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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No.	387	Press
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176-177		
Dated	6. 2.	18 69.

Not to be folded or roughly handled

No. 176. Read the following Proceedings of the Government of India in the Public Works Department, (Irrigation,) dated Fort William, 11th December 1868, No. 366 I.

Extent to which Irrigation Canals should be designed for cold weather or moonsoon irrigation.
Read—

From the Under Secretary to the Government of Bombay, in the Public Works Department, Irrigation Branch, to the Secretary to the Government of India, Public Works Department, dated 21st November 1868, Nos. 146 I—2,738.

With reference to Circular No. 107, dated 25th October 1867, I am directed to transmit, for the information of the Government of India, a Memorandum from the Chief Engineer for Irrigation, No. 1,906, dated 12th ultimo, forwarding, with his remarks, reports from certain Executive Officers in the Irrigation Department, Dekkan, on the question of designing Irrigation Works for cold weather or moonsoon irrigation.

—

Report by the Chief Engineer for Irrigation, Bombay, dated 12th October 1868, No. 1,906.

1. Agreeably to Government Resolutions Nos. 108 I, dated 23rd November 1867, and 102 I and 107 I of 3rd and 11th August 1868, reports have been submitted by four of the Executive Engineers in the Dekkan, Captain Penny, Mr. Griffith, Mr. Campbell, and Lieutenant Buckle. These reports are attached. They illustrate the largeness of the moonsoon supply of water in the rivers; the extreme smallness of the rubbee supply; the cultivation of the same grains at different seasons, whenever there is sufficient rain; the smallness of the rain-fall, except close to the ghauts; and the absence of rice cultivation.

2. With respect to the last point, the question is raised as to how far the people will change their ordinary staple crop for rice when works of irrigation are constructed; and as this question has an important bearing on the subject of the papers received from the Government of India, it is desirable to consider it.

3. In the Dekkan, where the rain-fall is small and precarious, straw is of great value to the cultivators. It is required in large quantities for their cattle, and it fetches a high price in the market. Joyaree straw being infinitely more valuable for forage than rice straw, it is clear, I think, that the latter crop would never entirely supersede the former, even were the water-rates the same, whereas under fair and equitable arrangements, they ought to be in the proportion of about four to one, the higher charge being placed upon the rice. Supposing the water to be sold by volume, the effect would be the same.

4. In questions of this nature, facts, however small they may appear to be, are useful, and I am in possession of two which support the view I have expressed. In Khandeish, during the moonsoon of 1852, when there was scarcity of rain, and the small plots of irrigated land on the old village works were cultivated to their utmost capability, I noticed that sugar-cane, bajaree, and rice were grown side by side. The first had been in the ground for some time, being the usual crop grown, but the remainder of the land which, under ordinary circumstances, would have been kept for the succeeding year's sugar crop, was sown with rice and bajaree, when the rain failed. Had rice been really so much more valuable than bajaree, it would have been grown to the exclusion of the latter on the whole of the unoccupied ground, as there was no want of water in the water-course at that season. Again, bajaree and jowaree straw are both brought into Poona for forage, whereas rice straw, though procurable within 15 miles, is never brought in, except in small quantities, for the purpose of packing articles, and not for forage.

5. The following statement shows the cultivator's profit per acre on different irrigated crops, as ascertained by Major Elphinstone when Superintendent of Survey Settlement in Khandeish:—

Name of Crop.	Profit per acre
Sugar-cane ...	RS.
Rice (best) ...	115
" (ordinary) ...	30
Haldee ...	25
Guavas and limes ...	45
Onions, large ...	55
Garlic ...	25
Vegetables ...	23
Egg plant ...	37
Sweet potato ...	17
Early " ...	23
Onions, small ...	12
Red pepper ...	17
Earth-nut ...	21
Indian corn ...	23
Carrots ...	23
Peas ...	16
Gram ...	11
Wheat ...	11
Mussoor ...	24
Methee ...	11
Bajeree and other jerayat crops ...	11
	25

The above figures show the average profits, and it appears that the difference between the best kind of rice and bajeree and other rain crops is only Rupees 5, the former being Rupees 30 and the latter Rupees 25. During years of deficient rain-fall the bajeree, &c., would have a higher relative value. It is also to be observed that Khandeish is thinly populated, and forage for cattle is more plentiful than is commonly the case in other parts of the Dekkan. The profits for jowaree and bajeree there, are therefore, less than they would be in other places.

6. There seem to be other reasons for concluding that rice will not be grown to the exclusion of other crops. All along the ghauts, and in the Konkan between them and the sea, rice is already produced in large quantities under the rain-fall alone, which is extremely heavy, being generally not less than 100 inches, and confined to the monsoon of four months. Now rice is not the staple food of the people in the Dekkan, and it is evident, therefore, that if it were produced in large quantities on the irrigation works, to the exclusion of the ordinary crops which now occupy the ground, such an alteration in prices of the different grains must take place as to make rice unprofitable, or less profitable than bajeree and jowaree. The state of the market would evidently prevent rice being grown to the exclusion of other crops which furnish the grains most in use for food by the people, and forage for their cattle. No doubt the present prices have something to do with the very limited use of rice by the Dekkan people; but, after all, rice is but poor food when unaccompanied with fish, which the Dekkan people do not get. Konkan people, who principally use the rice, do obtain fish from being close to the sea. It may be doubted, therefore, whether even a large increase in the quantity of rice would materially diminish the demand for the grains which for ages have formed the staple food of the people in the Dekkan.

