Report of the

# Grasslands Trials Unit

## 1975 - 79

## FALKLAND ISLANDS

APPENDIX 4 & 5

AP. 4.1.

A REPORT INTO THE INVESTIGATION PROGRAMME 1977/78 AND RECOMMENDATIONS FOR THE CONTROL AND ERADICATION OF BRUCELLA OVIS INFECTION IN FALKLAND ISLAND RAMS.

RESUME A synopsis is given of the world and Falkland Island history of Brucella ovis infection. The disease is briefly described and the laboratory technique, materials and the testing method used in the investigation programme are discussed. The results show that the incidence is widespread but at a low level (3.56%) with the majority of farms known to be infected. It is suggested that eradication of this disease is possible basing laboratory diagnosis on the Agar-gel diffusion test. Recommendations are made for the control and eradication of one of the very few infectious bacterial diseases of Falkland Island sheep.

## INTRODUCTION

Ram epididymitis caused by Brucella ovis was first reported in 1955 in Australia and New Zealand. It has subsequently been reported in many sheep-raising countries including the United States and Argentina. The first published report concerning the disease in the Falkland Islands was in 1971 (Davies et al, 1971) although it is reported that a visiting Veterinarian had diagnosed epididymitis prior to this date.

Confirmation of the disease was obtained in 1969 by laboratory culture of the Brucella organism (Davies et al, 1971). It was thought that, at that time, the disease was limited in its distribution throughout the Islands with the main incidence occuring on a farm which had imported rams from Australia. A warning was given that unless breeders were constantly vigilant and regularly examined the rams, the disease could becono a widespread problem.

In 1974, it was reported (Bostelmann 1974) that Brucella-derived epididymitis was a widespread problem and strict control measures were advised. A limited number of ram serum samples were sent to the Pan American Zoonosis Centre in Argentina for laboratory diagnosis. Subsequently most farms became engaged in their own control programmes based on separation of the old rams from the young ones - sometimes with the slaughter of all mature rams - and manual examination of the rams' genital organs. Although there is no information available concerning the incidence of Brucella ovis infection in flocks at that time, it would appear that these control measures have considerably reduced the numbers of infected rams.

In 1976 with the existence of a veterinary diagnostic laboratory - albeit of limited proportions - the farmers were informed that it would be possible to investigate the incidence of the disease by the local examination of ram serum samples.

This paper reports the findings of the survey and makes several recommendations.

## THE DISEASE

Brucella ovis primarily causes a chronic infection in rams in which the bacterial damage and subsequent reaction by the animal often results in decreased functional capability of the testes and epididymides. A ram may excrete the bacteria for many years without showing any palpable lesions.

Invasion by Brucella organisms of a pregnant ewe's placental membranes causes interference with the nutrition of the developing foetus resulting in reduced lamb birth weights, increased perinatal mortality or abortion. The presence of the bacteria in the uterus of a ewe may also cause interference with the implantation of a fertilized ovum.

Although a very small percentage of ewes may carry the bacteria from one pregnancy to the next, the vast majority are thought to shed the infection soon after the termination of the pregnancy. Some lambs may be born with positive antibody titres but it is thought unlikely that congential infection leads to the production of Brucella ovis organisms in the mature animal.

Rams usually become infected by mating with infected ewes; but they may also become contaminated during the course of their pre-seasonal homosexual activities or by contact with infected foetal membranes or discharges from ewes.

LABORATORY TECHNIQUES

Neither physical examination of the testes for signs of epididymitis nor cultural examination of semen for the isolation of Brucella ovis can be relied upon to identify all infected male animals. The complement-fixation test has come to be accepted as an effective diagnostic test for individual animals upon which control measures can be based but is complicated and requires highly trained personnel and laboratory equipment. It was therefore decided to base the diagnosis of Brucella ovis infection on the Agar-gel Diffusion Method (Myers et al 1970) the results of which are similar to those obtained by the complement-fixation test.

The Agar-gel Diffusion Method is based on the detection of antibodies in those rams which have become infected with Brucella ovis bacteria. The test is performed by the application of a thin layer of a suitable type of agar onto a microscope slide. When the agar has become semi-solid a trough is cut in the centre and five small wells are cut on either side of the trough. Extracts of shattered Brucella ovis bacteria are placed in the trough and a small sample of serum from each of ten rams is placed in the wells. The microscope slide is then placed in an incubator for 72 hours. If a ram is infected or has been infected with Brucella ovis bacteria, he will have antibodies circulating in the blood stream which have been produced specifically to counter that infection. In the test, these antibodies diffuse through the agar-gel from the wells and meet the extracts of Brucella ovis bacteria (the antigen) which are diffusing outwards from the trough. Where these two (the antibodies and antigen) meet, a small white line of reaction is formed between the well and the trough. Those rams which contributed the serum which produces the white line are, or have been, infected with Brucella ovis bacteria. Absence of a white line of reaction signifies that the rams do not have the antibodies against Brucella ovis and therefore probably do not have the infection. It should be recognised that, although this test is over 90% accurate in revealing infected animals, it is not 100% accurate. In other words, a small number of infected animals will appear to be un-infected.

The results of the test were scored on an arbitrary scale equivalent to numbers 0 to 5. The lowest figure signifying absence of reaction and 5 corresponding to a strongly positive reaction.

The microslides were examined after 48 hours and 72 hours and all reactions noted. It is estimated that laboratory time consumed by the processing of these samples was approximately 3 minutes per ram sample.

MATERIALS

The Brucella ovis antigen was supplied free of charge by the Pan American Zoonosis Centre near Buenos Aires. The freeze dried contents of the sealed vials provided when reconstituted with 2ml of sterile water, sufficient antigen for 4 microslide tests (equivalent to 10 rams per slide).

All other laboratory equipment and chemicals were supplied by the Ministry of Overseas Development under Technical Assistance terms for the Grasslands Trials Unit Laboratory.

Blood samples were taken from rams using sterile evacuated tubes (Vacutainers : Becton-Dickinson). These tubes and needles were purchased from England and the farms were charged a fee to cover the purchase and freight costs.

TESTING METHOD

Each ram was restrained in a sitting position which enabled the scrotal contents to be examined and the blood sample to be withdrawn without the ram or the operator having to change position. Examination of the scrotal contents was by manual palpation and, although some rams with palpable abnormalities were blood sampled, the majority were rejected forthwith. A brief examination was also made of the prepuce and penis and any with defects were rejected. The blood sample was taken from the left jugular vein.

The blood sample tube was then labelled and the ram's number (either a spray mark or ear tag number) and age were recorded. (On some farms it proved impossible to record the rams' ages).

It was decided not to test all the rams rejected for physical defects due to the problems of having to carry more blood sampling tubes in the Aircraft and also because stocks of the antigen were always limited and it was considered more important to test those rams which were to be used for breeding.

The farms were advised to kill all rams which were found to have palpable abnormalities whether or not they were considered to be Brucella-induced lesions.

The blood samples were stored at as cool a temperature as could be found on the farms until they were transported to Stanley for laboratory processing. The delays in transportation were frequent, caused considerable anxiety and, when long, were considered to introduce a degree of uncertainty about the test.

Overall the rate of testing was estimated to be one ram in 40 seconds.

RESULTS

Two farms have had all the rams tested twice and 24 farms have had but one test. A small sample of rams on a further 5 farms have also been tested.

Testing began in May 1977 and concluded in April 1978 with the majority (4,004) being tested between January and April 1978. The results are as follows:-

| | |
|---|---|
| NUMBER OF RAMS TESTED | 4,710 |
| NUMBER FOUND INFECTED | 168 |
| PERCENTAGE OF TOTAL | 3.56% |
| NUMBER OF RAMS IN THE FALKLANDS | 7,951 (approx) |
| PERCENTAGE TESTED | 59% (approx) |

Of farms on which all the rams have been tested, the distribution is as follows:-

GEOGRAPHICAL INCIDENCE

| AREA | WEST FALKLAND | | EAST FALKLAND |
|---|---|---|---|
| | MAINLAND | ISLANDS | MAINLAND |
| NUMBER OF FARMS TESTED | 6 | 5 | 7* |
| NUMBER OF FARMS NOT TESTED | 1 | 3 | 10 |
| NUMBER OF FARMS INFECTED | 5 | 1 | 6 |
| NUMBER OF RAMS TESTED | 1,997 | 377 | 1,601 |
| NUMBER OF INFECTED RAMS | 66 | 1 | 53 |
| PERCENTAGE OF TOTAL RAMS | 3.3% | 0.27% | 3.3% |
| VARIATION IN PERCENTAGE | 0 to 8.2% | 0 to 0.68% | 0 to 7.2% |

One other island was also tested and one ram was found infected.

* Two of these farms were tested twice.

Of the 3 farms on which small samples of the ram population were tested (a total of 94 rams) one ram was found to be infected.

The two farms which were tested twice showed a decrease in the incidence. Farm A which was tested in May 1977 and April 1978 was apparently free from Brucella ovis infection on the second test, the first test having revealed a 4.9% incidence. Farm B, tested in May 1977 and January 1978 showed a decrease in incidence from 9.4% to 6.7%. It is thought that this second figure would have been much lower if the rams had not been allowed to run and mate with a small number of ewes immediately prior to and at, the time of the first testing.

The Age Incidence was as follows:-

| AGE (years) | 1 | 2 | 3 | 4 | 5 | 6 | 7,7+ | MIXED AGES | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| NUMBER OF RAMS TESTED | 1071 | 817 | 843 | 569 | 214 | 91 | 37 | 1068 | 4710 |
| PERCENTAGE INFECTED | 2.15 | 4.65 | 4.03 | 4.57 | 2.80 | 6.59 | 5.40 | 2.25 | 3.5 |

No ram which had not been shorn at least once was tested.

It is interesting to note that the lower incidence in the 5 year old rams coincides with the period when Mr. R. W. Bostelmann M.R.C.V.S. was resident in the Falklands for 8 months and active in the advocation of a control programme based on manual palpation of the rams' testes and separation of the young rams from the older ones. These rams were less than a year old at that time.

DISCUSSION

From the figures given above, it can be seen that Brucella ovis infection is widespread amongst the rams of the Falkland Islands and is known to be present on 14 farms. Although the overall incidence is not very high, it is quite probable that the infected rams cause an appreciable increase in perinatal mortality and decrease in lamb marking percentages.

It is apparent that some rams are retained until of quite considerable age and that there is a higher level of infection in these old rams than in youger ones. These older rams are usually of the conformation particularly favoured by the farm manager and may well have been imported from another farm several years previously and so retained for their "special" breeding value.

During the course of the testing programme, it became apparent that few farm managers routinely tested their rams by manual palpation of the scrotal contents. This fact was substantiated by the number and type of the lesions detected. This type of simple examination, on which there has been ample advice published locally, must be regarded as a routine job whether or not Brucella ovis infection is known to exist on a farm. Such examination would eliminate a high proportion of those rams which are subfertile or sterile due to bacterial infections such as that due to Corynebacterium ovis (the "boils" bacterium) or due to congential or acquired deformities. All rams should be examined before they are put with the ewes and again when they are removed from the ewe flocks.

The persistence of the Brucella ovis bacteria and the care which must be taken, is shown by the two farms which reported that they had slaughtered all their rams but the hoggs 5 or 6 years ago. However, the infection still persists.

Although positive antibody titres to Brucella Canis have been reported in human serum samples, there is no evidence yet available which suggests that some of the ovine serum samples showing positive reactions are due to Brucella Canis and not Brucella ovis infection.

RECOMMENDATIONS

Now that the investigative programme has been completed, the farms can move on to the stage of tightening their control methods with the eventual aim of eradication of the disease. To this end, it is recommended that all rams be manually examined before they are put to the ewes and again when they are removed from the ewe flocks.

It is recommended that, on infected farms, the rams be removed from ewe flocks before the lambs are born.

It is recommended that, when the rams are gathered for testing of any sort, all those absent are located as soon as possible and either tested or slaughtered.

It is recommended that all rams are slaughtered at 5 years old at the latest. (Incidentally, it is considered that retention of rams beyond this age is a tacit admission of a very low rate of genetic improvement or the complete absence of any genetic improvement at all.)

It is recommended that young rams be kept separate from older ones at all times. This separation may be in the form of running two consecutive age groups of rams together throughout their lives, or alternatively, keeping each age group separate from all others.

It is recommended that, in the absence of a more efficient and feasible testing method, control and ultimately eradication is based on results obtained from the Agar-gel Diffusion Method. (AG)

Acknowledging the fact that the AG test is not 100% accurate (the inaccuracies being due to false negatives), it is recommended that a farm may not be considered free from Brucella ovis infection until no positive reactions have been found in the entire farm ram flock for two consecutive tests which preferably have an intervening mating season. A further check test may be carried out after a period of two years.

It is recommended that farms do not purchase rams from other farms which are not regarded as free from infection according to the system outlined above, unless those rams have been tested twice by the AG method and held in isolation for that period.

It is recommended that farms make greater efforts to locate and produce all their rams for testing on the same occasion.

With the logistical and managemental problems involved in on-farm laboratory diagnosis (such as intermittent electrical supply, limited air freight capacity, etc.) it is considered that this work should be continued in the Grasslands Trials Unit laboratory. It is recommended that a part-time unskilled assistant be employed to reduce the volume of work handled by the single laboratory technician at present working in the G.T.U. investigational laboratory.

Although the actual removal of samples from rams in a fairly rapid process, it being possible to sample in the region of 450 rams in one day, the time involved in transporting the operative to and from the farms together with the delay in the transportation of the samples to the laboratory, means that those 450 rams may occupy 5 or 6 days of the operative's time. It is necessary to have a central organisation which maintains contact with the farms. Whilst the Grasslands Trials Unit Veterinarian will be able to organise the programme and assist in the sampling, he will not be able to allocate sufficient time to blood sample all the rams once a year for 2 or 3 years. Therefore, it is recommended that a part-time lay blood tester be employed. This person can be locally trained in the technique and method of blood sampling and his employment would be for the duration of the annual testing programme. It is considered that the employment of a lay blood tester would be more satisfactory than reliance on sampling by farm staff - although several have been shown how to do this.

In order to ensure rapid transport of the blood tester, his equipment and the blood samples, it is recommended that he be given official Government priority for, and assistance in, transport by the Falkland Islands Government Air Service.

