Eastern Free State dryland cultivar trial at Reitz in 2022/2023

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The Eastern Free State is a large potato production area where 48 of the country's producers are producing a substantial portion of the country's commercial potatoes on approximately 9 384 ha.
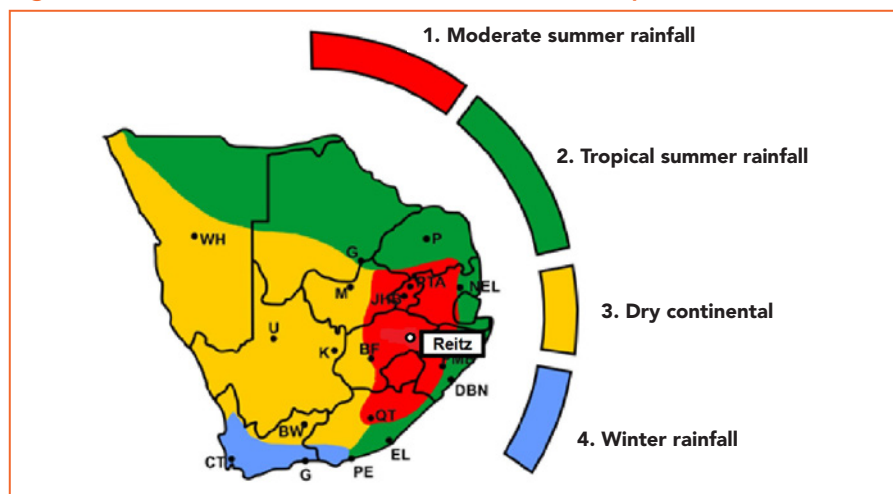
The most prominent cultivars produced for table usage in this area are Mondial, Lanorma and Panamera.

Reitz is located in South Africa's temperate rainfall area (*Figure 1*) and has been receiving an average rainfall of 509 mm (local ARC weather station) over the past 19 years. The region is characterised by warm summers and very cold winters, with frost occurring from mid-May to early September.

The Reitz cultivar trial was laid out in a randomised block design with three replications per cultivar. *Table 1* contains additional technical information relating to the trial. Soil samples were taken prior to planting to determine the soil nutrient status of the trial site (*Table 2*).

Differences in growing periods

The cultivar trial included cultivars with short and long growing periods. Hence, growing periods can influence the eventual yield of certain cultivars. The length of growing periods is subject to the nature of the season, but is regarded as the amount of time that lapses from emergence to natural leaf senescence.

Figure 1: Location of Reitz in the Eastern Free State production area.

1. Moderate summer rainfall

2. Tropical summer rainfall

3. Dry continental

4. Winter rainfall

Table 1: Summary of technical information regarding trial site and layout.

Farm	Middelbult (Fick & Seun Bdy)			
Co-worker	Geyer Terblanche			
Planting date	21 October 2022			
Harvest date	16 March 2023			
Irrigation/dryland	Dryland			
Double or single rows	Staggered – double rows in contour			
Leaf senescence	Natural			
Interrow spacing	0.9 m			
In-row spacing	45 cm			
Trial site	18 m^2			
Fertilisation programme	Nutritional value			
	N (kg/ha)	P (kg/ha)	K (kg/ha)	Ca (kg/ha)
Total	120.35	69.01	113.8	31.0

Table 2: Soil nutrient status of the trial site before planting.

pH (H$_2$O)	P Mehlich III (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	K (ppm)	B (ppm)	Fe (ppm)	Cu (ppm)	B (ppm)	Mn (ppm)
5.6	61	178	265	62	178	0.42	148	2.0	0.42	46

Table 3: Cultivar characteristics relating to growing period, plant readiness, plant population (%) and haulm counts.