7. It would also seem to be worthy of consideration whether it is desirable to increase the rice cultivation, except to a very limited extent. It is clearly a disadvantage to have a population principally dependent for its food upon one kind of grain only, and especially rice, which is but poor food, and it is a question whether Government should not discourage the very extensive cultivation of rice by an enhancement of the water-rate for it. Certainly, undue encouragement to its culture should not be given by allowing the people to have the water at a cheaper rate than for other crops.

8. I will now proceed to the main question discussed in the papers from the Government of India, as to whether canals should be principally designed for the monsoon or the rubbee crop.

The circumstances under which we have to construct such works in the Dekkan seem to leave no doubt as to the correct solution as far as the Dekkan is concerned.

9. Taking the whole of the Dekkan country which falls within this Presidency, and beyond which our irrigation operations do not extend, it cannot be said that there is great preponderance of crop in any particular season. There is no cold weather such as would retard the growth of tropical grains, and we find that the people are ready to grow the staple crops whenever they have rain for them. This fact is clearly shown in travelling from west to east at the end of the monsoon. Near the Ghats the crops are matured and being reaped, but as we proceed eastward, where the latter rain is most to be relied upon, we find the very same crops in different stages of progress, sometimes nearly matured, and sometimes only just sown.

10. These facts, and the smallness of the rain-fall, which varies from about 14 to 28 inches, remove all difficulty as to the season when the people require the water. They will evidently take it whenever it is available. This being admitted, the next question which occurs is, when is the water available? or proceeding at once to the nature of the works, when can a supply of water be most easily furnished? Unquestionably during the monsoon, and accordingly our works are mainly designed with that end in view.

11. There is a most important point to consider, however, in the designing of the works. It is one which is well understood in Northern India, though there is no direct allusion to it in the papers received from the Government of India. Provided the people can use the water with advantage at all seasons, it is clearly more profitable to construct a canal which will carry a constant supply, than one which will only carry a supply for four months in the year. This may not be of so much importance where circumstances admit of the construction of simple, inexpensive works; but in the Dekkan generally, where the cost of the works must be heavy, it is essential to financial success that the canal, with all its attendant weirs and aqueducts, should not lie idle, or comparatively idle, for eight months in the year, and the nearer a work approaches to what is commonly considered the standard of excellence in Northern India, that is, carrying a constant supply, the more beneficial it will be.

12. It may, of course, be advanced that, to secure a country from the effects of a season of drought, it would be better to have a large work which will simply provide water for the one crop which forms the staple food of the people; but, practically, there is a difficulty about this, which, in any but a very flat or Deltaic country, where works are comparatively inexpensive, makes such an arrangement impossible, because the great cost of the works, and the small average returns, must make the undertaking so unremunerative as to preclude it being carried out.

13. To induce the people generally to use the water extensively for the common crops, it must be given to them at a low rate, and where the works are expensive, there cannot be a remunerative return, unless the supply of water is maintained throughout the year for the culture of the more valuable crops like sugar-cane and fruits, which cannot be raised with profit without irrigation, and for which we know the people can pay very high rates.

14. It would not, moreover, as well as I can judge, suffice to construct a canal to carry the requisite supply of water for the staple crop, and trust to the people making full use of it during a season of drought. The construction of the minor distributing or field channels is not the work of a day, and the plots of land demand great labor to level them, bank them up, and otherwise prepare them for the water. If we trust to such operations being done at the last moment, when the failure of the rain becomes evident, the extent of irrigation will be so small as to be practically almost useless in preventing a famine. To secure the full working effect of a canal, the people must have been accustomed to use the water regularly, and they must have their fields also in a constant state of readiness.

15. The best condition of matters we can hope for is, to have irrigation steadily practised for all kinds of crops, and then when the dreaded time approaches, and the failure of the rain becomes evident, nearly all the land, including such as has been set aside for fallows, which falls under the canal, will be sown with the crops which elsewhere are failing for want of rain. The greatest

*Proceedings of the Madras Government, Public Works Department,
6th February 1869.*

economy in the use of the water will on such occasions be necessarily practised by the cultivators, and we may expect the utmost working effect from the canal in providing the crops which are most required.

16. There is an indirect effect also of canals which produce the more valuable crops, and are always kept in the highest condition of efficiency. They must enormously increase the wealth of the people, who cease to be a million of poor cultivators dependent entirely for food on their staple crop, and liable to be reduced to the utmost destitution from anything which may seriously affect that crop. Do what we may with works of irrigation for staple crops, we can but very partially avert the effect of drought, for on such occasions the four months canal which we suppose to be annually worked up to its fullest capabilities, cannot make up for the want of rain where the crops have been raised by canal and rain combined. The staple crop which it has been customary to raise on the canal cannot then be equal to that raised during a year of more favorable rain-fall, and in other spots, the same crop, where not under command of the canal (and the area must ever be vast), of course fails altogether.

