SOME RECENT DEVELOPMENTS FOR STUDYING AND ENHANCING WOOL PRODUCTION

INTRODUCTION

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Australia's receipts from wool in the last financial year totalled $2 billion. Recent predictions by the International Wool Secretariat indicate that there is room for optimism about the future of wool as a dollar earner. The reserve price scheme has certainly provided a very valuable measure of viability. It has also provided research workers with a benchmark for objectively determining the value of endeavours designed to economically and practically increase production.

Each sheep incurs for the producer an annual running cost of $4-$6. This situation obviously applies irrespective of annual wool production of the individual; the object of this exercise is to examine the prospects of increasing nett returns per head. The contract embraces some new areas of technology and attempts to exploit these within a practical framework. The first part of our presentation describes some basic research comparing peripheral and systemic inputs as determinants of fibre production. In the second section we have concentrated on applied research and, in particular, examined ways of practically administering formulations designed to enhance production. Finally, we have presented some preliminary information concerning tensile strength measurements of grazing sheep. This is included in the contract since we have a data bank which could interest research workers studying wool production and because we identified some unexpected findings which could have economic considerations for producers.

Some basic procedures

Parenteral or Post-ruminal administration of the sulphur amino acids methionine and cyst(e)ine has a substantial effect on the wool growth of sheep under experimental conditions. Positive responses ranging from 20% to 200% have been reported although the mean increase has been around 60-70% (see Reis 1979). However, the roles of peripheral and systemic factors in mediating these responses to the administration of exogenous amino acids are not understood. We believe it is important to study wool production in vivo in such a way as to divorce peripheral from systemic inputs. The desire to do this obviates the problem that the systemic mediation of substrate availability can trigger off a cascade of molecular events which can in turn contribute to the final expression of fibre production. We have therefore described ways in which both systemic and peripheral availability of amino acids can influence fibre production. The peripheral events are monitored by autoradiographically measuring production in a discrete area of skin the afferent vasculature to which is catheterised to enable the administration of amino acids at dose rates which have virtually no effect on systemic circulating levels. This type of preparation permits several measurements of wool growth to be accurately made over short periods of time. The average period of catheter patency is 26 days; the frequency of isotope tracing can be reduced to 3 days. Hence several production periods can be monitored in each preparation. Animals are routinely catheterised bilaterally so that saline infusion on the contralateral side can be used as the basis for control measurements. Ipsilateral catheterisation of both 'efferent and afferent vasculature provides a further dimension to the understanding of peripheral events. The site of catheterisation is the cutaneous branch of the deep circumflex iliac artery which serves the skin of the flank and anterior border of the hindlimb.

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Validation of the technique was substantiated by making measurements of blood flow (radioactive microspheres, isotope dilution); normal fibre production (labelled cysteine administration) in catheterised and non-catheterised sites; and the area of skin served by the afferent vessel (dye perfusion, label assimilation in the delineated site). In addition, latex perfusion studies were done to establish the vascular tree structure of the region.

It has been necessary to make accurate determinations of fibre production by autoradiography. This has been done by treating fibre volume calculations as a series of truncated cones and developing a computer program to effectively handle the vast amount of data generated. The measurements presented in this contract represent the integration of some 5000 individual observations.

Some applied procedures

The early amino acid studies of Reis and Schinkel (1963) focused investigations on amino acid protection to prevent ruminal breakdown to ammonia. Ferguson (1975) reviewed the current knowledge on protection of dietary proteins and amino acids against microbial fermentation and the wool growth responses that had occurred in pen experiments. Wheeler et al. (1979) evaluated the wool growth response to several methionine formulations designed to resist rumen degradation. These paddock studies demonstrated increases (c. 36%) in wool growth under some conditions. A smaller increase (c. 13%) in wool growth was measured when methyl and ethyl esters of methionine were fed via a molasses/salt lick to nutritionally stressed lactating ewes at Julia Creek (Stephenson et al. 1981). However, the irregular intake of supplement when voluntary feeding systems are used (e.g., Nolan et al. 1975) is a significant factor constraining the practical adoption of the use of licks for economic gains in wool production.

