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Effect of Different Sowing Dates for the Management of Chilli Pests

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ABSTRACT

The field experiment was conducted at Spices Research Centre, Shibganj, Bogra, Bangladesh during Rabi season of 2015-16 to assess the effect of varying sowing dates against insect pest of chilli. The treatments were T_1= 30 August (1st sowing); T_2= 15 September (2nd sowing); T_3= 30 September (3rd sowing); T_4= 15 October (4th sowing), T_5= 30 October (5th sowing) and T_6= 15 November (6th sowing). Sowing was done at 15 days interval from August to November in the experimental field. The results showed that the maximum mean aphid (9.27/leaf), thrips (10.77/leaf), mite(11.51/leaf) and fruit borer population like *H. armigera* and *S.litura* larvae (8.25 and 6.74/plant, respectively) were found in 15 November sowing and minimum number of those insect pest were present in 30 August sowing. Red ripe chilli yields were also found to differ in descending order as follows: 30 August (13.05 t/ha)> 15 September (12.70 t/ha)> 30 September (10.30 t/ha)> 15 October (8.41 t/ha)> 30 October (5.20 t/ha)> 15 November (3.10 t/ha). It was inferred that early sowing (30 August or 15 September) resulted in lower incidence of aphids, thrips, mite and fruit borer. Such low level of insect pest caused less crop injury which resulted in enhancing the red ripe yield of chilli. So, it is suggested that for early sowing of winter chilli, the appropriate planting time may be 30 August to 15 September.

Key words: Sowing date, management, chilli pests, chilli

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INTRODUCTION

Chilli (*Capsicum frutescens L.*) is an important commercial spice as well as vegetable crop grown all over Bangladesh. It is an important condiment used for imparting pungency and colour to the food being rich in vitamin C, A, B, oleoresin and red pigment. In Bangladesh, both summer and winter chilli covers about two laces thirty one thousand and seventy seven (2, 31, 077 acres) acres and produces dry chilli about one lac two thousand two hundred fifty one (1, 02,251 tons) tons (BBS, 2014). The crop is known to harbour more than 50 insect and 2 mite pests of which, thrips, *Scirtothrips dorsalis* Hood and the mites, *Polyphagotarsonemus latus* Banks are the major constraints for higher yields (Reddy and Puttaswamy, 1984). These sucking pests attack the crop at seedling stage itself and continue until 1st harvest, causing severe crop losses up to 34 per cent (Ahmed *et al.*, 1987). In addition recently, the fruit borer has also taken an upper hand and known to cause considerable damage to the crop by boring into the fruit leading to fruit whitening and fruit drop. Aphids, thrip, mite and fruit borer are the major insect pests of chilli often resulting in significant crop losses (Ahmed *et al.* 1987; Kandasamy *et al*., 1990). In order to save the crop from the pest ravages, farmers resort to six to as many as 20 times of chemical sprays (Lingappa *et al*., 2002) leading to pest resurgence, destruction of natural enemies and pesticide residues in fruits (Smitha, 2002). As pesticide residues in chilli are of great concern from the point of exports and domestic consumption as well, nonchemical pest management strategies such as appropriate sowing time is a better approach. Late planting, as it is known in many crops, attracts greater intensity

of pests and subsequent plant damage (Anonymous, 2004). Lewis (1973) observed that time of sowing and harvesting crops can also reduce the severity of injury. Adesiyun (1981 & 1982) found that damage caused by shoot flies to sorghum planted early in the season was low and insignificant and this low population was on the scanty vegetation during the dry season. Kisha (1977) stated that early transplanted onions were usually well established before attack began in mid-February. Patel (1992) reported that the population of chilli thrips remains low during July- August due to rains and showed a peak in September-October. Sowing time provides insect control without any additional costs, acts as preventive measure against buildup of insect with other method of pest control and free from environmental pollution problems. This type of research work has not so far been conducted in Bangladesh. So, the study was conducted to assess the effect of varying sowing dates on insect populations and red ripe yield of chilli.

