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Population of *Thrips tabaci* Lindeman under natural, organic and inorganic production system of cotton

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Abstract : In two year study on seasonal occurrence of *Thrips tabaci* Lindeman in cotton crop grown under natural, organic and inorganic system, the thrips incidence remains below economic threshold level (ETL) during seasons of *kharif* 2018 and 2019 from 25th to 37th standard meteorological week (SMW). Mean thrips population 0.22-1.22 nymphs/leaf and 0.01-2.97 nymphs/leaf was recorded in 2018 and 2019, respectively. Results clearly indicates that source of nutrient as well insect pest management strategies did not influence significantly the mean population of thrips, except 28th and 33rd SMW during 2019 and 27th, 30th and 35th SMWs of 2018. Irrespective to source of nutrients and insect pest management strategies the peak population of 1.22 nymphs/leaf and 2.97 nymphs/leaf was observed during 2018 and 2019 respectively in 31st SMW. Irrespective to pest management strategies, non significantly but lowest mean population of 0.49 nymphs/leaf and 0.87 nymphs/leaf in cotton were recorded in treatment where nutrients were applied through natural sources in 2018 and 2019 respectively.

Key words: Cotton, farming system, inorganic, *kharif*, natural, organic, SMW, thrips

Cotton (*Gossypium hirsutum* L.) is one of the most important fiber and cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. India occupy largest cotton acreage (13.373 m ha) and production (36.5 m bales) in the world (CICR, 2020). Despite the fact that cotton is not edible, it could improve food security by providing farmers with cash to purchase food. The insect pests constitute one of the major limiting factors in the production. Nagrare *et al.*, (2022) recorded 251 arthropod pest species and economic damage between 20-60 per cent. Among the vast array of insect pests, major sucking pests are, whitefly, *Bemisia tabaci* (Gennadius); leafhopper, *Amrasca biguttula biguttula* (Ishida); mealy bug, *Pnenacoccus solenopsis* Tinsley; thrips, *Thrips tabaci* Lindeman; and aphid, *Aphis gossypii* Glover. *T. tabaci* in the cotton is most consistent, invasive and destructive pest that reduces yield. It infests cotton in seedling stage itself and also acts as vector for various plant viruses, and has attained major pest status recently (Sanjta and Chauhan 2015; Patel and Patel 2014). Vennila *et al.* (2007) studied that infestation of thrips during the fruiting phase causes premature dropping of squares, and the crop maturity is delayed combined with yield reductions. A common sign of a heavy thrips infestation is the distorted leaves that have turned brownish around the edges and cup upward. Thrips also found on underside of the leaves damaging them by piercing the epidermis of the tissues and sucking the sap oozing out of wounds (Sanjta and Chauhan, 2015). During favorable conditions, this pest causes heavy losses to development and growth of the crops (Zhang *et al.*, 2013). Cook *et al.* (2011) reported that cotton seedlings are most susceptible, causing losses of as much a 30–50 per cent of lint yield. The repeated use of synthetic chemical insecticides as crop protectants against insect pests has posed serious hazards to environment, humans, resistance in pests to insecticides and natural enemies. (Balakrishnan *et al.*, 2009). Kamal *et al.* (2009) carried out study on organic cotton and concluded that consumption of organic products is increasing; however, product development and innovations in certification, processing, labelling and packaging are needed to further stimulate demand. Organic agriculture still incorporates a numbers of chemical alternatives. New approaches of natural farming encourage the natural symbiosis of soil micro flora and crop plants (Devarinti, 2016). Chaudhary *et al.* (2022) conducted two year experiments on natural farming of sugarcane and advocated the viability of natural farming in intensive chemical farming adopting North Indian state of Haryana. There is very scanty information about the incidence of thrips in under organic and natural system of cotton. Keeping this in view, these studies were taken up to monitor the population of thrips in different natural, organic and inorganic production and protection system of non *Bt* cotton during *kharif* seasons of 2018 and 2019.

