ISSN 0258-7122
Bangladesh J. Agril. Res. 35(3) : 395-401, September 2010

EVALUATION OF MOSQUITO NET BARRIER ON CUCURBIT SEEDLING WITH OTHER CHEMICAL, MECHANICAL AND BOTANICAL APPROACHES FOR SUPPRESSION OF RED PUMKIN BEETLE DAMAGE IN CUCURBIT

A. K. M. KHORSHEDUZZAMAN[1], Z. NESSA[2] AND M. A. RAHMAN[2]

Abstract

Seedling bed netted with mosquito net barrier against red pumpkin beetle, *Aulacophora foveicollis* (Lucas) in sweet gourd was evaluated with other chemical, mechanical, and botanical approaches during 2006-07 and 2007-08 cropping seasons. Among six treatments, results indicated that seedling bed of sweet gourd covered with mosquito net barrier upto 45 days before planting was found to be most effective and provided 97.59 and 100% protection with higher benefit cost ratio of 21.99 compared to 9.74 with Furadan 5G applied in soil; as of 4.35 using neem seed oil for the average of two years applied against red pumpkin beetle.

Keywords: Mosquito net barrier, cucurbit, pumkin beetle.

Introduction

Cucurbits *(Cucurbita spp.)* include 12 crop species (Alam, 1969) and 16 crop species (Nasiruddin, 1995), are the important vegetables in terms of production and year-round availability in Bangladesh. The vegetables are available as leafy vines and fruits (green and yellow) with higher nutritious values (ß-carotene), long shelf-life and acceptable palatability to all levels of consumers (Anonymous, 2006). Raising seedlings in the nursery bed and transplant into the main field or direct sowing are the commonly used methods followed by the farmers for cucurbit cultivation. But potential damage during seedling stage caused by red pumpkin beetle, *Aulacophora foveicollis* (Lucas), appeared as an important constraint to successful production of cucurbit vegetables (Nasiruddin, 1992). Damage by this pest to cucurbit occurs mainly at seedling stage either in seed bed or in main field. The beetle feeds on leaves, flowers and some cases fruits and the grub attacks the roots and under-ground stems (Alam, 1969). Damage severity largely affects on growth and development of the young growing plants that delay flowering and fruiting due to reduced total leaf area and loss of seedlings vigour. Attack at very 3 early stage sometimes may cause death of the seedlings (Nasiruddin, 1992). The authors also reported that 100% crop may fail to grow up when seeds are directly sown in the main field. It is noted that the beetles prefer cotyledonus and young tender leaves and at the

[1]Senior Scientific Officer, [2]Principal Scientific Officer, [3]Scientific Officer, Entomology Section, HRC, Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh.

advent of the spring, the beetles defoliate the cucurbit seedlings to such an extent that sometimes the crop has to be resown for 3 to 4 times (Alam, 1969).

Many studies have been made for controlling red pumpkin beetle in field level mostly with insecticides. But none could produce appreciable level of protection. It is thus essential to develop a low cost, effective and eco-friendly approach for management of this pest. Protection of cucurbit seedlings from red pumpkin beetle with mosquito net barrier, a chemical, mechanical and some botanicals were assessed.

