

Mondstuk van die Suid-Afrikaanse aartappelbedryf • Mouthpiece of the South African potato industry

CHIPS

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**ROL VAN BESPROEINGSBESTUUR EN
STELSELDOELTREFFENDHEID IN DIE
OPTIMALISERING VAN AARTAPPELPRODUKSIE**

**DNA-BASED IDENTIFICATIONS:
LATEST TRENDS AND WHAT THEY REVEAL
ABOUT FUNGI ASSOCIATED WITH PED**

**Moerkweker van die jaar
finaliste bekendgestel**

**Role of cover crops
in nematode control**

**KwaZulu-Natal cultivar trial
conducted at Cedara**

KwaZulu-Natal cultivar trial conducted at Cedara in 2021/2022

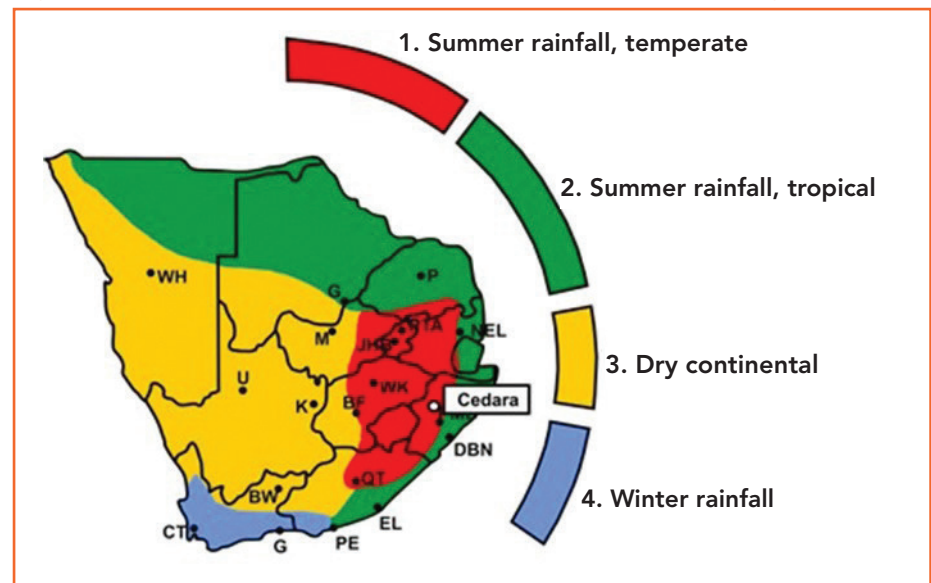
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The Cedara Research Station (S29° 32' 15 33, E30° 16' 09 19) is situated in the moist mist belt zone of the KwaZulu-Natal Midlands (900 to 1 400 m above sea level), which receives an average annual rainfall of between 838 and 1 140 mm, depending on locality (Figure 1).

The warm and wet summer conditions are ideal for the occurrence of early blight (*Alternaria solani*) (Sorauer) and late blight (*Phytophthora infestans*) (Mont de Bary) in potatoes (*Solanum tuberosum* L.). The severity of these diseases, especially late blight, can cause up to 100% crop loss if fungicides are not applied regularly.

As a result, seed and table producers will incur large financial losses while householders, who do not always have the resources to purchase fungicides, could become food insecure if their crop fails. Therefore, an irrigated trial was conducted to identify cultivars with good tolerance to late blight. As rural householders usually do not have access to water to irrigate

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



their potatoes, a dryland cultivar trial was also conducted.

Irrigated fungicide trial

Fourteen cultivars under irrigation were evaluated in a split-plot trial with three replications. The cultivar was

the main plot, with one half receiving fungicides weekly from ridging until 90% senescence, while no fungicides were applied to the other half.

Six fungicides, namely chlorothalonil, cymoxanil/famoxadone+mancozeb, cymoxanil/mancozeb, difenoconazole,

Table 1: Monthly rainfall and monthly average maximum and minimum temperatures.

Month	Rainfall		Maximum temperature		Minimum temperature	
	2021/22	Long-term average	2021/22	Long-term average	2021/22	Long-term average
	(mm)		(°C)		(°C)	
September	72	50	24.2	22.3	9.8	8.8
October	55	84	23.1	22.5	10.2	10.7
November	76	112	24.2	23.4	13	12.5
December	210	127	25.5	24.8	14.7	14
January	242	125	27.8	25.2	16.5	15
Total/average	655	498	25	23.6	12.8	12.2

mancozeb and mancozeb/metalaxyl-M, were applied in rotation. In total, 13 sprays were done. Insecticides were applied regularly to the entire trial.

The trial was planted on 14 September 2021 at a seeding rate of 37 037 tubers/ha. Each split-plot consisted of four rows of 5 m in length and spaced 0.9 m apart. Data was collected from the two middle rows.

Fertiliser was applied according to Fertrec recommendations for a 70 t/ha yield based on the results of soil analysis. In total, 80 kg/ha phosphorous (P), 240 kg/ha potassium (K) and 240 kg/ha nitrogen (N) were applied. Thirteen ratings of disease severity were done from 15 November 2021 to 31 January 2022.

Harvesting occurred from 5 January to 9 February, two to three weeks after the senescence of each plot. There was well above-average rainfall during December and January (Table 1). From planting until 31 January 2022, 600 mm of rainfall was reported. The trial received 95 mm of irrigation water from planting until 2 November 2021. Thereafter, no irrigation water was necessary. The average monthly maximum and minimum temperatures were warmer than the long-term average.

At planting, the tubers of Foxy were plant-ready while the tubers of the other cultivars were considered fresh or slightly fresh (Table 2). The number of days from planting to 75% emergence ranged from 20 for Foxy and Tyson, to 30 for El Mundo.

Significantly lower plant populations were measured for Mondeo and Sababa, compared to the other cultivars. The number of haulms per plant ranged from 3.05 for Tyson, to 7.05 for Electra. Overall population density and the number of haulms per plant were not significantly correlated to yield.

Rapid infection of potato blight

The very wet and humid conditions experienced during this growing season were conducive to the development and rapid spread of both early and late blight, the latter of which was more dominant. At 62 days after planting (DAP), all the cultivars had some plants infected with late blight, irrespective of the fungicide treatments.

Figures 2 to 5 give an indication of how quickly the cultivars became infected over time. Late blight infection on Alverstone Russet and Tyson spread rapidly from 70 DAP when no fungicides were applied, and at 87 DAP the plants were dead (Figure 3). Among the longer-season cultivars, the disease severity on Mondial, Allison, Lanorma and Mondeo also increased rapidly at 70 DAP (Figure 5).

At 113 DAP, the plants of these cultivars were dead. The rates of infection increased almost similarly between the two fungicide treatments for Sababa, El Mundo, Electra, Connect and Panamera, indicating that these cultivars had better tolerance to late blight than the others.

Tyson had the shortest growing period, while Panamera had the longest (Figure 6). The application of fungicides extended the time from planting to 90% senescence by 19.66 days overall. Mondial and Alverstone Russet had the largest decreases in the growing period when no fungicides were applied (38.7 and 36.3 days, respectively), indicating poor tolerance to late blight. No significant

differences were measured for growing season length between the fungicide treatments for El Mundo, Electra and Connect.

Without fungicides, the reduced growing period resulted in decreases of 19.38 and 11.18% for the mass of Large and Large/Medium tubers, respectively (Figures 7 and 8). However, no significant differences were measured between the fungicide treatments for the percentage mass of Large tubers produced by Connect and Alverstone Russet (Figure 9). Without fungicides, Alverstone Russet produced no Large or Large/Medium tubers, while the mass of Large tubers produced by Allison, Mondial and Sifra was <2%.

