Cotton
RESEARCH & DEVELOPMENT

Annual, Progress and Final Reports

REPORTS

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **DAN 165C**

Annual Report: ☐ Due 30-September

Progress Report: ☐ Due 31-January

Final Report: ☒ Due 30-September
(or within 3 months of completion of project)

Project Title: Capital Funding - Germination/Plant Growth Cabinets

Project Commencement Date: 1/07/02 **Project Completion Date:** 30/6/03

Research Program: 3 Crop Protection

Part 2 – Contact Details

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Part 3.3 – Final Reports

1. Outline the background to the project.

Weed surveys conducted by Charles (1989), Roberts (1996 unpublished) and Taylor (2002 unpublished) indicate that the majority of weeds affecting cotton production in Australian farming systems are annual and ephemeral species. These species include bladder ketmia, peach vine, caltrop, yellow vine, annual ground cherry and phasey bean. A review of the literature concerning these species reveals that the biology and ecology of the majority of these species is either poorly understood or has not been investigated. The survival strategy for the majority of weed species found in cotton farming systems revolves around their ability to produce large quantities of seed with varying seed dormancy and germination characteristics that enable them to exploit the cotton agro-ecosystem.

To devise better management strategies for these troublesome weeds it is essential for weed scientists to be able to study the biology and ecology of these weeds, in particular, how environmental factors interact with natural genetic variability to influence seed germination and dormancy. A better understanding of how these environmental factors impact seed germination and dormancy will enable growers to introduce more timely control measures.

The three main environmental factors influencing germination and dormancy of buried seed are temperature, light and water availability. As well, a number of other mechanisms influence seed dormancy during seed production, for example temperature and photo-period. As cotton is grown over a range of different geographic and climatic zones in Australia it is likely that the environmental conditions encountered at each of these locations will result in different dormancy states of seed for those species that are common across the geographic regions (eg bladder ketmia).

While it is possible to examine some aspects of the biology and ecology of these weeds in the field, the variability of field conditions and the wide geographical spread of the cotton industry mean that field studies are a very inefficient method of acquiring data. The provision of germination/plant growth cabinets would enable the three weed scientists stationed at the Australian Cotton Research Institute to investigate the seed biology of many of these species more fully. Four cabinets allow treatments to be replicated between cabinets so that treatments will not need to be repeated over time. This will greatly increase the output and efficiency of the cabinets.

Additionally, having two of the germination/plant growth cabinets of sufficient size to allow plants to develop through to maturity will enable scientists to explore the impact of environmental conditions during seed production and examine the effect of environment on herbicide efficacy. The efficacy of the majority of herbicides used in the cotton industry is influenced by temperature, humidity and soil moisture. The two larger cabinets will make it possible to quantify the minimum and optimum spray conditions for the control of specific problem weeds such as nutgrass and polymeria take-all. This will enable the development of clear guidelines for growers providing them with information as to when they can expect good control from herbicides and conversely when control is likely to be poor. This will give an immediate dollar return to growers who will be able to make more informed spray decisions and consequently improve production and sustainability.

In addition to the growth cabinets a position for a dedicated weed ecologist has been established at the Australian Cotton Research Institute. The weed ecologist will rely heavily on the growth cabinets for future research work.

The benefits to the Cotton Industry in providing the germination/growth cabinets are:

1. A greater understanding of the biology and ecology of a number of troublesome weed species that will result in better management and control of those species.

2. A greater understanding of the variation present in different populations of weeds common to a number of localities that will result in more specific management techniques being developed for those species.

3. Specific guidelines on the effect of environmental factors on herbicide efficacy for some of the more troublesome weeds.

2. List the project objectives and the extent to which these have been achieved.

To source and purchase germination and plant growth cabinets enabling weed scientists to evaluate biological and ecological traits of specific problem weeds.

Specific criteria used to select the germination and plant growth cabinets.

