



Annual Report of the Sugarcane
Research Scheme, Bombay-Deccan,
Padegaon, 1933-34.

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ANNUAL REPORT OF THE SUGARCANE RESEARCH SCHEME,
DECCAN, PADEGAON, FOR 1933-34.

ADMINISTRATION.

I held charge of the office throughout the year. My colleagues Dr. R. D. Rege and Dr. J. K. Basu continued in their posts throughout the year. Dr. R. D. Rege held charge of my duties during my absence from headquarters to attend meetings of the sub-committee of the Imperial Council of Agricultural Research.

ACCOUNTS.

The total expenditure for the year 1933-34 amounted to Rs. 83,379-15-1 and the receipts credited into the treasury amounted to Rs. 7,399-0-6.

COLLOQUIUM MEETINGS.

This institute has organized a body with Dr. W. Burns as its president for encouraging lectures on the latest developments in agricultural sciences. During the year the following gentlemen have kindly delivered lectures for which the body is very thankful. Arrangements have already been made with the editors of various periodicals for publication of the same.

Name of the lecturer.	Subjects.
(1) Dr. S. V. Desai, B.Sc., Ph.D. (Lond.)	Nature of Viruses.
(2) Mr. M. N. Kamat, B.Ag., M.Sc. (Winconsin)	Some aspects of University education in the United States.
(3) Dr. V. K. Badami, L.Ag., Ph.D. (Cantab.)	X-Ray as a new force in Plant Breeding.
(4) Mr. M. Vaidyanathan, M.A.	Statistics as applied to agricultural problems.
(5) Rao Bahadur T. S. Venkatraman, B.A.	Breeding of cane to suit special tracts.

ACKNOWLEDGMENTS.

The scheme has to acknowledge with thanks the help in the form of suggestions for statistical layout of experiments received from Dr. Fisher, Mr. Vaidyanathan, Dr. R. J. Kalamkar and Prof. P. C. Mahalanobis.

The reports of the work done in 1933-34 in the three sections :—

- (1) Soil Physics Section,
- (2) Crop Physiology Section,

(3) Agricultural Section,
are enclosed herewith.

The office work was well managed by the Head Clerk Accountant Mr. V. R. Utgi.

Illegible.

*Principal Agricultural Officer,
Sugarcane Research Scheme for Deccan,
Padegaon.*

ANNUAL REPORT OF THE SOIL PHYSICS SECTION FOR THE YEAR 1933-34.

STAFF.

I was in charge of the Soil Physics Section throughout the year. The staff remained as in last year, at two graduate assistants and one non-graduate assistant.

RESEARCH.

I. Genetic Soil Survey.

(i) *Classification*.—According to Ramann (Evolution and classification of Soils, 1st English edition) "Regur" or the black cotton soil of Peninsular India, which forms by far the larger portion of the Deccan canal tract, is a climatic soil type as it occurs on various rock formations and yet presents similar characteristics. The differentiation into sub-types has therefore to be sought in special influences which are responsible for their development. Of these, relief is the most important in this tract having a bearing on some of the other factors such as texture, soil moisture and sub-soil water table.

From dynamic considerations, the soils of the region can be classified into two major groups. In the first group, the texture of soil gets heavier with increasing depth. The primary processes are the weathering of soil particles on slopes and the mechanical transportation of these disintegrated or weathered material by wind or erosion. Finer particles are removed and deposited at first which are followed by coarser material in a regular sequence. This is aggravated when the slope is a steep one. On the other hand, if the slope is very gentle the soil formation is a very slow process and there may be very little variation in texture with depth. In the second group of soils, the texture becomes lighter with depth and this is the case when the soils formed *in situ*, the influences of weathering being less pronounced with increasing depth. These two major divisions are of far-reaching importance and explain to a great extent the inherent fertility of soils and their behaviour under different environmental conditions. These broad soil groups are again capable of further sub-divisions into minor genetic types according to profile characteristics, such as colour, structure, concretions, etc.

Since our last report we have come across two more soil types thus making a total of five genetic soil types. The description of the profiles of these soil types are given in Table I, Appendix I.

During this survey of the Nira right bank canal, we have thoroughly examined twenty five soil profiles and soil samples have been collected for laboratory analysis. Great care has been taken in selecting them. About eight to ten trial pits were dug in each place and they were rapidly examined to find out the most mature profile of the locality, which was subsequently taken up for detailed study. Thus it was possible to trace out any sporadic soil variation in the profile and the type of a particular area determined. The classification table based on morphological description is given in Table II, Appendix I.

(ii) *Effect of irrigation on different soil types*.—Since the ultimate aim of this survey is to study the behaviour of each of the soil types under irrigation-agriculture, profiles under cultivation and irrigation for reasonably long periods corresponding to the natural types were selected. The details of agricultural practice, tillage, crop yields and rotations were collected to assess

the productivity of the soil types and their behaviour under irrigation. The effect of irrigation on the soil reaction, total soluble salts and humus on different soil types are given in Table III, Appendix I.

Discussion.—If we compare the soil reactions of the unirrigated profiles we find that the soil type II-D shows higher values than any other profile and I-E the lowest of all. Soil type II-C shows higher total soluble salts and the concentration increases with depth. Types II-D and I-E contain less salts and are distributed uniformly over the whole profiles. Percentage of humus is fairly high in all the profiles and varies between 1.2 to 1.5 per cent.

Under well-irrigation soil reaction is lowered in two cases *e.g.*, II-A and II-D accompanied by lowering in the concentration of the total salts. Significance of this is brought out when we consider the 'exchange acidity' of the irrigated and un-irrigated profiles. In the case of II-A the 'exchange acidity' is considerably increased pointing out the replacement of bases by hydrogen ion in the inner complexes. Soil reaction increases under irrigation in types II-C and I-E. This increase in pH is accompanied by lowering of total salts. The 'exchange acidity' is also markedly diminished in the case of I-E. Determination of replaceable bases and saturation capacities of these profiles will be taken up this year when it will be possible to get a better insight into these reactions and to recommend preventive measures from soil deterioration in each of these soil types.

Losses of humus under irrigated conditions have taken place in the soil types II-C, I-E and II-D in order of magnitude, the percentage loss over the whole profile being thirty-six, thirty-five and fourteen respectively. From local information it is gathered that II-C is under well-irrigation for sixty years, I-E for fifty years and II-D being only under irrigation for thirty five years. Taking into consideration that this information can only be approximate, it shows fairly well a constancy of rate of loss in all these types. In the case of type II-A there has been an actual gain in humus the percentage increase being eleven per cent over a period of seventy five years. It may be mentioned in this connection that the rotations and manuring are not very dis-similar under the well-irrigated conditions of the Nira right bank canal. Thus it shows that the need of organic manuring may be different in different soil types.

II. Soil Fertility Survey.

(i) *Behaviour of cane soils.*—Seventeen cane soils* have been selected from various representative places, from the whole length of Nira left bank canal whose complete history is known. From the previous history, it has been possible to classify these soils under two groups from the point of view of fertility: (A) Soils which are either improving or remaining stationary (B) soils which are deteriorating. These are shown in Table IV and by arrows in Graph I in the appendix. The soils have been arranged in order of descending fertility, this being calculated as the number of tons of canes produced per 100 lbs. of nitrogen. It will be evident from the graph that the more fertile soils are either improving or remaining steady with the exception of one soil, *e.g.*, No. 45. It will be also noticed that the shallower types of soils come under group (A) whereas the heavier soils fall under (B) under the existing systems of irrigation agriculture.

There are four main factors which are responsible for soil deterioration or improvement, *viz.*, the quantity of irrigation water, tillage operations, manuring and crop rotations. (1) Nothing very definite can be gathered as regards the exact quantity of water used in cane cultivation excepting the fact that

* Soils where cane has been grown for a long time.

there is a tendency among the cultivators of over-irrigating rather than under-irrigating their plots. The irrigation dose may work up to about 140" acre inches in most cases. (2) The cultural operations for cane are not also very dis-similar, the usual practice being three ploughings by iron plough, ridging, weeding, interculturing and earthing up. (3) About manuring more definite informations are available. General trend in the present day manuring is to diminish the doses of nitrogen, bulk of the reduction falling on the quantities of F. Y. M. used; safflower cake is often replaced by equal weight of castor thus reducing the nitrogen content of the manure appreciably. A striking feature of the change consists in the introduction of sulphate of ammonia during the last decade. With the data available at our disposal it is hardly possible to say anything definite about the efficiency of this change-over in the manuring. However, there are evidences of a beneficial effect of this mixed manuring in the shallow soils (1'-2' ft.). (4) History regarding the crop rotations in these soils are fairly reliable and we shall discuss now the merits of these rotations in different soils (see Tables IV to VI in the appendix). In a shallow well-drained soil a three year rotation of cane—cotton—rabi

jowar, or—
 cane— & ^{rice} — ^{jowar} or (No. 12) has proved successful in
 gram bajri
 improving the productivity of soil. Even a two year
 rotation of cane—bajri (Nos. 8 and 9) or
 cane— ^{cotton & gram} or (No. 51) has proved beneficial. Still
 wheat

more exhausting rotation of cane—ratoon—^{bajri or} ^{jowar or} ^{rice} has been found distinctly harmful in the long run (No. 49). In the case of deep soils (4'-8' ft.) all the soils are showing signs of deterioration excepting the soil No. 19. Here they are practising a four year rotation of cane—jowar—bajri—rice. Next best to this is a three year rotation of cane—jowar—bajri and gram; but unfortunately this has lately been changed into a two-year rotation of cane—cotton. Hence it is not possible to say whether a three-year rotation would have kept up the fertility of the soil. At present most of the rotations practised in deep soils, so far examined by us, are two-year ones and the soils are showing signs of deterioration. Graph 2 in the appendix shows the periods under fallows and exhausting crops for different systems of rotations.

Significance of some of the physical properties of cane soils.

(1) *Base saturation capacities of soils.*—This is a measure of the total colloidal material in soil and the significance of the method employed has already been discussed by Crowther and Basu in a paper (Jour. Agric. Sci. XXI 689-715, 1931). This is fairly high in most of the soils and reflects in a general way the potential fertility of a soil. (See Graph I and table VI given in the appendix). It will also be seen that the shallower soils are richer in colloids than the heavier types of soils.

(2) *Rate of increase in electrical conductivity of soil solution.*—Sen and Wright (Jour. Agri. Sci. 21, 1931, p. 1-13) have shown that the rate of increase in electrical conductivity is an indication of the relative fertility of soils. Our results, so far, show that the rate of increase in electrical conductivity is correlated more closely with the amount of manures applied than with the fertility of different soils as will be evident from the graph. It is probable that the micro-organic activity is increased by heavy manuring (organic) in cane plots thus causing the increased rate in electrical conductivity without proportionate-

ly increasing the fertility of the soil. Thus it is likely that this method will prove useful as a measure of the residual effect of heavy manuring in soils.

(3) *Colloidal mechanical factor*.—Tiulin (Perm. Agri. Expt. Stat. Dept. of Agric. Chem. 1928, 2, pp. 1-24) has worked out an empirical method which measures the potential power of soils to give good tilth. This is termed colloidal mechanical factor and is obtained by dividing the percentage of silt by saturation capacity of soils. This, in fact, gives us an idea of the permanent soil tilth which is not affected in short intervals of time. It seems (see Table VI) that these soils are well adjusted as regards their crumb forming material and under proper management are likely to give very desirable tilth.

(4) *Total soluble salts*.—This is done by the L and N Soils Bridge by the electrical conductivity method. (See U. S. Depts. of Agric. Cir. No. 423). There is an indication that the actual percentage of total soluble salts is inversely proportional to the rate of increase in electrical conductivity of soils. This requires further data for corroboration. Only very high salt concentrations seems to affect the crop yield.

(5) *Soil reaction*.—This is done by the Biilmann's Quinhydrone method using Veivel KCl-HCl electrode. (Biilmann, E. Jour. Agric. Sci. 1924, 14). This is also occasionally checked by the colorimetric method. Differences in soil reactions in the irrigated soils of the Nira left bank canal are very little, the values varying from 8.0 to 8.5 in most cases. Only in salt affected areas it may go up to 9.0 to 10.5. It is hoped that wider variations may be found when other canals will be taken up for survey.

(6) *Calcium carbonate*.—This is determined by the Scheibler's calcimeter which is extensively used for soil surveys in the continental laboratories. All the soils are fairly well supplied with calcium carbonate with the exception of Nos. 25, 51 and 49 (see Table VI in the appendix).

(ii) *Effect of cane growing on the physico-chemical properties of soils—Comparison between fallows, dry cultivated and eight-months' irrigated plots versus cane plots*.—It was proposed to take samples of soils under fallow, dry cultivation, eight months' irrigation and perennial irrigation with canes, for comparison of the important soil properties under each of these treatments. In a well-developed canal like that of Nira left bank, it was found very difficult to obtain all these types under similar conditions. However some reliable pairs (with and without cane) were obtained during this survey and the comparison of the soil properties are given in Table VII, Appendix I. Summary of results are briefly stated below :—

- (1) Under the canal conditions, there has been increase in the base saturation capacity in cane plots over the corresponding plots without cane, in eight cases and decrease in two out of fourteen cases. The fall in saturation capacity is usually accompanied by fall in yield of cane.
- (2) Rate of increase in electrical conductivity has gone up in the cane plots over the control in ten cases out of a total of fourteen. This value has gone down in four cases. Falling off in this value is very often accompanied by soil deterioration.
- (3) Colloidal mechanical factor has changed adversely in eight cases and favourably in five cases by growing sugarcane. The former change is specially noticeable in the comparison between eight months' irrigated and perennial irrigated plots.
- (4) The total soluble salts have increased in seven cases and diminished in six cases by cane growing. When only the fallow plots are

compared with cane plots we find that the total salts are lowered by irrigation.

- (5) Soil reaction has gone down in eight cases by growing cane. There is rise only in one case. Exchange acidity is increased under perennial irrigation and cane growing only in five cases.
- (6) Loss of CaCO_3 has taken place by growing cane under canal irrigation in twelve cases out of a total of fourteen. If the average is worked out in all the pairs of plots, we come to a net loss of 1.96 per cent. This gives us an annual loss of 1690 lbs. per acre foot of soil if we assume that these plots are brought under cane cultivation for the last forty years.

III. Farm Experiments.

(i) *Harvest data and botanical observations.*—The layout of experimental plots for soil fertility studies on the farm in three series for the study of interaction of water, manure and crops on the soil colloids has already been described in the last year's report. Planting of cane in series III (croppings and fallowing) was done in the heavy (chopan) and medium soils early in February but in the light soil the planting was delayed till the end of March due to land being not available early enough. Table No. VIII at the Appendix gives the germination, yield and other observations taken at harvest time. The figures for unmanured and manured are averages for two plots, the second plot in each case having been maintained for ratooning this year. It will be seen from the table that the germination was good in all the soils and particularly in the heavy soil where even in the unmanured it approached 70 per cent. Next to this is the light soil and then comes the medium soil where the germination was affected due to inherent lower fertility on account of soil erosion in former times. The manured plots where F. Y. M. at the rate of forty cart-loads or 40,000 lbs. per acre was applied just before planting, show a relatively higher germination than the unmanured by about 17 to 22 per cent. in all the types of soil. The cane crop was harvested from 10th to 14th January 1934 which gave a growing period of eleven months to the cane in the medium and heavy soils and that of nine months in the light soil. The cane was not therefore fully mature but still it was necessary to harvest it because of the system of continuous growing of cane on the same plots that has been adopted, which leaves only a short time after harvest for preparatory tillage for the subsequent planting. The approximate ratios of yield of the unmanured to manured in the heavy, medium and light soils are $1/2 \cdot 75$, $1/4 \cdot 17$ and $1/2 \cdot 87$ respectively. The actual yields of unmanured plots especially in the medium and light soils are very poor. The observations in columns 6, 7 and 8 were taken on six plants in each plot that were maintained for periodical observations. (1) The most pronounced effect of manure is seen on the number of canes and the weight of individual cane. (2) There is a larger number of canes in the manured treatment which can be ascribed to the better germination and more profuse tillering. (3) The number of internodes in the unmanured and manured treatments is nearly the same though the height of each internode in the latter is about $1\frac{1}{2}$ times that of the former. (4) The other factors, i.e. the circumference (which was measured at the central internode), the brix and other constituents of juice do not show a very appreciable change with manure.

(ii) *Nitrification and nitrogen recuperation in soils.*—The idea of this experiment is to find out the best treatment or combination of treatments which will favour the optimum production of available nitrogen. Four types of

fallows were tried in three different types of soils and samples were collected and analysed periodically for moisture and nitrate. Periodical soil analysis was also done for total nitrogen to test the fixation of nitrogen in soil. The following abbreviations are used in this section:—

Cultivated and irrigated	C. I.
Cultivated and unirrigated	C. Ui.
Uncultivated and irrigated	Uc.I.
Uncultivated and unirrigated	Uc. Ui.

Fallows.—(1) *Heavy soil.*—When the nitrate nitrogen over a depth 0-18" is considered, the following points are worth noticing in the four types of fallows (see Graph 3 in the appendix). Cultivation favours nitrification in this type of soil (ref. statistical significance of cultivation on nitrification Table IX) whereas irrigation lowers the nitrate content to a certain extent. Maximum nitrate formation takes place in the month of September when 1.05 and .89 mgms. of nitrate may be found in the soil in the C. Ui. and C. I. fallows respectively. In the Uc. I. plot, the nitrate content is fairly high in March and May (.71 and .84 mgms.) after which it gradually loses nitrate till January. Uc. Ui. fallow starts with low nitrate content in March (.52 mgms.) keeps it up till July and then loses slowly till a value of .26 mgms. is reached in January.

(2) *Medium soil.*—In the months of July and November all the type of fallows (except Uc. I.) show high nitrate nitrogen in the soil. The nitrate in mgms. per 100 gms. of soil for C. I., Uc. Ui. for these periods are .67, .73, .78 and .79, .56 and .43 respectively. Lowest level is reached in the month of September for the above three fallows. In the case of Uc. I. fallow, the nitrate content diminishes from .44 in March to .25 in May after which it slightly rises in September and then there is gradual fall till December.

(3) *Light soil**.—In the light soil Uc. Ui. fallow gives the maximum accumulation of nitrate in the month of July about .80 mgms. being present in 0-12" inches of soil at this period. There is very rapid rise in nitrate in this system from May to July but the fall is also very rapid till the end of August after which there is steady fall till December. When this is combined with cultivation (*i.e.*, C. Ui.) the nitrate level is low throughout, the values fluctuating between .34 to .29. The U. I. plot loses nitrate from May (.31 mgms.) till August end (.10) after which there is a slight rise. The C. I. fallow on the other hand shows improvement in nitrate from May to the end of August (.51 mgms.) and then there is fall in November and December. This clearly shows the vigorous nature of nitrification in this soil under irrigation (ref. statistical significance of irrigation on nitrification Table IX). It has got an important bearing on the economy of sugarcane growing as the growing period of cane corresponds closely to this maximum production of nitrate nitrogen. This is also true in the case of heavy soil but this is not so in the medium.

Cane plots.—Fluctuations in the nitrate nitrogen in cane plots in three types of soils are given in the graph Nos. 3, 4 and 5 in the appendix and need not be discussed here.

Movement of manures in soil.—Lateral distribution of nitrate was studied by taking samples from the ridge, balk and furrow in specific instances and the results are summarised below:

- (a) In the manured cane plots there are large quantities of nitrate in the balk one month after the application of the first top dressing.

*Soil here being very shallow, depth has been considered only upto 1 foot.

- (b) Evidence of leaching down of nitrate in the furrow and accumulation of nitrate in the ridge are pronounced especially in the medium soil.
- (c) In the unmanured cane plots probably nitrification starts in the balk and then gradually the nitrates are washed down in the furrow.
- (d) In the control C. I. plots, there is a higher percentage of nitrate in the furrow and to a certain extent to the lower depths of the ridge.

Statistical analysis of nitrate data.—In order to get an estimate of error in single plot experiments, each plot of one 'guntha' (45.4' × 24') was divided into two sub-plots (22.7' × 24') from each of which composite samples were taken. These samples were taken by random selection from eight spots on the balk.

The number of samples were 120 in the medium and heavy soil and 80 in light soil as under :—

	Heavy	Medium	Light
Occasions (seasons)	5	5	5
Depths	3	3	2
Treatments	4	4	4
Replicates	2	2	2
	120	120	80

The analyses of variance, standard deviation and coefficients of variability for three types of soils are given in Tables IX and X in the appendix.

Soil moisture.—Moisture contents of soils under different treatments are given in Graph 6 in the appendix. Relative effects of various treatments are very similar in the three types but it is also evident that the medium soil has got a high field saturation than either of the light or heavy soil. These correspond with their maximum water holding capacities in the laboratory which are 62.70 per cent. 85.80 per cent. and 62.08 per cent. for the heavy, medium and light soils respectively.

Nitrogen changes in soil.—The gains or losses in the total nitrogen under various treatments are given in the Table XI. It will be observed there that the nitrogen recuperations under different systems of fallows are widely different in the three different types of soil. Some of these methods may prove to be economic propositions in the Deccan canal conditions. We have found that weeds play an important role in this connection. (1) They store the nitrogen in the monsoon against the leaching action by rains and return it to the soil in winter and dry weather when they wither. (2) Nitrogen is also fixed from atmosphere by leguminous weeds and thus the nitrogen content of soils goes on increasing under fallow. (3) Soils also gain in humus. (4) Power of nitrogen recuperation seems to be greatest in the light soil under Uc. Ui. system of fallow which explains to a certain extent the high nitrogen content generally associated with light soils which are left fallow for a long time. (5) Under irrigation, the recuperative powers of heavy and medium soils can be increased considerably.

(vii) *Studies of weeds.*—This was taken as a side study in connection with our experiments on the effect of water, manure and crops on soils. It is known that when a soil is brought under irrigation the nature of its flora

changes. It would be interesting to know how step by step this change is brought about in irrigated soil under different manuring and cropping ; and in which way these changes are going to affect the soil humus, nitrogen fixation and the physical conditions of soil.

A considerable amount of informations has already been obtained in connection with the differential response of weeds to manure and water. For want of space this can not be dealt with here. Further work on the enrichment of soil by burying in of weeds is in progress.

(iv) *Green manuring experiments.*—These experiments were conducted in three types of soil to study the rate of decomposition of sann hemp. They come under series II of the farm experiments where there are five other nitrogenous fertilizers under investigation this year namely, sulphate of ammonia-F. Y. M., calcium cyanamide, nitrate of soda and safflower cake.

Sann was grown on the 10th of June 1933 and buried in on the 2nd September. Nature of nitrification in the three types of soils will be clear from the Graph No. 7 given in the appendix. Main features of this experiment may be summarised as follows :—

- (1) Process of nitrification is slow till the 28th of October which may be ascribed to light showers prevailing during this period.
- (2) There has been rise in nitrate nitrogen in the soil from the 28th October till the 14th November. This rise has been again retarded by some showers which fell between the 14th to the 29th November.
- (3) From the 29th November till the 13th December the nitrate nitrogen rose to very high values. At this stage a second ploughing was given and soon after there was a shower of 64 cents. The nitrate figures in the light and medium soil fell down to very low values whereas in the heavy soil the good effect of this ploughing was marked by continuous rise in the nitrate nitrogen.
- (4) Nitrification of sann is very rapid in the light soil and the decomposition is more or less complete by the middle of December. In the medium soil this process is slightly slower and the decomposition is complete by the first week of January. In the heavy soil however the rate of nitrification is much slower than those in the other two soils and the green matter requires much longer time for complete disintegration.

The Table XII in the appendix gives some idea regarding the increase in nitrogen and humus due to sann green manuring.

(v) *Effect of irrigation and manuring and cropping on soil reaction and total salts.*—Changes in the colloidal complex due to irrigation, manuring and cropping are usually reflected in the soil reaction and total soluble salts. Hence it is proposed to follow these in all the three series every year. Finally the exchangeable bases and the base saturation capacities of these soils will be taken up to find out the nature of these interactions with the soil colloids.

One year's experiments have given but very little change in these directions and need not be discussed at this stage.

(vi) *General farm experiments.*—The idea of these experiments is to get corroborative evidences of our small plot experiments in large scale trials of the Agricultural Section. Some experiments were undertaken last year to study the effect of water, manure and crops on soil in block Nos. I-A, II-A, II-B, III-C and IV-C but the results will be repeated again this year. Two

interesting side issues which have come up in this connection may be summarised briefly :

(a) *Effect of Crop on soil tilth.*—For a comparative study, soil samples were taken from under sann, jowar, cotton, P. O. J., Pundia and control fallows from II-B block in the middle of August. These soils were tested for moisture contents, total salts, pH, friability, structure fineness and dispersion coefficients. General trend of these experiments shows that soil tilth follows a descending order as follows : sann > jowar > P. O. J. > Pundia > fallow > cotton.

(b) *Effect of soil scraping.*—Due to unevenness of the soil surface most of our area requires levelling before any irrigation can be given to the soil. This introduces new soil factors which disturbs the normal growth of crops on such soils. It has been observed that there are three main soil factors which may affect the crops under such circumstances :

- (1) When very dry soils are scraped fine granules are produced which are not generally suitable for the growing plants.
- (2) In the dry tropical regions with low precipitation as obtain in the famine tract of the Deccan, the surface soil is usually rich in soluble salts which maintain the good tilth of a highly colloidal soil. But the sub-soil due to low salt content gets puddled when exposed by scraping.
- (3) The lower immature soil horizons possess higher colloidal, mechanical factor thus shewing their inherent inability to form good soil crumbs. Hence if the soil is scraped beyond the mature 'A' horizon the proper soil tilth is not obtainable easily.

(vii) *Sub-soil water table.*—It has been the experiences in the past in the Deccan canal tract that vast areas of land have gone to waste due to water-logging and salt efflorescence by growing sugarcane for a period of 10-15 years. Main cause of this damage is the rise of sub-soil water due to unwise irrigation. It is however, not known to what extent various climatic and soil factors are responsible for such rise in the sub-soil water table in an irrigated land. In order to investigate this problem we have dug bore holes at various places in the farm and the fluctuations of the water tables are being recorded weekly. An idea of the periodical fluctuations in the medium soil (95 acres) block (average of 5 bore holes) and in the heavy soil (5 acres) will be obtained from the Graph 8 and statistical significance of the various factors from the Table XIII given in the appendix.

J. N. BASU,
Soil Physicist,
Sugarcane Research Scheme for Deccan, Padgaon-

ANNUAL REPORT OF THE CROP PHYSIOLOGY SECTION FOR THE
YEAR 1933-34.

I continued to be in charge of the post of the Crop Physiologist throughout the year. Two lines of investigations *viz.* application of sulphate of ammonia with planting and a basic dose of superphosphate which have given very promising results are handed over to the Agricultural Section for large scale trials. Some minor problems as the nitrification of sann (*Crotalaria juncia*) and compost making have been also partly investigated during the course of the year. The detailed treatment of all the accumulated data is considered to be beyond the scope of the present report. It is proposed to deal with only the outstanding results which are expected to throw light on the major problems under investigation. (Appendix II).

I.—METHODS.

