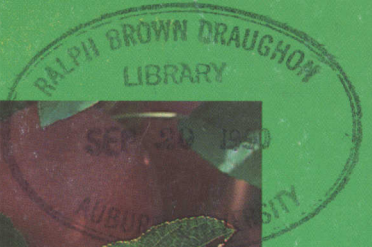


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Evaluation of Five Non-Spur Strains of Red Delicious Apples in Central Alabama



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*Information contained herein is available to all persons
without regard to race, color, sex, or national origin.*

EVALUATION OF FIVE NON-SPUR STRAINS OF RED DELICIOUS APPLES IN CENTRAL ALABAMA

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INTRODUCTION

APPLES ARE PRODUCED commercially in the North Atlantic, North Central, and Pacific Northwestern regions of the United States and as far south as North Carolina, South Carolina, north Georgia, and Tennessee. However, apples have been produced only on a limited commercial basis in Alabama in recent years. This limited production occurs at the higher elevations of north Alabama and in central Alabama.

The Red Delicious has been the most widely grown apple variety in the United States since its introduction around 1894 (15). The original Red Delicious developed more surface red color than other varieties and developed the typical prominent calyx lobes characteristic of the variety today. In the 1920's, bud mutations were found in Red Delicious that produced fruit with greater red color than the original variety. These high coloring sports were named and released as new strains of Red Delicious. The search for better coloring strains continues, and currently there are several hundred strains of the variety on the market with new introductions occurring each year.

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Because of climatic conditions, older strains of Red Delicious apples produced in Alabama have not competed well with fruit produced in traditional apple growing regions. The Red Delicious fruit matures in mid-August in Alabama and, because of high night temperatures during the maturation period, fail to develop the high degree of red coloration typical of fruit grown in the northern growing regions (2). High night temperatures occurring during the postbloom period also inhibit the development of the calyx lobes typical of the variety (2, 10, 14). Therefore, the Red Delicious fruit produced in Alabama do not develop the red color, are flatter in shape, and do not possess the "typiness" typical of the northwestern and northern grown Red Delicious fruit.

In the early 1960's, considerable interest in growing Red Delicious apples was generated in Alabama. Many plantings were established in central and north Alabama. Primary strains of Red Delicious initially planted included selections such as Richardred, Skyline Supreme, Ryan Red, Vance, and Starkrimson. There was no information on performance of these strains of Red Delicious in Alabama.

This study was conducted to determine ultimate tree size, yield potential, fruit quality, and ripening date of five non-spur strains of Red Delicious apples on MM106 rootstock in the Piedmont area of central Alabama.

MATERIALS AND METHODS

An experimental planting of five strains of non-spur Red Delicious apples on MM106 rootstock was established in the spring of 1965 and 1966 at the Piedmont Substation, Camp Hill. A randomized complete block planting design was used with three replications of six trees per variety in each replication. The planting was established on a 16- by 24-foot spacing with 113.4 trees per acre. The trees were trained to a modified central leader system. In the winter of 1972, and in each pruning season through 1975, the trees were reduced in height to about 8.5 feet with a Fossum tree pruner. Detailed hand pruning was carried out after mechanical pruning. Beginning in 1976, the trees were hand pruned only and were allowed to increase about 1.5 feet in height each year. The non-spur Red Delicious strains evaluated were Top Red, Vance, Red Prince, Red King, and Red Queen. The Top Red, Red Prince, and Red Queen trees were planted in the spring of 1965 and the Vance and Red King trees in the spring of 1966. The pollinator variety, Gold-

spur Golden Delicious on MM106 rootstock, bloomed 7 to 10 days after the Red Delicious trees and was topworked to Mollies Delicious in the spring of 1968. Beginning in the spring of 1969 and each season thereafter, hives of bees were moved into the orchard at the rate of one hive per acre when 15 percent of the blossoms were open and removed at petal fall. Stabilized Golden Delicious pollen was used with bee hive inserts to help ensure pollination. Recommended practices for fertility and weed, insect, and disease control were followed.

Tree spread, height, and trunk diameter were recorded in the fall of 1969, 1971, 1975, 1979, and 1982. Yield data were recorded each season from 1970 to 1982, except in 1971 when only a few scattered fruit were produced. Fruit samples were collected periodically during the ripening season from 1971 to 1982 to determine the optimum maturity date. Maturity indices evaluated at each sample date were fruit firmness, percent soluble solids, size, percent fruit surface with a solid red blush, total fruit surface with red color development, ground color, flesh color, and seed color.

Fruit firmness was measured by use of an Instron Model 1122 Universal Testing Instrument with an 11-mm plunger. Soluble solids were measured by use of a hand-held refractometer. Percentages of the fruit surface with some red color development and solid red blush were subjectively rated and expressed as a percent of the total fruit surface. Flesh and ground colors were subjectively evaluated. Ground color was expressed as green with a yellow tint (GYT), yellow with a green tint (YGT), or yellow (Y). Flesh color was expressed as green (G), green with a white tint (GWT), white with a green tint (WGT), white (W), white with a yellow tint (WYT), yellow with a white tint (YWT), or yellow (Y).

Tentative standards to determine when Red Delicious apples reach an acceptable maturity level for harvesting were developed in Virginia and have been adapted to other areas (9). These standards are based on fruit firmness and percent soluble solids. The value ranges vary to take into account soil types, water stress, general tree age and vigor, and climatic conditions. The tentative standard indicates Red Delicious apples would be of acceptable maturity for early marketing if testing 16.5 or less pounds firmness regardless of sugar level, or if 12.5 percent soluble solids or higher, regardless of firmness. For Delicious testing 16.5 pounds pressure or firmer, or for fruit with less than 12.5 percent soluble solids, a standard of 18.5 pounds firmness and 11.0 percent soluble solids can be used. A sliding scale is used for lower or higher firmness or soluble solids in a

ratio of 1 pound firmness to 0.5 percent soluble solids, or 0.2 pound pressure to 0.1 percent soluble solids.

<i>If average pressure test firmness is not over:</i>	<i>and</i>	<i>soluble solids percent is not less than:</i>
16.5	10.0
17.5	10.5
18.5	11.0
19.5	11.5
20.5	12.0
21.5	12.5

RESULTS

Tree Size

All trees made excellent growth during the first 17-18 years of the orchard's life as measured by trunk diameter, tree spread, and height, table 1. In 1969, the trunk diameter of Vance and Red King

