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Apple Variety Performance On The Cumberland Plateau Of Tennessee

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INTRODUCTION

Apple production in Tennessee was estimated to be 361,000 bushels in 1972 (2). Principal commercial production areas are the Eastern mountains, the Plateau, the Eastern Highland Rim, and the northwest corner of the state.

Apple variety performance has been under investigation since 1950 at the Plateau Experiment Station. Over 100 varieties have been evaluated. Bulletin No. 432, "Apple Production on the Cumberland Plateau," was published in 1967 and reported on overall orchard performance. A report of rootstock performance, Bulletin No. 488, "Twenty Year's Research with Size-Controlling Rootstocks on the Cumberland Plateau," was published in 1972.

The objectives of these tests have been to evaluate new varieties and rootstocks as they became available and to evaluate the possibility of apple production in the Plateau area. The Plateau has some distinct advantages and disadvantages for apple production. Cool night temperatures enhance color development. Also, disease and insect problems are more easily controlled by recommended spray schedules than in other areas of the state. However, winter temperature ranges are severe and quite hardy varieties are generally the only ones to survive. The shallow, sandy soils of most areas are not too favorable. Site selection is most important; however, many satisfactory sites are available.

PROCEDURE

The orchard at the Plateau Experiment Station is located on a Hartsells sandy loam soil with a slight to moderate northern slope. Soil depth is about 3 feet. The site was cleared from woods in 1949, limed with 3 tons of agricultural limestone, and fertilized with 160 pounds of P_2O_5 per acre. Additional fertilizer was added to cover crops grown during 1949. Five trees of each of 17 varieties on seedling rootstock were planted in 1950. Numerous trees of new varieties have been added to the original planting as they were released since that time. Most of the trees added since 1960 are on size-controlling rootstocks.

The orchard cultural system consisted of cultivation and cover crops for the first 10 years. Permanent sod, primarily of orchard-grass, was established in 1960.

Chemical weed control under the trees has been by terbacil, paraquat, or simazine. Fertilization has been at rates to maintain medium phosphate and potash levels in the soil. Various nitrogen rates have been used. The rate of 150 pounds of ammonium nitrate per acre broadcast has appeared to be suitable for trees of all sizes and ages. Boron at 1 pound per acre and lime at 2 tons per acre have been added about every third or fourth year.

University of Tennessee Agricultural Extension Service spray schedules have been followed using an air blast sprayer. Materials and time of application of the schedules followed in 1972 are given in Table 1. Similar schedules were followed in all other years. Complete information concerning recommended spray schedules is available in Extension Circular 438 of the University of Tennessee Agricultural Extension Service. Note that no insecticides were used in sprays applied during the bloom period of late April to avoid poisoning bees working the blooms.

The varieties evaluated have been primarily in observational plantings. Therefore, it is difficult to compare yield performance between varieties. However, the data seem to indicate the yield potential of each variety.

Table 1. Materials and time of application for 1972 spray program

Materials*	Date
Dormant Oil	March 30
Cyprex, Ferbam, Systox	April 6
Cyprex, Ferbam, Guthion	April 14
Captan	April 20**
Captan	April 27
Captan, Lead Arsenate	May 2
Captan, Lead Arsenate	May 11
Captan, Guthion	May 25
Captan, Guthion	June 8
Polyram, Imidan	June 23
Captan, Guthion, Galecron	July 10
Captan, Guthion, Galecron	July 25
Captan, Guthion	August 7
Captan, Guthion	August 29

***Rates of each chemical and complete spray schedules are given in Agricultural Extension Circular 438, "Fruit Spray Schedules, 1972." The use of trade names does not imply endorsement solely to these products.**

****Streptomycin usually used at this period was not available in 1972.**

RESULTS

Annual production has been fairly consistent since 1964. Severe winter injury has resulted in many varieties being dropped from the tests. Many trees, some of standard varieties, were killed by a low temperature of -25° F during the winter of 1962-63. This low temperature also killed most of the fruit buds, severely reducing the total 1963 crop production.

Insect and disease problems have not been a major problem. Fire blight has been the only serious disease noted. Some varieties have been dropped from the test due to fire blight susceptibility. Streptomycin applied most years during the bloom period to control fire blight has been highly effective. A buildup of red mites has occurred in early July of each year. Two applications of miticide have provided excellent control.

It would be difficult to report all of the information concerning each variety in this bulletin. Therefore, the varieties tested will be broken into four groupings. Group I consists of adapted varieties with rather complete information presented. Group II consists of varieties that were fairly well adapted. Group III consists of varieties that have performed unsatisfactorily. Group IV consists of varieties that haven't been tested sufficiently to draw conclusions concerning their performance, primarily due to lack of enough years of testing.

APPLE VARIETIES (GROUP I) TESTED FOR SEVERAL YEARS AND FOUND WELL ADAPTED

This group of varieties consists of those which have performed well. These are Red Delicious, Golden Delicious, Cortland, Mutsu, Turley, Staymen, Julyred, and Tydeman's Red. A brief description of performance of each is presented in Table 2.

