Thesis presented by "Ascribe", concerning sub-section (b) of the Field Husbandry section of the Master of Agricultural Science degree.

"A Preliminary Ivestigation of some of the Habital Characters of Crested Dogstail grass (Cynosurus cristatus), and an Attempted Evaluation of Various Lines of Crested Dogstail."

A PRELIMINARY INVESTIGATION OF SOME OF THE HABITAL CHARACTERS OF CRESTED DOGSTAIL GRASS (CYNOSURUS CRISTATUS), AND AN ATTEMPTED EVALUATION OF VARIOUS LINES OF CRESTED DOGSTAIL.

THE AIMS OF THE INVESTIGATION:-

(1) To obtain correlations between the habital characters of Crested Dogstail which may prove of help to breeding work in the future.

(2) A preliminary evaluation of various lines of different origin which may be of value in aiding future mass selection.

INTRODUCTORY:-

Observation of spaced single plants of Crested Dogstail was begun for this paper early in November, 1930, at the Massey Agricultural College, Palmerston North. Observation was carried on thereafter continuously, except for a break of three weeks immediately after 26th January when all the plants observed were mown, until the end of February, 1931.

The seed from which these plants were derived had been sown thickly in rows about a foot apart in April, 1930. The seedlings resulting were transferred in the latter part of September and early October, 1930 to a cultivated area of ground where they were planted in row formation with 22 inches between the rows and 20 inches between the plants in the rows.

Every line of seedlings was represented by about 125 to 150 plants in two, and in a few cases in three, adjacent rows. The planted area was kept free of weeds throughout the period of observation.

ORIGIN OF THE LINES:-

Seed was obtained early in 1930 from the seed-testing branch of the Department of Agriculture. Both stripped and

threshed seed was represented, the bulk being from Southland with a few samples from the Sandon district. In addition seed was collected (one seed from every plant) from paddocks and road-sides within a thirty mile radius of Palmerston North. Further, two lines were derived from seed harvested from mass selections made by the plant-breeder the previous year.

The following gives an idea of the distribution of the lines over the various places of origin:-

Southland----------44 lines

Sandon------------- 9 lines

Palmerston North--- 7 lines

Selections--------- 2 lines

Commercial lines of unknown origin----- 5 lines

The planted land was divided into three plots ~~flats~~ viz., Plot I, Plot IIA, Plot IIB.

THE ESTABLISHMENT OF THE SPACED SINGLE PLANTS:-

Twenty of the lines constituted plot IIA (consisting of about 146 plants per line, a total of 2,852 plants). These made up the first lot to be transplanted and established much better than the remaining 47 lines which constituted plot IIB and plot I (consisting of about 130 plants per line, a total of 6,284 plants). The plants which were the later in being transplanted became established fairly uniformly, though relatively poorly.

This differential establishment was reflected in the observed rate of growth of the plants, plants of plot IIA being better developed than plants of plots IIB and I. On this account these two lots have been kept separate in the recorded data and in discussion of the data, as it is thought that a comparison between the plants of plot IIA and the plants of the other two plots would lead to irregularities.

WEATHER CONDITIONS:-

The weather conditions during the summer of 1930-31 were conducive to good grass growth, the rainfall in particular being fairly abundant and evenly distributed throughout the period.

In the late spring of 1930, during the time of transplanting, there was a very high rainfall with low temperatures and heavy winds. These conditions did not allow the best establishment of the seedlings. Thus the plants may not have been able to reach the full expression of their normal habital characteristics, but even so comparative records for this series of plants for this season would hold good.

SOIL CONDITIONS:-

The soil of the planted area is a light alluvial loam of medium fertility and of fairly good water-holding capacity. It is therefore capable of supporting a good growth of grass. There appears to be a reasonable uniformity of soil type throughout the area. Any minor differences in soil type probably would not be sufficient to cause any great difference in the habital characters as between plants in the three plots.

Before the exsertion of the panicles a light "rogueing" of the plants in every line was carried out. Those plants which were very poorly established were marked off by stakes and were not observed further. To avoid the error of rogueing a poor line heavily and therefore not leaving a true representative sample of that line, rogueing was done in any one plot so that approximately equal numbers of plants were discarded from all lines of that plot.

PHOTOGRAPHY:-

On the 9th January, 1931, about eleven days after the general zenith of flowering in the plots, two photographs of

plants "in situ" were taken. Owing to the windy weather the remainder of the photographs were taken in a glass-house on the 11th January. The selected representative plants were dug up, and as much soil as possible was removed with them to the glass-house. After the photographs were taken, the sods were returned to the plots immediately and carefully and firmly restored to their respective places. Heavy rain fell the next day, and from subsequent observation the growth of the plants did not appear to have been materially affected. Thus the recovery after cutting of these plants was probably not affected by their removal for photographic purposes. However, any effect, on the average, would be negligable.

Prints of the photographs are presented at the end of this thesis. The plants depicted are representative of the different types observed with the exception of types showing differences in panicle characters.

DATE OF FLOWERING:-

The first character to be examined critically was date of flowering. This date for any one plant was taken as that when the first flower of any head had exserted its anthers. It would have been more accurate to have taken the date for any one plant as that when say flowering was shown by any three heads as was done in the case of exsertion of the panicles by single spaced Perennial Ryegrass plants at Aberyswyth (Jenkin, Welsh Journal of Agriculture, Volume 6, 1930, Page 148.). This may be especially so seeing that a common feature of these Dogstail plants was the emergence precociously of one head, and occasionally two heads, on a plant. However, it was observed that generally this head(s) flowered a fairly definite time before the other heads of the plant. The more accurate determination of the flowering date was impossible owing to the amount of time involved.

Flowering date as measured is an indication of a definite stage reached in development, but the individuality shown by

different plants, both in number of heads flowering together and the length of the period over which they continue to flower, was very marked. In fact there were, in many plants, several groups of inflorescences with different average flowering dates. According to early observation this latter fact did not appear to bear any relation to any habital character and was not studied further.

MEASUREMENT OF HABITAL CHARACTERS IN SEVEN LINES:-

From plot IIA, containing the more vigorously growing plants, seven lines comprising commercial and selected strains were used for measurements of characters making up the habit of growth of the plants. These lines were:- UV2, 5327, 6104, P3, UV1, C1, and 5616. They comprise over 1000 plants and were measured after the zenith of flowering in the plot, the time occupied in measuring being a little over three weeks.

Some error might be expected in comparing data recorded in the earlier part of this period with that recorded in the later part. However, during this time the plants appeared to make little vegetative growth, most of their energy being devoted to seed production so that error from this cause would be slight.

The following measurements and counts were made:-

1. The number of barren tillers occurring on every plant was counted "in situ". Stapeldon says, (Journal of the British Ministry of Agriculture, Volume 34, Page 147), "the relative potential tillering capacity of different species and strains can be studied by growing plants under such conditions as give scope for maximum production." It is held that this is a suitable method of determining relative production.

II. The number of panicle tillers was counted similarly.

III. The height and the diameter of every plant were measured to the nearest half inch. These measurements expressed as a ratio in every case may give an indication of the relative erectness and inclination of the plants. It represents "the ratio of the vertical height from the ground to the ligule of the uppermost leaf of an average panicle shoot to the distance across the plant from the upper ligule of a shoot on one side to the upper ligule of a shoot on the other." (Stapledon, Journal of Ecology, Volume 16, 1928, Page 77).

IV. Head Density:- With every plant three typical mature heads were selected. In a length of 1½ inches measured from the base of every one of these selected panicles the number of groups of spikelets was counted. The average value of these three counts was afterwards calculated and recorded as "head density".

It was thought, from previous observation, that the closer headed types were also the plants with the larger number of barren tillers. The determination of "head density" value was made to test this idea.

V. After all measurements had been completed on the seven lines, these plants were judged on points, (1 to 10) for resistance to withering. This is one of the values quoted by Jenkin in the article "Perennial Ryegrass at Aberyswyth" (Welsh Journal of Agriculture, Volume VI, 1930.)

A small amount of withering was due to disease, but by far the greatest amount had a physiological cause. Withering in any one plant began shortly after flowering on that plant had begun. It steadily increased during the flowering period and repidly progressed during seed setting. Since all these plants were judged at the same time for "resistance to withering", instead of at different times according to flowering date and

at the same growth stage, the earlier flowering plants have been judged more harshly than under the more accurate system of recording the data.

Other observations made at the same time but not studied in conjunction with those given above are:-

(a) The height distribution of the panicles.

(b) Shape of head.

(c) Inclination of head.

(d) Proliferation of head.

Casual comparisons did not promise any diagnostic value for these observations so that they have not been included in this paper.

VI. Counts of the number of barren tillers in the aftermath were begun on 22nd February 28 days after all the plants had been cut down with a scythe to ground level. The counting occupied about three days.

This drastic cutting did not appear to inhibit the recovery of the plants, for good growth was accomplished by the majority in the monthly period.
There was abundant rainfall over the period.

Some panicle tillers appeared in the aftermath but these were few. A large number of plants did not produce panicle tillers and the few that did had only one (or rarely two) so that the number of panicle tillers in the aftermath is without statistical significance.

The Remaining Sixty Lines.

The Methods Used in the Preliminary Evaluation of the Lines (other than the seven lines of Plot IIA subjected to measurement):-

On the 22nd, 23rd, and 24th January, 1931, a little over three weeks after the general zenith of flowering and before much seed had been shed, every plant was judged by eye for density

and resistance to withering, points 1 - 10 being awarded in each case.

The term "density" refers to the volume of leafage produced by the barren tillers at that time, while "resistance to withering" pertains to the amount of foliage, in relation to the whole amount, that was not withered.

These plants were cut down to ground level at the same time, the 24th and 26th January, as the plants of the seven measured lines on Plot IIA. On the 25th February, 31 days after the cutting, most of the plants had made good growth. Some had died. All were judged on density of aftermath growth, points 1 to 10 being awarded for "recovery".

A GENERAL NOTE ON THE SYSTEM OF TAKING AND RECORDING THE DATA:-

The stage of development before cutting at which the measurements, counts, and judgments were made differed more or less for all plants. Therefore the comparisons between the various values as made are not so useful as they would have been if the values had been determined at the same growth stage for all plants. The least useful comparisons from this point of view are those between the various determinations and resistance to withering, since, as has been noted previously, withering progressively increased over the flowering and seed-setting period of any plant. As regards the other comparisons, however, the disutility is almost negligable, since there was little vegetative growth in the plots after the general zenith of flowering and up to the time of mowing.

If the mowing had been done for every plant at the same time after flowering, more useful comparisons between "recovery" and the other values would have been possible than those which actually have been made. It was felt, however, that the extra work involved in following this system was not justified.

DISCUSSION OF RESULTS.

A. The Plants of the Seven Lines Measured

(Lines C1, UV2, 5327, 6104, P3, UV1, 5616 of Plot II A.)

Correlation diagrams were drawn out seeking relations between the different measurements made, especially between the number of barren tillers and the other values obtained. It soon appeared that there was no relation between several of these values. Both significant and non-significant correlations for one line (line C1) are given in diagrams 1 - 11 (pp. 13-23). With the other six lines only those values which show a definite correlation are given (see diagrams 12 to 29).

Correlation coefficients ~~were~~ also were made out for line C1. These are given in the appropriate diagrams (see diagrams 1 to 11) and indicate more precisely than the diagrams the relations and the significance of the relations. They also indicate the possible magnitude of the correlations recorded in diagrams 12 to 29.

Line C1, Plot II A (Diagrams 1 to 11 with the correlation coefficients given therein):-

It is seen that the only significant, positive correlations are those of diagrams 1, 2, and 11, representing respectively correlations between,

(a) The number of barren tillers at flowering time and the number of barren tillers in the aftermath growth - diagram 1.

(b) The number of barren tillers at flowering time and resistance to withering after flowering - diagram 2.

(c) The number of barren tillers in the aftermath and resistance to withering after flowering - diagram 11.

In diagram 9 there is a hint of a positive correlation between the number of panicle tillers after flowering and the ratio of height to diameter. Diagrams made out for two of the other lines measured, however, did not show any better result

so that there is apparently no correlation between these two values.

No relation appears to exist between any of the following:-

(a) Number of barren tillers and ratio of height to diameter - diagram 3.

(b) Number of barren tillers and head density - diagram 4.

(c) Number of barren tillers and number of panicle tillers - diagram 5.

It was thought from previous observation that plants with a large number of barren tillers generally had few panicle tillers. The results of this investigation do not indicate such a relation.

(d) Number of barren tillers and date of first flowering - diagram 6.

Observation suggested that the more stemmy plants were the earlier in flowering. As the ratios of the number of barren tillers to the number of panicle tillers in these plants, that is, values for "stemminess", were not calculated no definite pronouncement on this idea, as regards this investigation, can be made. However the absence of relation between the values given at (d), above, does not help to further the idea.

(e) Number of panicle tillers before cutting and number of barren tillers in the aftermath - diagram 7.

(f) Number of panicle tillers before cutting and resistance to withering - diagram 8.

(g) Number of panicle tillers and ratio of height to diameter - diagram 9.

(h) Number of panicle tillers and date of first flowering - diagram 10.

GENERAL NOTES ON THE DIAGRAMS.

1. Single circles represent single correlation values at the positions of the circles.

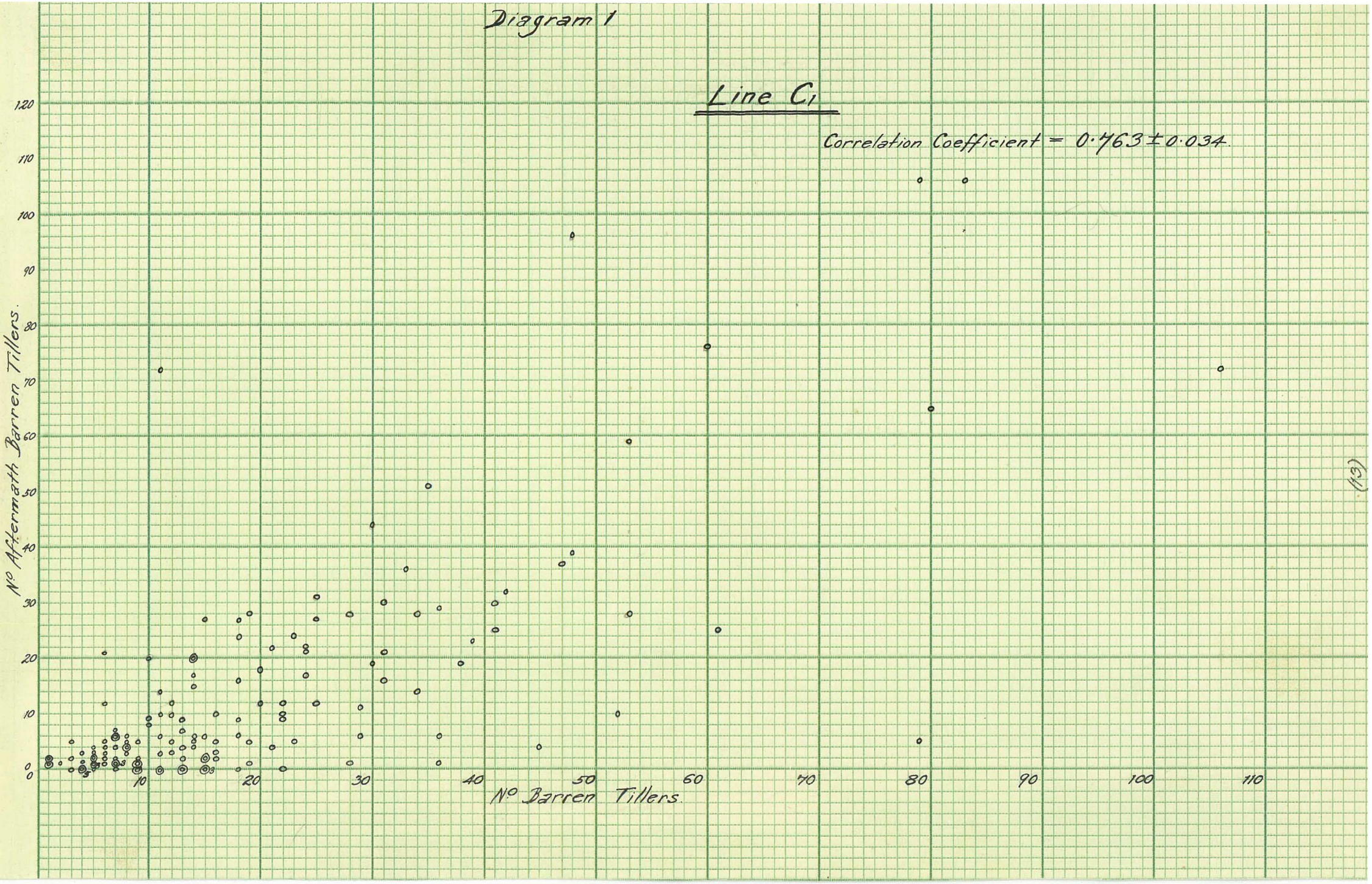
2. Double circles represent two correlation values coincident at the position of every double circle.

3. Where more than two values are coincident at any point, a number representing the total number of values coincident at that point is written above the double circle surrounding the point.

Diagram 1

Line C1

Correlation Coefficient = 0·763 ± 0·034

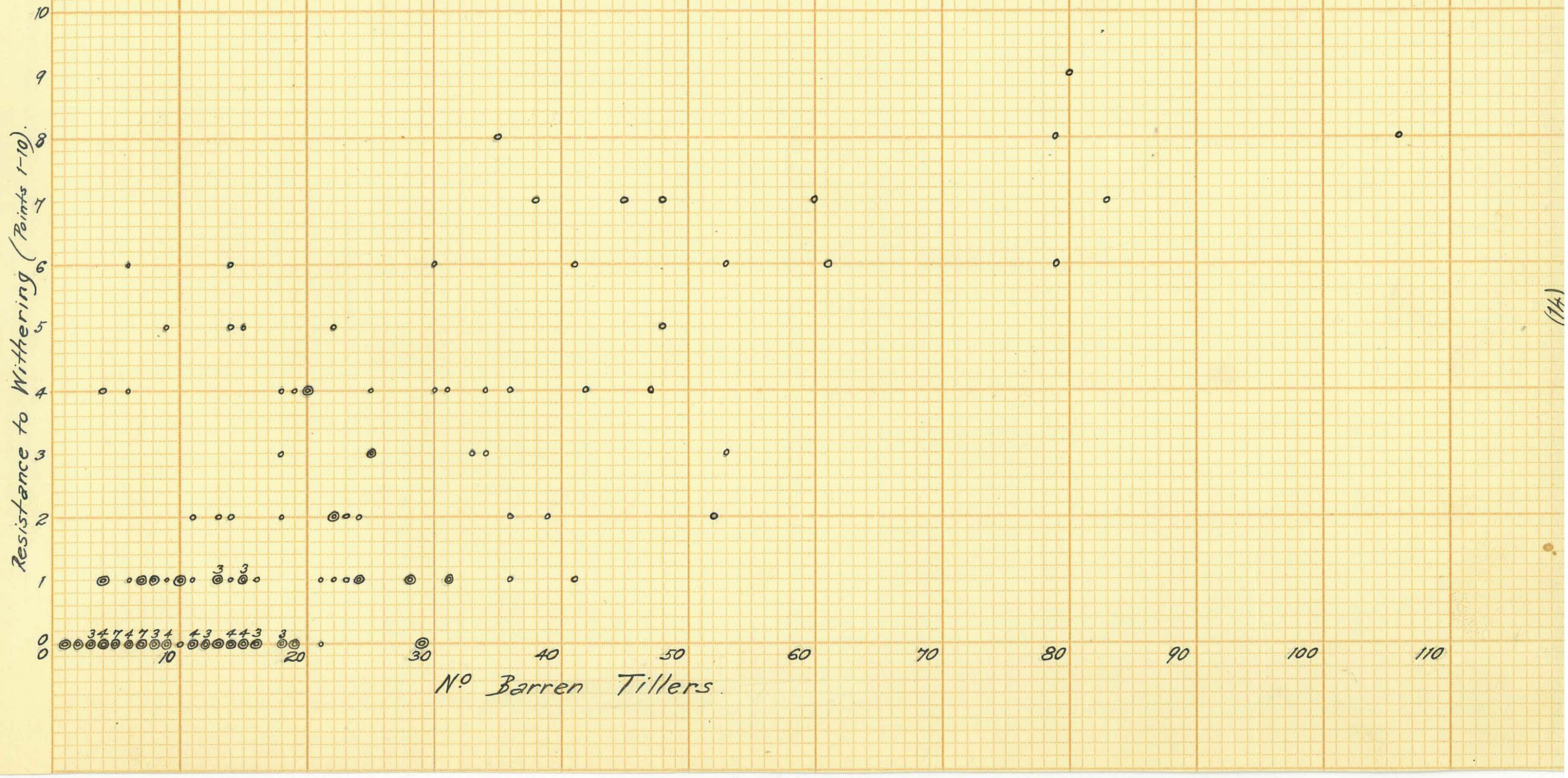


(11)

Diagram 2

Line C1.

