11/8/55
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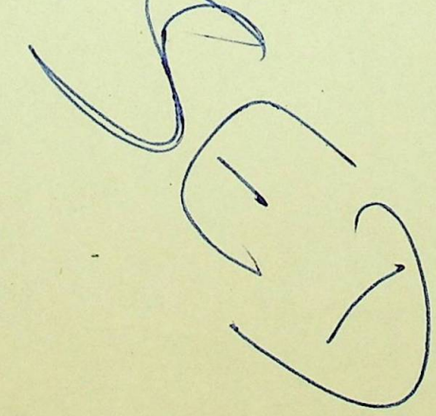
PASTURE IMPROVEMEN

Experiments,
Fertilisers,



25.

GUSTAVUS STANTON YONGE

Punta Arenas, 11th. August 1955.

1/25/1956

To The,
Agricultural Department.
STANLEY
Falkland Islands.

Dear Sirs;

Referring to my conversation in Punta Arenas with your Mr. Fern during his visit to Punta Arenas, regarding the improvement by heavy stocking, combined with rotanional grazing, I should be willing to cooperate by facilitating the use of the necessary land of up to fifty or sixty acres, which could be cut up into four paddocks with a small paddock in the center for a dry sleeping ground with shelters.

I also declare that I would be willing to participate in some of the expenses, provided they are not to heavy.

Awaiting your reply on this matter,

Yours faithfully.

G. Stanton Yonge

Gustavus Stanton Yonge.

AGRICULTURAL DEPARTMENT
6th Sept. 1955
FALKLAND ISLANDS

2/25/1937

From His Excellency the Governor

to the ~~Honourable the Colonial Secretary~~ Agricultural Officer.

Next time the rangers are having a large number (say 300 or more) cattle, what about putting them all for a few days in the 60 acre, having previously scattered it with grass seed? Would not the cattle trample in the seed & manure it, & at the same time eat off the coarse grass.

ORA
3/12/37

the aircraft operators, would amount to only 20% of the total cost involved.

17. As an indication of the area you may expect to have treated in a year using one Beaver aircraft, the following table is of interest:-

INTENSITY	225 lbs.	450 lbs.	675 lbs.	900 lbs.	1125 lbs.
ACRES P.A.	9000	4500	3000	2250	1800
SQUARE MILES P.A.	15	7½	5	3¾	3

Thus, at a rate of 2 cwt of fertiliser per acre, a small farm such as Rincon Grande would require one year to completely cover. It is obvious from this why New Zealand is employing such a very large number of aircraft for this work. In justification of aerial top- dressing however, I do feel that to complete the same area in the same time by any other means would prove equally costly, and there may well be many pastures in the Colony to which access by any other form of transport would be wellnigh impossible.

18. It is obvious to me that if top-dressing were seriously undertaken in the Colony, and that after five years it was proving to be of lasting benefit to the pastures, then there would be general demand from the farmers for the rate of application to be speeded up. With one aircraft it would take well over two hundred years to complete the whole of the Falkland Islands! And that at the low rate of application of 2 cwt. per acre! Provided that the treatment was economically beneficial, working on the basis of the scheme I have proposed above extension and speeding up would be a simple matter, for it would only require additional aircraft and teams to be brought to the Colony, each aircraft and team working as an independent unit. I can quite well visualise that in ten years time we may well see as many as five aircraft employed in the Colony purely for agricultural purposes. But this you may feel is unnecessarily futuristic, and I agree that the first step is to decide whether there is any future in such treatment of the pastures at all. If there is a future, then I consider the small trials proposed in the early part of this paper would be well worthy of the limited expenditure involved.

(Sgd) John Huckle

Harbour Master.

petrol is established at Fitzroy by sea transport. The aircraft and team will then fly to Fitzroy, where they will be based until the operation there is completed. Provided that the dropping area is within ten nautical miles of the fuel and fertiliser depot, I estimate that 1½ tons will be dropped per flying hour, so to complete the 500 acres about 35 flying hours will be required, probably taking about three weeks. During that period it will be necessary for the aircraft to be flown to Stanley once for a 25 hour overhaul. After the completion of this work the aircraft will proceed to the next settlement, where a fuel and fertiliser depot will already be established.

13. As previously stated, accurate costing can only be carried out after the actual intensity of coverage (lbs. per acre) required is known. However, the following data may provide a useful guide. It can be assumed that the total flying operations per annum wll cost approximately £10,000 composed as follows:-

	£
Aircraft capital depreciation	2,500
Insurance (on the water risks, pilot, etc)	700
Fuel and oil (based on 600 hours flying p.a)	3,000
Aircrew (pilot and mechanic, including bonus)	2,100
Maintenance based on 600 hours flying - (24 minor inspections @ £20, C. of A. overhaul @ £400)	880
Spare parts and contingencies	500
Ground controller	300
Total aircraft operating costs p.a.	£9,980

14. In the above it will be noted that the annual flying hours have been assumed to be 600, which may prove to be a conservative estimate since in this type of operation the pilot is concerned solely with local and not area weather, and with a bonus to think about he may be expected to seize every opportunity. The annual C. of A. overhaul which will ground the aircraft for an appreciable time can be timed to coincide with the shearing season, during which farms are fully occupied ahd have little chance to attend to other activities.

15. The farmer is not however particularly interested in the cost of the flying operations in themselves. He requires to know the cost per acre covered, and to produce estimates for this there are two variable factors to be considered; firstly the intensity of the coverage, and secondly the flying hours per annum. The second variable I have arbitrarily fixed at 600 hours, this estimate being based upon my personal experience of flying conditions in the Colony. With that fixed, I have tabulated below the cost per acre of aerial top-dressing for varying intensities of coverage as follows:-

INTENSITY	225lbs.	450 lbs.	675 lbs.	900lbs.	1125 lbs
COST OF TREATMENT	£1.5.-.	£2.10.-.	£3.15.-.	£5.-.	-. £6.5.-.

16. It can be seen from the above table that if the cost of the fertiliser delivered to the farm were £60 per ton, the actual aerial dressing charge, including a profit margin for

/the

obviated by a protective coating of some material such as pitch. The consideration that weighed heaviest in favour of the Beaver as opposed to other types in my mind was that there is already available in the Colony skilled maintenance personnel for this type and also a holding of spare parts. Were another type employed for top-dressing, these two factors would have to be introduced into the Colony, with an inevitable increase of capital expenditure and annual costs. The cost of an equipped Beaver seaplane at present would be about £20,000.

