In Shed Testing for Profit

Incorporating:
Objective Sheep Selection
"InShedAssessor"
Objective Clip Preparation
"Classer"

THE UNIVERSITY OF MELBOURNE

MACKINNON

Introduction

This training course is designed to provide you with information about the value of testing your sheep for fibre diameter. Specifically, we will examine the benefits that may accrue from having an estimate of the fibre diameter of every sheep in the mob.

Although many wool producers are using equipment on their farms to determine the fibre diameter measurements, it is still possible to obtain measurements of fibre diameter, by collecting samples and submitting these to a laboratory.

During this course, we will examine the following basic principles:

1. **There is a predictable level of variation in any mob of sheep.** This range in fibre diameter between sheep within the mob is highly predictable

    - We can take advantage of the spread of fibre diameters in two ways:

        - To help select superior replacement sheep for the flock, and thereby increase the rate of genetic gain of the flock ('objective sheep selection').

        - To help class wool into fine (and broad) lines, thereby increasing wool income ('objective clip preparation').

2. **Objective sheep selection** is a strategic use of in-shed testing. You either use it year-in-year-out, or not at all. Objective sheep selection will not be profitable on all commercial farms. Profits are more likely on farms that have good weaning percentages, particularly when large premiums for fine wools are expected. The decision support tool, InShedAssessor will help you to determine the profitability of objective sheep selection for your farm.

3. **Objective clip preparation** of wool is a tactical use of in-shed testing. It should be reserved for those years in which it is clearly profitable. Prior to shearing, use the decision support tool Classer to estimate the profitability of objective clip preparation and to provide guidance on the optimal preparation.

4. Other potential uses of inshed testing are:

    - Price risk management – delivery to specifications

    - Deciding which sheep to sell if you are undertaking a partial de-stocking program

    - Managing wool quality

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and are based on work undertaken at the Mackinnon Project during the years 2000-2002 by various individuals.

Variation in fibre diameter

Variation between sheep

Testing all your sheep in a mob, or a flock will show you the range in fibre diameter between individual sheep.

In all flocks of sheep, there is a large amount of variation between individual sheep. As a general rule, there is about x μm range in fibre diameter between individual sheep in small flocks and y μm range in fibre diameter between individual sheep in larger flocks. A mob of breeding ewes will have a larger amount of variation.

As a general rule of thumb, you could expect 95% of your sheep to have a fibre diameter range of:

- 2 x 0.07 x the average fibre diameter of your wool clip for small mob sizes (less than 750 sheep); and
- 3 x 0.07 x the average fibre diameter of the mob for larger mob sizes (more than 750 sheep).

Therefore, for a 21μm mob, you would expect the range in your sheep to be:

- 2 x 0.07 x 21 = 21 +/- 2.9μm, which means
- 95% of sheep will range from 18.1μm to 23.9μm in a small mob; or
- 95% of sheep will range from 16.6μm to 25.4μm in larger mobs.

We have found there is higher variation in mobs of lambing ewes and slightly lower variation in finer mobs of sheep, with a fibre diameter of less than 18.0μm.

It is this variation which allows us to select sheep which are finer, producing finer fleeces over their lifetime. We can then breed from them and subsequently reduce the fibre diameter in our sheep flock. The finer sheep remain the finer sheep, over time. Therefore, early age identification and selection of young sheep will select those

This variation also provides us with opportunities to class the wool clip according to how the market is performing and optimise our income from clip preparation.

Question: What is the expected range in fibre diameter for your maiden ewes?

Average Fibre Diameter =_____ μm (FD)

FD x 0.07 = _____ (A)

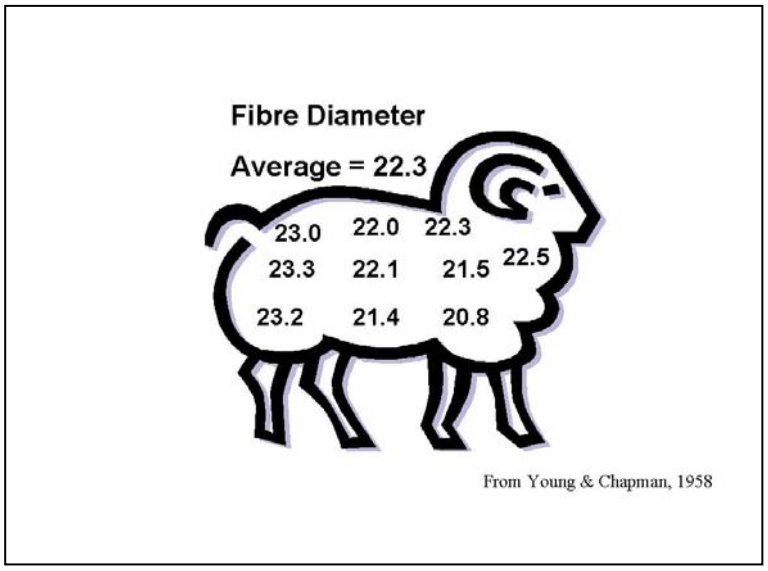
FD + 2 x (A) _____ = _____ (highest expected FD)

FD – 2 x (A) _____ = _____ (lowest expected FD)

Variation in fibre diameter within the fleece

There is also a large amount of variation within a fleece. Sampling wool from different places within the fleece will lead to different test results (figure 2). The midside sample is traditionally viewed as the place most likely to represent the average fibre diameter of the whole fleece. The hip bone (or pin bone) site is often used as a site to collect measurements. In general, the difference in fibre diameter between the mid side sample and the hip bone is around 0.9μm. However, this figure varies between flocks and between sire groups of progeny within a flock.

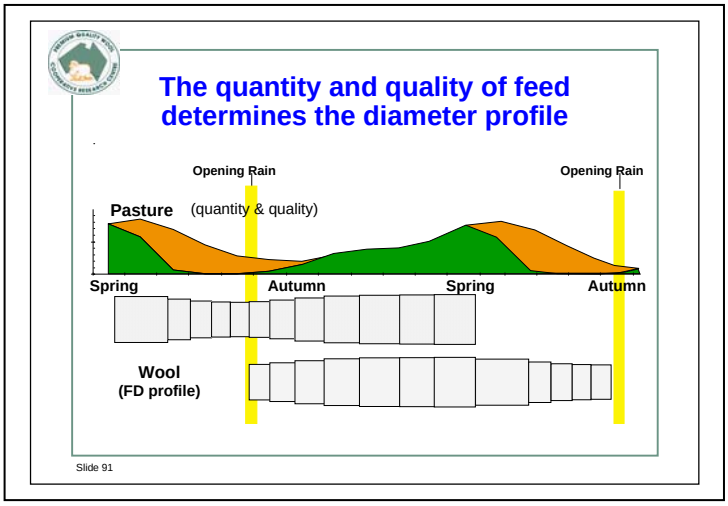
This level of variation is known as within-fleece, between site variation.



Wool producers who have used mid side samples to obtain fibre diameter measurements have found that the average fibre diameter measurement of the mid side sample correlates very well with average bale fibre diameter, when these fleeces are combined.

Because the hip bone samples are higher in fibre diameter than the mid side samples, this needs to be taken into account when you are deciding how to class your wool using objective measurement.

