EFFECT OF SOME BOTANICALS AND BIO-CONTROL AGENTS IN CONTROLLING BRINJAL SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUEN) IN BRINJAL

MD. NASIR UDDIN

DEPARTMENT OF ENTOMOLOGY

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

DHAKA 1207

JUNE, 2010

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BY

MD. NASIR UDDIN

REGISTRATION NUNBER: 04-01464

A thesis
Submitted to the Faculty of Agriculture,
Sher-e-Bangla Agricultural University, Dhaka
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE
IN
ENTOMOLOGY

SEMESTER: JANUARY-JUNE, 2010

Approved by:

(Dr. Md. Mizanur Rahman)	**(Dr. Md. Razzab Ali)**
Supervisor	**Co-Supervisor**
&	**&**
Professor	**Professor**
Department of Entomology	**Department of Entomology**
SAU, Dhaka	**SAU, Dhaka**

Chairman
Department of Entomology

&
Examination Committee

ACKNOWLEDGEMENTS

The author first wants to articulate his enormous wisdom of kindness to the Almighty Allah for His never ending blessing, protection, regulation, perception and assent to successfully complete the Master of Science in Entomology.

The author like to express his deepest sense of gratitude and sincere appreciation to his honorable supervisor Dr. Md. Mizanur Rahman, Professor, Department of Entomology, Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh, for his continued supervision, support, encouragement, practical criticism and invaluable suggestions throughout the study period and gratuitous labor in conducting and successfully completing the research work and the preparation of the manuscript.

The author also expresses his gratefulness and best regards to respected Co-Supervisor, Md. Razzab Ali, Professor, Department of Entomology, Sher-e-Bangla Agricultural University, Dhaka for his pedagogic guidance, helpful comments and constant inspiration throughout the research work and preparation of the thesis.

The author expresses his sincere respect to the Chairman Department of Entomology, Sher-e-Bangla Agricultural University, Dhaka for valuable suggestions and pleasant cooperation during the study period. The author also expresses heartfelt thanks to all the teachers of the Department of Entomology, SAU, for their valuable suggestions, instructions, cordial help and encouragement during the period of the study.

The author expresses his sincere appreciation to his brother, sisters, relatives, well wishers and friends for their inspiration, help and encouragement throughout the study period.

Dated: *The Author*
Place: SAU, Dhaka

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ABSTRACT

The experiment was conducted at the Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh to study the effect of some botanicals and bio-control agents in controlling Brinjal Shoot and Fruit Borer (BSFB) during the period from April to October 2009. The experiment consists of the following management practices: T_1: Neem oil @ 4ml/L of water at 7 days interval; T_2: Neem seed kernel @ 300g/L of water at 7 days interval; T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval; T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval; T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension/L of water + Safeclean 2.5 ml/L of water at 7 days interval; T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval and T_7: Untreated control. The plants treated with T_1 treatment (Neem oil @ 4 ml/L of water at 7 days interval), resulted significantly lowest percentage of infested shoot &fruit compared to those of other treatments during early, mid and late fruiting stage. Significantly the highest yield was obtained in plant under the treatment T_1. The treatments T_2 (Neem seed kernel @ 300g/L of water at 7 days interval) and T_3 (*Trichogramma evanescence* @ 0.1g/6 m^2 after 7 days interval) also gave more or less similar result as treatment T_1. The yield contributing characters found highest in T_1 treatment for length and girth of fruits, weight of individual fruit, edible portion, non edible portion and yield per hectare. The highest Benefit Cost Ratio was found in T_1 may be due to the minimum infestation and cost compared to the other treatment components and the highest yield was produced in this treatment. Length, girth of healthy fruits, individual fruit weight and edible portion of fruit showed significant positive relation with yield of brinjal.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Eggplant (*Solanum melongena* L.) is commonly known as brinjal in Indian sub-continent is a self-pollinated annual crop and belongs to the family Solanaceae. Eggplant is the principal and most popular vegetable crop in Bangladesh and extensively grown in both *Rabi* and *Kharif* seasons. It covers an area of 74,711 acres, is about 15% of total vegetable growing area of country. Its annual production in Kharif is scanty and brinjal plays an important role to cover during the shortage of vegetable lean period (Anon., 1995). More than 20 varieties of eggplant are grown in different regions of the country.

Brinjal is very much susceptible to insect pest that attack from seedling stage to final harvest. The incidence of the pest occurs either sporadically or as outbreak every year throughout the country wherever the eggplant is grown (Alam, 1969) and this crop is infested by 53 species of insect pests (Nayer *et al*., 1995). Out of them 8 species are considered as major pests causing serious damage to the crop. One species of mites is considered as minor pests as it generally cause little damage to brinjal. The insect pests cause enormous losses to brinjal in every season and every year. Brinjal shoot and fruit borer, BSFB (*Leucinodes orbonalis* Guenee) is the most destructive of all the pests of brinjal in Bangladesh (Alam, 1969) and India (Tewari and Sandana,

1990) and also a major pest in some other countries of the world (Dhanker, 1988).

Brinjal shoot and fruit borer (BSFB) is active throughout the year at places having moderate climate. They are very active in summer months especially in the rainy season. The intensity of infestation by this pest may go over 90% (Kalloo, 1988). The yield loss has been estimated up to 86% (Ali *et al*., 1986), 67% (Islam and Karim, 1991) in Bangladesh, and 95% (Naresh *et al*., 1986) in Hanyana India. In the early stage of crop growth, the newly hatched larvae bore into petioles and midribs of leaves and tender shoots and close the entry holes with their excreta and feed inside (Butani and Jotwani, 1984). At this stage of plant growth, the insect damage both shoots and fruits. Secondary infections caused by certain fungi may cause further deterioration of the fruits (Islam and Karim, 1994).

Considering the importance of brinjal and severity of BSFB problem a wide range of organophosphorus, carbamates and synthetic pyrethroids with various spray formulations have been advocated from time to time against this pest (Prakash, 1988; Yein, 1985; Metho and Lal, 1981; Yardani *et al*., 1981). Among the available pest control techniques, chemical means are still vital and provide a rapid, cost-competitive, typically effective and valuable pest management tool due to inadequate knowledge of farmers and unavailability of non-chemical pest management approaches. According to pesticides association of Bangladesh pesticide use for growing brinjal was 1.41 kg/ha whereas for vegetables altogether it was 1.12 kg/ha whiles it was

only 0.2 kg/ha in rice (Grainge and Ahmed, 1988). Socio-economic studies of current BSFB control practices in Jessore District of Bangladesh indicated that 98% of farmers relied exclusively on the use of insecticides and more than 60% of farmers sprayed their crop 140 times or more in the 6-7 months cropping season (Anon., 2003). Although it is not documented how much active material could be left in Brinjal fruit after washing and cooking, it may be assumed that the use of highly toxic insecticides on the Brinjal would widen the possibilities of consumers to be intoxicated.

In the context of Bangladesh, since harvesting and selling of brinjal are done without bothering for the pre-harvest interval, pesticide residue levels in such brinjal would undoubtedly be above Maximum Residue Limit (MRL). In most of the cases, the farmers either forgot or did not care to follow the instructions and went on using insecticides at their own choice or experience. Farmers usually spray insecticide in their field indiscriminately considering the level of infestation and without thinking the economic return of their investment. As a result, harmful impact of insecticides on man, animal, beneficial insects and environment is imposing a serious threat. Indiscriminate use of insecticides is reported to cause insecticide resistance in insect pests, resurgence and secondary pest's outbreak. The accumulation of insecticide residues in food is increasing at an alarming rate and there is a chance of health hazards due to these detrimental toxicants. But research on alternative non-chemical approaches like cultural, mechanical, biological, host plant resistance etc. undertaken against this pest in Bangladesh and elsewhere throughout the world is limited.

In recent years, there has been tremendous renewed interest in botanical neem products been used in some Asian countries (Karim *et al.,* 1992). Parasitic wasps viz. *Trichogramm* sp. egg parasitoid (Mohanraj *et al.,* 1995), *Bacillus thuringiensis* insect pathogenic bacterium are the new introduction in Bangladesh for the management BSFB. Many parts of the world use *Trichogramma* sp. successfully for crop production (Hasan, 1992). The egg parasitoid *Trichogramma* can achieve a level of control that is near 100% in some years or areas (Kim and Heinrichs, 1985; Kim *et al.,* 1986). *Bacillus thuringiensis* (Bt) is an insecticide with unusual properties that make it useful for pest control in certain situations.

Considering the present situation it is necessary to identify suitable management practices of brinjal shoot and fruit borer (BSFB). Therefore, the present study was designed with the following objectives:

1. To evaluate the effectiveness of selected botanicals and bio-control agents against brinjal shoot and fruit borer;

2. To find out a suitable control option which comprising with botanicals and bio-control agents for suppression of brinjal shoot and fruit borer;

3. To analyze the benefit cost ratio of various botanicals and bio-control agents in the present study.

CHAPTER 2

REVIEW OF LITERATURE

Brinjal is one of the most important vegetable crop in Bangladesh as well as many countries of the world. Brinjal shoot and fruit borer (BSFB) is the most destructive pest of brinjal. For controlling BSFB it is necessary to have a concept of the origin and distribution, pest status and host range, nature of damage, seasonal abundance, and bionomics of this pest. Farmers mainly control BSFB through use of different chemicals. But the concept of management of pest employing eco-friendly materials gained momentum as mankind became more safely about environment. Use of botanicals and bio-control agents is the recent and ecofriendly approaches for pest control. Information related to management of BSFB using botanicals and bio-control agents is very scanty. Nevertheless, some of the important and informative works and research findings related to the control of BSFB through botanicals and bio-control agents so far been done at home and abroad have been reviewed in this chapter.

2.1 Origin and Distribution of BSFB

According to Butani and Jotwani (1984), *Leucinodes orbonalis* Guenee, the most destructive pest of eggplant is widely distributed not only in the Indian sub-continent but also in South Africa, Congo and Malaysia. Eggplants are severely attacked by shoot and fruit borer in the tropics but not in the temperate zone. Eggplant is a native of India and is extensively grown in all the Southeast Asian countries. It was introduced into Spain from India during the Moorish invasion from where it spread throughout Europe then into America. The domesticated non- bitter types spread eastward into China by the fifth century BC from India (Yamaguchi, 1983).

2.2 Pest Status and Host Range of BSFB

Shoot and fruit borer is the most destructive insect pest of eggplant (Alam and Sana, 1962; Alam 1969; Butani and Jotwani, 1984; Nair, 1986; Chattopadhyay, 1987). It can also infest potato, tomato and peas (Hill, 1983). Several Solanaceous crops and wild *Solarium* species are also attacked by this pest (Karim, 1994). According to Isahaque and Chaudhuri (1983), the alternate hosts of BSFB were *Solarium nigrum, S. indicum, S. torvum, S. myriacanthum* and potato.

2.3 Nature of Damage of BSFB

Eggplant is severely attacked by shoot and fruit borer during the rainy and summer season. The losses due to its infestation are sometimes reported to be more than 90% (Kallo, 1988). The damage by this pests starts soon after transplanting of the crop and continues up to the last harvest of the fruits. The eggs are laid singly and deposited on the ventral surface of the leaves, shoots, flower buds, and petiole and occasionally on the fruit. In young plants, the larvae bore into the petioles and midribs of large leaves and also bore into the young shoots. Immediately after boring, the larvae close the entry hole with their excreta and feed inside (Butani and Jotwani, 1984). The infested shoots droop due to disruption of vascular system and ultimately wither (Alam and Sana, 1962).

At later stage of the plant growth, the larvae bore generally through calyx and later into the flower buds and the fruits without leaving any visible sign of infestation and feed inside (Butani and Jutwani, 1984). The infested flower buds dry and shed. When fruits are available they prefer to bore into the fruits. Infested

fruits show exit holes along with excreta. When an infested fruit is cut open, dark excreta, moulds and sometime rotten portion is found. Often the infested fruits become unfit for human consumption and marketing. The full grown larvae come out through the exit hole and drop on the ground for pupation in the soil or plant debris, the larvae feed on the pith tissues of infested fruits by boring tunnels. The per cent infestation of fruits is more than that of the shoots (Alam and Sana, 1962). The pest is reported to cause 1 to 16% damage to shoots and 16 to 64% to fruits in Bangladesh (Butani and Jotwani, 1984). Hami (1955) found that vitamin C (ascorbic acid) is reduced to the extent of 68% in infested fruit. Peswani and Rattan Lal (1964) reported that this borer damaged 20.7% fruits and if only damaged portion of these fruits is discarded, the loss in weight comes to 9.7%.

2.4 Seasonal abundance of BSFB

The seasonal history of shoot and fruit borer varies considerably with varying climatic conditions throughout the year. Hibernation does not take place and the insects are found active in summer months, especially in rainy season. They are less active during February to April (Alam, 1969). A study revealed that the population of this insect began to increase from the first week of July and peaked (50 larvae per 2m) during the third week of August. The population to this pest was positively correlated with average temperature, mean relative humidity and total rainfall (Shukla, 1989).

During winter months, the duration of different stages last for longer periods. Overlapping of generations was observed. There are altogether five generations of

the pest in a year of which three occur during May to October and two from November to April. During summer months, each generation covers about four to six weeks but in winter months it covers up to the extent of sixteen weeks (Alam, 1969).

There is a considerable mortality of larvae by rot caused by fungus during winter and by predatory black ants, *Camponotus compressus* F. during summer. Pupal mortality has been observed during rainy season due to attack of *Ichneumonid* parasitoid. The adult moths are also attacked by the black ant, *Camponotus compressus* F. (Alam, 1969). Maximum population of adult moths has been observed in the month of December and April (Alam, 1969). Populations of *Leucinodes orbonalis* on eggplant increased in the 1st and 3rd and declined in the 2nd and 4th generations. Patel *et al*., (1988) observed low population variation in minimum and maximum temperature but high relative humidity and heavy rain enhanced the population of this pest.

In another study Mohanraj *et al*. (1995) reported that the infestation of shoots began 30 days after transplanting, peaked in the 2nd week of September and reached zero on the 1st week of November. Fruit was infested from the 3rd week of September and the infestation peaked in the 2nd week of November. On the summer crop, shoots were infested from the 3rd week of January and the infestation peaked in the 2nd week of February. Infestation of fruit peaked in the 1st week of April. Infestation levels were lower during the summer than during Kharif.

2.5 Bionomics of BSFB

The adult *Leucinodes orbonalis* Guenee moths are white and cryptic in nature (Alam, 1969) with 22 to 26 mm long at wing expanse (Butani and Jotwani, 1984). Head and thorax are variegated with black and brown color. The white fore wings have conspicuous black and brown patches and dots, the hind wings are opalescent with black dots along the margins (Butani and Jotwani, 1984). The margins of both the wings are provided with fine bristle like hairs. Mating takes place in the second night after emergence. The male dies after copulation and female after egg deposition. The eggs are laid singly and deposited on shoots, flower buds, petioles and on the ventral surface of the leaves. Eggs are laid during the later part of the night and continue till the early hours in the morning (Alam, 1969). The number of egg laid by a female varies from 11 to 68 with an average of 42. But, Butani and Jotwani (1984) reported that a female lays an average of 250 eggs. According to Baang and Corey (1991), the average number of eggs laid per female was 121.5 ± 0.449 and of these 79.24% were viable. The egg measures on an average 0.44 mm × 0.32 mm with creamy white colour and changed into yellow to yellowish orange as the development proceeds. The young larva on hatching measures 1.49 mm × 0.41 mm with slender abdomen tapers posterior. It is dull white color with yellowish tinge which later turns into creamy white. The full-fed larva measures 16.3 mm × 3.16 mm in its widest part. The body is light pinkish in color with creamy tinge. The thoracic and the first three abdominal segments are more pinkish than those of the rest (Alam *et al,* 1964). The pupa is formed within a boat shaped cocoon of dirty brown coloured silk which is spun by

the full grown larvae before pupation in a suitable dark or semi-dark place in soil and plant debris. During rainy season pupation takes place on the stems or shoots or the dried leaves of the plants (Alam, 1969). The full-grown pupa measures 6.4 mm × 1.66 mm. The anal segment of the male pupa is devoid of bristles, whereas the female pupa has eight bristles with curved tips at the anal segment. The incubation, larval and pupal periods are 3 to 5, 12 to 15 and 7 to 10 days during the summer and 7-8, 14-22 and 13-15 days in the winter, respectively (Butani and Jotwani, 1984 ; Alam and Sana, 1962). The full-grown larva shows a pre-pupal period of 3-4 days. The life cycle is completed in 34 to 59 days with five or more overlapping generations per year (Alam and Sana, 1962; Alam, 1969). The insects are active throughout the year with more activity in the summer and rainy season than in the winter months (Alam and Sana, 1962). Sandanayake and Edirisinghe (1992) observed that *Leucinodes orbonalis* 1^{st} instar larvae occurred in flower buds and flowers, while 2^{nd} instars larvae were present in all susceptible parts of the plant. Larvae were confined to the shoots and fruits in their 3^{rd} and 4^{th} instars, while 5^{th} instars larvae were found only in the fruits. The size of entry hole made by a larva was found to be a good indicator of its instars.

Yin (1993) reported that in case *of Leucinodes orbonalis* one to six generations were completed annually over-wintering as pupae. Adults were not active during the day; copulation and oviposition take place at night. The eggs were laid separately on the lower surface of young leaves (80-88%). One female laid about 200 eggs. The hatching rate was 57.5-85.0% at 25-30°C. Larval stage lasted for 21.2-12 days. Pupated mainly in decomposed, leaves and under withered branches

and fallen leaves, and in the soil. Pupal stage lasted for 8-15 days. Another study revealed that the egg stage averaged 5.4 days, the larval stage 17.5 days, the pupal stage 9.8 days, the pre-oviposition and oviposition periods 1.2-2.1 and 1.4-2.9 days, respectively, and adult male and female life-span 1.5-2.4 and 2.0-3.9 days respectively. Average fecundity (eggs/female) ranged from 84.5 in January to 253.5 in May (Metho *el al.,* 1983). Alam *et al.* (1964) reported that the total length of the *Leucinodes orbonalis* life cycle ranged from 19 to 28 days. The eggs were laid mostly on the underside of the leaves. The pest had 6 larval instars. The duration of larval development ranged from 9 to 13 days and the pupal period lasted for 7 to 11 days.

2.6 Management of BSFB

2.6.1 Use of botanical pesticides

More than 2000 species of plants have been reported to possess insecticidal properties (Grainge and Ahmed, 1988). The seeds and leaves of the neem tree *(Azadirachta indica)* contain terpenoids with potent anti-insect activity. One of the most active terpenoids in neem seeds is azadirachtin, which acts as an antifeedent and causes growth disruption against a wide range of insect pests at microgram level. The active terpenoids in neem leaves include nimbin, deactylnimbin and thionemone (Simmonds *et al.*, 1992). The leaf extract of neem tested against the leaf caterpillar of brinjal, *Silepa docilis* Bult. at 5% concentration exhibited a high antifeedent activity (Jacob and Sheila, 1994).

Neem *(Azadicachat Indica A. Juss*) seed oil, a botanical pesticide have also been used to control different insect pests of important agricultural crops in different countries of the world. More than 2000 species of plants have been reported to posses' insecticidal properties (Grainge and Ahmed, 1988). The neem tree *(Azadirachta indica* A. Juss) is one of them. The development and use of botanical pesticides become an integral part of the integrated pest management (IPM) strategies. Stoll (1992) summarized the potential benefits of botanical pesticides which diminish the risk of resistance development, natural enemy elimination, secondary out break of pest and ensure overall safety to the environment.

The seed and leaves of the neem tree contain terpenoids with potent anti-insect activity. One of the most active terpenoids in neem seeds is "azadirachtain" which acts as an antifeedant and growth disrupter against a wide range of insect pest at microgram levels. The active terpenoids in neem leaves include nimbin, deactylnimbin and thionemone (Simmonds *et al.,* 1992).

During last two decades neem oil and extracts from leaves and seeds have been evaluated as plant protectant against a wide range of arthropod and nematode pests in several countries of the world. Although, most of the trails are laboratory based but it is not scanty in case of field condition. Ketkar (1976) reviewed 95 and Jacobson (1985) reviewed 133 papers on neem and documented neem's potential in the management of arthropods pests (Warthen, 1979).

Ahmed and Grainge (1985) and Saxena (1988) summarized the effectiveness of neem oil against 87 arthropods and 5 nematodes, 100 insects and mites and 198 different species of insects, respectively.

Experiment with botanical pesticides has also been conducted in Bangladesh on a limited scale. Islam (1983) reported that extract of leaf, seed and oil of neem, showed potential as antifeedants or feeding and oviposition deterrents for the control of brown plant hopper, green leaf hopper, rice hispa and lesser rice weevil. He also conducted experiments to asscertain the optimal doses of the extract against rice hispa, and pulse beetle. Addition of sesame or linseed oil to extract of neem resulted in higher mortality of the grubs and in greater deterrence in feeding and oviposition compared to those obtained with extract alone (Islam, 1986).

