VARIATIONS OF VARIETY CHARACTERISTICS IN TOMATO PRODUCTION.

THESIS

PRESENTED BY

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FOR

DEGREE

OF

MASTER OF HORTICULTURE.

INTRODUCTION.

Variations in the behavior of tomatoes as influenced by various methods of culture and training have been noted by investigators for many years and careful study of their work reveals some real or possibly apparent contradictions. Certain methods of training for example are said by some to greatly increase the size of the fruit while another reports that the increase in size was very slight for this particular method.

In order to determine the methods suited to Kentucky conditions, considerable data was taken, a part of which is given in the following tables.

The seed for the varieties here considered were secured from the same strain in order to eliminate any differences that might occur from that factor. Myers (6) found in his study of variety strains that -- "it has been shown that variations occured in yield of more than thirteen tons per acre of marketable fruit. These differences must be attributed, not to environment -- but to heredity, etc."

The seeds were planted the first week in March in flats and transplanted into pots when the second leaves

appeared. The plants were grown in the greenhouse till about April 15th when they were put into cold-frames and planted in the field as near May 10th as possible.

Ten plants of each variety were grown for comparisons with one alternate to be used in case of accident.

The plants which were neither pruned nor staked are spoken of as "running." These were set in the field 4 feet apart in rows 6 feet apart. Staked and pruned vines were planted 2 feet apart in rows 4 feet apart. These were allowed to grow until they were 12 to 15 inches in height when they were staked and pruned to one stem.

VARIATIONS IN CHARACTERS OF VARIETIES, RUNNING.

Ten varieties were observed in this series thru 3 years except Santa Rosa as shown in Table I. Considerable variations occured from year to year. In 1917 the weather conditions were very favorable while in 1918 and 1919 the crop was shortened considerably by draught. It will be noticed that the highest yielding variety one year may not be another. It is apparent therefore that varieties are not all affected alike by the varying conditions of weather, soil and culture. Red Head, Stone, Greater Baltimore and Early Detroit suffered more than the others from draught in 1919. Beauty was uniform in size, shape and color, quality fair. Bonny Best was one of the most satisfactory because of its quality and uniformity of size and shape of fruit, as well as productiveness. Chalk's

Jewell was the most consistent in production, somewhat variable in size and fair in quality. Red Head averaged rather small, uniform in size and shape, fair in quality. Stone was uniform in size and shape, medium to large, productive, fair in quality. Sunrise, similar to Earliana, irregular in size and shape, only fair in quality. Santa Rose, similar to Ponderosa but not so large and more regular in shape, quality good.

TABLE I

Variations in Yield of Running Vines

Variety	Yield of marketable fruit, in pounds from ten plants			
	1917	1918	1919	Average
Beauty	147.5	97.3	74.6	106.4
Bonny Best	142.1	100.7	97.1	113.3
Chalk's Jewel	160.1	127.7	111.3	133.
Red Head	181.5	138.6	63.1	127.7
Stone	145.6	126.	50.1	107.2
Sunrise	172.6	101.2	88.6	130.8
Santa Rosa		124.5	82.6	103.5
Earliana	146.4	105.	87.9	113.1
Greater Baltimore	144.3	106.1	76.5	108.9
Early Detroit	147.2	142.1	61.	116.7

Earliana, irregular in size and shape, productive, quality fair. Greater Baltimore, similar to Stone but earlier, smaller in size and somewhat irregular in size. Early Detroit, uniform in size shape and color, quality

very good, often cracks badly.

All varieties were sprayed with Bordeaux Mixture, and were very free from diseases. The growth was vigorous and apparently normal.

Conclusions: These data show that the better strains of tomato varieties such as were used for these data, when grown with no training or pruning, do not have any very striking differences as far as total production is concerned. The selection of a variety depends largely on the use that is to be made of the fruit and therefore, quality and uniformity of size, shape and color should be considered as well as productiveness.

VARIATIONS IN CHARACTERS OF VARIETIES, STAKED AND PRUNED TO ONE STEM.

The yield of marketable fruit from the ten varieties in this series will be found in Table II.

It is often said that certain varieties cannot stand pruning while others respond to it and produce improved crops from its practice. Green (4) says "avoid the extremely early sorts, such as the Earliana class, which under most conditions cannot stand severe pruning."

It will be noted in this connection that the variety Earliana gave the lowest average for the three years but the difference in the average for Earliana is very slight. Other varieties of the Earliana type such as Red Head and Sunrise did not show a falling off in yield

as the result of pruning. Such varieties as Beauty, Stone and Early Detroit, none of which are of the Earliana type, averaged slightly higher and in several instances as in Beauty in 1917 and in 1919 gave a yield less than that of Earliana. Santa Rosa gave a high average for the two years but Bonny Best, Greater Baltimore and Chalk's Jewel gave the best averages in the order named.

TABLE II

Variations in Yield of Marketable Fruit From Plants When Staked and Pruned, in Pounds From Ten Plants.

Variety	1917	1918	1919	Average
Beauty	36.1	64.9	49.3	50.1
Bonny Best	61.4	50.4	67.7	59.8
Chalk's Jewel	56.3	46.	64.	55.4
Red Head	47.8	50.1	53.1	50.3
Stone	47.1	65.8	49.6	54.1
Sunrise	52.5	42.7	61.1	52.1
Santa Rosa		65.	70.6	67.8
Earliana	41.9	45.7	58.	48.5
Greater Baltimore	57.6	71.6	43.5	57.5
Early Detroit	47.1	68.9	45.3	53.7

Conclusions: From these facts we may conclude that the variations of yield in varieties as affected by pruning are not as great as have been supposed and it will be noted that the varieties gave a more uniform yield when pruned than when they received no pruning. Varieties of the Earliana Type appear to be affected as much as any

by severe pruning but the differences are not clear cut.

It will be observed by comparisons between the pruned and unpruned vines that the yield per plant was reduced by pruning but this is offset by the greater number of plants that may be used on an acre.

VARIATIONS IN EARLINESS OF RIPENING AS INFLUENCED BY STAKING AND PRUNING.

The earliness of ripening is a very important factor from the standpoint of profits in tomato production since the price usually drops very materially soon after the general crop begins to ripen. Any methods that will hasten the ripening period are therefore eagerly sought after by market gardeners. Staking and pruning is the usual method employed to accomplish this purpose. However, the grower is anxious to know to what extent the staking and pruning will hasten the maturity of the crop and very little data can be found on this point.

Rosa (8) says, "pruning to a single stem will give a comparatively early crop of fancy fruit." Green (4) found that a plant thus grown, ripens its fruits much earlier than does a plant allowed to grow unpruned on the ground. Thompson (11), Whipple (13) and Schermerham (13), Kyle (3), Bailey and Corbett (1), Stone (10) and others report that fruit will ripen earlier when staked and pruned. Lloyd and Brooks (5) in their experiments found that "plants pruned to single stems sometimes ripen their first specimen earlier than the unpruned plants but in other cases,

the reverse was true. In every instance the plants pruned to single stems produced low yields of early tomatoes and on the average these yields were much lower than those from plants less severely pruned or left unpruned."

TABLE III

Days Increase in Earliness by Staking and Pruning

Season 1919.

