COMPATIBILITY OF CERTAIN FUNGICIDES AND INSECTICIDES USED FOR THE CONTROL OF MAJOR DISEASES AND INSECT PESTS INFESTING THE RICE CROP

By

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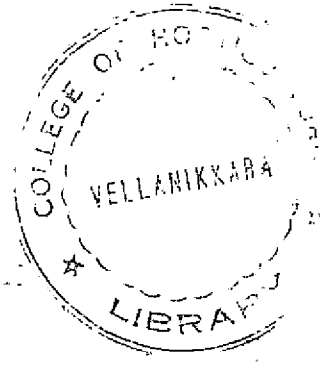

THESIS

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Master of Science in Agriculture

Faculty of Agriculture
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Department of Plant Pathology
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DECLARATION

I hereby declare that this thesis entitled "**Compatibility of certain fungicides and insecticides used for the control of major diseases and insect pests infesting the rice crop**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Vellanikkara,
7 - 9 -1992.

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CERTIFICATE

Certified that this thesis entitled "Compatibility of certain fungicides and insecticides used for the control of major diseases and insect pests infesting the rice crop" is a record of research work done independently by **Miss.Kalpana, T.A.** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associate-ship to her.

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CERTIFICATE

We, the undersigned members of the Advisory Committee of **Miss.Kalpana, T.A.**, a candidate for the degree of Master of Science in Agriculture, agree that the thesis entitled "Compatibility of certain fungicides and insecticides used for the control of major diseases and insect pests infesting the rice crop" may be submitted by Miss.Kalpana, T.A. in partial fulfilment of the requirement for the degree.

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Kalpana, T.A.

To my parents

CONTENTS

LIST OF TABLES

Introduction

INTRODUCTION

Rice is the staple food of more than 60 per cent of the world's inhabitants, which contribute 50 per cent of our total food production. In India, rice, the most important and extensively grown food crop, occupying about 40 million hectares, which is about 40 per cent of the total area under cereals in the country. Though the introduction of high yielding varieties and improved farming technology have resulted in the green revolution, the increased incidence of insect pests and diseases, still remains one of the important limiting factors in achieving the expected potential yield. The phenomenal green revolution in food grain crops, became a reality, only with the adoption of intensive plant protection measures.

The diseases and insect-pests affecting rice crop, are the major biological constraints, in rice production. Since rice is grown under different climatic condition, it is susceptible to a large number of pests. Of the various fungal diseases, rice blast caused by Pyricularia oryzae Cavara and sheath blight caused by Rhizoctonia solani Kuhn. and among insect pets, the brown planthopper, Nilaparvata lugens Stal. and the rice leaffolder Cnaphaloerocis medinalis Guen. deserve special attention.

Pesticides play an integral role in the control of pests such as fungi, insects and weeds, on field crops and orchards to produce and conserve food grains, fruits and vegetables.

Very often farmers face disease and insect-pest problems simultaneously in his field, but the combination of effective fungicides and insecticides have not been formulated as a recommendation. The advantage of applying insecticides and fungicides together could be striking. Ease of application, proper timing, increased application efficiency and reduced application costs will be achieved, if combined application turns out to be effective. This technology will particularly be advantageous in a state like Kerala, where the cost of labour is very high.

As a rule, a fungicide compatible with one or groups of insecticide need not necessarily be compatible with others also. Physical, chemical and phytotoxic incompatibilities may arise in the combined use of fungicides and insecticides (Sharvelle, 1979). Synergistic effect of fungicide-insecticide combination (KAU, 1981, 1987) and antagonistic effect of combinations (Gradis and Sutton, 1981 and Babu, 1988) have also been reported by many workers.

Considering all these aspects, detailed investigations were, therefore, undertaken to study the compatibility of fungicides and insecticides used for the control of major diseases and insect-pests infesting rice crop.

Review of Literature

REVIEW OF LITERATURE

2.1 Incidence of blast and sheath blight on rice

Rice blast is one of the earliest known diseases of rice and is reported as early as in 1913. The devastating epidemic nature of the disease was reported in 1919 from the Tanjore delta area of Tamil Nadu (Padmanabhan, 1965). The disease is caused by Pyricularia oryzae, which was named by Cavara (1891) and was described by Shirai (1896).

Blast is generally considered as the most disastrous disease of rice because of its wide distribution and its destructiveness under favourable conditions. Rice seedlings or plants at tillering stage are more susceptible to the disease and are often completely killed. Several studies have been made to estimate the yield losses due to panicle blast and leaf blast (Goto, 1965; Exconde and Raymundo, 1970; Awoderu and Esuruoso, 1975). In India, an yield loss of 2,66,000 tons of rice has been reported during the year 1960-61 by Padmanabhan (1965).

Miyake (1910) first described sheath blight disease in Japan and named the causal organism Sclerotium irregulare. The first Indian report on the incidence of the disease was

from Punjab in 1963 (Paracer and Chahal, 1963). In Kerala, the disease occurred in a severe form after the introduction of high yielding varieties. The disease is caused by Rhizoctonia solani Kuhn (PS. Thanatephorus cucumeris (Frank) Donk) (OU, 1973; Gangopadhyay, 1983). About 20 per cent reduction in yield has been estimated due to the development of the disease upto the flag leaf stage. According to Hori (1969) this disease can cause 25 per cent loss in yield when the pathogen attacks the uppermost flag leaf.

2.2 Incidence of brown planthopper and leaffolder

Brown planthopper, Nilaparvata lugens (Stal.) is a major pest of rice in most tracts of India (Rai and Zutrhi, 1969 ; Abraham and Nair, 1975). In Kerala, till 1973 this has been a minor pest. From 1973 onwards it has assumed importance as the most important pest. The pest occurs in all the growth stages of the crop under favourable conditions, but usually causes serious damage when they infect the crop at booting and hard dough stages (Alam et al., 1978; Natarajan and Palchamy, 1978; Sogawa and Kusumayadi, 1984).

Guenu (1854) made detailed studies on the insect leaffolder and named it as Cnaphalocrocis medinalis. The first record of this pest in India was that of Lefroy (1909). Severe incidence of this pest has been reported from Kerala (Rajamma and Das, 1969) and Madras (Anon, 1971).

2.3 Control measures

2.3.1 Chemical control of blast disease

A number of fungicides have been tested against blast disease by various workers.

Kameshwar Row (1976) reported that Hinosan as the best fungicide against rice blast. Superiority of Hinosan was also reported by many workers (Subramanian and Ramaswamy, 1973; Nair and Tony, 1974; Shah, 1979). The effectiveness of dust formulation of Hinosan against blast was reported by Yamaguchi (1974). The therapeutic effect of Hinosan was found out by Mohiuddin et al. (1978). Kueh et al. (1983) reported that, leaf blast caused by P. oryzae was well reduced by Hinosan. The efficiency of Hinosan against blast disease was also reported by Kempf in the same year. Lewin et al. (1986) achieved significant control of blast disease on rice with ediphenphos. Mohit Singh and Shukla (1987) noticed effective control of P. oryzae with 4 sprays of Hinosan at 15 days intervals from treating the seed with Agallol-3. Reddy and Satyanarayanan (1988) obtained good control of P. oryzae with different formulations of ediphenphos. Naidu and Reddy (1989) observed that, ediphenphos reduced leaf blast but not neck blast.

Fabregat et al. (1985) conducted field trials against P. oryzae using various fungicides and found that, carbendazim

50 per cent one kg ha^{-1} ai ensured adequate protection of the foliage. An economic schedule for chemical control of rice blast disease was given by Sannegowda and Pandurangegowda (1986). They found out that, Bavistin (carbendazim) one g l^{-1} spray at tillering + Hinosan (ediphenphos) one g l^{-1} at heading and after flowering gave the best profit. Tewari and Row (1986) and Reddy and Satyanarayana (1988) found that, all the formulations of carbendazim were effective in reducing the disease with significant increase in yield. Naidu and Reddy (1989) also reported the effectiveness of carbendazim against leaf blast.

Effectiveness of the fungicide Benlate (benomyl) against rice blast disease was reported by Kempf (1983) and Kuch et al. (1985). Rao and Muralidharan (1986) also reported that, Benlate was more effective in controlling of leaf blast in dry paddy nursery.

Several systemic fungicides were also tried against rice diseases. Fukunaga (1966) found out the effectiveness of kitazin against blast disease. Similar findings were also reported by many workers (Benlloch, 1975; Row and Padmanabhan, 1976; Kempf, 1983).

Lakshmanan et al. (1980) reported that Vitavax was very effective in controlling rice blast disease.

Isoprothiolane 40 E.C. as root dip for 12 h before transplanting followed by one spray at panicle initiation and one at heading reduced incidence of P. oryzae (Verma and Kumar, 1985). Fabregat et al. (1985) conducted field trials against P. oryzae and concluded that isoprothiolane 40 per cent at 0.8 and 1.2 l ha^{-1} ai gave good control of the disease. Its effectiveness against rice blast was also reported by Lewin et al. (1986) and Naidu and Reddy (1989).

Tomiya et al. (1990) reported the antifungal activity of phosphazomycin-C against P. oryzae.

2.3.2 Chemical control of sheath blight disease

Yamaguchi (1974) reported that, Hinosan was very effective against Corticium sasakii , the sheath blight organism. Mathai and Nair (1976) have evaluated seven fungicides against C. sasakii in the field and observed reduction in disease intensity and pronounced increase in yield in the case of Hinosan as compared to other six fungicides.

Effectiveness of ediphenphos in controlling sheath blight organism in field was proved by many workers also (Mukherjee, 1978; Varadarajan and Rajan, 1978; Kannaiyan and Prasad, 1979; Rajan et al., 1979; Lakshmanan et al., 1980;

Gokulapalan, 1981; Roy, 1981; Lulu Das, 1986; Annie Thomas, 1987).

Efficacy of Hinosan and Kitazin against sheath blight disease have been reported by Kannaiyan and Prasad (1977); Jaganathan and Kannaiyan (1978); Rajan et al. (1979); Kannaiyan and Prasad (1979) and Dev and Satyarajan (1980).

Varma and Menon (1977) conducted a field trial with six fungicides against the sheath blight disease and they observed that Kitazin in the granular form was better and the most effective in reducing the C. sasakii infection and increasing the yield.

Bhaktavatsalam et al. (1977) opined that, Bavistin was the most effective fungicide.

Superiority of carbendazim against R. solani was reported by many workers (Dev and Satyarajan, 1980; Lakshmanan et al., 1980; Lee and Courtney, 1981; Reddy et al., 1981; Roy, 1981; Arunyanart et al., 1986; Dev and Mary, 1986; Tobari and Binesh, 1987; Paromita, 1988).

In vitro studies using various fungicides against R. solani showed that the fungus was highly sensitive to carbendazim (Behva et al., 1982; Kesavan, 1984; Martin et al.,

1984; Prasad and Hiremath, 1985; Lakshmanan and Nair, 1986; Sha, 1986; Jones et al., 1987; Tobari and Binesh, 1987).

Growth and Rush (1988) in their experiment found that, Benlate 50 WP (benomyl) gave good control of R. solani and is improved by addition of a surfactant.

Kannaiyan and Prasad (1979) observed that Vitavax (Carboxin) completely inhibited the sclerotial germination.

Varadarajan and Rajan (1978) reported captafol to be effective against sheath blight, but Roy (1981) considered this chemical to be less effective compared to carbendazim and ediphenphos.

Rajan et al. (1979) reported good control of the disease by spraying Dithane Z-78 or Dithane M-45.

Validamycin was also reported as very effective treatment for controlling sheath blight by many workers (Dev and Mary, 1986; Arunyanart et al., 1986; Devi et al., 1987; Izadyar and Baradaran, 1989).

Trials conducted by Ahmed et al. (1988) with seven fungicides to control sheath blight revealed that, propiconazole and thiophanate - methyl + thiram gave the best control of the disease.

Suryadai and Kadir (1989) based on their trials conducted against sheath blight, concluded that, Triazole was the most effective fungicide.

2.3.3 Chemical control of Brown planthopper (Nilaparvata lugens Stal.)

Various chemicals have been evaluated against BPH. Effectiveness of monocrotophos in controlling BPH was reported by various workers (Skaria and Das, 1981; Rao et al., 1984; Patel et al., 1986).

Quinalphos was also found effective against BPH (Balasubrahamonian and Michael, 1976; Skaria and Das, 1981; Rao et al., 1984; Pillai and Nair, 1986; KAU, 1986)

Patnaik et al. (1986) conducted field trials with 12 granular insecticides and found that carbofuran was the most effective. Efficacy of carbofuran was also found out by Murthy et al. (1988). Murthy et al. (1990) observed that, carbofuran at one kg ai ha^{-1} gave complete protection against N. lugens.

Effectiveness of BPMC (fenobucarb) against BPH was reported by Patnaik et al. (1986) and Krishnaiah and Buchaiah, 1987).

Huang et al. (1989) showed that, Applaud (buprofezin) gave the best results, being effective against the pest and harmless to most natural enemies present. Its efficiency was also reported by Lu and Gong (1990) and Pan and Zhao (1990).

2.3.4 Chemical control of leaffolder (Cnaphalocrocis medinalis Guen.)

Effectiveness of monocrotophos in controlling leaffolder (C. medinalis) was reported by many workers (Endo and Masuda, 1983; Ray, 1985; Sain et al., 1987; Raju et al., 1988; Pandya et al., 1989).

Superiority of quinalphos against leaffolder was proved by many workers (Godase and Dumbre, 1985; Sain et al., 1987; Raju et al., 1988).

Raju et al. (1988) reported phosphamidon to be effective against leaffolder eggs.

Panda and Shi (1989) reported the effectiveness of phosalone against rice leaffolder.

Carbofuran was also found effective against leaffolder (Valencia and Heinrichs, 1981; Saroja and Raju, 1982; Balasubramanian et al., 1983; Pillai and Nair, 1984; Sundararaju, 1985; Murthy et al., 1988; Kandasamy and

Ravikumar, 1986; Pandya et al., 1989; Murthy et al., 1990). But, Panda and Shi (1989) opined that plots treated with carbofuran (Carbofuran 3 G at one kg ai ha^{-1}) had more leaf damage than untreated plots.

Effectiveness of Chlorpyriphos against C. medinalis was reported by many workers (Gang, 1985; Kandasamy and Ravikumar, 1986; Sain et al., 1987; Raju et al., 1988).

2.4 Insecticidal action of fungicides and fungicidal action of insecticides

The insecticidal action of the fungicide zineb on the antifeedant activity of the fourth instar larva of Spodoptera mauritia was found out by John et al. (1982). Medrano et al. (1984) found that, a spray of 0.1 per cent ediphenphos reduced hatching of brown planthopper eggs and also killed nymphs, that emerged. The fungicidal action of the chemicals Sevidol and Thimet on the inhibition of the growth of Rhizoctonia solani were reported by Lakshmanan and Nair (1986).

2.5 Compatibility of fungicides and insecticides

Bhaskaran et al. (1976) reported that ediphenphos in combination with phosalone and quinalphos controlled leaffolder, whorl maggot, green leafhopper and white leafhopper of rice more effectively than when the insecticide

was applied alone. He also reported the combining ability of ediphenphos with methyl parathion in controlling Helminthosporium leaf spot and many other insect pests of rice. Leaffolder of rice was more effectively controlled by combined spray of Hinosan with monocrotophos. Raju et al. (1988) studied the compatibility of ediphenphos, mancozeb, and carbendazim with phosphamidon and monocrotophos against sheath rot and leaffolder of rice in field condition. They opined that, spraying monocrotophos in combination with any of the three fungicides was the effective treatment, keeping leaffolder population well below the economic threshhold. Babu (1988) studied the compatibility of ediphenphos, carbendazim and captafol with monocrotophos, quinalphos and HCH against sheath blight and brown planthopper. The result showed that, monocrotophos and quinalphos can be combined with captafol and ediphenphos without any antagonistic effect or even with synergistic effect. He also reported that combination of HCH with captafol did not show any antagonistic effect, but antagonistic action was observed in combination with ediphenphos and carbendazim.

Singh and Sethunathan (1987) studied the combined effect of carbendazim and mancozeb with thiobencarb, tolelofos-methyl and fenitrothion on mycelial growth and sclerotial germination in R. solani in nutrient medium and natural soil. Raju et al. (1988) studied the compatibility of

ediphenphos, mancozeb and carbendazim with phosphamidon and monocrotophos against Sarocladium oryzae and C. medinalis and found that, combined spraying of monocrotophos with carbendazim gave lowest incidence of S. oryzae.

Jeong et al. (1985) tested five pesticide mixtures in granular formulations for phyrochemical properties and efficiency of simultaneous control of brown planthopper and rice blast caused by Pyricularia oryzae. They found that, the active ingredient for all formulations were more stable than those of each pesticide alone, except for combination of probenazole and fenthion. More effective control of rice blast was achieved with the mixture of isoprothiolane with propoxur or with carbofuran. Carbofuran mixed with isoprothiolane or probenazole gave better control of BPH. However, the mixture of isoprothiolane with propoxur or carbofuran and probenazole with carbofuran were the most effective for the simultaneous control of rice blast and brown planthopper.

Chakrabarthy and Mutalkar (1979) reported that maximum tuber yield was obtained when captafol and dimethoate were applied in combination on potato than the treatments were given independently. Olunloyo (1983) reported that application of captafol at 15 g ai l^{-1} combined with lindane at 1 g ai l^{-1} was effective against inflorescence die back of cashew. Tripathi et al. (1985) obtained effective control of

Alternaria leaf spot and aphid on Brassica campestris by mixed sprays of captafol and methyl demeton or captafol and phosphamidon.

Chatrath et al. (1977) reported that fungicidal property of Vitavax and Benomyl was unaffected when applied in combination with malathion and HCH against loose smut of wheat. Vitavax and Aldrin EC 30 effectively controlled disease of barley caused by Ustilago hordei (Pers) (Bhalnagar, 1986).

Bordeaux mixture or Zineb in combination with methyl parathion effectively controlled the powdery mildew of grape vine and the insect Clysia (Nedyalkov, 1975). Chacko et al., (1977) reported that Bordeaux mixture sprayed with 0.05 per cent Malathion or 0.3 per cent methyl parathion was found to be as effective against Cocecus viridis of coffee as the insecticide used alone.

Thiram when applied in combination with Malathion on apple for the control of disease and pest, no ill effects were noticed on plants (Murphy et al., 1961). Compatibility of thiram and heptachlor applied @ 3 g and 2.5 g respectively per kg of seed as a seed treatment against Tanymccus of maize was reported by Tanase and Paulian (1973). Thiram, Fytolan and Dithane M-45 were reported to be compatible with monocrotophos (KAU, 1981).

Song et al. (1987) studied the stability and efficacy of mixed pesticides to control sheath blight and brown planthopper. Eight wettable powders were formulated by mixing two fungicides and one insecticide. Five were different ratios of pencycuron and isoprocarb and three of mepronil (3'-isopropoxy-0-toluanilide) and isoprocarb. The combinations of pencycuron and isoprocarb showed very high synergism against sheath blight (R. solani) and brown planthopper (N. lugens) on rice in topical application tests in the laboratory and in green house studies.

Tripathi et al. (1985) reported that captafol and mancozeb are compatible with methyl demeton and phosphamidon separately for control of Alternaria leaf spot and aphid on Brassica campestris. Effective control measures of Alternaria leaf spot and aphid could be obtained by mixed sprays of captafol and methyl demeton or captafol and phosphamidon.

Materials and Methods

MATERIALS AND METHODS

3.1 Isolation and culturing of the fungi

Rice plants showing typical symptoms of blast and sheath blight were collected from Agricultural Research Station, Mannuthy, Thrissur to isolate the pathogens Pyricularia oryzae and Rhizoctonia solani respectively. The infected plants were washed in running tap water to remove soil particles and dried with blotting paper. The diseased portions of infected plants showing characteristic symptoms were cut into small bits and then surface sterilized with 0.1 per cent mercuric chloride solution for 45 seconds. The bits were then washed in three changes of sterile water to remove the traces of mercuric chloride adhering to it. Each bit was carefully picked up and was placed aseptically in a sterilized petridish containing Potato Dextrose Agar (PDA). The plates were incubated under laboratory conditions. The isolates were purified by single spore isolation in case of P. oryzae and repeated hyphal tip plating in the case of R. solani and the organisms were maintained on PDA by sub-culturing periodically. Pathogenicity of the isolate thus obtained was proved following Koch's postulates.

3.2 Raising rice plants for the pot culture studies

The rice variety 'Annapoorna' was used for the pot culture studies. Wet land soil was dried, homogenised and mixed with dried FYM at appropriate quantity and filled in pots. Urea, superphosphate and muriate of potash were applied in each pot in required quantities to give half nitrogen, full phosphorus and half potash of 70:35:35 kg ha^{-1} of NPK. The remaining quantities of nitrogen and potash were applied in two equal splits at active tillering and panicle initiation stages respectively (KAU, 1989)

Eighteen to twenty days old seedlings were transplanted at the rate of three seedlings per pot after thorough puddling of pot mixture with sufficient amount of water. The water level in each pot was maintained at 2 cm, throughout the growth period of the crop.

3.3 Rearing of brown planthopper (Nilaparvata lugens)

Potted rice plants prepared as described above were used for rearing Nilaparvata lugens. The plants were kept in an insect proof cage covered with muslin cloth. These caged plants were kept under normal temperature, humidity and light intensity. The initial populations of N. lugens were collected from the fields of Rice Research Station, Moncombu and reared in the laboratory for stabilizing the population.

To obtain pure clones, fifth instar nymphs were caged separately on individual plants and when they became adults, one male and female were transferred using an aspirator to another caged plant for mating and egg laying. The progenies obtained from this were used as stock-culture. Ten to fifteen females were transferred from the stock-culture to caged plants for egg-laying. This ensured that each plant had egg laid by the insects on the same day and thus the nymphs emerging on each plant were of uniform age.

3.4 Rearing of leaffolder (Cnaphalocrosis medinalis)

The first instar larvae of Cnaphalocrosis medinalis were collected from Agricultural Research Station, Mannuthy and reared on potted paddy plants in the insect-proof cage. When the leaves of the plants in one pot were eaten up, the larvae were transferred to fresh potted plants. The fourth instar larvae required for the experiment were drawn from the cultures thus maintained in the laboratory.

3.5 Details of plant protection chemicals used for the study

The commonly recommended plant protection chemicals for rice cultivation in this state were used for the study: (Table 1)

Table 1. Details of plant protection chemicals used for the study

Generic names	Formulations	Selected dosage of chemicals (%)			Manufacturing company
A. Fungicides					
Ediphenphos	Hinosan 50% EC	0.1	0.075	0.05	Bayer (India) Ltd.
Carbendazim	Bavistin 50% WP	0.1	0.075	0.05	BASF India Ltd.
Captafol	Foltaf 80% WP	0.3	0.225	0.15	Rallis India Ltd.
Tridemorph	Calixin 80% EC	0.1	0.075	0.05	BASF India Ltd.
B. Insecticides					
Phosphamidon	Dimecron 85% SL	0.05	0.0375	0.025	Hindustan Ciba Geigy Ltd.
Monocrotophos	Nuvacron 36% SL	0.05	0.0375	0.025	Hindustan Ciba Geigy Ltd.
Quinalphos	Ekalux 25% EC	0.05	0.0375	0.025	Sandoz (India) Ltd.
Phosalone	Zolone 35% EC	0.07	0.0525	0.035	Voltas Ltd.

Table 2. Treatments used in the experiment

T_1	Ediphenphos	0.05%			T_{25}	Ediphenphos	+	Monocrotophos	0.0375%
T_2	"	+	Phosphadimon	0.025%	T_{26}	"	+	"	0.05%
T_3	"	+	" "	0.0375%	T_{27}	Ediphenphos	0.1%		
T_4	"	+	" "	0.05%	T_{28}	"	+	Phosphamidon	0.025%
T_5	"	+	Quinalphos	0.025%	T_{29}	"	+	"	0.0375%
T_6	"	+	"	0.0375%	T_{30}	"	+	"	0.05%
T_7	"	+	"	0.05	T_{31}	"	+	Quinalphos	0.025%
T_8	"	+	Phosalone	0.035%	T_{32}	"	+	"	0.0375%
T_9	"	+	"	0.0525%	T_{33}	"	+	"	0.05%
T_{10}	"	+	"	0.07%	T_{34}	"	+	Phosalone	0.035%
T_{11}	"	+	Monocrotophos	0.025%	T_{35}	"	+	"	0.0525%
T_{12}	"	+	"	0.0375%	T_{36}	"	+	"	0.07%
T_{13}	"	+	"	0.05%	T_{37}	"	+	Monocrotophos	0.025%
T_{14}	Ediphenphos	0.075%			T_{38}	"	+	"	0.0375%
T_{15}	"	+	Phosphamidon	0.025%	T_{39}	"	+	"	0.05%
T_{16}	"	+	"	0.0375%	T_{40}	Carbendazim	0.05%		
T_{17}	"	+	"	0.05%	T_{41}	"	+	Phosphamidon	0.025%
T_{18}	"	+	Quinalphos	0.025%	T_{42}	"	+	"	0.0375%
T_{19}	"	+	"	0.0375%	T_{43}	"	+	"	0.05%
T_{20}	"	+	"	0.05%	T_{44}	"	+	Quinalphos	0.025%
T_{21}	"	+	Phosalone	0.035%	T_{45}	"	+	"	0.0375%
T_{22}	"	+	"	0.0525%	T_{46}	"	+	"	0.05%
T_{23}	"	+	"	0.07%	T_{47}	"	+	Phosalone	0.035%
T_{24}	"	+	Monocrotophos	0.025%	T_{48}	"	+	"	0.0525%

Table 2 (Contd.)

T_{49}	Carbendazim	+	Phosalone	0.07%	T_{73}	Carbendazim	+	Phosalone	0.035%
T_{50}	"	+	Monocrotophos	0.025%	T_{74}	"	+	"	0.0525%
T_{51}	"	+	"	0.0375%	T_{75}	"	+	"	0.07%
T_{52}	"	+	"	0.05%	T_{76}	"	+	Monocrotophos	0.025%
T_{53}	Carbendazim 0.075%				T_{77}	"	+	"	0.0375%
T_{54}	"	+	Phosphamidon	0.025%	T_{78}	"	+	"	0.05%
T_{55}	"	+	"	0.0375%	T_{79}	Captafol 0.15%			
T_{56}	"	+	"	0.05%	T_{80}	"	+	Phosphamidon	0.025%
T_{57}	"	+	Quinalphos	0.025%	T_{81}	"	+	"	0.0375%
T_{58}	"	+	"	0.0375%	T_{82}	"	+	"	0.05%
T_{59}	"	+	"	0.05%	T_{83}	"	+	Quinalphos	0.025%
T_{60}	"	+	Phosalone	0.035%	T_{84}	"	+	"	0.0375%
T_{61}	"	+	"	0.0525%	T_{85}	"	+	"	0.05%
T_{62}	"	+	"	0.07%	T_{86}	"	+	Phosalone	0.035%
T_{63}	"	+	Monocrotophos	0.025%	T_{87}	"	+	"	0.0525%
T_{64}	"	+	"	0.0375%	T_{88}	"	+	"	0.07%
T_{65}	"	+	"	0.05%	T_{89}	"	+	Monocrotophos	0.025%
T_{66}	Carbendazim 0.1%				T_{90}	"	+	"	0.0375%
T_{67}	"	+	Phosphamidon	0.025%	T_{91}	"	+	"	0.05%
T_{68}	"	+	"	0.0375%	T_{92}	Captafol 0.225%			
T_{69}	"	+	"	0.05%	T_{93}	"	+	Phosphamidon	0.025%
T_{70}	"	+	Quinalphos	0.025%	T_{94}	"	+	"	0.0375%
T_{71}	"	+	"	0.0375%	T_{95}	"	+	"	0.05%
T_{72}	"	+	"	0.05%	T_{96}	"	+	Quinalphos	0.025%

Contd.

Table 2 (Contd.)

