Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
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http://ansinet.com

Asian Journal of Plant Sciences
Volume 1 Number 2: 205-207, 2002

Varietal Performance of Wheat (*Triticum aestivum*) Against Wheat Aphid (*Macrosiphum miscanthi*) and its Chemical Control with Different Doses of Insecticides

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Abstract: The effectiveness of three different tested insecticide and their doses against aphids on wheat showed that Tamaron gave highest reduction in the aphid population followed by Thiodon and Cypermethrin (Ripcord). All of the tested insecticides were found significantly different to control in term of reduction in aphid population and in increase of yield of wheat.

Key words: Wheat, control, aphid, yield

Introduction

Wheat *(Triticum aestivum)* is one of the most important cereal crop and the staple food through out the world including Pakistan. It is extensively grown both in irrigated and rained areas around the world. A lot of efforts have been made in the country to develop high-yielding dwarf varieties. These varieties have replaced the traditional varieties. Due to the introduction of new varieties and use of insecticides, especially in cotton growing areas, several species of aphids have become serious pests in some areas. Among these wheat aphid *(Macrosiphum miscanthi)*, bud cheery aphids *(Rhopalosiphum padi)* and english grain aphid *(Sitopion avenae)* are more common. The aphids initiates feeding at the base of the leaves near the top of the plant. As the colony develops, the leaf edges begin to roll inward, enclosing the aphids in tubular, protective structure. This protection makes the aphid un-accessible to natural enemies and insecticidal spray. As a result of salivary toxins injection by the aphid, plants become purplish and develop longitudinal and whitish streaks on leave. The damage is particularly sever in cold and cloudy weather during winter. They mostly appear from December to January. Trdan and Milevoj (1999) reported that aphid caused 10 to 50% reduction in crop yield directly and 20 – 80% indirectly.

Dahams *et al.* (1985) tested Denton, Wichita, Chinese and Russian wheat varieties in southern plains areas of Oklahoma. Denton was found less preferred by the aphids and less susceptible to the attack of aphid as compared to the other varieties. Atkins and Dahams (1991) screened 10 wheat varieties in the field against aphid population. The late sown varieties Marquis, Ceres, Thatcher, Ribal and Mida were found resistant to the attack of aphids. Bayles and Clark (1991) evaluated in field trials the relative susceptibility of 15 cultivars of spelmar (*Triticum durum*) 16 cultivars of Einkorn (*Triticum monococcum*) and 13 cultivars of Khpali (*Triticum Dicoccum*) against wheat aphid in United States. Minimum aphid infestation was reported in Einkorn and maximum in the spelmar.

Sing and Sircar (1983) evaluated the toxicity of insecticide against different species of aphid. The most toxic compounds against *Aphis craccivora, Brevicoryne brassicae, Dactyesotus earthami, Lipaphis erysimi, Myzus persicae and Macrosiphum miscanthi,* were Phorate, Dimenthoate, Carbryl and Endosulfan. Lindane and Phidan were also found effective against aphid and relatively safe against *Coceinella septempunctata.* Karishniah and Mohan (1983) conducted an experiment on control of wheat aphid and observed that the population of aphid on wheat was in considerable number after third spray of Quinalphos, Matamidophos in November. Chloropyripos (0.5 kg ha^{-1}). Monocrotophos (both at 0.3 and 0.5 kg ha^{-1}) Endosulfan (0.7 kg ha^{-1}) gave effective control and suppressed the population after fortnight of spray. Performance of Monocrotophos at 0.3 kg ha^{-1} and Phospamidon, Phenthoate, Methomyl (0.5 kg ha^{-1}) were found equally effective. Chlorofenvenphos, Asspnate, Malathion, Fenetrothion, Trichlrphon, Garlic oil, Carbaryl and Dicrotophos also provided control of this pest. Gandhale *et al.* (1983) used Endosulfan, Quinaophos, Fenitrothion, Phosalone and Malathion at 0.05%, Formothion and Thiometon at 0.02% against *Macrosiphum miscanthi* in field trials in Maharshta, India in 1976-78. The highest mortality was caused by Thiometon (77.28%), while Malathion was found least effective (62.48% mortality). The aphids mortalities in the remaining treatments were ranged from 7.50 to 76.57%. Tewari and Moorthy (1983) conducted field plot tests in India in 1982-83 to determine the effectiveness of sprays of 10 insecticides in the Aphis control and to note their effects on the predator *Menochilus sexmaculatus.* On the basis of effectiveness against the aphid and low toxicity to the predator, they recommended Endosulfan, Metasystox and Dimethoateat a dose of 700 g $acre^{-1}$. Cypermethrin. Fenvalerate, Permethrin, Deltamethrin, Malathion and Carbaryl were found less toxic to the aphid. Shafique (1984) used different insecticides for the control of aphid on wheat. He found maximum mortality in plot treated with Tamaron 96 EC (96%) followed by Inexiot 60 EC (78%). Lannate 20 EC (60%) and Dimecron 100 EC (51%) after 24 hours of spray. After 96 hours of spray Tamaron, Dimecron, Inexiop and Lannate gave 87, 78, 76 and 95% mortality, repectvely,. Dimecron and Tamaron gave 77% and 60% mortality of aphid after one and two weeks respectively. Maximum yield was obtained in the plots treated with Dimecron (746kg ha^{-1}) followed by Tamaron (725kg), Inexiot (710kg), Lennate 620kg) as compared to 325 kg in the check point.

