

KwaZulu-Natal dryland cultivar trial conducted at Cedara over three growing seasons

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The increasing use of irrigation for the production of potatoes and other crops is a global phenomenon.

This trend is expected to continue due to climate change and the ever-increasing demand to produce more food from limited arable land to feed the growing world population. Consequently, the pressure on water sources will increase.

Currently, 83% of potato production fields in South Africa are irrigated. However, not all growers have access to irrigation water. Some areas do not receive sufficient rainfall for good yields to be obtained, and in some growing seasons the rainfall received may be below the quantities required for yields to be economically viable. Therefore, the identification of high-yielding cultivars with good water use efficiency is necessary.

Dryland conditions evaluated

A research project was implemented at the Cedara Research Station (S29° 32' 15 33, E30° 16' 09 19), which is situated in the moist mist-belt zone of the KwaZulu-Natal Midlands (900 to 1 400 m above sea level with 830 to 1 140 mm annual rainfall). The objective was to evaluate the performance of potato cultivars grown under dryland conditions. This report contains the results obtained from three growing seasons (2019/20 to 2021/22).

The trials were planted on a Hutton soil (46 to 50% clay) on 19 September 2019, 17 September 2020 and 14 September 2021 at a seeding rate of 37 037 tubers/ha in rows spaced 0.9 m apart. Fertiliser was applied according to Fertrec recommendations for a 70 t/ha yield based on the results of soil analyses. Six fungicides and five insecticides

were applied weekly in a rotation from ridding until 90% senescence.

The tubers were harvested two to three weeks after 100% senescence, then graded according to size (Large >250 g; Large medium 170 to 250 g; Medium 100 to 170 g; Small 50 to

100 g; Baby 5 to 50 g) and weighed to determine yield. The data was subjected to the analysis of variance (ANOVA) procedure in the statistical package, Genstat (22nd edition). Differences between treatment means were measured using Fisher's

Figure 1: Location of the Cedara Research Station potato cultivar evaluation trial.

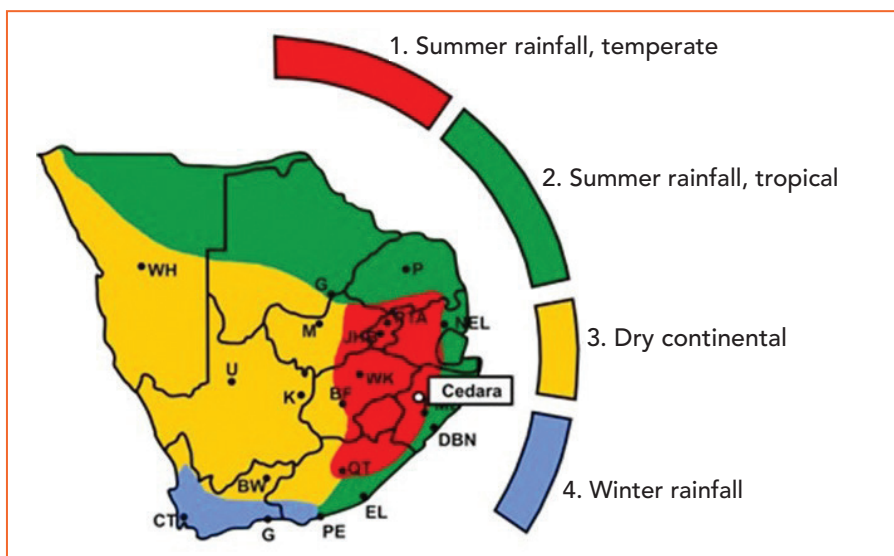


Figure 2: Monthly rainfall in the three growing seasons and the long-term monthly means at Cedara. (Long-term data: 93 years' data: 1923 to 2015, ARC-ISCW, Cedara)

