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**Anurag Shivcharan Khandare**
Post Graduate Institute, M.Sc. (Agril. Entomology), Department of Agricultural Entomology, Agriculture Assistant, Vasantrao Naik Marathwada Krishi Vidyapeeth, DR. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, P.O, Akola, Maharashtra, India

**Anand Nagsen Warghat**
Ph.D. Scholar (Agril. Entomology), Department of Agricultural Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

**SM Thakare**
Assistant Professor, Department of Agricultural Entomology, Post Graduate Institute, DR. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, P.O, Akola, Maharashtra, India

**Corresponding Author:**
**Anurag Shivcharan Khandare**
Post Graduate Institute, M.Sc. (Agril. Entomology), Department of Agricultural Entomology, Agriculture Assistant, Vasantrao Naik Marathwada Krishi Vidyapeeth, DR. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, P.O, Akola, Maharashtra, India

# Evaluation economical vaibility of insecticides through stem smearing on sucking pests of cotton in relation to yield

**Anurag Shivcharan Khandare, Anand Nagsen Warghat and SM Thakare**

**Abstract**
The present investigation entitled "Evaluation Economical Vaibility of Insecticides through Stem Smearing on Sucking Pests of Cotton In Relation To Yield" was conducted during *kharif* season of 2014-15 at Experimental farm of Department of Agril. Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to evaluate the effects of stem smearing treatments on sucking pests (aphids, leafhoppers, thrips and whiteflies), natural enemies, yield and ICBR of cotton. Amongst the treatments tested, the treatments with imidacloprids 48 FS @ 1:5 recorded highest yield of seed cotton i.e. 134.13 kg/ha. Maximum reduction of population of leafhoppers and thrips was noticed in treatments of acephate 50 + imidacloprid 1.8 SP @ 1:5 and emerged as most effective recording higher net profit (1039.64 Rs./ha). The stem smearing with imidacloprid 48 FS @ 1:5 and acephate 50 + imidacloprid 1.8 SP @ 1:5 dilutions applied at 20 and 40 days after emergence proved better in recording higher avoidable losses i.e. 34.70 to 34.31 per cent.

**Keywords:** Sucking pests, effect, newer insecticides, cotton, stem smearing

## Introduction
Cotton is a commercial crop that plays an important role in strengthening economy of 82 countries across the world. Cotton contributes about 65 per cent of the total raw material needs of textile industry in India. Cotton and textile exports account for nearly one-third of total foreign exchange earnings of India & as insect pest problems in agriculture have shown a considerable shift during first decade of twenty-first century due to ecosystem and technological changes. The global losses due to insect pests have declined from 13.6 per cent in post-green revolution era to 10.8 per cent towards the beginning of this century. In India, The pest scenario in cotton ecosystem is changing fast and is assailed by multitude of pests as it evolves through various production levels. Adoption of BT cotton has not only changed the cultivation profile, but also the pest scenario. While there is a decline in the pest status of bollworms, the sap feeders, viz. aphids, leafhoppers, mirids and mealy bugs are emerging as serious pests (Vennila, 2008) [15, 16]. The insecticides are used most of the time as foliar applications, which provide effective control. However, foliar application has a varying range of adverse impacts on natural enemies and there is a dearth of information regarding the impacts it has on predaceous arthropods in cotton when applied through different methods. In addition to the foliar application, seed dressing (Gupta *et al*., 1998), soil application, drenching through roots (Cloyd and Bethke, 2010) or trunk injections (Tomizawa and Casida, 2003) were found effective against pests and reported to be safe to predators. Stem smearing is very useful in dry areas, where spraying of pesticides cannot be taken due to scarcity of water. It requires much less pesticides than spray application, there is appreciable reduction in pesticides load in the environment, ensuring better benefit for production and easy to carry out, compared to other methods of pesticide use.

## Materials and Methods
The problems of sucking pests after bollworm have become quite serious. At seedling stage the heavy infestation reduces the crop yield to great extent. However, indiscriminate use of insecticides resulted into elimination of natural enemies from cotton ecosystem. As such in order to evaluate the economic viability of insecticides through stem smearing against sucking pests, natural enemies and yield of cotton, a field experiment was conducted using variety

PKV-Rajat at the experimental field of Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *kharif* 2014-15.

**Materials**

The material required for conducting field experiment viz., cotton seed (variety PKV-Rajat), Fertilizers, insecticides viz., Imidacloprid 70 WS, Imidacloprid 48 FS, Acephate 50 +Imidacloprid 1.8 SP, Clothianidin 50 WDG, rope, tape, pegs, weighing balance etc. were supplied by the Department of Entomology, Dr.PDKV, Akola. The detailed information regarding insecticides, their common names, trade name, formulation and source of supply is given in Table 1.

