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Efficacy of neem oil and neem kernal powder against major sucking pests on brinjal under field conditions

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Abstract:

The experiment was carried out at the farmer's field to evaluate the efficacy of botanical pesticides in comparison to synthetic insecticide against major sucking insect pests on brinjal. The overall results of 4 sprays showed that Novastar 56 EC, (Bifenthrien 6% EC

and abamectin 0.07%) caused maximum population reduction of whitefly (70.54%) followed by neem oil (61.04%) and neem powder (57.99%). Jassid population was reduced (73.08%) by Novastar followed by neem oil (61.54%) and neem powder (59.79%), aphid population was reduced (74.58%) by Novastar followed by neem oil (66.51%) and neem powder (61.49%). Similarly Novastar reduced maximum population of thrips (66.48%) followed by neem oil (58.50%) and neem kernel powder (55.34%). The present study further revealed that higher yields (660kgs) were recorded in Novastar plot followed by neem oil (580kgs) and neem powder (540kgs). The results showed that there was no significant difference in effectiveness between neem oil and neem powder at (P<0.05) level.

Key words: Novastar, neem oil, neem powder, Hybrid variety Semeins, sucking pests, efficacy.

Introduction

This manual lists the major sucking pests of the most commonly grown vegetables including brinjal in Tandojam and its surroundings. Here we present pest control in terms of Integrated Pest Management from the perspective and choices available to resource poor farmers.

Brinjal, eggplant or Aubergine, *Solanum melongena* L (Salanaceae) is one of the most consumed vegetable crops due to its relatively inexpensiveness and easy availability throughout the year. There are approximately 15-20 different varieties of eggplant. This can be grown successfully under the climatic conditions prevailing in South India and the Deccan Plateau. It comes up well even in hilly regions where the temperature does not come down below 5° C. Eggplant is believed to have been domesticated in India, China, Thailand, Burma or someplace else in Southeast Asia. In Asia it is grown on a fairly wide scale in China, Japan, India and Pakistan (Omkar and Jame, 2003).

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China is the largest producer of brinjal and contributes about 68.7 per cent of the world's brinjal production (Table-1).

The first use of eggplant was probably medicinal rather than culinary: Its flesh still has a bitter after-taste if it is not treated, despite centuries of domestication experimentation. Brinjal contains water (92.7%) with some protein (1.1%), fiber and carbohydrates (0.02%) and no fats. It is rich in Vitamin A and B (Shanmugavelu, 1989).

Besides its importance as a vegetable in daily life it is also subjected to attack by a number of insect pests like shoot and fruit borer, *Leucinodes orbonalis* (Guenee.), whitefly, *Bemisia tabaci* (Gennadius), jassid, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossipy* (Glover); Mexican bean beetle, *Epilachna varivestis* (Mulsan), red spider mite, *Tetranychus urticae* (Koch) and some non-insect pests (Eswara and Srinivasa, 2001). Among these pests, major sucking pests like whitefly, jassid, aphid and thrips are big threats to brinjal growers which attack right from nursery stage till harvesting resulting in economic loss to the marketable yield (Regupathy et al., 1997).

Farmers mainly rely on pesticide use but due to their hazardous effects on environment with high shares of cost to total material input cost, the farmers are not willing to grow eggplant (Gapud and Canapi 1994). Besides this, the use of synthetic insecticides in crop protection programmes around the world has resulted in disturbances of the environment, pest resurgences, pest resistance to pesticides and lethal effect to non-target organisms in the agro-ecosystems in addition to direct toxicity to users. Therefore, it is necessary to search for the alternative means of pest control, which can not only minimize the use of synthetic pesticides but also is environment friendly as well as cost friendly to farming community.

The bio-pesticides as key IPM tool are the important alternatives to minimize or replace the use of synthetic pesticides as they possess properties like toxicity to the pests,

repellency, antifeedant, insect growth regulatory activities against agricultural pests (Prakash and Rao, 1989, 1986, 2003; Prakash et al., 1987, 1989, 1990). Moreover, bio-pesticides are simple in use; low-cost Integrated Pest Management (IPM) tool that provide satisfaction, sustainable agriculture management. Use of neem bio-pesticides in the field of IPM have been in the market for quite long time and their effectiveness against chewing, sucking pests and borers on many vegetables and grain crops have been demonstrated with variable success (Akbar et al., 1993, 1996, 1999; Dash et al., 1997; Bhatnagar and Sharma, 1997; Kumar and Bhatt, 1999; Ganguli and Ganguli, 1998; Bhanukiran and Panwar, 2000; Ahmed et al., 2002).

