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Prediction of phenological stages of six maize (*Zea mays* L.) hybrids based on required growing degree days

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Abstract

An experiment was under taken at the Agricultural College farm, Bapatla during two consecutive years of *rabi* 2016-17 and 2017-18. The experiment was laid out in randomized block design with six treatments in four replications. Maize hybrids 900M Gold, DKC 9142, DKC 9120, DKC 9081, DKC 9042 and Pinnacle showed significant differences in plant height, stem girth, number of leaves and initiation of reproductive organs. All maize hybrids grew to its maximum height in 77 to 84 calendar days after sowing with a thermal requirement of 1131 to 1221 °Cd. Maize hybrids attained maximum stem girth (2.63 to 2.84) in 70 calendar days with thermal requirement of 1033 °Cd. Significantly higher stem girth was found in pinnacle and DKC 9142 followed by 900M Gold and DKC 9120 in both the seasons of crop growth. The maximum number of leaves was attained at 70 DAS with cumulative heat units of about 1028 °Cd. During *rabi* 2016 to 17, DKC 9142 took less number of days (28.50) for tassel primordial initiation followed by pinnacle (29.0), DKC 9042 (29.25) and DKC 9120 (29.50) and 900MGold took more (30.00) followed by DKC 9081(29.75). During *rabi* 2017 to 18, it was less in DKC 9142 (28.38) followed by DKC 9042 (29.00) and more in 900M Gold (29.38), Pinnacle (29.38) and DKC 9081 (29.25). During tassel primordial initiation, the heat units accumulated was 467.0 °Cd for DKC 9081 and 900M Gold during *rabi* 2016 to 17, while in *rabi* 2017 to 18 it was 488.7 °Cd for DKC 9042, 503.3 °Cd for pinnacle and 900M Gold, 503.8 °Cd for DKC 9120 and 517.6 °Cd for DKC 9081.

Keywords: phenological, hybrids, *Zea mays* L.

1. Introduction

Maize is a *monoecious* crop, it differs in the pattern of initiation and development of pistillate as well as staminate flowers. The initiation of floral *primordia* corresponds to the time when a particular leaf from the top begins to elongate. The duration of floral primordia varies with the variety and weather. When the number of leaves to be developed on the stem is constant, the leaf number can be taken as a measure of physiological age of plant. This applies to photoperiod insensitive varieties and also to the same variety grown under the same environmental conditions.

Growing degrees (GDs) is defined as the mean daily temperature (average of daily maximum and minimum temperatures) above a certain threshold base temperature accumulated on a daily basis over a period of time. Negative values are treated as zeros and ignored. The base temperature varies among crops and the value is derived from the growth habits of each specific crop. The base temperature is that temperature below which plant growth is zero. For example, cereal and forage crops show little growth or development when average temperatures are below 5°C.

Growing degree days (GDD) are used to measure corn growth stages relative to temperature. As Growing season progresses, daily Growing degree units are added together to obtain or define the stages of the maize crop (Lauer, 1997) [4]. The development of leaf in the maize plant is closely related to the temperature this could be explained by the required GDD for each leaf initiation to the different phenological and physiological stages. Growing degree days (GDD) is a weather-based indicator for assessing crop development. It is a calculation used by crop producers that is a measure of heat accumulation used to predict plant and pest development rates such as the date that a crop reaches maturity.

In the absence of extreme conditions such as drought or disease, plants grow in a cumulative stepwise manner which is strongly influenced by the ambient temperature. The Growing Degree Days calculation allows producers to predict the plants' pace toward maturity. Daily growing degree day values are added together from the beginning of the season, providing an indication of the energy available for plant growth. Growing degree day totals are used for comparing the progress of a growing season to the long-term average and are useful for estimating crop development stages and maturity dates.

Unless stressed by other environmental factors like moisture, the development rate from emergence to maturity for many plants depends upon the daily air temperature. Because many developmental events of plants and insects depend on the accumulation of specific quantities of heat, it is possible to predict when these events should occur during a growing season regardless of differences in temperatures from year to year.

GDD units can be used to: assess the suitability of a region for production of a particular crop; estimate the growth-stages of crops, weeds or even life stages of insects; predict maturity and cutting dates of forage crops; predict best timing of fertilizer or pesticide application; estimate the heat stress on crops; plan spacing of planting dates to produce separate harvest dates.

2. Materials and Methods

The experiment was conducted in field number 8, Orchard block of the farm of Agricultural College, Bapatla. The farm is geographically located on the eastern side of peninsular India, situated at an altitude of 5.49m above mean sea level, 15°54' Northern latitude, 80°25' Eastern longitude and about 7 km away from Bay of Bengal in Agro-climatic Zone III of Andhra Pradesh.

2.1. Plant height (cm)

The plant height was measured from the base of the main stem to the tip of the terminal leaf and expressed in cm.

2.2. Stem girth (cm)

Stem girth of tagged plants was measured in cm at the base of the plant using vernier calipers and expressed in centimeters (cm).

2.3. Number of leaves plant⁻¹

Total number of leaves per plant was counted by tagging the 5th leaf of five randomly selected plants per plot at 14 DAS before the germination leaves senesced. When senescence had progressed, 10th leaf was tagged. Total number of leaves were counted from 7 DAS to anthesis while number of green leaves were counted up to physiological maturity. The number of leaves are counted based on the physical appearance and leaf tip emergence of the plant at everyday observation for counting the leaf number index in relation to the age of the plant.

Leaf appearance rate was calculated on leaf tip (LN Tip) and

on expanded leaf (LN exp) basis. A leaf was assumed expanded when ligule is visible.

The accumulated leaf number (LN) was calculated starting at crop emergence by calculating LAR as per Streck *et al.*, 2009 presented in the following.

$$LN = \sum LAR$$

Where,

LN= Leaf number

LAR= Leaf appearance rate

2.4 Growing degree days(GDs)

The data pertaining to various weather elements during crop growth period in *rabi* season of both the years 2016-17 and 2017-18 were recorded from the meteorological observatory of IMD located at the Agricultural College Farm, Bapatla are presented in Tables 7 and 7.1. The GDD was computed as:

$$GDD = (T_{max} + T_{min}) / 2 - T_{base}$$

Where T_{max}= Maximum temperature, T_{min} =Minimum temperature and T_{base}= Base temperature

The accumulated HTU are cumulative GDD over the days

2.5 Statistical Design

The data were analyzed by following the analysis of variance (ANOVA) technique as suggested by Panse and Sukhatme (1978) [7]. The statistical hypothesis of equalities of treatment means was tested by the test in ANOVA at 5 percent level of significance to compare different treatment means.

3. Results and Discussions

Maize is an economically important crop because of its widespread commercial production and utilization. It is well known that nutrient deficiency in most cultivated crops during the growth season causes imbalance, leading to low productivity and reduction in yield. Nutrient supply in critical stage of the crop, especially during the phase shift from vegetative to reproductive stage determines the crop productivity.

3.1 Plant height (cm)

The growth of maize hybrids in terms of plant height was recorded at an interval of 7 days (Table 1) and its physiological phase shift from vegetative to reproductive stage was observed for six maize hybrids (Fig. 1). Plant height increased gradually with the advancement of crop age, reaching maximum level at physiological maturity.

During *rabi* season 2016-17, at 7 DAS, plant height varied from 12.4 to 14.6 cm, DKC 9142 (V2) was found taller than DKC 9120 (V3), DKC 9081(V4) and on par with 900M Gold, DKC 9042 and Pinnacle. At 14 to 28 DAS, the plant height of maize hybrids didn't vary. At 35 DAS, plant height ranged from 144.2 to 164.8 cm, significantly higher in Pinnacle and lower in 900M Gold than the other four hybrids which were on par with each other.

