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COMMITTEE FOR TRADE, INDUSTRY AND ENTERPRISE DEVELOPMENT

Working Party on Standardization of Perishable Produce and Quality Development

Specialized Section on Standardization of Fresh Fruit and Vegetables
Forty-eighth session, 23-26 April 2002, Geneva

Item 3 (b) of the Provisional Agenda

PROPOSAL TO REVISE UNECE STANDARDS

APPLES AND PEARS

Transmitted by New Zealand

Note by the secretariat : The following document contains proposals from New Zealand concerning weight sizing and amendments to the list of varieties.

A. Weight Sizing versus diameter

1. Executive summary

It is timely to recognise the changing retailer expectation (regarding the importance of fruit weight) and advances in technology made since the initial development of the UN/ECE apple sizing standard.

Recent surveys in New Zealand show that there is not a robust predictive relationship between fruit diameter and fruit weight. Relying on fruit diameter to achieve all sizing objectives is therefore extremely difficult in the current commercial environment. Applying fruit diameter using a fruit weight packing process also introduces a range of practical limitations in packing a consistently sized fruit.

New Zealand industry data shows that by ensuring individual fruit weight is within a defined weight range a consistent fruit size is produced.

New Zealand supports the introduction of the weight sizing option as an alternative to the diameter sizing in the UN/ECE apple standard, and provides recommendations for minimum weights and tolerances.

2. Introduction

The validity of basing the sizing standard on fruit diameter rather than fruit weight has been raised at the UN/ECE level on several occasions over the past 15 years. The fruit sizing methodology adopted by industry during this period has also progressed significantly to a point where sizing methodology and equipment are increasingly accurate and automated.

During this timeframe the New Zealand pip fruit industry has met a changing customer expectation regarding:

- Supplying product in commercial volumes
- Re-designed packaging
- Increased emphasis on the accuracy and definition of sizing.

New Zealand welcomes the decision taken at the 47th Session of the UN/ECE Specialized Section on Standardization of Fresh Fruit & Vegetables to include the option of sizing by weight. The following paper discusses the implications of sizing by diameter and weight and provides data to support proposals for minimum weights and tolerances to ensure uniformity of fruit size.

3. Background

Customer requirements and availability of technology are the key drivers of change in the sizing methodology during recent years.

3.1 Retailer requirements

- Most retailers now specify a minimum fruit weight within each package.
- If the supplier does not deliver to a minimum package weight, the retailer will implement penalties against the supplier.
- Package weights of fruit packed in rows and layers transpose directly to individual fruit weights.

3.2 Changes to sizing methodology

There are 5 distinct methods by which apples are commercially sized

- Manual selection by human eye
- Dimensional sizing by mechanical means (various roller types)
- Dimensional sizing by electronic means (cameras)
- Weight sizing by mechanical means (spring balance)
- Weight sizing by electronic means (load cells)

Basing fruit size on the equatorial diameter was consistent with sizing practices at the time the UN/ECE sizing standard was initially developed. Early sizing machines, (using large screw mechanisms), allowed fruit of different diameter to drop at successive drops.

The basis of size has now progressed and, commercially, fruit diameter is only one of the parameters defining size.

Today the great majority of commercially traded fruit, especially that sold through retail outlets, is sized electronically. Most measure size by electronic load cells (example New Zealand 95%, Washington State 85%) although a small number use photosizers that sort on defined geometric parameters (e.g. diameter, diameter plus length, or volume).

It is recognized that sizing methods vary by country in relation to the level of technology available. In recognition of this variation, diameter sizing, methods are still considered relevant in certain situations.

New Zealand industry experience and data supports a view that by ensuring individual fruit weight is within a defined weight range, uniformity of pack presentation (in relation to sizing) is produced.

Difficulties of electronic diameter sizing

While it is easy for a human to orientate an apple and establish the equatorial diameter with a sizing ring, it is in practice very difficult to achieve this with electronic optical sorting methods available today.

To measure equatorial diameter it is necessary to first establish the orientation of the fruit and the location of the stem and calyx axis. Although, a camera can provide accurate measurements, (+/- 0.8mm), there are currently limitations in determining which measured diameter is the equatorial diameter.

3.3 The significance of weight based standards

The package/fruit weight focus in recent years has significantly influenced the design and configuration of packaging in the industry. The primary objective in packaging redesign in New Zealand has been to maximize the weight in the pack for any given pack volume while maximizing the storage potential of the fruit.

The most commonly used packaging type in the New Zealand export apple industry is the telescopic, multi layer tray carton, which relies on each layer of fruit to support some of the weight of the carton and the cartons above in a pallet. Any oversized apples in a tray will receive more pressure and any undersized fruit will not carry their share of the weight thereby causing bruising of fruit in the tray.

