Potatoes Aartappels SA

CHIPS

POTATO CULTIVAR TRIAL SUPPLEMENT 2023/2024

Cultivar diversity is important in keeping our potato industry competitive

By Dirk Uys and Enrike Verster, Potatoes SA

South Africa is a diverse country with continuous potato production, harvesting and supply to the fresh produce as well as processing industry. Potatoes are cultivated and processed for 52 weeks of the year and are sourced from all our provinces. These crops are evaluated under irrigation as well as dryland conditions.

Up to date on cultivars

Our potato producers need to know and understand how newer potato cultivars perform in different regions and planting conditions, and how they measure up in respect of pest and disease tolerance.

Cultivar selection is a critical decision any producer has to make as this will enable him or her to realise optimal yields and production efficiencies. It is becoming increasingly important in cultivar evaluations to also focus on quality characteristics such as specific gravity (SG), dry matter (DM), appearance, internal quality, and cooking preferences. And we should also not neglect the importance of how it tastes. The latter is of course a crucial aspect of consumer buying decisions and has the potential of differentiating the product offered to the consumer.

Choosing a spud

During the World Potato Congress held in Adelaide in June 2024, it was valuable to note that our production efficiencies match the best in the world. However, consumers elsewhere are probably more aware of the cooking properties of potatoes and are presented with a great selection in this regard.

South Africa is currently blessed with 142 potato cultivar types, some of which perform better in respect of agronomic properties and others in terms of consumer preferences. Every year we notice how cultivar quality differs among our various production regions. It is important that variety within cultivars reduces the producer's risk, and it is therefore wise that they don't rely on only one variety. Planting a selection will spread the production risk.

In future, our intention is to enable a meta-analysis of our historic data so as to monitor trends over multiple dimensions such as environmental and production conditions, as well as quality parameters. This will also include a greater focus on quality.

Potatoes SA's cultivar trials

Potatoes SA's cultivar trials cover most of South Africa's production regions and consist of a minimum of 12 trials planted and harvested each year, including a few product trials. These trials offer producers independent information on cultivar selection and product efficacy in their region and under their unique seasonal conditions.

Potatoes SA strives to enable growers to make informed decisions regarding what cultivar to plant on their farms. We depend on our producers' dedication to these trials as well as the support of our seed companies that provide new innovations in the cultivar space. Potatoes SA appreciates the support of our agronomists, and every single employee and helping hand on every farm, in collecting the results. We are fortunate to have excellent collaborators who assist us in achieving this momentous task. To them we would also like to convey a heartfelt thanks.

CONTENTS

2 Southwestern Free State product trial under irrigation at Petrusburg in 2020/23
8 Southwestern Free State cultivar trial under irrigation at Petrusburg in 2023
14 Northern Cape cultivar trial under irrigation at Douglas in 2023
19 Western Free State cultivar trial under irrigation at Bultfontein in 2023
25 Western Free State cultivar trial under dryland conditions at Kroonstad in 2023
30 Limpopo cultivar trial under irrigation at Dendron in 2023
35 Limpopo cultivar trial under irrigation at Tom Burke in 2023
40 Processing trial under irrigation at Marble Hall in 2023
46 Sandveld cultivar trial under irrigation at Aurora in 2023/24
54 Ceres/Koue Bokkeveld cultivar trial under irrigation at Donkerbos in 2023/24
61 Eastern Free State dryland cultivar trial at Reitz in 2023/24
67 Eastern Free State cultivar trial under irrigation at Bethlehem in 2023/24

Southwestern Free State product trial under irrigation at Petrusburg from 2020 to 2023

By Enrike Verster, Anjé Erasmus and Herman Haak, Potatoes SA, and Johan Odendal, producer

The Southwestern Free State potato production region produces approximately 3% of the country's commercial potatoes on 1 473 ha. The most prominent cultivars produced for commercial usage (table and processing potatoes) are Sifra (80%), Innovator (9%) and Mondial (5%).

Petrusburg falls within South Africa's dry continental area (*Figure 1*) and for the past 22 years, the farm on which the trial was planted has been receiving an average annual rainfall of 554 mm. This region is characterised by very hot summers and cold winters, with frost occurring from June to August. In 2017, frost was recorded as late as November.

The product trial at Petrusburg was laid out in a randomised design with three repetitions per treatment. *Table 1* provides technical information relevant to the trial. Soil samples were taken before planting to determine the soil nutrient status of the trial site (*Table 2*).

A large variety of companies with diverse programmes were included in the product trial. In this article only the programmes (treatments) which have completed their three years in the trial was included, as stipulated by policy. During all three seasons of the trial, the relevant programmes were tested on the cultivar Sifra in addition to the standard farm programme (control).

The evaluation of treatments such as those in the Petrusburg product trial provides results regarding, among others, yield and marketing indices. The purpose of the trial is to test the performance of the relevant programmes within the region, and it is therefore important to note that the programmes are not necessarily measured against one another but

Figure 1: Location of Petrusburg in the Southwestern Free State production area.

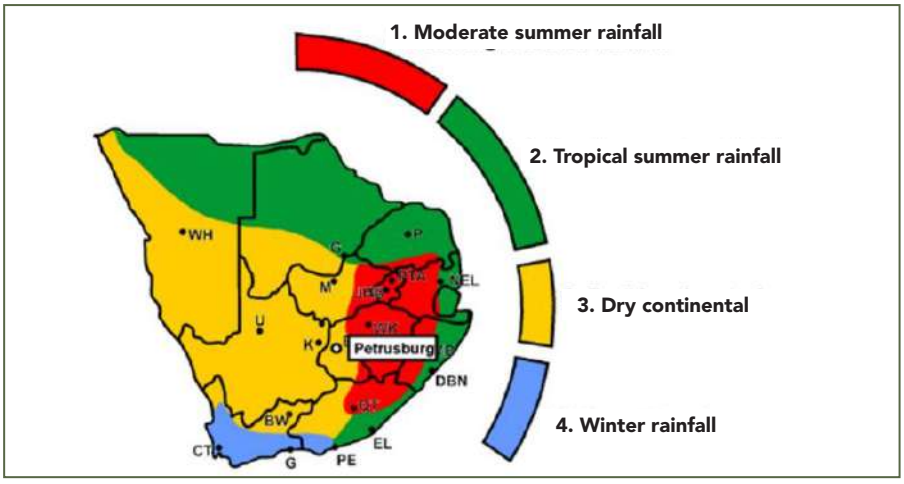


Table 1: Summary of technical information regarding the trial site and layout.

Farm	**Lushof Boerdery, Theronskop**		
Producer	Johan Odendal		
Planting date	20 August 2020	19 August 2021	25 August 2022
Harvest date	22 January 2021	12 January 2022	20 January 2023
Irrigation/dryland	Irrigation		
Double or single rows	Double rows		
Leaf senescence	Chemical		
Interrow spacing	0.75 m		
Intra-row spacing	28 cm		
Plant density	39 685 plants/ha		
Cultivar	Sifra (short to medium growth period, 90 to 100 days)		
Fertiliser programme	**Nutritional value**		
	N (kg/ha)	P (kg/ha)	K (kg/ha)
Total (season 1)	280	118	175
Total (season 2)	275	137	153
Total (season 3)	296	142	154

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

	Gross density (kg.m^{-3})	pH (KCl)	P (P-Bray I)	K	Ca	Mg	Na	% of CEC[1] K	% Ca	% Mg	% Na
			(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	%	%	%
Season 1	1 362	4.5	13.4	195.7	259	122.1	8.4	16	48.8	32.2	1
Season 2	1 075	4.7	10	143	283	102	6	14	54	32	1
Season 3	1 304	4.6	12	158	222	68	6	19	53	27	1

[1]*CEC = cation exchange capacity.*

Figure 2: Rainfall (2020 to 2023) as well as the long-term average.

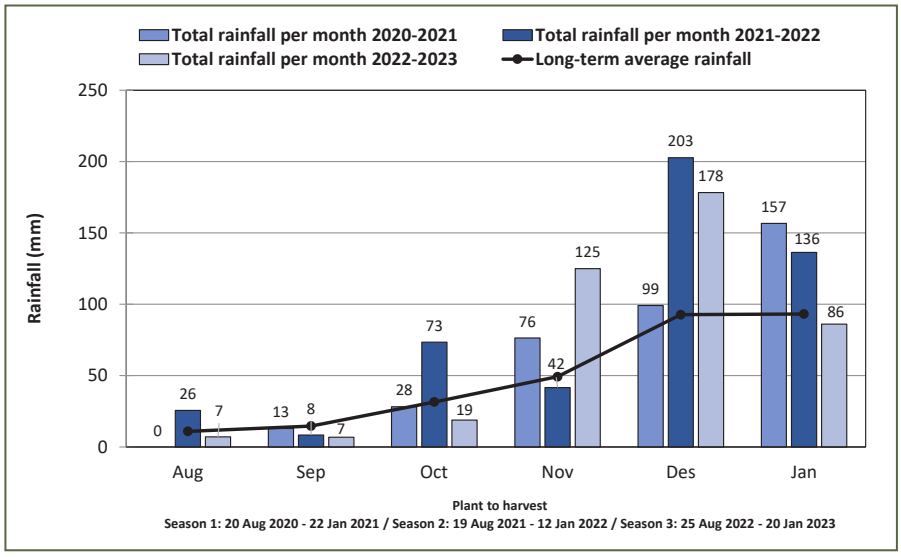


Figure 3: Minimum (2020 to 2023) as well as long-term temperatures.

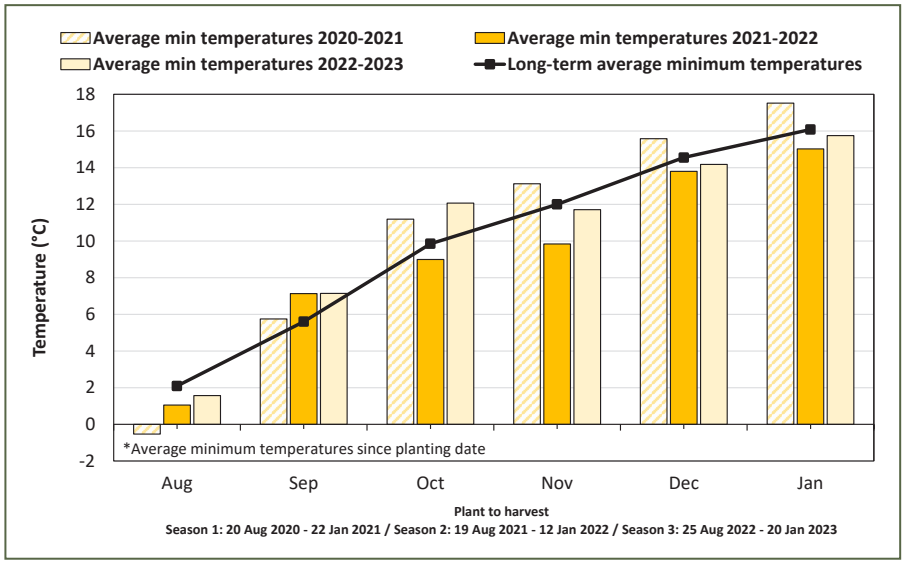
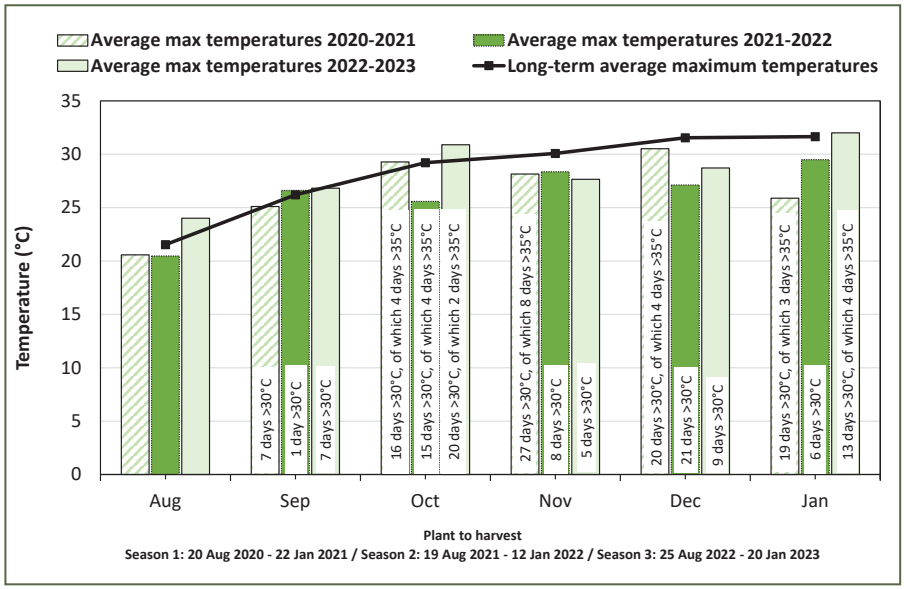


Figure 4: Maximum (2020 to 2023) as well as long-term temperatures.



rather against the control (standard farm programme).

Different programmes have different outcomes, and the finer details of a programme can be discussed with the relevant representative.

The farm's standard spraying and fertilisation programmes served as the control treatment in the trial. This article therefore includes the control treatment as well as the programmes set out in *Table 3*.

The marketing index of the treatments is calculated by classing each treatment and sorting it according to quality and size group (for example class 1 Large or class 2 Large-medium). In this trial, all three replications are thrown together, washed, classed and sorted by the packhouse.

Price comparisons are then made with market prices as obtained at harvest time. The performance of the treatments cannot be based on the results of one particular season alone, since climate and seed tuber quality vary from one year to the next. For this reason, as a rule, programmes are preferably tested over at least three seasons.

As with any crop, temperature, water availability (whether through irrigation scheduling or rainfall), as well as heat units are important factors that play a significant role during the potato plant's growth period. These factors are therefore taken into account when a trial is evaluated.

Weather data for the relevant seasons of this trial is obtained from a nearby Agricultural Research Council (ARC) weather station. The relevant ARC weather station is located 9 km from the trial site at Petrusburg.

Rainfall trends over three seasons

Figure 2 shows the rainfall trends of the past three seasons. Season one received average rainfall in comparison to the long-term trend, with the exception of January where far above-average rainfall was recorded. Optimal irrigation scheduling was therefore applied as much as possible.

Season two was characterised as a fairly wet season, especially in the last two months. Far above-average

Table 3: Programmes of product participants.

Bayer 1	Bayer 2	Bayer 3
Intended role of products in the programme: • Nematocidal effect for the control of certain nematodes, fungicidal effect against early blight.	**Intended role of products in the programme:** • Systemic fungicidal effect. • Fungicidal effect and plant resistance stimulator.	**Intended role of products in the programme:** • Nematocidal effect for the control of certain nematodes, fungicidal effect against early blight. • Systemic fungicidal effect. • Fungicidal effect and plant resistance stimulator.
Cosmocel 1	**Cosmocel 2**	**Cosmocel 3**
Intended role of products in the programme: • Provides elasticity and promotes structural components of cell walls. • Support of plant resistance in respect of moisture losses and high temperatures.	**Intended role of products in the programme:** • Disruption of seed dormancy. • Uniform germination and thus improvement of stand and tuber initiation. • Promotes plant rhizosphere and therefore absorption. • Conducive to plant resistance. • Biomass accumulation.	**Intended role of products in the programme:** • Improves plant's water efficiency – better handling of water stress. • Stimulates plant's microbiome – ultimate organic components – conducive to plant resistance. • Increases effectiveness of mineral elements – less nitrate leaching. • Increases biomass accumulation and tuber quality.
Karabos 1	**Karabos 2**	**InteliGro (Rolfes)**
Karabos' products include, among others, products derived from vegetable fermentation as well as beneficial soil bacteria and microbes.		A highly specialised product range of biological concentrates and nutritional supplements.
Intended role of products in the programme: • Active carbon source. • Micronutrition. • Supplies and makes elements available to plants. • Natural resistance against bacterial illnesses. Produces natural antibiotics. • Acts against vascular diseases. • Conducive to cell biology and potential. • Activates the functioning of herbicides.	**Intended role of products in the programme:** • Attracts beneficial microbes and initiates interactions. • Supports cell division and development. • Promotes supply of elements to plants. • Antimicrobial resistance against harmful mould and bacteria. • Improves root growth and resistance to stress and drought. • Activates the functioning of herbicides.	**Intended role of products in the programme:** • Promotes stem elongation and natural stress management. • Fungicidal action. • Addresses nutritional deficiencies; increases plant immunity and stress resistance. • Promotes active root development and stimulation of above-ground growth. • Promotes above-ground growth and quality. • Favourable during tissue formation and chlorophyll synthesis, and severe periods of stress. • Micronutrients. • Promotes tuber fill and quality.

rainfall and wet conditions gave rise to high incidence of late blight. As a result, the crop died off a week or two earlier than is normal for spraying for leaf senescence.

Season three received above-average rainfall during the last half of the season during tuber fill, which probably .led to the quality problems recorded and a large number of waste potatoes.

Temperatures and heat units

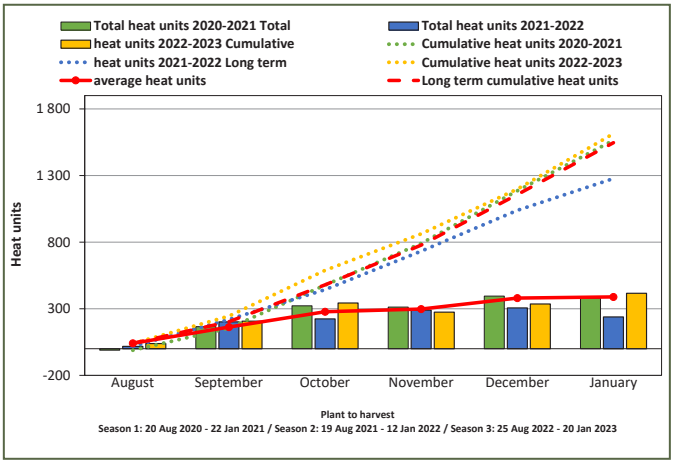
Minimum and maximum temperatures are detailed in *Figures 3* and *4*. Looking at *Figure 3* it is clear that season two experienced lower average minimum temperatures than the long-term average temperatures. *Figure 4* shows the average maximum temperatures per month, as well as the number of days per month during which maximum temperatures above 30 and 35°C were recorded.

The accumulation of heat units during a growing period is an important factor in the development of the plant. The trend of heat units available for the last three seasons shows that slightly more heat units were accumulated in seasons three and one compared to the average long-term cumulative heat units, while fewer were recorded during season two. The fewer heat units recorded for season two can be attributed to above-average rainfall recorded during the season, which meant many cloudy and cooler days.

Yield index

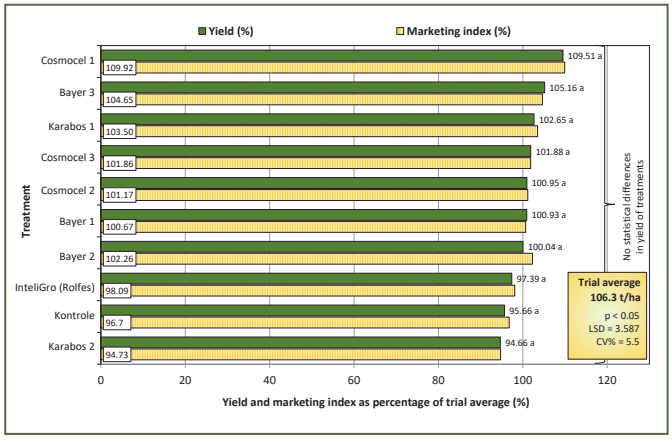
Yield data collected on harvest day was subjected to statistical processing using the GenStat® programme. The Tukey test of least significant differences (LSD) was used to separate the mean. The treatment effect during this particular trial (*Figure 5*) was statistically significant ($p<0.05$) and the coefficient of variation (CV) was consistently low (11, 5.5 and 6.6%). These factors indicate that the trial was executed well, and the results are therefore reliable.

Figure 5: Heat units (2020 to 2023) as well as long-term average heat units.



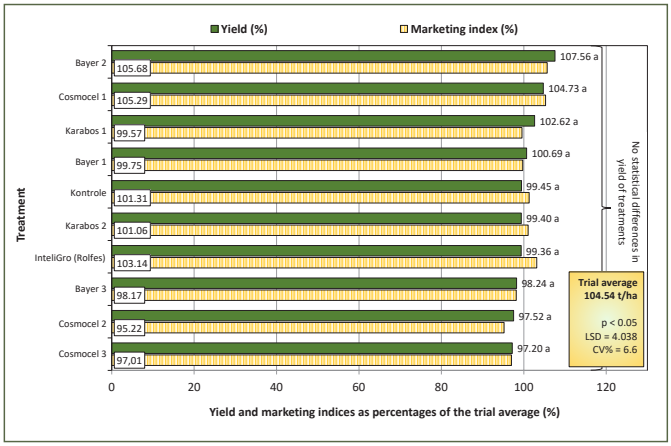
*Total heat units determined specifically for potatoes as a crop (threshold temperature = 5°C). Calculated from hourly data..

Figure 6: Total yield and marketing indices per treatment as a percentage of trial average (Season 1: 2020 to 2021).



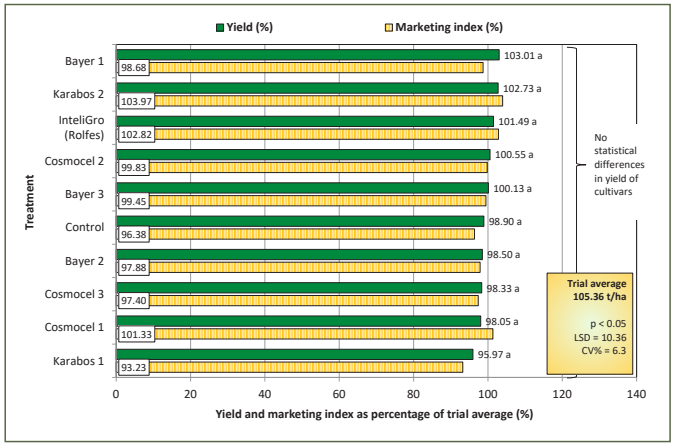
*Values followed by the same letter are not significantly different from each other. **Trial average and statistical processing for the season includes all 19 participants from the season in question.

Figure 7: Total yield and marketing indices per treatment as a percentage of the trial average (Season 2: 2021 to 2022).



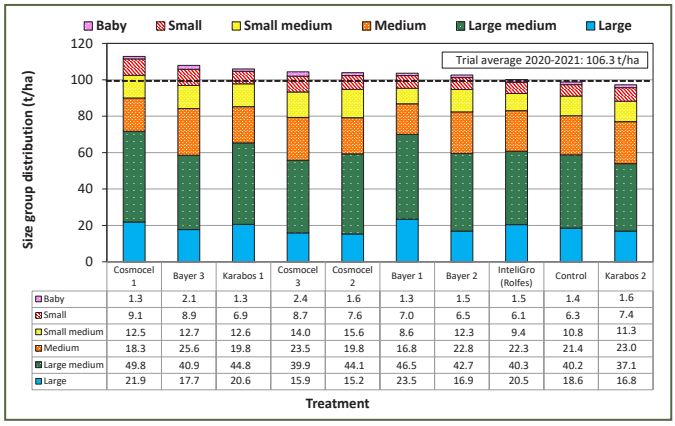
*Values followed by the same letter do not differ significantly from one another. **Trial average and statistical processing for the season includes all 23 participants from the season in question.

Figure 8: Total yield and marketing indices per treatment as a percentage of trial average (Season 3: 2022 to 2023).



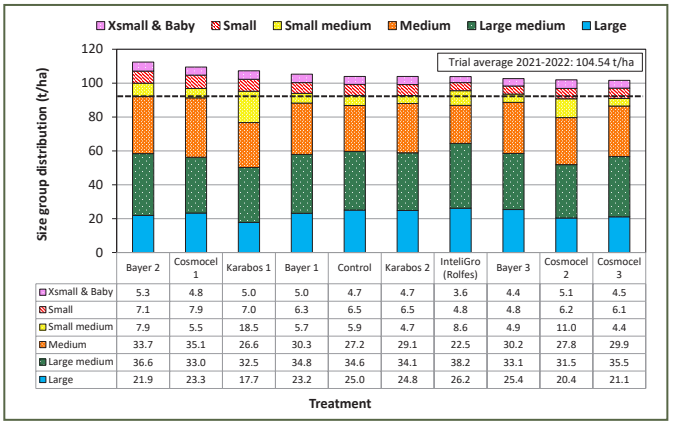
*Values followed by the same letter do not differ significantly from one another. **Trial average and statistical processing for the season includes all 22 participants from the season in question.

Figure 9: Size group distribution of each relevant treatment (Season 1: 2020 to 2021).



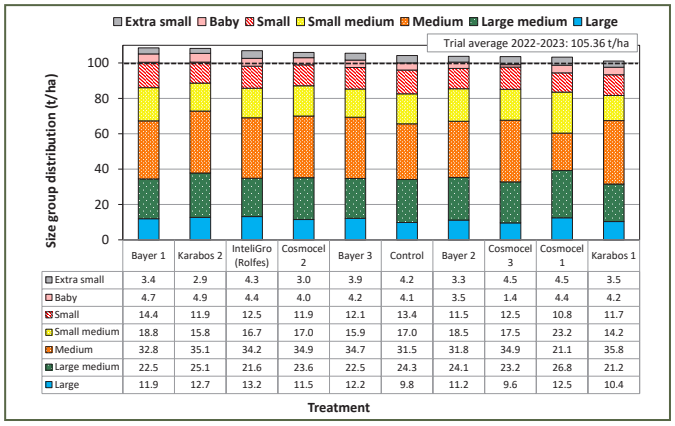
	Cosmocel 1	Bayer 3	Karabos 1	Cosmocel 3	Cosmocel 2	Bayer 1	Bayer 2	InteliGro (Rolfes)	Control	Karabos 2
Baby	1.3	2.1	1.3	2.4	1.6	1.3	1.5	1.5	1.4	1.6
Small	9.1	8.9	6.9	8.7	7.6	7.0	6.5	6.1	6.3	7.4
Small medium	12.5	12.7	12.6	14.0	15.6	8.6	12.3	9.4	10.8	11.3
Medium	18.3	25.6	19.8	23.5	19.8	16.8	22.8	22.3	21.4	23.0
Large medium	49.8	40.9	44.8	39.9	44.1	46.5	42.7	40.3	40.2	37.1
Large	21.9	17.7	20.6	15.9	15.2	23.5	16.9	20.5	18.6	16.8

Figure 10: Size group distribution of each relevant treatment (Season 2: 2021 to 2022).



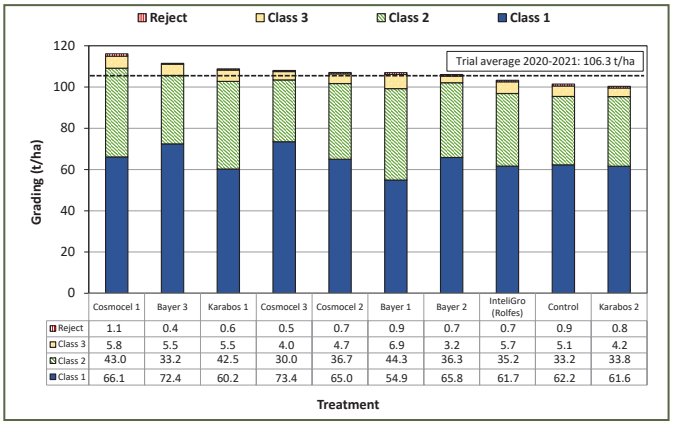
	Bayer 2	Cosmocel 1	Karabos 1	Bayer 1	Control	Karabos 2	InteliGro (Rolfes)	Bayer 3	Cosmocel 2	Cosmocel 3
Xsmall & Baby	5.3	4.8	5.0	5.0	4.7	4.7	3.6	4.4	5.1	4.5
Small	7.1	7.9	7.0	6.3	6.5	6.5	4.8	4.8	6.2	6.1
Small medium	7.9	5.5	18.5	5.7	5.9	4.7	8.6	4.9	11.0	4.4
Medium	33.7	35.1	26.6	30.3	27.2	29.1	22.5	30.2	27.8	29.9
Large medium	36.6	33.0	32.5	34.8	34.6	34.1	38.2	33.1	31.5	35.5
Large	21.9	23.3	17.7	23.2	25.0	24.8	26.2	25.4	20.4	21.1

Figure 11: Size group distribution of each relevant treatment (Season 3: 2022 to 2023).



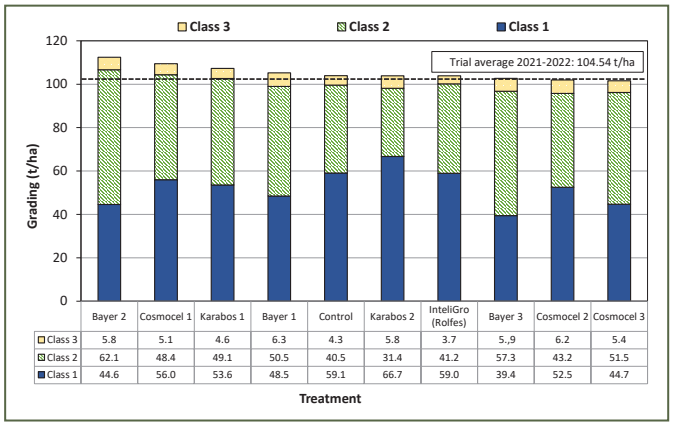
	Bayer 1	Karabos 2	InteliGro (Rolfes)	Cosmocel 2	Bayer 3	Control	Bayer 2	Cosmocel 3	Cosmocel 1	Karabos 1
Extra small	3.4	2.9	4.3	3.0	3.9	4.2	3.3	4.5	4.5	3.5
Baby	4.7	4.9	4.4	4.0	4.2	4.1	3.5	1.4	4.4	4.2
Small	14.4	11.9	12.5	11.9	12.1	13.4	11.5	12.5	10.8	11.7
Small medium	18.8	15.8	16.7	17.0	15.9	17.0	18.5	17.5	23.2	14.2
Medium	32.8	35.1	34.2	34.9	34.7	31.5	31.8	34.9	21.1	35.8
Large medium	22.5	25.1	21.6	23.6	22.5	24.3	24.1	23.2	26.8	21.2
Large	11.9	12.7	13.2	11.5	12.2	9.8	11.2	9.6	12.5	10.4

Figure 12: Grading of each relevant treatment (Season 1: 2020 to 2021).



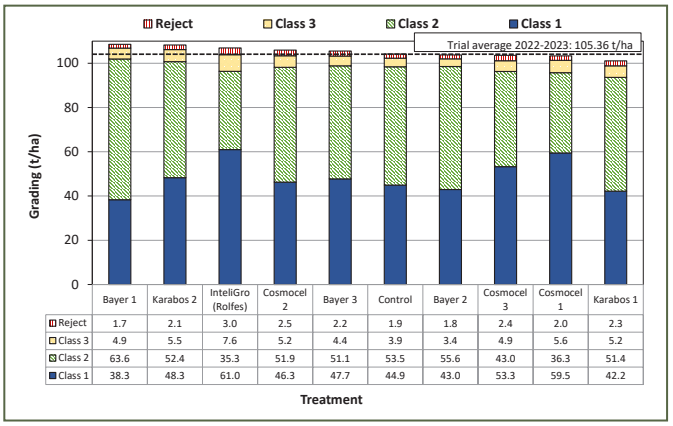
	Cosmocel 1	Bayer 3	Karabos 1	Cosmocel 3	Cosmocel 2	Bayer 1	Bayer 2	InteliGro (Rolfes)	Control	Karabos 2
Reject	1.1	0.4	0.6	0.5	0.7	0.9	0.7	0.7	0.9	0.8
Class 3	5.8	5.5	5.5	4.0	4.7	6.9	3.2	5.7	5.1	4.2
Class 2	43.0	33.2	42.5	30.0	36.7	44.3	36.3	35.2	33.2	33.8
Class 1	66.1	72.4	60.2	73.4	65.0	54.9	65.8	61.7	62.2	61.6

Figure 13: Grading of each relevant treatment (Season 2: 2021 to 2022).



	Bayer 2	Cosmocel 1	Karabos 1	Bayer 1	Control	Karabos 2	InteliGro (Rolfes)	Bayer 3	Cosmocel 2	Cosmocel 3
Class 3	5.8	5.1	4.6	6.3	4.3	5.8	3.7	5.,9	6.2	5.4
Class 2	62.1	48.4	49.1	50.5	40.5	31.4	41.2	57.3	43.2	51.5
Class 1	44.6	56.0	53.6	48.5	59.1	66.7	59.0	39.4	52.5	44.7

Figure 14: Grading of each relevant treatment (Season 3: 2022 to 2023).



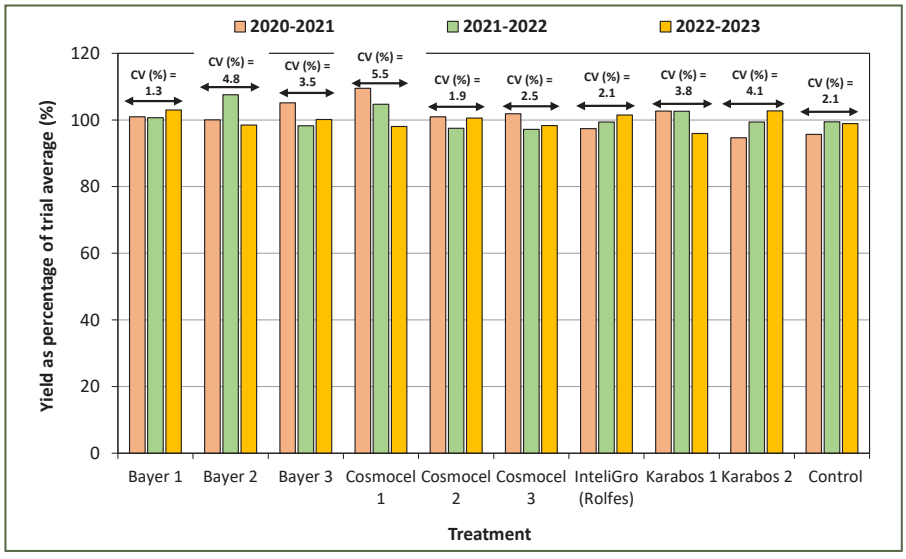
	Bayer 1	Karabos 2	InteliGro (Rolfes)	Cosmocel 2	Bayer 3	Control	Bayer 2	Cosmocel 3	Cosmocel 1	Karabos 1
Reject	1.7	2.1	3.0	2.5	2.2	1.9	1.8	2.4	2.0	2.3
Class 3	4.9	5.5	7.6	5.2	4.4	3.9	3.4	4.9	5.6	5.2
Class 2	63.6	52.4	35.3	51.9	51.1	53.5	55.6	43.0	36.3	51.4
Class 1	38.3	48.3	61.0	46.3	47.7	44.9	43.0	53.3	59.5	42.2

The yield from each of the treatments is divided by the trial average (the trial average of all the treatments is taken as 100%). This creates a yield index and each treatment's performance in terms of yield is read as a percentage of the trial average.

The average yield of the trial for the three seasons was 106.3, 104.54 and 105.36 t/ha. The above-average performance of the past three seasons can be attributed to three factors. Firstly, the trial was conducted on soil that did not have a history of potato production. Secondly, the trials were planted at a slightly higher plant population per hectare than in the past. Thirdly, and possibly the factor that played the biggest role, was the good quality irrigation water which had a much lower sodium content.

