SUB-SOILING

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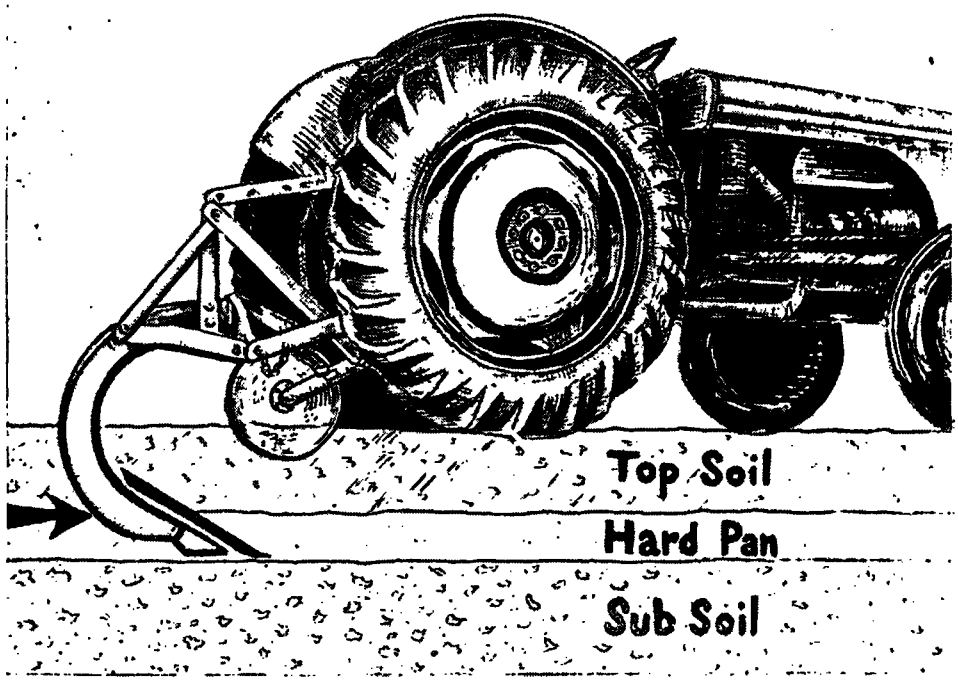
THE operation of sub-soiling is extensively known and its effects well be appreciated in the Western Hemisphere. It is an operation that, probably because it is dependent upon agricultural machinery, is comparatively unknown and unappreciated in Asia where it is of so very much greater importance.

FIG. I



The Sub-soiler

The Implement

It is so little known that it is considered necessary to give a brief description of this implement and its function, as illustrated in Fig. 1. Basically consisting of a very strong but narrow quality-steel shank or hook mounted in the normal manner at the rear of the tractor, it is fitted with a reversible, replaceable point and, also, normally with a form of coulter for cutting any top growth. It will be appreciated that, to operate in subsoil well below any previous operation that the ground may have received, it is necessary that the implement must be built of materials and to a design that will adequately withstand heavy shock loads and be operated by a tractor with satisfactory power and traction.

The functioning of the subsoiler can be readily understood from the illustration, which shows the typical layer construction of an average soil. Beneath the top-soil, which may vary from zero to probably twelve inches depth, will always be found a layer where the soil is compressed and which is referred to as the " hard pan," the depth of which is again variable.

" Hard Pan " Formation

In land which has been worked for a period often of many generations—it is easy to understand that the continual passage across the surface by working animals and humans does continually exert a pressure downwards on the soil and that, although the top few inches may be regularly loosened each time the soil is prepared for cropping, this pressure will eventually consolidate the soil beneath the seed-bed.

In virgin land as reclaimed, it will be realised that the soil has been washed downwards by each successive monsoon since the beginning of time and that an action exactly similar to that of a filter has taken place. Little by little, with each following rain the soil has been worked down by the fall and pressure of the water and consolidation has occurred somewhere beneath the surface—exactly as a filter will eventually become chocked by arresting sediment carried in a fluid passing through it.

Effects of " Hard Pan "

After this " hard pan " has been formed, it is obvious that further rainfall will penetrate through the top-soil until it meets the resistance of the compressed soil, when its path will immediately be turned in the direction of any gradient that may exist and the water will run off to the lowest point. If there is no gradient it will accumulate above the " hard pan," as it can go no further downward, so forming a wet area or marsh, until dried out by the action of the sun.

FIG. IV.

Sub-soiler in operation on a coconut estate in Ceylon

It should from these facts be clear that, unless firmly held together by plant roots and humus, further rainfall will each time create erosion by carrying off all loose soil with the water in its path to the lowest point of contour and that, although a heavy fall of rain may have taken place, only a negligible proportion will have entered into or beyond the " hard pan." It very often occurs that plants, which have started strong and well, will weaken and fail after rains have finished and this will almost certainly be because they have used up the moisture that was left in the top-soil after rains and, because of the " hard pan," cannot obtain any that may be present below that pan.

