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APPLE ORCHARDS OF MISSOURI
SOILS AND VARIETIES

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APPLE ORCHARDS OF MISSOURI:

SOILS AND VARIETIES.

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The purpose of this thesis is to discuss the apple soils of Missouri; telling why some are better than others for growing fruit, giving their locations, and also discussing the varieties best suited to these sections. In addition to the above there will also be given data, taken in the variety orchard on the Missouri Experiment Station grounds, on new varieties being tested; giving descriptions of the tree and fruit, and comments on whether or not they are suited for orchards in this State. The information for this thesis was obtained from the growers themselves, from analyzing soils from the different districts, and for the latter, by observations made in the Experiment Station orchard.

As Missouri is divided up into four distinct divisions by the soil formations, each will be treated separately, as follows: (1) The North Missouri prairie district, including the hilly country bordering the Mississippi River; (2) the Loess district; (3) the Ozark uplift and border; and (4) the small shale clay prairie in Bates, Cass, Jackson, Johnson, and Henry counties.

Apple orchards, like all other crops, must be planted on good soil to secure the best results. A soil that will produce good general crops may not be suited to apple growing. Just what constitutes a good orchard soil is not well understood by many growers. The information obtained from the farmers themselves proves this. Some orchards on low grounds have reached the age of twelve years without producing a good crop. To secure the best results from an apple orchard, it should be planted on land with a deep, porous subsoil; one that has good underground and surface drainage. The soil must allow the surplus water from the heavy rains and snows to drain down below the roots of the trees; then during dry times to be brought back by capillary action. This insures a well aerated soil, in which there will be no danger of diseases caused by soggy and sour soils. The surface must afford good air drainage. Districts lacking this usually suffer from the late spring frosts. The soil should be of medium fertility. Poor soil produces small, scraggy trees, while very rich soil is apt to make wood growth instead of fruit. As an example of good soil may be cited that of the Ozark uplift. Any soil that is low, boggy, or not well drained is not fit for apple orcharding. Also soils with stiff clay or hard-pan subsoil should be avoided.

SOIL FORMATIONS OF MISSOURI.

Missouri is endowed with a great diversity of soils. Perhaps this is one of the reasons why she prospers in so many lines of agricultural pursuits. The State may be said to be divided into three general divisions by the soil formations.

1. The prairie district, which is divided into the North Missouri prairie and the shale clay prairie in the central western part of the State.

2. The Loess formation, along the Missouri River, in St. Louis county, and in the southeastern corner of the State.

3. The Ozark uplift and border..

Each of these sections has a large number of apple orchards. The Ozark region is well known for its "big red apples". Advocates of North Missouri claim that their soil is just as good for orcharding as that of the Ozark regions. Soil experts, however, say that the Loess is the ideal apple soil.

THE NORTH MISSOURI PRAIRIE.

The North Missouri district includes all the country north of the Missouri except the Loess formation. With the exception of the small hilly strip along the Mississippi River, this section is a black, fertile prairie. Some portions are rolling, but as a whole it is comparatively level. The surface is well drained by numerous streams flowing south or southeastward.

The soil is a clay loam, formed by the erosive action of glaciers. In order to learn something of the structure, mechanical analyses were made of samples taken near the towns of Columbia, Unionville, Monroe City, Kirksville, and Jacksonville. Sixty-eight and seventy-one hundredths per cent. of these soils were fine clay; the largest particle measuring only .00228 millimeters in length. The remaining per cent. was almost wholly fine silt, running from .25 to .00228 millimeters in size. This analysis corresponds very closely to that of the famous Ozark region; which places it, in this respect, as a good apple soil. The fertility of this soil is unquestioned. Mechanical analyses proved that organic matter was present in abundance. The growers place the depth of the rich top soil^{at} from six inches to two feet. They say that they have a red, porous, clay subsoil. This would insure good underground drainage.

This section then, answers the requirements for a good orchard soil, as to structure, fertility and surface drainage. The surface, however, is not irregular enough to insure the best air drainage, and to protect the trees against high winds.. Further, the orchards here do not have the benefits that are derived from the higher altitude of the more southern part of the State. The warm, bright days are not so numerous during the ripening period; but, on the other hand, bitter-rot is not so prevalent as in the southern section. Reports of the growers give this section as having 21% less bitter-rot than the southern portion of the State.

Although this district possesses many of the characteristics required of a good apple soil, the growers so far have not been very successful in growing the more tender and high quality varieties, like the Jonathan, Grimes, etc. They say that their money has been made by growing Ben Davis.

The table below gives the most important varieties, as to value, acreage, total per cent. of growers who plant them, and the choice of varieties that would be planted in a new orchard. These data were secured from the growers themselves in answer to the inquiry "What are the five most important varie-

ties in your orchard, the number of acres planted to each, and what varieties would you set in a new orchard?"

TABLE I.

Giving the percentages of all the growers consulted who have given these varieties 1st, 2nd, 3rd, etc., place, as having been with them the most profitable; also the total of all the per cents. each variety has received, the per cent. of acreage to each variety, and the total per cent. of those who would plant any of these in a new orchard.

Growers' estimate of the five most profitable varieties in the order of their worth. Percentage giving--						Total of each var.	Acreage	New Orchard
VARIETIES	1st Place	2nd Place	3rd Place	4th Place	5th Place			
	%	%	%	%	%	%	%	%
Ben Davis	68.75	12.50	15.62	3.12	.00	100.00	38.10	83.33
Jonathan	28.12	40.62	12.50	3.12	.00	84.36*	11.21	43.33
Grimes	.00	12.50	9.37	3.12	3.12	28.11		
Mo. Pippin	3.12	6.21	3.12	9.37	.00	21.82		
York Imp.	.00	3.21	6.21	6.21	3.12	18.66		13.33
Jeniton	.00	.00	6.21	9.37	.00	15.85		
Gano	.00	9.37	6.21	.00	.00	15.85	2.23	20.00

*This means that 84.36% of the growers have planted Jonathan in their orchards, 28.11% have planted Grimes, and so on with the remaining varieties.

The tender varieties have either been dropped from the list or have greatly decreased in per cents. of those who would plant them in a new orchard. Jonathan has decreased nearly one-half. Ben Davis has lost some, but this is due to growers dropping it when they have better success with some other variety. The Gano is the only variety that has made any gains. It is as hardy as the Ben Davis, and has the advantage of being more highly colored. Some of the growers would plant these in place of Ben Davis if they were planting a new orchard.

The summation of the discussion of this soil formation is as follows:

1. This soil has the required mechanical structure.
2. The soil is fertile.
3. The surface drainage is medium good.
4. The contour of the land is not ideal.
5. Up to the present time fancy varieties have not proven a success.
6. The Ben Davis is most profitable, while the Gano is making gains and has a promising future.

THE LOESS FORMATION.

The Loess formation, in most part, is situated in a narrow strip on each side of the Missouri River, reaching its widest extent in Carroll and Saline counties. Besides this strip, small patches are to be found along the Mississippi River. The origin of this soil is not definitely known; however, it is generally thought to be of wind formation. Among the growers of this section this formation is known as "brown loam". It is composed of fine silt and clay. The mechanical analysis gives 54.44% as clay, or soil that will stay in suspension in water longer than five minutes. These particles are comparatively large when placed side by side with those decanted from soils of other formations. The largest of these particles were .0038 millimeters in length, which was a third larger than those of any other soil, and when examined under the microscope they were found to have sharp, angular outlines. This and their large size would prevent packing and insure a porous soil. The lightness of these particles strengthens the theory of wind formation. Aside from the 53.44% of clay, nearly all of the remainder of the Loess consists of fine silt. Forty-three and fifty-six hundredths per cent. of the soil is composed of soil particles ranging from .25 to .0038 millimeters in size. Only three per cent. consisted

of particles between 1.2 and .25 millimeters in size. There was no gravel or other rock fragments of larger size present.