There was no significant statistical difference among the treatments in terms of yield. Again, it is important to note that the treatments are not entirely comparable given the different and diverse outcomes of the various programmes.

Figure 15: Performance of treatments over three years (expressed as a percentage of the trial average).



**Coefficient of variation (CV %) is included in the figure: A value that essentially represents the degree of difference in performance in the specific treatment over the number of years. The larger the CV % value, the more varied the performance of the treatment/programme over the number of years indicated on the graph.*

The size distribution of the treatments is compared in *Figures 9* to *11*. In season one, Cosmocel 3 and Bayer 3 delivered the highest amount of class 1 potatoes, but in season two Karabos 2 was the programme that delivered the most class 1 potatoes with InteliGrow (Rolfes) and Cosmocel 1 with the most class 1 yield in season three (*Figure 12* to *14*). Season three generally yielded more waste potatoes than the previous seasons. This is attributed to continuous wet conditions and blight that had a negative influence on quality.

The performance of treatments fluctuates between seasons simply because the climate differs from one season to the next. Therefore, it is important to consider the consistent performance of a programme over several seasons, instead of basing decisions on one season's good performance. Bayer 1, Cosmocel 2 and the control programme show the least variation for the past three seasons in the Petrusburg trial (*Figure 15*).

For enquiries, contact Enrike Verster at enrike@potatoes.co.za or Anjé Erasmus at anje@potatoes.co.za.

Southwestern Free State cultivar trial under irrigation at Petrusburg in 2023

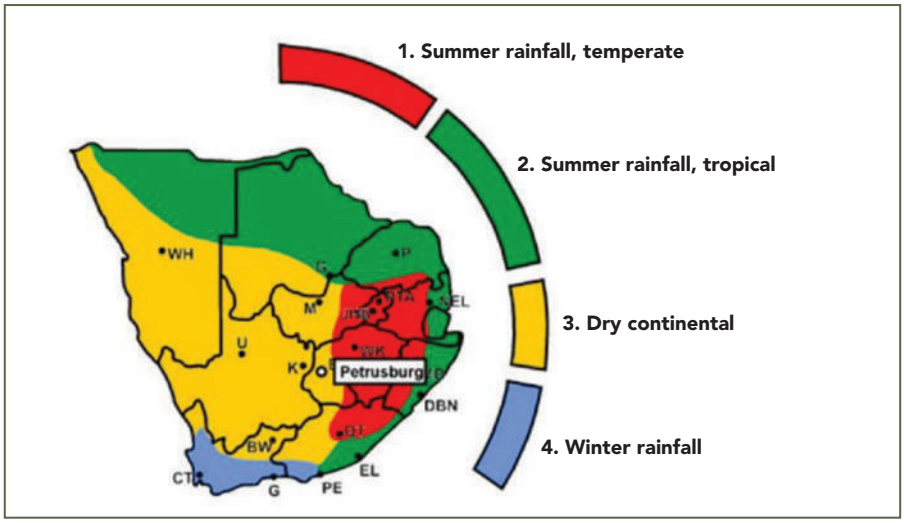
By Enrike Verster and Laryssa van der Merwe, Potatoes SA, and Johan Odendal, producer

Approximately 1.7% of South Africa's commercial potatoes are produced on 954 ha (2023/24 harvest year) located in the Southwestern Free State potato production region.

The main cultivars produced for commercial consumption (table and processing) are the region's main harvest of Sifra (89%) followed by Mondial, Panamera, and Innovator.

Petrusburg is located in South Africa's dry continental area (*Figure 1*).

Figure 1: Location of Petrusburg in the Southwestern Free State production region.



The farm on which the trial was planted has recorded an annual average rainfall of 570 mm over the last 24 years. This region is characterised by very hot summers and cold winters, with frost occurring from June to August. The region even recorded frost in November 2017.

The cultivar trial at Petrusburg was laid out in a randomised block design with three replications per cultivar. Relevant technical information relating to the trial is summarised in *Table 1*. Soil samples were collected before planting to determine the soil nutrient status of the trial site (*Table 2*).

Cultivars with short and long growth periods were included in the cultivar trial. As a result, growth periods could affect the yield of certain cultivars. The length of growth periods is subject to the nature of a given season but is regarded as the time that passes from emergence to natural leaf senescence.

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

Farm	**Lushof Farm, Theronskop**				
Producer	Johan Odendal				
Planting date	25 August 2023				
Harvesting date	25 January 2024				
Irrigation/dryland	Irrigation				
Double or single rows	Double rows				
Leaf senescence	Chemical				
Interrow spacing	0.75 m				
In-row spacing	28 cm				
Plant density	39 685 plants/ha				
Fertiliser programme	**Nutritional value**				
	N (kg/ha)	P (kg/ha)	K (kg/ha)	Ca (kg/ha)	S (kg/ha)
Total	**284.75**	**137**	**143.5**	**222.75**	**166.5**

Figure 2: Rainfall during the 2023/24 season as well as the long-term average rainfall.

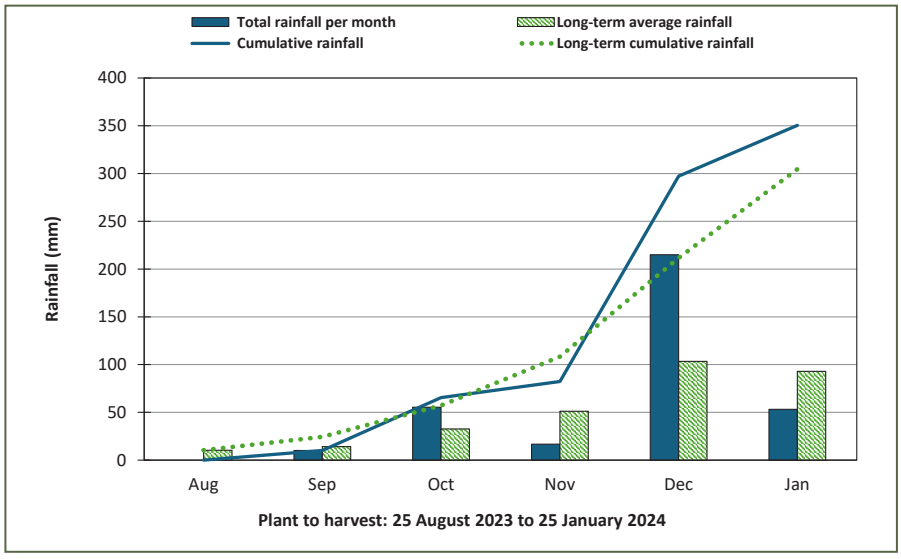


Figure 3: Minimum and maximum temperatures during the 2023/24 season as well as the long-term average temperatures.

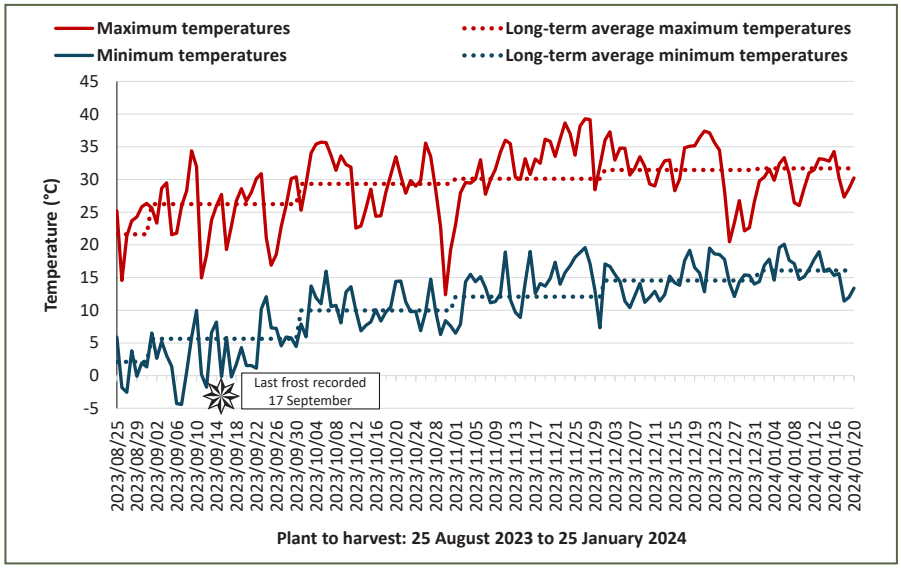


Table 3 outlines how these growth periods vary from cultivar to cultivar. The plant readiness of seed potatoes at the time of the trial, as well as plant density (%) and haulm count observed later on in the growth period, are indicated in *Table 3*.

Marketing indices

The evaluation of new cultivars in the Petrusburg cultivar trial delivered results regarding, among others, yield and marketing index. The marketing indices of the relevant cultivars are calculated by classing and sorting each cultivar according to quality and size distribution, for example, Class 1 Large or Class 2 Large-medium. All three replications from this trial were combined, washed, and sorted by the packing store. Prices were then compared to market prices at harvest time.

The performance of new cultivars cannot be based on the results of one particular season only, since climate and seed potato quality can vary from one year to the next. It is for this very reason that cultivars are preferably tested across several seasons.

Weather data

As with any crop, temperature, availability of water (good irrigation schedules or rainfall), as well as heat units are important factors with a significant influence on the potato plant's growth period. These factors are therefore taken into account when

Table 2: Soil nutrient status of the trial site.

Gross density (kg.m^{-3})	pH (KCl)	P (P-Bray I)	K	Ca	Mg	Na	% CEC[1] K	% CEC[1] Ca	% CEC[1] Mg	% CEC[1] Na
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	%	%	%
1 210	4.7	9	191	265	88	6	19	52	28	1

[1]*CEC: cation exchange capacity.*

The cultivar trial at Petrusburg was laid out in a randomised block design with three replications per cultivar.

Tabel 3: Characteristics relating to growth period, plant readiness, population density (%) and haulm count for relevant cultivars.

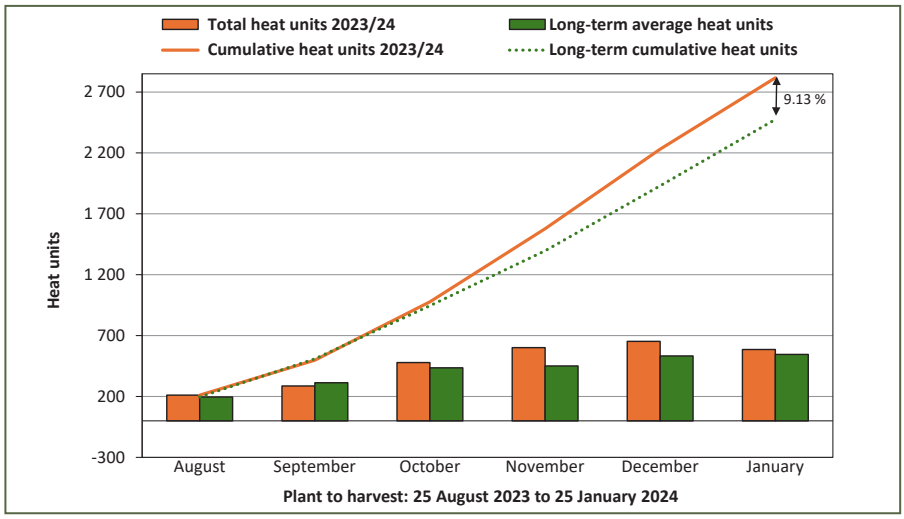
Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)[3]	Haulms per plant	Haulms per ha
11Z49A1	Medium	(100)	1	94	3	111 912
11Z55A5	Medium	(100)	1	83	1.4	46 114
Amany	Medium tot lank	(110)	2	94	2.3	85 799
Cayman	Medium	(100 – 110)	3	85	7	236 126
Connect	Medium tot lank	(120)	2	94	3.3	123 103
Foxy	Kort tot medium	(90 – 100)	3	94	6	223 823
Lanorma	Kort	(80 – 90)	3	99	4.4	172 868
Lilly	Medium	(100)	1	94	3.2	119 372
Mondial	Medium tot lank	(110 –115)	1	91	2.4	86 672
Noya	Medium	(90 –110)	1	90	1.8	64 290
Panamera	Medium	(90 – 110)	3	92	3.7	135 088
Sababa	Medium tot lank	(110 – 115)	3	92	5	182 551
Sifra	Kort tot medium	(90 – 100)	3	96	3.1	118 103
Sound	Medium	(110)	2	94	2.6	96 990
Tyson	Kort tot medium	(90 – 100)	2	96	2.2	83 815

[1]*General guidelines and categories (days from emergence to leaf senescence depending on the season): short: 70 to 90 days; short to medium: 80 to 100 days; medium: 90 to 110 days; medium to long: 90 to 120; long: 90 to 140 days.*
[2]*Plant readiness of seed potatoes: 1 - fresh; 2 - slightly fresh; 3 - ready for planting; 4 - slightly old; 5 - old.*
[3]*Plant density (%) is determined by looking at the repetition of each cultivar which comprises of 36 plants per 10 m row per plot.*

Table 4: Main reasons for downgrading.

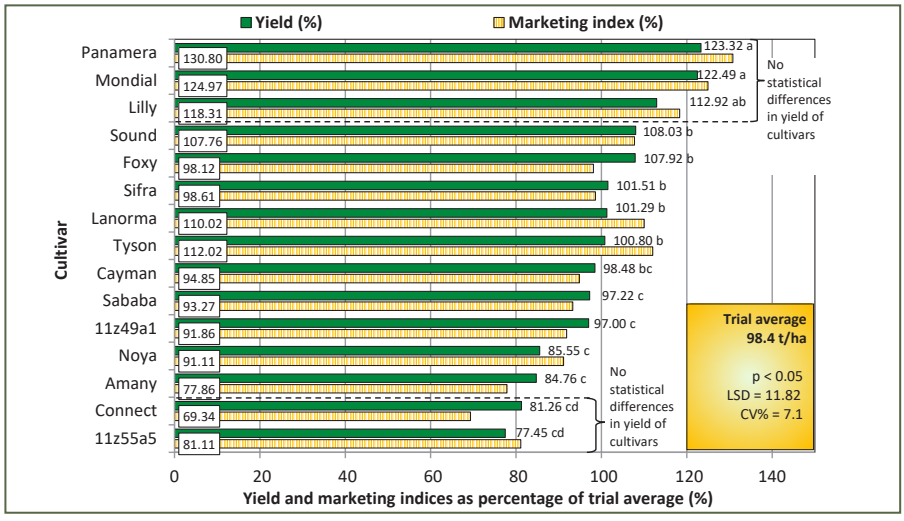
Cultivar	Moth damage	Greening	Stem-end rot	Common scab	Soft rot	Porcupine damage	Hollow heart	Brown spot
11Z49A1	x	x			x			
11Z55A5	x	x			x			
Amany	x		x	x				x
Cayman	x	x	x					
Connect	x	x	x	x				
Foxy	x	x	x				x	
Lanorma	x	x	x			x		x
Lilly	x				x			
Mondial			x					
Noya	x	x	x					
Panamera	x			x	x			
Sababa	x	x	x					
Sifra	x				x	x		
Sound	x		x					
Tyson	x	x	x					

Figure 4: Heat units recorded during the 2023/24 season as well as long-term average heat units



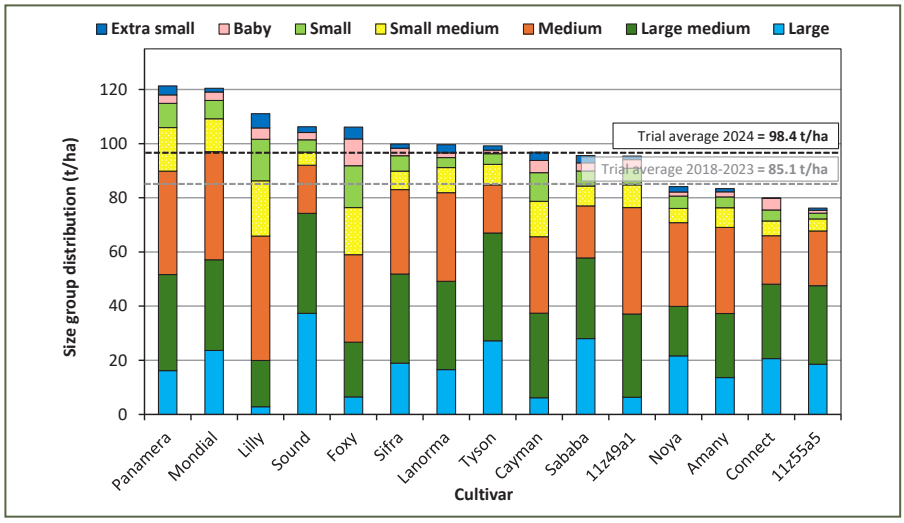
**Total heat units determined specifically for potatoes as a crop (temperature threshold = 5°C). Calculated using hourly data.*

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



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

Figure 6: Size group distribution of all cultivars in the trial.



evaluating cultivar performance. In the case of this trial, relevant daily data regarding the season in question was obtained from a Hortec weather station on the farm where the trial site is located. The Agricultural Research Council's (ARC) weather station from which the long-term data was obtained, is located 9 km from the trial site.

The rainfall trend for the 2022/23 season (*Figure 2*) delivered significantly higher cumulative rainfall figures than the long-term average rainfall. More than double the long-term average rainfall was recorded in December, following a dryer November month.

Figure 3 illustrates minimum and maximum temperatures. The last burst of frost was recorded on 17 September. Earlier in the same month, severe frost was recorded with minimum temperatures lower than -4°C for two consecutive days. In November and December, 44 days of temperatures above 30°C were recorded and 18 days with maximum temperatures higher than 35°C.

Heat units are another important factor to consider, as the development of the plant is based mainly on the collection of heat units during a growth period. The trend of available heat units for this cultivar trial was significantly more compared to the cumulative long-term data of heat units (*Figure 4*). This can be attributed to the season's above-average number of warm days, especially during November and December, which led to the accumulation of more heat units.

Yield indices

Yield data collected during harvest day is statistically processed using the GenStat® program. The mean was separated using the Tukey test of least significant differences (LSD). The cultivar effect during this trial (*Figure 5*) was statistically significant ($p<0.05$) while the coefficient of variation (CV) was low (7.1%). These factors indicate that the trial was well executed, and the results are therefore reliable.

The average yield of the cultivar trial for the 2023/24 season was 98.4 t/ha.

Figure 7: Grading of all cultivars in the trial.

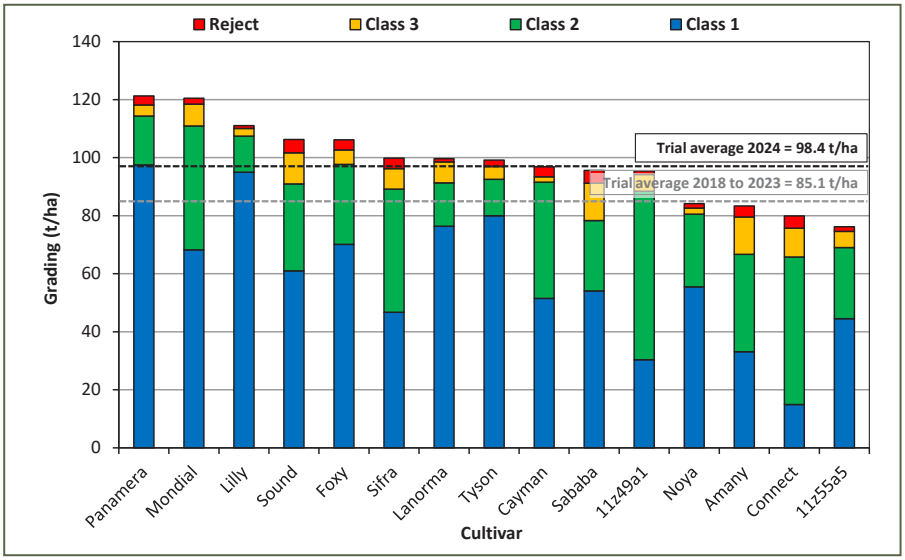
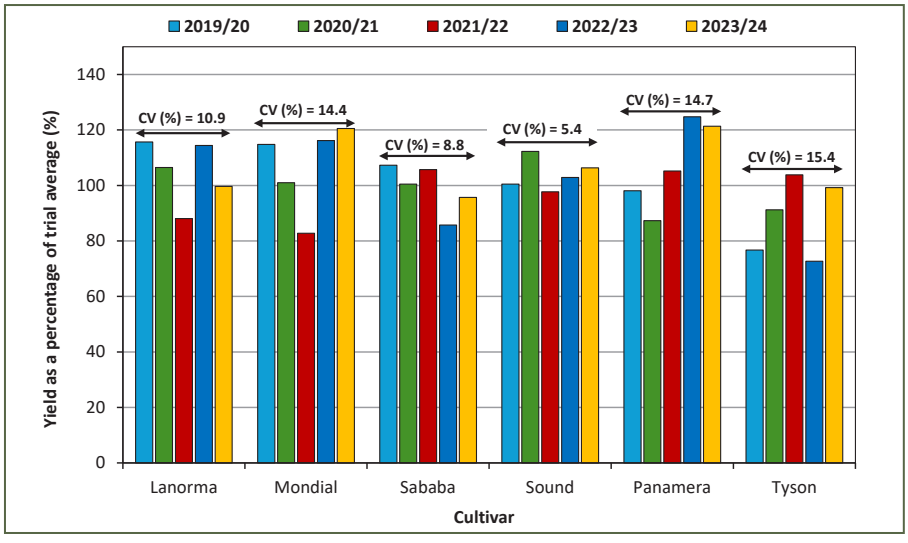


Figure 8: Performance of cultivars included in the trial for five years (indicated as % of the trial average).



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.

The yield of each cultivar is divided by the trial average (the average of all the cultivars is accepted as 100%). This creates a yield index and each cultivar's performance in terms of yield is read as a percentage of the trial average.

The average yield of the cultivar trial for the 2023/24 season was 98.4 t/ha. This is higher than the trial averages of the previous five cultivar trials (85.1 t/ha) conducted at Petrusburg (2018 to 2023). Optimal irrigation scheduling and water quality can be listed as factors contributing to good yields.

Quality and downgrading

Statistically, the cultivars Panamera, Mondial, and Lilly delivered the highest yield (*Figure 5*). The same cultivars achieved the highest marketing index, which can be attributed to the higher yield of Large tubers as well as good-quality cultivars.

Size distribution and grading are indispensable evaluations when studying a cultivar's marketability (*Figures 6* and *7*). Reasons for downgrading are taken into consideration when the potatoes are classed (*Table 4*). The main reasons for downgrading were moths and stem-end rot. This led to a larger number of Class 2 and 3 potatoes. Brown spot and hollow heart were detected in a few cultivars.

Just as seasons tend to fluctuate, so does the performance of cultivars from one season to the next. This is simply because the climate is never

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

Cultivar	Chip colour[1]	SG[2]	DM[3]
11Z49A1	49	1.072	18.6
11Z55A5	47	1.064	16.8
Amany	56	1.077	19.7
Cayman	52	1.082	20.5
Connect	43	1.066	17.3
Foxy	41	1.058	15.5
Lanorma	47	1.070	18
Lilly	48	1.060	16.1
Mondial	50	1.063	16.5
Noya	43	1.071	18.3
Panamera	41	1.073	18.7
Sababa	43	1.071	18.4
Sifra	40	1.068	17.6
Sound	44	1.063	16.5
Tyson	43	1.066	17.3

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

the same from one season to the next. Therefore, it is important to consider consistent cultivar performance across seasons instead of making decisions based on just one season's good performance. Sound currently exhibits the least variation throughout 2020 to 2024 in the Petrusburg cultivar trial (*Figure 8*).

Finally, processing characteristics can also be evaluated when observing the internal quality of potatoes. To comply with processing requirements, cultivars have to comply with a chip colour norm of >50 and a specific gravity (SG) of ≥1.075 (*Table 5*). Amany and Cayman met the chip colour and SG requirements, but unfortunately brown spot was detected in Amany.

Special thanks to the co-worker, Lushof Farm, the Southwestern Free State working group, participating seed suppliers (FPD, GWK, RSA and Wesgrow), and Anjé Venter and Laryssa van der Merwe of Potatoes SA.
For enquiries, contact Enrike Verster at enrike@potatoes.co.za or Laryssa van der Merwe at laryssa@potatoes.co.za.

Northern Cape cultivar trial under irrigation at Douglas in 2023

By André Prins, GWK, and Enrike Verster, Potatoes SA

Eighteen producers are currently producing potatoes for the country's fresh produce markets on 2 214 ha in the Northern Cape potato production region. Approximately 60.74% of this region's potato production comprises seed potatoes. The main cultivars earmarked for commercial production in this region include Lanorma, Sifra and Mondial.

Douglas is located in South Africa's dry continental area (*Figure 1*) with an annual average rainfall of approximately 200 mm for the last six years. Winters are cold with regular frost, while summers can be extremely hot.

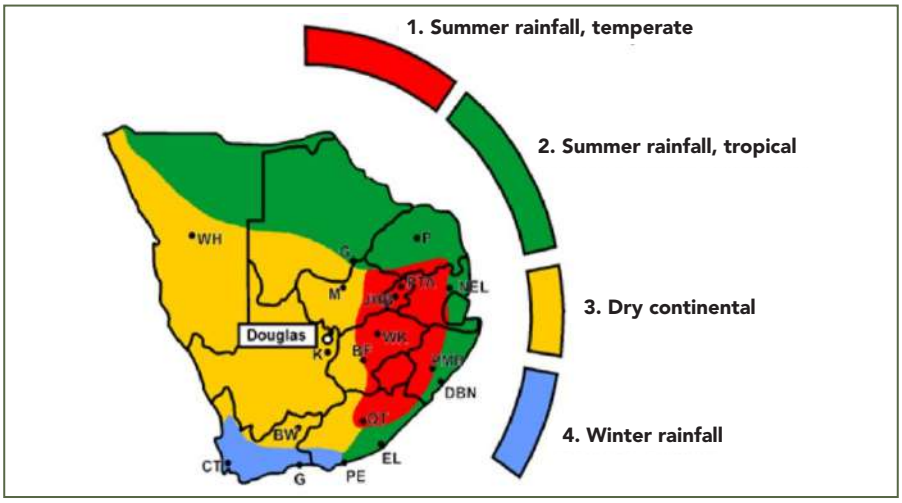
The cultivar trial was carried out in sandy loam soil and laid out in a randomised block design with three replications per cultivar. *Table 1* contains additional technical information relating to the trial.

The cultivar trial included cultivars with short and long growing periods. Hence, growing periods can influence the eventual crop yield of certain cultivars. Growing periods are defined as the number of days from emergence to leaf senescence, depending on the season. A potato plant's lifetime can be divided into five growth phases which include sprout development, vegetative growth, tuber initiation, tuber filling and maturity.

Table 2 illustrates how the growth period differs from one cultivar to another. Environmental factors and management practices influence the different growth phases and their time of commencement.

Population density and haulm count influence tuber size and yield.

Figure 1: Location of Douglas in the Northern Cape production region.



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

The number of eyes per tuber is dependent on the cultivar and can determine the number of sprouts produced per tuber. In this instance, the plant readiness of seed potatoes is very important seeing as better plant readiness leads to better sprouting in seed potatoes. Plant readiness of seed potatoes during the planting of this trial as well as population density and haulm count are indicated in *Table 2*.

The evaluation of new cultivars such as those in this trial provides, among others, results regarding yield and marketing index. The marketing index of the specific cultivars is calculated by classing and sorting each cultivar according to quality and size group distribution (for example, Class 1 Large or Class 2 Large medium). Prices are then compared to market prices as obtained during harvesting time. The performance of new cultivars cannot be based on

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

Farm	**Bossiespan**		
Producer	Jaco Mulke		
Planting date	26 January 2023		
Harvest date	31 August 2023		
Irrigation/dryland	Irrigation		
Double or single rows	Double rows		
Leaf senescence	Natural		
Intra-row spacing	0.9 m		
Trial site	18 m^2		
Population density	44 444 plants/ha		
Tuber size	250 count (average 100 g)		
Fertiliser programme			
	Nutritional value		
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**
Total	**220**	**185**	**216**

Table 2: Characteristics regarding growing period, plant readiness, population density (%) and haulm count for each cultivar.

Agent	Cultivar	Growing period (days)[1]		Plant readiness[2]	Plant density (%)	Haulms per plant	Haulms per ha
GWK	**11Z49A1**	Medium to long	(100-120)	3	100	6.4	284 442
GWK	**11Z55A5**	Medium to long	(100-120)	3	97	5.0	215 553
GWK	**Amany**	Medium to long	(110)	3	92	5.1	208 531
GWK	**Connect**	Medium to long	(120)	3	80	5.0	177 776
RSA	**Foxy**	Short to medium	(90-100)	2	97	3.6	155 198
GWK	**Kelly**	Long	(120)	3	92	5.4	220 798
GWK	**King Russet**	Short	(80-90)	3	100	7.4	328 886
GWK	**Lanorma**	Short	(80-90)	3	100	5.3	235 553
GWK	**Lilly**	Medium	(100)	3	92	8.0	327 108
	Mondial	Medium to long	(110-115)	2	100	5.6	248 886
GWK	**Noha**	Medium	(100)	3	100	3.9	173 332
GWK	**Noya**	Medium to long	(120)	3	95	2.5	105 555
	Panamera	Long	(120-125)	3	89	5.5	217 553
	Sababa	Medium to long	(110-115)	3	100	6.7	297 775
	Sifra	Short to medium	(90-100)	3	98	5.8	252 620
	Tyson	Short to medium	(90-100)	3	91	4.3	173 909

[1]General guidelines and categories (days from emergence to leaf senescence, depending on the season): Short = 70 to 90 days; short to medium = 80 to 100 days; medium = 90 to 110 days; medium to long = 90 to 120 days; long = 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 = Fresh; 2 = slightly fresh; 3 = ready for planting; 4 = slightly old; 5 = old.

Figure 2: Rainfall during the 2023 season and the long-term average rainfall.

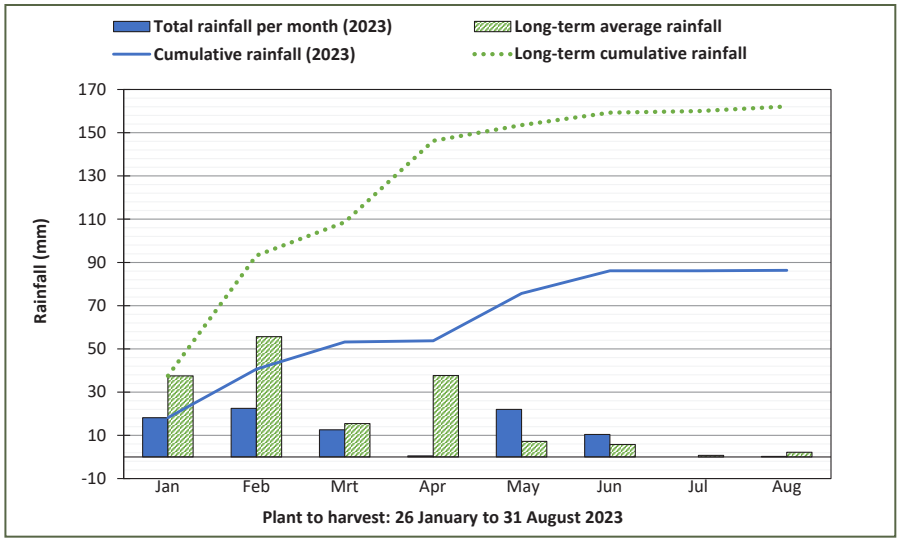


Figure 3: Minimum and maximum temperatures during the 2023 season as well as long-term temperatures.

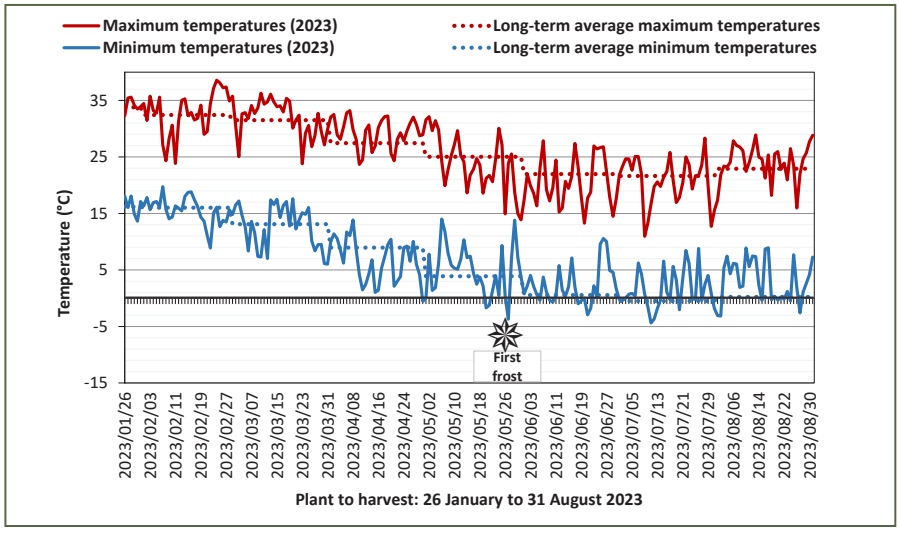
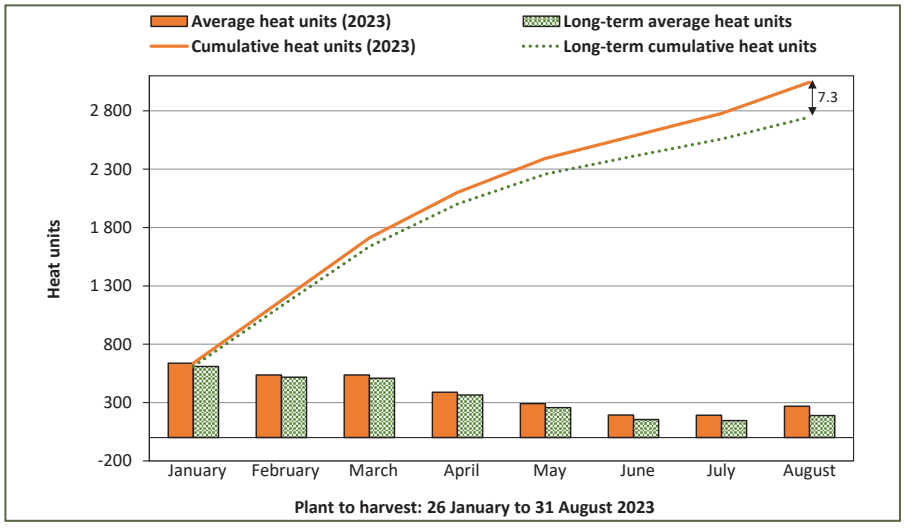


Figure 4: Heat units during the 2023 season, as well as the long-term average.



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

one specific season only, as climate can vary from one year to the next. Therefore, cultivars are preferably tested across several seasons.

As with any crop, aspects such as temperatures, the availability of water (whether through good irrigation scheduling or rainfall) as well as heat units, are all important factors that have a fundamental influence during the potato plant's growing period. These factors are thus taken into consideration when the performance of cultivars is evaluated.

Rainfall and irrigation

The season's rainfall was substantially lower than the long-term average rainfall trend for the growing season (*Figure 2*). In this dry continental region, there is heavy reliance on good irrigation scheduling for potatoes.

Temperatures and heat units

Figure 3 indicates minimum and maximum temperatures. Temperatures below freezing point were recorded regularly since the end of May. These continuous below-freezing temperatures led to natural foliage die-off.

Cultivars with short and long growing periods were included in the cultivar trial. Growing periods can affect the crop yield of cultivars.