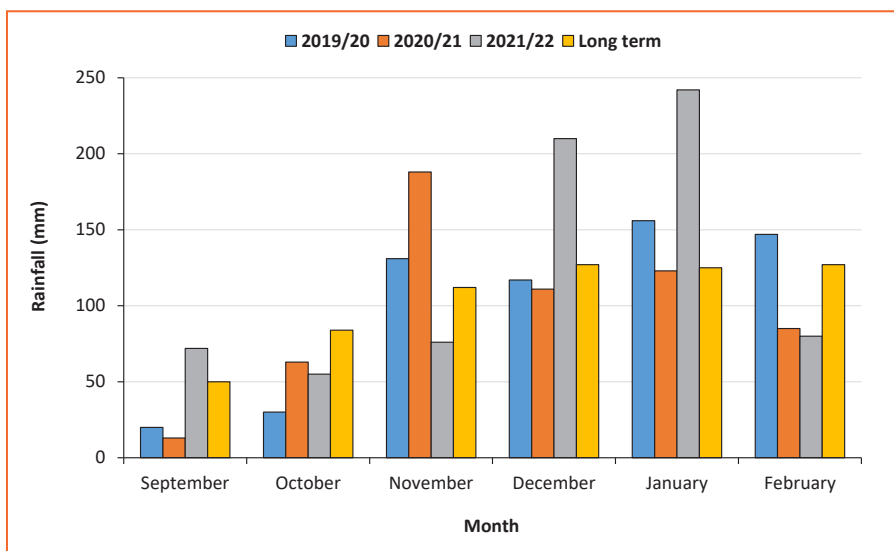


Figure 3: Monthly mean maximum and minimum temperatures in the three growing seasons and the long-term monthly means. (Long-term data: 93 years' data: 1923 to 2015, ARC-ISCW, Cedara).

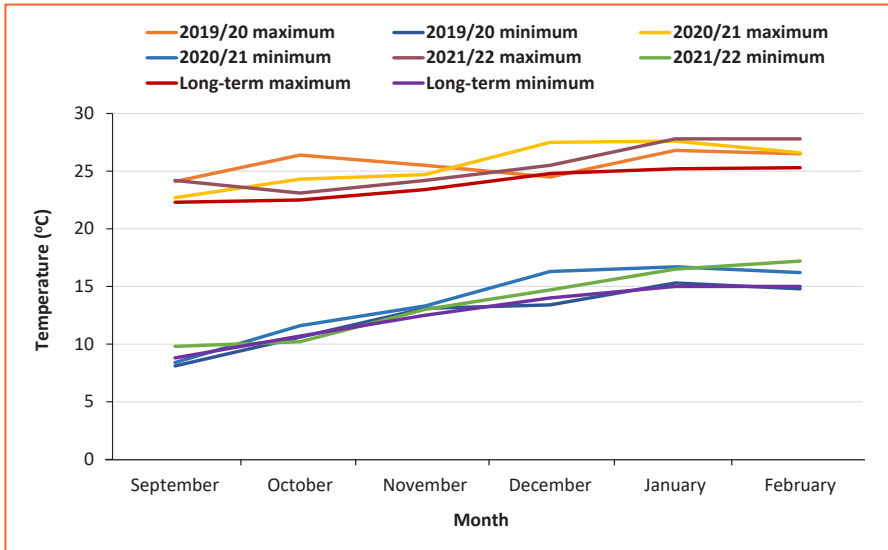
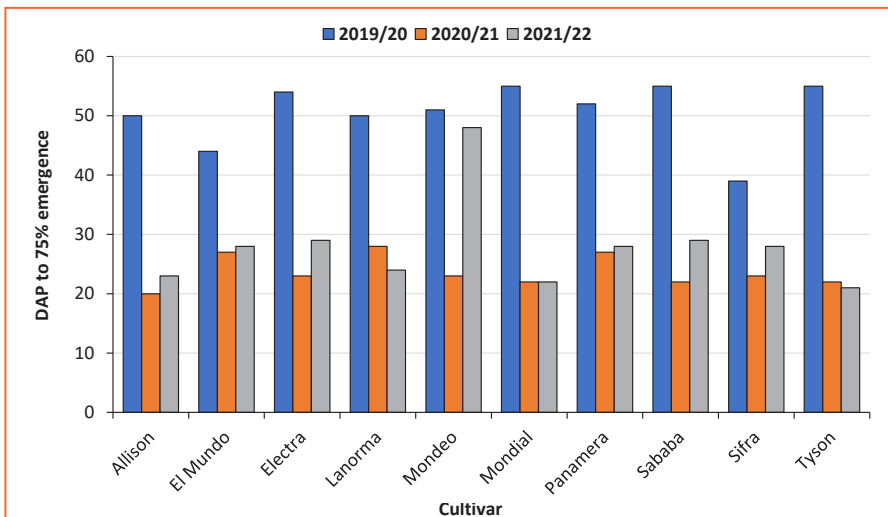


Table 1: Seed quality rating* at planting of the ten cultivars in the three growing seasons

Cultivar	2019/20	2020/21	2021/22	Mean
Allison	3.0	3.0	1.0	2.3
El Mundo	3.0	2.0	1.0	2.0
Electra	3.0	2.0	1.0	2.0
Lanorma	3.0	2.5	2.0	2.5
Mondeo	2.5	2.0	1.0	1.8
Mondial	3.0	3.0	1.0	2.3
Panamera	3.0	2.5	1.0	2.2
Sababa	3.0	3.0	1.0	2.3
Sifra	4.0	3.0	1.0	2.7
Tyson	3.0	3.0	2.0	2.7
Mean	3.1	2.6	1.2	2.3

*1 = Fresh seed; 3 = Well-sprouted; 5 = Over-sprouted.