The products of this section speak for its fertility. Some of the most fertile counties of the State are located in this formation. Large crops of all kinds are produced. When the orchardists were asked whether they used fertilizers, as a rule, they said that they do not. Some said that their soil is too fertile as it is, for orcharding. Some clover and cowpeas are grown, but more as ~~catch~~ catch crops or for forage than for the purpose of enriching the ground. Many of the growers plant their orchards to general crops.

The contour of this section is ideal for apple growing, as it answers all the requirements of good air and water drainage. The Missouri River running through the center, together with its large number of tributaries and ravines, makes the physical aspect very rugged. On account of this hilly nature of the region, there is no danger of the cold air settling over the land and endangering the fruit by late spring frosts. The cold air flows down to the Missouri River as easily as the surface water. That this air drainage is necessary is evident when growers who have

planted orchards on low ground complain of losing their crops by late spring frosts, while orchards on higher ground escape.

That this section is adapted to all kinds of fruit growing, and especially to the apple, will be made evident by the following facts. It has been shown that this soil possesses the required fertility, texture and contour.

Another factor to be taken into consideration is the geographical location. A soil may possess all the above qualifications, but fail as an apple section on account of the unfavorable climate, or the lack of transportation facilities. Missouri occupies the most favorable position in the Union for apple growing. The Loess district occupies the most favorable position in Missouri, when all things are taken into consideration. The native flora includes all kinds of wild fruits. Those common in the North, East, South and West are found here. The clear, bright atmosphere of the autumn months insures the perfect maturing of the fruit. Nowhere in the State, or even in the United States, are better colored or more perfect apples found.

The transportation facilities of this section are unexcelled. The Missouri and Mississippi Rivers

insure a water-way to the Gulf. The M. K. & T., Mo. P., the Wabash, and other railroads, with their connecting lines, reach all the important apple markets in the United States, Canada and Mexico. Connections are made with the steamship lines, and through these Missouri apples are placed on European markets.

Besides these other favorable conditions, the most remarkable and important is the depth of the soil of this formation. The growers place the depth all the way from one foot to "bottomless". Those who have studied this soil say that it reaches the depth of two hundred feet in some places. The value of this cannot be over estimated. The porosity of this soil allows the surplus water from the heavy snows and rains to drain down below the tree roots. This insures a soil free from diseases due to waterlogging. Furthermore, during dry times water can be brought up from great depths by capillary action, and the trees be tided safely through long dry seasons, while those on less favorable soils would suffer severely.

With an ideal soil like this we would expect good results in fruit growing. The table below will give an idea of the varieties grown here and which have the most promising future. The data for this table are the results of an inquiry sent out to the

leading growers of this district, asking them what are their five most profitable commercial varieties; the acreage of each variety planted; and what varieties they would set out if they were planting a new orchard.

TABLE III.

Giving the percentages of all the growers consulted who have given these varieties 1st, 2nd, 3rd, etc., place, as having been with them the most profitable; also the total of all the per cents. each variety has received; the per cent. of acreage of each variety, and total per cent. of those who would plant any of these in a new orchard.

Growers' estimate of the five most profitable varieties in the order of their worth. Percentages giving--						Total of each var.	Acreage	New Orchard
VARIETIES	1st Place	2nd Place	3rd Place	4th Place	5th Place			
Ben Davis	55.26	19.46	13.15	8.42	5.26	100.00	66.19	61.76
Jonathan	28.94	34.21	8.42	5.26	2.63	79.46*	16.81	76.46
Gano	8.42	19.46	8.42	8.42	.00	44.72	10.67	38.23
Wine Sap	.00	2.63	26.31	10.52	2.63	42.09	2.06	20.58
Mo. Pippin	.00	8.42	5.26	2.63	10.52	26.83	4.27	14.70
Grimes G.	.00	.00	5.26	10.52	8.42	24.20		
Maiden's Blush	2.63	8.42	2.63	.00	2.63	16.31		

*This means that 79.46% of all the growers have planted Jonathan in their orchards, 44.72% have planted Gano, and so on with the remaining varieties.

Ben Davis holds first place as to acreage and as the most profitable in the orchards now planted; but in choosing varieties for a new orchard a majority of the growers have placed Jonathan in the lead. Many of the growers leave Ben Davis and Gano out of their estimations for new orchards and would plant Jonathan exclusively. They say that the Jonathan trees are healthy and long lived; also that they produce good crops. Not only does this variety produce good crops, but also the grower has no trouble in disposing of the apples at a much higher price than can be obtained for the Ben Davis or Gano. The Jonathan ripens earlier than the Ben Davis. It is also more susceptible to the fungous diseases that are so destructive to the fruit during the ripening period. Moreover, the early season is more apt to be subjected to warm, muggy weather, which gives the best conditions for this fungus to grow. This disease can be held in check by spraying. However, this form of cultivation is not very highly developed in Missouri. The farmers themselves admit this is true, when their answers to inquiries show that only 13.31% spray four times or more. Any spraying below this would hardly suffice to check a fungous disease, especially where, as in the Loess region, the larger per cent, of those who spray use dust, and apply it whenever the time suits them. Notwithstanding the lack of scientific treatment, it is seen that the

Jonathan is making headway. However, it must not be forgotten that the Ben Davis is at present the leading variety. This is largely due to the fact that orchards in this district are comparatively young. The growers' estimation is that 68.42% of the orchards of the Loess district are fifteen years old or younger. Also, the orchardists are just beginning to realize the value of this soil for producing fancy apples.

In summing up the discussions of the Loess formation, the following conclusions are drawn:

1. The mechanical structure of the soil is ideal for apple growing.
2. The soil is sufficiently fertile.
3. The surface configuration of this section affords the best of water and air drainage.
4. The geographical location could not be improved upon.
5. Up to the present time the growers have been making the most money out of the Ben Davis, but the prospects for the Jonathan in the future are very good.

THE OZARK UPLIFT AND BORDER.

The Ozark formation is made up of the region known as the Ozark uplift, composed of a high plateau surrounded by hills, and the border country. This section occupies nearly the whole of the ^{State} ~~country~~ south of the Missouri River. This section is or was heavily timbered with forests of hard wood. Scattered among the trees on the hillsides are to be found wild grapes, crab apples, and small fruits of all descriptions. Papaws and persimmons grow in abundance in the valleys and even extend far up the slopes. When the native fruits are taken into consideration, it is no wonder that this region became the early home of the Missouri apple. Its hills produce fruit so large in size and brilliant in color that it well deserves the title of "The Land of the Big Red Apple".

The soil is well adapted to apple growing on account of its texture, fertility, contour and geographical location. This formation is made up of a light, thin, top soil, with a deep, red, porous, clay subsoil. In order to learn something of the structure of this soil, mechanical analyses were made of samples taken near the towns of Victoria, Dixon, Lebanon, Lamar, El-Dorado Springs, and Cuba. These analyses show that the per cent. of clay is high. Seventy-two and eight hundredths per cent. is made up of particles that remain in

suspension in water for five minutes or over. These particles are .00228 millimeters or less in size. Nineteen per cent. are from .25 to .00228 millimeters in size, and 9% are .31 millimeters or larger. This soil also has mixed through it fragments of flint, limestone, moory and other rocks of various sizes. Large, thrifty apple trees are found growing on soil so rocky and rough that it is almost impossible to cultivate except by digging around the trees with a pick.

