17.6	17.5	17.6	17.8	20.1	17.6	20.1
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	17.2	17.8	17.0	17.5	19.8	17.9	19.8
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	17.4	18.0	17.8	17.8	20.0	17.8	20.0
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	17.4	17.9	17.9	18.0	19.9	17.4	20.1
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	17.7	18.1	17.7	17.8	19.8	17.9	19.8
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.8	17.4	17.9	17.5	20.1	17.8	20.1
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.8	17.0	17.8	17.6	19.7	17.8	19.7
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.7	17.4	17.6	17.0	19.8	17.7	20.0
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.9	17.2	18.0	17.8	20.0	17.9	19.9

Soil temperature of both the years as influenced by different treatment combinations have been presented in table 4.4.2.3 graphically illustrated in fig. 4.4.2.3.

On the basis of pooled data of both the years, maximum soil temperature *i.e.* 18.5, 18.0, 20.2, 19.30 and 23.5°C were noted under control at 30, 75, 90, 105 and 120 DAP, respectively, but 18.1 and 18.0°C were maximum at 45 DAP and 60 DAP, respectively under T<sub>7</sub> and T<sub>11</sub>. Minimum values 17.1, 17.40, 17.45, 17.30, 19.8, 18.6 and 23.0 °C were recorded under T<sub>6</sub>, T<sub>10</sub>, T<sub>1</sub>, T<sub>10</sub>, T<sub>10</sub>, T<sub>6</sub> and T<sub>9</sub> at different days after planting, respectively.

**Table 4.4.2.3. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry (pooled).**

Treatments	30DAP	45DAP	60DAP	75DAP	90DAP	105DAP	120DAP
T <sub>0</sub> : Control	18.50	17.90	17.55	18.00	20.20	19.30	23.50
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	18.20	17.50	17.45	17.75	20.00	19.00	23.35
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	16.95	17.80	17.50	17.35	19.80	18.80	23.05
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	18.20	17.70	17.60	17.80	20.10	18.85	23.15
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	17.95	17.80	17.50	17.80	19.80	18.95	23.00
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	17.30	18.00	17.80	17.75	20.00	18.90	23.05
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	17.10	17.90	17.90	17.90	19.90	18.60	23.25
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	18.20	18.10	17.70	17.85	19.80	19.00	23.00
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.35	17.40	17.90	17.75	20.10	19.05	23.10
T <sub>9</sub> : 75% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.80	17.50	17.80	17.65	19.70	19.00	23.00
T <sub>10</sub> : 50% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	17.70	17.40	17.60	17.30	19.80	19.00	23.05
T <sub>11</sub> : 50% NPK + MSWC + Mulch (Paddy straw) + Bio-inoculant	17.40	17.55	18.00	17.75	19.90	19.00	23.10

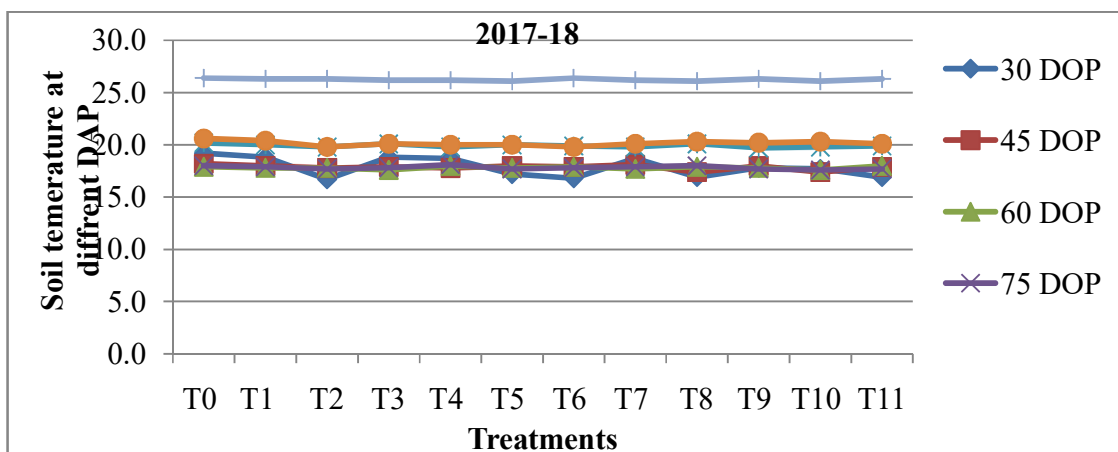


Fig. 4.4.2.1. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry during 2017-18.

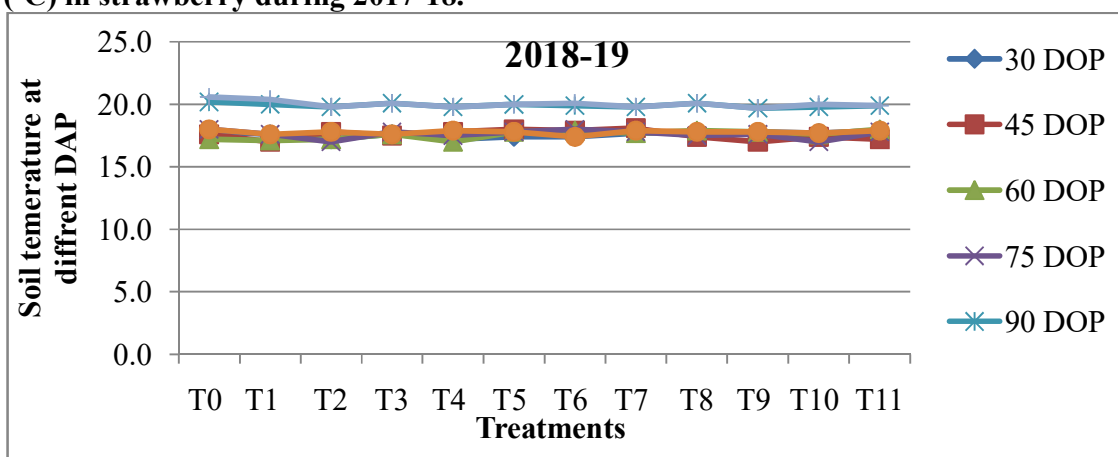


Fig. 4.4.2.2. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry during 2018-19.

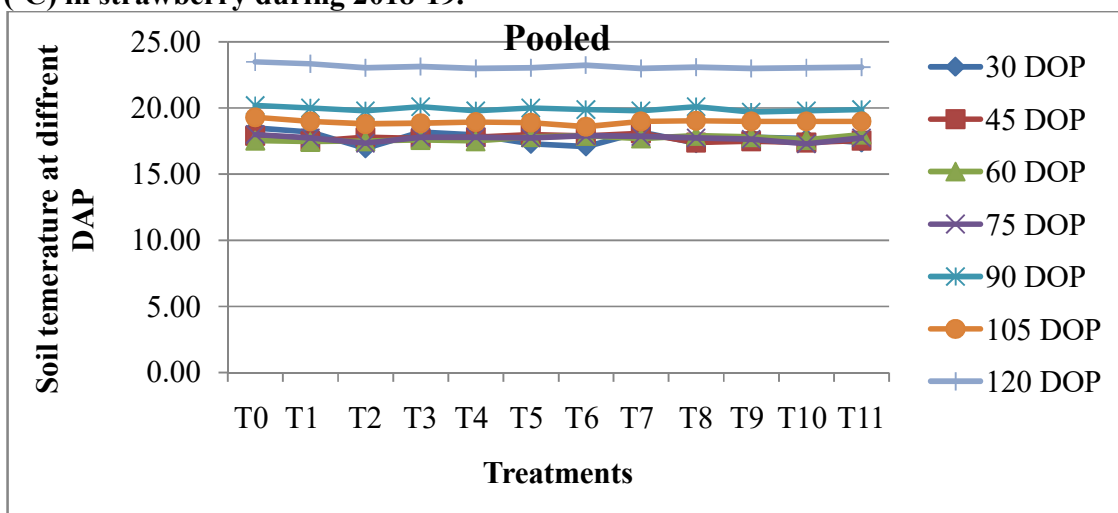


Fig. 4.4.2.3. Efficacy of organics, bio-inoculant and mulching on soil temperature (°C) in strawberry (pooled).

