Lachenalia: Development and Commercialization of a New Flower Bulb Crop

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Abstract

The Roodeplaat Vegetable and Ornamental Institute of the ARC initiated the *Lachenalia* breeding program in 1973. The first potplants were commercially available in 1997. Several problems were encountered that hampered earlier availability of the product in the commercial sector. The problems were largely due to the fact that *Lachenalia* is a novel product. This overview of the program discusses the importance of commercialization as part of the introduction of a new crop. Even after the first hybrids became commercially available, continued inputs from the research team were needed for success. These inputs included continued research in crop production, active technology transfer to growers and the actual establishment of new commercial growers as well as the production of propagation material. The experience gained during this period gave researchers an important insight in the necessary procedures involved in the development of new crops in South Africa.

INTRODUCTION

Lachenalia J. F. Jacq ex Murray (Hyacinthaceae) is a bulbous genus that consists of more than a 100 described species. It is endemic to South Africa (SA) and Namibia and has a distribution throughout the winter rainfall areas of South Africa (Duncan 1996, Dold & Phillipson 1998), with the largest concentration of species in the Western Cape Province. The main reason for selecting this genus in the development of a new crop, was the large phenotypic variation present in the genus. There are three different basic flower forms. The hyacinth (*L. carnosa* Bak., *L. unicolor* Jacq.), the bell shaped flower (*L. aloides* (L.f.) Engl.) and the tubular flower (*L. bulbifera* (Cyrillo) Engl., *L. viridiflora* W.F. Baker). The colors range from reds, oranges, pinks, yellows, purples, greens, whites and even blues.

The breeding program on the genus started in 1973 at the Roodeplaat Vegetable and Ornamental Plant Institute of the Agricultural Research Council (ARC-Roodeplaat) (Lubbinge 1980). The genus has a three-year breeding cycle from seed to flower and once a suitable hybrid has been selected, the hybrid is propagated vegetatively. The main aim of the program is the breeding of new pot plants. This implies specific selection criteria for short, compact plants, acceptable multiplication rates (multiplication is mainly done via leave cuttings), good keeping quality and regular flowering. The commercial grower must also be able to manipulate the flowering time of the crop to produce pot plants throughout the year.

An evaluation of the development path of the program is discussed. The development of the breeding program is reviewed from the start to the present situation and the process is evaluated in terms of our current approach to new product development (Niederwieser, Kleynhans and Hancke, 2000). We conclude with a discussion of the importance of the whole product approach and the involvement of a multi-disciplinary

team in the commercialization of the products of the breeding program.

PHASES OF THE LACHENALIA PROGRAM

The development of the research program has been divided into five phases by Niederwieser et al (1998). The fifth phase is updated to include the latest developments.

Phase I: Establishment of a Genebank and Evaluation of the Breeding Potential (1965-1972)

During the first phase of the breeding program that stretched over a seven year period from 1965-1972 the program consisted of a small genebank. Basic procedures for breeding and genebank maintenance were determined and the first species-species crosses were made. Selections (based on phenotypic appearances) were made and material was supplied to several growers for evaluation. This phase was concluded by the SA Bulb Grower Association's recommendation that hybrids have a commercial potential.

Phase II: Development of Improved Hybrids (1973-1982)

The second phase of the breeding program stretched over a period of nearly 10 years. During this period a large number of crosses were made and superior hybrids were produced. Initial characterization and evaluation work was done and the first problems arose. Growers identified the susceptibility of *Lachenalia* to the *Ornithogalum* mosaic virus. The virus problem was addressed by the initiation of tissue culture propagation for the supply of disease-free stock material to growers. This phase was concluded by the application for Plant Breeders Rights for 5 cultivars.

Phase III: Evaluation of the Commercial Potential (1983-1992)

The approach of the institute during the first three phases of the project was that the bulb growers in SA and The Netherlands had enough expertise to develop suitable cultivation practices. This, however, proved to be a fatal mistake that delayed the commercialization of lachenalia for several years. The extent of this mistake became apparent during phase III.

Local growers experienced problems, because no cultivation information or information on virus control was available. They planted the bulbs in the wrong soil types, used incorrect storage temperatures, fertilization etc. and they did not have the expertise or resources to conduct in-house cultivation trials. These problems were emphasized when the first trials were conducted in Holland. The Dutch applied techniques of well-known winter bulbs such as hyacinth on lachenalia with detrimental results. Conditions in the Northern Hemisphere greatly differs from that in SA and that also had a large effect on the growth habit of the plants. This emphasized the fact that a whole new set of production protocols was needed to commercialize the project. This phase was concluded with a visit to Holland in 1992 by the project leader (the political isolation of South Africa was ended in 1991). Prior to 1991 researchers in South Africa were isolated and networking was difficult.

Nineteen ninety-two is seen as the watershed year for the lachenalia program. Several Dutch breeders emphasized the importance of the whole product approach for new crops. For the successful commercialization of a new crop all the relevant information including production protocols must be available. This led to the realization of the fact that ARC-Roodeplaat had to take a strong lead in not only the actual commercialization of the product but most important the development of the required technology for production and the continuous supply of disease free propagation material.

Phase IV: Revitalizing of the Research Program (1993-1996)

The above-mentioned decision led to the start of a multi disciplinary research program with a large committed team. During this period an average of 250 crosses per year were made. A hybrid evaluation system including all the relevant selection criteria was established, implemented and improved. Several propagation methods were tested

and the basic cultivation requirements were determined. There was a tremendous improvement in potplant production methods. A plant improvement scheme was established which included an in vivo and in vitro production unit at Roodeplaat. Regular working group meetings was held with local growers to exchange the acquired information and technology.

