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Read the following papers :—

No. 639. From the Superintending Engineer, 2nd Division, to the Chief Engineer for Irrigation, dated Camp at Masulipatam, 3rd August 1871, No. 53.

I HAVE the honour to enclose copy of a report by Lieutenant D. McNeil Campbell, R. E., in whose range the irrigation experiment, ordered in G. O., No. 1,462, 15th June 1870, was carried out, and a statement showing the supply of water, rainfall, etc., day by day on the three plots of 3 acres each at Chebrole.

1 Copy of Lieutenant Campbell's report.
1 Statement.

2. The latter is not, I fear, very accurately kept, but any errors must be common to all, and relative comparison will be fair enough; while the fact that the average produce of the 9 acres is very nearly that of 9 acres adjoining not subject to experiment tends to show that the error is not very considerable.

3. I would however support Captain Vibart's suggestion that the experiment be tried again at a cost of Rupees 31 with better supervision, and propose to sanction the expenditure from Repairs Agricultural immediately.

4. From the summary it appears that to the first plot 15,460 cubic yards were supplied (rain included) during 104 days, or 2·06 per hour per acre :—

	Cubic yards.	Days.	Per hour per acre.
To the second plot ...	18,594	104	2·48
third plot ...	22,140	104	2·95

				Rs.	A.	P.	Rs.	A.	P.
The first plot produced $3\frac{44}{64}$ candies of paddy at 24 Rs. per candy...				79	13	5			
450 Maunds of straw				22	8	0			
							102	5	5
Second plot produced $\frac{37}{64}$ candies of paddy at 24 Rs. per candy...				67	14	0			
430 Maunds of straw				21	8	0			
							89	6	0
Third plot produced $3\frac{3}{64}$ candies of paddy at 24 Rs. per candy...				73	2	0			
422 Maunds of straw				21	1	7			
							94	3	7
Total...							285	15	0

5. Lieutenant Campbell observes as the result of his experiment that to produce the best crops 1·42 cubic yards per hour per acre is required for ploughing and planting.

2·56 for the first month
1·60 „ „ second „
1·39 till the crops are ripe.

6. Another plot adjoining supplied from the same tank is supposed to have

received an average of three yards per hour per acre, its cultivators drawing water from the old sluice and uncontrolled by us; its produce was—

	Rs.	A.	P.
3 $\frac{14}{125}$ Candies of paddy	74	7	11
420 Maunds of straw	21	0	0
	95	7	11
Or for 9 acres	286	7	9
The 9 acres under management produced	283	15	0
Compensation to the ryots is therefore due	0	8	9

7. At Peraly the experiment was a failure. The pipes were not ready early enough; the crop was not sown till September, and was therefore not strong enough to stand the heavy fall of rain, 22nd October.

	Rs	A.	P.
The 9 acres produced paddy and straw to the value of	44	3	11
The adjoining crop being worth	213	12	0
The ryots have lost	169	8	1

which I beg permission to pay.

In G. O., No. 1,462, 15th June 1870, were sanctioned	200	0	0
In G. O., No. 589, dated 28th February 1871, were sanctioned ...	200	0	0
	400	0	0
The cost of the cistern pipes, etc., at Chebrole ...	201	9	10
Do. do. at Peraly ...	133	1	3
Compensation at Chebrole	0	8	9
Do. at Peraly	169	8	1
	504	11	11

As there has been a saving in construction of Rupees 65-4-11, Rupees 104-11-11 only are needed to adjust all the charges.

8. I would beg to call attention to the point of the returns relatively to the ryot and the Government.

9. Lieutenant Campbell has omitted the cost of seed, interest on plant, etc., but allowing for these the cost of cultivating 1 acre is probably under Rupees 12.

10. The price of paddy and straw was not only low in consequence of abundant crops, but appears to have been entered exceptionally low by Lieutenant Campbell; the rates are below those given in other places, but even with these the Government assessment was only one-fifth of the produce and the ryot received nearly half as his own produce.

From Lieutenant D. McNEIL-CAMPBELL, R. E., Officer in charge of No. 2 Range, Kistna District, to the Executive Engineer, Western Delta, Kistna District, dated Bapatla, 16th June 1871.

I HAVE the honour to forward the following report on the irrigation experiments conducted in this range last year.

2. Government having sanctioned Rupees 200 in June 1870 for the purpose of conducting two experiments in this range to ascertain the quantity of water required for rice cultivation, Lieutenant Smith, who was then Range Officer, fixed upon Chebrole and Peraly as the most suitable places, the soil near the former being black cotton, and near the latter sand. Agreements were

then taken from the ryots to the effect that they would render every assistance in their power, and that they would in no way interfere with the experiments, provided Government gave them compensation for any loss they might sustain.

3. The ground chosen for the experiment at Chebrole was situated near the black tank and was 9 acres in extent; it was divided by bunds into three portions of 3 acres each, and at one end a drainage channel was dug having a calingulah for measuring the surplus water discharged.

4. A cistern of brick-in-chunam and plastered was built near No. 1 Irrigation channel (from the tanks), and was supplied with water from that channel through a small sluice at which a register was kept.

5. The water was discharged from the cistern by three iron pipes on the level of the ground and was carried to the fields by small open channels of tiles-in-chunam; the pipes were 1·03, 1·18, and 1·32 inches in diameter, and the cistern was constructed so that when full there would be a head of 1 foot 6 inches on the pipes by which the discharges were calculated at 1½, 2, 2½ cubic yards per hour per acre, using the formula D = A. C. $\sqrt{2\,gh}$ C. being taken ·611.

6. A lascar on Rupees 6 per month was placed in charge of the experiment, and was ordered to keep a register showing the height of water in the supply sluice to the cistern, in the cistern itself and on the calingulah. These measurements were to be taken three times a day, and the rainfall, state of crops, etc., were to be entered in a column of remarks; no thermometer being available, the temperature could not be noted; the direction of the wind was noted only after the crops had risen to some height.

7. I forward herewith a table prepared from the above register in which the amount of water supplied per acre per hour is shown; the discharge over the calingulah could not be entered, as I found by calculation that in many days the discharge was considerably greater than the rainfall and water supplied from the cistern, added together which shows that the water from other fields near was also discharged over it.

8. It can be seen from the table that the ploughing was commenced on the 25th August and the planting was completed in No. 1 and No. 3 plots on the 14th September, and in No. 2 on the 4th September. The quantity of water used is shown in the following tables:—

Table B.

Time of Supply.	1st Plot.		2nd Plot.		3rd Plot.		Remarks.
	Cubic yards supplied.	Cubic yards per acre per hour.	Cubic yards supplied.	Cubic yards per acre per hour.	Cubic yards supplied.	Cubic yards per acre per hour.	
From 22nd Aug. to 14th Sept.	2,464	1·42	.....	.....	3,746	2·16	The amounts supplied includes rainfall.
From 22nd Aug. to 4th Sept.	.....	.....	1,343	1·33	.....	.....	
From 15th to end of Sept....	2,698	2·50	.....	.....	3,789	3·50	
From 5th to end of Sept....	.....	.....	5,032	2·79	.....	.....	
October	5,719	2·56	6,488	2·9	7,230	3·24	
November	3,476	1·60	4,264	1·97	5,635	2·56	
From 1st to 11th December.	1,103	1·39	1,467	1·85	1,840	2·32	

9. The land was ploughed to a depth of about 5 inches. The quantity of seed planted was ⅛ candy per acre; it was of the first quality called Kuruma; sixteen bandy loads of manure were used per acre; it was composed of a mixture of fresh cowdung, cowdung ashes, and mud. The crops

were cut on the 27th December, and were carefully weighed and measured in the presence of Maunsing, the Navigation Superintendent, and the yield was as follows :—

		Rs.	A.	P.
1 Candy 8,325 lbs.	First plot $3\frac{2}{12}\frac{2}{12}$ candies at 24 Rupees per candy	79	13	5
	450 Maunds of straw at 1 Rupee per 20 maunds	22	8	0
	Total ...	102	5	5
	Second plot $2\frac{8}{12}$ candies at 24 Rupees per candy	67	14	0
	430 Maunds of straw at 1 Rupee per 20 maunds	21	8	0
	Total ...	89	6	0
	Third plot $3\frac{3}{12}$ candies at 24 Rupees per candy	73	2	0
	422 Maunds of straw at 1 Rupee per 20 maunds	21	1	7
	Total ...	94	3	7

The above are the values on the spot. It appears from this that the field supplied with the smallest amount of water produced the largest crops, and therefore from the table we will find that the proper supply of water required to produce the best crops is 1·42 cubic yards per acre per hour during the processes of ploughing and planting 2·56 cubic yards for the first month, 1·60 the next, and 1·30 till the crops are ripe, but, as last year, there was an unusual amount of rain. I should say that, judging from both tables A. and B. in average years, the number of cubic yards of water per acre per hour that will produce the best crops (exclusive of rainfall) would be 1·35 during the times of ploughing and planting two for the first six weeks, and 1·5 after that till the crops are ripe.