It is recommended that the blood testing of all Falkland Island rams becomes an annual event for 2 or 3 consecutive years. The programme should be scheduled to take place so that the rams are bled shortly after shearing. Although this may be regarded as a difficult time of year, each farm would be involved for only one or two days per year.

In order to ensure regular supplies of Brucella ovis antigen, it is recommended that the antigen be acquired from the Pan American Zoonosis Centre under a formal arrangement for supply.

CONCLUSION

Falkland Island sheep are subject to only three major non-nutritional diseases. Hydatidosis is the subject of an eradication campaign and infection due to Corynebacterium ovis is probably decreasing in incidence although still widespread. Brucella ovis infection is a contributary factor in the low lamb production and can be eradicated from the Islands in a relatively short time.

REFERENCES


| | |
|---|---|
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# The Investigations of the effects in adult wethers of supplementation of dietary Cobalt at Port Stephens and Fox Bay West 1978.

Trial codes: Co(W)PS 1978, Co(W)FBW 1978

Companion Reports: 4.2(2); 4.2(3); 4.2(4).


## Summary

Two groups of 100 six year old wethers were each given a cobalt bullet (Permaco-S, T.V.L.) and compared with 100 untreated controls on each of two farms. On one farm, Fox Bay West, the treatment produced an increase in wool production and in survival over the winter period. However, on the other farm, Port Stephens, although the treatment eliminated Vitamin B12 deficiency from the group there was no difference in the wool yield or survival rate between the treated and control groups. It is concluded that cobalt bullets have lost their efficiency after $5\frac{1}{2}$ years use.

Copper, Haemoglobin and Packed Cell Volume levels in samples taken at Port Stephens apparently did not vary with season or Vitamin B12 status and were all within the ranges quoted as normal for sheep.


## Object

To investigate the response in terms of survival and wool production by adult wethers to the supplementation of their dietary intake of Cobalt, and thus, by inference, to obtain information concerning the longevity of Cobalt bullets.

The sheep at Port Stephens were used to study Vitamin B12 levels during the period and to determine certain haematological levels in these free ranging adult wethers.

## Treatment and Method

At Port Stephens at the end of May 1979 and at Fox Bay West in mid January 1978, 200 six year old wethers were drafted off from their flocks and randomly divided into two groups of 100 which were identified by means of individually numbered ear tags. On each farm the cobalt supplementation was given by means of a cobalt bullet (Permaco-S, T.V.L.) to one of the two groups. All the sheep were allowed to return to their normal flocks which were run in a rotation of four camps at Fox Bay West and in three camps at Port Stephens.

Furthermore at the time of selection of the sheep at Port Stephens, clotted and oxalated blood samples were taken from a randomly selected sample of sheep. Additional samples were taken from sheep in each of the two groups in mid October 1978 and at shearing in January 1979. Duplicate serum samples were preserved by the addition of a preservative containing one part chlorobenzene, one part 1,2-dichloroethane to two parts n-butyl chloride. These samples were despatched to Newcastle Veterinary Investigation Laboratory for Vitamin B12 estimations.

In the GTU laboratory, the oxalated blood samples were subjected to estimations for Haemoglobin, Copper and Packed Cell Volume.

At shearing on both farms, the fleece weights were recorded as was the presence or absence of the study animals. At Fox Bay West the fleeces were "trimmed" of the belly and neck pieces before being weighed. These pieces were weighed in lots of 10 to give a mean correction factor. At Port Stephens, the whole, untrimmed fleeces were weighed.

## Results

(a) The results of the investigation at Fox Bay West are shown in Table 1 and show a significant difference in the trimmed fleece weights between the two groups:-

| | | |
|---|---|---|
| Cobalt Supplemented | 3.22kg | |
| No Cobalt Supplementation | 2.90kg | ($t = 3.074$, $P < 0.005$) |

There was also a significant difference in the survival rates of the two groups:-

| | | |
|---|---|---|
| Cobalt Supplemented | 89% | |
| No Cobalt Supplementation | 75% | (Chi square = 6.64, P = 0.01) |

(Although the absence of a sheep might mean that it has more "vigour" and is thus able to avoid gathering, for the purposes of these investigations, absence at shearing, unless known to be otherwise, is taken as indicating that the sheep died during the study period).

(b) At Port Stephens, however, there was no significant difference in the survival rates or the wool yield of the two groups (as shown in Table 2):-

| | | |
|---|---|---|
| Cobalt Supplemented | 3.80kg Wool | 84% Survival |
| No Cobalt Supplementation | 3.80kg Wool | 88% Survival |

(c) The haematological samples taken from the Port Stephens wethers produced the results shown in Tables 3 and 4.

No difference was found in the blood levels of Copper, Haemoglobin or Packed Cell Volume either when the sheep were divided into "Cobalt Supplemented" and "no Cobalt" groups or into "Vitamin B12 deficient" and "Vitamin B12 sufficient" groups.

All the samples were pooled to find grand mean levels for these parameters:-

| | | |
|---|---|---|
| Copper (µg/ml ± 1SD) | 1.05 ± 0.16 | 66 samples |
| Haemoglobin (g/ml ± 1SD) | 11.2 ± 1.4 | 61 samples |
| Packed Cell Volume (per cent ± 1SD) | 28 ± 4 | 61 samples |

The Vitamin B12 analysis, shown in Table 3, showed that the administration of a cobalt bullet had a significant effect on the percentage of sheep which had blood levels below "normal" (taken as 0.5ng/ml).

At the outset of the investigation, in early winter, 75% of the sheep had Vitamin B12 levels below normal but by mid spring none of the treated sheep and 50% of the untreated ones were "subnormal". At shearing none of the treated and 42% of the untreated sheep had B12 levels below normal.

The Vitamin B12 levels were quoted with an arbitrary upper limit set at 2.5ng/ml. The percentage of sheep in each of the two groups with serum levels of Vitamin B12 at 2.5ng/ml or higher are shown in Table 3b.

## Discussion

The managers at both Port Stephens and Fox Bay West have, for many years, treated all lambs at weaning with cobalt bullets. This follows experimentation by T. Beatty and C. H. Robertson in the 1940's and 50's (farm records) which showed that cobalt supplementation was effective in markedly decreasing losses of hoggs.

Apart from one occasion when, due to probable mistaken understanding of the mechanism of action of the cobalt bullets, engineer's grub screws were given as grinders to adult sheep, there has been no work on the effective "longevity" of these bullets.

It has been reported that, on average, the bullets should last four years (Whitelaw 1977 pers. comm.) and the indication from the two trials reported here certainly suggest that they do not last 5½ years.

Although the effectiveness of the administration of cobalt bullets in eliminating Vitamin B12 deficiency at Port Stephens was not reflected in differences in fleece weights or survival rates of the sheep, the statistical significance of the treatment of the Fox Bay West sheep is marked. This disparity might be due to the fact that the trial at Port Stephens was started in midwinter (May 1978) four months after the Fox Bay West trial. So that, although the Vitamin B12 levels had time to alter and reflect the relative cobalt status of the sheep, the wool growth period of shearing to May was sufficient to mask the effect of the deficiency at Port Stephens.

Previous workers (C. D. Young, 1966; T. H. Davies, 1970) have quoted soil and pasture samples from the Falklands as being low to very low in Cobalt and Copper. Although none of these samples was taken from the Fox Bay West/Port Stephens area it seems likely that the levels of these elements will be low in pastures available to sheep on these two farms which have the similar geological classification of the Port Stephens Beds from the Lower Devonian Period. Detailed information on this subject will become available as a result of the soil and pasture survey at present being undertaken and initial results indicate that the Copper levels of many grass species are very low (1 to 2 ppm D.M. Whitegrass).

However the blood copper levels in the sheep at Port Stephens all fell within a normal range of 0.7 to 1.3 µg/ml (Blood and Henderson 3rd Edition). Similarly the values for the Haemoglobin Concentration and Packed Cell Volume were in the normal range of 8-14 g/ml and 22-40% respectively (Doxey D. L., Veterinary Clinical Pathology, 1977).

From the commercial point of view a simple calculation may be made showing the benefits of treatment of this class of sheep (using the whole fleece weight of the sheep at Fox Bay West as an example):-

Cost: bullet 14 pence plus ancillary charges 3 pence = Total 17 pence
Total cost of treating 100 wethers = £17.00
At a wool price of £1.10 per kilogram the increased return as a result of the treatment was £(89 x 3.42 - 75 x 2.90) x 1.1 = £95.568
Therefore for an outlay of £17 approximately £78 additional profit was accrued as a result of treatment of 100 six year old wethers.

Acknowledgements are due to Peter Robertson and Jimmy Robertson, the managers of Port Stephens and Fox Bay West respectively, for their enthusiasm and efforts: to J. C. Bell for the Vitamin B12 estimations and to Heather Rogers for the other haematological estimations, and to J. Riley for statistical analysis and advice.

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Circulation: All farms and other interested bodies
ODM
H. Rogers
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TABLE 1

FOX BAY WEST Co(W)FBW 1978

| | | Treatment | Control | SED Mean | CV% |
|---|---|---|---|---|---|
| Number at start 15.1.78 | | 100 | 100 | | |
| Number at shearing 11.12.78 | | 89 | 75 | | |
| % absent at shearing | | 11% | 25% | | |
| Number available for analysis | | 87 | 74 | | |
| Mean fleece weight (Trimmed) | kg | 3.22 | 2.90 | 0.658 | 21.4 |
| Calculated fleece correction factor | kg | +0.20 | +0.19 | | |
| Derived mean whole fleece weight | kg | 3.42 | 3.09 | | |

TABLE 2

PORT STEPHENS Co(W)PS 1978

| | | Treatment | Control | SED Mean | CV% |
|---|---|---|---|---|---|
| Number at start 31.5.78 | | 100 | 100 | | |
| Number at shearing 3.1.79 | | 84 | 68 | | |
| % absent at shearing | | 16% | 12% | | |
| Number available for analysis | | 82 | 88 | | |
| Mean fleece weight (whole) | kg | 3.80 | 3.80 | 0.716 | 18.8 |

TABLE 3

PORT STEPHENS Co(W)PS 1978

3a

Percentage of sheep with Vitamin B12 levels below a "normal" of 0.5ng/ml
Total number of samples examined shown in parentheses.

| | 31.5.78 | 14.10.78 | 3.1.79 |
|---|---|---|---|
| Cobalt supplemented | (start) | 0% (12) | 0% (18) |
| No cobalt supplement | 75% (8) | 50% (6) | 42% (21) |
| Chi square | | 7.2, $p < 0.01$ | 10.0, $p < 0.01$ |

3b

Percentage of sheep with Vitamin B12 levels 2.5ng/ml or above
Total number of samples examined shown in parentheses.

| | 31.5.78 | 14.10.78 | 3.1.79 |
|---|---|---|---|
| Cobalt supplemented | (start) | 75% (12) | 94% (18) |
| No cobalt supplement | 25% (8) | 33% (6) | 24% (21) |
| Chi square | | 2.9, $p > 0.05$ | 19.7, $p < 0.C05$ |

## TABLE 4

PORT STEPHENS Co(W)PS 1978

| | DATE | SHEEP WITH VIT B12 BELOW NORMAL | NUMBER INVOLVED | SHEEP WITH VIT B12 ABOVE NORMAL | NUMBER INVOLVED | GRAND MEAN | NUMBER INVOLVED |
|---|---|---|---|---|---|---|---|
| Copper | 31.5.78 | 0.98 ± 0.10 * | 6 | 0.98 ± 0.01* | 2 | | |
| (μg/ml) | 14.10.78 | 1.18 ± 0.20 | 3 | 1.03 ± 0.22 | 15 | 1.05 ± 0.16 | 66 |
| | 31.1.78 | 1.03 ± 0.10 | 9 | 1.07 ± 0.17 | 30 | | |
| Haemoglobin | 31.5.78 | 10.3 ± 1.2 * | 6 | 10.3 ± 0.1 * | 2 | | |
| (g/100 ml) | 14.10.78 | 8.9 ± 1.3 | 3 | 10.3 ± 1.3 | 16 | 11.2 ± 1.4 | 61 |
| | 3.1.79 | 12.0 ± 0.9 | 9 | 11.9 ± 1.1 | 24 | | |
| Packed | 31.5.78 | 27 ± 3 * | 6 | 27 ± 0 * | 2 | | |
| Cell Volume | 14.10.78 | 19 ± 4 | 3 | 26 ± 4 | 16 | 28 ± 4 | 61 |
| (%) | 3.1.79 | 30 ± 3 | 9 | 30 ± 3 | 24 | | |

* All levels are expressed in units as shown ± 1 Standard Deviation where applicable.

## The investigations of the effects of supplementation of dietary cobalt in ewe hoggs on a variety of different farms.

| | | | |
|---|---|---|---|
| Trial Codes: | Co(HE)JH 1978 | Co(HE)S 1978 | Co(HE)FBW 1978 |
| | Co(HE)JE 1978 | Co(HE)W 1978 | Co(HE)PS 1978 |
| | Co(HE)SL 1978 | | |

Companion Reports: 4.2(1); 4.2(3); 4.2(4).


### Summary

On each of seven farms, one group of untreated (control) ewe hoggs was compared with a similar group which had been given a cobalt bullet (Permaco-S, T.V.L.) at weaning. There was a response in terms of increased production, on the three farms, Port Stephens, Fox Bay West and Weddell Island, which share similar geological morphology.

The absence of a demonstrated benefit on the other farms is taken as indicating that a dietary deficiency of cobalt is not limiting the growth of ewe hoggs over their first winter. This growth is shown to be very poor and it is suggested that it is a limitation to the realisation of the sheeps' life-time potential.


### Object

The aim of this study was, in the absence of detailed knowledge of levels of dietary cobalt, to investigate the response, in terms of survival and wool production, of ewe hoggs to the supplementation of their dietary intake of Cobalt.

### Background

Since the pioneer work of C. H. Robertson and T. Beatty in the 1940's and 1950's at Fox Bay West and Port Stephens, there has been little scientific work into the effects of dietary cobalt supplementation. Trial and error and stockmen's observations, however, have led to the use of Cobalt bullets on several Falkland Island farms.

Pasture and soil analyses (C. D. Young, 1966; T. H. Davies, 1970) indicate the possibility of a widespread cobalt deficiency in the Falkland Islands which is not corroborated by the clinical picture presented by young sheep except on those farms which already administer supplementary cobalt.

