J. Cotton Res. Dev. **33** (1) 50-56 (January, 2019) **ISSN No. 0972-8619**

Study of flowering behavior and boll setting in various *Gossypium arboreum* L. varieties in different planting conditions

SUNAYANA*, R.S. SANGWAN AND PINKI

Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar-125004

****E-mail : nainapunia@gmail.com***

ABSTRACT : Cotton plant having indeterminate growth habit and flowering starts nearly 55-65 days after sowing depending upon the sowing time, variety and environmental factors. In the present study efforts were made to find out the critical period of reproductive stage *i.e.* flowering period and boll setting. Experimental material consists of three varieties of *desi* cotton namely, HD 123, HD 324 and HD 432 grown under three different sowing conditions (early, normal and late sown) in three replications at recommended spacing. The effective boll setting per cent was recorded and it ranged from 43.2 to 73.5 in different sowing period. In early sown conditions the variety HD 123 produced 52 per cent higher flowers as compared to late sown conditions. All the varieties produced more flowers in early sown conditions. The period from July 25 to August 14 was observed most ideal time for flowering and boll formation in all the varieties irrespective of sowing period indicated that utmost care is required during this period for higher yield. During the experimental period, a total of 62284 flowers were tagged and overall boll setting per cent was 59.6 while boll setting under different sowing periods was 59.1, 60.9 and 59.1 of all the varieties.

Key words: Effective boll setting, flowering behavior, *G. arboreum*, sowing time

Cotton crop had a profound influence on men and matter. It is popularly known as the "White Gold". India has been the traditional home of cotton and cotton textiles. It occupies the place of pride in Indian agriculture and economy by earning valuable foreign exchange. In Haryana it is grown in an area of about 6 lakh ha. During the year 1975 cotton was grown in 2.54 lakh ha area in Haryana and the area under American cotton at that time was 1.07 lakh ha and *desi* cotton 1.47 lakh ha. After that farmers inclination towards American cotton increased, and its area in 1980 increased to 2.14 lakh ha compared to 1.06 lakh ha of *desi* cotton (Anonymous, 2017**)**. Reasons being problems of small sized bolls, more shedding of fruiting bodies and *kapas* in *desi* cotton. Although it has certain advantages like resistance to sucking pests and cotton leaf curl virus disease (CLCuD). In Haryana; there was a tremendous jump in area under this species from 12000 ha in the year 2015 to 38000 ha during the year 2016 due to farmer's disillusion of American cotton mainly due to heavy incidence of whitefly and cotton leaf curl virus disease (CLCuD). Sizeable area under *desi* cotton is very essential to sustain cotton crop, as it serves as a barrier for whitefly as well as CLCuD spread. To sustain the advantages of *Bt* cotton it also serves as refugia crop. To sustain the cultivation of *desi* cotton its problem needs to be addressed. Cotton crop has indeterminate growth habit and its flowering starts in first

fortnight of July and continued till end of September under normal conditions. There is heavy shedding of floral bodies during this period. This experiment was conducted to study the pattern of flowering and boll setting under different sowing periods and to identify the most suitable period for obtaining higher seed cotton yield (Sawan *et.al.*, 2012).

The present study was conducted during *kharif*, 2016 at research farm of CCS Haryana Agricultural University, Hisar. It is situated in the semi arid zone at an elevation of 215.2 m with a longitude of 75^0 46′ East and latitude of $29^0$10′ North. Experiment include three varieties of *desi* cotton namely HD 123, HD 324 and HD 432, grown in six replications at recommended spacing of 67.5 cm between rows and plants were kept 30 cm apart under three different sowing conditions Early (II fortnight of April), normal(I fortnight of May) and late sown(II fortnight of May). Each variety was grown in 8 rows of 6 m length of in each replication. Plant stand was good under all the sowing conditions in all the varieties. Observations were recorded as and when sizeable number of flower opening started *i.e.* from July 4 and it remained continued upto September 12. Uniformity was kept in tagging of flowers and efforts were made to tag all the flowers on weekly basis under normal situation except on rainy days and irrigated conditions. The numbers of opened flowers in a particular week were tagged with a coloured woolen thread in different weeks for their identification and how many of them produced the bolls were counted at boll opening time. Recommended agronomic and plant protection measures were adopted during the crop season. In early sown conditions tagging of flowers started in first week of July while in normal and late sown conditions it started in second fortnight of July and continued by mid September in all the three varieties. Data was recorded on weekly basis. Hence early sown condition had data of 10 weeks, whereas in normal and late sown conditions had data of 8 weeks for number flowers produced and number of bolls produced by these flowers were counted.

