KwaZulu-Natal cultivar trial under irrigation at Greytown in 2022/23

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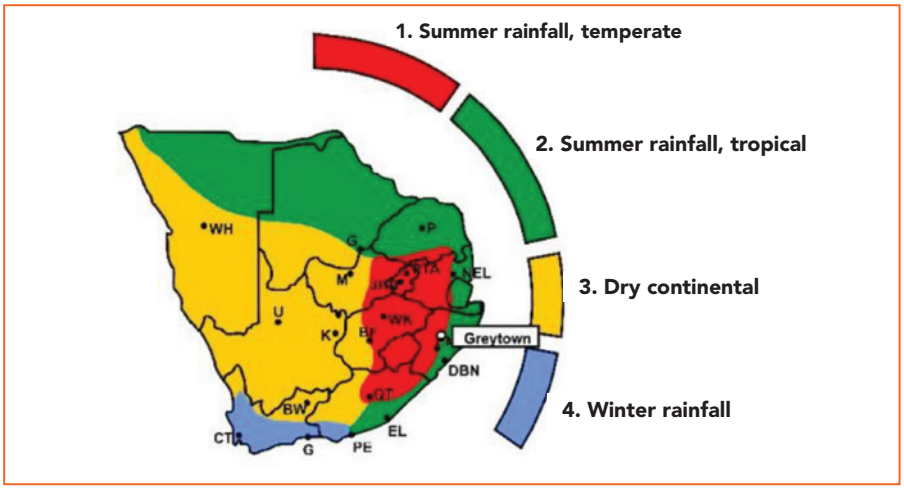
The KwaZulu-Natal production region produces approximately 5% of the South African potato crop. The region plants potatoes both under irrigation and on dryland, and cultivates them for the seed, table and processing markets. The main cultivars earmarked for the table and processing markets include Mondial, Valor and Sifra in winter, and Valor, Mondial, Fianna, Up-to-Date and Lanorma in summer. Popular cultivars for seed potatoes produced in this area are Mondial, Valor and FL2108.

Figure 1: Location of Greytown in the KwaZulu-Natal production region.



Trial location and design

This trial was conducted at Greytown, a town situated 1 155 m above sea level on the banks of the Umvoti River in a fertile timber-producing area of KwaZulu-Natal. Greytown is located in a warm and temperate area with a significant annual average rainfall of 688 to 1 140 mm throughout the year (*Figure 1*). Greytown has two production seasons, namely a winter season with planting taking place from February to July, and a summer season with planting that takes place from August to January.

The trial was carried out in sandy loam soil and laid out in a randomised block design with three

The cultivars Allison, Mondial, Panamera, Noya and Lanorma statistically produced the highest yields.

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

Farm	**Golden Grow**
Planting date	23 August 2022
Harvesting date	24 January 2023
Irrigation/ dryland	Irrigation
Double or single rows	Two single rows
Leaf senescence	Chemical
Intra-row spacing	0.75 m
Inter-row spacing	30 cm
Trial site per unit	15 m^2
Population density	44 444 plants/ha

Figure 2: Rainfall (2022/23 season) and long-term average rainfall.