The collection of heat units during a growing period is an important factor in a potato plant's development. The trend of heat units available for the season's cultivar trial seemed to be somewhat higher than the trend of average long-term heat units. (*Figure 4*)

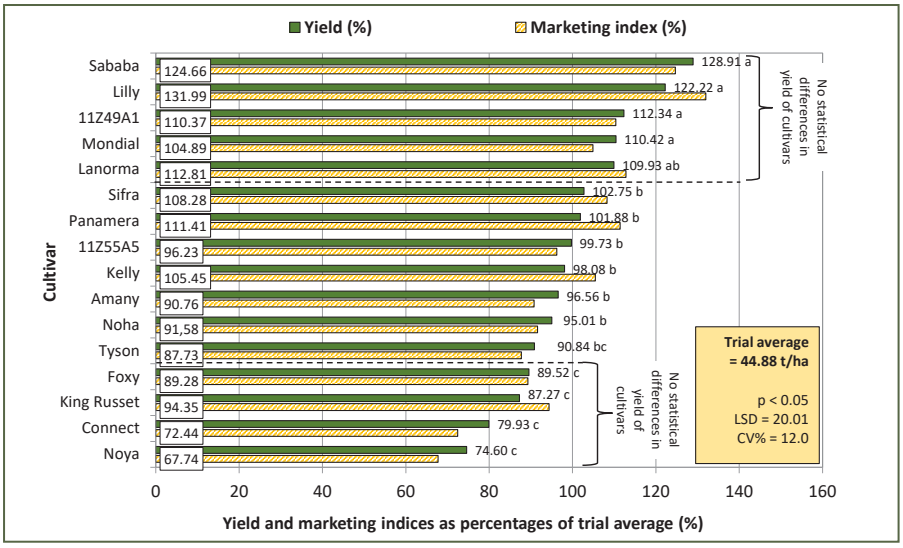
The yield index

Yield data collected during harvest was subjected to statistical processing using the GenStat® program. The Tukey test of least significant differences (LSDs) was used to separate the mean. The cultivar effect during this specific trial (*Figure 5*) was statistically significant ($p<0.05$) and the coefficient of variation was acceptably low (12%).

These factors indicate that the trial was well executed and the results reliable. The yield of each of the cultivars is divided by the trial average (the trial average of all the cultivars is taken as 100%). A yield index is created and each cultivar's performance is then read as a percentage of the trial average.

The average yield for the 2023 season trial was 44.88 t/ha.

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.*

Figure 6: Grading of each cultivar.

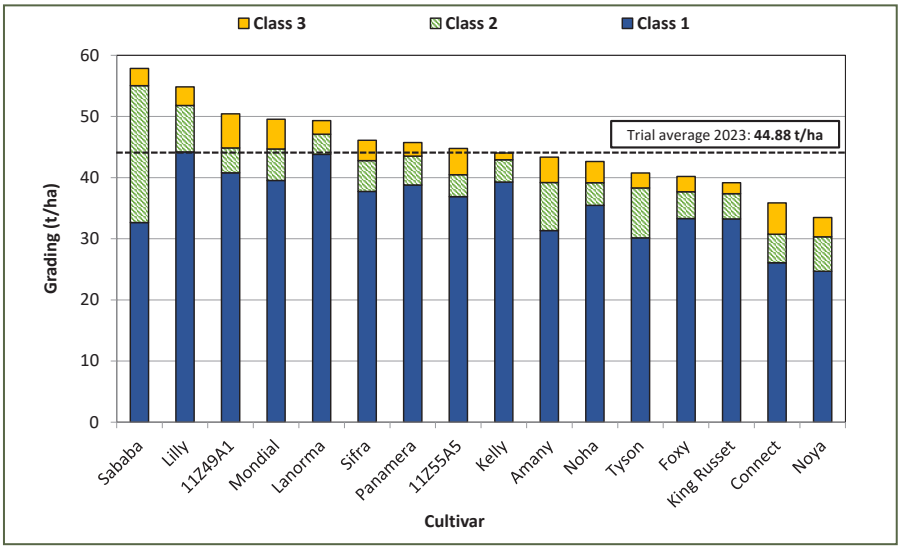


Figure 7: Size-group distribution of each cultivar during final harvest.

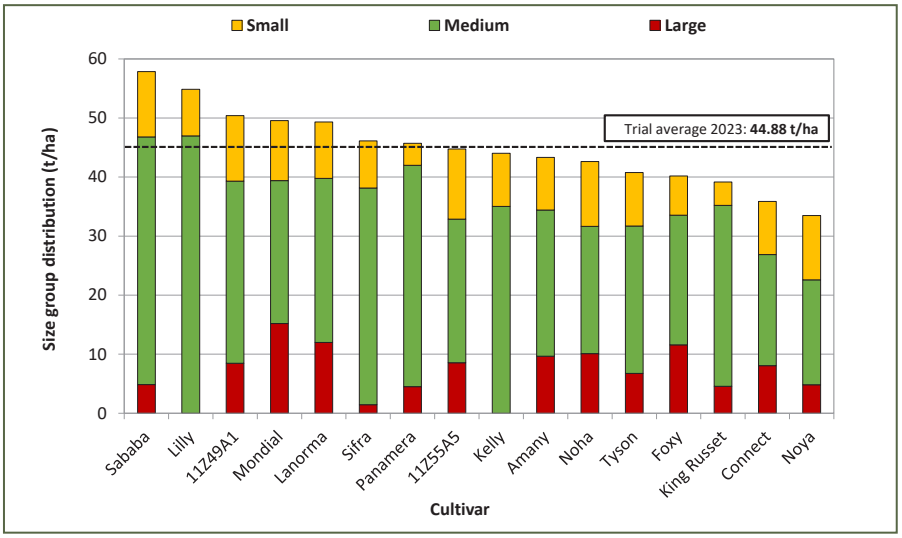


Table 3: Main reasons for downgrading during the Douglas harvest in 2023.

Cultivar	Malformation	Rhizoctonia	Growth cracks	Other cracks	Common scab	Silver scab	Moth	Insects	Greening
11Z49A1					x		x		x
11Z55A5	x			x		x	x		
Amany		x			x		x		x
Connect			x		x		x		x
Foxy						x	x	x	x
Kelly			x	x			x		
King Russet	x			x			x		
Lanorma					x		x	x	x
Lilly					x	x		x	x
Mondial			x	x			x	x	x
Noha		x			x		x	x	
Noya		x			x		x	x	x
Panamera			x					x	x
Sababa		x				x	x		x
Sifra					x		x	x	
Tyson	**x**		x				x	x	

Table 4: Processing characteristics and internal quality of cultivars in the 2023 trial. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour [1]	SG[2]	Dry Matter[3]
11Z49A1	60.89	1.065	17.1
11Z55A5	49.77	1.059	15.8
Amany	60.45	1.073	18,7
Connect	59.69	1.068	17.6
Foxy	58.11	1.061	16,1
Kelly	53.99	1.057	1.4
King Russet	52.72	1.075	19.2
Lanorma	62.54	1.064	16.8
Lilly	45.34	1.075	19.2
Mondial	56	1.064	16.9
Noha	51.15	1.065	1.1
Noya	64.70	1.071	18.3
Panamera	55.87	1.070	18.2
Sababa	60.45	1.060	15.9
Sifra	62.19	1.062	16.3
Tyson	50.52	1.068	17.7

[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.*

The cultivars Sababa, Lilly, 11Z49A1, Mondial and Lanorma statistically produced the highest yields. Lilly produced the highest marketing index which can be ascribed to a good yield of Medium tubers as well as minimal Class 3 tubers.

Market prices for Class 1 Medium-sized potatoes were R5 more than Class 1 Large potatoes during the week of harvesting; this will influence the marketing index as indicated on the graph where Lilly produced the highest marketing index. The main reasons for the downgrading of each cultivar (*Tabel 3*) were investigated to determine which challenges the specific cultivars were faced with in terms of quality index. Moth damage, malformation and common scab were the main reasons for downgrading.

Lastly, to adhere to processing requirements, cultivars must meet the chip colour standard of >50 and specific gravity (SG) of ≥1.075. Only King Russet met the SG and chip colour requirements. (*Tabel 4*).

Special thanks to the producer and farm, the Northern Cape Potato Work Group as well as Anjé Erasmus, Damien da Cal and Dikgetho Mokoena of Potatoes SA. For more information, contact André Prins at andrep@gwk.co.za or Enrike Verster at enrike@potatoes.co.za.

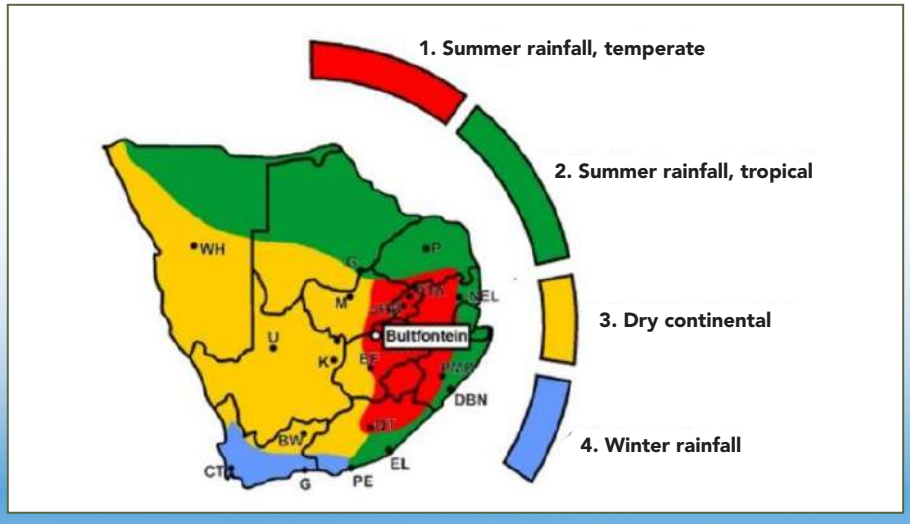
Western Free State cultivar trial under irrigation at Bultfontein in 2023

By Enrike Verster, Anjé Erasmus and Laryssa van der Merwe, Potatoes SA, and Izak Cronjé, producer

The Western Free State is a major potato-producing region where 40 producers produce approximately 14% of the country's potatoes on approximately 7 372 ha. The main cultivars earmarked for commercial use (table and processing potatoes) include Mondial (33%), Sifra (39%) and Lanorma (18%).

Bultfontein is located in South Africa's summer rainfall area where an annual average rainfall of approximately 580 mm is received.

Figure 1: Location of Bultfontein in the Western Free State production region.



The region's temperate climate includes warm summers (warmest in December and/or January) and cold winters with possible frost from April to August.

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

Growth periods

Cultivars with short and long growth periods were included in the trial. The growth periods of certain cultivars may have impacted the crop yield. The length of growth periods is determined by seasonal conditions and is measured as the number of days from emergence to leaf senescence. *Table 2* sets out the variations in growth periods among the different cultivars. Environmental

The average trial yield for the 2023 season is 51.28 t/ha. This is similar to the average yield of the previous five seasons of 50.8 t/ha.

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

Farm	**Oasis**					
Producer	Izak Cronjé					
Planting date	17 January 2023					
Harvest date	7 September 2023					
Irrigation/dryland	Irrigation					
Double or single rows	Double rows in one furrow					
Leaf senescence	Natural					
Intra-row spacing	1 m					
Inter-row spacing	37 cm					
Trial site per unit	20 m^2					
Population density	27 000 plants/ha					
Fertilisation programme						
Nutritional value						
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**	**Ca (kg/ha)**	**Mg (kg/ha)**	**S (kg/ha)**
Total	**296**	**106**	**200**	**109**	**41**	**84**

factors and management practices influence the timing of different growth phases.

The size of tubers and overall yield are influenced by factors such as population density and haulm count per seed potato. The number of eyes on each tuber varies depending on the cultivar and determines the sprouting potential of tubers. Plant readiness of seed potatoes is important in this regard, seeing as seed potatoes that are ready for planting tend to sprout better, and produce the ideal number of sprouts per stem for every cultivar as opposed to tubers that are not yet ready for planting.

However, seed potatoes that are too old produce many stems and small tubers. The plant readiness of

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

Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
11Z49A1	Medium to long	(100-120)	3	85	4	98 900
11Z55A5	Medium to long	(100-120)	3	80	4	90 300
Allison	Medium to long	(120)	3	89	5	108 000
Amany	Medium to long	(110)	3	91	3	72 275
CMK2015	Long	(120)	2	82	5	102 300
Connect	Medium to long	(120)	3	46	3	39 375
Foxy	Short to medium	(90-100)	2	65	3	57 750
Kelly	Long	(120)	3	80	4	79 550
Lilly	Medium	(100)	3	94	4	110 925
Mondial	Medium to long	(110-115)	3	83	4	99 000
Noha	Medium	(100)	3	82	5	100 100
Noya	Medium to long	(120)	3	54	2	33 350
Palace	Long	(110-115)	2	93	4	111 250
Panamera	Medium	(90-110)	3	69	3	51 800
Panamera*	Medium	(90-110)	3	82	3	57 200
Prince	Long	(110-115)	2	98	4	109 975
Sababa	Medium to long	(110-115)	2	100	4	113 400
Sifra	Short to medium	(90-100)	3	91	4	85 750
Sound	Medium	(110)	3	83	4	94 500
Tyson	Short to medium	(90-100)	3	83	3	63 000

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short = 70 to 90 days; short to medium = 80 to 100 days; medium = 90 to 110 days; medium to long = 90 to 120 days; long = 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 = fresh; 2 = slightly fresh; 3 = ready for planting; 4 = slightly old; 5 = old.
**A cultivar was withdrawn from the trial and was replaced with commercial Panamera seed from the farm to maintain the trial plan.*

Figure 2: Rainfall (2023 season) and long-term average rainfall.

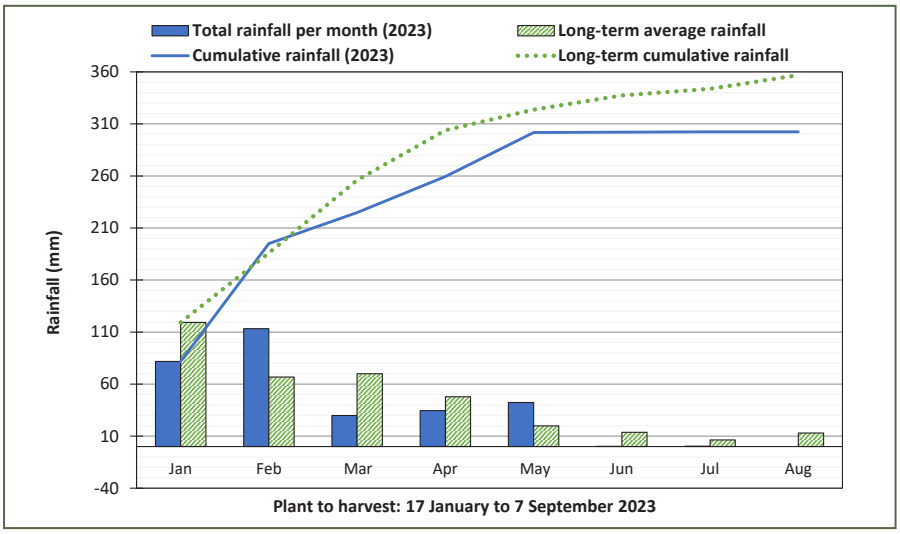


Figure 3: Minimum and maximum temperatures (2023 season) as well as long-term average.

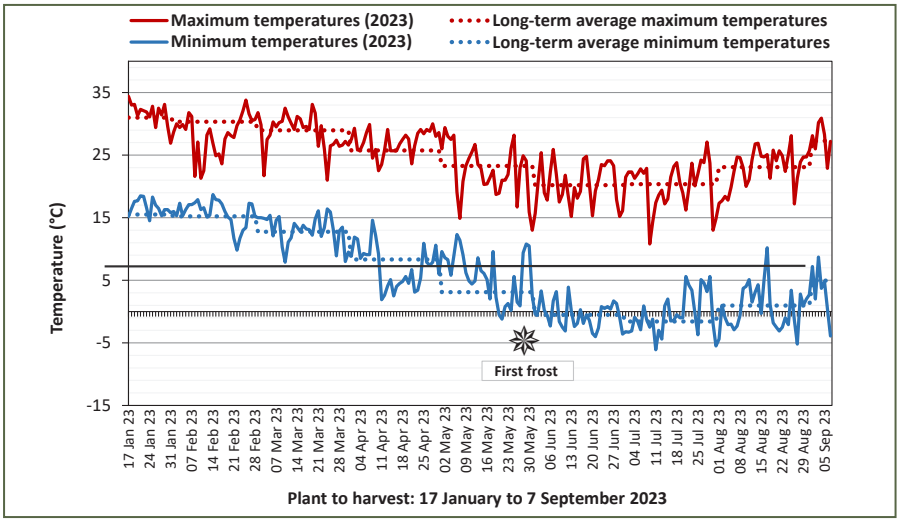
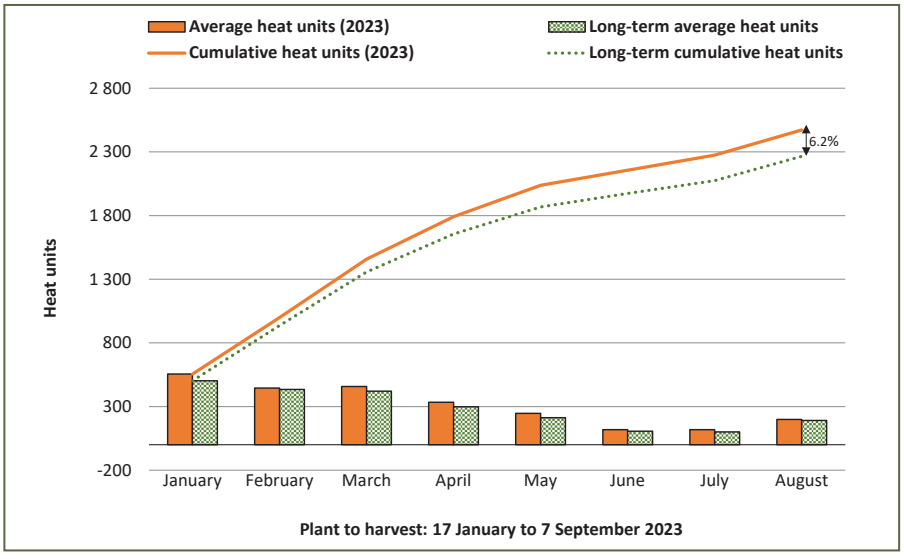


Figure 4: Heat units (2023 season) as well as long-term average heat units.



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

seed potatoes during the planting of the trial as well as the population density and haulm count observed later during the growth period, are indicated in *Table 2*.

Yield and marketing indices

Cultivar evaluations such as the Bultfontein cultivar trial provide results regarding both crop yield and marketing index. The marketing index for the specific cultivars is calculated by classing and sorting each cultivar based on quality and size groups (for example Class 1 Large or Class 2 Large-medium).

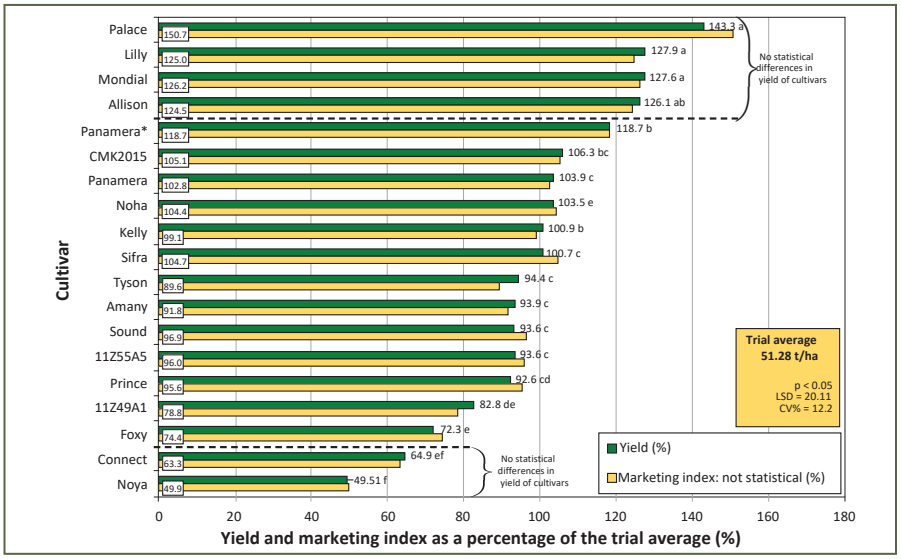
The three replications in the trial were combined and then classed and sorted by the packhouse. Prices were then compared to market prices obtained during the harvest. It is important to note that the performance of new cultivars cannot be solely based on the results of one specific season, as climate conditions vary from year to year. Therefore, cultivars are tested over several seasons.

Abiotic factors

Temperature, daylight length, water availability (be it rainfall and/or good irrigation scheduling) as well as heat units are important factors that significantly influence the potato plant's growth period. Hence, these factors are carefully considered during the evaluation of cultivar performance. Relevant daily and long-term weather data was obtained from a Hortec weather station located near the trail site, as well as from the nearest Agricultural Research Council's (ARC) weather station.

During the 2023 season, the average rainfall was below the norm (*Figure 2*). However, in February, the month after planting, as well as May, towards the end of the growth period, above-average rainfall was recorded. Stem rot was observed in specific cultivars during population and haulm counting. The excessive rainfall towards the end of the growth period may have contributed to the quality problems, such as malformation, which were observed.

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.*
**Panamera: A cultivar was withdrawn from the trial and replaced by a commercial Panamera seed from the farm to maintain the trial plan.*

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

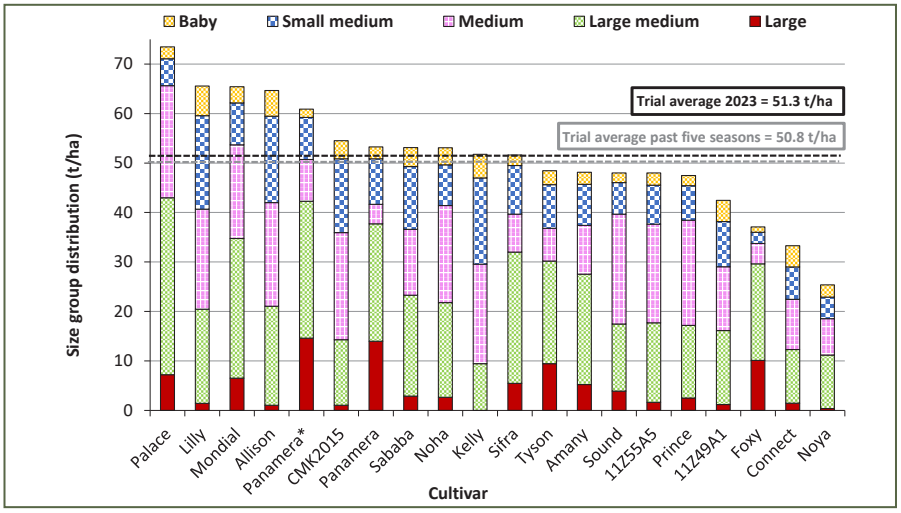


Figure 7: Grading of each cultivar during final harvest.

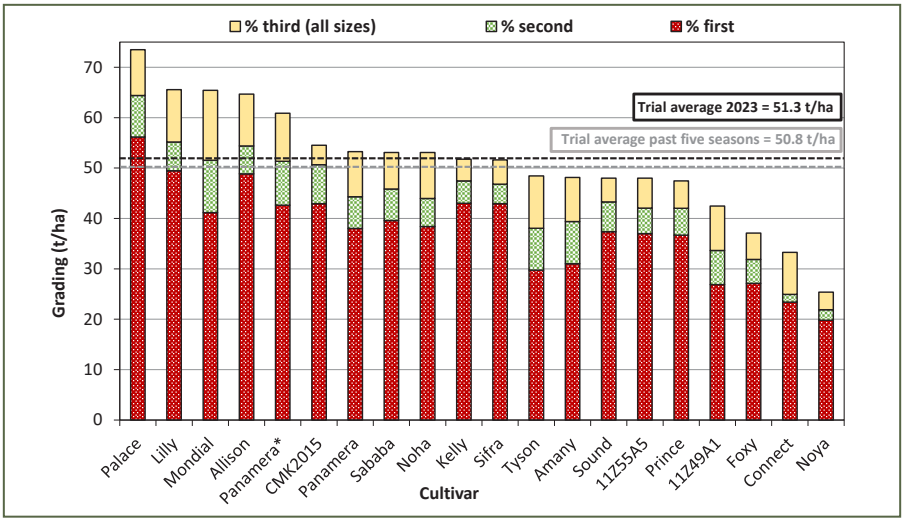


Figure 3 displays the minimum and maximum temperatures, showing major fluctuations recorded in especially maximum temperatures. Temperatures dropped below freezing towards the end of May in 2023, which naturally led to leaf senescence.

Heat units

The collection of heat units during the growth period is an important factor to consider in terms of plant growth. The trend of heat units available for the cultivar trial during this particular season seems to have been above the long-term data trend for the whole season (*Figure 4*).

Yield data collected during harvest was subjected to statistical processing using the GenStat® program. The Tukey test of least significant differences was used to separate the mean.

The cultivar effect during the specific trial (*Figure 5*) was statistically significant ($p<0.05$) in terms of yield, while the coefficient of variation was low (12.2%). This indicates that the trials were well executed, and the results are reliable. The yield of every cultivar is divided by the trial average (the trial average of all the cultivars is taken as 100%). A yield index is created, and every cultivar's performance is read as a percentage of the trial average.

Cultivar performance

The average yield for the 2023 season was 51.28 t/ha. This is very similar to the average yield of the previous five seasons of 50.8 t/ha. The cultivars Palace, Lilly, Mondial, and Allison statistically delivered the highest yields. The same cultivars also achieved the highest marketing index. This can be ascribed to a good yield of Large and Class 1 tubers (*Figures 5, 6* and *7*).

Size-group distribution and grading are essential evaluations when considering a cultivar's marketability. The main reasons for the downgrading of every cultivar (*Table 3*) as well as the internal quality are also important factors that need to be considered.

Table 3: Main reasons for downgrading.

Cultivar	Growth cracks	Other cracks	Common scab	Silver scab/ black dot	Rhizoctonia	Moth	Greening	Malformation	Hollow heart
11Z49A1		x	x	x		x			
11Z55A5				x		x			
Allison		x		x		x	x		
Amany			x	x		x	x	x	
CMK2015	x			x		x	x	x	x
Connect						x	x	x	
Foxy	x			x	x	x	x		
Kelly					x	x	x		
Lilly		x	xx	x		x			x
Mondial	x	x		x		x		x	
Noha		x			x	x	x	x	
Noya			x	x	x	x	x		x
Palace				x		x	x		
Panamera	x	x	x			x	x	x	
Panamera*	x	x	x			x	x	x	
Prince						x	x	x	
Sababa				xx		x	x		
Sifra		x		x		x		x	
Sound	x					x			
Tyson	x	x	x	x		x			

Table 4: Cooking and processing characteristics of cultivars. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	Dry matter DM[2]	SG[3]
11Z49A1	52.4	15.7	1.059
11Z55A5	51.4	16.7	1.064
Allison	52.0	17.8	1.069
Amany	50.7	17.1	1.065
CMK2015	53.3	19.2	1.075
Connect	48.4	17.8	1.069
Foxy	53.4	16.6	1.063
Kelly	55.2	19.7	1.078
Lilly	49.5	15.8	1.059
Mondial	50.3	17.0	1.065
Noha	56.1	17.9	1.069
Noya	52.5	18.2	1.070
Palace	56.0	17.2	1.066
Panamera	53.3	20.8	1.083
Panamera*	60.0	19.8	1.078
Prince	53.9	17.2	1.066
Sababa	46.6	17.1	1.065
Sifra	51.6	17.4	1.067
Sound	51.4	17.8	1.069
Tyson	52.4	15.7	1.059

[1]Chip colour with a value of >50 and without defects is acceptable for the chip industry.
*[2]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.*
[3]Specific gravity of ≥1.075 is acceptable for the processing industry.

The potatoes planted in this trial were cultivated under irrigation.

Moth damage, silver scab, black dot and relatively low specific gravity (SG), as noted in the trial, are problems that can arise when tubers remain in the soil for an extended period before being harvested. According to the available weather data, more heat units were noted during the winter months compared to the long-term average. This could have contributed to increased moth pressure on the potatoes still in the soil. Internal defects in the form of hollow heart were identified in three of the cultivars.

Cultivar performance differs from one season to the next due to the ever-changing climate. Therefore, it is important to assess cultivar performance consistently across multiple seasons. Sifra has exhibited the least variation in the Bultfontein area over the last three and five seasons. (*Figures 8* and *9*).

Lastly, when considering the internal quality of potatoes, cooking and processing qualities can also be evaluated. To comply with processing requirements, cultivars have to comply with a chip colour standard of >50 and an SG of ≥1.075. Seventeen out of 20 cultivars complied with the prescribed chip colour, but only CMK2015 and Kelly had the correct prescribed SG as well as chip colour (*Table 4*).

Figure 8: Performance of cultivars included in the trial for three years (expressed as a percentage of the trail average).

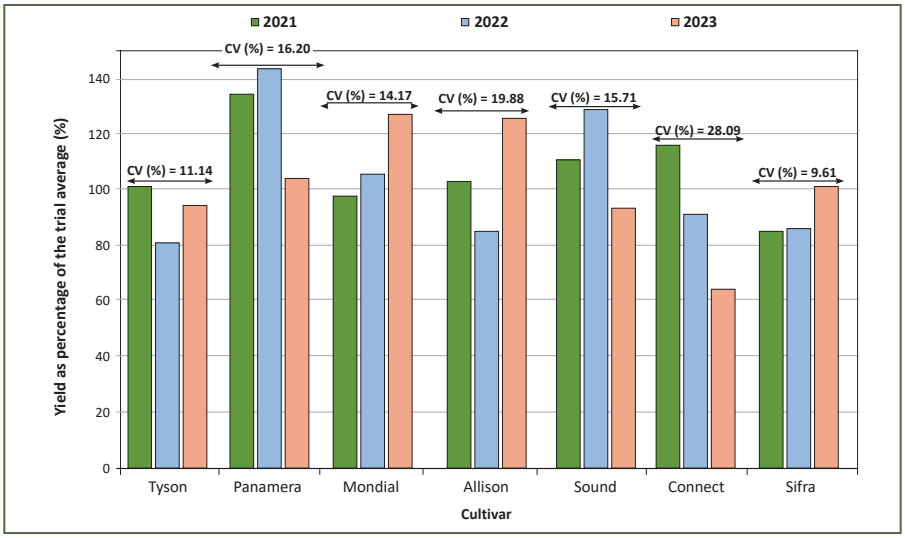
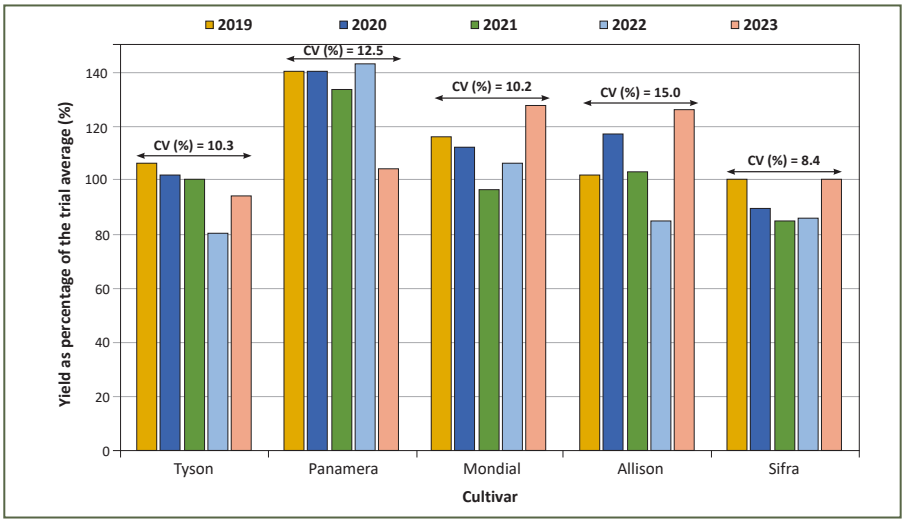


Figure 9: Performance of cultivars included in the trial for five years (expressed as percentage of the trial average).



Special thanks to the farm and co-worker as well as the trial participants and Western Free State Potato Workgroup. For enquiries, contact Enrike Verster at enrike@potatoes.co.za, Anjé Erasmus at anje@potatoes.co.za or Laryssa van der Merwe at laryssa@potatoes.co.za.

The Kroonstad trial was carried out in sandy loam soil and laid out in a randomised block design with three replications per cultivar.

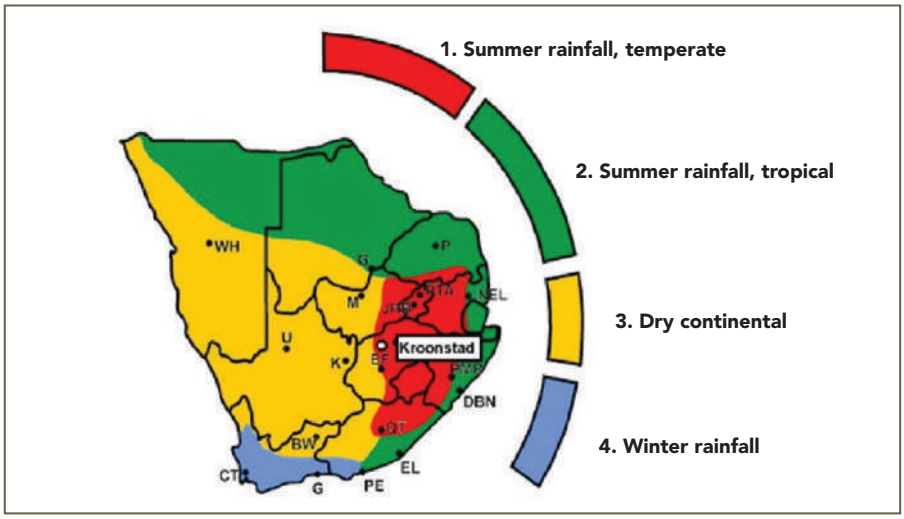
Western Free State cultivar trial under dryland conditions at Kroonstad in 2023

By Enrike Verster, Anjé Erasmus and Laryssa van der Merwe, Potatoes SA
and Fanus van Zyl, Potato Network South Africa

The Western Free State is a large potato production region where 30 producers produce potatoes on approximately 6 990 ha. The main cultivars produced (approximately 6% processing, 67% seed potatoes, 27% table potatoes, mostly under irrigation) are Sifra (34%), Panamera (31%) and Mondial (17%).

Kroonstad is located in South Africa's summer rainfall area (*Figure 1*) and received an average annual rainfall of 820 mm for the last three years, as measured by the Agricultural Research Council, which is well above long-term average rainfall for the region. The moderate climate of the region includes very hot summers (warmest in December/January) and cold winters with frost that can occur from April.

Figure 1: Location of Kroonstad in the Western Free State production region.



