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Efficacy of new molecules against mango flower webber under high density planting systems

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Abstract
Management of mango flower webber under high density planting system (HDPS) with newer molecules was conducted at the Regional Horticultural Research and Extension Centre, Dharwad, Karnataka during 2016-17. The results revealed that evaluation of new molecules against mango flower webber under HDPS revealed that two rounds of combination of profenophos 50 EC at 2.5 ml/l + azadirachtin 10000 ppm at 1.0 ml/l recorded lowest webber population (0.45 larvae /panicle), higher fruit yield (q /ha) and higher net returns Rs. 300555 with highest B: C ratio (5.26) as compared to the individual components and found to be economical in managing flower webber. Next best new molecules were flubendiamide, emamectin benzoate and lambda cyhalothrin. Generally, the combination of new molecules with azadirachtin could be deployed to combat the menace of flower webber more effectively in mango ecosystem.

Keywords: Mango flower webber, new molecules, azadirachtin, high density planting system

1. Introduction

The "King of fruits," mango (*Mangifera indica* L.) is one of the most important and delicious fruit crops grown throughout the tropical and subtropical regions of the world. Recently, area under high density is increasing so as to increase the production and productivity of mango. In the country, mango is grown over an area of 2262.77 thousand ha (35 % of total fruit-growing area) with an annual production of 19,687 thousand MT, which accounts for 60 per cent of the total world mango production with the productivity of 8.70 MT per hectare. In Karnataka, mango is cultivated in an area of 192.61 thousand hectares with an annual production of 1829.21 thousand MT and productivity of 9.49 MT per hectare during 2016-17[1]. Under high density planting system (HDPS), to realize the higher productivity, one has to optimize the parameter of growth and minimize unproductive components of plants without sacrificing the overall health of the tree and quality of fruits. High density orcharding enables planting of more number of trees per unit area as compared to the traditional system of planting. However, this intense orchard system may impact arthropod diversity because of change in microclimate *viz.*, increased humidity and low light intensity due to increase in tree canopy, thus favouring the multiplication and buildup of insect pests.

The major obstacles to enhance the productivity are biotic and abiotic stresses. Intensive orchard management practices like high density planting technique, dominance of few varieties, and change in cultural operations, climate volatility and injudicious use of insecticides had adversely impacted the diversity and abundance of arthropods in mango. Among the biotic factors, insect pests play an important role in the production and productivity of mango. Over 400 species of insect and mite pests are reported to feed on mango at various phenological stages in different mango growing parts of the world [2]. Mango flower webber, *Eublemma versicolor* Walker (Noctuidae: Lepidoptera) is an occasional pest throughout India. Its infestation starts from the month of December. High temperature and humidity prevailing during June-November are favourable. The caterpillar webs the flowers in the inflorescence and feeds inside the webbings by remaining in silken galleries. It also bores into the inflorescence stalk causing withering of the flowers and drying up of inflorescence. The skeletonization and drying of leaves is also noticed. The moth is purplish grey with oblique lines on the wings. It lays eggs singly on the pedicels and sepals of flower buds. The incubation period is 3-4 days. The full grown larva is smooth, greenish yellow with light brown head and a pro - thoracic shield measuring 20 mm in length. The larval period is 18-20 days. It pupates inside the inflorescence and emerges as adult in 8-9 days. The life cycle is completed in 29-33 days. Even though it is an occasional pest, in recent years it has become one of the major insect pest during flowering season in mango growing areas of Karnataka.

The pest status under HDPS of mango is different from conventional planting method which is largely relying on use of synthetic chemical insecticides. However, injudicious usage of insecticides has resulted in the development of resistance and resurgence in insect pests beside residue problem in the fruits. It is therefore, imperative to work out the insect pest diversity, spatial and temporal distribution under HDPS of mango and management of economically important pests to realize high yields and quality fruits. In view of changed pest scenario under HDPS, it is, therefore, essential to evaluate new molecules and also with combination of azadirachtin for the management of flower webber. Considering the economic position of mango in Indian agriculture, its increased area under HDPS and subsequent change in pest status, the investigation was undertaken on **"**Efficacy of new molecules against mango flower webber under high density planting systems".

