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University of the State of Missouri.

COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

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# Agricultural Experiment Station.

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BULLETIN NO. 46.

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## **The Grape.**

- I. A Study of Types and Varieties.**
- II. A Study of the Pollination of Cultivated Grapes.**
- III. Methods Pursued by Practical Growers.**

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COLUMBIA, MISSOURI.

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April, 1899.

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E. W. STEPHENS, Printer, Columbia, Missouri.

University of the State of Missouri.

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# The Grape.

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By J. C. WHITTEN, Horticulturist.

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## I. A STUDY OF TYPES AND VARIETIES.

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### THE EXPERIMENTAL VINEYARD.

For several years a number of varieties of grapes have been grown on the Horticultural grounds. One of the experimental vineyards is now fifteen years old. Others have been planted from time to time, during the past ten years. In the spring of 1894 a vineyard of 130 varieties was planted, comprising all the more promising varieties in the older vineyards, and many newer sorts then coming into prominence. This planting has been enlarged each season since, until it now contains about 150 kinds. The present bulletin deals mainly with the grapes planted in 1894 they having just completed their fifth season's growth and their third or fourth season's fruiting. This has enabled us to compare vines of the same age.

The following is a summary of the results of these studies:

I. The following varieties ripened in 1898 ahead of Moore's Early: Early Ohio, Champion, Green Mountain, Moyer, Hartford, Jewel, Ives, Janesville, New Haven, Aminia and Brighton.

II. Among the best very early varieties for commercial planting, judging from our own experience and the experience of practical growers, are: Green Mountain, Campbell's Early, Jewel, New Haven, Aminia, Brighton, Moore's Early and Norfolk.

III. The grapes having the largest berry are: Columbian Imperial, McPike, Eaton, Salem and Moore's Early.

IV. The Ozark is the most vigorous and productive variety we have tested.

V. Among the most promising comparatively new, or little known varieties are: America, Aminia, Brilliant, Campbell's Early, Green Mountain, Hicks, McPike, New Haven, Norfolk, Ozark, Rochester and Rommel.

VI. In our opinion more attention might profitably be given to the growing and working up a demand for fine table grapes, especially the earlier varieties. The demand for grapes of the best quality increases as the consumers become acquainted with their merits, and acquire a taste for them.

VII. It pays to sack fine table grapes of most varieties as it adds to their appearance, and keeping qualities, thus increasing their value and insuring ready sale at good prices. Those that are capable of self-fertilization should be sacked while in blossom or before; those incapable of self-fertilization should be sacked as soon as the fruit has set.

VIII. Those varieties which have descended from our native *Æstivalis* grape, or from the closely related Post Oak grape, are more healthy, vigorous and drouth resisting and hold their fruit longer than other classes of grapes in this section. They are also more prolific if we count simply the number of berries set regardless of size. In some varieties of this class, the berries attain very large size without diminishing the number of berries in a cluster. Ozark is an example.

IX. Varieties of the *Labrusca* class have the largest and handsomest fruit, and produce most in quantity, though not in numbers of grapes. They sometimes suffer from the heat of summer.

X. The hybrid varieties between the American and European grapes, average highest in quality, though they lack the vigor, health and drouth resisting capacity of our native grapes.

XI. About sixty per cent of the varieties tested are capable of perfect self-fertilization, that is, they will set fruit without the aid of pollen from other varieties. The remaining forty per cent are not fruitful unless pollenized by other sorts, and should be planted adjacent to strong pollen-bearing sorts that flower at the same time.

XII. Where the above mentioned self-sterile varieties are pollenized by other sorts, the variety furnishing the pollen apparently has nothing to do with determining the quality of the fruit thus produced.

## DETAILS OF THE EXPERIMENTS.

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The main objects of these tests have been :

1. To compare the merits of some of the newer varieties with those of the older, standard sorts, for commercial purposes and for the home table.

2. To compare, not only the *varieties*, but the different *classes* of grapes, in order to ascertain particularly what *species*, or what *types* of the various species, are the most promising for this section.

3. To ascertain what varieties are, and what ones are not capable of self-fertilization—that is, capable of setting fruit without the influence of pollen from other varieties.

4. To note the period of blossoming of each variety, in order that the planter may know what sorts flower at the same time, in case mixed planting is practiced to insure cross-fertilization.

5. To ascertain the weight of the average marketable bunch and berry of each variety, in order to insure a more accurate comparison of the size, and also with the hope that similar data will be taken in other states, to aid in determining where each type of grape reaches its best development.

In the following tables will be found the results of such of these studies as admit of tabulation.

The varieties are arranged alphabetically. The species to which the variety belongs is abbreviated. The X indicates that the variety is a hybrid between the two species named. Hybr. indicates a hybrid in which one or more of the parent species is unknown.

Vigor, health, productiveness and flavor are scored on a scale of 10.

The weight is given in grams. These weights do not indicate the maximum size of bunches and berries, but the *average* weight of the marketable bunches and berries.

The color is indicated by abbreviations: b. indicates blue, blk. black, r. red, w. white, d. dark and l. light. Thus d. r. signifies dark red.

The dates of flowering and ripening are indicated by the number of the month and day of the month as 5—27 indicating the fifth month and twenty-seventh day, or May 27.

The period of fruiting, or length of time the ripe fruit holds on the vine is indicated by s. short, m. medium and l. long.

In gathering these data, the writer is indebted to Mr. N. O. Booth, Assistant, and to Mr. W. L. Howard, one of our students, for their cooperation in the work. They have assisted in taking the weights of the various sorts, and in other ways have added to the data. In noting the flavor and the actual time of ripening of the various sorts, they have been consulted, in order that the average opinion of three individuals might be reached, instead of the possibly biased opinion of one.

The dates of blossoming given are for 1898, and were taken by Miss C. R. Jackson, a student in Horticulture, who also took the data on the pollination of the various sorts, for that year, to compare with similar data taken during the two previous seasons by the writer.

TABLE SHOWING ORIGIN, PRODUCTIVENESS, CHARACTER OF FRUIT AND CHARACTERISTICS OF THE PLANTS OF DIFFERENT VARIETIES OF GRAPES.

Name of Variety.	Species.	Vigor. . . . .	Health. . . . .	Productiveness. . . . .	Weight, in grams, of average fruit cluster	Weight, in grams, of average berry. . . . .	Color of fruit. . . . .	Flavor. . . . .	First flower. . . . .	Full bloom. . . . .	Last flower. . . . .	Date of ripening. . . . .	Period of fruiting. . . . .	Self-fertilizing, or not self-fertilizing. . . . .		Partially self-fertilizing. . . . .
														YES.	NO.	
Agawam. . . . .	Labr. x Vin. . . . .	7	7	8	53.66	2.65	d. r.	9	5-27	6-3	6-7	9-7	m.			yes.
Amber. . . . .	Rip. x Labr. . . . .	8	7	6	37.68	1.66	l. r.	9	5-27	6-2	6-7	9-12	s.	yes.		
Amber Queen. . . . .	Labr. x Vin. . . . .	5	6	5	32.	2.1	d. r.	9	5-27	6-1	6-5	8-22	s.		no.	
America. . . . .	Line. x Rup. . . . .	10	10	9	63.	1.4	d. r.	8	6-3	6-6	6-9	9-3	l		nc	
Aminia. . . . .	Labr. x Vin. . . . .	7	8	6	56.2	2.7	b.	9	5-28	6-4	6-6	8-13	m.		no.	
August Giant. . . . .	Rip. x Vin. . . . .	7.5	7	6	81.8	2.42	blk.	7	5-28	6-4	6-6	8-24	s.		no.	
Bacchus. . . . .	Rip. . . . .	8	6	6	51.75	1.4	blk.	7		5-27		9-11	m.			yes.
Barry. . . . .	Labr. x Vin. . . . .	8	6	7	65.8	3.28	blk.	8	5-27	6-2	6-6	8-21	m.		no.	
Beauty. . . . .	Æst. x Vin. . . . .	5	7	7	86.	2.	l. r.	8	5-28	6-2	6-6	8-26	s.	yes.		
Berkman's. . . . .	Rip. Hybr. . . . .	7	5	4	35.	1.75	l. r.	10	5-27	5-31	6-3	9-10	s.	yes.		
*Black Defiance. . . . .	Labr. x Vin. . . . .						blk.		6-1	6-5	6-8	9-5		yes.		
Black Eagle. . . . .	Labr. x Vin. . . . .	7	6	7	57.87	2.45	blk.	8.5	6-1	6-5	6-8	8-15	m.		no.	
Black Hawk. . . . .	Labr. . . . .	7	8	7	44.5	1.92	blk.	7.5	5-27	6-1	6-3	8-26	s.		no.	
Black Pearl. . . . .	Rip. . . . .	6.5	7	5	33.7	1.02	blk.	6		5-27	6-2	9-6	s.	yes.		
Brighton. . . . .	Labr. x Vin. . . . .	7	7	6	77.	2.11	d. r.	10	5-29	6-5	6-8	8-13	s		no.	
Brilliant. . . . .	Labr. x Vin. . . . .	9	8	9	84.3	2.9	l. r.	10	5-28	6-3	6-5	9-10	m.	yes		
Cambridge. . . . .	Labr. . . . .	9	8	5	94.66	2.62	blk.	6.5	5-28	6-5	6-8	9-1	m.	yes.		

\*Winter kills and rots.

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TABLE SHOWING ORIGIN, PRODUCTIVENESS, CHARACTER OF FRUIT AND CHARACTERISTICS OF THE PLANTS OF DIFFERENT VARIETIES OF GRAPES.—Continued.

