R/AGR/GRA/1#8

GRASSLANDS TRIALS UNIT

FALKLAND ISLANDS

The purpose of this report is to provide an easily read summary of the GTU' activities during the period 1975 to 1980. More detailed information on some points may be available on direct application to the Grasslands Trials Unit.

Over a year has elapsed since the report was written and it may be obvious to some that current findings and ideas have superceded those presented. It is intended to update this report from time to time.

I hope you will find the booklet interesting and instructive.

We will be pleased to receive any comments be they adverse or complementary.

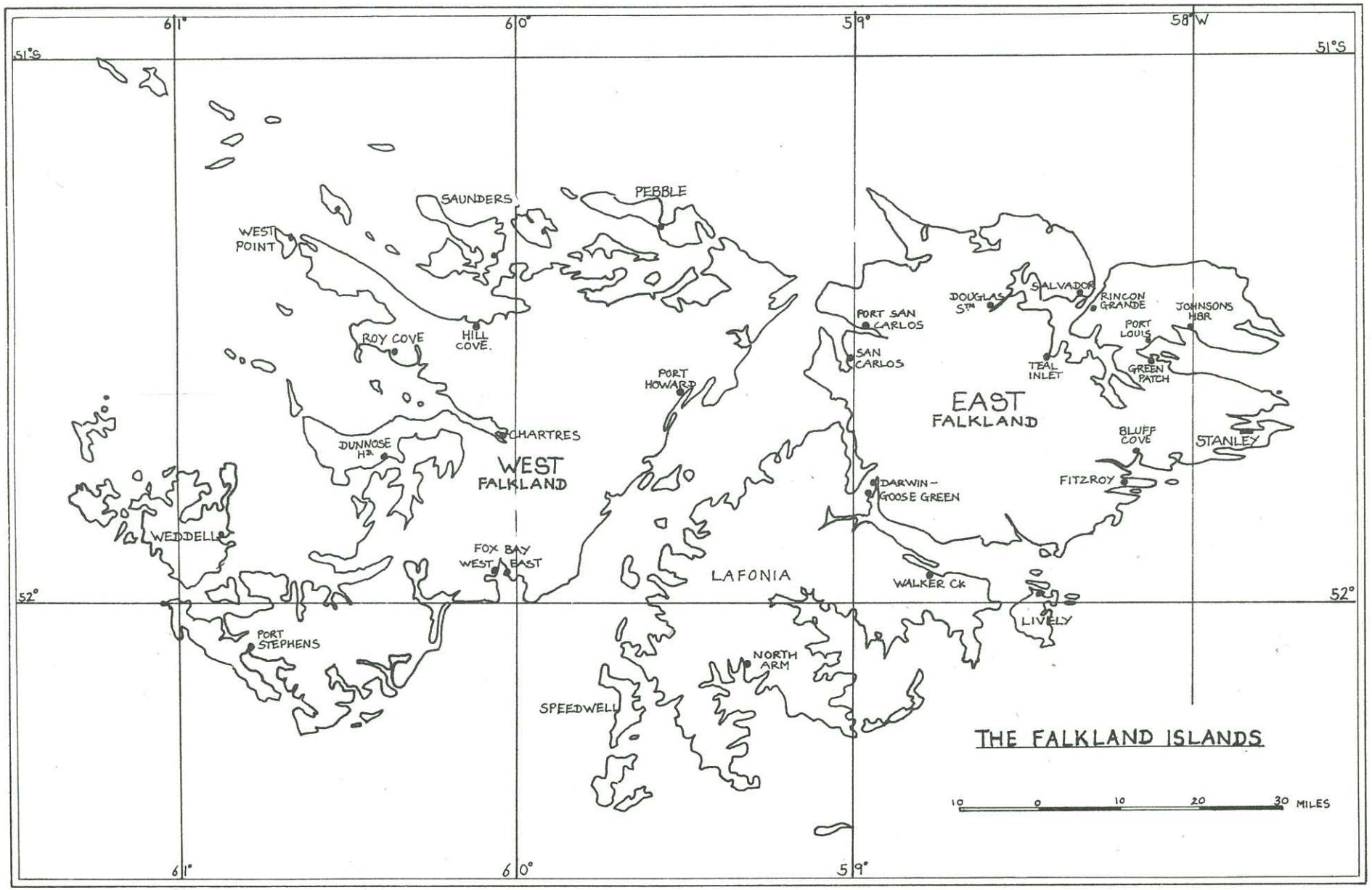
John A. Ferguson
Team Leader
Grasslands Trials Unit
Stanley.

With the Compliments

of the

Grasslands Trials Unit

Stanley,
Falkland Islands.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FOX BAY WEST
FOX BAY EAST
LAFONIA
PORT STEPHENS
NORTH ARM
SPEEDWELL
PORT SAN CARLOS
SAN CARLOS
DOUGLAS Stn
SALVADOR
RINCON GRANDE
JOHNSONS HBR
PORT LOUIS
TEAL INLET
GREEN PATCH
EAST FALKLAND
BLUFF COVE
STANLEY
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INTRODUCTION TO THE FALKLAND ISLANDS

The Falkland Islands lie 480 miles (770km) North-East of Cape Horn, between Longitudes 61° and 57° West and Latitudes 51° and 53° South. There are two large islands, East Falkland and West Falkland and many smaller ones giving a total land area of some 4,700 square miles (a little less than 12,000 sq km). The islands are treeless grasslands and moorland and rocky hills rising to 2,312ft (about 705m.), except in the South-West of East Falkland where the terrain is more undulating. There are approximately 1,800 inhabitants, half of whom live in the capital of Port Stanley while the remainder live mainly in sheep station settlements situated in sheltered inlets around the coast. Agriculture is the principal industry with approximately 580,000 sheep being shorn annually.

The Falkland Islands is a British Colony.

THE GRASSLANDS TRIALS UNIT OF THE FALKLAND ISLANDS

Introduction

The Grasslands Trials Unit (GTU) of the Falkland Islands was set up in 1975 to carry out investigational work on the vegetation and livestock of the Falkland Islands with a view to developing improved sheep farming systems. Many reports have been produced on the Falkland Islands and an even greater number of recommendations made to increase agricultural output, but the effect of such advice was limited because little was known of the biology of the islands' agriculture and the constraints on production imposed by the environment. The GTU investigates many aspects of Falkland Island Agriculture in order that subsequent changes in land or sheep management will be based on scientific information.

It is intended that this short report, and subsequent reports, will provide a summary of the available information for those interested in Falkland Island Agriculture. Much of the data presented are from few measurements and must be thought of as provisional or preliminary. Most of the data were collected between 1975 and 1980 by the GTU. Some of the more important questions yet to be answered before any major agricultural changes may be recommended are listed at the end of this report.

A list of technical terms used is appended.

Climate

The only comprehensive meteorological data available are from Port Stanley (Latitude 51°43'S, Longitude 57°52'W) and some of the information is summarised in Figure 1. Some less detailed information is available from a few settlement records.

