E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(10): 675-679
Received: 29-08-2025
Accepted: 30-09-2025

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Preparation of crop weather calendar for cotton (*Gossypium hirsutum* L.) and soybean (*Glycine max* L.) crop under the Central Maharashtra Plateau Zone

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DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i10j.4043

Abstract
The Central Maharashtra Plateau Zone (CMPZ) is a predominantly rainfed agro-ecosystem where climatic variability significantly influences crop productivity and pest dynamics. This study aimed to develop crop-weather-pest calendars for cotton (*Gossypium hirsutum* L.) and soybean (*Glycine max* L.) based on long-term datasets. Historical meteorological records (2005-2024), crop phenology observations and pest incidence data were analyzed to determine critical growth stages, optimal sowing windows and key weather parameters influencing pest outbreaks. Results revealed that early sowing of cotton during the 25th Standard Meteorological Week (SMW) and soybean during the 26th SMW resulted in extended crop duration and higher yield potential. Major cotton pests-aphids (*Aphis gossypii*), jassids (*Amrasca biguttula biguttula*), whiteflies (*Bemisia tabaci*) and thrips (*Scirtothrips dorsalis*) exhibited peak incidence under maximum temperatures of 30-32 °C, minimum temperatures of 21-22 °C, relative humidity above 70% and intermittent rainfall conditions. In soybean, infestations of leaf miner (*Aproaerema modicella*), girdle beetle (*Oberea brevis*) and stem fly (*Melanagromyza sojae*) were closely linked to specific temperature and rainfall patterns during the reproductive growth stages. The developed crop-weather-pest calendars offer week-wise recommendations for crop management, pest forecasting and contingency planning. These tools enhance climate-resilient and sustainable agricultural practices across the rainfed production systems of the CMPZ.

Keywords: Crop-weather-pest calendar, cotton, soybean, Central Maharashtra Plateau Zone, phenology, pest incidence, agrometeorology, ETL, Peak level

Introduction
The Central Maharashtra Plateau Zone (CMPZ) encompasses major parts of Aurangabad, Jalna, Beed, Osmanabad, Parbhani, and Nanded districts, the entire Latur and Buldhana districts, and portions of Akola, Amravati, Yavatmal, Jalgaon, Dhule, and Solapur. The zone covers an estimated area of 7.5 million hectares, of which approximately 6.78 million hectares are gross cropped, while 9.90% is under forest cover (Anonymous, 2016) [29]. Agriculture in this zone is predominantly rainfed, making it highly vulnerable to climatic variability and extremes such as droughts, unseasonal rainfall and temperature fluctuations.

Bt cotton (*Gossypium hirsutum* L.) is among India's most important commercial crops, contributing nearly 24% of global cotton production and supporting about six million farmers along with 40-50 million people engaged in related industries. India ranks first globally in cotton acreage (12.47 million ha, representing 39% of the world's area) with Bt cotton covering nearly 96% of the cultivated area. However, nearly 67% of cotton cultivation in India remains rainfed, resulting in comparatively low productivity (441 kg/ha^{-}) and placing India 33rd globally in yield (Anonymous, 2022b) [30].

Cotton, a subtropical crop, requires 600-2500 mm of rainfall and optimal temperature conditions ranging between 25-35°C for proper growth and development. In the Marathwada region, where rainfed conditions prevail, climatic variability significantly affects phenological processes such as flowering, boll formation and yield (Jaybhaye *et al.*, 2016; Boyd *et al.*, 2004; Parvin *et al.*, 2005) [12, 31, 32].

Drought stress, temperature extremes and unseasonal precipitation frequently disrupt the crop's growth cycle, leading to yield instability.

Soybean (*Glycine max* L.), another major crop of the CMPZ, serves as a dual-purpose pulse and oilseed crop containing 38-44% protein and 18-22% oil, thereby playing a crucial role in human nutrition, livestock feed, and industrial applications. India is a leading exporter of soya meal and importer of soya oil. However, soybean productivity is constrained by several biotic stresses, with over 275 insect pest species reported, including the girdle beetle (Oberea brevis), whitefly (Bemisia tabaci), and green semilooper (Chrysodeixis acuta) (Patel *et al.*, 2020) [19]. The crop performs best in clay loam soils with a pH of 6.0-6.5 and is particularly sensitive to both drought and waterlogging, especially during the early vegetative stages (Misal, 2019) [18].

