Original Research Article

Incidence of cotton thrips, *Thrips tabaci*Lindemanand its correlation with weather parameters

ABSTRACT

Investigations on incidenceof cotton thrips(*Thrips tabaci* Lindeman)on *Bt* and non-*Bt* cotton hybrid were carried out at Main Cotton Research Station, Navsari Agricultural University, Surat (Gujarat) during *Kharif,* 2017-18.Thrips initiated from fourth week of June (26th SW) and it continued till first week of December (49th SW) in *Bt* and non-*Bt* cotton. The peak activity of thrips observed during third week of August (34th SW) in *Bt* hybrid and the higher fluctuation of thrips was observed during the second week of August to third week of September and first week of October. Thrips population had significant negative correlation with maximum temperature in *Bt* cotton. In case of non-*Bt*, the peak activity of thrips was found during first week of September (36th SW). As far as association with abiotic factors was concerned, maximum temperature and bright sunshine hours had significantly negatively correlation, while minimum temperature and morning relative humidity were positively associated.

Keywords: Thrips; Incidence; Cotton; Correlation; Bt& Non-Bt hybrid

1. INTRODUCTION

Cotton (*Gossypium hirsutum*L.), is the “King of fibre” popularly known as “White gold”, an important cash crop in India. The total cotton production was recorded at 113.32 million bales from 32.20 million hectares of total cultivated area with the productivity of 766 kg/ha in the world. The production of cotton was 29.00 million bales from the 13.35 million hectares of cultivated area and the productivity was 473 kg/ha in India [1]. The major cotton producing states are Gujarat, Maharashtra, Telangana, Andhra Pradesh, Karnataka, Madhya Pradesh, Haryana, Rajasthan and Punjab in India.Among the various causes of low productivity of cotton in India the insect pests is one of the major cause.Nowadays sucking insect pests *viz.,* sap feeders aphid; *Aphis gossypii* Glover, leafhopper; *Amrascabiguttulabiguttula*Ishida, thrips; *Thrips tabaci*Lindeman and whitefly; *Bemisiatabaci*Gennadius are the major importance [2].Sucking pests alone caused 40 to 50 per cent damage if unattended [3].In the era of climate change, also recognized the serious pest status of thrips in *Bt* and non-*Bt* cotton, groundnut, chillies, citrus and pomegranate [4].The thrips, *T.tabaci* being the minute in size and having short life cycle, inflicting damage unnoticed by the farmers and appeared as one of the limiting factor in achieving higher productivity of cotton. The infestation at seedling stage damaged the leaves which became wrinkled, curled upwards and distorted with white shiny patches. The affected plants showed rusty appearances in patches on lower surface of leaves. The top leaves of the affected plants with rusty appearance could be visible from a distance. Severe

infestation during vegetative crop growth caused late bud formation and premature dropping of squares during fruiting stages and delayed crop maturity and ultimate yield reduction. The feeding by thrips on the developing bolls late in the season caused spots or wounds on the pericarp but that did not affect the ripening of the boll or the quality of the seed [5].The study on population dynamics helps in decision makingfor the timely application of various control measures. Therefore, the present investigation was carried out onthe incidence of thrips in *Bt*and non-*Bt*cotton hybrid.

2. MATERIALS AND METHODS

In order to study the population dynamics and impact of weather parameters on the incidence of thrips in *Bt* and non-*Bt* cotton, a field experiment was carried out on short to medium duration hybrid, G.Cot.Hy.8 BG II *Bt*and G.Cot.Hy.8 non-*Bt*. The field trials were conducted atthe Main Cotton Research Station, Navsari Agricultural University, Surat (Gujarat) during*Kharif,*2017-18.The incidence of thrips (nymphs and adults) was recorded from three leaves (each from top, middle and bottom canopy) on fifty randomly selected plants. Observations were recorded during morning hours (8 to 10 AM) on account of low movement helping in assessing population counts. The observations were recorded at weekly intervals from seven days after germination till harvest. For recording observations, the whole plot was divided into ten equal quadrates and five plants was selected randomly and tagged in each quadrate. Plots were kept completely free from any insecticidal spray during the whole cropping season. In order to study the instantaneous effect of weather parameters on the population fluctuation of thrips*,* the weekly observations on the nymphal and adults population were averaged and correlated with the physical factors of environment *viz.,* maximum and minimum temperature, morning and evening relative humidity, bright sunshine hours, rainfall and rainy days.The weekly data on various weather parameters were obtained from the Meteorology Observatory, Main Cotton Research Station, Navsari Agricultural University, Surat during season.

