



# Asian Journal of Plant Sciences

ISSN 1682-3974

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Management of Aphid (*Myzus persicae*) on Autumn Sown Potato Crop

<sup>1</sup>Muhammad Tahir Jan, <sup>2</sup>Muhammad Idrees Khan, <sup>1</sup>Rashid Mahmood and <sup>3</sup>Muhammad Naeem  
<sup>1</sup>Entomology Section, <sup>2</sup>Breeding Section, Central Cotton Research Institute, Multan, Punjab, Pakistan  
<sup>3</sup>Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan

**Abstract:** For aphid management, mix cropping (PBM and PRM), four insecticides (DDVP, Anthio, Monitor and Laser) and yellow plastic sheet trap were used. The incidence of the pest was recorded on the leaves of the potato plants and yellow plastic sheets. The emergence of the pest on the crop occurred during October, which increased to the peak 43 aphids/leaf in the month of December. However on yellow plastic sheets, alate form of the aphids were recorded during the third week of September, which remain in abundance from the fourth week of November to the third week of December with the highest count 235 aphids/trap during second week of December. Among the treatments YPT, PBM and Monitor were found most effective against aphids during the entire growing season. Maximum reduction (72%), in YPT, (70%) in PBM and (52%) in the plot reserved for Monitor, in the aphid population was recorded. In the remaining treatments 40-50% of the population was reduced during the intact growing season of the potato crop when compared with control.

**Key words:** Aphid, management, mix cropping, insecticides, yellow plastic sheets

### Introduction

Potato (*Solanum tuberosum*) is the world's most important food crop with annual production of nearly 300 million tones on more than 12 million hectares (Martin *et al.*, 1990). Three crops of potato are annually grown in Pakistan, i.e., autumn and spring crops in the plains and summer crop in the hills (Anonymous, 1991a). The total area under potato cultivation was 72900 hectares with an average production of 10 tones per hectare, where as in NWFP the crop was grown on 6900 hectares with an average yield of 13.4 tones per hectare (Anonymous, 1991b). Aphids infest the foliage of potato crop (Panajotou and Katis, 1986) and is a vector of "PVY" (Potato Viral Yellow) (Turl and Mc-Donald, 1987) and leaf roll mosaic (Palgrave, 1972). On the crop planted on 1<sup>st</sup> Sept. the aphid population reached a peak number in the 1<sup>st</sup> week of Nov. and declined thereafter. The pest disappeared by the 3<sup>rd</sup> week of December (El-Saadany and Fattah, 1980). The pest *M. persicae* was also observed in the 1<sup>st</sup> week of December with 1.68 aphids per plants, which increased to 9.01 per plant in the 4<sup>th</sup> week of January (Anwar *et al.*, 1987). Among the management practices, vegetational diversity is a useful tactics in the control of insect pests in various agroecosystems. It might change herbivore population and interferes with visual host finding cues. Mix culturing also disrupts the olfactory cues of the pest in host finding and once the pests leave the polyculture, they have difficulty in locating and relocating their host plants (Shahjahan and Streams, 1973 and Andow, 1992). Similarly the subsequent removal of alfalfa in the dicultural agroecosystem reduced the herbivore population in the alfalfa-soybean mix cropping (Poston and Pedigo, 1975). Organophosphorus sprays were used against *M. persicae* when population density reached 71500/100 leaves which increased the tuber yield of potato about 10 % (Southall and Sly, 1976). Carbofuran (Curater) used as granules and sprays against *M. persicae* showed good effects on potato yields (Koble, 1975). For monitoring and control of aphids, large (150 x 100 cm<sup>2</sup>) medium (20 x 25 cm<sup>2</sup>) or (20 x 40 cm<sup>2</sup>) and small (12.5 x 12.5 cm<sup>2</sup>) sticky plastic sheets in various directions were found equally effective (Shahid, 1986; Ali, 1986; Rehman and Shahid, 1988). Keeping in view the importance of the crop and the damage caused by the aphid, a research project was initiated to determine the population density of aphids, to assess the effect of Potato-Berseem and Potato-Radish mix / Inter cropping over the relative effectiveness of four insecticides on the population density of aphids and to determine the effect of yellow sticky plastic sheet traps for monitoring and control of aphids.

