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Lucerne as Trap Crop in Wheat for Development of Predators Population Against Wheat Aphids (Aphididae: Homoptera)

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Abstract.- Studies on utilization of lucern (*Medicago sativa* L.) as a predator source in strips parallel to wheat cultivar, Inqlab–91 were compared with wheat not having lucern as trap crop during 2004-05. The experiment was laid out in Randomized Complete Block Design with three replications. Populations of aphids, ladybird beetles and syrphid flies were counted from each plant of one square feet of wheat. The maximum population of aphids was observed on plots not trap cropped with lucern. The establishment of beneficial insects on lucern harbouring aphids helped to delimit the aphid population in intercropped wheat plots and maintained them below economic injury level. This reveals the role of trap cropping of fodder crops in wheat to decrease the insecticide application chances on this cereal crop of great importance.

Key words: Trap cropping, ladybird beetle, lucern, syrphid fly, wheat aphids.

INTRODUCTION

Wheat *(Triticum aestvium* L.), a leading cereal grain crop, is cultivated on an area of 8176 thousand hectares showing 1.8% an increase over the last year in Pakistan. The yield per hectare was also increased by 1.5 % (Anonymous, 2004). It is the first cereal crop grown before rice and maize in Pakistan contributing more than 70% for provision of the total carbohydrates in the daily diet of people in Pakistan (Anonymous, 2000).

Out of four major aphid species present, *Schizaphis graminum* (Rond) has attained a great importance during the last few years. These sap feeders reduce the vitality of the plants by sucking the cell sap from their whole plants especially leaves to make them look pale and wilt. Sooty mould develops fast on the honeydew excreted eventually affecting the rate of photosynthesis in plants (Van Roermund *et al.*, 1986; Wratten and Redhead, 1976). For the last few years, it is being severely attacked by wheat aphids (Aheer *et al.*, 1993; Hamid, 1983; Hashmi *et al.*, 1983) can decrease its yield from 35-40% (Girma *et al.*, 1993; Kieckhefer and Gellner, 1992).

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The decline in availability of parasitoids occurred due to intensive agriculture reducing the availability of non-crop habitats where alternative aphids may be present. Alternative hosts in adjacent strips could act as a temporal and spatial bridge that may help to maintain parasitoid populations until wheat aphid populations become sufficient for parasitoids to get establish (Langer *et al.*, 1997). Use of insecticides is not recommended due to its direct use as cereal crop result in health hazards and environmental pollution. Certain crops of low importance have been used as an alternate source of host plant or as a trap crop with the major crop of importance to maintain the insect pest level under certain limit to decrease the insecticide usage.

The objective of the present studies was to determine the role of lucern crop as a source of predatory insects to kill the aphids present in the adjacent wheat fields.

MATERIALS AND METHODS

The present research trial was conducted at the experimental area of University College of Agriculture, Bahauddin Zakariya University Multan, Pakistan during the year 2005. Lucern was used as trap crop in wheat cultivar, Inqlab–91 in parallel fashion to compare the availability of predatory fauna in these plots with no trap cropped wheat plots. The experiment was laid out in a Randomized

Complete Block Design (RCBD) with three treatments and three replications. Each wheat plot contained twenty rows with row-to-row distance of 12 cm. The trap cropped lucern plots contain six rows on both sides of these wheat plots. No lucern was trap cropped with wheat as a check to compare the effectiveness of these predators in lucern crop. Plots were checked weekly for aphid and predatory insects like ladybird beetles and syrphid flies population and parasites presence till the crop maturity. Observations were taken with sample size of one square feet of wheat from five random spots in each plot. All plants in one square feet were stroke ten times with a stick gently. The falling aphids and beneficial insects were collected on a white paper of 1.5 square feet placing under the plants and counted. The presence of predators was also observed from the same samples observed for aphids. The parasites were observed from the aphids collected from each plots and kept in Petri dishes for emergence of parasitoids from them.

The data was subjected to statistical analysis of variance and LSD test at 5% probability level to compare the means. All the standard agronomic practices were followed through out the growing season uniformly in all the plots.

RESULTS AND DISCUSSION

Number of aphids were first counted on lucern, trap cropped wheat and wheat with no trap cropping with lucern respectively when observed on February 5, 2005 (Table I). However, the number of aphids increased more in wheat plots not trap cropped with lucern followed by trap cropped wheat plots with lucern on February 22, 2005. The aphid population showed almost the same trend on the next weekly observation taken on March 01, 2005. Predators were not observed during this three weeks period in these plots. On March 8, 2005 a non-significant difference in aphid population was observed in both wheat plots trap cropped with lucern and those without trap cropping with lucern. However, aphid number increased in lucern plots adjacent to wheat plots. The establishment of predators *i.e.,* ladybird beetles and syrphid flies were seen in all the plots *i.e.,* lucern plots, wheat plot trap cropped with lucern and those without trap cropped with lucern. Ladybeetles are an important group of aphid predators in agricultural crops (Hodek and Honek, 1996). Potential of the generalist predator *Coccinella septempunctata* to control pest aphids in wheat fields in landscapes with varying levels of prey in non-crop habitats that *C. septempunctata* reproduction and the associated control of pest aphids is affected by both the availability of non-pest aphids in non-crop habitats and the infestation date of pest aphids in wheat fields (Bianchi and Werf, 2004).