The growing season, as defined by the 10cm soil temperature being greater than 5.5°C, is from mid-October to late April at Port Stanley. The date on which this temperature is reached at Stanley, Darwin, Port Howard and West Point is shown in graphical form on Figure 2. The 10cm soil temperature at Port Stanley is unlikely to exceed 10.5°C during even the warmest months (December to February). Air temperature rarely rises above 20°C or falls below -6°C and ground frosts may occur in any month. Wind speed averages 17 knots (8.5m/s) with approximately 50% of the winds blowing from between the South-West and North-West. Snow seldom lies more than three or four days. Rainfall is far from uniform throughout the islands (ranging from about 300mm to more than 650mm annually) and occurs in every month. At Port Stanley, where rainfall is high, a soil water deficit may occur from October to March.

The constant winds and frequent occurrence of frosts make arable farming difficult. It may be concluded that climatically the islands provide a relatively poor environment for agriculture.

Soils

Soil characteristics are largely governed by:-

a. underlying bed rock;

b. sand and rock deposited by the sea, glaciers and wind;

and c. climate.

The cool, maritime climate and low soil bacterial activity have combined to promote the formation of fibrous peats throughout the islands. It

is only in very small areas that mineral soils are encountered. In general natural fertility is low except where penguins or seals have manured the land.

Laboratory analyses indicate that camp soils are acid (typically in the range pH4.0 to pH5.0). Organic content is high, usually greater than 35% and often in excess of 70%. Phosphorus is generally deficient while potassium and magnesium levels are usually adequate. In settlement paddocks where stock pass through in large numbers, and in some coastal strips where sea creatures have manured the land phosphorus levels are often higher.

Soils are often shallow, but in some areas acid peats occur which may reach several metres in depth. Conventionally soil acidity is corrected by the use of lime. It has been calculated that to raise soil pH to 6.5 (a level acceptable for arable cropping in Europe and elsewhere) about 15 tonnes per hectare (6 tons per acre) of ground limestone are required. For grassland, however, a pH of 5.5 is adequate requiring dressings of 6 tonnes per hectare (2.5 tons per acre) of ground limestone. There is no source of limestone in the islands, shell-sand deposits are inadequate and, at present, internal transport difficulties prevent movement of large quantities of material overland even if the lime could be imported economically.

With one or two exceptions, imported concentrated chemical fertilizers have only been used to provide a crop of hay or help to establish a small area of forage for settlement cows during the winter. Present GTU experiments will quantify the need for such fertilizers in establishing and maintaining pastures sown with introduced species.

Pasture agronomy

The agronomy programme is divided into two major studies:-

1. the natural vegetation:
2. sowing of introduced grasses.

TABLE 1

Plant communities important to the sheep industry

Community	Principal species present	
	Scientific name	Common name
1. Coastal green (5,000kg DM/ha)	*Poa pratensis*	smooth stalked meadowgrass
	P. annua	annual meadow grass
	Gunnera magellanica	pigvine
	Juncus scheuzerioides	small jointed rush
2. Valley green (6,000kg DM/ha)	*P. pratensis*	smooth stalked meadowgrass
	G. magellanica	pigvine
	Blechnum magellanica	fern
	Festuca magellanica	native fescue
	Deschampsia flexuosa	wavy hair grass
	J. scheuzerioides	small jointed rush
3. Bogged white grass community (4,500kg DM/ha)	*Cortaderia pilosa*	white grass
	P. pratensis	smooth stalked meadowgrass
	J. scheuzerioides	small jointed rush
	G. magellanica	pigvine
	B. penna-marina	small fern
	F. erecta	land tussac
4. Lax white grass communities (700 - 3,000kg DM/ha)	*C. pilosa*	white grass
	G. magellanica	pigvine
	B. penna-marina	small fern
	Myrtealo nummulara	
	Festuca sp.	fescues
	Luzula alopecusis	
	Bryophytes	
	Oreobolus obtrusangulus	oreob
	Baccharis magellanica	christmas bush

1. Natural vegetation

Table 1 summarises those principal naturally occurring plant communities identified by the GTU as being important to the sheep industry. Estimates have been made of annual dry matter production. Coastal and valley greens provide high quality feed for the sheep but are estimated to comprise only 5% of the total land area. Whitegrass (Cortaderia pilosa) communities account for 40 to 50% of the land area, but provide forage of relatively low feed value. Diddle-dee (Empetrum rubrum) is generally regarded as of little value to grazing stock. Laboratory analyses are being carried out to determine feed values of some of the more important species.

Whitegrass growth, early in the season, is slow but it accelerates during midsummer. Dieback from the tip has been found to occur in December and increases through the season. Other species also grow slowly in the early part of the season, possibly due in part to lack of moisture and low soil temperatures. The GTU has found that on average only 23% of the available feed in whitegrass is green. Burning removed about 80% of the standing material. When compared with an unburned patch the ratio of green-to-dead whitegrass was three times greater in the first year following burning. To maintain the high green-to-dead ratio following burning it is essential to change grazing management. Studies are being undertaken at North Arm (Peat Banks and Sound camps) on a lax whitegrass community to record changes in the amount and quality of individual grass species under one such system of controlled grazing.

Diddle-dee is the second most abundant plant species after whitegrass. Attempts have been made to improve camp dominated by diddle-dee by its partial destruction with a flail mower, the theory being that:-

a. finer grass species would be encouraged;

and b. young diddle-dee of better feed value would grow.

Results are inconclusive, but close flail mowing will kill diddle-dee.

Tussac (Poa flabellata) at one time was more widespread, but through uncontrolled grazing is now restricted to specially preserved areas (e.g. islands and points) and may be used for overwintering dairy cows and horses.

In its present state the production potential from the natural vegetation is low and is unlikely to sustain high levels of individual animal output.

2. Introduced pastures

Introduced grasses have been sown throughout the Falkland Islands since the early 1950's, particularly in the drier less-productive diddle-dee areas. Generally Yorkshire fog (Holcus lanatus) and occasionally bents (Agrostis spp.) were introduced, usually without fertilizer. Other species such as cocksfoot Dactylis glomerata, red fescue Festuca rubra and perennial ryegrass Lolium perenne have been tried, but Yorkshire fog has been the most successful. Many such reseeds have regressed. Some of the early work of the GTU looked into the possibilities of their salvage and improvement of output by top dressing with fertilizers and the introduction of other grass species. In some instances the old reseeds responded to applications of lime and phosphates and/or the introduction of other pasture species.

Direct drilling of pasture species into open camp by means of a Bettinson 3D drill was tried in several places. One was at Roy Cove on diddle-dee ground, while another was at Goose Green on whitegrass camp. On both sites Yorkshire fog was drilled and it established and grew without the aid of fertilizers, but no spreading from the drills occurred. Stock were attracted onto the whitegrass area at Goose Green within the first year of drilling and this in turn may improve the utilisation of the natural vegetation and thus its quality. It has not yet been possible to assess fully this technique in the Falkland Islands, but it must be noted that direct drilling is proving to be of only limited use in the United Kingdom and elsewhere.