2. Materials and methods

Management practices comprising of new molecules was conducted at RHREC, Dharwad. The experiments were laid out in Randomized Block Design (RBD) with three replications. The mango orchards under the study were nine year old with variety, Alphonso under high density planting system of 5×5 m spacing. The treatment detail for insecticides experiment was described in Table 1 which included ten treatments and three replications. Totally 90 trees (10×3×3) were required for the experiment. The first spray was imposed when considerable incidence was noticed during flowering period and second spray was imposed 15 days after first spray.

2.1 Observation

While recording the observations on flower webbings, five inflorescences with infested flower webber were selected randomly from each tree to record pre-count. Similarly, post count observations were recorded by selecting five new inflorescence infested with flower webber at every observation following destructive sampling to know the presence of caterpillars inside the webs at one, seven and 14 days after imposing the treatments (Table-1).

Table 1: Treatments details for evaluating new molecules against mango flower webber under HDPS

Treatments		Dose	
		(ml or g/l)	(g a.i/ha)
T_1	Lambda cyhalothrin 5 EC	0.5 ml/l	25
T_2	Profenophos 50 EC	2.5 ml/l	1250
T_3	Flubendiamide 480 SC	0.2 ml/l	960
T_4	Emamectin benzoate 5 SG	0.2 g/l	10
T_5	T_1 + Azadirachtin 10000 ppm	0.5 ml + 1.0 ml/l	25+10
T_6	T_2 + Azadirachtin 10000 ppm	2.5 ml/l + 1.0 ml/l	1250+10
T_7	T_3 + Azadirachtin 10000 ppm	0.2 ml/l + 1.0 ml/l	960+10
T_8	T_4 + Azadirachtin 10000 ppm	0.2 g/l + 1.0 ml/l	10+10
T_9	Azadirachtin 10000 ppm	1.0 ml/l	10
T_{10}	Untreated check	------	-----

2.2 Yield and cost economics: The treatment wise fruit yield per tree was recorded and computed to quintal per hectare basis. Further, cost economics was on total yield in quintal per hectare, cost of insecticide, other cost of cultivation and gross return based on market price at Rs. 40 per kg. The following formulae were used for calculation of B:C ratio.

i. Gross return = Yield x Market price of mango (Rs. 40/kg)
ii. Net Returns = Gross Return - Total Cost
iii. B: C ratio = Gross Return / Total Cost

3. Results and Discussion

The pre-treatment count of flower webber population was uniform across the various treatments and it gradually increased during the course of experiment as revealed from the larval population in the untreated check during the first season (2016-17). The mean larval population per five panicles before imposition of treatments varied from 2.20 to 2.53 which were on par with each other. The data of one day after spray showed that there is no significant variation among the treatments statistically but they were numerically differed from each other with larval population ranged from 1.60 to 2.27 larvae per five panicles. After 14 days of post treatment, maximum reduction of larval population was observed with lambda cyhalothrin 5 EC at 0.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (1.47 larvae /5 panicles), profenophos 50 EC at 2.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (1.33 larvae /5 panicles), flubendiamide at 0.2 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (1.07 larvae /5 panicles) and emamectin benzoate 5 SG at 0.2 g/l + azadirachtin 10000 ppm at 1.0 ml per litre (1.40 larvae /5 panicles) which were on par with each other. Among the individual components lambda cyhalothrin 5 EC at 0.5 ml per litre (1.60 larvae /5 panicle), emamectin benzoate 5 SG at 0.2 g/l (1.67 larvae/5 panicle), profenophos 50 EC at 2.5 ml per litre (1.87 larvae/5 panicle) minimized the larval population significantly as compared to untreated check (2.47 larvae/5 panicle), nevertheless, they were significantly inferior when applied in combination with azadirachtin (10000 ppm) in suppressing the larval population at 14 days after first spraying. Fourteen days after second spray, least larval population was recorded in treatment combinations, *viz.*, lambda cyhalothrin 5 EC at 0.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (0.60 larvae /5 panicles), profenophos 50 EC at 2.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (0.53 larvae /5 panicles), flubendiamide at 0.2 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (0.40 larvae /5 panicles) and emamectin benzoate 5 SG at 0.2 g/l + azadirachtin 10000 ppm at 1.0 ml per litre (0.47 larvae /5 panicles) which were on par with each other (Table 2).

