
FARMING AND PASTURE IMPROVEMENT ON SAND COUNTRY

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ALONG the west coast of the southern part of the North Island from Paekakariki in the south to Patea in the north and extending inland for from two to twelve miles is a belt of sand country covering approximately 270,000 acres. Most of it is suitable for farming but an extensive area is more suitable for afforestation. Large areas are only partly developed and production generally is low. Although there has been a marked improvement in farming in the area in the past decade there is still great scope for improvement.

The sand country consists of a complex of dunes, sand plains and small peaty areas. This sand originally carried to the sea by rivers is deposited on the beach by wave action and is then blown inland to form the dunes so characteristic of the sand country.

The young dunes along the coast are mainly raw sand with little vegetative cover and are unsuitable for good pasture growth, but the older, consolidated inland dunes, which usually run at right angles to the coast have a fair cover of topsoil and can produce fairly good pastures.

Between the dunes are extensive sand plains which range from flattish to fairly undulating and the height of the watertable is very variable. Drainage of the flat land is impeded in places by the dunes and where drainage is very poor the soil stays wet for most of the year. At the other extreme are the excessively drained areas where the subsoil is dry for most of the year. Much of the flat land, however, is intermediate between these extremes and, provided excess water is removed by artificial drainage, it will maintain good pasture growth throughout the year. The soils may, however, vary from paddock to paddock or even within paddocks, and hardly any farms consist of a single soil type. South of the Manawatu River, the dunes are much higher and the flats much less in area and higher above sea level than they are farther north.

Large areas of the sand country still remain relatively undeveloped. These are mainly the excessively dry lupin and gorse infested dunes and flats but there are other areas too that tend to be too swampy and are difficult to drain. Such undeveloped areas are used mainly for run-off for dairy and beef cattle and the more intensive development has been largely confined to the more fertile and heavier soils where soil moisture is satisfactory for pasture growth throughout the year.

Drainage

Though the soils of the sand country are free draining, most of the low-lying flats are very wet because of a persistently high watertable which at times is at soil level or even above it. Artificial improvement of drainage is therefore an important factor in increasing production. The sandy nature of the soil will not permit the use of tiles or moles and in any case, deep drainage is not advisable, as the soil contains little clay to hold moisture and a reasonably high watertable is necessary for good pasture growth. Drainage should therefore aim at the removal of surface water only and for this purpose broad V-shaped drains have been found most suitable.

Climate

The summers are warm, the winters fairly mild and the rainfall is reliable and evenly distributed throughout the year. The 35 in. of rain per annum is one of the lowest in the North Island, but the average distribution is generally so good that this fact is perhaps not generally realized. Abnormal periods of heavy rain or drought can occur, however, almost at any time of the year, and can have a very marked effect on management, pasture growth, and stock and farm returns. The sand country is subject to strong and persistent westerly winds which have an adverse effect on stock and plant growth. The winds increase in frequency in spring, causing loss of moisture, particularly on exposed sites, and a considerable amount of sand erosion and drift.

Mineral Requirements

The soils are deficient in a number of major and minor elements, which must be corrected to get high plant and animal production. However, from trials and soil tests carried out by the Department of Agriculture both major

and minor element requirements are now fairly clearly understood and over the past ten years or so there has been marked improvement in both stock and pastures.

Practically all of the sand country responds to phosphorus and potassium and it is now general practice to topdress pastures annually with potassic superphosphate at 2½ to 3 cwt per acre. This is usually applied in early autumn, which is generally considered to be the best time to apply the fertilizer but on some of the drier soils where subterranean clover is the dominant legume it would probably be better to topdress very early in the spring as this would coincide with the start of the period of peak pasture growth on this class of land. A few farmers, however, apply the fertilizer in split autumn and spring applications and possibly because of the likelihood of leaching of potassium this practice is warranted on sand country. It is also probable that higher rates than 3 cwt per acre should be used, at least initially, but this opinion needs confirmation by more trials. Most of the soils are moderately acid to slightly alkaline and in trials there has often been good responses to lime but so far lime has not been widely used.

With the exception of molybdenum on some areas there have been no significant pasture responses to trace elements ; the use of molybdenum, however, is not recommended because of a general copper deficiency.

Until a few years ago stock thrift problems were very prevalent on much of the sand country and on some farms great difficulty was experienced in rearing young cattle in particular and it was not an uncommon practice to shift young stock on to clay and other soils for a period to correct deficiencies. Also lambing percentages tended to be low in some areas and hogget mortality was exceptionally high.