The deep, porous, red clay subsoil is the redeeming feature of this section. It acts as a reservoir for holding surplus water. The surplus water is carried down far below the roots of the trees, where it is held in reserve. This fact is impressed upon the visitor when he is able to quench his thirst from cool springs bubbling from the foot of almost every hill. These springs remain fresh and vigorous through long, dry seasons, thus testifying to the abundance of the water supply. The springs are not the only outlet of this reservoir. During dry weather capillary action brings to the roots of the trees, which have penetrated deep into this subsoil, moisture so that fruit is produced here when less favorable sections fail from drought.

The subsoil also possesses the required elements for growth. The top soil is not fertile. When

it is cropped continuously with cereals it soon becomes exhausted. Land that has just been cleared will produce a few good crops, then quickly decline. The fruit growers of the Ozark region say that their top soil is only from one to eight or ten inches deep. They do not use any commercial fertilizers. Forty per cent. sow cowpeas or clover and a few scatter what stable manure they can get in their orchards. This, together with the success with which the wild fruits grow, proves that high fertility is not required for apples. Vines and apple trees have reached enormous size in this section. Some of the oldest orchards in the State are located here. The trees have not only reached a very great size but they continue to produce large crops of fruit.

The irregularity of the surface of the Ozarks is admirably suited to apple growing. A large section of this region consists mostly of chains of hills. Water and air drainage are ideal. The cold atmosphere quickly drains into these valleys and thereby insures that a large area will be free from late spring frosts. Anyone who has traveled overland in this region at night in late spring will have this fact impressed upon him. On going into a valley he will be suddenly plunged into a mass of cool, damp air and then emerge again into the warm atmosphere as he climbs the next slope.

The geographical location is good. The climate is not severe. The long, mild seasons with abundance of rainfall during the early and middle part, then the clear bright atmosphere during the ripening period, insure the best conditions for producing large, highly flavored, and beautifully colored apples. Although diseases are not very destructive here, they are more so than in the first two districts mentioned. This is especially true with the bitter rot.

While the transportation facilities are not as good as are those of the Loess district, yet they are pretty well supplied. Trunk-lines of railroads run from St. Louis and Kansas City through this section. These, with their connecting roads, place the growers in touch with all the great apple markets in this country.

The fame of this apple-growing section is widespread. From answers to an inquiry sent out to the leading growers of this section, asking them what five varieties they found most profitable, the number of acres planted to each, and what varieties they would select if they were to plant a new orchard, the results below were obtained.

TABLE III

Giving the percentages of all the growers consulted who have given these varieties 1st, 2nd, 3rd, etc., place, as having been with them the most profitable; also the total of all the per cents. each variety has received; the per cent. of acreage to each variety; and total per cent. of those who would plant any of these in a new orchard.

Growers' estimate of the five most profitable varieties in the order of their worth. Percentage giving-						Total of each var.	Acreage	New Orchard
VARIETIES	1st Place	2nd Place	3rd Place	4th Place	5th Place			
Ben Davis	69.23	9.61	7.69	3.84	3.84	94.21*	82.89	65.95
Jonathan	13.26	17.50	26.92	7.69	5.76	71.13	11.80	51.06
Gano	3.84	19.23	7.69	1.92	1.92	34.60	1.41	23.40
Ingram	7.69	7.69	13.26	3.84	3.84	36.32	3.20	25.53
Grimes G.	1.92	11.52	9.61	5.76	1.92	30.73		27.65
Wine Sap	1.92	5.76	3.84	11.52	5.76	28.80		17.02

* means that 94.21 per cent. of the growers have planted some Ben Davis in their orchards, and 71.13 per cent. have planted some Jonathan, and so on with the remaining varieties.

The Ben Davis is the leader in this section, and bids fair to hold its own. The Jonathan is its nearest competitor, but it is 23 per cent. behind. In the choice for new varieties they hold their relative positions. The per cent. of decrease in either case is twenty-nine and a fraction. The decrease in the per cents. of those who would plant a given variety in a new orchard seems to indicate a decline in orcharding. However, a farther study of the information obtained from the growers themselves proves this is not true. Growers are specializing on two or three varieties instead of planting eight or ten, as was the custom formerly.

-- SUMMARY. --

1. The mechanical structure of this soil is good.
2. The soil is not very fertile, but notwithstanding this, first class fruit is produced.
3. The subsoil affords the best of underground drainage.
4. The contour of the land affords ideal water and air drainage.
5. The geographical location is good.
6. Up to the present time the growers have been making the most money out of Ben Davis, and facts seem to indicate that it will hold its own for sometime in the future.

THE PRAIRIE REGION OF CENTRAL WESTERN MISSOURI.

The prairie region in the western part of the State includes only a few counties. The soil is a limestone, shale clay formation, with a subsoil varying from gravelly to a stiff clay. Mechanical analyses were made of samples of soil taken near the towns of Harrisonville and Adrian. Sixty-four per cent. of the soil is clay. The largest particles are only .00228 millimeters in size. Twenty-three and five-tenths per cent. is fine silt, the particles varying from .25 millimeters to .00228 millimeters in size; and twelve and five-tenths per cent. from .625 to .31 millimeters in size. The top soil is medium deep and fertile. No commercial fertilizers are used, and stable manure is used only on the thin places in the orchards. Growers say that cowpeas are the best fertilizer for this section.

The contour of this formation is not as well suited to apple growing as that of the Loess or Ozark. The surface is not undulated enough to insure complete air drainage. Growers say that the depressions are not large enough to cause any noticeable differences between trees planted in them and those planted on higher ground.

The mechanical analysis comes nearer corresponding to that of the Loess than those of any of the

other formations. However, the stiff clay subsoil and the contour would keep it out of that class of apple soil. Yet one of the largest apple orchards in the State is located in this section. As this grower was the only one heard from in this section, no definite conclusions can be drawn with reference to varieties. This answer as to the most profitable varieties will be given. He says that Jonathan is the most profitable, Grimes Golden second, Gano fourth and Ben Davis fifth. In the estimations for a new orchard, Jonathan, Grimes Golden, Maiden's Blush, York Imperial and Wine Sap are given.

SUMMARY.

1. Texture, according to mechanical analysis, is good.
2. Subsoil poor, therefore imperfect underground drainage.
3. Contour not good.
4. Available data favor tender varieties.

DESCRIPTIONS OF SOME NEW VARIETIES.

In connection with the varieties mentioned in the foregoing discussions, descriptions of some of the new varieties now being tested in the experimental orchard at this Station will be given. The larger per cent. of the list to be given belong to the fall and early winter groups. These groups include only a small portion of the varieties being tested; yet they give a fair representation of this orchard. None of these varieties could be recommended as being better than the well known apples now generally grown.

The experimental orchard is over ten years old, and as there have been some extra good fruit seasons during this period, the varieties have had an opportunity to prove their ability to bear. It will be seen that many of the varieties have not borne enough to pay for their planting. Others produce good crops, but the fruit is of inferior quality. Some have produced large crops of good flavored fruit and deserve farther trial.

Besides the varieties described below, notes were taken on the Fall Wine, Holt, Louise, Baker, Daru, Rittenhouse, Swenker, Magyar, and Red Russet. None of these have borne to any extent.

EXPLANATIONS OF TERMS.

