



# Assessing the drought tolerance of selected grapevine scion cultivars grown under dryland conditions in the Swartland region of South Africa



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## Introduction

- Grapevines depend on adequate water for sustainable yield and quality.
- According to climate change forecasts, rainfall in the Western Cape could become lower.
- In drier regions such as the Swartland, many vineyards are grown under dryland conditions or with limited volumes of irrigation water.
- During droughts, vineyards produce low yields with the possibility of poor wine quality.
- Drought tolerance refers to the degree to which a plant is adapted to arid or drought conditions. Therefore, risk of yield losses for dryland, as well as irrigated vineyards could be reduced if drought tolerant scion cultivars are planted more extensively.



## Introduction...

- Drought tolerant scion cultivars could ensure more sustainable viticulture in the dryland and irrigated regions of the Western Cape, or if climate changes result in reduced rainfall.
- However, there is presently no scientifically based information on the growth, yield and quality aspects for alternative scion cultivars under South African conditions.
- Consequently, the project was carried out to generate the knowledge to make recommendations on scientifically verified results.
- The project aimed to assess grapevine responses in an almost worst case scenario, *i.e.* under dryland conditions in a sandy loam soil in the Swartland region.



# Materials & methods



## Cultivar selection

- A survey was carried out among viticulturalists and they identified possible drought tolerant scion cultivars that could hold promise for the South African wine industry.
- Nine red and eight white grape cultivars were planted in a field trial on Fairview Farm near Malmesbury in July 2018 and the cultivars were evaluated for a number of seasons. All cultivars were grafted onto 99 Richter.

Red	Arinarnoa	An	1B
	Durif	Df	1A
	Grenache noir	Gn	513
	Malbec	Mc	71B
	Marselan	Mz	980
	<u>Pinotage (reference)</u>	Pi	45K
	<u>Shiraz (reference)</u>	Sz	1C
	Tempranillo	Tp	776
	Touriga nacional	Tn	1A
White	Assyrtiko	Da	12566 2K
	<u>Chardonnay (reference)</u>	Cy	277E
	<u>Chenin blanc (reference)</u>	Sn	220B
	Macabeo	Mx	1025
	Marsanne	Mv	574
	Piquepoul blanc	Ph	463
	Verdelho	Vh	1B
	Vermantino	We	856





## Measurements

- Soil water content (SWC)
- Leaf ( $\Psi_L$ ) and stem water ( $\Psi_S$ ) potential
- Grapevine yield responses (2021-2024)
- Cane mass at pruning (2019-2024)
- Experimental wines were evaluated by a tasting panel
- A performance index was calculated