### Materials and Methods

Research project was under taken at the Agricultural Research Farm, NWFP Agricultural University, Peshawar. Commercial

cultivar AAI-Thamash@ was sown on 10<sup>th</sup> September, 1994 on an area of 720 m<sup>2</sup> in 32 sub plots (8 treatments x 4 replications) each measuring 5 x 4.5 m confined to Randomized Complete Block Design (RCB Design) with DMR Test at 5% level of significance (Walter, 1967). The distance between plots was ½ m, between the rows 75cm and between the plants 20cm was maintained. There were six rows each having 25 plants in every sub plot containing in all, 150 plants. At the sowing time, "DAP" fertilizer was applied at the rate of 2 bags ha<sup>-1</sup>. The data on insect pests was recorded at weekly interval from date of sowing to harvest. Treatments details are given as under:

#### Insecticidal trials

T <sub>1</sub> :	DDVP 80%	@200 mlacre <sup>-1</sup>
T <sub>2</sub> :	Anthio 25 EC	@250 mlacre <sup>-1</sup>
T <sub>3</sub> :	Monitor 600 EC	@500 mlacre <sup>-1</sup>
T <sub>4</sub> :	Laser 25 EC	@500 mlacre <sup>-1</sup>
T <sub>5</sub> :	Check	(Untreated plots for population density)

#### Non insecticidal trials

PBM	Potato-Berseem mix cropping
PRM	Potato-Radish mix cropping
YPT	Yellow plastic sheet traps

#### Sampling and analysis for aphids

**Population dynamics:** In each sub plot three plants were randomly selected. Aphids were counted on leaves of the top, middle and bottom branches of the plant.

**Yellow plastic sheet trap flag (YPT):** Aphids are attracted to yellow color which helps in monitoring and to some extent to control the winged form aphids (alate). A plastic sheet of 30x30 cm<sup>2</sup> on wooden frame was fixed one meter above the ground level in T<sub>3</sub> during the crop was emerged. Common mobile oil was used as adhesive material on the sheet for aphids and the sheet would cleaned and applied the material at fortnight interval as done by Shahid (1986). The aphids were counted on both plant leaves and plastic sheets.

**Mix/inter cropping system:** Berseem and radish were mix sown separately after thirty days of potato sowing. But before sowing, all the agronomic practices to potato crop like hoeing, soil raising and tilling were completed. Berseem was sown between the ridges with broadcast method while radish was sown on alternate edge of ridges as directed by the Department of Farm Management. Berseem was removed subsequently at fortnight intervals for fodder purposes whereas full grown leaves of radish were left as such and removed at the time when potato crop was harvested. The population of aphids were recorded only on the leaves of potato crop.

**Insecticide application:** The insecticides were used at the recommended doses in T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> respectively. These insecticides were sprayed once during second week of December. Besides routine data, data one day before the spray and three data at one day interval after spray was recorded to find the comparative efficacy of the insecticides.

**Results and Discussion**

**Population dynamics:** The population of both forms of the aphids (wingless aphids from the leaves and winged (alate) on the yellow sheets) were recorded. The pest was flowed out during September that gradually reached a peak in December and then decreased thereafter (Fig. 1 and 2). On the leaves, the pest emerged during October. Maximum population (43 aphids per leaf) was found during December with highest seasonal mean 15.55 per leaf. Previously the highest population of *Myzus persicae*, on the crop planted on 1<sup>st</sup> Sept. was recorded in the 1st week of Nov. which declined thereafter and disappeared by the 3rd week of December (El-Saadany and Fattah, 1980). The pest was also observed in the 1<sup>st</sup> week of December with 1.68 aphids per plants which increased to 9.01 per plant in the 4th week of January (Anwar *et al.*, 1987).