MATERIALS AND METHODS

The study was conducted at Spices Research Centre, Shibganj, Bogra, Bangladesh (geographic coordinates 25.0167° N, 89.3167° E) during Rabi season of 2015-16. The experimental plot was prepared with five ploughings and cross ploughings followed by laddering to break the clods as well as to level the soil. The weeds and stubbles of previous crops were collected and removed from the soil. The unit plot size was 3 m × 1.5 m and spacing was 50 cm × 50 cm. The treatments were T_1= 30 August (1st sowing); T_2= 15 September (2nd sowing); T_3= 30 September (3rd sowing); T_4= 15 October (4th sowing), T_5= 30 October (5th sowing) and T_6= 15 November (6th sowing). Treatments were assigned in a randomized complete block design with three replications. BARI Morich-3 was used as test crop for this trial. In addition to 5 t/ha of cow dung, the crop was fertilized with N_{120} P_{60} K_{100} S_{20} B_2 kg/ha. The entire amount of cow dung, P, S, B and 1/3 of K was applied during final land preparation. The N and rest K was applied in 3 equal splits at 25, 50 and 70 days after sowing (DAS) (Anonymous, 2010). Three weeding were done at 25, 50 and 75 days after sowing and three irrigations were done at 10-20 days interval during vegetative growth stage. To control Anthracnose of chilli, the crop was sprayed with Tilt 250EC @ 0.5ml/L of water at 65 DAS. Depending on the maturity, the red ripe chilli was harvesting from February, 2016 and completed on 02 May, 2016. The whole experimental plot was kept free from spraying of any insecticide. The population count of aphids and thrips were taken at 30, 60 and 90 days DAS. While the population count of mite was taken at 60 and 90 DAS. For counting the population, five plants were selected randomly in each plot and tagged. Six leaves on the top canopy of each selected plant were observed by using binocular microscope in laboratory following destructive sampling procedure. The mean population of aphids, thrips and mites per leaf was worked out. The observations on larval population of chilli fruit borer, *H. armigera* and *S. litura* were made on five randomly selected plants from each treatment at 60, 90 and 120 DAS. The mean larval population was worked out. The Minolta SPAD 502 chlorophyll meter was used for the measurement of chilli leaf color. Yield of red ripe chillies from different plucking were recorded from each treated plots and computed as t ha^{-1}. Another data on plant height at 112 DAS, Chlorophyll Concentration Index (CCI) at 112 DAS, fruit length, fruit diameter, single fruit weight and red ripe yield at harvest were recorded. The recorded data were analyzed and mean values were adjusted and separated by Duncan's Multiple RangeTest (DMRT) according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Incidence of chilli pest with weather parameter is presented in Table 1 and the number of different insect population per plant observed at different standard week in chilli is presented in Fig. 1. It was evident from the study that aphid incidence was started in 40th standard metereiological week (SMW) (0.60/leaf) and continued till the harvest of the crop. Population ranged from 0.80 to 2.52 and reached its peak 2.22/leaf and 2.89/leaf during 48th SMW and 15th SMW, respectively.

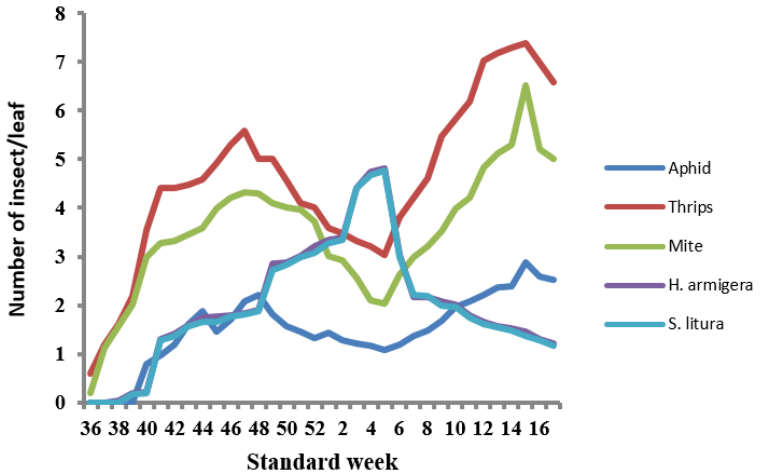

Figure 1: Mean number of insect population per plant observed at different standard week in chilli

However, thrips incidence was started in 36th SMW and continued till the harvest of the crop. Population ranged from 0.60 to 7.38 and reached its peak 4.59/leaf during 44th SMW and 7.38 during 15th SMW. Similar results were reported by Varadharajan *et al*. (1995), Bindu and Patel (2001) and Patel *et al*. (2009).

In case of mite appeared in the first week of October i.e 36th SMW, the population ranged from 0.20 to 6.53/leaf. Population steadily reached two peaks level during 47th and 13th SMW and overall its peak (5.12/leaf) was recorded in 13th SMW. Present results were in concurrence with the findings of Roopa (2009) and Nandini *et al*. (2010).