Results of fungicide treatment

Fungicide treatment had no significant effect on the percentage mass of Large/Medium tubers produced by Panamera, Electra, Connect, Lanorma, Sababa and El Mundo. Overall, yield was significantly positively correlated to growing season length and the percentage mass of Large and Large/Medium tubers.

Table 2: Plant readiness of tubers, number of days after planting to 75% emergence, population density and haulm count.

Cultivar	Plant readiness ¹	75% emergence (DAP ²)	Population density (number/ha)	Haulm count (number/plant)
Allison	1	21	36 674 a	6.35 ab
Alverstone Russet	1.5	21	36 674 a	6.35 ab
Belmonda	2	22	36 674 a	3.67 ef
Connect	2	21	36 311 ab	3.90 e
El Mundo	1	30	35 403 b	5.30 cd
Electra	1	28	36 129 ab	7.05 a
Foxy	3	20	37 037 a	6.03 bc
Lanorma	2	22	36 492 ab	3.25 ef
Mondeo	1	27	31 590 d	5.17 d
Mondial	1	21	37 037 a	6.57 ab
Panamera	1	24	37 037 a	3.12 ef
Sababa	1	22	33 588 c	4.95 d
Sifra	1	25	36 674 a	3.57 ef
Tyson	2	20	36 492 ab	3.05 f
Average	1.5	23	35 987	4.88

¹ Plant readiness of seed potatoes: 1 – fresh, 2 – slightly fresh, 3 – plant-ready, 4 – slightly old, 5 – old. ² DAP: Days after planting.

Figure 2: Disease severity over time for the seven earlier maturing cultivars with fungicide applications.

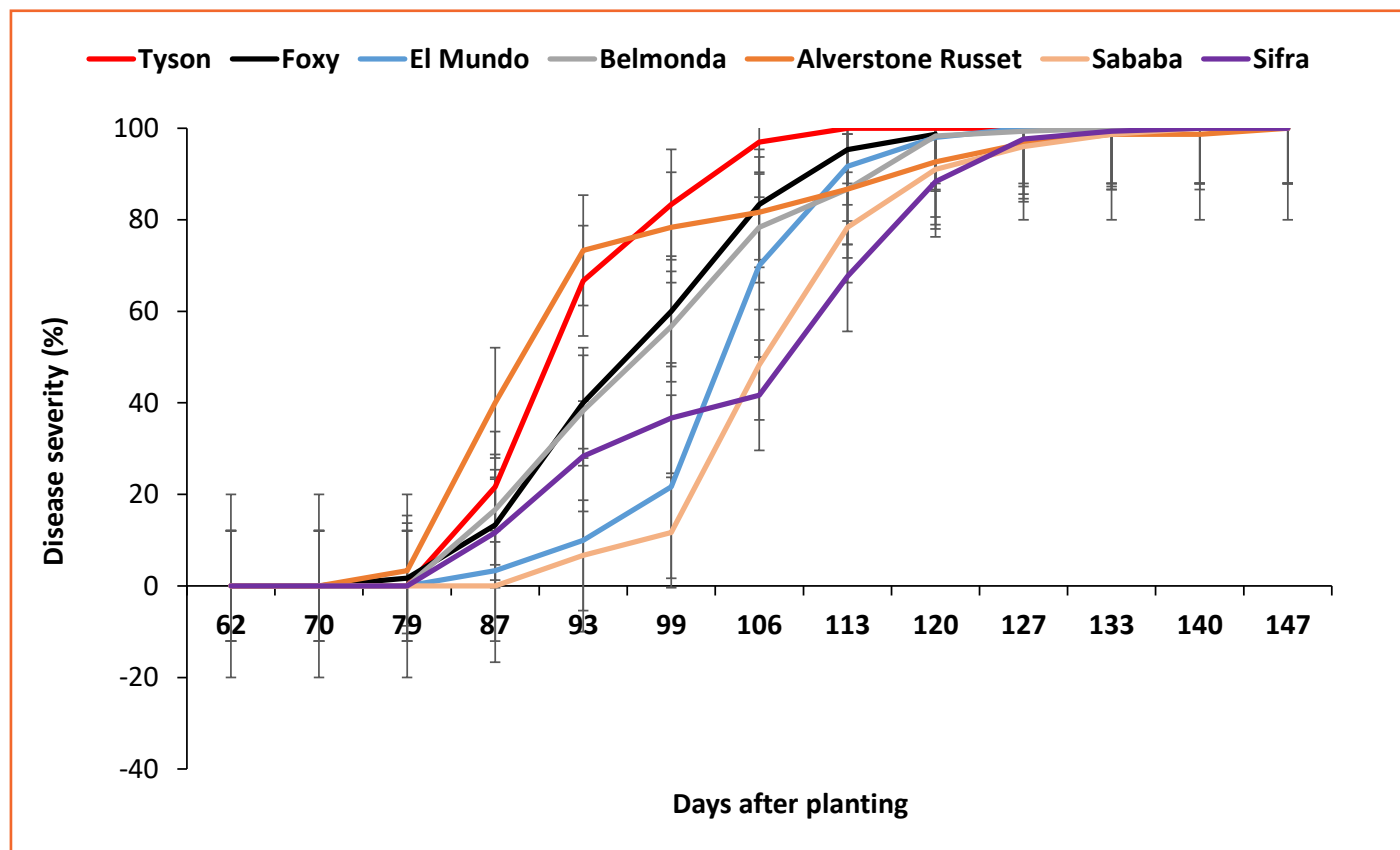


Figure 3: Disease severity over time for the seven earlier maturing cultivars without fungicide application.

