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Evaluation of Integrated Management Practices Against Fruit Fly on Cucumber

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Abstract: An experiment was carried out to evaluate three packages viz., perforated polyethylene bagging, covering fruits by PVC pipe and poison bait trap against fruit fly on cucumber. Bagging of cucumber with perforated polyethylene bags at immature stage significantly reduced the fruit fly infestation. The level of fruit fly infestation under PVC pipe was higher compared with bagged ones but it was lower than bait-trap used. The bagging of fruits for combating the fruit fly on cucumber might be considered as an IPM package.

Key words: IPM package, fruit fly, bait-trap, PVC pipe and microclimate

Introduction

Cucumber (*Cucumis sativus* L.) is an important cucurbitaceous vegetable grown almost all over the tropical and sub-tropical countries of the world. Among the insect pests threatening the production of this crop, the cucurbit fruit fly, *Bactrocera cucurbitae* Coquillett, is of major importance (Kabir *et al.*, 1991). The damage due to this pest causes great economic loss to the cucurbit growers. York (1992) reported up to 50% damage of cucurbits. Atwal (1996), on the other hand, reported 100% damage of melon by the attack of fruit fly. Several control measures have been suggested but the control of this pest appeared difficult because of its internal feeding habit (Kapoor, 1993). Application of some systemic insecticides like Dipterex 80SP (Nasiruddin and Karim, 1992) and use of bait-traps (Nasiruddin, 1990) have been tried in Bangladesh with partial success. Spraying insecticides is not a potential method (Williamson, 1989) besides, these are very dangerous for health and environment. Cultural control (Butani and Jotwani, 1984; Kapoor, 1993; Nasiruddin and Karim, 1992 and Yawalkar, 1985) of the fruit fly have also been tried. But the management of the fruit fly is still a far cry (Butani and Jotwani, 1984). Considering these, an experiment was conducted to find effectiveness of three packages viz., polyethylene bagging of fruits, covering fruits by PVC pipe and bait-trap against fruit fly on cucumber as a tool of integrated pest management (IPM).

Materials and Methods

The experiments on evaluation of integrated management practices against fruit fly on cucumber were carried out at Regional Horticulture Research Station, Akbarpur, Moulvibazar during 1997-98 and 1998-99. The experiment consisted of four treatments viz., (1) perforated polyethylene bagging, (2) covering fruits by PVC pipe (3) bait trap [Sweet gourd pulp(100 g) + Metasystox 25 EC(0.5 ml)] and (4) untreated (control). The treatments were assigned using randomized complete block design with five replication. A local popular variety was selected as crop. Two seedlings were planted in each pit and three pits were made in each 3 x 1 m² sized plot. Intercultural operations were done as and when needed. Propping as well as trellis of 1.5 m height made up of bamboo pillars were provided. The treatments were started to apply at the age of 1st flower plants. Each fertilized flower was covered by a transparent perforated polyethylene bag (30 x 10 cm²). The mouth of the bag was closed by thin jute rope. At maturity, bagged fruits along with other fruits were harvested, checked and post treatment data were recorded. Bait trap was changed at every three days interval. PVC pipe (15 cm long and 3 inches diameters) was used to cover the fruits. The upper and lower portion of the pipe was open. The pipe was hung by the support of wire with trellis. The healthy and infested fruits were counted and percentage of infestation by number and weight were calculated. Data on single fruit weight (g) and marketable

yield (t ha⁻¹) were as well as benefit cost ratio (BCR) was calculated. Percent data were transformed and analyzed using MSTAT software and means were separated by least significant difference (LSD) test.

Results and Discussion

Efficacy of different treatments on percent fruit infestation by number: The treatments under study significantly varied from the untreated control in year 1997-98 (Table 1). The highest percent of fruit infestation was recorded in the untreated control (40.83 %) followed distantly by bait trap (26.97 %) and PVC pipe (22.55 %). The lowest fruit infestation (9.30 %) was observed in the polyethylene bagging treatment. Accordingly, the percent fruit infestation reduction over untreated control was the highest in polyethylene bagging treatment (77.22 %) was followed by PVC pipe (44.77 %) and bait-trap treatment (33.95 %). In PVC pipe treatment, the reduced infestation might be due to solid physical barrier. The more number of infestation in PVC pipe than polyethylene bagging possibly due to the open ends of upper and lower portion. The highest infestation reduction over untreated control was found in polyethylene bagging treatment (77.22 %) followed by PVC pipe treatment (44.77 %). The lowest infestation reduction over untreated control was observed in bait-trap treatment (33.95%).

