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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

Revenue DEPARTMENT

G.O. No.	1293	Press.
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Dated	12.8.1878	197

Not to be folded or roughly handled

1293
1

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

12th August 1878, No. 1,293.

Read the following paper:—

No. 169. Proceedings of the Board of Revenue, dated 19th July 1878, No. 2,004.

Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Sydapet, 27th June 1878, No. 573:—

I HAVE the honor to submit the following report in compliance with the instructions conveyed in paragraph 15 of G.O., No. 3,255, of the 16th of November last.

2. The first experiments in sub-soil drainage, conducted by officers of the Sydapet Farm, were begun in 1873; the next was started in 1875; and the last of them (which, though not conducted on the farm, were carried out in close proximity to it) were begun in 1876. In all five experimental plots, measuring together about 7 acres, have been drained. These plots may be distinguished as Nos. 1, 2, 3, 4, and 5.

3. These experiments were not designed to determine the comparative results they would afford; however, Nos. 1 and 2 were expected to yield results that could be compared, they having been instituted at the same time and in the same field under similar conditions; and the same was the case with Nos. 4 and 5.

4. The whole of the drainage was conducted in the same way under what is known as the "parallel" or "grid-iron" system. All of the land drained was before drainage in a very bad physical state and quite unproductive, excepting under very favorable circumstances.

5. *Experiment No. 1.*—This plot measured 8,742 square yards. The parallel drains were $3\frac{1}{2}$ feet deep and 24 feet apart and the main drain was 4 feet deep.

6. When this experiment was instituted it was found quite impossible to obtain drain pipes any where near Madras, and native potters and tile-makers refused to make them, excepting at a price so high as to prohibit the use of the pipes in field drainage. Under these circumstances, a quantity of ordinary 2-inch sewage pipes were obtained in Madras. Of course, it would not be fair to charge the experiment with the original cost of these pipes, as for field drainage purposes they were very little superior to ordinary drain pipes. Since that time we have succeeded in making pipes on the farm. The following is the cost per 1,000 now incurred for making ordinary 2-inch drain pipes:—

	RS.	A.	P.
Preparing the clay	0	8	0
Removing the clay to the machine	0	3	0
Screening the clay	0	12	0
Making the pipes	1	0	0
Rolling the pipes	0	14	0
Labor at the kiln	0	8	0
Fuel consumed	4	0	0
Superintendence, wear and tear of plant, breakages, &c.,			
25 per cent. on outlay	1	15	3
Total	9	12	3

The cost per thousand for 2-inch pipes was Rupees 9-12-3, or in round figures Rupees 10. The average cost for making 4-inch pipes was Rupees 15 per thousand. All the pipes were made one foot in length.

7. Taking the foregoing figures for determining the cost of the pipes, the drainage of Plot No. 1 cost as below :—

	Total Cost.			Cost per Acre.		
	RS.	A.	P.	RS.	A.	P.
Cutting 1,088 lineal yards of parallel drains, at Rupees 3-8-0 per 200 lineal yards	19	0	8	10	8	8
Cutting 95 lineal yards of main drain, building an outlet, and providing a grate	6	13	11	3	12	10
3,264 2-inch pipes at 10 Rupees per 1,000	32	10	3	18	1	2
285 4-inch do. at 15 do. do.	4	4	5	2	5	11
Cart-hire for conveying the pipes from the kiln to the field	3	0	0	1	10	7
Laying the pipes and filling the earth into the trenches, 29 men at 3 Annas, and 53 women at 2 Annas	12	1	0	6	10	10
Total ...	77	14	3	43	2	0

8. Had the parallel drains been made one foot deeper and placed further apart, which it is now evident they might have been, the cost would have been considerably reduced; thus had they been placed 36 feet apart instead of 24 feet, and made $4\frac{1}{2}$ feet deep the cost of draining an acre would have been under Rupees 30, which sum could have been recovered by an annual rent charge of Rupees 2-3-0 per acre, paid during twenty-five years, in which time the whole of the capital with interest at 5 per cent. would be recovered.

9. The results first perceptible, after draining this plot, were very encouraging not merely was the difference that between no crop and a fair crop, but very abundant crops were obtained considering the low capabilities of the soil.