Our basic research endeavours have been supported by practical efforts designed to economically administer wool growth formulations to sheep. To date these efforts have concentrated on using methionine as the basic ingredient. The cost of this compound and the fact that "high transsulphurating" sheep can make valuable use of it have prompted its evaluation as a model for testing delivery systems. Future developments may see the inclusion of other compounds designed to maximise the rate of transsulphuration and cysteine assimilation.

A large part of our supplementation program has revolved about the concept of water medication which has been developed to accurately administer 2-3 g methionine per day to sheep. This concept offers potential advantages in terms of compulsory, regular and correct dosing of medicament. We have attempted to exploit the possibility of "flushing" methionine through the rumen in a l-3 litre drink as either free acid or a homogenate in oil. Realising that this route of administration may have seasonal and regional limitations we have taken steps to minimise these by enticing sheep to consume medicated trough water in preference to surface water (addition of sucrose to the reservoir) and by maximising water intakes (provision of salt licks and electrolytes).

Finally, we have expanded our field studies to examine the tensile strength of wools under grazing situations. The advent of sale by description will place added emphasis on the quantitative assessment of tensile strength. It is likely that wools of high tensile strength will attract higher prices than counterparts of lower tensile strength although the "sliding scale of returns" has not yet been calculated. Any attempts to examine ways of improving nett returns from wool should pay cognisance to this factor and should evaluate ways in which on-farm management procedures can be developed to exploit the concepts of sale by description. The preliminary information presented here provides some insight into the scope for furthering research in this area.

If the general thrust of the programme outlined here were eventually to gain some degree of practical adoption then we could envisage a situation where 2 tooth wethers were routinely fleece weighed to draft off an elite nucleus of sheep for preferential management. These sheep would respond readily to supplements designed to increase their rate of wool production. In order to ensure regular and compulsory intake of the supplement they would be placed in a water medication paddock. Medication procedures would also embrace the use of drenches and oral blowfly control measures without the need to muster. They would also permit supplementation with NPN, sulphur, and phosphorus, etc., as required. It is our hope that this type of management strategy would increase nett returns per head by up to $2 per year. Perhaps we could cover the annual cost of shearing!

A STUDY OF THE PERIPHERAL UTILISATION OF SULPHUR AMINO ACIDS FOR FIBRE PRODUCTION IN THE SHEEP

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MATERIALS AND METHODS

Preparation of the isolated cutaneous site (ICS)

The cutaneous branch of the deep circumflex iliac artery passes ventrally on the medial face of the tensor fasciae latae muscle and serves the skin and subcutaneous tissues over the ventrolateral wall of the abdomen and cranial aspects of the thigh (May 1964). Using normal aseptic surgical procedures, a modified 26G pediatric cannula was inserted in a retrograde fashion into one of the small arterial branches supplying the tensor fasciae latae muscle. It was suitably anchored so that the tip of the cannula lay at the arterial bifurcation. The cannula was exteriorised in the dorsal lumbar region. The area of skin served was delineated by the infusion of 5 ml of sterile 0.2% w/v Evans blue in normal saline through the cannula. The outline was traced on paper and the area measured with a direct reading planimeter. Cannulae were inserted bilaterally into each sheep and patency was maintained by the continuous infusion of sterile normal saline until the experiment began after a recovery period of 7 days. The patency of each cannula was monitored twice during each experiment by a brief infusion of the dye.

Experimental procedures

Studies were conducted using adult Peppin Merino wethers of 30-40 kg live weight. Each sheep was housed individually and offered a daily ration of 800 g lucerne pellets. There were four experiments in all. The sheep in experiment 1 were surgically prepared with a chronic indwelling catheter in the jugular vein for systemic infusion. In experiments 2, 3 and 4, all animals were prepared with bilateral isolated cutaneous sites (ICS).

