A Status Quo Review of Climate Change and the Agricultural Sector of the Western Cape Province

Brief for the Deciduous Fruit Sector
The SmartAgri project

Smart Agriculture for Climate Resilience (SmartAgri), a two-year project by the Western Cape Department of Agriculture and the Western Cape Department of Environmental Affairs & Development Planning, was launched in August 2014. SmartAgri responds to the need for a practical and relevant climate change response plan specifically for the agricultural sector of the Western Cape Province. By March 2016, the University of Cape Town’s African Climate and Development Initiative (ACDI) and a consortium will deliver a Framework and Implementation Plan which will guide and support the creation of greater resilience to climate change for farmers and agri-businesses across the province. The project will provide real and practical information and support, and inspire farmers in a manner which optimizes their decision making and ensures sustainability at a local level.

This brief was prepared for the deciduous fruit farming sector of the Western Cape. It summarises the findings of the Status Quo Review of Climate Change and Agriculture in the Western Cape Province. This study covers current climate risks and impacts across the sector and how risks and potential benefits are expected to shift under a changing climate. It also considers how climate risks and impacts can be reduced and managed. This is approached in the context of provincial economic and social development goals, and careful use of scarce and valuable natural resources.
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Climate change in the deciduous fruit production regions

As a result of global climatic changes, the Western Cape faces a warmer future. This poses serious threats to agricultural commodities in the province, including deciduous fruit. Changes in annual rainfall as well as changes to the spatial distribution, seasonal cycles and extremes in rainfall are also likely, even if the extent and direction of these changes are still uncertain. The SmartAgri project is focusing on the planning and preparation needed in the agricultural sector in order to deal with this threat over the next 10–40 years.

Agricultural production is closely linked to climate and weather. These linkages are sometimes straightforward, for example seasonal total rainfall influencing crop yield. More commonly they involve far more specific influences such as dry spell duration during key fruit set phase, or rainfall during the harvesting period. Higher temperatures are often tolerated as long as rainfall and/or irrigation are sufficient. However, temperature sensitivities can be much more complex, for example the reduction in fertilisation brought about by a heat wave during flowering. Thus, a discussion of the impacts of climate change on agricultural production requires focused attention to specific threats to specific crops and at specific times in the seasonal cycle. In addition, local conditions such as production potential and microclimate influence the extent of the threat.

The deciduous fruit production potential of the Western Cape is determined by local climate, ocean and mountain influences and soils, but is primarily limited by the need for cold winters and availability of water. Pome fruit production (apples and pears) is concentrated in the Bokkeveld, Piketberg, the cooler areas of the Boland and the Langkloof Valley in the east. Stone fruit (peaches, nectarines, apricots, plums, prunes) are grown in the Bokkeveld, Piketberg, the warmer areas of the Boland and the Little Karoo. In the Berg River region and parts of the Breede River region, water for irrigation is provided by the large public dams connected to the Western Cape Water Supply System, private farm dams and the rivers and their tributaries. Other regions such as the Bokkeveld, Piketberg and Langkloof are reliant on local dams and sometimes groundwater.

The SmartAgri project is assessing ten agro-climatic zones in the region covering most of the deciduous fruit production, based on Relatively Homogeneous Farming Areas: Bokkeveld, Cape Town–Winelands, Swartland, Piketberg, Grabouw-Villiersdorp-Franschhoek, Breede, Little-Karoo, Montagu-Barrydale, Tankwa-van Wyksdorp, and Bo-Langkloof-Outeniqua (Figure 1).
Figure 1. Map of the Western Cape Province showing the 23 agro-climatic zones used in the SmartAgri project, and the deciduous fruit growing regions of the Western Cape (circles).
How will the climate of this area change into the future? Climate modeling studies show with a high degree of certainty (i.e. almost all the models agree) that the western parts of the province will experience continued warming and reductions in winter rainfall by mid-century and thereafter. An important change in the climate system involves the shifting of the rain-bringing frontal storm tracks further south during winter. Some models indicate the possibility of wetting in the eastern part of the province, including the Bo-Langkloof. Summer thunderstorms are likely to become more intense in the interior regions transitioning towards summer rainfall. However, the influence of the mountains and ocean will lead to more complex results at local level, particularly for rainfall. In the short term, these influences could lead to increased rainfall on the windward mountain slopes, for example, or rainfall shifting into autumn and spring. Future changes in total annual rainfall will depend strongly on the strength of various system responses to the changing global climate. Since the science is not yet able to provide absolute certainty, both increased and decreased rainfall should be considered by farming communities.

