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INQUISITION ON DIFFERENT DATE OF TRANSPLANTING ON THE OCCURRENCE AND INTENSITY OF RICE LEAF FOLDER *CNAPHALOCROCIS MEDINALIS* (GUENEE) IN CENTRAL UTTAR PRADESH INDIA

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ABSTRACT

The experiment was conducted at Crop Research farm; Nawabganj CSA University of Agriculture and Technology Kanpur on three dates of sowing (2nd, 4th week of July, and 1st week of August at 10 days interval) in Randomized completely block design (RCBD). During Kharif 2017, maximum per cent leaf infestation 8.20 and 7.08 was occurred in maturity and reproductive stage respectively at 3rd August sown crop followed by 24th July sown crop with 5.48 and 4.75 per cent infestation and minimum per cent leaf infestation 3.75 and 2.43 was recorded in 8th July sown rice crop in protected crop. The maximum 19.06 per cent avoidable with Rs. 21762/- was recorded in 3rd August sown crop followed by 24th and 8th July sown crop with Rs. 9567.9 and Rs. 6697.50 respectively. in *Kharif* 2018, the crop sown on 3rd August, also observed highest 7.85 and 7.80 per cent leaf infestation in reproductive and vegetative stage respectively followed by 24th July sown crop. Furthermore, minimum 4.18 and 2.70 per cent leaf infestation was observed in 8th July sown crop. The highest 17.41 per cent avoidable loss worth Rs 12693/- was also recorded in 3rd August, and minimum 7.65 per cent worth Rs 4350/- in 8th July Sown crop Per cent leaf infestation and with respect to different three dates of sowing were found similar trend in both the years. Pooled data of both the year (Kharif 2017 & 2018) revealed that 18.25 per cent avoidable loss worth Rs. 13510/- was observed during the experiment (Table 4.8). Present study calculated grain yield in protected and unprotected plot in terms of yield and data revealed that at protected condition the yield varied from 42.28 to 47.15 qtl/ha and unprotected condition the yield ranged from 34.57 to 43.21 qtl/ha in Pant 12 variety.
Keyword: Rice leaf folder, standard week, vegetative and reproductive stage, avoidable losses.

Introduction

Rice *Oryza sativa* L., is the most important food crop of the world providing major source of food energy for more than half the human population particularly in Asian countries as well as India and Uttar Pradesh. In India rice is grown under three diverse agro-ecological condition namely irrigated (45%), Rainfed low land (39%), and rainfed upland (16%) by adopting various good agronomical practices to minimize pests' population below economic threshold level in a integrated manner. Rice cultivation in India is 43.90 million hectares with a production of 114.45 million tonnes (Agriculture at a glance 2022). It constitutes 52 per cent of total food grain production and 55 per cent of total cereal production Singh, 2013 (Singh *et al*., 2013). Uttar Pradesh produces 15.27 million tone rice in 5.7 million ha area with average productivity of 2679 kg per ha. More than 100 insect species have been reported to attack rice crop of which leaf folder are the major ones (Pathak and Dhaliwal, 1981) responsible for significant decline in yield of rice across the cropping system zones. Yield losses due to leaf folders ranging from 63 to 80 percent were reported in rice (Teng *et al*., 1993). Agronomic practices for pest management such as field geometry, nursery management, age of seedlings, planting

time/date of sowing/transplanting, plant density, weed and water and nutrient management etc play very important role to minimize insect pest population in rice crop.

The recent trend of pest management is not only on the use of insecticides but also use of resistant/ tolerance varieties and manipulation of agronomic practices like date of sowing, fertilizer doses, which is ecofriendly, cheap, stable and compatible with other components (Raju, 2000). The number of transplanted rice seedlings is also influenced by the sowing date and various dates of sowing have a significant impact on the occurrence of biotic stress, particularly insect pests. Planting at the right time helps to minimize pest damage. The present study was planned to short out the right time to accelerate appropriate techniques to minimize the rice leaf folder infestation and avoid yield losses.

Materials and Method

This experiment was conducted on three dates of sowing (2nd, 4th week of July, and 1st week of August at 10 days interval) in Randomized completely block design (RCBD) to know the relation of yield attributes and major pest infestation at Crop Research farm, Nawabganj CSA University of Agriculture and Technology Kanpur. Twenty-one-day old seedlings were transplanted at 20×15 cm spacing. For the occurrence and intensity of rice leaf folder, a 10×9 m^2 untreated plot was maintained. Each time, sowing of the nursery and planting was done separately. Five spots each of one square meter were marked randomly and from each selected one square meter area, three hills were selected randomly for recording observations.