T_{97}	Captafol	+	Quinalphos	0.0375%	T_{118}	Tridemorph	0.05%		
T_{98}	"	+	"	0.05%	T_{119}	"	+	Phosphamidon	0.025%
T_{99}	"	+	Phosalone	0.035%	T_{120}	"	+	"	0.0375%
T_{100}	"	+	"	0.0525%	T_{121}	"	+	"	0.05%
T_{101}	"	+	"	0.07 %	T_{122}	"	+	Quinalphos	0.025%
T_{102}	"	+	Monocrotophos	0.025%	T_{123}	"	+	"	0.0375%
T_{103}	"	+	"	0.0375%	T_{124}	"	+	"	0.05%
T_{104}	"	+	"	0.05%	T_{125}	"	+	Phosalone	0.035%
T_{105}	Captafol	0.3%			T_{126}	"	+	"	0.0525%
T_{106}	"	+	Phosphamidon	0.025%	T_{127}	"	+	"	0.07%
T_{107}	"	+	"	0.0375%	T_{128}	"	+	Monocrotophos	0.025%
T_{108}	"	+	"	0.05%	T_{129}	"	+	"	0.0375%
T_{109}	"	+	Quinalphos	0.025%	T_{130}	"	+	"	0.05%
T_{110}	"	+	"	0.375%	T_{131}	Tridemorph	0.075%		
T_{111}	"	+	"	0.05%	T_{132}	"	+	Phosphamidon	0.025%
T_{112}	"	+	Phosalone	0.035%	T_{133}	"	+	"	0.0375%
T_{113}	"	+	"	0.0525%	T_{134}	"	+	"	0.05%
T_{114}	"	+	"	0.07%	T_{135}	"	+	Quinalphos	0.025%
T_{115}	"	+	Monocrotophos	0.025%	T_{136}	"	+	"	0.0375%
T_{116}	"	+	"	0.0375%	T_{137}	"	+	"	0.05%
T_{117}	"	+	"	0.05%	T_{138}	"	+	Phosalone	0.035%

Contd.

Table 2 (Contd.)

T_{139}	Tridemorph	+	Phosalone	0.0525%	T_{155}	Tridemorph	+	Monocrotophos 0.0375%
T_{140}	"	+	"	0.07%	T_{156}	"	+	" 0.05%
T_{141}	"	+	Monocrotophos	0.025%	T_{157}	Phosphamidon	0.025%	
T_{142}	"	+	"	0.0375%	T_{158}	"	0.0375%	
T_{143}	"	+	"	0.05%	T_{159}	"	0.05%	
T_{144}	Tridemorph 0.1%				T_{160}	Quinalphos	0.025%	
T_{145}	"	+	Phosphamidon	0.025%	T_{161}	"	0.0375%	
T_{146}	"	+	"	0.0375%	T_{162}	"	0.05%	
T_{147}	"	+	"	0.05%	T_{163}	Phosalone	0.035%	
T_{148}	"	+	Quinalphos	0.025%	T_{164}	"	0.0525%	
T_{149}	"	+	"	0.0375%	T_{165}	"	0.07%	
T_{150}	"	+	"	0.05%	T_{166}	Monocrotophos	0.025%	
T_{151}	"	+	Phosalone	0.035%	T_{167}	"	0.0375%	
T_{152}	"	+	"	0.0525%	T_{168}	"	0.05%	
T_{153}	"	+	"	0.07%	T_{169}	Control		
T_{154}	"	+	Monocrotophos	0.025%				

3.6 Concentrations of fungicides and insecticides used for *in vitro* *in vivo* experiments

The concentrations of chemicals used were the concentrations recommended for field use and two lower concentrations such as three-fourth and half the recommended concentrations. The fungicides and insecticides were used independently and also in combination and each treatment was replicated thrice. The treatments used in the experiment are given in Table 2.

3.7 Effect of combining different concentrations of fungicides and insecticides on their fungicidal properties in the laboratory using *P. oryzae* and *R. solani* as test organisms

Bioassay of the chemicals was conducted by poison-food technique (Zentmayer, 1955) to find out the effectiveness of the selected chemicals against *P. oryzae* and *R. solani*. The trade name, formulations and concentration (percentage) of the fungicides and insecticides used are given in Table 1.

Sixty ml of Potato Dextrose Agar medium was taken in 250 ml conical flasks and sterilized in an autoclave under 15 lbs pressure for 20 minutes.

The chemicals were mixed with the PDA medium in suitable proportion to get the desired concentrations and poured into sterilized petridishes at the rate of 20 ml per plate. Mycelial discs of 10 mm diameter were cut out from

actively growing culture of the fungus (two weeks old) and each of them was placed in the centre of each petridish. The petridishes were incubated at room temperature. Mycelial disc placed in petridishes containing media alone (no fungicide) served as control. The colony diameter was measured when the growth in the control fully covered the medium in the petridish. The percentage inhibition was calculated by using the formula (C-T) x 100/C where C and T were the colony diameters in control and treatment respectively (Vincent, 1927).

3.8 Effect of combining different concentrations of fungicides and insecticides on their insecticidal properties in the laboratory using N. lugens and C. medinalis as test insects

The experiment was conducted using N. lugens and C. medinalis as test insects adopting standard bioassay technique (Heinrichs et al., 1981).

Suitable proportions of chemicals as described in Table 1 were prepared and each petridishes were sprayed with 1 ml of various chemicals. The sprayed petridishes were kept under an electric fan for 10-15 minutes with the lid slightly open. When the spray fluid had dried up, fourth instar caterpillars of C. medinalis and fourth instar nymphs of N. lugens were transferred to the petridishes separately and kept covered. For each treatment three replications were

maintained. The mortality of the insects were observed 24 hours after treatment.

3.9 Effect of combining fungicides and insecticides on the control of blast, sheath blight, brown planthopper and leaffolder

The study was carried out as pot culture experiment adopting completely randomised design. The combination and dose of fungicides and insecticides tested were those mentioned in Table 2.

a. Control of blast caused by Pyricularia oryzae

The plant at tillering, panicle initiation and flowering stages were inoculated with culture of P. oryzae and inoculated portions were covered with wet cotton. The plants were also sprayed with spore suspension of P. oryzae and infected bits of leaf were put in the pots to ensure the infection (Subrahmanyan et al., 1982). The plants were covered with moistened polythene bags and the bags were frequently moistened to maintain high humidity for the infection.

The intensity of the disease was measured just before the treatment and then at 10 days intervals till harvesting adopting Standard Evaluation System for Rice Diseases (IRRI, 1976) with 0-9 scale.

Score chart for blast disease

Scores	Description
0	No incidence
1	Two or three small brown specks on leaves
3	Slightly elongated specks on few leaves (below 10 per cent leaf area)
5	About 15-23 per cent leaf area shows typical blast lesions of 1-2 cm long
7	25-50 per cent leaf area shows large necrotic blast spots
9	51-100 per cent leaf area shows large necrotic blast spots combined with neck infection/neck infection alone

The Disease Index (DI) was worked out using the following formula and the per cent deviation over control was worked out.

$$DI = \frac{\text{Sum of scores obtained} \times 100}{\text{Number of total hills observed} \times 9}$$

b. Control of sheath blight caused by Rhizoctonia solani

The plants at tillering, panicle initiation and flowering stages were inoculated with sclerotia of R. solani. The sclerotia were placed in between the culm and leaf sheath and were covered with moist cotton. Characteritic symptoms of

the disease appeared in two-three days around the point of inoculation. The plants were sprayed with required concentrations of chemicals, immediately after the initial symptoms were developed.

The intensity of disease was measured just before the treatment and then at 10 days intervals till harvest adopting Standard Evaluation System for Rice Diseases (IRRI, 1976) with 0-9 scale.

Score chart for sheath blight

Scores	Description
0	No incidence of disease
1	Lesions limited to lower ¼ of leaf sheath
3	Lesions present in lower ½ of leaf sheath
5	Lesions present on more than ½ of leaf sheaths and slight infestation on lower one or two leaves also
7	Lesion present on more than 3/4 of leaf sheaths. Severe infection on lower leaves and slight infection on upper leaves also
9	Lesions reaching top of tillers and severe infection on leaves

DI and per cent deviation over control were worked out using the same formula as in the case of blast.

c. Control of brown planthopper (Nilaparvata lugens)

The fourth instar nymphs of N. lugens were released on the rice plants at tillering, panicle initiation and flowering stages at the rate of ten nymphs per caged plants after the treatment with chemicals.

The efficiency of the chemicals were judged on the basis of mortality of insects noted 24 h after treatment.

d. Control of leaffolder (Cnaphalocrocis medinalis)

The fourth instar larvae of C. medinalis were released on the plant at tillering, panicle initiation and flowering stages at the rate of ten larvae per plant after the treatment.

The insecticidal effect of the treatments were assessed in terms of the mortality of insects noted 24 h after the release of insects on treated plants.

Statistical analysis

All the data were analysed statistically using analysis of covariance technique.

RESULTS

4.1 Effect of different concentrations of fungicides, insecticides and their combinations on the control of blast disease (P. oryzae) and leaffolder (C. medinalis) of rice

Rice plants at tillering, panicle initiation and flowering stages were artificially inoculated with P. oryzae and the fungicides and insecticides were sprayed separately and in combination after the symptom expression. The intensity of the disease was measured at 10 days interval till harvest. Data on the per cent control of the disease over check are presented in Tables 3 and 4. Per cent deviations were taken based on the control value at 10 days after spraying. In the case of insect studies, the insects were released after the treatment. The insecticidal effect of the treatments were assessed in terms of mortality of insects noted 24 h after the release on treated plants.

Tillering stage

4.1.1 Effect of ediphenphos with different combinations of insecticides

It is evident from the data presented in Table 3 that, when ediphenphos alone was tried at different concentrations maximum control of the disease over the check as well as the

mortality of the insects were observed at highest concentration. Minimum control of the disease and mortality of the insect were found with lowest concentration.

Lowest concentration of ediphenphos with highest concentration of phosalone gave maximum control of the disease over check and the effect of treatment has decreased later on. Lowest control was noticed with ediphenphos 0.075 per cent and monocrotophos 0.0375 per cent concentration. In the case of C. medinalis maximum mortality was noticed in treatment with ediphenphos 0.075 per cent + quinalphos 0.05 per cent and minimum was in treatment with lowest concentration of ediphenphos and phosphamidon.

4.1.1.1 Combination of ediphenphos with phosphamidon

Highest concentration of ediphenphos and phosphamidon gave maximum control of the disease and its effect decreased to 21 and then to 4 per cent after 20 and 30 days of treatment. Lowest concentration of the same combination gave minimum control of the disease.

In the case of mortality of leaffolder, maximum and minimum values were obtained by the combined application of highest and lowest concentrations of ediphenphos and phosphamidon respectively.

4.1.1.2 Combination of ediphenphos with quinalphos

Mixing highest concentration of ediphenphos with lowest concentration of quinalphos was found to be the best as 22 per cent control of the disease was obtained and efficiency of the treatment was reduced later on. Minimum control was noticed in ediphenphos 0.075 per cent + quinalphos 0.05 per cent.

The insect mortality varied from 90 per cent to 96 per cent in lowest concentrations of ediphenphos with quinalphos and ediphenphos 0.075 per cent with highest concentration of quinalphos respectively.

4.1.1.3 Combination of ediphenphos with phosalone

Forty four per cent control of blast disease was obtained by mixing highest concentration of phosalone with lowest concentration of ediphenphos and the per cent control was decreased later on. Lowest control was noticed with treatment combination containing highest concentration of ediphenphos and phosalone.

Combination of ediphenphos 0.075 per cent + phosalone 0.035 per cent yielded maximum mortality of insects and

ediphenphos 0.075 per cent + phosalone 0.07 per cent gave minimum control.

4.1.1.4 Combination of ediphenphos with monocrotophos

Mixing highest concentration of ediphenphos and monocrotophos resulted in maximum control of blast and minimum control was noticed with ediphenphos 0.075 per cent and monocrotophos 0.0375 per cent.

Combination of highest concentration of ediphenphos and monocrotophos was found to be the best as 90 per cent control of the insect was obtained, where as, the treatment combinations of ediphenphos 0.075 per cent with monocrotophos 0.025 per cent and 0.0375 per cent gave only 76 per cent control.

4.1.2 Effect of carbendazim with different combinations of insecticides

Among the three levels of carbendazim tried, lowest concentration gave maximum control of the disease and its efficiency decreased to 16 and 14 per cent after 20 and 30 days of treatment respectively. Maximum mortality of C. medinalis was noticed with carbendazim 0.075 per cent.

In combination with various insecticides, carbendazim 0.075 per cent with highest concentration of phosalone gave best result and per cent control decreased later on. Lowest concentration of carbendazim with highest concentration of quinalphos resulted in lowest control of the disease.

Maximum mortality of leaffolder was obtained for treatment combinations involving highest concentrations of carbendazim and quinalphos.

4.1.2.1 Combination of carbendazim with phosphamidon

Maximum and minimum control of blast was noticed in treatment combinations of carbendazim 0.075 per cent with 0.0375 per cent and 0.05 per cent of phosphamidon respectively.

Lowest concentration of carbendazim in combination with highest and lowest concentration of phosphamidon gave maximum and minimum mortalities of insects respectively.

4.1.2.2 Combination of carbendazim with quinalphos

Lower concentrations of carbendazim in combination with lower concentration of quinalphos gave maximum control of blast. Carbendazim 0.05 per cent + quinalphos 0.05 per cent and

carbendazim 0.1 per cent + quinalphos 0.0375 per cent gave minimum control of the disease.

The insect mortality ranged from 86 per cent (carbendazim 0.05 per cent + quinalphos 0.025, carbendazim 0.075 + quinalphos 0.025, carbendazim 0.075 per cent + quinalphos 0.0375 per cent) to 96 per cent (carbendazim 0.1 + quinalphos 0.0375 per cent, carbendazim 0.1 per cent + quinalphos 0.05 per cent).

4.1.2.3 Combination of carbendazim with phosalone

Phosalone 0.07 per cent in combination with carbendazim 0.075 per cent resulted in highest control of the disease and its efficiency decreased to 40 per cent and then to 30 per cent, 20 and 30 days after application. The phosalone 0.0525 per cent in combination with carbendazim 0.05 per cent resulted in the lowest control of disease.

Highest concentration of phosalone in combination with all the three levels of carbendazim resulted in maximum control of C. medinalis and combination of lowest concentrations of phosalone and carbendazim resulted in minimum control of the insect.

4.1.2.4 Combination of carbendazim with monocrotophos

The per cent control of blast was maximum (33 per cent) for the treatment combination, carbendazim 0.075 per cent + monocrotophos 0.0375 per cent and its residual action reduced to 21 per cent after 20 days and 14 per cent after 30 days of treatment.

Insect mortality ranged from 73 per cent (carbendazim 0.075 per cent + monocrotophos 0.0375 per cent) to 83 per cent (carbendazim 0.1 per cent + monocrotophos 0.1 per cent).

4.1.3 Effect of captafol with different combinations of insecticides

Maximum and minimum control of the disease and mortality of insects were given by the highest and the lowest concentrations of the fungicide respectively.

Among the various combinations, captafol 0.22 per cent + phosalone 0.035 per cent and captafol 0.3 per cent + phosalone 0.0525 per cent gave maximum (45 per cent) control of blast. The residual action decreased to 19 per cent and then to 14 per cent after 20 and 30 days of treatment. Captafol 0.15 per cent + phosphamidon 0.025 per cent resulted in minimum control of disease.

In the case of mortality of leaffolder, maximum (96 per cent) and minimum (63 per cent) values were obtained with captafol 0.3 per cent + quinalphos 0.05 per cent and captafol 0.15 per cent + phosalone 0.035 per cent respectively.

4.1.3.1 Combination of captafol with phosphamidon

Here, best control of disease (27 per cent) was obtained by combining the two higher concentrations of captafol (0.3 per cent) and phosphamidon (0.025 per cent) and the lowest by mixing captafol 0.15 per cent with phosphamidon 0.025 per cent.

Captafol 0.3 per cent + phosphamidon 0.05 per cent was the most effective against leaffolder (83 per cent control) whereas captafol 0.15 per cent + phosphamidon 0.0375 per cent resulted in 66 per cent mortality.

4.1.3.2 Combination of captafol with quinalphos

Among the various combinations of captafol and quinalphos tested, captafol 0.3 per cent + quinalphos 0.0375 per cent gave highest control (35 per cent) of blast and its efficiency was reduced to 25 per cent after 20 days and 14 per cent after 30 days of treatment. Captafol 0.15 per cent + quinalphos 0.05 per cent was the least effective (3 per cent) treatment against the disease.

Combinations involving highest concentrations of captafol and quinalphos resulted in maximum mortality (96 per cent) of leaffolder and lowest concentration of captafol and 0.0375 per cent of quinalphos resulted in minimum control (76 per cent) of the insect .

4.1.3.3 Combination of captafol with phosalone

Maximum (45 per cent) control of the disease was obtained for the treatment combinations captafol 0.225 per cent + phosalone 0.035 per cent and captafol 0.3 per cent + phosalone 0.0525 per cent and minimum (6 per cent) for the treatment, captafol 0.15 per cent + phosalone 0.07 per cent.

Insect mortality varied from 63 per cent (captafol 0.15 per cent + phosalone 0.035 per cent) to 83 per cent (captafol 0.15 per cent + phosalone 0.07 per cent).

4.1.3.4 Combination of captafol with monocrotophos

Maximum (33 per cent) and minimum (1 per cent) control of disease was shown by the treatment combinations of highest and lowest concentrations of two pesticides respectively.

Maximum (86 per cent) and minimum (66 per cent) mortality of C. medinalis was observed for the treatment combinations captafol 0.3 per cent + monocrotophos 0.05 per cent

and captafol 0.3 per cent + monocrotophos 0.025 per cent respectively.

4.1.4 Effect of tridemorph with different combinations of insecticides

It is evident from the Table that, tridemorph 0.05 per cent, 0.075 per cent and 0.1 per cent gave 15 per cent, 15 per cent and 33 per cent control of the disease and 6, 16 and 20 per cent control of the insect respectively.

In combination with insecticides, best control of the disease was observed with (60 per cent) tridemorph 0.1 per cent in combination with monocrotophos 0.0375 per cent and its residual effect decreased from 60 per cent to 58 per cent after 20 days and to 25 per cent after 30 days of treatment. Combination of tridemorph 0.05 per cent with monocrotophos 0.025 per cent gave lowest control of the disease.

Maximum (96 per cent) and minimum (63 per cent) values for mortality of insects were shown by treatment combinations, tridemorph 0.075 per cent + quinalphos 0.05 per cent and tridemorph 0.075 per cent + phosalone 0.0525 per cent respectively.

4.1.4.1 Combination of tridemorph with phosphamidon

Combination of lowest concentration of tridemorph (0.05 per cent concentration) and highest concentration of phosphamidon (0.05 per cent) resulted in maximum control of blast disease (33 per cent). The extent of control was reduced to 13 and then to 7 after 20 and 30 days respectively and combination of highest concentration of tridemorph (0.1 per cent) and phosphamidon (0.05 per cent) has minimum effect (6 per cent control) on control of the disease.

Among the various combinations tried, insect mortality varied from 63 to 86 per cent. Maximum control was noticed at highest concentrations of tridemorph and phosphamidon and minimum control by lowest concentration of tridemorph and phosphamidon.

4.1.4.2 Combination of tridemorph with quinalphos

In this combination, maximum (45 per cent) control of the disease was exhibited by treatment combination, tridemorph 0.075 per cent + quinalphos 0.025 per cent and minimum value was by tridemorph 0.075 per cent + quinalphos 0.05 per cent and tridemorph 0.1 per cent + quinalphos 0.0375 per cent combinations.

Mortality of C. medinalis varied from 83 to 96 per cent. Maximum value was given by tridemorph 0.05 per cent + quinalphos 0.025 per cent and the minimum by tridemorph 0.075 per cent + quinalphos 0.05 per cent.

4.1.4.3 Combination of tridemorph with phosalone

Maximum control (45 per cent) of the disease was obtained for treatment combination, containing highest concentrations of tridemorph and phosalone. Tridemorph 0.05 per cent + phosalone 0.0525 per cent gave only 9 per cent control of the disease.

In the case of mortality of insect, the value varied from 63 to 80 per cent. Treatment combinations viz., tridemorph 0.075 per cent + phosalone 0.07 per cent; tridemorph 0.1 per cent + phosalone 0.0525 per cent and tridemorph 0.1 per cent + phosalone 0.07 per cent were equally effective and gave maximum control of the pest.

4.1.4.4 Combination of tridemorph with monocrotophos

Tridemorph 0.1 per cent + monocrotophos 0.0375 per cent recorded maximum control of the disease (60 per cent) and per cent control of disease decreased to 58 after 20 days and to 25 after 30 days of treatment. Lowest concentrations of

Table 3. Effect of different fungicides, insecticides and their combinations on the control of blast (P. oryzae) and leaffolder (C. medinalis) at tillering stage

Treatments				Per cent deviation from control* Days after spraying 10	20	30	Per cent mortality of C. medinalis**
Ediphenphos 0.05%				14 (2.889)	8 (3.079)	5 (3.184)	16 (0.169)
"	+	Phosphamidon	0.025%	5 (3.150)	-6 (3.536)	-8 (3.642)	70 (0.782)
"	+	"	0.0375%	8 (3.097)	-7 (3.100)	1 (3.297)	70 (0.782)
"	+	"	0.05%	15 (2.884)	6 (3.142)	0 (3.328)	73 (0.833)
"	+	Quinalphos	0.025%	16 (2.947)	6 (3.142)	4 (3.198)	90 (1.206)
"	+	"	0.0375%	12 (2.987)	11 (2.966)	7 (3.122)	90 (1.206)
"	+	"	0.05%	17 (2.853)	8 (3.030)	0 (3.329)	93 (1.356)
"	+	Phosalone	0.035%	24 (2.680)	13 (2.939)	3 (2.952)	83 (0.991)
"	+	"	0.0525%	26 (2.480)	4 (3.212)	-8 (3.647)	80 (0.927)
"	+	"	0.07%	44 (2.304)	32 (2.532)	5 (3.174)	83 (0.991)
"	+	Monocrotophos	0.025%	9 (3.080)	10 (3.037)	-8 (3.648)	83 (0.991)
"	+	"	0.0375%	8 (3.097)	7 (3.107)	-9 (3.649)	80 (0.927)
"	+	"	0.05%	2 (3.260)	2 (3.283)	-34 (5.031)	80 (0.927)
Ediphenphos 0.075%				19 (2.787)	13 (2.943)	9 (3.061)	20 (0.202)
"	+	Phosphamidon	0.025%	13 (2.943)	-4 (3.486)	-8 (3.642)	73 (0.833)
"	+	"	0.0375%	24 (2.700)	22 (2.721)	14 (2.927)	73 (0.833)
"	+	"	0.05%	15 (2.894)	8 (3.080)	0 (3.328)	76 (0.877)
"	+	Quinalphos	0.025%	9 (3.057)	8 (3.080)	7 (3.122)	90 (1.206)
"	+	"	0.0375%	7 (3.110)	7 (3.115)	0 (3.329)	93 (1.356)
"	+	"	0.05%	1 (3.350)	-1 (3.360)	-10 (3.691)	96 (1.420)
"	+	Phosalone	0.035%	24 (2.680)	14 (2.939)	12 (2.985)	73 (0.833)
"	+	"	0.0525%	14 (2.939)	3 (3.230)	-3 (3.647)	83 (0.991)
"	+	"	0.07%	11 (2.966)	-3 (3.426)	-8 (3.648)	90 (1.206)
"	+	Monocrotophos	0.025%	2 (3.260)	2 (3.264)	-9 (3.649)	76 (0.877)
"	+	"	0.0375%	0 (3.338)	-17 (3.545)	-14 (3.875)	76 (0.877)
"	+	"	0.05%	7 (3.115)	2 (3.283)	-4 (3.482)	83 (0.991)
Ediphenphos 0.1%				25 (2.656)	21 (2.756)	10 (3.046)	26 (0.274)
"	+	Phosphamidon	0.025%	19 (2.787)	2 (3.283)	0 (3.325)	83 (0.991)
"	+	"	0.0375%	19 (2.787)	9 (3.080)	7 (3.122)	86 (1.142)
"	+	"	0.05%	32 (2.517)	21 (2.763)	4 (2.927)	80 (0.927)

Contd.

Table 3 (Contd.)

Treatments				Per cent deviation from control			Per cent mortality of C. medinalis
				Days after spraying			
				10	20	30	
"	+	Quinalphos	0.025%	22 (2.731)	22 (2.747)	4 (2.927)	90 (1.206)
"	+	"	0.0375%	4 (3.219)	3 (3.256)	0 (3.323)	90 (1.206)
"	+	"	0.05%	13 (2.947)	13 (2.974)	7 (3.128)	93 (1.356)
"	+	Phosalone	0.035%	15 (2.894)	15 (2.904)	7 (3.125)	83 (0.991)
"	+	"	0.0525%	6 (3.139)	6 (3.152)	3 (3.249)	86 (1.142)
"	+	"	0.07%	16 (2.872)	17 (2.858)	8 (3.099)	86 (1.142)
"	+	Monocrotophos	0.025%	10 (3.037)	-7 (3.588)	-15 (3.905)	83 (0.991)
"	+	"	0.0375%	17 (2.843)	17 (2.849)	7 (3.126)	86 (1.142)
"	+	"	0.05%	19 (2.787)	9 (3.080)	6 (3.122)	90 (1.206)
Carbendazim 0.05%				24 (2.698)	16 (2.884)	14 (2.939)	10 (0.101)
"	+	Phosphamidon	0.025%	16 (2.884)	6 (3.142)	5 (3.182)	73 (0.833)
"	+	"	0.0375%	22 (2.744)	14 (2.939)	5 (3.128)	76 (0.877)
"	+	"	0.05%	24 (2.698)	24 (2.699)	14 (2.939)	86 (1.142)
"	+	Quinalphos	0.025%	30 (2.571)	22 (2.735)	14 (2.931)	86 (1.142)
"	+	"	0.0375%	6 (3.139)	0 (3.328)	-5 (3.506)	90 (1.206)
"	+	"	0.05%	4 (3.219)	-9 (3.662)	-9 (3.684)	93 (1.356)
"	+	Phosalone	0.035%	20 (2.784)	13 (2.966)	7 (3.131)	73 (0.833)
"	+	"	0.0525%	2 (3.260)	2 (3.283)	0 (3.325)	76 (0.877)
"	+	"	0.07%	19 (2.808)	17 (2.858)	14 (2.933)	86 (1.142)
"	+	Monocrotophos	0.025%	22 (2.733)	12 (2.975)	7 (3.132)	76 (0.877)
"	+	"	0.0375%	4 (3.219)	-5 (3.496)	-8 (3.646)	76 (0.877)
"	+	"	0.05%	4 (3.219)	3 (3.256)	0 (3.323)	80 (0.927)
Carbendazim 0.075%				22 (2.733)	12 (2.975)	7 (3.132)	16 (0.169)
"	+	Phosphamidon	0.025%	17 (2.843)	7 (3.115)	7 (3.132)	76 (0.877)
"	+	"	0.0375%	25 (2.680)	14 (2.939)	7 (3.132)	80 (0.927)
"	+	"	0.05%	0 (3.534)	-11 (3.734)	-13 (3.818)	83 (0.991)
"	+	Quinalphos	0.025%	8 (3.079)	-1 (3.380)	-3 (3.443)	86 (1.142)
"	+	"	0.0375%	28 (2.606)	24 (2.692)	8 (3.099)	86 (1.142)
"	+	"	0.05%	17 (2.861)	12 (2.973)	12 (2.973)	93 (1.356)
"	+	Phosalone	0.035%	33 (2.517)	33 (2.696)	23 (2.724)	80 (0.927)
"	+	"	0.0525%	48 (2.251)	34 (2.496)	23 (2.724)	80 (0.927)
"	+	"	0.07%	50 (2.218)	40 (2.386)	35 (2.473)	86 (1.142)
"	+	Monocrotophos	0.025%	1 (3.315)	-6 (3.563)	-16 (3.968)	76 (0.877)
"	+	"	0.0375%	33 (2.517)	21 (2.763)	14 (2.927)	73 (0.833)
"	+	"	0.05%	22 (2.744)	22 (2.746)	14 (2.925)	76 (0.877)

Contd.