3. RESULTS AND DISCUSSION

Population dynamics of thrips, *T. tabaci*on *Bt*cotton

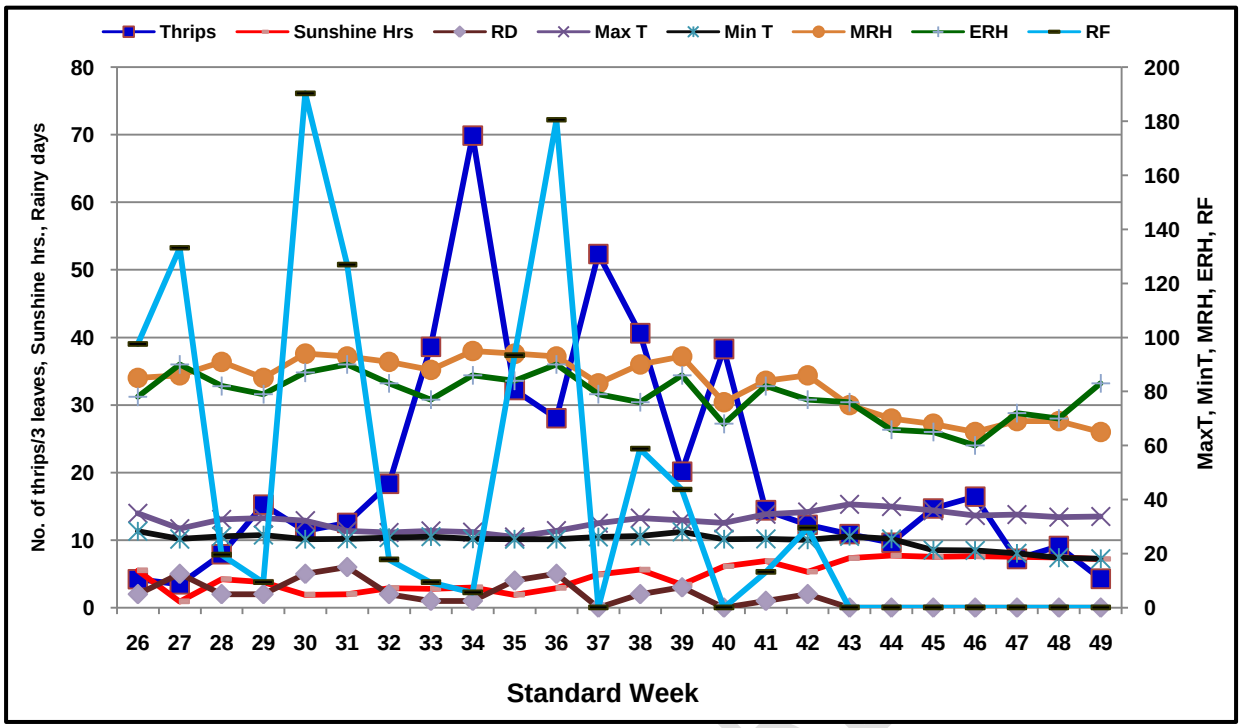
The periodical week wise data on population of thrips per three leaves are summarized in Table 1 and depicted in Figure 1. The pest appeared from fourth week of June (26th standard week) and it continued till first week of December (49th SW) which range from 3.46 to 69.88 thrips/3 leaves. The incidence of thrips gradually increased up to third week of August (34th SW) and showing first peak (69.88 thrips/3 leaves). Slightly reduction in incidence was recorded during fourth week of August and first week of September (35th and 36th SW) and then showed second peak (52.34 thrips/3 leaves) during second week of September (37th SW). Again the thrips population decreased during fourth week of September (39th SW) and showed third peak (38.30 thrips/3 leaves) during first week of October (40th SW). The above ETL (>10 thrips/leaf) incidence of thrips was observed during the second week of August (33rd SW) to third week of September (38th SW) and first week of October (40th SW). The population of thrips gradually decreased from second week of October (41st SW) to first week of December (49th SW) and disappeared from the cotton crop from second week of December (50th SW). Thus, it is clear from data that relatively higher activity (28.06 to 69.88 thrips/3 leaves) observed during second week of August to first week of October in G.Cot.Hy.8 BG II hybrid. In line with the present findings, Bhute et al. [6] found that peak incidence of thrips (107.65/3 leaves)