Field trail with neem products have shown, not only a decrease in damage by pest but also an increase in crop yield compared to those obtained with recommended synthetic insecticides. A methanol suspension of 2-4% of the neem leaves have been used against the caterpillar of diamondback moth, *Plutella xylostella* and it was as effective as either synthetic insecticides mevinphous (0.05%) or deltamethrin in (0.02%) in Togo (Dreyer, 1987). In Thailand, a field trail showed that piperanyl butoxide increased the efficacy of neem and the combination was as active as cypermethrin (0.025%) against *Plutella xylostella* and *Spodoptera litura,* which revealed that neem oil with synthetic insecticides may have some synergetic effect in controlling insect pests (Sombatsiri and Tigvattanont, 1987). Fagoonee (1986) used neem in vegetable crop protection in Mauritius and showed

neem seed kernel extract was found to be effective as deltamethrin (Decis) against the *Plutella xylostella* and *Crocidolomia binotalis.* He also found neem extract alternate with insecticides gave best protection against *Helicoverpa armigera.* Neem product have been used to control vegetable pests under field condition and good control of *Plutella xylostella* and Pyralid, *Hellula undalis* on cabbage was achieved with weekly application of 25 or 50 gm neem kernel powder/liter of water (Dreyer, 1987). The leaf extract of neem tested against the leaf caterpillar of brinjal, *Selepa docilis* at 5% concentration had a high anti-feedant activity with a feeding ratio of 28.29 followed by 3% having only medium anti-feedant properties with 23.89 as the feeding ratio (Jacob and Sheila, 1994).

Entomologist of many countries including India, The Philippines, Pakistan and Bangladesh has conducted various studies of neem against different insect pests. Most of the cases the investigators have been used a particular concentration of the neem extract. Neem seed kernel extracts (3-5%) were effective against *Nilaparbata lugens, Nephotettix* spp., *Marasmia patnalis, Oxya nitidula* and Asian gall midge. Neem leaf extract, however, is less effective than neem seed kernel extract. But the same extract of 5-10% was highly effective, inclusive of *Scirpophaga incertulus* and thrips. Damage by leaf folders was reduced by 3% neem oil. Neem seed kernel extracts reduced egg deposition on rice seedling by *Nephotettix* spp. and *Nilaparbata lugens* (Jayaraj, 1991). Neem seed kernel extract was an effective antifeedent to pigeon pea pod borer. He also found that there has been no adverse effect, even though neem was systemic. According to him neem oil can be used @ 1-3% without any problem. But 5% neem oil will

cause phytotoxicity in many plants. The effect of neem oil is systemic, though not persistent. It should be noted that application of neem oil beyond 5% will cause serious phytotoxicity in rice. At 3%, the initial phytotoxicity effects are minimum and the plant can recovered completely. Thus, neem oil should be applied at concentrations not beyond 3% (Jayaraj, 1991).

Most of the cases, the user of neem oil use it at different doses ranged from 0.5-50% (Krishnaiah and Kalode, 1991). They use different emulsifier to mixe neem oil with the water. Neem oil normally stays separately on the upper surface of the water. Detergent in water helps neem oil to emulsify in the water. In a field observation of neem oil Krishanaiah and Kalode (1991) used soap as emulsifier with water. Another study with neem oil in rice field, Palanginan and Saxena (1991) added 1.66% Teepol (liquid detergent) to the extract solutions as an emulsifier. In a study of Bangladesh Rice Research Institute (BRRI), Gazipur, Alam (1991) added 1 ml (0.1%) of teepol detergent per liter of water and spray at 7 days interval against stem borer of rice.

2.6.2 Biological control

Mallik *et al.,* (1989) reported that *Trathala flavoorbitalis* cam. is the parasitoid of the BSFB. *Trathala flavoorbitalis* is recorded from *L. orbonalis* in India and also in Srilanka where *L. orbonalis* is its major host and where an average parasitisation level of 36.2% has been reported (Sandanayake and Edirisinghe, 1993). In Hissar, India, *Trathala* was found as the only parasitoid of *L. orborialis* which attack the larvae of BSFB ranging from 13.2 to 18.21% in winter to 12.9%

in summer when 95.2% of fruits were infested (Naresh *et al.,* 1986). *Trathala flavo-orbitalis* is identified as an effective larval parasitoid against BSFB in Bangladesh. The rate of parasitism varied from 20 to 25% (Anon., 2001).

Trathala flavoorbitalis was recorded parasitizing the eggplant pest *L.orbonalis* in Bihar, India in 1986-88. Parasitism increased the host pupal period to 11-18 days, as compared to 6-14 days for healthy pupae. Adult parasitoids lived for 4-7 days in the laboratory (Mallik *et al.*, 1989).

Tewari and Sandana (1990) reported a larval ectoparasite, *Bracon* sp. on *L.orbonalis* on eggplant in Karnataka, India and stated the possibility of its use in the biological control of the pest. Naresh *et al.*, (1986) reported that the *L.orbonalis* larval population peaked in May and the pest was active throughout the year where *Trathala* sp. caused 12.90-18.18% parasitism of larvae. The parasitoid was active throughout the winter and summer seasons and preferred mature host larvae.

Itamoplex sp. recorded for the first time in the Indian state of Himachal Prodesh parasitizing the pyralid *L. orbonalis* is a serious pest of eggplant there. About 9-15% of pupae of the pyralid that were collected from the field was parasitized (Verma and Lal, 1985). A species of *Phanerotoma* near *P.hendecasisella* and *Campyloneura* sp, are recorded for the first time as parasites of larvae of *L.orbonalis.* The parasites were found attacking larvae infesting eggplant near Bangalore, Karnataka, India in July 1982. Combined parasitism was only 1-2% (Tewari and Moorthy, 1984).

2.6.2.1 *Trichogramma Sp*.

Trichogramma sp are extremely tiny wasps in the family *Trichogrammatidae*. While it is uncommon for an insect's scientific name, especially one so long and unusual as *Trichogramma*, to also become its common name, the commercial development of this natural enemy and the fact that it attacks so many important caterpillar pests has earned it a place in the popular vocabulary of many pest management advisors and producers.

Trichogramma wasps occur naturally in almost every terrestrial habitat and some aquatic habitats as well. They parasitize insect eggs, especially eggs of moths and butterflies. Some of the most important caterpillar pests of field crops, forests, and fruit and nut trees are attacked by *Trichogramma* wasps. However, in most crop production systems, the number of caterpillar eggs destroyed by native populations of *Trichogramma* is not sufficient to prevent the pest from reaching damaging levels.

Recognizing the potential of *Trichogramma* species as biological control agents, entomologists in the early 1900s began to mass rear *Trichogramma* for insect control. Although a small commercial production of *Trichogramma* eventually developed in the U.S., insect control research and commercial efforts focused on the development of chemical pesticides following the discovery of DDT (73). This was not the case in the Soviet Union and China, both of which developed programs to control several crop pests with *Trichogramma*. In these countries, insectaries were less expensive and less sophisticated than production facilities for

synthetic insecticides, and could be located on farms where labor was inexpensive and readily available. Also, control standards were not as stringent, and releasing *Trichogramma* was often better than no control at all (King, 1993).

Species and distribution

The genus *Trichogramma* is one of 80 genera in the family *Trichogrammatidae*. All members of this family are parasites of insect eggs. *Trichogrammatidae* includes the smallest of insects, ranging in size from 0.2 to 1.5 mm. Within the genus *Trichogramma*, there are 145 described species worldwide; 30 species have been identified from North America and an estimated 20 to 30 species remain to be described. The species most commonly collected from crops and orchards are *atopovirilia, brevicapillum, deion, exiguum, fuentesi, minutum, nubilale, platneri, pretiosum,* and *thalense* (Neil *et al*., 1998).

Life cycle

The effect of temporary host deprivation on parasitization rates of *T. cacoeciae* [*T. cacaeciae*] and *T. dendrolimi* was investigated by Hegazi and Khafag (2001). The insect host in the experiments was *Sitotroga cerealella*. The study was conducted with females that we allowed to engage in 3 days of oviposition after various periods of host deprivation. It seems that the production and management of eggs by the two species is completely different. During the first day of oviposition, parasitization by *T. cacoeciae* was almost unaffected after 1 to 5 days of host deprivation. As deprivation time increased, however, the number of parasitized hosts decreased from an average of 28.6+or-2.0 hosts provided at emergence to an

average of 12.5+or-2.3 hosts when the waiting time was 10 days. The number of hosts parasitized on the first day of parasitization by *T. dendrolimi* was not affected whatever the waiting tests period. During the second or third days of oviposition, the lack of suitable hosts for *T. cacoeciae* did not depress egg-laying potentiality, whereas a strong reduction in parasitization rates by *T. dendrolimi* occurred in the next 2 days of oviposition whatever was the waiting period. This leads to ca. 50% reduction in total activity of 3 days of oviposition. Only in *T. cacoeciae* was it possible to distinguish between ageing and host deprivation. The data suggest that *T. dendrolimi* is a typical proovigenic species, while T. cacoeciae is neither definitely proovigenic nor synovigenic. A slight decrease in rate of emergence of offspring of *T. cacoeciae* females that had waited 8 to 10 days for their hosts was observed.

The functional response of third generation of the *Trichogramma brassicae* reared in laboratory, was studied by Asgari *et al*. (2004) at various densities (5, 10, 20, 40, 80, 100, 120) of the *Sitotroga cerealella* eggs under 25+or-1 degrees C, %60+or-5 RH, and 16 L:8 D.h. photoperiod. One day old eggs of angoumois grain moth. *S. cerealella,* in 15 replications for 24 hours were exposed to one-day old female wasps. Functional response of *T. brassicae* was found to be type III. Searching efficiency (a) handling time and maximum attack rate were estimated, 0.168+or-0.055, 1.468+or-0.121 and 16.34, respectively.

2.6.2.2 *Bacillus thuringiensis*

Bacillus thuringiensis (Bt) is a Gram-positive, soil-dwelling bacterium, commonly

used as a biological alternative to a pesticide; alternatively, the Cry toxin may be extracted and used as a pesticide. *B. thuringiensis* also occurs naturally in the gut of caterpillars of various types of moths and butterflies, as well as on the dark surface of plants (Wikipedia).

Distribution and use

Bacillus thuringiensis Berliner isolates were detected by Theunis *et al*. (1998) in 57% of 801 samples of rice grain dust, soil, rice field arthropods, and miscellaneous habitats (rice straw compost and mammal faeces) collected at 100 sites in the Philippines. The collection yielded 3950 isolates of *B. thuringiensis* (8.7 isolates/ positive sample). Grain dust from rice mills was the richest source (63%) of the samples were positive, with 10.2 isolates/positive sample), followed by rice field arthropods, soil, and miscellaneous habitats. Polyclonal antibodies to six o-endotoxin groups (Cry1A, Cry1B, Cry1C, Cry1D, Cry1E, and Cry3A) were used in enzyme-linked immunosorbent assays (ELISA) to characterize the toxins produced by each isolate. Subsamples of isolates representing the diversity of isolate sources and o-endotoxin profiles were bioassayed against the yellow stem borer, *Scirpophaga incertulas* (walker) and striped stem borer, *Chilo suppressalis* (Walker).

2.6.3. Botanical products

Field studies were conducted by Korat *et al* (2009) during three successive wet seasons (1995-97) in rice fields in Gujarat, India, to determine the efficacy of various concentrations of azadirachtin (Nimbicidine, Neemax, and Neem Gold (all 300 ppm), Econeem (3000 ppm), Neem Azal T/S (10 000 ppm) and Fortune Aza (1500 ppm)) compared to chlorpyrifos for the control of *Cnaphalocrocis medinalis*, *Sogatella furcifera* and *Scirpophaga incertulas*. Results showed that although all neem formulations were effective against pests and resulted in an increased yield none were superior in efficacy to chlorpyrifos.

Safe clean, safe max, and neem oil are the botanicals products use for controlling insect and pests. Safe clean is a detergent type products and safe max produced from mehogoni plant oil, whereas neem oil prepared from leaf of neem plant.

CHAPTER 3

MATERIALS AND METHODS

The experiment was conducted to study the effect of some botanicals and bio-control agents in controlling brinjal shoot and fruit borer in brinjal during April to October 2009. The detail materials and methods of this experiment are presented below:

3.1 Experimental site

The experiment was conducted at the central farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh, which is situated in $23^0 74^/$N latitude and $90^0 35^/$E longitude (Anon., 1989).

3.2 Soil

The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) corresponding AEZ No. 28 and is shallow red brown terrace soil. The characteristics of the soil under the experimental plot were analyzed in the Soil Testing Laboratory, SRDI, Dhaka and has been presented in Appendix I.

3.3 Climate

The climate of experimental site was subtropical, characterized by the winter season from November to February and the pre-monsoon period or hot season from March to April and the monsoon period from May to October (Edris *et al*., 1979). Meteorological data related to the temperature, relative humidity and rainfall during the experimental period was collected from

Bangladesh Meteorological Department (Climate Division), Sher-e-Bangla Nagar and has been presented in Appendix II.

3.4 Planting material

BARI Begun-8 (Plate 1) was used as the test crop of this experiment. The seeds of BARI Begun-8 were collected from Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur.

Plate 1. Photograph showing plant and fruits of BARI begun-8

3.5 Land preparation

The land was first opened with the tractor drawn disc plough. Then the soil was ploughed and cross ploughed. Ploughed soil was then brought into desirable fine

tilth by the operations of ploughing, harrowing and laddering. The stubble and weeds were removed. Experimental land was divided into unit plots following the design of experiment. During land preparation 10 t/ha decomposed cowdung were mixed with soil.

3.6 Manures and fertilizers application

Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MP) were used as a source of nitrogen, phosphorous, and potassium, respectively. Manures and fertilizers that were applied to the experimental plot following doses/ha, Urea 120 kg/ha, TSP 150 kg/ha and MP 80 kg/ha, respectively (Anon., 2005). The entire amount of TSP and MP was applied as basal dose at the time of land preparation. Urea was applied as top dressing in three equal splits at vegetative stage and early and mid fruiting stage.

3.7 Treatments of the experiment

The experiment consists of the following management practices:

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

3.8 Experimental layout and design

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. An area of 24.50 m × 13.00 m was divided into three equal blocks. Each block was divided into 7 plots, where 7 treatment combinations were allocated at random. There were 21 unit plots altogether in the experiment. The size of the each unit plot was 3.0 m × 2.5 m. The distance maintained between two blocks and two plots were 1.0 m and 0.5 m, respectively.

3.9 Raising of seedlings and transplanting

Brinjal seeds of BARI Begun-8 were sown directly in the Nursery bed. The beds were lightly irrigated regularly for ensuring proper growth and development of the seedlings. Thirty day old healthy seedlings (3/4 leaf stage) were transplanted in the experimental plots.

3.10 Intercultural operations

Irrigation was done at 30 and 45 Days after transplanting (DAT). The crop field was weeded twice; first weeding was done at 25 DAT and second at 40 DAT.

3.11 Crop sampling and data collection

Five plants from each treatment were randomly marked inside the central row of each plot with the help of sample card.

3.12 Monitoring and data collection

The brinjal plants of different treatment were closely examined at regular intervals commencing from germination to harvest. The following data were collected during the course of the experiment-

- Number of healthy shoots
- Number of infested shoots
- Shoot infestation in number (%)
- Number of healthy fruits
- Number of infested fruits
- Fruit infestation in number (%)
- Weight (g) of healthy fruits
- Weight (g) of infested fruit
- Fruit infestation in weight (%)
- Plant height at harvest (cm)
- Length of healthy fruit (cm)
- Length of infested fruit (cm)
- Girth of healthy fruit (cm)
- Girth of infested fruit (cm)
- Individual fruit weight (g)
- Edible portion (%)
- Non-edible portion (%)

- Fruit yield per plot (kg)
- Fruit yield per hectare (ton)

3.13 Determination of shoot damage

All the healthy and infested shoots were counted from 5 randomly selected plants from middle rows of each plot and examined. The collected data were divided into early, mid and late fruiting stage according to harvest time. The healthy and damaged shoots were counted and the percent shoot damage was calculated using the following formula:

$$\% \text{ Shoot damage} = \frac{\text{Number of damaged shoot}}{\text{Total number of shoot}} \times 100$$

3.14 Determination of fruit infestation in number

All the healthy and infested fruits were counted from 5 randomly selected plants from middle rows of each plot and examined. The collected data were divided into early, mid and late fruiting stage. The healthy and infested fruits were counted and the percent fruit damage was calculated using the following formula:

$$\% \text{ Fruit infestation} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits}} \times 100$$

3.15 Determination of fruit infestation in weight

All the healthy and infested fruits were weighted from 5 randomly selected plants from middle rows of each plot and examined. The collected data were divided into early, mid and late fruiting stage. The healthy and infested fruits were weighted and the percent fruit infestation was calculated using the following formula:

$$\% \text{ Fruit infestation} = \frac{\text{Weight of infested fruit}}{\text{Total weight of fruit}} \times 100$$

3.16 Harvest and post harvest operations

Harvesting of fruit was done when the fruits attained marketable sized**.** The optimum marketable sized fruits were collected by hand picking from each plot and yield was converted into t ha^{-1}.

3.17 Procedure of data collection

3.17.1 Plant height at harvest

The plant heights of 5 randomly selected plants were measured with a meter scale from the ground level to the top of the plants and the mean height was expressed in centimeter (cm). Data were recorded from the inner rows plant of each plot during harvesting period.

3.17.2 Fruit length

Healthy and infested fruits were collected from 5 randomly selected plants and length for healthy and infested fruit was measured and the mean length was expressed on per fruit basis in centimeter (cm).

3.17.3 Fruit girth

The circumstances of healthy and infested fruits of 5 randomly selected plants were measured with a meter scale at base, middle and upper level and average were calculated and expressed in centimeter (cm) for healthy and infested fruit. Data were recorded from the inner rows plant of each plot during harvesting period.

3.17.4 Individual fruit weight

Healthy fruits were collected from the ten randomly selected plants and were weighted by a digital electronic balance. The weight was expressed plant^{-1} basis in gram (g).

3.17.5 Edible and non-edible portion of infested fruit

Infested fruits from 5 randomly selected plants were collected and observed edible and non-edible portion and expressed in percentage.

3.17.6 Fruits yield plot^{-1}

The fruits were collected from 5 each plot in each harvest and weighted. The weight of fruits per plot was expressed in kilogram (kg).

3.17.7 Fruits yield hectare^{-1}

Fruits per plot were converted into hectare and the weight of fruits per hectare was calculated and expressed in ton.

3.18 Statistical analyses

The data on different parameters as well as yield of brinjal were statistically analyzed to find out the significant differences among the effects of some botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB). The mean values of all the characters were calculated and analyses of variance were performed by the 'F' (variance ratio) test. The significance of the differences among the mean values of treatment in respect of different parameters was estimated by the Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

The study was conducted to find out the effect of some botanicals and bio-control agents in controlling brinjal shoot and fruit borer in brinjal in the central farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from April to October 2009. The analysis of variance (ANOVA) of the data on shoot and fruit infestation and different yield contributing characters and yield are given in Appendix III-IX. The results of comparative effectiveness of treatments consisting of various control measures in reducing the infestation of brinjal shoot and fruit borer (BSFB) was evaluated. Influence of these treatments on yield, extent of damage were presented and discussed under the following headings.

4.1 Effect of different treatments on shoot infestation of brinjal

4.1.1 At early fruiting stage

Number of healthy shoots plant^{-1}, number of infested shoots plant^{-1} and percent infestation of shoot plant^{-1} at early, mid and late fruiting stage in controlling brinjal shoot and fruit borer showed statistically significant difference for some botanicals and bio-control agents (Table 1-3).

The results revealed that the highest number of healthy shoots plant^{-1} (22.20) was recorded in T_1 treatment (Neem oil @ 4ml/L of water at 7 days interval) which was statistically similar (21.40, 21.10 and 20.07) with T_2 (Neem seed kernel @ 300g/L of water at 7 days interval), T_3 (*Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval), and T_5 (*Bacillus thuringiensis* serovar kurstaki @ 1ml suspension/L of water + Safeclean 2.5 ml/L of water at 7 days interval), respectively. Again, the lowest number of healthy shoots plant^{-1} (16.13) was recorded in T_7 (untreated control) which was also statistically similar (9.33 and

10.11) with T_6 (Botanical pesticides Safeclean 5 ml/L of water at 7 days interval) and T_4 (*Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval), respectively. The highest number of infested shoots (2.47) was recorded in T_7 treatment followed (1.20) by T_6, while the lowest number of infested shoot (0.80) in T_1 which was statistically similar (0.93, 1.00) with T_2 and T_3 respectively while T_4 and T_5 (1.07 and 1.07) were statistically similar(Table 1).

The percentage of shoot infestation was highest by number (13.25) was recorded in T_7 treatment which was closely followed by (6.52) T_6 treatment. On the other hand, the percentage of shoot infestation was lowest by number (3.48) in T_1 treatment which was statistically similar with (4.19) T_2. The percent of shoot infestation reduction over control in brinjal was estimated for different management practices and the highest percentage (73.74) was recorded for the treatment T_1 and the lowest (50.79) from T_6 treatment (Table 1).

The comparisons of the results of the present study with existing findings revealed that spraying of neem oil @ 4ml/L of water at 7 days interval performed maximum healthy shoot and minimum infested shoot as well as lowest percentage of shoot infestation followed by neem seed kernel @ 300g/L of water at7 days interval, while in control treatment the situation is reverse under the trail followed by botanical pesticides safeclean 5 ml/L of water at 7 days interval. Butani and Jotwani (1984) reported that larvae bore generally through calyx and later into the flower buds and the fruits without leaving any visible sign of infestation and feed inside the pest is reported to cause 1 to 16% damage to shoots.

