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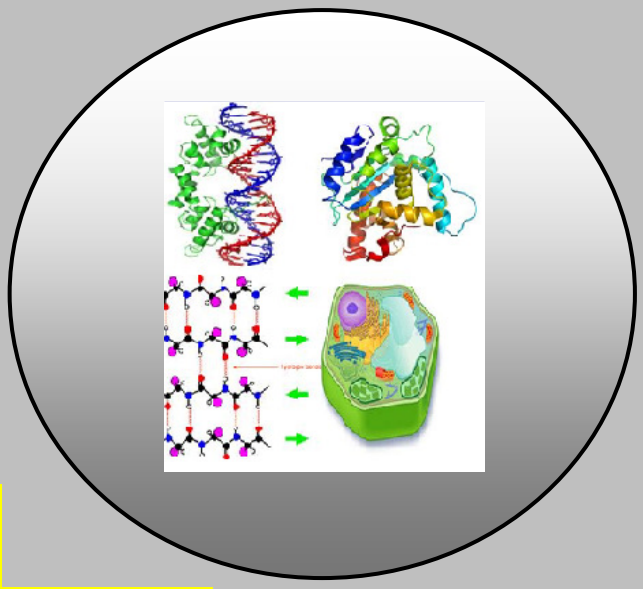

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Evaluation of Local Banana Cultivars under Coconut Shade in Goa

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ABSTRACT

A systematic performance evaluation of seven local cultivars of banana viz., Amti (Mysore), Velchi (Ney Poovan), Raspali (Silk), Saldatti (Pachanadan), Savarboni (Bluggoe), Myndoli (Horn Plantain), and Sugandi (Pisang Awak)along with Grand Naine was carried out for one main + two ratoon crops under adult coconut plantation. Velchi took 299 days to flower but 412 days to harvest. Amti bunches were harvested earlier (403 days) than Velchi. Myndoli took the longest duration to flower (429 days) and harvest (532 days). Among the cultivars evaluated, lowest sucker production (0.51) per mat was noticed in Myndoli whereas the highest (1.93) in Velchi. The cultivar Grand Naine was the shortest (162.5 cm) whereas Myndoli was the tallest (450.70 cm) which also renders difficulty in maintenance of crop. Plant girth was highest in Myndoli (70.88 cm), whereas, Amti recorded the least plant girth of 40.90 cm. highest bunch weight of 16.80 kg was recorded in Myndoli and the least bunch weight of 8.30 kg was observed in Sugandi. Minimum number of hands (5.56, 6.12) per bunch was observed in Savarboni and Myndoli, whereas the maximum (12.32) was in Amti. During first ratoon crop, Velchi and Saldatti recorded the lowest bunch weight of 10.50 kg whereas it was maximum (16.05 kg) in Grand Naine. Amti recorded the maximum of 13.53 hands. The average hand weight ranged from 0.81 kg in Velchi with lowest finger weight to 2.31 kg in Myndoli having highest finger weight. In second ratoon crop, highest bunch weight (15.45 kg) was recorded in Grand Naine followed by Myndoli (15.25 kg).

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Pulp: peel ratio and quality characters like TSS and total titrable acidity also varied significantly among the cultivars evaluated. Cost: benefit ratio for main and two ratoons was higher in Raspali (1: 2.21), Savarboni (1: 2.31), Myndoli (1: 2.4 7) and Grand Naine (1: 2.48) followed by Amti (1: 1.95), Saldatti (1:1.85), Velchi (1: 1.67) and Sugandi (1:1.15). Considering duration for flowering and fruiting, propping needs and market, cultivation of two or more cultivars like Myndoli, Grand Naine, Velchi and Amti under coconut shade will be highly remunerative to the farmers of Goa.
Key words: Goa-local banana cultivars-Grand Naine- coconut shade-evaluation.

INTRODUCTION

Goa is a small state admeasuring 3607 sq.km, in which more than 50% of the cultivated lands are covered with horticultural crops especially cashew, coconut and areca nut. Besides these plantation crops, fruit crops like mango, banana and pineapple are also cultivated in Goa. Banana cultivars of Goa are claimed to be local to Goa and the basic details about them like vernacular names, International names and their genome are as follows: Amti (Mysore- AAB), Raspali (Silk- AAB), Velchi (Neypoovan- AB), Saldatti (Pachanadan-AAB), Savarboni (Bluggoe-ABB), Myndoli (Giant Plantain-AAB) and Sugandi (Pisang Awak- AAB). These are cultivated either as monocrop or intercropped in coconut or areca nut plantations in different places of Goa. Intercropping banana in coconut interspaces is a profitable venture recommended in many places in India like Kerala (Rao *et al*, 2008), and in other countries like Srilanka (Liyanage *et al.,* 1985)) and Philipines (Villanueva, 2008).

