



Asian Journal of Plant Sciences

ISSN 1682-3974

science
alert

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Management of Insect Pests of Autumn Potato Crop in Diverse Culture in NWFP (Peshawar)

M. Tahir Jan, ¹M. Naeem, M. Idrees Khan and Rashid Mehmood
Central Cotton Research Institute, Multan, Pakistan

¹Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan

Abstract: During the crop season leafhoppers and aphids were found the serious pests of potato crop with seasonal mean of 15.55 per branch and 5.21 per sweep, in control plot (monoculture) respectively. The field cricket was also found damaging the tubers but the population was low. Potato crop was mix grown with berseem (PBM) and radish (PRM) as control strategy. Over 70% reduction in leafhopper population occurred due to inter-cropping tactics as compared to control. However among the inter-cropping system, PBM combination was found better than PRM.

Key words: Management, insect pests, inter-cropping system, potato

Introduction

Several studies provided convincing evidence for the utility of vegetational diversity in the control of insect pests in various agro-ecosystems. *Empoasca fabae* caused the greatest damage to soybean at the time of 1st alfalfa harvest in the dicultural agro-ecosystem. However the subsequent removal of alfalfa reduced the leafhopper population in the alfalfa-soybean mix cropping (Poston and Pedigo, 1975). Response of *E. fabae* to beans (*Phaseolus vulgaris*) in four weed habitats (bean monoculture, beans with *Brassica kaber*, beans with broadleaf and grassy weeds) were examined. Visual samples showed that leafhopper density was highest in bean monocultures, lowest in unweeded beans and intermediate in the remaining weed habitats. These results suggested that mixed broadleaf and grassy weeds did not affect total *E. fabae* population density but did affect the spatial distribution of *E. fabae* among weedy and cultivated host plants (Andow, 1992). Shajahan and Streams (1973) found that mix culturing disrupted the olfactory cues of the pests in host finding. Similarly *lygus* bugs (*Lygus helpenus*) preferred alfalfa over cotton when these crops were interplanted in 20ft wide strips (Sevacheria and Stern, 1974).

Andow *et al.* (1986) suggested early season elimination of *Phyllotreta cruciferae* by chemical treatments when living mulches are used. They found that population of *P. cruciferae* and aphids (*Brevicoryne brassicae*) were much lower in cabbage interplanted with living mulches (*Agrostis palustris*, *Festuca rubra* and *Trifolium repens*) than on cabbage in bare ground monoculture. Elmstron *et al.* (1988) also observed that immigration by *P. Cruciferae* was 1.3 times faster into broccoli monoculture whereas emigration was 2 times faster from broccoli-white clover (*Trifolium repens*) diculture than from monoculture. Similarly when population of green peach aphid declined on peach trees, another population of the pest increased on *Chenopodium abium* and pig weeds on the floor of the orchards. Then orchard grass as ground cover which greatly minimized the number of suitable weed hosts of the pest (Georage, 1975).

Keeping in view the importance of potato and the damages caused by insect pests in Pakistan, studies were under taken to assess the effectiveness of Potato-Berseem and Potato-Radish mix/inter cropping on the population density of aphids, leafhopper and field cricket to ensure the control measures effective and economical.

Materials and Methods

The effect of diverse culture on the population density of the insect pests of autumn sown potato was studied at the NWFP Agricultural University Peshawar (Pakistan) during 1994-1995. Commercial cultivar "Al-Thamash" was sown on 10th September, 1994 on an area of 300 m² in 12 sub plots (3 treatments x 4 replications) each measuring 5.0 x 4.5 m² at Agricultural Research Farm, NWFP Agricultural University Peshawar. The distance

between each plot was 0.5 m. Row to row distance was maintained at 75 cm whereas plants were kept at 20 cm from each other. At the sowing time, DAP fertilizer was applied at the rate of 2 bags ha⁻¹. All the plots were irrigated as and when needed. The data on insect pests was recorded at weekly interval from sowing to harvest and presented on monthly bases.

To determine whether the inter-cropping has any effect on the population density of insects of potato crop, potato was mix grown with berseem and radish in separate plots. Berseem was broadcasted within the ridges (PBM) and radish on the alternate ridges (PRM) along with potatoes on the top of the ridges.

In each sub plot three plants were randomly selected from aphids counted on leaves of the top, middle and bottom branches of the plant. For LH, hand net was used. The number of LH was counted after each sweep in consecutive three sweeps in every plot. Where as complete sub plot was used as sampling unit for counting field cricket (FC). Data were recorded at weekly intervals. All the data obtained were analyzed using RCB Design with DMR-Test at 5 % level of significance (Walter, 1967).

