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CHIPS

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COVER CROPS AND NEMATODE MANAGEMENT: TOLERANCE TO *MELOIDOGYNE ENTEROLOBII*

WES-VRYSTAATSE KULTIVARPROEF ONDER BESPROEIING OP BULTFONTEIN

Pesticide maximum residue limits and market access

Tendense op varsproduktemarkte

PSA small grower development programme in Limpopo

KwaZulu-Natal cultivar trial under irrigation at Greytown in 2020/2021

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The KwaZulu-Natal (KZN) production region produces about 5% of the South African potato crop. The region plants potatoes for the seed, table and processing market, under irrigation as well as on dryland. The main cultivars earmarked for the table and processing market include Mondial, Valor and Sifra in winter, and Valor, Mondial, Up-to-Date, Lanorma and Fianna in summer. The popular cultivars for the seed market produced in this area are Mondial, Valor and FL2108.

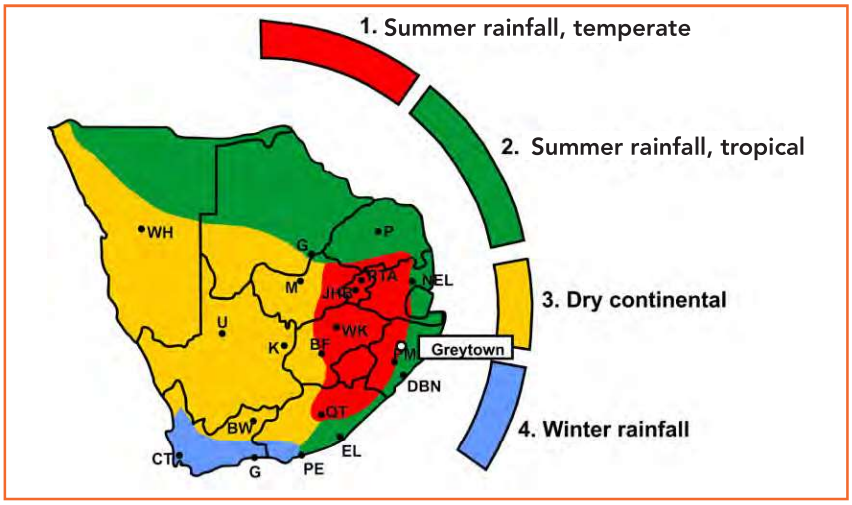
Trials were conducted at Greytown, a town situated 1 155 m above sea level on the banks of the Umvoti River, in a fertile, timber-producing area of KZN. Greytown is situated in a warm and temperate area with a significant annual average rainfall of 688 to 1 140 mm throughout the year (*Figure 1*).

Greytown has two production seasons, namely a winter planting that takes place from February to July, and a summer planting from August to January. The trial site consisted of sandy loam soil and the trial was 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*.

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

Farm	a heritage of growth golden grow
Planting date	18 August 2020
Harvest date	19 January 2021
Irrigation/dryland	Irrigation
Double or single rows	Two single rows
Leaf senescence	Chemical
Spacing between rows	0.75 m
Inter-row spacing	0.3 m
Area per plot	15 m^2
Plant density	44 444 plants/ha

Figure 1: Location of Greytown in the KZN production region.



Effect of certain characteristics

It is important to note that growth periods can influence the yield of cultivars. Growth periods are defined as the total number of days from emergence to leaf senescence, depending on the season.

The exact timing of the four stages of growth depends on the environment and management practices, which vary between localities as well as cultivars due to the different growth periods, among others. The plant readiness of seed potatoes, population density (%)

Table 2: Characteristics regarding growth period, population density (%) and haulm count for each of the relevant cultivars in 2020/2021.

