

CLAY SOILS: A CRISIS AHEAD?

By FRANK SYKES

MEETING some friends who farmed clay soils, I found them all muttering about soil structure, which is to do with grains of soil and how they behave when wet or dry. It is something we have taken for granted for too long, perhaps, and it is of vital importance.

If one kneads a lump of wet clay, it becomes like an uncooked dumpling and, in that condition, the hair root of a plant can neither penetrate nor obtain from it the elements for growth. Present anxiety stems from the 1968 wet harvest and a prolonged period of rain that followed. The use of heavy machinery and high horsepower tractors in wet weather leaves a trail of damage which worries the men who use them on heavy soils, and yet it is the bigger machines which help to reduce costs.

Soil types vary widely, from a pure sand which has no structure and which can grow crops only by hydroponics, to the richer loams which may be treated roughly by the farmer. These soils have a natural structure that soon re-establishes itself after maltreatment. The grains of soil separate, air recirculates round them, roots can penetrate, and as the surface moisture evaporates it is replaced from the subsoil by capillarity. Capillarity is the force often demonstrated by the action of blotting paper when it comes into contact with a liquid. At the other end of the scale are impossible soil types, such as where gault clay and the lower greensand meet. This area usually grows timber, and its incidence is one of the reasons why Sussex is well wooded. When dry, this soil set like concrete and when wet, it is like butter, and woe betide those who try to cultivate it.

In some parts of the eastern counties the average rainfall is as low as 19 in. per annum, compared with five times that amount in the Lake District. Where the soil is suitable and contours not so steep, cereals are grown widely in the 30-35 in.

rainfall belt. This includes a large area of chalkland in the south, the Cotswolds in the south-west and a narrower band of sandy soils stretching north through Herefordshire and Shropshire. For the most part these are lighter soils which favour cheap cereal production, despite a comparatively high rainfall and provided the chances of a difficult harvest period are taken into account. Under long cereal rotations, they present many problems but they are spared this one. Further east and north over a large part of the midlands, rainfall is lower but the soil is a heavy clay. Traditionally these areas were under grass, and incidentally included the best of the fox-hunting shires. Previously they felt the plough only at times of national emergency, after the Crimean War and after the two World Wars. Now, however, they remain ploughed, mainly because grazing beef cattle and growing fat lambs have become steadily less profitable. For some years now the only really profitable branch of grass farming has been milk production. So long as a substantial proportion of the farm remained under grass rotation as a break from cereals, or when the remains of old grass sward stayed undecomposed in the soil, all went well. Continuing economic pressure enticed farmers to grow more cereals and less grass until the effects of a harvest much wetter than usual drew attention to the dangers which must have been building up unrecognised for a number of years.

Some of the midlands clays can become nearly sterile if they are not sufficiently supplied with decaying vegetable matter. This is an extreme case and covers a relatively small area, but it appears possible that a much larger area of very fertile clay, which has been farmed productively for hundreds of years using horses as a source of power and maintaining a high level of humus con-

tent by folding sheep on forage crops, by sowing grass breaks and by winter feeding cattle to gain the dung they produced, is in danger of a dramatic fall infertility.