Until such time as more extensive knowledge of the nature and composition of the sheeps' diet becomes available, it was decided to instigate this study over a wide range of types of management to investigate whether or not there was any evidence of subclinical cobalt deficiency in farms which do not practise supplementation and to obtain, from all the farms involved, accurate information concerning wool weights. On some farms body weights were also recorded as was, on one farm, the length of the sheeps' wool.

### Treatments and Methods

On each farm, two groups of randomly chosen ewe lambs were formed at, or soon after weaning. The farms involved and the sizes of the groups are indicated below:-

| West Falkland | | East Falkland | |
|---|---|---|---|
| Weddell Island | 2 x 100 | Sea Lion Island | 2 x 60 |
| Port Stephens | 2 x 100 | San Carlos | 2 x 100 |
| Fox Bay West | 2 x 100 | Salvador | 2 x 26 |
| | | Johnsons Harbour | 2 x 100 |
| Total | 600 | Total | 572 |

One of the two groups on each farm was designated "Control" and the other "Treatment" in which each ewe lamb was given one Cobalt bullet (Permaco-S, T.V.L.) at weaning. All the study sheep were returned to their respective flocks and run under the normal system of management on each farm.

At Salvador and Port Stephens the sheep were weighed twice and once respectively during the winter period as well as at weaning and at shearing. In all cases absence from a recording session, unless known to be otherwise, has been taken as indicating that the sheep had died.

At Sea Lion Island the sheep were weighed at weaning and at shearing and the additional length of wool measurement was taken at these times. The measurement was made by gently apposing unstretched wool fibres to a scale at a site located approximately six inches posterior to the base of the neck and in the midline of the sheeps' back. Although recording error of this measurement was undoubtedly great, the results give an indication of the dimensions of this fleece parameter.

Results (Summary)

The detailed results of each trial are shown in Tables 1 to 7. On some farms, the fleeces were "trimmed" by removal of the dag ends, bellies and necks before being weighed. The weights of these "trimmings" were recorded in lots of 10 to obtain a mean correction factor which could be added to the calculated mean trimmed fleece weight to give a "derived mean whole fleece weight".

The comparative fleece weights of the sheep which received treatment are shown in Table 8. These values make no account for the amount of mineral or vegetable matter in the fleeces. There is a considerable variation between farms ranging from 1.71kg at Salvador to 3.83kg at Sea Lion Island.

Only at Fox Bay West and at Port Stephens were there significant differences in fleece weights between the treatment and control groups:-

| Farm | Fleece Weight | | |
|---|---|---|---|
| | Treatment | Control | |
| Fox Bay West | 1.79kg* | 1.6kg | $F = 6.306,\ p < 0.025$ |
| Port Stephens | 2.12kg[x] | 1.96kg | $F = 5.293,\ p < 0.025$ |

(* Trimmed fleece weight  [x] Whole fleece weight)

At Johnsons Harbour, Salvador, Sea Lion Island and San Carlos there were no significant differences in the survival between treatment and control sheep. At Port Stephens, Fox Bay West and Weddell Island, however, not only were the losses generally greater in treated and control sheep than on other farms but there were significant differences between the treatment and control groups on each farm.

| Farm | | Weaning | Numbers at midwinter | Shearing | Chi square |
|---|---|---|---|---|---|
| Fox Bay West | T | 100 | | 78 | |
| | C | 100 | | 49 | $= 18.14,\ p < 0.005$ |
| Weddell Island | T | 100 | | 90 | |
| | C | 100 | | 56 | $= 3.15,\ p < 0.10,\ p > 0.05$ |
| Port Stephens | T | 100 | 93 | 90 | wean - midwinter $= 14.17,\ p < 0.005$ |
| | C | 100 | 73 | 56 | midwinter - shearing $= 15.53,\ p < 0.005$ |

(T = Treatment Group  C = Control Group)

On the farms at which sheep were weighed - Salvador, Sea Lion Island and Port Stephens - it was only at the latter place, Port Stephens, where any difference was found in the sheep body weights. These values were recorded on freshly shorn sheep and the difference had not been apparent at the midwinter weighing. The weight change, which was a weight loss, between midwinter and shearing was also significantly different between the treatment and control groups:-

Weight change from Midwinter to Weight after Shearing

| | | |
|---|---|---|
| Treatment | - 1.13kg | $F = 12.238$, $p < 0.005$ |
| Control | - 2.19kg | |

## Discussion

It can be seen from these results that a response to dietary cobalt supplementation is apparent in ewe hoggs at Port Stephens, Fox Bay West and Weddell Island. At all three farms the benefit was manifest in terms of increased survival and, at Port Stephens and Fox Bay West, also in terms of increased wool production. It is interesting to note that these results are produced in spite of variation in the management of hoggs throughout their first winter between these three farms, and that there is a common link between these farms in the geological classification of the underlying strata - the Port Stephens Beds of the Lower Devonian Period. None of the other farms involved in these trials has a similar geological conformation. Full trace element analysis, including cobalt estimations, is awaited for soil and pasture samples from the area of Port Stephens Beds.

Examination of the body weights of the ewe hoggs involved in this trial, as shown in Figure 1 which also shows the body weights of wether hoggs in similar trials (see separate report), reveals that, at weaning, ewe lambs are lighter than wether lambs and this difference in weight is carried through the winter and is still apparent at shearing in November/December. Also noticeable is the fact that, apart from the well grown hoggs at Sea Lion Island, the shorn hoggs are about the same weight when 13 to 14 months old than they were when 5 to 6 months old. If, as is thought likely, early growth in sheep is related to their life time performance, then these ewe (and wether) hoggs are being severely restrained from a realisation of their true potential. The absence of a response to cobalt supplementation on several farms indicates that it is not this element which is the restraining factor and, combined with the absence of clinical indication of other deficiencies, suggests that energy intake is probably limiting the growth of young sheep. This conclusion is borne out by the growth of the ewe hoggs at Sea Lion Island where there is more food of a better quality available than, in general, on mainland farms.

From the commercial point of view, a simple calculation may be made showing the cost benefits of treatment of the ewe lambs at Fox Bay West:-

Cost: 14 pence per bullet + 3 pence per sheep "ancillary charges"
= 17 pence per sheep treated = £17 per 100.
At a wool price of 110 pence per kilogram, the increased return as a result of the treatment was $(78 \times 2.10 - 49 \times 1.90) \times 1.1 = £77.77$
Therefore, for an outlay of £17 an additional £60.77 profit was accrued as a result of treatment of 100 ewe hoggs. It should be noted that this calculation is only relevant for the first year of life and the decreased losses resulting from the treatment have a compound effect in later years.

Acknowledgements: are due to the managers and staff of all the farms involved in these trials for their willingness to take on the extra work of measurement and recording. Thanks are also due to Miss J. Riley for statistical analysis and advice.

R. A. Whitley
May 1979

Circulation: All farms and other interested bodies
ODM
J. Riley
M Vagg
H. Rogers

TABLE 1

WEDDELL ISLAND Co(HE)W 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at start (1.78) | | 100 | 100 | |
| Number present at shearing (20.11.78) | | 95 | 88 | |
| % absent at shearing | | 5% | 12% | |
| Number available for analysis | | 95 | 88 | |
| Mean fleece weight (whole) | kg | 3.24 | 3.34 | 0.607 |

TABLE 2

PORT STEPHENS Co(HE)PS 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number of sheep present at weaning 1.2.78 | | 100 | 100 | |
| Number of sheep present at midwinter 23.6.78 | | 93 | 73 | |
| Number of sheep present at shearing 15.11.78 | | 90 | 56 | |
| % absent at midwinter | | 7% | 27% | |
| % absent midwinter to shearing | | 3.2% | 23.3% | |
| % absent weaning to shearing | | 10% | 44% | |
| Number available for analysis | | 90 | 56 | |
| Mean body weight at weaning | kg | 18.3 | 18.1 | 2.74 |
| Mean body weight at midwinter | kg | 20.4 | 20.0 | 3.00 |
| Mean body weight at shearing (shorn) | kg | 19.3 | 17.6 | 2.82 |
| Mean body weight change weaning to midwinter | kg | +2.07 | +1.79 | 1.587 |
| Mean body weight change midwinter to shearing | kg | -1.13 | -2.19 | 1.795 |
| Mean fleece weight (whole) | kg | 2.12 | 1.96 | 0.394 |

TABLE 3

FOX BAY WEST Co(HE)FBW 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 8.2.78 | | 100 | 100 | |
| Number present at shearing 27.11.78 | | 78 | 49 | |
| % absent at shearing | | 22% | 51% | |
| Number available for analysis | | 76 | 48 | |
| Mean fleece weight (trimmed) | kg | 1.79 | 1.61 | 0.383 |
| Calculated fleece correction factor | kg | 0.31 | 0.29 | |
| Derived mean fleece weight | kg | 2.10 | 1.90 | |

TABLE 4

SEA LION ISLAND Co(HE)SL 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 27.1.78 | | 60 | 60 | |
| Number present at shearing 3.11.78 | | 58 | 56 | |
| Number available for analysis | | 58 | 56 | |
| Mean body weight at weaning | kg | 26.1 | 26.3 | 3.55 |
| Mean body weight at shearing (shorn) | kg | 32.3 | 32.5 | 3.78 |
| Mean change in body weight 27.1 to 3.11.78 | kg | +6.21 | +6.12 | 3.23 |
| Mean trimmed fleece weight | kg | 3.24 | 3.35 | 0.476 |
| Calculated fleece correction factor | kg | +0.588 | +0.591 | |
| Derived mean whole fleece weight | kg | 3.83 | 3.94 | |
| Mean wool length at weaning 27.1.78 | cm | 5.51 | 5.48 | 0.710 |
| Mean wool length at shearing 3.11.78 | cm | 14.60 | 14.40 | 0.99 |
| Mean change in wool length 27.1 to 3.11.78 | cm | +9.11 | +8.92 | 0.993 |

TABLE 5

SAN CARLOS    Co(HE)JB 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at start 9.2.78 | | 100 | 100 | |
| Number present at shearing 14.11.78 | | 88 | 90 | |
| % absent at shearing | | 12% | 10% | |
| Number available for analysis | | 88 | 90 | |
| Mean fleece weight (trimmed) | kg | 2.64 | 2.62 | 0.463 |
| Calculated fleece correction factor | kg | 0.25 | 0.24 | |
| Derived mean whole fleece weight | kg | 2.89 | 2.86 | |

TABLE 6

SALVADOR    Co(HE)S 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 1.3.78 | | 26 | 26 | |
| Number present at Autumn 5.5.78 | | 22 | 24 | |
| Number present at Spring 4.9.78 | | 24 | 24 | |
| Number present at Summer 4.12.78 | | 22 | 22 | |
| % absent 1.3.78 to 5.5.78 | | 3.9% | 3.9% | |
| % absent 5.5.78 to 4.9.78 | | 4.0% | 4.0% | |
| % absent 4.9.78 to 4.12.78 | | 8.7% | 8.7% | |
| % absent 1.3.78 to 4.12.78 | | 15.4% | 15.4% | |
| Number available for analysis | | 24 | 24 | |
| Mean body weight at weaning | kg | 19.6 | 20.7 | |
| Mean body weight at Autumn | kg | 20.8 | 22.4 | |
| Mean body weight at Spring | kg | 18.6 | 19.8 | |
| Mean body weight at shearing (unshorn) | kg | 20.4 | 21.3 | |
| Mean body weight change 1.3.78 to 4.9.78 | kg | -1.04 | -0.92 | 2.347 |
| Mean body weight change 4.9.78 to 4.12.78 | kg | +1.80 | +1.57 | 1.955 |
| Mean fleece weight (whole) | kg | 1.71 | 1.83 | 0.392 |

TABLE 7

JOHNSONS HARBOUR    Co(HE)JH 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number at start (April 1978) | | 100 | 100 | |
| Number at shearing (20.11.78) | | 65 | 74 | |
| % absent at shearing | | 35% | 26% | |
| Number available for analysis | | A | A | |
| Mean fleece weight (trimmed) | kg | 3.05* | 2.55* | A |

* figures calculated by division of total yield divided by number of sheep shorn. Individual weights not recorded.

A - No Statistical Analysis performed.