Considering the customer expectation and availability of new technology, in commercial practice weight sizing has provided the most consistent sizing within a pack across the entire range of apple varieties. In addition to providing the consumer with a uniformly sized product, consistent sizing is also critical to avoid bruising of fruit during storage and transport.

4. The relationship of weight versus diameter

With the commercial shift to individual fruit weight, the New Zealand industry recognized the importance of measuring the relationship between fruit diameter and weight.

Surveys (400 fruit per size for each variety and region) conducted in New Zealand by ENZA during 1999-2000 provides a basis for understanding the relationship between fruit weight and diameter.

The survey results for Royal Gala and Braeburn (Hawkes Bay) are summarized in Appendix 1.

4.1 Key findings

- The relationship between fruit diameter and size, although consistent, is not highly accurate. For any given fruit diameter the weight range relative to the mean weight is 29% for Royal gala and between 22-24% for Braeburn (based on 2 standard deviations).
- As fruit diameter increases, the difference between the heaviest and lightest fruit increases. e.g. Braeburn of diameter 55mm produces an 18 gram range in weight whereas for 100mm diameter the range increases to 96 grams.
- When expressed as a percentage of the mean fruit weight there is a consistency of weight range for any given diameter. At two standard deviations the percentage weight range was consistently 29% for Royal Gala and 22-24% for Braeburn.

4.2 Discussion points

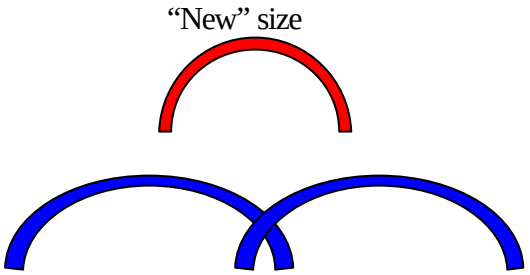
- The use of one sizing parameter (e.g. diameter) in the UN/ECE standard would be appropriate where a close relationship can be shown between this parameter and other key sizing parameters (e.g. weight). The surveys undertaken indicate that a close relationship does not exist.
    - Accurately predicting fruit weight based on a fruit diameter has significant limitations.
    - Although the weight range increases as fruit size increases for any given fruit diameter, the percentage weight range (relative to the mean) is relatively consistent. This supports using a percentage variation as an appropriate tolerance for weight sizing.
    - With most lines of apples it is extremely hard to guarantee a minimum pack weight if fruit is sized by diameter. Fruit geometry and fruit density are both too variable.
    - Conversely the ability to guarantee minimum fruit diameter requirements using weight sizing equipment on it's own is extremely difficult.

5. Impacts of diameter sizing for weight based systems

Addressing either fruit diameter or fruit weight individually has a similar outcome in achieving a consistent fruit size in any package. The limitations in fruit sizing become apparent when an attempt is made at trying to achieve both weights and diameter sizing at the same time.

The practical impacts of using minimum diameters when the commercial focus is on individual fruit weight include:

- Current package types and configurations have been designed on the basis of package weight and fruit fit. A specific fruit diameter requirement can consequently impact on individual fruit fit in the pack and consequently fruit quality.
- To accurately meet a minimum fruit diameter, using weight sizing equipment, each grower line of fruit needs to be corrected for fruit density and shape changes prior to packing.
- Practical implications of meeting a minimum pack weight but also a minimum diameter has resulted in up to 50% of fruit suitable for weight being rejected for diameter.
- Packing to a specified diameter requirement has produced the example depicted below where it has effectively created an in between size. Often the minimum sizes defined don't align to commercial size definition. The added influence of fruit density changes between grower lines makes this a complex equation.



Typical size profile: Size 100 Size 90

6. Recommendations

New Zealand strongly supports the proposed changes to the UN/ECE Apple Standard to provide for recognition of individual fruit weight as the basis for sizing. New Zealand supports the proposal to provide an option to measure fruit size by using either fruit weight or fruit diameter. This enables those who wish to continue sizing fruit by traditional methods to do so while also allowing larger commercial suppliers to use modern technology and size by weight.

6.1 Minimum Weight

New Zealand supports a minimum fruit weight for each class as follows;

	Extra	*I*	*II*
Large fruit varieties	*110g*	*90g*	*90g*
Other varieties	*90g*	*80g*	*70g*

The minimum fruit weight recommendations are supported by the studies undertaken in New Zealand. These studies, show a reasonable comparison between current minimum diameters and the minimum weights depicted above. Due to the limitations in the relationship between diameter and fruit weight, a tolerance should be considered for any absolute minimum that is set.

