

## Impact of Cue-Lure traps against melon fruit fly on bottle gourd in Malda district of West Bengal

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### Abstract

A frontline demonstration was carried out with an objective to mass trapping, monitoring and management of melon fruit fly in bottle gourd through cue-lure traps during kharif season (July to September) of 2020 and 2021 at Gopalpur village of Malda district, West Bengal. The cue-lure based melon fruit fly management in bottle gourd gave 26.6% higher yield, 23.7% higher gross income, 146% higher net income and 54.41% higher benefit-cost ratio than farmers' practice whereas this technology exhibited 77.14% lower insect infestation and 24.85% lower cost of cultivation during both the years. The pooled data of extension gap (27.5 q/ha), technology gap (46.6 q/ha) and technology index (31.07%) emphasized the need to educate the farmers through various extension means for the adoption of demonstrated technical intervention to increase the yield of bottle gourd.

**Keywords:** Melon fruit fly, bottle gourd, cue-lure, mass trapping

### Introduction

Among vegetables, cucurbitaceous vegetable covers a major share (area 159.16 thousand hectares and production 1748.16 thousand tonnes) of total vegetables in the state of West Bengal (NHB, 2011). Bottle gourd is grown in an area of 153 thousand hectares with a production of 2529 thousand metric tonnes (Anonymous, 2017) [1]. Melon fruit fly, *B. cucurbitae* (Coq.) is one of the main tropical fruit flies causing considerable damage in cucurbits. Fruit flies lay eggs inside fruits and, upon hatching, the larvae start feeding on pulp, thus making the fruits unfit for human consumption. Fruit flies have a high reproductive potential, with short and overlapping generations. As a result, there can be sudden outbreaks (Bateman, 1972) [2]. Extent of yield loss caused by the pest to cucurbitaceous vegetables ranging from 30-100% depending upon cucurbit species and the season in different parts of the world (Sisodiya, 2007) [16]. According to Drew and Romig (2013) [7], *Bactrocera* sometimes can cause 100% losses to produce. About 21% of fruit fly infestation was found in bottle gourd (Sohrab *et al.*, 2018) [17]. Screening of 13 several cucurbitaceous vegetables for two seasons revealed that bottle gourd was the most preferred host of *B. cucurbitae* (Nath and Bhushan, 2006) [11]. As the cucurbit fruits are harvested at a short span of time for selling, it is difficult to rely on insecticides as a means of controlling this pest due to its cryptic nature (Kardinan, 2000) [8]. The farmers show little concern for the residual effect of chemicals, being more concerned about profit. The vegetables are brought to the market long before the chemicals have broken down. However, regular use of synthetic chemicals disturbs and pollute ecosystem, annihilate natural enemies' population and results in the development of resistance and resurgence of the target pest (Susanto *et al.*, 2020) [19]. On the other hand, it is very much difficult to manage the pest simply through the application of chemical pesticides due to their peculiar biological features (Bhowmik and Das, 2024) [3]. The para-pheromone, cue-lure traps have been reported to attract *B. cucurbitae* males. A lower concentration of cue-lure might mimic a natural pheromone level, triggering mating behavior and

leading to increased trap catches. 5 % cue-lure embedded with blue sticky trap to be the most superior treatment with significantly higher trap catches of the melon fruit fly (Prem *et al.*, 2025) [14]. Besides this, as cue-lure is a specific para-pheromone for attracting male cucurbit fruit fly, this also helps to create an imbalance on male: female ratio in the environment and causes comparatively low infestation due to the production of unfertilized eggs by female. Moreover, this eco-friendly management tactics is necessary to minimize the hazardous effects of synthetic chemical insecticides on human health, edible produce an ecosystem (Kardinan, 2003) [9]. Keeping this in view this technology has been adopted by Malda KVK in farmers' field *i.e.* management of fruit flies through mass trapping with cue-lure pheromone traps in cucurbitaceous vegetable fields so as to increase the productivity as well as quality and quantity of cucurbits.