Variation in diameter within a fibre



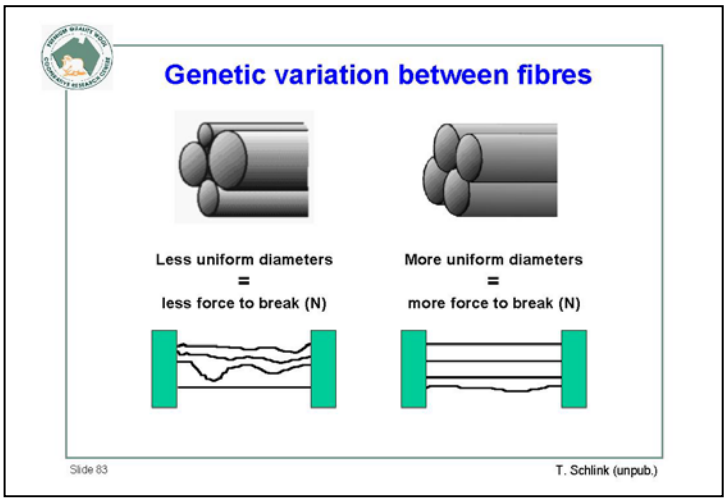
The fibre diameter of wool grown depends on the level of nutrition available to the animal. Sheep with high levels of nutrition will tend to produce wool with a higher fibre diameter. Conversely, sheep with lower levels of nutrition tend to produce wool with a lower fibre diameter. In sheep managed in a Mediterranean environment, in southern Victoria, we have found up to 7μm difference in fibre diameter along the wool staple. This is related to seasonal conditions. These sheep averaged 16.5μm wool over an eleven month period. However, they were growing 14.0μm wool in April (prior to the autumn break) and 21μm wool in September, after the spring flush.

This type of variation is known as within-staple or within-fibre variation. It is largely related to different levels of nutrition throughout the year, and is higher in flocks managed under Mediterranean environments under improved pasture conditions,

than flocks managed on native type pastures. Some of the differences in fibre diameter profile between sheep are known to be genetic in origin, although most of the variation is due to the management of the sheep.

Examination of the average fibre diameter along fibres is known as the **fibre diameter profile**. If you use an OFDA2000 instrument to obtain your wool measurements, you will also receive information about the fibre diameter profile with your results.

Variation between fibres within a staple



There are large differences between the fibre diameter of different fibres within a wool staple. This is largely under genetic influences.

Genetic selection for reduced CVD results in reduced variation in fibre diameter between fibres.

Coefficient of variation of fibre diameter (CVD) and staple strength

CVD provides a measure of both the within fibre variation in diameter and the between fibre variation in diameter. If you select sheep with low CVD, relative to their contemporaries, their progeny will have higher staple strength. Within a mob of sheep, there will be a range of sheep with different levels of CVD. As mentioned previously, most of that variation is due to differences in between fibre diameter.

Objective Sheep selection and InShedAssessor

In most commercial wool producing flocks, replacement ewes are selected by visual appraisal. Hoggets are examined at around 1.5 years of age and the best looking are selected as replacement ewes. Typically, 60% to 90% of ewes are retained, the exact proportion depends upon the weaning percentage of the flock.

Visual appraisal is a highly inaccurate method for estimating fibre diameter. Consequently, this traditional method of ewe selection is unlikely to contribute much to fibre diameter reduction in a flock.

For those farmers wishing to reduce the fibre diameter of their flock, you can obtain fibre diameter measurements of all the ewe hoggets. You can then use this information to select your replacement ewes. Preferably, the fibre diameter information should be combined with fleece weight measurements and other important information in a properly worked out selection index. Contact The Mackinnon Project if you are unsure about selection indexes. This approach is called **objective sheep selection**.

Objective sheep selection can bring profits through two routes:

The selected ewes will be shorn probably another 4 or 5 times more before they are cast for age. About 60% of the superiority of the selected ewes in fibre diameter will be demonstrated in each of the subsequent shearings. So, for one round of selection, the farmer is rewarded with finer fleeces for the rest of the selected ewes' life. This reduction in fibre diameter in the lifetime of selected ewes is called the **'current generation gain'**.

The selected ewes will pass part of their superiority in fibre diameter through to their lambs, resulting in finer fleeces from the lambs for the rest of their life. This reduction in fibre diameter of the offspring is called **'genetic gain'**.

Current Generation Gain

When you make decisions about selecting sheep on the basis of their fibre diameter, you will obtain some benefits simply because the sheep you have selected are finer than they would have been had you not tested these sheep.

Of course, the benefits will depend upon how much you can reduce the fibre diameter of this group of sheep through testing. This will depend upon how many sheep you are in a position to cull. Table 1 gives you an indication of the fibre diameter of the mob after the sheep have been selected using objective clip preparation:

Fibre Diameter before classing	Average fibre diameter after culling different percentages from the flock			
	20%	**30%**	**40%**	**50%**
17μm	16.6	16.5	16.3	16.2
18μm	17.6	17.4	17.3	17.1
19μm	18.6	18.4	18.2	18.0
20μm	19.5	19.4	19.2	19.0
21μm	20.5	20.3	20.1	19.9

Table 1: Average fibre diameter of a sheep flock, after different culling levels and given different initial fibre diameters.

In the first year of testing, you will still be selling the fleeces from all of these animals. Therefore, you will achieve no benefits from testing these sheep (unless you are using objective clip preparation to class their wool). At their second (and subsequent) shearing, these sheep will maintain some of their superiority, although not all. This is where you start to accumulate the benefits of using the technology.

Genetic gain

Not all of an individual's superiority is passed on to its progeny. The proportion of the superiority passed on is known as the heritability. Fortunately, the heritability for fibre diameter is very high, at around 50%. This means that about 50% of the animals' superiority for fibre diameter will be passed on.

Objective sheep selection is a STRATEGIC use of in-shed testing. That is, you should either decide to do it year-in year-out or not at all. If objective sheep selection is stopped, the gains that have been previously made will slowly erode away.

Objective sheep selection is always profitable for ram breeders, ensuring the most rapid rate of genetic gain. Ram breeders should therefore be year-in-year-out users of in-shed testing.

In contrast, objective sheep selection is not always profitable for commercial wool producers.

Determining if objective sheep selection is profitable for a commercial farm is not a simple matter. Fortunately, we have developed a decision support software tool called InShedAssessor that we recommend farmers use to help them decide if they should use objective sheep selection every year.

InShedAssessor estimates the economic consequences of objective ewe hogget selection for a wide range of flock and financial situations. It estimates expected dollar return from both the current generation gain and the genetic gain and compares these against the costs of testing. Since the economic gains from objective selection accumulate slowly over time, InShedAssessor also provides an estimate of the expected cash flows over a ten- year period of use.

Using InShedAssessor shows that, in general, objective ewe selection is profitable in flocks that have relatively high weaning percentages (say, 85% plus) and when you expect relatively high premiums for finer wool. Even then, it may not always be sensible to use objective sheep selection because of the cash flow position. There is always a delay of several years before objective selection becomes cash positive. Table 3 shows the benefits you can receive by from testing all your ewes each year, and selecting the top ewes on the basis of their measurements. In calculating the benefits in this table, it has been assumed that wethers are kept until they are 3.5 years of age, the average greasy fleece weight produced is 5.0kg with a yield of 72%, and testing costs $2 per sheep. It has assumed there are 2000 ewes in the flock and that the ewe hogget portion is tested annually.

Weaning Percentage	Micron Premium (c/kg)	Years to break even	Annual Benefit after breakeven occurs	Net Present Value
70%	200	5	$685	-$2,832
70%	400	3	$1,370	$3,941
80%	200	2	$3,230	$21,026
80%	400	1	$6,460	$53,032
95%	200	1	$5,411	$40,454
95%	400	1	$10,253	$89,002

Table 2: Benefits from testing annually ewes for fibre diameter, under different market conditions and with different weaning percentages.

Farmers choosing to use objective sheep selection also gain the potential advantages that come from objective clip preparation.

