INVESTIGATIONS ON THE ROLE OF GLUCOSINOLATES AS A SULFUR-RESERVE FOR THE RAPE PLANT.

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ABSTRACT

A pot trial with spring rape was carried out in order to test the hypothesis that glucosinolates (GSL) may act as a sulfur-reserve for the rape plant in case of a S-deficiency.
In varying developmental stages, the sulfur supply of the plants was interupted. The GSL content was then measured at different intervals during the period of sulfur-deprivation.
A noticable reduction in the GSL content within the plants was subsequently observed, but the calculation of the GSL-amount per pot and per plant respectively, shows that the lower GSL-concentration was merely a result of dilution.

INTRODUCTION

The discussion in the literature over the role of glucosinolates in the rape plant (Schnug,1991), advocates the hypothesis that glucosinolates may act as a sulfur-reserve for the plant in the event of a sulfur deficiency.
In a very simply designed pot trial with spring rape, a series of plants in varying developmental stages were subjected to an elimination of external sources of sulfur as described in the following table (Meuthen, 1993):

EXPERIMENTAL

Design of the pot trial:

Veget. stage	23-25 rosette	31-35 shooting	51-53 budding	64-65 flowering	85-89 * maturity
Harvest dates	1	2	3	4	5
Variable	Weeks under S-deficiency				
A	0 **	3	6	9	12
B		0 **	3	6	9
C			0 **	3	6
D				0 **	3
E					0 **

* = BBA-code; ** = Control "K"
A1/B2/C3/D4/E5 = continous S-fertilization
A2/B3/C4/D5 = 3 weeks S-deficiency
A3/B4/C5 = 6 " "
A4/B5 = 9 " " ; A5 = 12 weeks S-deficiency

The GSL-concentration in the rape plants are given in fig.1:

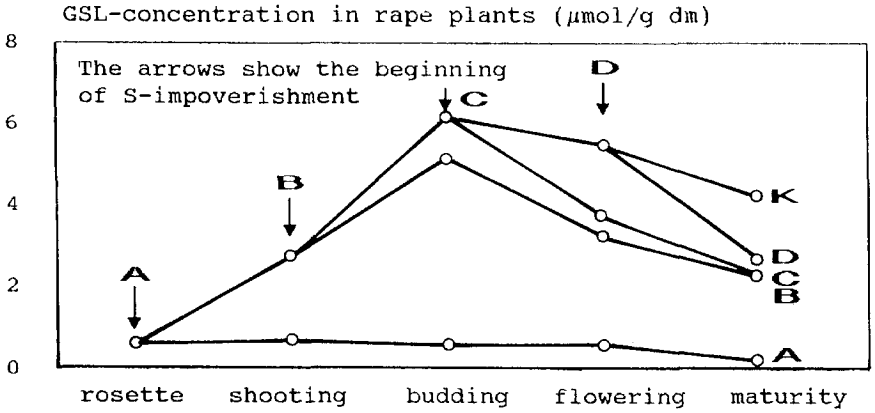

Fig. 1: Influence of the sulfur supply on the GSL-content in rape plints

The GSL concentrations are varying between the control "K" (continuous S-fertilization) and the variable "A" (S-deficiency, beginning in the rosette stage) at each of the harvest dates. All variables show a decrease of the GSL-content in the later vegetation stages, beginning with the rosette stage. These reductions in GSL-content are caused by an increase of plant dry matter as can be seen in figure 2.

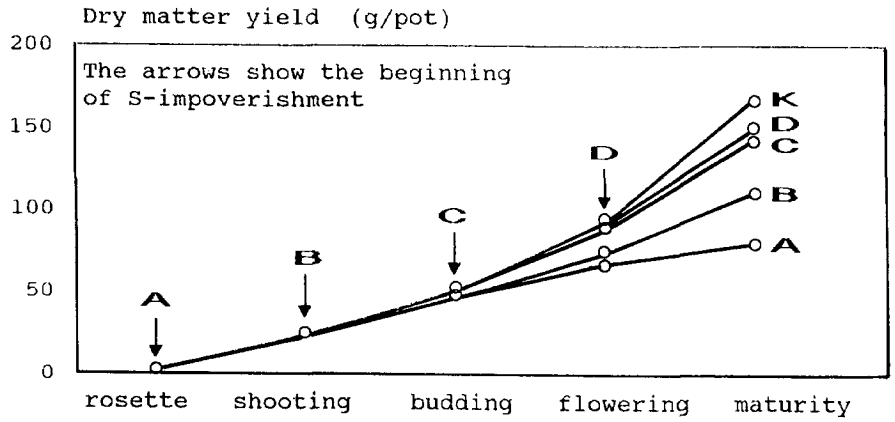

Fig. 2: Influence of the sulfur supply on the dry matter yield of rape plants, in g per pot

Figure 2 shows the strong interdependence between sulfur supply and the subsequent yield of dry matter.
In the figure 3 the total calculated amounts of glucosinolates per plant and per pot respectively are presented.

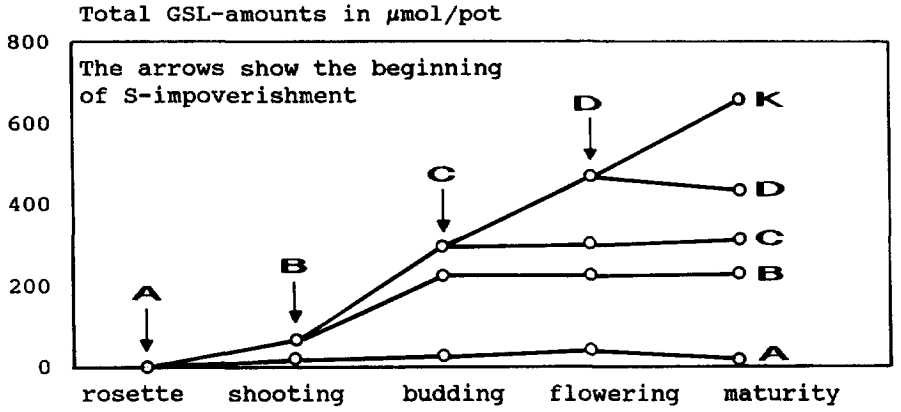

Fig. 3: Influence of the sulfur-supply or -deficiency on the total GSL-amounts per pot (Spring rape, 0-type)

If glucosinolates are to act as a sulfur reserve in the event of a S-deficiency, then a degradation of the GSL-molecule must occur bevore the sulfur, which is stored in the glucosinolates, can be incorporated into the primary metabolism of the rape plant.
The results in figure 3 reveal that there is no breakdown of glucosinolates. Rather, the biosythesis of glucosinolates, starting with beginning of S-deficiency, is obviously reduced or stopped, but the amounts GSLs remain on the same level until plants' maturity.
In prior investigations (Marquard *et al.*, 1968; Schnug, 1991), it was clearly shown that cleveage products of GSLs, like aglucones or sulfate, can be used as a S-source by the plant. But, up to now, there exists no clear proof that a decomposition of GSLs in undemaged plants is possible, since substrate (glucosinolate) and enzyme (myrosinase) are stored in different cellular compartments.

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