TABLE 1. INFLUENCE OF STRAIN ON TREE SIZE OF NON-SPUR RED DELICIOUS APPLE TREES ON MM106 ROOTSTOCK OF VARIOUS AGES

Variety	Trunk diameter	Tree height	Tree spread	Seasonal terminal growth	Height (last mech. pruning)
	<i>In.</i>	<i>Ft.</i>	<i>Ft.</i>	<i>Ft.</i>	<i>Ft.</i>
4-year-old					
Top Red	2.68a ¹	10.2a	6.9a	-	-
Vance	2.24b	10.0a	6.5a	-	-
Red Prince	2.82a	10.1a	6.7a	-	-
Red King	2.23b	9.9a	6.5a	-	-
Red Queen	2.93a	10.0a	6.9a	-	-
6-year-old					
Top Red	3.75ab	12.5a	10.8a	-	-
Vance	3.71b	13.0a	11.2a	-	-
Red Prince	4.06ab	13.0a	11.1a	-	-
Red King	3.77ab	12.8a	11.3a	-	-
Red Queen	4.09a	13.1a	11.6a	-	-
10-year-old					
Top Red	5.73a	14.2a	13.8a	4.5a	9.3a
Vance	5.77a	14.5a	14.2a	4.9a	9.3a
Red Prince	6.02a	15.1a	13.9a	4.4a	9.5a
Red King	5.95a	16.1a	15.3a	6.0a	9.3a
Red Queen	5.97a	15.0a	14.1a	4.8a	9.3a
15-year-old					
Top Red	7.15a	15.2a	17.8a	1.3a	8.3a
Vance	7.14a	15.5a	17.8a	1.4a	8.7a
Red Prince	7.57a	15.7a	18.8a	1.3a	8.4a
Red King	7.52a	16.2a	18.6a	1.5a	8.7a
Red Queen	7.72a	15.8a	18.8a	1.4a	8.5a
18-year-old					
Top Red	7.56a	15.3a	17.2a	1.6a	-
Vance	7.36a	16.1a	16.8a	1.7a	-
Red Prince	7.79a	16.6a	17.6a	1.8a	-
Red King	7.69a	17.0a	18.9a	1.8a	-
Red Queen	7.38a	15.6a	17.1a	1.6a	-

¹Mean separation within columns in the appropriate group, by Duncan's multiple range test, 5 percent level.

was less than Top Red, Red Prince, and Red Queen. Vance and Red King were planted in 1966 and the other three strains were planted in 1965; therefore, this difference was probably due to age and not strain. There were no differences in trunk diameter, tree spread, or height due to variety during this experiment.

The trees made excessive vegetative growth during the 1972-75 period and over the next several years because of the severe mechanical pruning previously mentioned. From the spring of 1976 through the spring of 1982, the trees were hand pruned and allowed to increase in canopy height about 1.5 feet each season. In 1979 and 1982, the trees made from 15-18 inches of terminal growth and ranged in height from 15.5 to 16.3 feet at the end of the 1979 growing season and 15.3 to 17.0 feet at the end of the 1982 growing season. The trees were approaching their mature fruiting height as evidenced by the crop load, terminal growth, and stabilized tree height from 1979 through 1982.

Yield

A few fruit were produced in 1968 and 1969; however, the first light commercial crop was not produced until 1970 when the trees were in the 5th and 6th leaf, table 2. Lower yields were produced by Vance and Red King in 1970, probably reflecting the 1-year younger age. No crop was set in 1971 and the crop in 1973 was reduced by a low temperature of 25.5°F on April 14. During the 13 years of fruiting, 1970-82, Red Queen and Red Prince produced the highest yields and Red King produced the lowest yields. Larger annual yields were produced beginning in 1975, with yields fluctuating from one year to the next, with a high crop year preceeding a lower crop. During the 8-year period, from 1975 to 1982, Red Queen produced significantly higher yields than Red King but did not yield more than any of the other strains. There was no difference in yield among any of the other strains.

Maturity

Data collected on maturity indices and fruit quality from fruit samples (collected periodically during the fruit maturation period each season from 1971 through 1982) are summarized in table 3 with the yearly data being presented in appendix tables 1-12. The strains of non-spur Red Delicious tested did not vary in quality measurements of fruit size, length/diameter (L/D) ratio, fruit firmness,

TABLE 2. EFFECT OF STRAIN OF NON-SPUR RED DELICIOUS APPLES ON MM106 ROOTSTOCK ON YIELD PER ACRE

Year	Yield per acre by variety									
	Top Red		Vance		Red Prince		Red King		Red Queen	
	Bu.		Bu.		Bu.		Bu.		Bu.	
1970.....	92a ¹	(0.8 ²)	54b	(0.5)	118a	(1.1)	30b	(0.3)	109a	(1.0)
1971.....	-		-		-		-		-	
1972.....	467bc	(4.1)	423c	(3.7)	582a	(5.1)	312d	(2.6)	546ab	(4.8)
1973.....	158a	(1.4)	80c	(0.7)	115b	(1.0)	17d	(.2)	169a	(1.5)
1974.....	184ab	(1.6)	200ab	(1.8)	225a	(2.0)	87b	(.8)	187ab	(1.7)
1975.....	545ab	(4.8)	652a	(5.8)	719a	(6.3)	390b	(3.4)	692a	(6.1)
1976.....	462a	(4.1)	313a	(2.8)	377a	(3.3)	272a	(2.4)	589a	(5.2)
1977.....	667a	(5.9)	649a	(5.7)	831a	(7.3)	657a	(6.0)	810a	(7.2)
1978.....	343a	(3.0)	403a	(3.6)	438a	(3.9)	370a	(3.3)	408a	(3.6)
1979.....	1,119a	(9.9)	930a	(8.2)	1,217a	(10.7)	853a	(7.5)	1,209a	(10.7)
1980.....	747ab	(6.6)	606b	(5.3)	953a	(8.4)	787ab	(6.9)	970a	(8.6)
1981.....	1,265b	(11.2)	1,617a	(14.3)	1,019bc	(9.0)	863c	(7.6)	1,260b	(11.1)
1982.....	740a	(6.5)	943a	(8.3)	1,023a	(9.0)	905a	(8.0)	822a	(7.3)
Cumulative yield.....	6,787b	(59.9)	6,869b	(60.6)	7,617a	(67.2)	5,542c	(48.9)	7,770a	(68.5)
13-year av. yield.....	522b	(4.6)	528b	(4.7)	586a	(5.7)	426c	(3.8)	598a	(5.3)
8-year av. yield.....	736ab	(6.5)	764ab	(6.7)	822ab	(7.3)	637b	(5.6)	845a	(7.5)

¹Mean separation, within rows, by Duncan's multiple range test, 5 percent level.

²Value in parenthesis is the yield in bushels per tree.

TABLE 4. EFFECT OF STRAIN OF RED DELICIOUS ON FRUIT MATURITY AS MEASURED BY FIRMNESS AND PERCENT SOLUBLE SOLIDS OR BY RED COLOR