Already, the weather data shows that warming has occurred (on average approximately 1.0 °C over the last 50 years), particularly in mid- to late summer. There has been a decrease in rain days during late summer–autumn (January to April) and early spring (August) but more rain days in early summer (November-December) in the western regions. It may indicate a progressively later starts and end to the seasons. As yet there are no detectable trends in total rainfall during the winter season or annually across the deciduous fruit production areas.

Future increased temperatures are almost a certainty. The greatest increases are likely to be inland and the lowest increases along the coast indicating a moderating effect from the Indian and Atlantic Oceans. Expected increases in mean annual temperature for mid-century are in the range of 1.5 °C to 3 °C, with the Bokkeveld and Bo-Langkloof areas tending towards the middle part of this range. Both maximum and minimum temperatures will increase leading to increased heat stress for fruit crops, but also lower risks associated with low temperatures.

The Western Cape experiences regular flooding events, droughts and heat waves, and occasional hailstorms. These events have had significant impacts on farmers. Floods are the most common problem, causing the most damage and costs for response and recovery. The Bo-Langkloof area is particularly vulnerable to damage to storage dams by heavy rainfall and flooding. An increase in extreme rainfall events is likely in the core of the winter season which could increase the risk of flooding.

Heat waves are expected to become more frequent. Figure 2 shows the monthly count of days exceeding 32 °C for De Keur (Bokkeveld) and Elgin (mainly pome fruit areas), and for Robertson (stone fruit area), as well as projected changes in the same statistic for mid-century. This shows that under climate change, the occurrences of hot days will increase dramatically.
Figure 2. Observed (grey) and projected possible range of increased (red) number of hot days (> 32°C) per month for De Keur (Bokkeveld), Elgin and Robertson. Projections are for the 2040 – 2060 period and based on 11 different climate models. Height of the grey bars indicates median number of hot days from observed historical climate records. Red bars indicate the range of projected increases in number of hot days (10th to 90th percentile range) in addition to the observed (or current) values.
The Bo-Langkloof fruit production region has a climate with a tendency towards year-round rainfall, but with high variability, and it has a low water storage capacity. This area is expected to be responsive to either drying (negative) or wetting (positive) and shifting rainfall patterns (seasonality). The lower water storage capacity renders it vulnerable to periods of low rainfall.

Hailstorms are relatively rare and localised in the Western Cape, but when they occur they have the potential to inflict substantial physical and economic damages on farms. In November 2006, a hailstorm in the Haarlem area (Bo-Langkloof) damaged almost 400 hectares of fruit trees, at a cost of R9.4 million. In November 2013, hail damage wiped out apple and pear crops on scores of farms in the Witzenberg, Ceres and Koue Bokkeveld areas and caused significant damage to much of the remaining crop. The predictability of the occurrence of hail is quite poor as a result of the dynamic and chaotic nature of the weather systems giving rise to hail.
Climate change risks and impacts on deciduous fruit production

Deciduous fruit production in this region is sensitive to higher temperatures and heat waves, reduced seasonal rainfall and longer dry spells, higher frequency of heavy rainfall and flooding, more frequent and heavier late spring and early summer rainfall, and rising CO₂ levels. Other possible high impact climate risks for pome fruit production include frost, hail and strong wind. Since these are often erratic, highly localised and poorly captured by climate models, their future risk and impact is not understood.

