‘Sick Crops’ in the Southern Mallee in 1995

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Why are there so many ‘sick crops’ in the Victorian Southern Mallee in 1995?
A wet, cold and overcast July resulted in many wheat crops, throughout the southern Mallee, looking extremely poor. On casual inspection, it became clear that there were reasons other than the cold weather making crops look ‘sick’. A project initiated by the Birchip Cropping Demonstration Sites, identified the reasons for the poor crops and found that:

1. colder and wetter conditions than average resulted in slow crop growth
2. many crops were sown deeper than the optimum depth
3. a long wet period with quite severe waterlogging following emergence caused crop stress
4. during the long wet period, many crops were nitrogen deficient. (The benefits of topdressing urea can now be seen at several sites which were topdressed with 30 kg/ha of nitrogen.)
5. Yellow leaf spot was carried over on cereal stubble and all crops recorded a low level of this disease
6. CCN (eelworm) was found on the majority of crops, with the most severe infestations on those paddocks which, in 1993, had Schooner or Weeah barley; or were in pasture which was not winter cleaned (ie. grasses were not removed in July/August of 1993)
7. fertility levels were low in many crops. Zinc levels were chronically low. Whether this was due to a lack of the nutrient in the soil or to the CCN knotting the roots so that the crop could not take up the required nutrients is not known. Low phosphorus and sulphur levels in the crops were also found.
8. low levels of Rhizoctonia (bare patch) were found at several sites. Low levels of zinc can increase the severity of Rhizoctonia.
9. some of the crops recovered and yields obtained were relatively very good

Introduction
In July 1995, it became evident that many wheat crops in the southern Mallee were performing very poorly. Growth was slow and many crops appeared stunted and yellow. Weather in June and July was cold and wet for prolonged periods. However, many crops which were withstanding the adverse climatic conditions appeared to be growing well. Cereal Cyst Nematode (CCN or eelworm) appeared to be causing problems in some crops but neither the extent nor the severity of the disease was known. Some other crops, which looked poor, did not, on first investigation, appear to be infested with eelworm.

The Birchip Cropping Demonstration Sites group decided to diagnose the problems of these wheat crops and initiated a project to investigate the ‘Sick Crops’ syndrome. In early August, twenty paddocks were inspected. We obtained a three year history from the owner, took wheat tissue samples for nutrient analysis, and dug up plants with roots attached for a disease assessment. We also looked at sowing depth, use of herbicides in 1994 and 1995, sowing date, variety sown, extent of waterlogging etc.

This report outlines all our findings and makes suggestions on management practices which will reduce the likelihood of similar problems occurring in future years.

Growing Conditions
The season began early with good opening rains in late April. Above average rainfall was recorded during May, June and July (Figure 1). Waterlogged, soggy crops were widespread. In many paddocks, wheat growing around crabholes started to die. It was cold, and temperatures were below average (Figure 2). The cold and wet conditions also meant that the days were overcast during June and July and daily hours of sunshine were well down on average (Figure 3).