17. But when the people have learned to grow various crops by means of perennial canals, and have become wealthy, their power of passing through a calamitous period is greatly increased. The lands which would, under ordinary circumstances, be fallow for a succeeding year's sugar or other crop requiring great fertility of soil, are at once used for raising the staple food crop which is failing elsewhere, while the wealth of the people generally, and the variety of occupation they have from having embarked in different branches of trade at the same time, render them less dependent for employment on that crop, and enable them to tide over the difficult time. There is always food of some kind somewhere, and what the people want is the means of buying it. Wealth and occupation not wholly connected with the crop which furnishes the staple food, furnish such means.

18. In looking at the question of which kind of irrigation is most valuable, the remarks I have recorded apply of course more particularly to the parts of the country to which I have been accustomed. Indeed, I could not venture to offer an opinion on the requirements of the Soane Valley, which I have never seen. I can only explain the point of view from which I regard the question as applied to this side of India. The general conclusion to which I think my observations tend, however, is, that irrigation works should be designed to carry as large a volume of water during the monsoon as the people are likely to utilize under a fair water-rate, but that the nearer such works approach to what is considered the standard of excellence in Northern India and in Italy, the more valuable they prove to the country.

From F. D. CAMPBELL, Esq., Executive Engineer for Irrigation, Sattara, to the Chief Engineer for Irrigation, Bombay, dated 29th January 1868, No. 56.

1. In accordance with instructions conveyed in your Memorandum, No. 2,133, dated 13th December 1867, I have the honor to forward you the following report on the subject of cold weather and monsoon irrigation.

2. From what I have seen of the systems adopted by the ryots in different parts of these districts, it appears to me that there is no fixed relation between the values of the two kinds of irrigation; it differs greatly in different parts of the same Collectorate, depending, as it does, so much on the time of the year when the principal fall of rain takes place.

3. In the Eastern Districts of this Collectorate, which generally lie between 50 and 100 miles east of the ghats, the heaviest and most certain fall takes place in September and October, and the crops there most generally cultivated on the good soils or rubbee, viz., "shallo" gram and wheat (not garden); but on poor, high-lying unretentive soils, "dookree" and "bajaree" are sown, and allowed to take their chance and thrive as they can on the moisture obtained from occasional light showers which may reach them from the south-west.

*Proceedings of the Madras Government, Public Works Department,
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4. In the tract of country which lies nearer the ghats, those ryots who possess good land are far more independent, and take their choice each year, to a great extent, as to whether they will allow the land to rest during monsoon, or during the cold weather; occasionally the same field is sown during the monsoon with either "oodeeth" or "mudkee," (which quickly ripens), and after reaping, it is again prepared and sown with "shalloo." On the high and shallow soils, the system is similar to that adopted in the Eastern Districts, but of course the crops are more certain.

5. From the above facts it is of course clear that monsoon irrigation in the Eastern Districts would be comparatively far more valuable than in those nearer the ghats, where during some years it would not be used at all, except for the area under sugar-cane.

6. As a rule, I think that in Districts where rice is not much cultivated, a canal capable of carrying a supply of water sufficient for the rubbee crops will also be large enough to carry the monsoon supply. But in the Eastern Districts, where occasionally it may be necessary to give some of the rubbee crops their first watering before the monsoon crops have received their last, the canal might be constructed with a slightly larger section to meet contingencies.

From F. R. GRIFFITH, Esq., Executive Engineer for Irrigation, Ahmednuggur and Nassick, to the Chief Engineer for Irrigation, Poona, dated 29th May 1868, No. 563.

1. With reference to the Resolution of the Government of Bombay, No. 108 I—2,822 of 1867, dated 23rd November last, forwarded to me under your No. 2,133, dated the 18th December last, I have the honor to submit the following observations.

2. In the districts under my charge there is a very narrow belt on the Eastern slope of the Western Ghats, where alone a sufficient rain-fall may be depended upon for the production of a monsoon crop. This belt is not more than ten to twenty miles in its average width, and the surface of the ground is of so broken a nature from the vicinity of the ghats, that it may be considered of no value for irrigational purposes on anything but a very small scale.

3. The whole of the Ahmednuggur and Nassick irrigable districts, therefore, may be considered liable to suffer from want of seasonable monsoon rains, and in no part of these districts outside of the belt mentioned is there rain sufficient for rice cultivation.

