Full Length Article

SPACE AND HEIGHT OPTIMIZATION FOR PLACEMENT OF DELTA TRAPS IN POULTRY UNIT FOR EFFECTIVE HOUSE FLY TRAPPING

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ABSTRACT

The present study was carried out to optimize the space and height for placement of baited delta traps to lure and kill house flies in Japanese Quail layer unit at Poultry Research Station, Madhavaram, Chennai where birds were raised in Californian caged system. Red acrylic delta traps with Z-9-Tricosene-Fish meal pellet baits were used for the optimization study. Height optimization of placement of traps was estimated by placing the traps at four different heights in poultry units, viz., ground level, 0.3 m above ground level, 0.6 m above ground level and 0.9 m above ground level. The optimal distance for placement of the acrylic delta trap was estimated by placing the traps at four different distances within poultry units, viz., close to each other, 0.3 m distance between two traps, 0.6 m distance between two traps and 0.9 m distance between two traps. Trap height optimization trial results revealed that maximum number of flies were trapped at ground level, followed by 0.3 m above ground level, 0.6 m above ground level and 0.9 m above ground level in the descending order of preference. Trap distance optimization trials revealed that more flies got trapped when the distance between two traps was 90 cm followed by 0 cm, 60 cm and 30 cm distance between traps. Results revealed that house fly delta traps deployed at ground level at a trap distance of 90 cm could be effective in house fly trapping and can play a vital role in integrated house fly management strategies.

Keywords: Delta trap, house fly, height, distance, optimization

Received : 25.05.2023 Revised : 12.07.2023 Accepted : 12.07.2023

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INTRODUCTION

Traps play a major role in control of house flies as part of integrated house fly management strategies. Integrated house fly management strategies are widely used in fly control and traps can be used in this approach thereby minimizing the use of insecticides (Colacci *et al.,* 2020, Hinkle and Hogsette, 2021, Geden *et al.,* 2021, Guarino *et al.,* 2022). Proper positioning of traps is vital in order to attain maximum trap catch rates. It also helps to recommend proper guidelines in trap placement for poultry farmers and entrepreneurs to ascertain the maximum utilization of traps in a given area inside the premises of poultry units. Traps especially those baited with pheromone lures must be positioned in such a way that flies detect the pheromone source easily (Hogsette, 2008). Therefore, proper placement of traps plays a major role in trap efficiency. Optimization of height and inter-trap distance is very important before placement of traps. In general, house flies prefer to stay indoors in poultry units due to the availability of food and breeding resources (Hogsette *et al.,* 1993) and most of the flies can be seen at ground levels feeding on spilled feed and actively breeding on the droppings. Placement of traps close to ground levels could attract more flies than suspending traps above ground levels. In addition, number of traps to be deployed in a unit and optimum distance between traps is also equally important (Smallegange, 2004). The present study was undertaken to optimize the height and distance of placement of red acrylic delta traps baited with pellet baits in poultry units.

MATERIALS AND METHODS

Red acrylic delta traps fabricated by following the USDA approved dimensions for delta trap used for actively flying insects with a length of 28 cm, width of 20 cm, height of 15 cm and sides of 20 cm with a 20 x 20 cm insert at the base where a yellow sticky insert of 20 x 20 cm dimension was placed (Fig. 1). The yellow sticky insert was prepared from a yellow-coloured sticky insect glue roll sheet purchased from Harmony Ecotech, Hyderabad. Pellet baits prepared using fish meal and the pheromone Z-9-Tricosene (FMP pellets) and similar pellet baits with added antioxidant BHT (FMPB pellets) were used as lures in delta traps. The trial was carried out in the Research farm at Poultry Research Station, Madhavaram in a confined area housing Japanese Quail layer birds reared in Californian cage system. The unit housed birds in "M" type cages with a capacity of 3000 birds and the dimensions of the unit were 100 feet length x 12 feet width. For trap height optimization, six trials were carried out and for trap distance optimization, eight trials were carried out at different time periods. All trials were conducted in summer in the months of May to July, 2016 and the units where the trial was conducted had a high level of house fly infestation.