Each experiment was divided into three or four sequential periods of 4 to 5 days, each delineated by the administration of L-(^{35}S)-cysteine as a marker for the autoradiographic measurement of wool growth. Sheep receiving systemic infusions were given individual intravenous doses of 100 µCi. Sheep prepared with ICS were given 10 µCi per side over a period of 30 minutes.

In experiment 1, 12 sheep were allocated by stratified randomisation on wool production to four groups of three animals each. Sterile normal saline was infused during period 1. This served as a control period. During periods 2, 3 and 4,

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groups received either saline or 1, 2 or 3 g L-cysteine/d in sterile saline via the jugular catheter.

In experiments 2, 3 and 4 sterile saline was infused into each ICS during period 1. This served as a control period. For the remaining periods, one side of each sheep was infused with a sterile amino acid solution while saline infusion was maintained on the contralateral side. The data of Reis et al. (1973b) indicated that the infusion of an optimum quantity of cysteine (1.5–2.0 g/d) will increase plasma concentrations of this amino acid two to threefold. Consequently, the minimum dose of cysteine infused via the ICS (100 mg/d) was based on a knowledge of the cutaneous blood flow (Hales 1973) and was consistent with the desired changes in plasma concentration. Infusions of methionine and glutathione were isosulphurous with cysteine.

In experiment 2, two groups each of three sheep received ICS infusions of either 100 or 200 mg cysteine per day. Experiment 3 examined the extent to which reduced glutathione (254 mg/d) influenced fibre production in two sheep. This rate of administration was equivalent to providing 100 mg cysteine per day. In experiment 4 methionine was infused through the ICS at 123 mg/d (two sheep), and 246 mg/d (four sheep).

One week after the end of each experiment, six wool staples were plucked and pooled from each flank site. The growth of 50 individual fibres from each sample was measured using autoradiographic techniques. The maximum responses in wool growth were calculated by simple proportion taking into account changes in the wool growth of control animals (systemic infusion) or on control sides of the ICS sheep. The values were then expressed as a percentage.

RESULTS

The mean wool growth (ng/fibre/d) of each group in periods l-4 of experiment 1 are given in Table 1. Wool growth increased by 46%, 48% and 56% in response to systemic infusions of either 1, 2 or 3 g cysteine per day.

TABLE 1 Effect of systemic cysteine infusion on wool growth (ng/fibre/d)

Cysteine (g/h/d)	Period				Response (%)
	1	2	3	4	
0	138	141	138	139	
1	165	195	233	241	+46
2	173	220	254	257	+48
3	176	222	265	275	+56

Infusing 100 mg cysteine per day per ICS increased fibre growth by 11%, 26% and 39% in three sheep (Table 2). Increases of 40%, 44% and 61% were recorded in response to 200 mg cysteine per day. ICS infusions of glutathione which were isosulphurous with 100 mg cysteine increased fibre production by 30% and 32% in two sheep.

Infusions of methionine per ICS which were isosulphurous with 100 mg cysteine increased fibre growth by 11% and 15% in two sheep (Table 3). Higher doses of methionine (246 mg/d) produced responses in four sheep ranging from -5% to +11%.

TABLE 2 Effect of cysteine infused per ICS on wool growth (ng/fibre/d)

Animal/side	Dose (mg/d)	Period				Response (%)
		1	2	3	4	
110 C	0	190	182	171	186	
110 T	100	147	174	183	200	+39
28 C	0	149	153	191	177	
28 T	100	170	184	231	224	+11
163 C	0	104	108	89	94	
163 T	100	89	101	92	101	+26
169 C	0	113	110	127	122	
169 T	200	149	165	223	231	+44
75 C	0	102	96	101	114	
75 T	200	114	116	129	178	+40
136 C	0	108	89	90	99	
136 T	200	133	136	154	196	+61

C = control side; T = treated side

TABLE 3 Effect of methionine infused per ICS on wool growth (ng/fibre/d)