Table 1: Plant height (cm) of maize hybrids during *rabi* 2016-17

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	114.9	220.2	334.8	434.9	541.4	632.8	730.7	829.6	929.2	1027.6	1135.7	1236.2	1338.7	1447.5
Hybrids														
900MGold (V1)	14.1	43.7	73.8	97.5	144.2	188.8	206.0	250.8	253.5	254.0	254.3	254.5	254.5	254.5
DKC 9142 (V2)	14.6	44.7	75.7	99.2	158.0	204.5	230.0	262.8	266.8	267.8	268.5	268.5	268.5	268.5
DKC 9120 (V3)	12.4	43.1	78.2	98.2	156.5	203.3	226.8	260.5	264.8	265.0	265.8	266.3	266.3	266.3

DKC 9081 (V4)	12.4	44.2	73.7	95.2	152.8	194.5	217.8	251.8	256.5	256.8	257.0	258.0	258.0	258.0
DKC 9042 (V5)	13.3	45.3	76.5	95.0	154.5	197.3	225.8	259.6	262.0	262.3	262.5	262.8	262.8	262.8
Pinnacle (V6)	13.4	45.1	79.7	99.0	164.8	209.0	241.8	270.0	273.3	273.5	274.3	274.5	274.5	274.5
SEm±	0.94	3.3	3.00	3.89	3.07	3.22	3.75	3.86	3.71	3.29	3.05	2.78	2.78	2.78
CD(p=0.05)	2.02	NS	NS	NS	6.54	6.86	8.00	8.23	7.91	7.02	6.52	5.94	5.94	5.94
CV%	10.0	10.50	5.51	5.66	5.79	7.28	5.36	5.10	5.99	5.77	4.64	3.49	3.49	3.49

Table 2: Plant height (cm) of maize hybrids during *rabi* 2017-18

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	141.6	253.4	352.5	457.3	557.7	653.6	748.5	838.6	942.5	1032.7	1130.7	1226.8	1334.9	1424.8
Hybrids														
900MGold (V1)	13.9	41.5	78.3	121.0	151.5	172.8	194.8	217.8	229.8	241.3	262.0	262.0	262.0	262.0
DKC 9142 (V2)	14.4	45.5	83.5	131.3	161.0	174.3	201.3	222.8	235.8	246.3	268.8	268.8	268.8	268.8
DKC 9120 (V3)	12.6	41.8	78.0	120.3	156.5	169.5	200.5	217.5	228.5	241.3	267.5	267.5	267.5	267.5
DKC 9081 (V4)	11.9	43.5	79.8	120.5	155.3	170.5	194.5	214.8	230.3	238.0	259.8	259.8	259.8	259.8
DKC 9042 (V5)	13.2	42.3	79.3	125.3	153.8	174.5	197.0	215.8	228.0	240.5	266.8	266.8	266.8	266.8
Pinnacle (V6)	14.4	51.3	84.5	127.5	164.8	174.8	202.8	220.0	233.0	246.0	267.0	267.0	267.0	267.0
SEm±	0.54	1.85	3.40	4.16	4.34	2.68	3.85	3.85	3.14	2.48	2.47	2.47	2.47	2.47
CD(p=0.05)	1.16	3.94	NS	8.88	9.25	NS	8.21	NS	6.69	5.30	5.27	5.27	5.27	5.27
CV%	9.75	5.90	5.97	4.74	5.90	6.20	5.74	5.49	7.92	6.45	4.31	4.31	4.31	4.31

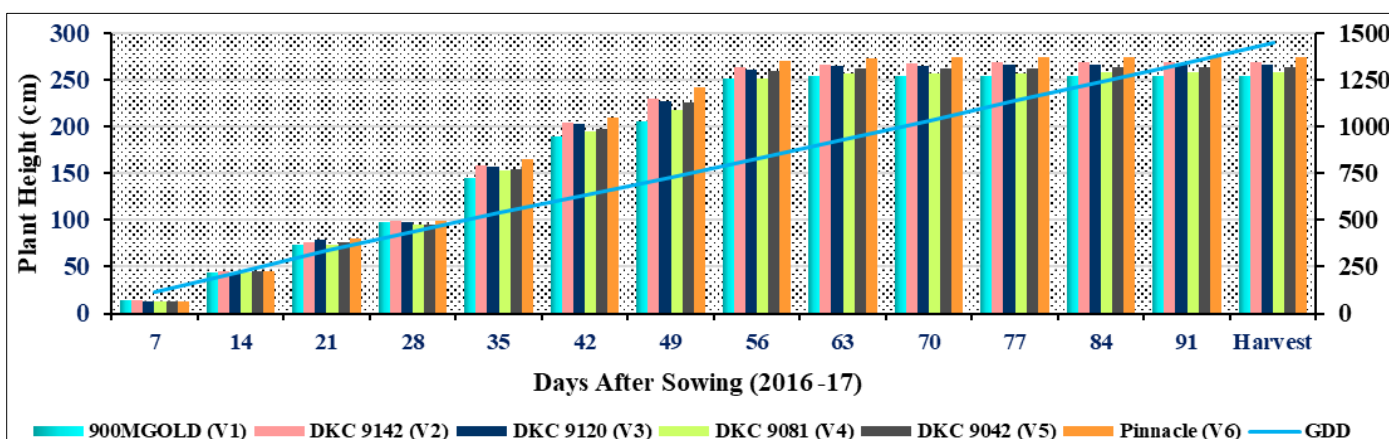


Fig 1: Plant height of maize hybrids during *rabi* 2016-17

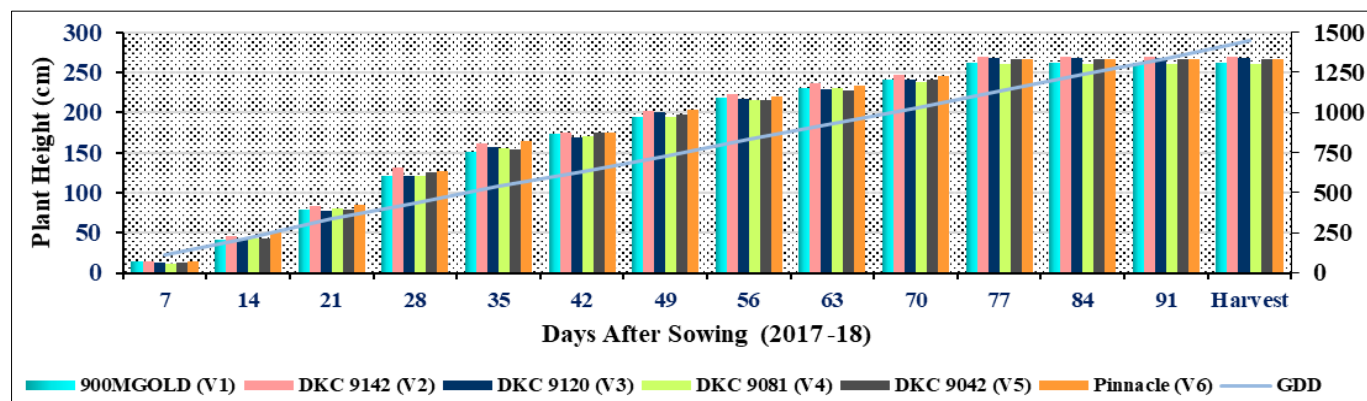


Fig 2: Plant height of maize hybrids during *rabi* 2017-18

which were on par with each other. At 42 DAS, plant height was significantly high in Pinnacle followed by DKC 9142, DKC 9120 compared to DKC 9042, DKC 9081 and 900M Gold. At 49 DAS, it varied from 206.0 to 241.8 cm, significantly higher in Pinnacle and lower in 900M Gold than the other four hybrids. Later at 56 to 77 DAS, Pinnacle was found taller followed by DKC 9142, which showed parity with DKC 9120 and DKC 9042, while it was minimum in 900MGold and DKC 9081. Finally at 84 DAS to harvest, Pinnacle was found taller, 900M Gold and DKC 9042 were found shorter than the other three hybrids. DKC 9142 grew to its maximum height at 77 DAS, while the other five attained it at 84 DAS.