In Goa, different cultivars are grown in different taluks, with very few exceptions where farmers have opted for a complete polyclonal intercropping of banana under coconut. Polyclonal system of growing banana in India is predominant owing to the regional preferences. The best variety of one region may not be the best in other region. Nendran (AAB) banana is grown in Malabar region from time immemorial, which made to believe that it is indigenous to Malabar (Jacob, 1952).

However, in Goa, the performance of cultivars *per se* and the intercropping of banana under coconut have not been systematically studied. Therefore, this evaluation study was initiated with the objectives to find the cultivar suitability of banana under coconut and to study the performance of various cultivars systematically.

MATERIAL AND METHODS

Banana varieties like Amti, Velchi, Raspali, Saldatti, Savarboni, Myndoli, and Sugandi along with Grand Naine (AAA) as control were planted under coconut shade during August 2003. Sword suckers of these cultivars were collected from farmers' fields and Goa state Government farms.

A field of adult coconut palms at a spacing 8 x 8 m was selected for taking up the trial at ICAR Research Complex for Goa. Banana suckers were planted at 2 x 2 m spacing as an intercrop to coconut, in randomized block design (RBD) with three replications. In an area of nearly 2100 sq.m, around 365 banana plants were accommodated in interspaces of 34 palms. Each cultivar had around 45 plants in the field. Regular package of practices like fertilizer application, irrigation, de-suckering, removal of old leaves, propping *etc.* were followed. Observations like, plant height at harvest, plant girth at one meter height from ground level during harvest, days taken for flowering, days taken for harvest, bunch weight, number of hands per bunch, hand weight, number of fingers per hand, individual finger weight, finger length, finger girth were recorded. Fruit quality parameters such as pulp: peel ratio, total soluble solids (TSS) and total titrable acids were recorded (AOAC, 1980). TSS and titrable acids in the fruit pulp were estimated during main crop only. During the course of study, the weight of all bunches harvested were weighed and then average drawn. The yield per unit area was calculated as the product of average bunch weight and banana plant population of 1764 plants per hectare under adult coconut palms of 8 x 8 m spacing. After harvest of main crop, first ratoon crop was taken and all the observations were recorded, following which, second ratoon crop was taken up. All data were statistically analysed using Web Agri Stat Package (WASP version 2.0), for interpretation and drawing conclusions.

RESULTS AND DISCUSSION

Main crop

Among all cultivars evaluated, Velchi was the earliest to flower (299 days) after planting followed by Saldatti (309 days).Myndoli took the longest gestation period of 429 days. But by that time, cultivars like Grand Naine, Saldatti, Amti and Velchi, were ready for harvest of main crop bunches and time taken was 398, 402, 403 and 412 days respectively (Fig .1). The cultivars showed significant difference in time taken for flowering and harvest in main and following two ratoon crops. In a study conducted at Jalgaon, Bhalerao (2007) found that Grand Naine took 280 days to flower and 386 days for harvest of main crop. Rema *et al* (2002) reported that Myndoli recorded the longest crop cycle of 409 days under Kerala conditions. Medhi (1994) reported that Bharat Moni (Plantain) took a maximum of 491 days to harvest bunches. Baruah *et al.,* (2007) found that Dwarf Cavendish was found to be most precocious (275 days for shooting) and Kachkal (Cooking type) took maximum time of 391 days for shooting, whereas Champa (Mysore) took 376 days and Malbhog (Silk) took 351 days. Though the findings of present study are in line with the crop duration recorded in other places, it is evident that the time taken to shoot out inflorescence as well as harvest of bunches is higher by an average of one month because of the partial shade under which the cultivars were tried.

In first ratoon crop, Velchi was the earliest to shoot inflorescence (473 days), followed by Amti (528 days). Velchi came to harvest in 568 days after planting; Amti in 661 days; Sugandi and Grand Naine in 673 and 675 days respectively. Dinesh Kumar *et al.*, (2008) found that Rasthali took 295 days to flower and 401 days to harvest during main crop. However during first ratoon, it took 248 days to flower and 349 days to harvest at Orissa condition. Babu Ratan *et al.,* (2008) also found that Grand Naine took 220 days to flower and 324 days to harvest during main crop whereas it took 146 days to flower and 263 days to harvest during first ratoon, thereby taking 543 days for completion of main + one ratoon cycle under open climatic conditions of Andhra Pradesh.