#### 4.4.3. Soil pH

Soil pH of both years and pooled as influenced by different treatments combinations have been depicted in table 4.4.3 and graphically illustrated in fig. 4.4.3.

During the year 2017-18, maximum soil pH (8.01) was noted with T<sub>0</sub> and followed by T<sub>7</sub> (7.94), T<sub>2</sub> (7.93) and T<sub>3</sub> (7.92). Minimum soil pH (7.46) was recorded in T<sub>11</sub>.

During the year 2018-19, maximum soil pH (7.89) was recorded with T<sub>0</sub> and followed by T<sub>3</sub> (7.87), T<sub>5</sub> (7.84) and T<sub>4</sub> (7.82). Lowest (7.38) soil pH was recorded in T<sub>11</sub>.

On the basis of pooled data of both the years, it was found that maximum soil pH (7.95) in T<sub>0</sub> and followed by T<sub>3</sub> (7.90), T<sub>7</sub> (7.88) and T<sub>4</sub> and T<sub>5</sub> (7.85). Minimum soil pH was (7.42) recorded in T<sub>11</sub>.

#### 4.4.4. Electrical conductivity (dS m<sup>-1</sup>)

Soil electrical conductivity of both years and pooled as influenced by different treatments combinations have been depicted in table 4.4.4 and graphically illustrated in fig. 4.4.4.

In the year 2017-18, maximum electrical conductivity (0.414 dS m<sup>-1</sup>) was noted with T<sub>10</sub> and T<sub>7</sub> and followed by T<sub>5</sub> (0.409 dS m<sup>-1</sup>), T<sub>9</sub> (0.388 dS m<sup>-1</sup>) and T<sub>2</sub> (0.385 dS m<sup>-1</sup>). Minimum (0.327 dS m<sup>-1</sup>) electrical conductivity was recorded under T<sub>0</sub> (control).

During the year 2018-19, greatest electrical conductivity (0.521 dS m<sup>-1</sup>) was recorded with T<sub>9</sub> and followed by T<sub>8</sub> (0.503 dS m<sup>-1</sup>), T<sub>8</sub> (0.481 dS m<sup>-1</sup>) and T<sub>4</sub> (0.474 dS m<sup>-1</sup>). Lowest (0.377 dS m<sup>-1</sup>) electrical conductivity was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum electrical conductivity (0.454 dS m<sup>-1</sup>) in T<sub>9</sub> and followed by T<sub>7</sub> (0.447 dS m<sup>-1</sup>), T<sub>5</sub> (0.436 dS m<sup>-1</sup>) and T<sub>8</sub> (0.435 dS m<sup>-1</sup>). Minimum electrical conductivity (0.352 dS m<sup>-1</sup>) was recorded under T<sub>0</sub> (control).

**Table 4.4.3. Efficacy of organics, bio-inoculant and mulching on soil pH in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	8.01	7.89	7.95
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	7.93	7.77	7.85
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	7.89	7.74	7.82
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	7.92	7.87	7.90
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	7.88	7.82	7.85
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	7.86	7.84	7.85
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	7.82	7.80	7.81
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	7.94	7.82	7.88
T <sub>8</sub> : 75% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	7.53	7.54	7.53
T <sub>9</sub> : 75% NPK+MSWC+Mulch (Paddy straw)+ Bio-inoculant	7.83	7.76	7.80
T <sub>10</sub> : 50% NPK+ FYM +Mulch (Paddy straw) + Bio-inoculant	7.73	7.68	7.70
T <sub>11</sub> : 50% NPK+MSWC+Mulch(Paddy straw)+ Bio-inoculant	7.46	7.38	7.42
CD at 5%	0.265	0.183	0.224
SEm±	0.090	0.062	0.076

**Table 4.4.4. Efficacy of organics, bio-inoculant and mulching on electrical conductivity (dS m<sup>-1</sup>) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.327	0.377	0.352
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	0.385	0.452	0.418
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	0.383	0.444	0.414
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	0.379	0.392	0.385
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	0.374	0.474	0.424
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	0.409	0.462	0.436
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	0.385	0.468	0.427
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	0.414	0.481	0.447
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	0.368	0.503	0.435
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	0.388	0.521	0.454
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	0.414	0.441	0.427
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	0.382	0.448	0.415
CD at 5%	0.068	0.081	0.074
SEm±	0.023	0.027	0.025

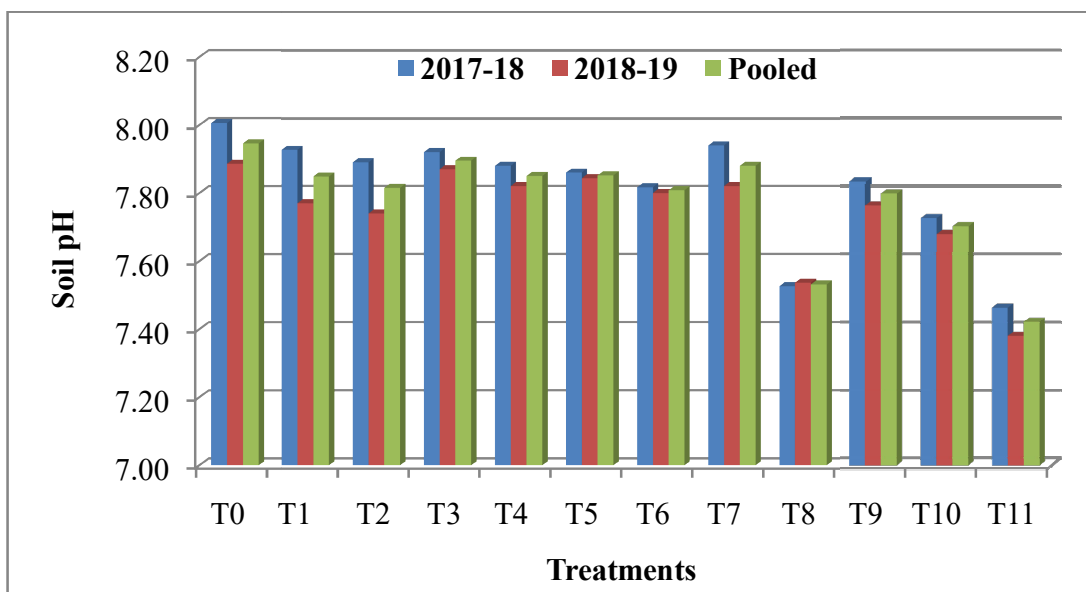


Fig. 4.4.3. Efficacy of organics, bio-inoculant and mulching on soil pH in strawberry.

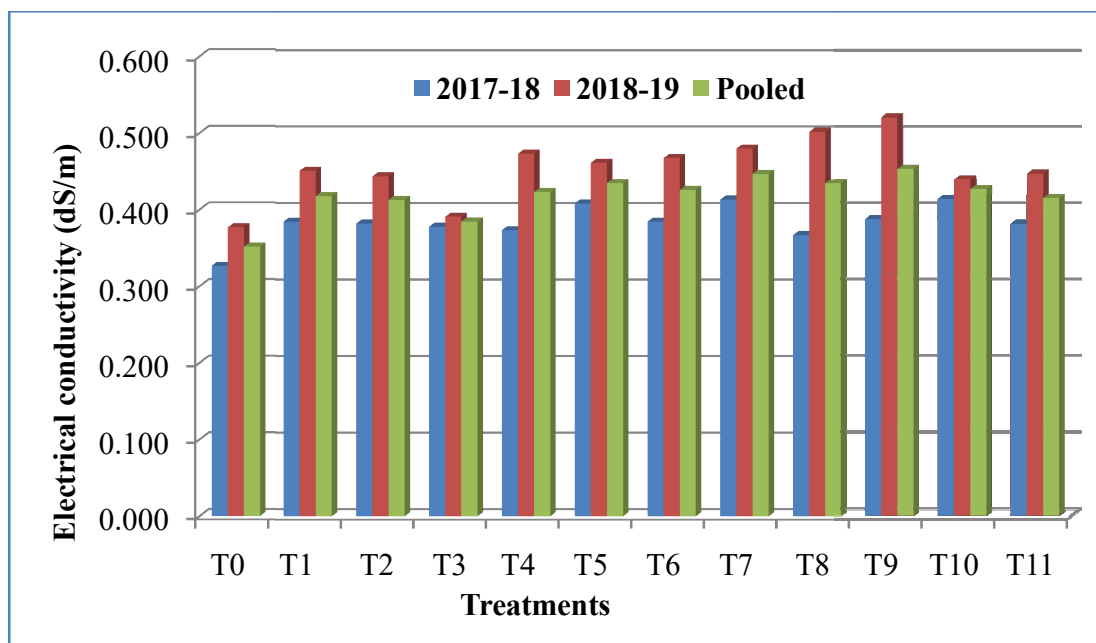


Fig. 4.4.4. Efficacy of organics, bio-inoculant and mulching on electrical conductivity ( $\text{dS m}^{-1}$ ) in strawberry.

