Chapter 7 – Global issues for cotton research and development in northern Australia

7.1. Physical resources

Outside the Ord River, the Daly Basin, and the established cropping areas in north Queensland (Atherton Tableland/MDIA, Lakeland Downs and Lower Burdekin/Bowen areas) soil surveying and land resource assessment is not in sufficient detail for large-scale irrigation development.

The potential water resources of the region are immense. The mandate region for this study includes the Gulf of Carpentaria and the Timor Sea drainage divisions, which account for 43% of Australia's annual surface water run-off. Groundwater resources are also significant. Except for established irrigation areas in Queensland and the Ord River (under review) water resource allocations for larger scale developments have not been made. In many areas there may be insufficient data to calculate these flows. This is because all watercourses are strongly seasonal and there is considerable between and within season variability in stream flow. In many regions the interaction between surface and groundwater systems is poorly understood.

With the exception of some of the established cropping areas in north Queensland the majority of arable soils appear similar. That is red and yellow earths, and poorly drained cracking clays all having low to moderate inherent soil fertility. This implies similar issues for crop nutrition, soil surface management and irrigation distribution systems. Inherent salinity occurs within many areas (e.g., Flinders, Einasleigh and Legune plains).

7.2. Production systems research and development

7.2.1. CROP ADAPTATION

The analyses presented in Chapters 4, 5, and 6 suggest there are three common crop adaptation issues across northern Australia as follows:

1. length of growing season as determined by rainfall pattern and temperature
2. for winter season crops, the lower extreme of adaptation to sub-optimal night temperatures during reproductive growth
3. lack of long-term climatic records in many areas.

7.2.1.1. Length of growing season

A summer dominant rainfall pattern is common to northern Australia but, more importantly, so is high rainfall variability during the seasonal transitions. Temperature determines the length of the growing season and the sowing date required for avoidance of harvest rainfall. Obviously a modelling approach is required to account for climatic variability, although current modelling tools can simulate potential yield and predict the timing of boll opening and harvest maturity, they cannot predict the effect of rainfall or temperature on lint quality.

Research is required to develop relations between fibre quality and rainfall that can be applied to the evaluation of new growing regions.

Trafficability can be a problem on clay-textured soils where rainfall variability has a greater impact on sowing and harvesting operations than on lighter textured soils. Operations research will be required to evaluate options for avoiding the effects of sowing delays through changed cultural operations. In addition, variety duration x sowing date options should also be considered.

7.2.1.2. Crop adaptation to sub-optimal mid season temperatures

The extent of potential winter growing areas and production risks associated with extreme seasons in regions currently trialling winter production requires an understanding of the relationships between minimum temperature and fruit growth, development and retention. The Cotton CRC could facilitate a collaborative research effort to address these questions. This would involve field research at cool locations and links with controlled environment studies conducted by Cotton CRC researchers in southern Australia.

7.2.1.3. Lack of long-term climatic records.

Climatic records are inadequate for some sites (e.g., Marrakai Plains, Lower Fitzroy River, Mitchell River, Bains River). Lack of records can only be addressed by simulating data and/or collection of local data to develop correlations with nearby long-term stations.

7.2.2. Sustainable production systems with minimal chemical usage

This is a very important objective for cotton R&D in northern Australia. Research and development needs, although broadly the same across northern Australia, will require regional tailoring. Obviously the Cotton CRC has a key role in facilitating collaboration among researchers in this area of research.

Common sustainable production research outcomes are as follows:

- integrated pest management strategy
- area wide pest management strategy
- BollgardII™ registration and resistance management strategy
- disease management/prevention strategies (alternaria, cotton rust, fusarium)
- incorporation of physiological understanding of plant compensation from insect damage into insect pest management practices

- irrigation practices and distribution systems that maximise water use efficiency and minimise environmental impacts
- integrated weed management practices that minimise the use of residual herbicides and chemicals with a higher risk to the wider environment
- rotations, covercrops, tillage and soil surface management practices, compatible pest management strategies to maintain soil structure and prevent erosion and run-off
- varieties adapted to the environment and compatible with sustainable management systems.

7.2.2.1. The impact of geographic spread and summer and winter cropping on insect migration

Climatic analysis suggests December/January sowing dates for summer cropping areas in Queensland (e.g., Richmond), and optimal winter sowing dates from late March (north Queensland, Katherine) through to May (Broome). Will insect pests such as resistant *Helicoverpa armigera* migrate from the Emerald area (September sown) to Richmond (January sown) a distance of about 600 km and then on to winter growing areas in Qld, NT, and WA? Insect migration models should be applied to evaluate the insect migration scenarios.