Animal/side	Dose (mg/d)	Period				Response (%)
		1	2	3	4	
21 C	0	160	169	160	155	
21 T	123	169	187	195	188	+15
22 C	0	213	213	204	195	
22 T	123	185	205	193	186	+11
41 C	0	186	166	161		
41 T	246	187	190	178		+10
181 C	0	216	182	162		
181 T	246	207	159	147		- 5
48 C	0	185	202	186		
48 T	246	120	146	129		+11
101 C	0	157	179	193		
101 T	246	164	187	195		0

C = control side; T = treated side

DISCUSSION

The development of the isolated cutaneous site described in this paper enables quantitative responses to substrates to be measured after their administration directly into the afferent stream supplying a discrete area of wool-growing skin. A period of patency of 26 days (Hoey and Hopkins 1983 in press) is sufficient time to observe both qualitative and quantitative effects of various treatments on parameters such as fibre growth, fibre morphology and ectoparasite development.

The experiments reported here provide an initial foray into the area of substrate requirements for wool growth by concentrating on those amino acids of known growth-promoting ability. The data suggest that the action of cysteine in increasing fibre growth is mediated principally via local factors. This does not deny a role for endocrine factors as specific stimulators or modulators of wool growth (Wallace 1979), but indicates that effects such as supplying a limiting amino acid or extra sulphydryl groups (Reis 1979) are responsible for the increases reported here. The response to reduced glutathione suggests that it supplied cysteine for increased production. Whether this metabolic transaction is a normal function is not known. The extent of the response to glutathione raises the question of its possible direct effects on fibre production as well as any effects arising from its contribution to the regional cysteine pool. These preliminary studies warrant further investigation to support or refute these ideas.

The inability of peripherally administered methionine to stimulate fibre growth is in marked contrast to its effect when given systemically. Reis et al. (1973a) reported similar positive responses to abomasal supplements of l-2 g/d of methionine, cystine or cysteine. The findings of others (Williams et al. 1972) have slightly favoured methionine. As the principal role of methionine in this regard is to supply cysteine via the transsulphuration pathway, our data indicate that the capacity of this metabolic conversion in the skin is limited. Downes et al. (1964) first demonstrated the ability of the skin to transsulphurate intradermal doses of (^{35}S)-methionine. Approximately 90% of the label incorporated into the fibre was identified as (^{35}S)-cystine. However, incorporation rate was very low. The data offer only qualitative evidence of the existence of this pathway in the skin and do not permit calculation of the quantitative nature of the transaction when relatively high concentrations of cold methionine are circulating through the vascular bed of the skin.

The reasons for the very low levels of cutaneous transsulphuration are open to speculation. They may reflect the low activity of a rate-limiting enzyme in the pathway, or alternatively, an insufficient supply of cofactors necessary for maximum enzyme function. The supply of pyridoxine (Vitamin B6) and cobalamin (Vitamin B12) may be important in this regard.

While our studies to date have suggested that only cysteine is active at the follicle level, practical supplementation programmes based on this amino acid are precluded because of their high cost. Methionine is the only amino acid likely to satisfy this primary economic criterion. As such, the transsulphuration pathway becomes the exploitable target for basic wool growth research. In addition, the need to protect this amino acid from ruminal degradation and to ensure its efficient absorption from the small intestine are problems which are receiving our attention. A number of approaches have been tried and these are the focus of the next section of this contract.

SOME PRACTICAL ASPECTS OF ADMINISTERING WOOL GROWTH FORMULATIONS

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MATERIALS AND METHODS

(i) In order to gain preliminary information about the extent to which methionine is degraded in the rumen when ingested as a 2 litre drink the following procedures were adopted. Four rumen-fistulated wethers were maintained on a low

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nitrogen (1.0% N) barley stubble diet. They were then allowed to drink 2 litres water containing either 0 or 5 g methionine per litre. This procedure was carried out in a latin square sequence. This sequence was repeated by drenching the sheep with 200 ml water containing either 0 or 10 g methionine. The extent of ruminal degradation of methionine was measured by recording sequential changes in rumen ammonia concentrations during the 6 hours after amino acid ingestion.