I have mentioned a minimum of ground equipment. At the moment I can only foresee the necessity for very little: a few maintenance tools for the mechanic; hoses and a small petrol-driven pump for washing the aircraft at the end of the days flying operations; and a dozen or so heavy planks for making a temporary slipway at the settlement at which the aircraft is based.

8. The Pilot. He must by law hold a C.P.L. I have written to the B.A.L.P.A. for up-to-date figures of salaries for pilots engaged in this type of work, but inevitably it will be higher than that paid to F.I.G.A.S. pilots. I anticipate it will be approximately £1200 per annum, with a bonus on the acreage covered, which is the normal procedure elsewhere.

9. The Mechanic. I have noted above that he need not be a licensed engineer. He should however be sufficiently qualified to be capable of performing the routine daily inspection reliably. All other inspections and the annual C. of A. overhaul will be performed by F.I.G.A.S. engineers, and for this service the top-dressing company will pay a fee. I consider a reliable mechanic could be obtained for a salary of £600 per annum, plus a bonus on acreage covered.

10. The Ground Controller. His duties, assisted by a labourer loaned from the farm concerned, would be to mark the dropping lines, and in view of the lack of contoured maps for the Colony he would be required to pass heights of the ground check points to the aircraft, either by means of an R/T set or by an agreed system of signals. For this work a locally engaged man could be very quickly trained. I originally considered that such a man could be trained at each settlement while the aircraft was based there, but I have come to the conclusion that it would be better to have a complete team working together all the time, especially as the additional expenditure is negligible. The ground controller need not be paid more than £250 per annum plus a bonus on acreage covered.

11. Apart from the man mentioned above who would constitute the other marker working with the ground controller, casual labour would be required at the farms from time to time to assist in beaching operations. Refuelling and replenishing with fertiliser would be carried out by the pilot and mechanic however.

12. I have visualised the operations being carried out in the following manner. Assume that the first requirement is for the aircraft to spread 50 tons of fertiliser over 500 acres of Fitzroy Farm. Initially a dump of fertiliser and

/petrol

4. I am not anticipating that farmers in the Colony will want to spread their pastures with guano! This fertiliser has been selected for the purpose of the experiment only as being comparatively easy to obtain locally and yet at the same time capable of producing visible results on treated pasture. I understand that a more likely treatment to be applied in the first instance if aerial top-dressing is entered into here would be the spreading of cobalt to cure its deficiency in the soil of the Colony and thus improve the condition of the stock. I would recommend to the attention of the committee the possibility of combining cobalt with a highly concentrated chemical fertiliser and possibly grass seed. There may be very good technical reasons why it is not possible to combine treatments in this manner, but viewed purely from the flying aspect it would be quicker and more economical in the long run to put down three treatments simultaneously than three separately. I respectfully submit that this consideration would be worthy of discussion by the committee if it is decided that aerial top-dressing in the Colony should be carried out. Even with the use of aircraft the treatment of the Colony's pastures would be a very long-term policy, and like so many farming projects, it is unlikely to show tangible results for a number of years.

5. The trials proposed above will only be of value if there is any possibility that large-scale top-dressing will one day be undertaken here. It would obviously be a waste of time and money to carry out the experiment if there is never to be any hope of larger operations. To assess this hope would therefore be a primary duty of the committee, and in this assessment economics will obviously be a deciding factor. Unfortunately it is impossible for me to make hard-and-fast estimates of the costs involved until the treatment required has been finalised. However, I have during the past twelve months considered the problems involved carefully, and I am pleased to be able to inform you that I consider aerial top-dressing on a large scale here a practical economic proposition, and purely to initiate discussion by the committee, I have the honour to submit the following conclusions.

6. The operations should be undertaken on a profit-making basis by a private enterprise concern, closely allied to F.I.G.A.S. A confidential rider to this paper is attached which gives my reasons for this conclusion. This concern should not be built up into a large, unwieldy organisation. Initially, the following is the required establishment:-

(a) Equipment. 1 Beaver seaplane, equipped for dusting.
A minimum of ground equipment.

(b) Personnel. 1 C.P.L. Pilot
1 Mechanic (not a licenced engineer).
1 Ground Controller (locally recruited and unskilled)

I will now deal with each of these requirements in turn.

7. Beaver Seaplane. After careful thought I consider this aircraft would be quite suitable to undertake the work. The possibility of abrasion to the rear of the floats can be

/obviated

COPY

3/25/56

Harbour & Aviation Department,
PORT STANLEY.

4th February, 1956.

Your Excellency,

IMPROVEMENT OF COLONY'S PASTURES BY AERIAL TREATMENT

If it is considered desirable to improve large areas of grassland in the Falkland Islands by treatment with either chemical or natural fertilisers, the obvious, and possibly only, method of application in a country where other forms of transport are so limited is by the use of aircraft. It is interesting to note that the most recent figures published by the Commonwealth Air Transport Council disclose that in New Zealand 237 aircraft are at present employed solely for agricultural work, and that during 1955 no less than 279,006 tons of fertilizer were dropped on pasture land from the air. New Zealand, with a surface are of 103,000 square miles, is approximately 25 times bigger than the Falkland Islands, but even so, if we were to utilise aircraft in the Colony proportionate to those engaged in agriculture in New Zealand there would have to be nine aircraft in service here.

2. I consider that the time is now ripe to conduct a small, practical experiment in this Colony to prove the possibilities of top-dressing pastures here, using for this resources already locally available and without incurring capital expenditure. I have outlined a scheme to Messrs. Barton and Fern, both of whom are in favour of the general principle. This experiment, which would incur the expenditure of £100 at the most from Public Funds, would consist of three parts.

3. (a) Committee. I would like a qualified committee formed to conduct the experiment. It is essential, if it is to be of any real value, that all stages be accurately observed and assessed. If you approve of the experiment in general , I would be grateful if you would give consideration to a committee composed of the following members:- Your Excellency, Messrs. Barton and Fern and myself.

(b) Initial Trial. The object of the initial trial would be to prove that locally constructed equipment fitted to the F.I.G.A.S. Beaver can produce sufficiently good results to justify carrying out the main part of the experiment. This initial trial would consist of spreading 1000 lb. of peat mould on the race course and from this drop the swathe width and the intensity of coverage could be assessed. If the intensity of coverage is considerably more, or considerably less than that required for the main trial, this trial would enable the calibration of the home-made drop chute to be carried out

(c) The final stage of the experiment. This would consist of treating an agreed are of average pasture with a ton of guano. The guano is readily available from South Georgia and could be shipped to the Colony for this experiment in either the R.R.S. "John Biscoe" or the S.V. "Shackleton". The main expense involved in the experiment is incurred in obtaining guano.

