



**Title: Impact of  
climate change on  
the quality of fruit  
and vegetables  
produced in South  
Africa**

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# Introduction

- Climate change is a topic of interest all over the world (e.g. Cop 27)
- It manifests in various ways
- Globally, the phenomenon is a threat to human lives, food security and sustainable development
- South Africa is not immune to climate change
- South Africa has experienced higher mean annual temperature increases than the global average (1.5 times higher)
- Extreme weather events (floods, drought, hail etc) are also on the increase



# Introduction

- South Africa has a distinct spatial distribution in future projections of temperature increases and precipitation trends
- Average annual temperatures in Coastal areas will increase by 1.5 to 2 °C in the intermediate future
- While inland areas will experience increases of between 3 and 3.5 °C
- Reason for lower increase in coastal regions is the moderating effect of the ocean

# Introduction

- **Future projections point towards an increase in mean annual rainfall in the Eastern parts of SA**
- **While the Western parts of the country will experience a decrease in annual rainfall**
- **Plant production and fruit quality are highly dependent on the weather/climate**
- **Therefore, changes in temperature and precipitation will inevitably affect fruit and vegetable production and quality**



# Introduction

The main objective of this study was to evaluate the impact of climate change on the quality of fruit and vegetables produced in South Africa



# Project plan

- In conducting the projects, specific areas and products were selected as case studies
- Products included in the project:
  - Citrus, Plums, Apples – main export fruit types
  - Potatoes
- Provinces in South Africa for data collection
  - Limpopo, Western and Eastern Cape

# South Africa: Country Location





# Map showing provinces used for data collection



**Limpopo** – Province in the North of the Country and the largest citrus producing region in SA

**Eastern Cape** – Situated along the Eastern Coastline of SA, with direct access to the Indian Ocean. This is the second largest citrus producing region in SA

**Western Cape** – Situated on the southwestern tip of the African continent, with access to the Indian Ocean on to the east and the Atlantic Ocean to the west. Largest deciduous fruit production region

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# Project plan.....

- Fruit quality data was collected from packhouses in the three provinces
- Unless stated otherwise, data was pooled across varieties for the different fruit types
- Information on Potatoes was collected from the commodity body
- Some fruit quality data on arrival in the market was obtained from exporters
- A qualitative survey was conducted by sending a questionnaire to growers in the selected production regions

# Results

## Qualitative survey on climate change

- **88% of growers who participated in survey are aware of climate change and concerned about this phenomenon going into the future**
- **These growers report experiencing rising temperatures, less rainfall and an increasing frequency of extreme weather events in their production regions**
- **44% of growers who participated in the survey reported reduced productivity and changes in fruit quality**
- **Some of the quality changes seen on fruit were: higher sunburn, higher acid values and higher °Brix**

# Results continued

## Qualitative survey on climate change

- **75% of growers found it necessary to use more advanced or more scientific production techniques to succeed in production**
- **44% of the growers already have some orchards under nets**
- **50% of respondents use degreening to improve colour on citrus fruit**

# Results continued

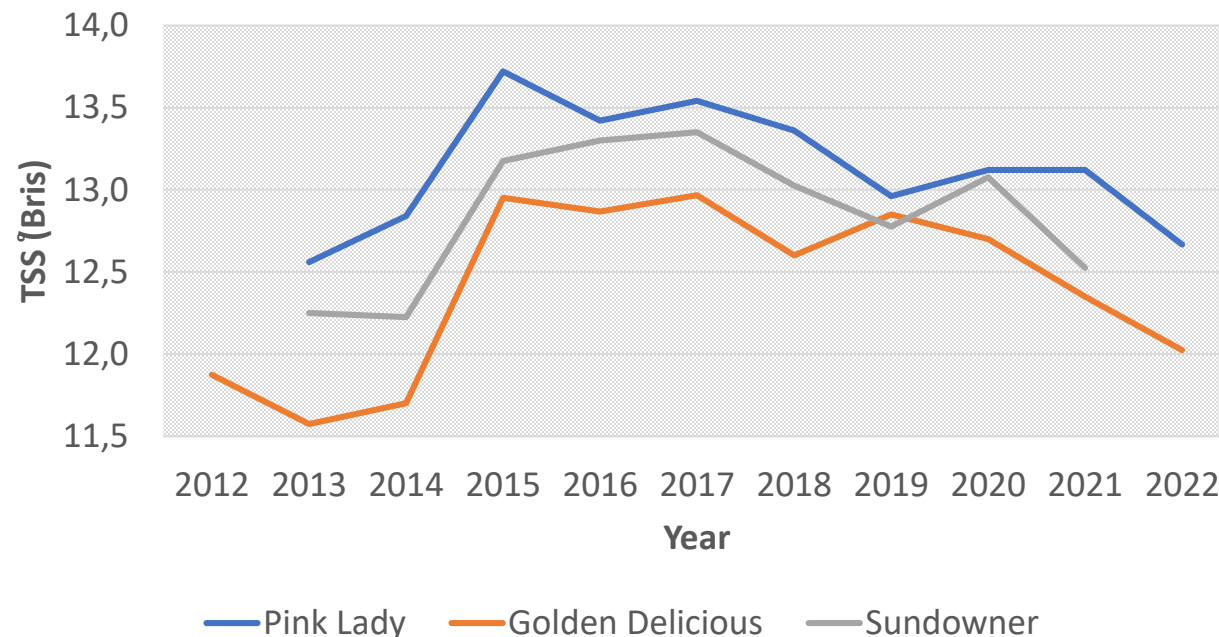
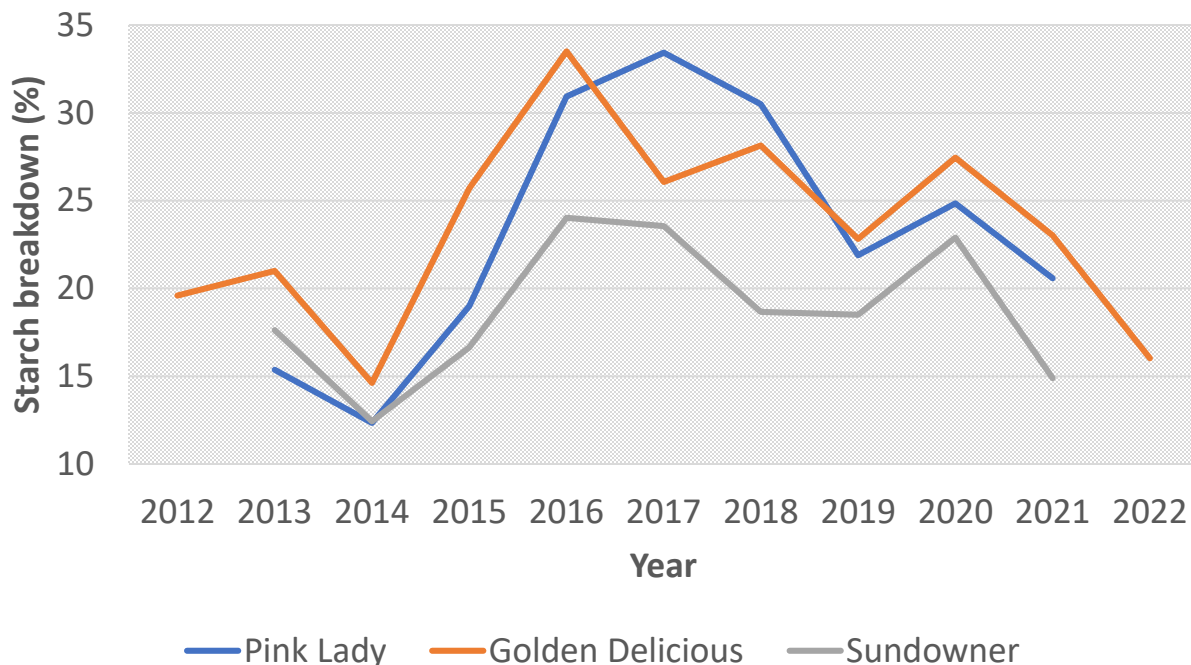
In summary:

