

Research that fuels economic growth

Stimulating economic growth in South Africa has been a major challenge for both Government and the private sector over the past decade. The fresh produce export industry has shown how innovation-based research is a critical part of the solution to enhancing competitiveness, market access and growth.

Consider, for example, the case of the locally developed avocado cultivar, called 'Maluma'.



'Maluma' avocados have a favourable seed-to-flesh ratio and are characterised by a rough skin that is less easily damaged during harvest, export and ripening.



'Star Ruby' grapefruit, depleted of lycopene, scars easily when chilled. Chilling injury does not damage the fruit itself. However, the marks that are left on the rind of the grapefruit are unattractive, which lowers the price consumers are willing to pay.

Thanks to research that showed how fruit damage could be limited through rapid cooling after harvesting, this avocado cultivar is now being exported in much higher volumes than before. With only 10% less fruit damage, the avocado industry saves more than R3.3 million a year. Improved production and harvesting practices have furthermore led to higher prices for the commodity. Export customers now pay R50 per carton more for better quality fruit, yielding an additional R15 million on 300 000 cartons exported per year. All this for a research investment that cost less than R480 000.

The programme under which this study – and many other such projects – were carried out, is the Post-Harvest Innovation (PHI) Programme. The PHI Programme is an initiative of the Fresh Produce Exporters' Forum (FPEF), and one of seven Sector Innovation Fund (SIF) programmes funded by the National Department of Science and Technology and industry associations.

Research carried out under the PHI Programme focuses on the development and improvement of post-harvest technologies identified by the industry associations, including the Subtropical Growers' Association, Hortgro Science, the Pomegranate Producers' Association of South Africa, South African Table Grape Industry, Citrus Research International, Cape Flora SA, Tomato Growers' Organisation and the Onions Producers' Association.

During its 3rd funding phase (2015 - 2018), the Programme successfully rolled out 41 new projects, ensuring a growing level of innovation in the industry. Export statistics show that fresh fruit exports have consistently grown since 2015 to 2017 from R30.2 billion to R40.5 billion, which amounts to a 34% growth over the two-year period. Linked to these projects, the PHI Programme also increased high level human capacity to support future industry growth, having supported the training of 40 post graduate students and six postdoctoral students related to these projects.



The PHI Programme has entered its fourth phase (PHI-4) in October 2018, having successfully secured R14.9 million from the Sector Innovation Fund of the DST. This funding will be matched jointly by the industry partners.

A project was undertaken that looked into ways to decrease the damage suffered by 'Star Ruby' grapefruit while in cold storage en route from South Africa to export destinations in the USA and the East. Just over R617 000 was spent on the study. Today, five years later and with the study's recommendations implemented, South Africa's exports to the USA, China and South Korea have jumped from 88 704 cartons per year to 1.866 million – a 21-fold increase. Over the same period, the national income from 'Star Ruby' grapefruit exports have increased from R68 million to R323 million per year.

Another powerful example of the bottom-line impact research can have, is found in the pome fruit industry. Superficial scald is a post-harvest physiological disorder that seriously limits the storage life of a number of apple and pear cultivars. It appears in the form of brown or black patches on the skin of the fruit, and although it does not affect taste, it certainly decreases the fruit's value.

The chemical that has been used in South Africa since the 1960s to control superficial scald is now so tightly regulated in the EU that the local industry had to find an alternative solution. A study was designed to test international storage protocols on locally produced cultivars that had to complete long journeys to their export destinations.

Approximately R2 million was invested, resulting in the development of storage protocols that effectively



Top left: 'Star Ruby' grapefruit that grows in full shade develops high levels of lycopene. Above: The presence of lycopene is higher in fruit growing in the shade. Direct sunlight depletes lycopene levels.



Above: Colour charts like these are now being used in pack houses to help make export decisions. Fruit that is completely pink (number 1 on the chart) or more than 80% pink (number 2) can be exported to the USA. Fruit with a 60% to 80% pink cover (numbers 3 and 4 on the chart) can be exported to Japan given that country's shorter cold sterilisation requirement. Fruit that falls in numbers 5 to 8 on the chart, can only be exported to markets that have no cold sterilisation requirements.



Left: Pears with scald and without scald - the difference between pears stored in regular atmosphere versus dynamic controlled atmosphere.