In year 1998-99 the highest percent of fruit infestation was recorded in the untreated control 43.01%. Percent of fruit infestation in the polyethylene bagging treatment and PVC pipe were 8.48 and 20.86 % respectively. Accordingly, the percent fruit infestation reduction over untreated control was the highest in polyethylene bagging treatment (80.28 %). In PVC pipe and bait-trap treatments, the reduction over control was 51.50 and 38.69 %, respectively. The treated plots had significant variation statistically to the untreated control.

Pooled over two years: It is noted that all the treatments were significantly different from each other. The highest percent of fruit infestation was recorded in the untreated control (42.12%) and the lowest (9.87%) was observed in polythene bagging treatment. Percent of fruit infestation in the plots treated with PVC pipe and bait-trap were 21.95 and 25.98 %, respectively. Accordingly, the percent fruit infestation reduction over untreated control was the highest in polyethylene bagging treatment (76.57 %) followed by PVC pipe (47.89 %) and bait-trap treatment (38.32 %). All the treatments were found better than the control. Polyethylene bagging performed the best and the other treatments were also far better than the control in reduction of infestation.

The reduced infestation observed in bagged fruits might be due to the physical barrier created by the bags which refrained the female flies from laying eggs on these fruits. The less number of infestation observed in these fruits might be due to the presence of unnoticed eggs already laid on fruits before bagging was done.

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Table 1: Effect of different treatments on the percent fruit infestation by number for the control of fruit fly

Treatments	% fruit infestation			Infestation reduction over control (%)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
T ₁	9.30(17.68)d	8.48(16.84)d	9.87(17.56)d	77.22	80.28	76.57
T ₂	22.55(28.31)c	20.86(27.13)c	21.95(27.89)c	44.77	51.50	47.89
T ₃	26.97(31.27)b	26.37(30.85)b	25.98(30.60)b	33.95	38.69	38.32
T ₄	40.83(39.69)a	43.01(40.94)a	42.12(40.43)a	-	-	-

Table 2: Effect of different treatments on percent fruit infestation by weight for the control of fruit fly

Treatments	% fruit infestation			Infestation reduction over control (%)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
T ₁	10.35(18.72)e	10.86(19.22)e	9.94(18.32)d	67.70	65.53	68.46
T ₂	14.66(22.47)d	16.25(23.77)c	16.23(23.72)c	54.24	48.43	48.51
T ₃	22.44(28.24)b	22.61(28.35)b	21.72(27.72)b	29.96	28.25	31.09
T ₄	32.04(34.45)a	31.51(34.11)a	31.52(34.13)a	-	-	-

Table 3: Effect of different treatments on single fruit weight for the control of fruit fly

Treatments	Single fruit weight (g)			Increase of single fruit wt. Over control (%)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
T ₁	235.1b	233.7b	228.4d	-16.90	-17.97	-16.09
T ₂	286.7a	280.3a	280.3b	+ 1.34	-1.61	+ 2.98
T ₃	285.7a	286.2a	286.7a	+ 0.99	+ 0.46	+ 5.33
T ₄	282.9a	284.9a	272.2c	-	-	-

Table 4: Effect of different treatments on marketable yield of cucumber

Treatments	Marketable yield (t/ha)			Increase of yield (ton/ha) over control (%)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
T ₁	19.36a	19.92a	19.93a	199.23	206.46	177.96
T ₂	11.05b	10.53b	10.53b	70.79	62.00	46.86
T ₃	10.90b	9.17c	9.78c	68.47	41.08	36.04
T ₄	6.47d	6.50d	7.17d	-	-	-

Figures in parenthesis are corresponding transformed values on which analysis was done. In a column, means followed by same letter(s) are statistically identical by DMRT at 5 % level of significance.