In the same trend, in present study, Velchi took a very short duration of 95 days between of harvest of first ratoon and flowering of second ratoon i.e., after 630 days of planting. But, cultivars like Savarboni and Raspali took almost double the duration i.e., 1188 and 1185 days respectively, to flower in the second ratoon crop. The second ratoon crop of Velchi was harvested at the earliest (720 days) followed by Sugandi (891 days), Amti (912 days) and Grand Naine (945 days). Raspali took the longest duration (1295 days) to harvest, followed by Savarboni (1268 days) and Myndoli (1250 days).

Table 1. Vegetative characters of cultivars evaluated

Varieties	Plant height at harvest (cm)			Plant girth at harvest (cm)			No. of suckers per mat
	Main crop	I ratoon	II ratoon	Main crop	I ratoon	II ratoon	
Amti	290.40	285.23	287.56	40.90	41.90	41.25	1.30
Raspali	275.50	281.67	285.87	46.07	47.47	49.98	1.28
Velchi	350.40	359.03	345.64	48.10	47.00	46.89	1.94
Saldatti	347.20	358.60	367.88	42.53	45.60	49.74	1.23
Savarbon	400.50	406.63	400.45	69.74	65.61	65.26	1.72
Myndoli	450.70	448.30	451.15	70.88	70.90	70.56	0.51
Sugandi	290.50	300.60	300.17	46.58	49.45	50.05	1.23
Grand Naine	162.50	170.03	168.55	43.58	43.67	43.61	1.20
CD (P=0.01)	12.28	14.54	1.63	5.07	4.50	3.71	0.24

The vegetative growth and stature of all the cultivars evaluated were fairly normal. A significant varietal difference was noticed in the plant stature traits of cultivars evaluated (Table 1).

During main crop, Grand Naine was shortest in height with 162.5 cm, whereas, Myndoli was observed to be the tallest of all (450.70 cm), followed by Savarboni (400.50 cm). Similarly, Myndoli also recorded the maximum plant girth (70.88 cm), followed by Savarboni (69.74 cm). Amti recorded the minimum girth (40.90 cm), followed by Saldatti (42.53 cm) and Grand Naine (43.58 cm). Likewise, during the first ratoon also, Grand Naine was observed to be the dwarfest (170.03 cm), followed by Raspali (281.67 cm) and Amti (285.23 cm). Myndoli was the tallest cultivar (448.30 cm), followed by Savarboni (406.63 cm). Similarly, during second ratoon also, the same trend was noticed with Grand Naine recording the lowest plant height of 168.55 cm and Myndoli the maximum of 451.15 cm. Amti recorded the minimum plant girth of 41.25 cm, whereas, Myndoli recorded the maximum of 70.56 cm. Bhalerao (2007) also observed that plant height and stem girth of Grand Naine were 191.50 cm and 74.40 cm respectively. Medhi (1994) found during an evaluation trial at Assam that, Chenichampa (Neypoovan) 253 cm and 49.35 cm; Bharat Moni (Giant / Horn Plantain) 230 and 46.67 cm; Malbhog (Silk) 228 cm and 48.50 cm and Kachkal (Cooking type) 278 and 51.17 cm respectively for plant height and plant girth. In another evaluation study conducted at Assam by Baruah *et al.*(2007), it was found that, the highest psuedostem height (272.25 cm) was found in Champa (Mysore), followed by Kachkal (cooking type; 271.25 cm). In the present study, the findings are in similar line, except that, the plant height is more, due to intercropping under coconut shade. There was noticed a phenomenon of competence for sunlight with the adult coconut palms. Consequently, Myndoli and Savarboni required support of bamboo stakes due to their tall stature. Suckering habit of cultivars was observed before desuckering. Myndoli had a very shy suckering habit (0.5), whereas Velchi showed a profound suckering habit with 1.94 suckers per mat (Table 1). Velchi, being a diploid and of comparatively shorter duration, with additional advantage of high suckering tendency, therefore, produced more number of bunches in a short duration, when compared to others. Considering these factors, Velchi also being a choice cultivar in market, can be recommended as a suitable intercrop under coconut plantation in Goa. In a similar performance evaluation study, Hipparagi (2002) has recommended Elakkibale (Velchi) as the best profitable cultivar for Southern Karnataka. Bharuah *et al.,* (2007) reported a significant difference in suckering habit at 5 % level. He observed a range of 3.25 in Lacaton to 10.00 in Kachkal and Bhutmanohar.