Figure 4: Number of days after planting (DAP) to 75% emergence of the ten cultivars in the three growing seasons.



protected least significant difference (LSD) procedure at a 5% confidence level (P=0.05).

The importance of seed quality

The resilience of potato tubers to remain viable when very dry conditions are experienced for a long period after planting was evident in the 2019/20 growing season. Very little rain fell from planting until the last week in October and the mean maximum temperatures for September and October were considerably warmer than the long-term means (Figures 2 and 3).

This resulted in the cultivars taking a mean of 51 days after planting (DAP) to reach 75% emergence (Figure 4). However, Sifra took 39 days to emerge, but the plant stand was significantly lower (Figure 5), which resulted in a significantly lower yield compared to the other cultivars (Figure 8). The tubers of Sifra were slightly 'over-sprouted' at planting, whereas the tubers of the other cultivars were 'well-sprouted' (Table 1).

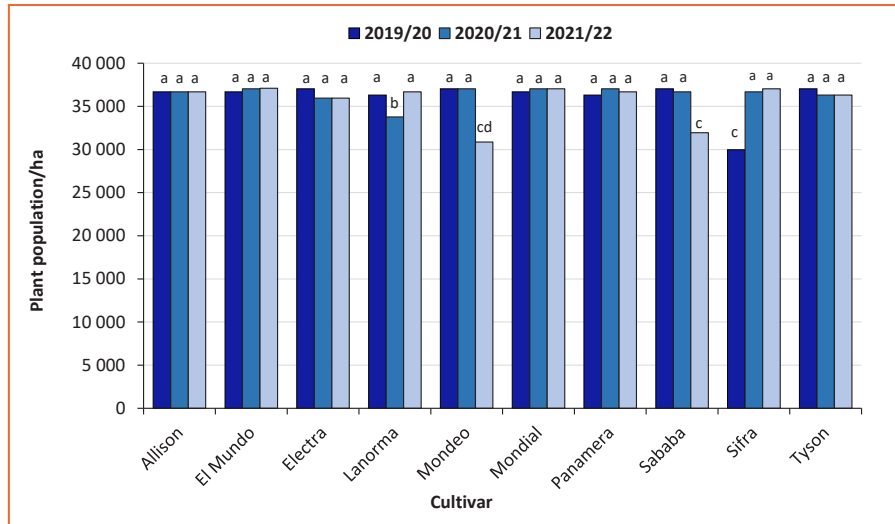
This indicates the importance of seed quality at planting, especially under dryland conditions. Despite the delayed emergence, the mean plant population was not significantly different to the means of the other two growing seasons.

Due to sufficient rain after planting in the 2020/21 and 2021/22 growing seasons, the cultivars took a mean of 24 and 28 DAP to reach 75% emergence, respectively (Figure 4). As the seed was fresher (less sprouted) in the 2021/22 growing season, 75% emergence occurred slightly later. In addition, the seedlings of Mondeo took 48 days to reach 75% emergence. The plant stand of Mondeo, together with that of Sababa, was significantly lower than the other cultivars (Figure 5). In the 2020/21 growing season, Lanorma had a significantly lower plant stand than the other cultivars. Overall, plant population was significantly positively correlated to yield.

Haulms per plant

A significant interaction was measured between the cultivars and seasons for

Figure 5: Plant population/ha of the ten cultivars in the three growing seasons.



Values with the same alphabetical letter are not significantly different.

Figure 6: Number of haulms/plant of the ten cultivars in the three growing seasons.