	10%	25%	50%
Beauty	6	9	9
Bonny Best	6	2	3
Chalk's Jewel	6	1	1
Red Head	10	13	2
Stone	-3	2	4
Sunrise	5	5	6
Santa Rosa	2	3	2
Earliana	5	4	4
Greater Baltimore	15	9	3
Early Detroit	8	3	2
Average	7 days	5.1 days	3.6 days

In summing up these reports it appears that it is generally agreed that staking and pruning hastens the maturity of the fruit while some indicate that the increase in earliness is rather slight or may even be delayed by this treatment.

In order to determine the extent that staking and pruning have in hastening maturity, daily pickings (except

Sunday) were made through the 1919 season.

In Table III will be found the increase in earliness in days for 10, 25 and 50 percent of the crop of each variety.

In the case of Greater Baltimore the first 10% of the crop was produced 15 days earlier than on the unpruned vines. This was the greatest increase in earliness and was followed by a rapid decline in yield toward the end of the season. Red Head was earlier by 10 and 13 days, respectively for the first 10 and 25% of the crop but half the crop was produced only two days earlier. In only one case was earliness delayed by pruning. The first 10% of the Stone crop was 3 days later than those unpruned. However, by the time 25 and 50% of the crop were produced there was an increase of 2 and 4 days respectively. Averaging the varieties, 10% of the crop was borne one week earlier on the pruned vines than on the unpruned. 25% of the crop was 5.1 days and 50% of the crop 3.6 days earlier by staking and pruning.

The relative earliness of the varieties are indicated in Table IV. In this table the average number of ounces produced per plant was taken for running and those staked and pruned to and including the following dates: July 25, August 1, August 10 and August 30 when the season closed.

A number of surprises were noted in examining this

TABLE IV

Variations in Earliness of Ripening.

Ounces Marketable Fruit Per Plant. Season 1919.

Varieties	July 25		Aug. 1		Aug. 10		Aug. 30	
	*R.	**S & P	R.	S & P	R.	S & P	R.	S & P
Beauty	1.1	2.4	1.9	5.7	12.2	36.2	118.4	78.8
Bonny Best	4.2	5.4	7.8	16.0	54.2	55.2	155.2	108.3
Chalk's Jewel	10.0	9.4	16.1	15.6	67.5	42.5	177.6	102.4
Red Head	13.0	25.8	15.6	28.8	46.0	39.1	100.9	84.9
Stone	7.4	6.5	10.2	10.5	21.9	28.2	80.1	79.3
Sunrise	2.3	2.9	5.4	14.6	47.8	64.2	141.7	97.7
Santa Rosa	2.2	3.8	3.3	5.3	21.3	36.4	132.1	112.9
Earliana	6.0	5.1	10.5	14.0	37.1	56.9	140.6	92.8
Greater Baltimore	6.6	10.0	6.6	14.0	22.2	28.5	122.4	70.6
Early Detroit	4.6	6.8	5.5	11.4	33.7	31.4	97.6	72.4
Average	5.7	7.8	8.2	13.5	36.3	41.5	126.6	90.0
Difference in favor of pruned vines		2.1		5.3		5.2		-36.6

*R - Running

**S & P - Staked and Pruned

data. It was found that some of the varieties usually spoken of as mid-season or late, produced more marketable fruit by August 1, than some varieties called early. However, the order was changed considerably by August 10. Since the price usually declines rapidly after August 10, the varieties are given in order of their production of marketable fruit from unpruned and unstaked vines on or before that date. Chalk's Jewel, Bonney Best, Sunrise, Red Head, Earliana, Early Detroit, Greater Baltimore, Stone, Santa Rosa and Beauty. The staking and pruning changed the order as follows: Sunrise, Earliana, Bonny Best, Chalk's Jewel, Red Head, Santa Rosa, Beauty, Early Detroit, Greater Baltimore and Stone. Earliness of ripening is often calculated by the ripening of the first specimens.

If the date of ripening of the first fruits is taken as a criterion of their earliness the order stands as follows: Red Head, Chalk's Jewel, Greater Baltimore, Earliana, Stone, Bonny Best, Early Detroit, Sunrise, Santa Rosa and Beauty. This order is quite at variance with the quantity of early fruit that each produced. Therefore we may conclude that the date of the first mature fruits are not always a correct basis for classifying varieties according to earliness.

By reference to Table IV it will be noticed that on the average the staking and pruning increased the early product per plant in the fore part of the season. By

July 25 the difference in favor of pruning was 2.1 ounces per plant and increased to 5.3 ounces by August 1 and 5.2 ounces by August 10 after which they fell off rapidly in yield and at the end of the season produced 36.6 ounces per plant less than those that were not staked and pruned.

Figures I to V show that the advantage in early production by staking and pruning is in the first part of the season. After the first 25 to 50% of the crop is produced on the staked and pruned vines, the yield does not equal that of the untrained vines.

Conclusions: Staking and pruning hasten the early production of the first 10 to 25% of the crop by approximately one week and the first half of the crop by 3 or 4 days.

Varieties are usually disturbed from their normal period of ripening by staking and pruning and sometimes results in retarded ripening altho this is not usually the case.

From the standpoint of varieties which will bear a large proportion of their crop early in the season, Chalk's Jewel, Bonny Best, Sunrise, Earliana and Red Head are dependable.

VARIATIONS IN THE SIZE OF FRUIT OF THE VARIOUS VARIETIES AS INFLUENCED BY STAKING AND PRUNING.

Observations have frequently been recorded of increased size of fruit by staking and pruning and occasionly evidence is produced to show that there is no in-

crease in size from this practice.

Stuckey and Temple (9) state that "the fruit on the pruned, staked vines was larger---than on the unpruned, unstaked vines."

Green (4) says "The fruit averages larger in size" in speaking of the effect of staking and pruning to one stem.

Lloyd and Brooks (5) find that "Pruning to single stems not only failed to increase the size of the early fruit but also reduced the foliage to such an extent that the fruit was badly exposed, sunburning and cracking of the fruit followed."

Earle (2), Stone (10) and others find the size definitely increased by pruning. Olney (7) reports that "the average increase in the size of the fruit for the twenty-seven varieties grown in 1918 was 10½ percent."

Data taken on this point in 1919 is found in Table V. It will be noticed that there is considerable variation among varieties. Beauty, Bonny Best, Red Head, Sunrise, Earliana and Early Detroit showed only slight increases in the size of the fruit from pruning. The fruit of Chalk's Jewel, Stone, Santa Rosa and Greater Baltimore was decidedly larger on the staked and pruned vines. The greatest increase in size was made in the case of Stone in which the increase was 2.1 ounces per fruit or 37½ percent.

An average of the ten varieties gave an increase

of nearly 17 percent. Reference to figures Nos. 6 to 15 show that the greatest difference in size occurs during the latter part of the season when the unpruned vines dwindle rapidly in size.

TABLE V

Variations in Size of Fruit on Pruned and Unpruned Vines, Average Weight of One Fruit.