After seven months of storage in regular atmosphere 'Packham's Triumph' pears (top left) and 'Granny Smith' apples (top right) develop severe superficial scald symptoms that only appear once the fruit is taken out of cold storage. However, when applying dynamic controlled atmosphere technologies, these South African grown cultivars suffer no ugly brown and black patches. The fruit has a long shelf life and remain firm and are deliciously tasty and fragrant once ripe.

prevent superficial scald on susceptible apple and pear cultivars. As a result, exports of 'Granny Smith' apples and 'Packham's Triumph' pears to the EU could continue, and increased by 25%, between 2014 and 2017. The value of this continued trade was R3.44 billion. If the new technologies were not available, only 7% 'Packham's Triumph' pears could be exported to the EU, and only about 35% of the current apple exports would have been possible.

Research has proven to be invaluable in the development of new export markets, of which pomegranates are a prime case in point. In the past decade, pomegranates have become one of the few new additions to the South African fruit basket. The industry has seen significant growth since the first commercial plant propagating material was brought in from India, Israel and the USA in the early 2000s.

Touted as a superfood, the market for pomegranates is booming. South Africa competes with countries such as Chile, Australia, Peru and Argentina to supply the off-season demands for pomegranates of consumers in the Northern Hemisphere from March until May. However, exporting these fruits can be a risky business. Fungal diseases, such as black heart disease, can cause post-harvest losses of up to 30% and more, and because external symptoms are seldom visible at harvest, it is virtually impossible to take preventative action.

In the interest of establishing and maintaining a competitive edge in the global market, two PHI Programme-supported studies were done to create a harvest maturity index, an index of post-harvest fungal diseases that compromise export quality and jeopardise market access, and standards for handling, packaging, storage, transport and marketing.

An investment of R823 000 has armed this fledgling industry with substantial new knowledge on production and handling protocols that will enable producers to increase the volume of sellable fruit and its competitiveness among Southern Hemisphere exporting countries. The industry body, POMASA, estimates a benefit of between R20 million and R45 million in the coming season through improved quality and reduced decay incidence.

Grain chinch bug, a phytosanitary pest that occurs only in the Western Cape, has caused many headaches for exporters of citrus, pome and stone fruit. Trying to control this pest in the field is extremely difficult. Even ONE insect can cause whole consignments of export fruit to be rejected.

It is estimated that producers suffer losses of up to R20 million per year due to PPECB rejections of consignments at the pack house alone. This figure does not account for rejections of consignments at the ports and cost of additional treatments and/or redirecting the fruit to another market.

Until a decade or two ago, methyl bromide was the post-harvest fumigant of choice and this bug's only nemesis. But due to environmental issues, the use of this fumigant has been phased out. Pressed to find new solutions, these industries jointly invested R783 212 in two PHI research studies to investigate the efficacy of Vapormate®, a new 'green' post-harvest fumigant.

These two studies set out to generate data towards developing specific protocols for commercial application of Vapormate® to control external phytosanitary pests, such as grain chinch bug, mealybugs, scale insects and Fullers rose beetle on citrus, pome and stone fruit. It also investigated the most effective combination of fumigation with Vapormate® or carbon dioxide and a short cold treatment for the control of fruit fly and false codling moth, both internal phytosanitary pests.

These studies made the registration of Vapormate® technology possible for use by the relevant industries in South Africa. Applying



The SA pomegranate industry suffered an economic loss of about R23 814 000 due to decay problems in $\pm 30\%$ of exported fruit landing in EU market in 2017.

this technology, is both easy and economical. Installation of Vapormate® is estimated to be R300 000 at the most.

The impact of these studies is significant. For example, simply treating citrus, pome and stone fruit with Vapormate® will cut the losses due to PPECB rejections at the pack house alone with



Finding even one grain chinch bug can cause a whole consignment of fruit to be rejected. Using Vapormate® technology can totally eliminate this risk.

about R20 million per season. As mentioned, this figure does not include the prevention of losses occurring in nodes further down the value chain.

In many cases the research has found that fairly simple changes can have far-reaching – and profitable – impacts. The National Development Plan identifies agriculture as one of the critical growth areas in the economy, and the PHI Programme certainly contributes to this imperative.

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