10. The amount produced from 3 acres of the adjoining land not under the experiment was

	Rs.	A.	P.
$3\frac{11}{12}$ Candies at 24 Rupees per candy	74	7	11
420 Maunds of straw at 1 Rupee per 20 maunds	21	0	0
	95	7	11

11. I find from the register of the Black tank sluice that the amount of water supplied to the last-mentioned land was about 3 cubic yards per acre per hour; this seems strange, as it proves that, with an average supply of 1·9 and 3 cubic yards per acre per hour, the crops are more than a 10th, an average supply 2·19 and 2·75; however, if the experiment can be depended on, it at least shows that better crops can be produced with an average supply of 1·9 cubic yards per acre per hour than with any greater quantity up to 3 cubic yards per acre. It costs a ryot on an average Rupees 17-8-0 per acre to cultivate rice; the different expenses are as follow :—

	Rs.	A.	P.
Ploughing and preparing ground	2	8	0
Planting	2	8	0
Manuring	2	8	0
Cutting	2	0	0
Grinding	2	0	0
Sist	6	0	0
Total ...	17	8	0

12. The value of the produce of 1 acre watered with about 1·9 cubic yards per hour, as shown by the experiment, is Rs. 34-1-9; consequently the profits to the ryots would be Rupees 16-9-9.

	Rs.	A.	P.
The cost of the cistern, etc., at Chebrole was	107	8	10
Superintendence	30	0	0
Total Expenditure ...	197	8	10
The value of the produce of the 9 acres was	285	15	0
The value of the produce of 9 acres of the adjoining fields was ...	286	6	2

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Therefore the compensation to be paid to ryots Rupees 0-7-2, and consequently the total cost of the experiment to Government is Rupees 198.

13. The experiment at Peraly was a complete failure; the seeds were not planted till very late, owing to the cistern and pipes not being ready; the ground chosen was very low and the drainage bad; for several weeks there was 18 inches of water lying in the fields; during the whole time the crops were in the ground, namely, from the 22nd September to the 31st January (131 days), it was only necessary to supply water from the cistern for thirty one days. Nothing can be proved from this experiment and it would therefore be useless to give tables of the discharge, etc. The extent of the ground, the arrangement of the cistern channels, etc., was the same here as at Chebrole; the yields of the plots, as found by measurements, were as follow :—

		Rs.	A.	P.
	First plot $\frac{12}{12}\frac{2}{12}$ candy at 24 Rupees per candy	15	3	7
	57 Maunds of straw at 1 Rupee per 20 maunds	2	13	7
	Total ...	18	1	2
	Second plot $\frac{11}{12}\frac{5}{12}$ candy at 24 Rupees per candy	11	5	2
	30 Maunds of straw at 1 Rupee per 20 maunds	1	8	0
	Total ...	12	13	2
	Third plot $\frac{11}{12}$ candy at 24 Rupees per candy	11	6	5
	39 Maunds of straw at 1 Rupee per 20 maunds	1	15	2
	Total ...	13	5	7

Therefore the value of the produce of the 9 acres was Rupees 44-3-11.

Value of produce of 9 acres of adjoining land not under the experiment.

	$7\frac{7}{12}$ Candies at 24 Rupees per candy	186	4	10
	549 Maunds of straw at 1 Rupee per 20 maunds	27	7	2
	Therefore the compensation to be paid to the ryots	169	8	1
	Cost of cistern	100	7	5
	Superintendence	25	8	0
	Total cost to Government ...	304	7	6

From Lieutenant D. McNEIL-CAMPBELL, R.E., Assistant Engineer in charge of 2nd Sub-Division, to the Executive Engineer, Western Delta, dated Bapatla, 21st November 1871, No. 307.

With reference to your docket No. 275,* dated 2nd instant, I have the honour to report as follows :—

* Enclosure is herewith returned.

1st.—The land selected is 734 yards distant from Chebrole black tank, which is supplied from the Commamore channel by a branch channel four miles in length. The average water level of the tank above the land while the experiment lasted was 4·71 feet, and the maximum and minimum difference was 2·92 feet.

2nd.—When I took charge of the range in the commencement of October, I was informed that the discharge was through iron pipes, and that Lieutenant A. C. Smith, my predecessor, had found by experiment the co-efficient to be ·614; this appeared small, but I thought it might be accounted for by the pipes being roughly made, or from some other cause. I now find that pipes were first placed in the cistern, they were afterwards removed and thin plates substituted, and it was through

the latter that Lieutenant Smith found the co-efficient of discharge to be ·614, which is right, and there is therefore no error in my table of discharges. While the cistern was full, I was of course unable to find out that these plates had been substituted for pipes, and it was only by examining the empty cistern at Peraly a few days ago that I discovered the mistake, and was then informed that the discharge at Chebrole was regulated in the same manner. The iron plates used are $\frac{1}{8}$th inch thick.

3rd.—The cistern was supplied from a channel (from the black tank) by a sluice, and a rough stone dam was placed below to raise the water to the proper level. The water in the cistern was kept as much as possible at a uniform height of 1 foot 6 inches; but when there was heavy rain this head had to be reduced in order to prevent the fields from being flooded. The cistern was provided with an escape weir, so that the water should not rise above the required level, namely, $1\frac{1}{2}$ feet. On *the 10th and 18th September, 9th October, and 6th November, it appears that an excess* of water was let into the cistern and consequently there was 1 inch of water flowing over the weir; the head of water was, therefore, 1 foot 7 inches, which accounts for the large discharge through the plates on these days. The Acting Chief Engineer observes that no water was admitted to the lands from the cistern on the 21st and from 23rd to 30th October, and states that he presumes the water was thus retained owing to the difficulty of estimating the quantity discharged from each plot; it certainly was impossible to estimate the quantity of water discharged from each plot, as there was only one surplus weir for the three plots; but the water was not retained for this reason, but because there was so much rain that more water would probably have destroyed the crops. I fail to see why the experiment is untrustworthy owing to the surplus water not having been measured, for I don't think that because a certain quantity of water was discharged that therefore that water was not necessary for the crops. This would be presuming that any extra water, besides what is absorbed and evaporated, is useless; it would no doubt be interesting to know the quantity of water run off to find how much could be utilized for further irrigation, but I don't see that it affects the experiment itself. The Chief Engineer in his Circular No. 1, dated 15th February 1870, writes that information is wanted on two points:—

1*st.*—What is the quantity of water really required to the proper irrigation of an acre of different descriptions of rice cultivation with different soils, amounts of rainfall, etc.?

2*nd.*—What quantity of water is actually used?

I am of opinion that the first question has been answered fully by the experiment, which proves that with certain soil, rainfall, etc., a certain quantity of water produces better crops than any larger quantity. The second question has not been answered, as the surplus was not measured, but as Major Mullins says in the same memorandum the point may be best ascertained from areas of any size, the irrigation works of which are provided with sluice and regulators which will allow of the supply and the surplus being measured with fair accuracy.