Pome fruit

In the warmer production regions the winter climate is seldom cold enough to provide sufficient chilling for the trees to emerge from dormancy in spring. Rest-breaking chemical agents are routinely used to overcome this problem and ensure strong flowering and fruit set. The industry uses models to track the accumulation of Daily Positive Chill Units (DPCUs) during autumn and winter.

Under climate warming, accumulation of chill units will decrease, eventually reaching a critical threshold at which apple production would no longer be commercially sustainable in the warmer areas. Even moderate warming of less than 1 °C will have serious implications for sustained production in the Elgin-Grabouw-Vyeboom-Vyeveld-Villiersdorp region, and warming of 2 °C and higher will result in all years not reaching the threshold of 800 DPCU for the current set of cultivars. In the colder production regions the winters are currently always cold enough to provide sufficient chilling. Under future warming of up to 2.0 °C in the colder Koue Bokkeveld region, total seasonal chill will remain sufficient (i.e. over the threshold of 800 DPCU).

Increasing temperatures are leading to earlier tree phenological development in spring across the world. According to one study, apple and pear cultivars in the south-western Cape have been flowering 1.6 days per decade earlier over the period 1973 to 2009, associated with temperature increases of +0.45 °C per decade in early spring (August / September). However, further monitoring and analysis are required.

Very warm post-bloom spring temperatures influence the carbohydrate balance (production versus respiratory loss) of apple fruitlets during the critical cell division and early growth stages (first 55 days), and can lead to smaller fruit. A negative carbon balance occurs above a fruit surface temperature (FST) of 25 °C (air temperature ca. 20 - 22 °C). In Western Cape production regions, air temperatures >25 °C are common in this period, and temperatures >30 °C are occasionally experienced. Thus, significant springtime warming under climate change could worsen the small fruit size problem in some cultivars in the warmer regions. In the colder production areas, moderate warming during the early spring could prove beneficial to fruit farmers. Pollination, fruit set and early fruit growth are better when conditions are warm (ca. 20 °C).
Heat stress combined with high light levels can result in sunburn on pome fruit. Sunburn damage in the Western Cape can amount to 20-30% of the fruit cull in the orchard and up to 10% rejection of packed cartons thereafter. Only slightly sunburnt fruit can be marketed fresh, the remainder is processed for much lower income. Maximum daily air temperatures exceeding 35 °C can result in a fruit surface temperature (FST) of 45 °C and above, which gives rise to sunburn. In addition, water stress aggravates sunburn development by increasing FST.

A third quality problem associated with high temperatures is insufficient red colour in blushed cultivars, which has significant price implications. In apple peels, synthesis of the red pigment peaks during ripening (one month before harvest) and is induced at low temperatures (<15 °C). Thereafter, colour development responds positively to rising temperature up to ca. 25 °C, with a rapid reduction as temperatures rise above this threshold. Typical daily maximum temperatures in the primary apple producing regions are around 25-29 °C in the relevant months (January to March) which contributes to poor colour.

Pears develop maximum red pigment concentrations about midway between flowering and harvest, followed by a slow decrease in colour until harvest. High temperatures lead to degradation of the pigment and fading of red colour in a linear manner between 10 and 30 °C. Periods of high temperatures, even on a single hot day, reduce red colour significantly. Existing risk of poor colour in apples and pears will be exacerbated by warming associated with climate change. However, in the colder production areas, late summer and early autumn temperatures tend to drop off more quickly, and red colour development is generally less problematic compared to the warmer areas.

