



Limpopo cultivar trial under irrigation at Tom Burke in 2022

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The Limpopo production region produces approximately 22% (2021 harvest year) of the total potato production, which makes it the highest in South Africa.

The region plants potatoes under irrigation for the table and processing markets.

Trials are executed at Tom Burke, which is basically located on Botswana's border. Tom Burke is a tropical

summer rainfall area with an annual average rainfall of 371 mm throughout the year (*Figure 1*). Very hot summers occur while winters are cold with black frost occurring in June and July.

The trial was carried out in a randomised block design in sandy loam soil with three replications. Additional technical information regarding the trial site and layout is summarised in *Table 1*.

Soil samples were taken prior to planting to determine the soil nutrient status of the trial site. The results of the soil analyses for this trial are contained in *Table 2*.

It is important to note that growth periods can affect the crop yield of cultivars. Growth periods are defined as the number of days from emergence to leaf senescence, depending on the season. The exact timing of the four growth phases depends on

Figure 1: Location of Tom Burke in the Limpopo production region.

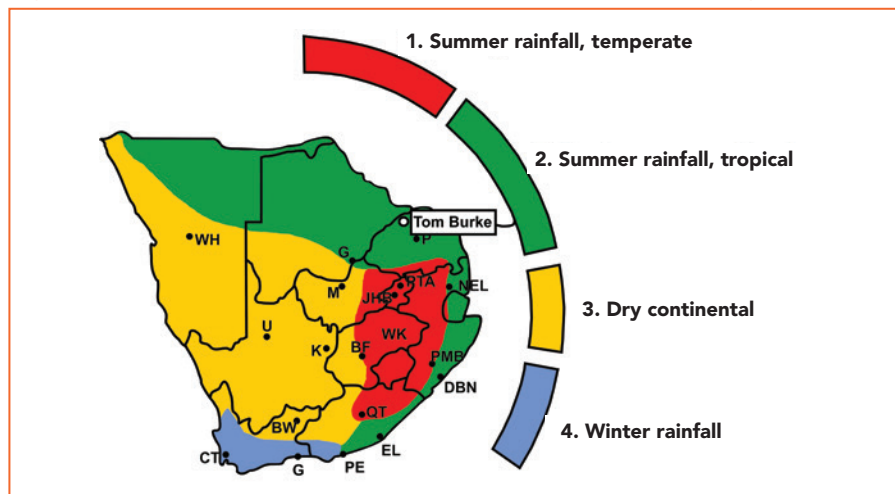


Table 1: Summary of technical information regarding the trial site and layout.

Farm	Ratho Farm
Producer	Jako Nel
Planting date	19 May 2022
Harvest date	19 October 2022
Irrigation/dryland	Irrigation
Double or single rows	Double rows
Leaf senescence	Natural
Intra-row spacing	0.75 m
Inter-row spacing	0.30 m
Trial site per unit	15 m ²
Population density	44 444 plants/ha

Table 2: Soil nutrient status of the Tom Burke cultivar trial prior to planting, 2022.