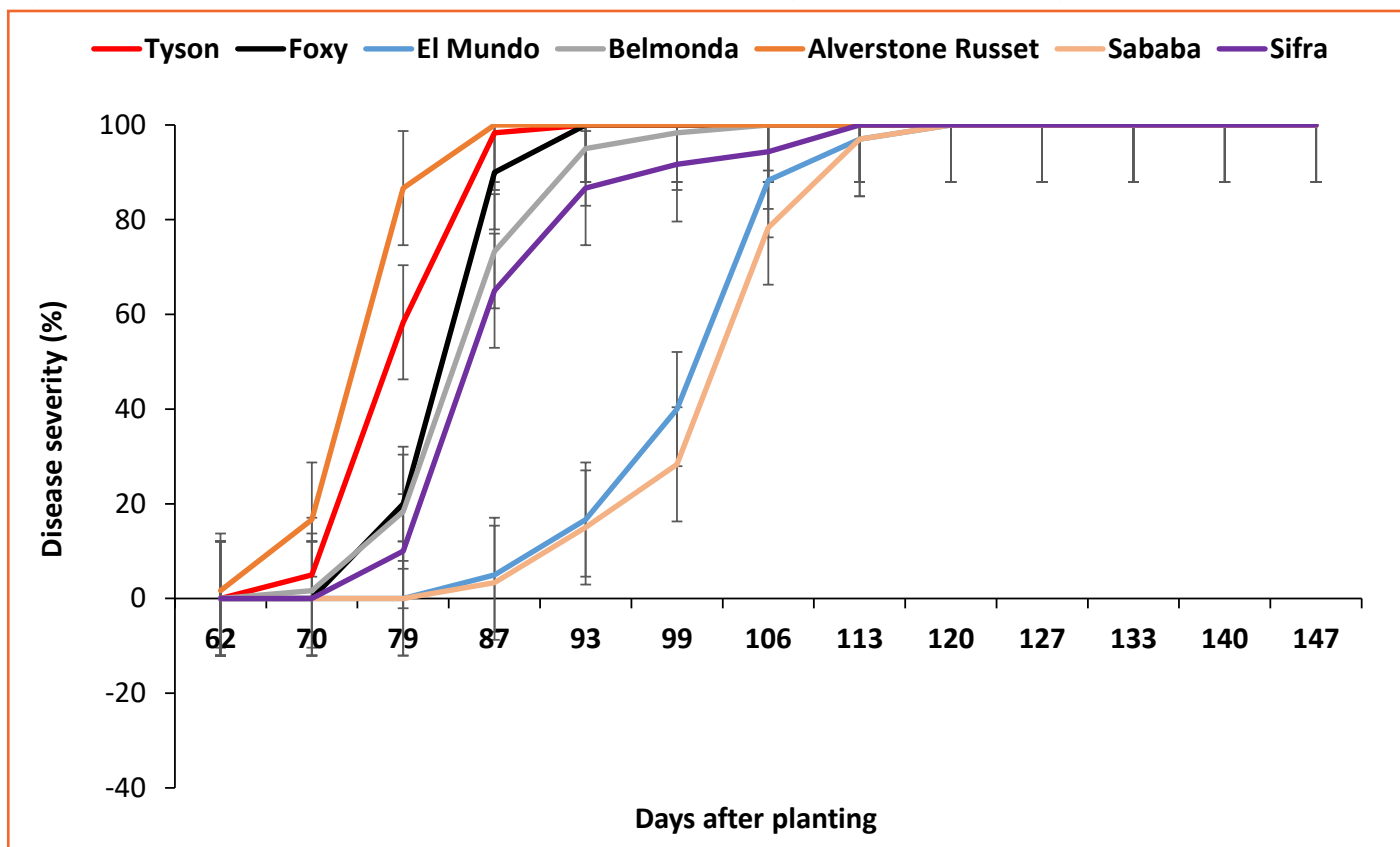


Figure 4: Disease severity over time for the seven later maturing cultivars with fungicide application.

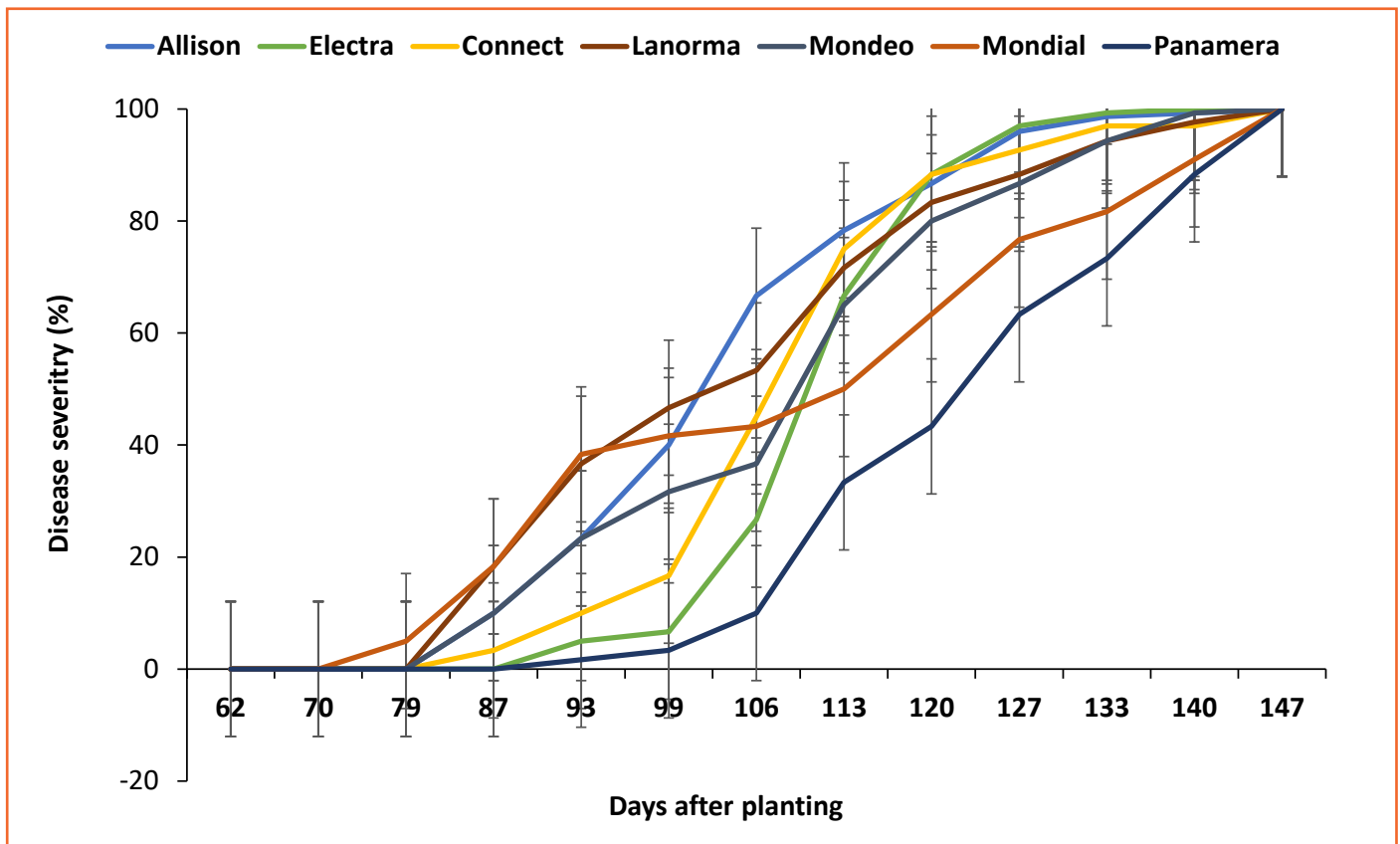


Figure 5: Disease severity over time for the seven later maturing cultivars without fungicide application.