Neem pesticides derived from the Neem tree (*Azadirachta indica A. Juss*.), containing several chemicals, including 'azadirachtin' and having effects on the reproductive and digestive systems of many pests (Kalra and Khanuja, 2007). Neem oil, derived from crushing the seeds, is antidermatonic, a powerful vermifuge and is bitter in taste. It has a wide spectrum of action and is highly medicinal in nature. Neem oil and neem powder are used to protect plants and crops against pests specially sucking pests. It is effective against insecticide-resistant pests, highly environmentally compatible, non-toxic to mammals and birds, and does not affect beneficial insects. Neem powder can also be used as a soil treatment for controlling nematodes, especially in nurseries. Neem oil and neem powder are ideal for Integrated Pest Management programs. Though Neem oil and neem powder have no immediate knockdown effects on pests, but reduce their feeding and death occurs within several days, as its residual effects may persist for at least one week (Endersby and Morgan, 1991). Here in this study, we report effects of neem oil and neem powder in comparison to synthetic insecticide against major sucking pests on brinjal in field conditions.

Materials and Methods

Bio-pesticides, survey methods, data collection and Analytical methods

The neem oil, neem powder and Novastar 56 EC were purchased from the local market of District Tando Allahyar, Sindh-Pakistan.

Dose management for pesticide and bio-pesticides along with survey time selection

(i) ***Experimental field*****:** The experiment was carried out under normal field conditions at a farmer's field near Tajpur, District Tando Allahyar from January 20 to March 12, 2012 (sowing till harvesting).

(ii) **Survey, plot size management and dose management methods:**

The commonly grown Hybrid variety of Brinjal (Semeins) was grown into three equally divided sub-plot sizes of 6x7m ($42m^2$) with Randomized Complete Block Design (RCBD) method. Fifty-five days old seedlings were transplanted at 60 cm row to row and 30 cm plant-to-plant distance. As such experiment had three treatments, T1 (Neem oil), T2 (Neem powder) and T3 (Novastar®). The efficacy of neem powder and neem oil was compared with the insecticide Novastar 56 EC, (Bifenthrien 5% EC and abamectin 0.62%). The insecticides were applied four times at the interval of 15 days.

Dose preparation

The leaves with seeds of neem were crushed or grounded. The neem kernel powder (1kg) were grounded through grinder and soaked in 12.5 litters of water for 16 hours. After adding 20 gm detergent powder, 2% suspension was obtained. The plot size was $1/2^{th}$ of an acre; therefore 125 ml per tank and 4 tanks of spray suspension were applied in one spray using a knapsack hand sprayer. Similarly, neem oil 1% at 800 ml/ acre dose was

applied. As such, 50 ml per tank was applied. The dose of Novastar 56 EC was 500 ml/acre. Novastar was sprayed as control for comparison with neem powder and neem oil spray against Brinjal pests.

Data collection

We used visual estimation and sweeping net to investigate major sucking insect pests like whitefly, jassid, aphid and thrip. Data were taken as (a) Pre-treatment observation (before the application of pesticides) and (b) Post-treatment observation (after the application of pesticides) throughout the study. The pre-treatment observations were taken 24 hours before the application of pesticides. The post-treatment observations were recorded at 3, 7, and 14 days after application of pesticides. From each treatment 5 plants were randomly observed and 3 leaves per plant i.e. one from top, one from mid and one from bottom portion of plant were observed for recording, whitefly, jassid, aphid and thrips population. The reduction percent of pest population was calculated using Abbot Formula 1925.

$$\text{Reduction} = \frac{\text{Pre treatment-Post treatment}}{\text{Pre treatment}} \times 100$$

In the end yield data in kgs of Brinjal were also recorded from all treatments.

