SUMMARY

Disease Surveys.

Commercial cotton (*Gossypium hirsutum* L.) fields in the McIntyre, Gwydir, Namoi and Macquarie valleys of New South Wales were inspected in November and March each season. Commercial fields in the Bourke area were also inspected during March surveys.

The incidence and severity of bacterial blight on Deltapine cultivars has been significantly reduced in recent years. The disease was not observed during the November 1991 survey.

Verticillium wilt was present in a significant proportion of the fields inspected in all areas. The disease was most prevalent in crops in the Namoi valley where it was present in over 90% of crops and where the mean incidence for the last three seasons has been over 25%. The increasing incidence of verticillium wilt in individual fields that have been surveyed on several occasions during the last six seasons is of particular concern.

Seed/seedling losses have varied from 27.5% in the 1991/92 season to 41.2% in 1989/90 with the greatest losses occurring in the Macquarie Valley.

The incidence of Phytophthora boll rot has generally been low although wet conditions in February 1990 resulted in a mean incidence of 2.67% with up to 26% of bolls affected in one crop.

Alternaria leaf spot was rarely observed in New South Wales with the exception of some isolated areas. The disease was regularly observed causing some defoliation late in the season in crops on the property 'Red Mill' north-east of Moree. Low infestations of Alternaria leaf spot are often seen in the Maules Creek area east of Narrabri and the disease was also observed on crops of 'Pima' in the Bourke area in February 1992.

Over recent years and in most gin yards there has been an increasing occurrence of module rot associated with the entry of water into the module - especially around tarp ropes. The seed cotton becomes discoloured and a species of *Coprinus* (the 'inky cap' mushrooms) is often present.

Bacterial Blight

The success of the seed scheme for controlling blight in the Deltapine cultivars has been monitored by testing the level of seed infestation in commercial seed lots and by blight assessments during the disease surveys. The percentage of planting seed infested with the blight pathogen has decreased from 12.0% in 1985/86 to 0.016% in 1990/91. Consequently the mean incidence of blight on seedlings and bolls in commercial cotton crops has been reduced from 10.13% to 0.04% and from 19.56% to 0.29% respectively during the same period. The goal of the 'Blight Investigation Group' was achieved and the disease was not observed at all during the November 1991 survey.

Isolates of the blight pathogen have been collected whenever encountered during the disease surveys of commercial crops. Growth chamber experiments to identify the races of the pathogen have continued to indicate that Race 18 is predominant. No other races have been detected in these studies.

The use of 0.2% 'Pulse' (an organo-silicone surfactant) as an aid to inoculation with bacterial blight was evaluated in the field in December, 1992. The results show that 'Pulse' significantly improved the success of

the inoculation even though applied under adverse environmental conditions. 'Pulse' has since been successfully used to aid inoculation with the blight pathogen in the Deltapine cotton breeding nurseries at Boggabilla.

Verticillium Wilt

The most significant development in the control of verticillium wilt of cotton in Australia has been the release of cultivars with improved resistance to the pathogen. The cultivar 'Sicala V1' has been shown to be significantly more resistant to verticillium wilt than the current commercial cultivars and it yields better than other cultivars when the incidence of verticillium wilt is high.

Six field experiments have so far indicated no consistent or significant advantage of raking and burning for the control of the verticillium wilt pathogen although this failure may be associated with the very high levels of inoculum already present in the soil at those trial sites that were used. It would appear that the pathogen is able to adequately survive in association with the finer crop residues (petioles, leaves, bracts etc.) that are not included in the raking and burning process.

Over 150 potential biocontrol agents have been isolated from the roots of healthy plants growing in areas with a high incidence of verticillium wilt, from cotton soils that appear to be suppressive to the disease and from infested crop debris from a previous season. The efficacy of these organisms is to be compared with that of agents being used in overseas work.

Seedling Diseases

Each year CSD with the co-operation of NSW Agriculture evaluate current and potential seed treatments at the Narrabri Agricultural Research Station. Several biological treatments have also been evaluated in recent years. No treatments have been shown to be consistently superior to the current standard seed treatment.

Hopper-box and in-furrow fungicide treatments have also been evaluated in all three seasons. Despite significant improvements in plant stand there has been no observed yield benefit resulting from the treatments. These experiments were planted early in the season thereby allowing plants time to compensate for reduced stand resulting from seedling disease. None of the experiments had levels of seedling disease which would require replanting.

Black Root Rot

Black root rot caused by *Thielaviopsis basicola* is an important disease of cotton in California where it causes significant yield losses. The disease was first reported in Australia in 1990 at two sites but has since been observed on specimens from a field at Dalby in southern Queensland and on specimens collected from four properties in the Wee Waa area of New South Wales.

Soil samples were collected from 30 commercial fields with a long history of cotton cultivation during November 1990 and assayed for the presence of *T. basicola*. Results showed that the pathogen is not widely distributed in cotton cropping areas. Apart from several fields in the Wee Waa area where the disease is common the distribution of the pathogen in cotton soils is limited. With the exception of the Wee Waa area, the

pathogen was only found in soil from one field in the Macquarie Valley and one field in the McIntyre Valley. The population of *T. basicola* in the soil was low in both of these fields.

On the basis of these results, and considering the situation in California, it is important that the distribution and incidence of black root rot caused by *T. basicola* is monitored. Growers need to be warned that the disease can be spread in soil attached to farm machinery so that the necessary precautions can be taken.

Alternaria Leaf Spot

Several attempts have been made during the last three seasons to artificially generate epidemics of alternaria leaf spot in cotton at the Narrabri Agricultural Research Station. Despite the use of cv. 'Pima' which is very susceptible to the disease, overhead sprinkling, the spreading of diseased leaf material from an infected crop and inoculation with laboratory-grown spores no significant disease development has occurred.

Vesicular Arbuscular Mycorrhiza (VAM)

Very poor early season plant growth resulting from inadequate VAM establishment was observed in crops growing in newly developed fields near Warren, Burren Junction and Cryon in November 1992 and near Brewarrina in early 1989. The elapsed time between the initial clearing and the planting of the crop appears to be an important factor. Affected plants eventually grew rapidly and became rank with delayed maturity.

The elimination of VAM fungi by methyl bromide fumigation resulted in very poor, stunted early season growth in plots at the Narrabri Agricultural Research Station. The stunted plants in the fumigated plots eventually recovered and grew vigorously, becoming taller than plants in unfumigated plots. There was no significant difference in seed cotton yield from fumigated and unfumigated plots sown in early October. However, fumigated plots yielded 23.7% less seed cotton than did unfumigated plots for the early November sowing.

It was noted that cotton plants from fumigated soil in the field at the Narrabri Agricultural Research Station developed symptoms identical to those symptoms present on cotton plants growing in fields near the Galathera Creek. Subsequent studies showed that plants from the Galathera area had low levels of VAM infection.

Fumigation with methyl bromide improved early season growth of cotton on a Galathera site. It is possible that the fumigant removed deleterious rhizosphere microorganisms that inhibit VAM colonisation. Other effects could be due to reductions in specific cotton root pathogens.

Investigations Into Factors Associated With Fibre Damage In Cotton

The 1991 harvest was accompanied by very warm, dry conditions and most cotton was harvested by the middle of May although rainfall during late May, June and July delayed the harvest of some late crops until August.

An extensive study detected many samples with relatively high levels of fibre damage. However, this fibre damage was not accompanied by high pH which therefore suggested a physical cause of the observed damage. A comparison of the incidence of fibre damage in hand-ginned cotton and machine-ginned cotton indicated that the ginning and lint

cleaning processes are responsible for a proportion of the damage that can be observed on fibres. The moisture content of the seed cotton may be a factor in determining the amount of physical damage that may occur. It has been suggested that very dry seed cotton is particularly prone to fibre damage during processing and much of the seed cotton delivered to gins early in the season had < 5% moisture . Problems in distinguishing between physical damage and damage as a result of microbial degradation made it difficult to identify the factors conducive to the development of cavitoma in cotton.

Cavitoma as indicated by the presence of fibre damage and high pH was only detected in lint from some late harvested crops exposed to rain and in lint from modules affected by coprinus module rot. Very high levels of fibre damage occurred when seed cotton in modules was exposed to local flooding and waterlogging, however, pH was found to be 'normal'.

Results of experiments with mini bales and mini modules appear to confirm the expected increase in pH and fibre damage as moisture content is increased. There was difficulty in obtaining and maintaining desired moisture contents within the mini-bales and mini-modules.

Plant Quarantine and Diseases of Cotton

The Australian cotton industry has developed rapidly since the early 1960's when irrigation became available. Bacterial blight, Verticillium wilt and Phytophthora boll rot have caused significant yield reductions but Australian production areas have been kept free of several potentially important plant pathogens which are present in other countries. The pathogens that cause bacterial blight and Verticillium wilt have been present in Australia for many years. More virulent races and strains of these same pathogens have developed in overseas production areas and the introduction of these new races and strains must be prevented. Standard plant quarantine procedures have achieved the level of protection required by the Australian cotton industry with the possible exception of the introduction of races of the bacterial blight pathogen by symptomless epiphytic transfer. The quarantine dilemma is whether to attempt to provide optimum conditions so that the pathogen, if present, can express symptoms in the host and be detected or to provide conditions that will minimise the growth and development of the pathogen and other epiphytic micro-organisms, if present.

The presence of soil and/or plant material on second-hand machinery imported from overseas constitutes a weak link in the effectiveness of quarantine attempts to prevent the introduction of exotic pathogens into Australia. Those involved in bringing second-hand machinery into Australia should ensure thorough cleaning of such equipment prior to importation. The inspection of this machinery by Quarantine officers also needs to be thorough and the efficacy and feasibility of fumigation could be considered.