The emergence of the alate form of the aphids occurred during the third week of September that remained active till second week of January (Fig. 2). The pest was abundant from last week of November till third week of December. The peak (235 aphids/YPT) was found during the second week of December. In past, these sheets were used by Shahid (1986), Ali (1986) and Rehman and Shahid (1987) for the control of aphids.

**Management tactics:** All the management tactics were found better and effective against aphid. Among the mix cropping system, PBM (Potato-berseem mix grown) was far better than PRM (Radish-potato mix grown). Similarly in the plots reserved for yellow plastic sheet (YPT), the population of the wingless aphids was significantly lower. Among the four insecticides, Monitor was found significantly good against aphids and the other three insecticides were found similar in action.

**Response of (*Myzus persicae*) to mix cropping:** Seasonal means of aphid population was 4.62 in PBM, 8.05 in PRM with 70.3% reduction in PBM and 48.23% in PRM against 15.55, in control plots (Table 1). The reason for low population in PBM and PRM may be the effect of diverse habitat, as it is thought that in polyculture insect pest population is considerably lower than in monoculture. Tehvanainen and Root (1972) called the phenomenon as "Associational; resistance" which refers to reduced herbivore attack that a plant experience in association with genetically or taxonomically diverse plant habitat. Andow (1992) suggested herbivore were more likely to find and remain on host plants that occur in large, dense and pure stands. Plant species diversity, when interferes with visual host finding cues in locating and relocating host plants after leaving polyculture, alter the herbivore population.

**PBM verses PRM:** In PBM 42.6% more aphids were reduced than in PRM (Table 1). The reason for the lowest population in PBM was that berseem was cut at various intervals subsequently for fodder purpose while radish left undisturbed to grow uniformly. However both the crops were terminated along with potato crop. Subsequent removal of berseem at different interval disrupted the olfactory and visual cues of aphids due to which the pest could not relocate its host, was therefore, unable to re-establish its population in PBM and thus confirms the findings of Shahjahan and Streams (1973) and Andow (1991). Similarly it is also observed that radish is a broad leaved plant which is believed that aphids are more attracted to broad leaf as Andow (1992) studied many *Empoasca* spp. and *E. fabae* in particular are more attracted to broad leaved weeds in diverse plant habitat whereas population reduces when grassy weeds i.e., maize sugarcane etc are used in polyculture habitats.

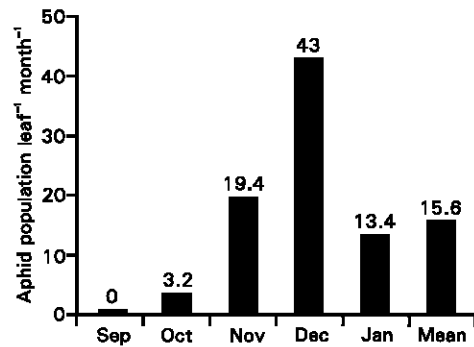


Fig. 1: Population of aphid in different months of year 1994-95

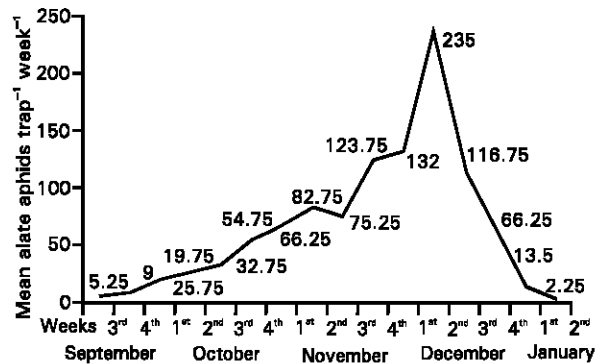


Fig. 2: Monitoring of number of aphids through yellow sticky plastic sheets

Table 1: Pest population of insect pests of autumn potato crop in mix cropping system

Months	Population dynamics			Percent reduction over control
	PBM	PRM	Control	
September	0.00	0.14	00.00	
October	1.33	2.19	03.19	PBM 70.30
November	7.41	12.37	19.44	PRM 48.23
December	13.14	21.43	42.98	Differences between the treatments
January	1.21	4.08	13.17	PBM < PRM 42.60%
Seasonal mean	4.62	8.05	15.55	