Correlation Coefficient = 0·742 ±0·037.

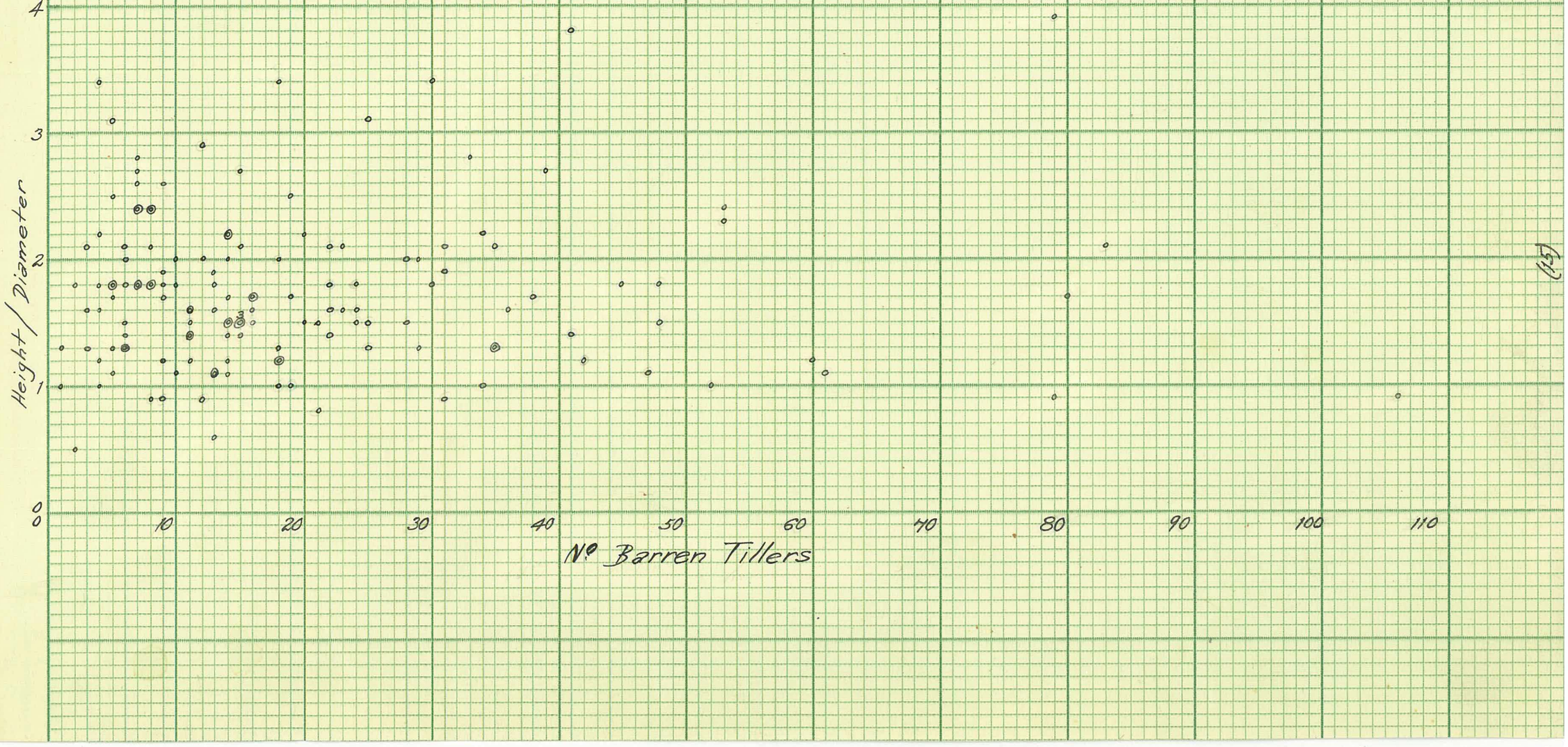


(14)

Diagram 3

Line C1

Correlation Coefficient = 0·03 ± 0·08



(15)

Diagram 4

Line C1.

Correlation Coefficient = -0.022 ± 0.083.

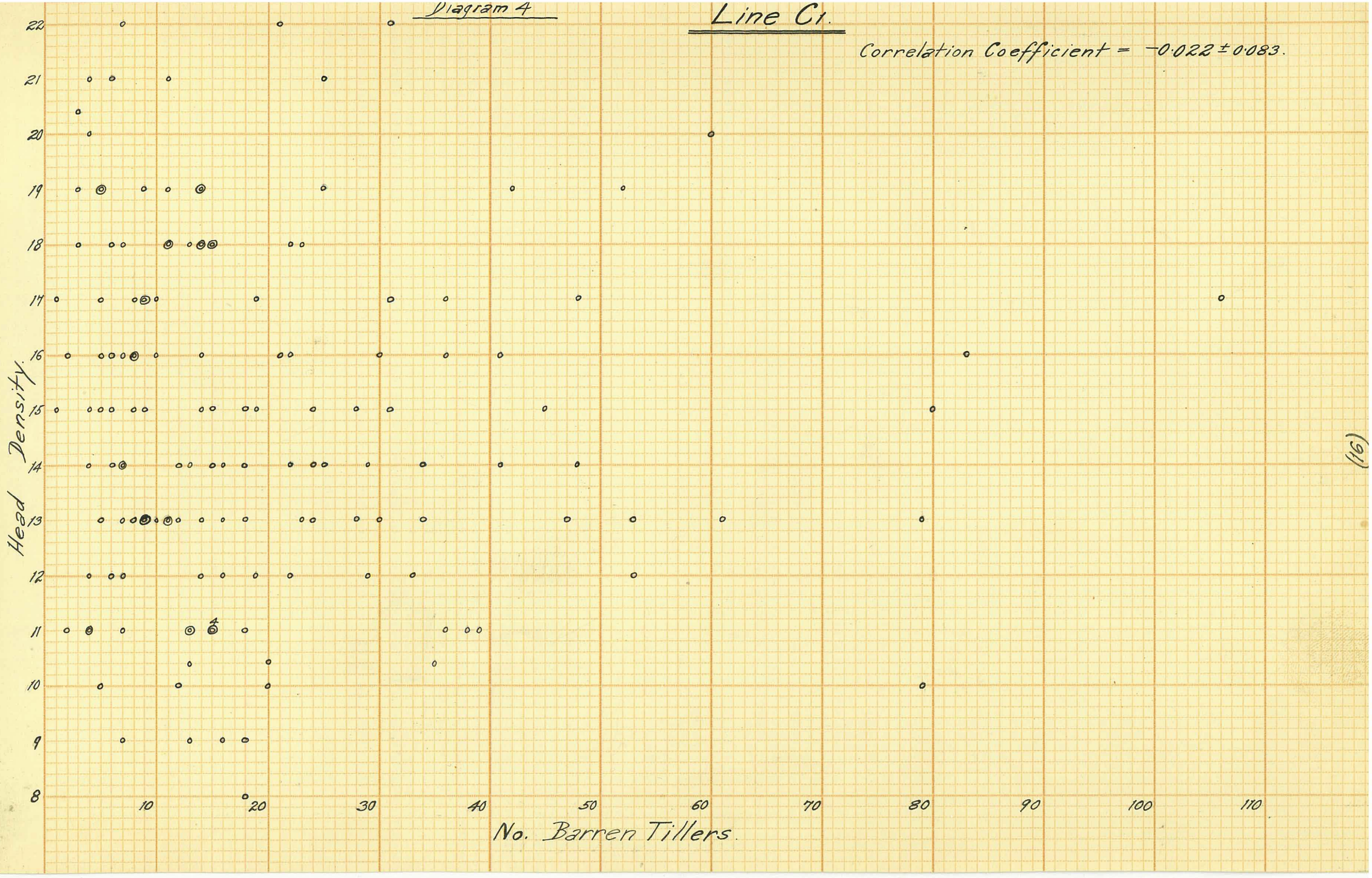


Diagram 5

Line C1.

Correlation Coefficient = 0.063 ± 0.083.

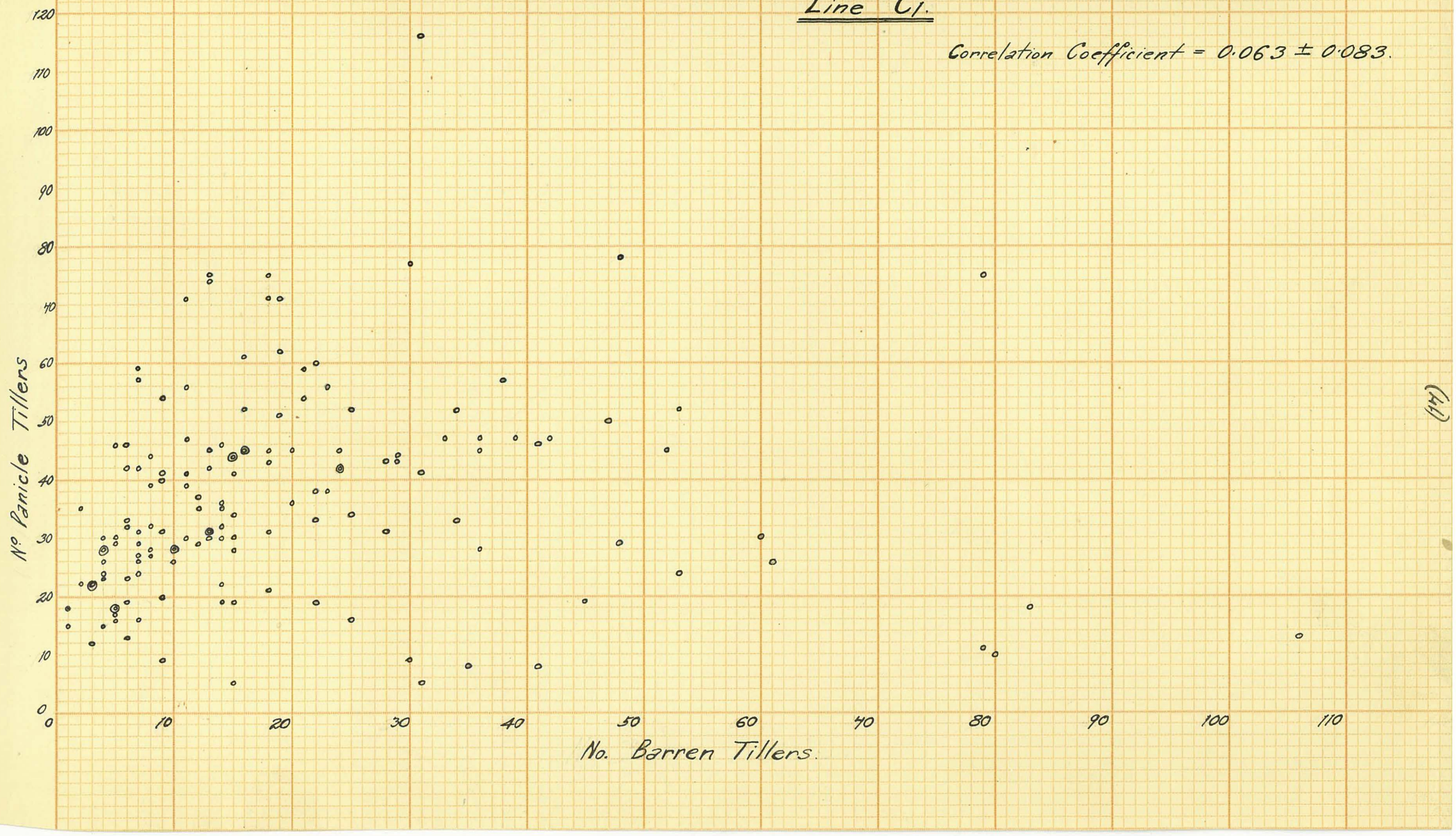
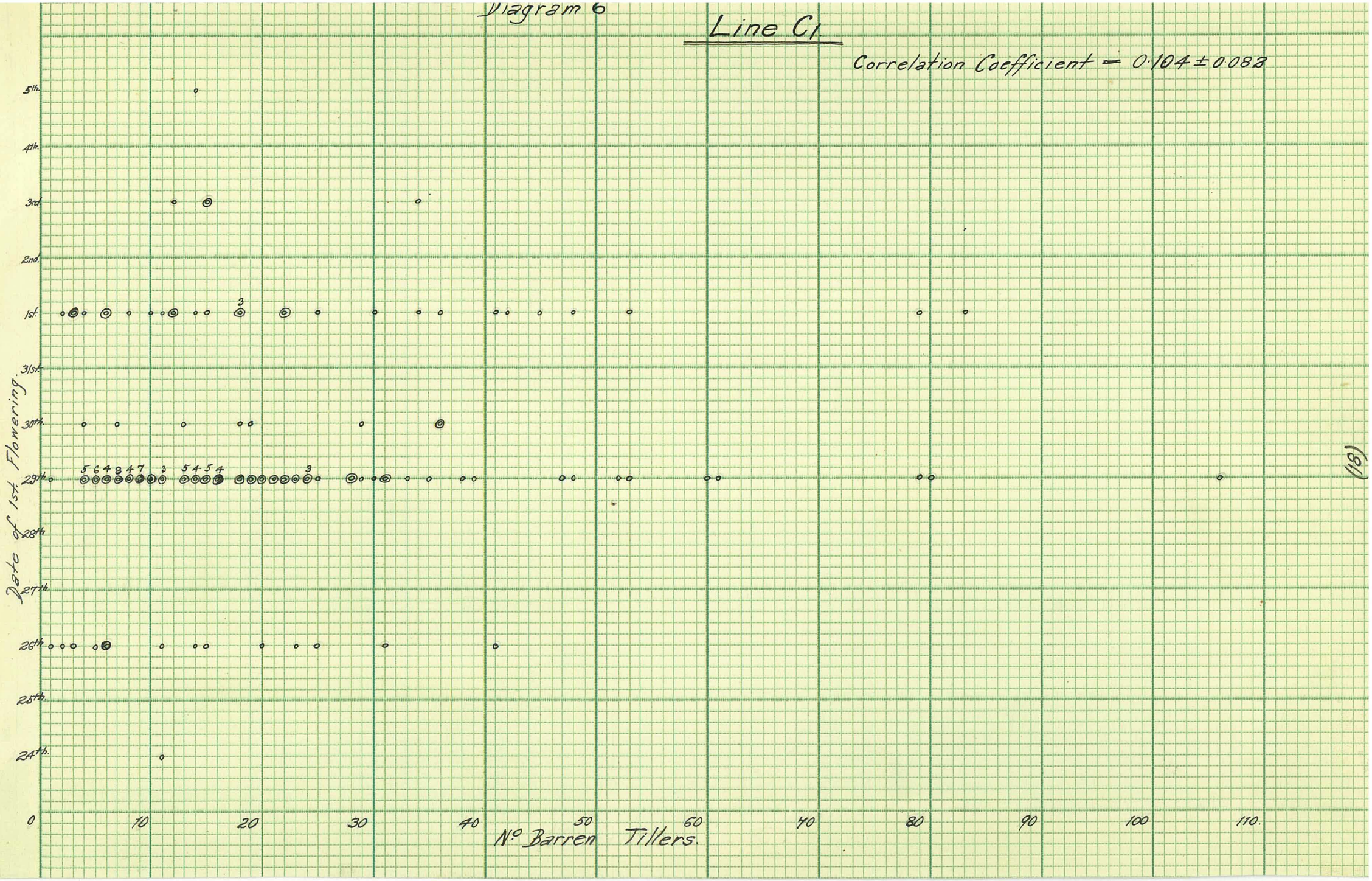


Diagram 6

Line C1.

Correlation Coefficient = 0·104 ± 0·083



(18)

Diagram 7

Line C1.

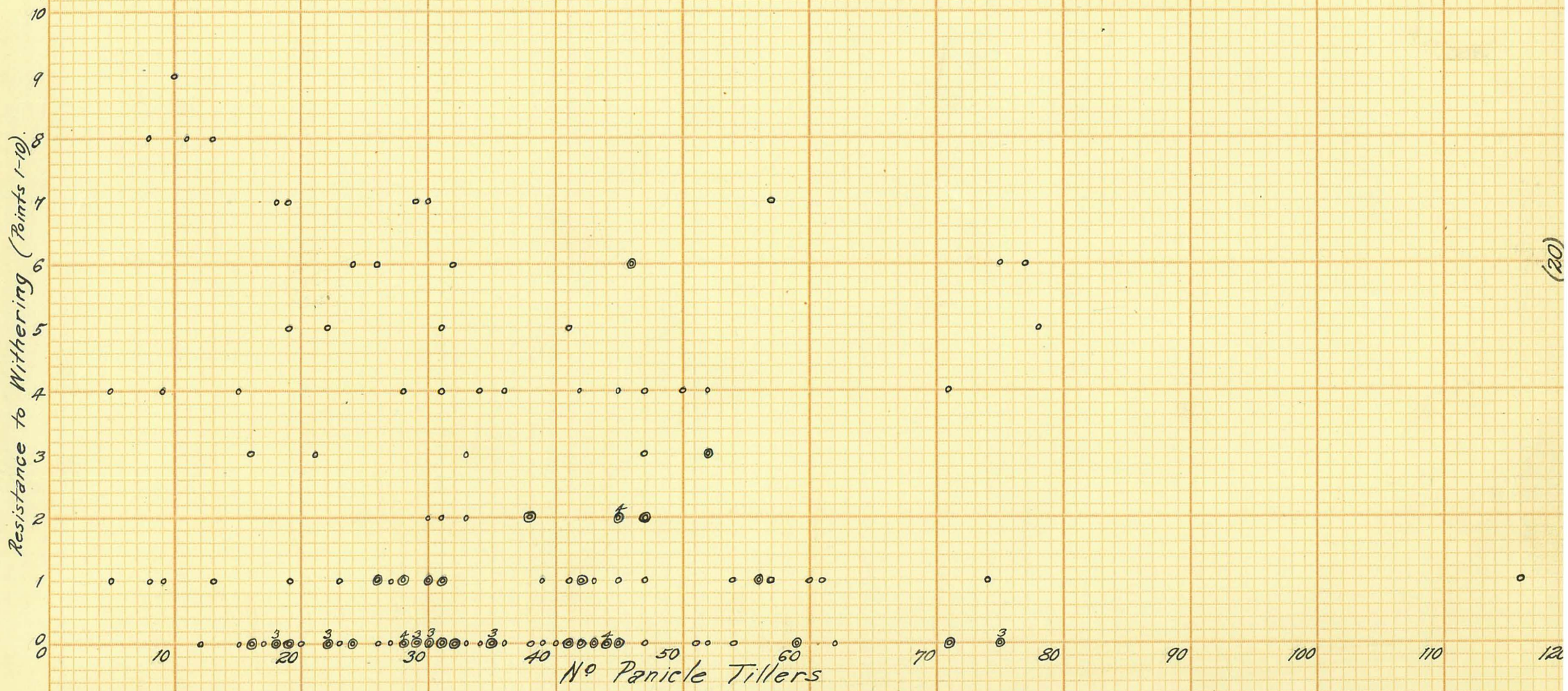
Correlation Coefficient = 0·010 ± 0·083.

