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Effect of pongamia cake, neem cake and vermicompost on sucking insect pests of chilli

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Abstract
The present experiment was conducted to assess the effectiveness of neem cake, vermicompost and pongamia cake on the activity of chilli thrips (*Scirtothrips dorsalis* Hood) and mite (*Polyphagotarsonemus latus* Banks) under field condition at Main Agricultural Research station University of Agricultural sciences, Raichur during 2014 -15. The results indicated that crop amended at planting with neem cake (250 kg/ha) and vermicompost (1t/ha) were effective in keeping the sucking pests density in check, being comparable to recommended insecticides. At 15th DAT blanket application with fipronil and dicofol and at 30th DAT second spray with fenpyroximate and spinosad. Similar trend of efficacy of organics was seen in managing leaf curl manifestations too. Significantly highest red chilli yield was registered in the crop receiving neem cake at 250 kg/ha (10.42 q/ha). This was followed by vermicompost at 1t/ha (10.12 q/ha). Untreated crop yielded significantly lowest at 6.73 q/ha red chillies**.** The research highlights the utility of organics in managing sucking pests of byadagi chilli that has potential export value.

Keywords: Neem cake, vermicompost, *Polyphagotarsonemus latus*, *Scirtothrips dorsalis,* leaf curl

Introduction
In India, chilli is grown in almost all the states. Andhra Pradesh is the largest producer of chilli in India contributing to about 30 per cent to the total area and 50 per cent of the production followed by Karnataka (20% area and 10% production), Orissa (9%), Tamil Nadu (8%), Maharashtra (15%) and other States contributing 18 per cent of the area Anon., 2012 [1].
Although, the crop has got greater export potentialities besides huge domestic requirement, a number of limiting factors have been attributed for low productivity. Among them occurrence of viral diseases as well as ravages caused by insect pests are significant ones. The pest spectrum of chilli crop is complex with more than 293 insects and mite species debilitating the crop in the field as well as in storage. Amongst these, aphids, *Myzus persicae* Sulzer; *Aphis gossypii* Glover; thrips, *Scirtothrips dorsalis* Hood; yellow mite, *Polyphagotarsonemus latus* Banks and fruit borer, *Helicoverpa armigera* (Hubner) are the most vital production constraints. A total of 39 to 57 insect pests were recorded in Karnataka on nursery and field condition, respectively Reddy and Puttaswamy, 1983 and 1984. [20, 21] The yield loss caused by thrips (*S. dorsalis*) and mites (*P. latus*) was more than 90 per cent in Karnataka and 34.14 per cent in Tamil Nadu, respectively Dhandapani *et al.,* 2003 [4]. Thrips and mites desap chilli crop resulting leaf curling, petiole elongation (murda) in presence of viral diseases, most of the time. Puttarudraiah 1959 [16] reported the involvement of thrips and mites in most cases and viruses in rare cases, as the cause of the murda complex in Karnataka. However, reports on vector transmission of leaf curl are quite contradictory because of complexities and several types of chilli viruses Bidari, 1982 [3] Ravi, 1991 [19], though recent information indicated significant role of viruses transmitted by aphids, whiteflies besides direct damage by thrips and mites feeding Giraddi and Verghese, 2007 [6] Gundannavar and Giraddi, 2013 and 2014 [9, 10].
Keeping these points and facts in view, the following objectives were framed for studies on the management of sucking pests of chilli in the present investigation.
1. To assess the effectiveness of soil application of plant cakes against chilli thrips and mites.

Materials and method
The present experiment was conducted under field condition at Main Agricultural Research Station, University of Agricultural Sciences, Raichur during 2014-15 in order to assess the effectiveness of soil application of plant cakes (250 kg ha-1) was done in a block of 336 square

meter area for each treatment. A control was maintained without application of organic amendments. 30 to 35 days old seedlings were transplanted in the main field with a spacing of 90 × 15 cm between rows and plants, respectively with a plot size of 4.5 × 1.2 m2 in a randomized complete block design (RCBD) consisting of nine treatments and replicated thrice.

The organic amendments selected for the present study are listed in Table 1.

Table 1: List of organics tested for their efficacy against thrips and mites

S. No.	Treatment combination
1	Pongamia cake + Need based insecticide and acaricide application with best oil
2	Neem cake + Need based insecticide and acaricide application with best oil
3	Vermicompost + Need based insecticide and acaricide application with best oil
4	Control with need based insecticide and acaricide application with best oil

Leaf curl index (LCI) was worked out in 0-4 scale as suggested by Niles 1980 and yield (q ha-1) was recorded for each treatment as dried chillies.

Scoring was done thrice and averaged. In case of organic treatments, scoring was done at 50 per cent flowering, 80 and 100 days after transplanting. In case of insecticides/ oil + acaricidal sprays, it was done at 50 per cent flowering, 70 (after first spray), 100 (after second spray) and 130 (after third spray) days after transplanting.

Result and discussion

Among the organics evaluated, neem cake (250 kg/ha) and vermicompost (1t/ha) application kept the thrips and mite density at significantly lowest level means at 1.9 thrips/leaf and 7.20 mites/leaf, respectively, being comparable untreated control 7.14 thrips/leaf and 12.88 mites/leaf that received chemical interventions.