#### **4.4.5. Organic carbon content (%)**

Soil organic carbon percent of both years and pooled as influenced by different treatments combinations have been depicted in table 4.4.4 and graphically illustrated in fig. 4.4.4.

In the year 2017-18, maximum soil organic carbon content (0.29%) was noted with T<sub>3</sub>, T<sub>5</sub>, T<sub>8</sub> & T<sub>11</sub> and followed by (0.28%) in T<sub>2</sub>, T<sub>4</sub>, T<sub>6</sub>, T<sub>8</sub> and T<sub>9</sub> respectively. Minimum organic carbon percent (0.22%) was recorded in T<sub>0</sub> (control).

During the year 2018-19, greatest organic carbon content (0.34%) was recorded with T<sub>5</sub> and followed by (0.33%) in T<sub>4</sub>, T<sub>7</sub>, T<sub>8</sub> and T<sub>9</sub> respectively. Lowest organic carbon percent (0.24%) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum organic carbon percent (0.31%) in T<sub>5</sub>, T<sub>8</sub> and T<sub>9</sub> and followed (0.30%) in T<sub>4</sub>, T<sub>6</sub>, T<sub>7</sub>, T<sub>8</sub> and T<sub>9</sub> respectively. Minimum (0.23%) organic carbon percent was recorded in T<sub>0</sub> (control).

#### **4.4.6. Microbial properties (population)**

Microbial properties (population) of both years and pooled as influenced by different treatments combinations have been presented in table 4.4.6 and graphically illustrated in fig. 4.4.6.

In the year 2017-18, maximum soil microbial population (282) was noted with T<sub>10</sub> and followed by (272) in T<sub>8</sub> and (268) in T<sub>9</sub>. Minimum (27) microbial population was recorded in T<sub>0</sub>.

During the year 2018-19, greatest microbial population (306) was recorded with T<sub>10</sub> and followed by (298) in T<sub>11</sub> and (287) in T<sub>9</sub>. Lowest microbial population (31) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum microbial population (294) in T<sub>10</sub> and followed by (281) in T<sub>11</sub> and (277.5) in T<sub>9</sub> respectively. Minimum microbial population (29) was recorded in T<sub>0</sub> (control).

**Table 4.4.5. Efficacy of organics, bio-inoculant and mulching on soil organic carbon (%) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	0.22	0.24	0.23
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	0.25	0.30	0.27
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	0.28	0.31	0.29
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	0.29	0.30	0.29
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	0.28	0.33	0.30
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	0.29	0.34	0.31
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	0.28	0.32	0.30
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	0.28	0.33	0.30
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	0.29	0.33	0.31
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	0.28	0.33	0.31
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	0.28	0.32	0.30
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	0.29	0.32	0.30
CD at 5%	0.027	0.044	0.035
SEm±	0.009	0.015	0.012

**Table 4.4.6. Efficacy of organics, bio-inoculant and mulching on soil microbial population (x10<sup>4</sup> cfu/g) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	27	31	29
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	29	32	30.5
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	33	31	32
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	29	29	29
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	34	34	34
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	42	39	40.5
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	30	33	31.5
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	27	29	28
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	272	269	270.5
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	268	287	277.5
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	282	306	294
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	264	298	281
CD at 5%	5.462	5.556	5.509
SEm±	1.839	1.870	1.854

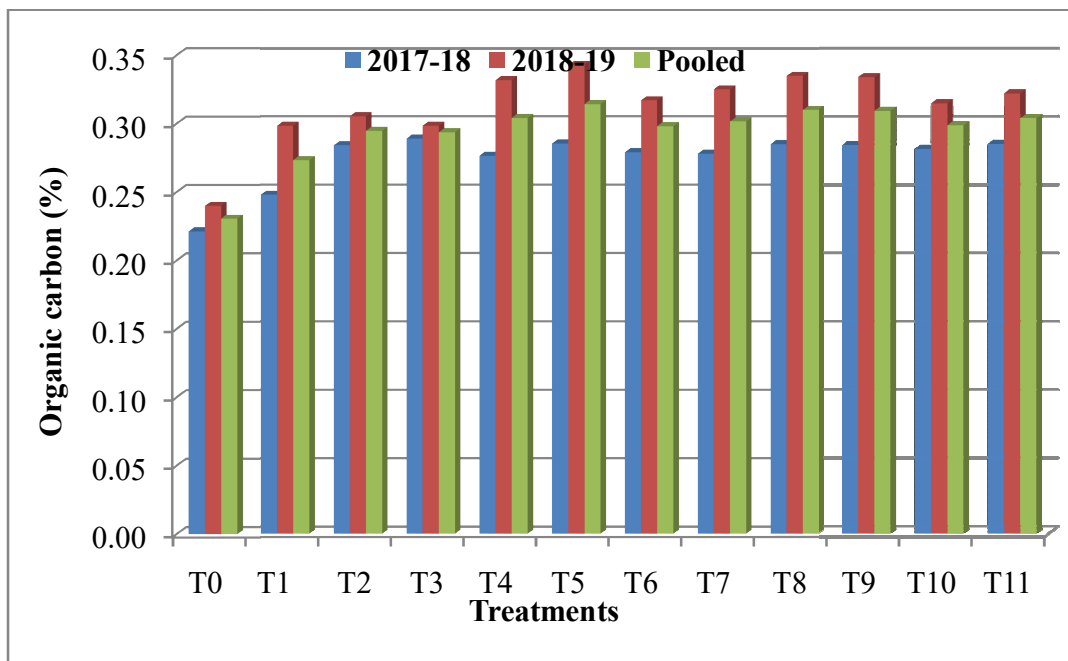


Fig. 4.4.5. Efficacy of organics, bio-inoculant and mulching on soil organic carbon percent in strawberry.

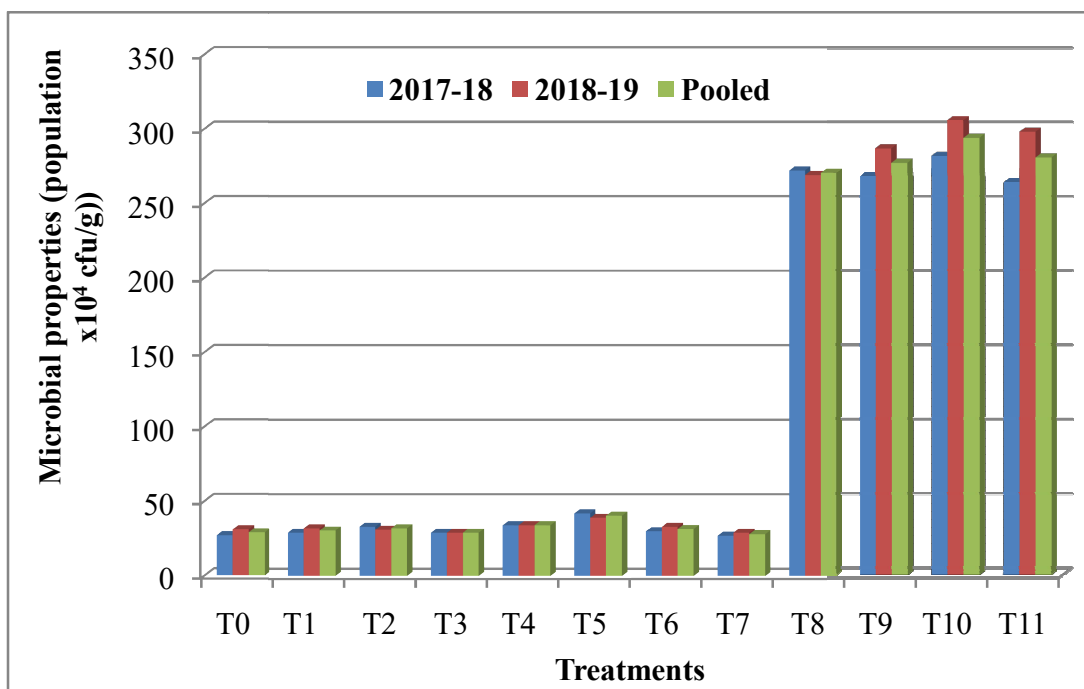


Fig. 4.4.6. Efficacy of organics, bio-inoculant and mulching on soil microbial ( $\times 10^4$  cfu/g) in strawberry.

