PREFACE

Insect pests are causing heavy losses to our crops, fruitsand vegetables in the range from 15 to 60%. Their control, at present in Pakistan, is done mainly through the use of insecticides. Whereas, in many countries, use of insecticides is being discouraged due to pollution of the environment through toxic residues left in the atmosphere and even on the products consumed. Pakistan is importing pesticides approximately worth Rs. 16 billion every year to control insect pests. About54% of these pesticides are being used in cotton, 16% inrice, 13% in sugarcane, 9 % in fruits & vegetables and 7% in other uses. Inspite of this, the insect pests are still imposing serious threats to our agricultural economy. The main reasons are that they have developed high resistance against pesticides and thereby demanding heavy dose rates and repeated applications. With this situation, per acre cost of production has been increased. Other concerns are environment pollution, health hazards and forthcoming trade challenges of WTO. Biological control is the most effective when used with other compatible pest control practices in Integrated Pest Management (IPM) program. These practices include cultural control, planting pest resistant varieties, sterile insect technique, males/females annihilation technique through pheromones and usingselective insecticides when other practices fail to keeppest numbers below the economic threshold levels. Biological control is neither hazardous to human healthnor to environment. There is not much chance for the pests to develop resistance against natural enemies that commonly occurs with insecticides.

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PROBLEMS

Cotton is the main cash crop of Pakistan. The potentialproduction of this crop is reduced by more than 30% due to the ravages of insect pests. The crop is infested by two types of pests, one is called bollworm complex i.e., spotted, spiny, pink and American bollworms andarmyworm and the other is known as sucking complex i.e., jassids, thrips, whiteflies, aphids, mites and mealybugs. Borers are the serious pests of sugarcane. The control of these pests by insecticides has always been difficult due to the concealed feeding habit of thedamaging larvae. These insect pests are top, stem, rootand Gurdaspur borers, and pyrilla.

CONTROL MEASURES

Biological control offers one of the most promising, environment friendly and sustainable approaches for the management of insect pests of cotton, sugarcane, fruits and vegetables.

NIAB has started R&D work on bio- control management of insect pests of agricultural crops especially cotton and sugarcane, and assisting farmers by providing them *Trichogramma* and *Chrysoperla* cards in bulk for field releases.

PARASITOID, TRICHOGRAMMA

Trichogramma is a very tiny wasp that destroys eggs of all bollworms in cotton, borers in sugarcane, maize, rice, vegetables and fruits by depositing its own eggs inside the host eggs. It completes its life cycle within 7-9 days and emerges as adult. One wasp destroys 190 eggs in its life time.

Methods of using Trichogramma in Field

There are 2-3 thousands parasitoids on one card that are prepared in the laboratory. These cards are installed in field by staple pins underside of leaves according to thedose rate and time as given in table below. Theseapplications are repeated after 15 days interval.

PREDATOR, CHRYSOPERLA

It is a green coloured lacewing insect that preys and consumes directly its hosts. It destroys sucking insect pests, small larvae of bollworms, borers and pyrilla in crops, fruits and vegetables. One larva of *Chrysoperla* can consume upto 400 aphids or 11200 mites or 250 whiteflies in its life time.

Methods of using Chrysoperla in Field

There are 250-300 *Chrysoperla* eggs one card which are prepared in the laboratory. These cards are applied in field according to dose rate and time as given in tablethroughout crop season. Applications are to be repeatedafter 15 days interval.

