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MANAGEMENT OF GIANT AFRICAN SNAIL, *ACHATINA FULICA* FERUSSAC UNDER PROTECTED CULTIVATION OF CAPSICUM

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ABSTRACT : The experiment was conducted at the High Tech Horticulture Unit, U.A.S., Dharwad during *kharif,* 2015 under poly-house condition by artificial releasing of field collected giant African snail (GAS) in order to evaluate the efficacy of chemicals/ poison bait and estimation of yield of capsicum. Among the various chemical and poison bait tested against the GAS, metaldehyde 2.5% pellets @ 5 kg/ha was found most effective and registered highest mortality (90.00%) at 15 days after treatment. This was followed by crystal salt @ 25 kg/ha and bleaching powder @ 25 kg/ha by documenting 86.67 and 83.33 per cent snail mortality, respectively. Significantly highest fruit yield was recorded in metaldehyde treatment (12.12 kg/m^2) followed by crystal salt (11.96 kg/m^2) and bleaching powder (11.80 kg/m^2) treatments. Also the maximum yield increase over control was obtained in the treatment with metaldehyde 2.5% pellets @ 5 kg/ha (54.78%) followed by crystal salt @ 25 kg/ha (54.18%) and bleaching powder @ 25 kg/ha (53.56%).

Key words : Giant African snail, metaldehyde, bleaching powder, crystal salt, yield increase.

INTRODUCTION

Giant African Snail (GAS) is one of the world's largest and most damaging land snail pests. It belongs to phylum: Mollusca, class: Gastropoda, order: Stylommatophora and family: Achatinidae. It is reported to feed on at least 500 different types of plant species (Capinera, 2011) and is extensively studied snail of economic, ecological and medical importance (Raut and Barker, 2002). GAS was reported for the first time causing damage to ornamental and vegetable crops in Bengaluru during *kharif*, 1979 (Veeresh *et al*, 1979). It was also reported that 20 per cent chilli seedlings damaged by GAS (Sunita, 2007). But information on the management and yield estimation of GAS under protected cultivation of capsicum are not available. Hence, this experiment was conducted under poly-house condition to test the efficacy of different chemicals/poison baits and on the estimate of yield on capsicum.

MATERIALS AND METHODS

To evaluate the efficacy of different treatments mentioned here under, an experiment was laid out in RCBD on capsicum grown in protected cultivation with nine treatments and three replications. The capsicum variety indra was grown at a spacing of 35 x 45 cm^2 with a plot size 2 x 1 m^2.

At 30 days after planting of capsicum 10 snails were artificially released in each plot and all the plots were covered with nylon net for a week period to prevent the escape of snail from one plot to another. The above mentioned poison baits were broadcasted in each plot during evening hours as per the dosages mentioned and dead snail count was made at 1, 3, 7, 10 and 15 days after treatment (DAT) during morning 7.00 to 8.00 am. Further, to calculate per cent mortality the data was subjected to statistical analysis with suitable conversions.

Percent increase in yield was calculated by using the formula :

$$\text{Per cent yield increase} = \frac{\text{Yield in respective treatment} - \text{Yield in control}}{\text{Yield in respective treatment}} \times 100$$

Preparation of poison baits

For 60 kg of rice bran, 12 kg of jaggery and 24 litres of water was added and mixed well in a container. The mouth of the container was tied with cloth and kept 48 hrs for fermentation. After 48 hrs, respective chemicals were added and broadcasted in the capsicum field @ 60 kg/ha (6.0 g/m^2).

RESULTS AND DISCUSSION

The observations recorded on the per cent mortality of giant African snail to evaluate the efficacy of different chemicals and poison baits on capsicum crop (30 days after sowing) are presented in Table 1. Before imposition of treatment uniform sized *A. fulica* were collected from fields and released at 10 numbers for each treatment.

A day after treatment

The data on mortality of snails obtained at 1 DAT ranged from 0.00 to 43.33 per cent. The maximum mortality of 43.33 per cent was recorded in crystal salt @ 25 kg/ha and was significantly superior over all other treatments. This was followed by metaldehyde 2.5% pellets @ 5 kg/ha with 36.67 per cent mortality, bleaching powder @ 25 kg/ha with 30.00 per cent mortality, which differed significantly from each other. Copper sulphate and thiodicarb 75 WP poison baits @ 60 kg/ha both were recorded with 26.67 per cent mortality, produced similar effect. Tobacco powder @ 25 kg/ha and methomyl 40 SP poison baits @ 60 kg/ha registered 23.33 and 20.00 per cent mortality, respectively. While boric powder @ 25 kg/ha was documented only 3.33 per cent snail mortality.

Three days after treatment

At 3 DAT, the trend in treatment efficacy observed at 1 DAT was continued. Application of crystal salt registered significantly highest mortality of 63.33 per cent proved to be superior over others. Metaldehyde 2.5% pellets and bleaching powder were next best treatments to follow by recording 56.67 and 46.67 per cent, respectively. As seen in earlier application boric powder was least effective by registering only 6.67 snail mortality at 3 DAT.