In cotton once fruiting begins, fruiting branches tend to be produced at each successive main-stem node. The first fruiting branch is often produced at the sixth or seventh node on

Table 1. Effect of different sowing conditions on boll setting (%)

Weeks*	HD 123			HD 324			HD 432		
	Early	Normal	Late	Early	Normal	Late	Early	Normal	Late
1	53.7	—-	—-	57.9	—-	—-	73.5	—-	—-
2	56.2	—-	—-	63.9	—-	—-	70.4	—-	—-
3	60.7	61.7	59.6	69.5	64.9	68.3	64.6	64.1	62.9
4	60.4	61.3	60.1	50.6	64.8	49.9	50.8	62.0	52.8
5	60.6	66.1	68.0	58.8	53.7	50.1	55.4	61.3	59.8
6	63.4	58.4	62.6	58.7	57.7	50.4	59.4	66.0	58.9
7	61.0	59.4	61.4	60.3	63.9	58.7	60.1	50.5	54.1
8	61.8	62.3	62.3	61.6	58.4	61.9	56.2	57.0	53.5
9	60.6	45.6	62.0	55.1	72.5	64.3	58.7	58.5	66.0
10	57.1	63.9	60.6	43.2	70.2	71.0	62.1	58.7	71.2
Total	**59.5**	**60.5**	**62.1**	**57.4**	**62.0**	**56.9**	**59.9**	**60.3**	**59.0**

the main stem. The time interval for the development of two successive fruiting bodies on the same sympodial branch is approximately six days. The time requirement for a square to develop into a flower is not significantly influenced by external conditions (Dhamayanthi and Rathinavel, 2014). Cotton plant due to its indeterminate growth habit continuously adds vegetative growth simultaneously with reproductive development throughout the crop season if it gets proper environmental conditions for vegetative growth. However, under North Indian conditions effective flowering in cotton generally starts in the beginning of July and continued upto end of September. Afterward flowers do not result into the effective bolls because their opening time coincides with the low day and night temperatures and may remain unopened with poor fibre quality. Identification of optimum period for flowering and effective boll setting has great relevance. In the present study; effective boll setting ranged from 43.2 (HD 324, early sowing) to 73.5 per cent (HD 432, early sowing). Under early sown conditions the variety HD 123 had produced the maximum number of flowers and effective bolls. These were 25.3 per cent and 28.0 per cent higher than HD 432 and HD 324 (Fig.1-3). Under early sown conditions effective boll setting per cent was 59.5, 57.4 and 59.9 in the varieties HD 123, HD 324 and HD 432, respectively (Table 1). Under normal sown conditions perusal of Fig. 4-6 revealed that the numbers of flowers produced were almost similar in different varieties and effective boll setting

Table 2. Flowering and boll setting in different varieties under various sowing periods

Sowing period/ Variety	Number of tagged flowers				Number of effective bolls				Per cent boll setting
	HD 123	HD 324	HD 432	**Total**	HD 123	HD 324	HD 432	**Total**	
Early	9635	7196	8702	**25533**	5737	4134	5209	**15080**	**59.1**
Normal	6192	6173	7033	**19398**	3745	3829	4244	**11818**	**60.9**
Late	4626	6185	6542	**17353**	2875	3521	3857	**10253**	**59.1**
Total	**20453**	**19554**	**22277**	**62284**	**12357**	**11484**	**13310**	**37151**	**59.6**