Variety	Running	Staked and Pruned	Increase by Pruning
Beauty	5.8 ozs.	6.3 ozs.	.5 ozs.
Bonny Best	5.2 "	5.7 "	.5 "
Chalk's Jewel	5.1 "	6.4 "	1.3 "
Earliana	5.8 "	6. "	.2 "
Early Detroit	5.1 "	5.4 "	.3 "
Greater Baltimore	5.2 "	6.2 "	1. "
Red Head	4.7 "	5.5 "	.8
Santa Rosa	7.3 "	9.3 "	2. "
Stone	5.6 "	7.7 "	2.1 "
Sunrise	5.5 "	6.1 "	.6 "
Average	5.5 "	6.4 "	.9 "

Conclusions: The average size of the fruit is definitely increased by staking and pruning. The amount of increase in size depends largely on the variety and ranges from zero to two ounces per fruit.

Varieties of the Earliana type appear not to be very responsive to increases in size of the fruit by pruning.

The size of the early fruit is not materially affected by pruning but the size during the latter part of the season when the fruit of unstaked, unpruned vines dwindles rapidly in size.

SUMMARY

1. Untrained, unpruned tomatoes of good strains gave no striking differences in total production but there was a marked difference in the quality and the uniformity of size, shape and color.

2. Staking and pruning to one stem gave a more uniform production of marketable fruit than when unpruned and untrained. Varieties of the Earliana type appear to be least suited to severe pruning altho the total yield of marketable fruit was practically equal to the others.

3. Staking and Pruning hastens the maturity of the first 10% of the crop by approximately one week and the first half of the crop by three or four days. The date of maturity of the first specimens is not a true indication of the relative earliness of a variety.

4. The fruit of some varieties average materially larger when the vines are staked and pruned while others are only slightly increased in size, as an average for the season.

The early or first part of the crop is not materially increased in size but the size is maintained thruout the season, whereas those on unpruned vines dwindle rapidly in size toward the end of the season. Varieties of

the Earliana type do not respond to increased average size of fruit to the same degree that many others do. The average increase in size of fruti for all varieties by staking and pruning was nearly 17 percent.

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FIG. I-V _ Variations in Earliness of Ripening as influenced by Staking & Pruning

FIG. I.

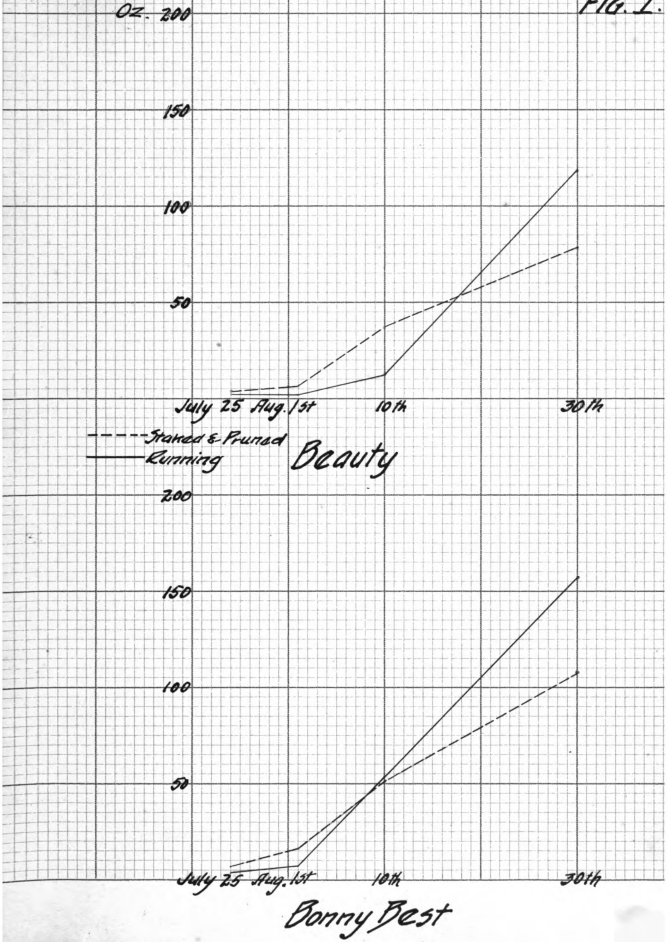
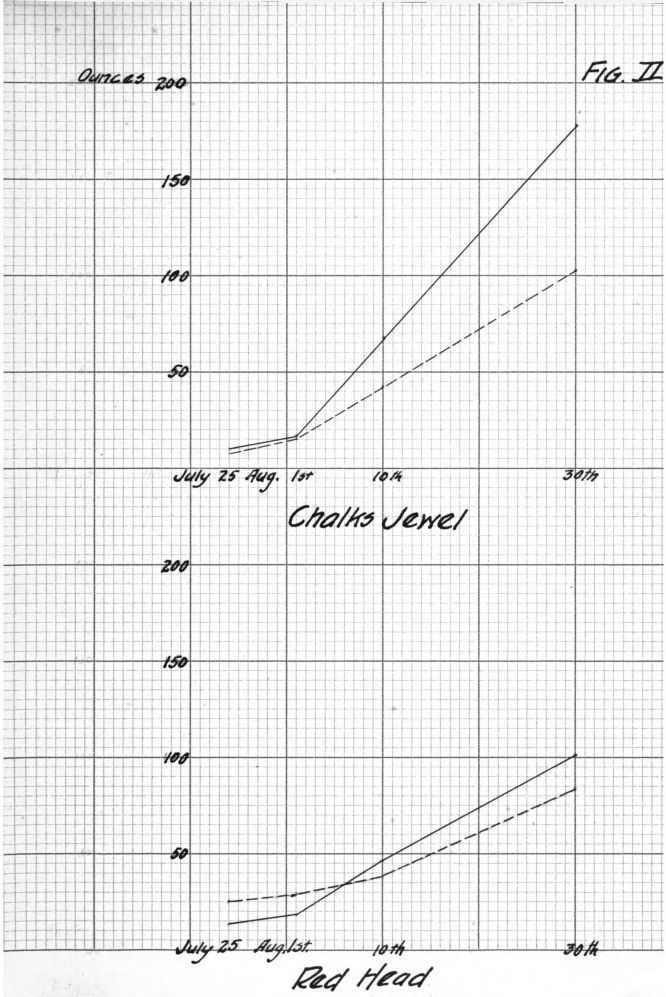


FIG. II


Ounces
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50
July 25
Aug. 1st
10th
30th
Chalks Jewel
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150
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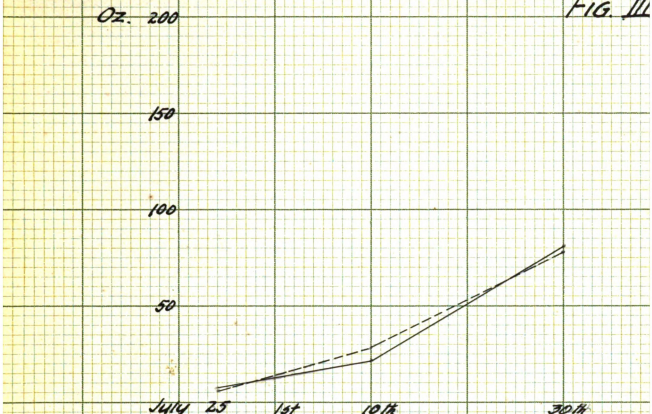
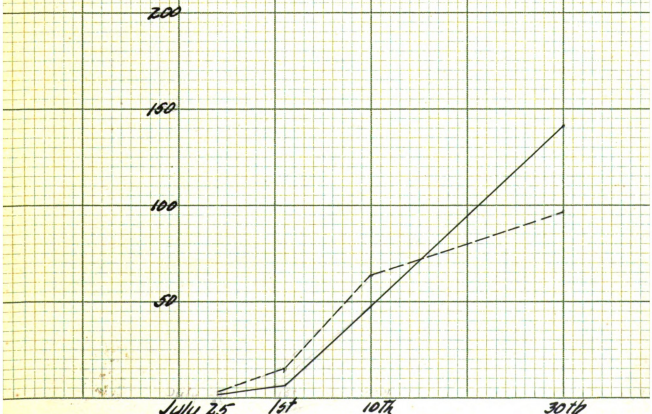
Aug. 1st
10th
30th
Red Head

