final report

Project code: B.SCC.0179

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Date published: December 2014

ISBN: 9781740362856

PUBLISHED BY
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Quantifying the costs associated with grass seed damage to lamb carcases

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Abstract

The cost of the grass seed damage to processors has knock-on costs throughout the business. Consequently, it can be complex to estimate the cost of downgraded carcases. This project attempted to quantify the increased operational costs on the slaughter floor and boning room relative to the degree of grass seed infestation. Further to this, primal cuts were evaluated for decreased marketability due to reduced weight or damage to the integrity of the cuts. The level of damage that the primal could sustain before being downgraded was also assessed.

A grass seed module (GSEED module) was then developed within Excel to calculate the cost of grass seed contamination to the business on a whole carcase and per kilogram basis. The module estimates the amount of trim removed relative to the location and severity of GSEED infestation and its impact on the final primal weight. The module allows the user to edit the costs of production, severity of primal down grade, and lost revenue.

The GSEED module was developed to assist processors quantify the cost of GSEED infestation, and to help understand where the costs are occurring along the processing chain. Additionally, the module estimate of GSEED cost could help justify penalties applied to seedy lambs that are traded over the hooks and underpin communications to prime lamb producers.

Executive summary

Grass seed damage to lamb carcases has been more prevalent over the last few seasons due to the optimal growing conditions. The loss of production that occurs throughout the supply chain is well recognised both on-farm and post-farm gate. However, beyond the farm gate the actual financial losses have been difficult to measure as there are "knock-on" costs throughout the entire business.

Processors are aware that the losses occurring within their businesses must be backed by an accurate costing model. This is necessary, firstly, to understand the impact on their profit margin and, secondly, to justify the reduction in the schedule price for downgraded carcases traded over the hook. This forms an important component to provide rigor to communications to prime lamb producers.

The objectives of this project were; to quantify the costs at each stage of processing grass seed damaged carcases, and to understand the dynamics within an abattoir when handling downgraded product to minimises losses, whilst satisfying QA requirements and customer's expectations.

The cost modelling of grass seed (GSEED) incidence and its impact on the plant efficiency was programmed into a module which was integrated into the Lamb Value Calculator (LVC). Users are able to customise the inputs of the LVC and the "Grass Seed Module" to suit their businesses, so that the impact of grass seeds on carcase value can be estimated.

The GSEED module captures information in the following areas;

- Severity and location of GSEED infestation
- Estimated trim wastage from the slaughter floor (S/F) and boning room pre-trim
    - Calculate the loss of primal weight
    - Account for the revenue from the extra trim wastage
- Additional processing costs on S/F and boning room.
    - Impact on chain speed
    - Additional cost of extra trimming personnel
    - Impact on processing capacity
- Adjusting the HSCW and Carcase purchase price at the scales.
- Nominated cut down grades and their associated values and additional boning costs.

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1. Background

Numerous areas in a meat processing company are affected by grass seed (GSEED) damage leading to downgraded product as well as reduced plant efficiencies. A non-exhaustive list of the areas impacted by GSEED damaged carcases is shown in Table 1. As part this project the slaughter floor (S/F) and boning room areas were investigated to understand how each processing area can be affected by the incidence of GSEED.

A complex model is required to account for the financial losses associated with grass seed damage. This is because inefficiencies and opportunity costs create "knock-on" costs throughout a business. The information from the S/F and boning room will be used to develop a basic costing model to be integrated into the Lamb Value Calculator (LVC). The areas that were investigated during the trial period have been marked in Table 1.

Table 1: The areas of meat processing business that are potentially impacted by grass seed damaged carcases.

Processing Areas	Investigated
Slaughter floor:	
Slowing of chain speed	●
Additional QA compliance checks	●
Tally Penalties	●
Loss of skin value	
Loss of slaughter man morale	
Possible requirement to operate an additional chiller to hold carcases	
Boning Room	
Loss of product (i.e. trim)	●
Product downgrade (chilled to frozen, Loss of Primal integrity)	●
Inability to weight range heavily trimmed carcases.	
Requirement to manage additional specs	●
Marketing	
Lost opportunity cost for downgraded carcases.	
Inability to fill orders.	
Potential increase in freight costs for partial fill orders.	
Sourcing markets for downgraded product.	
Requirement to slaughter additional carcases to fill orders.	
Increased risk of suspension of Export Licence.	
Increased risk associated with lambs sourced from saleyards vs. OTH.	

The LVC is a Microsoft Excel based program that was developed for an earlier MLA funded project (B.LSM.0037). The additional cost and the revenue lost by the processor due to GSEED were incorporated into the existing infrastructure of the calculator. The user can establish a carcase value and then assess the impact GSEED is having at different stages of carcase processing.

The GSEED module allows the user to customise the incidence and location of grass seed contamination, and capture additional S/F and boning room costs and any cut down grades that may occur.

2. Project objectives

The aim of this project was to:

- Quantify the costs incurred by the meat industry when processing lamb carcases that have GSEED damage by undertaking a time-in-motion study of the S/F and boning room and a comparative boning study.
- Develop a GSEED module in the LVC to estimate the costs incurred from grass seed damage.

3. Methodology

To quantify the cost of GSEED damage within a processing plant, data were collected in three areas:

- Side to side comparative boning trial.
- Impact of GSEED on primal endpoint.
- Benchmarking wastage trim at pre-scales and pre-boning stages.

3.1 Comparative boning trial

Carcases with varying degrees of GSEED damage were selected prior to trimming on the S/F, and the trimmers were instructed to only perform a standard hygiene trim.

The selected carcases were railed off post scales and were then assessed for the incidence of grass seed. The degree of GSEED damage was assessed using the plants grading criteria shown in Table 2. The grading criteria was based on counting the number of seeds within a given primal regions. Each carcase was divided into five primal regions, flap, fore quarter (FQ), rack, shortloin and hind quarter (HQ).

Table 2: Grading criteria of grass seed incidence when assessing the damage within each primal region on a lamb carcase.

	Level of GSEED infestation		
	Light	Medium	Heavy
GSEED Count	<12	12 -20	>20

The left hand side (LHS) of each carcase was trimmed on a stationary rail to remove all the GSEED. The trim weight was recorded for each primal region. The right hand side (RHS) was not trimmed, so that the primal integrity was maintained into the boning room. This enabled the primal weights between each side to be compared in the boning room. After the final weighing of the primal cuts, any GSEED was removed and weighed.

The boning protocol used in earlier yield trials co-funded by MLA and Sheep CRC (Lean Merino Trial 2006, Lean X-bred Trial 2007) was adopted.