Red Delicious is the most widely-grown variety in the United States. Red Delicious trees showed only slight damage from the severe 1962-63 winter. The three original trees fruited until they were removed from the orchard in 1971 upon completion of the test period. Yields of the three original trees and of 14 trees on various size-controlling rootstocks set in 1960 are presented in Table 3.

Red Delicious fruit quality has been excellent. The climate is very favorable for desirable fruit color development. There are many red color strains available, but all these have not been evaluated. Red-spur and Starkrimson are two spur type varieties being tested. These varieties appear promising.

Golden Delicious trees set in 1950 were killed by the freeze damage of the 1962-63 winter. Yields of these for the early period of the test and of 14 trees on various size-controlling rootstocks set in 1960 are shown in Table 3. Golden Delicious fruit quality has been excellent. Fruit has shown a tendency to russet in most years. Use of Cyprex and Ferbam increased the amount of russet. Therefore, the orchard spray program has not included these chemicals after fruit set. The rootstock tests have shown that rootstocks MM 106 and MM 111 were associated with a reduced amount of russet (3). Also, certain russet-free varieties are now being studied (4).

Table 2. Specified characteristics of apple varieties (Group I) tested for several years and found well adapted at the Plateau Experiment Station, Crossville.

Variety	Bloom date	Harvest date	Fruit color	Fruit size	Winter injury	Fireblight damage
Julyred	April 20-25	July 15	Striped	Medium	Moderate	Severe
Tydemans Red	April 25-30	Aug. 25	Red	Medium	Moderate	Severe
Red Delicious	April 23-28	Sept. 20	Red	Medium	Slight	Slight
Golden Delicious	April 25-30	Sept. 25	Yellow	Medium	Moderate	Slight
Cortland	April 23-28	Sept. 25	Red Striped	Medium	None	Moderate
Turley	Apr. 28 May 3	Oct. 1	Red	Large	Moderate	Slight
Stayman	April 23-28	Oct. 5	Red	Medium to Large	Slight	Moderate
Mutsu	April 25-30	Oct. 10	Yellow	Large	None	Slight

Cortland trees survived the severe winter of 1962-63. Yield (Table 3) of these three original trees was good until they were removed in 1970. Quality and consumer acceptance of Cortland has been excellent. Fruits had a flat McIntosh-type shape and a red stripe to almost full deep red color. Trees had profuse small twig growth requiring considerable pruning. Cortland developed from a cross of McIntosh with Ben Davis (1). Cortland has been superior to McIntosh in these tests.

Mutsu was developed in Japan as a russet-free Golden Delicious. It resulted from a cross of Golden Delicious and the Japanese variety, Indo (1). Two Mutsu trees were set in 1960. Two trees on EM VII rootstock were set in 1964. Yields of these trees have been very high (Table 3). Mutsu fruits have been very large with no russet. Quality has been excellent. Fruits have been more tart and juicy than Golden Delicious. Fruit ripened about October 10, and kept well in storage. Consumer demand for Mutsu has been excellent. Mutsu trees have been vigorous growers on standard rootstocks.

Three **Turley** trees set in 1950 did not survive the severe 1962-63 winter. Three more trees were set in 1964. The yield of these three trees has been outstanding. Turley—a Winesap type—produced fruit with good color, large size, and good flavor. The flavor is not as tart as most Winesap. Consumer acceptance

Table 3. Yields of apple varieties (Group I) tested for several years and found well-adapted, Plateau Experiment Station, Crossville

Variety	Year set	Number trees	Ann. yield 1st 5 fruiting years	Ann. yield 1st 10 fruiting years	Total number fruiting years	Average annual yield per tree
			------Bu/Tree------			Bu/Tree
Red Delicious	1950	3	5.8	7.2	14	10.0
Red Delicious*	1960	14	2.2	6.4	10	6.4
Golden Delicious	1950	3	6.7	–	6	6.7
Golden Delicious*	1960	14	4.0	7.7	10	7.7
Cortland	1950	3	6.4	9.1	13	12.5
Mutsu	1960	2	15.8	–	7	14.3
Mutsu*	1964	2	5.3	–	7	4.9
Turley	1950	3	9.1	–	6	9.1
Turley	1964	3	7.1	–	6	6.8
Stayman	1950	3	8.5	9.4	13	11.2
Stayman*	1962	12	3.8	–	9	5.3
Julyred	1962	2	4.8	–	6	4.7
Tydeman's Red*	1963	2	2.6	–	6	2.8

*On various size-controlling rootstocks.

has been fair, but few nurseries offer Turley trees. Trees have been vigorous growers.

Stayman is somewhat questionable, due to fruit cracking in seasons with uneven rainfall distribution. Cracking was severe in 1971 and 1973. Hopefully, some recently-released growth regulators being tested will ease this problem. Two of three Stayman trees set in 1950 were killed during the 1962-63 winter. Yields of these and 12 trees on various size-controlling rootstocks have been favorable (Table 3). Fruit color and quality of Red Stayman have been outstanding. Consumer acceptance has been excellent. Trees have been vigorous growers.

Julyred is a July-maturing variety with excellent flavor and quality for this season. Fruits have been red striped to almost full red in color. Keeping quality has been fairly good. Yields of two trees set in 1962 (Table 3) have been fair. Trees are vigorous and upright.

Tydeman's Red is another McIntosh type variety. Yields of two trees on EM VII rootstock set in 1963 are shown in Table 3. Fruit has a flat shape with a full red color. Harvest date has been early August. Trees are open centered and are not very vigorous. Fireblight has been the most serious problem encountered with Tydeman's Red.

APPLE VARIETIES (GROUP II) FAIRLY WELL ADAPTED

This group of varieties include Jonathan, Idared, McIntosh, Spigold, Melrose, Monroe, Spartan, Lodi, Summer Rambo, Jonalicious, and Rome Beauty. These varieties have had good fruit quality, but also had one or more serious faults that limit their usefulness.

Jonathan and Idared had severe fire blight problems. Some trees had to be removed due to trunk damage from fire blight.

McIntosh, Spigold, and **Melrose** had poor fruit appearance, but excellent fruit quality. McIntosh trees were very winter hardy. Melrose has been somewhat questionable as to winter hardiness. Melrose fruits had a severe russet that damaged the appearance.

Monroe and **Spartan** both had a short keeping period in storage. Fruit quality of both seemed to vary from season to season. Both tended to have small fruit. Monroe is a Red Rome type and Spartan is a McIntosh type. Spartan fruit quality has been outstanding some seasons.

Lodi and **Summer Rambo** matured in July and August, respectively. These are primarily used for cooking. Keeping period has been short. Both have been moderately susceptible to fireblight and both lacked fruit color. These two varieties have been rather widely-grown commercially in past years.

Jonalicious fruit has been excellent in color and quality. Tree yields have been fairly good. The major problem has been core cracking of the fruit. Some fruit were cracked so badly that rot problems were encountered.

Rome Beauty yields have been high. Quality has been good. Gallia Beauty and Red Rome 262 have been strains producing well-colored fruit. Tree loss due to winter injury has been the only problem.

APPLE VARIETIES (GROUP III) THAT HAVE NOT PERFORMED SATISFACTORILY

This group of varieties have had one or more faults that were so severe that they were removed from the planting. These varieties will have no further testing because they appear to be poorly adapted to plateau conditions.

These varieties, along with their most severe problems, are listed in Table 4.

Table 4. Major problems of apple varieties (Group III) that have not performed satisfactorily at the Plateau Experiment Station, Crossville

Variety	Fire-blight	Winter injury	Poor eating quality	Poor fruit appearance	Poor fruit color
York		X	X		
Jonagram	X				
Franklin		X			
Milton	X				X
Jonadel			X	X	
Red Delight		X	X		
Ben Davis			X	X	
Melba			X	X	
McCoun			X	X	
Red Gravenstein		X			
NY E145*					
GDWF			X	X	
Cox Orange Pippin				X	X
NY 45503	X				
Delcon			X		
NY 16884*					X
NY 50-9*			X		
Connel Red			X		X
King Cole			X		
Ottawa 292	X		X		
Summer Champion			X	X	
Pyrols Delicious			X	X	
Northern Spy			X	X	X
Reinato Encarnada			X	X	X
Brambleys Seedling	X		X		X
Mignan		X			
Davey			X	X	
Blaze			X	X	
King Lucious		X	X		
Mio				X	
Snovit			X	X	X
Fenton	X		X		X
Sokeri-Miron				X	X
Wrikparent				X	X
Early McIntosh			X	X	

Table 4. Continued

Variety	Fire-blight	Winter injury	Poor eating quality	Poor fruit appearance	Poor fruit color
Yellow Transparent			X	X	
Wellington			X		
Barry*	X				
Webster*					
Huvitis			X		
Laxtons Fortune		X			
Kimballs McIntosh			X	X	X
Sonderskov			X		X
Crandall			X		X
Cusset		X			
Wealthy		X			
Ruby		X			
N.J. #12		X			
Anoka			X		
Jon Grimes	X				
Wayne	X				
King David		X			
P.I. 280011	X		X		
N.Y. 49-18		X			
Gallen	X		X		
Jerseyred			X		X

*Discontinued at request of breeder.

GROUP IV – NEW VARIETIES BEING TESTED

Group IV consists of 27 varieties established within the past 1 to 8 years. Some of these appear to be highly promising. These varieties and description of each as to favorable, unfavorable, or no decision are listed in Table 5. Few observations have been made concerning most of these varieties.

Table 5. Ratings concerning varieties of Group IV—new varieties being tested at the Plateau Experiment Station, Crossville

Variety	Favorable	Unfavorable	No decision
Primegold			X
Goldspur		X	
Jonagold	X		
Hardrick			X
Red Paducah			X
Puritan			X
Niagara			X
Polly Eades	X		
Empire	X		
Quinte		X	
Roanoke	X		
Jonamac	X		
Shenandoah	X		
Imperial Stayman			X
Dakota			X
Holiday			X
Paulared			X
Smoothee	X		
Jonnee	X		
Molly Delicious	X		
Raritan		X	
Summerred	X		
Sungold	X		
NY 44410-1	X		
NJ 46			X
Redspur	X		
Starkrimson	X		

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