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STANDARDIZATION OF DIFFERENT DOSES OF POISON BAITS AGAINST FALL ARMYWORM (*SPODOPTERA FRUGIPERDA* J. E. SMITH) INFESTING MAIZE

T.D. Rakholiya[1]*, A.V. Khanpara[2], B.V. Gondaliya[1] and Bhumika Solanki[1]

[1]Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India.
[2]Polytechnic in Agriculture, College of Agriculture, Junagadh Agricultural University, Gujarat, India.
*Corresponding author E-mail : tanvirakholiya147@gmail.com

ABSTRACT

Investigation on standardization of different doses of poison baits against fall armyworm, *Spodoptera frugiperda* infesting maize was conducted at PG Research Lab, Department of Entomology, College of Agriculture, JAU, Junagadh in 2022. The efficacy of poison baits after 24 hours revealed that *S. frugiperda* can be effectively managed by Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ ha with the highest per cent mortality (93.51 and 78.33 mean per cent mortality of larvae) at both 60 g and 30g of baits, respectively. The lowest larval mortality was found in Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25 kg wheat bran/ha.

Key words : Fall armyworm, Mortality, Poison baits, *Spodoptera frugiperda*.

Introduction

Maize, scientifically named *Zea mays* subsp. *Mays*, originated in southern Mexico, where it was first domesticated by indigenous peoples approximately 10,000 years ago. Among all cereal crops, maize stands out for its immense potential, capable of producing impressive biological growth and grain yields in a relatively short time. Its title as the "queen of cereals" stems from its highly efficient photosynthesis process, known as the C4 mechanism, which plays a key role in its agricultural significance. India produced 33.62 million tonnes of maize over an area of 10.04 million hectares in 2021-22. During the kharif season of 2022-23, maize production reached 23.10 million tonnes, covering 9.68 million hectares (Anonymous, 2022). In Gujarat, key districts involved in maize cultivation include Dahod, Panchmahal, Vadodara, Kheda, Banas kantha, Bharuch, Anand, and Dang. During the 2020-21 season, the state recorded a maize-growing area of 2,867.05 hectares, with a total production of 4,360.36 million tonnes and an average yield of 1,520.85 kg per hectare during the *kharif* season (Anonymous, 2020-21). Maize plants are targeted by around 140 different insect species, each causing different levels of damage. Among these, the fall armyworm is a highly invasive arthropod pest, with its larval stage being the most harmful. Its scientific name, *Spodoptera frugiperda*, comes from Latin, where "*frugiperda*" means "lost fruit," reflecting the pest's capacity to devastate crops (Anonymous, 2017a). Maize yield losses due to fall armyworm infestations have been reported to reach up to 34%. Poison bait, which is a blend of attractants, carriers, and toxic substances, is useful in cases where spraying, dusting, or fumigation is not feasible, such as with cutworms and armyworms that spend most of the day underground, or in large crop areas that are difficult to protect with spraying. Baits help minimize issues related to runoff and drifting, which are common with liquid or dust insecticides (Jech *et al*., 1993).

Materials and Methods

An experiment to evaluate the effectiveness of different doses of poison bait against the fall armyworm was conducted in 2022 at the P.G. Laboratory of the Department of Entomology, College of Agriculture, JAU, Junagadh. The study followed a Completely Randomized

Design (CRD), consisting of six treatments and three replications.

Treatments details

S. no.	Treatments
T_1	Emamectin Benzoate 5% SG 125 g/ha + 5 kg jaggery + 25 kg wheat bran/ha
T_2	Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha
T_3	Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25 kg wheat bran/ha
T_4	Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha
T_5	Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25 kg wheat bran/ha
T_6	Control with 5 kg jaggery + 25 kg wheat bran/ha

Methodology

Preparation of poison baits

Poison bait was prepared by mixing wheat bran, insecticide and jaggery by adding water. The wheat bran was spread on the hard ground floor and jaggery was dissolved in water and then sprinkled on the bran evenly. The required quantity of poison was dissolved in water and sprinkled on the bran. Water was poured into the mixture and stirred properly. Later, this mixture was transferred to gunny bags and kept for 48 hours for fermentation. The baits were made in a circular shape from this fermented mixture after it became hardened.

Application method

To know the efficacy of the poison bait on *S. frugiperda*, different six treatments (*viz.*, Emamectin benzoate, Thiodicarb, Spinetoram, Indoxacarb, Carbosulfan) with recommended quantity of jaggery and wheat bran were evaluated for larval preference and mortality under laboratory condition. For this purpose, 30 and 60 g of bait from each treatment were kept in a Petri plate and five third instar larvae were released in each plate. The observation of live and dead larvae was recorded 24 hrs. after the bait application. Jaggery and wheat bran were added to the control plate. The data was converted into percent mortality using Abbott's formula (1925) and modified by Henderson and Tilton (1955).

$$\text{Corrected percent mortality} = 100 \times \left(1 - \frac{Ta \times Cb}{Tb \times Ca}\right)$$

Where,

Tb = Number of fall armyworm larvae observed before treatment

Ta = Number of fall armyworm larvae observed after treatment

Cb = Number of fall armyworm larvae that were observed before treatment in the control plate

Ca = Number of fall armyworm larvae was observed after treatment in the control plate

Results and Discussion

A study was carried out on the standardization of different doses of poison baits against fall armyworm, *S. frugiperda* infesting maize in laboratory. Poison baits prepared using the chemicals given in Table 1 were applied in laboratory. The baits were made in a circular shape from this fermented mixture after it became hardened. 30 and 60 g of bait from each treatment were kept in a Petri plate. The observation of live and dead larvae was recorded 24 hrs. after the bait application. Corrected percent mortality was counted and transformed by arc sine transformation.

