

RELATIONSHIP BETWEEN SULPHUR SUPPLY AND GLUTATHIONE CONCENTRATION IN VEGETATIVE TISSUE OF OILSEED RAPE

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ABSTRACT

Glutathione plays a key role in the stress physiology of plants. In *Brassica* species glutathione is also involved in the trigger mechanism by which under conditions of sulphur deficiency sulphur bound in glucosinolates can be remobilised.

Results from experiments investigating the influence of the sulphur supply on glutathione concentration in vegetative plant tissues are reported which reveal a close relationship between both factors.

INTRODUCTION

Without external sulphur (S) supply *Brassica napus* varieties will suffer from severe S deficiency in northern areas of Europe (Schnug & Haneklaus, 1994). Under these conditions the remobilisation of sulphate bound in glucosinolates (GSL) contributes significantly to the maintenance of plant vigour. The model of the biorecyclisation of GSL's (Schnug & Haneklaus, 1993) assumes that the GSL splitting enzyme myrosinase does not necessarily have to be compartmentalised in idioblasts as the myrosinase activity in cells is controlled by the concentration of ascorbic acid. The maintenance of reduced ascorbic acid is dependent upon its regeneration from dehydroascorbate in the ascorbate/glutathione cycle (Halliwell & Gutteridge, 1989), whereas the S supply is an important external factor influencing glutathione (GSH) biosynthesis (de Kok et al., 1981). Aim of the presented work was therefore to establish the relationship between the S supply and the GSH contents in vegetative tissue of oilseed rape.

EXPERIMENTAL

The greenhouse experiment was designed as a pot (10 kg Kick-Brauckmann) trial with four replicates and sand as substrate. S was applied before sowing as K_2SO_4 in amounts of 0, 50, 125 and 250 mg/pot S, whereby the potassium supply of the treatments was kept even by application of potassium chloride. All other nutrients were sufficiently supplied for optimum growth. The first sampling of younger fully differentiated leaves of the upper third of the plants was 35 days after sowing; subsequent sampling was carried out every ten days for a total of four occasions.

After shock freezing the samples were extracted by means of 0.1N HCl (Schupp & Renneberg, 1988). GSH was determined by photometric absorption (Smith, 1985).

RESULTS AND DISCUSSION

The GSH concentrations found in vegetative tissue of *Brassica napus* (300 - 1300 nmol/g) are in accordance with the range found in other plant species (De Kok et al., 1981). The results of the greenhouse trial with varied S supply reveal that the S supply has a strong and significant influence on the GSH concentrations in the leaf tissue (Figure 1).

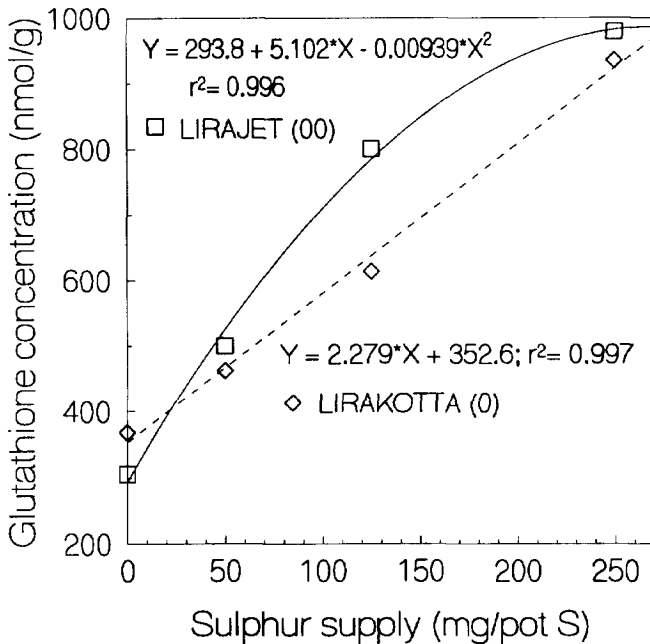


FIGURE 1. Relationship between S supply and glutathione concentration in leaf tissue of oilseed rape 45 days after sowing

Differences in the sensitivity towards the S supply become evident for single and double low varieties with tendentially higher GSH concentrations in the double low cultivar. Also under field conditions the GSH concentrations varied in dependence on the S supply, whereby the values determined were distinctly lower and showed a higher variability than those from the greenhouse experiment (Schnug et al., 1995a).

The GSH concentration will not only depend on the S supply, but also on plant age. During development of the plants an increase of the GSH concentration until 45 days after sowing could be detected, followed by a continuous decrease within the next 3 weeks (FIGURE 2). The effect of plant age on GSH concentration in the plant tissue is related to the S supply (FIGURE 2) and increases with the amount of S supplied.

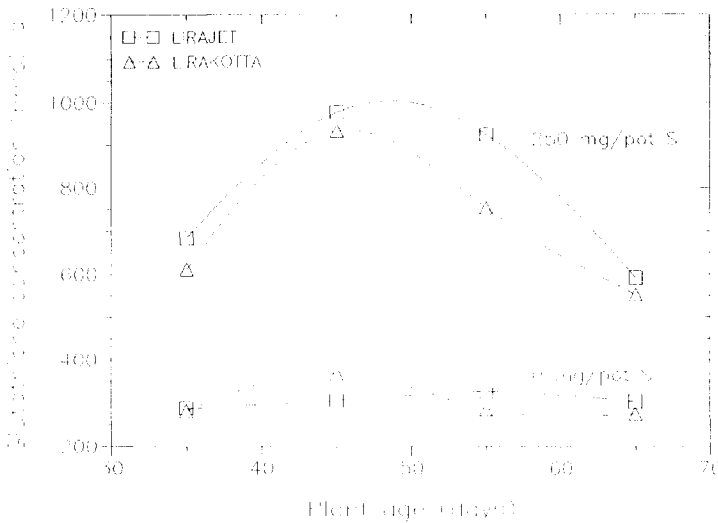


FIGURE 2. Influence of plant age of oilseed rape on GSH concentrations in leaf tissue

The results show that the S supply of oilseed rape is an important factor which significantly influences the GSH concentration in the vegetative tissue and supports the hypothesis of biorecyclisation of glucosinolates (Schnug and Haneklaus, 1994) and reinforces the importance of S as a key factor maintaining environmental influences on the stress resistance of oilseed rape (Schnug et al., 1995b).

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