References:- Beach, "The Apples of New York", pp. 28-36; Thomas, "The American Fruit Culturist", 21st edition, pp. 260-261 and 265-271.

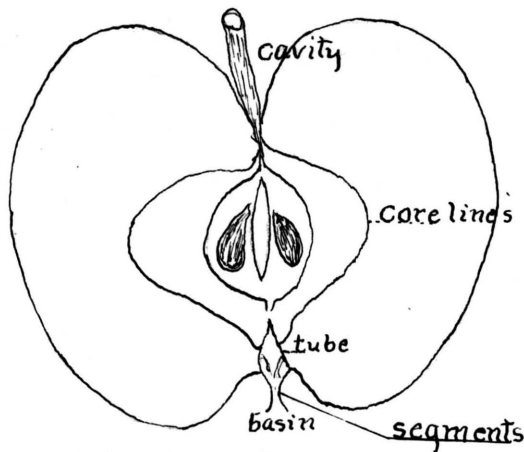


Figure I

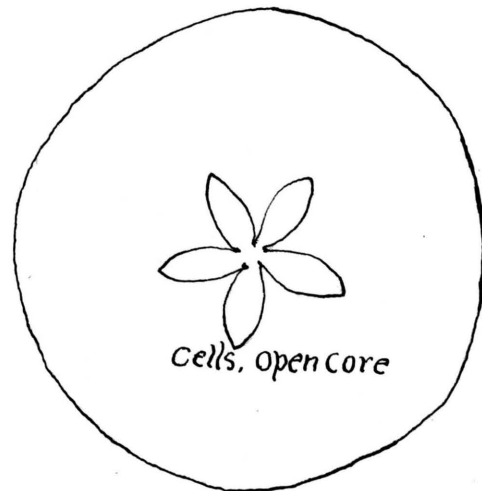


Figure II

When the core lines are clasping they come up on the side of the tube, as in Figure I; they are meeting when they meet at the point of the tube.

The core is median when situated half way between the stem and tube.

The core is open when the cells open into each other, as in Figure II, and closed when distinct,

as in Figure III.

Dots are submerged when they appear to be below the surface, areolar when they have circles around them. The cavity is said to be stellate when its color spreads out in rays, as in Figure IV.

The tree is said to be erect when the branches rise as in Figure V; spreading as in Figure VI; irregular as in Figure VII; and straggling as in Figure VIII.

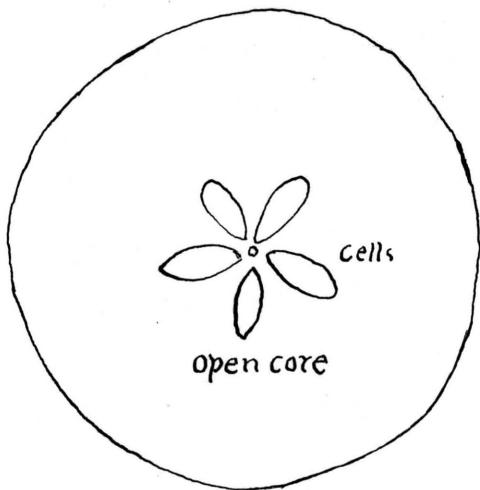


Figure III

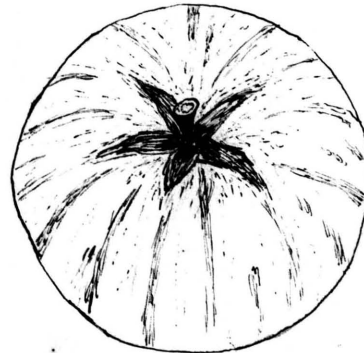


Figure IV



Figure V



Figure VI



Figure VII



Figure VIII

Notes on varieties being tested on the Horticultural Grounds season of 1906.

ASHTON. Tree thrifty, head spreading and open, limbs slightly irregular, bark very dark colored.

Fruit, medium to large; shape, oblate conical to conical, sides irregular, sometimes elliptical; skin thick and tough; calyx half open to closed; surface smooth; color, ground color yellow, over color dark red with very dark red stripes and splashes; general appearance dark red; dots medium in number, size varies, color gray; cavity, medium wide, deep, acute, waved, and sometimes lipped; color, red russet, and sometimes stellate; stem, medium long and medium stout; basin, medium to wide, shallow to medium deep; shape, obtuse, wrinkled; core, open to half open, conical, core lines medium clasping; tube conical; flesh, white, slightly tough, juicy, sweet; quality, good; Fruit ripens about the 27 September.

This apple could not be recommended as a variety to be planted extensively. So far it has proven a medium bearer. It has produced some fruit each year for the last four years.

BEACH. Tree, thrifty; heading spreading, medium open, color of bark dark greenish. Fruit, medium to large; shape oblate to oblate conical; skin, thick; calyx, closed; surface, smooth; color, ground color pale yellow, over color deep red with light patches near apex, very heavy bloom; dots distinct, medium in number and size; color brown; cavity, wide, medium deep, acute, waved; stem, short, medium in size; basin, wide, shallow, wrinkled, segments of calyx, flat convergent; core, closed, oblate, lines meeting, position median; tube, conical; flesh, white with faint yellow shading; texture, coarse, firm, medium juicy, sub-acid; quality, fair; season, winter.

Up to the present time this variety has borne twice; a large crop in the year 1906, and a small one the year before. This variety does not have the qualities of a good market apple.

BALDWIN. Tree, thrifty, with spreading, open head and dark greenish colored bark.

Fruit, large to very large; shape, roundish ovate; skin, medium thick; calyx, closed; surface, rough, slightly unctuous; color, ground color pale yellowish green, over color carmine with red splashes, and dark red shading extending down from cavity over a good portion of the fruit; dots, distinct, many, brown-

ish to white, size varies; cavity, narrow to wide, medium to deep, acute to acuminate, color greenish russet; stem, medium to long; basin, medium to wide, shallow, obtuse, waved to wrinkled, segments, erect with tips divergent; core, closed, cordate, clasping, median; tube, conical; flesh, nearly white with a greenish yellow tinge, nearly breaking, medium juicy, subacid; quality, good; season, August and September. This variety has borne for the last two years (1905-1906). It produced a large crop last year (1906). In this district it makes a fine early fall apple, while in New York and Canada it is their best winter apple.

COOPER MARKET. Tree, limbs irregular, spreading, head medium dense, bark dark greenish.

Fruit, medium to large; shape, conical, sides nearly regular; skin, thin; calyx, closed; surface smooth; color, ground color yellowish green, over color, brownish red with stripes of dark red; predominant color brownish red; dots, distinct, many, large, brownish; cavity, medium to wide, deep, acute, color russet; stem, short to medium, medium stout; basin, below medium, shallow, obtuse, wrinkled; segments, connivent, very small; core, open, nearly globular; tube, conical; flesh, white, crisp, firm, juicy, light acid; quality good; season, winter. This variety has produced only one crop in the last four years. The crop of 1906 was large.

DUMELow. Tree, thrifty, with spreading and medium open head; bark, dark greenish brown;

Fruit, size, above medium; shape oblate, sides irregular; skin, medium thin, tender; calyx, half open to closed; surface unctuous; color, ground color, light greenish yellow, over color, pale red blush, with short red stripes; predominant color greenish yellow; dots obscure, light gray, medium size; cavity, narrow, shallow, acute, greenish russet, often lipped, waved; stem, short and stout; basin, medium wide, shallow, obtuse wrinkled; segments, erect, convergent; core, open, oblate, clasping, position median; tube, funnel form; flesh, white with yellowish tinge, crisp, breaking, juicy, acid; quality, poor to fair; season, September to October. This variety has been only a medium producer. So far it has not shown the qualities of a commercial variety.