A general copper deficiency in the area has been recognized for many years and at one time it was general practice to apply copperized superphosphate to pastures but even this did not always result in thrifty stock. It is now known that the reason for this was that there is also a selenium deficiency and possibly to a lesser extent a shortage of cobalt. Most farmers now carry out an intensive drenching or injection programme with these elements and the class of stock now produced compares favourably with the best elsewhere.

Weeds and Insect Pests

The worst weeds of the sand country are gorse and, to a lesser extent, blackberry. They are mainly found on the

less productive, drier land and especially on run-offs. Another important weed is tree lupin and, although it is scheduled as a noxious weed in some districts, there can be little doubt that it has played an important role in the improvement of dune country and one wonders whether the destruction of this weed on the partially consolidated hills is always warranted.

Insect pests are a real problem on much of the sand country, the worst being grass-grub, subterranean caterpillar, white-fringed weevil, sand weevil and springtails. At a field day last July, the writer unearthed 3 grass-grubs, 45 subterranean caterpillars and 33 white-fringed weevil larvae from one cubic foot of soil. On the whole, the control of grass-grub by use of DDT has been reasonably satisfactory but as has been the case elsewhere, effective control of subterranean caterpillar has not been so good and it is felt that there is a great need for cheaper and longer lasting chemicals for use against this pest. White-fringed weevil and sand weevil are becoming an increasingly important pest of pastures and crops on sandy soils. It is known that the larvae can and do cause serious damage to establishing pastures and crops but the effect on older pastures has not yet been seriously investigated. In addition, the adult can cause failures in brassica crops. The control of this insect poses a problem because DDT does not give satisfactory control and the place of aldrin requires further investigation before its use can be generally recommended.

Water Supplies

There are hardly any creeks running through the sand country and most farmers depend on subsurface water for stock. Water can usually be found at depths of 12 to 15 ft and shallow wells are frequently used. However, the water from these is not particularly good, being discoloured by ironstone and often murky. An alternative method adopted on some farms is to sink deep wells and reticulate water round the farm from the one source. This water is clear, though hard, and remains fairly clean in the troughs.

Land Utilization and Agriculture

Farming of sand country is just as complex as the soils and there is considerable variation in the methods and costs of developing the land for farming. Factors which influence use and costs are original vegetative cover, the relative proportion of moist flats, dry flats and dune areas, whether the land is used for sheep or dairy farms and the methods of development used,

Younger Unconsolidated Dunes

There are several thousand acres of unconsolidated dunes and they occur mainly near the coast although scattered areas may be found inland. They have not been farmed, as pastures cannot be maintained owing to the dryness, lack of consolidation and heavy drifting of the sand. When Europeans first took up land on the sand country there was very little under drifting sand. However, indiscriminate grazing by cattle resulted in a loss of vegetative cover and started many sand drifts. About 30,000 acres of this land is now fit only for afforestation, but, before it can be used for this purpose, it is invariably necessary to stabilize the sand by planting marram grass and tree lupin. Pine trees thrive on this class of country and about 6,500 acres have been planted with *Pinus radiata*, some for protective purposes and some for timber production.

Older Stabilized Dunes

There are considerable areas of old consolidated sand hills carrying either clean native pastures, or rough cocksfoot/browntop pastures with scattered lupin and bracken fern growth. In their undeveloped state, these old sand hills are often broken and hummocky on the surface, are difficult to work with normal farm implements, and have a low stock-carrying capacity. The majority will support better pastures if oversown and topdressed, which is normally done from the air. Better still, if they can be cultivated, sown to summer feed crops and regrassed with suitable pasture mixtures, their value from a stock-carrying, production, and workable point of view is greatly enhanced. Particular emphasis is placed on this rapid and complete change to higher-production pastures on the dairy farms of the coast. In Horowhenua County many of the coastal dairy farms produce whole milk for Wellington City supply.

The old sand hill country has built up 12 in. to 15 in., sometimes deeper, of black humus-impregnated loamy top soil, which is safe to work with no particular danger of sand blows and erosion problems.