Climate change has emerged as a major threat to the productivity of key crops in Maharashtra-cotton, soybean, wheat and gram due to erratic rainfall patterns, delayed monsoon onset and rising temperatures. These climatic aberrations adversely affect seed germination, pest and disease dynamics and overall yield stability (Anonymous, 2019) [33]. To address these challenges, precision crop management integrating agrometeorological approaches such as weather characterization, agro-meteorological indices and predictive modeling has become essential (Wankhede, 2020; Bal *et al.*, 2023).

The difference between crop weather calender of cotton and soybean crops includes Indian Meteorological Department detailing phase-wise weather norms, pest and disease associations and meteorological thresholds and CRIDA Hyderabad contains the agro-ecological and phenological details for cotton at Parbhani, including optimum temperature, RH, and pest incidence windows.

The Crop Weather Calendar (CWC) is a valuable agrometeorological tool that provides detailed information on the temporal relationship between crop growth stages, prevailing weather conditions, and pest and disease occurrence (Anonymous, 2022) [1]. A typical CWC consists of three segments: (i) the upper part representing climatic normals, (ii) the middle part depicting crop phenology and favorable weather conditions, and (iii) the lower part indicating pest and disease-favorable weather periods (Rao *et al.*, 2015) [20, 25].

Materials and Methods

The present investigation entitled "Preparation of Crop Weather Calendar for Cotton (*Gossypium hirsutum* L.) and Soybean (*Glycine max* L.) under the Central Maharashtra Plateau Zone" was carried out at the Department of Agricultural Meteorology, College of Agriculture, VNMKV, Parbhani, during 2024-2025.

The study aimed to develop crop weather calendars (CWCs) for cotton and soybean based on long-term weather, crop and pest data. Parbhani is located in the Marathwada region of Maharashtra lies at 19º16′ N latitude, 76º47′ E longitude and 409 m above mean sea level. It falls under the semi-arid, sub-tropical zone and receives an average annual rainfall of about 963 mm, mostly during the southwest monsoon season (June-September). For this study twenty years (2005-2024) of daily weather data were collected from the Agrometeorological Observatory, Department of Agricultural Meteorology, VNMKV, Parbhani. The weather data has been systematically organized year-wise for Bt cotton and soybean cultivation over the 2005-2024 period, corresponding to 24th SMW through 4th SMW for Bt cotton and soyean is 24th SMW to 43th SMW. This twenty-year dataset serves as a valuable resource for strategic agricultural planning, particularly in identifying opportunities for expanding priority crops, optimizing existing cropping systems, or introducing new varieties into agro climatically favorable zones within the region. The relevant meteorological parameters have been compiled in the parameters included rainfall, temperature, relative humidity, evaporation, bright sunshine hours, and wind speed.

Crop growth and phenological data were compiled from M.Sc. theses (2013-2022) from departmental and field trials (2023-2025). Growth stage-wise information including duration, weather conditions was analyzed for both crops. Cotton growth stages included sowing to emergence, seedling, square formation, flowering, boll formation, boll bursting, and successive pickings, while soybean growth stages included sowing to emergence, branching, flowering, pod formation, grain development, and maturity. Pest incidence data for the same period (2005-2024) were obtained from the Cotton Research Station and the AICRP on Soybean, VNMKV, Parbhani. The major pests studied were aphid, jassid, thrips, and whitefly in cotton, and girdle beetle, semilooper, jassid, tobacco caterpillar, and whitefly in soybean. Years and meteorological weeks exceeding economic threshold levels (ETL) were identified to determine peak pest infestation periods.

Structure of crop weather calender

The crop weather calendars for both crops were prepared by integrating three layers of information. The upper part included computed weekly climatic normals such as rainfall, temperature, humidity, evaporation, sunshine hours, and wind speed for the crop-growing season. The middle part presented phenological stages along with optimum weather conditions required for each stage to achieve maximum yield. The lower part provided pest incidence data indicating the weather conditions favouring pest buildup and the corresponding ETL and peak infestation weeks.