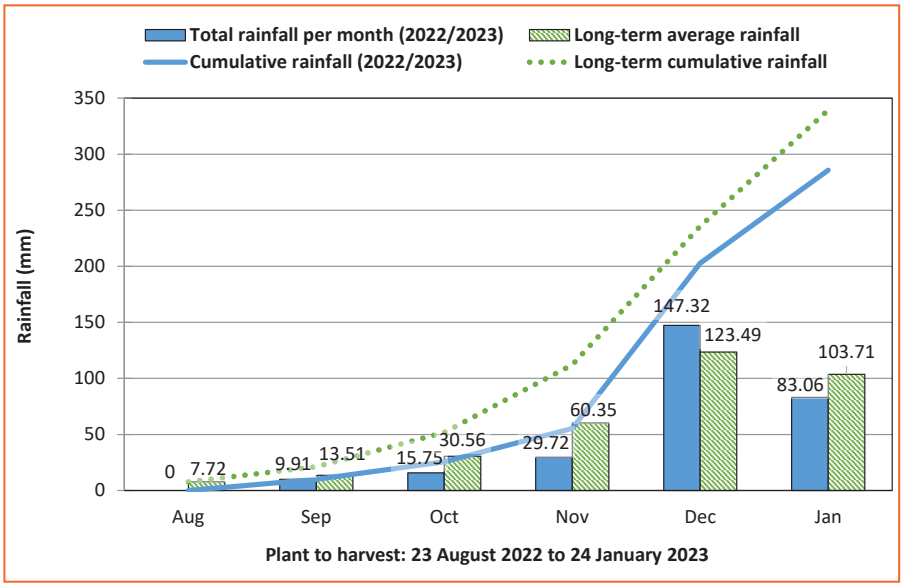
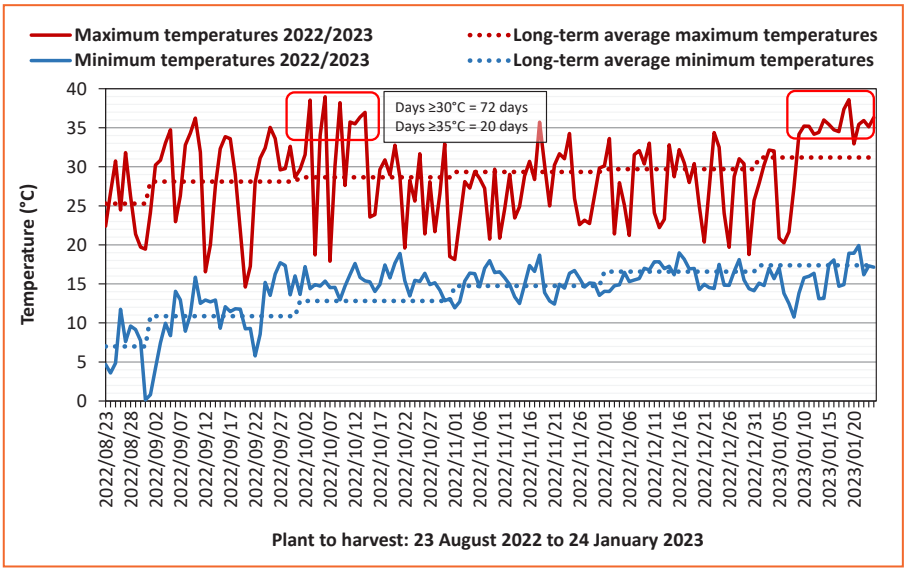


Figure 3: Minimum and maximum temperatures (2022/23 season) as well as long-term average.



replications per cultivar. Additional technical information regarding the trial site and layout is summarised in *Table 1*. 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 variation between cultivars during the four growth phases depends on the environment and management practices. This varies among cultivars due to different growth periods combined with the factors mentioned previously. The cultivars, plant readiness of tubers, population density (%) and haulm count of this trial are indicated in *Table 2*.

Temperature and weather

Temperature, daylight length and water (be it rainfall and/or irrigation scheduling) are the most important abiotic factors influencing the growth, yield and quality of potatoes. To determine the adaptability of new cultivars in the Greytown 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 Agricultural Research Council's (ARC) Ivala Muden Station (-28.97029, 30.37931) located 30 km from the trial site. The rainfall trend of the 2022/23 growing season was lower than the long-term average trend with most months receiving less rainfall in total than usual (*Figure 2*). However, intense rain showers were reported as challenges experienced during the growing season despite the moderate rainfall reflected in the available weather data.

The minimum as well as maximum temperatures (*Figure 3*) for the 2022/23 growing season followed the same trend as in previous years, with the exception of extremely high maximum temperatures (>35°C) recorded in early to mid-October and again in January.

The minimum temperatures, on the other hand, were slightly higher at the end of September until November compared to the long-term data. Significant fluctuating temperatures throughout the growing season were also observed, with temperatures higher than 35°C for 20 days and temperatures higher than 30°C for 72 days in total throughout the growing season.

Heat units are also an important factor to consider in terms of plant growth. The trend of heat units for the 2022/23 growing season followed more or less the same trend as the long-term average, as is depicted in *Figure 4*. At the end of the season, the heat units of the 2022/23 growing season were 1.9% higher than the long-term cumulative heat units.

