

## PREMATURE SENESCENCE OF COTTON

Mr G. Harden

Q.D.P.I. Emerald  
PO Box 81 Emerald 4720

Dr J. K. Kochman

Q.D.P.I. Toowoomba  
PO Box 102 Toowoomba 4350

A problem involving leaf death and fall before all bolls are adequately developed, has occurred in cotton growing areas for some years. Early reports of this date back to at least 1981. In November 1988 and again in 1989 the problem was particularly severe in the Emerald irrigation area with growers suggesting yield losses of 25%.

A conspicuous feature of this premature defoliation in most years has been the presence of leaf spot disease caused by the fungi *Alternaria macrospora* and *Alternaria alternata*. These are considered to be serious pathogens of upland cotton only when plants are weakened (Sciunbato and Pinkard, 1972). Observation and circumstantial evidence suggest that plant stress, crop nutrition, soil type, and crop phenology may contribute to the severity of infection and leaf drop.

Apart from field observations there is no information on the cause of defoliation and therefore no known method of alleviating the problem. Hence, during late 1989, we commenced investigations with the following aims: -to define the extent of premature defoliation in cotton growing

areas; to examine the factors associated with premature defoliation and; to determine its effect on cotton yield and quality.

During the 1989-1990 growing season, low humidity and high temperatures in central Queensland provided a poor environment for infection and spore survival. Consequently, the incidence of *Alternaria* leaf spot decreased and yields appeared to benefit. Discoloration of the upper plant was still evident, however, in the locations where leaf drop occurred in previous years. This begins as an interveinal reddening of the upper surface of the terminal leaf then progressively affecting leaves further down the plant. On severely affected leaves these areas became bronzed and finally withered. First signs usually appeared during boll filling with greatest damage occurring where appearance was earliest.

These symptoms closely match those observed in New South Wales where *Alternaria* leaf spot is uncommon and the problem is termed 'premature senescence'. This suggests that leaf spot is not a causal factor in disease but is an opportunistic pest of weakened plants. Leaf spot increases plant damage, but premature senescence is the primary cause of yield loss.

General incidence of senescence appears to have increased in the Emerald district for the 1989-1990 season, while at Biloela and in N.S.W., the level has decreased (Allen.S and Stone.M, pers. comm.). Several possible causes of senescence are being investigated including nutritional disorders, crop development, and infectious diseases.

In the U.S.A. and Africa a similar set of symptoms has been attributed to potassium deficiency and the association with *Alternaria* leaf spot noted (Hillocks and Chinodya, 1989). A survey of plant tissue in affected crops this year correlated symptom progression with loss of mobile nutrients from the upper plant especially K, P and Zn (soil data not yet available). A planned fertiliser field trial, whole plant uptake study, and survey of plants prior to symptom development may clarify the role of nutrition in premature senescence.

The possibility that a pathogenic organism may be involved in weakening plants or restricting nutrient uptake and movement cannot be overlooked. In some fields at Emerald ca 60% of senescent plants suffered from discoloration or rotting of root wood in non-waterlogged areas. Several species of fungi and bacteria have been isolated from roots and tested on seedlings *in vitro*, but these remain to be tested on mature plants. To determine whether soilborne disease is a cause of senescence rather than merely opportunistic, a glasshouse trial is currently growing in pasteurised soil and an untreated control. Further investigations may include searching for viruses and other organisms in affected plants, and the response to preplant soil solarisation and fungicides.

The size and condition of plants at boll filling will also be examined for their effect on the disease. This might be achieved by comparing the effects of various planting dates, fertiliser strategies, and possibly hormonal chemicals such as PIX, on reducing symptom severity in the field.

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