All commercial pome fruit production in the Western Cape is under irrigation. A comprehensive review on the water requirements of apple orchards has been compiled, and an intensive field study is underway. Under climate change projected for the south-western parts of the province, irrigation water demand for maintenance of current production levels is expected to increase by ~10% by mid-century, rising to more than 20% towards the end of the century. Projected decreases in winter and annual rainfall and possibly more frequent and/or severe droughts, and associated risk of dams not filling sufficiently, would lead to more frequent irrigation water curtailments, putting orchards under stress and reducing yields and fruit quality.

Climate warming, seasonal shifts in rainfall and humidity could affect the infestation levels of pests and diseases through changes in the species occurring and their rate of multiplication. The potential threat applies equally to drying or wetting scenarios. Changes in pest and disease incidence due to climate change will vary depending on the individual host responses and the pathogen or pest itself. The short life cycles of insects, their mobility, high reproductive potential and sensitivity to temperature means that even small changes in climate can result in a rapid and prolific response. There is particular concern about the highly damaging fruit fly species, false codling moth, mites, certain moths and stinkbugs, and nematodes, as well as the mildew species and cankers.
Overall, local research indicates that climate change could cause a significant reduction of the area suitable for apple production before mid-century, with most of the warmer production regions being affected. Suitable apple producing climates could become limited to the colder high-lying areas of the Koue Bokkeveld by 2050.

Pears are less chill-dependent than apples. Initial moderate warming (1-1.5 °C) during the fruit growth period could lead to slight yield gains in the cooler Elgin region, and slight losses in the warmer Ceres and Wolseley regions. With continued warming (2-3 °C) yield losses are estimated at between 5 % and 20 % depending on cultivar and region. The main problems would include reductions in fruit size and red colour, and increased sunburn in some cultivars. Early cultivars with lower chill requirements and early harvest are expected to be least sensitive. Should irrigation water not be sufficiently available, losses would be substantially higher.

**Stone fruit**

Stone fruit thrive in warm to hot and drier climates and have a low to medium winter chill requirement, except for cherries and some almond cultivars which have a medium to high chill requirement. Recent releases of low-chill cherry cultivars have led to new plantings outside the core Koue Bokkeveld region. Other climate risks to stone fruit include some risks common to all fruit production, such as reduced availability of water, shifts in phenology (earlier flowering), shifts in pests and diseases, and disruptive weather events such as frost, hail, strong wind and heatwaves.

Since flowering occurs during early spring in many cultivars, a specific risk relates to late winter and early spring weather, including cold rainy and/or windy conditions or frost during the pollination and early growth period. Rainy conditions during the harvest period increase the risk of fungal infection. Extended water-logging and flooding are highly detrimental to stone fruit orchards since they easily lead to diseases such as root rot. On the other hand, climate drying could open up new areas to stone fruit production linked to reduced risks of fungal attack. These considerations have not been studied in South Africa with reference to climate change. Stone fruit production in the cooler production regions can be expected to remain relatively resilient but the warmest areas of the Little Karoo could begin to show negative impacts.

A South African review on the water use of fruit tree orchards pointed out the tremendous diversity of species, cultivars and bio-physical growing conditions (climate, soils and management practices) that exist across the industry. This is particularly true for stone fruit production. Projections of climate change impacts are thus highly complex and have not been attempted in South Africa. It is likely that the impacts will be felt very differently between the western and eastern production regions, depending on changing rainfall amounts and seasonality, and changes in risks such as hail and strong wind which are not yet well modelled.

The following table summarises key sensitivities for each agro-climatic zone:
Table 1. Summary table of climate change sensitivities for each agro-climatic zone in the deciduous fruit production regions. The summary indicates overall agricultural sensitivites and is not specific to deciduous fruit production.