Most of the genetic gain in a commercial flock comes from the ram source

One final, but very important point about objective sheep selection on commercial flocks: Make sure that “you are not pissing against Niagara Falls”.

In commercial flocks, the great majority of genetic gain comes from the RAMS THAT ARE PURCHASED. Ewe selection provides a bit of the froth and bubble – nice to have but not the meaty bit. There is absolutely no point objectively selecting your ewes for reduced fibre diameter if your ram source is not doing the same. The best way to make money genetically is to ensure that you go to a ram stud that has the same breeding objectives as you and is using objective sheep selection in their rams. The returns from doing that will always beat the hell out of any returns you may get from objectively selecting your own ewe hoggets.

Ram selection is far more important than ewe selection for the commercial woolgrower. On a typical farm, rams contribute more than 80% of the overall genetic gain.

Despite this, many producers still place a great deal of emphasis on ewe selection, believing that this will further improve the genetics of their flock. However, in a typical self-replacing Merino flock the time and expense spent in ewe selection is unjustified. Spending time on choosing a profitable ram source will bring higher returns.

Ewe selection and genetic improvement

The rate of genetic improvement is directly related to the proportion of rams and ewes selected from the flock as replacements.

Most Victorian flocks have relatively low weaning percentages - around 70-75%. With a 70% weaning percentage, at least 80% of the ewe weaners are required as ewe replacements. After the obvious culls are identified and rejected there is little or no opportunity to place any emphasis on production characteristics.

On average, ewes kept for 5 years produce 4 lambs in their lifetime. On the other hand, rams joined at 1% leave about 75 progeny per year, depending upon weaning rates. This is why it's imperative that the rams used in the flock are the best available. Making a mistake with one ewe doesn't make much difference to the performance of the flock. Making a mistake with rams can be catastrophic.

The relative contribution of ram and ewe selection to genetic improvement at different weaning rates is demonstrated in Figure 1. As you can see, unless you can afford to cull your ewe replacements heavily (ie. have a high weaning percentage), there is little to be gained by from placing a heavy emphasis on ewe selection.

These results were determined by assuming ewes are kept until they are 5 years of age and had average survival rates for Merino ewes.

To achieve a 30% gain from ewe selection, weaning rates need to be around 115%. This isn't a realistic figure and is not achieved by many Merino breeders.

How to make genetic progress in a commercial flock

The main impact of genetic improvement strategies for self-replacing commercial wool flocks is first through selecting more profitable bloodlines, and then by selecting superior rams from that bloodline.

We know that bloodline selection can have an enormous impact on profit in a typical self-replacing flock. Ram selection within a bloodline has about 10% of that impact, while the benefits of ewe selection are about 0.5% the benefits of bloodline selection.

However, in the case of ewes entering a nucleus flock, the selection intensity is higher and so each ewes' contribution to genetic improvement is much greater than is normally the case in a self-replacing commercial flock.

Additionally, in this case the ewe is potentially the dam of a ram. This means her impact over the whole flock is wider because she could potentially contribute half of a ram's genes, which in turn are more widely distributed.

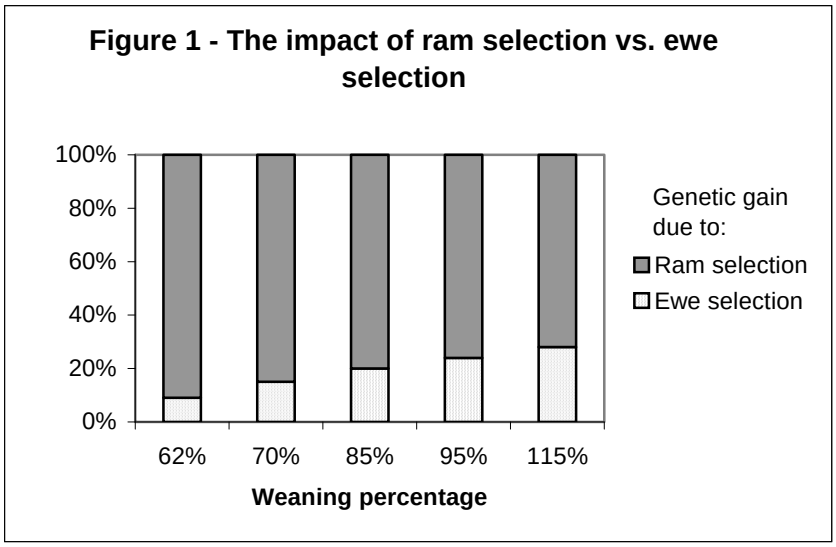


Figure 1: The relative impact of ram selection compared to ewe selection

Summary – objective sheep selection

In summary, objective sheep selection is a strategic use of in-shed testing. You either use it year-in-year-out or not at all. Objective sheep selection will not be profitable on all commercial farms. Profits are more likely on farms that have good weaning percentages, especially when a large premium for finer wool is expected. Objective sheep selection should be reserved for those farms in which it is profitable. Use the decision support tool InShedAssessor to help determine the profitability of objective sheep selection for your farm.

InShedAssessor

InShedAssessor calculates the benefits for individual wool producers of testing all their commercial ewes every year. You input information directly related to your flock performance, and the benefits and cash flow accruing over time are calculated.

Assessing the long-term benefits of testing maiden ewes each year

The profits from testing maiden ewes on an annual basis depend on a number of factors. These include:

- Your weaning percentage
- Age wethers sold
- Clean fleece weight
- How much value you believe you will receive from reducing your fibre diameter.
- The cost of testing

InShedAssessor uses all these inputs to determine whether or not annual testing of your maiden ewes will be profitable over the long therm.

As a general, rule, you will need a weaning percentage of higher than 80% to achieve long term benefits from testing your maiden ewes each year. If your lambing percentage is lower than 80%, you will need to be keeping wethers until they are at least 4.5 years of age, and will need to increase your income by at least 200 c/kg clean for each fibre diameter. Higher greasy fleece weights (that is higher than 4.5kg) will also assist you in achieving increased benefits.

Using InShedAssessor

The main screen for InShedAssessor appears is shown in Figure 1 (below):

There are a number of inputs required to determine the long-term profitability of testing individual sheep. These inputs should relate to what happens in YOUR flock over a period of time. These inputs do not relate to what happened last year, or the year before.

To determine the profitability of testing all your ewes every year, we need to know the long term production levels of your flock.

InShedAssessor allows you to enter your own data, and decide whether or not it will be profitable for you to increase your income by testing your ewes every year.

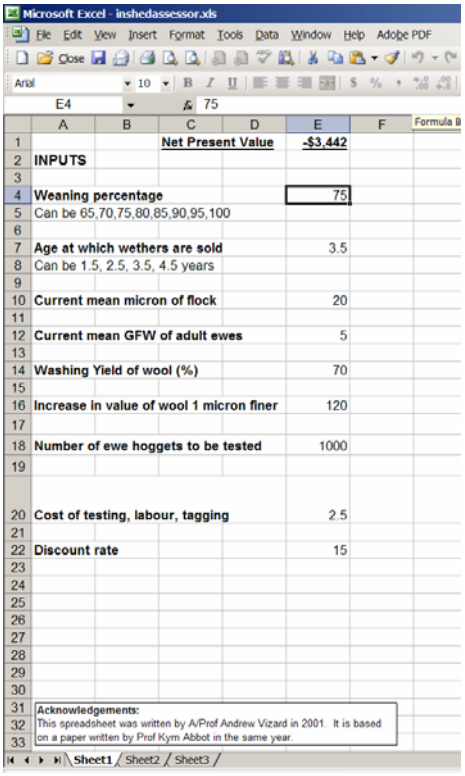


Figure 1: Input screen for InShedAssessor

Weaning Percentage – This is your long-term WEANING percentage, not your lambing percentage. Remember, this reflects the number of sheep you will have available for selection and therefore, the number of inferior sheep you will be able to cull.