(ii) Peppin Merinos at the "Toorak" Research Station were run in large pens and offered a maintenance diet of 400 g lucerne + 800 g of mature Flinders grass hay daily. These sheep were randomly selected from a line of 3 year old wethers of average live weight 44 kg. They were watered at troughs harnessed to water medication devices. These devices measured water intakes and allowed for medication of the trough water at a rate which was commensurate with intake. This procedure enabled a methionine supplement to be administered to the treated sheep at a rate of 2-3 g/day. Aqueous methionine was firstly homogenised with paraffin oil at a w/v ratio of 1:1 in a standard milk homogeniser operating at 21000 kPa.

Ten sheep were allowed a settling in period of 28 days during which no measurements were recorded. During the next 28 days fibre production measurements were made using the clipped patch technique. Animals were then stratified into two groups on the basis of these pre-treatment clean wool yields. One group received no medication in its drinking water, the other consumed the methionine supplement. Clean wool production was then measured during the next 28 days in order to gauge the response to supplementation.

(iii) The studies were supported by in vitro measurements in which methionine and methionine-oil complexes (1:1 ratio) were incubated in rumen liquor to examine the extent of amino acid degradation during a 3 hour period of incubation. This assay monitored ammonia production rates and was based on the use of 40 mg methionine in 50 ml of a 1:4 rumen liquor:buffer solution.

RESULTS

(i) Sheep consuming 2 litres water containing 10 g methionine showed a 5% elevation in rumen ammonia concentrations. The 2 litre intake without methionine reduced ammonia concentrations by 27%. In contrast to these results ammonia concentrations subsequent to a 200 ml drench with and without 10 g methionine were altered by +31% and -1% respectively. Changes in the rumen concentration were first evident within 1 hour of ingestion. Values peaked at 2-3 hours. Mean concentrations of peak values were used in the calculations.

(ii) The average daily intake of methionine via drinking water was 2.7 g/hd. This intake increased clean wool yields by 30.2%. The increase was significant ($P \leq 0.05\%$) and was calculated on the basis of comparisons made with the contemporaneous controls consuming non-medicated water. Sheep readily drank the medicated water. Daily intakes of the group consuming water containing methionine and oil were in fact 11% higher than those of control sheep.

(iii) The in vitro studies demonstrated a 90% increase in the ammonia concentrations of rumen liquor treated by the addition of free methionine acid. However, homogenising this acid with paraffin prior to its addition to the liquor increased the ammonia concentration by only 45% thereby indicating a marked reduction in methionine degradation when the amino acid was provided in this form.

DISCUSSION

The in vivo and in vitro experiments reported here provide some insight into the ways in which methionine may be successfully administered to sheep. The use

of water medication as the main vehicle of administration has appeal since it ensures regular and compulsory intake for each sheep. It seems possible that the intake of methionine in a 2 litre drink rather than in a 200 ml drench offers an opportunity for reducing the rate of ruminal degradation of methionine. The effect could obviously be a function of flushing the water soluble components of medicament through the rumen. It should be noted that our attempts to drench sheep with 2 litres of water containing 10 g of methionine were less successful. Voluntary intake of medicament appears to be an important consideration.

The addition of oil to the methionine formulation could be successfully used to enhance the flushing effect. This situation may arise from physical protection provided through the lipid encapsulation of methionine particles. The formulation may also have a tendency to float in the rumen liquor which could decrease rumen retention time and decrease the degree of degradation. The formulation was miscible in the drinking water and readily acceptable to the sheep. The stability of the emulsion was evident by the increase in clean wool production over a 28 day supplementation period. The cost of paraffin used in this formulation was less than 0.5 cents/hd/d.

The in vitro studies with methionine + oil supported the in vivo findings that this formulation was capable of eliciting a marked response in terms of clean wool production. Further in vitro work is indicated since it provides a means of examining other formulations and the methionine:lipid ratio in these formulations.