Results of second year (Table 3) and pooled data (Table 4) divulged the same trend as observed during the first year of experimentation. Results revealed that, there was significant reduction in larval population to an extent to 0.27 to 0.45 larvae per five panicle with flubendiamide at 0.2 ml per litre + azadirachtin 10000 ppm at 1.0 ml/l, profenophos 50 EC at 2.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml/l, lambda cyhalothrin 5 EC at 0.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre and emamectin benzoate 5 SG at 0.2 g/l + azadirachtin 10000 ppm at 1.0 ml per litre even on seven and 14 days after second spray as compared to individual components. The next best treatments were flubendiamide 480 SC at 0.2 ml per litre followed by emamectin benzoate 5 SG at 0.2 g/l. The other molecules such as lambda cyhalothrin 5 EC at 0.5 ml per litre, profenophos 50 EC at 2.5 ml per litre and azadirachtin 10000 ppm at 1.0 ml per litre were moderate in their effective in reducing the population (Table 4). The results suggested that combination of new molecules with azadirachtin could be deployed to combat the menace of flower webber more effectively in mango ecosystem.

The superiority of present findings of insecticides used along with azadirachtin may be attributed to cessation of larval feeding due to antifeedant activity of azadirachtin and thereby larvae become weak due to starvation and thus easily vulnerable to insecticides. Further, azadirachtin acted as a precursor to increase the effectiveness and persistence of new molecules against flower webbers. Hence, new molecules and azadirachtin combination would be deployed to combat the menace of flower webber more effectively in mango ecosystem.

Since the literature pertaining to the combination of biopesticides and insecticides are lacking against the flower webber, hence, the efficacy of combinations of insecticides and biopesticides on other lepidopteran insects are discussed here. The mortality of *Helicoverpa armigera* on cotton was found to be enhanced when neem oil was combined with endosulfan and phosalone than that of sole application of insecticides [3]. Similarly, the efficacy of Neem oil (4 %), NSKE (5 %) and their combination with endosulfan (0.07%) in reducing the brinjal fruit borer, *Leucinodes orbonalis.* [4]. Chlorpyriphos @ 0.05% + neemazal was effective in reducing the larval population of *Maruca vitrta* on black gram even with chlorpyriphos at half of their original dose had moderate efficacy against *M. vitrata* [5]. NSKE (4 %) + cypermethrin (0.5 ml/l) combination recorded minimum leaf damage and found to be best combination to manage *Phyllocnistis citrella* Stainton in citrus [6]. Similarly, efficacy was noticed by [7] that NSKE (5%) along with DDVP (0.5 ml/l) against spotted pod borer registered highest yield and cost benefit ratio. The synergistic activity of neem oil formulation with endosulfan against *Spodoptera litura* and observed that combined treatment of the two significantly inhibited the Esterase-S-Transferase activity of the insect pest [8].

In the present study, flubendiamide a green labelled insecticide is reported to have extremely strong insecticidal activity against lepidopterans. The novel biochemical mode of action of flubendiamide exhibited excellent Larvicidal activity as an orally ingested toxicant by targeting and disrupting the Ca_2 + balance. This resulted in rapid cessation of feeding and extended residual control, providing superior plant protection against a broad-range of economically important lepidopteran pests.