Agent	Cultivar	Growth period (days)[1]		Plant readiness[2]	Population density (%)	Haulms per plant	Haulms per ha
WEE grow	Allison	Medium to long	(120)	3	100	6.9	306 664
WEE grow	Alverstone Russet	Medium to long	(110-115)	2	98.53	5.6	245 153
GWK	Belmonda	Short to medium	(100)	2	98.53	3.8	166 354
WEE grow	Electra	Short to medium	(100)	3	100	7	311 108
First Potato Dynamics	Kingsman	Medium	(100-110)	2	100	4.1	182 220
GWK	Lanorma	Short	(80-90)	3	100	4.4	195 554
First Potato Dynamics	Markies	Medium to long	(120)	3	100	5.8	257 775
WEE grow	Mondial	Short to medium	(95-100)	3	100	4.3	191 109
WEE grow	Panamera	Short to medium	(95-100)	3	100	6.1	271 108
WEE grow	Sababa	Medium to long	(110-115)	3	100	4.6	204 442
WEE grow	Sifra	Short to medium	(90-100)	3	100	4.4	195 554
First Potato Dynamics	Sound	Medium	(100)	3	100	6.8	302 219
GWK	7 Four 7	Short	(80)	2	100	2.6	115 554
GWK	Taisiya	Short to medium	(90)	3	100	3.8	168 887
WEE grow	Tyson	Short to medium	(90-100)	3	100	2.6	115 554

[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 = plant-ready, 4 = slightly old, 5 = old.
[3]Plant density was determined by one replicate of each cultivar comprising two rows with 34 plants, which equate to 68 plants per unit.

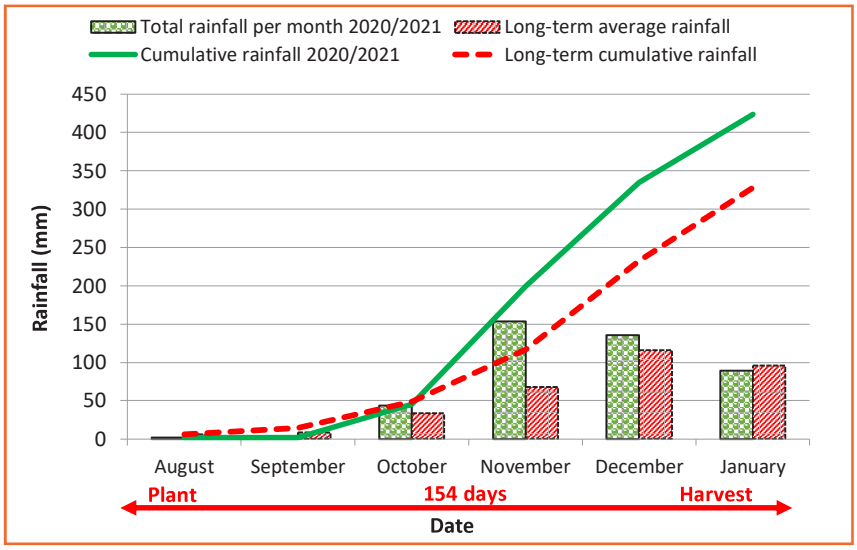
and haulm count of this trial are indicated in *Table 2*.

Temperature, photoperiod (day length) and water are the most important abiotic factors that influence the growth pattern, yield and quality of potatoes. To determine the adaptability of new cultivars in the Greytown area, it is important to take these factors into account when evaluating the performance of the different cultivars.

It is also important that the cultivars are evaluated for several seasons, as climatic conditions differ from one season to the next. The daily weather data was obtained from the Agricultural Research Council's (ARC) Ivala Muden Station (-28.97029, 30.37931), situated 30 km from the trial site.

Rainfall during the 2020/2021 growing season followed the same trend as in previous years, except for November which received more rainfall (during the bulking stage) compared to the long-term data (*Figure 2*).

Figure 2: Rainfall during the growing season (2020/2021) as well as the long-term average rainfall.