This being the first regular working season of the scheme a great deal of time was spent in evolving and standardizing methods suitable for the investigations. Some of the methods are now standardized and are given in short below :

- (i) *Botanical.*—In the flowering varieties due to the rapid elongation of the peduncle of the inflorescence at the flowering time, the usual method of measuring height from the base of the furrows to the highest visible transverse coloured mark on the leaf blade shows false increase in height and consequently gives quite an erroneous conception of the growing period of cane. In order to eliminate the effect of flowering, this method is therefore changed in the beginning of September well before the appearance of the flag leaf to the similar mark on the leaf blade of the highest mature internode. This is taken to be the one from which the leaf sheath just begins to part which is not found to be the case with immature internodes.

In addition to the height, observations are also taken as regards the number of mature and total internodes circumference and tillering and a factor is evolved for the calculation of the yield from these morphological observations. This is now being tried on other varieties to test its universal applicability. It is thought that the varieties with a high tendency to pith formation at their maturity stage may not be guided by this factor. This method is intended to be a substitute for the dry weight method which requires actual cutting of the plants and as such is not possible in the statistical layout.

- (ii) *Root studies.*—Sugarcane in this tract is an irrigated crop and is planted in furrows four feet apart. Under these conditions the plant is observed to develop its root system mostly by lateral spread and the method has been evolved to get a thorough idea of this. The plants are selected near the end of the rows away from the irrigational channel. A clean vertical section of the soil is taken just touching the selected plant at right angles to the row to a depth of about 2' and 2' on either side of the plant and the soil is washed by means of a bucket sprayer taking care not to dislodge any roots from their natural position. A four inch deep zone of the complete lateral and vertical spread is thus obtained and is immediately sketched with a note as regards

orientation, number, activity etc. For quantitative determinations, an iron frame with six inch square compartments is held in vertical position from the base of the clump and the pins are run through the root zone to divide it into 6" squares. Roots from these squares are carefully cut, dried and weighed. Some typical results are represented in table I.

- (iii) *Wilting stage*.—The standard method as recommended in the text books is not possible in the field studies as it requires removal of the plant to humid chamber. It was thought that when the plant just attained the permanent wilting stage, the assimilatory activities of the leaves would be at a standstill and as such there would not be any increase of organic matter due to photosynthesis during the course of the day. Ganog's punch method was therefore tried and it has given very promising results, a typical instance of which is given in table II.

II.—EXPERIMENTAL.

The detailed layout of the experiments has been fully described in the annual report for 1932-33.

(A) *Bioclimatic study*.

Though main regular working of the meteorological observatory could be started from April 1933, data as regards temperature, humidity and rainfall are available for the past few years. The climatic records are considered from the standpoint of the cane season which begins from January in this tract. Graph I gives deviation of rainfall as well as the number of rainy days from the average monthly value of the past twelve years. In addition outstanding features of the different seasons (Table III) give a complete idea of the seasonal fluctuations. It would be seen that the 1932 season was characterized by very high precipitation, high maximum temperature as well as high humidity the most favourable conditions for the cane growth. The general impression had been that some of the varieties like E. K. 28 and *Pundia* had given the best response to this type of climate. On the other hand the season of 1933 seems to be a normal one except for the maximum summer temperatures which were below normal and for the highest number of rainy days.

Climatic records are as yet too meagre to draw statistical correlations with the physiological activities of the plant and therefore no such attempts have been made. A few data have however been analysed as regards their effect on (a) germination (b) top borer attack and (c) growth. The results are given in tables IV, V, VI and Graph II. Temperature seems to be the controlling factor in (a) while humidity in (b) and (c).

Some investigators have shown a high positive correlation of growth with the number of rainy days. A detailed study on daily growth during the monsoon of 1932 however suggests that under irrigational conditions it is not the actual rainfall, but the conditions precursing to it which are more suitable for growth. The results are tabulated in table VII with the temperature and humidity figures which were available at the time. It is quite evident from those that growth is checked by the actual rainfall. Periodical botanical observations have shown that the period of maximum growth corresponds with August and September when such climatic conditions are much more frequent.

(B) *Water Requirement of Sugarcane.*

(a) Total delta.

(i) *Pot culture.*—This experiment could not be started till late in April and as such the crop was not a normal one. Some indications as regards loss by evaporation and transpiration have however been obtained which are given in table VIII.

(ii) *Field studies.*—These studies were carried out on a field with an average two to three feet depth of soil with *murum* isobath which is typical of the tract considered most suitable for cane cultivation. The method followed for estimating water requirement of the crop under varying irrigational delta consists in computing loss of water from soil moisture determined a day before and three days after every irrigation in one foot depth upto *murum* sub-soil. The data so obtained is converted into acre inches and is given in table IX after making adjustment for the effective rainfall by actual pot culture experiments and for the interval between two samplings by calculating periodical daily loss and adding the same to the total.

The figure for total water utilized (column 5) includes both loss by evaporation and transpiration. In the field studies it is difficult to assess with accuracy the role of evaporation as apart from transpiration as the uncropped plots under the same treatment do not exactly represent the state of the cropped ones which are shaded by the crop itself. As the main idea of the experiment is however to assess the total water requirement of the crop, which naturally includes loss by evaporation as well, no special attempt has been made in the field studies to differentiate between the two systems.

The results clearly show, that whatever the irrigational treatment, the water requirement of the crop under field conditions is almost the same and comes to near about seventy inches. This may be attributed to the field water-holding capacity beyond which water given in irrigation could not be retained by the soil and as a result much of the irrigational dose in higher waterings would be leached out. This is very well illustrated in table X which give percentage soil moisture before and after irrigation for two feet depth average for the whole year. It is quite evident that whatever the irrigational treatment, the difference in soil moisture after irrigation comes to almost the same figure (col. 5) which is about equal to the irrigational dose of seventy inches and any excess above this figure would be removed to lower layers by percolation.

The physiological response of the varieties to different treatments shows varietal differences (table XI). In the case of Pundia 130" has definitely produced a deleterious effect. The crop is much inferior in all the characteristics and the final yields have been significantly low. Periodical growth studies (data not given) indicate that the deleterious effect starts in August—at an early stage of plant life. On the other hand P. O. J. 2878 has favourably responded to the higher waterings.

The periodical study of the root system shows only the intensity of the roots in the lower waterings—with practically no difference in the actual spread lateral or vertical in the different treatments. A typical illustration is given in table I.

(b) Periodical distribution of total delta.

(i) *Field studies.*—The judicious utilization of water for irrigation is dependent upon its efficient periodical distribution which is controlled by the

periodic water requirement of the crop. The soil moisture data are therefore analysed in relation to different developmental stages of plant life and the results are given in table XII.

Attention is drawn to column No. 9 which gives daily water requirement during different stages of plant life. It shows that the loss per day is high and almost similar both at formative and grand period stages. It is however highest at the flowering stage and lowest at the maturity stage. Columns 7 and 8 give the receipts and expenditure of water. It would be seen that in 70" expenditure has exceeded the receipts during the grand period and flowering stages. The moisture percentage also falls greatly (col. 3) and it is observed that if the irrigational dose in this treatment is not supplemented by rain between the intervals, moisture percentage is reduced to such a low figure as wilting coefficient of the soils. On the other hand at the maturity stage the same dose is far in excess of the crop requirement leading to the accumulation of moisture in the soil and even percolation to lower depths. It would thus be quite evident that it is in the lower delta that the periodical distribution is the most important to get optimum advantage from its application. In the higher waterings there is always an excess of water and distribution may not play as important part.

(ii) *Wilting coefficient series*.—Another suitable method for evaluating periodical water requirement of the crop is to find its drought resisting power. This has been investigated by field experiments in three types of soil by stoppage of irrigation at different periods of plant life till the stage of permanent wilting. Irrigation was applied immediately the stage of wilting was reached, further treatment being the same as in the control. A tabulated statement of the period of stoppage of water is given on page 27.

Though visual inspection was the criterion for the estimation of the stage of permanent wilting it was also verified by the quantitative method described above. A few typical results are given in table II. It is observed that due to soil variations there is fluctuation as regards the permanent wilting in the same type of soil. The different soil types have not however, shown any great variation among themselves.

The comparison between the varieties shows slightly higher susceptibility of Pundia to drought than P. O. J. 2878. These variable responses of the varieties would be quite clear by the study of their root system (Fig. I). Because of the wide spacing the root system has shown a greater tendency towards lateral spread. The figures also indicate the capacity of P. O. J. 2878 to tap a larger area and suggest its higher drought enduring power. This is further confirmed by the wilting coefficient of the soil (Table XIII).

The most important point would be however to estimate the effect of such drastic treatments on the physiological behaviour of the plants and the final yields. Graph III gives a typical instance of the periodical increase in height for one variety in one type of soil only. It shows that during the period of drought the growth is almost entirely checked. Irrigation seems to have vitalized the plants and the curve shows a steep rise which is much more apparent in the case of the May series. The root system which was practically dead at the time of wilting was observed to put in a mass of new, living, thick roots after four days of watering. Further, the study of some important physiological characteristics (table XIV) also suggests either equality or superiority of the wilting coefficient series over control. It is thus quite evident that this treatment actually stimulates crop growth and may be said to equal in this respect the operation of earthing up. Attention is drawn to column 8 which shows the superiority of the December series as regards maturity over all others.

Periods of stoppage of water in the Wilting coefficient series.

Treatment.	Date of last regular irrigation.	Pundia.				P. O. J. 2878.			
		No. of plots.	Date of wilting.	No. of days crop remained without irrigation.	Remarks.	No. of plots.	Date of wilting.	No. of days crop remained without irrigation.	Remarks.
1	2	3	4	5	6	7	8	9	10
April W. C.	3-4-33	6 all soils.	28-4-33	25	..	6 all soils.	1-5-33	28	
May W. C.	3-5-33	1 (L. S.)	20-5-33	17	..	1 (L. S.)	23-5-33	20	
		1 { (1 L. S.) (1 M. S.) (2 H. S.)	27-5-33	24	Disturbed by rain (17 cents for two days).	2 { (1 L. S.) (1 M. S.)	27-5-33	24	Disturbed by rain (17 cents, for two days).
		1 (M. S.)	2-6-33	30	Disturbed by rain (90 cents for four days) no wilting.	3 { (1 M. S.) (2 H. S.)	2-6-33	30	Disturbed by rain, no wilting (90 cents for four days.)
December W. C.	29-11-33	6	9-1-34	31	Disturbed by rain (75 cents for two days). Harvesting started on 9th Jan. 1934, no wilting.	6	9-1-34	31	Disturbed by rain (75 cents. for two days). Harvesting started on 9th Jan. 1934, no wilting.

Note.—L.S. = Light soil. M.S. = Medium soil. H.S. = Heavy soil. This differentiation in the types of soils is based upon the depth of the soil with *murum* isobath which is the standard of classification followed at present in the Deccan canal tract.

The statistical analysis of the yield data shows that due to two replications only, the standard error of the mean is very high and as such, no treatment has shown any significant difference over control. It is, however, felt that promising results obtained in this experiment may be to some extent attributed to the abnormal nature of the previous season which was characterized by very heavy precipitation. It is, therefore, proposed to run the experiment under similar controlled conditions for one season more before finally laying it out on a large scale.

(C) *Manurial requirement of sugarcane.*

Experiments for this investigation were laid in the medium soil only. Planting was done with single eye-buds to facilitate periodical removal of the clumps. The layout of the experiment was as follows:—

Treatment.	Variety.
(1) 150 lbs. N	Pundia.
(2) 150 lbs. N	P. O. J. 2878.
(3) 300 lbs. N	Do.
(4) 50 lbs. N	Do.

Except the manuring dose, methods of cultivation, irrigation etc. were exactly according to the standard Manjri method.

The statistical treatment of the whole season's data brings out a very high coefficient of variability, being 19.4 per cent. and 13.0 per cent. for Pundia and P. O. J. respectively. As a result even five clumps averaging about twelve to fifteen plants fall greatly short of the required number of periodical samples to get significant results from different treatments. Further it was found that clumps could not be taken as the basis for the calculation of yield as well as mineral intake per acre as such calculations gave abnormal results. There is also a great likelihood of personal bias in random selection with a tendency to select the best plants. The method has been modified for the current season to avoid all these defects in the sampling technique, by dividing the plots in three feet rods and harvesting only alternate rods by drawing lots. It would be seen that this system entirely eliminates individual predilections. Increase in the number of clumps from five to an average of about twenty to thirty would correspondingly reduce the error and at the same time area sampling is expected to facilitate calculation of the data on acre basis.

(i) *Physiological response.*—Germination in all the plots was excellent being about 75 per cent. at the end of eight weeks. Application of varying quantity of sulphate of ammonia three weeks after planting has practically produced no effect either on the rate or total percentage success in germination (Table XV). Periodical increase in dry weight (graph II) differentiates between the growth of the two varieties. Pundia's high susceptibility to atmospheric factors, specially humidity is quite apparent, as the periodicity in the growth curves closely corresponds with the fluctuations in the humidity. On the other hand P. O. J. 2878 appears to be much more independent of external environment as could be judged from its growth rate under unfavourable climatic conditions of April and May. The effect of treatments is well represented in tables XVI and XVII. They clearly show the insufficiency of fifty lbs. nitrogen treatment. While in all other treatments mother canes as well as tillers showed uniform growth rate, in this treatment tillers were observed to grow at the expense of the mother canes. The ratio of leaves to stem is found to be constant under different treatments, though varying according to the periodical stage of the plant.

Due to the periodical removal of clumps, the yield data of harvest time cannot be taken as a reliable index of the actual yield. The efficiency of the 50, 150 and 300 lbs. nitrogen treatments from the standpoint of yield is therefore calculated on clump basis only and this comes to $0.8=1=1.5$ taking 150 lbs. nitrogen as 1. Periodical brix readings indicate early ripening in the case of lower dose. The lowest treatment had reached its maximum brix within nine months of planting and by harvest time (18-1-34) it was showing a slight fall. On the other hand, 150 lbs. nitrogen had taken eleven months to attain the same brix, while 300 lbs. nitrogen had just equalled the others at the harvest time.

The study of the periodical development of the root system shows a definite gradient from lower to higher doses in its spread (Fig. II).

(ii) Intake of mineral constituents : Due to high statistical error in periodical sampling, attempts to calculate the yield as well as the mineral intake per acre crop from clump analysis data have given very abnormal results. The alternative method of assuming a figure for yield of 150 lbs. N treatment from the average yield of adjoining plots was followed in this case. The yield figure for any one period gives the absolute production of leaves and stems till that period and the mineral intake is calculated on this figure. The results are illustrated by graphs IV, V & VI.

It has been already explained (graph II) that *Pundia* is vitalized into real activity by about the middle of May and the high increase in weight during this period coincides with rapid intake of mineral constituents. While the plant has shown more than 200% increase in dry weight within twenty days from 12th May, the intake of nitrogen during this period has risen from 0.26 to 2.12 grms. per clump *i.e.*, has exceeded 400% with similar phenomenal absorption of other constituents as well. P. O. J. has also shown similar trend though to a less degree. It seems therefore that during the formative stage, the mineral intake is very little, while within the grand period stage, it is almost completed (graph IV). The graph further exhibits the tendency of the plants to absorb large quantities of any constituent if it is freely available in the soil, returning the excess at harvest time (Nitrogen pillar for 300 lbs. N treatment). This further supported by juice analysis which shows increase in concentration of the mineral constituents with the approach of the harvest time (table XVIII). It is quite likely that some ingredients like nitrogen and phosphates which have been absorbed to their maximum extent at early stages in the life of the plants may be on the downward path, while increased concentration of potash and calcium may be due to continued absorption. As the yield in the case of this treatment is 50 per cent higher than the next lower treatment, this higher absorption seems however beneficial to the crop. More detailed work is required in this connection.

The study of the relative importance of different constituents (graphs V and VI) enabled one to arrange the elements in the following serial order according to their intake :—

K — N — Ca — P

when however one considers their availability in the soil this serial order requires to be changed to—

N — P — Ca — K.

The soils of the canal tract are poor in their nitrogen content and the system of manuring is mainly based upon it. Some experiments conducted with superphosphate and sulphate of potash (table XIX) further suggest favourable effect of phosphates on soils newly brought under sugarcane cultivation.

Sulphate of potash has practically produced no beneficial effect and the analyses of the soils also show it to be very high in these soils. Further the study of the efficiency of the different manurial treatments reveals that Pundi utilizes about sixty per cent of the total nitrogen applied while P. O. J. requires the whole lot (94 per cent.) under the same treatment and sixty six per cent. in the case of the 300 lbs. N. On the other hand, in the case of fifty lbs. N, the top dressing definitely falls short of the crop requirements which is supplemented to the tune of 66 lbs. from the soil nitrogen itself.

The periodical analyses of plants under different treatments have thus given a clear conception, not only of the total but also periodic requirement of the crop. The study of periodic nitrate movement in the soil gives us on the other hand the idea of the availability to the crop of the important food materials. This is illustrated in graph VII which leads one to three inferences:—(1) The peak of nitrification is reached long before the plant starts its activity and as such there is likelihood of some losses. (2) By earthing up time the soil in the furrow is entirely depleted of its nitrate content and it is only varieties like P. O. J. 2878 with their extensive root system which are able to tap the ridge nitrate. (3) From October onwards, there is accumulation of nitrates in the soil which may affect maturity. This seems to be due to the slow nitrification of cake applied at earthing up time. The system of application of top dressings as recommended in the standard Manjri method would thus require some modification.

(D) *Relation of water to manure.*

In order to estimate the ultimate destination of top dressing of fertilizers, it is necessary to know besides the intake by the crop, its lateral as well as vertical distribution due to irrigation. Only movement of nitrogen is being investigated at present. The analysis of leaching from pot culture experiments has shown that loss of nitrates by percolation is very little from the cropped pots, the figures for the whole period of the experiment being 0.55 and 1.7 lbs. for 70" and 130" respectively. This comes to 0.4 and 1.2 per cent. of nitrogen applied in top dressings. Higher loss with higher waterings is thus apparent. No such clear division was, however, observed in the field experiments (graph VII).

Detailed study of nitrate figures for different depths (data not given) shows three distinct stages in the movement of nitrates corresponding with crop growth. During the formative stage nitrate accumulation goes on in the soil, which is reflected by the increase in the second and even the third foot with soils of higher depths. Active nitrification at such lower depths is not expected and there seems to be a definite leaching effect at this stage. After earthing up, high crop activity coupled with slower nitrification of cake practically eliminates the loss of nitrates by leaching and during this period the plots show only a trace of nitrates in the lower depths. By maturity stage all the layers show again a rise in the nitrate content. As the periodical irrigational dose at this stage exceeds greatly the water holding capacity of the soil (table XII) it is at this period that the greatest loss in nitrates by leaching is expected. Analyses of soils for total nitrogen at planting and harvest time (table XX) suggest that there is also a definite nitrogen holding capacity of the soil beyond which, whatever the treatment, the soil can not retain it under irrigational conditions.

(E) *Quality of Gul.*

The quality of gul is dependent upon three factors, viz., (1) colour (2) hardness and (3) taste. Brilliant yellow colour with sufficient hardness, as

not to liquify in humid conditions and sweet taste carries the highest price. In the Bombay Presidency, certain tracts in Kolhapur State and Belgaum District come under this category. Compared to these, Deccan canal tracts are much inferior, the worst being the Nira right bank. It would be thus seen that the problem is a very important one as the cultivators' income mainly depends upon it.

Periodic juice analyses (table XVIII) brings out clearly the difference between the varieties and treatments and its likely effect on the quality of gul. Attention is drawn to column 7, which shows that P. O. J. 2878 contains in its juice higher nitrogen and lower P_2O_5 per ton of crop than Pundia; this is reflected in the colour of gul, which is inferior in the case of P.O.J. Analysis of gul samples under varying treatments of water and manure are given in table XXI. The salt content as well as nitrogen is decreased with the increasing delta which corresponds with the improvement in colour. Better type of gul is also obtained in the F. Y. M. series. It seems therefore, quite evident that higher quantities of salt affect the colour of gul. The salty taste seems to be also due to high ash content specially the alkali salts. The farm guls all had this taste while gul from the best tract of Kolhapur showed sweet taste and had only 0.6% of ash.

The keeping quality of gul seems to be mainly dependent upon its glucose content. Analysis of some samples collected from both the best and worst tracts of Kolhapur show only the difference in their glucose content, the figures being 8.75 and 12.77%, respectively. P. O. J. gul has also a good keeping quality and its glucose content is very much low (table No. XXI). It has been however observed that gul from which sonamali (dirty extraneous matter appearing just before the striking point of gul) is claimed to keep well in humid climates though containing higher glucose content. The process resembles one of immersing gul blocks in sugar solution. Two such samples are analysed and their keeping quality during the ensuing monsoon will be observed.

R. D. REGE,
Crop Physiologist,
Sugarcane Research Scheme for Deccan, Padegaon.

**ANNUAL REPORT OF THE AGRICULTURAL SECTION FOR
THE YEAR 1933-34.**

(1) Administration and staff.

I remained in charge of the section throughout the year. The personnel of assistants which consisted of three graduates remained unchanged without any member proceeding on leave. Two additional agricultural overseers and sub-overseers for a period of 3½ months were recruited to help the present staff during the harvesting period of the cane crop.

The work in the agricultural section mainly falls under two heads: (1) experimental work other than cane varietal work and general management of the farm and estate and (2) cane varietal work and chemical work in the laboratory. Mr. V. N. Apte with Mr. P. S. Kulkarni looked to the first section and Mr. N. B. Patwardhan was entrusted with the second section.

During the year I had to do arduous duty of continuously training the whole staff, who was not specialized for this type of work, to suit to the requirements of this new layout, and the staff had also to put in strenuous work.

(2) Distribution of farm area.

As reported in the last year's report the whole area was required to be divided for irrigation and other purposes. The area is distributed as under:

Total area.		Available for crops.		Under channels.		Roads.	
A.	gts.	A.	gts.	A.	gts.	A.	gts.
104	10	82	33·9	7	25·15	13	29·6

(3) DISTRIBUTION OF AREAS UNDER DIFFERENT CROPS IN ALL SECTIONS.

The following shows the distribution:—

Section.	Cane.		Sann.		Nilawa.		Cotton.		Other miscellaneous crops.		Fallow under roads and channels etc.		Total.
	A.	gts.	A.	gts.	A.	gts.	A.	gts.	A.	gts.	A.	gts.	
Agricultural section	21—	1	18—38·5		16—36·1		6—39·6		15—29·4		16—30·9		96—15·5
Crop Physiology Section	1—7·16		1—18·84		..		1—3·26		..		0—33·94		4—23·2
Soil Physics section	0—23		0—0·8		0—1		..		..		2—26·5		3—11·3
													104—10

(4) EXPERIMENTAL WORK.

(1) *Season.*—Table showing bimonthly maximum and minimum temperatures, humidity and precipitation at Padegaon in 1933-34 is appended (table I).

Tillage operations such as ploughing etc. in November and December before planting cane have a great influence on the cane crop. The precipitation in 1932-33 till November end was 33.72 inches, *i.e.*, nearly double the average and the rains continued till November end. Abnormal moisture content in the soil was a great hindering asset which postponed the tillage operations and even when completed to catch the planting season, normal tilth was not secured.

The rainfall in 1933-34 was normal. The temperatures in April and May were somewhat below normal. The month of August was wet, yet the sann crop could be buried in time without any stoppage.

In the life of the soil this was the first year when cane was planted and when it had to adapt itself to continuous irrigation. In this land, even though the tillage operations were postponed as mentioned above, yet without losing the planting season, which would have resulted in a loss of year of the scheme, planting of cane was done no sooner the blocks were levelled after scrapping wherever it was essential. By the middle of February some of the important experiments were planted.

On the whole a fairly good germination was secured. In some blocks it was found to have been affected owing to the following factors :—

- (a) Defective tilth,
- (b) Scraping of the soil for levelling,
- (c) Import of seed from outside,
- (d) Land new for irrigation purpose.

The following table will explain to what extent the above factors have affected germination and consequent yield.

Field	PUNDIA		P. O. J. 2878		REMARKS.
	Germinations.	Yield in tons.	Germinations.	Yield in tons.	
II-A. Non-scraped and non-levelled.	43	32.8	45	41.6	The yields are calculated from the whole plot for the net acre.
II-B. Area scraped and levelled, etc.	31.6	20.5	34.6	29.4	

The borer (*Diatroea auricilia*) attack was found to be severe in some blocks to cane and in some it was not traced to be so much intense. It ranged from 8.5 to 36 per cent. Mosaic was detected in the imported varieties specially H. M. 607 and H. M. 609 from Hebbal Mysore.

In spite of the above drawbacks, the yield of cane crop was fairly average. Other rotation crops to cane have done well.

(2) *Layout*.—On page 22 of the last year's annual report under method of experimentation, general information about plot size, replicates and layout has been given. In 1932 the yield data of sann crop which was grown to test fertility trend was sent to Dr. Fisher of Rothamstead, to the Statistician to the Imperial Council of Agricultural Research and to Prof. Mahalanobis, Calcutta. The opinions of the first two were received in time before the actual planting commenced, whilst that from Prof. Mahalanobis was received late in June.

Exceedingly useful suggestions were received, abstracts of which are given below :—

Dr. Fisher (17-12-1932) :—

“ I have tested two of the areas and find in the first case the variation within blocks of six plots is 15·3 per cent. and in the second case variation within blocks of nine plots as high as 28·7 per cent. Six-fold replications would only reduce this value by dividing by six which still leaves very high errors in the experimental means.

I will make two suggestions which may possibly be useful. The equivalent of a greatly increased replication may be obtained by arranging the manurial or other variables so that all combinations are tried in a large complex experiment. An example which proved very precise is shown in my paper on ‘ The arrangement of field experiments ’ in the Journal of the Ministry of Agriculture XXXIII pp. 503—513.

Secondly it is possible that the variation in the hemp will be found to be significantly correlated, within sets of plots treated alike, with the subsequent variation in sugarcane in the same land. In this case a considerable improvement in precision may sometimes be obtained by treating the results with the analysis of covariance of which I give a fully worked and discussed example in the 4th edition (sect. 49·1) of my book on “ Statistical Methods for Research Workers.”

Mr. Vaidyanathan, Statistician, Imperial Council of Agricultural Research (6-1-1933) :—

“ I agree to your general scheme subject to the following few suggestions :

Varietal.—Here I have no suggestions to make except that you may reduce the number of varieties if you can and examine the varieties in detail.

Plot size.—Your plot size (main plot 1/40 acre) seems to me to be small. My recent investigation on the ideal plot size for cane Co. 205 in Pusa have shown that a size between 1/20 and 1/30 acre with length to breadth about 10 : 1 gives the minimum experimental error. Can you not combine your plots so that length : breadth is definitely increased from your present ratio 1 : 9 which appears to me to be too small. But I recognize your difficulty in having any such combination.

Number of replicates : This seems to be alright.”

Prof. Mahalanobis—No. 335 of 16-6-1933 :—

“ The analysis given above shows the existence of large differences in soil fertility under the sann crop in the blocks. Assuming that such soil differences would continue to exist under sugarcane, the lowest differences in mean yield which would be capable of detecting in the proposed plot designed would be large. It is therefore necessary to increase the number of replications very considerably by reducing the size of a single plot. The most advisable course would appear to be to use the Latin Square arrangement wherever possible as this would enable the fluctuations in soil fertility being eliminated between both rows and columns. With the adoption of a smaller size of plots it should be possible to replicate complete Latin Square in each block.”