Table 3 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of C. medinalis
				10	20	30	
Carbendazim 0.1%				13 (2.947)	13 (2.949)	7 (3.123)	13 (0.134)
"	+	Phosphamidon	0.025%	17 (2.842)	17 (2.849)	3 (3.247)	76 (0.877)
"	+	"	0.0375%	7 (3.110)	-14 (3.869)	-16 (3.966)	83 (0.991)
"	+	"	0.05%	1 (3.304)	-14 (3.864)	-16 (3.968)	83 (0.991)
"	+	Quinalphos	0.025%	2 (3.271)	-3 (3.449)	-5 (3.506)	90 (1.206)
"	+	"	0.0375%	4 (3.219)	-9 (3.680)	-11 (3.768)	96 (1.420)
"	+	"	0.05%	4 (3.219)	3 (3.256)	0 (3.329)	96 (1.420)
"	+	Phosalone	0.035%	26 (2.645)	24 (2.682)	22 (2.732)	80 (0.927)
"	+	"	0.0525%	32 (2.530)	31 (2.550)	31 (2.548)	83 (0.991)
"	+	"	0.07%	9 (3.057)	8 (3.080)	7 (3.122)	86 (1.142)
"	+	Monocrotophos	0.025%	24 (2.698)	24 (2.699)	14 (2.939)	76 (0.877)
"	+	"	0.0375%	1 (3.308)	-1 (3.374)	-17 (4.024)	80 (0.927)
"	+	"	0.05%	22 (2.731)	20 (2.772)	14 (2.924)	83 (0.991)
Captafol 0.15%				0 (3.338)	-1 (3.380)	-8 (3.614)	16 (0.169)
"	+	Phosphamidon	0.025%	0 (3.338)	-2 (3.400)	-1 (3.380)	70 (0.782)
"	+	"	0.0375%	2 (3.260)	2 (3.260)	-9 (3.649)	66 (0.738)
"	+	"	0.05%	3 (3.240)	-5 (3.501)	-9 (3.649)	73 (0.833)
"	+	Quinalphos	0.025%	12 (2.987)	5 (3.170)	7 (3.334)	83 (0.991)
"	+	"	0.0375%	8 (3.098)	-6 (3.563)	-16 (3.968)	76 (0.877)
"	+	"	0.05%	3 (3.241)	-6 (3.563)	-16 (3.968)	93 (1.356)
"	+	Phosalone	0.035%	15 (2.894)	15 (2.904)	7 (3.334)	63 (0.687)
"	+	"	0.0525%	20 (2.784)	13 (2.966)	7 (3.334)	73 (0.833)
"	+	"	0.07%	6 (3.139)	-14 (3.819)	-21 (4.231)	83 (0.991)
"	+	Monocrotophos	0.025%	1 (3.315)	-5 (3.178)	5 (3.182)	76 (0.877)
"	+	"	0.0375%	2 (3.260)	-4 (3.881)	-21 (4.248)	80 (0.927)
"	+	"	0.05%	2 (3.260)	2 (3.260)	-9 (3.649)	86 (1.142)
Captafol 0.225%				30 (2.567)	21 (2.763)	13 (3.131)	16 (0.169)
"	+	Phosphamidon	0.025%	4 (3.219)	-6 (3.536)	-9 (3.649)	76 (0.877)
"	+	"	0.0375%	4 (3.219)	3 (3.256)	0 (3.338)	66 (0.738)
"	+	"	0.05%	12 (2.987)	-4 (3.868)	-21 (4.224)	76 (0.877)
"	+	Quinalphos	0.025%	4 (3.219)	3 (3.256)	-9 (3.649)	83 (0.991)
"	+	"	0.0375%	4 (3.220)	-6 (3.533)	-11 (3.765)	90 (1.206)
"	+	"	0.05%	9 (3.057)	8 (3.080)	0 (3.339)	86 (1.142)
"	+	Phosalone	0.035%	45 (2.304)	19 (2.798)	14 (2.931)	76 (0.877)
"	+	"	0.0525%	24 (2.702)	23 (2.706)	3 (3.246)	70 (0.782)
"	+	"	0.07%	35 (2.464)	22 (2.727)	14 (2.924)	80 (0.927)

Contd.

Table 3 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of C. medinalis
				10	20	30	
"	+	Monocrotophos	0.025%	4 (3.219)	3 (3.256)	-8 (3.646)	80 (0.927)
"	+	"	0.0375%	5 (3.182)	2 (3.283)	0 (3.339)	76 (0.877)
"	+	"	0.05%	1 (3.315)	-6 (3.563)	-8 (3.645)	83 (0.991)
Captafol 0.3%				32 (2.511)	30 (2.567)	14 (2.931)	23 (0.236)
"	+	Phosphamidon	0.025%	27 (2.624)	11 (3.062)	-10 (3.705)	73 (0.833)
"	+	"	0.0375%	21 (2.769)	10 (3.039)	-8 (3.645)	86 (1.142)
"	+	"	0.05%	14 (2.939)	-6 (3.536)	-16 3.965)	83 (0.991)
"	+	Quinalphos	0.025%	30 (2.571)	11 (3.002)	7 (3.134)	86 (1.142)
"	+	"	0.0375%	35 (2.477)	25 (2.672)	14 (2.925)	93 (1.356)
"	+	"	0.05%	25 (2.680)	14 (2.939)	14 (2.925)	96 (1.420)
"	+	Phosalone	0.035%	33 (2.507)	22 (2.735)	7 (3.134)	76 (0.877)
"	+	"	0.0525%	45 (2.304)	19 (2.798)	14 (2.925)	76 (0.877)
"	+	"	0.07%	15 (2.894)	14 (2.904)	7 (3.134)	76 (0.877)
"	+	Monocrotophos	0.025%	29 (3.057)	19 (2.798)	17 (2.812)	66 (0.738)
"	+	"	0.0375%	33 (2.507)	11 (3.062)	7 (3.134)	76 (0.877)
"	+	"	0.05%	16 (2.876)	10 (3.037)	2 (3.288)	86 (1.142)
Tridemorph 0.05%				15 (2.894)	6 (3.142)	6 (3.128)	6 (0.067)
"	+	Phosphamidon	0.025%	14 (2.934)	7 (3.134)	7 (3.134)	63 (0.687)
"	+	"	0.0375%	11 (3.041)	9 (3.062)	7 (3.134)	66 (0.738)
"	+	"	0.05%	33 (2.517)	13 (2.966)	7 (3.134)	83 (0.991)
"	+	Quinalphos	0.025%	22 (2.733)	5 (3.178)	5 (3.182)	83 (0.991)
"	+	"	0.0375%	27 (2.624)	18 (2.834)	6 (3.138)	86 (1.142)
"	+	"	0.05%	20 (2.784)	20 (2.784)	14 (2.927)	90 (1.206)
"	+	Phosalone	0.035%	25 (2.668)	14 (2.931)	7 (3.127)	66 (0.738)
"	+	"	0.052%	9 (2.819)	3 (2.982)	0 (3.340)	76 (0.877)
"	+	"	0.07%	12 (2.987)	11 (2.998)	7 (3.131)	63 (0.687)
"	+	Monocrotophos	0.025%	5 (3.178)	-12 (3.792)	-21 (4.228)	83 (0.991)
"	+	"	0.0375%	8 (3.097)	10 (3.107)	14 (2.921)	73 (0.833)
"	+	"	0.05%	9 (3.057)	2 (3.283)	7 (3.128)	86 (1.142)
Tridemorph 0.075%				15 (2.894)	7 (3.107)	7 (3.125)	16 (0.169)
"	+	Phosphamidon	0.025%	13 (2.947)	6 (3.142)	5 (3.182)	76 (0.877)
"	+	"	0.0375%	17 (2.853)	16 (2.876)	7 (3.122)	76 (0.877)
"	+	"	0.05%	9 (3.057)	2 (3.283)	0 (3.325)	83 (0.991)
"	+	Quinalphos	0.025%	45 (2.304)	19 (2.798)	14 (2.931)	90 (1.206)
"	+	"	0.0375%	27 (2.627)	7 (3.107)	0 (3.328)	86 (1.142)
"	+	"	0.05%	15 (2.894)	7 (3.107)	7 (3.125)	96 (1.420)

Contd.

Table 3 (Contd.)

Treatments				Per cent deviation from control (Days after spraying) 10	20	30	Per cent mortality of C. medinalis
"	+	Phosalone	0.035%	35 (2.467)	12 (2.975)	12 (2.989)	76 (0.877)
"	+	"	0.0525%	45 (2.304)	32 (2.532)	7 (3.134)	63 (0.687)
"	+	"	0.07%	25 (2.680)	24 (2.682)	6 (3.128)	80 (0.927)
"	+	Monocrotophos	0.025%	59 (2.094)	30 (2.567)	14 (2.439)	80 (0.927)
"	+	"	0.0375%	25 (2.680)	14 (2.939)	14 (2.939)	70 (0.782)
"	+	"	0.05%	22 (2.733)	14 (2.939)	12 (2.990)	86 (1.142)
Tridemorph 0.1%				33 (2.517)	24 (2.700)	14 (2.927)	20 (0.202)
"	+	Phosphamidon	0.025%	15 (2.894)	15 (2.904)	7 (3.125)	66 (0.738)
"	+	"	0.0375%	15 (2.894)	7 (3.107)	-9 (3.651)	70 (0.782)
"	+	"	0.05%	6 (3.110)	7 (3.107)	0 (3.329)	86 (1.142)
"	+	Quinalphos	0.025%	33 (2.517)	32 (2.571)	7 (3.131)	86 (1.142)
"	+	"	0.0375%	15 (2.894)	13 (2.904)	14 (2.921)	90 (1.206)
"	+	"	0.05%	18 (2.837)	16 (2.879)	7 (3.134)	93 (1.356)
"	+	Phosalone	0.035%	33 (2.517)	21 (2.763)	7 (3.131)	70 (0.782)
"	+	"	0.0525%	30 (2.571)	19 (2.798)	18 (2.927)	80 (0.927)
"	+	"	0.07%	45 (2.304)	20 (2.562)	14 (2.931)	80 (0.927)
"	+	Monocrotophos	0.025%	50 (2.218)	47 (2.265)	35 (2.473)	86 (1.142)
"	+	"	0.0375%	60 (2.090)	58 (2.119)	25 (2.668)	90 (1.206)
"	+	"	0.05%	43 (2.380)	42 (2.419)	12 (2.993)	86 (1.142)
Phosphamidon			0.025%	15 (2.890)	3 (3.241)	0 (3.339)	53 (0.566)
"			0.0375%	6 (3.138)	0 (3.339)	0 (3.339)	53 (0.566)
"			0.05%	2 (3.288)	-9 (3.682)	-10 (3.694)	66 (0.738)
Quinalphos			0.025%	27 (2.624)	26 (2.657)	18 (2.728)	80 (0.927)
"			0.0375%	15 (2.837)	12 (2.978)	7 (3.128)	86 (1.142)
"			0.05%	27 (2.624)	17 (2.834)	14 (2.924)	93 (1.356)
Phosalone			0.035%	27 (2.624)	18 (2.834)	14 (2.925)	46 (0.489)
"			0.0525%	20 (2.774)	11 (3.002)	7 (3.128)	60 (0.661)
"			0.07%	11 (3.011)	7 (3.128)	3 (3.228)	80 (0.927)
Monocrotophos			0.025%	11 (3.011)	3 (3.239)	-3 (3.453)	53 (0.566)
"			0.0375%	15 (2.837)	10 (3.037)	7 (3.125)	53 (0.566)
"			0.05%	20 (2.774)	11 (3.002)	0 (3.325)	80 (0.927)
Control				0 (3.338)	-6 (3.548)	-10 (3.698)	13
CD (0.05)				NS	NS	NS	NS

Figures in parentheses are transformed values

tridemorph + monocrotophos resulted in minimum (5 per cent) control of the disease.

Monocrotophos (0.0375) per cent) with tridemorph (0.1 per cent) was most effective against the insect.

4.1.5 Effect of insecticides alone on the control of blast and leaffolder

When insecticides were tried alone, to study their fungicidal activity, quinalphos at 0.025 and 0.05 per cent showed some fungicidal activity (27 per cent control of the disease). Least fungicidal activity (2 per cent control) was shown by phosphamidon 0.05 per cent, while maximum control of insect was given by (93 per cent control) quinalphos 0.05 per cent.

The efficacy of pesticidal treatments at panicle initiation stage on the control of blast and leaffolder could not be assessed since symptoms of the disease were not developed by artificial inoculation at that stage.

Flowering stage

4.1.6 Effect of ediphenphos with different combinations of insecticides

When ediphenphos was tried at different concentrations the highest concentration resulted in maximum control of disease whereas the insect mortality was maximum at 0.075 per cent concentration (Table 4).

When the fungicide was combined with various

insecticides, maximum control (28 per cent) of the disease over check was noticed with highest concentration of the fungicide and 0.0525 per cent of phosalone. The per ceht control of the disease decreased to 18 after 20 days of treatment.

Ediphenphos with quinalphos as well as monocrotophos at highest concentrations gave 90 per cent mortality of leaffolder.

4.1.6.1 Combination of ediphenphos with phosphamidon

Maximum control of disease (31 per cent) was obtained by mixing ediphenphos 0.075 per cent with phosphamidon 0.0375 per cent, and per cent control was decreased to 18 after 20 days. The lowest control was noticed for lower doses of the same pesticide combination.

Maximum (83 per cent) and minimum (53 per cent) mortalities of C. medinalis were resulted from combinations of the highest and lowest concentrations of ediphenphos and phosphamidon respectively.

4.1.6.2 Combination of ediphenphos with quinalphos

By mixing highest concentration of the fungicide with lowest concentration of quinalphos, maximum (26 per cent)

control of the disease could be achieved and the effect of treatment decreased to 22 per cent, after 20 days. Minimum control (11 per cent) was noticed with ediphenphos 0.075 per cent + quinalphos 0.05 per cent combination.

Maximum (90 per cent) and minimum (66 per cent) mortalities of leaffolder were obtained by mixing highest and lowest concentrations of two pesticides.

4.1.6.3 Combination of ediphenphos with phosalone

Here, best control of the disease was obtained by mixing highest concentration of ediphenphos and 0.0525 per cent concentration of phosalone, but the extent of control was decreased to 18, after 20 days of treatment. The least effective combination was ediphenphos 0.05 per cent with phosalone 0.0525 per cent.

Maximum (83 per cent) and minimum (70 per cent) mortalities of leaffolder larvae were noticed with highest and lowest concentrations of ediphenphos and phosalone mixtures respectively.

4.1.6.4 Combination of ediphenphos with monocrotophos

In this case, combination of highest concentrations of the fungicide and the insecticide resulted in maximum control

of the disease (26 per cent) as well as the insect (90 per cent) and the per cent control decreased to 13 after 20 days. Combination of lowest concentration of ediphenphos with 0.05 per cent concentration of monocrotophos resulted in lowest (7 per cent) control of the disease. Combination of lowest concentrations of ediphenphos (0.05 per cent) and monocrotophos (0.025 per cent) resulted in minimum (53 per cent) control of the disease.

4.1.7 Effect of carbendazim with different combinations of insecticides

Of the three different concentrations of carbendazim, the maximum and minimum control of the disease as well as the mortality of insects were observed in the highest and lowest concentrations tried respectively.

In combination with insecticides, best control of the disease (51 per cent) was obtained for the treatment combination, carbendazim 0.1 per cent + phosalone 0.07 per cent and per cent control of disease decreased after 20 days of treatment. Minimum control was obtained for the treatment, carbendazim 0.05 per cent + monocrotophos 0.05 per cent.

While considering the mortality of insects, combination of highest level of the fungicide and the lowest level of the insecticide quinalphos was found to be the best as 93 per cent

control was obtained and the least control of the insect was noticed when lowest concentration of the two pesticides were mixed.

4.1.7.1 Combination of carbendazim with phosphamidon

Carbendazim 0.05 per cent in combination with 0.05 per cent concentration of phosphamidon resulted in maximum control (27 per cent) of the disease, and its residual action decreased to 14 per cent after 20 days of treatment, while carbendazim 0.075 per cent in combination with phosphamidon 0.05 per cent resulted in lowest control of the disease (2 per cent control).

A combination of highest concentrations of carbendazim and phosphamidon gave maximum (86 per cent) mortality of the insect and lowest concentrations of same combination gave minimum mortality of the insect.

4.1.7.2 Combination of carbendazim with quinalphos

Maximum control of the disease obtained from this combination was 43 per cent (carbendazim 0.05 per cent + quinalphos 0.05 per cent) and minimum was 3 per cent (carbendazim 0.05 per cent + quinalphos 0.025 per cent).

Better control of leaffolder (93 per cent) was

obtained for the treatment combination of highest concentration of carbendazim and lowest concentration of quinalphos and lowest control of leaffolder (63 per cent) was obtained from carbendazim 0.05 per cent + quinalphos 0.0375 per cent.

4.1.7.3 Combination of carbendazim with phosalone

Maximum (51 per cent) and minimum (19 per cent) control of the disease was noticed in treatment combinations of highest and lowest concentrations of carbendazim and phosalone respectively.

While, combination of highest concentrations of two chemicals resulted in maximum mortality (83 per cent) of the insect, combination of carbendazim 0.075 per cent with phosalone 0.0525 per cent resulted in minimum control of the insect (53 per cent).

4.1.7.4 Combination of carbendazim with monocrotophos

Highest concentration of monocrotophos when combined with highest concentration of carbendazim resulted in highest control of the disease (31 per cent) as well as the mortality of insect and monocrotophos 0.05 per cent in combination with carbendazim 0.05 per cent resulted in lowest control of the disease. Minimum control of the insect (36 per cent) was noticed in treatment with lowest concentrations of carbendazim + monocrotophos.

4.1.8 Effect of captafol with different combinations of insecticides

When captafol at various concentrations was tried, 0.3 per cent concentration was found to be the best as 23 per cent control of disease was obtained over the check, and per cent control was decreased to 13 after 20 days of treatment. Lowest control of the disease (6 per cent) was obtained for lowest concentration of the fungicide tried.

In the case of insect, C. medinalis, all the three concentrations showed similar observation (20 per cent control).

Maximum control of 55 per cent was obtained when the fungicide at 0.225 per cent concentration was mixed with quinalphos 0.0375 per cent and the per cent control of disease decreased to 32 after 20 days of treatment. Lowest control of the disease was noticed in treatment captafol 0.225 per cent + monocrotophos 0.05 per cent.

Highest mortality of leaffolder larvae (90 per cent) was obtained when highest concentration of captafol was mixed with highest concentration of quinalphos and lowest mortality was obtained for lowest concentration of captafol in combination with monocrotophos and phosphamidon 0.0375 per cent.

4.1.8.1 Combination of captafol with phosphamidon

Captafol 0.225 per cent + phosphamidon 0.05 per cent recorded maximum control (54 per cent) of disease and its per cent control was decreased to 22 after 20 days of treatment. Captafol 0.225 per cent + phosphamidon 0.025 per cent resulted in minimum control (1 per cent).

Combination of captafol 0.225 per cent + phosphamidon 0.05 per cent resulted in maximum mortality of the insect (80 per cent) and combination of above concentration of fungicide with 0.0375 per cent concentration of phosphamidon resulted in minimum control of the insect C. medinalis.

4.1.8.2 Combination of captafol with quinalphos

In this combination, best control of the disease (55 per cent) was recorded for the treatment combination, captafol 0.225 per cent + quinalphos 0.0375 per cent and the least control (1 per cent) was noticed in treatments captafol 0.225 per cent + quinalphos 0.025 per cent and captafol 0.3 per cent + quinalphos 0.025 per cent.

Here, mortality varied from 40 per cent to (captafol 0.15 per cent with quinalphos 0.025 per cent and 0.0375 per cent) 90 per cent (captafol 0.3 per cent + quinalphos 0.05 per cent).

4.1.8.3 Combination of captafol with phosalone

Highest control noticed in this combination was 17 per cent (captafol 0.3 per cent + phosalone 0.03 5 per cent) and per cent control of disease was decreased to 15 after 20 days of treatment and lowest control (1 per cent) was noticed in treatment captafol 0.225 per cent + phosalone 0.035 per cent.

In the case of mortality of insects, it varied from 46 per cent (captafol 0.15 per cent + phosalone 0.0525 per cent and captafol 0.225 per cent + phosalone 0.0525 per cent) to 73 per cent (captafol 0.15 per cent + phosalone 0.07 per cent and captafol 0.3 per cent + phosalone 0.07 per cent).

4.1.8.4 Combination of captafol with monocrotophos

Combination of lowest concentration of captafol with 0.0375 per cent concentration of monocrotophos resulted in maximum control of the disease (50 per cent) and its effect decreased to 7 per cent after 20 days. Minimum control was noted in treatment combination captafol 0.225 per cent with monocrotophos 0.05 per cent.

In the case of insect mortality, maximum (80 per cent) and minimum (30 per cent) values were given by combinations

involving highest and lowest concentrations of captafol and monocrotophos respectively.

4.1.9 Effect of tridemorph with different combination of insecticides

From the data presented in Table4 it is evident that, tridemorph 0.1 per cent gave maximum control (31 per cent) of the disease over other two concentrations tried and per cent control over check was decreased to 15 after 20 days of treatment. The lowest concentration of fungicide showed minimum control (19 per cent). The same trend was noticed in the case of mortality of leaffolder also.

But in combination with insecticides, its efficiency decreased and the maximum control of disease noticed was only 18 per cent (tridemorph 0.075 per cent with phosphamidon 0.025 per cent and phosalone 0,07 per cent) and minimum control was noticed with tridemorph 0.1 per cent + quinalphos 0.025 per cent.

When mortality of insects was assessed, highest concentrations of tridemorph and quinalphos recorded maximum (93 per cent) and lowest concentration of tridemorph in combination with lowest concentrations of phosalone and monocrotophos resulted in minimum values (40 per cent).

4.1.9.1 Combination of tridemorph with phosphamidon

In this case, maximum (18 per cent) and minimum control was noticed in treatment combinations tridemorph 0.075 per cent + phosphamidon 0.025 per cent and tridemorph 0.05 per cent + phosphamidon 0.0375 per cent respectively. The per cent control of the disease was decreased after 20 days of treatment.

Sixty six to ninety per cent control of insect could be achieved by mixing tridemorph with phosphamidon and minimum and maximum values were given by treatment combinations tridemorph 0.05 per cent + phosphamidon 0.0375 per cent and tridemorph 0.1 per cent + phosphamidon 0.05 per cent respectively.

4.1.9.2 Combination of tridemorph with quinalphos

Lowest concentration of tridemorph when combined with quinalphos 0.05 per cent resulted in maximum control of (7 per cent) the disease and its effect decreased after 20 days and highest concentration of tridemorph in combination with quinalphos 0.025 per cent resulted in minimum control (0 per cent) of disease.

Combination of highest concentrations of tridemorph and quinalphos gave maximum (93 per cent control) mortality of

the insect C. medinalis and combination of tridemorph 0.05 per cent + quinalphos 0.0375 per cent gave minimum mortality (46 per cent) of the insect.

4.1.9.3 Combination of tridemorph with phosalone

In this combination, maximum control of the disease was (18 per cent) given by treatment combinations, tridemorph at 0.075 as well as at 0.035 per cent with phosalone 0.075 per cent and minimum value was (5 per cent) given by tridemorph 0.05 per cent + phosalone 0.035 per cent.

While in the case of mortality of insect, the value varied from 40 per cent (tridemorph 0.05 per cent + phosalone 0.035 per cent) to 90 per cent (tridemorph 0.1 per cent + phosalone 0.07 per cent).

4.1.9.4 Combination of tridemorph with monocrotophos

Tridemorph 0.075 per cent + monocrotophos 0.05 per cent recorded highest control (16 per cent) of the disease and combination of lowest concentrations of tridemorph and monocrotophos gave minimum control of the disease.

Combination of lowest concentrations of tridemorph and monocrotophos resulted in minimum mortality (40 per cent) of the insect, and highest concentrations of tridemorph and

Table 4. Effect of different fungicides, insecticides, and their combinations on the control of blast (P. oryzae) and leaffolder (C. medinalis) at flowering stage

Treatments			Per cent deviation from control (Days after spraying)		Per cent mortality of leaffolder
			10	20	
Ediphenphos	0.05%		12 (4.576)	5 (4.878)	23 (0.236)
"	+ Phosphamidon	0.025%	9 (4.715)	5 (4.878)	43 (0.444)
"	+ "	0.0375%	10 (4.675)	9 (4.691)	60 (0.661)
"	+ "	0.05%	19 (4.326)	11 (4.639)	73 (0.833)
"	+ Quinalphos	0.025%	15 (4.482)	8 (4.773)	66 (0.738)
"	+ "	0.0375%	13 (4.547)	8 (4.773)	76 (0.877)
"	+ "	0.05%	13 (4.547)	9 (4.691)	76 (0.877)
"	+ Phosalone	0.035%	22 (4.195)	2 (5.048)	73 (0.833)
"	+ "	0.0525%	9 (4.719)	3 (4.980)	76 (0.877)
"	+ "	0.07%	14 (4.511)	5 (4.897)	80 (0.927)
"	+ Monocrotophos	0.025%	16 (4.442)	3 (4.980)	53 (0.566)
"	+ "	0.0375%	14 (4.511)	3 (4.980)	63 (0.687)
"	+ "	0.05%	7 (4.775)	3 (4.980)	80 (0.927)
Ediphenphos	0.075%		16 (4.427)	10 (4.664)	30 (0.303)
"	+ Phosphamidon	0.025%	16 (4.428)	3 (4.974)	63 (0.687)
"	+ "	0.0375%	31 (4.380)	18 (4.350)	70 (0.782)
"	+ "	0.05%	18 (4.345)	1 (5.091)	73 (0.833)
"	+ Quinalphos	0.025%	17 (4.387)	13 (4.554)	80 (0.927)
"	+ "	0.0375%	18 (4.363)	11 (4.615)	80 (0.927)
"	+ "	0.05%	11 (4.637)	4 (4.918)	83 (0.911)
"	+ Phosalone	0.035%	17 (4.387)	12 (4.591)	73 (0.833)
"	+ "	0.0525%	15 (4.482)	4 (4.931)	73 (0.833)
"	+ "	0.07%	15 (4.459)	9 (4.691)	76 (0.877)
"	+ Monocrotophos	0.025%	9 (4.719)	2 (5.048)	66 (0.738)
"	+ "	0.0375%	11 (4.636)	4 (4.952)	76 (0.877)
"	+ "	0.05%	12 (4.594)	-3 (4.849)	83 (0.991)
Ediphenphose	0.1%		25 (4.097)	19 (4.328)	26 (0.274)
"	+ Phosphamidon	0.025%	22 (4.195)	16 (4.428)	80 (0.927)
"	+ "	0.0375%	18 (4.334)	14 (4.515)	80 (0.927)
"	+ "	0.05%	18 (4.345)	15 (4.451)	83 (0.991)

Contd.

Table 4 (Contd.)