4. It appears to me that in the Dekkan the main feature of irrigation must of necessity be the adaptation of the canals to an extensive use of the monsoon water. All our rivers rising in the Western Ghats are to be depended on for a large monsoon supply, even though the local rains of the Eastern Districts should entirely fail; but as their discharge decreases very rapidly during the cold weather, and, after bad monsoons, nearly ceases towards the end of the hot season, if our projects were based on the supply available in the latter seasons only, the best of them would become insignificant and totally inadequate to the wants of the country; whereas the monsoon waters are not only capable of saving a perishing crop in a season of local drought, and thus diverting scarcity and ensuring one good monsoon crop on the area of land commanded, but they would give the ryots a choice of crop, and enable them to cultivate rice to a large extent, where they now can only grow bajaree and jowarree, and the former crop yielding a profit to the grower inferior to sugar-cane alone, the gain to cultivators in commanding monsoon irrigation, even in ordinary seasons, will be very great.

5. In my opinion, therefore, all irrigational projects founded on weirs across the Dekkan rivers should be based on the principle of utilizing, as far as possible, the monsoon waters for rice and other monsoon crops, but especially the former, the cultivation of which, I believe, will be limited only by the supply of water available. The cold weather and perennial irrigation will, of course, be very valuable, but from the rapid diminution in the supply the rivers afford in these seasons, the good this description of irrigation will afford the country, and the revenue it will yield to Government, will be small when compared with the results of the large field of monsoon irrigation when the people shall have learnt to make the most of it, and when the assessment has been fixed at a figure that somewhat corresponds with the advantage they derive from it.

*Proceedings of the Madras Government, Public Works Department,
6th February 1869.*

From Captain C. B. F. PENNY, R. E., Executive Engineer for Irrigation, Sholapore, to the Chief Engineer for Irrigation, Bombay, dated 6th August 1868, No. 873.

1. The report expedited in your No. 1,372 of the 5th instant, had entirely escaped my notice—indeed, I feel very loath to give an opinion on the subject, as the question has been studied by so many able men, and yet so very opposite opinions appear to be held.
2. The question of the extent to which irrigation canals should be designed, whether sufficiently large for monsoon irrigation, or merely for the cold weather crop, would appear to have arisen from the *presumed* fact that monsoon irrigation comprehends nearly entirely rice cultivation; thereby necessitating a much larger canal, if made for monsoon irrigation entirely, than would be necessary if constructed for irrigating only rubbee or cold weather crops.
3. In the Sholapore Districts, however, rice is by no means the staple food of the people. The average rain-fall is only about 26 inches in the year, and when monsoon irrigation from wells is practised, the people generally use the water to assist the dry crops usually grown at that season. The amount of water, therefore, necessary for general monsoon irrigation purposes is less than that required for rubbee or perennial cultivation.
4. It would appear, then, that, unless the practice of the people become very much altered on the introduction of irrigation canals into this part of the country, a canal of sufficient capacity for cold weather crops will also be generally sufficient for irrigating an equal area of ground during the monsoon months.

From Lieutenant A. L. BUCKLE, R. E., Acting Executive Engineer for Irrigation, Poona Districts, to the Chief Engineer for Irrigation, Poona, dated 7th August 1868, No. 726.

1. Referring to your Endorsement No. 2,133 of 1867, on Government Resolution No. 108 I—2,822, I have the honor to observe that it appears to me that the question, whether canals should carry the monsoon, or the cold weather, discharge of the rivers from which they are led, is one which requires a different solution in each particular district. The monsoon and rubbee crops are those which supply the staple food of the people, and it appears reasonable that the canal intended to save a particular tract of country from famine, should, if possible, be designed to carry the greatest quantity of water for the crop which the people generally raise. But the question depends still more on the nature of the rivers. In this district, without storage, but little water for rubbee can be supplied. The rivers are comparatively small, and there are no works either in existence or proposed, except within a moderate distance of the ghats in which the rivers rise. After the rains cease, the rivers fall rapidly, and in December afford but a slender stream; at the same time the fact of their taking their rise in the Western Ghats renders the monsoon supply of water a never failing one. Hence, as the primary object of irrigation works is to prevent famine by securing one good crop on the land every year, it appears advisable in this part of the country to design canals with a view to their carrying the monsoon water of the rivers.
2. As examples of the capabilities of the rivers in these districts to supply water for rubbee crops, the two rivers upon which works are proposed, the Moota and the Neera, may be considered. Neither of these could supply more than 50 cubic feet per second for rubbee irrigation, a quantity sufficient for only some 7,500 Acres, or about one-twentieth of the area commanded. If, therefore, the canals here were designed on a small scale, to utilize only the rubbee water, the possibility of famine would not be averted, and the first condition to be observed in the construction of irrigation canals would not be fulfilled.

ORDER.—Ordered, that copies of these papers be forwarded to the Governments of Madras, Bengal, North-Western Provinces, and the Punjab. Chief Commissioners of Oudh and Central Provinces. Commissioner of Mysore.

(Signed) C. H. DICKENS, Colonel, R. A.
Secretary to the Government of India.

*Proceedings of the Madras Government, Public Works Department,
6th February 1869.*

No. 177. ORDER THEREON, 6th February 1869, No. 387.

IRRIGATION, No. 8.