TABLE 8

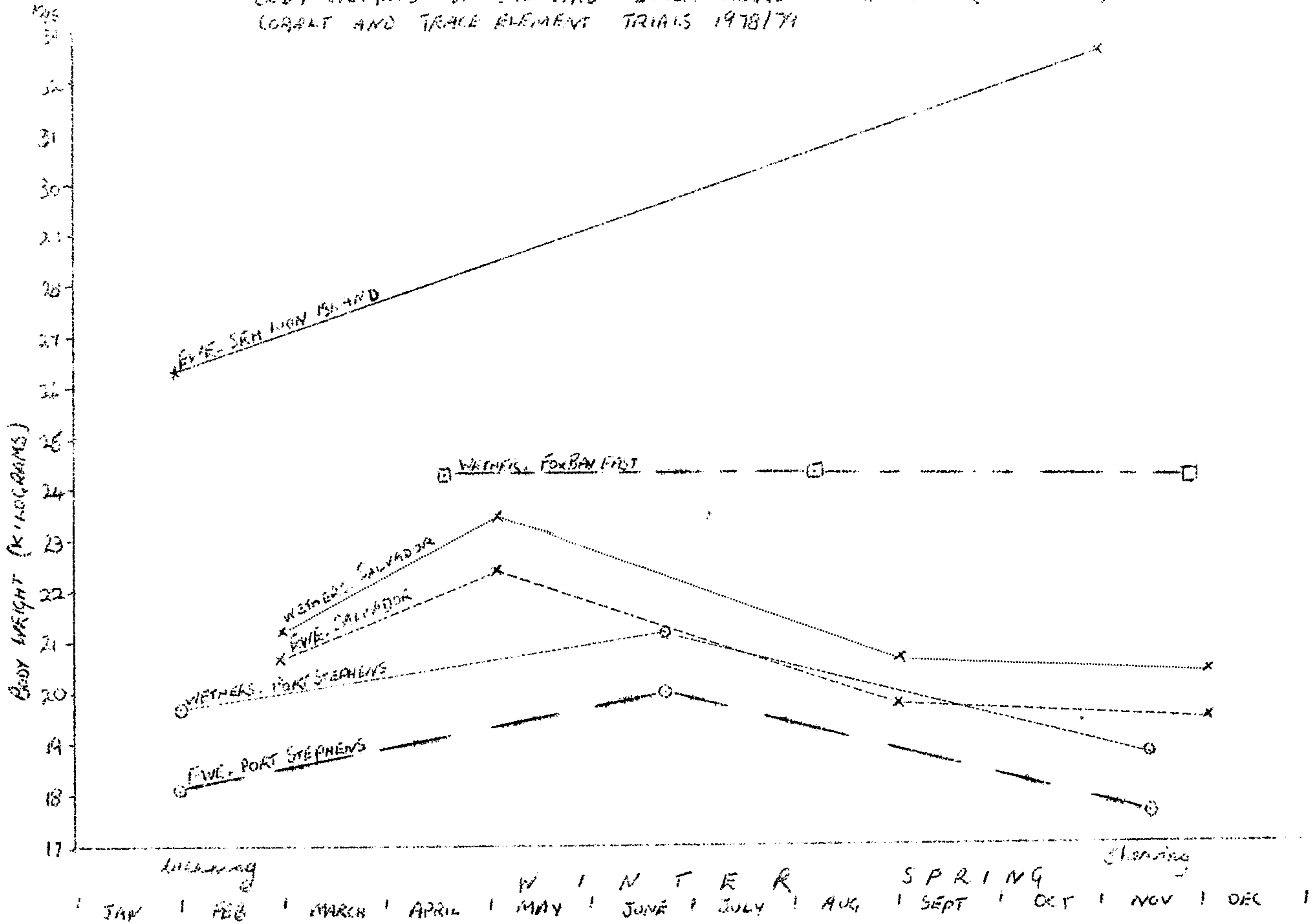
MEAN WHOLE FLEECE WEIGHTS (kg)
from sheep which received treatment at weaning

| | |
|---|---|
| Salvador | 1.71 kg |
| Fox Bay West | 2.10 kg |
| Port Stephens | 2.12 kg |
| San Carlos | 2.89 kg |
| (Johnsons Harbour | 3.05 kg)* |
| Weddell Island | 3.24 kg |
| Sea Lion Island | 3.83 kg |

* This is a trimmed fleece weight - the correction factor is not available.

FIGURE 1

BODY WEIGHTS OF EWE AND WETHER HOGGS IN CONTROL (UNTREATED) GROUPS IN COBALT AND TRACE ELEMENT TRIALS 1978/79



# The investigations of the effects of supplementation of dietary cobalt in wether hoggs on four Falkland Island farms.

Trial codes: Co(HW)S 1978 Co(HW)P 1978
Co(HW)PS 1978 Co(HW)HC 1978

Companion Reports: 4.2(1); 4.2(2); 4.2(4);


## Summary

On each of four farms one group of untreated (control) wether hoggs was compared with a similar group which had been given a cobalt bullet (Permaco-S, T.V.L.) at weaning. The only apparent response to treatment was in a markedly decreased death rate at Port Stephens. A comparison is made with the effect of treatment of ewe hoggs on this farm.

The absence of response on the other farms is taken as indication that cobalt intake is not a factor limiting production.

It is suggested that the absence of an increase in body weight from weaning to shearing is a contributary factor to the failure of sheep to realise their true potential.


## Object

The aim of this study was, in the absence of detailed knowledge of levels of dietary cobalt, to investigate the response, in terms of survival and wool production, of wether hoggs to the supplementation of their dietary intake of cobalt. (Further details may be obtained from the Companion Reports q.v.)

## Background

At Port Stephens, it is the normal custom to give a cobalt bullet at weaning of all sheep. At Hill Cove a similar practice has been in operation for some time but with little apparent effect on the sheep apart from shepherds' reports that they have more vitality and "are easier to gather" when they were given cobalt.

## Treatments and Methods

On each of three farms on West Falkland and one on East Falkland, two groups of randomly chosen wether lambs were formed at, or soon after weaning. The farms involved and the sizes of the groups are shown below:-

| East Falkland | | West Falkland | |
|---|---|---|---|
| Salvador | 2 x 31 | Port Stephens | 2 x 50 |
| | | Hill Cove | 2 x 100 |
| | | Pebble Island | 2 x 100 |
| Total | 62 | Total | 500 |

On each farm, one of the two groups was designated "Control" and the other "Treatment" in which each wether lamb was given one cobalt bullet (Permaco-S, T.V.L. at weaning. All the study sheep were then returned to their respective flocks and run under the normal system of management on each farm.

At Salvador and Port Stephens the sheep were weighed twice and once respectively during the winter period, as well as at weaning and shearing. In all cases, absence from a recording session, unless known to be otherwise, has been taken as indicating that the sheep had died even though it is possible that they may have been alive but had avoided being gathered.

Results (Summary)

The detailed results of each trial are shown in Tables 1 to 4. Due to sampling and recording errors the data from Hill Cove was not subjected to statistical analysis.

A comparison of the whole fleece weights of wether hoggs is shown in Table 5.

At no farm was there a difference in the fleece weights between the Treatment and Control groups. Similarly the administration of cobalt had no apparent effect on body weight or change in body weight at Port Stephens or at Salvador.

The Treatment group at Port Stephens, however, showed a very much lower loss rate (10%) than did the control group (54%) (Chi square = 22.24, $p < 0.005$). This benefit from the treatment was not shown at the other farms.

Discussion

Port Stephens is the only farm in this group which has regularly treated all the lambs at weaning with cobalt bullets because of an observed (but not calculated) decrease in losses from weaning to shearing. This observation is now supported by the calculations shown in Table 2 which shows the dramatic effect of cobalt supplementation. It is surprising, therefore, that there is no difference between Treatment and Control groups in terms of fleece weight or body weight at shearing especially as it has been shown that cobalt supplementation has a beneficial effect on these parameters in ewe hoggs (Companion Report 4.2(2)). It is suggested that further investigation of these results may be warranted in order to exactly define the response to cobalt supplementation.

The absence of response to treatment at Salvador and Pebble Island may be taken as an indication that cobalt is not limiting production. It is surprising, therefore, that the body weights of sheep at Salvador are as low as they are at Port Stephens (See Figure 1). As stated before (Companion Report 4.2 (2)), the failure to increase body weight as well as body size from weaning to shearing must have a restraining effect on the realisation of life-time potential.

Acknowledgements are due to the managers and staff of all the farms involved in these trials for their willingness to take on the extra work of measurement and recording. Thanks are also due to Miss J. Riley for the statistical analyses and helpful advice.

R. S. Whitley
May 1979

Circulation: All farms and other interested bodies
ODM
M. Vagg
H. Rogers
J. Riley

TABLE 1

SALVADOR Co(HW)S 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 1.3.78 | | 31 | 31 | |
| Number absent (presumed dead) 5.5.78 | | 1 | 2 | |
| Number absent (presumed dead) 4.9.78 | | 2 | 7 | |
| Number absent (presumed dead) 4.12.78 | | 7 | 7 | |
| % loss 1.3.78 to 5.5.78 | | 3.2 | 6.5 | |
| % loss 5.5.78 to 4.9.78 | | 3.3 | 17.2 | |
| % loss 4.9.78 to 4.12.78 | | 17.2 | 0.0 | |
| Number available for analysis | | 28 | 24 | |
| Mean body weight at weaning 1.3.78 | kg | 21.9 | 21.2 | |
| Mean body weight at Autumn 5.5.78 | kg | 23.7 | 23.5 | |
| Mean body weight at Spring 4.9.78 | kg | 20.7 | 20.7 | |
| Mean body weight at shearing (unshorn) 4.12.78 | kg | 22.5 | 22.1 | |
| Mean change in body weight 1.3.78 to 4.9.78 | kg | -1.09 | -0.67 | 1.767 |
| Mean change in body weight 4.9.78 to 4.12.78 | kg | +1.41 | +0.87 | 1.918 |
| Mean whole fleece weight | kg | 1.83 | 1.73 | 0.337 |

TABLE 2

PORT STEPHENS Co(HW)PS 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 1.2.78 | | 50 | 50 | |
| Number present at midwinter 23.6.78 | | 47 | 35 | |
| Number present at shearing 15.11.78 | | 45 | 23 | |
| % loss weaning to midwinter | | 6 | 30 | |
| % loss midwinter to shearing | | 4.3 | 34.3 | |
| % loss weaning to shearing | | 10 | 54 | |
| Number available for analysis | | 43 | 23 | |
| Mean body weight at weaning 1.2.78 | kg | 18.9 | 19.7 | 3.10 |
| Mean body weight at midwinter 23.6.78 | kg | 20.9 | 21.2 | 3.13 |
| Mean body weight at shearing (shorn) 15.11.78 | kg | 19.4 | 18.8 | 2.98 |
| Mean body weight change weaning to midwinter | kg | +2.02 | +1.55 | 1.994 |
| Mean body weight change midwinter to shearing (shorn) | kg | -1.56 | -2.05 | 1.884 |
| Mean whole fleece weight | kg | 1.93 | 1.84 | 0.334 |

TABLE 3

HILL COVE Co(HW)HC 1978

| | | Treatment | Control |
|---|---|---|---|
| Number present at dipping | | 100 | 100 |
| Number present at shearing | | 87 | 85 |
| % loss dipping to shearing | | 13 | 15 |
| Mean recorded fleece weight (trimmed) | kg | 2.50 | 2.37 |

(data not subjected to statistical analysis because of sampling and recording errors)

TABLE 4

PEBBLE ISLAND Co(HW)P 1978

| | | Treatment | Control | SED Mean |
|---|---|---|---|---|
| Number present at weaning 30.3.78 | | 100 | 100 | |
| Number present at shearing 21.11.78 | | 95 | 97 | |
| % absent at shearing | | 5 | 3 | |
| Number available for analysis | | 95 | 97 | |
| Mean fleece weight (trimmed) | kg | 2.3 | 2.2 | 0.41 |
| Calculated fleece correction factor | kg | 0.5 | 0.5 | |
| Derived mean whole fleece weight | kg | 2.8 | 2.7 | |

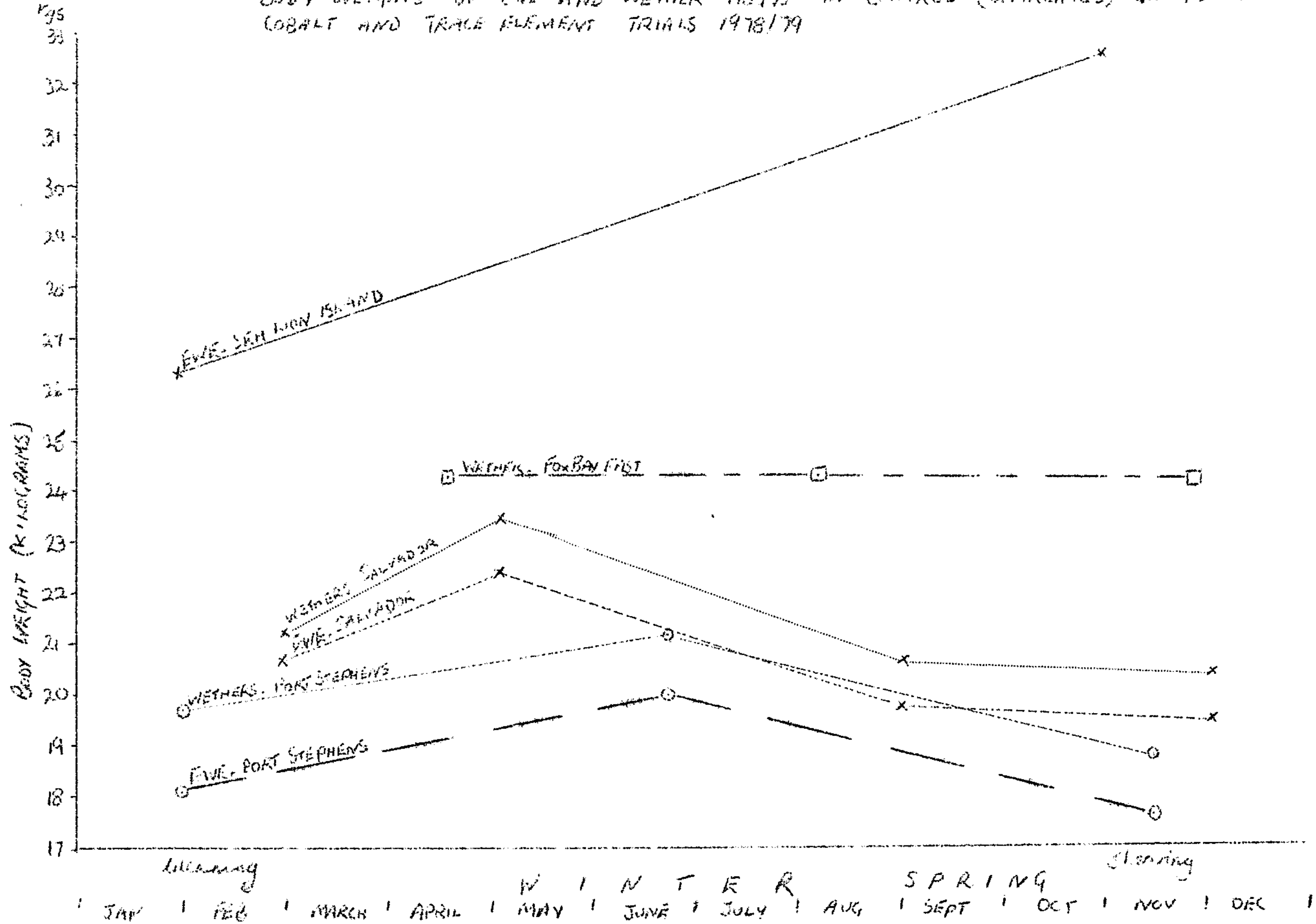
TABLE 5

Mean whole fleece weights from cobalt treated wether hoggs

| | |
|---|---|
| Salvador | 1.83 kg |
| Port Stephens | 1.93 kg |
| Pebble Island | 2.80 kg |

FIGURE 1

BODY WEIGHTS OF EWE AND WETHER HOGGS IN CONTROL (UNTREATED) GROUPS IN COBALT AND TRACE ELEMENT TRIALS 1978/79



## A comparative trial at Fox Bay East into the effects of administration of Cobalt, Selenium and Multielement tablets to wether hoggs.