T₁= Polyethylene bagging T₂= PVC pipe T₃ = Bait trap T₄= control

Table 5: Economic analysis of various treatments for the control of fruit fly in cucumber (Pooled over two years)

Treatments	Cost of pest management(Tk./ha)	Yield (ton/ha)	Gross return (Tk.)	Net return (Tk.)	Adjusted net return(Tk.)	Benefit cost ratio
T ₁	12177.00	19.93	159440	147263.00	+ 89903	+ 7.38
T ₂	10283.50	10.53	84240	73956.50	+ 16596.5	+ 1.61
T ₃	8519.00	9.78	78240	69721.00	+ 12361.00	+ 1.45
T ₄	-	7.17	57360	57360	-	-

Cost of bagging

Polyethylene bag(10''x 6'') @ Tk. 70/kg and 1 kg = 450 No. of bags.

Jute rope @ 25 Tk./Kg and 1 kg = 450 no. of fruits can be tied.

Labour cost @ 70 Tk. /day.

Total cost of bagging = 12177.00 Tk./ha.

Cost of PVC Pipe

* Price of PVC pipe = 20 Tk./ft,

* Total cost of PVC pipe = 10283.50 Tk./ha

Cost of bait trap

Metasystox @ Tk. 75/125 ml. 3 ml L⁻¹ of water is needed for each bait trap at each time; Bait trap was changed 15 times, i.e , every 3 days after.

Sweet gourd pulp @ 8.00 Tk./Kg

Earth pot @3.00 Tk. per piece.

Labour @ 70 Tk./day .

* **Total cost of bait trap = 8519.00 Tk./ha.**

* **Farmgate price of cucumber per kg = 8.00 Tk.**

Another probable reason might be the oviposition by the female pushing her ovipositor through the minute pores of the bags. The lowest level of infestation as evident in bagged fruits corroborates with the findings of Amin (1995), Anonymous (1987) and Kapoor (1993).

Percent fruit infestation by weight: It is revealed that during year 1997-98 all the treatments showed significant differences (Table 2). Polyethylene bagging (T_1) treatments obtained the lowest (10.35 %) and the highest infestation in untreated control (32.04 %) of fruits by weight. Regarding the percent fruit infestation 14.66 % was in PVC pipe and in bait trap treatment was 22.44 %. Percent reduction of fruit infestation over untreated control was the highest in polyethylene bagging treatment (67.70 %) followed by PVC pipe treatment (54.24 %) and bait-trap treatment (29.96 %).

In year 1998-99 all the treatments showed significant difference. The lowest fruit infestation 10.86 % was obtained in polyethylene bagging treatment closely followed by PVC pipe (16.25 %). Polyethylene bagging treatment had the best performance over the control. Percent decrease in fruit infestation over untreated control was the highest in T_1 treatment (65.53 %) followed by PVC pipe treatment (48.43 %) and bait-trap treatment (28.25 %). Percent fruit infestation by weight varied due to severity of infestation. Because partial damage was found in polyethylene bagging treatment. As a result only 10.35 to 10.86 % fruit was damaged by weight. The more percent infestation by weight in PVC pipe than polyethylene bagging possibly due to the ends open of upper and lower portion. In bait-trap and untreated control treatment comparatively higher percent fruit infestation were found due to open condition of fruits. Nasiruddin (1990) obtained the similar trend of percent infestation by weight using bait-trap in snake gourd than untreated control for controlling fruit fly.

Pooled over two years: It is recorded that all the treatments were significantly superior to the untreated control. The untreated control (T_0) and Polyethylene bagging (T_1) treatments obtained the highest (31.52 %) and the lowest (9.94 %) fruit infestation respectively.

Polyethylene bagging treatment had the best performance followed by other treatments over the untreated control. Percent reduction in infested fruits by weight over untreated control was the highest in T_1 treatment (68.46 %) followed by PVC pipe treatment (48.51 %) and bait-trap treatment (31.09 %).

