



## **EFFECT OF GUARD CROPS ON POPULATION DENSITY OF PEA APHID (*ACYRTHOSIPHON PISUM* HARRIS) AGAINST PEA (*PISUM SATIVUM* L.)**

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**Abstract:** A field trial was conducted during two rabi cropping seasons 2017-18 and 2018-19 to evaluate the role of some field crops as guard plants in pea crop. Sorghum, bajra and maize were cultivated at the boundaries of target crop (pea crop) to explore their ability to attract pea aphids (*Acyrtosiphon pisum* Harris) away from pea crop. The outcome of the study revealed that sowing of maize at the boundaries of pea fields was not much effective in reducing the aphid infestation. On the other hand, fields surrounded by sorghum showed most effective protection from pea aphids attack on pea crop followed by bajra and polyculture (sorghum, bajra and maize with pea crop).

**Keywords:** *Acyrtosiphon pisum*, Guard crop, Infestation, Polyculture, Target crop.

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### **INTRODUCTION**

Pea (*Pisum sativum* L.) (Family: Fabaceae) is one of the most important pulse crop grown worldwide, mainly in agro-climatic zones like tropical, subtropical, temperate and high elevated areas. In countries like India, where 23-39% population follow vegetarian diet, pea counters the problem of protein needs. It can be consumed as vegetable (fresh green pod) as well as pulse (dried seeds) and the plant can be used as fodder for cattle. Along with protein, peas also contain starch, amylase, dietary fibers, micronutrients like Ca, Mg, Cu, Fe, Mn, Zn, K and P (Dahl *et al.*, 2012). In India, land occupied

under pea cultivation is 3,70,000 ha. and the total production is 35,17,000 mt. (Meena *et al.*, 2016).

Insect pests play major role in yield loss of pea. Several types of insects infest all parts of pea plant at different stages of plant development (Yadav and Patel, 2015). There is a variety of aphids occur in nature that affect various plants (Singh and Singh, 2019) and their control is more or less related with weather (Rien *et al.*, 2021). The most important insects affecting pea crops are pea aphid (*Acyrtosiphon pisum* Harris), pea leaf miner (*Phytomyza atricornis* Goureau), pod borer complex (*Etiella zinckenella* Treischke), corn



earworm (*Helicoverpa armigera* Hubner), bean pod borer (*Maruca vitrata*), pea weevil (*Bruchus pisorum*) etc. (Shantibala *et al.*, 2007, Arya, 2018).

Nowadays, aphids become a major threat for pulses along with pea (Sadeghi *et al.*, 2009). The pea aphid complex (including 12 aphid species) is found all over the globe (Kanturski *et al.*, 2020). Pea aphids depend on sap of plant phloem (Zhang *et al.*, 2016). It punctures the epidermal tissue of plant with the help of its stylet and reached to the phloem sieve tube fluid (Stavriniades *et al.*, 2009). *Acyrtosiphon pisum* feeds on variety of leguminous crops, about 11-15 host species like soybean, faba bean, pea, snap bean etc. It can affect plant health directly or indirectly. Directly it can reduce the biomass of host plant by sucking the sap but indirectly it transmits many diseases because it acts as a vector of many viruses and bacteria (Paudel *et al.*, 2018). For aphid control, farmers mainly use several harmful chemical insecticides but there are no effective pesticide and tools available for their control (Fakhouri *et al.*, 2021). By using chemical pesticides, chances may increase resistance from these chemicals resulting into increase the frequency of treatment, however herbal pesticide may play a crucial role (Tripathi, 2021). In addition, excessive use of pesticides are causing environmental pollution that in turn creating a threat for biodiversity, sustainable development, human health, survival and ecological balance (Ashok, 2017; Verma, 2018, 2019; Prakash and Verma, 2022).

Some traditional practices follow for aphid control under integrated pest management. Use of natural enemies for their control are significant such as parasitoids of aphids: parasitic wasp, *Aphadus* spp., *Aphalinus* spp., *Diaeretiella rapae*; predators of pea aphids: lacewing, ladybird beetles, predatory mites, syrphid flies. Regular field monitoring for aphids and defender population, barrier/guard crops like sorghum, millets and maize around the field, tall border crops also reduce the pest population. However, use of biopesticides and botanical extracts are much helpful for aphid management. Trap crop also known as barrier crop or sacrificial crops are cultivated near the target crop for attracting

insect pests which can cause threat for target crop (Shelton and Badenes-Perez, 2006). This practice not only manages the insect pests of crop but also supports the natural enemies' population by vegetative diversification (Sarkar *et al.*, 2018). They narrated that guard crops will be helpful to enhance agricultural yield in upcoming days.

The purpose of this research was to investigate the effect of some guard plants on pea aphid (*Acyrtosiphon pisum* Harris) against pea crops.