The use of the water flushing principle together with formulations which can afford some protection from ruminal breakdown highlights the potential of water medication in certain practical circumstances. If we can take the work of Ferguson and colleagues a step further towards practical reality then we will obviously seek to do this by further evaluating methionine supplements in grazing sheep of high and low production status. Our current field trials are following this approach and seeking to elicit practical and economical advantages from 'high transsulphurating' animals given supplements designed to provide the correct amount of methionine post-ruminally and to maximise the utilisation of this substrate for fibre production.

PRELIMINARY OBSERVATIONS *ON* SOME FACTORS WHICH INFLUENCE THE TENSILE STRENGTH OF WOOL

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MATERIALS AND METHODS

The equipment used for measuring tensile strength was purchased from CSIRO Division of Textile Physics. It is a hand operated prototype model from which subsequent developments evolved to produce a fully automated procedure. Three staples were drawn from the mid-side of each fleece and routinely tested. Mean values are presented.

The various groups of sheep used in these observations were selected from a series of on-going experiments. Data relating tensile strength with genotype, stocking rate, dietary crude protein percent intake, live weight, wool production status and physiological state are presented. Further specific information relating to methodology is presented in the Experimental and Results section.

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EXPERIMENTAL AND RESULTS

Initial observations were designed to examine the variations in tensile strength of wool from 163 wethers in a strain comparison trial conducted at the "Toorak" Research Station. Seven different strains of Merino constituting 20-27 sheep per strain were sampled at two successive shearings. Table 1 indicates the large between year variation in tensile strength. Seasonal conditions in 1981-82 were more favourable than in 1982-83. The between bloodline variation was relatively small but strains 4 and 6 obviously maintained tensile strength in the face of seasonal adversity to a greater extent than strains 5 and 7. Strains l-4 were of Peppin bloodline; 5-7 were of South Australian bloodline.

TABLE 1 Mean staple strength measurements of seven strains of Merino wethers

Strain	Staple strength (Newtons/kilotex)		Diff N/ktex
	1981-82	1982-83	
1	63	43	20
2	68	48	20
3	70	49	21
4	70	59	11
5	64	40	24
6	61	43	18
7	65	40	25

