FOWLERS GAP ARID ZONE RESEARCH STATION

SOME OBSERVATIONS ON PASTORAL MANAGEMENT IN THE WESTERN DIVISION OF NEW SOUTH WALES

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FOWLER'S GAP ARID ZONE RESEARCH STATION

UNIVERSITY OF NEW SOUTH WALES

This Field Station of 98,000 acres (39,200 hectares) is situated 70 miles (110 kilometres) north of Broken Hill in western New South Wales. It was leased to the University in 1966 to facilitate arid zone research, particularly into problems concerning the pastoral industry in the region. With an average rainfall of 8 inches (20 centimetres) distributed through the year, the Station is climatically representative of much of the southern Australian arid zone. The Station carries some 5,000 sheep, and has a small laboratory as well as residential facilities for scientists. Its policy is guided by a Consultative Committee which includes representatives of the pastoralists and of other local interests, of the New South Wales Departments of Lands and Conservation, and of C.S.I.R.O., as well as of the University. The Station is presently administered through the University's Robinson College at Broken Hill.

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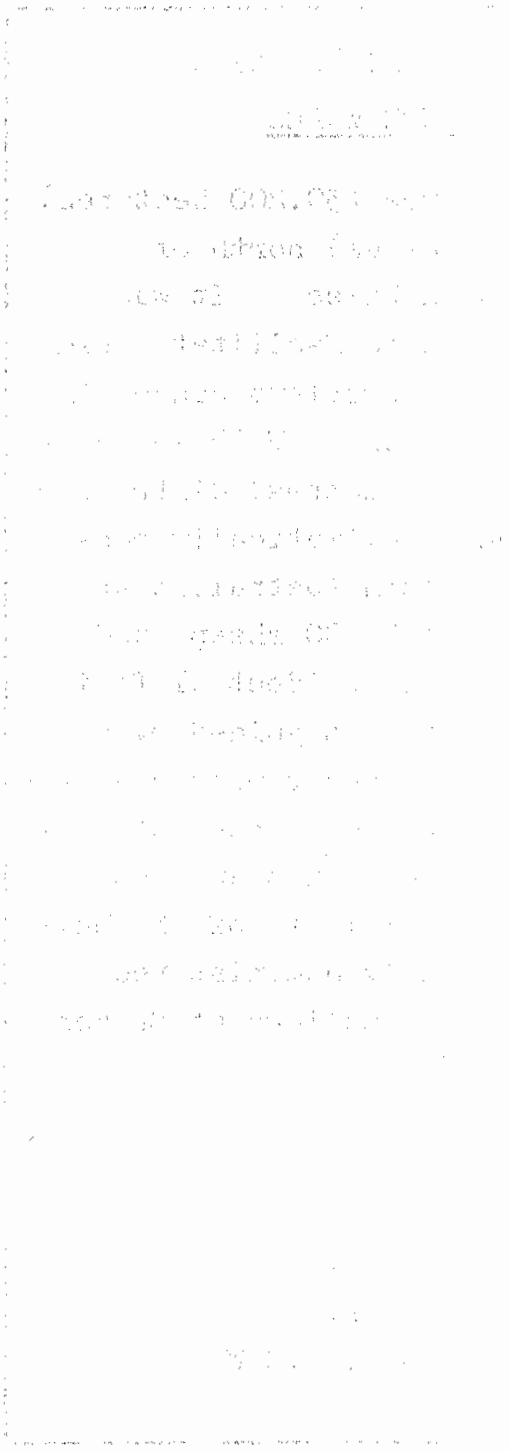

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PREFACE

In 1966 the University of New South Wales took over the lease of Fowler's Gap Station and has continued to develop the area as an Arid Zone Research Station to study the problems of the environment and to provide facilities for undergraduate teaching and post-graduate training.

The University established a Consultative Committee comprising members of the Pastoral Industry and Government Departments who meet with the academic staff to discuss the activities of the Station. As Fowler's Gap Arid Zone Research Station acts as the focal meeting point with the pastoralists of the area it is the logical nucleus for the distribution of research findings, under the auspices of the Consultative Committee. In this way it is proposed to produce a series of publications from the Station.

The present publication is the first in a series of Fowler's Gap Research Bulletins from the Station. Except for the first chapter Bulletin No. 1 consists principally of a series of articles which appeared during 1968-1969 in the "West Darling Pastoralist", the monthly newsletter of the Pastoralists' Association of West Darling.

The articles were written while Dr. Chudleigh was carrying out a data collection programme in the region for the purpose of constructing a mathematical model of the pastoral management system. Wool and stock prices and other figures used in this publication are compatible with those obtained during the years 1968 and 1969. Some of the articles present a general discussion on problems faced by the grazier, whilst others probe more deeply into problems through reports on surveys and budgeting exercises.

A.H. WILLIS
Pro-Vice-Chancellor

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Fowler's Gap
Consultative Committee

INTRODUCTION

"Increased production" is a phrase commonly advocated by Wool Industry leaders as the answer to rising costs and falling prices. This slogan evinces ideas of pasture improvement, superphosphate and higher stocking rates, but when the area in question imposes the severe limitations of low and unreliable rainfall the problem is not so easily solved.

The two annual outputs from a sheep breeding enterprise, total wool production and turnoff of sale sheep, are chiefly influenced by the three following factors:

i) The number of sheep carried from year to year;

ii) Wool production per head;

iii) Lambing percentage.

A brief analysis of the situation is presented in Chapter 1, which summarises some results of an area survey.

How can each of these three factors be improved to make increased contributions to annual output? This problem is discussed in Chapters 2, 3 and 4 of this Bulletin.

Chapter 5 outlines the limited enterprise choices available to the Western Division grazier, and examines some analytical tools which can assist in assessing the various enterprises.

The classification of management decisions together with a discussion of factors which influence a grazier in his decision-making are dealt with in Chapter 6.

CHAPTER ONE
REPORT ON PRELIMINARY SURVEY OF THE WEST DARLING REGION

During the period 15th January to 23rd February, 1968, interviews were held with thirty graziers whose stations gave a reasonable representation by area of the West Darling region of New South Wales. These graziers were selected for interview primarily on their probability of holding records, whilst all grazier members of the Fowler's Gap Consultative Committee were also included. These two factors could have introduced a slight bias in the sample towards the more progressive and cosmopolite members of the region. Figure 1 shows the distribution of the properties in the sample.

DISTRIBUTION OF PROPERTIES INCLUDED IN THE PRELIMINARY SURVEY

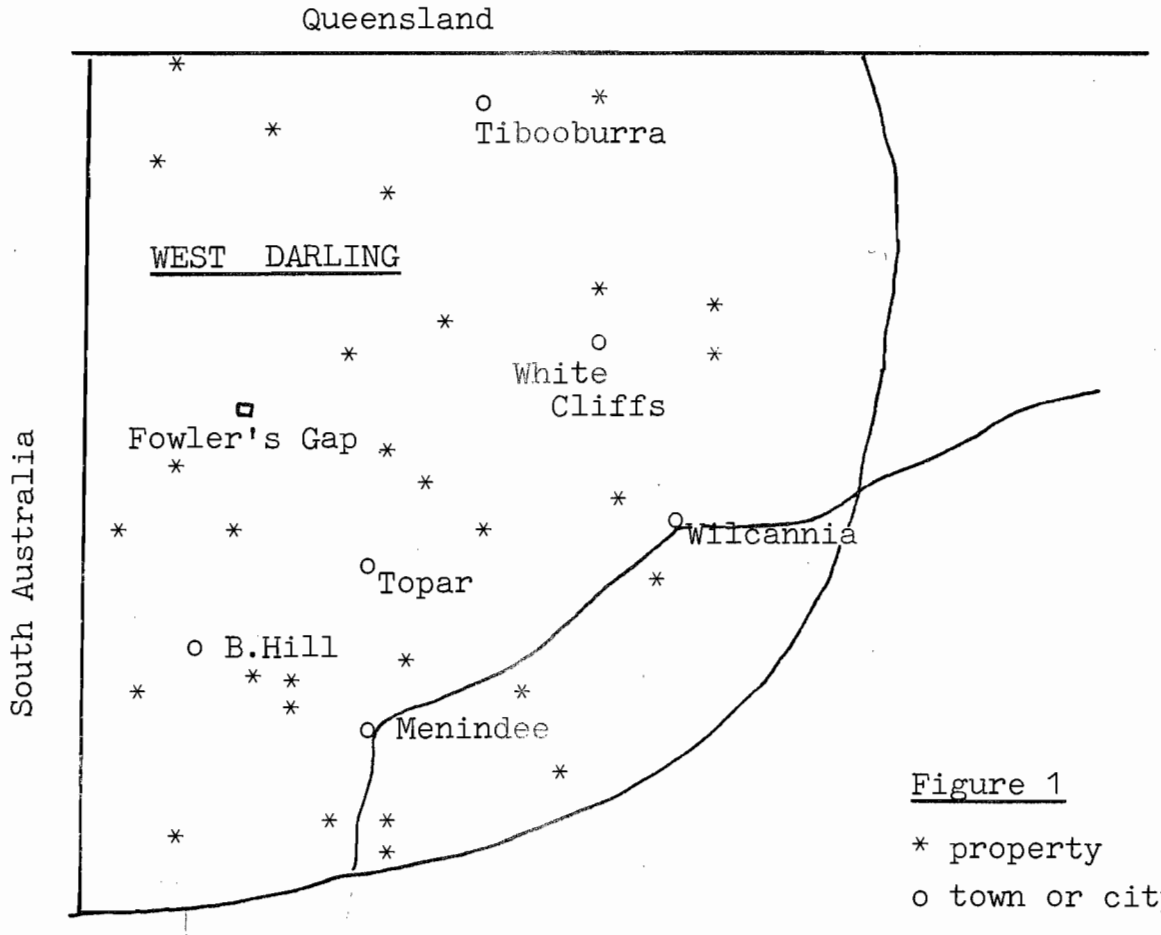


Figure 1

* property

o town or city

Information collected in the survey has been assembled in three categories:

1. Physical data
2. Management practices
3. General

PHYSICAL DATA

a) Previous Ownership

Fifty-seven per cent of pastoralists had fathers or uncles as previous owners of the stations, and these stations had been in the family for an average of 50 years.

Of those that had bought in themselves, the average time of occupancy was 21 years. Fifteen per cent of these had bought in in the past ten years.

b) Station Size

The average station size was 95,000 acres, with distribution as follows:

Size of Station	Number of Stations
14,000 - 40,000 acres	2
40,000 - 60,000 acres	7
60,000 - 80,000 acres	7
80,000 - 100,000 acres	5
100,000 - 120,000 acres	3
120,000 - 140,000 acres	2
140,000 - 160,000 acres	2
> 160,000 acres	2

c) Land Type

When land types were divided into the six classes:

Hilly country
Undulating gibber country
Undulating or flat loamy country
Sandy country
Flooded country
Black river country,

it was found that only 17 per cent of properties were limited to one land type, while 55 per cent consisted of two types, 21 per cent of three types, and 7 per cent of more than three types.

d) Stock Rating

The Western Lands rating of acres per sheep averaged out at 18 for the properties surveyed; the range was from 11 up to 27.

e) Paddock Size

The average paddock size over all of the stations was 8,700 acres, excluding small holding paddocks. The average number of sheep per paddock with set stocking was 485. Average paddock size increased with total acreage of station, as did the average stock rating.

Table 1

Station size, paddock size, stock rating and mob size on sample properties -

Station Size (acres)	Average Paddock Size (acres)	Average Stock Rating (acres per sheep)	Average Mob Size Paddock With Set Stocking (sheep)
0 - 40,000	5,750	12.5	460
40 - 60,000	6,500	13.3	490
60 - 80,000	7,570	17.1	440
80 - 100,000	8,200	20.8	395
100 - 120,000	10,000	17.3	580
120 - 140,000	10,000	23.5	425
140 - 160,000	12,500	22.5	555
> 160,000	17,000	25.0	680

f) Water

The ratio of the number of surface water sources to the number of underground water sources was 2:1. Most pastoralists thought that stock generally did better on surface water, but only three of these thought that bore water had any adverse effect on wool production.

The main reasons given for the present distribution of bores and tanks were:

i) Availability of bore water at an economic depth

ii) Quality of the underground water

iii) Nature of the soil and run-off characteristics

iv) Catchment areas and topography

v) Personal preference.

f) Water (Cont.)

Other factors permitting, new tanks have been placed in central positions in paddocks whilst bores were often placed to provide permanent water to two or more paddocks. Several pipelines were in operation.

Of those who used surface water, 56 per cent had no tanks equipped with mills or pumps, 26 per cent had all their tanks equipped while 18 per cent had some tanks equipped.

