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Effect of age of mango rootstocks with different AM fungi on growth and grafting success

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ABSTRACT

An experiment was conducted to assess the effect of mango rootstocks with different AM fungi, *i.e., Gigaspora margarita, Glomus fasciculatum, Acaulospora laevis* and *Glomus monosporum* along with uninoculated control on growth and grafting success. The inoculation of *Gigaspora margarita* and *Glomus fasciculatum* resulted in highest germination (47.19%), while uninoculated stocks had recorded significantly highest germination index (3.84), *Gigaspora margarita* and *Acaulospora laevis* inoculation stones took significantly lower days for initiation of germination (9.25 days) and completion of germination (46.75 days). Interaction of 10 months old rootstocks with *Gigaspora margarita* recorded maximum vegetative parameters. Significantly maximum graft-take, per cent survival of grafts, sprout height, number of leaves and graft diameter were exhibited in different aged rootstocks inoculated with AM fungi when compared to non-AM rootstocks.

Key words : Mango, AM fungi, Rootstock, Graft-take graft diameter

Mango is most popular among the tropical fruits of the world and is rightly described as 'king of fruits' owing to its delicious taste, captivating flavour and attractive aroma. The mango grafts are raised on seedling rootstocks of unknown source resulting in variation among the grafts. It is essential to standardise the rootstocks for different mango cultivars in different agro-climatic regions to have uniform growth, high yield, good quality fruits and dwarf stature of plants for high density planting. It is known fact that the rootstocks showed marked effects on the growth and subsequent bearing habit and quality of fruits in most of the fruit crops. Hence, there is need to select suitable rootstocks of locally available variety. Raising of rootstocks and proper use of rootstock is also important. Now-a-days, mango is commercially propagated by softwood grafting with varied degree of success. It needs the proper age of rootstocks for softwood grafting. Positive response to inoculation with arbuscular mycorrhizal (AM) fungi is well established for wide variety of horticultural crops (Moroneck *et al.*, 1981 and Bagyaraj, 1992) and also inoculation of the rootstocks with efficient AM fungi may hasten their growth and make them ready for grafting in much lesser time, which in turn improve growth rate. Efficient fungi thus selected can be used for inoculation in mango nurseries and have some beneficial effect on early germination, growth and graft-take (Santosh *et al.*, 2004; Bassanagowda, 2005 in mango and Venkat *et al.*, 2004 in citrus). Keeping this in view, an experiment was conducted to study the effect of age of mango rootstocks with different AM fungi on growth and grafting success by inoculating different AM fungi in mango.

MATERIALS AND METHODS

The present investigation was carried out at Department of Pomology, Kittur Rani Channamma College of Horticulture, Arabhavi. The design of the experiment adopted was completely randomised factorial design with different AM fungi, *Gigaspora margarita, Glomus fasciculatum, Acaulospora laevis, Glomus monosporum* and without AM fungi as first factor and five second factors comprising of two, four, six, eight and ten months old rootstocks. Scions of one season old shoots of pencil thickness, free from pest and disease were selected from 20 years old grafted Alphonso trees. The observations were recorded daily for germination parameters, three months after grafting (MAG) for graft success and graft survival percentage and three months for graft growth parameters

RESULTS AND DISCUSSION

Out of four fungi used for germination of mango stones, there existed varied host response on germination significantly superior over control which had recorded 39.76 per cent germination. Inoculation of *Gigaspora margarita* and *Glomus fasciculatum* (47.19 each) recorded significantly higher germination followed by *Glomus monosporum* (45.62). Initiation of germination with the AM fungi was also earlier as compared to control (13.00 days), *i.e.*, early germination was observed with *Gigaspora margarita Acaulospora laevis* (9.25 days each), *Glomus fasciculatum* (10 days) and *Glomus*

monosporum (10.75 days) inoculations. Complete germination of mango stones with higher germination vigour index of 3.84 to 2.29 was attained in a span of 50.75 to 46.75 days recording significantly much low time span than the germination in control stones (50.75 days) *Gigaspora margarita* and *Acaulospora laevis* inoculation stones took significantly lesser days for initiation of germination (9.25 days) and completion of germination by *Acaulospora laevis* (46.75 days), which was statistically at par with *Glomus monosporum* (47.00 days) (Table 1). This could probably be due to the fact that soon after sowing of the fresh stones they might have started imbibing water as well as leaching several metabolites including amino acids, organic acids, inorganic ions, sugars, phenolics and protein (Simon, 1984). These solute leachates are important because they help AM fungal spores to germinate as there will be a molecular and chemical dialogues between AM fungi and hosts, in turn AM fungi might had helped in better seed germination by mutualistic symbiosis with seed and competing with pathogens for space and nutrients. Increased germination percentage and rate of germination due to AM fungal species is also reported in mango (Santosh, 2004 and Bassanagouda, 2005), aonla (Swamy *et al.*, 2005). The increased per cent germination with decrease in the number of days taken for germination observed in the present investigation (Table 1) could be explained by the fact that the introduced AM fungi might have been efficient root colonisers and might had established well in the rhizosphere (Manjunath, *et al.*, 1983).