DEVONSHIRE DUKE. Tree, large, thrifty, head medium spreading, dense; color of bark, dark greenish.

Fruit, size, medium to large, shape, oblate, slightly conic, nearly regular; skin, thick, tough; calyx, open to partly closed; surface rough, russet; color, ground color, golden, over color, light russet, somewhat netted; dots obscure, medium number, grayish, large; cavity, narrow to medium, medium deep, acute to acuminate, grayish russet, sometimes lipped, slightly waved; stem, very short and stout; basin, medium wide,

very shallow, oblate, walls very sloping, segments deflected; core closed, oblate, clasping, median; tube conical; flesh, white with yellowish tinge next skin, firm, somewhat coarse, crisp, juicy, subacid; quality good to very good; season, September 14. This variety produced a large crop in 1906, the first in four years.

DOWNING BLUSH. Tree, thrifty, head, medium spreading, medium open, bark, dark greenish color.

Fruit, large to very large; shape, oblate, sides nearly even; skin, medium thin, medium tender; calyx closed; surface polished; color, ground color, light greenish yellow, over color, light carmine, blush over cheek extending over about one-third of apple, also a few thin splashes of red; dots, obscure, many, white, large, very slightly sunken areolar; cavity, medium to wide, deep, acute to acuminate, green and russet; stem, short, slender; basin, broad, shallow, obtuse, ridged and waved; segments short connivent; core; half open, oblate, clasping, median; tube, funnel form; flesh, white, breaking, medium juicy, subacid; quality very good; season, September 1. Similar to Maiden's Blush but later. So far has proven as good a bearer.

FERRIS. Tree, thrifty, head spreading, open, limbs somewhat irregular, color of bark, dark brownish.

Fruit, small; shape, conical to oblate conical, sides nearly regular; skin medium thick; calyx

closed; surface unctuous; color, ground color yellow, over color light red with bright red stripes and splashes; dots, obscure, many, color grayish, medium size, submerged; cavity, medium to wide, shallow, obtuse to acute, color greenish red, slightly lipped; stem, medium to long, stout to medium; basin wide, medium deep, obtuse to acute; segments connivent; core, open, conical, clasping, medium; tube, conical; flesh, light cream colored, breaking, medium firm, juicy, light subacid; quality good; season, fall. Produced large crop in 1906 and a small one in 1904. Good for home use.

FAUST'S ROME BEAUTY. Tree, thrifty, head medium upright and medium open, bark light greenish brown.

Fruit, size, large, oblate; shape, conical, sides slightly ribbed; skin, medium thick; calyx, half open; surface smooth, with light bloom; color, ground color, greenish yellow, over color, light red with bright red stripes and splashes; dots, distinct, many, light gray, large, sometimes areolar, sunken; cavity, wide, medium deep, obtuse, ribbed, color greenish russet, sometimes stellate; stem, medium to long, slender to medium stout, sometimes clubbed; basin medium to narrow in width, shallow, obtuse, wrinkled; segments, erect, divergent, long acuminate; core, open, conical, clasping, median; tube conical; flesh, yellowish white, breaking, juicy, firm, subacid; quality good to very good; season,

winter. Up to date this variety has proven to be only a medium good bearer.

GREENING. Tree, thrifty, head spreading, medium dense, bark dark brownish color.

Fruit, size, medium to large; shape oblate to oblate conical; sides irregular; skin medium thick, medium tough; calyx closed; surface smooth, slightly unctuous; color, pale green with under shading of yellow, white scarf-skin around cavity; dots, medium distinct, many, color white, size large, much areolar; cavity wide, medium depth, obtuse, greenish with white splashes, sometimes stellate, ribbed; stem, long, medium slender; basin, medium to wide, shallow, very obtuse, wrinkled; core, closed, oblate, clasping, median; tube conical; flesh, color light cream, crisp to breaking, firm, juicy, mild acid; quality, good to very good; season winter. This variety so far has not proved a good bearer.

INDIAN. Tree, medium thrifty, branches, upright, head open, bark light green;

Fruit, medium size; shape conical, sides medium regular; skin, thin, tough; calyx closed; surface smooth; color, ground color greenish yellow, over color bright red splashes over pale red; dots, distinct, medium in number, nearly white, large, areolar and sunken, cavity, narrow to medium wide, medium deep, acute, lipped

and ribbed, greenish color; stem, medium to long, medium slender to stout; basin, narrow, shallow, obtuse, wrinkled; segments connivent; core, closed, conical, clasping, median; tube funnel form; flesh, white, crisp, firm, juicy, subacid; quality fair; season, winter. Medium bearer, so far not fit for commercial purposes.

LADY. Tree, upright, color of bark brownish.

Fruit, small, conical, sides irregular; skin, thin; calyx closed; surface smooth; color, ground color pale green, over color light red blush with a few light russet splashes; dots, distinct, medium size, whitish to brown, areolar; cavity, wide, shallow, obtuse, sometimes lipped, waved, russet, sometimes stellate; stem, short, stout; basin, medium wide, shallow, obtuse; segments connivent; core, conical, clasping median; tube conical; flesh, white, firm, crisp, juicy, flavor subacid; quality good; season, late summer. As yet this variety has not proven a very good bearer.

McKINLEY. Tree, upright, medium open head, color of bark, dark brownish green.

Fruit, size small; shape, conical, sides elliptical; skin, thin, tender; calyx closed, surface smooth, pale; color, ground color bright yellow, over color greenish mottled; dots, distinct, many, color white to brown, small to medium, somewhat areolar; cavity, medium wide,

medium to shallow, obtuse, yellow with russet overlaying, waved, elliptical; stem, medium short and stout; basin, narrow, shallow, obtuse, wrinkled; segments, tips deflected, small to medium size; core closed to partly open, conical, clasping, median; tube, funnel form; flesh, white, firm, breaking, medium juicy, sweet; quality good; season, late summer and early fall. So far, good bearer; good for local use. The fruit is too small for a good seller.

MIHALYFI. Tree, thrifty, head, medium spreading, open, color of bark light brown.

Fruit, Size, medium to large; shape, oblate conical, sides elliptical; skin, thin, tender; calyx closed to half open; surface medium smooth, unctuous; color, ground color greenish yellow, over color, bronze, blush on cheek; dots, obscure, many, color white, large, much areolar, submerged; cavity, wide, medium deep, acute to oblate, ribbed, color greenish; stem, very short, stout; basin, medium to wide, medium deep, obtuse; segments divergent; core, closed, oblate conic, clasping, median; tube, funnel form; flesh, light yellow, crisp, coarse, juicy, acid; quality, fair to good; season, winter. Not suitable for market. Produced heavy crop in 1906.

MOTHER. Tree, head upright, dense, bark almost black.

Fruit, Size, medium to small; shape, round, slightly ovate, sides irregular; skin, thin, tender; calyx closed; surface unctuous; color, ground color yellowish green, over color carmine with red splashes reaching nearly to basin; dots, obscure, many, color brown, medium size, raised, some areolar; cavity, narrow, deep, acuminate, color russet, lipped; stem, long, slender; basin, medium to narrow, shallow, obtuse, waved to wrinkled; segments, erect, tips divergent; core, half open, oblate globular, clasping, median; tube, funnel form; flesh, yellowish white, breaking, juicy, subacid; quality, very good; season, August. Up to date this variety has not proven a good bearer.