Table 2. Bunch characters and yield of cultivars evaluated

Varieties	No. of hands /bunch			Av hand weight (kg)			No. of fingers / hand		
	Main crop	I ratoon	II ratoon	Main crop	I ratoon	II ratoon	Main crop	I ratoon	II ratoon
Amti	12.32	13.53	12.25	1.036	0.925	0.995	14.46	14.45	15.02
Raspali	8.53	8.67	7.75	1.162	1.243	1.428	10.70	10.78	13.30
Velchi	11.67	12.90	11.50	0.781	0.810	0.710	14.57	15.23	13.62
Saldatti	6.55	7.67	7.75	1.603	1.350	1.500	11.03	11.41	12.17
Savarboni	5.56	7.70	6.50	2.100	1.580	1.820	9.47	9.65	9.50
Myndoli	6.12	6.30	6.20	2.68	2.310	2.300	11.83	13.85	12.50
Sugandi	6.51	8.07	9.50	1.270	1.450	1.180	15.65	13.66	13.97
Grand Naine	7.70	11.23	7.25	1.746	1.440	2.010	14.00	14.70	13.86
CD (P=0.01)	1.484	1.757	1.580	0.224	0.301	NS	0.999	1.348	NS

The cultivars evaluated showed a great variation in bunch weight and were significantly different from each other. Other than Velchi, rest was triploids (Figure 2 and Table 2). Myndoli recorded the highest bunch weight (16.80 kg), followed by cooking type Savarboni (12.04 kg). In Kerala, Rema *et al* (2002) recorded 25 kg of bunch weight for Myndoli whereas, under Orissa conditions, Lenka et al., (2002) evaluated different types of cooking bananas and found that a minimum of 16 kg was recorded per bunch in type Gaja Bantal (similar to Savarboni), whose cooking quality and market acceptability was the highest among all. Medhi (1994) recorded bunch weights of 13.37 kg, 14.19 kg and 15.35 kg in cultivars Bharat Moni (Plantain type), Malbhog (Silk) and Kachkal (Cooking type) respectively. Baruah *et al.,* (2007) reocorded bunch weights of 12.50 kg, 10.01 kg, 12.00 kg and 11.89 kg in Champa (Mysore), Kachkal (cooking type), Bhutmanohar (similar to Sugandi) and Malbhog (Silk). These findings corroborate with those of present study. In the present study, Saldatti recorded the least bunch weight (8.30 kg) followed by Sugandi (8.58 kg). In terms of yield per unit area, Myndoli recorded the highest yield of 29.64 t /ha, followed by Savarboni (21.24 t / ha). Saldatti recorded the minimum yield of 14.64 t/ ha.

Table 3. Fruit characters of cultivars evaluated

Varieties	Finger wt (g)			Fruit length (cm)			Fruit diameter (cm)		
	Main crop	I ratoon	II ratoon	Main crop	I ratoon	II ratoon	Main crop	I ratoon	II ratoon
Amti	71.85	65.15	65.32	11.23	11.20	12.60	3.32	3.34	3.26
Raspali	120.15	115.23	102.77	12.97	12.92	14.11	4.00	4.00	3.86
Velchi	60.70	54.47	59.23	10.19	10.58	11.00	3.03	3.09	3.63
Saldatti	131.09	118.32	115.59	19.32	19.46	17.438	3.52	3.62	3.97
Savarbon	145.53	166.08	158.85	20.30	19.75	19.50	4.55	4.73	4.63
Myndoli	226.54	168.50	170.35	21.71	23.31	21.00	5.30	5.45	5.25
Sugandi	86.37	106.50	82.63	12.03	12.07	13.25	3.17	3.07	3.30
Grand Naine	120.76	106.33	115.07	16.32	16.50	14.52	3.36	3.38	3.11
CD (P=0.01)	9.487	15.045	22.230	1.561	1.657	3.360	0.313	0.554	0.870

Although, Myndoli and Savarboni recorded less number of hands per bunch (6.12 and 5.56 respectively), the greater hand weight (2.68 kg and 2.10 kg per hand for Myndoli and Savarboni respectively) contributed towards the higher bunch weight (Table 2). Amti recorded the highest number of hands per bunch (12.32), followed by Velchi (11.67). Saldatti produced appreciable hands weighing on an average 1.603 kg and Velchi recorded the lowest hand weight of 0.781 kg. Significant difference in yield was mainly due to the inherent yielding ability of the cultivars. Similar reports were given by Ray and Yadav (2002). Also Bhalerao (2007) observed that Grand Naine produced 8.77 hands per bunch and 152 fingers per bunch. Medhi (1994) observed 7.23 and 7.82 hands per bunch in cooking type and Raspali type of Assam. In the present study, Grand Naine produced on an average, 8.6 hand per bunch and 123 fingers per bunch under Goa conditions.