TABLE 2

Soil analysis on experimental reseeds

Site	pH	Soluble P (ppm)	Soluble K (ppm)	Organic matter (%)
Teal Inlet (Picaso)	4.80	2.8 VL	560 VH	37.7
Goose Green (Hope Cottage Rincon)	4.25	3.2 L	760 VH	23.4
Chartres (Goring)	4.80	0.6 VL	600 VH	36.3
Roy Cove (Herbert Stream)	4.40	0.26 VL	400 H	33.8

L = low H = high VL = very low VH = very high

(*pH5.5 acceptable for pastures on high organic matter soils)

More recently the GTU has turned its attention to establishing large areas of reseed using both introduced species (red fescue, cocksfoot, perennial ryegrass, smooth-stalked meadow grass (Poa pratense) and common bent (Agrostis tenuis)) and compound fertilizers. Trials at Roy Cove and Chartres on the West, and Goose Green and Teal Inlet on the East have shown that a seed mixture containing these species sown at 28kg per hectare (25lb per acre) with 250kg per hectare (2 cwt per acre) of FISONS 'HEAVY LAND' (12:24:0) will establish and grow following rotovation (on its own), or rotovation and burning of the resultant trash. Table 2 indicates soil chemical analysis of the four sites. No particular species has done consistently well or consistently badly in the first year of study.

In a study which started in January 1980 at Teal Inlet the establishment of introduced grass species was improved by the inclusion of lime in the seed bed. The addition of nitrogen also increased the percentage ground cover, but the response to phosphorus was unclear in this trial. With the highest level of nitrogen at 64kg per ha (51 units per acre) the inclusion of lime did not improve the level of establishment. The information from this experiment is still to be fully analysed. Further work is planned and in progress.

After a sward is established it is important to know what further fertilizer dressings will be required to maintain it, and how often such applications are needed. Early trials (again assessing ground cover) at Teal Inlet and Goose Green on East Falkland showed that on reseeds in their second season both nitrogen and phosphorus together increased ground cover of introduced grass species when up to 64kg/ha (51 units/ac) nitrogen and 64kg/ha (51 units/ac) phosphorus were applied. Only at Teal Inlet did ground cover improve with the dressing of phosphorus alone. The sown grasses failed to respond to either nitrogen or phosphorus at Roy Cove

and Chartres on West Falkland where water may have been limiting. The addition of potassium fertilizer had no effect on any site.

From time to time clovers have been introduced. In particular white clover (*Trifolium repens*) has been tried both with and without innoculation of nitrogen fixing *Rhizobia*. Results have been variable but the acidity, the general deficiency of phosphorus and other factors make widespread establishment of effective nitrogen fixing clover unlikely at present. Much development work in the laboratory and field is required, but it is intended to drill some innoculated clover seeds into the above-mentioned reseeds when soil fertility has improved following heavy grazing.

The study of the introduction of exotic pasture species both with and without chemical fertilizers is still in its infancy, but so far the indicators are favourable. Input-output relationships will be determined both from the biological and economic points of view in due course.

TABLE 3

Present Performance of Falkland Island Sheep

(expressed as percentage of ewes put to ram)

	Lambs marked	Lambs weaned/ dipped	Hoggs shorn	Hoggs reaching $2\frac{1}{2}$ years of age
Male	32	28	26	23
Female	34	31	28	25
Total	66	59	54	48

Typical recorded body weights:

Adult ewes at mating	36 - 48 kg
Lambs at birth	3.5 - 4.5 kg
Lambs at weaning	18 - 25 kg
Adult weathers after shearing	50 - 55 kg

Overall stock losses (excluding culls and consumed)	11%
Annual loss of adult sheep	10%
Average wool produced (all classes)	3.59 kg

Animal production

Present production and performance

Today the majority of sheep in the Falkland Islands are of the Corriedale type, although many other breeds (including Merino, Cheviot, Polwarth, Romney and Lincoln) have been introduced from time to time. It is difficult to obtain meaningful averages of sheep performance in the Falkland Islands, but in Table 3 there is a general summary of stock outputs and losses. These data are from stock record books from about half of the Falkland Island farms and information from measurements and trials by GTU personnel. It is clearly illustrated in Table 3 that stock losses are high and lamb weaning weights are low, emphasising that undernutrition is a major factor limiting output.

Studies are being carried out in flocks managed in both traditional and non-traditional units to obtain more exact information on animal performance (e.g. cycles of body weight and condition, wool growth and yield). Figures 3, 4 and 5 illustrate typical cycles of body weight and total wool yield of all classes of dry sheep. To obtain such information groups of sheep are weighed, have their fatness assessed and their wool specially marked on seven occasions throughout the year.

Adult dry ewes and wethers have their maximum rate of wool growth during March and April when their body weight and fatness are greatest. Wool growth is least during periods of nutritional stress: breeding ewes have least wool growth from mid-pregnancy to marking time: adult dry ewes grow least wool in August to September, and wethers, which are typically run on poorest camps produce least wool in the period July to December.

Reproduction

Within the programme of study of animal production emphasis is laid upon obtaining more information on the capacity of the Falkland Islands sheep for reproduction. A series of investigations have been designed to

determine:-

a. The ovulation rate and its seasonal pattern;

b, Mating success;

c. Embryonic and foetal mortality;

d. Lambing percentage (number of lambs born, marked and weaned).

Ewes were slaughtered at intervals during the 1980 breeding season (February to July) to determine the pattern and rate of ovulation in groups of adult and maiden ewes on Pebble Island (see Figure 6). The information from this study, that ovulation is at a maximum in May, is supported by limited data from North Arm and Goose Green.

Detailed records from Pebble and elsewhere indicate that in general almost all ewes are mated at least once. Slaughter experiments show that embryonic and foetal mortality during early and mid pregnancy respectively are both about 10 and 3%. GTU records indicate that 90-95 lambs are born per 100 ewes put to the ram. This contrasts with the marking and weaning percentages reported in Table 3. It becomes simple to calculate the principal period of loss knowing the number of animals conceived, born, marked, weaned and shorn.

Lamb birthweights of 3.5 to 4.5kg and weaning weights of 18 to 25kg are low to normal for the Corriedale breed indicating a lack of adequate nutrition. It is generally recognised that lambs with low birthweights are more likely to die at lambing time. Similarly the low weaning weights are likely to affect the animals lifetime performance.

These facts on sheep performance and reproduction permit several conclusions about the sheep in the conditions generally prevailing in the Falkland Islands:-

a. Lambing percentages are unlikely to reach more than 100%;

b. Sheep are often very short of food particularly during late winter

and spring;

c. Stock losses, particularly in young stock, are high.

These conclusions in turn indicate ways whereby increased output is probably best achieved:-

a. Improvements in reproductive rate through keeping alive the animals born;

b. Increases in individual wool production will be achieved through improved nutrition and other factors.

Further investigation is required. The genetic potential for ovulation of the Falkland Island sheep and the ewe's ovulatory and reproductive responses to changes in body weight and condition before mating will be the subject of a new study.

Animal health

Many aspects of the animal health and animal production programmes overlap. For example, in investigations into young stock losses, the role of endoparasites or metabolic disorders must be considered.