On receipt of the opinions from Dr. Fisher and Mr. Vaidyanathan, the help of Dr. R. J. Kalamkar, Ph.D. was taken through Dr. G. W. B. Normand b the Director of Agriculture for working out figures of some of the blocks for the

combination of blocks. His suggestions were utilized and the type of layout was decided as under for different experiments.

Serial No.	Description of experiment.	Layout.	Number of replicates.
1	Requirements of nitrogenous top dressing with sann as basic manure for the cane crop.	Randomised and replicated treatment and varieties pooled together.	6
2	Requirements of organic manure (F. Y. M.) and nitrogenous top dressings for the cane crop.		6
3	Requirements of water and the effect of different doses and quantities of manure and water on the cane crop.		6

In January 1934, the Statistician to the Imperial Council of Agricultural Research visited the scheme, when he was able to see the crop and conditions of the plot size. He expressed his opinion that the present plot size need not be reduced.

(3) *Organization and methods adopted for conducting experiments as per new layout.*—It has been explained in the first year's report that all experimental work has been laid down as per new layout described above. This method is entirely different from the old method of experimentation with original and duplicate plots and involves greater and closer attention and heavier responsibilities. Besides the sugarcane crop under irrigation, which has a life cycle of eleven to thirteen months with a three year rotation system, requires not only more managerial supervision than other crops like cotton, rice, jowar and wheat that have a life cycle of four to nine months, but is found to be complicated due to some of the factors like right type of seed for planting, proper time of harvest, exact methods of recording brix, crushing etc. There was very little experience available to suit the Deccan conditions.

This new experimentation method required—

- (1) Utmost precautions against vitiation of results,
- (2) Strict uniformity of methods in the several operations,

and hence in the first year good deal of time was spent in thinking out and settling (1) the type of supervision that was necessary for each important operation for cane and other rotational crops, both in the field and manufacturing process and (2) methods to be adopted in carrying out various operations. The methods adopted cannot be regarded as perfect, modifications would be introduced later on as the experience will teach us. The details of methods adopted for handling cane crop are summarized below :—

Cane.

(1) *Seed supply.*—For each experiment the planting material utilized is of the same age and from a uniform block of soil.

(2) *Brix record*.—(1) In the case of general experiments like the one of manure and water quantities, the brix reading of each plot is recorded when the whole plot is completely crushed. (2) In the case of varieties under trial in different stages the following methods are adopted :—

- (a) Where the material of cane is extremely limited a single random stool is selected, crushed and brix recorded at every turn.
- (b) Where the material of cane is sufficient five feet row is cut, crushed and brix recorded at every turn.

With a view to know the behaviour of the varieties as regards early or late maturity, brix readings were recorded from November at every ten days interval till the time of attainment of maximum brix and purity.

No systematic statistical work has been done in adopting the five feet method. But looking to the environments of the station, as it has shown that it is better than a single random stool, which is affected by human factor, this is adopted.

(3) *Irrigation*.—The cane requires irrigation all throughout the year as rainfall is only 18". The crop is irrigated once in eight days in hot weather and once in ten days during the rest of the period. In the water requirement experiments the interval maintained between two irrigations all throughout the year is ten days.

(4) *Harvest* : (a) Time for harvesting varieties :—

In all general experiments there are two varieties—Pundia and P. O. J. 2878. These were decided to be harvested at 12½ and 11½ months respectively. In the case of varietal trial the varieties were harvested when each attained maximum purity.

(b) Period for harvesting the experimental block :—

In harvesting each variety from the general experimental block, the following factors had to be considered :—

- (1) Irrigation turn,
- (2) Sampling for juice analysis,
- (3) Crushing within a specific period as would not affect cane and consequent gul ratio.
- (4) Management of harvest by the limited graduate staff.

The period has been fixed from two to four days for harvest. In the case of varietal trial any single variety from all replicates is arranged to be harvested within two days.

(5) *Crushing*.—Crushing of cane harvested from each treatment is done on the same day as far as possible or within twenty-four hours from the time of harvest. Cane from all experimental plots except ring portions is crushed on Chatnooga No. 92 crusher.

(6) *Analysis of samples*.—In the general experiments like manure and water only brix reading is recorded for each plot after crushing and a composite sample of juice and bagasse of each treatment is analysed for sucrose, glucose purity, fibre and sucrose in cane. In the case of varieties, only in final trial

of cane varieties, each plot juice and bagasse is analysed for items mentioned above.

(7) *Manufacture of gul.*—A special set of six Poona single furnaces has been constructed. This has facilitated gul making of each individual plot independently.

(8) *Weights.*—Cane is harvested and weights recorded per main plot as well as for the ring separately.

Experiences with the new layout, organization and methods of working etc. :—

(1) *Area and cost.*—In the irrigation farming like the one adopted, at Padegaon for the new layout, sixteen per cent more area is required. For a net area of forty gunthas of cane 46·4 gunthas area is essential. Similarly about sixty per cent. more cost is essential for carrying out this type of experiment than usual.

(2) *Supervision.*—The graduate overseer is required to work cent per cent. more in the conduction of these experiments than with other crops. The following chart shows how he is fully engaged with the field during several months of the year.

(3) *Supply of sets.*—As mentioned above the question of planting material really is a complicated one, when compared to the wheat, cotton, etc. seeds. For the present the material for planting is taken from experimental blocks which is eleven to twelve months old. It is found difficult to meet the required supply for planting the block. Hence a block of twelve acres having four acres of cane is quite essential to meet this difficulty. This would not only obviate the necessity of cutting from experimental blocks but would increase the efficiency of experiments.

(4) *Results of experiments.*—The results of the following experiments are summarized below :—

- I. Requirements of nitrogenous top dressing with sann as basic manure for the cane crop.
- II. Requirements of organic manure (F. Y. M.) and nitrogenous top dressings for the cane crop.
- III. Requirements of water and the effect of different quantities of water on the cane crop.
- IV. (A) Final trial of promising cane varieties.
(B) Preliminary trial of cane varieties together with sugarcane sorghum hybrids.
(C) Intermediate trial No. 2 of varieties of cane.
(D) Intermediate trial No. 1 of varieties of cane.
- V. Trial of different nitrogenous fertilizers with sann as basic manure on the cane crop.

NOTE.—The dimensions of the plot with a ring and without a ring in experiments Nos. I, II, III, IV-A and V are :—

Whole plot = 54·44' × 32' = 4 cents = 1/25 acre.

Main plot = 45·44' × 32' = 2·5 cents = 1/40 acre.

N. T. R.

I.—REQUIREMENTS OF NITROGENOUS TOP DRESSING WITH *sanu* (CROTALARIA JUNCEA) AS BASIC MANURE FOR CANE CROP.

Plan and yield in lbs. per plot of 1/40 of an acre, exclusive of ring.

A 1370	C 2534	H 2046	E 1597
B 2061	F 1917	D 2672	G 2108
H 2327	A 1866	B 1992	C 2527
E 1628	F 2024	D 2326	G 2507
C 2446	B 1938	F 2555	E 1939
A 2232	H 2522	D 2344	G 2455
G 2051	C 1977	F 1669	B 1323
D 2616	A 1523	H 2473	E 1522
H 2114	E 1422	B 1887	C 2422
F 1315	D 1968	A 1153	G 1990
G 1720	D 2386	F 1461	A 1431
C 1801	E 1281	B 1318	H 1943

Index.	Pundia. Artificial and organic N. in lbs.	Index.	P. O. J. 2878 Artificial and organic N in lbs.
A	75	E	75
B	100	F	100
C	150	G	150
D	200	H	200

The quantities of manure are per acre.

N. T. R.

System of replication. . . .	6 randomised blocks of eight plots each.
Area of each plot.	1/40th of an acre.
Varieties.	{ Pundia, P. O. J. 2878.
Basal manuring.	<i>Sann</i> as green manure.
Top dressings.	Safflower cake and sulphate of ammonia in different quantities.
Time of application of top dressing.	{ 3 weeks after planting { 1/3rd total N. from sulphate of ammonia. 8 weeks after planting { 1/3rd total N. from cake and sulphate of ammonia. 5th month at earthing up time. { 1/3rd total N. from cake.
Date of planting.	24th January 1933.
Date of harvest.	{ P. O. J. 2878—15th January 1934. Pundia—7th February 1934.
Growth notes.	Planting was done at the normal time in January. The germination of the crop was normal ranging from 53·52 to 62·94 per cent. in Pundia and 45·83 to 64·66 per cent. in P. O. J. 2878. The attack of borer was not serious. It was only 8·7 per cent. in Pundia and 4·99 per cent. in P. O. J. 2878.

Summary of —

N. T. R.

SUMMARY OF RESULTS.

TREATMENTS.

Cane weights in tons.

	Pundia.				P. O. J. 2878.				General mean.	Standard error of treatment mean.	Significance by Z test.	Critical difference for significance.
	A	B	C	D	E	F	G	H				
(1) Per acre	28.49	31.31	40.79	42.59	28.06	32.26	38.09	40.08	35.21	1.7	Significant	4.6
(2) Per cent. on general mean.	81	89	116	121	79	92	108	114				
(3) Per cent. on control of varieties separately.	70	77	100	104	74	84	100	105				

VARIETIES.

Cane weights in tons.

	Varieties.		General mean.	Standard error of variety mean.	Significance by Z test.	Critical difference for significance.
	Pundia.	P. O. J. 2878.				
(1) Per acre	35.8	34.6	35.21	0.85	Not significant.	1.72
(2) Per cent. on general mean	102	98				
(3) Per cent. on control	100	96				

ANALYSIS OF JUICE AND CANE.

	Pundia.				P. O. J. 2878.			
	A	B	C	D	E	F	G	H
Per cent. Sucrose	14·61	14·75	14·60	13·72	20·59	20·42	20·66	19·44
Per cent. Glucose	1·65	1·65	2·03	2·12	0·26	0·26	0·31	0·45
Per cent. Purity	86·17	85·96	84·92	83·26	92·05	91·00	92·33	90·67
Per cent. Fibre in cane	10·88	10·46	9·77	9·52	12·29	13·83	13·43	13·32
Per cent. Sucrose in cane	12·57	12·83	12·86	12·2	16·47	16·59	16·65	16·19

Conclusions.—It is too early to draw any conclusions.

In treatment, 150 lbs. N in the case of Pundia shows indications of superiority over 75 and 100 lbs. N whilst 200 lbs. N has not shown significance. P. O. J. 2878 acts similar to Pundia in case of superiority of 150 lbs. N over 76 and 100 lbs. N. But 200 lbs. N shows slightly significant results over 150 lbs. N. In variety, no significance is found.

R. O. M.

II.—REQUIREMENTS OF ORGANIC MANURE (F. Y. M.) AND NITROGENOUS TOP DRESSINGS FOR THE CANE CROP.

Plan and yield of cane in lbs. per plot of 1/40 of an acre exclusive of ring.

Q 1663	R 2596	H 1760	I 1772	O 1663	P 1417	N 1753	L 2394	M 2233
A 714	C 1544	E 1141	D 1198	B 1029	J 1244	G 1945	F 1798	K 2319
Q 1321	R 2481	H 1406	K 1946	N 2134	I 1879	M 2055	G 1544	P 2195
F 2000	E 2058	J 1640	A 1991	O 2692	C 1876	L 2376	D 2097	B 2228
R 2341	A 1287	J 1371	L 2728	I 1909	D 1699	N 2164	B 1945	E 2114
G 1403	H 1845	P 2014	C 2558	K 2208	F 2405	O 2926	M 2468	Q 2649
F 1591	H 1270	B 1291	J 1933	E 1687	A 1639	N 2217	M 1865	O 2016
C 1270	I 1518	D 1318	I 1812	P 1608	G 939	Q 1702	K 1440	R 1435
B 624	J 895	R 1680	A 559	N 1606	K 1090	E 603	M 925	O 1249
P 1324	C 1592	I 1712	G 1209	F 1333	H 1415	D 996	Q 2201	L 1951
E 856	M 863	B 908	J 952	A 716	I 1378	G 805	F 1097	D 508
P 905	L 1106	Q 1342	R 1490	C 1076	O 971	H 1109	N 1042	K 1006

Pundia.			P. O. J. 2878.		
Index.	F. Y. M. lbs.	+ Artificial and organic N in lbs.	Index.	F. Y. M. lbs.	+ Artificial and organic N in lbs.
A	10,000	50	J	10,000	50
B	10,000	100	K	10,000	100
C	10,000	150	L	10,000	150
D	20,000	50	M	20,000	50
E	20,000	100	N	20,000	100
F	20,000	150	O	20,000	150
G	30,000	50	P	30,000	50
H	30,000	100	Q	30,000	100
I	30,000	150	R	30,000	150

N. B.—Quantities of manure are per acre.

R. O. M.

System of replication . . .	Six randomised blocks of eighteen plots each.
Area of each plot	1/40th of an acre.
Varieties	Pundia. P. O. J. 2878.
Basal manuring	Farm yard manure in different quantities.
Top dressing	Safflower cake and sulphate of ammonia in different quantities.
Time of application of top dressing.	3 weeks after planting. { 1/3rd total N from Sulphate of ammonia. 8 weeks after planting { 1/3rd total N. from cake and sulphate of ammonia. 5th month earthing up time. { 1/3rd total N from safflower cake.
Date of planting	6th February 1933.
Dates of harvest	P. O. J. 2878—26th to 31st January 1934. Pundia—21st to 24th February 1934.
Growth notes	Some portions of the block were required to be scraped for levelling. Tillage operations had therefore to be delayed and soon after, planting had to be done. In portions scraped Pundia showed greater unevenness in germination than P. O. J. 2878. The mean germination in different treatments of Pundia ranged from 24·96 to 50·61 and of P. O. J. 24·51 to 58·11. The cane on scraped portions did not even make normal growth in the latter period. In the rest of the area the crop was normal. The borer attack was 15·40 per cent. in Pundia and 11·16 per cent. in P. O. J. 2878.

SUMMARY OF RESULTS.

TREATMENTS.

Cane weights in tons.

	Pundia.									P. O. J. 2878.								Gen. mean.	Std. error of treatment mean.	Sig. by Z test.	Critical dif for sig.	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q					R
(1) Per acre	20.55	23.87	29.51	23.26	25.17	30.69	23.33	26.19	30.26	23.91	29.78	36.8	30.98	32.48	34.26	28.16	32.37	35.78	28.74	2.4	Sig.	6.74
(2) Per cent. on general mean.	72	83	103	81	88	107	81	91	105	83	104	128	108	113	119	98	113	124	..	..	..	..
(3) Per cent. on control of each variety separately.	68	79	97	77	83	101	77	86	100	67	83	103	87	91	96	79	90	100	..	..	..	..

VARIETIES.

Cane weights in tons.

	Variety.		General mean.	Standard error of variety mean.	Significance by Z test.	Critical difference for significance.
	Pundia.	P. O. J. 2878.				
(1) Per acre	25.87	31.62	28.74	0.8	Significant	1.56
(2) Per cent. on general mean	90	110	..	..	..	..
(3) Per cent. on control	100	122	..	..	..	..

ANALYSIS OF JUICE AND CANE.

	Pundla.										P. O. J. 2878.								
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
Per cent. Sucrose	16.34	16.23	16.26	16.49	16.20	16.28	16.65	16.91	16.20	21.56	20.92	20.33	20.50	20.88	20.03	21.41	20.26	20.06	
Per cent. Glucose	1.36	1.47	1.53	1.49	1.66	1.59	1.43	1.32	1.69	0.35	0.19	0.29	0.27	0.21	0.27	0.18	0.38	0.25	
Per cent. Purity	88.10	87.77	88.14	88.64	88.85	88.70	89.42	89.68	86.02	92.89	92.15	91.91	92.85	92.39	89.75	93.64	90.59	90.40	
Per cent. Fibre in cane	10.13	9.99	9.44	10.22	10.34	8.86	9.17	9.88	9.37	13.64	14.11	13.31	13.25	14.21	14.24	13.54	12.01	13.78	
Per cent. Sucrose in cane	13.92	14.23	14.52	14.51	14.21	14.20	14.40	14.97	14.06	17.83	17.07	16.88	17.22	17.08	16.49	17.58	17.18	17.09	

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Conclusions.—The crop has shown response to the quantity of top dressings rather than basic manure.
 In treatment—no superiority over control.
 In variety—P. O. J. 2878 has shown superiority over Pundla.

R. W. M.

REQUIREMENTS OF WATER AND THE EFFECT OF DIFFERENT DOSES AND QUANTITY OF MANURE AND WATER ON THE CANE CROP.

Plan and yield in lbs. per plot of 1/48 of an acre exclusive of ring.

J 1464	J 1454	L 1297	C 1883	J 1451	A 1545
F 1682	G 1113	C 1885	D 2040	E 1890	C 1858
A 800	L 1141	D 1700	F 1847	K 1684	K 1539
G 817	H 661	F 1551	A 1035	D 1828	J 1520
H 700	C 1822	K 1270	L 1011	F 1408	D 1731
C 1375	D 2071	J 1324	G 766	B 827	L 1361
D 1959	I 1141	G 993	H 873	G 1206	E 1382
L 1534	A 1407	B 1068	J 1976	L 1848	G 1181
E 1540	F 1563	E 2180	B 1599	I 1630	B 1127
I 1575	B 1405	I 1976	K 1838	C 1998	F 2250
B 1827	K 1968	H 1093	E 2221	H 1347	I 1913
K 2033	E 2423	A 2150	I 1937	A 2081	H 1268

Pundia.

Index.	Artificial and organic N in lbs. per acre.	Quantity of water acre inches per acre.
A	50	95
B	50	130
C	150	70
D	150	95
E	150	120
F	150	130

P. O. J. 2878.

Index.	Artificial and organic N in lbs. per acre.	Quantity of water acre inches per acre.
G	50	95
H	50	130
I	150	70
J	150	95
K	150	120
L	150	130

NOTE 1.—The first two treatments in each variety, viz., A & B and G & H were introduced by the Crop Physiologist to see the effects of minimum dose of manure combined with the normal and maximum quantities of water. Since the results of these are discussed by him in his section, the calculations are made for the remaining four treatments for the two varieties that belong to the agricultural section.

NOTE 2.—The size of the main plot in this experiment is reduced to 1/48th owing to one row being given to the Crop Physiologist for study.

R. W. M.

- System of replication. Six randomised blocks of twelve plots each.
- Area of each plot . 1/48th of an acre.
- Varieties . . . Pundia,
P. O. J. 2878.
- Basal manuring . . *Sann* as green manure.
- Top dressing . . . Safflower cake and sulphate of ammonia, in different quantities.
- Time of application of top dressing . 3 weeks after planting { 1/3rd total N from sulphate of ammonia.
8 weeks after planting { 1/3rd total N from cake and sulphate of ammonia.
5th month at earthing up time. { 1/3rd total N from cake.
- Date of planting . . 13th and 14th February 1933.
- Date of harvesting . . P. O. J. 2878—9th and 10th February 1934.
Pundia—24th to 26th February 1934.
- Growth notes . . . The construction of underground channels for irrigation being in progress, tillage operations could not be done in November. The channel work was completed by the beginning of February, *i.e.*, only a week before planting. This affected the germination and the subsequent growth. The borer attack varied from 13·95 per cent. to 22·80 per cent. in Pundia and 11·36 per cent. to 15·11 per cent. in P. O. J. 2878.

P. W. M.

SUMMARY OF RESULTS.

TREATMENTS.

Cane weights in tons.

	Pundia.				P. O. J. 2878.				General mean.	Standard error of treatment mean.	Significance by Z test.	Critical difference for significance.
	C	D	E	F	I	J	K	L				
(1) Per acre	38.65	40.45	43.35	36.79	36.32	32.80	36.9	29.25	36.81	2.43	..	6.9
(2) Per cent. on general mean.	105	110	118	100	99	89	100	79	..	..	..	..

VARIETIES.

Cane weights in tons.

	Variety.		General mean.	Standard error of variety mean.	Significance by Z test.	Critical difference for significance.
	Pundia.	P. O. J. 2878.				
(1) Per acre	39.81	33.8	36.81	1.21	Significant	2.4
(2) Per cent. on general mean	108	92	..	..	..	..
(3) Per cent. on control	100	85	..	..	..	..

ANALYSIS OF JUICE AND CANE.

	Pundia.				P. O. J. 2878.			
	C	D	E	F	I	J	K	L
Per cent. Sucrose	15.09	15.03	14.79	15.80	19.51	20.21	20.54	21.03
Per cent. Glucose	2.06	1.89	2.14	1.92	0.40	0.31	0.33	0.31
Per cent. Purity	86.10	86.20	84.59	87.14	91.52	92.34	92.45	93.58
Per cent. Fibre in cane	9.44	9.87	9.85	9.11	14.68	16.28	14.95	14.54
Per cent. Sucrose in cane	13.19	13.18	12.93	13.93	16.02	16.28	16.68	16.89

Conclusions.—It is too early to draw any inference. 130 acre inches treatment has shown deleterious effect both on Pundia and P. O. J. 2878.

IV. A.—FINAL TRIAL OF SUGARCANE VARIETIES.

In this section, ten varieties were tested, inclusive of two new selections from Coimbatore bred by the Second Cane Breeding Officer and one from Hebbal Farm. The soil in the block was greatly disturbed owing to scraping and deposition in the course of levelling; consequently the germination was badly affected. The attack of borer was very intense. The following table shows the germination percentage at six weeks and borer attack (average of six replicates), as was recorded in the third week of May 1933.

S. No.	Variety.	Germination at six weeks.	Borer attack percentage.
1	P. O. J. 2878	33.91	16.5
2	Co. 290	44.46	12.5
3	Str. D. 109	39.79	20.8
4	H. 109	37.69	23.5
5	E. K. 28	26.37	20.6
6	Co. 360	16.0	15.6
7	Co. 402	37.0	27.3
8	H. M. 320	22.34	19.0
9	H. M. 89	54.17	24.3
10	Pundia	43.41	26.8

The intense borer attack inhibited the growth in the early stages; Coimbatore selections made up during the growing period and showed some important characters which require further corroboration.

The following table shows how the seven important varieties have progressed at different stages as regards germination, number of tillers, and number of canes at harvest (*millable cane*) in spite of low germination.

Table showing stand of cane at different periods from germination till harvest.

Variety.	Shoots at different period.					Remarks.
	At six weeks germination 27th Mar. 1933.	17th to 25th May 1933.	7th to 21st July 1933.	22nd Sept to 4th Oct. 1933.	At harvest. 27th Jan. to 20th Mar. 1934.	
	(Average data of six replications.)					
Co. 290	533	2,866	3,051	1,694	1,474	Buds planted 1,200.
H. M. 320	268	1,112	1,415	1,193	715	
E. K. 28	316	1,209	1,415	935	653	Date of planting=12th Feb. 1933.
Pundia	521	1,857	2,275	996	696	
Co. 360	191	894	1,373	934	840	
P. O. J. 2878	407	1,725	1,919	1,039	957	
Co. 402	444	2,798	2,575	1,208	989	

Similarly the following table shows the performances as regards brix readings of different varieties from November onwards:—

Variety.		Brix and purity reading on different dates.						Remarks.
		28-29 Nov.	24-25 Dec.	14-15 Jan.	3-8 Feb.	2 & 3 March.	17-20 March	
P. O. J. 2878	B	18.73	20.42	21.39	B=Brix. P=Purity. Brix readings are of sample of a 5' row.
	P	85.62	90.00	92.32	..	..	..
Co. 290	B	..	18.66	19.70	20.70	..	..
	P	..	86.44	87.60	89.75	..	..
Str. D. 109	B	15.54	17.83	17.55	17.87	..	..
	P	79.72	84.84	86.01	88.17	..	..
H. 109	B	15.65	17.45	17.19	18.51	..	..
	P	85.01	86.06	87.12	92.51	..	..
E. K. 28	B	16.67	17.90	..	19.50	..	..
	P	82.77	86.75	..	91.84	..	..
Co. 360	B	..	16.99	19.54	20.31	21.38	..	
	P	..	86.40	90.23	91.13	92.54	..	
Co. 402	B	..	..	..	16.57	17.08	17.21
	P	..	..	..	87.30	86.00	89.04
H. M. 320	B	..	..	..	16.86	17.50	17.58
	P	..	..	..	85.04	86.73	87.85
H. M. 89	B	..	..	..	21.48	21.12	21.72
	P	..	..	..	93.85	91.61	92.30
Pundia	B	..	..	..	16.67	17.82	17.99
	P	..	..	..	82.14	85.71	86.40

The analysis of yield is summarized below:—

Plan and yields in lbs. per plot of 1/40 of an acre exclusive of ring.

G 1485	E 1063	H 955	B 2132	F 1399	I 1711	J 1952	A 2234	C 1704	D 2010
B 1964	E 1376	D 1837	A 1822	C 1601	I 2507	F 2420	G 2905	H 1895	J 2261
D 1782	E 2050	A 2032	C 1916	I 2507	B 2784	G 2706	J 1716	H 1621	F 2362
J 2523	C 2335	F 2559	G 3759	E 2443	I 2536	H 1855	D 1817	B 2428	A 2123
A 2201	E 1765	C 2015	J 2386	H 1498	I 2110	G 1877	D 1573	B 2553	F 2008
I 1931	G 1912	J 1921	D 1422	F 1589	A 1889	C 1545	B 2433	H 1296	E 1407

Index
letter.

Variety.

Index
letter.

Variety.

A P. O. J. 2878 (P. O. J. 2878
× E. K. 28).
B Co. 290 (Co. 221 × D. 74).
C Str. D. 109.
D H. 109.
E E. K. 28 (P. O. J. 100 × E. K. 2).

F Co. 360 (P. O. J. 2725 × Q 116).
G Co. 402 (Vellai × Co. 243).
H H. M. 89.
I H. M. 320.
J Pundia.

System of replication	. . .	Six randomized blocks of ten plots each.
Area of each plot	. . .	1/40th of an acre.
Varieties	. . .	(1) P. O. J. 2878. (6) Co. 360. (2) Co. 290. (7) Co. 402. (3) Str. D. 109. (8) H. M. 89. (4) H. 109. (9) H. M. 320. (5) E. K. 28. (10) Pundia.
Basal manuring	. . .	Sann hemp as green manure.
Top dressing	. . .	Sulphate of ammonia and safflower cake each supplying 75 lbs. N.
Time of application of top dressing.	3 weeks after planting.	—50 lbs. N from S/A.
	8 weeks after planting	{ 25 lbs. N from S/A and 25 lbs. N from safflower cake (mixed).
	5 to 6½ months at earthing up time.	50 lbs. N from safflower cake.
Date of harvest	. . .	P. O. J. 2878 . . . 27th January 1934. Co. 290 . . . 3rd February 1934. Str. D. 109 . . . 15th February 1934. H. 109 . . . 16th February 1934. E. K. 28 . . . 17th February 1934. Co. 360 . . . 6th March 1934. Co. 402 . . . 17th March 1934. H. M. 320 . . . 18th March 1934. H. M. 89 . . . 19th March 1934. Pundia . . . 20th March 1934.
Previous crop	. . .	Sann.
Growth notes	. . .	The germination was very defective for the causes mentioned above. It varied from 7 to 60 per cent. Similarly the borer attack was very severe and its intensity was from 9 to 34 per cent. However the varieties recouped in the monsoon period.