Minimum vs maximum temperatures

The minimum and maximum temperatures (*Figure 3*) of the 2020/2021 growing season followed the same trend as in

The average yield for the 2020/2021 season was 47.4 t/ha.

previous years, except for the maximum temperatures being lower in January. The minimum temperatures, on the other hand, were slightly higher in November compared to the long-term data.

During the last two months of the growing season, both the minimum and maximum temperatures fluctuated significantly and were higher than 35°C for 18 days, and higher than 30°C for 86 days. Heat units are another vital factor to consider, as the development of the plant is primarily dependent on the accumulation of heat units. It is therefore accepted that the plant must accumulate a certain number of heat units for the development phase to be completed.

The heat units for the 2020/2021 growing season followed the same pattern as the long-term average (*Figure 4*). At the end of the season, the heat units of the relevant year's growing season were 5.4% higher than the long-term cumulative heat units.

The yield data was statistically processed using the GenStat® program and the average was separated using the Tukey test of least significant differences (LSD). The cultivar effect of the 2020/2021 trial (*Figure 5*) was statistically significant ($p < 0.05$) in terms of yield, while the coefficient of variation (CV) was low (10.4%).

This indicates that the trials were well executed, and the results

Figure 3: Minimum and maximum temperatures (°C) during the growing season (2020/2021) as well as the long-term average.