Communicated to the Superintending Engineers in continuation of G. O., No. 2,683, dated 22nd August 1868.

(True Extract.)

Colonel, R. E.,
Secretary to Government.

To Superintending Engineers.
To the Chief Engineer for Irrigation.

Govt. of [1869] Madras.

PUBLIC WORKS.

To

THE SUPERINTENDING ENGINEERS

cc, cc, cc

Dated February, 6th

Recd.

G. O. 6th February 1869, No 387

FEBRUARY.
Nos. 176-177

Irrigation Canals.—Proceedings of the Government of India, forwarding papers regarding the extent to which Irrigation Canals should be designed for cold weather or monsoon irrigation, communicated to the Officers concerned

96
Enclosure to Public Works Nos. 366—72 I of 1868.

No. 146 I—2733, dated 21st November, 1868.

From—COLONEL J. G. FIFE, R. E., Under Secy. to the Govt. of Bombay, in the P. W. Dept., Irrign. Branch,

To—Secretary to the Government of India, P. W. Dept.

With reference to Circular No. 107, dated 25th October 1867, I am directed to transmit, for the information of the Government of India, a Memorandum from the Chief Engineer for Irrigation, No. 1906, dated 12th ultimo, forwarding with his remarks, reports from certain Executive Officers in the Irrigation Department, Dekkan, on the question of designing Irrigation Works for cold weather or monsoon irrigation.

No. 1906, dated 12th October, 1868.

Report by COLONEL J. G. FIFE, R. E., Chief Engineer for Irrigation, Bombay.

Agreeably to Government Resolutions Nos. 103 I, dated 23rd November 1867, and 102 I and 107 I of 3rd and 11th August 1868, reports have been submitted by four of the Executive Engineers in the Dekkan, Captain Penny, Mr. Griffith, Mr. Campbell and Lieutenant Buckle. These reports are attached. They illustrate the largeness of the monsoon supply of water in the rivers; the extreme smallness of the rubbee supply; the cultivation of the same grains at different seasons, whenever there is sufficient rain; the smallness of the rain-fall, except close to the ghâts; and the absence of rice cultivation.

2 With respect to the last point, the question is raised as to how far the people will change their ordinary staple crops for rice when works of irrigation are constructed; and as this question has an important bearing on the subject of the papers received from the Government of India, it is desirable to consider it.

3. In the Dekkan, where the rain-fall is small and precarious, straw is of great value to the cultivators. It is required in large quantities for their cattle, and it fetches a high price in the market. Jowaree straw being infinitely more valuable for forage than rice straw, it is clear, I think, that the latter crop would never entirely supersede the former, even were the water-rates the same, whereas under fair and equitable arrangements, they ought to be in the proportion of about four to one, the higher charge being placed upon the rice. Supposing the water to be sold by volume, the effect would be the same.

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5. The following statement shows the cultivator's profit per acre on different irrigated crops, as ascertained by Major Elphinstone when Superintendent of Survey Settlement in Khandeish :—

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Rice (best)	...	...	...	...	...	...	...	...	...	30
" (ordinary)	...	...	...	...	...	...	...	...	...	25
Haldee	...	...	...	...	...	...	...	...	...	45
Guavas and limes	...	...	...	...	...	...	...	...	...	55
Onions, large	...	...	...	...	...	...	...	...	...	25
Garlic	...	...	...	...	...	...	...	...	...	23
Vegetables	...	...	...	...	...	...	...	...	...	37
Egg plant	...	...	...	...	...	...	...	...	...	17
Sweet potato	...	...	...	...	...	...	...	...	...	23
Early "	...	...	...	...	...	...	...	...	...	12
Onions, small	...	...	...	...	...	...	...	...	...	17
Red pepper	...	...	...	...	...	...	...	...	...	21
Earth-nut	...	...	...	...	...	...	...	...	...	23
Indian corn	...	...	...	...	...	...	...	...	...	16
Carrots	...	...	...	...	...	...	...	...	...	11
Peas	...	...	...	...	...	...	...	...	...	11
Gram	...	...	...	...	...	...	...	...	...	24
Wheat	...	...	...	...	...	...	...	...	...	11
Mussoor	...	...	...	...	...	...	...	...	...	11
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The above figures show the average profits, and it appears that the difference between the best kind of rice and bajeree and other rain crops is only Rs. 5, the former being Rs. 30 and the latter Rs. 25. During years of deficient rain-fall the bajeree, &c., would have a higher relative value. It is also to be observed that Khandeish is thinly populated, and forage for cattle is more plentiful than is commonly the case in other parts of the Dekkan. The profits for jowarree and bajeree there, are therefore less than they would be in other places.

