

## **SOUTH AFRICAN LOW CHILL VARIETAL DEVELOPMENT PROGRAMME**

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### **INTRODUCTION**

The production of stone fruit varieties with a low chilling requirement in South Africa are largely restricted to the warmer areas of the Northern Provinces as well as certain micro-climates in the Western and Eastern Cape Provinces of South Africa. South Africa does not have indigenous low chill stone fruit genetic resources and are therefore largely dependent on obtaining foreign genetic resources from our fellow researchers abroad.

For many years South Africa has been excluded from exchanging genetic material of deciduous fruit, especially material with low chilling requirements. This situation has gradually diminished since early 1990 and we were gradually allowed access to some of the older genetic resources of the world. Such acquisitions were only possible through good relationships which were built over a period of time with fellow breeders and researchers abroad. Through these strong relationships we managed to broaden and strengthen our genetic base from which we are operating from.

By means of careful selection of breeding parents and recurrent selection, the ARC Infruitec-Nietvoorbij managed to obtain significant successes. Currently the stone fruit breeding programme of the ARC is comparing favorably to the large number of foreign low chill varieties available to a selected few in South Africa.



**Ruby Sweet**

### **RESEARCH AND DEVELOPMENT**

The ARC stone fruit breeding programme is situated at the Bien Donné Experiment farm in the Simondium area near Paarl, approximately 60 km North-East from Cape Town in the Western Cape Province of South Africa.



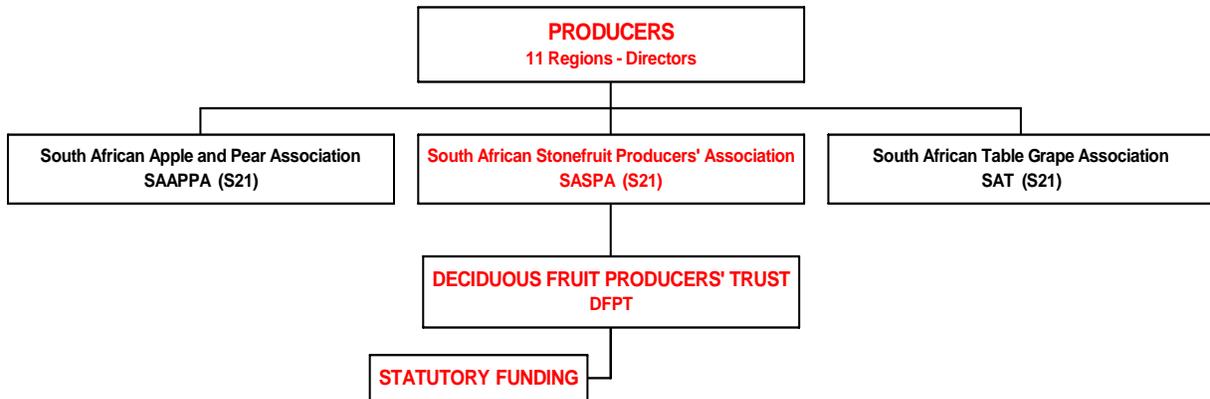
*ARC Bien Donn  Experiment farm*

Simondium is a medium chilling area with average chilling hours of approximately 500-700 (<7.2°C), making the identification process for low chilling varieties with short fruit development periods (FDP) more complicated.

Alpine nectarine (FDP 100 days) released in 1997 also shows significant low chill characteristics and is widely adapted and planted in South Africa. Honey Blush peach (FDP 80 days) also shows the same characteristics and is planted only in the low chill areas (550 hours <7.2°C) of South Africa with the least chance of frost occurrence. Although the Honey Blush peach will produce a commercial crop in the cooler areas, the fruit is smaller, maturing later in the season therefore making it less of a proposition to plant in these areas.

Following on the success of the Honey Blush peach, there are also a number of new plum, apricot, plum, peach and nectarine selections currently in an advance stage of evaluation in the traditional low chilling areas of South Africa. There are currently 8289 new peach and nectarine seedlings spaced 4m x 1m in the ARC phase 1 orchards on Bien Donn  from which new varieties with possible low chill characteristics can be identified. The past 8 years 23 new peach and 106 new nectarine selections were identified harvesting earlier than week 50 on the Bien Donn  Experiment farm in Simondium. Experience have shown us, when these new selections are planted in the traditional low chilling areas, the harvesting periods of many of these new selections will shift back with at least 14 days. Most of these promising, new varieties are harvesting the similar period to or earlier than the standard early maturing commercial varieties available in South Africa.