Trial code: Co/T/S(HW)FBE 1978

Companion Reports: 4.2(1); 4.2(2); 4.2(3)

### Summary

Three groups each of 50 wether hoggs were treated with different trace element supplementation regimes and the effect, in terms of survival, body weight change and fleece production, was compared with an untreated control group.

The group treated with Selenium (Dystocel : Intervet) on two occasions had a significantly greater fleece weight than both the group treated with Cobalt (Permaco-S, T.V.L.) and the Trace Element Tablets (Arnolds Veterinary Products) group or the control group. This difference was not reflected in body weight changes.

It is suggested that these results warrant further investigation in the light of pasture analyses and over an extended period. It is shown that the study animals lost body weight from the start in April until they were shorn in November.

### Object

The aim of the study was, in the absence of detailed knowledge of levels of intake of trace elements in the diet, to investigate the response of four groups of wether hoggs to the administration of one of these treatments in terms of survival to shearing, fleece weights and body weights.

Fox Bay East is a farm which has given cobalt bullets to lambs at weaning over a period of 17 years but which ceased this practice in 1977 with the only observed difference being that the untreated sheep were "slightly harder to gather".

### Background

The reports of C. D. Young (1966) and T. H. Davies (1971) indicated that a variety of major and minor (trace) elements were available at levels in various pasture species, which are generally thought to be less than sufficient. Although only few pasture samples have as yet been analysed for Selenium content (R. S. Whitley, unpublished), it is possible that it is yet another to be added to the list of elements which are below "normal" levels in Falkland Islands herbage.

### Treatments and Methods

Four groups of 50 wether hoggs were made from a randomly selected group drafted from the main hogg flock. Whilst one group remained an untreated control, the others were each allocated one of three treatments as follows:-

Group Co: each given one Permaco-S (T.V.L.) Cobalt bullet at the outset of the trial on 19.4.78

Group T: each given on Trace Element Tablet (Arnolds Veterinary Products) on 19.4.78 and 8.8.78
Trace Element Tablets contain Iron, Copper, Cobalt, Iodine and Manganese.

Group S: each given a subcutaneous injection of Selenium as Potassium Selenate (Dystocel : Intervet) at 2.25mg per 45kg body weight on 19.4.78 and 8.8.78

These 200 wether hoggs were then run together in an area normally used as a holding paddock as it was impossible to run them with the rest of the hogg flock.

Body weights were recorded on three occasions - 19th April, 8th August and 28th November at shearing.

Results (Summary)

Due to a broken fence, some of the wether hoggs under study escaped from their paddock and so were not available for shearing on 28th November. These animals have been omitted from the calculations.

The detailed results are shown in Table 1 and the comparison of body weights between the treatments is shown in Figure 2 with a comparison of the body weights of these wether hoggs with those on other farms in Figure 1.

It may be seen from Table 1 that none of the treatments had any apparent effect on body weight or in change in body weight over the two periods from Autumn (19.4.78) to late winter (8.8.78) and from then until shearing.

The fleece weights, however, showed a variation ($F = 7.311$, $p < 0.025$) which upon examination, would appear to be a response to treatment with Selenium producing a significant difference in trimmed fleece weight over the two other treatments and the control.

Discussion

It was originally intended that this study should begin at weaning so that the data would be accumulated over the whole of the "crisis" period from weaning to shearing. This plan proved difficult and the selection and first treatment was made in mid April. The effects of the treatments were studied for a little over seven months which may not be a sufficient length of time when considering the effects of cobalt when the suspected deficiency is marginal in any case.

The response of the group of wether hoggs treated with Selenium in terms of wool yield but not body weight gain suggests that further investigations involving this element may be warranted especially if the herbage samples at present being analysed at Compton indicate an insufficiency.

Figure 1, in combination with the absence of body weight gain in response to the treatments, strongly suggests that nutritional factors (energy) are limiting the growth and production in young sheep.

Acknowledgements: All the selection, treatment and weighing procedures were performed by Mr. Cockwell and his staff to whom many thanks are due. Miss J. Riley is to be thanked for the statistical analysis and her advice.

R. S. Whitley
May 1979

Circulation: All farms and other interested bodies
ODM
M. Vagg
H. Rogers
J. Riley

TABLE 1

FOX BAY EAST          Co/T/S(HW)FBE 1978

| | | Cobalt | TE Tabs | Selenium | Control | F | SED Mean |
|---|---|---|---|---|---|---|---|
| Number present at start 19.4.78 | | 50 | 50 | 50 | 50 | | |
| Number present at 8.8.78 | | 49 | 49 | 49 | 48 | | |
| Number present at 28.11.78 | | 45 | 44 | 41 | 44 | | |
| % loss 19.4.78 to 8.8.78 | | 2 | 2 | 2 | 4 | | |
| % loss 8.8.78 to 28.11.78 | | 8 | 10 | 16 | 8 | | |
| % loss 19.4.78 to 28.11.78 | | 10 | 12 | 18 | 12 | | |
| Number available for analysis | | 36 | 34 | 34 | 33 | | |
| Mean body weight at start 19.4.78 | kg | 24.3 | 24.2 | 25.3 | 24.3 | 0.455 | 4.41 |
| Mean body weight at Spring 8.8.78 | kg | 23.8 | 24.4 | 25.2 | 24.3 | 0.639 | 4.33 |
| Mean body weight at shearing 28.11.78 (unshorn) | kg | 26.6 | 27.7 | 28.6 | 26.9 | 1.262 | 4.60 |
| Mean body weight change 19.4.78 to 8.8.78 | kg | -0.49 | -0.12 | 0.00 | -0.12 | 1.276 | 1.472 |
| Mean body weight change 8.8.78 to 28.11.78 | kg | +2.82 | +3.26 | +3.42 | +2.82 | 0.653 | 2.232 |
| Mean fleece weight (trimmed) | kg | 2.56 | 2.88 | 3.11 | 2.71 | 7.311 | 0.516 |
| Calculated fleece correction factor | kg | 0.40 | 0.39 | 0.45 | 0.35 | | |
| Derived mean whole fleece weight | kg | 2.96 | 3.27 | 3.56 | 3.06 | | |

FIGURE 1

BODY WEIGHTS OF EWE AND WETHER HOGGS IN CONTROL (UNTREATED) GROUPS IN COBALT AND TRACE ELEMENT TRIALS 1978/79

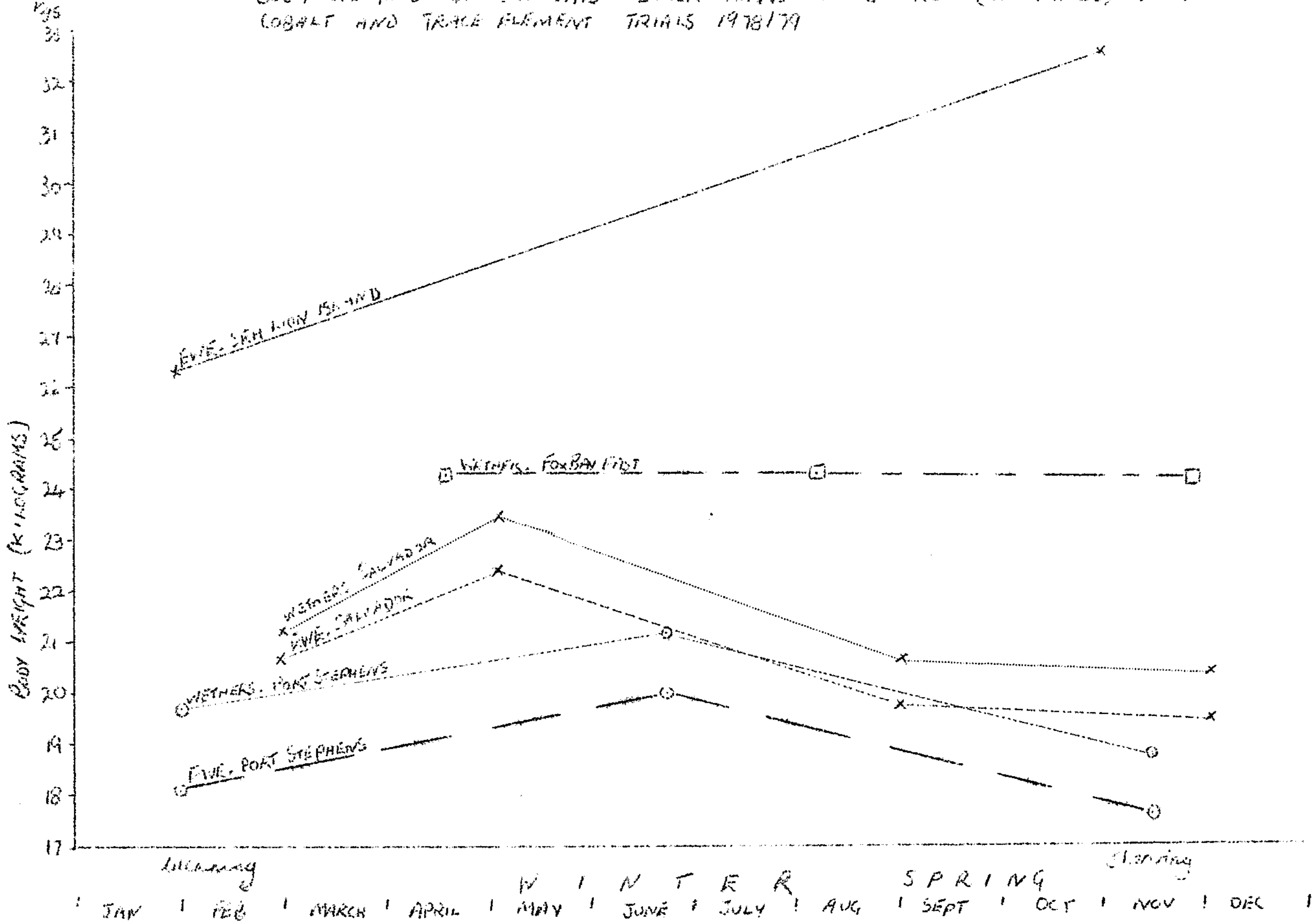
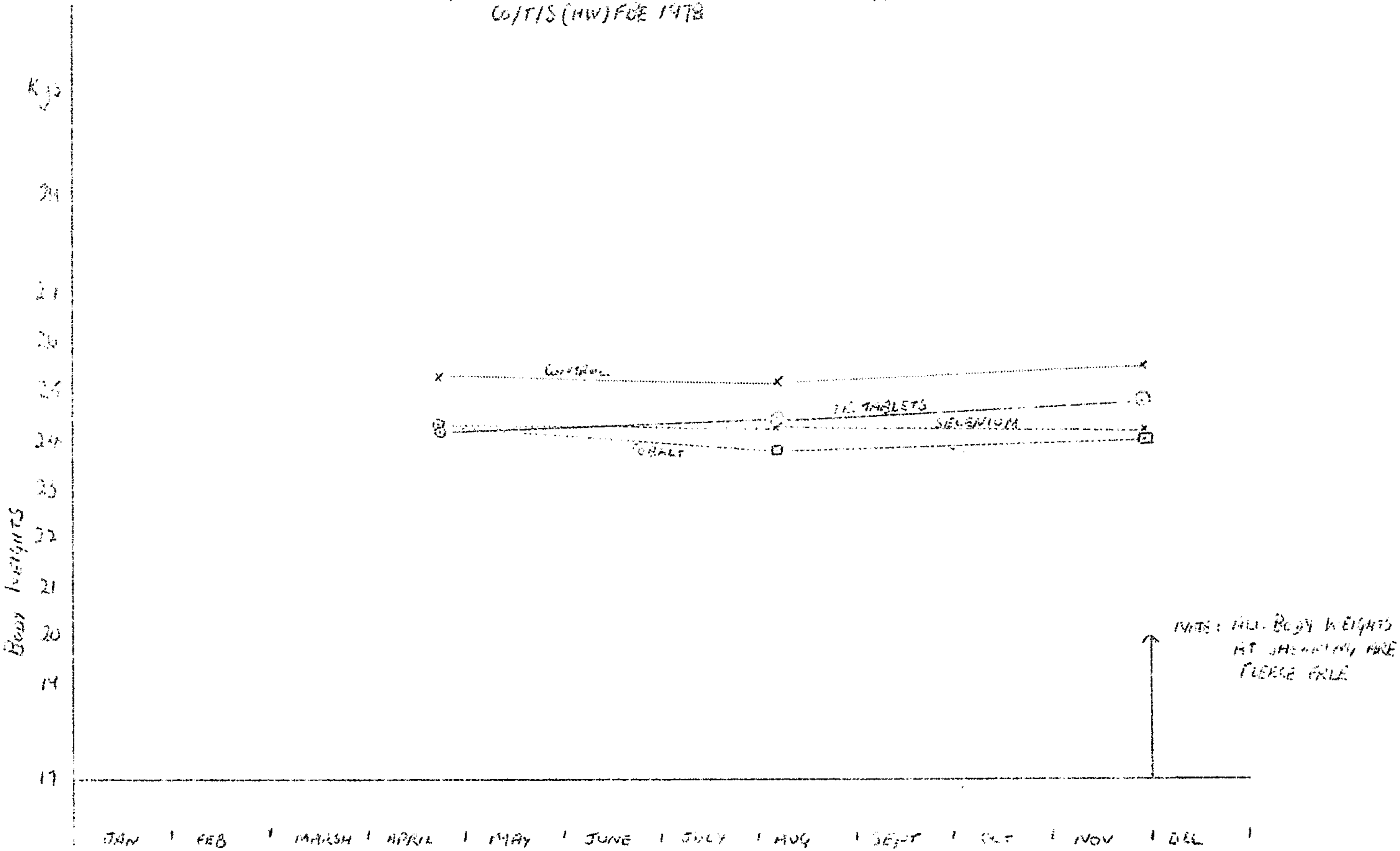


FIGURE 2

BODY WEIGHTS OF 4 GROUPS OF WETHER HOGGS AT FOX BAY EAST 1978
Co/T/S (HW) FOE 1978



A report of the investigation at Port Stephens during the period 1977 to 1979 into the effects of administration of a cobalt bullet (Permaco-S, T.V.L.) to maiden ewes prior to their first lambing in terms of success in rearing lambs over two seasons and wool production.