<table>
<thead>
<tr>
<th>Name</th>
<th>Main water resource features</th>
<th>Main climatic features</th>
<th>Climate change temperature projections¹</th>
<th>Main commodities</th>
<th>Future agricultural potential²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bokkeveld</td>
<td>Farm dams, good water resources and large storage capacity</td>
<td>Winter rainfall, cold winter minimum temperatures, occasional snow</td>
<td>Medium range warming</td>
<td>Pome fruit³, wheat, stone fruit⁴, onions, potatoes, Cattle</td>
<td>Remains high as long as the dams fill up</td>
</tr>
<tr>
<td>Bo-Langkloof-</td>
<td>Dams, insufficient storage capacity, use of ground-water</td>
<td>Rainfall throughout the year with spring and autumn peaks; recent floods, droughts and fires</td>
<td>Low to medium range warming</td>
<td>Pome fruit, hops, wheat Cattle, sheep, goats</td>
<td>Increasingly marginal, constrained by water availability and extremes</td>
</tr>
<tr>
<td>Outeniqua</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breede</td>
<td>Breede River, dams, farm dams, very large storage capacity</td>
<td>Winter rainfall; hot dry summers</td>
<td>Medium range warming</td>
<td>Wine grapes, wheat, stone fruit, pome fruit, olives Broilers, egg layers</td>
<td>Remains high as long as dams fill up</td>
</tr>
<tr>
<td>Cape Town -</td>
<td>WCWSS large dams, farms dams, rivers, large storage capacity, almost fully committed</td>
<td>Winter rainfall; warm to hot dry summers, snow on very high ground, windy in summer</td>
<td>Low range warming</td>
<td>Wine and table grapes, wheat, stone fruit, vegetables, olives, canola, berries Broilers, egg layers, pigs</td>
<td>Remains high as long as dams fill up</td>
</tr>
</tbody>
</table>

[1] Due to model uncertainties both decreasing and increasing rainfall scenarios should be considered
[2] For the medium term future 2040-2060
[4] Peaches, nectarines, apricots, plums, prunes
<table>
<thead>
<tr>
<th>Name</th>
<th>Main water resource features</th>
<th>Main climatic features</th>
<th>Climate change temperature projections(^1)</th>
<th>Main commodities</th>
<th>Future agricultural potential(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grabouw-Villiersdorp-Franschhoek</td>
<td>WCWSS large dams, farm dams, very large storage capacity</td>
<td>Unique climate, more cloudy, misty and wet than surrounding areas</td>
<td>Low range warming</td>
<td>Pome fruit, wine grapes, wheat, barley, stone fruit, berries</td>
<td>Remains high as long as dams fill up, but apples become unviable due to warming</td>
</tr>
<tr>
<td>Little Karoo</td>
<td>Farm dams, few seasonal rivers, large storage capacity</td>
<td>Hot summers, cold winter minimum temperature</td>
<td>Medium to high range warming</td>
<td>Wheat, vegetables, wine grapes, stone fruit, olives</td>
<td>Remains moderately high as longs as dams fill up</td>
</tr>
<tr>
<td>Montagu-Barrydale</td>
<td>Rivers, dams, low storage capacity</td>
<td>Winter rainfall, cold in winter with occasional heavy rain, hot in summer</td>
<td>Medium range warming</td>
<td>Stone fruit, wheat, barley, wine grapes, pome fruit, citrus, olives</td>
<td>Remains high as longs as dams fill up</td>
</tr>
<tr>
<td>Piketberg</td>
<td>Farm dams, very low storage capacity</td>
<td>Unique island mountain climate, wetter and cooler than surrounding area</td>
<td>Medium range warming</td>
<td>Pears, fynbos flowers, stone fruit, wheat, citrus, herbs/essential oils, wine grapes, Cape rush</td>
<td>Remains viable as long as farm dams fill up, but changing due to warming</td>
</tr>
<tr>
<td>Swartland</td>
<td>WCWSS large dams, Berg River, farm dams, large storage capacity</td>
<td>More reliable dryland conditions than further north. Winter rains, with cool conditions, hot to very hot in summer</td>
<td>Low to medium range warming</td>
<td>Wheat, wine and table grapes, canola, olives, citrus, vegetables, stone fruit</td>
<td>Remains high but with increasing yield variability</td>
</tr>
<tr>
<td>Tankwa-van Wyksdorp</td>
<td>Medium storage capacity, use of groundwater</td>
<td>Very hot and very dry; cold winter minimum temperature</td>
<td>Medium to high range warming</td>
<td>Wheat, stone fruit, wine grapes</td>
<td>Slowly declining productivity, constrained by heat and water availability</td>
</tr>
</tbody>
</table>
Natural resource use and management

