

Paths of sand particles moving in saltation—or jumping—in the Groningen wind tunnel. Between 55 and 72 per cent of the sand is moving in this way. (Arrows show wind direction.)

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To tame the jumping soil

Holland's fight for land is not only against the sea. Intensive cultivation and mechanisation are damaging the soil structure. At Groningen scientists are investigating methods of anchoring the surface crust

by ROGER TURFF

THE wind blows away £1 million worth of farm crops in Holland every year. The coastal flats and sandy land in the south are a perfect target for the springtime westerlies sweeping in from the sea.

Intensive cultivation and increased use of machines are steadily destroying the soil structure of these areas. Organic matter levels are falling and continuous movement of the soil is reducing the size of its particles.

Dr. Petrus Peerlkamp, who leads the soil physics team at the Institute of Soil Fertility at Groningen, says that in some years wind damage causes losses of up to £4 million. Holland, he points out, is a small country with a big population greedily demanding more and more space for houses, roads and factories. She cannot afford to let the wind ravage those areas which remain in cultivation.

"We have about 200,000 acres which are likely to blow if the conditions are right," Dr. Peerlkamp told me. "The biggest single area is that of the bulb grounds which lie behind the dunes on the coast. This is land made by the wind and now the wind is trying to take it away. In the south and east there are 5,000 acres of light land where asparagus is the main crop. The rest is arable and horticultural land mainly in the south of the country. Altogether 15 per cent of our arable land is likely to blow away."

Apart from actual crop losses the disappearance

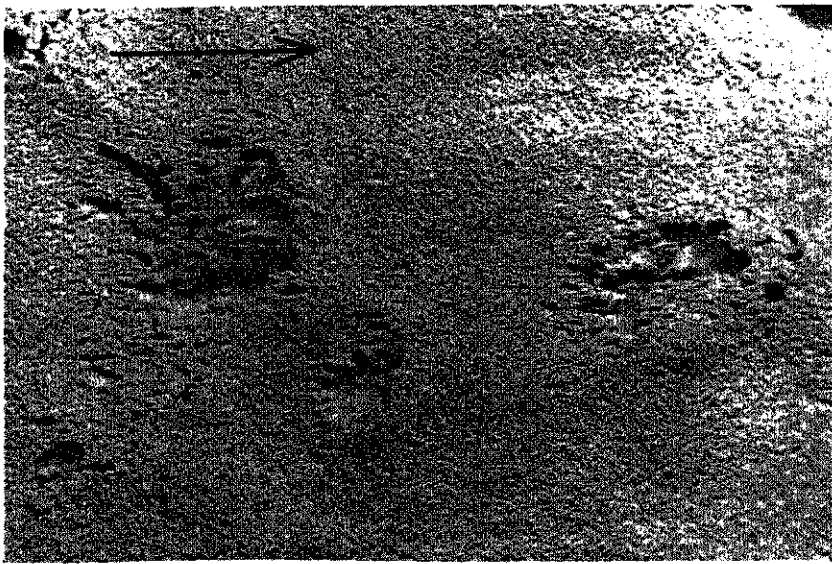
of the soil itself, in a country where large areas lying below sea level have been laboriously reclaimed, is no mean problem. Dr. Peerlkamp says this aspect is even more serious in neighbouring parts of west Germany where a great deal of new land has been made at enormous expense in the last 15 years.

Research work at Groningen has been based on systems of holding down the soil rather than protection from windbreaks and screens. A variety of agents have been used to form caps or crusts on the soil surface—most of them based in potato starch compounds. Liquid slurry has also been examined.

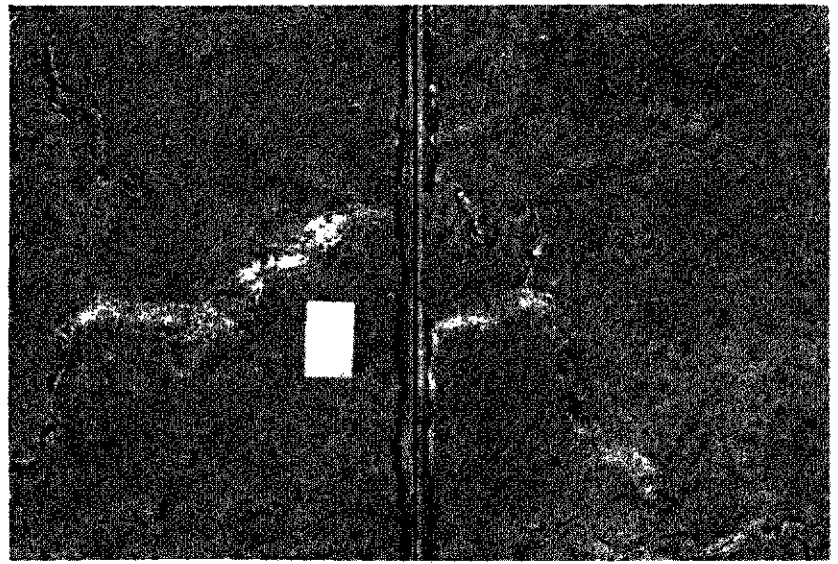
"The problem with all these materials is that their effect is quickly reduced to nothing when rain acts as a solvent to wash them down into the soil," said Dr. Peerlkamp. "The other problem is that in the wind loose particles will come from some source—perhaps an untreated field—and will scour and break the treated surface. Then the wind gets in and lifts up the crust."

This is well illustrated in the wind tunnel at Groningen built to study the effects of varying wind speeds on different materials. The tunnel reproduces speeds of up to force 12 on the Beaufort scale and I was shown a sample of starch on silty sand which was damaged and blown in a few seconds at a moderate force 5.