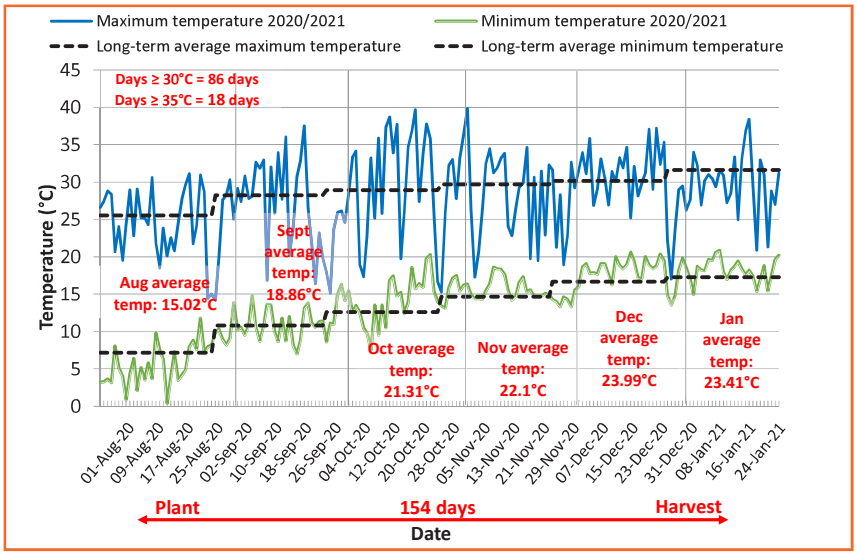
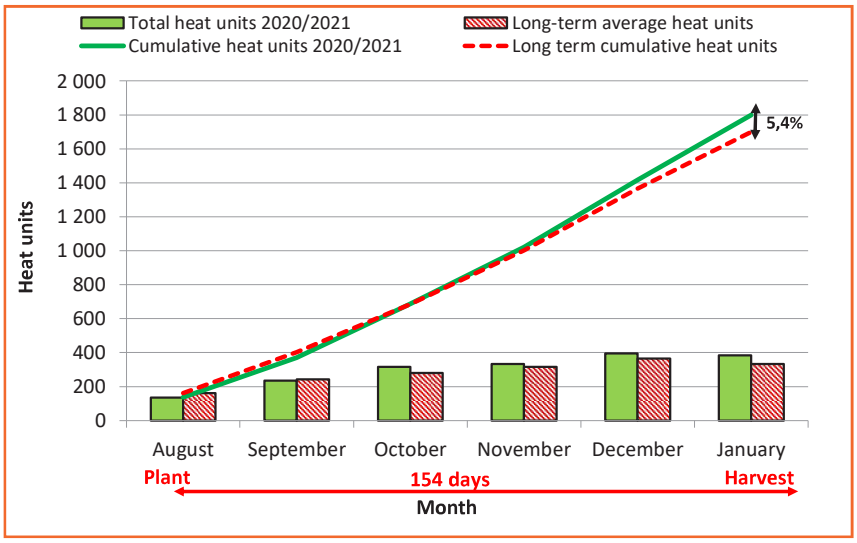
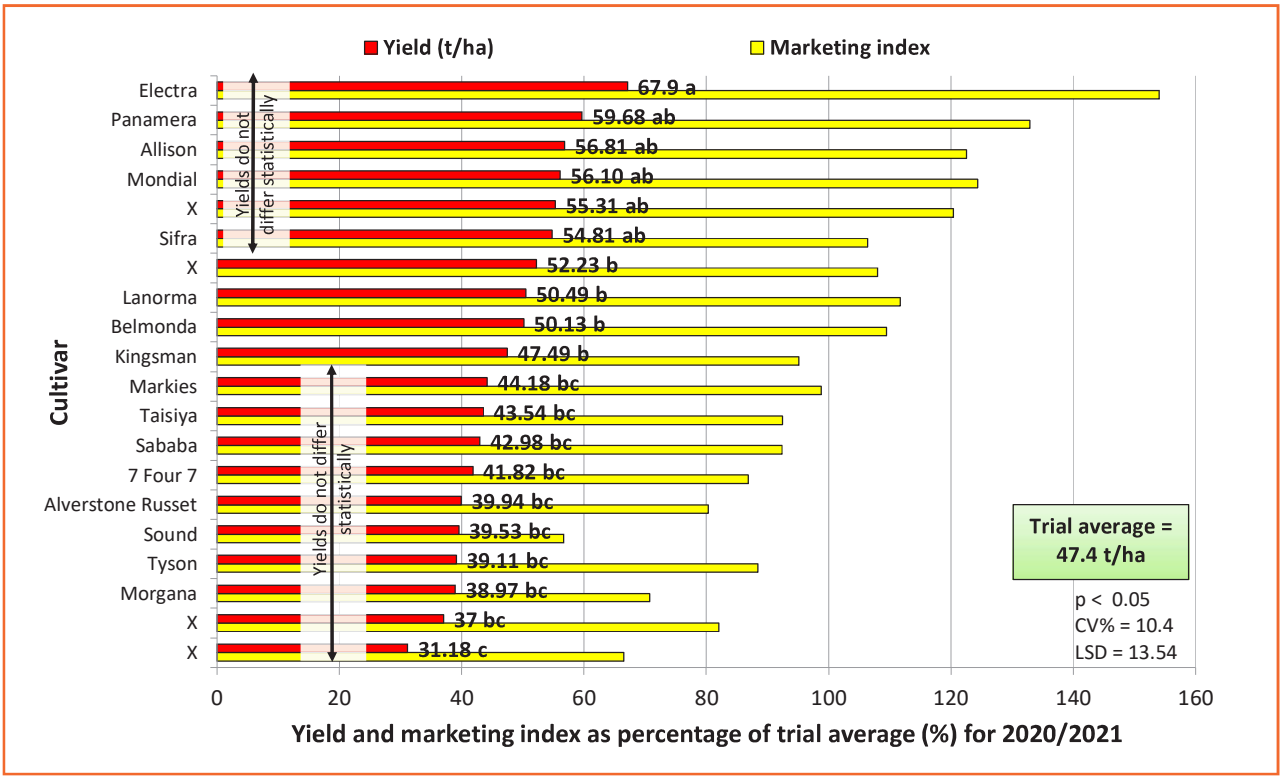


Figure 4: Heat units during the growing season (2020/2021) as well as the long-term average.



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

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



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

Table 3: The main reasons for downgrading during the 2020/2021 Greytown harvesting.