FIG. III

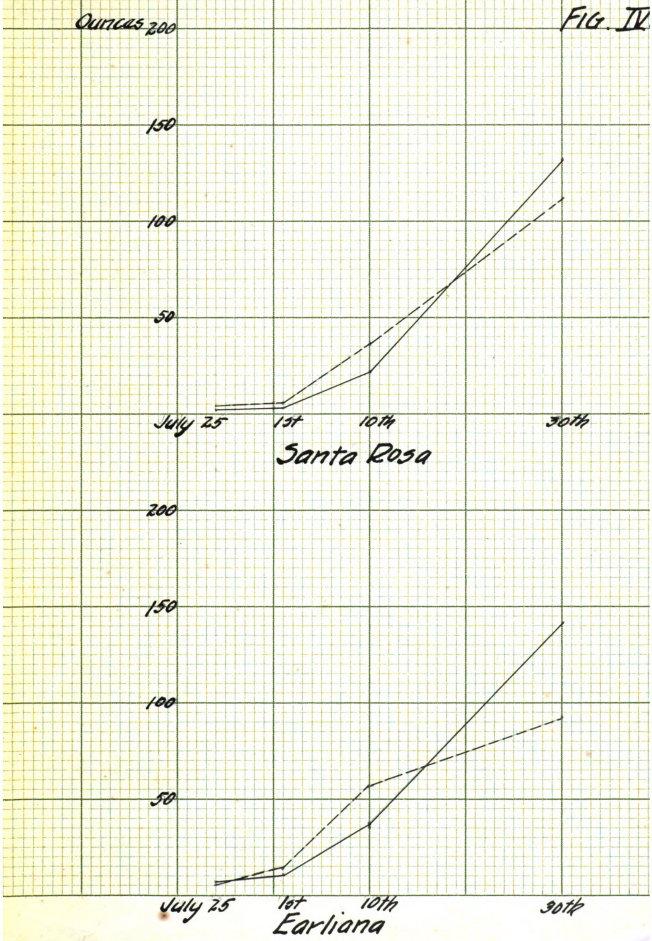


Stone



Sunrise

FIG. IV.


Ounces
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July 25
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Santa Rosa
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July 25
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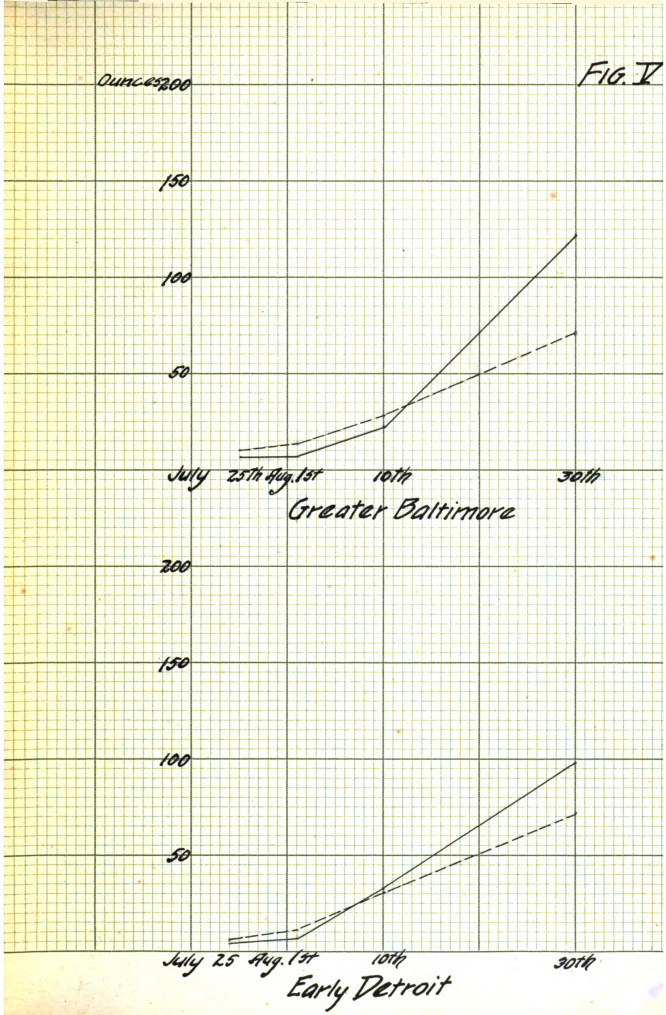
30th
Earliana

FIG. V


Ounces
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July 25th
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Greater Baltimore
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10th
30th
Early Detroit

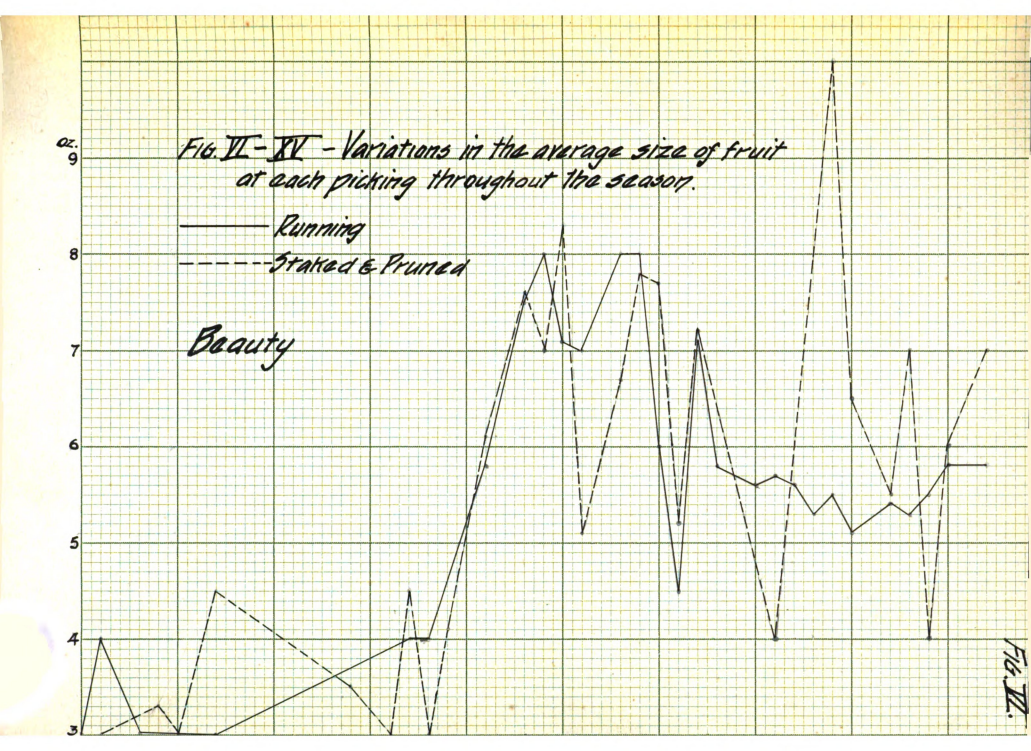
oz.
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Fig. VI - XV - Variations in the average size of fruit at each picking throughout the season.
Running
Staked & Pruned
Beauty
Fig. VI.

