

Table 1 Effect of copper sulphate on the growth, chlorophyll and nitrogen content, and nitrogenase activity of *Azolla-Anabaena* complex

Cu level (ppm)	Fresh weight (g)	Dry weight (g)	Chlorophyll (mg/g fresh wt)	Nitrogen (mg/g dry wt)	Nitrogenase activity (nmol C ₂ H ₄ formed/g/h)
0	26.7	1.14	0.53	39	762
2	25.9	1.10	0.53	39	759
5	21.6	0.91	0.49	38	686
10	18.3	0.78	0.43	35	460
20	9.8	0.42	0.36	31	288
CD at 5%	1.3	0.07	0.08	2	79

In *A. pinnata*, the decrease in dry matter production with increasing Cu level in the culture medium is closely associated with the decrease in nitrogen content. Nitrogen content is directly related to the capability of this species to fix nitrogen. A direct correlation has been shown to exist between photosynthesis and nitrogen fixation⁸. The present results clearly indicate that Cu above 2 ppm resulted in reduction of chlorophyll content. This would ultimately affect nitrogenase activity. Higher concentration of Cu has been shown to inhibit the enzyme invertase by inactivation of the active centre because of reaction with Cu²⁺ ion⁹. Cu²⁺ was found to catalyse the oxidation of SH groups and cause the formation of SS groups, thereby inactivating the enzyme¹⁰. Inactivation of enzymes results in derangement in metabolism, and ultimately affects growth.

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GROWTH RESPONSE AND ROOT COLONIZATION IN CULTIVARS OF SESAME TO VAM FUNGI

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IN India fat and edible oil are derived from oil-seed crops such as groundnut, palm, soybean, sunflower, sesame, coconut, etc. Most of these crops are grown in nutrient- and moisture-deficient soils. Recent researches on plant nutrition and vesicular-arbuscular mycorrhizal (VAM) associations indicate that these fungi play a major role in nutrient acquisition from soils deficient in phosphorus and other elements as well as better water uptake under stress¹⁻³. VAM symbiosis and the effects of VAM on the growth and nutrient uptake in inoculated groundnut have been worked out earlier^{2, 4-6}. In soybean VAM association and uptake of nutrients have been investigated^{1, 7, 8}. However very little information is available on VAM association either in sunflower² or in sesame (*Sesamum indicum* L.).

The sesame varieties Gowri, JE X Phule Til, E-8 and T-4 have been chosen for the present study. The rhizosphere soil samples and root pieces were collected and studied for VAM association^{9, 10}. VAM fungal spores of individual species were collected from the field soil⁹. These were surface-sterilized and multiplied in sterilized soil and sand (1:1) mixture with *Cenchrus ciliaris*. This constituted the soil inocula used for evaluating the cultivar response in pot trials using an alfisol. Such inocula were raised for seven VAM species. Pot trials were conducted in the glass house. The soil inoculum (50 g) for each VAM species, containing 10 spores/g was placed below the sesame seed bed to ensure that all the growing roots passed through the inoculum layer. Of the cultivars tested, Gowri responded favourably. VAM root colonization pattern¹¹ and growth response² were studied using seven VAM fungi obtained and the data are presented.

Rhizosphere soil samples and root pieces collected

Table 1 VAM colonization in four cultivars of sesame (pot experiments)

Mycorrhizal culture	Gowri				JE X Phule Til				E-8				T-4			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
<i>A. morrowae</i>	70	35	15	20	30	20	5	5	50	30	10	10	45	20	15	10
<i>G. fasciculatum</i>	80	35	15	30	35	25	5	5	60	30	10	20	40	15	15	10
<i>G. mosseae</i>	20	15	5	—	5	5	—	—	15	10	5	—	10	5	5	—
<i>G. epigaeum</i>	60	30	20	10	20	10	5	5	40	20	15	5	40	20	10	5
<i>G. monosporum</i>	90	40	20	30	30	20	5	5	70	30	25	15	60	30	15	15
<i>G. constrictum</i>	30	20	10	—	5	5	—	—	10	10	—	—	5	—	—	—
<i>G. margarita</i>	90	30	25	35	30	15	10	5	40	25	10	5	50	30	10	10

A, per cent root colonization; B, per cent of roots showing hyphae; C, per cent of roots showing arbuscules, and D, per cent of roots showing vesicles.

from the field site were found to be colonized by *Acaulospora morrowae*, *Glomus constrictum*, *G. fasciculatum*, *G. monosporum*, *G. epigaeum*, *G. mosseae* and *Gigaspora margarita*. The stock cultures of *Acaulospora morrowae*, *G. fasciculatum*, *G. mosseae*, *G. epigaeum*, *G. monosporum*, *G. constrictum* and *G. margarita*, when tested on different cultivars of sesame, Gowri has been found to be heavily infested. Pot culture experiments with VAM fungi (table 1) indicated that *G. margarita*, *G. monosporum* and *G. fasciculatum* were the best root colonizers as they enhanced plant growth significantly when compared to the other VAM fungi (figure 1). *A. morrowae* and *G. epigaeum* gave moderate response. However *G. mosseae* and *G. constrictum* did not show much effect. The present results

indicate greater response of Gowri cultivar in terms of growth, root colonization and VAM association, among the four varieties of sesame tested.