Data relating to yields

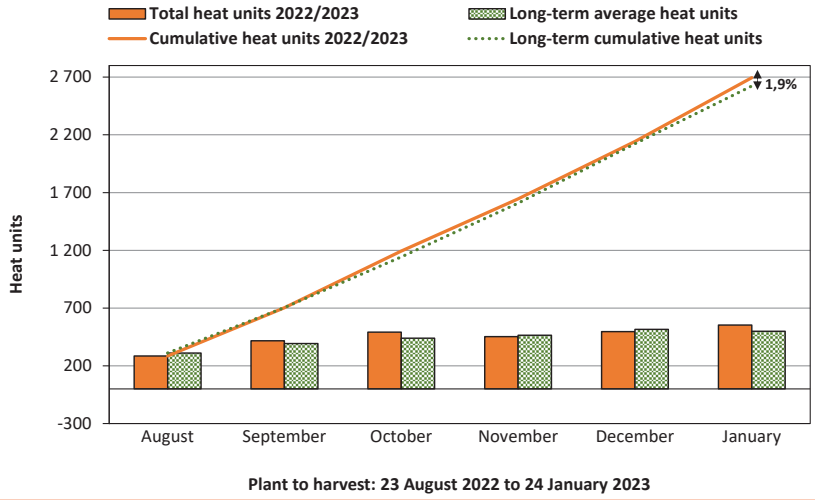
Yield data collected during harvest was subjected to statistical processing using the GenStat® program. The Tukey test of least significant differences (LSD) was used to separate the mean. The cultivar effect of the 2022/23 trial (*Figure 5*) was statistically significant ($p < 0.05$) in terms of yield, while the coefficient of variation (CV) was within specifications (19.8%). This indicates that the trials were well executed and that the results are reliable.

The average yield for the 2022/23 season was 42.16 t/ha whereas the previous season's was 65.9t/ha. This may largely be attributed to environmental challenges – despite the seemingly moderate rainfall per month as recorded in the available weather data, large and intense rainfall showers contributed to challenges during the growing season.

Cultivar performance

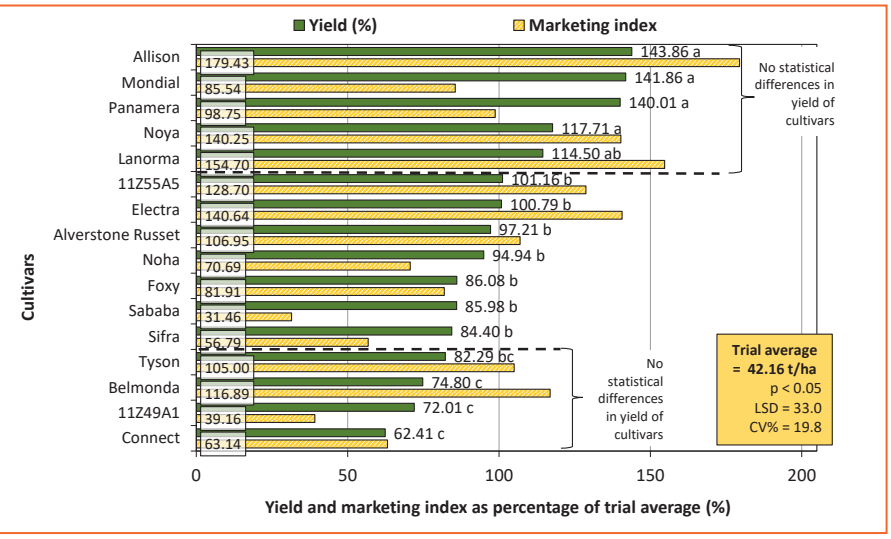
During the 2022/23 trials (*Figure 5*) the cultivars Allison, Mondial, Panamera, Noya and Lanorma statistically produced the highest yields. To determine cultivar performance in terms of yield and quality, the researchers utilised yield, size-group distribution and class to calculate a marketing index according

Figure 4: Heat units (2022/23 season) as well as long-term average.



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

Figure 5: Total yield and marketing indices per cultivar as a percentage of the trial average.



**Values followed by the same letter do not significantly differ from one another.*

The variation between cultivars during the four growth phases depends on the environment and management practices.

Table 2: Growing periods, plant readiness, population density (%) and haulm count.