/4.

4/25/56

No. 1755.

It is requested that, in any reference to this memorandum the above number and date should be quoted.

MEMORANDUM.

16th February, 1956.

To: The Agricultural Officer,

STANLEY.

From: Acting Colonial Secretary,

Stanley, Falkland Islands.

SUBJECT:- Improvement of the Colony's Pastures by Aerial Treatment.

I am directed to enclose herewith a Memorandum received from the Harbour Master on the above subject and to inform you that His Excellency would be pleased if you would serve on the suggested Committee - paragraph 3 (a) of the Memorandum refers.

2. His Excellency has considered the proposals set out in the Memorandum and thinks that some steps should be taken to give effect to them.

Department of Agriculture
17 FEB 1956
FALKLAND ISLANDS

Acting Colonial Secretary.

JB/LJH.

5/25/56

25th February 1956

The Hon. The Colonial Secretary,

STANLEY.

FROM :
AGRICULTURAL OFFICER

IMPROVEMENT OF THE COLONY'S PASTURES BY AERIAL TREATMENT.

I acknowledge the receipt of your memorandum No. 1755 of the 16th February 1956, and note that His Excellency would like me to ser on the suggested committee.

With due respect however, I would ask whether my suggestion fo the setting up of an Agricultural Advisory Committee in this Colony could be adopted, as I am convinced that such a Committee would be th best authority to deal with this matter. I would prefer to see full co-Operation from the Farming Community right from the outset, and above all, continuity. It is my opinion that only with an Agricultura Advisory Committee can this be obtained to the satisfaction of all concerned.

While I am in favour of preliminary experimental work being carried out to devise a method of treating pastures from the air, I feel that before any fertilisers are used, ttese should be tested in ground experiments on plots, in order to ascertain what particular fertilisers are required in the Falkland Islands.

EDWARD T. FERN

AGRICULTURAL OFFICER.

6

From E.G.Rowe care of Messrs Goñi Pontin y Cia.
Calle Sarmiento 329 6° Piso
BUENOS AIRES
17th April, 1956

F. Fern, Esq.
Agricultural Officer
Port Stanley.

Dear Mr. Fern,

re Australian barley (BROMUS UNIOLOIDES)

Due to a mistake in this office (while my cousin was away on holiday) 50 bags of the above type of seed was sent to Port Stanley, where it arrived per 'Fitzroy' at end of March.

I have made the necessary enquiries at this end to find out what good can be got out of it, and the seedmen's catalogues say:-

" It is without doubt the best green fodder plant for winter feeding, and grows from Autumn to Spring, forming , given suitable conditions, clumps which get to be perenials.

In the Argentine it is to be found from Latitude 25° South, to 54° South (that is 2 degrees further South than the Falklands.)

It prefers good rolling ground and does best with ample rains.

All kinds of animals eat it with gusto.

Sow from February to November at the rate of 25 to 30 lbs. per acre. "

Thus this mistake may prove to be beneficial in the end to the agriculture of the islands, by the introduction of a new type of green fodder, which does not need tp be cut, dried and warehoused like the oats fodder at present in use. As the stuff grows during the winter and the cattle can be allowed to graze it direct.

There are only 50 bags of this seed and in order to cover our costs I should like to sell those bags at £2.10.-- each. Each bag weighs approximately [redacted] 66 lbs. and would therefore be sufficient to sow something over 2 acres. I am asking Mr. Reive to send you a generous sample of the seed, which you will see is a very fine light seed. I understand it is difficult to sow by drill, but can be successfully down by hand or by means of the usual 'fiddle'.

P.T.O.

from overleaf.

Thanking you in anticipation for anything you may see fit to do with the object of getting this 'seed' tried out, I am, with my best wishes and kind regards,

Yours sincerely,

E.G.Rowe.

With the Compliments

of the

Colonial Secretary

Secretariat,

Stanley.

8. 9. 61.

REPORT ON VISITS TO FALKLAND ISLANDS SHEEP STATIONS

Farming in the Falkland Islands is based today on the production and export of wool. Sheep are the dominant live stock, but there is very little export of mutton or live sheep, the only utilisation of the sheep for food being the consumption within the Islands of mutton obtained from five year old wethers. There are at present no pastures suitable for fat lamb production.

The sheep of the Islands are primarily Romneys or Corriedales or admixtures of the two. Their numbers appear to be still declining, though less rapidly than formerly, from the peak of 807,000 reached in 1898. This has, however, been offset by an increase in the average annual wool clip per sheep. The annual export of wool, though rather less than that of 50 years ago, is greater than it was 50 years ago. For the quinquennial period 1955-1959 the average individual fleece weight based on wool exported and total sheep numbers was 7.42 lb. If based on sheep shorn the average was 8.37 lb., but, in addition to the shorn wool, camp wool from dead sheep and skins from slaughtered sheep, all included in exports, must be considered so that the actual average fleece weight was likely to be between the two. In either case it shows a significant increase during the last twenty years.

As is common in all countries where wool is the dominant farm product, cattle are as a rule unpopular. They are maintained primarily to ensure a supply of milk and butter for farm residents and the provision of some beef in winter. The beneficial effects of cattle grazing on the sheep pastures, though real, are secondary interests. Cattle number approximately 12,000, compared with about 620,000 sheep.

The system of sheep husbandry is extensive grazing, in the main set stocking, though slight modifications of this have been introduced on a few stations in recent years. Over the Islands as a whole there is one sheep to approximately five acres, but this covers a range from one to two acres or less on some of the smaller island units, to one to ten acres or more on the poorer or higher lying areas covered with undrained peat or extensive stone runs. The general level of sheep nutrition tends to be low, and is definitely low in winter. All animals mature slowly, and it is customary for ewes to produce their first lambs at three years of age.

Many stations have difficulty in maintaining sheep numbers and in too many cases ewes are kept beyond normal culling age to augment the total lamb crop. This is necessary because of two main weaknesses in the industry - low lamb crops and high mortality. The majority of lamb crops, as counted in early November at the lamb marking and based on ewes mated, are between 60% and 65%. On good stations they may reach 70% or over, but some drop to around 50%. This is a reflection of nutritional levels and of the difficulties at lambing of shepherding large flocks in enormous enclosures. At this level of lamb production, maintenance and selection of stock are difficult, and are rendered more so because mortality in young sheep and at all ages is high. Thus losses around 15% are common in hoggets between weaning and first clipping 10-11 months later. In the best cases they are around 10% but in the worst they rise to over 20%. General flock mortality naturally varies according to locality but on the average is between 10% and 12%.