2. In conclusion, I beg to state that though the experiment is of great theoretical interest, I am of opinion that it will never be of any practical use; for suppose it is proved that on a small and well prepared piece of ground, say $1\frac{1}{2}$ cubic yards, per acre per hour produces the best crops and that we therefore allow this discharge through a sluice irrigating 1,000 acres, it is very probable that some of the fields would be almost dry and others perfectly irrigated and some have an excess of water, thus the discharge will always have to be regulated by the state of the fields and no theoretical supply will be proper, an allowance in excess of this must always be made and the amount of this allowance can only be guessed from experience of the cultivation of large areas; for in no case will it be found that a large extent of field is in the same condition, some of them will be better ploughed and absorb more water than others, some will be high, some low, some will have steep slope, others a slight one, and some will be nearly level.

3. It will be very difficult even to find out experimentally what amount of water is required and the experiment will have to be continued for many years. There have already been several experiments and the results have in cases been different even with the same soil, and so they will

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continue to differ, and it will only be by taking the mean of a number of experiments that a true theoretical result will be arrived at; that these results differ is natural, when it is taken into consideration that even in carefully prepared grounds there are many conditions that would effect the crops; thus the slightest (even imperceptible) difference in the ploughing in the slope of the ground, in the quality of the seed, in the temperature of the water, etc., etc., might increase or decrease the produce materially.

No. 140.

FORWARDED to the Chief Engineer for Irrigation with reference to his No. 169 of 17th October 1871.

CAMP KAMARAPULLY,
15th January 1872.

(Signed) F. J. MOBERLY, Colonel, R.E.,
Superintending Engineer, 2nd Division.

TABLE A.—*Table showing the quantity of water used in the Irrigation Experiment at Chebrolu.*

Month.	Date.	1st Plot. Area Acres 3, Drain of Supply Pipe 1·02″. Number of cubic yards supplied from cistern.	Rain fall in cubic yards.	Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.	2nd Plot. Area Acres 3, Drain of Pipe 1·18″. Number of cubic yards supplied from cistern.	Rain fall in cubic yards.	Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.	3rd Plot. Area Acres 3, Drain of Pipe 1·32″. Number of cubic yards supplied from cistern.	Rain fall in cubic yards.	Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.
August 1870.	22	35·28	.....	35·28	·49	.....	47·52	.....	47·52	·66	.....	58·32	.....	58·32	·81	
	23	35·28	.....	35·28	·49	.....	47·52	.....	47·52	·66	.....	58·32	.....	58·32	·81	
	24	35·28	.....	35·28	·49	.....	47·52	.....	47·52	·66	.....	58·32	.....	58·32	·81	
	25	35·28	.....	35·28	·49	2 acres ploughed once.	47·52	.....	47·52	·66	The whole field ploughed.	58·32	.....	58·32	·81	The whole field ploughed except 4 coontas.
	26	44·16	.....	44·16	·61	2½ acres ploughed ...	59·52	.....	59·52	·82	The whole field planted except 5 coontas.	74·16	.....	74·16	1·03	Do. do.
	27	44·16	.....	44·16	·61	2½ do. do. ...	59·52	.....	59·52	·82	Do. do. ...	74·16	.....	74·16	1·03	Do. do.
	28	50·40	201·60	252·00	3·50	2¾ do. do. ...	65·28	201·60	266·88	3·70	Do. do. ...	84·48	201·60	286·08	3·97	The whole field ploughed once and 1 acre ploughed twice.
	29	50·40	.....	50·40	·70	3 acres ploughed once. 1½ acres ploughed for the 2nd time.	65·28	.....	65·28	·82	2½ acres planted ½ acre ploughed	84·48	.....	84·48	1·17	The whole field ploughed once, ¾ acre ploughed twice.
	30	76·8	.....	76·8	1·06	1¼ acres planted and the remainder ploughed once.	102·96	.....	102·96	1·43	Do. do. ...	129·12	.....	129·12	1·76	3 acres ploughed once, 1 acre ploughed twice.
	31	76·8	.....	76·8	1·06	Do. do. ...	102·96	.....	102·96	1·43	Do. do. ...	129·12	.....	129·12	1·76	Do. do., 1½ acres ploughed twice.
	1	58·56	.....	58·56	·81	1½ acres planted ... ½ acre ploughed twice.	84·48	.....	84·48	1·17	The whole field planted.	99·44	.....	99·44	1·38	3 acres ploughed twice.
	2	108·00	.....	108·00	1·50	1¼ acres ploughed once	144·00	.....	144·00	2·0	Do. do. ...	180·00	.....	180·00	2·5	Do. do.
	3	105·12	.....	105·12	1·46	Do. do. ... 3 acres ploughed 3 times, 2¼ acres transplanted.	140·40	.....	140·40	1·95	The whole field transplanted.	175·20	.....	175·20	2·43	Do. do., 8 coontas planted.
	4	95·52	.....	95·52	1·32	2½ do. do. ... ½ acre ploughed once.	127·20	.....	127·20	1·76	Do. do. ...	158·68	.....	158·68	2·20	8 coontas transplanted, etc., the remainder ploughed twice.
						Total...	1,141·68	201·60	1,343·28	18·54						
September 1870.	5	108·00	.....	108·00	1·50	2½ acres transplanted. ½ acre ploughed once.	144·00	.....	144·00	2·0	Crops thriving well.	180·00	.....	180·00	2·5	Do. do.
	6	108·00	.....	108·00	1·50	Do. do. ...	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	Do. do.
	7	74·24	.....	74·24	1·03	Do. do. ...	129·36	.....	129·36	1·79	.....	161·28	.....	161·28	2·26	8 coontas transplanted, 1½ acres ploughed thrice, remainder do. twice.
	8	67·2	.....	67·2	·93	Do. do. ...	90·48	.....	90·48	1·25	.....	112·80	.....	112·80	1·56	1 acre transplanted, 2 acres ploughed thrice.
	9	108·00	.....	108·00	1·50	Do. do. ...	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	Do. do.
	10	110·64	403·2	513·84	7·27	The whole field planted except ¼ acre.	150·24	403·2	553·44	7·68	.....	185·32	403·2	588·52	8·17	Do. do.
	11	108·00	.....	108·00	1·50	Do. except 8 coontas.	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	2 acres planted.
	12	108·00	.....	108·00	1·50	Do. do. ...	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	2½ do.
	13	108·00	.....	108·00	1·50	The whole field planted.	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	The whole field planted.
	14	108·00	.....	108·00	1·50	Do. do. ...	144·00	.....	144·00	2·0	.....	180·00	.....	180·00	2·5	Do. do.
	Total.	1,859·12	604·8	2,463·92							Total...	3,141·52	604·80	3,746·32		

