Influence of Measured Characteristics on Price Received for Merino Wool from the Traprock Area of Southern Queensland

P. M. Pepper[1], M. Rose[1] and D. M. D. Mills[2]
[1]Sheep and Wool Institute, Dept of Primary Industries, Locked Mail Bag 4, Moorooka, Qld, Australia 4105
[2]Ennisclare, Gore, Qld, Australia 4352

ABSTRACT: In this study of a commercial wool clip sold in the years 1991/92-1996/97, the effect of wool characteristics, (staple length, staple strength, fibre diameter, position of break, vegetable matter, hauteur, yield and coefficient of variation of staple length) on price was explored together with their effect on the ratio of price received per lot to the average weekly price (1994/95 basis) for clean wool of the same fibre diameter. Fibre diameter and where the point of break occurred had the most effect on price. As hauteur, staple length and yield increased, so did the price ratio but it decreased as the percentage of vegetable matter and the coefficient of variation of the staple length increased. The ratio of proceeds if all wool had been sold at average weekly market price, to proceeds if all wool had been 21μm or less, indicated little financial advantage over the six-year period as most sale lots were under 22μm. To raise the proceeds of sale above the proceeds estimated using average market price for each lot, the analyses suggested that hauteur, staple length and its coefficient of variation, could be considered, in addition to fibre diameter, when sourcing wethers for purchase.

Key Words: Wool Quality, Clean Wool Price, Wool Characteristics

INTRODUCTION

Fibre diameter and length are the two most important characteristics of textile fibres (Adams and Oldham, 1998). Although on a macro basis, fibre diameter is the single most important determinant of price, there is a complex interaction with other wool characteristics influencing the price a producer receives for any lot. This is coupled with the vagaries of buyer demand.

In this paper we explore the interaction of wool characteristics with price for a typical property in the Traprock area of Southern Queensland, Australia to objectively determine where fleece quality can be improved to provide greater financial return. Pastures in good condition consist of short palatable perennial grasses such as *Dichanthium spp*. growing on the shallow hard-setting, loamy, duplex soils. Pastures in poor condition have less palatable grasses such as *Aristida spp.* and *Bothriochloa spp.* and *Eragrostis spp.* (Weston *et al.*, 1981). On most properties in the area, the sheep are kept solely for wool growing and Merino wethers are purchased elsewhere.

To increase their returns from the sale of wool, woolgrowers can influence three areas: wool quality, clip preparation and the timing and method of selling their clip. This study addresses the first.

MATERIAL AND METHODS

Records of wool sales from "Ennisclare", Gore, Queensland, a property in the Traprock country were compiled over a six-year period (1991/92- 1996/97) together with the results of wool analyses including measurements (greasy and clean fleece weight, vegetable matter, fibre diameter, yields) and additional measurements (staple length and strength and position of break). Hauteur was estimated for fleece lines from the TEAM (Trials Evaluating Additional Measurement) equation cited by Couchman *et al.* (1992):

$$H= 0.52SL+ 0.47SS + 0.95FD - 0.19MPB^* - 0.45VM -3.5$$

where H = hauteur (mm), SL = staple length (mm), SS = staple strength (N/ktex), FD = fibre diameter(μm), MPB* = adjusted percentage breaks at midpoint (%) and VM =vegetable matter (%). The value of MPB* is determined from the percentage of staples which broke in the middle portion (MPB) as follows -

for MPB values 0 to 45, MPB*=45

for MPB values 46 to 100, MPB*=MPB

As there are many factors affecting price outside the control of the producer, the ratio of clean (and greasy) wool price per kg received per lot to the average weekly price (1994/95 basis) for clean wool of the same fibre diameter was computed together with the difference between the clean price received and the average weekly clean price. Prices were corrected to 1997/98 values using the yearly average of the consumer price index for Brisbane.