#### **4.4.7 Available soil nitrogen content (kg ha<sup>-1</sup>)**

Available nitrogen content of both years and pooled as influenced by different treatments combinations have been presented in table 4.4.7 and graphically illustrated in fig. 4.4.7.

In the year 2017-18, maximum available soil nitrogen content (87.56 kg ha<sup>-1</sup>) was noted with T<sub>10</sub> and followed by (87.13 kg ha<sup>-1</sup>) in T<sub>11</sub> and (86.98 kg ha<sup>-1</sup>) in T<sub>8</sub>. Minimum (75.11 kg ha<sup>-1</sup>) available nitrogen content was recorded in T<sub>0</sub> (control).

During the year 2018-19, greatest available nitrogen content (94.97 kg ha<sup>-1</sup>) was recorded with T<sub>9</sub> and followed by (94.93 kg ha<sup>-1</sup>) in T<sub>11</sub> and (94.89 kg ha<sup>-1</sup>) in T<sub>10</sub>. Lowest (77.28 kg ha<sup>-1</sup>) available nitrogen content was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum available nitrogen content (91.23 kg ha<sup>-1</sup>) in T<sub>10</sub> and followed by (91.03 kg ha<sup>-1</sup>) in T<sub>11</sub> and (90.17 kg ha<sup>-1</sup>) in T<sub>9</sub> respectively. Minimum (76.19 kg ha<sup>-1</sup>) available nitrogen content was recorded in T<sub>0</sub> (control).

#### **4.4.8 Available soil phosphorus content (kg ha<sup>-1</sup>)**

Available phosphorus content of both years and pooled as influenced by different treatments combinations have been presented in table 4.4.8 and graphically illustrated in fig. 4.4.8.

In the year 2017-18, maximum available soil phosphorus content (15.60 kg ha<sup>-1</sup>) was noted with T<sub>11</sub> and followed by (15.51 kg ha<sup>-1</sup>) in T<sub>4</sub> and (15.45 kg ha<sup>-1</sup>) in T<sub>8</sub>. Minimum available soil phosphorus content (11.97 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

During the year 2018-19, greatest available soil phosphorus content (16.65 kg ha<sup>-1</sup>) was recorded with T<sub>8</sub> and followed by (16.60 kg ha<sup>-1</sup>) in T<sub>11</sub> and (16.44 kg ha<sup>-1</sup>) in T<sub>5</sub>. Lowest available soil phosphorus content (13.59 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum available soil phosphorus content (16.10 kg ha<sup>-1</sup>) in T<sub>11</sub> and followed by (16.05 kg ha<sup>-1</sup>) in T<sub>8</sub> and (15.85 kg ha<sup>-1</sup>) in T<sub>4</sub> respectively. Minimum available soil phosphorus content (12.78 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

**Table 4.4.7. Efficacy of organics, bio-inoculant and mulching on available soil nitrogen ( $\text{kg ha}^{-1}$ ) content in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	75.11	77.28	76.19
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	84.52	90.27	87.40
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	83.22	90.18	86.70
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	83.46	86.42	84.94
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	86.33	90.00	88.16
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	83.59	93.95	88.77
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	84.55	91.29	87.92
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	83.79	91.83	87.81
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	86.98	92.99	89.99
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	85.36	94.97	90.17
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	87.56	94.89	91.23
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	87.13	94.93	91.03
CD at 5%	6.055	8.301	7.178
SEm±	2.038	2.794	2.416

**Table 4.4.8. Efficacy of organics, bio-inoculant and mulching on available soil phosphorus content ( $\text{kg ha}^{-1}$ ) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	11.97	13.59	12.78
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	15.04	15.68	15.36
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	14.67	15.83	15.25
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	14.35	14.40	14.38
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	15.51	16.19	15.85
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	14.80	16.44	15.62
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	14.16	14.50	14.33
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	13.57	15.52	14.54
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	15.45	16.65	16.05
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	14.45	16.27	15.36
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	15.12	16.02	15.57
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	15.60	16.60	16.10
CD at 5%	1.599	1.432	1.515
SEm±	0.542	0.485	0.513

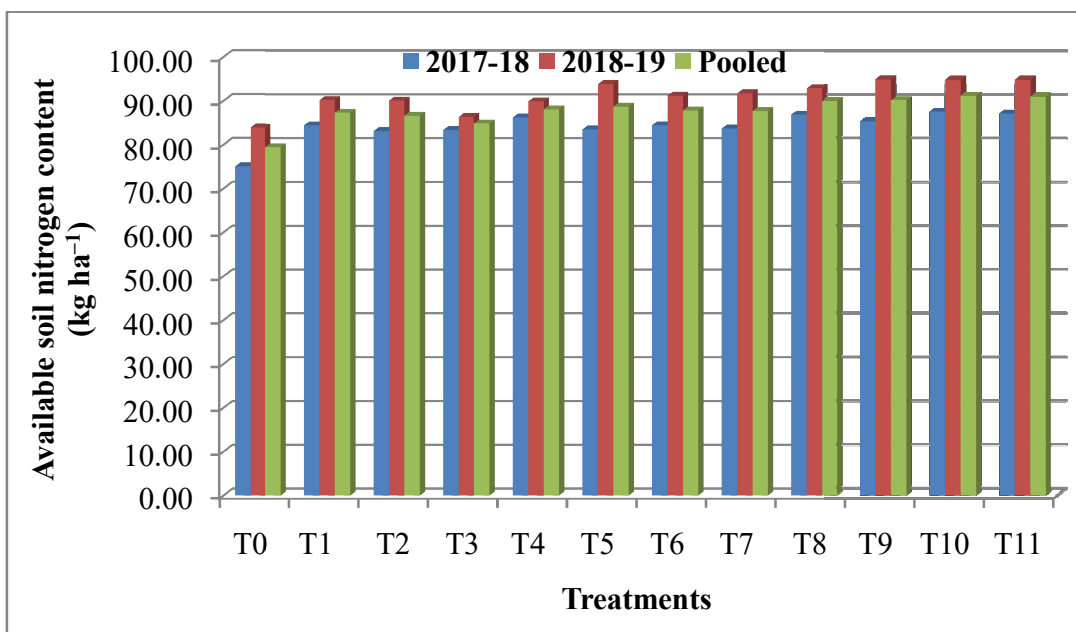


Fig. 4.4.7. Efficacy of organics, bio-inoculant and mulching on available soil nitrogen content (kg ha<sup>-1</sup>) in strawberry.