Table 2: Influence of plant cakes and vermicompost on the activity of chilli thrips

S. No.	Treatments*	Number of thrips/ leaf									
		1 week (45 DAT)	2 week (53 DAT)	3 week (59 DAT)	4 week (66 DAT)	5 week (73 DAT)	6 week (80 DAT)	7 week (87 DAT)	8 week (94 DAT)	9week (101 DAT)	Average
1	Pongamia cake @ 250 kg/ha	6.40^{b} (2.63)	5.77^{c} (2.50)	5.50^{b} (2.45)	3.43^{c} (1.98)	2.70^{c} (1.79)	2.63^{c} (1.77)	2.37^{c} (1.69)	1.23^{c} (1.32)	0.83^{b} (1.15)	3.43^{c} (1.92)
2	Neem cake @ 250 kg/ha	4.70^{a} (2.28)	4.47^{a} (2.23)	2.77^{a} (1.81)	1.41^{a} (1.30)	1.27^{a} (1.29)	1.17^{a} (1.29)	0.97^{a} (1.21)	0.33^{a} (0.91)	0.33^{a} (0.91)	1.93^{a} (1.47)
3	Vermicompost @ 1 t/ha	4.67^{a} (2.27)	4.57^{a} (2.25)	4.53^{b} (2.24)	2.63^{b} (1.77)	1.87^{b} (1.54)	1.83^{b} (1.53)	1.80^{b} (1.52)	0.60^{b} (1.05)	0.30^{a} (0.89)	2.53^{b} (1.67)
4	Control	6.50^{d} (2.65)	6.47^{d} (2.64)	6.27^{d} (2.60)	7.43^{a} (2.82)	10.37^{c} (3.30)	10.50^{d} (3.32)	14.10^{d} (3.82)	1.67^{d} (1.47)	1.03^{c} (1.24)	7.14^{d} (2.65)
S.EM±		0.04	0.03	0.09	0.03	0.04	0.05	0.02	0.03	0.03	0.04
CD @ 5%		0.15	0.12	0.30	0.12	0.13	0.16	0.07	0.11	0.10	0.14

Figures in parentheses are $\sqrt{x+0.5}$ values

Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05)

* Need based application of insecticide/ acaricides along with basal application of plant cakes and vermicompost

Table 3: Influence of plant cakes and vermicompost on the activity of chilli mite

S. No.	Treatments*	Number of mites/ leaf								
		1 week** (45 DAT)	2 week (53 DAT)	3 week (59 DAT)	4 week (66 DAT)	5 week (73 DAT)	6 week (80 DAT)	7 week (87 DAT)	8 week (94 DAT)	Average
1	Pongamia cake @ 250 kg/ha	26.07^{b} (5.15)	5.73^{b} (2.88)	4.47^{c} (2.23)	4.23^{c} (2.18)	3.87^{c} (2.09)	3.87^{c} (2.09)	3.83^{c} (2.08)	3.83^{c} (2.08)	10.09^{c} (2.91)
2	Neem cake @ 250 kg/ha	22.70^{a} (4.82)	4.43^{a} (2.22)	3.20^{a} (1.92)	3.13^{a} (1.91)	2.17^{a} (1.63)	2.17^{a} (1.63)	2.13^{a} (1.62)	2.07^{a} (1.60)	7.20^{a} (2.46)
3	Vermicompost @ 1 t/ha	27.07^{c} (5.25)	6.37^{c} (2.62)	4.13^{b} (2.15)	4.07^{b} (2.14)	3.40^{b} (1.97)	3.37^{b} (1.97)	3.47^{b} (1.99)	3.37^{b} (1.97)	9.15^{b} (2.81)
4	Control	33.27^{d} (5.81)	5.79^{d} (2.50)	5.80^{d} (2.51)	6.27^{d} (2.60)	6.37^{d} (2.62)	6.43^{d} (2.63)	6.43^{d} (2.63)	7.90^{d} (3.16)	12.88^{d} (3.36)
S.EM±		0.06	0.13	0.05	0.04	0.03	0.03	0.03	0.03	0.05
CD @ 5%		0.20	0.46	0.17	0.14	0.10	0.12	0.10	0.10	0.19

Figures in parentheses are $\sqrt{x+0.5}$ values

Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05)

* Need based application of insecticide/ acaricides along with basal application of plant cakes and vermicompost

Table 4: Leaf curl index as influenced by chilli thrips and mite feeding

S. No.	Treatments	Leaf curl index			
		At 50% flowering	At 80 DAT	At 100 DAT	Average
1	Pongamia cake @ 250 kg/ha	0.57	1.06[b]	1.00[b]	0.88[b]
2	Neem cake @ 250 kg/ha	0.33	0.56[a]	0.40[a]	0.43[a]
3	Vermicompost @ 1 t/ha	0.53	1.00[b]	0.53[ab]	0.69[ab]
4	Control	0.93	2.18[c]	1.87[c]	1.66[c]
	S.Em±	-	0.02	0.08	0.08
	CD @ 5%	NS	0.08	0.24	0.24