Trial Code: Co(E)PS 77/79

Companion Reports: 4.2(1); 4.2(2); 4.2(3); 4.2(4)

## Summary

Two groups of 100 shorn ewes were randomly selected from the maiden ewe flock prior to their first lambing. One group was given a cobalt bullet (Permaco-S, T.V.L.) whilst the other remained an untreated control. All members of both groups had been given a cobalt bullet when weaned as lambs.

It was apparent that the additional cobalt bullet had no significant effect on the production performance of these ewes as measured in terms of wool production, lamb production or reappearance at recording sessions (which is taken as an indication of survival).

It is concluded that it would be unnecessary to administer a second bullet to maiden ewes either to act as a grinder to remove possible deposits around the bullet or to supplement the existing bullet as a source of cobalt.

## Introduction

As mentioned in greater detail in the Companion Reports 4.2(1), 4.2(2) and 4.2(3), Port Stephens is a farm which has administered cobalt bullets to all lambs at weaning for several years with a resultant decrease in hogg losses and, as shown in Companion Reports 4.2(2) and 4.2(3), increased wool production from the surviving animals.

The directions on the label of the container of the cobalt bullets gives the following instruction:- quote "Important: To be effective the pellet must be swallowed. For best results use a gun which delivers direct into the gullet. In order to maintain the surface of the pellet clean and active by abrasive action, CSIRO recommend that each animal dosed with a pellet be dosed also with one appropriate grinder. This cleansing action may also be achieved by giving two pellets." end quote. Also the directions quoted in the Index of Veterinary Specialities (I.V.S.) Volume 19 No. 1 indicates that one bullet should be given annually. Thus it was decided to instigate a trial to investigate whether or not maiden ewes show an increased production in terms of live weight gain, lambing performance and wool production in response to being given a second bullet just prior to their first lambing having been given the first treatment when weaned as lambs.

## Materials and Methods

At Port Stephens farm the maiden ewes are shorn shortly prior to their first lambing. On 3rd November 1977 200 ewes were randomly withdrawn from the maiden ewe flock immediately after shearing. These sheep were then randomly divided into 2 groups of 100, and individually eartagged and weighed. The members of one group (Co) were given a cobalt bullet (Permaco-S, T.V.L.) in the recognised manner whilst the other group (C) remained as untreated controls.

All these sheep were then returned to the flock with which they ran until 23rd March 1978 when they were gathered and drafted off from the other ewes and lambs. All the sheep remaining in groups C and Co were weighed and their udders examined for evidence of having lactated (presence or absence of milk or watery fluid). These ewes were then returned to the flock having been weaned from their lambs.

On 16th May 1978 rams were put out with a flock of 3040 ewes which included the remainder of the trial sheep (groups C and Co).

On 7th February 1979 this flock was brought in to the settlement and the groups C and Co were drafted from the rest of the flock. They were then shorn - the whole fleece weights being recorded - weighed and their udders examined for evidence of having lactated (either Yes cr No).

All the sheep on the farm, and therefore those in groups C and Co, are given a cobalt bullet when weaned as lambs. Thus, when members of the treated group Co were given their second bullet immediately prior to their first lambing, it was 3 years since they had had their first bullet. Similarly at their second mating which started on 16th May 1978 the time since their first bullet was 3½ years.

Results and Discussion

The results are given in detail in Tables 1 to 6.

It is apparent from these results that the additional cobalt bullet had no significant effect on the production performance of these ewes during the period of the investigation. Thus it would seem an unnecessary expense to follow the manufacturer's advice and administer a second cobalt bullet either to act as a grinder or because the first bullet has become ineffective after one year in the sheep. These results should be compared with the details of the trial at Port Stephens and Fox Bay West in which a second bullet was given to 5 year old wethers and was effective in decreasing mortality and increasing wool production (Companion Report 4.2(1).)

The prelambing body weight of the maiden ewes is very low at a mean of 30.4kgs. 5 months later at weaning, the ewes weighed 36.2kgs but by the next weaning time in 1979 they had dropped to 29.7 kgs. These figures compare with approximately 43kg, 41.5kg and 43kg respectively in the FYRGS Control flock at Salvador. Furthermore at Port Stephens we know (Companion Report 4.2(2) that ewe lambs are weaned at 18kg (approx) but at their first shearing are only 18.5kg.

These low body weights in young sheep at Port Stephens may well be a major contributing factor to the low lambing percentages (from Table 4a, only 55% of ewes recorded present at first weaning had produced a lamb which had suckled and, similarly, from Table 4b, 46% at second weaning).

Examination of Table 2 which indicates the body weight change from 3.11.77 (prelambing) to 23.3.78 (weaning) in relation to the ewes' lambing performance reveals that there may be an interaction between the cobalt treatment and lambing in the contribution towards the +8.51kg and +3.64kg gain respectively for barren and lambed ewes. However, this must be due to chance (as suggested by the coefficient of variation of 120%) because the ewes were either already in lamb or barren when the treatment was given.

Table 3 shows that the cobalt treatment had no effect on the change of body weight during the lactational period (+3.88kg Control; +3.41kg Cobalt F = 0.283) in those ewes which lambed.

As would be expected the mean whole fleece weights (Table 4) of the ewes barren at the second lambing was higher than for those ewes which lambed, 3.77kg and 3.58kg respectively. Contributing to the latter figure will be some ewes which gave birth to lambs but subsequently lost them in the early stages of lactation. The treatment had no apparent effect on wool production

Tables 5 and 6 indicate that the extra cobalt supplementation had no effect on lambing (which is understandable for reasons outlined above) or the second lambing. Neither was there any relation between first lambing performance and subsequent absenteeism at second weaning.

For the purposes of the analysis of the results from this investigation, a ewe which had fluid in her udder at the time of examination - whether it be "water" or milk - was taken as evidence that she had given birth and reared a lamb. Absence of such fluid lead to classification of the ewe as barren. Neither of these decisions is absolute but is accepted as satisfactory within the terms of this investigation. If, however, the presence of "water" in the udder is taken as indicating that the ewe was drying up due to the loss of her lamb or absence of sufficient food to sustain lactation, it was noted that 15 out of the 48 Control and 17 out of the 49 Cobalt ewes in the first lactation only partly reared their lambs. In other words, only 33 Control and 32 Cobalt sheep out of the 100 original maiden ewes in each group were still lactating when the lambs were weaned on this farm where weaning and marking is simultaneous.

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## TABLE 1

PORT STEPHENS Co(E)PS 77/79

Mean Body Weights in Kgs

| Group | Control | | Cobalt | |
|---|---|---|---|---|
| | Weight | Number | Weight | Number |
| Prelambing 3.11.77 (shorn) | 30.30 | 100 | 30.44 | 100 |
| 1st Weaning 23.3.78 | 36.29 | 88 | 36.18 | 85 |
| 2nd Weaning 7.2.79 (shorn) | 29.87 | 57 | 29.59 | 60 |

## TABLE 2

PORT STEPHENS Co(E)PS 77/79

Mean Body Weight Changes in Kgs from 3.11.77 to 23.3.78

| | | | 2nd Lambing | | | | |
|---|---|---|---|---|---|---|---|
| | | | Barren | | Lambed | | |
| Treatment | | | Mean | Number | Mean | Number | Mean of all |
| Control | 1st Lambing | Barren | 7.65 | 13 | 9.78 | 9 | |
| | | Lambed | 4.13 | 20 | 2.77 | 13 | |
| | | Mean | 5.52 | 33 | 5.64 | 22 | |
| Cobalt | | Barren | 8.00 | 10 | 9.83 | 9 | |
| | | Lambed | 1.68 | 17 | 4.70 | 20 | |
| | | Mean | 4.02 | 27 | 6.29 | 29 | |
| Margin | | Barren | | | | | 8.51 |
| | | Lambed | | | | | 3.64 |

## TABLE 3

PORT STEPHENS Co(E)PS 77/79

Mean Change in Body Weight in Kgs from 3.11.77 to 23.3.78

| | C | Co | Mean | SED Mean | CV% |
|---|---|---|---|---|---|
| a) of those ewes known to have lambed (at first lambing) | +3.88 | +3.41 | +3.64 | 4.38 | 120.2 |
| b) of all ewes recorded | +6.11 | +5.49 | +5.81 | no analysis of variance performed | |

## TABLE 4

PORT STEPHENS Co(E)PS 77/79

Mean Whole Fleece Weights in Kgs at 7.2.79

| | C | Co | SED Mean | CV% |
|---|---|---|---|---|
| a) Ewes Barren at Second Lambing | 3.87 | 3.66 | 0.699 | 18.5 |
| b) Ewes which lambed at Second Lambing | 3.66 | 3.51 | 0.815 | 22.8 |

## TABLE 5

PORT STEPHENS Co(E)PS 77/79

| | | Group C | Group Co |
|---|---|---|---|
| Number at Start 3.11.77 | | 100 | 100 |
| a) Number at weaning 2.3.78 | which had lambed | 47 | 49 |
| | had not lambed | 41 | 36 |
| | were missing | 12 | 15 |

Chi square = 0.699 p = 30% on 2df

| | | Group C | Group Co |
|---|---|---|---|
| b) Number at weaning 7.2.79 | which had lambed | 24 | 29 |
| | had not lambed | 33 | 28 |
| | were missing | 43 | 43 |

Chi square = 0.882 p = 35% on 2df

c) Status at 2.3.78 of 86 ewes

| | | Group C | Group Co |
|---|---|---|---|
| Missing at 2nd lambing | lambed | 14 | 12 |
| | barren | 19 | 17 |
| | missing | 10 | 14 |

Chi square = 0.432 p = 19% on 2df

d) Omitting those ewes missing in a) and b) above Chi square tests give the following picture:-

number at weaning 2.3.78 Chi square = 0.314 p = 42% on 1df

number at weaning 7.2.79 Chi square = 0.882 p = 65% on 1df

## TABLE 6

PORT STEPHENS Co(E)PS 77/79

Ewes which lambed:-

| | Neither year | Both years | 1st yr but not 2nd | 2nd yr but not 1st | Total |
|---|---|---|---|---|---|
| Control A0 | 13 | 10 | 20 | 9 | 55 |
| Cobalt A1 | 10 | 20 | 17 | 9 | 56 |
| Total | 23 | 30 | 37 | 18 | 111 |

Chi square = 2.109 p = 45% on 3df

A report into the investigation of the effects of Cobalt and Selenium supplementation in breeding ewes at Salvador during the season 1977/78.

Trial Codes: Co/S(E)S/1 77/78
Co/S(E)S/2 77/78

Summary

Two similar trials were superimposed on the Grasslands Trials Unit year-round grazing system 2-pasture scheme at Salvador during 1977 and 1978. In each trial, one of which involved the "Treatment" flock and the other the "Control" flock, ewes were divided into two age groups, Adult (A) and Young (Y), each of which was divided into four treatments so that there were 24 ewes in each group.

One group (Co) was given supplementary cobalt in the form of a Cobalt bullet (Permaco - S, T.V.L.) whilst groups S1 and S2 were given subcutaneous potassium selenate (Dystocel, Intervet) prior to the start of mating with group S2 receiving an additional treatment at the end of the mating period. Group C was an untreated control.

It was found that the selenium and cobalt treatments had no effect in terms of the measured parameters. It was found however, that the adult ewes performed better than the younger ewes in terms of lambing percentage, birth weight of lambs (4.2 kg) and lamb growth rate (230 gm/day). The "adult" group of ewes lost a significantly higher percentage of their pre-lambing body weight during early lactation.

Although the mean packed cell volume of 126 samples taken prior to mating was slightly above the normal range. It was thought this was due to stress and dehydration. Otherwise the haemoglobin concentrations and red blood cell count fell in the normal range. The copper concentration at the onset of lambing was on the borderline of deficiency (0.6 µg/ml) but, in an atmosphere of unknown intake levels and normal blood levels, interpretation of this value is treated guardedly.

Introduction

Mineral and trace element deficiencies in Falkland Island pasture and soil have been suspected for many years but relatively little factual information is available (Gibbs 1946, King et al 1969, Davies et al 1971). Throughout the years, a variety of on-farm trials have been performed using copper, cobalt, selenium, vitamin D and anthelmintics with inconclusive results in many instances. However, cobalt supplementation has been given to sheep at some farms with spectacular results in decreasing hogg deaths and improving body condition. (File records of trials at Fox Bay West and Port Stephens and reports 4.2(2) & 4.2(3).).

On some farms, cobalt supplementation of the diet (usually by administration of a cobalt bullet) has failed to show any benefit and the practice has been discontinued. However, this decision was usually made without any controlled trials having been carried out. Whereas, on other farms, although the gross wool clip and the annual death rate of young sheep seemed little affected by cobalt supplementation, the weaned lambs have been treated with cobalt bullets because the stockmen believe the hoggs have more vitality and "gather better" when being collected and driven at shearing time.

It is apparent that there is a variation in the sheep response to cobalt supplementation between farms and between areas of the Falkland Islands.

Although detailed information concerning trace element levels in Falkland Island soils and pastures is now being accumulated, at the time of the initiation of this investigation at Salvador no such information was available. Thus it was decided to investigate the effects on breeding ewes of the administration of cobalt and selenium, both of which elements may well be at a level below that which is generally accepted to be "normal" for sustaining sheep production.

It has been found (Mudd et al 1973) that, in some areas the administration of selenium to ewes not only influenced the number of lambs born per ewe but also there was a variation in the sex ratio of the lambs born. It was hoped that, if such a response was recorded in the Falklands, it could be related, at a later date, to the selenium levels in analysed pasture and soil.

The opportunity arose whereby this investigation could be superimposed on the detailed recording involved in the Grasslands Trials Unit Year-round Grazing System (YRGS) 2-pasture system trial taking place at Salvador. Due to the nature of the latter investigation, it was necessary to run two simultaneous duplicate investigations into the effects of Cobalt and Selenium supplementation which were measured in terms of lambing percentage, lamb birth weight, lamb growth rate, lamb sex ratio, lamb survival over the first $1\frac{1}{2}$ to 2 months of life, and the change in the ewes' mean body weights over the lactational period.

Blood samples were taken to determine the values of some haematological parameters at different times in the year.