Correlation studies of the weather parameters i.e., average maximum and minimum temperature (ºC), relative humidity (%) and rainfall (mm) and mean larval population fluctuation of *C. medinalis* on different dates of sowing were statistically analyzed. Yield data on different date of sowing were also recorded and analyzed statistically.

Result and Discussion

Kharif Year 2017

The mean larval population was observed from 31st SW to 44th SW during Kharif 2017 in 8th July, 24th July and 3rd August sown rice crop (Table 1.0). The lowest mean larval population i.e. 0.25, 0.75, 0.75, 0.5 and 1.25 larvae/3 hill was observed during 31st, 32nd, 33rd, and 34th and 35th SW respectively with temperature (minimum and maximum) ranged 26.3-33.2^{0}C, 25.8-33.1^{0}C, 26.1-34.3 ^{0}C, 25.5-32.9 ^{0}C and 25.2-33.3^{0}C ^{0}C, respectively, and relative humidity in terms of 78, 84.5, 77, 84 and 82.5 per cent were recorded respectively in 8th July sown crop. The population reached to the peak in 41st SW with larval population of 6.5 followed by 43rd SW with larval population 6.25 and min. and max. Temperature ranged was 22.9-35.8^{0}C and 19.3-35.9 ^{0}C, and relative humidity was in terms of 63.5 and 62 per cent, respectively during Kharif 2017.

The Minimum larval population of 24th July sown crop was 1.75 in 31st SW and reached peak in 41st SW with and 8.5 followed by 42nd and 43rd SW with 8.75 and 7.25. The minimum and maximum temperature ranged was 26.3-33.3^{0}C, 22.9-35.8^{0}C and 19.3-35.9^{0}C 15.7-34.3^{0}C with relative humidity in terms of 78, 63.5, 62 and 58 per cent respectively. Third August sown rice crop observed minimum larval population with 2.0 in 31st SW and maximum 8.5 in 42nd SW followed by 8 & 7.5 in 41st SW and 43rd SW. The minimum and maximum temperature ranged was 26.3-33.3^{0}C, 19.3-35.9^{0}C, 22.9-35.8^{0}C and 15.7-34.3^{0}C with Relative humidity in terms of 78, 62, 63.5 and 58 per cent respectively. The results of the present study are in consonance with earlier researcher. Rautaray *et al*. (2019) were recorded lowest infestation (8.23%) in the 1st July transplanting and highest infestation (15.62%) when it was transplanted 30th August.

Mean larval population on 8th July sown crop indicated that minimum temperature, relative humidity and rainfall have significantly negative (r=-0.726, -0.818, -0.480) correlation and maximum temperature and bright sunshine hour recorded positive correlation (r=0.381, 0.645) respectively. However, when crop sown on 24th July, mean larval population was significantly negative (r=--0.675, -0.807, -0.466) with minimum temperature, relative humidity and rainfall respectively and positive correlation (0.433, 0.542) with maximum temperature and bright sunshine hour, respectively. In third dates of sowing on 3rd August, also were found negative correlation (r=-0.752, -0.855 and -0.481) with minimum temperature relative humidity and rainfall respectively, and positive correlation (r=-0.388, 0.580) with maximum temperature and bright sunshine hours, respectively (Table 4.1).

Kharif Year 2018

The minimum larval population 0.25.1.25 and 1.0 were recorded in 31st SW of 8th July, 24th July and 3rd August sown crop and the minimum and maximum temperature ranged was 23-28.5^{0}C and relative humidity was 92 per cent recorded . The maximum larval population of rice leaf folder was 6.0 & 8.5 in

41st SW in 8th July & 24th July sown crop; while maximum larval population 8.5 was observed in 42nd SW in 3rd August Sown crop and, the minimum and maximum temperature ranged was 19.2-34.2 & 16.6-35.2 and relative humidity was 58.5 and 49.5 per cent respectively