Among the different age of rootstocks inoculated with different AM fungi, eight months old rootstocks exhibited maximum graft success (77.33%) and graft survival (82.06%) (Table 2). Among different AM fungi, rootstocks inoculated with *Gigaspora margarita* recorded maximum success (56.67%) and survival (78.81%). Interaction effect with age of rootstock and different AM fungi on graft success and survival was found non-significant. The growth parameters like sprout height (4.84 cm), graft diameter (11.58 mm) and number of leaves (6.51) were maximum on Alphonso grafted with 10 months old rootstock (Table 3). Among different AM fungi, rootstocks inoculated with *Gigaspora margarita* recorded maximum sprout height (5.73 cm) (Table 3),

Table 1 : Effect of different AM fungi on germination of mango stones

Treatment	Number of days taken for germination			Germination (%)	Germi-nation vigour index
	Initiation	50 per cent	Comple-tion		
T_1 – Control	13.00	32.50	50.75	39.76	3.84
T_2 – *Gigaspora margarita*	9.25	28.50	48.25	47.19	2.74
T_3 – *Glomus fasciculatum*	10.00	28.50	48.25	47.19	2.29
T_4 – *Acaulospora laevis*	9.25	26.75	46.75	45.31	2.94
T_5 – *Glomus monosporum*	10.75	27.25	47.0	45.62	2.96
S.E. ±	0.452	0.665	0.764	0.380	0.016
C.D. (P=0.05)	1.362	2.003	2.301	1.145	0.0550

Table 2 : Effect of AM fungi and age of rootstocks on graft success and graft survival

Treatments	Graft success (%)						Graft survival (%)					
	Age of rootstocks											
	Two	Four	Six	Eight	Ten	Mean	Two	Four	Six	Eight	Ten	Mean
T_1 – Control	23.33	26.67	23.33	66.67	63.33	40.67	44.44	38.89	55.55	69.82	74.27	56.59
T_2 – *Gigaspora margarita*	36.67	43.33	46.67	86.67	70.00	56.67	63.89	78.33	71.67	88.88	90.27	78.81
T_3 – *Glomus fasciculatum*	30.00	33.33	43.33	80.00	63.33	50.00	55.55	72.22	61.67	87.36	84.12	72.18
T_4 – *Acaulospora laevis*	23.33	26.67	33.33	80.00	66.67	46.00	55.55	61.11	61.11	83.66	80.15	68.31
T_5 – *Glomus monosporum*	26.67	30.00	36.67	73.33	70.00	47.33	44.44	52.78	63.89	80.55	79.95	64.32
Mean	28.00	32.00	36.67	77.33	66.67	48.13	52.78	60.66	62.78	82.06	81.17	68.00
For comparing the means of	S.E. ±			C.D. (P=0.05)			S.E. ±			C.D. (P=0.05)		
T	1.71			4.85			2.40			6.78		
Age	1.71			4.85			2.40			6.78		
T x Age	3.83			NS			5.36			NS		

NS = Non-significant

Table 3 : Effect of AM fungi and age of rootstocks on sprout height (cm), graft diameter (mm) and number of leaves of mango grafts at 90 days after grafting

Treatment	Sprout height at 90 DAG						Graft diameter at 90 DAG						Number of leaves at 90 DAG					
	Age of rootstock (Month)																	
	Two	Four	Six	Eight	Ten	Mean	Two	Four	Six	Eight	Ten	Mean	Two	Four	Six	Eight	Ten	Mean
T_1	1.63	1.81	2.04	2.33	3.98	2.16	6.58	7.60	8.33	8.93	11.00	8.49	4.11	4.36	4.63	4.90	5.08	4.62
T_2	4.59	5.49	5.81	6.26	6.51	5.73	8.41	8.84	9.62	10.24	11.94	9.81	5.95	6.21	6.41	6.85	7.01	6.50
T_3	2.68	3.27	3.59	3.97	4.49	3.60	8.58	8.95	9.41	10.30	12.02	9.88	5.33	5.74	5.98	6.38	6.51	5.99
T_4	4.48	4.97	5.41	5.87	6.27	5.40	8.24	8.60	9.42	10.09	11.80	9.63	5.49	5.85	6.10	6.39	6.55	6.08
T_5	2.32	2.59	2.89	3.31	3.95	3.01	8.31	8.59	9.22	9.78	11.13	9.40	6.33	6.63	6.86	7.31	7.42	6.91
Mean	3.14	3.63	3.95	4.35	4.84	3.98	8.02	8.52	9.20	9.87	11.58	9.44	5.44	5.76	6.01	6.37	6.51	6.02
For comparing the means of				S.E.±	C.D. (P=0.05)			S.E.±		C.D. (P=0.05)				S.E.±		C.D. (P=0.05)		
T				0.035	0.098			0.044		0.124				0.014		0.053		
Age				0.035	0.098			0.044		0.124				0.014		0.053		
T x Age				0.077	0.219			0.098		0.278				0.032		0.089		

T_1 – Control, T_2 – *Gigaspora margarita*, T_3 – *Glomus fasciculatum*, T_4 – *Acaulospora laevis*, T_5 – *Glomus monosporum*,
DAG = Days after grafting

Glomus monosporum showed maximum number of leaves (6.91) (Table 4) and *Glomus fasciculatum* showed maximum graft diameter (9.88 mm) which was at par with *Gigaspora margarita* (9.81 mm)

Interaction of 10 months old rootstocks with *Gigaspora margarita* recorded maximum sprout height (6.51 cm), *Glomus fasciculatum* recorded maximum graft diameter (12.02 mm) and *Glomus monosporum* recorded maximum number of leaves (7.42) (Table 3) at 90 days after grafting. Maximum sprout heigth, maximum number of leaves with highest survival per cent of grafts was observed with *Gigaspora margarita* followed by *G. fasciculatum* and *A. laevis* and rootstocks of eight, ten and six months performed better results indicating theses organisms as best suitable organisms for mango grafts success . The other AM fungi were also found superior over control. Similar differential response for AM fungal species to host was reported by Santosh *et al*. (2004) and Bassanagowda (2005) in mango. Regarding age of rootstocks, similar results were reported by Desai and Patil (1984) and Valsalakumari *et al*. (1985) in mango.

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