Cultivar	Growing period (days)[1]		Plant readiness[2]	Plant population (%)	Haulms per plant	Haulms per ha
11Z49A1	Medium	(100)	3	83	4	81 974
11Z55A5	Medium	(100)	3	65	3	48 147
Allison	Medium to long	(120)	1	72	7	124 442
Alverstone Russet	Medium to long	(100)	1	70	4	69 134
Amany	Medium to long	(110)	3	83	3	61 480
Belmonda	Medium	(100-110)	3	56	5	69 134
CMK2012	Long	(120)	1	72	5	88 887
CMK2015	Long	(120)	1	65	4	64 196
Foxy	Short to medium	(90-100)	3	77	5	95 060
Kelly	Long	(120)	3	95	5	117 282
Lady Alicia	Medium	(95-100)	2	32	3	23 703
Lanorma	Short	(80-90)	3	83	3	61 480
Lilly	Medium	(100)	3	70	5	86 418
Mondial	Short to medium	(95-100)	1	79	3	58 517
Noya	Short	(80-90)	3	72	3	53 332
Palace	Long	(110-115)	1	74	4	73 085
Panamera	Short to medium	(95-100)	1	83	4	81 974
Prince	Long	(110-115)	1	81	2	39 999
Sababa	Medium to long	(110-115)	2	81	3	59 999
Sifra	Short to medium	(90-100)	2	70	4	69 134
Sound	Medium	(95-100)	1	70	7	120 985
Tyson	Short to medium	(90-100)	2	68	4	67 159

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): Short = 70-90 days; Short to medium = 80-100 days; Medium = 90-110 days; Medium to long = 90-120 days; Long = 90-140 days.
[2]Plant readiness of tubers: 1 = Fresh; 2 = Slightly fresh; 3 = Plant ready; 4 = Slightly old; 5 = Old.

Table 3 illustrates how the growing periods differ among cultivars. *Table 3* also indicates the plant readiness of tubers at the time of planting of the trial, as well as the plant population and haulm count observed later in the growing period.

Cultivar performance and yield

The evaluation of new cultivars such as those in the Reitz cultivar trial, among others, delivers results regarding yield and marketing index. The marketing index of the cultivars in question are classed and sorted according to quality and size group, for example class 1 Large or class 2 Large medium.

Similar price comparisons are then made to market prices as obtained at the time of harvest. The performance of new cultivars cannot be based on one specific season only, as climate can vary from one year to the next. Therefore, cultivars

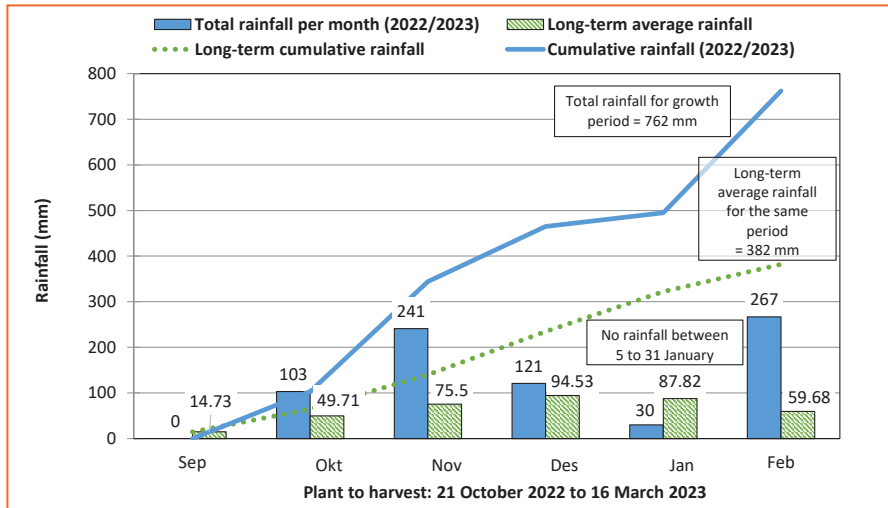**Figure 2: Rainfall in the 2022/23 season as well as long-term average rainfall.**

