Internat. J. agric. Sci. Vol.2 No.2 July 2006 : (499-502)

Neem-based integrated management approaches for insect pests okra (*Abelmoschus esculentus* L. Moench.)

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ABSTRACT
A study was conducted during two successive summer seasons of 2000 and 2001 to assess the effectiveness of some neem based integrated management approaches against the Jassid and shoot and fruit borer on okra. The treatments comprised soil application of neem cake @ 200 kg ha^{-1} with 3 foliar application of neem seed kernel extract (5%)/neem oil (3%)/Amrutguard (0.5%)/neem leaf decoction @ 0.5 kg/Chlorpyriphos 20 EC @ 0.5 kg/Endosulfan 35 EC @ 0.5 kg and recommended insecticide of Monocrotophos 36 SL @ 0.4 kg. All the integrated treatments were found quite effective against the Jassid and shoot and fruit borer and were significantly superior over recommended insecticide. However, integrated neem cake treatments with inclusion of Endosulfan and Chlorpyriphos performed better than those with other integrated treatments in reducing the pests incidence and producing more marketable fruit yield. Also these integrated treatments proved profitable with the maximum cost benefit ratio.

Key words : Neem products, Insecticide, Okra, Jassid, Shoot and Fruit borer.

INTRODUCTION
Okra, *Abelmoschus esculentus* L. Moench. is the most important vegetable crop grown extensively in India. One of the major constraints for the low productivity of okra in India is that the crop is more vulnerable to the attack by as many as 13 major insect and non-insect pests during its different growth stages (Dhamdhere *et al*., 1984). Among all these insect pests, Jassid, *Amrasca biguttula biguttula* Ishida and shoot and fruit borer, *Earias vittella* Fabricius are the most serious pests and a major limiting factors in okra cultivation (Rahman, 1983).

Attempt to control these pests by insecticides is fraught with problems of resistance, resurgence, secondary infestation, phytotoxicity, toxicity to beneficial organisms, residues in food beyond the tolerance limits posing unwarranted health hazards to the consumers. The increasing concern for environment safety and global demand for pesticide residue free food have evoked keen interest to use neem products in pest control, which are easily biodegradable and do not leave any harmful toxic residue in fruits besides conserving the natural enemies. The efforts were, therefore made to asses the effectiveness of some neem-based integrated management practices against the insect pests on okra with a view to decrease the pesticide load in okra ecosystem.

MATERIALS AND METHODS
Experiments were conducted for two successive summer seasons during 2000 and 2001 at the University Apiary, Rajendra Agricultural University, Pusa Farm, Samastipur, Bihar to assess the effectiveness of some neem-based integrated management approaches against the insect pests on okra. The experiment was laid out in a randomized block design with six treatments (Table 1). Each treatment was replicated thrice, each plot measuring 3 m x 2 m. The okra (cv. Pusa Sawani) seeds were sown on 16th February in both the years with a spacing of 30 cm x 30 cm. Crops were raised following standard agronomic practices.

Methodology used in preparation of some neem products :

1. Neem seed kernel extract (NSKE 5%) -

500 grams of powdered neem seed kernel were soaked in 10 litres of water for 24 hrs, filtered and the aliquot was made up to 10 litre with water. In 10 litres of spray material, 100 gm of reetha or ordinary washing soap was added and thoroughly mixed before spraying.

2. Neem leaf decoction (NLD) -

The neem leaf decoction was prepared by boiling 1.65 kilo of fresh neem leaves in 10 litres of water for 30 minutes.

3. Neem oil (3%) -

In 10 litres of water, 300 ml of commercially available neem oil was dissolved and 100 gm of reetha or detergent cake was added to obtain 3 per cent spray solution and mixed thoroughly before spraying.

Insecticidal application :

Soil application of neem cake @ 200 kg ha^{-1} were applied at the time of last ploughing. First foliar applications of neem products and other safer insecticides including recommended insecticide were done on 22nd March after 20 days of the crop emergence followed by 2nd and 3rd foliar spray treatments on 12th April and 3rd May after 40 and 60 days of the crop emergence, respectively in both the years. Spraying was done late in the afternoon with high volume knapsack sprayer (ASPEE make) and a through coverage of leaf area, tender shoots and fruits was insured. Spraying were done @ 200-500 litre of water ha^{-1}, depending on the height of the crop. Control plot sprayed only water.

Observation on population density of the pests :

Jassid :

Observations on the pest activity were recorded in each plot of the replicates, a day preceding and 3 and 7 days following the foliar treatments in both the years. Jassid nymphs as well as adults population were observed from three leaves consisting of 2nd, 3rd and 4th each of the 10 randomly selected tagged plants in each of the replicates after Krishnaiah *et al*. (1979). Both the Jassid nymphs and adults were counted on lower surface of leaves in boarder area of plots in the early morning (7 AM to 9 AM), the time during which the Jassids were found inactive. The population of Jassids counts in all the replicates were taken together and average population per 30 leaves per 10 plants was worked out and transformed into square root, x + 0.5 value for analysis of variance.

Shoot and fruit borers :

All the plants in a plot were considered for recording shoot and fruit borer incidence. Harvesting of okra fruits was done at weekly interval. Observations on the pest incidence, viz., shoot damage (total number of shoots and damaged shoots) and fruit damage (total number and total weight of healthy and damaged fruits) were recorded on weekly basis and ultimately pooled together, separately for the respective parameters after tabulating replication wise at each observation to worked out mean value of the pest

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