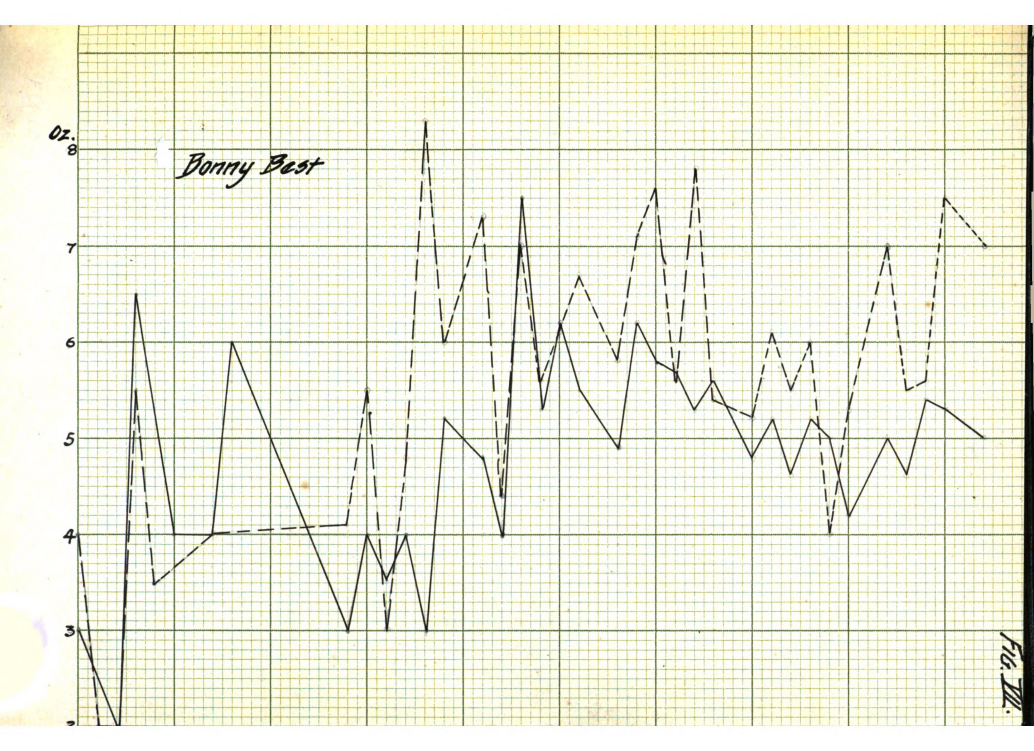


Fig. III.

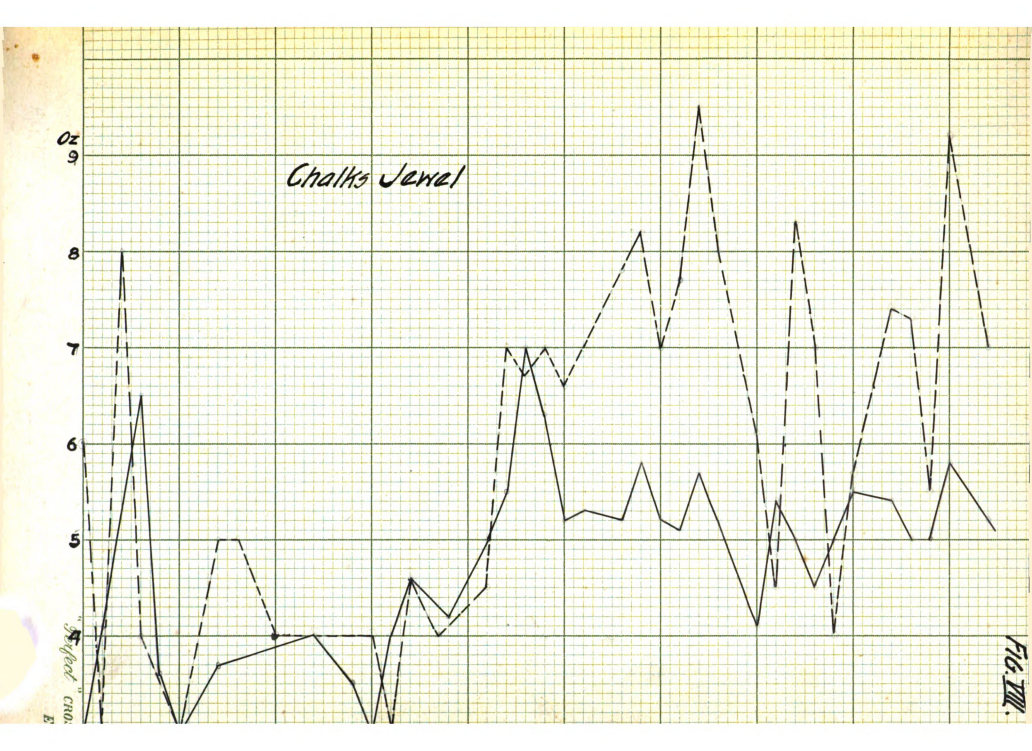


FIG. III.