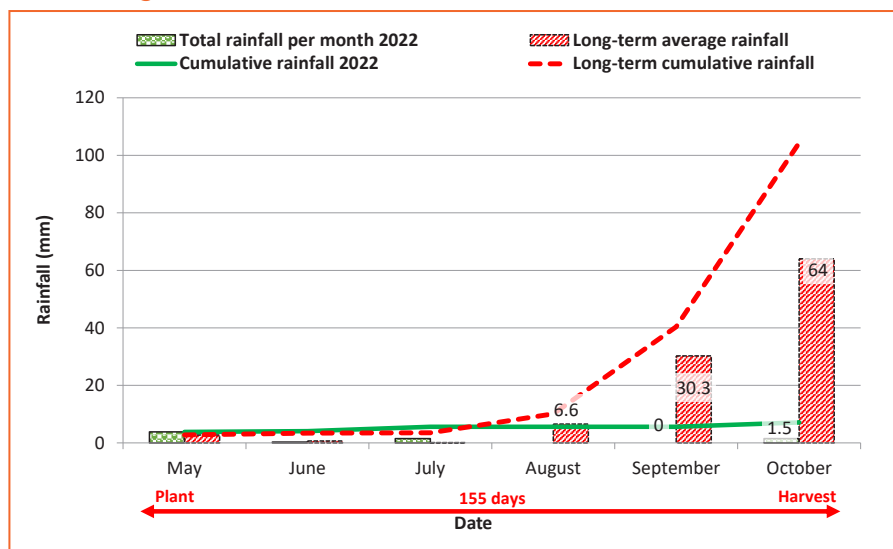
Gross density (kg/m ³)	pH (H ₂ O)	P-Mehlich	Ammonium acetate						% van CUC ¹			
		P	K	Ca	Mg	Na	S	K	Ca	Mg	Na	
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	%	%	%	
1.49	8.21	62	152	616	218	27	2	7.24	57	33	2.18	

¹CUC = cation exchange capacity.

Clay% = 6	Silt (%) = 16	Sand % = 78
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Fertilisation programme							
	Nutrient status						
	N	P	K	Ca	Mg	S	
	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Total	271.9	72.8	283	1 004.1	72	336.4	

Figure 2: Rainfall during the 2022 growing season, as well as the long-term average rainfall.



the environment and management practices that vary between localities as well as cultivars due to, among others, different growth periods. The cultivars, plant readiness of tubers, population density (%) and haulm count of this trial are indicated in Table 3.

Seasonal influences

Temperature, daylight length and water are the most important abiotic factors influencing the growth patterns, yield and quality of potatoes. To determine the adaptability of new cultivars in the Tom Burke area, it is important to consider these factors when evaluating the performance of different cultivars. It is also important that the cultivars are evaluated across several seasons, since climate differs from one season to the next.

Daily weather data was obtained from the Hanover station on the trial site, whereas the long-term weather data was obtained from the Agricultural Research Council’s (ARC) Swartwater station (-22.85186, 28.19898). Small amounts of rainfall were recorded throughout the growing season. In the 2022 growing season a total of 7.11 mm of rain was recorded. This is lower than the long-term average rainfall of 104.3 mm (Figure 2).

The minimum as well as maximum temperatures (Figure 3) for the 2022 growing season were consistently lower than in previous years. During August to October of the growing season, the maximum temperature fluctuated significantly and was between 35 and 42°C for 34 days and above 30°C for 72 days.

The optimal average air temperature for tuber filling varies between 14 and 22°C. When temperatures rise above 29°C, little or no tuber growth will take place as carbohydrates are then used for respiration. No frost damage was recorded during the growing season.

Effect of heat units

Heat units are also an important factor to consider since the development

of the plant is largely based on the collection of heat units. It is therefore assumed that the plant must collect a certain number of heat units to complete a developmental phase.

The heat units for the 2022 growing season were slightly lower than the long-term average heat units and are indicated in Figure 4. At the end of the season, the cumulative heat units of the long-term data were 30.4% lower than the cumulative heat units of this year's season.

Cultivar performance and yield

Yield data collected during harvest was subject to statistical processing using the GenStat® program and the mean was separated using the Tukey test of least significant differences (LSD). The cultivar effect of the 2022 trial (Figure 5) was statistically significant ($p < 0.05$) in terms of yield, while the coefficient of variation (CV) was low (16%). This indicates that the trials were well executed and that the results are reliable.

The average yield (77.7 t/ha) for the 2022 season was (27.3 t/ha) lower than the trial average of the previous three years (50.4 t/ha). During the 2022 trials (Figure 5) the cultivars Foxy, Sound, Valor, Panamera, Mondeo, Sifra and Sababa produced the highest yields and also delivered a higher yield than the trial average (77.7 t/ha).

