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Effect of dates of sowing on the incidence of aphid, *Myzus persicae* (Sulzer) on cumin, *Cuminum cyminum* Linn

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Abstract
An experiment was conducted at the Department of Entomology, college of agriculture, SKRAU, Rajasthan, Bikaner during *Rabi* to find out the insect pest attacking cumin crop sowing at different dates to determine the optimum dates of sowing. It is seen that the incidence and population fluctuation of various insect pests was very much dependent on the prevailed climatic conditions of the cropping season. The late sown (5th December) crops received higher pest infestation and followed by crop sown (25 November). The early sown (25 October) received lowest pest infestation. The highest yield (2.30 q ha^{-1}) was obtained from November 5 sowing crop. The second highest yield (2.05 q ha^{-1}) was obtained from October 25 sowing which was statistically identical to November 15, November 25 and December 5 sowings crop. Again, the delayed sowings after mid November to onward provide yield of 1.80 q ha^{-1} to 1.40 q ha^{-1} which were very poor. Hence, for ensuring higher yield and less insect pest infestation, cumin should be sown within the period of October 25 to December 5 and the best date of sowing should be November 5.

Keywords: *Myzus persicae*, cumin crop, sowing of dates

Introduction
Cumin (*Cuminum cyminum*) an important seed spice crop belongs to family Apiaceae. It is a drought tolerant, tropical or subtropical crop. The stem of plants is slender and branched, rarely exceeding 1 feet in height and somewhat angular. India is the largest producer and consumer of cumin seed in the world. In India, it occupied an area of 8.1 lakh hectares with annual production 5.0 lakh tones (Anonymous, 2015-16). The crop is mainly cultivated in Rajasthan and Gujarat. Both the states together contribute more than 95 per cent of total country cumin production. It grows abundantly in the mild, equable climate where rich well drained, sandy, loamy soil and the sunny, conducive environment are available. Cumin is a sensitive crop. Various factors such as attack of insect pests and diseases, temperature, weather, irrigation facilities and clear sky etc affect the development of the crop. Productivity is mainly dependent magnitude of insect pests and diseases thus its production largely depends upon these factors. Cumin has been found to be infested by many insect pests *viz*., aphid, *Myzus persicae* (Joshi and Mathur, 1967) [8]; *orthops compestris* (L.) and *Lygus compestris* (L.) (Korez, 1977) [11]; Gram pod borer, *Heliothis armigera* (Judal and Upadhyay, 1989) [9] and brown wheat mite, *Petrobia latens* (Gupta, 1990) [5]. Among the insect pests aphid, *Myzus persicae* (Sulz.) was reported as the major insect pest of cumin in Rajasthan. It is a well established fact that the attack of insect pests depends upon climatic conditions, crop growth stage and the incidence of natural enemies at a particular time. Hence, alterations in sowing time cause a significant effect on the infestation of a specific pest on a given crop. Earlier this practice was evaluated by (Kanwat, 1988) [10] on fennel and other workers on different crops, but the climatic conditions have changed now and their effects on pests need reconsideration.

Materials and Methods
The experiment was conducted at Department of Entomology, COA, SKRAU, Rajasthan, Bikaner, during Rabi 2016. Five sowing dates at 10 days intervals starting from October 25 to December 5 were considered as different treatments to find out in the pest incidence and effect on grain yield. The experiment was laid out in a simple randomized block design with five treatments (sowing dates). Each treatment was replicated four times. The unit of plot size was 3 x 3m with a distance of 50 cm between the plots and 100 cm between the replications.

The sowing of cumin variety GC-4 was sown in row with the spacing of 30 cm. The cumin plants of different sowing dates were closely examined at regular interval commencing from germination till harvest. (52nd standard week to 10th standard week *i.e.*, last week of December to the first week of March).
The population of aphid was recorded from five randomly selected and tagged plants in each plot. Frequent visits of the experimental field were made to observe the occurrence of aphid on the plants. The population estimation was done at weekly intervals as soon as aphid appeared and counted on three umbels (lower, middle and upper) from each of the five tagged plants. The population of aphid was counted in the early morning hours at weekly intervals from appearance to the harvesting of the crop. Yield of cumin seed was also recorded after harvesting of crops.

Interpretation of data
The data obtained on aphid population from experimental plots were subjected to analyses of variance after transforming them to $\sqrt{X + 0.5}$. The yield per kg per plot was converted into quintal per hectare and then statistically analyzed compared by critical difference sowing with aphid population. The correlation coefficient (r) between date of sowing with aphid population and yield were also computed.