/Much.....

Much of the mortality is due to drowning in the open drainage ditches and will be difficult to reduce except in so far as the ditches can be improved and better winter nutrition can maintain increased vigour and sheep may be more able to survive until rescued, if they cannot get out of a ditch themselves. There appears to be no major disease responsible for any significant proportion of the losses. Symptoms described indicated some losses from pregnancy toxaemia and pulpy kidneydisease, but the number of cases is too few to justify remedial measures under the husbandry system. Cobalt deficiency has been established on some stations and it is possible that other trace elements may be deficient and may cause debility and some mortality in sheep. The majority of flocks have access to sea shores, but where they do not they show a marked craving for seaweed if the opportunity occurs. Under the management system provision of minerals is difficult to arrange and gatherings for frequent regular dosing of sheep would be impossible. For this reason the cobalt bullet type of treatment is a very great advantage.

A reduction in flock mortality should result from the policy of breeding for clean faced sheep, free from wool blindness. While wool blindness is a serious problem in any country and is held by many to be associated with reduced lamb crops, it is even more serious in the Falkland Islands where ditches are a hazard. Blind sheep cannot avoid ditches. In breeding for wool and importing rams from countries where high fleece weights are important, the Falkland Islands sheep have in the past suffered severely from an excess of face wool, but in recent years there has been a systematic effort to select for clean faces and this is having a definite effect. It does, however, take a long time before such a defect is eliminated and from 12-15 years is necessary before a flock can be considered reasonably free if selection is rigorous.

The majority of rams used are bred in the Falkland Islands. For the main flock on most stations rams are usually bred in a stud flock of selected ewes, and rams for these stud ewes may be home bred or partly obtained from other stations. A small number of stations have specialised in ram breeding and supply neighbours. One or two stations have a small pedigree flock for breeding elite rams to be used in a stud flock of the best ewes selected from the main flock. The stud flock breeds rams for the latter. It is the practice of the bigger stations to import a small number of rams periodically from Kent or Australia or New Zealand and on occasions from South America. If from Kent or South America it is usual for them to be inspected for type and for freedom from wool blindness before purchase, but this is difficult in the case of Australia and New Zealand. Though high prices are paid and a specification of requirements given most rams imported in this way have proved to be more or less wool blind.

Importation of rams should not, however, be necessary any longer. There are sufficient sheep in the Falkland Islands of the right type for the selection of special breeding flocks which could produce a number of elite rams bred in the local environment. Animals bred locally and having the right characters would be more effective than imported sires of the same quality bred in a different environment. The essentials of success in such a breeding policy are concentration on one desirable character (at the most two, but preferably one), ruthless culling from the elite flock of all sheep not up to the set standard and a reliable but simple system of recording for the elite flocks.

SETTLEMENT FIELDS

At nearly all settlements and frequently at outlying shepherds' houses there are a number of fields used for grazing cattle or horses or stud flocks and sometimes for growing hay crops, either of grass or oats. Most of these were

created/.....

created earlier this century, but some are still being made by enclosing and ploughing part of a holding paddock or a camp. On new fields one or two crops of oats for hay may be taken and then grass and clover seeds sown, using typical British seed mixtures. The sown grasses and clovers appear in the sward for the first year or two, but only a small proportion persist long, the determining factor being the amount of fertiliser used. Though lacking in vigour Cocksfoot appears to survive better in more settlement fields than other sown grasses, but is seldom seen in pastures eight to ten years of age. Timothy also survives for two or three years, but Perennial Ryegrass is disappointing In older swards Yorkshire Fog and Agrostis are usually dominant, but where Red Fescue has been included it may become the principal survivor. Thus at Port Howard where the settlement fields give a stronger impression of an upland British farm than at any other station, the swards are now very largely Red Fescue, except in recent seedings. These fields have had occasional dressings of fertiliser and the results here and elsewhere confirm the recommendation of Dr. Wm. Davies that Creeping Red Fescue should be included with the normal Ryegrass, Cocksfoot and Timothy grasses in a seeds mixture for settlement fields. Recent British trials have shown the value of the Aberystwyth bred S59 Red.Fescue, which can stand heavier grazing than the more common strains.

Many of these settlement fields contain some wild white clover, though it seldom shows vigorous growth. It may be widespread thoughout the sward, but even where the grazing pressure is only moderate the plants remain dwarf in size, and when inoculation of the seed has been carefully carried out, there is only a little nodulation.

Under present policy the incentive to improve settlement fields is not great. They could be made to grow better grass by accepted British methods, though investigation might show more appropriate techniques, but the better grazing or improved hay crops could only be used to produce more milk and butter or to produce older wethers or cattle in better condition for slaughter. This might improve social standards, but would not lead to an increase in anything that could be sold for cash, an essential to meet the high cost of raising soil fertility. A smaller area would, of course, produce the same dairy produce or meat, but in relation to the large size of the stations this is not of material importance.

If there were a possibility of exporting lamb to the United Kingdom market then improvement would assume a different aspect. Improved settlement fields could be used for breeding lambs for slaughter from selected or older age ewes, using rams of a breed with appropriate carcase quality. Experiments over a period of years would be essential to develop the most suitable pastures and ewe and lamb management, and some financial assistance would be necessary until the numbers produced were adequate to enable slaughtering and transport costs to become competitive. On a small scale, sending sample consignments, these would be more than individual stations could be expected to bear for the period of years that would elapse before success or failure could be determined. Some such development might well be the means of utilising the freezing plant at Ajax Bay, but it can only be based on the export of lamb carcases. As indicated later, lime and fertiliser costs are high, and the creation of lamb fattening pastures is unlikely to approach the cost range of similar pastures in New Zealand, at present the main exporter of lamb to Britain, unless a sourcecan be obtained much nearer than the United Kingdom.

THE NATURAL PASTURES/.....

