https://doi.org/10.29321/MAJ.10.A04550

Soil and Water Conservation*

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Soil conservation is good land husbandry — proper use of soil and maintenance of fertility or productivity. The conservation of soil and water resources is of utmost importance in India. There is no political economic, social or scientific disagreement about this fact. Fertile soil is a matter of national concern, and the food problem can be solved only in terms of soil and water.

Soil Depletion. Improper cultural practises, added to the financial distress of the Indian cultivators made them virtually exploit the soil. Excessive cultivation without putting any thing in the soil result in our soil being exhausted. The soil fertility was tapped at a rate more than it can build naturally. The deplete and move on policy was extended and enforced by the preference of immediate yield. As a result of such long neglect our soils have become exhausted and probably this accounts for the low yield in all food crops.

Remedies. It is well known that soil fertility can be maintained by proper manuring and the organic content can be increased by the application of green manure judiciously combined with chemical fertilisers.

Farm yard manure viz., cattle urine and cowdung go along way to improve the organic content and fertility of the soil; but it is a sad sight to see that the resource is not being fully utilised by our ryots. It is worth while for us to educate our ryots regarding the potentialities of farm yard manure. Besides our rural cattle stalls are such that the urine is allowed to waste. Cheap type of cattle stalls to suit our economic condition should be evolved. The research on these lines will be a step in the right direction.

The proper utilisation of our sewage and sullage water in our cities and towns will greatly add to the fertility of our fodder. Though here and there we hear of these being utilised as manure after composting or by other processes such as activated sludge plant or septic tanks, most of our town sewers are allowed to discharge into rivers or sea and go to waste. There is unlimited scope and potentialities and it will be worth while to explore the possibilities as to how best we can utilise the town refuse, sewage and sullage.

The following improved farming practices may be adopted and advocated for conserving soil :—

(a) Crop rotations, where possible to conserve soil and fertility.

(b) Contour farming in all cultivated fields except where extremely irregular topography makes contouring impractical.

* A paper read at College Day and Conference, July 1948.

(c) Contour strip cropping on clean cultivated land.

(d) Terracing on cultivated lands of reasonable slope when proper water disposal is practical.

(e) Systematic pasture management including controlled grazing, contour furrowing or ridging and weed control.

(f) Retirement from cultivation areas that are subject to several erosion and use of such areas for pasture, meadow and wood land.

(g) Location and construction of farm ponds and reservoirs to impound surplus water from fields, pastures and wood lands.

A co-ordinated use of these measures each being applied to that portion of the land adapted for its use, should result in the maximum conservation of both the soil and its fertility.

Erosion. Perhaps erosion is more contributory to soil depletion than anything else. Erosion in short is soil drifting or the process of soil removal by natural agencies like wind and rain. Top soil so essential for plant growth is lost by erosion. Periodical rainfall on natural slope of the cultivated land is partly absorbed and a major portion lost as surface flow or run off. This apparently calm looking run off, carries with it the necessary and important plant food namely, humus which the nature had supplied to the land after long periods of biological changes. Not only the humus, but also the soil and sometimes the sub-soil are transported by the moving water. Not only there is loss of soil but there is no supply of water to the sub-soil which is the reservoir for plant life and other uses of mankind. These contribute to the failure of crop for want of fertility of the land and the drinking water and other supplies from the wells fall low and even get dried up. Thus soil erosion is a menace to agriculture and therefore must be successfully tackled at all costs. It is generally thought that erosion is not a problem in our province. Though it is not pronounced in the whole of province it is a serious menace in the Ceded Districts, Coimbatore, Tinnevelly, Nilgiris and Vizag. Districts. The erosion observations conducted at A. R. S. Hagari show that there is considerable soil erosion in that area where the slope varies for 0·5 to 3%. It is one of our post-war programmes to implement a comprehensive water and soil conservation by controlling erosion.

Erosion Control-Measures. For purposes of erosion control, soil erosion may be deemed to consist of two distinct processes. They are :— (1) Displacing or tearing the soil loose. (2) Transporting the soil material.