was recorded in 40th SMW (1st week of October) in *Bt* cotton. Babu and Meghwal[7] noted that thrips population was higher during 39 to 41st standard week and population ranged from 0.0 to 87.0/3 leaves in *Bt* cotton. As per the Latif et al. [8], the thrips population reached its peak and was highest during the third week of August (7.66/leaf) and onwards decreasing in October due the maturity of the crop. Bhanderi et al.[9]revealed that peak activity of thrips observed during 31st to 34th SW with peak population (65.75 thrips/3 leaves) in 32nd in RCH 2 BG II hybrid. According to Rawal et al.[10], peak activity of thrips was observed during 25th to 40th SMW (3rd week of June to 1st week of October) in *Bt* cotton. Sharma and Sharan [11]revealed that the peak population (51.0 thrips/3 leaves) of thrips was observed in 34th SMW (3rd week of August) in *Bt* cotton. Badgujar et al. [12]reported that activity of thrips was started from 32nd to 33rd SW and goes its highest peak population (110.2 thrips/3 leaves) recorded in 40th SW in first season whereas highest peak population (75.4 thrips/3 leaves) observed in 38th SW in second season on BG II hybrids.

Table 1: Population dynamics of thrips, *T. tabaci* in *Bt*and non-*Bt*cotton

Sr. No.	Standard Week (SW)	Weeks of Month	No. of thrips/3 leaves	
			***Bt*cotton**	**Non-*Bt*cotton**
1	26	25 June – 01 July	4.20	2.86
2	27	02 July – 08 July	3.46	5.26
3	28	09 July – 15 July	7.92	8.54
4	29	16 July – 22 July	15.24	10.20
5	30	23 July – 29 July	11.38	12.44
6	31	30 July – 05 August	12.54	11.14
7	32	06 August – 12 August	18.32	17.54
8	33	13 August – 19 August	38.62	22.16
9	34	20 August – 26 August	69.88	27.66
10	35	27 August – 02 Sept.	32.22	32.58
11	36	03 Sept. – 09 Sept.	28.06	35.72
12	37	10 Sept. – 16 Sept.	52.34	30.18
13	38	17 Sept. – 23 Sept.	40.62	23.54
14	39	24 Sept. – 30 Sept.	20.14	15.08
15	40	01 Oct. – 07 Oct.	38.30	12.04
16	41	08 Oct. – 14 Oct.	14.42	9.14
17	42	15 Oct. – 21 Oct.	12.26	7.58
18	43	22 Oct. – 28 Oct.	10.88	8.24
19	44	29 Oct. – 04 Nov.	9.60	5.66
20	45	05 Nov. – 11 Nov.	14.68	7.82
21	46	12 Nov. – 18 Nov.	16.44	8.28
22	47	19 Nov. – 25 Nov.	7.22	3.84
23	48	26 Nov. – 02 Dec.	9.12	0.64
24	49	03 Dec. – 09 Dec.	4.28	1.34
25	50	10 Dec. – 16 Dec.	0.00	0.00
26	51	17 Dec. – 23 Dec.	0.00	0.00
27	52	24 Dec. – 31 Dec.	0.00	0.00
		Mean	**20.51**	**13.31**

Figure 1: Population dynamics of thripsin relation to weather parameters on *Bt* cotton