Table 4. Quality characters of banana cultivars evaluated

Varieties	Pulp: peel ratio			TSS (%)	Titrable acidity (%)
	Main crop	I ratoon	II ratoon		
Amti	3.1: 1	3.06: 1	4.39: 1	23.58	0.62
Raspali	3.92: 1	3.87: 1	4.50: 1	25.38	0.48
Velchi	4.69: 1	4.88: 1	4.21: 1	25.88	0.55
Saldatti	1.81: 1	1.81: 1	2.60: 1	24.76	0.49
Savarboni	1.75: 1	1.74: 1	1.74:1	--	--
Myndoli	2.02: 1	2.04: 1	2.05:1	30.85	0.31
Sugandi	2.52: 1	2.48: 1	2.68: 1	23.600	0.26
Grand Naine	1.91: 1	1.94: 1	3.15: 1	21.68	0.40
CD (P=0.01)	0.267	0.256	0.950	2.680	0.220

Note: TSS (%) and titrable acidity (%) recorded during main crop. Savarboni being a cooking banana was not tested for quality characters like TSS and acidity.

Sugandi recorded the highest number of fingers per hand (15.65) followed by Velchi (14.57) and Amti (14.46). Myndoli recorded the highest individual fruit weight (226.54 g) followed by Savarboni (145.53 g) (Table 3). Similarly Myndoli and Savarboni bore long fruits (21.71 cm and 20.30 cm respectively), followed by Saldatti (19.32 cm). Highest fruit diameter (5.30 cm) was also observed in Myndoli followed by Savarboni (4.55 cm) and Raspali (4.00 cm). Appreciable pulp: peel ratio (4.69: 1) was noticed in Velchi, followed by Raspali (3.92: 1). Savarboni being a thick-skinned cooking banana recorded the least pulp: peel ratio of 1.75: 1 (Table 4). Baruah *et al.,* (2007) found that finger length ranged from 11.43 cm in Chenali to23.15 cm in Garomaina (Plantain type), finger girth varied from 9.65 cm in Lacaton to 12.30 cm in Krishnasagar, finger weight ranged from a minimum of 47.20 cm in Chenali to a maximum of 254.60 cm in Kachkal (starchy cooking type). He has also reported a minimum of 5.50 hands per bunch in Asomiya Malbhog (probably a natural mutant of Silk at Assam) and a maximum of 10.75 in Simolumanohar.

First ratoon crop

There was no much difference in plant height and plant girth between main crop and first ratoon crop. (Table 1). Myndoli recorded the maximum plant height (448.30 cm) and plant girth (70.90 cm), followed by Savarboni (406.63 cm and 65.61 cm). Grand Naine recorded the maximum bunch weight (16.05 kg), followed by Myndoli (14.58 kg). Minimum bunch weight (10.50 kg) was recorded by Velchi and Saldatti, followed by Raspali (10.86 kg) (Figure 2). There was a general increase in yield in all cultivars except Myndoli, which recorded 25.72 t/ha. But, Grand Naine recorded the maximum of 28.31 t/ha. A minimum of 18.52 t/ha was observed in cultivars Velchi and Saldatti. The difference in performance of cultivars was statistically significant. In a management trial on Raspali at Orissa, Dinesh Kumar *et al.*, (2008) found that, in a population of 2500 plants per ha (similar to present study) plants recorded psuedostem height of 276.10 cm in main crop and 262.30 cm in first ratoon; pseudo stem girth of 65.10 cm and 60.20 cm in main and ratoon crop respectively; 5.72 and 6.12 hands per bunch; 8.2 and 7.6 kg bunch weight and an estimated yield of 20.6 and 19.0 t/ha respectively for main and first ratoon crops. In an evaluation trial, Grand Naine recorded a maximum bunch weight of (14.95 kg) (Deshmukh and Badgujar, 2002). In another trial by Kanamadi *et al.,* (2002), a bunch weight of 10.55 kg /plant (25.27 t/ha) and 12.76 kg / plant (32.56 t /ha) was recorded in cv. Rajapuri . In general, triploid cultivars particularly those in commercial plantations are generally superior to diploids in terms of vigour, productivity and acceptability (Shepherd et al, 1986).

Amti recorded the maximum number of hands per bunch (13.53), followed by Velchi (12.90 kg) with average hand weights of 0.925 kg and 0.814 kg respectively for cultivars Amti and Velchi (Table 2). Cultivar Myndoli recorded the least number of hands per bunch (6.30). Though Velchi recorded the minimum hand weight of 0.81 kg, it recorded the maximum number of fingers per hand (15.23). This was followed by Grand Naine (14.70), Amti (14.45) and Myndoli (13.85) (Table 2). Similar to main crop, Myndoli recorded the highest individual fruit weight of 168.5 g, followed by Savarboni (166.08 g) (Table 3). Similarly Myndoli produced the longest fruits (23.31 cm) with highest fruit diameter (5.45 cm). Velchi produced the fruits of minimum length of 10.58 cm, followed by Raspali (12.92 cm) and Sugandi (12.07 cm).