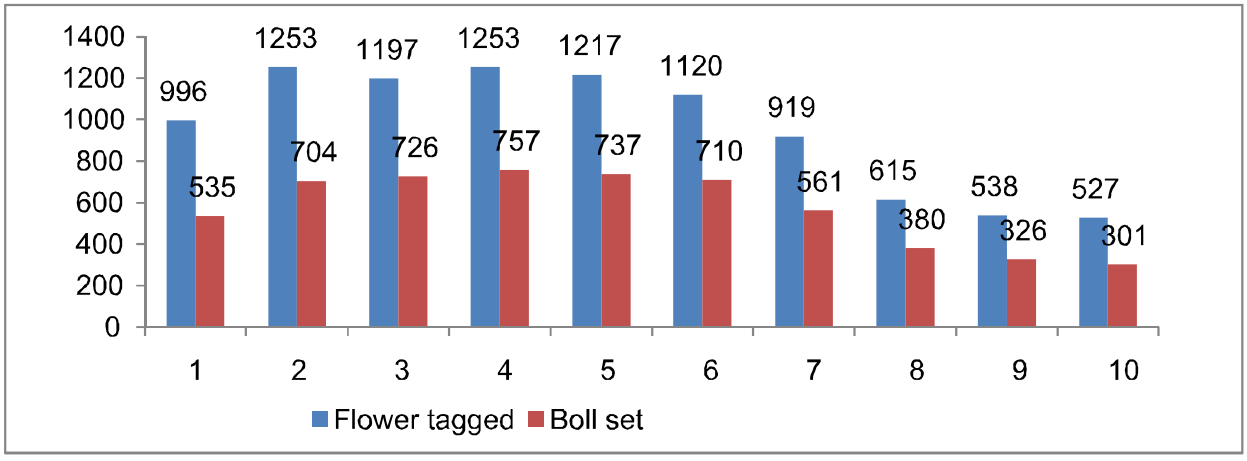

Fig. 1. Weekly flowering and boll setting in variety HD 123 under early sown conditions

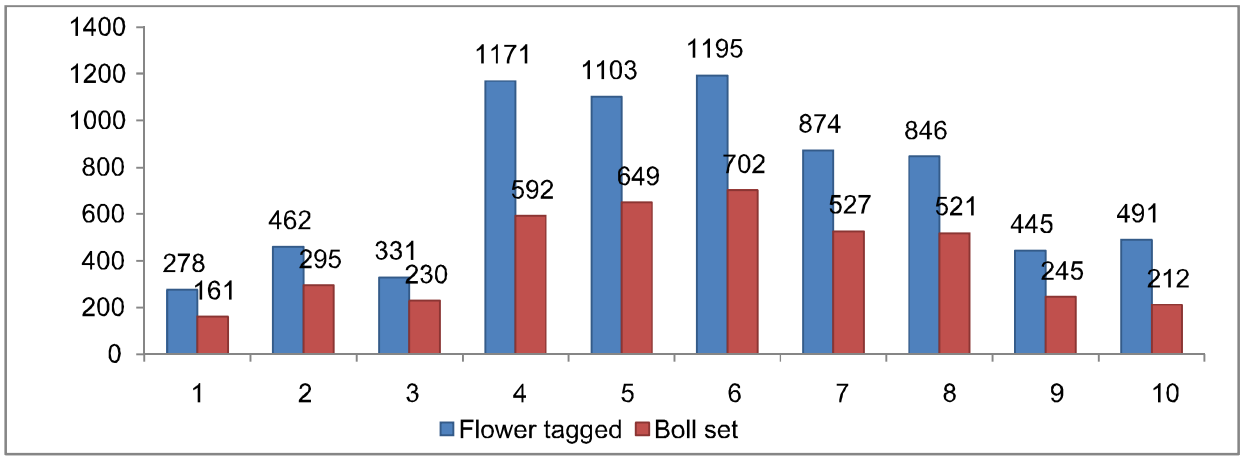

Fig. 2. Weekly flowering and boll setting in variety HD 324 in early sown conditions