Year	Date each strain reached acceptable level of maturity based on firmness and percent of soluble solids or red color									
	Top Red		Vance		Red Prince		Red King		Red Queen	
	Firmness and pct. ss	Red color	Firmness and pct. ss	Red color	Firmness and pct. ss	Red color	Firmness and pct. ss	Red color	Firmness and pct. ss	Red color
1971.....	8-27	8-6	8-27	8-20	8-27	8-13	8-27	8-13	8-27	8-13
1972.....	8-18	8-4	8-18	8-25	8-18	9-1	8-18	8-18	8-18	9-15 ⁺
1973.....	8-6	8-17	8-6	8-20	8-6	8-28	8-6	8-23	8-6	8-28
1974.....	8-5	8-12	8-5	8-16	8-5	8-23	8-5	8-12	8-5	8-23 ⁺
1975.....	8-11	8-5	8-5	8-5	8-5	8-22	8-8	8-22	8-11	8-25
1976.....	8-9	8-9	8-9	8-9	8-9	8-20	8-9	8-20	8-9	8-20
1977.....	8-5	8-8	8-5	8-22 ⁺	8-5	8-15	8-5	8-15	8-5	8-22
1978.....	8-10	8-14	8-10	8-21	8-10	8-25	8-10	8-10	8-10	8-25 ⁺
1979.....	8-10	8-10	8-10	8-17	8-10	8-24	8-10	8-13	8-10	8-24
1980.....	8-15	8-25	8-15	9-5 ⁺	8-15	9-5 ⁺	--	--	--	--
1981.....	8-10	8-10	8-10	8-21	8-10	8-28 ⁺	8-10	8-28	8-10	8-24
1982.....	8-13-	8-13-	8-13-	8-20 ⁺	8-13-	8-20	8-13-	8-13-	8-13-	8-20 ⁺
Av. maturity.....	8-12	8-11	8-11	8-19	8-11	8-22	8-11	8-17	8-11	8-25

TABLE 5. THE DATE OF FULL BLOOM, MINIMUM MATURITY DATE, AND NUMBER OF DAYS FROM FULL BLOOM UNTIL MATURITY OF FIVE STRAINS OF NON-SPUR RED DELICIOUS APPLES, 1971-82

Year	Date of full bloom	Minimum acceptable ¹ maturity date	Days from bloom to maturity
1971.....	4-15	8-27	134
1972.....	3-26	8-18	146
1973.....	4-14	8-6	114
1974.....	4-4	8-5	123
1975.....	4-5	8-11	128
1976.....	3-28	8-9	135
1977.....	3-28	8-5	131
1978.....	4-3	8-10	129
1979.....	4-7	8-10	125
1980.....	4-10	8-15	127
1981.....	4-4	8-10	128
1982.....	4-1	8-13	135
Av.	4-4	8-11	130.6

¹Minimum maturity level based on fruit firmness and percent soluble solids.

percent soluble solids, flesh color, ground color, or date on which they would meet a minimum level of maturity based on firmness and percent soluble solids. The average date each strain reached an acceptable minimum level of maturity was August 11, table 4. This varied from as early as August 5 in 1973, 1974, and 1977 to as late as August 27 in 1971. However, only Top Red had a sufficient percent of the fruit surface with a solid red blush by August 11 to meet the U.S. Extra Fancy grade (6). Top Red had developed a solid red blush over 50 percent of the fruit surface in 7 of the 12 years by the time the fruit met the acceptable minimum maturity level based on firmness and percent soluble solids (1, 9).

During the 12-year period from 1971 through 1982, the average full bloom date was on April 4, table 5. However, the date of full bloom varied from as early as March 26 in 1972 to as late as April 15 in 1971. Based on the minimum acceptable maturity date of August 11, these strains required an average of 130 days from full bloom to maturity during this 12-year period, table 3. The number of days from full bloom to maturity varied from 114 days in 1973 to 146 days in 1972.

DISCUSSION

The non-spur Red Delicious strains on MM106 rootstock evaluated in this study produced trees that were larger than desired. This probably reflects the long growing season in the South and the pruning and training system used in the early years of tree development. Had the newer training system (3, 7) using clothes pins and

wire braces to develop the scaffold branches and feathering to induce earlier spur development been used, tree growth should have been limited by earlier and heavier fruiting. The trees had reached their mature fruiting height in the fall of 1979 as evidenced by the reduced cumulative growth over the next three seasons. Only vigorous sprout growth was removed during the last three seasons. Tree size can be held to a more manageable height by spur type strains and by more size controlling rootstocks. Trees in this study filled their allotted space in 10 to 12 years. Because of the long growing season in Alabama, young apple trees make more seasonal vegetative growth than is made in more northern fruit growing areas. Therefore, it is imperative that proper nitrogen fertilization and training procedures of the young trees be followed to induce early fruiting and discourage excessive vegetative growth (3, 7). If spur type strains and more dwarfing rootstocks are used, more trees could be planted per acre with higher anticipated yields per acre being produced.

Yield during the early years was reduced by the severe pruning practiced in an attempt to hold tree size down. However, yield was at an acceptable level during the last eight seasons of fruiting. The yield produced during this period was greater than reported in Tennessee (5) and in the range of the 700-bushel-per-acre production reported to be the goal of Washington State apple growers (8).

The maturity evaluations depict the problems Alabama apple growers have faced in marketing their crop. Even though yield and fruit quality other than red surface color have been adequate, the growers have encountered marketing resistance caused by the lack of red color. The fruit matures prior to the poor coloring strains developing sufficient red color to compete with the highly colored fruit coming from controlled atmospheric storage. Top Red was the only strain evaluated in this study that developed sufficient red color to compete favorably with the fruit from controlled atmospheric storage. However, other high coloring strains evaluated in variety evaluation plantings in Alabama developed sufficient red color to compete with fruit from other areas. Some of these strains are Early Red-one, Oregon Spur, Red Chief, Sharp Red, and Starkrimson. These strains have produced good crops of large, highly colored fruit. Early Red-one matures about 1 week earlier than most other strains and 100 percent of the fruit surface develops a solid red blush before the fruit matures. Starkrimson ripens about 7 to 10 days later than most other strains of Red Delicious.

High night temperatures occurring during the ripening period of apples inhibit red color development (4, 11, 14). In Alabama, it should be anticipated that most strains of Red Delicious will develop insufficient red color because they ripen in early to mid-August when high night temperatures are encountered. Therefore, strains should be evaluated for their ability to color under high night temperatures. Only those possessing the ability to develop sufficient red color should be planted. These new high coloring strains of Red Delicious would give Alabama apple growers an advantage in marketing because fruit would ripen in August adequately to meet minimum grade standards and compete favorably with fruit from storage.

The 130-day average ripening period from bloom to harvest during this 12-year study is less than the number of days generally reported necessary for fruit development and maturation (1, 11). Eggert reported that temperatures during the first 30 to 40 days after bloom were the most influential in determining the elapsed time from bloom to harvest (4). Olsen and Martin suggest that climatic conditions near the normal harvesting period also have important effects on the maturation process (11). Their work indicates low night temperatures might stimulate the initiation or speed of reactions involved in the maturation process and warm night temperatures might adversely affect the maturation process. Olsen and Martin suggest that in each fruit growing area an average number of days from bloom to harvest can be used as a general guide for harvest (11). However, fluctuations in the optimum period from bloom to harvest and in fruit quality can be expected from year to year due to annual climatic variations. It should be noted that in 10 of the 12 years reported in this study, the fruit reached a minimum maturity level for harvest based on percent soluble solids and fruit firmness, near the 130-day average. However, in 1972 the fruit were 16 days later in reaching maturity and in 1973 they reached maturity 16 days earlier.