Second ratoon crop

Yield characters of crop was recorded and furnished in tables 2 and 3. Maximum bunch weight of 15.45 kg was recorded in Grand Naine, followed by Myndoli (15.25 kg). Velchi being a diploid again recorded a minimum bunch weight of 8.38 kg (Figure 2). Velchi recorded a minimum yield of 14.78 t/ha, whereas, Grand Naine recorded a maximum of 27.25 t/ha, followed by Myndoli (26.90 t/ha). The cultivars showed significant difference in growth and bunch characters except average hand weight and number of fingers per hand.

Amti had maximum (12.25) hands per bunch, followed by Velchi (11.50). The same trend was noticed in previous crops also. Myndoli showed minimum number of hands (6.20) that weighed higher than all others (2.30 kg). Minimum hand weight of 0.71 kg was seen in Velchi, followed by Amti (0.995 kg). Maximum number of fingers per hand (15.02) was noticed in Amti, followed by Sugandi (13.97). Among the cultivars evaluated, Myndoli recorded the maximum finger weight (170.35 g), followed by Savarboni (158.85 g), whereas, the minimum finger weight (59.23 g) was exhibited by Velchi. Myndoli recorded the maximum fruit length (21.00 cm) and fruit diameter (5.25 cm), whereas Velchi recorded minimum fruit length (11.00 cm) and Grand Naine, a minimum fruit diameter (3.11 cm). Similar evaluation trials were taken up with different cultivars of banana under both East and West coast conditions. Cultivars like Poovan, Thenkadali, Monthan, Robusta and Peyan performed well; Rasthali, Kolikodu, Neypoovan, Saba and Karpuravalli performed moderately, whereas, Red banana, Matti, Anaikomban and Nendran were poor performers. (Shakila and Ruban, 2007).

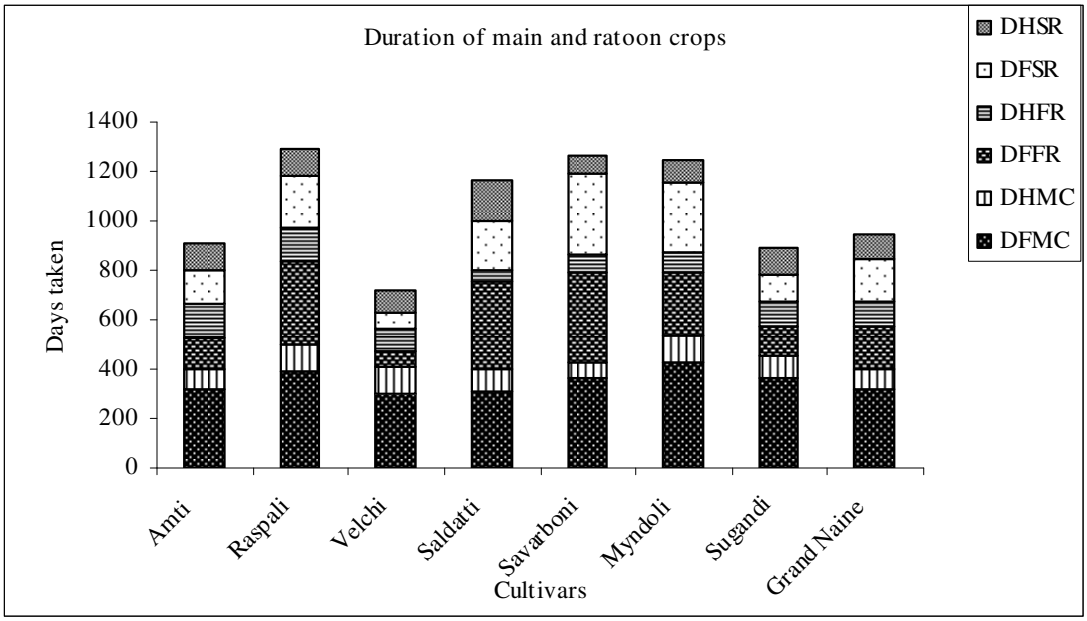

Fig 1. Duration taken for different cultivars of banana to flower and fruit during main and ratoon crops.

DFMC- Days taken for flowering in main crop, DHMC-Days taken for harvest of main crop
DFFR- Days taken for flowering in first ratoon, DHFR-Days taken for harvest of first ratoon
DFSR- Days taken for flowering in second ratoon, DHSR-Days taken for harvest of second ratoon.