Photographs representing crop growth stages and pest incidence were taken from field experiments (2023-2025) and included in the CWC for visual reference. The optimum weather conditions for crop growth and pest development were established based on long-term averages. For example, cotton growth stages required rainfall ranging from 16.8-176.2 mm and temperatures between 21.5-35°C, while soybean required rainfall between 16.9-228.4 mm and temperatures from 22-33°C. Similarly, pest development was associated with specific weather ranges, such as 27-36°C and 70-96% morning humidity for cotton aphid and 28-34°C and 73-96% humidity for soybean girdle beetle.

The finalized Crop Weather Calendars (Plates 1 & 2) thus serve as a comprehensive guide integrating weather, crop and pest dynamics, providing valuable tools for timely farm operations, pest management and climate-resilient crop planning in the Central Maharashtra Plateau Zone.

Result and Discussion

The study analyzed the growth, development and yield performance of cotton and soybean crops under different sowing dates using long-term weather and field data from Department of Agricultural Meteorology, College of Agriculture, VNMKV, Parbhani. The phenological stages and were calculated for each crop, revealing that both crops showed variations in growth duration depending on the time of sowing. Early sowing in the 25th Standard Meteorological Week (SMW) resulted in a longer crop duration,While delayed sowing reduced both values. These results indicated that early sowing allows the crops to utilize favorable weather conditions, leading to better growth and productivity.

The yield performance of both crops also varied with sowing

time. Cotton sown in the 25th SMW consistently recorded the highest yield, averaging 914 kg/ha, whereas delayed sowings in the 28th SMW showed almost a 50% yield reduction. Similarly, soybean sown in the 26th SMW gave the best yield performance, averaging 1580 kg/ha, with noticeable yield reductions under late sowing. These findings suggest that timely sowing during the onset of monsoon ensures optimal temperature, rainfall, and humidity for growth. Late sowing exposed crops to unfavorable weather during reproductive stages, leading to yield decline. Hence, early to optimum sowing weeks (25th-26th SMW) were found most suitable for achieving maximum productivity in both crops.

The weather analysis across crop phenological stages highlighted the close relationship between climatic factors and crop growth. Moderate rainfall and warm temperatures supported vegetative growth, while excessive rain and high humidity during flowering and boll formation increased pest incidence, especially in cotton. The crop weather calendar developed for Parbhani provided a detailed week-wise pattern of temperature, rainfall, humidity, sunshine hours, and pest occurrence, which can help in predicting crop behavior and guiding timely management practices. Overall, the study emphasizes that understanding weather-crop interactions and selecting appropriate sowing times are vital for improving yield stability and reducing pest pressure in cotton and soybean under the Central Maharashtra Plateau Zone.

Crop weather calender of Bt cotton and soybean crops

1. Upper part (Climatic normals): The computed weekly normals for the crop growing period, *viz*., rainfall (mm), weekly maximum temperature (ºC), minimum temperature (ºC), maximum relative humidity (%), minimum relative humidity (%), evaporation (mm), bright sunshine hours (hrs), and wind speed (Km/hr) are arranged in standard meteorological week-wise in the upper portion of CWC (Plate 1 & 2).

2. Middle part (Phenological observations)

The middle part includes information worked out for phenological stages of Bt cotton and soybean crop separately and which is represent the natural suitability of standard weather condition to grow the crops.