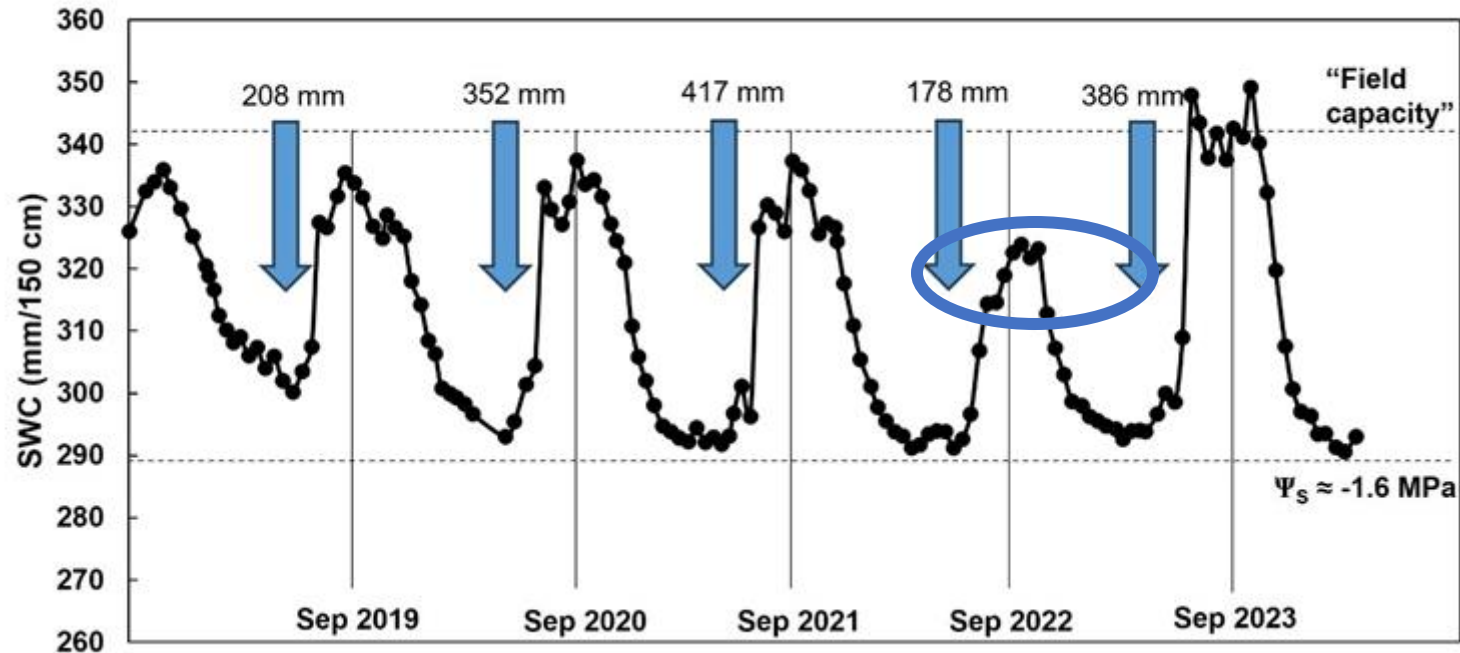


# Results



## Soil water content

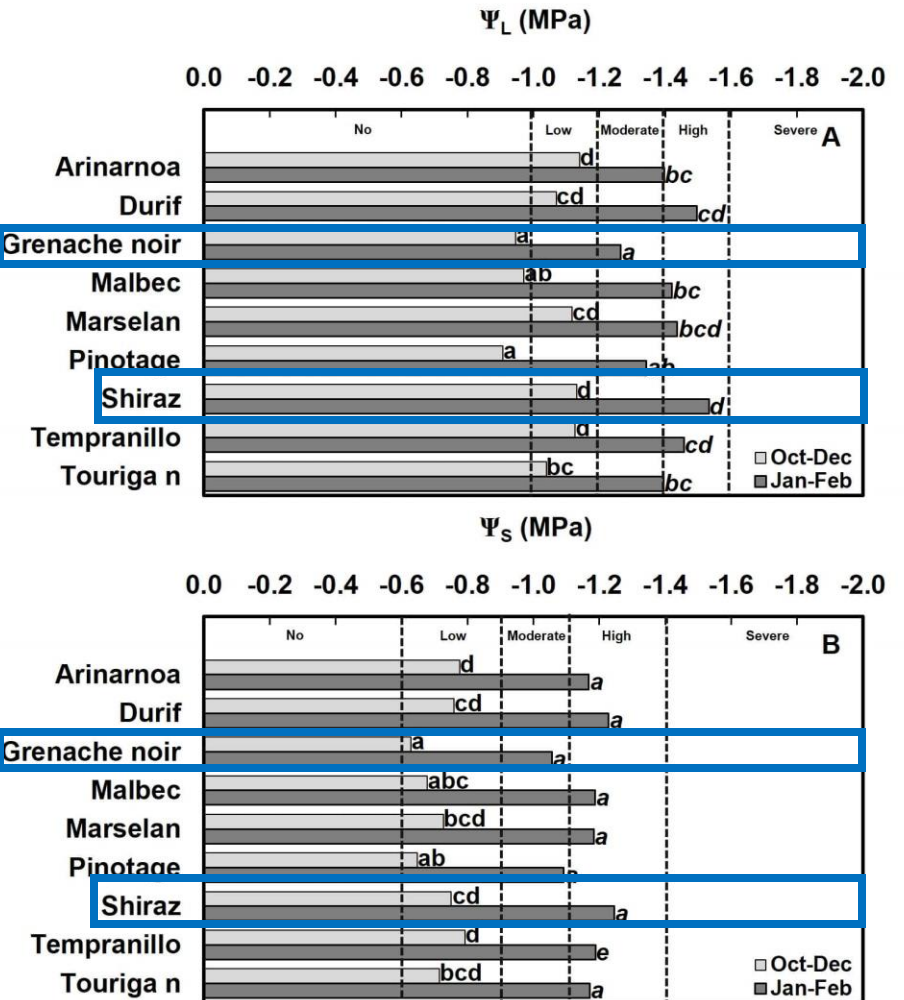
- There was variation in the SWC of the different seasons with the 2022/23 season being the driest one.



Variation in SWC on the grapevine rows as determined for the duration of the project. Horizontal lines respectively indicate field capacity and the SWC that corresponds to a midday stem water potential ( $\Psi_s$ ) of -1.6 MPa. The vertical lines indicate the beginning of September for every year.