Diseases and their control

Many of the diseases common in farm animals of temperate zones are not encountered in the Falkland Islands or have not yet been discovered. The nature of the soil and very extensive system of sheep farming probably prevents many diseases (such as foot rot) which have been introduced in imported sheep in the past. Sheep scab (caused by Psoroptes communis var ovis) was introduced but has long since disappeared, and recently the ked (Melophagus ovinus) has all but been eradicated. Extensive lesions (Caseous Lymphadinitis - known as boils) may be observed in lungs, livers and carcases of slaughtered animals. The economic significance of this problem cannot be accurately assessed, but it is believed to be the cause of a significant invisible loss by reducing animal output through discomfort, tissue damage

and debility.

Hydatid cysts have been recorded in recent years in animals and humans. Before the start of the eradication campaign in 1970 over 30% of sheep were infected. By 1979 the incidence in adult sheep was less than 10% due to strict control of offal disposal, dog kennelling and a compulsory dog treatment programme using Droncit (Praziquantel - Baer).

There is a joint GTU/Sheep Owners Association programme now in progress to eradicate Brucella ovis - a major cause of epididymitis. All rams are blood sampled annually and the sera screened for the presence of B. ovis antibodies by the complement fixation test. The national incidence in 1980 was 5.6% with 15 out of 34 farms being infected. All rams producing a positive reaction to the test are slaughtered as potentially less fertile animals. To be declared B.ovis free a farm will be required to have two successive years without any ram producing a positive reaction to the test. At least a further two or three years will be required to eradicate the disease.

Other problems relating to health

Several mineral imbalances may occur in the Falkland Islands sheep. Favourable economic responses to administration of cobalt bullets have been recorded on some parts of West Falkland, with reductions in mortality of both young (hogg) and adult stock. The cause of this apparent deficiency has been studied but this is a notoriously complex subject and progress in understanding the problem has been slow. Further trials involving minerals are not planned at present.

Worms are known to exist in the Falkland Islands sheep. The following species have been recorded:-

a. In the stomach:

Haemonchus contortus

Ostertagia circumcincta

b. In the small intestine:

Trichostrongylus vitrinus

Nematodirus filicollis

Strongyloides papillosus

Moniezia expansa (tapeworm)

c. In the large intestine:

Chabertia ovina

Trichuis ovis

d. In the lungs:

Dictyocaulus filaria

Ostertagia sp., Trichostrongylus sp. and N. Filicollis are probably the most economically important.

It has generally been believed that gut parasites have little effect upon sheep production in the Falkland Islands. But it is well known elsewhere that the presence of worms reduces the condition of sheep and their ability to survive harsh conditions. Preliminary observations indicate that some young sheep in the Falkland Islands may become very heavily infected with worms after weaning. Monitoring programmes and investigations involving management changes and the use of anthelmintic drugs are helping to measure the effect of worms upon sheep production and mortality.

Changes in systems of production which may involve heavier stocking rates or periods of stock concentration will possibly bring about changes in animal health. It is very important to monitor animal health when altering systems of production.

Goose study

Part of the GTU remit is to study the Upland and Brent geese with a view to quantifying their impact upon production.

During the last three years an understanding of the Upland Goose life cycle, population dynamics, diet and food requirement has been formed. There is now some information on seasonal changes in population density on various pasture types on East Falkland. Geese are attracted to reseeds, but control by shooting is unlikely to be effective since geese move in from elsewhere. Scaring devices are also unlikely to reduce goose damage, for the Upland Goose is indifferent to man's presence and unfamiliar objects and sounds.

Indirect methods of control are more likely to succeed. For example reseeds should be sited away from water to prevent heavy grazing by shedding flocks. The GTU will be studying the effect of reseeded grass length and quality on goose numbers in order to obtain an idea of the form of pasture management which produces a sward least attractive to the goose during different seasons.

Systems of animal production

Only after extensive collection of data, study and experimentation is it possible to construct new systems of animal production and management. Nutritionally, the three most important periods of the breeding sheep year are:-

a. one month before to one month after mating;

b. one month before lambing starts;

c. during early and mid lactation.

Figure 7 illustrates the food requirement curve of a breeding ewe throughout the year.

The two-pasture system for the management of breeding ewes aims to provide a method of budgeting or rationing available feed so as to make the greatest possible nutritional impact upon lamb production. In the Falkland Islands this has been achieved by fencing within ewe camps to separate the

best quality natural herbage (valley and coastal greens) from poorer areas. The sheep graze the better areas before mating and again from late pregnancy through to weaning. At other times of the year when their food requirements are less they are herded into the poorer area thus resting the better quality pasture. Experience of this method of lamb production is limited and on some farms success is more likely than on others. Small improvements in lamb output by some farms are claimed, while no benefit is observed by others. It is probable that in some cases advantages will always be small because of insufficient high quality feed in the better area to merit the change in management. By reseeding, more high quality pasture is made available in the better areas. The GTU is now investigating the effect of reseeding upon output in such a system of management.

Other non-traditional systems of sheep production have been investigated e.g. rotational grazing of natural vegetation. The GTU is measuring and recording changes in production associated with one system.

Questions yet to be answered

What is the Falkland Islands sheep's response to improved nutrition throughout the year? It is planned to determine the breeding ewe's reaction to changes in body weight and condition prior to and during mating. Will young stock losses be reduced with improved nutrition or are the principal causes of loss the terrain or management? Will more wool be cut if dry sheep are better fed? What is the best cycle of weight and body condition for maximum wool growth in the Falkland Islands?

How does the natural vegetation respond to heavy grazing? What happens to introduced species when sown into natural swards with and without concurrent changes in management in the Falkland Islands? What are the economic responses to fertilizers in the Falkland Islands? How is sown pasture best managed for its maintenance and to make the greatest impact

upon production?

There are still many other questions to be asked and answered before real changes in systems of production can be made. To date many innovations have been introduced to bolster traditional methods of production. The GTU seeks supports for both traditional and new systems of wool and lamb production for the Falkland Islands.

Appendix

Technical Term

exotic	introduced, improved
regressed	deteriorated
rotovation	cultivated by rotovator (rotary hoe)
innoculation	introduction of small quantities
embryonic	early stage of lamb in female
foetal	later stage of lamb in female
ovulatory	egg producing potential or capacity
endoparasites	internal parasites e.g. stomach worms

Project personnel in August 1980

J A FERGUSON	Sheep production specialist and Team Leader
R S WHITLEY	Veterinary Surgeon
A S GRIEVE	Veterinary laboratory technician/biochemist
MISS M R BURKETT	Pasture agronomist
A E WATSON	Agronomy assistant
N KEENLEYSIDE	General Assistant
MRS S HALFORD	Secretary

Previous personnel

C D KERR	Sheep management specialist and Team Leader until November 1979
J H McADAM	Pasture agronomist
R W SUMMERS	Goose Officer
J HARRADINE	Goose Officer
MISS H ROGERS	BIOCHEMIST
T P MAITLAND	FIELD OFFICER

The GTU thanks all persons who aid and support its work throughout the islands. The co-operation of all farm managers is especially acknowledged.

