Efficient Sampling to Determine Distributions of Fruit Quality and Yield in a Commercial Apple Orchard

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Introduction

In-situ assessment of fruit quality and yield can provide critical data for marketing and for logistical planning of the harvest, as well as for site-specific management. Our objective is to develop efficient field sampling procedures for this purpose.

Materials and Methods

We used the 'fractionator' sampling procedure (Wulfsohn et al. 2012) and the BranchSampler software (Gardi et al. 2007) to obtain representative fruit samples of the main cultivar, 'Fuji Raku Raku', from a 7 ha apple orchard near Molina, Chile, before harvest (Fig. 1) Sampling periods were selected to obtain a large enough sample to reliably estimate the distributions of fruit caliber and quality. The data was also used to obtain an unbiased but imprecise estimate of total yield. Sampled fruit were taken to the lab for measurements of mass, firmness, malic acid content, soluble solids content and starch index. Estimated yield and caliber distribution were compared with packing house records of yield and caliber of fruit for export.

Fig. 1. Nested systematic sampling was applied at row, tree, branch, segment and fruit levels. Location labels on map show number of segments sampled on tree.

Results

The sample consisted of 70 fruit counted on 56 branch segments distributed on 36 trees obtained in 2.5 h by a two-person team. Visibly defective and very small fruit were excluded from the samples. Marketable yield was estimated as 295.8 tons (CE=17%). Field and packing house reports indicated that of 348.2 tons sent to packing, 263.0 t was packed for export. Figure 2 shows the estimated distribution of caliber compared with packing house records. Fruit quality distributions were compared with quality for export as summarized in Table 1.

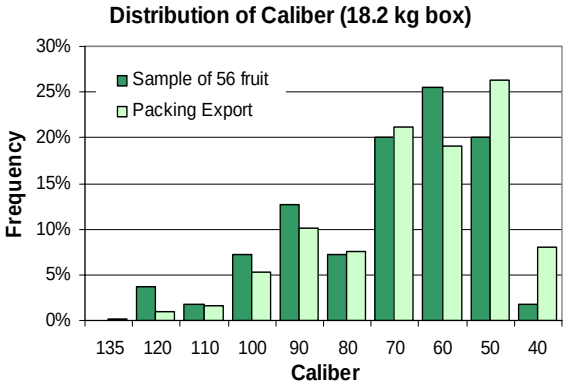

Fig. 2. Comparison of size distribution estimated from a sample if 56 fruit with size distribution of fruit packaged for export.

More intensive sampling can be used for precise yield estimation and for creating maps of quality and yield.

Conclusion

The fractionator protocol provides a simple and efficient procedure to obtain representative samples of fruit at the field scale.

Table 1. Export quality standard for Fuji apples and estimated % of fruit in orchard meeting norm

Parameter	Standard	Range in sample	% export quality
Firmness kg	6.4 - 9.1	5.9 - 10.4	86%
Soluble solids °Brix	> 12.0%	12.1 – 18.6	100%
Starch Index	5 - 7	4 - 10	43%

References

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