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Farmnote

Potassium deficient barley is more susceptible to powdery mildew disease

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Summary:

- ∇ Barley grown on potassium (K) deficient soil (Colwell K< 50 ppm) is more susceptible to powdery mildew.
- ∇ Trials conducted from 2002 to 2004 in the south coast of WA revealed that application of K fertilizer decreased powdery mildew and increased grain yield in potassium deficient (responsive) soils.
- ∇ Reduction in powdery mildew was greater with a chloride source of K fertilizer (potassium chloride or muriate of potash) compared to sulfate source of fertilizer (potassium sulphate or sulfate of potash).
- ∇ A management package for powdery mildew includes an application of K fertiliser in K marginal soil coupled with fungicide protection.

Introduction

Most soil in south western region of Western Australia (WA) are sandy soils where barley (*Hordeum valgarae* L.) is grown as a major crop annually. About 75% of the soils are sandy and have recently become K deficient for cereal and canola crops due to removal of K in hay and grain. In many of these soils it is now profitable to apply K fertiliser to cereal crops. Soils commonly deficient in K include deep sand (> 40cm), up to 40 cm sand over loam or clay.

Leaf diseases such as powdery mildew in barley crops in the region have increased in recent years due to growing susceptible barley varieties in disease prone environments particularly in the medium (greater than 350 to 450 mm annual average) to high (greater than 450 annual average rainfall) rainfall regions of WA.

Role of potassium in plants

Potassium affects the metabolism processes in plants and in K deficient plants soluble nitrogen compounds and sugars accumulate and are sources of nutrients and energy for diseases. Adequate K nutrition increases cell wall strength, cuticle thickness and increases the production of phenols that are important for diseases resistance in plants. As stomata are open longer in K deficient plants the chances of disease entry to the leaf tissue is increased. K functions within the plant have an important role in determining the improved resistance of K adequate plants to foliar diseases.

Influence of potassium on powdery mildew

Three years field experiments (7 trials) conducted in the southern region of WA revealed that application of K (4 wks after emergence of barley seedlings) either as chloride (muriate of potash) or as sulfate (sulphate of potash) could significantly reduce powdery mildew on barley in K deficient sandy soils (less than 50 ppm of K). Of the two sources of K used, in many K deficient soils the general trend was that muriate of potash (chloride) had less disease compared to sulfate of potash (sulphate) (Figure 1). Disease severity (per cent leaf area disease) decreased with increasing K application up to 40 kg K/ha. Application of potassium earlier and subsequent fungicide sprays had less powdery mildew compared to potassium only.

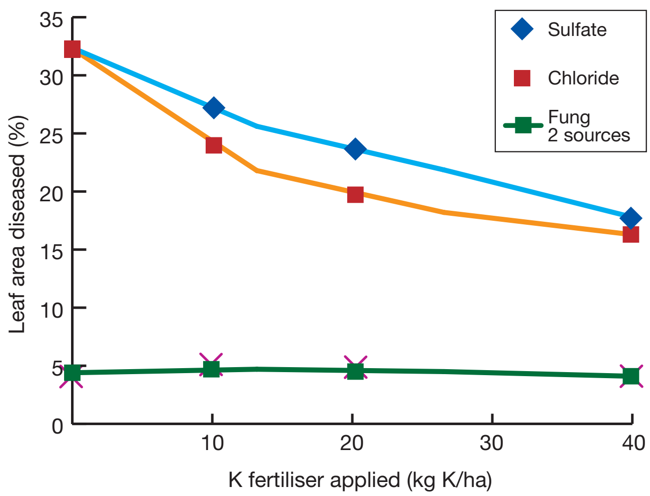

Figure 1. The percentage leaf area diseased (%LAD) response of barley to application of K fertilizer (kg K/ha) with and without the application of fungicides to control powdery mildew. Symbols :(◆) sulfate K source no fungicide applied; (■) chloride K source no fungicide applied;(–■–) chloride K source and sulfate K source. Triadimefon @ 125 g ai /ha applied at Z22 (tillering), Z32 (stem elongation), Z40 (flag leaf emergence) and Z59 (heading).

Influence of potassium on grain yield

In this series of trials it was shown that application of K could increase grain yield (Figure 2). Grain yield responses to applied K in the absence of powdery mildew (fungicide protected) was similar for both sources of fertiliser K. In the presence of powdery mildew, yield response to applications of muriate of potash was larger than yield responses to applied sulfate of potash for application of 10 and 20 kg K/ha with different yield response curves. There were no yield responses beyond 40 kg K/ha for either source of K fertiliser. Application of K fertiliser in combination with fungicide spray increased the grain yield compared to K fertiliser only reflecting the significant impact that powdery mildew has on barley yield

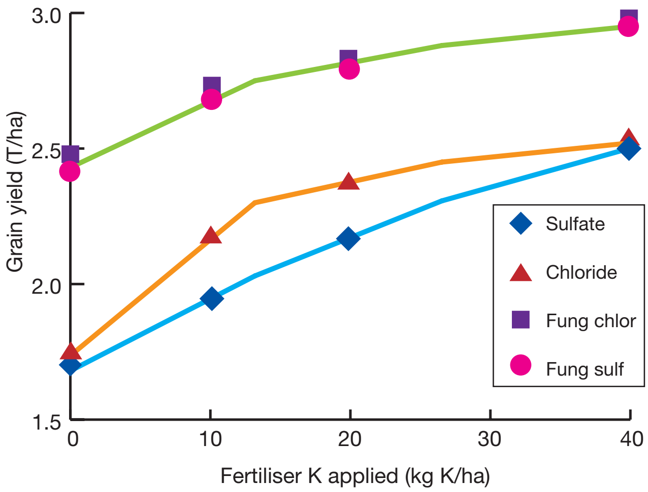

Figure 2. The grain yields (kg/ha) response of barley to application of K fertilizer (kg K/ha) with and without the application of fungicides to control powdery mildew. Symbols :(◆) sulfate K source no fungicide applied; (▲) chloride K source no fungicide applied; (■) chloride K source with fungicide applied at 4 growth stages; and (●) sulfate K source with Triadimefon @ 125 g ai /ha applied at Z22, Z32, Z40 and Z59.

Conclusions: For K marginal soils application of K decreases powdery mildew and increases grain yield of barley. The chloride source (muriate of potash, KCl) is the cheapest and most effective K fertiliser in this study. The K experiments revealed that in medium to high rainfall regions 20 to 50 kg/ha of muriate of potash or 44 to 97 kg/ha sulfate of potash were required to achieve maximum grain yields. These K fertilisers should be applied at 4-6 weeks after cereal plants have emerged and developed sufficient root systems to take up most K so reducing possible leaching of K below plant roots. It is apparent from the experiments that application of K reduces the powdery mildew but not to the level of protection observed by fungicide spray. Therefore in addition to application of K, additional fungicide spray should be considered in an integrated powdery mildew management system.

Further Reading:

Jayasena, K. and Loughman, R. (2001). Managing barley leaf diseases. No. 64/2001.

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