In Kharif 2018, Mean larval population on 8th July sown crop indicated that minimum temperature, relative humidity and rainfall have significantly negative (r=--0.782, -0.942, -0.624) correlation and maximum temperature and bright sunshine hour recorded positive correlation (r=0.670, 0.939) respectively. However, when crop sown on 24th July, mean larval population was significantly negative (r=---0.741, -0.907, -0.601) with minimum temperature, relative humidity and rainfall respectively and positive correlation (0.664, 0.870) with maximum temperature and bright sunshine hour, respectively. In third dates of sowing on 3rd August, also were found negative correlation (r=-0.806, -0.937and -0.632) with minimum temperature relative humidity and rainfall respectively, and positive correlation (r=0.647, 0.901) with maximum temperature and bright sunshine hours, respectively. The present finding revealed that sowing dates had significant effect on the incidence of leaf folder. Panda and Shi (1989) observed the peak incidence of leaf folder during heading and late vegetative stage. Kichu *et al.* (2017) reported maximum infestation was observed during June-July when the crop was at tillering stage i.e., 60, 75 and 90 days after sowing with irrespective date of Sowing at experimental research farm SASRD, Nagaland with three dates of sowing viz. 17th April, 2nd May and 17th May 2014 in upland rice. Mishra *et al.* (1998) reported maximum infestation during 7-9 weeks after transplanting. Khakwani *et al.* (2006) noticed that most of the yield contributing parameters like days to 50 per cent heading, leaf folder infestation etc. was significantly affected by date of transplanting and the highest yield were obtained in early transplanted rice. The present study is corroborated with Prakash *et al.* (2014) who found that early transplanting might be helpful to avoid greater leaf damage.

Yield assessment at different date of sowing and growth stage of rice due to incidence of *C. medinalis* in Kharif 2017

It is clear from the data of the year 2017, maximum per cent leaf infestation 8.20 and 7.08 was occurred in maturity and reproductive stage respectively at 3rd August sown crop followed by 24th July sown crop with 5.48 and 4.75 per cent infestation and minimum per cent leaf infestation 3.75 and 2.43 was recorded in 8th July sown rice crop in protected crop. The maximum 19.06 per cent avoidable with Rs. 21762/- was recorded in 3rd August sown crop followed by 24th and 8th July sown crop with Rs. 9567.9 and Rs. 6697.50 respectively.

It is obvious from Table-4.5 that, in *Kharif* 2018, the crop sown on 3rd August, also observed highest 7.85 and 7.80 per cent leaf infestation in reproductive and vegetative stage respectively followed by 24th July sown crop. Chhavi *et al.* (2017) reported that the leaf infestation caused by paddy leaf folder was more at maturity stage than reproductive stage for both protected and unprotected plot.Furthermore, minimum 4.18 and 2.70 per cent leaf infestation was observed in 8th July sown crop. The highest 17.41 per cent avoidable loss worth Rs 12693/- was also recorded in 3rd August, and minimum 7.65 per cent worth Rs 4350/- in 8th July Sown crop.

Per cent leaf infestation and with respect to different three dates of sowing were found similar trend in both the years. Pooled data of both the year (Kharif 2017 & 2018) revealed that 18.25 per cent avoidable loss worth Rs. 13510/- was observed during the experiment. present study calculated grain yield in protected and unprotected plot in terms of yield and data revealed that at protected condition the yield varied from 42.28 to 47.15 qtl/ha and unprotected condition the yield ranged from 34.57 to 43.21 qtl/ha in Pant 12 variety. Chhavi *et al.* (2017) also reported that at protected condition the yield varied from 46.22 to 76.45 qtl/ha and in unprotected condition the yield varied from 35.26 to 53.42 qtl/ha in Arize 6129. She also reported avoidable loss which varied from 11.9 to 37.9 per cent in different rice varieties. At protected condition Saikia and Parmeswaran (1999) also reported that the yield loss due to paddy leaf folder at different growth stage where in unprotected plots there was higher leaf folder damage and lower grain yield with yield loss of 4.2 to 5.5 per cent. They also observed reduced damage due to leaf folder and higher grain yield in paddy plot with protection.

Table 1 : Effect of different dates of sowing on incidence of larvae of Rice Leaf folder during 2017.