Name of Variety.	Species.	Vigor	Health	Productiveness	Weight, in grams, of average fruit cluster.	Weight, in grams, of average berry	Color of fruit.	Flavor.	First flower	Full bloom	Last flower	Date of ripening	Period of fruiting	Self-fertilizing, or not self-fertilizing.		Partially self-fertilizing
														YES.	NO.	
Carmen	Linc. x Aest.	8	8	7	128.5	1.53	blk.	8	6-3	6-7	6-9	9-2	m.	yes.		
Catawba	Labr.	8	7	8	165.	2.35	d. r.	7	5-29	6-2	6-5	9-6	m.	yes.		
Centennial	Æst. Hybr.	5	7	6	54.	1.2	w.	6	5-29	6-5	6-7		l.	yes.		
Challenge	Labr. x Vin.	7	7	6	37.1	1.52	l. r.	8		5-29	6-1	9-3	m.	yes.		
Champion	Labr.	8	7	7	30.7	2.6	b.	5	5-27	5-31	6-2	8-9	s.			yes.
Clinton	Rip.	8	6	3	19.	1	blk.	6	5-27	5-30	6-1	8-31	m.			
Columbian Imperial	Labr. x Rip.	8	7	6	96.5	5.66	d. r.	6	5-27	6-3	6-6	9-15	m.	yes.		
Concord	Labr.	8	7	9	103.1	2.98	blk.	6	5-28	6-2	6-6	8-22	m.	yes.		
Conqueror	Labr. x Vin.	9.5	7	3	50.6	1.75	blk.	6	5-27	5-31	6-2	9-9	s.			yes.
Cottage	Labr.	8	8	7	70	2.22	blk.	7	5-27	6-1	6-5	8-20	l.			yes.
*Creveling	Labr. x Vin.	4	5	5			blk.	7	5-29	6-5	6-7	8-21	s.		no.	
Cunningham	Æst.	7	6	6	51.	1.	b.	8	6-6	6-10	6-13	9-20	l.	yes.		
Cynthiana	Æst.	9	9	8	41.45	.81	blk.	9	6-5	6-9	6-14	9-5	l.	yes.		
Delaware	Labr. x Vin.	5	6	6	47.	1.05	l. r.	9	5-31	6-5	6-8	9-4	l.	yes.		
Diamond	Labr. x Vin.	8	9	9	128.5	1.85	w.	8	5-29	6-5	6-7	8-21	s.	yes.		
Diana	Labr.	7	7	6	59.5	1.31	l. r.	7	5-29	6-4	6-7	9-8	m.			yes.
Dracut Amber	Labr.	7	8	7	42.5	2.27	d. r.	6	5-27	6-1	6-5	8-23	m.	yes.		
Duchess	Labr. x Vin.	6	6	5	28.75	1.11	w.	7	6-1	6-6	6-9	9-4	m.			yes.
Early Ohio	Labr.	8	7	7	118.	2.55	blk.	5	5-27	6-1	6-6	8-7	s.	yes.		

\*Rots badly.

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Early Victor.	Labr.	7.5	8	7	44.	1.59	blk.	6	5-27	6-1	6-5	8-13	m.	yes.		
Baton	Labr.	7.5	8	7	79.9	3.88	blk.	5	5-28	6-3	6-6	8-25	s.	yes.		
Eclipse.	Labr. x ?	10	9	9			w.	10	5-30	6-2	6-6			yes.		
Elvicand	Cand. x Rip. x Labr.	8	8	8			d. r.	7	5-27	6-3	6-5	9-9	l.	yes.		
Elvira	Labr. x Rip.	8	7	8	58.	1.9	w.	6	5-27	6-1	6-3	9-4	l.	yes.		
Empire State	Labr. x Rip.	7.5							6-3	6-5	6-11			yes.		
Etta	Ripa.	8	7	8	80.	2.8	w.	7	5-27	6-4	6-7	9-17	l.	yes.		
Eumelan	Æst.	6.5	7	7	31.	1.6	blk.	8	5-28	6-5	6-7	8-20	m.		no.	
Faith	Rip.	8	6	3	33.5	.89	w.	6	5-27	6-1	6-5	8-20	s.		yes.	
Fern Munson	Line. x	7	8	6	29.	1.7	b.	8	6-4	6-7	6-9		l.	yes.		
Gazelle	Hybr.	7	7	8	108.	1.3	w.	8	5-29	6-3	6-8	9-1	l.	yes.		
Goethe	Labr. x Vin.	7	5	7	98.	3.53	l. r.	10	5-28	6-3	6-7	8-18	m.	yes.		
Gold Coin	Æst. x Labr.	7	8	7	92.	2.4	w.	6	6-2	6-5	6-8	9-1	l.	yes.		
Gr'n Mt. (Winch'll)		6	8	8	54.	1.4	w.	9	5-28	6-4	6-7	8-10	s.	yes.		
Grein's Golden	Rip. x ?	7	7	6	75.	2.78	w.	5	5-27	6-1	6-6	9-7	m.		no.	
Hartford	Labr.	6	7	7	57.	2.1	blk.	4	5-27	6-1	6-4	8-10	m.		yes.	
Hayes	Labr.	6	6	5	64.62	1.67	w.	6	5-28	6-2	6-5	8-23	m.	yes.		
Herbemont	Æst.	7	4	3	21.	1.41	d. r.	10	5-27	5-30	6-2	8-30	m.	yes.		
Herbert	Labr. x Vin.	8.5	8	5	68.2	3.46	b.	7	5-27	6-1	6-5	8-24	m.		no.	
Hermann	Æst.	8	9	5	77.	.75	bl.	7	6-4	6-8	6-13	9-17	l.			
Ideal	Æst. x	8	7	4	65.	2.83	d. r.	9	5-29	6-5	6-7	8-17	s.		no.	yes.
Iona	Labr.	4	5	7	77.5	1.7	l. r.	9.5	5-30	6-5	6-7	9-4	m.		yes.	
Iron Clad	Rip. x Labr.	10	9	1	16.	1.16	blk.	4	5-27	6-1	6-1	9-15	s.		no.	
Isabella	Labr.	6	6	5	62.83	3.14	b	7	5-27	6-1	6-5	9-1	m.		no.	
Israella	Labr.	8	8	5	72.55	2.4	d. r.	4	5-27	6-1	6-4	9-5	m.	yes.		
Ives	Labr.	7.5	7	8	60.5	1.3	blk.	4	5-27	6-1	6-4	8-12	m.	yes.		
Jaeger	Æst. x Line.	8	8	8	133.	1.33	b.	7	6-2	6-5	6-8	8-27	l.	yes.		
Janesville	Labr. x Rip.	8	8	2	30.	2.2	blk.	3	5-27	5-30	8-12	l.	yes.			
Jefferson	Labr.	3	8	9	158.3	2.	l. r.	10	6-2	6-7	6-10	9-6	m.	yes.		
Jewel	Æst. x Vin.	6	7	9	40.		b.	7	5-28	6-2	6-5	8-11	m.		no.	
Lady	Labr.	4	6	6	60.6	2.7	w.	6.5	5-29	6-2	6-6	9-1	s.		yes.	
Lady Washington	Labr. x Vin.	5	8	3	47.5	2.	w.	8	5-29	6-3	6-7	9-6	l.	yes.		
Lindley	Labr. x Vin.	7.5	7	9	78.66	2.97	l. r.	9	5-28	6-5	6-8	9-3	m.		no.	

TABLE SHOWING ORIGIN, PRODUCTIVENESS, CHARACTER OF FRUIT AND CHARACTERISTICS OF THE PLANTS OF DIFFERENT VARIETIES OF GRAPES.—Continued.

Name of Variety.	Species.	Vigor	Health	Productiveness	Weight, in grams, of average fruit cluster.	Weight, in grams, of average berry	Color of fruit	Flavor	First flower	Full bloom	Last flower	Date of ripening	Period of fruiting	Self-fertilizing, or not self-fertilizing		Partially self-fertilizing	
														YES.	NO.		
Marion	Rip.	9	9	4	42.25	1.915	blk.	6		5-27		9-4	l.		no.	yes.	
Martha	Labr.	7	8	8	51.8	1.7	w.	7	5-28	6-2	6-7	8-19	s.	yes.			
Mary Ann	Labr.	7	8	6	67.	2.14	b.	4	5-27	6-1	6-6	8-15	m.	yes.			
Mason	Labr.	6	6	4	38.3	3.	w.	7	5-28	6-3	6-8	8-25	m.	yes.			
Massasoit.	Labr. x Vin.	7	6	5	63.4	2.32	d. r.	9.5	5-28	6-4	6-7	8-13	s.	yes.			
Missouri Riesling	Rip.	7.5	7	9.5	65.8	1.68	w.	6	5-27	6-3	6-8	9-1	m.				
Montefiore	Rip.	7.5	8	3	27.5	1.47	blk.	7.5	5-27	6-2	6-6	8-30	s.	yes.			
Moore's Early	Labr.	8	7	8	83.1	3.68	b.	7	5-28	6-2	6-6	8-13	s.	yes.			
*Moyer	Æst x	5	5	4			l. r.	8	5-29	6-3	6-5	8-10	s.		no		
†Naomi	Rip. x Vin.																
Neosho	Æst.	10	10	5	38.	.9	b.	7	6-5	6-8	6-11	9-15	l.		no.		
New Haven	Labr.	6	8	7	55.9	2.18	b.	7.5	5-28	6-3	6-5	8-12	m.	yes.			
Niagara	Labr.	7	7	7	98.7	1.97	w.	7	5-29	6-2	6-5		s.	yes.			
Noah	Rip. x	8	8	6	93.65	1.95	w.	7	5-28	6-3	6-8	9-15	l.	yes.			
Norfolk	Labr. x Vin.	7.5	7	6	61.6	2.2	d. r.	8	5-28	6-3	6-5	8-15	m.	yes.			
North Carolina	Labr.	8.5	8	8	67.6	2.6	blk.	5	5-27	6-1	6-5	8-19	m.		no.		
N'rth'rn Muscadine	Labr.	9	8	7	51.	2.2	r.	7.5	5-27	5-31	6-4	8-14	l.	yes.			
Norton	Æst.	9	9	8	43.5	.775	blk.	9	6-5	6-10	6-14	9-5	l.	yes.			
Othello	Rip. x Vin.	9	8	6	77.6	2.1	blk.	7	5-27	6-1	6-6	9-10	l.	yes.			
Ozark	Æst.	10	10	10	75.	2.1	blk.	7	6-1	6-7	6-9	9-8	l.		no.		

\*Cracks and shrivels.

†Did not grow well enough to furnish any data.

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## GRAPES LISTED IN ORDER OF RIPENING IN 1898.

In noting the comparative date of ripening of the different varieties of grapes it should be borne in mind that they differ in this respect in different seasons. For example, in dry hot seasons Delaware sometimes ripens very early, while in wet cool seasons it is much later. Again, it is difficult to determine just when some varieties may be said to be fully ripe. Janesville and Mary Ann are among the first to begin to color, and consequently are ripe *in appearance* before they are in quality. A very sweet grape, like Goethe, is very agreeable to the taste long before it is fully ripe, while a grape of poor quality, like Venango, does not *appear* to be ripe until after its true ripening period is past. The following list will, however, give a very approximate idea of the comparative date of ripening of the various sorts.

