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Effect of Temperature & Humidity on Litchi Fruit and Its Physico-chemical Relation with Fruit Skin Cracking

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Abstract: **Fruit cracking is one of the major limiting factors in the cultivation of lychee, especially early cultivators (Singh, 1986). The early varieties are more prone to the problem of fruit cracking in comparison to late cultivars. The low atmospheric humidity, high temperature and hot winds during fruit development and maturity stage favour fruit cracking. Light irrigation to maintain soil moisture and to improve humidity has been found to minimize this problem through maintenance of a better micro-climate. Mulching with farm residues and 3 irrigations significantly reduced the cracking (Singh, 1986) in a trial conducted on the cultivar Shahi. In addition, spraying with either 100 PPM NAA or 0.2 percent borax during the developing stage of the fruits has been found to be highly effective in checking the cracking.**

Keywords: **Litchi, Cultivars, Fruit Quality, Cracking, Effect.**

1. INTRODUCTION

The lychee (*Litchi chinensis*, Sonn) an important sub-tropical evergreen fruit crop belonging to family "Sapindaceae", is believed to have originated in China. In India, lychee was introduced in the 18th century through Burma and from there it spread to many countries. India and China account for 91 percent of the world lychee production but it is mainly marketed locally. In India, 428,900 metric tones of lychee is produced annually from 56,200 hectares. Lychee being exacting in climatic requirement is confined to a few states with 74 percent of production recorded in Bihar. In this state, lychee is the livelihood for millions of people.

The extensive production of litchi fruit is limited by high sensitivity to soil and climatic conditions and short postharvest life. The litchi plant requires cool dry winters and warm wet summers for good production (Menzel, 2001) and both low or high temperatures (Menzel & Simpson, 1988), nutrients (Qui et al, 1999) and irrigation (Li et at, 2001) may result in undesirable yield losses or decreased fruit quality (Waseem, 2002).

Fruit cracking is a major issue in litchi, but is less important in longan. Cracking in litchi is most common in China (Chen and Huang, 2001) and India (Mitra and Ghosh, 1991). In India, one-third of the crop may be lost in susceptible cultivars such as 'Muzaffarpur' & 'Dehradun' (Kanwar et al, 1972) studies have examined the susceptibility of different cultivars to cracking and role of temperature, humidity & water.

2. MATERIALS & METHODS

The study of temperature & humidity on litchi fruit & its relation with fruit skin cracking was carried out during the year 2012 & 2013 to evaluate different physical and chemical characteristics of four cultivars of litchi (*Litchi chinensis*, Sonn).

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The experiment was conducted & Data was recorded on physical and chemical characteristics of the litchi fruits from different cultivar.

1. **Fruit weight (gm) :-** The fruit weight of 10 fruit in each treatment in each replication was estimated with the help of an electronic balance measuring gram quantity to the third decimal.
2. **Fruit pulp weight (gm) :-** The pulp weight was recorded by removing the skin and stone and weight of pulp in 10 randomly taken fruits from each treatment in each replication with the help of an electronic balance measuring gram quantity to the third decimal.
3. **Fruit skin cracking (%) :-** Fruit cracking %age was recorded by counting the number of total and cracked fruits on the tagged branches & converting the differential into %age.
4. **Specific gravity :-** The specific gravity was recorded from the selected fruits by measuring their weight (gm) in air and in water & then applying the following formula :-

$$\text{Specific gravity} = \frac{\text{weight in air}}{(\text{weight in air} - \text{weight in water})}$$

5. **Total Soluble Solids (%) :-**The fruit juice was extracted from the nature selected fruits and the TSS measured through hand held refractometer (KROSS HRN-16). The refractometer was first calibrated by using distilled water to have a zero reading. The reading on the prism plate were noted to one decimal place.
6. **Fruit skin calcium content (mg/100g DW) :-** The selected fruits from the tagged branches were thoroughly washed for ten minutes with tap water and then with distilled water. The fruit skins from the samples were peeled and once again washed with distilled water and allowed to oven dry at 70^0C until the achievement of a constant weight. The dried samples were ground to powder and sealed in petri dishes for chemical analysis.
7. **Fruit skin boron content (mg/100g DW) :-** The peeled skin of the selected fruits were washed thoroughly first with the tap water & then with distilled water. Ten grams of the sample was taken and dried for 12 hours at 75^0C in oven & then ashed for 3 hours at 525^0C. Ashes were extracted with 10ml of 2M HNO_3 and were heated on a hot plate. Filtered contents after dissolution were diluted to a final volume of 50 ml. This solution was used for determination of born content in the fruit skin by the azomethine-H method using atomic absorption flame spectro-Photometer.

