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Effect of Sulfur Fertilization on Rapeseed-mustard and Groundnut

By

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Summary

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Rapeseed-mustard and groundnut, two oilseed species, were compared for their sulfur status at various levels of sulfur nutrition. Rapeseed-mustard contained a higher amount of sulfur per unit dry matter during vegetative and reproductive stages. This may be attributed to the presence of sulfur-rich glucosinolates which are characteristic for crucifers. Sulfur fertilization enhanced the yield, total sulfur content and protein-cysteine content of seeds in both species. Sulfur fertilization did not affect the oil content of the seeds.

Introduction

Sulfur fertilization may be needed to optimize yields of crop plants which grow on sulfur deficient soils (SPENCER 1975). The sulfur requirement strongly differs between crop species. Crucifers, which contain high amounts of the glucosinolates have a high sulfur demand (SCHNUG 1990). In general, oilseed plants have also a high sulfur need (AULAKH & PASRICHA 1988, TANDON 1986, KANWAR & MUDAHAR 1985). Sulfur fertilization has been shown to increase the oil content in seeds of groundnut (SINGH 1986), rapeseed-mustard (AULAKH & al. 1980), sunflower (SINGH & SAHU 1986) and sesame (GAUR 1980). In the present study, we have studied the effect of sulfur fertilization on rapeseed-mustard and groundnut, two major oilseed crops grown in India.

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Materials and Methods

Groundnut (*Arachis hypogaea* cv. J-11) and rapeseed-mustard (*Brassica juncea* cv. Pusa bold) were grown in cemented pots filled with sandy loam soil with 8 ppm available sulfur. The soil was fertilized with nitrogen and potassium with 60 and 30 kg ha^{-1}, respectively. Sulfur was supplied at various levels in the form of calcium sulfate. Appropriate amounts of calcium oxide were supplied to equalize the amount of calcium in all the pots at the various calcium sulfate fertilization levels. Periodical samplings starting from 30 days after sowing were taken at 15 day intervals. After harvesting the plant material was oven dried at 80° C. The experiment was set up as a randomized block design with four replications. Finely ground samples from the plant parts harvested at different stages of growth were analyzed for sulfur (CHESNIN & YIEN 1950) and nitrogen (TECHNICON-MONOGRAPHI 1971) Content.

Seed and pod weights were measured at maturity. Amino acid content in seed was estimated according to CHATTERJEE & ABROL 1975. Oil content of the seeds was measured by pulsed nuclear magnetic resonance technique (TIWARI & al. 1974).

Results and Discussion

A comparison between rapeseed-mustard and groundnut was made for their sulfur status in different plant parts. Rapeseed-mustard contained a four to five fold higher sulfur content in root and leaf compared to that of groundnut (Table 1). Rapeseed-mustard also contained higher sulfur content in the seed which is more than five fold when compared to groundnut. These results confirm that the sulfur requirement of rapeseed-mustard is much higher than that of groundnut. High sulfur content in rapeseed-mustard can be attributed to the presence of various glucosinolates (BUNTING 1986, SCHNUG 1990) which is characteristic for the *Cruciferae* family. The values obtained here for sulfur content in groundnut are comparable to the other oilseed crops such as sunflower, sesame and linseed (AULAKH & al. 1985).

Sulfur fertilization not only enhanced the seed sulfur concentration but also increased yield in both the species (Table 2). Apparently, the soil in the control pots contained too little sulfur for optimal crop yield. Several other studies on sulfur fertilization of oilseed crops have also shown an increase in both yield and oil content of seeds (SINGH 1986, AULAKH & al. 1980, SINGH & SAHU 1986, GAUR 1980). However, in our study sulfur fertilization did not affect the oil content of the seeds of both rapeseed-mustard and groundnut (Table 2).

Sulfur fertilization resulted in an enhanced content of cysteine of the seed proteins, whereas the methionine content was not affected (Table 3).

Our results demonstrated that even though rapeseed-mustard has a higher sulfur demand than groundnut, sulfur fertilization enhanced both yield and sulfur content of seeds of both species.

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Table 1. Sulfur concentration (%) in root, stem and leaf as a function of growth stage in rapeseed-mustard and groundnut. DAS, days after sowing.

DAS	Rapeseed-mustard			Groundnut		
	root	stem	leaf	root	stem	leaf
30	0.14	0.20	0.62	0.05	0.20	0.25
60	0.30	0.50	0.92	-	-	-
75	0.39	0.37	1.13	0.03	0.18	0.21
90	0.15	0.38	1.07	-	-	-

Table 2. Effect of sulfur fertilization on sulfur concentrations, yield and oil content of rapeseed-mustard and groundnut.

Fertilizer treatment ($kg\ ha^{-1}$)	Rapeseed-mustard			Groundnut		
	Seed-S (%)	Seed yield ($g\ plant^{-1}$)	Oil (%)	Seed-S (%)	Seed yield ($g\ plant^{-1}$)	Oil (%)
Control	0.88	17.0	39.5	0.15	15.1	42.7
30	1.00	20.0	39.0	0.18	16.1	42.8
60	0.97	20.4	40.2	0.20	18.2	42.3

Table 3. Cysteine and methionine concentration (g 100 g $protein^{-1}$) in seeds of rapeseed-mustard and groundnut as effected by sulfur (60 kg ha^{-1}) application. Values are averages of two replications.

	Rapeseed-mustard		Groundnut	
	Cysteine	Methionine	Cysteine	Methionine
Control	2.18	2.51	1.31	2.80
Sulfur	2.88	2.62	1.52	2.83

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