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Evaluation of IPM module for management of giant African snail, *Achatina fulica* (Bowdich) in grape vine

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ABSTRACT

Field experiment was conducted by the Agricultural Research Station, Niphad on farmer's field at Songaon, Tal. Niphad Dist. Nasik (M.S.) during *Kharif* 2008-09, 2009-10 and 2011-12 to assess the performance of IPM module against snails in grape vineyard in comparison to non IPM (farmer's practice). Result revealed that the IPM module comprising of various components *viz*., Clean cultivation *i.e.* cleaning and burning of waste pruned material, Removal of weeds from bunds and make it clean, Eliminate, all places where snails can hide, Collection and destruction of snails before sunrise and after sunset in solution of 5% copper sulphate or lime solution, Collection and destruction of eggs laid by snails in field/garden near the root zone of the grape vine, Use of different traps as dry grass or waste material of vegetables heap or wetted gunny bags or old PVC pipe of 6 inch length at 20 to 25' distance in field/garden during evening hrs., Use of poison bait of Methomyl 40 SP : Wheat or rice bran or straw 50 kg + 2 per cent jaggery solution +25 g yeast + 50 g Methomyl 40 SP /ha. (Soaking wheat straw in water and 2 per cent jaggery solution and 25g yeast and at the time of application mix 50g methomyl 40SP. Application of this mixture in field/garden at various locations and near the bund by spreading during 15 days interval at 5 time or need based), Application of 5 per cent Metaldehyde @5 kg/ha at two times at 15 to 20 days interval as need based application in field/garden at the time of evening, Application of tobacco dust around the field *i.e.* 5 feet from bund as 5cm wide band in field/garden and also between two rows @ 50kg/ha at 3 times of 20 days interval afford excellent control of snails with higher yield (18.63 t/ha), monetary benefit (Rs. 327267/ha), net income (Rs. 230257/ha) and B:C ratio (3.36).

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INTRODUCTION

The giant African snail, *Achatina fulica* Bowdich is one of the most extensively studied snails in the world (Mead, 1961). It belongs to the phylum-Mollusca, class-Gastropoda, subclass- Pulmonata, and order-

Stylommatophora, family- Achatinidae. These land snails are plentiful in the high rainfall areas of tropical countries. *A. fulica* is major crop pest species that originated in East Africa but has been spreading across the globe (Raut and Barker, 2002). *A. fulica* was reported for first time causing damage to ornamental and vegetable crops in Bangalore during *Kharif* season 1979 (Veeresh *et al*., 1979) and this snail was supposed to have been brought along with plant material from various part of India. *A. fulica* has been established in almost all states of India and there causing a serious threat to agriculture. Moreover, the extent of damage caused by *A. fulica* generally depends on size of the snail and age of the plants which makes it very difficult to estimate the damage of *A. fulica.* Sridhar *et al*. (2012) studied the extent of damage caused by *A. fulica* in six different crops and found that the extent of damage was highest in mulberry leaves *i.e.,* 100 per cent followed by groundnut (40-50%) and papaya (40%) and the cucumber was the least preferred host (20%). The heavy incidence of snail was recorded during September- October. Giraddi *et al*. (1996) reported 30.6 and 25.4 per cent damage to chilli and okra seedling, respectively. Reddy and Puttaswamy (1984) recorded it as an occasional pest of chilli seedling in the nursery.

There are several examples of successful implementation of IPM various vegetable and field crops. Several researchers have attempted to develop suitable IPM modules for snails and slugs in vegetable, so far available information in this regard is meagre. The snails as a destructive potential of this pest on grape vine was recorded heavily in various parts of Nasik district. Hence, considering the economic importance of this serious pest the present study was undertaken to evaluate the specific IPM module in comparison to non IPM (farmer's practice) for the control of snails in grapevine.

MATERIAL AND METHODS

Field experiments were conducted by the Agricultural Research Station, Niphad on farmer's field at Songaon Tal: Niphad Dist: Nashik during *Kharif* 2008-09, 2009-10 and 2011-12 evaluate IPM module against snails in grape vine *var.* Thompson seedless in comparison to the non-IPM module as a farmers practice. The experiment was taken up on 0.40ha block divided into two halves, one half receiving IPM technology and other half was non IPM. Various recommended agronomic practices were followed. The details of IPM module and non IPM (farmer's practice) are furnished below.

