

## 大邱市 인근 3地域 사과 '후지'의 果實品質 比較

愼英範 車垠昊 植松齊\* 久保井榮\* 三浦泰昌\* 佐藤幹夫\*  
慶北大學校 · 東京農業大學\*

Comparison of Fruit Quality of Apple 'Fuji' Produced  
in Different Three Areas in Taegu

Syn Yeong-Beom, Cha Eun Kyoung  
Hitoshi Uematsu\*, Sakae Kuboi\*, Yasumasa Miura\*, and Mikio Sato\*

Dept. of Hort. Kyung Pook National University, Taegu  
Laboratory of Horticultural Science, Junior College of Tokyo University of Agriculture\*

### Abstract

This investigation was attempted to know fruit quality of apple 'Fuji' grown at three different areas of Taegu. Fruits were gathered from hill side area : Kyungsangpookdo yongchongun chongtongmynn synwonri, flat area : Kyungsangpookdo yongchongun synyoungmyun younjeongri and river side area : Kyungsangpookdo yongchongun kewmhoyeub naenhchundong

Results were as follows :

1. In fruit sampling, we made an effort to select the same size of fruit from all areas. However, the size at river side area was about 40g lighter and minimum length was shorter than those of the other areas. On the other hand, maximum and minimum diameter of the fruit at flat and river side areas were longer than hill side area.

Accordingly, shape index of the fruit in river side area was flatter than the other areas.

This difference may be due to temperture, soil moisture content, etc. In squeeze rate of the fruit, no significant difference was recognized among areas.

2. Though, rate of fructose in total sugar was almost 50% in all areas, sucrose,

fructose and sorbitol concentration of hill side area were higher than the other areas, however glucose was reverse and brix was almost same as total sugar concentration.

3. Rate of malic acid in total acid was almost 98% and citric acid was only 2% in all areas. Malic acid concentration of hill side area was higher than the other areas and titratable acid concentration was almost same as total acid.

## Introduction

A number of investigations have been done about the effect of different climatic conditions on fruit quality of apple (Kawasaki, 1986 : Kunisawa et al., 1985 : Nakagawa, 1986 : Tomana and Yamada, 1988 : Watanabe, 1985) Tomana and Yamada reported that rate of glucose in total sugar in cool area was decreased by low temperature. However sucrose was reverse.

Recently, rising quality of apple fruit is because fruit price is quite different between high and low quality.

On the other hand, as little is known about the difference of fruit quality in apple 'Fuji' among different growing areas in Taegu, so we investigated about comparison of quality of 'apple' produced among three different areas in Taegu.

## Material and Method

Fifty medium sized fruit were taken in each area. The fruits were harvested on November 2 and 3, 1993 at hill side, flat and river side in Taegu. An effort

was made to choose the nearly same sized fruit at the three different area.

Difference between day and night temperature at the hill side area, Kyungpookdo yongchongun chongtongmyun synwonri, is very high at beginning of fruit growing period to harvesting period especially in fall season.

Flat area, Kyungpookdo yongchongun synyoungmyun younjeongri, has typical temperature of Taegu, and in the river side area, Kyungpookdo yongchongun keumhoyetb naenhchundong, air and soil moisture during summer growing season is higher than hill side and flat areas.

Fresh weight, length and diameter, flesh hardness, brix, titratable acid and squeeze rate of the fruits were analyzed.

Then, juice was frozen at -20°C and analyzed sugar and acid composition by Shimadzu LC-10A, high performance liquid chromatography (HPLC).

Condition of sugar analysis by HPLC :  
Column : Shodex SC1011, Carrier : pure water, Flow rate : 0.8ml/min.  
Column temperature : 79°C, Detector.

RID-6A.

Condition of acid analysis by HPLC(post column method) :

Column : Shimpack SCR-102H, Carrier : p-Toluenesulfonic acid monohydrate, : p-Toluenesulfonic acid monohydrate, EDTA(2Na), Bis-Tris, Flow rate : 0.8ml/min. Column temperature : 40°C, Detector.CDD-6A.

Condition of acid analysis by HPLC(post column method) :

Column : Shimpack SCR-102H, Carrier : p-Toluenesulfonic acid monohydrate, : p-Toluenesulfonic acid monohydrate, EDTA(2Na), Bis-Tris, Flow rate : 0.8ml/min. Column temperature : 40°C, Detector : CDD-6A.

## Results

Comparison of the fruit quality among the three different areas was shown Table 1.

Fruit weight of hill side and flat area were heavier than that of river side area. Maximum and minimum of fruit length in hill side was longer than those of flat and river side area.

However, maximum and minimum of fruit diameter was almost reverse. Shape index of fruit of river side area was flatter than the other areas. Flesh hardness was 5.76kg/cm<sup>2</sup> in flat area and 4.42kg/cm<sup>2</sup> in river side area. Brix value of the hill side area, flat area and river side area were 15.2, 14.1 and 13.0 respectively. Titratable acid of hill

side area was slightly higher than that of the other areas. At 1st, rate of squeeze in hill side area was slightly higher than the other areas. However, at 6th, no significant difference was recognized on the rate of three areas.