Many of the impacts of climate change on agriculture show strong linkages with the ecological system and the natural resources which provide the means for farming. In the deciduous fruit production areas, the most important factors and threats to consider are water supply and demand by numerous competing users, fire risk, invasive alien plant infestations, and biodiversity loss. All are expected to become worse under climate change.

Land and soils

Arable land in the core deciduous fruit production regions is also intensively utilised for the irrigated production of wine and table grapes, other fruit and vegetable crops. Shifting production to other areas in response to climate change will not be easy and the sector will need to adapt to changing conditions on its existing land ‘footprint’.

Water resources

Water resources are already stressed with low level of assurance for agricultural use. Climate change is likely to increase this stress through increasing evapotranspiration, more variable and very likely reduced rainfall and increasing crop water demand. The probability for increasing rainfall shown by some climate models, particularly for the eastern production areas, means that the future could take on many forms, both positive and negative.

Crop irrigation accounts for a very high proportion of water use in the various deciduous fruit production regions (generally >60% of water supply). For this component of production, water storage and conveyancing capacity and maintenance of infrastructure are essential. The protection and management of high-yielding catchments and flow-regulating wetlands and river banks upstream of farmlands is critical for the optimisation of water flows serving agriculture. Options to increase water supply, such as water conservation and demand management through improved irrigation efficiencies, will also need to be developed.

The fruit production area of the Koue Bokkeveld lies in the upper Olifants catchment where rainfall is higher and stream flows fill the farm dams. Groundwater is extensively used in the Koue Bokkeveld and there exists concern around over-abstraction. The projected reductions in rainfall for the western parts of the province are likely to place increasing pressure on water resources but fruit farming will remain resilient as long as dams fill up.

In the Langkloof region there is a high reliance on a few dams which are not part of an integrated system. Farmers have expressed concern over the water storage situation and favour the development of greater storage capacity, both for increasing the assurance of supply for irrigation and for the control of floods. The future rainfall projections are more uncertain in the eastern parts of the province than in the western parts, and there is a possibility that rainfall may increase in the east.
The highly developed and integrated water supply system for the greater Cape Town area (the Western Cape Water Supply System, WCWSS) provides a reasonable degree of resilience to potential climate change impacts for this main demand centre and the intensive agriculture practiced within its boundaries. Future additional water sources and re-use of water are receiving high levels of attention from water planners. However, water quality in parts of the Berg River and its tributaries is negatively impacted by salinity, sub-standard effluent return flows and runoff from dense urban settlements. There is a risk that irrigation water not complying with the required standards by international export markets will have a very significant economic impact.

**Biodiversity and ecosystems**

Healthy ecosystems connected to working landscapes are the foundation for clean air and water, fertile soil and food production. They provide an immensely valuable role in buffering agriculture from the worst effects of climate variability and climate change, provide opportunities for adaptation, and provide sinks for the absorption of carbon dioxide.

The region contains ecosystems with exceptional biodiversity, some of which is under threat from extensive land transformation. Other threats to ecosystems within or surrounding farmlands include destruction of riverbanks and wetlands, which act as flow regulators and drought buffers. Invasive alien plants and wildfires are expected to become more problematic under climate change, particularly on farms close to the mountains. High fire risk conditions are projected to increase by between 40 % and 300 % from the western to the eastern parts of the province with rising risks to crops, livestock and farming infrastructure.
A climate resilient sector

Responding to climate-related risks involves decision-making in a changing but uncertain world. The agricultural sector of the Western Cape is adapting by responding to the demands posed by current climate variability and extremes in the context of other equally challenging socio-economic drivers and pressures. Irrespective of production system, location or resource status, if producers and their value chain have access to a wider choice of appropriate options, they are able to innovate and improve their practices tailored to their own situation and needs.

