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Short Communication

Non-chemical management of shoot and fruit borer (*Leucinodes orbonalis* Guenee) on brinjal

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Brinjal (*Solanum melongena* Linn.) is an important vegetable crop grown all over the country in different types of soil. Brinjal shoot and fruit borer (*Leucinodes orbonalis* Guen.) is most important, noxious and typical cosmopolitan pest causing serious damage to brinjal cultivation and limits the yield to very low level. The affected growing point is damaged and showed typical drooping symptom, whereas, affected fruits showed holes and fetch less price in the market. The increasing concern for environmental safety and global demand for pesticide residue free food has evoked keen interest in pest control through eco-friendly plant products which are easily biodegradable and do not leave any harmful toxic residues besides conserving natural enemies.

Field experiment was conducted at Horticultural Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during *kharif* 2012. The brinjal seedlings of *var.* GOB-1 were transplanted in the plots of 3m × 3m size at 75cm × 60cm plant spacing. There were eight treatments including control and each treatment was replicated four times. All the crop management practices except the insecticide applications were followed to maintain healthy crop growth. Spraying was done late in the afternoon with high volume knapsack sprayer. Total three sprays were applied at 15 days interval when initial damage of *L. orbonalis* Guen. was started commencing 35 days after transplanting. Observations were recorded on infested shoots and fruits from five randomly selected plants from each treatment plots before as well as 7 and 14 day after each spray. The fruit damage on number as well as weight basis was observed during each picking by counting the total healthy as well as infested fruits to work out the per cent fruit infestation. The data recorded from the field were subjected to statistical analysis. To find out an effective and economical control of shoot and fruit borer incremental cost benefit ratio was worked out for each treatment. Yield increase over control was calculated by yield of treatment minus yield of control and per cent yield increased over control was calculated by yield of treatment minus yield of control divided by yield of treatment into one hundread.

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RESULTS AND DISCUSSION

The data presented in Table 1 shows that the seven days after first application T_3 (11.66%) was found significantly more effective in recording lowest mean percentage of shoot infestation and was at par with T_5 (16.25%). Fourteen days after first application T_5 (10.69%) recorded significantly lower shoot borer infestation and were as effective as T_6 (12.66%), T_3 (13.73%), T_7 (13.98%), T_2 (15.08%) and T_1 (14.88%) in reducing the shoot borer infestation. Control plot recorded significantly highest shoot borer infestation (23.25%).

Seven days after second application of treatment, T_5 (8.69%) recorded significantly lower shoot infestation which was at par with T_1 (10.88%), T_3 (11.00%) and T_6 (11.02%), respectively. Fourteen days after second application of treatment, T_5 recorded significantly the lowest shoot infestation (5.89%) and was at par with T_3 (7.54%). However, control plot recorded significantly highest shoot infestation (16.50%).

Table 1 Effect of various non-chemical treatments against the infestation of *L. orbonalis* on brinjal