Lal (1992) conducted an experiment to test the efficacy of various insecticides against aphids. According to him, Endosulfan at 500 g\ha gave the most effective control, followed by Phosalone, Cypermethrin at 10 g ha^{-1}. Deltamethrin at 10 g ha^{-1} also provided good control of this pests. Malathion at 1000 g ha^{-1} and Carbaryl 2000 g ha^{-1} were found less effective. Sipes (1999) applied different insecticides to reduce the aphid infestation on wheat in Sudan. Diafenthiuron (as Polo) and Chlorpyrifos + Endosulfan were applied in December 1997. Diafenthiuron gave excellent long-lasting control of wheat aphid *(Macrosiphum miscanthi)* as compared to Chlorpyrifos + Endosulfan. Reddy *et al.* (1999) tested dust formulation of Methyl parathion, Fenitrothion, Quinalphos, Endosulfan, Carbaryl, Delta methrin, permethrin Cypermethrin, Malathions and pirimicarb against wheat aphid *(Macrosiphum miscanthi).* Pirimicarb, Cypermethrin, Endosulfan, Carbarryl gave 95% mortality and other gave satisfactory (79%) aphid mortality.

Keeping in view the importance of the crop and its substantial loss by wheat aphids, a project was initiated with the objective: To evaluate the performance of different varieties of wheat *(Triticum aestivium* and to determine the most effective insecticide and its dose against wheat aphids.

Materials and Methods

Two experiments viz. varietal trial and chemical control were conducted at the experimental farm of Faculty of agriculture, Gomal university, D.I.Khan during 1999 – 2000 to determine the performance of wheat varieties against aphid attack and to find out the most effective insecticide against this pest.

Varietal trial experiment: The experiment was laid out in Randomized Complete Block design. The following wheat varieties were selected for their performance against the pest, Bakhtawar, MH-97, Daman 98, Pirsbak 91 and Suleman. The seeds were sown on November 15, 1999 in the plots measuring 2 x 3 m^2 in tar wattar condition. Row to row distance was kept 30 cm. This trial was not treated with any insecticide. All agronomic practices were equally applied in all of the treatments. The data was recorded on the basis of number of aphid $leaf^{-1}$. For this purpose 10 plants were selected in each sub plot randomly. Number of aphids were counted on three leaves which was selected at bottom middle and top of each plant and mean of counts was recorded.

Chemical control: The chemical control trail was conducted in two factors factorial design. The following insecticides were used (Table 1). Wheat variety 'Inqilab' was sown in the same way as described above. Treatment of insecticide was given when the number of aphids reached to economic threshold level i.e., (10 aphid $leaf^{-1}$). Insecticides were sprayed with the help of knapsack sprayer. Data were recorded after 24, 48,

Table 1: Doses(ml na^{-1}) of insecticides.