- there is a high grower awareness of climate change;
- there is concern for the future, there are some negative effects on fruit quality; and
- growers are adapting production



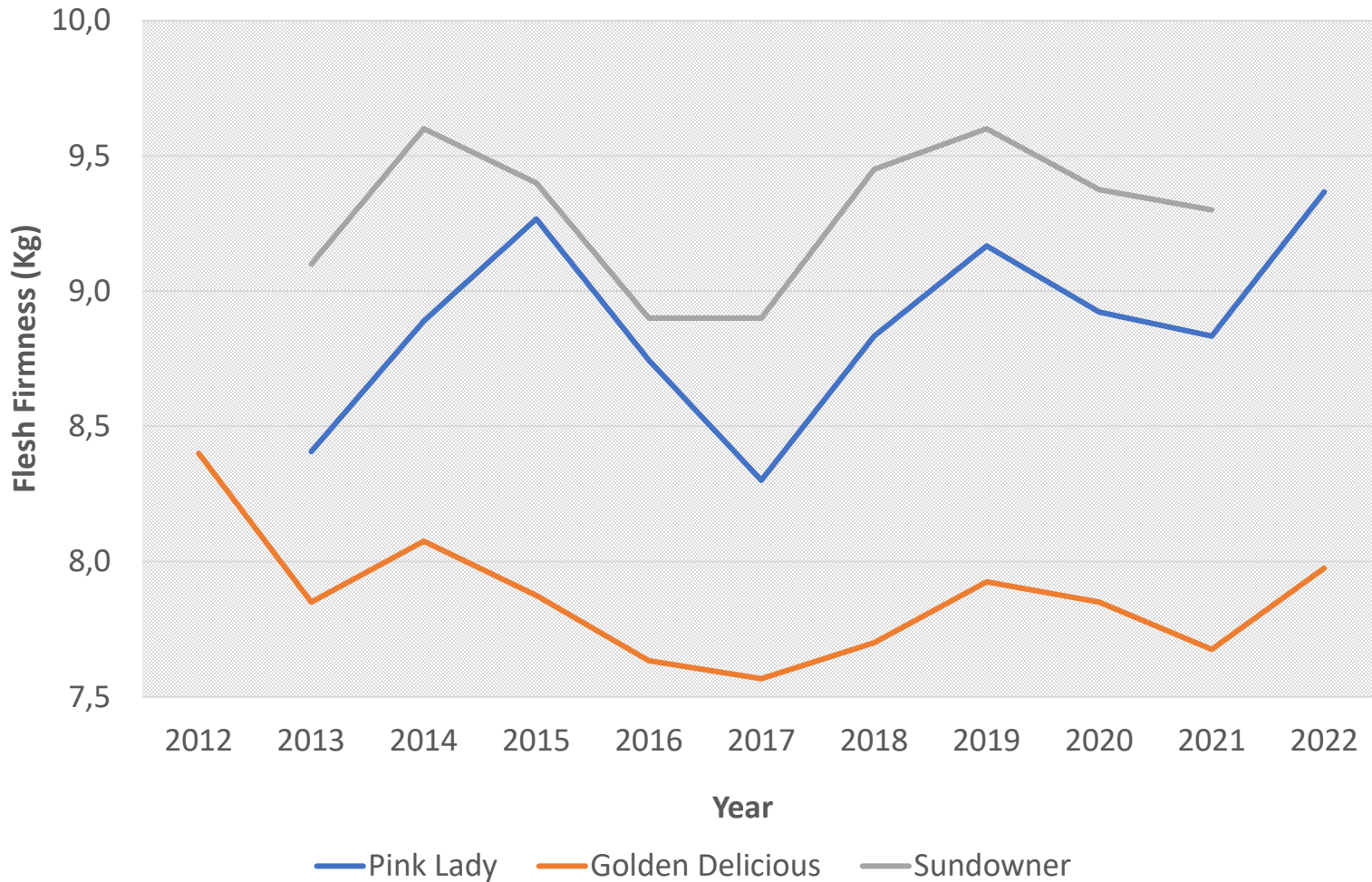
# Impact of climate change on the quality of Apples in the Western Cape