Thus soil erosion is the detachment and transportation of soil materials by erosive agents. The principle of erosion control must be to improve the adhesive powers of the soil and reduce the run off and velocity of run off which transport the soil.

Soil conservation (erosion control) may be broadly classified as :— (1) Biological control and (2) Mechanical control.

Biological Control. If the soil is performing its natural biological functions of feeding and being fed by living organisms it will not in general erode seriously. Biological soil conservation is not new ; indeed, the cultural operations that were evolved to keep humid soils in good heart may be regarded as biological measures of soil conservation. They improved the soil structure, æration and drainage and by enabling the soil to support the rich flora and fauna (microscopic as well as macroscopic), kept the plant nutrients circulating in the surface layers. Consequently the productivity of soil and cohesive property of the soil are improved, and thereby resistance to erosion is built up. Biological control chiefly consists of:— (1) Use of manure, lime, soil building legumes and appropriate mineral or other fertilizers to improve productivity (2) Mixed farming and crop rotations (3) Regulated forestry and grazing (4) Selective weeding (5) Cover cropping.

Mechanical Control. Mechanical control chiefly aims to reduce the run off and the velocity of run off which is chiefly responsible for the transportation of soil. Of the different means of mechanical control such as contour bunding, terracing, contour trenching, listing gully damming and strip cropping it is proposed to make a mention of the contour bunding and terracing as they are mainly responsible for combating erosion. At the same time detailed data to adapt these measures to suit our conditions are not available.

Contour Bunding. In sloping lands subject to erosion, bunds are thrown along the contours with a view to arrest erosion and impound water to conserve the same and allow it to soak through the soil and these are known as contour bunds. They shall be designed to hold the maximum run off and shall be so spaced that the run off does not attain the velocity at which the soil will be transported. The run off water shall not be allowed to attain a velocity higher than the critical velocity for the soil (critical velocity for a soil is the maximum velocity, the soil can stand without being eroded). Thus the design of contour bunds is becoming a specialised engineering job in which the local characterestics of climate, rainfall, erodability of soil, its critical velocity and the velocity the run off will attain in a particular slope have to be considered. So far no such observations and research have been done in our department in these lines. We have not determined the erodability of the soil, (its cohesive power and resistance to transportation), its critical velocity and the velocity the rain water can attain in a particular slope. We have been using empirical formulæ given by American Books — which are meant for American soils and climatic conditions. It is high time extensive soil erosion research is taken up on the above lines.

Terracing. Perhaps there is no other word so widely used and misunderstood. The term terracing is often misunderstood and generally the bench terracing (levelling the land into benches having horizontal cultivable lands) is thought of as terracing. This is no doubt one of the several methods of terracing, but technically terraces divide a large sloping area into a number of distinctly separate ones. Each area has its own drainage facilities. Or in other words terracing is essentially a process of constructing a series of drainage channels across the slope of the hill side whose function is to collect the run off water before it attains the harmful velocity and conduct it slowly to an erosion-proof out let. These drainage channels are usually partly run in cutting and partly in embankment by providing bunds along the contour, known as level terraces or with a little fall (say 1 in 300) known as graded terraces. The Americans have evolved different types of terraces depending on their mode and type of formation and the important among them are the Mangum terrace and Nichols terrace. The terrace bunds have to be designed to hold the rain water till they reach the erosion-proof out let and have to be spaced so that the run off water does not exceed the critical velocity.

Contour bunding is adapted in semi arid areas where the rainfall is low and every inch of water has to be conserved. Contour bunding aims at soil and water conservation. Terracing is adopted in places of heavy rainfall where periodical rains seldom fail. No attempt is therefore made to conserve water. Terrace bunds aim at arresting the rain water before they attain the eroding (or critical) velocity and is conducted slowly and finally disposed of through an erosion-proof out let.

It has been generally pointed out that for our semi arid areas, contour bunding is not suitable as the area in the upstream side are likely to be water stagnated and the sowing season may have to be put of on that count. This is a difficulty that cannot be said to be insurmountable. A contour drain on the downstream side connected by drainage pipes across the bunds will dispose of the water without erosion and give a second opportunity for the soil to absorb water. There can be no water stagnation. However these suggestion have to be tried. Yet another objection is the breaching of bunds. There is no reason why a properly designed bund-designed to hold the maximum run off should breach. However as a safety measure escape weirs may be provided and the surplus water could be diverted through existing drainage channels or vankas.