Figure 3: Minimum and maximum temperatures in the 2022/23 season as well as long-term temperatures.
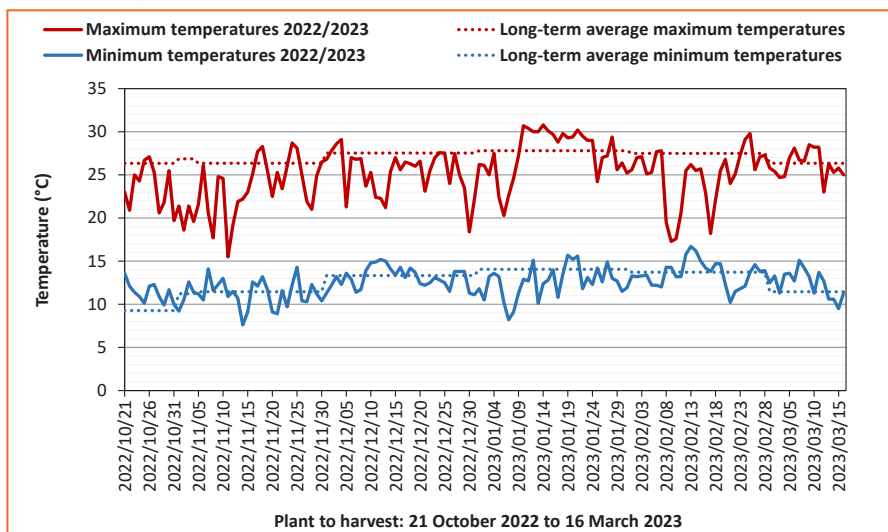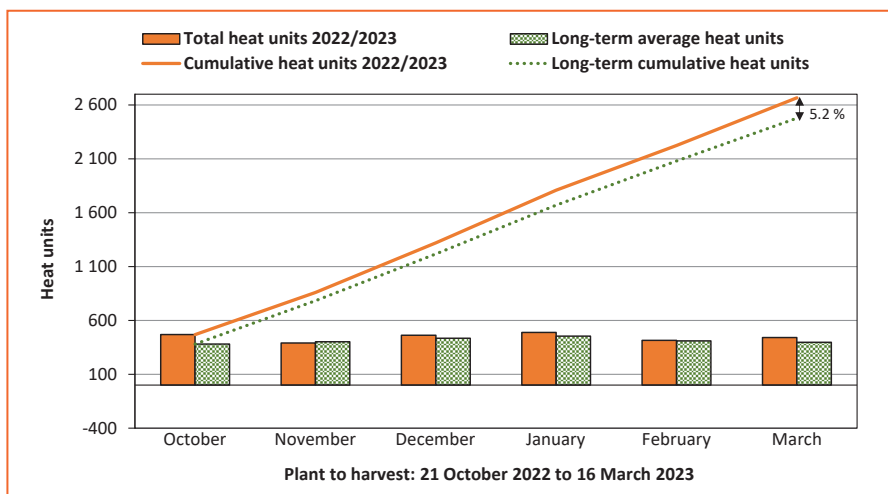

Figure 4: Heat units in the 2022/23 season as well as long-term average heat units.

Total heat units determined specifically for potatoes as a crop (threshold temperature = 5°C). Calculated from hourly data.

are tested across a number of seasons.

Seasonal aspects

As with any crops, aspects such as temperature, availability of water (whether good irrigation scheduling or rainfall) as well as heat units are all important factors that have a fundamental influence during the potato plant's growth period. Relevant daily and long-term weather data is obtained from a nearby Hortec weather station as well as a selected ARC weather station located as close as possible to the trial site.

The 2022/23 season (*Figure 2*) was characterised by above-average rainfall. During the later stages of the growing period in January, no rainfall was recorded. This was followed by excessively high rainfall in the form of regular showers during the last month of growth. These observations were reflected in quality problems recorded as malformation.

Figure 3 contains minimum and maximum temperatures. Along with the months of above-average rainfall, the season was also characterised by major fluctuations in maximum temperatures.