The incidence *Helicoverpa armigera* was started in 38th SMW and continued till the harvest of the crop. Population ranged from 0.03 to 4.82 and reached its peak (4.82 larvae/plant) in 5th SMW. These results were in support of Nadaf and Kulkarni (2006). Mean population *Spodoptera litura* larvae per plant indicated that, incidence started in 39th SMW and the highest population was observed (4.78 larvae/plant) in the 5th SMW. Similar results were reported by Nadaf and Kulkarni (2006) and Nandini *et al*. (2010).

Table 1: Incidence of chilli pest with weather parameter

Month and year	Week	Std. Week	Average Temperature (0c)	Relative Humidity (%)	Rainfall (mm)	Mean no. of aphid /twig	Mean no. of thrips /leaf	Mean no. of mite/leaf	Mean no. of H. armigera (larvae)/plant	Mean no. of S. litura (larvae)/plant
September 2015	I	36	23.9	88.1	88	0.00	0.60	0.20	0.00	0.00
	II	37	24.8	83.6	04	0.00	1.20	1.12	0.00	0.00
	III	38	25.0	83.4	60	0.00	1.62	1.58	0.03	0.00
	IV	39	26.5	82.2	46	0.00	2.20	2.02	0.20	0.18
Mean			25.1	84.3	198	0.00	1.41	1.23	0.06	0.05
October 2015	I	40	26.4	80.3	00	0.80	3.54	2.98	0.22	0.20
	II	41	26.9	78.8	12	0.98	4.40	3.28	1.30	1.28
	III	42	27.9	81.8	12	1.20	4.40	3.32	1.42	1.38
	IV	43	29.2	85.1	15	1.62	4.48	3.45	1.60	1.58
	V	44	30.5	80.8	00	1.88	4.59	3.58	1.75	1.65
Mean			28.2	81.4	39	1.30	4.28	3.32	1.26	1.22
November 2015	I	45	28.7	82.2	00	1.45	4.92	3.98	1.78	1.65
	II	46	29.2	81.3	00	1.70	5.30	4.20	1.80	1.78
	III	47	30.0	84.5	00	2.08	5.58	4.32	1.84	1.82
	IV	48	30.7	78.5	00	2.22	5.00	4.30	1.90	1.88
Mean			29.7	81.6	00	1.86	5.20	4.20	1.83	1.78
December 2015	I	49	18.3	86.1	00	1.82	5.02	4.11	2.85	2.72
	II	50	17.6	90.0	00	1.58	4.56	4.00	2.89	2.83
	III	51	20.5	82.7	00	1.45	4.09	3.96	3.01	2.98
	IV	52	23.0	77.1	00	1.32	4.02	3.72	3.22	3.09
Mean			19.9	84.0	00	1.54	4.42	3.95	3.00	2.91
January 2016	I	1	15.3	82.3	00	1.44	3.58	3.02	3.34	3.28
	II	2	18.1	84.2	00	1.28	3.48	2.92	3.40	3.35
	III	3	18.2	85.7	09	1.22	3.32	2.58	4.42	4.40
	IV	4	18.6	85.1	00	1.17	3.22	2.11	4.75	4.68
	V	5	20.1	85.1	00	1.08	3.04	2.04	4.82	4.78
Mean			18.1	84.5	09	1.24	3.33	2.53	4.15	4.10
February 2016	I	6	19.3	80.9	00	1.20	3.82	2.63	3.04	2.98
	II	7	21.8	79.9	00	1.38	4.20	2.98	2.17	2.22
	III	8	24.5	73.0	00	1.48	4.62	3.22	2.17	2.20
	IV	9	24.6	69.1	00	1.68	5.48	3.52	2.09	2.00
Mean			22.6	75.7	00	1.43	4.53	3.09	2.37	2.35
March 2016	I	10	26.2	73.4	00	1.98	5.84	3.98	2.01	1.96
	II	11	26.6	67.4	00	2.09	6.18	4.20	1.80	1.75
	III	12	26.8	70.5	00	2.22	7.02	4.84	1.65	1.62
	IV	13	26.9	69.8	32	2.38	7.18	5.12	1.58	1.55
Mean			26.6	70.3	32	2.17	6.56	4.54	1.76	1.72
April 2016	I	14	27.0	85.0	02	2.40	7.30	5.30	1.52	1.48
	II	15	30.6	78.1	00	2.89	7.38	6.53	1.45	1.37
	III	16	31.7	71.6	00	2.60	6.98	5.20	1.30	1.28
	IV	17	32.5	65.1	00	2.52	6.59	5.02	1.22	1.17
Mean			30.5	75.0	02	2.60	7.06	5.51	1.37	1.33