Table 1. Infestation of brinjal shoot caused by the brinjal shoot and fruit borer (BSFB) in different treatments at early fruiting stage during kharif season, 2009

Treatment	Brinjal shoot in number plant^{-1}			
	Healthy	Infested	% infestation	Infestation reduction over control (%)
T_1	22.20 a	0.80 c	3.48 e	73.74
T_2	21.40 ab	0.93 bc	4.19 de	68.38
T_3	21.20 ab	1.00 bc	4.51 cde	65.96
T_4	18.47 bcd	1.07 bc	5.47 c	58.72
T_5	20.07 abc	1.07 bc	5.08 cd	61.66
T_6	17.40 cd	1.20 b	6.52 b	50.79
T_7	16.13 d	2.47 a	13.25 a	--
$LSD_{(0.05)}$	2.826	0.251	1.000	--
CV(%)	8.13	11.60	9.25	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.1.2 At mid fruiting stage

The highest number of healthy shoots plant^{-1} (29.47) was recorded in T_1 treatment which was statistically similar with (28.53 and 26.60) T_2 and T_3 treatment respectively, whereas the lowest (21.00) number of healthy shoots was recorded in T_7 treatment which was also statistically similar (22.53 and 23.67) with T_6 and T_4, respectively. The highest number of infested shoots (3.87) was recorded in T_7 treatment followed by (2.00, 1.67 and 1.60) T_6, T_4 and T_5 respectively. Again, the lowest number of infested shoot (1.07) was recorded in T_1 treatment which was statistically similar (1.33) with T_2 (Table 2).

The highest percentage of shoot infestation in number (15.56) was recorded in T_7 treatment followed by (8.16) T_6 treatment, while the lowest percentage of shoot infestation by number (3.49) was recorded in T_1 treatment (Table 2) which was statistically similar with (4.46) T_2. Brinjal shoot infestation percentage reduction over control was estimated for different management practices and the highest percentage (77.57) was recorded for the treatment T_1 and the lowest percentage (47.56) from T_6 treatment (Table 2).

From the findings it is revealed that spraying of neem oil @ 4ml/L of water at 7 days interval performed maximum healthy shoot and minimum infested shoot as well as lowest percentage of shoot infestation followed by neem seed kernel @ 300g/L of water at 7 days interval, while in untreated control treatment the situation is reverse under the trail followed by safeclean 5 ml/L of water at 7 days interval. Korat *et al,* (2009) reported earlier that all neem formulations were effective against brinjal pests and resulted in ncreased yield.

Table 2. Infestation of brinjal shoot caused by the brinjal shoot and fruit borer (BSFB) in different treatments at mid fruiting stage during kharif season, 2009

Treatment	Brinjal shoot in number plant^{-1}			
	Healthy	Infested	% infestation	Infestation reduction over control (%)
T_1	29.47 a	1.07 d	3.49 e	77.57
T_2	28.53 a	1.33 cd	4.46 de	71.34
T_3	26.60 ab	1.53 c	5.47 cd	64.85
T_4	23.67 cd	1.67 bc	6.61 c	57.52
T_5	25.47 bc	1.60 bc	5.91 cd	62.02
T_6	22.53 d	2.00 b	8.16 b	47.56
T_7	21.00 d	3.87 a	15.56 a	--
$LSD_{(0.05)}$	2.746	0.394	1.493	--
CV(%)	6.09	11.85	11.83	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.1.3 At late fruiting stage

The highest number of healthy shoots plant^{-1} (33.73) was recorded in T_1 treatment which was statistically similar with (32.87) T_2 and (31.60) T_3, respectively. On the other hand, the lowest (22.80) number of healthy shoots plant^{-1} was recorded in T_7 treatment which was statistically similar with (25.67) T_6. The highest number of infested shoots plant^{-1} (5.27) was recorded in T_7 treatment followed by (2.93, 2.63, 2.53 and 2.40) T_6, T_4, T_5, and T_3, respectively, whereas the lowest number of infested shoot (1.27) was recorded in T_1 treatment which was similar with (1.53) T_2 (Table 3).

The highest percentage of infested shoot in number was recorded in (18.75) T_7 treatment followed by (10.27) T_6 treatment, while the lowest percentage of infested shoot was recorded in (3.62) T_1 treatment which was statistically similar with (4.45) T_2. Brinjal shoot infestation percentage reduction over control was estimated for different management practices and the highest percentage (80.69) was recorded for the treatment T_1 and the lowest percentage from (45.23) T_6 treatment (Table 3).

Butani and Jotwani (1984) reported that larvae bore generally through calyx and later into the flower buds and the fruits without leaving any visible sign of infestation and feed inside the pest is reported to cause 1 to 16% damage to shoots. Damage by leaf folders in rice was reduced by 3% neem oil. Neem seed kernel extracts reduced egg deposition on rice seedling by *Nephotettix* spp. and *Nilaparvata lugens* (Jayaraj, 1991).

Table 3. Infestation of brinjal shoot caused by the brinjal shoot and fruit borer (BSFB) in different treatments at late fruiting stage during kharif season, 2009

Treatment	Brinjal shoot in number plant^{-1}			
	Healthy	Infested	% infestation	Infestation reduction over control (%)
T_1	33.73 a	1.27 c	3.62 e	80.69
T_2	32.87 ab	1.53 c	4.45 e	76.27
T_3	31.60 abc	2.40 b	7.06 d	62.35
T_4	28.53 cd	2.67 b	8.57 c	54.29
T_5	30.27 bc	2.53 b	7.74 cd	58.72
T_6	25.67 de	2.93 b	10.27 b	45.23
T_7	22.80 e	5.27 a	18.75 a	--
$LSD_{(0.05)}$	2.938	0.503	1.278	--
CV(%)	5.63	10.65	8.32	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) are not significantly different and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.2 Effect of different treatments on fruit infestation of brinjal

The effect of various treatments on the number of healthy fruits plant^{-1}, percent infestation of fruit plant^{-1} infestation reduction over control at early, mid and late fruiting stage by number and weight in controlling brinjal shoot and fruit borer showed statistically significant differences for some botanicals and bio-control agents are presented in Table 4-6.

4.2.1 At early fruiting stage

At early fruiting stage the healthy fruit plant^{-1} was highest (7.00) in T_1 treatment which was statistically similar (6.53 and 6.20) with T_2 and T_3, respectively, while the lowest (4.60) number was recorded in T_7 treatment which was statistically similar with (4.67, 5.07 and 5.53) T_6, T_4 and T_5, respectively. The highest number of infested fruit plant^{-1} (0.67) was recorded in T_7 treatment, whereas the lowest number of infested fruit (0.13) was recorded in T_1 and T_2 treatment which was statistically similar with (0.20 and 0.27) T_3, T_4, T_5 and T_6, respectively (Table 4).

The highest percentage of infested fruit in number (12.64) was recorded in T_7 treatment. Again, the lowest percentage of infested fruit in number (1.79) was recorded in T_1 treatment which was statistically similar with (2.09, 3.13, 4.60, 5.03 and 5.35) T_2, T_3, T_5, T_4 and T_6, respectively. Brinjal fruit infestation percentage reduction over control at early fruiting stage in number was estimated for some botanicals and bio-control agents and the highest percentage (85.84) was recorded for the treatment T_1 and the lowest percentage (57.67) from T_6 treatment (Table 4).

Table 4. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at early fruiting stage in number during kharif season, 2009

Treatment	Brinjal fruit by number			
	Healthy	Infested	% infestation	Infestation reduction over control (%)
T_1	7.00 a	0.13 b	1.79 b	85.84
T_2	6.53 a	0.13 b	2.09 b	83.47
T_3	6.20 ab	0.20 b	3.13 b	75.24
T_4	5.07 c	0.27 b	5.03 b	60.21
T_5	5.53 bc	0.27 b	4.60 b	63.61
T_6	4.67 c	0.27 b	5.35 b	57.67
T_7	4.60 c	0.67 a	12.64 a	--
$LSD_{(0.05)}$	0.935	0.195	3.302	--
CV(%)	9.28	9.77	13.52	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) are not significantly different and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.2.2 Brinjal fruit in weight

The highest weight of healthy fruit plant^{-1} (752.05 g) was recorded in T_1 treatment which was statistically similar with (708.28 g and 663.10 g) T_2 and T_3, respectively, while the lowest (463.56 g) weight of healthy fruits plant^{-1} was recorded in T_7 treatment which was also statistically similar with (497.11 g and 543.78 g) T_6 and T_4, respectively. The highest weight of infested fruit (68.33 g) was recorded in T_7 treatment, while the lowest weight of infested fruit (22.00 g) was recorded in T_1 treatment which was statistically similar with (21.67 g, 32.67 g, 36.67 g and 37.00 g) T_2, T_3, T_4, T_5 and T_6, respectively (Table 5).

The highest percentage of infested fruit in weight (12.84) was recorded in T_7 treatment. Again, the lowest percentage of infested fruit in weight (2.72) was recorded in T_1 treatment which was statistically similar (3.06 and 4.70) with T_2 and T_3, respectively. Brinjal fruit infestation percentage reduction over control in weight at early fruiting stage was estimated for some botanicals and bio-control agents and the highest percentage (78.82) was recorded for the treatment T_1 and the lowest percentage (46.11) from T_6 treatment (Table 5).

From the findings it is revealed that spraying of Neem oil @ 4ml/L of water at 7 days interval performed lowest percentage of fruit infestation in weight followed by neem seed kernel @ 300g/L of water at 7 days interval, while in control treatment the situation is reverse under the trail. The similar studies ware conducted on the effect of neem products on brinjal shoot and fruit borer (*Leucinodes orbonalis*). Among the different neem products neem oil 4% recorded less fruit damage (9.07%) and higher yield (24.48 t/ha). (Raja *et al*. ,1998).

Table 5. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at early fruiting stage in weight during kharif season, 2009

Treatment	Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	752.05 a	22.00 b	2.72 d	78.82
T_2	708.28 a	21.67 b	3.06 cd	76.17
T_3	663.10 ab	32.67 b	4.70 bcd	63.40
T_4	543.78 cd	37.00 b	6.39 b	50.23
T_5	597.48 bc	36.67 b	5.85 bc	54.44
T_6	497.11 d	37.00 b	6.92 b	46.11
T_7	463.56 d	68.33 a	12.84 a	--
$LSD_{(0.05)}$	92.70	20.17	2.855	--
CV(%)	8.63	11.08	16.44	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) are not significantly different and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.3.2 Brinjal fruit in number

The highest number of healthy fruit plant^{-1} (10.53) was recorded in T_1 treatment which was statistically similar with (9.53 and 9.33) T_2 and T_3, respectively. Again, the lowest (6.20) number of healthy fruits per plant was recorded in T_7 treatment which was statistically similar with (7.07) T_6. The highest number of infested fruit (1.13) was recorded in T_7 treatment. On the other hand the lowest number of infested fruit (0.27) was recorded in T_1 treatment which was statistically similar with (0.33 and 0.40) T_2 and T_3, respectively (Table 6).

The highest percentage of infested fruit in number plant^{-1} (15.52) was recorded in T_7 treatment, again the lowest percentage of infested fruit in number (2.45) was recorded in T_1 treatment which was statistically similar (3.35 and 4.11) with T_2 and T_3, respectively. Brinjal fruit infestation percentage reduction over control at mid fruiting stage in number was estimated for some botanicals and bio-control agents and the highest percentage (84.21) was recorded for the treatment T_1 and the lowest percentage (44.72) from T_6 treatment (Table 6). Butani and Jotwani (1984) reported that the pest is reported to cause 16 to 64% damage to fruits.

Table 6. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at mid fruiting stage in number during kharif season, 2009

Treatment	Brinjal fruit by number			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	10.53 a	0.27 e	2.45 e	84.21
T_2	9.53 ab	0.33 de	3.35 de	78.41
T_3	9.33 ab	0.40 cde	4.11 de	73.52
T_4	8.13 bc	0.53 bc	6.13 c	60.50
T_5	8.80 b	0.47 cd	5.02 cd	67.65
T_6	7.07 cd	0.67 b	8.58 b	44.72
T_7	6.20 d	1.13 a	15.52 a	--
$LSD_{(0.05)}$	1.343	0.178	1.787	--
CV(%)	8.87	18.85	15.57	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.3.2 Brinjal fruit in weight

The highest weight of healthy fruit plant^{-1} (993.22 g) was recorded in T_1 treatment which was statistically similar (954.94 g and 919.49 g) with T_2 and T_3, respectively, while the lowest (555.93 g) weight of healthy fruits per plant was recorded in T_7 treatment. The highest weight of infested fruit (106.63 g) was recorded in T_7 treatment, whereas the lowest weight of infested fruit (33.15 g) was recorded in T_1 treatment which was statistically similar (40.17 g) with T_3 and closely followed (60.10 g, 63.33 g, 67.93 g and 68.33 g) with T_3, T_5, T_4 and T_6, respectively (Table 7).

The highest percentage of infested fruit in weight (16.11) was recorded in T_7 treatment, whereas the lowest percentage of infested fruit in weight (3.23) was recorded in T_1 treatment which was statistically similar (4.04) with T_2 and closely followed (6.14) by T_3 treatment. Brinjal fruit infestation percentage reduction over control in weight at mid fruiting stage was estimated for some botanicals and bio-control agents and the highest percentage (79.95) was recorded for the treatment T_1 and the lowest percentage (42.52) from T_6 treatment (Table 7).

It is revealed that spraying of neemoil @ 4ml/L of water at 7 days interval gave lowest % of fruit infestation while in control treatment the highest percent fruit infestation was recorded, Singh (2003), reported that spraying neem oil @ 5% was effective in reducing the fruit borer incidence (20.63%) and increased yield (82.5q/ha) compared to control (27.7q/ha).

Table 7. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at mid fruiting stage in weight during kharif season, 2009

Treatment	Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	993.22 a	33.15 c	3.23 e	79.95
T_2	954.94 ab	40.17 c	4.04 e	74.92
T_3	919.49 ab	60.10 b	6.14 d	61.89
T_4	783.06 c	67.93 b	8.04 c	50.09
T_5	852.71 bc	63.33 b	6.94 d	56.92
T_6	672.21 d	68.43 b	9.26 b	42.52
T_7	555.93 e	106.63 a	16.11 a	--
$LSD_{(0.05)}$	110.3	9.154	1.088	--
CV(%)	7.57	8.19	7.96	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.4.1 Brinjal fruit in number

The highest number of healthy fruit per plant (7.73) was recorded in T_1 treatment which was statistically similar with (7.07) T_2. On the other hand the lowest (5.53) number of healthy fruits per plant was recorded in T_7 treatment which was statistically similar with (5.67 and 6.07) T_6 and T_4, respectively. The highest number of infested fruit (1.27) was recorded in T_7 treatment, whereas the lowest number of infested fruit (0.27) was recorded in T_1 treatment which was statistically similar with (0.33) T_2 (Table 8).

The highest percentage of infested fruit in number (18.63) was recorded in T_7 treatment, while the lowest percentage of infested fruit in number (3.31) was recorded in T_1 treatment which was statistically similar (4.54) with T_2 and closely followed (6.55) by T_3. Brinjal fruit infestation percentage reduction over control at late fruiting stage in number was estimated for some botanicals and bio-control agents and the highest percentage (82.23) was recorded for the treatment T_1, while the lowest percentage (53.35) from T_6 treatment (Table 8). The results obtained from the present study were similar with the findings of Sarode *et al.* (1994).

Table 8. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at late fruiting stage in number during kharif season,2009

Treatment	Brinjal fruit by number			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	7.73 a	0.27 c	3.31 d	82.23
T_2	7.07 ab	0.33 bc	4.54 cd	75.63
T_3	6.60 bc	0.47 b	6.55 bc	64.84
T_4	6.07 cde	0.53 b	8.03 b	56.90
T_5	6.47 bcd	0.53 b	7.65 b	58.94
T_6	5.67 de	0.53 b	8.69 b	53.35
T_7	5.53 e	1.27 a	18.63 a	--
$LSD_{(0.05)}$	0.811	0.187	2.920	--
CV(%)	7.08	19.03	10.02	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.4.2 Brinjal fruit in weight

The highest weight of healthy fruit per plant (744.37 g) was recorded in T_1 treatment which was statistically similar (668.24 g) with T_2, while the lowest (517.08 g) weight was recorded in T_7 treatment which was statistically similar (538.42 g and 573.66 g) with T_6 and T_4, respectively. The highest weight of infested fruit (118.57 g) was recorded in T_7 treatment. On the other hand, the lowest weight of infested fruit (34.12 g) was recorded in T_1 treatment which was closely followed (43.77 g, 48.58 g and 50.72 g) by T_2, T_3 and T_5, respectively (Table 9).

The highest percentage of infested fruit in weight (18.67) was recorded in T_7 treatment, again the lowest percentage of infested fruit in weight (4.38) was recorded in T_1 treatment. Brinjal fruit infestation percentage reduction over control in weight at late fruiting stage was estimated for some botanicals and bio-control agents and the highest percentage (76.54) was recorded for the treatment T_1 and the lowest percentage (51.31) from T_6 treatment (Table 9).

From the findings it is revealed that spraying of neem oil @ 4ml/L of water at 7 days interval performed maximum healthy fruit and minimum infested fruit as well as lowest % of fruit infestation in weight followed by neem seed kernel @ 300g/L of water at 7 days interval, while in control treatment the situation is reverse under the trail followed by Botanical pesticides safeclean 5 ml/L of water at 7 days interval. Joyoti D. Pareet, 2006, reported that botanical spray was more effective in reducing the shoot (15.64%) and fruit infestation (18.49%) and recorded highest marketable fruit yield (122.20 q/ha) against BSFR in brinjal.

Table 9. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments at late fruiting stage in weight during kharif season, 2009

Treatment	Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	744.37 a	34.12 d	4.38 e	76.54
T_2	668.24 ab	43.77 c	6.16 d	67.01
T_3	625.69 bc	48.58 bc	7.23 cd	61.27
T_4	573.66 cde	53.83 b	8.60 bc	53.94
T_5	610.42 bcd	50.72 bc	7.75 bc	58.49
T_6	538.42 de	53.75 b	9.09 b	51.31
T_7	517.08 e	118.57 a	18.67 a	--
$LSD_{(0.05)}$	77.41	7.886	1.517	--
CV(%)	7.12	7.69	9.64	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.5 Fruit bearing status throughout the growing season

Number of healthy fruits plant^{-1}, number of infested fruits plant^{-1} and percent infestation of fruit plant^{-1} throughout the growing season by number and weight in controlling brinjal shoot and fruit borer showed statistically significant differences for some botanicals and bio-control agents are presented in Table 10-11.

4.5.1 Brinjal fruit in number

The highest number of healthy fruit per plant (25.27) was recorded in T_1 treatment which was statistically similar (23.13) with T_2, whereas the lowest (16.33) number of healthy fruits per plant was recorded in T_7 treatment which was statistically similar with (17.40) T_6. The highest number of infested fruit (3.07) was recorded in T_7 treatment, whereas the lowest number of infested fruit (0.67) was recorded in T_1 treatment which was statistically identical (0.80) with T_2 and closely followed (1.07) by T_3 treatment (Table 10).

The highest percentage of infested fruit in number (15.85) was recorded in T_7 treatment, while the lowest percentage of infested fruit in number (2.57) was recorded in T_1 treatment which was statistically similar (3.36) with T_2 and closely followed (4.59 and 5.76) by T_3 and T_5, respectively (Figure 1). Brinjal fruit infestation percentage reduction over control throughout the growing season in number was estimated for some botanicals and bio-control agents and the highest percentage (83.79) was recorded for the treatment T_1, whereas the lowest percentage (50.91) from T_6 treatment (Table 10).

Table 10. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments throughout the growing period in number during kharif season, 2009

Treatment	Brinjal fruit by number			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	25.27 a	0.67 e	2.57 f	83.79
T_2	23.13 ab	0.80 de	3.36 ef	78.80
T_3	22.13 bc	1.07 cd	4.59 de	71.04
T_4	19.27 de	1.33 bc	6.47 bc	59.18
T_5	20.80 cd	1.27 bc	5.76 cd	63.66
T_6	17.40 ef	1.47 b	7.78 b	50.91
T_7	16.33 f	3.07 a	15.85 a	--
$LSD_{(0.05)}$	2.161	0.287	1.619	--
CV(%)	11.75	13.74	4.54	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.5.2 Brinjal fruit in weight

The highest weight of healthy fruit plant^{-1} (2489.6 g) was recorded in T_1 treatment which was statistically similar (2331.5 g) with T_2 and closely followed (2208.3 g) by T_3 treatment. On the other hand the lowest (1536.6 g) weight of healthy fruits per plant was recorded in T_7 treatment. The highest weight of infested fruit (293.53 g) was recorded in T_7 treatment, while the lowest weight (89.28 g) was recorded in T_1 treatment which was statistically similar (105.60 g) with T_2 (Table 11).

The highest percentage of infested fruit in weight (16.04) was recorded in T_7 treatment and the lowest percentage of infested fruit in weight (3.46) was recorded in T_1 treatment (Figure 2). Brinjal fruit infestation percentage reduction over control in weight throughout the growing season was estimated for some botanicals and bio-control agents and the highest percentage (78.43) was recorded for the treatment T_1 and the lowest percentage (46.82) from T_6 treatment (Table 11).

From the findings it is revealed that spraying of neem oil @ 4ml/L of water at 7 days interval performed maximum healthy fruit and minimum infested fruit as well as lowest percentage of fruit infestation in weight followed by neem seed kernel @ 300g/L of water at 7 days interval, while in control treatment the situation is reverse under the trail followed by Botanical pesticides safeclean 5 ml/L of water at 7 days interval. Butani and Jotwani (1984) reported that the pest is reported to cause 16 to 64% damage to fruits.