Fruit quality

In main and first ratoon crops, Velchi recorded the highest pulp: peel ratio of 4.69: 1 and 4.88: 1 indicating thin skin. The minimum ratio was noticed in Savarboni, it being a cooking type (1.75: 1, 1.74:1 and 1.74: 1 during main, first and second ratoon crops). Saldatti, which means banana with thick skin in Konkani (regional language of Goa) also, had low pulp: peel ratio (1.81: 1). Similarly, Ramkumar and Rajan (2007) reported that pulp percentage was maximum (85.9%) in Neypoovan and that pulp: peel ratio varied from 1.16 to 6.13 and it was higher in Neypoovan and minimum in Malaikali. Rekha and Prasad (2002) also have reported high significant variations among cultivars evaluated for fruit weight, pulp weight and peel weight. In the present study, among the cultivars evaluated, Myndoli was the sweetest (30.85 % TSS), followed by Velchi (25.88 %) and Raspali (25.38 %), whereas Grand Naine recorded minimum TSS of 21.68 %. Medhi (1994) also reported Malbhog (Silk) had the highest TSS (24.22%) among the cultivars evaluated. Amti was the sourest cultivar with 0.62 % of titrable acidity whereas Sugandi recorded the least acidity of 0.26%. Total soluble solids constitute mainly of sugars in banana pulp and thus more TSS content indicates more sweetness.

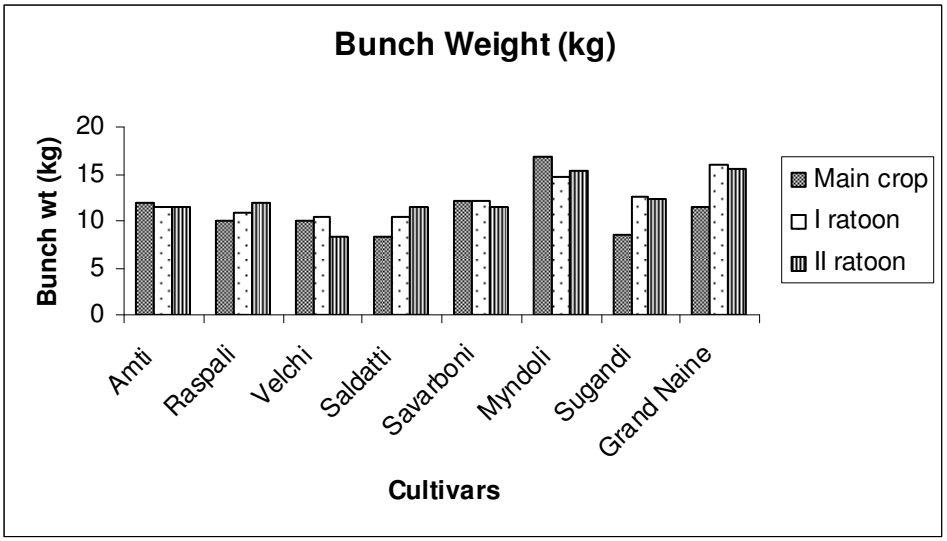

Fig 2. Bunch weight of banana cultivars evaluated during main and ratoon crops.

Cost economics

Working out cost economics for one main and two ratoons, it was found that Raspali (1: 2.21), Savarboni (1: 2.31), Myndoli (1: 2.4 7) and Grand Naine (1: 2.48) showed higher cost benefit ratios followed by Amti (1: 1.95), Saldatti (1:1.85), Velchi (1: 1.67) and Sugandi

(1:1.15). In a similar case, Marimuthu *et al* (2007) reported that banana cv. Monthan (Savarboni) could be profitably grown as intercrop in adult coconut garden to get more return from the unit area.

However, under Goa condition, owing to shorter duration and sustained market, cultivars like Velchi, Amti and Saldatti will fetch good returns. High cost incurred in propping of Myndoli plants, breakage losses and long duration are few important criteria that go against this cultivar despite the higher returns due to their high prices. Therefore, polyclonal culture i.e., cultivation of two or more chosen cultivars from the above group *ie*., Myndoli + Grand Naine+ Velchi or Savarboni + Amti + Velchi or Raspali + Amti + Velchi or Saldatti + Amti + Velchi (or) cultivation of Grand Naine + Velchi along with any other local variety of regional preference under coconut shade will be highly remunerative to the farmers. It has been proved that banana and coconut are companion /mixed crops synergistic in growth and sharing the inputs. Banana forms a major / essential component either in homestead farming, small land holding or mixed cropping with other perennials as well as multi-storied, multi-species cropping systems and mixed farming system in Asian and Pacific Countries. Being a partial shade tolerant crop, growing banana in coconut provides a favourable micro-climate to plantations and also increases the yield of coconut due to the sharing of inputs as well as addition of biomass to plantations, which add nutrition on recycling (Rethinam, 2002).