Treatments			Per cent deviation from control (Days after spraying) 10	20	Per cent mortality of leaffolder
" + Quinalphos		0.025%	26 (4.076)	22 (4.215)	83 (0.991)
" + "		0.0375%	25 (4.093)	19 (4.302)	86 (1.142)
" + "		0.05%	25 (4.093)	19 (4.302)	90 (1.206)
" + Phosalone		0.035%	24 (4.141)	10 (4.664)	80 (0.927)
" + "		0.0525%	28 (3.995)	18 (4.356)	80 (0.927)
" + "		0.07%	22 (4.195)	9 (4.691)	83 (0.991)
" + Monocrotophos		0.025%	19 (4.326)	5 (4.900)	76 (0.877)
" + "		0.0375%	24 (4.124)	20 (4.291)	86 (1.142)
" + "		0.05%	26 (4.086)	13 (4.553)	90 (1.206)
Carbendazim 0.05%			6 (4.822)	0 (5.122)	26 (0.274)
" + Phosphamidon		0.025%	18 (4.345)	6 (4.828)	46 (0.489)
" + "		0.0375%	14 (4.506)	8 (4.744)	50 (0.526)
" + "		0.05%	27 (4.373)	14 (3.817)	63 (0.687)
" + Quinalphos		0.025%	3 (4.991)	2 (5.043)	80 (0.927)
" + "		0.0375%	20 (4.290)	6 (4.819)	63 (0.687)
" + "		0.05%	43 (3.589)	39 (3.682)	70 (0.782)
" + Phosalone		0.035%	9 (4.708)	5 (4.875)	56 (0.610)
" + "		0.0525%	11 (4.556)	0 (5.112)	66 (0.738)
" + "		0.07%	23 (4.159)	15 (4.477)	80 (0.927)
" + Monocrotophos		0.023%	2 (5.035)	-1 (5.169)	36 (0.372)
" + "		0.0375%	2 (5.035)	-1 (5.162)	46 (0.489)
" + "		0.05%	2 (5.029)	-4 (5.367)	70 (0.782)
Carbendazim 0.075%			18 (4.345)	12 (4.564)	36 (0.372)
" + Phosphamidon		0.025%	9 (4.719)	-3 (5.275)	46 (0.489)
" + "		0.0375%	3 (5.011)	2 (4.281)	43 (0.449)
" + "		0.05%	2 (5.038)	-2 (5.243)	76 (0.877)
" + Quinalphos		0.025%	9 (4.708)	-3 (5.293)	86 (1.142)
" + "		0.0375%	8 (4.758)	2 (4.999)	76 (0.877)
" + "		0.05%	7 (4.816)	1 (5.076)	86 (1.142)
" + Phosalone		0.035%	21 (4.243)	9 (4.725)	60 (0.661)
" + "		0.0525%	12 (4.567)	5 (4.875)	53 (0.566)
" + "		0.07%	37 (3.754)	19 (4.329)	60 (0.661)
" + Monocrotophos		0.025%	1 (5.080)	1 (5.083)	46 (0.489)
" + "		0.0375%	6 (4.830)	3 (4.988)	40 (0.404)
" + "		0.05%	4 (4.931)	-4 (5.366)	76 (0.877)

Contd.

Table 4 (Contd.)

Treatments				Per cent deviation from control (Days after spraying) 10	20	Per cent mortality of leaffolder
Carbendazim 0.1%				31 (3.920)	15 (4.480)	43 (0.449)
"	+	Phosphamidon	0.025%	11 (4.636)	4 (4.952)	66 (0.738)
"	+	"	0.0375%	19 (4.326)	8 (4.763)	83 (0.991)
"	+	"	0.05%	17 (4.373)	4 (4.952)	86 (1.142)
"	+	Quinalphos	0.025%	30 (3.945)	22 (4.202)	93 (1.356)
"	+	"	0.0375%	24 (4.125)	18 (4.365)	70 (0.782)
"	+	"	0.05%	23 (4.188)	17 (4.393)	76 (0.877)
"	+	Phosalone	0.035%	21 (4.224)	14 (4.510)	66 (0.738)
"	+	"	0.0525%	41 (3.648)	4 (4.952)	80 (0.927)
"	+	"	0.07%	51 (3.336)	23 (4.179)	83 (0.991)
"	+	Monocrotophos	0.025%	23 (4.179)	19 (4.299)	60 (0.661)
"	+	"	0.0375%	31 (3.920)	17 (4.401)	63 (0.687)
"	+	"	0.05%	31 (3.920)	18 (4.348)	80 (0.927)
Captafol 0.15%				6 (4.864)	3 (4.984)	20 (0.202)
"	+	Phosphamidon	0.025%	1 (5.080)	0 (5.112)	46 (0.489)
"	+	"	0.0375%	6 (4.837)	-3 (5.235)	63 (0.687)
"	+	"	0.05%	3 (4.971)	-3 (5. 293)	73 (0.833)
"	+	Quinalphos	0.025%	10 (4.679)	3 (4.984)	40 (0.404)
"	+	"	0.0375%	30 (3.920)	18 (4.365)	40 (0.404)
"	+	"	0.05%	39 (3.680)	29 (3.985)	73 (0.833)
"	+	Phosalone	0.035%	13 (4.553)	0 (5.126)	50 (0.526)
"	+	"	0.0525%	7 (4.816)	2 (5.046	46 (0.489)
"	+	"	0.07%	7 (4.816)	1 (5.083)	73 (0.833)
"	+	Monocrotophos	0.025%	8 (4.731)	-1 (5.162)	40 (0.404)
"	+	"	0.0375%	50 (3.421)	7 (4.783)	30 (0.303)
"	+	"	0.05%	2 (5.038)	-1 (5.206)	73 (0.833)
Captafol 0.225%				20 (4.286)	13 (4.549)	20 (0.202)
"	+	Phosphamidon	0.025%	1 (5.080)	1 (5.083)	43 (0.449)
"	+	"	0.0375%	6 (4.858)	0 (5.112)	30 (0.303)
"	+	"	0.05%	54 (3.334)	22 (4.202)	80 (0.927)
"	+	Quinalphos	0.025%	51 (3.918)	10 (4.679)	43 (0.449)
"	+	"	0.0375%	55 (3.315)	32 (3.875)	80 (0.927)
"	+	"	0.05%	6 (4.858)	0 (5.144)	80 (0.927)
"	+	Phosalone	0.035%	1 (5.102)	-1 (5.162)	50 (0.526)
"	+	"	0.0525%	8 (4.766)	1 (5.091)	46 (0.489)
"	+	"	0.07%	9 (4.722)	0 (5.112)	66 (0.738)

Contd.

Table 4 (Contd.

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of leaffolder
				10	20	
"	+ Monocrotophos	0.025%		23 (4.188)	14 (4.150)	33 (0.343)
"	+ "	0.0375%		31 (3.920)	19 (4.299)	50 (0.526)
"	+ "	0.05%		0 (5.275)	-8 (5.552)	73 (0.833)
Captafol	0.3%			23 (4.169)	13 (4.544)	20 (0.202)
"	+ Phosphamidon	0.025%		9 (4.726)	1 (5.080)	60 (0.661)
"	+ "	0.0375%		28 (4.022)	12 (4.564)	60 (0.661)
"	+ "	0.05%		23 (4.168)	16(4.423)	60 (0.661)
"	+ Quinalphos	0.025%		1 (5.080)	0 (5.146)	60 (0.661)
"	+ "	0.0375%		8 (4.749)	1 (5.059)	80 (0.927)
"	+ "	0.05%		22 (4.195)	17 (4.405)	90 (1.206)
"	+ Phosalone	0.035%		17 (4.398)	15 (4 480)	50 (0.526)
"	+ "	0.0525%		15 (4.456)	4 (4.936)	60 (0.661)
"	+ "	0.07%		13 (4.527)	7 (4.803)	73 (0.833)
"	+ Monocrotophos	0.025%		1 (5.102)	-3 (5.293)	40 (0.404)
"	+ "	0.0375%		15 (4.456)	9 (4.700)	53 (0.566)
"	+ "	0.05%		18 (4.342)	7 (4.783)	80 (0.927)
Tridemorph	0.05%			19 (4.314)	3 (4.984)	33 (0.343)
"	+ Phosphamidon	0.025%		4 (4.941)	-1 (5.208)	73 (0.833)
"	+ "	0.0375%		0 (4.679)	-8 (4.757)	66 (0.738)
"	+ "	0.05%		7 (4.775)	3 (4.980)	76 (0.877)
"	+ Quinalphos	0.025%		5 (4.899)	-1 (5.179)	50 (0.526)
"	+ "	0.0375%		3 (4.169)	4 (4.917)	46 (0.489)
"	+ "	0.05%		7 (5.038)	-1 (5.210)	90 (1.206)
"	+ Phosalone	0.035%		5 (4.908)	-1 (5.179)	40 (0.404)
"	+ "	0.052%		13 (4.539)	4 (4.917)	50 (0.526)
"	+ "	0.07%		14 (4.511)	3 (4.980)	76 (0.877)
"	+ Monocrotophos	0.025%		3 (5.275)	-5 (5.430)	43 (0.449)
"	+ "	0.0375%		2 (5.040)	0 (5.144)	43 (0.449)
"	+ "	0.05%		11 (4.610)	-2 (5.235)	70 (0.782)
Tridemorph	0.075%			20 (4.290)	5 (4.815)	33 (0.343)
"	+ Phosphamidon	0.025%		18 (4.479)	10 (4.381)	70 (0.782)
"	+ "	0.0375%		15 (4.456)	7 (4.785)	80 (0.927)
"	+ "	0.05%		14 (4.124)	10 (4.381)	76 (0.877)
"	+ Quinalphos	0.025%		2 (5.040)	-5 (5.405)	53 (0.566)
"	+ "	0.0375%		8 (4.744)	2 (5.048)	86 (1.142)
"	+ "	0.05%		5 (4.777)	7 (4.785)	90 (1.206)

Contd.

Table 4 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of leaffolder
				10	20	
"	+	Phosalone	0.035%	18(4.345)	3 (4.980)	50 (0.526)
"	+	"	0.0525%	12 (5.048)	2 (5.251)	66 (0.738)
"	+	"	0.07%	18 (3.995)	5 (4.890)	86 (1.142)
"	+	Monocrotophos	0.025%	6 (4.847)	-3 (5.313)	46 (0.489)
"	+	"	0.0375%	15 (4.477)	-2 (5.227)	50 (0.526)
"	+	"	0.05%	16 (4.425)	-3 (5.275)	73 (0.833)
Tridemorph	0.1%			31 (3.920)	15 (4.445)	43 (0.449)
"	+	Phosphamidon	0.025%	16 (4.425)	10 (4.655)	76 (0.877)
"	+	"	0.0375%	10 (4.655)	-3 (5.275)	93 (1.356)
"	+	"	0.05%	17 (4.398)	-1 (4.689)	90 (1.206)
"	+	Quinalphos	0.025%	5 (4.892)	-7 (5.532)	46 (0.489)
"	+	"	0.0375%	7 (4.803)	1 (5.066)	83 (0.991)
"	+	"	0.05%	2 (5.048)	1 (5.083)	93 (1.356)
"	+	Phosalone	0.035%	12 (4.599)	7 (4.785)	60 (0.661)
"	+	"	0.0525%	16 (4.425)	4 (4.914)	60 (0.661)
"	+	"	0.07%	17 (4.398)	8 (4.736)	90 (1.206)
"	+	Monocrotophos	0.025%	2 (5.040)	1 (5.106)	53 (0.566)
"	+	"	0.0375%	13 (4.539)	7 (4.803)	66 (0.610)
"	+	"	0.05%	15 (4.444)	4 (4.917)	86 (1.142)
Phosphamidon			0.025%	3 (4.980)	-15 (6.060)	43 (0.449)
"			0.0375%	5 (4.890)	-5 (5.417)	60 (0.661)
"			0.05%	9 (4.721)	3 (4.964)	43 (0.449)
Quinalphos			0.025%	13 (4.525)	13 (4.525)	63 (0.687)
"			0.0375%	12 (4.592)	-1 (4.924)	66 (0.738)
"			0.05%	7 (4.1775)	-1 (4.924)	83 (0.991)
Phosalone			0.035%	8 (4.766)	0 (5.127)	53 (0.566)
"			0.0525%	12 (4.594)	0 (5.127)	56 (0.610)
"			0.07%	8 (4.756)	0 (5.129)	76 (0.877)
Monocrotophos			0.025%	8 (4.757)	7 (4.813)	23 (0.236)
"			0.0375%	21 (4.235)	10 (4.675)	43 (0.449)
"			0.05%	20 (4.290)	13 (4.522)	80 (0.927)
Control				0 (5.132)	-10 (5.717)	6
CD (0.05)				NS	NS	0.3023

Figures in parantheses are transformed values

monocrotophos resulted in maximum mortality (86 per cent) of C. medinalis.

4.1.9.5 Effect of insecticides alone

It is clear from the Table 4 that among the insecticides tried, monocrotophos at 0.0375 per cent showed some fungicidal effect against blast disease as it gave 21 per cent control of the disease over other insecticides and phosphamidon 0.025 per cent showed least fungicidal action. Maximum mortality of C. medinalis (83 per cent) was given by highest concentration of quinalphos and minimum (23 per cent) by lowest concentration of monocrotophos.

4.2 Effect of different concentrations of fungicides, insecticides and their combinations for the control of sheath blight (R. solani) and brown planthopper (N. lugens)

The rice plants at tillering, panicle initiation and flowering stages were inoculated with sclerotia of R. solani and the intensity of the disease was measured at 10 days interval till harvest.

Data on the per cent control of the disease over check and per cent mortality of the insect towards the chemicals are presented in Tables 5, 6 and 7.

Tillering stage

4.2.1 Effect of ediphenphos with different combinations of insecticides

Among individual applications, ediphenphos at 0.075 per cent gave best result, as 20 per cent control was obtained, and per cent control of disease was decreased to 12 after 20 days and 3 after 30 days of treatment (Table 5).

Highest control of brown planthopper was obtained from highest concentration of ediphenphos (30 per cent control).

In combination with insecticides, ediphenphos 0.1 per cent was found to be the best, as 23 per cent control of disease was obtained (ediphenphos 0.1 per cent + quinalphos 0.0375 per cent) and its efficiency decreased after 20 days of treatment and there was no residual effect after 30 days. Lowest control (5 per cent) was noticed with ediphenphos 0.075 per cent in combination with monocrotophos 0.0375 per cent.

In the case of mortality of insects, minimum value was noticed in treatment combination involving lowest concentrations of ediphenphos and monocrotophos and maximum control was noted with highest concentrations of ediphenphos with quinalphos and phosalone.

4.2.1.1 Combination of ediphenphos with phosphamidon

Ediphenphos at 0.01 per cent in combination with phosphamidon resulted in highest control (20 per cent) of sheath blight, and the combination of lowest concentration of ediphenphos with phosphamidon 0.0375 per cent resulted in lowest control (7 per cent) of the disease.

In the case of mortality of insects, combination of highest concentrations of the two pesticides was the best, as 90 per cent control could be obtained and lowest control (50 per cent) was noticed in combination of lowest concentration of the pesticides tried.

4.2.1.2 Combination of ediphenphos with quinalphos

In this combination, mixing highest concentration of ediphenphos with 0.0375 per cent concentration of quinalphos was found to be superior as 23 per cent control of sheath blight over control was obtained and per cent control decreased to 7 after 20 days of treatment and later on no residual effect was noticed. Lowest control noticed (10 per cent) was in treatment combination involving lowest concentration of ediphenphos and highest concentration of quinalphos.

Combination of highest concentrations of ediphenphos

and quinalphos resulted in maximum control (96 per cent) of insect and lowest concentrations of the same pesticide combination resulted in minimum control (43 per cent) of the insect.

4.2.1.3 Combination of ediphenphos with phosalone

Maximum control of the disease (20 per cent) and mortality of insects (96 per cent) were obtained from treatment combination containing two higher doses of the pesticides, and per cent control of the disease decreased to 17 and then to 12 after 20 and 30 days of treatment. Lowest control of the disease (7 per cent) and mortality of insects (53 per cent) were noticed in treatment combination with lower concentrations of ediphenphos and phosalone.

4.2.1.4 Combination of ediphenphos with monocrotophos

Lowest concentration of ediphenphos in combination with highest concentration of monocrotophos resulted in better control of (18 per cent) disease and its effect decreased to 11 per cent and then to -1 per cent after 20 and 30 days of treatment. Lowest (9 per cent) control of the disease was noticed in treatment ediphenphos 0.075 per cent + monocrotophos 0.05 per cent.

Mortality of brown planthopper varied from 40 per cent to 83 per cent with ediphenphos 0.05 per cent + monocrotophos 0.025 per cent and ediphenphos 0.1 per cent + monocrotophos 0.05 per cent respectively.

4.2.2 Effect of carbendazim with different combinations of insecticides

When carbendazim alone was tried in different concentrations, maximum control over check (9 per cent) was noticed with lowest concentration. While in the case of mortality of insects, maximum value (13 per cent) was obtained with carbendazim at 0.075 per cent.

When combined with insecticides, its efficiency, both fungicidal and insecticidal, increased and maximum of 30 per cent control of the disease was noticed in treatment carbendazim 0.075 per cent + quinalphos 0.025 per cent. Combination of lowest concentrations of carbendazim (0.05 per cent) and phosphamidon (0.05 per cent) resulted in least control (1 per cent) of the disease. In the case of mortality of insect, maximum mortality (93 per cent) was noticed with highest concentration of carbendazim and monocrotophos and minimum with carbendazim 0.075 per cent + quinalphos 0.025 per cent (46 per cent).

4.2.2.1 Combination of carbendazim with phosphamidon

Carbendazim 0.075 per cent + phosphamidon 0.05 per cent gave maximum control (16 per cent) of disease and carbendazim 0.05 per cent + phosphamidon 0.05 per cent gave minimum value.

In this case, mortality of N. lugens varied from 56 per cent (carbendazim 0.075 per cent + phosphamidon 0.025 per cent) to 80 per cent (carbendazim 0.075 per cent + phosphamidon 0.05 per cent).

4.2.2.2 Combination of carbendazim with quinalphos

Maximum (30 per cent) and minimum control (1 per cent) were given by treatments carbendazim 0.075 per cent + quinalphos 0.025 per cent and carbendazim 0.05 per cent + quinalphos 0.05 per cent respectively.

While, highest concentration of carbendazim + quinalphos gave maximum mortality (86per cent), Carbendazim 0.075 per cent + quinalphos 0.05 per cent gave minimum mortality (46 per cent) of the insect N. lugens.

4.2.2.3 Combination of carbendazim with phosalone

In this combination, maximum control of disease (17 per cent) was obtained from treatment carbendazim 0.075

per cent + phosalone 0.0525 per cent and minimum (2 per cent) was from carbendazim 0.05 per cent + phosalone 0.0525 per cent).

However, highest concentrations of carbendazim and phosalone gave maximum control (90 per cent) of the insect, N. lugens and lowest concentration of carbendazim in combination with phosalone 0.035 per cent gave minimum control (53 per cent).

4.2.2.4 Combination of carbendazim with monocrotophos

Lowest concentration of monocrotophos in combination with highest concentration of carbendazim resulted in maximum control (16 per cent) of the disease and per cent control was decreased to 11 after 20 days of treatment and there was no effect after 30 days. Lowest control was noticed in treatment involving carbendazim 0.075 per cent + monocrotophos 0.025 per cent.

4.2.3 Effect of captafol with different combinations of insecticides

Highest concentration of captafol was found to be the best over other two concentrations for the control of the disease as well as the insect when tried alone and no residual effect was noticed after 30 days of application.

The maximum control of the disease in mixed application was noticed in treatment captafol 0.225 per cent + quinalphos 0.05 per cent (20 per cent control) and minimum control was noted with lowest concentration of captafol with monocrotophos (0.0375 per cent).

4.2.3.1 Combination of captafol with phosphamidon

Combination of highest concentrations of captafol and phosphamidon resulted in maximum control (19 per cent) of disease as well as mortality of insect (76 per cent) and per cent control decreased to 14 and 10 after 20 and 30 days of treatment respectively. Lowest concentrations of captafol and phosphamidon when mixed resulted in least control of the disease and mortality of the insect.

4.2.3.2 Combination of captafol with quinalphos

Captafol 0.225 per cent in combination with highest concentration of quinalphos (0.05 per cent) gave good control of disease (20 per cent) but its effect decreased after 20 days of treatment to 15 per cent and, then to 9 per cent after 30 days. Lowest concentration of captafol in combination with quinalphos 0.05 per cent resulted in minimum control of the disease.

Combination of highest concentrations of captafol and quinalphos gave highest mortality (86 per cent) and captafol 0.225 per cent + quinalphos 0.025 per cent gave minimum mortality (53 per cent) of N. lugens.

4.2.3.3 Combination of captafol with phosalone

Maximum (16 per cent) and minimum (5 per cent) control of the disease was noticed with treatment combinations involving highest concentration of captafol and phosalone at 0.035 per cent and lowest concentration of captafol and phosalone at 0.07 per cent respectively.

In the case of mortality of insects, the effect varied from 43 per cent (captafol 0.15 per cent + phosalone 0.035 per cent) to 76 per cent (captafol 0.225 per cent + phosalone 0.07 per cent).

4.2.3.4 Combination of captafol with monocrotophos

Mixing highest concentrations of captafol (0.3 per cent) and monocrotophos (0.05 per cent) was found to be the best as 15 per cent control of the disease and 83 per cent mortality of the insect could be obtained, but per cent control decreased after 20 days to 10. But captafol 0.15 per cent in combination with monocrotophos 0.0375 per cent gave minimum control of the disease and captafol 0.225 per cent in

combination with monocrotophos 0.025 per cent gave lowest mortality of N. lugens.

4.2.4 Effect of tridemorph with different combinations of insecticides

When tridemorph alone was tried at different concentrations, the maximum control of disease over check was noticed at 0.05 per cent concentration, and the insect mortality was maximum at 0.1 per cent concentration.

In combination with insecticides, it yielded maximum of 17 per cent control of the disease (tridemorph 0.075 per cent + phosalone 0.07 per cent) but per cent control decreased after 20 days of treatment. Lowest control was noticed in treatment with lowest concentration of tridemorph plus phosalone 0.035 per cent as well as monocrotophos 0.0375 per cent.

In the case of mortality of the insect, combination of tridemorph and quinalphos at highest concentrations recorded maximum mortality (96 per cent) and lowest concentrations of tridemorph and phosalone gave minimum mortality (40 per cent) of N. lugens.

4.2.4.1 Combination of tridemorph with phosphamidon

In this case, combination between tridemorph 0.075 per

cent and phosphamidon 0.025 per cent was found to be the best against sheath blight and tridemorph 0.1 per cent + phosphamidon 0.025 per cent gave lowest control of the disease.

Maximum mortality (96 per cent) of N. lugens was noticed in combination of tridemorph and phosphamidon at highest concentrations and minimum mortality (53 per cent) in tridemorph 0.075 per cent + phosphamidon 0.025 per cent.

4.2.4.2 Combination of tridemorph with quinalphos

Tridemorph 0.075 per cent + quinalphos 0.05 per cent and tridemorph 0.1 per cent + quinalphos 0.025 per cent were equally effective and gave maximum control (16 per cent) while tridemorph and quinalphos both at 0.05 per cent levels resulted in minimum (2 per cent) control of sheath blight.

Mixture of highest concentrations of tridemorph and quinalphos gave maximum mortality (90 per cent) and lowest concentrations of the same combination gave minimum mortality (43 per cent) of the insect.

4.2.4.3 Combination of tridemorph with phosalone

Here highest and lowest control of sheath blight disease was given by treatment combinations, tridemorph 0.075

per cent + phosalone 0.07 per cent and tridemorph 0.05 per cent + phosalone 0.035 per cent respectively.

Combination using highest concentrations of tridemorph and phosalone yielded maximum control of the insect (86 per cent control) and combination of lowest concentrations of tridemorph and phosalone resulted in minimum control (40 per cent) of insect.

4.2.4.4 Combination of tridemorph with monocrotophos

Highest concentration of tridemorph in combination with 0.0375 per cent concentration of monocrotophos gave 16 per cent control of the disease and per cent control decreased to 13 after 20 days andto2 after 30 days of treatment. Minimum control was noted in combination, tridemorph 0.05 per cent + monocrotophos 0.0375 per cent.

Maximum mortality of N. lugens (83 per cent) was obtained from mixture of the highest concentrations of tridemorph and monocrotophos and minimum mortality was from the lowest concentrations of the same pesticides.

4.2.5 Effect of insecticides alone

When insecticides alone were tested for their fungicidal activity, it was found that, maximum of 15 per cent

Table 5. Effect of different fungicides, insecticides and their combinations on the control of sheath blight (R. solani) and brown planthopper (N. lugens) at tillering stage

Treatments			Per cent deviation from control (Days after spraying)			Per cent mortality of N. lugens
			10	20	30	
Ediphenphos 0.05%			13 (4.966)	8 (5.196)	0 (5.615)	20 (0.202)
"	+ Phosphamidon	0.025%	10 (5.098)	-3 (5.781)	-4 (5.837)	50 (0.526)
"	+ "	0.0375%	7 (5.250)	-2 (5.696)	-9 (6.141)	70 (0.782)
"	+ "	0.05%	13 (4.963)	7 (5.242)	-4 (5.837)	83 (0.991)
"	+ Quinalphos	0.025%	13 (4.966)	9 (5.150)	-5 (5.911)	40 (0.404)
"	+ "	0.0375%	11 (5.039)	-1 (5.640)	-9 (6.141)	73 (0.833)
"	+ "	0.05%	10 (5.098)	-3 (5.772)	-15 (6.591)	86 (1.142)
"	+ Phosalone	0.035%	7 (5.220)	-8 (6.071)	-10 (6.246)	53 (0.566)
"	+ "	0.0525%	10 (5.118)	1 (5.564)	-6 (5.989)	60 (0.661)
"	+ "	0.07%	8 (5.206)	-5 (5.921)	-12 (6.395)	76 (0.877)
"	+ Monocrotophos	0.025%	15 (4.862)	10 (5.109)	-6 (5.989)	40 (0.404)
"	+ "	0.0375%	16 (4.854)	10 (5.111)	-3 (5.761)	43 (0.440)
"	+ "	0.05%	18 (4.760)	11 (5.039)	-1 (5.581)	73 (0.833)
Ediphenphos 0.075%			20 (4.661)	12 (4.996)	3 (5.436)	23 (0.236)
"	+ Phosphamidon	0.025%	18 (4.760)	11 (5.039)	6 (5.281)	60 (0.661)
"	+ "	0.0375%	18 (4.760)	12 (5.003)	6 (5.281)	73 (0.833)
"	+ "	0.05%	15 (4.617)	8 (5.217)	-5 (5.929)	86 (1.142)
"	+ Quinalphos	0.025%	22 (4.818)	10 (5.094)	7 (5.242)	56 (0.610)
"	+ "	0.0375%	16 (4.594)	5 (5.342)	-10 (6.254)	56 (0.610)
"	+ "	0.05%	22 (4.932)	2 (5.488)	-6 (5.995)	93 (1.356)
"	+ Phosalone	0.035%	14 (4.932)	-1 (5.682)	-4 (5.815)	76 (0.877)
"	+ "	0.0525%	18 (4.760)	12 (5.003)	12 (5.018)	76 (0.877)
"	+ "	0.07%	17 (4.785)	13 (4.981)	6 (5.304)	83 (0.991)
"	+ Monocrotophos	0.025%	9 (5.126)	5 (5.371)	1 (5.559)	46 (0.489)
"	+ "	0.0375%	5 (5.344)	4 (5.413)	-6 (5.965)	70 (0.782)
"	+ "	0.05%	14 (4.921)	12 (5.003)	-1 (5.656)	76 (0.877)
Ediphenphos 0.1%			12 (5.009)	11 (5.068)	4 (5.399)	30 (0.303)
"	+ Phosphamidon	0.025%	18 (4.760)	14 (4.935)	2 (5.508)	80 (0.927)
"	+ "	0.0375%	16 (4.852)	11 (5.039)	1 (5.566)	86 (1.142)
"	+ "	0.05%	20 (4.689)	17 (4.805)	-4 (5.821)	90 (1.206)

Contd.