SIMPLE CORRELATION BETWEEN CHILLI PEST POPULATION AND WEATHER PARAMETERS

Correlation Co-efficient values (r) of chilli insect pest incidence with weather parameters is presented in Table 2. There was a positive correlation between temperature and aphid population in chilli. The correlation coefficient was r = +0.3999. The figure indicated that aphid population was increased with the increase of temperature. Aphid population was negatively correlated with relative humidity in chilli. The correlation coefficient was r = -0.6602. This indicated that aphid population decreased with the increase of relative humidity. Similarly, aphid population was significantly negatively correlated with average rainfall in chilli. The correlation coefficient was r = -0.7909*. The figure indicated that aphid population decreased with the increase of average rainfall.

It was evident from Table 2 that there was a positive correlation between temperature and thrips population in chilli. The correlation coefficient was r = +0.4945. The figure indicated that thrips population was increased with the increase of temperature. Thrips population was negatively correlated with relative humidity in chilli. The correlation coefficient was r = -0.7691*. This indicated that thrips population decreased with the increase of relative humidity. Similarly, aphid population was significantly negatively correlated with average rainfall in chilli. The correlation coefficient was r = -0.6970*. The figure indicated that aphid population decreased with the increase of average rainfall. Similar results were reported by Duraimurugam and Jagadish (2002), Shukla (2006), Panickar and Patel (2001), Nandini *et al*. (2010) and Vanisree *et al*.(2011).

It was evident from Table 2 that there was a positive correlation between temperature and mite population in chilli. The correlation coefficient was r = +0.4918. The figure indicated that mite population was increased with the increase of temperature. Mite population was negatively correlated with relative humidity in chilli. The correlation coefficient was r = -0.6105. This figure indicated that mite population decreased with the increase of relative humidity. Similarly, mite population was significantly negatively correlated with average rainfall in chilli. The correlation coefficient was r = -0.7084*. This indicated that mite population decreased with the increase of average rainfall.

Table 2: Correlation Co-efficient values (r) of chilli insect pest incidence with weather Parameters

Weather parameter	Aphid	Thrips	Mite	Fruit borer	
				H. armigera	*S. litura*
Average temperature	+0.3999	+0.4945	+0.4918	-0.7176*	-0.7198*
Average relative humidity	-0.6602	-0.7691*	-0.6105	+0.1723	+0.1694
Average Rainfall	-0.7909*	-0.6970*	-0.7084*	-0.6804	-0.6769

It was found from Table 2 that there was significantly negative correlation between temperature and *Helicoverpa armigera* population in chilli. The correlation coefficient was r = -0.7176*. This indicated that *H. armigera* population was increased with the decrease of temperature. *H. armigera* population was positively correlated with relative humidity in chilli. The correlation coefficient was r = +0.1723. This figure indicated that *H. armigera* population increased with the decrease of relative humidity. Similarly, *H. armigera* population was negatively correlated with average rainfall in chilli. The correlation coefficient was r = -0.6804. This indicated that *H. armigera* population decreased with the increase of average rainfall.

Similarly, it was found from Table 2 that there was significantly negative correlation between temperature and *Spodoptera litura* population in chilli. The correlation coefficient was r = -0.7198*. This indicated that *Spodoptera litura* population was increased with the decrease of temperature. However, *Spodoptera litura* population was positively correlated with relative humidity in chilli. The correlation coefficient was r = +0.1694. This indicated that *Spodoptera litura* population increased with the decrease of relative humidity. Similarly, *Spodoptera litura* population was negatively correlated with average rainfall in chilli. The correlation coefficient was r = -0.6769. The figure indicated that *Spodoptera litura* population decreased with the increase of average rainfall.

EFFECT OF DIFFERENT SOWING DATES AGAINST INSECT PEST OF CHILLI

Effect of different sowing dates against insect pest of chilli is presented in Table 3. Sowing was done one after another in order to assess whether early planting had any advantage in reducing insect pests and increasing yield of chilli. The results showed that the maximum mean aphid (9.27/leaf), thrips (10.77/leaf) and mite (11.51/leaf) population were found in 15 November sowing followed by 30 October sowing (5.17, 8.17 and 7.15/leaf, respectively) and the minimum number of those insect pest (0.87, 1.10 and 0.98/leaf, respectively) were present in 30 August sowing which was statistically similar to 15 September sowing (1.32, 1.85 and 1.83/leaf). Similarly, the lowest fruit borer population like *H. armigera* and *S.litura* larvae **(**0.60 and 0.46/plant) was also recorded from 30 August sowing followed by 15 September sowing (1.69 and 0.98 larvae/plant) and the highest number of those insect (8.25 and 6.74/leaf) was recorded from 15 November sowing. This supported the findings of Pollard (1955), who reported that careful selection of sowing date makes it possible to ensure that the vulnerable stage in a crop does not coincide with the period of pest abundance. Lewis (1973) observed that time of sowing and harvesting crops can also reduce the severity of injury.