SUMMARY OF RESULTS.

Cane in tons per acre.

	Name of variety.										General mean.	S. E. of treatment mean.	Whether general effect of treatment significant by Z test.	Critical difference for significance.
	P. O. J. 2878	Co. 290	Str. D. 109	H. 109	E. K. 28	Co. 360	Co. 402	H. M. 89	H. M. 320	Pundia				
(1) Per acre	36·61	42·54	33·09	31·07	30·07	36·72	43·59	26·97	39·86	37·96	35·85	2·42	Significant	6·74
(2) Percentage on general mean	102·10	118·70	92·30	86·68	83·87	102·40	121·40	75·23	111·20	105·90	100·00			
(3) Percentage on control pundia	96·45	112·00	87·18	81·87	79·21	96·74	114·60	71·06	105·10	100·00				
(4) Percentage on P. O. J. 2878	100·00	116·2	90·38	84·87	82·13	100·30	119·10	73·67	108·90	103·7				

Analysis of juice and cane.

	P.O.J.2878	Co. 290	Str. D. 109	H. 109	E. K. 28	Co. 360	Co. 402	H.M. 320	H.M. 89	Pundia.
Per cent sucrose in juice	20·07	18·0	16·69	17·35	18·05	19·63	14·65	15·25	19·82	16·11.
Per cent reducing sugar	0·43	0·96	1·07	0·90	0·80	0·32	0·73	1·30	0·59	1·75
Purity	92·17	87·38	89·02	91·85	90·57	93·40	86·36	85·65	91·89	88·55
Fibre in cane	12·17	14·06	13·75	13·91	13·26	11·72	12·99	12·46	12·64	9·23
Sucrose in cane . . .	17·05	15·15	14·64	14·44	15·05	16·41	11·69	12·45	16·65	13·99

Conclusions:—It is too early to draw any conclusions. However the indications observed are worth recording.

- (1) Coimbatore selections show a tendency to do well even if the soils are new.
- (2) Co. 360 shows equally good results as P. O. J. 2878 and is found to be slightly later than P. O. J. 2878.
- (3) Co. 402 appears to be a very late variety; it is a heavy yielding variety with a consequent low brix.

The table below shows the mineral intake by different varieties:—

Mineral intake in pounds per ton of crop (only millable cane exclusive of roots, trash and tops).

Variety.	N	CaO	K ₂ O	P ₂ O ₅	Total ash.	Soluble ash.
Pundia	0.74	0.50	2.43	0.28	11.70	5.24
P. O. J. 2878	0.70	0.74	5.33	0.51	26.29	18.12
E. K. 28	0.70	0.71	3.55	0.51	12.74	7.07
Co. 360	1.07	0.49	5.83	0.68	20.01	12.39
Co. 402	0.66	0.41	4.56	0.79	15.36	9.72

B. Preliminary trial of cane varieties.

This consisted of—

- I. New selections from Coimbatore and Hebbal Mysore, and
- II. Sugarcane Sorghum Hybrids.

I. *New selections from Coimbatore and Hebbal Mysore.*—In this five varieties from Coimbatore and four from Hebbal Mysore were tested. The planting material was limited and hence area planted under each variety varied from $\frac{1}{2}$ to 1 cent according to available material. Besides for the further testing, planting material was utilized from the same area. Owing to these two factors, performances of germination and growth together with brix and purity were only recorded and summarized in table II. This has supplied information on relative growth, sucrose and earliness. Co. 416, Co. 419 and H. M. 606 and 609 are some of the promising varieties.

II. *Trial of sugarcane sorghum hybrids.*—Six strains of sugarcane sorghum hybrids were received from Coimbatore together with Co. 281. Only their ripening tests were recorded, as the material was extremely limited. It was planted at two periods, *viz.*, February and June, to see how it grew in these two different seasons. The growth was normal for February planting but was found to be stunted with June planting. None of the strains showed the maximum purity at six months under the Deccan conditions. June planted crop was utilized for multiplication of seed. The performances of February planting as regards, growth, weight of cane and juice analysis at three specific periods are given in table III.

D.—Intermediate trial of cane varieties No. I.

In this section, five varieties received in the year 1931-32 from Coimbatore were tested in the same block wherein the preliminary trial of cane varieties

was conducted. The varieties Co. 403, 404, 405 and 406 have shown promising performances which are summarized in table II.

Intermediate trial of cane varieties No. II.

Fifteen selections received from Coimbatore were tested. The block in which these were planted, was disturbed owing to scraping in the course of levelling which affected the germination and consequently the yields. The test was in duplicate, non-randomised. The general level of yield in this block is low on account of bad germination consequent to soil-disturbance when compared with other varietal blocks ; even in such disturbed conditions, some of the varieties have shown their comparative yielding capacity.

The varieties have been tentatively grouped as early, mid-late and late on the basis of maximum brix and purity.

The table below shows how the twelve varieties have performed from the point of germination, etc :—

Table showing performances as regards germination, weight of cane, brix and purity readings, etc., in intermediate varietal trial
No. II.

S.No.	Group.	Name of variety.	Parentage.	Germination at six weeks.	Av. wt. per cane.	No. of canes per acre.	B = Brix. P = Purity.	4th Nov.	26th Nov.	25th Dec.	6th Jan. 1934.	25th and 26th Jan.	5th Feb.	20th Feb.	28th Feb.	26th March.
1	Early	Co. 364.	P. O. J. 2725 × Fiji B (Badila).	29.58	3.05	15840	B	...	...	20.04	20.20	...	...	20.08		
2							P	...	...	91.64	91.22	...	...	92.81		
3		Co. 407.	P. O. J. 2725 × B. 3412.	62.83	1.63	34800	B	19.30	21.87	22.69	22.55	...	...	23.64		
4							P	86.22	85.76	91.64	90.48	...	...	93.22		
5		Co. 408.	P. O. J. 2725 × Co. 243.	30.08	2.05	33360	B	...	...	20.71	21.18	21.16	...	21.80		
6							P	...	...	92.12	91.79	92.60	...	92.06		
7		Co. 411.	P. O. J. 2727 × P. O. J. 2878.	31.99	2.11	20400	B	17.40	19.49	20.76	20.91	...	...	21.91		
8							P	83.35	87.52	91.79	92.02	...	...	91.77		
9		Co. 413.	Co. 290 × 247 B	52.24	2.53	40080	B	...	17.84	18.63	19.93	20.04	19.87	
10	P						...	84.80	88.08	90.44	90.88	...	90.86			
11	Co. 414.	Co. 359 × Co. 360	38.5	3.16	19200	B	...	20.14	20.56	21.35	...	...	22.04			
12						P	...	87.34	91.87	93.91	...	...	90.46			
13	Co. 365.	P. O. J. 2725 × Q. 813.	22.33	2.24	15360	B	...	...	18.69	18.43	19.25	...	...	21.73		
14						P	...	...	87.54	86.96	89.76	...	93.01			
15	Mid-late.	Co. 410.	P. O. J. 2727 G. C. (self or possible cross with D 74).	25.58	2.44	29300	B	...	17.62	19.11	19.26	18.73	...	20.16		
16				25.83			P	...	74.80	88.51	89.25	90.61	...	91.89		
17	Co. 412.	P. O. J. 2878 × Co. 243.			2.72	21600	B	...	17.05	17.10	17.58	18.46	...	...	19.92	
18							P	...	84.89	86.50	93.07	92.23	94.06	

Table showing performances as regards germination, weight of cane, brix and purity readings etc., in intermediate varietal trial
No. II—contd.

S. No.	Group.	Name of variety.	Parentage.	Germination at six weeks.	Av. wt. per cane.	No. of canes per acre.	B = Brix. P = Purity.	4th Nov.	28th Nov.	25th Dec.	6th Jan. 1934.	25th and 26th Jan.	5th Feb.	20th Feb.	28th Feb.	28th March.
10	Late	Co. 400	Vellai × Q 813	40·67	3·07	14160	B	...	...	18·03	16·53	17·53	18·94	19·10	...	18·77
							P	...	...	85·41	83·12	85·00	88·60	89·41	...	90·05
11		Co. 401	Vellai × Q 813	39·41	3·92	9760	B	...	...	18·27	17·28	18·94	19·50	19·35	...	19·21
							P	...	...	89·39	88·07	84·07	93·18	91·94	...	95·30
12		Co. 415	Maur 1237 × P. O. J. 1410.	43·91	2·81	23040	B	...	18·20	18·08	17·70	18·77	...	19·02	...	19·07
							P	...	84·72	85·17	86·42	88·28	...	89·95	...	90·78
13		P. O. J. 2878.	P. O. J. 2364 × E. K. 28.	40·99	2·68	22320	B	19·02	20·75	22·16	21·91	...	...	...	...	22·20
							P	84·70	83·76	91·24	91·33	...	...	...	94·21	
14		Co. 290	Co. 221 × D. 74	34·67	2·11	36000	B	...	16·83	19·99	20·40	...	...	...	...	...
							P	...	81·70	88·37	90·16	...	...	...	...	...
15		E. K. 28	P. O. J. 100 × E. K. 2.	47·58	2·91	16300	B	...	18·38	19·80	19·41	20·94	...	...	...	...
							P	...	86·62	90·20	92·86	92·19	...	...	...	...
16		Pundla	.....	25·67	3·49	16320	B	...	...	...	...	18·02	...	18·47	...	...
							P	...	...	...	...	86·06	...	89·35	...	...

NOTE.—Brix readings are from a sample of 5' row cut.

SUMMARY OF RESULTS.

Cane weight in tons.

	Name of variety.																General mean.
	Co. 364	Co. 407	Co. 408	Co. 411	Co. 413	Co. 414	Co. 365	Co. 410	Co. 412	Co. 400	Co. 401	Co. 415	P. O. J. 2878	Co. 290	E. K. 28	Pundla.	
(1) Per acre .	21·05	23·94	30·45	23·06	44·54	26·60	15·70	32·44	25·37	23·97	20·84	30·96	25·09	32·29	22·52	28·23	20·57
(2) Per cent. on general mean.	79·23	90·12	114·70	86·80	167·7	100·1	59·10	122·10	95·50	90·24	78·45	116·60	94·23	121·50	84·78	106·30	100·00

Analysis of juice and extraction percentage.

	Co. 364	Co. 407	Co. 408	Co. 411	Co. 413	Co. 414	Co. 365	Co. 410	Co. 412	Co. 400	Co. 401	Co. 415	P. O. J. 2878	Co. 290	E. K. 28	Pundla.
Percentage sucrose .	19·47	22·04	20·07	20·10	18·06	19·94	20·21	18·52	18·74	17·01	18·31	17·32	20·07	18·00	18·05	16·11
Percentage reducing sugar.	0·18	0·14	0·23	0·22	0·32	0·20	0·40	0·39	0·15	0·75	0·47	0·63	0·43	0·96	0·80	1·75
Purity	92·81	93·22	92·06	91·77	90·86	90·46	93·01	91·89	94·06	90·65	95·32	90·78	92·17	87·38	90·57	88·55
Extraction	62·42	59·50	58·61	60·07	64·16	63·75	62·90	65·54	63·09	66·55	67·88	64·36	64·77	64·88	64·63	71·83

Conclusion.—It is too early to draw any conclusions, yet Co. 413, Co. 410, Co. 415 and Co. 408 are showing prominence and Co. 407 shows earliness with high sucrose content.

V. TRIAL OF ALTERNATIVE NITROGENOUS FERTILIZERS WITH SANN AS BASIC MANURE.

Plan and yield in lbs. per plot of 1/40 of an acre exclusive of ring.

F 2123	D 2107	C 1441	A 2092	B 1806	E 1619
C 1761	E 2059	F 1870	A 2091	B 2183	D 1785
B 2082	D 2292	F 1839	C 1694	E 1889	A 2080
F 2039	D 2309	B 2181	E 1824	A 2211	C 1871

Index.

Artificial in lbs. per acre.

- A Standard No. 1 (150 lbs. N)
 B Standard No. 2 (150 lbs. N)
 C Sulphate of ammonia alone (150 lbs. N)
 D Safflower cake and nitrate of potash
 (150 lbs. N)
 E Safflower cake and nitrate of soda (150
 lbs. N)
 F Safflower cake and calcium cyanamide
 (150 lbs. N)

System of replication.—Four randomised blocks of six plots each.

Area of each plot.—1/40th of an acre.

Variety.—Pundia.

Basal manuring.—Sann hemp as green manure.

Top dressing :—

Safflower cake—nitrate of potash (150 lbs. N).

Safflower cake—calcium cyanamide (150 lbs. N)

Standard No. 1

Standard No. 2

} Safflower cake—S/A (150 lbs. N).

Sulphate of ammonia alone (150 lbs. N).

Safflower cake and nitrate of soda (150 lbs. N).

Time of application of top dressing :—

3 weeks after planting.— $\frac{1}{3}$ rd total N from sulphate of ammonia, nitrate of potash, nitrate of soda, calcium cyanamide.

8 weeks after planting.— $\frac{1}{3}$ rd total N from cake and nitrate of soda, nitrate of potash, calcium cyanamide and sulphate of ammonia alone.

5th month earthing up time.— $\frac{1}{3}$ rd total N from cake and sulphate of ammonia alone.

Date of planting.—21st January 1933.

Date of harvest.—1st and 2nd February 1934.

Growth notes.—Planting was done at the normal time. The germination of the crop was good. It ranged from 59·91 to 63·31 per cent. in different treatments. The attack of borer was not severe. It was only 7·97 per cent.

SUMMARY OF RESULTS.

TREATMENTS.

Cane weight in tons.

	Pundia.					General mean.	Standard error of treatment mean.	Whether general effect is significant by Z test.	Critical difference for significance
	A & B	C	D	E	F				
(1) Per acre	37·19	30·21	37·91	33·0	35·14	35·1	1·45	Significant	4·4
(2) % on general mean	106	86	108	94	100				
(3) % on control	100	81	102	89	94				

Analysis of cane and juice.

	Pundia.				
	A & B	C	D	E	F
% Sucrose	14·30	13·49	14·19	14·81	14·43
% Glucose	1·96	2·08	2·01	1·91	1·98
% Purity	84·09	82·58	84·47	86·32	85·37
% Fibre in cane	9·7	9·26	8·97	10·35	10·71
% Sucrose in cane	12·69	12·22	12·47	12·91	12·25

Conclusion.—It is too early to draw any conclusions. However the standard dose adopted with S/A and cake has shown better except potassium nitrate combination, over the rest.

*Principal Agricultural Officer,
Sugarcane Research Scheme, Padegaon.*

APPENDIX I.

Tables and Graphs relating to the Annual Report of the Soil Physics Section.

TABLE I.

Profile description of the genetic soil types.

(A) Deep black soil overlying "murum" or weathered trap, with no colour horizon but giving heavier and more compact structure with increasing depth. The surface soil is crumbly and loose and interspersed with roots.

(B) Dark grey horizon rich in clay up to a depth of about 2 ft. overlying a layer with lighter texture, interspersed with patches of brown material extending upto about 4 ft. Below this is a brownish red horizon with similar texture with concretions of calcium carbonate and silicates. This layer varies in depth and usually goes up to the 'murum'.

(C) Deep black soil becoming lighter in colour and texture with increasing depth, with no sharp line of demarcation, extending upto 3½—4 ft. Below this there is a white sandy material with good drainage. Black concretions of lime are usually met with just above the sandy substratum.

(D) Dark grey soil changing into lighter shades gradually with depth; a band of lime of varying thickness intervenes between the soil and 'murum'. The depth of the soil is between 2½—3 ft. Here the soil gets coarser with depth.

(E) Greyish black soil of about 2 to 3 ft. in depth with 'murum' sub-soil. A distinctly compact laminated structure is noticeable at a depth of about a foot from the surface which extends nearly to the bottom. The upper part of the profile is loose and granular. The texture increases with depth.

TABLE II.

Genetic classification of soils.

Major division—mode of formation.	Types.	No. of profiles.	Names of places.
Transported (I)	A	2	Malsiras.
In situ (II)	B	5	Padegaon, Dharam-puri.
Do.	C	5	Bhamburdi, Khudus.
Do.	D	4	Akluj.
Transported (I)	E	5	Mahalung.
Unclassified . . . . .	..	4	Morochoi, Gursala.

TABLE III.

Reaction, total soluble salts and humus in different depths of unirrigated and irrigated soil profiles on the Nira right bank canal.

Profile Nos.	Place.	Type.	Depth.	Unirrigated.				Irrigated.				Gain due to Irrigation.				
				pH in water.	pH in N. KCl	Total soluble salts %.	Humus %	pH in water.	pH in KCl.	Total soluble salts %.	Humus %.	pH in water.	pH in KCl.	Total soluble salts %.	Humus %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
4 & 11	Malsiras	II-A	0-0"	8.57	7.66	0.37	1.41	<i>Under irrigation—75 years.</i>				1.54	-0.63 (-7.3)	-0.91 (-11.9)	-0.14 (-38.0)	0.13 (9.2)
				6-12"	8.79	7.56	0.36	1.37	7.94	6.75	0.23	1.43	-0.30 (-3.4)	-0.30 (-4.0)	-0.09 (-25.0)	0.06 (4.4)
				12-18"	8.66	7.59	0.38	1.26	8.42	7.26	0.28	1.27	-0.18 (-2.1)	-0.33 (-4.3)	-0.10 (-26.3)	0.01 (0.8)
				18-23"	8.76	7.62	0.35	0.78	8.50	7.38	0.29	1.04	-0.26 (-3.0)	-0.26 (-3.4)	-0.06 (-17.1)	0.31 (42.40)
				23-29"	...	...	...	...	8.54	7.34	0.28	0.87	...	...	...	...
				29-33"	...	...	...	...	8.16	7.08	0.31	0.65	...	...	...	...
				33-41"	...	...	...	...	8.54	7.26	0.29	0.94	...	...	...	...
14 & 16	Khudus	I-C	0-6"	8.72	7.39	0.31	1.54	<i>Under irrigation—60 years.</i>				1.16	-0.05 (-0.6)	0.21 (2.8)	0.04 (18.0)	-0.33 (-24.7)
				6-12"	8.99	7.82	0.41	1.49	8.67	7.60	0.35	0.85	0.04 (0.4)	0.01 (0.1)	-0.18 (-44.0)	-0.54 (-36.2)
				12-18"	8.44	7.73	0.86	1.43	8.39	7.63	0.20	0.87	0.45 (5.8)	-0.10 (-1.3)	-0.57 (-66.2)	-0.56 (-39.1)
				18-24"	8.56	7.56	1.16	1.35	8.86	7.59	0.43	0.60	0.30 (3.5)	0.03 (0.4)	-0.73 (-63.0)	-0.69 (-51.1)

TABLE III—contd.

Profile Nos.	Place.	Type.	Depth.	Unirrigated.				Irrigated.				Increase due to irrigation.			
				pH in water.	pH in N.KCl.	Total soluble salts %.	Humus %.	pH in water.	pH in KCl.	Total soluble salts %.	Humus %.	pH in water.	pH in KCl.	Total soluble salts %.	Humus %.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14 & 16— contd.	Khudus—contd.	I-C.— contd.	24-30"	8.76	7.85	0.85	0.57	8.98	7.59	0.37	0.56	0.22 (2.5)	-0.26 (-0.8)	-0.48 (-56.5)	-0.01 (-0.02)
			30-36"	8.46	7.33	0.87	1.06	8.99	7.43	0.46	0.52	0.53 (6.3)	0.10 (0.1)	-0.41 (-46.0)	-0.54 (-51.1)
20 & 18 .	Akluj . . .	II-D .	<i>Under irrigation—35 years.</i>												
			0-6"	8.94	7.67	0.23	1.32	8.77	7.92	0.37	1.15	-0.17 (-2.0)	0.25 (3.3)	0.14 (60.8)	-0.17 (-12.9)
			6-12"	8.81	7.86	0.23	1.26	8.83	7.84	0.22	1.16	0.02 (0.2)	-0.02 (-0.25)	-0.01 (-4.4)	-0.10 (-9.9)
			12-18"	9.01	7.77	0.25	1.22	8.84	7.81	0.19	1.04	-0.17 (-1.9)	0.04 (0.5)	-0.06 (-24.0)	-0.16 (-13.1)
			18-24"	9.01	7.81	0.20	1.21	8.76	7.84	0.15	0.96	-0.25 (-2.8)	0.08 (0.3)	-0.05 (-25.0)	-0.25 (-20.7)
			24-30"	9.01	7.76	0.23	1.19	...	...	...	...	...	...	...	...
21 & 22 .	Mahalunq . . .	I-E .	<i>Under irrigation—50 years.</i>												
			0-6"	8.64	7.71	0.24	1.52	8.89	7.83	0.18	1.31	0.25 (3.0)	0.12 (1.5)	-0.06 (-25.0)	-0.21 (-13.8)
			6-12"	8.63	7.71	0.20	1.57	8.75	7.85	0.25	0.81	0.12 (1.4)	0.14 (1.8)	0.05 (25.0)	-0.76 (-48.4)
			12-18"	8.57	7.71	0.37	1.42	8.79	7.85	0.23	0.76	0.22 (2.5)	0.14 (1.8)	-0.14 (-38.0)	-0.66 (-46.7)
			18-24"	8.59	7.69	0.28	1.51	8.89	7.83	0.21	1.02	0.30 (3.5)	0.14 (1.8)	-0.07 (-25.0)	-0.49 (-32.4)
24-30"	8.59	7.66	0.25	1.48	...	...	...	...	...	...	...	...

* Soil samples of each profile have been collected upto the depth of murum.
 Note.—Figures in brackets in the last four columns indicate percentage increases of values over the original.

TABLE IV.

Table showing the yield of cane in successive periods of ten years with the corresponding manuring expressed in lbs. N. per acre.

Soil No.	FIRST PERIOD			SECOND PERIOD			THIRD PERIOD			REMARKS.
	Yield per acre	Manure in lbs. of Nitrogen	Nitrogen required to produce 40 tons of cane	Yield per acre	Manure in lbs. of Nitrogen	Nitrogen required to produce 40 tons of cane	Yield per acre	Manure in lbs. of Nitrogen	Nitrogen required to produce 40 tons of cane	
1	2	3	4	5	6	7	8	9	10	11
8	50	440	352	50	440	352	52	420	323	Improving
9	50	440	352	50	440	352	48	420	350	
11	55	620	451	55	620	451	55	510	371	Stationary
12	40	520	520	60	570	380	40	307	307	Improving
15	60	480	320	55	430	313	35	455	520	Do.
16	55	360	262	55	280	204	55	360	262	Deteriorating
19	55	556	404	44	510	464	51½	418	325	Stationary
22	..	..	..	..	..	..	50	330	264	Improving
25	..	..	..	..	..	..	48	310	258	
31	32½	260	320	32½	240	295	32	380	475	Deteriorating
34	32	340	425	32	340	425	32	380	475	Do.
36	35	200	229	35	260	297	30	350	467	Do.
45	50	260	208	40	300	300	35	300	343	Do.
46	35	400	457	40	425	425	30	420	560	Do.
47	40	360	360	40	430	430	40	420	420	Do.
49	50	395	316	50	395	316	40	375	375	Do.
51	50	430	344	42	320	305	42	330	314	Improving

TABLE V.

Table showing the texture and sub-soil conditions of soils.

Soil No.	Place	Cultivator	TEXTURE		INDEX OF TEXTURE		Soil depth ft.	Drainage condition	Sub-soil water level ft.	Nature of cultivation
			0-12"	12"-24"	0-12"	12"-24"				
8	Jalochi	K. R. Borawke	Sandy loam	..	0.63	..	1	Good	10	Cane.
9	Do.	Do.	Do.	..	0.57	..	1	"	10	Do.
11	Vadgaon	A. B. Bokil	Do.	Sandy loam	0.60	0.44	4	"	6	Do.
12	Korhala	V. S. Peshwe	Do.	Do.	0.67	0.78	1½	"	5	Do.
15	Do.	B. R. Bhagat	Do.	Do.	0.86	0.95	1½	Fair	10	Do.
16	Hol	G. G. Kadam	Do.	Do.	0.87	0.92	4	Good	7	Do.
17	Do.	Do.	Do.	Do.	0.99	0.71	4.5	Bad	3	Fallow land.
19	Karanja	Bapurao Kenjale	Clay loam	Clay loam	0.21	0.24	8	Fair	12	Cane.
22	Lasurna	S. T. Jachak	Do.	Do.	0.52	0.56	2	Good	..	Do.
23	Do.	Do.	Do.	Sandy loam	0.13	0.79	2-2½	"	..	8 months' crop.
24	Do.	Do.	Sandy loam	Do.	0.95	0.62	1	"	..	Dry crops only.
25	Belwadi	D. B. Jamdar	Do.	Do.	0.56	..	1	"	21	Cane.
26	Do.	Do.	Do.	Sandy loam	0.99	0.76	2	"	21	Fallow.
27	Do.	A. B. Jamdar	Do.	Do.	1.89	1.26	2	"	35	8 months' crop.
31	Nimbut	K. K. Kakade	Clay loam	Do.	0.48	0.64	6	Bad	12	Cane.

32	Do.	Do.	Sandy loam	Do.	0.82	1.10	6	"	12	8 months' crop.
34	Do.	Do.	Do.	Do.	1.32	1.07	6	"	4	Cane.
35	Do.	M. G Savant	Do.	Do.	1.02	1.48	5-6	"	1½	Fallow.
36	Do.	S. B. Kakade	Clay loam	Do.	0.58	0.65	6	Fair	5	Cane.
37	Do.	G. B. Kakade	Sandy loam	Do.	1.21	0.73	6	"	5	8 months' crop.
42	Shanghvi	H. R. Suryavanshi	Do.	Do.	1.41	0.87	8-10	"	8	Dry crops.
43	Do.	K. A. Suryavanshi	Do.	Do.	1.16	0.79	8-10	"	8	8 months' crop.
44	Do.	S. A Tawre	Do.	Do.	0.91	0.76	8-10	"	8	Fallow.
45	Do.	K. M. Tawre	Do.	Loam	0.80	0.68	6	"	5	Cane.
46	Malad	S. T. Jagtap	Do.	Sandy loam	1.00	0.83	8	Bad	6	Do.
47	Do.	M. Bhongale	Do.	Do.	0.81	0.88	4	Fair	6	Do.
48	Do.	B. H. Dhawan	Do.	Do.	0.85	0.95	2-2½	Good	6	8 months' crop.
49	Bawda	G. N. Patil	Loam	Loam	0.43	0.65	2	"	5	Cane.
50	Do.	Do.	Do.	Sandy loam	0.38	1.40	2	"	5	Dry crops.
51	Do.	D. M. Aiya	Clay loam	Do.	0.24	1.62	1½	"	50	Cane.
52	Do.	Do.	Do.	Do.	0.30	1.25	2	"	50	8 month's crop.

TABLE VI.

Table showing the saturation capacity, rate of increase in conductivity, colloidal mechanical factor, total salts, pH and calcium carbonate contents of soils.