3.1 Fruit yield (q/ha) and cost economics of various new molecules in the management of mango flower webber

The pooled data clearly indicated that highest fruit yield was registered in combination of new molecules with azadirachtin *viz.*, profenophos 50 EC at 2.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre recorded highest fruit yield (92.76 q /ha) which was followed by lambda cyhalothrin 5 EC at 0.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre (89.62 q/ha), emamectin benzoate 5 SG at 0.2 g/l + azadirachtin 10000 ppm at 1.0 ml per litre (87.13 q/ha) and flubendiamide 480 SC at 0.2 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre at 0.2 ml per litre + 1.0 ml per litre (86.38 q/ha) which were on par with each other, indicating these were equally effective in recording higher yield as compared to individual treatment applications. Cost economics indicated that among the different treatments, profenophos 50 EC + azadirachtin 10000 ppm registered the maximum net returns (Rs. 300555/ha) with highest B:C ratio (5.26) as compared to other treatments. Similarly, lambda cyhalothrin 5 EC at 0.5 ml per litre + azadirachtin 10000 ppm at 1.0 ml per litre exhibited net returns (Rs. 289230/ha) with B: C ratio (5.18) and suggesting these two combinations were more cost effective and feasible (Table 5).

Table 2: Evaluation of new molecules against mango flower webber under HDPS during first year (2016-17)

Treatments		Dosage (g or ml/l)	Larval population per five panicle						
			First spray				Second spray		
			1 DBS	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS
T_1	Lambda cyhalothrin 5 EC	0.5 ml/l	2.40 (1.70)^{a}	2.13 (1.62)^{cd}	1.93 (1.56)^{bc}	1.60 (1.45)^{b}	1.53 (1.42)^{bc}	1.33 (1.35)^{c}	1.13(1.28)^{c}
T_2	Profenophos 50 EC	2.5 ml/l	2.33 (1.68)^{a}	2.27 (1.66)^{d}	2.07 (1.60)^{bc}	1.87 (1.54)^{b}	1.73 (1.49)^{c}	1.53 (1.42)^{c}	1.27 (1.33)^{c}
T_3	Flubendiamide 480 SC	0.2 ml/l	2.53 (1.74)^{a}	1.80(1.51)^{abc}	1.67 (1.46)^{ab}	1.53 (1.42)^{ab}	1.40 (1.37)^{abc}	1.20(1.29)^{bc}	0.93 (1.20)^{bc}
T_4	Emamectin benzoate 5 SG	0.2 g/l	2.47 (1.72)^{a}	1.93 (1.56)$^{a-d}$	1.73 (1.49)^{bc}	1.67 (1.47)^{b}	1.47 (1.40)^{bc}	1.27 (1.32)^{c}	1.00 (1.22)^{c}
T_5	T_1+ Azadirachtin 10000 ppm	0.5 ml + 1.0 ml/l	2.27 (1.66)^{a}	1.73 (1.49)^{abc}	1.67 (1.47)^{ab}	1.47 (1.40)^{ab}	1.33 (1.35)^{abc}	0.80(1.13)^{ab}	0.60 (1.03)^{ab}
T_6	T_2+ Azadirachtin 10000 ppm	2.5 ml/l + 1.0 ml/l	2.20 (1.64)^{a}	1.67 (1.47)^{ab}	1.53 (1.43)^{ab}	1.33 (1.35)^{ab}	1.13 (1.27)^{ab}	0.73(1.11)^{ab}	0.53 (1.02)^{a}
T_7	T_3+ Azadirachtin 10000 ppm	0.2 ml/l + 1.0 ml/l	2.40 (1.70)^{a}	1.60 (1.45)^{a}	1.33 (1.35)^{a}	1.07 (1.25)^{a}	0.93 (1.20)^{a}	0.67(1.08)^{a}	0.40 (0.94)^{a}
T_8	T_4+ Azadirachtin 10000 ppm	0.2 g/l +1.0 ml/l	2.53 (1.74)^{a}	1.80 (1.51)^{abc}	1.53 (1.42)^{ab}	1.40 (1.38)^{ab}	1.27 (1.33)^{abc}	0.77(1.13)^{ab}	0.47 (0.98)^{a}
T_9	Azadirachtin 10000 ppm	1.0 ml/l	2.20 (1.64)^{a}	2.07 (1.60)^{bcd}	1.87 (1.54)^{abc}	1.80 (1.52)^{b}	1.60 (1.45)^{bc}	1.40 (1.37)^{c}	1.33 (1.35)^{c}
T_{10}	Untreated check	-----	2.27 (1.66)^{a}	2.27 (1.66)^{d}	2.33 (1.68)^{c}	2.47 (1.72)^{c}	2.60 (1.76)^{d}	2.67 (1.78)^{d}	2.73 (1.80)^{d}
S. Em ±			0.03	0.05	0.05	0.04	0.06	0.06	0.05
C. D. at 5 %			NS	0.14	0.15	0.13	0.18	0.19	0.16