## Leaf and stem water potential of the red cultivars

- Midday  $\Psi_L$  measurements taken in the pre-veraison period fell into the no to low water constraints class with Grenache and Pinotage having lower constraints than the other cultivars.
- Midday  $\Psi_L$  was substantially lower for all of the red cultivars in the post-veraison period, and the midday  $\Psi_L$  fell mainly in the moderate to high water constraints classes.
- Grenache had higher midday  $\Psi_L$  and  $\Psi_S$  compared to Shiraz.



Mean pre-December and post-December midday (A)  $\Psi_L$  and (B)  $\Psi_S$  in red wine grape cultivars grown under dryland conditions near Malmesbury over the course of the study. Bars designated by the same letter for each time period do not differ significantly ( $p \leq 0.05$ ).

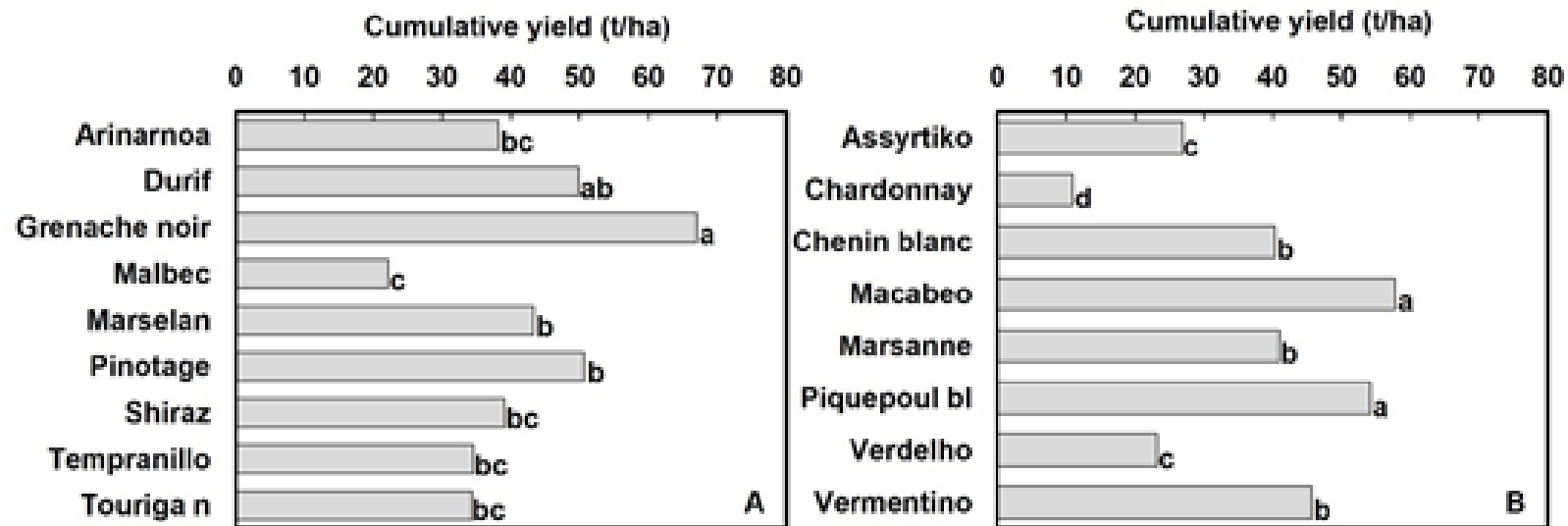
## Time of ripening

- Harvest started at the end of January and continued until March.