The reasons given for equipping tanks were:

i) Bogging

ii) Economy of water use

iii) Higher quality wool

iv) Easier management in poor seasons.

The reasons given for not equipping were:

i) Sheep "do better" on open water

ii) Economy of maintenance and labour

iii) A higher lambing percentage

iv) Uneconomical return.

g) Labour

A unit of labour was defined as "a man fully occupied on the station, whether an owner, manager owner's son or stationhand". Table 2 shows the distribution of labour over the stations and the sheep carried per labour unit.

g) Labour (Cont.)

Table 2

Labour units and sheep per labour unit on sample properties -

Total Labour on Stations	Number of Stations	Average Sheep Numbers per Station	Sheep per Labour Unit
1	4	2,985	2,985
2	18	4,360	2,180
3	6	6,530	2,175
4	1	9,000	2,250
11	1	20,100	1,825

The overall average was 2,280 sheep, or 1,525 breeding ewes per labour unit. The labour distribution over the size of the flock is given below:

Size of Flock (sheep)	Sheep per Labour Unit
- 5,000	2,545
4,000 - 5,000	2,285
3,000 - 4,000	1,970
3,000 -	1,425

Grooms, gardeners, etc., were not included in this analysis. Five of the stations normally employed such a person but two had discontinued the position due to the drought. Also, two stations were operating with less labour than normal due to the drought.

h) Cattle

Fifty per cent of the stations carried a breeding unit of cattle in a normal season. Thirteen per cent were at present considering running some cattle permanently in the future.

i) Flock Size

The average number of grown sheep just before lambing was 4,819 made up of:

lambing ewes
12 months' old ewes
wethers 12 months or older.

i) Flock Size (Cont.)

The average number of ewes mated in normal years was 3,525.

j) Strain

The stations were running sheep of the following strains:

		No. Stations on Strain
Bungaree	- always	14
Collinsville	- always	10
Bungaree	- changed from Collinsville in last 20 yrs.	2
Collinsville	- changed from Bungaree in last 20 yrs.	2
Flairville	-	1
Koonoona	-	1

One station on Collinsville blood is in the process of changing to Flairville.

MANAGEMENT PRACTICES

a) Mating

The average number of rams mated was 2.9 per 100 ewes, the extremes being 1.5 and 5. Rams were normally left in for about eight weeks.

The popularity of each month of the year for commencing mating is shown below.

Month	Number of Stations Commencing Mating in this Month
January	8
February	3
March	4
April	0
May	1
June	0
July	1
August	0
September	0
October	0
November	4
December	6
Double matings	2
Variable	1

The graziers indicated that there was a great deal of flexibility in the actual time of mating due to seasons and the above data is for normal years.

The reasons given for mating in these months were as follows:

January

Cooler weather at lambing
Fits in with shearing and crutching
Greater chance of green feed in winter
Conception rate of ewe is highest
Lamb survival rate is higher
Evasion of blowfly at lambing.

February

Cooler weather at lambing
Fits in with shearing and crutching
Ewes are still coming in to water
Better chance for ram.

a) Mating (Cont.)

March

Cooler weather for lambing
Fits in with shearing and crutching
Greater chance of green feed in winter
Conception rate of ewe is highest
Ram is more virile
Evasion of blowfly at lambing.

May

Conception rate of ewe is highest
Evasion of grass seed
Greater chance of more feed in spring.

July

Fits in with shearing and crutching.

November

Cooler weather at lambing
Greater chance of green feed in autumn
Fits in with shearing and crutching.

December

Ram is more fertile
Cooler weather at lambing
Fits in with shearing and crutching
Greater chance of green feed at lambing.

b) Lamb-Marking and Lamb-Marking Percentages

Fifty-three per cent of stations used rings at lamb-marking, 20 per cent used the knife, 10 per cent a combination of knife and rings, and 17 per cent used either the rings or the knife, depending on the season.

The average stated lamb-marking percentage was 74, but it is suspected that this figure may be higher than the true situation when allowance is made for the extremely low percentages during drought years.

c) Weaning

Eighty-three per cent of pastoralists took the lambs off their mothers in a normal season at least two months before the next mating. The average age of weaning was $5\frac{1}{2}$ months.

d) Fly Control

Sixty per cent of pastoralists were practising mulesing and a further 13 per cent said they may start in the near future, while 27 per cent thought it unnecessary.

Of those who mulesed, 30 per cent did so at lamb-marking, 30 per cent between six and nine months, and 40 per cent at an older age than nine months.

The reasons given for not mulesing were:

i) Programme of jetting and crutching was quite effective in controlling the fly

ii) Too cruel

iii) Programme of culling was efficient.

Jetting practices were quite common, even amongst those who mulesed. Crutching was carried out usually one per year with the most popular months being February - March and September - October.

e) Shearing and Dipping

The distribution of shearing time by month was as follows:

Month	Number Stations Normally Shearing in this Month
March	10
April	5
June	1
July	5
August	8
September	1

The availability of contractors seemed to play a large part in the decision of when to shear, although a trend towards shearing earlier in the calendar year was evident. Reasons given for this were:

i) An early spring shearing necessitates shearing with young lambs at foot

ii) The spring is usually very dusty and windy

e) Shearing and Dipping (Cont.)

iii) Better wool prices at the end of selling

iv) To shear before the Bathurst burr is at its worst stage for wool contamination.

Two-thirds of the pastoralists dipped off shears every year; some dipped whenever necessary, and others have never dipped at all.

f) Mustering

Very few stations still used the horse to any extent for mustering purposes, and their limited use was principally in very hilly or boggy country. Four-wheel drive vehicles and motor bikes were most commonly used while utilities seem to be gaining popularity on the flatter country, being less expensive and equally efficient. Light planes were used on three stations for general inspection and as mustering aids.

g) Grazing Policy

Most pastoralists believed it was better to stock lightly over the whole station rather than operate any system of rotational grazing. Some qualifications expressed were:

i) The occasional spelling of a paddock was sometimes practised if it had been badly affected by drought, stock or wind. Results from complete spelling were never spectacular and it was believed that regeneration was equally effective under light stocking

ii) The saving of paddocks with permanent (bore) water and the utilisation of paddocks with less permanent sources of water was practised in one or two cases. Hilly country was sometimes held in reserve as it is not susceptible to drifting

iii) Flooded country was used more intensively after a good rain

g) Grazing Policy (Cont.)

iv) Stony (gibber) country was hard to regenerate and required greater care

v) Holding paddocks were spelled between shearing and crutching times.

The main reasons for having small numbers of sheep in all paddocks were:

i) Saved paddocks were very susceptible to grazing by the kangaroo. Evidently the sheep and the kangaroo prefer not to graze in close association, so when a paddock is void of sheep, it is preferred by the kangaroo. It was commonly thought that sheep and kangaroos ate much the same food

ii) Utilisation of best feed before it is cut about and blown away by the wind

iii) The prevention of the cutting up of a paddock by large mobs of sheep near watering points, thus exposing the country to erosion

iv) Smaller mobs lead to better mating and lambing results.

One pastoralist used only half his country at once. The reason given for this strategy was that it involved less labour to inspect watering points and stock for flies.

h) Culling and Fleece Weighing

Most ewes were culled for age between 5 and 6 years. Young ewes were usually classed before their second shearing, and the characteristics considered of most importance were:

i) Conformation and size

ii) Wool type, density and length of staple.

h) Culling and Fleece Weighing (Cont.)

Only one of the thirty stations kept wethers past the second shearing. Age of disposal was as follows:

Age Range	Number of Stations Selling Wethers
0 - 6 months	3
6 - 12 months	16
12 - 18 months	7
18 - 24 months	3
3 years	1

Fleece weighing was not carried out on any of the stations visited. However, it is known that at least four other stations in the area are practising some form of fleece weighing.

i) Disease, Pests and Weeds

All stations were disease-free, although some stations had histories of brucellosis, pregnancy toxaemia, hypocalcaemai and urinary calculi.

The chief pests listed were the kangaroo as a competitor and the eagle as a predator. Other pests included the rabbit (on decline), euro, goat, crow and fox. Poisoning of eagles and foxes was carried out on many stations prior to lambing.

Poison herbs and weeds constituted a local danger to grazing stock. Among the most dangerous were: Caustic bush, Wild lucerne, Darling pea and Nightshade.

Most pastoralists considered that Noogoora burr was impossible to eradicate, but most spent some time in cutting and spraying. Bathurst burr was also quite prevalent.

GENERAL

a) Carrying Capacity

It was generally thought that the carrying capacity of the country has increased slightly over the last ten to twenty years. This has been due to the decrease in rabbit population, the increased number of watering points, and more fences. Others believed that the carrying capacity has not been increased but has rather been stabilised in that a fixed number of sheep can be carried for longer periods during droughts.

b) Vegetative Changes

It was the general opinion that no total quantitative changes in the vegetation were evident in the past twenty years, perhaps except for a general decrease in top feed. Many examples of localised changes were given:

i) A decrease in Mulga (4 stations)

ii) A decrease in Saltbush and an increase in Mitchell grass (5 stations)

iii) An increase in Bluebush (5 stations)

iv) An increase in Copper burr and a decrease in bush and grasses (4 stations)

v) A decrease in useful vegetation and an increase in inedible shrubs (4 stations)

vi) A decrease in Bluebush (3 stations)

vii) A change in the dominant grass species (2 stations)

viii) An increase in the dominant grass species and a decrease in Copper burr (1 station).

c) Research Needs

The most frequent topics mentioned as priorities in research were:

i) Lambing percentage (ram percentage and time of year of mating)

c) Research Needs (Cont.)

ii) Introduction of a more drought-resistant species of plant

iii) Reclamation and regeneration of claypans.

Other topics mentioned included:

i) Patterns of grazing and distances travelled by sheep

ii) Effect of Saltbush and bore water on wool production

iii) Desalination

iv) Economics of surface and bore water

v) Less expensive ways of boring

vi) Water evaporation

vii) Cloud seeding

viii) Irrigation

ix) Life cycles and regeneration of Acacia sp.

x) Comparative nutritive values of fodders

xi) Plant breeding with existing species especially Copper burr

xii) Control of Noogoora burr

xiii) Effects of scrub cutting

xiv) Investigation into the spread of Hop bush and other non-edible shrubs

xv) Establishment of existing species in localised areas; e.g., flooded or swampy areas

xvi) Dust penetration in wool

c) Research Needs (Cont.)

xvii) Economics of feeding sheep

xviii) Benefits of mulesing.

There was a general feeling about research which can be expressed: "They can't do much, but any research won't go amiss".

d) Further Opinions

Sixty-one per cent of pastoralists regarded the average station in the area to be too small given average seasons and present prices. Twenty-six per cent thought they were adequate in size, and thirteen per cent believed the situation was becoming marginal. Most graziers expressed interest in economic research in this area.

Cattle were regarded only as a limited alternative to grazing sheep, since it was felt that only certain types of country were suitable for cattle.

Kangaroo farms were regarded as completely non-feasible to all pastoralists, while goats were viewed with a certain amount of scepticism.

The Western Lands Commission was held in the highest regard by all pastoralists.

CHAPTER TWO

SHEEP NUMBERS

a) Control of Numbers

The Western Lands Commission imposes a restriction on the maximum number of sheep that can be carried on each Western Division holding. Most graziers agree that these ratings are quite realistic for the region with regard to the long-term productivity of the area. In the short-term, control is based on the number of sheep being carried with respect to the existing season and condition of the country, so that the long-term ratings are only an average of sheep numbers in good and bad years. Thus, Western Lands' ratings impose sensible restrictions on sheep number policies.

However, a breeding flock appears to introduce a degree of rigidity into the system. This may be derived from the mating and shearing dates, the period of pregnancy, very young lambs or, perhaps, the pride of establishing a breeding flock over a number of years. Most would agree that an all-wether flock would enhance sheep number flexibility, but, with isolated exceptions, a breeding flock is more profitable than an all-wether flock providing a reasonably high average lamb-marking percentage is obtained.

The simplest method of achieving flexibility in numbers is by buying and selling as the feed situation dictates. The priorities attached to the order of disposal and purchase of different age classes of ewes in destocking and restocking programmes are of importance. Older ewes may be the first to become adversely affected by a prolonged stress period, but, they may be of greater value when restocking, because of their higher lamb-marking percentages. The system of running a small buffer wether flock so that small number changes may be effected without intruding on the breeding flock is worthy of consideration.

The success of buying and selling operations is due to a complex of experience, business sense and luck. Buying and selling, however, is not always possible because of extremes in prices, sheep shortages, high transport costs and financial hardships. Greater attention should be given to increasing flexibility within the breeding flock

a) Control of Numbers (Cont.)

itself. Many systems with this aim are probably in operation at present.

