Wine is one of South Africa’s flagship agricultural sectors, with both a long history and a global status. The wine industry has a long value chain within the South African economy, strong heritage and brand value, a global profile and is a significant earner of export revenue. In 2018, South Africa was the ninth country in overall volume production of wine, processing 3.4% of the world’s wine that year. As wine is in specific terroir in the south of the country located on the southern tip of a continent, there are limited opportunities to shift the industry southwards to accommodate a shift in climatic zones. Changing climate is already affecting wine grape production in South Africa, and climate projections anticipate increasingly adverse conditions. Climate models suggest that the coastal regions, in which most of South Africa’s wine is grown, should expect a temperature increase of roughly 1.5°C, while inland regions could be 2-3°C above pre-industrial levels by 2100. Changes in precipitation are difficult to predict in the region due to the influence of varied topography, but run-off from rain is expected to be 10-20% less by 2050, principally due to higher evapotranspiration rates. Grape producers already report an increase in extremely hot days (above 36°C), and shifts in seasonal patterns of temperature, wind and rain. Climate shifts are driving phenological changes and complicating vineyard management. Uneven bud-break in spring due to warmer spells, combined with delayed onset of spring, complicating the timing of the ripening of berries and harvesting of grapes.
Value chain of the wine sector in South Africa

The value chain builds on five main production processes from terroir farming to retail. Each process involves specific activities, which are conducted by direct actors, and engage identified indirect actors.

Main challenges in the sector

The South African wine industry is growing in volume but continues to grapple with issues of labour relations, perceived elite status, international markets and rising input prices. Given these challenges, climate change is an emergent business opportunity for farmers and intermediaries. The figure below illustrates the principles of precision farming (Greencape, 2019).

Changes in the weather that could affect production and operations and related impacts

- Reduced rainfall and insufficient irrigation water during hot summer months, in conjunction with higher temperatures and increasing competition for water, is already affecting grape production in many production areas, and the difficulty is expected to get worse.
- Higher winds and warmer weather, in conjunction with periodic drought conditions, is stressing vines and making them more vulnerable to disease. While producers are adapting to this new reality with one-off dry or hot years, cumulative and dry years place undue stress on vines and lead to declines in production and quality.
- The increasing risk of wildfires for Western Cape agriculture is considered to be linked with changing climate patterns.
- There is industry-wide concern that more frequent dry years will stress vineyards beyond their capacity, and that higher temperatures will make it diﬃcult for acid-sugar ratios long enough into the summer to maintain the high quality of produced wine.

Main climate-related impacts affecting the value chain

- Hotter drier weather reduces yields and quality, and rising input costs due to higher water usage increases production costs. As margins shrink labour employed, contributes to social disruption.
- Wine suffers reputational damage due to “luxury go goods” status and water requirements. Due to longer and more intense periods of drought, water availability is being strongly impacted on the national competition for water is increasing.

Resilience Solutions

Leading resilience solutions: The two leading resilience solutions identified in the BRPM analysis are alley cropping and precision farming.

1. Alley cropping

Description: Alley cropping provides long-term benefits to soil quality, vineyard micro-climate and pest management. It also provides short-term benefits in terms of cash-flow and revenue diversity. Alley cropping on its own is rarely targeted at climate resilience but enhances it in a number of ways.

Alley cropping impacts water management by altering the hydrologic cycle through increased water infiltration. Nutrient cycling and soil quality are impacted as alley crops cycle the nutrients to the surface through plant litter. Reduced soil erosion by wind and water help maintain soil quality, and the leaf canopy of the alley crop can reduce soil evaporation to soil moisture. Pest management can be strengthened through the habitat diversity created by alley crop species. In turn attracts a more diverse set of pests and predators. By supporting biodiversity, and associated populations of natural enemies, pest cycles can be interupted, reducing the need and cost of chemical sprays.

Type of production

The South African wine grape industry is commercial and capital intensive. Almost all grape growers in South Africa are focused on high-quality table and wine grapes, with a large variety of export products from table grapes to raisins, dried table, and sultanas.

3,800 grape wine growers, many of which farm a mix of crops. 43% of which produce under 100 tonnes of grapes p.a. (i.e. boutique farms of less than 30 ha), 37% produce between 100-500, 12% produce between 500-1,000 tonnes and 8% produce between 1,000-5,000 tonnes. There are only 7 producers with an output of over 5,000 tonnes of grapes p.a.

Value chain diagram - Value chain of wine sector in South Africa

BRPM diagram - Value chain of wine sector in South Africa

BRPM analysis - Alley cropping

Resilience contributions: Where effectively applied, it reduces moisture and soil carbon loss and cool vineyards. Alley cropping can provide fodder or pasture and reduce cooling requirements and can be used in fire management and to enhance soil fertility.

Market opportunities: Alley cropping can be applied widely in the wine sector (and fruit and olive cropping can be applied widely in the wine sector). Alley cropping can provide fodder for animals or pasture, reduces cooling requirements, and can be used in fire management and to enhance soil fertility.