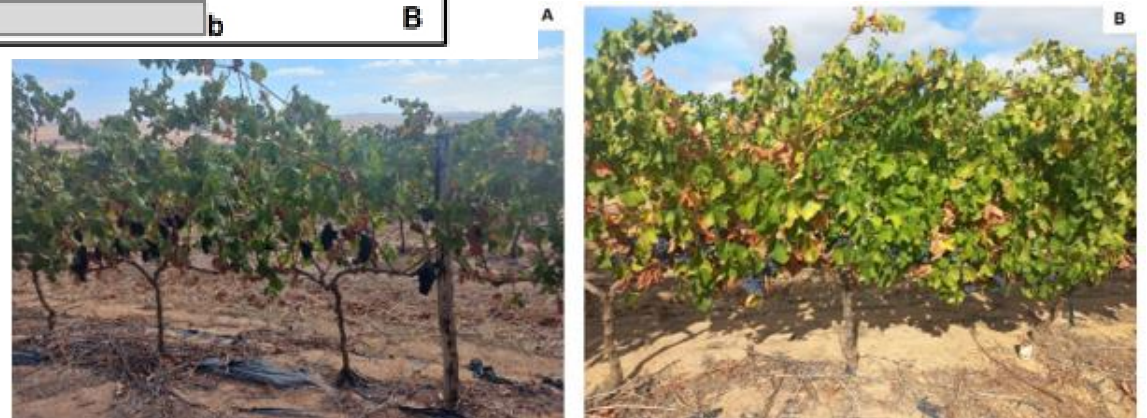
Group	Cultivar	Harvest date				Anticipated harvest period
		2020/21	2021/22	2022/23	2023/24	
Red	Arinarnoa	25 Feb.	23 Feb.	24 Feb.	20 Feb.	Late Feb.
	Durif	25 Feb.	1 March	14 Feb.	13 Feb.	Late Feb.
	Grenache noir	17 Feb.	8 March	28 Feb.	13 Feb.	Mid Feb. to March
	Malbec	5 March	16 Feb.	14 Feb.	13 Feb.	Mid Feb. to March
	Marselan	17 Feb.	3 March	7 March	20 Feb.	Mid Feb. to March
	Pinotage	08 Feb.	10 Feb.	10 Feb.	13 Feb.	Early Feb.
	Shiraz	17 Feb.	1 March	6 Feb.	13 Feb.	Mid Feb. to March
	Tempranillo	17 Feb.	10 March	24 Feb.	13 Feb.	Mid Feb. to March
	Touriga nacional	5 March	10 March	7 March	2 Feb.	Early March
White	Assvrtiko	8 Feb.	10 Feb.	10 Feb.	2 Feb.	Early Feb.
	Chardonnay	5 Feb.	28 Jan.	3 Feb.	25 Jan.	Late Jan. to early Feb.
	Chenin blanc	8 Feb.	16 Feb.	14 Feb.	2 Feb.	Early to mid Feb.
	Macabeo	3 March	23 Feb.	22 Feb.	13 Feb.	Late Feb. to early March
	Marsanne	10 Feb.	16 Feb.	1 Feb.	2 Feb.	Early to mid Feb.
	Piquepoul blanc	3 March	1 March	22 Feb.	13 Feb.	Late Feb. to early March
	Verdelho	5 Feb.	28 Jan.	30 Jan.	25 Jan.	Late Jan. to early Feb.
	Vermentino	8 Feb.	16 Feb.	14 Feb.	13 Feb.	Early to mid Feb.

## Yield and its parameters

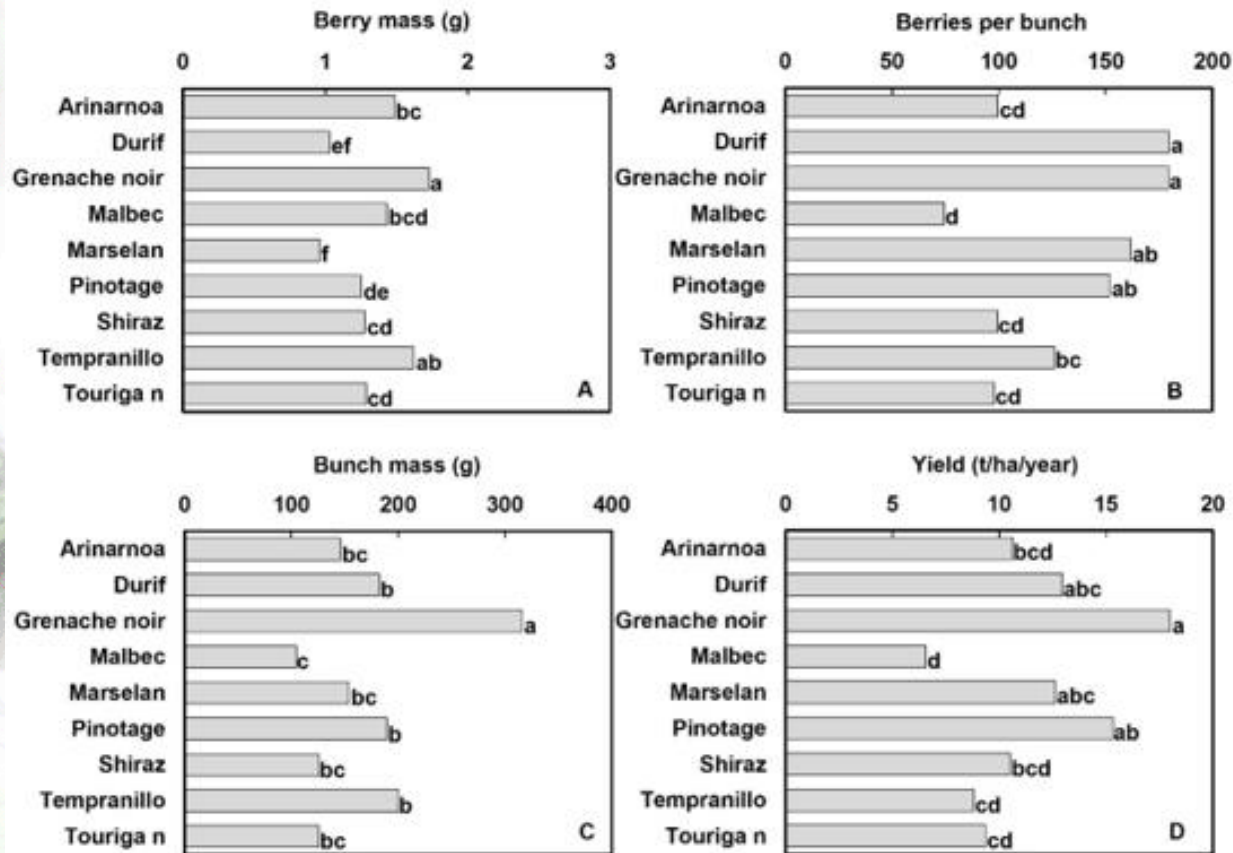
- Grenache produced the most grapes and Malbec the least for the red cultivars.
- Piquepoul blanc and Macabeo produced the most grapes for the white cultivars whereas Chardonnay produced the lowest yield.