The results on correlation (Table 2) between incidence of thrips and different weather parameters revealed that only maximum temperature (r = -0.496*) showed significant negative association whereas, bright sunshine hours (r = -0.247), rainfall (r = -0.136) and rainy days (r = -0.110) showed non-significant negative association with the thrips population. The minimum temperature (r = 0.275), morning relative humidity (r = 0.373) and evening relative humidity (r = 0.085) had positive association with the incidence of thrips infesting *Bt* cotton hybrid. According to Shivanna et al. [13]revealed that minimum temperature and relative humidity showed non-significant positive whereas rainfall had negative effect on the thrips population in *Bt* cotton. Babu and Meghwal[7]stated that main contributing weather factor for the incidence of thrips in *Bt* cotton was maximum temperature (r = -0.613**) and sunshine hours (r = -0.344**).Muchhadiya et al.[14]reported that thrips population had significant negative correlation with sunshine hours in *Bt* cotton. Singh et al. [15]stated that thrips population had positive correlation with morning relative humidity (0.219) but negative correlation with rainfall (-0.210) in *Bt* cotton. Kumar et al. [16]reported that thrips population was significantly negatively correlated with maximum temperature in *Bt* cotton. Majeed et al.[17]found that relative humidity and rainfall did not influence the thrips population on *Bt* cotton. Rawal et al.[10] noticed that thrips population in *Bt* cotton showed negative correlation with sunshine hours. According to Sharma and Sharan [11]relative humidity and rainfall had no significant role on fluctuation of thrips population. Janu et al. [18]revealed that maximum temperature correlated significantly negative while minimum temperature, morning and evening relative humidity correlated significantly positive with thrips population.

Table 2: Correlation between the incidence of *T. tabaci*and weather parameters on *Bt* and non-*Bt* cotton

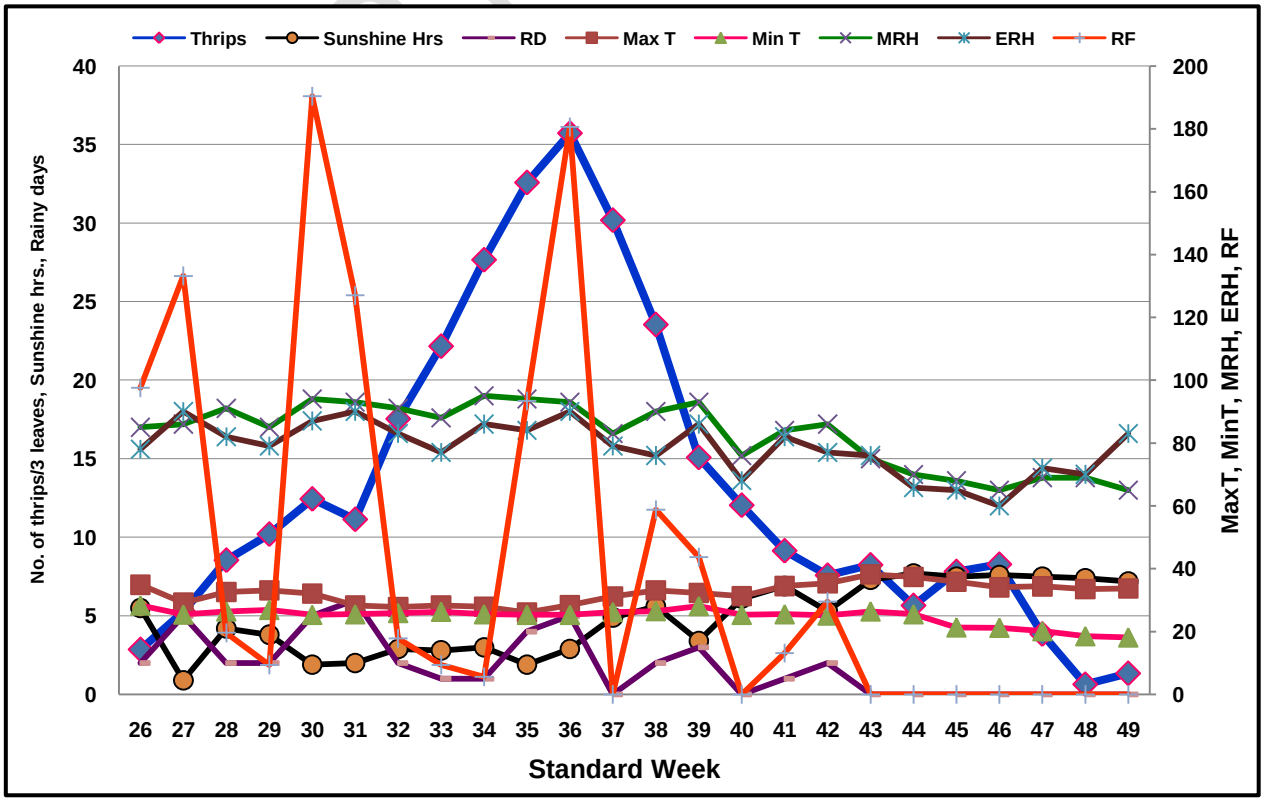
Weather parameters	Correlation co-efficient (r)	
	***Bt* cotton (G.Cot.Hy.8 BG II)**	**Non-*Bt* cotton (G.Cot.Hy.8)**
Maximum Temperature, ^{o}C (MaxT)	-0.496*	-0.667**
Minimum Temperature, ^{o}C (MinT)	0.275	0.405*
Morning Relative Humidity, % (MRH)	0.373	0.614**
Evening Relative Humidity, % (ERH)	0.085	0.377
Bright Sunshine Hours	-0.247	-0.515**
Rainfall, mm(RF)	-0.136	0.275
Rainy days (no.)	-0.110	0.303