6.2 Tolerances for weight range in the pack

The acceptable fruit weight range within a package is dependant on the size of the fruit. The proposed tolerance accounts for this by applying an allowable percentage range.

"To ensure there is uniformity of size within a package, the difference in diameter or individual fruit weight between the fruit in the same package shall be limited to:

20% of the average individual fruit weight in the package"

Appendix 1: Fruit weight and diameter survey results for Royal Gala and Braeburn

Royal Gala weight versus diameter relationship

Figure 1 and Table 1 show the relationship between fruit diameter and weight for Hawkes Bay Royal Gala (2000 season).

Figure 1:

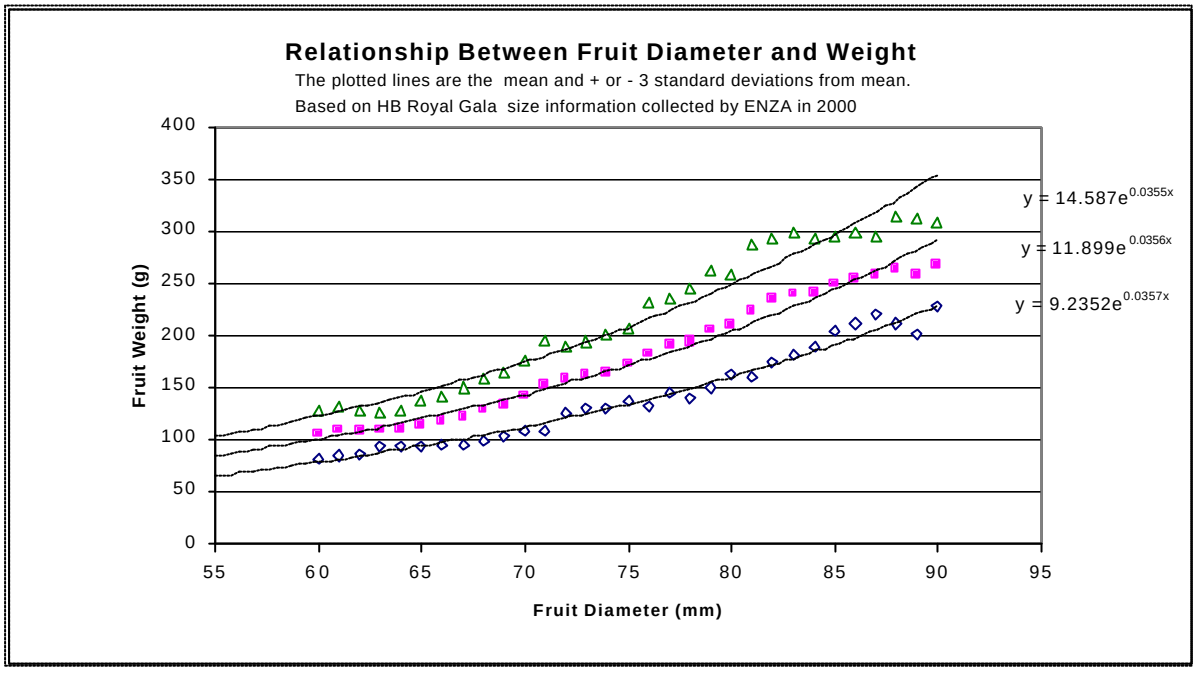


Table 1: Royal Gala weight and weight range for a given fruit diameter

Diameter (mm)	Mean wt. (gm)	Weight Range (2 Standard Deviations)		Weight Range (3 Standard Deviations)	
		(gm)	As % of mean	(gm)	As % of mean
55	84	72 - 97	29%	66 - 102	43%
60	101	86 - 115		79- 122	
65	120	102 - 138		94 - 146	
70	144	122 - 164		112 - 174	
75	172	146 - 196		134 - 208	
80	205	175 - 284		161 - 248	
85	245	209 - 280		192 - 297	
90	293	249 - 334		230 - 354	
95	350	298 - 399		274 - 423	42%
100	418	356 - 477		328 - 505	

Braeburn weight versus diameter relationship

Figure 2 and Table 2 show the relationship between fruit diameter and weight for Hawkes Bay Braeburn (1999 season).