The five non-spur strains of Delicious evaluated in this study did not differ in fruit L/D ratios. They did not have a L/D ratio of .93, generally considered necessary to be classed as "typy" fruit (10). However, these non-spur strains had higher L/D ratios than many strains developed in Alabama (2). Earlier research indicated that fruit typiness was affected by postbloom temperatures during the first 2-3 weeks after bloom (12). Later research has indicated fruit shape can be adversely affected by high temperatures during the first 30 to 40 days after bloom (4), and Westwood (13) reported that

high temperatures the first 100 days of fruit development can adversely affect fruit shape. Red Prince and Red King generally had more development of the calyx lobes than the other three varieties. Top Red generally had less calyx lobe development, making it appear to be more oblate than the other strains tested. However, there were no significant differences in the L/D ratios.

Red Delicious apples can be profitably produced in Alabama if the proper strains are grown. Yields produced in the State compare favorably with those of the northern production areas. However, because of the high night temperatures during the maturation period, many strains do not develop adequate red surface color to meet the Federal grade standards and are difficult to sell through established marketing channels. Therefore, only strains that have been evaluated and proven to possess the ability to color under the climatic conditions in Alabama should be grown.

Growers have been applying ethephon during most production years to enhance red coloration of fruits. This treatment (1 pint per 100 gallons) is applied 7 to 10 days before normal harvest. Results of the practice vary from good to poor depending on the temperatures in late July-early August. Applications made when temperatures are not excessively high (less than 85°F) have given good results. However, if daytime highs are in the 90's with nighttime low's in the 70's, development of red color is poor and this condition is somewhat aggravated during dry weather. Ethephon should not be applied if air temperatures are above 85°F. If applied under such conditions, fruits develop a very unattractive rosy-greenish skin color.

Although ethephon is another chemical tool available to the apple grower, it cannot always be used to salvage the crop. Therefore, the ideal approach is for growers to establish orchards using the spur and non-spur Red Delicious strains which have superior red coloring characteristics under Alabama conditions. Ethephon could then be applied on an "as needed" basis during a given season.

CONCLUSION

The non-spur strains of Red Delicious evaluated in this study did not vary in growth rate or size of the mature fruiting trees. The mature non-spur Red Delicious apple trees on MM106 rootstock grown on the Piedmont soils in central Alabama averaged from 15.3 to 17.0 feet tall and 17.1 to 18.9 feet wide. Four of the five strains tested produced acceptable yields when compared to production in other areas of the country. During the last 8 years of the study, the

highest yielding strain, Red Queen, produced an average yield of 845 bushels per acre and the lowest yielding strain, Red King, produced an average yield of 637 bushels per acre.

During the 12-year period, from 1971 through 1982, the average full bloom date varied from as early as March 26 in 1972 to as late as April 15 in 1971. Based on the percent soluble solids and firmness, the fruit reached a minimum acceptable maturity level by August 11. The fruit required an average of 130 days from full bloom to reach a minimum acceptable maturity level. The days required for maturity varied from a low of 114 days in 1973 to a high of 146 days in 1972. The strains did not differ in quality other than red color development. Top Red was the only strain that produced sufficient red color to meet grade standards by the early harvest dates.

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APPENDIX

APPENDIX TABLE 1. MATURITY INDICES ON FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1971

Sample date	Firmness		Pct. soluble solids		Fruit dia., in.	Pct. red color (blush)	Ground color	Flesh color	Pct. seed color
	Side of fruit		Side of fruit						
	Red (lb./sq.in.)	Green	Red	Green					
Top Red									
8-16	23.3	--	9.8	--	2.74	88	GYT	WGT	33
8-13	21.6	21.6	9.6	9.6	2.68	89	GYT	W	82
8-20	22.9	22.6	10.0	9.4	2.76	99	GYT	WYT	82
8-27	23.9	24.7	11.6	10.8	2.94	95	GYT	WYT	93
9-3	22.9	22.7	12.0	11.6	2.90	94	Y	WYT	98
9-8	19.6	--	14.0	--	2.88	95	Y	WYT	100
Vance									
8-6	23.1	--	8.6	--	2.58	48	G	G	34
8-13	22.7	22.5	9.6	9.0	2.66	56	GYT	W	70
8-20	21.4	22.3	10.4	10.2	2.81	81	GYT	WYT	90
8-27	24.6	23.9	11.0	10.2	2.71	81	Y	WYT	92
9-3	22.5	21.6	11.2	11.0	2.81	96	Y	WYT	93
9-8	17.6	--	13.4	--	2.74	83	Y	WYT	98
Red Prince									
8-6	24.3	--	8.6	--	2.58	57	GYT	G	37
8-13	22.4	22.3	10.0	9.4	2.70	75	GYT	W	79
8-20	22.5	22.2	10.4	9.2	2.78	85	GYT	WYT	80
8-27	24.5	23.9	10.8	10.2	2.84	93	GYT	WYT	95
9-3	23.4	22.1	11.6	11.8	2.90	95	Y	WYT	100
9-8	19.2	--	13.0	--	2.85	85	Y	WYT	100
Red King									
8-6	21.8	--	8.2	--	2.63	74	GYT	G	36
8-13	22.8	23.1	9.6	9.4	2.59	86	GYT	W	82
8-20	22.3	22.5	10.6	10.0	2.73	94	GYT	WYT	88
8-27	23.8	23.2	11.5	11.0	2.80	91	Y	WYT	96
9-3	22.8	22.2	11.6	10.8	2.75	96	Y	WYT	98
9-8	18.4	--	12.6	--	2.85	95	Y	WYT	100
Red Queen									
8-6	23.7	--	9.0	--	2.76	72	GYT	WGT	29
8-13	21.7	22.3	9.8	9.8	2.66	84	GYT	WGT	73
8-20	21.6	21.7	10.2	10.0	2.76	88	GYT	WYT	86
8-27	23.7	23.6	10.8	10.0	2.83	94	Y	WYT	98
9-3	22.8	23.2	12.2	11.8	2.66	96	Y	WYT	99
9-8	19.2	--	13.8	--	2.75	96	Y	WYT	100