If it is desired to increase numbers to take advantage of a flush season, cast-for-age ewes could be retained for another year. Alternatively, young wethers could be kept for a longer period than normal. Culling percentage in young ewes could be decreased or culls could be kept separate and run for a further period before disposal. If acceptable to the management system the joining date could be advanced by a few months.

When restocking after a drought, numbers could be increased at a quicker rate by similar methods of lowering the culling percentage or expanding the age structure of the flock. Double matings could yield further restocking rate increases.

If the season is poor and destocking appears imminent, higher levels of culling may be considered in the normal culling programme. If sheep are down in condition the possibility of postponing joining may be desirable.

A system that may reduce seasonal feed fluctuations and consequent sheep number variability is that of spatial diversification of stations. Although rainfall is usually low in the entire West Darling during a drought season, some areas can be more favoured than others. The concept of multiple ownership of stations may significantly reduce fluctuations in the availability of total feed at any given time, although associated with such a system would be increased costs of administration, freight and management. However, these costs may be overriden by the increased stability of sheep numbers.

A parallel system is in operation at present in agistment. This works quite well at times but, decisions could be made with more certainty and the system would operate much more smoothly and efficiently if the agistor were the agistee.

However, within these restrictions there still remains a degree of choice for the pastoralist with respect to:

i) Whether excess feed is utilised in good seasons

a) Control of Numbers (Cont.)

ii) The stage and degree of destocking in poor seasons

iii) The stage and degree of restocking after a drought period.

These three factors influence the number of sheep carried from year to year.

b) Utilisation of Excess Feed

To what degree should excess feed be utilised in good seasons without detracting from the stability of the country in drought years?

On some types of country, feed surpluses are often blown away or eaten by native animals by the time the next drought comes along, even assuming the feed shortage occurs soon after the good season. Thus, in many cases, the argument for "saving of pasture" in the physical sense may not be convincing.

On the other hand, some botanical characteristic associated with drought tolerance may be favoured by long growth periods without defoliation. Perhaps an opposing force is in operation and defoliation during periods of active growth of the plants may strengthen and prolong drought tolerance. Indeed, experience suggests that light grazing encourages many of the important bush species to remain healthy and vigorous. Heavy defoliation at different times of the year could have varying effects due to the occurrence of germination or seed setting of different species.

There is far too little known about:

i) The effects on the pasture due to the utilisation of feed in times of plenty;

ii) The animal's influence on different species at different grazing pressures at different growth stages at different times of the year.

As feed conditions deteriorate, the point at which some form of destocking is initiated is one of the most critical management decisions forced upon the pastoralist. Similarly, decisions on the time and extent of restocking following a drought season are critical because pasture recovery may be jeopardised

b) Utilisation of Excess Feed (Cont.)

if sheep are introduced too early.

No specific answers are available as to where safe limits lie, but it must be stressed that this knowledge is of vital importance. Some pastoralists already have theories on these grazing/plant relationships; and perhaps they are making better decisions concerning sheep number policies.

c) Livestock Flexibility

It is logical that the pastoralist who can vary his livestock numbers to meet seasonal feed fluctuations with no adverse effect on the pasture will obtain a greater production output in the long term, but even if all the botanical knowledge were established so that an optimal sheep number policy could be designed from the point of view of the pasture, difficulties arise as to how flexibility can be injected into the livestock system to take advantage of this knowledge.

CHAPTER THREE

WOOL PRODUCTION

1. Factors Affecting Wool Cut per Head:

The amount of wool cut per grown sheep assumes great importance in an environment where wool per acre cannot be increased permanently by increasing sheep numbers. Among the more important factors that influence wool cut per head are: age, sex, pregnancy and lactation, breeding or genetic characteristics, climate and nutrition.

It has been frequently recorded elsewhere that wool production increases with age to a maximum at about 2 or 3 years and then falls away slowly at a rate of about 2 - 3% each year. Wethers generally cut about 10% more wool than ewes. Ewes which have been subject to pregnancy and lactation may cut up to 20% less than dry ewes.

More objective data for West Darling sheep on these age and biological differences in wool cuts, combined with similar information on reproduction rates may be helpful in forming flock composition policies and disposal and purchasing priorities during and after droughts.

a) Fleece Weighing

It is known that fleece weight is quite highly inherited. Indeed, visual culling has yielded substantial increases in wool cut per head over the past century. Selection on visual wool characteristics such as staple length and fibre density have given rise to more wool per unit area of skin while selection for large-framed sheep has resulted in a greater skin area. However, from the point of view of ranking fleece weights in a correct order of magnitude, visual selection is usually only about 40% as effective as selection by objective measurement; hence the development of fleece weighing.

As rams are bought in from studs (many of which practice fleece weighing) the only other means of genetic improvement available to the pastoralist is through selection of young replacement ewes. However, by fleece weighing ewes, greasy cut per head can be increased genetically only very slightly (.02 pounds per year). But disregarding this genetic gain from generation to generation, selection on ewes fleece weight could still increase flock cut per head by a significant amount (0.3 pounds increase over random selection) due to the intrinsic value of retaining animals of superior merit.

a) Fleece Weighing (Cont.)

Lower responses would be achieved (0.2 pounds) if visual selection on fleece weight is already practised. This improvement (say 0.2 pounds) would not be cumulative from year to year and would only be maintained so long as fleece weighing was continued for each generation.

The responses above are calculated for a 20% culling rate. The response will probably be reduced further as a certain proportion of the flock will necessarily be culled visually for obvious deformities, breech wrinkle etc. The degree of visual culling would vary but perhaps less attention should be paid to some characteristics not associated with fleece weight than has previously been the case.

It seems then that no large increases in wool cut per head will arise from fleece weighing ewes but the economics would be worthy of investigation. Of far greater significance to improvement of fleece weight through breeding is the selection of the ram on fleece weights.

b) Controlled Grazing

A seasonal rhythm of wool growth has been identified in several countries including Australia. The rhythm exhibits higher rates of growth in the summer and lower rates in the winter. This effect is thought to be due to the influence of temperature or changing day length or a combination of both. As well, these two climatic factors together with rainfall, humidity, evaporation and light intensity, exert major effects on wool cuts by determining feed availability.

The effect of nutrition on wool growth is enormous. The quantity and quality of the feed available to sheep changes markedly from season to season and year to year and it appears that green feed availability may be of greater significance to the rate of wool growth than total feed availability. This hypothesis has been substantiated by the C.S.I.R.O. at Deniliquin.

As a matter of interest an analysis of 154 observations from records of ten stations in the West Darling has shown that the level of rainfall in the

b) Controlled Grazing (Cont.)

spring and summer months was associated with wool cut per head, higher rainfall in these periods yielding higher wool cuts. The level of rainfall in autumn and winter months was not of any great significance. The same effect was apparent when an analysis of the importance of rainfall in different months was made; rainfall in the months of October, November, December, January and March were of greatest significance.

Two factors could be operating:

i) Green feed is usually scarcer in the hotter periods so that higher levels of rainfall at this time make a greater contribution to an annual green feed continuum than higher levels of rainfall in the cooler months.

ii) There is a more efficient usage of the increased feed availability at this time as it coincides with the period of high wool growth potential due to temperature and light.

There is a possibility that controlled grazing in certain seasons could favour species which would respond to rain at times when green feed is often scarce. An example of a similar principle has been demonstrated at Deniliquin under conditions where fissure weed (Kochia ciliata) is a prevalent pasture component in summer. Grazing fissure weed pastures in the previous July resulted in a summer yield of 35 lb. dry matter per acre, while when grazed in October the summer yield was reduced to 11 lb. of dry matter per acre. The question remains whether management to discriminate against some species and to favour others would be feasible in the West Darling considering the low grazing pressures, large paddocks, and complex species distribution. Certainly it would be of limited value until the palatability of species and determination of diets under different patterns of availability are defined.

b) Controlled Grazing (Cont.)

Associated with wool cut per head is the sheep number policy discussed in Chapter Two. With higher grazing pressure competition for nutrients increases. This will be of little importance in good seasons but as the total feed availability drops, competition becomes more intense and wool growth suffers. If grazing pressures are lower initially, a decline in wool growth rate will be delayed to some degree. To clarify this relationship information is required on the reduction of feed availability due to sheep intake, competitor intake, trampling, natural deterioration, and severe climatic conditions; e.g., thunderstorms and windstorms.

c) Protected Proteins

Much has been heard lately of how sheep can substantially increase their rate of wool growth when small amounts of protein or amino acids are injected into the fourth stomach. Ruminants cannot handle excess protein in the diet due to the otherwise magnificent attribute of being able to utilise poor quality fibrous feeds; i.e., the presence in the rumen of bacteria and protozoa. Thus, there is a limit to the amount of wool forming materials that can be introduced into the manufacturing system. If the required materials, or amino acids (protein is made up of a series of amino acids joined together), could be introduced into the manufacturing system without being degraded by the microbes in the rumen, this limit could be raised enormously. If we think of the manufacturing system as commencing in the fourth stomach, how can the protein be introduced without being subjected to microbial attack?

Direct injections have been suggested. This does not appear practical under extensive conditions unless large doses can be given which can be utilised over long periods. Perhaps the most hopeful techniques under investigation are those which allow the protein to pass through the rumen normally but protect it from the microbes by either coating it with chemical substances or by modifying its own chemical structure. How these supplements could be administered to flocks would be a problem in this environment. Perhaps some form of slow release protein bullet will be developed.

c) Protected Proteins (Cont.)

It appears that the first commercial application may be in drought feeding where protein supplements could be administered with the normal feed. This would be in fact a method of feeding for production instead of maintenance. The position of drought feeding economics must be substantially improved.

Another suggestion is to make the sheep drink more so that the protein would spend only a short time in contact with the destructive microbes. This method may work satisfactorily by giving sheep high salt diets. Proposed work at Fowler's Gap on salt intake could be of major importance in this field.

Although still only in the experimental stage, the discovery of the implications of protecting protein from the rumen microbes is one which could mean substantial increases in wool cuts in the years ahead.

2. Wool Value per Sheep:

In the West Darling Region wool production per acre cannot be raised safely merely by increasing stocking rate. In such an environment, the value of wool produced per head assumes great importance and is one measure of how a station and its management are performing. This value will depend on several factors:

i) The weight of greasy wool cut per head

ii) The yield of the wool

iii) The quality number of the wool

iv) The clean market value for that particular type of wool on the day of sale disregarding lot to lot fluctuations.

It is desirable to obtain heavy wool cuts, high yields, fine wool, and to capture general market peaks as well as market peaks for the particular type of wool sold. But the attainment of these objectives is complicated by market fluctuations which appear to be randomised, and also by the fact that the finer the wool, the lighter the cut and the lower the yield.

2. Wool Value per Sheep (Cont.)

The grower is faced with two main questions:

i) How does a particular station's wool value per head compare with that of another station to allow assessment of land, livestock and management performance?

ii) What is the most profitable type of wool to grow? How much extra cut per head does a grower require before it pays to switch to broader wool?

or

How much wool cut per head can he sacrifice and be better off by moving into finer wool?

As market prices are unpredictable in the long-term, in the short-term and even between clips of equal merit, long-term averages for different wool types are probably most meaningful. Again even though wool cuts, yields and fibre fineness vary substantially on the one station from year to year, it is assumed that they will most likely vary in about the same proportions irrespective of wool type. Therefore, an average wool cut, average yield and average fibre fineness are meaningful in making comparisons between clips, necessarily over the long-term.

Towards the end of 1968, information on wool yields and wool types was collected from Adelaide Woolbrokers. The information was for 15 stations in the West Darling area, for clips sold during the 1958 - 68 period. From the bale composition of each clip and brokers' estimates of yields for specific lots an average clip yield was calculated. The quality number for each big lot sold was derived from the corresponding type number for each lot. Quality numbers for fleece wool, pieces and backs were converted into the number of crimps per inch using the conversion table shown on the next page, (Table 1). An average number of crimps per inch, weighted on the number of bales in each lot, was then calculated for each clip. The number of crimps per inch was used as a measure of fibre fineness instead of quality number as the former is a quantitative measure and so may be conveniently shown on a graph.

TABLE 1

Quality Number	Number of Crimps Per Inch
70's	16.5
64's	12.5
64/60's	12.0
60/64's	11.0
60's	10.5
60/58's	10.0
58/60's	9.0
58's	8.5
58/56's	8.0
56/58's	7.0
56's	6.5
50's	4.7

The average clean prices for wools of different quality numbers sold at Adelaide for the period August, 1967 to January, 1969, are shown in Table 2.

TABLE 2

Quality Number	Price Cents/pound
70's	111
64's	96
60's	82
58's	68
56's	61
50's	50

The relationship between crimps per inch and clean price can be represented by Graph 1. The average clip fibre fineness for the 15 stations varied from just under 64's quality to just under 58's quality, with many individual lines being above and below these qualities.