3. RESULTS AND DISCUSSION

The incidence of fruit cracking occurs in litchi when the pressure of the expanding aril exceeds the tensile strength and the extensibility of the pericarp. Shortage of nutrients, especially of calcium and drought and high temperatures, which retard the growth of the skin, increase cracking.

Fruit and pulp weight (g) : The fruit weight varied significantly in litchi cultivars with the maximum fruit weight recorded in cultivar Gola (23.08g) followed by China and Surahi with 22.02 and 20.69g respectively (Table-I).

Total Soluble solids and total sugars (%) :- The TSS orded in cultivars Gola (22.13%) was significantly higher than those of the cultivars china and surahi (20.39 & 19.49% respectively).

Reducing & Non-reducing Sugars (%) :- The reducing sugar contents of litchi fruits varied significantly among different cultivars in cultivar Gela followed by 14.28 and 13.73% in cultivars China & Surahi respectively.

Specific Gravity of Fruit :- The specific gravity of fruit is related to cell size and intracellular spaces and has been used as maturity and quality index in fruits.

Fruit Cracking (%) :- The tendency of fruit skin cracking is a serious post-harvest problem of litchi fruit (Li et.al, 2001). The data on fruit cracking percentage reveled the highest fruit cracking in cultivars Gola (43.50%), followed by Surahi & China cultivars (31.19 & 23.15 respectively).

Fruit skin strength (kg cm^{-2}) :- The fruit skin strength of litchi cultivars varied significantly with the maximum (3.26 kg cm^{-2}) in cultivar Bedana followed by cultivars Surahi & China with 2.47 & 2.26 kg cm^{-2} respectively.

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Boron content of litchi fruit skin (mg/100g DW) :- The data on boron content of litchi fruit skin indicated that cultivar Bedana had the highest boron content of the fruit skin (0.120 mg/100g DW). Followed by cultivars China and Gola with 0.112 & 0.109 mg/100g DW. Cultivar Surahi with 0.101 mg/100g DW had the lowest boron content among the cultivars under study (Table – II).

Calcium content of Litchi fruit skin (mg/100g DW) :- The calcium content of the fruit skin varied significantly among the cultivars and was the highest (5.00 mg/100g DW) in cultivar Surahi followed by cultivar China and Gola with 4.938 & 4.750mg ca/100g dry weight. Litchi Cultivar Bedana had the least calcium content of 4.375 mg/100g dry weight (DW)-(Table-II)

Table I: The influence of plant age on fruit and pulp weight, TSS, total sugars, reducing and non-reducing sugars %age of litchi cultivars.

Fruit Quality Characteristics of Litchi cultivars						
Plants Age	**Fruit weight (g)**	**Pulp weight (g)**	**TSS (%)**	**Total Sugars (%)**	**Reducing Sugars (%)**	**Non-Reducing Sugar (%)**
10 Years	20.05	14.94	19.57	18.78	12.91	5.87
20 Years	20.44	15.03	19.56	18.80	12.92	5.86
Significance	NS	NS	NS	NS	NS	NS
Cultivars China	22.026	16.27b	20.39	19.67b	14.28	5.39
Gola	23.08a	16.58a	22.13	21.57a	17.98	3.59
Surahi	20.69c	15.90c	19.49	18.50c	13.73	4.73
Bedana	15.20d	11.19d	16.27	15.43d	5.67	9.76
LSD	0.561	0.139	0.067	0.432	0.034	0.026

Interaction between age and cultivar = Non significant

Table II: The specific gravity of fruit and skin strength, calcium and boron content and fruit cracking percentage of litchi cultivars.

Fruit and Fruit Skin Characteristics					
Plants Age	**Specific Gravity of Fruit**	**Skin Stength (kg cm^2)**	**Fruit skin B content (mg/100g DW)**	**Fruit skin Ca content (mg/100g DW)**	**Cracked Fruit (%)**
10 Years	1.61	2.52	0.11	4.719	27.14
20 Years	1.069	2.49	0.11	4.813	25.97
Significance	NS	NS	NS	NS	NS
Cultivars China	1.052 c	2.26 c	0.112 b	4.938 b	23.15
Gola	1.092 a	2.02 d	0.109 b	4.750 c	43.50
Surahi	1.085 b	2.47 b	0.101 c	5.000 a	31.19
Bedana	1.031 d	3.26 a	0.120 a	4.375 d	10.09
LSD	0.007	0.019	0.002	0.015	0.029

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