Optimum weather condition for cotton and soybean required for optimum crop yield respectively, Cotton: Sowing to emergence stage, rainfall 16.8-40.3 mm, Tmax 32.4-32.6°C, Tmin 23.4-24.5°C, Morning relative humidity 80-87%, evening relative humidity 52-65%, seedling to square formation, rainfall 29.1-33.9 mm, Tmax 30.1-31.1°C, Tmin 22.4-23°C, Morning relative humidity 87-90%, evening relative humidity 67%, flowering to boll formation rainfall 60.6-71.5 mm, Tmax 30.7-31.4°C, Tmin 22.5-22.6°C, Morning relative humidity 88-89%, evening relative humidity 62-67%, boll formation to boll bursting rainfall 160.6-176.2 mm, Tmax 30.2-31.2°C, Tmin 21.5-22.2°C, Morning relative humidity 90-91%, evening relative humidity 63-69%. and Soybean: Sowing to emergence stage rainfall 16.9-34.4 mm, Tmax 32.9-33.6°C, Tmin 22.6-23.1°C, Morning relative humidity 81-87%, evening relative humidity 53-62%, seedling to branching stage rainfall 93-228.4 mm, Tmax 28.9-30.1°C, Tmin 22.3-22.5°C, Morning relative humidity 89-93%, evening relative humidity 72-77%, flowering to pod formation rainfall 16.6-20.9 mm, Tmax 30.7-31.2°C, Tmin 22.4-22.5°C, Morning relative humidity 86-87%, evening relative humidity 62-65%, grain formation to pod development rainfall 60.4-135.5 mm, Tmax 30.4-31.1°C, Tmin 22-22.1°C, Morning relative humidity 88-89%, evening relative humidity 63-64%.

Bottom part (Pest observations)

The last part of the crop weather calendar contains the climatic triges for major pests as well as for completion of phenological stages of cotton and soybean crop and which are susceptible to changes in weather conditions. This information is a guiding tool to farmers for need-based plant protection, i.e., spraying of the insecticides and pesticides.

The optimum weather condition for increase the pest population for cotton aphid (aphis gossypii clover) rainfall 1.2-233 mm, rainy days 1-6, Tmax 27-36°C, Tmin 8-23 °C, Morning relative humidity is 70-96% and evening relative humidity is 20-85%, Jassid (A. biguttula biguttula) rainfall 13.6-207 mm, rainy days 0-6, Tmax 27-36°C, Tmin 8-23°C, Morning relative humidity is 50-96% and evening relative humidity is 20-88%, Thrips (Thrips tabaci Lindeman). Rainfall 233 mm, rainy days 0-6, Tmax 17-36°C, Tmin 6-24°C, Morning relative humidity is 44-97% and evening relative humidity is 22-88%, Whitefly (Bemisia tabaci Gennadius) rainfall3.6-207 mm, rainy days 0-6, Tmax 27-36°C, Tmin 9-23°C, Morning relative humidity is 68-96% and evening relative humidity is 20-85%.

For soybean the optimum weather condition for increase the pest population girdle beetle (Obereopsis brevis Swedenbord) rainfall 1.4-207 mm, rainy days 1-6, Tmax 28-34°C, Tmin 18-23°C, Morning relative humidity is 73-96% and evening relative humidity is 39-85%, Semilooper (G. gema) rainfall 233 mm, rainy days 1-6, Tmax 28-34°C, Tmin 19-23 °C, Morning relative humidity is 73-97% and evening relative humidity is 52-79%, Tobacco caterpillar (Spodoptera utura Fabricus), rainfall 165 mm, rainy days 1-5, Tmax 29-35°C, Tmin 20-23°C, Morning relative humidity is 79-96% and evening relative humidity is 41-85%, Jassid rainfall 1.2-233 mm, rainy days 1-6, Tmax 28-34°C, Tmin 20-23°C, Morning relative humidity is 74-96% and evening relative humidity is 41-85% and whitefly (Bemisia tabaci Gennadius) rainfall 1.8-141 mm, rainy days 1-5, Tmax 28-35°C, Tmin 20-24°C, Morning relative humidity is 74-94% and evening relative humidity is 41-77%.

Conclusion

It plays a major role in the success or failure of crops. In this region farmers often face uncertain rainfall, temperature fluctuations and changing monsoon patterns. Which affect the growth and yield of cotton and soybean. A crop weather calendar helps farmers plan their activities-such as sowing, irrigation, fertilizer use and pest control according to expected weather conditions. This ensures better timing of operations, reduces risks, and improves productivity.

From a future perspective, this research is useful for promoting climate-smart agriculture. As weather patterns continue to shift due to climate change, farmers will need updated and scientific guidance for managing their crops efficiently. A well-prepared crop weather calendar can be used by agricultural departments, Krishi Vigyan Kendras, and mobile advisory services to give timely information to farmers. This study will not only benefit for farmers today but also help develop long-term strategies for sustainable and resilient farming in the Central Maharashtra Plateau Zone.