For each quality number within the 64's - 56's range, the corresponding number of crimps per inch, together with the average yield for the 15 stations over the ten years are shown in Table 3, on the next page.

GRAPH 1

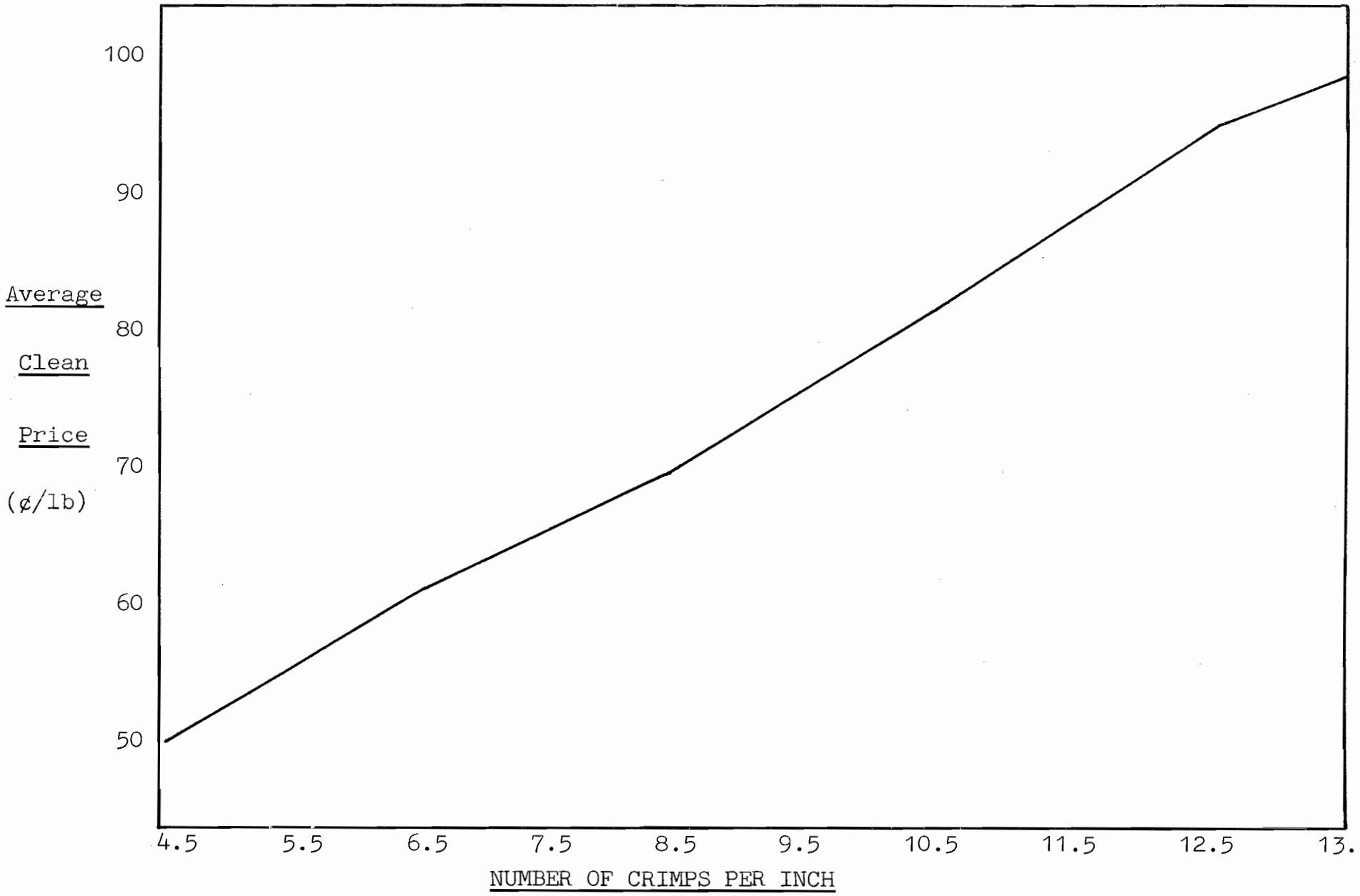

100
90
80
70
60
50
Average
Clean
Price
(¢/lb)
4.5
5.5
6.5
7.5
8.5
9.5
10.5
11.5
12.5
13.
NUMBER OF CRIMPS PER INCH

TABLE 3

Quality Number	Number of Crimps Per Inch	Average Clip Yield (%)
64's	12.5	50.0
64/60's	12.0	50.6
60/64's	11.0	51.9
60's	10.5	52.6
60/58's	10.0	53.2
58/60's	9.0	54.5
58's	8.5	55.1
58/56's	8.0	55.8
56/58's	7.0	57.0
56's	6.5	57.7

This table can be represented by Graph 2.

Using these average clip yields corresponding greasy prices can be calculated for any clip of known average crimps per inch.

For example, if a clip has an average number of crimps per inch of 10 then reading from Graph 1, the average clean price shall be 78 cents per pound. The corresponding greasy price shall be this clean price multiplied by the particular average clip yield for a wool of 10 crimps per inch; i.e., 53.2 (from Graph 2).

The greasy price shall thus be: $78 \times 53.2 = 41.5$ cents per pound.

With an average wool cut per head of, say, 12 pounds, the value per head of this wool would be:

$12 \times 41.5 = \$4.98.$

From this type of calculation, tables can be constructed to show various combinations of wool cut and fibre fineness resulting in the same wool value per head (Table 4), on the next page.

GRAPH 2

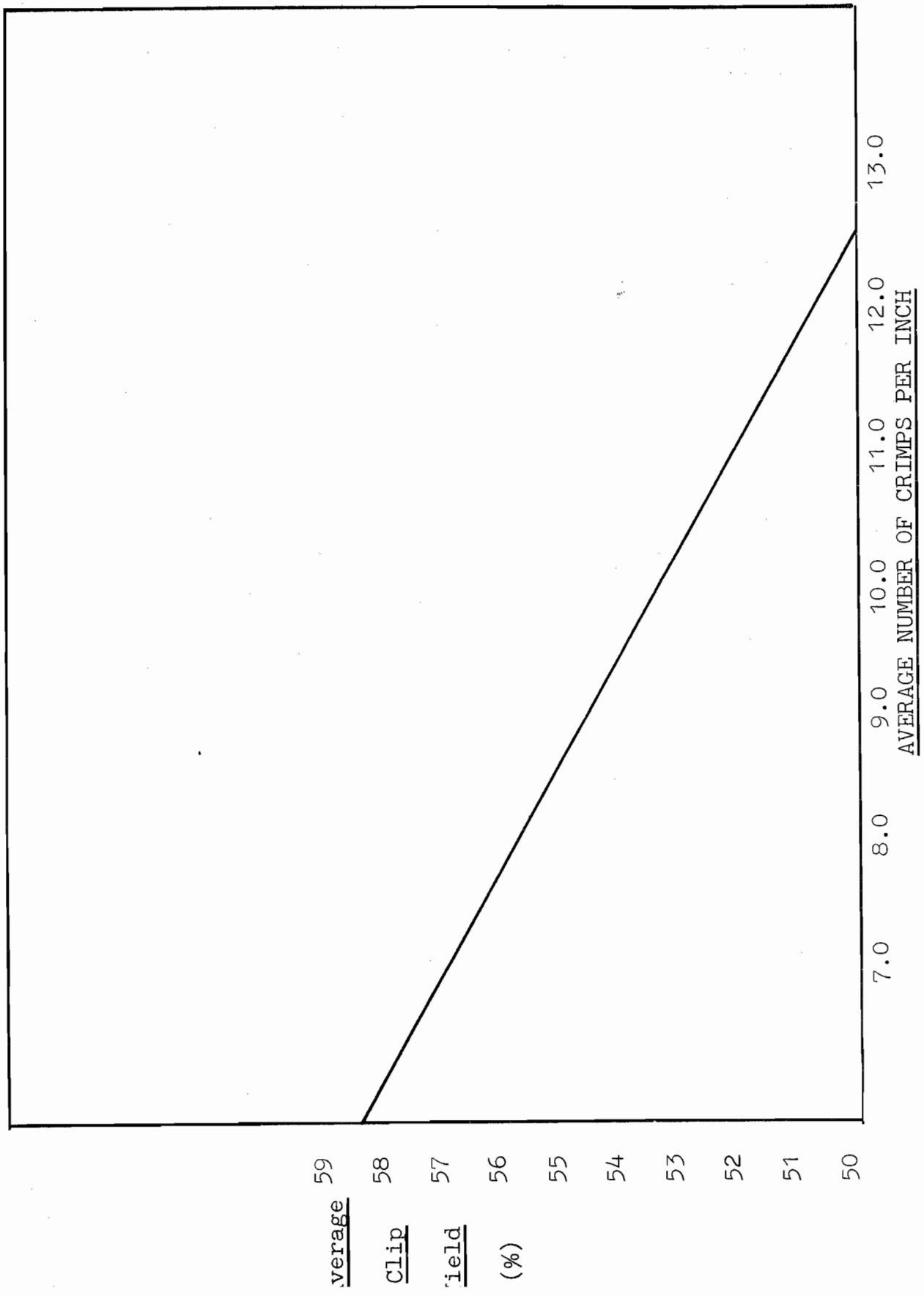

59
58
57
56
55
54
53
52
51
50
verage
Clip
ield
(%)
7.0
8.0
9.0
10.0
11.0
12.0
13.0
AVERAGE NUMBER OF CRIMPS PER INCH

TABLE 4

Average Crimps Per Inch	Wool Cut per Head in Pounds to Give a Wool Value per Head of:			
	$4	$5	$6	$7
12.5	8.3	10.2	12.3	14.3
12.0	8.6	10.7	12.9	15.0
11.5	8.8	11.0	13.2	15.3
11.0	9.0	11.3	13.5	15.8
10.5	9.3	11.6	13.9	16.2
10.0	9.6	12.0	14.4	16.8
9.5	9.9	12.4	14.9	17.3
9.0	10.3	12.8	15.4	17.9
8.5	10.7	13.3	16.0	18.6
8.0	10.9	13.6	16.3	19.0
7.5	11.0	13.8	16.5	19.2
7.0	11.2	14.0	16.8	19.6

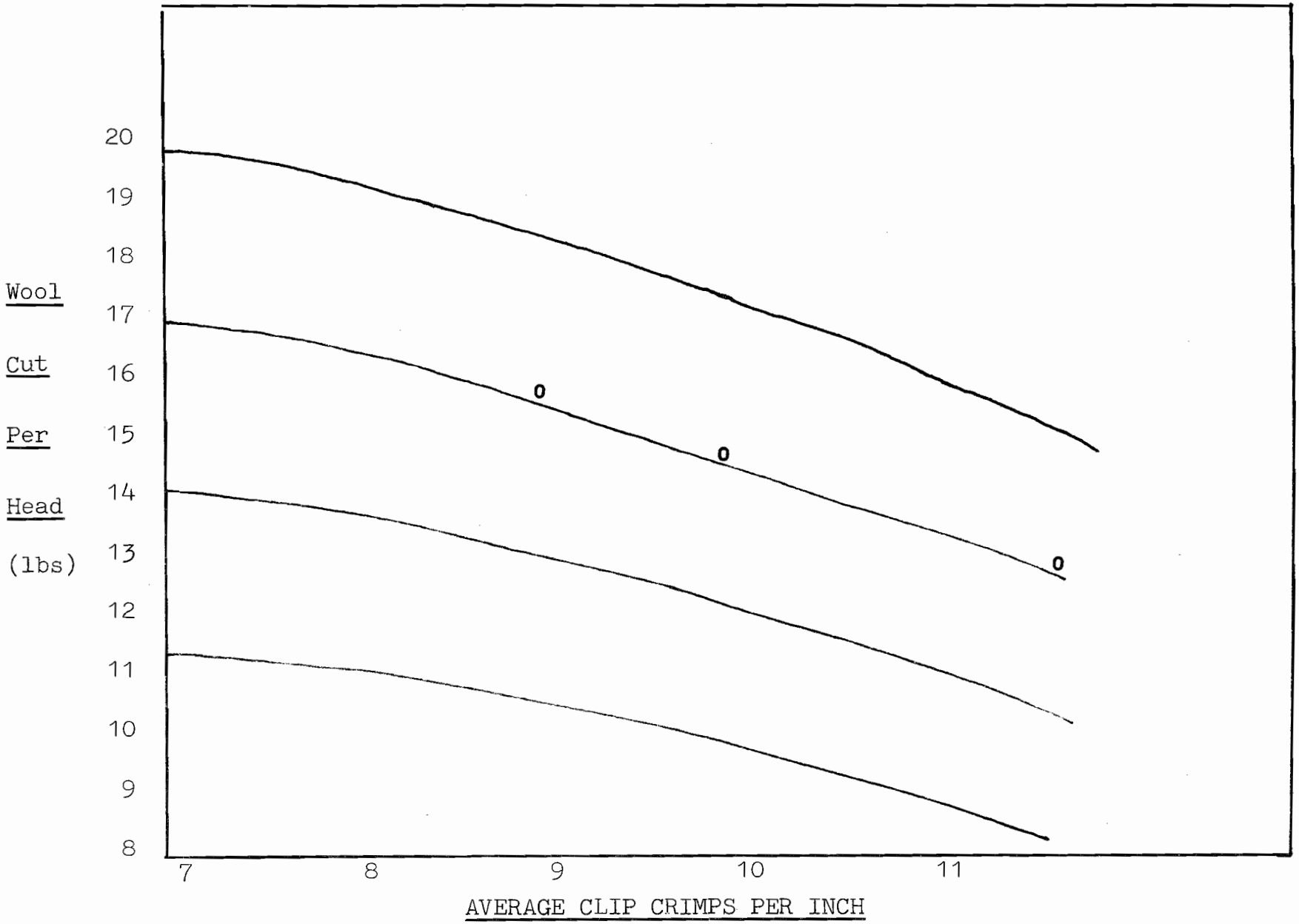
Table 4 can be represented by Graph 3 which has several lines each of which represents a fixed wool value per head.