August 7, Early Ohio.	August 19, North Carolina.
August 9, Champion.	August 20, Eumelan.
August 10, Green Mountain.	August 20, Faith.
August 10, Moyer.	August 20, Potter.
August 10, Hartford.	August 20, Cottage.
August 11, Jewel.	August 20, Wells.
August 12, Ives.	August 21, Creveling.
August 12, Janesville.	August 21, Barry.
August 12, New Haven.	August 21, Diamond.
August 13, Aminia.	August 22, Amber Queen.
August 13, Brighton.	August 22, Concord.
August 13, Early Victor.	August 22, Wyoming Red.
August 13, Moore's Early.	August 22, Rommel.
August 13, Massasoit.	August 23, Dracut Amber.
August 14, Northern Muscadine.	August 23, Hayes.
August 14, Whitehall.	August 24, August Giant.
August 15, Black Eagle.	August 24, Herbert.
August 15, Mary Ann.	August 24, Worden.
August 15, Norfolk.	August 25, Eaton.
August 16, Perkins.	August 25, Mason.
August 17, Ideal.	August 25, Wilding.
August 18, Telegraph.	August 26, Beauty.
August 19, Martha.	August 26, Black Hawk.
	August 26, Ulster.

- August 27, Jaeger.  
 August 30, Montefiore.  
 August 30, Herbemont.  
 August 31, Clinton.  
 September 1, Cambridge.  
 September 1, Gazelle.  
 September 1, Gold Coin.  
 September 1, Isabella.  
 September 1, Lady.  
 September 1, Missouri  
     Riesling.  
 September 1, Venango.  
 September 1, Woodruff Red.  
 September 2, Carman.  
 September 3, America.  
 September 3, Challenge.  
 September 3, Lindley.  
 September 4, Duchess.  
 September 4, Elvira.  
 September 4, Iona.  
 September 4, Marion.  
 September 4, Salem.  
 September 5, Norton.  
 September 5, Israella.  
 September 5, Taylor Bullit.  
 September 5, Vergennes.  
 September 5, Rentz.  
 September 5, Rochester.  
 September 5, Requa.  
 September 5, Wilder.  
 September 5, Black Defiance.  
 September 5, Cynthiana.  
 September 6, Catawba.  
 September 6, Peter Wylie.  
 September 6, Lady Wash-  
     ington.  
 September 6, Black Pearl.  
 September 6, Jefferson.  
 September 7, Agawam.  
 September 7, Greins Golden.  
 September 7, Transparent.  
 September 8, Goethe.  
 September 8, Diana.  
 September 8, Ozark.  
 September 8, Poughkeepsie  
     Red.  
 September 8, Uhland.  
 September 9, Delaware.  
 September 9, Conqueror.  
 September 9, Elvicand.  
 September 10, Brilliant.  
 September 10, Berckmans.  
 September 10, Othello.  
 September 10, Pearl.  
 September 11, Bacchus.  
 September 11, Pocklington.  
 September 11, Roger's No. 2.  
 September 12, Amber.  
 September 15, Columbian  
     Imperial.  
 September 15, Noah.  
 September 15, Iron Clad.  
 September 15, Neosho.  
 September 17, Etta.  
 September 17, Hermann.  
 September 20, Cunningham.

## GRAPES LISTED ACCORDING TO AVERAGE WEIGHT OF BERRY.

	<i>Grams.</i>		<i>Grams.</i>
Columbian Imperial....	5.66	Israella.....	2.4
Eaton .....	3.88	Rochester..	2.39
Salem.....	3.77	Perkins .....	2.36
Moore's Early.....	3.68	Catawba....	2.35
Goethe .....	3.53	Poughkeepsie Red.....	2.33
Woodruff Red.....	3.52	Massasoit .....	2.32
Wells .....	3.48	Dracut Amber.....	2.275
Herbert.....	3.46	Telegraph .....	2.25
Wilder .....	3.34	Cottage.....	2.22
Barry .....	3.28	Potter.....	2.22
Worden .....	3.21	New Haven.....	2.18
Isabella .....	3.14	Mary Anne.....	2.14
Requa .....	3.125	Brighton.....	2.11
Vergennes .....	3.05	Norfolk .....	2.2
Mason .....	3.00	Janesville .....	2.2
Venango .....	3.00	Northern Muscadine... 2.2	
Rommel .....	2.99	Amber Queen.....	2.1
Concord .....	2.98	Hartford.....	2.1
Niagara .....	2.97	Othello.....	2.1
Lindley .....	2.97	Ozark.....	2.1
Brilliant .....	2.9	Whitehall.....	2.05
Diamond .....	2.85	Jefferson.....	2
Ideal.....	2.83	Wyoming Red.....	2
Etta....	2.8	Beauty .....	2
Greins Golden.....	2.78	Lady Washington.....	2
Lady .....	2.7	Noah.....	1.95
Aminia.....	2.7	Wilding .....	1.945
Agawam .....	2.655	Black Hawk....	1.92
Cambridge .....	2.62	Marion..	1.91
Pocklington .....	2.61	Elvira .....	1.9
Champion .....	2.6	Berckmans .....	1.75
North Carolina.....	2.6	Conqueror .....	1.75
Early Ohio.....	2.554	Uhland .....	1.75
Renty .....	2.48	Martha.....	1.7
Black Eagle.....	2.45	Fern Munson .....	1.7
August Giant.....	2.42	Iona .....	1.7
Gold Coin.....	2.4	Missouri Riesling.....	1.68

Hayes .....	1.67	Gazelle .....	1.3
Amber .....	1.66	Iron Clad .....	1.16
Pearl .....	1.61	Duchess .....	1.115
Eumelan .....	1.6	Taylor Bullit.....	1.07
Early Victor.. ..	1.59	Delaware .....	1.05
Carman .....	1.53	Black Pearl.....	1.02
Challenge.....	1.52	Centennial.....	1.02
Mantefiore.....	1.47	Clinton.....	1
Peter Wylie.....	1.4	Transparent .....	1
Herbmont.....	1.41	Cunningham .....	1
Green Mountain .....	1.4	Neosho.....	.9
America .....	1.4	Faith .....	.89
Bacchus .....	1.4	Cynthiana .....	.81
Jaeger .....	1.33	Norton .....	.775
Diana .....	1.31	Hermann .....	.75
Ives .....	1.3		

GRAPES LISTED ACCORDING TO AVERAGE WEIGHT OF BUNCH.

	<i>Grams.</i>		<i>Grams.</i>
Catawba.....	165.0	Beauty .....	.86
Jefferson.....	158.3	Brilliant .....	.84.3
Poughkeepsie Red....	134.1	Moore's Early .....	.83.1
Rochester .....	133.3	August Giant.....	.81.8
Jaeger.....	133	Telegraph .....	.80.5
Carman .....	128.5	Etta....	.80
Diamond .....	128.5	Eaton .....	.79.9
Early Ohio.. ..	118	Lindley .....	.78.6
Rommel .....	109	Othello.....	.77.6
Gazelle .....	108	Iona .....	.77.5
Worden .....	104.2	Brighton .....	.77
Concord .....	103.1	Herman .....	.77
Niagara .....	98.7	Greins Golden....	.75
Goethe .....	98	Ozark .....	.75
Columbian Imperial...	96.5	Salem .....	.73
Cambridge .....	94.66	Requa .....	.70.5
Noah.....	93.65	Potter .....	.70
Gold Coin.....	92	Cottage .....	.70
Vergennes .....	89.7	Herbert .....	.68.2
Peter Wylie.....	87	North Carolina.....	.67.7

Mary Anne.....	67	Conqueror .....	50.6
Ives .....	66.5	Pearl .....	47.7
Ironclad .....	66	Lady Washington.....	47.5
Venango .....	66	Delaware .....	47
Wilder.....	66	Wyoming Red.....	46.7
Barry .....	65.8	Black Hawk.....	44.5
Missouri Riesling .....	65.8	Early Victor.....	44
Uhland .....	65.5	Norton .....	43.5
Ideal .....	65	Dracut Amber.....	42.6
Hayes .....	64.6	Marion .....	42.2
Massasoit .....	63.4	Whitehall .....	41.7
America .....	63	Cynthiana.....	41.45
Isabella .....	62.8	Jewel .....	40
Rentz .....	62.5	Wilding .....	38.5
Norfolk .....	61.6	Mason .....	38.3
Perkins.....	60.6	Neosho.....	38
Lady .....	60	Challenge .....	37.1
Diana .....	59.5	Amber .....	37.6
Pocklington .....	58.6	Berckmans .....	35
Elvira .....	58	Black Pearl.....	33.7
Black Eagle .....	57.87	Faith.....	33.5
Hartford .....	57	Amber Queen.....	32
Aminia .....	56.2	Eumelan .....	31
Woodruff Red.....	54.37	Champion.....	30.7
Centennial .....	54	Janesville.....	30
Green Mountain (Win-		Fern Munson.....	29
chell).....	54	Montefiore.....	27.5
New Haven.....	53.9	Duchess.....	21.7
Agawam .....	53.6	Herbemont.....	21
Martha .....	51.8	Taylor Bullit.....	19.7
Bacchus .....	51.7	Clinton.....	19
Cunningham .....	51	Israella.....	12.55
Northern Muscadine...51		Transparent.....	9

## VARIETIES TO PLANT.

The varieties most largely grown for profit in this state, by those who depend upon shipping to supply the ordinary demand, are Moore's Early, Worden and Concord. These standard sorts have been found to succeed well on the Station grounds.

The following ripening ahead of Moore's Early, and found to succeed well here are Early Ohio, Champion, Hartford, Green Mountain, Jewel and Aminia, maturing in the order named.

The best table grapes, combining fine quality, with at least a fair vigor and productiveness are Green Mountain, New Haven, Aminia, Brighton, Moore's Early, Norfolk, Massasoit, Ideal, Diamond, Barry, Rommel, Woodruff Red (finer in appearance than in quality), Lindley, Challenge, Norton, Rochester, Jefferson, Agawam, Poughkeepsie Red, Brilliant and Berckmans, ripening in the order named.

### NOTES ON VARIETIES.

The standard varieties of grapes have been so thoroughly described in the Bushberg (Mo.), Catalogue, in Mitzky's "Our Native Grapes" and elsewhere, that it is not our purpose to describe in detail the individual varieties tested at the Station. Several of these varieties, including some old sorts as well as some of the newer introductions, are comparatively new to cultivation in this State, and are exciting considerable interest here. For that reason it is deemed advisable to publish a few statements concerning the following varieties that deserve to be better known in Missouri. The table will supply additional information.