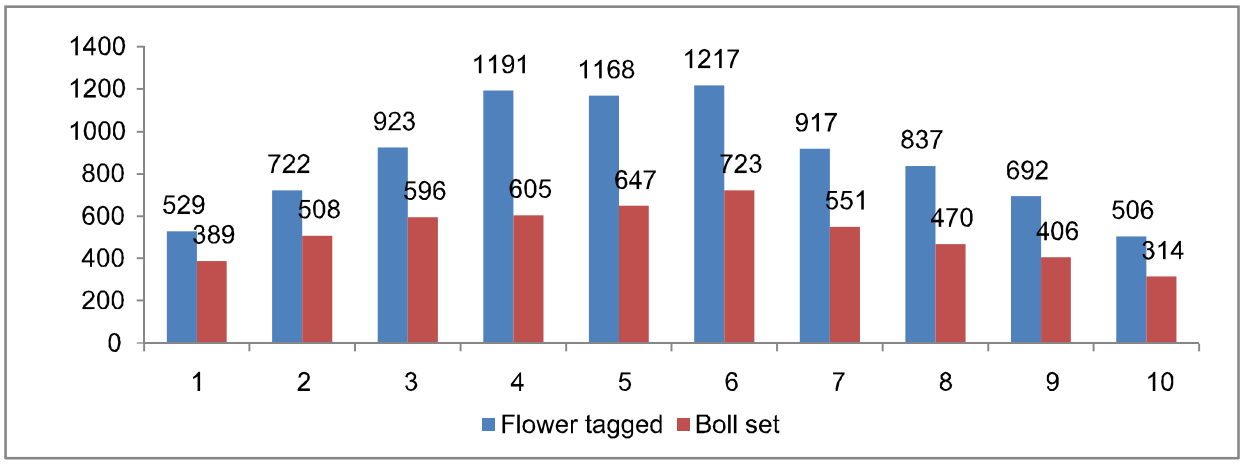

Fig. 3. Weekly flowering and boll setting in variety HD 432 in early sown conditions

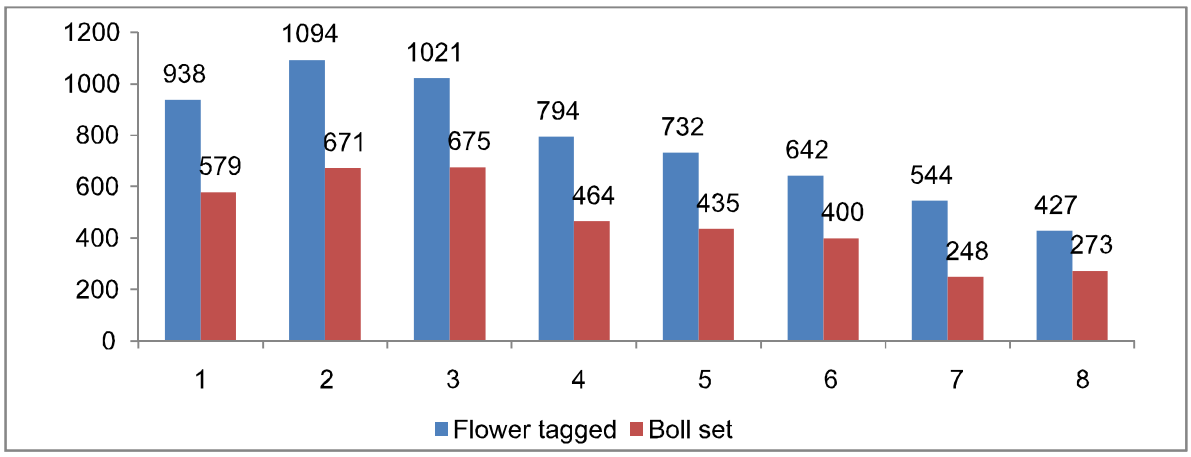

Fig. 4. Weekly flowering and boll setting in variety HD 123 in normal sown condition