DBS - Day before spray DAS - Day after spray HDPS-High density planting system (5 × 5 m) Figures in the parentheses are $\sqrt{x+0.5}$ transformed values In a column, means followed by same alphabet(s) do not differ significantly by DMRT (P=0.05)

Table 3: Evaluation of new molecules against mango flower webber under HDPS during second year (2017-18)

	Treatments	Dosage (g or ml/l)	Larval population per five panicle						
			First spray				Second spray		
			1 DBS	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS
T_1	Lambda cyhalothrin 5 EC	0.5 ml/l	1.87(1.54)^{a}	1.80 (1.51)^{abc}	1.60 (1.45)^{cd}	1.47 (1.39)^{b}	1.27 (1.33)^{b}	1.00 (1.22)^{b}	0.73 (1.11)^{cd}
T_2	Profenophos 50 EC	2.5 ml/l	1.87 (1.54)^{a}	1.87 (1.54)^{bc}	1.67 (1.47)^{cd}	1.53 (1.42)^{b}	1.33 (1.35)^{b}	1.07 (1.25)^{b}	0.93 (1.19)^{d}
T_3	Flubendiamide 480 SC	0.2 ml/l	2.00 (1.58)^{a}	1.67 (1.47)^{abc}	1.47 (1.40)^{bcd}	1.40 (1.38)^{b}	1.00 (1.22)^{b}	0.67 (1.08)^{b}	0.40 (0.93)^{abc}
T_4	Emamectin benzoate 5 SG	0.2 g/l	1.87(1.54)^{a}	1.73 (1.49)^{abc}	1.53 (1.42)^{bcd}	1.47 (1.40)^{b}	1.13 (1.28)^{b}	0.80 (1.14)^{b}	0.53 (1.01)^{bc}
T_5	T_1+ Azadirachtin 10000ppm	0.5 ml + 1.0 ml/l	1.80(1.52)^{a}	1.60 (1.44)^{abc}	1.40 (1.38)$^{a-d}$	1.33 (1.35)^{ab}	1.00 (1.22)^{b}	0.67 (1.08)^{b}	0.42 (0.95)^{abc}
T_6	T_2+ Azadirachtin 10000 ppm	2.5 ml/l + 1.0 ml/l	1.53(1.42)^{a}	1.40 (1.38)^{ab}	1.20 (1.30)^{ab}	1.20 (1.30)^{ab}	0.93 (1.20)^{b}	0.67 (1.08)b	0.37 (0.93)^{abc}
T_7	T_3+ Azadirachtin 10000 ppm	0.2 ml/l + 1.0 ml/l	1.73(1.49)^{a}	1.27 (1.33)^{a}	1.13 (1.27)^{a}	0.93 (1.19)^{a}	0.40 (0.94)^{a}	0.20 (0.83)^{a}	0.13 (0.79)^{a}
T_8	T_4+ Azadirachtin 10000 ppm	0.2 g/l + 1.0 ml/l	1.93(1.56)^{a}	1.40 (1.38)^{ab}	1.33 (1.35)^{abc}	1.27 (1.33)^{ab}	1.07 (1.25)^{b}	0.73 (1.10)^{b}	0.23 (0.86)^{ab}
T_9	Azadirachtin 10000 ppm	1.0 ml/l	1.73(1.49)^{a}	1.80 (1.52)^{abc}	1.73 (1.49)^{de}	1.60 (1.45)^{b}	1.33 (1.35)^{b}	1.07 (1.25)^{b}	1.00 (1.22)^{d}
T_{10}	Untreated check	-----	1.67(1.47)^{a}	2.00 (1.58)^{c}	2.13 (1.62)^{e}	2.20 (1.64)^{c}	2.33 (1.68)^{c}	2.40 (1.70)^{c}	2.40 (1.70)^{e}
S. Em ±			0.04	0.05	0.04	0.06	0.05	0.05	0.06
C. D. at 5 %			NS	0.15	0.13	0.18	0.15	0.16	0.18