**Table 1:** The details of insecticides

| Sr no | Common name | Formulation | Trade name | Chemical name | Source |
|---|---|---|---|---|---|
| 1 | Clothianidin | 50WDG | Dantotus | E-1-(2-chloro-1,3-thiazol-5-methyl)-3-methyl-2-nitroguanidine | M/S. Sumitomo chemical India pvt. ltd. Mumbai |
| 2 | Acephate + Imidacloprid | 50+1.8 SP | Lancergold | O, S-dimethyl acetylphosphoramidothioate+1-(6-chloro-3-pyridylmethyl) | M/S. United phosphorus ltd., Gujrat |
| 3 | Imidacloprid | 48 FS | Gauchu | 1-(6-chloro-3-pyridylmethyl) | M/S. Bayercrop science Ltd., Mumbai |
| 4 | imidacloprid | 70 WS | Imidapower | 1-(6-chloro-3-pyridylmethyl) | M/S. Canary agro chemical pvt. ltd Delhi |

**Details of experiment conducted-**

Year of experiment : 2014-15
Design of experiment : Randomized Block Design (RBD)
Number of replication : Three (3)
Number of treatments : Eleven (11)
Crop : Cotton
Variety : Non Bt (PKV-Rajat)
Spacing : 90 cm x 60 cm
Plot size : Gross Plot 7.2 m x 6.0 m
Net Plot 5.4 m x 4.8 m

Spacing between replication : 1.8 m
Spacing between treatments : 1.2 m
Fertilizer dose : 50:25:25 kg NPK/ha
12. Date of sowing : 26-07-2014
13. Date of emergence : 05-08-2014

**1.3 Treatment details**

$T_1$ : Clothianidin 50 WDG @ 1:5 (I:W) by Stem smearing at 20 and 40 days after germination(DAG)
$T_2$ : Clothianidin 50 WDG @ 1:10 (I: W) by Stem smearing at 20 and 40 days after germination (DAG).
$T_3$ : Clothianidin 50 WDG @ 1:20 (I:W) by Stem smearing at 20 and 40 days after germination(DAG)
$T_4$ : Acephate 50 + Imidacloprid 1.8 SP @ 1:5 (I: W) by Stem Smearing at 20 and 40 days after germination (DAG).
$T_5$ : Acephate 50 + Imidacloprid 1.8 SP @ 1:10 (I:W) by Stem Smearing at 20 and 40 days after germination(DAG)
$T_6$ : Acephate 50 + Imidacloprid 1.8 SP @ 1:20 (I: W) by Stem Smearing at 20 and 40 days after germination (DAG).
$T_7$ : Imidacloprid 48 FS @ 1:5 (I: W) by Stem smearing at 20 and 40 days after germination (DAG).
$T_8$ : Imidacloprid 48 FS @ 1:10 (I: W) by Stem smearing at 20 and 40 days after germination (DAG).
$T_9$ : Imidacloprid 48 FS @ 1:20 (I: W) by Stem smearing at 20 and 40 days after germination (DAG).
$T_{10}$ : Imidacloprid 70 WS @ 10 g/kg by seed treatment
$T_{11}$ : Untreated control

**Statistical analysis**

The data so obtained on the pests, natural enemies and yield was subjected to statistical analysis after suitable transformation as per the statistical guidelines given by Gomez and Gomez (1984).

**(a) Calculation of avoidable losses**

The avoidable loss due to pests was worked out using the following formulae given by (Pradhan, 1983).

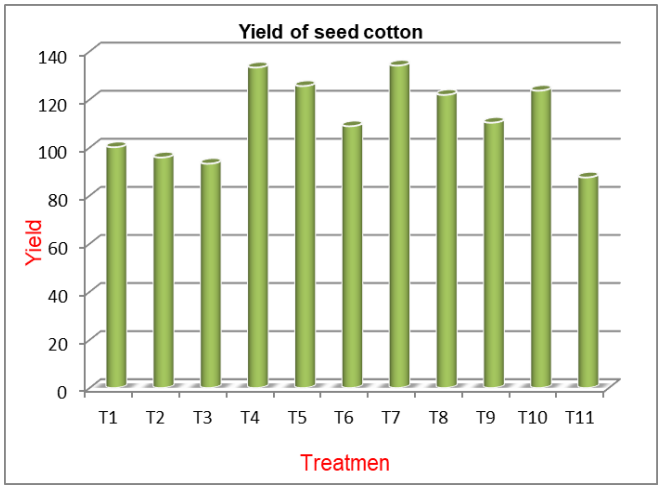
$$\text{Per cent avoidable loss in yield} = \frac{T - UT}{T} \times 100$$

Where,
T = Yield in treated plot.
UT = Yield in untreated plot.