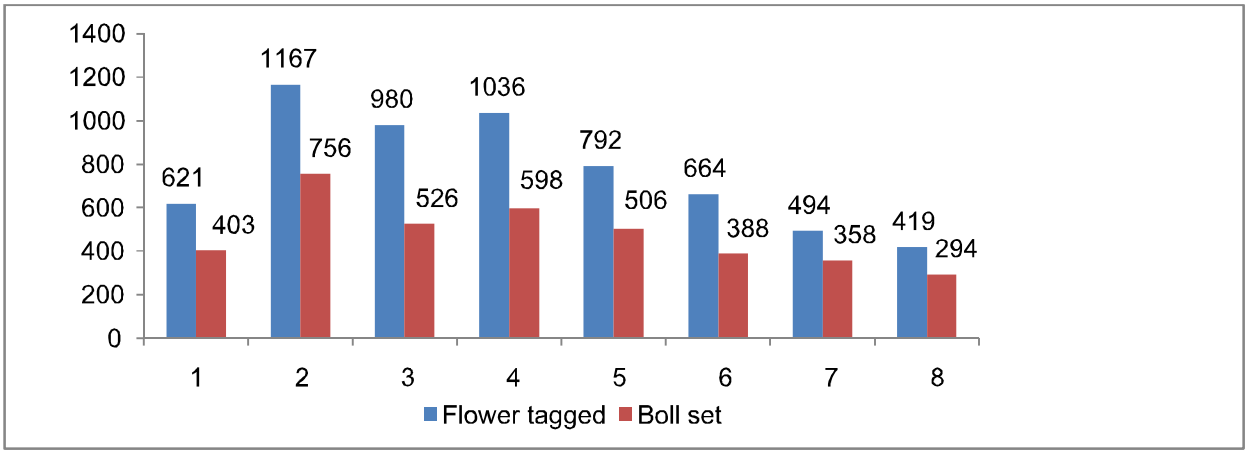

Fig. 5. Weekly flowering and boll setting in variety HD 324 in normal sown conditions

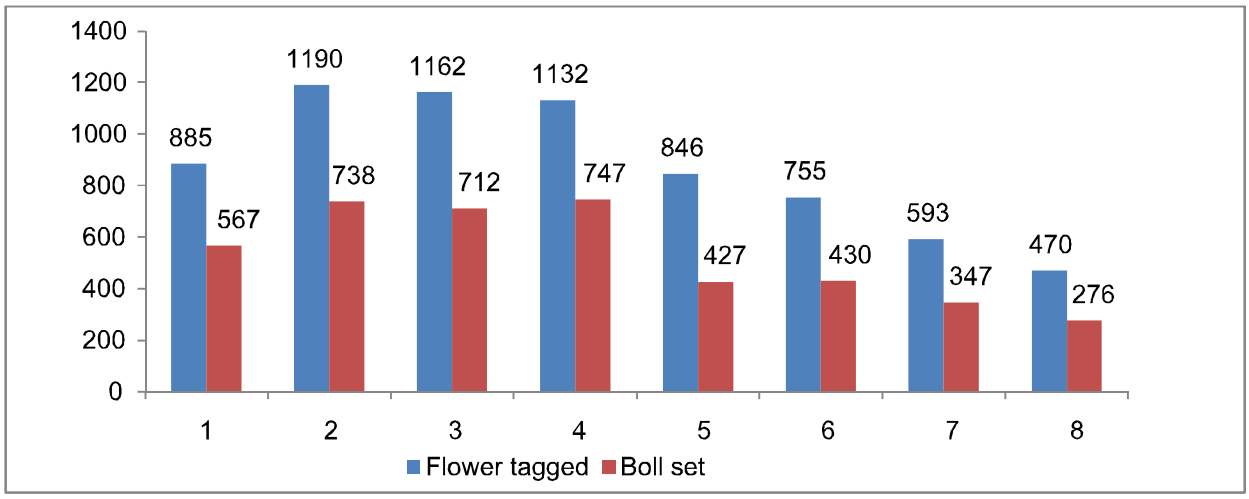

Fig. 6. Weekly flowering and boll setting in variety HD 432 in normal sown conditions