Application of 30 g poison baits

The result presented in Table 1 and exemplified in Fig. 1 discovered the mean percent mortality of *S. frugiperda* with the application of 30 g poison baits in treatments was 43.31%, 78.38%, 56.67%, 55.02% and 21.62%, respectively. The highest percent mortality (78.33%) was found in treatment 2 with Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha. The second highest larval mortality was 56.67% with Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25 kg wheat bran/ha. And then Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha gave 55% larval mortality which was at par with Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25 kg wheat bran/ha. The lowest larval mortality (20.00%) was found in Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25 kg wheat bran/ha.

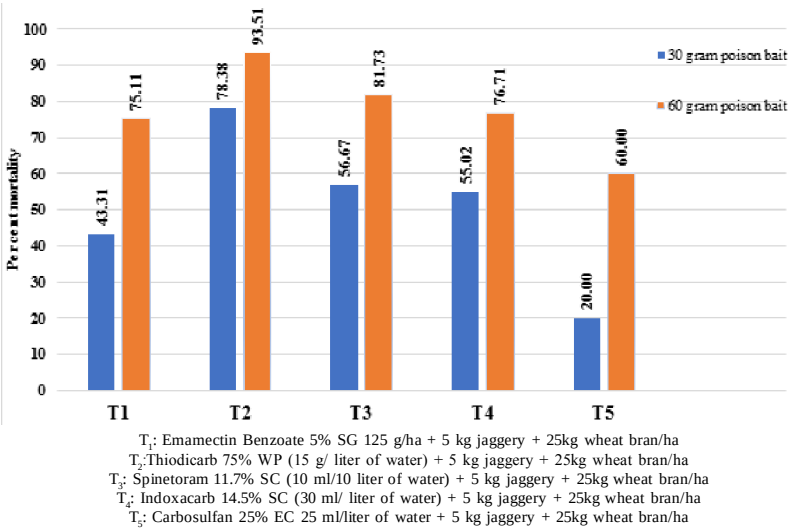
Application of 60 g poison baits

The result was presented in Table 1 and showed in Fig. 1 discovered the mean per cent mortality of *S. frugiperda* with the application of 60 g poison baits in treatments was 75.11%, 93.51%, 81.73%, 76.71% and 60%, respectively. The highest per cent mortality (93.51%) was found in treatment 2 with the dose of Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha. The second highest larval mortality was 81.73% with Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25 kg wheat bran/ha. Then third highest was treatment 4 of Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25 kg wheat bran/

Table 1 : Effect of different doses of poison baits on *S. frugiperda.*

S. no.	Treatments	Mean per cent mortality in 30 g poison bait	Mean per cent mortality in 60 g poison bait
T_1	Emamectin Benzoate 5% SG 125 g/ha + 5 kg jaggery + 25 kg wheat bran/ha	41.154(43.31)	60.075(75.11)
T_2	Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha	62.290(78.38)	75.241(93.51)
T_3	Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25 kg wheat bran/ha	48.836(56.67)	65.954(81.73)
T_4	Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha	47.879(55.02)	61.145(76.71)
T_5	Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25 kg wheat bran/ha	26.565(20.00)	50.768(60.00)
	S. Em. ±	1.32	1.41
	C. D. at 5%	4.16	4.45
	C. V.	5.04	3.92

Note: Mean in parentheses were retransformed values, those outside were arc sin transformed values.



T_1: Emamectin Benzoate 5% SG 125 g/ha + 5 kg jaggery + 25kg wheat bran/ha
T_2:Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25kg wheat bran/ha
T_3: Spinetoram 11.7% SC (10 ml/10 liter of water) + 5 kg jaggery + 25kg wheat bran/ha
T_4: Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25kg wheat bran/ha
T_5: Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25kg wheat bran/ha

Fig. 1 : Effect of different doses of poison baits on *S. furgiperda.*

ha with 76.71% mortality which was at par with treatment 3. The fourth one was Treatment 1 with Emamectin Benzoate 5% SG 125 g/ha + 5 kg jaggery + 25 kg wheat bran/ha with 75.11% mortality which was at par with Treatment 4 of Indoxacarb 14.5% SC (30 ml/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha with 76.71% mortality.

Conclusion

The results revealed that the highest percent mortality (78.33%) was found in treatment 2 with the dose of Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha and the lowest larval mortality (21.62%) was found in Carbosulfan 25% EC 25 ml/liter of water + 5 kg jaggery + 25 kg wheat bran/ha at 30g dose of poison bait. And at 60g dose of poison baits, the highest per cent mortality (93.51%) was found in treatment 2 with the dose of Thiodicarb 75% WP (15 g/ liter of water) + 5 kg jaggery + 25 kg wheat bran/ha.

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