Analytical methods

Raw data management

All the raw data were processed into mean reduction percent with overall reduction percent by Microsoft Office Excel 2007, Microsoft Office Word 2007. Finally all the data were statistically analyzed and LSD at 0.05% was also tested by using Statix-8.1 computer software program.

Results

Whitefly, *Bemisia tabaci* (Genn):

The data in table-2 indicated that after three days the bio-pesticides along with Novastar insecticide gradually reduced whitefly population on brinjal. Synthetic insecticide (Novastar) caused maximum population reduction followed by neem oil and neem powder. Novastar registered the highest toxicity and whitefly population reduction ranged in between (81.66-88.65%) followed by neem oil (73.02-80.93%) and neem powder (70.09-79.14%) 3 days after spray. The result further revealed that overall maximum population reduction (70.54 a) of whitefly after four sprays was recorded in Novastar followed by (61.04 b) neem oil and (57.99 b) neem kernal powder. The average population reduction of pest was highest in Novastar applied treatment and was significantly different compared with neem insecticides. Neem oil showed better control of pest but it was not significantly different from neem powder.

JASSID, *Amrasca bigutella bigutella* (Ishida)

Table-3 data indicate that Novastar showed the maximum pest mortality (>83%) 3 days after application, followed by neem oil (>75%) and neem powder (>73%). Effectiveness of all insecticides decreased at post treatment interval of 7 days. The results further depict that Novastar registered the highest jassid population reduction ranged in between (82.89-86.45%) followed by neem oil (72.14-78.82%) and neem powder (70.15-77.59%) after 3 days in all four sprays. The result further revealed that overall maximum reduction after four sprays (73.08 a) of jassid was recorded in Novastar followed by (61.54 b) neem oil and (59.79 b) neem kernal powder. There was no significant different in effectiveness between neem oil and neem powder.

Aphid, *Aphis gossypii* Glover

The data in table-4 showed the population reduction of aphid after application of insecticides .Novastar showed the maximum pest mortality (>87%) 3 days after application, followed by neem oil (>79%) and neem powder (>77%). Effectiveness of all insecticides decreased at post treatment interval of 7 days. The results further depict that Novastar registered the highest aphid population reduction ranged in between (83.04-93.78%) followed by neem oil (77.49-80.83%) and neem powder (74.90-78.91%) after 3 days in all four sprays. The result further revealed that overall maximum reduction after four sprays (74.58 a) of aphid was recorded in Novastar followed by (66.51 b) neem oil and (61.46 b) neem kernal powder. There was no significant different in effectiveness between neem oil and neem powder.

Thrip, *Thrips tabaci* (Lindeman):

Table-5 showed the population reduction of thrips after application of insecticides. Novastar showed the maximum pest mortality (>82%) 3days after application, followed by neem oil (>67%) and neem powder (>72%). After three days the effectiveness of all insecticides gradually decreased. The results further depict that Novastar registered the highest thrip population reduction ranged in between (77.39-85.35 %) followed by neem oil (72.06-76.48 %) and neem powder (68.51-75.77 %) after 3 days in all four sprays. The result further revealed that overall maximum reduction after four sprays (66.48 a) of thrip was recorded in Novastar followed by (58.50 b) neem oil and (55.34 b) neem kernal powder. There was no significant different in effectiveness between neem oil and neem powder.

The data in Table-5 indicate those higher yields (660kgs) were recorded in Novastar plot followed by neem oil (580kgs) and neem powder (540kgs).