THE NATURAL PASTURES

Valuable though the settlement fields may be, the core of the sheep husbandry system is the camps where the flocks must live throughout the year. In "The Grasslands of the Falkland Islands" (1939), Dr. William Davies described the grassland vegetation. His account is still applicable and no attempt is made here to give a similar description. The dominant species is White Grass (Cortaderia pilosa) with the prostrate shrub Diddle Dee (Empetrum rubrum) the next most common. Legumes are absent. White Grass is ubiquitous, and as Dr. Davies showed is unpalatable to sheep and tends to be high in fibre and low in nutritive value. Both it and Diddle Dee are probably increasing, the latter being little eaten except for its fruits, the seeds of which are dispersed by both sheep and birds. Dr. Davies gave the botanical analyses of several areas which he examined in detail. Twenty years later it is not always possible to ensure that the same areas are seen, but when Dr. Davies' tables are compared with my own observations, the impression is that the unpalatable White Grass and Diddle Dee are becoming even more dominant and that there is also an increase, on those parts of the grazings where sheep have concentrated, of annual grasses such as Poa annua and Aira praecox.

The natural pastures on which the sheep graze, usually referred to as camps, are large enclosures. Though a small number may be 1,000 acres or less, the great majority range from 5,000 to 15,000 acres, with a few between 20,000 and 30,000 acres. Under such conditions, with one sheep to 5 acres, sheep can exercise marked preferences in respect of the plants they eat. Obviously they take the most palatable first and only turn to the less palatable when compelled. This is natural sheep behaviour on all extensively grazed set stocked pastures. In spring and early summer they persistently nibble off all the young succulent leaf shoots of the palatable grasses, thus preventing them building up in their roots and stem bases the food reserves they need to survive the following winter and start growth early the next spring. Plants so treated become progressively less vigorous and in time are exhausted and disappear, a process accelerated by the shading effect of the coarse grasses which are uneaten in summer when making their maximum growth. Where nothing is done either to rest the palatable plants from this continuous denudation of leaf or to stimulate them with supplementary plant food in the form of fertiliser there is only one possible trend, a gradual deterioration of the sward due more to the increase in coarse herbage than to any decline in soil fertility.

Under such conditions there is a greater contrast between the summer and winter nutrition of sheep than there is on pastures where different grazing management is practised. In a normal winter, growth is at a stand still and the sheep, having eaten all the palatable herbage, must turn to White Grass and similar coarser plants which were uneaten during the previous summer and so are overgrown, very fibrous and low in feeding value. Sheep not only dislike fibrous grass and restrict what they eat of it, but they cannot digest it efficiently. The rumen bacterial organisms that attempt to digest fibre need adequate protein supplies to function effectively, and these they cannot get from fibrous grass. If Falkland Islands sheep could be given supplementary protein they would not only benefit from the protein but would eat and deal with more White Grass. Under existing camp conditions, however, there are very great difficulties in providing any supplementary food. While these winter conditions are a handicap to any sheep they are especially so to ewes which at the time they are advancing in pregnancy and preparing for parturition and lactation are forced on to a steadily declining and inadequate diet.

/This is.....

This is the principal reason for thin ewes in spring, weakly lambs at birth, high mortality and low lamb crops.

Falkland Islands natural grazings appear to provide ample evidence that there has been much deterioration of this kind, but without knowing personally the character of the pastures say fifty years ago it is impossible to indicate the extent of this process, but if they have not declined they are unlike others in the world that have been subjected to the same type of grazing management. The presence in many areas of goose grass (Aira praecox), an annual grass species able to persist because a part of its life is spent in the seed stage, is an indication of continuous overgrazing of these parts. Where it occurs in coastal belts and is dominant, other species have been displaced by continuous overgrazing by sheep, augmented by the trampling and dunging of sea birds and animals, which also initiate some erosion. Its presence amongst White Grass is an indication that the finer grasses formerly growing between the White Grass bogs have been exhausted and the ground thus left vacant has been colonised by goose grass. Though these natural pastures are not really overstocked they are definitely overgrazed in parts.

Without some change in grazing management there is likely to be a further, even though slow, decline in the quality and in the productive capacity of the camps. Though only parts are heavily grazed, they are nevertheless like all pastures, in need of rest periods. It is well established that without periodic rest pasture does decline in productivity. With rest periods quality can be maintained and production increased. Fortunately several Falkland Islands' managers have become convinced of the need for resting their camps and are developing a technique of permitting this, to which reference is made later.

Along certain coastal strips, as well as in some inland parts of the West Falkland, there are, and have been, cases of erosion arising most probably from acombination of wind erosion and over-grazing. Some such cases are still spreading, but the methods of combating erosion by planting Marram grass (Ammophila arenaria) are well demonstrated on several stations, very good work of this kind being seen at Fox Bay East and Fox Bay West. It cannot, however, be stressed too strongly that the true Marram grass is much superior to others and is worth the extra trouble and cost involved in procuring it.

Dr. Davies stressed the value of Tussac (Poa flabellata) plantations, and rightly advocated their extension and careful fencing and control. The sheep station visited with the heaviest rate of sheep stocking is able to put all its flock on to Tussac grazings during winter, thus benefiting the normal camps. To provide Tussac plantations for some of the very large flocks would be impracticable, but they might well be considered for select groups or for younger ages.

CAMP IMPROVEMENT

Improvement of the camp as a whole, or even of parts of it, is a difficult problem under Falkland Island climatic and geographical conditions. The existing fertility level is low. Nearly all swards show a band of undecayed organic matter on the soil surface, indicating poor bacterial action due to shortage of lime and nitrogen. Indications of the need for phosphate can also be seen, as well as evidence of its effect. Thus, at Darwin, there is an acre plot which was given 1 ton Ground Mineral Phosphate in 1937. Though the effects were wearing off, this plot can still be seen as being rather greener, better eaten and with a better proportion of finer grasses. At North Arm a strip ten yards wide

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dressed recently with Ground Mineral Phosphate was distinctly greener and the White Grass was recovering more quickly after burning. Though no special evidence of potash deficiency was obvious it may be in short supply, especially on soils such as those of Lafonia, derived from felspar. Deficiencies of lime, phosphate and potash most probably account for the lack of vigour in the white clover which is commonly found near settlements, where it has the benefit of heavier concentrations of animals with more animal excreta and greater consolidation.

Though everyone agrees that lime and fertilisers would be beneficial for selected areas, little is used, except in settlement fields, because of their cost. Some organic fertiliser may be obtained from South Georgia, but as a rule supplies have to be obtained from the northern hemisphere, and actual prices paid showed the cost of lime on sheep stations as just under twenty times the price, less subsidy, in Britain, and that of fertilisers as between 2½ and 3 times the net cost to the British farmer. These prices are due to the freight charges.