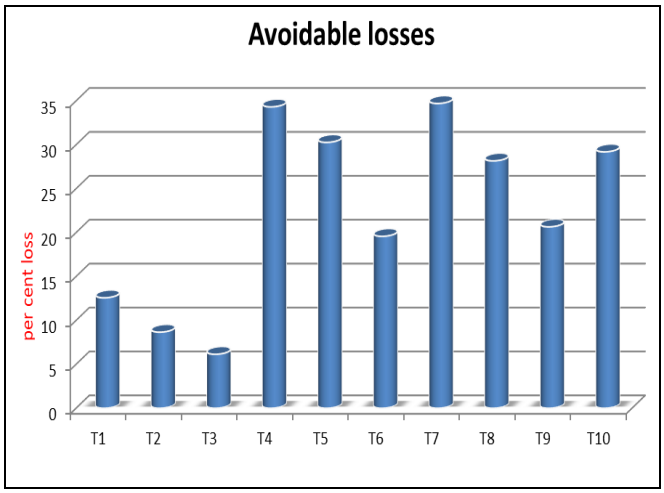
**Table 2:** Effects of treatments on yield of seed cotton

| Treatment | | Yield of seed cotton | | |
|---|---|---|---|---|
| | | g/plot | Kg/ha | Avoidable Loss (%) |
| $T_1$ | Clothianidin 50 % WDG @ 1:5 (I:W) by stem smearing | 259.65 | 100.17 | 12.57 |
| $T_2$ | Clothianidin 50 % WDG @ 1:10 (I:W) by stem smearing | 248.54 | 95.89 | 8.66 |
| $T_3$ | Clothianidin 50 % WDG @ 1:20 (I:W) by stem smearing | 241.86 | 93.31 | 6.14 |
| $T_4$ | Acephate 50 % + Imidacloprid 1.8 % SP @ 1:5 (I:W) by stem smearing | 345.59 | 133.33 | 34.31 |
| $T_5$ | Acephate 50 % + Imidacloprid 1.8 % SP @ 1:10 (I:W) by stem smearing | 325.58 | 125.61 | 30.27 |
| $T_6$ | Acephate 50 % + Imidacloprid 1.8 % SP @ 1:20 (I:W) by stem smearing | 282.25 | 108.89 | 19.57 |
| $T_7$ | Imidacloprid 48 % FS @ 1:5 (I:W) by stem smearing | 347.68 | 134.13 | 34.70 |
| $T_8$ | Imidacloprid 48 % FS @ 1:10 (I:W) by stem smearing | 316.02 | 121.92 | 28.16 |
| $T_9$ | Imidacloprid 48 % FS @ 1:20 (I:W) by stem smearing | 286.08 | 110.37 | 20.65 |
| $T_{10}$ | Imidacloprid 70 % WS @ 10 g/kg by seed treatment | 320.62 | 123.70 | 29.19 |
| $T_{11}$ | Untreated control | 227.02 | 87.58 | - |
| | ' F' test | | Sig. | |

| | | | | |
|---|---|---|---|---|
| | SE(m)± | | 7.18 | |
| | CD at (5 %) | | 21.18 | |
| | CV (%) | | 11.08 | |




1.



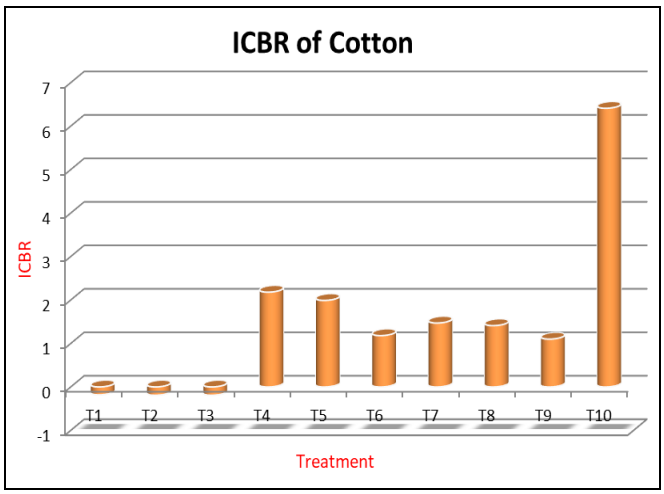

2.