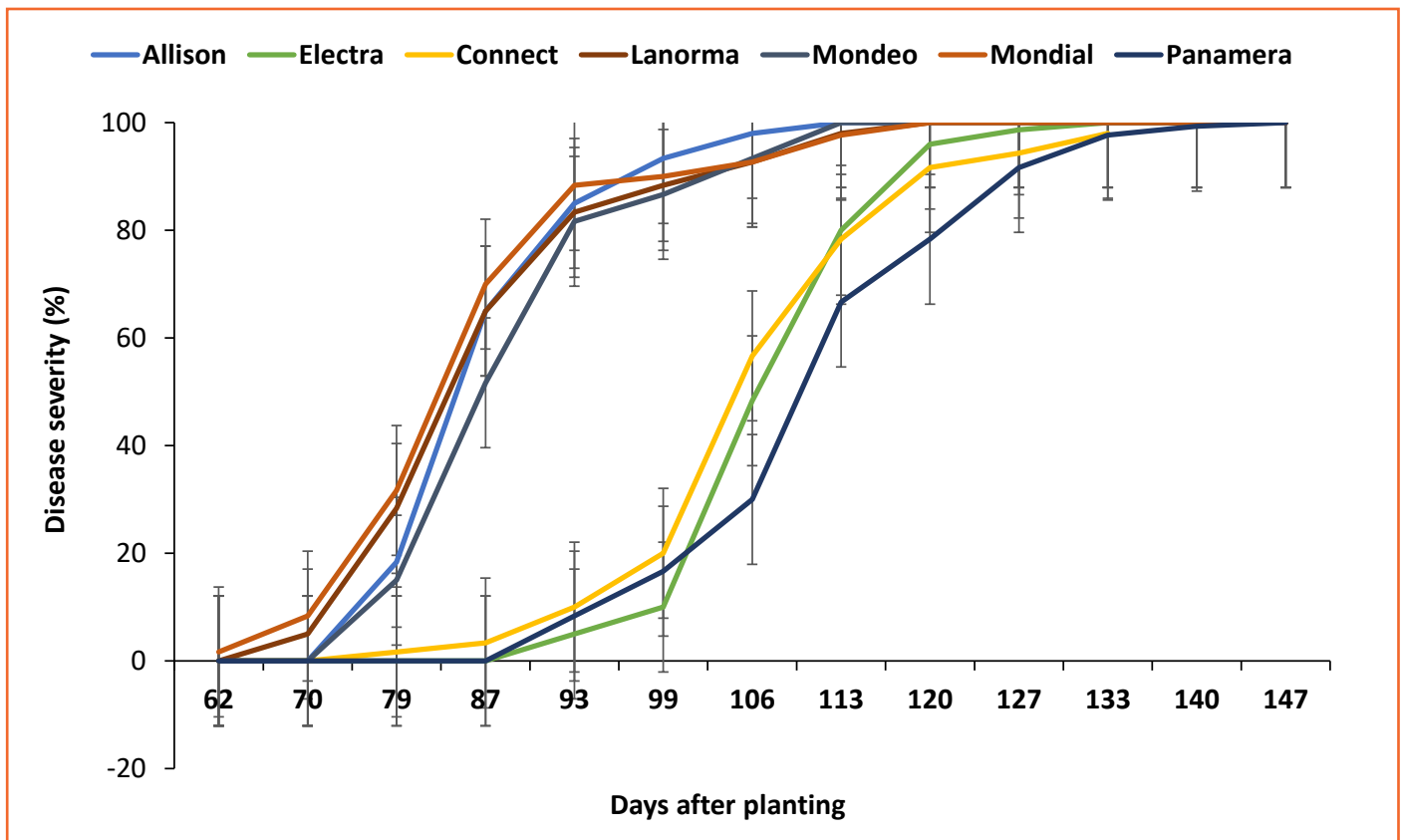


Figure 6: Number of DAP to 90% senescence for the 14 cultivars with and without fungicides.

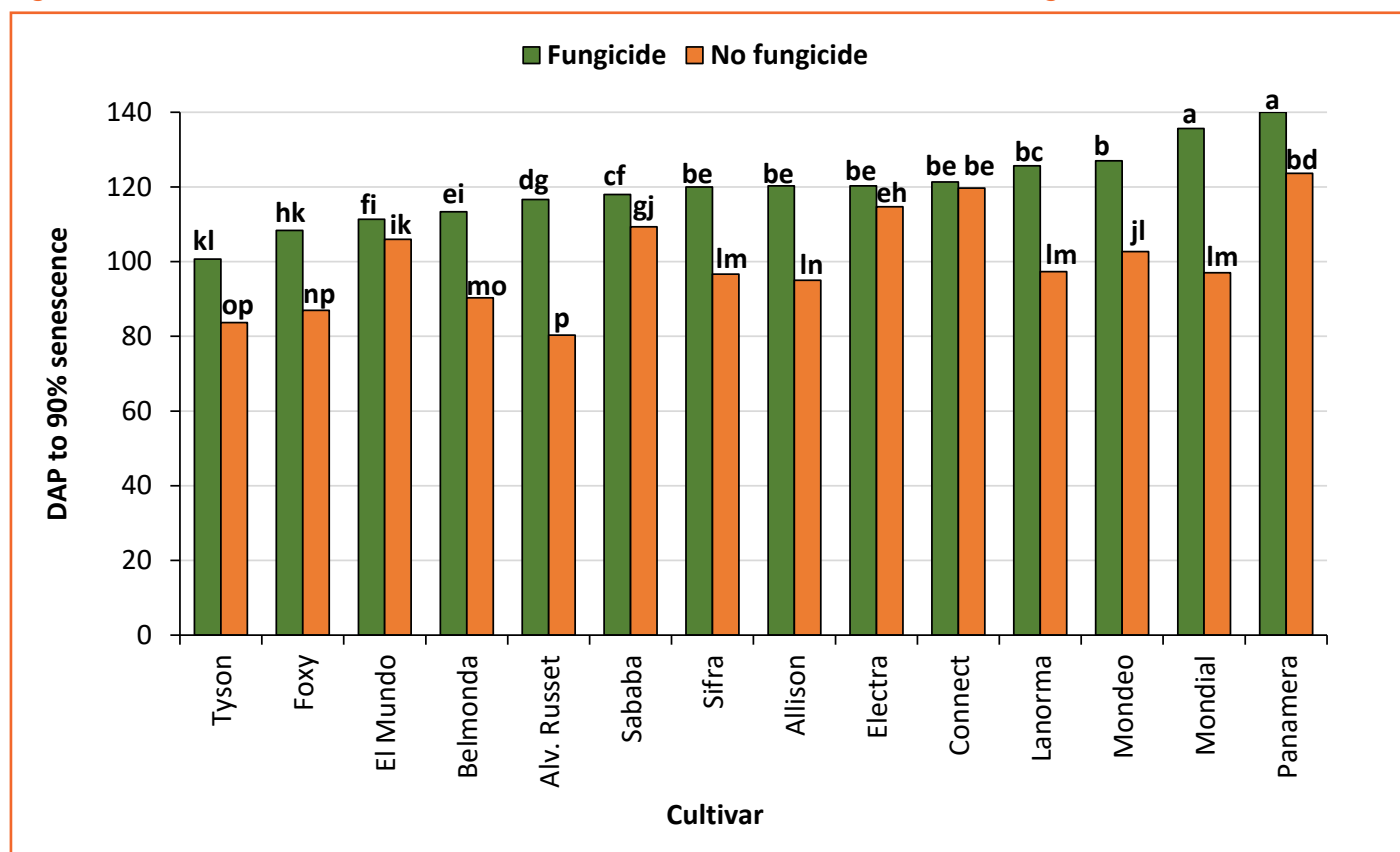


Figure 7: Percentage mass of the tubers at the five size grades combined for the 14 cultivars with fungicide applications.

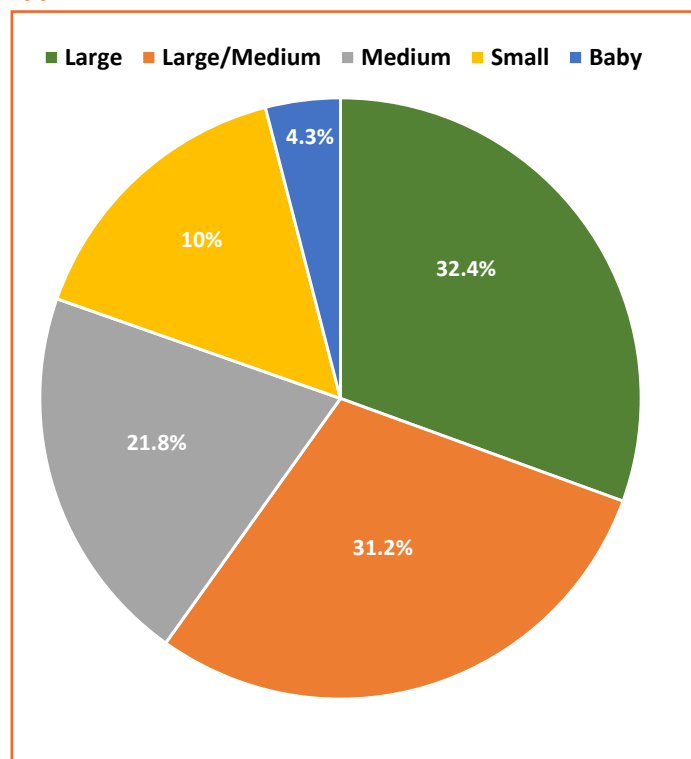


Figure 8: Percentage mass of the tubers at the five size grades combined for the 14 cultivars without fungicide applications.