Soil No.	Saturation capacity Mgm. equiv. per cent 0-12"	Rate of increase in electrical conductivity. 0-12" per cent		Colloidal mechanical factor $\times 100$	Total salts per cent		pH in water		pH in N.KCl.		Calcium Carbonate per cent	
		after 7 days	after 10 days		0-12"	12"-24"	0-12"	12"-24"	0-12"	12"-24"	0-12"	12"-24"
1	2	3	4	5	6	7	8	9	10	11	12	1
8	36.60	95.43	105.93	74.28	0.30	..	8.37	..	7.78	..	20.11	..
9	34.60	97.40	102.51	69.54	0.27	..	8.52	..	7.78	..	23.12	..
11	33.70	66.96	66.96	83.45	0.34	0.25	8.50	8.43	7.58	7.68	8.59	11.79
12	26.95	101.31	103.75	104.35	0.24	0.22	8.42	8.46	7.53	7.57	14.34	15.62
15	59.50	22.55	22.55	45.69	0.34	0.46	8.55	8.47	7.70	7.60	4.02	3.46
16	56.95	66.91	66.91	43.89	0.34	0.32	8.28	8.49	7.48	7.48	7.83	10.13
17	27.70	30.43	25.22	82.35	1.01	1.40	8.57	8.75	7.62	7.70	11.05	10.25
19	38.25	85.62	89.83	117.64	0.24	0.30	8.18	8.57	7.46	7.64	7.00	7.15
22	62.25	66.91	73.91	47.18	0.40	0.28	0.45	8.55	7.57	7.64	8.75	10.11
23	63.00	63.71	63.71	74.60	0.55	0.41	8.39	8.67	7.53	7.57	10.72	10.60

24	50.25	59.67	65.47	47.88	0.32	0.40	8.48	8.75	7.55	7.54	8.27	9.42
25	58.75	54.22	55.90	50.63	0.48	..	8.34	..	7.64	..	3.28	..
26	57.25	49.08	50.62	43.66	0.58	0.48	8.22	8.53	7.41	7.43	5.23	5.64
27	59.25	69.92	85.28	27.95	0.37	0.35	8.54	8.52	7.58	7.62	5.73	10.32
31	40.00	112.20	110.54	73.44	0.23	0.27	8.39	8.50	7.44	7.55	8.21	8.79
32	64.00	157.71	164.24	39.55	0.56	0.86	8.37	8.19	7.44	7.52	8.32	6.43
34	44.75	104.77	113.54	46.09	0.26	0.28	8.39	8.66	7.36	7.42	4.81	6.13
35	35.25	36.20	50.48	64.71	0.68	1.50	8.78	8.66	7.56	7.68	7.63	9.35
36	50.00	95.28	102.96	58.75	0.33	0.33	8.45	8.54	7.42	7.36	5.28	4.61
37	44.25	70.52	75.07	46.61	0.32	0.35	8.54	8.74	7.45	7.73	4.98	6.08
42	35.67	55.50	72.77	57.47	0.71	1.50	8.77	8.36	7.39	7.45	9.53	8.61
43	39.00	53.91	72.51	57.69	0.38	0.90	8.70	8.56	7.37	7.44	9.40	9.53
44	35.75	42.07	48.80	69.23	1.00	1.40	8.73	8.63	7.43	7.50	8.28	9.53
45	43.75	45.89	53.56	64.00	0.93	0.52	8.24	8.34	7.37	7.37	8.15	8.46
46	37.75	105.18	108.22	78.64	0.30	0.30	8.17	8.56	7.09	7.21	6.76	7.52
47	43.25	88.29	92.85	72.98	0.34	0.38	8.09	8.08	7.15	7.11	7.65	8.19
48	40.75	60.05	77.47	79.75	0.27	0.37	8.70	8.86	7.68	7.66	10.25	9.49
49	68.00	105.79	118.10	57.35	0.33	0.34	8.37	8.45	7.20	7.36	3.76	3.89
50	68.75	67.49	67.60	54.91	0.29	0.30	8.32	8.47	7.18	7.35	6.04	6.76
51	56.25	119.51	123.13	80.00	0.31	0.35	8.46	8.37	7.26	7.17	0.91	0.58
52	64.50	94.78	119.78	57.36	0.29	0.33	8.49	8.60	7.62	7.56	1.92	2.28

TABLE VII.

Comparative tables of soil properties—fallow, dry-cultivated, eight-months' irrigated plots versus cane plots.

Numbers of pair.	Saturation capacity. Mgm. equiv. per cent. 0-12".		Rate of increase in electrical conductivity per cent. 0-12".		Colloidal mechanical factor $\times 100$ 0-12".		Total salts per cent. 0-12".		pH in water 0-12".		pH in N. KCl 0-12".		Calcium carbonate per cent. 0-12".	
	Fallow.	Cane plot.	Fallow.	Cane plot.	Fallow.	Cane plot.	Fallow.	Cane plot.	Fallow.	Cane plot.	Fallow.	Cane plot.	Fallow.	Cane plot.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
17 & 16 .	27.70	56.95 ⁺	30.43	66.91 ⁺	82.35	43.89 ⁻	1.01	0.34 ⁻	8.57	8.28 ⁻	7.62	7.48 ⁻	11.05	7.83 ⁻
26 & 25 .	57.25	58.75	49.08	54.22 ⁺	43.66	50.63 ⁺	0.58	0.48 ⁻	8.22	8.34 ⁺	7.41	7.64 ⁺	5.23	3.28 ⁻
44 & 45 .	35.75	43.75 ⁺	42.07	45.89 ⁺	69.23	64.00 ⁻	1.00	0.93 ⁻	8.73	8.24 ⁻	7.43	7.37 ⁻	8.28	8.15 ⁻
	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.	Dry cultivation.	Cane plot.
24 & 22 .	50.25	62.25 ⁺	59.67	66.91 ⁺	47.88	47.18 ⁻	0.32	0.40 ⁺	8.48	8.45 ⁻	7.55	7.57 ⁻	8.27	8.75 ⁺
35 & 34 .	35.25	44.75 ⁺	36.20	104.77 ⁺	64.71	46.09 ⁻	0.68	0.26 ⁻	8.78	8.39 ⁻	7.56	7.36 ⁻	7.63	4.81 ⁻
42 & 45 .	35.67	43.75 ⁺	55.50	45.89 ⁻	57.47	64.00 ⁺	0.71	0.93 ⁺	8.77	8.24 ⁻	7.39	7.37 ⁻	9.53	8.15 ⁻

50 & 49 .	68.75	68.00	67.49	105.79 ⁺	54.91	57.35 ⁺	0.29	0.33 ⁺	8.32	8.37	7.18	7.20	6.04	3.76 ⁻
	Eight months.	Cane plot.	Eight months.	Cane plot.	Eight months.	Cane plot.	Eight months.	Cane plot.	Eight months.	Cane plot.	Eight months.	Cane plot.	Eight months.	Cane plot.
23 & 22 .	63.00	62.25	63.71	66.91 ⁺	74.60	47.18 ⁻	0.55	0.40 ⁻	8.39	8.45	7.53	7.57	10.72	8.75 ⁻
27 & 25 .	59.25	58.75	69.92	54.22	27.95	50.63 ⁺	0.37	0.48 ⁺	8.54	8.34 ⁻	7.58	7.64	5.73	3.28 ⁻
32 & 34 .	64.00	44.75 ⁻	157.71	104.77 ⁻	39.55	46.09 ⁺	0.56	0.26 ⁻	8.37	8.39	7.44	7.36 ⁻	8.32	4.81 ⁻
37 & 36 .	44.25	50.00 ⁺	70.52	95.28 ⁺	46.61	58.75 ⁺	0.32	0.33	8.54	8.45 ⁻	7.45	7.42	4.98	5.28 ⁺
43 & 45 .	39.00	43.75 ⁺	53.91	45.89 ⁻	57.69	64.00 ⁺	0.38	0.93 ⁺	8.70	8.24 ⁻	7.37	7.37	9.40	8.15 ⁻
48 & 47 .	40.75	43.25 ⁺	60.05	88.29 ⁺	79.75	72.98 ⁻	0.27	0.34 ⁺	8.70	8.09 ⁻	7.68	7.15 ⁻	10.25	7.65 ⁻
52 & 51 .	64.50	56.25 ⁻	94.78	119.51 ⁺	57.36	80.00 ⁺	0.29	0.31 ⁺	8.49	8.46	7.62	7.26 ⁻	1.92	0.91 ⁻

TABLE VIII.

Germination of cane and various observations taken at harvest time.

Treatment.	Per cent. germination.	No. of canes per plot (0.61 g).	Calculated yield per acre in tons.	Calculated weight of each cane.	Height of cane in inches	Circumference in inches.	No. of mature internodes.	*Extraction.	Brix at 17.5°C.	Sucrose.	Glucose on juice.	Purity.
1	2	3	4	5	6	7	8	9	10	11	12	13
Light soil—Pundia—28th March 1933.												
Unmanured	55.0	202	7.18	1.21	49.4	4.1	19.6	64.4	14.38	11.97	1.84	83.24
Manured	67.0 (121.8)	278 (137.6)	20.59 (286.7)	2.53 (209.2)	81.3 (164.6)	4.7 (114.6)	20.0 (102.1)	67.6 ..	15.88 (110.4)	12.46 (104.1)	2.16 (117.2)	78.46 (105.5)
Medium soil—Pundia—3rd February 1933.												
Unmanured	47.5	166	7.90	1.73	60.3	4.1	17.0	53.0	17.79	15.10	1.10	84.87
Manured	55.6 (117.0)	371 (223.5)	32.91 (417.0)	3.02 (174.6)	85.6 (142.0)	3.9 (95.1)	17.7 (104.1)	65.0	17.78 (100.0)	15.12 (100.2)	1.67 (152.0)	84.98 (100.1)
Manjri standard method .	40.6 (85.5)	288 (173.6)	24.62 (311.7)	2.91 (168.2)	86.5 (143.5)	4.7 (114.6)	22.0 (129.5)	62.1 ..	18.72 (105.2)	15.57 (103.2)	1.41 (128.2)	83.17 (98.2)
Heavy soil—Co.290—1st February 1933.												
Unmanured	66.0	396	15.30	1.32	121.7	2.9	18.4	50.8	22.31	20.53	0.55	92.0
Manured	79.0 (118.6)	745 (188.2)	41.91 (274.0)	1.92 (145.4)	127.2 (104.5)	3.2 (110.4)	17.9 (97.4)	58.2 ..	22.06 (98.4)	20.00 (97.4)	0.64 (116.2)	90.6 (98.5)
Manjri standard method .	76.8 (115.4)	648 (163.6)	37.55 (247.0)	1.99 (150.8)	132.6 (109.0)	3.4 (117.2)	17.2 (92.4)	52.4 ..	22.74 (103.2)	20.98 (102.3)	0.57 (103.7)	92.2 (100.3)

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* The cane was crushed in power-crusher, Chattanooga No. 192.

N.B.—(1) Figures in brackets indicate the relation of the manured treatments with reference to the unmanured as 100.

(2) The figures in columns 6, 7 and 8 are of observations on 6 plants in each treatment maintained for botanical observations from the beginning.

TABLE IX.

Analysis of variance of periodical nitrate content.

Due to	Degrees of freedom.	Sum of squares.	(V_1) Mean square.	$\frac{1}{2} \log V_1 \times 10^3$.	$\frac{1}{2} \log_e \frac{V_1}{V_2}$ 'Z'.	Significance.
<i>I.—Heavy (Chopan) Soil.</i>						
Season	4	0.4889200	0.1222	3.5542	2.2933	Significant.
Depth	2	0.0202067	0.01010	2.3526	1.0917	Do.
Cultivation	1	0.0512533	0.05125	2.9697	1.7088	Do.
Irrigation	1	0.0003333	0.0003333	0.6020	— .6589	Not significant.
	8	0.5607133	0.07009	3.2762	2.0153	Significant.
2nd, 3rd and 4th order interactions.	51	0.6409734	0.01257	2.4170	1.1561	Do.
ERROR	60	0.0747000	(V_2) 0.001245	1.2609		
Total	119	1.2763867	0.01073	2.3379	1.0770	Do.
<i>II.—Medium Soil.</i>						
Season	4	0.2273673	0.05684	3.1715	1.4764	Do.
Depth	2	0.0161477	0.007574	2.1667	0.4686	Not significant.
Cultivation	1	0.0811720	0.08117	3.3496	1.6545	Significant.
Irrigation	1	0.0335664	0.03357	2.9082	1.2131	Do.
	8	0.3572534	0.04466	3.0509	1.3558	Do.

TABLE IX—contd.

Analysis of variance of periodical nitrate content—contd.

Due to	Degrees of freedom.	Sum of squares.	(V_1) Mean square.	$\frac{1}{2} \log_e V_1 \times 10^3$.	$\frac{1}{2} \log_e \frac{V_1}{V_2}$ 'Z'.	Significance.
II.— <i>Medium Soil</i> —contd.						
2nd, 3rd & 4th order interactions.	51	0.3635808	0.007129	2.1334	0.4383	Significant.
Error	60	0.178038	0.002967	1.6951		
Total	119	0.8988720	0.007554	2.1623	0.4672	Do.
III.— <i>Light Soil</i> .						
Season	4	0.1297376	0.03243	2.8009	1.2635	Significant.
Depth	1	0.0056113	0.005611	2.0137	0.3863	Not significant.
Cultivation	1	0.0027613	0.002761	1.6591	0.0317	Do.
Irrigation	1	0.0515113	0.05151	3.1222	1.4948	Significant.
	7	0.1896215	0.02709	2.8009	1.1735	Do.
2nd, 3rd & 4th order interactions.	32	0.3290973	0.01028	2.3163	0.6889	Do.
Error	40	0.1036500	0.002591	1.6274		
Total	79	0.6223688	0.007878	2.1834	0.5560	Do.

TABLE X.

Standard deviation and coefficients of variability for three types of soil.

	Heavy.	Medium.	Light.
Standard deviation . . . .	.03528	.05447	.05080
Coefficient of variability	21.90 per cent.	36.07 per cent.	35.35 per cent.

TABLE XI.

Nitrogen content, expressed in mgms. per 100 gms. of oven-dry soil, in different treatments of soil fertility studies series III (cropping), after one year of experiment.

0-12".

Treatment.	Heavy soil.				Per cent. increase over original.	Medium soil.			Per cent. increase over original.	Light soil.			Per cent. increase over original.	Remarks.
	Original N.	N after 1 year.	Increase in N.	Per cent. increase over original.		Original N.	N content after 1 year.	Increase in N.		Original N.	N content after 1 year.	Increase in N.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Composite sample	44.0	..	..	..	43.0	..	..	..	62.0	..	..	..
Manjri standard method.	..	45.8	1.8	4.1	..	42.9	-0.1	0.2	..	57.5	-4.5	-7.2		
Continuous cane unmanured.	..	44.5	0.5	1.1	..	42.4	-0.6	-1.2	..	61.1	-0.9	-1.4		
Continuous cane manured.	..	42.5	-1.5	-3.4	..	45.8	2.8	6.5	..	64.5	2.5	4.0		
Fallow cultivated and irrigated.	..	42.5	-1.5	-3.4	..	40.7	2.3	5.3	..	61.7	-0.3	-0.5		
Fallow uncultivated and irrigated.	..	54.1	9.9	22.5	..	50.4	7.4	17.2	..	67.0	5.0	8.1		
Fallow uncultivated and unirrigated.	..	47.8	3.8	8.6	..	48.9	5.9	13.7	..	75.0	13.0	21.0		
Fallow cultivated and unirrigated.	..	45.4	1.4	3.2	..	45.7	2.7	6.3	..	67.4	5.4	8.7		

TABLE XII.

Table showing nitrogen recuperation and enrichment of soil humus by sann green manuring in the three types of soil.

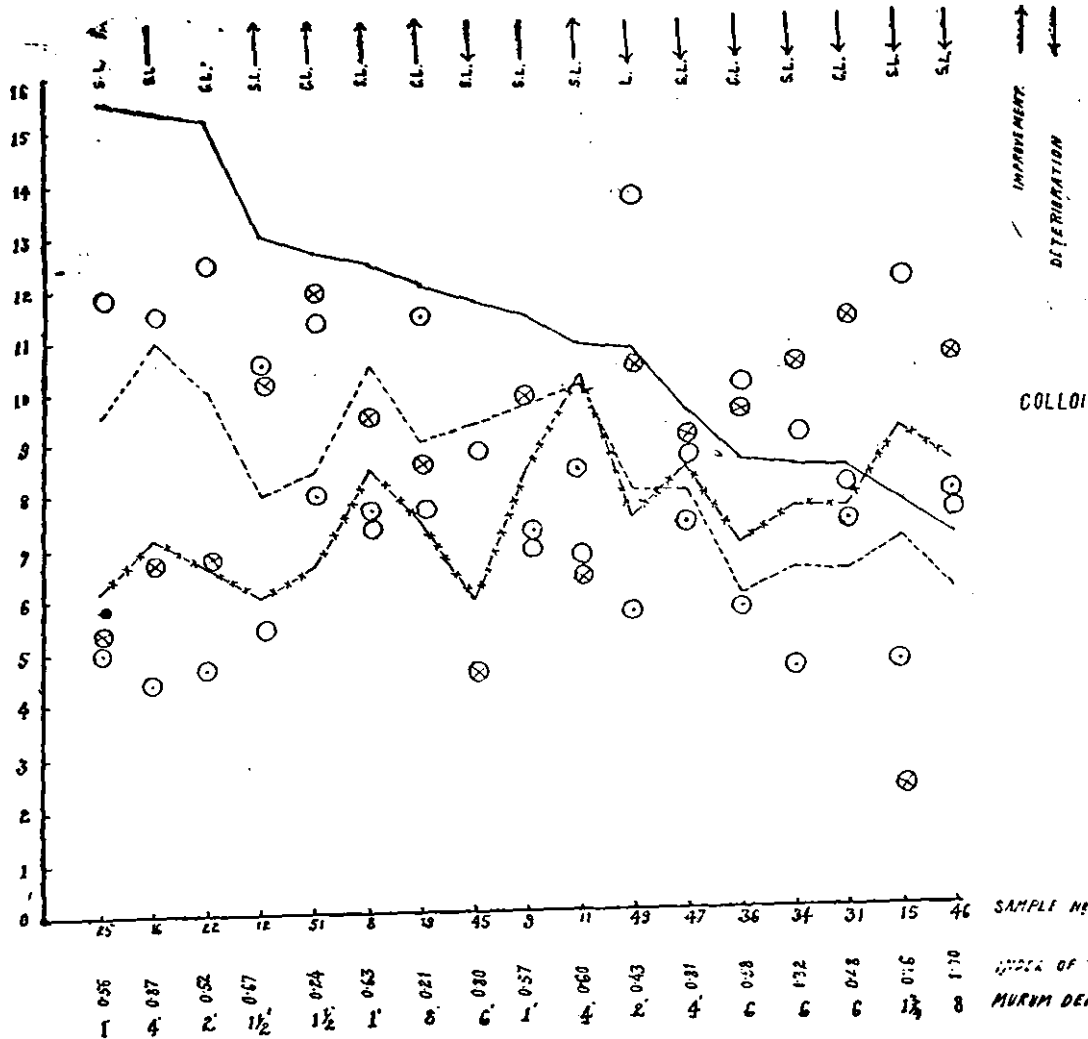
Soil	% Nitrogen		% humus	
	Original	Final	Original	Final
	18-2-33	7-1-34	18-2-33	7-1-34
Medium	0.0435	0.0486	1.02	1.41
Light	0.0659	0.0861	1.57	1.4
Heavy	0.0421	0.0542	1.38	1.43

TABLE XIII.

Correlation coefficients (r) of depths of sub-soil water table and the quantities of irrigation water given rainfall, mean weekly soil temperature and atmospheric temperature.

Soil	Values of 'r'		n	P=.01	P=.05	P=.1
	Medium	Heavy				
Irrigation water	+ .3615	+ .4517	24	.4968	.3892	
Rainfall	- .1856	- .6333	36	.4132	.3445	.2780
Soil temperature. . . .	+ .8075	+ .6422	36	.4132	.3445	.2780
Atmospheric temperature . .	+ .4867	+ .1450	36	.4132	.3445	.2780

GRAPH No 1.



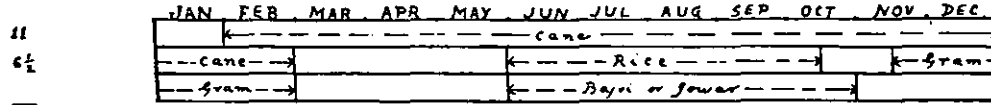
SOIL FERTILITY & ITS RELATION WITH SOIL COLLOID, RATE OF INCREASE IN ELECTRICAL CONDUCTIVITY & COLLOIDAL MECHANICAL FACTOR.
(SOIL FERTILITY SURVEY)

- Yield of corn per unit manure = N.
- - - Yield of corn per acre.
- x-x- Manure = N applied per acre.
- ○ ○ Saturation capacity (colloid).
- ⊗ ⊗ ⊗ Rate of increase in electrical conductivity.
- ⊙ ⊙ ⊙ Colloid mechanical factor.

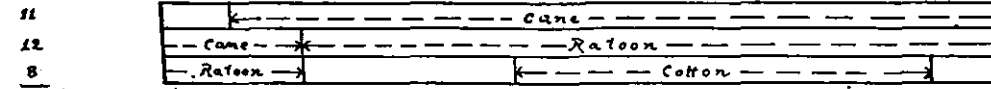
EFFECTIVENESS OF DIFFERENT ROTATIONS IN LIGHT AND HEAVY SOIL - SOIL FERTILITY SURVEY

LIGHT SOIL.

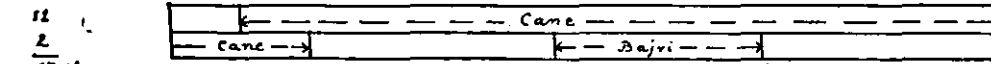
Exhausting Period



17½ / 36



31 / 36



13 / 24

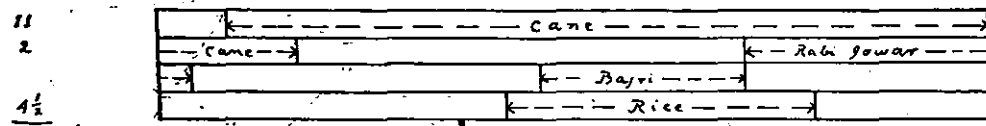
Fallow Period

1
4
5
10 / 36

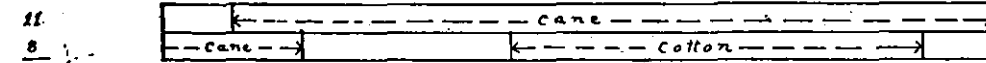
1
4
5 / 36

1
7
8 / 24

HEAVY SOIL



17½ / 48



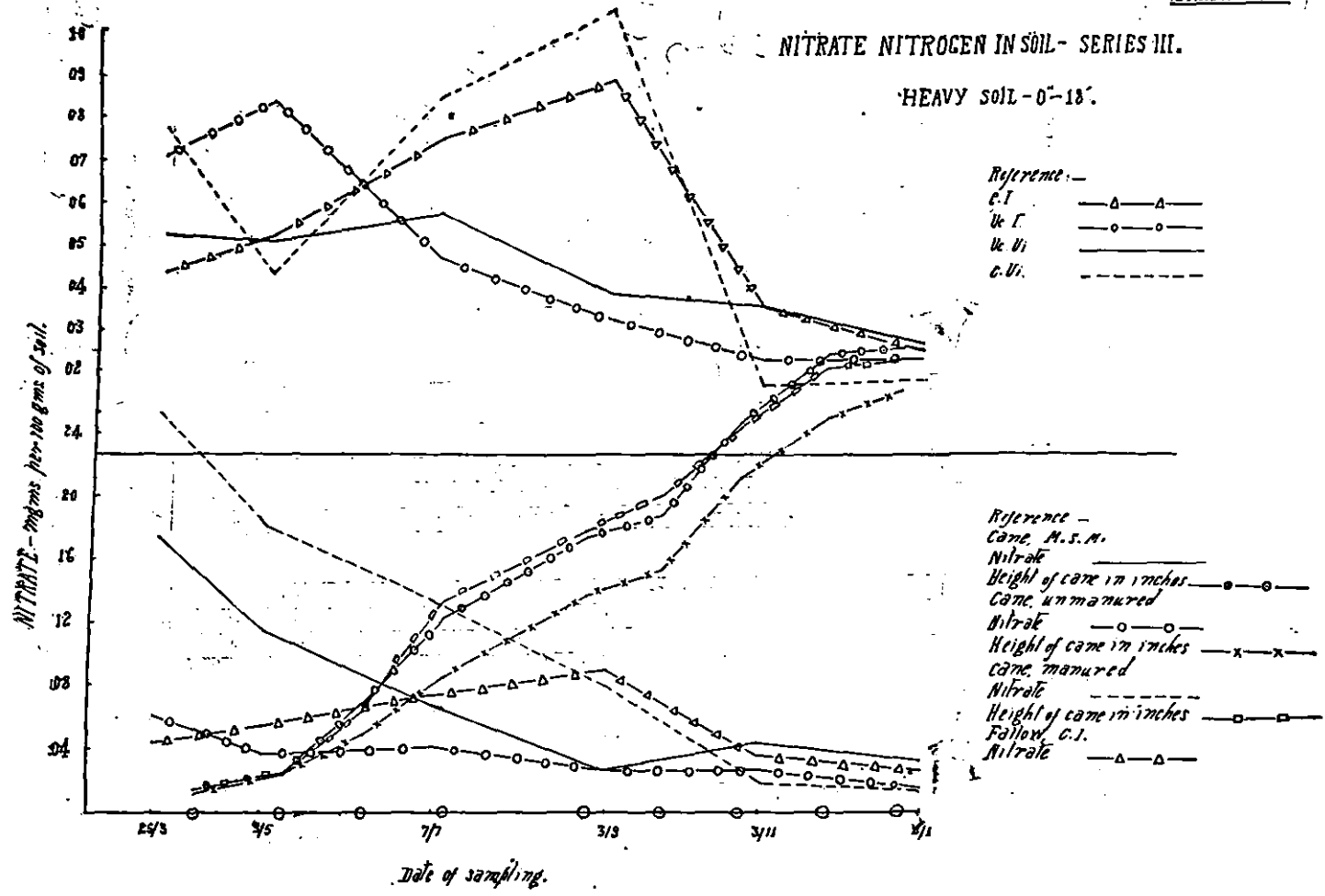
19 / 24

1
6½
8½
7½
23½ / 48

1
4
5 / 24

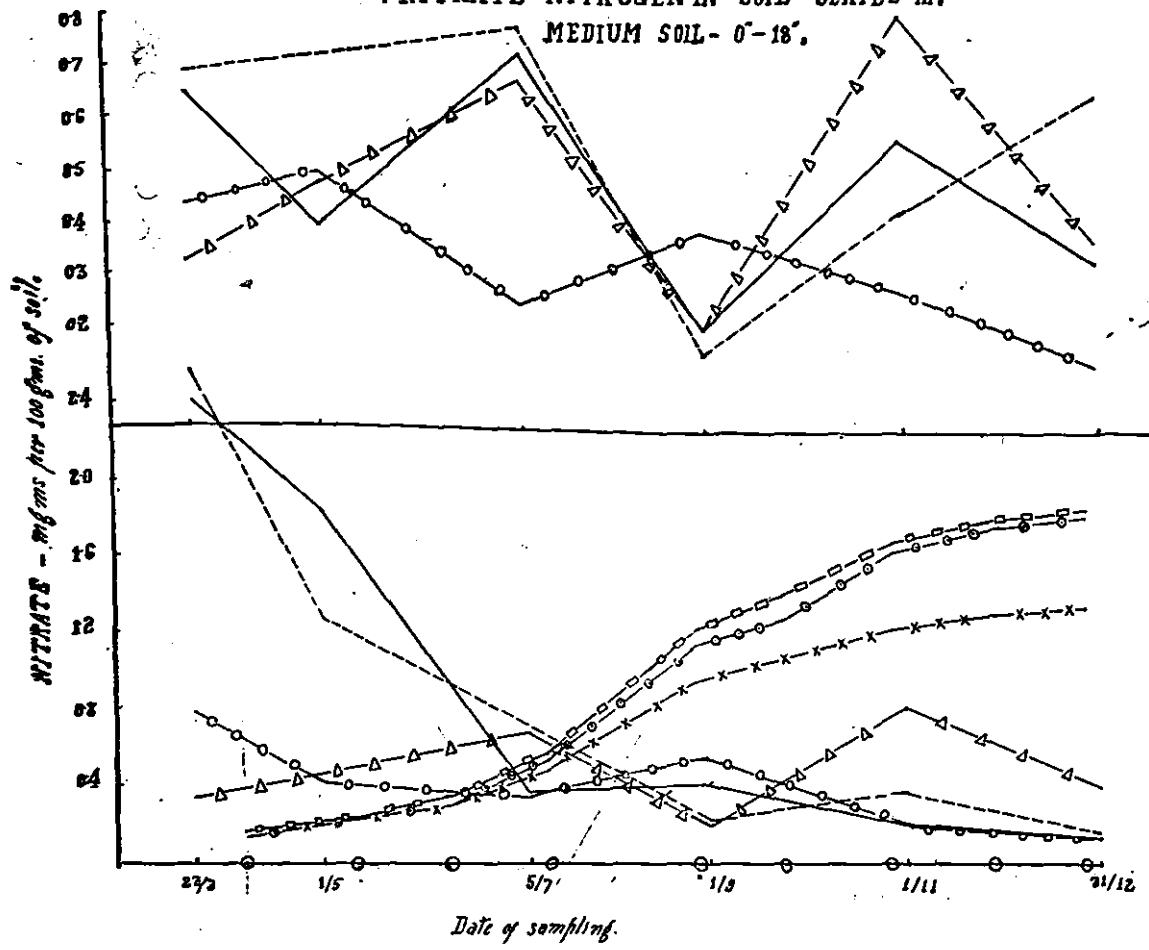
NITRATE NITROGEN IN SOIL - SERIES III.