(141)

Diagram 8

Line C1

Correlation Coefficient = 0·082 ± 0·082.



(20)

Diagram 4.

Line C1

Correlation Coefficient = 0·393 ± 0·071

Diagram 10

Line C1

Correlation Coefficient = 0·055 ± 0·083.

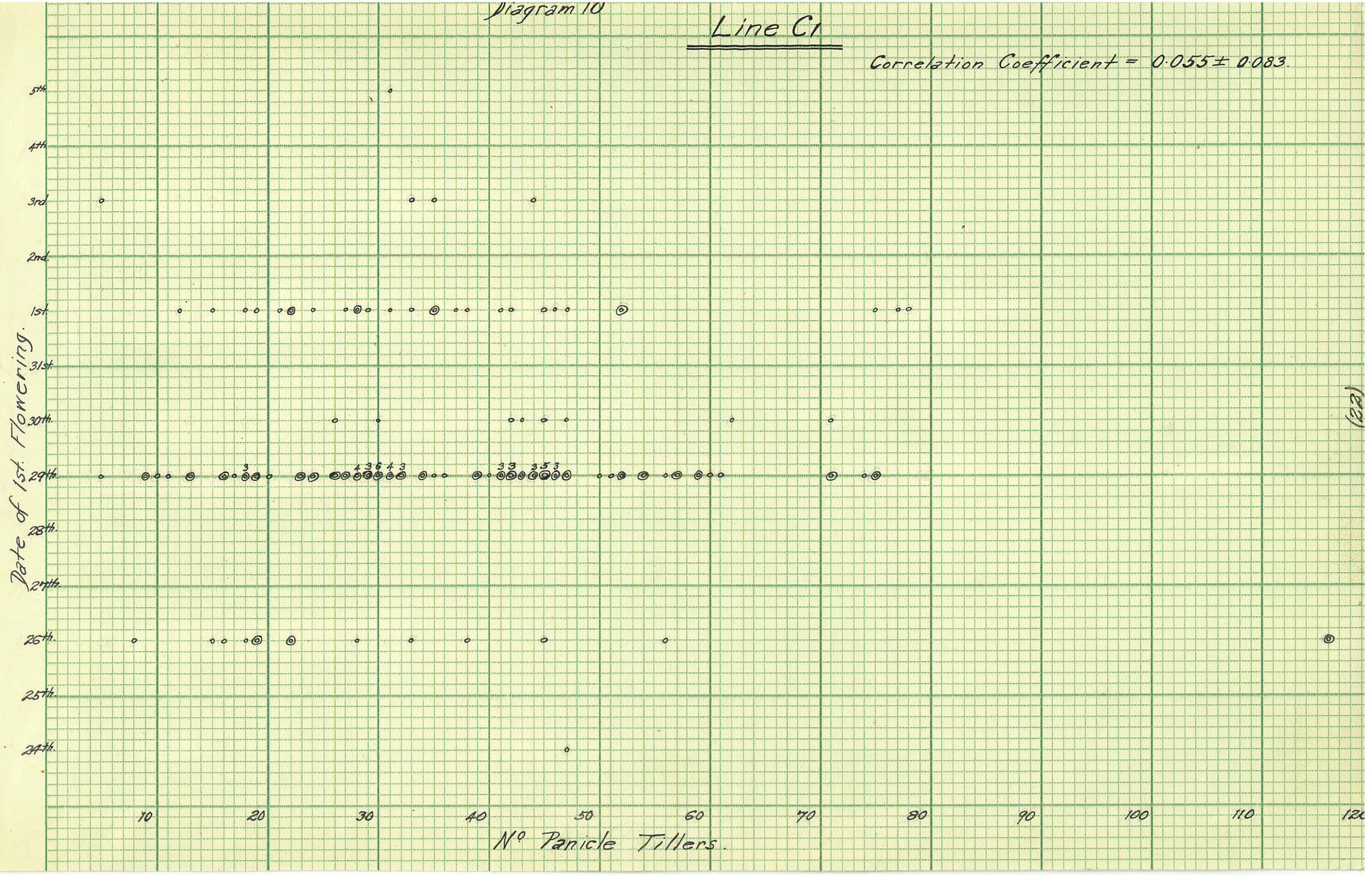
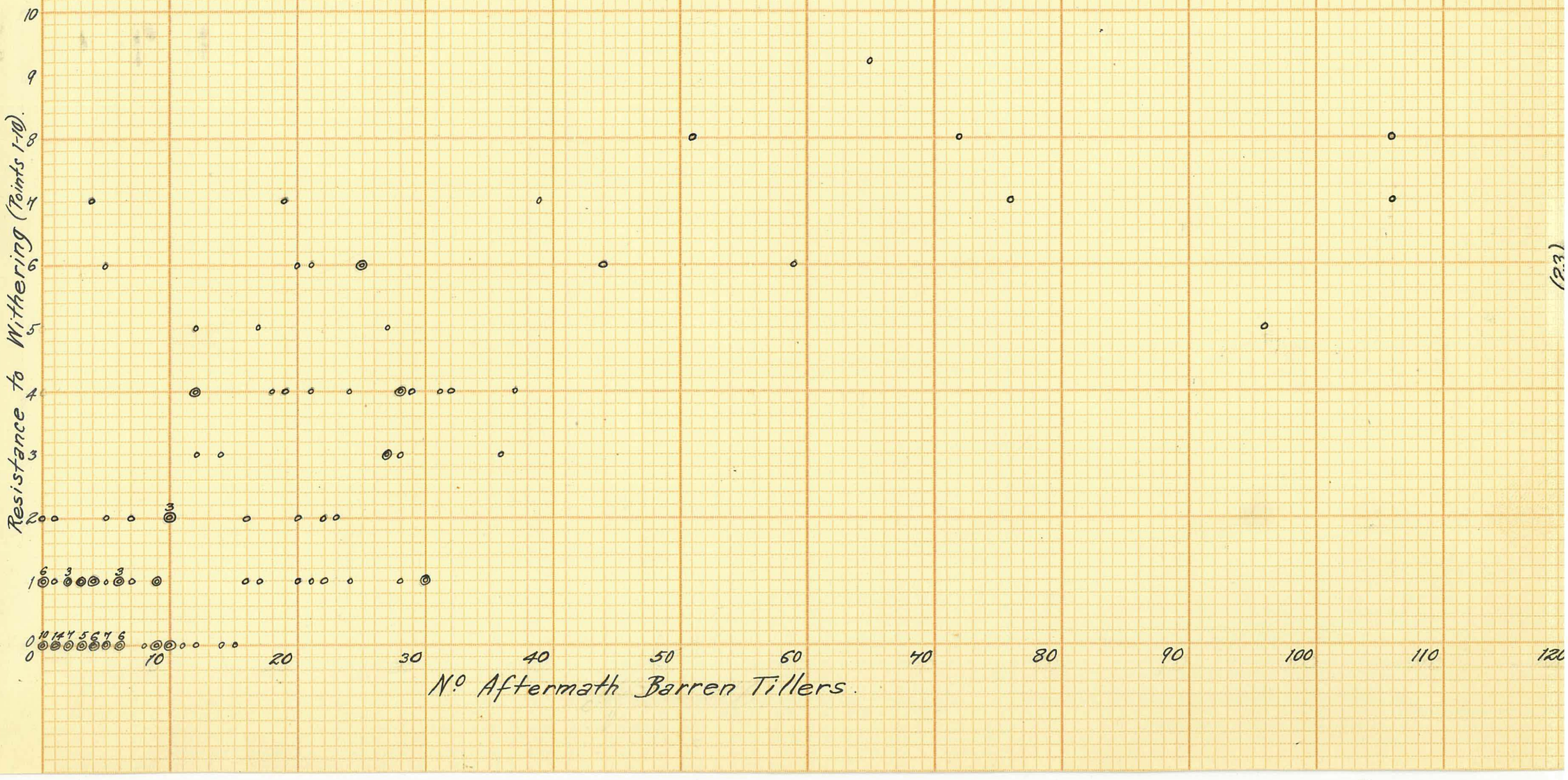


Diagram 11

Line C1.

Correlation Coefficient = 0·708 ± 0·042.



(23)

The Six Lines of Plot II A, Lines UV2, 5327, 6104, P3, UV1, 5616. (Diagrams 12 to 29 (pp. 25-42)).

The correlations of significance in the case of line C1 also appear significant in the other six lines measured. Thus:-

(a) The number of barren tillers at flowering time is definitely positively correlated with the number of barren tillers in the aftermath - diagrams 12 to 17.

(b) The number of barren tillers at flowering time is positively correlated with resistance to withering after flowering - diagrams 18 to 23,

and (c) The number of barren tillers in the aftermath is related in a positive way to resistance to withering after flowering - diagrams 24 to 29.

Diagram 12

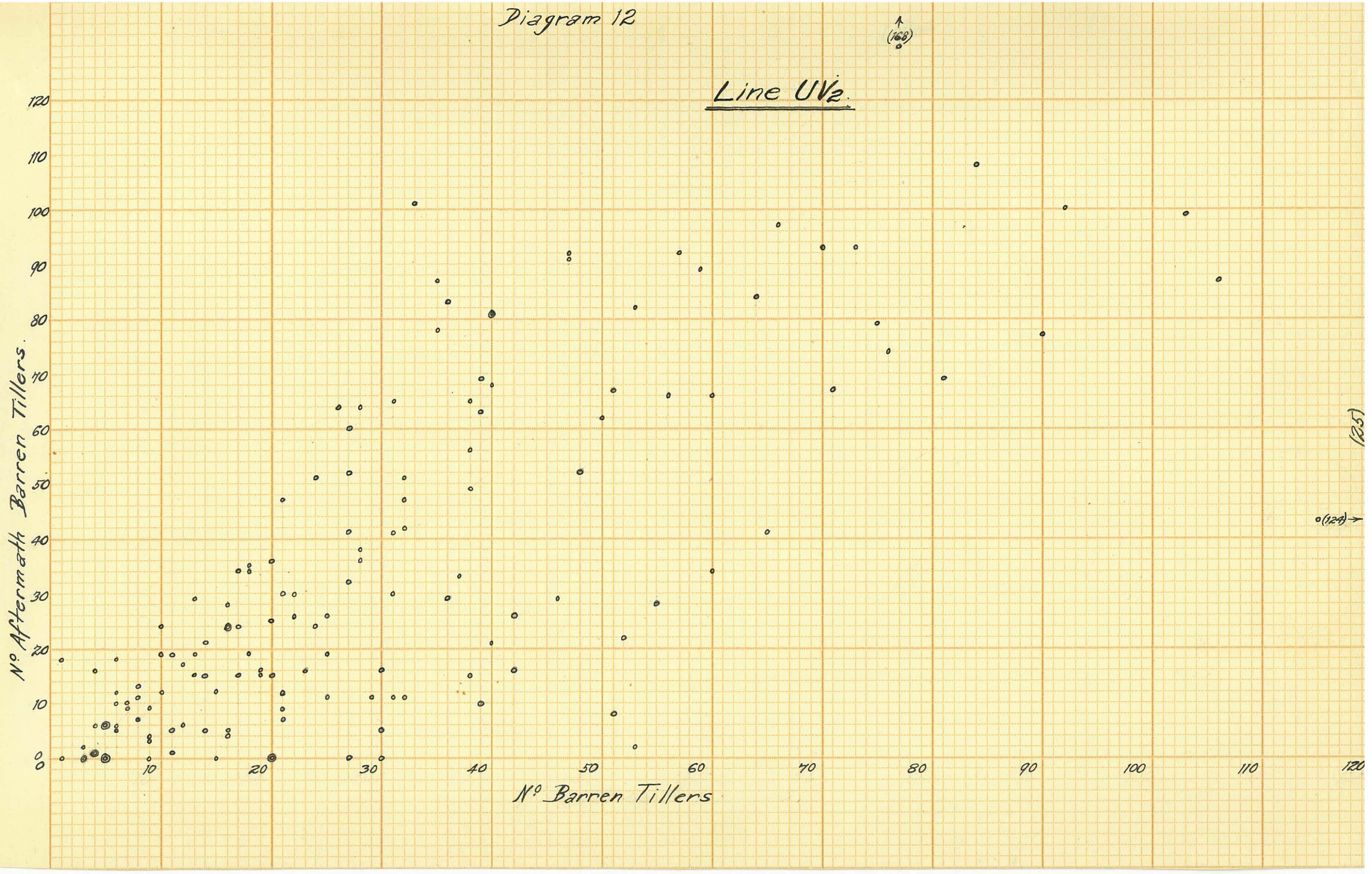

Line UV2.
(168)
(124)
(12.5)
No Aftermath Barren Tillers.
No Barren Tillers
0
10
20
30
40
50
60
70
80
90
100
110
120

Diagram 13.

Line 5327.

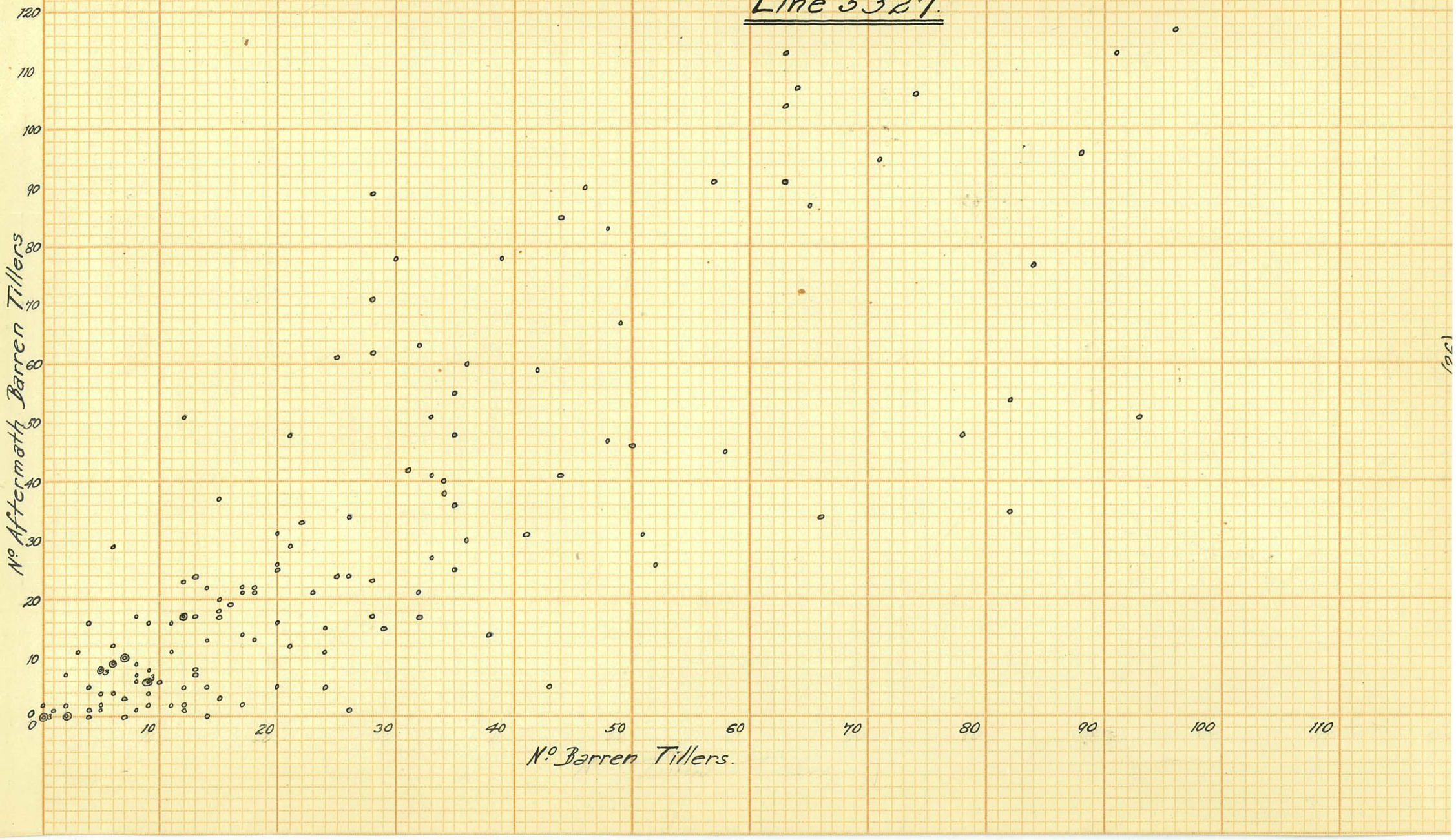


Diagram 14

Line 6104.

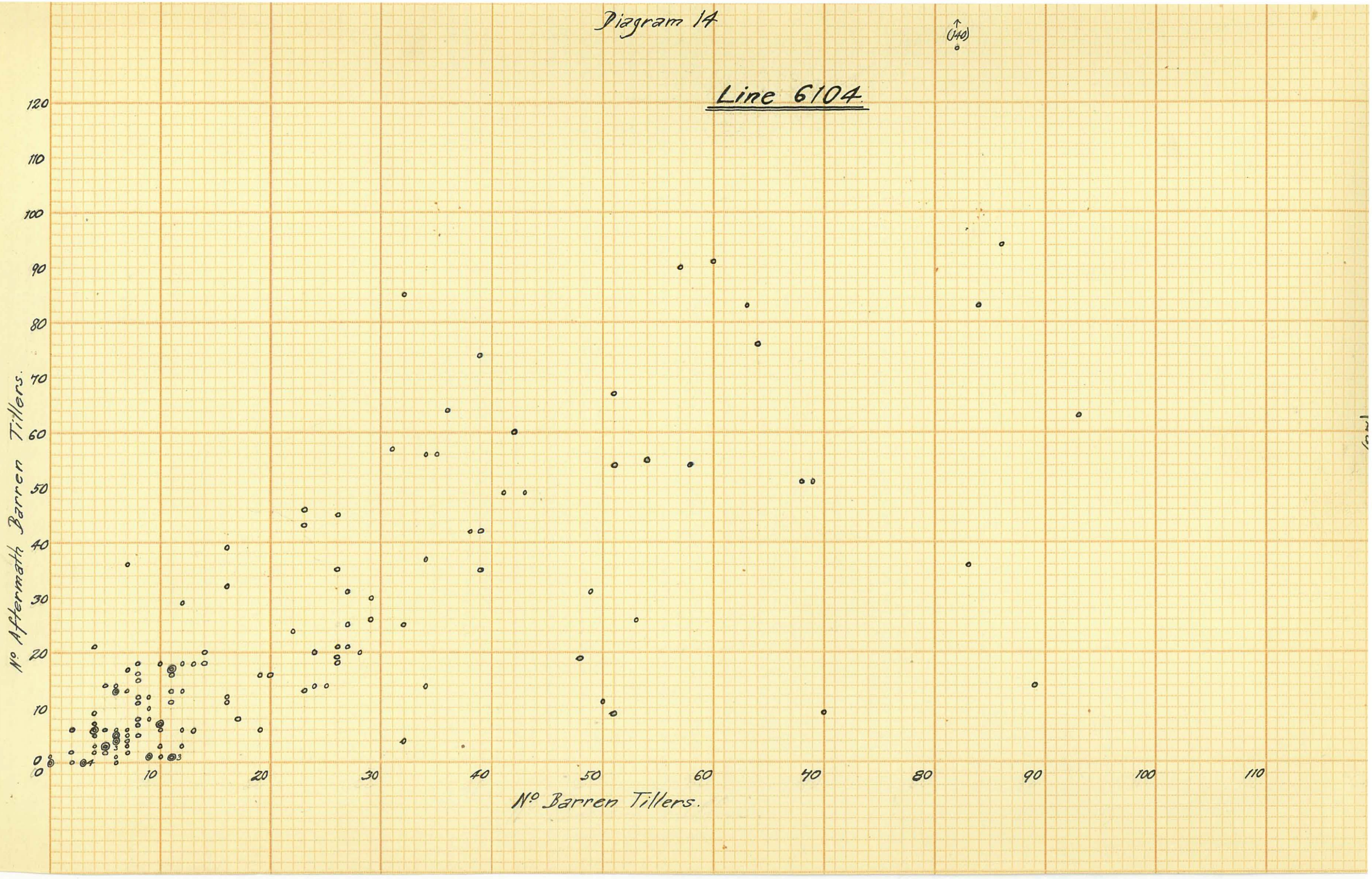


Diagram 15

Line P3.