Discussion

In this study neem based insecticides were used to test their effectiveness compared to synthetic insecticide, Novastar against major sucking insect pests of Brinjal. Although Novastar showed maximum effectiveness but Neem oil was comparatively more effective than neem powder against sucking pests. The maximum activity of insecticides was observed 3-days after application. Insecticide activity was substantially reduced 7-days after application and there was almost 50% reduction in effectiveness 15 days after application. The neem based insecticides were comparatively less toxic to the sucking insect pests of brinjal compared with synthetic insecticide Novastar. Neem based insecticides are widely used in the pest management of insect pests of vegetables and other crops. There are many studies reported in literature on the use and the effectiveness of neem insecticides. Solsoly and Solsoly (1987) tested efficacy of 2% seed oil against insect pests of cotton and reported that leafhoppers and aphids were not adequately controlled by neem insecticide compared with check insecticides Metasysox R and Selecron 500. Lowery (1994) found application of neem seed oil effectively controlled several aphid species. It's antifeedant activity to strawberry aphid .*Chaetosiphon fragaefolii* was lost within 24 h following application. Efficacy of neem insecticide was variable, however, depending on the species of aphid instar, and host plants. Ahmed and Khan (1995) studied the comparative efficacy of neem oil against cotton sucking pests, whitefly, jassid and thrips compared with synthetic insecticides Tamaron and Polytrin- c .Neem oil gave encoring results but Tamaron and Polytrin-c showed the highest mortality of all three insect species. Srisivasan *et al* (2000) tested efficacy of neem products against leaf hopper, *Amrasca bigutella bigutella* on brinjal and for effective control of pest by neem insecticides. Bharaj and Sawant (2001) compared four neem products with dimethoate

for their efficacy against safflower aphid and found the lowest pest population in dimethoate treated plots followed by 1% neem oil. Durmusoglu *et al* (2003) determined efficacy of two commercial formulations of neem (neem Azal T/S and neem oil) against *Nezara viridula*. neem oil was more effective than neem Azal T/S. Zubair (2005) evaluated efficacy of bio pesticides in controlling jassid and cutworm on sugar beet compared with synthetic insecticide, Lorsban was most effective insecticide showing the highest mortality (93.4%) followed by bio-neem oil (79.16%) and neem powder (78.6). Kaleri *et al* (2011) conducted studies on the efficacy of bio pesticides against insect pests of okra .The maximum reduction of white fly was 54.48% of Hing followed by 39.18% on neem extract and 37.39% on neem oil. The maximum reduction percentage of thrips was 46.72% neem extract followed by 42.70% neem oil. The maximum reduction percentage of jassid was 57.33% on neem extract followed by 48.56% neem oil.

Conclusion

It is concluded from this study that all pesticides were effective up to 7- days of sprays. After 7- days of sprays, the pesticides degraded and lost their effect against all pests. Novastar recorded the maximum population reduction of all pests (whitefly, jassid, aphid, thrips) followed by Neem oil (1%) and Neem powder (2%). Maximum yield was recorded in Novastar treated plot.

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Conflict of interest declaration: The authors have declared that no conflicts of interests exist.

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Table-1 Area, Production and Productivity of Brinjal in Different Countries during 2005

Country	Area in Ha.	Production in Mt	Productivity in Kg/Ha
China	951,615	17,030,300	17,896
Egypt	43,000	1,000,000	23,255
India	510,000	8,200,000	16,078
Indonesia	43,012	252,216	5,863
Italy	12,619	373,635	29,608
Japan	12,000	395,000	32,916
Philippines	21,000	182,000	8666
Sudan	12,000	230,000	19,166
Thailand	12,000	68,000	5,666
Turkey	35,000	880,000	25,142
World	1,765,076	30,523,867	17,293

Table-2: Population Reduction Percentage of whitefly after application of insecticides on brinjal under field conditions.

1st Spray

Insecticide	3 days	7 days	14 days	average
Neem oil	80.00	62.91	40.29	61.06
Neem powder	76.64	60.87	34.82	57.44
Novastar	88.65	76.51	48.95	71.37

2nd spray

Insecticide	3 days	7 days	14 days	Average
Neem oil	73.21	61.96	35.98	57.05
Neem powder	70.09	56.30	31.91	52.77
Novastar	81.66	73.47	43.23	66.12

3rd spray

Insecticide	3 days	7 days	14 days	Average
Neem oil	80.93	67.59	42.42	63.64
Neem powder	79.14	65.92	39.12	61.39
Novastar	88.58	77.68	50.91	72.39

4th spray

Insecticide	3 days	7 days	14 days	Average
Neem oil	73.02	66.26	47.98	62.42
Neem powder	71.47	64.37	45.28	60.37
Novastar	83.34	77.72	55.87	72.31

Overall mean

Insecticide	1st spray	2nd spray	3rd spray	4th spray	Average
Neem oil	61.06	57.05	63.64	62.42	61.04 b
Neem powder	57.44	52.77	61.39	60.37	57.99 b
Novastar	71.37	66.12	72.39	72.31	70.54 a

Table-3: Population Reduction Percentage of jassid after application of insecticides on brinjal under field conditions.