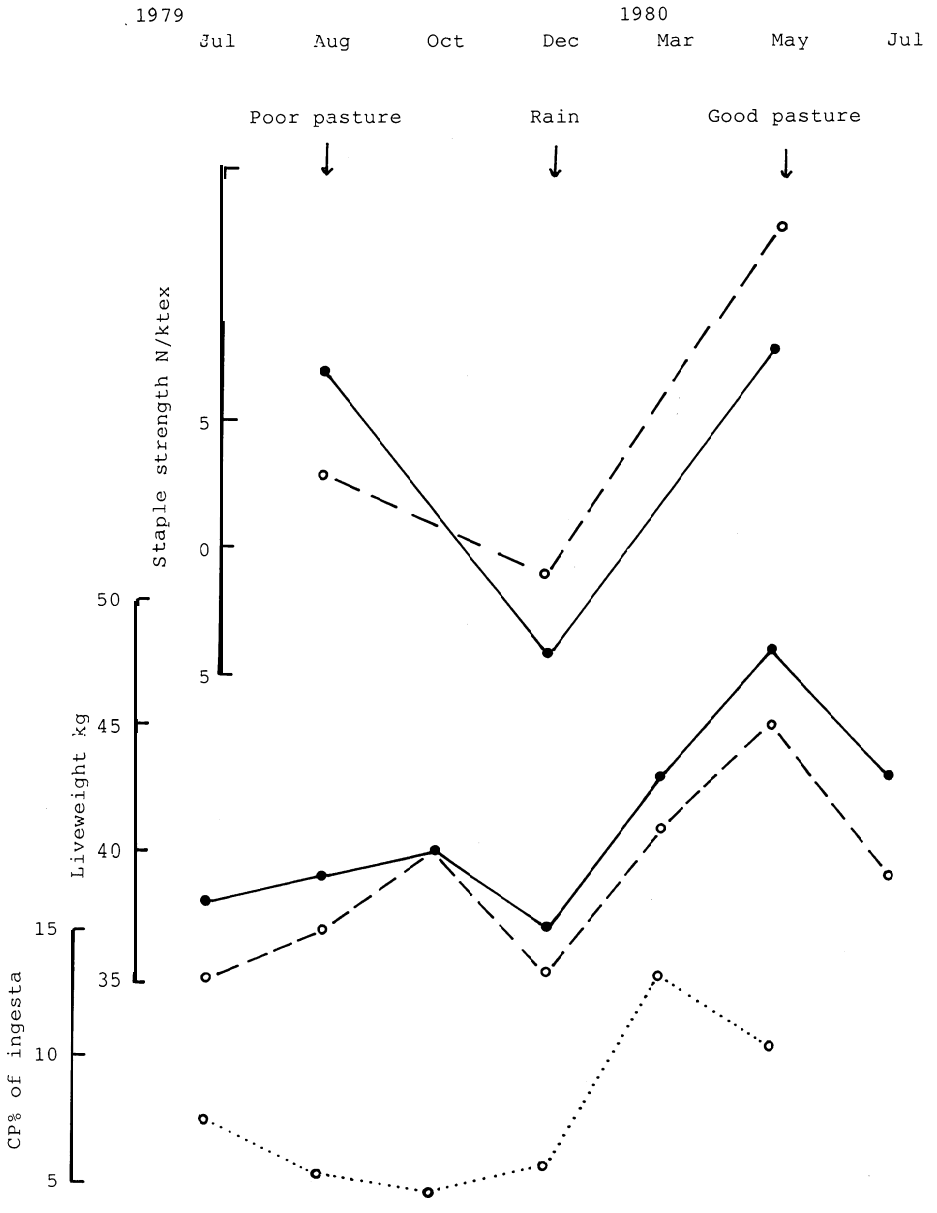
A second experiment was designed to monitor production responses in relation to different stocking pressures. A study conducted at Charleville clearly showed that five monitor sheep depastured at recommended stocking rates grew wool with a markedly lower mean tensile strength rating (27 N/ktex, range 20-32) than two replicated groups of five animals run at half this stocking rate (37 N/ktex, range 30-43; 48 N/ktex, range 42-52).

In a third study a comparison of high and low producing sheep at "Toorak" revealed that production status had some bearing on seasonal changes in staple strength (Fig. 1). The high producing sheep suffered a decrease of 11 N/ktex in tensile strength in association with the break in the season. The low producing counterparts suffered a decrease of only 3 N/ktex during the same period. The sheep were fitted with oesophageal fistulae. The relationships between tensile strength and crude protein percent intake and live weight are also depicted in Fig. 1.

In a further study at "Toorak", groups of 14 sheep were sampled in order to study the effects of pregnancy and lactation on tensile strength. Mean value of non-pregnant animals was 26 N/ktex (range 18-40) and of pregnant and lactating animals 22 N/ktex (range 10-32).

Finally in this series of observations the extent to which flystrike influenced tensile strength was gauged by collecting 24 samples of affected wools submitted through the auction system. Staples selected for evaluation were drawn from the stained flyblown portion and the adjacent non-stained portion of each fleece. Tensile strength measurements were made in order to put an objective assessment on wools visually appraised and prefixed Wl. This procedure enabled us to align our objective results with the scale of discounts applied to these wools according to the A.W.C. schedule.

The mean tensile strength of staples drawn from stained portions was



ig. 1. Staple strength and live weight of high (●——●) and low (o- - -o) producing sheep, and crude protein percent of ingesta (o·····o) in paddock studies at "Toorak" Research Station

3 N/ktex (range 16-31) and from the adjacent non-stained staples 29 N/ktex range 20-50). These data when applied to the A.W.C. schedule of discounts ould indicate that the wools subjectively appraised as W1 actually measured as (non-stained) and W2 (stained). Assessed by the current method of visual ppraisal these wools would have suffered a discount of 20 cents/kg greasy ype 79). Objective measurement however showed that they would be likely to

suffer a discount of approximately 30 cents/kg greasy after the introduction of sale by description. *No* allowance or discount has been made for colour. It should be noted that these penalties apply to within sheep comparisons. Our preliminary observations show the differences between the tensile values of flystruck and non-struck sheep are even greater.