Several actions were also taken for commercialization of lachenalia during this phase. A royalty administration agent (RAI) was appointed to handle the royalty administration in all countries except SA. An agent was appointed as exclusive distribution agent in all countries excluding SA. Ten varieties were protected by plant breeder's rights in The Netherlands. A trade name "Cape Hyacinth" was registered for the lachenalias and a commercial potplant grower was identified in Holland.

Phase V: Commercialization and Smaller Research Program (1997-Present)

A smaller research program and the development of a production system for lachenalia characterized this period. A market study that was conducted in the late 80's estimates the potential market for lachenalia for Europe at 20 million bulbs per annum. Initial trials in the USA were completed and markets such as the East have not yet been targeted. The potential for successful commercialization thus exists. The bottleneck for the sale of large amounts of flowering bulbs, however, lied in the production of these bulbs by commercial growers.

The first actual sale of bulbs started in March 1997 with 20 000 bulbs being sold locally and 50 000 bulbs exported to The Netherlands. A further 150 000 bulbs was exported in 1998, 260 000 in 1999 and 350 000 at the beginning of 2000. Again ARC-Roodeplaat had to take a strong lead in the actual commercial production of lachenalia bulbs during this period. During 1997 and 1998 there was only one commercial grower with exclusive rights to produce lachenalia bulbs. When amounts did not grow as predicted, ARC-Roodeplaat had to identify additional commercial growers.

To convince commercial growers to become involved in the production of *Lachenalia,* researchers needed detailed information in terms of production schedules, infrastructure and financial requirements. During 1998 and 1999 ARC-Roodeplaat spent a considerable amount of time in developing production systems that satisfy the market demand and the commercial grower's requirements.

This led to the development of a production system consisting mainly of three types of commercial growers. Firstly the propagator, who multiplies mother material obtained from ARC-Roodeplaat through leaf cuttings. Secondly the market bulb grower, who grows the small bulblets obtained from leaf cuttings to marketable size and thirdly the commercial potplant grower, who plants the dry bulbs in pots and sell the potted plants to the end-user. Propagators and market bulb producers are in South Africa while the pot plant growers are in the areas where pot plants are marketed.

The development of this production system is seen as one of the most important steps for successful commercialization. With this system in place at commercial growers, the estimated marketable amount for 2001 is 500 000 bulbs, rapidly moving into the millions after that. Due to the small amounts of bulbs sold and resulting small royalty income, the research during this period was limited to certain aspects of crop production and the evaluation of hybrids. Research on cytogenetics and bulb physiology is being done through collaboration with universities. It will, however be necessary to expand the research capacity in the near future as new questions and problems arise from the commercial growers.

To be able to supply new and improved cultivars in the future, crossings have been resumed in the current season. It is expected that the information obtained from the basic cytogenetic research will contribute to a more effective breeding program. The availability of chromosome numbers of species accessions enables the breeder to plan the fertility/sterility of hybrids. Information on the relatedness between and within species contributes to the planning of breeding strategies.

EVALUATION OF THE BREEDING PROGRAM

In our view, the new crop lachenalia should have been available in the market 10 years earlier. Valuable lessons have been learned however, and this experience should contribute to more effective programs to develop new flower bulb crops in South Africa.

Lachenalia was correctly identified as a genus with good potential for new crop development. There is enough variation present within the genus for breeding including large color variation and flower forms. The product was well targeted for the pot plant market in countries in the Northern Hemisphere, as *Lachenalia* species have basic characteristics, which make them suitable for pot plant production. At the time, species were available in the wild and numerous field trips were undertaken to collect accessions for the genebank.

During Phase I of the program, valuable information was obtained on basic aspects of breeding (crossability, pollination, pollen storage, handling of seed, etc) and production (multiplication, bulb storage, susceptibility for virus disease, etc). The SA Bulb Growers Association identified a number of promising hybrids towards the end of this phase. If these hybrids (prototypes) were propagated and produced for the pot plant market at the end of this phase, progress could have been much faster during later phases as the team would have been forced to develop production methods in Phase II.

The breeding during Phase II gave rise to superior hybrids. In fact, all the hybrids that are currently produced, were made during this phase. If the prototypes of Phase I were produced during this phase, production methods would probably have been available for commercial production and commercialization and partners could have been in place towards the beginning of Phase III in the early 1980's. In reality, this work only started in the early 1990's when funding became less available.

The involvement of commercial growers was evident from the start of the program in that a Dutch partner was appointed for commercialization, but a real commitment was not evident. It should be kept in mind that the target market for *Lachenalia* bulbs was Europe and export became increasingly difficult during the 1980's. It was difficult for South African researchers (ARC-Roodeplaat was part of the Department of Agriculture) to cooperate with fellow researchers and companies in Europe. The political isolation together with the fact that production methods were insufficient, probably contributed to the fact that the product was not commercially available in the 1980's. Progress was only really made after Roodeplaat assumed the leading role in production and commercialization. Since agents and producers have been put in place and production and marketing are underway, the institute can concentrate once again on breeding and research.

In conclusion a whole product approach from early on in the development is of great importance for final success. In a world where funding for the development of new products are scarce it is very important to have a prototype of the end product available for marketing as early as possible. In South Africa where our target market will be for export purposes it is also essential to obtain committed partners in targeted countries. Final success does not end with the availability of a superior hybrid, but goes all the way including commercial production and marketing.

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