APPENDIX TABLE 2. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1972

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
7-28 ...	18.7	8.0	2.69	--	--	--	73	G	G	14
8-4	18.4	8.0	2.74	--	--	75	96	GYT	G	35
8-11 ...	16.7	8.2	2.69	--	--	68	95	GYT	WGT	49
8-18 ...	16.7	10.6	2.73	--	--	67	79	GYT	WGT	81
8-25 ...	16.7	10.8	2.72	--	--	80	100	GYT	WGT	90
9-1	15.8	11.4	2.80	--	--	88	100	GYT	WYT	100
9-8	16.0	11.6	2.79	2.54	.91	92	100	YGT	WYT	100
9-15 ...	14.8	12.4	2.78	2.48	.89	94	100	Y	Y	100
Vance										
7-28 ...	19.9	9.0	2.72	--	--	--	36	G	G	26
8-4	18.3	8.6	2.72	--	--	9	40	G	GWT	39
8-11 ...	18.3	9.0	2.74	--	--	43	71	GYT	WGT	73
8-18 ...	17.2	11.2	2.66	--	--	42	77	GYT	WGT	90
8-25 ...		12.2	2.64	--	--	54	92	GYT	WYT	98
9-1	15.3	11.2	2.70	--	--	66	95	GYT	WYT	100
9-8	15.9	11.8	2.78	2.56	.92	72	95	GYT	WYT	100
9-15 ...	16.4	12.0	2.76	2.55	.92	86	95	YGT	Y	100
Red Prince										
7-28 ...	19.4	8.6	2.74	--	--	--	45	G	G	19
8-4	19.2	8.4	2.69	--	--	10	70	GYT	G	37
8-11 ...	16.5	8.8	2.76	--	--	23	76	GYT	WGT	72
8-18 ...	17.6	11.0	2.66	--	--	24	73	GYT	WGT	86
8-25 ...	17.2	12.2	2.66	--	--	42	95	GYT	WGT	97
9-1	15.7	12.2	2.76	2.52	.91	61	97	GYT	WYT	100
9-8	16.4	12.2	2.76	2.52	.91	65	97	GYT	WYT	100
9-15 ...	16.1	13.2	2.84	2.48	.87	84	97	YGT	Y	100
Red King										
7-28 ...	20.1	8.8	2.64	--	--	--	76	G	G	26
8-4	17.7	8.0	2.73	--	--	44	91	GYT	GWT	54
8-11 ...	16.6	8.0	2.80	--	--	45	92	GYT	WGT	56
8-18 ...	16.9	11.0	2.63	--	--	50	90	GYT	WYT	100
8-25 ...	16.9	11.4	2.73	--	--	60	95	GYT	WYT	100
9-1	16.3	11.8	2.70	--	--	54	95	GYT	WYT	100
9-8	16.8	12.4	2.80	2.46	.88	70	98	YGT	WYT	100
9-15 ...	16.6	13.0	2.80	--	--	88	98	YGT	YWT	100
Red Queen										
7-28 ...	17.7	8.2	2.63	--	--	--	59	G	G	26
8-4	17.5	8.0	2.58	--	--	30	82	GYT	GWT	54
8-11 ...	16.6	8.3	2.75	--	--	47	78	GYT	WGT	56
8-18 ...	16.4	10.8	2.74	--	--	39	88	GYT	WGT	100
8-25 ...	16.3	10.8	2.76	--	--	41	94	GYT	WGT	100
9-1	16.1	10.8	2.71	--	--	43	98	GYT	WYT	100
9-8	16.3	10.8	2.79	2.58	.93	48	99	GYT	WYT	100
9-15 ...	15.4	11.6	2.93	2.52	.86	49	91	YGT	GWT	100

APPENDIX TABLE 3. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1973

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit dia., in.	Pct. red color		Ground color	Flesh color	Pct. seed color
				Blush	Total			
Top Red								
8-6.....	18.1	11.8	2.56	8	70	GYT	GWT	100
8-10.....	17.4	11.7	2.77	45	79	GYT	GWT	100
8-14.....	17.0	11.9	2.71	47	80	GYT	WGT	100
8-17.....	17.3	11.6	2.71	51	84	GYT	WGT	90
8-20.....	16.0	12.0	2.92	68	84	GYT	WGT	100
8-23.....	16.0	12.7	2.80	39	72	GYT	WGT	100
8-28.....	15.3	13.4	2.70	75	99	YGT	WYT	90
8-31.....	15.3	13.1	2.90	89	94	Y	YT	100
Vance								
8-6.....	17.8	12.0	2.66	6	85	GYT	GWT	100
8-10.....	16.8	12.4	2.69	8	48	GYT	WGT	100
8-14.....	17.6	11.7	2.74	22	71	GYT	WGT	100
8-17.....	16.8	12.4	2.82	34	62	GYT	WYT	100
8-20.....	15.5	12.7	2.83	58	88	YGT	WYT	85
8-23.....	16.0	12.7	2.78	35	70	GYT	WGT	100
8-28.....	13.8	12.8	2.87	59	80	GYT	WYT	100
8-31.....	16.2	13.0	2.72	80	95	YGT	WYT	100
Red Prince								
8-6.....	17.4	12.1	2.77	5	54	GYT	GWT	90
8-10.....	17.0	12.2	2.76	4	51	GYT	W-GYT	100
8-14.....	17.8	12.9	2.82	20	64	GYT	WGT	100
8-17.....	17.1	12.6	2.75	26	79	GYT	W	100
8-20.....	15.9	12.7	2.84	41	88	YGT	WYT	95
8-23.....	16.9	12.7	2.78	48	96	YGT	WYT	100
8-28.....	14.5	13.6	2.82	62	77	YGT	WYT	100
8-31.....	15.7	13.6	2.89	69	95	YGT	WYT	100
Red King								
8-6.....	17.1	11.7	2.68	21	70	GYT	GT	100
8-10.....	17.4	11.3	2.70	40	82	GYT	WGT	100
8-14.....	17.7	11.5	2.79	29	82	YT	WGT	100
8-17.....	17.1	11.1	2.80	46	82	GYT	WGT	100
8-20.....	15.8	11.9	2.81	43	91	YGT	WYT	90
8-23.....	16.8	11.6	2.73	64	81	YT	WYT	100
8-28.....	16.1	12.6	2.69	79	100	YGT	WYT	100
Red Queen								
8-6.....	16.3	11.2	2.83	8	29	GYT	G	100
8-10.....	16.7	10.6	2.95	3	49	GYT	WGT	100
8-14.....	16.8	11.7	2.70	23	71	GYT	WGT	100
8-17.....	17.3	11.4	2.61	26	74	GYT	WGT	100
8-20.....	15.0	11.7	2.92	22	83	YGT	W	95
8-23.....	15.1	11.9	2.85	49	69	GYT	WYT	95
8-28.....	14.1	11.8	2.94	63	97	YGT	WYT	100
8-31.....	15.6	12.6	2.74	77	88	YGT	W	100

APPENDIX TABLE 4. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1974

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit dia., in.	Pct. red color (blush)	Ground color	Flesh color	Pct. seed color
Top Red							
8-5	15.8	11.3	2.58	34	GYT	WGT	58
8-9	15.0	12.2	2.94	47	YGT	WYT	52
8-12	14.6	12.2	2.78	51	YGT	WGT	58
8-16	14.9	12.5	2.97	66	YGT	WGT	59
8-19	15.7	12.4	2.90	61	YGT	WYT	62
8-23	15.8	12.2	2.89	71	YGT	WYT	65
Vance							
8-5	15.1	13.1	2.86	18	GYT	WGT	60
8-9	14.9	13.4	2.80	39	GYT	WGT	58
8-12	13.8	13.2	2.71	45	YGT	WGT	62
8-16	16.6	13.4	2.78	53	YGT	WYT	71
8-19	16.7	13.4	2.96	64	YGT	WYT	63
8-23	14.8	13.4	2.90	69	YGT	WYT	61
Red Prince							
8-5	16.3	12.6	2.88	13	G	WGT	59
8-9	15.8	12.8	2.69	14	GYT	WGT	61
8-12	14.2	12.8	2.82	27	YGT	WGT	58
8-16	15.9	12.5	2.94	33	YGT	WGT	62
8-19	15.7	13.1	2.97	39	YGT	WYT	66
8-23	15.5	13.5	2.90	63	YGT	WYT	63
Red King							
8-5	14.8	13.9	2.86	26	GYT	WGT	60
8-9	17.8	13.4	2.89	47	YGT	WGT	59
8-12	13.8	13.7	3.00	53	YGT	WGT	62
8-16	15.7	13.0	2.87	81	YGT	WYT	72
8-19	16.5	13.1	2.80	65	YGT	WYT	64
8-23	13.7	13.2	2.92	59	YGT	WYT	66
Red Queen							
8-5	15.9	12.7	2.85	9	G	WGT	61
8-9	17.6	12.4	2.95	18	GYT	WGT	60
8-12	14.8	13.2	2.91	8	GYT	WGT	63
8-16	16.5	13.5	2.99	17	GYT	WYT	59
8-19	17.0	11.9	2.96	17	GYT	WYT	60
8-23	15.1	13.2	2.93	49	YGT	WYT	61