### Materials and Methods

#### Site description

The frontline was conducted at Gopalpur village (25°13'1.51" N latitude and 87°55'29.02" E latitude), Ratua-I, Malda district of West Bengal with 20 farmers during kharif (July to September) season of 2020 and 2021. The soil of the experimental site was sandy loam in texture with good water holding capacity, drainage facility with moderate fertility status. The experimental area is situated under subtropical humid climate. The soil was fertile with pH 6.55, low in organic carbon 0.14% and EC 0.12 dS m<sup>-1</sup> and high level of available nitrogen (365.85 kg ha<sup>-1</sup>), phosphorus (85.43 kg ha<sup>-1</sup>) and potash (196.46 kg ha<sup>-1</sup>).

#### Description of cue-lure traps in demonstrated technology

Cue-lure traps were installed at the platforms fixed in or near the cucurbitaceous vegetable fields of each location at the time of crop germination at ground level with nylon wire along the trellises. The traps were made with plastic jars with six holes (0.5 cm in diameter) on each side at middle of the lid and the radius of the jar was 0.3 mm with white

coloured body and yellow coloured lid. This para-pheromone lure (cue-lure) attracts male fruit flies. The size of the trap was 10 cm in diameter and 12 cm in length. The cue-lure blocks were placed inside a small green coloured plastic cage (3 cm in diameter and 4 cm in length) with 8 longitudinal holes (for better evaporation and communication with fruit fly) fixed with a screw from the middle of the jar. These traps are manufactured by Pheromone chemicals, Hyderabad. This commercial cylindrical plastic traps were used to trap male flies that were incapable of escaping until starving to death as it allows the one-way movement of fruit fly. The old cue-lure blocks were replenished with fresh blocks after every two months. The attracted fruit flies were removed from the trap after every 7-10 days and then the bottle was recapped for further trapping. Generally, 8-10 traps per acre were used for proper monitoring and management. Traps were tightly fixed on the tree at least 6 ft above the ground. No pesticides were applied on the particular orchards during the course of our study and only regular management tactics (cultural, prophylactic, etc.) were used.

**Details of farmers’ practice**

Farmers applied conventional insecticides i.e. lambda-cyhalothrin, acephate, cypermethrin, imidacloprid and other synthetic pyrethroids and organo-phosphates to control mango fruit fly. Regular management tactics (cultural, prophylactic, etc.) were also used in farmers’ practice.

**Collection of data**

The observations were taken at 7 days intervals in each trap in farmers’ plot. Relative abundance of adult male *B. cucurbitae* population over time was estimated using trap capture data. Because *B. cucurbitae* populations have a 1:1 sex ratio (Bhowmik *et al.*, 2014) [4], female populations were assumed to be similar (Chen and Ye, 2007) [6]. The infestation of fruits was calculated by picking fruits of marketable size at three days interval. Infested and healthy fruits were weighted and counted separately. Percentage of fruits damage on number and weight basis were worked out by the following formula (Preetha and Nadarajan, 2006) [13].

$$\text{Insect infestation (\% (number basis))} = \frac{\text{Total no. of infested fruits}}{\text{Total no. of picked fruit}} \times 100$$

$$\text{Insect infestation (\% (weight basis))} = \frac{\text{Total weight of infested fruits}}{\text{Total weight of picked fruit}} \times 100$$

$$\text{Per cent yield increase over control} = \frac{\text{Demonstration yield} - \text{Control yield}}{\text{control yield}} \times 100$$

To determine the extension gap (EG) and technology gap

(TG), the following equations were used (Samui *et al.*, 2000) [15]:

EG = Yield of demonstrated technology - farmers’ yield (control)

TG = Potential yield- demonstration yield

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential Yield}} \times 100$$

**Results and Discussion**

**Effect on yield**

The average fruit yield in cue-lure based practice was recorded 127.95 q/ha, whereas it was recorded only 101.0 q/ha in farmers’ practice during 2020-2021. The use of cue-lure provided average 26.7% higher yield over farmers’ practice during 2020-2021 (Table 1).