7.3. Regional development and infrastructure issues

Most potential growing areas in northern Australia are undeveloped for irrigated farming. Therefore the timeframe for development is dependent on land and water availability. The Cotton CRC should develop a strategic approach for supporting research in new areas. **There is simply more to do than can possibly be funded by the Cotton CRC.** Some suggestions for a strategic approach to R&D participation by the Cotton CRC in new areas are listed below:

- The Cotton CRC should focus on its strengths, which are skills in sustainable cotton production systems research.
- The Cotton CRC should thoroughly review the likely timetable for land and water surveying and environmental impact assessment for irrigation development before making commitments to production systems R&D.
- A large-scale trial phase is essential and must be included in an R&D plan for any new area. Funding must be available to underwrite infrastructure (e.g., picking equipment, mini gin) and the cost of production at sub-commercial scale.

Land title issues are very important in much of the region described in the Scoping Study and will have a

TABLE 7.1: *A comparison of region specific production systems issues for the 4 sites where the Australian Cotton CRC is currently involved in northern Australia.*

	BROOME	ORIA	KATHERINE - DALY	RICHMOND
Growing Season	May-November	April-October	March-October	December-July
Arable Soil Type	Sandy loam	Cracking clay	Clay loam and sandy clay loam	Cracking clay, some inherent salinity
Irrigation System	Sub surface drip	Furrow	Sub surface drip/Overhead	Furrow
Crop Rotation/ Tillage system	Wet season cover crop + alternative dry season crop. Conservation tillage	Wet season cover crop + alternative dry season crop. Tillage system yet to be determined.	Wet season cover crop + alternative dry season crop. Conservation tillage	Wet season rotation crop. Need for dry season crop and tillage system are yet to be determined
Potential Pests(in addition to Helicoverpa armigeria, H. puntigera, Fusariam and Verticillium)	Nematodes, cotton rust, Altenaria. Others yet to be determined	Mirids, malveaceous weeds, red shouldered leaf beetle, cotton rust, Altenaria. Others yet to be determined	Mirids (brown and green), green vegetable bug, nematodes, cotton rust, Altenaria, annual grass weeds in zero till crops. Others yet to be determined	Yet to be determined
Climatic Issues	Low night temperatures.Impact of relatively low and variable wet season rainfall on cover cropping	Effect of rainfall combined with clay soil on sowing and picking operations Low mid season night temperatures	Relatively high frequency of sub-optimal mid-season night temperatures. Higher rainfall toward crop maturity	Variable within season rainfall, potential for supra optimal temperatures

major bearing on the timeframe for the development of irrigated agriculture (if it occurs). With respect to land with potential to grow cotton, land title is currently being negotiated for agriculture usage in the M2 development of the ORIA, the Katherine/Daly area and in the Broome area.

7.4. Communication

A communication strategy is required and should incorporate interest groups, the general community and within the Cotton CRC. The suggestion of sustainability issues symposium(s) with emphasis on community education in the research and development process should be adopted. However an integrated approach to community consultation/awareness is required and should include local tailoring. The Cotton CRC should instigate an evaluation process to provide a mechanism for internal review of communication methods employed and for the development of new methods.

An objective for the Cotton CRC by the end of its life (5 years hence) would be to have '*community acceptance of cotton farming as an environmentally friendly industry*'.

7.5. Environmentally and politically sensitive areas

There are several areas where cotton farming could be emotive and politcaly sensitive should possibly avoid. These include cotton growing in close proximity to the Great Barrier Reef, damming the Fitzroy River (WA) and cotton farming in near the lower Daly River (NT). Dam development could be a locally sensitive issue and in some cases may have national significance (e.g., Fitzroy River, WA). The Cotton CRC requires a mechanism to assess the sensitivity of areas and potential political issues before committing to support cotton R&D. Direct community or interest group consultation may identify new sensitive or emotive issues in areas where cotton research is currently conducted (e.g., under what conditions would AFANT support cotton in the lower Daly?).

7.6. Staffing

Successful R&D requires qualified and committed staff. There are three main issues with respect to cotton R&D staffing in northern Australia:

- Most local staff lack cotton experience and have had little exposure to cotton farming. Membership of the Cotton CRC can enable training to occur with partner organisations and others in southern Australia. The basing of experienced production agronomists on-site (as at the ORIA and Richmond) will assist farmer collaborators in gaining experience in growing cotton.
- High staff turnover is a characteristic of the more isolated areas of northern Australia.
- Attracting experienced professional staff to isolated areas (geographically and professionally) is very difficult. Employers need to ensure that periods working in isolated locations form part of a career path within their organisations.

7.7. Funding options

The Cotton CRC has a role to assist in finding funds for research and development in addition to the existing sources of funds (i.e. commercial partners, CRDC, government agencies). Possibilities include: ACIAR, and the Federal Government's salinity initiative.