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Influence of phosphate solubilizing microorganisms on the germination rate of groundnut (*Arachis hypogea* L.) seeds

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A study was conducted to determine the rate of capacity of germination and to compare the rate of germination of groundnut seeds (*Arachis hypogea* L.) var. S.B. XI under laboratory conditions while they are treated with different isolates of phosphate solubilizing microorganisms (P. S. M.).

The seeds were impregnated with respective carrier materials of each culture containing 25 g. charcoal + 25 ml. Broth culture + 10 ml. Jaggery syrup + 10 ml. distilled water. The seeds were separately treated with eleven selected P.S.M. namely *A.niger, P. striata, P. aeruginosa, P. fluorescence, Alcaligens* sp., *Arthrobacter* sp., *Corynebacterium* Sp., *Candida aquatica, Beijerinkia mobilis, Enterobacter* sp., and *Erwinia* sp., and placed on germination paper maintaining the relative humidity along with control seeds where no culture treaments were given. Early germination was observed with treated seeds and percentage of germination and qualities of plumule were found to be superior with the treated seeds than that of controls. The percentage of germination of the treated seeds were found up to 96-100% while that of control were up to 82% and the length of plumules of the treated seeds were found up to 13.0 cm. while that of control is up to 4cm only. Hence, it can be observed that bacterization of groundnut seeds with P.S.M. for germination is desirable to improve the quality and rate of germination of groundnut seeds.

Key words : *Arachis hypogea* L., germination, phosphate solubilizing microorganisms, bacterization

INTRODUCTION

Groundnut (*Arachis hypogea* L) is a multipurpose corp. The groundnut has been accepted by Indian as vegetable oil corp during the middle of the late 19th century and since than occupied the first place among the oil seed crops. In the gamut of annual oil seed corps grown in India, groundnut occupy for about 34.5% of the total area and the 40.3% of the total production, thus occupy the first place among oil seed crops. The oil seed production has gone up from 11 million mt. during 1986 to 87 to 24.96 mt. during 1996 to 97. Eight states viz. Gujarat, Maharashtra, Andhra Pradesh, Rajasthan, Madhya Pradesh, Uttar Pradesh, Karnataka and Tamil Nadu account for nearly 90% of the oil seeds area and production in the century.

Groundnut serves as an important supplementary food for human, as it contains an average of 44—48% edible oil and 25% high quality protein. The groundnut being legume requires small quantity of nitrogen but being rich in protein and oil, it has relatively high requirement for phosphorus. Poor availability of this nutrient markedly reduces their requirement for phosphorus. Poor availability of this nutrient markedly reduces their growth. For proper growth and higher yield phosphorus are therefore applied. However, only 15—20% of the applied phosphorus are utilized by plants and remain 80% are remained fixed as acidic solids. More over, by the year 2002/2003 the world demand for phosphate as plant nutrient would be about 70 million tons of P_2O_5 per annum. To meet this demand, huge investments would have to be

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made in fertilizer factories. Not only the fertilizers they produce be high priced but the factories themselves would have an adverse effect on the environment. In this case, Phosphate Solubilizing Microorganisms can offer a viable alternative, which is more economic and ecofriendly (Gaur 1990). In the light of this the present investigation was conducted to produce healthy and early matured crops with high corp yield production.

MATERIAL AND METHODS

The seeds of groundnut (*Arachis hypogea* L) were subjected to hot water treatment to break dormancy to bring scarification of seeds by suggested method. Seeds were kept in boiling water (100°C) for 50–60 seconds. This was followed by seed inoculation with selected (11) efficient strains of PSM. The microbial inoculums were prepared for seed inoculation with 25 ml of litre inocula of broth cultures ranging from 22 to 35 × 10^7 cells/ml. + 10. sterile distilled water. The seeds were impregnated with each different titre inocula separately for each treatment. The seeds were then placed on moist germination papers, the papers kept in seeds germinator at 20°C with relative humidity maintaining at 90%. Each treatment was replicated 3 times with 100 seeds along with the control.

RESULTS AND DISCUSSION

The effect of seed inoculation with the selected eleven (11) phosphate solubilizing isolate namely *Aspergillus niger, Pseudomonas striata, Pseudomonas aeruginosa, Pseudomonas flurescence, Arthrobacter sp., Alkaligens sp., Beijerinkia mobilis, Corynebacterium sp., Candida aquatica, Enterobacter* and *Erwinia* species of seed germination paper at 20°C. The germination percent were determined after one week.

The results of the experiments carried out on germination paper *in vitro* as compared to suggested methods are given accordingly in Table 1. From the experimental results (Table 1), it was observed that seed inoculation with phosphate solubilizing microorganisms were found to be highly effective for imporving seed germination as compared to control (soaked in coal distilled water) and hot treatment (soaked in boiling water for 50—60 second). It was observed that the treated seed showed germination percent of 96 to 100% while that of control showed by 20% seed germination. It was also observed that not only improvement in germination percent there was much increased in the quality of the plumules over control.

Table 1 : Effect of seed inoculation with phosphate solubilizing microorganisms on percent seed germination of groundnut seeds as compared to suggested methods on germination paper at 20°C.

Treatment	Titre imoculum cells/ml.	% seed Germination	Length of plumule in cm.	Diameter of radical in cm.
Aspergillus riger	23 × 10^6 (Propaguly/ml)	99.66	9.13	2.5
Pseudomonas striata	29 × 10^6	100	11.8	2.6
P. aeruginosa	38 × 10^6	96	10.6	3.1
P. fluorescence	29 × 10^6	99	12.5	2.5
Arthrobacter sp	35 × 10^6	95.3	9.5	3.6
Alkaligens sp	31 × 10^6	96	9.8	2.2
Beijerinkia mobilis	40 × 10^6	98	11.9	3.2
Corynebacterium sp	33 × 10^6	96.3	19.9	2.1
Candida aquatica	32 × 10^6	96.6	9.2	3.2
Enterobacter sp	41 × 10^6	99.3	13.6	2.8
Erwinia sp	36 × 10^6	97.3	9.3	2.5
Control (soaked in cold D/W)	—	82	4.4	1.5
Hot water treatment (soaked in boiling D/W for 50 to 60 seconds)	—	86.6	5.1	1.8

Average of 3 replicates.

Seed inoculation with *Aspergillus niger, Pseudomonas striata, Pseudomonas aeruginosa, Pseudomonas flurescence* showed more improvement in the seed germination as compared to other isolates. There was slight increase in the germination capacity of the hot water treated seeds over the control (soak in cold distilled water). The experimental results revealed that seed inoculated with phosphate solubilizing cultures proved to be highly effective for rising the seed germination percent and to improve the quality of plumules and hence the seedlings.

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