Comparison of sugar and acid content was shown in Table 2. Sucrose, fructose and sorbitol content of hill side area was higher than the other areas and those, especially sucrose, of river side area were lower than the other areas. Total sugar contents was almost the same tendency as brix. Though the rate of malic acid in the total acid was about 88%, the rate of hill side area was higher than other areas. On the other hand, citrid acid of three areas was about 2%.

## Discussion

An effort was made to choose same fruit size in the three different areas, however there was significant difference (about 40g in the fresh weight) between river side area and hill side, flat side area.

Maximum and minimum length of hill side area were higher than the other areas. However diameter of hill side area was reverse. Therefore, shape index (D/L index) of fruit of river side area was flatter than other area. Ishihara (1927) reported that pear fruit produced at warm area in Japan was flatter than cool area. Suzuki et

Table 1. Comparison of quality of apple 'Fuji' among three different region in Teagu.

	Fruit weight (g)	Fruit				
		Length (cm)		Diameter (cm)		
		Max.	Min.	Max.	Min.	
Hill side area	398a <sup>2</sup>	9.17a	8.50a	9.45b	9.00b	
Flat area	399a	9.05a	8.15b	9.71a	9.28a	
River side area	354b	8.40b	7.45c	9.75a	9.27a	
	Shape index (D/L)	Hardness (Kg/cm <sup>2</sup> )	Brix	Titratable acid (g/100ml)	Rate of squeeze(%)	
					1st	6th
Hill side area	1.03c	5.26b	15.2a	0.39a	32.9a	72.7a
Flat area	1.07b	5.76a	14.1b	0.38ab	29.7b	71.0a
River side area	1.16a	4.42c	13.0c	0.36b	29.6b	71.7a

<sup>2</sup>Different letters represint significantly different values (P=0.05)by Duncan's multiple range test.

Table 2. Comparison of sugar and acid composition of apple 'Fuji' among different region in Taegu.

	Sucrose	Glucose	Fructose	Sorbitol	Total sugar (g/100ml)
Hill side area	4.89a	1.46c	7.51a	1.25a	15.11a
Flat area	4.05b	2.18b	6.67b	0.63b	13.52b
River side area	3.05c	2.54a	6.22b	0.45b	12.26c
	Citric acid		Malic acid		Total acid (mg/100ml)
Hill side area	6.85b		480.98a		487.82a
Flat area	6.88b		412.49b		419.37b
River side area	8.69a		412.61b		430.30b

<sup>2</sup>Different letters represent significantly different values (P=0.05)by Duncan's multiple range test.

al.,(1967) also reported that drought treatment of the soil from September to October made taller fruit in young citrus trees. Kumashiro K. and S.Tateishi (1966) using apple 'Jonathan' reported the same results as Suzuki et al. Namely, the fruit hardness was low when fruit was in high moistured soil. It suggested that river side area which temperature

was relatively higher than hill side area and soil moisture content was higher than the other areas, produced flatter and softer flesh hardness fruit comparing to the other areas. So higher brix of hill side area may be due to the different soil moisture and temperature, etc.

Titratable acid of hill side area was slightly higher than the other areas

and at 1st. rate of squeeze was also slightly higher than the other areas.

Tomana T. and H. Yamada (1988), (1988) reported that concentration of sucrose in apple fruit in cool area was higher than warm area. However glucose was reverse.

In this experiment, the result was almost the same as Tomana T. and H. Yamada i.e., sucrose of hill side area was higher than river side area. However, glucose was reversed. Fructose of each area were almost 50% of total sugar. Sorbitol of hill side area was higher than the other areas and result of total sugar was almost same as brix.

Malic acid occupied almost 98% of total acid and malic acid of hill side area was higher than the other areas. On the other hand, citric acid of river side area was higher than the other areas. However citric acid was only 2% of total acid. Kliever(1964) reported higher malic acid concentration of grape in cool area than warm area. It suggests that higher malic acid of hill side area may be due to lower temperature than the other areas in Taegu.

## 적 요

산지(영천군 청통면 신원리), 평지(영천군 신령면 연정리), 강변지(영천군 금호읍 냉천동)의 과수원에서 각각 '후지' 과실을 채취하여 대구시 인근의 과신품질을 조사하였다.

결과는 다음과 같다.

1. 각 지역 공히 품질이 평균적인 과실을 채취하였고 강변지 과실 중량이 40g정도 작았고, 과실중경 최소치가 다른 지역에 비해 작았다.  
평지 과실의 횡경은 최대치, 최소치 모두 산간지보다 큰 것으로 나타났다.  
과형지수는 강변지 과실이 다른 지역에 비해 편원형이었다.  
이러한 과형의 차이는 온도, 토양수분함량 등에 의한 것으로 생각된다.  
과실 착즙률은 각 지역간 유의한 차가 인정되지 않았다.
2. 각 지역 공히 후지과실 전당의 50%정도가 프락토스인 것으로 나타났고, 산지의 슈크로스, 프락토스, 솔비톨 함량이 다른지역에 비해 높은 수치를 나타내었으나 글루코스는 다른 지역에 비해 낮은 수치를 나타내었고, 당도는 전당함량과 거의 같은 수치를 나타내었다.
3. 각 지역 공히 후지과실 전산의 98% 정도가, 능금산이었고 시트르산이 2%를 차지하였다. 산지과실의 능금산 함량이 다른지역에 비해 높은 수치를 나타내었고 적정산은 전산함량과 거의 같은 수치를 나타내었다.

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