Treatment	Mean per cent damage of shoot								Mean per cent damage of fruit	
	1 DBS	1st spray		2nd spray		3rd spray		Pooled of three spray	Number base	Weight base
		7 DAS	14 DAS	7 DAS	14 DAS	7 DAS	14 DAS			
T_1 - Green Chilli extract 5%	22.99	27.09	22.69	19.26	17.32	14.82	13.73	19.15	22.73	22.46
	(15.25)	(20.74)	(14.88)	(10.88)	(8.86)	(6.54)	(5.63)	(10.76)	(14.93)	(14.60)
T_2 - Garlic bulb extract 2%	22.97	27.53	22.85	20.64	17.89	15.87	14.72	19.92	25.38	24.91
	(15.23)	(21.36)	(15.08)	(12.43)	(9.44)	(7.48)	(6.46)	(11.61)	(18.37)	(17.74)
T_3 - Infested shoot and fruit pruned at weekly interval	22.33	19.97	21.75	19.37	15.94	13.88	12.34	17.21	21.23	21.30
	(14.44)	(11.66)	(13.73)	(11.00)	(7.54)	(5.75)	(4.57)	(8.75)	(13.11)	(13.20)
T_4 - Tobacco decoction 1.5%	23.16	26.39	25.09	21.86	19.12	16.83	14.73	20.67	23.99	23.25
	(15.47)	(19.76)	(17.98)	(13.86)	(10.73)	(8.38)	(6.47)	(12.46)	(16.53)	(15.58)
T_5 - Neem oil 0.5%	23.21	23.77	19.09	17.14	14.04	12.01	11.08	16.19	18.07	17.70
	(15.53)	(16.25)	(10.69)	(8.69)	(5.89)	(4.33)	(3.69)	(7.77)	(9.62)	(9.24)
T_6 - NSKE 5%	22.03	26.01	20.84	19.39	16.95	14.83	13.52	18.59	22.36	21.95
	(14.07)	(19.23)	(12.66)	(11.02)	(8.50)	(6.55)	(5.47)	(10.16)	(14.47)	(13.97)
T_7 - Bt formulation @ 1.5g/lit water	21.23	25.35	21.96	21.34	19.41	16.61	14.88	19.93	24.10	24.05
	(13.11)	(18.33)	(13.98)	(13.24)	(11.04)	(8.17)	(6.59)	(11.62)	(16.67)	(16.61)
T_8 - Control	23.34	33.24	28.83	25.92	23.97	20.50	18.33	25.13	32.11	31.72
	(15.69)	(30.05)	(23.25)	(19.11)	(16.50)	(12.26)	(9.89)	(18.03)	(28.25)	(27.64)
S. Em.±	0.82	1.48	1.48	0.94	0.75	0.73	0.68	0.43	0.94	0.98
C. D. at 5%	N.S.	4.36	4.37	2.76	2.20	2.16	2.00	1.20	2.76	2.89
C. V. %	7.23	11.33	12.97	9.09	8.28	9.37	9.61	10.90	7.91	8.38

Table 2 Effect of various non-chemical treatment on the yield of marketable fruits of brinjal

Treatments	Yield of marketable fruits (Q/ha)	Yield increase over control (Q/ha)	Percent increase over control
T_1 - Green chilli extract 5%	351.62	75.20	21.39
T_2 - Garlic bulb extract 2%	321.40	44.98	14.00
T_3 - Infested shoot and fruit pruned at weekly interval	381.65	105.23	27.57
T_4 - Tobacco decoction 1.5%	332.52	56.10	16.87
T_5 - Neem oil 0.5 %	402.80	126.38	31.37
T_6 - NSKE 5%	364.43	88.01	24.15
T_7 - Bt formulation @ 1.5g/lit water	339.41	62.99	18.56
T_8 - Control	276.42	----	----
S. Em.±	13.42	----	----
C. D. at 5%	39.49	----	----
C. V. %	7.75	----	----

Seven days after third application of non-chemical treatments T_5 recorded significantly lowest shoot infestation of 4.33 per cent being at par with T_3 (5.75%). Fourteen days after third application of non-chemical treatments T_5 recorded significantly lowest shoot infestation of 3.69 per cent and was at par with T_3 (4.57%). All other treatments were effective to reduce shoot infestation than control plot (9.89%), respectively.

The data on shoot damage pooled over three spray presented in Table 1 revealed that all non-chemical treatments recorded significantly lower damage (7.77% to 12.46%) than control (18.03%). The non-chemical treatment T_5 recorded significantly lowest shoot infestation (7.77%) which was at par with T_3 (8.75%). All other treatments were effective to reduce shoot infestation than control plot (18.03%) where highest shoot infestation observed. Similar results have been shown by Murugesan and Murugesh (2009) and Mathur *et al.*, (2012).

The data presented in Table 1 revealed that treatment T_5 was significantly superior to other treatments which recorded lowest percentage (9.62%) of fruit infestation. Among the other treatments T_3 (13.11%) was found more effective in reducing fruit infestation on number basis being at par with T_6 (14.47%), T_1 (14.93%), T_4 (16.53%), whereas control plot recorded lowest percentage fruit damage of (28.25%), respectively.