# Change in the maturity of apples in the Western Cape



- Starch breakdown was higher during the drought years (2016 to 2018) in the WC
- TSS measure in °Brix was also higher during the drought years than before or after this period
- Climate change may affect the phenology and maturity time for apples

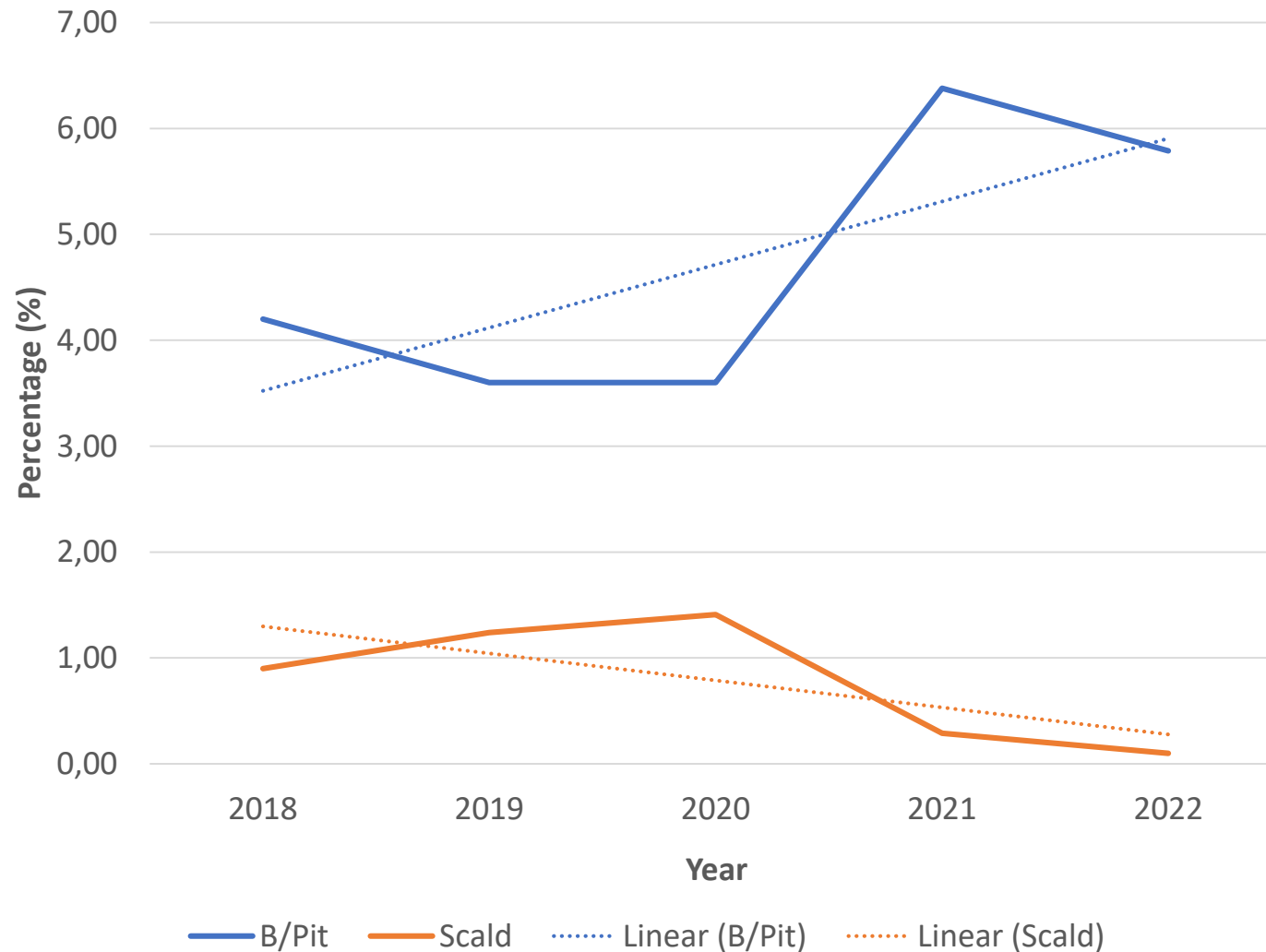
# Change in the maturity of apples in the Western Cape



- Flesh firmness on apples decreased during the drought years in the Western Cape compared to the period before and after this episode
- Supports the idea that phenology and time of some varieties may change due to climate change



