Crop rotation can reduce black root rot severity in cotton crop

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Black root rot of cotton has been observed in most farms in the Macquarie, Namoi, Gwydir and Macintyre valleys. It is causing high yield losses in the cooler areas where continuous cultivation of cotton is followed. The disease develops over time when the fungus *T. basicola* is present in adequate amount where cotton is grown in the environment favorable for infection. There are various management options including crop rotation that when integrated can reduce the disease severity to a large extent.

Recent drought conditions and water constraints are compelling growers to reschedule cropping sequences on cotton farms. In light of these constraints, it is possible that many growers would be planning to adopt rotation with low water requiring crops. In such a situation, it would be worth trying crops, which can reduce *T.basicola* spore population and disease severity.

Most winter legumes are known to be host for *T. basicola* and cotton growers should avoid planting these crops in severely infested fields. Summer legumes are also host for the pathogen but can escape infection if planted late in the season when warm climatic conditions prevail.

Cereal crops are not host for the black root rot causing fungus and in rotation with cotton will not increase the disease severity. However, rotation with cereal for a single season will not decrease the pathogen population enough to reduce disease severity in the following cotton crop. This is mainly because resting spores close to the roots of cotton can infect and produce microconidia for secondary infection within 2.5 days (Linderman & Toussoun, 1968), therefore infection may soon reach the level that would occur under continuous cotton growing. In preliminary research, the population of *T. basicola* in a severely infested field was reduced dramatically by three consecutive years of wheat whereas, single rotation had no effect. The disease severity was very low in three years continuous wheat even after

following two years of continuous cotton (fig.1). However, it is not yet known whether the effect is similar for all soil types.

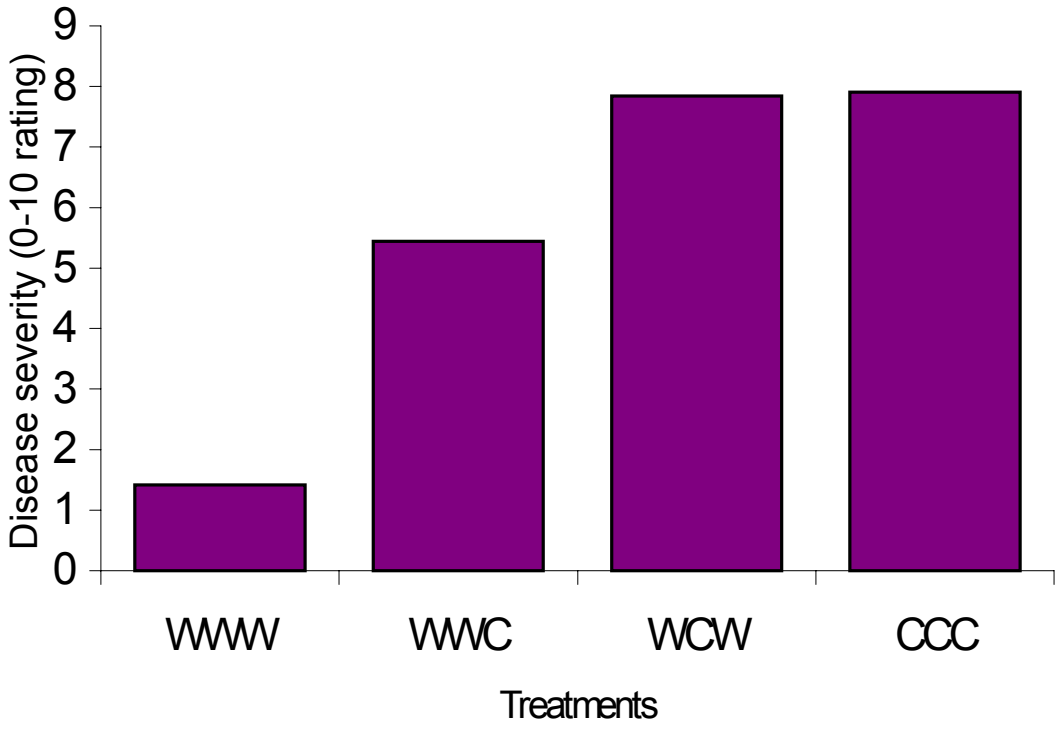

Fig.1. Cotton rotated with three years of continuous wheat has significantly low disease severity in second year of continuous cotton. Treatments included three years wheat (WWW), two years wheat and one year cotton (WWC), wheat and cotton in alternate years (WCW). These treatments were followed by two years continuous cotton.