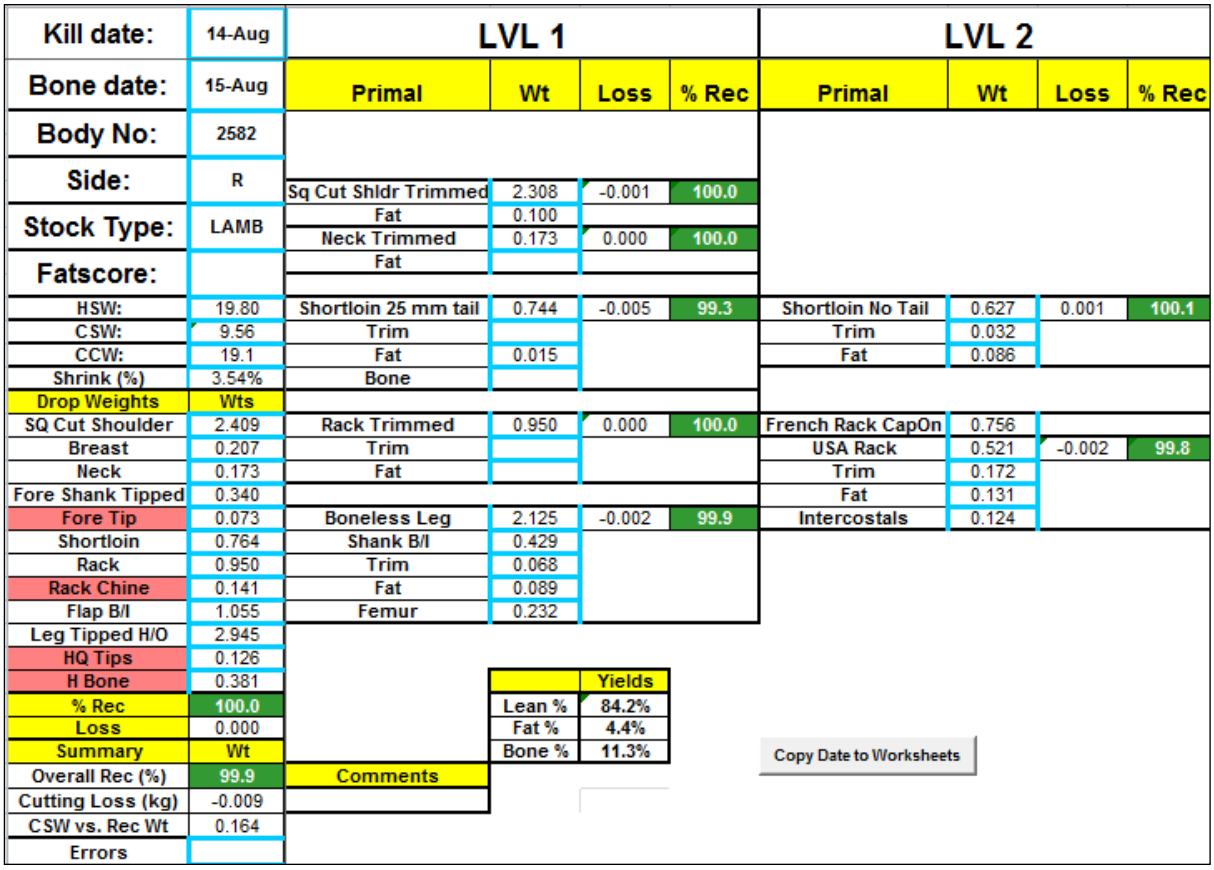
Each carcase was split along the vertebra and the sides were boned separately according to the primal specification. The weight of each of the following primal cuts was recorded for each side of a carcase:

- Flap bone in
- Square cut shoulder
- Neck

- Shortloin 25 mm tail (one rib)
- Shortloin no tail
- Rack trimmed
- French rack cap on
- USA rack cap off frenched
- Boneless leg

The prepared leg and shoulder primals were assessed for damage by the boning room foreman, and if necessary downgraded from chilled product to frozen or trimmings. The loin cuts were appraised for subcutaneous fat damage, and could be downgraded to a cap off product or sliver skin off eye muscle.

An example of boning worksheet for the right side of a carcase is shown in Figure 1.



Kill date:	14-Aug	LVL 1				LVL 2			
Bone date:	15-Aug	Primal	Wt	Loss	% Rec	Primal	Wt	Loss	% Rec
Body No:	2582								
Side:	R	Sq Cut Shldr Trimmed	2.308	-0.001	100.0				
Stock Type:	LAMB	Fat	0.100						
Fatscore:		Neck Trimmed	0.173	0.000	100.0				
		Fat							
HSW:	19.80	Shortloin 25 mm tail	0.744	-0.005	99.3	Shortloin No Tail	0.627	0.001	100.1
CSW:	9.56	Trim				Trim	0.032		
CCW:	19.1	Fat	0.015			Fat	0.086		
Shrink (%)	3.54%	Bone							
Drop Weights	Wts								
SQ Cut Shoulder	2.409	Rack Trimmed	0.950	0.000	100.0	French Rack CapOn	0.756		
Breast	0.207	Trim				USA Rack	0.521	-0.002	99.8
Neck	0.173	Fat				Trim	0.172		
Fore Shank Tipped	0.340					Fat	0.131		
Fore Tip	0.073	Boneless Leg	2.125	-0.002	99.9	Intercostals	0.124		
Shortloin	0.764	Shank B/I	0.429						
Rack	0.950	Trim	0.068						
Rack Chine	0.141	Fat	0.089						
Flap B/I	1.055	Femur	0.232						
Leg Tipped H/O	2.945								
HQ Tips	0.126								
H Bone	0.381			Yields					
% Rec	100.0			Lean %	84.2%				
Loss	0.000			Fat %	4.4%				
Summary	Wt			Bone %	11.3%				
Overall Rec (%)	99.9	Comments							
Cutting Loss (kg)	-0.009								
CSW vs. Rec Wt	0.164								
Errors									

Figure 1: An example boning worksheet used to capture the primal weights for each side of a carcase (All weight are shown in kilograms).

A total of 34 carcases were boned for the side to side comparative trial. The distribution of HCW and GR fat depths are shown in Table 3. Unfortunately while undertaking boning trial the incidence of grass seed damage was low and intermittent, which meant that the proposed trial designed was reduced in scope.

Table 3: The weight and fat depth distribution of carcases boned at JBS Bordertown.

	GR Ranges						
HCW Ranges	3 - 4mm	5 - 6mm	7 - 8 mm	9 - 11mm	12 - 15mm	16 - 19 mm	Total
≤ 15kg		1					1
15.1 -18kg	2	1		3			6
18.1 - 20kg		4	2	2			8
20.1 - 22kg		3	2	2	3		10
22.1 - 24kg			1	1	4	1	7
24.1 - 26kg		1					1
>26kg					1		1
Grand Total	2	10	5	8	8	1	34

3.2 Benchmarking S/F trimming and boning room pre-trim

The amount of trim removed on the slaughter floor and in the boning room pre-trim was benchmarked by weighing carcases pre and post trimming. When trimming exceeded the standard AUS-MEAT trim, the possible reason was recorded. The presence of GSEED was recorded, along with any excessive trim and/or damage to primal integrity.

4. Results

The 34 carcases selected for the comparative boning trial were assessed for GSEED infestation across the five primal regions. The degree and frequency of GSEED damage for the dataset is shown in Table 4.

Table 4: The degree and frequency of carcases with GSEED damage selected for boning (34 hd).