During *rabi* 2017-18 the same trend was observed (Table 2 and Fig 2). Among the maize hybrids, a slight increase in height 1 to 2 cm was observed in hybrids DKC 9120 and DKC 9081, while DKC 9042 grew 4cm taller and 900M Gold and Pinnacle grew 8 cm taller than that during *rabi* 2016-17. At 7DAS, plant height varied from 11.9 to 14.4 cm, DKC 9081 (11.9) had less plant height and Pinnacle and DKC 9142 (14.4) exhibited its domination in height followed by 900M Gold (13.9), which showed parity with DKC9042. At 14 DAS, Pinnacle was significantly taller than other five hybrids which were on par in height except DKC 9142. At 28 DAS, DKC 9142 was found taller followed by Pinnacle and DKC 9042, while the other three were short and on par. At 35 DAS,

Pinnacle attained the highest, significantly higher than 900M Gold, DKC 9042, DKC 9081 and on par with DKC 9142 and DKC 9120. At 49 DAS, DKC 9081 was found shorter than Pinnacle and on par with other hybrids, which also showed parity with pinnacle.

At 63 DAS, plant height ranged from 228.0 to 235.8 cm, high in DKC 9142, which was found on par with Pinnacle, DKC 9081 and 900M Gold. On the other hand, it was low in DKC 9042 but found on par with hybrids other than DKC 9142. Later at 70 DAS, DKC 9142 and Pinnacle stood superior in plant height to DKC 9081, DKC 9042 and on par with 900M Gold and DKC 9120. Finally at 77 DAS to harvest DKC 9142, Pinnacle, DKC 9120 and DKC 9042 grew to similar height and superior to 900M Gold and DKC 9081. The requirement of thermal time for maize hybrids to attain the maximum height in *rabi* 2017-18 is 1131 GDD, while in *rabi* 2016-17, it was 1131GDD for DKC 9142 and 1227 for other hybrids.

Among six hybrids, 900M Gold and DKC 9081 were found relatively shorter than DKC 9142, Pinnacle, DKC 9120 and DKC 9042 in both the seasons. During *rabi* 2016-17, the hybrid Pinnacle was taller than other hybrids, while in the second season it was on par with the hybrids other than 900M Gold and DKC 9081. These hybrids grew to its maximum height in 77 to 84 calendar days after sowing with a thermal requirement of 1131 to 1227 growing degree days, coinciding with emergence of tasseling and silking. This is in confirmation with the finding of Abendroth *et al.* (2011), who redefined the corn growth stages from VI to V 18 as vegetative growth and denoted the tassel emergence stage as VT which occurs approximately at 1135 GDD, where the silking emergence starts two to three days of tassel appearance.

The similar pattern of growth was observed in maize by Yuvas and Unav 2016, who reported that maize reached to its maximum height in between 70 to 77DAS, prior to milk stage. The same finding that plant height is one of the morphological parameters with physiological significance of photosynthetic assimilates translocation that ultimately contributes for crop productivity was confirmed by Anjum *et al.* (2014) in maize hybrid pioneer 32V16 which recorded the maximum height prior to its milking stage. Variation in plant height among hybrids could be due to genotypic variation. Sangoi and Salvador (1997) stated that plant height in maize was significantly influenced by single effect of cultivar (Genetical character) and subjected to variation by environment as well as management.

All six maize hybrids took to grow to its maximum plant height in 77 to 84 calendar days after sowing with 1131 to 1227 GDD.

3.2 Stem girth (cm)

Stem girth is one of the parameters to express its ability to partitioning of dry matter and mobilization of assimilates. The stem girth of maize hybrids was recorded at 7 days interval until the harvest and was statistically analyzed (Table 3 and Fig. 3).

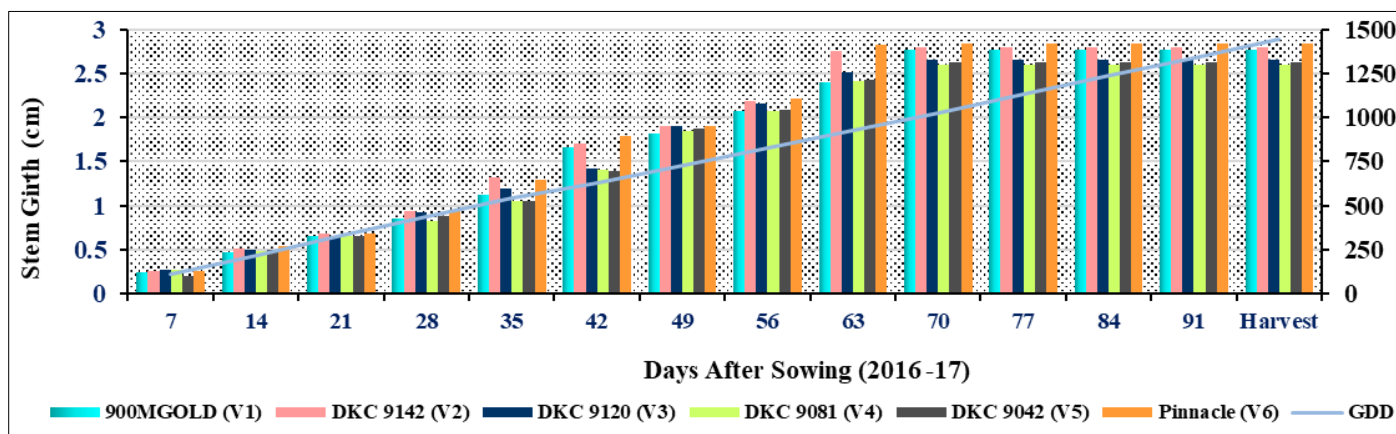
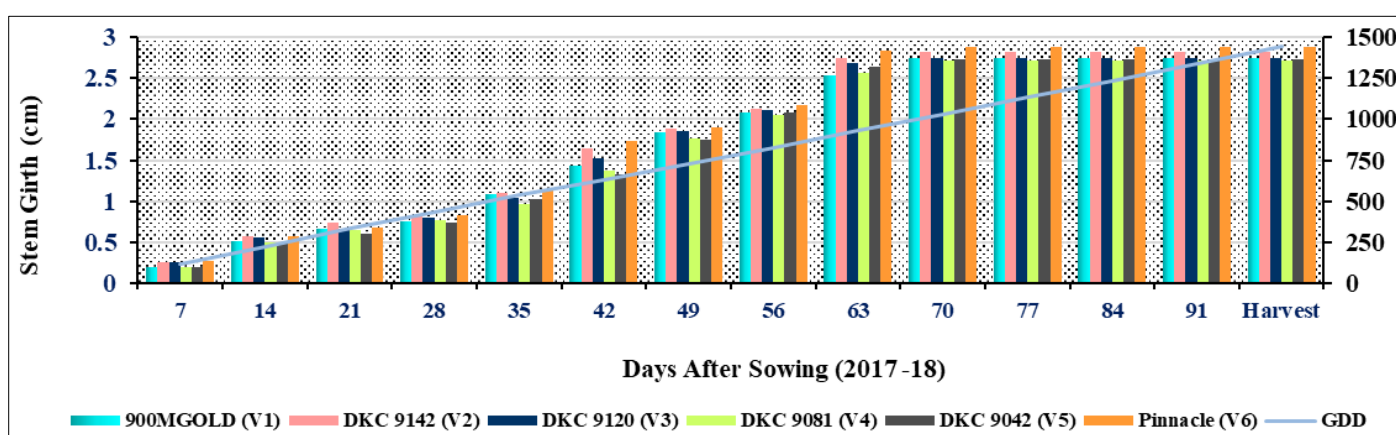
During *rabi* 2016-17, stem girth of maize hybrids at 7 DAS, ranged from 0.21 to 0.28 cm. Maximum girth was noticed in DKC 9120, which showed parity with DKC 9081, DKC 9142 and Pinnacle, while the minimum was noticed in DKC 9042. The hybrid 900M Gold had the stem girth superior to DKC 9042 and inferior to other four. At 14 DAS, Pinnacle and DKC 9142 showed maximum girth, while the others showed minimum.

