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# The Effect of Two *Glomus* Species on Sudan Grass Sown in Alkaline Sandy Soil

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**Abstract.** It was found that *Glomus mosseae* and *G. fasciculatum* had quite a different effect on growth of Sudan grass [*Sorghum sudanese* (Piper) Stapf] in sterilized alkaline soil (pH 8.0) in a greenhouse experiment. The infection percentage of *G. mosseae* was 83 that of *G. fasciculatum* only 11.

## Introduction

It has been noticed that the inoculation of field crops with selected strains of vesicular-arbuscular mycorrhizal (VAM) fungi is more effective in increasing host growth [1-5], than using those indigenous fungi in field soils. Particularly noteworthy inoculum in field soils may be low, resulting in little host infection. Secondly, it has been reported that different species of VAM fungi, when inoculated to the same host and soil under the same environmental conditions may give different growth responses. Mosse [12] examined seven species of VAM on the onion seedlings cultured in one soil. Nonetheless, these fungi exhibited significant differences in their effect on host growth. Sanders et al. [4] tested the effect of four species of VAM fungi on the growth of onion seedlings. Three VA species showed similar effects on growth response whereas the fourth one was without any effect.

Difference in growth-promoting effects may arise from different effectivity of VAM fungus when it is inoculated in different soils. Hayman [6], for instance, found that *Acaulospora laevis* and *Glomus fasciculatum* "E3" are most effective in alkaline and neutral soils.

Sudan grass [*Sorghum sudanese* (Piper) Stapf] was recently introduced as green forage feed for animals for dairy production throughout the Kingdom. This endeavour, examines the growth response of the plant inoculated with two VAM fungi when sown in alkaline sandy soils of the Qasseem region, Saudi Arabia.

## Materials and Methods

A sandy soil was collected from sand dunes in the Qasseem region (26° 10′ N 44°E) in Saudi Arabia. The level of Phosphrous (P) was 3.75 ppm as determined by the method of Olsen et al. [7] and pH 8.0.

The soil was autoclaved for three hours. Three kilograms of the autocalved soil was put in each 3000 $cm^3$ pot. Level of (P) after autoclaving was also found to be 3.75 ppm. Part of the original soil, microbiota was added back to each pot by mixing about 25 g of unsterlized soil in about 100 ml distilled water. The soil solution was decanted through a series of screens, the finest with openings of 45 $\mu$m, fine enough to remove indigenous mycorrhizal spores and course enough to allow other soil microorganisms to pass through. The filtrate was further filtered using a Buchnner funnel apparatus.

The experiment consisted of three treatments (completely randomized design). Each treatment contained four replicates. In the first treatment, 50 g of soil containing 22 spores of *G. mosseae* per g [8] was used as the inoculum. The second was inoculated with 50 g of soil containing 22 spores of *G. fasciculatum* per g,while in the third, which constituted the control, 50 g of sterlized soil was added. The inocula were completely spread and thoroughly mixed within 4 cm depth below the soil surface.

To exclude the intraspecific competition factor each pot was hand seeded with 15 seeds of *Sorghum sudanese*. The pots were placed in a green house that provided growing conditions of 12 hr photoperiod, 1000 Lux, 27°C and watered once a week with $\frac{1}{2}$ X Hoaglanḍ's solution without phosphorus [9].

After seven weeks, the plants were carefully harvested by cutting at soil level and dry weighed to determine the yield. The roots were harvested and preserved in FAA solution. Segments of fixed roots were cleared in 10% KOH and stained with trypan blue by the Phillips and Hayman procedure [10] and examined for the presence of VA mycorrhiza.

## Results and Discussions

Visual observation of the growing plants revealed that growth response to colonization was the same for all treatments in the first four weeks because either possibly the VAM fungus grew as parasite or was not effective before the transfer of P to the host began. After four weeks the growth of the controls started to fall off; fol-

lowed by the *G. fasciculatum* inoculated plants, while the *G. mosseae* inoculated plants were generally taller and more vigorous than those of the other two treatments (Fig. 1). This is mainly attributed to the fact that mycorrhizal fungi are beneficial symbiotic microorganisms that increase the growth and yield of inoculated plant by increasing mainly P uptake [5,11].

Seven weeks after planting, the total dry weights and percentages of infection were determined and statistically analyzed by F-Test (Table 1). This displayed high significant difference ($P \leq 0.01$) for yields of *G. mosseae* inoculated plants when compared with the controls and *G. fasciculatum* treatments. The F-test showed non-significant differences in yield between the controls and *G. fasciculatum* treatments. Nevertheless, visual observations indicated differential responses of growth to *G. fasciculatum* inoculations (Fig. 1).


**Fig. 1. Comparison between (1) Control, (2) *Glomus fasciculatum*, and (3) *G. mosseae* inoculations on the growth of Sudan grass.**

The total frequency of infection was 83% and 11% for *G. mosseae* and *G. fasciculatum* respectively (Table 1). These results are in agreement with several reports that VAM fungi have different growth stimulating effects on their host [1,4,12]. Furthermore, the results showed that *G. mosseae* is more effective in this alkaline sandy soil than *G. fasciculatum* because of its adaptation to acid soils [6]. This finding supports the notion advanced by Mosse [1] that the most important factor affecting the symbiotic relationship is the interaction between the fungus and soil.

**Table 1. Dry weight of Sudan grass plants in pots after 7 days of inoculation with various VA fungi**

| Treatment | Mean dry weight, g | Percentage of infection |
|---|---|---|
| Control | 0.2025a | 0 |
| *G. fasciculatum* | 0.2925a | 11 |
| *G. mosseae* | 0.6725b | 83 |

Means followed by different letters are statistically different at $P \leq 0.01$.

It is possible that selected VAM fungi may one day be used in the field to replace indigenous mycorrhizal fungi and limit the need for phosphorus and perhaps other fertilizers.

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# تأثير نوعين من جنس قلومس على عشب السودان المزروع في تربة قلوية

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(استُلم في ٢٦ من ربيع الآخر ١٤٠٩هـ، قُبل للنشر في ٢٥ شوال ١٤٠٩هـ)

**ملخص البحث**. وجد أن فطرى قلومس موسيى وقلومس فاسيكيوليتم لهما تأثير مختلف على نمو عشب السودان المزروع في تربة معقمة قلوية (الرقم الهيدروجيني ٨) داخل بيت زراعي محمي. ووجد أن نسبة الإصابة بفطرة قلومس موسيى كانت ٨٣٪ بينما بلغت نسبة الإصابة بفطرة قلومس فاسيكيوليتم ١١٪ فقط.