Materials and Method

The experiment was conducted in vegetable research field of Horticulture Research Centre in Joydebpur during 2006-07 and 2007-2008 cropping seasons. Six treatments viz., soil application with Furadan 5G @ 5 g/plant at 3 days before planting, mechanical control with sweeping net at 3 days interval for 45 days, spraying neem seed oil @l0ml/l+5m1 trix (detergent) at 7 days interval, spraying neem seed karnel extract @ 50g/l of water at 7 days interval, seedling bed covered with mosquito net barrier upto 45 days old seedlings and an untreated control were used. Treatment materials were collected from local market of Gazipur and neem seed oil and neem seeds were collected from Chapai Nawabgonj. The experiment was laid out in a randomized complete block design with 3 replications in field. Unit plot size was l0m × 3m with 2m inter plot distance. Seeds were sown in poly-pots in an open floor seedbed. The treated seedling bed with mosquito net barrier was applied before germination aside of the whole seedbed. Twenty five days old seedlings were transplanted into the main field except those under mosquito net barrier (45 days old seedlings were planted 20 days later) in mid January. Other treatments were applied in the main field as described in the treatment application. Standard planting density and cultivation procedures were followed for sweet gourd to raise a good crop following Anonymous (2006) and Rashid (1993). Number of infested seedlings' leaf area consumed was recorded in both the nursery bed and main field. The date of first flowering, number of total flowers and yield of marketable fruits were recorded. Data were analyzed by computer based MSTAT-C program and means were separated using least significant difference (LSD) test. Data were further calculated based on original data to show the effectiveness of the treatments variation. Benefit cost ratio was calculated on the basis of cost incurred for individual treatment following the procedure by Ali and Karim (1991). Costs of treatments incurred for materials and labourer for preparation and application of treatments were calculated following Anonymous (1986 and 1994). In these studies, it was noted that cost of pest management and types of interventions were strictly maintained and purposefully made similar in both the years.

Results and Discussion

Seedlings infestation and marketable fruit yield

In 2006-07 cropping season, the results obtained from the study revealed that the effectiveness of treatments differed significantly. Among the treatments, seedlings of 45 days old under net barrier offered the lowest (1.47%) and untreated control received the highest (27.98%) leaf infestation. The highest reduction (94.75%) of leaf infestation was calculated in the seedlings of 45 days old under mosquito net barrier treatment and the lowest (24.73%) and (25.84%) in mechanical control with sweeping net at 3 days interval for 45 days and spraying neem seed karnel extract @ 50g/l of water at 7 days interval treatment, respectively. The remaining treatments offered more than 50% reduction. Again, considering the yield, the highest yield (13.47 t/ha) was obtained in seedlings of 45 days old under mosquito net barrier and the lowest (7.33 t/ha) in untreated

Table 1. Percentage of leaf infestation of sweet gourd by red pumpkin beetle and fruit yield on different treatments.

Treatments	Leaf infestation (%)		Infestation reduction over control (%)		Mean fruit yield (ton/ha)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Soil application with Furadan 5G @5 g/ plant 3 days before planting	13.57 c	11.69 b	51.50	43.20	10.88 ab	12.90 ab
Mechanical control with sweeping net at 3 days interval	20.75 b	16.84 a	25.84	18.17	9.76 ab	11.43 ab
Foliar spraying Neem Seed Oil (NSO) @ 10 ml/L + 5m1 Trix at 7 days interval	13.47 c	9.05 b	51.86	56.03	9.56 ab	11.38 ab
Foliar spraying Neem Seed Karnel Extract (NSKE) @ 50g/L of water at 7 days interval	21.06 b	16.92 a	24.73	17.78	8.95 ab	11.42 ab
Seedlings of 45 days old under mosquito net barrier at nursery	1.47 d	0.00 c	94.75	100.00	13.47 a	16.24 a
Untreated control	27.98 a	20.58 a	-	-	7.33 b	9.48 b

Means in the same colunm followed by same letter(s) are not significantly different at 5% level.

control (Table 1). Rest of the treatments offered higher yield in comparison with untreated control during 2006-07 cropping season. The percent leaf infestation and marketable fruit yield of pumpkin during 2007-08 season also differed significantly among the treatments but followed the similar trend (Table 1). A maximum of 71.65% and 26.02% infestation reduction over control was recorded when Neembicidin 3ml/L and Furadan @ 3g/plant were applied against red pumpkin beetle in sweet gourd (Anon., 2004). Tomato seedlings netting with nylon net received the lowest virus infection which ultimately offered the highest yield as reported by Maleque *et al.* (2003).

Table 2. First flowering, total number of flowers and percent leaf area consumption by red pumpkin beetle in sweet gourd in different treatments.