PBM: Potato-Berseem Mix Cropping

PRM: Potato-Radish Mix Cropping

Table 2: Percent reduction in aphid population after insecticide application

Treatments	Mean pop. one day before spray	% red. after 1 <sup>st</sup> day of spray	% red. after 2 <sup>nd</sup> day of spray	% red. after 3 <sup>rd</sup> day of spray	% red. after 3 days of spray
DDVP	50.08	66.90	80.69	92.82	80.02b
Anthio	52.53	75.00	86.93	90.58	86.42bc
Monitor	49.42	84.06	93.81	97.81	91.90c
Laser	45.25	70.92	80.86	91.27	81.02b
Check	46.58	00.00	02.50	08.70	03.73a

Means followed by different letters are significantly different at 5 % level of significance.

Table 3: Comparison among the insecticide applications for percent reduction (%) in aphid population (%)

Treatments	% Population	% Reduction
PBM	29.7	70.3
PRM	51.8	48.2
YPT	28.2	71.8
DDVP	52.7	47.3
Anthio	56.3	43.7
Monitor	47.7	52.3
Laser	53.5	46.5
Control	0	0

Table 4: Mean Population Density of Aphids per branch of Potato plant at Malakendher Farm of the NWFP Agricultural University Peshawar, Pakistan

Treatments	September	October	November	December	January	Seasonal mean
PBM	0.00	01.33	07.41b	13.14cd	01.21cd	04.62cd
PRM	0.14	02.19	12.37ab	21.43b	04.08b	08.05b
YPT	0.00	01.41	07.62b	11.01d	01.54c	04.39d
DDVP	0.00	02.29	17.68a	20.86b	00.13d	08.19b
ANTHIO	0.08	03.56	19.50a	20.51b	00.17d	08.75b
MONITOR	0.00	02.35	16.81a	17.89bc	00.04d	07.42bc
LASER	0.00	03.50	19.03a	18.77b	00.13d	08.32b
CHECK	0.00	03.19	19.44a	42.98a	13.17a	15.55a

Means followed by different letters are significantly different at 5 % level of significance

PBM: Potato-Berseem Mix

PRM: Potato-Radish Mix

YPT: Yellow Plastic Sheet Traps

**Relative efficacy of insecticides:** Four insecticides DDVP, Anthio, Monitor and Laser were applied during second week of December. All the insecticides controlled more than 65% of the pest after one day of the spray which increased to more than 80% during second day after spray. Similarly on the third day of the spray more than 90% of the pest reduced (Table 2). On average, more than 80% of the population of aphids were reduced in three days after spray.

Among the insecticides, Monitor was found more efficient as 92% of aphids were reduced which was followed by Anthio which reduced 86% of aphids. Previously Organophosphorus sprays were used against *M. persicae* when population density reached 71500/100 leaves which increased the tuber yield of potato about 10 % (Southall and Sly, 1976). Carbofuran (Curator) used as granules and sprays against *M. persicae* showed good effects on potato yields (Koble, 1975).

**Analogy among the treatments:** Among the treatments YPT, PBM and Monitor were found most effective as lowest population of aphids were recorded during the entire growing season (Table 3). In YPT 72%, in PBM 70% and in the plot reserved for Monitor 52% of the aphid population remained lower than in control plots. In the remaining treatments less than 50% of the population was recorded during the intact growing season of the potato crop. However all the treatments were better than the control plot.

During September to November pest was gradually increased and then reached the peak during December (Table 4). Plots reserved for the insecticidal application and the control were almost similar till November because no insecticide was applied till 11<sup>th</sup> December in which the pest population was significantly dropped after the applications. Among the non insecticidal treatments, PRM was statistically less effective against aphids as compared to PBM and YPT. For aphid management, the three types of practices, (diverse culture, yellow plastic sheet trap and insecticides) were found most effective. Among the diverse culture practices, potato-berseem mix cropping was significantly better than potato-radish mix cropping. Similarly YPT was used efficiently to monitor and control the alate form of aphids. Although there were no apparent

differences among the insecticides, monitor was however found slightly better against aphides.