#### MATERIALS AND METHODS

The analysis of the effects of guard plants on population density of pea aphid (*Acyrtosiphon pisum* Harris) against pea (*Pisum sativum* L.) were carried out in experimental garden of Dayanand Girls Post Graduate College, Kanpur, India during rabi seasons of 2017-2018 and 2018-19. There were three plots applied for each treatment and the size of each plot had 4×5 m<sup>2</sup>. The cultivar of pea selected for this work was 'Rachna' obtained from Chandrashekhar Azad University of Agriculture and Technology, Kanpur. There was no synthetic and biopesticide treatment against the pea aphids applied on plots. The sampling was done weekly and randomly selected 30 leaves (total 90 leaves per treatment). The guard crop seeds were sown one month before the sowing of main crop (pea) just because they attain some height and trap pests effectively.

The effect of guard plants/barrier plants on pea aphids was determined through the following procedure (treatment):

Treatment A: Sorghum seeds were sown at the boundaries of pea field.

Treatment B: Bajra seeds were sown at the borders surrounding pea field.

Treatment C: Maize seeds were sown at the borders surrounding pea field.

Treatment D: Sorghum, bajra and maize (polyculture) seeds sown at three sides, one side left with no cultivation.

Treatment E: Pea was sown alone.

**RESULTS AND DISCUSSION**

**Table 1 : The changes in population density of *Acyrtosiphon pisum* individuals on pea plants surrounded by different guard plants during cropping season 2017-18.**

Sampling dates	Total no. of pea aphids/90 leaves in 2017-18					
	A	B	C	D	E	Total
12 Nov.	0	0	0	0	0	0
19 Nov.	0	0	0	0	0	0
26 Nov.	0	0	2	0	1	3
03 Dec.	0	8	15	7	12	42
10 Dec.	2	21	32	18	35	108
17 Dec.	0	27	44	26	56	153
24 Dec.	9	30	56	41	78	214
31 Dec.	13	37	65	60	89	264
07 Jan.	25	51	83	95	106	360
14 Jan.	41	59	104	135	140	479
21 Jan.	51	65	128	156	162	562
28 Jan.	16	48	98	130	82	374
04 Feb.	12	36	47	84	53	232
11 Feb.	3	11	35	50	38	137
18 Feb.	0	5	13	38	25	81
<b>Total</b>	172	398	722	840	877	3,009
<b>Mean</b>	11.46	26.5	48.13	56	58.4	200.6

F = 4.01 \*, P-Value = 0.005, F crit = 2.502, L.S.D. = 28.66

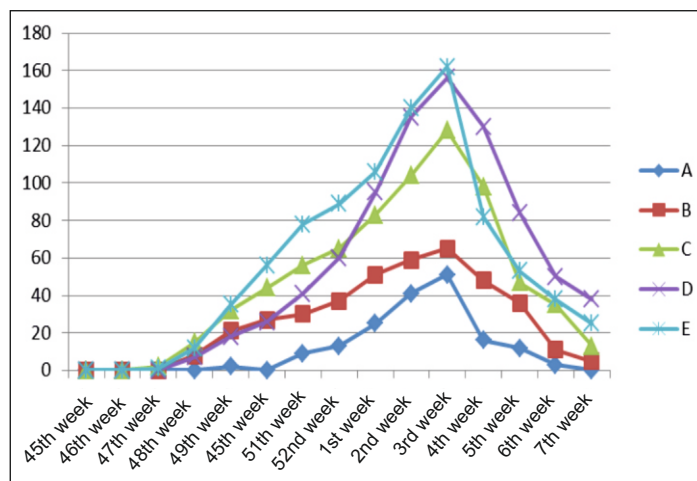
A = Sorghum plants surrounded pea crop.

B = Bajra plants around pea crop.

C = Maize plants around pea crop.

D = Sorghum, bajra and maize cultivated with pea crop.

E = Pea plant alone.



**Graph1: Changes in population density of pea aphids on pea crop sowing with different guard plants and alone in cropping season 2017-2018.**

**Table 2 : The changes in population density of *Acyrtosiphon pisum* individuals on pea plants surrounded by different guard plants during cropping season 2018-2019.**

Sampling dates	Total no. of pea aphids/90 leaves in 2018-19					
	A	B	C	D	E	Total
28 Oct.	0	0	0	0	0	0
04 Nov.	0	0	0	0	0	0
11 Nov.	0	0	0	0	0	0
18 Nov.	0	1	5	0	3	9
25 Nov.	0	12	29	3	20	64
02 Dec.	6	17	47	6	45	121
09 Dec.	9	13	72	25	57	176
16 Dec.	18	29	88	34	95	264
23 Dec.	23	41	96	54	120	334
30 Dec.	28	56	114	77	157	432
06 Jan.	36	58	162	146	185	587
13 Jan.	55	30	136	140	168	529
20 Jan.	21	24	130	95	123	393
27 Jan.	13	16	93	60	112	294
03 Feb.	0	4	65	15	86	170
10 Feb.	0	3	40	1	54	98
<b>Total</b>	209	304	1077	656	1225	3471
<b>Mean</b>	13.06	19	67.31	41	76.56	216.9