**AGAWAM.** One of the hardiest, most productive, and for this section one of the best of Roger's hybrids, though slightly musky in flavor and not quite equal in quality to some of his best sorts.

**AMERICA.** For this section this grape is one of the most promising of Munson's hybrids. It endures heat and drouth of summer almost perfectly and yet it is also uninjured by our winters. It seems to be proof against the attacks of the leaf

hopper and fungous diseases. Though said to be perfect in fertilization it has not proven to be so on our grounds, having never set fruit here when the flower clusters were sacked before opening.

**AMINIA.** One of the earliest and best of Roger's hybrids. Ripens with or before Moore's Early and is very promising where a delicious early table grape of fine appearance is desired. It is comparatively firm in flesh, keeps well and is as free from rot as any of Roger's.

**BARRY.** Another of Roger's hybrids, follows Aminia, has a fine bunch of beautiful, very dark grapes of good quality. Bears abundantly and is fairly hardy and resistant of drouth and disease for a Vinifera hybrid. Should be included in the list of good table grapes.

**BEACON.** One of the best growers of all of Munson's hybrids that we have tried. So handsome and compact is the foliage as to make it a beautiful cover for arbors, etc. During the dry hot weather of summer its large, glossy leaves retain their rich, fresh green color and present a beautiful appearance where the pure Labruscas mostly wilt and suffer. We have not fruited it sufficiently to speak authoritatively concerning its fruit.

**BERCKMANS.** Equal to the Delaware in flavor and a much better grower and producer here. Holds its fruit well, especially when sacked.

**BLACK EAGLE.** A very good medium early grape. Endures our summers as well as most Labrusca hybrids and is superior in quality to the Concord.

**BRIGHTON.** One of the most delicious early Labrusca X Vinifera hybrids. A fairly strong grower and produces well. Its delicate skin cracks badly before maturity unless sacked. Not self-fertilizing hence it should be planted with other sorts and should not be sacked until the fruit has set.

**BRILLIANT.** The finest in quality of any of Munson's hybrids that we have tested. This grape is of particular interest as being a secondary hybrid—a cross between Lindley and Delaware—both of which are Labrusca X Vinifera hybrids. It is the strongest grower, the most drouth resistant, freest from disease and holds its beautiful bunches of large, translu-



cent, red berries the longest of any of the *Vinifera* hybrids we have tried. In our judgment it is equal in quality to the best.

**CAMPBELL'S EARLY.** While this has not yet fruited on the Station grounds it has made fine growth and is so highly spoken of by adjacent growers that we mention it here.

**CARMAN.** One of Munson's which also endures alike the dry, hot weather of summer and cold of winter. While its foliage has not the denseness and beauty of America or Beacon it is free from disease and insects and the vine is a strong grower and one of the heaviest producers. The clusters are large and handsome, berry medium, firm, black and of good quality.

**CHAMPION.** A dark grape of the *Labrusca* type, its principal point of merit being earliness. While one of the earliest dark grapes it is not of high quality and the berries have even a greater tendency to shrivel than the old, well known Hartford.

**COLUMBIAN IMPERIAL.** The largest grape we have ever fruited. Vine a very rank grower, endures drouth as well as most *Labruscas*; cluster large, berry exceedingly large, round, dark, of fairly good quality; seeds small for so large a grape; ripens late. Seemed very promising the first two seasons it fruited. It sets a medium crop of fruit. If not sacked it rots as badly as most *Labruscas*. Is perfectly self-fertilizing and the clusters should be sacked before the flowers open.

**COTTAGE.** Of all the *Labrusca* grapes which we have tried, no others except Potter and Northern Muscadine can equal this variety in the perfection of its cane and foliage development. The leaves are abundant, symmetrical, thick, firm, rich, bright green in color, are free from leaf hoppers and maintain their freshness throughout the summer, not being scorched or injured to any great extent by drouth or heat. The canes have a characteristic rich brown color and mature to the very tip. The fruit is like Concord, but firmer, of better quality, holds on remarkably long for a *Labrusca* and is remarkably free from rot. This grape impresses us as being very promising, for this section of the country, as a market grape, or as a basis upon which to cross for new varieties, where a *Labrusca* parent is desired.

**CUNNINGHAM.** A fine late grape of the *Æstivalis* class, with a fine large shouldered bunch, and though its berry is small it is of good quality.

**CYNTHIANA.** May be said to be identical with Norton except that it has a slightly larger, more definitely shouldered bunch. (See Norton).

**DIAMOND.** The best white grape we have tried. Very productive, strong grower, good.

**EARLY OHIO.** The earliest grape we have fruited, being fully a week ahead of Moore's Early. Much like Concord in vine and fruit, but the berry is slightly smaller and of poorer quality. Begins fruiting when very young, is prolific and is capable of carrying a large crop. May be valuable where extreme earliness is required.

**EATON.** A fine looking grape, very large in both bunch and berry; productive, but sometimes ripens unevenly. Below Concord in flavor.

**ELVICAND.** A cross between Elvira and the Mustang grape of Texas, thus being the pioneer of a type of grape distinctly new in cultivation. The native Mustang grape has so nearly lost its objectionable flavor in this promising offspring that we look with much interest to the future possibilities of this type.

**ELVIRA.** Very prolific, a fair table variety and said by some to be the best white wine grape.

**GAZELLE.** Deserves to be better known. Very large, compact, beautiful cluster, berry very small but delicious, ripens late, good after most other grapes are gone, vine kills back a little in hard winters.

**GOETHE.** One of the finest of Roger's hybrids. Rank grower if well managed and sprayed, becoming weak if allowed to overbear or neglected. Bunches very large, sometimes three or four to a single shoot; berry very large, elongated, beautiful amber color unsurpassed for beauty and quality as a late table grape.

**GREEN MOUNTAIN.** The earliest white grape we have fruited and one of the best, particularly when sacked. Should be sacked before the flowers open.

**HERBEMONT.** Of first quality but rots.

**HICKS.** A new variety which we have not fruited but which we believe to be very promising from what we have seen of it.

**IONA.** One of the finest in quality but a weak grower.

**JANESVILLE.** One of the earliest to color up but slow to reach its best flavor, never becoming very good.

**JEFFERSON.** One of the best table grapes, having a beautifully shouldered bunch and good sized berry of superior flavor and texture. A weak grower and must be carefully managed.

**JEWEL.** Valuable on account of its earliness, being between Early Ohio and Moore's Early in season. Of good quality for an early grape.

**LINDLEY.** One of Roger's; nearly equal in quality to Goethe and one of the finest and freest from rot of the *Vinifera* hybrids. Should be included as a medium season table grape.

**MASSASOIT.** One of the best of Roger's table grapes, coming just after *Aminia* and before *Lindley*.

**MCPIKE.** Another grape that, while it has not fruited with us, has made such fine growth and has been so highly praised by others in this section who have fruited it that we mention it here. It is one of the largest and handsomest grapes we have seen.

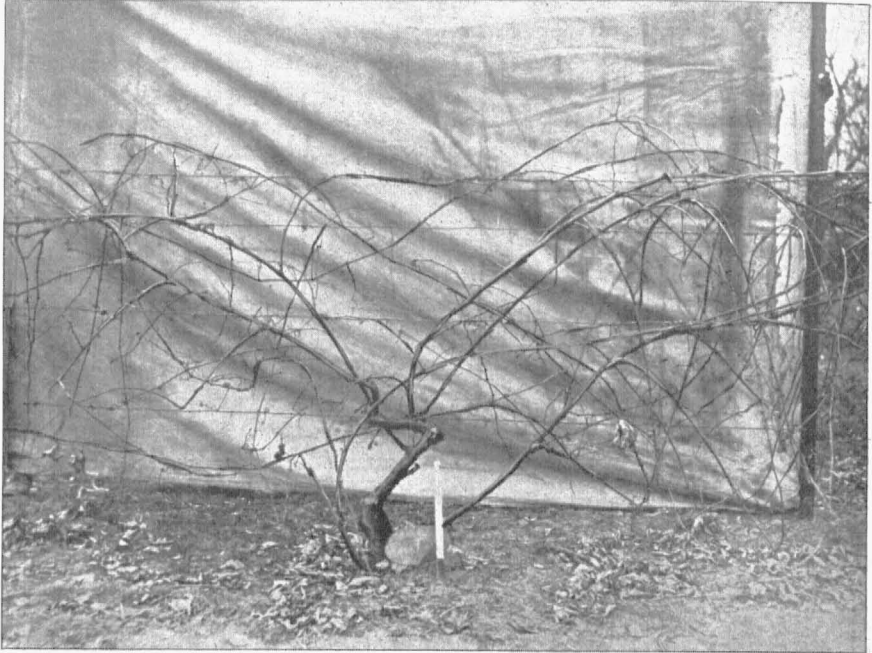
**NEOSHO.** One of the most vigorous, handsome, healthy and drouth resisting vines in the collection, being equaled in this respect only by *America* and *Beacon*. Fruit much like *Norton* but smaller in both bunch and berry. A beautiful vine for arbors or screens and apparently a promising parent for grape breeding.

**NEW HAVEN.** Medium early grape of *Concord* type, but much superior in quality. Deserves further trial.

**NORFOLK.** A very early grape of the *Catawba* type, ripening ahead of *Moore's Early*; prolific and of fine quality.

**NORTON.** A fine variety of the *Aestevalis* class. Though recommended by growers chiefly as a wine grape it is one of the best in quality and holds on long after most other varieties are gone, making it a very desirable table grape. With us it is free from rot and the vigorous vine endures drouth as is characteristic of its species.

OZARK. (Stayman's No. 26.) In many respects the most remarkable grape on the Station grounds. It seems strange that it has never become better known. While it is of *Aestivalis* parentage it seems to have departed to a remarkable degree



*Plate I.—Ozark, in winter condition; showing vigor of growth of vine which bore a heavy crop.*

from this type in respect to size, producing bunches much larger than Concord, with berries fully as large. The vine is the rankest grower and one of the healthiest and most drouth resistant on the grounds. It bears two clusters of fruit to the shoot, the first one being very large and the second one very small. (This small second bunch brings down the average weight of bunch given in the table.) Bunch large, finely shouldered, compact, berry large, round, black; skin medium thick, pulp firm, of fair quality, juicy. Holds its fruit well on

the vine and is not much subject to rot. The most enormous cropper on the grounds. A young vine, pruned on the renewal system to three canes of about four feet each, produced ninety-three pounds of fruit in a single season. Furthermore this vine was growing near our experimental orchard and was somewhat crowded by a fruit tree.