SW	Period of observations	Mean larval population /folded Leaves/3 hills			Mean abiotic factors					
		Dates of sowing			Temperature (^{0}C)		Relative Humidity (%) Morning	Relative Humidity (%) Evening	Av. Relative humidity	Rainfall (mm)
		2nd week of July (8th July)	4th week of July (24th July)	1st week of August (3rd August)	Min.	Max.				
31	31 July -06 Aug	0.25	1.75	2	26.3	33.2	86	70	78	5.3
32	07 Aug-13 Aug	0.75	1.75	2.25	25.8	33.1	93	76	84.5	112.6
33	14 Aug-20 Aug	0.75	1.5	2.5	26.1	34.3	86	68	77	1
34	21 Aug-27 Aug	0.5	1.5	2.25	25.5	32.9	92	76	84	89.2
35	28 Aug-3 Sept	1.25	3.25	3.25	25.2	33.3	91	74	82.5	2.2
36	4 Sep-10 Sep	2	2.5	3	25.3	35.1	89	65	77	3.6
37	11p Se-17 Sep	2.75	3.75	4.25	25.7	36.2	86	58	72	0
38	18Sep-24 Sep	3.75	5	4.75	25.3	33.7	91	79	85	34.5
39	25 Sep-01 Oct	4.25	5.25	5.5	23.3	34.1	90	60	75	0.2
40	02 Oct-08 Oct	5.5	6	6.25	22.7	35.4	87	51	69	0
41	09 Oct-15 Oct	6.5	8.5	8	22.9	35.8	82	45	63.5	0
42	16 Oct-22 Oct	6.25	8.75	8.5	19.3	35.9	87	37	62	0
43	23 Oct-29 Oct	5.75	7.25	7.5	15.7	34.3	86	30	58	0
44	30 Oct-05 Nov	4.75	5	6	16	30.9	91	46	68.5	0

Table 2: Effect of different dates of sowing on larvae of Rice Leaf folder during 2018.

SW	Period of observations	Mean larval population/folded Leaves/3 hills			Mean abiotic factors					
		Dates of sowing			Temperature (^{0}C)		Relative Humidity (%) Morning	Relative Humidity (%) Evening	Av Relative Humidity	Rainfall (mm)
		2nd week of July (8th July)	4th week of July (24th July)	1st week of August (3rd August)	Min.	Max.				
31	31 Jul -06 Aug	0.25	1.25	1	23	28.5	97	87	92	333.5
32	07 Aug-13 Aug	0.5	2	1.75	25.7	33.1	86	71	78.5	28.4
33	14 Aug-20 Aug	0.75	1.75	1.75	25.8	33.8	86	71	78.5	53.1
34	21 Aug-27 Aug	0.75	1.75	2	24.9	31.9	89	77	83	122
35	28 Aug-3 Sept	1	2.75	2.75	25	31.6	90	77	83.5	42.3
36	04 Sep-10 Sep	1.75	2.5	2.75	23.9	30.8	90	79	84.5	110.2
37	11Sep-17 Sep	2.5	3.25	3.5	23.5	32.4	85	63	74	19.6
38	18Sep-24 Sep	3.25	4.5	4.75	23.6	32.7	82	61	71.5	3
39	25 Sep-01 Oct	4.5	5	5.25	22.7	33.9	78	50	64	8.6
40	02 Oct-08 Oct	5.25	5.5	5.75	20.6	35.6	73	40	56.5	0
41	09 Oct-15 Oct	6.0	8.5	8.25	19.2	34.2	77	40	58.5	0
42	16 Oct-22 Oct	5.75	8.25	8.5	16.6	35.2	70	29	49.5	0
43	23 Oct-29 Oct	5.25	6.75	7.25	14.2	33.1	70	30	50	0
44	30 Oct-05 Nov	4.25	4.5	5.75	14.4	32	83	36	59.5	0

Table 3: Incidence of Leaf folder in paddy at different date of sowing stages during Kharif 2017.

Date of sowing	Leaf Infestation %					
	Vegetative stage (July-August)		Reproductive stage (August-September)		Maturity stage (September-October)	
	Protected	Unprotected	Protected	Unprotected	Protected	Unprotected
8th July	0 (0.0)	0 (0.0)	2.43 (9.21)	2.425 (8.94)	3.75 (11.16)	7.1 (15.45)
24th July	0 (0.0)	1.2 (6.23)	4.75 (12.64)	4.95 (12.84)	5.48 (13.52)	7.83 (16.24)
3rd August	0.63 (4.25)	1.25 (6.36)	7.08 (15.51)	8.125 (16.56)	8.20 (16.62)	8.65 (17.10)
SEM	1.08	0.40	0.80	0.25	0.40	0.20
SED	1.52	0.56	1.13	0.36	0.57	0.28
CD (P=0.05)	3.7	1.37	2.79	0.88	1.4	0.70
CD (P=0.01)	5.64	2.08	4.22	1.33	2.12	1.06

Table 4: Incidence of Leaf folder in paddy at different date of sowing stages during *Kharif* 2018.