In order to determine cultivar performance in terms of yield and quality, aspects such as yield,

Figure 3: Minimum and maximum temperatures (°C) during the 2022 growing season as well as the long-term temperature.

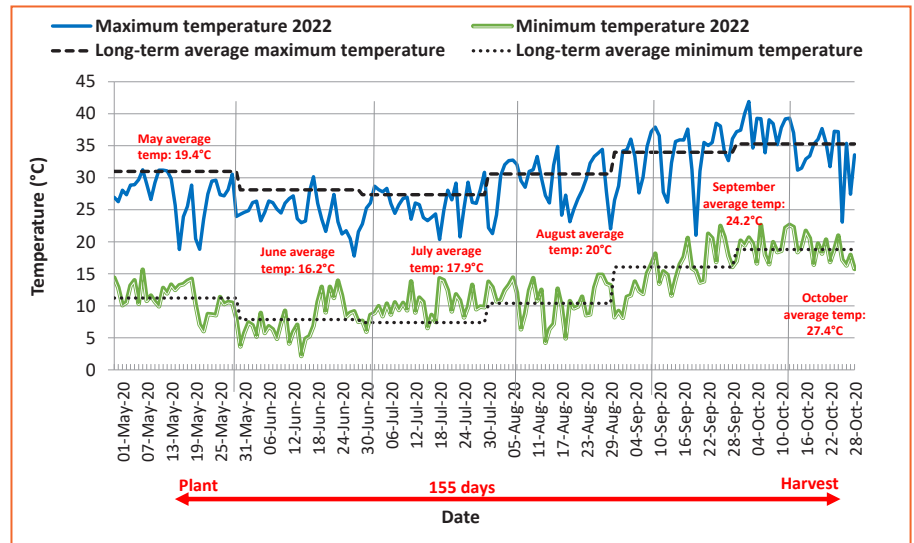
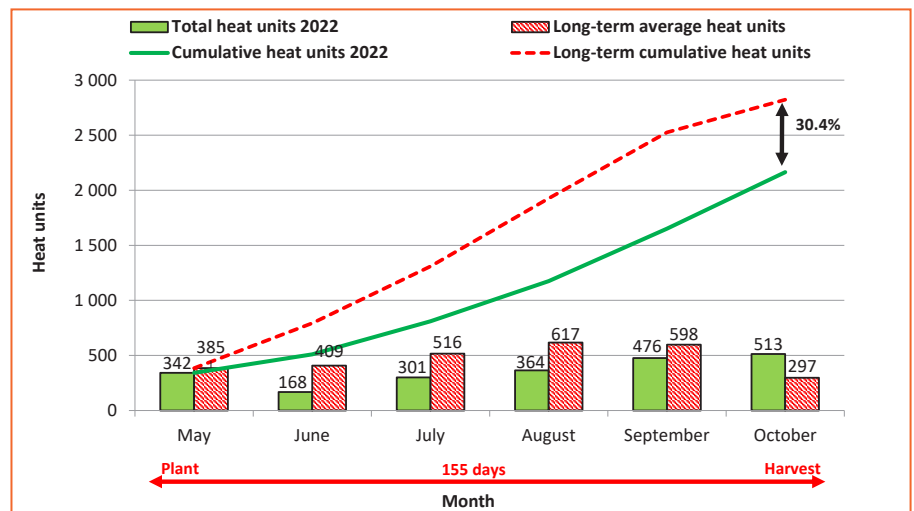


Figure 4: Heat units during the 2022 growing season, as well as the long-term average.



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



Table 3: Characteristics relating to growth period, plant readiness, population density (%) and haulm count for each cultivar in the 2022 Tom Burke cultivar trial.

