Pattern of Intra-Plant Variation in Fruit Quality in Litchi cv. Shahi With Respect to Size and Type of Fruit Sample

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ABSTRACT

An experiment was conducted at HARP, Ranchi during 2004-05 to study the amount of intra-plant variation in different fruit quality parameters as influenced by sample size and method of sampling in litchi cv. Shahi. Fully mature randomly collected Litchi fruits of different sample sizes (T_1=5 fruits/sample, T_2 = 10 fruits per sample, T_3 = 15 fruits per sample, T_4 = 20 fruits per sample and T_5=25 fruits per sample) and sampling types (T_6=composite sample consisting of two set of 5 fruits each, T_7=composite sample consisting of two set of 10 fruits each, T_8= composite sample consisting of two set of 15 fruits each, T_9= composite sample consisting of three set of 5 fruits each, T_{10}= composite sample consisting of three set of 10 fruits each and T_{11}=composite sample consisting of four set of 5 fruits each) were analyzed for different quality parameters like fruit weight, TSS, total sugar and titratable acidity. Significant differences among the treatments were observed in the values of average fruit weight and titratable acidity. An in-general higher value of intra-plant coefficient of variation in fruit quality was observed in case of simple sampling (T_1-T_5) than that in case of composite sampling (T_6-T_{11}). Composite sample consisting of three set of 10 fruits each (T_{10}) exhibited the minimum values of intra-plant coefficient of variation (%) in case of fruit weight, TSS and total sugar content which was at par with that in case of T_7, T_9 and T_{11}. Keeping in view the ease in fruit sample collection and volume of work for quality analysis, composite sampling consisting of two set of 10 fruits each (T_7) can be considered effective for minimizing the error due to intra-plant variation in fruit quality of litchi.

INTRODUCTION

Litchi (Litchi *chinensis* Sonn.) is a popular subtropical fruit relished for its pleasant flavour and distinct taste. Being a fruit of high export potential, production of quality fruits fulfilling the CODEX standards holds the key. Crop manipulation strategies aiming towards improvement in fruit quality should aim towards efficient monitoring of different

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fruit quality parameters. In litchi, intra-plant variation in flower bud differentiation and fruit set time (Das, 2004) gives rise to differential intra-plant fruit maturity. Rai *et al.* (2001) have indicated direct influence of heat unit summation governed by time of fruit set on fruit quality of litchi. Obviously, intra-plant variability in fruit quality as a result of differential time of fruit set contribute significantly towards the variation in fruit quality among the different treatments in researches involving quality analysis. The variability in fruit quality parameters can be large and as a result of various factors that affect fruit quality. Some factors affect individual fruit (Denny, 1922), whereas most effects on variation in fruit quality are at the whole tree level resulting in variability in fruit quality among orchards within a region, among trees, within a tree and among fruit (Berry and Castle, 2003). Therefore, knowledge of amount of intra-plant variability in fruit quality is a pre-requisite for fruit quality research and plays a pivotal role in experimental design. Improper sample size and sampling method, contribute significantly towards erroneous results in researches involving fruit quality. Therefore, standardization of appropriate sample size and sampling methods is one of the important strategies for minimizing intra-plant variation in fruit quality in litchi. A number of literature is available on standardization of sample size for quality analysis in different fruit crops (Appleman and Richards, 1939; Denny, F.E, 1922; Jones *et al*,1957; Reitz and Sites, 1948; Wallace *et al.* 1955; Berry and Castle, 2003). However, no such work has been reported in case of litchi. Keeping this in view, the current study examines the amount of intra-plant variation in different fruit quality parameters as influenced by sample size and method of sampling in litchi cv. Shahi.

MATERIALS AND METHODS

The experiment was conducted at Farm No.1 of Horticulture and Agro-forestry Research Programme during fruiting season of 2005. Fully mature litchi fruits of different sample sizes (T_1=5 fruits/sample, T_2=10 fruits/sample, T_3=15 fruits per sample, T_4=20 fruits per sample, T_5=25 fruits per sample) and sampling types (T_6= composite sample consisting of two set of 5 fruits each, T_7= composite sample consisting of two set of 10 fruits each, T_8= composite sample consisting of two set of 15 fruits each, T_9= composite sample consisting of three set of 5 fruits each, T_{10}= composite sample consisting of three set of 10 fruits each and T_{11}= composite sample consisting of four set of 5 fruits each) were randomly collected from all sides of 20 years old litchi trees cv. Shahi. From each plant, 20 samples of each treatment were collected for analysis of different quality parameter. Samples were collected from randomly situated litchi plants of uniform vigour and canopy size.