6. There seem to be other reasons for concluding that rice will not be grown to the exclusion of other crops. All along the ghâts, and in the Konkan between them and the sea, rice is already produced in large quantities under the rain-fall alone, which is extremely heavy, being generally not less than 100 inches, and confined to the monsoon of four months. Now rice is not the staple food of the people in the Dekkan, and it is evident, therefore, that if it were produced in large quantities on the irrigation works, to the exclusion of the ordinary crops which now occupy the ground, such an alteration in prices of the different grains must take place as to make rice unprofitable, or less profitable than bajeree and jowarree. The state of the market would evidently prevent rice being grown to the exclusion of other crops which furnish the grains most in use for food by the people, and forage for their cattle. No doubt the present prices have something to do with the very limited use of rice by the Dekkan people; but, after all, rice is but poor food when unaccompanied with fish, which the Dekkan people do not get. Konkan people, who principally use the rice, do obtain fish from being close to the sea. It may be doubted, therefore, whether even a large increase in the quantity of rice would materially diminish the demand for the grains which for ages have formed the staple food of the people in the Dekkan.

7. It would also seem to be worthy of consideration whether it is desirable to increase the rice cultivation, except to a very limited extent. It is clearly a disadvantage to have a population principally dependent for its food upon one kind of grain only, and especially rice,

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which is but poor food, and it is a question whether Government should not discourage the very extensive cultivation of rice by an enhancement of the water-rate for it. Certainly, undue encouragement to its culture should not be given by allowing the people to have the water at a cheaper rate than for other crops.

8. I will now proceed to the main question discussed in the papers from the Government of India, as to whether canals should be principally designed for the monsoon or the rubbee crop. The circumstances under which we have to construct such works in the Dekkan seem to leave no doubt as to the correct solution as far as the Dekkan is concerned.

9. Taking the whole of the Dekkan country which falls within this Presidency, and beyond which our irrigation operations do not extend, it cannot be said that there is great preponderance of crop in any particular season. There is no cold weather such as would retard the growth of tropical grains, and we find that the people are ready to grow the staple crops whenever they have rain for them. This fact is clearly shown in travelling from west to east at the end of the monsoon. Near the Ghâts the crops are matured and being reaped, but as we proceed eastward, where the latter rain is most to be relied upon, we find the very same crops in different stages of progress, sometimes nearly matured, and sometimes only just sown.

10. These facts, and the smallness of the rain-fall, which varies from about 14 to 23 inches, remove all difficulty as to the season when the people require the water. They will evidently take it whenever it is available. This being admitted, the next question which occurs is, when is the water available? or proceeding at once to the nature of the works, when can a supply of water be most easily furnished? Unquestionably during the monsoon, and accordingly our works are mainly designed with that end in view.

11. There is a most important point to consider, however, in the designing of the works. It is one which is well understood in Northern India, though there is no direct allusion to it in the papers received from the Government of India. Provided the people can use the water with advantage at all seasons, it is clearly more profitable to construct a canal which will carry a constant supply, than one which will only carry a supply for four months in the year. This may not be of so much importance where circumstances admit of the construction of simple, inexpensive works; but in the Dekkan generally, where the cost of the works must be heavy, it is essential to financial success that the canal, with all its attendant weirs and aqueducts, should not be idle, or comparatively idle, for eight months in the year, and the nearer a work approaches to what is commonly considered the standard of excellence in Northern India, that is, carrying a constant supply, the more beneficial it will be.

12. It may, of course, be advanced that, to secure a country from the effects of a season of drought, it would be better to have a large work which will simply provide water for the one crop which forms the staple food of the people; but, practically, there is a difficulty about this, which, in any but a very flat or Deltaic country, where works are comparatively inexpensive, makes such an arrangement impossible, because the great cost of the works, and the small average returns, must make the undertaking so unremunerative as to preclude it being carried out.

13. To induce the people generally to use the water extensively for the common crops, it must be given to them at a low rate, and where the works are expensive, there cannot be a remunerative return, unless the supply of water is maintained throughout the year for the culture of the more valuable crops like sugar-cane and fruits, which cannot be raised with profit without irrigation, and for which we know the people can pay very high rates.

14. It would not, moreover, as well as I can judge, suffice to construct a canal to carry the requisite supply of water for the staple crop, and trust to the people making full use of it during a season of drought. The construction of the minor distributing or field channels is not the work of a day, and the plots of land demand great labour to level them, bank them up, and otherwise prepare them for the water. If we trust to such operations being done at the last moment, when the failure of the rain becomes evident, the extent of irrigation will

be so small as to be practically almost useless in preventing a famine. To secure the full working effect of a canal, the people must have been accustomed to use the water regularly, and they must have their fields also in a constant state of readiness.

15. The best condition of matters we can hope for is, to have irrigation steadily practised for all kinds of crops, and then when the dreaded time approaches, and the failure of the rain becomes evident, nearly all the land, including such as has been set aside for fallows, which falls under the canal, will be sown with the crops which elsewhere are failing for want of rain. The greatest economy in the use of the water will on such occasions be necessarily practised by the cultivators, and we may except the utmost working effect from the canal in providing the crops which are most required.

