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Performance of litchi cultivar for yield and physico-chemical quality of fruits

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ABSTRACT

The influence of 14 cultivars (namely Ajhauli, Bedana, China, Dehradun, Dehra Rose, Deshi, Green, Kasba, Late Bedana, Longia, Purabi, Rose scented, Shahi and Trikolia of litchi (*Litchi chinensis* Sonn.) on yield and physicochemical quality of fruits was evaluated. Fruit samples were collected at the peak harvest during the month of May from 16 years old healthy trees. The parameters which were assessed were cracking percent, fruit and pulp yield, fruit length and diameter, shape index, peel thickness, seed, peel and pulp percent, pulp and peel ratio, pulp and seed ratio, Total Soluble Solids (TSS), Titrable acidity, TSS and acid ratio, ascorbic acid content, total reducing and non-reducing sugars and total sugar acid ratio. The result indicated that cultivar Kasba, Bedana and Late Bedana bears good quality fruits while the highest yield was recorded in cultivars Shahi followed by China and Rosescented.

Key words: Litchi, cultivars, physico-chemical quality, fruits.

INTRODUCTION

Litchi is one of the important sub-tropical fruit crops of India, is highly specific to climatic requirements and probably due to this reason its cultivation is restricted to few countries in the world. Even in India, the crop has limited distribution and major area under this crop is in Bihar followed by West Bengal. In Bihar this crop is the livelihood for millions of people as it provides both on-farm and off-farm employment. There is an utmost need to make Indian litchi globally competitive since it is highly export oriented in nature and has great potential to earn foreign exchange in the international market. The short span of availability of fruits coupled with poor shelf-life limits the duration of availability of fruits in national and international market. Thus, there is a need to select the cultivars which are not much popular but has lot of potentials related to production, size, colour, shelf-life etc., and popularize these varieties. Smith (9) has emphasized the effect of variety on leaf nutrient content and quality of fruits.

MATERIALS AND METHODS

At the experimental site, 16 years old 14 cultivars (Ajhauli, Bedana, China, Dehradun, Dehra Rose, Deshi, Green, Kasba, Late Bedana, Longia, Purabi, Rose scented, Shahi and Trikolia) were selected which are planted at ICAR-RCER Research Centre, Ranchi. The soil condition of the experimental site at the depth of 0-15 cm was pH of 5.68, EC-0.05 (dsm^{-1}), OC-0.46%, P-1.23 ppm, K-63.45 ppm, S-50.10 ppm, Ca-316.7 ppm, Mg-12.58 ppm, Mn–30.00 ppm, Zn–0.63 ppm, Cu – 2.67 ppm, Fe – 11.66 ppm.

About 50 fruits were collected from six trees in each variety and the samples were made in three sub-samples (replicates) in each variety at the peak harvest during the month of May. Samples collected were brought to laboratory and their physico-chemical parameters were assessed. The physical parameters recorded were cracking percent, yield (kg/plant) of fruit, yield of pulp (kg/plant), fruit length and diameter (cm), shape index, peel thickness (cm), seed, peel and pulp percent, pulp and peel ratio and pulp and seed ratio. The chemical parameters i.e., Total Soluble Solid (TSS) (0^0Brix), Titrable acidity (citric acid-g/100g), TSS and acid ratio, ascorbic acid content (mg/100g), total reducing and non-reducing sugars and total sugar acid ratio were estimated as per the method described by Ranganna (7). TSS was recorded using hand refractrometer.

RESULTS AND DISCUSSION

The analysis of variance of 14 cultivars in this investigation revealed significant variation in physico-chemical quality of fruits (Table 1 and 2). Nutritional studies by Naik (5) confirm that litchi fruits have almost all nutrients required for daily intake by an adult in India as recommended by Chundawat and Gupta (2). Fruit cracking is one of the serious physiological disorders of

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Table 1. Physical characters of different cultivars of Litchi.

S. No.	Varieties	Fruit yield (kg/ plant)	Yield of pulp (kg/ plant)	Cracking (%)	Length (cm)	Diameter (cm)	Shape Index	Peel thickness (cm)	Fruit wt. (g)	Seed (%)	Peel (%)	Pulp (%)	Pulp: Peel	Pulp: seed
1	Ajhauli	72.42	45.82	27.58	3.48	3.04	1.15	0.11	15.53	18.64	18.24	63.13	3.51	3.42
2	Bedana	32.75	23.15	0.24	3.32	3.13	0.94	0.15	16.7	9.81	19.51	70.68	3.63	7.37
3	China	95.33	55.72	0.33	3.4	3.1	1.1	0.14	14.8	20.6	20.94	58.46	2.82	2.87
4	Dehradun	67.00	48.06	14.27	2.82	2.41	1.17	0.12	16.5	15.88	13.45	71.74	5.83	4.53
5	Dehra Rose	74.87	55.47	10.01	3.34	2.96	1.13	0.12	20.76	13.93	11.95	74.12	6.29	5.44
6	Deshi	83.03	55.49	13.63	3.5	2.98	1.18	0.12	16.47	18.94	14.42	66.65	4.81	3.63
7	Green	84.72	52.01	24.44	3.57	2.87	1.27	0.12	15.39	20.41	18.24	61.35	3.38	3.07
8	Kasba	37.00	26.58	0.00	3.78	3.37	1.12	0.17	28.19	13.43	14.34	72.23	5.16	5.39
9	Late Bedana	54.22	40.61	0.00	3.36	3.18	1.06	0.12	16.84	7.16	17.76	75.08	4.29	10.87
10	Longia	63.85	43.1	0.00	3.17	2.74	1.16	0.12	13.96	18.49	140	67.51	4.83	3.65
11	Purabi	80.65	57.11	0.95	3.31	3.1	1.07	0.14	22.95	12.65	15.62	71.73	4.84	5.94
12	Rosescented	88.05	60.84	8.85	3.63	3.14	1.16	0.11	20.76	17.58	13.37	69.05	5.26	3.97
13	Shahi	100.3	74.94	12.25	3.4	2.82	1.21	0.10	19.1	13.23	11.99	74.78	6.25	5.77
14	Trikolia	42.37	30.07	12.03	3.37	2.87	1.14	0.11	17.83	15.49	11.63	70.83	5.20	4.59
	LSD (5%)	9.71	6.61	0.41	0.17	0.17	0.09	0.01	1.73	1.96	2.14	3.07	0.76	1.13

Table 2. Chemical characters of different cultivars of Litchi

S. No.	Varieties	TSS (0^0Brix)	Acidity (Citric acid-g/100g)	TSS: Acid	Ascorbic acid (mg/100g)	Total sugar (g/100g)	Total sugar: acid	Reducing sugar (g/100g)	Non-reducing sugar (g/100g)
1	Ajhauli	20.22	0.3	66.79	30.14	12.53	41.49	10.9	1.67
2	Bedana	19.33	0.28	68.87	24.3	10.2	36.38	8.67	1.53
3	China	20.22	0.29	71.18	39.17	10.95	38.49	9.23	1.71
4	Dehradun	20.75	0.41	50.23	40.33	11.87	28.75	10.3	1.59
5	Dehra Rose	21.27	0.37	58.26	38.73	12.19	33.27	10.4	1.77
6	Deshi	22.82	0.37	61.42	39.67	13.48	36.31	10.4	3.08
7	Green	21.42	0.33	66.37	39.52	11.55	35.82	9.39	2.16
8	Kasba	20.23	0.4	50.76	19.94	11.24	28.23	9.55	1.69
9	Late Bedana	18.17	0.27	68.78	21.66	10.38	39.33	9.05	1.33
10	Longia	19.27	0.28	68.53	34.68	11.5	40.86	9.44	2.06
11	Purabi	20.1	0.29	70.57	37.95	11.04	38.79	9.12	1.92
12	Rosescented	20.37	0.37	55.79	41.29	12.98	35.58	10.8	2.61
13	Shahi	22.3	0.38	58.51	36.63	12.97	34.03	10.3	2.64
14	Trikolia	22.43	0.36	63.43	38.37	12.7	35.93	10.3	2.41
	LSD (5%)	0.95	0.03	5.83	4.32	1.36	9.71	0.28	0.39

litchi, characterized by splitting of peel (epicarp) wherein fruits become unfit for marketing was found to be significantly influenced by the cultivars. The cracking percent of fruits ranged between 0.24 percent to 27.58 percent. No cracking was recorded in cultivars Kasba, Late Bedana, Longia, Bedana, China and Purabi. Mid-season maturing cultivars recorded less cracking while in early maturing cultivars cracking ranged from 8.63 to 28.04 percent. Cultivars Ajhauli and Green recorded highest cracking followed by Dehradun, Shahi, Dehra rose and Rose scented. Interestingly, late cultivar had no cracking while early maturing cultivars had higher cracking percent. According to Singh and Singh (8), nutrients like K, Ca, Zn, Mn, Cu, B and Mo are involved in physiological process during fruit growth period and thus their deficiency resulted in fruit cracking. Differences in yield due to cultivars were highly significant, the highest yield was recorded for cultivar Shahi (100.30 kg/ tree) followed by China (95.33 kg/tree) while the lowest yield was recorded by the cultivar Bedana (32.75 kg/ tree). The mean maximum fruit length and diameter was recorded by cultivar Kasba (3.78 and 3.37 cm) while the minimum was recorded for cv. Dehradun (2.82 and 2.41 cm). The fruit weight was recorded highest for cultivar

Kasba (28.19 g/fruit) while the lowest was for cv. Longia (13.96 g/fruit). Similar ranges were reported by Pandey and Sharma (6). The mean pulp percent was recorded highest in cv. Late Bedana (75.08%) while the lowest was recorded in cv. China (58.48%). This clearly indicates that during the selection of suitable cultivar the pulp content should be taken into consideration other than the fruit weight. The pulp and seed ratio range varied between 10.87 (cv. Late Bedana) and 2.87 (cv. China) which showed wide variability (Fig. 1). The differences in different physical characters between varieties might be due to their genetic varietal characteristics. Similar results were obtained by Ghosh *et al.,* (3) and Badiyal and Awasthi (1). Highest TSS (^{0}Brix) value was recorded for cultivar cv. Deshi (22.82) followed by Trikolia (22.43) while the lowest was for Late Bedana (18.17). Acidity (Citric acid-g/100g) was recorded maximum in cultivar Dehradun (0.41) followed by cv. Kasba (0.40) and minimum was recorded in cultivar Late Bedana (0.27). These differences might be due to their inherent characters. The role of pyruvic acid in the process of respiration might be manifested and expressed in the form of titrable acidity. Cultivar China recorded highest TSS and Acid ratio (71.18) followed by Purabi (70.57) while the lowest was recorded for cultivar Kasba (50.76). These differences in TSS and Acid ratio in different cultivars were due to different levels of TSS and acid in different cultivars. The ascorbic acid content (mg/100g) was recorded highest in cv. Rosescented (41.29) and lowest in cv. Kasba (19.94) while the total sugar (g/100g) content was recorded highest in cultivar Deshi (13.48) and lowest in cv. Bedana (10.20). The differences in ascorbic acid might be due to genetic effect of the variety.

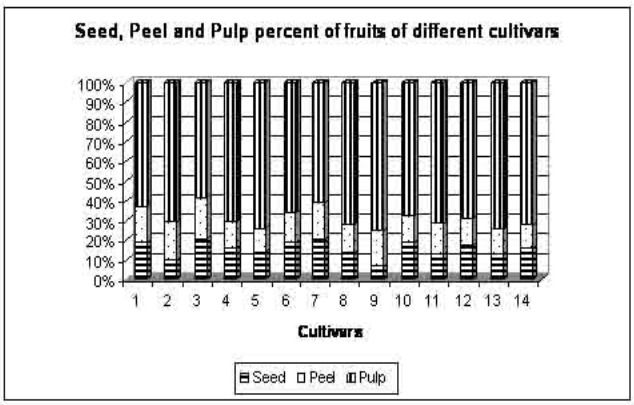

Fig. 1. Seed, Peel and Pulp percent of different cultivars of litchi.

1-Ajhauli, 2-Bedana, 3- China, 4- Dehradun, 5- Dehrarose, 6- Deshi, 7- Green, 8- Kasba, 9- Late Bedana, 10- Longia, 11- Purabi, 12-Rosescented, 13- Shahi, 14- Trikoloa

Similar varietal differences have been observed by Tripathi *et al*., (10) and Jain *et al.,* (4). Total sugar and acid ratio was highest in cultivar Ajhauli (41.49) and lowest in Kasba (28.23). Reducing sugar (g/100g) was recorded highest in cultivar Rosescented (10.82) and the lowest for cultivar Bedana (8.67) while non-reducing sugar (g/100g) was recorded highest in cultivar Deshi (3.08) and lowest in Late Bedana (1.33). Differences in sugar content might be due to maximum conversation of starch into sugar which might be related to inherent varietal character. The present results were in confirmation of Tripathi *et al.* (10), Ghosh *et al.* (3) and Jain *et al.* (4).

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Effect of IBA, time of layering and rooting media on air-layers and plantlets survival under different growing nursery conditions in guava

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ABSTRACT

The present investigation on the effect of IBA concentrations, time of layering and rooting media on rooting, root characters and survival percentage of rooted air layers under different growing nursery conditions *i.e* open and polyhouse conditions on guava, cv. L-49 were carried out during 2008-09. Three different concentration of IBA viz., 2000, 3000 and 4000 ppm were used in three time of layering viz., 15th June, 15th July and 15th August with two rooting media viz., sphagnum moss and coco peat. It was revealed that High percentage of rooting and root characters of air layers of guava have been successfully achieved by exogenous application of IBA at 4000 ppm. Regarding the time of layering, 15th August gave the maximum rooting success and root attributes. Among the rooting media, moist sphagnum moss produced highest rooting percentage and root characters. The survival of rooted air layers was found to be maximum with the treatment combination of IBA at 4000 ppm, 15th August and sphagnum moss and polyhouse conditions produced higher survival than open conditions after 45 days of detachment from the mother plants.

Key words: IBA, layering, media, nursery, guava.

INTRODUCTION

Guava is one of the most important tropical fruit with high nutritive value, pleasant aroma and good flavours. Guava (*Psidium guajava* L.) belongs to the family Myrtaceae and of tropical American origin. Owing to its hardy nature it comes up well even under neglected. The fruits are liked by rich and poor equally and are popularly known as the "Apple of Tropics". Preponderance of seedling progeny appears to be the main constraint in the popularization of guava (*Psidium guajava* L.). It is mostly propagated from seed. However, plants raised from seeds are not true to type and evidently take longer time to reach to bearing stage when compared to vegetative propagated materials. Air layering reported to have yielded good results. Air layering with the help of growth substances stimulating root primordial in air layers of fruit plants (Tyagi and Patel, 8). However, the percentage of establishment and survival of rooted layers in open conditions is very poor (Singh, 5) and is not achieving up to an expectation of the demand at cheaper rate with high establishment and survival percentage. Polyhouse technology has been in use for crop production in more than fifty countries all over the world. Application of this technology is more common for vegetable production and in India is a recent phenomenon but gaining important these days. To facilitate better percentage of establishment and survival of rooted layers, a polyhouse nursery condition is the alternative to an open nursery conditions.

MATERIALS AND METHODS

The experiment was carried out during 2008-09, on a Guava cv. L-49 orchard, planted at a spacing of 4 x 4 m in square system of planting at Fruit Research Station, Sangareddy, Medak district, Andhra Pradesh, from 15th June to 15th December, 2008. The time of layering was done in 3 months *i.e.* 15th June (M_1), 15th July (M_2) and 15th August (M_3) with moist sphagnum moss (S) and coco peat (C) as rooting media and they were soaked in water over night and squeezed it before used to avoid excess water and IBA concentrations used were control (I_0), 2000 ppm (I_1), 3000 ppm (I_2) and 4000 ppm (I_3). The period of observations was 75 days after layering and for establishment percentage was taken at 45 days after transplanting under both open and polyhouse nursery. The selected plants were healthy, well matured, uniform and vigorous. These selected plants were kept under

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ideal cultural practices, the flowers and fruits were frequently removed from the layer shoots during the course of studies and the soil was light to medium in texture (Sandy loam) locally called as 'chalka'. The shoot selected was of one year old and of pencil thickness with the average length of 60cm and showing brown streaks on the bark.

In a selected shoots, a ring of bark about 2-2.5 cm were girdled carefully by giving two circular cuts a bout 45-60cm below the top end of a shoots and the exposed portion was rubbed. The lanolin paste containing IBA in difference concentrations was applied evenly above the upper portion of the cut ring with the help of glass rod. Control shoots were left as such. A sleeve (15 X 20 cm) of black polythene (150 gauges) was then covered. These air layers were separated from the parent plants 75 days after layering by given three installations cut at an interval of one week, so as to reduce the shock of sudden detachment. After detachment of air layers shoot, ten of the successful rooted shoots were transplanted in the polybag (10 x 15 cm) containing Soil: Sand and FYM in the ratio of 1:1:1. These were maintained under both polyhouse and open field for studying their establishment.

The experiment was laid out in Factorial Randomized Block Design. The treatment was replicated thrice; each replication was a unit of 20 layers. The data were then analysed as per method of Panse and Sukhatme (4) for factorial under randomized block.

RESULTS AND DISCUSSION

The results revealed that IBA concentrations, time of layering and rooting media exhibited a significant effect on rooting and root parameters presented in Table 1. Among IBA concentrations, IBA at 4000 ppm produced the highest rooting (83.15 %), primary roots (9.14), secondary roots (22.82), length of longest roots (8.92 cm), and highest fresh weight (2.35 gm) and dry weight (0.43 g) of root layer^{-1}. Where as the minimum value of these characters were recorded under control. IBA at higher concentration (4000 ppm) gave better result than at lower concentrations or under control and there appeared to be an increasing tendency of rooting with an increasing concentration, this might be at higher concentration of IBA the quantity of auxin reaching the cambial activity may be adequate for initiating root primordia, so the highest performance was seen at higher concentrations of IBA. Indicating the possibility of better success with employing higher concentrations of IBA (Bhagat *et al*., 2). The maximum number of primary and secondary roots might be due to hormonal effect leading to accumulation of internal substances and their downward movement. Regarding the number of secondary roots might be due to more cell division. The maximum mean length of longest roots, suggesting that higher concentration of IBA stimulated faster growth of roots resulting in maximum length as reported by Tyagi and Patel (8). The highest roots weight may be attributed to the fact that external application of auxin generally stimulate the movement of natural auxin and others materials in downward direction from the leaves and shoot tips, which accumulate at the incision made on the shoot resulting in the formation of roots with higher

Table 1. Effect of IBA concentrations, time of layering and rooting media on rooting and root parameters in guava air-layering.

Factor	Rooting (%)	Primary roots	Secondary roots	Length of longest root (cm)	Roots weight (g)	
					Fresh	Dry
I_0	63.70	2.80	4.77	1.76	0.445	0.081
I_1	74.45	5.04	10.82	4.87	1.276	0.230
I_2	78.47	6.79	17.53	6.95	1.831	0.335
I_3	83.15	9.14	22.82	8.92	2.346	0.433
CD (0.05)	0.30	0.02	0.04	0.04	0.004	0.001
M_1	71.94	4.99	12.04	4.53	1.280	0.231
M_2	74.95	6.07	14.30	5.81	1.503	0.277
M_3	77.94	6.77	15.61	6.53	1.641	0.302
CD (0.05)	0.41	0.03	0.05	0.06	0.006	0.001
S	76.55	6.22	14.59	5.91	1.533	0.281
C	73.34	5.67	13.37	5.34	1.416	0.259
CD (0.05)	0.36	0.03	0.04	0.05	0.005	0.001

I_0= Control, I_1= IBA 2000ppm, I_2= IBA 3000 ppm, I_3= IBA 4000 ppm, M_1= 15th June, $M_{2=}$ 15th July , $M_{3=}$ 15th August , S= Sphagnum moss and C= Coco peat, *Data in parenthesis indicates angular transformed values