In the agricultural sector, technology plays an important part in productive potential and ability to adapt. It includes physical infrastructure, machinery and equipment (hardware) and knowledge and skills (software), as well as the biological technology with which farmers produce.

For deciduous fruit crops in the Western Cape, flexible adaptation approaches such as the use of heat-tolerant fruit types and cultivars, careful soil management, best practice Integrated Pest Management and new technologies such as shade netting, combined with the fertilising effects of rising atmospheric CO₂, could provide some resilience to low levels of warming. However, in the warmest apple production areas, the future will depend on the successful introduction of low chill cultivars with acceptable yield and quality attributes and storage potential.

The greatest threat may arise through malfunctioning water storage infrastructure and irrigation systems, as well as increasing competition from other water users such as growing settlements, particularly in times of drought, which could lead to reductions in water allocations to farms. Innovative solutions such as those being implemented as part of the Berg River Improvement Plan should also be considered as this will reduce the current water quality risk as well as the potential increased water quality risk under future climates. Precision irrigation guided by satellite imaging (‘FruitLook’) has been proven to reduce water use and costs.

In all cases marketing and processing options should be re-evaluated on a continuous basis in order to optimise the opportunities presented by shifts in production and markets.
Energy use and reducing greenhouse gas emissions from agriculture

The generation of electricity and the use of liquid fossil fuels such as diesel leads to greenhouse gas emissions which cause climate change, but energy is an essential input in agricultural production and processing. In the Western Cape the sector is responsible for 2% of energy use and 5% of greenhouse gas emissions, excluding the transport component. Estimates suggest that the livestock sub-sector is accountable for approximately 16% of provincial agricultural emissions (highest contribution from cattle), grains and field crops for 28% (highest contribution from wheat), fruit and wine for 55% (highest contributions from pome fruit and wine grapes) and other commodities for 1%.

The economic competitiveness of the agricultural sector must be maintained and increased. One component of this is to ensure international acceptability of agricultural products from the province by minimising the environmental impact of their production and complying with agreed standards for energy use and emissions.

The ‘carbon footprint’ of pome and stone fruit production, packaging and storage in South Africa is being measured through the Confronting Climate Change (CCC) project. The results show that the largest sources of greenhouse gas emissions are electricity usage (especially for irrigation pumping, packhouse operations and cold storage), the use of nitrogen based fertilisers, diesel usage, and packaging. Measures to reduce emissions include the reduction of electricity consumption through improved efficiencies and switching to renewable (non-fossil) energy sources such as wind or solar, or the more efficient and lower use of nitrogen-based fertilisers. Where organic waste is high, waste-to-energy technologies provide opportunities to generate energy and reduce emissions.
Key actions which farmers can implement

What are key actions deciduous fruit farmers can take to be able to respond effectively to existing climate risks and projected climatic changes? The following priorities were highlighted by the status quo assessment and by farmers attending the stakeholder workshops:

1. **Improved management of water resources** to optimise water use efficiency, reduce water losses in the system, and preserve and restore good water quality. Monitor soil moisture levels and depletion rates carefully and irrigate orchards optimally according to best practice. Register with FruitLook in order to obtain free advice on irrigation scheduling which can increase water use efficiency. Aim to maintain an organic soil cover at all times to retain moisture. Water infrastructure must be well maintained to prevent losses. Catchments and wetlands require conservation and good management – maintain the necessary buffer of unfarmed and undisturbed land between riverbanks / wetlands and the cultivated lands.