Table 11. Infestation of brinjal fruits caused by the brinjal shoot and fruit borer (BSFB) in different treatments throughout the growing period in weight during kharif season, 2009

Treatment	Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)
T_1	2489.6 a	89.28 c	3.46 e	78.43
T_2	2331.5 ab	105.60 c	4.35 d	72.88
T_3	2208.3 bc	141.35 b	6.02 c	62.47
T_4	1900.5 d	158.76 b	7.70 b	52.00
T_5	2060.6 cd	150.72 b	6.83 c	57.42
T_6	1707.7 e	159.18 b	8.53 b	46.82
T_7	1536.6 f	293.53 a	16.04 a	--
$LSD_{(0.05)}$	164.1	18.95	0.834	--
CV(%)	6.79	6.21	7.72	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.6 Effect of temperature, rainfall and humidity on fruit infestation of brinjal at different harvesting time

With increasing of temperature at different harvesting time, percent fruit infestation of brinjal increasing and with increasing the temperature percent fruit infestation also followed increasing trend (Figure 3) and it was highest in 5th harvesting, when the highest mean temperature was raised at 30.35^{0}C. Similar results were obtained by Dhillon *et al.*, (2005). They observed that the extent of losses vary 30 to 100% depending on the species and season, and the abundance of BSFB increases when the temperature fall bellow 32^{0}C. Brevault *et al.*, (2000) also reported that the developmental rate of the different life stages increased linearly with increasing temperature upto 30^{0}C.

Percent brinjal fruit infestation trend was found more or less similar when the mean rainfall was bellow 185 mm and the trend was increasing when the mean rainfall was more than 265 mm (Figure 3). Result also supported with the report of Hui *et al.*, (2007) they concluded that the population was depressed when the amount of monthly mean rainfall was lower than 50 mm but increased when rainfall ranged from 200 to 1000 mm and when the amount of monthly rainfall was higher than 628 mm the BSFB population was reduced remarkably.

Like temperature positive effect was also found in case of relative humidity. With increasing relative humidity, percent fruit infestation increased and with the decreasing relative humidity, percent fruit infestation decreased. It was highest in 5th harvesting time when the highest relative humidity was 85% (Figure 3). Dhillon *et al.*, (2005) also stated that the abundance of BSFB increased when the relative humidity ranges 60 to 70%. Narayan and Batra (1960) reported that most of the BSFB species are more or less active at temperatures ranging between 12^{0}C-15^{0}C and become inactive below 10^{0}C.

4.7 Yield and yield contributing characters

4.7.1 Plant height (cm)

Plant height at final harvest of brinjal showed a statistically significant difference in terms of for some botanicals and bio-control agents (Figure 4). The longest plant (124.08 cm) was found in T_1 treatment which was statistically similar (120.99 cm, 117.62 cm and 115.50 cm) with T_2, T_3 and T_5 treatment. On the other hand, the shortest plant (101.50 cm) was recorded in T_7 treatment which was statistically similar (104.87 cm and 111.23 cm) with T_6 and T_4 treatment (Figure 4). Plant height increased with the decrease of shoot infestation level. Probably shoot infestation hinders the normal growth of brinjal fruit.

Plant height of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (22.25) was recorded for the treatment T_1 and the lowest percentage (3.32) was recorded from T_6 treatment.

4.7.2 Length of healthy fruit (cm)

Significant difference was recorded in terms of length of healthy fruit of brinjal for some botanicals and bio-control agents (Table 12). The maximum length of healthy fruit (26.25 cm) was found in T_1 treatment which was statistically similar (24.83 cm, 24.29 cm and 23.20 cm) with T_2, T_3 and T_5 treatment, whereas the minimum length (20.93 cm) was found in T_7 treatment which was statistically identical (21.46 cm and 22.68 cm) with T_6 and T_4 treatment (Table 12).

Length of healthy fruits of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (25.42) was recorded for the treatment T_1, while the lowest percentage (2.53) was recorded from T_6 treatment (Table 12).

4.7.3 Length of infested fruit (cm)

A statistically significant difference was recorded in terms of length of infested fruit of brinjal for some botanicals and bio-control agents (Table 12). The maximum length of infested fruit (22.29 cm) was found in T_1 treatment which was statistically similar (21.59 cm and 21.06 cm) with T_2 and T_3 treatment. On the other hand, the minimum length of infested fruit (17.07 cm) was recorded in T_7 treatment which was statistically similar (17.46 cm) with T_6 (Table 12).

Length of healthy fruits of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (30.58) was recorded for the treatment T_1 and the lowest percentage (2.28) was recorded from T_6 treatment (Table 12).

Table 12. Effect of botanicals and bio-control agents against brinjal shoot and fruit borer (BSFB) in terms of length of healthy and infested fruit

Treatment	Length of fruit			
	Healthy		Infested	
	Length	Increase over control (%)	Length	Increase over control (%)
T_1	26.25 a	25.42	22.29 a	30.58
T_2	24.83 ab	18.63	21.59 a	26.48
T_3	24.29 abc	16.05	21.06 ab	23.37
T_4	22.68 bc	8.36	19.25 bc	12.77
T_5	23.20 abc	10.85	19.08 bc	11.78
T_6	21.46 bc	2.53	17.46 c	2.28
T_7	20.93 c	--	17.07 c	--
$LSD_{(0.05)}$	3.212	--	2.035	--
CV(%)	7.72	--	5.81	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significntly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.7.4 Girth of healthy fruit (cm)

A statistically significant difference was recorded in terms of girth of healthy fruit of brinjal for some botanicals and bio-control agents (Table 13). The maximum girth of healthy fruit (7.31 cm) was found in T_1 treatment which was statistically similar (7.07 cm and 6.63 cm) with T_2 and T_3 treatment. On the other hand, the minimum girth of healthy fruit (5.17 cm) was recorded in T_7 treatment which was statistically similar (25.53 cm and 6.01 cm) with T_6 and T_4 treatment (Table 13).

Girth of healthy fruits of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (41.39) was recorded for the treatment T_1 and the lowest percentage (6.96) was recorded from T_6 treatment (Table 13).

4.7.5 Girth of infested fruit (cm)

A statistically significant difference was recorded in terms of girth of infested fruit of brinjal for some botanicals and bio-control agents (Table 13). The maximum girth of infested fruit (6.59 cm) was found in T_1 treatment which was statistically similar (6.41 cm and 6.02 cm) with T_2 and T_3 treatment. Again, the minimum girth of infested fruit (4.81 cm) was recorded in T_7 treatment which was statistically similar (5.11 cm) with T_6 (Table 13).

Girth of healthy fruits of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (37.01) was recorded from T_1 and the lowest percentage (6.24) from T_6 treatment (Table 13).

Table 13. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of girth of healthy and infested fruit

Treatment	Girth of fruit			
	Healthy		Infested	
	Girth (cm)	Increase over control (%)	Girth (cm)	Increase over control (%)
T_1	7.31 a	41.39	6.59 a	37.01
T_2	7.09 ab	37.14	6.41 ab	33.26
T_3	6.63 abc	28.24	6.02 abc	25.16
T_4	6.01 cde	16.25	5.51 cde	14.55
T_5	6.29 bcd	21.66	5.74 bcd	19.33
T_6	5.53 de	6.96	5.11 de	6.24
T_7	5.17 e	--	4.81 e	--
$LSD_{(0.05)}$	0.871	--	0.727	--
CV(%)	5.91	--	5.27	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.7.6 Individual fruit weight (g)

A statistically significant difference was recorded in terms of individual fruit weight of brinjal for some botanicals and bio-control agents (Table 14). The highest weight of individual fruit weight (85.34 g) was obtained in T_1 treatment which was statistically similar (84.82 g and 82.39 g) with T_2 and T_3 treatment. On the other hand, the lowest weight (66.97 g) was recorded in T_7 treatment which was statistically similar (68.96 g) with T_6 (Table 14).

Individual fruit weight of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest percentage (27.43) was recorded for the treatment T_1 and the lowest percentage (2.97) was recorded from T_6 treatment (Table 14).

4.7.7 Edible portion (%)

A statistically significant difference was recorded in terms of edible portion of brinjal for some botanicals and bio-control agents (Table 14). The highest edible portion (95.77%) was found in T_1 treatment which was statistically similar (94.18%, 92.36%, 89.66% and 88.15%) with T_2, T_3, T_5 and T_4, treatment, respectively, while the lowest edible portion (76.33%) was recorded in T_7 treatment (Table 14).

Table 14. Effect of botanicals and bio-control agents against brinjal shoot and fruit borer (BSFB) in terms of single fruit weight, edible and non edible portion of infested fruit

Treatment	Individual fruit weight (g)	Increase over control (%)	Edible portion (%)	Non edible portion (%)
T_1	85.34 a	27.43	95.77 a	4.23 c
T_2	84.82 a	26.65	94.18 a	5.82 c
T_3	82.39 a	23.03	92.36 ab	7.64 bc
T_4	73.77 bc	10.15	88.15 ab	11.85 bc
T_5	75.69 b	13.02	89.66 ab	10.34 bc
T_6	68.96 cd	2.97	85.15 b	14.85 b
T_7	66.97 d	--	76.33 c	23.67 a
$LSD_{(0.05)}$	6.234	--	7.364	7.364
CV(%)	4.56	--	6.66	16.96

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.7.8 Non edible portion (%)

A statistically significant difference was recorded in terms of non edible portion of brinjal for some botanicals and bio-control agents (Table 14). The lowest non edible portion (23.67%) was found in T_7 treatment, whereas the lowest portion (4.23%) was recorded in T_7 treatment which was similar (5.82%, 7.64%, 10.34% and 11.85%) with T_2, T_3, T_5 and T_4, treatment, respectively (Table 14).

Effect of different treatments on the yield of brinjal

4.7.9 Yield plot^{-1} (kg)

Healthy fruit yield, infested yield and increase over control obtained from different treatment varied significantly (Table 15). The treatment T_1 produced the highest yield per plot (29.95 kg) was found in T_1 treatment which was statistically similar (28.98 kg, 28.50 kg and 27.77 kg) with T_2, T_3 and T_5 treatment, while the lowest yield per plot (18.24 kg) was recorded in T_7 treatment (Table 15).

Fruit yield per plot of brinjal increased over control was estimated for some botanicals and bio-control agents and the highest value (64.20%) was recorded for the treatment T_1 and the lowest value (37.61%) was recorded from T_6 treatment (Table 15).

4.7.10 Yield hectare^{-1} (ton)

Some botanicals and bio-control agents showed significant difference in terms of yield per hectare of brinjal (Table 15). The highest yield per hectare (49.92 ton) was found in T_1 treatment which was statistically similar (48.31 ton, 47.50 ton and 46.29 ton) with T_2, T_3 and T_5 treatment, whereas the lowest yield per hectare (30.40 ton) was recorded in T_7 treatment (Table 15).

Table 15. Yield of brinjal from different treatments against BSFB) during kharif season, 2009

Treatment	Yield of fruit			
	Yield per plot (kg)	Increase over control (%)	Yield per hectare (ton)	Increase over control (%)
T_1	29.95 a	64.20	49.92 a	64.21
T_2	28.98 ab	58.88	48.31 ab	58.91
T_3	28.50 abc	56.25	47.50 abc	56.25
T_4	25.59 bc	40.30	42.65 bc	40.30
T_5	27.77 abc	52.25	46.29 abc	52.27
T_6	25.10 c	37.61	41.84 c	37.63
T_7	18.24 d	--	30.40 d	--
$LSD_{(0.05)}$	3.542	--	5.903	--
CV(%)	7.57	--	7.57	--

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

Fruit yield per plot of brinjal increase over control was estimated for some botanicals and bio-control agents and the highest value (64.21%) was recorded for the treatment T_1 and the lowest value (37.63%) from T_6 treatment (Table 15).

4.8 Economic Analysis

The analysis was done in order to find out the most profitable botanicals and bio-control agents based on cost and benefit of various components. The results of economic analysis of brinjal showed that the highest net benefit of Tk. 454,200 ha^{-1} was obtained in T_1 treatment and the second highest net benefit was found Tk. 438,100 ha^{-1} in T_2. The highest benefit cost ratio (3.34) was estimated for T_5 treatment and the lowest (2.81) benefit cost ration for T_6 treatment under the trial (Table 16). The highest BCR was found in the treatment T_1 may be due to the minimum infestation cost compared to the other treatment components and highest yield.

4.9 Relationship between yield contributing characters and yield ha^{-1}

4.9.1 Relationship between length of fruit yield ha^{-1}

The data on length of fruit were regressed against yield ha^{-1} and a positive linear relationship was obtained between them. It was evident from the Figure 5 that the equation $y = 3.0134x - 26.599$ gave a good fit to the data, and the co-efficient of determination ($R^2 = 0.7398$) showed that, fitted regression line had a significant regression co-efficient. It is evident from the regression line and equation that, the yield increased with the increased of length of fruit for some botanicals and bio-control agents in controlling BSFB in brinjal.

Table 16. Cost of production of brinjal for against brinjal shoot and fruit borer (BSFB) management practices

Treatments	Cost of pest Management (Tk.)	Total Yield (t/ha)	Gross return (Tk.)	Net Return (Tk.)	Adjusted net return (Tk.)	Benefit cost ratio
T_1	45000	49.92	499200	454200	150200	3.34
T_2	45000	48.31	483100	438100	134100	2.98
T_3	40000	47.5	475000	435000	131000	3.28
T_4	35000	42.65	426500	391500	87500	2.50
T_5	45000	46.29	462900	417900	113900	2.53
T_6	30000	41.84	418400	388400	84400	2.81
T_7	0	30.4	304000	304000	0	

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

In a column means having similar letter(s) did not differ significantly and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

T_1: Neem oil @ 4ml/L of water at 7 days interval

T_2: Neem seed kernel @ 300g/L of water at 7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 at 7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water at 7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval

T_7: Untreated control

4.9.2 Relationship between girth of fruit and yield ha^{-1}

Correlation study was done to established a relationship between breadth of fruit and yield (t/ha). From the study it was revealed that significant correlations existed between the characters. The regression equation y = 7.5351x - 3.5513 gave a good fit to the data and the value of the co-efficient of determination (R^2 = 0.802). From this it can be concluded that increase the girth of fruit increase the yield (Figure 6).

4.9.3 Relationship between individual fruit weight and yield ha^{-1}

When the data individual fruit weight and yield hectare^{-1} were regressed a positive relationship was obtained between these two characters. Here the equation y = 0.7624x - 14.743 gave a good fit to the data, and the value of the co-efficient of determination (R^2 = 0.7464) showed that the fitted regression line had a significant regression coefficient. Increase the yield per hectare due to the increase of individual fruit weight of brinjal (Figure 7).

4.9.4 Relationship between edible portion and yield ha^{-1}

The data on edible portion of fruit were regressed against yield ha^{-1} and a positive linear relationship was obtained between the characters. It was evident from the Figure 8 that the equation y = 0.9887x - 43.948 gave a good fit to the data, and the co-efficient of determination (R^2 = 0.9692) showed that, fitted regression line had a significant regression co-efficient. It is evident from the regression line and equation that, the yield increased with the increased of edible portion of brinjal.

CHAPTER V

SUMMARY

The study was conducted to find out the effect of some botanicals and bio-control agents in controlling brinjal shoot and fruit borer in brinjal in the central farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from April to October 2009. BARI Begun-8 was used as the test crop of this experiment. The experiment consists of the following management practices: T_1: Neem oil @ 4ml/L of water at 7 days interval; T_2: Neem seed kernel @ 300 g/L of water at 7 days interval; T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of water at 7 days interval; T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water at 7 days interval; T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension/L of water + Safeclean 2.5 ml/L of water at 7 days interval; T_6: Botanical pesticides Safeclean 5 ml/L of water at 7 days interval and T_7: Untreated control. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications.

Significant difference was observed on the number of healthy shoot at early, mid and late fruiting stage in controlling brinjal shoot and fruit borer (BSFB) by using some botanicals and bio-control agents. At early fruiting stage, the highest number of healthy shoots per plant (22.20) was recorded in T_1 treatment and the lowest (16.13) number in T_7. The highest number of infested shoot (2.47) was recorded in T_7 treatment, while the lowest number (0.80) in T_1 treatment. The highest percentage of infested shoot (13.25) was recorded in T_7 treatment, again the lowest (3.48) in T_1 treatment. Percent brinjal shoot infestation reduction over control was estimated for different management practices and the highest percent (73.74) reduction over control was recorded for the treatment T_1 and the lowest percent (50.79) from T_6 treatment. At mid fruiting stage, the highest number of healthy shoots per plant (29.47) was recorded in T_1, whereas the lowest (21.00) in T_7 treatment. The highest number of infested shoots (3.87) was recorded in T_7 treatment, again the lowest number (1.07) was recorded in T_1 treatment.

The highest percentage of infested shoot in number (15.56) was recorded in T_7 treatment, while the lowest (3.49) in T_1 treatment. Percent brinjal shoot infestation reduction over control was estimated for different management practices and the highest percentage (77.57) was recorded for the treatment T_1 and the lowest (47.56) from T_6 treatment. At late fruiting stage the highest number of healthy shoots per plant (33.73) was recorded in T_1 treatment and the lowest (22.80) in T_7 treatment. The highest number of infested shoots (5.27) was recorded in T_7 treatment, whereas the lowest number (1.27) in T_1 treatment. The highest percentage of infested shoot in number (18.75) was recorded in T_7 treatment, while the lowest (3.62) in T_1 treatment. Percent brinjal shoot infestation reduction over control was estimated for different management practices and the highest percent (80.69) was recorded for the treatment T_1 and the lowest value (45.23) from T_6 treatment.

Number of healthy fruit, infested fruit, percentage of infestation at early, mid, late and throughout the fruiting stage in controlling BSFB by using some botanicals and bio-control agents showed a statistically significant difference. Throughout the growing season the highest number of healthy fruit per plant (25.27) was recorded in T_1 treatment, whereas the lowest number (16.33) was recorded in T_7 treatment. The highest number of infested fruit (3.07) was recorded in T_7 treatment, again the lowest number (0.67) in T_1 treatment. The highest percentage of infested fruit in number (15.85) was recorded in T_7 treatment, while the lowest (2.57) in T_1 treatment. Percent brinjal fruit infestation reduction over control throughout the growing season in number was estimated for some botanicals and bio-control agents and the highest percent (83.79) reduction over control was recorded for the treatment T_1, whereas the lowest percent (50.91) from T_6 treatment. The highest weight of healthy fruit per plant (2489.6 g) was recorded in T_1 and the lowest weight (1536.6 g) was recorded in T_7 treatment. The highest weight of infested fruit

(293.53 g) was recorded in T_7 treatment, while the lowest weight of infested fruit (89.28 g) was recorded in T_1 treatment. The highest percentage of infested fruit in weight (16.04) was recorded in T_7 treatment and the lowest (3.46) in T_1 treatment. Percent brinjal fruit infestation reduction over control in weight throughout the growing season was estimated for some botanicals and bio-control agents and the highest percent (78.43) reduction over control was recorded for the treatment T_1 and the lowest percent (46.82) from T_6 treatment.

Yield contributing characters and yield of brinjal showed a statistically significant difference by using some botanicals and bio-control agents. The longest plant (124.08 cm) was observed in T_1 treatment and the shortest plant (101.50 cm) in T_7 treatment. The maximum length of healthy fruit (26.25 cm) was found in T_1 treatment, whereas the minimum length (20.93 cm) in T_7 treatment. The maximum length of infested fruit (22.29 cm) was recorded in T_1 and the minimum length (17.07 cm) in T_7 treatment. The maximum girth of healthy fruit (7.31 cm) was found in T_1 treatment and the minimum girth (5.17 cm) in T_7 treatment. The maximum girth of infested fruit (6.59 cm) was found in T_1 treatment, again the minimum (4.81 cm) in T_7 treatment. The highest weight of individual fruit weight (85.34 g) was obtained in T_1 treatment and the lowest weight (66.97 g) in T_7 treatment. The highest edible portion (95.77%) was found in T_1 treatment, while the lowest (76.33%) in T_7 treatment. The lowest non edible portion (23.67%) was found in T_7 treatment, whereas the lowest non edible portion (4.23%) in T_7 treatment. The highest yield per hectare (49.92 ton) was obtained in T_1 treatment and the lowest yield per hectare (30.40 ton) was recorded in T_7 treatment. The highest benefit cost ratio (3.34) was estimated for T_5 treatment and the lowest (2.81) benefit cost ration for T_6 treatment.

CONCLUSION AND RECOMMENDATION

The present study revealed that the increased yield per hectare of brinjal with decrease rate of fruit/shoot infestation and the reduced weight of infested fruits might be obtained by applying Neem oil @ 4 ml/L of water at 7 days interval. Treatment T_2 consists of Neem seed kernel @ 300g/L of water at 7 days interval might be chosen as the alternative approach.

Evaluation of treatment T_3 using *Trichogramma evanescense* @ 0.1g/6 m^2 of water at 7 days interval, treatment T_5 *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension/L of water + Safeclean 2.5 ml/L of water at 7 days interval applied against brinjal shoot and fruit borer revealed that treatment T_1 having Neem oil @ 4ml/L of water at 7 days interval ensured rate of shoot/fruit infestation with increased yield. Treatment T_2 consisting of Neem seed kernel @ 300g/L of water at 7 days interval could be the second

effective option for controlling brinjal shoot and fruit borer. These two treatments could be integrated with the judicious use of selective chemicals and non-chemical approaches for combating this obnoxious pest. On the other hand, treatment T_3 and T_5 also have significant effect in suppressing this pest and it might be tested with other chemical and non-chemical components (i.e. pheromone, mechanical and cultural operation etc.) to combat this pest. However, further trials may be undertaken in order to confirm the validity of these results.