**Fig 1, 2:** Effects of treatments on yield of seed cotton & avoidable losses

**Table 3:** Effects of treatments on ICBR and Net profit of cotton

| Treatments | Dose | Yield (kg/ha) | Increase in yield over control | Quantity of insecticides (ml/ha) or (g/ha) | Rate of insecticides | Cost of treatments per ha. | Price of increase in seed cotton | Net profit | incremental cost benefit ratio (ICBR) |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 01:05 | 100.17 | 12.59 | 168.36 | 2244.80 | 2964.80 | 528.68 | -2436.12 | 1: -0.18 |
| $T_2$ | 01:10 | 95.89 | 8.30 | 84.18 | 1122.40 | 1842.40 | 348.68 | -1493.72 | 1: -0.19 |
| $T_3$ | 01:20 | 93.31 | 5.73 | 42.09 | 561.20 | 1281.20 | 240.46 | -1040.74 | 1: -0.19 |
| $T_4$ | 01:05 | 133.33 | 45.74 | 168.36 | 161.63 | 881.63 | 1921.26 | 1039.64 | 1:2.18 |
| $T_5$ | 01:10 | 125.61 | 38.02 | 84.18 | 80.81 | 800.81 | 1597.03 | 796.22 | 1:1.99 |
| $T_6$ | 01:20 | 108.89 | 21.31 | 42.09 | 40.41 | 760.41 | 894.91 | 134.50 | 1:1.18 |
| $T_7$ | 01:05 | 134.13 | 46.55 | 168.36 | 606.10 | 1326.10 | 1955.11 | 629.01 | 1:1.47 |
| $T_8$ | 01:10 | 121.92 | 34.34 | 84.18 | 303.05 | 1023.05 | 1442.16 | 419.11 | 1:1.41 |
| $T_9$ | 01:20 | 110.37 | 22.79 | 42.09 | 151.52 | 871.52 | 957.03 | 85.50 | 1:1.10 |
| $T_{10}$ | 10 g/kg | 123.70 | 36.11 | 15 | 56.70 | 236.70 | 1516.71 | 1280.01 | 1:6.41 |
| $T_{11}$ | | 87.58 | | | | | | | |

Price of seed cotton Rs. 4200 per quintal
Cost of per treatments per ha= Cost of insecticides + application charges/ha
Application charges/ha= for stem smearing (4labour @ Rs.180/day)
Application charges/ha= for seed treatments (1 labour @ Rs.180/day)

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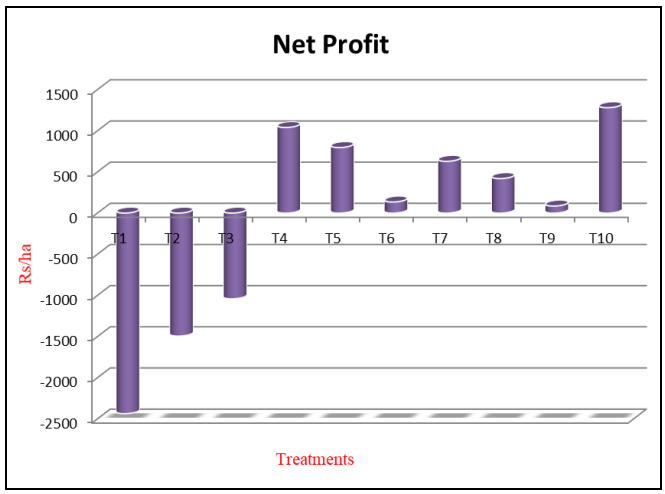


4.