The collection of heat units during a growing period is a vital aspect in the development of a potato plant. The trend of heat units available for the season's cultivar trial at Reitz seems to be higher than the long-term data for heat units, even though above average high temperatures were recorded in October prior to planting time. More heat units were accumulated later on in the growing period than the long-term data tendency reflects, despite the above-average rainfall and numerous overcast days throughout the season (*Figure* 4).

Yield data collected during harvest is subjected to statistical processing using the GenStat® program. The Tukey test of least significant differences (LSDs) is used to separate the average. The cultivar effect during this specific trial (*Figure 5*) was statistically significant

Figure 5: Total yield per cultivar as a percentage of the trial average.
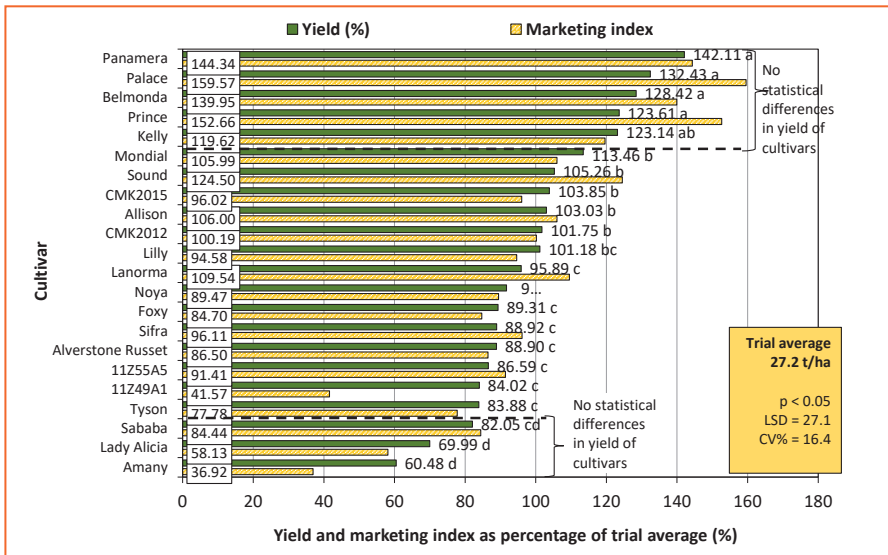
Values followed by the same letter do not differ significantly from one another.