16. There is an indirect effect also of canals which produce the more valuable crops, and are always kept in the highest condition of efficiency. They must enormously increase the wealth of the people, who cease to be a million of poor cultivators dependent entirely for food on their staple crop, and liable to be reduced to the utmost destitution from anything which may seriously affect that crop. Do what we may with works of irrigation for staple crops, we can but very partially avert the effect of drought, for on such occasions the four months canal which we suppose to be annually worked up to its fullest capabilities, cannot make up for the want of rain where the crops have been raised by canal and rain combined. The staple crop which it has been customary to raise on the canal cannot then be equal to that raised during a year of more favourable rain-fall, and in other spots, the same crop, where not under command of the canal (and the area must ever be vast), of course fails altogether.

17. But when the people have learned to grow various crops by means of perennial canals, and have become wealthy, their power of passing through a calamitous period is greatly increased. The lands which would, under ordinary circumstances, be fallow for a succeeding year's sugar or other crop requiring great fertility of soil, are at once used for raising the staple food crop which is failing elsewhere, while the wealth of the people generally, and the variety of occupation they have from having embarked in different branches of trade at the same time, render them less dependent for employment on that crop, and enable them to tide over the difficult time. There is always food of some kind somewhere, and what the people want is the means of buying it. Wealth and occupation not wholly connected with the crop which furnishes the staple food, furnish such means.

18. In looking at the question of which kind of irrigation is most valuable, the remarks I have recorded apply of course more particularly to the parts of the country to which I have been accustomed. Indeed, I could not venture to offer an opinion on the requirements of the Soane Valley, which I have never seen. I can only explain the point of view from which I regard the question as applied to this side of India. The general conclusion to which I think my observations tend, however, is, that irrigation works should be designed to carry as large a volume of water during the monsoon as the people are likely to utilize under a fair water-rate, but that the nearer such works approach to what is considered the standard of excellence in Northern India and in Italy, the more valuable they prove to the country.

No. 56, dated 29th January, 1868.
From—F. D. CAMPBELL, Esq., *Executive Engineer for Irrigation, Sattara,*

To—*Chief Engineer for Irrigation, Bombay.*

In accordance with instructions conveyed in your Memorandum No. 2133, dated 13th December 1867, I have the honour to forward you the following report on the subject of cold weather and monsoon irrigation.

2. From what I have seen of the systems adopted by the ryots in different parts of these Districts, it appears to me that there is no fixed relation between the values of the two kinds of irrigation; it differs greatly in different parts of the same Collectorate, depending, as it does, so much on the time of the year when the principal fall of rain takes place.

3. In the Eastern Districts of this Collectorate, which generally lie between 50 and 100 miles east of the Ghâts, the heaviest and most certain fall takes place in September and October, and the crops there most generally cultivated on the good soils or rubbee, viz., "shalloo" gram and wheat (not garden); but on poor, high-lying, unretentive soils, "dookree" and "hajeree" are sown, and allowed to take their chance and thrive as they can on the moisture obtained from occasional light showers which may reach them from the south-west.

4. In the tract of country which lies nearer the Ghâts, those ryots who possess good land are far more independent, and take their choice each year, to a great extent, as to whether they will allow the land to rest during monsoon, or during the cold weather; occasionally the same field is sown during the monsoon with either "oodeeth" or "mudkee," (which quickly ripens), and after reaping, it is again prepared and sown with "shalloo." On the high and shallow soils, the system is similar to that adopted in the Eastern Districts, but of course the crops are more certain.

5. From the above facts it is of course clear that monsoon irrigation in the Eastern Districts would be comparatively far more valuable than in those nearer the Ghâts, where during some years it would not be used at all, except for the area under sugar-cane.

6. As a rule, I think that in Districts where rice is not much cultivated, a canal capable of carrying a supply of water sufficient for the rubbee crops will also be large enough to carry the monsoon supply. But in the Eastern Districts, where occasionally it may be necessary to give some of the rubbee crops their first watering before the monsoon crops have received their last, the canal might be constructed with a slightly larger section to meet contingencies.

No. 563, dated 29th May, 1868.

From—F. R. GRIFFITH, Esq., *Exec. Engr. for Irrigation, Ahmednuggur and Nassick,*
To—*Chief Engineer for Irrigation, Poona.*

With reference to the Resolution of the Government of Bombay, No. 108 I.—2822 of 1867, dated 23rd November last, forwarded to me under your No. 2133, dated the 18th December last, I have the honour to submit the following observations.

2. In the Districts under my charge there is a very narrow belt on the Eastern slope of the Western Ghâts, where alone a sufficient rain-fall may be depended upon for the production of a monsoon crop. This belt is not more than 10 to 20 miles in its average width, and the surface of the ground is of so broken a nature from the vicinity of the ghâts, that it may be considered of no value for irrigational purposes on anything but a very small scale.

3. The whole of the Ahmednuggur and Nassick irrigable Districts, therefore, may be considered liable to suffer from want of seasonable monsoon rains, and in no part of these Districts outside of the belt mentioned is there rain sufficient for rice cultivation.