To make use of this Graph calculate the average wool cut per head of grown sheep and read across from the vertical axis. If the number of bales of wool of each quality number is known then it is easy to work out an average number of crimps per inch for the clip using the conversion table shown previously. When this number is identified, read up from the horizontal axis. Where this line meets the former line from the vertical axis is the point on the Graph describing the station's wool production in terms of fineness, wool cut and value.

Three points describing wool production of three West Darling stations are shown on Graph 3. Although these three stations are producing different types of wool and have different wool cuts, the value per head is roughly the same ($6.10). The chart should be used on clips from flocks that are composed of mainly ewes and in which wethers are usually sold before two years of age.

If regional standards were derived for wool value per head, it would be possible for each pastoralist to define his point of wool production and compare it with the district standards. If value per head is below average, implications of the particular land type, sheep classing programme or perhaps management might be involved. If it was felt that the value of wool produced is actually higher than defined by the Graph, the matter could be investigated further by

GRAPH 3


Wool Cut Per Head (lbs)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
8
9
10
11
AVERAGE CLIP CRIMPS PER INCH

2. Wool Value per Sheep (Cont.)

obtaining estimates of the station's wool yields, which could be higher than the average yields used. This would raise the greasy price and hence wool value per head. Indeed, it has been found in analysing wool yields that stations more open and of softer country usually have lower wool yields. Time of shearing is another factor which is suspected as influencing wool yield.

It can be seen from the chart that cuts of 3/4 - 1 lb. can be sacrificed to produce a wool of one more crimp per inch. This means that in changing from an average clip of 58's to an average clip of 60's, 1½ - 2 lb. could be sacrificed without any change in wool value per head. Likewise, instead of producing an average 60/64's clip, if one changed to a 58/60's clip one would have to obtain at least an extra 1½ - 2 lb. of wool to make the change profitable.

The value of wool cut per head is not the only factor affecting the return per sheep. Reproduction rate is another factor which, in some cases, may compensate for a low wool value per head. This is dealt with in the following chapter.

CHAPTER FOUR

REPRODUCTIVE PERFORMANCE

1. Survey:*

In December, 1968 and January, 1969, a postal survey was undertaken by the district sheep and wool officer, Mr. J. Becke. A total of 230 questionnaires were sent out to pastoralists in the Wilcannia and Broken Hill Pastures Protection Board districts, and 130 were returned.

The survey was undertaken in order to try to identify factors contributing to the large variance of reproductive performance between stations.

Factors included in the analysis were:

i) Average lamb marking percentage for the station

ii) Strain of sheep

iii) Month of commencement of joining

iv) Number of months of wool growth usually present at lambing

v) Length of the joining period

vi) Proportion of rams used

vii) Average paddock size for joining

viii) Average distances between watering points on the station

ix) Average number of watering points per paddock on the station

x) Average number of sheep watering on each watering point

xi) Region (White Cliffs, Menindee, Ivanhoe, Wilcannia, Topar, Fowler's Gap, Broken Hill, Pooncarrie).

The analysis was carried out with the aid of the University of New South Wales computer in Sydney.

* This report was written in conjunction with Mr. J. Becke of the N.S.W. Department of Agriculture.

1. Survey (Cont.)

Considerable reservation must be employed in interpreting the results as cross-sectional surveys of this nature can be misleading due to a number of reasons:

a) The data, although reliable, are not always accurate enough for an exact interpretation of statistical results.

b) Individual differences between stations manifest in factors other than those described may obscure the results.

c) Associations between factors considered in the analysis may obscure any true cause-effect relationships.

With these reservations in mind results were as follows:

a) Lamb marking percentages varied between 50% and 105% with an average of 79%.

b) There were no significant differences between different strains of sheep although there was a slight tendency for the Bungaree Strain to be associated with a higher performance (Bungaree 80%, Collinsville 77%). This trend is not very meaningful as extremely good performances can be obtained from both strains. Perhaps there may be particular land types or watering point distributions where one strain may perform better than the other. On the other hand there is probably so much variance of type and conformation within each strain itself that "strain" may be less meaningful in reproductive performance than other sheep characteristics like average body weight or wool count.

c) The month of commencement of joining was found not significant in the statistical sense, although a strong trend existed; this trend is shown by some grouped results in Table 1, on the next page.

1. Survey (Cont.)

c)

TABLE 1

Month of Commencing of Joining	Average Lamb Marking Percentage	Number of Stations in Group
Oct..Nov..Dec	75%	28
Jan..Feb	78%	34
March..April	84%	26
May..Jun..Jul	81%	4

One would expect reproductive performance to be higher with an autumn joining due to a higher level of fertility in ewes at this time. The figures reported here are only averages and the variance of performance within any one joining period is very high, lessening the significance of the average differences.

d) The amount of wool on the ewes at lambing time was found to be significant; the more wool, the lower the lamb marking percentage. However, this factor was found to be correlated to some degree with the time of joining. Those stations joining early (Nov..Dec) had a tendency to shear in the spring, after lambing. Those stations joining later (Feb. Mar) tended to shear in the autumn, before lambing. This association confounds the effect of a pre-lamb shearing.

However, the amount of wool at lambing time still remained slightly significant when the factor of joining month was accounted for. This would indicate the possibility that a pre-lamb shearing may be beneficial to lamb survival.

e) Length of joining varied from 4 - 12 weeks with a mean of 8 weeks. This factor was not associated with lamb marking percentage.

f) Proportion of rams varied from 1.75% to 4% with a mean of 2.9%. Again, this factor was not associated with lamb marking percentage. It could be that these factors (length of joining and ram proportion), being easily changeable from year to year, have been adjusted on each individual station over the years. Each station could be at an optimum level of these factors.

1. Survey (Cont.)

f) On the other hand, a third factor such as mob size at joining could be implicated and hiding any effect of these two factors.

g) The next three factors will be considered together as they are all associated with one another. Their mean values and ranges are shown in Table 2.

TABLE 2

Factor	Mean	Range
Av. Paddock Size for Joining (acres)	8,900	3,000-20,000
Av. Distance between Watering Points (miles)	3.1	1.25 - 6.0
Av. Number of Sheep per Watering Point	572	200 - 1,300
Av. Number of Watering Points per Paddock	2	1 - 4

The average paddock size for joining was slightly significant; as paddock size increased, lamb marking percentage decreased about 1½% per extra 1,000 acres increase in paddock size.

The average distance between watering points was even more significant, with lamb marking percentage decreasing as this distance increased.

The average number of sheep per watering point appeared the most important factor in the whole analysis; for every 100 sheep per watering point, lamb marking percentage dropped one per cent. The average number of watering points per paddock was not significant.

The associations between each of these factors and the other three lead to difficulty in interpreting the results as it is uncertain which is the most significant causal factor. For instance, it could be the influence of the size of the paddock on the number of missed ewes at joining. It could be the influence of the distances ewes and small lambs have to travel to water leading to mismothering. Or it

1. Survey (Cont.)

g) could be due to overcrowding at watering points at lambing time, again leading to severe mismothering.

Whatever the real reason or reasons are it would appear that reproductive performance would be increased as the grazing pressure around watering points was decreased. This could be achieved by decreasing paddock size associated with an increase in the number of watering points and strategic positioning of these watering points so as to minimise distances walked and to increase feed utilisation.

The reason for the absolute number of watering points per paddock not being significant is not clear. One would immediately assume that large paddocks would have more watering points than smaller paddocks and hence distances travelled to water would be roughly the same. However, there appeared to be no relationship between paddock size for joining and the number of watering points per paddock.

As the number of watering points per paddock increased, distances between waters decreased only slightly; implications of paddock shape and watering point distribution within the paddock could partly explain a lack of association between reproductive performance and the number of watering points per paddock. It appears that the distances between watering points are the important element of this system.

An alternative theory is that the relationship is not linear at all; that is, lamb marking percentage increases as the number of waters per paddock increases up to a point ($1\frac{1}{2}$ - $2\frac{1}{2}$) and then additional watering points tend to depress performance. The data show a slight trend towards such a relationship. A reason could be perhaps an increased propensity for small ewe-ram groups to form at joining under conditions of abundant watering points.

h) Regional and average lamb marking percentages are shown in Table 3, on the next page.

1. Survey (Cont.)

h)

TABLE 3

Region	Average Lamb Marking %	% Stations Autumn Joining
Pooncarrie	84%	37%
Broken Hill	83%	15%
Menindee	82%	70%
Fowler's Gap	81%	23%
Topar	77%	20%
Ivanhoe	77%	43%
White Cliffs	74%	30%
Wilcannia	74%	25%

The differences between regions were not considered significant.

Conclusions

No firm conclusions from these results can be made. It appears that average lamb marking percentages are not extremely sensitive to ram proportion, length of joining, region or strain of sheep. There is a trend towards better performances being achieved from autumn joinings.

Investment in watering and fencing may yield increased performance up to a point, but where this point is cannot be defined. A number of factors are implicated here which are difficult to disentangle with our present knowledge. Indeed, the analysis of the survey highlights how little biological and behavioural information is available at present.

It must be kept in mind that directly applicable information for individual stations cannot be expected from such a survey. Conclusions may have little bearing on the individual station with its own particular history, environment, management etc.

It is wished to thank pastoralists for their co-operation in this survey. Whilst nothing of great significance has emerged to help increase reproductive performance, it is a step forward in trying to comprehend the complexities of reproduction in the West Darling Region.

2. Factors Affecting Reproductive Performance:

A high level of reproductive performance in the breeding flock allows greater flexibility at culling time and contributes substantially to annual income through an increase in the numbers of sale sheep.

Lamb marking percentages (measured as a proportion of lambs marked to ewes at marking time) for the West Darling region average around 70%. However, this figure does not take into account those years in which a joining is not made due to very poor seasonal conditions; the true annual "average" would, therefore, be slightly lower. Some pastoralists achieve consistently high percentages, some consistently low percentages, and others widely varying results from year to year. How, if at all, can the present level of reproductive performance be raised?

Maiden ewes usually exhibit a shorter heat period and display weaker expressions of oestrous. It is also possible that maiden ewes shed fewer eggs, may lose more lambs during the embryonic stage, and may possess a less favourable maternal behaviour than older ewes. Thus, maiden ewes generally give the worst performance of any age group in the flock.

There exists a general pattern of increasing reproductive performance with the age of the ewe, maximum performance being reached at about six years in most cases. At this age, ewes have their best chances of bearing a lamb as well as their best chances of producing twins. After this age performance gradually declines. The question here is one of finding an optimal economic culling policy taking into account the decrease in wool cut per head after 2 or 3 years of age, and the higher reproductive performance of later years. More accurate data on lamb marking percentages for different age groups in the West Darling, together with prices for cast-for-age ewes and young cull ewes, and the comparative ability of ewes of different ages to survive and produce in harsh conditions, would enable a meaningful assessment of different flock age structures to be made.

Some pastoralists do not welcome the arrival of twin lambs. Single lambs are stronger at birth, can tolerate more severe environmental conditions, grow out quicker, and are usually higher producers in their early life. For these reasons, lambs born as twins often may be culled from the flock, and this could develop into an unintentional but real selection against fertility.