F = 6.414; P-value = 0.00017; F crit = 2.49; L.S.D. = 31.42

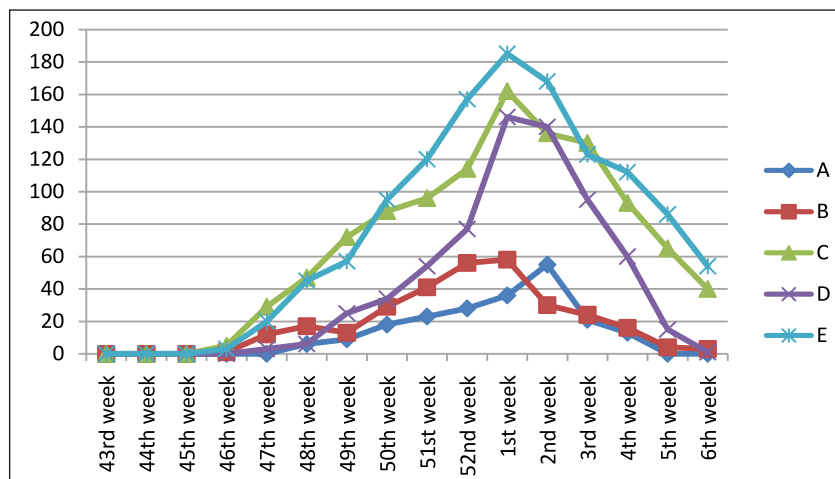
A = Sorghum plants surrounded pea crop.

B = Bajra plants around pea crop.

C = Maize plants around pea crop.

D = Sorghum, bajra and maize cultivated with pea crop.

E = Pea plant alone.



**Graph 2: The changes in population density of pea aphids on pea crop sowing with different guard plants and alone in cropping season 2018-2019.**

Data of table 1 and graph 1 (rabi season 2017-18) demonstrated the effect of different kind of guard plants on aphid population against pea crop. Sorghum as guard/barrier plants were most effective for attracting aphid populations, followed by bajra plants then to treatment with maize, polyculture (sorghum, bajra, maize sown with pea crops) and pea alone was taken into consideration. The mean number of pea aphids captured from pea crop surrounded by sorghum guard plants was 11.46 aphids/ 90 leaves, whereas the mean of aphids captured from pea plants surrounded by bajra plants was 26.5 aphids/ 90 leaves. The mean number of aphids observed from pea crop surrounded by maize plants, polyculture (sorghum + bajra + maize + pea) and pea alone were 48.13 aphids/ 90 leaves, 56 aphids/ 90 leaves and 58.4 aphids/ 90 leaves. The mean numbers showed that sorghum and bajra surrounded by pea crop were comparatively more liable to be attracted by aphid population than maize, polyculture of sorghum, bajra, maize with pea crop, and pea alone. The statistical analysis provided significant F value for the difference between the population mean density of pea aphid individuals on pea plant surrounded by different types of guard plants. The LSD was 28.66.

Upon analyzing the data of table 2 and graph 2 (rabi season 2018-19), almost similar kind of results were obtained like season 2017-18. In season 2018-19, authors found an increase in the total aphid population, which was 3,471 (quite higher than 2017-18, which was 3,009). The mean numbers of aphid population on pea crop surrounded by sorghum, bajra, maize, polyculture (cultivation of sorghum + bajra + maize with pea plants) and pea crop grown alone were 13.06 aphids/ 90 leaves, 19 aphids/ 90 leaves, 67.31 aphids/ 90 leaves, 41 aphids/ 90 leaves and 76.56 aphids/ 90 leaves respectively. In this cropping season, the sorghum plants guarded pea plants were highly effective to attract population of pea aphid followed by bajra plants and polyculture with pea but maize as a guard plant was not so effective and pea grown alone was also not able to control the aphid population. The statistical analysis of table 2 provided significant F value for the difference between the

population mean density of aphid population on pea plant bordered with different types of guard plants. The LSD (least significant difference) of table 2 was 31.42.

In the authors' knowledge, there was no magnificent work conducted to find out this point of investigation. So authors had to use the results of some authors on another pulse crops. Soybean sown without any guard plants were the favorable target for aphid attack (Abdallah, 2012). He also concluded that if soybean was cultivated with polyculture (maize, moongbeans and sunflower) then aphid attack was minimum on soybean. According to Korlapati *et al.* (2015), pea aphid population can be controlled by cultivation of sorghum, bajra and maize.

### CONCLUSION

Thus, it can be concluded that aphids are a big problem to pulses and other crops. This study reports good results to control aphid infestation by using guard plants. It in turn suggests an eco-friendly substitute of synthetic and harmful pesticides as the latter exert adverse long term effects on the environment.

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