2. **Use cultivars and rootstocks best suited to local soil and climatic conditions.** Move towards the choice of lower chill cultivars in areas which do not receive sufficient chilling.

3. **Look after the honeybees** which perform a critical service to farming in this region. Current disease pressures on hives and insufficient forage sources could become worse under the additional stress of climate change. Farmer can actively provide honeybees with additional sources of forage and do everything in their power to help contain the current disease problem.

4. **Install shade netting over orchards** to reduce heat stress and improve fruit quality. Since the research on shade netting for deciduous fruit is still in its infancy, use this technology carefully at first and begin with on-farm trials. Monitor the positive and negative impacts. Discuss this technology with industry researchers and extension personnel in order to optimise the benefits.

5. **Natural hazards and pest and disease outbreaks pose a high risk in some parts of the region and pro-active risk management should be practiced by farmers.** These should include learning from established long-term experience of dealing with droughts, better holistic flood and drought planning by all role players (farmers and government in partnership), greater attention to firebreak management, and accessing the best available weather forecasts for decision making purposes. In the future, the development of early warning systems relating to pests and diseases will be critical.
The energy crisis and climate change are both driving the need for increased efficiencies of energy use and the greater use of renewable energy on-farm. Farmers who need energy for irrigation pumping and maintenance of the cold chain for perishable produce are particularly vulnerable. The use of variable speed pumps and strategic irrigation scheduling can reduce pumping costs (and water use) significantly. Farmers can install photovoltaic systems on the roofs of farm buildings (e.g. sheds, packhouses), or attached to water pumps, to increase reliability of supply, bring down costs, and simultaneously reduce the carbon footprint of the farm operations. In addition, reduce the synthetic nitrogen fertiliser usage, which can be achieved through more precise application as and when the plant needs it, and utilize small scale waste-to-energy technology which could provide an opportunity to both reduce waste-related emissions and reduce the reliance on grid electricity.

Further information on all these responses and opportunities, and others, can be found on the GreenAgri information portal: www.greenagri.org.za
Conclusion and way forward

The Western Cape agriculture sector is faced with numerous difficulties and climate change will exert its influence in the context of multiple interacting drivers and pressure points. It can thus be regarded as a stress multiplier. Agriculture is highly dependent on effective risk management covering economic, environmental and social sustainability.

All farms in the fruit production areas can experience exposure to variable and extreme weather, but some are able to draw on resources and skills to ‘bounce back’ relatively unscathed, whereas others never fully recover and become morbid or fail. Economies of scale and diversification across commodities and agro-climatic zones renders larger farming groups with greater resources much more resilient than small, undiversified and resource-poor farming operations. A shift to more resilient crop types, cultivars and farming systems (climate smart agriculture) can buffer agriculture against some aridification without negatively impacting profitability or jobs.

Nevertheless, there will be ‘winners’ and ‘losers’ and the sector together with government needs to identify the latter and jointly provide support. The SmartAgri project is currently developing the Climate Change Response Framework and Implementation Plan for the province, which will provide the mechanisms for such support. We warmly invite comment on the issues summarised in this brief, and the needs of farmers and other role players in responding to climate change.

Contact us:

To find out more or send comments or questions please visit www.greenagri.org.za.
Publications In This Series

Brief for the Grain and Livestock sector: Swartland and greater West Coast region

Brief for the Grain and Livestock sector: Rûens

Brief for Mixed Farming and Regional Commodities: Little Karoo

Brief for Dairy and other Regional Commodities: Southern Cape

Brief for the Livestock sector: Central Karoo

Brief for the Citrus sector

Brief for the Table Grape sector

Brief for the Deciduous Fruit sector

Brief for the Olive sector

Brief for the Wine sector

Brief for the Honeybush sector

Brief for the Rooibos sector

Brief for the Fynbos Cutflower sector

Brief for the Potato and Vegetable sectors

Brief for the Intensive Livestock sector

Brief for Peri-urban Food Gardens and Food Security