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Vesicular arbuscular mycorrhiza and genotype effect on Peanut symbiosis and growth *

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Keywords—Colonization, peanut genotypes, phosphorus

Introduction

Peanuts are largely grown in nutrient and moisture deficient soils of the semi-arid tropics of India and West Africa. Growth and nutrient uptake, particularly phosphorus and zinc were increased by Vesicular Arbuscular Mycorrhizal (VAM) inoculation (Krishna & Bagyaraj, 1984). This paper reports on the influence of VAM and fertilizer phosphorus on P nutrition and growth of peanuts and genotypic differences in VAM colonization.

Materials and Methods

Pot trials using an Alfisol (pH 7.2; 2.0 PPM Olsen's P) with and without VAM (Glomus epigaeum) were conducted in a glasshouse, maintained at 27-31°C, to examine the extent of phosphate uptake and growth by peanuts (TMV 2) from VAM inoculation. A second pot trial with an Alfisol (pH 6.5; 2.5 ppm Olsen's P) examined the differences in P uptake ability of 10 different VAM fungi, from a partially acidulated rock phosphate (Kodjari rock), applied at 6 kg P ha^{-1} basal. The greenhouse-grown plants were harvested 60 days after planting, and their phosphorus contents were measured by vanadomolydate method (Jackson, 1971).

The genotypes each of spanish, velencia, virginia bunch, and runner types were grown in with 3 replications at ICRISAT Center (17° 36 'N, 78° 16 'E soil pH 7.2, 8.0 ppm Olsen's P) and Anantapur (14° 41 'N, 73° 'E, soil ph 6.5, 13.0 Olsen's P), in South India during the 1985 and 1986 rainy seasons. VAM colonization and P uptake measurements were made on 60-day-old plants.

Results and Discussion

The phosphorus response graphs of VAM-inoculated and noninoculated peanuts (Fig 1) show that between 2.5 and 12.5 ppm Olsen's P, mycorrhizal plants had significantly (P 0.05) higher shoot dry matter and total P. Between 4-12.5 ppm the non-mycorrhizal plants did not respond to P application, while inoculated plants responded with increased growth and P uptake. Clearly, peanut derives appreciable benefits in terms of P uptake from VAM.

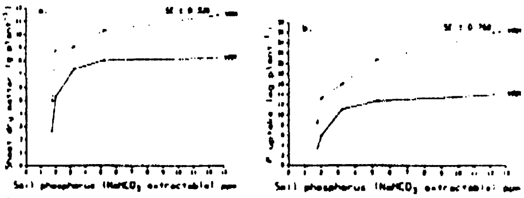

Fig 1. Shoot dry matter (a) and phosphorus uptake (b) of peanuts grown in an Alfisol at different levels of available phosphorus with and without VAM inoculation.

VAM fungi are known to augment P uptake from rock phosphates containing sparingly soluble phosphorus. In a comparison, efficiencies of 10 different VAM fungi in terms of growth response, and P uptake from Kodjari rock phosphate, differed significantly (Fig 2). Inoculation with Gigaspora calospora resulted in greatest growth, while Glomus fasciculatum resulted in highest P uptake. Two different isolates of the same species, Glomus monosporum differed in their ability to enhance P uptake. Research is needed to determine if it is possible to exploit these variations.

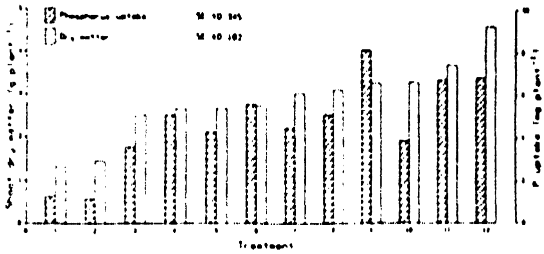

Fig 2. Response of groundnut cultivar TMV 2 to inoculations with various mycorrhizal fungi in an Alfisol amended with Kodjari rock phosphate (at the rate of 6 kg P ha^{-1} basal). ICRISAT Center, summer 1985.

Treatments:

1 - Control	7 - Glomus clarum
2 - Rock phosphate (RP)	8 - Glomus monosporum-2
3 - Glomus mosseae	9 - Glomus fasciculatum
4 - Gigaspora margarita	10 - Acaulospora sp.
5 - Glomus caledonium	11 - Glomus epigaeum
6 - Glomus monosporum-1	12 - Gigaspora calospora

Genotypes differ for VAM colonization and P uptake. It is said that genetic constitution and its physiological need for phosphorus could affect the extent of VAM colonization (Krishna et al 1985). Four field trials with 10 genotypes each of spanish, valencia, spreading bunch and runner types revealed that significant differences occurred between genotypes for VAM colonization in each botanical group. Location effects were also significant. They ranged from 22-39% for the spanish genotypes, 16 to 34% for valencia, 2239% for spreading bunch and 17-39% for runner. Such differences in VAM colonization are attributable to the interaction of differences in root anatomy and physiology with VAM fungi. A higher level of colonization is an indication of better fungal/root contract: is a prerequisite for increased VAM benefits and better adaptation to nutritional deficiency. The possibilities of modifying the amount of VAM colonization by genetic methods are being explored.

Table 1. Mean VAM colonization of 40 genotypes grown at 2 locations in South India during 1985 and 1986.

Spanish		Valencia		Spreading bunch		Runner	
ICG no.	Col (%)	ICG no.	Col (%)	ICG no.	Col (%)	ICG no.	Col (%)
1164	39	1629	34	3047	39	3948	39
10505	38	1908	32	2671	38	5363	34
7827	36	7885	30	4507	33	4159	32
1101	34	10974	30	4449	31	5302	30
10525	31	2738	30	3833	31	4344	30
1521	30	4790	28	3030	31	156	30
1773	29	1707	26	2490	26	2607	26
5305	24	10470	21	R33[illegible]	26	5139	26
221	24	1697	19	3064	25	4149	21
1506	22	10509	16	4224	22	5622	17

SE ± 5.0

ICG no. = ICRISAT Center Groundnut collection number
Col (%) = Percentage colonization

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