Cultivar	Insect damage	Mechanical damage	Common scab	Sun damage	Malformation	Stem-end rot	Greening	Growth cracks
Allison	X					X	X	X
Alverstone Russet	X						X	
Belmonda	X		X				X	X
Electra	X				X		X	
Kingsman	X			X				
Lanorma	X	X						
Markies	X	X					X	
Mondial	X				X			
Morgana	X			X			X	X
Panamera	X		X				X	
7 Four 7	X	X						
Sababa	X	X		X	X		X	
Sifra	X		X					
Sound	X	X					X	
Taisiya			X				X	
Tyson	X	X						

are reliable. The average yield for the 2020/2021 season was 47.4 t/ha. During the 2020/2021 trials (*Figure 5*), the cultivars Electra, Panamera, Allison, Mondial and Sifra produced the highest yields. The cultivars Electra, Panamera, Allison, Mondial, Sifra, Lanorma, Belmonda and Kingsman delivered a yield higher than the trial average (47.4 t/ha).

Highest marketing index for Electra

To determine the performance of the cultivars in terms of yield and quality, the trial utilised yield, size distribution and class to calculate the marketing index according to the average market prices of that specific day. The yield, multiplied by the prevailing price (which is determined by the tuber size distribution and grading), equals the marketing index (*Figure 5*).

The highest marketing index, which was attained by Electra, was the result of a high percentage large tuber size distribution (*Figure 6*) and a high percentage Class 1 grading (*Figure 7*). Size distribution and grading are also used to class potatoes. These factors are therefore crucial to ensure an optimal, economically marketable yield.

The tuber size distribution is indicated in *Figure 6*, the grading of the yield in *Figure 7*, and the main reasons for downgrading of the various cultivars are indicated in *Table 3*. The LINTUL-POTATO-DSS plant-growth model was used to calculate the potential potato yield, which is defined as the theoretical top-yield limit if water, nutrients and biological factors are at a seasonal optimum during the trial's growing season.

This allows us to evaluate how the actual yield attained compares with the simulated potential yield. The control cultivar, Mondial, was used to determine the potential potato yield of 73.6 t/ha, as influenced by the specific area's environmental factors (soil type, climate, planting date and harvest date, among others).

Table 4: Cooking and processing characteristics as well as internal quality of the yields for 2020/2021 (conducted by ARC Roodeplaat).

Cultivar	Chip colour[1]	SG[2]	Dry matter (%)[3]	Hollow heart (%)	Brown spot (%)
Allison	43	1.08	20.3	-	-
Alverstone Russet	57	1.059	15.86	-	-
Belmonda	47	1.091	22.64	-	-
Electra	39	1.065	17.3	-	-
Kingsman	44	1.094	23.42	-	-
Lanorma	53	1.091	22.59	-	✓
Markies	54	1.086	21.55	-	-
Mondial	47	1.055	15.01	-	-
Morgana	56	1.056	15.24	-	-
Panamera	49	1.06	16.08	-	-
7 Four 7	36	1.061	16.34	-	-
Sababa	58	1.098	24.14	-	-
Sifra	39	1.086	21.67	-	-
Sound	49	1.11	26.62	-	-
Taisiya	48	1.061	20.6	-	-
Tyson	55	1.076	19.45	-	-
≥ Norm (Acceptable for processing)			< Norm (Not acceptable for processing)		

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

All cultivars except Alverstone Russet, Lanorma, Markies, Morgana, Sababa and Tyson complied with the chip colour standard of > 50.

Figure 6: Tuber size distribution of each cultivar during final harvesting.