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August 1980

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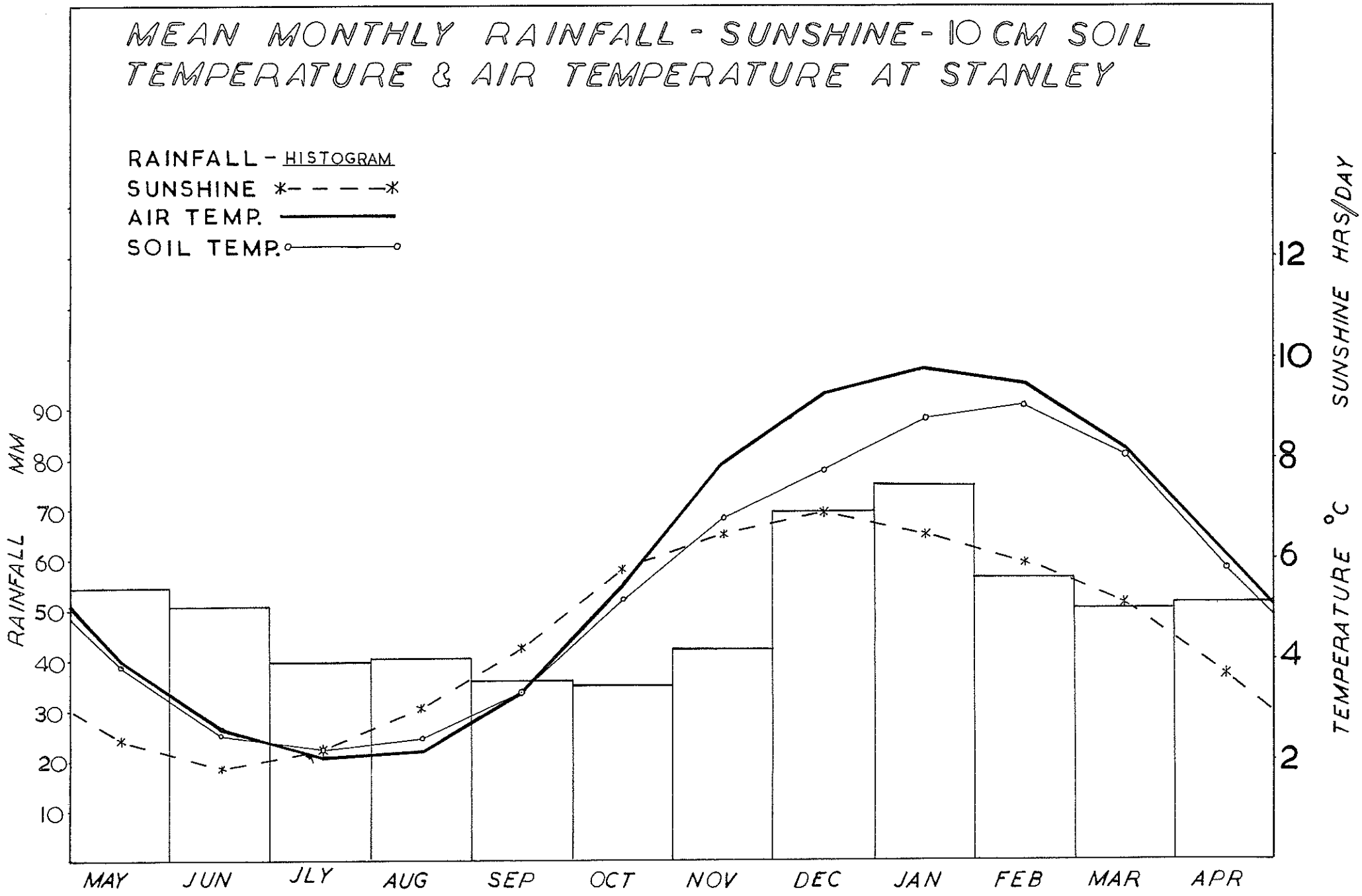
FIGURE 1.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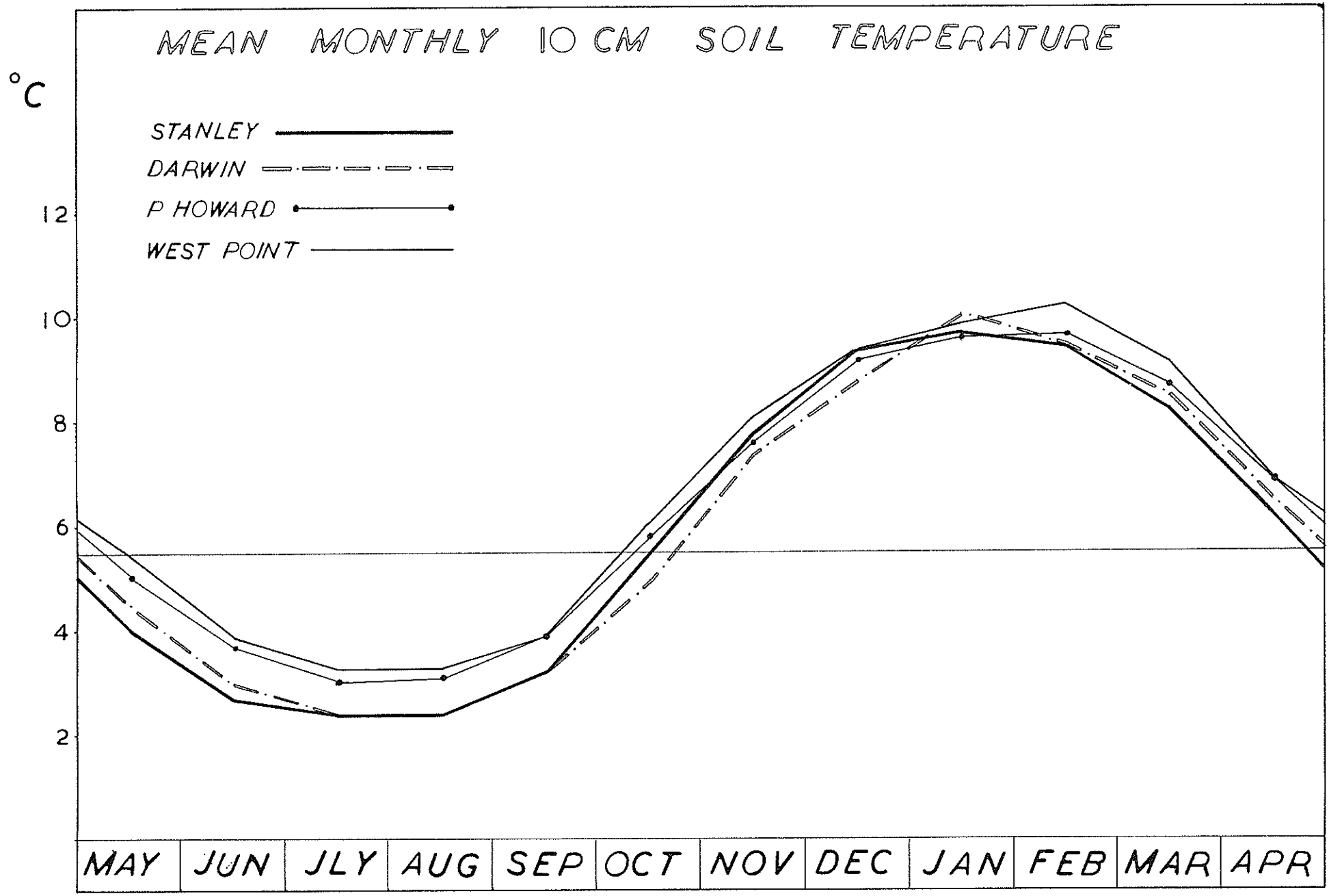
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FIGURE 3