Slurry has given good results, particularly when chopped straw is used to help aggregation. This



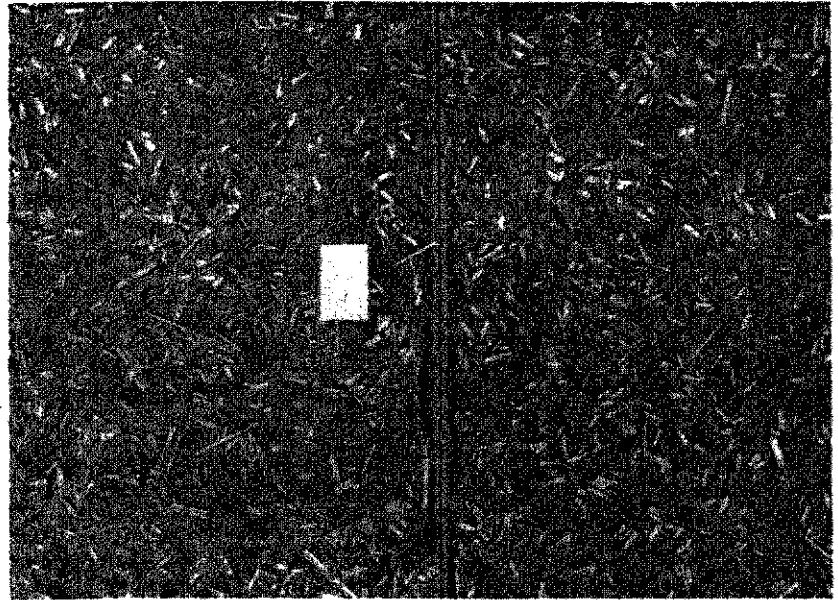
Sand blown over an artificial crust damages it and the soil underneath is blown out of the cracks.



Sand covered with a mulch of slurry after drying. Cracks are developing and the underlying sand can be blown out.



A mulch of town refuse compost has been spread as moist as possible and then sprayed. If used as coarsely as this it gives good protection to the underlying soil.



This sand has been covered with a mulch of slurry and cut straw. This produces a rougher surface which breaks up wind currents and prevents surface cracking.

produces a rougher surface than starch and helps to break up the wind currents which stream along the surface. But it is prone to cracking in dry periods and a combination of sun and wind is disastrous. Slurry is fairly cheap. Starch, at about £4 an acre plus spreading costs, is not.

Apart from mulches made from processed domestic refuse, one foolproof system has been discovered. This uses a liquid plastic which gave complete wind protection, required only one application and had no ill effect on crop growth and penetration. It has one snag. It costs £200,000 an acre.

But the dustbins of Holland have provided the cheapest and most efficient protection against erosion yet. Only a well-grown windbreak compares favourably with the rubbish mulch produced by the Institute of Soil Fertility. Under test the mulch has withstood wind speeds of typhoon strength. It is light to transport and fairly easy to spread. But the cost still rules it out for anything but the highest value crop.

The Dutch have used refuse as an aid to land reclamation for centuries. The early drainers used a layer of rubbish beneath the topsoil to give extra freeboard and, more recently, very finely ground refuse has been a popular mulch for market garden crops. The fine material, however, is unsuitable as a protection against the wind. Dutch specialists say that the ideal particle for a surface layer has

about a 3 mm diameter and that as this size decreases the likelihood of blowing increases. Their research has been aided by the Dutch method of refuse disposal, which is done in large mills capable of grinding the rubbish to any consistency between large granules and powder. In Britain most refuse is put through incinerators.

The production of the mulch is simple. Dust-carts shoot their loads on to large tips which are frequently slaked with water to wash the finer contents down in the heap. Metal, bikes and bedsteads are drawn off with magnets. The heap is left for about six months, during which time some fermentation takes place. It is then fed through the mill, ground down and passed back under the magnets to remove the small metal.

For the purposes of mulching the compost should contain no more than .05 per cent glass and .30 per cent carbon particles of more than 6.5 mm diameter. Large pieces of glass would be dangerous to both men and the crop and chunks of carbon—coke in particular—are too light and easily blown. According to the Groningen research the material will contain from 6 to 23 per cent organic matter, negligible quantities of other nutrients, and up to 40 per cent moisture.

There is no indication of the acreage which has already been treated in Holland but the cost suggests that it would be small. Delivered, the compost costs a little over £2 a ton to which must be added charges for spreading and irrigation.

Spreading may be done by hand from the back of a truck or with a fertiliser spinner but I understand that some Dutch machinery firms have shown interest in making specialised equipment.

Irrigation is essential, for the material is fairly dry and will blow unless it is sprayed at once. This washes the small particles down into a firm bed from which the larger pieces protrude to give a rough finish. It is this rough surface which breaks the force of the wind and prevents the jumping effect of moving particles. Unfortunately irrigation also increases the quantity of compost required as it is essential to get a well-closed layer. Any gap will be found and opened by the wind.

For small areas it may be possible to lay a good cover with 16 tons to the acre but rates of up to 32 tons an acre have been used on larger areas. As any form of cultivation immediately destroys the protective cover this makes an annual cost of using compost anything from £32 to £64 an acre. This might be reduced where minimal cultivation techniques are practised and there would be an improvement of aggregation where the material was in use over a period of several years but very few crops would stand the cost.

On the other hand, the Dutch physicists have discovered a valuable research tool. They know how to improve aggregation and effectively prevent erosion; now they only have to beat the cost.