HEAVY SOIL - 0"-18"



NITRATE NITROGEN IN SOIL- SERIES III.
MEDIUM SOIL- 0"-18".

GRAPH No 4.



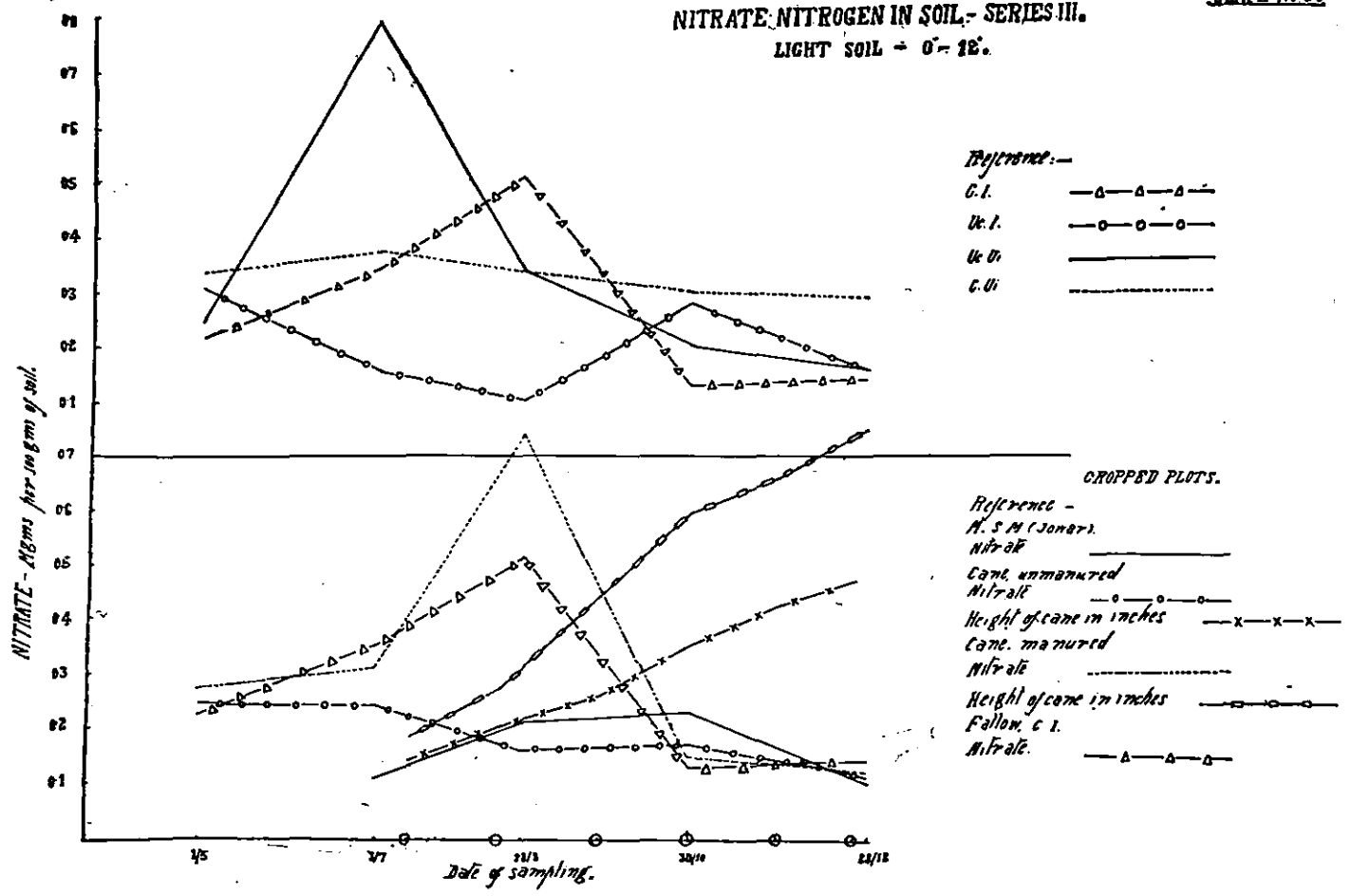
FALLOW.

- Reference:-
 C. I. — Δ—Δ—
 U. I. — ○—○—
 Dc. Vi. — ———
 C. U. — - - - -

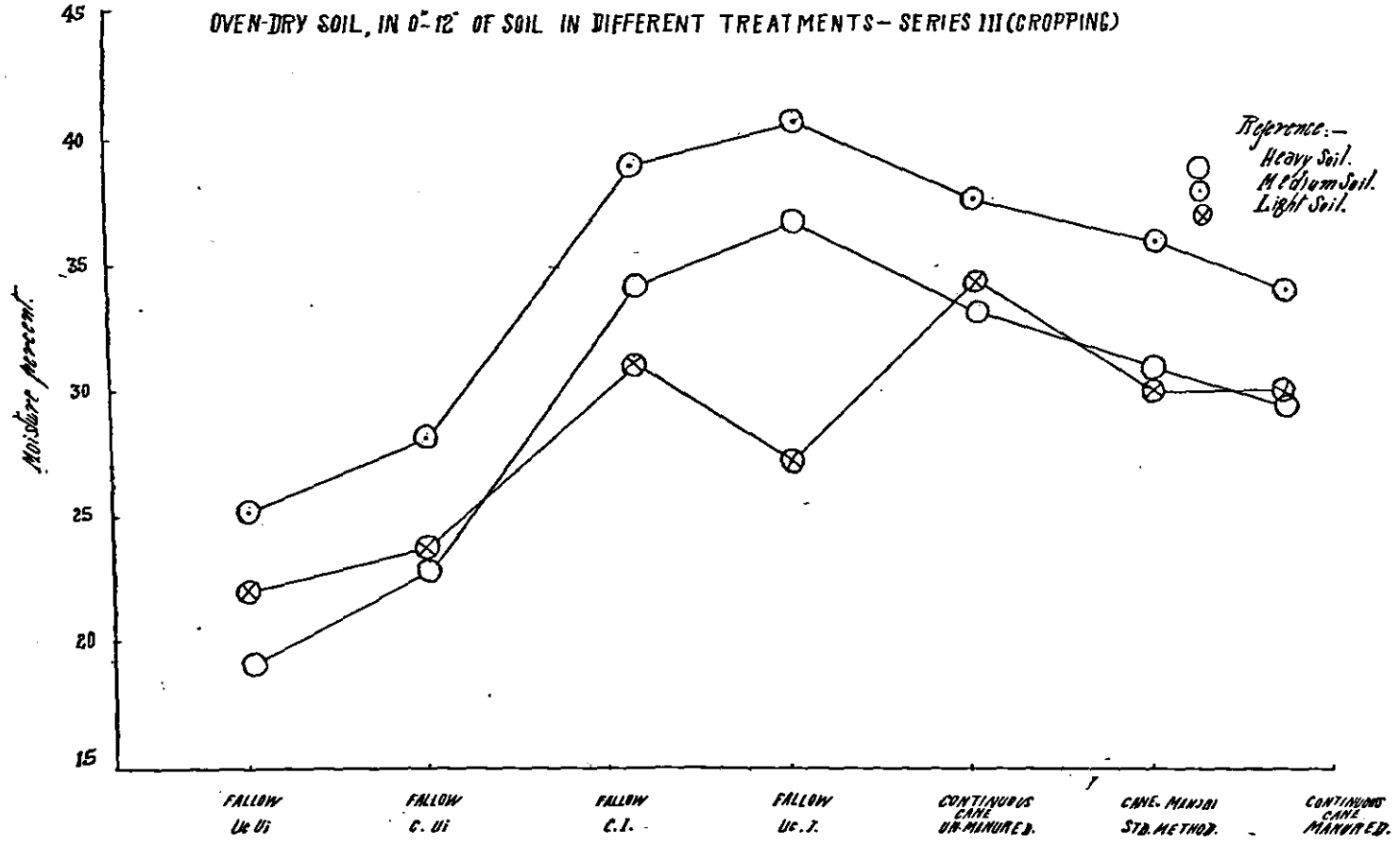
CROPPED PLOTS

- Reference:-
 Cane, Manjri standard Method.
 Nitrate —————
 Height of cane in inches. —○—○—
 Cane, Un-manured
 Nitrate —○—○—
 Height of cane in inches. —x—x—
 Cane, Manasod.
 Nitrate - - - - -
 Height of cane in inches —□—□—
 Fallow, C. I.
 Nitrate —Δ—Δ—

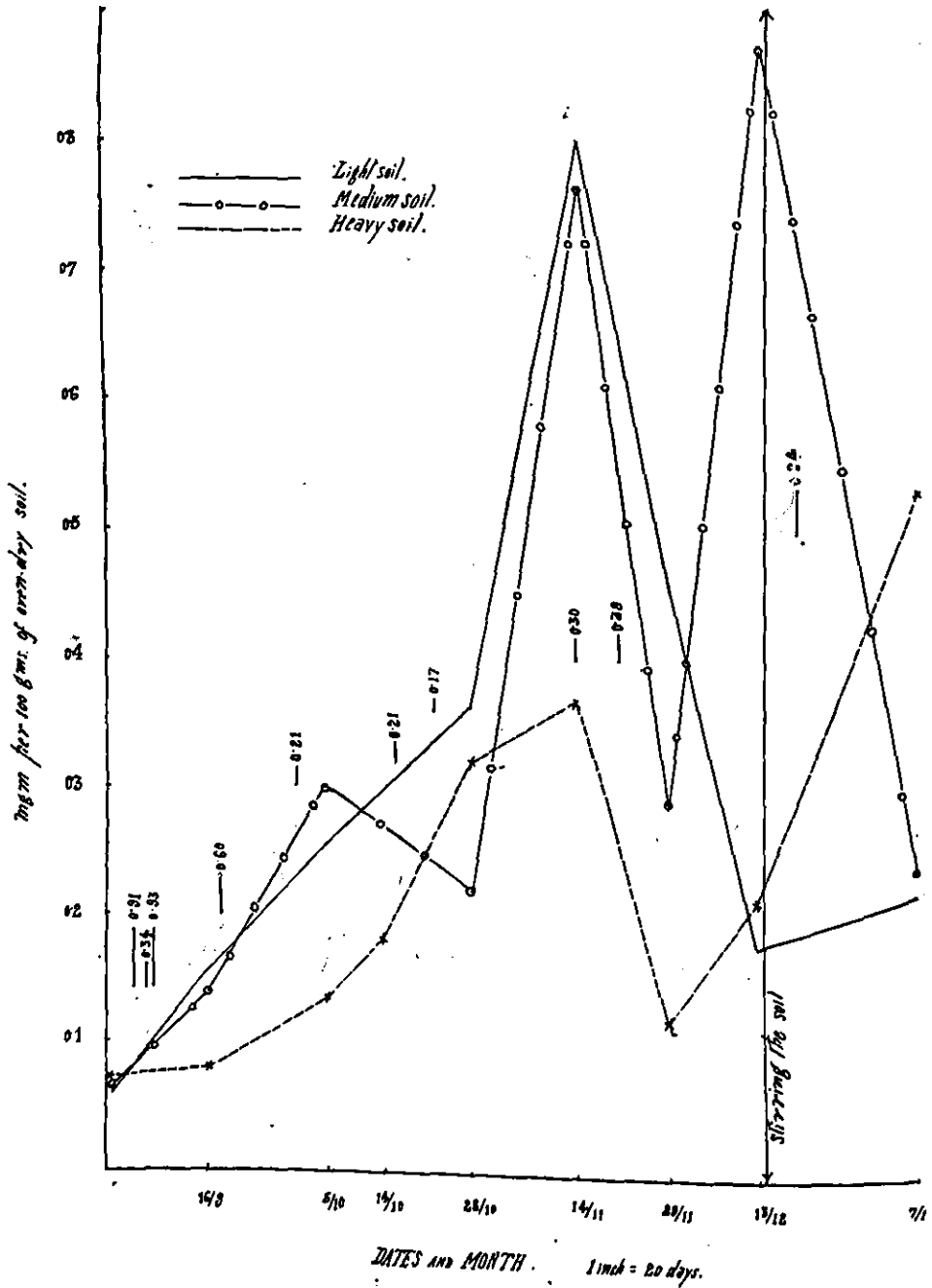
NITRATE-NITROGEN IN SOIL.- SERIES III.
LIGHT SOIL - 0'-12".



AVERAGE MOISTURE CONTENT, DURING THE CROP SEASON, EXPRESSED AS PERCENTAGE ON OVEN-DRY SOIL, IN 0"-12" OF SOIL IN DIFFERENT TREATMENTS - SERIES III (CROPPING)



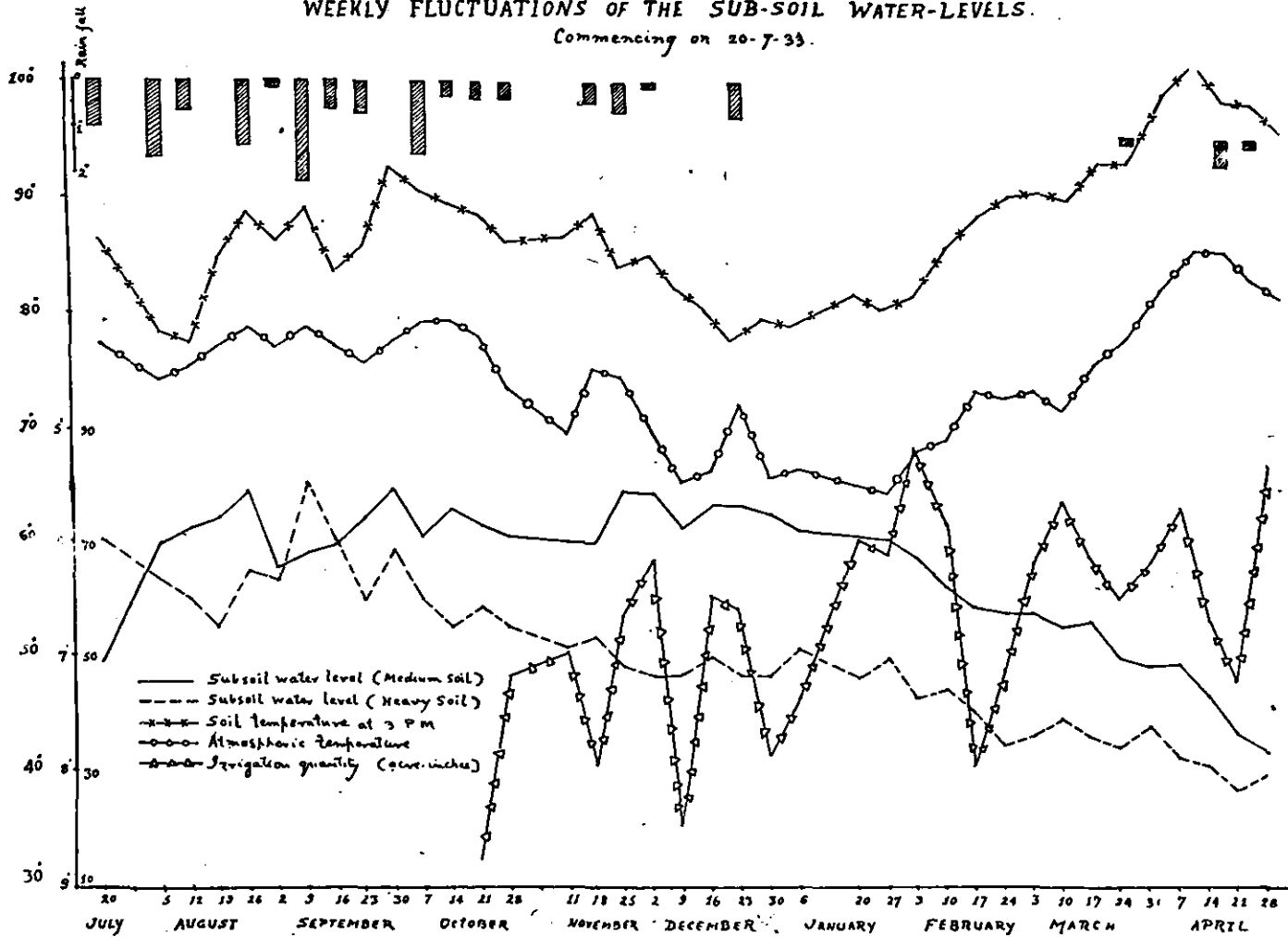
FLUCTUATIONS OF NITRATE NITROGEN EXPRESSED AS MCM.
PER 100 GMS. OF OVEN-DRY SOIL IN GREEN MANURING.
PLOTS IN THREE TYPES OF SOIL- SERIES II(MANURING).



WEEKLY FLUCTUATIONS OF THE SUB-SOIL WATER-LEVELS.

Commencing on 20-7-33.

GRAPH NO 8



APPENDIX II.

TABLES, GRAPHS AND FIGURES RELATING TO THE ANNUAL REPORT OF THE
CROP PHYSIOLOGY SECTION.

TABLE I.

Quantitative distribution of the root system in gms. (Eight months after planting)

150 lbs. N+70"—P. O. J. 2878.

	Average height of mature internodes per plant...50.7".				No. of tillers—3.				
10.12	1.01	1.32	2.51	5.28	3.48	0.76	0.16	0.59	4.99
6.28	0.88	1.62	2.22	1.56	2.72	1.60	1.43	0.39	6.14
1.78	0.11	0.44	0.52	0.71	0.56	0.61	0.30	..	1.47
18.17	1.99	3.38	5.25	7.55	6.76	2.96	1.90	0.98	12.50
Total—30.76									

150 lbs. N + 130"—P. O. J. 2878.

	Average height of mature internodes per plant...69.6"				No. of tillers—3.				
4.99	0.27	0.99	1.16	2.58	1.15	0.55	0.21	0.26	2.17
4.67	0.15	1.27	1.12	2.13	1.72	0.80	1.55	1.17	5.25
1.58	..	0.53	0.79	0.27	0.16	0.02	0.37	0.39	0.94
11.24	0.42	2.79	3.06	4.98	3.03	1.37	2.13	1.83	8.36
Total—19.60.									

TABLE II.

Assimilatory activities of the leaf under different treatments.

(Ganogs' method).

	Number of days of drought.	Percent increase of dry wt. at 3 p.m. over 8 a.m.
Control	5	12.3
April wilting coefficient	25	—1.6

TABLE III.

Data of outstanding meteorological observations.

	Average of past 12 years.	1932 Jan. to Dec.	1933 Jan. to Dec.	1934 Jan. to May.
1. Total rainfall in inches . . .	19.12±2.16	33.72	17.93	..
2. Number of rainy days . . .	50±3.7	64	73	..
3. Average annual maximum tem- perature F.	..	91.0	89.9	..
4. Average annual minimum tempera- ture F.	..	64.3	64.4	..
5. Average annual mean temperature	..	77.7	76.6	..
6. Average annual relative humidity at 8 a.m.	..	74.0	69.0	..
7. Highest maximum F	108.5	105.0	106.0
8. Number of days of maximum temperature of 105°F and above.	..	29	2	19
9. Lowest minimum F.	46	43	38
10. Date of lowest minimum	4th Feb.	25th Jan.	23rd Jan.
11. Lowest relative humidity at 8 a.m.	..	41	30	30
12. Date when recorded	12th to 16th March	28th April	18th March

TABLE IV.

Germination percentage in the medium soil in relation to temperature.

Period	1933				1934			
	Av. min. temp. F°	Av. mean temp. F°	Germination percentage.		Av. min. temp. F°	Av. mean temp. F°	Germination percentage.	
			Pundia	P. O. J. 2878			Pundia	P. O. J. 2878
3 weeks .	54.9	73.5	16.5± 1.6	14.0± 1.3	48.6	66.9	6.7± 0.82	1.0± 0.23
6 weeks .	57.3	76.1	58.6± 2.0	59.5± 2.5	52.7	73.0	47.5± 1.73	36.0± 1.81
8 weeks .	62.7	81.5	61.5± 2.0	65.6± 2.1	55.3	74.0	55.5± 1.4	57.4± 1.29
10 weeks .	..	..	..	..	..	..	57.2± 1.2	63.6± 1.3

TABLE V.

Percentage increase in borer attack in relation to climatic conditions.

Dates.	Percentage increase in borer attack		Temperature (average between the periods)			Relative humidity % (average between the periods)		
	Pundia	P. O. J. 2878	Max. F.	Min. F.	Mean F.	8 a.m.	3 p.m.	Mean.
5-4-34 .	132.8	60.4	102	70	86	61	36	48
19-4-34 .	130.9	302.3	103	71	87	62	16	39
1-5-34 .	54.8	32.1	102	68	85	50	12	31
17-5-34 .	35.4	27.95	103	70	86	31	14	22
1-6-34 .	70.3	63.6	102	72	86	58	20	39

TABLE VI.

Correlation coefficients of growth with mean temperature and humidity with their probable error.

	Total. 21.4-33 to 27-1-34.	Periodical.			
		Forma- tive stage. 16-3-33 to 11-5-33	Grand period of growth 11-5-33 to 28-9-33.	Flower- ing stage 28-9-33 to 17-11-33.	Maturity stage 17-11-33 to 5-2-34
Growth and mean tempera- ture.	+0.017± 0.128	-0.75± 0.169	-0.46± 0.142	+0.93± 0.045	+0.77± 0.115
Growth and humidity	+0.74± 0.057	+0.7± 0.195	+0.62± 0.115	+0.92± 0.045	+0.28± 0.256
Growth and mean tempera- ture after eliminating the effect of humidity.	+0.13± 0.128	..	..	..	..
Growth and humidity after eliminating the influence of mean temperature.	+0.75± 0.056	..	..	..	..

TABLE VII.

Atmospheric factors and daily growth. (Daily observations at 9 a. m.)

Dates.	Daily increase in height.		Temperatures.			Relative humidity at 8 a.m.	Rainfall inches.
	Pundia.	E.K.28.	Max. F.	Min. F.	Mean F.		
1st Sep. 1932 .	0.38	0.65	88.0	70.0	79.0	93.0	2.30
2nd Sep. 1932 .	1.00	1.25	90.0	71.5	80.7	87.0	..
3rd Sep. 1932 .	1.00	1.10	90.0	71.5	80.7	89.0	..
4th Sep. 1932 .	0.75	0.65	86.0	71.0	78.5	91.0	0.03
5th Sep. 1932 .	0.75	0.50	84.5	70.0	77.2	95.0	0.77

TABLE VIII.

Data of pot-culture experiments.

Serial No.	Treatment.	Total quantity received.	Closed.		Open.		Evaporation. 7-4.	Yield dry wt. in lbs.	Efficiency in transpiration.*
			Total quantity leached out.	Transpiration.	Total quantity leached out.	Transpiration and evaporation.			
1	2	3	4	5	6	7	8	9	10
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.		
1	70	51.17	7.34"	43.83	3.38	47.79	3.96	0.54	0.88
2	95	68.98	9.87"	59.11	5.98	63.00	3.89	0.51	0.51
3	130	93.68	19.32"	74.36	14.18	79.50	5.14	0.45	0.44

* Number of grms. of dry matter produced per Kgm. of water.

TABLE IX.

Total loss of soil moisture in acre—inches.

0-24".

16-2-33 to 5-2-34.

Treatment.	Total delta received in irrigation (inches).	Total rainfall (inches).	Total water applied to the crop. (inches).	Total water utilized both in transpiration and evaporation. (inches).
1	2	3	4	5
70"	52.06	17.94	70	70.9
95"	77.06	17.94	95	68.8
130"	112.06	17.94	130	73.4

TABLE X.

Soil moisture per 100 gms. of dry soil (average for the whole year).

0-24".

Treatment.	Irrigational doses, Inches.	Soil moisture, a day before irrigation.	Soil moisture, a day before irrigation.	Difference.
1	2	3	4	5
70"	1.5	35.9	39.7	3.8
95"	2.2	38.5	42.0	3.5
130"	3.2	30.8	43.9	4.1

TABLE XI.

Some physiological characteristics of the crop under varying water treatment.

	Pundia.			P. O. J. 2878.		
	150N+ 70".	150N+ 95".	150N+ 130".	150N+ 70".	150N+ 95".	150N+ 130".
1. Percentage germination	30.8	34.6	32.3	50.0	46.3	34.8
2. Average height of mature internodes in inches.	78.9	78.6	68.4	72.3	72.1	77.2
3. Average circumference in inches.	4.9	4.8	4.2	3.3	3.3	3.6
4. Average total number of mature internodes.	22.0	20.3	18.3	12.8	11.3	12.4
5. Ratio of mother cane to tiller.	1:1.5	1:1.75	1:1.9	1:1.4	1:1.7	1:2.25
6. Average yield per 1/48 acre plot in lbs.	1,686	2,015	1,485	1,385	1,610	1,308
7. Average weight per cane in lb.	5.3	4.8	4.1	2.6	2.9	2.8
8. Efficiency of total delta applied.	5.5	4.2	2.8	5.1	3.4	2.2

Note.—No. 1, 6 and 7 are average of two replications and are obtained from the records kindly supplied by the agricultural section. The rest are average on twelve plants in two replications per treatment.