Table 3: Stem girth (cm) of hybrids during *rabi* 2016-17

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	114.9	220.2	334.8	434.9	541.4	632.8	730.7	829.6	929.2	1027.6	1135.7	1236.2	1338.7	1447.5
Hybrids														
900MGold (V1)	0.3	0.5	0.7	0.9	1.1	1.7	1.8	2.1	2.4	2.8	2.8	2.8	2.8	2.8
DKC 9142 (V2)	0.3	0.5	0.7	0.9	1.3	1.7	1.9	2.2	2.8	2.8	2.8	2.8	2.8	2.8
DKC 9120 (V3)	0.3	0.5	0.6	0.9	1.2	1.4	1.9	2.2	2.5	2.7	2.7	2.7	2.7	2.7
DKC 9081 (V4)	0.3	0.5	0.7	0.8	1.1	1.4	1.9	2.1	2.4	2.6	2.6	2.6	2.6	2.6
DKC 9042 (V5)	0.2	0.5	0.7	0.9	1.1	1.4	1.9	2.1	2.4	2.6	2.6	2.6	2.6	2.6
Pinnacle (V6)	0.3	0.5	0.7	1.0	1.3	1.8	1.9	2.2	2.8	2.8	2.8	2.8	2.8	2.8
SEm±	0.01	0.02	0.02	0.03	0.11	0.11	0.04	0.23	0.06	0.06	0.06	0.06	0.06	0.06
CD(p=0.05)	0.02	0.04	NS	0.08	0.24	0.23	NS	0.05	0.13	0.13	0.13	0.13	0.13	0.13
CV%	7.20	5.93	5.69	6.27	13.66	10.02	3.44	1.57	3.48	3.26	3.26	3.26	3.26	3.26

Table 4: Stem girth (cm) of maize hybrids during *rabi* 2017-18

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	141.6	253.4	352.5	457.3	557.7	653.6	748.5	838.6	942.5	1032.7	1130.7	1226.8	1334.9	1424.8
Hybrids														
900MGold (V1)	0.2	0.5	0.7	0.8	1.1	1.4	1.8	2.1	2.5	2.8	2.8	2.8	2.8	2.8
DKC 9142 (V2)	0.3	0.6	0.7	0.8	1.1	1.6	1.9	2.1	2.7	2.8	2.8	2.8	2.8	2.8
DKC 9120 (V3)	0.3	0.6	0.7	0.8	1.0	1.5	1.9	2.1	2.7	2.8	2.8	2.8	2.8	2.8
DKC 9081 (V4)	0.2	0.5	0.7	0.8	1.0	1.4	1.7	2.1	2.6	2.7	2.7	2.7	2.7	2.7
DKC 9042 (V5)	0.2	0.5	0.6	0.7	1.0	1.3	1.8	2.1	2.6	2.7	2.7	2.7	2.7	2.7
Pinnacle (V6)	0.3	0.6	0.7	0.8	1.2	1.7	1.9	2.2	2.8	2.9	2.9	2.9	2.9	2.9
SEm±	0.01	0.04	0.04	0.03	0.07	0.14	0.06	0.05	0.06	0.03	0.03	0.03	0.03	0.03
CD(p=0.05)	0.03	0.09	NS	0.07	0.15	0.30	0.13	0.11	0.13	0.06	0.06	0.06	0.06	0.06
CV%	10.59	11.96	9.20	6.21	9.58	13.46	4.83	3.62	3.24	1.54	1.54	1.54	1.54	1.54

Fig 3: Stem girth of maize hybrids during *rabi* 2016-17Fig 4: Stem girth of maize hybrids during *rabi* 2017-18

At 28 DAS, Pinnacle had maximum girth compared to DKC 9081 and 900M Gold but on par with DKC 9142, DKC 9120 and DKC 9042. At 35 DAS, DKC 9142 stood superior by having stem girth greater than DKC 9081, DKC 9042 and on par with Pinnacle, DKC 9120 and 900M Gold. At 42 DAS, Pinnacle, DKC 9142 and 900M Gold possessed the maximum girth compared to the other three hybrids. Later at 56 DAS and 63 DAS, Pinnacle and DKC 9142 had the girth significantly greater than other hybrids. Finally at 70 DAS to harvest Pinnacle, DKC 9142 and 900 M Gold had the girth on par with each other and superior to other hybrids. All hybrids attained the maximum level of stem girth in 70 calendar days with thermal requirement of 1028 growing degree days.

During *rabi* 2017-18, stem girth of maize hybrids at 7 DAS ranged from 0.19 to 0.27 cm (Table 4 and Fig. 4). Maximum stem girth was noticed in Pinnacle, which showed parity with DKC 9142 and DKC 9120, while the minimum was noticed in DKC 9081 and 900M Gold was superior to DKC 9081 and on par with DKC 9042. At 14 DAS, Pinnacle showed maximum girth followed by other five hybrids. At 28 DAS, Pinnacle had more stem girth compared to DKC 9142, and on par with DKC 9120 and DKC 9081. 900M Gold recorded lower stem girth but superior than DKC 9042. At 35 DAS, Pinnacle stood superior by having stem girth greater than DKC 9081, and on par with DKC 9142, 900M Gold, DKC 9120 and DKC 9042. At 42 DAS, Pinnacle, DKC 9142, DKC 9120 and 900M Gold possessed the maximum girth compared to the other two hybrids. Later at 56 DAS and 63 DAS, Pinnacle and DKC 9142 had the girth significantly greater than other hybrids. Finally at 70 DAS to harvest Pinnacle and DKC 9142 had the girth on par with each other and superior to other hybrids.

Maize hybrids attained maximum level of stem girth in 70 calendar days with thermal requirement of 1033 growing degree days. At 70 DAS the crop was attained the maximum stem perimeter as it shifted to the milking stage of the cob, where the stem reserves mobilization is rapid. In *rabi* 2016-17, at very early seedling stage, DKC 9120 had high stem girth and maintained that on par with Pinnacle and DKC 9142 upto 35 DAS. At 14 DAS and later Pinnacle and DKC 9142 had high stem girth followed by DKC 9120 and 900M Gold. In *rabi* 2017-18 also finally Pinnacle and DKC 9142 attained maximum stem girth followed by 900M Gold. A slight difference of stem diameter increment were noticed in *rabi* 2017-18 crop, which could be attributed to the variation in availability of more accumulated heat units to the crop. These findings are in confirmation with Nemoto *et al.* (1995). The hybrid 900M Gold is shorter than Pinnacle and DKC 9142 but attained the stem girth on par with those two.