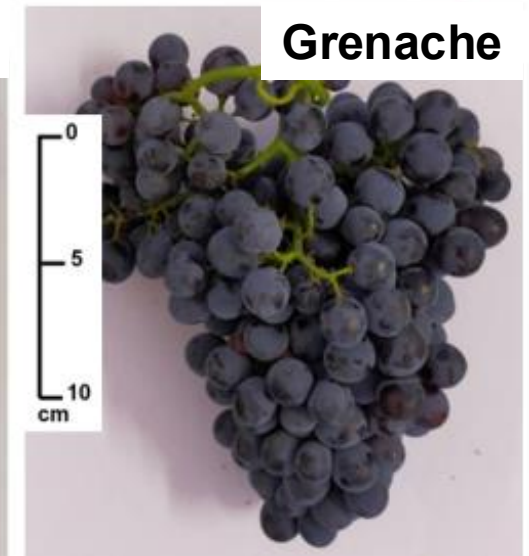
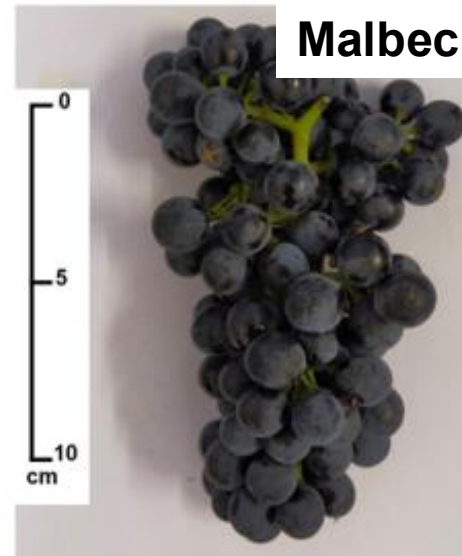
Cumulative yield after four seasons for (A) the nine red and (B) eight white cultivars. Bars designated by the same letter do not differ significantly ( $p \leq 0.05$ ). Data for red and white cultivars were analysed separately.