Treatments	Leaf area consumption (%)		Consumption reduction over control (%)		Days required for first flowering		Flowers/plant (no.)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Soil application with Furadan 5G @ 5 g/plant 3 days before planting	19.47 b	14.67 b	44.83	48.83	81.6 c	85.5 c	87.8 b	94.3 b
Mechanical control with sweeping net at 3 days interval	33.33 a	27.33 a	5.55	4.67	103.9 b	105.7 b	83.5 b	89.7 bc
Foliar spraying NSO @ 10 ml/L + 5ml Trix at 7 days interval	18.75 b	16.75 b	46.87	41.58	107.5 b	l09.8 b	88.7 b	9l.3 b
Foliar spraying (NSKE) @ 50g /L of water at 7 days interval	21.33 b	19.56 b	39.56	31.78	102.7 b	108.3 b	87.4 b	89.3 bc
Seedlings of 45 days old under mosquito net barrier at nursery	0.85 c	0.00 c	97.59	100.00	67.6 d	71.4 c	111.2 a	113.7 a
Untreated control	35.29 a	28.67 a	-	-	113.8 a	125.2 a	68.5 c	77.4 c

Means in the same column followed by same letter(s) are not significantly different at 5% level.

Table 3. Average of two years (2006-2007 and 2007-2008) benefit cost-ratio of different treatments used against red pumpkin beetle in sweet gourd.

Materials/ laborer used/ha	Average pest control cost (Tk/ha)	Yield of marketable fruit (t/ha)	Gross return/ha	Net return/ ha	Adjusted net return/ ha	Benefit cost ratio
Furadan5G (7.2 kg applied once)	3,240.00	11.89	1,18,900.00	1,15,660.00	31,560.00	9.74
Sweeping netting (sweeping 15 times)	8,200.00	10.60	1,06,000.00	97,800.00	13,700.00	1.67
Neem Seed Oil (8.6L, Trix-4.3L for 6 sprays)	3,848.00	10.47	1,04,700.00	1,00,852.00	16,752.00	4.35
Neem Seed Kernel (43 kg for 6 sprays)	5,890.00	10.19	1,01,900.00	96,010.00	11,910.00	2.02
Seedling of 45 days old under mosquito net barrier (1l0m × l.5m setting once)	2,805.00	14.86	1,48,600.00	1,45,795.00	61,695.00	21.99
Untreated control	0.00	8.41	84,100.00	84,100.00	0.00	-

Labourer required for: Insecticide preparation and application: NSO 2 labourer/ha; Sweeping and NSKE: 4 labourer/ha; Furadan application: 12 labourer/ha.

Cost of materials: Furadan @ Tk. 250.00/kg; Mosquito-net @ Tk. 17.00/rn^2 Neem seed oil @ Tk. 140.00/kg; Trix detergent @ Tk. 280/L; Neem seed karnel @ Tk. 70.00/kg; Sweep-net @ Tk. 250.00; Labourer @ Tk. 120.00

Market price of sweet gourd: Average Tk. 10.00/kg according to the local market.

Leaf consumption and flowering

During 2006-07, mean days required for first flowering varies significantly and ranged from 71 to 125 days among the treatments. The lowest (71 days) required for first flowering in the treatment where seedlings used were completely protected by the mosquito-net barrier upto 45 days at seedbed and the highest

(125 days) was required in the untreated control plots. At flowering stage of the plant, total number of flowers was recorded highest (113.7) with higher male: female ratio (1.8:1) in the plants which were protected by the mosquito net barrier and the lowest (77.4) with higher male: female ratio (2.3:1) in the untreated control plots. The total number of flowers in the remaining treatments were more or less similar within a range of 89-94.

The percent leaf area consumption was measured in both seedbed and main field. The highest leaf consumption (28.67%) was recorded in the untreated control plot, which was statistically similar (27.33%) to mechanical control with sweeping net plots. The leaf consumption was similar in plots with treatments of foliar spraying with neem seed karnel extract, neem seed oil and the soil application with Furadan 5G which were next to control treatment (Table 2). Seedling from mosquito net barrier planted plants had only 0.85% consumption in the first year and nil (0.00) in the second year. Percent leaf consumption reduction over control showed that seedling from seedbed with net barrier provided almost cent percent reduction, while 32-49% reductions was found in other treatments and the lowest of 6% in mechanical control treatment (Table 2).