Table 3: Effect of different sowing dates against insect pest of chilli

Treatments	Mean no. of aphid/leaf	Mean no. of thrips/leaf	Mean no. of mite/leaf	Mean no. of Fruit borer (larvae)/plant	
				H. armigera	*S. litura*
30 August	0.87d	1.10e	0.98d	0.60e	0.46d
15 September	1.32d	1.85e	1.83d	1.69d	0.98cd
30 September	2.67c	3.25d	2.07d	1.98d	1.48c
15 October	3.10c	5.71c	5.10c	3.46c	2.95b
30 October	5.07b	8.17b	7.15b	5.21b	3.25b
15 November	9.27a	10.77a	11.51a	8.25a	6.74a
CV (%)	10.31	6.89	8.53	9.55	12.66
Level of sigf.	**	**	**	**	**

Data represent mean of three observations, Mean followed by the same letter (s) in the same column did not differ significantly from each other at 1% level by DMRT.

EFFECT OF DIFFERENT SOWING DATES ON YIELD CONTRIBUTING CHARACTER OF CHILLI

Effect of different sowing dates on yield contributing character of chilli is presented in Table 4. It was evident that significantly the tallest plant (67.47 cm) was recorded from 30 August sowing which was statistically similar to 15 September sowing (64.80 cm) and the smallest plant (33.60 cm) was observed from late sowing (like 15 November). Patel and Patel (2012) reported that plant height was significantly and negatively correlated with sucking pest. However, the maximum Chlorophyll Concentration Index at 112 DAT (62.40), fruit length (8.92 cm), fruit diameter (0.80 cm) and single fruit weight (30 g) was recorded from 30 August sowing plot while the lowest number of this parameter was recorded from late sowing (15 November) plot.

Table 4: Effect of different sowing dates on yield contributing character of chilli

Treatments	Mean plant height at 112 DAT	SPAD value (CCI) at 112 DAT	Fruit Length (cm)	Fruit diameter (cm)	Single fruit wt. (g)
30 August	67.47a	62.40a	8.92a	0.80a	30a
15 September	64.80ab	60.80a	8.83a	0.77a	28a
30 September	59.73ab	57.70ab	7.54ab	0.68ab	27a
15 October	57.07b	56.30ab	7.38b	0.59b	21b
30 October	44.40c	50.20b	6.72b	0.40c	13c
15 November	33.60d	42.80c	5.28c	0.34c	10c
CV (%)	5.37	5.19	6.94	6.84	5.70
Level of sigf.	**	**	**	**	**

Data represent mean of three observations, Mean followed by the same letter (s) in the same column did not differ significantly from each other at 1% level by DMRT. CCI= Chlorophyll Concentration Index of leaf

Effect of different sowing dates on yield of chilli is presented in Fig. 2. The highest red ripe chilli yield (13.05 t/ha) was obtained from 30 August sowing which was statistically similar to 15 September sowing (12.70 t/ha) and the lowest yield was obtained from 15 November sowing (3.10 t/ha) followed by 30 October sowing (5.20 t/ha). Kisha (1977) found that early transplanted onions produced significantly higher yields than onions transplanted later.

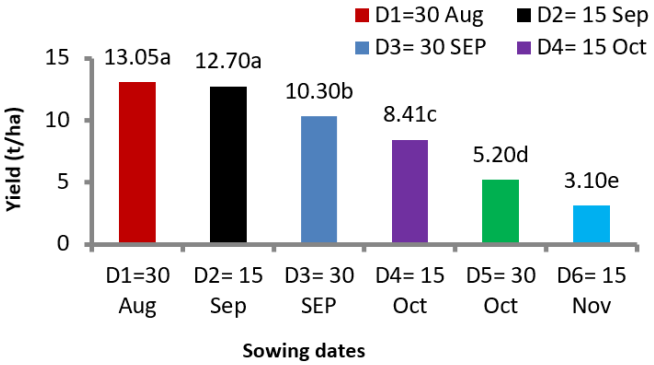

Figure 2: Effect of different sowing dates on yield of chilli

CONCLUSION

From the above study, it may be concluded that early seed sowing (30 August to 15 September) resulted lower insect pest with higher yield of chilli.

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