DAT - Days after transplanting
NS - Non- significant
Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05)

Table 5: Dry chilli yield, net returns and benefit cost ratio as influenced by application of plant cakes and vermicompost

S. No.	Treatments	Cost of cultivation (ha^{-1})	Cost of basal application of plant cakes and vermin compost (ha^{-1})	Total cost of cultivation (ha^{-1})	Dry chilli yield (q/ha)	Gross returns (q^{-1})	Net returns (ha^{-1})	B:C ratio	Incremental returns (ha^{-1})	Incremental cost (ha^{-1})	ICBR
1	Pongamia cake @ 250 kg/ha	27000	5000	32000	9.70	97000	65000	3.03	29700	7000	4.24
2	Neem cake @ 250 kg/ha	27000	7000	34000	10.42	104200	70200	3.16	36900	9000	4.10
3	Vermicompost @ 1 t/ha	27000	6000	33000	10.12	101200	68000	3.06	33900	8000	4.24
4	Control	25000	0.00	25000	6.73	67300	42300	2.69	0.00	0.00	0.00

*Price:Rs.10000/quintal

Leaf curl index is the ultimate manifest symptom of mite ravage. At 50 per cent flowering of the crop, all the treatments recorded lower leaf curl index (LCI) including control that were statistically on par with each other (Table 4) while, at 80 DAT, neem cake recorded the least leaf curl index (0.56), while the treatment vermicompost and pongamia cake leaf curl were on par with each other (1.00 and 1.06). The untreated control recorded higher leaf curl index (2.18). At 100 DAT neem cake recorded the least leaf curl index (0.40) and was on par with vermicompost (0.53) followed by pongamia cake (1.00). Untreated control recorded highest leaf curl index of (1.87). The same trend was observed for means of curl index with mean value also. But all the treatments were significantly superior to untreated control in recording less leaf curl index.

The yield is the ultimate parameter to determine the effectiveness of treatments. Superior dry chilli yield was noticed in treatments incorporated with neem cake and vermicompost (10.42 and 10.12 q/ ha) respectively with benefit cost ratio of 3.16 being on par with each other, followed by pongamia cake that recorded 9.70 quintal per hectare while, untreated control recorded 6.73 quintal per hectare with a benefit cost ratio of 2.69.

The data on mite population as influenced by different organics indicated that the treatment neem cake proved to be superior with least mite population. The reduction observed in the pest density on the crop treated with vermicompost and neem cake could be attributed to changed biochemistry of the plant due to organic nutrition, which would probably make plant system defensive against pest infestation. There are no reports on the effect of vermicompost or neem cake solely (without NPK fertilizers) on pest activity. Varma and Supare 1997 [28] and Varghese 2003 [27] with low NPK observed significantly lower activity of thrips and mites in chilli amended with vermicompost and the present study is in close agreement with these reports. Similar effects of vermicompost were also reported by Ramesh 2000 in managing leafhopper and thrips damage to groundnut crop, Surekha and Arjunarao 2000 [23] against aphids and leafhoppers in bhendi. Altered biochemistry and enzyme activity has been reported to be the cause of induced resistance in soybean receiving organic nourishment Jinsa *et al.*, 2012 [11].

Several authors have reported the role of neem cake in managing the sucking pests in chilli. The superior effect of neem cake in the present study is in line with the findings of Giraddi and Smitha 2004 [5] as they found that neem cake at 200 kg per ha and 50 per cent RDF recorded significantly less mite population in chilli. Identical results were also obtained by Varghese and Giraddi 2005 [26] who reported that neem cake at 500 kg per ha along with 50 per cent RDF (NPK) in combination with two and three sprays of RPP (dimethoate 30 EC and dicofol 18.5 EC) was superior in having least population of thrips and mite which ultimately resulted in reduction of chemical interventions in crop ecosystem. Similar effects of neem cake was reported in chilli by Mallikarjuna Rao and Ahmed 1986 [12] against chilli thrips, Mallikarjuna *et al.* 1999 [13] against chilli aphids and Giraddi *et al.* 2003 [7] versus thrips and mites in chilli.

In other crop ecosystems also, the efficacy of neem cake in bringing down the pest populations was on record *viz.*, Tandon and Lal 1980 against sucking pests on mango, Saxena *et al.* (1984) [22] on BPH in rice, Thulaseedharan 1988 [25] in cotton in reducing the incidence of leaf hoppers, aphids, whiteflies and mites; Rajendran 1993 [17] in okra against spider mites, leaf hoppers, aphids and whiteflies, Balasubramanian and Muralibhaskaran 2000 [2] in managing leaf hoppers, aphids, thrips and whiteflies in cotton; Godase and Patel 2001 [8] against aphids in brinjal. Manu 2005 [14] also found that the neem cake at 500 kg per ha recorded lower population of thrips, aphids and white flies on cotton.

Conclusion

From the results obtained in the present investigation following conclusions are made

- Among the organics and cakes, neem cake application to soil resulted in effective suppression of thrips and mites infesting chillies, followed by vermicompost application.

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