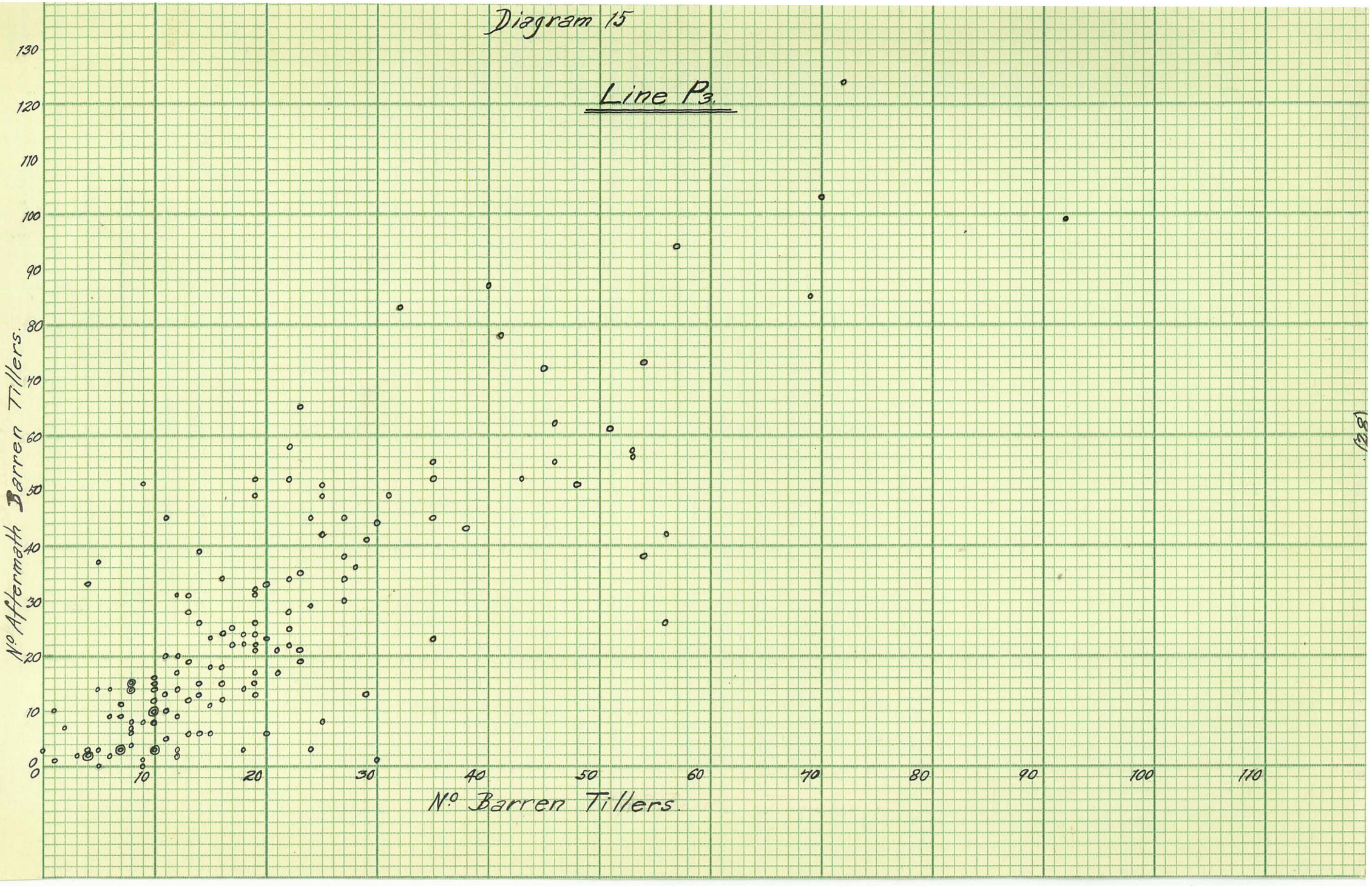


Diagram 16

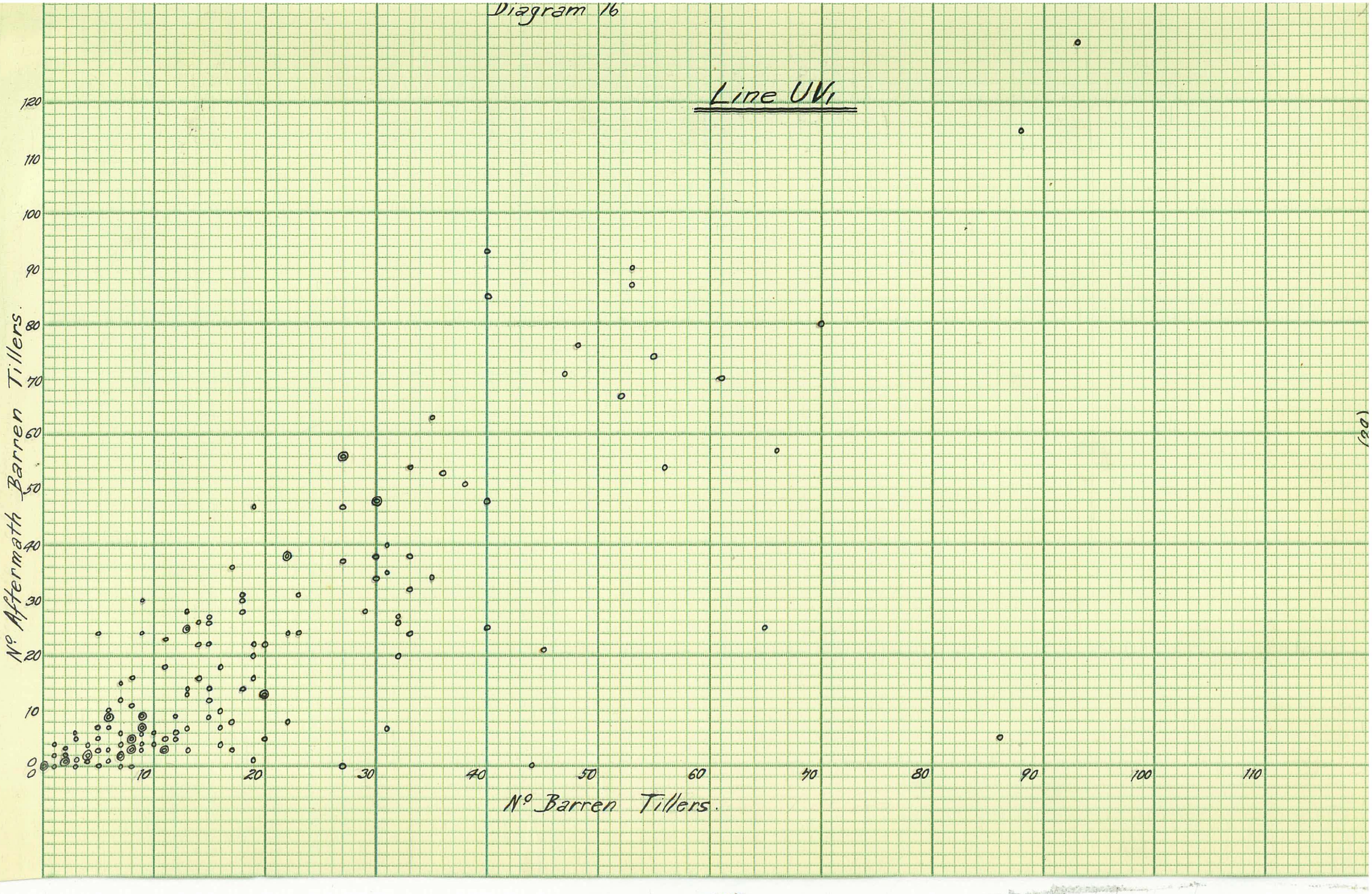
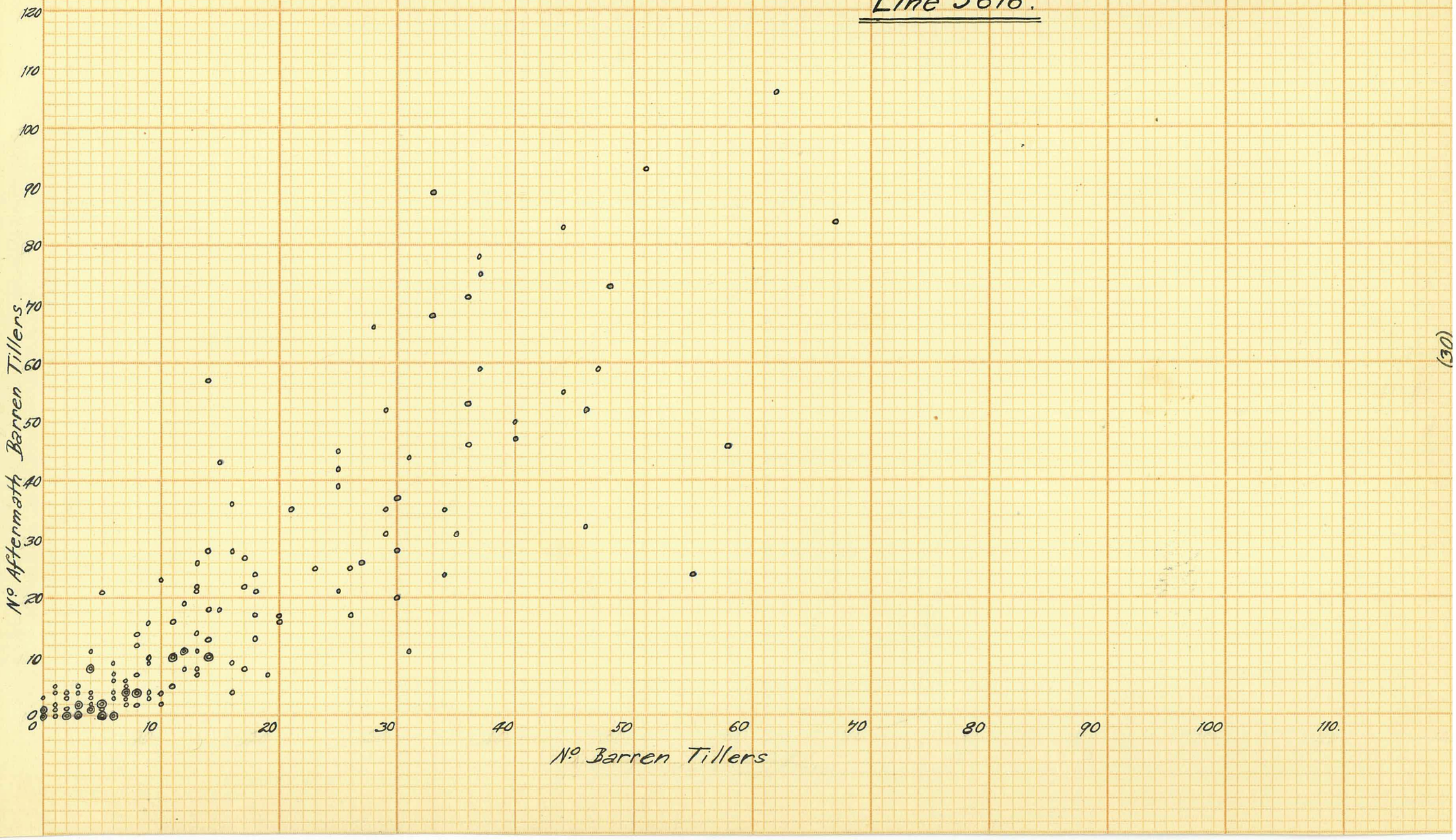

Line UV1
No Aftermath Barren Tillers.
No Barren Tillers.
0
10
20
30
40
50
60
70
80
90
100
110
120

Diagram 17.

Line 5616.



(30)

Diagram 18

Line UV2

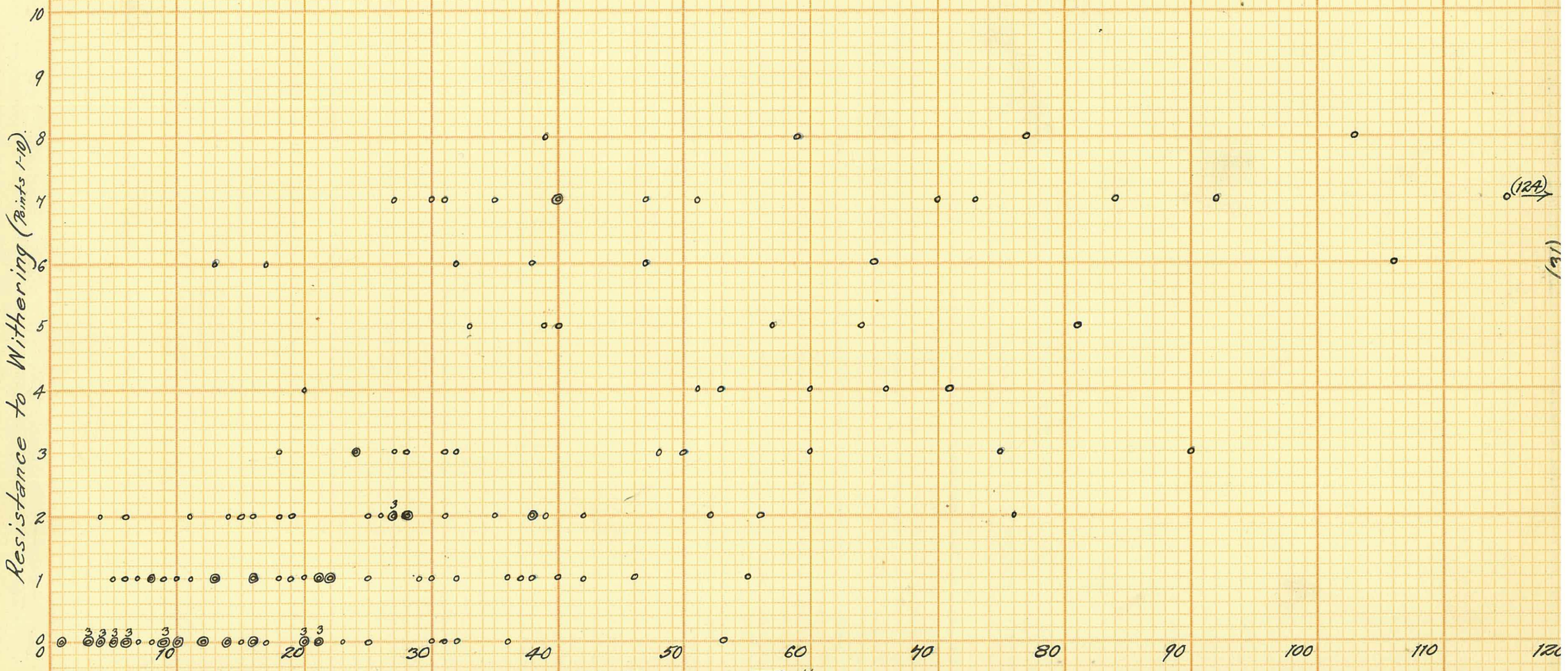


Diagram 19.

Line 5327.