DISCUSSION

The advent of sale by description will focus considerable attention on the importance of tensile strength as a determinant of price premiums and penalties. At this stage there is very little objective information pertaining to the ways in which sheep management strategies will determine the tensile strength of the end product. The initial observations presented here indicate the need to generate a data bank relating to on-farm strategies.

Genetic factors could at least partly determine tensile strength ratings. This study has shown that the bloodlines under study were not dissimilar during good seasonal conditions but that some lines were better capable of maintaining tensile strength than others when adverse conditions prevailed.

The relationship between the crude protein percentage of the diet and the concomitant tensile strength of the wool produced indicate that the lowest strength readings coincided with the break in the season. It is obviously important to generate research programmes designed to evaluate specific supplementation programmes which attempt to circumvent this practical problem.

While our pregnant and lactating sheep did not grow wool of significantly lower tensile strength than the dry sheep this finding occurred when all strength measurements were low. A further evaluation of the parameter under a range of seasonal conditions is warranted since considerations such as time of shearing, time of joining and supplementation procedures could minimise discounts.

The impact of parasite challenge on tensile strength is likely to be a subject of considerable attention. Our preliminary data indicate that hitherto unexpected decreases in strength will heavily penalise producers who do not institute adequate helminth and blowfly control procedures.

As yet there is no commercial evaluation of the cost differential relating to the various degrees of tensile strength as measured in N/ktex. CSIRO research has indicated that 5–10 N/ktex would be frankly tender, lb-15 N/ktex tender and 15-25 N/ktex part tender. It also suggests that the subjective flick method of testing for tenderness as used by wool appraisers is presumed to be approximately 25 N/ktex. This would suggest that wools of greater strength than 25 N/ktex are difficult to assess subjectively, whereas to a manufacturer, the objective information delineating the strength of these sound wools could be commercially exploited. Therefore it can be presumed that a price differential will appear in the market place as more and more wool is sold by description, with premiums for the upper levels of strength and discounts for the very low levels. Management strategies employed by the producer may need modification or alteration to avoid the evident stress periods that could produce a lowering of tensile strength with a consequent lowering of value for his wool production. Our research is designed to make us aware of the factors affecting tensile strength in wool, and to be able to offer objective advice to producers through our extension service.

SUMMARY

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This contract integrates some basic and applied aspects of research designed to maximise nett returns from wool. It describes new procedures for understanding the systemic and peripheral events which determine fibre production. The work has delineated the magnitude of responses to graded doses of cysteine, glutathione and methionine administered peripherally. It questions the ability of the skin to transsulphurate methionine to the extent where cysteine assimilation can evoke marked increases in fibre production. It shows that increases in the concentration of glutathione in the afferent vasculature of the skin cause a marked elevation in fibre production.

The applied work attempts to develop further the efforts of our CSIRO colleagues in providing a practical means of administering methionine to grazing sheep. We have described water medication procedures which enable the supplement to be taken daily in a l-3 litre drink and thereby provide an opportunity for flushing the material through the rumen to minimise degradation by micro-organisms. In addition, we have indicated that the homogenisation of the amino acid with oil may further reduce ruminal degradation.

At this stage we believe there is room for guarded optimism about the possibility of practically and economically increasing per head production. Our preliminary observations indicate that exploitation of this procedure may involve the initial selection of high producing sheep which are best able to utilise the supplements effectively. Further exploitation may come from administering the material when prevailing seasonal conditions provide the optimum nutritional background.

The final part of our applied efforts examines some of the possible management considerations destined to assist producers make the best possible use of sale by description. We have provided preliminary evidence of the ways in which tensile strength might be influenced by a considerable array of management decisions. It is our opinion that the industry will need the extensive support of research endeavours if sale by description is to be introduced commensurate with the best interests of growers.

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