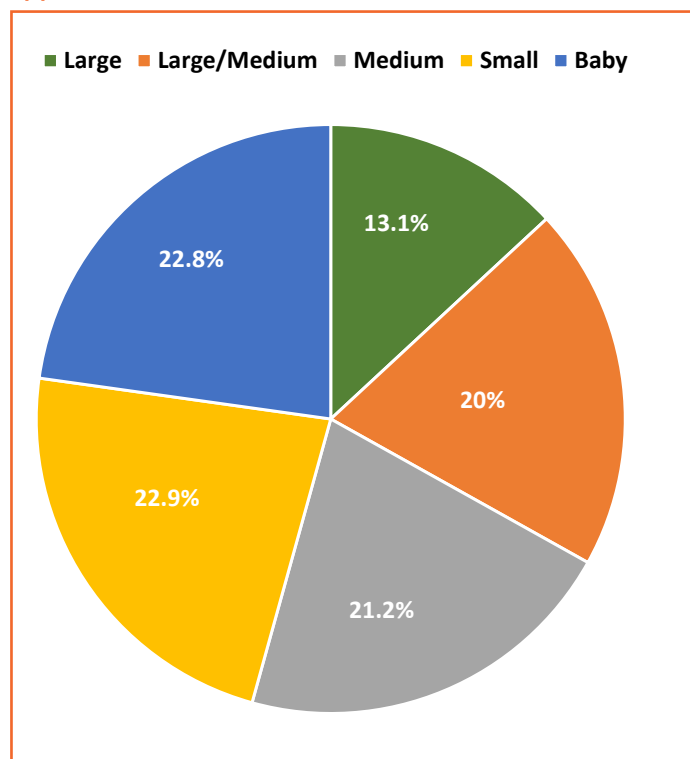
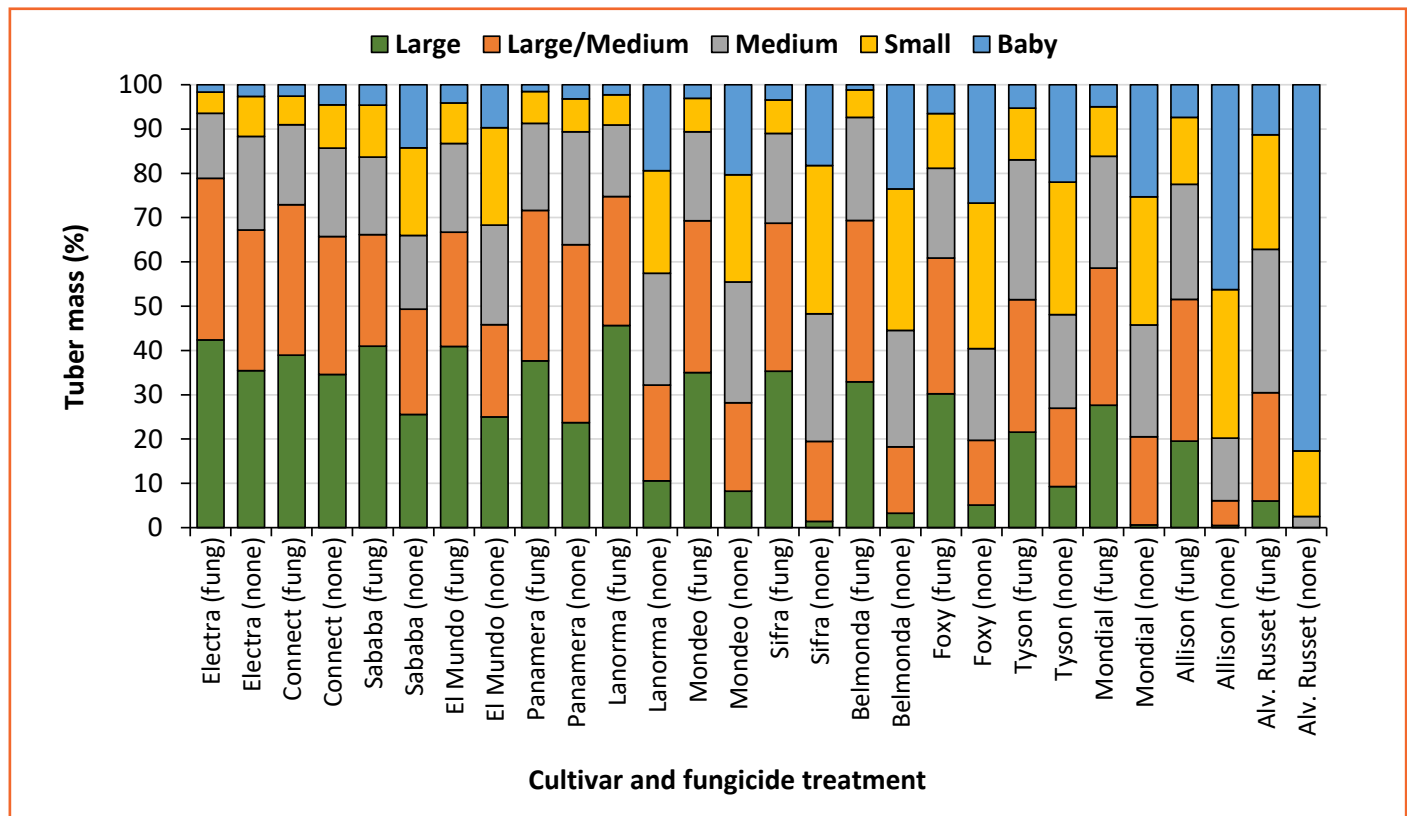


Figure 9: Percentage tuber mass at the five size grades for the 14 cultivars with and without fungicides.



*fung: with fungicide; none: without fungicide.

Figure 10: Yield of the 14 cultivars with and without fungicide applications.