Fortunately for us, the good relationships our researchers and breeders had with fellow researchers in foreign countries, eventually paid off allowing the ARC to keep up with the "Jones's" of the world, breeding for low chill stone fruit varieties. I personally think the ARC are very close to be on par with our fellow breeders abroad in producing significant numbers of very early maturing, low chill stone fruit varieties. The breeding of low chill stone fruit varieties in South Africa is not a separate breeding programme, but forms an integral part of our national mandate to develop new, unique stone fruit varieties for all of the South African stone fruit industries. The ARC breeding and research objectives are set in cooperation with the Deciduous Fruit Producer's Trust (DFPT) through the South African Stone fruit Producers' Association (SASPA) managed by producers. See structure below.



The traditional method of making crosses between varieties with short FDP and those with FDP's of more than 90 days, had its limitations on the long run. Recently more efforts were put into the development of more precocious, early maturing varieties for the export as well as the local formal and informal markets.

Due to the short FDP's of early maturing, low chilling varieties it was decided to follow the embryo culture technique for germinating seeds of low chilling crosses. As this was not a standard practice for us to germinate stone fruit seeds, it immediately brought about some additional practical problems regarding the sterilization, germination and development of low chilling progenies. Additional research and trial runs needed to be carried out over the past three years to enable us to germinate embryos from parents with low chilling requirements and short FDP's.



*Embryo culture FDP 80 days*

### **ADAPTABILITY**

South Africa has a very broad range of climatic regions and micro climates, allowing producers to plant varieties suitable for low to medium chilling requirements in the same regions, keeping elevation and slopes in consideration. This is not the ideal situation as one would rather follow the basic rule of planting low chilling, early maturing varieties in early ripening areas and *vice versa* for late maturing, traditionally medium to high chilling varieties.



**South Africa provinces**

For the calculation of chilling units, the identification of low chilling sites and the evaluation of low chill varieties, the method of calculating chilling units by means of the Richardson model had its limitations in the warmer South African regions.

Peach varieties with low chilling requirements for instance performs equally well in areas where low or even negative Richardson chilling units are expected. This phenomenon led to the development of the Positive Chilling Units model, known as the Infruitec Chilling Units (ICU) model during 1995 by Gavin Linsley-Noakes (J. S.AFR.SOC. HORT. SCI.4 (1) MAY 1994). With the ICU model the assumption is made that the fixation of chilling units is a physiological process that becomes irreversible after a time laps of 30-39 hours. Although the negative values do have an influence during this fixation period, it will be ignored for the calculation of the ICU. By doing so, the carry-over-effect of negative chilling units is largely eliminated, giving us a more accurate forecast of chilling units in warmer areas. The ICU model was adapted further to a 24 hour instead of 39 hours calculation cycle, without compromising on accuracy. See table below.

#### **COMPARISON BETWEEN INFRUITEC, RICHARDSON AND AUSTRALIAN CHILLING UNITS**

Mth	SIMONDIUM (Acc)				ROBERTSON (Acc)				GROBLERSDAL (Acc)			
	ICU	RCU	<7.3°	ACU	ICU	RCU	<7.3°	ACU	ICU	RCU	<7.3°	ACU
MAY	<b>30</b>	17	22	180	<b>43</b>	3	52	190	<b>31</b>	17	128	229
JUN	<b>248</b>	224	152	560	<b>203</b>	158	198	562	<b>114</b>	99	379	530
JUL	<b>312</b>	280	226	743	<b>283</b>	199	330	746	<b>158</b>	133	556	783

*ICU = Infruitec; RCU = Richardson; <7.3 = Hours below 7,3°C; ACU = Australian Chilling Units*

Considering that only 57 (27 April + 30 May) ICU were received until the end of May during the winter of 2005 at the Bien Donné Experiment farm in Simondium and the promising performance of some new selections, it is therefore expected that the ARC currently have more selections suitable for low chilling conditions than were initially anticipated.

## **OPPORTUNITIES AND PARTNERSHIPS**

The ARC is currently engaged in several evaluation and commercialization partnerships in the world by either doing it themselves or finding partners with whom the ARC have long standing relationships. There is however certain prerequisites to which organization should adhere to before the ARC would engage in any agreements or exchange of genetic materials. Some of these criteria would be:

- a) Effective protection and the control of the intellectual property of the ARC.
- b) Experience and track record of such organization with other breeding programmes.
- c) Financial advantage to the ARC.
- d) Cultivars will be handled individually.
- e) Single channel marketing for effective control.



*ARC Partnerships*

Thank you very much for listening.

## **ACKNOWLEDGEMENTS**

My sincere thanks to the management and the organizing committee of Low Chill Australia (LCA) for inviting me to take part in this conference, as well as the financial contribution made towards my travel to Australia. Please be assured of my hearty appreciation. Thank you very much and hoping to see you soon in South Africa.

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