Costs of this order make the raising of soil fertility extremely difficult, more particularly when the outlays have to be recovered through the sale of wool and not of meat. On an improved diet the Merino is the only breed that tends to give first priority to producing more wool rather than more meat. Others tend to put on meat first and wool second, though those like the Corriedale and Polwarth, with some Merino ancestry, may apportion the extra food more or less equally between meat and wool.

Without experimental evidence to the contrary it seems that economic camp improvement can only be brought about either by introducing other grasses at existing fertility levels or by altered grazing management, or a combination of both. Various methods of achieving the former have been tried, including aerial distribution of seed. Perhaps the most widespread has been broadcasting the seed on the surface, either with or without some surface harrowing or discing. Sod-seeding, ploughing and reseeding and rotavation are also being tried. Whenever grass seeds such as Yorkshire Fog and Agrostis (Brown Top) have been scattered on well eaten swards there is ample evidence that they have established, even if slowly. Other grasses (Ryegrass, Cocksfoot, Timothy), which demand a higher level of fertility, may have germinated but have either not survived or have produced plants lacking in vigour. White clover has sometimes established on well consolidated ground alongside roads and paths, but has not been successful enough to justify its use. One or two cases were seen where it was stated that Yorkshire Fog seed has been sown six years or more ago following surface discing or harrowing, and it had germinated and produced plants which only survived for about three years. Invariably these areas were covered with unpalatable native vegetation and there had been no grazing control following seeding. As the seeded areas were only a minor part of the camps concerned, the sheep would undoubtedly concentrate in spring on the more palatable Yorkshire Fog plants and exhaust them. To ensure survival controlled grazing is essential, especially at low fertility levels. An outstanding example of this is the Grave Cove Point (Roy Cove Station), to which Dr. William Davies referred in his report. Over twenty years later it is said to be still an outstanding grazing, but the secret of its success appears to be that it is grazed intensively by sheep for a short spell each year, being rested, apart from a small number of cattle and horses, for the rest of the year.

Sod-seeding has been tried in Lafonia and at Hill Cove. The Falkland Island Company have sod-seeded 12,000 acres, a most

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commendable effort, have tried various seeds, with and without fertiliser, and have modified the seeding machines to give a method of seeding more appropriate to the Falkland Islands soil and climate. It is still too early to assess the full results of this seeding technique, and though the first results are not so spectacular as those attained by other methods, the cost is very much lower. Without the use of some fertiliser, however, sod-seeded plants have much more difficulty in establishing themselves, since they have to suffer competition from the plants of the existing sward in respect both of shading and for the available plant nutrients in the soil. Where the young seedlings have a supply of fertiliser adjacent to their roots, they can compete more successfully and establishment is greatly enhanced.

In Lafonia there was also to be seen throughout some camps an extensive scheme of ploughed strips five yards or so wide and seeded with Yorkshire Fog. When seen from the air these presented a fascinating pattern, and it was interesting to observe the concentration of ewes and lambs (early January, just before weaning) on these strips, in preference to the native vegetation of the camp. On examination these strips, some of which had been ploughed several years previously, showed the very slow decay of the White Grass turf. This may be due partly to the difficulty of turning the furrow slice completely when there is so much wiry herbage to bury, with the result that air is not excluded, but it also indicates a lack of lime and nitrogen necessary for the organisms which decompose organic matter. As a result there were cases where the old turf was growing and competing with the new grass.

A more satisfactory method of dealing with White Grass than ploughing was seen at Hill Cove where in the past two seasons 300-400 acres have been rotavated. After the rotavator has gone over the ground twice the White Grass bogs are sufficiently dis-integrated to die so that when subsequently seeded with Yorkshire Fog all the available fertility is at the disposal of the new grass seedlings. At Hill Cove seeding is done in a combined operation in which one tractor hauls a flat roller, a broadcast seed drill, a Cambridge roller and a light harrow in tandem. When first seen the areas seeded in the previous season were not looking well because prolonged drought had restricted growth and on some parts germination, but when seen later following rain the promise was much better. Undoubtedly this technique can lead to much improved grazing.

Though rotavation seems more promising for White Grass camps, normal ploughing is quite satisfactory for Diddle Dee areas where the soil beneath the surface mat is invariably more friable and free of the penetrating and binding roots of White Grass. Ploughed areas of Diddle Dee were seen at Roy Cove, Douglas Station and Teal Inlet. At Roy Cove it was anticipated that the ploughing and reseeding of 1,500 acres would have been completed by February, 1961. The herbage being ploughed down is primarily Diddle Dee and Christmas bush (Baccharis magellanica) and after earlier trials with various grasses the ploughed areas are now all being seeded with Yorkshire Fog at either 12 lb. per acre of dressed seed or 30 lb. of undressed seed. After ploughing the ground is disced twice, then Cambridge rolled, followed by a Danish seed drill modified to sow at 3 inch spacings, after which it is again rolled. These successive operations give a fine and reasonably firm seed bed.

The roseeds seen at Roy Cove were most impressive, even though those sown in the dry summer of 1959-60 were struggling to survive in the desiccating winds of November 1960, and some areas needed resowing. Subsequent rain ensured their success. It was stated

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that the cost of these reseeds was between 90/- and 100/- per acre. Also seen at Roy Cove were reseeded areas of Yorkshire Fog, to be harvested for seed, and which had received a complete fertiliser (N.P.K.) dressing at 1½ cwt. per acre with cross dressings of 1½ cwt. per acre Nitro-chalk and Muriate of Potash. When seen, the dominant effect was that of the additional Nitrogen, which appeared to be producing extra seed heads more than adequate to cover the cost. Later the value of the phosphate and potash may be more obvious. On a settlement field reserved for hay and seeded to good grasses in 1940 the effects of fertiliser on the yield and persistence of good grasses were obvious.

There was unanimity on the question of the most suitable grass seed to sow for camp improvement, Yorkshire Fog being used almost exclusively. It has the advantage that it will stand a considerable degree of acidity, and does not require high fertility conditions. Where it is uneconomic to use lime and fertilisers, it is difficult to suggest alternatives, more particularly in view of its success where tried and managed for survival. It was interesting to examine some of the areas where seeds were sown in 1935 and 1936 in trials designed by the Welsh Plant Breeding Station and reported by Dr. Wm. Davies. In most of them Yorkshire Fog is the only grass originally sown that has survived, though in some even it was absent. Sometimes, as at Darwin, wild white clover was still present though lacking in vigour and not having spread outside the original plots which had phosphate. Where clover did survive, however, it was in plots on settlement fields that had been cultivated. On West Point Island where the plots were placed in the camp, there was one very small surviving white clover plant. This island is the most intensively stocked sheep station in the Falklands, and the camp herbage is not normally permitted to become overgrown so that clover would have a better chance of survival here than in camps elsewhere.