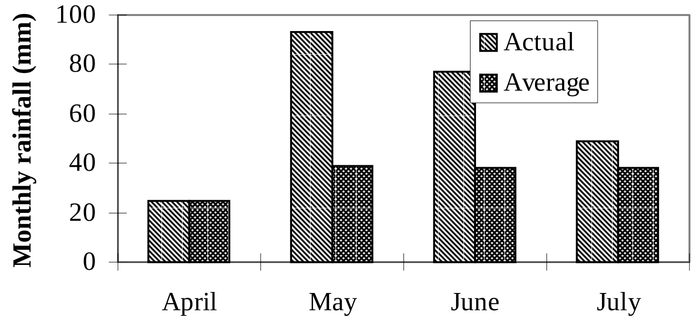

Figure 1. Monthly rainfall (actual '95 and average) for Birchip

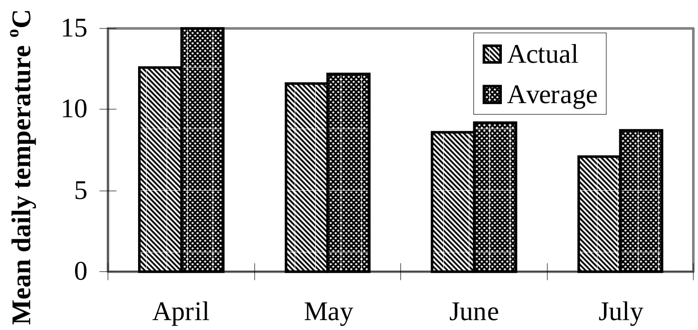

Figure 2. Mean daily temperatures (actual '95 and average) for Warracknabeal

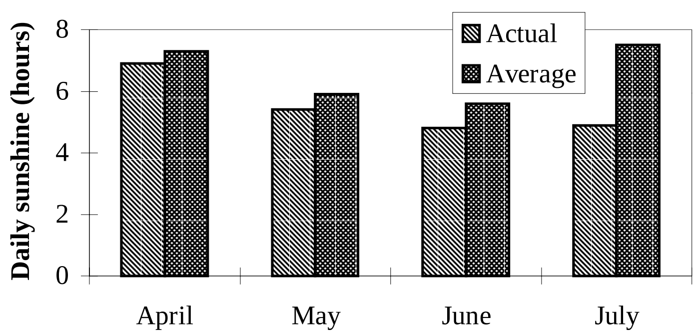

Figure 3. Mean daily sunshine hours (actual '95 and average) for Mildura

The wet, cold and overcast conditions resulted in slow germination and crops did not grow well in waterlogged soils. Overall, crop vigour was down. Crops remained green only on those paddocks with better soil structure. On most paddocks, yellow patches appeared in late June and July.

Paddock History

1994 was a drought year with very little crop growth. Most of the paddocks were in a break crop (vetch, peas or medic pasture) in 1994. During the drought, grass weeds and volunteer cereals did not grow well and by September most of the paddocks were clean of grass weeds. In 1993, 16 out of the 20 paddocks were in a CCN susceptible crop (Meering wheat or Schooner barley). Three other paddocks were in medic pasture, in which grasses were not removed during the winter period. Only one paddock was in a resistant cereal (Galleon barley).

Crop Disease Levels in 1994

Cereal Cyst Nematode was found in all paddocks. Several paddocks were severely affected with CCN, and had average severity score on the plants of 3 (out of 5).

Three paddocks were soil tested for CCN (Sironem test), and readings were low (readings of less than 1.5). Two of these paddocks had CCN scores of 2. The difference in CCN levels reported between the soil bioassay and the crop could be due to sampling errors.

The paddocks with the worst CCN (score of 3 or higher) were sown to malting barley or were in pasture from which the grasses had not been cleaned over winter. The paddock which was in Galleon barley in 1993 still had quite a high level of CCN infestation this year. This particular paddock was in wheat in 1992, and it is likely that the CCN numbers built up in that year.

Yellow leaf spot was quite common early in the season and all paddocks showed low levels of the disease. Yellow leaf spot rarely causes major problems. Rhizoctonia (bare patch) and Take-all were also found in quite a few of the paddocks, but root damage was generally very low.

Nutrient Status

Zinc was found to be low in most of the paddocks. Whether this was due to the CCN causing root knotting and thereby restricting the uptake of nutrients, or whether the availability of zinc is chronically low cannot be determined in this study.

Some crop samples were also very low in phosphorus and sulphur. This may have been aggravated by the infestation of eelworm shortening the roots.

Boron levels were not considered to be near the toxic level.

The NIR (Near Infra-red Reflectance) procedure was used to determine the nitrogen and fructan contents for each crop. About half of the crops were low in nitrogen, indicating a stress on crop development.

The fructan percentage is the level of sugar in the plant which, in relation to the nitrogen level, indicates the stress level of the crop. Fructan levels are often reported as high in relation to the nitrogen content when the crop is stressed either by a lack of a nutrient or because the crop is waterlogged. Unfortunately, the NIR-Fructan reading did not pick up a stress such as CCN. Several of the paddocks with a high CCN score did not have a high fructan reading in relation to the nitrogen status of the crop.

Management in 1995

Most of the wheat crops sown were Meering and all paddocks, except for one, were sown in May. Establishment (seedling number per square metre) was very poor in some paddocks. The optimum number of seedlings is between 150 to 200 plants per square metre. Of even greater concern was the low stem number for many of the crops. For optimum yield potential, a wheat crop needs 500 to 600 stems at the end of tillering (average of three to four tillers per plant). Many of the crops had only a single stem or one tiller and had stem numbers below 200 stems per square metre. Quite a few of these crops had not yet reached the end of tillering and new tillers may still form on the development of the secondary roots.

Many of the crops had been sown at a depth greater than is optimum for the variety. Meering has only a moderately long coleoptile (growing shoot of 65 mm). Deep sown crops took some time to emerge and the time of emergence co-incided with cold and wet conditions, Yellow leaf spot and CCN. We noticed that, within the one paddock, the deeper sown plants had a greater incidence of CCN.

It is more than likely that a combination of stresses induced by deep sowing (resulting in weak seedlings), CCN infestation and Yellow leaf spot all contributed to poor crops.

A broad range of herbicides was used in 1994 and 1995 and there was no direct relationship between herbicide use and poor crops.

The wet and cold conditions, together with disease and the effect of deep sowing, slowed crop growth to such an extent that in some paddocks the crop was approximately 10 to 14 days behind normal development.