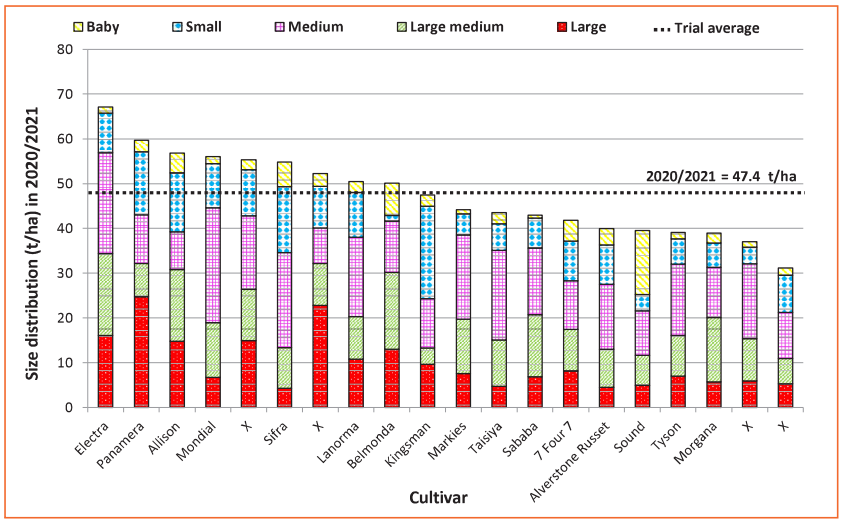


Figure 7: Grading of each cultivar during final harvesting.

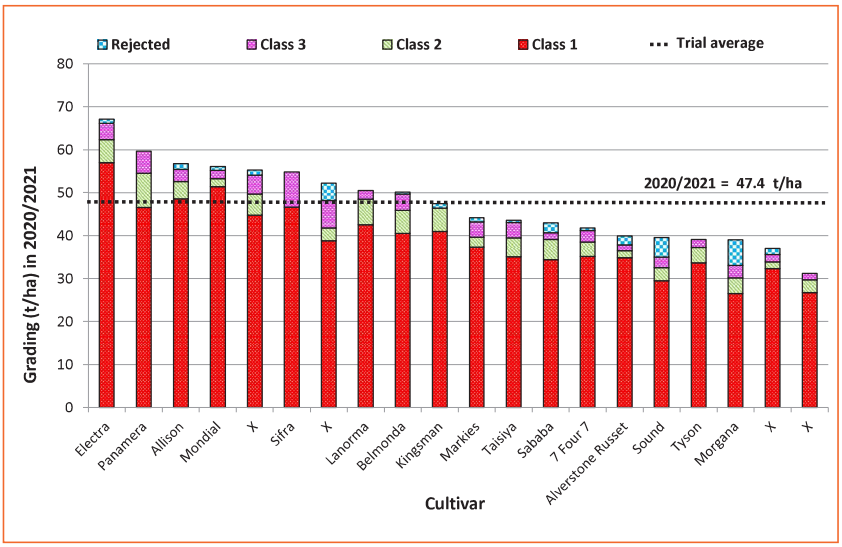


Figure 8: Flesh colour and internal quality of yields during 2020/2021 at Greytown.

The difference between the potential and actual trial yield refers to the yield gap. It illustrates the extent to which producers optimally utilise their environment and available resources to attain high yields. The ratio between the actual and potential yield rate reached 65% for this trial.

Cultivar performance not yet known

As the cultivar trial was carried out in Greytown for the first time, no feedback could be given on the performance of the cultivars over the past three years as yet.

It is furthermore important to focus on the internal quality of the product to ensure an optimal economically marketable yield and thus profitability.

This includes important factors such as processing characteristics, specific gravity (SG) and internal defects (hollow heart, brown spot and vascular bundle discolouration), as summarised in *Table 4*. During the 2020/2021 growing season, all the cultivars except Alverstone Russet, Lanorma, Markies, Morgana, Sababa and Tyson complied with the chip colour standard of > 50.

As far as SG is concerned, the cultivars Allison, Belmonda, Kingsman, Lanorma, Markies, Sababa, Sifra, Sound and Tyson achieved the norm of ≥ 1.075 for processing. In the case of internal defects, the cultivar Lanorma presented brown spot. *Figure 8* illustrates a virtual display of each cultivar's characteristics.

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