DBS - Day before spray DAS - Day after spray HDPS-High Density Planting System (5 × 5 m) Figures in the parentheses are √x+0.5 transformed values In a column, means followed by same alphabet(s) do not differ significantly by DMRT (P=0.05)

Table 4: Evaluation of new molecules against mango flower webber under HDPS (Pooled data)

	Treatments	Dosage (g or ml/l)	Larval population per five panicle						
			First spray				Second spray		
			1 DBS	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS
T_1	Lambda cyhalothrin 5 EC	0.5 ml/l	2.13(1.62)^{a}	1.97(1.57)^{bc}	1.77(1.50)^{abc}	1.53 (1.42)^{b}	1.40(1.38)^{cd}	1.17(1.29)^{cd}	0.93(1.19)^{de}
T_2	Profenophos 50 EC	2.5 ml/l	2.10(1.61)^{a}	2.07(1.60)^{c}	1.87(1.54)^{bc}	1.70 (1.48)^{b}	1.53(1.43)^{d}	1.30(1.34)^{d}	1.10(1.25)^{de}
T_3	Flubendiamide 480 SC	0.2 ml/l	2.27(1.66)^{a}	1.73(1.49)^{bc}	1.57(1.44)^{ab}	1.47 (1.40)^{b}	1.20(1.30)^{bcd}	0.93(1.20)^{bcd}	0.67(1.08)^{bcd}
T_4	Emamectin benzoate 5 SG	0.2 g/l	2.17(1.63)^{a}	1.83(1.53)^{bc}	1.63(1.46)^{ab}	1.57 (1.44)^{b}	1.30(1.34)^{bcd}	1.03(1.23)^{bcd}	0.77(1.12)^{cde}
T_5	T_1+ Azadirachtin 10000 ppm	0.5 ml + 1.0 ml/l	2.03(1.59)^{a}	1.67(1.47)^{bc}	1.53(1.43)^{ab}	1.40 (1.38)^{b}	1.17(1.29)^{abc}	0.73(1.11)^{abc}	0.51(1.00)^{abc}
T_6	T_2+ Azadirachtin 10000 ppm	2.5 ml/l + 1.0 ml/l	1.87(1.54)^{a}	1.531.43)^{bc}	1.371.37)^{ab}	1.27 (1.33)^{ab}	1.03(1.24)^{ab}	0.70(1.09)^{ab}	0.45(0.97)^{abc}
T_7	T_3+ Azadirachtin 10000 ppm	0.2 ml/l + 1.0 ml/l	2.07(1.60)^{a}	1.43(1.39)^{b}	1.23(1.31)^{a}	1.00 (1.21)^{a}	0.67(1.08)^{a}	0.43(0.96)^{a}	0.27(0.88)^{a}
T_8	T_4+ Azadirachtin 10000 ppm	0.2 g/l + 1.0 ml/l	2.23(1.65)^{a}	1.60(1.45)^{a}	1.43(1.39)^{ab}	1.33 (1.35)^{b}	1.17(1.29)^{abc}	0.75(1.12)^{abc}	0.35(0.92)^{ab}
T_9	Azadirachtin 10000 ppm	1.0 ml/l	1.97(1.57)^{a}	1.93(1.56)^{bc}	1.80(1.52)^{bc}	1.70 (1.48)^{b}	1.47(1.40)^{d}	1.23(1.31)^{d}	1.17(1.29)^{e}
T_{10}	Untreated check	------	1.97(1.57)^{a}	2.13(1.62)^{c}	2.23(1.65)^{c}	2.33 (1.68)^{c}	2.47(1.72)^{e}	2.53(1.74)^{e}	2.57(1.75)^{f}
S. Em ±			0.03	0.04	0.04	0.05	0.04	0.05	0.03
C. D. at 5%			NS	0.11	0.12	0.15	0.12	0.15	0.09