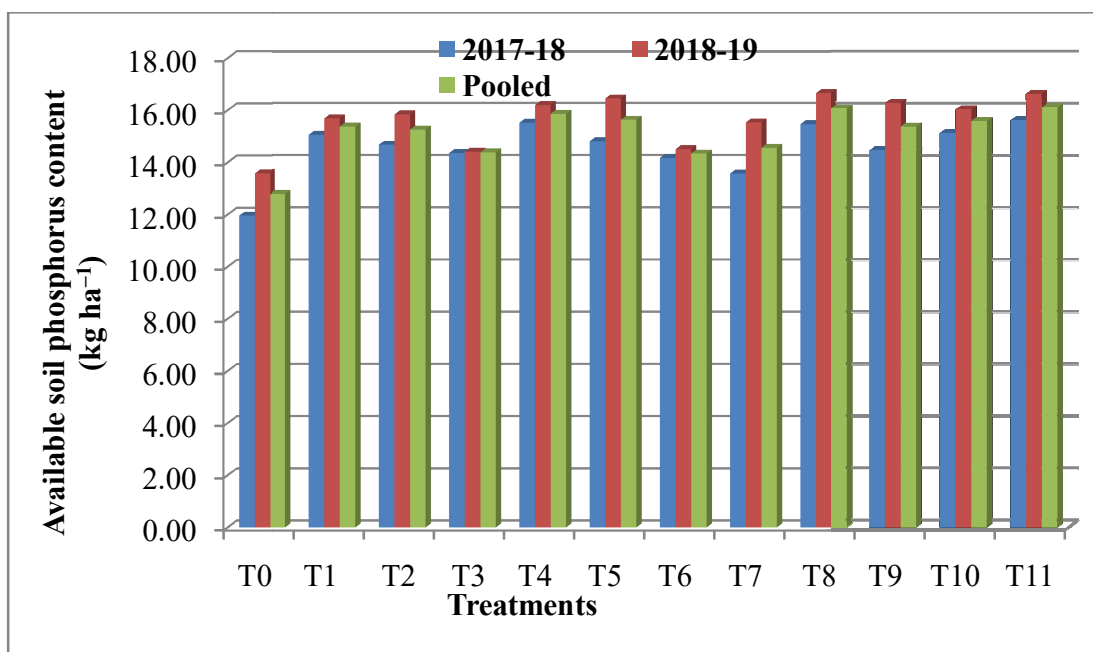


Fig. 4.4.8. Efficacy of organics, bio-inoculant and mulching on available soil phosphorus (kg ha<sup>-1</sup>) content in strawberry.

#### 4.4.9. Available soil potash content (kg ha<sup>-1</sup>)

Available potash content of both years and pooled as influenced by different treatments combinations have been presented in table 4.4.9 and graphically illustrated in fig. 4.4.9.

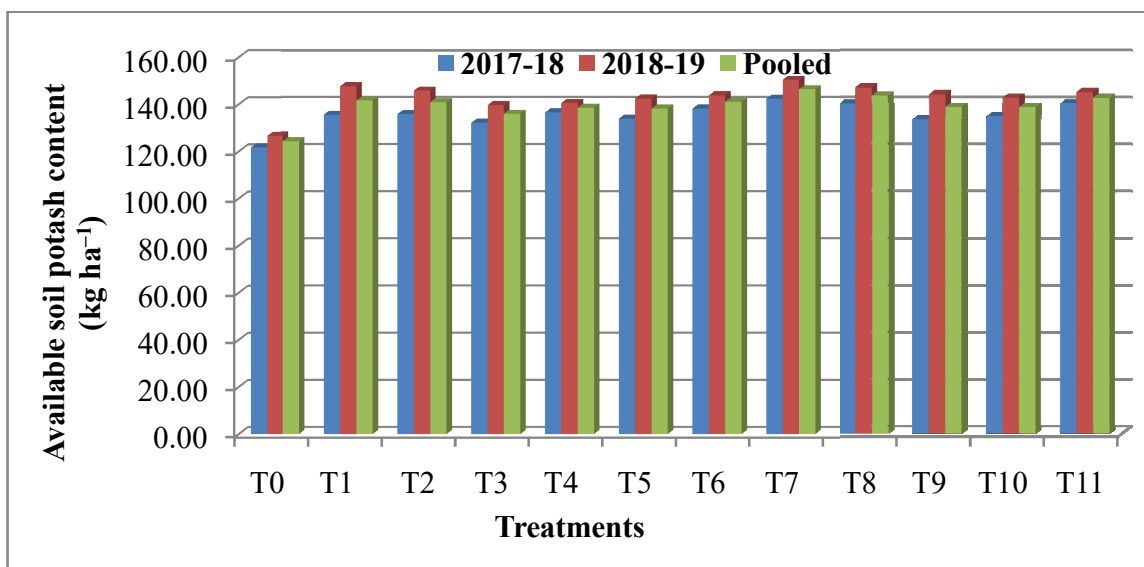
In the year 2017-18, maximum available soil potash content (142.31 kg ha<sup>-1</sup>) was noted with T<sub>7</sub> and followed by (140.40 kg ha<sup>-1</sup>) in T<sub>11</sub> and (140.21 kg ha<sup>-1</sup>) in T<sub>8</sub>. Minimum available soil potash content (121.76 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

During the year 2018-19, greatest available soil potash content (150.26 kg ha<sup>-1</sup>) was recorded with T<sub>7</sub> and followed by (147.63 kg ha<sup>-1</sup>) in T<sub>2</sub> and (147.08 kg ha<sup>-1</sup>) in T<sub>8</sub>. Lowest available soil potash content (126.71 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

On the basis of pooled data of both the years, it was found that maximum available soil potash content (146.29 kg ha<sup>-1</sup>) in T<sub>7</sub> and followed by (143.65 kg ha<sup>-1</sup>) in T<sub>8</sub> and (142.79 kg ha<sup>-1</sup>) in T<sub>11</sub> respectively. Minimum available soil potash content (124.23 kg ha<sup>-1</sup>) was recorded in T<sub>0</sub> (control).

**Table 4.4.9. Efficacy of organics, bio-inoculant and mulching on available potash content (kg ha<sup>-1</sup>) in strawberry.**

Treatments	Year		Pooled
	2017-18	2018-19	
T <sub>0</sub> : Control	121.76	126.71	124.23
T <sub>1</sub> : 100% NPK + Mulch (Paddy straw)	135.46	147.63	141.55
T <sub>2</sub> : 75% NPK + Mulch (Paddy straw)	135.78	145.76	140.77
T <sub>3</sub> : 50% NPK + Mulch (Paddy straw)	132.15	139.58	135.87
T <sub>4</sub> : 75% NPK + FYM + Mulch (Paddy straw)	136.51	140.48	138.49
T <sub>5</sub> : 75% NPK + MSWC + Mulch (Paddy straw)	133.82	142.40	138.11
T <sub>6</sub> : 50% NPK + FYM + Mulch (Paddy straw)	138.14	143.76	140.95
T <sub>7</sub> : 50% NPK + MSWC + Mulch (Paddy straw)	142.31	150.26	146.29
T <sub>8</sub> : 75% NPK + FYM + Mulch (Paddy straw) + Bio-inoculant	140.21	147.08	143.65
T <sub>9</sub> : 75% NPK+MSWC + Mulch (Paddy straw)+ Bio-inoculant	133.49	144.29	138.89
T <sub>10</sub> : 50% NPK+ FYM + Mulch (Paddy straw) + Bio-inoculant	134.77	142.82	138.80
T <sub>11</sub> : 50% NPK+MSWC+Mulch (Paddy straw) + Bio-inoculant	140.40	145.18	142.79
CD at 5%	10.068	9.706	9.887
SEm±	3.389	3.267	3.328



**Fig.4.4.9 Efficacy of organics, bio-inoculant and mulching on available soil potash content (kg ha<sup>-1</sup>) in strawberry.**

#### 4.5 Cost economics of treatments

Net income and benefit: cost ratio of treatments wise of crop is deciding factor for its adaptation by the farmers for its commercial production. It is important to determine regarding yield of strawberry with application of each treatment combinations.

Data pertaining to cost economics of strawberry crop as prejudiced by the combinations of different treatments have been depicted in table 4.5.

In the year 2017-18, the highest (22.69:1) benefit: cost ratio was obtained under T<sub>9</sub>: 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant which was followed by T<sub>8</sub>: 75% NPK + FYM + mulch (paddy straw) + bio-inoculant (21.87:1). Maximum net income (Rs.37, 44,027.00) was also obtained under T<sub>9</sub> and followed by T<sub>8</sub> (Rs.35, 63,460.58).The lowest (6.75:1) benefit: cost ratio was scored under T<sub>0</sub> while least net income was also scored in treatment T<sub>0</sub> (Rs. 9, 20,408.38).