Age wethers are sold (years) – how long do you keep your wethers? The more fleeces you retain from the wether offspring of your selected ewes, the higher the benefits of testing maiden ewes each year.

Average micron of the flock (μm) – this is your long-term average fibre diameter of your WHOLE flock.

Average greasy fleece weight of adult ewes (kg) – How much wool do you expect to cut from your adult ewes? The more wool each ewe cuts, the higher the benefit you will obtain through keeping those with the lower fibre diameter.

Expected yield (%) – What yield do you normally achieve across your wool clip?

Expected increase in the value of wool 1μm finer than you currently produce (c/kg clean) – consider over the next ten years (not this year, and not just last year) how much you believe you will receive per kg if your wool is 1μm finer. You need to take a long term view here. The WoolCheque (www.woolcheque.com.au) website gives long-term micron premiums for a range of fibre diameter categories. The table below gives you a guide with respect to different micron premiums, which have existed in the past. These figures are provided as a guide only, and do not take into account other discounts, which you may receive. For example, if you regularly produce tender wool, these price differences between fibre diameter categories may be lower.

As a rough guide, you may wish to start with an increase in wool price of 100c/kg.

	Increase in c/kg <u>clean</u> for wool 1μm finer, MF4, Southern Indicator (Source: Pricemaker, Woolmark Company), no discounts for length, strength, POB or colour		
Fibre Diameter (μm)	**Last season (2000/2001)**	**1999/2000 season**	**Last three years**
19	547	358	353
20	462	317	309
21	156	193	153
22	43	85	53
23	23	25	20
24	23	25	20
25	26	11	17

Table 3: Increase in clean wool price in different wool selling seasons by reducing fibre diameter.

Table 4 demonstrates that over the last three years, 20μm wool has been worth 309c/kg more than 21μm. This figure was 462c/kg last season (2000/01) and was 317c/kg for the 1999/2000 season.

You can find this website at: http://www.woolcheque.com.au. You may find that prices for they type of wool you produce may vary.

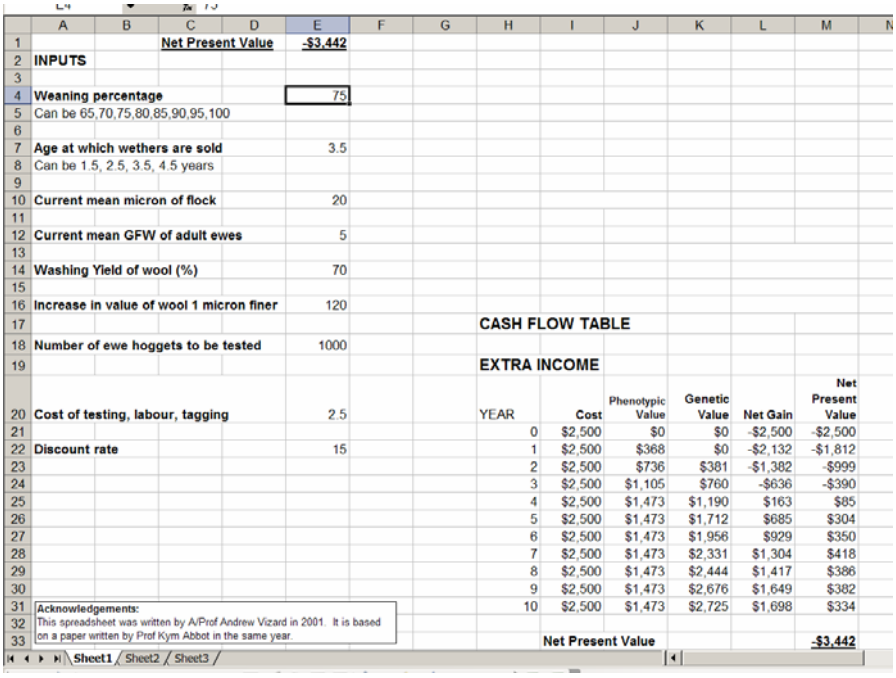
Number of ewe hoggets to be tested – This is simply your expected ewe hogget drop, and is used to calculate the discounted net present value of testing for each year.

Total cost of testing, including labour, and tagging – the cost of testing not only includes the cost of the actual test. You will need to tag the sheep with individual ear tags either at testing or prior to testing, and there will also be a labour component involved.

Discount Rate (%) – this is the value of your money over time. For example, $100 cash left “under the bed” will have a lower spending value in 10 years time, because of inflation. Also, if you have $100 to invest, you may choose to invest this money in other pursuits either on or off your farm. It is the opportunity cost of having your money tied up in the sheep, and recognises that you may not receive returns from your testing for many years after you have spent the money.

What does the output from InShedAssessor mean?

After you have entered your inputs into InShedAssessor, the output screen breaks down your costs and returns spread over a ten year period (Figure 2).



	Net Present Value	-$3,442
INPUTS		
Weaning percentage		75
Can be 65,70,75,80,85,90,95,100		
Age at which wethers are sold		3.5
Can be 1.5, 2.5, 3.5, 4.5 years		
Current mean micron of flock		20
Current mean GFW of adult ewes		5
Washing Yield of wool (%)		70
Increase in value of wool 1 micron finer		120
Number of ewe hoggets to be tested		1000
Cost of testing, labour, tagging		2.5
Discount rate		15

CASH FLOW TABLE

EXTRA INCOME

YEAR	Cost	Phenotypic Value	Genetic Value	Net Gain	Net Present Value
0	$2,500	$0	$0	-$2,500	-$2,500
1	$2,500	$368	$0	-$2,132	-$1,812
2	$2,500	$736	$381	-$1,382	-$999
3	$2,500	$1,105	$760	-$636	-$390
4	$2,500	$1,473	$1,190	$163	$85
5	$2,500	$1,473	$1,712	$685	$304
6	$2,500	$1,473	$1,956	$929	$350
7	$2,500	$1,473	$2,331	$1,304	$418
8	$2,500	$1,473	$2,444	$1,417	$386
9	$2,500	$1,473	$2,676	$1,649	$382
10	$2,500	$1,473	$2,725	$1,698	$334
		Net Present Value			-$3,442

Acknowledgements:
This spreadsheet was written by A/Prof Andrew Vizard in 2001. It is based on a paper written by Prof Kym Abbot in the same year.

Sheet1 / Sheet2 / Sheet3

Figure 2: Output screen from InShedAssessor

Each year, you will encounter a cost associated with testing all your maiden ewes. As a consequence of testing, you will receive income from two sources:

the selected sheep, which will be finer, and achieving higher prices for their wool; and

the progeny of these selected sheep, which will also be finer compared to no selection.

Of course, each year, you are incurring a cost, and you are not receiving the benefits until some years later.

Increase in income from selected sheep – each year, you are testing one group of sheep (the maidens). They will have five fleeces, so you will receive an increase in income, compared to no selection for every year they provide you with a fleece, as they will be finer. We have assumed that in your first year of testing (year 0), that you shear and sell the wool from each sheep tested. Therefore, there is no benefit derived from testing those sheep. However, after shearing, they will be sold and the finer sheep you have selected will maintain their fineness. In your second year of testing (year 1), you will have finer fleeces from these sheep as a consequence of testing. In your third year of testing, you will have finer fleeces from both the original sheep tested and the maiden sheep tested in the previous year. Five years after you have started testing, all ewes on the property will be tested, and you will achieve the benefits of selection from each of these drops of sheep.