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

Growth periods

Cultivars with short and long growth periods were included in the trial. The growth periods of certain cultivars may have impacted the crop yield. The length of growth periods is determined by seasonal conditions and is measured as the number of days from emergence to

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

Farm	**Grootkuil**
Producer	Kobus Crous
Planting date	18 January 2023
Harvest date	28 September 2023
Irrigation/dryland	Dryland
Double or single rows	Single rows
Leaf senescence	Natural
Intra-row spacing	1.8 m
Trial site per unit	18 m^2
Population density	16 000 plants/ha

leaf senescence. *Table 2* indicates the variations in growth periods among the different cultivars. Environmental factors and management practices influence the timing of different growth phases.

It would be ideal to harvest cultivars when they are harvest-ready, but that is not practical when the trial is conducted on a commercial farm.

The size of tubers and overall yield are influenced by factors such as population density and haulm count per seed potato. The number of eyes on each tuber varies depending on the cultivar and determines the sprouting potential of tubers. Plant readiness of seed potatoes is important in this regard, seeing as seed potatoes that are ready to be planted sprout better and produce the ideal number of sprouts per stem for every cultivar.

The plant readiness at the time of planting the trial as well as the population density and haulm count observed later in the growing period are indicated in *Table 2*.

Average yield

New cultivar evaluations such as the Bultfontein cultivar trial, provide results related to both crop yield and marketing index. The marketing index for the specific cultivars is calculated by classing and sorting each cultivar based on quality and size groups (for example Class 1 Large or Class 2 Large-medium). In this trial, all three replications were classed and sorted by the packhouse.

Table 2: Characteristics regarding growth period, plant readiness, population density (%) and haulm count.

Cultivar	Growing period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
11Z49A1	Medium to long	(100-120)	4	94	4.1	61 956
11Z55A5	Medium to long	(100-120)	4	92	4.6	67 467
Allison	Medium to long	(120)	3	81	3.5	45 111
Alverstone Russet	Medium to long	100	3	100	3.5	56 000
Amany	Medium to long	(110)	3	92	2.8	41 067
CMK2015	Long	(120)	3	89	4.4	62 578
Foxy	Short to medium	(90-100)	3	28	3.8	16 889
Kelly	Long	(120)	4	92	3.4	49 867
Lilly	Medium	(100)	3	97	4.2	65 333
Mondial	Medium to long	(110-115)	3	81	4.3	55 422
Mondial*	Medium to long	(110-115)	3	72	3.6	41 600
Noya	Medium to long	(120)	4	58	2.4	22 400
Palace	Long	(110-115)	3	94	3.5	52 889
Panamera	Medium	(90-110)	3	81	3.1	39 956
Prince	Long	(110-115)	3	89	4.6	65 422
Sababa	Medium to long	(110-115)	3	97	4.8	74 667
Sound	Medium	(110)	3	94	3.7	55 911
Up-To-Date*	Medium to long	(90-120)	3	53	2.9	24 489

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short = 70 to 90 days; short to medium = 80 to 100 days; medium = 90 to 110 days; medium to long = 90 to 120 days; long = 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 = fresh; 2 = slightly fresh; 3 = ready for planting; 4 = slightly old; 5 = old.
**Commercial cultivars from the farm entered into trial.*

Figure 2: Rainfall (2023 season) and long-term average rainfall.

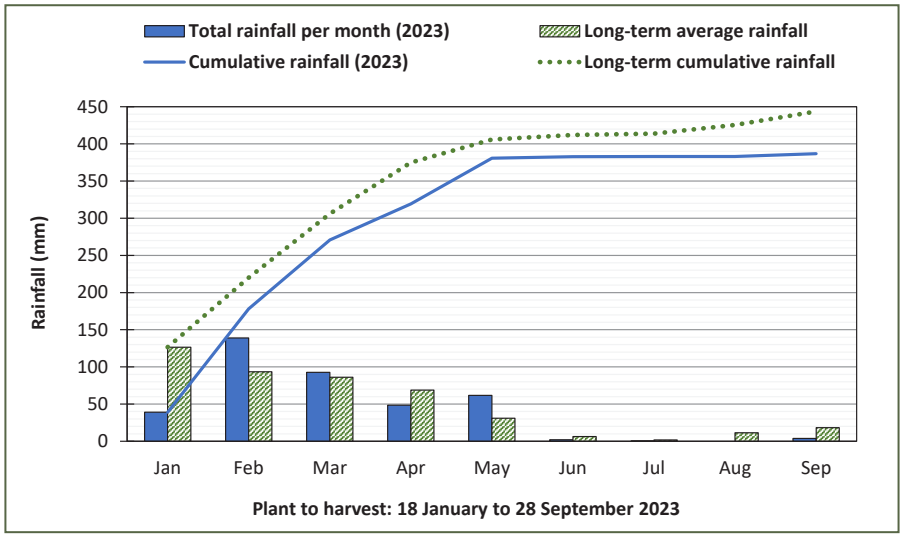


Figure 3: Minimum and maximum temperatures (2023 season) as well as long-term average.

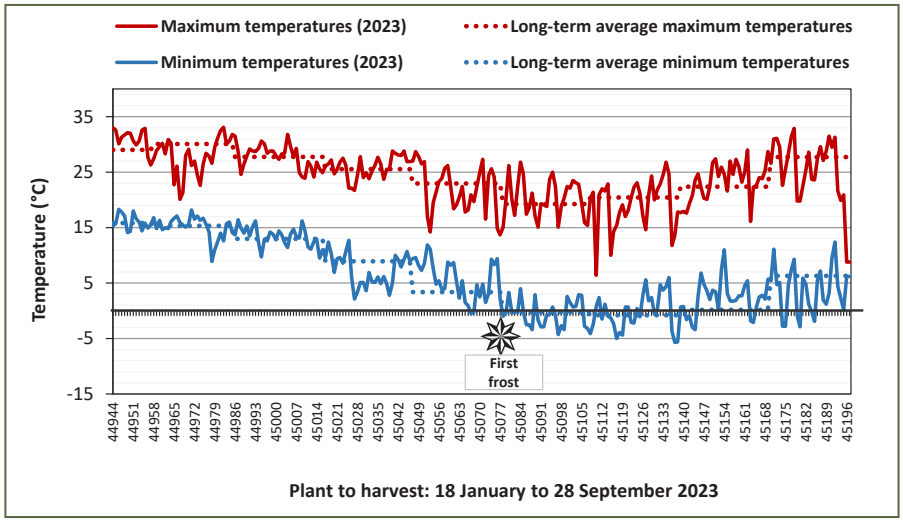
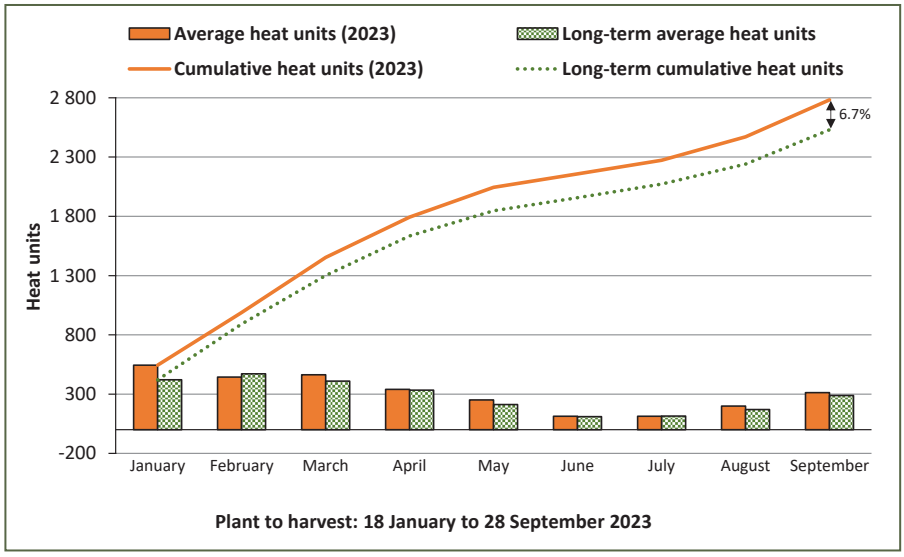


Figure 4: Heat units (2023 season) as well as long-term average heat units.



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

Prices were then compared to market prices obtained during the harvest. It is important to note that the performance of new cultivars cannot be solely based on the results of one specific season, as climate conditions vary from year to year. Therefore, cultivars are tested over several seasons.

Abiotic factors

Temperature, daylight length and the availability of water (be it rainfall and/or good irrigation scheduling) as well as heat units are important factors that significantly influence the potato plant's growth period. Hence, these factors are carefully considered during the evaluation of cultivar performance. Relevant daily and long-term weather data was obtained from a Hortec weather station located near the trail site, as well as from the nearest Agricultural Research Council's (ARC) weather station.

The rainfall trend for the 2023 season indicated lower (than the normal long-term average) rainfall. January received exceptionally low rainfall (*Figure 2*). At the end of the growing period, in May, above-average rainfall was recorded.

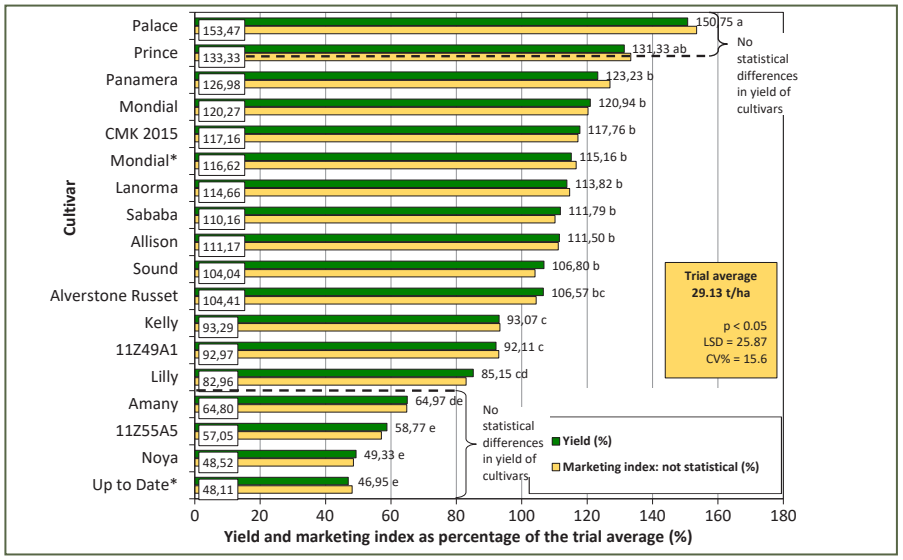
Figure 3 displays the minimum and maximum temperatures. From the beginning of May until the end of August days with temperatures under freezing were recorded during winter. Moderate maximum temperatures were experienced throughout the season with no recorded days exceeding 35°C.

The collection of heat units during the growth period is an important factor to consider in terms of plant growth. The trend of available heat units available for the cultivar trial during this particular season seems to have been far above the long-term data trend for heat units (*Figure 4*).

Yield index

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

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.
**Commercial cultivars from the farm entered into trial.*

Figure 6: Grading of each cultivar.

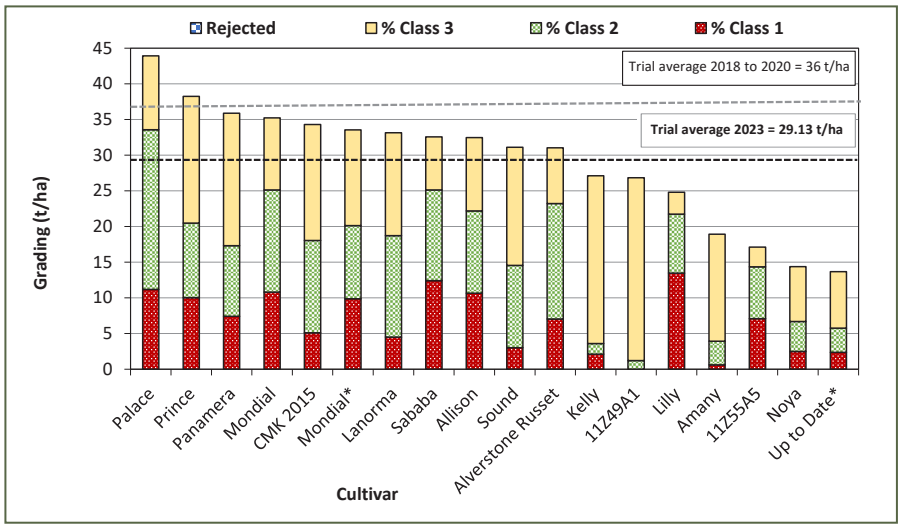
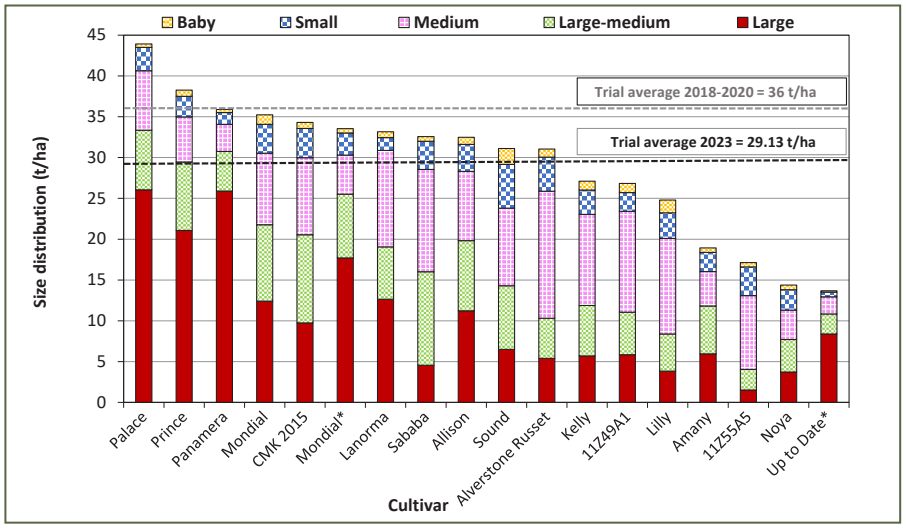


Figure 7: Size-group distribution of each cultivar.



The main reasons for downgrading were the substantial occurrence of common scab as well as silver scab.

statistically significant ($p<0.05$), while the coefficient of variation was low (15.6%).

This indicates that the trials were well executed, and the results are reliable. The yield of every cultivar is divided by the trial average (the trial average of all the cultivars is taken as 100%). A yield index is created, and every cultivar's performance is read as a percentage of the trial average.

The average yield for the 2023 season is 29.13 t/ha, which is somewhat lower than the trial average of 36 t/ha that was noted from 2018 to 2020. Palace and Prince produced the highest yields (*Figure 5*). Palace and Prince as well as Panamera achieved the highest marketing index – this can be ascribed to a good yield of Large as well as Class 1 tubers.

Size-group distribution and grading are essential evaluations when considering a cultivar's marketability. (*Figures 6* and *7*).

Downgrading and quality

The main reasons for downgrading were significant occurrences of common scab as well as silver scab. The trial site experienced severe common scab pressure, resulting in significant damage, except for certain cultivars.

Cultivar performance differs from one season to the next due to the

Table 3: Main reasons for downgrading.

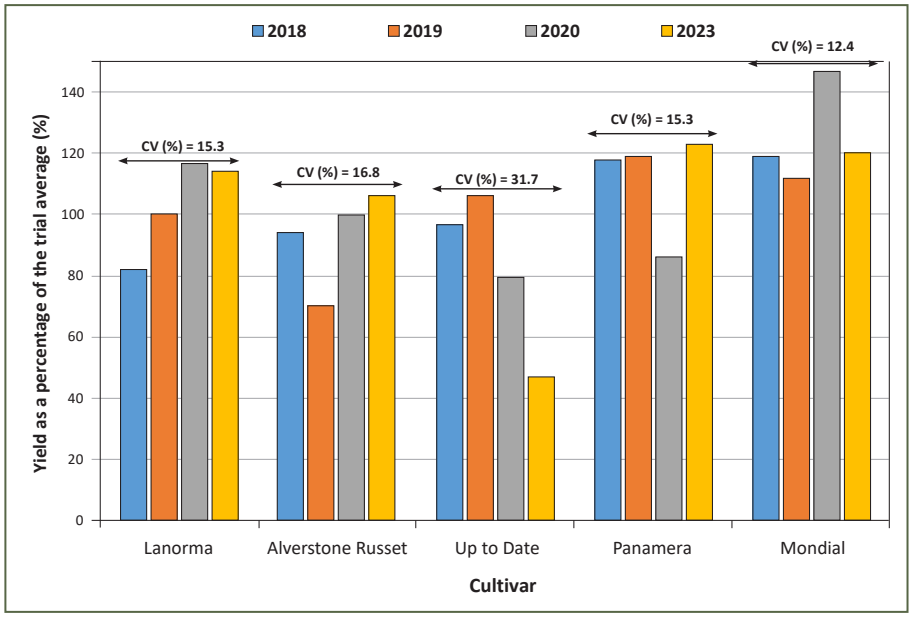
Cultivar	Common scab	Growth cracks	Fissure scab	Silver scab	Malformation	Moth	Greening
11Z49A1	x			x			
11Z55A5	x			x			
Allison	x			x	x		x
Alverstone Russet	x			x			x
Amany	x					x	
CMK2015	x			x		x	x
Foxy	x				x		
Kelly	x			x	x		x
Lanorma	x			x			
Lilly	x			x		x	
Mondial	x	x	x	x	x	x	x
Mondial*	x	x	x	x			x
Noya	x	x	x	x			x
Palace	x		x	x			x
Panamera	x		x	x		x	x
Prince	x					x	x
Sababa	x			x			x
Sound	x			x			
Up-To-Date*	x			x	x		x

Table 4: Cooking and processing characteristics of cultivars. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	DM[2]	SG[3]
11Z49A1	61.6	17.1	1.065
11Z55A5	62.4	17.7	1.068
Allison	50	19	1.074
Alverstone Russet	58.3	20.4	1.081
Amany	56.1	19.3	1.076
CMK2015	63.1	20.3	1.081
Foxy	39.5	16.6	1.063
Kelly	63.8	18.3	1.071
Lanorma	65.3	17.8	1.069
Lilly	55	16.7	1.064
Mondial	47.5	17.6	1.068
Mondial*	57.1	16.7	1.063
Noya	61	19	1.074
Palace	63.8	21.9	1.088
Panamera	56	18.7	1.073
Prince	65.2	20.4	1.081
Sababa	56.7	17.4	1.067
Sound	59.2	17.5	1.067
Up-to-Date*	48.3	19.1	1.075

[1]Chip colour with a value of >50 and without defects is acceptable for the chip industry.
*[2]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.*
[3]Specific gravity of ≥1.075 is acceptable for the processing industry.

Figure 8: Performance of cultivars entered into the proof for three years (expressed as a percentage of the trial average).



ever-changing climate. Therefore, it is important to assess cultivar performance consistently across multiple seasons. Mondial, Lanorma and Panamera exhibited the least variation in the Kroonstad trial of 2018 to 2023 (*Figure 8*).

Lastly, when considering the internal quality of potatoes, cooking and processing qualities can also be evaluated. None of the cultivars indicated hollow heart or internal brown spots. To comply with processing requirements, cultivars have to comply with a chip colour standard of >50 and an SG of ≥1.075 (*Table 4*). Alverstone, Russet, Amany, CMK2015, Palace and Prince complied with both SG and chip colour requirements. Most of the cultivars had the correct chip colour.

Special thanks to the farm and co-workers as well as the trial participants and Western Free State Potato Workgroup. For enquiries, contact Enrike Verster at enrike@potatoes.co.za, Anjé Erasmus at anje@potatoes.co.za or Laryssa van der Merwe at laryssa@potatoes.co.za.

Limpopo cultivar trial under irrigation at Dendron in 2023

By Enrike Verster, Potatoes SA

Limpopo is a major potato production region where approximately 25% of the country's total commercial potatoes are produced by 103 producers. The main cultivars earmarked for the table and processing markets are Mondial, Valor and Sifra.

Dendron, located in South Africa's summer rainfall area (*Figure 1*), received an average of 362 mm annual rainfall in the last 21 years according to information obtained from the nearby Agricultural Research Council (ARC) weather station. Winters in this area are short and cool, while summers are long and warm. During the winter months, from May to July, the region experiences long-term temperatures of an average minimum of 6°C and maximum of 24°C. A few days had temperatures below 0°C.

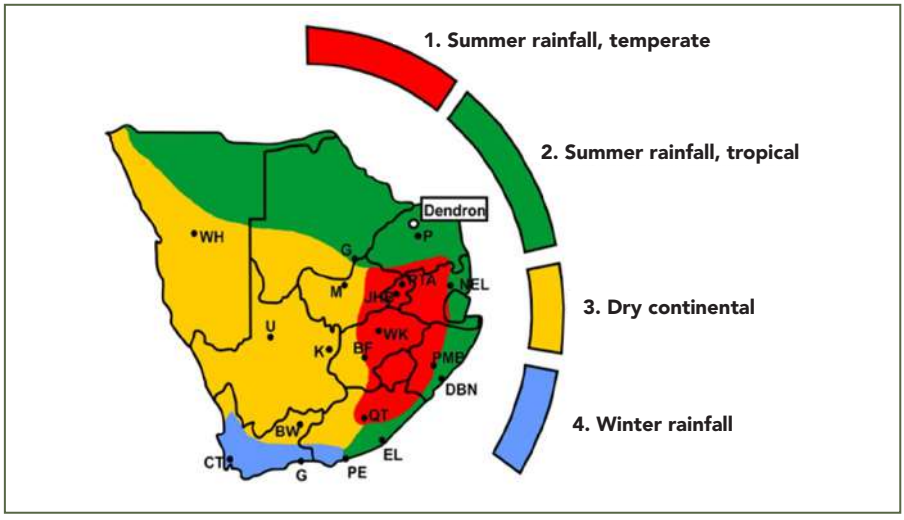
Hence, two production seasons are feasible in the Dendron area: an early planting period from January to March, followed by the main planting from April to July. This area is one of the most significant contributors to the South African potato industry due to these two planting periods.

The cultivar trial at Dendron was laid out in a randomised block design with three replications per cultivar. Additional technical information regarding the trial can be found in *Table 1*. Before planting, soil samples were collected to assess the nutrient contents of the soil at the trial site (*Table 2*).

Growth periods

The cultivar trial included both short and long growth period cultivars. Growth periods can therefore affect the crop yield of certain cultivars. Growth periods are defined as the

Figure 1: Location of Dendron in the Limpopo production region.



The marketing indices for the specific cultivars are calculated by sorting and classing each cultivar based on quality and size group distribution.

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

Farm	**Zandput**					
Producer	Mossie Jongbloed					
Planting date	16 May 2023					
Harvest date	5 October 2023					
Irrigation/dryland	Irrigation					
Double or single rows	Two single rows per cultivar					
Intra-row spacing	0.9 m					
Inter-row spacing	30 cm					
Trial site per unit	18 m^2					
Population density	37 037 plants/ha					
Fertiliser programme	**Nutritional value**					
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**	**Ca (kg/ha)**	**S (kg/ha)**	
Total	**180**	**50**	**96**	**27**	**119**	

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

pH (H_2O)	Density (g/ml)	P	K	Ca	Na	Fe	Mn	Cu	Zn	B	S	Al
		P Bray II (mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
5.6	1.2	27	282	478	18	58.9	85.5	2.66	4.05	4.42	2.87	315
Sand 76%				**Clay 15%**					**Silt 9%**			

Table 3: Characteristics regarding growth period, plant readiness, population density (%), and haulm count for each cultivar.

Agent	Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
GWK	**Amany**	Medium to long	(110)	<1	96	1	35 555
GWK	**Connect**	Medium to long	(120)	<1	100	4	148 148
RSA	**Foxy**	Short to medium	(90-100)	1	96	3	106 666
GWK	**Kelly**	Long	(120)	<1	100	2	74 074
GWK	**Lilly**	Medium	(100)	1	100	4	148 148
WEC grow	**Mondial**	Short to medium	(95-100)	1	100	2	74 074
GWK	**Noya**	Short	(80-90)	<1	90	3	99 999
WEC grow	**Panamera**	Short to medium	(95-100)	<1	100	2	74 074
WEC grow	**Sababa**	Medium to long	(110-115)	2	100	4	148 148
WEC grow	**Sifra**	Short to medium	(90-100)	3	100	2	74 074
First Potato Dynamics	**Sound**	Medium	(95-100)	2	93	5	172 222
WEC grow	**Tyson**	Short to medium	(90-100)	2	90	2	66 666

[1]General guidelines and categories (days from emergence to leaf senescence, depending on the season): short: 70 to 90 days; short to medium: 80 to 100 days; medium: 90 to 110 days; medium to long: 90 to 120 days; long: 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 – fresh; 2 – slightly fresh; 3 – ready for planting; 4 – slightly old; 5 – old.

number of days from emergence to leaf senescence, depending on the season.

Table 3 provides a breakdown of how these growth periods differ among different cultivars. Plant readiness of seed potatoes during the planting of the trial as well as population density and haulm count that can be observed later in the growth period, are indicated in *Table 3*.

Marketing index

In the Dendron cultivar trial, the evaluation of new cultivars delivered results relating to, among other things, yield and marketing index. The marketing indices for the specific cultivars are calculated by sorting

Figure 2: Rainfall as well as long-term average rainfall during the 2023 growing season.

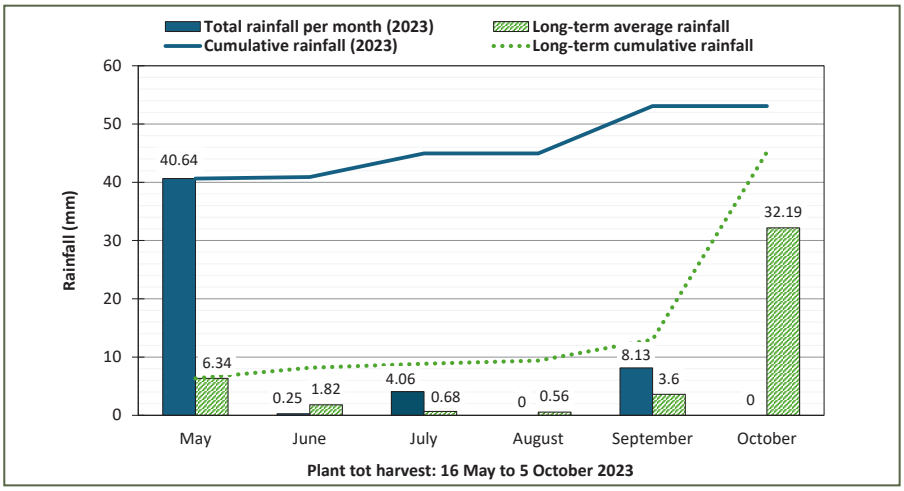


Figure 3: Minimum and maximum temperatures (°C) during the 2023 season, as well as the long-term average temperatures.

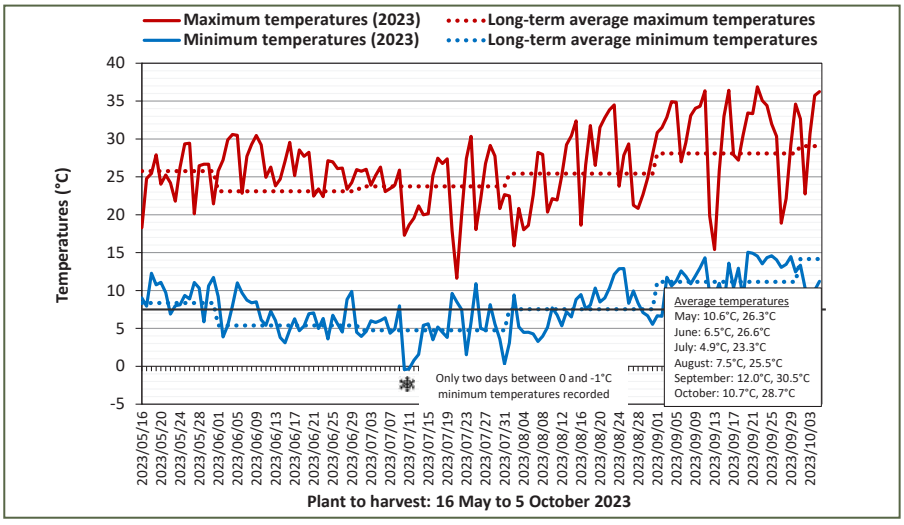
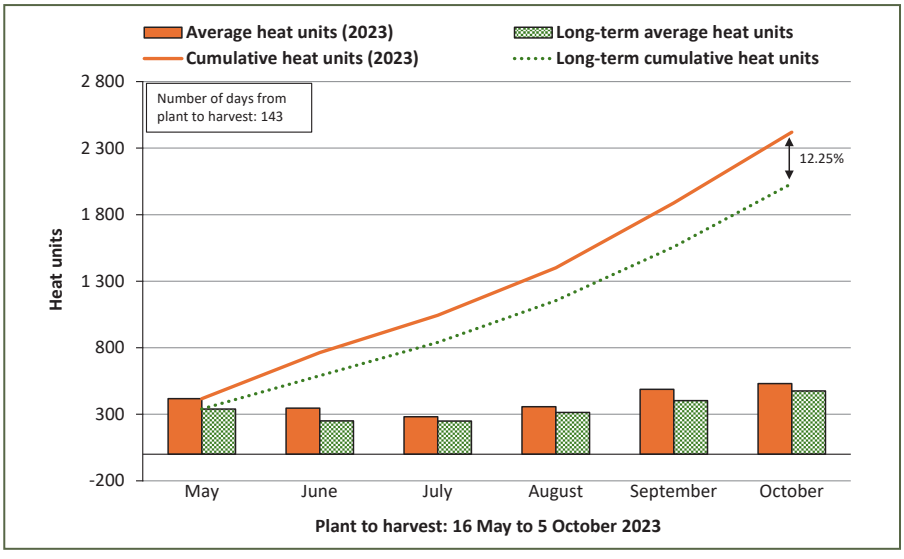


Figure 4: Heat units during the 2023 season, as well as the long-term average heat units.



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

and classing each cultivar based on quality and size group distribution (e.g., Class 1 Large or Class 2 Large to Medium).

Price comparisons are made using market prices obtained during harvest. The performance of new cultivars cannot be based solely on results from a single season, as climate conditions vary from one year to the next. Therefore, cultivars are preferably tested across multiple seasons.

During the potato's growth period factors such as temperature, water availability (either through a good irrigation schedule or rainfall), and heat units play a crucial role. These factors are therefore considered when evaluating the performance of the cultivars.

Seasonal aspects

Daily weather data was obtained from a weather station near the trial site, with long-term data obtained from a nearby ARC weather station.

Figure 2 illustrates the recorded rainfall dates. This season received less rainfall than the traditional October average. Because Dendron receives summer rainfall, proper irrigation scheduling is important, especially during hot periods.

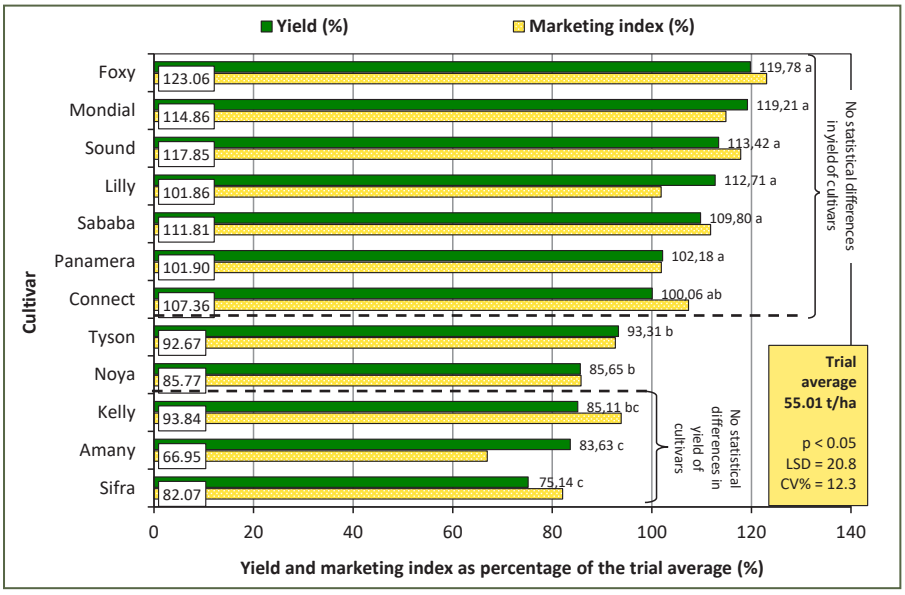
Figure 3 displays both minimum and maximum temperatures. Significant fluctuations in maximum temperatures can be observed during the last three months of the season. No notable frost was observed, with only two days during which temperatures dipped slightly below freezing point throughout the entire season.

Heat units play a crucial role in potato plant development. The trend of heat units available for the cultivar trial this season in Dendron appears to exceed the long-term data trend of heat units. This increase is due to a slightly warmer winter compared to the long-term average (*Figure 4*).

Significant cultivar effect

The yield data collected during harvest was subjected to statistical

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.*

Figure 6: Size-group distribution of each cultivar.

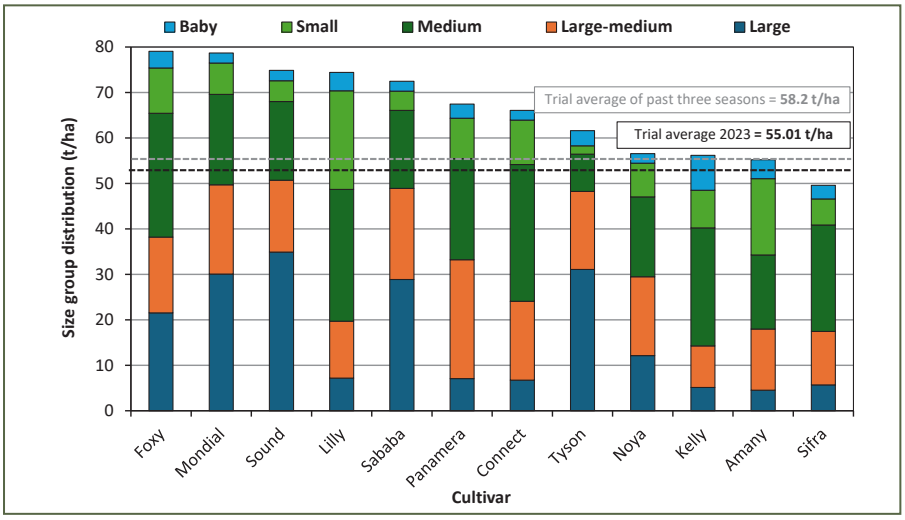
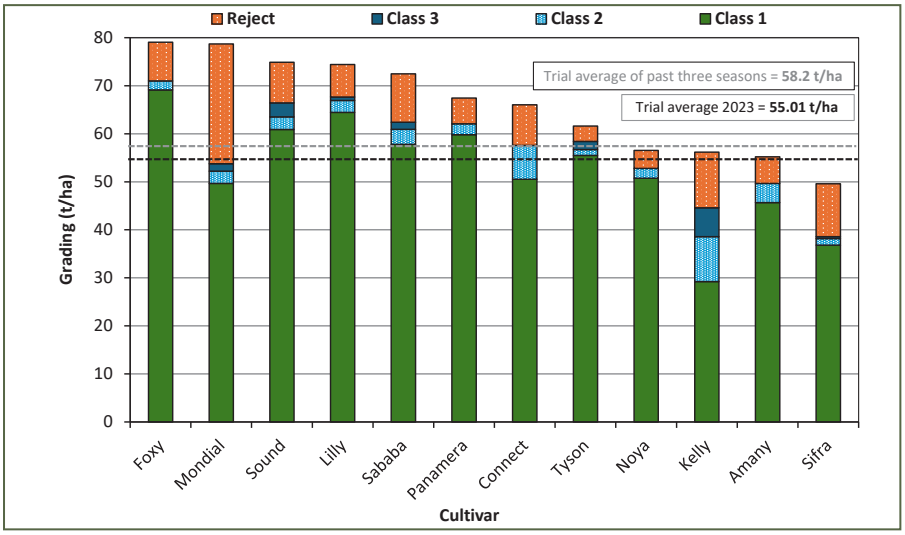


Figure 7: Grading of each cultivar.



processing using the GenStat® program. The Tukey test of least significant differences (LSD) was used to separate the mean. The cultivar effect in this trial (*Figure 5*) was statistically significant ($p<0.05$) while the coefficient of variation (CV) was low (9.6%). These factors indicate that the trial was well executed and that the results are reliable.

