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Effect of nitrogen sources on Whitefly, *Bemisia tabaci* Genn. In Chilli, *Capsicum annuum* L.

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Abstract
The effect of nitrogen sources on whitefly, *Bemisia tabaci* Genn. in chilli, *Capsicum annuum* L. were conducted at S.K.N. College of Agriculture, Jobner, Rajasthan during *Zaid*, 2014 and 2015. The different sources of nitrogen the treatments were T_4 100% N through NC, T_3 75% N through NC + 25% through urea, T_8 100% N through VC and T_7 75% N through VC + 25% through urea resulted in the population of 3.82 to 4.08 whitefly/ three leaves were found most effective against the pest and the maximum fruit yield of chilli, *C. capsicum* was also obtained in these treatments, while the treatments of T_{10} 50% N through FYM + 50% through urea and T_9 25% N through FYM + 75% through urea was found least effective.

Keywords: Nitrogen sources, chilli, *Capsicum annuum* L. Whitefly, *Bemisia tabaci* Genn

Introduction

Chilli, *Capsicum annuum* L. belongs to the family Solanaceae is an important spice cum vegetable crop commonly used in Indian dietary. It is grown throughout the year as a cash crop and used in green and red ripe dried stage for their pungency, colour and other ingredients in all culinary preparations of rich and poor alike to impart taste, flavour and colour. Nutritionally, it is a rich source of vitamin A, B and C. Capsaicin is an alkaloid responsible for pungency in chillies has medicinal properties and it prevents heart attack by dilating the blood vessels (Gill, 1989) [7]. India is the largest consumer and exporter of chilli in the world with a production of 1492 million tonnes from an area of 775 thousand hectares during 2014 (Anonymous, 2014) [3]. In India, it is intensively cultivated in Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Rajasthan and in hilly areas of Uttar Pradesh (Ratnakumari *et al*., 2001) [16]. In Rajasthan, it is cultivated in an area of 12.21 thousand hectares with an annual production of 17.71 million tonnes (Anonymous, 2013) [2]. The major chilli growing districts of Rajasthan include Jodhpur, Swai Madhopur, Pali, Jalore, Bhilwara, Jaipur, Ajmer, Tonk, Udaipur and Bharatpur.

The chilli crop is attacked by a number of insect-pests right from germination to harvest of the crop, out of them whitefly is a major sucking insect pests, responsible for low productivity, reduce up to 50 per cent yield (Ahmed *et al*., 1987) [1]. This pest causes serious damage to chilli crop by direct feeding and transmits deadly chilli leaf curl disease. Both the adults and nymphs of whitefly suck the cell sap from tender regions and cause leaves to shrivel. In case of severe infestation, there is malformation of leaves, buds and fruits, which may damage about half of the crop. The attacked plants are stunted and may finally dry up.

In the last few decades, awareness of health consciousness lead to organically produced food stuffs. The tremendous demand for organically produced food has led to the creation of new export avenues for developing countries. Organic farming is a holistic production management system which involves the use of organic manures, botanical pesticides and biological pest control strategies which can act as an alternative to the costlier, non-eco-friendly and energy intensive chemical inputs. Keeping these points in view in the present field experiments was conducted to evaluate the effect of nitrogen sources against whitefly in chilli, *C. capsicum* crops.

Material and Methods

The experiment was laid out in a Randomized Block Design (RBD) with fourteen treatments including standard check and untreated control, each replicated thrice. The plot size was 2.25 x 1.50 m^2 keeping row to row and plant to plant distance of 45 and 30 cm, respectively. The chilli variety 'RCH-1' (recommended for this region) was used for the experiment. The recommended packages of practices were followed to raise the crop at S.K.N. College of

Agriculture, Jobner, Rajasthan during *Zaid*, 2014 and 2015. The observations on population of whitefly were recorded on three leaves of chilli at top, middle and bottom canopy from five randomly selected and tagged plants in each plot. The population was counted visually or by using magnifying lens in early morning hours (Bhede *et al*., 2008) [5]. The observations initiating from 30 days after transplanting at two weeks interval. The yield of green chilli per plot was also recorded and converted into q/ha. The mean data of whitefly population and fruit yield were statistically analysed. The data of population of whitefly were transfer in to √x+0.5 values for analysis.