3.3 Number of leaves Plant⁻¹

The number of leaves in all hybrids from sowing to harvest increased from 3 to 16 (Table 5 & Fig. 5). During *rabi* 2016-17, among the hybrids at 7 DAS, Pinnacle and DKC 9142 significantly recorded the highest leaf number compared to DKC 9120, 900M Gold, which recorded the lowest and followed by DKC 9081 and DKC 9042, which in turn were also found on par with DKC 9120 and 900M Gold. At 14 DAS, 900M Gold had the leaf number lower than other five hybrids which were found on par with leaf number ranging from 5.0 to 5.5. At 21 and 28 DAS, DKC 9142, Pinnacle and DKC 9120 had the leaf number significantly higher than DKC 9081, 900M Gold and DKC 9042. At 35 DAS, leaf number was significantly less in DKC 9081 and DKC 9042 than other

four hybrids which were found on par with leaf number ranging from 10.8 to 11.5. At 42 DAS, Pinnacle recorded significantly more number of leaves than DKC 9081, which had the less and on par with DKC 9142, DKC 9042, DKC 9120 and 900M Gold, which in turn also showed parity with DKC 9081. At 49 DAS, Pinnacle and DKC 9142 had the leaf number greater than DKC9042, 900M Gold and on par with DKC 9120, DKC 9081 which showed parity also with DKC 9042 and 900M Gold. At 56 DAS, Pinnacle had more leaf number, significantly greater than DKC 9081, DKC 9120 and on par with DKC 9142, DKC9042 and 900M Gold, which were also on par with DKC 9081. Later at 63 DAS, Pinnacle, DKC 9142 and 900M Gold had significantly more leaf number than DKC 9081 and these four hybrids were found on par with DKC 9042 and DKC 9120. Finally at 70 DAS to harvest, leaf number was significantly high in pinnacle, DKC 9142 and 900M Gold compared to other three hybrids. All hybrids attained the maximum leaf number in 70 calendar

days after sowing with cumulative heat units of about 1028 °Cd.

During *rabi* 2017-18, for second season of the experiment among the maize hybrids, Pinnacle (3.8) expressed its dominance in leaf development at 7 DAS and continued upto 49 DAS along with another hybrid DKC 9142 (Table 6). At 7 DAS leaf number plant⁻¹ varied from 3.0 to 3.8, Pinnacle and DKC 9142 had the leaves significantly greater than DKC 9042 and on par with other three hybrids. At 14 DAS, Pinnacle and DKC 9142 had the leaves significantly more in number. The increase in leaf number simultaneously continued along with crop age and architecture, where from 14 DAS to 35 DAS ranged between 5.75 (900M Gold) to 11.75 (Pinnacle). From 49 DAS to 63 DAS the same trend was shown by six hybrids and the maximum numbers of leaves were attained at 70 DAS by recording 16 leaves per plant.

Table 5: Number of leaves in maize hybrids during *rabi* 2016-17

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	114.9	220.2	334.8	434.9	541.4	632.8	730.7	829.6	929.2	1027.6	1135.7	1236.2	1338.7	1447.5
Hybrids														
900MGold (V1)	3.0	4.2	6.2	8.8	10.8	11.8	13.0	14.3	14.8	15.8	15.8	15.8	15.8	15.8
DKC 9142 (V2)	3.8	5.5	7.1	10.2	11.5	12.3	13.8	14.5	15.0	16.0	16.0	16.0	16.0	16.0
DKC 9120 (V3)	3.0	5.2	6.6	10.0	10.8	11.8	13.3	14.0	14.5	15.5	15.5	15.5	15.5	15.5
DKC 9081 (V4)	3.5	5.0	6.0	9.0	9.8	11.5	13.3	13.8	14.0	15.0	15.0	15.0	15.0	15.0
DKC 9042 (V5)	3.5	5.0	6.5	9.0	10.0	12.0	13.0	14.3	14.5	15.0	15.0	15.0	15.0	15.0
Pinnacle (V6)	4.0	5.5	7.0	10.0	10.8	12.5	13.8	14.8	15.0	16.0	16.0	16.0	16.0	16.0
SEm±	0.29	0.29	0.26	0.19	0.35	0.43	0.29	0.35	0.34	0.23	0.23	0.232	0.232	0.232
CD (p=0.05)	0.63	NS	0.57	0.42	0.76	0.93	0.63	0.76	0.74	0.49	0.49	0.49	0.49	0.49
CV%	12.09	6.73	5.18	2.93	4.77	5.19	3.16	3.54	3.36	2.11	2.11	2.11	2.11	2.11

Table 6: Number of leaves in maize hybrids during *rabi* 2017-18

Days After Sowing	7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	Harvest
GDD	141.6	253.4	352.5	457.3	557.7	653.6	748.5	838.6	942.5	1032.7	1130.7	1226.8	1334.9	1424.8
Hybrids														
900MGold (V1)	3.3	5.8	7.3	8.8	11.0	12.3	13.8	15.5	15.8	16.0	16.0	16.0	16.0	16.0
DKC 9142 (V2)	3.8	6.0	7.8	9.8	11.3	12.8	14.5	15.8	16.0	16.0	16.0	16.0	16.0	16.0
DKC 9120 (V3)	3.5	5.5	7.3	8.8	10.5	12.3	13.3	14.5	15.5	15.8	15.8	15.8	15.8	15.8
DKC 9081 (V4)	3.3	5.0	6.8	8.8	10.3	11.8	13.3	14.5	15.3	15.5	15.5	15.5	15.5	15.5
DKC 9042 (V5)	3.0	5.8	6.8	8.5	10.5	11.8	13.5	14.5	15.3	15.5	15.5	15.5	15.5	15.5
Pinnacle (V6)	3.8	6.0	7.8	9.8	11.8	12.8	14.8	15.8	16.0	16.0	16.0	16.0	16.0	16.0
SEm±	0.28	0.26	0.45	0.37	0.35	0.47	0.36	0.40	0.24	0.25	0.25	0.25	0.25	0.25
CD (p=0.05)	0.61	0.57	0.979	0.806	0.757	NS	0.778	0.870	0.520	NS	NS	NS	NS	NS
CV%	11.94	6.16	8.96	5.91	4.62	5.44	3.73	3.82	2.21	2.28	2.28	2.28	2.28	2.28