Table showing the quantity of water used in the

Month.	Date.	1st Plot. Area Acres 3, Drain of Supply Pipe 1·02″. Number of cubic yards supplied from cistern.	Rain fall in cubic yards.	Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.	2nd Area Acres 3, Number of cubic yards supplied from cistern.	Rain fall in cubic yards.
September 1870.	15	108·00	806·4	914·40	12·70	Crops thriving well.	144·00	806·4
	16	108·00	.....	108·00	1·50	.....	144·00	.....
	17	108·00	.....	108·00	1·50	.....	144·00	.....
	18	110·64	.....	110·64	1·53	.....	150·24	.....
	19	108·00	.....	108·00	1·50	Crops thriving well.	144·00	.....
	20	108·00	.....	108·00	1·50	.....	144·00	.....
	21	108·00	161·1	269·10	3·73	.....	144·00	161·1
	22	108·00	120·90	228·90	3·17	.....	144·00	120·90
	23	108·00	.....	108·00	1·50	.....	144·00	.....
	24	108·00	.....	108·00	1·50	.....	144·00	.....
	25	108·00	.....	108·00	1·50	.....	144·00	.....
	26	108·00	.....	108·00	1·50	.....	144·00	.....
	27	95·12	.....	95·12	1·46	.....	140·40	.....
	28	108·00	.....	108·00	1·50	.....	144·00	.....
	29	.....	.....	.....	.....	Pipes closed.	.....	.....
	30	108·00	.....	108·00	1·50	.....	144·00	.....
	Total.	1,609·76	1,088·40	2,698·16		Total...	3,540·72	1,491·60
October 1870.	1	108·00	.....	108·00	1·50	.....	144·00	.....
	2	108·00	.....	108·00	1·50	.....	144·00	.....
	3	108·00	.....	108·00	1·50	.....	144·00	.....
	4	108·00	.....	108·00	1·50	.....	144·00	.....
	5	105·12	.....	105·12	1·46	.....	140·40	.....
	6	108·00	.....	108·00	1·50	.....	144·00	.....
	7	80·48	.....	80·48	1·12	.....	106·56	.....
	8	108·00	.....	108·00	1·50	.....	144·00	.....
	9	116·64	.....	116·64	1·62	.....	156·96	.....
	10	108·00	.....	108·00	1·50	.....	144·00	.....
	11	108·00	806·4	914·40	12·70	.....	144·00	806·4
	12	105·12	201·6	306·72	4·26	.....	140·40	201·6
	13	108·00	.....	108·00	1·50	.....	144·00	.....
	14	108·00	.....	108·00	1·50	.....	144·00	.....
	15	105·12	.....	105·12	1·46	.....	140·40	.....
	16	105·12	.....	105·12	1·46	.....	140·40	.....
	17	70·92	.....	70·92	·98	.....	96·30	.....
	18	101·76	806·4	908·16	12·61	.....	131·80	806·4
	19	101·76	403·2	504·96	7·01	.....	131·80	403·2
	20	101·76	201·6	303·36	3·21	.....	131·80	201·6
	21	.....	302·4	302·4	4·17	.....	.....	302·4
	22	108·00	403·2	511·20	7·10	.....	144·00	403·2
	23	.....	241·8	241·8	3·35	.....	.....	241·8
	24	.....	100·8	100·8	1·40	.....	.....	100·8
	25	.....	.....	.....	.....	.....	.....	.....
	26	.....	.....	.....	.....	.....	.....	.....
	27	.....	.....	.....	.....	.....	.....	.....
	28	.....	.....	.....	.....	.....	.....	.....
	29	.....	.....	.....	.....	.....	.....	.....
	30	.....	.....	.....	.....	.....	.....	.....
	31	70·2	.....	70·2	·97	.....	110·56	.....
	Total.	2,252·00	3,467·4	5,719·4	.....	Total...	3,020·38	3,467·4

Irrigation Experiment at Chebrole.—(Continued.)

2nd Plot. Drain of Pipe 1·18″. Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.	3rd Plot. Area Acres 3, Drain of Pipe 1·42″. Number of cubic yards supplied from cistern.	Rain fall in cubic yards.	Total number of cubic yards in 24 hours.	Average number of cubic yards per acre per hour.	Remarks.
950·40	13·20	.....	180·00	806·4	986·40	13·70	
144·00	2·0	.....	180·00	.....	180·00	2·5	
144·00	2·0	.....	180·00	.....	180·00	2·5	
150·24	.....	.....	185·52	.....	185·52	2·57	
144·00	2·0	Crops thriving well.	180·00	.....	180·00	2·5	Crops thriving well.
144·00	2·0	.....	180·00	.....	180·00	2·5	
305·10	4·23	.....	180·00	161·1	341·10	4·73	
264·90	3·67	.....	180·00	120·90	300·90	4·17	
144·00	2·0	.....	180·00	.....	180·00	2·5	
144·00	2·0	.....	180·00	.....	180·00	2·5	
144·00	2·0	.....	180·00	.....	180·00	2·5	
144·00	2·0	.....	180·00	.....	180·00	2·5	
140·40	1·95	.....	175·20	.....	175·20	2·43	
144·00	2·0	.....	180·00	.....	180·00	2·5	
.....	.....	Pipes closed.	.....	.....	.....	.....	Pipes closed.
144·00	2·0	.....	180·00	.....	180·00	2·5	
5,082·32		Total...	2,700·72	1,088·4	3,789·12		
144·00	2·00	.....	180·00	.....	180·00	2·50	
144·00	2·00	.....	180·00	.....	180·00	2·50	
144·00	2·00	.....	180·00	.....	180·00	2·50	
144·00	2·00	.....	180·00	.....	180·00	2·50	
140·40	1·95	.....	175·20	.....	175·20	2·43	
144·00	2·00	.....	180·00	.....	180·00	2·50	
106·56	1·46	.....	134·08	.....	134·08	1·86	
144·00	2·00	.....	180·00	.....	180·00	2·50	
156·96	2·14	.....	196·08	.....	196·08	2·72	
144·00	2·00	.....	180·00	.....	180·00	2·50	
950·40	13·20	.....	180·00	806·4	986·40	13·70	
342·00	4·75	.....	175·20	201·6	376·80	5·23	
144·00	2·00	.....	180·00	.....	180·00	2·50	
144·00	2·00	.....	180·00	.....	180·00	2·50	
140·40	1·95	.....	175·20	.....	175·20	2·43	
140·40	1·95	.....	175·20	.....	175·20	2·43	
96·30	1·33	.....	120·24	.....	120·24	1·67	
941·20	13·02	.....	170·40	806·4	976·80	13·56	
538·00	7·47	.....	170·40	403·2	573·60	7·96	* Owing to the quantity of rain the bunds separating the fields were entirely covered with water and washed away in many places
336·40	4·67	.....	170·40	201·6	372·00	5·16	
302·4	4·17	.....	.....	302·4	302·4	4·17	Pipe closed.
547·20	7·60	.....	180·00	403·2	583·20	* 8·10	
241·8	3·35	.....	.....	241·8	241·8	3·35	
100·8	1·40	.....	.....	100·8	100·8	1·40	Pipe closed.
.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	
110·56	1·53	.....	120·72	.....	120·72	1·67	Pipes opened.
6,487·78	.....	Total...	3,703·12	3,467·4	7,230·52	.....	

No. 26.

Note by the Acting Chief Engineer for Irrigation.

With his letter No. 53, dated 3rd August 1871, the Superintending Engineer of the 2nd Division forwarded a report from Lieutenant D. McNeil Campbell, R.E., of the experiments undertaken by him under G. O., No. 1,462, of 15th June 1870, relative to the quantity of water required to bring a rice crop to maturity. As it appeared that the quantity of water passing to the lands had not been correctly calculated, a reference was made to the Superintending Engineer on the subject, and from Lieutenant Campbell's reply it would appear that the water was not supplied through pipes as originally stated, but by a notch in a thin plate, the quantities of water supplied are therefore correct.

No. 169, 17th October.

2. *The experiment was tried at Peraly and Chebrole.* The experiment at Peraly failed completely, owing to the lateness of the season at which it was undertaken, and to defective drainage of the site selected.

3. At Chebrole the experiment was tried on a plot of 9 acres, which was divided into three parts of 3 acres each, and these were supplied with different quantities of water, the results being as follows:—

Number of plot.	Average supply of water per hour in cubic yards.	Yield of Paddy in Candies.	Value of Paddy in Candies.	Yield of Straw in Maunds.	Value.	Total value of Crop.
			Rs. A. P.		Rs. A. P.	Rs A. P.
1	1·93	$3\frac{2}{5}\frac{0}{1}\frac{8}{6}$	79 13 5	450	22 8 0	102 5 5
2	2·3	$2\frac{7}{2}\frac{5}{6}\frac{2}{1}$	67 14 0	430	21 8 0	89 6 0
3	2·74	$3\frac{3}{6}\frac{4}{4}$	73 2 0	422	21 1 7	94 3 7

From these it would appear that the greatest yield was from the plot which received nearly 2 cubic yards per hour, but the yield from the plot receiving $2\frac{3}{4}$ cubic yards per hour was higher than that from a plot which received $2\frac{1}{3}$ cubic yards per hour, while from a neighbouring plot cultivated in the ordinary manner, and which is believed to have received about 3 cubic yards per hour, the yield was somewhat higher than that from the experimental plot which was supplied with $2\frac{3}{4}$ cubic yards per hour.