Result and Discussion

In the present study fourteen combinations of nitrogen sources including standard check and untreated control, were evaluated against whitefly in chilli crop. Among the different combinations of nitrogen sources tested against the whitefly of chilli, all the combinations were found significantly superior over untreated control in reducing the population of whitefly, however they were inferior to standard check *i.e.* alternate sprays of dimethoate 30EC/ Oxydemeton-methyl 25EC + recommended FYM and NPK in POP (0.58/three leaves). The minimum population of whitefly was recorded in the treatments of T_4 (100% N through NC), T_3 (75% N through VC + 25% through urea), T_8 (100% N through VC) and T_7 (75% N through VC + 25% through urea) resulted in 3.82, 3.91, 4.00 and 4.08 whitefly per three leaves which were proved most effective and at par with each other. However, these treatments were significantly inferior to the standard check. The treatments *viz.*, T_{12} comprising 100% N through FYM (4.86/ three leaves), T_2 comprising 50% N through NC + 50% through urea (5.34/ three leaves), T_6 comprising 50% N through VC + 50% through urea (5.43/ three leaves), T_{11} comprising 75% N through FYM + 25% through urea (5.52/ three leaves), T_1 comprising 25% N through NC + 75% through urea (5.59/ three leaves) and T_5 comprising 25% N through VC + 75% through urea (5.65/ three leaves) were found moderately effective, while T_9 comprising 25% N through FYM + 75% through urea (6.66/ three leaves) and T_{10} comprising 50% N through FYM + 50% through urea (6.16/ three leaves) were found least effective in reducing the population of whitefly. The maximum yield of chilli fruits was also obtained in the treatment of T_4 (100% N through NC), T_3 (75% N through VC + 25% through urea), T_8 (100% N through VC) and T_7 (75% N through VC + 25% through urea) exhibited in 86.52, 84.79, 83.85 and 82.54 q/ha whereas, minimum was obtained in the treatment of T_9 comprising 25% N through FYM + 75% through urea (62.57 q/ha) and T_{10} comprising 50% N through FYM + 50% through urea (63.61 q/ha).

The descending order of effectiveness of different treatments on the basis of pooled data was T_{13} (standard check), T_4 (100% N through NC), T_3 (75% N through VC + 25% through urea), T_8 (100% N through VC), T_7 (75% N through VC + 25% through urea), T_{12} (100% N through FYM), T_2 (50% N through NC + 50% through urea), T_6 (50% N through VC + 50% through urea), T_{11} (75% N through FYM + 25% through urea), T_1 (75% N through FYM + 25% through urea), T_5 (25% N through VC + 75% through urea), T_{10} (50% N through FYM + 50% through urea) and T_9 (25% N through FYM + 75% through urea).

Singh *et al*. (2006) [18] recorded lowest whitefly population in the reatment of neem cake + normal P and double K; which were at par with vermicompost Gundannavar and Giraddi (2013) [11] reported split application of neem cake and vermicompost at transplanting was found to be the most effective treatment is conformity with the present result. Sudhakar *et al.* (1998) [19] recorded lowest whitefly population in the treatments of neem cake and vermicompost on brinjal crop are agreement with the present findings. Balasubramanian and Muralibhaskaran (2000) [4] observed that basal application of neem cake 250 kg ha^{-1} and 45 N kg ha^{-1} was effective in reducing the whitefly population on cotton crop also in agreement with the present results. However, no much work was found on whitefly in chilli, so the chilli thrips work were used to discussed the present result. Verma and Supare (1997) [23] recorded least thrips incidence in the plots applied with half dose of NPK + half dose of FYM + full dose of vermicompost, corroborate the present finding. Mallikarjuna Rao *et al.* (1998) [15] reported that application of neem cake @ 500 kg ha^{-1} to soil reduced the thrips population support the finding. Sashidhra (1999) [17] also reported that organic sources like FYM and vermicompost reduced the sucking pest population in chilli corroborate the present result. Giraddi *et al.* (2003) [10] found combined applications of neem cake (500 kg ha^{-1}) with 50 per cent RDF significantly lowered thrips population support the present finding. Giraddi and Verghese (2007) [9] also reported that crop amended at planting with neem cake (1000 kg ha^{-1}) and vermicompost (2500 kg ha^{-1}) were effective in keeping the thrips density in check, being comparable to recommended insecticides fully support the present result. The present findings are in agreements with those of Ukey *et al*. (2001) [20], Linappa *et al*. (2002) [13], Mallapur *et al*. (2003) [14], Varghese (2003) [22], Giraddi and Smitha (2004) [8], Varghese and Giraddi (2005) [21], George and Giraddi (2007) [6] and Gundannavar *et al*. (2007) [12].