Date of sowing	Leaf Infestation %					
	Vegetative stage (July-August)		Reproductive stage (August-September)		Maturity stage (September-October)	
	Protected	Unprotected	Protected	Unprotected	Protected	Unprotected
8th July	0 (0.00)	0.250 (1.44)	2.70 (9.43)	2.58 (9.17)	4.18 (11.70)	4.13 (11.71)
24th July	0.88 (3.78)	1.975 (7.77)	4.35 (11.99)	4.60 (12.32)	4.68 (12.44)	7.03 (15.35)
3rd August	0.00 (0.00)	2.750 (9.50)	7.80 (16.20)	7.05 (15.33)	7.85 (16.25)	8.13 (16.56)
SEM	1.27	1.39	0.43	0.37	0.81	0.34
SED	1.80	1.96	0.62	0.52	1.14	0.48
CD (P=0.05)	4.40	4.80	1.51	1.28	2.80	1.17
CD (P=0.01)	6.68	7.26	2.29	1.94	4.24	1.78

Table 5 : Per cent Avoidable losses indifferent dates of sowing with larvae of Rice leaf folder during *Kharif* 2017.

Date of sowing		Avoidable losses during *Kharif* 2017						
	Mean Yield in Protected (qtl)	Mean Yield in unprotected (qtl)	Avoidable loss (qtl/ha)	% loss	Value of additional yield (Rs.)	cost of treatment (Rs.)	Net profit (Rs.)	B:C Ratio
8th July	48.15 (6.97)	43.83 (6.66)	4.321	8.97	6697.5	4350	2347.53	1.5397
24th July	45.06 (6.75)	38.89 (6.28)	6.173	13.69	9567.9	4350	5217.90	2.1995
3rd August	42.90 (6.59)	34.72 (5.93)	14.04	19.06	21762	4350	17412.0	5.0028
SEM	0.05	0.08						
SED	0.07	0.11						
CD (P=0.05)	0.17	0.25						
CD (P=0.01)	0.24	0.35						

Table 6 : Per cent Avoidable losses indifferent dates of sowing with larvae of Rice leaf folder during *Kharif* 2018

Date of sowing		Avoidable losses during *Kharif* 2018						
	Yield in Protected (qtl)	Yield in unprotected (qtl)	Avoidable loss (qtl/ha)	% loss	Value of additional yield (Rs.)	cost of treatment (Rs.)	Net profit (Rs.)	B:C Ratio
8th July	46.14 (6.83)	42.59 (6.56)	3.549	7.69	6211.4	4350	1861.42	1.43
24th July	44.29 (6.69)	39.20 (6.30)	5.093	11.50	8912	4350	4562.03	2.05
3rd August	41.67 (6.49)	34.41 (5.91)	7.253	17.41	12693	4350	8342.90	2.92
SEM	0.05	0.07						
SED	0.07	0.10						
CD (P=0.05)	0.16	0.22						
CD (P=0.01)	0.23	0.32						

Table 7 : Pooled data of Per cent avoidable losses indifferent dates of sowing with larvae of Rice leaf folder during *Kharif 2017 &* 2018.

Date of sowing		Avoidable losses during *Kharif* 2017&2018						
	Yield in Protected (qtl)	Yield in unprotected (qtl)	Avoidable loss (qtl/ha)	% loss	Value of additional yield (Rs.)	cost of treatment (Rs.)	Net profit (Rs.)	B:C Ratio
8th July	47.15 (6.90)	43.2099 (6.61)	3.94	8.35	6895	4350	2545	1.59
24th July	44.68 (6.72)	39.0432 (6.29)	5.63	12.61	9852.5	4350	5502.5	2.26
3rd August	42.28 (6.54)	34.57 (5.92)	7.72	18.25	13510	4350	9160	3.11
SEM	0.05	0.07						
SED	0.07	0.11						
CD (P=0.05)	0.16	0.23						
CD (P=0.01)	0.22	0.33						