	Degree of GSEED infestation				
PRIMAL REGION	Heavy	Medium	Light	No Seed	Total
FLAP	25	7	2		34
FQ	11	13	7	3	34
RACK	2	5	17	10	34
SHORTLOIN			19	15	34
LEG	11	6	15	2	34

4.1 S/F hot trim to remove GSEED – Trial conditions

The LHS of each carcase was trimmed on a stationary rail to remove all the grass seed. The trim weight was recorded for each primal region. Although the RHS also had grass seed damage it was left untrimmed. The weight of trim removed from the LHS with respect to primal regions and GSEED damage is shown in Table 5.

Table 5: The weight of wastage trim taken from the LHS of a carcase when removing GSEED under trial conditions.

	Degree of GSEED infestation/Wastage (kg) removed from LHS.		
PRIMAL REGION	Heavy	Medium	Light
FLAP	0.267	0.126	0.048
FQ	0.131	0.056	0.027
RACK	0.020	0.036	0.024
SHORTLOIN			0.021
LEG	0.085	0.048	0.018

Generally, the amount of wastage increased with GSEED infestation, however, the rack primal was an anomaly as the amount of wastage decreased with heavy seed infestation. There were only two carcases that had heavy seed infestation over the rack primal, so with more data it is expected a similar relationship would be observed for the rack as was seen with the other primals.

The weight of the primal cuts from the trimmed (LHS) and un-trimmed (RHS) sides was compared for each carcase. The average weight difference between the primals from each side is summarised in Table 6. The comparative boning trial was performed on carcases with no seed to assess what level of boning variability can exist. The level of variability of primal weight between sides ranged from 0.012kg to 0.031kg, which highlights the difficulty in boning consistently. There could be side to side weight differences due to high puller damage or variability from uneven splitting of the carcase. Such weight differentials between sides could mask the effect of GSEED damage on the primal weights, or lead to inconsistent results relative to the GSEED damage.

Table 6: The average weight differential between GSEED damaged and undamaged primals.

	Degree of GSEED infestation and Primal Weight Difference(kg)			
Primal Cuts	Heavy	Medium	Light	No Seed
Flap Bone In	0.217	0.232	-0.075	
Sq. Cut Shldr	0.150	0.201	0.107	0.012
Rack Cap on	0.021	0.030	0.060	0.021
Short loin No Tail			0.092	0.058
Boneless Leg	-0.006	0.020	0.002	0.031

The removal of GSEED from the LHS was reflected in a lower primal weight for the flap (bone in) of between 0.217 - 0.232kg when the GSEED incidence was medium to heavy in the flap region. The square cut shoulder was 0.107 – 0.201kg lighter when the GSEED incidence was low to heavy in the FQ region. The weight difference of the other primals was not noticeably affected by the removal of GSEED. The lower weight of the rack (cap on) could not be attributed to the GSEED, as the LHS was approximately 0.02 – 0.06kg lower irrespective of GSEED damage. The weight of the boneless leg was not affected by the degree of GSEED infestation, as the weight between sides was comparable irrespective of GSEED prevalence. It was common that medium to heavy GSEED damage of the HQ would be concentrated around the shank region which would have very little impact on the weight of the boneless leg.

Relative to the wholesale price for each primal the loss in returns was estimated from the primal weight differences due to GSEED damage (Table 7). For the Flap Bone In $0.91 - $0.97 was lost from the cut when the GSEED damage is medium to heavy. Similarly, for the Square Cut Shoulder, $0.77- $1.03 was lost in revenue for medium to heavy seed damage. The lost revenue on the rack was not as clear due to the inconsistent primal weight difference relative to GSEED damage (see Table 6), however, the loss in revenue for the rack cap on could range from $0.35 to $0.99 if GSEED was evident.

Table 7: The average price differential between GSEED damaged primals and undamaged primals.

	Wholesale Price	Degree of GSEED infestation and Primal Price Difference ($)			
Primal Cuts	($/kg)	Heavy	Medium	Light	No Seed
Flap Bone In	$4.20	$0.91	$0.97	-	
Sq. Cut Shldr	$5.10	$0.77	$1.03	$0.55	-
Rack Cap on	$16.50	$0.35	$0.50	$0.99	-
Short loin No Tail	$8.70			$0.80	-
Boneless Leg	$8.40	-	-	-	-

4.2 Relationship between primal marketability and GSEED damage

Under commercial conditions it is not uncommon to have grass seed damaged carcases trimmed heavily, even if there is only light seed infestation. The chain speed on the S/F and in the boning room places time constraints on trimmers that necessitate the removal of greater quantities of trim to ensure all seed is removed expediently to satisfy QA requirements.

The total removal of GSEED from the carcase relies on both trimmers on the S/F and those undertaking the boning room pre-trim. Generally the S/F trimmers did not have the time to remove all the GSEED once the infestation was light/medium and had spread beyond the flap region to the FQ and HQ shank, or when the incidence was higher than 25% of the carcases in a mob. To accommodate such mobs the chain speed was slowed. Even then, upon inspection of carcases in the chiller, grass seeds could readily be seen. So the reliance is placed on the boning room pre-trim to tidy up any seed affected lambs. Such reliance on the boning pre-trim often caused tension between the two departments, and some cases required the boning room to re-allocate staff within the room to manage seedy carcases. On one occasion when there was a large line of GSEED damaged carcases, an extra trimmer was obtained from the S/F, but usually the boning room staff are shifted from primal preparation to the pre-trim area. The extra processing costs associated with extra pre-trim staff will be discussed later in the report.

With the removal of GSEED the selvage fat and/or the muscle fascia are regularly damaged. The location and incidence of the damage has a large bearing on cut suitability for the chilled market. An alternative endpoint when the selvage fat has been removed in full (or in part) is the frozen market. In some cases individual denuded muscle groups can be prepared to suit specific markets (e.g. eye of loin), but this depends on the orders for the day. However, where the muscle fascia has been heavily damaged it is generally allocated to trim, irrespective of the primal.

The relationship between the GSEED incidence and market endpoint of the main primal was investigated on a small subset of the boning group (15 – 18 carcases) (Table 8). The LHS primals were prepared to specifications and were graded by the boning room supervisor.

Table 8: The market grade of four primal cuts with differing levels of GSEED damage

			Degree of GSEED infestation			
Primal Cuts	Market Grade	Price ($/kg)	Heavy	Medium	Light	No Seed
Sq. Cut Shldr	Chilled	$5.10	1	5	3	1
	Frozen	$4.80	2	3	1	
	Trimmings	$3.30	1	1		
Rack Cap On	Chilled	$16.50	1	2	10	1
	Cap off Rack	$21.50			1	
	1" Rack	$22.50				
Shortloin	Chilled	$8.70			11	1
	Eye muscle only	$22.50			3	
Boneless Leg	Chilled	$8.40	2	1	9	
	Frozen	$8.10	3			
	Trimmings	$3.30	1			

When the FQ had medium to heavy GSEED damage, the square cut shoulder was likely to be downgraded to frozen product or trimmings. Seven out of the 13 carcases graded (54%) with medium to heavy GSEED on the FQ, were downgraded from the chilled square cut shoulders to a frozen product or trim.