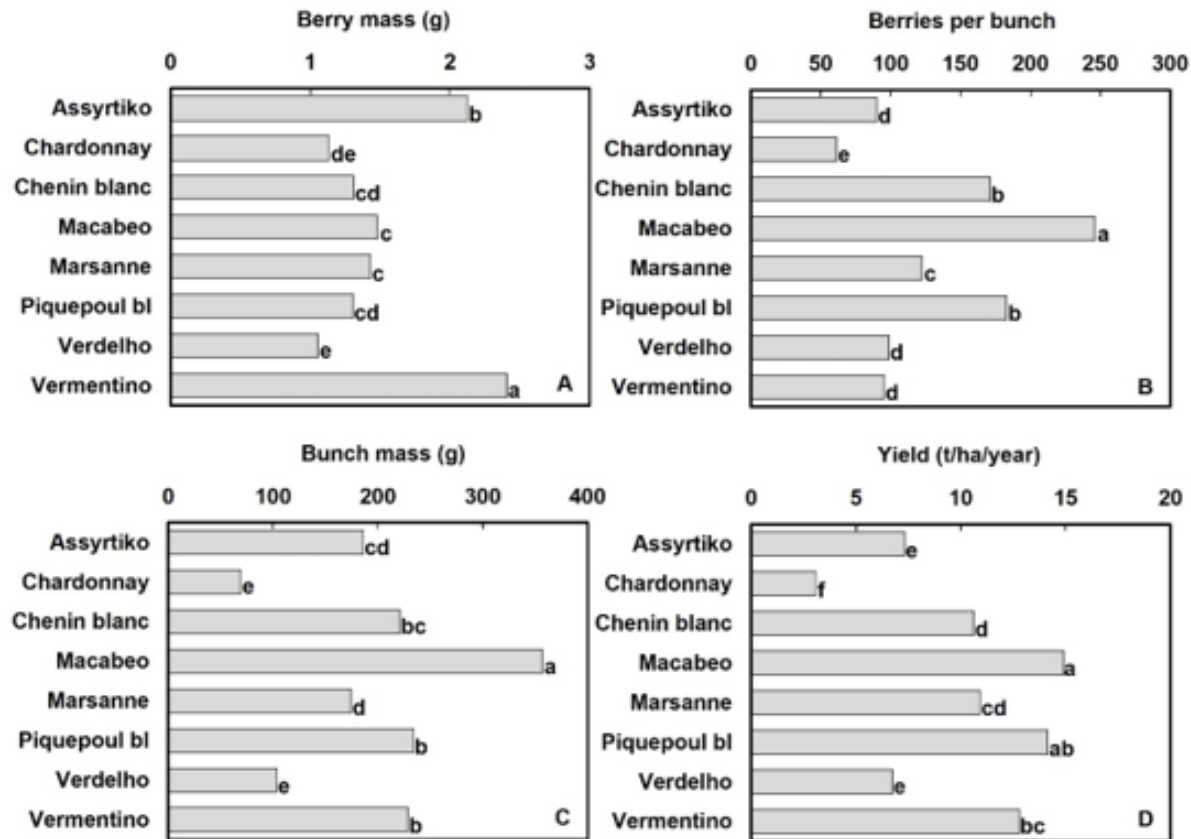
# Yield and its parameters...



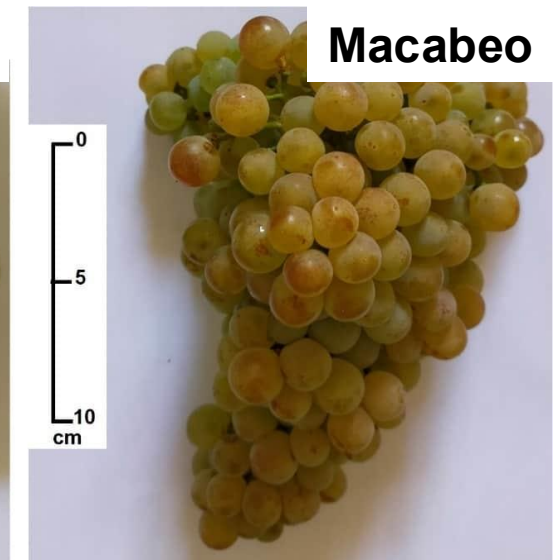
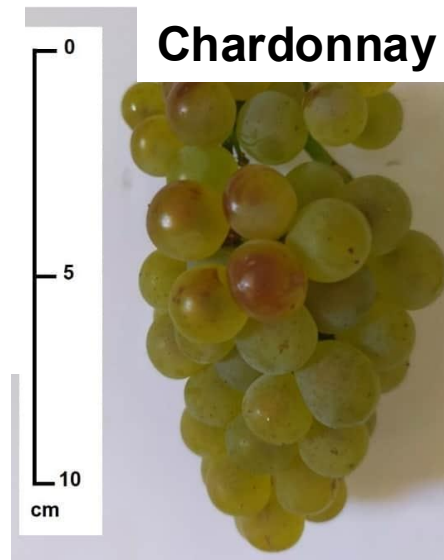
Average (A) berry mass, (B) berries per bunch, (C) bunch mass and (D) yield for the 2020/21, 2021/22, 2022/23 and 2023/24 seasons. Data are the means for the red cultivars.