Results
The effect of five dates of sowing *viz.*, 25th October, 5th November, 15th November, 25th November and 5th December were evaluated on occurrence of *M. persicae*. The results of investigations have been presented in Table 1 revealed that occurrence of *M. persicae* started in 52nd standard meteorological week. Initially populations of *M. persicae* in all the dates of sowing plots were very low. The population increased gradually and reached to its peak in the fourth week of January (4th Standard meteorological week) and thereafter declined till the crop mature. At the peak, maximum number of aphid (106.50/ 3 umbels) was observed in crop sown on 5th December which was statistically at par with the crop sown on 25th November with the aphid population 97.50 per three umbels. The lowest population 73.0 aphid per three umbels was recorded on the crop sown on 25th October and followed by crop sown on 5th November (82.25 aphids/ 3 umbels); however, these were statistically at par. At the peak population of *M. persicae* on crop sown on 15th November was 89.00 aphids per three umbels which were at par with the population observed in crop sown on 25th November. After peak, aphid population declined gradually.
The data presented in Table 1 and Fig. 1 revealed that the yield of cumin seed in five dates of sowing ranged from 1.15 to 2.30 q ha^{-1}. The data of yields was presented in Table 1 indicated that maximum yield of cumin seed (2.30 q ha^{-1}) obtained from the crop sown 5th November followed by 25th October sown crop with 2.05 q ha^{-1} seed yield. The minimum yield (1.15 q ha^{-1}) was recorded in the crop sown on 5th December followed by the crop sown on 25th November (1.40 q ha^{-1}) and 15th November (1.80 q ha^{-1}).
A significant positive correlation (r= 0.994) was obtained between sowing dates and aphid population which indicated that the aphid population increased with the delay in sowing time. The relationship between the sowing dates and seed yield revealed a negative correlation (r= - 912). A negative correlation (r= - 0.878) was also recorded between aphid population and seed yield, (Table 2).

Table 2: Correlation between sowing dates, aphid population and seed yield of cumin

S. No.	Particulars	Correlation coefficients (r)
1.	Sowing dates and aphid population	0.994
2.	Sowing dates and seed yield	- 0.912
3.	Seed yield and aphid population	- 0.878

*Significant at 5 % level of significance

Discussion
With the increasing and indiscriminate use of insecticides, insects have developed resistance against them. Moreover, insecticides cause environmental pollution, which makes life more miserable and increase the health hazards to mankind and animals hence, a cultural method to manage *M. persicae* on cumin by altering the sowing time of crop was attempted in the present investigation. The data on the effect of variations in the time of sowing on the incidence of *M. persicae* indicated that there was a definite pattern of incidence in relation to the different sowing dates. The minimum population (73.00 aphids/ 3 umbels) during peak period was recorded from the crop sown on 25th October, followed by crop sown on 5th November and 15th November which exhibited 82.25 and 89.00 aphids per three umbels, respectively. However, maximum infestation (106.50 aphids/ 3 umbels) was recorded on late sown crop *i.e.* 05th December. It was concluded that the aphid population increased with the delay in sowing time. Highest seed yield (2.30 q ha^{-1}) was obtained from the crop sown on 05th November. The yield in 25th October sown crop reduced probably due to extra early sowing, but found higher than the crop sown on 15th and 25th November. The reduction in yield in late sown crop on 5th December was probably due to heavy infestation of aphid. It is well known that certain stages of crop growth are preferred by the insect pests for feeding and breeding (Kogan, 1982) the difference in sowing time resulted in availability of different stage of crop at a time and the difference in aphid population might be due to succulent stage of late sown crop which was preferred by the aphid for its multiplication. These results are in agreement with those of Bana (2007) [2] who reported that minimum incidence of aphid was recorded from early sown crop (15th October) as compared to late sown crop (30th November). However, highest seed yield (9.32 q ha^{-1}) was recorded in crop sown on 30th October whereas; it was minimum in 30th November sown crop. Lekha (2002) [14] reported that the crop sown on 10th October and 20th October (Early sowing) showed minimum infestation of aphid and maximum yield. The maximum population was found in the crop sown on 20th November *i.e.* the late sown crop. The present finding also get support from the observations of Choudhary *et al.* (2007), Kumari and Yadav (2004) [13], Meena *et al*. (2002) [15] Jain and Yadav (2004), Meena *et al*. (2002) [15] Jain and Yadava (1989) [7], Gupta and Yadav (1989) who reported that the early sown crop was less infested by aphid that gave higher yield in comparison to late sown crop. In the present investigation, a significant positive correlation was obtained between sowing dates and aphid population which indicated that the aphid population increased with the delay in sowing time. The relationship

between sowing dates and seed yield revealed a negative significant correlation. A negative correlation was also recorded between aphid population and seed yield. Bana (2007) [2] found positive correlation between sowing dates and aphid population; however, such matrix was negative with regards to seed yield. Kumari and Yadava (2004) [13] were also found highly significant and positive correlation between sowing dates and aphid population also support the present finding.

