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APPLE GUIDE FOR KANSAS RETAILERS¹

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Photograph by Bureau of Plant Industry, U. S. D. A.

A SPLENDID DISPLAY OF APPLES AND OTHER FRUIT

INTRODUCTION

Economies in handling fruits by the retail trade are based largely on a realization that the fruits are living organisms and that they must have favorable living conditions until they are on the consumer's table. These conditions vary widely for different fruits, but among those found in American markets, the *Apple* is the easiest to satisfy and can go through the trying period of merchandising with the least loss. The outstanding value of the apple in the human diet makes its conservation a public duty.

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IMPORTANCE OF THE APPLE

The dominant fruit in the United States and in Kansas is the apple. This is true whether the production or the consumption phase of its importance is taken as the basis. Census reports indicate that between one-fourth and one-half of all the fruits consumed in United States is apple. It has long stood at the head of the list.

This fruit has many properties which contribute to its leadership. Important among these are its early introduction and improvement in this country, its high quality among fruits, its many varieties adapted to special uses, the length of season during which the fruit is available, its superior keeping and handling qualities, and its proved place among the health-promoting foods. These make the apple most nearly the universal favorite among American fruits and provide an opportunity for its skillful merchandising by retail outlets throughout the nation. Profits from sales vary with the knowledge of these characteristics and the care with which the fruit is handled in the market.

GENERAL CHARACTERISTICS OF APPLES

Correct choice of apple fruits to place on a retail market and proper care of them during the time they are the property of the retailer to a large extent depend on certain prominent peculiarities of the different varieties. Lacking a knowledge of these varietal characteristics, wrong recommendations will be made to customers by the retailers, thereby losing their good will; and losses due to spoilage and waste will be increased for both retailer and consumer. Among these important characteristics are season of use, color, size, quality, freedom from blemish and handling value. Given proper relative valuations, these items would constitute a score card which would serve to rank the various varieties of apples. A brief discussion of the meaning and the importance of each of these items will be attempted.

Season of Use.—Much good fruit is spoiled by too early or too late marketing. Every variety of apple has its own season when its fitness for its particular use is at a high point. It should be sold and used during this period. The more common error in this matter is keeping a popular variety on the display shelf too late. Not only is its reputation injured by its poor condition but later varieties which are then at their best are robbed of their day in the sun. The growers, the retailers and the consumer all lose when Jonathan and Delicious are allowed to invade the season of Winesap and Ben Davis.

Summer Apples.—First grade apples could be placed on Kansas retail markets every month of the year if this were desirable. Actually, the summer months are given over to the small fruits and the soft tree-fruits so the apple must make its annual record during the months September to May. This omits July and August when

two important and delicious apple products known as green apple sauce and green apple pie are available; but, though these desserts are of top quality, they use but a small part of the total apple crop and that a part which is more hazardous for the dealer to handle than any other. It comes from the early or summer varieties of apples. They are available in Kansas from the first of July when Yellow Transparent is large enough to use until the last of August when Wealthy should give up the market to Jonathan for these uses.

Early Winter Group.—The second group of apples on the basis of season includes the early winter varieties. This is both the largest and, in some ways, the most important class. Typical varieties are Jonathan and Delicious. These varieties reach maturity on the trees in September and, when given correct storage, fill the market period until January. With them begins a use to which summer varieties cannot aspire—eating “out of hand,” or dessert apples.

Most of the early winter apples are general purpose varieties. They are of high quality for both dessert and culinary uses, consequently the highest rate of consumption of this fruit occurs during this season of feast days. Jonathan and Grimes apples are under no handicap in competing for the housewife’s favor with any other fruit then on the market.

Late Winter Group.—A number of important apple varieties belong in the late winter group of varieties. They are harvested in October and with good storage become ripe for general use in January. It would be possible to keep many of them until the next crop is harvested, or even ready to use, but this is not economical, so the practical season for late winter apples ends in May. For any Kansas market, Winesap is the typical representative of the late winter group.

Much greater diversity of characteristics is found among the late winter varieties than among those of the other two groups. The finest baking apples, for illustration, are found here and especially in the midwinter months when York and Rome are at their best. Than these, no better breakfast fruit can be found. First-class dessert apples and others which grade excellent for all culinary purposes are found on the market at this time.

A list of the apple varieties commonly found on Kansas markets is shown in Table 1. They are arranged in approximate order of ripening though this is sometimes complicated by climatic variations during the growing season.

TABLE 1.—THE APPLE CALENDAR; TIME OF RIPENING.

VARIETY NAME	GROUP	HARVEST	MARKET SEASON
Yellow Transparent..	Summer.....	July.....	July
Early Cooper.....	Summer.....	July.....	July
Oldenburg (Duchess),	Summer.....	August.....	August
Wealthy.....	Summer.....	August.....	August and September
King David.....	Early Winter...	September..	September-November
McIntosh.....	Early Winter...	September..	October-January
Jonathan.....	Early Winter...	September..	October-February
Delicious.....	Early Winter...	September..	October-February
Grimes Golden.....	Early Winter...	September..	October-February
Golden Delicious....	Early Winter...	September..	October-February
York Imperial.....	Midwinter.....	October.....	November-February
White Pearmain.....	Midwinter.....	October.....	November-February
Black Twig.....	Midwinter.....	October.....	November-February
Rome.....	Midwinter.....	October.....	November-March
Ben Davis.....	Late Winter....	October.....	December-April
Gano.....	Late Winter....	October.....	December-April
Stayman.....	Late Winter....	October.....	December-May
Winesap.....	Late Winter....	October.....	December-May
Ingram.....	Late Winter....	October.....	December-May

COLOR

Sale of apples on the retail market is affected more strongly by color than by any other feature. Unfortunately, a majority of housewives give to this character a value far beyond its real worth. Within a variety, high color is an indication of maturity at the time of harvest and thus shows better quality than poorly-colored specimens of the same variety; but when this comparison is so extended that two or more varieties compete and the most-highly colored is chosen on that basis, the consumer, the retailer, and the grower all may be losers. Grimes Golden, a yellow apple, and Gano, a highly-colored, red apple, were once offered free to the public under a sign, "Help yourself to an eating apple." The result? More than half of the Grimes Golden were left when the last unripe but bright red Gano had disappeared, and students of horticulture who were "in the know" on this subject had taken many of the Grimes.