Many of the measured wool characteristics are highly correlated. This is especially the case for derived characters such as H and coefficient of variation of staple length (SLCV). Hence, the influences of these various wool characteristics on the price ratios and differences were investigated using principal component analysis of the correlation matrix after the manner of Dudzinski (1975). The ratios and difference between price received and average weekly price were regressed against those orthogonal principal components which explained the majority of variation in the wool characteristics. The numbers of bales were used as weights in the regression analyses. Most of the data was derived from fleece lines because additional measurements such as staple length, staple strength and point of break were rarely performed on other lines.

Variations from the average price received at a sale for a particular wool type may be due to a number of factors. In order to see if the woolgrower received more or less than the market average at the time of sale, the proceeds over the five-year period were estimated by summing the product of the clean fleece weight of lots and the actual clean price received, corrected to 1997/98 prices. Proceeds were then calculated assuming the lots had been sold at the corrected average weekly price. The ratio of these two figures was then calculated.

Since fibre diameter is the principal determinant of wool value, the impact of keeping all lots at 21μm or less was investigated. Fibre diameter of 21μm was selected as a realistic value for sourcing wethers in Queensland. The proceeds if all wool had been 21 μm or below and sold at the corresponding corrected average weekly price for that micron, were estimated for the six-year period. The ratio of proceeds if wool sold at the average price to the proceeds if all wool had been 21 μm or below and sold at the average price was calculated.

RESULTS

Table 1 shows that the wool characteristics are highly correlated illustrating the need to reduce them to orthogonal predicting variables by principal component analyses. The first five principal components (PC) are also listed in Table 1 with how much of the total variation in the wool characteristics each principal component explained. The first principal component vector reflects the differences between the wool characteristics (hauteur, staple length, yield, and fibre diameter) and those with a negative association with them. (vegetable matter and coefficient of variation). The third component is a measure of strength and the fifth, a measure of fibre diameter and points of break. The second and fourth components are difficult to interpret biologically.

Table 2 shows the correlation between the wool characteristics and measures of price. The significant terms ($P<0.05$) from the regression analyses are given in Table 3. For clean wool price and greasy wool price principal component five could explain 25% and 25% respectively of the variation. Including principal component one increased this to 29% and 41%, and principal component three to 37% and 51% respectively.

For the clean price ratio, greasy price ratio and the difference between clean price received and the average, principal component one explained the majority of the variation (66%, 73% and 62% respectively). With the inclusion of principal component five, 74%, 78% and 70% respectively of the variation was explained. With the inclusion the second component, this was increased to 77%, 87% and 72%, respectively. The coefficients translated back to those for the original variables are given in Table 4.

Table 1. Statistics of predicting variables and principal components (PC) of correlation matrix of wool from a property in the Traprock area of Queensland from 1991/92-1996/97 (Y=yield %, VM=vegetable matter %, FD=average fibre diameter μm, SL=staple length mm, SLCV=coefficient of variation of staple length, SS=staple strength N/ktex, TPB=% breaks at tip, MPB=% breaks at midpoint, BPB=% breaks at base, H=hauteur mm)

	Y	Log (VM+1)	FD	SL	SLCV	SS	Log (TPB+1)	Log (MPB+1)	Log (BPB+1)	H
Mean	71.6	.80	20.6	81	16	35.4	1.4	3.6	3.3	62.8
Range	51.8-78.4	0.18-1.9	18.9-23.5	61-93	11-26	22-48	0-3.8	1.1-4.6	0-4.6	47.7-74.0
Correlation matrix (n=71; figures in bold significant P<0.05)										
Y										
Log(VM+1)	**-0.64**									
FD	**0.45**	**-0.29**								
SL	**0.68**	**-0.60**	**0.39**							
SLCV	**-0.77**	**0.57**	**-0.43**	**-0.59**						
SS	**0.45**	**-0.28**	0.21	0.19	-0.19					
Log(TPB+1)	-0.15	**0.42**	**-0.28**	**-0.39**	**0.24**	0.02				
Log(MPB+1)	-0.12	0.20	**-0.29**	-0.18	0.18	0.19	**0.36**			
Log(BPB+1)	-0.02	**-0.25**	**0.38**	0.20	0.00	-0.05	**-0.65**	**-0.71**		
H	**0.64**	**-0.59**	**0.59**	**0.73**	**-0.46**	**0.59**	**-0.40**	**-0.39**	**0.51**	
Principal components (PC) (loadings >0.30 are in bold type)										
PC1 (45%)	**-0.37**	**0.36**	**-0.31**	**-0.38**	**0.34**	-0.19	0.26	0.20	-0.23	**-0.43**
PC2 (20%)	**0.33**	-0.09	-0.06	0.11	-0.23	**0.34**	**0.36**	**0.49**	**-0.57**	-0.01
PC3.(10%)	0.14	-0.20	-0.18	0.22	**-0.42**	**-0.71**	-0.11	-0.08	-0.21	**-0.35**
PC4 (8%)	0.14	**0.37**	**0.58**	-0.15	-0.21	-0.17	**0.53**	**-0.36**	-0.06	-0.01
PC5 (6%)	-0.16	0.27	**0.59**	0.15	0.01	-0.16	**-0.42**	**0.57**	-0.04	-0.09