# Change in the shelf-life quality of apples in the Western Cape

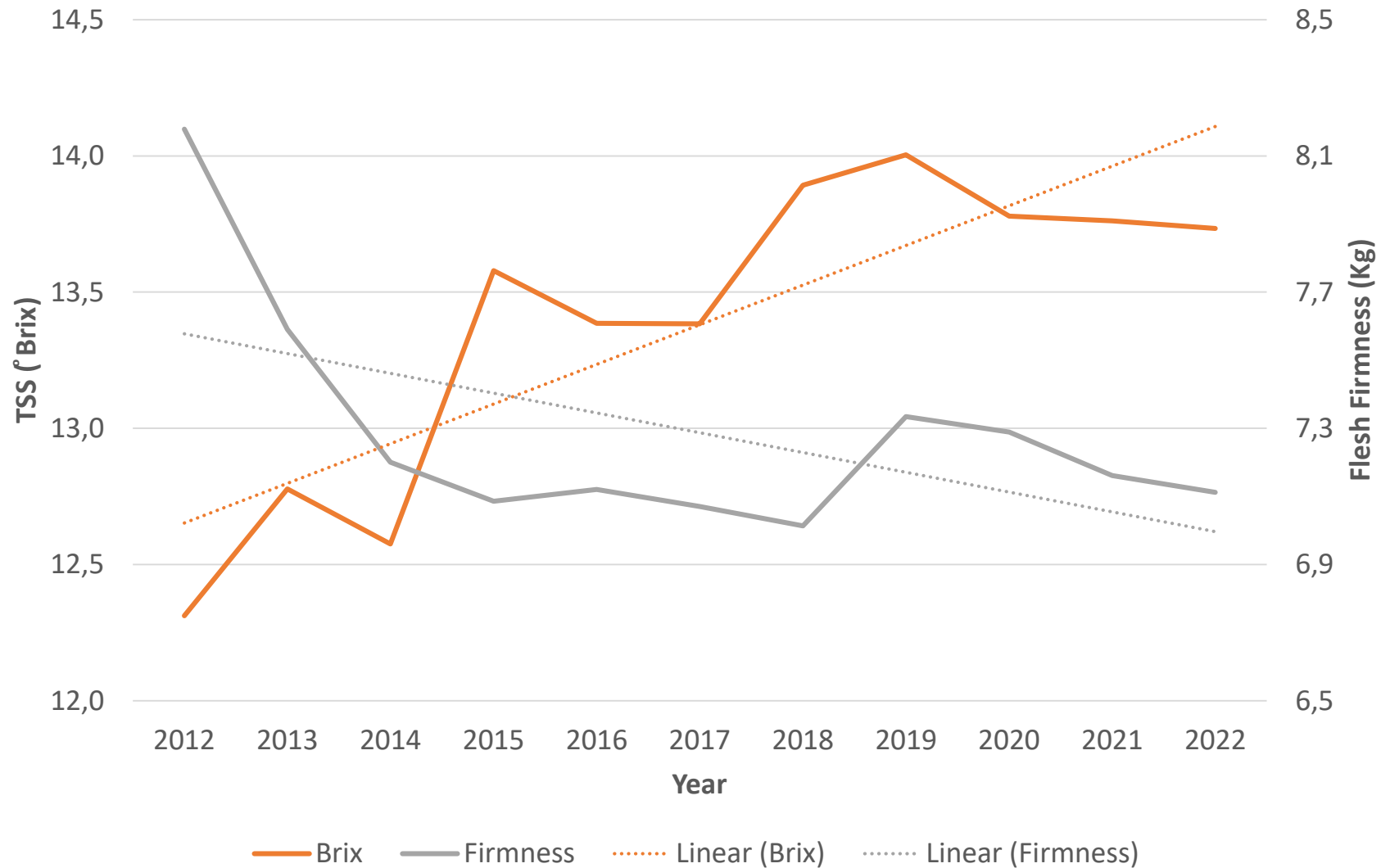


- Bitter Pit on all apple varieties fluctuated but showed an upward trajectory over the years
- Scald levels were low



