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Potassium chloride and suppression of diseases

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Vast research has shown that the incidence and rate of development of diseases may be reduced by an adequate and balanced mineral nutrition in many crops. In particular, potassium (K) and chloride (Cl) fertility have been effective in reducing crop injury from diseases. This means that potassium chloride (KCl) applications may not only result in higher yields as a response to nutrition deficiencies, but also result in lower levels of infestation from yield-limiting diseases.

Application of fertilizer is not a substitute for fungicides, but an important component in the integrated pest management (IPM), allowing reductions in the fungicide doses and thus decreasing pesticide and hazardous residues in food crops. This is in tune with stricter pesticide residue regulations and the increased awareness of the consumers for healthy and residue-free food.

The role of K in crop resistance to diseases was extensively reviewed by Perrenoud (1990). In general, an inverse relationship is found between available soil K and the severity of disease caused by bacteria and fungi (Huber and Arny, 1985). Potassium deficiency in late-season soybeans can lead to reduced yields and poor seed quality caused by pod and stem blight (*Diaphorte sojae* L.) and purple seed stain (*Cercospora kikuchii* L.) (Snyder and Ashlock, 1996). In potatoes, K fertilization was found to decrease the incidence on several diseases, such as late blight (*Phytophtora infestants*), dry rot (*Fusarium ssp.*), powdery scab (*Spongospora subterranea*) and early blight (*Alternaria solanii*) (Perrenoud, 1990; Marschner, 1995). Potassium applications resulted in suppression of diseases such as Tikka leaf spot (*Cercospora archidicola Hori.*) in groundnut (Umar *et al*., 1997) and leaf spot disease in cotton (small brown lesions caused by *Cercospora, Alternaria* and *Stemphylium*) (Harris, 1997). Potassium fertilizers such as MKP, applied as foliar sprays, were highly effective inducers of systemic protection against powdery mildew in cucumbers, mango, nectarines and grapes (Reuveni and Reuveni, 1993; Reuveni and Reuveni, 1995; Reuveni *et al.*, 1995).

The effects of Cl nutrition on plant diseases have been the subject of a number of investigations over the past two decades. In studies of the influence of K on disease reduction (Huber and Arny, 1985), Cl has been shown to aid in the suppression of diseases such as stalk rot of corn (*Diplodia maydis; Gibberella zeae*) (Younts and Musgrave, 1958), yellow rust (*Fusarium* spp.) in winter wheat (Russell, 1978), take-all root rot (*Gaeumannnomyces graminis* var. *tritici*) in wheat (Christensen *et al.*, 1981; Taylor *et al.*, 1981) and root and crown rot (*Rhizoctonia solani*) in sugar beet (Elmer, 1997).

The intricate relationship between K and Cl nutrition and their metabolic and physiological functions in the plant, as well as its interrelationship with various other nutrients within the plant and the soil, provide ample opportunity for these nutrients to modify disease resistance or susceptibility. Different explanations on the possible ways of action of both nutrients involved in the incidence of diverse diseases are presented. Different mechanisms such as nutritional effects, changes of the host-pathogen environment and production of disease inhibitory compounds are discussed.

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