Where this hill country can be cultivated, the initial breaking-in is normally carried out by an agricultural contractor, using a crawler tractor with a heavy type giant disc harrow. The practice is then to double cut all the hill tops and easy sidelings and as much of the workable slopes as possible in the late winter-early spring period, leaving the land in a rough state of cultivation for weathering and rot-

ting of the old turf. Bulldozing of lupin and scrub growth into heaps, and burning, may be necessary before giant discing is undertaken. The land is later further worked down with tandem disc harrows and tine harrows, rolled, and sown to a crop of soft turnips for summer feeding. Turnips are popular with dairy farmers. Previously, some sheep farmers used rape as a breaking in and summer feed crop, but, owing to its uncertainty from a ripening point of view, its popularity has declined. The turnip crop is normally easy to grow, it does not require high fertility for a successful crop, and it is a good milk producer over the dry summer period. The crop should be sown early and should be well away before the dry weather sets in in late spring. September is a good month for sowing. Popular varieties of turnips are New Zealand York Globe and Green Globe, which are quick maturing and palatable.

Repassing

After feeding-off the turnips, normally on the break-graze system, the land is disced and tine harrowed, rolled and sown to suitable pasture mixtures. These vary to some degree according to requirements. A typical mixture is shown in Table 1.

TABLE 1: TYPICAL PASTURE MIXTURE

	<i>lb/acre</i>
Certified perennial ryegrass	20 to 25
Certified short-rotation ryegrass	5 to 10
Certified cocksfoot	5
Certified white clover	2 to 3
Certified red clover	2
Certified subterranean clover	2
Total	36 to 41

On sheep farms, 1 to 2 lb of crested dogstail is normally included in the mixture.

Fertilizer Requirements

Phosphate and potash are recommended for all regrassing, 3 cwt of 30% potassic superphosphate being the normal amount applied at grassing down, and as a topdressing in the following autumn. An extra topdressing with superphosphate in the spring following sowing will give the pasture an additional boost,

The system described in regrassing discable sand hill country is one which has an immediate effect from a stock carrying and stock health point of view. It also results in better moisture-holding capacity of the land and the improved pastures are slower in drying out over summer periods than the old native pastures and recover more rapidly after normal autumn rains.

Stabilization of Sand Blows

In some districts, the consolidated dunes, in conjunction with their associated flats, are keenly sought after as run-offs by both dairy and sheep-beef farmers farming on wetter land. Recent market prices of run-offs are often higher than their productive value and usually they are owned or leased by people who are in a sound financial position and apparently prepared to pay for the easy and convenient method of overcoming wintering problems that a run-off provides. Unfortunately, many of these areas are deteriorating badly through poor grazing management. On some there has been a considerable reversion to bracken fern and lupin, blackberry, gorse, etc., through lax grazing and on others, especially where they are being grazed by sheep and beef cattle, large sand blows are developing with a resultant drop in production. The blows usually start off as small bare areas caused by sheep rubbing or lambs playing and gradually increase in size if not attended to. Each little blow must receive individual attention, but it can be readily controlled by covering with hay, tree lupin or other vegetative matter. Larger blows are much more difficult to control, especially when they are on steep uncultivable faces, but they can be restored relatively easily provided stock is excluded from the area for a period. Affected areas should be fenced off and bitter blue lupin or Borre lupin (if the area is rabbit-free) sown on the blows in early August at 3½ bushels per acre. Where possible, the seed is drilled in but on steeper country it has to be sown by hand or plane and the seed is then tramped in by stock. The area is then left untouched until after the lupin has reseeded in January when it is given a light discing to cover some of the seed, or stock is concentrated on the area to tramp the seed in. The seed germinates after the autumn rains and at this stage pasture species are introduced by overdrilling or hand-sowing. Work done by Department of Agriculture soil conservators has shown lucerne, *Phalaris tuberosa* and cocksfoot to be useful species for this purpose.

Sand Plains

The greatest agricultural production undoubtedly comes from the sand plains, especially the moister areas which are more extensive than the dry flats. Most of the farms on the wetter flats, however, contain a proportion of drier country in the form of consolidated hills and slightly elevated drier ridges. Much of this type of country lends itself admirably to dairying since it is possible to graze stock on the wetter land during the milking season and winter them on the drier areas when pastures on the wetter flats can be damaged by pugging. The wet and the dry soils are therefore complementary to each other. However, it is the manner and proportion in which the various types, sub-types and phases are associated which determines overall use.

Where there is a high proportion of moister land, dairy farming predominates, but there are quite a number of very good sheep-beef farms as well. Dairy production is gradually improving and a number of farms are carrying near to one cow per acre plus replacements and butterfat production of around 300 lb per acre is now becoming fairly common. This class of land when fully developed will also carry 6 ewes per acre plus supporting beef cattle and the lambs do exceptionally well.

