

Field and Processing Studies of 'Primegold Apple'

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Fruit quality tests have not been previously published for 'Primegold' apple which was recently introduced by a grower in Washington. The present study was done during 1971 and 1972 at Corvallis. 'Golden Delicious' grown under similar conditions was used as a standard of comparison.

Materials and Methods

Twenty trees of each variety were grafted and established at the Lewis-Brown Horticultural Research Farm in 1969. The first crop was available in October, 1971. Firmness and soluble solids tests were done on random, replicated samples immediately after harvest and the remaining fruit placed in storage at 30-32°F. After 4 months' storage, one box of fruit per variety was removed for processing and other tests. Final tests of firmness and eating quality were done on May 10, 1972, about 7 months after harvest. Firmness of fruit flesh was measured in pounds on 2 peeled sides of each fruit with a Magness-Taylor tester using a $\frac{1}{16}$ " head. Soluble solids of freshly expressed juice were measured with an American Optical hand refractometer. Fresh eating quality was rated on a scale of 1 to 9, with 1 to 3 being unfit for use and 7 to 9 being above average quality.

Samples for processing were removed from cool storage, held 18 hours at ambient temperature, then processed into canned slices, canned sauce, and frozen slices. Apples were peeled and cored mechanically, then sliced with hand sectioning device. Both peeled apples and slices were held in 2.5% salt solution to minimize oxidative browning. Within 30 min-

utes slices in brine were drained, rinsed, and divided into 3 sub-lots for processing.

Canned apple slices: Apple slices were immersed in a prepared sucrose syrup having the same soluble solids found in the raw apple. While immersed in the syrup, the slices were subjected to 27 inches of vacuum for 15 minutes and held an additional 15 minutes in the syrup after release of the vacuum to allow uptake of syrup by the slices. Cans were packed with 3 parts vacuumed slices to 2 parts sucrose syrup of adjusted brix so as to result in an equalized soluble solids content of 13%. The product was exhausted under atmospheric steam to a center temperature of 165°F, sealed, and cooked 20 minutes in a boiling water bath. The cooked product was cooled to 100°F, and placed in ambient storage.

Canned apple sauce: Slices in salt brine were drained, rinsed in water, and cooked with 20% water by weight until soft. The cooked slices were passed through a finisher equipped with $\frac{1}{8}$ inch perforated screen, and the weighed pulp was combined with sufficient dry sucrose to bring the equalized soluble solids to 18%. The sweetened sauce was heated to 170°F, filled into cans (plain tin body, "F" enameled ends), sealed, and processed 20 minutes at 220°F in a still retort. Cans were then cooled in water to 100°F and stored at ambient temperature.

Frozen apple slices: Slices were removed from the salt solution, rinsed in water, blanched 3 minutes in atmospheric steam, and cooled under a cold water spray. Slices were drained,

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transferred into poly bags of 3 lb. capacity, and frozen in a -25°F air blast. The frozen product was stored at -10°F .

Results and Discussion

'Primegold' fruit is about the same size as 'Golden Delicious,' but is much firmer and is rounder in shape (Table 1). The percentage of irregularly shaped fruit was the same for both varieties. Sugar level (soluble solids) was slightly higher with 'Primegold,' but this was not true of all samples. The tendency to russet was much greater with 'Golden Delicious.' Most of the russet found on 'Primegold' was at the stem basin, and the finish was generally better than 'Golden Delicious.'

'Primegold' trees 3 years of age and of similar size yielded less than half as much fruit as did 'Golden Delicious' trees (Table 1). The poor yield efficiency of 'Primegold' may have been due in part to its general susceptibility to powdery mildew, which reduced the effective leaf surface of new shoots.

After 4 months' storage, 'Primegold' was still much firmer than 'Golden Delicious.' Yellow skin color was the same for both varieties (Table 2); however, 'Primegold' fruit developed a sheen, which, along with a distinctive red blush made a more attractive fruit than 'Golden Delicious.' 'Golden Delicious' showed more discoloration from bruising than did 'Primegold.' 'Primegold' flesh color was ivory-white while that of 'Golden Delicious' was pale yellow. 'Primegold' showed a tendency toward mealy breakdown, scald, and core breakdown relative to 'Golden Delicious.' The overall eating quality of raw 'Primegold' was acceptable but lower than 'Golden Delicious.' 'Primegold' also was more tart, juicier, and contained more acids (Table 1).