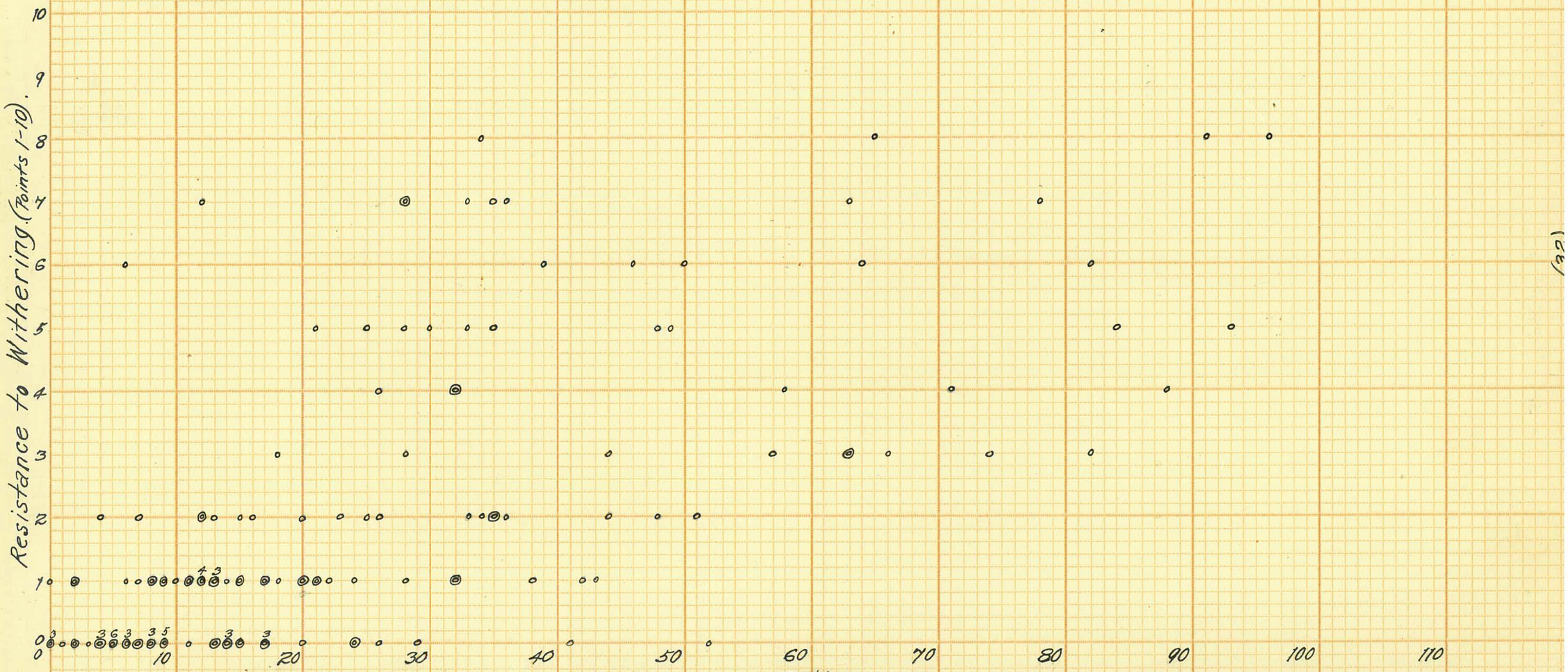
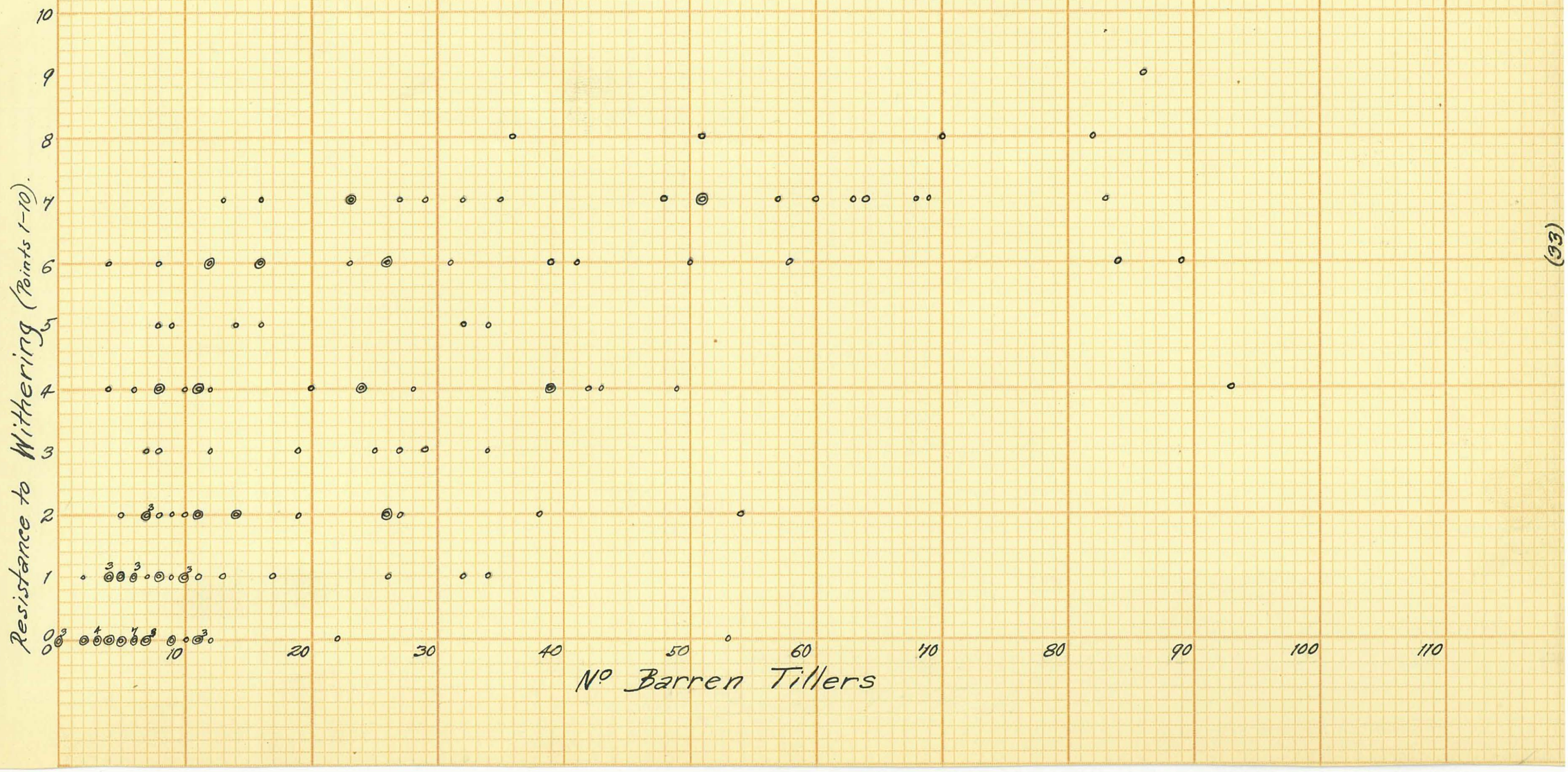


Diagram 20

Line 6104.



(63)

Diagram 21.

Line P3.

Diagram 21.

Line P3.

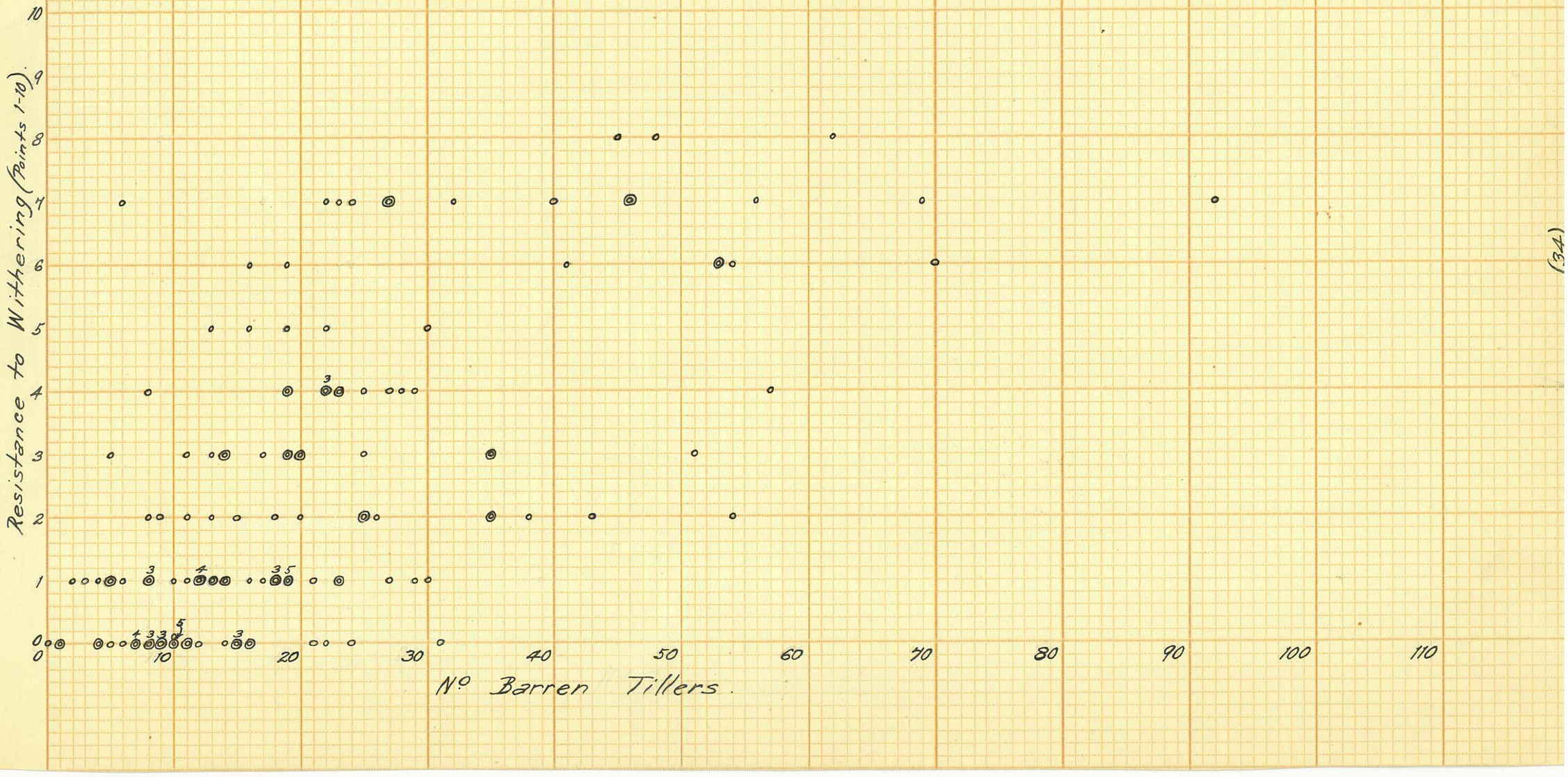


Diagram 22.

Line UV1

Diagram 23.

Line 5616.

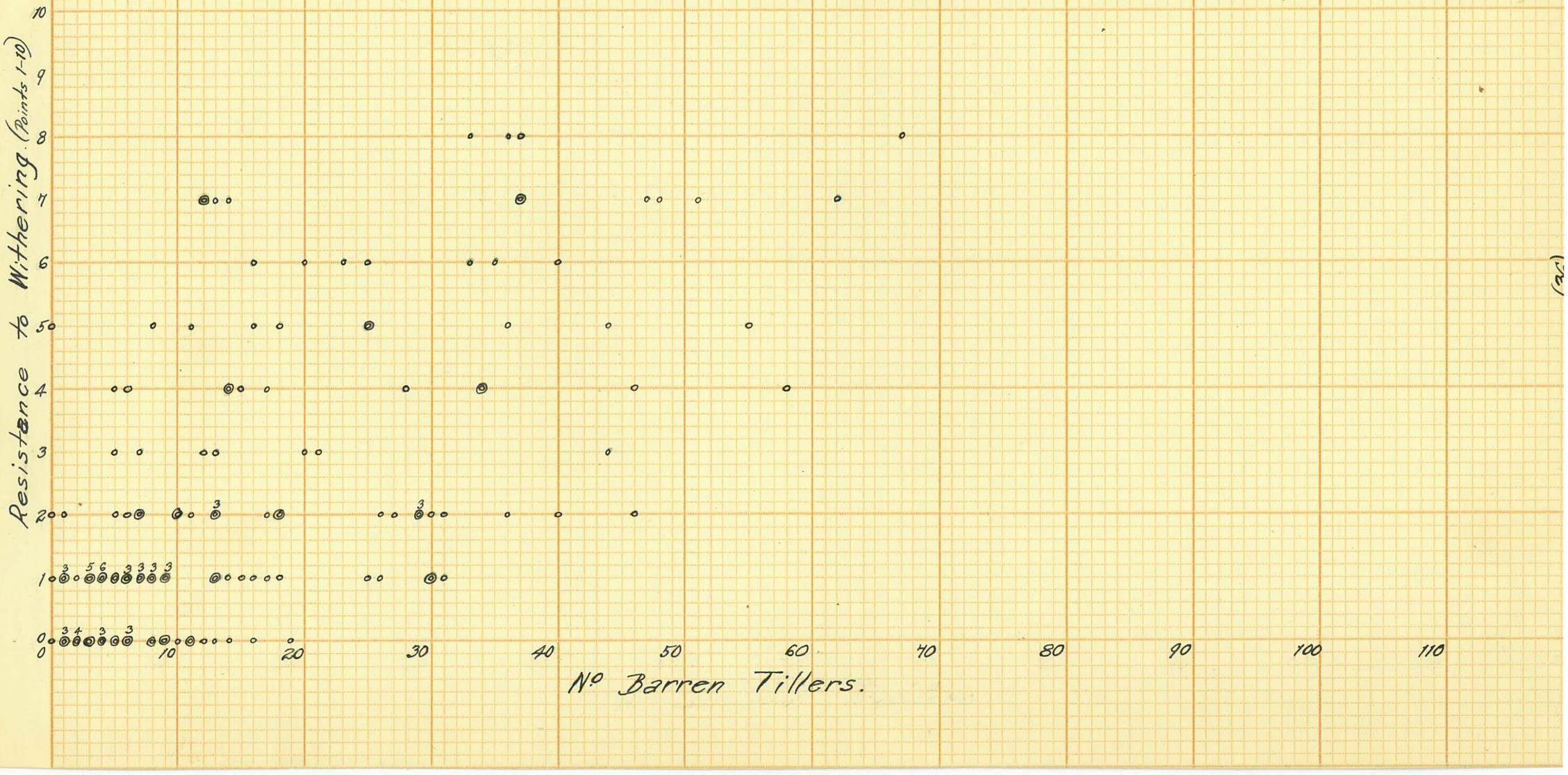


Diagram 24.

Line UV2.

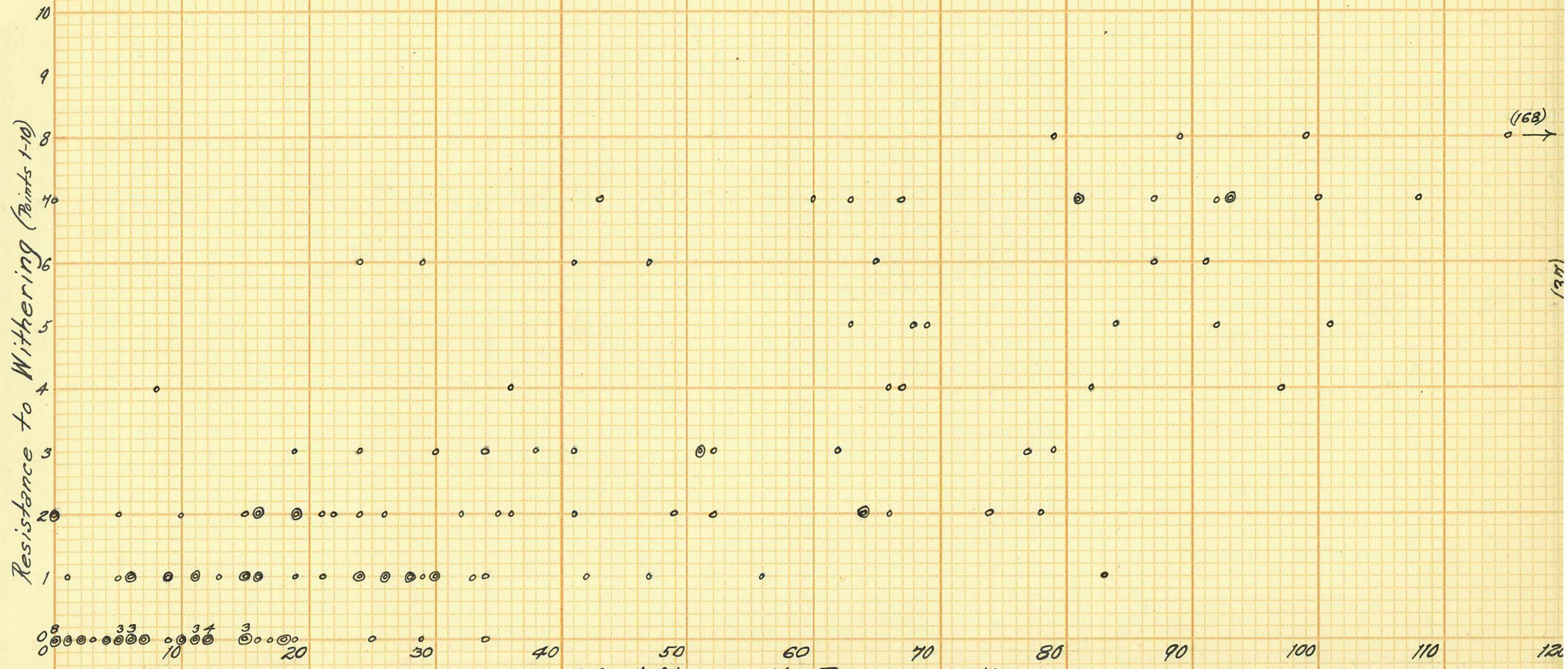


Diagram 25.

Line 5327.

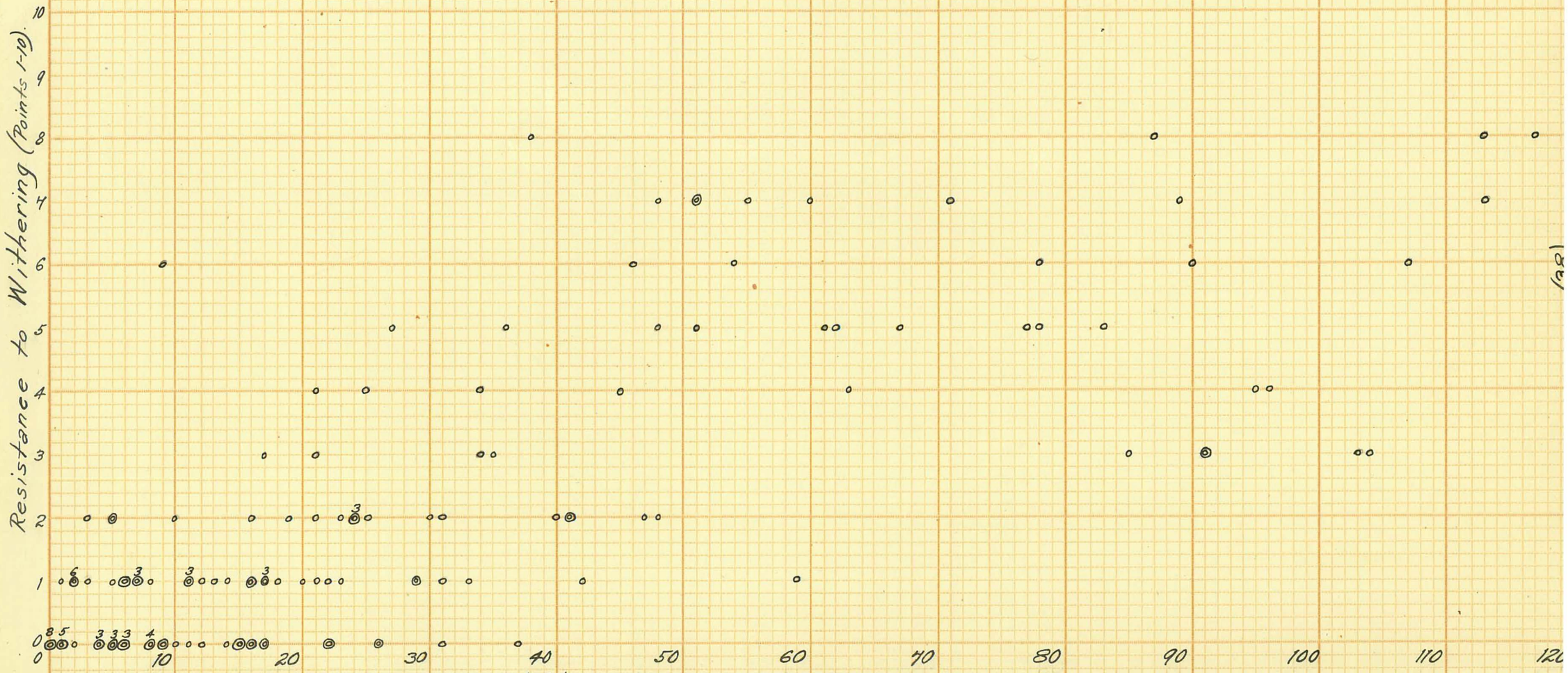


Diagram 26

Line 6104

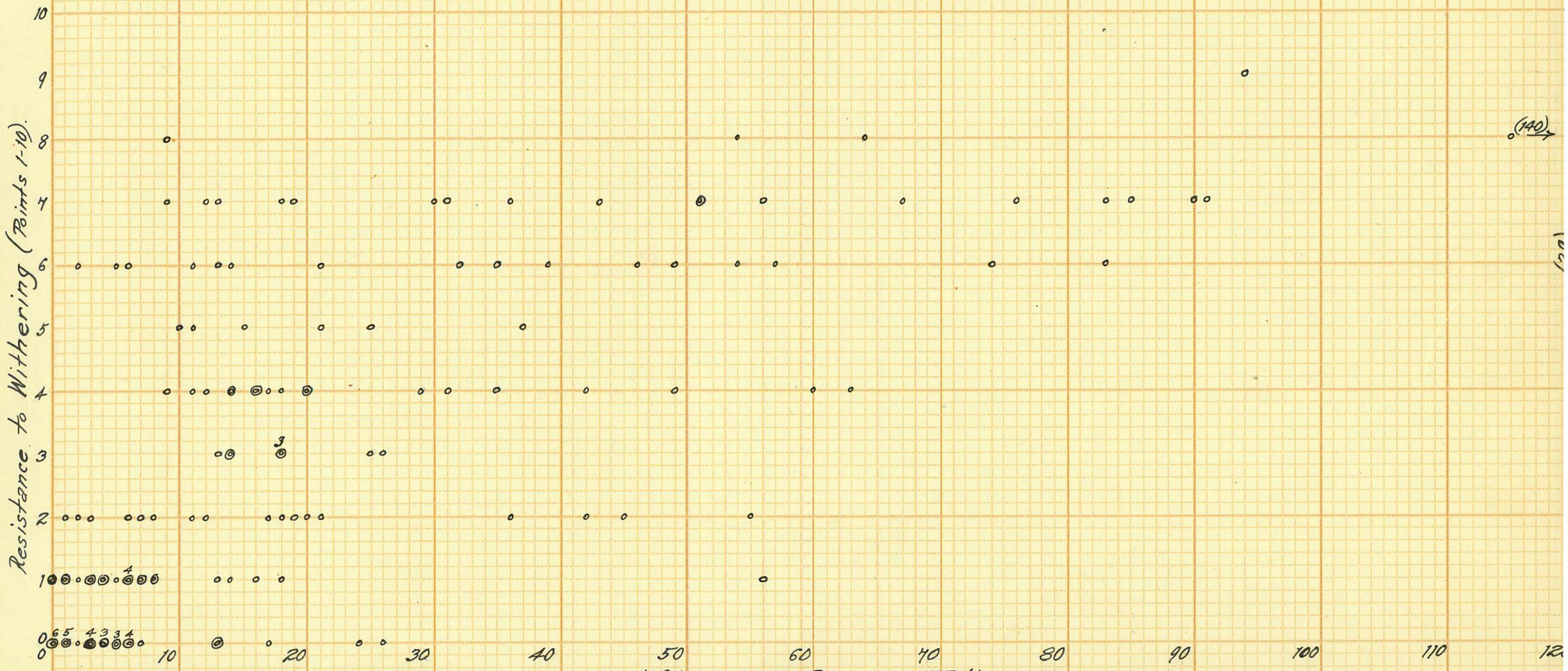


Diagram 27.