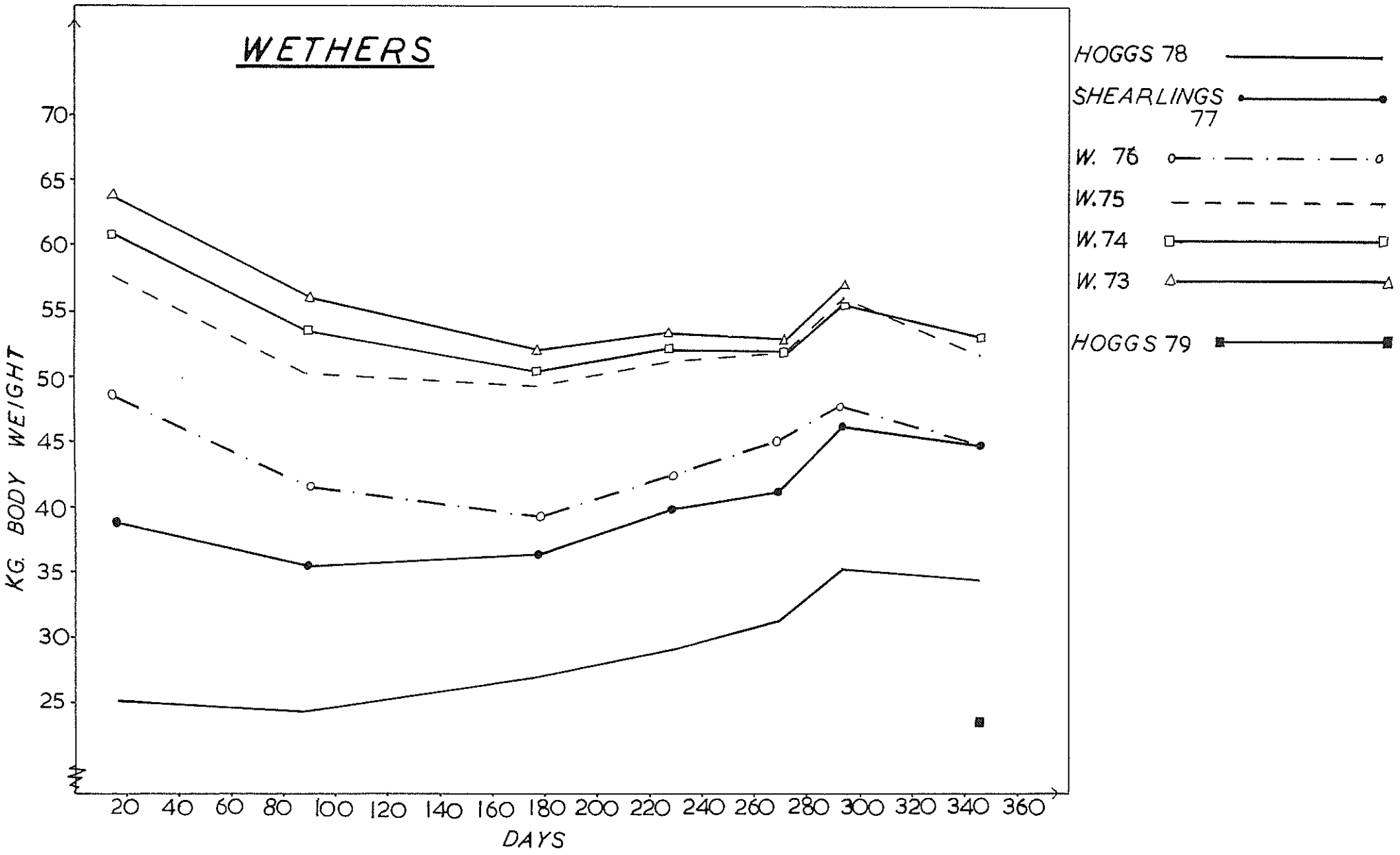
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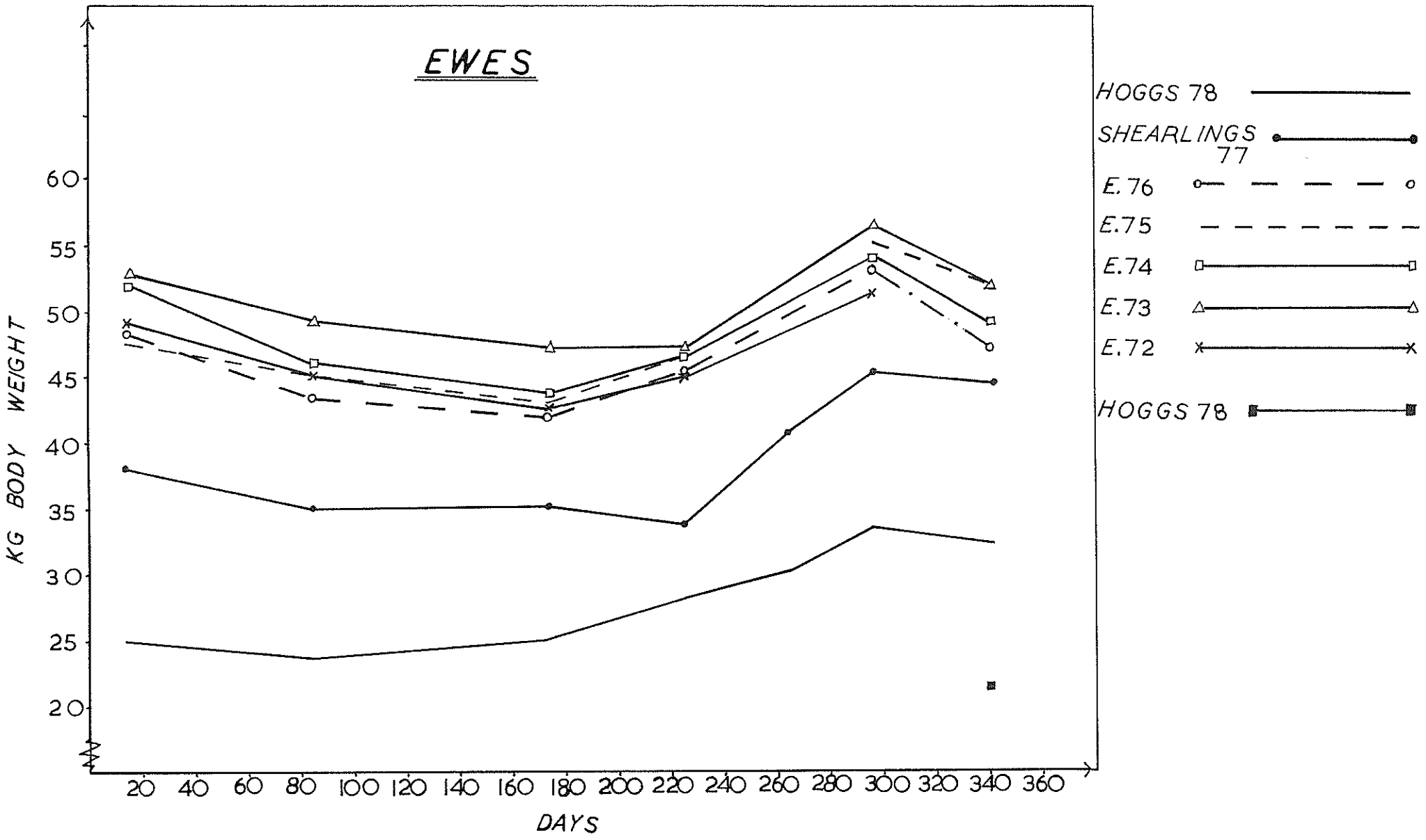
FIGURE 4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HOGGS 78

