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Influence of Sowing Dates on Percent Shoot Damage by *Earias vittella*. at Different Crop Ages of Okra Seed Crop

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The influence of sowing dates on the incidence of major insect pests on okra seed crop was assessed by sowing the cultivar, Arka Anamika on five dates viz., March 15th, March 22nd, March 29th, April 5th and April 12th in the season. The data on the population density of *Earias vittella* for each sowing date was recorded at weekly intervals and the data on fruit yield were recorded at harvest. The results indicated that the infestation of *Earias vittella* was highest on the crop sown on March 29th as compared to crop sown early i.e. March 15th and sown late i.e. April 5th in both the years (2014 & 2015) of the crop season.

Introduction

Vegetable based industries are emerging as powerful engine for economic growth in rural India as an excellent choice for cash crop. India is second largest producer of vegetable in the world accounting for about 10 percent of world production. In India, vegetables were cultivated in 9355.00 m ha with an annual production of 163388.00 MT in 2014 with a productivity of 17.30 MT/ha in 2013. Okra was cultivated in 524.00 m ha with an annual production of 6203.00 MT with a productivity of 11.90 MT/ha in 2013-14 (Anonymous, 2014). The productivity of okra is low due to many factors in which the attack of shoot and fruit borer, *E. vittella* and *Earias insulana* (Boisduval), is most serious pests of okra and causes 45.00-57.10% damage to fruits (Shrinivasan and Krishna Kumar 1983 and Nderitu et al. 2008). The information regarding insect pest appearance, infestation and its severity of damage in relation to sowing time on the okra seed crop need to be established. The manipulation of planting time helps to minimize pest damage by producing synchrony between host plant and the pest. Due to staggered sowing, pests are able to complete 1-2 additional generations in the season (Anitha and Nandihali 2008). In order to avoid these generation, sowing dates of the crop can be adjusted. The distinct differences in the pest fauna on the okra crop sown on different dates in the main season was observed in different agro-ecological conditions with early sown crop favouring the population build-up of leafhoppers, while the late sown crops suffered more damage by *Earias spp.* (Rai and Satpathy 1999). Therefore an experiment was conducted to find out the influence of sowing dates on the incidence of major insect pests on okra seed crop.

Materials and Methods

The effect of sowing dates on the population dynamics of the major insect pests in okra seed crop was carried out at vegetable Research Farm Kalyanpur, Kanpur (UP). The crop was sown on 15th March with 7 days interval for five sowing dates viz., T₁ - 15th March, T₂ - 22nd March, T₃ - 29th March, T₄ - 5th April, T₅ - 12th April as treatments in a randomized block design with four replications in 3 x 2.25 m² size plots. From each replication 5 plants were selected randomly for recording observation. All the observations were made at weekly intervals. The observation was taken starting from germination to till the harvest of the crop. The crop was raised by using all the recommended package of practices and kept unsprayed throughout the experimental period.

Results and Discussion

The data (Table 1) regarding per cent damaged shoots by *Earias vittella* on okra seed crop as influenced by sowing dates showed that the mean shoot damage was significantly higher (1.18 %) on okra crop sown in optimal sowing period (March 29th). It was closely followed by crop sown during very early (March 15th) and early (March 22nd) in the season which recorded seasonal average per cent damaged shoots of 1.08 and 1.06 per cent, respectively whereas crop sown during late (April 5th) and very late (April 12th) in the season recorded seasonal average per cent damaged shoots of 0.95 and 0.82 per cent, respectively in the crop season of 2014.

Table: 1. Effect of sowing dates on percent shoot damage by *Earias vittella* at different crop ages of okra crop

Per cent shoot damage during 2014								
Sowing dates	Days after sowing							Mean
	35	42	49	56	63	70	77	
15 th March	0.71	0.75	1.20	1.33	1.29	0.71	0.71	0.96
22 nd March	0.71	0.71	1.61	0.89	1.50	0.75	0.71	0.98
29 th March	0.78	1.48	1.54	0.80	1.28	1.20	1.12	1.17
04 th April	0.74	1.31	1.27	0.73	0.71	1.22	0.80	0.97
12 th April	0.73	0.74	1.22	0.71	0.71	0.71	0.71	0.80
CD (p=0.05)	0.04	0.17	0.24	0.09	0.18	0.26	0.10	0.18
Percent shoot damage during 2015								
15 th March	0.71	1.31	0.75	1.59	1.36	1.21	0.75	1.10
22 nd March	0.71	0.75	0.89	1.32	1.60	0.74	0.72	0.96
29 th March	0.71	0.72	0.74	1.25	1.26	0.76	0.71	0.87
04 th April	0.71	0.71	0.73	0.78	1.23	0.72	0.71	0.79
12 th April	0.71	0.71	0.71	0.74	0.75	0.72	0.71	0.72
CD (p=0.05)	N. S.	0.22	0.02	0.12	0.18	0.08	0.03	0.15