Efficacy of different treatments on single fruit weight: It is observed that during year 1997-98 all the treatments had similar effect on single fruit weight including untreated control except polyethylene bagging (Table 3). Statistical variations were not pronounced among the treatments except polyethylene bagging. The highest single fruit weight was observed in 286.7 g in PVC pipe while the lowest was in polyethylene bagging treatment (235.1 g). The percent decrease in single fruit weight in polyethylene bagging treatment over control was 16.90 %. But in other treatments, decrease or increase in fruit weight over control was very negligible. So, the weight of single fruit of bagged ones was significantly lower in comparison with that of other plots. The percent decrease of single fruit weight was the highest (16.90 %) in the polyethylene bagging treatment compared with the control. The lower weight obtained in the bagged fruits might be due to the change in microclimate inside the bag cover (Uddin *et al.*, 1998).

In year 1998-99, it is noted that the polyethylene bagging treatment produced the lowest fruit weight 233.7 g, which differed significantly with other treatments. The other treatments did not show any significant difference among themselves. This indicated that other treatments did not influence plant physiology. The percent decrease in single fruit weight in polyethylene bagging treatment over control was 17.97 %.

Pooled over two years: It is noticed that the polyethylene bagging treatment produced the lowest fruit weight 228.4 g, which varied significantly over the control. The second highest single fruit weight was found in bait trap treatment (286.7 g) followed by PVC pipe treatment (280.3 g) and untreated control (272.2 g). The percent decrease of single fruit weight was the highest (16.09%) in the polyethylene bagging treatment compared to the control.

Efficacy of different treatments on marketable yield of cucumber: During 1997-98 the polyethylene bagging treatment produced the highest marketable yield (19.36 t ha⁻¹) and the lowest yield was in the control (6.47 t ha⁻¹) (Table 4). PVC pipe and bait trap treatments had also significantly higher yield of 11.05 t ha⁻¹ and 10.90 t ha⁻¹ respectively compared to the control. The highest percent of marketable yield increase over control treatment was obtained in plots treated with Polyethylene bagging (199.23 %) followed by PVC pipe (70.79 %) and the lowest in bait trap (68.47 %). It is indicated that polyethylene bagging treatment had the highest reduction of fruit infestation. As a result, it had the maximum number of healthy fruits as well as the highest marketable fruits. Subsequently, the highest fruit infestation and lowest marketable yield was recorded in the control treatment. There was a substantial control of fruit fly by PVC pipe and bait-trap treatments, which contributed to higher marketable yield. Amin (1995) got the more or less equal level marketable yield using polyethylene/brown paper bagging than untreated control.

It is indicated that the treatment varied significantly with each other in 1998-99. The polyethylene bagging treatment produced the highest marketable yield (19.92 t ha⁻¹) and the lowest yield in the control (6.50 t ha⁻¹). PVC pipe and bait trap treatments had also the significantly higher yield of 10.53 and 9.17 t ha⁻¹ respectively compared with the control. The highest percent of marketable yield increase over control treatment was obtained in plots treated with Polyethylene bagging (206.46 %) followed by PVC pipe (62.00 %) and the lowest in bait trap (41.08 %). It is noticed that all the treatments did well in comparison to the untreated control. However, the treatment varied significantly among them where polyethylene bagging showed the highest performance.

Pooled over two years: It is indicated that the treatment had significant difference with each other. The polyethylene bagging treatment produced the highest marketable yield (19.93 t ha⁻¹) and the lowest yield in the control (7.17 t ha⁻¹). PVC pipe and bait trap treatments had also the significantly higher yield of 10.53 and 9.78 t ha⁻¹ respectively, compared with the control. The highest percentage of marketable yield increase over control treatment was obtained in plots treated with Polyethylene bagging (177.96 %) followed by PVC pipe (46.86 %) and the lowest in bait trap (36.40 %).

The benefit cost ratio (BCR) of different treatments is presented in Table 5. Variations in marketable yield caused by different treatments were significant. On the contrary, the calculated BCR provided a different trend due to variation on pest management cost. The adjusted net return was the highest in case of polyethylene bagging (7.38). PVC pipe treatment and bait trap treatment gave very poor BCR 1.61 and 1.45 respectively. Thus considering all these factors, polyethylene bagging is recommended as IPM tools for control of fruit fly in cucumber.

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