Trap height optimization trials

The optimal height for placement of acrylic delta trap was estimated by placing the traps at four different heights in poultry units, viz., ground level, 0.3 m above ground level, 0.6 m above ground level and 0.9 m above

ground level (Fig. 2). FMP pellet baits was used as the lure in all the traps. Since only four traps were used for the trial and the objective was to find out the number of flies trapped at different heights irrespective of the bait used, all four traps were baited with FMP pellets. Trap catches in all the four traps positioned at different heights was counted separately at 24 hrs interval for six days continuously and the optimal height of trap placement was determined. Traps were serviced at 24 hrs interval. Six trials were carried out.

Trap distance optimization trials

The optimal distance for placement of the red acrylic delta trap was estimated by placing the traps at four different distances within poultry units, viz., close to each other, 0.3 m distance between two traps, 0.6 m distance between two traps and 0.9 m distance between two traps (Fig. 3). A total of eight traps were used for the study in pairs. In each pair of traps, one trap was baited with FMP pellet and the other with FMPB pellet in order to find out if there are any variations in trap catches using two different pellet baits. Trap catches in all the four traps positioned at different distances were counted separately every 24 hrs for six days continuously and the optimal distance of trap placement was determined. Traps were serviced at 24 hrs interval. Eight trials were carried out.

RESULTS

Total number of flies trapped

A grand total of 20385 house flies were trapped in both the trials. In trap height optimization trial 883 flies were trapped using FMP pellet bait. In trap height optimization trial 19502 flies were trapped, out of which 9550 flies were trapped in FMP pellet baited traps and 9952 flies were trapped in FMPB pellet baited traps.

Trap height optimization trial

Trap height optimization trial results revealed that maximum number of flies were trapped at ground level, followed by 0.3 m about ground level, 0.6 m above ground level and 0.9 m above ground level in the descending order of preference. A total of 883 flies were trapped, out of which, 60.36 per cent (533 flies) were trapped in traps placed at ground level. At 0.3 m above ground level, 27.63 per cent (244 flies) were trapped while at 0.6 m above ground level, 9.96 per cent (88 flies) were trapped. Only 2.03 per cent (18 flies) were trapped at 0.9 m above ground level (Table 1). Variation in the number of flies trapped at different heights was highly significant statistically (χ^2 value = 946.9** $p<0.01^{HS}$). Male and female flies was found to be 48.13 per cent (425 flies) and 51.86 per cent (458 flies), respectively.

Trap distance optimization trial

Trap distance optimization trials revealed that more flies got trapped when the distance between two traps was 90 cm (30.42%, 5821 flies) followed by 0 cm distance between traps (24.51%, 4690 flies), 60 cm distance between traps (23.91%, 4576 flies) and 30 cm distance between traps (21.15%, 4047 flies) (Table 2). Variation in the number

of flies trapped at different distances in traps showed high statistical significance (χ^2 value = 465.67** $p<0.01^{HS}$).

A total of 19502 flies were trapped, out of which 48.97 per cent (9550 flies) were trapped using FMP pellets and 51.03 per cent (9952 flies) were trapped using FMPB pellets. Among the 9550 flies trapped using FMP pellet, 47.67 per cent (4553 flies) were males and 52.32 per cent (4997 flies) were females. Among the 9952 flies trapped using FMPB pellets, 43.69 per cent (4349 flies) were males and 56.30 per cent (5603 flies) were females. Variation in the number of flies trapped using FMP and FMPB pellets in traps placed at different distances was statistically significant (χ^2 value = 4.79* $p<0.05^{S}$).

DISCUSSION

Traps play a vital role in integrated house fly management strategies (Colacci *et al.,* 2020, Hinkle and Hogsette, 2021, Geden *et al.,* 2021, Guarino *et al.,* 2022). Pheromone baited traps must be positioned appropriately in order to facilitate flies to detect the pheromone source with ease (Hogsette, 2008, Geden *et al.* (2021). Proper placement of traps is crucial to improve the efficiency of traps.

Hogsette *et al.* (1993) used sticky card traps to lure and kill house flies from closed poultry houses and results showed that house flies preferred the interior parts of the houses, away from the walls. In the present observation, fly numbers were abundant in ground level compared to walls. More house flies were captured on traps placed <0.5 m above the floor (mean = 99) than on cards at the higher level (mean = 73). Smallegange (2004) concluded that not only the practicability of the traps, but also the number of traps that should be applied in a unit and the optimum placement of the traps also need to be standardized.