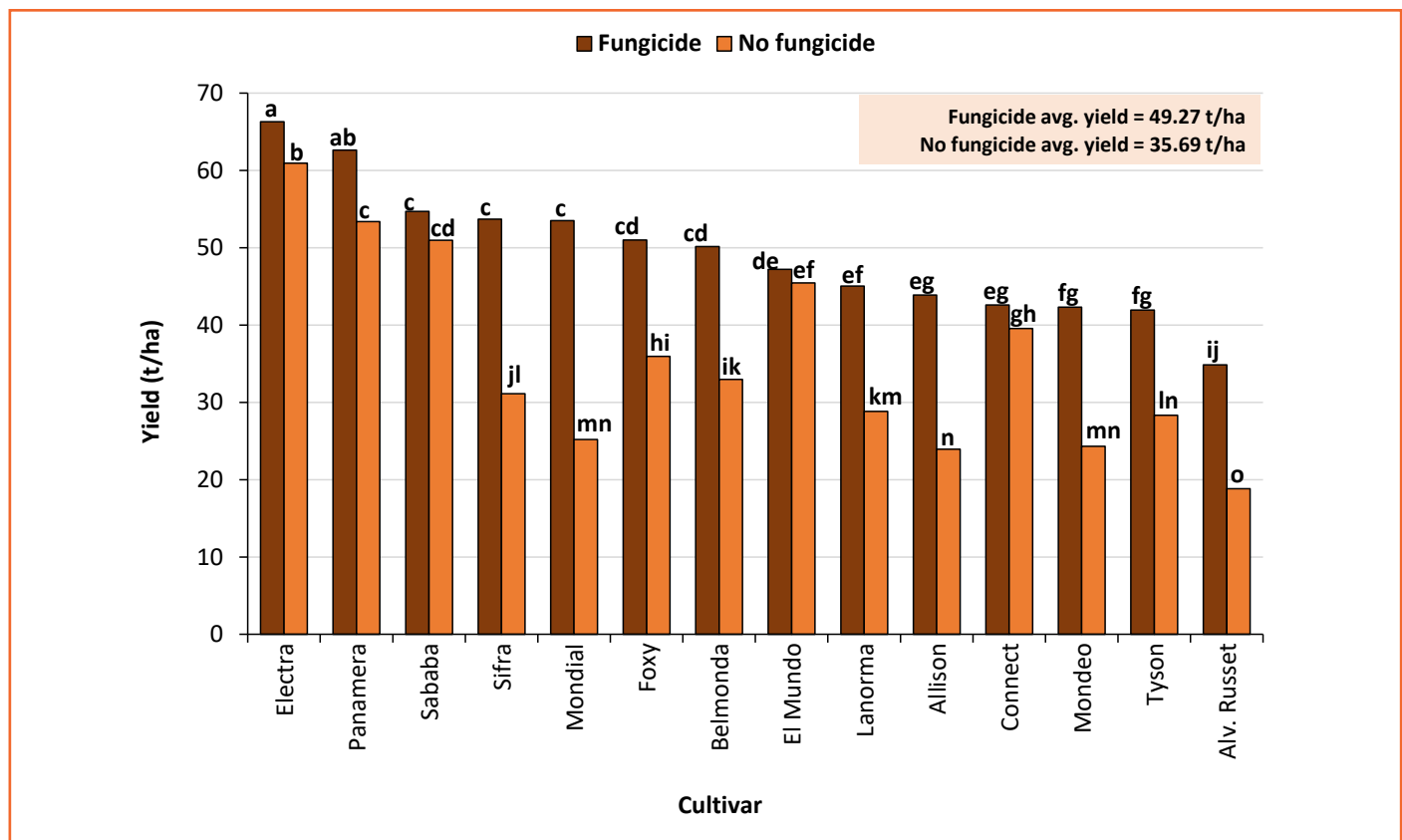


Table 3: Specific gravity of the 14 cultivars with the two treatments.

Cultivar	Fungicide	No fungicide	Average
Allison	1.0613 fh	1.0596 gj	1.0604
Alverstone Russet	1.0709 a	1.0703 ab	1.0706
Belmonda	1.0684 ac	1.0713 a	1.0699
Connect	1.0608 fi	1.0632 eg	1.0620
El Mundo	1.0553 k	1.0574 ik	1.0563
Electra	1.0577 hk	1.0570 ik	1.0573
Foxy	1.0564 jk	1.0509 l	1.0536
Lanorma	1.0585 hk	1.0596 hk	1.0585
Mondeo	1.0684 ac	1.0655 ce	1.0669
Mondial	1.0599 gj	1.0550 k	1.0575
Panamera	1.0657 ce	1.0600 gj	1.0628
Sababa	1.0641 df	1.0668 be	1.0654
Sifra	1.0643 df	1.0580 hk	1.0612
Tyson	1.0678 ad	1.0587 hk	1.0633
Average	1.0628	1.0609	1.0618

Electra and Alverstone Russet produced the highest and lowest yields, respectively, both with fungicide treatments (*Figure 10*). Overall, yield increased by 13.58 t/ha when

fungicides were applied. However, no significant differences in yield were measured between the fungicide treatments for Sababa, El Mundo and Connect.

Table 4: Number of DAP to 75% emergence, plant density, number of haulms per plant and SG of the 14 cultivars under dryland conditions.

Cultivar	75% emergence (DAP)	Plant population (number/ha)	Haulms (number/plant)	SG (number)
Allison	23	36 674 a	5.10 c	1.065 cd
Alverstone Russet	22	37 037 a	5.60 bc	1.074 a
Belmonda	24	37 037 a	3.40 d	1.071 b
Connect	25	37 037 a	3.07 d	1.067 c
El Mundo	28	37 037 a	7.23 a	1.058 e
Electra	29	35 948 a	6.83 ab	1.059 e
Foxy	23	36 674 a	6.93 ab	1.057 e
Lanorma	24	36 674 a	3.50 d	1.060 e
Mondeo	48	30 864 b	5.43 bc	1.072 ab
Mondial	22	37 037 a	6.20 ac	1.060 e
Panamera	28	36 674 a	3.20 d	1.064 d
Sababa	29	31 954 b	6.77 ab	1.065 cd
Sifra	28	37 037 a	3.47 d	1.064 d
Tyson	21	36 311 a	2.83 d	1.064 d
Average	27	36 013	4.97	1.064

The largest differences in yield between the fungicide treatments were recorded for Mondial (28.33 t/ha), Sifra (22.60 t/ha) and Allison (19.96 t/ha). The yields of Connect would have been higher, had blackleg not infected some of the plants. A significant interaction was measured for specific gravity (SG) between the cultivars and fungicide treatments (*Table 3*). Foxy, Mondial, Panamera, Sifra and Tyson had significantly lower SGs when fungicides were not applied, which resulted in a significantly lower average value for that treatment.

It is important to consider whether the application of fungicides is economically beneficial. The results indicated that yield increased by 13.58 t/ha with fungicide applications. At R42.14/10 kg pocket at the Durban Market (21 July 2022), this equates to an additional income of R57 226/ha.

As the cost of fungicides can range from R5 000 to R15 000/ha, it is clearly beneficial to apply fungicides. Based on prices obtained on 6 June 2022, the cost of the fungicides applied to the Cedara trial was R10 350/ha including VAT. Using this cost and the market price of R4 214/ton, an increase in yield of 2.46 t/ha was necessary to cover the cost of the fungicides.

Yield increases

All the cultivars except El Mundo had yield increases of >3 t/ha, therefore the application of fungicides was economically beneficial. However, if the cost of the fungicides had been R15 000/ha, then an increase in yield of 3.56 t/ha was required to cover the fungicide costs. Except for El Mundo and Connect, all the other cultivars had yield increases >3.65 t/ha.

In conclusion, the application of fungicides extended the growing period by 19.7 days overall, which resulted in an increase of 30.56% for the combined percentage mass of Large and Large/Medium tubers. Consequently, yield increased by 13.6 t/ha.

Based on the results obtained from this growing season and ignoring consumer preferences, Electra is recommended for growing in the KwaZulu-Natal Midlands because of its high yield and good tolerance to

Figure 11: Disease severity over time for the 14 cultivars in the dryland trial.