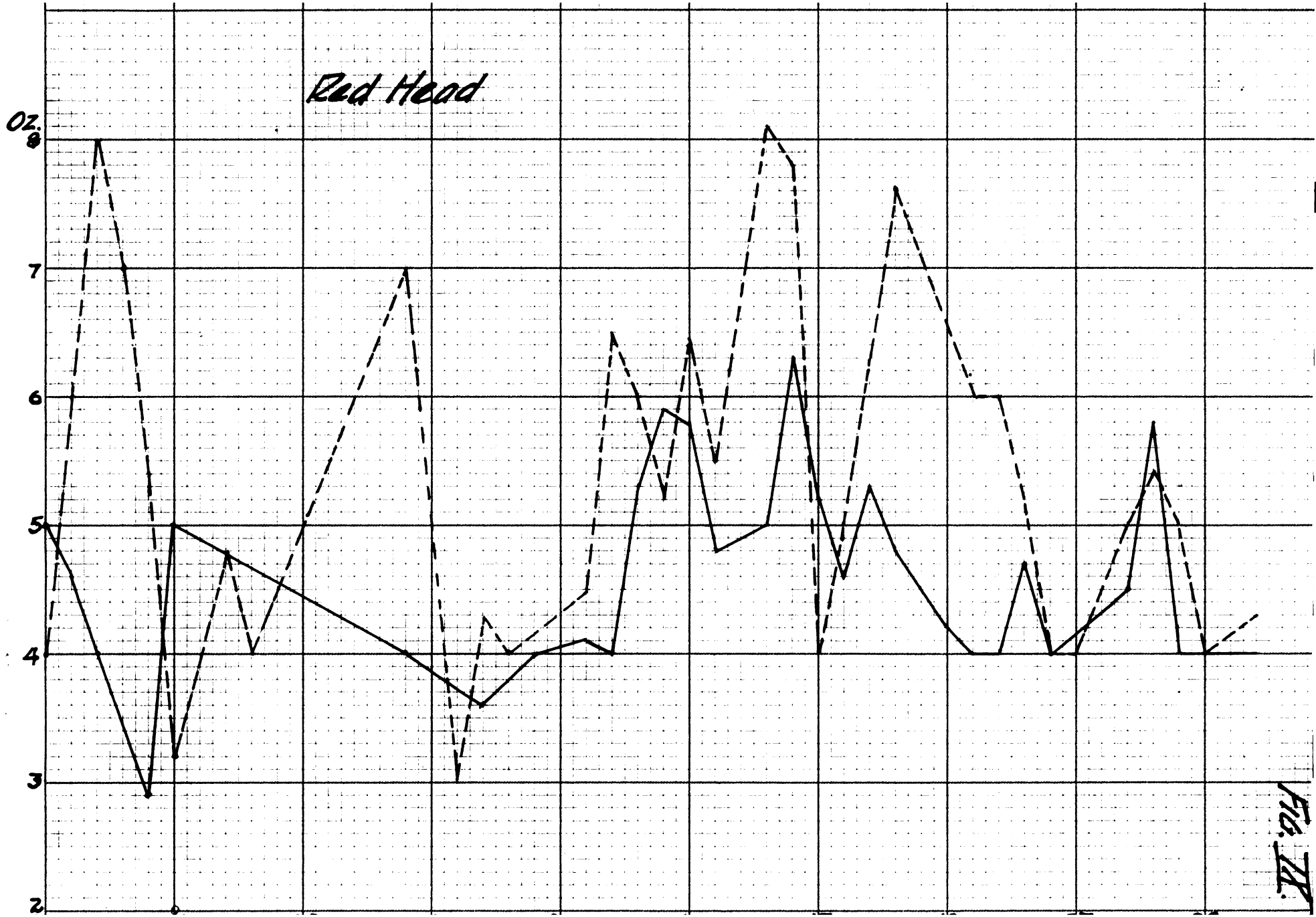


Fig. II.

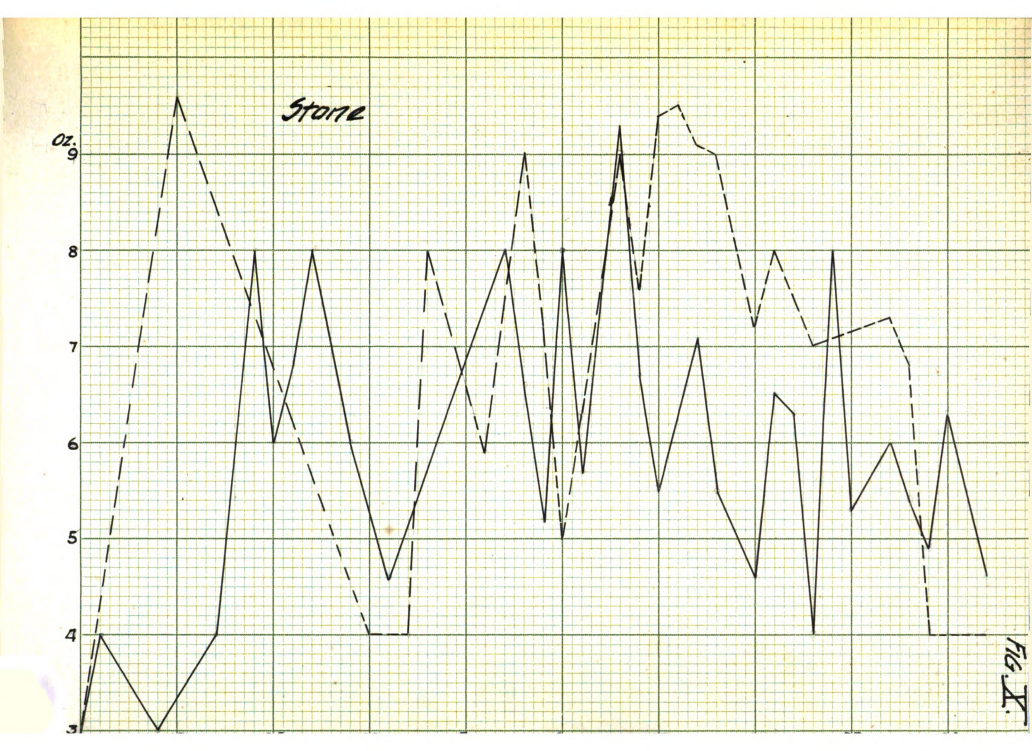


Fig. I.