MATERIALS AND METHODS

The two years field experiment was conducted at the CCS Haryana Agricultural University, *Krishi Vigyan Kendra*, Sadalpur (Hisar) during *kharif* 2018 and 2019. Cotton variety H 1098 (improved) was sown on 16thMay in 2018 and 27th April in 2019 in split plot design. Main plot treatments includes three sources of nutrient management (natural, organic and inorganic sources of nutrients), whereas sub plot treatments were insect pest management strategies (natural, organic, chemical and untreated control). Under natural farming application of Jeevamrit @ 500 liters/ha was done at pre sowing irrigation and every irrigation thereafter five times foliar spraying was done at 30 DAS (5%), 51 DAS (5%), 72 DAS (7.5%), 115 DAS (10%) and 137 DAS (10%). The organic sources of nutrients *i.e.* FYM @ 5 t/ha and vermi compost @ 2.5 t/ha and incorporated into the soil before the sowing of crops in *kharif* 2018. Recommended doses (100%) of fertilizers (nitrogen 87.5 kg, 30 kg phosphorus and 5.25 kg Zinc/hectare) as per agronomic practices of CCS HAU Hisar applied in cotton. Nitrogen applied twice *i.e.* half dose at square formation and half at flowering. Natural control of major sucking and bollworms was done through application of *brahmastra* @20 ltr/ha, *agniastra* @ 20 ltr/ha and dashparniarka @ 20 ltr/ha in 500 ltr of water/ha and *neemasra* @ 250 ltr/ha on ETL basis. In case of organic control foliar spray of *neem* based formulation (nimbecidine 300ppm @ 2.5 litre/ha) applied. Chemical control of major pests was done as per package of practices of CCS HAU Hisar, which includes dimethoate 30 EC, thiamethoxam 25WG, trizophos 40EC, spinosad 45SC, quinalphos 25EC and cypermethrin 25EC. The observations on population of thrips were recorded at weekly intervals from 25th to 37th SMW on three leaves (each from top, middle and bottom) per plants at five randomly selected plants in each plot throughout the crop period before 9:00 am during couple of years.

RESULTS AND DISCUSSION

A weekly thrips incidence data given in Table 1, Table 2 and Fig. 1 reveals that incidence is seen from 25th to 37th standard meteorological weeks (0.22-1.22 and 0.01-2.97 nymphs/leaf in 2018 and 2019, respectively) and with a overall mean population level of 0.50 nymphs/leaf and 0.89 nymphs/leaf during *kharif* 2018 and *kharif* 2019, respectively. During both the years of study thrips remains below ETL. The critical observation recorded on build up of thrips population under different natural, organic and inorganic system of cotton during different SMWs clearly shows that source of nutrient as well insect pest management strategies statistically did not affect the mean population of thrips in cotton except 28th and 33rd SMW during *kharif* 2019 and 27th, 30th and 35th SMWs of *kharif* 2018. Trend of increasing (25th to 31st SMW) and decreasing (32nd to 41st SMW) in mean population of thrips was recorded during both years (Fig. 1). Irrespective to source of nutrients and insect pest management strategies maximum population of thrips was observed during 29th to 31th SMW (2.24-2.97 nymphs/week) with a peak (2.97 nymphs/leaf) in 31st SMW in *kharif* 2019 whereas in *kharif* 2018 population of thrips was very low (0.22-1.22 nymphs/leaf) and peak was on 31st SMW (1.22 nymphs/leaf).

However, comparing the effect of nutrients on thrips population build up, non significantly but highest mean population of thrips (0.52 nymphs/leaf) in cotton were recorded in treatment where nutrients were applied through organic sources which was closely followed by inorganic (0.51 nymphs/leaf) and natural source of nutrients (0.49 nymphs/leaf) in *kharif* 2018 (Table 1), similarly in *kharif* 2019 non significantly but lowest mean population of thrips (0.87 nymphs/leaf) in cotton were recorded in treatment where nutrients were applied through natural sources which was closely followed by organic (0.89 nymphs/leaf) and inorganic (0.89 nymphs/leaf) source of nutrients (Table 2). While comparing the interaction effect of insect pest management strategies at same level of nutrients source, the mean population of thrips were not affected significantly in 2018 and 2019 crop season, but in 2018, minimum mean population of thrips (0.43 nymphs/leaf) where natural sources of nutrient were applied and pest controlled organically, similarly in 2019 minimum mean population of thrips (0.78 nymphs/leaf, 0.84 nymphs/leaf and 0.85 nymphs/leaf) were recorded where natural, organic and inorganic sources of nutrient were applied, respectively and pest controlled chemically. Likewise while comparing the interaction effect of source of nutrients applied at same level of insect pest management strategies, the mean population of thrips were not affected significantly during both year of study, but in *kharif* 2018 minimum mean population of thrips (0.52, 0.43, 0.56 and 0.45 nymphs/leaf) in cotton was recorded in treatment where nutrients were applied through natural sources with different insect pest management strategies (natural, organic, chemical and untreated control, respectively), similarly in *kharif* 2019 minimum mean population of thrips (0.84, 0.86, 0.78 and 0.98 nymphs/leaf) in cotton was recorded in treatment where nutrients were applied through natural sources with different insect pest management strategies (natural, organic, chemical and untreated control, respectively). In *kharif* 2018 irrespective to pest management strategies the weekly highest mean population of thrips (1.33 nymphs/leaf) was recorded in

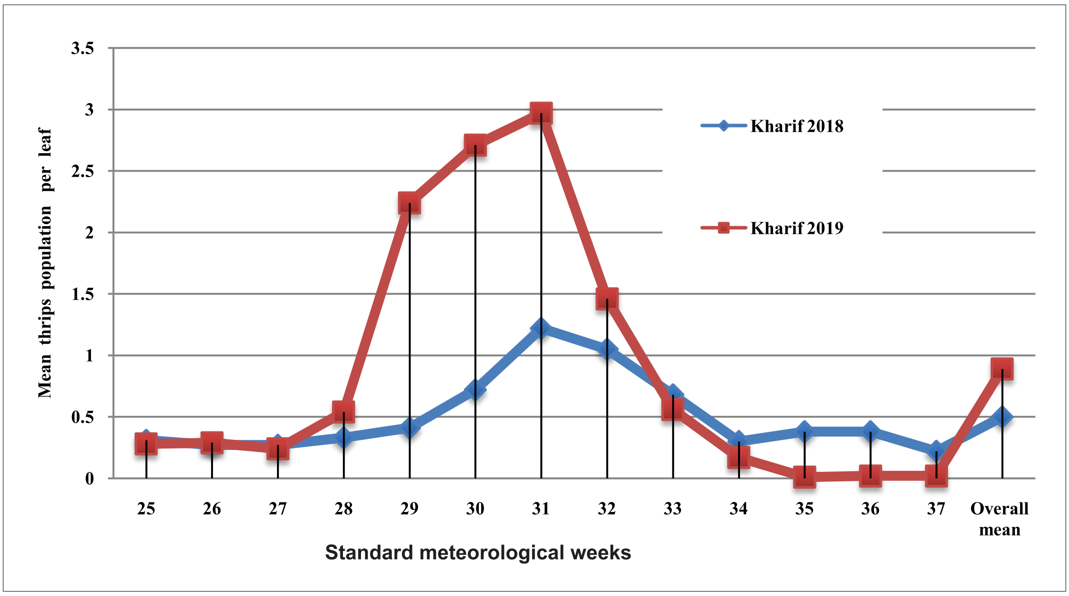

Fig. 1. Comparative mean population of thrips in cotton during *kharif* 2018 and 2019

Table 1. Population of *T. tabaci* in different cotton production and protection system during *kharif* 2018

Sources of nutrient management (A)	Insect pest management strategies (B)	Mean thrips population during different standard meteorological week (Nymphs/leaf)													
		25	26	27	28	29	30	31	32	33	34	35	36	37	Overall mean
Natural sources of nutrients (A1)	Natural control (B1)	0.33(1.15)	0.27(1.13)	0.20(1.10)	0.64(1.28)	0.64(1.28)	0.71(1.31)	1.18(1.48)	0.91(1.35)	0.71(1.30)	0.27(1.12)	0.38(1.17)	0.36(1.16)	0.13(1.06)	0.52(1.23)
	Organic control (B2)	0.24(1.12)	0.27(1.13)	0.20(1.10)	0.38(1.17)	0.38(1.17)	0.47(1.21)	0.78(1.33)	0.84(1.35)	0.69(1.30)	0.31(1.14)	0.42(1.19)	0.38(1.17)	0.20(1.10)	0.43(1.19)
	Chemical control (B3)	0.27(1.13)	0.24(1.12)	0.24(1.12)	0.40(1.18)	0.49(1.22)	0.84(1.36)	1.58(1.59)	1.04(1.42)	0.89(1.37)	0.27(1.12)	0.40(1.18)	0.38(1.17)	0.18(1.08)	0.56(1.25)
	Control (B4)	0.42(1.19)	0.27(1.13)	0.27(1.12)	0.22(1.10)	0.27(1.12)	0.82(1.35)	0.96(1.4)	0.78(1.33)	0.62(1.27)	0.36(1.16)	0.33(1.15)	0.38(1.17)	0.20(1.09)	0.45(1.21)
	Mean (A1)	**0.32(1.15)**	**0.26(1.12)**	**0.23(1.11)**	**0.41(1.18)**	**0.44(1.20)**	**0.71(1.31)**	**1.12(1.45)**	**0.89(1.36)**	**0.73(1.31)**	**0.30(1.14)**	**0.38(1.18)**	**0.37(1.17)**	**0.18(1.08)**	**0.49(1.22)**
Organic sources of nutrients (A2)	Natural control (B1)	0.44(1.20)	0.27(1.13)	0.38(1.17)	0.22(1.11)	0.33(1.15)	0.80(1.34)	1.22(1.49)	0.82(1.35)	0.53(1.24)	0.29(1.14)	0.36(1.16)	0.36(1.16)	0.29(1.13)	0.49(1.22)
	Organic control (B2)	0.31(1.14)	0.27(1.13)	0.33(1.15)	0.47(1.21)	0.47(1.20)	0.56(1.25)	0.82(1.35)	1.11(1.45)	0.60(1.26)	0.24(1.12)	0.53(1.24)	0.49(1.22)	0.22(1.10)	0.49(1.22)
	Chemical control (B3)	0.33(1.15)	0.33(1.15)	0.31(1.14)	0.31(1.14)	0.71(1.31)	0.73(1.32)	1.49(1.58)	1.27(1.50)	0.84(1.34)	0.31(1.15)	0.36(1.16)	0.36(1.16)	0.24(1.11)	0.58(1.26)
	Control (B4)	0.27(1.13)	0.20(1.10)	0.38(1.17)	0.47(1.21)	0.36(1.16)	0.71(1.30)	1.22(1.49)	0.82(1.35)	0.82(1.34)	0.31(1.14)	0.44(1.20)	0.38(1.17)	0.18(1.09)	0.50(1.23)
	Mean (A2)	**0.34(1.16)**	**0.27(1.13)**	**0.35(1.16)**	**0.37(1.17)**	**0.47(1.21)**	**0.70(1.3)**	**1.19(1.48)**	**1.01(1.41)**	**0.70(1.3)**	**0.29(1.14)**	**0.42(1.19)**	**0.39(1.18)**	**0.23(1.11)**	**0.52(1.23)**
Inorganic sources of nutrients (A3)	Natural control (B1)	0.20(1.10)	0.20(1.10)	0.31(1.14)	0.27(1.13)	0.33(1.15)	0.78(1.32)	1.29(1.51)	1.24(1.48)	0.58(1.26)	0.29(1.14)	0.33(1.15)	0.36(1.16)	0.20(1.10)	0.49(1.22)
	Organic control (B2)	0.27(1.13)	0.40(1.18)	0.18(1.09)	0.16(1.08)	0.40(1.18)	0.58(1.25)	1.29(1.51)	1.44(1.56)	0.58(1.25)	0.33(1.15)	0.38(1.17)	0.36(1.16)	0.22(1.11)	0.51(1.23)
	Chemical control (B3)	0.40(1.18)	0.36(1.16)	0.31(1.15)	0.29(1.14)	0.27(1.12)	0.53(1.24)	1.22(1.48)	1.60(1.61)	0.53(1.24)	0.38(1.17)	0.24(1.12)	0.40(1.18)	0.27(1.13)	0.52(1.23)
	Control (B4)	0.27(1.13)	0.20(1.1)	0.16(1.08)	0.16(1.08)	0.31(1.14)	1.07(1.43)	1.53(1.59)	0.76(1.32)	0.73(1.32)	0.27(1.12)	0.33(1.15)	0.38(1.17)	0.36(1.16)	0.50(1.23)
	Mean (A3)	**0.28(1.13)**	**0.29(1.13)**	**0.24(1.11)**	**0.22(1.10)**	**0.33(1.15)**	**0.74(1.31)**	**1.33(1.52)**	**1.26(1.49)**	**0.61(1.26)**	**0.32(1.15)**	**0.32(1.15)**	**0.37(1.17)**	**0.26(1.12)**	**0.51(1.23)**
Mean	B1	0.32(1.15)	0.25(1.12)	0.30(1.14)	0.38(1.17)	0.43(1.19)	0.76(1.32)	1.23(1.49)	0.99(1.39)	0.61(1.27)	0.28(1.13)	0.36(1.16)	0.36(1.16)	0.21(1.10)	0.50(1.22)
	B2	0.27(1.13)	0.31(1.14)	0.24(1.11)	0.34(1.15)	0.42(1.19)	0.54(1.24)	0.96(1.40)	1.13(1.45)	0.62(1.27)	0.29(1.14)	0.44(1.20)	0.41(1.19)	0.21(1.10)	0.48(1.21)
	B3	0.33(1.15)	0.31(1.14)	0.29(1.13)	0.33(1.15)	0.49(1.22)	0.70(1.3)	1.43(1.55)	1.30(1.51)	0.75(1.32)	0.32(1.15)	0.33(1.15)	0.38(1.17)	0.23(1.11)	0.55(1.25)
	B4	0.32(1.15)	0.22(1.11)	0.27(1.12)	0.28(1.13)	0.31(1.14)	0.87(1.36)	1.24(1.49)	0.79(1.33)	0.72(1.31)	0.31(1.14)	0.37(1.17)	0.38(1.17)	0.25(1.11)	0.49(1.22)
	Overall mean	**0.31**	**0.27**	**0.27**	**0.33**	**0.41**	**0.72**	**1.22**	**1.05**	**0.68**	**0.30**	**0.38**	**0.38**	**0.22**	**0.50**
SE(m) ±	A	0.01	0.01	0.01	0.03	0.03	0.05	0.02	0.05	0.04	0.03	0.02	0.01	0.03	0.01
	B	0.02	0.02	0.03	0.03	0.05	0.04	0.06	0.10	0.07	0.03	0.01	0.02	0.02	0.01
	Factor (B) at same level of A	0.04	0.03	0.05	0.06	0.09	0.07	0.10	0.17	0.12	0.05	0.02	0.04	0.03	0.02
	Factor (A) at same level of B	0.04	0.03	0.04	0.06	0.09	0.08	0.09	0.15	0.11	0.05	0.03	0.03	0.04	0.02
CD (p=0.05)	A	(NS)	(NS)	0.03	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)
	B	(NS)	(NS)	(NS)	(NS)	(NS)	0.09	(NS)	(NS)	(NS)	(NS)	0.03	(NS)	(NS)	(NS)
	Factor (B) at same level of A	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)
	Factor (A) at same level of B	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)

Figures in parentheses are √n+1 transformation

Table 2. Population of *T. tabaci* in different cotton production and protection system during *kharif* 2019

Sources of nutrient management (A)	Insect pest management strategies (B)	Mean thrips population during different standard meteorological week (Nymphs/leaf)													
		25	26	27	28	29	30	31	32	33	34	35	36	37 mean	Overall
Natural sources of nutrients (A1)	Natural control (B1)	0.31(1.14)	0.31(1.14)	0.49(1.22)	0.18(1.09)	2.36(1.83)	2.38(1.84)	2.82(1.95)	1.22(1.49)	0.51(1.22)	0.20(1.09)	0.00(1.00)	0.00(1.00)	0.09(1.04)	0.84(1.33)
	Organic control (B2)	0.29(1.13)	0.33(1.15)	0.44(1.20)	0.36(1.16)	2.60(1.9)	2.16(1.77)	2.82(1.95)	1.58(1.59)	0.36(1.16)	0.22(1.10)	0.00(1.00)	0.00(1.00)	0.09(1.04)	0.86(1.34)
	Chemical control (B3)	0.29(1.13)	0.27(1.13)	0.29(1.13)	0.13(1.06)	1.91(1.71)	2.31(1.82)	2.93(1.98)	1.31(1.51)	0.56(1.25)	0.18(1.08)	0.02(1.01)	0.00(1.00)	0.00(1.00)	0.78(1.32)
	Control (B4)	0.24(1.12)	0.20(1.1)	0.13(1.06)	0.67(1.29)	2.53(1.87)	2.56(1.85)	3.27(2.04)	1.73(1.65)	1.16(1.47)	0.20(1.10)	0.00(1.00)	0.04(1.02)	0.00(1.00)	0.98(1.38)
	Mean (A1)	**0.28(1.13)**	**0.28(1.13)**	**0.34(1.15)**	**0.33(1.15)**	**2.35(1.83)**	**2.35(1.82)**	**2.96(1.98)**	**1.46(1.56)**	**0.64(1.27)**	**0.20(1.09)**	**0.01(1.00)**	**0.01(1.01)**	**0.04(1.02)**	**0.87(1.34)**
Organic sources of nutrients (A2)	Natural control (B1)	0.29(1.13)	0.27(1.13)	0.04(1.02)	0.71(1.31)	2.02(1.74)	2.60(1.90)	3.51(2.11)	1.64(1.62)	0.53(1.23)	0.13(1.06)	0.00(1.00)	0.00(1.00)	0.02(1.01)	0.91(1.36)
	Organic control (B2)	0.29(1.13)	0.40(1.18)	0.04(1.02)	0.69(1.29)	2.20(1.79)	2.80(1.95)	2.80(1.93)	1.24(1.50)	0.24(1.11)	0.16(1.08)	0.00(1.00)	0.02(1.01)	0.02(1.01)	0.84(1.33)
	Chemical control (B3)	0.44(1.20)	0.20(1.1)	0.27(1.13)	0.73(1.32)	2.11(1.76)	2.58(1.89)	3.13(1.98)	1.22(1.49)	0.22(1.11)	0.07(1.03)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.84(1.34)
	Control (B4)	0.22(1.11)	0.27(1.13)	0.36(1.16)	0.80(1.34)	2.24(1.79)	2.93(1.96)	3.00(1.99)	1.71(1.64)	0.98(1.40)	0.20(1.10)	0.00(1.00)	0.04(1.02)	0.00(1.00)	0.98(1.38)
	Mean (A2)	**0.31(1.14)**	**0.28(1.13)**	**0.18(1.08)**	**0.73(1.31)**	**2.14(1.77)**	**2.73(1.92)**	**3.11(2.00)**	**1.46(1.56)**	**0.49(1.21)**	**0.14(1.07)**	**0.00(1.00)**	**0.02(1.01)**	**0.01(1.01)**	**0.89(1.35)**
Inorganic sources of nutrients (A3)	Natural control (B1)	0.22(1.11)	0.40(1.18)	0.24(1.11)	0.47(1.21)	2.07(1.75)	3.27(2.07)	2.93(1.96)	1.29(1.50)	0.40(1.18)	0.11(1.05)	0.00(1.00)	0.02(1.01)	0.00(1.00)	0.88(1.35)
	Organic control (B2)	0.27(1.12)	0.33(1.15)	0.31(1.14)	0.64(1.28)	1.89(1.70)	2.89(1.97)	2.78(1.94)	1.44(1.56)	0.24(1.12)	0.20(1.10)	0.02(1.01)	0.00(1.00)	0.02(1.01)	0.85(1.34)
	Chemical control (B3)	0.27(1.13)	0.27(1.13)	0.07(1.03)	0.36(1.16)	2.47(1.86)	2.89(1.95)	2.69(1.87)	1.42(1.55)	0.38(1.17)	0.22(1.11)	0.00(1.00)	0.00(1.00)	0.02(1.01)	0.85(1.34)
	Control (B4)	0.20(1.10)	0.20(1.1)	0.13(1.06)	0.78(1.33)	2.49(1.86)	3.22(2.00)	2.98(1.92)	1.69(1.61)	1.13(1.46)	0.18(1.08)	0.00(1.00)	0.02(1.01)	0.00(1.00)	1.00(1.39)
	Mean (A3)	**0.24(1.11)**	**0.30(1.14)**	**0.19(1.09)**	**0.56(1.25)**	**2.23(1.79)**	**3.07(2.00)**	**2.84(1.92)**	**1.46(1.55)**	**0.54(1.23)**	**0.18(1.09)**	**0.01(1.00)**	**0.01(1.01)**	**0.01(1.01)**	**0.89(1.35)**
Mean	B1	0.27(1.13)	0.33(1.15)	0.26(1.12)	0.45(1.20)	2.15(1.77)	2.75(1.93)	3.09(2.01)	1.39(1.54)	0.48(1.21)	0.15(1.07)	0.00(1.00)	0.01(1.00)	0.04(1.02)	0.87(1.35)
	B2	0.28(1.13)	0.36(1.16)	0.27(1.12)	0.56(1.25)	2.23(1.79)	2.61(1.90)	2.80(1.94)	1.42(1.55)	0.28(1.13)	0.19(1.09)	0.01(1.00)	0.01(1.00)	0.04(1.02)	0.85(1.34)
	B3	0.33(1.15)	0.24(1.12)	0.21(1.10)	0.41(1.18)	2.16(1.78)	2.59(1.88)	2.92(1.94)	1.32(1.52)	0.39(1.18)	0.16(1.07)	0.01(1.00)	0.00(1.00)	0.01(1.00)	0.83(1.33)
	B4	0.22(1.11)	0.22(1.11)	0.21(1.10)	0.75(1.32)	2.42(1.84)	2.90(1.94)	3.08(1.98)	1.71(1.63)	1.09(1.44)	0.19(1.09)	0.00(1.00)	0.04(1.02)	0.00(1.00)	0.99(1.38)
	Overall mean	**0.28**	**0.29**	**0.24**	**0.54**	**2.24**	**2.71**	**2.97**	**1.46**	**0.56**	**0.17**	**0.01**	**0.02**	**0.02**	**0.89**
SE(m) ±	A	0.04	0.01	0.04	0.03	0.05	0.08	0.15	0.11	0.04	0.02	0.00	0.01	0.01	0.02
	B	0.02	0.02	0.03	0.03	0.06	0.15	0.17	0.09	0.05	0.02	0.00	0.01	0.02	0.02
	Factor (B) at same level of A	0.04	0.04	0.06	0.06	0.11	0.26	0.30	0.15	0.08	0.04	0.01	0.01	0.03	0.04
	Factor (A) at same level of B	0.05	0.04	0.06	0.06	0.11	0.24	0.30	0.17	0.08	0.04	0.01	0.02	0.03	0.04
CD (p=0.05)	A	(NS)	(NS)	(NS)	0.08	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)
	B	(NS)	(NS)	(NS)	0.07	(NS)	(NS)	(NS)	(NS)	0.10	(NS)	(NS)	(NS)	(NS)	(NS)
	Factor (B) at same level of A	(NS)	(NS)	0.14	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)
	Factor (A) at same level of B	(NS)	(NS)	0.14	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)

Figures in parentheses are √n+1 transformation treatment where nutrients were applied through inorganic source during 31st SMW which was closely followed by organic sources (1.26 nymphs/leaf) during 32th SMW. In *kharif* 2019, while comparing the interaction effect of sources of nutrient and insect pest management strategies, highest weekly mean population of thrips (3.51 nymphs/leaf) in cotton were recorded in treatment combination where nutrient were applied through organic sources and insect pest were controlled naturally on 31st SMW which were non significantly and closely followed by treatment combination where nutrient were applied through natural sources and insect pest were not controlled (3.27 nymphs/leaf) at 31st meteorological week. In *kharif* 2019 irrespective to pest management strategies, the effects of nutrients on thrips was recorded highest incidence (3.11 nymphs/leaf) in treatment where nutrients were applied through organic source which was closely followed by natural sources (2.96) during 31st SMW. Irrespective to sources of nutrients and pest management strategies the overall mean population of thrips was non significant in *kharif* 2018, but highest when nutrients were applied organically and pests were controlled chemically (0.58 nymphs/leaf) and lowest when nutrients were applied naturally and pest control organically (0.43 nymphs/leaf). In respect of pest management strategies non significant but lowest mean seasonal weekly population (0.48 nymphs/leaf and 0.83 nymphs/leaf) of thrips was recorded during *kharif* 2018 and *kharif* 2019 when insects were controlled through organically and chemically, respectively. Similar results of incidence start week was obtained by Singh *et al.*, (2021) reported that thrips incidence started in 24th and 23rd SMW, and reached peak (9.42 and 9.83 thrips/leaf) at 31st SMW in 2017 and 2018, respectively. They further reported incidence varied from 0.00 to 18.36 and 0.00 to 18.33, respectively during 2017 and 2018, with the mean incidence being high in 2017 (2.45 nymphs/leaf) compared to 2018 (1.66 nymphs/leaf). These finding are in close proximity with results of Janu *et al.* (2017) who, reported incidence of thrips from the 27th SMW onwards and reached to its peak at 33rd SMW and in second season incidence started from 25th SMW and peak was on 31st SMW. Results mismatched with reported high range of 12.89 to 58.27 nymphs/leaf and 14.68 to 36.85 nymphs/leaf this may due climatic condition during season. Raza *et al.* (2015) from Pakistan reported that maximum (18.83 nymphs/leaf) and minimum (0.82 nymphs/leaf) population of thrips during 2011 on cotton.

CONCLUSION

Based on two year study on incidence of thrips in cotton grown under different production and protection system concluded thrips incidence occurred in cotton from 25th to 37th SMW (0.22-1.22 and 0.01-2.97 nymphs/leaf in 2018 and 2019, respectively). The thrips population remains below ETL and mean thrips population was not influenced by neither source of nutrients nor insect pest management strategies. Population stabilization under natural farming is good indication for future and feasibility of natural farming in highly exhaustive and costly cotton crop with cheap approaches against thrips incidence in cotton.

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