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Climate effect on maize planting dates

Khethoxolo Mbotho

Maize, a warm-weather crop, forms part of the daily diet as a staple food for human consumption and livestock feed in rural communities. The aim of producing this cereal crop is to obtain high yields. It is an important grain crop in South Africa and can be grown under diverse environmental conditions.

Low maize yields may result from a range of factors, such as limited production inputs, environmental conditions and management. Following good production practices is a foundation for achieving higher yields. Good agronomic practices that can be applied to increase maize yield include applying the recommended fertilizers rates, applying agrochemicals at the correct rates and planting at an appropriate seeding rate. Some of these practices are expensive for poor communities. One management practice that affects yield and can be manipulated by resource-poor farmers is planting date. Farmers often plant their maize late, outside their regional optimum planting time. This bulletin focuses on planting date and how it is affected by climate.

Limiting factors in achieving high maize yields are, among others, inputs, rainfall distribution and heat units (HU). Heat units are calculated as the daily average between the highest and lowest temperatures minus the base temperature (10 °C for maize) accumulated throughout the growing season. Maize requires approximately 750 HU per growing season and between 120 - 140 frost-free days, depending on the maturity class. Therefore, planting should not commence too early, especially in areas where average temperatures during spring are lower than 15 ℃, nor too late, such as between December and February, when the length of the growing season is shortened because the HU start to drop before the plants reach grain-fill. Ultra-quick and quick maize cultivars can be used for late planting and higher plant populations must be applied to compensate for low yields.

Optimum planting time

For farmers without resources for financial input in the cropping system, altering the planting date to within the optimum planting period can increase maize yield. Optimum planting time is location specific and depends on soil temperature and moisture having reached the threshold level for uniform seedling emergence. When these levels are met, planting can commence.

Planting during the recommended optimum period for an area will result in crops producing their highest yields (within the limits imposed by other production constraints). Planting at the recommended planting dates for an area means that the most favourable climatic conditions will generally occur between planting and physiological maturity.

Soil temperature

For maize, the minimum threshold soil temperature for even seedling emergence is between 10 °C and 15 °C. Soil temperatures ≥ 20 °C can result in even seedling emergence within five to seven days. The key is that the soil temperature must not be too variable in order to achieve even seedling emergence.

Soil moisture

Maize requires sufficient, well-distributed moisture around the seed's surface to germinate. As soon as 10 to 20 mm is received in one rainfall, early planting can commence, as long as temperature is not a limiting factor.

Some farmers have access to irrigation and therefore rainfall is not a limiting factor. Few farmers can afford the cost of irrigation. Due to excessively high summer temperatures (average daily maximum of 32.8 ˚C), farmers in the Jozini area who produce green mealies and who do not have access to irrigation are limited to planting their maize crop during winter months.

TABLE 1 Planting dates and corresponding daily average temperatures (AvT), average maximum temperatures (AvTmax) and rainfall during the 2016/2017 planting season for the first 20 days after planting (DAP).

Planting date	AvT (°C)	AvTmax (°C)	Rain 20DAP (mm)
15 SEP	14.42	20.51	49.53
30 SEP	14.77	20.74	49.30
15 OCT	18.38	24.14	70.60
31 OCT	17.24	22.29	75.94
15 NOV	18.51	24.33	22.61
30 NOV	20.34	26.79	22.61
15 DEC	21.57	28.64	16.26
31 DEC	19.62	26.02	7.62
15 JAN	20.86	28.03	7.10
31 JAN	21.49	27.83	47.74
15 FEB	19.76	25.59	100.07

Table 1 gives temperature and rainfall data for the 2016/2017 season on Cedara Research Station. The first 20 days after planting are crucial in ensuring quick and uniform seedling emergence. A range of possible planting dates is given, from early to late planting. These possible planting dates were chosen based on current recommendations and farmer practices with an aim of helping farmers to time their planting accordingly. As early as October, average temperatures were above 15 °C. This means the only limiting factor was soil moisture, without which early planting could have commenced. Although there were more incidences of rainfall in the early planting dates of 15 and 30 SEP than in the 'medium' season dates of 15 and 30 NOV, temperatures were too low and would have delayed emergence. This could also have given weeds and diseases an advantage over the maize plants. Therefore, cultivar selection is also important, especially when there is a delay in the onset of rainfall, thereby reducing the growing-season length. If this is the situation, it is advisable to choose a quick or quick-medium cultivar. However, this poses a problem, because farmers would have purchased a preferred cultivar well in advance.

Maize production under irrigation

South Africa has experienced two consecutive seasons of drought, which has significantly reduced major dam levels. As a result, 15% water use restrictions were implemented in the Umgungundlovu district and about 80% in the eThekwini district. These restrictions could have affected the planting time for farmers who had access to irrigation in the 2017/2018 planting season. Table 2 lists the dams of the Umngeni system, some in the North and South Coast systems and some in the inland areas.

TABLE 2 Current state of selected KZN dams (Umngeni-Water, 2017).

Dam	Capacity Million m^3	% full
Albert Falls	290.1	27.83%
Inanda	251.6	61.60%
Mearns	5.11	35.81%
Midmar	235.4	70.55%
Nagle	24.6	66.96%
Spring Grove	139.5	87.13%
Hazelmere	17.9	105.33%
Henley	1.52	101.00%
Ixopo	0.56	89.01%
E.J. Smith	0.98	100.05%
Nungwane	2.22	88.68%

With rainfall expected to be below-average during this particular season, predicting planting dates becomes difficult, and farmers have to make decisions depending on the onset and quantity of rainfall received.

The temperature and rainfall data in Table 1 is specific to Cedara in the 2016/2017 growing-season. This information will vary from location to location and from season to season. Each farm is different, therefore this information needs to be handled with caution and treated as an example.

Cedara falls under the BRU code Xc15 and BRG 5, the moist midlands mist-belt. Recent studies have indicated that in the KZN Midlands, dryland maize planting can commence between late-September to mid-December and still get relatively good yields (7 – 12 t ha^{-1}) irrespective of the growing season length of the cultivar. Previous experience on an individual farm can help determine the optimum planting time of that specific farm. This means each farmer needs to keep daily, monthly and yearly records. Among things to record are daily rainfall, daily minimum and maximum temperatures, soil moisture level, soil temperature, soil sampling date, soil analysis results, fertilizer and side-dressing application time and amounts, planting and harvest dates, and finally grain yield. These records will not only help improve farming practices in the following seasons, but will aid in determining the optimum planting time for a specific farm.

References

UMNGENI-WATER. 2017. Dam and Rainfall data: Latest dam data [Online]. Pietermaritzburg: Umngeni water. Available: http://www.umgeni.co.za/media_centre/drd.asp [Accessed 25 August 2017].

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Contact

Khethuxolo Mbotho
Scientific Technician
Tel: 033 355 9161
khethuxolo.mbotho@kzndard.gov.za

KZN Department of Agriculture & Rural Development
Agricultural Crop Research Services
Crop Scientific Research Services,
Crop Protection,
Cedara

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