

Evaluation of acid lime cultivars in laterite zone of West Bengal

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ABSTRACT

A study was made at MPS Farm, Jhargram, Paschim Midnapore during 2005 to 2010 with six cultivars namely, Pati Seedless, Pati Hybrid, Pati Baramasi, Kagzi Large, PKM-1 and Gandharaj of acid lime to find out the suitable acid lime cultivar for laterite soil of West Bengal. Evaluation trial conducted for six consecutive years indicated that 'Pati Hybrid', a bushy type with less spine in the branches, produced highest yield 46.3 kg plant⁻¹ having maximum fruit weight (167g) and size (7.1x6.2 cm). The cultivar 'Pati Seedless', an erect, spineless type, which gave maximum fruits in number (325) and 2nd high yielder by weight (26.0 kg plant⁻¹) was observed to have maximum juice content (49%), T.S.S. (6.0 °B) and vitamin C (28.5 mg100⁻¹ ml juice). Both the cultivars have been recommended for cultivation in the laterite zone of west Bengal. The cultivar 'Kagzi Large', a spreading type, could be considered for cultivation in laterite soil due to its consistence in bearing, good fruit size and lesser seed content.

Key words: Acid lime, fruit quality, laterite soil, plant growth, yield

Acid lime (*Citrus aurantifolia*) and lemon (*Citrus limon*) are the commercially important citrus fruits grown in India, besides sweet orange, mandarin and grape fruit. Lime and lemon, commonly called *lebu* or *nimbu* are very popular in West Bengal and its adjoining states for its refreshing juice. Demand of fresh fruit is always high all the year round, particularly during the summer months when the price of a fruit is goes up. The fruits having bigger size with more juice and less seed content are always in market demand. In West Bengal, no named varieties except 'Pati' and 'Kagzi' are either available or known by the growers. The acid lime prefers warm and dry climate with low rainfall (Chadha, 2009) for better growth and production. The red and laterite zone of West Bengal which covers the districts of Bankura, Purulia, Birbhum and Paschim Midnapore, have a dry climate and rainfall is low as compare to other parts of the state. This zone is considered to be ideally suitable for growing acid lime on commercial scale. As no investigation has been conducted earlier to know the best suitable variety or type for this zone for commercial cultivation of acid lime, an attempt was made in this regard.

MATERIALS AND METHODS

The investigation was carried out at the orchard of MPS Farm, Jhargram, during the period 2005 to 2010. Air layer plants of six cultivars namely Gandharaj, Kagzi Large, Pati Baramasi, Pati Hybrid, Pati Seedless and PKM – 1 were collected and planted at a spacing of 5 x 5m during 2002 following Randomized Block Design having four replication and two plants in each replication.

The soil of the experimental field was laterite having pH ranges from 5.5 to 6.0, available nitrogen 320 kg ha⁻¹, phosphorus 31 kg ha⁻¹ and potassium 110

kg ha⁻¹. Annual precipitation of the area was 1100 mm with maximum temperature was 42°C in May and minimum of 11°C in January. The plants were fertilized every year with 30 kg FYM, 300 g N, 200 g P₂O₅ and 200 g K₂O per plant year⁻¹ in two splits i.e. in June and September. Two to three prophylactic sprays were followed against leaf miner insect and bacterial canker and scab diseases. The observation on plant growth viz., height, basal girth and plant spread and spine characteristics were made at the plant age of 8-year i.e. in 2010. The fruit yield per year was calculated on the basis of total number of mature fruits harvested in different months of a year. For fruit weight and size, 20 mature fruits per plant were taken and average was calculated. For measuring juice content T.S.S., acidity and vitamin C, ten mature fruits (colour changing stage) were taken following the standard method (A.O.A.C., 1990). The data collected on various parameters have been statistically analysed to know the degree of variation of different characters among the cultivars.

RESULTS AND DISCUSSION

Phenotypic observation on plant growth indicated that the cultivars were significantly differed in respect of height, basal girth and plant spread (Table 1). The maximum height was measured in Pati Hybrid (387 cm) followed by Kagzi Large (346 cm) and minimum in Pati Baramasi (248 cm). The basal girth was also highest in Pati Hybrid (55.8 cm) and lowest in Pati Baramasi (21.3 cm). Due to spreading nature, Kazi Large had maximum plant spread (461 and 426 cm in E-W and N-S respectively) followed by Pati Hybrid (435 cm in E-W and 400 cm in N-S), while Pati Baramashi exhibited minimum spread (274 cm in E-W and 276 cm in N-S).

Table 1: Plant growth and habit of acid lime cultivars at Jhargram

Cultivar/variety	Growth of the plant at the age of 8-year				Shape of the canopy	Spine intensity	Spine size
	Height (cm)	Basal girth (cm)	Plant spread (cm)				
			E-W	N-S			
Gandharaj	313	30.7	297	330	Dwarf & drooping	Less	Medium
Kagzi Large	346	40.4	461	426	Spreading	More	Large
Pati Baramasi	248	21.3	274	276	Dwarf	Less	Large
Pati Hybrid	387	55.8	435	400	Bushy	Less	Medium
Pati Seedless	277	32.0	351	390	Erect	No spine	-
PKM-1	327	45.9	292	297	Spreading & drooping	More	Small
SEm(±)	4.1	1.9	5.3	5.5	-	-	-
LSD(0.05)	12.0	5.5	15.6	16.2	-	-	-

Regarding shape of the plant, dwarf nature was noted in Pati Baramashi, bushy in Pati Hybrid, erect in Pati Seedless, spreading in Kagzi Large, dwarf and drooping in Gandharaj and spreading and drooping in PKM-1. Presence of spine on the branches hinders the intercultural operations particularly harvesting. It was observed that Pati Seedless had no spine while PKM-1 and Kagzi Large had more spines. In other three cultivars namely Gandharaj, Pati Baramashi and Pati Hybrid comparatively lesser spine was observed on the branches. Large spine was noted in Kagzi Large and Pati Baramashi, medium in Pati Hybrid and Gandharaj and small in PKM-1.