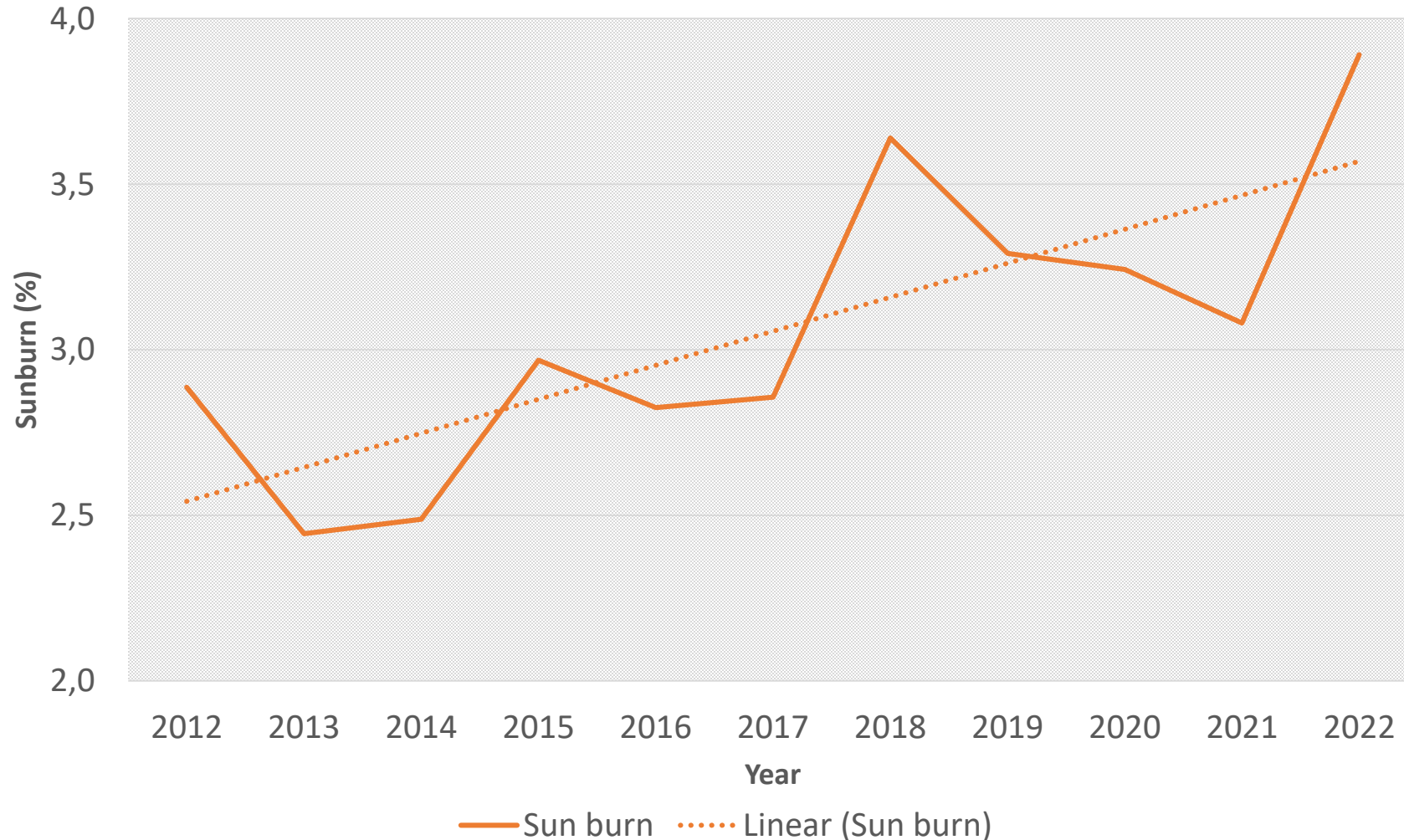
# Impact of climate change on the quality of plums in the Western Cape

# Impact of climate change on the plum maturity in the WC



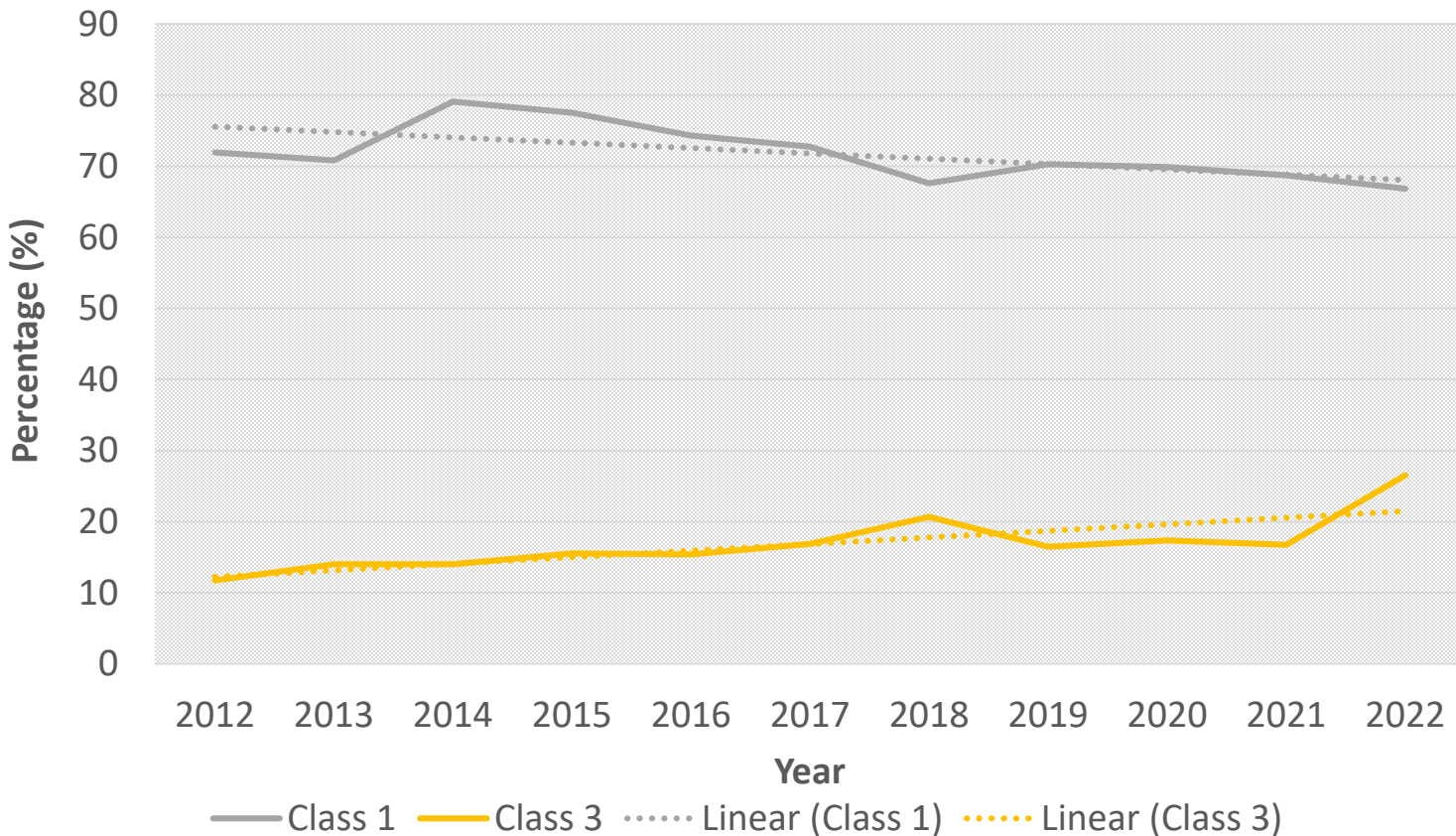
- Flesh firmness at maturity decreased over the years
- °Brix increased
- This may indicate changes in phenology, resulting in plums ripen faster
- Could result in changes in the timing of some varieties