The yield of every cultivar is divided by the trial average – the trial average of all the cultivars is taken as 100%. By doing this, a yield index is established and every cultivar's performance in terms of yield is expressed as a percentage of the trial average.

Yield and quality aspects

The average yield for the 2023 trial is 55.01 t/ha. This is slightly less than the average yield of 58.17 t/ha observed in the previous three seasons. The cultivars Foxy, Mondial, Sound, Lilly, Sababa, Panamera, and Connect produced the highest yields, with no statistical differences in yield. Foxy, Sound, and Mondial also achieved the highest marketing indices.

A good marketing index is attributed to a higher yield of Large potatoes and/or a good percentage of high-quality potatoes. Size group distribution and grading are crucial evaluations when assessing the marketability of a potato cultivar (*Figures 6* and *7*).

The main reasons for downgrading in this trial are indicated in *Table 4*. Malformation and silver scab had the biggest influence on the overall quality of the potatoes in this trial.

The performance of potato cultivars varies from one season to the next due to differences in climate. Therefore, it is important to monitor cultivar performance across multiple seasons. *Figure 8* illustrates the variation in specific cultivars over the past three years in this trial.

Lastly, when evaluating the internal quality of potatoes, processing characteristics come into play. To meet processing requirements, cultivars must adhere to a chip colour

Table 4: Main reasons for downgrading.

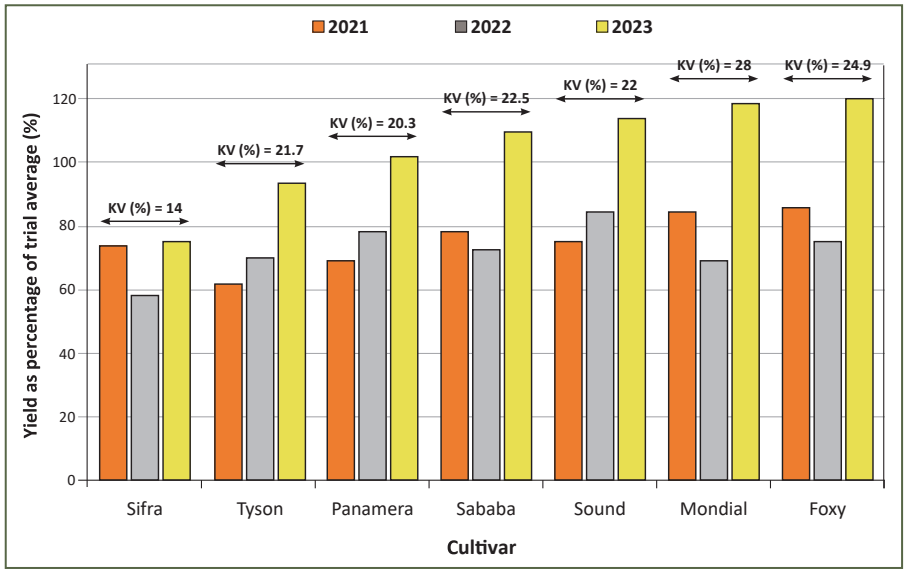
Cultivar	Fissure scab	Growth cracks	Silver scab	Malformation	Stem-end rot	Moth	Other insects	Greening	Common scab	Powdery scab	Loose skin	Mechanical damage	Hollow heart
Amany				x							x	x	
Connect	x		x	x					x	x		x	
Foxy		x	x	x								x	
Kelly	x			x							x		x
Lilly			x	x		x							
Mondial	x		x	x	x								
Noya				x			x					x	
Panamera	x			x			x					x	
Sababa	x	x	x						x			x	
Sifra		x	x					x					
Sound			x	x			x	x			x		
Tyson			x				x	x				x	

Table 5: Processing characteristics and internal quality. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	SG[2]	DM[3]
Amany	39.9	1.073	18.8
Connect	48	1.066	17.3
Foxy	36.5	1.065	17.1
Kelly	47.2	1.075	19.2
Lilly	45.7	1.063	16.5
Mondial	39.2	1.069	18
Noya	46.7	1.074	18.9
Panamera	43.9	1.071	18.4
Sababa	47.2	1.071	18.3
Sifra	39.4	1.065	17
Sound	34.5	1.074	18.8
Tyson	51	1.068	17.6

[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 8: Performance of cultivars that were included in the trial for three years (expressed as a percentage of the trial average).



The coefficient of variation (CV %) is indicated on the graph. Essentially, it means the degree of variation in performance of the specific cultivar over the number of years indicated on the graph. The larger the CV % value, the more variation in the cultivar's performance.

standard of >50 and a specific gravity (SG) of ≥1.075 (*Table 5*). Tyson met the required chip colour while Kelly met the SG requirement.

We thank the following contributors: Mossie Jongbloed, producer, Schalk Grobbelaar, working group chairperson, all participants including First Potato Dynamics, GWK, RSA Saadbeurs and Wesgrow, Ané du Plessis and other Potatoes SA staff involved. For more information, send an email to Enrike Verster at enrike@potatoes.co.za.

The cultivar trial at Tom Burke was laid out in a randomised block design of four replications per cultivar.

Limpopo cultivar trial under irrigation at Tom Burke in 2023

By Enrike Verster, Potatoes SA

Limpopo is a large potato production region where approximately 25% of the country's total commercial potatoes are produced by 103 producers. The main cultivars earmarked for the table and processing markets are Mondial, Valor and Sifra.

Tom Burke, located in South Africa's summer rainfall area (*Figure 1*), received an average of 372 mm annual rainfall in the last 16 years, according to data from a nearby Agricultural Research Council (ARC) weather station. Winters in this area are short and cool, while summers are very warm and long. During the winter months, from May to July, the region experiences long-term temperatures of an average of 6°C minimum and 27°C maximum. A few days had temperatures below 0°C.

Hence, two production seasons are feasible in the Tom Burke region: An early planting period from January to March, followed by the main planting from April to July. Because of these two plantings, this area is regarded one of the most significant contributors to the South African potato industry.

The cultivar trial at Tom Burke was laid out in a randomised

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

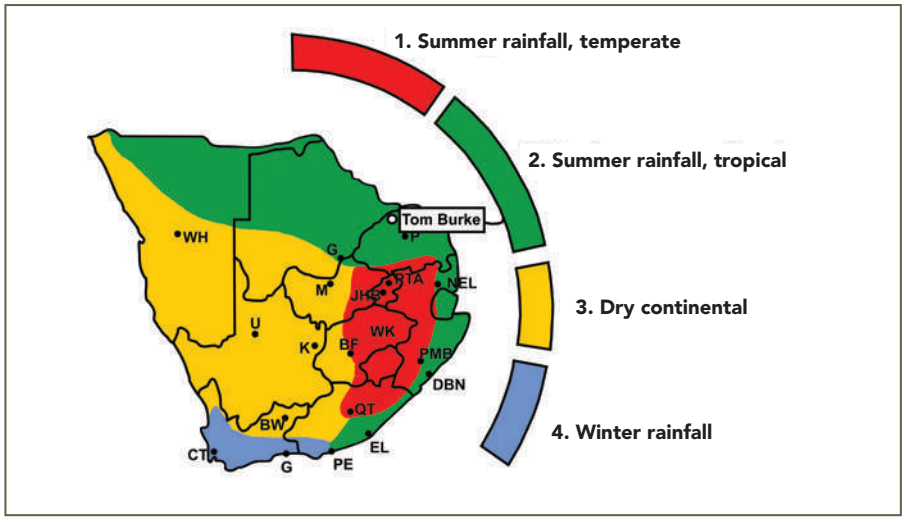


Table 1: Summary of technical information regarding the trial site and layout.

Farm	**Ratho Boerdery**
Producer	Jako Nel
Planting date	25 May 2023
Harvest date	18 October 2023
Irrigation/dryland	Irrigation
Double or single rows	Double 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

block design of four replications per cultivar. Additional technical information regarding the trial can be found in *Table 1*.

Growth periods

The cultivar trial included cultivars with both short and long growth periods. Growth periods can therefore affect the crop yield of certain cultivars. Growth periods are defined as the number of days from emergence to leaf senescence, depending on the season.

Table 2 provides a breakdown of how these growth periods differ

Table 2: Characteristics regarding growth period, plant readiness, population density (%), and haulm count for each cultivar.

Agent	Cultivar	Growth period (days)[1]		Vigour[2]	Haulms per plant	Haulm density[3]	Haulms per ha[4]
RSA	**Foxy**	Short to medium	(90-100)	3	2.7	2-3	119 999
	Mondial	Short to medium	(95-100)	2-3	1.9	2-3	84 444
	Panamera	Short to medium	(95-100)	3	2.5	2-3	111 110
	Sababa	Medium to long	(110-115)	3	4.4	2-3	195 554
	Sifra	Short to medium	(90-100)	1	3.0	1	133 332
First Potato Dynamics	**Sound**	Medium	(95-100)	2-3	3.7	2	164 443
	Tyson	Short to medium	(90-100)	2	2.1	2	93 332

[1]General guidelines and categories (days from emergence to leaf senescence, depending on the season): short: 70 to 90 days; short to medium: 80 to 100 days; medium: 90 to 110 days; medium to long: 90 to 120 days; long: 90 to 140 days.
[2]Vigour of plants: 1 = weak; 2 = moderate; 3 = strong.
[3]Haulm density: 1 = weak; 2 = moderate; 3 = strong.
[4]Haulms/ha when population density is at 100%.

The cultivar trial included cultivars with both short and long growth periods. Growth periods can affect the crop yield of certain cultivars.

Figure 2: Rainfall as well as long-term average rainfall during the 2023 growing season.

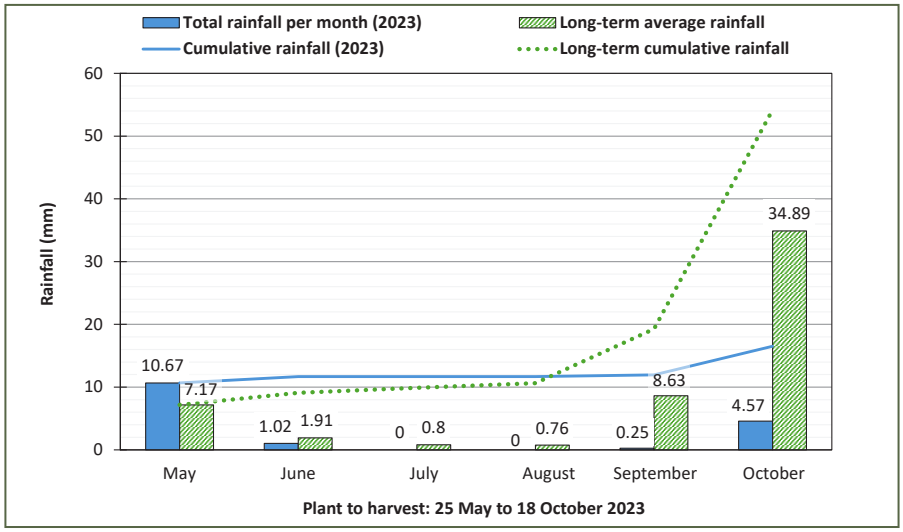


Figure 3: Minimum and maximum temperatures (°C) during the 2023 season, as well as the long-term average temperatures.

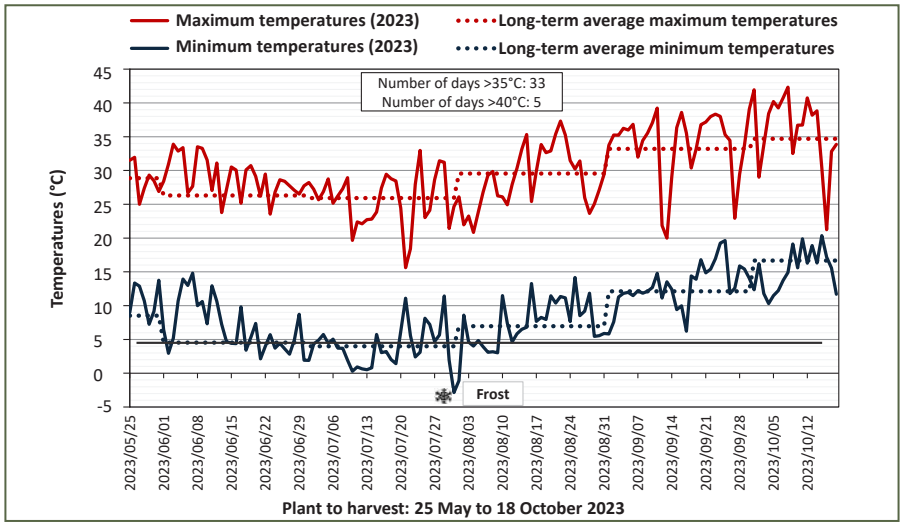
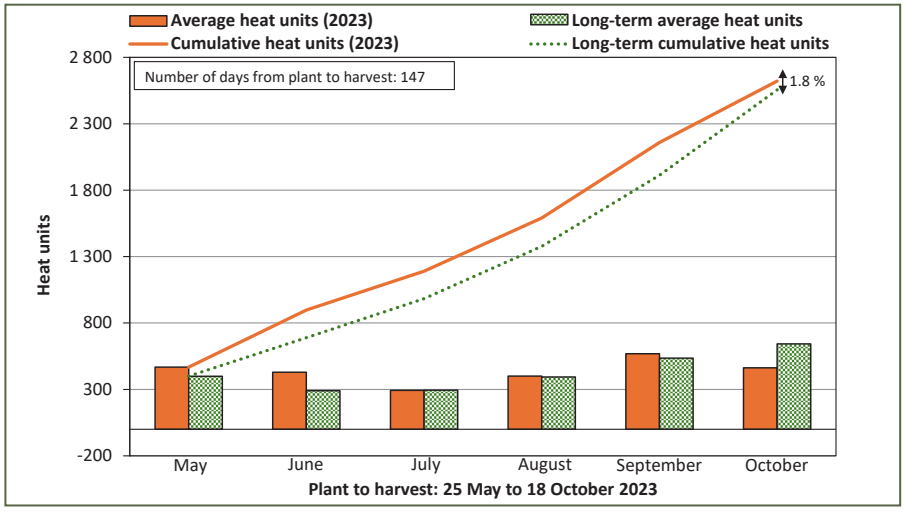


Figure 4: Heat units during the 2023 season, as well as the long-term average heat units.



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

among different cultivars. *Table 2* also indicates plant readiness of seed potatoes during the planting of the trial, as well as population density and haulm count that can be observed later in the growth period.

Marketing index

In the Tom Burke cultivar trial, the evaluation of new cultivars delivered results relating to, among others, yield and marketing index. The marketing indices for the specific cultivars are calculated by sorting and classing each cultivar based on quality and size group distribution (e.g., Class 1 Large or Class 2 Large medium).

Price comparisons are made using market prices obtained during harvest. The performance of new cultivars cannot be solely based on results from a single season, as climate conditions vary from one year to the next. Therefore, cultivars are tested over multiple seasons.

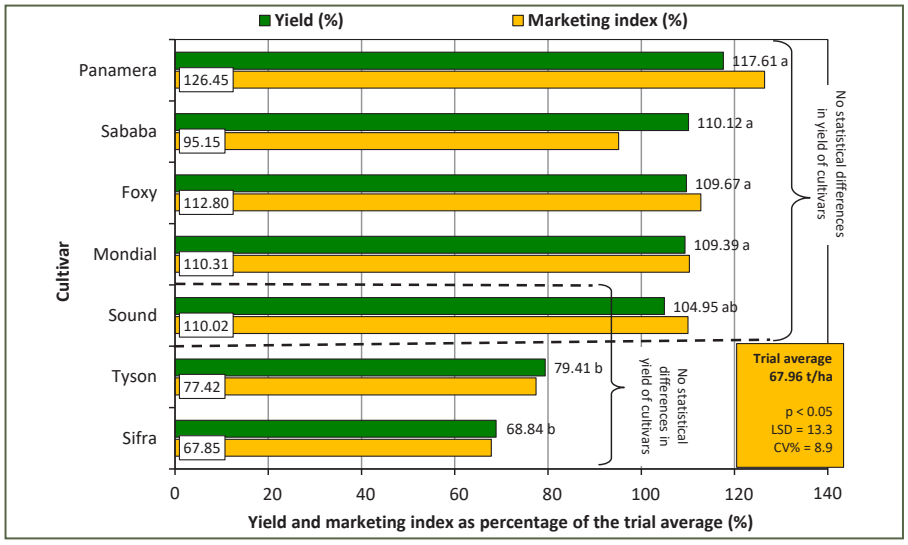
Seasonal aspects

During the potato plant's growth period, factors such as temperature, water availability (either through a good irrigation schedule or rainfall), and heat units play a crucial role. These factors are therefore considered when evaluating the performance of the cultivars. Daily weather data was obtained from a weather station near the trial site, whereas long-term data was obtained from a nearby ARC weather station.

Figure 2 illustrates the recorded rainfall dates. September and October traditionally receive more rain than what was recorded this season. Given that Tom Burke receives its rain in summer, proper irrigation is important, especially during critical growth periods when it is warm.

Figure 3 indicates the minimum and maximum temperatures. Throughout this season, significant temperature fluctuations occurred. There were 33 days with temperatures exceeding 35°C and five days surpassing 40°C. A single instance of frost was recorded at the end of July. Tyson and Sound received the most frost damage.

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.*

Figure 6: Size-group distribution of each cultivar.

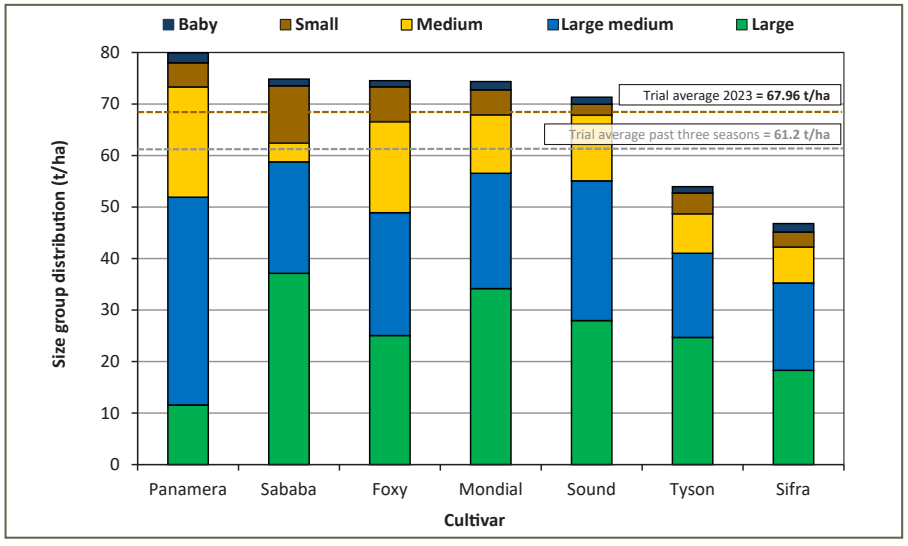
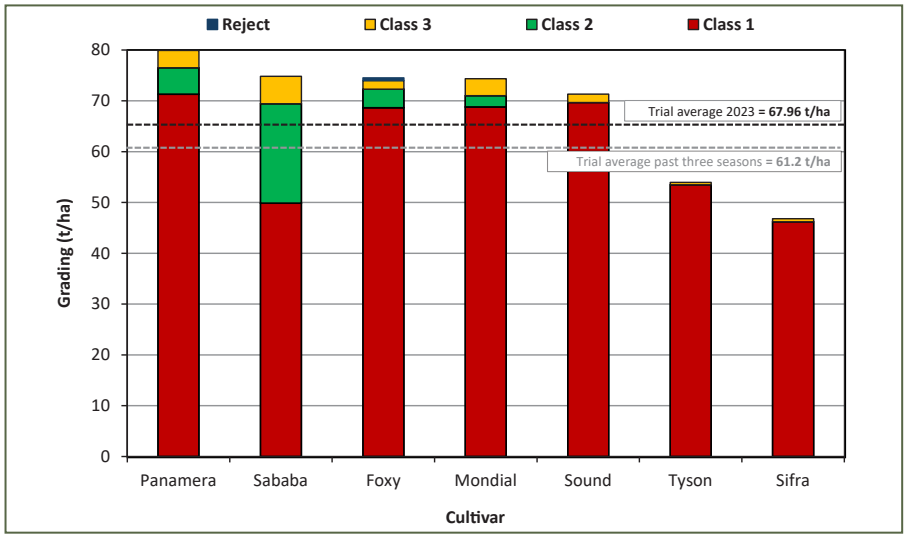


Figure 7: Grading of each cultivar.



Heat units play a crucial role in potato plant development. The trend of heat units available for the cultivar trial this season at Tom Burke appears to exceed the long-term data trend of heat units, especially in the first month after planting. From 25 May to 30 June, the average temperature was 2°C higher than the long-term average, resulting in more heat units accumulating during this period (*Figure 4*).

Yield averages

The 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 in this trial (*Figure 5*) was statistically significant ($p<0.05$) while the coefficient of variation (CV) was good (8.9%). These factors indicate that the trial was well executed and that the results are reliable.

The yield of each cultivar is divided by the trial average – the trial average of all the cultivars is taken as 100%. In doing so, a yield index is established and each cultivar's performance in terms of yield is expressed as a percentage of the trial average.

The average yield for the 2023 trial was 67.96 t/ha. This is higher than the average yield of 61.2 t/ha observed in the previous three seasons. The cultivars Panamera, Sababa, Foxy, Mondial, and Sound produced the highest yields, with no statistical differences in yield. Panamera also achieved the highest marketing index.

A good marketing index is attributed to a higher yield of Large potatoes and/or a good percentage of high-quality potatoes. Size group distribution and grading are crucial evaluations when assessing the marketability of a potato cultivar (*Figures 6* and *7*).

Quality and downgrading

The main reasons for downgrading in this trial are indicated in *Table 3*. Malformation and silver scab had

Table 3: Main reasons for downgrading.

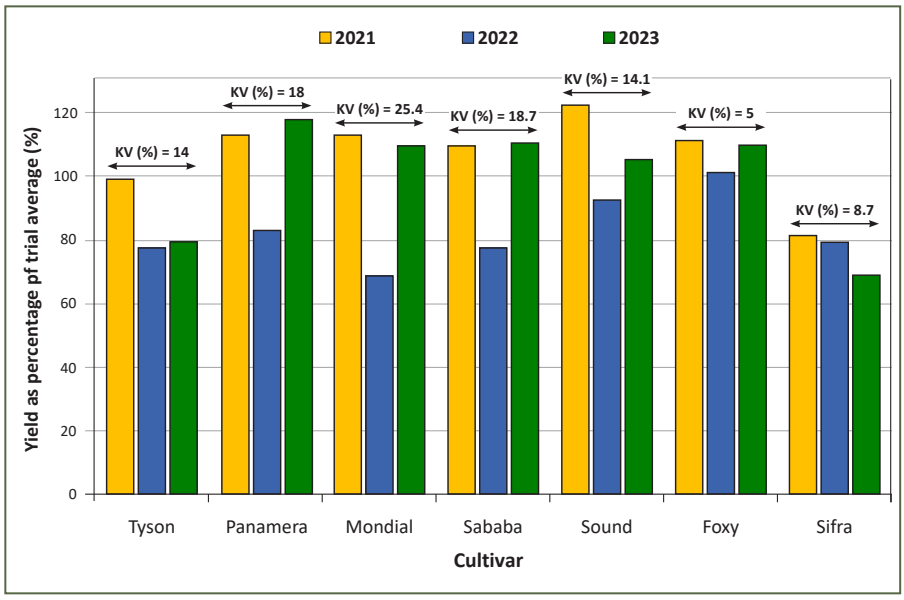
Cultivar	Malformation	Mechanical damage	Greening	Stem-end rot	Other cracks	Loose skin	Growth cracks	Moth	Other insects	Soft rot	Sunburn
Foxy		x	x						x	x	x
Mondial	x		x			x	x	x			
Panamera		x	x		x		x				
Sababa	x	x	x	x	x						
Sifra		x					x	x			
Sound			x							x	
Tyson	x		x					x			

Table 4: Processing characteristics and internal quality. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	DM[2]	SG[3]
Foxy	53.20	15.1	1.056
Mondial	41.59	16.1	1.060
Panamera	58.28	17.6	1.067
Sababa	52.23	17.2	1.066
Sifra	50.25	17.7	1.068
Sound	54.26	17.8	1.069
Tyson	42.53	17.5	1.067

[1]Chip colour with a value of >50 and without defects is acceptable for the chip industry.
*[2]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.*
[3]Specific gravity of ≥1.075 is acceptable for the processing industry.

Figure 8: Performance of cultivars that were included in the trial for three years (expressed as a percentage of the trial average).



The coefficient of variation (CV%) is indicated on the graph. Essentially, it means the degree of variation in performance of the specific cultivar over the number of years indicated on the graph. The larger the CV% value, the more the variation in the cultivar's performance.

the biggest influence on the overall quality of the potatoes in this trial.

The performance of potato cultivars varies from one season to the next due to differences in climate. Therefore, it is important to monitor cultivar performance across multiple seasons. *Figure 8* illustrates the consistencey by degree of varation of cultivars included in the trial for three consecutive seasons with Foxy and Sifra exhibiting the least variation.

Lastly, when evaluating the internal quality of potatoes, processing characteristics come into play. To meet processing requirements, cultivars must adhere to a chip colour standard of >50 and a specific gravity (SG) of ≥1.075 (*Table 4*). Almost all the cultivars met the required chip colour, while none met the SG requirement. No internal defects such as brown spot or hollow heart was detected.

We thank the following contributors: Jako Nel, producer, Schalk Grobbelaar, workgroup chairperson, and all participants including First Potato Dynamics, Aartappel Saadbeurs and WesGrow, Ané du Plessis and other Potatoes SA staff involved. For more information, contact Enrike Verster at enrike@potatoes.co.za.

Processing trial under irrigation at Marble Hall in 2023

By Enrike Verster, Potatoes SA

Marble Hall/Groblersdal is a production region where approximately 3% of South Africa's commercial potatoes (mainly for processing purposes) are produced on roughly 1 702 ha (2023 harvest year). FL2108, Hertha, Markies, and Innovator are the main cultivars produced for processing purposes in the area.

The trial was conducted between Marble Hall and Groblersdal. The area is located in South Africa's summer rainfall area (*Figure 1*) and received an average rainfall of 463 mm over the past 21 years. The region is

Figure 1: Location of Marble Hall in the Limpopo production area.

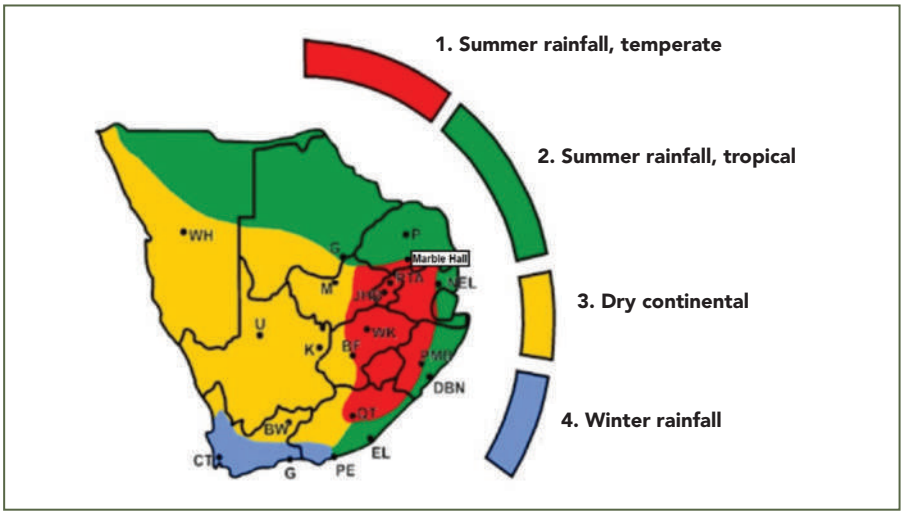


Table 1: Summary of technical information regarding the trial site and design.

Co-worker	**Jaco van den Heever (JFD Boerdery)**			
Planting date	15 June 2023			
	Frost: 25 July 2023			
Harvesting date	25 October 2023			
Irrigation/dryland	Irrigation			
Tuber size	220 count			
Double or single rows	Single rows			
Row width	0.8 m			
Population density	44 000 plants/ha			
Fertiliser programme	**Nutritional value**			
	N (kg/ha)	P (kg/ha)	K (kg/ha)	Ca (kg/ha)
Total	205	75	148	180

Figure 2: Rainfall for the 2023 season as well as the long-term average rainfall.

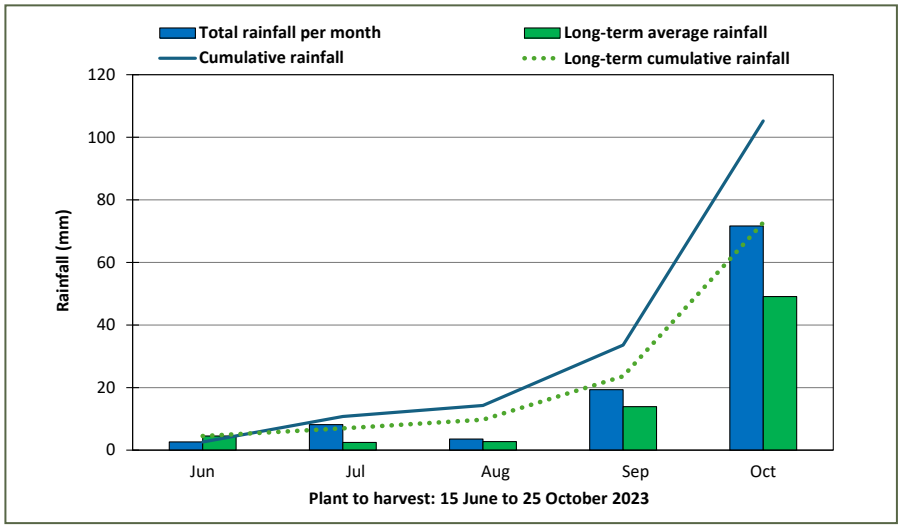
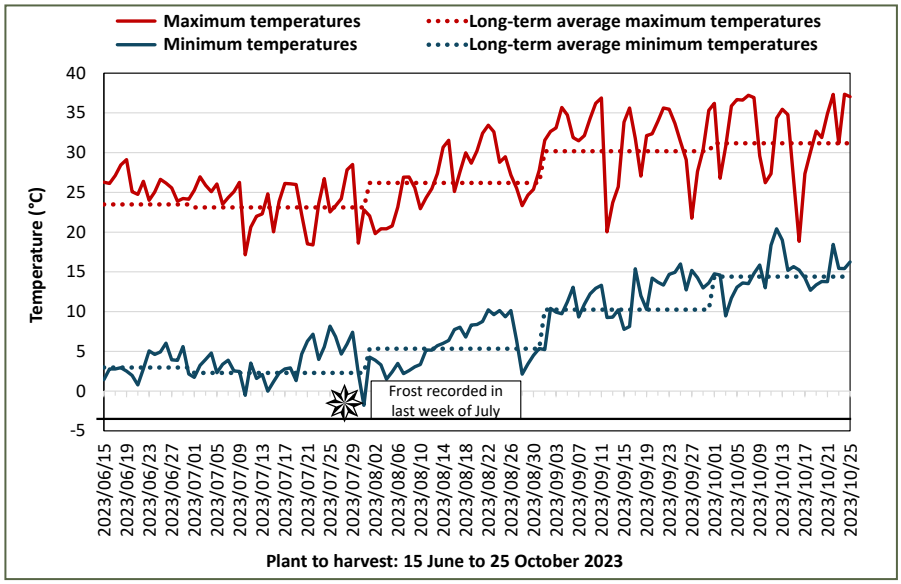


Figure 3: Minimum- and maximum temperatures during the 2023 season as well as long-term average temperatures.



characterised by very warm summers and winters, with the possibility of frost from July to August.

The cultivar trial was conducted in a randomised block design with three replications per cultivar. *Table 1* contains technical information relevant to the trial. Soil analysis results are supplied in *Table 2*.

Growth period and population

Included in the cultivar trial were cultivars with medium to long growth periods. Growing periods can, therefore, influence the eventual yield of certain cultivars. The growth period length is subject to the nature of the season but is regarded as the time that passes from emergence to natural leaf senescence.

Table 3 sets out how growth periods differ from one cultivar to the next. Tuber size and yield are influenced by plant density and the number of haulms per seed potato. The total number of eyes per tuber is determined by the cultivar and dictates how many sprouts are produced per tuber. In this regard, the plant readiness of seed potatoes is very important since plant-readiness usually leads to improved sprouting and more stems per sprout.

Table 3 indicates the plant readiness of seed potatoes at the time of the trial planting, along with population density percentage and haulm counts recorded later during the growing period.

Marketing indices

Cultivar evaluations such as the Marble Hall cultivar trial provide results regarding both crop yield and marketing indices. The marketing index for the specific cultivars is calculated by classing and sorting each cultivar on a sorting table set for specific size groups in the processing market. Sizes are set out as Large (70+ mm in diameter), Large-medium (70 mm), Medium (55 mm), Small (50 mm) and Extra-small (45 mm). The quality of the potatoes was fairly good and no significant reasons for downgrading were observed or noted.

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

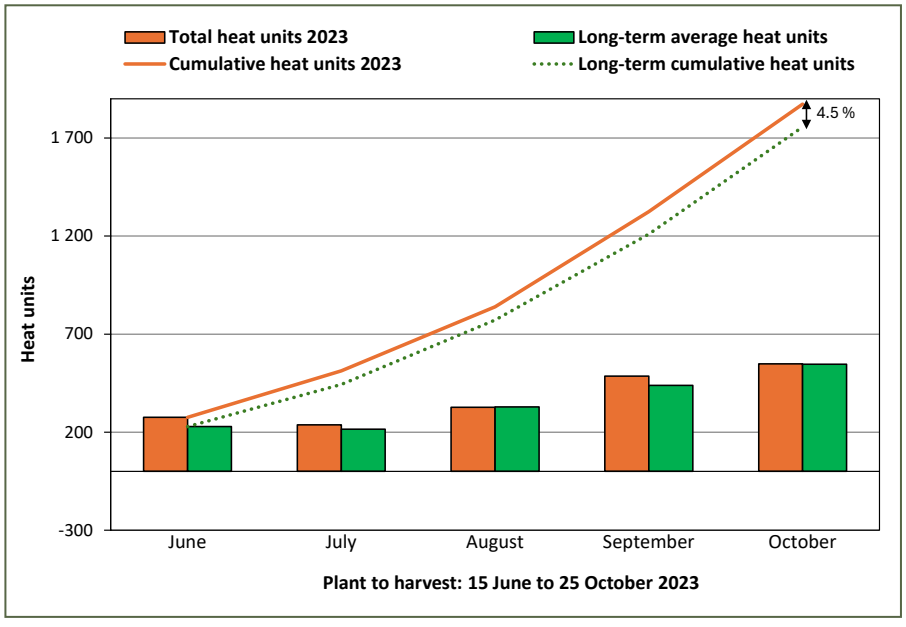
Density ($g.cm^{-3}$)	pH (KCl)	Cations					Base saturation			
		P-Bray 1	K	Ca	Mg	Na	K	Ca	Mg	Na
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	%	%	%
1.14	4.89	97	166	389	93	17	13.27	60.75	23.69	2.29

Table 3: Characteristics relating to growth period, plant readiness, population density (%) and haulm count for relevant cultivars.

Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
Alverstone Russet	Medium	(100)	2	77	2.8	94 864
Cayman	Medium	(100-110)	1	80	5.2	183 040
Markies	Medium to long	(110)	2	94	4.5	186 120
Moonlight	Medium to long	(110-120)	1	83	1.5	54 780
Norman	Medium	(90-100)	1	31	1.3	17 732
P1	Medium to long	(110)	2	94	4.1	169 576
P3	Medium	(95)	3	100	4.2	184 800
Satin King	Medium	(100-110)	2	97	4.1	174 988
Taurus	Medium to long	(110-120)	3	91	5.6	224 224

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short: 70 to 90 days; short to medium: 80 to 100 days; medium: 90 to 110 days; medium to long: 90 to 120 days; long: 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 = fresh; 2 = slightly fresh; 3 = ready for planting; 4 = slightly old; 5 = old.

Figure 4: Heat units during the 2023 season as well as long-term heat units.



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

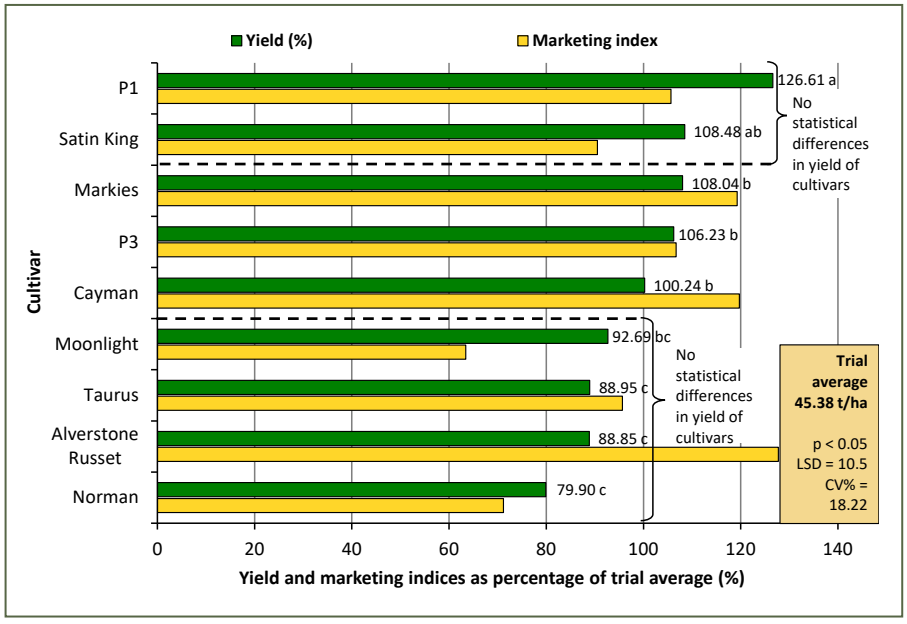
Prices were then compared to market prices obtained during the time of harvest. It is important to note that the performance of new cultivars cannot be based solely on the results of one specific season, as climate conditions vary from year to year. Therefore, cultivars are tested over several seasons.

Significant rainfall

Temperature and water availability (be it rainfall and/or good irrigation scheduling) as well as heat units are important factors that significantly influence the potato plant's growth period. Hence, these factors are carefully considered during the evaluation of cultivar performance.

Relevant daily and long-term weather data was obtained from the nearest Agricultural Research Council's (ARC) weather station.

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.*

During the 2023 season, the rainfall trend was above the norm (*Figure 2*). Scheduled irrigation was effectively managed during the growth period, primarily in winter. This was followed by significantly higher rainfall during October (during the late stages and with leaf senescence).

Figure 3 displays the minimum and maximum temperatures. Several warm days were recorded since August during this trial. A total of 41 days had temperatures above 30°C and 17 days above 35°C. This was recorded from August until harvesting day in October.

Dramatic fluctuations in maximum and minimum temperatures during important growth stages had a negative impact on tuber initiation and development. The producer recorded frost on the trial farm on 25 July. This ultimately influenced the yield.

The collection of heat units during the growth period is an important factor to consider in terms of plant growth. The trend of heat units available for the cultivar trial during this particular season seems to have been above the long-term data trend (*Figure 4*). The area experienced warm temperatures from August to October.

A significant cultivar effect

Yield data collected during harvest was subjected to statistical processing using the GenStat® program. The Tukey test of least significant differences was used to separate the mean.

The cultivar effect during the specific trial (*Figure 5*) was statistically significant ($p<0.05$) in terms of yield, while the coefficient of variation was within limits (18.22%). This indicates that the trial was well executed, and the results are reliable.

The yield of every cultivar is divided by the trial average (the trial average of all the cultivars is taken as 100%). A yield index is created, and every cultivar's performance is read as a percentage of the trial average.

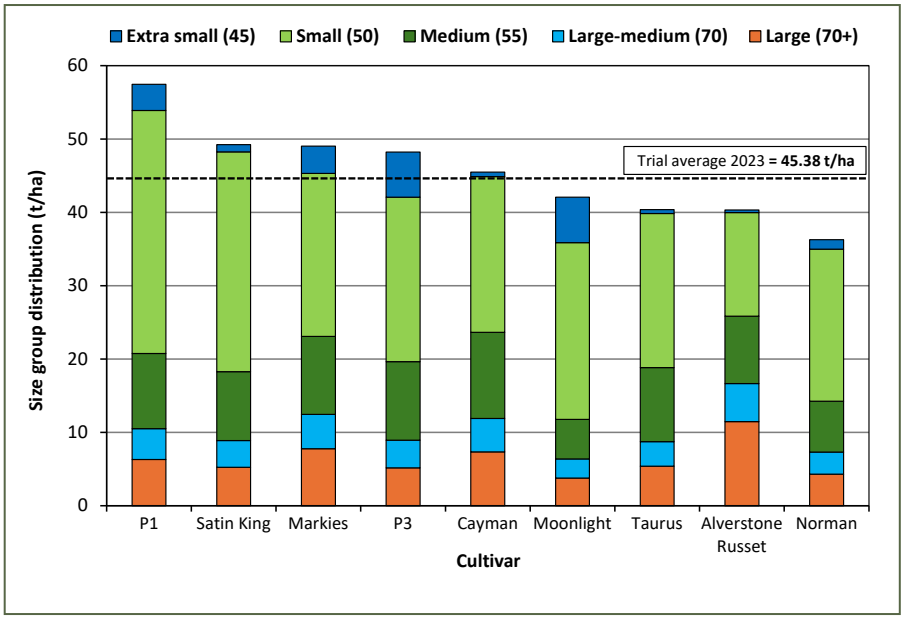
The cultivar trial was conducted in a randomised block design with three replications per cultivar.

Table 4: Processing characteristics of cultivars. (Carried out by ARC-Roodeplaat.)

Cultivar	SG[1]	DM[2]	Chip colour[3]	Flesh colour	Tuber shape	Cooking category[4]
Alverstone Russet	1.087	21.7	58.1	White	Oval	30
Cayman	1.082	20.6	59.8	Cream	Round	40
Markies	1.083	20.9	65.1	Dark yellow	Round	30
Moonlight	1.078	19.7	54.9	White	Round	40
Norman	1.089	22.2	63.1	White	Round	30
P1	1.088	21.9	64.3	Light yellow	Round	40
P3	1.082	20.7	62.7	Dark yellow	Oval	40
Satin King	1.085	21.4	56.7	White	Round	30
Taurus	1.087	21.8	58.1	Cream	Round	20

[1]Specific gravity of ≥1.075 is acceptable for the processing industry.
*[2]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.*
[3]Chip colour with a value of >50 and without defects is acceptable for the chip industry.
[4]Cooking category (taste and texture): 40 = firm potato with a fine texture; 30 = slightly mealy, reasonably firm potato with a mildly fine texture, 20 = mealy, crumbly to loose, 10 = very mealy to loose.

Figure 6: Size-group distribution of each cultivar.



Yield and quality

The average yield for the 2023 season was 45.38 t/ha. P1 and Satin King delivered the highest yields and Alverstone Russet, Cayman, and Markies fetched the highest marketing indices. Size-group distribution is an important factor to consider when evaluating a cultivar's marketability in the processing industry (*Figure 6*). This trial delivered mostly Medium and Small potatoes. Quality, tuber shape, and SG are also important considerations for processors.

Lastly, when considering the internal quality of potatoes, processing qualities can also be evaluated. This is especially important during a processing trial. To comply with processing requirements, cultivars have to comply with a chip colour standard of >50 and an SG of ≥1.075 (*Table 4*). All cultivars complied with the chip colour and SG requirements. The flesh colour and tuber shape were also evaluated. Internal quality was generally good, with a few cultivars exhibiting signs of vascular browning and none indicating brown spot or hollow heart.

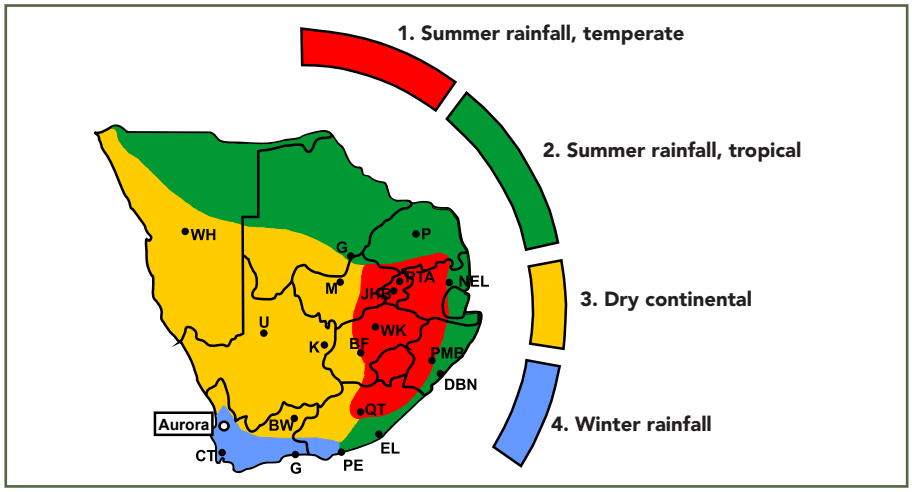
Special thanks to the following co-workers: Jaco van den Heever, producer, Danie Marais, Potato Seed Production, Eon Cordier, Wesgrow, Frank Osler, PepsiCo, Jeanine van Jaarsveld, First Potato Dynamics, and Damien da Cal, Dikgetho Mokoena, Laryssa van der Merwe and Billy Pholoso, Potatoes SA.
For more information, contact Enrike Verster at enrike@potatoes.co.za.

Sandveld cultivar trial under irrigation: Aurora 2023/24

By Enrike Verster and Laryssa van der Merwe, Potatoes SA,
Piet Brink, Sandveld working group, and Albert de Villiers, producer

The Sandveld production region produces approximately 13% (2023 harvest year) of the country's potatoes in summer and winter plantings on 6 487 ha. This region contributes to the entire potato supply chain – export, seed, table and processing potatoes. Table potatoes are primarily exported to Angola, while seed potatoes are exported to Mozambique. The main cultivars for table and processing purposes are Mondial, Sifra, FL2108, and Valor.

Figure 1: Location of Aurora in the Sandveld production area.



The trial was carried out on Rietfontein farm in the Aurora region, situated at the base of the western side of Piketberg. This area falls within South Africa's winter rainfall area (*Figure 1*), recording average annual rainfall of approximately 395 mm over the past 21 years, according to the closest Agricultural Research Council (ARC) weather station. The Rietfontein station on the farm recorded an average of 295 mm per year between 2018 and 2023.

The region's Mediterranean climate is characterised by warm summers and cold, wet winters. The planting period for this production region is unique,

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

Farm	**Fisantevlug, Rietfontein**
Producer	Albert de Villiers
Planting date	26 September 2023
Harvest date	20 February 2024
Irrigation/dryland	Irrigation
Double or single rows	Double rows
Interrow spacing	0.75 m
In-row spacing	0.30 m
Plant population	41 666 plants/ha

Table 2: Fertiliser programme.

	Nutritional value					
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**	**Ca (kg/ha)**	**Mg (kg/ha)**	**S (kg/ha)**
Before planting	48.75	69.1	66.78	105.4	17.8	83.4
Week 1	26.39	4.14	27.43	0	1.55	0
Week 2	26.39	4.14	27.43	0	1.55	0
Week 3	26.39	4.14	27.43	0	1.55	0
Week 4	27.79	4.48	26.88	18.1	1.34	0
Week 5	18.19	6.27	37.63	0	1.88	0
Week 6	27.79	4.48	26.88	18.1	1.34	0
Week 7	18.19	6.27	37.63	0	1.88	0
Week 8	27.79	4.48	26.88	18.1	1.34	0
Week 9	14.62	5.04	30.24	0	1.51	0
Week 10	14.62	5.04	30.24	0	1.51	0
Week 11	14.62	5.04	30.24	0	1.51	0
Week 12	14.62	5.04	30.24	0	1.51	0
Total	**306.15**	**127.66**	**425.93**	**159.7**	**36.27**	**83.4**
Two to three tonnes gypsum/ha						

Table 3: Soil nutrient status of the trial site before planting.

pH (KCl)	Density (g/cm³)	UIT H+ cmol (+)/kg	P Bray I (mg/kg)	K (mg/kg)	Na (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	% Ca (%)	% Mg (%)	% K (%)	% Na (%)	CEC
4.8	**1.525**	**0.265**	**40.5**	**21**	**12.5**	**101**	**29**	**45.05**	**21.25**	**4.75**	**4.95**	**1.1**

with potatoes being planted year-round. Most potatoes are, however, planted in February and June.

Trial design

The cultivar trial was conducted in sandy soil and laid out in a randomised block design with three replications per cultivar. Additional technical information regarding the trial is summarised in *Table 1*. *Table 2* outlines the past season's fertiliser programme. Soil samples were collected before planting to assess the soil nutrient status at the trial site (*Table 3*). Corrections to the pivot points were made on a varietal basis.

Cultivars with short and long growth periods were included in the trial. The growth periods of certain cultivars may have impacted the crop yield. The length of growth periods is determined by seasonal conditions, and is measured as the number of days from emergence to leaf senescence. *Table 4* outlines the variations in growth periods among different cultivars. Additionally, *Table 4* indicates the plant readiness of seed potatoes during planting, and provides information on population density and haulm count observed later during the growth period.

Yield and marketing indices

Evaluating new cultivars such as the Aurora cultivar trial provides results regarding, among other things, crop yield and marketing index as well as cooking quality and processing characteristics. Marketing indices for specific cultivars are calculated by classing and sorting each cultivar based on quality and size group distribution (for example Class 1 Large or Class 2 Large-medium).

Prices are then compared to market prices obtained during the week of harvest. The performance of new cultivars cannot be solely based on the results of one specific season, as climate conditions vary from year to year. Therefore, cultivars are tested across multiple seasons.

Abiotic factors

Temperature, radiation, water availability (whether through proper irrigation scheduling or rainfall), as well as heat units are important factors that significantly influence the potato plant's growth period. Hence, these factors are carefully considered during the evaluation of cultivar performance. Relevant weather data is obtained from a nearby weather station.

The average rainfall during the 2023/24 season (*Figure 2*) was below the norm, despite Aurora being in the winter rainfall region. However, there was an exception in September when extremely high rainfall was recorded between 1 and 26 September, just before the planting date.

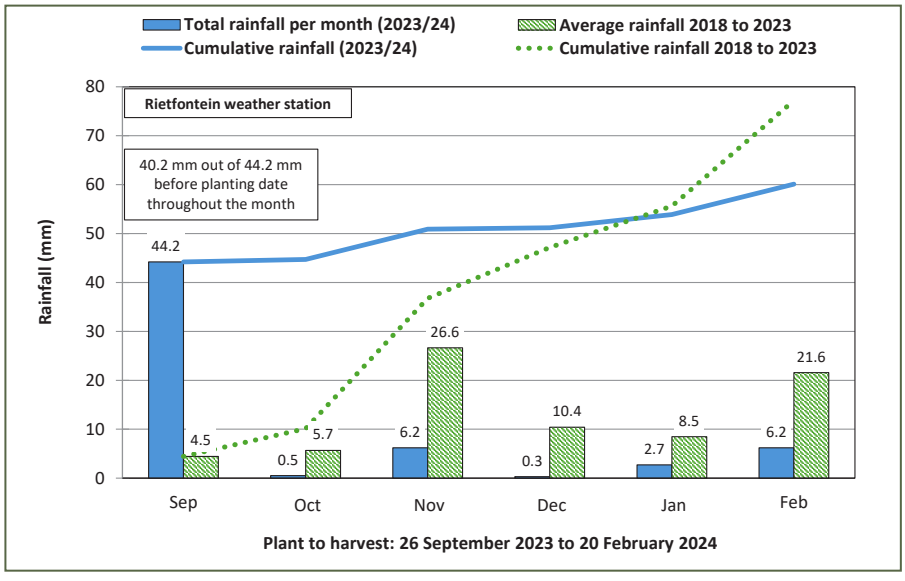
Figure 3 indicates the minimum and maximum temperatures. During this specific season, there were

Table 4: Characteristics regarding growth period, plant readiness, population density (%) and haulm count for each cultivar.

Agent	Cultivar	Growing period (days)[1]		Plant readiness[2]	Plant population (%)	Haulms per plant	Haulms per ha
GWK	11Z55A5	Medium to long	(100 – 120)	1	85	3	106 248
GWK	Amany	Medium to long	(110)	2	96	2.9	115 998
WEF grow	Cayman	Medium	(100 – 110)	2	90	3.1	116 248
RSA	Foxy	Short to medium	(90 – 100)	3	91	4.1	155 456
First Potato Dynamics	Lady Alicia	Medium	(95 – 100)	1	97	2.9	177 206
First Potato Dynamics	Lady Luce	Medium	(110)	0	93	2.5	96 873
GWK	Lanorma	Short	(80 – 90)	1	87	3.2	115 998
GWK	Lilly	Medium	(100)	2	90	4.3	161 247
WEF grow	Mondial	Medium to long	(110 – 115)	0	96	3.3	131 998
WEF grow	Norman	Medium	(90 – 100)	1	84	3.2	111 998
GWK	Noya	Medium	(90 – 110)	2	87	2.2	79 749
PEPSICO	P1	Medium to long	(110)	2	88	3.5	128 331
First Potato Dynamics	Palace	Long	(110 – 115)	1	99	3.2	131 998
WEF grow	Panamera	Medium	(90 – 110)	1	99	2.7	111 373
First Potato Dynamics	Prince	Long	(110 – 115)	0	97	3.3	133 373
WEF grow	Sababa	Medium to long	(110 –115)	1	96	2.9	115 998
WEF grow	Sifra	Short to medium	(90 – 100)	1	94	3.2	125 331
First Potato Dynamics	Sound	Medium	(100)	0	94	3.9	152 748
WEF grow	Tyson	Short to medium	(90 – 100)	2	96	2.6	103 998
RSA	Valor	Medium	(100)	2	84	3.4	118 998

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short: 70 to 90 days; short to medium: 80 to 100 days; medium: 90 to 110 days; medium to long: 90 to 120 days; long: 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 - fresh; 2 - slightly fresh; 3 - ready for planting; 4 - slightly old; 5 - old.

Figure 2: Rainfall during the 2023/24 as well as average rainfall for the six previous seasons.



major fluctuations in maximum temperatures. Temperatures above 30°C were recorded for a total of 77 days, with 23 days above 35°C and three days above 40°C during the growth period, substantially more than in previous seasons. Temperatures were constantly high during the start and close to the end of the growth period, averaging 0.7°C more than the previous three seasons.

Heat units and radiation

The collection of heat units during the growth period is an important factor to consider with regard to plant growth. The trend of heat units available for the cultivar trial during this season at Aurora seems to be very close to the long-term data trend (*Figure 4*),

Table 5: Main reasons for downgrading.

Cultivar	Loose skin	Nematodes	Powdery scab	Secondary growth	Rot (decay)	Growth cracks	Malformation	Greening	Common scab	Moth
11Z55A5	x				x	x				
Amany				x	x		x	x		x
Cayman	x				x	x				
Foxy					x					
Lady Alicia	x		x		x					
Lady Luce	x		x							
Lanorma	x				x					
Lilly	x	x	x		x					
Mondial	x				x	x				
Norman	x				x				x	
Noya	x		x		x					
P1	x									
Palace			x							
Panamera	x		x		x					
Prince	x	x	x						x	
Sababa	x	x			x					
Sifra	x	x	x		x					
Sound			x							
Tyson	x				x					
Valor	x									
<5% incidence				5-15% incidence				>15% incidence		

but it is important to note that it is still higher than the previous few seasons.

Another factor to consider is the daily solar radiation levels (*Figure 5*). This measurement reflects sunlight energy hitting a horizontal surface. Consequently, higher radiation levels lead to increased photosynthesis during the growth period. The average daily radiation observed during these seasons (including the previous seasons), partially explains why the yield has been lower over the last two seasons.

During the 2020/21 and 2021/22 seasons, radiation levels slightly exceeded those of the preceding two seasons. When considering long-term data, daily radiation accumulation decreased by 10.2% in 2023/24

Figure 3: Minimum and maximum temperatures (°C) during the 2023/24 season as well as temperatures during the six previous seasons.

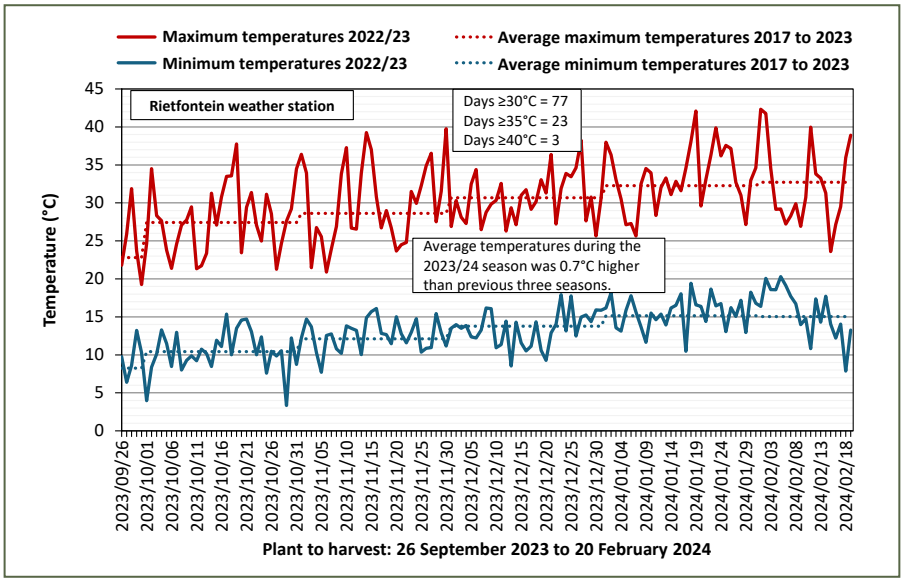
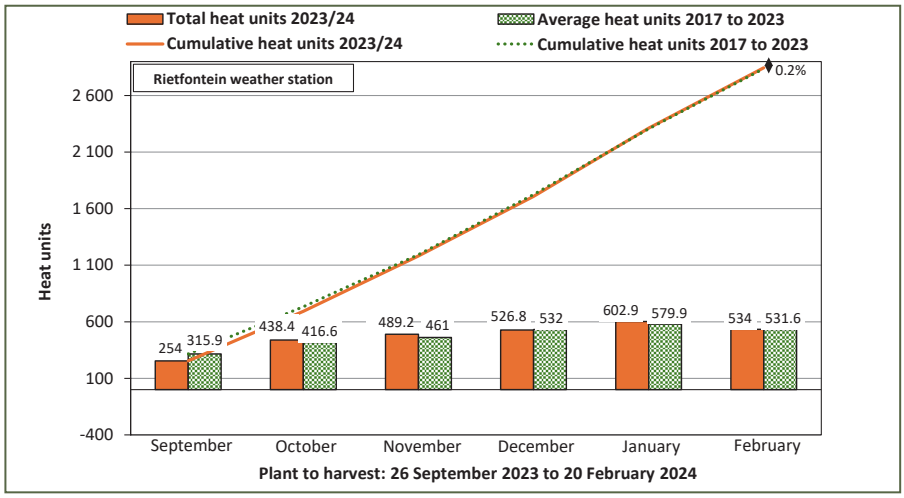


Figure 4: Heat units during the 2023/24 season, as well as the average heat units during the six previous seasons.



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

Figure 5: Average daily radiation during the 2023/24 season as well as the average radiation during the six previous seasons.

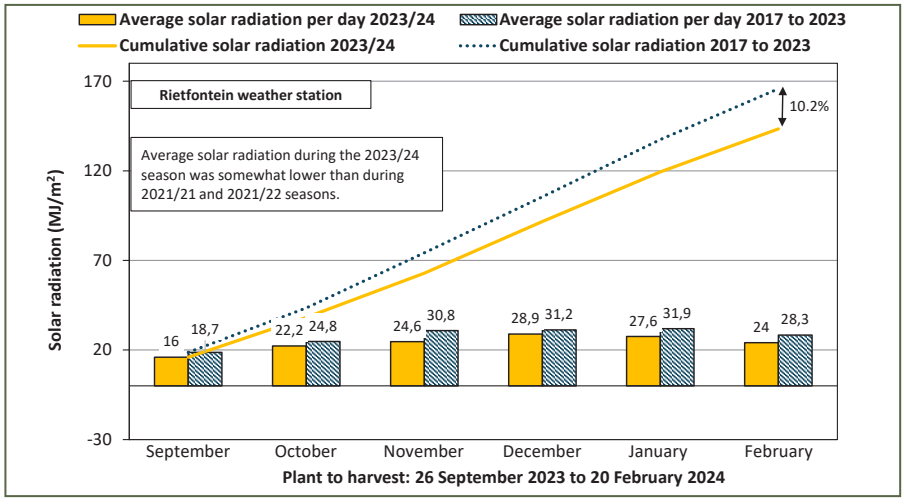
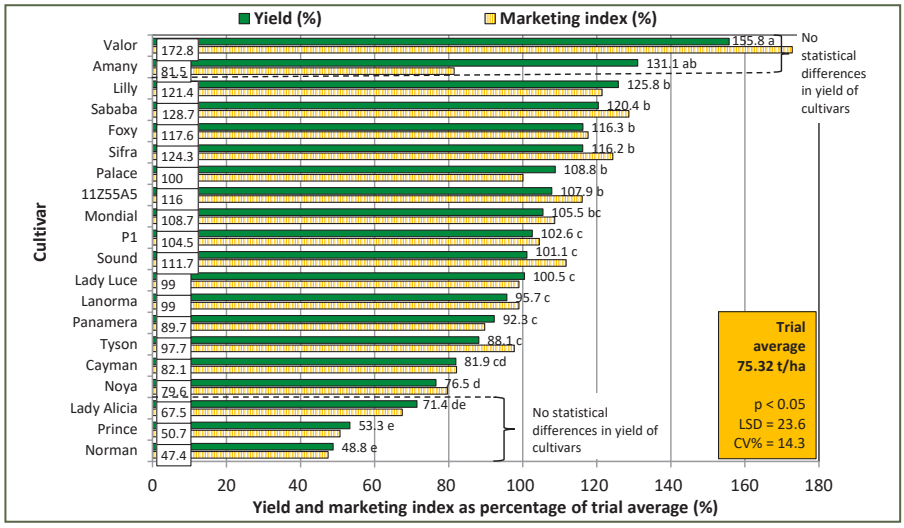


Figure 6: Total yield and marketing indices per cultivar as a percentage of the trial average.



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

compared to the period between 2017 and 2023. From November until the end of the season (roughly between tuber initiation and maturity) radiation (and effectively photosynthesis and ultimately yield) was lower than in previous seasons.

Significant cultivar effect

The 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 in this trial (*Figure 6*) was statistically significant ($p<0.05$) while the coefficient of variation (CV) was well within limits at 14.3%. These factors indicate that the trial was well executed, and that the results are reliable.

The yield of each cultivar is divided by the trial average (the trial average of all the cultivars is taken as 100%).

Size group distribution and grading are crucial evaluations when assessing the marketability of a potato cultivar. In this trial, potatoes were classed as marketable or non-marketable (rejected).

This way a yield index is established and every cultivar's performance in terms of yield is expressed as a percentage of the trial average.

Yield and quality aspects

The average yield of the 2023/24 trial is 75.32 t/ha, which is substantially lower than the previous six seasons' average of 92.1 t/ha. Also interesting to note is that the LINTUL simulations of the four previous seasons for Mondial in this region, have a yield potential averaging 129.8 t/ha but in this season it only yielded 79.5 t/ha. Valor and Amany produced the highest yields with no statistical difference in yield, but it is important to note that the relationship between marketable and non-marketable potatoes in Amany was less than desirable.

Valor, Sababa and Sifra achieved the best marketing indices. A good marketing index is ascribed to a higher

Figure 7: Size-group distribution of each cultivar in the trial.

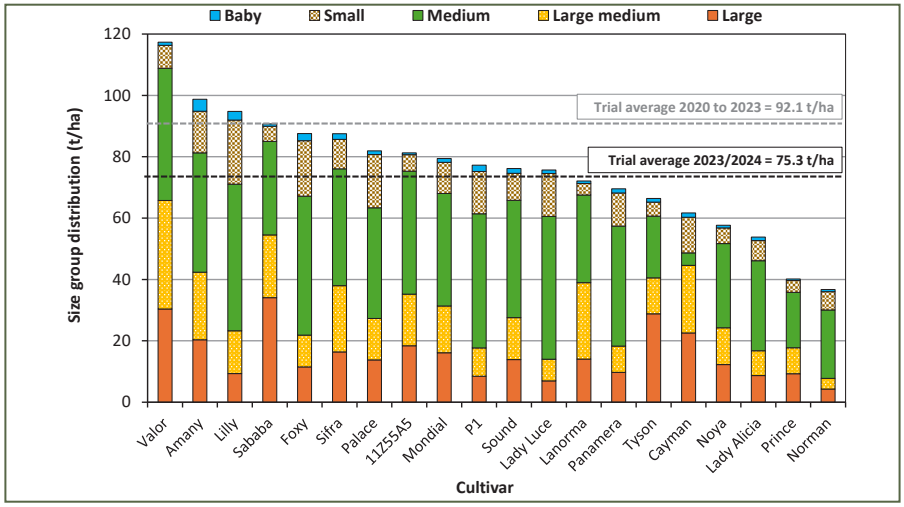


Figure 8: Grading of each cultivar in the trial.

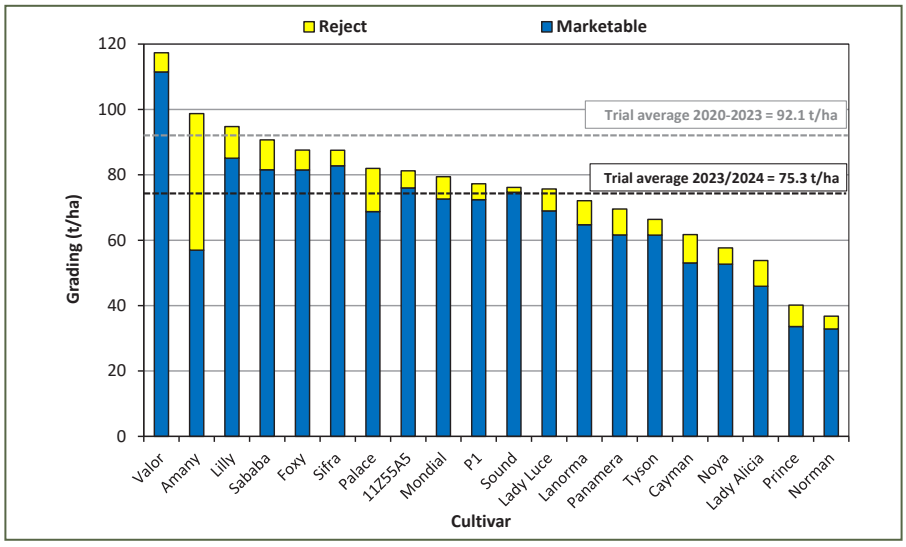
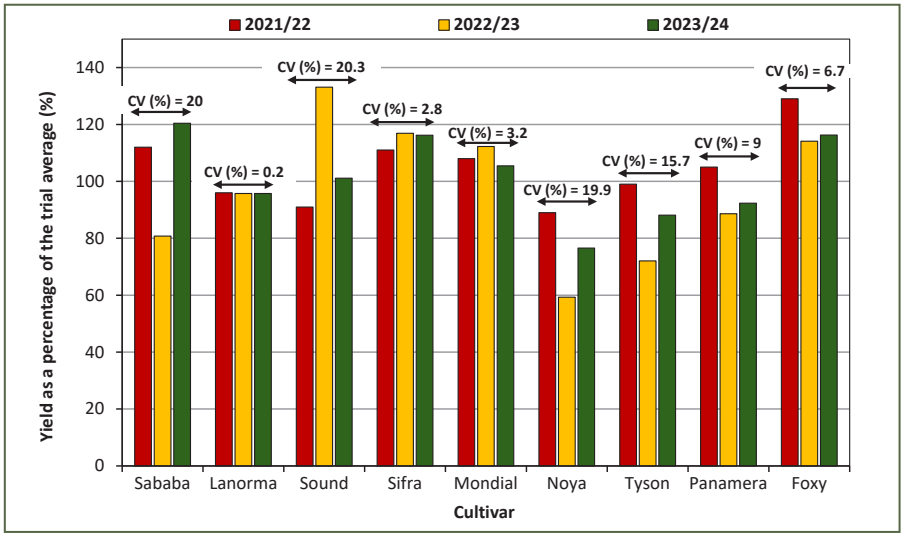


Figure 9: Performance of cultivars included in the trial for the past three years, expressed as a percentage of the trial average.



The coefficient of variation (CV %) is indicated on the graph. Essentially, it means the degree of variation in performance of the specific cultivar over the number of years indicated on the graph. The larger the CV % value, the greater the variation in the cultivar's performance.

Tabel 6: Keeping quality of cultivars observed six weeks after harvest.