10. Referring to this field before it was drained I wrote in my report for 1872-73 as follows:—"The soil is a stiffish loam, of a sour soapy character, resting on a sub-soil of a similar nature, and it has been almost unproductive during the five years I have been acquainted with it. The land was formerly (before it became the property of Government) used for growing paddy under the repeated cultivation of which it had become injured. When heavily seeded there was generally a fair looked well as long as their roots were confined to the few inches of healthy surface growth, and the plants became stunted, turned yellow, and gradually became the prey of fungoid diseases. It mattered not what crop was tried on this soil; the result invariably was the same, utter failure."

11. The land after being drained was thoroughly tilled and was prepared for maize and cotton, the produce of which per acre was as follows:—

	RS.	A.	P.
793 lbs. of maize, at 30 lbs. per Rupee			
1,104 " of cob stalks, skins, &c.	26	6	11
4,112 " of straw	2	12	2
70 " of cotton lint, at 120 Rupees per candy	18	5	9
153 " of do. seed	16	12	10
	3	1	0
Total ...	67	6	8

The cost of producing the crop and preparing it for market was as follows :—

Expenditure.		RS.	A.	P.
Ploughing, cleaning the soil				
Ridging		3	0	0
5½ tons of blood manure compost		0	8	0
27 parabs of lime		5	12	0
Carting and spreading manure		7	14	0
Splitting ridges		3	8	0
Chain harrowing ridges to consolidate the soil		0	8	0
Seed and sowing		0	2	0
Chain harrowing to cover seed		1	0	0
		0	2	0
Total ...		22	6	0

Cultivation during Growth.

2 ploughings between the rows	7	8	0
4 hand-hoeings			
Scaring birds, &c.	1	0	0

Harvesting the Maize crop.

Gathering cobs...	1	8	0
Carting	0	6	0
Peeling, tying, hanging, &c.	1	8	0
Shelling	0	8	0
Reaping straw	1	0	0
Carting straw	0	12	0
	5	10	0
Gathering cotton, ginning, &c.	10	0	0
Total ...	46	8	0

12. The difference between income and expenditure thus amounted to Rupees 20-14-8 per acre, from which if Rupees 2-3-0, the annual rent charge for drainage, be deducted the difference remaining to credit is Rupees 18-11-8.

13. Since it was drained this land has been regularly cropped, and it has yielded as fair results as other soils of the farm in a good physical state. Up to as late as the last monsoon the drainage appeared to be working very satisfactorily. I saw the outlet pipe on two or three occasions last monsoon discharging as much water as it could carry and therefore concluded that the whole drainage was working satisfactorily. However in January last, being anxious to ascertain the exact state of the pipes, I requested Mr. Benson to have a trench cut right across the parallel drains, and to expose the pipes. The following extract is from his report:—

"The drains were opened in two places: first at about one-third the distance from the end of the subsidiary drain, and again at their junction with the main. In the first case only one pipe was found to be completely blocked with silt; of the rest five were more or less so, and the remaining six were nearly clear; in the case of three pipes completely so; from one pipe (No. 3) a specimen showing clearly the stratification of the silt was taken and is sent herewith.

"On opening the pipes at their junction with the main I found that it was quite clear at the first cross drain only; the amount of silt in the main increased up to No. 10 cross drain, where a complete block exists, so that drains Nos. 11 and 12 are useless, although the latter is quite clear of silt. Besides cross drains Nos. 1 and 12, Nos. 2, 3, and 6 are still nearly, if not quite, free of silt at the spot where I opened them; drains Nos. 4, 5, 7, 9, and 11 are from half to two-thirds blocked, whilst Nos. 8 and 10 are completely so.

"I noticed that the clay used in joining the cross and main drain pipes was intact, although filled with roots. At the jointure of the pipes, in several cases, a portion of the cross drain pipe projects into the main, thereby causing a partial block in it; and further, whilst the pipes on the eastern side (Nos. 1, 2, &c.) enter the main with a considerable fall those towards the western side, where increased fall is of more necessity owing to their distance from the outfall, enter the main, with a very slight fall.

"Part of the blocking up of the pipes may be due to their having sunk unevenly since they were laid, for in the case of No. 1 I found when I opened it towards its upper end that it was full of water, which on opening the pipe ran out from both sides to the spot where I had come upon it. I do not think that the stoppages are due to the influences of the roots of plants, although I found grass roots all around the pipes, but not inside. I think that the sockets are not capable of fitting close enough to prevent the admission of very large quantities of soil, and that, in this particular instance, in some places the laying has not been perfect in placing the pipes as closely as possible together. The numerous cracks which drought causes in the soil of this field have, I think, there can be no doubt, been the main cause of the silting; for on the eastern side of the field where the soil is black clay they were most abundant and largest, the pipes have been more completely choked up, but on the western side where the soil is freer and lighter so much silt has not apparently entered the pipes."