The probable reasons of lower population of thrips and whitefly in the crop amended with organics could be attributed by possible changes in the biochemistry of the plant, in terms of bio-chemical substances and enzyme activity. Besides reduction in application rates of NPK fertilizers they also known to reduce the succulency of the foliage, might be the other cause of low incidence of sucking insect pests (Giraddi *et al*., 2003 and Giraddi and Smitha, 2004) [10, 8] which confirm the present results. Neem cake, vermicompost and farm yard manure improve physical properties of soil, provide all essential nutrients to plants besides nitrogen, neem cake also have insecticidal properties and they increase beneficial microbes in soil. The incidence of sucking insect pest in crops were comparatively less in healthy plants in the fertile soil.

Conclusion

It is concluded that the different sources of nitrogen the treatments T_4 of 100% N through NC, T_3 of 75% N through NC + 25% through urea, T_8 of 100% N through VC and T_7 of 75% N through VC + 25% through urea resulted in the population of 3.82 to 4.08 whitefly/ three leaves were found most effective against the pest and the maximum fruit yield of chilli was also obtained in these treatments, while the treatments T_{10} 50% N through FYM + 50% through urea and T_9 25% N through FYM + 75% through urea was found least effective.

Table 1 Effect of nitrogen sources on whitefly, *Bemisia tabaci* Genn. in chilli crop during *Zaid*, 2014, 2015 and pooled

S. No.	Treatments	Thrips population/ three leaves			Yield (q/ha)		
		2014	2015	Pooled	2014	2015	Pooled
T_1	25% N through NC + 75% through urea	5.57*	5.61	5.59	71.00*	71.95	71.47
		(2.46)**	(2.47)	(2.47)			
T_2	50% N through NC + 50% through urea	5.32	5.36	5.34	74.12	75.33	74.72
		(2.41)	(2.42)	(2.42)			
T_3	75% N through NC + 25% through urea	3.89	3.92	3.91	84.35	85.24	84.79
		(2.09)	(2.10)	(2.10)			
T_4	100% N through NC	3.80	3.84	3.82	86.05	87.00	86.52
		(2.07)	(2.08)	(2.08)			
T_5	25% N through VC + 75% through urea	5.64	5.67	5.65	70.25	71.30	70.77
		(2.48)	(2.48)	(2.48)			
T_6	50% N through VC + 50% through urea	5.41	5.45	5.43	73.60	74.78	74.19
		(2.43)	(2.44)	(2.44)			
T_7	75% N through VC + 25% through urea	4.06	4.10	4.08	82.00	83.08	82.54
		(2.14)	(2.14)	(2.14)			
T_8	100% N through VC	3.97	4.02	4.00	83.45	84.25	83.85
		(2.11)	(2.13)	(2.12)			
T_9	25% N through FYM + 75% through urea	6.64	6.69	6.66	62.15	63.00	62.57
		(2.67)	(2.68)	(2.68)			
T_{10}	50% N through FYM + 50% through urea	6.09	6.24	6.16	63.05	64.18	63.61
		(2.57)	(2.60)	(2.58)			
T_{11}	75% N through FYM + 25% through urea	5.50	5.54	5.52	72.33	73.10	72.71
		(2.45)	(2.46)	(2.45)			
T_{12}	100% N through FYM	4.85	4.87	4.86	75.23	76.13	75.68
		(2.31	(2.32)	(2.32)			
T_{13}	Check (Alternate spray of dimethoate 30EC/ Oxydemeton-methyl 25EC + recommended FYM and NPK in POP)	0.57	0.60	0.58	98.70	99.42	99.06
		(1.03)	(1.05)	(1.04)			
T_{14}	Untreated control (Recommended FYM and NPK in POP)	11.52	11.61	11.56	57.28	58.10	57.69
		(3.47)	(3.48)	(3.47)			
	SEm ±	0.06	0.06	0.06	2.10	2.16	1.90
	CD (p= 0.05)	0.17	0.19	0.18	6.12	6.29	5.53

* Data base on mean of three replications
** Figures in parentheses are angular transformed values
POP- Package of practices, NC- Neem cake, VC- Vermicompost, FYM- Farm yard manure

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