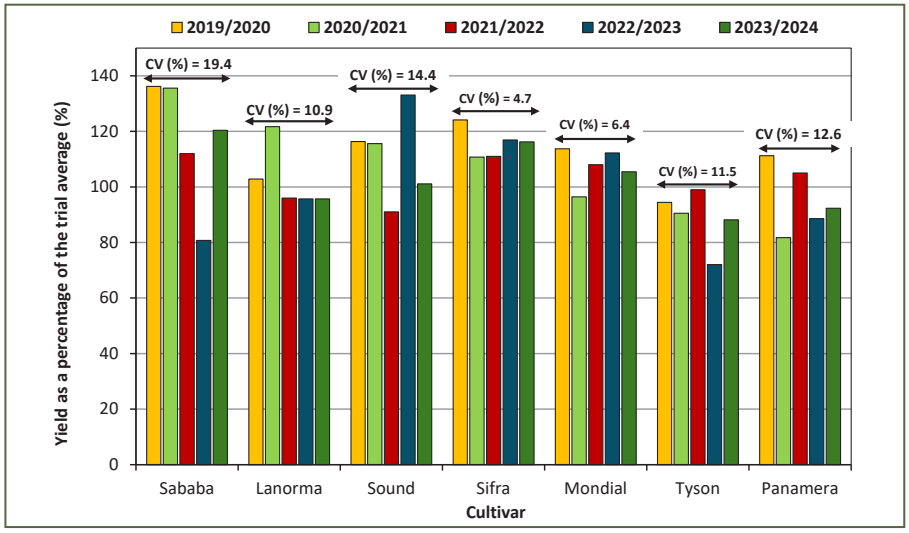
Cultivar	Condition after six weeks	Observations
11Z55A5	Medium to undesired	15% soft rot but the rest were firm. Silver scab was present.
Amany	Good	Firm with a few sprouted tubers.
Cayman	Medium to undesired	15% soft rot but the rest were firm. Started sprouting.
Foxy	Good	One or two were slightly wilted with sprouts.
Lady Alicia	Medium	5% soft rot but the rest were firm. Started sprouting.
Lady Luce	Medium to undesired	15% soft rot but the rest were firm. Started sprouting.
Lanorma	Undesired	30% and more had soft rot.
Lilly	Medium to undesired	15% soft rot, but the rest were firm.
Mondial	Medium to undesired	10% soft rot, but the rest were firm. Started sprouting.
Norman	Medium	5% soft rot, but the rest were firm. Started sprouting.
Noya	Undesired	30% soft rot. Others started sprouting and wilting.
P1	Good	Very good condition.
Palace	Undesired	30% soft rot. Others started to sprout and wilt.
Panamera	Medium	Firm with a few wilted spots.
Prince	Medium to undesired	15% soft rot, but the rest were firm. Started sprouting.
Sababa	Undesired	50% soft rot. Highly undesirable condition.
Sifra	Medium to undesired	15% soft rot, but the rest were firm.
Sound	Good	One or two slightly wilted tubers with sprouting.
Tyson	Good	One or two slightly wilted tubers.
Valor	Medium to undesired	15% soft rot, but the rest were firm. Started sprouting.

Table 7: Processing characteristics and internal quality. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	SG[2]	DM[3]
11Z55A5	45	1.064	17
Amany	45	1.070	18
Cayman	45	1.082	21
Foxy	35	1.061	16
Lady Alicia	54	1.077	20
Lady Luce	51	1.076	19
Lanorma	50	1.067	18
Lilly	44	1.058	16
Mondial	51	1.065	17
Norman	45	1.080	20
Noya	42	1.077	20
P1	47	1.079	20
Palace	45	1.071	18
Panamera	43	1.075	19
Prince	47	1.071	18
Sababa	44	1.065	17
Sifra	37	1.074	19
Sound	47	1.064	17
Tyson	45	1.065	17
Valor	39	1.075	19

[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 the calculating value.*

Figure 10: Performance of cultivars included in the trial for the past five years, expressed as a percentage of the trial average.



The coefficient of variation (CV %) is indicated on the graph. Essentially, it means the degree of variation in performance of the specific cultivar over the number of years indicated on the graph. The larger the CV % value, the greater the variation in the cultivar's performance.

yield of Large potatoes and Class 1 quality potatoes. A large percentage of non-marketable potatoes would for instance influence the marketing index negatively. Size group distribution and grading are crucial evaluations when assessing the marketability of a potato cultivar (*Figures 7* and *8*). In this trial, potatoes were classed as marketable or non-marketable (rejected).

Potato cultivar performance varies from one season to the next due to differences in climate. Therefore, it is important to monitor cultivar performance across multiple seasons. Cultivar variations over the past three to five seasons are illustrated in *Figures 9* and *10*.

Currently, Sifra and Mondial appear to be the most stable in this trial with Lanorma showing very stable

Table 8: Flesh colour and internal quality of cultivars in the 2023/24 trial at Aurora.

11z55A5


Amany


Cayman

Foxy

Lady Alicia


Lady Luce

Lanorma


Lilly

Mondial


Norman

Noya

P1

Palace

Panamera

Prince

Sababa

Sifra

Sound

Tyson

Valor

performance during the last three seasons.

Downgrading and quality

The main reasons for downgrading in this trial are indicated in *Table 5*. Loose skin, rot and powdery scab were the main reasons for the downgrading of potatoes from marketable to rejected. Keeping quality was also informally evaluated five weeks post-harvest. Commentary regarding the condition of the cultivars is set out in *Table 6*. Soft rot was a major role-player.

Lastly, when evaluating the internal quality of potatoes, processing characteristics come into play. To meet these processing requirements, cultivars must adhere to a chip colour standard of >50 and a specific gravity (SG) of ≥1.075 (*Table 7*). According to the analyses, only Lady Alicia and Lady Luce met both the SG and chip colour requirements. *Table 8* indicates the specific cultivar's flesh colour after harvest, both uncooked and fried.

Special thanks to the Sandveld workgroup, all trial participants and contributing Potatoes SA staff. For more information, send an email to enrike@potatoes.co.za.

The average yield of the trial for the 2023/24 season was 107.75 t/ha – significantly better than the 90.3 t/ha average of the past five seasons.

Ceres/Koue Bokkeveld cultivar trial under irrigation at Donkerbos in 2023/24

By Enrike Verster en Laryssa van der Merwe, Potatoes SA

The Ceres production area produces approximately 1.2% of all potatoes produced in South Africa. Planting in this region is under irrigation, and mainly for the production of table and processing potatoes (651 ha for the 2023 season). The main cultivars produced are FL2108, Sifra, FL2006, Avalanche and Lanorma.

Trials were carried out at Donkerbos in the Koue Bokkeveld, which is a winter rainfall area (*Figure 1*). An annual average rainfall of 569 mm was recorded by the nearest Agricultural Research Council (ARC) weather station

Figure 1: Location of Ceres/Koue Bokkeveld in the Western Cape production area.

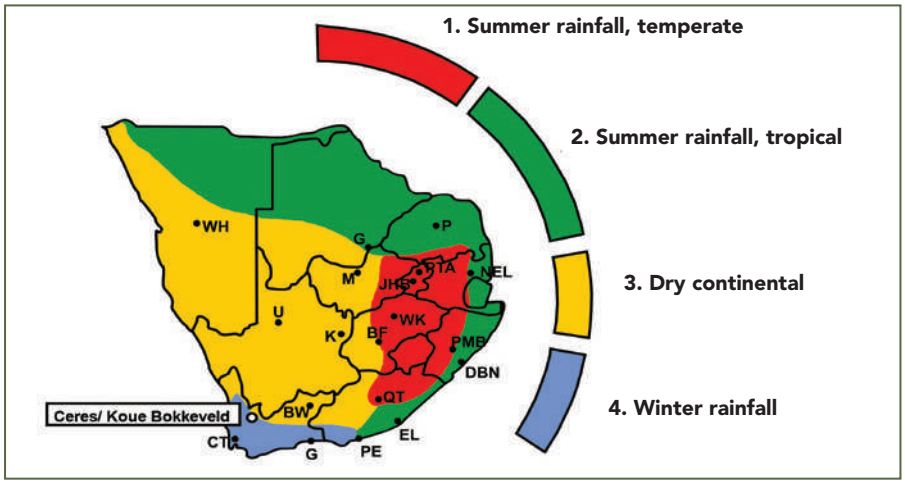


Table 1: Summary of technical information regarding the trial site and layout.

Farm	**Donkerbos (865 m above sea level)**		
Co-workers	Gerard Mostert, Hano Dreyer, Bennie Visagie, Daniël Victor and Inus Oosthuizen		
Planting date	24 October 2023		
Harvest date	10 April 2024		
Irrigation/dryland	Irrigation		
Double or single rows	Double rows		
Leaf senescence	Natural		
Inter-row spacing	0.9 m		
In-row spacing	0.215 m staggered		
Trial site	18 m^2		
Plant population	51 680 plants/ha		
Fertilisation programme	**Nutritional value**		
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**
Total	**366**	**154**	**447**

Table 2: Soil nutrient status of the trial site.

pH (KCl)	Density (g/cm^3)	C	P	K	Ca	Mg	Na	Cu	Zn	Mn	B
		%	Bray I (mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
5	1.275	0.44	138	41	308	28	14	2.76	2.01	3.4	0.4

for the last 21 years, but the Donkerbos weather station that is located on the farm recorded an average annual rainfall of 647 mm in the last five years. The area experiences warm summers, while winters are very cold and wet due to the frequent snow on the surrounding mountains.

The main planting period for the production area is from October to November. Plantings that are planted earlier or later run the risk of suffering rain damage.

The trial site consisted of sandy soil and the trial was planted in a completely randomised block design with three replications per cultivar. More technical information regarding the trial site and layout is summarised in *Table 1*. Soil samples were collected before planting to analyse the soil nutrient status of the trial site (*Table 2*).

Growth periods

Cultivars with short and long growth periods were included in the trial and therefore yields could ultimately be influenced by these growth periods. The length of growth periods is subject to the nature of the season but is defined as the number of days from emergence to natural leaf senescence.

The differences between these growth periods are indicated in *Table 3*. Plant readiness of tubers during the trial as well as population density and haulm count that were observed later in the trial, are indicated in *Table 3*.

The evaluation of new cultivars as in the case of the Ceres cultivar trial provides results regarding, among others, yield and marketing indices. The marketing index of the relevant cultivars is calculated by classing and sorting each cultivar according to quality and size groups (for example Class 1 Large or Class 2 Large-medium).

Corresponding price comparisons are then made with market prices as obtained at the time of harvest. The performance of new cultivars cannot be determined only based on the results of one particular season, because climate varies from one year to the next. That is precisely why the cultivars are tested over a number of seasons.

Factors influencing potato quality

As with any crop, aspects such as temperature, availability of water (whether through irrigation scheduling or rainfall), as well as heat units

Figure 2: Rainfall during the 2023/24 season as well as the rainfall of the last five seasons.

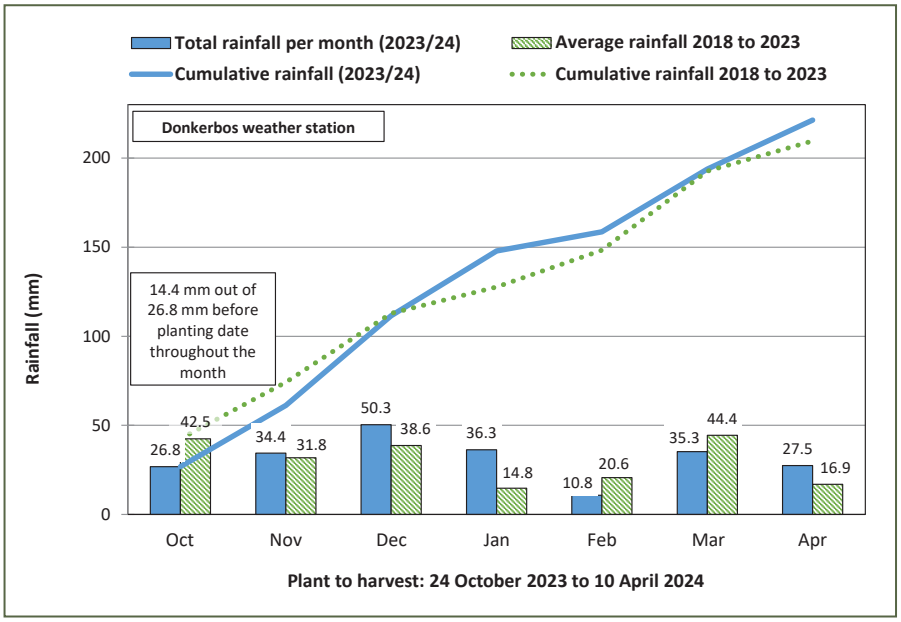
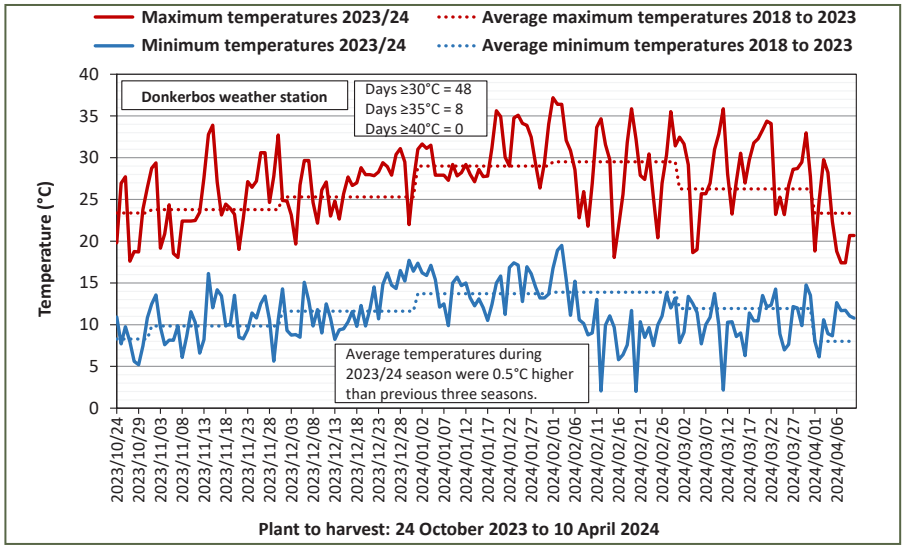


Table 3: Characteristics regarding growth period, plant readiness, population density (%) and haulm count for each cultivar in 2023/24.

Agent	Cultivar	Growth period (days)[1]		Plant readiness[2]	Plant population (%)	Haulms per plant	Haulms per ha
GWK	11Z55A5	Medium to long	(100 – 120)	2	83	4.2	180 156
GWK	Amany	Medium to long	(110)	3	73	4.6	173 541
Agri Grow	Cayman	Medium	(100 – 110)	2	68	3.8	133 541
GWK	Connect	Medium to long	(120)	2	80	4.5	186 048
RSA	Foxy	Short to medium	(90 – 100)	3	86	4.2	186 668
First Potato Dynamics	Lady Alicia	Medium	(95 – 100)	1	62	3.8	121 758
First Potato Dynamics	Lady Forte	Long	(120)	3	79	4.9	200 053
First Potato Dynamics	Lady Luce	Medium	(110)	1	89	4.3	197 779
GWK	Lanorma	Short	(80 – 90)	2	71	3.7	135 763
GWK	Lilly	Medium	(100)	3	89	4.6	211 578
Agri Grow	Mondial	Medium to long	(110 – 115)	2	89	3.8	174 782
Agri Grow	Norman	Medium	(90 – 100)	1	47	3	72 869
GWK	Noya	Medium	(90 – 110)	3	79	3.7	151 061
First Potato Dynamics	Palace	Long	(110 – 115)	2	79	4.6	187 805
Agri Grow	Panamera	Medium	(90 – 110)	3	76	4.9	192 456
First Potato Dynamics	Prince	Long	(110 – 115)	3	71	4.3	157 779
Agri Grow	Sababa	Medium to long	(110 – 115)	2	76	3.8	149 252
Agri Grow	Sifra	Short to medium	(90 – 100)	3	92	3.7	175 919
First Potato Dynamics	Sound	Medium	(95 – 100)	2	92	4.8	228 219
Agri Grow	Tyson	Short to medium	(90 – 100)	2	83	3.8	162 999
RSA	Valor	Medium	(100)	3	77	4.7	187 030

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short = 70 to 90 days; short to medium = 80 to 100 days; medium = 90 to 10 days; medium to long = 90 to 120 days; long = 90 to 140 days.
[2]Plant readiness of tubers: 1 = fresh; 2 = slightly fresh; 3 = plant ready; 4 = slightly old; 5 = old.

Figure 3: Minimum and maximum temperatures during the 2023/24 season as well as the temperatures for the last five seasons.

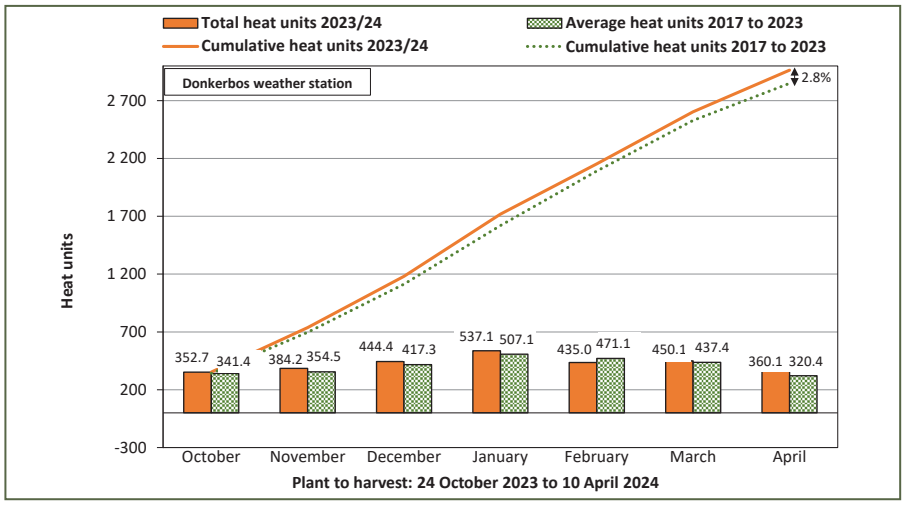


are important factors that play a significant role during the potato plant's growth. These factors are therefore taken into account when a trial is evaluated. Weather data was obtained from a weather station located on the farm where the trial was conducted.

The 2023/24 season (*Figure 2*) experienced above-average rainfall, especially in the early stages of the trial, roughly between tuber initiation and tuber filling. Slightly below average rainfall was recorded during the later stages of the growth period.

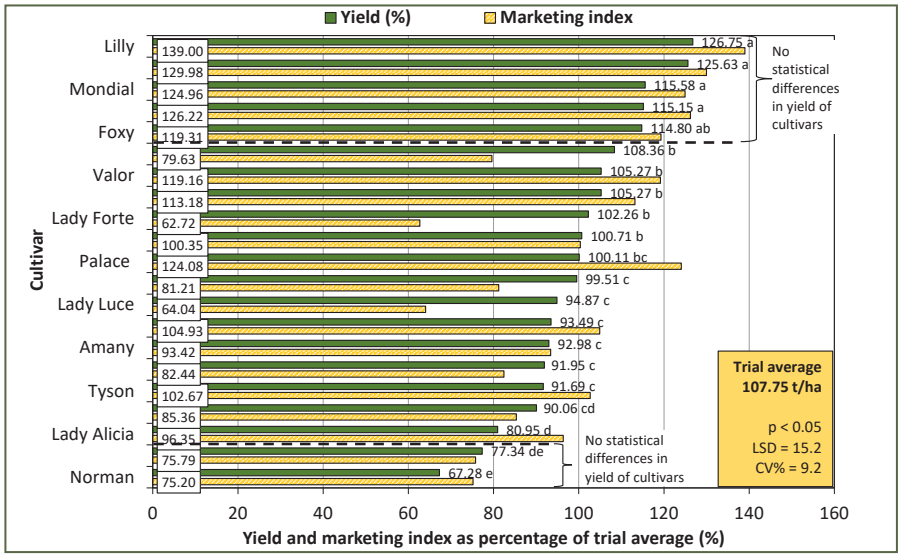
Figure 3 indicates minimum and maximum temperatures. The season experienced significant fluctuations in maximum temperatures.

Figure 4: Heat units during the 2023/24 season as well as heat units of the last five seasons.



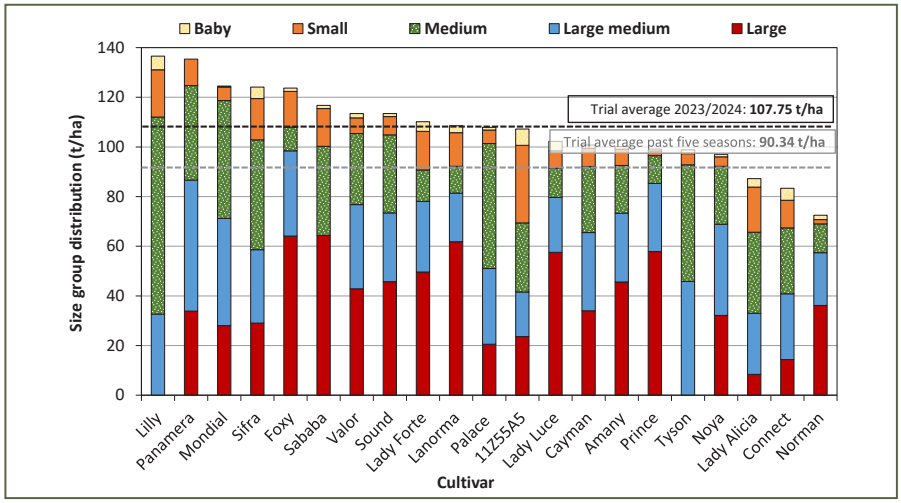
**Total heat units determined specifically for potatoes as a crop (threshold temperature = 5°C). Calculated from hourly data.*

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



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

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



Temperatures were above 30°C for 38 days and above 35°C for eight days.

Collecting heat units during the growth period is important during the development of a potato plant. The trend of heat units available for the cultivar trial in this season at Donkerbos, seems to be consistently above the long-term data trend of heat units (*Figure 4*).

The yield data was statistically processed using the Gen-Stat® program and the mean was separated using the Tukey test of least significant differences (LSDs). The cultivar effect during this trial (*Figure 5*) was statistically significant ($p<0.05$) and the coefficient of variation was low (9.2%). This indicates that the trial was well executed, and the results are reliable.

The yield of each cultivar is divided by the trial average (the trial average of all the cultivars is taken as 100%). This creates a yield index that reflects each cultivar's performance in terms of yield, as a percentage of the trial average.

Trial yield

The average yield of the trial for the 2023/24 season was 107.75 t/ha, significantly better than the average of the past five seasons of 90.3 t/ha. The higher yield can be attributed to several factors coming together, including optimal planting and harvesting time, increased heat unit accumulation, good soil quality, efficient irrigation scheduling, and of course the plant readiness and quality of tubers used in the trial. Lilly, Panamera, Sifra and Foxy delivered the best yield with no statistical differences in yield. Lilly, Panamera and Sifra recorded the best marketing indices.

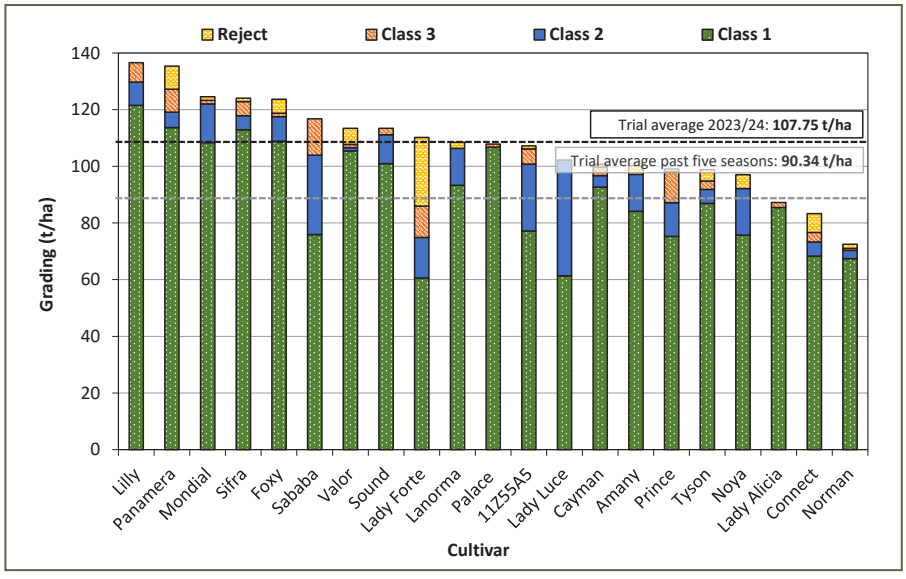
A good marketing index is characterised by a higher yield of Large potatoes and/or good quality potatoes. Size group distribution and grading are indispensable evaluations when considering a cultivar's marketability (*Figures 6* and *7*).

Cultivar performance fluctuates from one season to the next as the climate is never the same during different seasons. It is important to

Table 4: Main reasons for downgrading.

Cultivar	Loose skin	Malformation	Common scab	Greening	Rhizoctonia	Growth cracks
11Z55A5		7			2	3
Amany	3	7	2		3	
Cayman	2				3	1
Connect			3		3	
Foxy					3	
Lady Alicia					2	
Lady Forte	10				3	
Lady Luce	5				2	3
Lanorma					2	
Lilly					1	
Mondial	2				1	
Norman		3			1	
Noya		5			5	
Palace			1		2	
Panamera	5				5	2
Prince					2	
Sababa		7		2	3	
Sifra			2		2	
Sound					3	
Tyson			2		3	
Valor					25	
<5% incidence			5-15% incidence		>15% incidence	

Figure 7: Grading of each cultivar in the trial.



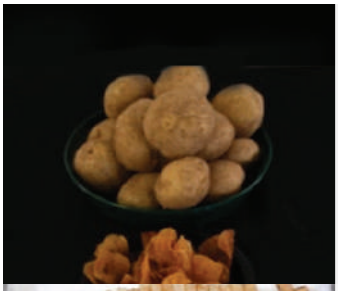
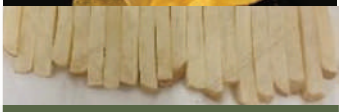
consider the consistent performance of cultivars across seasons, despite climate variation over time. Variations of cultivars during the past three and five seasons are indicated in *Figures 8* and *9*.

Table 4 illustrates the main reasons for downgrading. Rhizoctonia and loose skin were the main reasons for downgrading potatoes to Class 2 and 3.

Lastly, when looking at the internal quality of potatoes, its processing characteristics can also be evaluated. To adhere to these processing characteristics, cultivars must meet a

Lilly, Panamera, Sifra and Foxy delivered the best yield with no statistical differences in yield.

Table 5: Flesh colour, internal quality, chip colour and SG of the 2023/24 yield.

11z55A5	Amany	Cayman	Connect
SG 1.069	SG 1.078	SG 1.083	SG 1.070
			
Foxy	**Lady Alicia**	**Lady Forte**	**Lady Luce**
SG 1.065	SG 1.085	SG 1.087	SG 1.078
			
			
Lanorma	**Lilly**	**Mondial**	**Norman**
SG 1.077	SG 1.071	SG 1.077	SG 1.085
			
			
Noya	**Palace**	**Panamera**	**Prince**
SG 1.080	SG 1.089	SG 1.077	SG 1.082
			
			

Sababa	Sifra	Sound	Tyson
SG 1.067	SG 1.075	SG 1.071	SG 1.081

** Specific gravity of >1.075 is acceptable for the processing industry. No internal defects such as brown spot or hollow heart was detected.*

Valor
SG 1.073

Figure 8: Performance of cultivars included in the trial for three years expressed as a percentage of the trial average.

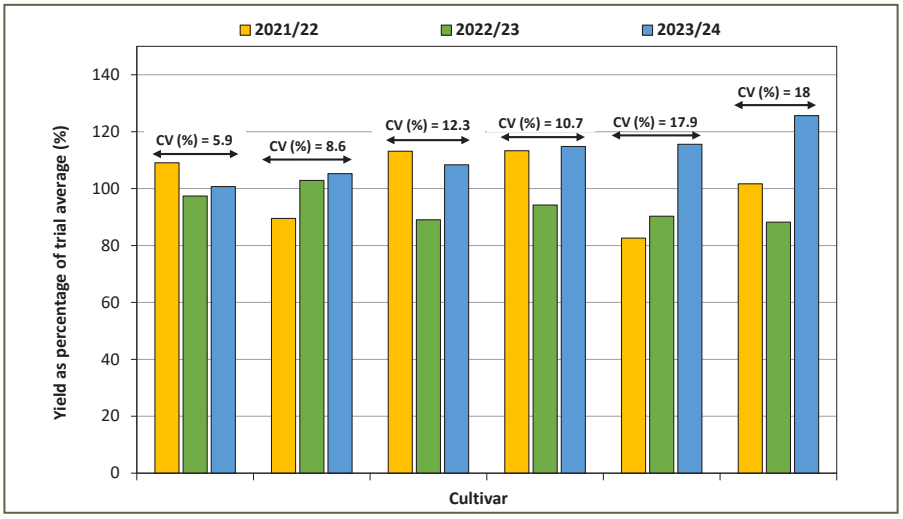
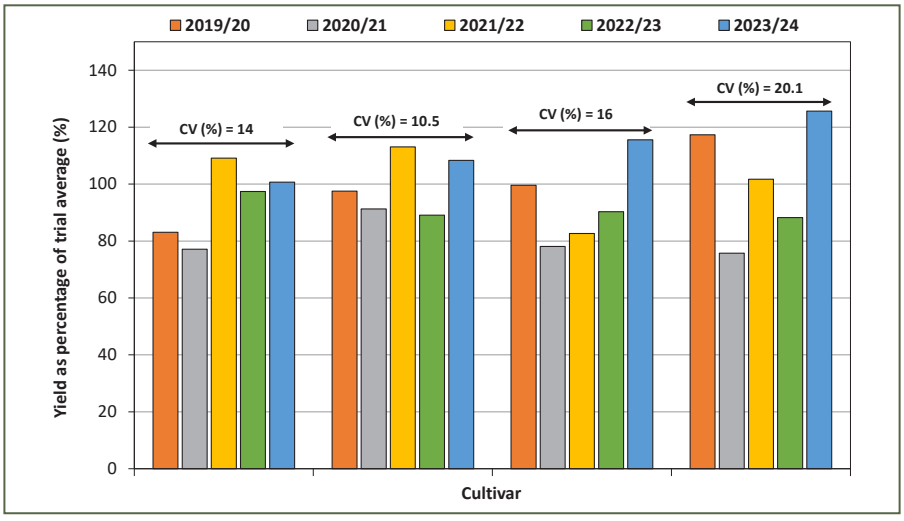


Figure 9: Performance of cultivars included in the trial for five years expressed as a percentage of the trial average.



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.

specific gravity (SG) norm of ≥1.075. (*Table 5*). Various cultivars met the SG requirement. Internal quality was evaluated to establish if the particular cultivar showed signs of hollow heart and brown spot. *Table 5* also indicates the flesh colour, internal quality, and chip colour.

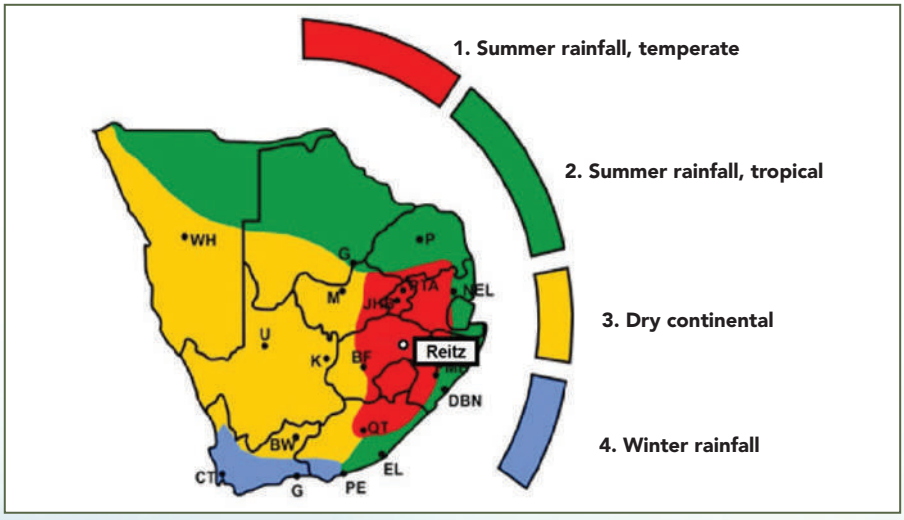
Special thanks to the farm and coworkers at Donkerbos, the Ceres Potato Working Group, all participants including FPD, GWK, RSA and Wesgrow, Soreen Gouws for the photographs, and participating Potatoes SA staff.
For more information, contact Enrike Verster at enrike@potatoes.co.za or Laryssa van der Merwe at laryssa@potatoes.co.za.

Eastern Free State dryland cultivar trial at Reitz in 2023/24

By Enrike Verster, Anjé Venter and Laryssa van der Merwe, Potatoes SA

The Eastern Free State is a major potato production area where 19% of the country's commercial potatoes are produced on approximately 9 522 ha (2023 harvesting year). The most prominent cultivars produced for table usage in this area are Mondial, Panamera and Lanorma.

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



Reitz is located in South Africa's temperate summer rainfall area (*Figure 1*) and has recorded an average annual rainfall of 509 mm over the past 20 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.

Differences in growth periods

The cultivar trial included cultivars with short and long growth periods. Hence, growth periods can influence the eventual yield of certain cultivars. The length of growth periods is subject to the nature of the season but is regarded as the amount of time

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

Co-worker	**Middelbult (Fick & Seun Bdy)**						
Planting date	Geyer Terblanche						
Harvesting date	28 September 2023						
Irrigation/dryland	28 March 2024						
Double or single rows	Dryland						
Leaf senescence	Staggered – double rows in contour						
Interrow spacing	Natural						
In-row spacing	0.9 m						
Trial site	72 cm						
Plant population	18 m^2						
Population density	15 432 plants/ha						
Fertilisation programme	**Nutritional value**						
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**	**Ca (kg/ha)**	**Mg (kg/ha)**	**S (kg/ha)**	**Zn (kg/ha)**
Total	**120.8**	**69.55**	**114.6**	**31**	**1.5**	**28.5**	**3.1**
	750 kg gypsum/ha						

that lapses from emergence to natural leaf senescence.

Table 2 illustrates how growth periods differ among cultivars. *Table 2* 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 growth 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 is calculated by classing and sorting every cultivar according to quality and size group – for example, Class 1 Large or Class 2 Large-medium.

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

Table 2: Cultivar characteristics relating to growth period, plant readiness, plant population (%) and haulm counts.

Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
11Z55A5	Medium to long	(100 –120)	2	96.7	2.4	35 802
Amany	Medium to long	(110)	2	93.3	2.3	33 127
Connect	Medium to long	(120)	3	73.3	3.3	37 345
Foxy	Short to medium	(90 – 100)	3	93.3	7.3	105 143
Lady Alicia	Medium	(95 – 100)	1	93.3	2.2	31 687
Lady Forte	Long	(120)	1	96.7	4	59 670
Lady Luce	Medium	(110)	1	96.7	2.8	41 769
Lanorma	Short	(80 – 90)	3	86.7	2.9	38 786
Lilly	Medium	(100)	2	96.7	4.1	61 162
Markies	Medium to long	(110)	2	90	2.8	38 889
Mondial	Medium to long	(110 – 115)	2	93.3	4.1	59 053
Noya	Short	(80 – 90)	3	90	3.6	50 000
Palace	Long	(110 – 115)	2	93.3	3.5	50 411
Prince	Long	(110 – 115)	1	96.7	2.3	34 310
Sound	Medium	(95 – 100)	1	96.7	5.5	82 047

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

Figure 2: Rainfall in the 2023/24 season as well as long-term average rainfall.