**POTTER.** So much like Cottage (which see) that the description of the latter suits it.

**POUGHKEEPSIE RED.** A very prolific, vigorous, fine late grape of the Catawba class. Some seasons it holds its fruit later than any other in the collection. Should be considered as a late table grape.

**ROCHESTER.** Much like Poughkeepsie Red but a better bearer, with more uniformly beautiful cluster and slightly earlier.

**ROMMEL.** Next to, if indeed not equal to, Diamond as a white grape and far more healthy, drouth resisting and free from insects and fungi.

**VERGENNES.** A fine, medium late, red table grape.

**WOODRUFF RED.** The largest and one of the handsomest of our red table grapes, and above the medium in quality.

### SACKING GRAPES.

We are frequently asked if sacking grapes pays, and when and how it should be done. During the past four seasons we have sacked, in various stages of development, a part of the fruit of every variety of grapes that has ripened upon the Station grounds. We use the ordinary manila sacks, of such size as to just accomodate the mature bunch of grapes. For ordinary protection the sack is put over the fruit cluster early in the season, and the mouth of the sack pinned as tightly as convenient, just above the fruit. The sacks protect the fruit from the birds as well as from insects and fungous diseases and greatly improve the color, general appearance, keeping qualities and sometimes the flavor of the fruit.

The earlier the sacks are put on the greater the certainty of preventing rot and other diseases. We have seldom known rot to appear in clusters that had been sacked as soon as the fruit

was fairly set—that is when the grapes were formed but only as large as pin heads. Where sacking was delayed until the grapes were one fourth to one third grown, some rot often appeared. Sacking at any period before ripening tends to lessen the proportion of rot as compared with grapes not sacked. In the case of varieties that are capable of self-fertilization we have had the best success by sacking them as soon as the flower clusters are large enough to admit of the operation, and before the blossoms open. Varieties that are not capable of self-fertilization of course will not set fruit in sacks, where pollen from other varieties is excluded. (See table.) Whenever the sacks have been put on before the blossoming period the clusters have been entirely free from rot except where the sacks were accidentally destroyed.

Varieties like Brighton, Hayes, Amber and others that have a tendency to crack open before ripening, may be brought to perfection, without cracking if sacked early. Poughkeepsie Red, Brilliant, Rochester, Norton and most sorts that ripen late will if sacked early, hold on the vines and constantly improve until long after unsacked grapes are gone.

The flavor, as well as the keeping quality, is much more improved in some varieties than in others by sacking. Green Mountain is improved more by sacking than any other variety we have tested. Like most of our early grapes, when ripened normally its fruit is all gone before September, and is only of medium quality. Sacked before the blossoms opened the clusters held on until late in autumn, when the fruit gradually turned to raisins. During September the berries assumed a sweet juicy, tender condition and were almost as delicious as hothouse forced grapes. Other varieties, especially New Haven, Aminia, Gazelle and Cunningham were much improved by sacking, but none so much as the Green Mountain. On the other hand the Goethe was more highly colored and possibly better flavored when not sacked, although the unsacked bunches were more subject to rot. Eaton, Wyoming Red, Ives, Janesville and some others were not improved in flavor by sacking.

## THE POLLINATION OF GRAPES.

It is a well known fact that many varieties of grapes are not capable of setting fruit if planted alone, but that, like the pistillate strawberries, they must depend upon the pollen of other varieties for perfect fertilization and fruitfulness.

A lack of self fertility is usually due to imperfect development of the stamens or pollen bearing organs. When the vines are in blossom the grower may generally discern by a study of the flowers, what varieties are and what ones are not capable of self-fertilization. Self-fertile varieties, like Concord, have strong, upright stamens, longer than the pistil and produce an abundance of pollen. Those which are lacking in self-fertility, like Salem, have smaller stamens which are curved more or less downward, under the pistil, and produce little or no pollen. A number of varieties, like Agawam, have only slightly recurved stamens, and are capable of partial self-fertilization, but will fruit much better if planted near some strong pollen bearing variety.

A glance at the table will show that a large proportion of the *Vinifera* hybrids are more or less self-sterile.

It is quite possible that the self-fertility of certain varieties depends somewhat upon whether the soil, climate and season are favorable to the perfect development of the vine. For example, America has been reported as being perfectly self-fertile farther south, yet it has never set fruit at this Station when pollen from other varieties was excluded from its flowers, though it is very prolific when pollination by other sorts is unrestricted. In the case of the Agawam, some of its flower clusters the past year seemed to produce much stronger stamens than did others. When inclosed in sacks before blossoming some of its clusters set fruit perfectly, while others set none.

During 1897, Ideal, a hybrid variety proved to be self-impotent early in the season, but self-potent later on, the season being favorable to a succession of bloom throughout the summer. Just before the time of blossoming nearly all the flower clusters on an Ideal vine were sacked, and, having almost abortive stamens, only the unsacked clusters set fruit. Having little fruit to carry the vine made vigorous growth and put out

a succession of blossoms. Toward midsummer it was noticed that the stamens of the flowers then opening were more upright, apparently more vigorous, and that fruit was setting; clusters that were still in bud were sacked and they set fruit perfectly, showing that they had become self-fertile.

When it is considered that in a general collection of grapes, on the Experiment Station grounds, nearly forty per cent are incapable of perfect self-fertilization, it becomes apparent that a knowledge of what sorts are and what ones are not self-fertile is of great importance to the grower. Varieties that are not self-fertile should not be grown in blocks by themselves but should be planted adjacent to some strong pollen bearing variety that blossoms at the same time.

In order to ascertain what varieties are and what ones are not self-fertile, a part of the flower clusters of each were inclosed in sacks before the blossoms opened, to exclude the pollen of other varieties. This operation has been repeated several seasons to verify the results, and to ascertain whether or not the degree of self-fertility of a given variety may vary in different years. With respect to this latter point, the self-fertilizing power of a given vine seems to remain very nearly if not quite the same in successive seasons. Reference to the tabular data shows what varieties are and what ones are not capable of self-fertilization.

#### EFFECT OF SOURCE OF POLLEN ON THE CHARACTER OF THE FRUIT.

In order to determine whether fertilizing a given variety with pollen from different varieties, would result in a difference in the quality of the fruit thus fertilized, twelve self-sterile sorts were each hand pollinated with pollen from Concord, Eaton, Diamond, Elvira, Cynthiana and Carmen. In only one case did the kind of pollen used seem to result in a difference in the varietal characters of the fruit thus fertilized. Two clusters of Lindley, fertilized with pollen of Diamond, were of lighter color, thinner skinned and of more delicate flavor than the Lindley fertilized by pollen of either of the other varieties. This may have been due, however, to the fact that these two clusters were the last ones fertilized, that they were low down in the body of the vine where they were densely shaded, and



ripened later than the others. Further investigation will be necessary to reach any definite conclusion as to the value of selecting any definite sort for pollenizing a given variety.

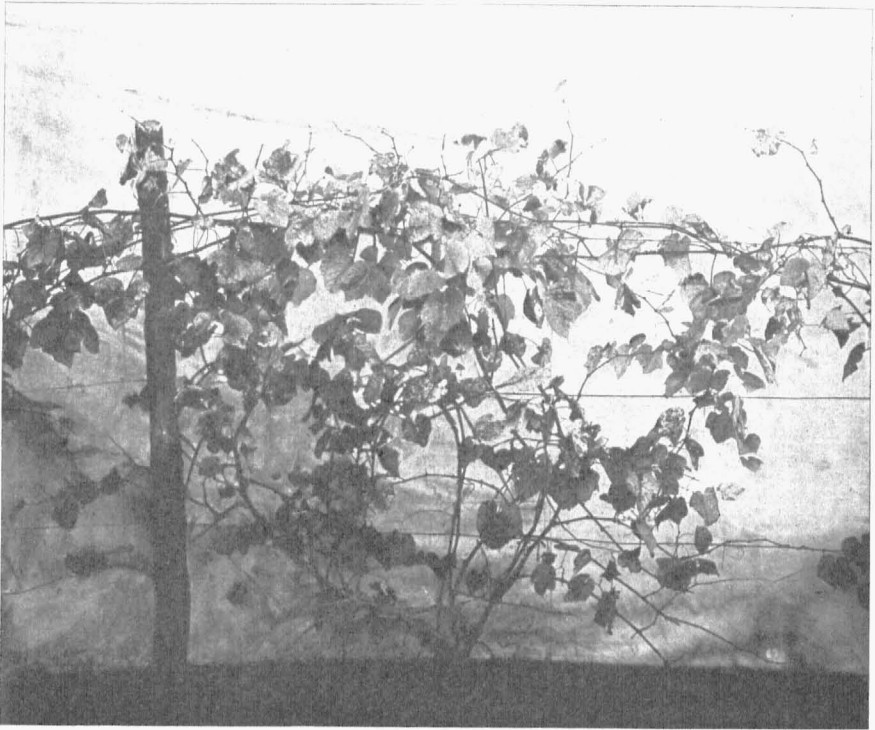
## ORIGIN OF AMERICAN GRAPES.

Nearly all the cultivated grapes of the United States, east of the Rocky mountains, originated from various native species found growing wild; by the early settlers of the country. Improvement of these wild grapes began by planting the seeds of the best of them and by cultivating and selecting the best of these seedlings. From the most promising of these cultivated vines seeds were again taken and planted, and so on until some of our cultivated varieties are many generations removed from the wild vine with which improvement started. As these seedling generations began to be cultivated they became more variable than the wild vines from which they descended, and improved forms appeared. Whenever a vine exhibited any particular merit it was propagated by means of cuttings, given a name and became known as a cultivated variety. In some cases wild vines have been found possessing sufficient merit to warrant their being propagated and named as distinct varieties. Neosho, one of our wine grapes and probably, also, Cynthiana and many others have been propagated directly from vines found growing wild in the woods. Improvement of our native grapes has progressed so rapidly in recent years that we now have more than 1000 named varieties in cultivation, though but few of these varieties are known to the average cultivator. Since our grapes may be grouped, or classified according to the species from which they sprang, a brief description (from a horticultural rather than from a botanical standpoint) of the species represented by the varieties mentioned in this bulletin is here given.