# Impact of climate change on sunburn incidence on plums in the Western Cape province



- The risk of Sunburn is evident
- Sunburn increased by 34%

# Impact of climate change on class distribution of plums in the WC

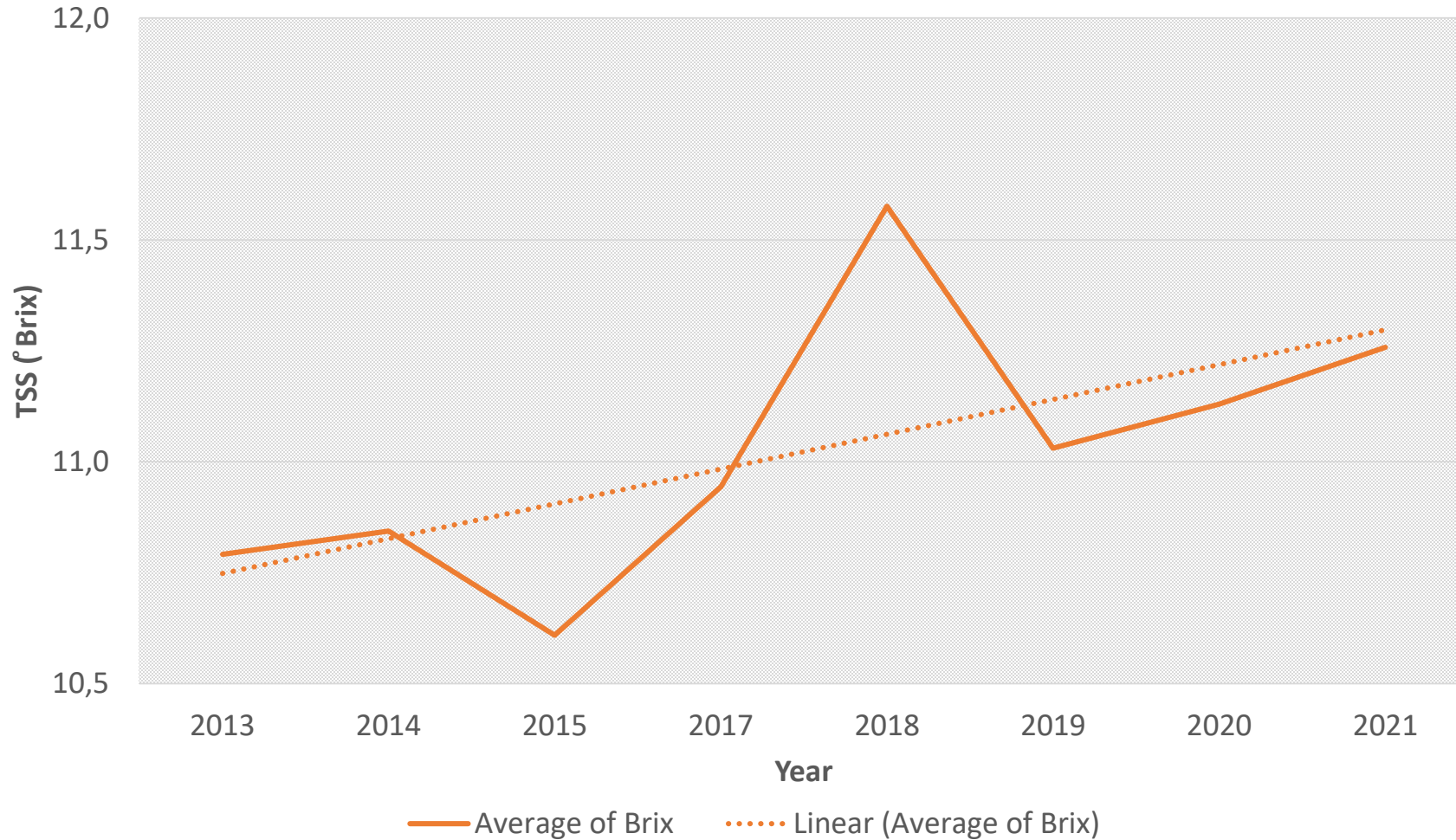


- There was a marginal decrease in class 1 (export quality) fruit & an increase in out of grade fruit
- Climate change may be resulting in more losses
- Quality data is lost in out of grade fruit as this fruit is not packed for export
- Other quality parameters like decay and fruit size did not show a clear trend