Reference has already been made to the large size of the sheep camps and to the practice that has developed on four or five stations which now arrange for certain camps to have a two to three months rest between shearing (December/January) and dipping (March), the sheep concerned being concentrated during this period on a high lying area which has no sheep for the rest of the year, but which during this short period may carry sheep at from 10 to 15 times the normal stocking rate for the station. This has the double advantage of resting the regular camp and of improving the herbage of the short term camp through the blitz grazing it receives, the White Grass being eaten in a way that never occurs except by such intensive stocking. The additional hooves, even though for two to three months only, have a beneficial effect in consolidating the turf, and three such areas seen after a few years of this treatment were greener and obviously providing more palatable herbage. White Grass dislikes heavy grazing and consolidation and there would appear to be a case for introducing grass seeds into one of these camps after the sheep have sufficiently reduced the surplus herbage. If, where circumstances permit, the seeds could be broadcast towards the end of the three month grazing period the sheep would trample them into the sward and encourage better germination with ultimately a better quality pasture.

On the stations where this short term concentrated stocking has been practised there is already evidence that there is benefit to the sheep as well as the pastures. Increased fleece weights and reduced mortality have been evident, and there are clear indications that more sheep can be carried. Where hoggets have been concerned they have grown better and suffered fewer losses.

Though the several methods of camp improvement being tried are all deserving of praise, they are unlikely to give their maximum result unless combined with some grazing control. In fact,

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in the existing condition of the camps the greatest return from expenditure on improvement is likely to be obtained from money invested in subdivision. It is well established that wherever it is possible to alternate grazing and rest periods this not only prolongs the effectiveness of a grazing but can if well controlled actually lead to its rejuvenation. Nearly every camp seen was in real need of a rest from grazing, but this will only be possible with fencing and subdivision. It would lead to genuine camp improvement if each were divided into at least four. This would enable the sheep to be concentrated in one area with better grazing of all the herbage, especially of the coarse grass, while the other areas would be rested and the finer grasses get a chance to recuperate. Movement from one area to the next would be when necessary. Some areas could be deliberately reserved for the ewes to go into three weeks or so before lambing, which would put the ewes in better condition for lambing and for nursing their lambs. It would also mean that greater concentration of ewes at lambing would make shepherding easier and save lambs, while at mating the rams would be better able to contact ewes and leave fewer ewes barren. The full benefits would only be seen after two or three years when the sheep were accustomed to the changed management. Even dividing each camp into two would be better than nothing, though the benefits that would result would in time encourage further subdivision. Such a policy must, of course, be carried out by people with local knowledge who know the topography of the terrain and the direction of prevailing winds that bring snow.

Controlled grazing of this kind is just as essential for the camp areas now being reseeded to Yorkshire Fog. Where these are only a minor part of a large camp and are unfenced they will be subject to continuous selective grazing. Moreover, sheep will tend to graze the reseeds but lie elsewhere at nights and by leaving their droppings off the improved area transfer fertility from the reseed. With lime and fertiliser this would not be serious but in their absence it will lead to a quicker deterioration and exhaustion of the new grasses. Fencing of the reseeds permits them to be grazed and rested whenever they need it and prevents the transfer of fertility from areas where it is vitally necessary if the expenditure on improvement is to bring a satisfactory return.

As was frequently pointed out, fencing and fence maintenance are costly both in money and labour. In camp improvement, however, fencing is likely to bring a better return than any other possible expenditure, through better herbage, better utilisation of herbage fitter ewes in winter, better lamb crops and more wool from more sheep. Five per cent more lambs per year could result in around ten per cent more sheep in five ~~five~~ years, and twenty-five per cent more in ten years.

At the present time fences in the Falkland Islands cost about £250 per mile. It might be possible to reduce this by the use of the New Zealand type wind generated electric fence, which in that country has reduced fencing costs from about £500 to £150 per mile. New Zealand fences must cope with greater cattle and sheep pressure than is required for Falkland Island conditions where £100 to £120 might provide the necessary fence, though smaller camps need better fences.

Controlled grazing and more sheep would also remove the need for burning White Grass. This is a most controversial topic amongst station managers. Normally burning is a process that leads to some fertility loss and to a greater dominance of coarse herbage, the finer grasses suffering more from the effects of fire. Under extensive stocking, however, White Grass cannot be kept in check by grazing and after some years the accumulation of uneaten herbage is

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such that in a dry period it is in itself a fire hazard. Controlled periodic burning every four or five years is in these circumstances necessary. On the other hand many shepherds and one or two station managers burn with greater frequency than this. What they do certainly creates more green shoots of White Grass for sheep grazing, but they do run a danger of eliminating grasses such as the natural Fescues, and allowing inferior ones to take their place. So long as grazing is as at present practised, some burning is necessary but is best not to be overdone.

THE FUTURE

The future of sheep farming under the conditions of the Falkland Islands deserves most serious consideration. An economy based on wool production only is vulnerable in conditions under which artificial fibres may in the future become highly competitive and force prices down. Methods of reducing the cost of wool production should, therefore, be continually under review, as well as the means of ensuring continued productivity under a system which is a form of extractive farming, since nothing is done at present to replace the materials removed annually in the form of wool and slaughtered sheep. Nitrogen and potash are probably the principal sufferers, since wool is the exported commodity.

It is possible that, as in other countries where extensive grazing is practised, the numbers of sheep are now such that the annual loss of minerals in wool and carcases is in rough balance with the annual increment available by natural processes. There is, however, nothing stable in nature and even where there is, this approximate balance productivity continues to decline for reasons other than those of declining soil fertility. This makes the need for investigation of the means of improving productivity all the more urgent.

In the Falkland Islands a major contribution to reducing costs would be made if lamb crops could be increased and mortality reduced. Better grazings providing better nutrition would lead to this and should produce earlier maturity in the sheep, whereby ewes could produce their first lambs at two years instead of three. An extra crop of lambs before the ewe reaches a normal casting age of six and a half years would mean fewer ewe hoggets necessary for flock maintenance and so permit a higher standard of selection. Subdivision of camps with controlled grazing rather than selective grazing by sheep is the obvious first step to this end, and one which can be taken immediately by any sheep station. It should, however, be accompanied by an active experimental programme into the techniques of securing economic improvement of the natural pastures through the correction of mineral deficiencies and the introduction of better grass and legume species.