Line P3.

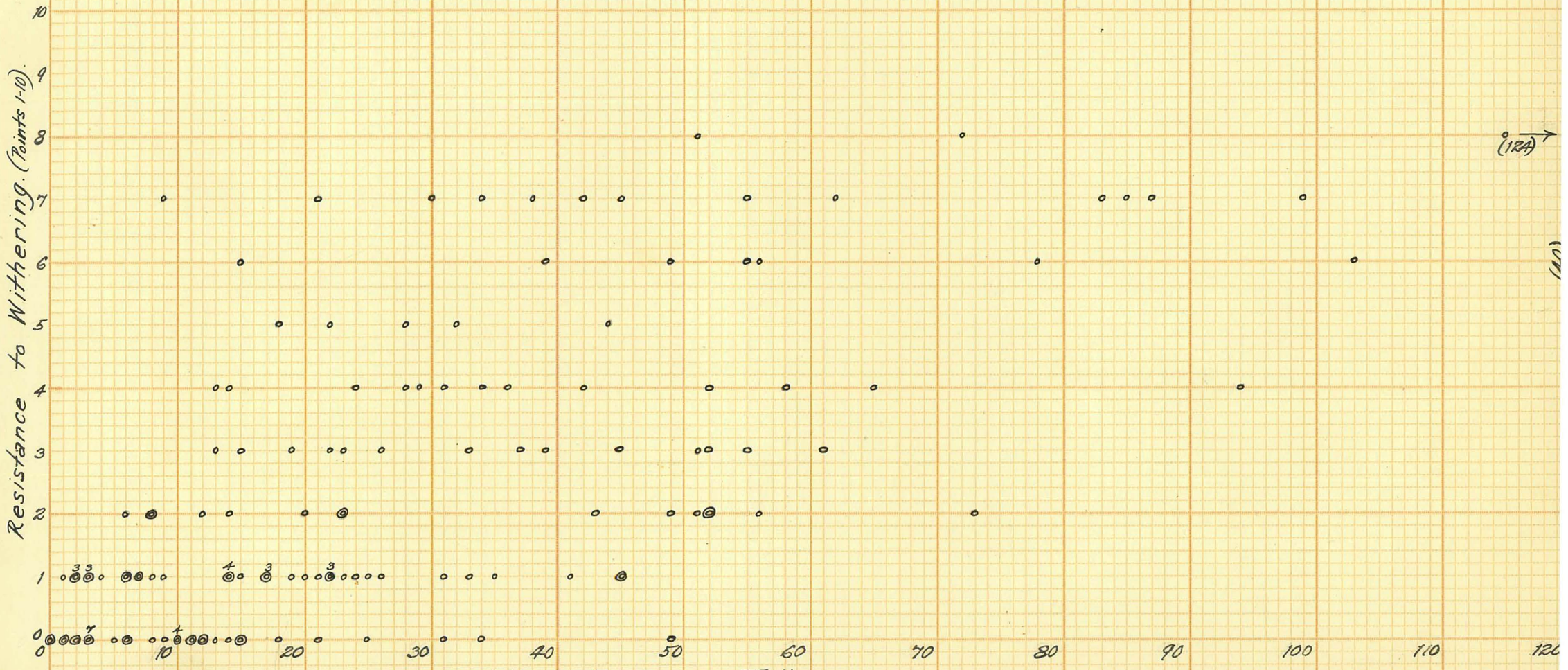


Diagram 28

Line U.V.1.

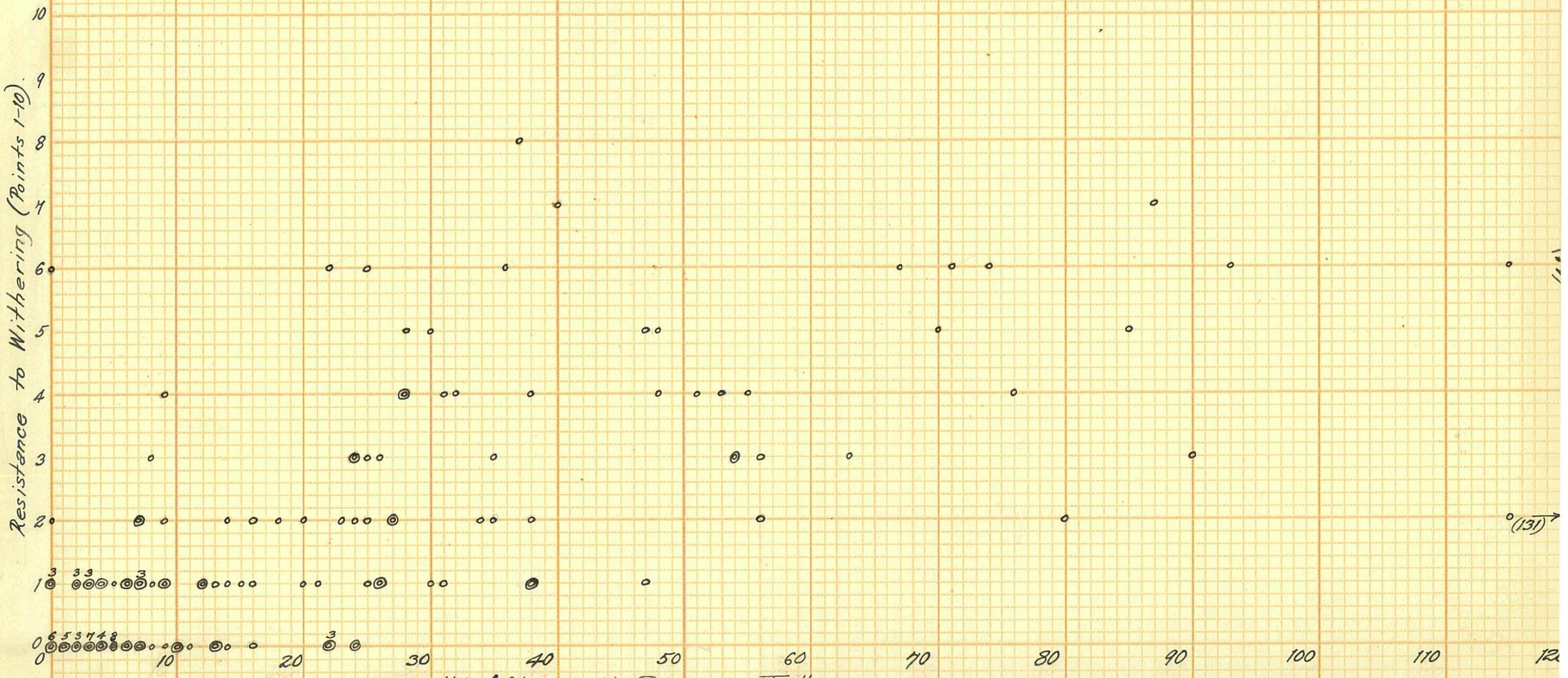


Diagram 29.

Line 5616

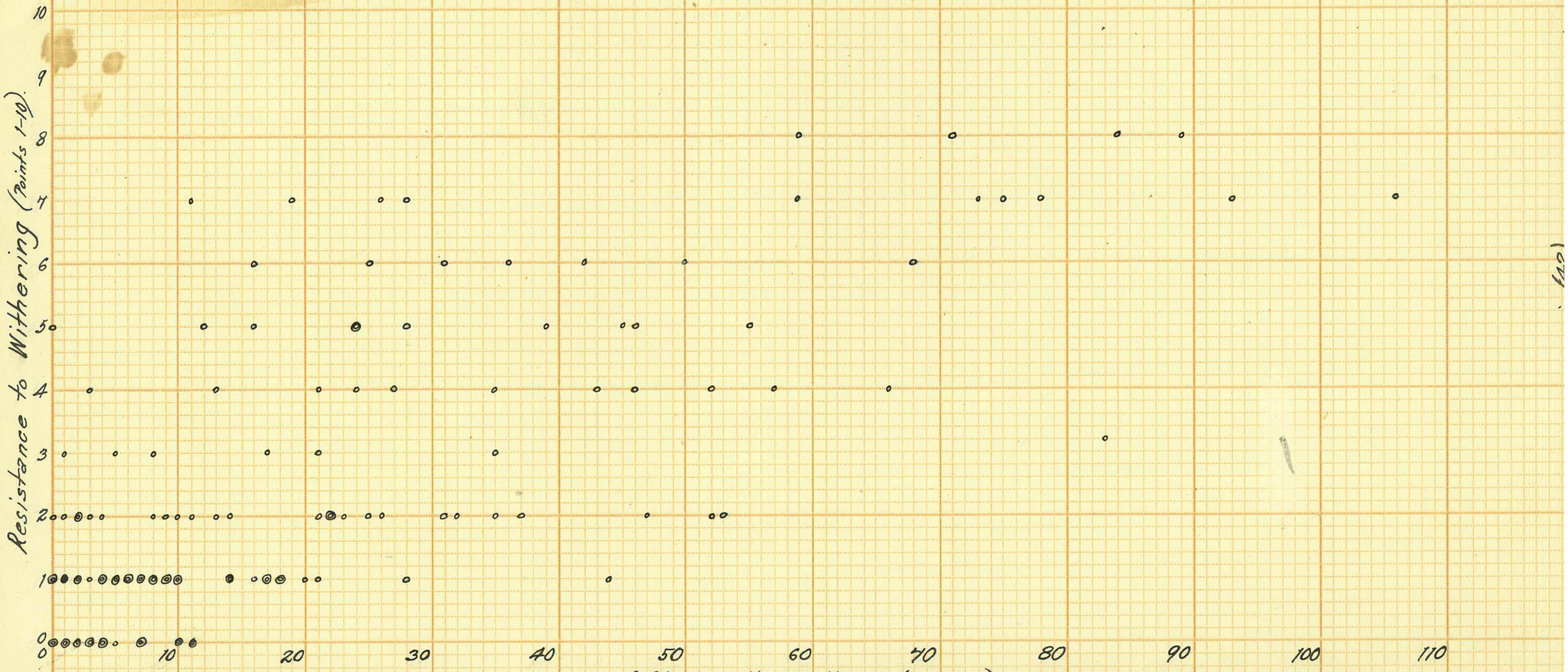


TABLE 1 (p. 44) shows the mean values of the measurements and counts made on plants of the seven measured lines arranged in descending order of mean number of barren tillers per plant in a line. It is seen from the table that lines with a high value for the mean number of barren tillers per plant have generally higher mean values for number of barren tillers in the aftermath.

However, the extreme condensation of facts as given in this table does not give a clear indication of the correlations that previously have been shown to exist. The table is presented chiefly for the sake of giving the data of these seven lines in a form similar to that given for the other sixty lines (see tables II - IV (pp. 48-50)).

From the "probable errors" calculated for Line C1 and given in footnote (2) of the table it is seen that the mean values shown are significant.

TABLE I.

Mean Values of Measurements* made on Plants of Seven Lines in Plot II A.

Line Number	Barren Tillers	Panicle Tillers	Aftermath Barren Tillers	Height Diameter	Head Density	Resistance to Withering (Points 1 to 10)
UV2	30.6	33.5	34.7	2.3	15.2	2.3
5327	25.7	25.6	29.4	2.1	15.1	2.1
6104	22.5	16.0	22.5	2.1	16.3	3.1
P3	20·6	31.9	27.6	1.8	14.9	2.4
UV1	20.5	27.9	22.5	2.0	14.9	1.8
C1	20.0	35.5	13.4	1.7	14.8	1.8
5616	16.5	21.2	20.3	2.3	16.5	2.4

NOTES:-

* (1) Except in the case of "Resistance to Withering" for which values were obtained from judgment observations on points, 1 to 10, least to greatest resistance.

(2) An indication of the significance of the above mean values is given by the "probable errors" calculated for the values of Line C1:-

	Barren Tillers	Panicle Tillers	Aftermath Barren Tillers	Ht/Dia.	Head Density	Resistance to Withering
C1.	± 1.5	± 1.5	± 1.9	± 0.14	± 1.2	± 0.15

(3) The lines are arranged in order of their mean number of barren tillers, greatest to least.

B. JUDGMENT VALUES OF THE REMAINING SIXTY LINES (made in an attempt at their preliminary evaluation):-

Values for density after flowering, and resistance to withering after flowering, and recovery after cutting are given for plot II A in table II (p.48), for plot II B in Table III (p.49), and for plot I in Table IV (p.50).
Values for the number of barren tillers at flowering time, and resistance to withering after flowering, and the number of barren tillers in the aftermath are given also for the seven measured lines of plot II A for the sake of comparison in Table V (p.51).

The mean values are given in brackets in all these tables.

The lines are grouped according to mean density values in Tables II to IV (see footnote (1) of Table II) and in descending order of average number of barren tillers in Table V. This grouping indicates that, in general, lines with larger mean densities have greater mean recovery and mean resistance to withering values than lines with smaller mean densities.

The relations are brought out further in diagrams 30, 31, and 32 (pp.52-54). It is apparent that for the lines taken together (using mean judged plant values) there are the same positive correlations as were found for single lines (using individual measured plant values). This shows that the observations made by judgment on points were fairly accurate as compared with the observations made by tiller counts.

The following are the correlations shown:-

(a) The mean densities of plants in every line is positively correlated with the mean recovery or aftermath densities of plants in every line - diagram 30.

(b) The mean densities of plants in every line is positively correlated with the mean resistance to withering

of plants in every line - diagram 31.

(c) The mean recovery densities of plants in every line is positively correlated with the mean resistance to withering of plants in every line - diagram 32.

FLOWERING IN THE SIXTY LINES:-

No relation seems to exist either between the mean densities and the flowering dates or between mean densities and range of flowering dates (Tables II to V).

Indications of range and distribution of first flowering in plots I and IIB, and in plot IIA are given in diagrams 33 and 34 (pp. 55, 56) respectively. This feature, although tabulated, is not regarded as of primary importance.

The Place of Origin of the plants does not appear to have any significance with regard to any of the observations on the plants, (Tables II to V), except in the case of one outstanding line, viz. P2, recorded in Table II. This line originated from seed collected by the plant-breeder from permanent pasture on the Massey Agricultural College farm, only one seed being taken from any one plant. The plants of this line seem to be, in general, of high density, of good resistance to withering, and possessed of good powers of recovery after cutting.

The general non-significance of "place of origin" is not remarkable considering that most of the lines originated in Southland where habital conditions are apparently fairly uniform. Moreover, the mixing and blending of seed by commercial seed firms tends to give a uniformly mixed origin to any lot of seed that may be purchased.

If the origin of any line was doubtful, a question mark has been inserted in the table next to the supposed place of origin.

The term "stripped" occurring in the "origin column" of

any table refers to the stripping method of harvesting of Dogstail seed, and in most cases (where marked with question marks) was judged by the plant-breeder as such from the relative colour and appearance of the seed sample.
The lines originating from this method of harvesting, representing as it does in general the obtaining of seed from permanent pastures, do not appear to have any characteristic which distinguishes them from the other lines.

A NOTE ON THE INVESTIGATION AS A WHOLE:-

No outstanding ecotypical groupings of plants of Crested Dogstail were found, and no particular lines were outstanding except line P2 recorded in group (a) of Table II. This negative result may have been due in part to the very unfavourable conditions for establishment of the seedling plants at the time of planting out, the habital characters not reaching full expression. However, this explanation does not apply to plants of plot II A which established well. Moreover, the existence of the excellent line, P2 of plot II A, shows that the general environmental conditions did not prevent good growth in all plants.

It seems probable that the absence of marked ecotypes maybe due to the general similarity of habitats from which the plants originated and to the mixing and blending of seed by seed firms. Apart from this last point the result is not surprising considering that, with a larger number of places of origin and with older pastures to draw upon, workers at the Aberystwyth Plant Breeding Station have not noted any remarkable differences of type in Crested Dogstail. (Journal of the British Ministry of Agriculture, Volume 34, Page 516).

TABLE II

Evaluation of Lines (Plot II A.)