Insecticides	Low	Medium	High
Thiodan 35 EC	200	400	500
Ripcord 10 EC	150	200	250
Tamaron 600 SL	300	400	500

72 hrs and one week of treatments. The data of treated plots were compared with that of control plots. The crop was harvested in April 2000 in morning time. Plants of each subplot was tied separately and respective tags were attach to them. The cost benefit ratio was determined, on the basis of yields achieved in each treated and untreated plots.

Results and Discussion

Performance of wheat varieties against aphid: The results in (Table 2) indicated that different varieties were found statistically non-significant to each other. Maximum aphid infestation was recorded in MH-97 while minimum infestation was recorded in Bakhtawar.The results revealed that none of the varieties was found resistant to the attack of aphids, however the aphid attack was less in Bakhtawar as compared to other tested varieties.

Table 2: Average number of aphid per leaf on different wheat varieties

Varieties	Mean of aphid $leaf^{-1}$
Bakhtawar	338.35
Suleman	357.76
Daman	362.33
Pirsbak 91	352.33
MH-97	397.00

Table 3: Number of aphids $leaf^{-1}$ recorded after different duration of insecticidal treatment

		Duration in days			
Treatment	Dose	One	Two	Three	Seven
	D_1	9.86B	9.63B	5.26BC	8.40B
Thiodan 35 EC	D_2	10.16B	5.80BCD	5.36BC	7.40B
	D_3	9.20B	5.36CD	5.06BC	6.80B
	D_1	9.13B	7.33BC	5.86BC	8.50B
Ripcord 10 EC	D_2	9.50B	6.60BCD	5.53BC	7.80B
	D_3	8.60B	8.30BC	8.20BC	8.30B
	D_1	9.00B	4.70CD	4.90BC	7.10B
Tamaron 600SL	D_2	6.45B	5.30CD	3.56C	7.10B
	D_3	6.00B	2.10D	3.96C	6.40B

Means followed by same letters are non-significantly different from each other at 5% level of probability.

Table 4: Yield (kg $plot^{-1}$) data of wheat crop in treated and untreated plots

Treatment	D_1	D_2	D_3	Mean
Thiodan	2.25ABC	2.5AB	2.25ABC	2.33AB
Ripcord	2.5AB	1.8ABCD	1.91ABCD	2.07AB
Tamaron	2.5AB	2.9A	2.41ABC	2.60A
Control	0.983D	1.33CD	1.58BCD	1.29B
Mean	2.053A	2.14A	2.04A	

Means followed by same letters are non-significantly different from each other at 5% level of probability.

Table 5: Cost benefit ratio of different treatments

Insecticides	Output (Rs ha^{-1})	Cost benefit ratio
Tamaron 600SL	4333.33	1:2.00
Thiodan 35EC	3883.34	1:1.80
Ripcord 10EC	3450.00	1:1.60
Control	2150.00	

Number of aphid/leaf on wheat after one day of spray: The data (Table 3) recorded after one day of spray of Thiodan 35EC, Ripcord 10EC and Tamaron 600SL shows that 9.86, 9.13 and 9.50 aphid/leaf were present respectively at low dose. 10.16, 9.50, 6.45 aphid/leaf were recorded at medium dose and 9.20, 8.60 and 6.00 aphids/leaf were recorded at high dose in the plots treated with the above mentioned insecticides respectively, whereas the average number of 19.80 aphids/leaf were recorded in control check plots. The date reveal that Tamaron was found most effective in the reduction of pest population at low, medium and high dose followed by Ripcord and Thiodan. All of the tested insecticides and their doses were found non-significantly different from each other at 5% level of probability in the control of aphid population on wheat plants. All of the tested insecticides were found significantly effective compared to control plots in the reduction of pest population. As for as doses are concern all of three doses of insecticides were found non-significantly different in the control of pest.