Water. Next to soil the most important resource and requirement for any crop is water. Of all the natural resources perhaps water has great potentialities — power, generation and irrigation.

The chief and main sources of water are:— (1) Rain water (2) Rivers and (3) Underground water supply. Water conservation with reference to agriculture would mean the utilising of these sources for agricultural needs to the fullest extent.

Rain Water. Rain water can be conserved by collecting them in tank or reservoirs and can be utilised for irrigation. These falling on cultivated sloping land can be conserved by contour bunding, contour trenching, listing etc. All the same we have during monsoons, large quantities of rain water running to waste through vankas throughout our province. Engineers can be entrusted to investigate the possibilities of utilising these rain water for irrigation purposes. The sloping cultivable lands in our province should be bunded along the contours to conserve the water and improve the fertility of the soil.

Rivers. Perhaps this is the least exploited natural resource, so vital to agriculture. On a rough calculation the mean annual supply of water in our (Indian) rivers appears to be the order of 2·3 million cubic foot per second. The mean annual consumption of water for agricultural purposes derived from the canals have been roughly figured out as 1,33,000 cubic foot per second. Possibly another 30,000 cubic foot is utilised for irrigation from wells. This means that less than 6% of the available water in our rivers is being utilised and the balance of 94% is running to wast into sea and in the process doing incalculable damages to life and property. It is difficult to say off-hand what portion of the 94% of our available water wealth which is at present running into waste can be put into beneficial use; but there is no gainsaying that a very substantial portion of it can be utilised. There is immense scope for great extension of irrigation facilities which will definitely solve our food problem. Though the Central Government have constituted an irrigation commission to explore the possibilities of extending the irrigation system, the Provincial Government should also follow and try to utilise every drop of water for irrigation purposes.

Ground Water. The world contains an unlimited ground water supply and perhaps it is thought there is no need to conserve it. It must be conserved and utilised. The ground water or sub-soil water is fed or recouped by rain water; and naturally if rain water is allowed to run to waste into the sea, the ground water supply will be depleted. Hence it is imperative that the rain water should be allowed to percolate through the soil by proper water conservation means such as, contour bunding, trenching, basin listing etc., with a view to maintain a steady supply to the ground water.

There is immense scope and it has proved to be so — to utilise these waters through wells for irrigation and help agriculture. We have taken

a step in the right direction in promulgating a well digging scheme. It is hoped ere long our province will have plenty of wells to irrigate all cultivable lands not commanded by any irrigation canals. It is highly necessary and it will be of immense help to the ryots if mapping of ground water supplies and preparation and issue of sub-soil water levels form a part of the activities of the Engineers of our department. On a perusal of the departmental activities from the administrative reports it will be noticed that exploration and mapping of ground water supplies were one of the activities of our department during the years 1917 to 1919. The work can be revived along with the investigation of arable areas under well irrigation.

Conclusion. Having said that the soil and water are the essential requirement of agriculture and any depletion or misuse of them will affect our crops — as it has already happened — let me conclude with an appeal to promulgate proposals for an extensive soil and water conservation scheme on the lines suggested in this paper.

ERRATA.

The following corrections are to be made in Volume XXXV of the Madras Agricultural Journal (October 1948).

1. **Page 293—Statement:**
   (a) Opposite to "S. No. 3" and under 'F' of G. J. 103 read as 16 for 26.
   (b) Opposite to "Value @ 10 lbs. grain etc." and under 'F' of Local (Paira) read as Rs. 26—13—0 for Rs. 26—3—0.
2. **Page 294—Statement:**
   Opposite to "Cash value @ 10 lbs. etc." under N. 4 read the total value as Rs. 69—2—0 for Rs. 9—2—0.
3. **Page 297. Line 8 from the top:**
   Read Miss I. P. Janaki for Mies G. P. Janaki.