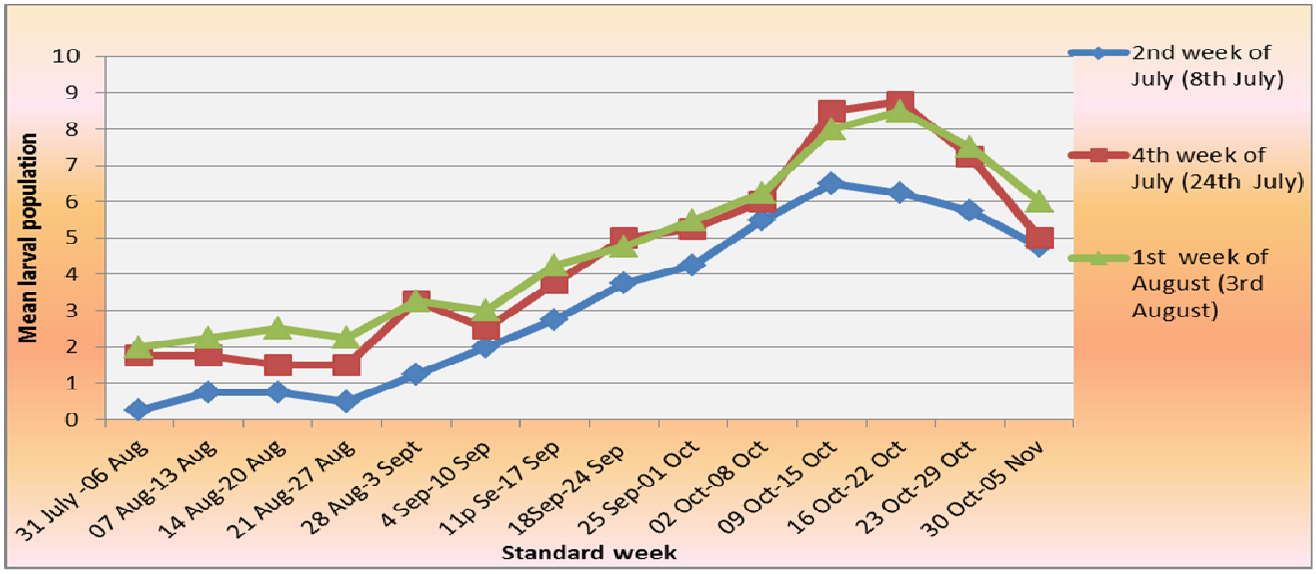

Fig. 1 : Incidence of larval population with different date of sowing in Kharif 2017

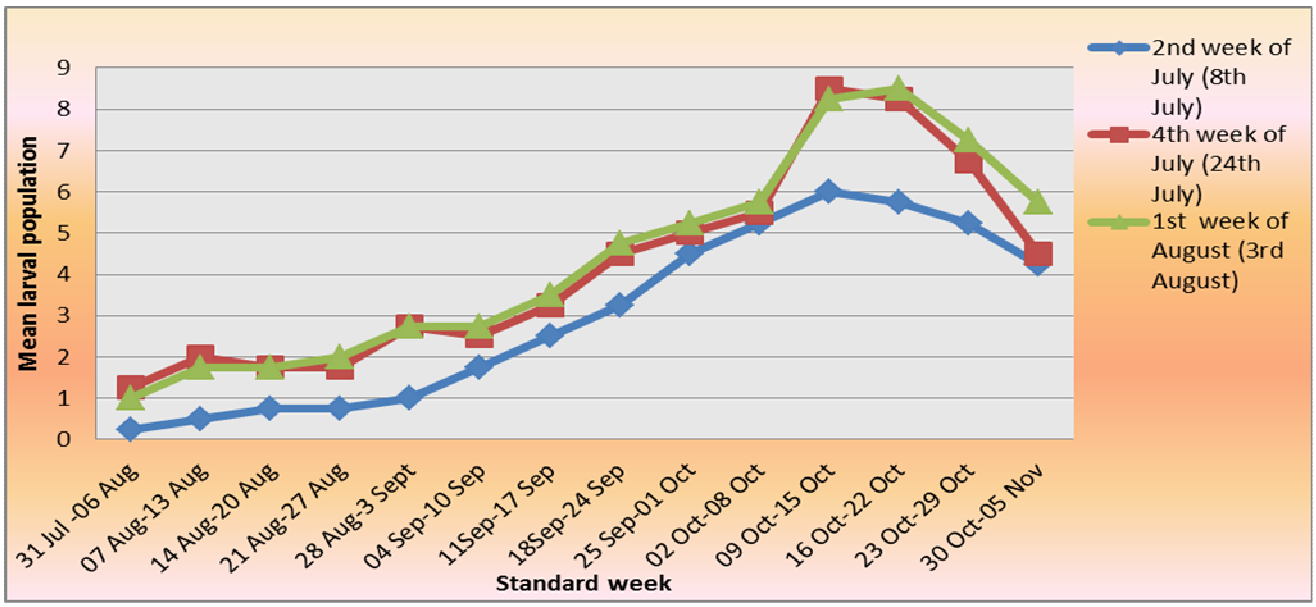

Fig. 2: Incidence of larval population with different date of sowing in Kharif 2018

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