MAGOG. Tree, thrifty, head medium upright, medium dense, bark, medium dark greenish.

Fruit, size, medium to very large; shape, roundish ovate, sides irregular, somewhat compressed; skin, thick, tough; calyx closed; surface polished; color, ground color light greenish yellow, over color carmine splashes, and whitish blotches over base end; dots, distinct, many, color white and brown, large, areolar; cavity, medium to wide, deep, acute to acuminate, waved, color green, sometimes with russet; stem, medium

length, slender; basin, wide, medium deep, obtuse to acute, waved to wrinkled; segments connivent; core, open, ovate, very small, clasping, median; tube, funnel form; flesh, white with greenish tinge at skin, crisp, nearly breaking, juicy, mild acid; quality, good; season, August and September. This variety has not borne very many apples at a time. It is not suited to this State.

MILLER BOY'S FAVORITE. Tree, thrifty, head spreading, medium open, bark dark brown.

Fruit, size medium to small; shape, globose, some oblong globular, to slightly oblate, sides ribbed; skin, thin, tender; calyx closed; surface smooth; color, ground color light yellow, over color light red blush, with dark red markings; dots, obscure, medium in number, brownish to gray, medium size, some areolar; cavity, wide, deep, acute to obtuse, russet, waved; stem, long, slender; basin, narrow, shallow, obtuse; segments deflected; core, closed to partly open, globular, clasping, median; tube, conical; flesh, white with a yellowish cast, breaking, fine grained, juicy, subacid; quality, good to very good; season, September. This variety has borne very little so far.

ONTARIO. Tree head spreading, open, bark, dark greenish color.

Fruit, Size, large; shape, oblate, slightly conical, sides irregular; skin, thick, tough; calyx closed, surface smooth; color, ground color, green tinged with yellow, over color, light red splashes extending well down the sides, bluish bloom; dots, submerged, color white, medium large, areolar; cavity, wide, deep, acute, waved, much russeted, in some, stellate; stem, medium to long, medium stout; basin, medium to wide, medium to deep, obtuse to acute, waved to wrinkled; segments connivent; core, half open, oblate, clasping, median; tube, funnel form; flesh, yellowish white, firm, crisp, juicy, acid; quality, good; season, September. So far this variety has borne few apples.

PICKET. Tree, thrifty, head medium spreading, medium open, bark, light green.

Fruit, size, small, shape, oblate conical, nearly regular; skin, thin, medium tough; calyx closed; surface rough; color, ground color, pale yellowish green, over color, medium dark russet; dots, medium distinct, few, grayish, medium size, raised; cavity, wide, shallow, obtuse, russet, slightly lipped; stem, medium size, slender; basin, wide, shallow, obtuse, waved; segments, divergent; core closed, oblate, clasping, median; tube, conical; flesh, white with

faint greenish tinge, firm, crisp, juicy, subacid; quality good; season, September. This variety produced a good crop in 1906, failed the other years. Good for home use.

RED CANADA. Tree, thrifty, head, medium spreading, bark yellowish green.

Fruit, Size, medium to small; shape, oblate conical, sides ribbed; skin, thin, medium tough; calyx closed; surface smooth; color, ground color, greenish yellow, over color, brownish red, with dark red stripes and splashes, light bloom; dots, distinct, many, light brown, large, some areolar; cavity, medium wide, medium deep, acute, broadly ribbed, russet, sometimes stellate; stem, medium size, slender to medium stout; basin, narrow, shallow, obtuse, wrinkled; segments connivent; core, half open to closed, oblate, slightly clasping, median; tube, funnel form; flesh, white with light yellow shading next skin, breaking, juicy, mild subacid; quality, good to very good; season, winter. Produces small crops here.

RED RUSSET. Tree, thrifty, head spreading, open; color of bark, dark brownish.

Fruit, size, large to medium; shape, oblate conical, approaching ovate, sides somewhat irregular; skin, thick, tough; calyx, half open; surface, medium

rough; color, ground color yellowish green, over color dark red with overlaying russet splashes; dots, distinct, many, brownish, large, areolar; cavity, wide to medium, shallow to medium, obtuse, almost regular, color greenish russet and in some specimens stellate; stems, short to medium, stout to medium; basin, wide, medium deep, obtuse, wrinkled; segments divergent; core, closed, oblate conical, slightly clasping, and median; tube conical; flesh, greenish white, firm, crisp, juicy, subacid; quality, good; season, September. Has not produced enough fruit, so far, to pay for planting.

SMALL ADMIRAL. Tree, small, head, spreading, open; bark, dark brown.

Fruit, size, medium to small; shape, oblate, some slightly oval, sides slightly irregular; skin below medium thick, medium tough; calyx closed; surface smooth; color, ground color, greenish yellow, over color, small russet splashes; dots, obscure, many, white to brown, medium size, areolar, green and white dots submerged; cavity, wide, shallow to medium, obtuse, color green to russet, slightly waved; stem, long, slender; basin, narrow to medium, very shallow, obtuse; segments, erect, convergent to connivent; core, closed, oblate, clasping, median; tube, funnel form; flesh, white near center with yellowish tinge at skin, crisp,

juicy, subacid; quality, good; season, August and September. Up to date this variety has not been a good bearer.

SWAAR. Tree, thrifty, head, medium spreading, dense, bark dark green.

Fruit, size, large to medium; shape, oblate to oblate conical, sides ribbed; skin, medium thin, brittle; calyx closed; surface medium smooth; color, greenish yellow; dots, obscure, many, brown, large, irregular, somewhat areolar; cavity, above medium wide, deep, acute, ribbed and lipped, russet, sometimes stellate; stem, medium to long, medium slender; basin, medium wide, shallow, obtuse, wrinkled; segments, tips divergent; core, closed, oblate, clasping, median; tube, funnel form; flesh, light cream, firm, crisp, juicy, medium acid; quality, good; season, October. This variety has produced only small crops during the last four years.

STAYMAN'S WINE SAP. Tree, thrifty, head, spreading, open, bark almost black.

Fruit, size, medium to large; shape, conical, sides nearly regular; skin, thick, medium tough; calyx closed; surface, medium smooth, unctuous; color, ground color, yellowish green, over color, dark red,

with deep red splashes, and stripes extending nearly to calyx; dots, distinct, many, color dark brown, large, areolar and irregular; cavity, wide, deep, acute, waved, color very dark russet, very often stellate; stem, medium to very long, slender; basin, medium wide, medium deep, obtuse, wrinkled; segments, divergent; core, half open to closed, conic, clasping, median; tube conical; flesh, white to light yellow, breaking, juicy, light acid; quality, good to very good; season, winter. This variety is equal to the Wine Sap.

STANDARD. Tree, thrifty, head spreading, medium thick, has a scraggy appearance, bark dark greenish colored.

Fruit, size, large to medium; shape, conical, sides irregular; skin thin; surface smooth, has light bloom; color, ground color, light bright yellow, over color, light red blush deepening at the cavity, splashed with deep red; dots, distinct, many, yellowish brown, small to large, much areolar; cavity, wide, deep, obtuse to nearly acute, waved, sometimes lipped, color greenish russet, sometimes stellate; stem, short to medium, slender to medium; basin, medium to narrow, medium deep, acute, waved to wrinkled; segments, erect, convergent;

core, closed to partly open, oblate, clasping, distant; tube funnel form; flesh, yellowish white, firm, breaking, juicy, sabacid; quality, very good; season, late summer and early fall. This variety has borne well so far. Would make a good variety for home market.

SPITZENBERG. Tree, thrifty, head spreading, open, bark, dark greenish brown.