4. It appears to me that in the Deccan the main feature of irrigation must of necessity be the adaptation of the canals to an extensive use of the monsoon water. All our rivers rising in the Western Ghâts are to be depended on for a large monsoon supply, even though the local rains of the Eastern Districts should entirely fail; but as their discharge decreases very rapidly during the cold weather, and, after bad monsoons, nearly ceases towards the end of the hot season, if our projects were based on the supply available in the latter seasons only, the best of them would become insignificant and totally inadequate to the wants of the country; whereas the monsoon waters are not only capable of saving a perishing crop in a season of local drought, and thus diverting scarcity and ensuring one good monsoon crop on the area of land commanded, but they would give the ryots a choice of crop, and enable them to cultivate rice to a large extent, where they now can only grow bajeree and jowaree, and the former crop yielding a profit to the grower inferior to sugar-cane alone, the gain to cultivators in commanding monsoon irrigation, even in ordinary seasons, will be very great.

5. In my opinion, therefore, all irrigational projects founded on weirs across the Deccan rivers should be based on the principle of utilizing, as far as possible, the monsoon waters for rice and other monsoon crops, but especially the former, the cultivation of which, I believe, will be limited only by the supply of water available. The cold weather and perennial

irrigation will, of course, be very valuable, but from the rapid diminution in the supply the rivers afford in these seasons, the good this description of irrigation will afford the country, and the revenue it will yield to Government, will be small when compared with the results of the large field of monsoon irrigation when the people shall have learnt to make the most of it, and when the assessment has been fixed at a figure that somewhat corresponds with the advantage they derive from it.

No. 873, dated 6th August, 1868.

From—CAPTAIN C. B. F. PENNY, R. E., *Executive Engineer for Irrigation, Sholapoor,*
To—*Chief Engineer for Irrigation, Bombay.*

The report expedited in your No. 1372 of the 5th instant, had entirely escaped my notice—indeed, I feel very loath to give an opinion on the subject, as the question has been studied by so many able men, and yet so very opposite opinions appear to be held.

2. The question of the extent to which irrigation canals should be designed, whether sufficiently large for monsoon irrigation, or merely for the cold weather crop, would appear to have arisen from the *presumed* fact that monsoon irrigation comprehends nearly entirely rice cultivation; thereby necessitating a much larger canal, if made for monsoon irrigation entirely, than would be necessary if constructed for irrigating only rubbee or cold weather crops.

3. In the Sholapoor Districts, however, rice is by no means the staple food of the people. The average rain-fall is only about 26 inches in the year, and when monsoon irrigation from wells is practised, the people generally use the water to assist the dry crops usually grown at that season. The amount of water, therefore, necessary for general monsoon irrigation purposes is less than that required for rubbee or perennial cultivation.

4. It would appear, then, that, unless the practice of the people become very much altered on the introduction of irrigation canals into this part of the country, a canal of sufficient capacity for cold weather crops will also be generally sufficient for irrigating an equal area of ground during the monsoon months.

No. 726, dated 7th August, 1868.

From—LIEUTENANT A. L. BUCKLE, R. E., *Acting Exec. Engr. for Irrigation, Poona Districts,*
To—*Chief Engineer for Irrigation, Poona.*

Referring to your endorsement No. 2133 of 1867, on Government Resolution No. 103 I—2322, I have the honour to observe that it appears to me that the question, whether canals should carry the monsoon, or the cold weather, discharge of the rivers from which they are led, is one which requires a different solution in each particular District. The monsoon and rubbee crops are those which supply the staple food of the people, and it appears reasonable that the canal intended to save a particular tract of country from famine, should, if possible, be designed to carry the greatest quantity of water for the crop which the people generally raise. But the question depends still more on the nature of the rivers. In this District, without storage, but little water for rubbee can be supplied. The rivers are comparatively small, and there are no works either in existence or proposed, except within a moderate distance of the ghâts in which the rivers rise. After the rains cease, the rivers fall rapidly, and in December afford but a slender stream; at the same time the fact of their taking their rise in the Western Ghâts renders the monsoon supply of water a never failing one. Hence, as the primary object of irrigation works is to prevent famine by securing one good crop on the land every year, it appears advisable in this part of the country to design canals with a view to their carrying the monsoon water of the rivers.

2. As examples of the capabilities of the rivers in these Districts to supply water for rubbee crops, the two rivers upon which works are proposed, the Moota and the Neera, may be considered. Neither of these could supply more than 50 cubic feet per second for rubbee irrigation, a quantity sufficient for only some 7,500 acres, or about one-twentieth of the area commanded. If, therefore, the canals here were designed on a small scale, to utilize only the rubbee water, the possibility of famine would not be averted, and the first condition to be observed in the construction of irrigation canals would not be fulfilled.

P.N. 512/1868

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6th Dec 1869 R. 190

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Govt. of 1869 Madras.

PUBLIC WORKS.

To
The Superintending Eng^r

Dated

Recd.

Encl.

G. O. 6 Feb 1869, No. 387

Nos. 176 & 177

Irrigation Canals Proo. of the
Govt India forward despatches
regarding the extent to which
Irrigation Canals should
be designed for cold weather
or monsoon irrigation - and
to the off^r concerned.