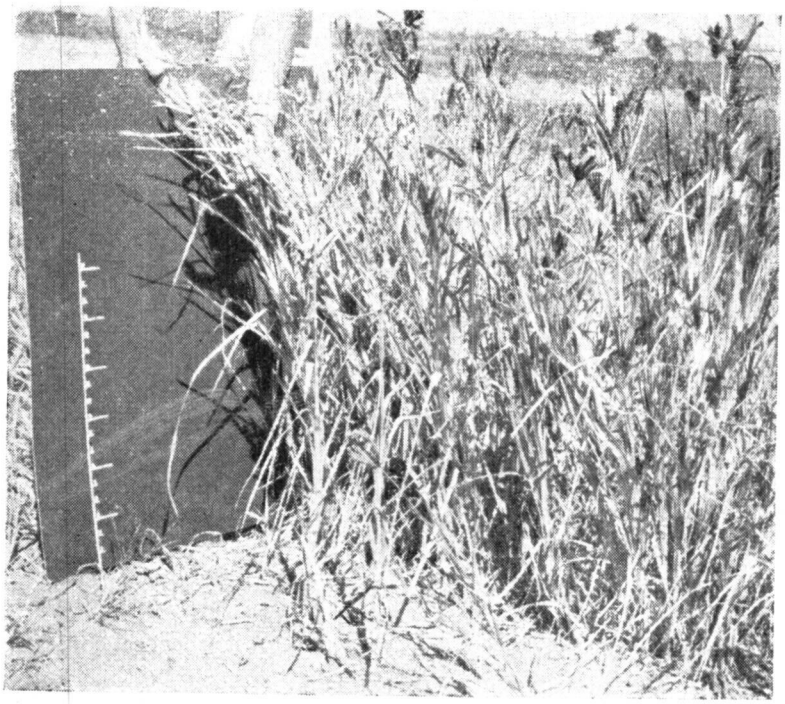
This aspect should also be equally applicable in regard to the chemical constituents in the soil on which plant life depends. It is reasonable to assume that in its passage through the top-soil the water from rainfall carries away various plant foods and that, although top-soil exists above

FIG. II

Without Sub-soiling

Crop obtained with normal cultivation only and no fertilisers or manures

FIG. III



With Sub-soiling

Crop obtained with normal cultivation and no fertilisers and manures

the insulation of the " hard pan," it is made increasingly deficient in nutrients. It is very probable that chemicals of which the top-soil is denuded by water action and, of course, successive plant growth, is available in further quantity below the " hard pan " but is thereby insulated from the plant root system. This insulation is not ordinarily removed by deep-ploughing.

The Effects of Sub-soiling

Vindication of the above theories is surely offered in the illustrations given of Ragi grown on dry, scrub land in Mysore State. Fig. 11 shows a very representative crop as obtained on land which had been prepared in the normal manner and which stood at an average height of 10 inches, being extremely thin and sparse. The other photograph, Fig. 111 depicts the standard of plant obtained after sowing similar seed on soil immediately adjoining, which had been subsoiled before ploughing and which, whilst standing 27 to 30 inches high, had a strength and thickness which does not compare and is to a reasonable standard. This result was obtained throughout the sub-soiled area, and absolutely similar treatment—without the use of fertilisers or manure—was given to each area with the exception of sub-soiling.

In summary, it was found that soil which was producing at the rate of only 800/850 lbs. per acre—well below the average—was raised to the quite normal yield of 1,200/1,300 lbs. entirely by the effect of using the subsoiler.

It was found during growth periods that whilst no moisture could be defined up to a depth of 12 inches where normal operation had occurred, the sub-soiled land showed a definite moisture content within 4 to 5 inches of the surface.

In sub-soiling, which was carried out at a spacing of 24 inches across the gradient to a depth of 18 to 20 inches, fragmentation or cracking of the " hard pan " had occurred which allowed water to enter directly downward at time of rainfall and be drawn upward again by capillary action by both the roots of the plants and by the sun as it was subsequently required. It may be assumed too, that by being able to penetrate more deeply, the roots found chemicals that were not present in similar quantities in the poor quality top-soil.

These extremely encouraging results are to be followed in alternative areas and with other crops for it is felt that this operation will have a most marked effect on dry land farming generally. It should also be well worth full experiment in relation to growth of plants as diverse as cereals and coconuts for the ability of the soil to store more water and to release a greater supply of chemicals could and should have a very major effect on crop returns.