Table 2. Correlation matrix of wool characteristics and price of wool (c/kg) from a property in the Traprock area of Queensland from 1991/92-1996/97 (Y=yield %, VM=vegetable matter %, FD= average fibre diameter µm, SL=staple length mm, SLCV=coefficient of variation of staple length, SS=staple strength N/ktex, TPB=% breaks at tip, MPB=% breaks at midpoint, BPB=% breaks at base, H=hauteur mm)

	Y	Log (VM+1)	FD	SL	SLCV	SS	Log (TPB+1)	Log (MPB+1)	Log (BPB+1)	H
Clean wool price	**0.25**	**-0.41**	-0.09	**0.32**	**-0.33**	-0.05	-0.21	**-0.48**	-0.15	0.22
Greasy wool price	**0.52**	**-0.57**	0.05	**0.48**	**-0.52**	0.09	-0.21	**-0.46**	-0.12	**0.38**
Clean wool price ratio	**0.79**	**-0.75**	**0.36**	**0.67**	**-0.66**	**0.48**	**-0.33**	**-0.32**	**0.26**	**0.76**
Greasy wool price ratio	**0.91**	**-0.76**	**0.43**	**0.71**	**-0.74**	**0.50**	**-0.27**	**-0.26**	0.17	**0.76**
Clean wool price difference	**0.76**	**-0.74**	**0.37**	**0.61**	**-0.64**	**0.48**	**-0.38**	**-0.32**	**-0.26**	**0.74**

Figures in bold significant P<0.05

Table 3. The coefficients of the regression equations predicting wool price (c/kg) from the principal components (PC)

Price variate	Constant	PC1	PC2	PC3	PC5	Variation explained
Clean wool price	724±15.4	-18±8.0		47±14.7	-111±21.0	37%
Greasy wool price	518±10.3	-26±5.3		37±9.9	-83±13.7	51%
Clean wool price ratio	0.969±0.007	-0.049±0.003	0.015±0.005		-0.047±0.009	77%
Greasy wool price ratio	0.695±0.005	-0.054±0.003	0.027±0.004		-0.041±0.007	87%
Difference in clean wool price	-28.6±6.2	-39.5±3.2	11.2±4.5		-40.6±8.5	72%

The ratio of the estimated proceeds received over the six-year period to the proceeds if wool had been sold at the average market price was 0.94. The ratio of the proceeds if wool had been sold at the average price to the proceeds if all wool had a fibre diameter of 21 µm or below and sold at the average market price was 0.99.

DISCUSSION

The coefficients of the original variables calculated from the combined effect of the significant principal components (one, five and three) show price increasing with yield, staple length, tip point of break and hauteur but decreasing with vegetable matter, fibre diameter, coefficient of variation of staple length, staple strength, and mid point of break (Table 4). The decrease with staple strength was surprising. However, there is still a large amount of variation unexplained. It is possible that a higher percentage of midpoint breaks could override any increase in staple strength making the wool cheaper or alternatively a wool of lower staple strength but with a low percentage of midpoint breaks might be dearer. Unexpected relationships could also be due to market demand and the availability of lines at the time of sale.