Fruit, size, medium; shape, oblate, some slightly conical to cylindrical; sides ribbed; skin, thin, tender; calyx closed; surface, medium smooth; color, ground color, light greenish yellow, over color, light yellowish red blush, with red stripes and shading, predominant color yellowish red; dots, distinct, many, yellowish gray, large, somewhat oblong, areolar, slightly raised; cavity, wide, medium to deep, obtuse to acute, waved to ribbed, color red and russet; stem, short to medium, medium slender; basin, narrow, medium deep, form acute to obtuse; segments, connivent, long, acute; core, half open, oblate, medium clasping, median; tube conical; flesh, yellowish white, crisp, juicy, subacid; quality, good to very good; season, winter. Up to the present this variety has not proven a good bearer here.

TOBIAS. Tree, thrifty, head upright, dense, color of bark, greenish brown.

Fruit, size, medium to small; shape, oblate to oblate conical, sides irregular, elliptical; skin, medium thin; calyx closed; surface smooth; color, greenish yellow; dots, very distinct, many, color, white to brown, size large, white dots submerged; cavity, medium to wide, medium deep, acute, broadly ribbed, color russet, slightly stellate; stem, medium to long, slender to medium; basin, medium wide, very shallow, very obtuse, wrinkled; segments, erect, convergent to connivent; core, open, oblate, medium clasping, median; tube, conical; flesh, white, breaking, juicy, subacid to light acid; quality, good; season October. This variety produced a good crop in 1906, the first in four years.

TOBIAS BLACK. Tree, vigorous, head spreading, open, color of bark dark greenish.

Fruit, size, large to medium; shape, oblong globular, sides irregular; skin, thick, tough; calyx closed; surface smooth; color, ground color, light greenish yellow, over color, light red with deep red splashes, light bloom; dots, distinct, many, brownish, size medium, somewhat areolar; cavity, wide, deep, acute, sometimes lipped, color russet and green; stem, medium to long,

slender; basin, wide, deep, obtuse to nearly acute; segments, long acuminate, tips deflected; core, closed, oblate conic, clasping, median; tube funnel form; flesh, white, firm, breaking, medium juicy, subacid; quality; good; season fall. This variety, so far, has not borne very large crops.

TITUS PIPPIN. Tree, thrifty, head, medium upright, medium dense, color of bark, medium greenish brown.

Fruit, size, large to medium; shape, conical to ovate conical, sides slightly ribbed; skin, thick, tough; calyx closed; surface, smooth, polished, has slight bloom; color, greenish yellow; dots, medium distinct, many, white, medium size, much areolar, submerged; cavity, medium narrow, deep, acute to acuminate, waved, color greenish; stem, long, medium slender; basin, medium to narrow, shallow, obtuse, wrinkled; segments, divergent tips; core, open, conical, clasping neck of tube, median; tube, funnel form; flesh, white with greenish cast, firm, crisp, juicy, subacid; quality, good to very good; season, fall. Up to the present time this variety has produced only one crop and that a small one.

TETOFISKY. Tree, thrifty, head, upright, medium dense, color of bark light brownish green.

Fruit, size, medium to small; shape, oblate conical; skin, medium thin; calyx closed; surface smooth, polished to unctuous, pale; color, ground color, pale yellowish green, over color, thin bright light red, splashes; dots, slightly obscure, many, white, small; cavity, medium wide, medium deep, acute, color pale; stem, short, stout; basin, medium wide, shallow obtuse, corrugated; segments, connivent; core, oblate, clasping, median; tube, funnel form; flesh, nearly white, firm, crisp, subacid; quality, good; season, July 4th to 20th. Variety bears medium large crops. Good for early local market.

WHITE DOCTOR. Tree, thrifty, head, spreading, open, color of bark, dark greenish.

Fruit, size, large to medium; shape, conical, slightly ribbed; skin, medium thick; calyx, half open to closed; surface, smooth; color, ground color, yellowish green, over color, brownish blush to russet on cheek; dots, medium obscure, brown and white, medium size, brown dots areolar, white dots submerged; cavity, medium to wide, deep, acute, broadly ribbed, giving a triangular appearance; stem, medium to long, slender; basin, above medium, wide, medium deep, acute, waved

to wrinkled; segments, erect convergent; core, closed, conical, clasping, median; tube, funnel form; flesh, very white, crisp, firm, juicy, subacid; quality, good; season, ripens last of September. Poor bearer so far.

YOPP. Tree, thrifty, head upright, medium open, color of bark light brown.

Fruit, size, medium; shape, round, slightly oblong to slightly ovate, sometimes irregular; skin, thin, tender; calyx, open to closed; surface, smooth; color, ground color, greenish yellow, over color, blushed with carmine on cheek; dots, obscure, many, white to brown, medium size; sometimes raised, areolar; cavity, medium wide, medium deep, acute, waved, color green, sometimes russeted; stem, medium long, slender to medium stout; basin, wide, shallow, obtuse, waved to wrinkled; segments, erect convergent, to erect divergent; core, closed, oblate, roundish, clasping, median; tube, conical; flesh, white, crisp, juicy, subacid; quality, good; season, September. This variety has been a good bearer up to the present time, but would not recommend it for Missouri orchards.

CONCLUSIONS.

It has been seen that Missouri has a great diversity of soils and that not only is this true, but, also, the contour of each section is different, and as a result of the combined conditions, the varieties of apples grown also differ to some extent. Furthermore, the geographical locations of the sections also accounts for the differences in varieties. The high altitude, the milder climate and the favorable soil conditions of the Ozark region make conditions more ideal for apple growing than those of North Missouri. The Loess formation, with its deep, porous soil and proximity to the Missouri River give unexcelled conditions for orcharding.

It has been proven that the Ben Davis is now, and promises to be for some time to come, the most profitable commercial apple for North Missouri. It is a well known fact that the Ben Davis is about the lowest priced apple on the market. The low price is due to its dry, pithy texture and poor flavor, also to the enormous crops it produces. Varieties such as the Jonathan, Huntsman and Grimes bring much more per bushel than the Ben Davis. The growers themselves place the money value of Jonathan 50 to 100 per cent. higher per bushel than what they get for Ben Davis. The higher

price of the Jonathan is due to its fine texture and flavor, also the crops are not so large as those of the Ben Davis. The Jonathan comes in the list of fancy dessert apples, while Ben Davis is bought as a general cooking apple. Yet it has been seen that Ben Davis is the leader in the choice of varieties for new orchards. The growers say they would plant Ben Davis in their new orchards because it bears more often and produces more apples to the acre than any other variety. One grower even went so far as to say that he could make more money growing Ben Davis at twenty-five cents per bushel than Jonathan at one dollar.

As proof that the Ben Davis is not placed first on account of its ability to withstand neglect, but because of its being better adapted to this section, the following facts, taken from the replies to the inquiries sent to the prominent growers of North Missouri, will be given. All the growers are troubled with borers; 50% of the orchards are badly infested with codling moth, and 10.61% to some extent; 44.83% are affected with fungous diseases, of which 15% is bitter rot, 15% scab, and the remainder, various others, such as "heart rot", blight, and "root rot". It appears then as though this is the cause of the more tender varieties being placed below the Ben Davis. How-



ever, these conditions were found in other sections of the State, where tender varieties are holding their own with the Ben Davis.

The cultivation of the North Missouri section is just as efficient as that of the remainder of the State. Only 18.75% of the growers give clean cultivation, 9.37% give their orchards no attention whatever, and the remainder of those replying to the inquiry prefer to grow crops in their orchards that will bring quick returns.

