Project Title: Improving the Prediction and Amelioration of Potassium Deficiency in Cotton
Project No: DAN82C

Research Organisation: NSW Agriculture

Principal Researchers: Dr Philip Wright

Telephone: 067 991500

Postal Address: Australian Cotton Research Institute
Myall Vale Mail Run
Narrabri NSW 2390

Summary Report

Introduction:

With improved nitrogen management and continued intensive cropping, premature senescence has the potential to become a limiting step in the production of cotton. Premature senescence occurs in all cotton growing areas of Australia. It is difficult to predict which crops will get the problem and to what extent lint yield and quality will be affected. In some years the problem can be widespread, while in other years it may occur only in small pockets in some valleys.

The symptoms have been associated either with low potassium soils (QLD) or with stress and cool weather superimposed on cotton crops with a high boll load (QLD & NSW). Yield losses caused by this syndrome may be as high as 30% (Harden and Kochman, 1990; Harden, 1992). Further, the impact of this syndrome is not limited to yield as poor potassium nutrition can also down grade fibre quality (Hearn, 1981; Cassman *et al.* 1990; Wright, 1994).

Objectives:

A). To establish the uptake and partitioning patterns of potassium in cotton.
B). To establish the most suitable predictor of deficiency amongst soil, leaf blade, leaf petiole and leaf petiole sap potassium; including the most appropriate potassium test.
C). To establish appropriate methods of within season amelioration of potassium deficiency.

Summary:

The above objectives were addressed with 10 field experiments over three seasons. Further, commercial crops were sampled and symptoms observed in as many commercial crops as possible.

A) The uptake of potassium by current commercially available cultivars is higher than has been reported in the past (as high as 200 kg K ha^{-1}). The partitioning patterns of potassium with the plant was found to differ

between cultivars, with the more susceptible cultivars not storing as much potassium in the leaves as the less susceptible cultivars. It is likely that these differences partly explain differences in susceptibility and provide an avenue for the future breeding of less susceptible lines.

B) The traditional method of sampling petioles to predict potassium status of the crop was found to be inadequate. Leaf blades were a better indicator. However, more work is required to develop a good diagnostic for premature senescence (currently being carried out in DAN107C). The use of hand held potassium selective electrodes (Cardy meter) to measure sap potassium levels was found to be to inaccurate for the range of potassium found in cotton plants and is not an appropriate diagnostic. Soil tests should be used to establish if a site needs to have soil applied potassium (eg potassium levels below 150ppm {or 0.4 meq 100g soil} in the top 30 cm of the soil profile using the ammonium acetate extraction method {or $CaCl_2$ or $BaCl_2$}).

C) For the majority of the industry which is based on soils with high levels of available potassium (>150 ppm) soil applied potassium is not an appropriate management tool. Foliar applied potassium needs more work to determine if it is a suitable method (being tested in DAN107C). Currently the best management option available to growers is the choice of the correct cultivar. Long season cultivars such as Sicala V2 being the least susceptible.

Communication of Results:

Wright, P.R. (1994) "Premature Senescence on High Potassium Soils". In - The Seventh Australian Cotton Conference Proceedings, pp 315-321.

Wright, P.R. (1996) "Premature senescence - Is it a threat to the industry ?". In - The Eighth Australian Cotton Conference Proceedings, pp 443-450.