During the year 2018-19, maximum (22.54:1) benefit: cost ratio was obtained in T<sub>9</sub>: 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant, which was followed by T<sub>8</sub> 75% NPK + FYM + mulch (paddy straw) + bio-inoculant (21.83:1). Similarly maximum net income was also achieved in T<sub>9</sub>: 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant (Rs. 37, 18,227.00). It was followed by T<sub>8</sub> 75% NPK + FYM + mulch (paddy straw) + bio-inoculant (Rs.35, 56,860.58). Minimum (6.63:1) benefit: cost ratio was found in T<sub>0</sub>, while least net income (Rs. 9, 04,808.38) was recorded under T<sub>0</sub>.

**Table 4.5: Cost economics of the different treatment combinations ha<sup>-1</sup>. in cv. Chandler of Strawberry**

Treatments	Treatment cost	Total cost	2017-18				2018-19			
			Yield (q/ha)	Gross income	Net income	B: C Ratio	Yield (q/ha)	Gross income	Net income	B: C Ratio
T <sub>0</sub>	00.00	1,36,391.62	52.84	10,56,800.00	9,20,408.38	6.75/1	52.06	10,41,200.00	9,04,808.38	6.63/1
T <sub>1</sub>	11,387.36	1,47,778.98	126.13	25,22,600.00	23,74,821.02	16.07/1	128.83	25,76,600.00	24,28,821.02	16.44/1
T <sub>2</sub>	10,921.75	1,47,313.37	109.95	21,99,000.00	20,51,686.63	13.93/1	120.32	24,06,400.00	22,59,086.63	15.34/1
T <sub>3</sub>	5,893.68	1,42,285.30	85.86	17,17,200.00	15,74,914.70	11.07/1	87.55	17,51,000.00	16,08,714.70	11.31/1
T <sub>4</sub>	13,036.37	1,49,427.99	150.53	30,10,600.00	28,61,172.01	19.15/1	141.49	28,29,800.00	26,80,372.01	17.94/1
T <sub>5</sub>	14,174.34	1,50,565.96	157.05	31,41,000.00	29,90,434.04	19.86/1	153.55	30,71,000.00	29,20,434.04	19.40/1
T <sub>6</sub>	8,171.70	1,44,563.32	122.69	24,53,800.00	23,09,236.68	15.97/1	122.86	24,57,200.00	23,12,636.68	16.00/1
T <sub>7</sub>	10,447.80	1,46,839.42	121.36	24,27,200.00	22,80,360.58	15.53/1	129.09	25,81,800.00	24,34,960.58	16.58/1
T <sub>8</sub>	26,547.80	1,62,939.42	186.32	37,26,400.00	35,63,460.58	21.87/1	185.99	37,19,800.00	35,56,860.58	21.83/1
T <sub>9</sub>	28,581.38	1,64,973.00	195.45	39,09,000.00	37,44,027.00	22.69/1	194.16	38,83,200.00	37,18,227.00	22.54/1
T <sub>10</sub>	21,094.80	1,57,486.42	172.33	34,46,600.00	32,89,113.58	20.89/1	172.4	34,48,000.00	32,90,513.58	20.89/1
T <sub>11</sub>	26,072.80	1,62,464.42	180.36	36,07,200.00	34,44,735.58	21.20/1	185.33	37,06,600.00	35,44,135.58	21.81/1

**Rates of different items and operations**

- Urea @ Rs. 6.5/kg
- DAP @ Rs. 30.0/kg
- MOP @ Rs. 19.0/kg
- FYM @ Rs. 50/100kg
- MSWC @ Rs. 500/100kg
- Bio-inoculant (PSB) @ Rs. 200/kg
- B: C ratio = Net income (Rs.)/Total cost of cultivation (Rs.)
- Total cost = Treatment cost (variable cost) + Fixed cost
- Net income = Gross income – Total cost of cultivation
- Labour cost @ Rs. 400/- man per day
- Land revenue @ Rs. 2500 for 6 month
- Runner cost @ Rs. 3.0/Runner
- Runner transports charge Rs 4000
- Average sale price of fruit Rs20000/q
- Tractor ploughing charge Rs. 800/hr

### DISCUSSION

Strawberry is a major fruit of temperate region, but with the advent of day-neutral cultivars, it grows profitably well in the sub-tropical regions also. A fruit of strawberry is a rich source of vitamins and minerals together with substantial flavour and now it is become a favourite fruit crop as a table purpose for millions of people around the world. Keeping this in view, the present investigation was conducted at the Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow (UP), India during 2017-18 and 2018-19. In the experiment, observations on growth, physical and yield, bio- chemical and soil parameters/properties of strawberry were recorded during both the years. The outcomes obtained from the research described in the preceding chapter have been discussed based on pooled analysis here in the light of the available information on the topic.

#### 5.1 Growth characters

Application of 100% NPK (recommended dose of fertilizers) in presence of paddy straw mulch showed prominent effect on growth characters of strawberry. On the basis of present study it is reported that the plant height, plant spread (E-W & N-S), number of leaves plant<sup>-1</sup> at different days after planting (DAP), length of leaf (cm), width of leaf, leaf area, length of petiole were increased significantly with the use of organics, bio-inoculant and mulching. The maximum plant height, plant spread (E-W & N-S), length of leaves, width of leaves, number of leaves plant<sup>-1</sup>, length of petiole, length of pedicel, duration of fruit harvesting and number of runners were recorded with 100 % NPK (recommended dose of fertilizers).

The increase of plant height, plant spread (E-W & N-S), number of leaves plant plant<sup>-1</sup> at different DAP; were maximum recorded with 100 % NPK (recommended dose of fertilizers) whereas, the minimum was recorded under control. With the application of fertilizers, organic manure and bio-fertilizers the increase has been reported by Nowsheen *et al.* (2006) and Tripathi *et al.* (2010) in strawberry.

Maximum leaf area was found in treatment 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas; the minimum leaf area was recorded under control. These findings are in close agreement with the result of Verma and Rao (2013) with treatment *Azotobacter* + PSB + vermicompost + 50% RDF of NPK and they reported maximum leaf area in strawberry. The increase in leaf area might be due to increased nitrogen availability generated by nitrogen fixing bacteria and phosphate solubilizing bacteria (PSB) that was due to release of growth regulators by the *Azotobacter* and PSB in the root zone was absorbed through roots that resulted in an increasing in leaf area. The increase in leaf area due to application of vermicompost + poultry manure +PSB +*Azotobacter* has also been reported by Jain *et al.* (2016).

## 5.2 Floral characters

Minimum number of days taken to produce first flower was noted in treatment 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. However, maximum number of days taken to produce first flower was recorded in control. These outcomes have got the support of the findings of Kumar *et al.*, (2015) who also recorded earliest flowering with the application of cent per cent Vermicompost + PSB and Shukla *et al.*, (2009), who recorded earliest flowering with NPK + PSB and NPK + *Azotobacter* application by Kumar *et al.* (2007) in tomato.

Minimum number of days taken to generate first flower indicated that balanced application of nutrients through organics (FYM & MSWC), bio-inoculant and inorganic sources supplied all the essential nutrients to plants to induce early reproductive phase.

During this investigation it was also achieved that highest number of flowers plant<sup>-1</sup> was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant, followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, lowest number of flowers plant<sup>-1</sup> was observed under control. These results have got the support from the findings of Verma and Rao (2013) who also recorded maximum number of flowers plant<sup>-1</sup> with the application of *Azotobacter* + PSB + vermicompost + 50% RDF. Similar increase in flowers plant<sup>-1</sup> was reported by Singh *et al.* (2015) in treatment vermicompost + *Azotobacter* + PSB + AM whereas, minimum number of flowers plant<sup>-1</sup> was observed under control.

Runners treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant, it was noted that minimum number of days taken to produce first fruit set. While the maximum number of days taken to produce first fruit set was noted under control. This result may be on account of extended growth of plant in the incidence of organics (FYM & MSWC) and Bio-inoculant (PSB). Minimum number of days taken to produce first fruit set due to outstanding strength imparted with the application of balanced nutrients through organics (FYM & MSWC), bio-inoculant.

Further, it was also obtained during this study that application of 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant scored maximum number of fruits plant<sup>-1</sup> followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum number of fruits plant<sup>-1</sup> was found under control.