**Significant at the P<0.01 level; * Significant at the P<0.05 level

Population dynamics of thrips, *T. tabaci*on non-*Bt*cotton

The data on population of thrips per three leaf (Table 1 and Fig. 2) revealed that the incidence of pest commenced from fourth week of June (26th SW) and it continued till first week of December (49th SW) which ranged from 0.64 to 35.72 thrips per three leaf. The incidence gradually increased up to first week of September (36th SW) showed its peak (35.72 thrips/3 leaves). Thereafter the population of thrips was decreased from third week of September (38th SW) up to first week of December (49th SW). The above ETL population of the thrips was observed during the fourth week of August (35th SW) to second week of September (37th SW). However, pest showed violent fluctuation for its activity with peak (35.72 thrips/3 leaves) during first week of September (36th SW). According to Phulse and Udikeri[19], the highest (34.00 thrips/3 leaves) activity of *T. tabaci* recorded during first fortnight of September (36 and 37th SMW) on non-*Bt* genotypes.

Figure 2: Population dynamics of thripsin relation to weather parameters on non-*Bt* cotton



To determine the influence of various abiotic factors in causing fluctuation in incidence of thrips, a correlation coefficient study attempted. The data showed that minimum temperature (r = 0.405*) and morning relative humidity (r = 0.614**) showed significant positive association with the thrips population. The maximum temperature (r = -0.667**) and bright sunshine hours (r = -0.515**) observed highly significant negative impact on fluctuation of the pest. Rest of the parameters under studied did not show any significant role on the population of the thrips infesting Non-*Bt*hybrid. According to Selvaraj and Adiroubane[20], thrips population had significant and positive correlation with minimum temperature and morning relative humidity in non-*Bt* cotton. Panwar et al.[21] reported that positive and significant association between thrips population and minimum temperature, morning relative humidity and rainy days. Bhanderi et al.[9] revealed that thrips population had significant and negative correlation with maximum temperature (r=-0.5427**) and sunshine hours (r=-0.7538**) whereas it was significant and positive correlation with minimum temperature (r=0.4789*), morning relative humidity (r=0.4928*) and evening relative humidity (r=0.4520*) in non-*Bt* cotton. Kumar et al. [16] reported that thrips population was significantly negatively correlated with maximum temperature in non-*Bt* cotton.

4. CONCLUSION

The peak population of *T. tabaci* was observed during the third week of August (34th SW) on*Bt*and during first week of September(36th SW) on non-*Bt*cotton. The peak activity of thrips*Bt* hybrid was recorded higher (69.88 thrips/3 leaves) on Bt cotton hybrid compared to non-*Bt*cotton hybrid (35.72 thrips/3 leaves). Thrips population had significant negative correlation with maximum temperature in *Bt* cotton. In case of non-*Bt*, maximum temperature and bright sunshine hours had significantly negatively correlated, while minimum temperature and morning relative humidity were positively associated.

REFERENCES

1. Anonymous. ICAR-AICRP (Cotton) Annual Report. ICAR-All India Coordinated Research Project on Cotton, Coimbatore, Tamil Nadu, 2021;1-5.
2. Vennila S. Pest management for cotton ecosystem. Current Science, 2008;94: 1351-1352.
3. Naqvi KM. Crop protection to boost up the cotton production. Seminar organized by ESSO, Fert. Co. Ltd. Pakistan.1976
4. Sharma HC. Climate change vis-à-vis pest management. Conference on National Priorities in Plant Health Management held at Tirupati during February 4-5, 2016. Organized by Plant Protection Association of India, NBPGR, Hyderabad, 2016; pp. 14-25.
5. Vennila S, Biradar VK, Sabesh M and Banbawale OM. Know Your Cotton Insect Pests, Thrips, Crop Protection Folder 3, Published under Technology Mission on Cotton Mini Mission I (3.1), CICR, Nagpur. 2007. pp. 1-2.
6. Bhute NK, Bhosle BB, Bhede BV and More DG. Population dynamics of major sucking pests of *Bt* cotton. Indian Journal of Entomology. 2012; 74(3): 246-252.
7. Babu SR and Meghwal ML. Population dynamics and monitoring of sucking pests and bollworms on Bt-cotton in humid zone of southern Rajasthan. The Bioscan, 2014; **9**(2): 629-632.