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Table 1. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at early, mid and late fruiting stage in terms of number of shoot per plant

Treatment	Number of shoots plant^{-1} at					
	Early fruiting stage		Mid fruiting stage		Late fruiting stage	
	% infestation	Reduction over control (%)	% infestation	Infestation reduction over control (%)	Healthy	Infested
T_1	3.48 e	73.74	3.49 e	77.57	3.62 e	80.69
T_2	4.19 de	68.38	4.46 de	71.34	4.45 e	76.27
T_3	4.51	65.96	5.47	64.85	7.06	62.35

	cde		cd		d	
T_4	5.47 c	58.72	6.61 c	57.52	8.57 c	54.29
T_5	5.08 cd	61.66	5.91 cd	62.02	7.74 cd	58.72
T_6	6.52 b	50.79	8.16 b	47.56	10.27 b	45.23
T_7	13.25 a	--	15.56 a	--	18.75 a	--
$LSD_{(0.05)}$	1.000	--	1.493	--	1.278	--
CV(%)	9.25	--	11.83	--	8.32	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 3. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at early fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Infestation reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	7.00 a	0.13 b	1.79 b	85.84	752.05 a	22.00 b	2.72 d	78.82
T_2	6.53 a	0.13 b	2.09 b	83.47	708.28 a	21.67 b	3.06 cd	76.17
T_3	6.20 ab	0.20 b	3.13 b	75.24	663.10 ab	32.67 b	4.70 bcd	63.40
T_4	5.07 c	0.27 b	5.03 b	60.21	543.78 cd	37.00 b	6.39 b	50.23
T_5	5.53 bc	0.27 b	4.60 b	63.61	597.48 bc	36.67 b	5.85 bc	54.44
T_6	4.67 c	0.27 b	5.35 b	57.67	497.11 d	37.00 b	6.92 b	46.11
T_7	4.60 c	0.67 a	12.64 a	--	463.56 d	68.33 a	12.84 a	--
$LSD_{(0.05)}$	0.935	0.195	3.302	--	92.70	20.17	2.855	--
CV(%)	9.28	9.77	13.52	--	8.63	11.08	16.44	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 4. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at mid fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over	Healthy	Infested	% infestation	Reduction over

				control (%)				control (%)
T_1	10.53 a	0.27 e	2.45 e	84.21	993.22 a	33.15 c	3.23 e	79.95
T_2	9.53 ab	0.33 de	3.35 de	78.41	954.94 ab	40.17 c	4.04 e	74.92
T_3	9.33 ab	0.40 cde	4.11 de	73.52	919.49 ab	60.10 b	6.14 d	61.89
T_4	8.13 bc	0.53 bc	6.13 c	60.50	783.06 c	67.93 b	8.04 c	50.09
T_5	8.80 b	0.47 cd	5.02 cd	67.65	852.71 bc	63.33 b	6.94 d	56.92
T_6	7.07 cd	0.67 b	8.58 b	44.72	672.21 d	68.43 b	9.26 b	42.52
T_7	6.20 d	1.13 a	15.52 a	--	555.93 e	106.63 a	16.11 a	--
$LSD_{(0.05)}$	1.343	0.178	1.787	--	110.3	9.154	1.088	--
CV(%)	8.87	18.85	15.57	--	7.57	8.19	7.96	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 5. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at late fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	7.73 a	0.27 c	3.31 d	82.23	744.37 a	34.12 d	4.38 e	76.54
T_2	7.07 ab	0.33 bc	4.54 cd	75.63	668.24 ab	43.77 c	6.16 d	67.01
T_3	6.60 bc	0.47 b	6.55 bc	64.84	625.69 bc	48.58 bc	7.23 cd	61.27
T_4	6.07 cde	0.53 b	8.03 b	56.90	573.66 cde	53.83 b	8.60 bc	53.94
T_5	6.47 bcd	0.53 b	7.65 b	58.94	610.42 bcd	50.72 bc	7.75 bc	58.49
T_6	5.67 de	0.53 b	8.69 b	53.35	538.42 de	53.75 b	9.09 b	51.31
T_7	5.53 e	1.27 a	18.63 a	--	517.08 e	118.57 a	18.67 a	--
$LSD_{(0.05)}$	0.811	0.187	2.920	--	77.41	7.886	1.517	--
CV(%)	7.08	19.03	10.02	--	7.12	7.69	9.64	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 6. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) throughout the growing season in terms of fruit per plant by number and weight during April-October, 2009

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	25.27 a	0.67 e	2.57 f	83.79	2489.6 a	89.28 c	3.46 e	78.43
T_2	23.13 ab	0.80 de	3.36 ef	78.80	2331.5 ab	105.60 c	4.35 d	72.88
T_3	22.13 bc	1.07 cd	4.59 de	71.04	2208.3 bc	141.35 b	6.02 c	62.47
T_4	19.27 de	1.33 bc	6.47 bc	59.18	1900.5 d	158.76 b	7.70 b	52.00
T_5	20.80 cd	1.27 bc	5.76 cd	63.66	2060.6 cd	150.72 b	6.83 c	57.42
T_6	17.40 ef	1.47 b	7.78 b	50.91	1707.7 e	159.18 b	8.53 b	46.82
T_7	16.33 f	3.07 a	15.85 a	--	1536.6 f	293.53 a	16.04 a	--
$LSD_{(0.05)}$	2.161	0.287	1.619	--	164.1	18.95	0.834	--
CV(%)	11.75	13.74	4.54	--	6.79	6.21	7.72	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 7. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of length and girth of healthy and infested fruit

Treatment	Length of fruit				Girth of fruit			
	Healthy		Infested		Healthy		Infested	
	Length	Increase over control (%)	Length	Increase over control (%)	Girth (cm)	Increase over control (%)	Girth (cm)	Increase over control (%)
T_1	26.25 a	25.42	22.29 a	30.58	7.31 a	41.39	6.59 a	37.01
T_2	24.83 ab	18.63	21.59 a	26.48	7.09 ab	37.14	6.41 ab	33.26
T_3	24.29 abc	16.05	21.06 ab	23.37	6.63 abc	28.24	6.02 abc	25.16
T_4	22.68 bc	8.36	19.25 bc	12.77	6.01 cde	16.25	5.51 cde	14.55
T_5	23.20 abc	10.85	19.08 bc	11.78	6.29 bcd	21.66	5.74 bcd	19.33
T_6	21.46 bc	2.53	17.46 c	2.28	5.53 de	6.96	5.11 de	6.24
T_7	20.93 c	--	17.07 c	--	5.17 e	--	4.81 e	--
$LSD_{(0.05)}$	3.212	--	2.035	--	0.871	--	0.727	--
CV(%)	7.72	--	5.81	--	5.91	--	5.27	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 8. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of single fruit weight, edible and non edible portion of infested fruit

Treatment	Individual fruit weight (g)	Increase over control (%)	Edible portion (%)	Non edible portion (%)
T_1	85.34 a	27.43	95.77 a	4.23 c
T_2	84.82 a	26.65	94.18 a	5.82 c
T_3	82.39 a	23.03	92.36 ab	7.64 bc
T_4	73.77 bc	10.15	88.15 ab	11.85 bc
T_5	75.69 b	13.02	89.66 ab	10.34 bc
T_6	68.96 cd	2.97	85.15 b	14.85 b
T_7	66.97 d	--	76.33 c	23.67 a
$LSD_{(0.05)}$	6.234	--	7.364	7.364
CV(%)	4.56	--	6.66	16.96

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 9. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of yield per plot and hectare

Treatment	Yield of fruit			
	Yield per plot (kg)	Increase over control (%)	Yield per hectare (ton)	Increase over control (%)
T_1	29.95 a	64.20	49.92 a	64.21
T_2	28.98 ab	58.88	48.31 ab	58.91
T_3	28.50 abc	56.25	47.50 abc	56.25
T_4	25.59 bc	40.30	42.65 bc	40.30
T_5	27.77 abc	52.25	46.29 abc	52.27
T_6	25.10 c	37.61	41.84 c	37.63
T_7	18.24 d	--	30.40 d	--
$LSD_{(0.05)}$	3.542	--	5.903	--
CV(%)	7.57	--	7.57	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 10. Cost of production of Brinjal for against Brinjal Shoot and Fruit Borer (BSFB) management practices

Treatments	Cost of pest Management (Tk.)	Yield (t/ha)	Gross return (Tk.)	Net Return (Tk.)	Adjusted net return (Tk.)	Benefit cost ratio
T_1	45000	49.92	499200	454200	150200	3.34
T_2	45000	48.31	483100	438100	134100	2.98
T_3	40000	47.5	475000	435000	131000	3.28
T_4	35000	42.65	426500	391500	87500	2.50
T_5	45000	46.29	462900	417900	113900	2.53
T_6	30000	41.84	418400	388400	84400	2.81
T_7	0	30.4	304000	304000	0	

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

Market price of brinjal @ Tk. 10,000 per ton

Table 2. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at early fruiting stage in terms of number of shoot per plant

Treatment	Early fruiting stage		Mid fruiting stage		Late fruiting stage	
	% infestation	Reduction over control (%)	% infestation	Infestation reduction over control (%)	Healthy	Infested
T_1	3.48 e	73.74	3.49 e	77.57	3.62 e	80.69
T_2	4.19 de	68.38	4.46 de	71.34	4.45 e	76.27
T_3	4.51 cde	65.96	5.47 cd	64.85	7.06 d	62.35
T_4	5.47 c	58.72	6.61 c	57.52	8.57 c	54.29
T_5	5.08 cd	61.66	5.91 cd	62.02	7.74 cd	58.72
T_6	6.52 b	50.79	8.16 b	47.56	10.27 b	45.23
T_7	13.25 a	--	15.56 a	--	18.75 a	--
$LSD_{(0.05)}$	1.000	--	1.493	--	1.278	--
CV(%)	9.25	--	11.83	--	8.32	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 3. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at early fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Infestation reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	7.00 a	0.13 b	1.79 b	85.84	752.05 a	22.00 b	2.72 d	78.82
T_2	6.53 a	0.13 b	2.09 b	83.47	708.28 a	21.67 b	3.06 cd	76.17
T_3	6.20 ab	0.20 b	3.13 b	75.24	663.10 ab	32.67 b	4.70 bcd	63.40
T_4	5.07 c	0.27 b	5.03 b	60.21	543.78 cd	37.00 b	6.39 b	50.23
T_5	5.53 bc	0.27 b	4.60 b	63.61	597.48 bc	36.67 b	5.85 bc	54.44
T_6	4.67 c	0.27 b	5.35 b	57.67	497.11 d	37.00 b	6.92 b	46.11
T_7	4.60 c	0.67 a	12.64 a	--	463.56 d	68.33 a	12.84 a	--
$LSD_{(0.05)}$	0.935	0.195	3.302	--	92.70	20.17	2.855	--
CV(%)	9.28	9.77	13.52	--	8.63	11.08	16.44	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 4. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at mid fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over	Healthy	Infested	% infestation	Reduction over

				control (%)				control (%)
T_1	10.53 a	0.27 e	2.45 e	84.21	993.22 a	33.15 c	3.23 e	79.95
T_2	9.53 ab	0.33 de	3.35 de	78.41	954.94 ab	40.17 c	4.04 e	74.92
T_3	9.33 ab	0.40 cde	4.11 de	73.52	919.49 ab	60.10 b	6.14 d	61.89
T_4	8.13 bc	0.53 bc	6.13 c	60.50	783.06 c	67.93 b	8.04 c	50.09
T_5	8.80 b	0.47 cd	5.02 cd	67.65	852.71 bc	63.33 b	6.94 d	56.92
T_6	7.07 cd	0.67 b	8.58 b	44.72	672.21 d	68.43 b	9.26 b	42.52
T_7	6.20 d	1.13 a	15.52 a	--	555.93 e	106.63 a	16.11 a	--
$LSD_{(0.05)}$	1.343	0.178	1.787	--	110.3	9.154	1.088	--
CV(%)	8.87	18.85	15.57	--	7.57	8.19	7.96	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 5. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) at late fruiting stage in terms of fruit per plant by number and weight

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	7.73 a	0.27 c	3.31 d	82.23	744.37 a	34.12 d	4.38 e	76.54
T_2	7.07 ab	0.33 bc	4.54 cd	75.63	668.24 ab	43.77 c	6.16 d	67.01
T_3	6.60 bc	0.47 b	6.55 bc	64.84	625.69 bc	48.58 bc	7.23 cd	61.27
T_4	6.07 cde	0.53 b	8.03 b	56.90	573.66 cde	53.83 b	8.60 bc	53.94
T_5	6.47 bcd	0.53 b	7.65 b	58.94	610.42 bcd	50.72 bc	7.75 bc	58.49
T_6	5.67 de	0.53 b	8.69 b	53.35	538.42 de	53.75 b	9.09 b	51.31
T_7	5.53 e	1.27 a	18.63 a	--	517.08 e	118.57 a	18.67 a	--
$LSD_{(0.05)}$	0.811	0.187	2.920	--	77.41	7.886	1.517	--
CV(%)	7.08	19.03	10.02	--	7.12	7.69	9.64	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 6. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) throughout the growing season in terms of fruit per plant by number and weight during April-October, 2009

Treatment	Brinjal fruit by number				Brinjal fruit by weight (g)			
	Healthy	Infested	% infestation	Reduction over control (%)	Healthy	Infested	% infestation	Reduction over control (%)
T_1	25.27 a	0.67 e	2.57 f	83.79	2489.6 a	89.28 c	3.46 e	78.43
T_2	23.13 ab	0.80 de	3.36 ef	78.80	2331.5 ab	105.60 c	4.35 d	72.88
T_3	22.13 bc	1.07 cd	4.59 de	71.04	2208.3 bc	141.35 b	6.02 c	62.47
T_4	19.27 de	1.33 bc	6.47 bc	59.18	1900.5 d	158.76 b	7.70 b	52.00
T_5	20.80 cd	1.27 bc	5.76 cd	63.66	2060.6 cd	150.72 b	6.83 c	57.42
T_6	17.40 ef	1.47 b	7.78 b	50.91	1707.7 e	159.18 b	8.53 b	46.82
T_7	16.33 f	3.07 a	15.85 a	--	1536.6 f	293.53 a	16.04 a	--
$LSD_{(0.05)}$	2.161	0.287	1.619	--	164.1	18.95	0.834	--
CV(%)	11.75	13.74	4.54	--	6.79	6.21	7.72	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 7. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of length of healthy and infested fruit

Treatment	Plant height	Length of fruit			
		Healthy		Infested	
		Length	Increase over control (%)	Length	Increase over control (%)
T_1	124.08 a	26.25 a	25.42	22.29 a	30.58
T_2	120.99 ab	24.83 ab	18.63	21.59 a	26.48
T_3	117.62 ab	24.29 abc	16.05	21.06 ab	23.37
T_4	111.23bcd	22.68 bc	8.36	19.25 bc	12.77
T_5	115.50 abc	23.20 abc	10.85	19.08 bc	11.78
T_6	104.87cd	21.46 bc	2.53	17.46 c	2.28
T_7	101.50 d	20.93 c	--	17.07 c	--
$LSD_{(0.05)}$		3.212	--	2.035	--
CV(%)	5.60	7.72	--	5.81	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 8. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of girth of healthy and infested fruit

Treatment	Girth of fruit			
	Healthy		Infested	
	Girth (cm)	Increase over control (%)	Girth (cm)	Increase over control (%)
T_1	7.31 a	41.39	6.59 a	37.01
T_2	7.09 ab	37.14	6.41 ab	33.26
T_3	6.63 abc	28.24	6.02 abc	25.16
T_4	6.01 cde	16.25	5.51 cde	14.55
T_5	6.29 bcd	21.66	5.74 bcd	19.33
T_6	5.53 de	6.96	5.11 de	6.24
T_7	5.17 e	--	4.81 e	--
$LSD_{(0.05)}$	0.871	--	0.727	--
CV(%)	5.91	--	5.27	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 9. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of single fruit weight, edible and non edible portion of infested fruit

Treatment	Individual fruit weight (g)	Increase over control (%)	Edible portion (%)	Non edible portion (%)
T_1	85.34 a	27.43	95.77 a	4.23 c
T_2	84.82 a	26.65	94.18 a	5.82 c
T_3	82.39 a	23.03	92.36 ab	7.64 bc
T_4	73.77 bc	10.15	88.15 ab	11.85 bc
T_5	75.69 b	13.02	89.66 ab	10.34 bc
T_6	68.96 cd	2.97	85.15 b	14.85 b
T_7	66.97 d	--	76.33 c	23.67 a
$LSD_{(0.05)}$	6.234	--	7.364	7.364
CV(%)	4.56	--	6.66	16.96

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 10. Effect of botanicals and bio-control agents against Brinjal Shoot and Fruit Borer (BSFB) in terms of yield per plot and hectare

Treatment	Yield of fruit			
	Yield per plot (kg)	Increase over control (%)	Yield per hectare (ton)	Increase over control (%)
T_1	29.95 a	64.20	49.92 a	64.21
T_2	28.98 ab	58.88	48.31 ab	58.91
T_3	28.50 abc	56.25	47.50 abc	56.25
T_4	25.59 bc	40.30	42.65 bc	40.30
T_5	27.77 abc	52.25	46.29 abc	52.27
T_6	25.10 c	37.61	41.84 c	37.63
T_7	18.24 d	--	30.40 d	--
$LSD_{(0.05)}$	3.542	--	5.903	--
CV(%)	7.57	--	7.57	--

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

In a column, numeric data represents the mean value of 3 replications; each replication is derived from 3 plants per treatment

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

Table 11. Cost of production of Brinjal for against Brinjal Shoot and Fruit Borer (BSFB) management practices

Treatments	Cost of pest Management (Tk.)	Yield (t/ha)	Gross return (Tk.)	Net Return (Tk.)	Adjusted net return (Tk.)	Benefit cost ratio
T_1	45000	49.92	499200	454200	150200	3.34
T_2	45000	48.31	483100	438100	134100	2.98
T_3	40000	47.5	475000	435000	131000	3.28
T_4	35000	42.65	426500	391500	87500	2.50
T_5	45000	46.29	462900	417900	113900	2.53
T_6	30000	41.84	418400	388400	84400	2.81
T_7	0	30.4	304000	304000	0	

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

Market price of brinjal @ Tk. 10,000 per ton

A

	HS_Early	IS_Early	%IS_Early	
T_1	22.20 a	0.80 c	3.48 e	73.74
T_2	21.40 ab	0.93 bc	4.19 de	68.38
T_3	21.20 ab	1.00 bc	4.51 cde	65.96
T_4	18.47 bcd	1.07 bc	5.47 c	58.72
T_5	20.07 abc	1.07 bc	5.08 cd	61.66
T_6	17.40 cd	1.20 b	6.52 b	50.79
T_7	16.13 d	2.47 a	13.25 a	--
	2.826	0.251	1.000	

T_1: Neem oil @ 4ml/L of water after 5-7 days interval

T_2: Neem seed kernel @ 300g/L of water after 5-7 days interval

T_3: *Trichogramma evanescense* @ 0.1g/6 m^2 of after 5-7 days interval

T_4: *Bacillus thuringiensis* serovar kurstaki @ 1.5ml/L of water after 5-7 days interval.