The rack cap on was not downgraded due to the level of seed, however, if the fat cap was damaged the cut would be converted to a cap-off product. Alternatively, where the muscle silver skin was damaged it could be boned as a 1 inch frenched rack to retain a higher level of profit rather than allocating it to trim.

The short loin cuts were boned from carcases that had light seed in the shortloin region, so the effect of higher GSEED incidence on the cut grade could not be assessed. It was interesting that of the 14 carcases that had light seed over the shortloin, 3 were downgraded from shortloin (no tail) to an eye of shortloin due to damage of the fat cap. This was also observed on the boning pre-trim chain where a single seed once removed from the shortloin fat cap, exposed the muscle silver skin, which meant the shortloin had to be boned out to an eye of shortloin. So, even a few seeds located over the loin muscle can cause the cut to be downgraded. If the silver skin of the eye of shortloin was damaged the cut could be placed through a skinning machine, and marketed as a skinned eye muscle.

Heavy seed infestation of the leg generally occurs on the hock region, so the integrity of the boneless leg could be maintained even under a medium to heavy seed incidence. As the GSEED spreads over the primal region, it was not uncommon to see the fat cover damaged, or even knife damage to the muscle integrity. Boneless leg with significant fat cover damage tended to be downgraded to frozen product even when it was pretty much denude of fat.

4.3 Benchmarking S/F trimming and boning room pre-trim

Slaughter Floor

For a standard run of lambs the amount of trim removed on the S/F was on average 0.812kg (0.3 – 1.35kg), of which 36% had their flaps removed partially or entirely (Figure 2). Flaps were readily removed if there were any hygiene issues. The channel and kidney fat were also included as part of the trim weight.

The trial carcases had two levels of trim applied – firstly a hygiene trim and secondly a trim to remove any GSEED. A hygiene trim performed by S/F trimmers removed on average 0.411kg (this weight also includes any channel fat). When these same carcases were trimmed for any GSEED under trial conditions, the average trim increased to 1.12kg (Figure 2). Under trial conditions the removal of seed was done to minimise the amount of wastage, but in doing so it did not replicated the severity of S/F trimming that occurred at chain speed for GSEED damaged carcases. The severity of trimming increased markedly as prevalence of GSEED spread in the FQ, HQ and at worst the saddle region.

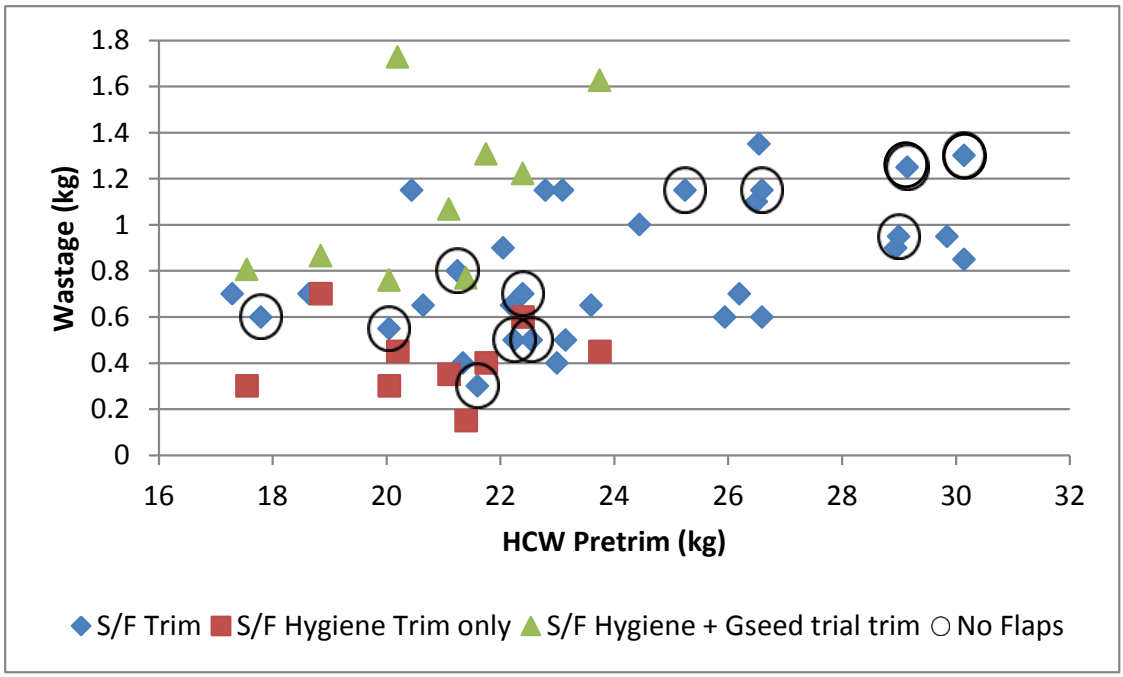


Figure 2: The amount of trim removed from carcases on the S/F at JBS Bordertown

The trim applied to the trial lambs could be considered a base line level of trim to remove GSEED. However, it is estimated that under commercial conditions the amount of trim could possibly be 20 - 30% higher. From observation, if there was light grass seed contamination found on the flaps it was common for them to be removed completely, which would account for ~ 0.5kg of wastage. The process of removing the flaps can be done in a timely manner without extra labour or slowing the chain speed. In any case it was not uncommon for the flaps to be discarded on regular carcases due to hygiene faults. Another area that was trimmed heavily in the presence of grass seed was the FQ, where selvage fat was readily removed.

Unfortunately at the time of the trial there were limited mobs affected by GSEED, so there was no opportunity to benchmark the amount trim relative to the degree of GSEED infestation.

Ideally, for mobs traded over the hooks that have GSEED damage, all GSEED should be removed prior to the scales so that GSEED infested product is not purchased at the grid price. Trim wastage can be on sold at ~$0.20/kg, so the removal of GSEED prior to the S/F scales would help offset some of the costs due to a potentially inferior product. Also removing all GSEED prior to the scales will reduce the carcase weight which will lower the OTH price. However, even at reduced chain speed it appeared near impossible to remove all the GSEED on the S/F. Carcases still carried GSEED into the boning room, placing extra pressure on pre-trim to tidy up carcases. The trim wastage removed in the boning room has been purchased at the grid price and therefore is removed at a significant loss.

Of the nine carcases that had a hygiene and GSEED trial trim, all but one (carcase 2) had heavy seed on the flaps. Carcase 4 had heavy GSEED damage on the flaps as well as the FQ and HQ. Similarly carcase 9 had heavy GSEED infestation on the flap and leg and medium on the FQ, which resulted in 1.6 – 1.8kg of trim being removed.