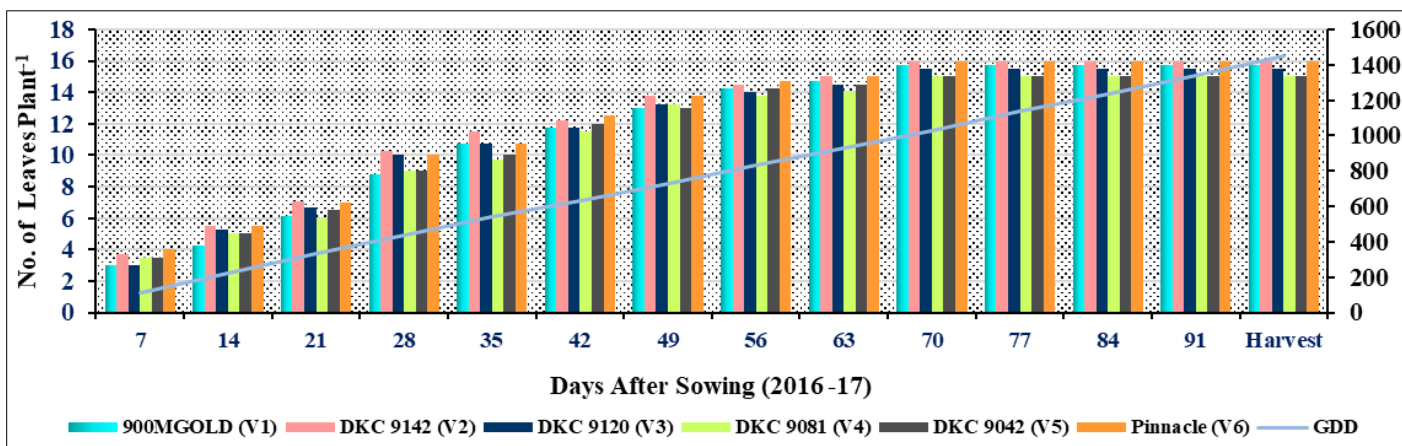


Fig 5: Number of leaves in maize hybrids during *rabi* 2016-17

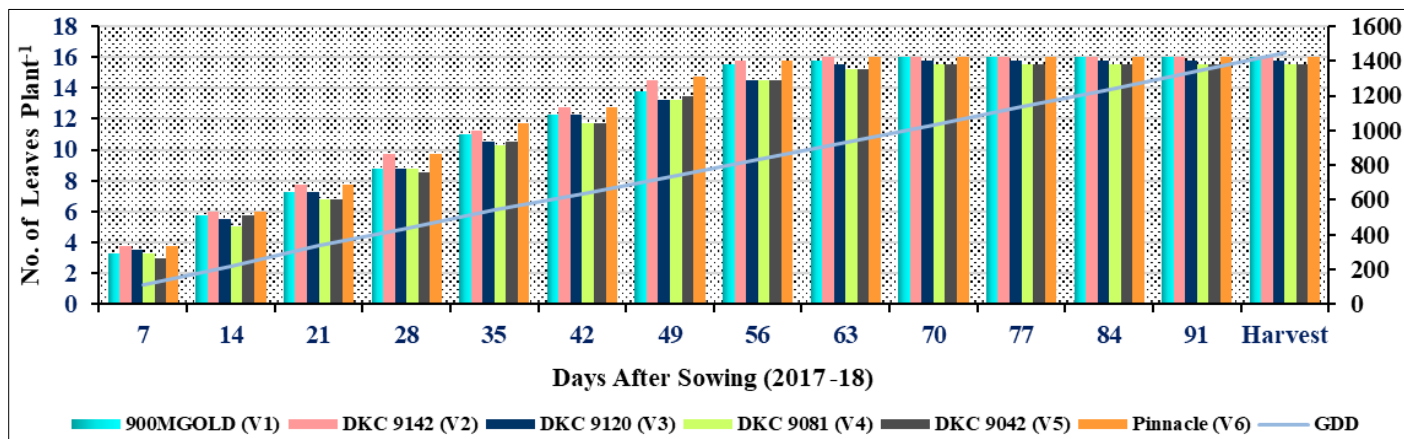


Fig 6: Number of leaves in maize hybrids during rabi 2017-18

In summary, the results indicated that during both the seasons, leaf number was found high in Pinnacle and DKC 9142 and low in DKC 9081 and DKC 9042. The other two hybrids (DKC 9120, 900M Gold) possessed comparatively less number of leaves during very early and some other days of observation, while during the grand growth period of leaf emergence (21 to 49 DAS), these two hybrids attained the leaf number on par with Pinnacle and DKC 9142. The number of leaf whorl expansion varies with hybrid and the rate of appearance and number was determined primarily by temperature and leaf development rates which were linearly related to accumulated heat units expressed as growing degree days (Padilla and Otegue, 2005).

Leaf development, represented by the appearance and accumulation of leaves is an important part of the vegetative development of agricultural crops. In maize, leaf development starts at emergence and ends with the appearance and expansion of the flag leaf, when the final leaf number was attained. In this crop, vegetative development overlaps the reproductive one. Therefore, leaf number is related to some reproductive developmental stages, such as ears and tassel initiation (Forsthofer *et al.* 2004) ^[3].

In the present investigation, at early stages of crop growth (14 DAS), the hybrids studied except 900M Gold possessed almost the similar leaf number and all attained the maximum

number leaves at 70 DAS. This indicated that it is the stage at which the final leaf number is defined and is varied from 15.0 to 16.0 during the period of 14 to 70 DAS, the increment in cumulative heat units was 807.4 °Cd and the increment in leaf number was 11.5 for the hybrids DKC 9142, Pinnacle and 900M Gold, 10.25 for DKC 9120 and 10.0 for DKC 9081 and DKC 9042. For all hybrids under study, the leaf appearance rate was found maximum during the period of 21 to 28 DAS.

3.4 Growing Degree days

During the crop growth period in *rabi* 2016-17 from sowing to harvest the daily maximum temperature ranged from 27.2 °C to 34.1 °C with an average of 30.7 °C. The daily minimum temperature for the same period ranged from 13.7 °C to 24.5 °C with an average of 19.1 °C. The daily mean temperature ranged from 22.6 °C to 28.3 °C with an average of 25.5 °C. The temperature ranged from 19.1 °C to 31.4 °C with an average of 24.56 °C. During the crop growth period in *rabi* of 2017-18 from sowing to harvest, the daily maximum temperature ranged from 28.7 °C to 33.5 °C with an average of 31.1 °C. The daily minimum temperature for the same period ranged from 14.4 °C to 23.9 °C with an average of 19.2 °C. The daily mean temperature ranged from 21.3 °C to 28.5 °C with an average of 35.5 °C.

Table 7: Calculation of growing degree days (GDD) during *rabi* 2016-17

S. No.	Date	Max. Temp (°C)	Min. Temp (°C)	Max RH (I) (%)	Min RH (II) (%)	RF (mm)	GDD (°C d)	Acc HTU	Wind Velocity (W/v)
1	15.11.16	32.1	24.5	89	76	0.0	18.3	18.3	05/03
2	16.11.16	33.1	23.5	89	78	0.0	18.3	36.6	04/02
3	17.11.16	31.0	24.1	86	75	0.0	17.6	52.8	05/03
4	18.11.16	31.0	21.4	85	70	0.0	16.2	69.0	05/03
5	19.11.16	31.3	19.7	88	64	0.0	15.5	84.5	04/02
6	20.11.16	30.2	19.8	89	63	0.0	15.0	99.5	04/02
7	21.11.16	31.4	19.4	85	61	0.0	15.4	114.9	03/02
8	22.11.16	31.8	18.3	88	60	0.0	15.1	130.0	03/02
9	23.11.16	31.8	18.5	89	67	0.0	15.2	145.2	03/03
10	24.11.16	31.3	19.2	82	62	0.0	15.3	160.5	03/02
11	25.11.16	31.0	18.0	88	51	0.0	14.5	175.0	03/02
12	26.11.16	32.0	17.9	86	63	0.0	15.0	190.0	03/02
13	27.11.16	32.4	16.8	76	46	0.0	14.4	204.4	03/02
14	28.11.16	33.8	17.8	76	57	0.0	15.8	220.2	03/02
15	29.11.16	32.2	18.8	93	78	0.0	15.5	235.7	03/01
16	30.11.16	32.2	19.0	96	54	0.0	15.6	251.3	03/02
17	1.12.16	30.5	17.9	78	55	0.0	14.2	265.5	04/02
18	2.12.16	33.0	23.0	88	76	4.7	18.0	283.5	08/04
19	3.12.16	32.1	22.7	84	76	0.0	17.4	300.9	06/03
20	4.12.16	31.2	22.2	87	72	0.0	16.7	317.6	06/02

21	5.12.16	31.8	22.5	86	74	0.0	17.1	334.8	07/04
22	6.12.16	31.5	19.7	83	60	0.0	15.6	350.4	03/02
23	7.12.16	30.6	17.3	86	52	0.0	14.0	364.4	05/03
24	8.12.16	31.9	18.2	82	49	0.0	15.0	379.4	04/02
25	9.12.16	31.5	15.9	69	51	0.0	13.7	393.1	03/02
26	10.12.16	31.3	15.7	74	63	0.0	13.5	406.6	03/02
27	11.11.16	29.5	16.7	75	67	0.0	13.1	419.7	04/02
28	12.12.16	28.7	21.5	76	78	Trace	15.2	434.9	06/03
29	13.12.16	29.5	21.7	93	80	10.7	15.6	450.5	11/06
30	14.12.16	29.6	23.4	93	87	2.2	16.5	467.0	08/04
31	15.12.16	27.2	22.1	91	69	15.8	14.6	481.6	05/03
32	16.12.16	30.7	22.1	91	74	0.0	16.4	498.0	06/04
33	17.12.16	29.7	19.8	90	74	0.0	14.7	512.7	04/02
34	18.12.16	31.0	18.2	91	72	0.0	14.6	527.3	02/01

Table 3.1: (Contd...)