T_5: *Bacillus thuringiensis* serovar kurstaki @ 1ml suspension /L of water + Safeclean 2.5 ml/L of water after 5-7 days interval

T_6: Botanical pesticides Safeclean 5 ml/L of water after 5-7 days interval

T_7: Control

Market price of brinjal @ Tk. 10,000 per ton

B

	HS_Mid	IS_Mid	%IS_Mid	
T_1	29.47 a	1.07 d	3.49 e	77.57
T_2	28.53 a	1.33 cd	4.46 de	71.34
T_3	26.60 ab	1.53 c	5.47 cd	64.85
T_4	23.67 cd	1.67 bc	6.61 c	57.52
T_5	25.47 bc	1.60 bc	5.91 cd	62.02
T_6	22.53 d	2.00 b	8.16 b	47.56
T_7	21.00 d	3.87 a	15.56 a	
	2.746	0.394	1.493	

C

	HS_Late	IS_Late	%IS_Late	
T_1	33.73 a	1.27 c	3.62 e	80.69
T_2	32.87 ab	1.53 c	4.45 e	76.27
T_3	31.60 abc	2.40 b	7.06 d	62.35
T_4	28.53 cd	2.67 b	8.57 c	54.29
T_5	30.27 bc	2.53 b	7.74 cd	58.72
T_6	25.67 de	2.93 b	10.27 b	45.23
T_7	22.80 e	5.27 a	18.75 a	
	2.938	0.503	1.278	

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33

Variable 3 : HF-Early(No.)
Function : _RANGE_

Error Mean Square = 0.2760
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.9346
s_ = 0.3033 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	7.000	A	Mean	1 =	7.000	A
Mean	2 =	6.533	A	Mean	2 =	6.533	A
Mean	3 =	6.200	AB	Mean	3 =	6.200	AB
Mean	4 =	5.067	C	Mean	5 =	5.533	BC
Mean	5 =	5.533	BC	Mean	4 =	5.067	C
Mean	6 =	4.667	C	Mean	6 =	4.667	C
Mean	7 =	4.600	C	Mean	7 =	4.600	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 4 : IF-Early
Function : _RANGE_

Error Mean Square = 0.01200
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.1949
s_ = 0.06325 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	0.1333	B	Mean	7 =	0.6667	A
Mean	2 =	0.1333	B	Mean	5 =	0.2667	B
Mean	3 =	0.2000	B	Mean	6 =	0.2667	B
Mean	4 =	0.2667	B	Mean	4 =	0.2667	B
Mean	5 =	0.2667	B	Mean	3 =	0.2000	B
Mean	6 =	0.2667	B	Mean	2 =	0.1333	B
Mean	7 =	0.6667	A	Mean	1 =	0.1333	B

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Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 5 : %Inf-Early
Function : _RANGE_

Error Mean Square = 3.445
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 3.302
s_ = 1.072 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	1.786	B	Mean	7 =	12.64	A
Mean	2 =	2.092	B	Mean	6 =	5.347	B
Mean	3 =	3.127	B	Mean	4 =	5.033	B
Mean	4 =	5.033	B	Mean	5 =	4.597	B
Mean	5 =	4.597	B	Mean	3 =	3.127	B
Mean	6 =	5.347	B	Mean	2 =	2.092	B
Mean	7 =	12.64	A	Mean	1 =	1.786	B

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 6 : HF-Early (Wt.)
Function : _RANGE_

Error Mean Square = 2715.
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 92.70
s_ = 30.08 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	752.0	A	Mean	1 =	752.0	A
Mean	2 =	708.3	A	Mean	2 =	708.3	A
Mean	3 =	663.1	AB	Mean	3 =	663.1	AB
Mean	4 =	543.8	CD	Mean	5 =	597.5	BC
Mean	5 =	597.5	BC	Mean	4 =	543.8	CD
Mean	6 =	497.1	D	Mean	6 =	497.1	D
Mean	7 =	463.6	D	Mean	7 =	463.6	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 7 : IF-Early
Function : _RANGE_

Error Mean Square = 128.5
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 20.17
s_ = 6.545 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	22.00	B	Mean	7 =	68.33	A
Mean	2 =	21.67	B	Mean	6 =	37.00	B
Mean	3 =	32.67	B	Mean	4 =	37.00	B
Mean	4 =	37.00	B	Mean	5 =	36.67	B
Mean	5 =	36.67	B	Mean	3 =	32.67	B
Mean	6 =	37.00	B	Mean	1 =	22.00	B
Mean	7 =	68.33	A	Mean	2 =	21.67	B

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 8 : %Inf-Early
Function : _RANGE_

Error Mean Square = 2.575
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.855
s_ = 0.9265 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	2.718	D	Mean	7 =	12.84	A
Mean	2 =	3.062	CD	Mean	6 =	6.920	B
Mean	3 =	4.696	BCD	Mean	4 =	6.394	B
Mean	4 =	6.394	B	Mean	5 =	5.850	BC
Mean	5 =	5.850	BC	Mean	3 =	4.696	BCD
Mean	6 =	6.920	B	Mean	2 =	3.062	CD
Mean	7 =	12.84	A	Mean	1 =	2.718	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 9 : HF-Mid (No.)
Function : _RANGE_

Error Mean Square = 0.5700
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.343
s_ = 0.4359 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	10.53	A	Mean	1 =	10.53	A
Mean	2 =	9.533	AB	Mean	2 =	9.533	AB
Mean	3 =	9.333	AB	Mean	3 =	9.333	AB
Mean	4 =	8.133	BC	Mean	5 =	8.800	B
Mean	5 =	8.800	B	Mean	4 =	8.133	BC
Mean	6 =	7.067	CD	Mean	6 =	7.067	CD
Mean	7 =	6.200	D	Mean	7 =	6.200	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 10 : IF-Mid
Function : _RANGE_

Error Mean Square = 0.01000
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.1779
s_ = 0.05774 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	0.2667	E	Mean	7 =	1.133	A
Mean	2 =	0.3333	DE	Mean	6 =	0.6667	B
Mean	3 =	0.4000	CDE	Mean	4 =	0.5333	BC
Mean	4 =	0.5333	BC	Mean	5 =	0.4667	CD
Mean	5 =	0.4667	CD	Mean	3 =	0.4000	CDE
Mean	6 =	0.6667	B	Mean	2 =	0.3333	DE
Mean	7 =	1.133	A	Mean	1 =	0.2667	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 11 : %Inf-Mid
Function : _RANGE_

Error Mean Square = 1.009
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.787
s_ = 0.5799 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	2.454	E	Mean	7 =	15.52	A
Mean	2 =	3.352	DE	Mean	6 =	8.584	B
Mean	3 =	4.112	DE	Mean	4 =	6.127	C
Mean	4 =	6.127	C	Mean	5 =	5.023	CD
Mean	5 =	5.023	CD	Mean	3 =	4.112	DE
Mean	6 =	8.584	B	Mean	2 =	3.352	DE
Mean	7 =	15.52	A	Mean	1 =	2.454	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 12 : HF-Mid (Wt.)
Function : _RANGE_

Error Mean Square = 3843.
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 110.3
s_ = 35.79 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	993.2	A	Mean	1 =	993.2	A
Mean	2 =	954.9	AB	Mean	2 =	954.9	AB
Mean	3 =	919.5	AB	Mean	3 =	919.5	AB
Mean	4 =	783.1	C	Mean	5 =	852.7	BC
Mean	5 =	852.7	BC	Mean	4 =	783.1	C
Mean	6 =	672.2	D	Mean	6 =	672.2	D
Mean	7 =	555.9	E	Mean	7 =	555.9	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 13 : IF-Mid
Function : _RANGE_

Error Mean Square = 26.48
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 9.154
s_ = 2.971 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	33.15	C	Mean	7 =	106.6	A
Mean	2 =	40.17	C	Mean	6 =	68.43	B
Mean	3 =	60.10	B	Mean	4 =	67.93	B
Mean	4 =	67.93	B	Mean	5 =	63.33	B
Mean	5 =	63.33	B	Mean	3 =	60.10	B
Mean	6 =	68.43	B	Mean	2 =	40.17	C
Mean	7 =	106.6	A	Mean	1 =	33.15	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 14 : %Inf-Mid
Function : _RANGE_

Error Mean Square = 0.3740
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.088
s_ = 0.3531 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	3.230	E	Mean	7 =	16.11	A
Mean	2 =	4.040	E	Mean	6 =	9.263	B
Mean	3 =	6.140	D	Mean	4 =	8.044	C
Mean	4 =	8.044	C	Mean	5 =	6.938	D
Mean	5 =	6.938	D	Mean	3 =	6.140	D
Mean	6 =	9.263	B	Mean	2 =	4.040	E
Mean	7 =	16.11	A	Mean	1 =	3.230	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 15 : HF-Late (No.)
Function : _RANGE_

Error Mean Square = 0.2080
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.8113
s_ = 0.2633 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	7.733	A	Mean	1 =	7.733	A
Mean	2 =	7.067	AB	Mean	2 =	7.067	AB
Mean	3 =	6.600	BC	Mean	3 =	6.600	BC
Mean	4 =	6.067	CDE	Mean	5 =	6.467	BCD
Mean	5 =	6.467	BCD	Mean	4 =	6.067	CDE
Mean	6 =	5.667	DE	Mean	6 =	5.667	DE
Mean	7 =	5.533	E	Mean	7 =	5.533	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 16 : IF-Late
Function : _RANGE_

Error Mean Square = 0.01100
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.1866
s_ = 0.06055 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	0.2667	C	Mean	7 =	1.267	A
Mean	2 =	0.3333	BC	Mean	5 =	0.5333	B
Mean	3 =	0.4667	B	Mean	6 =	0.5333	B
Mean	4 =	0.5333	B	Mean	4 =	0.5333	B
Mean	5 =	0.5333	B	Mean	3 =	0.4667	B
Mean	6 =	0.5333	B	Mean	2 =	0.3333	BC
Mean	7 =	1.267	A	Mean	1 =	0.2667	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 17 : %Inf-Late
Function : _RANGE_

Error Mean Square = 2.694
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.920
s_ = 0.9476 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	3.314	D	Mean	7 =	18.63	A
Mean	2 =	4.536	CD	Mean	6 =	8.694	B
Mean	3 =	6.552	BC	Mean	4 =	8.030	B
Mean	4 =	8.030	B	Mean	5 =	7.650	B
Mean	5 =	7.650	B	Mean	3 =	6.552	BC
Mean	6 =	8.694	B	Mean	2 =	4.536	CD
Mean	7 =	18.63	A	Mean	1 =	3.314	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 18 : HF-Late (Wt.)
Function : _RANGE_

Error Mean Square = 1893.
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 77.41
s_ = 25.12 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	744.4	A	Mean	1 =	744.4	A
Mean	2 =	668.2	AB	Mean	2 =	668.2	AB
Mean	3 =	625.7	BC	Mean	3 =	625.7	BC
Mean	4 =	573.7	CDE	Mean	5 =	610.4	BCD
Mean	5 =	610.4	BCD	Mean	4 =	573.7	CDE
Mean	6 =	538.4	DE	Mean	6 =	538.4	DE
Mean	7 =	517.1	E	Mean	7 =	517.1	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 19 : IF-Late
Function : _RANGE_

Error Mean Square = 19.65
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 7.886
s_ = 2.559 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	34.12	D	Mean	7 =	118.6	A
Mean	2 =	43.77	C	Mean	4 =	53.83	B
Mean	3 =	48.58	BC	Mean	6 =	53.75	B
Mean	4 =	53.83	B	Mean	5 =	50.72	BC
Mean	5 =	50.72	BC	Mean	3 =	48.58	BC
Mean	6 =	53.75	B	Mean	2 =	43.77	C
Mean	7 =	118.6	A	Mean	1 =	34.12	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 20 : %Inf-late
Function : _RANGE_

Error Mean Square = 0.7270
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.517
s_ = 0.4923 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	4.379	E	Mean	7 =	18.67	A
Mean	2 =	6.161	D	Mean	6 =	9.089	B
Mean	3 =	7.231	CD	Mean	4 =	8.599	BC
Mean	4 =	8.599	BC	Mean	5 =	7.748	BC
Mean	5 =	7.748	BC	Mean	3 =	7.231	CD
Mean	6 =	9.089	B	Mean	2 =	6.161	D
Mean	7 =	18.67	A	Mean	1 =	4.379	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 21 : THF (No.)
Function : _RANGE_

Error Mean Square = 1.476
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.161
s_ = 0.7014 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	25.27	A	Mean	1 =	25.27	A
Mean	2 =	23.13	AB	Mean	2 =	23.13	AB
Mean	3 =	22.13	BC	Mean	3 =	22.13	BC
Mean	4 =	19.27	DE	Mean	5 =	20.80	CD
Mean	5 =	20.80	CD	Mean	4 =	19.27	DE
Mean	6 =	17.40	EF	Mean	6 =	17.40	EF
Mean	7 =	16.33	F	Mean	7 =	16.33	F

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 22 : TIF
Function : _RANGE_

Error Mean Square = 0.02600
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.2869
s_ = 0.09309 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	0.6667	E	Mean	7 =	3.067	A
Mean	2 =	0.8000	DE	Mean	6 =	1.467	B
Mean	3 =	1.067	CD	Mean	4 =	1.333	BC
Mean	4 =	1.333	BC	Mean	5 =	1.267	BC
Mean	5 =	1.267	BC	Mean	3 =	1.067	CD
Mean	6 =	1.467	B	Mean	2 =	0.8000	DE
Mean	7 =	3.067	A	Mean	1 =	0.6667	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 23 : TInf.
Function : _RANGE_

Error Mean Square = 0.8280
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.619
s_ = 0.5254 at alpha = 0.050
 x
_

Original Order				Ranked Order			
Mean	1 =	2.566	F	Mean	7 =	15.85	A
Mean	2 =	3.362	EF	Mean	6 =	7.779	B
Mean	3 =	4.593	DE	Mean	4 =	6.467	BC
Mean	4 =	6.467	BC	Mean	5 =	5.762	CD
Mean	5 =	5.762	CD	Mean	3 =	4.593	DE
Mean	6 =	7.779	B	Mean	2 =	3.362	EF
Mean	7 =	15.85	A	Mean	1 =	2.566	F

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 24 : THF-Wt.
Function : _RANGE_

Error Mean Square = 8509.
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 164.1
s_ = 53.26 at alpha = 0.050
 x
_

Original Order				Ranked Order			
Mean	1 =	2490.	A	Mean	1 =	2490.	A
Mean	2 =	2331.	AB	Mean	2 =	2331.	AB
Mean	3 =	2208.	BC	Mean	3 =	2208.	BC
Mean	4 =	1901.	D	Mean	5 =	2061.	CD
Mean	5 =	2061.	CD	Mean	4 =	1901.	D
Mean	6 =	1708.	E	Mean	6 =	1708.	E
Mean	7 =	1537.	F	Mean	7 =	1537.	F

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 25 : TIF
Function : _RANGE_

Error Mean Square = 113.5
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 18.95
s_ = 6.150 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	89.28	C	Mean	7 =	293.5	A
Mean	2 =	105.6	C	Mean	6 =	159.2	B
Mean	3 =	141.3	B	Mean	4 =	158.8	B
Mean	4 =	158.8	B	Mean	5 =	150.7	B
Mean	5 =	150.7	B	Mean	3 =	141.3	B
Mean	6 =	159.2	B	Mean	2 =	105.6	C
Mean	7 =	293.5	A	Mean	1 =	89.28	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 27 - 33
Variable 26 : TInf.
Function : _RANGE_

Error Mean Square = 0.2200
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.8344
s_ = 0.2708 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	3.458	E	Mean	7 =	16.04	A
Mean	2 =	4.352	D	Mean	6 =	8.533	B
Mean	3 =	6.021	C	Mean	4 =	7.704	B
Mean	4 =	7.704	B	Mean	5 =	6.828	C
Mean	5 =	6.828	C	Mean	3 =	6.021	C
Mean	6 =	8.533	B	Mean	2 =	4.352	D
Mean	7 =	16.04	A	Mean	1 =	3.458	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 27 : Length-HF
Function : _RANGE_

Error Mean Square = 3.259
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 3.212
s_ = 1.042 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	26.25	A	Mean	1 =	26.25	A
Mean	2 =	24.83	AB	Mean	2 =	24.83	AB
Mean	3 =	24.29	ABC	Mean	3 =	24.29	ABC
Mean	4 =	22.68	BC	Mean	5 =	23.20	ABC
Mean	5 =	23.20	ABC	Mean	4 =	22.68	BC
Mean	6 =	21.46	BC	Mean	6 =	21.46	BC
Mean	7 =	20.93	C	Mean	7 =	20.93	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 28 : Length-IF
Function : _RANGE_

Error Mean Square = 1.309
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.035
s_ = 0.6606 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	22.29	A	Mean	1 =	22.29	A
Mean	2 =	21.59	A	Mean	2 =	21.59	A
Mean	3 =	21.06	AB	Mean	3 =	21.06	AB
Mean	4 =	19.25	BC	Mean	4 =	19.25	BC
Mean	5 =	19.08	BC	Mean	5 =	19.08	BC
Mean	6 =	17.46	C	Mean	6 =	17.46	C
Mean	7 =	17.07	C	Mean	7 =	17.07	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 29 : Girth_Healthy
Function : _RANGE_

Error Mean Square = 0.2400
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.8715
s_ = 0.2828 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	9.308	A	Mean	1 =	9.308	A
Mean	2 =	9.092	AB	Mean	2 =	9.092	AB
Mean	3 =	8.630	ABC	Mean	3 =	8.630	ABC
Mean	4 =	8.012	CDE	Mean	5 =	8.288	BCD
Mean	5 =	8.288	BCD	Mean	4 =	8.012	CDE
Mean	6 =	7.532	DE	Mean	6 =	7.532	DE
Mean	7 =	7.172	E	Mean	7 =	7.172	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 30 : Girth_Infested
Function : _RANGE_

Error Mean Square = 0.1670
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.7270
s_ = 0.2359 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	8.590	A	Mean	1 =	8.590	A
Mean	2 =	8.410	AB	Mean	2 =	8.410	AB
Mean	3 =	8.025	ABC	Mean	3 =	8.025	ABC
Mean	4 =	7.510	CDE	Mean	5 =	7.740	BCD
Mean	5 =	7.740	BCD	Mean	4 =	7.510	CDE
Mean	6 =	7.110	DE	Mean	6 =	7.110	DE
Mean	7 =	6.810	E	Mean	7 =	6.810	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 31 : Single fruit Weight
Function : _RANGE_

Error Mean Square = 12.28
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 6.234
s_ = 2.023 at alpha = 0.050
 x
_
Original Order Ranked Order

Mean	1 =	85.34	A	Mean	1 =	85.34	A
Mean	2 =	84.82	A	Mean	2 =	84.82	A
Mean	3 =	82.39	A	Mean	3 =	82.39	A
Mean	4 =	73.77	BC	Mean	5 =	75.69	B
Mean	5 =	75.69	B	Mean	4 =	73.77	BC
Mean	6 =	68.96	CD	Mean	6 =	68.96	CD
Mean	7 =	66.97	D	Mean	7 =	66.97	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 32 : Edible portion
Function : _RANGE_

Error Mean Square = 17.13
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 7.364
s_ = 2.390 at alpha = 0.050
 x
_
Original Order Ranked Order

Mean	1 =	95.77	A	Mean	1 =	95.77	A
Mean	2 =	94.18	A	Mean	2 =	94.18	A
Mean	3 =	92.36	AB	Mean	3 =	92.36	AB
Mean	4 =	88.15	AB	Mean	5 =	89.66	AB
Mean	5 =	89.66	AB	Mean	4 =	88.15	AB
Mean	6 =	85.15	B	Mean	6 =	85.15	B
Mean	7 =	76.33	C	Mean	7 =	76.33	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 33 : Non Edible Portion
Function : _RANGE_

Error Mean Square = 17.13
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 7.364
s_ = 2.390 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	4.230	C	Mean	7 =	23.67	A
Mean	2 =	5.823	C	Mean	6 =	14.85	B
Mean	3 =	7.639	BC	Mean	4 =	11.85	BC
Mean	4 =	11.85	BC	Mean	5 =	10.34	BC
Mean	5 =	10.34	BC	Mean	3 =	7.639	BC
Mean	6 =	14.85	B	Mean	2 =	5.823	C
Mean	7 =	23.67	A	Mean	1 =	4.230	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 34 : Yield/Plot
Function : _RANGE_

Error Mean Square = 3.964
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 3.542
s_ = 1.149 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	29.95	A	Mean	1 =	29.95	A
Mean	2 =	28.98	AB	Mean	2 =	28.98	AB
Mean	3 =	28.50	ABC	Mean	3 =	28.50	ABC
Mean	4 =	25.59	BC	Mean	5 =	27.77	ABC
Mean	5 =	27.77	ABC	Mean	4 =	25.59	BC
Mean	6 =	25.10	C	Mean	6 =	25.10	C
Mean	7 =	18.24	D	Mean	7 =	18.24	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 35 : Yield/Hectare
Function : _RANGE_

Error Mean Square = 11.01
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 5.903
s_ = 1.916 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	49.92	A	Mean	1 =	49.92	A
Mean	2 =	48.31	AB	Mean	2 =	48.31	AB
Mean	3 =	47.50	ABC	Mean	3 =	47.50	ABC
Mean	4 =	42.65	BC	Mean	5 =	46.29	ABC
Mean	5 =	46.29	ABC	Mean	4 =	42.65	BC
Mean	6 =	41.84	C	Mean	6 =	41.84	C
Mean	7 =	30.40	D	Mean	7 =	30.40	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 36 : HS_Early
Function : _RANGE_

Error Mean Square = 2.524
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.826
s_ = 0.9172 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	22.20	A	Mean	1 =	22.20	A
Mean	2 =	21.40	AB	Mean	2 =	21.40	AB
Mean	3 =	21.20	AB	Mean	3 =	21.20	AB
Mean	4 =	18.47	BCD	Mean	5 =	20.07	ABC
Mean	5 =	20.07	ABC	Mean	4 =	18.47	BCD
Mean	6 =	17.40	CD	Mean	6 =	17.40	CD
Mean	7 =	16.13	D	Mean	7 =	16.13	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 37 : IS_Early
Function : _RANGE_

Error Mean Square = 0.02000
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.2516
s_ = 0.08165 at alpha = 0.050
 x
_
Original Order				Ranked Order			
Mean	1 =	0.8000	C	Mean	7 =	2.467	A
Mean	2 =	0.9333	BC	Mean	6 =	1.200	B
Mean	3 =	1.000	BC	Mean	5 =	1.067	BC
Mean	4 =	1.067	BC	Mean	4 =	1.067	BC
Mean	5 =	1.067	BC	Mean	3 =	1.000	BC
Mean	6 =	1.200	B	Mean	2 =	0.9333	BC
Mean	7 =	2.467	A	Mean	1 =	0.8000	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 38 : %IS_Early
Function : _RANGE_

Error Mean Square = 0.3160
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.000
s_ = 0.3246 at alpha = 0.050
 x
_
Original Order				Ranked Order			
Mean	1 =	3.481	E	Mean	7 =	13.25	A
Mean	2 =	4.187	DE	Mean	6 =	6.524	B
Mean	3 =	4.508	CDE	Mean	4 =	5.468	C
Mean	4 =	5.468	C	Mean	5 =	5.078	CD
Mean	5 =	5.078	CD	Mean	3 =	4.508	CDE
Mean	6 =	6.524	B	Mean	2 =	4.187	DE
Mean	7 =	13.25	A	Mean	1 =	3.481	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 39 : HS_Mid
Function : _RANGE_