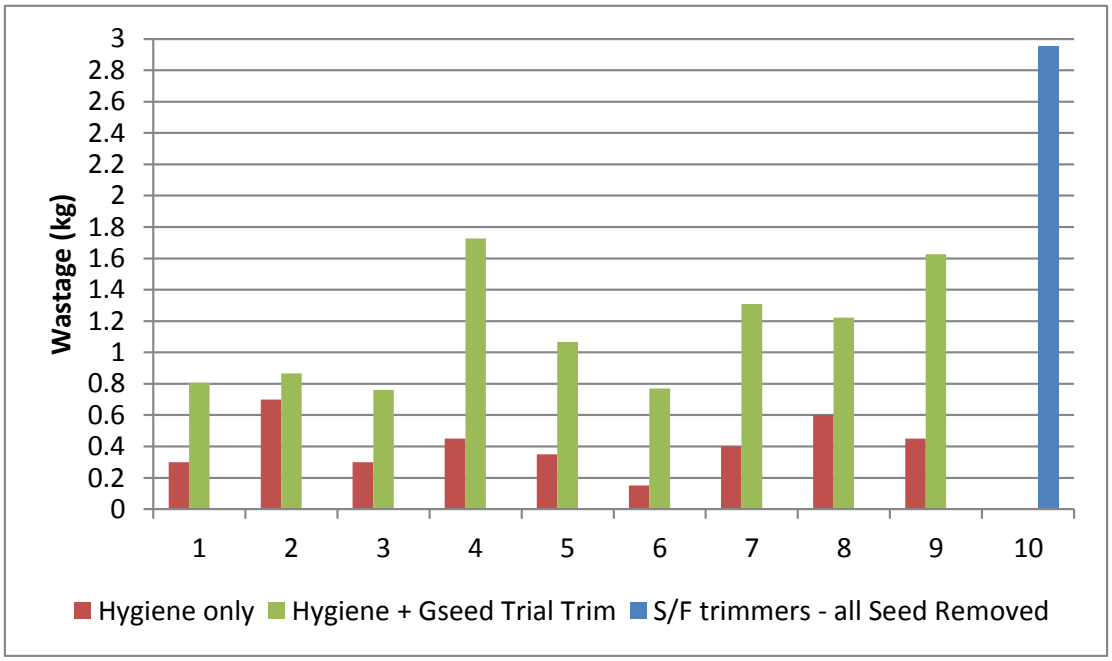


Figure 3: The amount of trim remove from carcases on the S/F at JBS Bordertown that were selected for the boning trial.

Carcase 10, although not a part of the boning dataset, was heavily infested on the flaps and FQ, as well as medium GSEED damage on the saddle and a light infestation on the leg (Table 9). An experienced S/F trimmer removed all the GSEED while on a stationary rail, removing 2.95kg of wastage. The trimming severity is shown in Figure 4. This was considerably more compared to the trim standard used for trial carcases with a similar level of infestation (Carcase 4 and 9), consequently, the amount of wastage removed pre-scales could be considerable more than that measured during the trial.

Table 9: The degree of GSEED infestation of carcase 10.

Primal Region	Heavy	Medium	Light
Flap	●		
FQ	●		

Rack	●	
Shortloin	●	
Leg		●

Figure 4: Trim severity applied to a carcase with heavy GSEED (carcase 10)

Boning Room

Under normal processing, the boning room pre-trim (5 staff in the collaborating plant) removes on average 0.47kg (0.05 – 0.9kg) per carcase. However, when the number of pre-trimmers increased from 5 to 7 the average amount of trim increased to 0.765kg (0.55 – 1kg) on a normal run of carcases. Increasing, the number of pre-trim staff by 2 people increased the amount of trim wastage by 63%, as there is a greater opportunity to remove any defects from the carcase.

For a small group of seedy lambs (N=13) the average amount of pre-trim removed was 0.715kg (0.4 – 0.95kg) per carcase with 5 pre-trimmers operating on the line. If for instance an extra 2 staff were added to the pre-trim area to handle a line of seedy carcases, the amount of trim could increase by 63% based on the above findings. So in theory the amount of trim would be ~1.16kg per carcase if 7 pre-trimmers were operating.

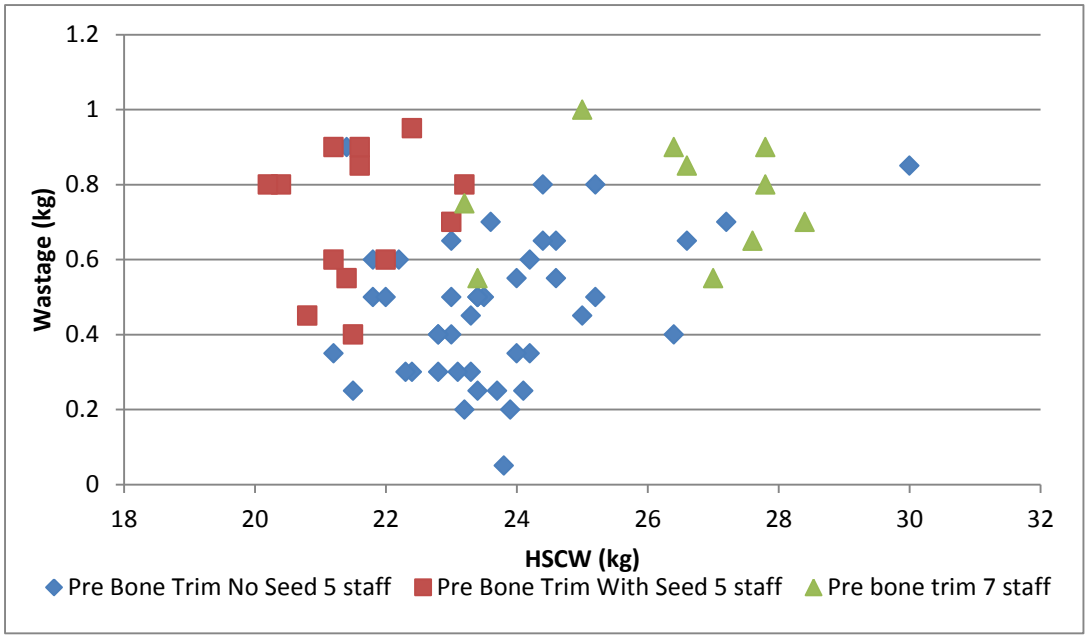


Figure 5: The amount of boning room pre-trim removed from carcases with and without seed.

4.4 Cost of processing at slower chain speeds

Slaughter Floor

The S/F chain speed could operate at maximum speed of 9.5 carcases per minute. However, when the frequency of seedy carcases within a mob approaches 40%, the chain speed was slowed to 8.5 carcases per minute. Consequently the slaughter cost increased by 12%. The decision to slow the chain is generally based on the frequency and severity of GSEED damage. Once grass seeds spread beyond the flap region into the FQ and HQ region and the frequency is above 10% the chain will be slowed to allow the trimmers to cope with the extra work load. When the frequency reached 40% even with light/medium infestation of the FQ and HQ, the chain speed was dropped to 8.5 carcases per minute.

Boning Room

The chain speed in the boning room was operated at the same speed as the S/F, but while attending the site the chain speed was maintained even while handling a line of seedy lambs.