Five days after treatment

At 5 DAT, metaldehyde registered highest mortality (76.67%) instead of crystal salt and found significantly superior to others. However, application of crystal salt and bleaching powder/ thiodicarb 75 WP stood next best weapons by recording 73.33 and 56.67 per cent snail mortality. Application of tobacco powder and boric powder has brought mortality of 50.00 and 16.67 per cent, respectively.

Seven days after treatment

The treatment efficacy trend observed at 5 DAT was repeated at 7 DAT also wherein standard molluscicide once again proved effective by recording 83.33 per cent snail mortality. Again application for crystal salt (80%) and bleaching powder (63.33%) were found effective alternatives of snail management. Application copper sulphate, methomyl and thiodicarb as poison bait were found effective treatments compare to tobacco powder and boric powder.

Ten days after treatment

At 10 DAT, metaldehyde continued to be the effective treatment by registering the highest mortality of (86.67%), which was significantly superior over other treatments. Application of crystal salt (83.33%), bleaching powder (70%) and methomyl poison bait (63.33%) were proved next best effective treatments for management of GAS under green house. The significantly least mortality was continued in the application of boric powder (30%).

Fifteen days after treatment

Significantly the highest mortality of GAS was documented in metaldehyde 2.5% pellets @ 5 kg/ha (90.00%) at 15 DAT. This was followed by crystal salt @ 25 kg/ha (86.67%), bleaching powder @ 25 kg/ha (83.33%), methomyl 40 SP poison bait @ 60 kg/ha (76.67%), copper sulphate poison bait @ 60 kg/ha (73.33), thiodicarb 75WP poison bait @ 60 kg/ha (70.00%) and tobacco powder (66.67%). However, boric powder recorded 36.67 per cent mortality and no sail mortality was documented in control during the first application.

Yield

Data presented in Table 2 indicate yield of capsicum which ranged from 5.48 to 12.12 kg/m^2 obtained in different poison baits/chemical treatments. Significantly highest yield was registered in metaldehyde 2.5% pellets @ 0.5 g/m^2 (12.12 kg/m^2) which was significantly superior to all the treatments. This was followed by crystal salt @ 2.5 g/m^2 (11.96 kg/m^2), bleaching powder @ 2.5 g/m^2 (11.80 kg/m^2), methomyl 40 SP poison bait @ 6.0 g/m^2 (11.10 kg/m^2), thiodicarb 75 WP poison bait @ 6.0 g/m^2 (11.06 kg/m^2), copper sulphate poison bait @ 6.0 g/m^2 (10.83 kg/m^2) and tobacco powder @ 2.5 g/m^2 (9.28 kg/m^2). The least yield of 5.75 kg/m^2 was obtained from plot treated with boric powder @ 2.5 g/m^2.

Per cent increase in yield

The maximum yield increase over control was obtained in the treatment with metaldehyde 2.5% pellets @ 5 kg/ha (54.78%) followed by crystal salt (54.18%). Whereas, the next best treatments were bleaching powder (53.56%), methomyl 40 SP (50.63%), thiodicarb 75 WP (50.44%), copper sulphate (49.40%) and tobacco powder (40.91%). The lowest yield increase of 4.75 per cent over control was recorded in boric powder treatment.

The present study under protected cultivation on capsicum seems to be first of its kind. However, the above results regarding the superiority of metaldehyde against snails in other crops are in line with the findings of several workers like Javaregowda (2006); Rafee *et al* (2013); Shilpa (2013) and Mallappa (2014).

Crystal salt registered as a next best treatment followed by metaldehyde caused 86.67 per cent mortality. The present findings are in line with Vanita *et al* (2011)

Table 1 : Evaluation of different chemicals and poison baits against giant African snail in protected cultivation of capsicum during *kharif*, 2015.