In the present sustainable trap height optimization study in poultry unit, maximum numbers of flies were trapped at ground level, followed by 0.3 m about ground level, 0.6 m above ground level and 0.9 m above ground level. Trap distance optimization trials revealed that more flies got trapped when the distance between two traps was 90 cm (30.42%) followed by 0 cm distance between traps (24.51%), 60 cm distance between traps (23.91%) and 30 cm distance between traps (21.15%).

Hogsette (2008) observed that trap placement close to floor was highly effective in poultry units due to the availability of huge number of foraging flies. Snell (2002) did studies on the optimum height of placement of UV light traps for house flies and results revealed that placement of traps at 0.9 m above ground level was optimal (71% catch) compared to 1.5 m above ground level (29% catch). It was concluded that even though different traps placed in various positions may appear identical, flies may see and perceive them in a completely different way. He also opined that proper positioning of traps could be a true trap enhancement factor and placing the traps in an area with little air circulation, proper height and with proper lighting in the

Table 1. Delta trap – sustainable trap height optimization trial in poultry unit (6 trials)

Trial No	Ground level		0.3 m above ground level		0.6 m above ground level		0.9 m above ground level		Total flies trapped in each trial at the end of 6 days
	No of flies	per cent	No of flies	per cent	No of flies	per cent	No of flies	per cent	
1.	29	45.31	16	25.00	14	21.87	5	7.81	64
2.	39	67.24	10	17.24	9	15.51	0	0.00	58
3.	110	82.08	13	9.70	11	8.20	0	0.00	134
4.	142	65.13	55	25.22	17	7.79	4	1.83	218
5.	115	55.28	71	34.13	18	8.65	4	1.92	208
6.	98	48.75	79	39.30	19	9.45	5	2.48	201
Total	533	60.36	244	27.63	88	9.96	18	2.03	883

χ^2 value = 946.9** ($p<0.01$)^{HS}

Table 2. Delta trap – sustainable trap distance optimization trial in poultry unit (8 trials)

Trial No	0 cm distance between two traps		30 cm distance between two traps		60 cm distance between two traps		90 cm distance between two traps		Total flies trapped in each trial at the end of 6 days	
	FMP pellet	FMPB pellet	FMP pellet	FMPB pellet	FMP pellet	FMPB pellet	FMP pellet	FMPB pellet	FMP pellet	FMPB pellet
1.	29	14	9	36	8	71	43	56	89	177
2.	4	34	14	37	37	67	20	24	75	162
3.	457	322	96	180	381	322	602	710	1536	1534
4.	617	637	494	390	490	463	619	710	2220	2200
5.	95	82	79	65	111	90	51	49	336	286
6.	55	33	45	35	70	125	35	90	205	283
7.	706	709	510	614	592	550	710	666	2518	2539
8.	457	439	747	696	577	622	700	736	2571	2771
Total	**2420**	**2270**	**1994**	**2053**	**2858**	**2310**	**2780**	**3041**	**9550**	**9952**

χ^2 value = 465.67** ($p<0.01$)^{HS} for variation in trap catches with trap distance

χ^2 value = 4.79* ($p<0.05$)^{S} for variation in flies trapped using FMP and FMPB pellets

Fig. 1. Red acrylic delta trap used for height and distance optimization study

Fig. 2. Delta traps placed at different heights in poultry unit for trap height optimization trial

Fig. 3. Delta traps placed in poultry unit for trap distance optimization trial

unit can make huge differences in attraction of flies towards traps.

Butler and Mullens (2010) observed that trap performance was optimal when traps were placed in high fly activity areas 1-2 m apart and house fly capture at one block, which was spatially separated by approximately 15 cm from the other was significantly different. Kaufman *et al.* (2005) suggested that large sticky traps in poultry farms should be placed at a rate of 6 traps/aisle (one trap for every 56 square meters of the building).

Positioning of house fly traps is vital in enhancing trap catches and effective implementation of house fly control strategies. Hence optimization of traps in terms of height and distance should be advocated according to the status of fly intensity in the farms.

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