Table 1: Incidence of *Myzus persicae* on cumin at different date of sowing during *rabi*, 2016-17

S. No.	Treatments	*Population/ 3 umbel on different standard meteorological week											Yield (q ha $^{-1}$)
		52	1	2	3	4	5	6	7	8	9	Overall mean	
1.	25th October, 2016	10.00 (3.24)	16.25 (4.09)	39.25 (6.30)	54.75 (7.43)	73.00 (8.57)	45.50 (6.78)	24.50 (5.00)	4.50 (2.22)	0.00 (0.71)	0.00 (0.71)	26.78 (5.22)	2.05
2.	05th November, 2016	8.25 (2.95)	21.00 (4.64)	48.50 (7.00)	67.25 (8.23)	82.25 (9.09)	51.75 (7.23)	29.75 (5.50)	7.75 (2.87)	1.75 (1.49)	0.00 (0.71)	31.83 (5.68)	2.30
3.	15th November, 2016	6.75 (2.69)	24.25 (4.97)	52.50 (7.28)	74.50 (8.66)	89.00 (9.45)	57.50 (7.61)	33.75 (5.85)	9.00 (3.08)	3.75 (2.05)	1.25 (1.31)	35.23 (5.98)	1.80
4.	25th November, 2016	3.00 (1.86)	26.50 (5.19)	56.50 (7.55)	79.75 (8.96)	97.50 (9.90)	67.25 (8.23)	40.25 (6.37)	11.50 (3.74)	8.00 (2.91)	3.75 (2.05)	39.60 (6.33)	1.40
5.	05th December, 2016	0.00 (0.71)	0.00 (0.71)	18.50 (4.36)	85.25 (9.26)	106.50 (10.34)	80.00 (8.97)	59.50 (7.75)	34.50 (5.91)	25.00 (5.05)	10.75 (3.35)	42.00 (6.52)	1.15
	S.Em±	-	-	0.09	0.13	0.15	0.12	0.12	0.09	-	-	0.03	0.11
	CD (0.05)	-	-	0.29	0.40	0.47	0.38	0.36	0.27	-	-	0.08	0.34

Figure in parentheses are log √ x+ 0.5
*Mean of four replications

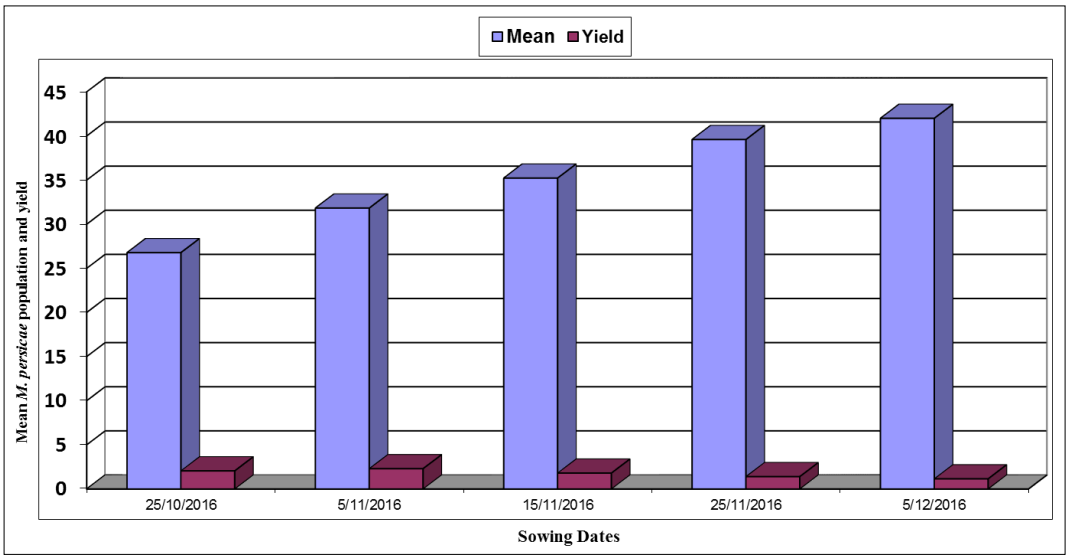

Fig 1: Effect of sowing dates on *Myzus persicae* population and seed yield of cumin

Conclusion

It is concluded that the incidence and population fluctuation of insect pest of cumin was very much dependent on the prevailing climatic conditions of the cropping season. The late sown (5th December) crops received higher pest infestation and followed by crop sown (25 November). Hence, for ensuring higher yield with less insect pest infestation, cumin should be sown within the period of October 25 to December 5 and the best date of sowing should be November 5.

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