35	19.12.16	30.8	17.5	91	63	0.0	14.1	541.4	03/02
36	20.12.16	30.5	16.4	91	54	0.0	13.4	554.8	03/01
37	21.12.16	30.9	15.6	82	45	0.0	13.2	568.0	03/01
38	22.12.16	31.5	13.7	74	54	0.0	12.6	580.6	02/01
39	23.12.16	31.9	14.7	79	54	0.0	13.3	593.9	03/01
40	24.12.16	31.2	14.5	85	58	0.0	12.8	606.7	02/01
41	25.12.16	29.8	16.2	92	58	0.0	13.0	619.7	03/02
42	26.12.16	30.1	16.0	89	67	0.0	13.1	632.8	03/02
43	27.12.16	31.1	18.1	94	50	0.0	14.6	647.4	03/02
44	28.12.16	31.5	17.3	96	64	0.0	14.4	661.8	04/02
45	29.12.16	30.0	16.8	94	67	0.0	13.4	675.2	04/02
46	30.12.16	30.3	18.2	93	74	0.0	14.2	689.4	03/02
47	31.12.16	30.2	18.3	93	59	0.0	14.2	703.6	04/02
48	1.1.17	30.1	17.2	87	60	0.0	13.6	717.3	04/02
49	2.1.17	30.9	16.0	91	68	0.0	13.4	730.7	04/02
50	3.1.17	30.3	17.2	88	72	0.0	13.7	744.4	04/02
51	4.1.17	30.5	18.7	86	74	0.0	14.6	759.0	03/02
52	5.1.17	31.4	18.1	93	65	0.0	14.7	773.7	03/02
53	6.1.17	31.3	17.7	93	67	0.0	14.5	788.2	03/01
54	7.1.17	30.2	18.1	89	66	0.0	14.1	802.3	04/02
55	8.1.17	30.1	17.7	86	62	0.0	13.9	816.2	04/02
56	9.1.17	29.9	16.9	89	56	0.0	13.4	829.6	04/02
57	10.1.17	30.1	17.8	80	65	0.0	13.9	843.5	04/02
58	11.1.17	30.0	20.9	89	75	0.0	15.4	858.9	04/02
59	12.1.17	29.8	19.7	93	72	0.0	14.7	873.6	03/02
60	13.1.17	30.5	19.9	86	62	0.0	15.2	888.8	04/02
61	14.1.17	29.0	17.9	91	70	0.0	13.4	902.2	04/02
62	15.1.17	29.6	17.7	96	65	0.0	13.4	915.6	04/02
63	16.1.17	30.6	16.7	92	61	0.0	13.6	929.2	04/02
64	17.1.17	30.4	16.3	91	58	0.0	13.2	942.4	03/02
65	18.1.17	30.5	15.7	88	58	0.0	13.1	955.5	04/02
66	19.1.17	30.0	16.3	89	50	0.0	13.1	968.6	05/03
67	20.1.17	30.7	14.8	78	27	0.0	12.8	981.3	06/03
68	21.1.17	31.7	20.4	78	35	0.0	16.0	997.3	07/04
69	22.1.17	31.4	18.5	89	59	0.0	14.9	1012.2	07/04
70	23.1.17	32.0	18.7	93	45	0.0	15.4	1027.6	05/03
71	24.1.17	31.5	18.1	88	65	0.0	14.8	1042.4	05/02

Table 3.1: (Contd...)

72	25.1.17	31.6	16.8	91	45	0.0	14.2	1056.6	05/03
73	26.1.17	30.6	19.4	89	65	0.0	15.0	1071.6	06/03
74	27.1.17	29.1	20.2	89	74	0.0	14.6	1086.3	05/03
75	28.1.17	30.9	21.6	96	73	0.0	16.3	1102.6	05/03
76	29.1.17	33.1	20.7	90	73	0.0	16.9	1119.5	04/02
77	30.1.17	33.1	19.2	88	71	0.0	16.2	1135.7	05/02
78	31.1.17	31.0	19.4	88	63	0.0	15.2	1150.9	05/02
79	1.2.17	30.8	17.7	89	69	0.0	14.3	1165.2	03/02
80	2.2.17	30.0	18.0	89	68	0.0	14.0	1179.2	04/02
81	3.2.17	30.3	17.7	89	64	0.0	14.0	1193.2	04/02
82	4.2.17	30.4	18.7	86	64	0.0	14.6	1207.8	04/02
83	5.2.17	30.1	17.7	89	55	0.0	13.9	1221.7	05/02
84	6.2.17	30.7	18.2	77	66	0.0	14.5	1236.2	05/03

85	7.2.17	31.7	17.7	86	65	0.0	14.7	1250.9	06/03
86	8.2.17	32.0	18.7	86	35	0.0	15.4	1266.3	04/02
87	9.2.17	33.7	18.8	79	57	0.0	16.3	1282.6	05/03
88	10.2.17	32.0	17.6	66	57	0.0	14.8	1297.4	05/03
89	11.2.17	30.7	17.0	91	53	0.0	13.8	1311.3	04/02
90	12.2.17	30.2	17.1	79	50	0.0	13.7	1325.0	04/02
91	13.2.17	30.4	17.0	84	44	0.0	13.7	1338.7	06/03
92	14.2.17	31.8	16.7	89	68	0.0	14.3	1353.0	05/03
93	15.2.17	33.0	19.6	89	59	0.0	16.3	1369.3	05/03
94	16.2.17	31.9	17.7	87	70	0.0	14.8	1384.1	05/03
95	17.2.17	32.1	18.6	88	57	0.0	15.4	1399.5	04/03
96	18.2.17	31.8	18.7	86	63	0.0	15.3	1414.8	04/02
97	19.2.17	31.9	19.7	83	66	0.0	15.8	1430.6	04/02
98	20.2.17	34.1	19.7	85	71	0.0	16.9	1447.5	04/02