Agent	Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)[3]	Haulms per plant	Haulms per hectare
GWK	11Z49A1	Medium	(100)	2	76	3.0	67 555
GWK	11Z55A5	Medium	(100)	3	74	7.0	65 777
	Allison	Medium to long	(120)	3	74	2.9	65 777
	Alverstone Russet	Medium to long	(110-115)	3	74	4.6	65 777
GWK	Belmonda	Short to medium	(100)	1	72	2.3	63 999
GWK	Connect	Medium to long	(120)	3	67	4.7	59 555
	Electra	Medium	(110)	2	85	3.2	75 555
RSA	Foxy	Short to medium	(90-100)	4	94	2.1	83 555
GWK	Lanorma	Short	(80-90)	1	94	6.2	83 555
	Mondial	Short to medium	(95-100)	3	88	2.9	78 221
GWK	Noha	Long	(120)	1	85	1.5	75 555
GWK	Noya	Medium	(100)	2	74	2.8	65 777
	Panamera	Long	(120-125)	3	97	3.3	86 221
	Sababa	Medium to long	(110-115)	3	72	5.3	63 999
	Sifra	Short to medium	(90-100)	3	72	5.6	63 999
	Tyson	Short to medium	(90-100)	3	67	3.2	59 555

[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; Long = 90-140 days.*
[2]*Plant readiness of seed potatoes: 1 - Fresh; 2 - Slightly fresh; 3 - Ready for planting; 4 - Slightly old; 5 - Old.*
[3]*Population density was determined on one replication of each cultivar, which consisted of two rows with 34 plants, equating to 68 plants per unit.*

Table 3: Processing characteristics and internal quality of the cultivars in the 2022/23 trial (Conducted by ARC-Roodeplaat).

Cultivar	Chip colour[1]	SG[2]	Dry matter (%)[3]	Hollow heart	Brown spot
11Z49A1	48	1.070	18.1		
11Z55A5	60	1.077	19.5		
Allison	50	1.069	17.9		
Alverstone Russet	35	1.083	20.8		
Belmonda	50	1.072	18.5		
Connect	38	1.060	16.1		
Electra	59	1.062	16.3		
Foxy	37	1.057	15.3		x
Lanorma	61	1.062	16.4		
Mondial	35	1.060	16.0		
Noha	36	1.064	16.8		x
Noya	35	1.072	18.6	x	
Panamera	50	1.073	18.7		
Sababa	49	1.063	16.5		
Sifra	35	1.065	17.0		
Tyson	56	1.069	17.9		
≥ Norm (acceptable for processing)			<Norm (unacceptable for processing)		

[1]*Chip colour with a value of >50 and without defects is acceptable for the 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 based on this calculating value.*

Figure 6: Size group distribution of each cultivar during final harvest.

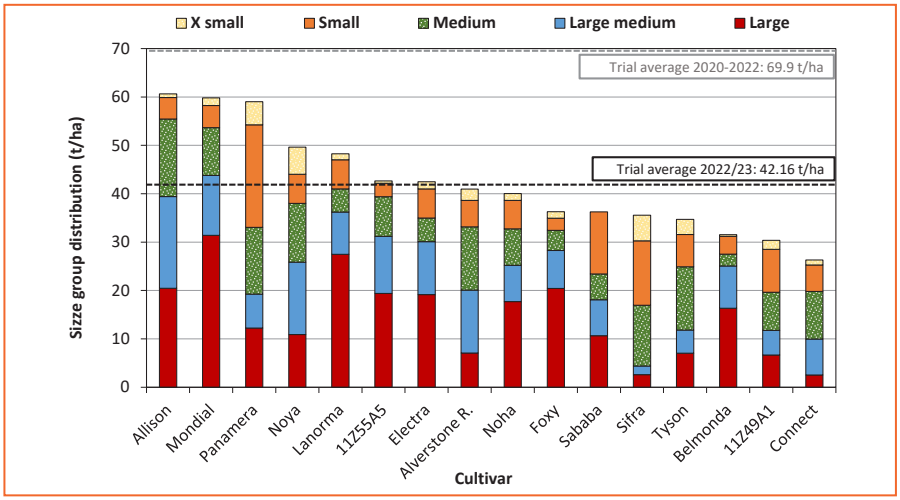


Figure 7: Grading of each cultivar during final harvest.