Carcases that are still carrying light seed into the boning can be managed by the standard number of 5 pre-trimmers. When the incidence of seed is any higher more pre-trim staff are required to maintain chain speed. Staff were relocated to pre-trim from other areas of the boning room. Up to 8 personnel may be required to maintain the chain speed for a line of seedy lambs.

The standard number of pre-trimmers was 5, or 5.5% of boning room personnel. An increase in the number of pre-trimmers to 8, or 8.8% of boning room personnel, led to an increase in the staff cost per carcase of approximately 60% but the chain speed was maintained and the entire room is operating at capacity.

The increased cost of pre-trim due to additional pre-trim staff would be equivalent to running the chain speed at 9.2 to 9.3 carcases/min while operating with the normal number of pre-trim staff.

So what is the optimal solution? To determine this three aspects are taken into account: meeting QA regulations, cut optimisation, and maintaining room tally. Maintaining tally is regularly the main determinate as clearing chiller space and minimising carry over distributes the operating costs across more carcases. However, primal cuts may not be able to be prepared for the most optimal market, which is a trade-off against carcase profitability.

Re allocating 3 staff from primal preparation to pre-trim, could potentially result in a lower revenue for a primal, as there are less staff preparing cuts to meet the most profitable market. An example was observed, where 3 people were moved from boning square cut shoulders to pre-trim for a line of seedy lambs. The square cut shoulders were no longer boned out, but instead were allocated to a frozen market, for which there was no order at that time.

5. Grass Seed module development

5.1 Severity and location of GSEED infestation

The severity of GSEED damage was graded into three different categories based on the number of seeds found within a primal region. A light GSEED infestation has less than 12 seeds, a medium infestation has between 12 – 20 seeds, and a heavy GSEED infestation has greater than 20 seeds in a primal region (see Table 2).

The GSEED grading can be assigned to multiple primal regions. The primal regions are listed below (Table 10) and ordered the same way that GSEED infestation generally spreads over the carcase.

Table 10: The primal regions which the GSEED grading criteria can be assigned.

Primal Region
Flap
Shoulder
Leg
Rack
Shortloin

Within the worksheet “GSEED Operational Costs” the user can assign the severity of the GSEED infestation against each primal region using the drop down list (Figure 6).

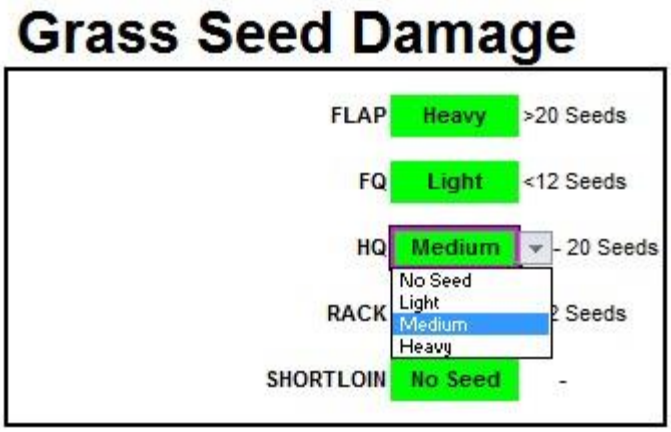


Figure 6: The severity of the GSEED infestation can be assigned to each primal region within the GSEED module.

5.2 Estimation of trim wastage associated with GSEED damage

Slaughter floor

The amount of trim wastage that will occur in removing the GSEED is estimated for the S/F and the boning pre-trim. Any revenue obtained from the trim wastage can be accounted for by entering an estimate price that would be received for it. In the example below trim wastage is priced at $0.20/kg, which results in a revenue of $0.12/hd (Figure 7).

Figure 7: The estimated trim wastage that occurs on the S/F and during the boning room pre-trim, removed from a carcase based on the severity of the GSEED infestation.

The estimation of the S/F Wastage trim was modelled from the trial so the regression estimated the S/F wastage based on the GSEED incidence and the carcase weight.

$$Extra\ S/F\ trim\ wastage = \sum_i a_{ij} * y$$

i – *primal region (i.e. Flap)*
j – GSEED infestation grade (Light. Medium, or Heavy)
a – beta coefficient based on GSEED grade and primal region
y – HSCW (kg)

Sufficient trial data was collected for the Flap and FQ relative to GSEED incidence to derive a regression to estimate the level of trim wastage. However, for the HQ, Rack and Shortloin the trim estimations were extrapolated as there was insufficient data collected during the trial.

It was assumed that for the same level GSEED grade (i.e. Light), the trim amount would increase relative to HSCW. Therefore, for a given GSEED grade, as HSCW increases the amount of wastage removed increases proportionally (Figure 8).