Efficiency of total delta is calculated as grams of millable cane per Kgm. of water.

TABLE XII.

Periodical water requirement of sugarcane under varying water treatments.

(acre inches)

0-24" depth.

Stage of growth.	Period.	Av. % moisture before irriga- tion.	Av. % moisture after irriga- tion.	Total quantity given in irrigation.	Rain	Total water received.	Total water utilis- ed.	Water require- ment per day.
1	2	3	4	5	6	7	8	9
				Inches. 70"	Inches.	Inches.	Inches.	Inches.
Formative stage .	16-2-33 to 11-5-33	} 36·1	40·5	14·9	0·18	15·08	15·6	0·18
Grand period stage	11-5-33 to 28-9-33	} 34·4	37·8	15·1	13·43	28·53	33·3	0·24
Flowering stage .	28-9-33 to 17-11-33	} 34·1	38·9	7·2	2·95	10·15	12·1	0·3
Maturity stage .	17-11-33 to 5-2-34	} 39·3	41·5	14·86	1·38	16·24	9·9	0·11
				52·08	17·94	70·00	70·0	
				95"				
Formative stage .	16-2-33 to 11-5-33	} 36·5	41·6	19·9	0·18	20·08	18·7	0·21
Grand period stage	11-5-33 to 28-9-33	} 37·0	40·7	26·9	13·43	40·33	29·2	0·21
Flowering stage .	28-9-33 to 17-11-33	} 37·8	43·1	10·6	2·95	13·55	13·8	0·35
Maturity stage .	17-11-33 to 5-2-34	} 42·4	44·5	19·66	1·38	21·04	7·1	0·08
				77·06	17·94	95·00	68·8	
				130"				
Formative stage .	16-2-33 to 11-5-33	} 38·1	43·2	26·9	0·18	27·08	17·7	0·2
Grand period stage	11-5-33 to 28-9-33	} 37·9	42·7	40·7	13·43	54·13	32·5	0·23
Flowering stage .	28-9-33 to 17-11-33	} 40·2	44·3	15·7	2·95	18·65	10·7	0·27
Maturity stage .	17-11-33 to 5-2-34	} 43·0	45·6	28·76	1·38	30·14	12·5	0·14
				12·06	17·94	130·00	78·4	

TABLE XIII.

Wilting coefficient of the soil.

Type of soil.	Depth.	Pundia.		P. O. J. 2878.	
		Wilting coefficient of soil.	% loss of moisture for the total period.	Wilting coefficient of soil.	% loss of moisture for the total period.
		1	2	3	4
Light soil	0-12"	25.2	7.3	23.5	13.8
Medium soil	0-12"	28.0	12.3	24.5	17.2
	12-24"	29.1	11.4	26.5	13.0
Heavy soil	0-12"	30.0	6.5	28.1	9.8
	12-24"	30.2	7.1	28.0	10.3
	24-36"	32.5	2.3	29.0	7.7

Note.—(a) In the case of light and medium soils, samples were taken up to murum layers while in the heavy soil these were taken upto 3' depth only.

(b) The crop in the heavy soil was extremely poor at this period; that of the light soil just below that from the medium soil which was best of all the types of soils.

TABLE XIV.

Some physiological characteristics of the wilting coefficient series.

PUNDIA.										P. O. J. 2878.								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Ratio of millable to non-millable cane at harvest time. Average of 2 plots.	Av. ht. at harvest time (av. of twelve canes). Inches.	Av. circumference at harvest time (av. of twelve canes). Inches.	Length of mature internodes (av. of twelve canes). Inches.	Wt. per cane in lbs. Av. of two plots.	Wt. of cane in lb. per 1/300 of an acre (av. of two replications.)	Brix.	Sucrose.	Purity.	Ratio of millable to non-millable cane at harvest time. Average of 2 plots.	Av. ht. at harvest time (av. of twelve canes). Inches.	Av. circumference at harvest time (av. of twelve canes). Inches.	Length of mature internodes (av. of twelve canes). Inches.	Wt. per cane in lbs. Av. of two plots.	Wt. of cane in lb. per 1/300 of an acre (av. of 2 replications).	Brix.	Sucrose.	Purity.
<i>Light so.</i>																		
Control	1:3.2	67.4	3.0	2.7	2.2	184	17.1	14.0	82.1	1:0.10	121.6	3.5	5.77	2.6	234	22.1	19.6	88.7
April W. C.	1:6.8	60.7	3.8	2.47	1.7	134	16.7	12.9	77.3	1:0.25	120.0	3.3	5.61	2.5	232	22.1	10.7	88.3
May W. C.	1:3.1	68.2	3.8	2.87	2.6	201	16.8	13.5	80.4	1:0.20	120.5	3.0	4.90	2.1	221	21.9	10.5	88.9
December W. C.	1:5.2	80.7	4.2	..	2.6	190	17.0	14.5	85.0	1:0.08	130.9	3.8	..	2.8	271	22.5	10.9	88.1
<i>Medium soil.</i>																		
Control	1:1.2	60.0	3.4	2.51	2.8	258	16.0	13.3	83.0	1:0.03	138.5	3.5	5.92	2.8	270	21.8	19.1	87.6
April W. C.	1:1.1	75.0	3.8	3.05	2.8	236	15.2	12.0	78.8	1:0.20	144.0	3.4	6.65	2.8	272	21.7	19.2	88.3
May W. C.	1:2.0	81.6	4.3	3.24	3.2	232	15.9	12.5	78.7	1:0.23	129.2	3.2	5.82	2.0	293	21.2	18.5	87.3
December W. C.	1:0.6	83.9	4.0	..	3.05	270	16.8	14.4	85.3	1:0.03	151.6	3.8	..	3.1	293	22.0	19.2	87.0
<i>Heavy soil.</i>																		
Control	1:2.2	76.7	4.6	2.71	3.7	281	15.9	12.2	76.8	1:0.27	115.1	3.3	5.55	3.3	319	21.4	19.0	88.6
April W. C.	1:6.5	86.8	4.6	3.35	3.5	238	15.1	12.3	81.4	1:0.02	136.2	3.4	6.49	3.4	345	20.85	18.9	90.3
May W. C.	1:8.4	84.7	4.6	3.48	4.0	269	15.6	13.6	87.1	1:0.35	128.5	3.6	5.56	3.0	266	19.92	16.3	81.8
December W. C.	1:2.3	86.5	4.6	..	4.05	272	16.4	13.6	82.8	1:0.26	154.8	4.1	..	3.5	326	21.07	19.5	90.1

NOTE.—Both the varieties were harvested within a week from 9-1-34. The low purity of Pundia is mainly due to this early harvesting.

TABLE XV.

Periodical germination percentage. 1933-34.

Variety—P. O. J. 2878.

Treatment.	1st dose 3 weeks after planting.	GERMINATION PERCENTAGE.		
		3 weeks.	6 weeks.	8 weeks.
50 lbs. N . . .	16.3 lbs. N	26	74	78
150 lbs. N . . .	50 lbs. N	15	65	73
300 lbs. N . . .	100 lbs. N	19	69	75

TABLE XVI.

Increase in growth under varying manurial treatments.

Variety—P. O. J. 2878.

Period 40 days—19-9-33 to 29-10-33.

Treatment.	Increase in height of mother cane only. Inches.	Average increase in height per plant in the clump. Inches.
50 lbs. N	14.86	26.4
150 lbs. N	46.1	49.2
300 lbs. N	44.2	41.2

TABLE XVII.

Important physiological characteristics at harvest time in different treatments.

Treatment.	Variety.	Height of mature inter- nodes in inches.	Length of indi- vidual mature inter- nodes in inches.	Circum- ference in inches.	Tillering ratio.
150 lbs. N	Pundia .	67.8	3.4	4.3	1 : 5.8
150 lbs. N	P. O. J. .	87.2	6.7	3.5	1 : 3.0
300 lbs. N	Do. .	99.5	6.6	3.6	1 : 3.3
50 lbs. N	Do. .	59.9	5.4	2.9	1 : 1.2

TABLE XVIII.

Periodical analysis of juice for mineral—constituents.

Treatment.	Name of constituents.	20.9.33		28.11.33		18.1.34	
		Lbs. per ton of millable cane.	Lbs. per acre. Yield of millable cane.	Lbs. per ton of millable cane.	Lbs. per acre. Yield of millable cane.	Lbs. per ton of millable cane.	Lbs. per acre. Yield of millable cane.
1	2	3	4	5	6	7	8
150 lbs. N Pundia	N	0.096	1.728	0.108	3.785	0.125	4.37
	P ₂ O ₅	0.016	0.284	0.082	2.87	0.137	4.79
	K ₂ O	0.0650	11.8	0.756	26.45	1.019	35.65
	CaO	0.282	5.08	0.340	11.92	0.307	10.74
150 lbs. N P. O. J. 2878.	N	0.123	4.05	0.123	4.95	0.267	8.42
	P ₂ O ₅	0.018	0.601	0.134	4.96	0.0948	3.510
	K ₂ O	0.878	28.95	0.671	24.85	0.893	33.05
	CaO	0.449	14.82	0.302	11.18	0.405	14.98
300 lbs. N P. O. J. 2878.	N	0.161	6.07	0.225	12.50	0.201	11.19
	P ₂ O ₅	0.013	0.492	0.189	10.56	0.101	5.61
	K ₂ O	0.763	28.75	0.498	27.65	0.733	40.7
	CaO	0.391	14.74	0.498	27.65	0.247	13.7
50 lbs. N P. O. J. 2878.	N	0.116	2.55	0.116	3.61	0.095	2.95
	P ₂ O ₅	0.014	0.316	0.067	2.09	0.108	3.35
	K ₂ O	0.470	10.34	0.566	17.70	0.589	18.27
	CaO	0.415	9.13	0.539	16.70	0.299	9.26

TABLE XIX.

Manurial experiment with Pundia.

	Per cent. of the tillers smothered up by earthing up.	Per cent. increase of millable cane at harvest time over germination.	Brix on 18th December 1933.	Brix on 11th January 1933.	Calculated yield per acre in tons.
Control . . .	22	82	14.9	16.0	34.8
Super phosphate .	4	94	17.7	16.9	42.7
Sulphate of potash .	14	72	15.9	16.2	36.3

TABLE XX.

Total nitrogen at planting and harvest time under varying treatments of water and manure.

(Grams per 100 gms. of air dried soil.)

Serial No.	Treatment.	Variety.	Planting time.		Harvesting time.	
			0-12".	12"-24".	0-12".	12"-24".
1	100 lbs. N . . .	Pundia .	0.035	..	0.045	..
2	150 lbs. N . . .	P. O. J. 2878	0.043	..	0.045	..
3	50 lbs. N . . .	P. O. J. 2878	0.049	..	0.049	..
4	300 lbs. N . . .	P. O. J. 2878	0.065	..	0.048	..
5	150 lbs. N+70" . . .	Pundia .	0.068	0.072	0.057	0.058
6	150 lbs. N+95" . . .	Pundia .	0.047	0.042	0.050	0.056
7	150 lbs. N+130" . . .	Pundia .	0.046	0.048	0.051	0.048
8	150 lbs. N+70" . . .	P. O. J. 2878	0.061	0.061	0.060	0.050
9	150 lbs. N+95" . . .	P. O. J. 2878	0.056	0.057	0.034	0.043
10	150 lbs. N+130" . . .	P. O. J. 2878	0.051	0.051	0.048	0.045

NOTE.—1 to 4 had only one foot depth of soil.

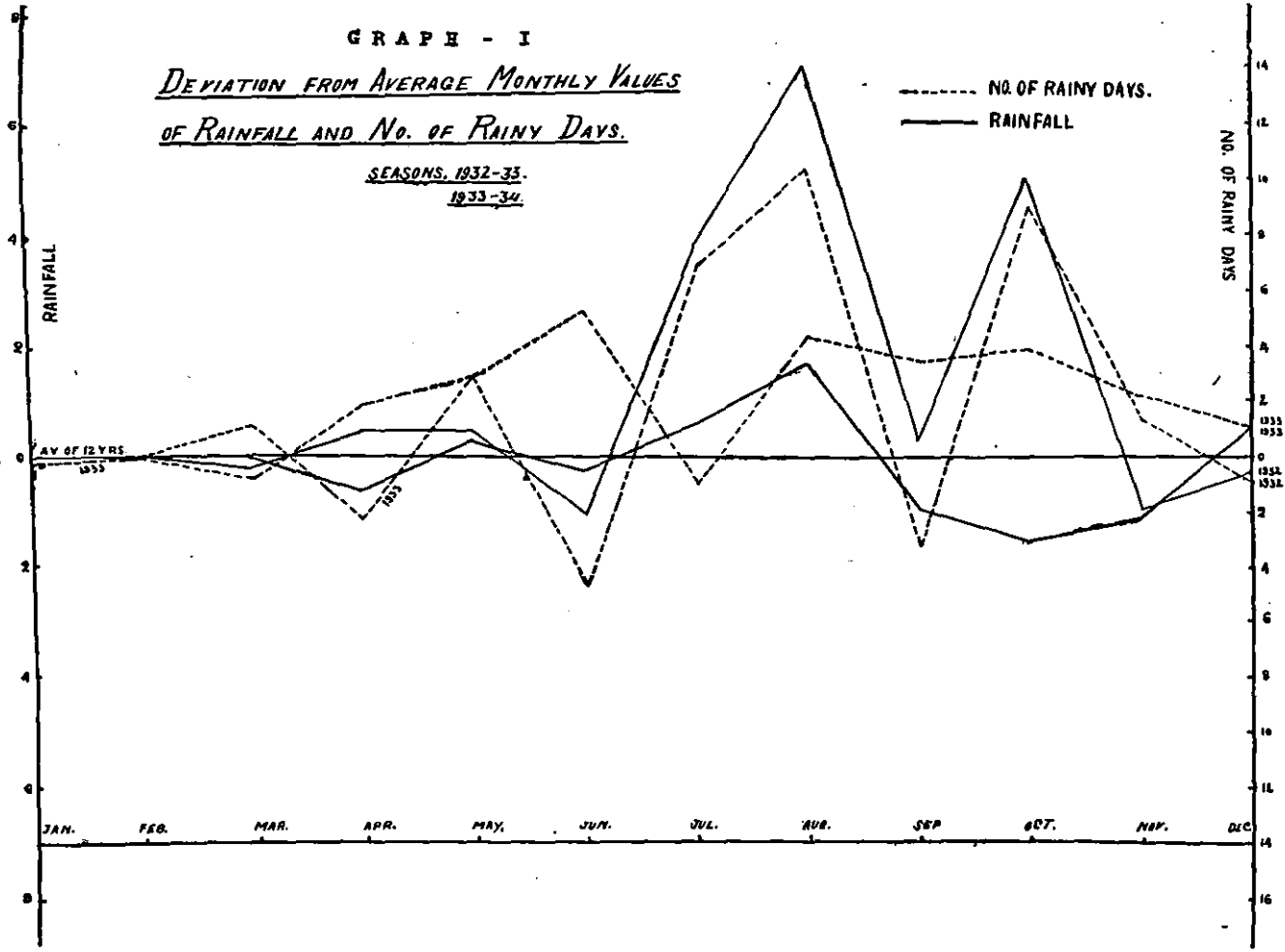
TABLE XXI.

Analysis of gul samples under varying treatments of water and manure.

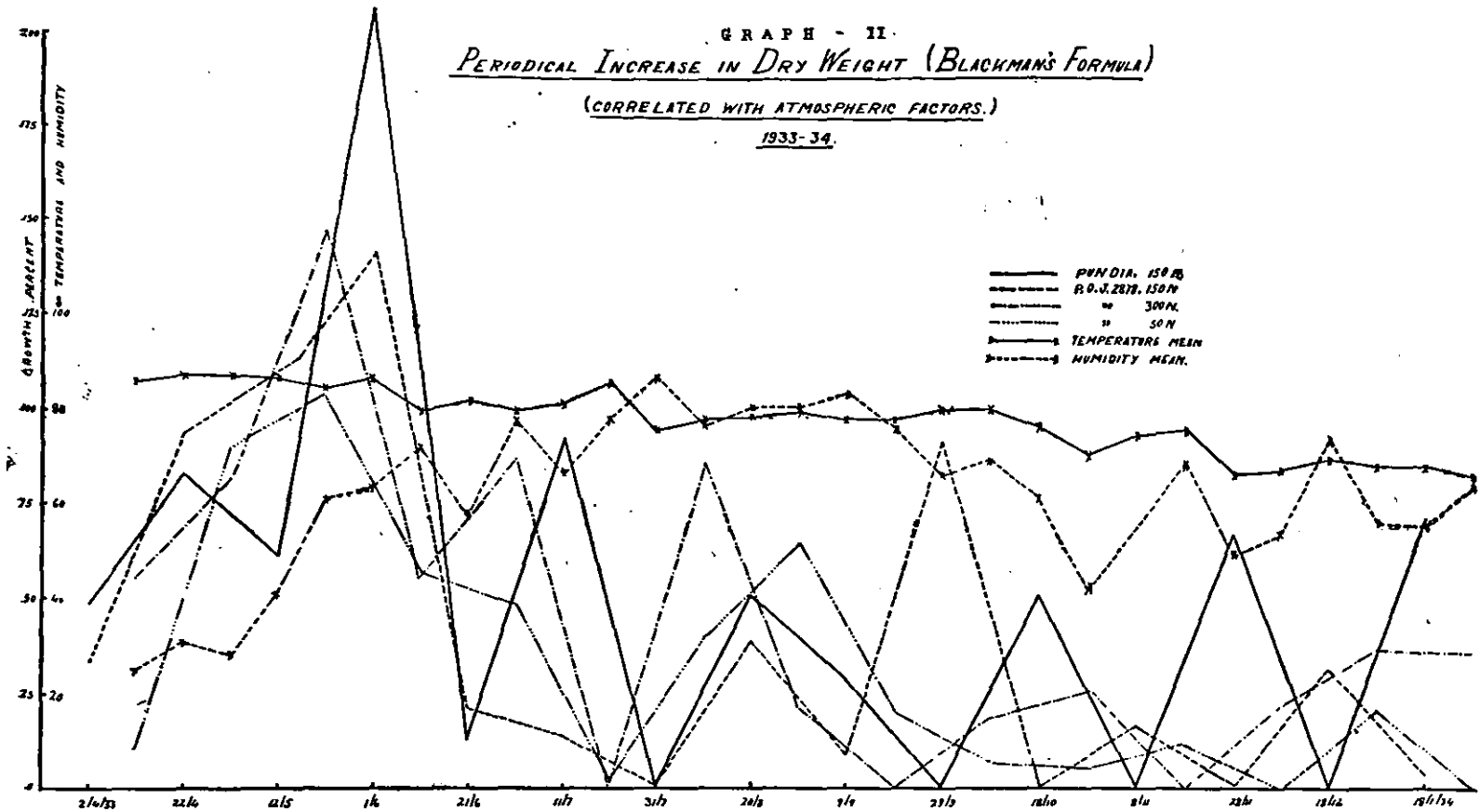
(Per cent. on oven dry basis.)

	Puzdla.							P. O. J. 2878.						
	70°.	95°.	120°.	130°.	10 cart loads F. Y. M.	20 cart loads F. Y. M.	30 cart loads F. Y. M.	70°.	95°.	120°.	130°.	10 cart loads F. Y. M.	20 cart loads F. Y. M.	30 cart loads F. Y. M.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ash	2·2	2·53	2·13	1·9	1·6	1·4	1·59	3·86	3·37	3·14	2·63	2·48	2·85	2·75
CaO	0·126	0·133	0·133	0·14	0·066	0·044	0·036	0·13	0·15	0·11	0·11	0·093	0·05	0·079
MgO	0·034	0·036	0·027	0·031	0·033	0·037	0·052	0·088	0·05	0·03	0·029	0·037	0·037	0·046
P ₂ O ₅	0·064	0·055	0·061	0·1	0·085	0·12	0·16	0·046	0·044	0·059	0·08	0·051	0·097	0·088
K ₂ O	0·84	0·95	0·93	0·89	0·76	0·66	0·64	1·16	1·02	1·36	1·6	1·0	0·96	0·86
Total Nitrogen	0·078	0·036	0·027	0·033	0·054	0·03	0·045	0·054	0·038	0·054	0·036	0·042	0·06	0·057
Total sugars	98·2	97·8	91·6	93·1	100·2	89·2	100·6	98·1	90·0	92·7	93·9	100·2	84·9	94·0
Glucose	12·2	12·9	11·7	9·0	15·22	11·42	14·4	5·81	3·75	4·82	5·62	3·45	4·22	5·1
Purity	87·6	86·7	87·2	90·3	84·6	87·2	85·6	94·1	95·8	94·9	94·04	96·5	95·3	94·6

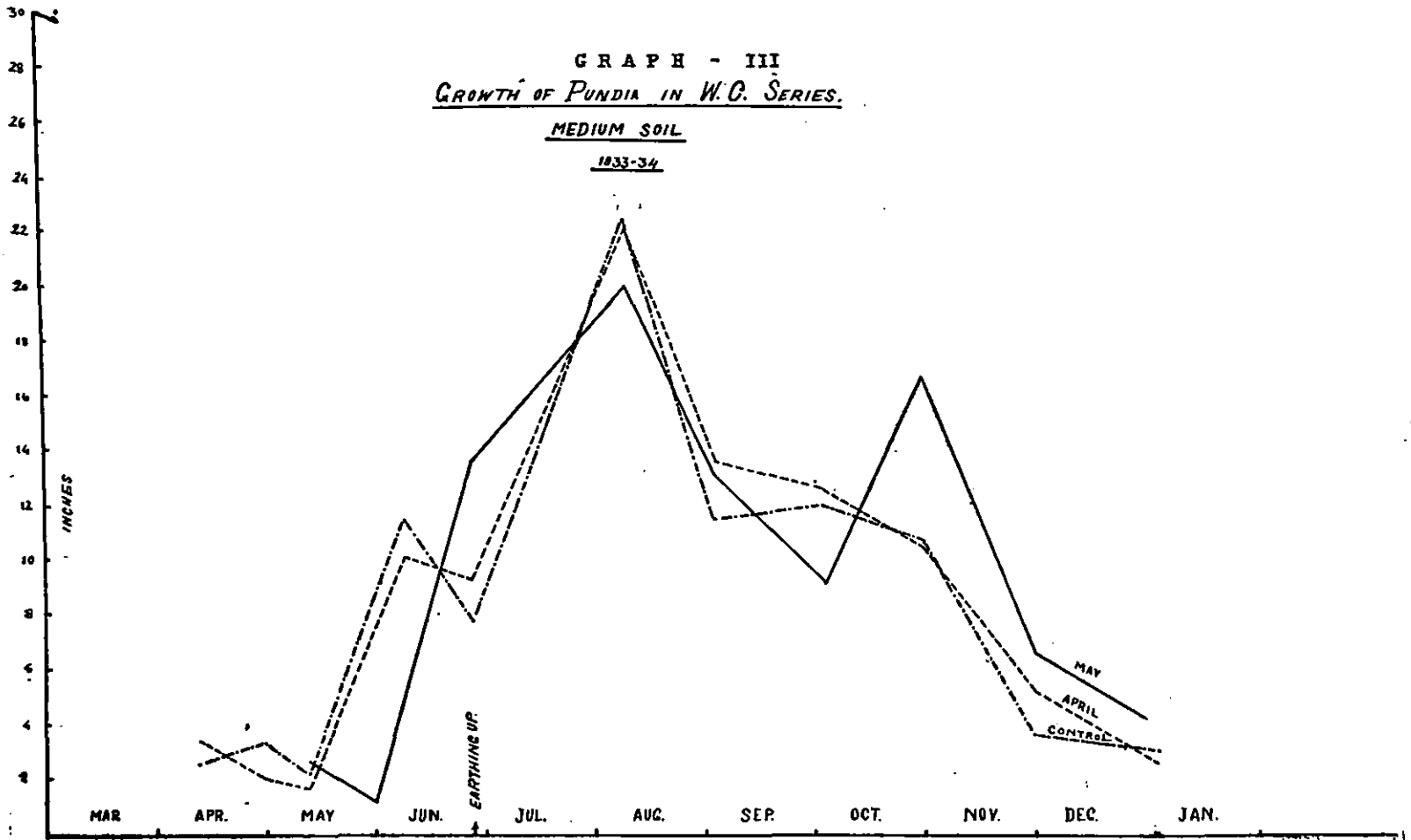
NOTE.—Nos. 1 to 4 had a basal dressing of sann green manuring. Nos. 5 to 7 received irrigation equal to about 95°. The quantity in the latter case was not however accurately measured. All plots received 150 lbs. N in top dressing.



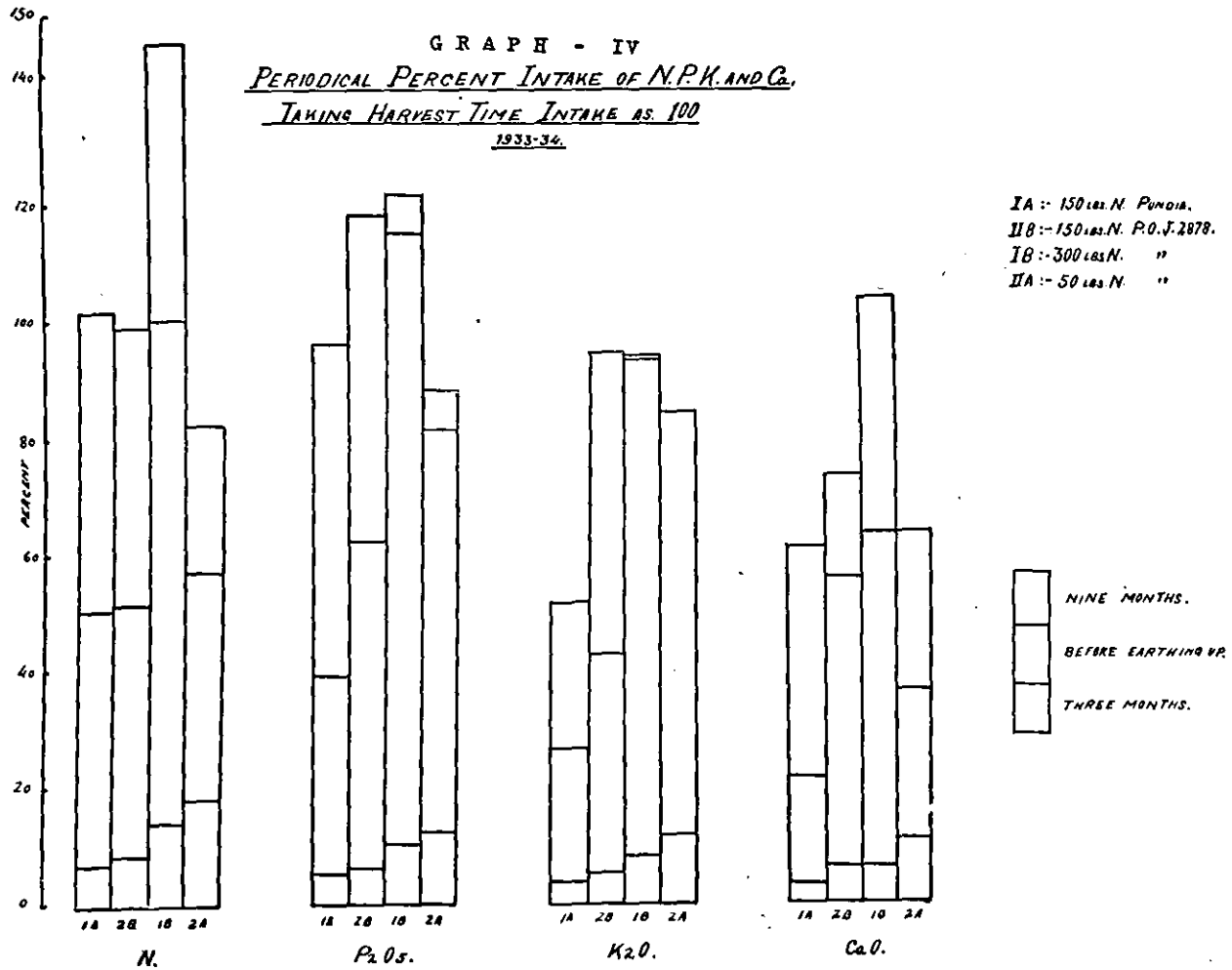
GRAPH - II.
PERIODICAL INCREASE IN DRY WEIGHT (BLACKMAN'S FORMULA)
 (CORRELATED WITH ATMOSPHERIC FACTORS.)
 1933-34.