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REFERENCES

A.O.A.C. 1980. *Official methods of Analysis*. 13th edn., Association of Official Agricultural Chemists, Washington, DC.

Babu Ratan, P., D.V. raghava Rao, Y.N.Reddy and D.Madhava Rao. 2008. Organic banana production system: Leaf emission, leaf senescence and crop duration in plant and ratoon cycles. *Indian. J. Hort.* **65** (2). p 134-136

Baruah, K., Baskarjyoti Sarma and Debajit Sut. 2007. Genetic variability in banana cultivars under Assam conditions. *Indian. J. Hort.* **64** (3). p 282-285

Bhalerao, V, P., A.D.Jagdhani and C.V.Pujari. 2007. Effect of different sources of nitrogen on yield and quality of Grand Naine banana. (in):*Proceedings of National Conference on Banana,* held during 25-28 October at National Research Center for Banana, Thiruchirapalli, p 97

Deshmukh, S, S. and C.D. Badgujar. 2002. Response of N, K fertigation and different plant densities on yield of banana Grand Naine. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 91.

Dinesh Kumar, V. Pandey and K.Anjaneyalu. 2008. Effect of planting density and nutrient management on growth, yield and quality of mico-propagated banana Rasthali Pathakapoora (AAB). *Ind.J.Hort*. **65** (3) p 272-276

Hipparagi,K, H.T.Naggraju, G.K.Mukunda and S.T.Bhairappanavar.2002. Performance of banana cultivars under wetland situations in Bhadra command of Karnataka. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 81

Jacob,K,C., 1952. *Madras banana: A monograph.* Superintendent, Govt. Press, Madras 1952

Kanamadi,V,C., S.N.Patil, A.M.Shirol, S.I.Hanama Shetti, N. Thammaiah and S.I.Athani. 2002. Effect of time and planting on yield and Quality characters in Banana rajapuri under Ghataprabha Command Area. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 78

Lenka, P,C., D.K. Dash, D.P Ray and S.Samal. 2002. Performance of culinary banana under agro-climatic conditions of Orissa. . *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 39

Liyanage, M,De,S, K.G.Tejwani and P.K.R.Nair. 1985. Intercropping under coconuts in Srilanka. *Agroforestry Systems* **2(**3): 215-228

Marimuthu, R., R.Vaithialingam and K.C.Gowthaman. 2007. Banana-most suitable intercrop for adult coconut garden (in):*Proceedings of National Conference on Banana,* held during 25-28 October at National Research Center for Banana, Thiruchirapalli, p 123

Medhi, G. 1994. Performance of some cultivars of banana (Musa paradisiacal L.) in Assam. *Haryana J. Hort. Sci*. **23** (3): 181-185

Ramkumar and S,Rajan. 2007. Evaluation of banana germplasm for physical and organoleptic characteristics under Lucknow conditions. (in):*Proceedings of National Conference on Banana,* held during 25-28 October at National Research Center for Banana, Thiruchirapalli, p 3

Rao, L, R., M.Shivamurthy and M.T.Lakshminarayan. 2008. Adoption of Sustainable Coconut and Banana Intercropping Practices- An Analysis*. Mysore. J.Agric. Sci.,* **42** (1): 67-74

Ray, S,K. and J.P. Yadav. 2002. Performance of banana under Low and High Input Crop Management Systems. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 75.

Rekha, A and M.B.N.V. Prasad. 2002. Evaluation of Pulp: peel content of some banana cultivars. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 28

Rema Menon, K.Aravindakshan and C.T. Chandralekha. 2002. Evaluation of Plantain (Musa AAB) variability in South India. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p 22

Rethinam,P. 2002.Synergistic Production System of banana with coconut –A Global Scenario. *(in): Abstacts "Global Conference on Banana and Plantain*", held during 28-31 October at Bangalore, p70

Shakila Arumugam and J. Sam Ruban. 2007. Evaluation of banana cultivars for coastal ecosystem. (in):*Proceedings of National Conference on Banana,* held during 25-28 October at National Research Center for Banana, Thiruchirapalli, p 95

Shepherd,K., J.L.Loyola Dantas and E.J.Alves 1986*. Mejoramiento genetico del banano*. pp 1-19 **In** Mejoramiento genetico del banano y platano en Brasil Y Honduras, Panama

Villanueva,V,G. 2008. Earn more from intercropping coconuts with bananas. *In PIA Daily News Reader*. dt 20.02.08

Web Agri Stat Package. *WASP 2.0.* www.icargoa.res.in

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