Further, the shoot damage varied between 0.71 to 1.61 per cent on March 22nd sown crop with highest number of damaged shoots recorded at 49 days after sowing (DAS), while the maximum shoot damage of 1.31, 1.54, 1.22 and 1.29 per cent, respectively on April 5th, March 29th, April 12th and March 15th sown crops was recorded on 42, 49 and 63 days old crop. During 2015, result showed that the mean shoot damage was significantly higher (1.14 %) on okra crop sown in early period (March 15th). It was closely followed by crop sown during (March 22nd) and (March 29th) in the season which recorded seasonal average per cent damaged shoots of 1.05 and 0.94 per cent, respectively whereas crop sown during late (April 5th) and very late (April 12th) in

the season recorded seasonal average per cent damaged shoots of 0.83 and 0.72 per cent, respectively in the crop season of 2015. The shoot damage varied between 0.75 to 1.60 per cent on March 22nd sown crop with highest number of damaged shoots recorded at 63 DAS, while the maximum shoot damage of 1.31, 1.59, and 0.89 per cent, respectively on March 15th and 22nd sown crops was recorded on 42, 63 and 49 days old crop.

The data presented in Table 2 indicated cumulative fruit damage inflicted by *Earias vittella* on okra seed crop varied considerably in response to crop establishment dates. During 2014, the damage to the fruits number basis (15.07%, respectively) was significantly higher on March 22nd sown crop and it was closely followed by March 15th sown crop with fruit damage of 13.44 per cent on number basis, respectively. Whereas, the crop planted during the late period (March 29th, April 5th and 12th) suffered comparatively lower fruit damage i.e. 8.45, 4.12 and 0.94 per cent on number basis, respectively. As observed during both the years, the okra seed crop sown on (March 29th, April 5th and April 12th) recorded significantly lower fruit damage on number basis (9.31, 6.70 and 4.52%, respectively) as against the crop sown on March 22nd and March 15th which recorded fruit damage to the extent of 17.58 and 13.39 per cent on number basis, respectively. Bairwa et al. (2005) also reported that infestation and fruit damage by shoot and fruit borer (*Earias insulana* and *E. vittella*) increased with delay in sowing of okra cv. Pusa Sawani sown on different dates (7, 14, 21 and 28 July) during kharif 2000, in Jobner, Rajasthan, India. The highest fruit yield of 32.02 q/ha was obtained under the earliest sowing.

Table: 2. Effect of sowing dates on per cent fruit damages by *Earias vittella* at different crop ages of okra crop

Sowing dates	Fruit damages (Number basis)	Fruit damage (Weight basis)
	2014	
15 th March	13.44 (21.40)	11.60 (19.82)
22 nd March	15.07 (21.80)	14.55 (22.31)
29 th March	8.45 (16.75)	7.35 (15.57)
04 th April	4.12 (11.10)	3.45 (10.48)
12 th April	0.94 (5.45)	0.77 (4.80)
SEm±	0.13	0.15
CD (p=0.05)	0.34	0.45
	2015	
15 th March	13.39 (21.28)	11.75 (19.90)
22 nd March	17.58 (24.66)	15.12 (21.81)
29 th March	9.31 (17.65)	8.45 (16.75)
04 th April	6.70 (14.88)	5.50 (13.44)
12 th April	4.52 (12.11)	3.50 (10.62)
SEm±	0.07	0.40
CD (p=0.05)	0.10	0.12

Figures in parentheses are arc sin transformed values.

Conclusion

Infestation and fruit damage by shoot and fruit borer (*Earias insulana* and *E. vittella*) increased with delay in sowing of okra from 15th March to 29th March. The findings can be used to plan appropriate sowing time of okra in agro-climatic conditions of Uttar Pradesh, India.

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