This research topic is selected because Bt cotton and soybean are the main crops grown in the Central Maharashtra Plateau Zone. Preparing a crop weather calendar, farmers and researchers can better understand the ideal time for sowing, irrigation, fertilizer use and harvesting based on local weather patterns.

CROP WEATHER CALENDER

Crop Name: Bt Cotton(Kharif)									Duration: (170-200) days				Location : C. M. P. Z. (Parbhani)								State: Maharashtra											
Climatic Parameters	Month	June			July					August				September				October					November				December				January			
	MW / Parameter	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4
	Rain (mm)	40.1	29.7	47.8	51.8	84.2	46.2	73.4	40.1	45.6	45.6	46.3	49.4	50.6	42.9	71.4	31.9	30.1	21.7	24.6	6.9	3.6	4.9	1.8	6.7	6.6	1.6	0.1	0.0	0.6	0.8	0.8	0.0	0.1
	Rainy day	2.0	1.8	2.5	2.3	2.9	2.7	3.2	2.0	1.7	2.3	2.5	2.4	2.7	2.6	2.7	1.8	1.3	1.1	0.7	0.7	0.2	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
	Tmax (° C)	36.0	34.7	33.5	32.6	31.4	31.5	30.5	30.7	30.5	30.8	30.7	30.5	30.1	31.3	31.2	31.9	32.5	33.1	32.7	32.3	31.5	31.6	31.3	30.8	30.4	30.0	30.0	29.2	29.2	29.4	29.4	30.6	30.8
	Tmin (° C)	23.7	23.5	23.0	22.9	22.6	22.7	22.3	22.1	22.1	22.0	21.1	22.7	21.8	21.8	21.5	21.3	21.0	19.7	18.9	16.4	15.6	14.8	14.3	15.1	13.7	13.7	12.6	10.2	10.7	11.7	11.0	12.2	11.0
	RH-I (%)	76.0	77.1	82.4	82.9	85.0	84.0	86.7	84.9	85.7	85.8	86.6	86.5	86.4	84.3	88.3	85.5	83.7	82.8	80.1	78.2	76.9	76.9	76.8	78.0	76.0	76.8	77.5	76.2	75.5	79.5	77.4	74.5	72.5
	RH-II(%)	45.0	49.3	56.0	59.3	63.5	65.1	66.6	66.1	64.3	65.6	64.6	63.9	65.3	64.9	64.4	59.2	53.6	47.7	43.6	37.0	38.2	36.5	37.3	39.0	38.4	38.4	35.8	31.6	33.8	36.5	33.3	30.2	28.6
	EVP(mm)	7.4	6.7	5.0	4.8	4.4	4.3	3.7	4.0	4.1	3.8	3.9	4.1	4.1	3.9	3.9	4.4	4.7	5.0	4.7	4.7	4.9	4.6	4.6	4.4	4.3	4.1	4.2	4.2	3.9	4.0	4.2	4.4	4.5
	BSS (hrs)	7.0	5.8	4.9	4.4	3.7	4.2	3.1	3.8	3.8	4.4	5.3	5.4	5.5	5.8	5.1	7.2	7.3	8.1	8.0	8.6	8.5	8.4	8.5	8.5	7.9	7.6	8.6	8.7	8.2	7.9	8.6	9.0	9.1
	WS(km/hr)	7.0	6.9	6.1	6.5	6.1	5.3	5.4	5.5	5.5	4.6	4.4	4.2	4.3	3.7	3.9	3.5	3.2	2.8	3.0	3.0	3.6	3.1	3.1	3.1	3.0	3.2	2.9	3.2	2.8	3.1	3.2	3.1	3.6