1st spray

Insecticide	3 days	7 days	14 days	Average
Neem oil	78.82	66.00	45.42	63.41
Neem powder	77.59	63.76	41.94	61.09
Novastar	86.45	76.65	57.15	73.41

2nd spray

Insecticide	3 days	7 days	14 days	Average
Neem oil	72.14	63.83	47.94	61.30
Neem powder	70.15	61.64	45.2	58.99
Novastar	82.89	75.68	57.48	72.01

3rd spray

Insecticide	3 days	7 days	14 days	average
Neem oil	75.96	64.03	46.78	62.26
Neem powder	75.30	62.00	42.28	59.86
Novastar	86.16	75.90	62.42	74.82

4th spray

Insecticide	3 days	7 days	14 days	average
Neem oil	74.84	62.97	41.83	59.88
Neem powder	71.39	60.38	40.59	57.45

Novastar	86.05	77.90	52.22	72.05

Overall mean

Insecticide	**1st spray**	**2nd spray**	**3rd spray**	**4th spray**	**Average**
Neem oil	63.41	61.30	62.26	59.88	61.54 (b)
Neem powder	61.09	58.99	59.86	57.45	59.79 (b)
Novastar	73.41	72.01	74.82	72.05	73.08 (a)

Table-4: Population reduction percentage of aphid after application of insecticides on brinjal under field conditions.

1st spray

Insecticide	**3 days**	**7 days**	**14 days**	**Average**
Neem oil	80.83	68.59	50.83	66.75
Neem powder	78.91	64.14	46.85	63.30
Novastar	93.78	79.58	63.51	78.96

2nd spray

Insecticide	**3 days**	**7 days**	**14 days**	**average**
Neem oil	78.65	69.12	41.01	62.93
Neem powder	75.42	64.01	38.82	59.42
Novastar	83.04	74.24	50.92	69.40

3rd spray

Insecticide	**3 days**	**7 days**	**14 days**	**average**
Neem oil	77.49	71.02	54.38	67.63
Neem powder	74.90	68.88	52.68	65.49
Novastar	87.40	77.98	65.22	76.87

4th spray

Insecticide	**3 days**	**7 days**	**14 days**	**average**
Neem oil	79.89	72.92	53.42	68.74
Neem powder	77.12	65.66	45.25	62.67
Novastar	86.37	78.38	66.57	77.10

Overall mean

Insecticide	**1st spray**	**2nd spray**	**3rd spray**	**4th spray**	**Average**
Neem oil	66.75	62.93	67.63	68.74	66.51 b
Neem powder	63.30	59.42	65.49	62.67	61.46 b
Novastar	78.96	69.40	76.87	77.10	74.58 a

Table-5: Population reduction percentage of thrips after application of insecticides on brinjal under field conditions.

1st spray

Insecticide	3 days	7 days	14 days	average
Neem oil	74.02	60.00	40.83	58.28
Neem powder	69.19	58.91	39.23	55.77
Novastar	83.27	71.1	45.51	66.63

2nd spray

Insecticide	3 days	7 days	14 days	average
Neem oil	76.48	65.00	49.97	63.82
Neem powder	75.77	60.71	48.51	61.66
Novastar	83.98	74.99	58.74	72.57

3rd spray

Insecticide	3 days	7 days	14 days	average
Neem oil	75.07	60.82	33.46	56.45
Neem powder	74.76	58.69	31.57	55.01
Novastar	85.35	68.65	41.64	65.21

4th spray

Insecticide	3 days	7 days	14 days	average
Neem oil	72.06	57.84	36.47	55.45
Neem powder	68.51	48.32	29.89	48.90
Novastar	77.39	62.92	44.21	61.50

Overall mean

Insecticide	1st spray	2nd spray	3rd spray	4th spray	Average
Neem oil	58.28	63.82	56.45	55.45	58.50 (b)
Neem powder	55.77	61.66	55.01	48.90	55.34 (b)
Novastar	66.63	72.57	65.21	61.50	66.48 (a)

Fig-1 Photographs showing efficacy of neem oil and neem kernel powder against brinjal insect pests under field conditions