- Require 2 seed germination cabinets and 2 plant growth cabinets
- All cabinets need to have temperature and lighting controls
- Plant growth cabinets need to have humidity control in addition to temperature and lighting
- Micro-processor for temperature, lighting and humidity control
- A single supplier needs to be able to provide the cabinets for ease of maintenance and technical support
- Provision of cabinets to be within budget

The germination and plant growth cabinets were purchased through Axyos technologies Brisbane and installed in the plant pathology inoculation room adjacent to the plant growth room (Figures 1-4). Axyos technologies were slightly more expensive for the 300L germination cabinets, however were cheaper overall ($48 400 not including transport and castors) than other supplied quotes. Thermoline L & M Australia were the next closest at $50 590, but could not supply humidity control in the larger cabinets. Extech Equipment Pty. Ltd. could not supply cabinets with a 750L capacity. They could offer either 507L cabinets or 930L cabinets. The 507L cabinets were insufficient for our requirements and the 930L cabinets were priced at $36 362 each, bringing the total cost for the four cabinets to $85 656 exceeding the total funding available and not providing any greater benefits than the Axyos cabinets. Our decision was to purchase the cabinets through Axyos technologies that were within budget and met our specifications.

Figure 1. The 300L seed germination cabinets positioned in the plant pathology innoculation room.

Figure 2. The two 750L plant growth cabinets, installed in the plant pathology inoculation room.

Figure 3. The internal arrangement of the 750L plant growth cabinets showing the variable shelf positions and light arrangements

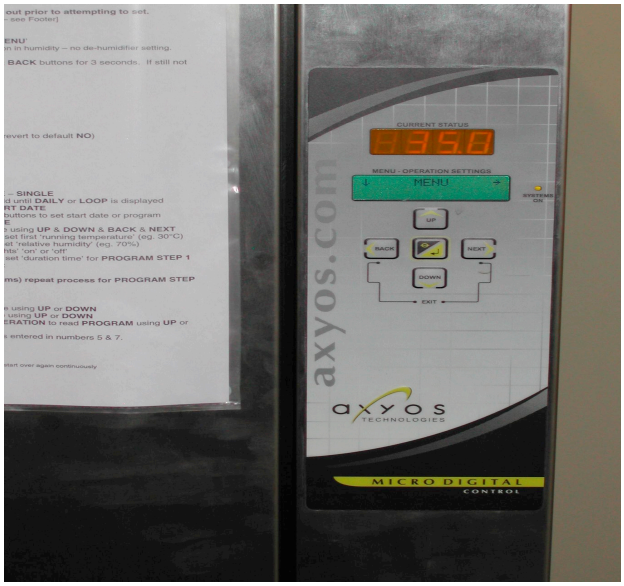

Figure 4. Microprocessor control unit fitted to each of the four cabinets

The temperatures in the growth cabinets were assessed using mini data loggers and temperature sensors to ensure that the processors were accurate and the temperatures displayed on the processor display were true. The temperatures for two of the cabinets are shown as examples in figures 5 and 6.