4. No arrangements were made for estimating the discharge of water passed off from each plot as surplus, while the experiment was conducted under a tank in which the water stood from about $6\frac{1}{4}$ to $3\frac{1}{4}$ above the level of the land while the experiment lasted; under the circumstances no satisfactory deductions can be drawn from the experiment.

5. The experiments were undertaken on the condition that the ryots were to receive compensation for any loss due to the experiments; the loss has been as follows:—

	Rs. A. P.
At Chebrole	0 8 9
At Peraly	169 8 1
Cost of cistern, etc., at Peraly	133 1 3
Do. do., at *Chebrole*	201 9 10
	504 11 11

Proceedings of the Madras Government, Public Works Department,
30th March 1872.

Rupees 400 were sanctioned for the experiments, leaving a balance of Rupees 104-11-11 to be provided, the sanction of which the Superintending Engineer solicits.

6. Lieutenant Campbell appears to misapprehend the object with which the experiment is being carried out; for he states, "I don't think that because a certain quantity of water was discharged that therefore that water was not necessary for the crops." The object of the experiment is to ascertain this very point, and it is on this account that it is absolutely necessary to estimate the quantity of surplus water which is allowed to escape from the plots, and to supply some plots with the minimum of water so that there shall be little or no surplus, and others with larger quantities in order that there may be water constantly running over the fields, and by a comparison of the outturn under these conditions it will be ascertained which is the more favourable condition for the rice crops.

7. If the experiments are carefully carried out and information on all points adverted to in G. O., No. 30, dated 8th January 1872, is correctly recorded, the most valuable deductions may be drawn from them.

(Signed) R. F. OAKES, Captain, R.E.,
Acting Chief Engineer for Irrigation.

No. 640. ORDER THEREON, 30th March 1872, No. 872A.

IRRIGATION, No. 30.

THE Government regret that no satisfactory deductions can be drawn from the experiments made in the 2nd Division relative to the quantity of water required to bring a rice crop to maturity owing to the unsuitableness of one of the sites selected for the experiment and to the omission to note the discharge of surplus water from each plot at the other site.

2. The Government direct that in the experiments to be carried out in 1872-73 under G. O., No. 30, dated 8th January 1872, the instructions contained in the Notes by the Acting Chief Engineer for Irrigation may be most carefully followed.

3. A sum of Rupees 104-11-11 to cover the cost of the experiment carried out in 1870-71 is sanctioned and allotted from the Minor New Works grant for the Madura District under Agricultural.

(True Extract.)

(Signed) R. F. OAKES, Captain, R.E.,
Acting Joint Secretary to Government.

To the Superintending Engineers, 2nd and 8th Division.
To all other Superintendending Engineers.
,, Controller of Public Works Accounts.
,, Chief Engineer for Irrigation.

Exd. E. C. Shunker.

(Signed) D. Lamb Lieut. R.E.
Assistant Engineer Kildare Div.

(True Copy)
Alleeds Colonel R.E.
Chief Engineer D. Div.

| | | |

| | | |

October 1880

17	70.92	0	70.92	.98	"	96.30	0	96.30	1.33	"	120.24	0	120.24	1.67			
18	101.76	806.4	908.16	12.61	"	134.80	806.4	941.20	13.02	"	170.40	806.4	976.80	13.56			
19	101.76	403.2	504.96	7.01	"	134.80	403.2	538.00	7.47	"	170.40	403.2	573.60	7.96			
20	101.76	201.6	303.36	3.21	"	134.80	201.6	336.40	4.67	"	170.40	201.6	372.00	5.16			
21	0	302.4	302.4	4.17	"	0	302.4	302.4	4.17	"	0	302.4	302.4	4.17			
22	107.20	403.2	511.20	7.10	"	144.00	403.2	547.20	7.60	"	180.00	403.2	583.20	8.10			
23	0	241.8	241.8	3.35	"	0	241.8	241.8	3.35	"	0	241.8	241.8	3.35			
24	0	100.8	100.8	1.40	"	0	100.8	100.8	1.40	"	0	100.8	100.8	1.40			
25	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
26	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
27	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
28	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
29	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
30	0	0	0	0	"	0	0	0	0	"	0	0	0	0			
31	70.2	0	70.2	.97	"	110.56	0	110.56	1.53	"	120.72	0	120.72	1.67			
Total	2252.00	3467.4	5719.4		Total	3020.38	3467.4	6487.78		Total	3763.12	3467.4	7230.52				
1	76.8	0	76.8	1.06	"	102.96	0	102.96	1.43	"	129.12	0	129.12	1.79			
2	76.8	0	76.8	1.06	"	102.96	0	102.96	1.43	"	129.12	0	129.12	1.79			
3	96.88	0	96.88	1.35	"	133.76	0	133.76	1.85	"	161.92	0	161.92	2.24			
4	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
5	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
6	110.64	0	110.64	1.53	"	150.24	0	150.24	2.06	"	185.52	0	185.52	2.57			
7	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
8	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
9	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
10	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
11	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
12	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
13	108.00	0	108.00	1.50	"	144.00	0	144.00	2.00	"	180.00	0	180.00	2.50			
13th forward	1333.12	0	1333.12		13th forward	1786.92	0	1786.92		13th forward	2225.68	0	2225.68				

Corrected Nov 8th

Owing to the quantity of rain the Limestone Refractory the pulps were entirely covered with water & washed away in many places

Offices opened

| | | |

B5

A4

were to be entered in a Column of Remarks, as no Thermometer being available the temperature could not be noted, the direction of the wind was noted only after the crops had risen to some height.

I forward herewith a table prepared from the above Register in which the amount of water supplied per acre per hour is shown; the discharge over the Caliyala could not be entered as I found by calculation that in many days the discharge was considerably greater than the rain fall and water supplied from the Cistern added together which shows that the water from other fields above, was also discharged over it.

It can be seen from the table that the ploughing was commenced on the 25th August and the planting was completed in No 1 No 3 Plots on the 14th September and in No 2 on the 4th September. The quantity of water used is shown in the following tables.

Table B.

Tab B

1st Plot. 2d Plot. 3d Plot.

Time of Sufsfly	Cubic yards Sufsfly	Cubic yards per Acre per hour	Cubic yards Sufsfly	Cubic yards per Acre per hour	Cubic yards Sufsfly	Cubic yards per Acre per hour	Remarks.
From 22d Augt to 14 Sept.	2464	1.42	"	"	3746	2.16	The
From 22d Augt to 4 Sept.	"	"	1343	1.33	"	"	Amounts
From 15th to 22d September	2698	2.80	"	"	3789	3.80	Sufsfly
From 5th to 22d September	"	"	5032	2.79	"	"	includes
October	5719	2.56	6488	2.9	7230	3.24	Rain
November	3476	1.60	4264	2.11	5535	2.56	fall
From 1st to 11th December	1103	1.39	1467	1.85	1840	2.32	

The land was ploughed to a depth of about 5 inches. The quantity of seed planted was to Candy per acre, it was of the 1st quality called Kuruma. 16 Candy loads of manure were used per acre it was composed of a mixture of fresh cowdung, cowdung ashes, & mud. The crops were cut on the 27th December and were carefully weighed and measured in the presence of Mr Dinning the Navigation Superintendent and the Yield was

as

No 2 or Daupatta Range

Office Daupatta

16th June 1871.

From The Officiar in charge
No 2 Range Kistna Delta

To The Executive Engineer
Western Delta K. D.

Sir

I have the honor to forward the following report on the Irrigation Experiments Conducted in this Range last year.

