supplies of cement at reduced rates are available to farmers for use in water conservation works as under :—

1. Farmers who obtain a loan from Irrigation Loan Funds or from the Land Bank for the purpose of constructing water conservation works can obtain the cement required for the construction of these works on a Government requisition at a reduced price of 2s. 7d. nett per bag (94 lbs.) f. o. r. Cement Siding. The requisition for the supply of cement will be issued by the Irrigation Engineer responsible for the inspection and supervision of the works proposed. (*The Rhodesia Agricultural Journal Vol.* XXXIV No. 2 February 1937 Pages 85 and 86).

Gleanings.

Soil Erosion. Compiled by W. C. Lester-Smith, B.A., Dip. Rur. Econ. (Oxon), A. I. C. T. A. (Trinidad). *Tropical Agriculturist, Ceylon,* Vol. 88, No. 2.

Soil erosion is a process which goes on in all places at all times and at rates which vary according to local conditions. * * * * The distribution of rain, its daily intensity and the frequency of short-period downpours of extreme severity, are of most importance. * * * * * It has been established from observations made in widely different parts of the world that practically all the rainfall of a day's heavy rain usually falls within 10, or even within 7, consecutive hours, while a disproportionately large fraction of that amount falls within 1, 2 or 4 hours.

The results of processes of soil erosion are of the kinds which may be referred to as internal and external.

The internal results are restricted to the land which is being eroded. The surface soil, which contains the greater part of the nutrient matter and the whole of the organic food of plants is bodily removed, and with it are lost, not only the actual salts which serve to nourish the plant, but also the micro-organisms which bring these salts into this condition is thus seriously reduced and its physical properties, such as water-retaining capacity, are altered by the destruction of its tilth.

The soil, depleted of its most valuable ingredients by erosion, ceases to be able to support the crops grown on it, with result that even the protection which these crops normally give is largely lost. Erosion now reaches its second stage. The remaining top soil is washed away bodily ; from the channels formed by the water as it rushes down the slopes, subsoil is scoured away and gullies and ravines develop.

The external results of erosion are many ; they take various forms and are of a serious nature. One result of the removal of a forest cover is interference with the flow of streams. Water is removed rapidly from unprotected land instead of being temporarily detained. The flow of streams arising in such land becomes irregular, being decreased during fair weather and becoming torrential during monsoon weather. Irrigation channels and rivers become choked by silt carried down from the eroded land, and irrigation works are often destroyed by the rush of water during heavy weather. Agricultural areas below the eroded land, such as paddy fields, may be ruined by the deposition of large quantities of sand silt.

The control of soil erosion. Soil erosion is caused primarily by the free movement of matter on the surface of the ground. * * * * * It is not generally realised that doubling the velocity of water increases its transporting power sixty-four times.

To reduce soil erosion to a minimum it is necessary to :—

1. Protect the soil from the direct erosive action of rain water falling on it.
2. Obtain the maximum absorption of the rain water where it falls.

3. Control the removal of the surplus rain water.
4. Arrange for the collection and replacement.

It should be the aim of all who undertake any work for the reduction and prevention of soil erosion, to put into practice all the measures necessary to effect the first three of the above to such a degree that the last measure becomes unnecessary.

Reducing the force with which rain falls upon the surface of the soil involves the establishment of something to cover and protect the soil from the beating action of rain water falling directly on to it. High and medium shade, in combination with ground cover crops effectively perform function (b); * * * * Ground covers, however perfect they may be, cannot entirely prevent the movement of water on surface of the soil under rainfall of high intensity; but they do effectively reduce the rate of flow of this water, and so where the absorptive capacity of the soil is high, give it time to sink in or be absorbed.

Ground covers must be regarded therefore, as of primary importance in the prevention of soil erosion since they perform three of the four functions necessary to reduce soil erosion to a minimum.

The establishment of a satisfactory ground, cover, as rapidly as is possible, must be regarded as an imperative necessity for the prevention of soil erosion. Almost all crops will permit of this, with exception of a limited number of short period or seasonal plants. In the case of seasonal or other crops in which it is essential that no weed growth be permitted, it should be remembered that the provision and maintenance of a satisfactory surface much of organic material which has not entirely lost its original plant structure, can to some extent take the place of ground cover.

The rate of movement of water over the surface of the soil irrespective of the presence of ground cover, will vary mainly in accordance with the degree of slope of the area concerned. * * * * In the past it was customary to lead the free water of the land in so-called drains by the easiest and quickest possible route, and no account was taken of the soil which went with it. * * * The Soil Erosion Committee considered that it was possible to control the movement of surface water and stop the downward movement of surface soil by the use of ground cover; drainage systems are to be regarded as a second line of defence against soil erosion. The first line of defence should be in front of the drains, and it should be efficient enough to render the drains unnecessary in all but the heaviest and most prolonged down-pours, or to ensure that the water which finds its way into the drains does not contain silt but is clear and colourless.

In recent years various modifications have taken place in existing drains; silt pits are perhaps the most common and the least efficient. Their effective capacity for the retention of water and the collection of silt is confined to the pits themselves. Once they are full of water they cease for practical purposes to exist; the water in the drain flows unhindered over them and with the exception of the very coarse particles carries away any silt with which it may be charged.

Cameron's lock and step system, advocated by Mr. E. O. Felsinger is a distinct improvement; in effect it results in the conversion of the drain into a series of silt pits separated by narrow walls. A quantity of water equal to the storage capacity of the basin thus formed, is held up in each section and soil which it carries has an opportunity to settle. It is calculated that this system will hold 2 inches of rain before the spills overflow.