Observations were recorded on average fruit weight, TSS (°B), total sugar content (%) and titratable acidity (%) in juice. The TSS was measured using a table top refractometer with temperature control (Advance, New Delhi, India make). The total sugar content of juice was measured using Lane and Eynon method (Ranganna, 1965). The titratable acidity was measured by titrating the juice against NaOH(N/10) till a pH of 8.2. In case of composite samples, each set per sample were analyzed separately for different parameters and the mean value were analyzed. The experiment was laid out in

a Randomized Block Design with 10 replications (1 plant per replication). The mean data in each tree and intra-plant coefficient of variation each treatment were subjected to Analysis of Variance (Panse and Sukhatme, 1956).

RESULTS AND DISCUSSIONS

Data on effect of sample size and sampling methods on fruit quality of litchi in the present experiment is presented in Table 1. As evident from the table, the different sample size and sampling methods did not result in significant changes in TSS and total sugar content of litchi fruit juice. However, significant differences were observed in case of average fruit weight and titratable acidity. Interestingly, none of the treatments among simple sampling (T_1 to T_5) and that in composite sampling (T_6 to T_{11}) differed significantly among each other with respect to average fruit weight. This clearly indicated a need for standardization of method of sampling for fruit quality analysis in litchi.

Table 1
Effect of Sample size on Fruit Quality of Litchi

Treatments	*Fruit weight (g)*	*TSS (°B)*	*Total sugar (%)*	*Acidity (%)*
5 fruits (T_1)	21.72	20.43	11.75	0.23
10 fruits (T_2)	22.04	19.87	11.40	0.19
15 fruits (T_3)	21.28	20.81	11.86	0.20
20 fruits (T_4)	20.98	20.81	12.13	0.17
25 fruits (T_5)	21.22	20.76	11.65	0.16
Composite sample consisting of two set of 5 fruits each (T_6)	22.34	20.15	11.68	0.24
Composite sample consisting of two set of 10 fruits each (T_7)	22.17	19.99	11.59	0.23
Composite sample consisting of two set of 15 fruits each (T_8)	21.63	20.05	12.08	0.19
Composite sample consisting of three set of 5 fruits each (T_9)	21.63	20.40	11.92	0.23
Composite sample consisting of three set of 10 fruits each (T_{10})	21.94	19.89	11.42	0.21
Composite sample consisting of four set of 5 fruits each (T_{11})	21.85	20.33	11.54	0.22
SEm	0.423	ns	ns	0.012
C.D. at 5%	0.838	ns	ns	0.025

Measure of coefficient of variation is a simple tool to determine the optimum sample size with minimum intra-plant variation. Data on effect of sample size and type of sampling on intra-plant coefficient of variation in fruit quality is presented in table 2. The data clearly indicates significant differences among the two different methods of sampling. An in-general higher value of intra-plant coefficient of variation in fruit quality was observed in case of simple sampling (T_1-T_5) than that in case of composite sampling (T_6-T_{11}). This indicates need for composite sampling in case of experiments involving quality analysis of litchi fruits for minimizing the error due to intra-plant variation in fruit quality. Composite sample consisting of three set of 10 fruits each (T_{10}) exhibited

the minimum values of intra-plant coefficient of variation (%) in case of fruit weight, TSS and total sugar content which was at par with that in case of fruit weight of T_7, T_9 and T_{11} and TSS and total sugar content of T_7, T_8, T_9, and T_{11}.

Table 2
Effect of Sample size on Intra-plant Coefficient of Variation in Fruit Quality

Treatments	*Intra-plant coefficient of variation (%)*			
	Fruit weight	*TSS*	*Total sugar*	*Acidity*
5 fruits (T_1)	7.95	5.40	12.51	10.28
10 Fruits (T_2)	6.42	4.14	10.84	10.24
15 fruits (T_3)	7.88	4.23	12.58	10.35
20 fruits (T_4)	6.64	4.21	11.25	12.70
25 fruits (T_5)	6.29	4.40	11.36	11.12
Composite sample consisting of two set of 5 fruits each (T_6)	5.54	4.48	9.59	8.13
Composite sample consisting of two set of 10 fruits each (T_7)	4.39	3.24	7.82	8.19
Composite sample consisting of two set of 15 fruits each (T_8)	5.32	3.42	9.85	8.43
Composite sample consisting of three set of 5 fruits each (T_9)	4.53	3.73	8.28	6.86
Composite sample consisting of three set of 10 fruits each (T_{10})	3.47	2.75	6.66	7.61
Composite sample consisting of four set of 5 fruits each (T_{11})	3.50	3.46	7.39	5.72
SEm	0.776	0.667	1.175	1.18
C.D. at 5%	1.536	1.322	2.327	2.35

The cause of this variability may be due to fruit to fruit variation in canopy position. Therefore, to take a representative sample from the tree and to avoid canopy related bias, fruit should be sampled from all canopy positions (Barry and Castle, 2003). Keeping in view the ease in fruit sample collection and volume of work for quality analysis, composite sampling consisting of two set of 10 fruits each can be considered effective for minimizing the error due to intra-plant variation in fruit quality of litchi.

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