## Materials and Methods

The subjects involved in this investigation were the ewes involved in the "Treatment" and the "Control" flocks of the YRGS 2 pasture trial at Ronda, Salvador. The trial involving the "Treatment" ewes thus became Co/S(E)S/2 77/78 and that with the "Control" flock Co/S(E)S/1 77/78. Thereafter, the members of both flocks which were used in the Cobalt/Selenium investigations were treated in an identical manner.

The ewes in each flock were divided into one of two categories according to their age. The "Adult" age group (A) consisted of 6, 5, 4 and 3-crop ewes, whilst the "Young" age group (Y) consisted of 2nd crop and maiden ewes.

The members of both age groups in each trial were subjected to a randomised selection process to allot them to one of four groups each containing 24 ewes, as shown below:-

Group S1 - ewes given selenium supplementation by a subcutaneous injection of Dystocel (Intervet) at the rate of approximately 3 mgm potassium selenate per 45kg body weight. The treatment was given at the outset of the trial on 8.6.77, 13 days before the commencement of mating.

Group S2 - ewes injected with potassium selenate (as above) 13 days before the commencement of mating and at the end of the mating period on 10.8.77 (i.e. at a maximum of 50 days since conception).

Group Co - ewes each given cobalt supplementation in the form of a cobalt bullet (Permaco - S, T.V.L.) 13 days prior to the commencement of mating.

Group C - ewes given no treatment - i.e. a control group.

A summary of the groupings is as follows:-

| Co/S(E)S/2 77/78 (YRGS Treatment flock) | | | | | | | | Co/S(E)S/1 77/78 (YRGS Control flock) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult (A) ewes | | | | Young (Y) ewes | | | | Adult (A) ewes | | | | Young (Y) ewes | | | |
| S1 | S2 | Co | C | S1 | S2 | Co | C | S1 | S2 | Co | C | S1 | S2 | Co | C |
| 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

The chronology of data recording was as follows:-

8.6.77 Initial selection of all groups and treatment of S1, S2, Co groups. 126 blood samples taken for haemoglobin and packed cell volume estimations.

21.6.77 Rams put in with both ewe flocks.

10.8.77 Rams removed from both flocks. S2 group given second treatment. 9 blood samples taken.

15.11.77 Ewes gathered and weighed. Then put in lambing paddocks where lamb recording took place involving details of lambs' birth weight, sex and ear number. 63 blood samples taken on 15.11.77.

9.1.78 Ewes and lambs gathered and weighed.

## Results

Table 1 shows the lambing percentage which has been calculated using an angular transformation on

$$\frac{\text{the number of ewes recorded as having lambed}}{\text{the number of ewes put to the ram on 21.6.77}} \times 100$$

The cobalt and selenium treatments had no apparent effect on lambing percentage but there was a significant difference between the ages ($p < 0.01$) with a significant $p < 0.01$ trial/age interaction with the ewes in the YRGS "Treatment" flock performing best.

With regard to the sex ratio of the lambs born, it was apparent that there was no difference between the treatments nor between "ages" nor trials (See Table 2). This is somewhat in conflict with the report of Mudd and Mackie (Vet Rec 1973) in which they found that different selenium supplementation rates had an apparent effect on the sex ratio. However the regime used in the two trials above was slightly different from that used by Mudd and Mackie and we do not yet have the value of the knowledge of the basic intake levels of dietary selenium.

It may be that the supplementary selenium was "swamped" by the normal dietary intake and therefore was superfluous to their requirements.

The birth weight of the lambs is shown in Table 3. The only significant difference between the age groups in both trials ($p < 0.01$) where the lambs from "adult" ewes weighed 4.2kg in both trials but only 3.9kg and 3.7kg in trials S/2 and S/1 respectively from the "young" ewes.

Mean lamb growth in kg per day from birth until 9.1.78 is shown in Table 4. The only significant difference was that between the age groupings ($p < 0.01$) where the lambs from adult ewes grow at a mean of 0.23 kg/day and those from young ewes at at mean of 0.22 kg/day.

Table 5 indicates the percentage lamb death rate from birth until 9.1.78 as calculated from

$$\frac{\text{lambing percentage - lambmarking percentage}}{\text{lambing percentage}} \times 100$$

(It should be noted that absence at the lambmarking recording was taken as indication that the lamb had died). An angular transformation was used in calculation of both the lambing percentage and the lambmarking percentage.

There was no significant difference between any of the trials, groups or ages. It is however, interesting to note that all the figures are high (with some being very high) indicating a sizeable loss of lambs between birth and marking when the farms normally make their first count of lambs. When considered with the low growth rate of the surviving lambs (see Table 4) at 0.22 kg/day there is an indication that lactational failure may be the factor affecting these two parameters of production.

The effect of lamb production on the ewes taken as in the flock situation is shown in Table 6 where the percentage weight change of ewes between 15.11.77 (the onset of lambing) and 9.1.78 is given having been calculated by

$$\frac{\text{weight on 15.11.77 - weight on 9.1.78}}{\text{weight on 15.11.77}} \times 100$$

There was a significant difference ($p < 0.01$) in the percentage weight loss between the "adult" and the "young" age groups where the older sheep lost more weight (as a percentage of the original weight) than did the younger sheep. It is apparent that this was not due to the treatments involved but may be a function of several other factors such as the greater body weight of the older ewes at the onset of lambing, the greater birth weight of their lambs (see Table 3) and the greater growth rate of their lambs (see Table 4). Thus it would appear that the older ewes are able to lose a greater percentage of their pre-lambing body weight than are younger ewes.

It should be noted that, in these calculations, no account has been made for those ewes which did not give birth to a lamb.

The results of the analyses of the blood samples is shown in Table 7 and Figure 1. Unfortunately it proved possible to sample only 9 sheep at the end of the mating period and so there is considerable disparity in the sample sizes of the three occasions. The haemoglobin concentration fell in the normal range (8 - 14 gm/ 100 ml) at all times but showed a gradual diminution during the period. The packed cell volume was slightly above normal on the first sampling date with some very high values (up to 55%). Thereafter the mean level fell to lie within the normal range (22 - 40%). The high mean value on the first occasion may have been due to a dehydration effect caused by the fact that the sheep were driven into the settlement to be weighed and treated for the two cobalt/selenium trials and held in restricted and strange surroundings over-night. The absence of readily available water in settlement paddocks and in shearing sheds is characteristic of Falkland Island farms.

On the second and third sampling dates, the samples were collected at the pens at Ronda and thus involved less stress to the animals.

The 13 samples on which copper estimations were performed gave a mean value of 0.6 µg/ml which may be regarded as being on the borderline of a deficiency (Underwood 1977 p. 65). There are, however, several factors which should be considered as contributing to this apparently low level. It is known that blood copper levels decrease during pregnancy and these samples were taken at the onset of lambing. The information available from the soil and pasture sampling survey at present being undertaken indicates that Cortaderia pilosa (Whitegrass) has a copper concentration (in October) of approximately 2.2ppm. Nevertheless, the Zinc and Iron levels are also low and, as yet, the Molybdenum levels are unknown. When more information concerning these several contradictory factors is available a more meaningful interpretation of blood copper levels will be possible.

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## TABLE 1

### Lambing Percentage

Calculated as $\frac{\text{No. ewes having lambed}}{\text{No. ewes put to ram}} \times 100$

| | Group | Adult ewes | Young ewes |
|---|---|---|---|
| Co/S(E)S/2 | S1 | 95.83 | 95.83 |
| | S2 | 79.17 | 91.67 |
| | Co | 79.17 | 91.67 |
| | C | 100.00 | 79.17 |
| Co/S(E)S/1 | S1 | 87.50 | 66.67 |
| | S2 | 100.00 | 83.33 |
| | Co | 100.00 | 79.17 |
| | C | 100.00 | 79.17 |

## TABLE 2

### Sex ratio of lambs born presented as percentage males

(Angular transformation was used in the analysis)

| | Group | Adult ewes | Young ewes |
|---|---|---|---|
| Co/S(E)S/2 | S1 | 57.14 | 40.91 |
| | S2 | 58.82 | 54.55 |
| | Co | 68.42 | 45.00 |
| | C | 54.55 | 38.99 |
| Co/S(E)S/1 | S1 | 36.84 | 60.00 |
| | S2 | 58.33 | 35.00 |
| | Co | 45.45 | 52.63 |
| | C | 54.17 | 47.37 |

## TABLE 3

**Mean Lamb birth weights in kgs.**

| | AGE GROUP | Adult ewes NUMBER | Adult ewes MEAN | Young ewes NUMBER | Young ewes MEAN |
|---|---|---|---|---|---|
| Co/S(E)S/2 77/78 | S1 | 21 | 4.16 | 20 | 3.78 |
| | S2 | 17 | 4.20 | 22 | 3.87 |
| | Co | 19 | 4.32 | 19 | 3.81 |
| | C | 22 | 4.13 | 18 | 3.94 |
| | MEAN: | 79 | 4.20 | 79 | 3.85 |
| Co/S(E)S/1 77/78 | S1 | 17 | 4.15 | 15 | 3.81 |
| | S2 | 24 | 4.27 | 20 | 3.75 |
| | Co | 21 | 4.26 | 19 | 3.81 |
| | C | 24 | 4.12 | 19 | 3.51 |
| | MEAN | 86 | 4.20 | 73 | 3.71 |

## TABLE 4

**Mean Growth Rate in kg/day from birth until 9.1.78**

| | AGE GROUP | Adult ewes RATE | Adult ewes NUMBER | Young ewes RATE | Young ewes NUMBER |
|---|---|---|---|---|---|
| Co/S(E)S/2 77/78 | S1 | 0.22 | 18 | 0.21 | 16 |
| | S2 | 0.23 | 10 | 0.22 | 18 |
| | Co | 0.23 | 15 | 0.22 | 12 |
| | C | 0.22 | 17 | 0.22 | 15 |
| | SUM | 0.23 | 60 | 0.22 | 61 |
| Co/S(E)S/1 77/78 | S1 | 0.22 | 15 | 0.22 | 12 |
| | S2 | 0.24 | 19 | 0.23 | 12 |
| | Co | 0.23 | 16 | 0.21 | 15 |
| | C | 0.22 | 22 | 0.21 | 14 |
| | SUM | 0.23 | 72 | 0.22 | 53 |

TABLE 5

Percentage lamb death rate from birth to 9.1.78

Calculated from $\frac{\text{Lambing percentage - Lambmarking percentage}}{\text{Lambing percentage}}$ x 100

| | GROUP | ADULT EWES | YOUNG EWES |
|---|---|---|---|
| Co/S(E)S/2 | S1 | 21.74 | 21.74 |
| | S2 | 47.37 | 18.19 |
| | Co | 21.06 | 40.91 |
| | C | 29.17 | 15.79 |
| Co/S(E)S/1 | S1 | 23.81 | 25.00 |
| | S2 | 12.50 | 40.00 |
| | Co | 25.00 | 15.79 |
| | C | 08.33 | 21.06 |

TABLE 6

Percentage weight change of ewes between 15.11.77 and 9.1.78

| | GROUP | ADULT EWES | NUMBER | YOUNG EWES | NUMBER |
|---|---|---|---|---|---|
| Co/S(E)S/2 | S1 | 20.81 | 21 | 16.11 | 20 |
| | S2 | 18.87 | 16 | 16.77 | 22 |
| | Co | 18.80 | 19 | 16.59 | 20 |
| | C | 18.98 | 20 | 16.56 | 18 |
| | SUM: | 19.42 | 76 | 16.51 | 80 |
| Co/S(E)S/1 | S1 | 19.27 | 19 | 18.28 | 14 |
| | S2 | 18.57 | 21 | 18.13 | 19 |
| | Co | 21.25 | 18 | 19.49 | 17 |
| | C | 21.37 | 24 | 17.70 | 18 |
| | SUM: | 20.14 | 82 | 18.39 | 68 |

TABLE 7

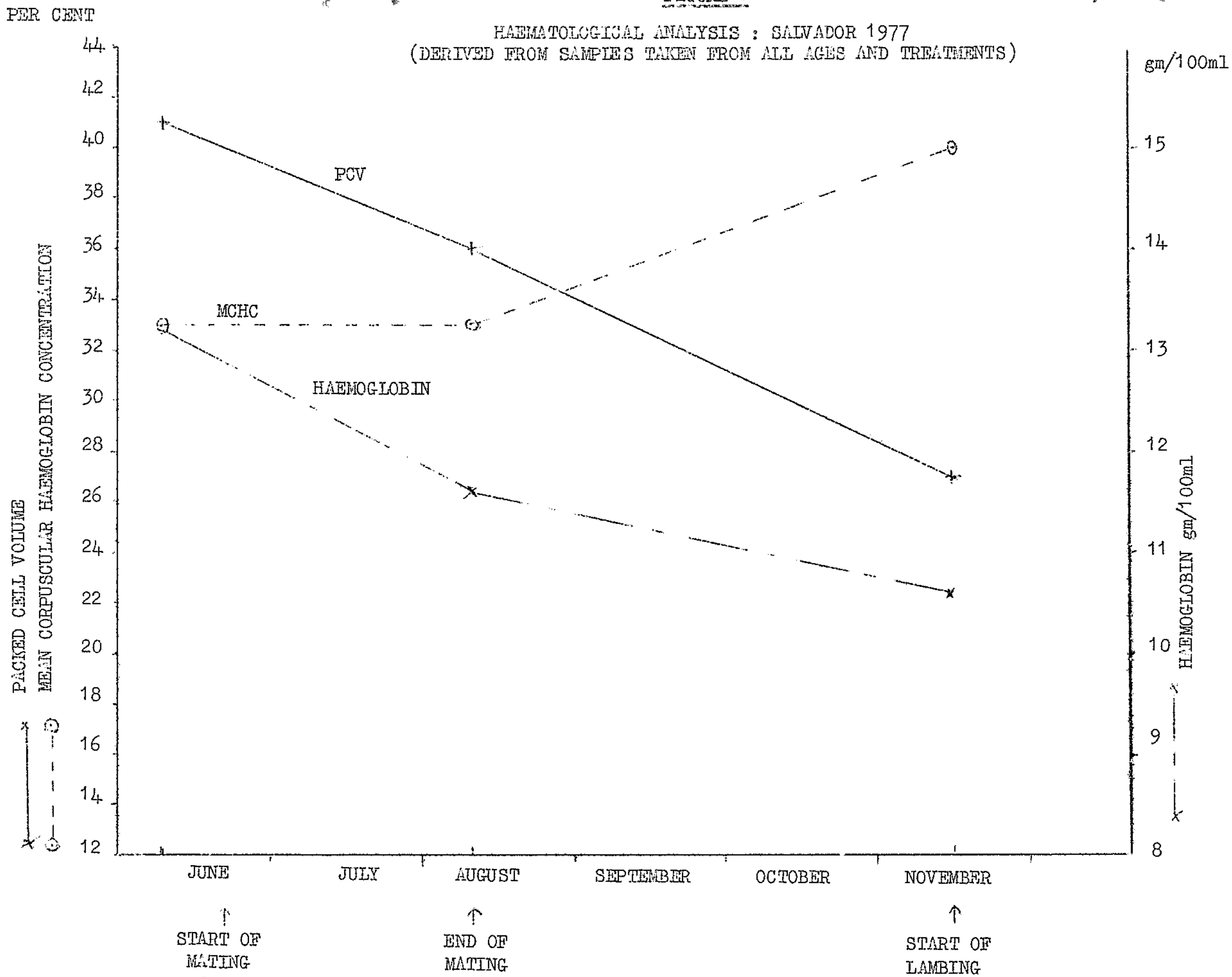
Haematological Analysis : Salvador 1977

(Derived from samples taken from all ages and treatments)