Results and Discussion

Pest population: The highest population was recorded during December. On average 43 aphids per branch, 15.3 leafhoppers per sweep and 3 field crickets per plot was recorded in the untreated plots (Table 1). The population of aphids, leafhoppers and field cricket was significantly lower in the treated plots when compared with the control (untreated plots). Seasonal means of aphid, leafhopper and field cricket population was 4.62, 1.08 and 0.52 in PBM, 8.05, 1.46 and 1.41 in PRM against 15.55, 5.21 and 1.65 in control plots, respectively. 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 that herbivore were more likely to find and remain on host plants that occur in large, dense and pure stands. They said that plant species diversity might alter herbivore population when plant species diversity interferes with visual host finding cues. Similarly herbivores have also difficulty in locating and relocating host plants after leaving polyculture.

Response of insect pests to mix cropping

Aphids: Significant control of aphids in PBM (70.3 %) and PRM (48.23 %) against the untreated plots was recorded (Table 1 and 2).

Leaf hoppers: More than 70% leafhoppers were reduced in both PBM and PRM. In PBM 79.27% and 72 % in PRM was reduced.

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

Months	Aphids (<i>Myzus</i> spp.) per branch			Leaf hoppers (<i>Empoasca</i> spp.) per weep			Field cricket (<i>Gryllus</i> spp.) per plot		
	TBM	PRM	Control	PBM	PRM	Control	PBM	PRM	Control
September	00.00	00.14	00.00	0.04	0.21	00.25	0	0	0
October	01.33	02.19	03.19	0.56	0.64	00.63	0.13	0.50	0.38
November	07.41	12.37	19.44	1.48	1.90	03.87	0.40	1.06	1.44
December	13.14	21.43	42.98	3.04	3.81	15.27	0.94	1.75	3.06
January	01.21	04.08	13.17	0.26	0.75	06.04	0.63	1.25	2.26
Seasonal mean	04.62	08.05	15.55	1.08	1.46	05.21	0.52	1.41	1.75

Table 2: Percent reduction of the insect pests in the mix cropping system

Treatments	Percent reduction over control (PAP)		
	Aphids (%)	Leaf hoppers (%)	Field cricket (%)
PBM	70.30	79.27	70.28
PRM	48.23	72.0	19.43
Seasonal mean in PAP	15.55	05.21	01.75
Differences between the treatments	PBM < PRM 42.60(%)	PBM < PRM 26.03(%)	PBM < PRM 63.12(%)
PBM	Potato-Berseem mix cropping	PRM	Potato-Radish mix cropping
PAP	Potato alone plots (control)		

Field cricket: The over all population of field cricket was significantly lowers. In PBM 70.28% and 19.43% in PRM was reduced against untreated plots.

PBM verses PRM: Potato-berseem was found a useful combination in plant protection point of view when compared with Potato-radish mix cropping against all the three mentioned pests. 42.6 % of aphids, 26% leafhoppers and 63% field cricket were more reduced in the former combination than the later one. In PBM, berseem was cut at various intervals subsequently for fodder purpose while radish left undisturbed to grow uniformly. However both the crop were terminated along with potato crop. Subsequent removal of berseem at different interval disrupted the olfactory and visual cues of leafhoppers and aphids due to which both the pests could not relocate their host, therefore unable to re-establish in PBM and were less abundant as compared to PRM. Shahjahan and Streams (1973) and Andow (1991) also made such inferences. Similarly it is also observed that radish is a broad leafed plant which is believed that aphids and leafhoppers are more attracted to broad leaf as Andow (1992) studied many *Empoasca* spp. and *E. fabae* in particular are more attracted to broad leafed weeds in diverse plant habitat whereas population reduces when grassy weeds i.e. maize sugarcane etc. are used in polyculture habitats. That's why the population of aphids and leafhoppers was scattered in PRM and the problem to relocate the host was not occurred and population of both the pests was higher than in PBM.

Field cricket population was higher (63.12 %) in PRM as compared to PBM. The reason for such discrepancies is that in farmer plots both the crops were tuberous and were well attracted to the pest, which was therefore abundant in PRM whereas in PBM berseem was found as ground cover which did not allowed the field crickets to establish. Therefore the pest more preferably shifted to either control plots or PRM. However the previous workers have recorded no evidence.

Acknowledgment

Grateful acknowledgments are hereby made to Dr. Rafique Attique Head of the Entomology Section and Ch. Abdul Gaffar, SSO Entomology Section, CCRI Multan for encouragement and cooperation extended to me in the compilation of the paper.

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