Until a few years ago, dairying also predominated on the drier flats but this class of land is now being used more and more for sheep and beef farming and for run-off purposes. Lambs do very well on the drier flats too but it is important that the lambs be drafted early as these flats usually dry out badly in summer.

Pastures

Under good management and adequate topdressing, high-producing pastures containing perennial and short-rotation ryegrass, cocksfoot and timothy can be maintained on the moister land. White and red clovers do well, while strawberry clover flourishes on the poorly draining soils and in places it replaces white clover.

On the drier flats, pastures consisting of ryegrass, cocksfoot, crested dogstail and subterranean and white clovers can be established but because of lack of moisture and fertility together with insect damage they tend to revert fairly rapidly to poorer species such as browntop and hairgrass. They can of course be restored to some extent by overdrilling or the feeding out of good hay. Lucerne is a good species on this class of land and although it is used

to some extent there is very considerable scope for expansion. It is usually sown in the autumn after a summer feed crop. At times, establishment tends to be poor because of wind damage, lack of moisture and insect damage. One or two farmers have had good results from drilling lucerne into run-out pastures and this practice is likely to increase. Once established, lucerne produces well for most of the year and greater use could be made of it for grazing purposes. It is probable too that *Phalaris tuberosa* might have a place on the drier land but fertility would need to be reasonably high for it to give worthwhile production. *Paspalum* has been tried but it has been virtually useless probably because of low fertility.

Supplementary Crops

Crops are frequently grown on the sand country for supplementary feed in times of shortage of pasture growth. Choumoellier and swedes are used fairly extensively in winter, especially on sheep farms, while turnips and rape provide summer feed especially on dairy farms. Pastures are renewed as the land is cropped and since cropping is carried out to provide supplementary feed and not as a means of pasture renewal, pastures tend to be left too long before renewal. However, with improved fertilizing, better control of insect pests and better stocking, the need for frequent renewal is less necessary than it used to be.

Cash Cropping

Very little cash cropping is done on the sand country but barley is sometimes grown after winter feed crops and yields are moderate.

Conclusion

The potential for increased agricultural production on the sand country is considerable. Admittedly there are many well-farmed properties but much of the area is only semi-intensively farmed and there are still large undeveloped areas, including good moist flats that could be developed quickly and cheaply. In addition, many of the inland consolidated dunes could be improved tremendously by the methods outlined in this paper.

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DISCUSSION

What is the carrying capacity in terms of ewes on the improved and consolidated flat and rolling sand country?

An example is the all-sand-country farm of A. T. and D. B. Kilsby, Foxton Road, Levin. This is a flat-to-rolling, sand-country fat lamb unit of 430 acres carrying 1,108 ewes, 80 ewe hoggets and 50 Polled Angus breeding cows. In addition, 98 to 100 2-year P/A steers and up to 500 lambs are bought-in for fattening each year. One hundred and thirty-two fat cattle, P/A steers, were turned off in the past season.

COMMENT: T. E. Ludecke said that there was a place for lucerne under a relatively low rainfall even with the watertable at an average of 10 to 15 feet. Experience in Central Otago under 8 in. rainfall, but with a watertable at 10 ft, showed that lucerne cut 10,000 lb of dry matter while with irrigation this increased to 13,000. Lucerne pasture should result in higher production on the sand country in question.

Is the urea of lucerne increasing on this sand country?

Yes. Because of its ability to withstand hot, dry summer conditions once it is well established, lucerne is important in farming on the coastal country between Paekakariki and Wanganui. The popularity of the crop depends on seasonal conditions; for instance, the 1961-64 seasons were unusually dry, renewed interest was shown in the crop, and many new stands were established.

Is it recommended that lucerne be included in the seeds mixture of ryegrass, white and subterranean clovers?

We have no experience of this practice, but believe that the strong competition from pasture growth, particularly subterranean clover growth in the season, would be detrimental to lucerne in grass/clover mixtures.

COMMENT: J. Whyte said that several trials in the South Island had demonstrated higher yields from pure lucerne rather than from lucerne grass mixtures.

Have any responses to sulphur and/or copper been recorded on the area in question — responses, that is, in terms of legume growth?

No known instance of responses to copper or sulphur has been recorded.

How much of a problem are grass-grub, subterranean grass caterpillar and white-fringed weevil?

White-fringed weevil damaged young lucerne in the Waitarere Beach area a year or two ago. Actually the weevil was first noted at Waitarere some years ago, when young pine trees were severely affected. In well-established lucerne stands, grass-grub and subterranean grass caterpillar are not the problem they are on coastal pastures.