As mentioned earlier, several sheep stations have been and are still attempting to improve the cropping potential of settlement fields and the grazing potential of paddocks and camps, but the technical problems that need investigation if more productive swards are to be possible on an economic basis are such that they require an investigator who can give his whole attention to them and who is not subject to the duties and distractions that are the lot of station managers. Twenty years ago the Department of Agriculture was so staffed that it could, in addition to its regulatory duties, undertake some experimentation and it showed that lime and phosphate were essential for the satisfactory spread of white clover and for greater persistence of improved grasses. They concluded that while this might be economically sound in smaller enclosures it could not be so in the camps.

Though subdivision of camps and controlled grazing will undoubtedly lead to more sheep and more wool, the question of

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raising the fertility and thereby the productivity of the natural pastures to any marked extent will still remain. This will involve changing the character of the herbage and replacing the dominant grasses by something more palatable and more flexible in use. Even Yorkshire Fog, though having value as a first step in improvement and being suitable at low levels of fertility, is not a grass on which a satisfactory long term policy can be based. It does not associate satisfactorily with a legume, an essential character in a grass to be used for permanent improvement. The need for nitrogen is definite, but the only practicable means of providing it is by a legume which will fix atmospheric nitrogen. From its presence round the settlements it appears that white clover is probably the most suitable legume, but an active experimental programme is necessary to determine this.

The experiments of the agricultural staff twenty years ago showed the effectiveness of the then conventional and heavy dressings of lime and phosphate in establishing clover and maintaining grass in a more palatable and persistent state. Since then there have been marked advances in the technical knowledge of soil and pasture improvement in many parts of the world and the applicability of these to Falkland Island conditions should be investigated. For instance, the value of molybdenum in reducing the need for heavy dressings of lime in establishing clover in parts of New Zealand, the need for copper for successful clover growth on peat in New Zealand, the necessity for sulphur in establishing clover on certain soils in Australia are examples of experimental results that have brought outstanding changes in areas previously thought unimprovable on an economic basis. In recent years in South America, local scientists working with the regionally based staff of F. A. O. and the Inter-American Institute of AgriculturalScience have shown that on some soils the calcium requirements of clover nodulation can be met by merely dusting the seed with lime, a result similar to that in parts of New South Wales where 1 cwt. lime resulted in successful subterranean clover establishment, whereas there was complete failure without lime. In Scotland sod-seeding white clover on peaty hill soils has not been satisfactory when done with fertiliser only, whereas with both lime and fertiliser, down separate spouts, success has been obtained.

Perhaps none of these techniques may be applicable on Falkland Islands soils, but they are all methods of improvement that should be investigated, along with trials of grass and legume species. To do so requires a young trained investigator, who has already a few years' active research experience, and who could spend a three to five years period in the colony. In the early stages this work would not require more than small areas for pilot trials on the main soil and camp types, but once the initial work has thrown up the most appropriate lines, these would need large scale investigation. It is obvious that station managers would be extremely willing to co-operate at all stages in this work.

ACKNOWLEDGEMENTS

The extensive tour undertaken to the sheep stationsmentioned in the attached sheet would not have been possible without the careful planning of H.E. Sir Edwin Arrowsmith and members of his Secretariat and the ready co-operation of station managers and others in facilitating visits and travel between stations. To them all for their cordial reception and the unfailing hospitality received in their homes, I wish to extend my sincerest appreciation.

Edinburgh
June, 1961

A. R. WANNOP

SHEEP STATIONS VISITED

October, 1960 - January, 1961

Oct. 31	Arrived Stanley
Oct. 31 - Nov. 2	At Government House. Discussions with H.E. The Governor, officials, and some station managers.
Nov. 2 - 5	Fitzroy
" 5 - 6	Darwin
" 6 - 7	North Arm
" 7 - 11	Darwin and Goose Green
" 11 - 12	San Carlos
" 12 - 16	Port San Carlos
" 16 - 18	Douglas Station
" 18 - 21	Teal Inlet
" 21 - 24	Rincon Grande
" 24 - 26	Port Louis
" 26 - 28	Green Patch
" 28 - Ded. 2	At Government House. Further discussions with H.E. The Governor and officials.
Dec. 2 - 6	Roy Cove
" 6 - 8	Carcass Island
" 8 - 9	West Point Island
" 9 - 12	Hill Cove
" 13 - 17	Pebble Island
" 17 - 24	Port Howard
" 24 - 27	Fox Bay East
" 27 - 29	Fox Bay West
" 30	Port Stephens and New Island
" 31	Weddell Island
" 31 - Jan 10	Chartres
Jan. 10 - 12	At Government House. Discussions with H.E. The Governor. Meetings with members Executive Council and general meeting with sheep owners and others.

1836/A

28th January, 65

To: C.T., A.C.S., A.C.P., C/C,
Oi/c Agric.

From: Colonial Secretary,

STANLEY.

Mr. C. R. Young.

The appointment of the above will be as Grasslands Officer.

Such terms as Pasture Improvements Officer or Advisor will not be used.

(Sgd.) W. H. Thompson

COLONIAL SECRETARY.

WHT/TB.

0102

30th April, 68.

Dear Sirs,

Soil Survey in the Falkland Islands.

The only reference I have on my file which may be of assistance to you is your LRD/N/2 of the 11th August, 1967, addressed to Mr. Sugg in the Commonwealth Office.

Dr. Clapperton of the Department of Geography at Aberdeen University called upon me just before he sailed northbound and said that, in his opinion, the peat boring machine should be kept in the Falkland Islands with a view to completing the soil sampling process in the southern Spring. Accordingly, we have kept the machine here, but if you wish for its return I will arrange for it to be sent by the next voyage of the M.V. "A.E.S.". In view of the time factor involved a brief telegram from you would be desirable.

Dr. Clapperton also thought that you might be satisfied with the sampling already done, and he felt that the figure of 60 trial holes was very much an optimum one. As you know, we have taken 33 samples. Would you be good enough to let me know whether you wish us to continue or whether the 33 samples will be enough.

Yours faithfully,

(W.H. THOMPSON)
COLONIAL SECRETARY.

Directorate of Overseas Surveys.

SC

c.c. Harbour Master - Please recover the peat boring maching from the B.A.S. store and take care of it until we know the outcome of this letter.

W.H.T.