Table 5. (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of N. lugens
				10	20	30	
"	+	Quinalphos	0.025%	17 (4.795)	13 (4.962)	7 (5.226)	63 (0.687)
"	+	"	0.0375%	23 (4.544)	7 (5.255)	0 (5.620)	93 (1.356)
"	+	"	0.05%	18 (4.760)	7 (5.266)	-2 (5.711)	96 (1.420)
"	+	Phosalone	0.035%	19 (4.695)	10 (5.107)	-5 (5.928)	80 (0.927)
"	+	"	0.0525%	19 (4.693)	14 (4.925)	4 (5.386)	86 (1.142)
"	+	"	0.07%	20 (4.655)	17 (4.781)	12 (5.011)	96 (1.420)
"	+	Monocrotophos	0.025%	10 (5.111)	8 (5.217)	5 (5.336)	60 (0.661)
"	+	"	0.0375%	15 (4.885)	13 (4.985)	10 (5.123)	63 (0.687)
"	+	"	0.05%	12 (5.031)	9 (5.150)	-1 (5.688)	83 (0.991)
Carbendazim 0.05%				9 (5.148)	8 (5.189)	3 (5.430)	3 (0.033)
"	+	Phosphamidon	0.025%	4 (5.375)	-2 (5.923)	-5 (5.938)	63 (0.687)
"	+	"	0.0375%	9 (5.148)	-10 (6.233)	-15 (6.621)	63 (0.687)
"	+	"	0.05%	1 (5.589)	-10 (6.233)	-17 (6.846)	70 (0.782)
"	+	Quinalphos	0.025%	5 (5.322)	4 (5.375)	-16 (6.710)	70 (0.782)
"	+	"	0.0375%	1 (5.589)	-4 (5.829)	-13 (6.455)	80 (0.927)
"	+	"	0.05%	3 (5.495)	-5 (5.923)	-8 (6.083)	83 (0.991)
"	+	Phosalone	0.035%	14 (4.904)	9 (5.150)	4 (5.412)	53 (0.560)
"	+	"	0.0525%	2 (5.477)	1 (5.568)	-6 (5.983)	70 (0.782)
"	+	"	0.07%	4 (5.414)	2 (5.509)	-2 (5.712)	76 (0.877)
"	+	Monocrotophos	0.023%	12 (5.021)	10 (5.108)	-4 (5.847)	63 (0.687)
"	+	"	0.0375%	7 (5.265)	5 (5.342)	-3 (5.789)	70 (0.782)
"	+	"	0.05%	7 (5.265)	4 (5.371)	-6 (5.976)	80 (0.927)
Carbendazim 0.075%				3 (5.446)	2 (5.509)	0 (5.589)	3 (0.033)
"	+	Phosphamidon	0.025%	14 (4.921)	11 (5.069)	-5 (5.883)	56 (0.610)
"	+	"	0.0375%	10 (5.103)	8 (5.189)	3 (5.468)	60 (0.661)
"	+	"	0.05%	16 (4.827)	7 (5.262)	-6 (5.986)	80 (0.927)
"	+	Quinalphos	0.025%	30 (4.300)	26 (4.461)	15 (4.864)	46 (0.489)
"	+	"	0.0375%	2 (5.508)	-4 (5.978)	-7 (6.036)	50 (0.526)
"	+	"	0.05%	14 (4.929)	2 (5.493)	-6 (5.985)	76 (0.877)
"	+	Phosalone	0.035%	7 (5.248)	6 (5.306)	-6 (5.938)	56 (0.610)
"	+	"	0.0525%	17 (4.795)	10 (5.111)	-1 (5.680)	66 (0.738)
"	+	"	0.07%	12 (5.021)	7 (5.223)	-3 (5.773)	86 (1.142)
"	+	Monocrotophos	0.025%	4 (5.375)	3 (5.451)	1 (5.546)	66 (0.738)
"	+	"	0.0375%	15 (4.899)	5 (5.342)	-5 (5.887)	80 (0.927)
"	+	"	0.05%	10 (5.081)	7 (5.242)	3 (5.421)	83 (0.991)

Contd.

Table 5 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of N. lugens
				10	20	30	
Carbendazim 0.1%				3 (5.446)	1 (5.541)	0 (5.589)	10 (0.101)
"	+	Phosphamidon	0.025%	12 (5.008)	9 (5.124)	-1 (5.567)	63 (0.687)
"	+	"	0.0375%	9 (5.148)	8 (5.189)	0 (5.601)	76 (0.877)
"	+	"	0.05%	12 (5.016)	9 (5.143)	1 (5.580)	76 (0.877)
"	+	Quinalphos	0.025%	14 (4.921)	10 (5.039)	-2 (5.707)	73 (0.833)
"	+	"	0.0375%	12 (5.023)	2 (5.487)	-1 (5.680)	76 (0.877)
"	+	"	0.05%	13 (4.979)	11 (5.061)	-5 (5.914)	86 (1.142)
"	+	Phosalone	0.035%	9 (5.148)	3 (5.416)	-1 (5.663)	73 (0.833)
"	+	"	0.0525%	15 (4.885)	14 (4.941)	5 (5.339)	83 (0.991)
"	+	"	0.07%	13 (4.973)	13 (4.986)	2 (5.480)	90 (1.206)
"	+	Monocrotophos	0.025%	16 (4.852)	11 (5.061)	-1 (5.619)	76 (0.877)
"	+	"	0.0375%	16 (4.851)	11 (5.058)	-1 (5.683)	80 (0.927)
"	+	"	0.05%	10 (5.111)	9 (5.138)	0 (5.621)	93 (1.356)
Captafol 0.15%				7 (5.265)	4 (5.342)	-9 (6.163)	13 (0.134)
"	+	Phosphamidon	0.025%	1 (5.567)	-2 (5.736)	-9 (6.141)	40 (0.404)
"	+	"	0.0375%	2 (5.495)	-2 (5.696)	-6 (5.974)	66 (0.738)
"	+	"	0.05%	4 (5.416)	-2 (5.696)	-9 (6.150)	56 (0.610)
"	+	Quinalphos	0.025%	2 (5.477)	-1 (5.661)	-9 (6.141)	60 (0.661)
"	+	"	0.0375%	9 (5.132)	8 (5.208)	-9 (6.137)	73 (0.833)
"	+	"	0.05%	1 (5.567)	-3 (5.772)	-5 (5.898)	73 (0.833)
"	+	Phosalone	0.035%	6 (5.284)	5 (5.342)	-4 (5.824)	43 (0.4490
"	+	"	0.0525%	12 (5.021)	10 (5.088)	-1 (5.688)	60 (0.661)
"	+	"	0.07%	5 (5.342)	-7 (6.011)	-9 (6.137)	63 (0.687)
"	+	Monocrotophos	0.025%	6 (5.272)	4 (5.388)	-5 (5.898)	46 (0.489)
"	+	"	0.0375%	0 (5.588)	-3 (5.788)	-4 (5.824)	50 (0.526)
"	+	"	0.05%	5 (5.342)	-5 (5.918)	-8 (6.110)	76 (0.877)
Captafol 0.225%				8 (5.197)	7 (5.261)	-9 (6.147)	13 (0.134)
"	+	Phosphamidon	0.025%	2 (5.477)	-14 (6.350)	-17 (6.732)	50 (0.526)
"	+	"	0.0375%	12 (5.012)	-1 (5.671)	-10 (6.246)	70 (0.782)
"	+	"	0.05%	10 (5.100)	8 (5.172)	3 (5.463)	76 (0.877)
"	+	Quinalphos	0.025%	7 (5.250)	-2 (5.695)	-16 (6.718)	53 (0.566)
"	+	"	0.0375%	2 (5.526)	-1 (5.695)	-11 (6.289)	63 (0.687)
"	+	"	0.05%	20 (4.689)	15 (4.899)	9 (5.155)	66 (0.738)
"	+	Phosalone	0.035%	15 (4.885)	8 (5.193)	0 (5.609)	50 (0.526)
"	+	"	0.0525%	13 (4.979)	4 (5.395)	2 (5.485)	66 (0.738)
"	+	"	0.07%	6 (5.282)	1 (5.568)	-4 (5.824)	76 (0.877)

Contd.

Table 5 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of N. lugens
				10	20	30	
"	+	Monocrotophos	0.025%	1 (5.571)	-3 (5.785)	-10 (6.199)	40 (0.404)
"	+	"	0.0375%	8 (5.182)	7 (5.265)	3 (5.461)	70 (0.782)
"	+	"	0.05%	14 (4.921)	8 (5.189)	6 (5.269)	76 (0.877)
Captafol 0.3%				13 (4.956)	9 (5.151)	0 (5.589)	26 (0.274)
"	+	Phosphamidon	0.025%	18 (4.747)	13 (4.958)	8 (5.208)	70 (0.782)
"	+	"	0.0375%	18 (4.760)	11 (5.039)	10 (5.110)	66 (0.738)
"	+	"	0.05%	19 (4.722)	14 (4.937)	10 (5.081)	76 (0.738)
"	+	Quinalphos	0.025%	14 (4.920)	9 (5.151)	7 (5.226)	73 (0.833)
"	+	"	0.0375%	7 (5.248)	1 (5.568)	-4 (5.847)	76 (0.877)
"	+	"	0.05%	10 (5.081)	5 (5.365)	4 (5.417)	86 (1.142)
"	+	Phosalone	0.035%	16 (4.827)	5 (5.342)	-2 (5.702)	63 (0.687)
"	+	"	0.0525%	10 (4.818)	4 (5.386)	0 (5.610)	70 (0.782)
"	+	"	0.07%	12 (5.016)	-5 (5.886)	-8 (6.120)	70 (0.782)
"	+	Monocrotophos	0.025%	12 (5.016)	2 (5.487)	-4 (5.824)	70 (0.782)
"	+	"	0.0375%	6 (5.280)	4 (5.420)	-3 (5.760)	80 (0.927)
"	+	"	0.05%	15 (4.885)	10 (5.081)	10 (5.113)	83 (0.991)
Tridemorph 0.05%				5 (5.344)	-12 (6.384)	-17 (6.768)	30 (0.303)
"	+	Phosphamidon	0.025%	5 (5.344)	-9 (6.185)	-13 (6.424)	63 (0.687)
"	+	"	0.0375%	6 (5.314)	-12 (6.346)	-16 (6.686)	73 (0.833)
"	+	"	0.05%	5 (5.344)	-7 (6.040)	-12 (6.350)	80 (0.927)
"	+	Quinalphos	0.025%	7 (5.220)	-2 (5.719)	-9 (6.141)	43 (0.449)
"	+	"	0.0375%	8 (5.193)	-4 (5.852)	-6 (5.952)	60 (0.661)
"	+	"	0.05%	2 (5.526)	-11 (6.333)	-13 (6.438)	80 (0.927)
"	+	Phosalone	0.035%	1 (5.548)	-14 (6.542)	-17 (6.732)	40 (0.404)
"	+	"	0.052%	2 (5.501)	-8 (6.126)	-1 (6.314)	53 (0.566)
"	+	"	0.07%	2 (5.526)	-3 (5.795)	-4 (5.825)	70 (0.782)
"	+	Monocrotophos	0.025%	3 (5.456)	-9 (6.138)	-11 (6.289)	50 (0.526)
"	+	"	0.0375%	1 (5.548)	-12 (6.359)	-13 (6.448)	53 (0.566)
"	+	"	0.05%	2 (5.526)	-6 (5.998)	-7 (6.018)	60 (0.661)
Tridemorph 0.075%				2 (5.526)	1 (5.541)	-15 (6.573)	33 (0.343)
"	+	Phosphamidon	0.025%	10 (5.118)	5 (5.338)	3 (5.442)	53 (0.566)
"	+	"	0.0375%	2 (5.526)	-2 (5.718)	-15 (6.581)	73 (0.833)
"	+	"	0.05%	6 (5.314)	2 (5.481)	-9 (6.195)	86 (1.142)
"	+	Quinalphos	0.025%	4 (5.376)	-6 (5.959)	-14 (6.500)	50 (0.526)
"	+	"	0.0375%	12 (5.541)	-6 (5.916)	-7 (6.041)	66 (0.738)
"	+	"	0.05%	16 (4.836)	2 (5.496)	-3 (5.804)	86 (1.142)

Contd.

Table 5 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)			Per cent mortality of N. lugens
				10	20	30	
"	+	Phosalone	0.035%	10 (5.118)	5 (5.338)	-3 (5.804)	43 (0.449)
"	+	"	0.0525%	12 (5.541)	7 (5.240)	5 (5.338)	60 (0.661)
"	+	"	0.07%	17 (4.795)	11 (5.062)	6 (5.281)	83 (0.991)
"	+	Monocrotophos	0.025%	4 (5.376)	-3 (5.768)	-12 (6.395)	66 (0.738)
"	+	"	0.0375%	5 (5.351)	-11 (6.313)	-14 (5.546)	73 (0.833)
"	+	"	0.05%	15 (4.881)	14 (4.928)	-4 (5.852)	76 (0.877)
Tridemorph 0.1%				3 (5.456)	-4 (5.852)	-7 (6.012)	40 (0.404)
"	+	Phosphamidon	0.025%	1 (5.571)	-11 (6.329)	-16 (6.641)	83 (0.991)
"	+	"	0.0375%	3 (5.456)	-5 (5.886)	-12 (6.344)	83 (0.991)
"	+	"	0.05%	3 (5.456)	1 (5.544)	-5 (5.888)	96 (1.420)
"	+	Quinalphos	0.025%	16 (4.822)	8 (5.188)	2 (5.499)	80 (0.927)
"	+	"	0.0375%	12 (5.016)	12 (5.016)	-1 (5.681)	83 (0.991)
"	+	"	0.05%	12 (5.016)	11 (5.062)	2 (5.489)	90 (1.206)
"	+	Phosalone	0.035%	7 (5.220)	5 (5.365)	-9 (6.187)	76 (0.877)
"	+	"	0.0525%	11 (5.056)	9 (5.143)	-6 (5.983)	83 (0.991)
"	+	"	0.07%	11 (5.056)	9 (5.143)	-1 (5.685)	86 (1.142)
"	+	Monocrotophos	0.025%	7 (5.220)	2 (5.487)	-5 (5.852)	66 (0.738)
"	+	"	0.0375%	16 (4.822)	13 (4.979)	2 (5.481)	83 (0.991)
"	+	"	0.05%	9 (5.145)	6 (5.313)	-1 (5.681)	83 (0.991)
Phosphamidon			0.025%	-8 (6.094)	-8 (6.121)	-14 (6.533)	56 (0.610)
"			0.0375%	-8 (6.094)	-12 (6.391)	-17 (6.719)	66 (0.738)
"			0.05%	3 (5.459)	-2 (5.689)	-9 (6.148)	73 (0.833)
Quinalphos			0.025%	10 (5.081)	-3 (5.805)	-5 (5.933)	70 (0.782)
"			0.0375%	9 (5.153)	1 (5.568)	-4 (5.824)	80 (0.927)
"			0.05%	14 (4.920)	7 (5.266)	-4 (5.820)	80 (0.927)
Phosalone			0.035%	-4 (5.855)	-8 (6.088)	-13 (6.485)	63 (0.687)
"			0.0525%	-5 (5.891)	-8 (6.088)	-12 (6.382)	70 (0.782)
"			0.07%	13 (4.980)	-3 (5.804)	-5 (5.933)	76 (0.877)
Monocrotophos			0.025%	0 (5.636)	-5 (5.886)	-9 (6.185)	53 (0.566)
"			0.0375%	4 (5.416)	2 (5.526)	-5 (5.914)	56 (0.610)
"			0.05%	15 (4.886)	7 (5.261)	-4 (5.824)	76 (0.877)
Control				0 (5.610)	-6 (5.989)	11 (6.304)	16 (0.169)
CD (0.05)				0.5795	0.7151	0.7974	NS

Figures in parentheses are transformed values

control was observed with monocrotophos 0.05 per cent, but per cent control decreased after 30 days of treatment. Lowest fungicidal action was noticed for phosphamidon 0.0375 per cent.

However highest concentrations of quinalphos gave maximum insect mortality (80 per cent) and minimum mortality (53 per cent) was given by lowest concentration of monocrotophos.

Panicle initiation stage

4.2.6 Effect of ediphenphos with different combinations of insecticides

When ediphenphos alone was tried at different concentrations, maximum control of the disease as well as the mortality of the insect over the check was observed at highest concentration. The minimum control of the disease and mortality of the insect were found with lowest concentrations (Table 6,.

Highest concentration of ediphenphos in combination with highest concentrations of phosphamidon, quinalphos and phosalone gave maximum control of the disease over check and after 10 days and later the per cent control decreased. Minimum control was noticed with the lowest concentrations of ediphenphos and phosphamidon combination.

In the case of brown planthopper, maximum mortality was noticed in treatment with highest concentrations of ediphenphos and phosphamidon and minimum was in treatment with lowest concentrations of ediphenphos and quinalphos.

4.2.6.1 Combination of ediphenphos with phosphamidon

Lowest concentrations of ediphenphos and phosphamidon gave minimum control of the disease whereas the highest concentration of ediphenphos and phosphamidon gave maximum control of the disease.

Insect mortality varied from 46 per cent to 96 per cent, with the lowest concentrations of ediphenphos and phosphamidon and highest concentrations of ediphenphos and phosphamidon respectively.

4.2.6.2 Combination of ediphenphos with quinalphos

Maximum and minimum control of the disease was noticed in treatment combinations involving ediphenphos 0.1 per cent + quinalphos 0.05 per cent and ediphenphos 0.075 per cent + quinalphos 0.025 per cent respectively.

While in the case of insect mortality, maximum (93 per cent) was achieved in treatment combination containing highest concentrations of ediphenphos and quinalphos and minimum

mortality was in the lowest concentrations of ediphenphos and quinalphos.

4.2.6.3 Combination of ediphenphos with phosalone

Mixing highest concentrations of ediphenphos and phosalone resulted in maximum control of the disease and mortality of insects and minimum control of the disease and insect mortality was noticed in treatment combination ediphenphos 0.05 per cent + phosalone 0.0525 per cent.

4.2.6.4 Combination of ediphenphos with monocrotophos

Highest concentration of ediphenphos when mixed with lowest concentration of monocrotophos gave minimum control of the disease. Combination of highest concentration of ediphenphos and monocrotophos resulted in maximum control of the disease as well as the mortality of insects.

4.2.7 Effect of carbendazim with different combinations of insecticides

When different doses of carbendazim were tried, maximum control of the disease and mortality of insects were noticed at highest concentrations and minimum at lowest concentrations.

When fungicide was combined with various insecticides, highest control was obtained from carbendazim 0.075 per cent + monocrotophos 0.05 per cent and lowest from carbendazim 0.05 per cent + phosalone 0.0525 per cent.

Mortality of insect varied from 33 per cent to 93 per cent with carbendazim 0.075 per cent and quinalphos 0.025 per cent and highest concentration of carbendazim and monocrotophos respectively.

4.2.7.1. Combination of carbendazim with phosphamidon

Mixing highest concentrations of carbendazim and phosphamidon resulted in maximum control of the disease and minimum control was noticed with carbendazim 0.075 per cent and phosphamidon 0.0375 per cent.

In the case of mortality of insects also, combination of highest concentration of carbendazim and phosphamidon was the best and combination of highest concentration of carbendazim with lowest concentration of phosphamidon yielded minimum mortality of the insect.

4.2.7.2 Combination of carbendazim with quinalphos

Highest doses of carbendazim and quinalphos gave maximum control (47 per cent) of the disease and effect of treatment has decreased later on and minimum control was noticed with treatment combination containing high concentration of carbendazim and low concentration of quinalphos.

Combination of highest concentrations of carbendazim and quinalphos yielded maximum mortality of insect and the lowest concentrations of the same combination was found to have no effect.

4.2.7.3 Combination of carbendazim with phosalone

Maximum of 36 per cent control of disease was noticed in treatment combination carbendazim 0.1 per cent + phosalone 0.0525 per cent and minimum control was noticed with lowest concentrations of the same combination.

Maximum and minimum insect mortalities were given by lowest concentrations of carbendazim and phosalone and carbendazim 0.1 per cent + phosalone 0.05 per cent respectively.

4.2.7.4 Combination of carbendazim with monocrotophos

Maximum control of disease recorded in this combination was 49 per cent (carbendazim 0.075 per cent + monocrotophos 0.05 per cent) and its effect decreased to 17 per cent after 20 days of treatment and minimum control (14 per cent) was noticed with lowest concentrations of carbendazim and monocrotophos.

Maximum insect mortality (93 per cent) was noticed in highest doses of carbendazim and monocrotophos which were equally effective and lowest mortality noticed (56 per cent) was with lowest concentrations of same fungicide and insecticide combination.

4.2.8 Effect of captafol with different combinations of insecticides

The data presented in the Tables showed that, maximum control of the disease as well as the insect mortality were given by highest concentration of the fungicide and minimum control was by lowest concentration of the fungicide when tried alone.

In combination with insecticides, maximum control of the disease was noticed with captafol 0.3 per cent quinalphos 0.0375 per cent and minimum control was with captafol 0.225

per cent + phosalone 0.035 per cent. While highest concentrations of captafol and monocrotophos yielded maximum insect mortality, lowest concentrations of the same combination yielded minimum mortality of the insect.

4.2.8.1 Combination of captafol with phosphamidon

In this combination, mixing highest concentration of captafol with lowest concentration of phosphamidon resulted in maximum control of the disease, and per cent control decreased after 10 days of treatment. Captafol 0.225 per cent + phosphamidon 0.05 per cent gave minimum control.

Highest concentrations of captafol and phosphamidon gave maximum mortality and lowest concentration of same pesticides gave minimum mortality of the insect.

4.2.8.2 Combination of captafol with quinalphos

Highest concentration of captafol in combination with quinalphos 0.0375 per cent gave maximum control of the disease and effect of the treatment was decreased after 20 days of treatment. Minimum control of the disease was noticed in captafol 0.225 per cent when combined with lowest concentration of quinalphos.

While combination of highest concentrations of captafol and quinalphos yielded maximum insect mortality, lowest

concentrations of the pesticides yielded minimum insect mortality.

4.2.8.3 Combination of captafol with phosalone

Combination of lowest concentration of the fungicide and highest concentration of the insecticide resulted in maximum control (41 per cent) of the disease and per cent control decreased to 27 per cent after 20 days of treatment. Captafol 0.225 per cent in combination with lowest concentration of phosalone yielded minimum control of the dissease.

Maximum insect mortality was given by captafol 0.5 per cent in combination with highest concentration of phosalone and minimum mortality was given by captafol 0.225 per cent in combination with lowest concentration of phosalone.

4.2.8.4 Combination of captafol with monocrotophos

Captafol 0.225 per cent gave maximum control of the disease in combination with highest concentration of monocrotophos and its effect decreased after 20 days. Combination of the lowest concentrations of the pesticides resulted in minimum control of the disease.

In the case of insect mortality, combination of the

highest concentration of the captafol and monocrotophos gave maximum mortality and combination of the lowest concentration of the same pesticides gave minimum mortality of the insect.

4.2.9 Effect of tridemorph with different combinations of insecticides

It is clear from the Table 6 that, the highest concentration of tridemorph gave maximum control (27 per cent) of the disease when applied individually and per cent control decreased later on. Lowest concentration gave minimum control.

Maximum mortality (30 per cent) of brown planthopper was given by tridemorph 0.075 per cent and itslowest concentration gave minimum mortality.

When the fungicide was mixed with insecticide, maximum control (46 per cent) of the disease was noticed with highest concentration of tridemorph and quinalphos mixture and minimum control of the disease and mortality of insects was noticed with lowest concentration of the fungicide with lowest concentration of phosalone. However, mortality of the insect was maximum (90 per cent) when highest concentration of tridemorph was mixed with highest concentration of phosphamidon.

4.2.9.1 Combination of tridemorph with phosphamidon

In this case, maximum control of disease as well as mortality of insects was noticed with highest concentrations of tridemorph and phosphamidon combination and minimum control of the disease and mortality of insects was observed with tridemorph 0.075 per cent in combination with lowest concentration of phosphamidon.

4.2.9.2 Combination of tridemorph with quinalphos

Here, mixing highest concentrations of tridemorph and quinalphos was found to be superior against sheath blight, but per cent control decreased after 20 days. Minimum control was noticed in lowest concentration of tridemorph in combination with quinalphos 0.0375 per cent.

Mortality of the insect was maximum when fungicide was mixed with highest concentration of the insecticide quinalphos and lowest mortality was given by treatment combination tridemorph 0.075 per cent + quinalphos 0.025 per cent.

4.2.9.3 Combination of tridemorph with phosalone

Combination of the highest concentrations of tridemorph and phosalone gave maximum control of the disease as well as the mortality of insects and per cent control of the disease

decreased later on. Combination of the lowest concentrations of tridemorph and phosalone gave minimum control of the disease and mortality of the insect.

4.2.9.4 Combination of tridemorph with monocrotophos

In this combination, mixing lowest concentrations of tridemorph with highest concentration of monocrotophos was found to be the best and per cent control decreased after 20 days. Minimum control was noticed with highest concentration of tridemorph and lowest concentration of monocrotophos mixture.

While highest concentrations of the fungicide and insecticide combination gave maximum mortality of the insect, lowest concentration of the same combination gave minimum mortality of the insect.

4.2.10 Effect of insecticides alone

Among the various insecticides tested for their fungicidal action, insecticide quinalphos was found to be the best as it gave 20 per cent control of the disease. Phosphamidon 0.025 per cent showed minimum fungicidal action.

Against N. lugens, highest concentration of the insecticide quinalphos was superior over other insecticides

Table 6. Effect of different fungicides, insecticides and their combinations for the control of sheath blight (R. solani) and brown planthopper (N. lugens) at panicle initiation stage

Treatments			Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
			10	20	
Ediphenphos 0.05%			28 (4.537)	18 (4.906)	16 (0.169)
"	+ Phosphamidon	0.025%	7 (5.440)	1 (5.727)	46 (0.489)
"	+ "	0.0375%	36 (4.262)	17 (4.971)	76 (0.877)
"	+ "	0.05%	36 (4.278)	16 (5.010)	86 (1.142)
"	+ Quinalphos	0.025%	24 (4.682)	19 (4.887)	40 (0.404)
"	+ "	0.0375%	39 (4.162)	22 (4.764)	66 (0.738)
"	+ "	0.05%	31 (4.440)	22 (4.764)	86 (1.142)
"	+ Phosalone	0.035%	9 (5.321)	-1 (5.847)	53 (0.566)
"	+ "	0.0525%	6 (5.460)	3 (5.635)	46 (0.489)
"	+ "	0.07%	26 (4.585)	11 (5.235)	73 (0.833)
"	+ Monocrotophos	0.025%	23 (4.703)	10 (5.254)	46 (0.489)
"	+ "	0.0375%	26 (4.585)	17 (4.971)	43 (0.449)
"	+ "	0.05%	38 (4.202)	30 (4.445)	80 (0.927)
Ediphenphos 0.075%			36 (4.262)	30 (4.445)	23 (0.236)
"	+ Phosphamidon	0.025%	31 (4.440)	22 (4.764)	63 (0.687)
"	+ "	0.0375%	22 (4.741)	17 (4.971)	73 (0.833)
"	+ "	0.05%	26 (4.585)	15 (5.047)	86 (1.142)
"	+ Quinalphos	0.025%	10 (5.260)	7 (5.435)	56 (0.610)
"	+ "	0.0375%	13 (5.114)	10 (5.264)	63 (0.687)
"	+ "	0.05%	31 (4.440)	29 (4.501)	90 (1.206)
"	+ Phosalone	0.035%	28 (4.525)	17 (4.975)	76 (0.877)
"	+ "	0.0525%	31 (4.440)	13 (5.131)	63 (0.687)
"	+ "	0.07%	34 (4.321)	13 (5.131)	83 (0.991)
"	+ Monocrotophos	0.025%	23 (4.703)	16 (4.991)	50 (0.526)
"	+ "	0.0375%	12 (5.160)	2 (5.665)	70 (0.782)
"	+ "	0.05%	28 (5.525)	17 (4.971)	83 (0.991)
Ediphenphos 0.1%			36 (4.262)	12 (5.170)	40 (0.404)
"	+ Phosphamidon	0.025%	39 (4.176)	30 (4.445)	83 (0.991)
"	+ "	0.0375%	39 (4.176)	22 (4.764)	90 (1.206)
"	+ "	0.05%	43 (4.057)	29 (4.501)	96 (1.420)

Contd.