The general view held at present is that the twinning

2. Factors Affecting Reproductive Performance: (Cont.)

ability of the Merino is quite highly heritable. Successful selection for twinning has been achieved at the Department of Agriculture's Research Laboratory, Trangie. It was found also at Trangie that twins and singles are almost undistinguishable by eighteen months of age. Rearing lambs under frequently more adverse feed conditions than at Trangie, as in the West Darling environment where hand feeding is impractical in most cases, may extend the period of time taken for twins to catch up to singles. An essential feature of selection for twinning, or ensuring that selection against twinning is not exercised, is the identification of twin lambs at, or soon after, birth. This would be a difficult task under extensive management conditions. It is possible that purchasing rams born as twins would be practicable.

Irrespective of whether twins are welcomed or not, any breeding towards increased fertility would probably be reliant on the culling of barren ewes. The culling of ewes which do not rear lambs will be unlikely to raise the reproductive performance of the current flock by any great amount. Evidence from the C.S.I.R.O. Field Station at Cunnamulla suggests that culling of barren ewes at three years of age would theoretically increase subsequent performance by about 2%. This would be the effect due to a ewe's performance at three years as a guide to her performance in later years. But it is possible that the genetic effect could be greater. Culling barren ewes at two years is not likely to give much genetic gain whilst if barrenness in the third year of age is used as the criterion for culling, worthwhile increases in the fertility of later generations may be achieved.

Culling of three year old ewes either for future performance of the existing flock, or for genetic gain in subsequent flocks, must necessarily increase the proportion of maiden ewes in the flock. However, with the corresponding lower performances of maiden ewes, there will be an initial tendency for the flock performance to fall.

There is an annual rhythm of sexual activity in ewes that is clearly marked in the British breeds of sheep. The rhythm exhibits a peak of activity in the autumn and low levels of activity in the spring. It is likely that this seasonal fertility is associated with decreasing day length. In the Merino the rhythm is not so well defined although most ewes do experience regular heat periods

2. Factors Affecting Reproductive Performance: (Cont.)

during late summer and autumn. Experiments on the Merino have shown that no one feature of the environment (like day length) is entirely responsible for their seasonal sexuality.

Extremes of temperature have important effects on reproductive performance. High temperatures can temporarily reduce the semen quality of the ram. High temperatures throughout pregnancy have been associated in other areas with reduced birth weights of lambs, which adversely affect survival rates. Both extremely hot and extremely cold conditions at lambing time can lead to fewer marked lambs. Low temperatures cause most losses when in association with wet, windy conditions.

In an analysis of West Darling lamb marking percentages, the month of joining had no apparent association with lamb marking percentage. That the more highly fertile period of the year is being masked by low survival rates at the subsequent time of lambing is one possibility. It is also possible that natural selection has occurred due to past spring and early summer joinings, thus favouring the occurrence of oestrous periods in these months. Still, no general evidence can be provided at present to suggest one lambing time as superior to another. Localised problems of grass seed and topography may be sufficient reasons on specific stations for preferring certain lambing periods.

The mating urge of rams can be suppressed at low levels of nutrition and less eggs are shed by the ewe when in poor condition. Therefore, nutrition before joining is of importance to high conception rates. Sudden changes of nutrition just before joining, like a green flush produced by summer storms, could be responsible for higher ovulation rates.

After mating, nutrition does not assume great importance again until the last 6 - 8 weeks of pregnancy when high losses of ewes from pregnancy toxaemia may occur due to a low or falling level of nutrition, especially if associated with any stress such as shearing. The latter situation could lead to severe management problems. Ewes which are denied reasonable levels of nutrition in late pregnancy produce poorly developed lambs and less milk; both factors usually reduce the number of lambs at marking. If lambs do survive but nutrition during lactation is poor, they may be subject to temporary, or even permanent, stunting.

2. Factors Affecting Reproductive Performance: (Cont.)

An analysis of data from ten stations in the West Darling revealed that high levels of rainfall before joining and between joining and lambing were associated with higher lamb marking percentages. This was probably due to higher body weights at joining and increased survival of lambs due to the higher nutritional level of ewes in the later stages of pregnancy and at lambing.

Because of the apparent absence of climatic effects other than rainfall on reproductive performance in the West Darling it could be possible that the greatest number of lambs per year may be achieved by either chasing good seasons or by double matings, although appreciation of management problems like shearing time and fly control with such systems must be made. On the other hand the once per year static lambing system is more tidy, more amenable to good management, comparatively less risky and much less demanding on the flock.

Ill health from any cause will usually lower reproductive performance. Such ailments as flystrike, vitamin 'A' deficiency in rams, and infection with Brucella Ovis and other infectious organisms at least possess tangible remedies or methods of prevention. Management procedures such as inspecting ewes for damaged or missing teats before joining, examination of all rams before joining for testicle abnormalities, minimising predation and disturbances at lambing, avoiding the necessity of long walks to water by ewes and young lambs, especially if troughing is used, and utilising the best pastures for pregnant and lactating ewes, would all be conducive to higher performances.

A much discussed factor among pastoralists is that of the percentage of rams joined. In a preliminary survey of West Darling stations the proportion of rams joined varied from as high as 5% to as low as 1½% and averaged just under the 3% level. As annual ram replacement costs (at 3% of rams) can constitute as much as 5% - 10% of total annual costs of the pastoralist, the question is of considerable importance. However, many factors could be involved. Optimal percentages could vary with the type of country, the size of paddocks, the numbers of watering points and distances between waters in each paddock, the age structure of the ram flock, the condition of the sheep at joining and the feed availability at the time of joining.

3. Sheep Husbandry Timing:

The two most important annual sheep husbandry events with respect to station organisation are shearing and lambing. The "normal" timing of these events varies from station to station depending on specific station problems and individual pastoralist's beliefs. "Normal" timing of these events is not always possible to follow every year due to varying seasonal conditions. However, most managers can identify the normal time when these operations are carried out.

a) Survey

In order to assess the relative importance of the many considerations involved in the choice of normal shearing, joining, and lambing dates a questionnaire was sent out to a number of pastoralists in the West Darling region. It is desired to thank the forty-five pastoralists who co-operated with this questionnaire. Their interest in the exercise was most encouraging. Unfortunately, the response was not sufficient to warrant a thorough analysis of the completed replies, but some of the more important features of the questionnaire were analysed.

Over 90% of husbandry timing systems belonged to one of the four following groups:

i) Join November - December, Shear February - March (16%)

ii) Join November - December, Shear July - August (19%)

iii) Join January - February, Shear March - May (33%)

iv) Join March - April, Shear April - August (23%)

Hereafter, these four systems shall be known as Systems i), ii), iii), iv). About 14% of pastoralists have made definite changes in their timing systems over the past ten years. Of these, five out of six were changes from a November - December joining to a later joining, and four out of six were changes from a July - August shearing to an earlier shearing.

3. Sheep Husbandry Timing: (Cont.)

a) Survey

Thirty-three per cent of pastoralists did not mules. Within timing systems i), ii), iii) and iv) the percentages not mulesing were 14, 37, 43 and 30 respectively.

For each completed questionnaire and within each of the three facets of husbandry timing, 2 points were scored for a reason if chosen as the most important reason, and one point if the reason influenced the timing. On this basis a relative weight for each reason was calculated and then expressed as a percentage of the total weight given to all the reasons. Table 1 shows the relative weights given to each reason, within each timing system, as well as over all systems.

TABLE 1

REASON	RELATIVE WEIGHT ATTACHED TO EACH REASON				
	SYSTEM				
SHEARING	i)	ii)	iii)	iv)	All Systems
Shearing contractors are hard to obtain at other times	0	0	6	2	5
Our normal time usually minimises burr contamination of wool	8	4	11	6	8
Our normal time usually yields best all round fly control	17	28	13	20	18
Our normal time fits in best with joining and lambing	29	20	18	20	21
Our normal time minimises dust contamination of wool	0	16	1	10	6

TABLE 1 (Cont.)

REASON	RELATIVE WEIGHT ATTACHED TO EACH REASON				
	SYSTEM				
	i)	ii)	iii)	iv)	All Systems
SHEARING					
Our normal time yields greater flexibility in joining time; joining can be postponed for a few months and the following lambing will not interfere with shearing	8	8	11	4	8
Our normal time usually coincides with periods of higher wool prices	0	4	1	4	2
Our normal time yields higher survival rates of lambs due to shearing before lambing	21	0	11	12	11
Our normal time avoids shearing very young lambs	17	4	15	14	14
Our normal time is less demanding on men and sheep, weatherwise	0	16	11	8	9
JOINING					
Joining is at this time as it is still hot and ewes are still coming in to water, leading to better contact between rams and ewes and better joining results	11	19	12	8	12
Rams are more virile at this time of the year and usually work better	0	0	2	18	6
Joining at this time and the resulting lambing fit in well with our shearing date	36	27	24	24	27
Joining is at this time of the year as ewes are ovulating at their peak rate and hence there is a greater chance of getting more ewes in lamb	4	0	12	21	11

TABLE 1 (Cont.)

REASON	RELATIVE WEIGHT ATTACHED TO EACH REASON				
	SYSTEM				
	i)	ii)	iii)	iv)	All Systems
JOINING					
Joining normally at this time allows greater flexibility in joining time in poor seasons; joining can be postponed if so desired without interfering with the next shearing	14	4	14	3	9
Joining at our time ensures lambing occurs at the most favourable time of the year climatically	28	38	28	16	27
Joining at our normal time usually finds ewes in good condition	7	12	8	11	9
LAMBING					
Lambing at our time enables lambs to be weaned before the onset of high temperatures	8	6	8	0	6
Lambing at our normal time is associated with higher survival rates of lambs to marking time, due to the cooler weather conditions	32	29	30	15	26
Lambing at our normal time enables weaners to be sold at the best time of the year market-wise	0	3	6	9	5
Lambing at our normal time is simply the result of the choice of joining time	12	0	4	24	9

TABLE 1 (Cont.)

REASON	RELATIVE WEIGHT ATTACHED TO EACH REASON				
	SYSTEM				
	i)	ii)	iii)	iv)	All Systems
LAMBING					
Lambing at our normal time is associated with greater chances of having a green pick available and so higher lamb survival rates	12	29	18	21	20
Lambing at this time fits in best with shearing	20	23	22	24	22
Lambing at our normal time usually ensures higher lamb survival rates from lamb marking to weaning	16	10	14	6	11

From the last column (weight attached for all systems) the three most important reasons for shearing time were:

i) Fits in best with joining and lambing,

ii) Provides best all round fly control,

iii) Avoids shearing very young lambs.

For joining time:

i) Joining and resulting lambing fit in best with shearing,

ii) Ensures lambing occurs at a favourable time climatically,

iii) Ewes all still coming into water leading to better ewe-ram contact and better joining results.

For lambing time:

i) Higher survival rates of lambs to marking due to cooler weather conditions,

3. Sheep Husbandry Timing: (Cont.)

a) Survey

ii) Fits in best with shearing,

iii) Higher lambs survival rates due to greater chances of a green pick being available.

It ssems there is a strong interrelationship between shearing and lambing time, as much attention is obviously given to choosing a lambing date which suits a fixed shearing date. Another broad observation is the greater importance given to aspects of lamb survival than to aspects of getting ewes in lamb. Flexibility in joining time is regarded as of relatively minor importance.

b) Attitudes

The following attitudes are indicated by comparing weights attached to reasons within the four timing systems:

i) Although burr problems can exist at most times of the year, the earlier shearing (autumn) is regarded as more conducive to burr evasion than the later shearing.

ii) The later shearing (winter-early spring) is regarded as yielding better all-round fly control than the autumn shearing.

iii) The winter-early spring shearing is held to be far more beneficial with respect to dust contamination than the late summer-autumn shearing.

iv) The avoidance of shearing very young lambs is regarded as a major reason for shearing before lambing.

v) Systems i) and iii) are considered the most flexible systems, whilst systems ii) and iv) provide very little flexibility at all. It would be unwise to delay a November-December joining if shearing was considered fixed and took place in July (system ii). Also, an autumn joining cannot be postponed for very long (system iv) because of the likelihood of running into hot weather at lambing time; in exceptional

3. Sheep Husbandry Timing: (Cont.)

b) Attitudes

v) circumstances, however, it might be worth the risk.

vi) Rams are considered to be much more active in a later joining than in the earlier joining.

vii) Increased ovulation rates in the autumn are a major reason for autumn joining.

viii) The July-August lambing is considered inferior to the earlier lambing from the point of view of weather conditions and lamb survival both to marking and to weaning time. The component(s) of weather involved may be wind, cold snaps or rainfall (chances of an inadequate feed situation).

ix) Later joining may be more favourable in order to obtain better prices for sale weaners.