Agent	Cultivar	Growth period (days) ¹		Plant readiness ²	Population density(%)	Haulms per plant	Haulms per ha
	Connect	Medium to long	(120)	1	100	2.9	128 888
	El Mundo	Short to medium	(90-100)	1	100	3.2	142 221
	Foxy	Short to medium	(95-100)	4	100	4.7	208 887
	Lanorma	Short	(80-90)	2	100	4.2	186 665
	Mondeo	Medium	(90-110)	1	100	3	133 332
	Mondial	Medium to long	(110-115)	4	93.9	3.8	158 585
	Panamera	Long	(120-125)	3	100	3.8	168 887
	Sababa	Medium to long	(110-115)	3	100	2.6	115 554
	Sifra	Short to medium	(90-100)	1	96.9	2	86 132
	Sound	Medium	(100)	4	90.9	4.8	193 918
	Tyson	Short to medium	(90-100)	2	96.9	2	86 132
	Valor	Medium	(100-110)	2	100	3.4	151 110
	Vicenta	-	-	1	100	1.4	62 222

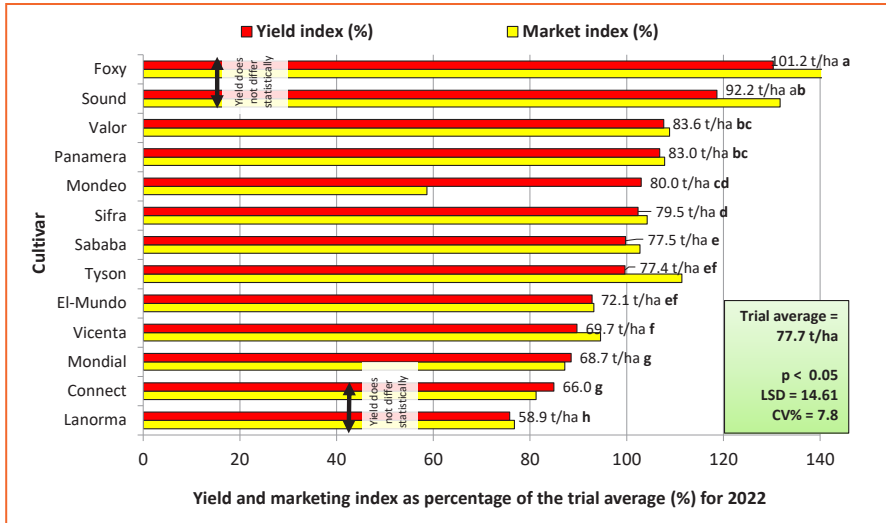
¹General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): Short: 70-90 days; Short to medium = 80-100 days; Medium = 90-110 days; Medium to long = 90-120; Long = 90-140 days.
²Plant readiness of seed potatoes: 1 - Fresh; 2 - Slightly fresh; 3 - Ready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

Table 4: Main reasons for downgrading during the 2022 Tom Burke harvest.

Cultivar	Growth cracks	Regrowth	Insect damage	Mechanical damage	Malformation	Moths	Abraded	Rhizoctonia	Common scab	Sand splitting	Silver scab and black dot	Stem-end rot	Greening	Rot
Connect														
El Mundo														
Foxy														
Lanorma														
Mondeo														
Mondial														
Panamera														
Sababa														
Sifra														
Sound														
Tyson														
Valor														
Vicenta														

<5% incidence
 5 tot 15% incidence
 >15% incidence

Figure 5: Total yield and marketing index 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 during final harvest.