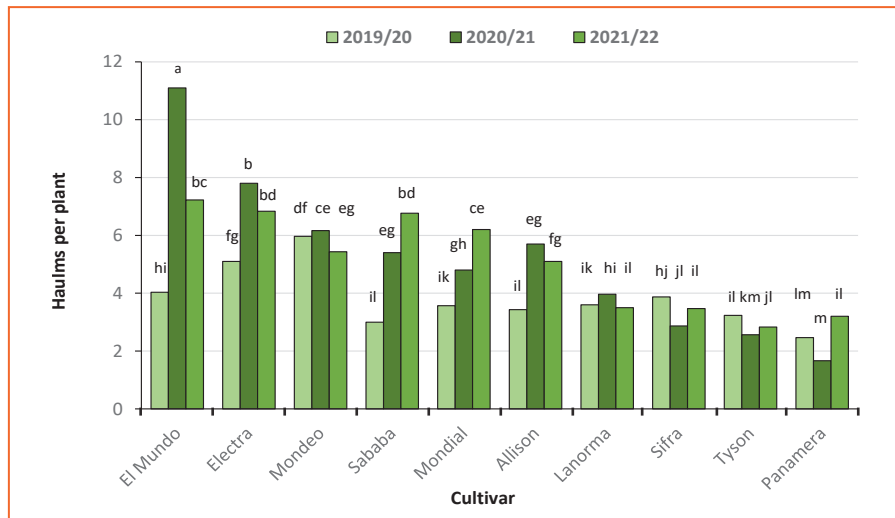
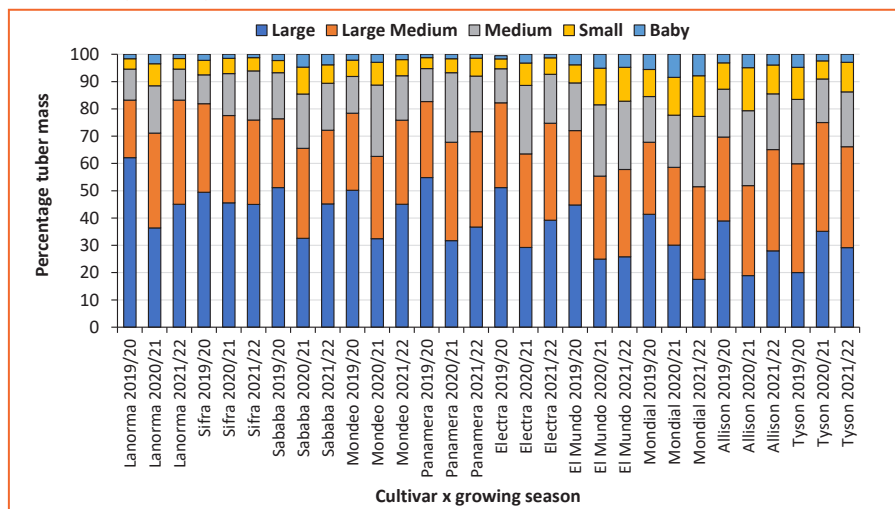


Figure 7: Percentage of tuber mass at the five grades for the ten cultivars in the three growing seasons.



the number of haulms produced per plant (Figure 6). The prolonged lack of rain after planting in the 2019/20 growing season reduced the energy levels in the tubers. This resulted in a significantly lower mean number of haulms per plant compared to the other two growing seasons.

While significant differences in the number of haulms per plant were measured between the three growing seasons for most cultivars, the numbers produced by Lanorma, Mondeo, Sifra and Tyson were not significantly different. El Mundo produced a significantly higher mean number of haulms per plant than the other cultivars. Panamera produced the lowest mean number of haulms per plant. Overall, the number of haulms per plant was significantly positively correlated to yield.

Table 2 indicates the number of days from planting to harvest of the cultivars in the 2019/20 growing season. Harvesting occurred approximately two weeks after 100% senescence. The number of days to 90% senescence was not recorded in the 2019/20 growing season but was in the 2020/21 and 2021/22 growing seasons. El Mundo and Panamera had the shortest and longest growth periods, respectively, in both seasons. The mean number of days to 90% senescence was significantly less in the 2021/22 growing season compared to the 2020/21 growing season (122 days versus 125 days).

Tuber size

Despite the delayed emergence of the seedlings in the 2019/20 growing season, the adequate rainfall received after emergence contributed to a significantly higher mean percentage mass of Large tubers compared to the latter two growing seasons (Figure 7).

This result could also have been due to fewer tubers produced per plant and therefore less competition, which allowed the tubers to enlarge. A significant interaction was measured for the percentage mass of Large tubers between the growing seasons and cultivars. However, no significant differences were measured for Sifra

between the growing seasons. The highest mean percentage mass of Large tubers was produced by Lanorma, but the value was not significantly different to those of Sifra, Sababa and Mondeo.