Table 7.1: Calculation of growing degree days (GDD) during *rabi* 2017-18

S. No.	Date	Max. Temp(°C)	Min. Temp(°C)	Max RH (I) (%)	Min RH (II) (%)	GDD (°Cd)	Acc HTU	RF (mm)	Wind Velocity (W/v)
1	15.11.17	31.0	23.2	77	66	17.1	17.1	0.0	05/03
1	16.11.17	33.5	22.4	81	61	17.95	35.05	0.0	04/02
2	17.11.17	33.2	23.7	76	73	18.45	53.5	0.0	05/03
3	18.11.17	32.5	23.9	89	83	18.2	71.7	0.0	03/01
4	19.11.17	30.0	23.2	87	79	16.6	88.3	21.0	02/01
5	20.11.17	32.5	23.7	87	83	18.1	106.4	0.1	03/01
6	21.11.17	32.4	24.1	84	70	18.25	124.6	1.0	03/02
7	22.11.17	32.2	21.8	87	72	17	141.6	0.0	04/02
8	23.11.17	32.0	22.7	88	71	17.35	159.0	0.0	04/02
9	24.11.17	32.5	23.2	92	82	17.85	176.8	8.7	02/01
10	25.11.17	31.7	21.7	85	69	16.7	193.5	0.0	04/02
11	26.11.17	30.2	19.0	89	53	14.6	208.1	0.0	04/02
12	27.11.17	30.1	19.8	86	64	14.95	223.1	0.0	03/02
13	28.11.17	31.6	18.4	84	59	15	238.1	0.0	04/02
14	29.11.17	31.5	19.2	86	55	15.35	253.4	0.0	05/03
15	30.11.17	30.1	18.5	81	70	14.3	267.7	0.0	06/03
16	1.12.17	28.7	20.6	81	62	14.65	282.4	--	06/03
17	2.12.17	29.8	18.7	83	62	14.25	296.6	--	06/03
18	3.12.17	29.9	18.0	77	52	13.95	310.6	--	06/03
19	4.12.17	30.1	18.0	82	62	14.05	324.6	--	05/02
20	5.12.17	29.6	18.7	84	70	14.15	338.8	--	06/03
21	6.12.17	29.3	18.2	84	69	13.75	352.5	--	05/03
22	7.12.17	30.8	18.3	89	67	14.55	367.1	--	03/02
23	8.12.17	30.6	17.7	88	57	14.15	381.2	--	03/02
24	9.12.17	32.4	17.6	72	38	15	396.2	--	03/01
25	10.12.17	33.0	17.0	84	40	15	411.2	--	05/03
26	11.12.17	33.0	18.2	68	72	15.6	426.8	--	03/01
27	12.12.17	31.2	19.1	91	65	15.15	442.0	--	03/01
28	13.12.17	30.3	20.4	84	70	15.35	457.3	--	03/01
29	14.12.17	31.5	19.5	86	74	15.5	472.8	--	02/01
30	15.12.17	31.8	19.9	91	57	15.85	488.7	--	03/02
31	16.12.17	31.1	18.0	85	53	14.55	503.2	--	04/02
32	17.12.17	30.6	18.0	91	58	14.3	517.5	--	05/03
33	18.12.17	30.3	17.0	85	51	13.65	531.2	--	04/02

Table 3.2: (Contd...)

34	19.12.17	31.2	16.7	89	60	13.95	545.1	--	04/02
35	20.12.17	29.4	15.7	85	42	12.55	557.7	--	04/02
36	21.12.17	30.0	14.4	87	60	12.2	569.9	--	05/03
37	22.12.17	30.8	18.2	96	71	14.5	584.4	--	05/02
38	23.12.17	30.2	17.3	92	71	13.75	598.1	--	04/02
39	24.12.17	30.0	17.4	87	54	13.7	611.8	--	04/02
40	25.12.17	30.1	17.4	92	72	13.75	625.6	--	04/02
41	26.12.17	30.0	18.7	84	65	14.35	639.9	--	03/02
42	27.12.17	30.9	16.5	90	70	13.7	653.6	--	03/01
43	28.12.17	29.2	15.6	86	37	12.4	666.05	--	03/02
44	29.12.17	29.6	12.9	83	46	11.25	677.3	--	04/02
45	30.12.17	30.0	15.8	87	59	12.9	690.2	--	04/02

46	31.12.17	30.8	17.5	94	33	14.15	704.3	--	04/02
47	1.1.18	31.3	17.4	85	65	14.35	718.7	0.0	05/03
48	2.1.18	31.6	18.7	86	64	15.15	733.8	0.0	05/03
49	3.1.18	30.7	18.7	82	62	14.7	748.5	0.0	04/02
50	4.1.18	30.8	17.5	91	62	14.15	762.7	0.0	04/02
51	5.1.18	30.2	15.9	88	61	13.05	775.7	0.0	03/02
52	6.1.18	29.8	15.0	83	47	12.4	788.1	0.0	03/02
53	7.1.18	29.0	15.2	85	55	12.1	800.2	0.0	03/02
54	8.1.18	29.0	15.2	90	50	12.1	812.3	0.0	03/02
55	9.1.18	29.1	16.7	83	39	12.9	825.2	0.0	05/02
56	10.1.18	29.3	17.5	84	62	13.4	838.6	0.0	05/03
57	11.1.18	30.5	17.7	91	70	14.1	852.7	0.0	04/02
58	12.1.18	31.0	20.4	84	65	15.7	868.4	0.0	03/02
59	13.1.18	31.3	19.7	88	78	15.5	883.9	0.0	02/01
60	14.1.18	30.6	20.0	88	73	15.3	899.2	0.0	03/02
61	15.1.18	30.0	18.4	96	52	14.2	913.4	0.0	03/02
62	16.1.18	30.0	19.6	89	77	14.8	928.2	0.0	02/01
63	17.1.18	30.5	18.1	91	65	14.3	942.5	0.0	03/02
64	18.1.18	30.0	16.4	82	60	13.2	955.7	0.0	03/02
65	19.1.18	30.3	16.7	91	58	13.5	969.2	0.0	03/02
66	20.1.18	29.6	16.5	89	54	13.05	982.3	0.0	03/02
67	21.1.18	29.2	16.2	83	53	12.7	995.0	0.0	04/02
68	22.1.18	30.0	14.7	90	50	12.35	1007.4	0.0	04/02
69	23.1.18	29.2	15.4	88	54	12.3	1019.7	0.0	03/02
70	24.1.18	29.1	17.0	85	67	13.05	1032.7	0.0	04/02
71	25.1.18	29.6	17.0	91	58	13.3	1046.0	0.0	03/02

Table 3.2: (Contd...)

72	26.1.18	31.7	18.1	89	68	14.9	1060.9	0.0	03/01
73	27.1.18	30.2	17.6	98	66	13.9	1074.8	0.0	04/02
74	28.1.18	30.6	18.4	91	61	14.5	1089.3	0.0	04/02
75	29.1.18	30.0	17.5	87	64	13.75	1103.1	0.0	04/02
76	30.1.18	30.0	17.8	91	61	13.9	1117.0	0.0	04/02
77	31.1.18	30.1	17.4	91	44	13.75	1130.7	0.0	03/02
78	1.2.18	31.7	15.8	85	24	13.75	1144.5	0.0	03/02
79	2.2.18	33.2	14.7	68	28	13.95	1158.4	0.0	03/02
80	3.2.18	32.7	17.4	91	38	15.05	1173.5	0.0	04/02
81	4.2.18	30.3	14.6	81	47	12.45	1185.9	0.0	03/02
82	5.2.18	29.7	15.2	83	55	12.45	1198.4	0.0	03/02
83	6.2.18	29.5	18.1	80	68	13.8	1212.2	0.0	04/02
84	7.2.18	30.8	18.4	86	65	14.6	1226.8	0.0	04/02
85	8.2.18	30.0	21.7	83	69	15.85	1242.6	0.0	03/02
86	9.2.18	32.8	20.0	91	71	16.4	1259.0	0.0	04/02
87	10.2.18	30.7	20.7	83	71	15.7	1274.7	0.0	05/03
88	11.2.18	30.8	21.0	78	72	15.9	1290.6	0.0	04/02
89	12.2.18	29.2	20.7	83	63	14.95	1305.6	0.0	05/03
90	13.2.18	30.7	19.4	91	66	15.05	1320.6	0.0	05/03
91	14.2.18	30.6	18.0	86	31	14.3	1334.9	0.0	05/03
92	15.2.18	32.0	17.1	82	63	14.55	1349.5	0.0	05/03
93	16.2.18	31.3	18.0	91	69	14.65	1364.1	0.0	04/02
94	17.2.18	32.9	20.0	84	68	16.45	1380.6	0.0	03/02
95	18.2.18	31.5	19.0	88	62	15.25	1395.8	0.0	04/02
96	19.2.18	30.7	18.0	86	60	14.35	1410.2	0.0	04/02
97	20.2.18	30.6	18.7	82	63	14.65	1424.8	0.0	

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