Government having sanctioned Rs 200 in June 1870 for the purpose of conducting two experiments in this Range to ascertain the quantity of water required for rice cultivation; Lt. Smith who was then Range Officer fixed upon Chabrole and Darly as the most suitable places, the soil near the former being black Cotton and near the latter sand.

Agreements were entered into from the Ryots to the effect that they would render every assistance in their power and that they would in no way interfere with the experiments provided Government gave them Compensation for any loss they might sustain.

The ground chosen for the experiment at Chabrole was situated near the black tank and was 9 acres in extent, it was

divided by bunds into 3 portions of 3 acres each & at once cut a drainage Channel was dug having a Calingulah for measuring the Surplus water discharged.

A cistern of brick in Chunam & plastered, was built near No 1 Irrigation Channel from the tanks and was supplied with water from that Channel through a small sluice at which a register was kept.

The water was discharged from the Cistern by 3 Iron pipes on the bank of the ground and was carried to the fields by small open Channels of tiles in Chunam. The pipes were 10 3/4, 1.18, & 1.32 inches in diameter and the Cistern was constructed so that when full there would be a head of 1.6" on the pipes by which the discharges were calculated at 1 1/2, 2, 2 1/2 ~~inches in diameter & the Cistern~~ was constructed so that when full there would be a head of 1.6" on the pipes by which the discharges were calculated at 1 1/2, 2, 2 1/2 Cubic yards per hour per acre, using the formula

$D = A.C. \sqrt{2gh}$ Calingula taken .614.

A Lascar on Rs 6 per month was placed in charge of the experiment and was ordered to keep a register showing the height of water in the supply sluices to the Cisterns, in the Cistern itself & on the Calingula, these measurements were to be taken three times a day and the rain fall, state of crops &

1 Candy 3325 lbs

as follows.

1st Plot $3\frac{209}{640}$ Candies at Rs 24 per Candy - 79 - 13 - 5

450 Maunds of Straw at Re 1 per 20 Maunds - 22 - 8 - 0

Total 102 - 5 - 5

2nd Plot $2\frac{53}{64}$ Candies at Rs 24 per Candy. 67 - 14 - 0

430 Maunds of Straw at Re 1 per 20 Maunds. 21 - 8 - 0

Total 89 - 6 - 0

3rd Plot $3\frac{3}{64}$ Candies at Rs 24 per Candy. 73 - 2 - 0

422 Maunds of Straw at Re 1 per 20 Maunds 21 - 1 - 7

Total 94 - 3 - 7

The above are the values on the 8th plot. It appears from this that the field supplied with the smallest amount of water produced the largest crops, and therefore, from the table we will find that the proper supply of water required to produce the best crops is 1.42 Cubic yards per acre per hour during the first two periods of ploughing and planting 2.56 Cubic yards for the first month 1.60 Between 1 & 1.39 till the crops are ripe. But at last year there was an abnormal amount of rain. I should say that, judging from both tables

A. B in average years, the number of cubic yards of water per acre per hour that will produce the best crops (Exclusive of rain fall) would be 1.35 during the times of ploughing and planting 2 for the first 6 weeks and 1.5 after that till the Crops are ripe

The Amount produced from 3 Acres of the adjoining land not under the experiment was

3 13/125 Candies at Rs 24 per Candy 74-7-11

420 Rounds of Shanal Rs 1/- per 20 Rounds 21-0-0

Total 95-7-11

I find from the Register of the Black tank Sluices that the amount of water supplied to the last mentioned land was about 3 Cubic yards per acre per hour, this seems strange as it proves that milk an average supply of 1.9 V 3 Cubic yards per acre per hour, the Crops are more than milk an Average Supply 2.19 V 2.75; however if the experiment can be depended on, it at least shows that better crops can be produced milk an average supply of 1.9 Cubic yards per acre per hour, than milk any greater quantity up to 3 Cubic yards per acre. Ito Costs a Ryot on an average Rs 17-8-0 per acre to cultivate piece the different Expenses are as follows-

Ploughing and preparing ground	2-8-0
Planting	2-8-0
Manuring	2-8-0
Cutting	2-0-0
Grinding	2-0-0
Sent	6-0-0
Total	17-8-0

The value of the produce of 1 acre watered milk about 1.9 Cubic yards per hour as shown by the experiment is 34-1-9 Consequently the profits to the Ryots would be 16-9-9

The Cost of the Cistern Vizt

at Chabrole was Rupees- 167-8-10

Superintendence- 30-0-0

Total Expenditure 197-8-10

The value of the produce of the 9 acres was Rupees- 285-15-0

The value of the produce of 9 acres of the adjoining fields was Rupees 286-6-2

Therefore the Compensation to be paid to Ryots Annas 7-2 Consequently the total Cost of the experiment to Government is Rupees 198-0-0

The Experiment at Darly was a Complete failure; the Seeds were not planted till very late, owing to the Cistern and pipes not being ready; the ground chosen was very low & the drainage bad; for Several weeks there was 18" of water lying in the fields; during the whole time the crops were on the ground Vizt from the 22d September to the 31st January (131 days) it was only necessary to supply

water from the Cistern for 31 days - Nothing can be proved from this experiment and it would therefore be useless to give tables of the discharges &c. The extent of the ground. the arrangement of the Cistern Channels &c. was the same here as at Chabrole, the yields of the plots as found by measurements were as follows.

1st Plot 0 $\frac{203}{320}$ Candies at Rs 24

per Candy -	15 - 3 - 7
57 Inands of Steam at Re 1 per 20 Inands -	2 - 13 - 7
Total	18 - 1 - 2

2nd Plot $\frac{151}{320}$ Candies at Rs 24

per Candy -	11 - 5 - 2
30 Inands of Steam at Re 1 per 20 Inands -	1 - 8 - 0
Total	12 - 13 - 2

3rd Plot $\frac{19}{30}$ Candies at Rs 24

per Candy -	11 - 6 - 5
39 Inands of Steam at Rs 1 per 20 Inands -	1 - 15 - 2
Total	13 - 5 - 7

Therefore the value of the produce of the 9 acres was Rupees 44 - 3 - 11

Value of the produce of 9 acres of adjoining land not under the Experiment.

$\frac{61}{320}$ Candies at Rs 24 per Candy 186 - 4 - 10

Steam 27 Inands of Steam at Re 1 per 20 Inands - 27 - 7 - 2

Candies 213 - 12 - 0

Brought Over - 213 - 12 - 0

Therefore the compensation to be paid to the Ryots. 169 - 8 - 1

Cost of Cistern 109 - 7 - 5.

Superintendence 25 - 8 - 0.

Total Cost & Government 304 - 7 - 6.

Have the honor to be
Sir
Your most obed Servt
Ed Balfour Capt 46th N.I.
and Engineer to Govt

(True Copy)
Goodeve Colonel R.E.
Sup. & Engineer 2nd Div

Enclosure in a letter No 23
of 3d August 1871 from
the Superintending Engineer
2nd Division to the Chief
Engineer for Irrigation

P.Pr. 1238/72

Superintending Engineers Office
2nd Div. Camp Thuriyapetty
3d August 1871

From
Colonel J. J. Moberly R.E.
Superintending Engineer 2nd Div.

To
The Chief Engineer
for Irrigation
Madras

Sir

I have the honor to enclose copy of a report by Lieut. A. Mahon Camp Adt R.E. in whose range the investigation mentioned in P.O. No 1462. 15th June 1870 was carried out and a statement showing the quantity of water, rain fall &c day by day on the 3 plots of 3 acres each at Kalrole.

2 The soil is not of a very accurately kept, but any errors must be common to all plots & relative comparison will be fair enough, while the fact that the manage per acre of the 9 acres is very nearly that of 9 acres adjoining not subject to experiment, leads to believe that the error is not very considerable.

3 I would however suggest Captain Mahon's suggestion that the experiment be carried again at a cost of Rs 35 with better observation and proposes to commence the expenditure from Rabi in agricultural immediately.