## References

- Ali, K., 1986. Effectiveness of yellow sticky plastic sheets for aphids trapping in sugar beet. M.Sc.(Hons). Agric. Thesis. Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan, pp :70
- Andow, D.A., 1991. Population diversity and arthropod population response. *Ann. Rev. Entomol.*, 36: 561-586.
- Andow, D.A. 1992. Population density of *E. fabae* in weed beans. *J. Eco. Entomol.*, 85: 379-383.
- Anonymous, 1991a. Six months report of Swiss potato project. Ministry of Food, Agriculture and Co-operatives, Food and Agriculture division, Islamabad, Pakistan, pp :36
- Anonymous, 1991b. Agriculture statistics of Pakistan. Ministry of Food, Agriculture and Co-operatives, Food and Agriculture division, Islamabad Pakistan, pp :79
- Anwar, M.P., G.H. Manshi, T. Hussain and M.L. Shahwani, 1987. Insect pests associated with potato crop at Tandojam. *Proceedings Zoological society of Pakistan*, pp :149-151.
- El-Saadany, G. and M.I.A. Fattah, 1988. Fluctuation of population densities of three Homopterous pests, *Myzus persicae*, *Aphis gossypii*, *Empoasca fabae* and *E. decipiens* attacking potato plants in Egypt. *Bull. Entomol. Soc. Egypt*, 6 :589.
- George, T., 1975. Weeds in orchards as important alternate source of green peach aphids in late spring. *Env. Entomol.*, 4: 958-960.
- Koble, W., 1975. Trials with curator insecticides in maize, beets, potatoes and vegetables with the consideration to effect on yield. *Pflanzenschutz-Nachrichten-Bayer*, 28 :144-151.
- Martin, J.H., W.L. Leonard and D.L. Stamp, 1990. Principles of Field Crop Production. 3<sup>rd</sup> Edition. Macmillan publishing Co. Inc. New York, pp: 898-932
- Palgrave, J.A.C., 1972. Aphids on Potatoes. *Rev. App. Entomol.*, (A). 63 :713; 1975.
- Panajotou P.C. and N. Katis 1986. Contribution to the study of potato aphids in Greece *Entomologia Hellenica*, 4 :11-14.

Jan *et al.*: Management of potato aphid (*Myzus persicae*)

- Poston, F.L. and L.P. Pedigo, 1975. Migration of plant bug and potato leafhoppers in a soybeans-alfalfa complex. *Env. Entomol.*, 49: 8-10.
- Rehman, A.U. and M. Shahid, 1988. Control of sarsoon aphid with colour traps. M.Sc. (Hons) thesis. Department of Entomology, NWFP Agriculture University, Peshawar, Pakistan, pp :72
- Shahid, M., 1983. Integrated control of insect pests of sugar beet. Annual Report 1985-86. PL-480 Project. Department of Entomology, NWFP Agriculture University, Peshawar, Pakistan, pp :13-14
- Shahjahan, M. and F.A. Streams, 1973. Plant defects of host finding by *Liophron pseud pallipes* (Hymenoptera, Braconidae) a parasitoid of the tarnished plant bugs. *Env. Entomol.*, 2: 921-925.
- Southall, D.R. and J.M.A. Sly, 1976. Routine spraying of potatoes to control aphids and potato blight during 1969-73. *Plant Pathol.*, 25 :89-98.
- Tehvanainen and Root, 1972. Population diversity and arthropod population response. *Ann. Rev. Entomol.*, 36: 561-586.
- Turl, L. A.D. and D.M. Mc-Donald, 1987. The relationship between suction trap catches and the spread of PVY in south east Scotland. (Aphid migration and forecasting Euraphid). System in Euro. Comm. Countries.
- Walter, T. F., 1967. Experimental design (Theory and application). Published by Ghalib Primlani Oxford and IBH Publishing Company.