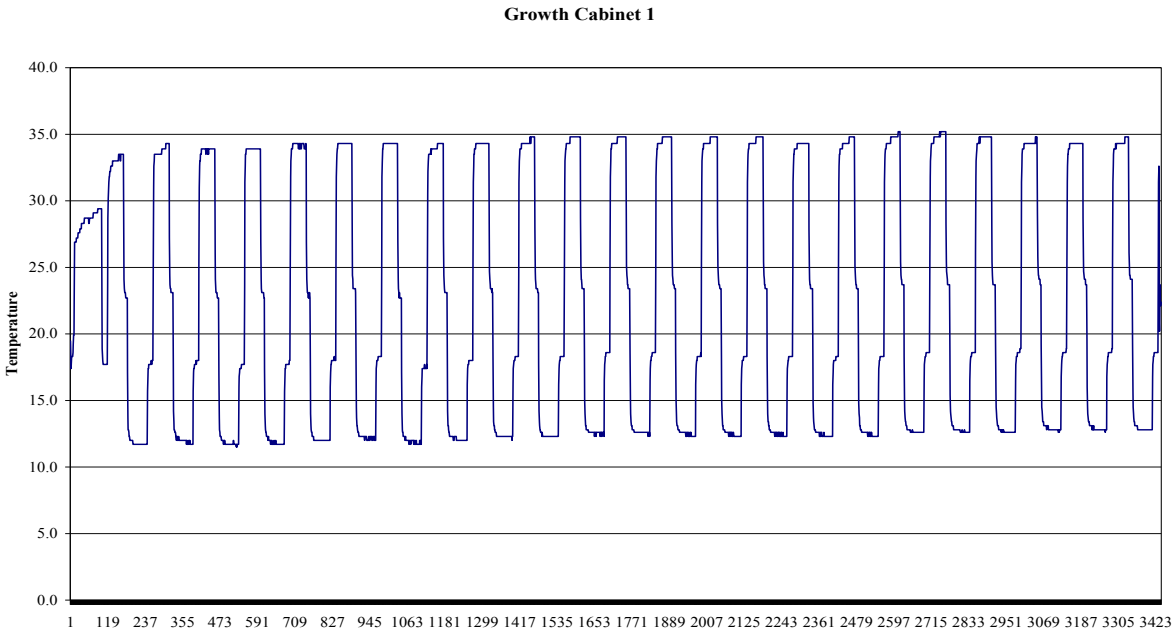

Figure 5. Temperature readings from plant growth cabinet set at 35C day temperature and 15C night temperature.

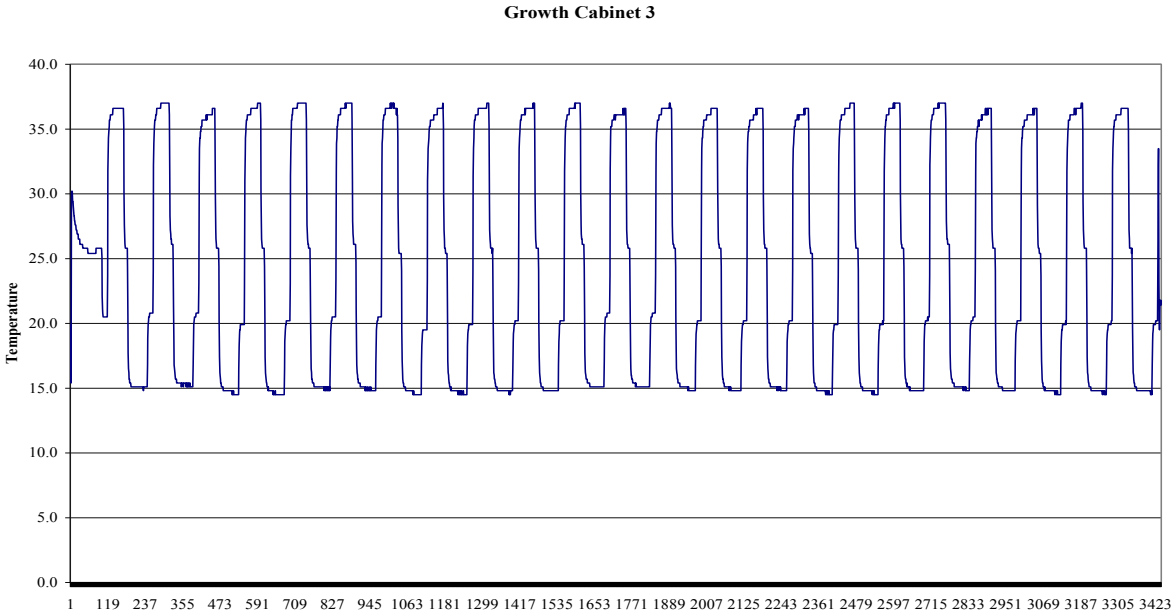

Figure 6. Temperature readings from plant growth cabinet set at 35C day temperature and 15C night temperature.

The cabinets are currently all in operation with a number of researchers and projects and are booked for further work for the duration of the cotton season.