Phenophase	Sowing to Emergence	Emergence to Seedling	Seedling to Square formation	Square formation to Flowering	Floweing to Boll setting	Boll setting to Boll bursting	Ball bursting to 1st Picking	1st Picking to 2nd Picking
Duration	5-7	16-17	16-17	11-12	12-13	24-25	28-31	20-24
Rain (mm)	16.8-40.3	89.5-92.8	126.-148.2	29.1-33.9	60.6-71.5	160.6-176.2	7-8.0	20.4-19.8
Rainy days	2-3	4-5	9	2-3	4-6	6-7	7-8	1
Tmax (° C)	34.4-34.6	32.7-33.1	30.4-30.5	30.1-31.1	30.7-31.4	30.2-31.2	31.7	32.5-32.6
Tmin (° C)	23.4-24.5	23.3-23.4	23.0	22.4-23.0	22.5-22.6	21.5-22.2	20.4-21.3	17.9-18.4
RH-I (%)	80-87	83-84	86-87	87-90	88-89	90-91	89	85
RH-II(%)	52-63	59-60	68-70	67	62-67	63-69	53-57	38-41
EVP(mm)	3.9-5.9	4.2	3.0-3.3	2.6-3.5	3.2-3.7	2.8-3.1	3.8-4.0	4.5-4.6
BSS (hrs)	3.9-6.0	4.8-5.0	3.2-3.4	1.4-3.5	3.2-4.8	2.8-3.1	3.8-4.0	4.5-4.6
WS(km/hr)	3.9-5.3	4.2-4.3	3.4-3.5	3.6-4.3	3.4-3.6	2.8	2.8-2.9	2.3-2.4

Favourable Weather for Insect Pest	Incidence		Economic Threshold Level (ETL)	
	Period	Weather Factors	Period	Weather Factors
Aphid, Jassid	29th-52nd MW	Tmax 26-36°C, Tmin 7-31°C, RHI 66-97%, RHII 20-85 %	32nd-43rd MW	Tmax 27-36°C, Tmin 8-23°C, RHI 70-96%, RHII 20-85 %
Thrips	31st-52nd MW	Tmax 25-36°C, Tmin 6-30°C, RHI 23-96%, RHII 19-88 %	33rd-47th MW	Tmax 27-36°C, Tmin 8-23°C, RHI 50-96%, RHII 20-88 %
Whitefly	31st-52nd MW	Tmax 17-36°C, Tmin 6-24°C, RHI 44-97%, RHII 22-88 %	33rd-42nd MW	Tmax 28-36°C, Tmin 9-22°C, RHI 44-95%, RHII 23-88 %
	31st-52nd MW	Tmax 13-36°C, Tmin 6-30°C, RHI 66-96%, RHII 19-85 %	33rd-47th MW	Tmax 27-36°C, Tmin 9-23°C, RHI 68-96%, RHII 20-85%

CROP WEATHER CALENDER

Crop Name: Soybean					Duration: 105-115 days					Location : C. M. P. Z. (Parbhani)												State: Maharashtra			
Climatic Parameters	Month	June			July					August				September				October							
	MW / Parameter	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43				
	Rain (mm)	40.1	29.7	47.8	51.8	84.2	46.2	73.4	40.1	45.6	43.6	46.3	49.4	50.6	42.9	71.4	31.9	30.1	21.7	24.6	6.9				
	Rainy day	2.0	1.8	2.5	2.3	2.9	2.7	3.2	2.0	1.7	2.3	2.5	2.4	2.7	2.6	2.7	1.8	1.3	1.1	1.0	1.0				
	Tmax (° C)	36.0	34.7	33.5	32.6	31.4	31.5	30.5	30.7	30.5	30.8	30.7	30.5	30.1	31.3	31.2	31.9	32.5	33.1	32.7	32.3				
	Tmin (° C)	23.7	23.5	23.0	22.9	22.6	22.7	22.3	22.1	22.1	22.0	21.1	22.7	21.8	21.8	21.5	21.3	21.0	19.7	18.9	16.4				
	RH-I (%)	76.0	77.1	82.4	82.9	85.0	84.0	86.7	84.9	85.7	85.8	86.6	86.5	86.4	84.3	88.3	85.5	83.7	82.8	80.0	78.0				
	RH-II(%)	45.0	49.3	56.0	59.3	63.5	65.1	66.6	66.1	64.3	63.6	64.6	63.9	65.3	64.9	64.4	59.2	53.6	47.7	43.0	37.0				
	EVP(mm)	7.4	6.7	5.0	4.8	4.4	4.3	3.7	4.0	4.1	3.8	3.9	4.1	4.1	3.9	3.9	4.4	4.7	5.0	4.7	4.7				
	BSS (hrs)	7.0	5.8	4.9	4.4	3.7	4.2	3.1	3.8	3.8	4.4	5.3	5.4	5.5	5.8	5.1	7.2	7.3	8.1	8.0	8.6				
	WS(km/hr)	7.0	6.9	6.1	6.5	6.1	5.3	5.4	5.5	5.5	4.6	4.4	4.2	4.3	3.7	3.9	3.5	3.2	2.8	3.0	3.0				

