APPLICATION OF *AZOLLA PINNATA* IN RICE CULTIVATION

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To determine the efficacy of *Azolla pinnata* on the yield of paddy variety GR-11, a trial was conducted in 1983–84 rainy season at the Sugarcane Research Station, Thasara, Gujarat. The sowing was done in July 1983 as a student paired plot design with twelve replications. The treatment consisted of 75 kg N as urea in three split doses and two crops of *Azolla* incorporated in soil (20 tonnes fresh weight/ha). The crop was grown at a spacing of 20 × 15 cm in a net plot size of 12.5 × 5 m and received 25 kg N and 50 kg P_2O_5/ha as a basal dressing. Standing water was maintained in the field from 5–10 cm almost throughout the crop period. Freshly collected *Azolla* plants were inoculated one week after transplanting into each of the plots receiving *Azolla*.

In the treatment of 75 kg N/ha, the highest grain yield of 7013 kg/ha was recorded as against 6166 kg/ha in *Azolla* inoculated treatment. The yield differences are highly significant suggesting that chemical N was superior to *Azolla* inoculation. The low yield in *Azolla* incorporated treatment could be due to limited supply of N form the *Azolla* incorporated treatment. This is because only two crops of *Azolla* were incorporated which can be at maximum give 60 kg N/ha. Singh reported that a thick layer of *Azolla* ensures about 30 kg of N/ha, which can be doubled by growing a second layer. This indicates that if three crops of *Azolla* could be incorporated in the soil, the supply of nitrogen through chemical fertilizer could be done away with.

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PHENOLICS AND GROWTH HABIT IN MANGO (*MANGIFERA INDICA* L.) VARIETIES

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DWARF mango varieties are known for their high density planting to minimise cost input and maximum productivity. Available technologies to identify clones as dwarf rootstocks are time consuming. Though leaf stomatal density[1], bark percentage[2], leaf chlorophyll content, leaf area and total dry matter of seedlings[3] were said to be associated with the growth and vigour of mango varieties, yet the findings are inconclusive and inconsistent. Hence, a simple test to identify dwarf clones in mango is of practical use in the varietal evaluation for dwarf stature, to use as possible rootstocks. Of late phenolic content in the bark is found to be a reliable index in the selection of dwarf rootstocks in apples[4]. A study was therefore undertaken to understand the possible association of phenolic content and growth habit in mango.

Twenty four-year old trees of seven varieties *viz* Kalepad, Cherumani, Mulgoa, Neelum, Bangalora, Rumani and Chinnarasam were selected from the well cared and uniformly maintained University orchard. Fresh bark samples were taken from non-flowering terminals[5] having a girth of about 6 cm on different branches. Total phenolic content of the bark was estimated according to the method of Bray and Thorpe[6]. Tree growth measurements of the sampled trees were recorded.

Results indicated significant variation in phenolic content and tree growth vigour among the varieties tested (table 1). Among the varieties studied Rumani had the highest content of phenolics (3860 μg/g) while Chinnarasam had the lowest value (2300 μg/g). Interestingly, varieties which had relatively higher phenolic content seem to be of dwarf statured comparatively. Cherumani with a total phenolic content of 3840 μg/g had the shortest growth characters *viz* 3.9 m tree height and 5.2 m and 4.9 m tree spread on north-south and east-west respectively. Chinnarasam with 2300 μg/g of phenolics showed maximum growth having a tree height of 10.1 m, and 13.9 m and 14 m tree spread on north-south and east-west respectively. Cherumani had 67% more of phenolics than Chinnarasam. As regards Rumani which comes fourth with respect to growth vigour had the maximum

Table 1 *Tree growth vigour and total phenolic content of bark in seven mango varieties (mean of 3 replicates)*

Variety	Tree height (m.)	Tree spread (m.)		Total* phenolics µg/g
		North-South	East-West	
Cherumani	3 9	5.2	4.9	3840
Mulgoa	5.1	8.2	8 8	3240
Kalepad	5 8	7.0	7.4	3190
Rumani	6.9	8.9	8.2	3860
Bangalora	7.8	10.4	11 4	2520
Neelum	8 4	14 8	14 6	2500
Chinnarasam	10.1	13.9	14 0	2300
CD at 5% *P*	0.61**	1.37**	0.98**	18 87**
Correlation with phenolic content	−0.7617**	−0.7690**	−0 8598**	

* In Catechol equivalents on fresh weight; ** Highly significant at 1% *P* level

phenolic content. The reasons for this exceptional behaviour are worthy of further investigation. However the general trend of total phenolics expressed in catechol equivalents indicates a definite relationship with growth vigour in mango. Statistical analysis of data showed a highly significant and negative correlation between tree growth vigour and phenolic content. The results indicated that the bark either alters the compounds moving through it or contained compound(s) which interfered with the growth of the tree. It had been shown in apple[7] that a transfer of a bark from a dwarf root-stock to a fast growing seedling resulted in dwarfing of the seedling. Later Schneider *et al*[8] isolated *in vitro* from the callous of the dwarf apple stock, a number of substances which were chemically identified as phenols and one such substance co-chromatographed with ferulic acid standard on gas chromatography[9]. Lockard *et al*[10] isolated a number of phenolic compounds such as *p*-hydroxybenzoic acid, *p*-coumaric acid, ferulic acid, phloretic acid and phloridzin from dwarf apple root-stocks. These phenols, which are either auxin antagonists or IAA oxidase co-factors[11], were present in large amount in dwarf apple stocks than what was necessary leading to growth inhibition in Lettuce hypocotyl. It is suggested that phenols in the bark reduce the amount or alter the form of auxin transported through it. The change in the auxin transported presumably affects root metabolism and subsequently the kind or amount of cytokinin exported from the roots to the shoots. The role of phenols in terms of its influence on the auxin synthesis[12] and translocation[13] are well documented. Thus, the phenolic content of mango bark may well serve as a useful tool in selecting dwarf clones.

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