Our grapes are referred to the genus *Vitis* comprising numerous species, among which the following will be considered.

THE NORTHERN FOX GRAPE. *Vitis Labrusca*. (Linn). Native from New England to South Carolina and from the Allegheny Mountains eastward to the coast; not known in a

wild state, in the Mississippi valley, is the parent species of more than one half of our cultivated grapes, including the Concord, Hartford, Catawba and Niagara. Distinguished from all other species by its "continuous tendrils" or inflorescence, that is having a tendril or flower cluster opposite each leaf, while other species have "intermittent" tendrils, that is two leaves,



*Plate II.—Diamond, showing foliage shriveled and dropping prematurely; characteristic of Labrusca grapes here, at close of dry, hot summer.*

each with a tendril opposite it, and then a third leaf with no such tendril. The fruit clusters of the grape occupy positions corresponding to those of the tendrils, hence on account of this continuous arrangement grapes of the Labrusca species often bear three or more clusters of fruit in succession, on the same branch, while other species bear only two clusters of fruit in

succession, the third leaf having no tendril or fruit cluster opposite it. The leaves of *Labrusca* are large, thick and very cottony beneath, especially while young. It has, generally, very large berries and large bunches. Except when hybridized with some other species its fruit usually has a distinct musky flavor.

This species, which has produced more cultivated varieties than all other species combined, is generally regarded as occupying the most important position in the make up of our American grapes. Its numerous varieties furnish grapes of every shade from white to red and black, of every quality from bad to good and of various seasons from the earliest to the latest. A single one of its varieties, Concord, is more largely planted and marketed than all other varieties and when we include Moore's Early, Worden, Wyoming Red and other popular sorts, it will be seen that the bulk of American grapes, grown and marketed east of the Rocky Mountains, belong to this species. While various cultivated varieties of this species succeed well in Missouri and will probably long continue to be important here, it should be borne in mind that they are not so capable of enduring our summers, particularly if the season be dry and hot as are some of the species that are native to this region, and to the south and west.

**THE RIVER BANK GRAPE.** *Vitis riparia*. (Michx). This species is of wider distribution than any other native American grape, being found along the streams, in many parts of the United States and Southern Canada, east of the Rocky Mountains. It extends farthest north and is the hardiest of our grapes. It is the parent of Clinton, Bacchus and other well known varieties. As these cultivated varieties indicate, its fruit is small in both bunch and berry. It may be distinguished from other species by having very thin diaphragms at the nodes of the stem, small, light green, shiny glabrous leaves, almost or quite without hairyness beneath, large stipules and very early flowering habit. This species with some of its cultivated varieties has become of great importance in European vineyards by furnishing a phylloxera proof stock upon which to graft the European varieties. The vines of this species, are rank, tall, straggling growers. They are readily propagated by means of cuttings. While grapes of this species are reasonably

free from rot, they are more susceptible to the attack of leaf hoppers than any other species. During certain seasons varieties of this class have their foliage almost entirely destroyed by this insect when other species in the same vineyard are injured but little. In fact the attacks of this insect on varieties of *riparia* are a serious drawback to its successful culture in this section. In the number of cultivated varieties which this species has furnished it ranks next to *V. Labrusca*.



*Plate III.*—Clinton, vigorous growth but foliage injured by leaf hoppers at close of dry, hot summer; characteristic of *Riparia* grapes at the station.

THE SUMMER GRAPE. *Vitis Aestivalis*. (Michx). This species is common on uplands throughout the middle and southern states. It has given rise to such varieties as Herbemont, Norton, Cunningham and many others, differing so much in

size, color, flavor and other characteristics as to be quite in keeping with the great variability of the species. While the berries are usually of medium size they are sometimes quite large, in Ozark, a comparatively new variety being as large as those of *Labrusca*. The medium size of its berries is usually atoned for by the large sized symmetrical and often beautifully shouldered cluster. Some of its distinguishing botanical characteristics are its large, firm leaves which are more or less cottony,

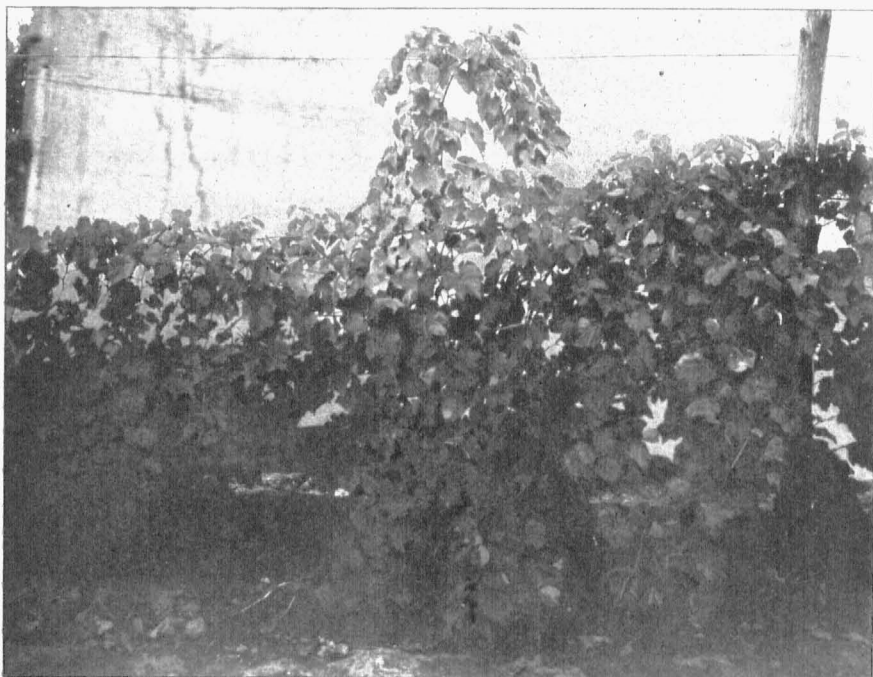


*Plate IV.—Neosho, showing vigorous growth and perfect foliage at close of hot, dry summer; characteristic of most Estivalis grapes at the station.*

dull, pale or glaucous and never shining beneath; also its short, rounded, downy stipules.

This species flourishes very abundantly, wild, in this state, and its cultivated varieties are admirably adapted to the climatic

conditions here, enduring the hottest, driest summers almost perfectly, being free from the attacks of leaf hoppers and, in most cases, reasonably free from rot. Its deep rooted vigorous habit and freedom from disease, render it a valuable kind upon which to graft certain other varieties. It furnishes some of our best table grapes as well as many that are admirably suited to wine making. It is believed that the *Aestivalis* is the



*Plate V.—America, showing vigorous condition and perfect foliage at close of dry, hot summer; characteristic of the post oak and rupestris hybrids.*

most promising species to which we may look in the future for varieties adapted to this section.

THE TEXAS POST OAK GRAPE. *Vitis Lincecumii*. (Buckley.) This grape was regarded by Engelmann as being a form of *V. Aestivalis* but was described by him as possessing

a more bushy habit, larger berries and a thicker coat of rusty down or tomentum than is typical of this species. Munson, who has taken a most prominent part in bringing the Post Oak grape into cultivation, regards it as a separate species, and the name, *V. Lincecumii*, is employed in designating the parentage of a number of his promising hybrids mentioned in this bulletin.

This species is a native to the Post Oak regions of Texas, extending northward into Arkansas and Missouri. It is said, by those who have studied it in its native habitat, to be one of the most resistant of drouth and heat of any of our native grapes. The behavior in our grounds of America, Beacon, Carman, Elvicand and others of Munson's hybrids, containing Post Oak blood, would certainly indicate the truth of this assertion. During the almost unprecedented drouth and heat of 1897, and the dry hot weather of the past season, these grapes maintained a freshness of foliage and normal growth of fruit, when most other varieties, particularly the *Vinifera* hybrids and the *Labruscas*, suffered severely.

**THE ROCK OR SAND GRAPE.** *Vitis rupestris*. (Scheele.) A low, bushy grape, with weak, deciduous tendrils, small, light green shiny leaves without lobes; berries middle sized, sweet, in small bunches. This grape does not climb much, and to the casual observer is almost as suggestive of a shrubby young cottonwood as of a grape vine. It grows very readily from cuttings and has been largely used as a stock upon which to graft other grapes, especially in France, its roots being immune to *Phylloxera*. This species is said to be immune to the grape rot. The pure *Rupestris* is growing on the Station grounds, but only one cultivated variety in our collection, America, a hybrid between *Lincecumii* and *Rupestris*, contains its blood.

Its valuable characteristics are immunity to fungous diseases and insects, the ease with which its cuttings strike root, its compact growth, within manageable limits, and the sweetness and dark rich coloring matter of its berries, said to be favorable to wine making.

**THE MUSTANG GRAPE.** *Vitis Candicans*. (Engelmann.) This grape, native of Texas and occasionally met with in

Florida, has as yet played very little part in the makeup of cultivated varieties of American grapes. While the berries are good size, the bunches are small. In Texas, the wild fruit is used for wine. This species is represented in cultivation by Elvicand, which is a cross between Elvira and the native Mustang grape. This variety originated by Munson is mentioned elsewhere in this bulletin.