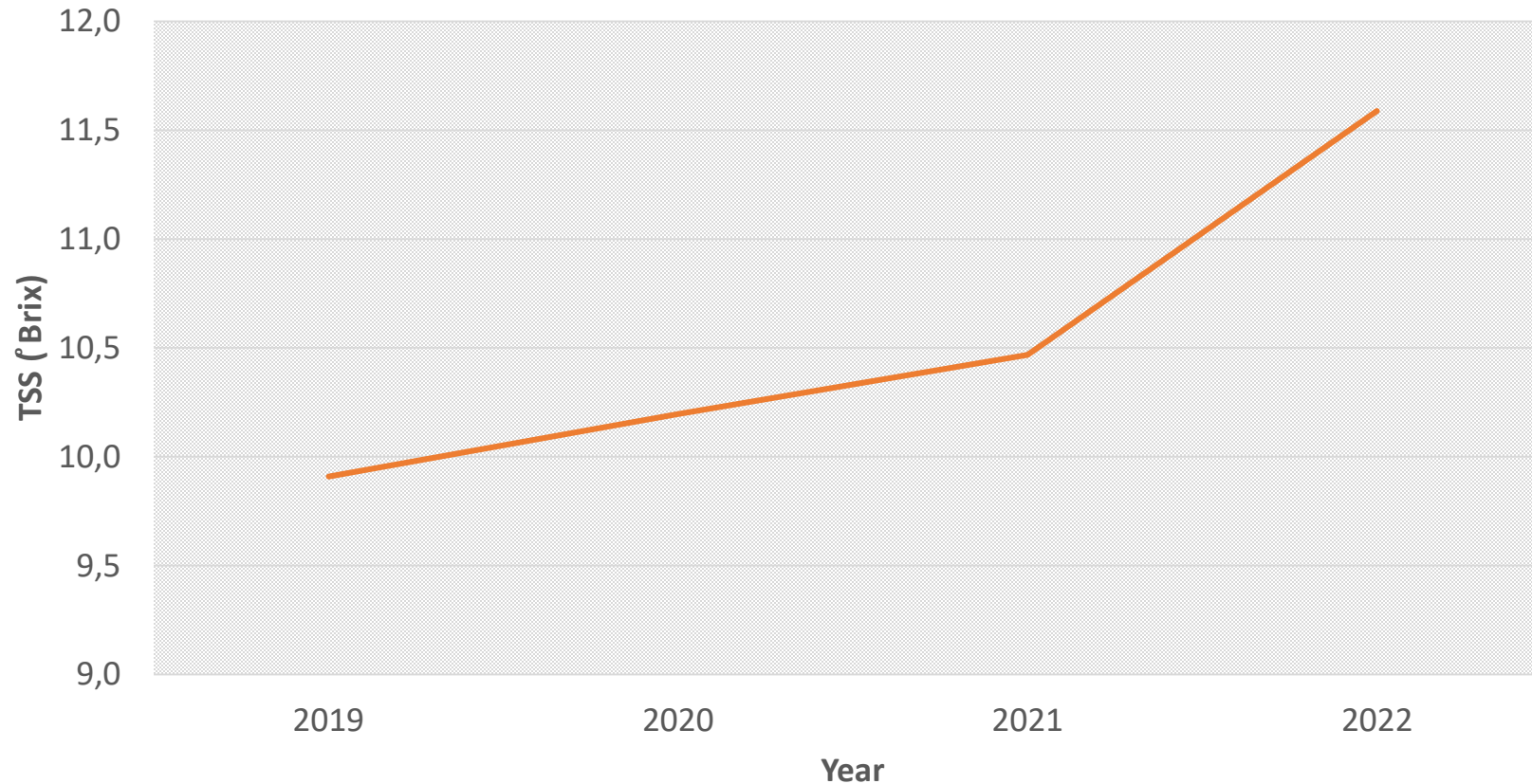
## Impact of climate change on the quality of citrus fruit in different provinces

# Change in maturity of citrus fruit in the Western Cape



- There was a marginal increase in TSS at maturity
- This could point towards a shift in phenology and may result in a change in the maturity window of some varieties

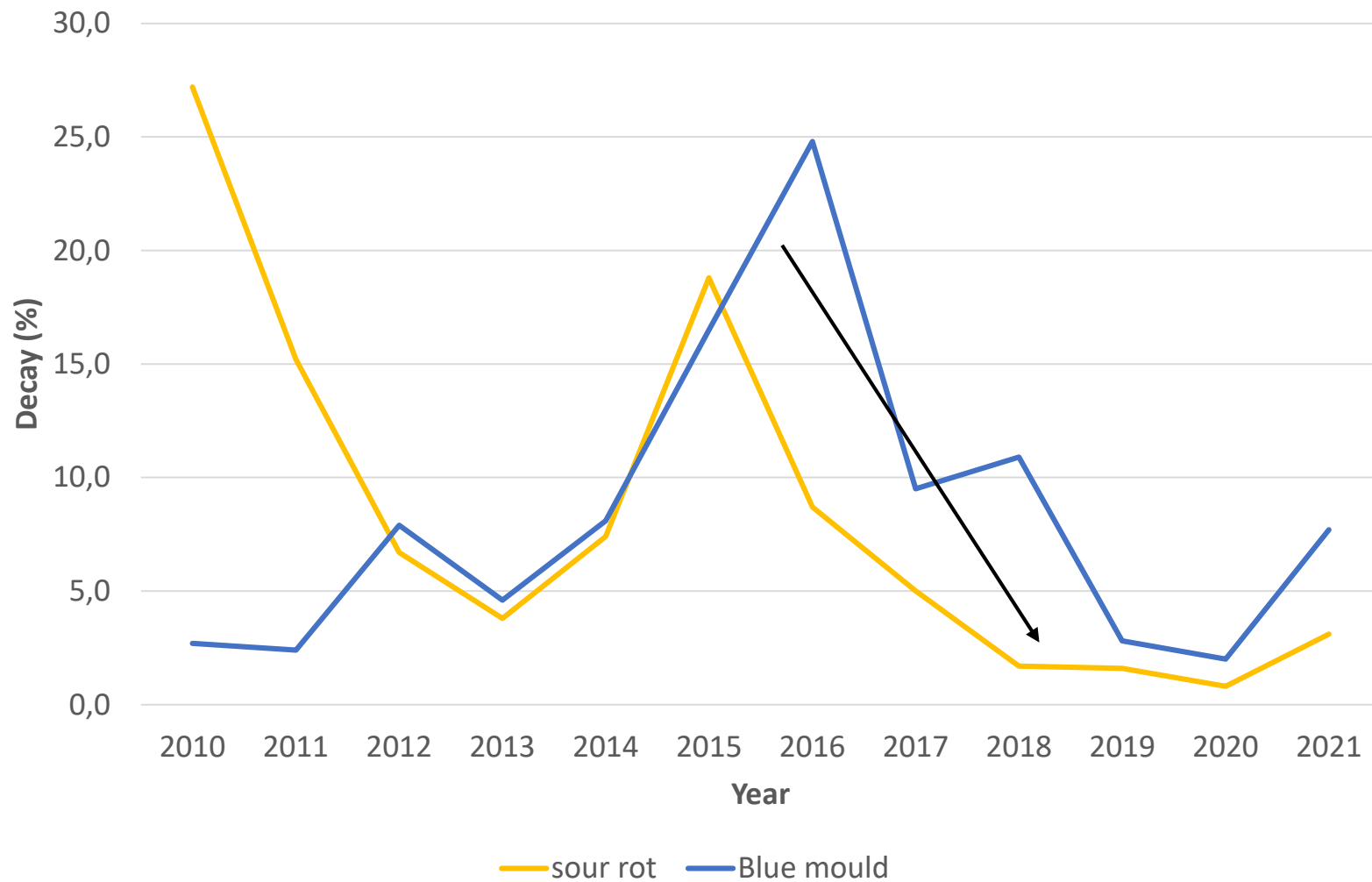
# Change on maturity of citrus fruit in Limpopo