4 From the Summary it appears that
the 1st plot 15460 Cubic yards were supplied
(rain included) during 104 days or 2.06 per hour
per acre

	Cubic yards	Days	per hour per acre
4 the 2nd plot	18596	104	2.48
3d "	22140	104	2.95

The 1st plot produced $3\frac{209}{640}$ Cwdies of Ladyed
24 Rs per Cwdy 79-13-5
450 Drams of Straw 22-8-0 102-5-5

2nd " $2\frac{215}{864}$ Cwdies of seeds
at 24 Rs per Cwdy 67-14-0
430 Yds of Straw 21-8-0 89-6-0

3d " $3\frac{3}{4}$ Cwdies of seeds
at 24 Rs per Cwdy 72-2-0
422 Yds of Straw 21-1-7 93-3-7

Rs 286-15-0

5 Lieut Campbell observed on the progress
of his experiment that to produce Rabee
crops 1.62 Cubic yards per hour per acre
is required for ploughing and planting
2.56 for the 1st Month
1.60 2nd "
1.39 till the crops are reaped

6 Another plot adjoining was supplied from
the same tank is supposed to have received
an average of 3 yds per hour per acre - its
cultivation drawing water from the old sluices
and

Person employed in the production was
$3\frac{13}{25}$ Cwdies of Ladyed - 74-7-11
420 Drams of Straw 21-0-0
95-7-11
or for 9 acres 286-7-9
The 9 acres under Management produced 286-15-0
Compensation to the Ryots
as therefore due 0-8-9

7 As Lieut Campbell's experiment was a
failure the fields were not ready early
enough the crops not down till September
& were therefore not strong enough to stand
the heavy fall of rain 22nd October; the 9 acres
produced Rabee and stand to Rs value of 44-3-11
The adjoining Crops being worth 213-12-0
the Ryots have lost 169-8-1
as their loss by remission of Rent
& Tank Irrigation is fixed at
Rs 200 by Govt Order 1462 15 Jun 1870 and
" " 589 dated 28 Feb 1871 " 200-0-0
400-0-0
The cost of the Cesses fixed at Rs for 9 acres 201-9-11
Paraly 133-1-3
Commutation at Rs for 9 169-8-1 304-11-11

as there has been a saving in Commutation
Rs 65-4-11 Rs 104-10-8 only are needed to
adjust all the charges

8 I would beg to call attention to the point of the returns relatively to the Ryot and the Government.

9 Lieut Campbell has omitted the cost of seed- interest on plant &c- but allowing for these the cost of cultivating one acre is probably under Rs. 12.

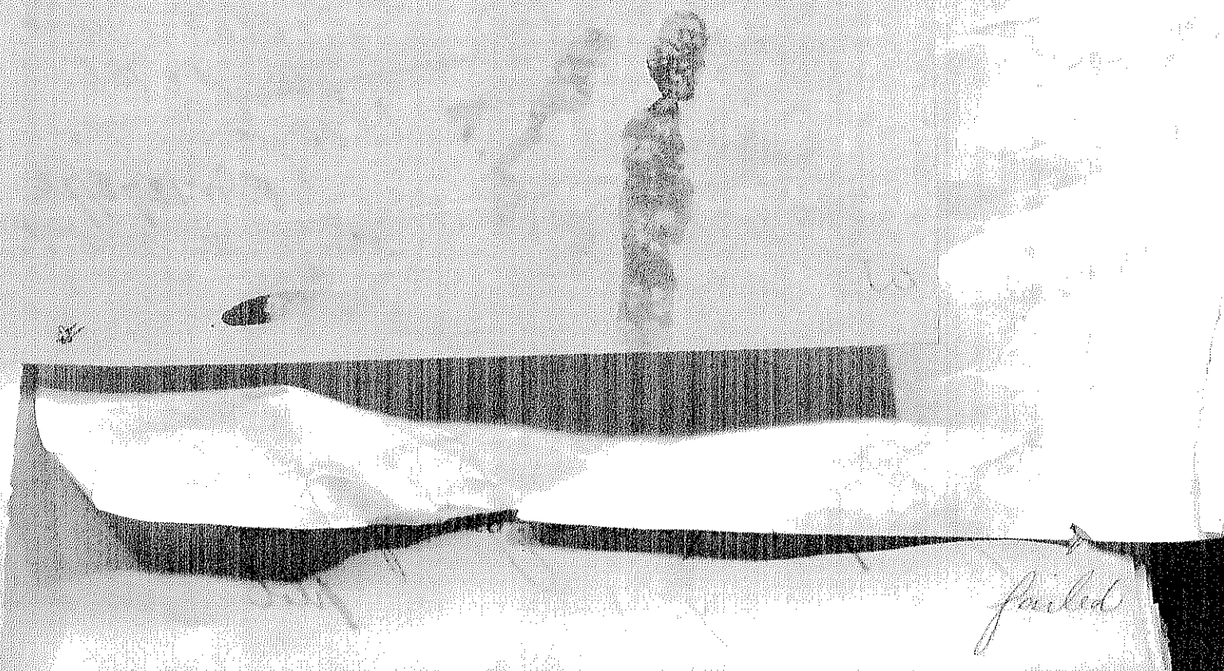
10 The price of paddy and straw was not only low in consequence of a bumper crop but appears to have been exceptionally low by Lieut Campbell- the rates are below those given in other places- but even with these, the Government assessment was only $\frac{1}{5}$ of the produce and the Ryot received nearly $\frac{1}{2}$ as his own profits.

Thanking the Hon'ble
&
Hon'ble Members of Council

I have &c &c

Superintendent Engineer &c &c

Selos



passed

No 26

Note by the Acting Chief Engineer for Fingo

with his Letter No 33 dated 3rd Augt to

the Superintending Engineer of the 2nd Division

forwarded a Report from Resident Engineer

Campbell &c of the expenditure undertaken

by him under GO No 262 of 15 June 1871

for the quantity of pails required to issue

a piece 8ft 6 inches long, the estimated rate

the quantity of wood proving to be 1½ inch

not less correctly calculated, & Reports were

made to the Superintending Engineer on the

subject and from Lieutenant Elmsley

Resty it would appear that the water was

supplied through pipes as originally stated but

by a notch in a stem piece, the quantities

made up pipes are therefore correct and

from the statement now submitted

said Chiefs the expenditure does not exceed

Enclosures 4

No 169
17 October

failed completely owing to the lateness of the season at which it was undertaken and to defective drainage of the site selected.

3. At Chebrolo the experiment was tried on a plot of 9 acres which was divided into 3 parts of 3 acres each and these were supplied with different quantities of water, the results being as follows

No. of Plot	Average supply of water per hour in cubic yards.	Yield of Paddy in Candies	Weight per Rs	Yield of Straw in pounds	Value	Total value of Crop
			Rs. as. p.		Rs. as.	Rs. as. p.
1	1·93	$3\frac{209}{640}$	79·13·5	450	22·8	102·5·5
2	2·3	$2\frac{53}{64}$	67·14·—	430	21·3	89·6
3	2·74	$3\frac{3}{64}$	73·2	422	21·1·7	94·3·7

4. From these it would appear that the greatest yield was from the plot which received nearly 2 cubic yards per hour, but the yield from the plot receiving $2\frac{3}{4}$ cubic yards per hour was higher than that from a plot which received $2\frac{1}{3}$ cubic yards per hour, while, from a neighbouring plot cultivated in the ordinary manner and which is believed to have received about 3 cubic yards per hour the yield was somewhat higher than that from the experimental plot which was supplied with $2\frac{3}{4}$ cubic yards per hour.

5. No arrangements were made for estimating the discharge of water passed off from each plot as supplied; while the experiment was conducted under a tank in which the water stood from about $6\frac{1}{4}$ to $3\frac{1}{4}$ above the level of the land, while the experiment lasted; under the circumstances no satisfactory deductions can be drawn from the experiment.