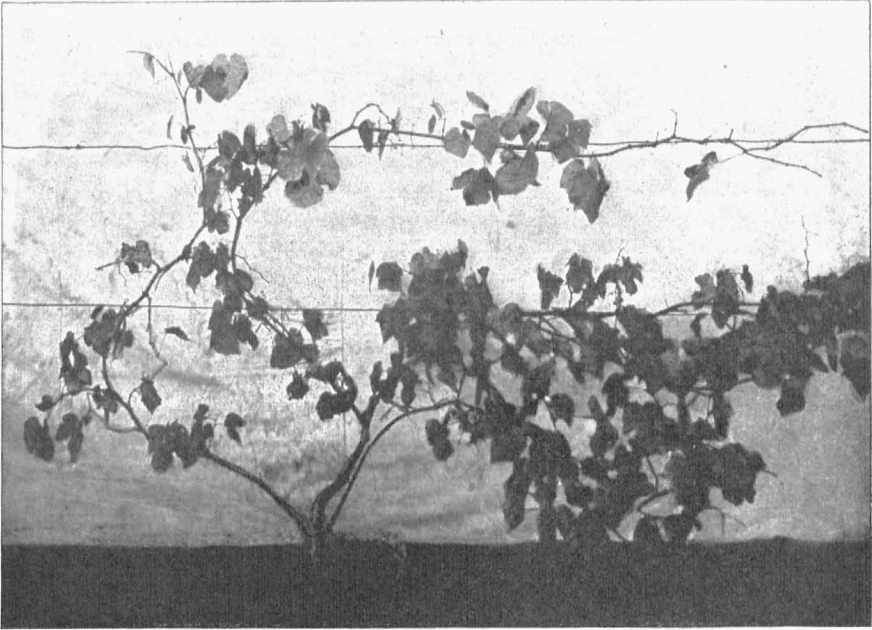
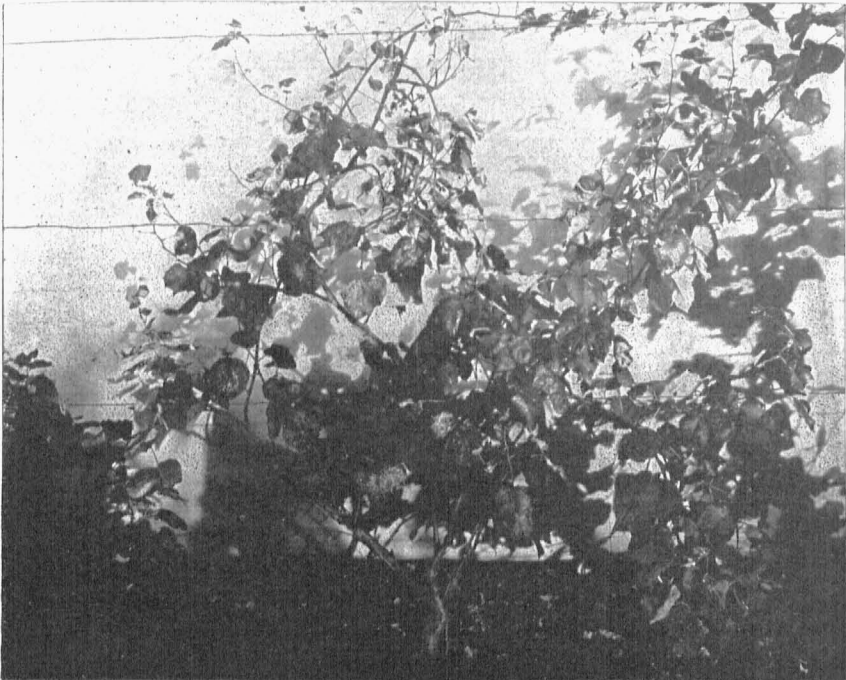


Plate VI.—Wilder, showing weak growth, injured by dry, hot summer; characteristic of *Vinifera* hybrids at the experiment station.

THE EUROPEAN GRAPE. *Vitis Vinifera*. (Linnaeus.) This is the grape of the Old World, in cultivation from time immemorial embracing the cultivated grapes of Europe. In this country it is cultivated in California and also furnishes the varieties forced in greenhouses. Its lack of hardiness and its susceptibility to disease in the eastern states prevents the cultivation of its pure forms, but hybridized with our native Ameri-



can varieties it has entered into the makeup of some of our finest table grapes, such as Delaware, the famous Roger's Hybrids and many others. These hybrids are usually lacking in hardiness and vigor, are subject to rot and other diseases, and yet their high quality imparted by the *Vinifera* parent, places them among our most important table grapes. With good culture, careful pruning and spraying to promote vigor and freedom from disease many of these hybrids succeed admirably in this state, except in unusually hot, dry summers.



*Plate VII.—Lindley, one of the most vigorous of the *Vinifera* hybrids at close of dry, hot summer.*

#### POSSIBLE DEMAND FOR SPECIAL VARIETIES.

We are often asked what are the best varieties of grapes to plant. This depends upon the purpose for which they are to be planted. If for market it depends upon the demands of the

market under consideration, and also upon the ability of the grower to create a definite demand, if that demand does not already exist. That variety is usually most in demand which is best known. With some people the Concord is the only grape wanted, because it is the only one that is well known to them. To some, any blue grape is a "Concord" regardless of size, flavor or date of ripening. In some places people have acquired a taste for Concord grapes, because of their predominance in the market, and they actually like them better than any other grape because of this acquired taste, for which they are not responsible. If they are buying table grapes they want prime Concord; if they make jelly they ask for Concord, slightly green; if they make a communion wine they use Concord, a little over ripe. This should not be understood as condemning the Concord—it only goes to prove that it is the most cosmopolitan of all our American grapes.

We have a large number of good varieties of American grapes. Different varieties are adapted to different purposes, as well as to different soils, localities and conditions. The Bushberg (Mo.) Catalogue describes 500 varieties, from which scores of kinds may be selected, any one of which may be better suited to some given purpose than is even the cosmopolitan Concord, or any other grape. Every year new varieties appear. Very rapid strides are now being made in the way of adapting these varieties to special purposes. The above facts are well known to every grape grower. They are not known to the general public. It is time the public discover that there are now many American varieties about equal in quality to the best European or California grapes. Why should the people of Missouri continue to pay ten or twenty cents per pound for California grapes, when our home grown product sells for two or three cents a pound? In Aminia, Brighton, Lindley, Brilliant, Goethe and many other sorts, we have varieties that are certainly as good as the California product, picked green and shipped half way across the continent.

The present rapid introduction of new varieties, adapted to special purposes, extends the grape season over a longer period, and adapts the grape to a greater number of special purposes. The improvement in the quality of certain kinds

renders the grape a more desirable dessert fruit. These facts increase the possibilities of a much larger consumption of the grape than now exists.

Some men make money by growing superior varieties and labeling them "Concord." The name suits the people; the improvement in quality suits them better. Once they buy such grapes they become anxious to secure this brand of "Concords" even at an advanced price.

Why not grow more of the best grapes; label them true to name; educate the consumers to an honest appreciation of the merits of each variety, as well as to the special purpose for which it is adapted, and thus increase the demand for a larger grape product? There are people in any market who want to buy good grapes, once they become acquainted with them. Goethe has sold here for eight cents per pound, to the few people who know its quality, when ordinary grapes were a drug in the market at two cents a pound.

#### OPINIONS OF REPRESENTATIVE MISSOURI GRAPE GROWERS.

In order to include in this bulletin the opinion of practical fruit growers, letters of inquiry were mailed to some of the leading grape growers of the state. Replies have been received from the following:

Hon. J. C. Evans, North Kansas City, Clay county, and Hon. L. A. Goodman, Westport, Jackson county, who, while located on the Missouri river hills in the western part of the state, have also extensive fruit interests in the Ozark regions of South Missouri and have given wide observation of the general fruit interests of the state. John Jaeger, of Neosho, Newton county, and Louis Zellner, of Granby, in the same county, represent Southwest Missouri. These two men were intimately associated with the late Hermann Jaeger, a vineyardist of national reputation.

S. H. Linton, of Marceline, Linn county, is a fruit grower of wide experience. His soil is the rich, rather heavy clay loam prevalent to the level districts of North Central Missouri.

Mr. G. E. Meissner, formerly of the grape firm of Bush & Son and Meissner, of Bushberg, Jefferson county, is certainly one of the most experienced grape growers in the state. Probably no one in the state is acquainted with a larger number of varieties or has more thoroughly tested the various methods of management of the different sorts of grapes than he. His location enables him to speak particularly of those conditions which prevail on the islands in the Mississippi river, south of St. Louis.

Judge Samuel Miller, of Bluffton, Montgomery county, and Jacob Rommel, of Morrison, Gasconade county, are well known as originators of popular varieties, and as writers upon the grape. They represent Central Missouri, being located on the highlands along the Missouri river.

Hon. N. F. Murray, of Oregon, Holt county, is located on the "loess" or drift formation in Northwest Missouri and as an officer of the State Horticultural Society and Farmer's Institute worker has had an opportunity to make wide observations upon Missouri fruit growing.

Mr. J. T. Snodgrass, of West Plains, Howell county, represents progressive fruit growing as it exists in the deep, rich, flinty soils of the Ozark region in South Central Missouri.

Mr. S. H. Van Trump, of Elmira, Ray county, is in a position to speak intelligently of the best methods to be employed on the "loess" formation northwest of Central Missouri.

Henry Wallis, of Wellston, St. Louis county, is one of the most experienced grape growers on the highlands near St. Louis. He has originated some of the handsomest and most valuable new varieties now coming into prominence in the state.

These gentlemen are not only experienced and successful growers but they are located in different parts of the state, and the opinions of each should be reliable for his soil and conditions, and of great value to grape growers.

The questions proposed, together with the replies received, are here given as follows:

1. What soil, slope and location do you prefer for grapes; and can the soil be made too rich?

A good fertile soil on a northeast or east slope. Can not be too rich unless it has an excess of humus.

J. C. EVANS,  
Western Missouri.

Southeast slope; high, with lower land close by. Soil porous, subsoil not tenacious. Soil may be too rich.

L. A. GOODMAN,  
Western Missouri.

Dry, gravelly land sloping north. JOHN JAEGER,  
Southwest Missouri.

East and northeast, level or sloping. The soil may be made too rich with humus. Good corn land is rich enough for grapes.

S. H. LINTON,  
North Missouri.

Will do well in almost any soil if well cultivated. Southern slope on hilly land. On sandy land of Meissner island three year old vines, trained to overhead trellis average 20 pounds.

G. E. MEISSNER,  
East Missouri.

Eastern or southeastern slope; clay loam and if a little sandy all the better. Too rich land results in too much wood growth and poor flavor.

SAMUEL MILLER,  
Central Missouri.

South slope, well drained. Not much danger of getting land too rich but too much stable manure may be used.

N. F. MURRAY,  
Northwest Missouri.

South hillsides; clay soil underdrained, and not too rich.

JACOB ROMMEL,  
Central Missouri.

Northwest slope. Our soil is heavy and rich, surface covered with broken rock.

J. T. SNODGRASS,  
South Missouri.

On southern slope of upland yellow sandstone soil, called "loess" our grapes ripen five days earlier than some varieties on lowlands. Soil here is rich enough if grapes are properly pruned.

S. H. VAN TRUMP,  
North Missouri.

Eastern or southeastern slope; high dry, somewhat sandy clay soil. Do not believe the soil can be made too rich.

HY. WALLIS,

East Missouri.

Any location or soil so long as good drainage is secured. Soil may be made too rich for rank growers.