| DATE | UNITS | HAEMOGLOBIN gm/100 ml | PACKED CELL VOLUME PER CENT | RED BLOOD CORPUSCLES $x\ 10^6/mm^3$ | MEAN CORPUSCULAR VOLUME $u^3$ | MEAN CORPUSCULAR HAEMOGLOBIN CONCENTRATION PER CENT | COPPER µg/ml |
|---|---|---|---|---|---|---|---|
| 8/6/77 | Sample Number | 126 | 126 | | | 126 | |
| (prior to mating) | Mean ± 1SD | 13.2 ± 1.1 | 41 ± 4 | | | 33 ± 2 | |
| | highest | 16.2 | 55 | | | 41 | |
| | lowest | 10.2 | 33 | | | 29 | |
| 10/8/77 | Sample Number | 9 | 9 | 8 | 8 | 9 | |
| (end of mating) | Mean ± 1SD | 11.6 ± 1.2 | 36 ± 4 | 9.4 ± 0.8 | 39.0 ± 0.4 | 33 ± 2 | |
| | highest | 14.0 | 42 | 10.4 | 47.6 | 38 | |
| | lowest | 9.8 | 29 | 8.0 | 36.0 | 31 | |
| 15/11/77 | Sample Number | 63 | 63 | | | 63 | 13 |
| (start of lambing) | Mean ± 1SD | 10.6 ± 1.0 | 27 ± 3 | | | 40 ± 2 | 0.6 ± 0.2 |
| | highest | 13.4 | 31 | | | 48 | 1.0 |
| | lowest | 8.2 | 20 | | | 36 | 0.3 |

FIGURE 1

HAEMATOLOGICAL ANALYSIS : SALVADOR 1977
(DERIVED FROM SAMPLES TAKEN FROM ALL AGES AND TREATMENTS)



## PRELIMINARY REPORT ON ANALYSIS OF GRASS SAMPLES TAKEN AT FITZROY (OCTOBER 1978) AND PORT STEPHENS (OCTOBER 1977)

Analysis so far has been for the following elements - Iron, Copper, Zinc, Manganese, Magnesium, Phosphorus, Calcium, Sodium and Potassium.

In the absence of detailed knowledge of what grasses and shrubs sheep eat, sampling has been based on supposition with emphasis on Whitegrass. Other grasses have been sampled but the numbers of samples are, as yet, few and the figures available should be treated with caution. For instance, two samples of smooth stalked meadow grass differed widely in Phosphorus, Calcium, Manganese and Copper.

Taking Whitegrass as an example, comparison may be made between Fitzroy and Port Stephens. Levels of the elements required to maintain normal health are given in brackets (the units are in parts per million).

| | FITZROY | PORT STEPHENS |
|---|---|---|
| Iron (30) | all samples borderline or above but the green matter of Whitegrass is very much lower in Iron than the dead matter. | 4 samples (out of 6) were below 17 ppm. The very low samples came from Gibraltar, Poncho Valley and Brown's Hill. |
| Copper (5) | all samples very low with a mean of 2. | all samples very low with a mean of 1.5. |
| Zinc (50) | all samples very low with little variation around the mean of 6.4. | as at Fitzroy |
| Manganese (40) | variation from 8 to 118 with a mean of 41. The lower values were found on the older rocks e.g. Port Stanley quartzites. | all samples were below 40 with a mean of 13 ppm which is lower than at Fitzroy. Lowest value 2.1. |
| Magnesium (1000 for lactating ewe) | all samples low mean 430 | mean 530 |
| Phosphorus (1700) | all samples very low mean 571 | mean 717 |
| Calcium (1000-2000) | only two samples were about 1000. Mean 496 | samples very low mean 331 |
| Sodium | mean 509 | mean 708 |
| Potassium | mean 2000 | mean 4000 |

Green Whitegrass contains very much more Potassium, Sodium, Phosphorus, Magnesium and Manganese than dead Whitegrass but it has less Iron and about the same Copper, Zinc and Calcium.

The main difference between the concentration of elements in Whitegrass at Fitzroy and Port Stephens is in Iron and Manganese where Port Stephens has less than Fitzroy but the reverse is true for Potassium.

The Land Systems Analysis report gives values for the concentration of some elements in herbage samples which were "grab" samples attempting to represent sheeps' eating behaviour. The generally low Copper levels agree with the above results but both are much lower than those given in the T. H. Davies report.

Zinc levels in the Land Systems Analysis report are slightly higher than the new findings but the Manganese levels are very much higher and represent adequate quantities of a mineral which has now been shown to be deficient in Whitegrass samples grown on the older rocks of the Devono-Carboniferous group. This discrepancy may be due to the possible inclusion in the Land Systems Analysis samples of Manganese rich diddle dee or Christmas Bush. Wherever the site, Whitegrass stands out in its low Manganese levels.

Other plant species sampled at Fitzroy provide the following information:-

| | |
|---|---|
| Copper | Copper is deficient in all grass species but adequate in diddle dee and Christmas Bush. The highest levels are in pigvine. |
| Iron | All grasses and shrubs, except Whitegrass, have adequate levels, Yorkshire fog and diddle dee being the highest. |
| Zinc | All grasses except smooth stalked meadow grass are very low as is diddle dee but Christmas Bush is the highest at borderline levels of 40 ppm. |
| Manganese | All grasses and shrubs have adequate levels except Whitegrass (see above). Diddle dee has highest levels. |
| Magnesium | Highest in Christmas Bush, pigvine and smooth stalked meadow grass. Lowest in sheeps' fachine and cinnamon grass. |
| Phosphorus | Only pigvine and smooth stalked meadow grass have adequate levels and Whitegrass and cinnamon grass have imbalanced ratio of Phosphorus to Calcium. |
| Calcium | Low in Whitegrass, Yorkshire fog and cinnamon grass. |
| Sodium, Potassium | Much higher in Christmas Bush than other plants and lowest in diddle dee.<br><br>Grasses, except Yorkshire fog, have about four times as much Potassium as Sodium. Shrubs have a 1:1 ratio. |

<u>Summary</u>

The predominantly low levels of Copper indicate that, unless they are affected by the Molybdenum, Sulphate, Iron complex, the sheep are supplementing their intake from grasses by consuming plants such as pigvine, Christmas Bush and diddle dee.

Most grass samples are deficient in Zinc.

Whitegrass growing on "old" rocks is deficient in Manganese.

18th February 1979

# Anthelmintic Treatment at Salvador 1978

Summary An investigation into the effects of administration of Thibenzole (Merke, Sharp, Dohme) to lambs at weaning and hoggs in midwinter compared to an untreated control at Salvador showed that, under this regime, there was no benefit in terms of improved survival chances, body weight changes or wool production as a result of the treatment.

Introduction The Hogg flocks at Salvador have a history of heavy losses of up to 20% from weaning to shearing and poor performance with indications of heavy helminth burdens.

In November 1977 it was possible to take some faeces samples from 5 ewe hoggs which had only recently left their normal pastures to be brought in to the shearing shed. The worm egg counts from these sheep varied from 4650 eggs per gram faeces to 108,000 epg.

Due to various constraints it was not possible to set up a full statistically valid trial to assess the effects of administration of an anthelmintic. Nevertheless, it was decided to mount a small trial which would obviously be of benefit to the sheep and which may give some signs of positive benefit in terms of body weight gain and fleece weights. It was also planned to investigate the problem further in the time interval before the results of this trial became available.

Method Three groups (C, $T_1$, $T_2$,) of 60 ewe hoggs were selected as randomly as possible from the ewe hogg flock and marked by means of an ear tag.

Out of each group of 60 hoggs, 30 were weighed and of these 30 10 were individually marked by means of a number on the ear tag.

The C group was given no treatment (controls) whilst the $T_1$ and $T_2$ group were both given the correct dose of Thibenzole (Merke, Sharp and Dohme Ltd.).

All these ewe hoggs were then returned to the flock and run under normal farm conditions on the hogg ground (i.e. held hoggs the previous year).

In May 1978, the hogg flock was moved into a winter camp (Churchill). The ewe hoggs with numbered ear tags in each group were weighed along with a random sample of 20 others from each group.

The $T_2$ group was also given a second treatment with Thibenzole.

At shearing in December 1978, the shorn body and whole fleece weights of all the sheep present were recorded but, apart from those sheep with numbered tags, only a random 20 from each group was used in the analysis.

Because of an error in recording, it proved impossible to calculate the loss rates of the 3 groups

Results

| | CONTROL (C) | $T_1$ | $T_2$ | |
|---|---|---|---|---|
| BODY WEIGHT Nov 77 | 19.45 ± 1.57 | 20.15 ± 2.99 | 19.10 ± 1.81 | |
| BODY WEIGHT May 78 | 30.17 ± 3.10 | 31.85 ± 4.10 | 28.06 ± 3.33 | |
| SHORN BODY WEIGHT Dec 78 | 30.19 ± 2.37 | 33.00 ± 1.68 | 31.25 ± 2.75 | GROUPS WITH NUMBERED EAR TAGS |
| No. present Nov | 10 | 10 | 10 | |
| No. present May | 9 | 10 | 9 | |
| No. present Dec | 8 | 7 | 8 | |
| WHOLE FLEECE WEIGHT | 2.83 ± 0.39 | 3.84 ± 0.56 | 3.11 ± 0.34 | |
| WEIGHT GAIN Nov-Dec | 10.67 ± 2.44 | 11.50 ± 2.08 | 12.00 ± 2.39 | |
| BODY WEIGHT Nov 77 | 20.15 ± 2.18 | 19.55 ± 2.32 | 20.38 ± 2.28 | |
| BODY WEIGHT May 78 | 31.78 ± 3.15 | 31.35 ± 2.89 | 31.05 ± 2.66 | RANDOM 20 FROM EACH GROUP |
| BODY WEIGHT Dec 78 | 31.85 ± 2.62 | 30.25 ± 3.23 | 31.30 ± 2.90 | |
| FLEECE WEIGHT | 3.33 ± 0.34 | 3.33 ± 0.56 | 3.24 ± 0.60 | |
| MEAN WEIGHT GAIN Nov-Dec | 11.70 | 10.70 | 10.92 | |

All body and fleece weights are in Kg ± 1 standar deviation
Mean fleece weight of all sheep pooled = 3.3kg

Mean of all body weights: Nov 77 19.87kg (90 animals)
May 78 31.00kg (88 animals)
Dec 78 31.21kg (83 animals)

Discussion The practice of grazing the same class of sheep on the same camps year after year is likely to lead to a build up of helminth larvae on the pasture especially when young sheep are involved. The overall stocking rates of sheep are misleading because the stock tend to congregate in certain areas where the density may be up to 2-5 per acre whereas the overall rate may be 3-5 acres per sheep.

The helminths of primary importance are Ostertagia species, Trichostrongylus species and Nematodirus filicolis. Evidence that the latter species is a serious problem is lacking but its presence presents an obvious potential hazard.

The figures show that there is no valid benefit gained by the treatment administered in the way in which it was in this trial. This is probably because the treated sheep were so outnumbered by the untreated ones in the flock that they rapidly became reinfested by larvae picked up from contaminated herbage.

The system of management at Salvador is such that 2 opportunities for anthelmintic treatment are provided - when the weaned lambs are put in to their first hogg camp and when they are moved in to their winter/spring quarters.

With the large numbers of sheep and acres involved in Falkland Islands management systems few controlled helminth investigations are possible. Treatment must be on a whole-flock basis and the "control" must be previous years' performance.

R. S. Whitley
December 1978

Appendix

## SECTION 5: LABORATORY STUDIES

Some of the Principal Techniques to be Used in the Laboratory:

### Disease Control 5.1

| | |
|---|---|
| Serology: | Complement Fixation (Microtechnique)<br>Haemagglutination<br>Rose Bengal Plate Test<br>Agglutination Test for Brucella |
| Bacteriology: | Sensitivity Testing<br>Standard Techniques used for the isolation and identification of bacteria |
| Parasitology: | McMaster counts for worm egg levels<br>Pasture larval counts<br>Post Mortem techniques for total worm counts of intestino parasites<br>Pepsinogen estimations in serum |
| Haematology: | Haematocrit (P.C.V.)<br>Haemoglobin<br>Cell counts (white and red) |

### Feed Evaluation 5.2

"In Vitro" digestibilities
Van Soest acid detergent fibre technique
Nitrogen determination (Kjeldahl)

### Microbiology 5.3

Techniques for the isolation, identification and propagation of nitrogen fixing bacteria
Innoculation of seeds with nitrogen fixing bacteria

### Soils Studies 5.4

pH determinations
Lime requirement of soils

| | |
|---|---|
| Determination of extractable "P" | (spectrophotometric) |
| Determination of extractable "K" | (flamephotometric) |
| Determination of "N" | (Kjeldahl) |
| Determination of "$NH_4$" | (Kjeldahl) |