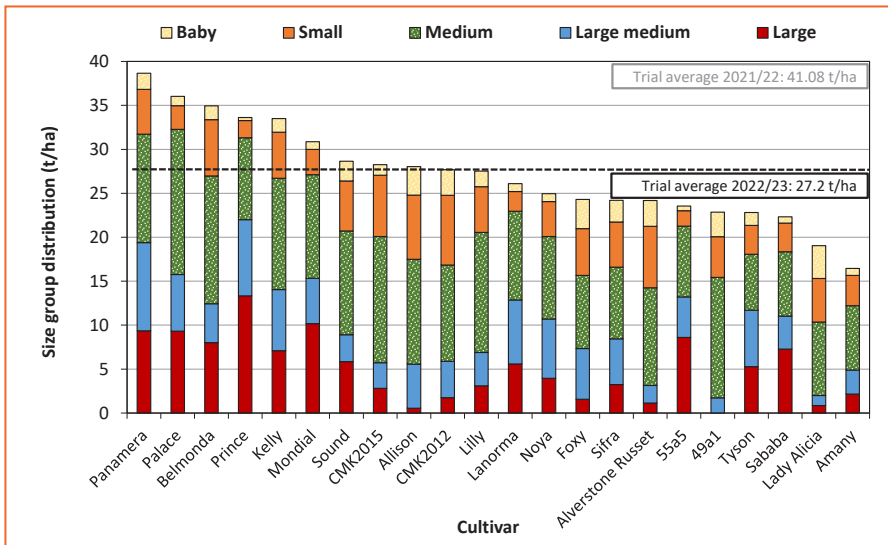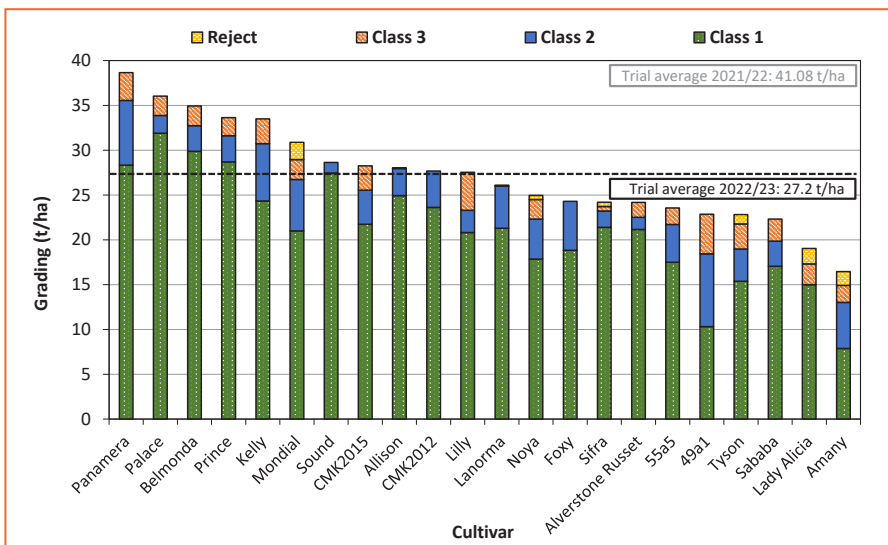**Figure 6: Size group distribution of each cultivar in the trial.**

Figure 7: Grading of each cultivar in the trial.

(p<0.05) while the coefficient of variation was within limits (16.4%). These factors serve to indicate that the trial was performed as well as possible amid challenging weather conditions; and porcupine damage, the results are reliable.

Yields and marketing index

The yield of each of the cultivars is divided by the trial average (the trial average of all the cultivars is taken as 100%). This is used to determine a yield index, with each cultivar's performance in terms of yield then read as a percentage of the trial average.

During this season, the trial site was plagued by porcupines and consequently missing values had to be used to successfully analyse the data. The GenStat® program effectively yields values through calculations based on the available data set. It is important to take note of the fact that it could have an influence on the data outcomes.

The average yield of the trial for the 2022/23 season is 27.2 t/ha, which is substantially lower than the previous season's average of 41.08 t/ha. Several types of blight were also noticed to lesser and greater degrees on the cultivars during the season. Panamera, Palace, Belmonda, Prince and Kelly delivered the best yields with no statistical difference in the yield. Panamera, Palace, Belmonda and Prince obtained the best marketing index.

A good marketing index is ascribed to a higher yield of large potatoes and/or a good percentage of good quality. Size group distribution and grading are indispensable evaluations when studying a cultivar's marketability (*Figure 6* and *7*).

Quality and downgrading

The main reasons for downgrading are indicated in *Table 4*. Given the weather conditions, the quality of the cultivars was generally good and very little moth damage was reported. Due to the nature of the season, the quality of the cultivars in

Table 4: Main reasons for downgrading.

Cultivar	Malformation	Fissure scab	Moths	Insects	Common scab	Growth cracks	Stem-end rot
11Z49A1				x	x		
11Z55A5		x					
Allison							
Alverstone Russet							
Amany	x						
Belmonda							
CMK2012							
CMK2015							
Foxy							
Kelly					x	x	
Lady Alicia							
Lanorma				x			
Lilly							
Mondial	x		x			x	
Noya							
Palace			x				
Panamera	x						
Prince				x		x	
Sababa	x						x
Sifra							
Sound			x				
Tyson							

No internal defects such as hollow heart or brown spot were present in any of the cultivars.

The average yield of the 2022/23 season's trial is 27.2 t/ha. This is substantially lower than the previous season's average of 41.08 t/ha.

Table 5: Processing characteristics of cultivars. (Performed by ARC-Roodeplaat).

| Cultivar	Chip colour[1]	SG[2]	DM (%)[3]
11Z49A1	55	1.080	20.13
11Z55A5	45	1.075	19.24
Allison	48	1.080	20.14
Alverstone Russet	61	1.088	21.91
Amany	50	1.068	17.58
Belmonda	58	1.066	17.18
CMK2012	61	1.076	19.39
CMK2015	56	1.082	20.72
Foxy	49	1.077	19.56
Kelly	56	1.085	21.26
Lady Alicia	61	1.105	25.56
Lanorma	50	1.096	23.66
Lilly	48	1.072	18.62
Mondial	52	1.068	17.63
Noya	53	1.077	19.64
Palace	39	1.077	19.66
Panamera	50	1.070	18.06
Prince	54	1.085	21.26
Sababa	58	1.073	18.79
Sifra	45	1.077	19.56
Sound	50	1.074	18.99
Tyson	42	1.086	21.55

[1]Chip colour with a value >50 and without defects is acceptable to the dry chip industry.
[2]Specific gravity of >1.075 is acceptable for the processing industry.
[3]The percentage of dry matter is a calculated value:
DM% = 24.182 + 211.04 * (SG-1.0988). The actual percentage value will differ slightly between varieties from this calculation value.

Figure 8: Performance of cultivars included in the trial for both years, expressed as a percentage of the trial average.
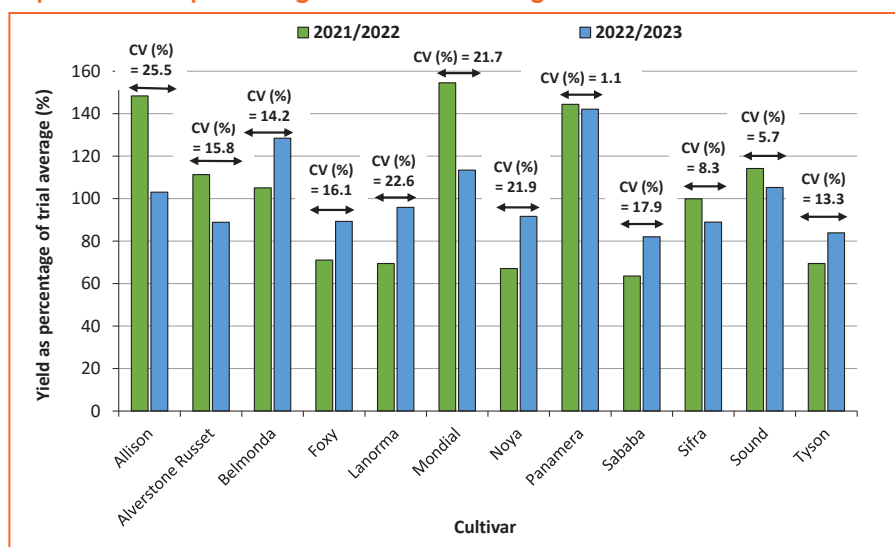
Coefficient of variation (CV %) is included in the graph: A value which essentially portrays the degree of difference in performance of a specific cultivar over the number of years in question. The greater the CV % value, the greater the variation in the cultivar's performance over the number of years depicted on the graph.

the trial was affected by malformation and growth cracks.

The performance of cultivars vary from season to season. This is simply because climate is never the same from one season to the next. Therefore it is very important to consider consistent cultivar performance across a number of seasons. This trial was conducted over a period of two years and the variation among cultivars is illustrated in *Figure 8*.

Lastly, when looking at the internal quality of potatoes, an evaluation can also be done of its processing characteristics. To meet these processing characteristics, cultivars must meet a chip colour norm of >50 and a specific gravity (SG) of ≥1.075 (*Table 5*). Various cultivars exhibited the required chip colour and met the SG requirement. C

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