Number of aphid $leaf^{-1}$ on wheat after two days of spray: The result recorded after two days of spray reveal that aphid population leaf were reduced to 9.63, 7.33, 4.70 at low dose; 5.8, 6.6 and 5.3 at medium dose and 5.36, 8.3 and 2.1 at high dose, in Thiodan, Ripcord and Tamaron treated plots respectively. Whereas the average number of 17.23 aphids/leaf were recorded in control check plots (Table 3). The data showed that Tamaron at low, medium and high doses was found significantly most effective followed by Thiodan and Ripcord. Ripcord and Thiodan were found non-significant to each other at 5% level of probability in the control of aphid population. All of the tested insecticides were found significantly effective compared to control plots. All of three tested doses of the insecticides were also found non-significantly different in the reduction of pest population.

Number of aphid $leaf^{-1}$ on wheat after three days of spray: The data (Table 3) obtained after three days of spray of Thiodan 35EC, Ripcord 10EC and Tamaron 600SL show that the aphids/plant were drop to 5.26, 5.86 and 4.9 respectively at low dose. 5.36, 5.53 and 3.56 aphids/leaf at medium dose and 5.06, 8.2, 3.96 aphids/leaf at high dose respectively. Whereas the average number of aphids/leaf were found 17.15 in control plots. The data showed that low, medium and high dose of Tamaron gave significantly good control of the pest, followed by Thiodan and Ripcord. The later two tested insecticides were found non-significantly different from each other at 5% level of probability in the control of aphid population on wheat. All of the tested insecticides were highly significant compared to the control plots. However the doses of the insecticides were proved non-significant in the reduction of aphid population.

Number of aphid $leaf^{-1}$ on wheat after one week of spray: The data of chemical control trail against aphids on wheat, recorded after one week (168 hours) show that 8.4, 8.5 and 7.1 aphids/leaf were recorded at low dose. 7.4, 7.8 and 7.1 were recorded at medium dose. 6.8, 8.3 and 6.4 at high dose in Thiodan 35EC, Ripcord 10EC and Tamaron 600SL treated plots respectively. The average number of aphids/leaf were recorded 16.46 in the control plots.The results revealed that Tamaron was found most effective at low, medium and high dose in the reduction of pest population, followed by Thiodan and Ripcord. All of the tested insecticides and their doses were found non-significantly different from each other at 5% level of probability in the control of aphid population. All of the tested insecticides were found significantly effective compared to the control plots.

Grain yield (kg $plot^{-1}$): The yield data (Table 4) of chemical control trial conducted against aphids on wheat reveal that grain yield 2.25, 2.5, 2.5 (kg $plot^{-1}$) was obtained in Thiodan 35EC, Ripcord 10EC and Tamaron 600SL treated plots at low dose. 2.5, 1.8 and 2.9 kg/plot at medium dose and 2.25, 1.91 and 2.41 kg/plot at high dose were recorded respectively. The average grain yield in control plots were 1.29 kg/plot. The data showed that Tamaron treated plots provided significantly good average yield followed by Thiodan and Ripcord. Ripcord and Thiodan were found non-significant to each other but significant compared to control plots.

Cost benefit ratio: The per hector earning (Table 5) in term of Rs 4333.333, 3883.33 and 3450.00 were obtained from wheat plots treated with Tamaron, Thiodan and Ripcord against wheat aphid, compared to check in which the grain yield worth 2150.00 per hector were obtained. Tamaron ranked first, followed by Thoidan and Ripcord in the cost benefit ratio. The results revealed that all of the three tested insecticides were found effective in the control of wheat aphid ompared to untreated (check). Tamaron was ranked first followed by Thiodan. Ripcord (Cypermethrin) was found effective upto two days of spray but it lost its efficacy against the pest

afterward. These results are more or less in agreement with the findings of previous workers. Karishniah and Mohan (1983) reported the efficacy of Metamidophos (Tamaron) against wheat aphid. Shafique (1984) obtained control of this pest and increase in wheat yield with application of Tamaron. Thiodan (Endosulfon) was found effective in the control of wheat aphid by Sing and Sircar (1983), Ganhale *et al.* (1983), Tewari and Moorthy (1983) and Lal (1992). Cypermethrin was found less effective against this pest. Similar results were recorded by Tewari and Moorthy (1983) and Lal (1992).

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