A further improvement which is subject to the same limitations however, is the following. The drain is divided by bunds as in the lock and step system but the sections between the bunds are excavated so as to be horizontal.

On gentle slopes and with an evenly distributed rainfall, the system of bunded catch water pits advocated in Java may be sufficient to provide for the holding up of all the run-off water. Rows of pits are dug in contour lines across the slope (Fig, 3)

Other works which aim at preventing the downward movement of water and soil on slopes, and thus aid in controlling the removal of surplus water, are stone terracing, the construction of contour and individual platforms and contour trench systems.

Much excellent stone terracing has been done on tea and rubber estates and there is no doubt that it does arrest a large amount of downward movement of soil on slopes. The efficiency of terraces depends more upon their frequency than on the height of the stone work, which it is considered, should not be more than 18 inches in height. Occasionally, however, much harm is done by water spilling over the tops of terraces and it is therefore essential that stone terracing should be supplemented by measures designed to ensure maximum retention and absorption of water falling on the terraces.

Contour platforms are considered to be a progressive method of opening new clearings and this system has proved its undoubted benefits. The platform slopes backwards into the hill, the inner edge being at least a foot below the outer. Small buttresses are left at intervals along the back of the platforms so that undue lateral movement of water is prevented. Silt pits are usually dug at the back of the platform, and the platforms are planted with cover crops which form a complete cover except for a space around each tree which is kept clean. There are no drains and the whole of the water falling on the land is absorbed.

In the contour trench system evolved by Mr. Denham Till the size of the trenches is first calculated so that they shall be sufficient on any area to contain the run-off water from the probable maximum downpour thereon. A level trench of the required dimensions, usually 3 ft. by 3 ft.; is cut at the base of the hill. Assuming that rubber is to be planted in rows 24 feet apart, the next trench, also level and of the same dimensions, is cut 24 feet from the centre of the first one and so on up the hill. The surface soil removed from the trench is thrown to the upper side and the subsoil to the lower side. The subsoil is used to form a bund on the lower side of the trench and creeping or other cover crops are grown on the bund. The trench is not filled in until immediately before planting, when it is half filled with top soil. Any rain which has fallen between the time of trenching and that of planting will have replaced some of the original surface soil thrown above the trench, and this may be increased by scraping the top soil from the ground above the trench until the requisite depth of soil is obtained. If no cover crop is grown other than that on the bund, local erosion taking place between the trenchs will result in the formation of a series of contour terraces.

The measure of next importance is to ameliorate the soil so that it attains its maximum absorptive capacity. The more water that is absorbed by the soil the less there is to run down the hill carrying soil with it. On hill side or sloping land the possibility of water logging does not require consideration, and the aim should be to absorb the maximum amount of water on such slopes both for the prevention of erosion and for the benefit of the soil itself. The cultivation of the soil is thus a matter of importance as it affects absorption, percolation, and the retention of soil moisture. Deep cultivation is preferable to superficial scraping, but while deep forking has a value in aiding absorption it will not prevent soil erosion. The results of experiments have shown that plain envelop forking increases erosion. It is necessary, therefore, that forking should be

supplemented by protection of the surface of the soil and by green manuring. Green manuring leads to the formation of humus which increases the water, retaining capacity of the soil, to the aggregation of soil particles by flocculation, and to the production of tilth.

The fertility value of the eroded and transported soil particles is considered to be sufficiently great to render their return to the area under cultivation extremely desirable. The accumulations in silt pits, contour trenches, drains, etc. render this easily possible after the water that was in them has been disseminated through percolation, absorption, etc.

The regular return of this soil to the cultivation area will enable these silt traps to be maintained in an effective condition. The location or silting of them in the necessary places will reduce the distance this eroded soil has to be transported back and thus save a considerable amount of labour and expenses.

Agricultural Fottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

Coconut nurseries and the selection of seedlings. The importance of raising a nursery for many agricultural crops is well recognised. It is particularly important for the coconut.

Seed nuts should not be planted in the field direct, but a nursery should be raised. This would facilitate easy selection of desirable seedlings, proper watering, control over pests and would prove not only convenient but economical.

A suitable piece of land with good drainage and close to a water source should be selected for the nursery. Sandy soil at least a foot deep is to be preferred. Besides the good drainage facilities it affords, it keeps off white ant attack commonly reported in the coconut nurseries.

The best time to start a nursery is the end of May or beginning of June so as to take advantage of the south west monsoon rains. Also it should be remembered that the seednuts which are harvested during the summer months should not get too dry.

The nut with the husk intact is buried in the soil to a depth of three-fourths of its length or flush with the soil, with the stalk end upwards. From various experiments conducted by the Agricultural Department it appears that the best position for planting is the vertical one, in which the germination is the quickest. The spacing to be given in the nursery depends upon the age of the seedling required, i. e., the length of the period for which the seedlings will be retained in the nursery. For obtaining 9 to 12 months old seedlings the nuts may be planted one to one and a half feet apart. Manuring of any sort is not necessary. Germination will commence in about two months and will extend to the fifth or sixth month. Watering is very necessary when the rains fail and during the hot season. While in loamy soils watering twice a week will suffice, in sandy soils it should be done every alternate day. The seedlings should be examined periodically for beetle and white ant attack. If the sun is too hot and scorching, partial shading by way of thatch may be provided so as to avoid scorching of young leaves.

The seedlings will be ready for transplanting by the commencement of the following year's south west monsoon rains Where the soils are light and easily drained, planting may be done at the beginning of the monsoon. In heavy soils and in places where the rains are heavy it is desirable that the transplanting is