APPENDIX TABLE 5. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1975

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit dia., in.	Pct. red color		Ground color	Flesh color	Pct. seed color
				Blush	Total			
Top Red								
8-5.....	16.7	9.9	2.95	54	94	GYT	WYT	90
8-8.....	16.0	9.6	3.05	65	94	GYT	WYT	100
8-11.....	16.2	10.1	3.01	63	92	GYT	WYT	99
8-15.....	15.3	11.1	3.00	73	98	YGT	WYT	98
8-18.....	16.5	10.9	2.99	63	96	YGT	WYT	100
8-22.....	15.3	11.0	3.05	82	98	Y	Y	100
8-25.....	15.5	11.1	2.99	75	98	Y	Y	100
8-29.....	15.1	11.5	2.98	78	100	Y	Y	100
Vance								
8-5.....	17.8	11.9	2.72	53	81	GYT	WGT	89
8-8.....	18.1	11.7	2.65	43	85	GYT	WYT	95
8-11.....	17.9	11.3	2.82	48	85	GYT	WYT	94
8-15.....	18.1	11.3	2.93	48	88	YGT	WYT	93
8-18.....	18.7	11.8	2.78	56	82	YGT	WYT	97
8-22.....	17.5	12.3	2.85	55	94	Y	Y	100
8-25.....	16.0	13.0	2.96	54	91	Y	Y	100
8-29.....	16.5	13.0	2.96	54	88	Y	Y	100
Red Prince								
8-5.....	18.1	11.4	2.83	23	78	GYT	WGT	95
8-8.....	17.9	11.3	2.94	23	83	GYT	WYT	100
8-11.....	17.0	11.0	2.82	32	91	GYT	WYT	100
8-15.....	17.3	11.2	3.01	45	90	YGT	Y	96
8-18.....	16.9	11.8	3.04	46	94	Y	Y	100
8-22.....	16.9	12.6	2.79	54	90	Y	Y	100
8-25.....	14.7	12.9	3.07	62	98	Y	Y	100
8-29.....	15.0	11.9	3.16	63	97	Y	Y	100
Red King								
8-5.....	16.9	10.0	2.76	37	93	GYT	WYT	90
8-8.....	16.5	10.3	2.75	33	88	GYT	WYT	90
8-11.....	16.8	10.5	2.77	38	90	GYT	WYT	100
8-15.....	16.6	11.3	2.88	38	94	YGT	WYT	98
8-18.....	16.3	11.1	2.86	43	92	YGT	WYT	98
8-22.....	15.8	11.0	3.05	53	95	YGT	Y	100
8-25.....	17.0	11.8	2.89	53	97	Y	Y	100
8-29.....	16.3	10.9	2.91	54	96	Y	Y	100
Red Queen								
8-5.....	16.6	10.1	2.78	19	83	GYT	WGT	87
8-8.....	16.7	10.1	2.90	16	82	GYT	WGT	100
8-11.....	16.4	10.9	2.90	32	79	GYT	WYT	100
8-15.....	17.2	10.5	2.88	26	92	GYT	WYT	100
8-18.....	17.5	10.5	2.93	28	87	GYT	WYT	100
8-22.....	16.6	10.3	2.99	36	92	YGT	Y	100
8-25.....	15.9	11.3	2.89	51	95	Y	Y	100
8-29.....	15.8	10.9	3.10	46	94	Y	Y	100

APPENDIX TABLE 6. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1976

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit dia., in.	Pct. red color		Ground color	Flesh color	Pct. seed color
				Blush	Total			
Top Red								
8-9.....	16.3	10.50	2.94	69	98	GYT	WGT	80
8-13.....	16.8	11.10	2.98	61	94	GYT	WYT	83
8-16.....	16.8	10.60	2.91	80	98	YGT	WYT	93
8-20.....	16.1	12.00	2.91	86	100	YGT	WYT	97
Vance								
8-9.....	17.5	13.10	3.00	64	94	YGT	WGT	81
8-13.....	16.7	11.70	3.11	63	98	YGT	WYT	88
8-16.....	16.8	14.00	2.98	69	94	YGT	WYT-Y	94
8-20.....	17.2	14.30	2.96	74	97	Y	Y	86
Red Prince								
8-9.....	16.3	12.50	2.98	31	86	GYT	WGT	67
8-13.....	16.1	11.90	3.13	39	91	YGT	WYT	--
8-16.....	17.3	13.00	2.89	48	93	YGT	WYT	93
8-20.....	17.8	13.70	2.90	54	94	Y	Y	88
Red King								
8-9.....	17.8	12.60	2.89	32	85	YGT	WGT-WYT	--
8-13.....	14.5	12.60	3.22	38	90	Y	Y	98
8-16.....	16.4	12.20	2.98	47	90	Y-YGT	Y	97
8-20.....	17.1	12.70	2.94	53	94	YGT	WYT-WGT	74
Red Queen								
8-9.....	17.4	11.10	2.88	18	88	GYT	WGT	96
8-13.....	15.6	11.40	2.98	40	94	GYT	WYT	97
8-16.....	16.2	11.80	2.97	46	96	YGT	WYT	88
8-20.....	16.1	12.70	2.91	55	96	Y	Y	85