Increase in income from offspring of selected sheep – these selected sheep will have finer progeny, which will start to have their first fleeces available for you to sell in your third year of testing (year 2). At this stage, it is only the progeny of your maiden

ewes, which have this superiority. After 7 years, all ewes have been tested, and therefore, all progeny born will have some superiority, compared to the situation had no testing occurred within the ewe flock.

Net increase in income – each year, you will be incurring costs associated with the testing, and the income benefits will start to occur in year 1, with the maximum benefits occurring in year 10, when all the ewes are tested and their progeny are all tested. The increase in income takes into account the discount rate you initially input into the equations. It takes into account that the money could have been invested elsewhere and achieving a higher rate of return.

Total NPV – The total Net Present Value – is simply the sum of the net increase in income over the ten years of testing. It takes into account all the costs and all the returns and is discounted, according to the discount value you input into the initial screen.

Case Study – Objective Sheep Selection

Sue and Bob have 3000 breeding ewes. Their current average fibre diameter is 20μm and their sheep produce 4.5kg greasy fleece weight per year. In general, they achieve a washing yield of 72%. They keep their wethers until they are 3.5 years of age, and weaning 80% lambs per ewe joined. They believe it will cost them $2.00 per test, and will are using a 10% discount rate. They are unsure how much their wool will be worth if the fibre diameter reduces by 1μm. They have decided to examine a few alternative situations (200, 300 and 400 cents/kg).

Testing 1200 sheep will cost them $2400 each year.

200 c/kg: Once all their sheep are tested, they will receive an increase in income of $4153/year, as a result of having finer sheep. The benefits of having finer progeny start to flow from year 2 onwards. They will have a positive cash flow after 2 years time.

300 c/kg: Once all their sheep are tested, they will receive an increase in income of $6229/year, as a result of having finer sheep. The benefits of having finer progeny start to flow from year 2 onwards. They will have a positive cash flow after 2 years time.

400c/kg: Once all their sheep are tested, they will receive an increase in income of $8306/year, as a result of having finer sheep. The benefits of having finer progeny start to flow from year 2 onwards. They will have a positive cash flow after 2 years time.

With a 75% weaning percentage, the benefits decline. At 200c/kg increase in income, it will take them an extra year to break even, and the net present value over ten years becomes $10,603.

If they decide to sell their wethers at a younger age, (that is, 1.5 years) the net present value declines to $6755, if they only receive an extra 200c/kg.

With a 75% weaning percentage, and if they are selling their wethers as 1½ year old sheep. They need an increase in income of at least 141c/kg to justify the expense of testing every sheep to break even every year.

Bob and Sue have decided that they can achieve a weaning percentage of at least 75%, and they will receive at least 141c/kg additional income across their clip for reducing their fibre diameter by 1μm. They have made the decision to test their ewes every year.

Exercise – InShedAssessor

Consider a flock of 2000 ewes with an average fibre diameter of 21μm producing 5kg greasy wool per year, with an average washing yield of 72%. The weaning percentage is 75%, and wethers are sold at 2½ years of age. Undertake an assessment for this farm about the benefits of annual in shed testing.

What is:

– ... The cost of testing? .....

– ... The number of ewe hoggets to be tested? .....

– ... The increase in value you expect/kg? .....

What are the returns?

– ... With the values as given above? .....

– ... With a 70% weaning percentage? .....

– ... With an 80% weaning percentage? .....

– ... With a 10% increase in wool value/kg? .....

– ... With a 20% decrease in wool value/kg? .....

Objective clip preparation and Classer

The second way of making money from in-shed testing is objective clip preparation.

Under certain market conditions it may be possible to exploit the large difference in fibre diameter between sheep by classing wool according to the individual fibre diameter of each fleece. This is a tactical use of in shed testing.

In this approach, individual fleeces are allotted to sale lines on the basis of their fibre diameter measurement, rather than the traditional subjective appraisal of the wool classer.

This is called 'objective clip preparation'. The classer is only required to remove obviously faulty fleeces – those that are doggy, affected by dermo, etc.

The optimum classing method to achieve profits will depend entirely upon the particular wool market you are selling your wool into. For example, with a 20μm line of wool and sheep cutting 2.88kg clean fleece weight, the expected returns from different wool markets depend upon the micron premiums and the level of the actual market. Under different market conditions, you may also find that the highest profit may occur with different line combinations. Table 5 gives some examples using different market conditions. Under high and low market premiums, the average fibre diameter of the three lines changes. If the cost of testing the animals is $2/sheep, then under market conditions with high micron premiums, the return is $2.44 - $2 = $0.44/sheep. This is a profit, but not a large profit, which could be quickly eroded if market conditions change between shearing and selling.

With low micron premiums, regardless of the average wool price, you will make a loss if you split your wool on fibre diameter.

Average fibre diameter of the:	High premiums high wool prices	High premiums low wool prices	Low premiums high wool prices	Low premiums low wool prices
Fine line	18.2	18.2	18.5	18.5
Medium line	19.7	19.7	20.2	20.2
Strong line	21.3	21.3	21.8	21.8
Return per head (not including testing costs)	$3.55	$2.44	$1.14	$0.76

Table 4: Returns per head when using objective clip preparation

Objective clip preparation is only profitable in certain market conditions. Remember, when objectively classing, you are splitting an average line into ones that are both finer and broader line. Sure, we expect to get a premium for the fine line, but equally we expect to get a discount for the broad line that is created.

Objective clip preparation is profitable only when the premiums received for the fine lines are greater than the discounts received from the broad lines that are created.

It is likely to be profitable to split your wool clip if there is a sharply "bent" micron-price curve (figure 3). The most profitable position to be is right on the "bend"(figure 3). It is never profitable to objectively prepare your clip when the micron-price curve is basically a straight line. Under those circumstances, the premium that is received by creating a fine line is exactly matched by an equal discount that is received for the broad line that is created (figure 4).

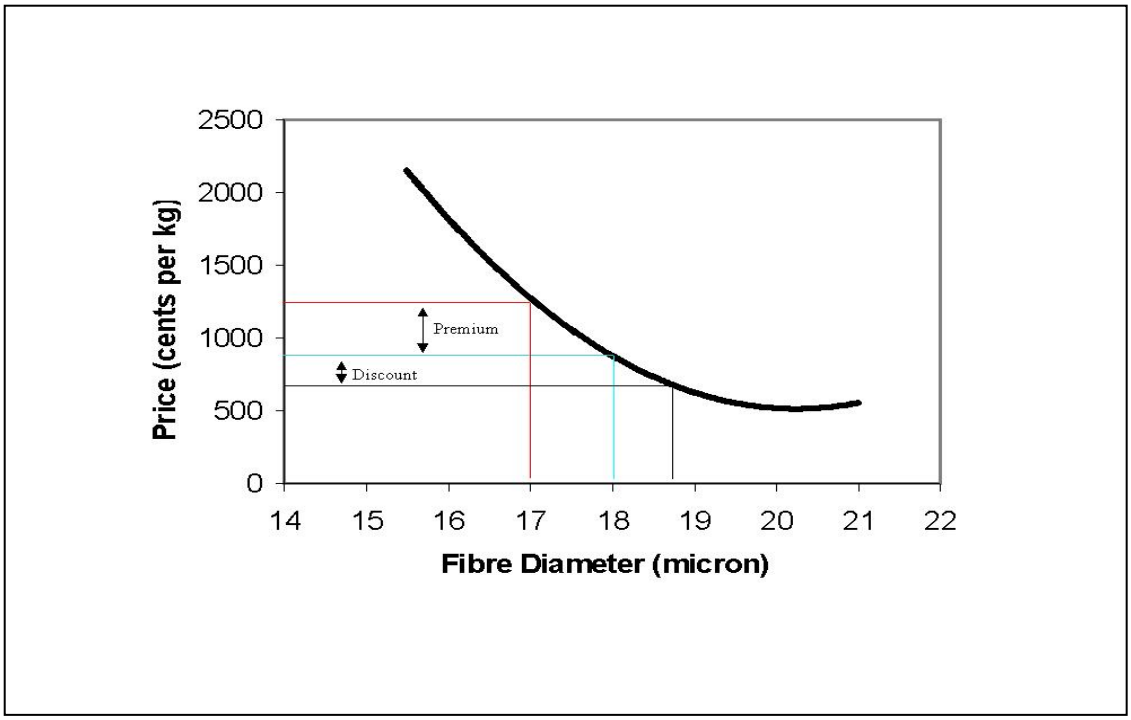


Figure 3: A "bendy" wool price graph, where objective clip preparation may be profitable, especially if your average fibre diameter is near the "bend". In this case, the premium is higher than the discount.