GRAPH - III
GROWTH OF PUNDIA IN W.G. SERIES.
MEDIUM SOIL
1933-34

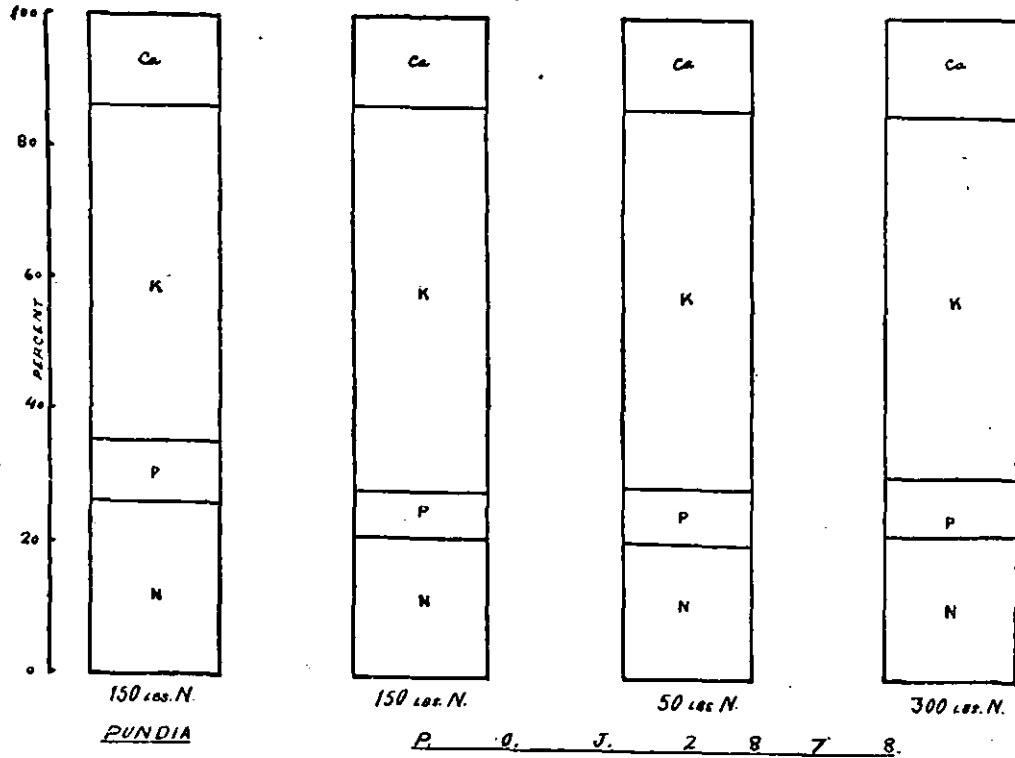


GRAPH - IV
PERIODICAL PERCENT INTAKE OF N.P.K. AND Ca.
TAKING HARVEST TIME INTAKE AS 100
1933-34.



GRAPH - V
PERCENT INTAKE OF MINERAL CONSTITUENTS
TAKING N, P, K AND Ca AS 100
(AVERAGE OF THE WHOLE SEASON.)

1933-34.

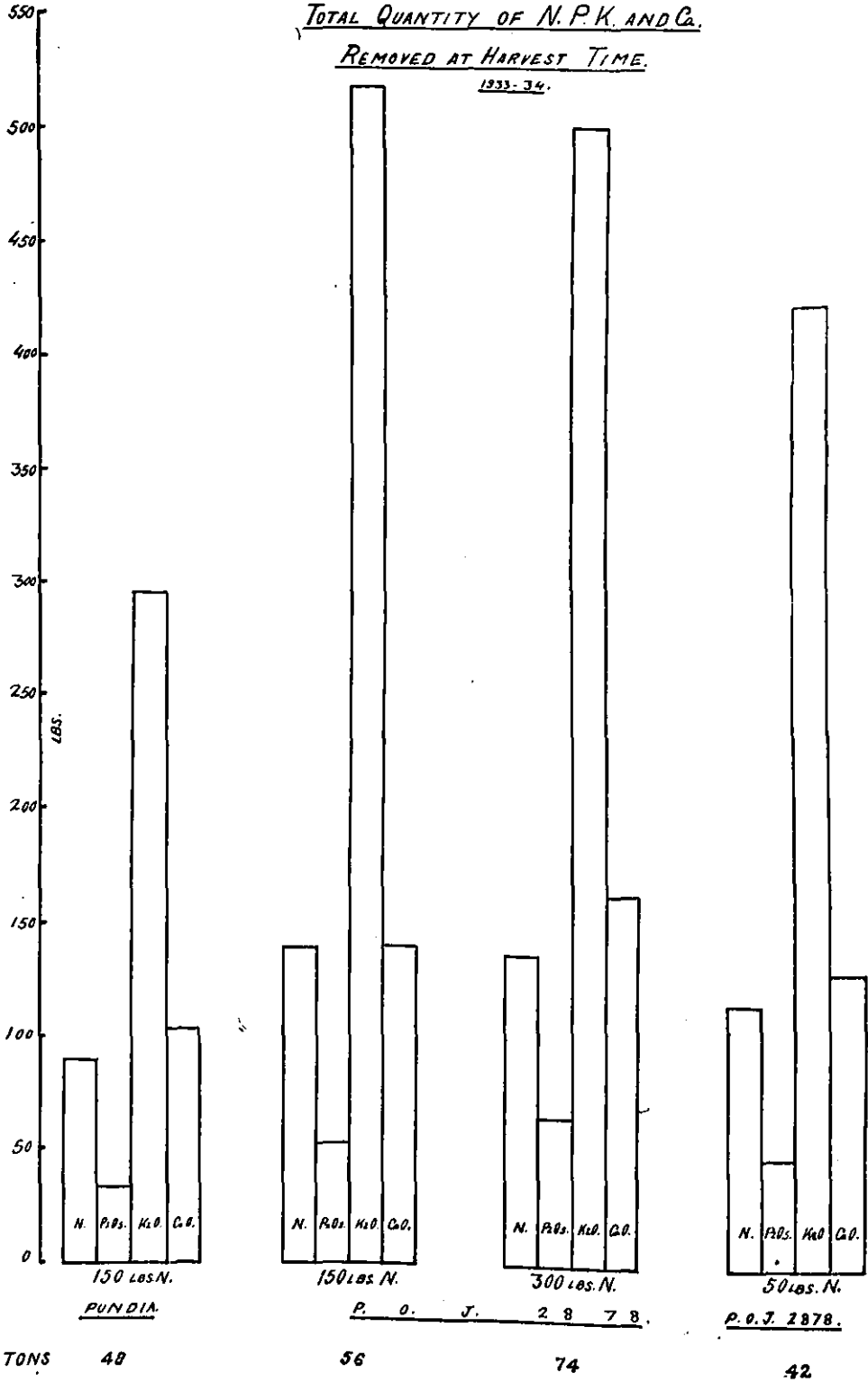


GRAPH - VI

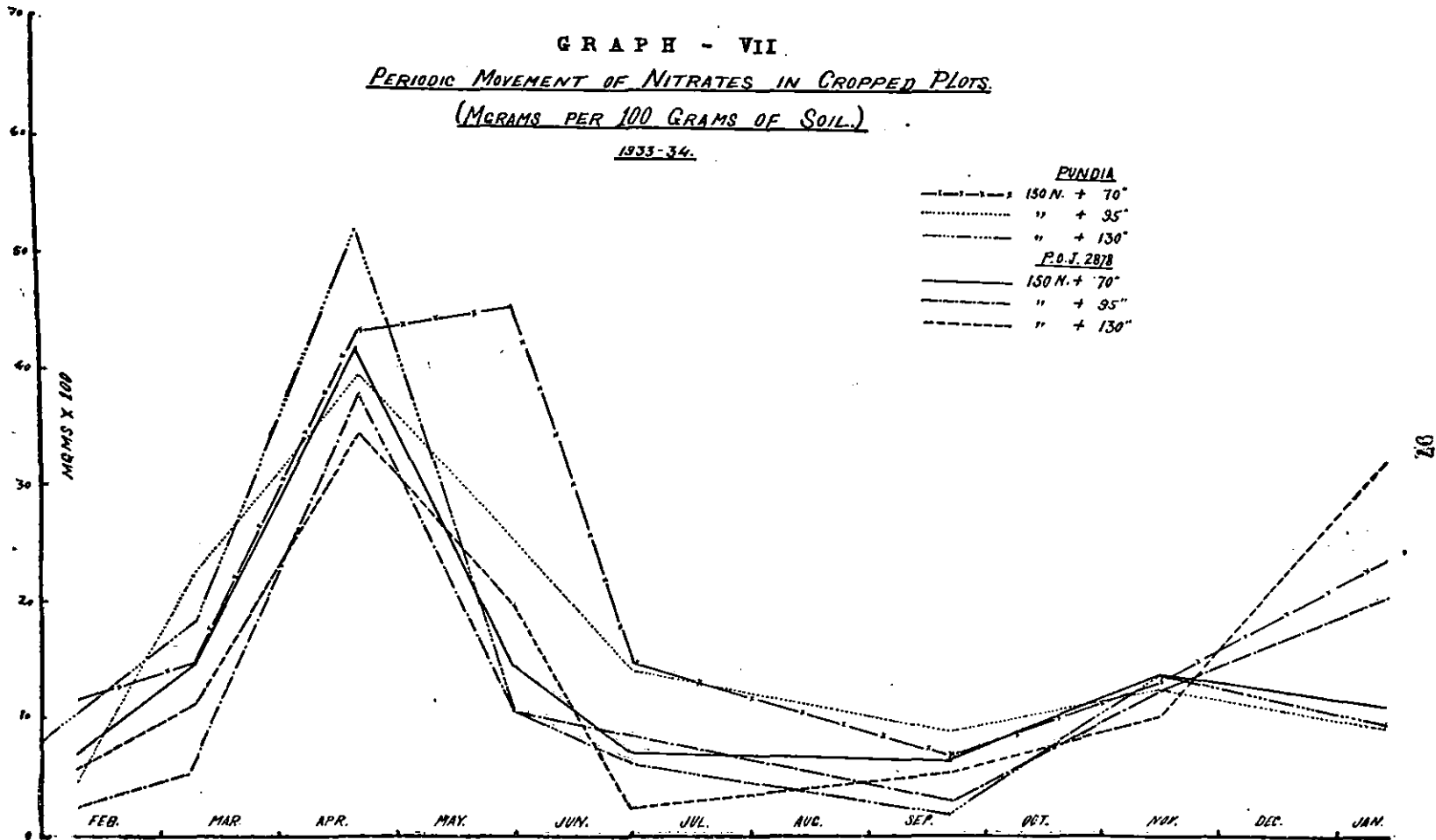
TOTAL QUANTITY OF N.P.K. AND Ca.

REMOVED AT HARVEST TIME.

1933-34.



GRAPH - VII.
PERIODIC MOVEMENT OF NITRATES IN CROPPED PLOTS.
(MGAMS PER 100 GRAMS OF SOIL.)
1933-34.



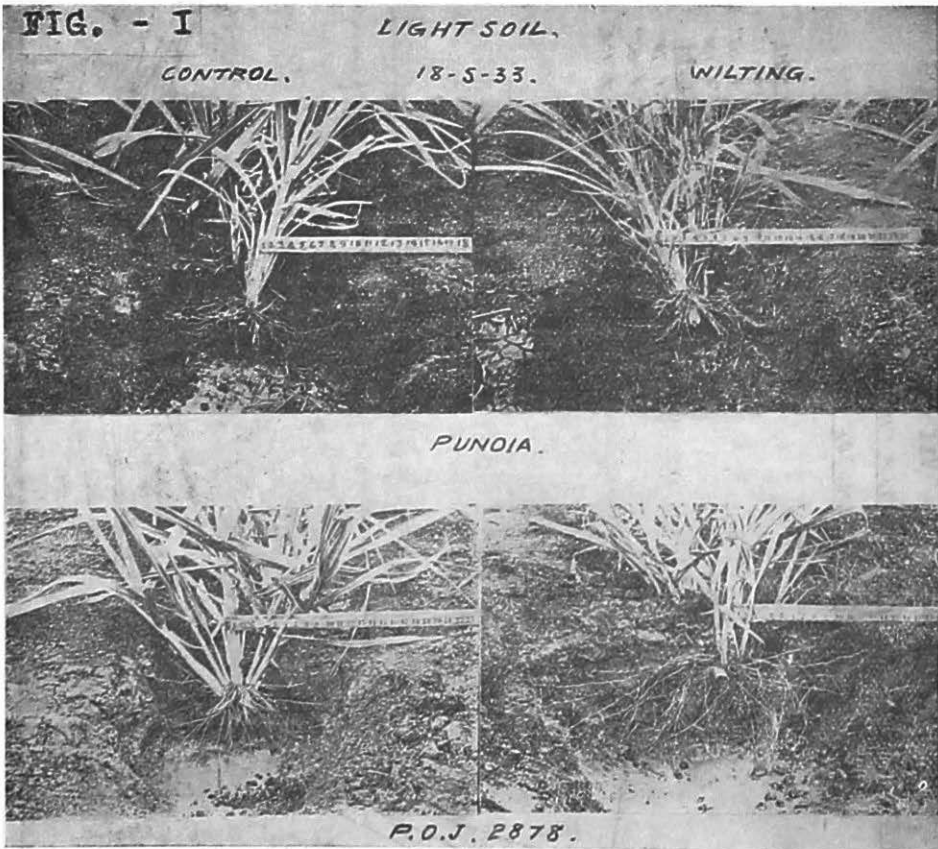
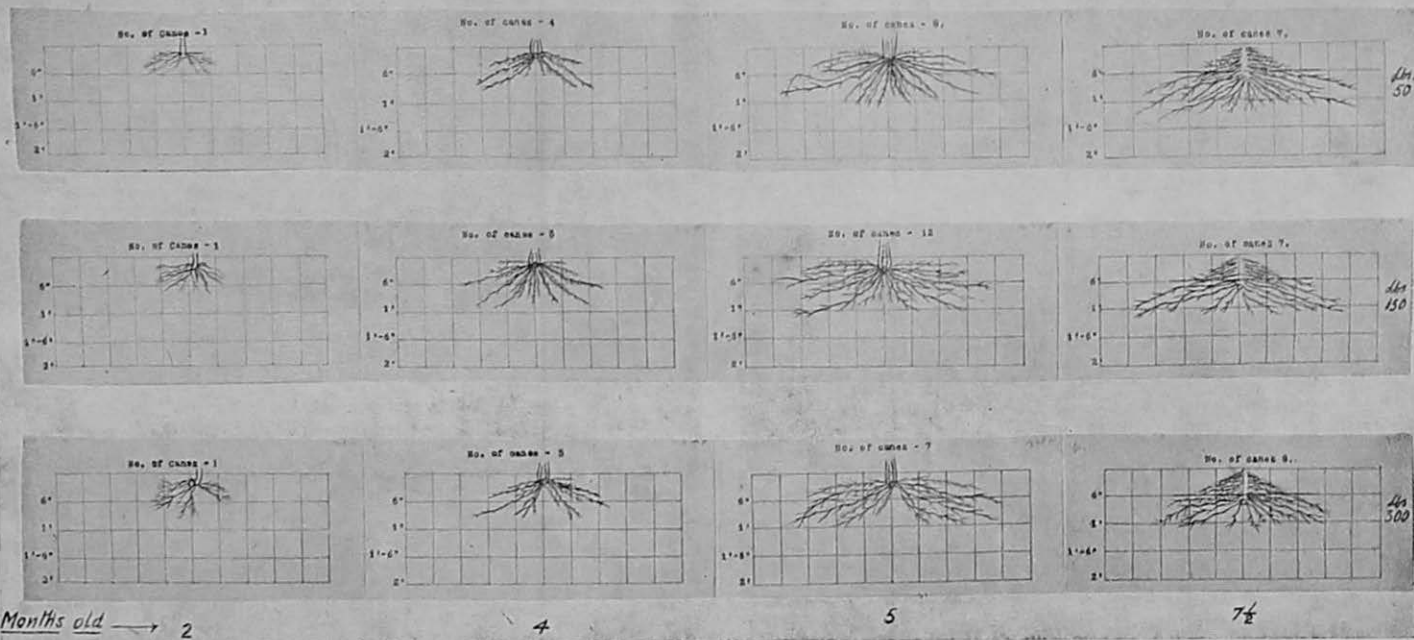


FIG. II

P.O.J. 2878



APPENDIX III.

TABLES RELATING TO THE ANNUAL REPORT OF THE AGRICULTURAL SECTION.

TABLE I.

Meteorological Record, from January 1933 to December 1933.

(Fortnightly averages) Padegaon Farm.

Serial No.	Month.	Temperature.		Humidity 8 A.M.	Wind velo- city.	Rain- fall Inches.	Rainy days.
		Max. °F.	Min. °F.				
1	Jan. (1st fortnight)	86.41	51.22	65.19	..	..	..
	(2nd ")	89.53	53.80	66.4	..	..	..
2	Feb. (1st ")	94.18	56.04	61.79	..	..	..
	(2nd ")	94.46	56.79	65.21	..	..	..
3	March (1st ")	98.56	60.78	54.63	..	0.18	2
	(2nd ")	101.5	63.93	53.87	..	..	..
4	April (1st ")	100.71	68.13	44.1	6.37	..	..
	(2nd ")	101.47	71.07	47.73	7.5	..	..
5	May (1st ")	99.5	72.0	59.6	7.68	0.16	1
	(2nd ")	94.88	73.03	78.06	8.58	0.78	4
6	June (1st ")	88.2	71.5	78.07	8.46	0.92	5
	(2nd ")	88.03	72.27	76.6	8.21	1.82	8
7	July (1st ")	86.13	72.8	78.9	9.59	0.86	3
	(2nd ")	83.72	70.0	84.75	7.18	1.74	7
8	Aug. (1st ")	80.23	69.6	89.2	6.86	2.07	7
	(2nd ")	85.66	69.9	84.94	5.02	1.59	4
9	Sept. (1st ")	85.5	70.13	87.27	4.65	2.77	10
	(2nd ")	86.3	67.53	83.53	5.86	1.92	4
10	Oct. (1st ")	89.23	69.33	88.73	3.52	0.99	9
	(2nd ")	86.94	62.16	78.13	4.14	0.31	2
11	Nov. (1st ")	87.53	55.77	64.13	2.41	0.44	2
	(2nd ")	85.23	60.83	84.66	3.0	0.63	3
12	Dec. (1st ")	83.13	47.37	73.13	2.3	..	..
	(2nd ")	82.0	54.78	85.63	2.47	0.75	2
Total		..	..	..	..	17.93	73

TABLE II.

Table showing performances of sugarcane varieties in preliminary and intermediate trial No. 1.

Serial No.	Variety.	Parentage.	Germination at six weeks.	Tillering ratio for 100 mother canes.	Average No. of internodes.	No. of canes per one cent. plot.	Wt. of single cane in lbs. (av. of col. 7 and 9.)	Wt. of cane per one cent. plot in lbs.	B = Brix. P = Purity	Brix and purity readings.						Remarks.
										7th Dec. 1933.	27th Dec. 1933.	7th Jan. 1934.	26th Jan. 1934.	8th Feb. 1934.	20th Feb. 1934.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Co. 403 .	Vellai x Co. 243 .	69.66	32.4	22	277	4.16	1152	B	..	18.74	18.22	20.31	20.11	..	
2	Co. 404 .	Vellai x P. O. J. 2878.	51.33	111.1	21	325	4.26	1384	P	..	88.55	80.52	92.72	94.10	..	
3	Co. 405 .	B. 6308 x P. O. J. 2686.	75.66	61.7	19	307	3.59	1317	B	74.09	79.79	..	84.10	88.14	..	
4	Co. 406 .	B. 6308 x Co. 281	73.00	51.1	18	331	3.07	1018	P	..	87.38	87.82	91.41	91.66	90.33	
5	Co. 409 .	P. O. J. 2725 x Fiji B (Badilla).	69.33	34.6	19	320	2.29	734	B	..	85.65	..	92.37	..	93.23	
6	Co. 416 .	Vellai x Co. 243 .	53.33	206.3	19	490	3.24	1586	P	..	17.88	18.67	20.66	..	20.21	
7	Co. 417 .	P. O. J. 2725 x Co. 290.	40.22	213.9	14	389	2.43	947	B	..	84.16	87.48	91.43	..	86.08	Seed im- ported.
8	Co. 418 .	P. O. J. 2725 x Co. 290.	39.33	166.1	18	314	2.56	804	P	..	14.95	..	17.85	..	..	Do.
9	Co. 419 .	P. O. J. 2878 x Co. 290.	54.66	158.5	17	424	3.23	1372	B	..	84.26	..	91.09	..	..	Do.
									P	..	17.07	17.07	..	18.44	..	Do.
									B	18.49	18.55	17.72	..	..	18.40	Do.
									P	83.89	86.40	86.90	..	..	89.02	Do.
									B	..	18.85	18.01	20.42	20.21	..	
									P	..	84.92	88.35	89.04	86.98	..	

TABLE II—*contd.*

Serial No.	Variety.	Parentage.	Germination at six weeks.	Tillering ratio for 100 mother canes.	Av. No. of internodes.	No of canes per one cent. plot.	Wt. of single cane in lbs. (av. of cols 7 and 9).	Wt. of cane per cent. plot in lbs.	B = Brix P = Purity.	Brix and purity readings.						Remarks.
										7th Dec. 1933.	27th Dec. 1933.	7th Jan. 1934.	26th Jan. 1934.	8th Feb. 1934.	20th Feb. 1934.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10	Co. 349 .	..	53.33	97.5	18	316	3.00	950	B	..	18.97	21.18	..	20.40	..	
									P	..	93.13	92.79	..	92.72	..	
11	H. M. 606	..	46.66	191.4	10	408	2.91	1186	B	..	17.61	..	..	..	..
									P	..	87.02	..	..	..	..
12	H. M. 607	..	31.33	30.7	23	258	3.98	1020	B	18.41	18.34	18.27	20.01	..	20.05	Affected by mosaic.
									P	88.92	88.00	89.73	89.60	..	90.57	
13	H. M. 608	..	58.66	174.5	25	230	3.13	720	B	..	..	..	19.98	..	20.75	
									P	..	..	..	91.77	..	92.66	
14	H. M. 609	..	51.33	188.3	18	444	2.48	1102	B	19.31	18.86	19.34	18.92	..	20.90	Do.
									P	87.42	90.53	91.31	90.51	..	92.08	
15	P. O. J. 2878.	..	75.00	68.0	15	378	3.00	1135	B	20.42	21.22	21.68	..	..	..
									P	88.31	93.48	92.62	..	..	..
16	Pundia .	..	55.66	55.0	21	253	3.11	786	B	..	15.77	15.72	17.33	..	18.22	
									P	..	80.65	80.78	83.81	..	88.22	

NOTE.—Brix reading 1s from a single random stool.

TABLE III.

Table showing performances of sugarcane sorghum hybrids. February planted crop.

S. No.	Variety.	Date of planting.	Age of crop in days.	Date of harvest.	No. of inter nodes.	Weight of cane in lbs.	Juice analysis.			
							Brix.	Sucrose%	Reducing sugars.	Purity.
1	2	3	4	5	6	7	8	9	10	11
1	Co. 351 .	14-2-33	245	17-10-33	..	..	16.63	13.55	..	81.47
			275	16-11-33	..	..	18.94	16.65	..	87.90
			305	16-12-33	18	1.56	19.31	16.96	0.60	87.86
2	Co. 352 .		245	17-10-33	..	..	16.74	14.71	..	87.86
			275	16-11-33	..	..	19.64	17.62	..	89.71
			305	16-12-33	18	1.63	20.65	18.58	0.21	89.93
3	Co. 353 .		245	17-10-33	..	..	16.64	13.99	..	84.09
			275	16-11-33	..	..	15.93	13.26	..	83.24
			305	16-12-33	16	1.81	19.39	16.99	0.36	87.62
4	Co. 355 .		245	17-10-33	..	..	13.97	10.26	..	73.41
			275	16-11-33	..	..	18.29	15.53	..	84.39
			305	16-12-33	20	2.25	19.17	17.20	0.34	89.71
5	Co. 356 .		245	17-10-33	..	..	12.37	8.80	..	71.15
			275	16-11-33	..	..	14.61	11.06	..	75.68
			305	16-12-33	18	2.19	19.29	17.00	0.72	88.14
6	Co. 357 .		245	17-10-33	..	..	15.88	13.26	..	83.49
			275	16-11-33	..	..	16.77	13.74	..	81.94
			305	16-12-33	19	2.19	18.87	16.94	0.40	89.78

TABLE III—*contd.*

S. No.	Variety.	Date of planting.	Age of crop in days.	Date of harvest.	No. of internodes.	Weight of cane in lbs.	Juice analysis			
							Brix.	Sucrose%	Reducing sugars.	Purity
1	2	3	4	5	6	7	8	9	10	11
7	Co. 281 .	14-2-33	245	17-10-33	..	..	14.38	10.87	..	75.61
			275	16-11-33	..	..	19.03	16.65	..	87.48
			305	16-12-33	15	1.94	19.91	17.54	0.28	87.96
8	P. O. J. 2878.		245	17-10-33	..	..	14.24	10.30	..	72.33
			275	16-11-33	..	..	17.77	14.49	..	81.55
			305	16-12-33	18	4.38	19.88	17.60	0.87	88.53
9	Purdia .		245	17-10-33	..	..	11.42	6.90	..	60.40
			275	16-11-33	..	..	13.83	10.35	..	74.82
			305	16-12-33	23	4.31	15.82	12.96	2.29	81.93

NOTE.—In the final test, the sample for analysis consisted of two random clumps from the plot.

GIPD—N 362 IC of AR—26-3-35—200,