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Effects of Manually Processed Bio-pesticides on Crop Production and Pest Managements in Okra (*Abelmoschus Esculentus* (L.) Moench)

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Abstract:
Efficiency of different botanical extracts were tested to find out optimal concentration of extracts along with the production rate. Botanical extracts were, Neem leaf extracts (3ml/l,5ml/l & 7ml/l),Garlic bulb extracts (5ml/l,10ml/l & 15 ml/L) & Papaya leaves extracts ((5ml/l,10ml/l & 15 ml/L), among them, the production of fruit only compromised while treating with papaya leaves extracts, while Neem leaves extracts and Garlic bulb extracts were outstanding. Higher concentrations of biopesticides were effective rather than the lower concentrations to inhibit the pests. In all cases, Neem leaf extracts were outstanding in production manner as well as pest management systems.
Keywords: Okra, Biopesticides & Pest management.

1. Introduction:

Okra *(Abelmoschus esculentus* L. Moench) is an annual vegetable crop in tropical and sub-tropical parts of the world (Thakur and Arora, 1986). It is one of the important nutritious vegetable crops grown round the year in Bangladesh. Its every 100 g green pod contains protein 1.8 g, carbohydrate 6.4 g, fiber 1.2 g, Vitamin C 18 mg, and Ca 90 mg (Rashid, 1999). Okra is a nutritious vegetable which plays an important role to meet the demand of vegetables of the country when vegetables are scanty in the market (Ahmed,1995). It is cultivated throughout Bangladesh but its average national yield is poor, only 3.07 t ha (Anonymous, 2000). The yield is very low as compared to the yield 9.7-10 t ha of other developed countries of the world (Thompson and. Kelley, 1979) the yield could reach as high as 30 t ha (Koay and Chua,1978).
Natural enemies, parasitoids and predators are the main sources of reduction in the populations of noxious insect pests (Pfadt, 1980). Biocontrol agents and neem extracts have been reported.
ecofriendly options for management of insect pests of okra (Al-Eryan *et al.*, 2001; Bindu *et al.,* 2003; Singh and Brar, 2004; Paulraj and Ignacimuthu, 2005). Neem oil produced non-toxic effects after spray and acted as antifeedant, growth inhibitor and oviposition deterrent against insects pests of okra and cotton (Ahmed *et al.*, 1995). Indiscriminate use of insecticides has resulted in killing of natural enemies and environmental pollution problem on the large scale. Adoptions of IPM strategies ensure safety of environment. In this regard encouragement of natural enemies occupies a central position in integrated pest management because biological control of pests and weeds through natural enemies is eco-friendly (Kapadia and Puri, 1991; Stelzel and Devetak, 1999; Biesinger and Haefner, 2005; Sardana *et al., 2005a;* Shivalingaswamy *et al.,* 2002; Telang *et al.,* 2004)
Botanical pesticides (Neem oil or garlic bulb extracts and papaya leaves extracts), microbial control (*Bacillus thuringiensis*) and biological control agents (spider, ant, lady bird beetle, *Orius*, myrid bug, *Laius, Chrysoperla, Trichogramma* etc.) should be integrated for economic management of insect pests (Arora, *et al*., 1996; Abro *et al.,* 2004; Memon *et al.*, 2004).
Okra has huge international demand, specifically in E.U. countries. But, the entrance of this product faced challenges due to lack of Good Agricultural Practices. Poor cultivation techniques, extreme use of pesticides, lack of knowledge on export quality of okra has made the situation difficult for farmers & Exporters to dominate in export market.
Therefore, the present study was carried out to find a way to produce export quality okra by using bio-pesticides, ensuring the reduction of harmful pests and quality fruit production.