14. I was much surprised to find the pipes silted up in the way described by Mr. Benson, seeing that the discharge of water from the outlet pipe was so large up to the time of the last heavy rains before Mr. Benson's investigation. It is possible that, though the pipes in some of the drains are silted up, the sub-soil water may flow along over the bottom of the drained trenches until it reaches the main pipes; and if this is so, and it continues, some benefit may still be experienced from the drainage.

1293
5

No. 2,004.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 19th July 1878.

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6. When this experiment was instituted it was found quite impossible to obtain drain pipes any where near Madras, and native potters and tile-makers refused to make them, excepting at a price so high as to prohibit the use of the pipes in field drainage. Under these circumstances, a quantity of ordinary 2-inch sewage pipes were obtained in Madras. Of course, it would not be fair to charge the experiment with the original cost of these pipes, as for field drainage purposes they were very little superior to ordinary drain pipes. Since that time we have succeeded in making pipes on the farm. The following is the cost per 1,000 now incurred for making ordinary 2-inch drain pipes :—

	RS.	A.	P.
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Removing the clay to the machine	0	3	0
Screening the clay	0	12	0
Making the pipes	1	0	0
Rolling the pipes	0	14	0
Labor at the kiln	0	8	0
Fuel consumed	4	0	0
Superintendence, wear and tear of plant, breakages, &c.	1	15	3
25 per cent. on outlay			
Total	9	12	3

The cost per thousand for 2-inch pipes was Rupees 9-12-3, or in round figures Rupees 10. The average cost for making 4-inch pipes was Rupees 15 per thousand. All the pipes were made one foot in length.

Sub-soil Drainage Experiment. According
 with remarks Proceedings of the Board of Revenue
 submitting report on the — conducted on the
 Sydapet Experimental Farm.
 AUGUST
 No. 163,170.
 G.O., 12th August 1878, No. 1,393.
 Dated August 19th.
 P. 17th.
 REVENUE.
 THE BOARD OF REVENUE.
 18th August 1878.

15. My own opinion is that the silt found its way into the pipes in the first instance chiefly while the land was full of very large cracks, just after the completion of the drainage and before the land had had time to experience any benefit therefrom.

16. Of course in such a novel experiment it was not to be expected that the workmen would perform the work in as satisfactory a way in every respect as could be desired; but taking it as a whole the work was very fairly done, and was quite equal to much of the work of the kind done in England and Ireland, in which countries there could be no doubt but that the work, as executed in this experiment, would have yielded satisfactory results.

17. *Experiment No. 2.*—This experiment was instituted at the same time and in the same field as Experiment No. 1. The area of the plot was 8,742 square yards. The ordinary drains were $3\frac{1}{2}$ feet deep and they were placed 24 feet apart. The main drain, which was placed at right angles to the parallel drains, was 4 feet deep, and at its outlet a grate was placed.

18. In this experiment broken stones were used instead of pipes; the stones were broken to a size sufficiently small to admit of them being passed through a ring of 3 inches in diameter; these stones after screening were placed in the parallel drains to the depth of 1 foot and in the main drain to the depth of $1\frac{1}{2}$ feet. Great care was exercised to prevent any soil falling into the trenches along with the stones.

19. Owing to the inability of the laborers to excavate narrow trenches to the depth required and to use ordinary drain tools there was no choice but to allow them to cut the trenches in their own way, that is by means of crowbars, mamooties, and baskets, which necessitated the trenches being of a sufficient width for this. The trenches at their bottoms were fully one-half wider than was necessary, and this compelled the use of a much larger quantity of stones than is usual.

20. The following statement shows the cost incurred for draining this plot:—

	Cost.			Cost per Acre.		
	RS.	A.	P.	RS.	A.	P.
Cost of cutting parallel drains, 988 lineal yards, at $3\frac{1}{2}$ Rupees per 200 lineal yards	17	4	8	9	9	2
Cost of cutting main drains, 97 lineal yards, building an outlet, and providing a grate	6	14	7	3	13	3
Cost of broken stones, 341 parabs at 4 Pies per parah, and 1,658 parabs at $3\frac{1}{2}$ Pies per parah ...	35	2	8	19	7	6
Cart-hire for carting broken stones from quarry, 66 days, at Annas 12	49	8	0	27	6	6
Cost of placing the broken stones in the drains, filling drains, &c., 25 men at 3 Annas per day, and 45 women at 2 Annas per day	10	5	0	5	11	1
* Total ...	119	2	11	65	15	6

21. The cost was very high, due chiefly to the large quantity of stones required and the expense incurred for carting them.