Benefit cost analysis

Economic analysis of different treatments were averaged (for both the years) and worked out to show the cost effectiveness of the treatments and presented in Table 3. The calculated benefit cost ratio (BCR) for each treatment showed that the highest BCR (21.99) was obtained in treatment where 45 days old seedlings were used from mosquito net barrier nursery followed by 9.74 in Furadan 5G applied in pit and 4.35 in Neem Seed Oil sprayed treatment. None of the other treatments offered appreciable BCR (Table 3). From the results, it might be concluded that nursery bed covered with mosquito-net barrier, cucurbit seedlings were effectively and economically sound and the variations in BCR of different treatments were the direct effect of marketable yield and the pest management cost incurred for different treatments. Nasiruddin *et al.* (2004) got the highest BCR using conventional and pheromone traps against fruit fly. Dutta *et al.* (2006) had the similar results with higher BCR (14.89-19.43) when tomato seedlings were netted with nylon net against whitefly and tomato leaf curl virus (TLCV) infection compared to other insecticide treatments.

References

Alam, M. *Z.* 1969. Insect Pests of Vegetables and Their Control in East Pakistan. ARI, Dacca Farm, Dacca 1215, 144 P.

Ali, M. I. and M. A. Karim. 1991. Rational insecticide use for the control of the cotton jassid, *Amrasca biguttula* (Shir.) Cicadellidae: Homoptera and the spotted ballwarm, *Earias vitetella* (F.) (Noctuidae: Lepidoptera) on cotton in Bangladesh. *Tropical Pest Management.* **37**(1): 66-70.

Anonymous. 2006. Sabji Utpadaner Unnatao Kolakowshal (Improved Technologies for Vegetable Production) (In Bangla). Vegetable Research Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 1701, pp. 54-118

Anonymous. 1994. Integrated control of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. at Jessore. *In:* Annual Research Report 1993-94. BARI, Joydebpur, Gazipur, Bangladesh, pp. 50-51.

Anonymous. 1986. Report of the workshop on cotton production and protection in the Humid- tropics. Batu, Malang, Indonesia, 13-17 May, 1986, 271 p.

Dutta, N. K., S. N. Alam and M. Nasiruddin. 2006. Development of management approach against the whitefly, *Bemisia tabaci* Genn, attacking tomato in Gazipur. *in:* Annual Research Report 2005-06, Entomology Division, BARI, Joydebpur, Gazipur, pp. 42-45.

Maleque, M. A., S. N. Alam, A. K. M. Ziaur Rahman and M. Nasiruddin. 2003. Integrated Management of the whitefly and viral diseases in the seed-bed and main field. *In:* Annual Research Report 2002-03, Entomology Division, BARI, Joydebpur, Gazipur, pp. 51-54.

Nasiruddin, M. 1995. *Fruit fly of Cucurbit Vegetables (Kumra Jatio Foshol Er Macchi Poka.* Folder in Bangla). Entomology Division, BARI, Gazipur.

Nasiruddin, M. 1992. Evaluation of different control methods for pumpkin beetle, *Aulacophora foveicollis* (Lucus) in Khira. *In:* Annual Research Report 1991-92, Entomology Division, BARI, Joydebpur, Gazipur, pp. 5-7.

Nasiruddin, M., S. N. Alam, A. K. M. Khorsheduzzaman, A.K.M. Ziaur Rahman, A.N.M. Rezaul Karim, H. S. Jasmine and Edwin G. Rajotte. 2004. Integrated Management of Cucurbit fruit fly, *Bactrocera cucurbitae* Coquillet in Bangladesh. IPM-CRSP Bangladesh Site: Technical Bulletin No. 1. l6p.

Rashid, M. M. 1993. Kumra Paribarer Shabji. *In.* Shabji Biggan (in Bangla). First ed. Bangla Academy, Dhaka, Bangladesh.