6. The experiments were undertaken on the condition that the Ryots were to receive compensation for any loss due to the experiments. The loss has been as follows

at

Co of C

Cost of Shebole ... 85-9

" " Peraboya ... 16-4-8

Cost of Cistern &c at Peraba ... 133-4-2

" " Shebole ... 201-9-10

504 11 11

Rs 500 were sanctioned for the experimental pumping establishment of Rs 1000-11-11 for the Irrigation, the expenditure of which the Superintending Engineer selects

6. Lieutenant Campbell appears to misapprehend the object with which the Experiment is being carried out for he states "I think that because a certain quantity of water was discharged that therefore that Quantity was no necessary for the Crops". The object of the Experiment is to ascertain this very point and it is on this account that it is absolutely necessary to estimate the quantity of surplus water which is allowed to escape from the plots & to supply some plots with the minimum of water so that they shall be flatter or precipitous & others with larger quantities in order that they may be water constantly running over the fields cultivated by a comparison of the outturn under these conditions it will be ascertained which is the most favourable Condition for the Rice Crop

7. If the Experiments are carefully carried out & information on all points adverted to in Nº 30 dated 8th January 1872 is correctly recorded the most valuable deductions may be drawn from them.

Fort St George
11th March 1872

I have &c
(Sd) J. Goe Captain RE
Offg Chief Engineer for Irrigation

To
The Secretary to Government

No 307.

Assistant Engineer's Office 2nd Dist
No. W Delta Division
21st December 1871.

From Lieutenant G. McNeil Campbell R.E.
Assistant Engineer in charge
2nd Sub Dn.

To Captain Henry H. Vibart R.E.
Executive Engineer Western Delta

Sir,

With reference to your docket No. 295 dated 2nd instant, I have the honor to report as follows.

1st. The land selected is 531 yards distant from Chebrole Ghaut which is supplied from the Ennemoore Channel by a branch channel 4 miles in length - the average water level of the bank above the land while the experiment lasted was 4.92' and the maximum and minimum difference was 2.92'.

2nd. When I took charge of the Range in the commencement of October, I was informed that the discharge was thro iron pipes and that Lieutenant A.G. Smith my predecessor had found by experiment the co-efficient to be .81; this appeared small; but I thought it might be accounted for by the pipes being roughly made or from some other cause - I now find that

Transcribed for Cornell

pipes were first placed in the cistern, they were afterwards removed and their plates substituted and it was through the latter that Lieutenant Smith found the co-efficient of discharge to be .614 which is right and there is therefore no error in my table of discharges. While the cistern was full, I was of course unable to find out that these plates had been substituted for pipes and it was only by examining the empty cistern at Parel a few days ago, that I discovered the mistake and was then informed that the discharge at Mahrole was regulated in the same manner; The iron plates used are $\frac{1}{8}$ inch thick.

2. The cistern was supplied from a channel (from the block tank) by a sluice, and a rough stone dam was placed below to raise the water to the proper level; the water in the cistern was kept as much as possible at a uniform height of 1'-6"; but when there was heavy rain this head had to be reduced in order to prevent the fields from being flooded. The cistern was provided with an escape weir so that the water should not rise above the required level viz 1'-6". On the 10th & 18th September, 9th October and 1st November it appears that an excess of water was let into the cistern and consequently there was 1" of water flowing over the weir; the head of water was therefore 1'-7" which accounts for the large discharge through the plates on these days. The acting Chief Engineer observes that no water was counted to the lands from the cistern on the 21st and from 23rd to 30th October and states that he presumes the water was then retained owing to the difficulty of estimating the quantity discharged from each plot, it certainly was impossible to estimate the quantity of water discharged from each plot as there was only one surplus weir for the three plots. But the water was not retained for this reason; but because there was so much rain, that more water would probably have destroyed the crops. I fail to see why the experiment is untrustworthy owing to the surplus water not having been measured, for I don't think that because a certain quantity of water was discharged, that therefore that water was not necessary for the crops. This would be presuming that any extra water besides what is absorbed and evaporated is useless; it would no doubt be interesting to know the quantity of water run off to find how much could be utilized for further irrigation but I don't see that it affects the experiment itself. The Chief Engineer in his Circular No 1 dated 15th February 1870 writes that

information is wanted on two points

1st What is the quantity of water really required to the proper irrigation of an acre of different descriptions of ground - treated with different soils, assumed Equal all [illegible] 1st

2nd What quantity of water is exhausted - Less of opinion that the latter question has been answered fully by the experiment which proves that with certain soil, rain fall &c a certain quantity of water proves better crops than any larger quantity

The 2nd question has not been answered as the surplus was not measured, but as Major Dunlop says in his letter, the point may be best ascertained from crops of any size the irrigation works of which are provided with sluices and regulators which will allow of the supply and the surplus being measured with fair accuracy

In conclusion I beg to state that the experiment is of great theoretical interest. I am of opinion that it will never be of any practical use. for suppose it proved that an annual and well prepared layer of ground 2 ozs 1½ yards

for acre per hour produces the best crops and we therefore allow this discharge through a sluice irrigating 1000 acres, it is probable that some of the soils will be absorbed very quickly and others [illegible] completed and some how or even quicker than the discharge will always have to be regulated by the state of the soils and actual supply will be proportioned as an allowance on account of the most always be made and the amount of this allowance can only be guessed from experience of the working of large areas, for it is not likely that a large extent of soils of the same description some of them will be better ploughed and absorb more water than others some will be high & dry others low, some will have deep subsoil others shallow and some will be more level

It will be very difficult even to find out experimentally what amount of water is required and the experiment will have to be continued for many years. There have already been several experiments and the results have in each been different and the results have in each been different even with the same soil and so they will continue to differ and it will only be by taking the mean of a number of experiments that a true theoretical result will be

mined at; that these results differ so
material, when it is taken into considera-
tion that even in carefully prepared grounds
there are many conditions that would affect
the crops; these the slightest (even imperceptible)
differences in the ploughing in the slope of
the ground, in the quality of the seed in the
temperature of the water &c &c might
increase or decrease the produce materi-
ally -

I have the honor to be
Sir,
Your Most obedt Servant
(Sgd) D. Gr. Neil Lieut Colonel R.E.
Assistant Engineer

No 160 (True Copy)
Forwarded to the Chief Engineer
for Irrigation with reference to his No 169 of
17 October 1871.

(Sgd) J. Thuillier Lt Colonel R.E.
Supdg Engineer & Director

Supdg Engr's Office
Chunar Rampart
15th January 1872

Public Works Depart.

Extract from Proceedings of the Madras Govt.

Read the following

Letter from Chief Engr. for Irrigation, dated 11th March 1899 No. 26

The Government regret that no satisfactory deductions can be drawn from the experiments made in 2nd Division relative to the quantity of water required to bring a nice Crop to maturity owing to the unsuitableness

Rupees 104-11-11 to cover the cost of the experiments carried out in 1870/71 is sanctioned and allotted from the Minor Works grants for the Chingleput District under Agric. - culturals.

1.7.72

Wardle

To The Supdg. Engr. 2nd Dn.
" Controller
" Chief Engr. for Irrigation
" All others Concd.

Desp. 9/4/72.

unsuitableness of one of the sites selected for the experiments and to the omission to note the discharge of surplus water from each plot at the other site.

The Government direct that in the experiments enjoined to be carried out in 1872/73 under G.O. No 30 dated 8th January/72 the instructions contained in the Notes by the Acting Chief Engineer for Irrigation may be most carefully followed.

A sum of

No. 278
Dept. of Int. Affairs.
PUBLIC WORKS.

The Superintending Engr
2 & 8 th Division

30 Rules 8 1/2 x 4

No. 1934640

Ex Clerk's Copy No.
Ex Day Ex Chief Engr
Ex Copy Letter from Ex
Ex Copy Ex Asst
Ex Ex Engineers for
Ex Division.