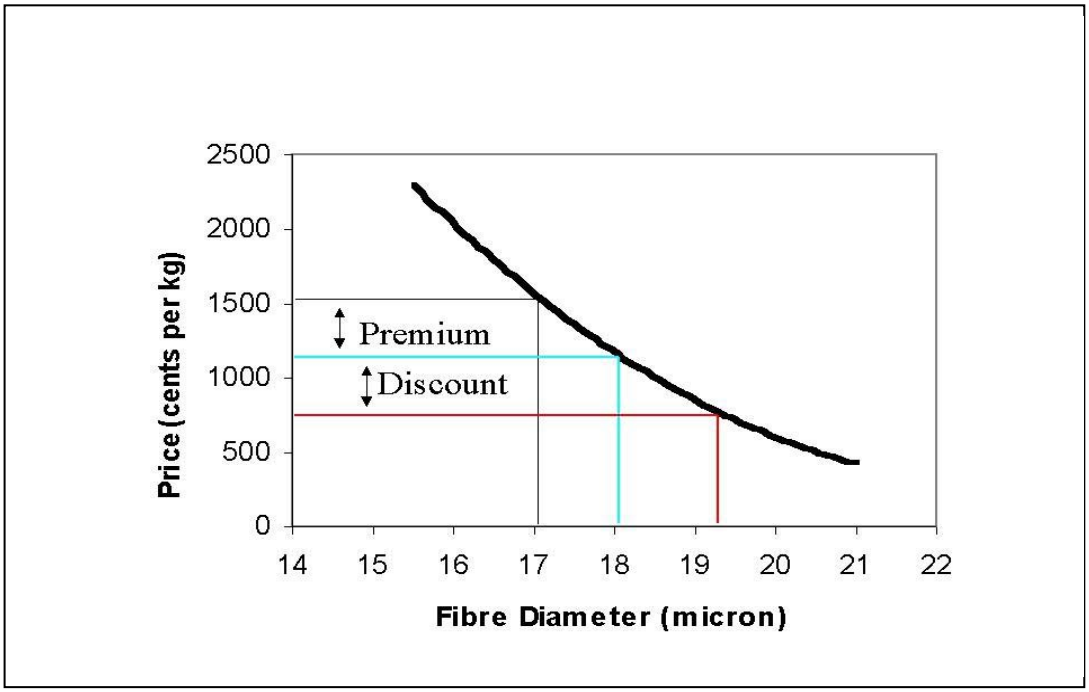


Figure 4: A straight line graph, where objective clip preparation will not be profitable, as the premium equals the discount.

Objective clip preparation is therefore a TACTICAL use of in-shed testing. It should not be used year-in- year-out regardless of the market conditions. Its use should be reserved for those years when objective classing clearly brings you profits. In other years, normal classing of wool will be more profitable.

Some examples of the potential benefits to be made by using are shown below:

Fibre Diameter	March 2000	May 2001	March 2002
19	$2.90	-$1.63	$2.01
20	$1.00	$2.17	-$0.21
21	$0.90	$0.53	-$1.63
22	$0.30	-$1.69	-$1.99
23	-$0.70	-$1.75	-$2.00

Table 5: Potential benefits to be made using objective clip preparation. The benefits relate to similar lines of wool, but split using three different market conditions.

Table 6 demonstrates that the profitability of using fibre diameter measurements to class your clip changes with the wool market. In May 2001, testing all your 20μm sheep would have given you an extra $2.17 per fleece. In March 2002, testing the same mob would have cost you $0.21. These figures take into account the cost of testing at $2/head.

Determining if objective clip preparation is profitable under a given set of circumstances is not a simple matter. Fortunately, we have developed a decision support software tool called Classer that we recommend farmers to use prior to shearing.

Classer estimates the profitability of objective clip preparation for any given mob in any given wool market. Additionally, Classer provides full guidance on how to prepare the clip to maximise net income. The program allows for the fact that the fibre diameter estimate is not 100% accurate, factors in the extra costs of creating lines of wool, and subtracts other selling costs. Then, to determine the net benefit of objective classing, Classer selects the clip preparation which gives the highest net return from objective classing and compares this to the net return from single-line preparation by traditional analysis.

It is important to realise that the potential benefits of objective clip preparation are substantially eroded if the clip is sub-optimally prepared. To capture the full value of objective clip preparation, the use of proper decision support tools, such as Classer is required.

In summary, objective clip preparation is a tactical use of in-shed testing. It should be reserved for those years in which it is clearly profitable. Prior to shearing, use the decision support tool Classer to estimate the profitability of objective clip preparation and to provide guidance on the optimal clip preparation.

Time lines to using Classer®

The following time lines are suggested to growers who wish to make the best use of Classer.

Time line	Instructions
3 months from anticipated shearing date	Use Classer® to identify mobs whose fibre diameter means that objective clip preparation will be profitable. Use last shearing's classer report to determine your fibre diameter and cut per head for each mob. It may be advisable to test the midside of a random sample of 20 sheep from each mob, just to determine whether this year's measurements are the same as last years. This may also give you a guide about whether or not they are likely to be tender. Wool price data is best obtained from ICS's Inshed testing Report. This can be found on the website, when using Classer©. Recognise that the price data that you use can be expected to be quite different to the wool market when you go to sell the wool, this is why you may need to repeat the analysis. Ideally, print-off a report for each mob. Pending your results, determine which method of collecting fibre diameter measurements you will use.
2 weeks out from start of shearing	Use Classer® to finalise which mobs and the total number of sheep, that you intend to test. Once again, obtain the best source of wool price data from the ICS report on the www.paddock.com.au website. If you are using an on-farm method of wool testing, confirm your

	booking and dates with your provider and shearing contractor. Advise your shearing contractor that you intend to test certain mobs. You will need to work closely with the shearers to help them do their job and get them to help make sure the clip preparation proceeds without hassle.
Start of each mob (during shearing)	Use Classer® to decide where the fibre diameter categories you wish to create. Pass on the micron ranges to shed staff. Some clients suggest that you put up clear signs in the shed so all staff can see the bin each fleece needs to go into.
Following first 100 sheep at shearing	Following the first 100 sheep have been shorn, check that the mob average FD is similar to your estimation. If significant differences are found, re-enter the true FD of the mob into Classer® to re-align your cutoff points. The fleeces from the 1st 100 sheep shorn is unlikely to significantly vary the average FD when the bales are core tested.
After shearing	Assemble records of fibre diameter and wool cut per mob. Do this for every mob shorn in the flock. This important information is used to assess the profitability of the exercise. It is amazing how hard this data is to find next year.
After this year's wool sales	Assess the success of your clip preparation.