There was a significant reduction in aphid population on March 15, 2005 where almost half of the number present in without trap cropped wheat plots. The number of predators increased a bit in number in this week but they remained non-significant to each other. Although the number of predators was more in wheat plots trap cropped with lucern as compared to wheat plots without lucern trap cropping yet they remained non-significant to each other. Number of aphids also decreased in lucern plots associated with wheat plots when observed on March 22, 2005. Number of aphids on March 29, 2005 in wheat plots trap cropped with lucern was non-significant with wheat plots not trap cropped with lucern but was significant to lucern plots. Data observed in first week of April revealed that maximum aphids were present in lucern plots which differed statistically to that in wheat plots not trap cropped with lucern followed by the wheat plots trap cropped with that of lucern. Although the number of predators were more in wheat trap cropped with lucern when compared to other treatments yet their number remained non-significant to each other. Alternative host presence along with wheat crop can increase parasitoid abundance that feed on other crop pests and consequently increase their pressure on cereal aphids (Langer and Hance, 2004). As studied by Langer *et al*. (1997) parasitoid activity in wheat crop fell down two weeks before wheat aphids appear and their parasitism remained low. So there was a little activity record of parasitism in aphids collected from these plots of lucern, wheat with trap cropping of lucern and without of it. This is in conformity with our results where negligible parasitism rate was recorded.

Table I.- Number of aphids and beneficial insects (ladybird beetle and syrphid flies) present on lucern, trap cropped wheat and non-trap cropped wheat.

Treatments	Dates of observation							
	15th Feb	22nd Feb	01st Mar	08th Mar	15th Mar	22nd Mar	29th Mar	05th Apr
Aphids in lucern	0.817 a	1.967 c	5.797 c	18.73 b	0.000 c	8.033 c	20.83 b	22.50 a
Beneficial insects in lucern	0.000 d	0.000 c	0.000 c	0.333 c	0.667 c	1.000 c	1.533 c	1.900 d
Aphids in trap cropped wheat	0.400 b	10.67 b	49.60 b	101.3 a	38.07 b	18.47 b	27.23 a	7.900 c
Beneficial insects in trap cropped wheat	0.000 d	0.000 c	0.000 c	0.333 c	2.333 c	2.467 c	2.90 c	3.600 d
Aphids in non- trap cropped wheat	0.200 c	20.37 a	78.17 a	105.1 a	50.07 a	40.43 a	22.4 ab	12.13 b
Beneficial insects in non- trap cropped wheat	0.000 d	0.000 c	0.333 c	0.667 c	1.667 c	1.600 c	1.93 c	2.533 d
LSD value	0.081	2.43	13.60	12.22	8.45	10.42	5.35	3.01

* Means not sharing a letter in common differ significantly at 5% probability level (LSD test)

Table II.- Correlation among aphids on lucern (T_1), wheat intercropped with lucern (T_2) and without lucern (T_3) meteoroligical data.

	Max Temp.	Min Temp.	RH at 8 AM	RH at 5 PM	T1	T2	T3
Max Temp.	1.00						
Min Temp.	0.71	1.00					
RH at 8 AM	-0.16	0.23	1.00				
RH at 5 PM	0.07	0.35	0.22	1.00			
T1	0.71	0.29	-0.53	0.21	1.00		
T2	0.01	-0.54	-0.76	-0.18	0.31	1.00	
T3	-0.18	-0.66	-0.34	-0.22	0.12	0.81	1.00

Table III.- Correlation among beneficial insects on lucern (T_1), wheat intercropped with lucern (T_2) and without lucern (T_3) meteoroligical data.

	Max Temp.	Min Temp.	RH at 8 AM	RH at 5 PM	T1	T2	T3
Max Temp.	1.00						
Min Temp.	0.71	1.00					
RH at 8 AM	-0.17	0.23	1.00				
RH at 5 PM	0.08	0.36	0.23	1.00			
T1	0.85	0.81	-0.07	0.12	1.00		
T2	0.95	0.78	-0.01	-0.05	0.88	1.00	
T3	0.96	0.67	-0.12	-0.11	0.85	0.99	1.00

An increase in agricultural production systems without pesticide use has made the other control methods like cultural, host plant resistance and biological control to integrate each other for this maximum output. Trap crops are used as a tactic to reduce the insect pest pressure in crops at priority to conserve the biological control agents necessary to maintain the population of insect pests (Landis *et al*., 2000). Amandine *et al*. (2005) recommended strip cropping the only way to manage the aphids in

wheat crop. They recommended the use of parasitoids at mass release during the cropping season of wheat to control the aphid population in wheat trap cropped with clover/ryegrass as a reservoir for these parasitoids. The availability of food and host directly affect the ladybird migration behavior and their associated bio control in the crop (Hodek *et al*., 1993). In these days with high inputs like mechanization, fertilizers and insect pest control with low rates of wheat crop made these crops less economical. The approach of integrated crop management with the proper utilization of the polyphagous predators like ladybirds and syrphid flies can help to reduce the yield losses due to major insect pests of wheat *i.e.*, aphids. As these predators overwinter in field boundaries and move to the wheat on availability of aphids (Anderson, 1997). The alternate host plant may serve as a host with insect pests to hide and feed before the insect pests harbour the main crop of interest. The number of aphids on lucern were found positively correlated with the maximum and minimum temperature as well as with the relative humidity recorded at the evening (Table II), while negative correlation was found with the relative humidity recorded in the morning (Table II). In the treatment having no lucern, negative correlation has been found with respect to all temperatures and relative humidity. The beneficial insect data showed the significantly positively correlation with temperature in all the three treatments, while the negative correlation was found with the relative humidity (Table III).

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