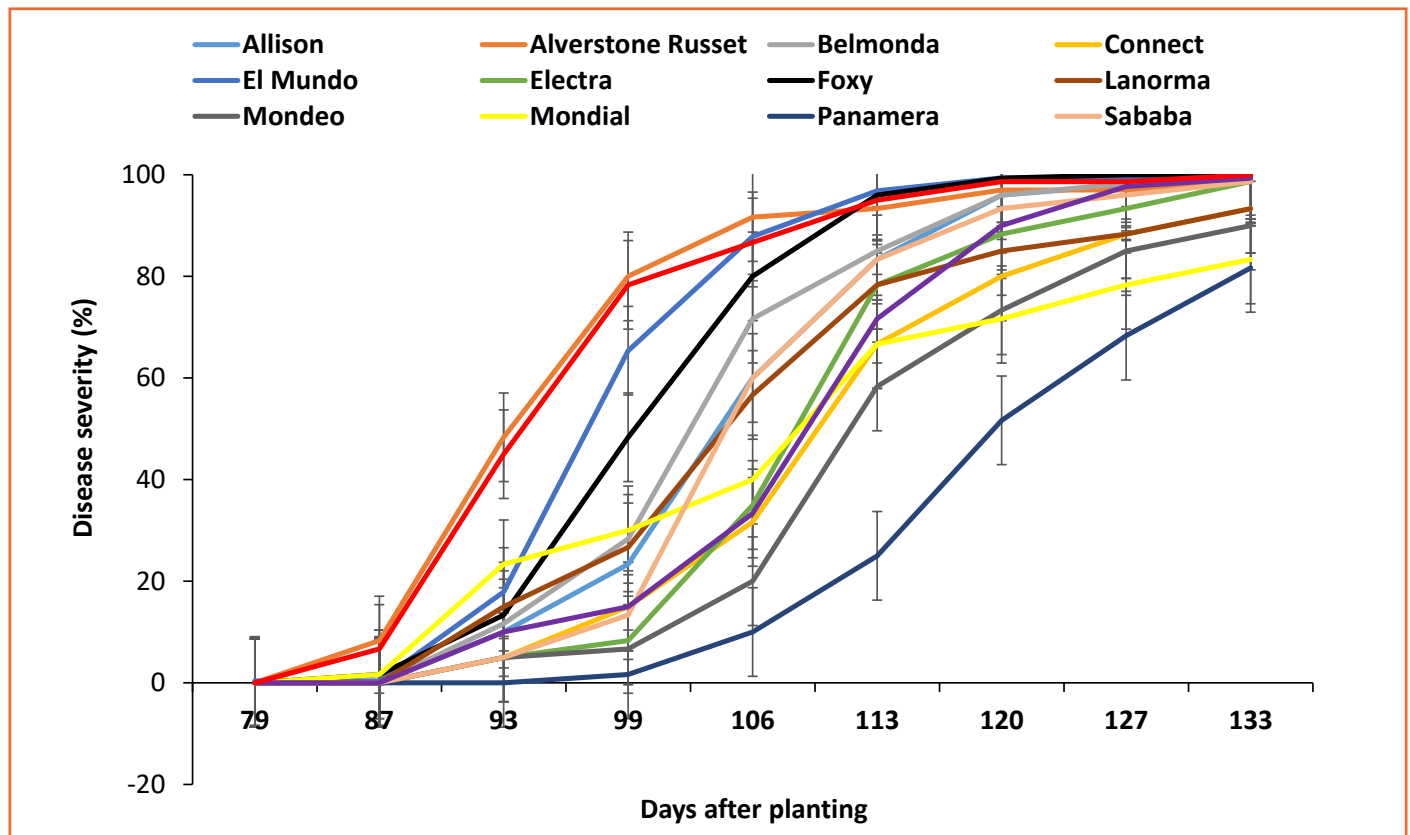


Figure 12: Number of days to 90% senescence of the 14 cultivars in the dryland trial.

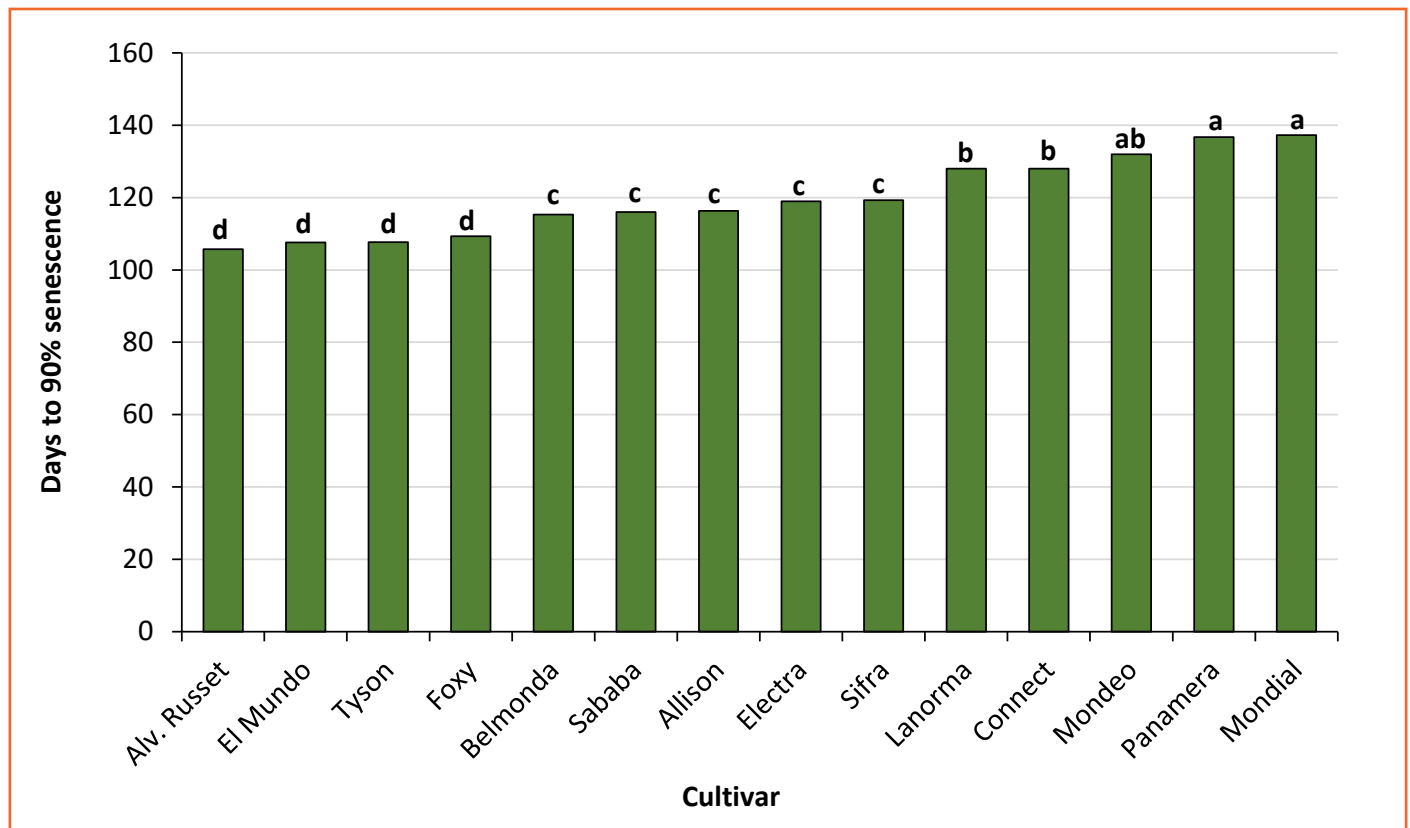


Figure 13: Tuber mass at the five sizes for the 14 cultivars in the dryland trial.