Issues with objective clip preparation

Tender wool in fine lines

In many clips, the finer fleeces are often those, which are more likely to be tender. When we are undertaking a classer analysis, discount the finer prices you expect to receive by 10-20%, depending upon the circumstances, to take this into effect.

Prediction of prices between shearing and sale & price volatility

When you input the prices for Classer, you are using today's prices to predict the market in 6-8 weeks time. The fine wool market is extremely volatile, and differences between micron categories can change substantially in a short time. This means that a clip preparation that was profitable prior to shearing may become unprofitable when you sell your wool.

The closer to shearing that you are able to undertake your Classer analysis, the more likely you will be able to predict the actual returns you are likely to receive. This does come down to a sensitivity analysis. If the projected profit you will receive is low, then consider the risks associated with using this technology.

Predicting fibre diameter of lines of wool using hip bone and mid side samples.

Many wool producers are using hip samples to determine the fibre diameter of each sheep. Research indicates there is a difference of between 0.5μm and 0.9μm between the actual fleece and the hip bone sample. This figure does change between flocks. Therefore, to determine the actual fibre diameter of your wool clip, you will need to measure at least 50 midside samples to determine the difference between the hip bone and the midside sample and subtract that amount from the average fibre diameter.

The midside sample is the site on the fleece, which most closely predicts the fibre diameter of the whole fleece. The relationship between the average fibre diameter of the whole fleece and the average fibre diameter of the midside sample will depend on how heavily the fleeces are skirted.

If you have tested your sheep using hip bone measurements, you will need to determine the difference between the average fibre diameter of the fleece and the measurements you have collected from the hip bone.

Accuracy of the testing equipment and its influence on profitability

There are a number of methods of testing individual sheep for fibre diameter. Some of these methods are have higher precision. The Classer program recognises this. It allows you to input the method you are using to collect the information and adjusts the results accordingly. The profitability of testing every sheep will depend on the method used, as the more precise the measurement, the higher the returns are likely to be.

Using last year's measurements to class this year's clip

The repeatability of fibre diameter is high. Measurements taken on young sheep can be used to predict the relative fibre diameter of another year's measurements. You do not need to test all mobs each year. The accuracy of using last year's measurements is not as high as using current measurements; however, this can be accounted for by using Classer.

Labour efficiency

Which method you use to collect fibre diameter measurements on your sheep will depend upon the availability of labour on your property. For example, if labour is short during shearing, you may choose to use a method, which provides you with the fibre diameter measurements prior to shearing. If it is difficult for you to collect measurements prior to shearing, you could hire an extra shed hand at shearing to cope with the demands that a Fleecescan machine will create in your shed.

You will need to determine when you can collect the measurements and cause the least amount of disruption to the activities on your property. some people collect measurements prior to shearing, and then draft the animals into their fibre diameter categories, so that tags do not need to be read at shearing.

Collating the information ie fleece weights with fibre diameters

Collating the fibre diameter measurements with the fleece weights is not a trivial job. To achieve this easily, you will need unique ear tag id's and some knowledge of using

computers. Microsoft Access will provide the best method of storing and collating this information, although many people tend to use MS Excel.

Identifying the animals uniquely

The most efficient systems have all their animals identified with a unique ear tag. This tag should incorporate the year of birth, as this will allow all the animals on the property to have unique identification. Many wool producers use coloured ear tags to designate the year of birth. This is quite suitable for use in the sheep yards. It does not provide you with a unique identification for each sheep. By using a 5 digit coding system, where the first digit is the year of birth, you will have a number for the computer, which provides you with a unique identification.

For example, 24560 is an animal born in 2002, and was the 4560th tagged animal in that drop.

Using Classer

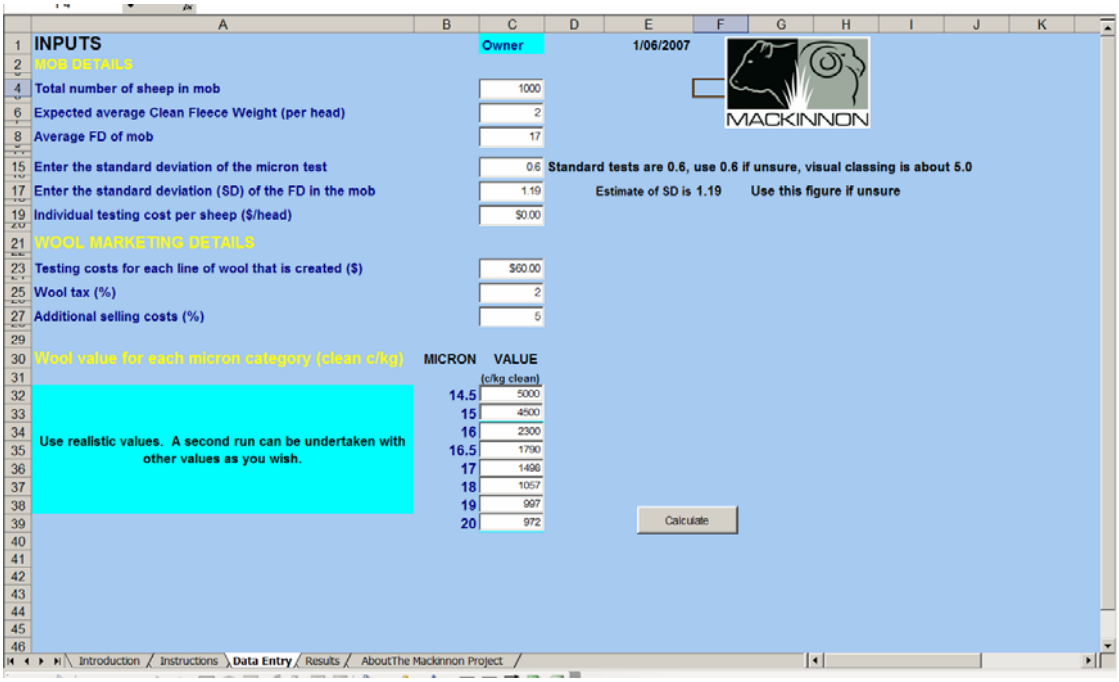


Figure 5: Input screen for Classer

Classer relies on a number of inputs to calculate the “best bet” method of clip preparation for your enterprise.

The classer input screen is shown in figure 6.

Total number of sheep in the mob - Enter the total number of sheep in the mob to be tested.

Expected average CFW – The clean wool production you expect to achieve from this mob (per head).

Average FD in mob – The average fibre diameter of the sheep in the mob you wish to test.

Individual testing cost per sheep – Cost per sheep of testing each sheep.

Testing costs for each line of wool that is created - Additional testing cost for each line.

Wool tax – The proportion of wool income paid as wool tax. For 2000/2001, this is set at 3%.

Additional selling costs – These are brokerage, and other selling costs. Remember, also that selling smaller lines of wool may have higher selling costs, which can be factored into the calculations.

Wool prices - Based on the average fibre diameter of your mob, you will need to enter clean wool prices for a range of different fibre diameters. This program uses a linear function between these prices to calculate to estimate clean wool prices. The program relies heavily on this information – so BEWARE. You can achieve spot point

of micron clean wool prices through AWEX or for finer fibre diameters, through Andrew Woods, at ICS. You will need to enter a price for each of the micron categories listed.

If you are prone to tender wool, it is advisable to conduct different analyses- One with the sound prices, the other with tender prices for the finer micron wool. This gives you a sensitivity analysis of the different alternatives available to you.

The ICS report gives you the average wool price for each fibre diameter range from 13.0μm to 30μm. It also calculates the expected premiums and discounts you could expect for different levels of staple strength and vegetable matter. Figure 6 shows you the output from the 7th June, 2002, ICS output report.