Table 6 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
				10	20	
"	+	Quinalphos	0.025%	16 (5.001)	9 (5.341)	63 (0.687)
"	+	"	0.0375%	14 (5.102)	4 (5.581)	86 (1.142)
"	+	"	0.05%	43 (4.057)	26 (4.604)	93 (1.356)
"	+	Phosalone	0.035%	32 (4.381)	19 (3.868)	63 (0.687)
"	+	"	0.0525%	36 (4.262)	22 (4.761)	80 (0.927)
"	+	"	0.07%	43 (4.057)	41 (3.121)	93 (1.356)
"	+	Monocrotophos	0.025%	11 (5.206)	2 (5.707)	56 (0.610)
"	+	"	0.0375%	16 (5.001)	11 (5.203)	83 (0.991)
"	+	"	0.05%	39 (4.176)	32 (4.385)	90 (1.206)
Carbendazim 0.05%				32 (4.381)	19 (4.868)	13 (0.134)
"	+	Phosphamidon	0.025%	23 (4.703)	6 (5.481)	63 (0.687)
"	+	"	0.0375%	22 (4.381)	19 (4.868)	70 (0.782)
"	+	"	0.05%	37 (4.220)	17 (4.971)	73 (0.833)
"	+	Quinalphos	0.025%	26 (4.855)	12 (5.170)	60 (0.661)
"	+	"	0.0375%	22 (4.763)	18 (4.906)	70 (0.782)
"	+	"	0.05%	28 (4.537)	20 (4.812)	60 (0.661)
"	+	Phosalone	0.035%	14 (5.107)	2 (5.681)	50 (0.526)
"	+	"	0.0525%	11 (5.226)	0 (5.778)	70 (0.782)
"	+	"	0.07%	24 (4.681)	15 (5.027)	86 (1.142)
"	+	Monocrotophos	0.025%	14 (5.087)	3 (5.621)	56 (0.610)
"	+	"	0.0375%	23 (4.703)	15 (5.027)	73 (0.833)
"	+	"	0.05%	47 (3.939)	22 (4.764)	83 (0.991)
Carbendazim 0.075%				43 (4.057)	17 (4.962)	46 (0.489)
"	+	Phosphamidon	0.025%	18 (4.907)	13 (5.131)	56 (0.610)
"	+	"	0.0375%	12 (5.171)	6 (5.464)	56 (0.610)
"	+	"	0.05%	36 (4.262)	22 (4.764)	76 (0.877)
"	+	Quinalphos	0.025%	18 (4.907)	12 (5.172)	33 (0.343)
"	+	"	0.0375%	32 (4.381)	23 (4.708)	43 (0.449)
"	+	"	0.05%	39 (4.162)	34 (4.341)	76 (0.877)
"	+	Phosalone	0.035%	10 (5.268)	-1 (5.869)	56 (0.610)
"	+	"	0.0525%	29 (4.500)	12 (5.170)	60 (0.661)
"	+	"	0.07%	30 (4.466)	14 (5.094)	80 (0.927)
"	+	Monocrotophos	0.025%	44 (4.018)	13 (5.131)	63 (0.687)
"	+	"	0.0375%	48 (3.905)	17 (4.971)	80 (0.927)
"	+	"	0.05%	49 (3.887)	17 (4.971)	86 (1.142)

Contd.

Table 6 (Contd.)

Treatments				Per cent deviation from control (Days after spraying) 10	20	Per cent mortality of N. lugens
Carbendazim 0.1%				43 (4.057)	22 (4.747)	33 (0.343)
"	+	Phosphamidon	0.025%	36 (4.262)	22 (4.746)	50 (0.526)
"	+	"	0.0375%	31 (4.440)	16 (5.019)	80 (0.927)
"	+	"	0.05%	47 (3.939)	41 (4.121)	86 (1.142)
"	+	Quinalphos	0.025%	14 (5.088)	2 (5.683)	73 (0.833)
"	+	"	0.0375%	32 (4.381)	26 (4.604)	76 (0.877)
"	+	"	0.05%	47 (3.939)	28 (4.544)	90 (1.206)
"	+	Phosalone	0.035%	26 (4.597)	13 (5.121)	66 (0.738)
"	+	"	0.0525%	36 (4.262)	20 (4.822)	83 (0.991)
"	+	"	0.07%	32 (4.381)	7 (5.401)	90 (1.206)
"	+	Monocrotophos	0.025%	39 (4.176)	19 (4.859)	76 (0.877)
"	+	"	0.0375%	39 (4.176)	22 (4.764)	90 (1.206)
"	+	"	0.05%	47 (3.939)	41 (4.121)	93 (1.356)
Captafol 0.15%				28 (4.340)	15 (5.027)	13 (0.134)
"	+	Phosphamidon	0.025%	22 (4.766)	8 (5.384)	26 (0.274)
"	+	"	0.0375%	28 (4.537)	16 (4.991)	33 (0.343)
"	+	"	0.05%	37 (4.221)	22 (4.763)	56 (0.610)
"	+	Quinalphos	0.025%	42 (4.073)	19 (4.868)	56 (0.610)
"	+	"	0.0375%	32 (4.381)	17 (4.971)	76 (0.877)
"	+	"	0.05%	21 (4.785)	13 (5.131)	76 (0.877)
"	+	Phosalone	0.035%	19 (4.585)	7 (5.425)	40 (0.404)
"	+	"	0.0525%	32 (4.381)	17 (4.971)	63 (0.687)
"	+	"	0.07%	41 (4.112)	27 (4.560)	60 (0.661)
"	+	Monocrotophos	0.025%	13 (5.130)	3 (5.631)	30 (0.303)
"	+	"	0.0375%	21 (4.785)	13 (5.125)	40 (0.404)
"	+	"	0.05%	32 (4.381)	19 (4.868)	73 (0.833)
Captafol 0.225%				34 (4.273)	22 (4.764)	20 (0.202)
"	+	Phosphamidon	0.025%	18 (4.918)	-3 (5.987)	40 (0.404)
"	+	"	0.0375%	29 (4.478)	13 (5.121)	70 (0.782)
"	+	"	0.05%	17 (4.966)	15 (5.047)	60 (0.661)
"	+	Quinalphos	0.025%	19 (4.884)	9 (5.326)	50 (0.526)
"	+	"	0.0375%	26 (4.584)	19 (4.859)	60 (0.661)
"	+	"	0.05%	28 (4.537)	23 (4.699)	73 (0.833)
"	+	Phosalone	0.035%	11 (5.225)	-3 (5.981)	46 (0.489)
"	+	"	0.0525%	18 (4.905)	10 (5.254)	73 (0.833)
"	+	"	0.07%	14 (5.107)	1 (5.765)	73 (0.833)

Contd.

Table 6 (Contd.)

Treatments				Per cent deviation from control		Per cent mortality of N. lugens
				Days after spraying		
				10	20	
"	+	Monocrotophos	0.025%	25 (4.644)	21 (4.783)	36 (0.372)
"	+	"	0.0375%	18 (4.907)	9 (5.321)	60 (0.661)
"	+	"	0.05%	43 (4.057)	21 (4.783)	80 (0.927)
Captafol 0.3%				36 (4.251)	17 (4.971)	30 (0.303)
"	+	Phosphamidon	0.025%	43 (4.051)	26 (4.604)	63 (0.687)
"	+	"	0.0375%	20 (4.821)	12 (5.189)	63 (0.687)
"	+	"	0.05%	33 (4.370)	21 (4.783)	80 (0.927)
"	+	Quinalphos	0.025%	33 (3.370)	18 (4.906)	66 (0.738)
"	+	"	0.0375%	44 (4.019)	33 (4.360)	70 (0.782)
"	+	"	0.05%	27 (3.939)	35 (4.281)	80 (0.927)
"	+	Phosalone	0.035%	14 (5.101)	10 (5.254)	60 (0.661)
"	+	"	0.0525%	16 (5.007)	11 (5.220)	70 (0.782)
"	+	"	0.07%	36 (4.273)	17 (4.935)	76 (0.877)
"	+	Monocrotophos	0.025%	29 (4.478)	26 (4.604)	73 (0.833)
"	+	"	0.0375%	32 (4.381)	21 (4.783)	76 (0.877)
"	+	"	0.05%	42 (4.095)	34 (4.341)	90 (1.206)
Tridemorph 0.05%				14 (5.106)	3 (5.628)	20 (0.202)
"	+	Phosphamidon	0.025%	26 (4.585)	17 (4.971)	63 (0.687)
"	+	"	0.0375%	27 (4.575)	26 (4.604)	73 (0.833)
"	+	"	0.05%	32 (4.381)	18 (4.904)	83 (0.991)
"	+	Quinalphos	0.025%	14 (5.107)	7 (5.407)	50 (0.526)
"	+	"	0.0375%	11 (5.229)	1 (5.765)	66 (0.738)
"	+	"	0.05%	19 (4.871)	17 (4.971)	86 (1.142)
"	+	Phosalone	0.035%	9 (5.321)	-3 (5.962)	40 (0.404)
"	+	"	0.052%	16 (4.985)	14 (5.094)	56 (0.610)
"	+	"	0.07%	44 (4.021)	33 (4.360)	73 (0.833)
"	+	Monocrotophos	0.025%	20 (4.849)	12 (5.162)	53 (0.566)
"	+	"	0.0375%	36 (4.262)	17 (4.935)	56 (0.610)
"	+	"	0.05%	45 (3.989)	21 (4.783)	56 (0.610)
Tridemorph 0.075%				17 (4.949)	10 (5.274)	30 (0.303)
"	+	Phosphamidon	0.025%	32 (4.381)	17 (4.971)	50 (0.526)
"	+	"	0.0375%	25 (4.644)	15 (5.072)	73 (0.833)
"	+	"	0.05%	14 (5.102)	2 (5.681)	73 (0.833)
"	+	Quinalphos	0.025%	13 (5.112)	-2 (5.902)	46 (0.489)
"	+	"	0.0375%	20 (4.849)	13 (5.131)	70 (0.782)
"	+	"	0.05%	31 (4.440)	17 (4.943)	86 (1.142)

Contd.

Table 6 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
				10	20	
"	+	Phosalone	0.035%	20 (4.849)	8 (5.361)	43 (0.449)
"	+	"	0.0525%	31 (4.418)	17 (4.971)	50 (0.526)
"	+	"	0.07%	17 (4.946)	13 (5.131)	83 (0.991)
"	+	Monocrotophos	0.025%	25 (4.644)	22 (4.764)	66 (0.738)
"	+	"	0.0375%	34 (4.321)	25 (4.635)	76 (0.877)
"	+	"	0.05%	45 (3.997)	34 (4.341)	86 (1.142)
Tridemorph 0.1%				27 (4.576)	19 (4.891)	26 (0.274)
"	+	Phosphamidon	0.025%	31 (4.440)	29 (4.501)	76 (0.877)
"	+	"	0.0375%	18 (4.897)	3 (5.621)	73 (0.833)
"	+	"	0.05%	39 (4.176)	29 (4.501)	90 (1.206)
"	+	Quinalphos	0.025%	16 (4.995)	11 (5.231)	76 (0.877)
"	+	"	0.0375%	39 (4.176)	26 (4.604)	76 (0.877)
"	+	"	0.05%	46 (3.979)	29 (4.501)	86 (1.142)
"	+	Phosalone	0.035%	16 (5.016)	9 (5.326)	76 (0.897)
"	+	"	0.0525%	32 (4.381)	17 (4.943)	80 (0.927)
"	+	"	0.07%	43 (4.057)	19 (4.868)	83 (0.991)
"	+	Monocrotophos	0.025%	13 (5.112)	5 (5.512)	60 (0.661)
"	+	"	0.0375%	40 (5.154)	19 (4.868)	76 (0.877)
"	+	"	0.05%	43 (4.057)	19 (4.868)	80 (0.927)
Phosphamidon		0.025%		10 (5.254)	7 (5.407)	30 (0.303)
"		0.0375%		11 (5.229)	1 (5.765)	50 (0.526)
"		0.05%		18 (4. 897)	9 (5.326)	76 (0.877)
Quinalphos		0.025%		20 (0.849)	6 (5.464)	63 (0.687)
"		0.0375%		17 (4.971)	2 (5.681)	76 (0.877)
"		0.05%		20 (4.849)	16 (4.991)	80 (0.927)
Phosalone		0.035%		15 (5.027)	4 (5.581)	66 (0.738)
"		0.0525%		13 (5.121)	0 (5.799)	70 (0.782)
"		0.07%		19 (4.868)	13 (5.121)	76 (0.877)
Monocrotophos		0.025%		19 (4.868)	10 (5.254)	43 (0.449)
"		0.0375%		17 (4.971)	16 (4.991)	66 (0.738)
"		0.05%		17 (4.971)	9 (5.326)	76 (0.877)
Control				0 (5.798)	-7 (6.264)	3 (0.033)
CD (0.05)				NS	NS	0.2544

Figures in parantheses are transformed values

tested and lowest concentration of the insecticide phosphamidon gave minimum mortality of the insect.

Flowering stage

4.2.11 Effect of ediphenphos with different combinations of insecticides

The data presented in Table 7 revealed that, ediphenphos 0.1 per cent gave maximum control of disease over other two concentrations tried. The same trend was observed in the case of mortality of brown planthopper also.

While in combination with insecticides, mixing ediphenphos 0.075 per cent with phosalone 0.07 per cent was the best (35 per cent) and after 20 days of treatment the per cent control decreased to 17. In the case of mortality of insects, highest concentrations of quinalphos and phosalone in combination with highest concentration of ediphenphos was found to be superior as 93 per cent control could be obtained.

4.2.11.1 Combination of ediphenphos with phosphamidon

Highest concentrations of ediphenphos and phosphamidon when combined, gave maximum control of the disease (19 per cent) and its effect decreased to 14 per cent after 20 days, minimum control (11 per cent) was noticed in treatment combination ediphenphos 0.075 per cent + phosphamidon 0.0375

per cent. Combination of highest concentration of ediphenphos with phosphamidon yielded highest mortality of (90 per cent) of the insect N. lugens and lowest mortality was noticed in treatment combination containing lowest concentrations of two pesticides.

4.2.11.2 Combination of ediphenphos with quinalphos

In this combination maximum control was obtained (24 per cent) by mixing highest concentration of ediphenphos and quinalphos and its effect decreased to 19 per cent after 20 days. Minimum control of the disease (10 per cent) was observed in treatment ediphenphos 0.075 per cent + quinalphos 0.025 per cent.

The insect mortality varied from 43 per cent to 93 per cent and maximum and minimum values were obtained from the highest and lowest concentration combinations of ediphenphos and quinalphos respectively.

4.2.11.3 Combination of ediphenphos with phosalone

Ediphenphos 0.075 per cent in combination with highest concentration of phosalone resulted in maximum control (35 per cent) of the disease and lowest control was given by treatment combinations ediphenphos 0.075 per cent + phosalone 0.0525 per cent and ediphenphos 0.1 per cent + phosalone 0.035 per cent.

Maximum and minimum mortalities (93 per cent and 40 per cent respectively) of N. lugens were given by treatment combinations ediphenphos 0.1 per cent + phosalone 0.07 per cent and ediphenphos 0.05 per cent + phosalone 0.035 per cent respectively.

4.2.11.4 Combination of ediphenphos with monocrotophos

Best control obtained (20 per cent) in this combination was from treatment involving ediphenphos 0.075 per cent + monocrotophos 0.05 per cent (per cent control decreased to 15 after 20 days) and lowest control was obtained from ediphenphos 0.05 per cent + monocrotophos 0.0375 per cent and ediphenphos 0.1 per cent + monocrotophos 0.025 per cent.

Combination of highest and lowest concentrations of ediphenphos and monocrotophos gave maximum (83 per cent) and minimum (43 per cent) mortality of insects.

4.2.12 Effect of carbendazim with different combinations of insecticides

Among the different concentrations of carbendazim, the maximum and minimum control of the disease and mortality of insect were given by highest and lowest concentration of the fungicide respectively.

In combination with insecticides, carbendazim 0.075 per cent + monocrotophos 0.0375 per cent gave best control of disease (36 per cent) and there was no residual effect after 20 days. Carbendazim 0.1 per cent + monocrotophos 0.0375 per cent gave lowest control (1 per cent) of the disease.

Maximum mortality obtained was 93 per cent (carbendazim 0.075 per cent + monocrotophos 0.05 per cent and carbendazim 0.1 per cent + monocrotophos 0.05 per cent) and minimum was 36 per cent (carbendazim 0.075 per cent + quinalphos 0.025 per cent).

4.2.12.1 Combination of carbendazim with phosphamidon

Carbendazim 0.075 per cent in combination with phosphamidon 0.0375 per cent resulted in maximum control (23 per cent) and carbendazim 0.075 per cent + phosphamidon 0.05 per cent resulted in minimum control (10 per cent) of the disease.

In the case of N. lugens, highest concentration of carbendazim and phosphamidon gave highest mortality (86 per cent) and carbendazim 0.075 per cent + phosphamidon 0.025 per cent gave minimum mortality (60 per cent) of the insect N. lugens.

4.2.12.2 Combination of carbendazim with quinalphos

Quinalphos 0.05 per cent when mixed with carbendazim 0.075 per cent yielded maximum of 17 per cent control and after 20 days per cent control decreased to 12, and combination of lowest concentration of carbendazim (0.05 per cent) and quinalphos (0.025 per cent)yielded minimum (11 per cent) control of the disease.

Combination of recommended concentrations of carbendazim (0.1 per cent) and quinalphos (0.05 per cent) resulted in maximum of 86 per cent mortality of N. lugens and combination of carbendazim 0.075 per cent + quinalphos 0.025 per cent gave lowest mortality (56 per cent) of insect.

4.2.12.3 Combination of carbendazim with phosalone

Maximum control of the disease obtained in this combination was 26 per cent (carbendazim 0.05 per cent with phosalone 0.035 per cent and 0.07 per cent and also carbendazim 0.1 per cent with phosalone 0.07 per cent) and minimum control was 7 per cent (carbendazim 0.075 per cent with phosalone 0.035 per cent and 0.0525 per cent).

Insect mortality varied from 46 per cent to 90 per cent (carbendazim 0.05 per cent + phosalone 0.025 per cent and

carbendazim 0.1 per cent + phosalone 0.07 per cent) respectively.

4.2.12.4 Combination of carbendazim with monocrotophos

Highest control of disease recorded was 36 per cent (carbendazim 0.075 per cent + monocrotophos 0.0375 per cent) and lowest was 1 per cent (carbendazim 0.1 per cent + monocrotophos 0.0375 per cent).

Highest concentration of monocrotophos in combination with carbendazim 0.075 per cent and 0.1 per cent gave maximum mortality (93 per cent) of the insect, and lowest mortality recorded was 60 per cent (carbendazim 0.05 per cent with monocrotophos 0.025 per cent and 0.0375 per cent and also carbendazim 0.075 per cent with monocrotophos 0.025 per cent).

4.2.13 Effect of captafol with different combinations of insecticides

From Table 7 it is obvious that, maximum control of the disease (18 per cent) was given by captafol 0.3 per cent and its efficiency was decreased by half after 20 days of treatment and minimum control by given by the lowest concentration tried. In the case of insect mortality also the same trend was repeated.

While maximum of 27 per cent control of the disease was obtained by combined application of captafol 0.15 per cent with phosphamidon 0.05 per cent (its effect decreased to 17 per cent after 20 days of treatment), minimum of 1 per cent control was noticed with treatment combinations involving captafol 0.225 per cent + phosphamidon 0.05 per cent and captafol 0.3 per cent + quinalphos 0.025 per cent.

Insect mortality varied from 40 to 86 per cent. Lowest mortality was given by treatments captafol 0.15 per cent with phosphamidon 0.025 per cent and monocrotophos 0.025 per cent and captafol 0.025 per cent + quinalphos 0.025 per cent and combination of highest concentrations of captafol and quinalphos.

4.2.13.1 Combination of captafol with phosphamidon

Phosphamidon 0.05 per cent in combination with captafol 0.15 per cent recorded maximum control (27 per cent) and captafol 0.225 per cent recorded minimum (1 per cent) control of the disease.

Highest concentration of phosphamidon in combination with highest concentrations of captafol recorded maximum mortality of the insect N. lugens and lowest concentrations of the same combination recorded lowest (40 per cent) mortality of the insect.

4.2.13.2 Combination of captafol with quinalphos

Maximum (26 per cent) and minimum (1 per cent) control of the disease was given by treatment combinations captafol 0.225 per cent + quinalphos 0.0375 and captafol 0.3 per cent + quinalphos 0.025 per cent respectively.

Insect mortality varied from 40 per cent to 86 per cent (captafol per cent + quinalphos 0.025 per cent and captafol 0.3 per cent + quinalphos 0.05 per cent) respectively.

4.2.13.3 Combination of captafol with phosalone

Combination of highest concentration of the insecticide phosalone and lowest concentration of captafol was found to be superior as 24 per cent control was obtained (per cent control decreased to 7 after 20 days of treatment). Lowest control was (6 per cent) noticed with treatment captafol 0.225 per cent + phosalone 0.035 per cent.

In the case of mortality of insects, best result was obtained from treatment combination captafol 0.225 per cent + phosalone 0.07 per cent (83 per cent mortality), lowest control (50 per cent control) was noticed with captafol 0.15 per cent + phosalone 0.035 per cent.

4.2.13.4 Combination of captafol with monocrotophos

In this case, highest (26 per cent) and lowest (6 per cent) control was noticed with treatments captafol 0.3 per cent + monocrotophos 0.0375 per cent and captafol 0.225 per cent + monocrotophos 0.025 per cent respectively.

Mortality of insect varied from 40 per cent (captafol 0.15 per cent + monocrotophos 0.025 per cent) to 83 per cent (captafol 0.225 per cent + phosalone 0.07 per cent and captafol 0.3 per cent + phosalone 0.07 per cent)respectively.

4.2.14 Effect of tridemorph with different combinations of insecticides

Among the three doses of tridemorph tried, 0.1 per cent concentration yielded best results over other two doses (13 per cent concentration). For the control of insect also the same concentration was found to be the best (30 per cent control).

In combined application, tridemorph 0.05 per cent with quinalphos 0.05 per cent was found to be superior (29 per cent control) and per cent control decreased after 20 days to 24 per cent.

In the case of insect mortality, best result (93 per cent mortality) was obtained when highest doses of two

chemicals were applied together (tridemorph 0.1 per cent + quinalphos 0.05 per cent).

4.2.14.1 Combination of tridemorph with phosphamidon

Maximum (14 per cent) control was noticed in treatments tridemorph 0.1 per cent + phosphamidon 0.0375 and 0.05 per cent and minimum (9 per cent) in tridemorph 0.1 per cent + phosphamidon 0.025 per cent.

Insect mortality varied from 53 per cent to 90 per cent (tridemorph 0.075 per cent + phosphamidon 0.025 per cent and tridemorph 0.1 per cent + phosphamidon 0.05 per cent) respectively .

4.2.14.2 Combination of tridemorph with quinalphos

In this combination, 0.075 per cent concentration of tridemorph when mixed with highest concentration of quinalphos resulted in maximum control of the disease (28 per cent) and its effect decreased to 23 per cent after 20 days of treatment and minimum control was noticed in treatment tridemorph 0.1 per cent + quinalphos 0.05 per cent (16 per cent control).

Combination of highest concentrations of tridemorph and quinalphos was superior as it gave 93 per cent mortality

of insect and lowest mortality was given by the treatment combination tridemorph 0.075 per cent with quinalphos 0.025 per cent.

4.2.14.3 Combination of tridemorph with phosalone

Maximum of 20 per cent control of the disease was noticed in treatment with highest concentration of tridemorph and phosalone at 0.07 per cent and lowest control (6 per cent) was noticed in treatment with lowest concentrations of the same combination.

Highest (86 per cent) and lowest (36 per cent) mortality of insect was noticed in treatment combinations tridemorph 0.1 per cent + phosalone 0.07 per cent and tridemorph 0.075 per cent + phosalone 0.035 per cent respectively.

4.2.14.4 Combination of tridemorph with monocrotophos

Lowest concentration of the fungicide tried when mixed with highest concentrations of monocrotophos yielded best control (21 per cent) in the case of sheath blight and lowest control (3 per cent) was noticed in tridemorph 0.075 per cent + monocrotophos 0.0375 per cent.

While highest insect mortality (76 per cent) was

Table 7. Effect of different fungicides, insecticides, and their combinations for the control of sheath blight (R. solani) and brown planthopper (N. lugens) at flowering stage

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
				10	20	
Ediphenphos 0.05%				8 (5.422)	6 (5.548)	16 (0.169)
"	+	Phosphamidon	0.025%	16 (5.058)	10 (5.321)	53 (0.566)
"	+	"	0.0375%	17 (5.003)	12 (5.240)	70 (0.782)
"	+	"	0.05%	16 (5.058)	16 (5.058)	86 (1.142)
"	+	Quinalphos	0.025%	15 (5.101)	8 (5.410)	43 (0.449)
"	+	"	0.0375%	16 (5.058)	5 (5.604)	70 (0.782)
"	+	"	0.05%	16 (5.058)	11 (5.261)	83 (0.991)
"	+	Phosalone	0.035%	11 (5.294)	1 (5.832)	40 (0.404)
"	+	"	0.0525%	18 (4.979)	14 (5.161)	63 (0.687)
"	+	"	0.07%	21 (4.858)	12 (5.232)	70 (0.782)
"	+	Monocrotophos	0.025%	14 (5.123)	5 (5.561)	43 (0.449)
"	+	"	0.0375%	11 (5.266)	1 (5.830)	46 (0.489)
"	+	"	0.05%	17 (5.003)	7 (5.467)	70 (0.782)
Ediphenphos 0.075%				8 (5.406)	4 (5.662)	26 (0.274)
"	+	Phosphamidon	0.025%	16 (5.036)	8 (5.452)	60 (0.661)
"	+	"	0.0375%	11 (5.291)	-5 (6.144)	70 (0.782)
"	+	"	0.05%	18 (4.969)	6 (5.532)	90 (1.206)
"	+	Quinalphos	0.025%	10 (5.322)	6 (5.521)	53 (0.566)
"	+	"	0.0375%	11 (5.278)	1 (5.802)	63 (0.687)
"	+	"	0.05%	20 (4.871)	13 (5.195)	90 (1.206)
"	+	Phosalone	0.035%	12 (5.213)	3 (5.678)	70 (0.782)
"	+	"	0.0525%	10 (5.322)	1 (5.791)	73 (0.833)
"	+	"	0.07%	35 (4.350)	17 (5.006)	73 (0.833)
"	+	Monocrotophos	0.025%	13 (5.192)	-1 (5.908)	53 (0.566)
"	+	"	0.0375%	16 (5.036)	-1 (5.816)	66 (0.738)
"	+	"	0.05%	20 (4.876)	15 (5.106)	66 (0.735)
Ediphenphos 0.1%				19 (4.938)	16 (5.058)	33 (0.343)
"	+	Phosphamidon	0.025%	12 (5.230)	8 (5.410)	76 (0.877)
"	+	"	0.0375%	16 (5.036)	4 (5.621)	83 (0.991)
"	+	"	0.05%	19 (4.923)	14 (5.152)	90 (1.206)

Contd.

Table 7 (Contd.)

Treatments				Per cent deviation from control		Per cent mortality of N. lugens
				Days after spraying		
				10	20	
"	+	Quinalphos	0.025%	17 (5.003)	4 (5.640)	50 (0.526)
"	+	"	0.0375%	15 (5.092)	15 (5.106)	90 (1.206)
"	+	"	0.05%	24 (4.738)	19 (4.906)	93 (1.420)
"	+	Phosalone	0.035%	10 (5.323)	-1 (5.923)	73 (0.833)
"	+	"	0.0525%	16 (5.058)	0 (5.861)	80 (0.927)
"	+	"	0.07%	25 (4.679)	20 (4.883)	93 (1.420)
"	+	Monocrotophos	0.025%	11 (5.266)	2 (5.752)	63 (0.687)
"	+	"	0.0375%	14 (5.123)	14 (5.152)	73 (0.833)
"	+	"	0.05%	17 (5.003)	13 (5.204)	83 (0.991)
Carbendazim 0.05%				11 (5.285)	10 (5.548)	13 (0.134)
"	+	Phosphamidon	0.025%	20 (4.897)	19 (4.921)	63 (0.687)
"	+	"	0.0375%	19 (4.923)	14 (5.152)	63 (0.687)
"	+	"	0.05%	14 (5.123)	14 (5.152)	73 (0.833)
"	+	Quinalphos	0.025%	11 (5.294)	5 (5.597)	66 (0.738)
"	+	"	0.0375%	13 (5.179)	7 (5.478)	76 (0.877)
"	+	"	0.05%	14 (5.123)	7 (5.478)	83 (0.991)
"	+	Phosalone	0.035%	26 (4.654)	25 (4.708)	46 (0.489)
"	+	"	0.0525%	12 (5.252)	5 (5.597)	66 (0.738)
"	+	"	0.07%	26 (4.661)	20 (4.883)	83 (0.991)
"	+	Monocrotophos	0.023%	8 (5.520)	-1 (5.923)	60 (0.661)
"	+	"	0.0375%	7 (5.461)	-14 (5.987)	60 (0.661)
"	+	"	0.05%	8 (5.428)	2 (5.740)	90 (1.206)
Carbendazim 0.075%				13 (5.179)	2 (5.1740)	23 (0.236)
"	+	Phosphamidon	0.025%	13 (5.179)	0 (5.868)	60 (0.661)
"	+	"	0.0375%	23 (4.765)	19 (4.920)	56 (0.610)
"	+	"	0.05%	10 (5.350)	-4 (6.183)	76 (0.877)
"	+	Quinalphos	0.025%	12 (5.257)	7 (5.459)	36 (0.372)
"	+	"	0.0375%	14 (5.123)	9 (5.378)	50 (0.526)
"	+	"	0.05%	17 (4.993)	12 (5.227)	73 (0.833)
"	+	Phosalone	0.035%	7 (5.471)	0 (5.878)	60 (0.661)
"	+	"	0.0525%	7 (5.471)	-2 (5.991)	70 (0.782)
"	+	"	0.07%	10 (5.350)	8 (5.435)	83 (0.991)
"	+	Monocrotophos	0.025%	20 (4.876)	12 (5.247)	60 (0.661)
"	+	"	0.0375%	36 (4.321)	-2 (5.972)	80 (0.927)
"	+	"	0.05%	34 (5.380)	-1 (5.920)	93 (1.356)

Contd.