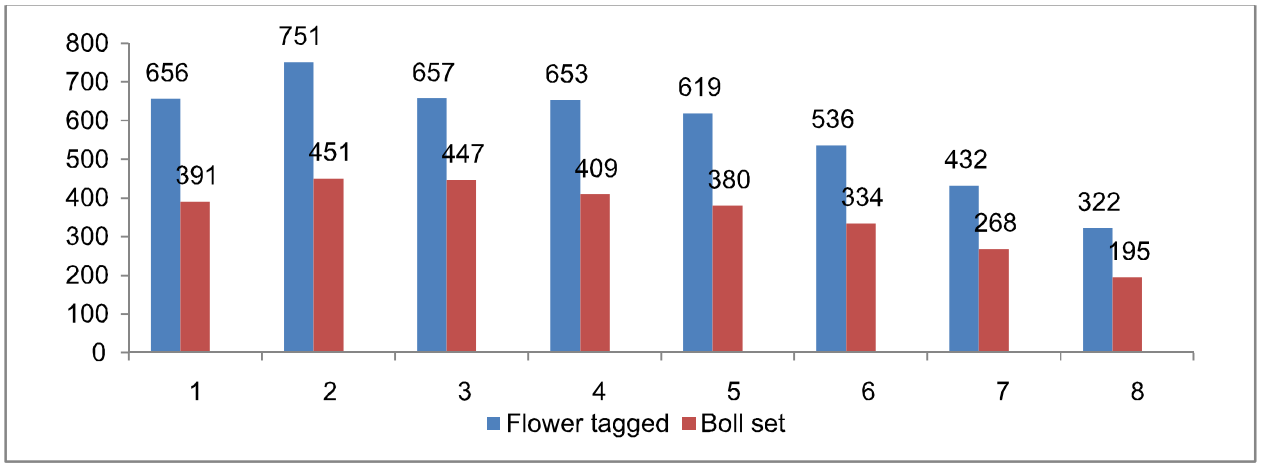

Fig. 7. Weekly flowering and boll setting in variety HD 123 in late sown conditions

per cent was 60.5, 62.0 and 60.3 in the varieties HD 123, HD 324 and HD 432, respectively (Table 1). Late sown conditions revealed that effective boll setting per cent was 62.1, 56.9 and 59.0 in the varieties HD 123, HD 324 and HD 432 respectively (Table 1). Data revealed that early sown conditions produced higher number of flowers and effective bolls compared to normal and late sown conditions. Observations of Table 1 and Fig. 1-9 indicated that July 25 to August 14 had produced the maximum flowers and effective bolls in all the varieties under different sown conditions. From these observations revealed that utmost care is required during this period for obtaining higher seed cotton yield. These results are in broad agreement with earlier findings of Sangwan *et al.,* 2010 regarding crossed boll setting in *desi* cotton. The variation in flowering and boll setting during a particular period may be due to variation in climatic conditions *i.e.* temperature, relative humidity, wind direction, wind speed, clear or cloudy sky etc. In early sown conditions the variety HD 123 produced 52 per cent higher flowers compared to late sown conditions whereas boll setting per cent under both the conditions

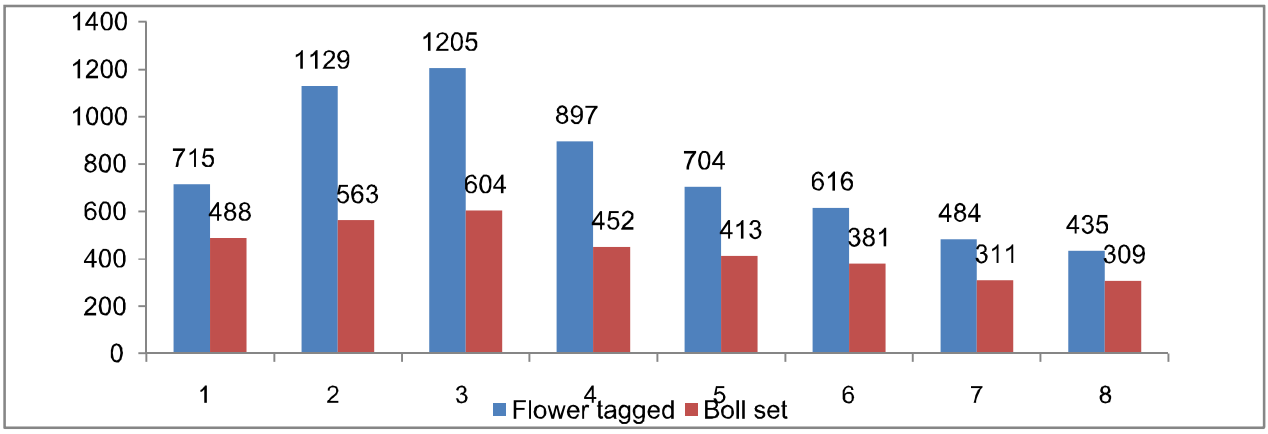

Fig. 8. Weekly flowering and boll setting in variety HD 324 in late sown conditions