Figure 2:

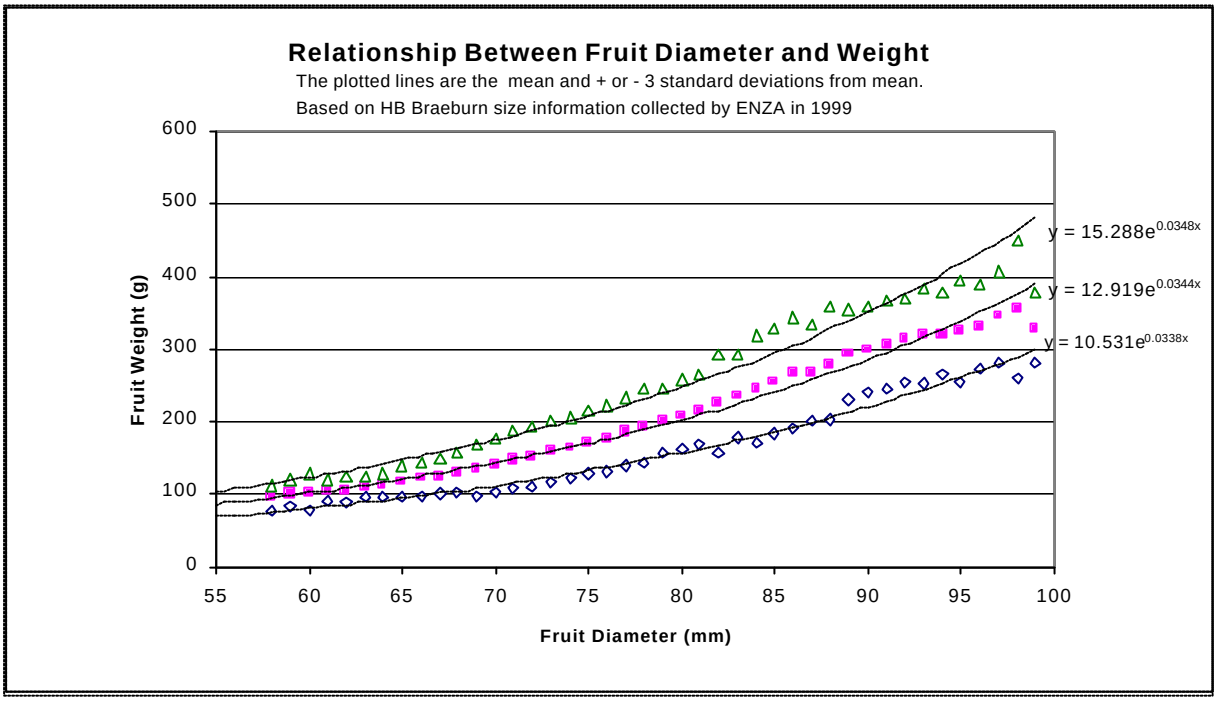


Table 2: Braeburn weight and weight range for a given fruit diameter

Diameter (mm)	Mean wt. (gm)	Weight Range (2 Standard Deviations)		Weight Range (3 Standard Deviations)	
		(gm)	As % of mean	(gm)	As % of mean
55	86	74 - 92	22%	68 – 104	42%
60	102	87 - 109		80 – 123	43%
65	121	103 - 130		95 – 147	
70	144	122 - 155		112 – 175	44%
75	171	145 - 184	23%	133 – 208	
80	203	172 - 218		157 – 247	45%
85	241	204 - 260		186 – 294	
90	286	242 - 309	24%	221 – 350	
95	339	286 - 367		261 – 417	46%
100	403	340 - 436		309 - 496	

B. UNECE Standard for Apples and Pears FFV-01 Revision of the list of varieties

New Zealand comments of draft List of Varieties tabled at the 47th Session of the UNECE Specialized Section on Fresh Fruit & Vegetables.

Proposed Changes to variety list

1. Additional varieties

The following varieties are recommended additions to the proposed list including updated trade names, recommended colour group and sizing classification.

Variety	**Synonyms**/Trade names	Colour group	Sizing classification
Alborz Seedling		C	Other varieties
Moonglo		C	Other varieties
Redfield	Red Braeburn™, Southern Rose™	A	Other varieties
Royal Gala		A	Other varieties
Scifresh	Jazz™	B	Other varieties
Sciray		A	Other varieties
Sunrise		A	Other varieties

2. Deleted varieties

The following deleted varieties are still commercially grown in New Zealand and are part of the export mix of varieties. It is recommended they remain on the list of varieties:

Apples: Orin

Pears: Concord, Conference, Winter Cole, and Winter Nellis

3. Updated synonyms/trade names

The following varieties have recent trademark criteria included and vary slightly to the description from the working group list:

Baigent	Brookfield ™
Joburn	Red Braeburn™, Aurora ™, Southern Rose™
Mariri Red	Eve ™, Red Braeburn™ Southern Rose™
Scired	Pacific Queen™
Sciglo	Southern Snap ™
Sciros	Pacific Rose™