ICS In Shed 0.5 Micron Price Curve Classing Guide

Week Ending 07-Jun-02

M39 & S35

Prices quoted in A$ cents per kg clean

	60 - 69mm Greasy Length			70 - 85mm Greasy Length					86 - 100mm Greasy Length				
	50 nkt	45 nkt	35 nkt	50 nkt	45 nkt	35 nkt	30 nkt	25 nkt	50 nkt	45 nkt	35 nkt	30 nkt	25 nkt
13.0	-	-	6742	16834	13347	12009	7816	7348	16474	14189	11786	7696	7825
13.5	-	-	5546	13786	10930	9782	6401	6140	13490	11619	9657	6302	6490
14.0	-	-	4114	10166	8060	7164	4720	4654	9948	8568	7126	4647	4870
14.5	-	-	3242	7753	6147	5426	3599	3646	7586	6534	5439	3544	3778
15.0	3085	3140	2569	5679	4503	3947	2649	2742	5558	4787	3987	2628	2815
15.5	2734	2771	2198	4414	3650	3142	2161	2254	4468	3564	3198	2119	2295
16.0	2241	2350	1932	3665	2883	2390	1764	1853	3540	2858	2565	1726	1870
16.5	2031	2218	1787	3019	2589	2060	1602	1667	2944	2523	2277	1537	1669
17.0	1787	2028	1650	2494	2073	1720	1459	1472	2531	2102	1926	1456	1537
17.5	1475	2016	1374	1926	1670	1453	1291	1284	2016	1669	1535	1347	1282
18.0	1100	1314	1087	1471	1268	1193	1131	1036	1466	1310	1225	1144	1071
18.5	997	1135	970	1175	1131	1085	1040	950	1183	1135	1098	1072	976
19.0	910	989	886	1051	1017	987	965	898	995	997	985	982	938
19.5	902	935	860	950	947	938	935	913	957	947	941	939	922
20.0	904	903	871	930	928	922	915	918	924	931	922	921	913
20.5	894	901	887	929	926	924	917	911	929	932	925	928	919
21.0	898	914	876	926	929	929	914	908	931	932	929	925	907
21.5	901	913	865	933	922	930	917	905	938	935	925	923	910
22.0	911	899	869	931	919	923	896	922	948	934	924	927	911
22.5	902	915	861	932	934	917	913	918	938	932	927	924	920
23.0	887	903	844	928	942	924	911	906	918	932	924	914	911
23.5	893	913	796	932	935	931	908	896	924	929	920	917	911
24.0	870	899	776	936	927	941	891	884	921	925	916	911	899
24.5	831	877	747	923	916	924	891	867	940	915	906	921	896
25.0	754	868	728	904	900	910	870	833	930	905	906	908	849
25.5	725	845	705	889	884	895	848	828	919	890	890	871	841
26.0	715	838	681	871	871	877	823	801	900	872	867	859	827
26.5	689	815	648	838	-	844	779	755	866	839	839	807	798
27.0	613	747	621	810	-	819	743	716	841	811	838	764	751

Figure 6: Wool prices from the ICS in shed report, June, 2002

Output from Classer

Prices used for calculations - Classer© uses a linear function between the prices you have entered to determine the value of each line of wool.

One line clip – Classer© gives the average fibre diameter and estimated net income from a one line clip. This is used as the basis for comparisons to the multiple line clips.

Two line clip – The number of fleeces to be classed into the fine and broad line is given, with the estimated average fibre diameter of each line, the total kg CFW in each line, and the estimated price received for each line. The percentage (of kg's) of the clip classed into each line is also given.

The **net return** indicates the total return from classing this line, and takes into account selling and testing costs for both the additional lines created and the individual sheep testing cost.

The **cut-off** provides you with the actual fibre diameter at which you decide to separate your wool. For example a cut-off of 20μm indicates that all wool less than 20μm goes into the fine line, while all wool greater than 20μm goes into the strong line.

Three line clip – The information provided here is the same, although there are now three lines, and two cut-off points are provided. The fine line will be all wool with a fibre diameter less than the lowest cut-off. The medium line will be all wool between the first and second cut-off point. The broad line will be all wool with a fibre diameter higher than the broader cut-off.

Four line clip – The results here are the same as for the three line, clip however, this information is provided for each of the four lines created in the clip.

Exercise using Classer

Using last weeks' wool prices, calculate the potential benefits or costs of testing every sheep to class a line of wool.

Assume that the average fibre diameter of the wool clip is 21.5μm, the average greasy fleece weight is 4.5kg and the average washing yield is 72%. Testing costs are $60 for each line of wool that is created, wool tax is 3%, and additional selling costs are 3.5%. What is the benefit for a two-line, three-line and four-line clip when using the OFDA2000, Laserscan, and laboratory testing?

Net benefits – Sound wool

	OFDA2000	Laserscan	Laboratory
Two-line	----------	----------	----------
Three-line	----------	----------	----------
Four-line	----------	----------	----------

Many wool producers find that the finer lines are often tender. To overcome the potential losses occurring as a result of this, we can discount the expected tender price by a fixed amount. If you discount the wool prices for the finest three fibre diameter ranges by 20%, how much do the benefits change?

Net benefits – tender wool in fine lines

	OFDA2000	Laserscan	Laboratory
Two-line	----------	----------	----------
Three-line	----------	----------	----------
Four-line	----------	----------	----------

Deciding which equipment to use

When you decide to start testing every sheep within individual mobs, or across the whole farm, there are a number of points to consider. It is not always profitable to test whole mobs of sheep. Also, different equipment will give you different results, and the accuracy of the test will certainly affect the outcome and the ultimate economic benefit you can expect to receive.

Points to consider:

- What is the accuracy of the test?
- For what purpose do you wish to use the results?
- What is the cost of the test?
- How easy is it to use the equipment?

What is the accuracy and precision of the test?

The accuracy of test is simply the closeness with which an observation for a measurement of a variable approximates its true value. An accurate test implies freedom from both random and systematic error. If you are using the test results to select sheep for genetic improvement, then you really only need to know the deviation of each animal from the average of the group. If you are using the tests for clip preparation, then you will need an accurate estimation of the fibre diameter of each fleece. Changes in the levels of accuracy of testing will change the average fibre diameter of the lines of wool you place together, potentially resulting in reduced returns.

The different testing equipment available for testing individual sheep within a mob has different levels of accuracy. How you wish to use this information will influence which equipment will be suitable for your situation.

The OFDA2000 technology is simple to use and allows you to get “instant” results, while the sheep are still in the yards. With the Fleecescan, you are able to get the results on the whole fleece instantly, but you will need to wait until shearing before you receive any information about the fibre diameter profile of your clip. Taking a midside sample and sending this to a laboratory allows you to obtain a profile of the range in fibre diameter within the mob before they sheep are shorn. However, there are no “instant” results, and you cannot easily “retest” any sheep, which look like they have anomalous results. For each of these technologies, you will require a different logistical approach.

If you are using the testing for clip preparation, and you have a high room for error, then a test with lower accuracy will be suitable (providing it costs less). If you are using the tests for clip preparation and require accurate results, you will need a test with a higher accuracy.

Further Reading

Variation in the fibre, fleece and between sheep

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Hansford, KA, Marler, JW, and McLachlan, IM (2002) A comparison of the performance of on-farm OFDA2000 and In-store FLEECESCAN. Part 2: Sheep selection and fleece classing. International wool textile organisation, Barcelona, May, 2002.(1)

(1) These papers are available at the following website:
http://www.awta.com.au/Publications/Publications.htm