Table 7 (Contd.)

Treatments				Per cent deviation from control (Days after spraying) 10	20	Per cent mortality of N. lugens
Carbendazim 0.1%				17 (5.003)	12 (5.240)	23 (0.236)
"	+	Phosphamidon	0.025%	19 (4.906)	17 (5.001)	66 (0.738)
"	+	"	0.0375%	14 (5.123)	4 (5.626)	76 (0.877)
"	+	"	0.05%	14 (5.123)	2 (5.723)	86 (0.142)
"	+	Quinalphos	0.025%	16 (5.058)	10 (5.321)	63 (0.687)
"	+	"	0.0375%	14 (5.123)	-2 (5.972)	73 (0.833)
"	+	"	0.05%	14 (5.123)	-2 (5.966)	86 (1.142)
"	+	Phosalone	0.035%	11 (5.285)	1 (5.790)	70 (0.782)
"	+	"	0.0525%	23 (4.765)	14 (5.152)	80 (0.927)
"	+	"	0.07%	26 (4.624)	14 (5.152)	90 (1.206)
"	+	Monocrotophos	0.025%	27 (5.561)	-5 (6.147)	73 (0.833)
"	+	"	0.0375%	1 (5.782)	-7 (6.281)	80 (0.927)
"	+	"	0.05%	15 (5.092)	12 (5.232)	93 (1.356)
Captafol 0.15%				5 (5.586)	-3 (6.052)	10 (0.101)
"	+	Phosphamidon	0.025%	6 (5.553)	1 (5.803)	40 (0.404)
"	+	"	0.0375%	18 (4.987)	14 (5.152)	60 (0.661)
"	+	"	0.05%	27 (4.612)	17 (5.006)	46 (0.489)
"	+	Quinalphos	0.025%	2 (5.752)	-3 (6.012)	53 (0.566)
"	+	"	0.0375%	10 (5.350)	-2 (5.978)	80 (0.927)
"	+	"	0.05%	17 (5.005)	5 (5.605)	80 (0.927)
"	+	Phosalone	0.035%	10 (5.322)	1 (5.832)	50 (0.526)
"	+	"	0.0525%	21 (4.863)	2 (5.751)	60 (0.661)
"	+	"	0.07%	24 (4.715)	7 (5.479)	53 (0.566)
"	+	Monocrotophos	0.025%	11 (5.266)	4 (5.639)	40 (0.404)
"	+	"	0.0375%	19 (4.921)	6 (5.536)	43 (0.449)
"	+	"	0.05%	25 (4.671)	7 (5.467)	76 (0.877)
Captafol 0.225%				6 (5.506)	-4 (6.129)	13 (0.134)
"	+	Phosphamidon	0.025%	2 (5.726)	-5 (6.170)	43 (0.449)
"	+	"	0.0375%	5 (5.586)	0 (5.866)	70 (0.782)
"	+	"	0.05%	1 (5.780)	-2 (6.012)	73 (0.833)
"	+	Quinalphos	0.025%	23 (4.760)	14 (5.120)	40 (0.404)
"	+	"	0.0375%	26 (4.670)	7 (5.467)	66 (0.738)
"	+	"	0.05%	17 (4.992)	10 (5.356)	73 (0.833)
"	+	Phosalone	0.035%	6 (5.553)	-1 (5.808)	53 (0.566)
"	+	"	0.0525%	14 (5.164)	1 (5.785)	60 (0.661)
"	+	"	0.07%	18 (4.981)	8 (5.410)	83 (0.991)

Contd.

Table 7 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
				10	20	
"	+	Monocrotophos	0.025%	6 (5.548)	1 (5.785)	50 (0.526)
"	+	"	0.0375%	7 (5.464)	4 (5.636)	70 (0.782)
"	+	"	0.05%	10 (5.350)	8 (5.441)	83 (0.991)
Captafol 0.3%				18 (4.988)	9 (5.378)	33 (0.343)
"	+	Phosphamidon	0.025%	14 (5.123)	2 (5.742)	66 (0.378)
"	+	"	0.0375%	6 (5.522)	-4 (6.105)	66 (0.738)
"	+	"	0.05%	6 (5.522)	-2 (6.010)	73 (0.833)
"	+	Quinalphos	0.025%	1 (5.813)	-9 (6.411)	60 (0.661)
"	+	"	0.0375%	7 (5.493)	-1 (5.905)	80 (0.927)
"	+	"	0.05%	11 (5.266)	8 (5.412)	86 (1.142)
"	+	Phosalone	0.035%	14 (5.123)	-2 (5.985)	60 (0.661)
"	+	"	0.0525%	17 (5.011)	5 (5.605)	66 (0.738)
"	+	"	0.07%	17 (4.993)	10 (5.316)	70 (0.782)
"	+	Monocrotophos	0.025%	21 (4.864)	2 (5.740)	70 (0.782)
"	+	"	0.0375%	26 (4.662)	19 (4.916)	73 (0.833)
"	+	"	0.05%	17 (4.993)	9 (5.402)	83 (0.991)
Tridemorph 0.05%				9 (5.379)	1 (5.821)	23 (0.236)
"	+	Phosphamidon	0.025%	13 (5.179)	4 (5.661)	63 (0.687)
"	+	"	0.0375%	10 (5.350)	-4 (6.101)	70 (0.782)
"	+	"	0.05%	12 (5.257)	5 (5.582)	76 (0.877)
"	+	Quinalphos	0.025%	21 (4.832)	17 (5.002)	50 (0.526)
"	+	"	0.0375%	23 (4.766)	20 (4.905)	73 (0.833)
"	+	"	0.05%	29 (4.560)	24 (4.720)	83 (0.991)
"	+	Phosalone	0.035%	6 (5.520)	-6 (6.256)	50 (0.526)
"	+	"	0.052%	7 (5.464)	3 (5.670)	46 (0.489)
"	+	"	0.07%	12 (5.229)	5 (5.582)	66 (0.738)
"	+	Monocrotophos	0.025%	20 (4.901)	12 (5.227)	43 (0.449)
"	+	"	0.0375%	21 (4.862)	8 (5.412)	50 (0.526)
"	+	"	0.05%	21 (4.862)	7 (5.491)	53 (0.566)
Tridemorph 0.075%				10 (5.327)	6 (5.524)	26 (0.274)
"	+	Phosphamidon	0.025%	12 (5.257)	2 (5.736)	53 (0.566)
"	+	"	0.0375%	10 (5.327)	0 (5.882)	63 (0.687)
"	+	"	0.05%	11 (5.260)	6 (5.531)	80 (0.927)
"	+	Quinalphos	0.025%	25 (4.689)	22 (4.806)	46 (0.489)
"	+	"	0.0375%	22 (4.792)	17 (4.991)	70 (0.782)
"	+	"	0.05%	28 (4.573)	23 (4.750)	86 (1.142)

Contd.

Table 7 (Contd.)

Treatments				Per cent deviation from control (Days after spraying)		Per cent mortality of N. lugens
				10	20	
"	+	Phosalone	0.035%	13 (5.179)	-1 (5.921)	36 (0.372)
"	+	"	0.0525%	11 (5.294)	-4 (6.112)	56 (0.610)
"	+	"	0.07%	13 (5.201)	-3 (6.027)	83 (0.991)
"	+	Monocrotophos	0.025%	6 (5.548)	-5 (6.170)	63 (0.687)
"	+	"	0.0375%	3 (5.664)	-5 (6.201)	70 (0.782)
"	+	"	0.05%	19 (4.920)	4 (5.657)	66 (0.738)
Tridemorph 0.1 %				13 (5.179)	5 (5.582)	30 (0.303)
"	+	Phosphamidon	0.025%	9 (5.383)	7 (5.491)	70 (0.782)
"	+	"	0.0375%	14 (5.1230	6 (5.356)	76 (0.877)
"	+	"	0.05%	14 (5.123)	7 (5.467)	90 (1.206)
"	+	Quinalphos	0.025%	16 (5.067)	5 (5.582)	70 (0.782)
"	+	"	0.0375%	25 (4.701)	7 (5.467)	76 (0.877)
"	+	"	0.05%	26 (4.667)	17 (5.013)	93 (1.356)
"	+	Phosalone	0.035%	10 (5.350)	6 (5.548)	70 (0.782)
"	+	"	0.0525%	3 (5.691)	-6 (6.213)	70 (0.782)
"	+	"	0.07%	20 (4.897)	8 (5.436)	86 (1.142)
"	+	Monocrotophos	0.025%	6 (5.520)	-4 (6.115)	53 (0.566)
"	+	"	0.0375%	9 (5.372)	-2 (5.978)	76 (0.877)
"	+	"	0.05%	12 (5.220)	10 (5.318)	76 (0.877)
Phosphamidon			0.025%	14 (5.123)	-2 (5.985)	40 (0.404)
"			0.0375%	7 (5.493)	-1 (5.905)	46 (0.489)
"			0.05%	1 (5.813)	-9 (6.411)	73 (0.833)
Quinalphos			0.025%	6 (5.522)	-4 (6.105)	66 (0.732)
"			0.0375%	6 (5.522)	-2 (6.010)	70 (0.782)
"			0.05%	7 (5.464)	4 (5.636)	80 (0.927)
Phosalone			0.035%	6 (5.553)	-1 (5.808)	50 (0.526)
"			0.0525%	11 (5.225)	-3 (5.981)	73 (0.833)
"			0.07%	14 (5.107)	1 (5.765)	76 (0.877)
Monocrotophos			0.025%	10 (5.367)	5 (5.592)	76 (0.877)
"			0.0375%	12 (5.220)	10 (5.380)	63 (0.587)
"			0.05%	16 (5.067)	5 (5.582)	76 (0.877)
Control				0 (5.862)	-9 (6.421)	6 (0.067)
CD (0.05)				NS	NS	0.2861

Figures in parantheses are transformed values

noticed in treatment combination tridemorph 0.1 per cent with monocrotophos 0.0375 per cent and 0.05 per cent and lowest (45 per cent) was in tridemorph 0.05 per cent + monocrotophos 0.025 per cent.

4.2.15 Effect of insecticides alone

When different concentrations of insecticides were compared, maximum control of the disease was noticed with highest concentration of monocrotophos. While in the case of mortality of insect N. lugens, highest concentration of quinalphos was found to be the best.

4.3 Effect of different concentrations of fungicides, insecticides and their combinations against Pyricularia oryzae and Rhizoctonia solani in vitro

Bioassay with chemicals was carried out using poison food technique as described in 'Materials and Methods' to find out the effectiveness of the selected pesticides against P. oryzae and R. solani.

Four fungicides, four insecticides and their different combinations were tested. In all the treatments a total inhibition of the test organisms were observed.

4.4 Effect of different concentrations of insecticides, fungicides and their combinations against Cnaphalocrocis medinalis and Nilaparvata lugens in vitro

The experiment was conducted in vitro using C. medinalis and N. lugens as test insects using standard bioassay technique as described in 'Materials and Methods'. The results on the per cent mortality of insects are summarised in Table 8.

4.4.1 Effect of phosphamidon with fungicides in different concentrations

Phosphamidon 0.025 per cent, 0.0375 per cent, and 0.05 per cent gave mortalities of C. medinalis ranging from 33.3 per cent to 70 per cent and maximum mortality was recorded in phosphamidon 0.05 per cent.

While in the case of N. lugens, the mortality range varied from 63.3 per cent to 73.3 per cent and highest concentration of phosphamidon (0.05 per cent) showed maximum mortality.

The maximum mortality of leaffolder (93.3 per cent) was recorded in 0.05 per cent concentration of phosphamidon in combination with tridemorph 0.1 per cent and 0.075 per cent. The results are statistically significant and the highest concentration of phosphamidon with tridemorph was found to be

superior but this was on par with all the concentrations tried with these two chemicals. The combination of phosphamidon 0.05 per cent with carbendazim 0.05 per cent was also found on par with the phosphamidon-tridemorph combination. The minimum mortality has been observed in phosphamidon 0.0375 per cent + captafol 0.15 per cent.

In the case of brown planthopper N. lugens, highest mortality (90 per cent) was recorded in the combination of highest concentrations of phosphamidon and ediphenphos. The lowest mortality (50 per cent) was observed in the treatment, phosphamidon 0.025 per cent + captafol 0.15 per cent.

4.4.1.1 Combination of phosphamidon with ediphenphos

In this combination maximum mortality (73.3 per cent) of C. medinalis was obtained when highest concentrations of two pesticides were mixed and minimum mortality by mixing phosphamidon 0.0375 per cent with ediphenphos 0.05 per cent. But, in the case of N. lugens maximum (90 per cent) and minimum (70.0 per cent) mortalities were noticed in pesticide combinations phosphamidon 0.05 per cent + ediphenphos 0.1 per cent and phosphamidon 0.0375 per cent + ediphenphos 0.075 per cent respectively.

4.4.1.2 Combination of phosphamidon with carbendazim

In combination with carbendazim, maximum mortality

(90.0 per cent) of C. medinalis was noticed in highest concentration of phosphamidon with lowest concentration of carbendazim and minimum mortality (70.0 per cent) was by mixing two lower concentration of the above pesticides. The maximum mortality (83.3 per cent) of N. lugens was recorded in highest concentrations of phosphamidon and carbendazim and lowest mortality (56.7 per cent) in its lowest concentration combination.

4.4.1.3 Combination of phosphamidon with captafol

Highest concentration combinations of phosphamidon with captafol resulted in maximum mortality (86.7 per cent) and phosphamidon 0.0375 per cent on combination with captafol 0.15 per cent resulted in lowest mortality (16.7 per cent) of the insect C. medinalis. But, maximum mortality (73.3 per cent) of N. lugens was noticed in highest concentration of phosphamidon in combination with lowest concentration of captafol. Minimum mortality (50.0 per cent) was observed in treatment combination containing two lower concentrations of pesticides.

4.4.1.4 Combination of phosphamidon with tridemorph

Maximum and minimum mortalities of C. medinalis and N. lugens were noticed in highest and lowest concentration combinations of phosphamidon and tridemorph respectively.

4.4.2 Effect of quinalphos with different combination of fungicides

In different concentrations of quinalphos tried alone, the highest mortality of C. medinalis was recorded in the higehst concentration and lowest in the lowest concentration. The same trend were observed in the case of N. lugens also.

In combination, maximum of 100 per cent mortality of leaffolder was noticed in highest concentration of quinalphos with ediphenphos and carbendazim and minimum mortality was observed in lowest concentration of quinalphos and tridemorph. In the case of N. lugens, lowest mortality (56.7 per cent) was recorded in the lowest concentration of quinalphos with 0.075 per cent of carbendazim and maximum mortality (96.7 per cent) was in the highest concentration of quinalphos with 0.225 per cent of captafol.

4.4.2.1 Combination of quinalphos with ediphenphos

The highest concentrations of quinalphos and ediphenphos resulted in the highest mortality (100 per cent) of the insect C. medinalis and minimum of 80 per cent mortality was recorded in the lowest concentration of the pesticide. While in the case of N. lugens, maximum mortality (90 per cent) was noticed with highest concentration

combination of pesticides and minimum mortality (60 per cent) with lowest concentration combination of the pesticides.

4.4.2.2 Combination of quinalphos with carbendazim

The highest concentration combination of quinalphos and carbendazim recorded maximum mortality (100 per cent) of C. medinalis and the lowest concentration combination of the same pesticides resulted in minimum mortality (83.3 per cent) of the insect. Maximum mortality (76.7 per cent) of N. lugens was noticed in highest concentration of quinalphos in combination with lowest concentration of ediphenphos and minimum mortality (53.3 per cent) in lowest concentration of quinalphos with carbendazim 0.1 per cent.

4.4.2.3 Combination of quinalphos with captafol

Highest concentrations of quinalphos in combination with lowest concentration of captafol resulted in maximum mortality (90 per cent) of the insect C. medinalis and the lowest concentration of quinalphos in combination with captafol 0.225 per cent resulted in minimum mortality (46.7 per cent) of the insect. In the case of N. lugens, maximum mortality (96.7 per cent) was noticed with highest concentration of quinalphos in combination with captafol 0.225 per cent and the minimum mortality (83.3 per cent) was in its lowest concentration.

4.4.2.4 Combination of quinalphos with tridemorph

Maximum mortality (96.7 per cent) of C. medinalis was observed in the highest concentration of quinalphos and tridemorph and minimum mortality (50.0 per cent) in the lowest concentration of quinalphos with 0.1 per cent of tridemorph. While, maximum (96.7 per cent) and minimum (70.0 per cent) mortalities of N. lugens was resulted from the highest and lowest concentration combinations of quinalphos and tridemorph respectively.

4.4.3 Effect of phosalone with different combinations of fungicides

In the three different concentration of phosalone, the maximum and minimum mortalities of the insects, C. medinalis and N. lugens were observed in the highest and lowest concentration of the insecticides respectively.

Combinations of highest concentrations of phosalone and tridemorph recorded maximum mortality of C. medinalis (100 per cent) and N. lugens (96.7 per cent). Minimum mortality was noticed in lowest concentration combination of phosalone and ediphenphos in the case of C. medinalis (43.3 per cent) and phosalone and carbendazim in the case of N. lugens (56.7 per cent).

4.4.3.1 Combination of phosalone with ediphenphos

Highest combination concentration of phosalone and ediphenphos resulted in maximum mortality of C. medinalis and N. lugens and lowest combination concentration of the same pesticide resulted in minimum mortality of the insects.

4.4.3.2 Combination of phosalone with carbendazim

The two higher concentrations of phosalone in combination with highest concentration of carbendazim gave maximum mortality (90.0 per cent) of C. medinalis and phosalone 0.0525 per cent in combination with carbendazim 0.05 per cent resulted in minimum mortality (66.7 per cent) of the insect. In the case of N. lugens, combination of highest concentration of the pesticides resulted in maximum mortality. Minimum mortality was recorded in the lowest concentration combination of the same pesticide.

4.4.3.3 Combination of phosalone with captafol

Highest concentration combination of phosalone and captafol resulted in maximum mortality (83.3 per cent) of C. medinalis and phosalone 0.0525 per cent in combination with two lower concentrations of captafol resulted in minimum mortality (46.7 per cent) of the insect. The maximum

mortality of N. lugens was noticed in the highest concentration of phosalone in combination with captafol 0.225 per cent while, lowest concentration of phosalone in combination with captafol 0.225 per cent resulted in minimum mortality of the insect.

4.4.3.4 Combination of phosalone with tridemorph

Maximum mortality of C. medinalis (100 per cent) and N. lugens (90.0 per cent) were obtained by mixing two higher concentration of the pesticides and minimum mortality by mixing two lower concentration of pesticides, phosalone and tridemorph.

4.4.4 Effect of monocrotophos with different combinations of fungicides

When monocrotophos alone were tried at different concentration, the maximum mortality of C. medinalis and N. lugens were noticed in its highest concentration and minimum mortality in the lowest concentration.

On combination, the highest concentration of monocrotophos and carbendazim gave maximum control (93.3 per cent) and lowest concentration of monocrotophos and ediphenphos gave minimum control of C. medinalis while, monocrotophos 0.0375 per cent + tridemorph 0.1 per cent gave

maximum control of N. lugens (86.7 per cent) and monocrotophos 0.025 per cent + captafol 0.225 per cent gave minimum control of the same insect.

4.4.4.1 Combination of monocrotophos with ediphenphos

Highest control (86.7 per cent) of C. medinalis was obtained from monocrotophos 0.05 per cent on combination with highest concentration of ediphenphos and lowest control (46.7 per cent) from monocrotophos 0.025 per cent in combination with ediphenphos 0.075 per cent. In the case of N. lugens, combination of highest concentration of the above pesticides gave maximum mortality (83.3 per cent). Monocrotophos 0.0375 per cent + ediphenphos 0.05 per cent gave minimum mortality (63.3 per cent).

4.4.4.2 Combination of monocrotophos with carbendazim

In this case, combination of highest concentration of monocrotophos and carbendazim gave maximum control (93.3 per cent) and combination of monocrotophos 0.025 per cent with carbendazim 0.075 per cent gave minimum mortality (60.0 per cent) of C. medinalis. Maximum control obtained in the case of N. lugens was 73.3 per cent (monocrotophos 0.05 per cent + carbendazim 0.075 per cent) and minimum control was 53.3 per cent (monocrotophos 0.025 per cent + carbendazim 0.1 per cent).

4.4.4.3 Combination of monocrotophos with captafol

Highest concentration of monocrotophos when mixed with highest concentrations of captafol, resulted in maximum mortality and lowest concentration of monocrotophos in combination with captafol 0.225 per cent resulted in minimum mortality of the insect C. medinalis. In the case of N. lugens, combination of highest concentration of monocrotophos and lowest concentration of captafol resulted in maximum control and combination of lowest concentrations of the same gave minimum control of the insect.

4.4.4.4 Combination of monocrotophos with tridemorph

In this case, combination of highest and lowest concentrations of the pesticides resulted in maximum and minimum mortalities of the insect C. medinalis respectively. But, monocrotophos 0.0375 per cent + tridemorph 0.1 per cent resulted in maximum control and monocrotophos 0.0375 per cent + tridemorph 0.05 per cent resulted in minimum control of the insect, N. lugens.

4.4.5 Fungicides alone

When fungicides alone were tested for their insecticidal activity, tridemorph 0.1 per cent gave maximum mortality (66.7 per cent) of C. medinalis and ediphenphos 0.1 per cent and 0.075 per cent gave maximum mortality (33.3 per cent) of N. lugens.

Table 8. Effect of different insecticides, fungicides and their combinations against C. medinalis and N. lugens in vitro

Treatments			Per cent mortality of C medinalis	Per cent mortality of N. lugens
Phosphamidon 0.025%			33.3 (0.566)	63.3 (0.687)
"	+ Ediphenphos	0.05%	53.3 (0.566)	86.7 (1.056)
"	+ "	0.075%	63.3 (0.698)	9.0 (0.927)
"	+ "	0.1%	66.7 (0.738)	86.7 (1.056)
"	+ Carbendazim	0.05%	70.0 (0.382)	56.7 (0.608)
"	+ "	0.075%	73.3 (0.833)	76.7 (0.897)
"	+ "	0.1%	86.7 (1.142)	70.0 (0.782)
"	+ Captafol	0.15%	23.3 (0.236)	50.0 (0.526)
"	+ "	0.225%	56.7 (0.604)	60.0 (0.661)
"	+ "	0.3%	53.3 (0.566)	70.0 (0.782)
"	+ Tridemorph	0.05%	50.0 (0.526)	60.0 (0.647)
"	+ "	0.075%	60.0 (0.661)	66.7 (0.731)
"	+ "	0.1%	66.7 (0.738)	70.0 (0.782)
Phosphamidon 0.0375%			50.0 (0.526)	70.0 (0.782)
"	+ Ediphenphos	0.05%	50.0 (0.526)	83.3 (0.991)
"	+ "	0.075%	60.0 (0.644)	70.0 (0.782)
"	+ "	0.1%	66.7 (0.738)	83.3 (0.991)
"	+ Carbendazim	0.05%	83.3 (0.991)	63.3 (0.687)
"	+ "	0.075%	90.0 (1.206)	66.7 (0.731)
"	+ "	0.1%	76.7 (0.877)	83.3 (0.991)
"	+ Captafol	0.15%	16.7 (0.169)	73.3 (0.826)
"	+ "	0.225%	60.0 (0.444)	63.3 (0.691)
"	+ "	0.3%	80.0 (1.047)	70.0 (0.782)
"	+ Tridemorph	0.05%	70.0 (0.782)	63.3 (0.698)
"	+ "	0.75%	73.3 (0.833)	76.7 (0.877)
"	+ "	0.1%	90.0 (1.206)	86.7 (1.142)
Phosphamidon 0.05%			70.0 (0.782)	73.3 (0.826)
"	+ Ediphenphos	0.05%	66.7 (0.738)	83.3 (0.991)
"	+ "	0.075%	66.7 (0.738)	86.7 (1.056)
"	+ "	0.1%	73.3 (0.833)	90.0 (1.120)
"	+ Carbendazim	0.05%	90.0 (1.266)	83.3 (0.991)
"	+ "	0.075%	90.0 (1.206)	76.7 (0.897)
"	+ "	0.1%	80.0 (1.047)	88.3 (0.991)

Contd.

Table 8 (Contd.)

Treatments				Per cent mortality of *C. medinalis*	Per cent mortality of *N. lugens*
"	+	Captafol	0.15%	76.7 (0.877)	66.7 (0.731)
"	+	"	0.225%	70.0 (0.782)	73.3 (0.833)
"	+	"	0.3%	86.7 (1.142)	70.0 (0.782)
"	+	Tridemorph	0.05%	83.3 (1.111)	63.3 (0.698)
"	+	"	0.075%	93.3 (1.356)	86.7 (1.056)
"	+	"	0.1%	93.3 (1.356)	86.7 (1.056)
Quinalphos 0.025%				50.0 (0.526)	46.7 (0.486)
"	+	Ediphenphos	0.05%	80.0 (1.047)	60.0 (0.647)
"	+	"	0.075%	80.0 (1.047)	80.0 (0.647)
"	+	"	0.1%	80.0 (1.047)	86.7 (1.056)
"	+	Carbendazim	0.05%	83.3 (1.091)	73.3 (0.826)
"	+	"	0.075%	90.0 (1.206)	56.7 (0.608)
"	+	"	0.1%	93.3 (1.356)	53.3 (0.564)
"	+	Captafol	0.15%	76.7 (0.897)	83.3 (0.991)
"	+	"	0.225%	46.7 (0.489)	90.0 (1.206)
"	+	"	0.3%	70.0 (0.782)	93.3 (1.270)
"	+	Tridemorph	0.05%	70.0 (0.782)	70.0 (0.782)
"	+	"	0.75%	60.0 (0.647)	73.3 (0.883)
"	+	"	0.1%	50.0 (0.526)	73.3 (0.833)
Quinalphos 0.0375%				53.3 (0.566)	73.3 (0.826)
"	+	Ediphenphos	0.05%	86.7 (1.142)	70.0 (0.782)
"	+	"	0.075%	86.7 (1.142)	70.0 (0.782)
"	+	"	0.1%	86.7 (1.142)	83.3 (0.991)
"	+	Carbendazim	0.05%	86.7 (1.142)	70.0 (0.782)
"	+	"	0.075%	93.3 (1.356)	70.0 (0.782)
"	+	"	0.1%	93.3 (1.356)	66.7 (0.731)
"	+	Captafol	0.15%	90.0 (1.206)	90.0 (1.206)
"	+	"	0.225%	70.0 (0.782)	86.7 (1.056)
"	+	"	0.3%	70.0 (0.782)	80.0 (0.927)
"	+	Tridemorph	0.05%	66.7 (0.738)	76.7 (0.871)
"	+	"	0.75%	63.3 (0.687)	83.3 (0.997)
"	+	"	0.1%	86.7 (1.142)	83.3 (0.991)

Contd.

Table 8 (Contd.)