FIGURE 5

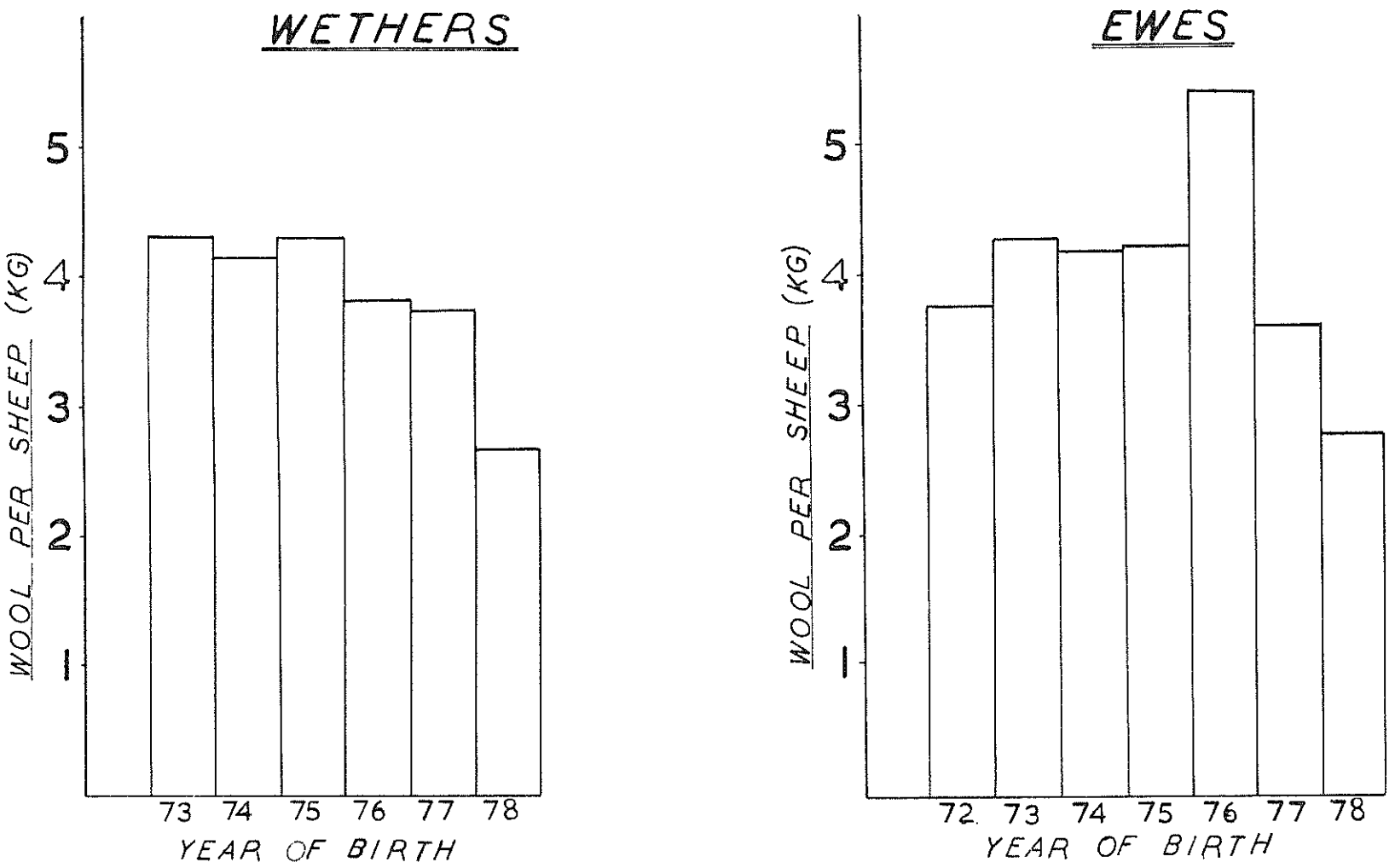

WETHERS
WOOL PER SHEEP (KG)
1
2
3
4
5
73
74
75
76
77
78
YEAR OF BIRTH
EWES
WOOL PER SHEEP (KG)
1
2
3
4
5
72
73
74
75
76
77
78
YEAR OF BIRTH