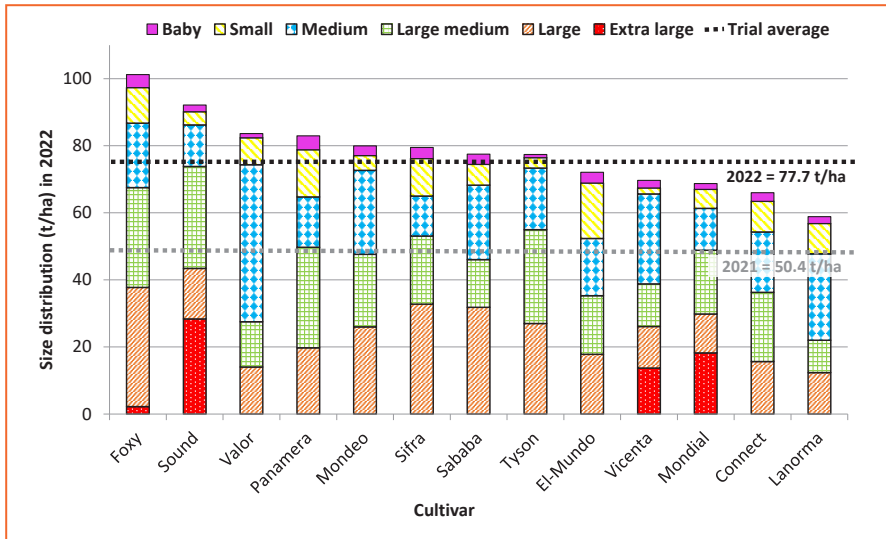
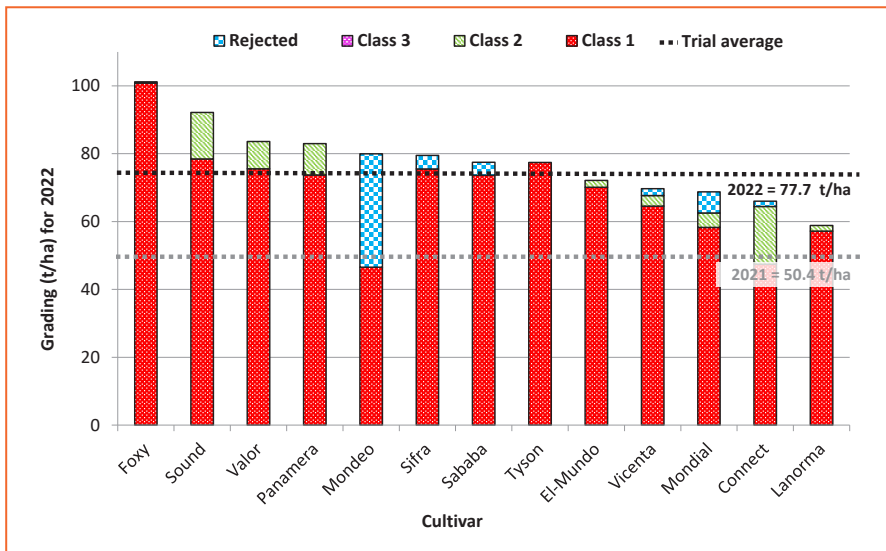


Figure 7: Grading of each cultivar during final harvest.



size-group distribution and class were considered to calculate a marketing index according to the average market prices for the day in question. The yield, multiplied by the prevailing price determined by the tuber size distribution and grading, provides the marketing index (Figure 5).

The highest marketing index, which was attained by Foxy and Sound, was the result of a high percentage of Large tuber size distribution (Figure 6) and a high percentage of Class 1 grading (Figure 7). Tuber size distribution and grading are also used to class potatoes. These factors are therefore crucial in ensuring an optimal, economically marketable yield.

Tuber size distribution is indicated in Figure 6, the grading of the yield in Figure 7, and the main reasons for the downgrading of the various cultivars are indicated in Table 4. High temperatures prior to harvest resulted in many downgrades because of regrowth.

Calculating yield potential

The LINTUL-POTATO-DSS plant growth model was used to calculate the potential potato yield of the control cultivar, Mondial (G4). Potential yield can be defined as the theoretical top yield limit in a situation in which water, nutrients and biological factors are optimal for the season during which the trial was grown. This information makes it possible to compare the actual yield obtained in the trial to simulated potential yields. The difference between the potential and actual yield is the yield gap. It illustrates how efficiently producers use their environment and available resources to achieve high yields.

The ratio between the actual (77.7 t/ha) and potential (85 t/ha) yield for this trial is 97%, revealing a small yield gap which indicates that the available environment was utilised efficiently. This means there are limited opportunities for further yield increases.

It is very important to note the consistency of cultivar performance

Table 5: Processing characteristics and internal quality for 2022. (Conducted by ARC-Roodeplaat).

Cultivar	Chip colour ¹	SG ²	Dry matter (%) ³	Hollow heart	Brown spot
Connect	50	1.071	18.38	0	0
El Mundo	48	1.065	17.05	0	0
Foxy	40	1.060	15.92	0	0
Lanorma	57	1.076	19.38	0	0
Mondeo	52	1.064	16.78	0	0
Mondial	57	1.071	18.24	0	0
Panamera	56	1.071	18.38	0	0
Sababa	60	1.066	17.27	0	0
Sifra	55	1.064	16.80	0	0
Sound	59	1.071	18.31	0	0
Tyson	56	1.067	17.44	0	0
Valor	52	1.074	18.96	0	0
Vicenta	54	1.076	19.26	0	0
≥ Norm (acceptable for processing)			<Norm (unacceptable for processing)		

¹Chip colour with a value of >50 and without defects is acceptable for the chip industry.

²Specific gravity of >1.075 is acceptable for the processing industry.

³The percentage dry matter is a calculated value: $DM\% = 24.182 + 211.04 * (SG - 1.0988)$. The actual percentage value will differ slightly between varieties based on this calculating value.

despite climate fluctuations over time. Figure 8 illustrates the three-year data for the cultivar trials in the Tom Burke production area. The coefficient of variation of every cultivar over three years is indicated above each cultivar. It would seem that Lanorma and

Sound are showing the least variation for the Tom Burke area.

Furthermore, it is also important to focus on the internal quality of the product to ensure economical, optimally marketable returns and, hence, profitability. This includes

important factors such as processing properties, specific gravity (SG) and internal defects (hollow heart and brown spot) which are summarised in Tables 5 and 6.


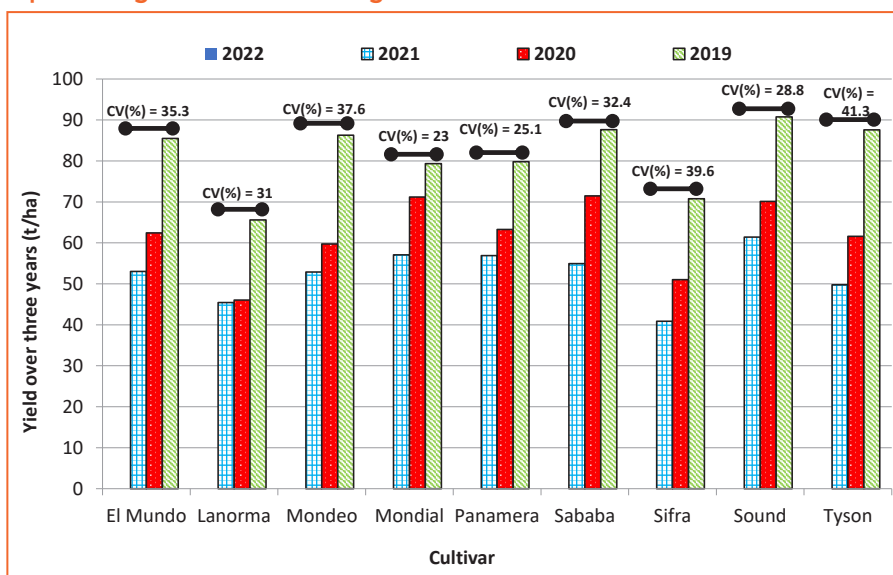
During the 2022 growing season, all the cultivars except El Mundo and Foxy met the norm of >50 for processing. Regarding SG, only Lanorma and Vicenta adhered to the norm of ≥1.075 for processing. No cultivar showed internal defects. 

Figure 8: Performance of cultivars measured over three years, indicated as a percentage of the trial average.



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