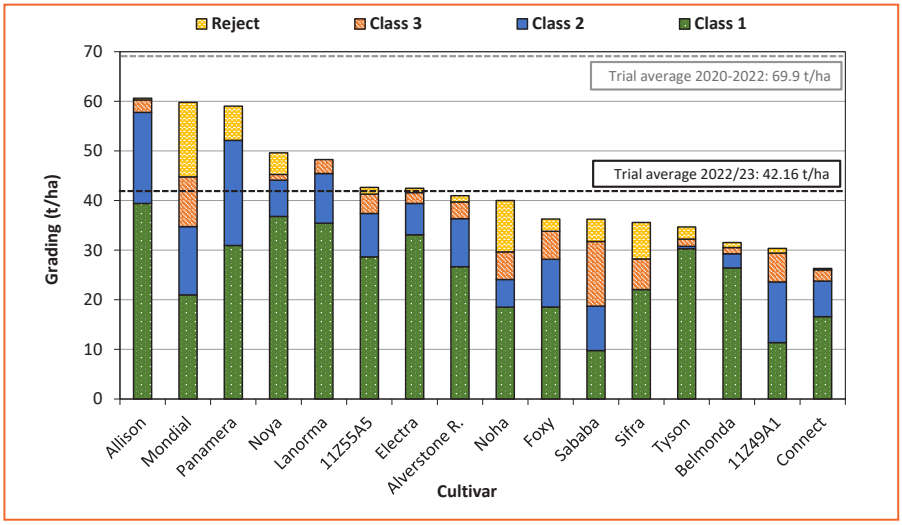
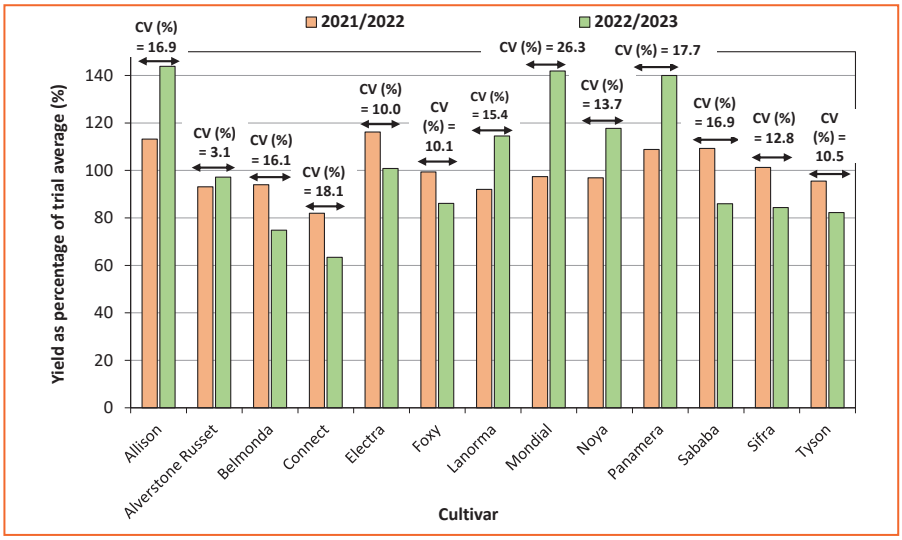


Figure 8: Performance of cultivars included in the trial for the past two years (illustrated as a percentage of the trial average).



Coefficient of variation (CV%) is included on the graph: A value that essentially depicts the margin of difference in the specific cultivar's performance over the years indicated on the graph. The greater the CV % value, the greater the cultivar's performance variance over the number of years indicated on the graph.

to the average market prices for the week of harvest (*Figure 5*). Allison, Lanorma, Electra and Noya produced the highest marketing indices which is the result of a high percentage of Large tuber size distribution (*Figure 6*) and a high percentage of Class 1 grading (*Figure 7*).

These factors are therefore important in ensuring an optimal, economically marketable yield. The main reasons for the downgrading of potatoes to lower classes were recorded as common scab, mechanical damage and damage inflicted by insects.

When looking at the performance of cultivars, it is important to take into account results over several seasons as each season differs from the next and cultivars are subjected to different challenges and conditions. *Figure 8* illustrates the performance of cultivars that had been entered into the trial for the past two seasons.

The internal quality of the potatoes needs to be evaluated to determine the purpose of the specific cultivar at the end of the day. This includes important factors such as processing properties, specific gravity (SG) and the identification of the cultivars' proneness to internal defects (hollow heart and brown spot) as contained in *Table 3*.

During the 2022/23 growing season, only the cultivar 11Z55A5 met the chip colour standard of >50 for processing, as well as the SG standard of ≥1.075. Alverstone Russet had the correct SG requirements and Electra, Lanorma and Tyson had the correct chip colour. In terms of internal defects, the cultivars Foxy and Noha had internal brown spot and Noya had hollow heart.

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CHIPS

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