Maximum percentage of fruit setting plant<sup>-1</sup> was also noted that with application of 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant and followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum percentage of fruit setting plant<sup>-1</sup> was scored under control.

Duration of fruit harvesting was significantly maximum with application of 100 % NPK (recommended dose of fertilizers) followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas; minimum duration of fruit harvesting was scored under control. Conjoint application of chemical and organic sources along with bio-inoculant helps in continuous supply of all the essential nutrients required during growth and reproductive phase including fruit set and development.

### **5.3 Fruit characters**

In the present study, significant increase in maximum length of fruit, diameter of fruit, size of fruit, volume of fruit, fresh fruit weight, dry fruit weight, fruit yield plant<sup>-1</sup>, fruit yield plot<sup>-1</sup> and fruit yield ha<sup>-1</sup> were recorded maximum with the application of 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant and minimum was scored under control.

The maximum length of fruit, diameter of fruit, size of fruit, volume of fruit, fresh fruit weight, dry fruit weight, fruit yield plant<sup>-1</sup>, fruit yield plot<sup>-1</sup> and fruit yield ha<sup>-1</sup> during the present study might be due to enhanced photosynthetic ability of plants nourished with 75% NPK+ MSWC + mulch (paddy straw) + bio-inoculant, which in turn might have preferentially enhanced accumulation of dry matter vis-à-vis substantial supply of nutrients.

#### **5.4 Bio-chemical characters of fruit**

On the basis of present study it was pragmatic that pH, TSS, TSS/Acid ratio, total sugars, reducing sugar and non-reducing sugar of berries were significantly increased by different treatment combinations of organics (FYM & MSWC) and bio-inoculant. Maximum pH, TSS, TSS/Acid ratio, total sugars, reducing sugar and non-reducing sugar were recorded with application of 75% NPK + FYM + mulch (paddy straw) + bio-inoculant followed by 75% NPK+ MSWC + mulch (paddy straw) + bio-inoculant. Minimum values were recorded under control respectively for all the characters. These results have got the support of findings of Umar *et al.* (2010) who also recorded maximum total soluble solids and total sugars with the application of 25 percent nitrogen through subabul + 75% nitrogen through urea (inorganic fertilizer) augmented with bio fertilizer and Tripathi and Mishra (2011) and Singh *et al.* (2012) also reported maximum TSS and total sugars with the application of *Azotobacter* and PSB.

Maximum titratable acidity was recorded in fruit juice of strawberry under control, whereas the minimum acidity was noted in 75% NPK + FYM + mulch (paddy straw) + bio-inoculant.

Maximum amount of ascorbic acid in fruit juice of strawberry was recorded under control whereas; minimum amount of ascorbic acid in fruit juice of strawberry was found in treatment 75% NPK+ MSWC + mulch (paddy straw) + bio-inoculant. The increase in ascorbic acid content might be due to the increased efficiency of microbial inoculants, increase in phosphorous availability and secretion of plant growth promoting hormones which accelerated the physiological process in the plant like carbohydrates synthesis etc. Organic management is known to contribute to the production of ascorbic acid in fruit (Premamali *et al.*, 2019). These results are also in

conformity with the findings of Singh *et al.* (2012) and Mishra and Tripathi (2012) with the application of *Azotobacter* and PSB in strawberry.

## 5.5 Soil characters

Though different treatments' showed high moisture content during the different period of moisture recording, the treatment showing the high moisture retention during the critical phase of the crop is considered. The moisture percent shown during critical phase, results in decrease of yield and increase in salt accumulation. Therefore in the current study the treatment was observed that maximum soil moisture was recorded fewer than 75% NPK + FYM + mulch (paddy straw) + bio-inoculant at 30 and 120 DAP, respectively. Minimum values were recorded under control at different days after planting. Application of paddy straw as mulch helps in in-situ soil moisture conservation and further organic amendments enhances moisture holding capacity of soil. These results are also in conformity with the findings of Li *et al.* (2020).

It was also observed that in maximum soil temperature was recorded under control at 30, 75, 90,105 and 120 DAP ,respectively. However, minimum value was recorded in 50% NPK + FYM + mulch (paddy straw) at 30 and 105 DAP and in 50% NPK + FYM + mulch (paddy straw) + bio-inoculant at 45, 75 and 90 DAP respectively. Increased soil temperature due to mulching and organic amendments also provides cooling effect on soil surface Ramakrishna et al., (2006).

Maximum soil pH was noted in control followed by 50% NPK + mulch (paddy straw). Minimum soil pH was recorded in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant.

The electrical conductivity was maximum noted under 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 50% NPK + MSWC + mulch (paddy straw) whereas, minimum under control. Soil organic carbon percent was maximum under 75% NPK + MSWC + mulch (paddy straw) , 75% NPK + FYM + mulch (paddy straw) + bio-inoculant and 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant respectively followed by in 50% NPK + FYM + mulch (paddy straw) + bio-inoculant, 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant and 50% NPK + MSWC + mulch (paddy straw) respectively. Whereas, minimum was recorded

under control. Organic manures and biofertilizers are known to have their effects on soil ecology and organic manure improves the bio-chemical properties of soil.

Microbial population count was found to be maximum under 50% NPK + FYM + mulch (paddy straw) + bio-inoculant followed by in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, minimum was recorded under control. The application of organic amendments like FYM and MSWC acts as substrate for soil native microbes and further inoculation of useful bacteria alleviates the microbial population load of the soil. Mulching in the respective treatments provides congenial environment for proliferation of soil microbes. These results are also in conformity with the findings of Lalruatsangi *et al.* (2018).

Maximum soil available nitrogen content was found in 50% NPK + FYM + mulch (paddy straw) + bio-inoculant followed by in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, minimum was recorded in control. Available phosphorus content was maximum noted in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Minimum was recorded in control. Maximum soil available potash content was found in 50% NPK + MSWC + mulch (paddy straw) followed by in 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Minimum available potash content was recorded under control. Organics are known to help overcome loss of nutrients through leaching processes vis-à-vis enhance soil native nutrient status.

## **5.6 Cost economics of treatments**

Maximum benefit: cost ratio was obtained under 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Maximum net income was also obtained under 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. The minimum benefit: cost ratio and net income under control. This might be due to the reason that the plants uptake nutrients directly through inorganic and organic fertilizers along with bio-inoculant. This combination enhanced the fruit quality as well as yield of plant.

### SUMMARY AND CONCLUSION

The present investigation entitled “Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh” was carried out during 2017-18 and 2018-19. The experiment was conducted at the Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow (UP), India. The experiment was laid out in randomized block design (RBD) with having twelve treatments along with control and replicated thrice.

The results of present investigation concerning to efficacy of organics, bio-inoculant and mulching on the vegetative growth, flowering, fruiting yield and fruit quality parameters of strawberry and soil properties have been summarized in this chapter.

1. The tallest plants were found with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, smallest plants were noted in control. It also has been obtained that the individual as well as combined application of an organics, bio-inoculant and mulching was statistically at par.
2. The maximum plant spread was observed with 100% NPK + mulch (paddy straw) application and followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum plant spread were scored in control. Plant spreads under different treatment combinations varied from 12.00 to 17.68 cm over a period of 120 days (E-W) after planting.
3. The maximum leaf length was achieved with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + Bio-inoculant whereas, minimum leaf length was noted in control in two consecutive years.

4. Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant resulted in maximum leaf area was found and followed by that in treatment where 100% NPK + mulch (paddy straw) was applied. However, minimum leaf area was noted in control.
5. The highest length of petiole was produced with 100% NPK + mulch (paddy straw) application followed by 50% NPK + MSWC + mulch (paddy straw) whereas, lowest length of petiole was found in control in two consecutive years.
6. The maximum number of leaves was recorded with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas; minimum number of leaves was scored in control.
7. The minimum days to first flowering was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 50% NPK+ MSWC+ mulch (paddy straw) + bio-inoculant. However, maximum days to first flowering were found in control.
8. A maximum number of flowers were found with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum number of flowers was found in control.
9. The highest length of pedicel was achieved with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. However; lowest length of pedicel was noted in control in two consecutive years.
10. The minimum days to first fruit set was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 50% NPK+ MSWC+ mulch (paddy straw) + bio-inoculant however, maximum days to first fruit set was found in control.

11. Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant get maximum number of fruits per plant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruits per plant were found in control.
12. Percentage of fruit setting per plant was maximum produced with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. However, minimum was found in control.
13. The highest duration of fruit harvesting was scored with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. However, minimum duration of fruit harvesting was found in control in two consecutive years.
14. The maximum numbers of runners/plant was produced with 100% NPK + mulch (paddy straw) application followed by 75% NPK+FYM + mulch (paddy straw) + bio-inoculant. However, minimum numbers of runners/plant was scored in control in two consecutive years.
15. The highest fruit length was obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum length of fruit was found in control in two consecutive years.
16. The maximum diameter of fruit was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant however; minimum diameter of fruit was noted in control in two consecutive years.
17. Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant obtained maximum size of fruit and followed by 100% NPK + mulch (paddy straw) whereas, minimum size of fruit was recorded in control in two consecutive years.

18. The maximum volume of fruit was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum volume of fruit was found in control in two consecutive years.
19. The maximum fresh fruit weight was showed with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum fresh fruit weight was found in control in two consecutive years.
20. Plants treated with 75% NPK + FYM + mulch (paddy straw) produced maximum specific gravity with application followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum specific gravity was noted in control.
21. Significantly maximum dry fruit weight was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum dry fruit weight was found in control in two consecutive years.
22. The maximum fruit yield/plant was found with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruit yield plant<sup>-1</sup> was recorded in control in two consecutive years.
23. The maximum fruit yield/plot was obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruit yield plot<sup>-1</sup> was scored in control in two consecutive years.
24. The maximum fruit yield/ha was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM +

mulch (paddy straw) + bio-inoculant. Whereas, minimum fruit yield  $\text{ha}^{-1}$  was noted in control in two consecutive years.

25. The maximum pH of fruit juice was showed with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum pH of fruit juice was scored in control in two consecutive years.
26. Significantly, maximum total soluble solids ( $^{\circ}\text{brix}$ ) of fruit juice were achieved with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum total soluble solids ( $^{\circ}\text{Brix}$ ) was found in control in two consecutive years.
27. Titratable acidity of fruit juice was minimum recorded with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, maximum titratable acidity was scored in control in two consecutive years.
28. The maximum TSS/Acid ratio of fruit juice was recorded with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum TSS/Acid ratio was found in control in two consecutive years.
29. Significantly maximum ascorbic acid content of fruit juice was obtained with Control application followed by 100% NPK + mulch (paddy straw). Whereas, minimum ascorbic acid content was recorded in 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant in two consecutive years.
30. Total sugars content of fruit juice was maximum showed with 75% NPK + FYM + mulch (paddy straw)+ bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw)+ bio-inoculant whereas, minimum total sugars content was scored in control in two consecutive years.

- 31.** The maximum reducing sugar content of fruit juice was achieved with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw). Whereas, minimum reducing sugar content was found in control in two consecutive years.
- 32.** Significantly maximum non-reducing sugar content of fruit juice was found with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum total non-reducing sugar content was scored in control in two consecutive years.
- 33.** Anthocyanin content of fruit juice maximum was recorded with 75% NPK + MSWC + mulch (paddy straw) application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum anthocyanin content was found in control in two consecutive years.
- 34.** The maximum soil moisture was recorded under 75% NPK + FYM + mulch (paddy straw) + bio-inoculant at 30 DAP, 75% NPK + mulch (paddy straw) at 45 DAP, 50% NPK + MSWC + mulch (paddy straw) at 60 and 105 DAP, 50% NPK + mulch (Paddy straw), at 75 DAP and 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant at 90 and 120 DAP respectively followed by 50% NPK + MSWC + mulch (paddy straw) at 30 and 45 DAP, 75% NPK + FYM + mulch (paddy straw) at 60DAP, 50% NPK + FYM + mulch (paddy straw) at 75, 90 and 105 DAP and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant at 120 DAP, respectively. Minimum values were recorded under control at different days after planting in all the respective treatments.
- 35.** Soil temperature was recorded maximum under control at 30, 75, 90,105 and 120 DAP respectively, but at 45 and 60 DAP it was found maximum under 50% NPK + MSWC + mulch (paddy straw) and 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant respectively followed by 100% NPK + mulch (paddy straw) at 30 and 120 DAP, at 45 DAP in 75% NPK + MSWC + mulch (paddy straw) and at 60, 90 and 105 DAP in 75% NPK + FYM + mulch (paddy straw) + bio-inoculant and at 60DAP 50% NPK + FYM + mulch (paddy straw),

respectively. Minimum value at 30 and 105 DAP in 50% NPK + FYM + mulch (paddy straw), at 45, 75 and 90 DAP in 50% NPK + FYM + mulch (paddy straw) + bio-inoculant, at 60DAP in 100% NPK + mulch (paddy straw) and at 120 DAP under 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant.

- 36.** Maximum soil pH was found under control followed by 50% NPK + mulch (paddy straw). Whereas, minimum soil pH was found in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant in two consecutive years.
- 37.** Maximum electrical conductivity was recorded under control followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum electrical conductivity was found under control in two consecutive years.
- 38.** Maximum organic carbon percent was found under 75% NPK + MSWC + mulch (paddy straw) and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant respectively followed by 75% NPK + FYM + mulch (paddy straw) and 50% NPK + FYM + mulch (paddy straw). Whereas, minimum organic carbon percent was found under control in two consecutive years.
- 39.** Microbial population count was maximum recorded under 50% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, minimum microbial population noted was found in control.
- 40.** Maximum available nitrogen content was found in 50% NPK+ FYM + mulch (paddy straw) + bio-inoculant followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas; minimum available nitrogen content was found under control.
- 41.** Maximum available phosphorus content was recorded with 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum available phosphorus content was found under control.

42. Maximum available potash content was recorded with 50% NPK + MSWC + mulch (paddy straw) followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum available phosphorus content was found under control.
  
43. Maximum benefit: cost ratio was obtained with 75% NPK + MSWC + mulch (paddy straw) application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum benefit: cost ratio was found in control in two consecutive years.
  
44. Maximum net income was also found with 75% NPK + MSWC + mulch (paddy straw) application followed by that obtained with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum net income was found in control in two consecutive years.

## CONCLUSION

In the present investigation with different treatments combinations to test the efficacy of organics, bio-inoculant and mulching on vegetative growth, yield, quality and soil parameters in strawberry *cv.* Chandler, it is an accomplished that application of 100% NPK of RDF significantly increased the plant height, plant spread at 120 DAP, number of leaves, leaf length, leaf width, length of petiole, length of pedicel, duration of harvesting and number of runners plant<sup>-1</sup>.

The maximum leaf area, days to first flowering, number of flowers, days to fruit set (minimum number of days), number of fruits, percentage of fruit setting, fruit yield plant<sup>-1</sup>, fruit yield plot<sup>-1</sup>, fruit yield ha<sup>-1</sup>. Length of fruit, width of fruit, weight of fruit, volume of fruit, fresh fruit weight, dry fruit weight and quality characters viz., total sugars, reducing sugar, non-reducing sugar and minimum ascorbic acid content were recorded in 75% NPK+MSWC + mulch (paddy straw)+ bio-inoculant. Whereas, specific gravity was maximum with application of 75% NPK + FYM + mulch (paddy straw).

As far as the bio-chemical characters of strawberry fruits are concerned application of 75% NPK + FYM + mulch (paddy straw) + bio-inoculant exhibited highest pH, TSS, TSS/Acid ratio and minimum titratable acidity were recorded whereas, maximum titratable acidity was recorded under control. However, maximum anthocyanin content was obtained under 75% NPK + MSWC + mulch (paddy straw).

Maximum benefit: cost ratio and maximum net income were obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum benefit: cost ratio and maximum net income were also found in control in two consecutive years.

On the basis of above findings, it may be concluded that for getting significantly maximum yield and bio-chemical quality of fruits with more propagating materials of strawberry runners should be fed with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant in the partially reclaimed alkali soil of central Uttar Pradesh, India.

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