Sl. No.	Treatment	Dosage (g/m^2)	Cumulative mortality of snails (%)					
			1 DAT	3 DAT	5 DAT	7 DAT	10 DAT	15 DAT
1.	Metaldehyde 2.5% pallets	0.5	36.67 **(37.26)^{b}	56.67 (48.83)^{b}	76.67 (61.12)^{a}	83.33 (65.90)^{a}	86.67 (68.59)^{a}	90.00 (71.57)^{a}
2.	Bleaching Powder	2.5	30.00 (33.21)^{c}	46.67 (43.09)^{c}	56.67 (48.83)^{c}	63.33 (52.73)^{c}	70.00 (56.79)^{c}	83.33 (65.90)^{c}
3.	Crystal Salt	2.5	43.33 (41.17)^{a}	63.33 (52.73)^{a}	73.33 (58.91)^{b}	80.00 (63.43)^{b}	83.33 (65.90)^{b}	86.67 (68.59)^{b}
4.	Methomyl 40 SP poison bait	6.0	20.00 (26.56)^{f}	30.00 (33.21)^{f}	46.67 (43.09)^{e}	56.67 (48.83)^{e}	63.33 (52.73)^{b}	76.67 (61.12)^{d}
5.	$CuSO_4$ poison bait	6.0	26.67 (31.09)^{d}	36.67 (37.27)^{e}	43.33 (41.17)^{f}	60.00 (50.76)^{d}	66.67 (54.73)^{d}	73.33 (58.91)^{e}
6.	Thiodicarb 75 WP poison bait	6.0	26.67 (31.09)^{d}	43.33 (41.17)^{d}	56.67 (48.83)^{c}	63.33 (52.73)^{c}	66.67 (54.73)^{d}	70.00 (56.79)^{f}
7.	Tobacco powder	2.5	23.333 (28.88)^{e}	36.67 (37.27)^{e}	50.00 (45.00)^{d}	53.33 (46.91)^{f}	63.33 (52.73)^{e}	66.67 (54.73)^{g}
8.	Boric powder	2.5	3.33 (10.51)^{g}	6.67 (14.97)^{g}	16.67 (24.08)^{g}	23.33 (28.88)^{g}	30.00 (33.21)^{f}	36.67 (37.26)^{h}
9.	Untreated control	—	0.00 *(0.71)^{h}	0.00 (0.71)^{h}	0.00 (0.71)^{h}	0.00 (0.71)^{h}	0.00 (0.71)^{g}	0.00 (0.71)^{i}
S.Em±			0.25	0.40	0.47	0.48	0.45	0.32
C.D. @ 5%			0.72	1.21	1.41	1.44	1.35	0.95
C.V. (%)			18.90	19.61	17.50	15.47	13.27	8.46

Figures in the parenthesis are √x+0.5* and arc sine** transformed values, DAR- Days after Release. Values in the column followed by common letters are non significant at p = 0.05 as per DMRT.

Table 2 : Estimation of yield and per cent increase in yield over control against giant African snail, *Achatina fulica* Ferussac under protected cultivation of capsicum.

Sl. No.	Treatments	Dosage (g/m^2)	Yield (kg/m^2)	Per cent yield increase over control
1.	Metaldehyde 2.5% pellets	0.5	12.12	54.78
2.	Bleaching powder	2.5	11.80	53.56
3.	Crystal salt	2.5	11.96	54.18
4.	Methomyl 40 SP poison bait	6.0	11.10	50.63
5.	$CuSO_4$ poison bait	6.0	10.83	49.40
6.	Thiodicarb 75WP poison bait	6.0	11.06	50.45
7.	Tobacco powder	2.5	9.28	40.95
8.	Boric powder	2.5	5.75	4.93
9.	Untreated control	—	5.48	—

who opined that common salt at 6 cm thickness was found effective barrier against the snails. Shilpa (2013) revealed that crystal salt 25 kg/ha recorded 89.03 per cent mortality of *C. semirugata* infesting green gram.

Bleaching powder was the next best dehydrating material for killing snails. It caused 83.33 per cent mortality of giant African snail under green house condition at 15 DAT. These findings are in conformity with the findings of Rafee *et al* (2013) and Shilpa (2013). While, Mallappa (2014) reported 86.10 per cent mortality of *A. fulica* in betel vine ecosystem by using bleaching powder @ 25 kg/ha at seven days after treatment.

The next best treatments were methomyl poison bait, copper sulphate, thiodicarb and tobacco powder which caused mortality of 76.67, 73.33, 70.00 and 66.67 per cent, respectively. The present findings are in line with Shivale and Bedse (2009) who revealed that 70 per cent snail population was controlled by using methomyl 40 SP @ 10 kg/ha of fermented food bait (50 kg wheat bran + 5 kg jaggery + 1500 g yeast)/ha. Further, Rafee *et al* (2013) opined that application of methomyl 40 SP @ 60 kg/ha and $CuSO_4$ @ 60 kg/ha were recorded the mortality of 72.63 and 71.27 at 7 DAT, respectively which also corroborate with present findings. The present finding on the effectiveness of copper sulphate bait against GAS is in agreement with results of many earlier workers. Shivale and Bedse (2009) revealed that copper sulphate

bait @ 100 g/kg food bait produced 64.60 and 34.00 per cent mortality of *A. fulica* in soybean after 3 and 7 days after application, respectively. Similarly, Kakoty and Das (1987) also found that copper sulphate caused 100 per cent mortality after one week of treatment against giant African snail. The findings are also in agreement with Shilpa (2013) and Mallappa (2014) who reported effectiveness of $CuSO_4$ poison bait against *A. fulica* and *C. semirugata*, respectively.

The perusal of literature revealed that the reviews pertaining to yield loss of capsicum due to giant African snail is not available. Hence, this appears to be the first study carried out on the estimation of yield of capsicum due to management of GAS.

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