Trichogramma Field Release Rate

Crop	Parasitoid Nos.	Card Nos.	Application Time
Cotton	50000 to 75000	20-25	July to September
Sugarcane	25000 to 45000	10-15	March to September
Fruits	80000 to 300000	32-100	Throughout fruiting Season
Vegetables	50000 to 100000	20-35	Throughout fruiting Season
*Parasitoids number or cards per acre per season			

Chrysoperla Field Release Rate

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Crop	Predators Nos.	Cards Nos.	Application Time
Cotton	40000 to 60000	160-240	June to September
Vegetables	60000 to 75000	240-300	Throughout fruiting Season
Fruits	35000 to 50000	140-200	Throughout fruiting Season
Flowers	29000 to 40000	116-160	Through out Season
*Predators number or cards per acre per season			

AENASIUS & CRYPTOLAEMUS FOR MEALYBUG

Mealybug is a continuous threat to cotton since 2005-2006. Mealy bug, *Phenacoccus solenopsis* has multiple advantages of parthenogenesis and ovisacs for their population increase, ability to withstand extremes of temperatures during the crop free periods and availability of alternate host plants almost year around. Research at NIAB is continued to determine the population dynamics and severity levels of mealy bug on major crops, weeds, ornamental and vegetable plants. It was found that it attacks 35 different plants including 14 weeds, 8 ornamental plants and 13 crop and vegetable plants. Its peak infestation was recorded from July-August followed by a decline from October- December. Maximum infestation of mealybug was noted on weed *Abutilon indicum* (86%), ornamental plant, *Hibiscus rosa-sinensis* (94%) and *Gossypium hirsutum* (67%). The overall infestation of mealybug in all host plants ranged from 2-94%. *Aenasius bambawalei* is a natural parasitoid of cotton mealy bug that nourishes and develops inside the body of host. It gives a range of 62% parasitization on mealy bug in experimental trials for biological control. The introduction and augmentation of this parasitoid is further needed to manage the pest. Its rearing has been started at NIAB in bio-control laboratories for its proper field conservation to get the maximum benefits to avoid indiscriminate use of pesticides. Moreover, feeding potential of the predator, Cryptolaemus has been found as 10-15 mealybugs/ day. While as a whole, this predator feeds on an average of 150-300 mealy bugs in its life span.

Mealybug Management

Uproot mealy bug infested crop plants and weeds regularly. Fill in natural enemy field reservoirs (NEFRs) by uprooted mealy bug infested plants for development of parasites & predators and their shifting to crop. Install 2-4 NEFRs for an area of 50-100 acres. Spray recommended insecticides safe to natural enemies at 5-7 days interval. Release Aenasius parasite @ 14-2- thousand/acre and Cryptolaemus beetles @ 25-30 thousand/acre.

COCCINELLID LADYBIRD BEETLES

Ladybird beetles are general predators that feed on a variety of slow moving insects, but they are best known for feeding on aphids. Both larvae and adult lady beetles feed on aphids. When released, adult beetles mate and lay eggs within 8-10 days. Female beetles lay 2-3 eggs per day for an average of 700 eggs over their 100-day lifetime. Larvae consume up to 400 aphids each, at a rate of 50-60 aphids per day for later stages. Over its entire life, one lady beetle can consume up to 5,000 aphids.

Introduction rates

Once the target pest has been detected, release at rates of 10-adults/infested plant, weekly, until established.

Depending upon infestation, the beetles have to be released @ of 2500 to 3000 beetles/acre usually during morning and evening hours.

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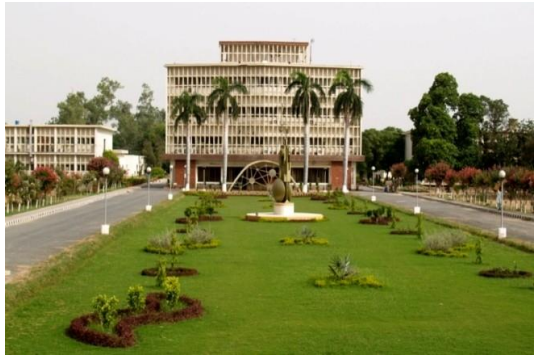
BIOLOGICAL CONTROL

AN ENVIRONMENT FRIENDLY

COMPATIBLE AND SUSTAINABLE

IPM APPROACH



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