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RESEARCH ARTICLE

Efficacy of various insecticides against foliage feeding wheat aphids

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ABSTRACT

The investigation was conducted during *Rabi* 2008-11. Seven insecticides were evaluated for the control of foliage feeding wheat aphids (*Rhopalosiphum padi*). Imidacloprid 0.04 per cent was found significantly effective against wheat aphids at 1, 2 and 7 days after spray and it was followed by thiamethoxam 0.0025 per cent and acetamiprid 0.01 per cent. Imidacloprid 0.04 per cent registered significantly highest yield of 52.60 q/ha which was at par with thiamethoxam 0.0025 per cent (52.19) and acetamiprid 0.01 per cent (50.42 q/ha). The plot without insecticidal spray recorded lowest yield of 38.36 q/ha. The highest monetary retun (Rs. 75,038/-), net income (Rs. 50,259/-) and benefit cost ratio (3.02) were observed in treatment with imidacloprid 0.04 per cent.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops and the staple food throughout the world. It is extensively grown both in irrigated and rainfed areas around the world. In, Maharashtra, wheat is grown on an area of 5.94 lakh ha with a production and productivity of 8.75 lakh tons and 14.73 kg/ ha, respectively during *Rabi* 2012-13, (Anonymous, 2013).

Among various foliage feeding wheat aphids (*Macrosiphum miscanthi*), bud cherry oat aphids (*Rhopalosiphum padi*) and English grain aphid (*Sitobion avenae*) are more common. The damage is severe in cold and cloudy weather duing winter. They appear mostly from December to January. Tradan and Milevoj (1999) reported that aphid caused 10 to 50 per cent reduction in crop yield. Among the wheat pests, aphids are the most widely distributed and are posing a serious threat to wheat crop throughout the world. (Yadev, 2003). They cause direct damage by sucking cell sap of leaves, young shoots, causing distortion, stunting, leaf curling, wilting and twisting. They cause indirect damage by depositing honey dew that reduce photosynthetic activity and induce sooty mould production and premature leaf senescence (Stern, 1967; Ozder, 2002). The nymphs and adults both reduce the yield (Sekhar *et al.*, 2001). Use of selective insecticides which have the least harmful effect on natural enemies could be the best option (Gair *et al.*, 1987).

Pest insects are the limiting factor for the healthy growth of cultivated plants, hence it is difficult to cultivate a crop without sound plant protection measures. Hence, it was thought while to study some important aspects of aphid management with view to find and effective control measures for reducing the economic losses caused by the wheat aphids in *Rabi* season.

MATERIAL AND METHODS

A field experiment was conducted during *Rabi* 2008-09, 2009-10 and 2010-11 on the research farm of Agricultural Research Station, Niphad, Dist. Nasik. The experiment consisted of Randomized Block Design with eight treatments *viz.*, imidacloprid 17.8 SL 0.04 per cent, chloropyrifos 20 EC

0.02 per cent, acetamiprid 20 SP 0.01 per cent, dimethoate 30 EC 0.03 per cent, quinalphos 25 EC 0.025 per cent, thiamethoxam 25 WG 0.0025 per cent, oxy demeton methyl 25 EC 0.025 per cent and untreated control and three replications on wheat variety, Trimbak (NIAW-301) in plot size 6 × 1.35 m (six rows of six meter row length).

The insecticidal sprays were applied at an interval of 15 days, initiating just after average infestation of aphids 10 aphids/shoot/plant. Five shoot from each treatment were selected randomly for recording observations. Observations were recorded on the basis of average population of survival of aphids. Pre-count was taken 24 hours before spray and post-count was taken on 1, 2, 7 and 15 days after spray. The average population of aphids survived per shoot was worked and the data were subjected to square root transformation. The experimental data were subjected to statistical analysis.

RESULTS AND DISCUSSION

The pooled data of three years (2008-09 to 2010-11) are presented in Tables 1 and 2 which, revealed that differences among the treatments were significant. The treatment with imidacloprid 0.004 per cent was found significantly effective against wheat aphids. It recorded 0.22, 0.02 and 0 aphids/shoot/plant at 1st, 2nd and 7th days after spray, respectively. It was followed by thiamethoxam and acetamiprid 0.01 per cent. The untreated control recorded significantly maximum number of aphids/shoot/plant. It was 43.13, 47.25, 47.27 and 50.20 at 1st, 2nd, 7th and 15th days after spray, respectively. The population of aphids increased after 7th day of spray in almost all the treatments. The same trend was found in each year during the study.