These different systems all have their advantages and disadvantages depending on specific station problems and station owner's beliefs. The major question is - how important is each of these factors in an economic sense? Perhaps some factors may be considered important when economically they are trivial, whilst the economic consequences of other factors may be marked. What is the real price penalty for dusty wool, allowing for the increased weight of wool sold? Does this compensate for the foregone benefits of a pre-lamb shearing? What are the real differences in ovulation rates at different times of the year? (At present we can only extrapolate from knowledge in other areas.) What are the probabilities of having a green pick available at different times of the year? These are the types of questions that must be answered before improved decisions on husbandry timing can be made.

c) Flexibility

Flexibility of timing operations is worthy of a last comment. Since "normal" systems are not always possible to follow due to seasonal conditions,

3. Sheep Husbandry Timing: (Cont.)

c) Flexibility

exceptions of the following nature occur:

i) Abnormal joining and lambing due to:

A previously missed joining due to poor seasonal conditions;

A previous very poor lambing;

Intentions to increase numbers quickly by joining twice per year or three times every two years;

An early joining to take advantage of a flush season.

ii) An early shearing in order to:

Decrease the load on animals in poor condition;

Prepare for forced sales;

Avert a severe fly wave.

The policy of some pastoralists never to stray from their normal system has its advantages and disadvantages. Advantages include a very neat animal management system conducive probably to superior handling of some aspects of sheep husbandry. Disadvantages of a rigid system are mainly due to a waste of reproductive potential and the stricter conditions imposed on shearing time. For example, if joining time is inflexible and in a particular year has to be cancelled due to the season, a lag period of twelve months will occur before joining can be effected.

Other pastoralists effect a little flexibility; shearing time is brought forward to meet conditions and joining may be postponed for several months when warranted. A third group exhibits considerable flexibility.

d) Joining

Associated with the flexibility of operations is the frequent dilemma facing pastoralists of whether to join at the normal time, postpone the joining, or cancel it altogether, given very poor existing

3. Sheep Husbandry Timing: (Cont.)

d) Joining

pastoral conditions. If joining is cancelled altogether all reproductive potential is lost. If joining is postponed, there is still a chance that seasonal conditions will change to allow a successful joining and lambing; of course, this alternative will only be available under certain organisational systems. Assuming the ewes and rams will mate, joining under very poor seasonal conditions will broadly result in one of two outcomes:

i) If the season breaks a reasonable lambing may ensue and nothing is lost whilst much is gained;

ii) If the season does not break the following adverse results may occur:

1. A very low survival rate for lambs;

2. High ewe losses;

3. Substantial fall in wool growth rate of ewes;

4. Loss of condition in ewes;

5. Sheep may have to be sold earlier due to a loss of condition and the extra usage of feed.

If joining is postponed under poor conditions and the season does not improve substantially, then eventually a decision on whether to join or not must be faced as postponements cannot continue indefinitely.

Needed Research

Much more information on the performance of the ewe under stress in relation to wool growth rates, death rates, lambing performances and lamb survival is necessary for decisions on joining under uncertainty to be made with greater conviction.

CHAPTER FIVE

ALTERNATIVE ENTERPRISES

1. Feasibility of a Beef Enterprise:

With the advent of improved feed conditions in 1968 many pastoralsits have considered the possibility of purchasing beef cattle to aid in their restocking programme. This has been brought about by the fact that over the past two decades the price of beef has almost doubled relative to the price of wool, whilst many experts believe that of our primary products beef has the most promising future. There is also recent evidence from higher rainfall country that our estimations of how much a cow eats compared with a ewe may have been too high. Consequently some farmers in the better watered areas of the pastoral zone may have to revise their ideas on the relative profitability of sheep and cattle.

What of the West Darling situation? It is appreciated that many stations consist of land types entirely unsuited for beef production, other stations would have a little potential, whilst some stations may have very good potential beef country. If it were feasible that the station could carry some cattle or more cattle the following points are worthy of consideration:

i) The competition for feed between sheep and cattle;

ii) The production variability of a beef enterprise;

iii) Variance in annual income;

iv) Capital requirements;

v) Availability of labour.

a) Competition

Competition between sheep and cattle for feed may not be of major importance in the area. If direct competition for feed existed, then with the purchase of 40 breeding cows, the number of breeding ewes would necessarily be reduced by about 300. Perhaps removal of vegetation by livestock makes less contribution to a deteriorated feed situation

1. Feasibility of a Beef Enterprise: (Cont.)

a) Competition

than do the harsh environmental conditions of wind, dust, heat, and stock trampling. Still, this would probably only apply up to a point, and after the grazing pressure reaches a specific level, competition for feed may be very real. Control, in the form of destocking, may have to be initiated before this point is reached.

b) Risk

This leads to the question of the greater risk attached to beef production in the region. It is generally accepted that cattle are less adapted than sheep to carry on through periods of low feed availability. Transport and marketing costs are high so that the more buying and selling operations required, the lower the profits. A comparison of the relative stability of sheep and cattle enterprises over a period of years would be most interesting.

c) Income

A reason for introducing beef cattle to sheep properties in higher rainfall areas is to avoid having farm income dependent on the vagaries of the wool market. In the West Darling, although sheep and wool prices contribute to the variability of pastoralists' incomes, probably of greater contribution is the varying production output due to the extremely variable climate. Thus, it may be hard to substantiate an argument for cattle actually stabilising income. However, with a further wool price decline, actual average income could be increased.

d) Capital Outlay

The extra capital required for housing cattle on the station (cattle yards, fencing, watering) would vary depending on the present state of improvements and on the envisaged management system. There is a greater initial capital outlay for cattle than for sheep if viewed on a per acre basis. This may necessitate a breeding programme in which actual net cash income from the cattle enterprise would be low for some years, and would not increase greatly until the required stable herd number is reached.

1. Feasibility of a Beef Enterprise: (Cont.)

e) Labour

One New South Wales survey by the Bureau of Agricultural Economics suggests that one beast has total annual labour requirements equal to approximately five sheep, which is less limiting for cattle if compared with substitution ratios varying from 6:1 to 8:1 for feed. Whether five sheep/beast would be an accurate comparison or not, and whether competition for feed exists or not to the extent of 6:1 or 8:1, one could generalise and suggest that labour should not be a real problem except in a few particular cases. Many beef cattle jobs can be done when sheep demands are low. Other jobs pertaining to cattle would have to be done anyway (e.g., inspecting waters). If the extra work due to the introduction of a small herd could be absorbed by the present staff and if sheep numbers are not reduced to any degree, efficiencies of labour usage must rise.

f) Conclusion

Given present prices the whole question of a cattle enterprise possibly revolves around the factor of the relative output stability over a number of years between the two enterprises.

The following situations could possibly warrant a closer look at the introduction or expansion of a beef enterprise:

i) Suitable country available;

ii) A favourable opinion of the risk and stability of the cattle system;

iii) Little additional capital expenditure required specifically for cattle;

iv) A present under-utilisation of permanent labour.

2. Enterprise Choice:

There is not a very large choice of grazing enterprises in the West Darling. Some alternatives can be listed:

i) An all-wether flock buying in replacements (W).

2. Enterprise Choice: (Cont.)

ii) A breeding ewe flock selling wethers at 1-2 years (say 19 months) and breeding replacements. (ewes 1).

iii) A breeding ewe flock selling wethers at 5-12 months (say 7 months) and breeding replacements. (ewes 2).

iv) A beef cattle herd selling yearlings and breeding replacements. (beef).

In assessing the virtues of each alternative, difficulties arise when reproductive performance, wool cuts, death rates, flock and herd composition, sale sheep values, wool and beef prices, and the costs of running each enterprise are introduced.

To make meaningful comparisons between the listed enterprises, it is necessary to introduce two concepts:

i) Enterprise Net Return:

The net return to an enterprise is the gross income from the enterprise less all of the variable costs associated with that enterprise. For example, in alternative ii), the net return for the breeding ewe flock is the gross income (the total value of wool produced per breeding or replacement ewes, wethers, and lambs, plus the value of sales of cast-for-age ewes, young cull ewes and wethers) less the total variable costs (e.g., shearing, dipping, crutching, jetting, mulesing and selling charges for wool and sheep).

Costs such as fencing and water repairs, depreciation, administration etc. are not included. These latter costs are often referred to as fixed costs whereas the former are known as variable costs as they vary with the number of sheep shorn, lambs mulesed, the amount of wool sold etc.

ii) Net Return per Unit of Enterprise:

If the net return to an enterprise is divided by the number of units in that enterprise a net return per unit of enterprise is obtained. For example, if 2000 ewes were joined each year and the net return was $10,000, the net return per unit is $5.00.

2. Enterprise Choice: (Cont.)

The definition of an enterprise unit is most important. In the listed alternatives a unit is defined as:

i) A wether;

ii) A breeding ewe (that is, the ewe with her associated lamb, wether and replacement ewe);

iii) A breeding ewe (that is, the ewe with her associated lamb, wether weaner and replacement ewe);

iv) A breeding cow (that is, the cow with her associated calf, yearling and replacement heifer).

Assumptions on lambing time, shearing time, culling procedures, death rates and reproductive performance enable a flock or herd composition for each enterprise to be defined for each month of the year. From this flock or herd composition and using assumed West Darling costs and prices, a series of net returns per enterprise unit was calculated for each enterprise for different levels of:

i) Reproductive performance;

ii) Differentials between wool cuts of ewe and wether flocks;

iii) Wool and beef prices.

These net returns are shown on Table 1.

A summary of assumptions made in calculating figures for Table 1 is shown below.

Summary of Assumptions made for Construction of Table 1

i) Wether Enterprise:

Flock size	- 2400 wethers
Replacements	- bought at 7 months, sold at $4\frac{1}{2}$ years
Losses	- 2% per annum.

2. Enterprise Choice: (Cont.)

Breeding Flock Enterprises:

Flock size	- 2400 breeding ewes
Lamb shearing	- shearing before 6 months of age
Age of first joining	- 19 months
Age of culling old ewes	- 5½ years
Young ewe culling rate	- varied between 8% and 45%, depending on reproductive performance of the flock in order to maintain breeding flock at 2400
Death rates	- lambs, lamb marking to 1 year 6% - grown sheep - 1 yr. - 2 yrs. 2% p.a. 2 yrs.- 3 yrs. 3% p.a. 3 yrs.- 4 yrs. 4% p.a. 4 yrs.- 5 yrs. 5% p.a.
Crutching wool cut	- ¾ lb. throughout
Lamb wool cut	- 2 lb.
Ram percentage	- 2½
Value of aged ewes (5½ yrs.)	- $5.00
Value of young cull ewes (1 yr.)	- $7.70
Value of wethers (7 months)	- $5.50
Value of wethers (19 months)	- $6.60
Value of wethers (4½ yrs.)	- $4.00

TABLE 1

ENTERPRISE	PRODUCTION LEVELS		NET RETURN PER ENTERPRISE UNIT $						
	Wool cut per head of grown sheep lb	Reproductive performance %	Gross Wool Price ¢/lb (ex crutchings).				Beef Price $/100 lb dressed wt.		
			30	40	50	60	24	32	40
Wethers	14	-	1.90	3.30	4.70	6.10	-	-	-
	15	-	2.16	3.66	5.16	6.66	-	-	-
	16	-	2.42	4.03	5.62	7.22	-	-	-
	17	-	2.69	4.39	6.08	7.78	-	-	-
Ewes (1)	13	60	7.87	8.97	10.07	11.17	-	-	-
	13	70	8.84	9.94	11.04	12.14	-	-	-
	13	80	9.81	10.91	12.01	13.11	-	-	-
	13	90	10.77	11.87	12.97	14.07	-	-	-
	13	100	11.74	12.84	13.94	15.04	-	-	-
Ewes (2)	13	60	6.80	7.55	8.30	9.05	-	-	-
	13	70	7.53	8.28	9.03	9.78	-	-	-
	13	80	8.26	9.01	9.76	10.51	-	-	-
	13	90	8.99	9.74	10.49	11.24	-	-	-
	13	100	9.72	10.47	11.22	11.97	-	-	-
Beef Cattle	-	60	-	-	-	-	27	38	49
	-	70	-	-	-	-	31	45	58
	-	80	-	-	-	-	36	51	66
	-	90	-	-	-	-	41	58	75
	-	100	-	-	-	-	46	65	84

2. Enterprise Choice: (Cont.)

ii) Beef Enterprise:

Herd size	- 40 breeding cows
Age of first joining	- 2 years
Age of culling old cows	- 8½ years
Losses	- 5% per annum
Liveweight of yearlings	- 500 lb.
Heifer culling rate	- varied between 0-60% depending on reproductive performance in order to maintain breeding herd at 40 cows.
Bull percentage	- 2½
Value of bull	- $400.00

From Table 1 it is possible to estimate break-even points. For example, assuming a wool price of 50 cents per pound, a wether clip of 15 lbs. and a reproductive performance of 70% for Ewes 1, we can say that it is preferable to run wethers if it is possible to run more than 11.04/5.16=2.17 wethers in place of one ewe unit. For a wool price of 40 cents per lb., the break even point would be 9.94/3.66 = 2.44 wethers per ewe.

a) Resources

Apart from the application of this technique these returns are of little value in comparing enterprises unless they are viewed in terms of the resources for which they compete. These resources such as feed, water, capital and labour are demanded in different quantities by each unit of each enterprise. But there is only a certain amount of each resource that is available. The concept of maximising profits in such situations rests on the allocation of these resources in the most optimal manner.