L. ZELLNER,

Southwest Missouri.

2. What varieties of grapes would you recommend for commercial list, in your locality, named in order of ripening? Moore's Early, Worden, Diamond and Concord.

J. C. EVANS,

West Missouri.

Moore's Early, Worden, Concord, Niagara, Pocklington, Goethe and Norton.

L. A. GOODMAN,

West Missouri.

Perkins, Ives, Concord, Delaware, Elvira, Martha, Norton and Munson.

JOHN JAEGER,

Southwest Missouri.

Campbell's Early, Green Mountain, Worden, Brighton, Concord, Niagara, Catawba and Labelle.

S. H. LINTON,

North Missouri.

Moore's Early, Champion, Concord, Worden, Niagara, Delaware, Brighton, Norton, Cynthiana and Goethe.

G. E. MEISSNER,

East Missouri.

Moore's Early, Worden, Concord, Diamond, Niagara, Woodruff's Red and Norton. Of new varieties, Campbell's Early, McPike, Hicks and Kentucky.

S. MILLER,

Central Missouri.

Moore's Early, Worden, Concord and Niagara.

N. F. MURRAY,

Northwest Missouri.

Campbell's Early, Moore's Early, Perkins, Diamond, Ives, Lady, Lutie, Concord, Niagara, Wilder, Delaware, Martha, Empire State, Elvira, Norton, Pocklington, Goethe, Catawba, Woodruff Red, Grein's Golden.

JACOB ROMMEL,

Central Missouri.

- Moore's Early, Worden, Niagara, Goethe and Delaware.  
J. T. SNODGRASS,  
South Missouri.
- Moore's Early, Early Victor, Worden, Concord, Ozark,  
Diamond, Niagara and Goethe. S. H. VAN TRUMP,  
North Missouri.
- Moore's Early, Campbell's Early, Worden, Hicks,  
Brighton, Niagara, Concord, Woodruff Red, Norton and  
Goethe. HY. WALLIS,  
East Missouri.
- Early Ohio, Early Victor, Moore's Early, Perkins, Dela-  
ware, Concord, H. Jaeger, Niagara, Wilder and Diana.  
L. ZELLNER,  
Southwest Missouri.
3. What varieties for home table use?  
Moore's Early, Worden, Diamond, Delaware and Concord.  
J. C. EVANS,  
West Missouri.
- Moore's Early, Worden, Niagara and Goethe.  
L. A. GOODMAN,  
West Missouri.
- Concord and Delaware. J. JAEGER,  
Southwest Missouri.
- Campbell's Early, Moore's Early, Brighton, Green Moun-  
tain, Worden, Pocklington, Delaware and Clinton.  
S. H. LINTON,  
North Missouri.
- Campbell's Early, Green Mountain, Brighton, Delaware,  
Diamond, Concord, August Giant, Empire State, Goethe and  
Lady Washington. G. E. MEISSNER,  
East Missouri.
- Campbell's Early, McPike, Hicks, Norton and Kentucky.  
S. MILLER,  
Central Missouri.
- Moore's Early, Worden, Concord, Niagara, Agawam and  
Goethe. N. F. MURRAY,  
Northwest Missouri.

Campbell's Early, Moore's Early, Delaware, Concord,  
Lutie, Woodruff Red, Niagara and Goethe.

JACOB ROMMEL,  
East Missouri.

Moore's Early, Delaware, Niagara and Goethe.

J. T. SNODGRASS,  
South Missouri.

Moore's Early, White Imperial, Matchless, Concord and  
Goethe.

S. H. VAN TRUMP,  
North Missouri.

Campbell's Early, Moore's Early, Early Victor, Green  
Mountain, Worden, Hicks, Niagara, Diamond, McPike,  
Wilder, Brilliant, Mo. Takay and Goethe.

HY. WALLIS,  
East Missouri.

Delaware, Brilliant, Elvira, Martha, Carman, Concord,  
Goethe and Fern Munson.

L. ZELLNER,  
Southwest Missouri.

4. What is your method of winter pruning?

Renewal system for most sorts: Get rid of all the old  
wood you can, leaving enough new wood to produce a crop.

J. C. EVANS,  
West Missouri.

Renewal system, leaving two or three canes and spurs.

L. A. GOODMAN,  
West Missouri.

Spur system.

JOHN JAEGER,  
Southwest Missouri.

Renewal system.

S. H. LINTON,  
North Missouri.

Depends upon the condition of the vine. Spur system for  
weak vines; renewal for strong vines. Would not use the largest  
canes.

G. E. MEISSNER,  
Central Missouri.

Use long canes (renewal) for some sorts, spur back to  
three eyes for others.

S. MILLER,  
Central Missouri.

In March cut laterals back to three to twelve inches.

N. F. MURRAY,  
Northwest Missouri.



In early winter cut away all wood except three or four canes, each four or five feet in length, for fruiting, and four or five spurs near the ground, cut to two buds each for renewal.

JACOB ROMMEL,

Central Missouri.

Cut back to two or three eyes, save all the new wood possible; renew the canes every year or two.

J. T. SNODGRASS,

South Missouri.

Standard spur system, advocated and popularized by Geo. Hussman.

S. H. VAN TRUMP,

North Missouri.

Cut away all bearing wood of last year, leaving three or four canes cut to five or eight eyes each and two or three spurs with two eyes.

HY. WALLIS,

East Missouri.

Renewal for Labruscas; spurs on old wood for Riparias and Aestivalis.

L. ZELLNER,

Southwest Missouri.

5. Do you summer prune? (Yes or no.)

All except L. A. Goodman, S. H. Linton, G. E. Meissner and N. F. Murray summer prune.

6. Do you prefer to train to a wire trellis or to stakes?

All use wire trellis except Mr. Snodgrass who prefers trellis for loamy soil but uses stakes to facilitate cultivating both ways where land is stony.

7. Do you prefer to run the rows north and south or east and west?

All run rows north and south except N. F. Murray, L. Zellner and Jacob Rommel.

8. How far apart, each way, do you plant?

J. C. Evans, L. A. Goodman and L. Zellner plant 8x10 feet. J. Jaeger, S. Miller and J. T. Snodgrass prefer 9x10 feet. S. H. Linton says 8x8 or 8x10 feet, and G. E. Meissner 8x9 or 8x10 feet. N. F. Murray plants 8x8 feet. Jacob Rommel says 6x8 feet. S. H. Van Trump plants 10x10 feet and Hy. Wallis prefers 8x8 to 9x9 feet. All agree that strong growers should be given more room than weak growers.

9. What is your method of cultivation?

All agree in giving clean, but shallow cultivation until about midsummer when cultivation should cease to allow wood to ripen. Mr. Van Trump ridges the rows slightly after three years.

10. Do you spray? If so, with what success?

All are successful in checking rot by spraying with Bordeaux mixture except Mr. Goodman, whose grapes have never show any rot; Judge Miller who has not been successful in making the spray stick in wet times; N. F. Murray who says he ought to but does not, and Mr. Van Trump who recommends one spraying with copper sulphate solution before the buds start. Early spray emphasized by nearly all.

11. What is your plan of picking, packing and marketing?

Ten pound baskets, open for local market, covered for shipping.

J. C. EVANS,

Pick and pack in baskets in the vineyard.

L. A. GOODMAN,

Pick and repack for market.

S. H. LINTON,

Twenty pound baskets with paper covers by boat; nine pound baskets by express.

G. E. MEISSNER,

Gather in a clear dry day and ship in ten pound and twenty pound baskets.

S. MILLER.

Best ripe bunches, all imperfect berries removed, packed in nine pound baskets.

J. ROMMEL.

Pick in one half bushel baskets, using grape shears; pack in seven and one half pound baskets and ship on orders.

J. T. SNODGRASS,

Market in eight pound and ten pound baskets as demanded.

S. H. VAN TRUMP,

Cut when fully ripe and market at wholesale in St. Louis in ten pound or twenty pound baskets.

HY. WALLIS.

12. What comparatively new varieties have you tried, and what are the especial merits of each?

Moore's Early and Worden.

L. A. GOODMAN,

North Missouri.

Campbell's Early.

S. H. LINTON,

North Missouri.

Campbell's Early and McPike will be leading sorts and Hicks is unsurpassed in quality.

Colerain quality unsurpassed but very small; would not recommend it.

N. F. MURRAY,  
Northwest Missouri.

Campbell's Early and Woodruff Red unsurpassed. Lutie much like Woodruff Red but very early.

JACOB ROMMEL,  
Central Missouri.

Campbell's Early is good; Early Ohio is of no value with us; Brilliant is fine, vine a little tender; Pocklington does poorly; Herbemont and Cunningham fine but rot; Elvira does well and is delicious.

J. T. SNODGRASS,  
South Missouri.

White Imperial best and earliest white grape; Matchless is a superior early black grape of highest quality; Ozark is the best large, late grape we have ever fruited. We have about forty varieties.

S. H. VAN TRUMP,  
North Missouri.

Campbell's Early and McPike are unsurpassed for growth, health, hardiness, size and quality for home or market. The Hicks combines more good qualities than any other black grape I know. Woodruff Red is superior to Goethe. Diamond is very delicate but a poor grower here. Green Mountain is a strong grower and fine early table grape. Lady Washington is a fine late sort. Eaton is praised too much. Pocklington is not valuable. Etta is worth less than Elvira. Champion, Hartford, Ives, and Janesville are not worth growing.

HY. WALLIS,  
East Missouri.

EFFECTS OF THE SEVERE WINTER OF 1898-9 UPON DIFFERENT VARIETIES OF GRAPES.

Since the foregoing was prepared for publication the very severe cold weather of January and February, 1899, has injured some varieties that usually winter safely here. The cold was unusually prolonged, the coldest weather being twenty-six degrees below zero.

The following varieties had their wood badly discolored nearly to the ground, though not killed : Duchess, Beacon, Lady, Naomi, Peter Wylie, Creveling, Jaeger, Iona, Gazelle, Black Eagle, Peabody, North Carolina, Israella, New Haven, Othello, Roger's No. 2, Jewel, Rommel, Black Defiance and Ragan.

The following were slightly injured : Eaton, Beauty, Am-inia, Norfolk, Brilliant, Iron Clad, Green Mountain, Venango, Amber Queen, Montefoire, Vergennes, Early Victor, Taylor Bullit, Ives, Janesville and Lady Washington.

Other varieties listed in this bulletin were uninjured.