# Yield and its parameters...

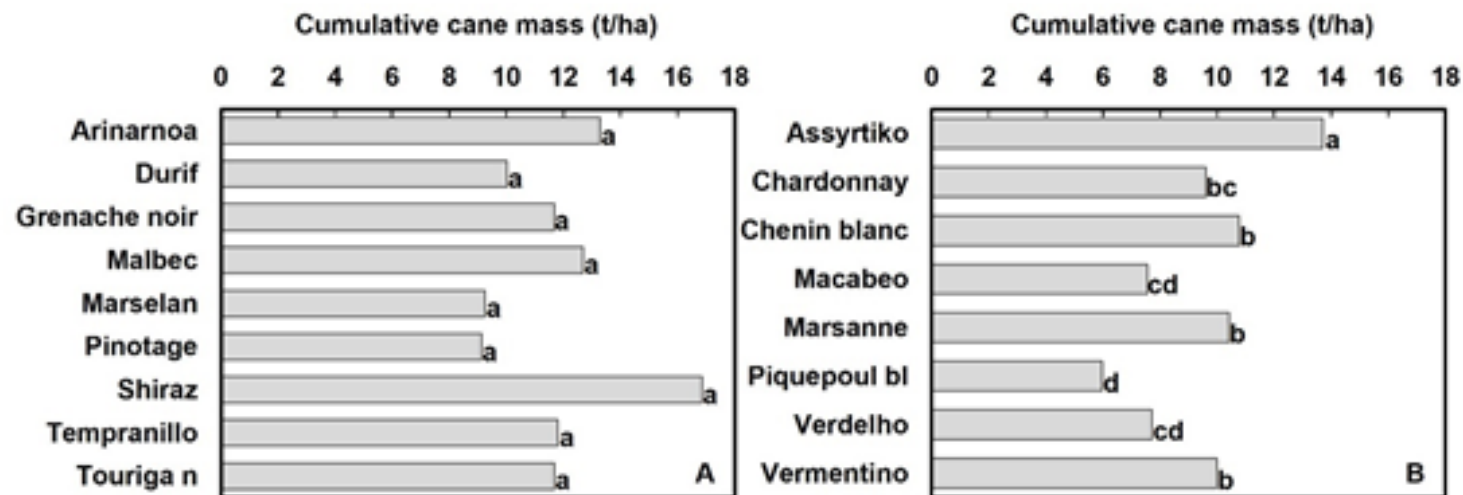


Average (A) berry mass, (B) berries per bunch, (C) bunch mass and (D) yield for the 2020/21, 2021/22, 2022/23 and 2023/24 seasons. Data are the means for the white cultivars.

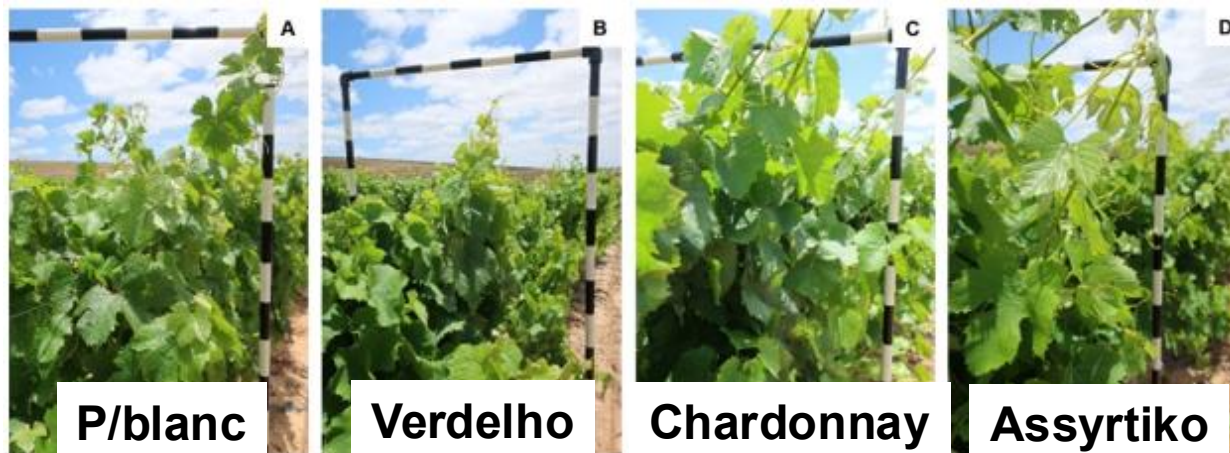


## Cane mass

- Under the prevailing conditions, Shiraz and Assyrtiko had the strongest vegetative growth in relation to the other red and white cultivars that were evaluated.
- Piquepoul blanc had the poorest growth.