(Averages in brackets)

Line Number	Origin	Number of Plants	Mean Flowering Date.	Range of Flowering Dates	Density 23/1/31	Resistance to Withering 23/1/31	Recovery 25/2/31
(a)							
P2	Permanent Pasture M.A.C.	145	3/1/31	23/12-14/1	265(1.8)	589(4.1)	457(3.2)
C2	Bainesse Sand.	146	31/12/30	26/12-5/1	214(1.5)	392(2.7)	266(1.8)
C4	Rangiotu Sand.	145	29/12/30	22/12-5/1	185(1.3)	373(2.6)	348(2.4)
6223	Southland	141	22/12/30	10/12-3/1	178(1.3)	381(2.7)	287(2.0)
6224	" (?)	141	26/12/30	19/12-3/1	185(1.3)	445(3.2)	320(2.3)
6217	" "	140	29/12/30	20/12-7/1	202(1.4)	432(3.8)	248(1.8)
(b)							
P1	Tapanui	146	1/1/31	28/12-5/1	112(0.8)	305(2.1)	272(1.9)
C3	Bainesse Sand	146	30/12/30	22/12-7/1	173(1.2)	236(1.6)	--------
6377	Commercial	142	29/12/30	18/12-10/1	139(1.0)	341(2.4)	249(1.8)
6103	Southland (Stripped)	143	1/1/31	26/12-7/1	109(0.8)	379(2.7)	445(3.1)
(c)							
P4	Tapanui	144	24/12/30	18/12-30/12	80(0.6)	299(2.1)	212(1.5)
6105	Sandon(?)	146	29/12/30	22/12-5/1	55(0.4)	305(2.1)	219(1.5)
6106	Sandon (Stripped)	143	26/12/30	21/12-1/1	52(0.4)	303(2.1)	170(1.2)

13 lines

NOTES:- (1) Group (a) consists of lines with mean densities of their plants equal to 1.2 or more.

Group (b) consists of those with density values 0.8 to 1.1.

Group (c) consists of those with density values 0.4 or less.

(2) The dates given above the three right hand columns refer to the time when the respective judgments were made.

TABLE III

Evaluation of Lines (Plot II B.)

(Averages in Brackets).

Line Number	Origin	Number of Plants	Mean Flowering Date.	Range of Flowering Dates.	Density 22/1/31	Resistance to Withering 22/1/31	Recovery 24/2/31 & 25/2/31
(a)							
6226	Southland	125	1/1/31	19/12-14/1	136(1.1)	200(1.6)	295(2.4)
C5	Oroua Downs Sand.	128	2/1/31	25/12-10/1	96(0.8)	387(3.0)	267(2.1)
6344	Southland	129	28/12/30	19/12-7/1	112(0.9)	497(3.9)	271(2.1)
6374	"	126	30/12/30	19/12-10/1	101(0.8)	550(4.4)	276(2.2)
6391	"	127	31/12/30	19/12-12/1	115(0.9)	583(4.6)	205(1.6)
5812	"	127	30/12/30	19/12-10/1	102(0.8)	455(3.6)	222(1.7)
(b)							
6246	Southland	130	26/12/30	19/12-2/1	93(0.7)	406(3.1)	130(1.7)
A.P.A 26	Terrace M.A.C.	130	30/12/30	25/12-7/1	81(0.6)	417(3.2)	238(1.8)
6375	Southland	127	31/12/30	19/12-12/1	89(0.7)	570(4.5)	233(1.8)
6589	"	126	28/12/30	19/12-7/1	73(0.6)	406(3.2)	164(1.3)
6392	"	127	31/12/30	19/12-12/1	92(0.7)	569(4.5)	211(1.7)
6539	"	126	28/12/30	19/12-7/1	74(0.6)	514(4.1)	206(1.6)
5849	"	129	28/12/30	19/12-7/1	58(0.4)	377(2.9)	162(1.3)
5291	"	129	30/12/30	19/12-10/1	82(0.6)	454(3.5)	205(1.6)
(c)							
6399	Sandon (Stripped)	129	30/12/30	20/12-10/1	41(0.3)	402(3.1)	156(1.2)
6501	" "	126	3/1/31	27/12-10/1	39(0.3)	388(3.1)	148(1.2)
5457	Sandon	123	30/12/30	22/12-7/1	26(0.2)	282(2.3)	133(1.1)

17 Lines

NOTE:- The grouping of lines into groups (a), (b), and (c) is in the same way as in Table II.

TABLE IV (Averages in brackets)

Evaluation of Lines (Plot I)

Line Number	Origin	Number of Plants	Mean Flowering Date.	Range of Flowering Dates.	Density (22/1/31) & 23/1/31	Resistance to Withering (22/1/31) & 23/1/31	Recovery (24/2/31) & 25/2/31
(a)							
5394	Southland	132	31/12/30	22/12-10/1	103(0.8)	412(3.1)	270(2.0)
5813	"	135	30/12/30	20/12-10/1	115(0.9)	502(3.7)	250(1.9)
5402	Southland (Stripped)?	151	29/12/30	20/12-7/1	125(0.8)	539(3.6)	303(2.0)
(b)							
5573	Commercial	118	2/1/31	25/12-10/1	82(0.7)	342(2.9)	239(2.0)
5800	"	120	31/12/30	22/12-10/1	52(0.4)	267(2.2)	208(1.7)
5482	Southland	123	31/12/30	22/12-10/1	88(0.7)	417(3.4)	241(2.0)
5610	"	131	27/12/30	19/12-5/1	79(0.6)	429(3.3)	218(1.7)
5803	"	130	27/12/30	19/12-5/1	92(0.7)	397(3.1)	235(1.8)
5385	"(Stripped?)	136	29/12/30	22/12-5/1	90(0.7)	488(3.6)	273(2.0)
5371	Sandon (27)	145	29/12/30	25/12-3/1	52(0.4)	289(2.0)	223(1.5)
5108	Sandon	140	27/12/30	19/12-5/1	54(0.4)	292(2.1)	213(1.5)
5390	Southland	141	27/12/30	19/12-5/1	52(0.4)	311(2.2)	224(1.6)
5289	"(Stripped?)	138	30/12/30	19/12-10/1	101(0.7)	418(3.0)	233(1.7)
5372	Sandon (27)	153	31/12/30	19/12-12/1	71(0.5)	383(2.5)	233(1.5)
5809	Southland	144	30/12/30	19/12-10/1	85(0.6)	440(3.1)	271(1.9)
5384	"(Stripped?)	155	30/12/30	19/12-10/1	104(0.7)	501(3.2)	310(2.0)
5382	Southland	144	26/12/30	19/12-3/1	54(0.4)	318(2.2)	209(1.5)
5393	"	151	30/12/30	19/12-10/1	78(0.5)	436(2.9)	247(1.6
5387	"	141	30/12/30	19/12-10/1	82(0.6)	510(3.6)	278(2.0)
5242	"	143	28/12/30	22/12-3/1	62(0.4)	395(2.8)	215(1.5)
5232	"	131	27/12/30	19/12-5/1	54(0.4)	354(2.7)	203(1.5)
5850	Sandon ?	127	1/1/31	22/12-12/1	46(0.4)	319(2.5)	171(1.3)
5420	Southland	174	30/12/30	19/12-10/1	115(0.7)	645(3.7)	316(1.8)
5421	"	145	30/12/30	19/12-10/1	67(0.5)	416(2.9)	249(1.7)
7783	"	152	30/12/30	19/12-10/1	61(0.4)	394(2.6)	248(1.6)
6627	"	120	1/1/31	19/12-14/1	76(0.6)	330(2.8)	221(1.8)
5113	"	151	28/12/30	19/12-7/1	99(0.7)	495(3.3)	340(2.3)
(c)							
5398	Southland	142	30/12/30	25/12-5/1	43(0.3)	314(2.2)	224(1.6)
5381	"(Stripped?)	139	30/12/30	22/12-7/1	41(0.3)	262(1.9)	182(1.3)
5892	Southland	134	28/12/30	19/12-7/1	46(0.3)	367(2.7)	238(1.8)

30 lines.

NOTE:- The grouping is as in Table II.

TABLE V

Evaluation of Lines (7 lines of Plot II A, critically examined.

(Averages in brackets)

Line Number	Origin	Number of Plants	Mean Flowering Date.	Range of Flowering Dates.	Number of Barren Tillers	Resistance to Withering (Points 1-10)	No of Barren Aftermath Tillers
UV2	Selection for erectness	146	31/12/30	22/12-10/1	4470(30.6)	334(2.3)	5060(34.7)
5327	Commercial	146	27/12/30	18/12-5/1	3759(25.7)	305(2.1)	4290(29.4)
6104	Southland	142	27/12/30	19/12-5/1	3192(22.5)	445(3.1)	3188(22.5)
P3	Tapanui	146	26/12/30	21/12-1/1	3009(20.6)	347(2.4)	4023(27.6)
UV1	Selection for UV-shape	146	28/12/30	21/12-5/1	2987(20.5)	257(1.8)	3287(22.5)
C1	Oroua Downs Sand	146	30/12/30	24/12-5/1	2917(20.0)	257(1.8)	1962(13.4)
5616	Commercial	146	29/12/30	22/12-5/1	2403(16.5)	352(2.4)	2969(20.3)

NOTE:-

The lines are arranged in descending order of their values for mean number of barren tillers.

Diagram 30.

Lines of Plots I and IIB (marked o) and Plot IIA (marked x).

Total N° of Lines = 59 { Plots I + IIB = 47 / Plot IIA = 12

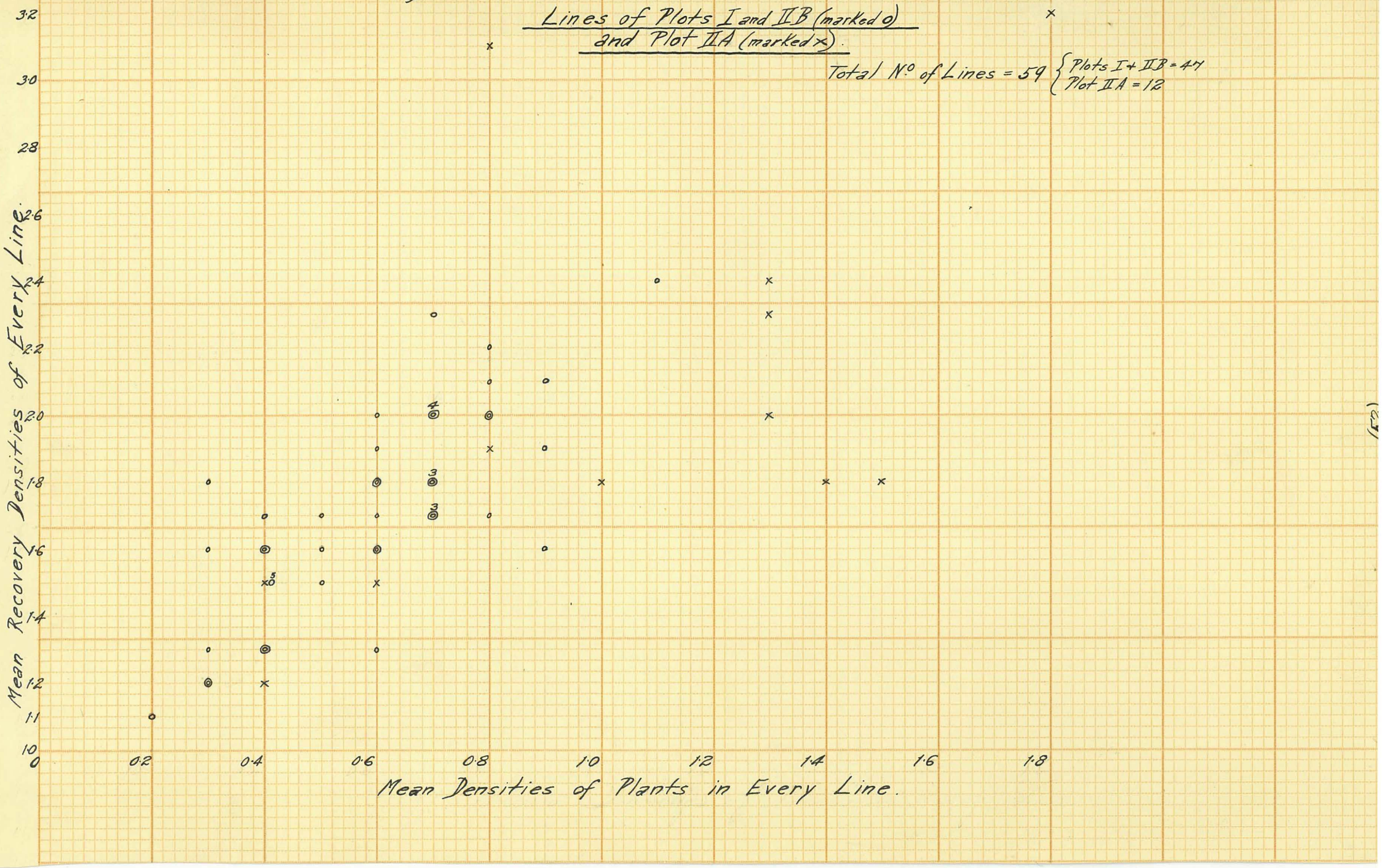


Diagram 31


Lines of Plots I and IIB (marked o), and Plot IIA (marked x).
Total No. of Lines = 60 { Plots I & IIB = 47. Plot IIA = 13
Mean Resistance to Withering of Every Line.
4·6
4·1
3·6
3·1
2·6
2·1
1·6
1·35
0
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·6
1·8
2·0
Mean Densities of Plants in every line.

Diagram 32.

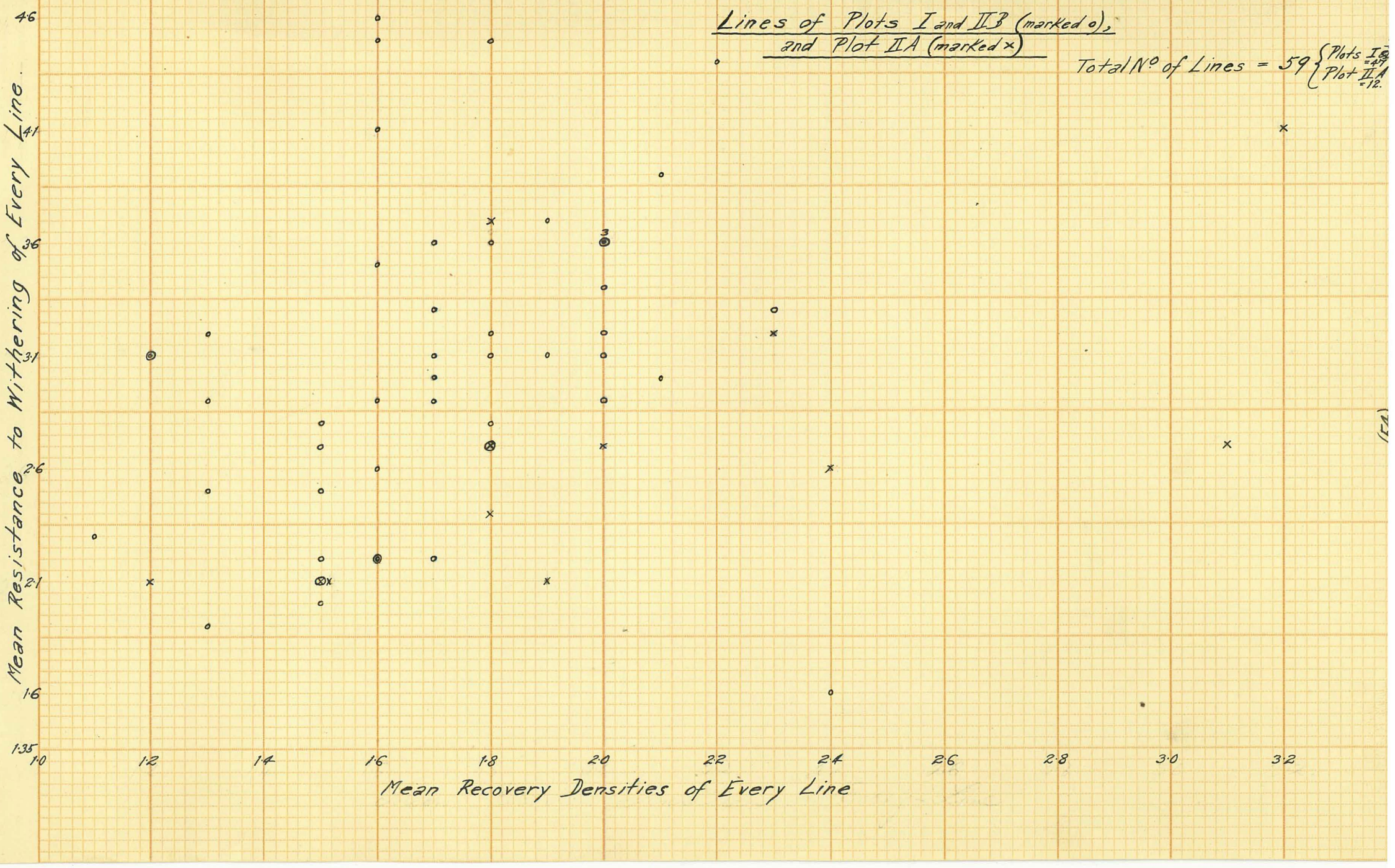

Lines of Plots I and IIB (marked o), and Plot IIA (marked x)
Total No of Lines = 59 { Plots I & IIB = 47 Plot IIA = 12.
Mean Resistance to Withering of Every Line.
4·6
4·1
3·6
3·1
2·6
2·1
1·6
1·35
1·0
1·2
1·4
1·6
1·8
2·0
2·2
2·4
2·6
2·8
3·0
3·2
Mean Recovery Densities of Every Line

Diagram 33

Flowering in Plots I and II B.

Dates on which 1st Flowering was noted.	Number of Plants.	
19th.	86	142
20th.	56	
22nd.	324	
25th.	1245	
27th.	1804	
29th.	1550	
31st.	580	
2nd	376	
3rd	91	193
5th.	102	
7th.	31	
10th.	28	
12th	5	
14th.	3	
	6284	= Total No of Plants.