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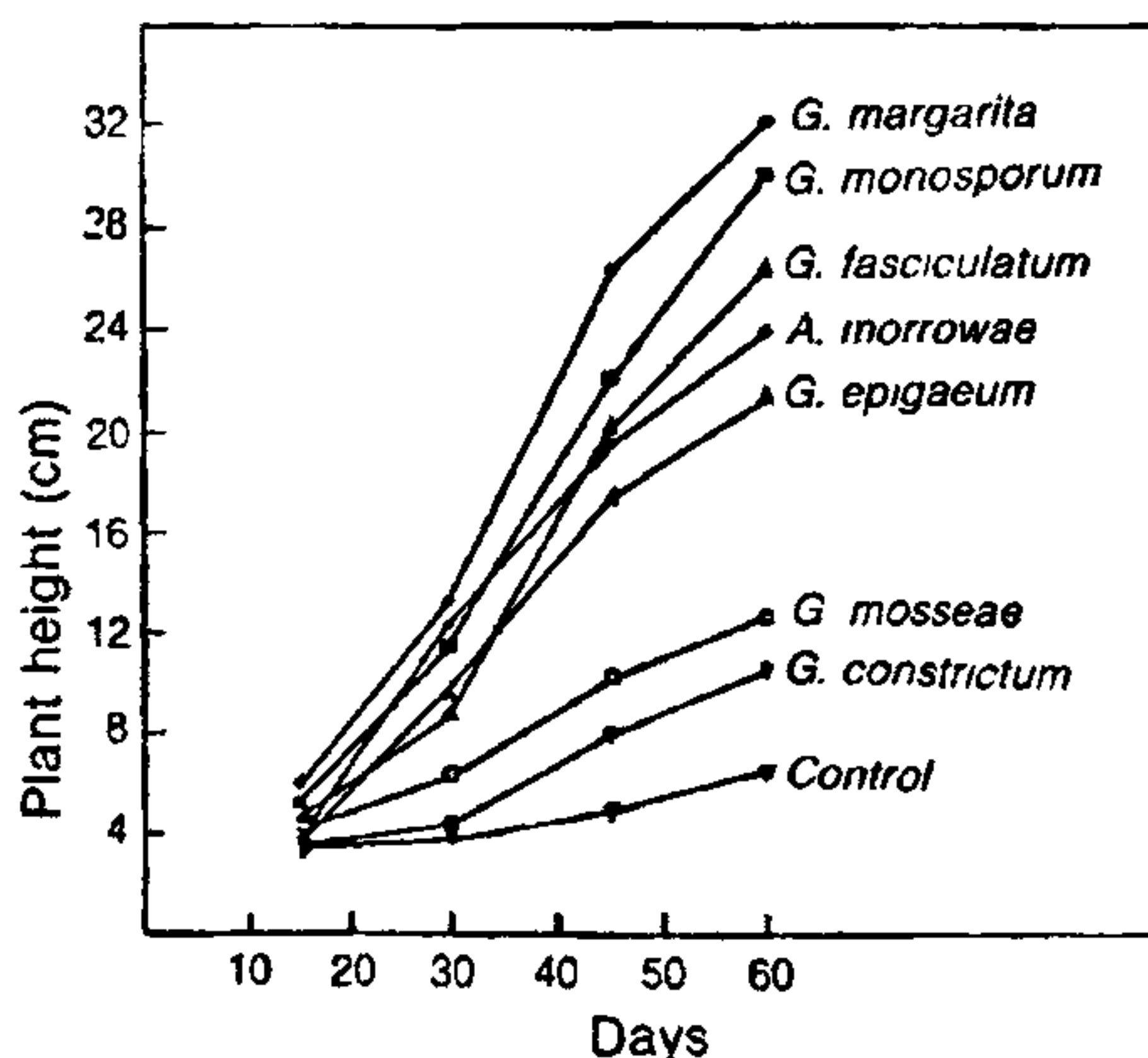


Figure 1. Growth response of VAM in Gowri variety of sesame.

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