Yield in 1995

After harvest the yields achieved in the paddocks were rated by the CCN count. In Figure 4 the paddock yield, expressed as a Water Use Efficiency, is expressed with the CCN count observed during the season. WUE of the crop rather than yield was used because with using WUE there is no effect due to the differing rainfall observed between the paddocks sampled.

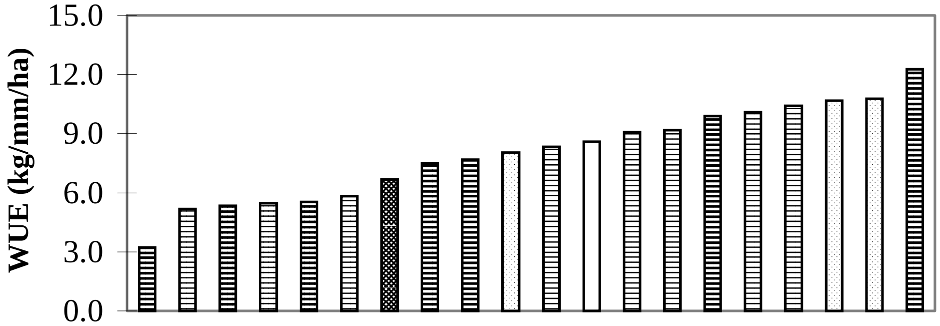

Figure 4. WUE (kg/mm/ha) of the twenty paddocks observed for CCN in August (each bar represents one paddock). The CCN intensity increases with darker shading of the bars.

The yields obtained were not related to the severity of CCN observed in the crop in August. This could be due to the very good finish to the season with excellent rains in October, and even short rooted crops managed to finish reasonable well. In addition, some of the better yielding paddocks were topdressed with Urea quite late in the season and these paddocks also recovered from the eelworm attack.

Management Implications for 1996 and 1997

1. The impact of CCN this year will be with us for quite a few years. CCN numbers in crops affected this year will build up into very large numbers. A minimum of two years of break crops will be required to reduce the CCN infestation to manageable levels. CCN numbers in years with grass free pastures, grain legume crops or oilseeds are reduced by around 80% per year, depending on the season (range of decrease is between 60 and 90%). Paddocks with a CCN level of 2 or more this year will need to be kept grass free until 1998, when it will be relatively ‘safe’ to grow a susceptible crop. During the break years the greatest culprits in multiplying CCN are the susceptible cereals (eg. Meering wheat, Schooner barley) and wild oats, whilst the resistant cereals and brome and ryegrass tend to keep the disease at a constant level.

   Management implication 1. Options for CCN infested paddocks are:
   - **to complete a two year grass free break with oilseeds, grain or pasture legumes**
   - **to try a one year break from a cereal, check CCN level with a soil bio-assay in 1997; if low then follow with a resistant and tolerant CCN cereal; if the bio-assay readings are high then plant another break crop.**

2. CCN is very common in cereal crops this year. All Schooner barley and wheat crops (ie. all susceptible cereals), <u>even those not showing visual symptoms</u>, should be checked for CCN on the roots. CCN numbers are likely to build up to very large numbers, and the rotation will need to be managed otherwise problems with CCN will arise in 1996 or 1997 on susceptible crops.

Management implication 2. All wheat and Schooner barley paddocks should be checked for root diseases this year. These records will be invaluable when working out rotations in future years.

3. Sowing depth is critical. Sowing wheat with a short coleoptile (growing shoot) too deep will reduce crop vigour. In some years the crop will recover, but in years such as this year, when emergence co-incides with stresses from diseases such as Yellow leaf spot and prolonged adverse weather conditions, crops do not recover. Weak seedlings are very susceptible to diseases.

   Management implication 3. Sow wheat shallow, especially varieties such as Meering which should not be sown deeper than 40 mm. This also means that the use of trifluralin and some seed dressings must be very carefully considered.

4. Fertility levels (especially phosphorus, nitrogen, zinc and sulphur) were below adequate for many of the crops sampled. Whether this was due to the crops being affected by CCN and therefore not being able to take up sufficient nutrients is not known.

   Management implication 4. Paddocks low in zinc, sulphur and phosphorus should be tissue tested again in 1996. If the crop is low again in 1996 then adjust fertiliser requirements accordingly.

Other Considerations

In the northern wheat belt (northern NSW and southern Queensland) poor crop growth has often been reported following long periods of fallow or after a prolonged drought (termed Long Fallow Disorder). The symptoms of poor growth have been attributed to a lack of Vasicular-Arbuscular-Mycorrhizal fungi (VAM) on the roots of wheat plants following a long dry period (or fallow). VAM associated with the roots of cereals assists with the uptake, by the cereals, of nutrients such as phosphorus and zinc. Whether a lack of VAM contributed to poor crops in the southern Mallee following the drought in 1994 is not known, but must be considered as a possibility.