Treatment details: **IPM module :**

– Clean cultivation *i.e.* cleaning and burning of waste pruned material.

– Removal of weeds from bunds and make it clean.

– Eliminate, all places where snails can hide.

– Collection and destruction of snails before sunrise and after sunset (5% copper sulphate or lime solution).

– Collection and destruction of eggs laid by snails in field/vine yard near the root zone of the grape vine.

– Use of different traps as dry grass or waste material of vegetables heap or wetted gunny bags or old PVC pipe of 6 inch length at 20 to 25' distance in field/ vine yard during evening hrs.

– Use of poison bait of Methomyl 40 SP : Wheat or rice bran or straw 50 kg + 2 per cent jaggery solution +25 g yeast + 50 g Methomyl 40 SP /ha (Soaking wheat straw in water and 2 per cent jaggery solution and 25g yeast and at the time of application mix 50g methomyl 40SP. Application of this mixture in field/vine yard at various locations and near the bund by spreading during 15 days interval at 5 time or need based)

– Application of 5 per cent Metaldehyde @5 kg/ ha at two times at 15 to 20 days interval as need based application in field/vine yard at the time of evening.

– Application of tobacco dust around the field *i.e.* 5 feet from bund as 5cm wide band in field/garden and also between two rows @ 50kg/ha at 3 times of 20 days interval.

Non IPM (Farmers Practice) :

– Application of 5 per cent Metaldehyde @5 kg/ ha (3-4 times)

Observations on pest incidence and population of number of babies and adult snails were recorded as pre count on randomly selected locations of 0.36 m^2 area in IPM as well as on-IPM (farmer's practice) plot. The yield data was also recorded from each plot and converted into t/ha. The experimental data were subjected to statistical analysis.

RESULTS AND DISCUSSION

The pooled data for consecutive three years (2008-09, 2009-10 and 2011-12) presented in Table 1, revealed

that in IPM module recorded significantly least number of babies and adult snails/0.36m^2 were 3.4, 2.6, 0.40, 0.80, 0.53, 0.27 and 0.0 at 10, 20, 30, 40, 50, 60 and 70 days, respectively. The pre count population of babies and adult snail/0.36m^2 in IPM plot and non IPM plot were 18.77 and 16.97. The highest (81.89%) reduction of snail population over farmer's practice (21.80%) was recorded in IPM module at 10 days after pre count. Significantly maximum population of snails/0.36m^2 (13.27, 19.93, 11.03, 11.67 12.13, 6.70 and 0.80) were recorded in non IPM plot (farmer's practice) at 10, 20, 30, 40, 50, 60 and 70 days after pre count. Similar trend of reduction of snail population was observed at remaining intervals. The effectiveness of the IPM module was also reflected on bunch yield of grape vine. The IPM plot recorded higher bunch yield (18.63 t/ha) as compared to non IPM (farmer's practice 17.23 t/ha). The per cent increased in yield over control in IPM plot was 8.13 per cent. Similar trends of results for population of snails and yield for consecutive three years were recorded.

The pooled data regarding monetary returns presented Table 2 revealed that the highest gross monetary returns, net income, B:C ratio and ICBR was Rs.3,27,267/ha, Rs.2,30,257/ha, 3.36 and 5.16, respectively were observed in IPM garden.

Data presented in Table 1 indicated that the IPM plot recorded significantly lower incidence of snails as compared to non IPM (farmer's practice). In the present findings of poison bait of methomyl 40 SP *i.e.* wheat or rice bran or straw 50 kg + 2 per cent jaggery solution +25 g yeast + 50 g methomyl 40 SP /ha was found most effective for attractant action and toxicity for snails.