DBS - Day before spray DAS - Day after spray HDPS-High Density Planting System (5 × 5 m) Figures in the parentheses are √x+0.5 transformed values In a column, means followed by same alphabet(s) do not differ significantly by DMRT (P=0.05)

Table 5: Yield and Cost economics of various new molecules in the management of mango flower webber under HDPS

	Treatments	Dosage (g or ml/l)	Yield (q/ha)			Cost of insecticides (Rs/ha)	Other production cost (Rs/ha)	Total cost (Rs/ha)	Gross returns* (Rs/ha)	Net returns (Rs/ha)	B:C ratio
			2016-17	2017-18	Pooled						
T_1	Lambda cyhalothrin 5 EC	0.5 ml/l	83.29^{c-f}	77.62^{bc}	80.45^{cde}	810	67000	67810	321813	254003	4.75
T_2	Profenophos 50 EC	2.5 ml/l	86.29^{b-e}	79.29^{bc}	82.79^{bcd}	2032	67000	69032	331160	262128	4.80
T_3	Flubendiamide 480 SC	0.2 ml/l	82.29^{def}	73.62^{cd}	77.96^{def}	4200	67000	71200	311826	240627	4.38
T_4	Emamectin benzoate 5 SG	0.2 g/l	79.44^{ef}	74.91^{cd}	77.18^{ef}	1600	67000	68600	308700	240100	4.50
T_5	T_1+ Azadirachtin 10000 ppm	0.5 ml + 1.0 ml/l	91.38^{bcd}	87.86^{b}	89.62^{bc}	2250	67000	69250	358480	289230	5.18
T_6	T_2+ Azadirachtin 10000 ppm	2.5 ml/l + 1.0 ml/l	95.49^{a}	90.03^{a}	92.76^{a}	3472	67000	70472	371026	300555	5.26
T_7	T_3+ Azadirachtin 10000 ppm	0.2 ml/l + 1.0 ml/l	90.29^{abc}	82.46^{b}	86.38^{b}	5640	67000	72640	345513	272873	4.76
T_8	T_4+ Azadirachtin 10000 ppm	0.2 g/l + 1.0 ml/l	91.89^{ab}	82.36^{b}	87.13^{b}	3040	67000	70040	348506	278467	4.98
T_9	Azadirachtin 10000 ppm	1.0 ml/l	79.55^{ef}	73.25^{cd}	75.75^{ef}	1440	67000	68440	303013	234573	4.43
T_{10}	Untreated check	------	78.26^{f}	69.22^{d}	74.39^{f}	0	**66000	66000	297546	230547	4.44
	S. Em ±		2.20	2.36	1.75		--	--	--	--	--
	C. D. at 5%		6.51	7.03	5.54		--	--	--	--	--

HDPS-High Density Planting System (5 × 5 m) *Market value of mango = Rs 40/kg ** Spraying cost of Rs 1000 excluded

4. References

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