22. The discharge of water from the outlet of this drained plot was never great, but it rapidly became smaller and smaller and entirely ceased in the second year after the drainage was done. On examining the drain trenches the stones were found to be intimately mixed and concreted together with fine silt through which no water could pass.

23. The soil after drainage appeared to be much improved and very fair crops of maize and cotton were obtained from the land in 1873-74. But the crop obtained in the following year was an inferior one, and all those produced on the land since have been greatly inferior to those yielded by the other portion of the field drained with pipes.

24. From this experiment nothing resulted to afford any encouragement to the use of broken stones in land-draining under such conditions as are met with here. The alternate expansion and contraction of land due to its alternate supersaturation and extreme dryness prove highly injurious to the efficacy of stone drains. In England and in Ireland I have known stone drains made in exactly the same way

as in this experiment last many years, working almost as satisfactorily as pipe drains. The cultivator who is willing to work can generally procure broken stones without any expenditure of money, which, when pipes have to be used, is usually unavoidable; hence in parts of India where the climate is not characterised by alternate extremes of drought and of moisture, stone drainage might probably suit the circumstances of the cultivator better than pipe drainage.

25. As far as the information I possess enables me to judge, I do not think that drainage by means of broken stones is at all suited to the general circumstances of the land of Southern India.

26. *Experiment No. 3.*—This was instituted in 1875; the land is situated at a very low level, and it is usually submerged every second or third year to a depth of from 2 to 5 feet by the overflow of water from the Marmalong tank during floods in the river Adyar.

27. It was not anticipated that the drainage of this land could be satisfactorily carried out from the impossibility at the time of procuring a proper outfall and from the soft marshy state of the soil.

28. The work was not carried out as an experiment, but simply as an ordinary work of reclamation. I have therefore no records showing details of expenditure. The result was so far satisfactory in that we have been enabled to make some use of the land after the periodical floodings to which it is subjected, whereas, prior to the drainage, the flood-water remained so long in the land but little could be done towards filling it until so late in the season as to be not worth while to sow it.

29. I asked Mr. Schiffmayer, a few days ago, to have the drain trenches opened out and the pipes exposed in order to determine their condition. The following is an extract from his report:—

"I examined the pipes yesterday; the following are the results:—

"Drain No. 1 (see accompanying Sketch-map)."

"About one-tenth of the number of pipes quite clear of silt.
Do. four-tenths do. contained only little silt.
Do. five-tenths do. half-filled with silt."

Drain No. 2.

"About two-tenths of the pipes clear of silt.
Do. seven-tenths do. contained a little silt.
Do. one-tenth do. half-filled with silt."

Drain No. 3.

"About one-tenth of the pipes clear of silt.
Do. two-tenths do. contained a little silt.
Do. four-tenths do. about half-filled with silt.
Do. one-tenth do. about three-fourths filled with silt.
Do. two-tenths do. completely filled with silt."

Drain No. 4.

"About one-tenth of the number of pipes clear of silt.
Do. five-tenths do. contained a little silt.
Do. one-tenth do. half-filled with silt.
Do. one-tenth do. three-fourths filled with silt.
Do. two-tenths do. completely filled with silt."

Drain No. 5.

"About one-tenth of the number of pipes clear of silt.
Do. three-tenths do. contained a little silt.
Do. six-tenths do. half-filled with silt."

Drain No. 6.

"About one-tenth of the number of pipes clear of silt.
Do. one-tenth do. contained a little silt.
Do. six-tenths do. half-silted up.
Do. two-tenths do. completely silted up."

Drain No. 7.

"About two-tenths of the number of pipes clear of silt.
 Do. two-tenths do. contained a little silt.
 Do. one-tenth do. three-fourths silted up.
 Do. five-tenths do. completely silted up."

Drain No. 8.

"About one-tenth of the number of pipes clear of silt.
 Do. three-tenths do. contained a little silt.
 Do. three-tenths do. half-silted up.
 Do. three-tenths do. three-fourths silted up."

Drain No. 9.