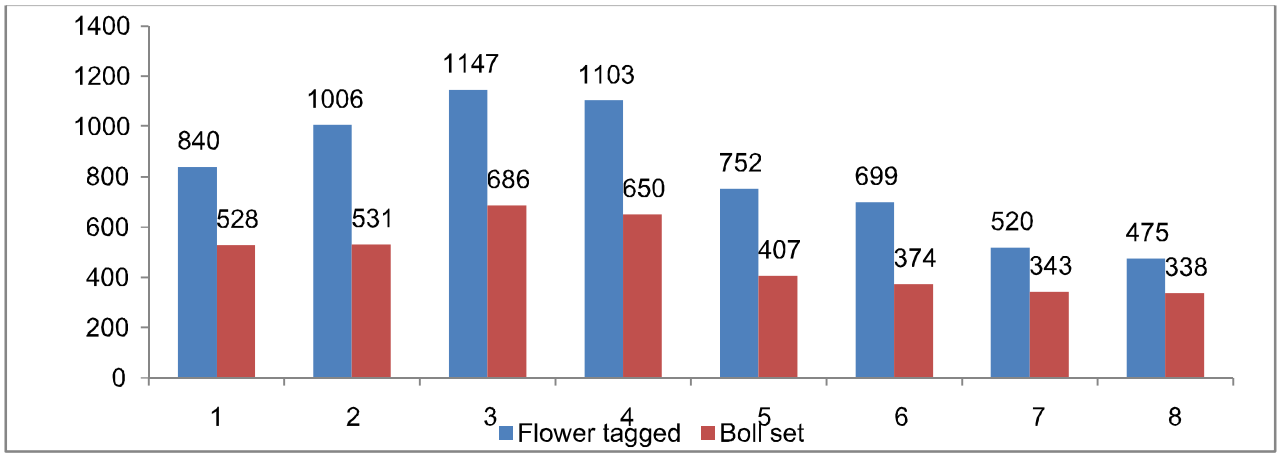

Fig. 9. Weekly flowering and boll setting in variety HD 432 in late sown conditions

was 59.5 and 62.1. The varieties HD 324 and HD 432 produced 14 and 33 per cent more flowers in early sown conditions compared to late sown conditions respectively and boll setting per cent was almost same. During the experimental period a total of 22277 flowers in the variety HD 432, 20453 in the variety HD 123 and 19554 in the variety HD 324 were tagged for recording observations in all three sowing periods (Table 4). Thus 62284 flowers were tagged and from these 37151 bolls were picked. The overall boll setting per cent was 59.6 and boll setting was 59.1 per cent in early, 60.9 per cent in normal and 59.1 per cent in late sown conditions of all the varieties. From these observations it can be concluded that boll setting per cent was least influenced by different sowing periods. Reddy *et al.,* 2001 observed that temperature in excess of a 30/20^{0}C day/night temperature regime resulted in significantly lower boll retention due to enhanced abortion of squares and young bolls. However, early sowing conditions had advantages over late sown conditions through number of flower production. Sarwar *et al.,* 2012 also observed the advantages of early sown conditions in cotton.

It can be concluded from the present study that early sown conditions seems to be most favorable for obtaining higher seed cotton yield because such conditions favors development of more fruiting bodies and crop was least affected by pest and diseases resulting in increased benefit to the cotton growers.

REFERENCES

Anonymous 2017. Status paper of Indian cotton. Directorate of Cotton Development, Ministry of Agriculture and Farmers Welfare, Government of India, pp. 182.

Sawan, Z.M., Hanna, L.I., Mc Cuistions, W.L. 2012. Response of flower and boll development to climatic factors before and after anthesis in Egyptian cotton. *Climate Res.* **29 :** 167–79.

Dhamayanthi, K P.M. and Rathinavel, K. 2014. Studies on flowering behaviour and fruiting pattern of early maturing germplasm lines of Egyptian cotton (*G.barbadense* L.). *Cotton Res. Jour.* **5 :** 150-57.

Sangwan, R.S., Siwach, S.S. and Punia, D.P. 2010. Factors affecting cross boll setting in hand emasculation and pollination techniques in *Gossypium arboreum. J. Cotton Res. Dev.* **24 :** 138-40.

Reddy, V.R., Baker, D.N. and Hodges, H.F. 2001. Temperature effects on cotton canopy growth, photosynthesis and respiration. *Jour. Agro.* **83 :** 699-704.

Sarwar, M., Farrukh Saleem, M., Ashfaq Wahid, M., Amir-Shakeel and Faisal-Bilal, M. 2012. Comparison of *Bt* and non *Bt* cotton (*Gossypium hirsutum*L.) cultivars for earliness indicators at different sowing datesand nitrogen levels. *Jour. Agri. Res.* **50:** 335-47.

Received for publication : May 5, 2018
Accepted for publication : November 18, 2018