Phenophase	Emergence	Seedling	Branching	Flowering	Pod Formation	Grain Formation	Pod Development	Pod Containing Full Size Grain	Dough Stage	Maturity
Duration	5-6	17-18	10-11	8-9	6-12	8-12	10-15	12-13	10-11	11-15
Rain (mm)	16.9-34.4	143.6-273.4	93.0-228.4	6.9-88.0	16.6-20.9	13.3-44.1	60.4-135.5	62.5-147.7	65.2-156.2	24.4-69.2
Rainy days	2-3	6-7	5-6	1-5	2	1-3	2-3	3	4-5	3-4
Tmax (° C)	33.0-33.6	31.8-32.0	26.0-30.1	29.7-31.3	30.7-31.2	29.6-31.4	30.4-31.1	31.3	30.5-30.8	31.3-31.8
Tmin (° C)	22.6-23.1	23.1-23.3	22.3-22.5	22.1-22.3	22.4-22.5	22-22.5	22-22.1	22.2	22-22.1	21.8-21.9
RH-I (%)	81-87	86	89-93	84-91	86-87	84-90	88-89	90	91-92	81-92
RH-II(%)	53-62	61-64	72-77	63-72	62-65	60-70	63-64	63-64	67-68	60-62
EVP(mm)	3.8-6.5	4.0-4.6	2.8-3.2	2.9-3.6	3.1-4.0	2.7-5.4	3.3-3.7	3.7-4.0	3-3.5.0	3.4-3.6
BSS (hrs)	4.9-5.3	4.2-4.3	2.8-4.0	2.6-3.7	3.0-4.1	3.1-5.0	5.0-6.2	5.2-6.2	4.1-4.5	5.3-5.4
WS(km/hr)	3.5-4.8	4.0-4.4	3.8-4.4	3.8-4.7	5.2-4.9	4.7-3.5	3.6-3.7	3.4-3.6	3.7-3.8	2.8-3.4

Favourable Weather for Insect Pest	Incidence		*Economic Threshold Level (ETL)/Peak Level#	
	Period	Weather Factors	Period	Weather Factors
Girdle beetle, Jassid, Sex, Tobacco caterpiller, Whitefly	# 29th-43rd MW	Tmax 27-34°C, Tmin 15-23°C, RHI 50-97%, RHII 20-88 %	# 32nd-40th MW	Tmax 28-34°C, Tmin 18-23°C, RHI 73-96%, RHII 39-85 %
	* 29th-41st MW	Tmax 30-33°C, Tmin 21-24°C, RHI 79-92%, RHII 49-70 %	* 33rd-35th MW	Tmax 28-34°C, Tmin 20-23°C, RHI 74-96%, RHII 41-85 %
	# 29th-42nd MW	Tmax 27-35°C, Tmin 18-23°C, RHI 50-97%, RHII 41-88 %	# 34th-40th MW	Tmax 28-34°C, Tmin 19-23°C, RHI 73-97%, RHII 52-79 %
	# 31st-39th MW	Tmax 28-35°C, Tmin 20-23°C, RHI 74-96%, RHII 41-85 %	# 33rd-39th MW	Tmax 29-32°C, Tmin 20-23°C, RHI 79-96%, RHII 41-85 %
	* 29th-41st MW	Tmax 28-34°C, Tmin 21-23°C, RHI 74-96%, RHII 41-85 %	* 33rd-39th MW	Tmax 28-35°C, Tmin 20-24°C, RHI 74-94%, RHII 41-77 %

*Economic Threshold Level (ETL), #Peak Level

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