8. Latif Z, Ahmed S, Sohail K, Khan L. and Ishfaq M. Population density of jassids*(Amrascabiguttulabiguttula)* and thrips (*Thrips tabaci*) on cotton crop and efficacy of some botanicals insecticides against cotton jassids and thrips. Journal of Biodiversity and Environmental Sciences. 2015; 7(1): 272-280.
9. Bhanderi GR, Patel RD, Desai HR, Sandipan PB and Solanki BG. Interaction of abiotic factors on population of insect pests and its natural enemies in Bt and non-Bt cotton. Advances in Life Sciences. 2016; 5(12): 5327-5336.
10. Rawal R, Dahiya KK, Lal R, and Kumar A. Inter-relation between abiotic factor and population dynamics of sucking insect pest in genetically modified cotton. International Journal of Agriculture Sciences.2016; 8(48): 2033-2037.
11. Sharma R. and Sharan L. Impact of abiotic factors on seasonal incidence of sucking pests in transgenic cotton ecosystem. International Journal of Current Advance Research.2016; 5(9): 1268-1269.
12. Badgujar AG, Bhosle BB and Sonkamble MM. Population dynamics of thrips, *Thrips tabaci* and whitefly, *Bemisiatabaci* on Bt cotton hybrids. International Journal of Current Microbiology and Applied Sciences; 2018; 6: 614-625.
13. ShivannaBK, Gangadhara NB, Basavaraja MK, Ngaraja MK, Kalleswaraswamy CM and Karegowda C. Impact of abiotic factors on population dynamics of sucking pests in transgenic cotton ecosystem. International Journal of Science and Nature.2011; 2(1): 72-74.
14. Muchhadiya DV, Saradava DV and Kabaria BB. Population dynamics of insect pests and some of their natural enemies and their correlation with weather parameters on Bt cotton. Indian Journal of Agriculture Science.2014; 84(5): 84-88.
15. Singh H, Kaur P. and Mukherjee J. Impact of weather parameters and plant spacing on population dynamics of sucking pests of cotton in south western Punjab. Journal of Agricultural Physics.2015; 15(2): 167-174.
16. Kumar D, Yadav SS, Saini VK, Dahiya KK. Impact analysis of genetically modified (*Bt*) cotton genotypes on economically important natural enemies under field conditions.Advance in Entomology.2016; 4: 61-74.
17. Majeed MZ, Javed M, Riaz MA and Afzal M. Population dynamics of sucking pest complex on some advanced genotypes of cotton under unsprayed conditions,Pakistan Journal of Zoology.2016; 48(2): 475-480.
18. Janu A, Dahiya KK and Jakhar P. Population dynamics of thrips, *Thrips tabaci*Lindeman in American cotton (*Gossypium hirsutum*). International Journal of Current Microbiology and Applied Sciences. 2017; 6(7): 203-209.
19. Phulse VB and Udikeri SS. Seasonal incidence of sucking pests and predatory arthropods in Desi and *Bt* transgenic cotton. Karnataka Journal of Agricultural Sciences. 2014; 27(1): 28-31.
20. Selvaraj S. and Adiroubane D. Influence of weather parameters on the incidence of thrips, *Thrips tabaci* Lindeman in cotton. Journal of Cotton Research and Development.2012; 26(2): 234-237.

21. Panwar TS, Singh SB and Garg VK. Influence of meteorological parameters on population dynamics of thrips (*Thrips tabaci*Lindeman) and aphid (*Aphis gossypii* Glover) in *Bt* and non *Bt* cotton at Malwa region of Madhya Pradesh. Journal of Agrometeorology.2015; 17(1): 136-138.