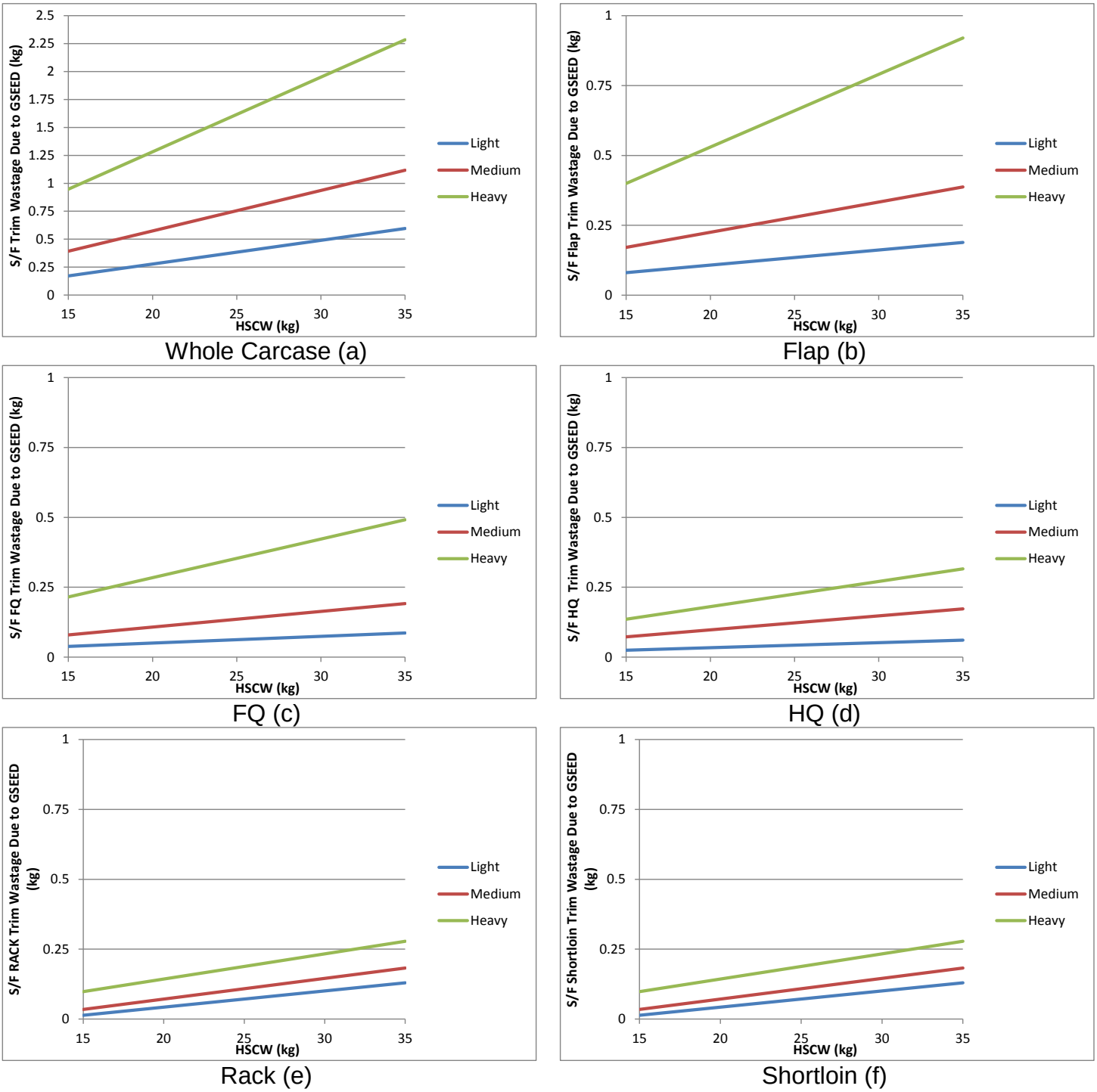


Figure 8: The modelling of the S/F trim wastage based on the severity of the GSEED infestation and HSCW for each primal region and the whole carcase (Whole Carcase (a), Flap (b), FQ (c), HQ (d), Rack (e) and the Shortloin (f)).

Boning Room Pretrim

During the trial it was noted that not all GSEED was removed on the S/F, therefore the boning room pre-trimmers had to trim heavier to remove any remaining seeds (Figure). Part of the GSEED trial was to benchmark the boning room pre-trim of normal lambs against GSEED damaged carcases. General production lambs were benchmarked and it was noted if there was any seed present, however the severity of GSEED infestation and amount of trim removed within a primal region could not be captured.

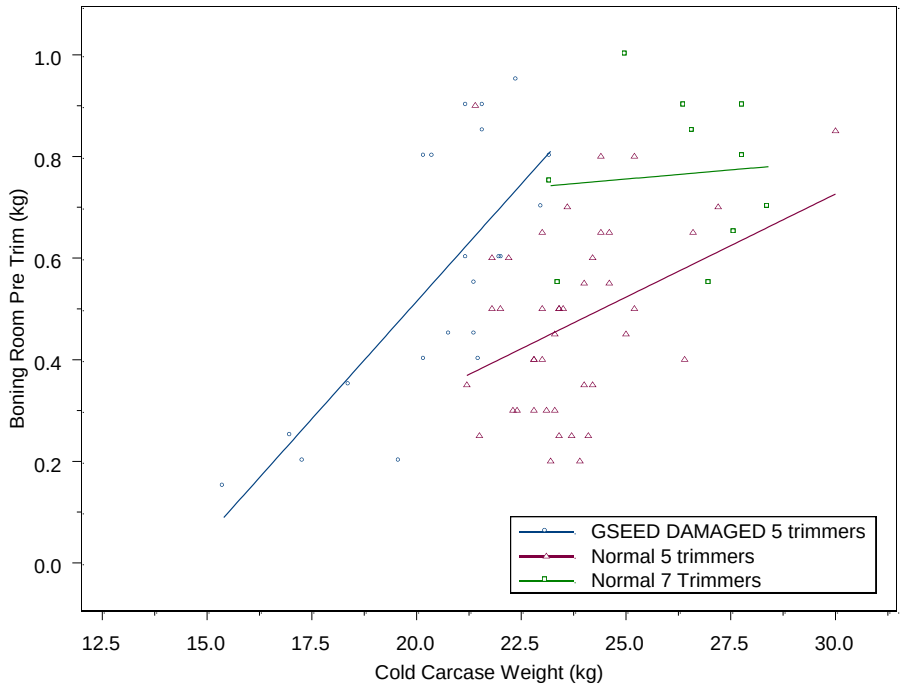


Figure 9: The benchmarking of boning room pre-trim for normal vs. GSEED damaged lambs. The number of trimmers was also recorded during benchmarking.

Using the pre-trim bench marking data as a guide the following rules were devised for the GSEED module to estimate the amount of pre-trim removed due to GSEED.

Assumption 1.
It was assumed during processing, that not all GSEEDS can be removed on the S/F and carcases will subsequently require further pre-trim in the boning room.

Assumption 2.
If all primal regions were graded with following grades for GSEED infestation, a fixed amount of extra pre-trim is removed (irrespective of carcase weight);

- Light seed infestation a maximum of 0.12kg of extra pre-trim
- Medium seed infestation, a maximum of 0.2kg of extra pre-trim, and
- Heavy seed infestation, a maximum of 0.36kg of extra pre-trim.

Table 11: The potential boning room pre-trim wastage that can be removed from a carcase with a uniform GSEED grade applied across all primal regions.

GSEED grade	Boning Room Pre-trim Wastage for Entire Carcase (kg)
Light	0.120
Medium	0.200
Heavy	0.360

Assumption 3.
Since multiple GSEED grades will be applied across primal regions, the amount of pre-trim removed from a given primal region will be determined by

- The GSEED grade for a given primal region, and
- The proportion of the given primal region relative to total primal weight.

$$Extra\ Boning\ Room\ Pretrim = \sum_i x_j * y_i$$

i – primal region (i.e. Flap)
j – GSEED infestation grade (Light. Medium, or Heavy)
x - extra boning pre-trim (kg) based on GSEED grade
y – proportion of a given primal region relative to total primal weight.

Assumption 4.
The proportion of a given primal region was calculated as a proportion of total primal weight. It was assumed that the entire flap will be removed on the S/F when GSEED damage was evident, and will not contribute to the boning room pre-trim. Consequently, the extra boning room pre-trim will only be allocated across the FQ, HQ, Rack and Shortloin, based on the proportion shown in Table 12.

Table 12: The proportion of each primal region relative to the sum of the primal regions (excludes the Flap) for cross breed (X-Breed) and Merino lambs. The proportions are used to allocate extra boning room pre-trim to each primal region based on the GSEED grading criteria.

	Proportions	
Primal Region	XB	Merino
Flap	-	-
FQ	0.39	0.41
HQ	0.40	0.40
Rack	0.11	0.11
Shortloin	0.10	0.09

5.3 Additional processing costs

The additional processing costs due to the reduction in the chain speed on the S/F or in the Boning Room are captured in the "GSEED Operational Costs" worksheet (Figure 6). The standard costs associated with the S/F and Boning Room are derived from the values entered into the Lamb Value Calculator. The costs are then revised based on the reduction in the chain speed. With the reduction in the S/F chain speed the kill capacity is sacrificed which results in the boning room not operating at capacity the following day. The costs associated with the lost capacity are included in the GSEED calculation.

The cost of skin down grade can also be entered along with other additional costs that may occur due to GSEED damage.