"About one-twentieth of the number of pipes clear of silt.
 Do. three-twentieths do. contained a little silt.
 Do. ten-twentieths do. three-fourths silted up.
 Do. six-twentieths do. completely silted up."

Main Drain.

"From the north end of the drain to the junction of the seventh parallel drain, the pipes nearly all contained some silt; they were mostly half-silted up, a few only being quite open."

"The pipes from the junction of the seventh parallel drain to the outfall were nearly all completely silted up. The small junction pipes were mostly open. Of the deposit filling the pipes, only little consisted of fine sand mixed with clay; the greater part consisted of coarse sand with a texture similar to the surface soil."

30. The remaining two experiments were conducted on a piece of land situated about a mile from the Experimental Farm. As I have recently submitted very full reports on these experiments,—*vide* Proceedings of the Board, No. 3,081 of the 6th of December 1876, and No. 1,326 of the 16th of May last—it seems to be unnecessary to review their results again here.

31. So far we have not succeeded in draining really efficiently any one of the experimental plots. The difficulties encountered were far greater than had been anticipated; owing chiefly to the peculiar physical condition of the soils and the very great and sudden changes to which they are subjected from extremes of drought and extremes of moisture. It is only immediately after the execution of the drainage and before the soil has had time to benefit from it that the cracks are so large and prove so injurious. If during the first year the silting-up of the pipes could be prevented, I do not think that there would be much likelihood of their silting up afterwards, provided proper care was taken by adopting deep tillage to keep the surface soil thoroughly open to a good depth.

32. Had it been possible to drain in two operations, as is the practice in many parts of the United Kingdom, I think that the difficulties experienced regarding the shrinkage and cracking of the soils could have been in a measure overcome. The practice I refer to is that in which the drain trenches are dug in the first year and the drainage completed in the second year. Here, if drain trenches were left open in the monsoon, they would be thoroughly ruined by the heavy rain, and the surface of the land would probably be much cut up and injured. We are therefore, I think, compelled to institute and complete the work between the monsoons.

33. We have, in carrying out these experiments, collected a large amount of information which will be useful in indicating modifications which can with advantage be introduced in carrying out drainage operation in this country.

34. Most of the experiments under notice, it must be remembered, were made under unusually adverse circumstances, for it rarely indeed happens in Europe that the Land Drainer is called upon to drain land by subsoil drains which at times is flooded by water to a depth of several feet.

35. I have arranged for the institution of another small experiment in which junction pipes in one piece will be used for connecting the parallel and main drains, and in which the junctions of the pipes will be protected by collars, while silt tanks will be placed in the main drain for the deposit and easy removal of the silt that finds its way into the pipes after they are first laid.

36. There is nothing I think disheartening in the fact that we have not yet discovered an efficient system of subsoil drainage fully adapted to the conditions met with in this Presidency. Even in England where the conditions are far more favorable for subsoil drainage, the practice of drainage was at first attended with many drawbacks and was adopted generally only after many years of patient investigation, during which these drawbacks were gradually overcome and removed.

37. There is no doubt whatever but that subsoil drainage can effect much good in this country on certain land, and I have no doubt but that the cost of drainage can be brought within a reasonable amount. I do not at all advocate the general drainage of land, but only of land either temporarily or permanently in a very bad physical state from the accumulation in it of stagnant water.

ENCLOSURE No. 1.—Sketch.

SUBMITTED for the information of Government.

2. These drainage experiments have not achieved success, but they clearly indicate the advantage of continued experiment.

3. If it was long before drainage experiments were brought to a successful issue in England, it is not to be expected that the desired end should be gained by one stride in India. The application of English methods to India shows that they are not exactly suitable, and that there are in this country peculiar difficulties to be contended with in the blockage of pipes by silt, formed seemingly by the extreme dryness of the surface soil, cracked by the heat of a tropical sun. This may possibly be obviated in some measure by the means which Mr. Robertson proposes to adopt.

4. Stone-draining proved more expensive than piping and a complete failure except for a time.

5. While the drains were in working order the crop obtained was an improved one, which indicates that a satisfactory system of draining suitable to the peculiarities of the climate is a desideratum to be further pursued.

6. As far as they go, the results are in the direction of progress, and the experiments should be continued.

(A true Copy and Extract.)

J. H. Munnell
 Acting Sub-Secretary.

To the Secretary to Government, Revenue Department, with Sketch to be returned.
 Copy to the Superintendent, Government Farms.

Exd. W. H. French.