Undercolor of Apples.—All apple fruits are green in color, with perhaps an overcast of bronze, while they are immature. As the ripening process begins near the close of the growth period, this green usually changes through a whitish green to the yellow undercolor of mature apples. All apple varieties have undercolor. It is usually yellow. A few varieties, of which Green Newtown and Rhode Island Greening are examples, retain the green undercolor when ripe. The yellow undercolor is more or less completely obscured by overcolor of red in the majority of apple varieties.

These overcolors are due to three different pigments: green comes from chlorophyll, yellow from carotene, and red from a soluble pigment, anthocyanin.

Overcolor of Apples.—The overcolor of apples is some tint or shade of red. It may vary from pink through orange and bright red to red-purple or almost black. The distribution of the overcolor also is variable and this may be an important varietal peculiarity. Common distributions are blushed—Maiden Blush and Winter Banana; striped—Ben Davis; and washed—Winesap. Combinations of these are found on many varieties.

Red of apples is a photographic product. It develops only when the fruit is exposed to sunlight, and the intensity of the red, among the fruits of a variety, is a measure of their exposure to light. Jonathan and Winesap grown in Wenatchee, Washington, are more red than the same varieties produced in Kansas, principally because of the longer summer days and fewer cloudy hours of the former region. So intense is this reaction that a photographic negative or a stencil will give a good print on highly-colored apples.

In a basket of Jonathan, or other highly-colored varieties, the apples with the most red were more mature and usually of better quality when harvested than the less well-colored ones. This rule does not hold in a comparison of fruits of different varieties. There, a yellow apple may or may not equal or surpass an all-red apple.

Typical colors and size of varieties commonly found on Kansas markets are listed in Table 2.

TABLE 2.—COLOR AND SIZE CHARACTERISTICS OF SOME APPLE VARIETIES.

VARIETY	COLOR	SIZE*
Yellow Transparent	Greenish white to light yellow	S to M
Early Cooper	Bright yellow; sometimes blushed	M
Red June	Yellow; striped and washed crimson	S to M
Oldenburg	Pale yellow; bright red in stripes and splotches	M
Wealthy	White; red striped with crimson	M
King David	Bright yellow; solid dark red	M
McIntosh	Whitish yellow; dark red, striped carmine	M
Jonathan	Yellow; bright red, striped and blushed	M
Delicious	Light yellow; light red, striped dark red	M to L
Grimes Golden	Golden yellow; rarely blushed	S to M
Golden Delicious	Golden yellow; sometimes blushed	S to M
York Imperial	Greenish yellow; light to purplish red	M to L
White Pearmain	Green or pale yellow; rarely striped red	M
Black Twig	Dull green; washed dull red, striped crimson	L
Rome	Yellow; washed and striped bright red	L
Ben Davis	Green or yellow; striped bright red	M to L
Gano	Yellow; nearly solid red, carmine	M
Stayman	Green to yellow; dull to bright red	M to L
Winesap	Light yellow; covered dark red, striped carmine	S to M
Ingram	Pale yellow; striped or mottled red	M

* S = small; M = medium; L = large. See page 6.

SIZE OF APPLES

Size is an important feature of apples. It is closely related to the use made of the fruit and is typical of varieties as indicated in Table 2. In setting standards for grades of apples a minimum size is specified, but this should vary on the bases of the variety and the principal use made of the fruit of a variety. Apples for baking, sauce, or pie should be medium to large because of the economy resulting from peeling and coring large fruit. In contrast, dessert apples, especially for children, are more economically used if they are small to medium in size. Children desire apples and will choose large ones but cannot eat at one time all of an apple larger than two and one-half inches.

Designating Size of Apples.—Three methods of describing size of fruits are in use. The most commonly used could be called the comparative method. This method divides varieties into groups on the basis of the comparative size of the fruit. The classes are named small, medium, and large. Considerable knowledge of apples is needed to apply these terms and they are found to vary for the same variety due to the environment. Winesap is small in West Virginia but is medium in Kansas or Washington. This is the method used in Table 2.

A second method of designating apple size is by measurement in inches of the cheek-to-cheek or horizontal diameter. This standard is applied to any variety and is commonly used in specifying the minimum size permitted in the various grades established by growers' organizations, the U.S. Department of Agriculture and in compliance with various state statutes. Attention of the reader is directed to an abstract of the U.S. Grade and pack regulations given later in this circular. Popular sizes vary from 2½ to 3¼ inches in cheek-to-cheek diameter.

The number of apples required to fill a container is the third method of indicating the size of apples. This basis was developed for the standardized box-pack of the Pacific Northwest and results in size uniformity of the apples in a container. Sizing for box packing is done by machinery. The best of these machines sizes by weight but this correlates closely with the cheek-to-cheek diameter among fruits of the same variety. Apples to be packed in baskets or barrels are not so carefully graded as to size as are those in the box pack. The Northwest standard box and the Midwest basket each contains one bushel of fruit and weighs 45 to 55 pounds. A barrel has cubic contents equal to three bushels. This container is used much less than formerly. Table 3 illustrates the use of this method and the approximate diameter of the apples in some of the more important box packs.

TABLE 3.—RELATION BETWEEN DIAMETER AND NUMBER OF APPLES IN A STANDARD BOX OF APPLES.

APPLES IN BOX, NUMBER	APPROXIMATE DIAMETER, INCHES*
88	3 5/16
96	3 3/16
104	3 1/8
113 or 112	3
125	2 7/8
150	2 3/4
175	2 5/8
188	2 9/16
200	2 1/4

* The relation between the cheek-to-cheek and stem-to-blossom diameters of apple varieties causes these measurements to vary. In most varieties the cheek-to-cheek diameter is the greater.

QUALITY OF APPLES

Quality of the apple is a characteristic which may be defined and analyzed but about which two persons who thoroughly understand the definition may differ when actual fruits of different varieties are compared. To many the tart, aromatic flavor and the firm flesh of the Jonathan are more pleasing than the sweeter, softer and more aromatic Delicious. Both rank in the “very good to best” quality group. The use which is made of the apple also affects its quality ranking. Ben Davis is only fair in dessert quality but is excellent for culinary uses and as dried apple stock.

DESSERT QUALITY

The term “dessert quality” is used in grading apples on the basis of their desirability when eaten raw or out of hand. Consumers will pay highest prices for apples which score well on this item and large quantities are so eaten—uncooked and unpared. Three features—texture of flesh, taste or flavor and aroma—affect the rating of apples for dessert quality. Each of these items will be considered briefly.

Texture of Flesh Affects Quality.—Flesh of the fruit of apple varieties varies widely in the amount of cell wall and fiber it contains. Only small or medium quantities of these cellulose tissues are desirable in apples of dessert quality, but larger quantities improve the quality of cooking apples. Tender, crisp, coarse, spongy, and even woody are comparative terms used to describe this character. A few varieties, rarely found in the markets, have melting flesh, a

common type of flesh with good dessert pears. Juicy and dry are also terms used in describing apple flesh.

Taste Affects Quality.—The flavor of an apple is detected by the sense of taste but may also be determined by chemical analysis. Apple flavor varies from sweet to sour or acid, with some intermediate grades known as mild-subacid and subacid. No well-known variety of apple is sweet, but Sweet Bough, a summer variety, and Tolman, an early winter variety, belong in this group, and are still found in some orchards. Nearly all commercial varieties fall in either the mild-subacid group, of which Delicious is an example, or the subacid group represented by Jonathan.

Flavor of an apple is determined by the ratio of the sugar to the acid in the fruit rather than by the actual amount of either sugar or acid. One of the important changes which marks the ripening of an apple is the change of its starch content to sugar. This sugar obscures the taste of the acid and largely accounts for the difference in flavor between green and ripe apples of the same variety. Comparatively small differences in the sugar-acid ratio serve to place varieties in different flavor groups. This relation is shown for a few important varieties in Table 4. Wealthy would be classed as acid, Grimes as mild subacid and all the others as subacid.

A number of the highest-quality apple varieties are rarely seen on Kansas markets and, unfortunately, are passing out of cultivation. They do not come to Kansas because they are better known and are in great demand on certain city or foreign markets and are not widely cultivated because of special demands as to environment, erratic bearing, or storage faults. Tompkins King, McIntosh, Esopus (Spitzenberg) and Yellow Newton are examples,

TABLE 4.—SUGAR AND ACID ANALYSIS OF SOME APPLE VARIETIES.
 (Dry Weight Basis.)

VARIETY	REDUCING SUGARS	SUCROSE	TOTAL SUGARS	ACID AS MALIC	RATIO TOTAL SUGAR TO ACID
	(percent)	(percent)	(percent)	(percent)	
Wealthy.....	7.40	1.71	9.11	0.50	1:0.055
McIntosh.....	7.21	1.91	9.12	0.38	1: .042
Jonathan.....	8.28	1.65	9.93	0.42	1: .042
Grimes.....	8.77	4.30	13.07	0.45	1: .035
Winesap.....	10.02	2.20	12.22	0.47	1: .038
Stayman.....	8.11	3.44	11.56	0.52	1: .045
Rome.....	6.77	3.16	9.93	0.41	1: .041
Ben Davis.....	6.91	2.95	9.86	0.42	1: .045

Aroma Affects Dessert Quality.—Volatile or essential oils are found in all ripe apples and affect the quality of the fruit through their appeal to the sense of smell. McIntosh, Delicious, Grimes, and Stayman owe much of their popularity as dessert apples to the abundance and attractiveness of their aroma. Those familiar with apples can identify many varieties by their odor alone, while other varieties, although aromatic, are not sufficiently individual to permit this. They just smell like good apples.

COOKING QUALITY OF APPLES

High-cooking or culinary quality of apples is combined with dessert quality in many varieties. Others which rank high in dessert quality may prove disappointing when cooked and a number which are low in rank for eating as dessert fruit are desirable for culinary uses. The subdivisions of quality are combined in arriving at the quality score in Table 5. When carried to the total column, this results in some inversions of the rating of varieties by consumers. A variety low in flavor and aroma may, because of its high value for culinary uses, deserve a quality grade equal to a fine dessert variety which does not yield a desirable product when cooked. Since Gano is a good cooking apple, though low in dessert quality, it has nearly as good a grade under quality as Delicious, which greatly excels Gano in dessert quality, but does not give as good cooked products because of its lack of acid. Varieties good or excellent for both uses—Jonathan, Grimes and Stayman Winesap—approach perfect under this heading.

Abundant Acid and Firm Texture.—A good cooking apple has abundant acid. This is balanced by the addition of sugar giving what is known as high or good flavor. The volatile oils are largely driven off during the cooking process.

Texture of flesh is of some importance in cooking quality but the method used by the cook has more influence. Flavor, color, and texture are the items used in judging sauce, pies, dumplings, and similar apple dishes. Flavor should be rich which results from high acid. Green apples rank high for this use while over ripe ones yield a product of poorer flavor. Color of cooked apples should be whiteish or light-golden yellow to reddish; not dark or lifeless. Texture should be smooth and even; never lumpy, syrupy or watery. Jellies and marmalades must not be granular in texture.

Fruits of different apple varieties vary widely in appearance when baked. Tough skin to hold the shape of the apple after baking and pleasing taste and color place Rome and York among the best varieties for this use.

CONDITION OR FREEDOM FROM BLEMISH

The condition of apples when purchased by the retailer or when sold by him to the consumer is one of the important characters of the fruit. It is related to the grade of the fruit when packed and blemishes must then be held to definite minimums if the regulations

are met. (See U.S. Apple Standards, page 15.) Blemishes may appear after the fruit has gone into trade channels, while in transportation or in storage for retail sale and thus reduce its value. These blemishes may be superficial or internal and reduce the sale value of the fruit. Miscellaneous Publication No. 168 of United States Department of Agriculture entitled Market Diseases of Apple, Pear and Quince, treats this subject fully and contains illustrations in color. It may be obtained from the Superintendent of Documents, Washington, D. C., for 40 cents.

SURFACE BLEMISHES

Some superficial blemishes of apples do not impair the use of the fruit but merely make it less attractive in appearance. Other surface blemishes may be either progressive in the area affected or may lessen the resistance of the apple to internal ills and are, therefore, more harmful. Four types of surface injuries are common.

Fungous Blemishes.—Sooty fungus and fly-speck fungus are truly superficial defects. They grow on the outer skin and look bad but do no other harm. In contrast, scab and blotch fungi may make but little progress while the apples are in cold storage but are more serious blemishes because they may provide a point of attack by other organisms causing fruit decay.

Insect Injuries.—Few apples showing insect injury should come to the retailers' shelves. Nearly all of them cause such severe and visible defects that the infested fruits are unsalable. Wormy apples caused by codling moth attacks and deformed apples due to feeding by curculio or aphids are examples. Codling-moth "stings" are the scars left by an unsuccessful attempt by the larva, or worm, of this insect to enter the fruit. When these are corked over they do no harm other than injury to the appearance of the apple. Even fancy-grade apples may show a small number of inconspicuous stings to a box of fruit.

Physiological or Functional Defects.—The defects of the surface of the apple not caused by any organism are said to be physiological in origin. Most common among these are skin defects caused by a stem or a leaf that has rubbed the fruit while it was growing, and a browning or russetting of the skin of many varieties called scald.

Scald causes great loss to dealers in apples when a few simple storage precautions are overlooked. It is caused by gases respired by the fruits themselves as they ripen. Thorough ventilation of the fruit will prevent scald but this is not practical in stored packages. These respired gases are soluble in oil, so an oiled paper wrap or shredded oiled paper mixed with the fruit in the package, at the rate of one-half pound to the bushel, will prevent this trouble. Fruit may look all right when brought out of cold storage but develop scald in a short time at room temperature. All stored apples should have the insurance and protection of the oiled paper.

Internal or Flesh Blemishes.—Internal defects of apples which appear after the fruit is packed are due to some of the same causes as the surface blemishes but are often much more destructive. Many of these ills actually destroy the flesh or render it unfit for food. They include the various rots and other types of breakdown of the apple which mark its end as a living organism.

Fungous Rots.—Each of the fungi which cause decay of the flesh of apples has a botanical name but the rotted tissue, or the spore bodies of the fungus, often has a typical color which supplies the common name. Important among these are black rot, brown rot, blue-mold rot, gray-mold rot, and pink-mold rot. Although these rots differ in color and their extension throughout the apple, they are similar in method of gaining entrance. This usually requires a break through the skin such as a stem puncture, a crack, or a bruise. Sometimes entrance may be made through the dots, or lenticles, which are poorly-protected points on the skin of the fruit.

Careful handling of the fruit at every stage from the tree to the parer is the principal means of control for these rots. Reduction of the numbers of infectious spores through sanitary care is an important secondary control measure. Low temperature, as 30° F., will stop the progress of the rot but will not kill the fungus. A decaying apple in a package increases the hazard for touching fruits and for the whole box or basket.

Insect Injury.—Most of the apples injured by insects fail to reach the retail market; they are among the culls which find their way to the cider and vinegar factories. If grading and inspection are at all lax, however, insect-infested fruits may appear on the market. Wormy apples result from the attack of codling moth. The infested apple is a loss but the emerging larva does not move to another apple nor do eggs hatch and the larvae attack fruits in storage. A comparatively new insect pest, the Oriental fruit moth, attacks the apple and may ruin the whole interior without giving notice of its presence by a scar on the surface as does the codling-moth larva.

San Jose scales are sometimes found on apples on the market. The most common place for this infestation is around the blossom end where the presence of the insect is indicated by red rings about one-eighth inch in diameter. The scale itself is usually destroyed during the washing and packing operations. The fruit suffers no further injury due to this insect but its presence indicates poor care of the orchard in which the fruit was grown.

Functional Disorders.—Second only to the rots as a cause of loss to fruit in transit or storage is a large group of physiological diseases. These result from the failure of the living cells of the apple to function in a normal way.

Functional disorders are of many types and have a number of causes. Core spot, Jonathan spot, drought and fruit spot are areas of dry dead cells in the flesh of the apple due primarily to either poor growing condition or improper storage of the fruit. Core rot,

internal breakdown, internal browning, soggy breakdown, water core and soft scald are diseasea which attack the flesh of apples in storage or on the retail market but are not due to any parasite. Their causes include late harvesting, delayed storage, too high or too low storage temperature, high temperature of display room, variety susceptibility and water core. The skin of the apple may show no signs of these troubles until late in the development of the disease, so their detection in early stages requires that sample fruits be cut through. Apples marketed too late in the season, as Jonathan or Delicious in March, show a high percentage of these disorders. (See the Apple Calendar, Table 1, in this connection.)

Mechanical Injuries.—Broken skin is a mechanical injury which causes great loss of apples due to the admission of fungi and subsequent rotting of the fruit. Stem punctures, box or basket slivers, and bruising are common causes of breaks in the protective covering of the apple. Their avoidance is so important that high-quality apples are handled more gently than eggs. Long stems are clipped and baskets and boxes are lined with soft paper. Bruises which do not break the skin may result in extensive breakdown of the flesh as often is found in Jonathan, or the dead cells may dry up without further injury, as commonly happens with Ben Davis. Apples may be injured by freezing either in transit or in storage. Decay resulting from freezing can be distinguished from other forms of breakdown by finding ice crystals in the tissue, though these do not always kill the tissue; by shriveled skin or sunken spots; and by the rapid breakdown of the vascular fibers or core lines in the flesh of the apple. Later, after thawing, all the flesh has a water-soaked appearance. Apples freeze at temperatures varying from 27.3° F. to 29.4° F. The average was found to be 28.4° F., when a large number of varieties were tested. Frozen apples sometimes thaw out with but slight injury but if “frozen to death” they are ruined. Any handling while frozen increases the damage.

HANDLING VALUE

Experienced dealers know that some varieties of apples deteriorate more rapidly than others under the necessary handling in packing, transporting, storage and selling. This varietal variation is due to inherent characters of the varieties, prominent among which are the type of skin and firmness of the flesh. Probably composition, enzymic activities and other flesh factors are involved, but these relations have not been fully investigated.

Firmness of Flesh.—This variation as between varieties seems due to the strength of the cell walls and the turgidity of the cells of the flesh. The test is applied during the normal storage life of the variety and, as would be expected, the flesh becomes softer as the storage is prolonged. The natural variation is so wide that varieties at both the soft and the hard ends of the scale are worth less on the market. Mother is an example of varieties too soft to undergo market handling and Lawver has a flesh too solid, approach-

ing woody, to satisfy any consumer. Nearly all of the commercial varieties of apple deserve a good grade of firmness of flesh.

Firmness of flesh can be measured accurately by the use of an instrument known as the pressure tester. This use is illustrated in Figure 1. It has value in determining the correct time to harvest apples as well as to trace the ripening process while the fruit is in storage.

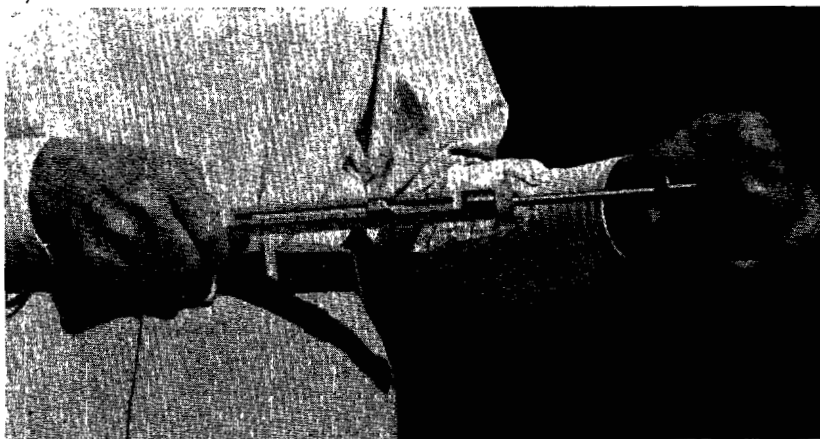


FIG. 1.—The dial on the pressure tester measures the force necessary to push the plunger into the fruit. This indicates the firmness of the apple.

Toughness of Skin.—A break in the skin of an apple is a serious defect because the protective value of the covering is lost and rot-producing germs may gain entrance. Causes of these skin punctures were mentioned under "Surface Blemishes." Every care must be taken to avoid them. The same variety may show a wide variation in this toughness of skin due to the environment under which the apples were grown. The conditions which produce high color of apples seem also to increase the thickness and toughness of the skin. They are principally cloudless days and long hours of daylight during the growing period of the fruit. Delicious and some other varieties occasionally develop this character beyond the desired maximum.

An attempt is made in Table 5 to evaluate a number of commercial apple varieties on the basis of their scores for the items mentioned in this discussion. The author is aware that fruits within a variety but grown in different regions or given varying care in the same section may show wide variation. The table thus has general rather than local significance and is worth study by growers, handlers, and retailers of apples. The varieties sometimes found on Kansas markets are listed in their approximate order of ripening.

TABLE 5.—SCORE CARD—VALUE OF APPLE VARIETIES TO CONSUMER.

VARIETY NAME	Color	Size	Quality	Handling value	Condition	Total
Possible score.....	10	20	30	15	25	100
Yellow Transparent..	8	15	20	8	18	69
Early Cooper.....	8	17	20	10	18	73
Oldenburg (Duchess)..	8	16	20	8	18	70
Wealthy.....	8	17	22	10	19	76
King David.....	10	13	23	12	20	78
Winter Banana.....	8	17	20	12	20	77
Jonathan.....	9	18	27	13	22	89
Grimes Golden.....	9	18	27	12	20	87
Delicious.....	9	18	23	13	22	85
Golden Delicious.....	8	16	26	12	21	83
White Pearmain.....	9	16	26	12	22	85
York Imperial.....	8	18	24	13	23	86
Arkansas (Black Twig)	7	19	18	13	23	80
Rome Beauty.....	8	18	23	13	24	86
Ben Davis.....	8	19	18	14	24	83
Gano.....	9	19	18	14	24	84
Stayman Winesap....	8	18	27	13	22	88
Ingram.....	8	15	25	14	23	85
Winesap.....	9	16	26	14	23	88

APPLE GRADE STANDARDS

The United States Department of Agriculture has for many years led in setting up standards for the grading of agricultural products. One of the principal values of these standards has been the aid they give in promoting sales of the graded product. Number 2 hard winter wheat has a definite meaning and can be made the basis of trades in this cereal on any market. Apple standards have been specified in a similar manner for the past 20 years but the enforcement of their use has been reserved for the various states. The result has been uneven adoption of the standards and variable administration of the regulation.

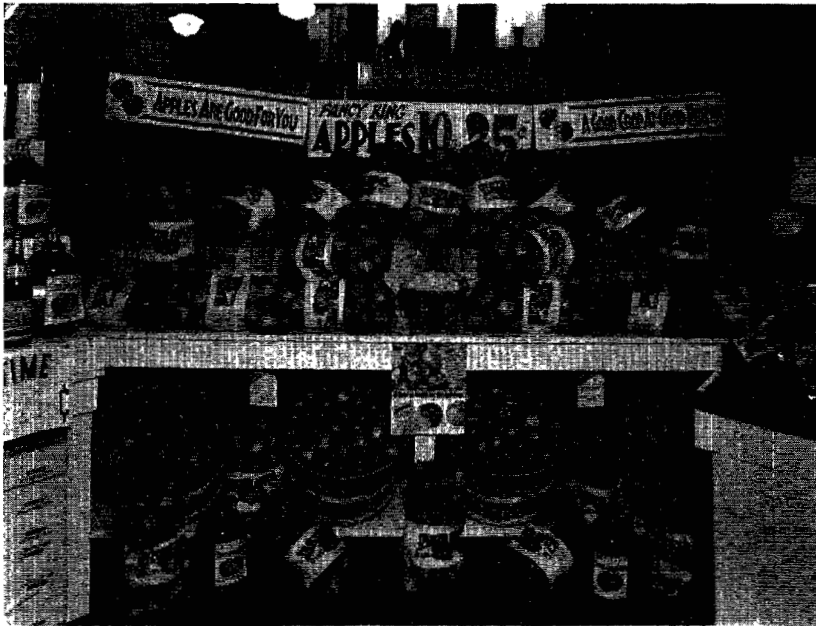
The Kansas legislature in 1933 made the United States standards, with certain additions, the legal standards for the state. The statute includes penalties for the violation of the standards act but no organization or appropriation has been provided for its enforcement. In the words of a former secretary of the Entomological Commission the law is at present "inoperative."

Any closed package of apples should be labeled for the protection of the dealer, the grower and the consumer. The Kansas statute requires a label showing the grade, variety and minimum size of the apples in the package and the name and address of the grower or the association that packed it. An example which would comply with the statute is given below:

Kansas grown—No. 1 Jonathan 2¼" Min. Packed by Wathena Apple Growers Association, Wathena, Kansas.

The United States grade standards provide for three grades of good winter apples. These differ principally in the amount of color. The specifications for the highest grade, U. S. Fancy, are as follows:

The apples in the package must be of one variety. They must be mature but not overripe, carefully hand-picked, clean and well formed. They must be free from decay, internal browning or breakdown, scald, freezing injury, broken skin, bruises and visible water core. The apples must be free from any damage, and damage is defined as any injury or defect which materially detracts from the



Photograph from Michigan State Apple Commission

FIG. 2.—A large and inexpensive display of apples and apple products.

appearance or keeping quality of the apples. Tolerances are set for most of these damages. For illustration, more than two healed stings of codling moth or any healed insect sting more than one-eighth inch in diameter is considered insect damage and excludes the fruit from this grade. For color requirements see Table 6.

U. S. No. 1 grade requirements are the same as for U. S. Fancy except that less color is required on solid red and striped varieties. The requirements are the same as for Fancy for yellow or green varieties such as Grimes Golden and Rhode Island Greening.

U. S. Commercial grade is similar to U. S. No. 1. The apples must be mature and free from defect or injury but have not developed sufficient color to grade U. S. No. 1.

Other grades are provided for less valuable winter apples. Early varieties, which are used principally for cooking, have special grade classifications. Additional grade names are No. 1, Early, Early Utility, Utility Combination (which must have not less than 50 percent of the highest grade named), Hail, Domestic (windfalls and unfit for storage) and Bulk. The last named are really culls.

TABLE 6.—COLOR REQUIREMENTS OF FANCY AND No. 1 APPLES.*

VARIETY	FANCY, COLOR	No. 1, COLOR
	(percent)	(percent)
Solid red:		
Arkansas Black	50	25
Gano	50	25
King Davis	50	25
Winesap	50	25
Similar Varieties	50	25
Striped or partially red:		
Jonathan	50	25
McIntosh	50	25
Missouri	50	25
Black Twig	33	15
Delicious	33	15
Ben Davis	33	15
Northern Spy	33	15
Rolls	33	15
Rome Beauty	33	15
Stayman	33	15
Wealthy	33	15
York Imperial	33	15
Willowtwig	25	10
Red cheek or blushed:		
Maiden Blush	(1)	None
Winter Banana	(1)	None
Yellow or green varieties:	(2)	(2)

* Abbreviated from Kansas standards for grading and packing apples.

- (1) Blushed cheek.
- (2) Characteristic color for the variety.

RETAIL SALES OF APPLES

Methods of retail merchandising the apple have changed in the past few years. Rarely does the present-day consumer buy a barrel of apples or attempt to put in home storage a winter's supply of this fruit. Instead, he makes more frequent purchases of smaller amounts. This change in consumer practice has caused several parallel changes in the trade. It is evident that more numerous purchases of small amounts, especially when the dealer maintains a delivery system, will require a higher unit-selling price. This may not be a real rise in price for the consumer if his former pur-

chase of larger quantities resulted in loss due to decay or waste. This system also tends to place a greater responsibility for correct storage and handling of the apple on the shoulders of the retailer. Fortunate is the retailer who can shift part of this responsibility to a nearby jobber or wholesaler. Purchases three times a week or every other day are not too frequent if the retailer and the jobber are located in the same city. Apples from cold storage will not long remain salable at store room temperatures.



Photograph from Appalachian Apple Service, Martinville, W. Va.

FIG. 3.—This type of display increases sales of apples but is expensive to build and injures much of the fruit used.

Apple Packages. — The major part of the apple crop of the United States is now packed in one-bushel containers, either box or basket. These may be “struck” or “heaped” in different states and usually are assigned definite weights by statute. The weight of a bushel of apples under federal standards is set at 50 pounds while that assigned by state statutes varies from 44 to 50 pounds. The Kansas measures are 2173.5 cubic inches for the standard apple box and the weight of one bushel of apples is fixed at 48 pounds. The dimensions of the apple basket are not rigidly fixed but its volume is the same as that of the standard box. A barrel is equal in volume to three bushels.

Many other containers smaller than one bushel have been devised as aids in retailing apples and in promoting mail order sales. Cor-

rugated or plain cardboard boxes have been widely used. Number of fruits rather than weight has been the common unit in these containers. Their use has been more successful in roadside markets than in fruit or grocery stores.

Retail Sales.—By far the greater part of retail apple sales in Kansas are now made by the pound and the fruit is carried home by the consumer or delivered by the retailer in paper bags. These sales vary in size between 2 or 3 pounds for the small family to 1 peck (12 pounds) or more for larger families. Restaurants, pie bakers and eating houses will buy in the packed containers.

Most of the consumers wish to see the apples they buy in the store. Because of this the fruit cannot well be made up in packages and sold in manila or other nontransparent paper. Net cloth bags and transparent paper have been used but most consumers appear to be opposed to buying such prepared packages of apples. It would be worth an effort by the retailer to induce the consumer to buy in larger quantities because sound apples sold during their proper season from good storage will keep for many days, even in a heated apartment.

Seasons for Varieties.—The four months, September through December, is the period during which apples can be sold most easily and can be retailed in larger individual sales. The volume declines in January but the demand is then constant until May 1. Much of the midwinter slump can be attributed to the attempt to clean up out-of-season varieties like Jonathan, Delicious and Grimes at this time when Winesap, Stayman, the Ben Davis group, and Rome are in their prime condition and should take over the apple market. It is true that the early winter varieties will still make a fine display when obtained from cold storage but their life after warming up is short. Their aroma and flavor disappear rapidly. The grower, the retailer, and the consumer will all eventually profit if the calendar for use of varieties given in Table 1 is rather closely followed.

Retail Prices of Apples.—Of necessity, large variations are found in the mark-up which retailers have to charge for the apples they handle. Competition has usually kept prices at a reasonable level but when the buyer pays 25 cents or even 10 cents for a single apple at a hotel fruit stand the price is too high or the cost of doing business for the sales stand is extravagant. Rarely are these high-priced apples larger than size 88 to the box or the price to the retail outlet more than \$3.00 a box. U. S. Fancy and No. 1 grade apples of the medium sizes, 100 to 125, can be sold profitably at one or two fruits for 5 cents in most crop years.

Dealers in apples sold by the pound will, like the growers, vary widely in their cost of doing business. In a panel discussion before the American Pomological Society in 1941, one dealer said he could afford to sell apples which cost him \$1 a bushel at the rate of 10 pounds for 25 cents while another said all he could give for that sum was 8 pounds. These men each retailed 8 to 12 carloads of apples annually. When the retailer can buy high-grade apples for

\$1 a bushel in either boxes or baskets, either the grower or the packer has failed to make a fair profit. The farmer expends 60 cents to \$1 in production costs for each bushel of high-grade apples he grows and packing house expenses, including cost of the container, are 30 to 35 cents. Transportation costs are fixed charges which are always collected.

Good apples are profitable to handle if the retailer sells them at 25 percent profit on selling price or one-third over cost.

In retail stores the rate of sale of apples on display declines after the third day and they are practically unsalable after about 10 days in most stores. This is a "cost of marketing" needing more study.

STORING OF APPLES BY THE RETAILER

Different retail establishments will vary widely in storage facilities for apples. The quantity of fruit handled and frequency of deliveries from the jobber will influence the storage requirements of the retailer but even the small store will profit from cold storage space for apples during both fall and spring. Temperature, relative humidity, and ventilation are under control in modern apple storages.

Temperature for Apple Storage. — The flesh of the apple does not freeze at 32° F., the freezing point of distilled water, because of the sugars dissolved in its juice. The recommended storage temperature is usually 34° to 36° F. in temporary storage. This will allow ripening to proceed slowly and, while it may favor the spread of some storage disorders, will delay others, such as soft scald and brown core, which progress more rapidly at 32°. The higher temperatures are maintained more economically. A moderate lowering of temperature to 45° will provide much better storage than in the sales room.

The approximate relation between storage temperature and ripening of apples has been stated in this way: They ripen twice as fast at 70° as at 50°; twice as fast at 50° as at 40°; and twice as fast at 40° as at 32°. Displays of apples in the store should never be near the source of heat or exposed to direct sunlight. Both heat and light shorten the life of apples.

Relative Humidity of Apple Storage. — One of the important hazards of stored apples is shriveling due to the loss of water from the cells. In a turgid apple the water content is about 84 to 85 percent so in theory a relative humidity of 85 percent should prevent wilting. Certain varieties having thin skin, e. g., Golden Delicious, may wilt at this relative humidity, so about 88 percent of saturation is often recommended. The fruit would not suffer directly from 90 or even 100 percent relative humidity but growth of fungi, especially molds, is favored and the fruit may be injured by them when the air nears saturation. Another objection to high humidity is the possibility of collection of condensed liquid water on the fruit due to unequal temperatures in different parts of the storage space.

Correct relative humidity is maintained in storages which are opened frequently by adding water vapor to the air by sprays or in liquid form on the floor of the storage chamber. Its management is difficult in storage rooms cooled by coils. Frequent defrosting is necessary and the source of frost on the coils must not be water drawn from the stored fruit. Relative humidity may be determined with fair accuracy by using a hygrometer but a sling psychrometer gives more accurate readings.

Ventilation of Apple Storage.—As long as the apple is alive it respire, that is, it absorbs oxygen and gives off carbon dioxide and certain other gases. Several storage diseases of apples are associated with concentrations of these gases while the fruit is in cold storage. Scald is the most important of these but this trouble can be controlled more easily and economically by the use of oiled wraps or shredded oil paper than by ventilation.

Nearly all apple storages of retailers will be ventilated adequately by opening of the doors for the stowing and removal of the fruit.

ADVERTISING THE RETAIL APPLE

On the average, a retailer of apples deals in several hundred other items so it is obvious that no large share of his advertising budget can be expended on any one fruit. The fact remains, however, that the demand for apples is somewhat seasonal and that profits have come to retailers from advertising in local media during the period October to January. Types of sales-boosting for the apple are always available in the store and are inexpensive. Other interested parties are the growers of the fruit and their organizations, wholesale and jobber dealers, manufacturers of machinery for orchard operations, apple-packing houses and managers of commercial cold storages.

Grower Organizations Share.—Some of the growers' organizations, both state and national in scope, are doing good work in advertising the apple. A leader among these is the National Apple Institute which, in addition to placing apple advertising on a national basis, though with only a small budget, maintains a representative in Washington, D. C., to assist in looking after the growers' interests.

Several states, including Washington, Michigan, and others, make apple advertising a state project and have set up offices for that purpose. These commissions assist stores in selling fruit and are also charged with enforcement of the grade and pack laws. They have proved that the foundation under any sales campaign is a standardized product. They realize that advertising might make a first sale but that only a satisfied customer comes back for more of the same. The sales task of the retailer is much simplified when he has assurance that his purchases of apples are strictly up to the grade specified and these state commissions do that for all dealers in their products. The Washington State Commission has sufficient funds to carry advertising in national magazines, as the citrus growers long have done.

Retailer Advertising.—Nearly all retail dealers in the apple will profit from advertising that fruit in a conservative way. This has been proved by the large chain stores and by individual stores which have tried it. They have used local newspapers and “in the store” methods for this purpose. Simple announcement of the apple variety of the week, change in price, a new recipe or an apple slogan are examples of inexpensive advertisements in local newspapers.

In the store advertising takes many forms. Important among these is the arrangement of the apple display. This should not be too large but should be artistic, neat and representative. It should



FIG. 4.—An economical and effective display of apples in original packages.

emphasize U. S. Standard graded apples because these are more economical for the store to handle and, for many uses, are cheaper than cull apples for the consumer. Experimental tests have proved that a given weight of prepared products from sound No. 1 apples costs less than an equal weight from ungraded, unsound apples.

Fruit displays similar to those shown in Figures 2, 3, and 4 increase apple sales. They are of greatest aid during apple week and on other special occasions. They have been credited with a 100-percent increase in sales.

Several national organizations have supplied colored posters to retailers as an aid in advertising the apple. When displayed in the store these posters have directed attention to the apples on display,

the in-season varieties and the dietary value of this fruit. They have definitely increased apple sales.

Printed matter from authoritative sources on the dietary and health qualities and methods of using the apple are available. Apples supply carbohydrates and minerals to the diet, are rich in vitamin C, or ascorbic acid, contain vitamin A and have important therapeutic values. Varieties differ in vitamin C content. Two apples of Winesap or of Rome Beauty will supply one day's entire need for an adult, whereas six fruits of Delicious or Jonathan are needed.

The Consumer Should Know—The great majority of housewives who purchase apples have no way by which to compare values of those exhibited on the retailer's stand. Students of this subject have found they are likely to buy on the sole basis of color or some other unimportant feature. This natural error, due to lack of information, could be remedied through a little inexpensive advertising by the retailer. One way to do this would be the use of placards placed above each variety giving the more important particulars regarding it. The variety name, the principal uses, the grade, the season to use, food values and the price are items in which any purchaser would be interested. Illustrative samples of such placards are given below:

JONATHAN
U. S. No. 1
Eat raw or cook
Vitamins A and C
Sept.-Jan.
6 lb. for 25¢

ROME BEAUTY
N. W. Extra Fancy
Tops for baking or sauce
Rich in Vitamin C
Jan. through March
6 lb. for 25¢

DELICIOUS
U. S. Fancy
Eat them raw
Best variety for dessert
Oct. to Feb.
6 lb. for 25¢

This promotional sales effort could well take the form of inexpensive folders to be placed in each package sold. These would give more details regarding the variety than the placards and would be individual for each of the common commercial varieties. Such enclosures could be prepared by anyone familiar with apple varieties.

The therapeutic value of the raw apple has long been known and recently has received wide attention in both Europe and America, especially in institutions for the care of children. Remarkable relief of digestive troubles, including diarrhea, dysentery, enteritis and dyspepsia, has been recorded. The number of patients was large

and the controls adequate. Both scraped or pulped apples and apple powder are used for small children. Its action is to cleanse and detoxify the intestine.

No other fruit has been used in the preparation of food as widely as the apple. Recipes number 100 or more in publications issued by departments of home economics in Land-Grant colleges. These range from the ubiquitous apple sauce, through jelly and pie to popular confections such as applets, candied apple slices and rings. The most popular desserts of the United States are made from the apple.

RETAILER OF APPLES AND THE PUBLIC

The grocer, as the retailer of foods is often called, has an important function in every community of Kansas. He is in a highly competitive business and is often burdened with services which cost money but are difficult to add to the price the consumer pays. Free delivery of purchased goods and charge accounts are examples. The fresh fruits and vegetables in his stock are especially hazardous because of their short life after they are placed on display. When properly handled the apple causes less loss from this cause than other products. One of the surest ways to cause a customer who knows and appreciates good fruit to decide to trade elsewhere is for the salesman to bruise the apples he is selling by rough or careless handling. The package is sometimes returned at once and a sale lost when fine-quality, high-priced apples are abused in this way. "Handle more gently than eggs" is no figure of speech for such fruit.

The retailer who learns apple varieties and grades is in the best position to profit from the superiority of that fruit. He will know that well-graded and well-packed apples will remain in salable condition much longer than those that have had poor treatment. He will know that the common apple varieties have been selected for culture, in part, because they fill nine months or more of the year with fruit in good season for the market. He will know that some varieties are best suited for eating raw, dessert use, others are best for baking or other culinary use and that a few varieties are near the top for all the many uses to which this fruit is put. From this knowledge the retailer himself will benefit.

He becomes a public benefactor when he can pass this knowledge on to his customers. It will be then that the retailer, the fruit grower, and the purchaser can cooperate in the production, the merchandising and the consumption of the leading fruit of the country. It will not always be easy for him to refuse to handle culls brought to him by farmer customers or fraudulently-packed baskets offered by some trucker at a low price but in doing so he will be aiding the skilled Kansas growers of apples and his reputation as a handler of good fruit with the consuming public.

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