Labour and capital may be limiting in some cases, but with the generally improved state of watering facilities on West Darling stations, it is suggested that

2. Enterprise Choice: (Cont.)

a) Resources

in most cases it is feed that is the most limiting resource. How can best use, in terms of dollars in the pocket, be made of this feed?

b) Feed Requirements

If the feed used by a wether in one month is taken as one feed unit, other enterprises can be expressed in terms of the number of feed units used for each breeding ewe unit or breeding cow unit. Returns from different enterprises can then be expressed in terms of a value per unit of feed used.

Accepted estimates of the relative feed requirements for different stock classes are shown in Table 2.

TABLE 2

COMPARATIVE FEED REQUIREMENTS

Class of Stock	No. of Feed Units Required per Month
Wethers, dry ewes and rams	1.0
Ewes, 1 month before lambing	1.4
Ewes, rearing a lamb to six months	1.6
Weaners, 6 - 12 months	1.0
Cow	8.0
Cow rearing a calf to six months	15.0
Calf 6 - 12 months	5.0

As feed requirements for a flock or herd vary on the one station from month to month depending on the husbandry and selling programme, and also because husbandry programmes vary from station to station, monthly feed demands during the year are not regular. However, due to irregular seasonal conditions it is uncertain whether the feed supply will be greater at any one time of the year than at any other time. Also, average stock numbers in the

2. Enterprise Choice: (Cont.)

b) Feed Requirements

West Darling, as used in this analysis, are geared to long term feed production expectancies rather than monthly or even seasonal feed production.

It is necessary to calculate the average monthly feed requirements per unit of each enterprise from the monthly flock and herd compositions. These requirements are shown in Table 3.

TABLE 3

FEED REQUIREMENTS FOR ENTERPRISE

Enterprise	Average Monthly Feed Requirements					
		Reproduction Rate				
		60	70	80	90	100
Wethers	1.0	-	-	-	-	-
Ewes (1)	-	1.94	2.05	2.15	2.25	2.36
Ewes (2)	-	1.66	1.72	1.77	1.83	1.88
Beef	-	15.50	15.75	16.00	16.25	16.50

c) Enterprise Profitability

The net return per feed unit is then calculated by dividing the net return per enterprise unit by the corresponding number of feed units used. Results are shown in Table 4, on the next page.

In most cases, breeding ewes appear the most profitable, but as wool prices increase, wethers increase in profitability. Similarly, as the differential in wool cut per head of wethers with respect to ewes increases so does the profitability of wethers. Given present wool prices, a high differential of 3 - 4 lb. per head between ewes and wethers, and extremely low lambing performances by a breeding flock, wethers could be given some consideration.

There is little difference in returns from ewes 1 and ewes 2. Given an average lamb marking performance of less than 80% of ewes 1 is more profitable than ewes 2 provided wool prices are above

TABLE 4

NET RETURN PER FEED UNIT

ENTERPRISE	PRODUCTION LEVELS		NET RETURN PER FEED UNIT						
	Wool cut per head lb.	Reproduction Rate %	Wool Price cents/lb.				Beef price $/100 lb.		
			30	40	50	60	24	32	40
Wethers	14	-	1.90	3.30	4.70	6.10	-	-	-
	15	-	2.16	3.66	5.16	6.66	-	-	-
	16	-	2.42	4.03	5.62	7.22	-	-	-
	17	-	2.69	4.39	6.08	7.78	-	-	-
Ewes (1)	13	60	4.06	4.63	5.19	5.75	-	-	-
	13	70	4.31	4.85	5.39	5.92	-	-	-
	13	80	4.57	5.08	5.59	6.10	-	-	-
	13	90	4.78	5.27	5.76	6.25	-	-	-
	13	100	4.99	5.45	5.91	6.37	-	-	-
Ewes (2)	13	60	4.10	4.55	5.00	5.45	-	-	-
	13	70	4.39	4.82	5.25	5.68	-	-	-
	13	80	4.66	5.09	5.51	5.94	-	-	-
	13	90	4.92	5.33	5.73	6.14	-	-	-
	13	100	5.17	5.57	5.97	6.36	-	-	-
Beef Cattle	-	60	-	-	-	-	1.74	2.45	3.16
	-	70	-	-	-	-	1.97	2.86	3.68
	-	80	-	-	-	-	2.25	3.19	4.12
	-	90	-	-	-	-	2.52	3.57	4.62
	-	100	-	-	-	-	2.79	3.99	5.10

2. Enterprise Choice: (Cont.)

c) Enterprise Profitability

about 38 ¢/lb. This means it will pay to keep the wethers the extra year under these conditions. However, if wool prices fall below about 38 ¢/lb., ewes 2 has the advantage which is increased further when lamb marking percentages are greater than 80%. It is stressed that these cut-off points are only rough and should only be viewed tentatively.

No provision has been made in these calculations for the construction of cattle yards, loading ramp, etc. It appears that only extremely high beef prices combined with high calving rates and low wool prices could improve the outlook for a beef cattle enterprise.

The results are summarised in Table 5, on the next page.

A vital question concerning these results is whether the relative feed requirements used are applicable to the West Darling. Factors such as feed destroyed due to trampling could narrow the relative feed usage of different classes of animals. If a pastoralist claims to have a reasonably accurate judgement of the number of ewes, that he could expect to join in a given season (taking into account indirectly the associated replacement ewes, weaners etc.) in comparison with the number of wethers or beef cattle units that could be run, it would be more meaningful to use Table 1 and the break-even method as outlined earlier.

Other factors influencing enterprise choice are other resources such as land type, labour availability, investment capital, as well as factors such as the flexibility and ease of management. The importance that many of these latter factors assume will be dependent on the particular station organisation and the likes, dislikes and aims of the management.

d) Conclusion

Because of the necessarily large number of assumptions and the uncertain substitution rates for different classes of livestock, firm conclusions cannot be reached. However, it appears that a breeding flock would give a greater return

TABLE 5

PRODUCTION LEVELS		ENTERPRISE WITH HIGHEST RETURN TO FEED USAGE			
		Wool Price cents/lb.			
Wool cut per head differential lb.	Reproductive rate for ewes	30	40	50	60
1	60	ewes 2	ewes 1	ewes 1	W
1	70	ewes 2	ewes 1	ewes 1	W
1	80	ewes 2	ewes 1 or 2	ewes 1	ewes 1 or W
1	90	ewes 2	ewes 2	ewes 1	ewes 1
1	100	ewes 2	ewes 2	ewes 2	ewes 1 or 2
2	60	ewes 2	ewes 1	ewes 1	W
2	70	ewes 2	ewes 1	ewes 1	W
2	80	ewes 2	ewes 1 or 2	ewes 1	W
2	90	ewes 2	ewes 2	ewes 1	W
2	100	ewes 2	ewes 2	ewes 2	W
3	60	ewes 2	ewes 1	W	W
3	70	ewes 2	ewes 1	W	W
3	80	ewes 2	ewes 1 or 2	W	W
3	90	ewes 2	ewes 2	ewes 1	W
3	100	ewes 2	ewes 2	ewes 2	W
4	60	ewes 2	ewes 1	W	W
4	70	ewes 2	ewes 1	W	W
4	80	ewes 2	ewes 1 or 2	W	W
4	90	ewes 2	ewes 2	W	W
4	100	ewes 2	ewes 2	W	W

2. Enterprise Choice: (Cont.)

d) Conclusion

than either wethers or beef cattle; with lower wool prices and high flock reproduction rates it may be most profitable to sell wether progeny before 12 months of age. In fact, this conclusion falls in line with a management system that is widely practised in the West Darling.

CHAPTER SIX

DECISION-MAKING

Management has been defined as "the process of selecting appropriate means in order to achieve a desired end". The probable objective or goal for most pastoralists would be the maximisation of net income over time subject to short term survival. Decision-making is the process of selection of the appropriate means of achieving goals.

Because of the nature of the West Darling environment, decisions are often made under conditions of great uncertainty. What then, are the types of decision alternatives facing the pastoralist, how are these decisions usually made and what implications do these decision types have with regard to the goals of management?

For the purposes of this analysis, management decisions have been classified into three groups:

1. Structural Decisions

   These decisions usually apply for long time periods (a period of years) and usually reflect a part of the static structure of the station.

   Examples would be -

   i) Cattle v. Sheep;

   ii) Strain of sheep and fibre fineness;

   iii) Permanent labour v. casual labour;

   iv) High long-term stocking rate v. low long-term stocking rate;

   v) High level of capital invested in improvements v. low level of capital invested in improvements.

2. Strategic Decisions

   These decisions are usually made on a long-term basis but are subject to annual change.

   Examples would be -

   i) Age of culling old ewes;

   ii) Proportion of wethers run in the normal flock;

   iii) Age of selling wethers if not kept past two years;

2. Strategic Decisions (Cont.)

iv) Time of joining;

v) Time of shearing;

vi) Other general annual husbandry policies, timing and techniques.

3. Tactical Decisions

These decisions are those made on the short-term due to environmental and market fluctuations.

Examples would be -

i) The timing of destocking in a deteriorating feed supply situation;

ii) The timing of restocking procedures after a seasonal break;

iii) Whether to sell, agist or feed in execution of a destocking decision;

iv) Whether to breed up normally, join immediately the season breaks, or buy straight away in execution of a restocking decision.

v) Other adjustments to general animal husbandry policies, timing and techniques.

a) Decision Media

It is probable that individual decisions are usually reached through one or more of four media:

i) Tradition;

ii) Experience;

iii) Planning and Deduction;

iv) Personal Preference.

The medium of tradition plays a large role in present West Darling management policy; e.g., strain of sheep, time of shearing, stocking policy. There are often good reasons for traditional practices, especially on an individual station with specific characteristics and problems. However, tradition is often a limiting factor in good decision-making.

Decision Making (Cont.)

a) Decision Media

Experience is an essential ingredient influencing decisions, especially in many tactical decisions pertaining to stock management. Many management problems can only be handled successfully with the aid of experience; e.g., shearing organisation, assessment of condition of stock, etc. However, experience in itself can often be misleading in such an uncertain environment. It would take many more years than a normal lifetime to experience even a small sample of the possible decision situations that can be forced upon a pastoralist. An important element of this medium is the analysis and classification of experience, especially the evaluation of results of past decisions.

Planning and deduction requires the observation of relevant facts and opinions from both experience and technical information, and then specifying and analysing possible solutions to the problem. For example, objective measurements of future chances of effective rainfall, market values for sheep, availability and cost of agistment, and drought severity in other regions could aid a pastoralist to make a decision as to the optimal destocking method at a particular time.

The existence of risk and uncertainity is no excuse for not planning. It would seem more desirable to formulate a plan (even if it is only based on assumptions) continue to look for new facts or better assumptions, and change the plan accordingly if the need arises.

Personal preferences often affect decisions made in risky situations. If two courses of action exist, the first appearing superior but more risky, the personal attitude to risk will influence the final decision. Also, personal preferences are often identifiable with structural decisions; e.g., comparitive like and dislike of sheep and cattle.

By their very nature, structural decisions will probably have a greater effect on income over a period of years rather than in any one year. With the scarce technical information available, especially when applied to an individual station, it is possible that decisions based on experience could

Decision Making (Cont.)

a) Decision Media

be approaching the optimal. However, long-term market changes and predictions together with production potential from new technology must be kept in sight if worthwhile changes are to be made to a traditional station structure.

Strategic decisions, defined as often of a fixed nature, are also likely to affect long-term income. It is the "subject to seasonal change" that earmarks these decisions. What degree of annual adjustment in such factors as animal husbandry practices and flock composition should be made in response to seasonal (and price) conditions? In this respect, tactical decision-making takes over.

Tactical decisions resulting in both good and poor outcomes will be made, thus contributing to fluctuating annual incomes. It is here that tactical decision-making differs from the other types in that they markedly affect specific annual income levels. The question is whether there are any methods of consistently achieving good outcomes from these decisions and hence raising the average income over a period of years.

The degree of income fluctuation will perhaps be of more concern to some pastoralists than average annual income itself. In this case tactical decision-making is of utmost importance and may justify a full-scale effort in collecting the facts and opinions available and making corresponding deductions in formulating a plan.

The analysis and evaluation of past decisions together with a keen eye on results of expanding technology, may well provide the optimal medium for making better decisions.