The data presented in Table 3 revealed that the yield differences due to spraying of insecticides were significant. Imidacloprid 0.04 per cent recorded significantly highest yield of 52.60 q/ha over rest of the treatments. This treatment was statistically at par with the treatments of thiamethoxam 0.0025 per cent (52.19 q/ha) and acetamiprid 0.01 per cent (50.42q/ha). The untreated control recorded lowest yield of 38.36 q/ha. The data in respect of economics of different treatments are also presented in Table 3. The additional yield (14.24 q/ha) and income (Rs.20,172 q/ha) over untreated control was more in imidacloprid 0.004 per cent. It was followed by thiamethoxam 0.0025 per cent and acetamiprid 0.01 per cent, which registered 13.83 and 12.06 q/ha and income of Rs. 19,489/- and Rs. 17,104/ha, respectively.

The monetary return (Rs. 75,038/-) and net income (Rs. 50,259) was maximum in treatment with imidacloprid 0.004 per cent. It was followed by thiamethoxam 0.0025 per cent (Rs.74355 and Rs. 49,623) and acetamiprid 0.01 per cent (Rs. 71,966 and Rs. 47,149). The maximum benefit cost ratio was found in treatment with imidacloprid 0.004 per cent (3.02) followed by thiamethoxam 0.0025 per cent (3.00) and acetamiprid 0.01 per cent (2.89) (Table 3). These findings are in supportive with reported by various researchers. All the insecticides, showed significant control of aphid population as compared to the control (Anonymous, 2009). Ahmed *et al.*

Table 1 : Effect of insecticides on population of wheat aphid (*R. padi*) at 1 and 2 days after spray

Sr. No.	Treatments	Conc. of insecticide (%)	Av. population of aphids/shoot/plant											
			Pre-count				Post count 1 day after spraying				Post count 2 days after spraying			
			08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled
1.	Imidacloprid 17.8 SL	0.004	23.46	25.30	20.33	23.02	0.27	0.20	0.20	0.22	0.0	0.00	0.07	0.02
			(4.94)	(5.13)	(4.62)	(4.90)	(1.10)	(1.10)	(1.10)	(1.10)	(1.00)	(1.00)	(1.03)	(1.00)
2.	Chloropyrifos 20 EC	0.02	27.11	24.90	25.67	25.87	9.20	7.80	5.50	7.50	5.03	4.20	3.73	4.32
			(5.30)	(5.09)	(5.16)	(5.18)	(3.19)	(2.97)	(2.55)	(2.92)	(2.45)	(2.28)	(2.17)	(2.31)
3.	Acetamiprid 20 SP	0.01	31.67	27.30	21.67	26.86	0.33	0.30	1.17	0.60	0.0	0.00	0.67	0.22
			(5.71)	(5.32)	(4.76)	(5.28)	(1.15)	(1.14)	(1.47)	(1.26)	(1.00)	(1.00)	(1.29)	(1.10)
4.	Dimethoate 30 EC	0.03	28.20	26.00	21.73	25.30	7.50	5.60	4.23	5.78	3.87	2.80	1.87	2.85
			(5.40)	(5.20)	(4.77)	(5.13)	(2.91)	(2.57)	(2.29)	(2.60)	(2.20)	(1.95)	(1.69)	(1.96)
5.	Quinalphos 25 EC	0.025	28.53	26.40	21.13	25.34	6.00	4.60	4.37	4.99	2.87	2.00	1.57	2.15
			(5.43)	(5.23)	(4.70)	(5.13)	(2.64)	(2.37)	(2.32)	(2.45)	(1.96)	(1.73)	(1.60)	(1.77)
6.	Thiamethoxam 25 WG	0.0025	27.93	26.60	24.60	26.38	0.37	0.60	0.43	0.47	0.0	0.00	0.30	0.10
			(5.37)	(5.25)	(5.06)	(5.23)	(1.17)	(1.26)	(1.20)	(1.21)	(1.00)	(1.00)	(1.14)	(1.04)
7.	Oxy demeton methyl 25 EC	0.025	28.00	27.60	22.87	26.13	6.76	7.40	5.93	6.70	3.23	3.60	3.57	3.47
			(5.38)	(5.35)	(4.89)	(5.21)	(2.78)	(2.90)	(2.63)	(2.77)	(2.05)	(2.14)	(2.13)	(2.11)
8.	Untreated control	-	28.13	25.40	22.73	25.41	74.20	29.90	25.30	43.13	83.47	31.0	27.27	47.25
			(5.39)	(5.14)	(4.87)	(5.14)	(8.67)	(5.56)	(5.13)	(6.64)	(4.94)	(5.66)	(5.32)	(6.95)
	SE ±		0.24	0.12	0.21	0.17	0.12	0.08	0.13	0.06	0.08	0.06	0.07	0.07
	C.D. (P=0.05)		NS	NS	NS	NS	0.37	0.23	0.40	0.18	0.24	0.17	0.20	0.20

Figures in parentheses are √ n+1 values

Table 2 : Effect of insecticides on population of wheat aphid (*R. padi*) at 7 and 15 days after spray

Sr. No.	Treatments	Conc. of insecticide (%)	Av. population of aphids/shoot/plant							
			7 days after spraying				15 days after spraying			
			08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled
1.	Imidacloprid 17.8 SL	0.004	0.0	0.00	0.00	0.00	11.80	1.60	3.63	5.68
			(1.00)	(1.00)	(1.00)	(1.00)	(3.57)	(1.61)	(2.15)	(2.58)
2.	Chloropyrifos 20 EC	0.02	7.23	2.10	1.63	3.65	26.70	12.30	10.30	16.43
			(2.86)	(1.76)	(1.62)	(2.16)	(5.26)	(3.65)	(3.36)	(4.17)
3.	Acetamiprid 20 SP	0.01	0.17	0.00	0.33	0.17	5.40	2.20	5.53	4.38
			(1.08)	(1.00)	(1.15)	(1.08)	(2.52)	(1.79)	(2.56)	(2.32)
4.	Dimethoate 30 EC	0.03	3.23	1.60	1.43	2.09	20.80	11.20	7.07	13.02
			(2.05)	(1.61)	(1.56)	(1.76)	(4.66)	(3.49)	(2.84)	(3.74)
5.	Quinalphos 25 EC	0.025	4.00	1.60	1.13	2.24	24.80	10.40	8.33	14.51
			(2.23)	(1.61)	(1.46)	(1.80)	(5.07)	(3.38)	(3.05)	(3.94)
6.	Thiamethoxam 25 WG	0.0025	0.0	0.00	0.33	0.11	6.20	1.80	3.93	3.98
			(1.00)	(1.00)	(1.15)	(1.05)	(2.68)	(1.67)	(2.22)	(2.23)
7.	Oxy demeton methyl 25 EC	0.025	5.07	1.10	1.97	2.71	18.80	4.80	11.27	11.62
			(2.46)	(1.45)	(1.72)	(1.93)	(4.44)	(2.41)	(3.50)	(3.55)
8.	Untreated control	–	85.17	27.20	29.45	47.27	110.5	17.70	22.40	50.20
			(9.28)	(5.31)	(5.52)	(6.95)	(10.55	(4.32)	(4.83)	(7.16)
	SE ±		0.13	0.09	0.07	0.06	0.20	0.14	0.10	0.14
	C.D. (P=0.05)		0.40	0.26	0.21	0.19	0.61	0.44	0.30	0.44

Figures in parentheses are √ n+1 values

Table 3 : Effect of the treatments on yield of wheat and economics of the different treatments

Sr. No.	Treatments	Conc. of insecticide (%)	Yield q/ha				% increase in yield over control	Additional yield over control (q/ha)				Additional income over control (Rs.)			
			08-09	09-10	10-11	Pooled		08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled
1.	Imidacloprid 17.8 SL	0.004	58.23	40.90	58.68	52.60	37.12	17.49	8.40	16.83	14.24	20988	12600	26928	20172
2.	Chloropyrifos 20 EC	0.02	50.20	36.80	47.69	44.70	16.53	9.46	4.30	5.84	6.34	11352	6450	9344	9049
3.	Acetamiprid 20 SP	0.01	55.56	39.09	56.62	50.42	31.44	14.82	6.53	14.77	12.06	17884	9795	23632	17104
4.	Dimethoate 30 EC	0.03	50.61	36.91	49.26	45.59	18.85	9.87	4.41	7.41	7.23	11844	6615	11856	10105
5.	Quinalphos 25 EC	0.025	51.02	36.74	48.76	45.51	18.64	10.28	4.24	3.91	6.15	12336	6360	6256	8317
6.	Thiamethoxam 25 WG	0.0025	58.43	40.74	57.40	52.19	36.05	17.69	8.24	15.55	13.83	21228	12360	24880	19489
7.	Oxy demeton methyl 25 EC	0.025	51.44	38.64	47.94	46.00	19.92	10.70	6.14	6.09	7.64	12840	9210	9744	10598
8.	Untreated control	–	40.74	32.50	41.85	38.36	–	–	–	–	–	–	–	–	–
	SE ±		1.16	1.27	0.73	0.58	–	–	–	–	–	–	–	–	–
	C.D. (P=0.05)		3.51	3.85	2.20	2.15	–	–	–	–	–	–	–	–	–

Table 3 Contd.....

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Sr. No.	Treatments	Conc. of insecticide (%)	Cost of cultivation + cost of insecticides (Rs.)				Monetary returns (Rs.)				Net income (Rs.)				Benefit cost ratio			
			08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled	08-09	09-10	10-11	Pooled	8-9	9-10	10-11	Pooled
1.	Imidacloprid 17.8 SL	0.004	23513	24166	26658	24779	69876	61350	93888	75038	46363	37184	67230	50259	2.97	2.54	3.52	3.02
2.	Chloropyrifos 20 EC	0.02	23247	23900	26385	24511	60240	55200	76304	63915	36993	31300	49919	39404	2.59	2.31	2.89	2.60
3.	Acetamiprid 20 SP	0.01	23647	24300	26505	24817	66672	58635	90592	71966	43025	34335	64087	47149	2.82	2.41	3.42	2.89
4.	Dimethoate 30 EC	0.03	23317	23970	26450	24579	60732	55365	78816	64971	37415	31395	52366	40392	2.60	2.31	2.98	2.64
5.	Quinalphos 25 EC	0.025	23447	24100	26590	24712	61224	55110	78016	64783	37777	31010	51426	40071	2.61	2.29	2.93	2.62
6.	Thiamethoxam 25 WG	0.0025	23422	24075	26700	24732	70116	61110	91840	74355	46694	37035	65140	49623	2.99	2.54	3.44	3.00
7.	Oxy demeton methyl 25 EC	0.025	23467	24120	26580	24722	61728	57960	76704	65464	38261	33840	50124	40742	2.63	2.40	2.89	2.64
8.	Untreated control	-	22797	23300	25630	23909	48888	48750	66960	54866	26091	25450	41330	30952	2.14	2.09	2.61	2.29

Cost of insecticides : for year 2008-09, 2009-10 and 2010-11

1. Imidacloprid 17.8 SL : Rs.1850/l,Rs.1850/l ,Rs.1900/l
2. Chloropyrifos 20 EC Rs. 150/l, Rs.150/l, Rs.155/l.
3. Acetamiprid 20 SP : Rs.110/100 g, Rs.110/100 g , Rs.110/100 g
4. Dimethoate 30 EC Rs.220/l , Rs.220/l, Rs.220/l
5. Quinolphos 25 EC : Rs.350/lit , Rs.350/lit, Rs.360/lit
6. Thiamethoxam 25 WG Rs.325/100 g, Rs.325/100g, Rs. 340/100g
7. Oxy-demeton methyl 25 EC : Rs.290/lit, Rs.290/lit, Rs.350/lit

Price of wheat grains : Rs.1200/q ,Rs.1500/q, Rs.1600/q

(2001) reported that the application of imidacloprid resulted in effective control of aphids and increased plant stand per unit area compared to those in untreated plots. The application of insecticides in addition to host plant resistance has been proven to be better for controlling aphids on wheat (Iqbal and Ali, 2005). Okley (2000) reported that primicarb application was effective in controlling the aphid infestation. Shukla and Pathak (2000) reported that monocrotophos (0.05%), methyl demeton (0.03%), dimethoate (0.03%) and deltamethrin (0.03%) were highly effective against the corn leaf aphid, *R. maidis* (Fitch.) on wheat.

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