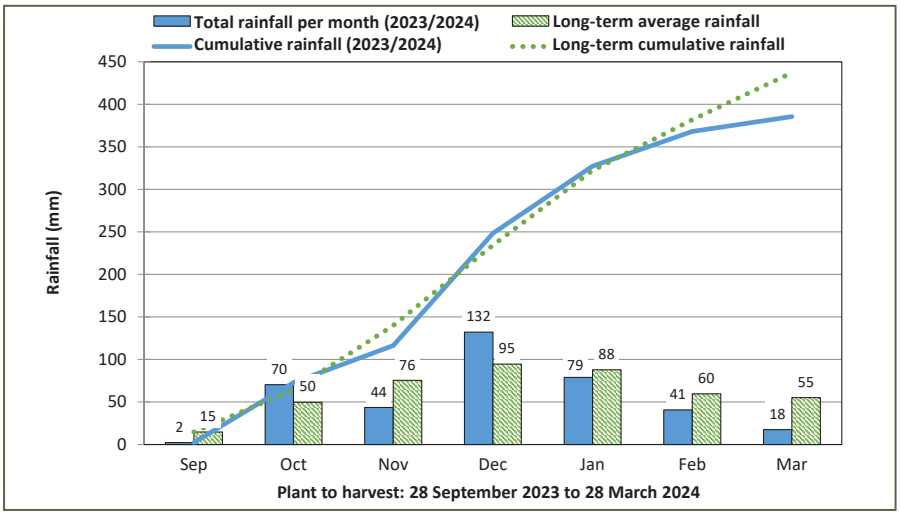


Figure 3: Minimum and maximum temperatures (2023/24 seasons) as well as long-term temperatures.

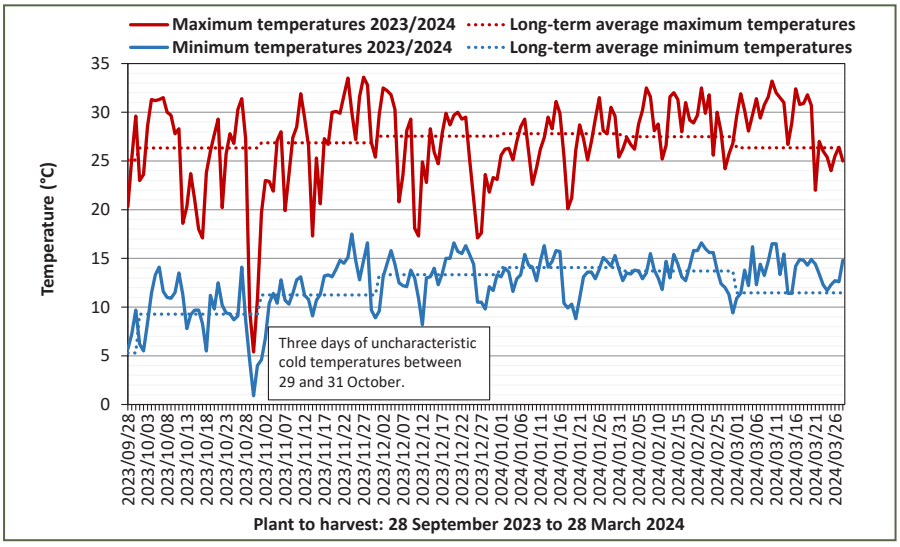
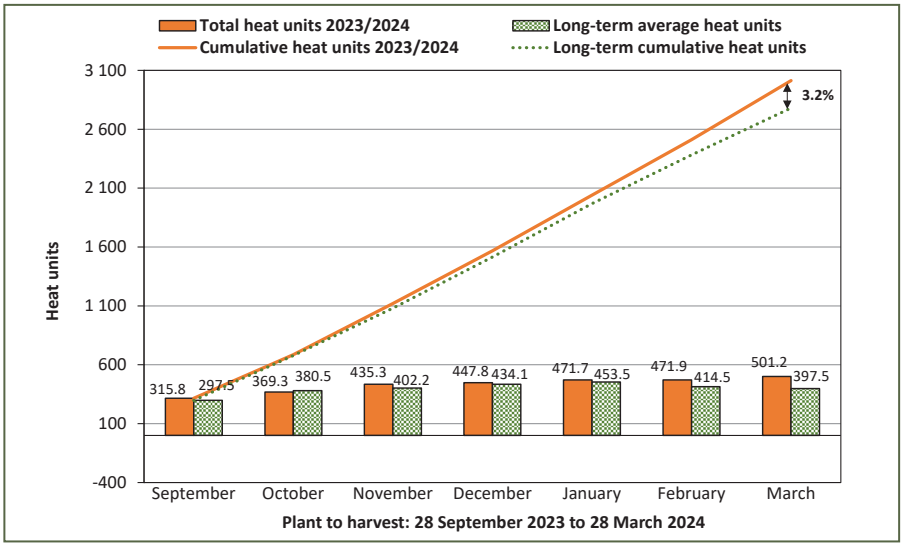


Figure 4: Heat units (2023/24 season) as well as long-term heat units.



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

Therefore, cultivars are tested across several seasons.

Seasonal aspects

As with any crop, 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. These factors are considered when evaluating cultivar performance.

Relevant daily and long-term weather data is obtained from a nearby Hortec weather station as well as a Agricultural Research Council (ARC) weather station located as close as possible to the trial site.

The 2023/24 season's monthly rainfall (*Figure 2*) varied more compared to the long-term average rainfall, but was more moderate than the previous season. Below-average rainfall was only recorded in the last two months before harvest. The yield, however, was not significantly impacted.

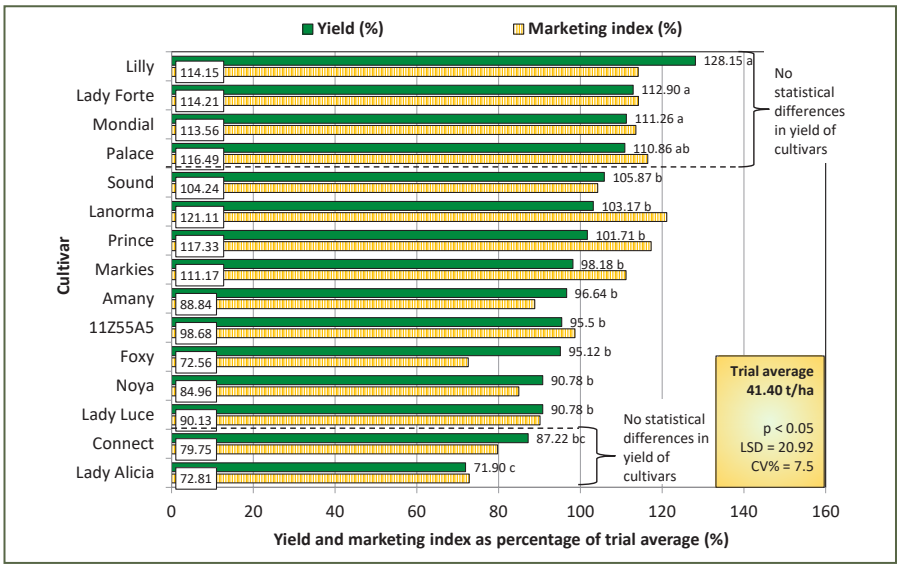
Figure 3 illustrates minimum and maximum temperatures. Along with months of above-average rainfall, the season was also characterised by major fluctuations in maximum temperatures.

The collection of heat units during a growth period is a vital aspect of the development of a potato plant. The trend of heat units available for the season's cultivar trial at Reitz seems close to, but still higher than, the long-term data trend for heat units (*Figure 4*).

Yields and marketing index

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 mean. The cultivar effect during this specific trial (*Figure 5*) was statistically significant ($p<0.05$) while the coefficient of variation (CV) was low (7.5%). These factors serve to indicate that the trial was well executed, and that the results are reliable.

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.

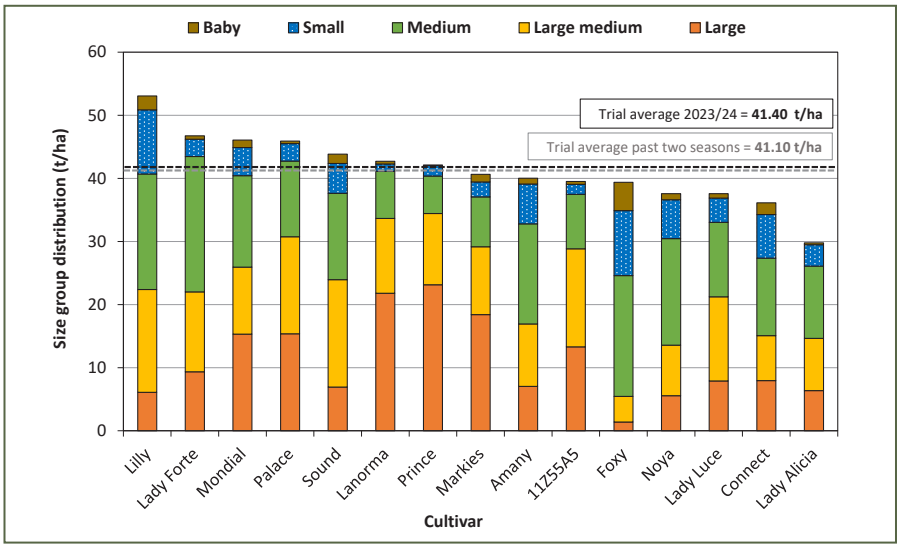
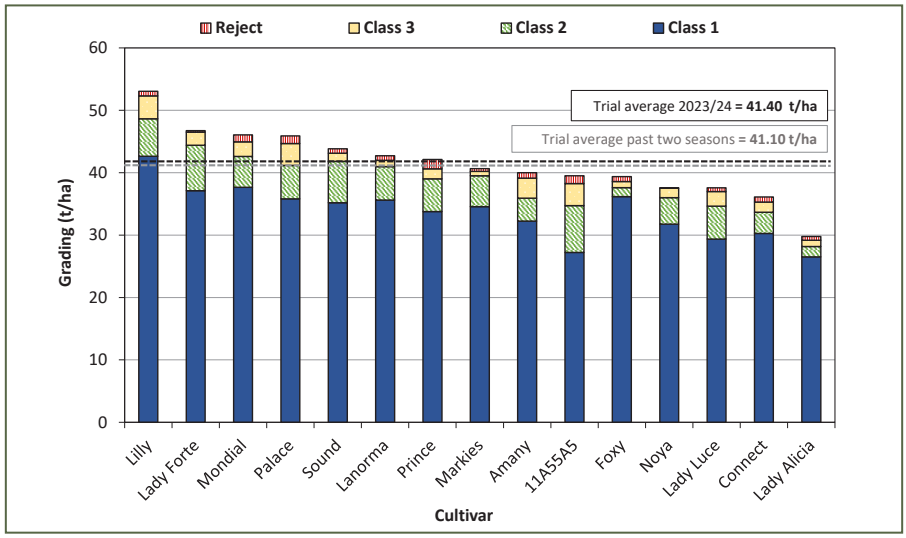


Figure 7: Grading of each cultivar in the trial.



The yield of each cultivar 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.

The average yield of the trial for the 2023/24 season is 40.4 t/ha which is substantially better than the previous season's average of 27.2 t/ha. The trial average was 41.08 t/ha for

Table 3: Main reasons for downgrading.

Cultivar	Malformation	Common scab	Moth	Insects	Growth cracks	Fissure scab	Powdery scab	Rot	Fusarium	Silver scab	Hollow heart
11Z55A5			x	x	x	x			x	x	
Amany	x		x	x	x			x			
Connect	x		x	x			x	x		x	
Foxy	x	x	x	x	x			x		x	
Lady Alicia			x	x				x			
Lady Forte		x	x	x			x	x			
Lady Luce			x	x				x		x	
Lanorma				x				x			
Lilly	x		x	x				x		x	
Markies	x	x	x					x		x	
Mondial	x				x	x	x	x			
Noya			x	x				x			
Palace		x							x		
Prince		x	x	x				x		x	x
Sound				x				x			

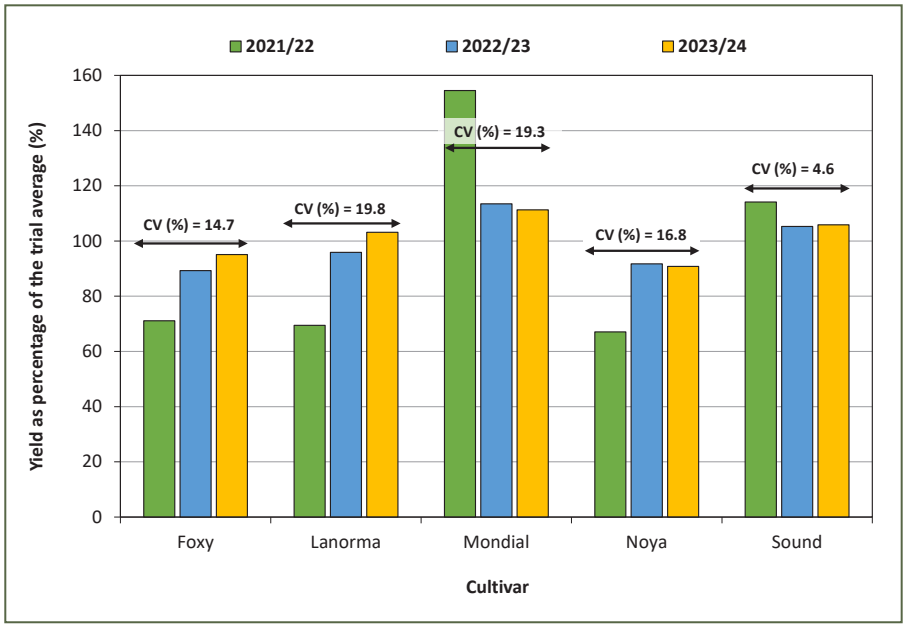
Table 4: Processing characteristics of cultivars. (Carried out by ARC-Roodeplaat.)

Cultivar	Chip colour[1]	SG[2]	DM[3]
11Z55A5	57	1.068	17.66
Amany	45	1.078	19.87
Connect	41	1.078	19.78
Foxy	43	1.071	18.38
Lady Alicia	57	1.091	22.63
Lady Forte	50	1.078	19.83
Lady Luce	45	1.081	20.51
Lanorma	48	1.074	19.03
Lilly	42	1.073	18.74
Markies	50	1.086	21.55
Mondial	48	1.067	17.48
Noya	39	1.080	20.25
Palace	38	1.088	21.81
Prince	53	1.089	22.19
Sound	47	1.073	18.71

[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.*

The marketing index of the cultivars in question is calculated by classing and sorting every cultivar according to quality and size group – for example, Class 1 Large or Class 2 Large-medium.

Figure 8: Performance of cultivars included in the trial for three seasons, 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.*

Lanorma, Prince and Palace obtained the best marketing indices.

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 (*Figures 6* and *7*).

Quality and downgrading

The main reasons for downgrading are indicated in *Table 3*. Moth and insect damage as well as rot were the main reasons for downgrading the quality of the cultivars in this trial.

The performance of cultivars varies from season to season. This is simply because the climate is never the same from one season to the next. Therefore, it is very important to consider consistent cultivar performance across several seasons. This trial was conducted over a period of three years and the variation among cultivars is illustrated in *Figure 8*. Currently Sound and Foxy varied the least across all three seasons.

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 4*). Lady Alicia, 11Z55A5 and Prince exhibited the required chip colour, and several cultivars met the SG requirement. Only Lady Alicia and Prince met both requirements.

Special thanks to the farm and co-workers, Fick & Seun Bdy, the Eastern Free State Potato working group, and participants FPD, GWK and RSA, and Anjé Venter and Laryssa van der Merwe of Potatoes SA.
For more information, contact Enrike Verster at enrike@potatoes.co.za, Anjé Venter at anje@potatoes.co.za or Laryssa van der Merwe at laryssa@potatoes.co.za.

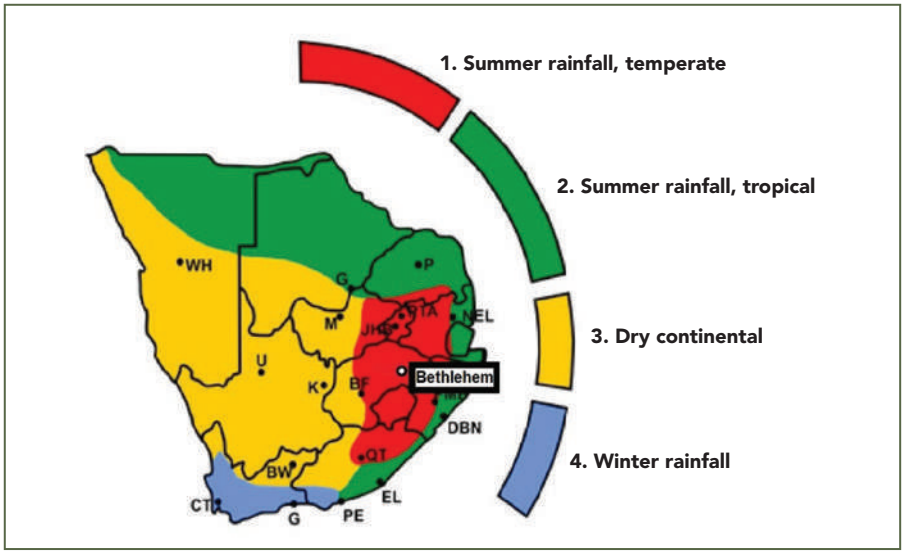
Eastern Free State cultivar trial under irrigation at Bethlehem in 2023/24

By Enrike Verster en Anjé Venter, Potatoes SA

The Eastern Free State is a major potato producing region where 19% of the country's commercial potatoes are produced on approximately 9 522 ha (2023 harvest year). The most prominent cultivars produced for table usage are Mondial, Panamera and Lanorma.

Bethlehem is located in South Africa's moderate summer rainfall area (*Figure 1*) and received average rainfall of approximately 684 mm over the past 19 years. The region experiences warm summers and very cold winters with possible frost from mid-May to early September.

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



Trial design

The Bethlehem cultivar trial was planted in a randomised block design with three replications per cultivar. *Table 1* contains additional technical information relevant to the trial.

Included in the cultivar trial were cultivars with short to long growth periods. Growth periods can, therefore, influence the eventual yield of certain cultivars. Growth period length is subject to the nature of the season, but is regarded as the amount of time that passes from emergence to natural leaf senescence. Soil analyses of the pivot on which the trial was executed are indicated in *Table 2*. *Table 3* provides an outline of how these growth periods vary from one cultivar to the next.

Plant readiness of the seed potatoes at the time of the trial,

The Eastern Free State is a major potato producing region where 19% of the country's commercial potatoes are produced on approximately 9 522 ha.

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

Farm	**Durabro**					
Co-worker	Wessel and Janke du Randt					
Planting date	3 October 2023					
Harvesting date	25 April 2024					
Irrigation/dryland	Irrigation					
Double or single rows	Double rows					
Leaf senescence	Natural					
Interrow spacing	0.9 m					
In-row spacing	46.29 cm					
Plant density	24 000 plants/ha					
Fertiliser programme	**Nutritional value**					
	N (kg/ha)	**P (kg/ha)**	**K (kg/ha)**	**Ca (kg/ha)**	**Mg (kg/ha)**	**S (kg/ha)**
Total	**249**	**110**	**279**	**278**	**30**	**189**

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

Density	pH (KCl)						% CEC[1]			
		P (Mehlich3)	K	Ca	Mg	Na	K	Ca	Mg	Na
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	%	%	%
1.2 to 1.3	4.5	35	135	750	70	7.5	9.5	72.5	17.5	<1

[1]CEC: cation exchange capacity.

as well as plant density and haulm count observed later on in the growing period, are also indicated in *Table 3*.

Classing and sorting

The evaluation of new cultivars in the Bethlehem trial delivered results regarding, among others, yield and marketing index. The marketing index of the relevant cultivars is calculated by classing and sorting each cultivar according to quality and size distribution, for example, Class 1 Large or Class 2 Large-medium. Price comparisons were then made to market prices at harvesting time.

The performance of new cultivars cannot be based on the results of one particular season only, since climate and seed potato quality can vary from one year to the next. It is for this very reason that cultivars are preferably tested across several seasons.

Temperatures and water

As with any crop, temperature, availability of water (good irrigation schedules or rainfall), as well as heat units are important factors with a significant influence on the potato

Table 3: Characteristics relating to growth period, plant readiness, population density (%) and haulm count for relevant cultivars.

Cultivar	Growing period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
11Z55A5	Medium to long	(100 – 120)	2	90%	3.5	75 600
Amany	Medium to long	(110)	2	90%	3.1	66 960
Foxy	Short to medium	(90 – 100)	2	90%	4.1	88 560
Lanorma	Short	(80 – 90)	2	80%	3.4	65 280
Lilly	Medium	(100)	2	96.7%	5.1	118 320
Markies	Medium to long	(110)	1	90%	3.2	69 120
Mondial	Medium to long	(110 –115)	3	88.3%	4.9	103 880
Noya	Short	(80 – 90)	3	91.7%	3.7	81 400
Palace	Long	(110 –115)	1	96.7%	3.3	76 560
Prince	Long	(110 –115)	1	71.7%	2.5	43 000
Sound	Medium	(95 – 100)	1	93.3%	4.3	96 320

[1]General guidelines and categories (days from emergence to natural leaf senescence, depending on the season): short = 70 to 90 days; short to medium = 80 to 100 days; medium = 90 to 110 days; medium to long = 90 to 120 days; long = 90 to 140 days.
[2]Plant readiness of seed potatoes: 1 = fresh; 2 = slightly fresh; 3 = ready for planting; 4 = slightly old; 5 = old.

Figure 2: Rainfall during the 2023/24 season as well as the long-term average rainfall.

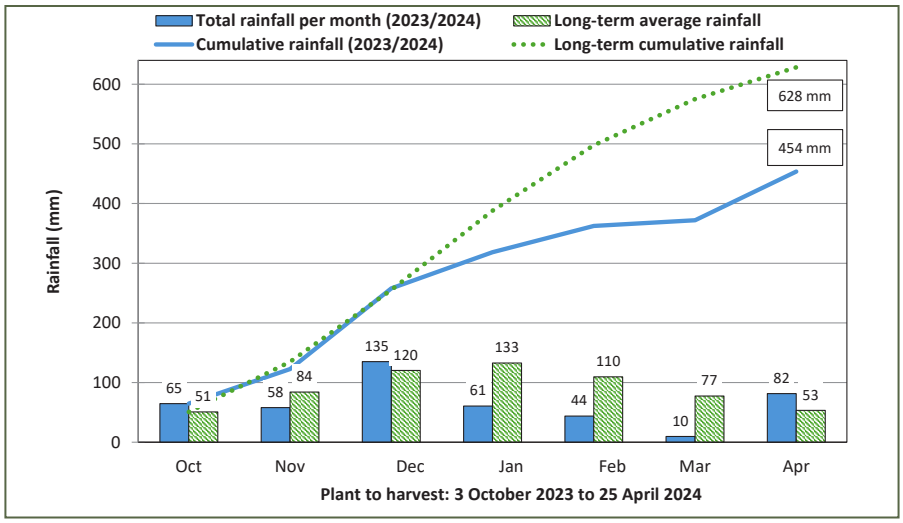


Figure 3: Minimum and maximum temperatures during the 2023/24 season as well as long-term average temperatures.

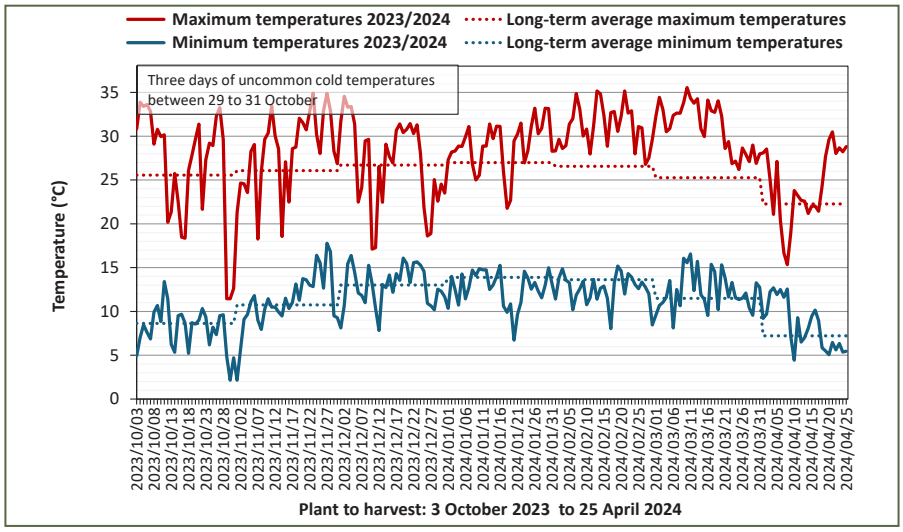
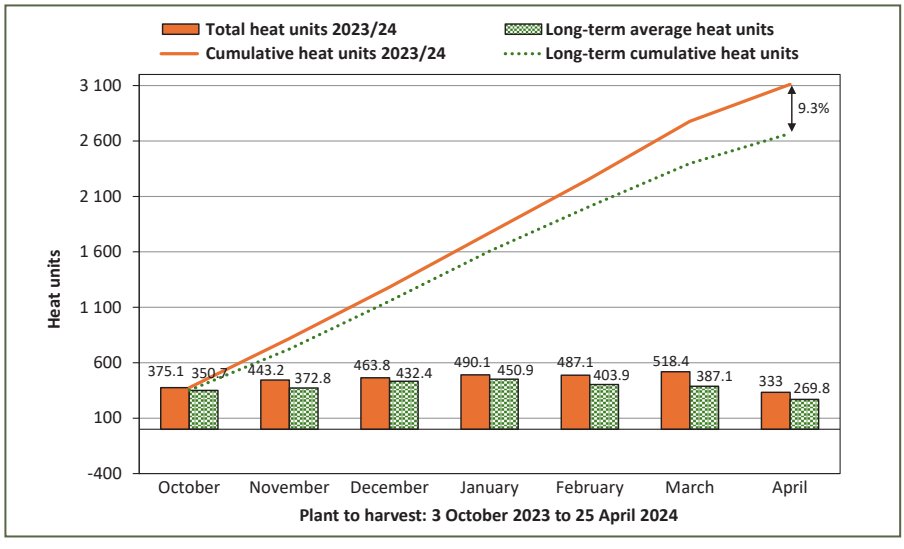


Figure 4: Heat units (2023/24 season) as well as long-term average heat units.



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

plant's growth period. These factors are therefore taken into consideration when evaluating cultivar performance. Relevant daily and long-term weather data is obtained from a selected Agricultural Research Council (ARC) weather station that is as close as possible to the trial site.

Rainfall figures in the 2023/24 season (*Figure 2*) were generally similar to the long-term average recorded per month at the start. However, since January, less rainfall (close to the end of the growth period) was recorded. Overall, less rainfall was ultimately recorded for the duration of the trial.

Influence of heat units

Figure 3 illustrates minimum and maximum temperatures. This particular season was characterised by particularly significant fluctuations in maximum temperatures. Far-above average temperatures were recorded for a period of three months in the last months before harvesting.

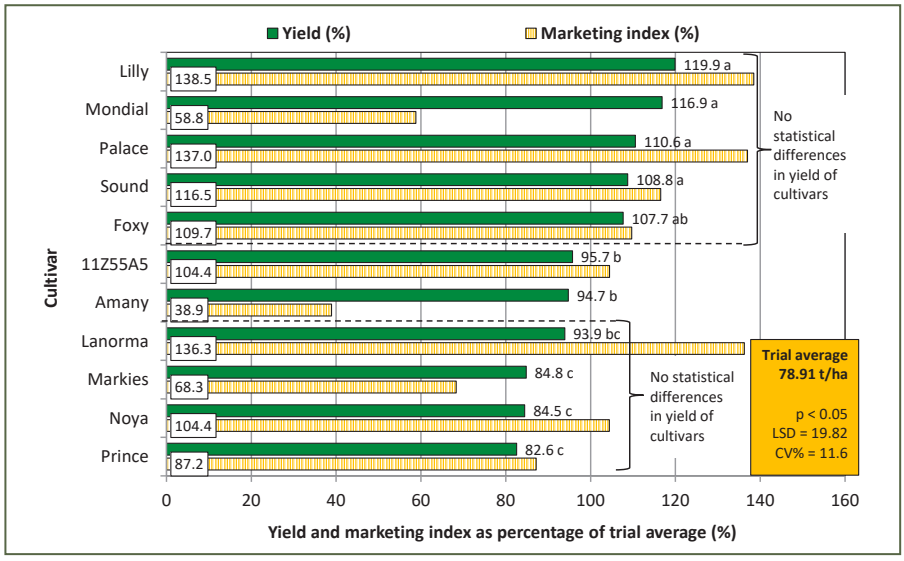
Heat units are another important factor to consider, as the development of the plant is mainly based on the collection of heat units during a growth period. The trend of available heat units for this cultivar trial at Bethlehem was higher throughout in respect of the cumulative long-term data of heat units (*Figure 4*).

The yield index

Yield data collected during harvest day is statistically processed using the GenStat® program. The mean was separated using the Tukey test of least significant differences (LSD). The cultivar effect during this trial (*Figure 5*) was statistically significant ($p<0.05$) in terms of yield while the coefficient of variation (CV) was low (11.6%). These factors indicate that the trial was well executed, and the results are therefore reliable.

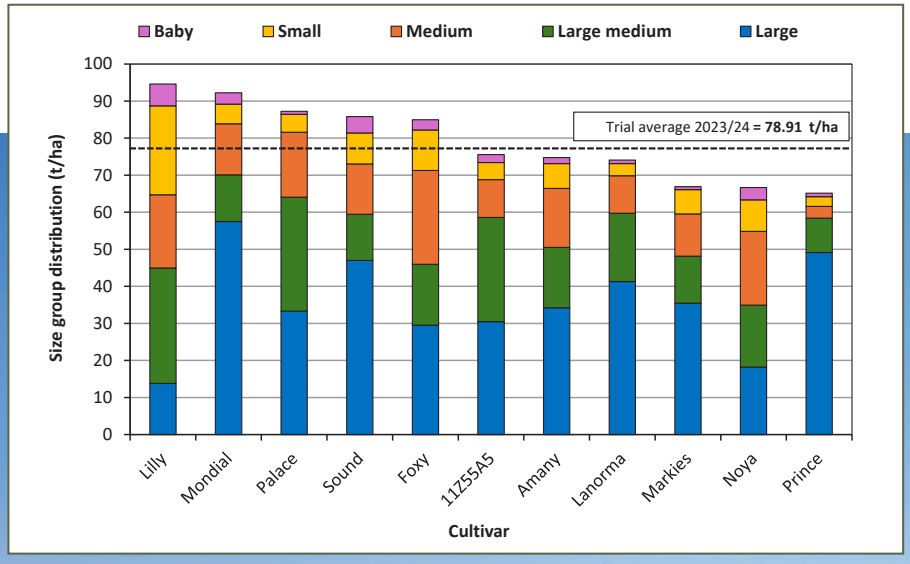
The yield of each cultivar is divided by the trial average (the average of all the cultivars is accepted as 100%). This creates a yield index and each cultivar's performance in terms of yield is read as a percentage of the trial average.

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



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

Figure 6: Size distribution of all cultivars in the trial.



Size distribution and grading are indispensable evaluations when studying a cultivar's marketability.

Table 4: Main reasons for downgrading.

Cultivar	Malformation	Moth	Growth cracks	Rot	Fusarium	Silver scab
11Z55A5	x	x		x		x
Amany	x	x	x		x	
Foxy		x		x		x
Lanorma		x				
Lilly		x		x		x
Markies		x		x		
Mondial	x	x	x	x		x
Noya		x				x
Palace		x		x		x
Prince		x		x		
Sound		x	x	x		x

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

Cultivar	Chip colour[1]	SG[2]	DM[3]
11Z55A5	54	1.100	25
Amany	62	1.069	18
Foxy	47	1.066	17
Lanorma	55	1.046	13
Lilly	49	1.064	17
Markies	53	1.074	19
Mondial	49	1.070	18
Noya	55	1.078	20
Palace	55	1.083	21
Prince	55	1.077	20
Sound	56	1.069	18

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

Trial yields

The average yield of the cultivar trial for the 2023/24 season was 78.91 t/ha. Lilly, Mondial, Palace, Sound and Foxy delivered the highest yield with no statistical differences in yield.

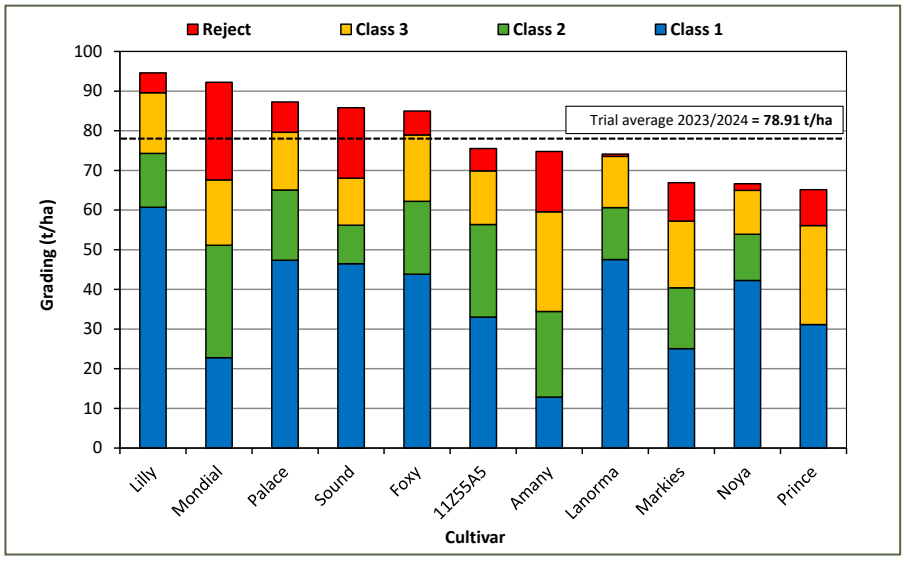
Lanorma, Palace and Lilly achieved the best marketing indices of Large potatoes and/or the highest number of good-quality potatoes.

Size distribution and grading are indispensable evaluations when studying a cultivar's marketability (*Figures 6* and *7*). Reasons for downgrading are indicated in *Table 4*. The main reasons for downgrading the quality of cultivars in this trial were moths, rot, and silver scab.

As seasons tend to fluctuate, the performance of cultivars changes from one season to the next. This is simply because the climate is never the same from one season to another. This was the first year that this trial was conducted, hence such a comparison was not possible.

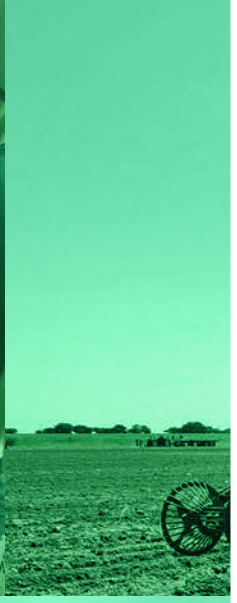
Finally, when observing the internal quality of potatoes, processing characteristics can also be evaluated. To comply with processing requirements, cultivars have to comply with a chip colour norm of >50 and a specific gravity (SG) of ≥1.075 (*Table 5*). The cultivars 11Z55A5, Noya, Palace and Prince met the chip colour and SG requirements.

Figure 7: Grading of all cultivars in the trial.



Special thanks to the farm and co-worker, Durabro Boerdery, the Eastern Free State Potato working group as well as the contributors FPD, GWK and RSA. For more information, contact Enrike Verster at enrike@potatoes.co.za or Anjé Venter at anje@potatoes.co.za.








Produced by:

PLAAS MEDIA

A breed of its own