Treatments				Per cent mortality of C. medinalis	Per cent mortality of N. lugens
Quinalphos 0.05%				70.0 (0.782)	76.7 (0.877)
"	+	Ediphenphos	0.05%	93.3 (1.356)	76.7 (0.877)
"	+	"	0.075%	93.3 (1.356)	86.7 (1.056)
"	+	"	0.1%	100.0 (1.571)	90.0 (1.020)
"	+	Carbendazim	0.05%	86.7 (1.142)	76.7 (0.877)
"	+	"	0.075%	100.0 (1.571)	73.3 (0.826)
"	+	"	0.1%	100.0 (1.571)	73.3 (0.826)
"	+	Captafol	0.15%	60.0 (0.661)	90.0 (1.206)
"	+	"	0.225%	90.0 (1.206)	96.7 (1.420)
"	+	"	0.3%	83.3 (0.991)	86.7 (1.056)
"	+	Tridemorph	0.05%	90.0 (1.206)	80.0 (0.941)
"	+	"	0.75%	86.7 (1.142)	83.3 (0.991)
"	+	"	0.1%	96.7 (1.420)	86.7 (1.056)
Phosalone 0.035%				53.3 (0.566)	70.0 (0.782)
"	+	Ediphenphos	0.05%	43.3 (0.449)	76.7 (0.877)
"	+	"	0.075%	70.0 (0.782)	86.7 (1.056)
"	+	"	0.1%	60.0 (0.661)	90.0 (1.206)
"	+	Carbendazim	0.05%	73.3 (0.833)	56.7 (0.604)
"	+	"	0.075%	76.7 (0.877)	66.7 (0.731)
"	+	"	0.1%	86.7 (1.142)	66.7 (0.731)
"	+	Captafol	0.15%	53.3 (0.560)	80.0 (0.991)
"	+	"	0.225%	56.7 (0.610)	70. 0 (0.782)
"	+	"	0.3%	60.0 (0.644)	80.0 (0.991)
"	+	Tridemorph	0.05%	50.0 (0.526)	66.7 (0.731)
"	+	"	0.75%	56.7 (0.604)	13.3 (0.833)
"	+	"	0.1%	63.3 (0.687)	86.7 (1.056)
Phosalone 0.0525%				60.0 (0.661)	73.3 (0.833)
"	+	Ediphenphos	0.05%	60.0 (0.661)	80.0 (0.991)
"	+	"	0.075%	66.7 (0.738)	86.7 (1.056)
"	+	"	0.1%	73.3 (0.953)	93.3 (1.270)
"	+	Carbendazim	0.05%	66.7 (0.738)	66.7 (0.731)
"	+	"	0.075%	86.7 (1.149)	76.7 (0.877)
"	+	"	0.1%	90.0 (1.206)	76.7 (0.877)
"	+	Captafol	0.15%	46.7 (0.489)	83.3 (0.941)
"	+	"	0.225%	47.7 (0.489)	83.3 (0.941)
"	+	"	0.3%	80.0 (1.047)	83.3 (0.941)
"	+	Tridemorph	0.05%	70.0 (0.782)	80.0 (0.941)
"	+	"	0.75%	76.7 (0.897)	83.3 (0.991)
"	+	"	0.1%	76.7 (0.897)	83.3 (0.991)

Table 8 (Contd.)

Treatments			Per cent mortality of *C. medinalis*	Per cent mortality of *N. lugens*
Phosalone 0.07%			76.7 (0.877)	76.7 (0.877)
"	+ Ediphenphos	0.05%	80.0 (1.047)	86.7 (1.056)
"	+ "	0.075%	66.7 (0.738)	93.3 (1.270)
"	+ "	0.1%	80.0 (1.047)	96.7 (1.420)
"	+ Carbendazim	0.05%	86.7 (1.142)	73.3 (0.826)
"	+ "	0.075%	80.0 (1.047)	76.7 (0.897)
"	+ "	0.1%	90.0 (1.206)	76.7 (0.897)
"	+ Captafol	0.15%	70.0 (0.782)	86.7 (1.056)
"	+ "	0.225%	73.3 (0.833)	90.0 (1.206)
"	+ "	0.3%	83.3 (0.991)	86.7 (1.056)
"	+ Tridemorph	0.05%	80.0 (0.927)	86.7 (1.056)
"	+ "	0.75%	93.3 (1.356)	86.7 (1.056)
"	+ "	0.1%	100.0 (1.571)	90.0 (1.20)
Monocrotophos 0.025%			43.3 (0.449)	66.7 (0.731)
"	+ Ediphenphos	0.05%	53.3 (0.489)	66.7 (0.731)
"	+ "	0.075%	46.7 (0.489)	70.0 (0.782)
"	+ "	0.1%	73.3 (0.833)	76.7 (0.877)
"	+ Carbendazim	0.05%	73.3 (0.833)	56.7 (0.604)
"	+ "	0.075%	60.0 (0.661)	56.7 (0.604)
"	+ "	0.1%	73.3 (0.953)	53.3 (0.570)
"	+ Captafol	0.15%	60.0 (0.644)	70.0 (0.782)
"	+ "	0.225%	56.7 (0.782)	53.3 (0.564)
"	+ "	0.3%	80.0 (1.047)	56.7 (0.604)
"	+ Tridemorph	0.05%	50.0 (0.526)	73.3 (0.825)
"	+ "	0.75%	53.3 (0.566)	73.3 (0.826)
"	+ "	0.1%	83.3 (0.991)	76.7 (0.877)
Monocrotophos 0.0375%			53.3 (0.566)	70.0 (0.782)
"	+ Ediphenphos	0.05%	53.3 (0.566)	63.3 (0.687)
"	+ "	0.075%	60.0.(0.661)	76.7 (0.877)
"	+ "	0.1%	73.3 (0.833)	76.7 (0.877)
"	+ Carbendazim	0.05%	76.7 (0.877)	66.7 (0.731)
"	+ "	0.075%	66.7 (0.738)	56.7 (0.604)
"	+ "	0.1%	90.0 (1.206)	66.7 (0.731)
"	+ Captafol	0.15%	76.7 (0.877)	63.3 (0.698)
"	+ "	0.225%	70.0 (0.782)	53.3 (0.564)
"	+ "	0.3%	80.0 (1.047)	56.7 (0.604)

Contd.

Table 8 (Contd.)

Treatments			Per cent mortality of C. medinalis	Per cent mortality of N. lugens
"	+ Tridemorph	0.05%	70.0 (0.782)	70.0 (0.782)
"	+ "	0.075%	83.3 (1.091)	80.0 (0.941)
"	+ "	0.1%	86.7 (1.142)	86.7 (1.056)
Monocrotophos	0.05%		73.3 (0.566)	70.0 (0.782)
"	+ Ediphenphos	0.05%	80.0 (1.047)	73.3 (0.826)
"	+ "	0.075%	86.7 (1.142)	83.3 (0.991)
"	+ "	0.1%	86.7 (1.142)	83.3 (0.991)
"	+ Carbendazim	0.05%	80.0 (1.047)	70.0 (0.782)
"	+ "	0.075%	80.0 (1.047)	73.3 (0.826)
"	+ "	0.1%	93.3 (1.356)	56.7 (0.610)
"	+ Captafol	0.15%	80.0 (1.047)	70.0 (0.782)
"	+ "	0.225%	83.3 (0.991)	66.7 (0.731)
"	+ "	0.3%	83.3 (0.991)	66.7 (0.731)
"	+ Tridemorph	0.05%	83.3 (0.991)	76.7 (0.877)
"	+ "	0.75%	83.3 (0.991)	80.0 (0.941)
"	+ "	0.1%	86.7 (1.142)	83.3 (0.991)
Ediphenphos	0.05%		13.3 (0.134)	23.3 (0.236)
"	0.075%		13.3 (0.134)	23.3 (0.341)
"	0.1%		13.3 (0.134)	33.3 (0.343)
Carbendazim	0.05%		6.7 (0.067)	6.7 (0.067)
"	0.075%		16.7 (0.168)	13.3 (0.168)
"	0.1%		13.3 (0.134)	13.3 (0.134)
Captafol	0.15%		13.3 (0.134)	6.7 (0.067)
"	0.225%		26.7 (0.274)	16.7 (0.168)
"	0.3%		50.0 (0.526)	16.7 (0.168)
Tridemorph	0.05%		50.0 (0.526)	13.3 (0.134)
"	0.075%		53.3 (0.566)	13.3 (0.134)
"	0.1%		66.7 (0.738)	20.0 (0.202)
Control			10.0 (0.101)	6.7 (0.067)
CD (0.05)			0.3650	0.2092

* Figures in parantheses are transformed values

DISCUSSION

Pesticides play an integral role in the control of diseases and insect pests. The application of pesticides in scheduled manner at different growth stages of crops, irrespective of the incidence of pests and diseases, was the strategic plant protection technology for crops which are vulnerable to a multitude of diseases and pests. Due to simultaneous occurrence of diseases and pests on rice and to reduce the cost of application of pesticides, it is often necessary to apply fungicides and insecticides in combination. Hence, a knowledge on the compatibility of fungicides and insecticides and its possible synergistic action are important in the concurrent management of the pest and disease problems in rice.

In the present investigation, *in vivo* and *in vitro* studies were carried out to find out the effectiveness of different concentrations of fungicides (ediphenphos, carbendazim, captafol and tridemorph) insecticides (phosphamidon, quinalphos, phosalone and monocrotophos) and their different combinations against two major diseases of rice viz., rice blast (*Pyricularia oryzae*) and sheath blight (*Rhizoctonia solani*) and two major pests viz., leaffolder (*Cnaphalocrocis medinalis*) and brown planthopper (*Nilaparvata*

lugens). In pot culture studies, the plants were inoculated with the test organisms at tillering, panicle initiation and flowering stages.

When the chemicals were applied at tillering stage, ediphenphos in combination with phosalone resulted in maximum control of P. oryzae whereas, in the case of R. solani, ediphenphos with quinalphos gave the maximum control. In both the cases, the fungicide applied in combination was found to be the best, than the fungicide applied alone. The treatment combination containing higher concentrations of ediphenphos and quinalphos, gave maximum mortality of C. medinalis and N. lugens. Higher concentration of ediphenphos and phosalone was also found to be effective against N. lugens. The present findings supported the earlier findings of Bhaskaran et al. (1976) that, ediphenphos in combination with phosalone and quinalphos controlled leaffolder more effectively, than when the insecticide was applied alone. Studies conducted at Kerala Agricultural University (1981) revealed the synergistic effect of fungicides on the insecticidal effect of quinalphos. Babu (1988) also reported that, ediphenphos can be combined with quinalphos and monocrotophos without any antogonistic or even with synergistic effect. The present investigation results also support the above findings.

Combined application of carbendazim (0.075 per cent)

with recommended dose of phosalone was found to be the superior among the other treatments tried against blast, whereas, in the case of sheath blight, the same concentration of carbendazim with lowest concentration of quinalphos gave maximum control. The recommended dose of the same fungicide and quinalphos was also found to be effective against leaffolder. However, Raju et al. (1988) observed that, spraying monocrotophos in combination with carbendazim, was the effective treatment in keeping the leaffolder population well below the economic threshhold. But in the present study, this combination was found to be effective against brown planthopper but not that much for leaffolder.

The fungicidal effect of captafol was found enhanced, by mixing with phosalone. The maximum fungicidal effect against blast was noticed by highest concentration of captafol with lowest concentration of phosalone, whereas, combination of recommended doses of captafol with quinalphos gave effective control of sheath blight, leaffolder and brown planthopper. This observation also support the earlier findings of Babu (1988).

The fungicidal property of tridemorph with different concentrations of insecticides were tried, and this fungicide was found to be effective against both P. oryzae and R. solani. The recommended dose of this fungicide with lower concentration

of monocrotophos was found to be the best for P. oryzae but, a lower concentration of tridemorph (0.075 per cent) with highest concentration of phosphamidon was most effective treatment against R. solani. The fungicidal property of tridemorph against R. solani of cowpea was also reported earlier by Sharma and Sohi (1980). When the insecticide was sprayed in combination with tridemorph, the highest concentration of quinalphos with lowest concentration of tridemorph gave the maximum mortality of C. medinalis, while, the recommended doses of phosphamidon and tridemorph was the best against N. lugens. The compatibility of tridemorph with different insecticides had not been studied earlier, but in the present investigation, it was clearly proved that tridemorph can be effectively combined with the four insecticides viz., phosphamidon, quinalphos, phosalone and monocrotophos.

In summarising the above findings, at tillering stage, tridemorph (0.1 per cent) and ediphenphos (0.075 per cent) gave maximum control of blast and sheath blight diseases respectively when the fungicides were applied alone, whereas, when it was applied along with different insecticides, tridemorph (0.1 per cent) + monocrotophos (0.0375 per cent) was found effective against blast but, carbendazim 0.075 per cent with quinalphos (0.025 per cent) was found effective in controlling the sheath blight disease. Among the four

insecticides tried, quinalphos (0.05 per cent) gave maximum control of both the insects, leaffolder and brown planthopper.

The efficacy of four fungicides and four insecticides, alone and in combination with different concentrations were also studied against the two diseases rice blast and sheath blight and two insect-pests leaffolder and brown planthopper during the panicle initiation stage.

The artificial inoculation of P. oryzae was a failure during panicle initiation stage and no symptoms were observed during this stage of the crop. Therefore, no observations were made for rice blast during panicle initiation stage. The leaffolder was studied in combination with rice blast and since the rice blast has not appeared on the experimental plant, no pesticidal spray has been done. Hence, leaffolder caterpillars were not released on this plant at panicle initiation stage.

In the case of sheath blight, the recommended doses of ediphenphos with phosphamidon, quinalphos and phosalone were found effective. But, the ediphenphos-phosphamidon combination was the best against brown planthopper.

The combination of carbendazim with different fungicides, only carbendazim and monocrotophos at its highest concentration was found to be effective, in controlling both

R. solani and N. lugens. The present findings were in accordance with the earlier findings of Raju et al. (1988).

Among captafol - insecticide combination, the best control of the disease was noticed in the recommended dose of captafol with quinalphos (0.0375 per cent) and with highest dose of monocrotophos, it also gave maximum mortality of N. lugens. This result confirmed the earlier findings of Babu (1988).

The highest concentration of tridemorph with quinalphos was found effective in controlling both R. solani and N. lugens but, the maximum insect mortality was observed in combination with recommended dose of phosphamidon.

The overall performance of the treatment at panicle initiation stage revealed that, recommended doses of carbendazim and quinalphos, was found best in controlling R. solani and N. lugens respectively. The superiority of carbendazim against R. solani was also reported earlier (Arunyanar et al., 1986; Dev and Mary, 1986; Torabi and Binesh, 1987; Paromita, 1988). The earlier workers, Skaria and Das (1981), Rao et al. (1984) and Pillai and Nair (1986) were reported the effectiveness of quinalphos against N. lugens. The present findings also agree with the earlier findings.

Combined sprays of higher concentrations of carbendazim and monocrotophos gave maximum control of sheath blight and brown planthopper at panicle initiation stage. However, maximum mortality of the insect was noticed in recommended concentrations of ediphenphos and phosphamidon.

The interaction of ediphenphos with insecticides at flowering stage revealed that, spraying ediphenphos (0.075 per cent) in combination with phosphamidon (0.0375 per cent) and phosalone (0.07 per cent) was the effective treatment in reducing the incidence of blast and sheath blight respectively. The combined spray of recommended doses of ediphenphos and quinalphos gave maximum mortality of leaffolder and brown planthopper.

Recommended dose of carbendazim used in combination with phosalone resulted in maximum control of P. oryzae, while, mixing highest concentration of carbendazim with monocrotophos was found to be the best against R. solani and N. lugens. The present findings support the result of the studies conducted by Schiller et al. (1982). In the case of C. medinalis, combination of highest concentration of carbendazim with lowest concentration of quinalphos gave best control.

Combined spraying of highest concentrations of

captafol with quinalphos was the most effective treatment in controlling both diseases and insect-pests.

The fungicide tridemorph and its combination with four insecticide, did not effectively check the blast disease during the flowering stage. However, the combination of recommended doses of tridemorph and quinalphos gave some control of R. solani and good control of the insect pests C. medinalis and N. lugens.

From the above findings it was observed that, during the flowering stage captafol (0.225 per cent) with quinalphos (0.0375 per cent) and carbendazim (0.075 per cent) with monocrotophos (0.0375 per cent) were the best combinations against blast and sheath blight respectively. These results thus indicate the feasibility of saving the cost of pesticides by reducing the doses when used in combination. When insecticides were tried individually, the recommended dose of quinalphos was found to be the superior, among others in controlling both C. medinalis and N. lugens and the mortality were 83 per cent and 80 per cent respectively. Whereas in combination, recommended dose of quinalphos with tridemorph gave better results and the mortality were 93 per cent for both the insect pests.

The fungicidal effect of insecticide was very meagre. However, monocrotophos gave 21 per cent control of blast and 16 per cent control of sheath blight. Babu (1988) also reported the fungicidal effect of monocrotophos. Various workers had reported the insecticidal activity of fungicides. Medrano et al. (1984) and Babu (1988) had reported the insecticidal effect of ediphenphos against N. lugens. In the present study also it was observed that, the fungicides ediphenphos and tridemorph had some insecticidal properties besides fungicidal properties against N. lugens and C. medinalis respectively. The results obtained in the laboratory studies also were in agreement with the observations in the pot culture experiment. In all cases combined application of pesticides were found to be superior than the individual application of chemicals. It is evident from the results that the fungicidal property of the chemical applied slightly decreased after 10 days. After 20 days the disease intensity has been increased considerably showing that, the chemicals have no residual effect.

Laboratory studies were also carried out to find out the effectiveness of different treatments against P. oryzae and R. solani. A total inhibition of the test-organisms were observed in all the treatments.

In the case of C. medinalis and N. lugens, the

recommended dose of phosphamidon gave maximum mortality. The insecticidal effect of phosphamidon was significantly altered when used in combination with fungicides. The maximum insect mortality was recorded in recommended doses of phosphamidon with tridemorph and ediphenphos against C. medinalis and N. lugens respectively.

Quinalphos when used in combination with fungicides, resulted in a higher mortality of both the insects, than when the insecticide was used alone. Recommended doses of quinalphos in combination with ediphenphos and carbendazim recorded 100 per cent mortality of C. medinalis, while maximum mortality of N. lugens was observed in its combination with captafol (0.225 per cent). The results of the in vitro studies were also found to be in agreement with the observations obtained in vivo. The synergistic action of quinalphos with different insecticides had been proved in vivo and in vitro. Babu (1988) had also reported that, insecticidal effect of quinalphos had a synergistic effect when combined with fungicides.

When phosalone was mixed with different fungicides, the mortality of the test insects were high, indicating the synergistic effect. Phosalone in combination with tridemorph and ediphenphos gave 100 per cent and 96.7 per cent mortality of the test insect C. medinalis. Almost same trend had been

observed in the case of mortality of N. lugens, where the per cent mortality were 96.7 and 86 respectively. The results of the in vivo studies also established the superiority of this combination.

Enhancement in the insecticidal effect of monocrotophos was observed in almost all combinations with fungicides. The maximum mortality (93 per cent) of leaffolder was observed in its combination with carbendazim. Ediphenphos and tridemorph combination gave the best result in the mortality of brown planthopper (83 per cent). Here also almost same trend was observed in in vivo studies.

When fungicides alone were tried for their insecticidal activity, the maximum insecticidal effects were given by recommended concentrations of tridemorph and ediphenphos against C. medinalis and N. lugens respectively.

From the results it is clear that, in vitro studies with pesticides almost reflected in vivo as far as insecticides and its combination with fungicides were concerned against C. medinalis and N. lugens. However, this trend was not reflected in the case of fungicide in combination with insecticides for the control of P. oryzae and R. solani. It may be due to the fact that, environmental condition may have much more influence on fungal pathogens than the insects.

Moreover, the disintegration of fungicides when applied *in vivo* might have different actions resulting in fluctuating results.

Based on the above studies, it was observed that recommended doses of quinalphos with carbendazim, and phosalone with tridemorph were the superior treatments in controlling the insect *C. medinalis* both *in vitro* and *in vivo*. As far as *N. lugens* was concerned, the best control was obtained with highest concentration of quinalphos with all combinations of fungicides except carbendazim. This findings were in accordance with the result of *in vivo* studies.

Summary

SUMMARY

The efficiency of four fungicides and four insecticides alone and in combination were tried at different concentrations (recommended, three-fourth and half the recommended concentrations) against two major diseases of rice namely, rice blast, caused by Pyricularia oryzae and sheath blight, caused by Rhizoctonia solani and two major insect pests namely, leaffolder Cnaphalocrosis medinalis and brown planthopper Nilaparvata lugens at tillering, panicle initiation and flowering stages of the crop. The experiments were conducted in vivo and in vitro conditions during 1989-91, at the College of Horticulture, Vellanikkara, Thrissur.

In general, in vivo studies revealed that, pesticides applied in combination, controlled diseases and insect-pests more effectively than when the pesticide was applied alone. The results of the study can be summarised as follows:

1. At tillering stage, the fungicidal effect of ediphenphos was found to be enhanced and maximum control of P. oryzae was noticed at lowest concentration of ediphenphos in combination with highest concentration of phosalone. Maximum mortality of leaffolder was noticed in ediphenphos (0.075 per cent) + quinalphos (0.05 per cent) combination.

2. In carbendazim - insecticides combination, maximum control of blast was observed in carbendazim (0.075 per cent) + phosalone (0.07 per cent) and maximum mortality of leaffolder was observed in combination of highest concentrations of the fungicide and quinalphos.

3. Synergistic effect of captafol against blast disease was noticed at its highest concentration, in combination with lower levels of phosalone. Maximum insect mortality was observed at the highest concentration of the above fungicide with quinalphos.

4. An enhancement in the fungicidal action of tridemorph against blast was noticed at its recommended concentration in combination with monocrotophos (0.0375 per cent). Maximum insect mortality of leaffolder was observed with tridemorph (0.075 per cent) in combination with recommended dose of quinalphos.

5. The efficacy of different treatments at panicle initiation stage against P. oryzae and C. medinalis could not be assessed, since artificial inoculation of P. oryzae was failed during this stage of the crop.

6. At flowering stage, ediphenphos (0.075 per cent) + phosphamidon (0.0375 per cent) was the best combination against blast, while mixing higher concentration of

ediphenphos with quinalphos and monocrotophos were found to be the best treatments against leaffolder.

7. Combined application of highest concentrations of carbendazim and phosalone was the effective treatment against P. oryzae while, the same fungicidal concentration in combination with quinalphos (0.025 per cent) gave maximum control of C. medinalis.

8. Among captafol - insecticide combinations tried, captafol in combination with quinalphos was found to be the best in controlling both P. oryzae and C. medinalis.

9. The application of tridemorph alone was found to be the best against blast than combined application with insecticides, while in the case of leaffolder, tridemorph (0.1 per cent) + phosphamidon (0.0375 per cent) gave effective control than the pesticides applied alone.

10. At tillering stage, ediphenphos (0.1 per cent) in combination with quinalphos (0.0375 per cent) gave maximum control of sheath blight disease, and the same fungicide in combination with quinalphos (0.05 per cent) and phosalone (0.07 per cent) gave maximum control of brown planthopper.

11. The best combinations of carbendazim with insecticides against sheath blight and brown planthopper were,

carbendazim (0.075 per cent) + quinalphos (0.025 per cent), and carbendazim (0.1 per cent) + monocrotophos (0.05 per cent) respectively.

12. Combined spraying of higher concentrations of captafol and quinalphos was the best treatment against R. solani and N. lugens.

13. Tridemorph (0.075 per cent) + phosalone (0.07 per cent) and tridemorph (0.1 per cent) + phosphamidon (0.05 per cent) were the best combinations against sheath blight and brown planthopper respectively.

14. At panicle initiation stage of the crop, combinations of highest concentrations of ediphenphos with all insecticides except monocrotophos were the effective treatments against R. solani, while ediphenphos in combination with phosphamidon at highest concentrations gave effective control of N. lugens.

15. Mixed spraying of highest concentrations of carbendazim and monocrotophos was the best treatment against sheath blight and brown planthopper.

16. Highest concentration of captafol in combination with quinalphos and phosalone were the effective treatments against R. solani and N. lugens respectively.

17. Maximum control of sheath blight and brown planthopper was observed at highest concentration of tridemorph in combination with highest concentrations of quinalphos and phosphamidon respectively.

18. At flowering stage, among ediphenphos-insecticide combinations, highest concentrations of ediphenphos and phosalone were found to be the best treatment for the control of both R. solani and N. lugens.

19. Carbendazim (0.075 per cent) in combination with monocrotophos (0.0375 per cent) was the effective treatment against sheath blight, while combination of the recommended concentrations of the above pesticides was the best against brown planthopper.

20. Mixed spraying of the recommended concentrations of the fungicide captafol and insecticide quinalphos gave best control of both R. solani and N. lugens.

21. In tridemorph - insecticide combinations, best control of sheath blight and brown planthopper was given by the combination containing highest concentrations of the fungicide and quinalphos.

22. In vitro studies were also carried out to find out the effectiveness of different treatments against P. oryzae and R. solani. A total inhibition of the test organisms were observed in all the treatments.

23. In the case of C. medinalis and N. lugens, maximum insect mortality was recorded at recommended doses of phosphamidon with tridemorph and ediphenphos.

24. Recommended doses of quinalphos in combination with ediphenphos and carbendazim recorded 100 per cent mortality of C. medinalis, while maximum mortality of N. lugens was observed in its combination with captafol 0.225 per cent.

25. Phosalone in combination with tridemorph and ediphenphos gave 100 and 96.7 per cent mortalities of C. medinalis and N. lugens respectively.

26. The maximum mortality of leaffolder was observed at recommended concentrations of monocrotophos + carbendazim, while in the case of N. lugens, monocrotophos 0.0375 per cent + tridemorph 0.1 per cent was the most effective treatment.

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COMPATIBILITY OF CERTAIN FUNGICIDES AND INSECTICIDES USED FOR THE CONTROL OF MAJOR DISEASES AND INSECT PESTS INFESTING THE RICE CROP

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ABSTRACT OF A THESIS

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ABSTRACT

The efficacy of four fungicides and four insecticides alone and in combination were studied at different concentrations (Recommended, three-fourth and half the recommended concentrations) against two major diseases of rice namely, rice blast caused by Pyricularia oryzae Cavara and sheath blight caused by Rhizoctonia solani Kuhn. and two major insect-pests namely, leaffolder Cnaphalocrocis medinalis Guen. and brown planthopper Nilaparvatha lugens Stal. at tillering, panicle initiation and flowering stages of the crop. The experiment was conducted in vivo and in vitro conditions during 1989-'91, at the College of Horticulture, Vellanikkara, Thrissur.

In general, combined application of fungicides and insecticides controlled the diseases and insect-pests more effectively than the treatments given separately.

At tillering stage, a synergistic effect of fungicide was observed, when it was sprayed along with insecticides. Among different combinations tried, tridemorph (0.1 per cent) + monocrotophos (0.0375%) and carbendazim (0.075%) + quinalphos (0.025 per cent) were the best combinations against blast and sheath blight respectively. In the case of leaffolder and

brown planthopper, quinalphos was found to be the best insecticide, when used alone and also in combination with fungicides.

At panicle initiation stage, combined sprays of higher concentrations of carbendazim and monocrotophos was the best combination in controlling both R. solani and N. lugens. But ediphenphos-phosphamidon combination was found to be the superior against N. lugens.

When combined spraying was given at flowering stage, captafol (0.225 per cent) + quinalphos (0.0375 per cent) and carbendazim (0.075 per cent) + monocrotophos (0.0375 per cent) were found to be the best combinations against P. oryzae and R. solani respectively. But, combination of recommended doses of quinalphos with tridemorph and ediphenphos and, phosalone with ediphenphos were the effective treatments in controlling C. medinalis and N. lugens respectively.

In in vitro studies, a total inhibition of the test organisms, viz. P. oryzae and R. solani were observed in all the treatments. Whereas, in the case of C. medinalis recommended doses of quinalphos in combination with ediphenphos and carbendazim and phosalone with tridemorph recorded highest mortality; while, highest dose of quinalphos with captafol and phosalone with ediphenphos were the superior combinations against N. lugens.

From the above findings it could be concluded that, the fungicides viz. ediphenphos, carbendazim, captafol and tridemorph are compatible with all the four insecticides tried viz. Phosphamidon, quinalphos, phosalone and monocrotophos in controlling the diseases, blast and sheath blight and insect pests leaffolder and brown planthopper.