2. Materials & Methods:

The entire research project was carried out in the Village Morahati of Mithapukur Thana at Rangpur district.
2.1 Land preparation and transplanting: The land was cleared and root stumps removed after weeding prior to sowing of seeds. Ploughing and harrowing were performed on the land before beds were made. The experiment was done with BARI dherosh 1. This variety is released by Bangladesh Agricultural Research Institute, Gazipur,

Bangladesh. The experiment was conducted to observe effects of different biopesticides as a pest management agent and yielding of export quality fruits. The three treatments was laid out in randomized completely block design (RCBD) with three replications. Seeds of okra cv. BARI derosh 1 were sown based on different treatment variables. The row to row distance was 50 cm while the plant to plant distance was 40 cm. Seed sowing was done manually. Before sowing the experimental plots were fertilized with 250: 80: 130: 100: 5: 10 kg of urea: tripe superphosphate: muriate of potash: gypsym: zinc oxide: boric acid as the recommended dose. During final land preparation one half of the urea and total amount of other fertilizers were applied and incorporated into soil. Rest of the urea was top dressed at flower initiation stage. Weeding was done two times manually with 'nirani'. Irrigation was done whenever necessary by water cane at afternoon. At maturity the crop was harvested at different intervals.

2.2 Manually Processed Bio-Pesticides:

2.2.1 Neem (*Azadirachta indica)* leaf Extracts: The biological effects of a neem-based biopesticide, containing 4.5% azadirachtin, which has potent and known anti-pest activity.

Firstly, fresh leaves were collected from neem trees and washed thoroughly. About 500g of leaves were used for extraction of neem juice. The leaves were blended with the presence of water and juice was extracted by filtration. About 100ml of neem extract was collected.

2.2.2 Garlic bulb extracts:

The outer layers of the matured garlic were peeled off. 200 g of garlic were mixed with 1 L of water and ground with a blender to obtain garlic juice. This juice was thoroughly mixed with additional 1 L of water. The mixture was then sieved to obtain a uniform extract. The spraying frequency was once in a week.

2.2.3 Papaya leaves extracts:

100 g of papaya leaves were collected and ground using blender. 1 L of water was then added and left to stay for 20 to 24 h. 1 L of water was later added to the mixture/extract which was sieved to obtain a uniform extract. 10 ml of fish oil and liquid soap were added to the garlic and papaya leaves extracts to improve their delivery and to allow them to stick unto the surface of the leaves of the plants. The spraying frequency was once in a we

2.3 Data Recording & Analysis:

Data recorded included shoot length and number of branches, which were measured at the beginning of flowering and at final harvest. Number of leaves was recorded only at flowering, because senescence and abscission were underway by final harvest. Fruiting pattern was recorded by twice-weekly harvests during 32 days. The first harvest was 6 days after the first flowering. Twelve plants were harvested from the center row of the three-row plots. The fruits from each harvest were classified by size expressed as pod length, based on USDA standards for

grades of okra (Grange, 1965); the classifications, in cm, were: very small <4.4; small 4.4 to 8.9; medium >8.9 but <12.7, and large >12.7. Fruit weight and number for each size classification were determined for each harvest. The number of total fruits and multiple fruits (2 or more fruits per plant) were recorded each day from the four remaining plants in the center row. This was a randomized complete block with nine treatments and three replications. The data for both years are combined. The linear statistical model included Year, Rep within Year, Trt year × Treatment and Error. Linear, quadratic, and cubic responses were calculated to test for the effect of increasing levels of chemical. A **LSD** is calculated for testing control vs. Biopesticide level effect. The plot was a randomized complete block in which the response contrasts were performed for each biopesticide over harvest.

3. Result & Discussion:

Growth response of the okra plants to the manually processed biopesticides were more pronounced at flowering than at the final stage of growth (Table 1). Neem extracts were outstanding among other treatments, which required lower concentration to suppress pest infestation without effecting growth of plant and quality fruit production. Neem extract successfully reduced the infestation of four of our concerned pests. Lower concentration of Neem extracts 3 ml/l was unsuccessful to inhibit the white fly only among the four concerned pest species but fruit production was not compromised (Table-2). Higher shoot length, leaf number and branches were also achieved followed by the treatment of Neem extracts. While demonstrating the efficiency of Neem leaf extracts, 5ml/l was the best concentration for plant growth. Vigorous plant growth was obtained by treating with 5ml/l Garlic bulb extracts, but not so effective then the Neem extracts. Also Garlic bulb extract showed more effectiveness in plant growth rather than the papaya leaf extracts.