FIGURE 6

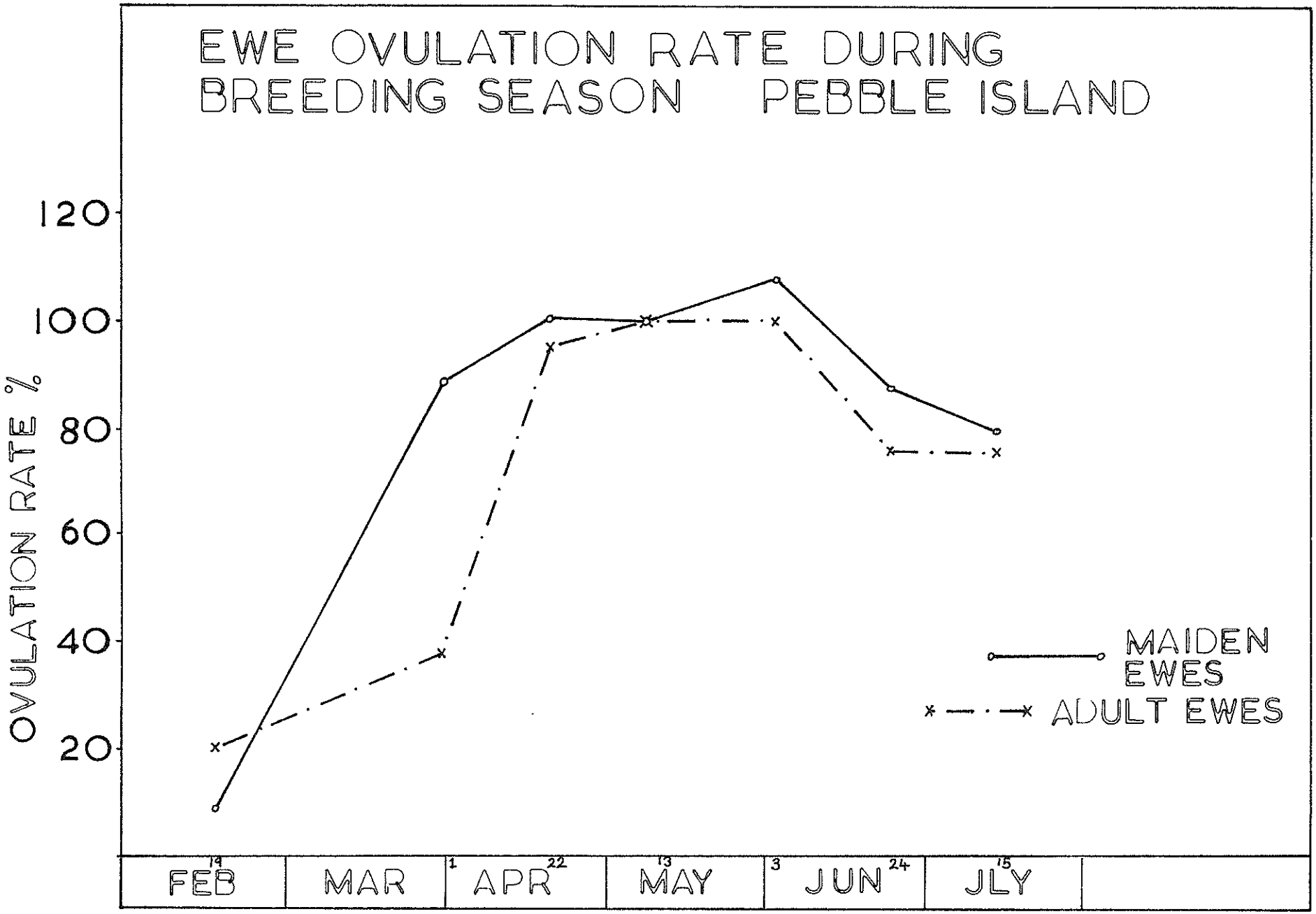
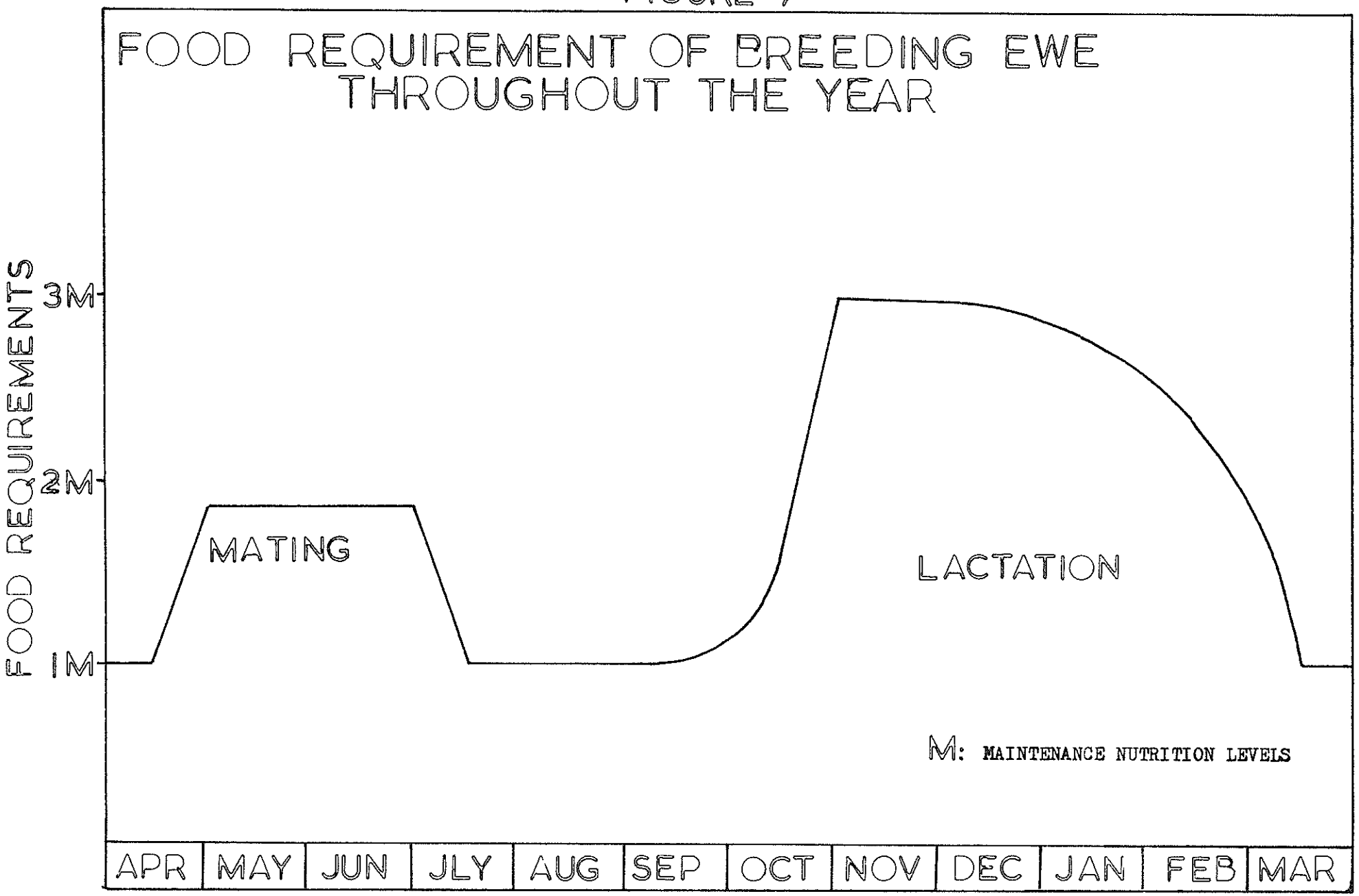

EWE OVULATION RATE DURING
BREEDING SEASON PEBBLE ISLAND
OVULATION RATE %
120
100
80
60
40
20
MAIDEN EWES
ADULT EWES
FEB 19
MAR
APR 1 22
MAY 13
JUN 3 24
JLY 15

FIGURE 7


FOOD REQUIREMENT OF BREEDING EWE
THROUGHOUT THE YEAR
FOOD REQUIREMENTS
3M
2M
1M
MATING
LACTATION
M: MAINTENANCE NUTRITION LEVELS
APR
MAY
JUN
JLY
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR