BACTERIAL BLIGHT - OUR PAST EXPERIENCE

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Bacterial blight of cotton is a major disease in most cotton growing countries of the world. It was first recorded in Australia in 1923 in Queensland and since then has been present in most crops in varying degrees of severity. This disease is caused by the bacterium *Xanthomonas campestris* pv. *malvacearum*.

Disease Symptoms. The disease attacks all aerial parts of the plant. Leaf spots are at first angular and greasy and then darken to a purplish black colour. Veins are frequently banded by diseased tissue causing large segments of the leaf to yellow and die. Severe leaf infection results in leaf drop. The pathogen can invade the stem via the leaf base or directly which results in the black arm symptom. Flowers and bracts are also attacked. Infection of the boll can occur at any site but when the base of the boll is invaded they either drop or fail to open. Boll spots are sites of invasion by other boll rotting organisms.

Survival of the pathogen. The bacterium is known to survive in dry leaf tissue in the laboratory for seven years but when infected leaf trash is buried the viability of the pathogen declines as the leaf tissue breaks down. However, it will survive until all the plant debris disintegrates on the soil surface. The bacterium free of debris does not survive in the soil for any length of time.

X. campestris pv. *malvacearum* is borne externally and internally in the seed. Seed treatment such as acid delinting destroys most of the externally borne bacteria but does not kill bacteria under the seed coat and in the embryo. Although the bacterium remains dormant in the seed until germination its viability declines over time. It also survives on the lint.

Epidemiology. The bacterium is introduced into the crop on the seed. Another primary source of inoculum is debris on the soil surface. Research in New South Wales and Queensland showed that in recent years seed transmission from acid delinted seed has been around 4%. The high level of seed transmission is a result of severe bacterial blight in seed crops and the possible infestation of seed from contaminated gins. Clean seed is contaminated by *X. campestris* pv. *malvacearum* when ginned following infested seed or by contact with infested gin dust.

Investigations have shown that plant debris under our present system of cultivation seems unimportant compared to infested seed as a source of primary inoculum.

A rapid build up of inoculum occurs in the crop following outbreaks of seedling blight and the organism is spread to other plants by rain drops or carried by wind driven rain. It has been stated that driving rain can spread the pathogen for 250 m (Davies and Sandidge 1977). The bacterium is carried in irrigation water. Leaf infection occurs via natural openings (stomata) in the presence of free moisture and when stomates are open. However, the bacterium also enters through wounds. Boll infection occurs either from infection sites on other parts of the same plant or from sites elsewhere in the crops or other crops.

Environmental Factors. Bacterial blight develops most rapidly at temperatures above 28°C. Research has shown there is a significant delay in symptom expression as the temperature drops particularly at temperatures of 20°C and below. Apparently seedling blight occurs within a specific temperature range. It has been reported the most severe seedling blight occurs between 21-26°C and declines as soil temperatures increase or decrease from this range (Massey, 1927; 1929).

Yield. Yield reduction due to *X. campestris* pv. *malvacearum* is difficult to determine and it varies from planting to planting and year to year. Data indicate that yield losses in the last few years have been greater in New South Wales than in Queensland. Losses from boll infection have varied from 1%-20% in individual plantings. However, no figure has been placed on the reduction caused by mid crop losses following severe leaf drop. These losses may have been underestimated. Regardless of the type of damage it has become apparent that bacterial blight plays a significant role in yield reduction in most cotton crops.

Races. Until recently 18 races of *X. campestris* pv. *malvacearum* had been recorded. However, race 19 was identified in Brazil and three others are suspected to be present in the Upper Volta and

Sudan. In Australia races 1, 3, 7, 10 and 18 have been identified and every effort is being made to prevent the entry of the new races.

Control. All commercial seed is acid delinted which reduces the level of seed infestation of *X. campestris* pv. *malvacearum* and so reduces seed transmission. Although this seed treatment does not eradicate the pathogen from the seed it helps to delay the development of epiphytotics.

In Australia there is no effective chemical control of the disease in commercial plantings. However, South Africans have found that KNO_3 sprays reduce the level of bacterial blight. The efficacy of such a compound needs to be evaluated. Bacterial blight is best controlled by planting resistant varieties.

The resistant variety Siokra has recently been released to the Australian industry but the growing of this variety in association with susceptible varieties places pressure on the genes for resistance thus providing conditions for the development of a new race. While susceptible and resistant varieties are grown in close association, it is essential that the sources of primary inoculum introduced into the crop be eliminated or minimised. Industry has recognised the urgency of reducing the level of seed transmission and has set up the "Blight Investigation Group" to investigate the feasibility of a clean seed scheme. The objective is to reduce the level of the pathogen in seed to 0.03% in five years.

Factors influencing outbreaks of bacterial blight. Over the last four years the level of seed infestation has built up due to severe epiphytotics in seed crops. Our research showed that the higher the inoculum concentration the more rapid the development of epiphytotics. Increased severity of bacterial blight has resulted from the compounding of the following factors, a high level of seed transmission, environmental factors favouring infection and disease development and growing of susceptible varieties. Californian research (Schnathorst, 1964) demonstrated that contamination of gins resulting from ginning infested seed increased the level of seed transmission. Dr S. Allen (Pers. Comm.) demonstrated the presence of the pathogen on gin blades and in dust in New South Wales.

California has been able to eliminate bacterial blight by producing clean seed, decontaminating the gins and strictly controlling the entry of infested seed (Schnathorst, 1969). I am sure that the Australian industry, by eliminating or at least minimising seed transmission, will achieve the situation where bacterial blight is a problem of the past.

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