While considering the pest infestation, Neem leaf extracts efficiently reduced the pest infestation (Table-3). Lower concentration of Neem leaf extracts sometimes failed to dominate the pest called white fly. In case of Garlic bulb extracts, lower concentration of treatments failed to control the pest infestation while higher concentration effectively reduced pest infestation. This scenario is more or less similar to papaya leaf extracts.

Fruit production was higher than the control for all concerned treatments. While Neem leaf extract treated plant produced outstanding number of all sizes of fruits, among the Neem leaf treatments, 7ml/l produced higher number of different size of fruits (Table-2). This is true for all other biopesticide treatments described here. We found that, higher concentration of biopesticide can induce more number of fruits. But, while considering the fruit production garlic bulb extracts was more effective then papaya leaf extract and less effective then Neem leaf extracts.

4. Conclusions:

It is concluded that proper application of biopesticides and natural enemies have good impact on plant yield parameter. The crop protection expenses of biopesticides were less compared to chemical insecticides. Also the quality fruit can be produced which can be exported to more profitable markets.

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Table-1: Effect of Manually processed Bio-pesticides on growth of Okra as determined at flowering and final harvest.

Biopesticide treatments ml/l	Average Shoot Length (cm)		Average No. of Leaves	Average No. of Branches	
	Flowering	Final	Flowering	Flowering	Final
0	48	120	25.2	4.1	5
Neem extracts					
3	54	127	23	3.8	5
5	53.2	129	28	4.2	5.2
7	56.1	117	20	4.0	4.7
Garlic Bulb Extract					
5	53	121	27	4.3	5.3
10	47	125	26.3	4	5
15	45	123	23	3.8	4.9
Papaya leaves Extract					
5	48	122	23	4	3.9
10	45	128	25	4.3	5.1
15	46	120	20	3.8	3.5

Table-2: Effect of different biopesticide concentrations on different grades of fruit production.

Biopesticide treatments(ml/L)		Fruit size							
		Very small*		Small		Medium		Large	
		Wt Kg/ha,hundreds	No. Thousands/ha	Wt Kg/ha,hundreds	No. Thousands/ha	Wt Kg/ha,hundreds	No. Thousands/ha	Wt Kg/ha,hundreds	No. Thousands/ha
Control	0	14.6	25.1	35.2	25.5	12.3	54.7	12.4	31.9
Neem Extracts	3.0	16.7	28.9	40.1	32.8	19.8	63.6	20.4	35.8
	5.0	18.2	27.8	40.4	33.2	19.7	59.8	22.2	35.7
	7.0	18.8	27.9	42.2	33.9	22.2	59.1	24.8	33.5
Garlic Extracts	5.0	15.1	26.5	37.2	27.9	14.4	56.9	15.8	32.2
	10.0	15.7	25.9	36.3	27.4	15.2	57.0	17.0	34.1
	15.0	16.3	27.1	40.1	30.1	19.7	59.5	19.2	35.0
Papaya leaves extracts	5.0	14.8	26.0	37.0	26.3	14.0	54.9	13.2	32.0
	10.0	15.0	25.4	39.2	26.9	15.2	55.5	14.7	34.5
	15.0	15.7	25.7	39.4	28.0	15.9	56.9	15.1	37.7
$LSD_{0.05}$		4.1	6.9	11.4	7.6	5.9	28.5	8.1	18.5

* Very small <4.4 cm; small 4.4 to 8.9 cm; medium >8.9cm but <12.7 cm, and large >12.7 cm
* Significant at *P=0.05*

Table-3: Sammarizing table of experiments with significant reduction of insect attack (+), (-) = No significant effect

Insects/Pest	Neem Extract (ml-liter^{-1})			Garlic Bulb Extract (ml-liter^{-1})			Papaya Leaves extract (ml-liter^{-1})		
Treatments	3	5	7	5	10	15	5	10	15
A. gossypii (cotton aphid)	+	+	+	-	+	+	-	+	+
E. vittella (spotted bollworm)	+	+	+	+	+	+	-	-	+
P. puncticollis (flea beetle)	+	+	+	-	+	+	-	+	+
B. tabaci (white fly)	-	+	+	-	-	+	-	-	+

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