The data on damaged fruits on weight basis in different treatments (Table 1) indicated that the treatment T_5 was recorded the lowest infestation (9.24%) and proved significantly superior to the rest of the treatments. The next effective treatments were T_3 (13.20%), T_6 (13.97%), T_1 (14.60%) and T_4 (15.58%) which were at par with one another. However, control plot recorded significantly highest per cent fruit infestation (27.64%) on weight basis. Similar results have been reported by Sasikala *et al.*, (1999) and Kardale *et al.*, (2010).

The data on fruit yield harvested from the different treatments presented in Table 2 revealed that the highest (402.80 Q/ha) fruit yield was harvested in T_5 and was at par with T_3 (381.65 Q/ha) and T_6 (364.43 Q/ha). However control plot recorded significantly lowest fruit yield 276.42 Q/ha, respectively.

The increase in fruit yield over control was also worked out and presented in Table 2 revealed that the maximum yield increased over control was recorded in the plots treated with neem oil 0.5 per cent (126.38 Q/ha) while minimum in plot treated with garlic bulb extract 2 per cent(44.98 Q/ha), respectively. Maximum increase in yield over control was recorded in neem oil 0.5 per cent, while minimum in garlic bulb extract 2 per cent. Similar

Table 3 Economics of various non-chemical treatments used for control of *L. orbonalis* infesting brinjal

Treatments	Quantity of insecticides for three applications (lit or kg/ha)	Cost of applied treatments (₹/ha)	Cost of labour (₹/ha)	Total cost of plant protection for three applications (₹/ha)	Yield (q/ha)	Gross realization (₹/ha)	Net realization over control (₹/ha)	Net profit (₹/ha)	ICBR
1	2	3	4	5	6	7	8	9	10
T_1 - Green chilli extract 5%	75 kg	2250	1080	3330	351.62	421944	90240	88020	1:26.43
T_2 - Garlic bulb extract 2%	30 kg	1050	1080	2130	319.19	383028	51324	49854	1:23.41
T_3 - Infested shoot and fruit pruned at weekly interval	----	----	4320	4320	381.65	457980	126276	124116	1:28.73
T_4 - Tobacco decoction 1.5%	22.5 kg	1237	1080	2317	332.52	399024	67320	66150	1:28.54
T_5 - Neem oil 0.5%	7.5 lit	3450	720	4170	402.80	483360	151656	149286	1:35.80
T_6 - NSKE 5%	75 kg	2250	1080	3330	364.43	437316	105612	104517	1:31.39
T_7 - *Bt* formulation @ 1.5	2.25 kg	2673	720	3339	339.41	407292	75588	74200	1:22.28
T_8 - Control	----	----	----	----	276.42	331704			

Note: - Labour charge: ₹ 120.00/labour/day (Two labours per hectare required for one spray and one laboure required for preparation of material before each spray)

Market price of fruit yield: ₹ 1200/quintal

1. Chilli: ₹ 30.00/kg.
2. Garlic: ₹ 35.00/kg
3. Tobacco leaf powder: 55.00/kg
4. Neem oil: 460.00/lit
5. Dry Neem seed: ₹ 30.00/kg
6. Halt: ₹ 297.00/ 250 gm
7. Laboure required for infested shoot pruning: 6 no. /week

results have been reported by Adiroubane and Raghuraman (2008) and Kardale *et al.* (2010).

The data presented in Table 3 concluded that the highest incremental cost benefit ratio (ICBR) was in the treatment T_5 (1:35.80) followed by T_6 (1:31.39), T_3 (1:28.73), T_4 (1:28.54), T_1 (1:26.43), T_2 (1:23.41) and T_7 (1:22.28), respectively. The similar results have reported by Kardale *et al.*, (2010) and Mathur *et al.*, (2012).

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