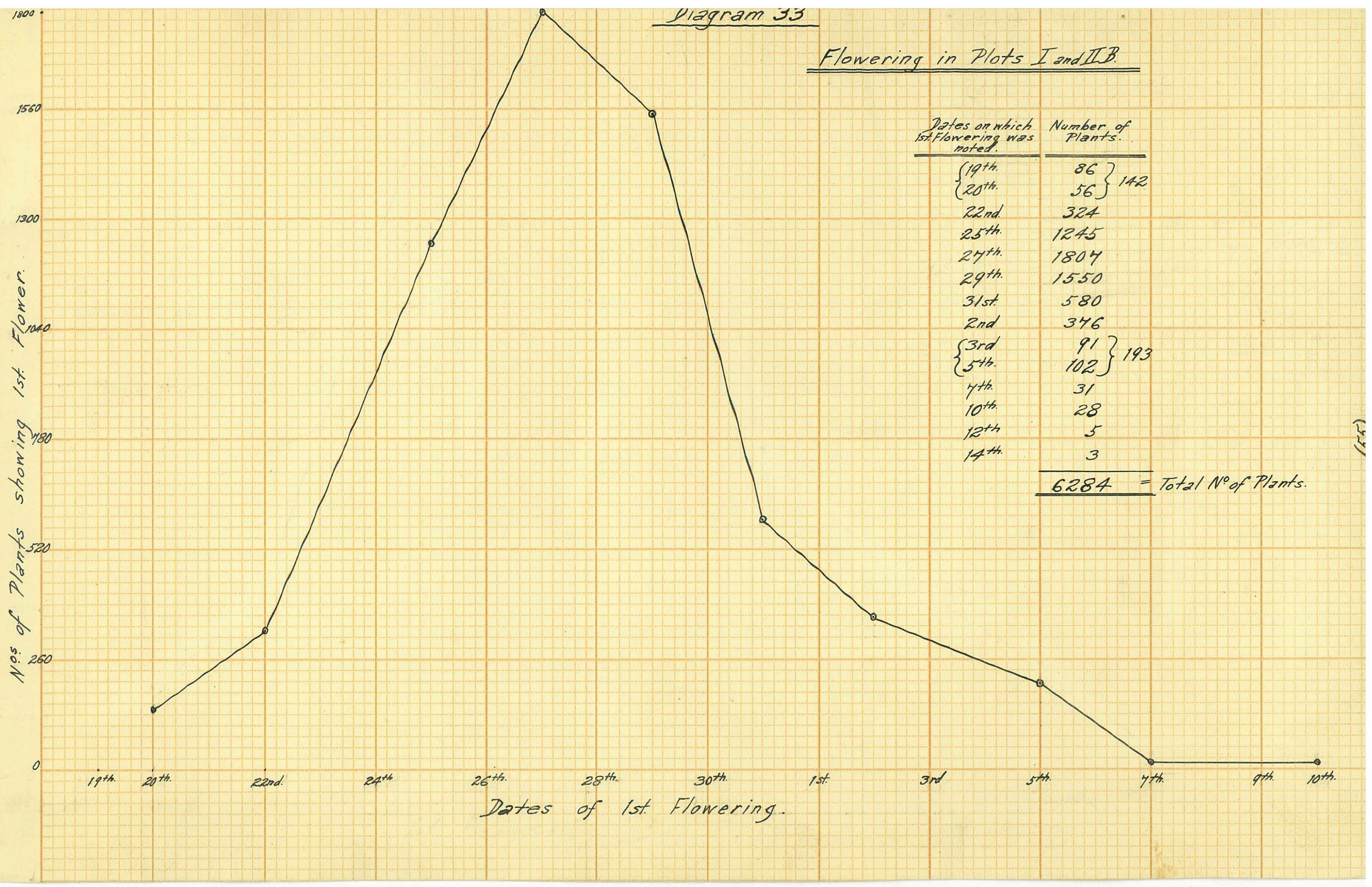
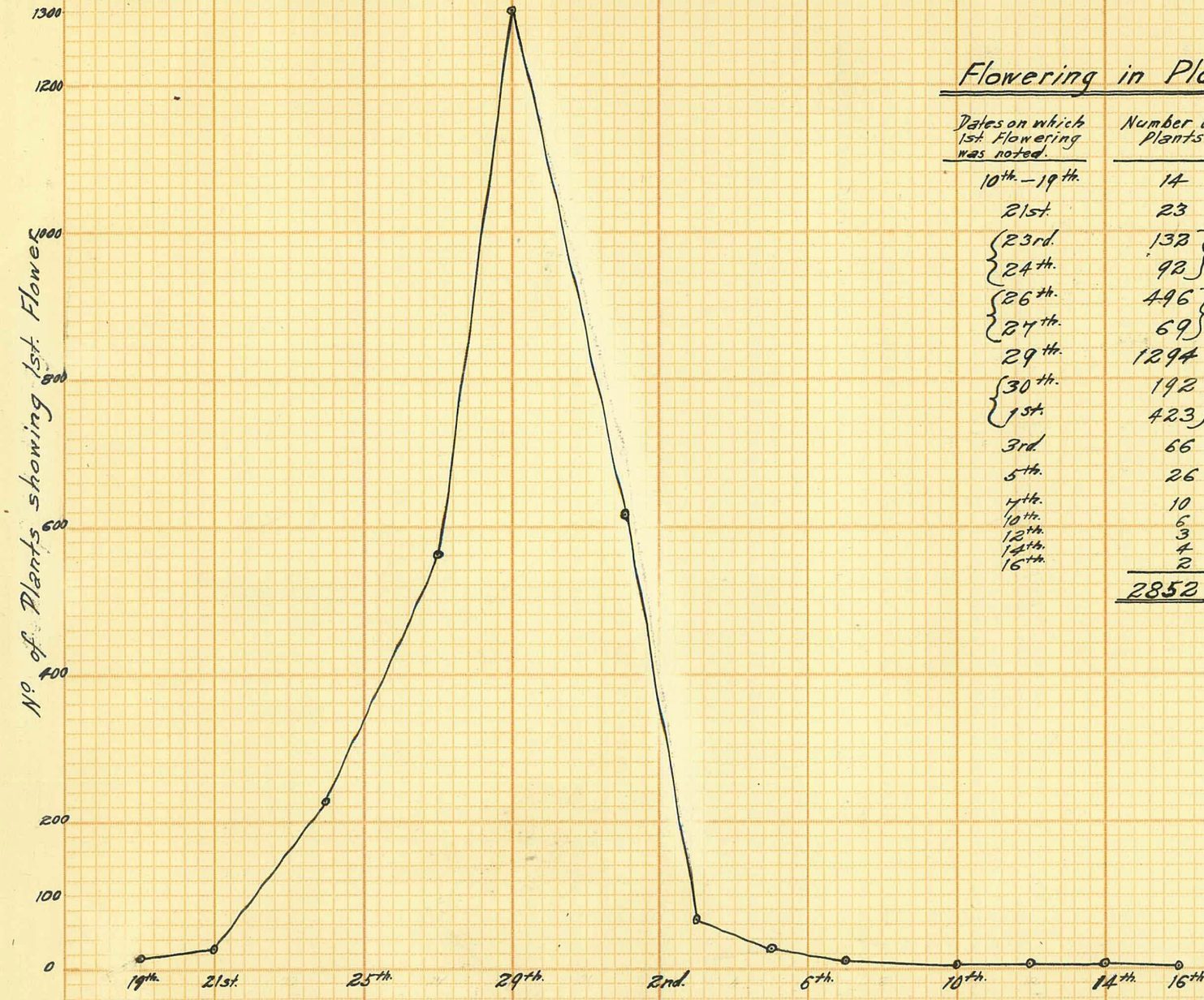


Diagram 54.



Flowering in Plot IIA

Dates on which 1st. Flowering was noted.	Number of Plants.	
10th. – 19th.	14	
21st.	23	
23rd.	132	224
24th.	92	
26th.	496	565
27th.	69	
29th.	1294	
30th.	192	615
1st.	423	
3rd.	66	
5th.	26	
7th.	10	
10th.	6	
12th.	3	
14th.	4	
16th.	2	

2852 = Total No. of Plants.

(55)

GENERAL CONCLUSIONS:-

A. In the summer season of 1930-31 Crested Dogstail in its seedling year showed the following characteristics:-

(1) The plants with a large number of barren tillers at flowering time produced a large number of barren tillers in the aftermath growth. Those with few barren tillers produced only a few in the aftermath.

(2) Just after flowering time plants with a large number of barren tillers showed less withering than plants with fewer barren tillers.

(3) The more resistant to withering a plant was just after flowering and before seed shedding the greater the number of barren tillers produced by the plant in the aftermath.

Apart from conclusions (1), (2), and (3) above the obtaining of correlated habital characters of value in leading to greater precision in breeding work in the future has been without result.

B. Concerning the attempt at the preliminary evaluation of lines of Crested Dogstail certain groups of lines (the (a) groups of tables II to IV and say the first three lines given in table V) have been separated as being superior to the other lines as far as density, resistance to withering, and power of recovery after cutting are concerned during the period of the observation.

This superiority must be tested for another season, and other characters of the plants such as "persistency" determined before definite mass selection is possible.

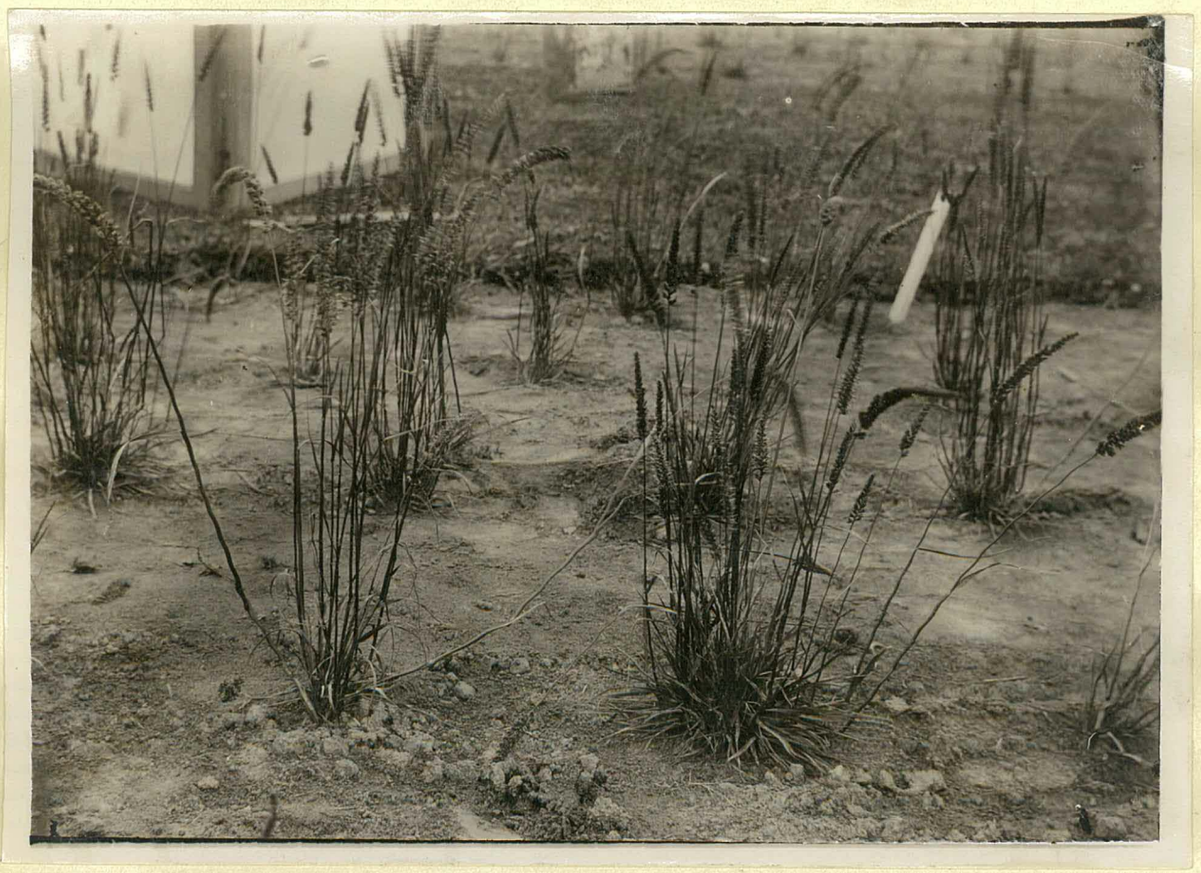


Fig. I. Plants 10 and 11, Line UV2, Plot IIA, "in situ".

Measurements :—	No. Barren Tillers	No. Panicle Tillers	No. Aftermath Barren Tillers	Height/Diameter	Head Density	Res. to Withering
No. 10 (to the Left Foregound)—	4	22	16	3·0	16	2
No. 11 (" " Right ")—	21	54	30	1·3	20	1

Plant 10 is very lax, of low vigour, rather erect, and susceptible to withering.

Plant 11 is more dense, of greater vigour, inclined, and highly susceptible to withering.

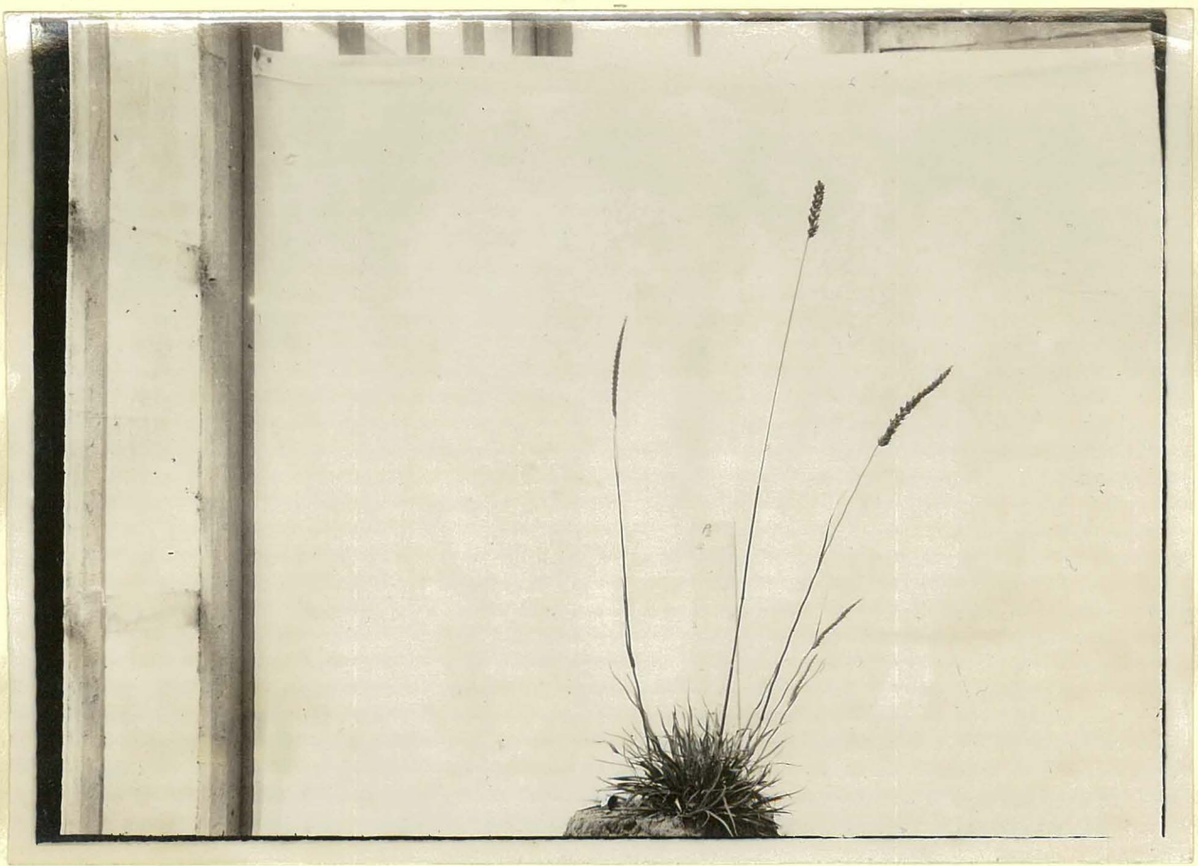


Fig. II. Plant 12, Line P2, Plot IIA.

Measurements:-

Nº Barren Tillers	Nº Panicle Tillers	Nº Aftermath Barren Tillers	Height/ Diameter	Head Density	Resistance to Withering
105	8	80	1·8	13	9.

This plant is one of high density, with very few heads, of high vigour, slightly inclined, and very resistant to withering.

Fig. III. Plants 134 (to left), 133 (to right) of Line P2, Plot II A.

Measurements :—	Nº Barren Tillers	Nº Panicle Tillers	Nº Aftermath Barren Tillers	Height / Diameter	Head Density	Resistance to Withering.
Nº 134	42	55	64	0·9	12	5
Nº 133	80	23	83	0·6	15	8

These two plants show well the correlation between density at flowering time and density in aftermath.

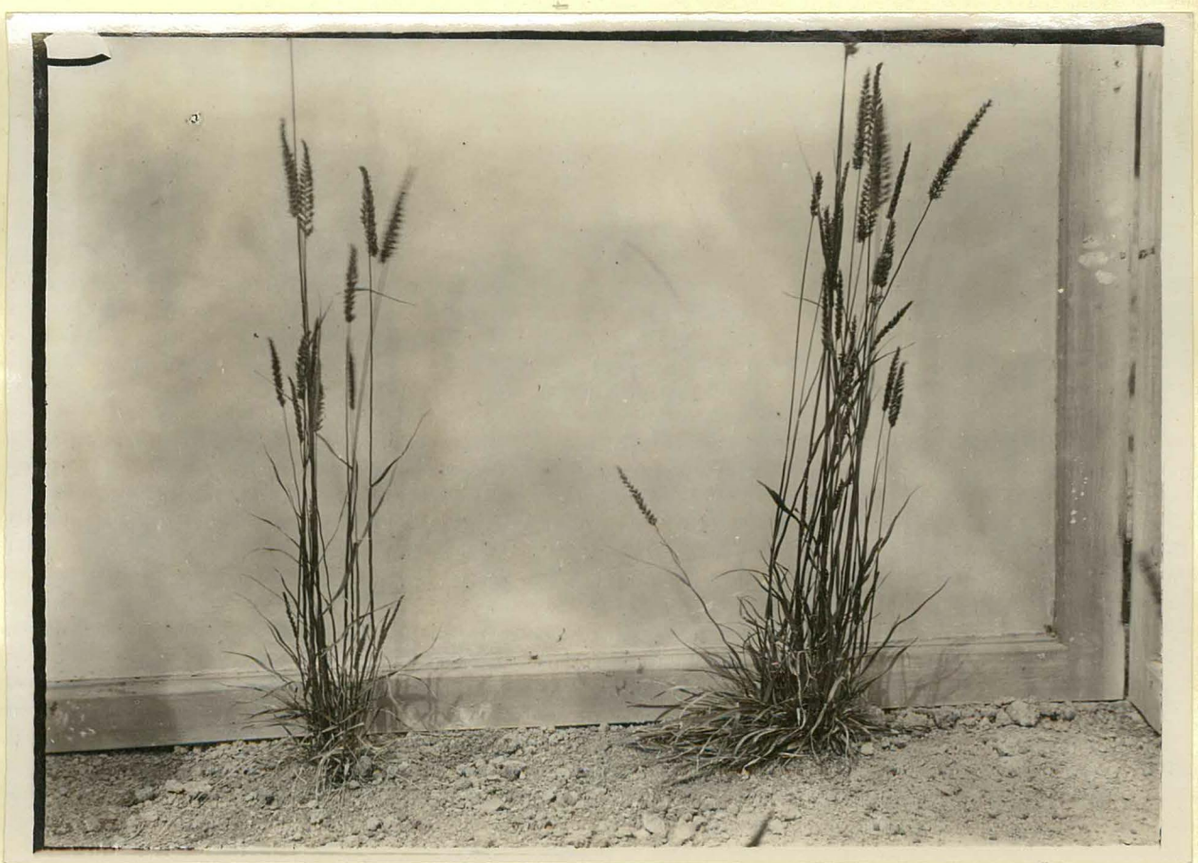


Fig. IV :— Plants 57 (to Left), 58 (to Right) of Line UV2, Plot II A.

Measurements :—	Nº Barren Tillers	Nº Panicle Tillers	Nº Aftermath Barren Tillers	Height/Diameter	Head Density	Resistance to Withering
Nº 57	25	52	11	1·0	11	0
Nº 58	103	18	99	2·1	21	8

Although both these plants are erect, they differ widely in all other characters that were measured. They show well the correlation of "Resistance to withering" with "Nº of Aftermath B. Tillers."

Fig. V. :— Plant 146 of Line 6104 and Plant 1 of Line C1 (These plants were next each other in the plot—IIA.)

Measurements :—	Nº Barren Tillers	Nº Panicle Tillers	Nº Aftermath Barren Tillers	Height/Diameter	Head Density	Resistance to Withering
Nº 146	89	31	14	1·9	15	6
Nº 1.	80	10	65	1·7	14	9

Although these plants have about the same number of barren shoots at flowering time, they differ appreciably in their resistance to withering, but conform with the general correlation, "Resistance to Withering" at flowering time and "Nº of Barren Tillers in the Aftermath".

Fig. VI:— Plants 7 (to Left), 10 (to Right) of Line C3, Plot II A.

Measurements :—	Nº Barren Tillers	Nº Panicle Tillers	Nº Aftermath Barren Tillers	Height/Diameter	Head Density	Resistance to Withering
Nº 7	112	34	106	1·2	20	7
Nº 10	77	103	91	1·3	20	3

These plants are notable in having a large number of panicle tillers along with a large number of barren tillers. Nº 10 has a much greater number of stem leaves than Nº 7.