**Fig 3, 4:** Effects of treatments on ICBR and net profit of cotton

## Results and Discussion

### Effects of treatment on ICBR and Net profit.

The data presented in Table 17 revealed that seed treatments of imidacloprid 70 WS 10 g/kg was recorded highest ICBR of 1:6.41 and emerged as a most economical, followed by treatment of acephate 50 + imidacloprid 1.8 SP @ 1:5 (1:2.18), acephate 50 + imidacloprid 1.8 SP @ 1:10 (1:1.99). Whereas the treatments with imidacloprid 48 FS @ 1:5 (1:1.47), imidacloprid 48 FS @ 1:10 (1:1.41), acephate 50 + imidacloprid 1.8 SP @ 1:20 (1:1.18) and imidacloprid 48 FS @ 1:20 (1:1.10). The treatment with clothianidin 50 WDG at 1:5 (1: -0.18), 1:10 (1: -0.19) and 1:20 (1: -0.19) recorded negative ICBR. However, regarding net profit the seed treatments of imidacloprid 70 WS @ 10 g/kg recorded highest net profit at 1280.08 Rs/ha. This was followed by treatments with, acephate 50 + imidacloprid 1.8 SP @ 1:5 (1039.64 Rs/ha), acephate 50 + imidacloprid 1.8 SP @ 1:10 (796.22 Rs/ha), imidacloprid 48 FS @ 1:5 (629.01 Rs/ha), imidacloprid 48 FS @ 1:10 (419.11 Rs/ha), acephate 50 + imidacloprid 1.8 SP @ 1:20 (134.50 Rs/ha) and imidacloprid 48 FS @ 1:20 (85.50 Rs/ha). The treatments with clothianidin were recording negative net profit due to pest load and higher cost of clothianidin. Similar finding also reported by Bharati Dhobale (2008) [4], Prasad *et al*. (2009a) they found that stem application of imidacloprid (200 SL) at 1:20 dilution and seed treatment with imidacloprid 70 WS @ 5 g/kg and 10 g/kg had realized higher seed cotton yield, ICBR and net profit with a low investment on insecticides by reduced number of insecticidal sprays.

Prasad *et al*. (2011) [3] found that the cost benefit ratio was favourable of IPM (1:1.55, 1:17.3 and 1:1.35 in in BG, BG II and NBt hybrids, respectively) module with low cost techniques like, stem treatments (imidacloprid @ 10 g/kg), stem application (imidacloprids @ 1:20) and spraying of botanical insecticides. Singh *et al*. (2011) [13] also reported that stem application and soil application of dimethoate or acephate at 30-40 DAS and 50-60 DAS for managements sucking pest give more gross income and net profit. Which conform present finding.

## Summary and Conclusion

The investigation were undertaken at, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *kharif* season of 2014-15 to study the effects of newer insecticides through stem smearing on sucking pests of cotton. The pest scenario in cotton ecosystem is changing fast and is assailed by multitude of pests as it evolves through various production levels. The stem smearing techniques are effective and economical hence the experiment was formulated with the objective to study their effects on sucking pests, natural enemies, yield and ICBR of cotton. The treatments were applied at 20 and 40 days after emergence and the observation were recorded on 5, 10, 15 and 20 days after each treatment.

### Effects of treatments on ICBR of cotton and Net profit.

The seed treatments of imidacloprid 70 WS 10 g/kg was recorded highest ICBR of 1:6.41 and emerged as a most economical, followed by treatment of acephate 50 + imidacloprid 1.8 SP @ 1:5 (1:2.18), acephate 50 + imidacloprid 1.8 SP @ 1:10 (1:1.99), imidacloprid 48 FS @ 1:5 (1:1.47), imidacloprid 48 FS @ 1:10 (1:1.41), acephate 50 + imidacloprid 1.8 SP @ 1:20 (1:1.18) and imidacloprid 48 FS @ 1:20 (1:1.10). The treatment with clothianidin 50 WDG at 1:5 (1: -0.18), 1:10 (1: -0.19) and 1:20 (1: -0.19) recorded negative ICBR. Regarding, net profit the seed treatments of imidacloprid 70 WS @ 10 g/kg recorded highest net profit at 1280.08 Rs/ha. This was followed by treatments with, acephate 50 + imidacloprid 1.8 SP @ 1:5 (1039.64 Rs/ha), acephate 50 + imidacloprid 1.8 SP @ 1:10 (796.22 Rs/ha), imidacloprid 48 FS @ 1:5 (629.01 Rs/ha), imidacloprid 48 FS @ 1:10 (419.11 Rs/ha), acephate 50 + imidacloprid 1.8 SP @ 1:20 (134.50 Rs/ha) and imidacloprid 48 FS @ 1:20 (85.50 Rs/ha). However stem smearing with clothianidin @ 1:5, 1:10 and 1:20 dilution recorded negative ICBR and net profit, because of its high cost.

## Conclusion

1. The treatments with imidacloprid 48 FS @ 1:5 and acephate 50 + imidacloprid 1.8 SP @ 1:5 recording higher avoidable losses i.e. 34.70 to 34.31 per cent.
2. On the basis of this study, it is advisable to use imidacloprid 48 FS @ 1:5 and acephate 50 + imidacloprid 1.8 SP @ 1:5 dilutions for managements of sucking pests on cotton and to get higher yield and ICBR by reducing the cost of plant protection.

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