Table 1 : Effect of treatments of IPM modules on population of snails and yield

Sr. No.	Days (after precount)	Treatments	Av. No. of babies and adult snails/ 0.36m^2 Year			Pooled Mean	% reduction of snails population over pre count
			2008-09	2009-10	2011-12		
1.	Pre count	IPM	19.20	16.50	20.60	18.77	0.0
		Non IPM	16.80	15.30	18.80	16.97	0.0
		t value	0.45	0.13	1.64	0.83	
2.	10	IPM	1.80	5.00	3.40	3.40	81.89
		Non IPM	11.60	12.40	15.80	13.27	21.80
		t value	4.76	9.63	11.49	8.98	
3.	20	IPM	6.00	1.00	0.80	2.60	86.15
		Non IPM	16.20	22.40	21.20	19.93	0.0
		t value	5.58	5.79	20.60	10.90	
4.	30	IPM	1.20	0.00	0.00	0.40	97.87
		Non IPM	13.00	8.50	11.60	11.03	35.00
		t value	24.08	16.86	12.50	18.20	
5.	40	IPM	1.00	0.00	1.40	0.80	95.73
		Non IPM	8.00	14.20	12.80	11.67	31.23
		t value	9.03	37.95	16.12	21.60	
6.	50	IPM	1.60	0.00	0.00	0.53	97.18
		Non IPM	12.00	12.60	11.80	12.13	4.84
		t value	6.87	10.42	13.71	10.60	
7.	60	IPM	0.80	0.00	0.00	0.27	98.56
		Non IPM	8.20	6.80	5.60	6.70	60.52
		t value	14.00	19.25	7.48	13.80	
8.	70	IPM	0.00	0.00	0.00	0.00	100.00
		Non IPM	1.60	0.80	0.00	0.80	95.28
		t value	3.13	1.00	-	1.10	
	Yield t/ha	IPM	19.80	18.60	17.50	18.63	8.13 (% increase over FP)
		Non IPM	18.40	17.10	16.20	17.23	-
		t value	5.91	7.07	8.20	7.40	-

IPM = Integrated Pest Management Non IPM = Farmers Practice

Table 2 : Economics of the different treatments

Sr. No.	Details	Treatments	Year			Pooled mean
			2008-09	2009-10	2011-12	
1.	Yield t/ha	IPM	19.80	18.60	17.50	18.63
		Non IPM	18.40	17.10	16.20	17.23
2.	Additional yield over FP (t/ha)	IPM	1.40	1.50	1.30	1.40
		Non IPM	-	-	-	-
3.	Additional income over FP (Rs.)	IPM	21000	27000	26000	24667
		Non IPM	-	-	-	-
4.	Cost of cultivation + cost of	IPM	91325	97280	102425	97010
	treatment (Rs.)	Non IPM	93400	98600	103200	98400
5.	Monetary returns (Rs.)	IPM	297000	334800	350000	327267
		Non IPM	276000	307800	324000	302600
6.	Net Income (Rs.)	IPM	205675	237520	247575	230257
		Non IPM	182600	209200	220800	204200
7.	B:C ratio	IPM	3.25	3.44	3.39	3.36
		Non IPM	2.96	3.12	3.14	3.07
8.	ICBR	IPM	6.32	5.11	4.05	5.16
		Non IPM	-	-	-	-

1.	Total cost of cultivation (2008-09, 2009-10, 2011-12)	:	Rs. 88000/-, 92000/-, 96000/-
2.	Cost of pesticides		
i)	Methomyl 40SP	:	Rs. 1000/kg, 1000/kg , 1300/kg
ii)	Metaldehyde 5%	:	Rs. 250/kg, 300/kg, 325/kg
iii)	Tobacco dust	:	Rs. 2.50/kg, 3.00/kg, 3.50/kg
3.	Cost of other ingredients		
i)	Yeast	:	Rs. 25/25g, 40/25g, 50/25g
ii)	Jaggery	:	Rs. 40/kg, 40/kg, 40/kg
4.	Price of Marketable Grapes	:	Rs. 15000/t, 18000/t, 20000/t

These finding are in conformity with those reported by EI-Sebae *et al*. (1982); Bhattacharya *et al*. (2014) and Ghamry *et al*. (1994) in laboratory and field condition.

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