BRPM analysis - Alley cropping

Rooter and drier weather reduces yields and quality, and rising input costs due to higher water usage increases production costs. Alley cropping on its own is rarely targeted at climate resilience but enhances it in a number of ways.

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Key sector stakeholders

- Direct actors: Farmers, farm workers, equipment providers, consulting firms, wine cellars and wineries, agents, logistics companies, wine rating companies, wine retailers (local and international), customers, and Fairtrade Foundation.
- Indirect actors: Consultants, financial institutions (banks & insurance) and investors, marketers, research centres, water users associations, labour unions, weather service providers, barrel makers, electricity providers, glass suppliers, government, port authorities, Wine and Agricultural Ethical Trade Association, SA Wine Industry Information and Systems NPC, logistics companies, and advertisers.

BRPM analysis - Alley cropping

The BRPM analysis was undertaken to analyse the different processes involved in the identified leading resilience solutions. A BRPM applied to the crop management process using alley cropping as a resilience solution targeting a climate-resistant wine industry is presented in the table below.

BRPM analysis - Precision farming in the wine sector in South Africa

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BRPM analysis - Precision farming in the wine sector in South Africa

The BRPM analysis was undertaken to analyse the different processes involved in the identified leading resilience solutions. A BRPM applied to the crop management process using precision farming as a resilience solution targeting a climate-resilient wine industry is presented in the table below.
In so doing the system is able to package that provides the farmer with an abundance of information. Utilities Software, a user-friendly software solution, has been providing software and hardware support to the South African agricultural sector for the last 17 years. The Continuous Logging Soil Moisture Probes, developed by DFM, inform farmers of surface temperatures, soil moisture content and temperature. Through continuous soil moisture content logging, farmers are able to prevent over- and under-irrigation, prevent unnecessary crop stress, promote root development and improve fertiliser uptake. This refined management capacity can save electricity and other expensive farming inputs. Reports that soil moisture probes can save up to 50% of irrigation water with no loss of yield are available in the citrus industry, while in irrigated maize production a 30% water saving is possible.

The data collected by the probes are downloaded to the DFM Probe Utilities Software, a user-friendly package that provides the farmer with an abundance of information. In so doing the system is able to prevent over and under watering, enhance root development of vines (or other crops), create the ideal air-water balance in the root zone, prevent unnecessary crop stress, improve fertilizer uptake, optimise salinity management, and manage soil water buffer. DFM has sold 65,000 units, but believes that roughly half the irrigation farmers in the country use some form of soil moisture probe, and accordingly that there is scope for expansion of their product.

Business examples

- **DFM Software solutions** manufactures and markets highly specialised end-user applications for the agricultural industry. DFM has been providing software support and hardware support to the South African agricultural sector for the last 17 years. The Continuous Logging Soil Moisture Probes, developed by DFM, inform farmers of surface temperatures, soil moisture content and temperature. Through continuous soil moisture content logging, farmers are able to prevent over- and under-irrigation, prevent unnecessary crop stress, promote root development and improve fertiliser uptake. This refined management capacity can save electricity and other expensive farming inputs. Reports that soil moisture probes can save up to 50% of irrigation water with no loss of yield are available in the citrus industry, while in irrigated maize production a 30% water saving is possible.

The greatest opportunities in the sector

- **Alley and cover cropping** is one example of an innovation that requires a programmatic roll-out from current levels around one third to full uptake. This would require an estimated 2,000 farms adopting the practice. There is also scope for ensuring that the benefits derived from alley cropping are greater. This would require research that allows farmers to tailor their alley cropping decisions to suit their context.

- **Precision farming** continues to grow in spite of programmes being perceived as expensive. The falling cost of surveillance due to the use of drones is lowering costs and facilitating uptake.

- The current frontier for farmers involves converting the wealth of data gathered by new surveillance technology into improved and implementable farming practices. This is a gap slowly being filled by a new type of agricultural consultants. In addition to farming practices, some consultants are linking the gathered data to markets, quality accreditation bodies and financial institutions.

- There is significant potential for financial institutions, such as credit and insurance providers, to take advantage of the data generated by precision farming solutions. For example, financial institutions could offer incentives for resilience (e.g. reduced premiums or other rewards), and insurers could sponsor the purchase of drones or data analysis software in exchange for access to the gathered data. This would not only allow the farmer to manage resources better, but also permit the financial institution to have greater insight into their client’s viability.

Quotes

“We simply don’t know exactly what to prepare for, but we know we are in trouble (from climate change).”

Michael Back, an experienced Western Cape wine farmer and wine maker

“Aerial surveillance used to be expensive and crude. Drone innovations in recent years have changed that. We can now identify which plant is doing well and which one is not within an orchard or a vineyard.”

Aerial surveillance representative for Yara (fertiliser company)