However, considerable variation in the price ratios and differences could be successfully explained. The use of ratios and differences is an attempt to remove market demand so that the effect of the wool characteristics can be investigated. The analyses of the ratios between the clean price received and the average weekly clean price for wool of that micron, the ratio of greasy price received to average clean weekly price and the difference between the clean price received and the average weekly clean price showed similar patterns. Principal components one, two and five were significant.

The coefficients of the original variables calculated from the combined effects of the significant principal components show price ratios and difference increasing with yield, staple length, staple strength, tip point of break and hauteur but decreasing with vegetable matter, fibre diameter, coefficient of variation of staple length, and mid-point of break. This agrees with published information (Anon, 1999) that variation in fibre diameter has the greatest influence (50-70%) on the clean price received for wool, with staple length, staple strength, vegetable matter and colour being the next most important characteristics. As principal component one explained the majority of variation in price ratio, the characteristics contributing to it should be focussed on in sheep selection to improve fleece quality.

Table 4. Regression coefficients with principal components translated back to those for the original variables of wool from a property in the Traprock area of Queensland from 1991/92-1996/97 (Y=yield %, VM=vegetable matter %, FD= average fibre diameter μm, SL=staple length mm, SLCV=coefficient of variation of staple length, SS=staple strength N/ktex, TPB=% breaks at tip, MPB=% breaks at midpoint, BPB=% breaks at base, H=hauteur mm, prices in c/kg)

	Constant	Y	Log (VM+1)	FD	SL	SLCV	SS	Log (TPB+1)	Log (MPB+1)	Log (BPB+1)	H
Clean wool price	2319	3.74	-98.3	-82.8	1.47	-4.73	-2.31	22.6	-59.6	-3.01	2.22
Greasy wool price	1498	3.48	-82.9	-57.3	1.68	-4.51	-1.37	14.0	-47.3	0.162	2.25
Clean wool price ratio	0.667	0.005	-0.071	-0.016	0.002	-0.005	0.003	0.008	-0.024	0.000	0.003
Greasy wool price ratio	0.160	0.006	-0.075	-0.010	0.003	-0.007	0.004	0.008	-0.015	-0.004	0.003
Difference in clean wool price	-259	3.85	-57.3	-13.1	1.93	-4.21	2.31	6.14	-19.9	0.611	2.48

A mean clean price ratio of 0.97 and a ratio of the estimated proceeds received to the proceeds if wool had been sold at the average market price, of 0.94 demonstrate that the wool the producer sold was nearly at the average market price overall. Yield, vegetable matter and coefficient of variation of staple length are largely dependent on seasonal conditions. The latter two may also be influenced by wool classing and skirting practices as well as flock structures. However the woolgrower could improve staple length by sourcing animals from flocks with breeding objectives that aim to improve staple length. Selection for clean fleece weight would be expected to result in an increase in staple length (Mortimer, 1987).

The ratio (0.99) of proceeds if all wool had been sold at average market price, to what it would have been if all wool had been 21μm or less, indicated little financial advantage over the six years period as average fibre diameter of most sale lots were under 22μm. This showed that the woolgrower was purchasing sheep which produced wool which was largely meeting the criterion of being under 21μm.

When buying in wethers, the woolgrower wishing to raise the value of a lot above market price, could consider the other characteristics highlighted by principal component one (hauteur, staple length and its coefficient of variation) in addition to fibre diameter. In particular, sheep with increased staple length could be purchased which would also result in improved hauteur in the wool.

Analyses such as those undertaken in this study, using sale information of measured wool characteristics and price, may provide woolgrowers with more specific information on where improvements may be made in the quality of their clips and hence in returns from their clip. These recommendations could then be incorporated into breeding objectives for sheep breeders when purchasing rams or used as guides for woolgrowers when purchasing wethers.

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Email: pepperp@dpi.qld.gov.au