Evaluation of Processed Products

Samples of the canned slices, canned sauce, and frozen slices produced from

Table 1. Various characteristics of 'Primegold' apple as compared to 'Golden Delicious.'

Variety	Immediate Postharvest Tests				Acid as malic percent	Fruit shape percent	Irregular shape percent	Russet index*	Trunk size cm ²	Yield lb.	Yield efficiency gm/cm ² trunk
	Fruit weight gm	Flesh firmness lbs.	Soluble solids percent	pH							
Primegold	172	22.7	15.0	3.75	.35	.966	32	0.8	15.3	13	200
Golden Del.	172	16.5	14.5	3.70	.24	1.015	32	3.0	15.7	30	648

*0 to 4 rating for russet severity.

Table 2. Fruit characteristics of 'Primegold' and 'Golden Delicious' after 4 months' cold storage at 30°F .

Variety	Skin color ¹				Discoloration from bruising	Mealy flesh percent	Scald percent	Core breakdown percent	Eating quality 0-9 scale
	Flesh firmness lbs.	rating	rating	rating					
Primegold	14.2	2.5	1.0	35	5	5	15	0	6.0
Golden Del.	11.0	2.6	1.5	25	0	0	0	0	7.0

¹Green-to-yellow rating (1 green, 9 sulfur yellow).

the 2 apple varieties were evaluated for quality acceptance by a staff panel of 8 members using a 9-point preference ballot. Also rated were samples of cooked apple pie filling prepared from the frozen slices. Table 3 summarizes the panel scores for several pertinent quality characteristics of the processed products.

Canned slices: Vacuum-syruped and canned slices produced from the 'Primegold' apple were judged by the panel to be acceptable but were less highly rated for color and brightness than 'Golden Delicious.' 'Primegold' slices were dull cream in color as contrasted to the pale yellow color of 'Golden Delicious' slices. Greater slice firmness was noted in the 'Primegold' product.

Canned sauce: 'Primegold' sauce developed a pink color which was considered unacceptable to the panel. The off-color of the sauce was attributed to discoloration which occurred rapidly when the slices were heated in the steam kettle during preparation for sauce. Flavor of the 'Primegold' product was also rated significantly lower than that of the 'Golden Delicious' sauce.

Frozen slices: Panel ratings for the defrosted 'Primegold' slices were in the unacceptable range for color and brightness. A rapid internal discoloration occurred in the 'Primegold' slice

when it underwent heating during the steam blanch operation for enzyme inactivation. This reddish-brown discoloration, which remained after freezing, did not occur with 'Golden Delicious.' Other qualities were similarly rated in the products of the 2 varieties.

Cooked frozen slices in pie mix: A severe discoloration problem was again noted by the panel in the 'Primegold' pie mix. The panel found better slice integrity in the 'Primegold' mix while other factors were equally rated across varieties.

Based upon the evaluation data reported here, the 'Primegold' apple is severely limited in its potential for processing. The rapid discoloration of the flesh, which occurs during heating or exposure to air, indicates the presence of a highly active phenol-oxidase enzyme system in this apple. Above average firmness makes 'Primegold' more useful for sliced pack than for sauce if discoloration can be controlled.

From the standpoint of overall growth, fruiting, production and processing, 'Primegold' is much less desirable than 'Golden Delicious' in productivity, mildew resistance, fruit shape, mealiness, scald, core breakdown, eating quality, and processed quality. It is better than 'Golden Delicious' only in firmness and in smoothness of finish.

Table 3. Average panel scores for quality factors and overall quality in products processed from 'Golden Delicious' and 'Primegold' apples.

Product	Variety	Panel score by quality factor ¹						Overall quality
		Color	Brightness	Mouth texture	Slice wholeness	Flavor		
Caned slices	G. Delicious	7.4	7.1	5.8	7.0	4.8		6.6
	Primegold	6.1	5.8	5.4	7.6	4.6		5.3
Canned sauce	G. Delicious	6.3	6.5	6.1	—	5.6		5.6
	Primegold	2.9	4.6	5.6	—	4.4		3.0
Thawed frozen slices	G. Delicious	6.0	4.9	4.5	5.8	4.0		4.7
	Primegold	1.5	2.1	4.3	6.3	4.0		2.4
Cooked frozen slices (pie mix)	G. Delicious	4.6	5.1	4.9	3.9	4.9		4.6
	Primegold	2.1	3.0	4.4	5.5	4.9		3.0

¹Scoring scale: 9-7 = superior
6-4 = acceptable
3-1 = unacceptable.