Error Mean Square = 2.382
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.746
s_ = 0.8911 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	29.47	A	Mean	1 =	29.47	A
Mean	2 =	28.53	A	Mean	2 =	28.53	A
Mean	3 =	26.60	AB	Mean	3 =	26.60	AB
Mean	4 =	23.67	CD	Mean	5 =	25.47	BC
Mean	5 =	25.47	BC	Mean	4 =	23.67	CD
Mean	6 =	22.53	D	Mean	6 =	22.53	D
Mean	7 =	21.00	D	Mean	7 =	21.00	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 40 : IS_Mid
Function : _RANGE_

Error Mean Square = 0.04900
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.3938
s_ = 0.1278 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	1.067	D	Mean	7 =	3.867	A
Mean	2 =	1.333	CD	Mean	6 =	2.000	B
Mean	3 =	1.533	C	Mean	4 =	1.667	BC
Mean	4 =	1.667	BC	Mean	5 =	1.600	BC
Mean	5 =	1.600	BC	Mean	3 =	1.533	C
Mean	6 =	2.000	B	Mean	2 =	1.333	CD
Mean	7 =	3.867	A	Mean	1 =	1.067	D

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 41 : %IS_Mid
Function : _RANGE_

Error Mean Square = 0.7040
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.493
s_ = 0.4844 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	3.489	E	Mean	7 =	15.56	A
Mean	2 =	4.459	DE	Mean	6 =	8.158	B
Mean	3 =	5.469	CD	Mean	4 =	6.605	C
Mean	4 =	6.605	C	Mean	5 =	5.911	CD
Mean	5 =	5.911	CD	Mean	3 =	5.469	CD
Mean	6 =	8.158	B	Mean	2 =	4.459	DE
Mean	7 =	15.56	A	Mean	1 =	3.489	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 42 : HS_Late
Function : _RANGE_

Error Mean Square = 2.727
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 2.938
s_ = 0.9534 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	33.73	A	Mean	1 =	33.73	A
Mean	2 =	32.87	AB	Mean	2 =	32.87	AB
Mean	3 =	31.60	ABC	Mean	3 =	31.60	ABC
Mean	4 =	28.53	CD	Mean	5 =	30.27	BC
Mean	5 =	30.27	BC	Mean	4 =	28.53	CD
Mean	6 =	25.67	DE	Mean	6 =	25.67	DE
Mean	7 =	22.80	E	Mean	7 =	22.80	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 43 : IS_Late
Function : _RANGE_

Error Mean Square = 0.08000
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 0.5032
s_ = 0.1633 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	1.268	C	Mean	7 =	5.267	A
Mean	2 =	1.533	C	Mean	6 =	2.933	B
Mean	3 =	2.400	B	Mean	4 =	2.667	B
Mean	4 =	2.667	B	Mean	5 =	2.533	B
Mean	5 =	2.533	B	Mean	3 =	2.400	B
Mean	6 =	2.933	B	Mean	2 =	1.533	C
Mean	7 =	5.267	A	Mean	1 =	1.268	C

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 44 : %IS_Late
Function : _RANGE_

Error Mean Square = 0.5160
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 1.278
s_ = 0.4147 at alpha = 0.050
x
_

Original Order				Ranked Order			
Mean	1 =	3.622	E	Mean	7 =	18.75	A
Mean	2 =	4.454	E	Mean	6 =	10.27	B
Mean	3 =	7.060	D	Mean	4 =	8.565	C
Mean	4 =	8.565	C	Mean	5 =	7.739	CD
Mean	5 =	7.739	CD	Mean	3 =	7.060	D
Mean	6 =	10.27	B	Mean	2 =	4.454	E
Mean	7 =	18.75	A	Mean	1 =	3.622	E

_

Data File : _NASIR_
Title : Effect of Botanicals and Bio-control agents against BSFB

Case Range : 41 - 47
Variable 45 : Plant height
Function : _RANGE_

Error Mean Square = 40.55
Error Degrees of Freedom = 12
No. of observations to calculate a mean = 3

Duncan's Multiple Range Test
LSD value = 11.33
s_ = 3.676 at alpha = 0.050
 x
_
Original Order Ranked Order

Mean	1 =	124.1	A	Mean	1 =	124.1	A
Mean	2 =	121.0	AB	Mean	2 =	121.0	AB
Mean	3 =	117.6	AB	Mean	3 =	117.6	AB
Mean	4 =	111.2	BCD	Mean	5 =	115.5	ABC
Mean	5 =	115.5	ABC	Mean	4 =	111.2	BCD
Mean	6 =	104.9	CD	Mean	6 =	104.9	CD
Mean	7 =	101.5	D	Mean	7 =	101.5	D

_

Data file: _NASIR_
Title: Effect of Botanicals and Bio-control agents against BSFB

Function: FACTOR

Experiment Model Number 7: One Factor Randomized Complete Block Design

Data case no. 1 to 21.

Factorial ANOVA for the factors:
Replication (Var 1: Replication) with values from 1 to 3
Factor A (Var 2: Treatment) with values from 1 to 7

Variable 3: HF-Early(No.)

Grand Mean = 5.657 Grand Sum = 118.800 Total Count = 21

T A B L E O F M E A N S

1	2	3	Total
1	*	5.600	39.200
2	*	5.629	39.400
3	*	5.743	40.200
*	1	7.000	21.000
*	2	6.533	19.600
*	3	6.200	18.600
*	4	5.067	15.200
*	5	5.533	16.600
*	6	4.667	14.000
*	7	4.600	13.800

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.080	0.040	0.1452	
2	Factor A	6	15.985	2.664	9.6682	0.0005
-3	Error	12	3.307	0.276		
	Total	20	19.371			

Coefficient of Variation: 9.28%

s_ for means group 1: 0.1984 Number of Observations: 7
y

s_ for means group 2: 0.3031 Number of Observations: 3
y

Variable 4: IF-Early
Grand Mean = 0.276 Grand Sum = 5.800 Total Count = 21

T A B L E O F M E A N S

1	2	4	Total
1	*	0.314	2.200
2	*	0.257	1.800
3	*	0.257	1.800
*	1	0.133	0.400
*	2	0.133	0.400
*	3	0.200	0.600
*	4	0.267	0.800
*	5	0.267	0.800
*	6	0.267	0.800
*	7	0.667	2.000

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.015	0.008	0.6316	
2	Factor A	6	0.598	0.100	8.2632	0.0011
-3	Error	12	0.145	0.012		
	Total	20	0.758			

Coefficient of Variation: 9.77%
s_ for means group 1: 0.0415 Number of Observations: 7
y
s_ for means group 2: 0.0634 Number of Observations: 3
y

==========

Variable 5: %Inf-Early
Grand Mean = 4.946 Grand Sum = 103.870 Total Count = 21

T A B L E O F M E A N S

1	2	5	Total
1	*	5.487	38.406
2	*	4.824	33.766
3	*	4.528	31.698
*	1	1.786	5.357
*	2	2.092	6.275
*	3	3.127	9.381
*	4	5.033	15.100
*	5	4.597	13.792
*	6	5.347	16.040
*	7	12.642	37.926

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	3.371	1.686	0.4894	
2	Factor A	6	242.886	40.481	11.7518	0.0002
-3	Error	12	41.336	3.445		
	Total	20	287.594			

Coefficient of Variation: 13.52%
s_ for means group 1: 0.7015 Number of Observations: 7
y
s_ for means group 2: 1.0716 Number of Observations: 3
y

==========

Variable 6: HF-Early (Wt.)
Grand Mean = 603.621 Grand Sum = 12676.045 Total Count = 21

T A B L E O F M E A N S

1	2	6	Total
1	*	602.955	4220.682
2	*	604.023	4228.164
3	*	603.886	4227.199
*	1	752.045	2256.136
*	2	708.279	2124.836
*	3	663.097	1989.290
*	4	543.782	1631.346
*	5	597.479	1792.437
*	6	497.106	1491.318
*	7	463.561	1390.682

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	4.733	2.367	0.0009	
2	Factor A	6	213303.580	35550.597	13.0936	0.0001
-3	Error	12	32581.388	2715.116		
	Total	20	245889.701			

Coefficient of Variation: 8.63%
s_ for means group 1: 19.6945 Number of Observations: 7
 y
s_ for means group 2: 30.0839 Number of Observations: 3
 y

Variable 7: IF-Early
Grand Mean = 36.476 Grand Sum = 766.000 Total Count = 21

T A B L E O F M E A N S

1	2	7	Total
1	*	39.429	276.000
2	*	35.286	247.000
3	*	34.714	243.000
*	1	22.000	66.000
*	2	21.667	65.000
*	3	32.667	98.000
*	4	37.000	111.000
*	5	36.667	110.000
*	6	37.000	111.000
*	7	68.333	205.000

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	92.667	46.333	0.3606	
2	Factor A	6	4376.571	729.429	5.6765	0.0053
-3	Error	12	1542.000	128.500		
	Total	20	6011.238			

Coefficient of Variation: 11.08%
s_ for means group 1: 4.2845 Number of Observations: 7
 y
s_ for means group 2: 6.5447 Number of Observations: 3
 y

Variable 8: %Inf-Early
Grand Mean = 6.069 Grand Sum = 127.453 Total Count = 21

T A B L E O F M E A N S

1	2	8	Total
1	*	6.435	45.047
2	*	6.053	42.374
3	*	5.719	40.031
*	1	2.718	8.153
*	2	3.062	9.186
*	3	4.696	14.088
*	4	6.394	19.181
*	5	5.850	17.550
*	6	6.920	20.761
*	7	12.845	38.535

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	1.800	0.900	0.3495	
2	Factor A	6	206.852	34.475	13.3887	0.0001
-3	Error	12	30.900	2.575		
	Total	20	239.551			

Coefficient of Variation: 16.44%
s_ for means group 1: 0.6065 Number of Observations: 7
 y
s_ for means group 2: 0.9265 Number of Observations: 3
 y

Variable 9: HF-Mid (No.)
Grand Mean = 8.514 Grand Sum = 178.800 Total Count = 21

T A B L E O F M E A N S

1	2	9	Total
1	*	8.686	60.800
2	*	8.714	61.000
3	*	8.143	57.000
*	1	10.533	31.600
*	2	9.533	28.600
*	3	9.333	28.000
*	4	8.133	24.400
*	5	8.800	26.400
*	6	7.067	21.200
*	7	6.200	18.600

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	1.451	0.726	1.2728	0.3153
2	Factor A	6	40.392	6.732	11.8073	0.0002
-3	Error	12	6.842	0.570		
	Total	20	48.686			

Coefficient of Variation: 8.87%
s_ for means group 1: 0.2854 Number of Observations: 7
 y
s_ for means group 2: 0.4360 Number of Observations: 3
 y

Variable 10: IF-Mid
Grand Mean = 0.543 Grand Sum = 11.400 Total Count = 21

T A B L E O F M E A N S

1	2	10	Total
1	*	0.514	3.600
2	*	0.600	4.200
3	*	0.514	3.600
*	1	0.267	0.800
*	2	0.333	1.000
*	3	0.400	1.200
*	4	0.533	1.600
*	5	0.467	1.400
*	6	0.667	2.000
*	7	1.133	3.400

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.034	0.017	1.6364	0.2353
2	Factor A	6	1.531	0.255	24.3636	0.0000
-3	Error	12	0.126	0.010		
	Total	20	1.691			

Coefficient of Variation: 18.85%
s_ for means group 1: 0.0387 Number of Observations: 7
y
s_ for means group 2: 0.0591 Number of Observations: 3
y

Variable 11: %Inf-Mid
Grand Mean = 6.453 Grand Sum = 135.522 Total Count = 21

T A B L E O F M E A N S

1	2	11	Total
1	*	6.127	42.886
2	*	7.057	49.402
3	*	6.176	43.233
*	1	2.454	7.361
*	2	3.352	10.055
*	3	4.112	12.337
*	4	6.127	18.382
*	5	5.023	15.068
*	6	8.584	25.752
*	7	15.522	46.567

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	3.839	1.920	1.9020	0.1916
2	Factor A	6	360.112	60.019	59.4655	0.0000
-3	Error	12	12.112	1.009		
	Total	20	376.063			

Coefficient of Variation: 15.57%
s_ for means group 1: 0.3797 Number of Observations: 7
y
s_ for means group 2: 0.5800 Number of Observations: 3
y

Variable 12: HF-Mid (Wt.)
Grand Mean = 818.794 Grand Sum = 17194.683 Total Count = 21

T A B L E O F M E A N S

1	2	12	Total
1	*	830.045	5810.318
2	*	831.212	5818.482
3	*	795.126	5565.883
*	1	993.217	2979.650
*	2	954.944	2864.833
*	3	919.494	2758.483
*	4	783.061	2349.182
*	5	852.706	2558.117
*	6	672.206	2016.617
*	7	555.933	1667.800

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	5886.753	2943.377	0.7658	
2	Factor A	6	456334.082	76055.680	19.7882	0.0000
-3	Error	12	46121.922	3843.493		
	Total	20	508342.758			

Coefficient of Variation: 7.57%
s_ for means group 1: 23.4323 Number of Observations: 7
 y
s_ for means group 2: 35.7934 Number of Observations: 3
 y

Variable 13: IF-Mid
Grand Mean = 62.820 Grand Sum = 1319.220 Total Count = 21

T A B L E O F M E A N S

1	2	13	Total
1	*	61.529	430.700
2	*	63.886	447.200
3	*	63.046	441.320
*	1	33.153	99.460
*	2	40.167	120.500
*	3	60.097	180.290
*	4	67.930	203.790
*	5	63.333	190.000
*	6	68.427	205.280
*	7	106.633	319.900

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	19.981	9.991	0.3773	
2	Factor A	6	10134.360	1689.060	63.7919	0.0000
-3	Error	12	317.732	26.478		
	Total	20	10472.073			

Coefficient of Variation: 8.19%
s_ for means group 1: 1.9449 Number of Observations: 7
 y
s_ for means group 2: 2.9708 Number of Observations: 3
 y

Variable 14: %Inf-Mid
Grand Mean = 7.680 Grand Sum = 161.288 Total Count = 21

T A B L E O F M E A N S

1	2	14	Total
1	*	7.429	52.005
2	*	7.778	54.444
3	*	7.834	54.839
*	1	3.230	9.689
*	2	4.040	12.120
*	3	6.140	18.420
*	4	8.044	24.131
*	5	6.938	20.815
*	6	9.263	27.790
*	7	16.107	48.322

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.673	0.337	0.9002	
2	Factor A	6	328.911	54.819	146.6159	0.0000
-3	Error	12	4.487	0.374		
	Total	20	334.071			

Coefficient of Variation: 7.96%
s_ for means group 1: 0.2311 Number of Observations: 7
 y
s_ for means group 2: 0.3530 Number of Observations: 3
 y

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Variable 15: HF-Late (No.)
Grand Mean = 6.448 Grand Sum = 135.400 Total Count = 21

T A B L E O F M E A N S

1	2	15	Total
1	*	6.371	44.600
2	*	6.286	44.000
3	*	6.686	46.800
*	1	7.733	23.200
*	2	7.067	21.200
*	3	6.600	19.800
*	4	6.067	18.200
*	5	6.467	19.400
*	6	5.667	17.000
*	7	5.533	16.600

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.621	0.310	1.4909	0.2641
2	Factor A	6	10.952	1.825	8.7652	0.0008
-3	Error	12	2.499	0.208		
	Total	20	14.072			

Coefficient of Variation: 7.08%
s_ for means group 1: 0.1725 Number of Observations: 7
 y
s_ for means group 2: 0.2635 Number of Observations: 3
 y

==========

Variable 16: IF-Late
Grand Mean = 0.562 Grand Sum = 11.800 Total Count = 21

T A B L E O F M E A N S

1	2	16	Total
1	*	0.543	3.800
2	*	0.514	3.600
3	*	0.629	4.400
*	1	0.267	0.800
*	2	0.333	1.000
*	3	0.467	1.400
*	4	0.533	1.600
*	5	0.533	1.600
*	6	0.533	1.600
*	7	1.267	3.800

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.050	0.025	2.1667	0.1573
2	Factor A	6	1.943	0.324	28.3333	0.0000
-3	Error	12	0.137	0.011		
	Total	20	2.130			

Coefficient of Variation: 19.03%
s_ for means group 1: 0.0404 Number of Observations: 7
y
s_ for means group 2: 0.0617 Number of Observations: 3
y

==========

Variable 17: %Inf-Late
Grand Mean = 8.201 Grand Sum = 172.214 Total Count = 21

T A B L E O F M E A N S

1	2	17	Total
1	*	8.032	56.226
2	*	7.734	54.136
3	*	8.836	61.851
*	1	3.314	9.942
*	2	4.536	13.609
*	3	6.552	19.657
*	4	8.030	24.091
*	5	7.650	22.950
*	6	8.694	26.083
*	7	18.627	55.882

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	4.549	2.274	0.8441	
2	Factor A	6	447.953	74.659	27.7097	0.0000
-3	Error	12	32.332	2.694		
	Total	20	484.834			

Coefficient of Variation: 10.02%
s_ for means group 1: 0.6204 Number of Observations: 7
y
s_ for means group 2: 0.9477 Number of Observations: 3
y

==========

Variable 18: HF-Late (Wt.)
Grand Mean = 611.125 Grand Sum = 12833.624 Total Count = 21

T A B L E O F M E A N S

1	2	18	Total
1	*	606.632	4246.426
2	*	601.246	4208.724
3	*	625.496	4378.474
*	1	744.366	2233.099
*	2	668.241	2004.724
*	3	625.692	1877.076
*	4	573.658	1720.975
*	5	610.424	1831.273
*	6	538.417	1615.251
*	7	517.075	1551.226

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	2270.152	1135.076	0.5995	
2	Factor A	6	110291.450	18381.908	9.7081	0.0005
-3	Error	12	22721.454	1893.454		
	Total	20	135283.056			

Coefficient of Variation: 7.12%
s_ for means group 1: 16.4467 Number of Observations: 7
 y
s_ for means group 2: 25.1227 Number of Observations: 3
 y

Variable 19: IF-Late
Grand Mean = 57.620 Grand Sum = 1210.015 Total Count = 21

T A B L E O F M E A N S

1	2	19	Total
1	*	58.282	407.975
2	*	56.707	396.950
3	*	57.870	405.090
*	1	34.122	102.365
*	2	43.767	131.300
*	3	48.583	145.750
*	4	53.833	161.500
*	5	50.717	152.150
*	6	53.750	161.250
*	7	118.567	355.700

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	9.340	4.670	0.2377	
2	Factor A	6	13851.647	2308.608	117.4981	0.0000
-3	Error	12	235.776	19.648		
	Total	20	14096.763			

Coefficient of Variation: 7.69%
s_ for means group 1: 1.6754 Number of Observations: 7
 y
s_ for means group 2: 2.5592 Number of Observations: 3
 y

Variable 20: %Inf-late
Grand Mean = 8.840 Grand Sum = 185.631 Total Count = 21

T A B L E O F M E A N S

1	2	20	Total
1	*	8.911	62.379
2	*	8.834	61.837
3	*	8.774	61.415
*	1	4.379	13.136
*	2	6.161	18.483
*	3	7.231	21.694
*	4	8.599	25.798
*	5	7.748	23.244
*	6	9.089	27.266
*	7	18.670	56.009

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.067	0.033	0.0459	
2	Factor A	6	382.799	63.800	87.8018	0.0000
-3	Error	12	8.720	0.727		
	Total	20	391.586			

Coefficient of Variation: 9.64%
s_ for means group 1: 0.3222 Number of Observations: 7
y
s_ for means group 2: 0.4922 Number of Observations: 3
y

==========

Variable 21: THF (No.)
Grand Mean = 20.619 Grand Sum = 433.000 Total Count = 21

T A B L E O F M E A N S

1	2	21	Total
1	*	20.657	144.600
2	*	20.629	144.400
3	*	20.571	144.000
*	1	25.267	75.800
*	2	23.133	69.400
*	3	22.133	66.400
*	4	19.267	57.800
*	5	20.800	62.400
*	6	17.400	52.200
*	7	16.333	49.000

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.027	0.013	0.0090	
2	Factor A	6	182.419	30.403	20.6046	0.0000
-3	Error	12	17.707	1.476		
	Total	20	200.152			

Coefficient of Variation: 5.89%
s_ for means group 1: 0.4591 Number of Observations: 7
y
s_ for means group 2: 0.7013 Number of Observations: 3
y

==========

Variable 22: TIF
Grand Mean = 1.381 Grand Sum = 29.000 Total Count = 21

T A B L E O F M E A N S

1	2	22	Total
1	*	1.371	9.600
2	*	1.371	9.600
3	*	1.400	9.800
*	1	0.667	2.000
*	2	0.800	2.400
*	3	1.067	3.200
*	4	1.333	4.000
*	5	1.267	3.800
*	6	1.467	4.400
*	7	3.067	9.200

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.004	0.002	0.0723	
2	Factor A	6	11.432	1.905	72.3133	0.0000
-3	Error	12	0.316	0.026		
	Total	20	11.752			

Coefficient of Variation: 11.75%
s_ for means group 1: 0.0614 Number of Observations: 7
 y
s_ for means group 2: 0.0937 Number of Observations: 3
 y

==========

Variable 23: TInf.
Grand Mean = 6.625 Grand Sum = 139.119 Total Count = 21

T A B L E O F M E A N S

1	2	23	Total
1	*	6.577	46.042
2	*	6.675	46.725
3	*	6.622	46.351
*	1	2.566	7.697
*	2	3.362	10.085
*	3	4.593	13.778
*	4	6.467	19.400
*	5	5.762	17.287
*	6	7.779	23.337
*	7	15.845	47.535

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.033	0.017	0.0202	
2	Factor A	6	355.112	59.185	71.4748	0.0000
-3	Error	12	9.937	0.828		
	Total	20	365.082			

Coefficient of Variation: 13.74%
s_ for means group 1: 0.3439 Number of Observations: 7
 y
s_ for means group 2: 0.5254 Number of Observations: 3
 y

==========

Variable 24: THF-Wt.
Grand Mean = 2033.541 Grand Sum = 42704.352 Total Count = 21

T A B L E O F M E A N S

1	2	24	Total
1	*	2039.632	14277.425
2	*	2036.482	14255.371
3	*	2024.508	14171.557
*	1	2489.628	7468.885
*	2	2331.464	6994.393
*	3	2208.283	6624.849
*	4	1900.501	5701.504
*	5	2060.609	6181.828
*	6	1707.729	5123.186
*	7	1536.569	4609.708

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	891.400	445.700	0.0524	
2	Factor A	6	2096627.134	349437.856	41.0655	0.0000
-3	Error	12	102111.416	8509.285		
	Total	20	2199629.949			

Coefficient of Variation: 4.54%
s_ for means group 1: 34.8656 Number of Observations: 7
 y
s_ for means group 2: 53.2581 Number of Observations: 3
 y

==========

Variable 25: TIF
Grand Mean = 156.916 Grand Sum = 3295.235 Total Count = 21

T A B L E O F M E A N S

1	2	25	Total
1	*	159.239	1114.675
2	*	155.879	1091.150
3	*	155.630	1089.410
*	1	89.275	267.825
*	2	105.600	316.800
*	3	141.347	424.040
*	4	158.763	476.290
*	5	150.717	452.150
*	6	159.177	477.530
*	7	293.533	880.600

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	56.894	28.447	0.2507	
2	Factor A	6	78486.876	13081.146	115.2909	0.0000
-3	Error	12	1361.545	113.462		
	Total	20	79905.315			

Coefficient of Variation: 6.79%
s_ for means group 1: 4.0260 Number of Observations: 7
 y
s_ for means group 2: 6.1499 Number of Observations: 3
 y

==========

Variable 26: TInf.
Grand Mean = 7.562 Grand Sum = 158.797 Total Count = 21

T A B L E O F M E A N S

1	2	26	Total
1	*	7.602	53.214
2	*	7.578	53.048
3	*	7.505	52.535
*	1	3.458	10.373
*	2	4.352	13.056
*	3	6.021	18.063
*	4	7.704	23.111
*	5	6.828	20.484
*	6	8.533	25.598
*	7	16.037	48.112

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.036	0.018	0.0811	
2	Factor A	6	308.573	51.429	233.5271	0.0000
-3	Error	12	2.643	0.220		
	Total	20	311.251			

Coefficient of Variation: 6.21%
s_ for means group 1: 0.1774 Number of Observations: 7
y
s_ for means group 2: 0.2709 Number of Observations: 3
y

==========

Variable 27: Length-HF
Grand Mean = 23.377 Grand Sum = 490.912 Total Count = 21

T A B L E O F M E A N S

1	2	27	Total
1	*	23.250	162.750
2	*	23.320	163.242
3	*	23.560	164.921
*	1	26.248	78.744
*	2	24.829	74.487
*	3	24.291	72.872
*	4	22.683	68.050
*	5	23.197	69.590
*	6	21.457	64.370
*	7	20.933	62.800

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.370	0.185	0.0568	
2	Factor A	6	64.074	10.679	3.2770	0.0380
-3	Error	12	39.106	3.259		
	Total	20	103.549			

Coefficient of Variation: 7.72%
s_ for means group 1: 0.6823 Number of Observations: 7
y
s_ for means group 2: 1.0422 Number of Observations: 3
y

==========

Variable 28: Length-IF
Grand Mean = 19.686 Grand Sum = 413.398 Total Count = 21

T A B L E O F M E A N S

1	2	28	Total
1	*	20.057	140.400
2	*	19.554	136.875
3	*	19.446	136.123
*	1	22.292	66.875
*	2	21.592	64.775
*	3	21.058	63.175
*	4	19.250	57.750
*	5	19.083	57.248
*	6	17.458	52.375
*	7	17.067	51.200

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	1.490	0.745	0.5690	
2	Factor A	6	74.045	12.341	9.4287	0.0006
-3	Error	12	15.706	1.309		
	Total	20	91.241			

Coefficient of Variation: 5.81%
s_ for means group 1: 0.4324 Number of Observations: 7
 y
s_ for means group 2: 0.6605 Number of Observations: 3
 y

Variable 29: Girth_Healthy
Grand Mean = 8.291 Grand Sum = 174.102 Total Count = 21

T A B L E O F M E A N S

1	2	29	Total
1	*	8.291	58.034
2	*	8.425	58.976
3	*	8.156	57.092
*	1	9.308	27.924
*	2	9.092	27.276
*	3	8.630	25.890
*	4	8.012	24.036
*	5	8.288	24.864
*	6	7.532	22.596
*	7	7.172	21.516

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.254	0.127	0.5280	
2	Factor A	6	11.091	1.848	7.6989	0.0015
-3	Error	12	2.881	0.240		
	Total	20	14.225			

Coefficient of Variation: 5.91%
s_ for means group 1: 0.1852 Number of Observations: 7
 y
s_ for means group 2: 0.2829 Number of Observations: 3
 y

Variable 30: Girth_Infested
Grand Mean = 7.742 Grand Sum = 162.585 Total Count = 21

T A B L E O F M E A N S

1	2	30	Total
1	*	7.742	54.195
2	*	7.854	54.980
3	*	7.630	53.410
*	1	8.590	25.770
*	2	8.410	25.230
*	3	8.025	24.075
*	4	7.510	22.530
*	5	7.740	23.220
*	6	7.110	21.330
*	7	6.810	20.430

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.176	0.088	0.5280	
2	Factor A	6	7.702	1.284	7.6989	0.0015
-3	Error	12	2.001	0.167		
	Total	20	9.879			

Coefficient of Variation: 5.27%
s_ for means group 1: 0.1543 Number of Observations: 7
y
s_ for means group 2: 0.2357 Number of Observations: 3
y

==========

Variable 31: Single fruit Weight
Grand Mean = 76.848 Grand Sum = 1613.805 Total Count = 21

T A B L E O F M E A N S

1	2	31	Total
1	*	76.604	536.226
2	*	76.566	535.960
3	*	77.374	541.619
*	1	85.342	256.025
*	2	84.820	254.460
*	3	82.389	247.166
*	4	73.767	221.300
*	5	75.689	227.066
*	6	68.956	206.867
*	7	66.973	200.920

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	2.913	1.456	0.1186	
2	Factor A	6	1011.110	168.518	13.7246	0.0001
-3	Error	12	147.342	12.279		
	Total	20	1161.364			

Coefficient of Variation: 4.56%
s_ for means group 1: 1.3244 Number of Observations: 7
y
s_ for means group 2: 2.0231 Number of Observations: 3
y

==========

Variable 32: Edible portion
Grand Mean = 88.800 Grand Sum = 1864.802 Total Count = 21

T A B L E O F M E A N S

1	2	32	Total
1	*	89.825	628.776
2	*	88.081	616.564
3	*	88.495	619.463
*	1	95.770	287.311
*	2	94.177	282.530
*	3	92.361	277.083
*	4	88.151	264.454
*	5	89.660	268.980
*	6	85.153	255.460
*	7	76.328	228.985

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	11.632	5.816	0.3394	
2	Factor A	6	780.528	130.088	7.5928	0.0016
-3	Error	12	205.598	17.133		
	Total	20	997.758			

Coefficient of Variation: 6.66%
s_ for means group 1: 1.5645 Number of Observations: 7
 y
s_ for means group 2: 2.3898 Number of Observations: 3
 y

==========

Variable 33: Non Edible Portion
Grand Mean = 11.200 Grand Sum = 235.198 Total Count = 21

T A B L E O F M E A N S

1	2	33	Total
1	*	10.175	71.224
2	*	11.919	83.436
3	*	11.505	80.537
*	1	4.230	12.689
*	2	5.823	17.470
*	3	7.639	22.917
*	4	11.849	35.546
*	5	10.340	31.020
*	6	14.847	44.540
*	7	23.672	71.015

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	11.632	5.816	0.3394	
2	Factor A	6	780.528	130.088	7.5928	0.0016
-3	Error	12	205.598	17.133		
	Total	20	997.758			

Coefficient of Variation: 16.96%
s_ for means group 1: 1.5645 Number of Observations: 7
 y
s_ for means group 2: 2.3898 Number of Observations: 3
 y

==========

Variable 34: Yield/Plot
Grand Mean = 26.307 Grand Sum = 552.444 Total Count = 21

T A B L E O F M E A N S

1	2	34	Total
1	*	26.307	184.150
2	*	25.726	180.082
3	*	26.888	188.213
*	1	29.954	89.863
*	2	28.985	86.954
*	3	28.500	85.500
*	4	25.591	76.774
*	5	27.773	83.318
*	6	25.105	75.314
*	7	18.240	54.720

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	4.723	2.361	0.5957	
2	Factor A	6	283.398	47.233	11.9156	0.0002
-3	Error	12	47.567	3.964		
	Total	20	335.688			

Coefficient of Variation: 7.57%
s_ for means group 1: 0.7525 Number of Observations: 7
 y
s_ for means group 2: 1.1495 Number of Observations: 3
 y

==========

Variable 35: Yield/Hectare
Grand Mean = 43.845 Grand Sum = 920.740 Total Count = 21

T A B L E O F M E A N S

1	2	35	Total
1	*	43.845	306.916
2	*	42.877	300.136
3	*	44.813	313.688
*	1	49.924	149.772
*	2	48.308	144.924
*	3	47.500	142.500
*	4	42.652	127.956
*	5	46.288	138.864
*	6	41.841	125.524
*	7	30.400	91.200

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	13.118	6.559	0.5957	
2	Factor A	6	787.217	131.203	11.9156	0.0002
-3	Error	12	132.132	11.011		
	Total	20	932.468			

Coefficient of Variation: 7.57%
s_ for means group 1: 1.2542 Number of Observations: 7
 y
s_ for means group 2: 1.9158 Number of Observations: 3
 y

==========

Variable 36: HS_Early
Grand Mean = 19.552 Grand Sum = 410.600 Total Count = 21

T A B L E O F M E A N S

1	2	36	Total
1	*	19.571	137.000
2	*	19.429	136.000
3	*	19.657	137.600
*	1	22.200	66.600
*	2	21.400	64.200
*	3	21.200	63.600
*	4	18.467	55.400
*	5	20.067	60.200
*	6	17.400	52.200
*	7	16.133	48.400

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.187	0.093	0.0370	
2	Factor A	6	92.712	15.452	6.1210	0.0039
-3	Error	12	30.293	2.524		
	Total	20	123.192			

Coefficient of Variation: 8.13%
s_ for means group 1: 0.6005 Number of Observations: 7
 y
s_ for means group 2: 0.9173 Number of Observations: 3
 y

==========

Variable 37: IS_Early
Grand Mean = 1.219 Grand Sum = 25.600 Total Count = 21

T A B L E O F M E A N S

1	2	37	Total
1	*	1.229	8.600
2	*	1.257	8.800
3	*	1.171	8.200
*	1	0.800	2.400
*	2	0.933	2.800
*	3	1.000	3.000
*	4	1.067	3.200
*	5	1.067	3.200
*	6	1.200	3.600
*	7	2.467	7.400

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.027	0.013	0.6667	
2	Factor A	6	5.726	0.954	47.7143	0.0000
-3	Error	12	0.240	0.020		
	Total	20	5.992			

Coefficient of Variation: 11.60%
s_ for means group 1: 0.0535 Number of Observations: 7
 y
s_ for means group 2: 0.0816 Number of Observations: 3
 y

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Variable 38: %IS_Early
Grand Mean = 6.071 Grand Sum = 127.496 Total Count = 21

T A B L E O F M E A N S

1	2	38	Total
1	*	6.093	42.653
2	*	6.229	43.600
3	*	5.892	41.243
*	1	3.481	10.443
*	2	4.187	12.560
*	3	4.508	13.525
*	4	5.468	16.403
*	5	5.078	15.234
*	6	6.524	19.573
*	7	13.253	39.758

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.402	0.201	0.6364	
2	Factor A	6	197.497	32.916	104.2593	0.0000
-3	Error	12	3.789	0.316		
	Total	20	201.687			

Coefficient of Variation: 9.25%
s_ for means group 1: 0.2124 Number of Observations: 7
 y
s_ for means group 2: 0.3244 Number of Observations: 3
 y

==========

Variable 39: HS_Mid
Grand Mean = 25.324 Grand Sum = 531.800 Total Count = 21

T A B L E O F M E A N S

1	2	39	Total
1	*	25.486	178.400
2	*	24.971	174.800
3	*	25.514	178.600
*	1	29.467	88.400
*	2	28.533	85.600
*	3	26.600	79.800
*	4	23.667	71.000
*	5	25.467	76.400
*	6	22.533	67.600
*	7	21.000	63.000

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	1.307	0.653	0.2743	
2	Factor A	6	175.025	29.171	12.2452	0.0002
-3	Error	12	28.587	2.382		
	Total	20	204.918			

Coefficient of Variation: 6.09%
s_ for means group 1: 0.5834 Number of Observations: 7
 y
s_ for means group 2: 0.8911 Number of Observations: 3
 y

==========

Variable 40: IS_Mid
Grand Mean = 1.867 Grand Sum = 39.200 Total Count = 21

T A B L E O F M E A N S

1	2	40	Total
1	*	1.914	13.400
2	*	1.857	13.000
3	*	1.829	12.800
*	1	1.067	3.200
*	2	1.333	4.000
*	3	1.533	4.600
*	4	1.667	5.000
*	5	1.600	4.800
*	6	2.000	6.000
*	7	3.867	11.600

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.027	0.013	0.2727	
2	Factor A	6	15.493	2.582	52.8182	0.0000
-3	Error	12	0.587	0.049		
	Total	20	16.107			

Coefficient of Variation: 11.85%
s_ for means group 1: 0.0836 Number of Observations: 7
y
s_ for means group 2: 0.1277 Number of Observations: 3
y

==========

Variable 41: %IS_Mid
Grand Mean = 7.092 Grand Sum = 148.941 Total Count = 21

T A B L E O F M E A N S

1	2	41	Total
1	*	7.250	50.747
2	*	7.139	49.971
3	*	6.889	48.224
*	1	3.489	10.466
*	2	4.459	13.378
*	3	5.469	16.407
*	4	6.605	19.816
*	5	5.911	17.733
*	6	8.158	24.473
*	7	15.556	46.668

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.477	0.239	0.3388	
2	Factor A	6	290.863	48.477	68.8530	0.0000
-3	Error	12	8.449	0.704		
	Total	20	299.789			

Coefficient of Variation: 11.83%
s_ for means group 1: 0.3171 Number of Observations: 7
y
s_ for means group 2: 0.4844 Number of Observations: 3
y

==========

Variable 42: HS_Late
Grand Mean = 29.353 Grand Sum = 616.409 Total Count = 21

T A B L E O F M E A N S

1	2	42	Total
1	*	29.686	207.800
2	*	29.629	207.405
3	*	28.744	201.205
*	1	33.733	101.200
*	2	32.868	98.605
*	3	31.600	94.800
*	4	28.535	85.605
*	5	30.267	90.800
*	6	25.667	77.000
*	7	22.800	68.400

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	3.909	1.955	0.7168	
2	Factor A	6	283.884	47.314	17.3501	0.0000
-3	Error	12	32.724	2.727		
	Total	20	320.517			

Coefficient of Variation: 5.63%
s_ for means group 1: 0.6242 Number of Observations: 7
 y
s_ for means group 2: 0.9534 Number of Observations: 3
 y

==========

Variable 43: IS_Late
Grand Mean = 2.657 Grand Sum = 55.804 Total Count = 21

T A B L E O F M E A N S

1	2	43	Total
1	*	2.572	18.004
2	*	2.714	19.000
3	*	2.686	18.800
*	1	1.268	3.804
*	2	1.533	4.600
*	3	2.400	7.200
*	4	2.667	8.000
*	5	2.533	7.600
*	6	2.933	8.800
*	7	5.267	15.800

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.079	0.040	0.4943	
2	Factor A	6	30.479	5.080	63.3704	0.0000
-3	Error	12	0.962	0.080		
	Total	20	31.520			

Coefficient of Variation: 10.65%
s_ for means group 1: 0.1070 Number of Observations: 7
 y
s_ for means group 2: 0.1635 Number of Observations: 3
 y

==========

Variable 44: %IS_Late
Grand Mean = 8.637 Grand Sum = 181.378 Total Count = 21

T A B L E O F M E A N S

1	2	44	Total
1	*	8.301	58.109
2	*	8.804	61.627
3	*	8.806	61.642
*	1	3.622	10.866
*	2	4.454	13.363
*	3	7.060	21.179
*	4	8.565	25.695
*	5	7.739	23.218
*	6	10.272	30.816
*	7	18.747	56.241

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	1.184	0.592	1.1467	0.3502
2	Factor A	6	452.480	75.413	146.1170	0.0000
-3	Error	12	6.193	0.516		
	Total	20	459.857			

Coefficient of Variation: 8.32%
s_ for means group 1: 0.2715 Number of Observations: 7
 y
s_ for means group 2: 0.4148 Number of Observations: 3
 y

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Variable 45: Plant height
Grand Mean = 113.683 Grand Sum = 2387.350 Total Count = 21

T A B L E O F M E A N S

1	2	45	Total
1	*	115.346	807.422
2	*	111.782	782.475
3	*	113.922	797.454
*	1	124.078	372.233
*	2	120.988	362.965
*	3	117.619	352.858
*	4	111.233	333.700
*	5	115.498	346.495
*	6	104.867	314.600
*	7	101.500	304.500

A N A L Y S I S O F V A R I A N C E T A B L E

K Value	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	45.053	22.526	0.5556	
2	Factor A	6	1237.071	206.178	5.0850	0.0082
-3	Error	12	486.556	40.546		
	Total	20	1768.680			

Coefficient of Variation: 5.60%
s_ for means group 1: 2.4067 Number of Observations: 7
 y
s_ for means group 2: 3.6763 Number of Observations: 3
 y

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Appendix III. Analysis of variance of the data on shoots per plant by number and weight as influenced by some botanicals and bio-control agents in controlling BSFB at early harvesting stage

Source of variation	Degrees of freedom	Mean square					
		Brinjal fruit by number			Brinjal fruit by weight (g)		
		Healthy	Infested	% infestation	Healthy	Infested	% infestation
Replication	2						
Treatment	6						
Error	12						

**: Significant at 0.01 level of probability

Appendix IV. Analysis of variance of the data on fruit per plant by number and weight as influenced by some botanicals and bio-control agents in controlling BSFB at early harvesting stage

Source of variation	Degrees of freedom	Mean square					
		Brinjal fruit by number			Brinjal fruit by weight (g)		
		Healthy	Infested	% infestation	Healthy	Infested	% infestation
Replication	2						
Treatment	6						
Error	12						

**: Significant at 0.01 level of probability

Appendix V. Analysis of variance of the data on fruit per plant by number and weight as influenced by some botanicals and bio-control agents in controlling BSFB at mid harvesting stage

Source of variation	Degrees of freedom	Mean square					
		Brinjal fruit by number			Brinjal fruit by weight (g)		
		Healthy	Infested	% infestation	Healthy	Infested	% infestation
Replication	2						
Treatment	6						
Error	12						

**: Significant at 0.01 level of probability

Appendix VI. Analysis of variance of the data on fruit per plant by number and weight as influenced by some botanicals and bio-control agents in controlling BSFB at late harvesting stage

Source of variation	Degrees of freedom	Mean square					
		Brinjal fruit by number			Brinjal fruit by weight (g)		
		Healthy	Infested	% infestation	Healthy	Infested	% infestation
Replication	2						
Treatment	6						
Error	12						

**: Significant at 0.01 level of probability

Appendix VII. Analysis of variance of the data on fruit per plant by number and weight as influenced by some botanicals and bio-control agents in controlling BSFB at throughout the growing season

Source of variation	Degrees of freedom	Mean square					
		Brinjal fruit by number			Brinjal fruit by weight (g)		
		Healthy	Infested	% infestation	Healthy	Infested	% infestation
Replication	2						
Treatment	6						
Error	12						

**: Significant at 0.01 level of probability

Appendix VIII. Analysis of variance of the data on healthy and infested fruit per plant as influenced by some botanicals and bio-control agents

Source of variation	Degrees of freedom	Plant height (cm)	Mean square			
			Length		Girth	
			Healthy	Infested	Healthy	Infested
Replication	2					
Treatment	6					
Error	12					

**: Significant at 0.01 level of probability

Appendix IX. Analysis of variance of the data on yield contributing characters and yield of brinjal gourd as influenced by some botanicals and bio-control agents in controlling BSFB at throughout the growing season

Source of variation	Degrees of freedom	Mean square				
		Single fruit weight	Edible portion	Non edible portion	Yield per plot	Yield per hectare
Replication						
Treatment	6					
Error	12					

**: Significant at 0.01 level of probability