Biofumigation involves growing crops that release substances that are toxic to the pathogen. These crops are incorporated into soil and produce volatile substances that either kill or suppress the fungus. Canola, vetch or mustard can be used as biofumigants for *T. basicola*.

Mustard and canola release isothiocyanates that may decrease the population of soilborne pathogens. When vetch is incorporated into soil, its breakdown can release ammonia levels

sufficient to kill *T. basicola* while it also provides nitrogen to the subsequent cotton crop. In a preliminary study on one-year rotation with canola followed by vetch, *T basicola* spore population was reduced to very low level (fig. 2).

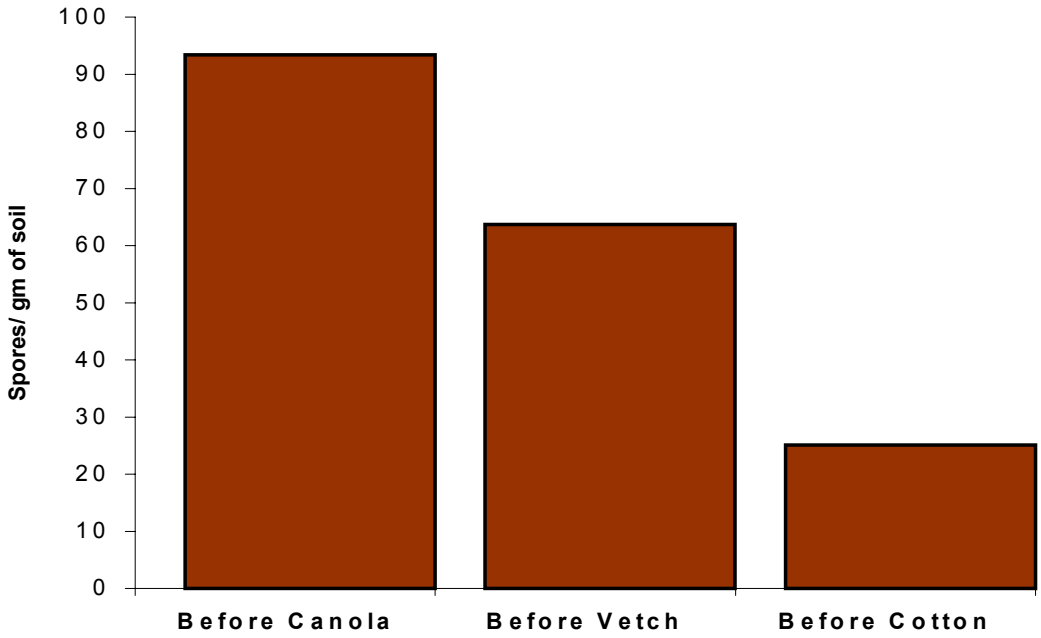

Fig.2. Rotation with canola followed by vetch biofumigation has reduced T. basicola spore population.

Growing rotation crops like canola that also have biofumigation effect followed by cereal crop would additionally increase the time that the remaining spores of *T. basicola* would have to survive until the next cotton crop and provide good soil structure and microbial diversity in addition to economic yield. Growing biofumigation crops for two years followed by a winter cover crop in a severely infested field may reduce *T. basicola* population to a large extent.

Solarization using polyethylene sheets (Allen & Lonergan, 2000) can also reduce the spore population. Clear polyethylene during daytime can increase the soil temperature up to 10 °C. There is biodegradable polyethylene available in the market that would be easy to handle.

When applied in conjugation with incorporation of biofumigation crops can accelerate anaerobic reactions producing gases that may be toxic to the pathogen. This practice can be adopted in the fields where growers do not want long-term rotation. This technique has been tried elsewhere for other crops; however, the polyethene sheets are expensive and needs testing for its feasibility and affordability to control *T. basicola* in Australian conditions.

Adopting these practices in coming winter season would certainly be a step towards reduced black root rot severity that can lead to increased cotton production with additional income from rotation crops.

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Reference

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