Therefore, with the above facts in view, it can be said that although the Ben Davis can stand neglect and yet produce paying crops, its superiority in North Missouri is due to its being a better bearer than Jonathan, Grimes, etc. Orchardists who have given their trees the best of treatment say that their Ben Davis is the most profitable as it is a sure bearer.

The adaptibility of the Loess district for apple growing, as was shown, is excellent. This fact is emphasized by the increased number of growers there who favor tender varieties. This increase is due to the location and also to the nature and condition of the soil, as is shown by the following facts:

The diseases and insect pests of this section are similar to those of the other formations. Forty-one and sixty-six hundredths per cent, of the growers say that their orchards are badly infested with codling



moth, and 19.88% say that they have them to some extent; 42.86% are troubled with diseases, 28% of which are blight, 17% scab, and 6.44% bitter rot. Only 12.12% of the growers give their orchards clean cultivation and 12.12% do not cultivate at all. The remainder grow such crops as corn, clover, and cowpeas, and grass. No variety has received special treatment. The Jonathan is given the same conditions as the Ben Davis. The treatment of the orchards, and insect pests and diseases, in the Loess district are similar to those of North Missouri. In the former the Jonathan has increased, while in the latter it has decreased in choice of varieties for new orchards.

Therefore, when these facts are considered, the conclusion is, the increase of the Jonathan is due to the soil and location.

However, as was shown, up to the present, the Ben Davis, in the majority of cases, has been by far the most profitable. The growers admit that it does not bring a high price, but the size of the fruit and the large crops it produces makes it valuable.

The location and adaptability of the Ozark region was also shown to be excellent. The cultivation of this section is similar to that of the preceding

sections, except more of the growers sow cowpeas in their orchards. The Ben Davis has been the most profitable and promises to hold its own in the future. A large percentage of the orchardists grow some Jonathans, but the percentage of those who would plant this variety in a new orchard has not gained on the Ben Davis.

It was shown that the Ozark district is almost, if not quite, an equal to the Loess for growing apples. The tender varieties have remained stationary in the former, while in the latter they made good gains. The following facts seem to explain why this is so:-

Codling moth and borers are not as bad in this section as in the preceding, but on the other hand fungous diseases are worse. They are 21% higher here than in North Missouri and 30% higher than in the Loess district. These diseases, and especially bitter rot, spread most rapidly during warm, moist weather. As the Jonathan ripens earlier than the Ben Davis, it is more liable to be subjected to conditions favoring fungous diseases. These facts seem to prove, since other things are equal, that fungous diseases tend to retard the progress of tender varieties in this section.

Taking the State as a whole, up to the present, Ben Davis has proven to be the most profitable

commercial variety, with Jonathan second, Gano third, and Grimes Golden fourth. The varieties that follow these are numerous, but each receives only a few per cents.

Estimations for new orchards show a strong tendency among the growers to devote their time to fewer varieties than heretofore. Ben Davis, Jonathan and Gano would be planted together more often than any other combinations. Many growers say they would devote their entire attention to a single variety.

The conclusions to be drawn from the data on the experimental orchard are, that very few of the new varieties tested are worth planting in an orchard. No one should plant a new variety to any considerable extent, unless it has first been tested in his section of the country. A variety that is profitable in one section of the country may be worthless in another. For example, take the Baldwin; in New York and Eastern Canada this is their most profitable winter apple; here in Missouri it ripens during the latter part of the summer, and as a result is of no value as a commercial variety in Missouri.

-- SUMMARY OF THE SOIL ANALYSES. --

In discussing the different soil formations of the State, mention was made of mechanical analyses of soils. These samples were obtained by taking a block of soil to a depth of one foot and thoroughly mixing. These analyses were made as follows:-

The apparatus consisted of a nest of five sieves , with meshes of the following sizes: sieve I 1.20 mm.; sieve II .625 mm.; sieve III .4165 mm.; sieve IV .313 mm.; sieve V .25 mm. A decanting cylinder and evaporating dish were also used. Fifty grams of air-dry soil was weighed out and run through sieve I, the particles being pressed through without crushing. The soil was boiled one-half hour to thoroughly separate the particles, then washed into the decanting cylinder. The cylinder was filled two-thirds full with water, well agitated, let stand for five minutes, and then decanted. This was repeated until the water was clear after standing for five minutes. A sample of the first decanted water was saved for examination under the microscope. The soil was thoroughly dried on the water bath, and then run through the nest of sieves. The soil remaining in each sieve was weighed separately, and its percentage of the whole determined. The total of all the per cents. of one soil subtracted from 100% gave the per cent. of soil carried off in the

decanted water. The size of the decanted particles was determined by microscopic measurement. In Table IV, page 55, are shown the average percentages of all the soils analyzed from each district.

This table shows that the Loess is, as to structure, very different from the other formations. The particles as a whole are very small. Only 3% are over .25mm. in size, and none of these are as large as 1.20mm; while in the other formations over 7% of the soils range from .25mm. to larger than 1.20mm. in size. Soils as fine as the Loess usually have a tendency to pack, but such is not the case with this Loess soil. Perhaps this is partly explained by the fact that the amount of clay in the Loess is very low. It is the clay that cements the particles together and causes the soil to be compact and renders it more or less impervious to water. The porosity of this soil is farther explained by the microscopic examination of the decanted portion. It was found that these particles were larger, more angular, and had more of a crushed appearance than those of the Ozark, North Missouri, or the Shale Clay Prairie. Therefore it can be said that the excellent condition of the Loess is due to the low percentage of

TABLE IV.

Districts from which soils were taken	Per cent. of soils caught in each sieve, in receiver, & decanted.							
	Sieve I Mesh 1.20 mm.	Sieve II Mesh .625 mm.	Sieve III Mesh .41 mm.	Sieve IV Mesh .31 mm.	Sieve V Mesh .25 mm.	Soil in Receiver .25mm and less	Decanted soil (clay)	Size of Decanted particles
Loess	.00	.36	.96	.70	.98	43.56	53.44	mm. .0038
Ozark	.74	2.25	2.20	1.62	1.15	19.06	72.08	.00228
North Missouri	.316	2.04	2.15	1.50	1.06	24.14	68.71	.00228
Shale clay prairie	.06	3.10	3.64	2.82	2.88	23.5	64.00	.00228

clay, and especially to the angular shape of the particles.

The results of the analyses of the Ozark, North Missouri, and Shale Clay Prairie soils show a close resemblance to each other, except that in the Ozark soil the amount of silt is much lower and the amount of clay higher than that of the other two formations. The higher percentage of clay in the Ozark formation would indicate an impervious soil, but such is not the case. Microscopic examinations show that the particles of clay are smaller and not as angular as those of the Loess. As the porosity of the Ozark soil cannot be attributed to the shape of the particles, as in the Loess, it must be due to the comparatively large amount of particles above .25mm. in size, and also to the low percentage of silt. The latter combined with the clay does not make as large an amount of fine soil as is found in the Loess. Therefore, the comparatively high percentage of large particles and the fragments of stone that could not be included in the analyses, answer the same purpose in the Ozark soil as do the irregular particles of the Loess in making a porous soil.

As the amount of large particles in the North Missouri and Shale Clay soils is about equal to that of the Ozark region and the amount of fine soil is no larger, these soils can be said to compare favorably with the latter as far as structure is concerned. Microscopic examinations also show a marked resemblance to the Ozark soil. With these facts in view it can be said that, structurally, the North Missouri and Shale Clay Prairie soils are good.