APPENDIX TABLE 7. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1977

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit dia., in.	Pct. red color		Ground color	Flesh color	Pct. seed color
				Blush	Total			
Top Red								
8-5.....	20.3	13.4	2.73	44	77	YGT	WYT	93
8-8.....	20.4	13.4	2.79	60	87	GYT	WYT	95
8-12.....	20.9	13.7	2.70	55	88	GYT	WYT	99
8-15.....	20.4	13.2	2.80	78	96	YGT	WYT	95
8-19.....	19.2	13.9	2.80	69	94	GYT	WYT	94
8-22.....	19.6	13.0	2.70	58	87	YGT	WYT	94
Vance								
8-5.....	18.3	14.3	2.53	28	51	GYT	WGT	96
8-8.....	16.6	14.7	2.79	25	58	GYT	WYT	97
8-12.....	18.9	14.7	2.80	31	61	YGT	WYT	97
8-15.....	18.4	14.5	2.60	30	58	YGT	WYT	97
8-19.....	15.0	13.1	2.80	41	70	YGT	Y	100
8-22.....	15.5	13.5	2.80	41	67	Y	Y	99
Red Prince								
8-5.....	19.3	12.6	2.57	25	67	GYT	WYT	92
8-8.....	15.9	14.3	2.73	26	71	YGT	WYT	91
8-12.....	18.3	14.4	2.80	23	70	GYT	WYT	100
8-15.....	17.4	15.5	2.80	52	82	YGT	Y	98
8-19.....	17.7	15.6	2.90	56	83	Y	Y	100
8-22.....	17.5	16.6	2.80	57	86	Y	Y	100
Red King								
8-5.....	23.3	16.4	2.56	29	79	GYT	WYT	96
8-8.....	21.0	15.2	2.62	36	81	YGT	Y	99
8-12.....	19.7	15.5	2.80	38	74	YGT	Y	99
8-15.....	17.2	15.3	2.90	69	82	GYT	Y	100
8-19.....	16.7	15.2	2.70	53	88	Y	Y	98
8-22.....	15.3	14.9	2.71	52	90	Y	Y	100
Red Queen								
8-5.....	19.8	12.5	2.75	29	80	GYT	WYT	95
8-8.....	19.0	13.5	2.81	27	65	GYT	WYT	98
8-12.....	19.8	14.1	2.90	37	82	Y	Y	95
8-15.....	16.8	14.6	2.90	45	89	Y	Y	98
8-19.....	15.1	--	3.20	42	90	Y	Y	100
8-22.....	15.3	15.5	2.90	51	89	Y	Y	100

APPENDIX TABLE 8. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1978

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
8-10 ...	18.1	15.3	2.63	2.35	0.89	47	77	GYT	WYT	100
8-11 ...	15.7	15.6	2.78	2.61	.94	44	87	GYT	WYT	97
8-14 ...	15.3	15.6	2.76	2.49	.90	51	99	GYT	WYT	100
8-18 ...	13.4	16.4	2.88	2.59	.90	50	82	GYT	WYT	95
8-21 ...	13.5	15.4	2.90	2.65	.91	60	87	YGT	WYT	100
8-25 ...	13.9	16.1	2.85	2.63	.92	61	91	YGT	Y	100
Vance										
8-10 ...	16.9	15.4	2.65	2.39	.90	34	64	GYT	WYT	100
8-11 ...	17.2	15.0	2.75	2.48	.90	44	72	GYT	WYT	100
8-14 ...	16.5	15.0	2.70	2.48	.92	42	78	GYT	WYT	90
8-18 ...	14.5	16.2	2.84	2.54	.89	48	88	YGT	WYT	100
8-21 ...	14.5	16.2	2.90	2.68	.92	67	91	YGT	Y	100
8-25 ...	14.5	16.8	2.75	2.70	.98	64	86	YGT	Y	98
Red Prince										
8-10 ...	18.0	14.8	2.60	2.39	.92	32	68	GYT	WYT	91
8-11 ...	16.1	15.0	2.69	2.43	.90	36	67	GYT	WYT	90
8-14 ...	14.8	15.0	2.78	2.58	.93	46	76	YGT	WYT	90
8-18 ...	14.3	14.8	2.90	2.65	.91	45	74	YGT	WYT	100
8-21 ...	11.1	15.4	2.95	2.65	.90	47	80	Y	Y	100
8-25 ...	11.4	17.2	3.03	2.74	.90	68	92	Y	Y	100
Red King										
8-10 ...	18.2	15.3	2.71	2.45	.90	73	97	GYT	WYT	94
8-11 ...	16.8	16.4	2.93	2.69	.92	74	94	GYT	WYT	100
8-14 ...	15.9	15.4	2.76	2.48	.90	87	98	GYT	WYT	100
8-18 ...	13.3	15.6	2.75	2.44	.89	63	97	YGT	WYT	100
8-21 ...	12.7	16.0	2.93	2.69	.92	69	91	YGT	WYT	100
8-25 ...	13.4	15.9	2.95	2.68	.91	63	91	YGT	Y	100
Red Queen										
8-10 ...	17.8	15.2	2.78	2.59	.93	30	76	GYT	WYT	96
8-11 ...	15.6	16.4	2.83	2.54	.90	13	74	GYT	WYT	100
8-14 ...	14.6	16.0	2.80	2.56	.91	25	71	GYT	WYT	100
8-18 ...	12.2	16.0	2.93	2.60	.89	32	73	GYT	WYT	100
8-21 ...	13.2	15.6	2.87	2.66	.92	34	73	GYT	WYT	100
8-25 ...	13.1	15.5	3.00	2.78	.93	43	79	YGT	Y	100

APPENDIX TABLE 9. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1979

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
8-10 ...	15.6	12.0	2.80	2.35	0.84	70	94	YGT	WYT	95
8-13 ...	16.9	12.2	2.82	2.48	.88	88	99	Y	WYT	100
8-17 ...	14.8	11.2	2.85	2.50	.88	83	97	YGT	WYT	100
8-20 ...	15.7	11.8	2.82	2.40	.85	94	100	Y	Y	100
8-24 ...	14.8	12.1	2.95	2.60	.88	93	100	Y	Y	100
Vance										
8-10 ...	16.0	12.2	2.75	2.40	.87	34	68	GYT	WGT	89
8-13 ...	16.4	11.6	2.71	2.40	.89	43	74	YGT	WYT	100
8-17 ...	15.1	11.5	2.98	2.62	.88	55	78	YGT	WYT	97
8-20 ...	15.5	11.7	2.83	2.50	.88	50	73	YGT	WYT	90
8-24 ...	15.7	12.1	2.80	2.53	.90	59	86	YGT	WYT	100
Red Prince										
8-10 ...	16.0	11.8	2.68	2.40	.90	40	75	GYT	WYT	99
8-13 ...	16.6	12.0	2.75	2.45	.89	44	82	GYT	WYT	90
8-17 ...	15.7	11.6	2.83	2.48	.88	45	84	GYT	WYT	90
8-20 ...	16.3	12.2	2.79	2.49	.89	49	81	YGT	WYT	100
8-24 ...	16.2	12.6	2.73	2.50	.92	54	87	Y	WYT	100
Red King										
8-10 ...	16.3	11.1	2.70	2.45	.91	43	81	GYT	WYT	99
8-13 ...	15.2	11.7	2.81	2.43	.87	55	93	YGT	WYT	100
8-17 ...	15.2	11.8	2.90	2.56	.88	63	87	YGT	WYT	100
8-20 ...	16.1	12.0	2.79	2.48	.89	60	88	YGT	WYT	100
8-24 ...	15.4	12.3	2.78	2.45	.88	63	97	Y	WYT	100
Red Queen										
8-10 ...	15.5	11.2	2.75	2.35	.86	36	78	GYT	WYT	96
8-13 ...	15.2	11.4	2.85	2.48	.87	44	75	GYT	WYT	90
8-17 ...	15.6	11.3	2.96	2.64	.89	39	69	GYT	WYT	99
8-20 ...	14.8	11.6	2.95	2.63	.89	40	78	YGT	WYT	90
8-24 ...	15.3	11.8	2.83	2.40	.85	54	89	YGT	WYT	96