The data presented in table- 2 indicated that fruit production in acid lime showed a wave length after attending the age of 5 year. All the cultivars reached to the stage of maximum fruit production at the age of 5 year (*i.e.* 2007). Among the six cultivars evaluated, 'Pati Seedless' constantly produced good number of fruits since its beginning with peak (471) in 2007 and have maximum number of fruits (325) in sixth years' average. The next promising cultivars were 'Kagzi Large' and 'Pati Hybrid' which yielded 293 and 277 fruits respectively as six years' average. 'Pati Baramashi' which is expected to be a good yielder resulted in poor in fruit production. Another cultivar PKM-1, a released variety from Tamil Nadu Agricultural University (Chadha, 2009) was also found to be a poor yielder in our conditions. From this observation it is conferred that for different set of agro-climatic condition, suitable variety/cultivar should be selected on the basis of their performance for at least 5 to 6 consecutive years' yield data. The six years' average yield data by weight in table- 1 indicated that the 'Pati Hybrid' gave maximum yield (46.3 kg fruits⁻¹ plant) followed by 'Pati Seedless' (26.0 kg⁻¹ plant). The yield potentiality as observed in Pati Hybrid was considered to be better than the study made by Jawaharlal *et al.* (1989) where they reported 36.6 kg yield⁻¹ tree from 911.7 fruits.

The fruit weight in acid lime which is directly correlated with the size is considered to be an important parameter for fetching good price. The data in Table 2 indicated that 'Pati Hybrid' placed the 3rd position in fruit production by number but by weight, it occupied the first in position, due to its extra ordinary highest fruit weight (167 g). The next weighable fruit was measured from the cultivar Gandharaj (93 g) followed by Pati Seedless (80 g). The length of fruit (7.5 cm) was recorded in Gandharaj while the fruits of Pati Hybrid had a good shape (7.1 x 6.2 cm). The fruit weight and size were noted minimum in PKM-1.

Fruit having lesser number of seeds is generally preferred by the consumers and also the preservation industry. The minimum number of seeds was counted from PKM-1 (10) followed by Kagzi Large (13) and maximum in Gandharaj (45). The 'Pati Seedless' by name seemed to be the seedless or lesser seed content but it had 31 seeds fruit⁻¹.

The juice content in the fruit was measured highest in Pati Seedless (49%) followed by Pati Hybrid (46%) and lowest in Gandharaj (36%). The Pati Seedless also had maximum T.S.S. (6.0 °B) and Vit. C (28.5 mg 100⁻¹ ml juice). The Vitamin C content in Pati Seedless could be comparable with the acid lime as studied on different rootstocks by Jawaharlal *et al.*, (1991) where it was reported to vary from 23.7 mg to 29.17 mg 100⁻¹ ml juice. The Gandharaj showed minimum in T.S.S. (4.7 °B) and Vit. C (12.0 mg.100 ml juice) content in the juice. The 'Gandharaj' a variety of *nimbu*, which has high demand in and around Kolkata markets for its pleasant scent, aroma and size, exhibited poor quality with regard to higher seed content, lower juice percentage, T.S.S. and Vit. C content.

Table 2: Evaluation of acid lime cultivars at Jhargram

Cultivar/ Variety	Fruit yield (number)						Average	Average fruit yield (kg plant ⁻¹)	Fruit weight (g)	Fruit length (cm)	Fruit breath (cm)	No. of seeds fruit ⁻¹	Juice (%)	TSS (°B)	Acidity (%)	Vit. C (mg100 ⁻¹ ml juice)
	2005	2006	2007	2008	2009	2010										
Gandharaj	240	192	174	34	198	132	162	15.1	93	7.5	5.6	45	36	4.7	4.8	12.0
Kagzi Large	178	146	575	328	323	208	293	18.2	62	6.7	5.0	13	38	5.7	4.2	14.5
Pati Baramasi	2	1	77	14	20	32	24	1.1	46	5.6	4.6	19	45	5.9	5.5	18.5
Pati Hybrid	197	230	421	186	346	280	277	46.3	167	7.1	6.2	24	46	5.7	5.3	16.5
Pati Seedless	297	323	471	208	332	320	325	26.0	80	5.9	5.8	31	49	6.0	4.9	28.5
PKM-1	8	1	32	32	19	21	19	5.1	27	4.3	4.0	10	44	5.7	5.0	22.5
SEm(±)	3.3	3.7	6.3	5.0	5.2	4.2	2.2	0.8	2.8	0.2	0.1	0.7	0.4	0.1	0.1	0.7
LSD(0.5)	9.5	10.8	18.4	14.7	15.3	12.4	6.4	2.4	8.1	0.7	NS	1.9	1.1	NS	NS	2.1

Note: NS- Non significant, Date of planting: July, 2002

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