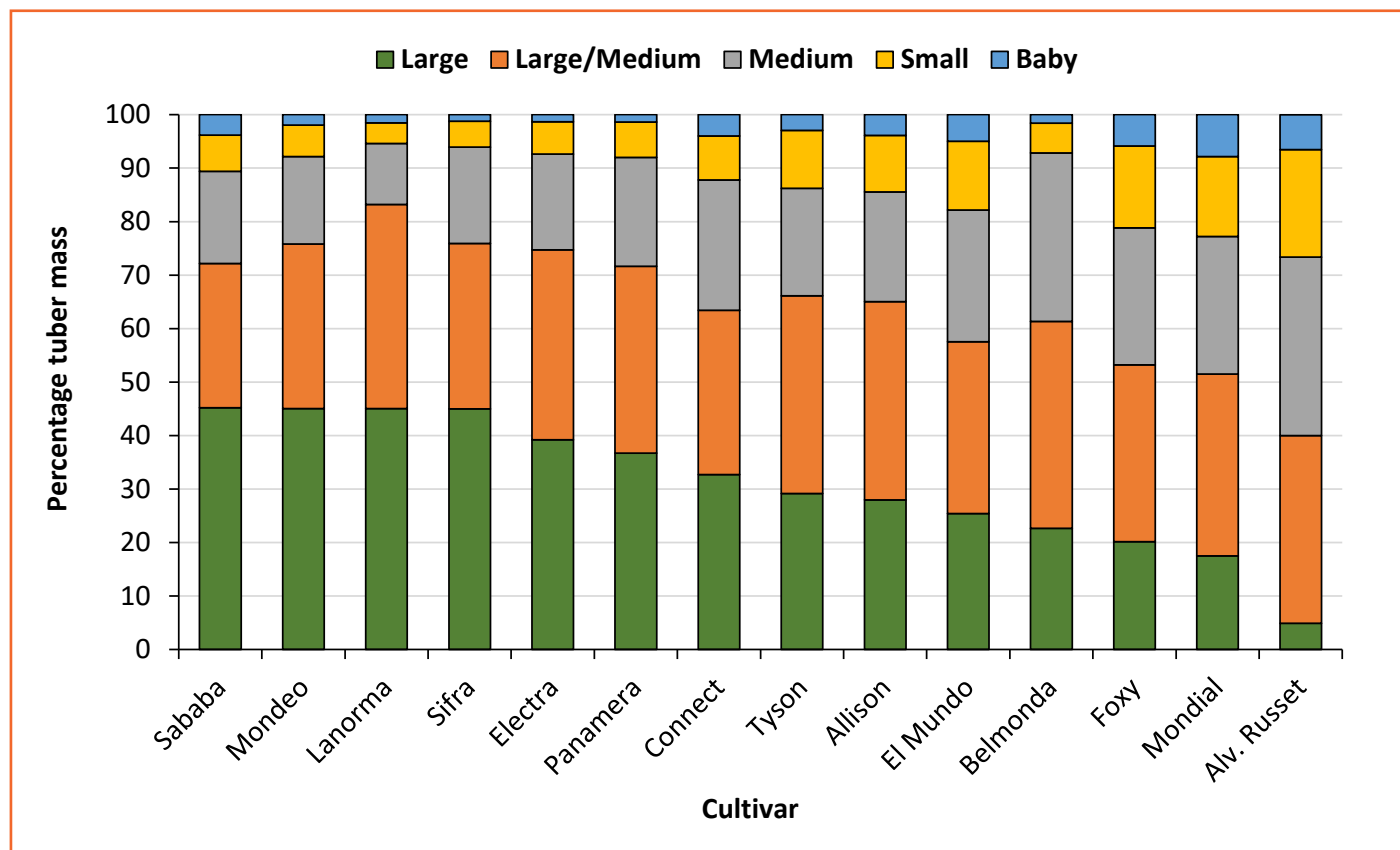
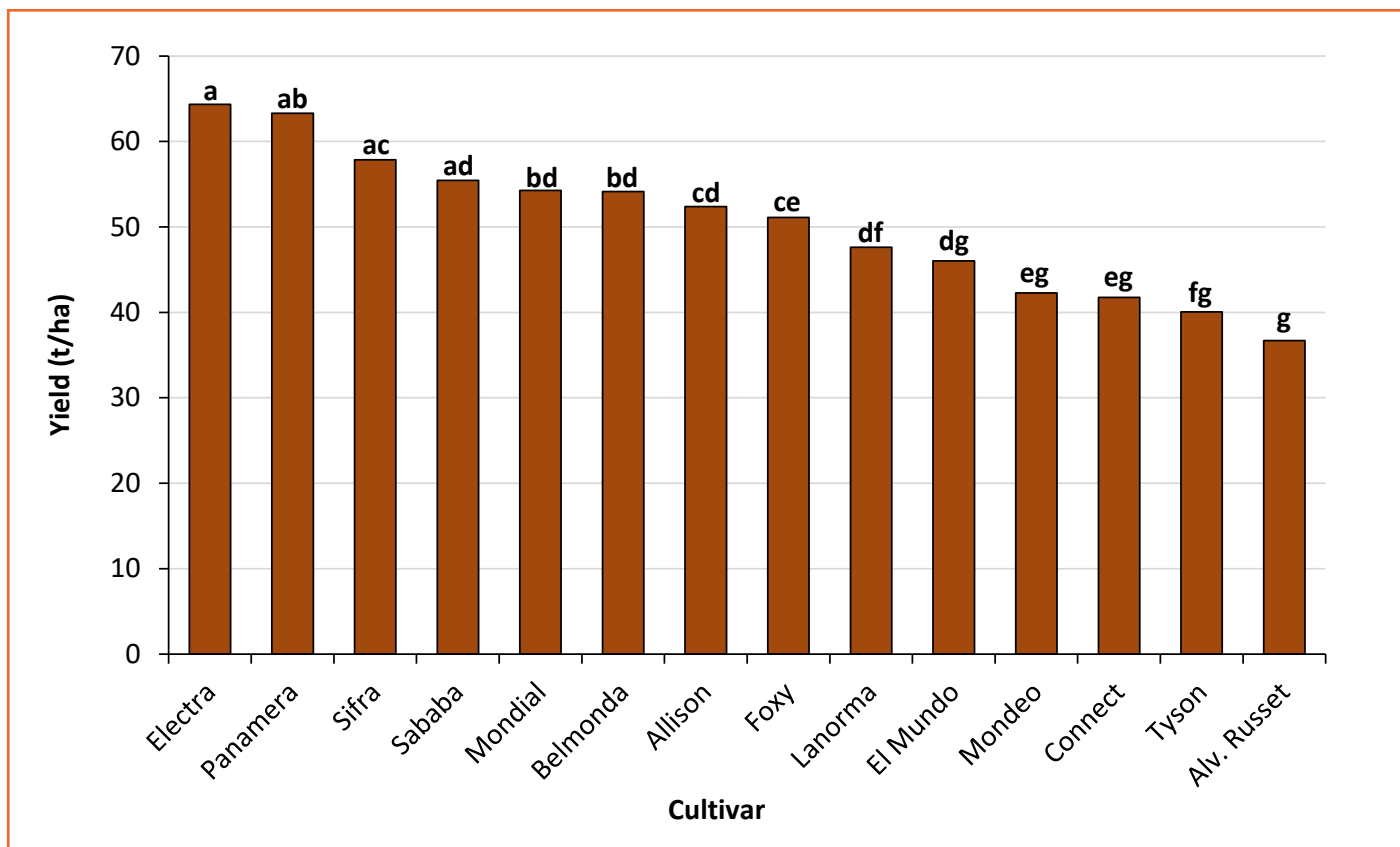


Figure 14: Yield of the 14 cultivars in the dryland trial.



late blight. However, Panamera is also recommended for producers who apply fungicides regularly.

Dryland cultivar trial

The dryland cultivar trial was planted on the same day as the irrigated fungicide trial (14 September 2021) and was situated 20 m away. The same fungicides and insecticides used in the irrigated fungicide trial were applied to the whole of the dryland trial and on the same day.

Overall, 75% emergence of the plants occurred four days later compared to the irrigated trial due to the soil being drier after planting, and because Mondeo took 48 days to reach 75% emergence (Table 4). The plant density of Mondeo and Sababa was significantly lower than the other cultivars. The number of haulms per plant ranged from 2.83 for Tyson to 7.23 for El Mundo. Overall, plant density and the number of haulms per plant were not significantly correlated to yield.

The average number of DAP to 90% senescence was the same for both trials (120 days) (Figure 12). However, as no irrigation water was applied to the dryland trial, the conditions were not as conducive for the development and spread of late blight. As a result, the disease severity ratings were initially lower, e.g., at 93 DAP; Alverstone Russet had 48% severity in the dryland trial (Figure 11) versus 73% in the irrigated trial (Figure 12), while Mondial had 23.3 and 38%, respectively.

Significant differences in percentage tuber mass were measured between the cultivars with all the size grades except Large/Medium (Figure 13). As with the irrigated trial, Alverstone Russet produced a significantly low percentage mass of large tubers. Due to the abundant rainfall from tuber initiation, the average mass percentages for each size grade were very similar to those of the irrigated trial (fungicides applied).

The average yield (50.52 t/ha) produced in the dryland trial (Figure 14) was almost similar to the average yield (49.27 t/ha) of the irrigated trial (fungicides applied). The yields of the individual cultivars were also similar, except for Allison, which had a much higher yield in the dryland trial (52.37 t/ha versus 43.89 t/ha).

As no significant differences in yield were measured between Electra, Panamera, Sifra and Sababa, these cultivars can be recommended for planting in the KwaZulu-Natal Midlands under dryland conditions. However, as there was abundant rainfall during this growing season, the reliability of these cultivars to perform well under drier growing conditions needs further investigation. 📍

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