- We see an increase (16%) in TSS at maturity
- This could point towards a shift in phenology and may result in a change in the maturity window of some varieties



# Incidence of decay of citrus fruit from the Eastern Cape



- The EC experienced drought from 2016 to 2021
- In this period the risk of decay on fruit decreased



## Impact of climate change on the quality of potatoes produced in South Africa

# Potato production

- Potato production region of South Africa are projected to experience between 1.5 and 2.9 °C rise in temperature
- Rainfall trends in potato production regions are inconsistent and uncertain but point towards less average rain in the West and a slight increase on the East
- The question is what is the net effect of these conditions on potato production and quality?

# Potato production and quality

- In South Africa, the temperature and rainfall changes are not going to negatively affect production.
- Instead, production is expected to increase slightly as rising temperature reduce the risk of frost in some production areas

# Climate change adaptation



- **Agriculture is faced with the task of improving productivity and quality in the midst of unfavorable temperature and rainfall trends**
- **To maintain productivity and quality, agriculture must adapt**
- **Adaptation is adjusting processes and practices at farm level to overcome the negative effects of climate change**
- **There are several approaches to adaptation**



# Production Technology

**Cultivar selection: fruit crops require a specific combination of climatic conditions to reach their full potential**

- **Therefore, cultivars do not produce and perform optimally in all production areas**
- **With climate change, marginal climate for a cultivar or product could result in higher crop failures**
- **Planting the correct product or cultivar in the correct area reduces the risk of crop failure**



# Production Technology

The use of shade netting: **shade nets are used to protect crops from adverse environmental factors**

- **Shade nets protect against wind scarring, sunburn, lower water consumption and losses through reduced evaporation**
- **It a good cropping technique to cope with climate change**





# Production Technology

Climate smart agriculture: as the world slowly migrate towards a climate catastrophe, none scientific farming will have limited success

- With limited water resource, scientific farming technique will allow crop production to be resilient
- the innumerable production and fruit quality challenges will be overcome by high tech. crop production
- We are seeing this in South Africa, where the irrigation and cropping systems are advanced and more internet based



# Post-Harvest Technology

Packhouse quality control: packhouses are able to remove defective fruit either manually or electronically

- Some of the effects of climate changes (sunburn, hail marks, poor colour etc) can be removed in the packhouse
- Out of grade fruit, due to the above mentioned, are culled or sent to a juice factory



# Post Harvest Technology

**Degreening:** Climate change may result in poor fruit colour in some fruit type including citrus

- While fruit colour can limit marketability of fruit, in citrus this issue can be overcome by degreening
- Degreening is the process of exposing poor coloured citrus fruit to exogenous ethylene to enhance colour development



# Plant breeding

- The development of new varieties that can withstand adverse effects of climate change is key for breeders
- Example:
- South Africa has a robust cultivar breeding program run by the Agriculture Research Council
- It has successfully released new citrus and deciduous fruit varieties

# Conclusions

Several factors are prominent in this study:

1. There is evidence that climate change may affect fruit phenology and result in a change in the time cultivars mature
2. There is evidence that climate change may affect fruit quality, in some cases negatively and in some cases positively
3. There are differences in the way different fruit types respond to the phenomenon of climate change. Plums and apples seemed more responsive compared to citrus

# Conclusions

4. There is evidence that fruit in different areas responds differently to climate change

5. While the work was done diligently, we were limited by the data we received from packhouses. With increases in out of grade fruit, there is a lot of information that is lost because this fruit is either culled on the farm or lost to juice in the packhouse.

6. There is need to continue with this work in a more structured manner and select orchards in different areas and monitor them for a period of time



# Acknowledgments

The PPECB would like to acknowledge the OECD for funding this study. Also, role players for providing fruit quality information and other stake holders who contributed to the study by editing the report, giving guidance and advice or providing necessary data and information.

Thank you for  
your attention

Danke für ihre  
aufmerksamkeit



**PPECB**

***RESEARCH &  
DEVELOPMENT***