**Effect on melon fruit fly infestation on bottle gourd**

The average fruit infestation (number basis) in cue-lure based practice was recorded 8.4%, whereas it was recorded 34.9% in farmers’ practice during 2020-21 as presented in Table 1. The weight basis average fruit infestation in demonstrated plots was 10.7% and in farmers’ practice it was 46.8%. The use of cue-lure provided 77.4% lower infestation over farmers’ practice during these years. This result is in conformity with the findings of Stonehouse *et. al.* (2004) [18] who pointed out that para-pheromone lures i.e. cue-lures have been successful for melon fruit fly management which ultimately reduces the infestation. About 60-70% fruit damage can be reduced and quality of cucurbits can be improved by this technology (Mandal and Kumar, 2025) [10].

**Effect on economics**

Table 1 shows the impact of the demonstrated technology on economics of bottle gourd production. The average cost of cultivation in demonstrated plots was 25.94% lower than farmers’ practice due to installation of cue-lure traps. The pooled gross and net economic returns for demonstrated plots were 11.14% and 89.91% higher, respectively, compared to farmers' practice. In comparison with farmers' practice, on an average 50.34% higher benefit-cost ratios was observed during 2020-21, which confirm the viability of the cue-lure based fruit fly management in demonstrated plot to enhance the gross income of the farmers. According to Mandal and Kumar (2025) [10], the cost of cultivation was minimized due to more than 10 times reduction in overall cost of insecticide application.

**Table 1:** Impact of cue-lure traps on yield and economics of bottle gourd during *kharif* season of 2020 and 2021

Technology	Year	Yield (q/ha)	% yield increase	Infestation/ha (%)		Cost of cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs/ha)	BC Ratio
				NB	WB				
DT	2020	123.5	25.38	9.4	11.6	28749	60276	31527	2.10
	2021	132.4	28.05	7.44	9.7	26540	61750	35210	2.33
	Average	127.95	26.7	8.4	10.7	27645	61013	33369	2.21
FP or control	2020	98.5	--	36.1	80.4	35892	54230	18338	1.51
	2021	103.4	--	33.6	74.3	38765	55569	16804	1.43
	Average	101.0	--	34.9	77.4	37329	54900	17571	1.47

DT = Demonstration Technology; FP = Farmers’ Practice; NB = Number basis; WB = Weight basis; BC = Benefit Cost ratio

**Extension Gap, Technology Gap and Technology Index**

Table 2 depicts the extension gap, technology gap and technology index of the demonstrated technology. The

extension gaps were 27.0 q/ha (pooled) during both years in demonstrated plot, reversing the trend of huge extension gaps by teaching farmers via various extension techniques

such as training and FLD for the adoption of upgraded and innovative technologies for production and protection (Bhowmik *et al.*, 2019) [5]. Technology gap was 22.05 q/ha (pooled), which confirms superior results in demonstrated plot. The observed technological gap can be associated with the variations in soil fertility and agricultural production

techniques, as well as current weather circumstances of the locality. The technology index observed in demonstrated plots was 14.7% (pooled) which proved the excellent performance of this innovative approach. This will hasten the implementation of the demonstrated technology to amplify the productivity of bottle gourd.

**Table 2:** Production performance of bottle gourd with demonstration technology under FLD programme during 2020 and 2021

Year	Average yield (q/ha)		% increase over farmer's practice	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
	Demonstration	Farmer's practice				
2020	123.5	98.5	25.38	25	26.5	17.7
2021	132.4	103.4	28.05	29	17.6	11.7
Average	127.95	101.0	26.71	27	22.05	14.7

Potential yield = 150 q/ha



Melon fruit fly catch per trap



Installation of pheromone i.e. cue-lure traps against melon fruit fly in bottle gourd

## Conclusion

Cucurbitaceous vegetable is a tropical vegetable crop and grown almost all tropical and sub-tropical situations. The symptom of attack by this insect is very common in cucurbits. This technology was conducted in Old Alluvial zone (Malda), West Bengal. Every year around 50% yield loss occurred due to attack of this pest. By adopting this technology, the disease incidence is reduced and yield was increased than the traditional method of treatment for melon fruit fly. This technology was initially conducted with 20 farmers and 12-acre areas in Ratua I block of Malda district and now it has good impact among the farming community as this is an eco-friendly approach and environmentally safe innovative approach to curb this devastating menace and increase the yield of cucurbitaceous vegetables. It reduces the unnecessary sprayings without having any particular idea about the infestation caused by the melon fruit fly.

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