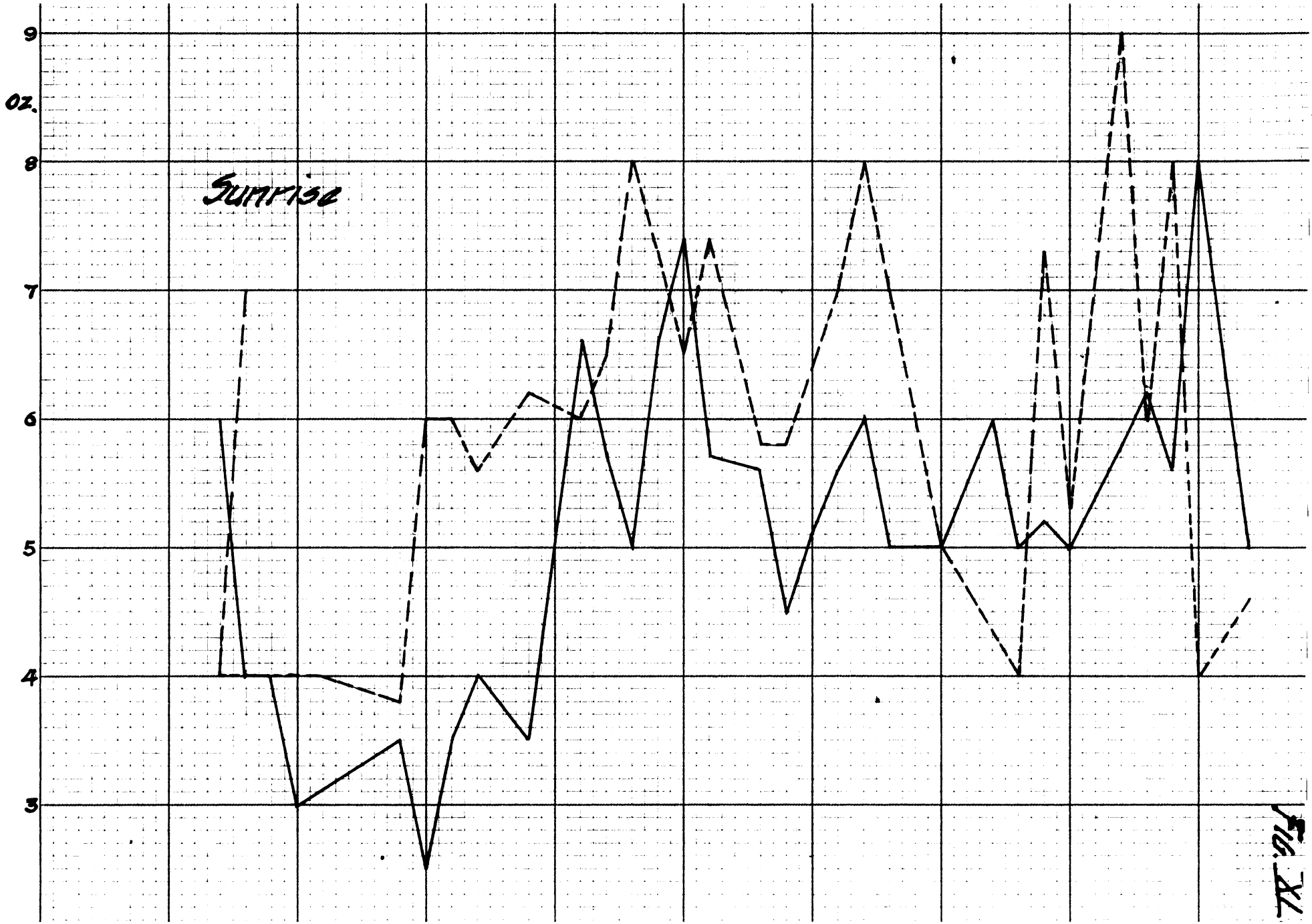


Fig. XL

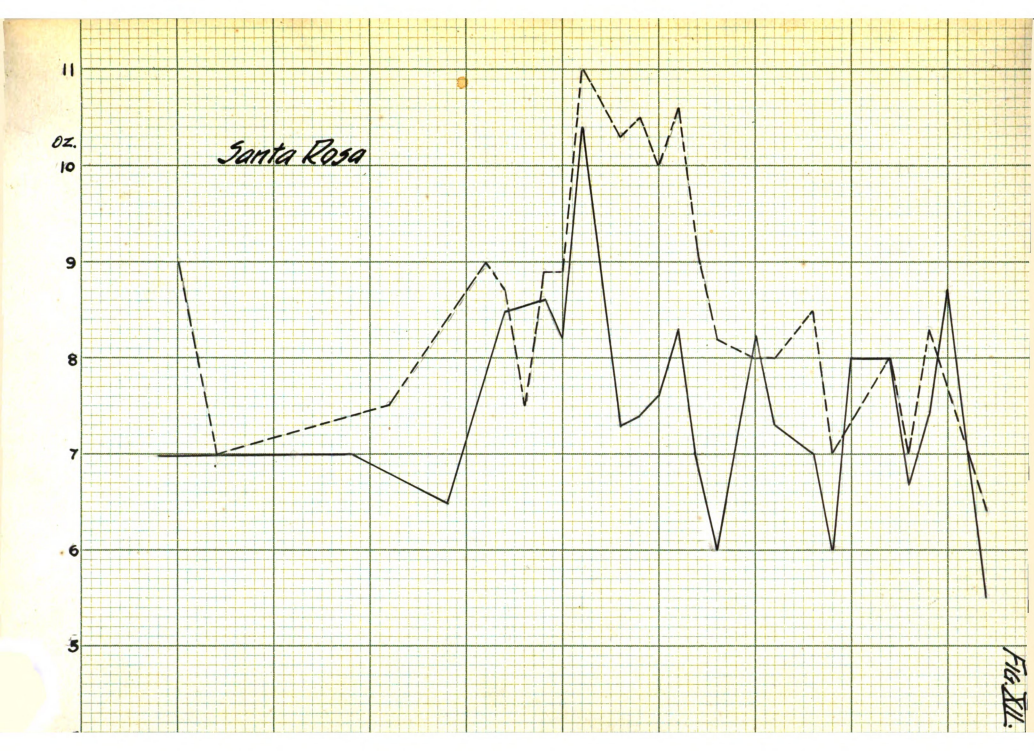


Fig. III.