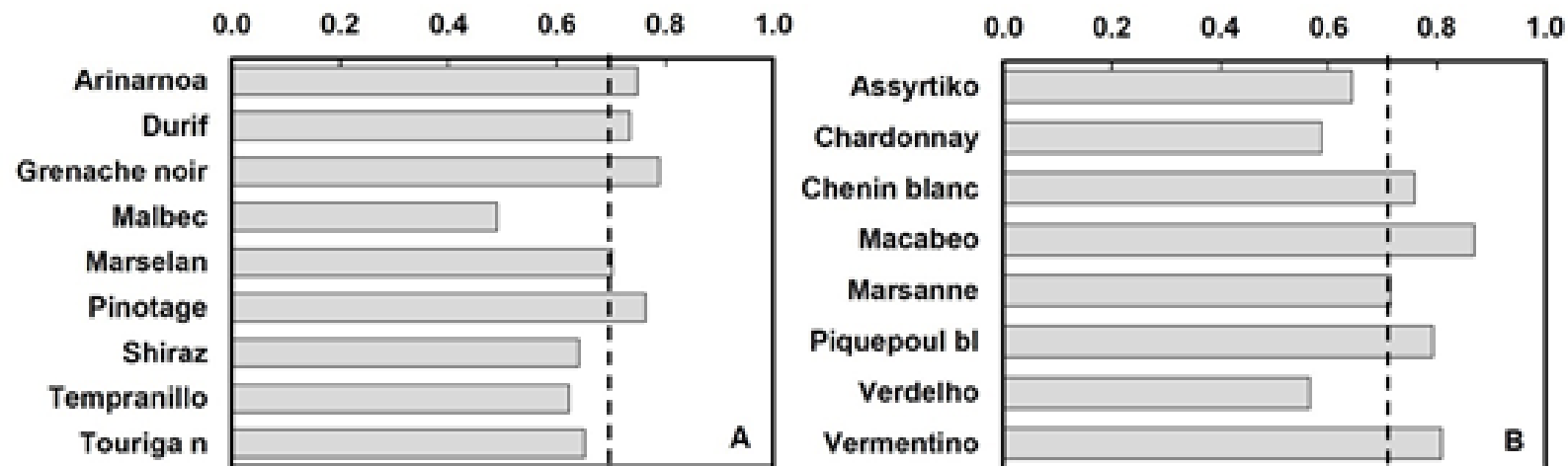


Cumulative cane mass from the 2018/19 until 2023/24 season for (A) the red and (B) white cultivars. Bars designated by the same letter do not differ significantly ( $p \leq 0.05$ ). Data for red and white cultivars were analysed separately.



## Performance index

- Grenache, Pinotage, Arinarnoa and Durif performed relatively better under the dryland conditions compared to the other red cultivars.
- Macabeo, Vermentino, Piquepoul blanc and Chenin blanc performed relatively better compared to the other white cultivars. Assyrtiko, Chardonnay and Verdelho had the lowest performance indices for the white cultivars.



Relative performance index with respect to yield and quality for the (A) red and (B) white cultivars. The dashed line indicates an index of 0.7.

## Conclusions and recommendations

- Results indicated that alternative wine grape scion cultivars can be a beneficial tool to mitigate the effects of climate change under the prevailing conditions.
- The project assessed grapevine responses in an almost worst-case scenario, *i.e.* under dryland conditions in a sandy loam soil in the Swartland region. This will enable extrapolation of the findings to other soil-climate scenarios.



Marselan



Tempranillo



Marselan



Tempranillo

Harvest in 2022/23

30 January 2023

## Conclusions and recommendations...

- **Based on the project results, the following aspects should be considered for cultivar selection:**
  - **If yield is the only consideration, then Grenache, Pinotage (reference cultivar), Durif and Marselan can be selected for the red grape cultivars.**

**Macabeo, Piquepoul blanc and Vermentino can be selected for the white grape cultivars. However, retarded ripening should be expected for Macabeo and Piquepoul blanc.**

- **When an optimum balance is sought between yield and overall wine quality, then Grenache, Pinotage (reference cultivar), Arinarnoa and Durif can be selected. The performance index was the lowest for Malbec.**

**For the white cultivars, the performance index was highest for Macabeo, Vermentino, Piquepoul blanc and Chenin blanc (reference cultivar). The performance index was the lowest for Chardonnay (reference cultivar) and Verdelho.**

## Conclusions and recommendations...

- **The soil must be prepared properly to ensure optimal soil conditions for the proliferation of grapevine roots throughout the entire soil profile up to a depth of 1 m particularly when the vineyards will be cultivated under dryland conditions.**
- **Once an alternative cultivar has been selected, ensure that the order is given timeously to the nursery given that they are alternative scion cultivars and might not necessarily be available at short notice.**
- **The cultivars should be trained onto a VSP system. In this regard, it will also be important to take the vegetative growth of the specific cultivar into account when deciding on the size of the trellis system.**
- **The marketing of wines made from alternative wine grape cultivars will need more attention so that consumers become more familiar with them.**

# THANK YOU



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