No significant interaction was measured between the seasons and cultivars for the percentage mass of Large Medium tubers. A significantly lower mean percentage of Large Medium tubers was measured in the 2019/20 growing season. Tyson had the highest mean percentage of Large Medium tubers, but the

value was not significantly different to those of Allison and Electra. Overall, the mass percentages of all grades were not significantly correlated to yield.

Good yields produced

The rainfall received from tuber initiation to the end of bulking in the three growing seasons was sufficient to ensure that good yields were produced (Figure 8). Due to the slow emergence of the cultivars and the fewer haulms/plant in the

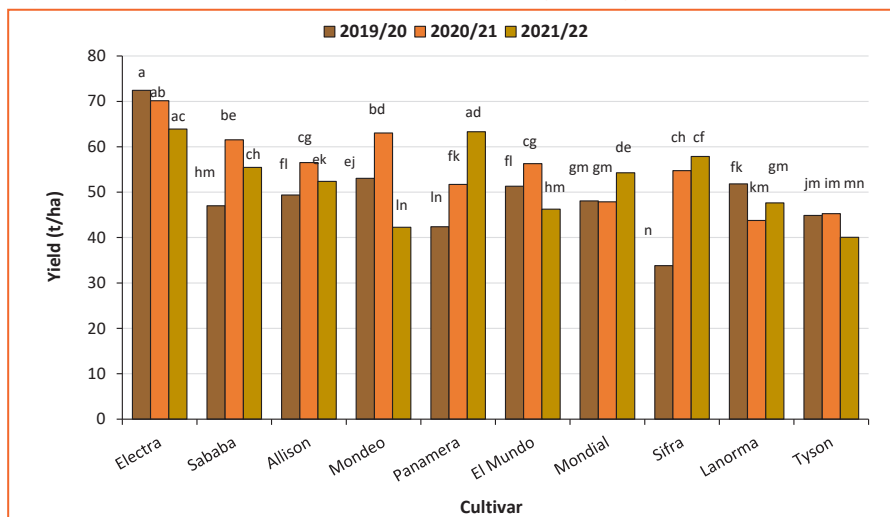


A dryland potato cultivar evaluation trial at the Cedara Research Station.

Table 2: Number of days after planting to harvest of the ten cultivars in the 2019/20 growing season and to 90% senescence in the 2020/21 and 2021/22 growing seasons.

Cultivar	2019/20	2020/21	2021/22	Mean
	Harvest (DAP)	90% senescence (DAP)		
Allison	167	124.3 ef	116.3 hi	120.3
El Mundo	160	112.0 ij	107.5 j	109.7
Electra	167	129.3 ce	119.0 gh	124.2
Lanorma	174	127.0 de	128.0 de	127.5
Mondeo	167	134.0 ac	132.0 bd	133.0
Mondial	174	131.7 bd	137.3 a	134.5
Panamera	167	134.0 ac	136.7 ab	135.3
Sababa	167	121.7 fg	116.0 hi	118.8
Sifra	154	119.0 gh	119.3 gh	119.2
Tyson	154	114.3 hi	107.7 j	111.0
Mean	165	124.7	122.0	123.4
LSD (P<0.05) season			1.641	
LSD (P<0.05) cultivar			3.669	
LSD (P<0.05) season x cultivar			5.188	
CV%			2.5	

Figure 8: Yield of the ten cultivars in the three growing seasons.



2019/20 growing season, the mean yield (49.42 t/ha) was significantly lower than in the 2020/21 growing season (55.10 t/ha), during which the rainfall was more evenly distributed.

Although a significant interaction was measured for yield between the growing seasons and the cultivars, no significant differences were measured for Allison, Electra, Lanorma and Tyson, indicating that these cultivars had greater yield stability despite the climatic variations between the growing seasons. Electra produced the highest yields in all three growing seasons. Tyson produced the lowest mean yield.

Conclusions and recommendations

When seed potato tubers lie dormant in very dry soil for an extended period after planting, the seeds must be of good quality to ensure that they remain viable.

Due to high rainfall in the KwaZulu-Natal Midlands, good yields (>50 t/ha) are obtainable under dryland conditions with most cultivars. However, the performance of the ten cultivars evaluated may have varied considerably compared to the results obtained if they were grown under much drier conditions.

Electra produced the highest yields in all three growing seasons and therefore it is recommended for growing under dryland conditions in the KwaZulu-Natal Midlands. 🍅

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