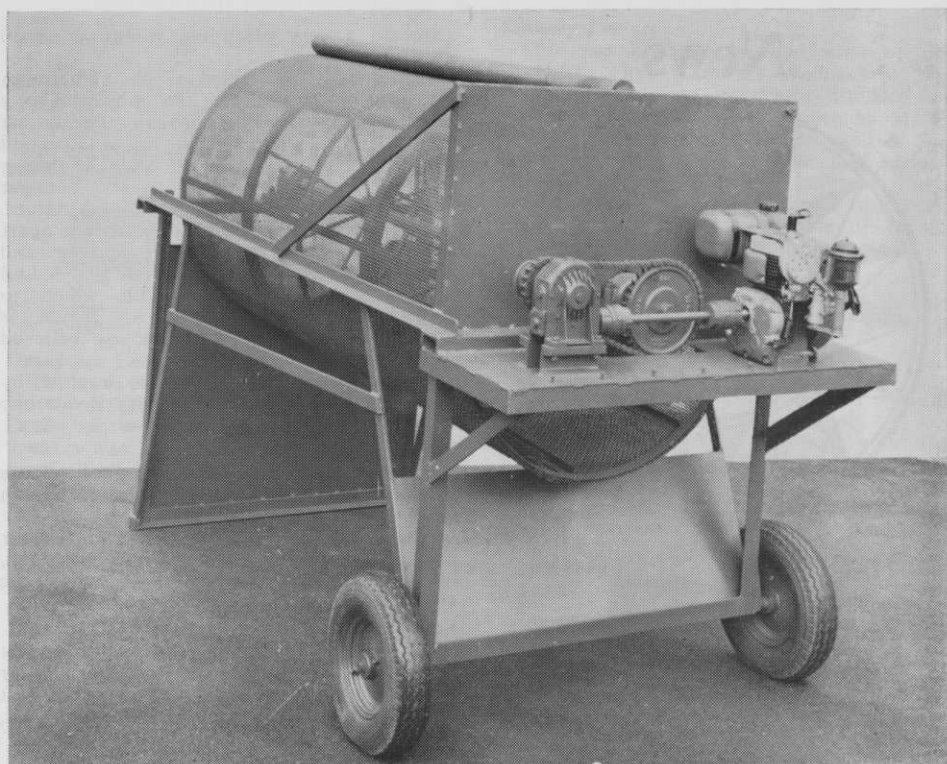
The damage is done in two ways. Firstly, there is the sheer weight of the machines and vehicles used on farms these days. Admittedly, wide tyres are designed to spread the load as far as possible, but there is an economic limit to the size of tyres with which a combine or trailer may be equipped. Further, when the land comes to be ploughed, two tractor wheels run in the furrow. The weight so imposed combined with even a small amount of wheel slip puddles the clay at a depth below the surface where frost cannot reach it in the average winter. The plough slide has much the same effect, although to a lesser degree. The other two wheels of the ploughing tractor puddle further areas of soil, in addition to that already damaged by the combine and corn trailer. Where sugar beet and potatoes are grown, more damage can follow when wet fields are harvested late in the season if the soil has become sodden. After a wet year the normal practice is to plough deeply, and hence to invert the damaged surface out of reach of any but an exceptional frost. The farmer may look with satisfaction at his neatly ploughed field: in due course, there is enough cold weather to pulverise the surface and the following year he sows his crop in a good seed bed. Below the plant, however, the layer of puddled soil which prevents root penetration and insulates the sub soil moisture from the surface, remains. Dry weather shrinks the clay, making it crack and this helps to put the soil right again. In a dry season the cracks will be several feet deep, hence deep enough to deal with the buried trouble, but the soil seldom dries out early in the year, and even if it does, the young, shallow rooted crops will suffer from drought. So it is only the action of frost or vegetable matter which makes for soil structure, or a combination of both, which can maintain a tolerable condition in these soils. Scientists warn us that the weight of machinery used these days damages the soil deeper than we think.

So far as we know for certain, only the grass ley of at least three years' duration can provide the complete remedy.

Under favourable conditions grass roots penetrate to 6ft. below the surface, and after the ley is ploughed, the benefit of decayed vegetable matter will continue to be felt in the soil for four years or more, provided there is no excessive damage by machinery. Unfortunately this solution is unacceptable on economic grounds. I have mentioned already the difficulties of converting grass into cash with profit, but even if it were profitable to introduce, stock farming would create many difficulties. This is because the soils under discussion are farmed very intensively with cereals, sugar beet, potatoes and vegetable crops involving considerable labour and much mechanisation. Cattle and sheep would need housing in winter and fencing in summer, all of which would require fresh capital. The stockmen would be hard to find, and worse still, other employees and machinery would be under-employed on the reduced arable acreage. Indeed many farmers would sooner sell out than adopt this drastic remedy.

Are there alternatives? Crawler tractors tread more lightly on the land, and do less damage at the time of ploughing. They have lost favour in recent years, because their use implies high maintenance costs. Besides, it would be far too expensive to equip combines and trailers with tracks. To produce dung deliberately was a feature of the old four course rotation, and each farm was equipped with its cattle yards. But with narrower margins today, there can be no place for a project which does not pay its way directly. At some future date, chemicals may come to our aid. Already it is possible to improve soil structure chemically, but so far this is practical only on a minute scale. If one needs to deal with topsoil a foot deep, three square yards of a field represent a ton of material to be treated, so this is an unlikely line of immediate progress. One can imagine soil structure being induced electronically, but here again the problem would be the sheer weight of soil to be treated. It has been suggested seriously that machines should be confined to running on concrete strips, but again the cost would be prohibitive.

The most likely way of ameliorating the damage may be by using surface cultivation instead of the plough. At



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least the cultivator leaves the soil it damages on the surface for winter frosts to put right, and chemicals may be used to kill weeds previously checked by deep ploughing. This treatment can provide some sort of answer, except in the exceptional season when ruts cut deep in the soil.

Slow moving trends in farming are very difficult to discern. A series of dry harvests and autumns can sweep the problem under the carpet until the next crisis when it may be found that the situation has deteriorated even further. Monoculture of cereals in Britain is nothing new. Two generations ago Farmer and Bayliss made their fortunes

growing barley exclusively, but they chose their soils and their crops were under-sown with trefoil. New methods must be tried, but in the meantime some of the unlucky ones may pay dearly. Agricultural economists study graphs and trends of the last decade and are apt to project them into the future. In the sixties new varieties kept the graphs rising steeply: in the seventies, the incidence of plant disease together with the problems concerning soil structure, could balance out the increased yields we have come to expect.

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