APPENDIX TABLE 10. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1980

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
8-15 ...	22.6	14.9	2.54	2.34	.92	12	62	GYT	WGT	71
8-18 ...	20.4	15.6	2.34	2.15	.91	27	65	GYT	WGT	80
8-22 ...	18.0	15.8	2.61	2.36	.90	38	63	GYT	WGT	91
8-25 ...	17.5	15.8	2.61	2.38	.91	51	68	GYT	WGT	91
8-29 ...	22.0	16.1	2.57	2.32	.90	34	66	YGT	WYT	90
9-1	20.6	16.1	2.51	2.26	.90	27	58	YGT	WYT	89
9-5	19.3	16.1	2.56	2.33	.91	24	60	YGT	WYT	96
Vance										
8-15 ...	23.7	14.0	2.51	2.60	.92	7	36	GYT	WGT	77
8-18 ...	19.0	14.5	2.43	2.27	.93	7	36	GYT	WGT	87
8-22 ...	17.8	14.7	2.63	2.48	.94	16	54	GYT	WYT	87
8-25 ...	19.2	15.4	2.64	2.45	.93	25	64	YGT	WYT	93
8-29 ...	21.3	15.1	2.63	2.43	.91	37	48	YGT	WYT	94
9-1	19.3	15.9	2.71	2.45	.91	26	57	YGT	Y	99
9-5	19.2	15.5	2.66	2.55	.96	29	55	Y	Y	99
Red Prince										
8-15 ...	23.9	14.0	2.42	2.20	.91	11	49	GYT	WGT	89
8-18 ...	21.6	15.2	2.44	2.24	.91	14	66	GYT	WGT	88
8-22 ...	18.1	14.9	2.70	2.47	.91	16	60	GYT	WGT	89
8-25 ...	18.7	15.7	2.64	2.41	.91	26	63	GYT	WGT	93
8-29 ...	18.4	14.5	2.52	2.36	.93	20	66	YGT	WYT	92
9-1	19.7	15.9	2.59	2.37	.91	18	52	YGT	WYT	93
9-5	19.4	16.0	2.60	2.41	.93	20	52	YGT	WYT	93

APPENDIX TABLE 11. MATURITY INDICES OF FIVE NON-SPUR RED DELICIOUS APPLE STRAINS ON MM106 ROOTSTOCK, 1981

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
8-10 ...	15.9	13.7	2.65	2.40	.91	52	75	YGT	WYT	95
8-14 ...	17.8	13.4	2.69	2.36	.88	55	80	YGT	WYT	91
8-17 ...	15.9	13.9	2.70	2.41	.89	56	80	YGT	WYT	97
8-21 ...	17.2	12.4	2.62	2.38	.91	62	86	YGT	WYT	94
8-24 ...	16.1	12.5	2.60	2.33	.90	61	86	YGT	WYT	99
8-28 ...	17.1	13.0	2.58	2.31	.90	71	92	Y	YWT	98
Vance										
8-10 ...	15.4	13.7	2.78	2.51	.90	28	49	GYT	WYT	94
8-14 ...	17.5	12.9	2.72	2.46	.90	32	59	GYT	WYT	94
8-17 ...	15.7	14.2	2.82	2.55	.90	31	58	YGT	YWT	95
8-21 ...	17.3	11.2	2.81	2.52	.90	50	75	YGT	YWT	96
8-24 ...	16.7	11.4	2.75	2.46	.90	55	81	YGT	YWT	99
8-28 ...	17.1	12.5	2.79	2.50	.90	55	79	Y	Y	99
Red Prince										
8-10 ...	17.2	12.9	2.60	2.35	.90	20	43	GYT	WYT	95
8-14 ...	18.2	12.5	2.52	2.34	.93	27	58	YGT	WYT	94
8-17 ...	15.8	14.3	2.68	2.39	.89	28	53	YGT	WYT	97
8-21 ...	18.0	11.1	2.74	2.43	.89	34	65	YGT	WYT	99
8-24 ...	17.6	12.3	2.71	2.41	.89	36	70	YGT	YWT	97
8-28 ...	17.0	13.3	2.58	2.35	.91	33	72	Y	Y	97
Red King										
8-10 ...	17.0	12.0	2.85	2.68	.94	42	73	GYT	WYT	100
8-14 ...	17.7	14.4	2.83	2.70	.95	35	69	GYT	WYT	100
8-17 ...	15.6	13.4	2.90	2.75	.95	28	68	YGT	WYT	100
8-21 ...	17.9	11.0	2.81	2.61	.93	46	83	YGT	YWT	95
8-24 ...	17.7	10.4	2.87	2.60	.90	62	93	YGT	YWT	100
8-28 ...	15.9	15.0	2.87	2.67	.93	70	91	Y	Y	100
Red Queen										
8-10 ...	17.9	15.1	2.84	2.70	.95	13	33	GYT	WYT	90
8-14 ...	15.6	14.0	2.91	2.78	.96	21	65	GYT	WYT	100
8-17 ...	16.5	14.2	2.78	2.68	.96	18	59	GYT	WYT	90
8-21 ...	16.7	12.4	2.75	2.61	.95	38	78	YGT	WYT	99
8-24 ...	12.7	13.2	2.85	2.60	.94	50	74	YGT	YWT	100
8-28 ...	16.1	13.2	2.75	2.59	.94	53	79	Y	Y	100

APPENDIX TABLE 12. MATURITY INDICES ON FIVE NON-SPUR RED DELICIOUS
APPLE STRAINS ON MM106 ROOTSTOCK, 1982

Sample date	Firmness, lb./sq. in.	Pct. soluble solids	Fruit size		L/D ratio	Pct. red color		Ground color	Flesh color	Pct. seed color
			Dia., in.	Length, in.		Blush	Total			
Top Red										
8-13 ...	14.2	12.2	2.98	2.88	.97	84	94	YGT	WYT	100
8-16 ...	13.9	13.2	3.05	2.80	.92	88	100	YGT	WYT	100
8-20 ...	14.0	13.1	2.99	2.75	.92	88	100	YGT	WYT	100
Vance										
8-13 ...	15.1	12.3	2.75	2.55	.93	40	62	YGT	WYT	100
8-16 ...	14.7	12.0	2.76	2.60	.94	30	56	YGT	WYT	100
8-20 ...	15.1	12.9	2.75	2.55	.93	42	75	YGT	YWT	100
Red Prince										
8-13 ...	14.6	12.0	2.91	2.75	.95	44	61	YGT	WYT	100
8-16 ...	14.6	12.4	2.85	2.74	.96	40	86	YGT	YWT	100
8-20 ...	15.4	12.9	2.98	2.79	.94	51	97	YGT	YWT	100
Red King										
8-13 ...	13.9	11.5	2.78	2.64	.95	60	90	YGT	WYT	100
8-16 ...	14.7	13.2	2.83	2.60	.92	63	99	YGT	WYT	100
8-20 ...	15.0	12.3	2.98	2.78	.93	67	100	YGT	YWT	100
Red Queen										
8-13 ...	13.1	12.0	2.91	2.78	.95	49	80	YGT	WYT	100
8-16 ...	11.3	13.6	3.01	2.73	.91	41	77	YGT	WYT	100
8-20 ...	11.3	13.5	3.02	2.75	.91	48	80	YGT	YWT	100