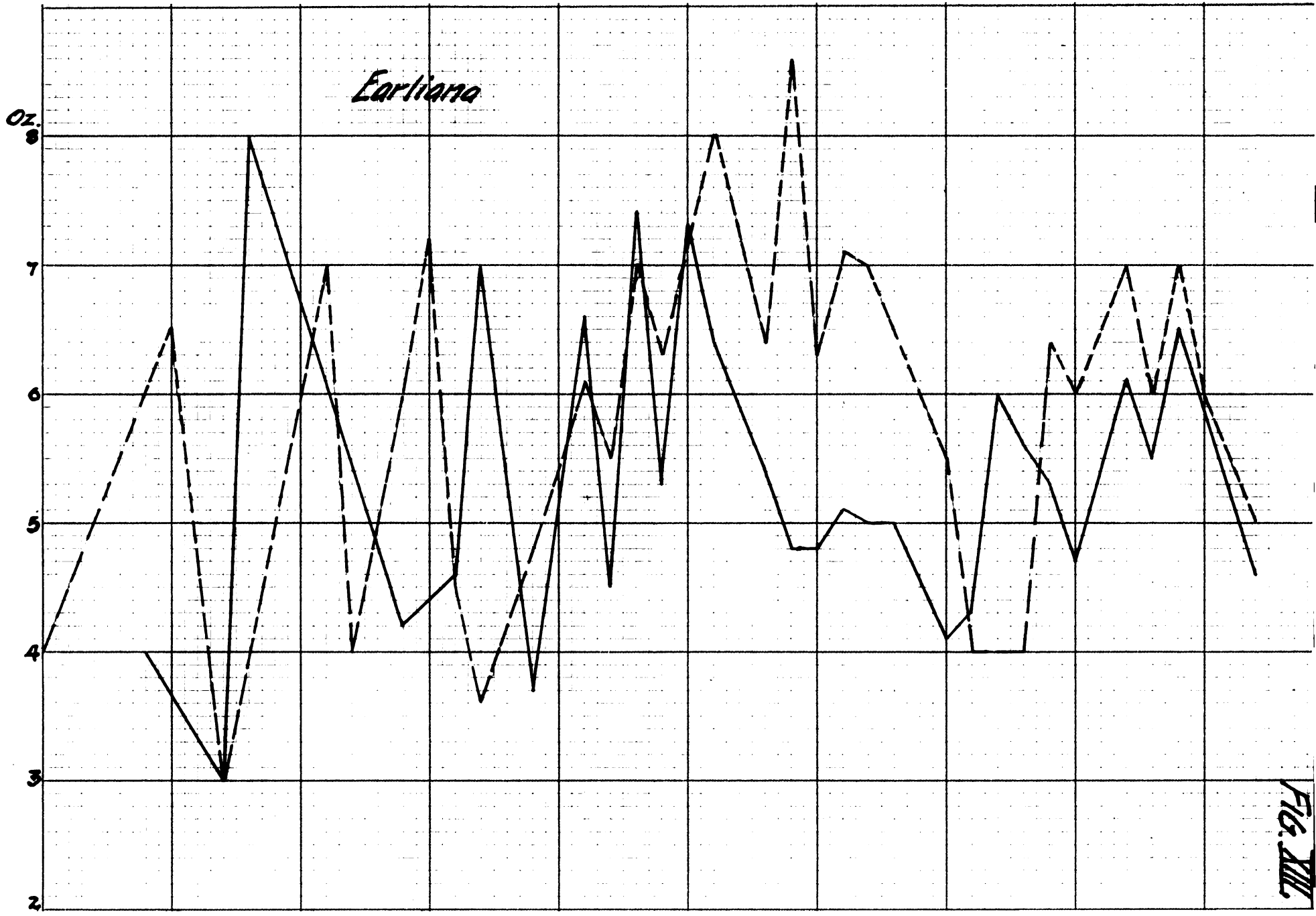
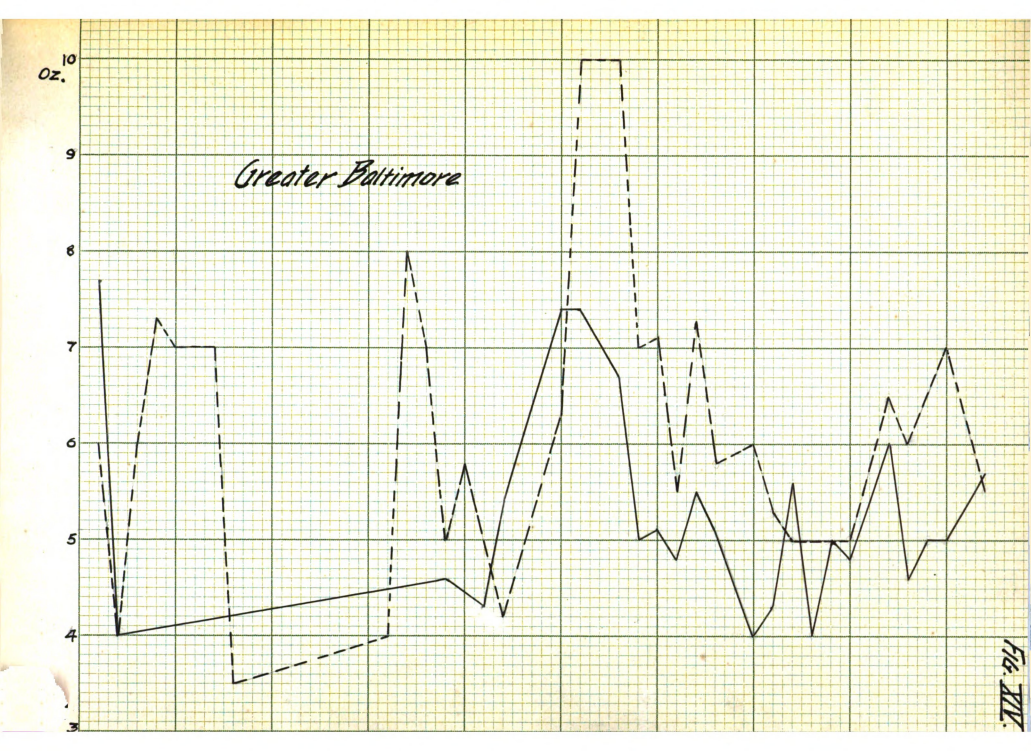


Fig. XIII.


Oz.
10
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Greater Baltimore
Fig. III.

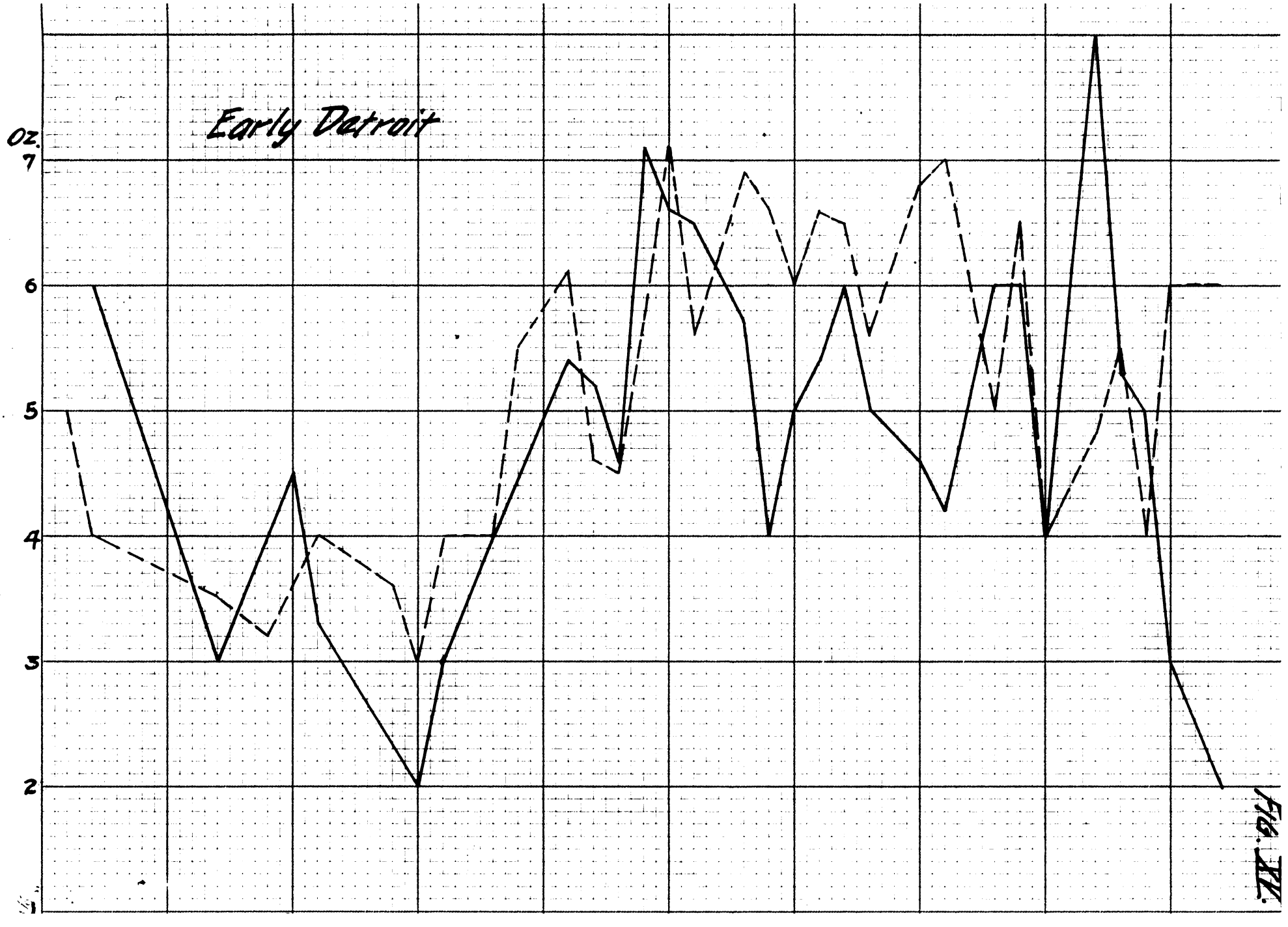

Fig. IV.