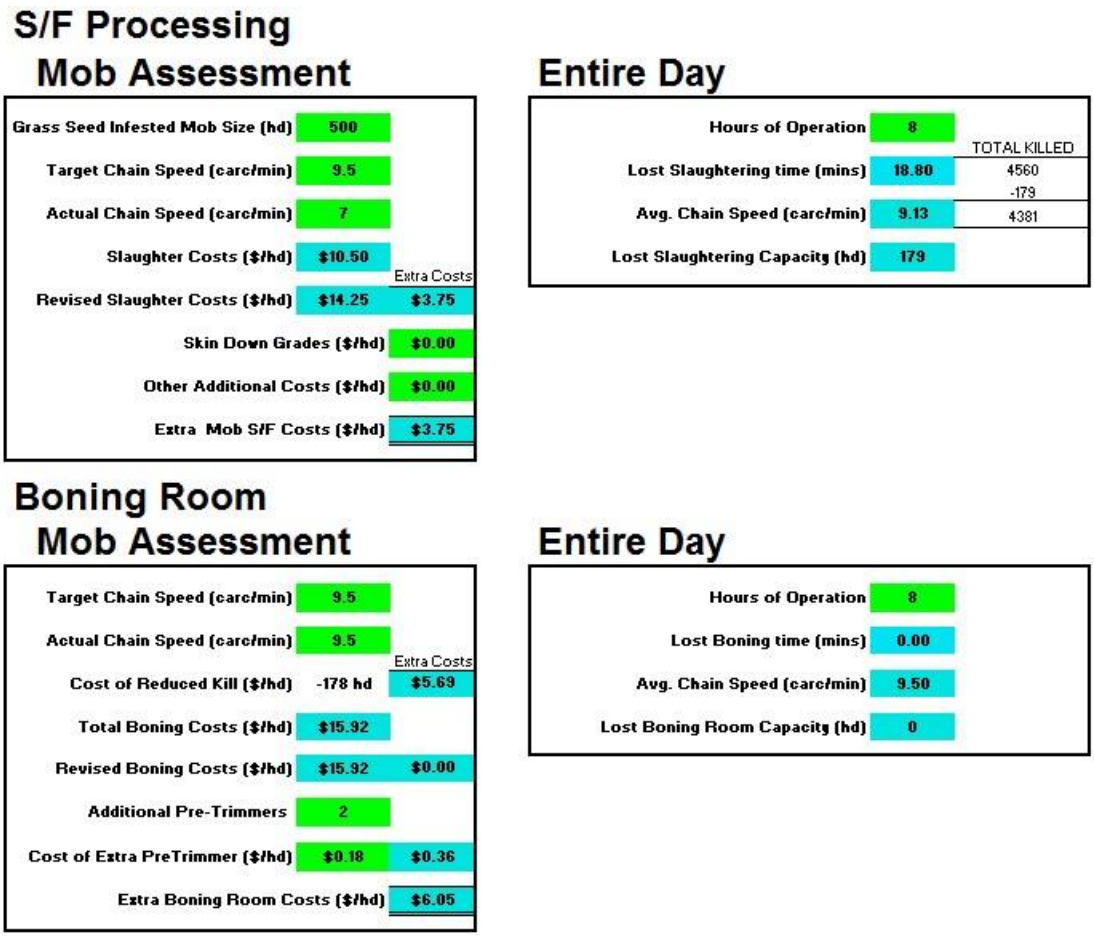


Figure 6: The calculation of additional processing cost that may occur in the boning room and S/F due to GSEED damage.

Additional pre-trimmers are often used in the boning room to avoid reducing the chain speed. There is a field to record how many extra pre-trimmers were employed along with the additional cost per head for each pre-trimmer.

5.4 Adjust HSCW and purchase price

On the S/F, the GSEED is removed prior to the scales, which will impact the HSCW depending on the severity of the GSEED damage. Within the GSEED module the HSCW is adjusted based on the S/F wastage, and the purchase price is recalculated (Figure 7).

For lambs purchased through the sale yards the, price per kilogram of adjusted HSCW is recalculated. Therefore, the GSEED damaged carcase, entering the boning room is going to be more expensive on a per kilogram basis.

The OTH purchase price is also recalculated based on the adjusted HSCW, as the lower weight may shift the carcase to a different price point. The difference in purchase price between the GSEED damaged carcase and a normal carcase is estimated.

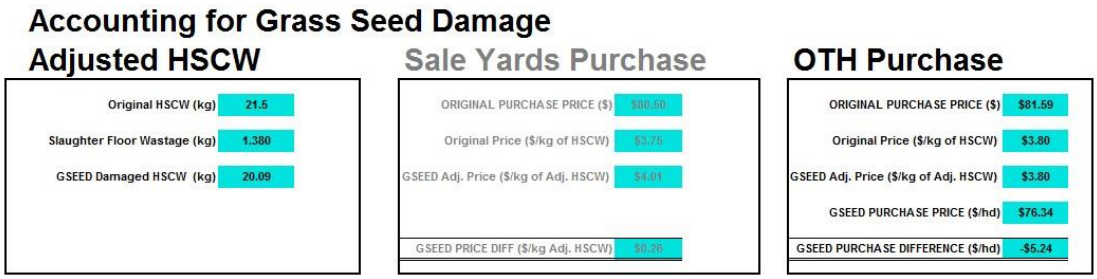


Figure 7: The HSCW is adjusted due to additional trimming on the S/F and the purchase price is recalculated for the type of trade selected by the user (Sale yards vs. OTH).

5.5 Nominate cut downgrades and their associated values

The GSEED module provides the user with the option to down grade primal cuts based on severity of GSEED infestation. Within the “GSEED Primal Downgrades” worksheet the prices for the downgraded cuts are entered along with any extra boning costs associated with preparing the cut

Figure 8: The fields within the “GSEED Primal Downgrades” worksheet to enter the prices for downgraded cuts and their associated boning costs.

Within the “GSEED Primal Downgrades” the user can nominate the downgraded cuts depending on the GSEED grade. The cut specifications selected in the Lamb Value Calculator are highlighted, so the user is aware which primal cuts can be downgraded (Figure 9). The downgraded cut that is underlined highlights the level of GSEED infestation for the primal region. The drop down menu allows the user to select downgraded cuts that are relevant to each primal cut. The default for the selection of any downgraded cut is a chilled product.

Down Grade Cut Selection

Primal Cut	Grass Seed Incidence Light	Medium	Heavy	Reduction in Primal Cut Price $/kg
1 Square Cut Shoulder (6mm fat)	Chilled	Frozen	Frozen	$0.30
5 Short Loin Trimmed 25 mm tail max 6mm fat	Chilled	Chilled	Eye S/S off	$2.91
5 Short Loin No Tail	Chilled	Frozen	Eye S/S off	
6 Rack Trimmed (6mm trim)	Chilled	Cap Off	Cap Off	
6 Frenched Rack Cap On (8 Rib) Frenched 50mm	Chilled	Chilled	Frozen	$0.30
6 Frenched Rack Cap Off (8 Rib) Frenched 50mm	Chilled	Chilled / Frozen / Cap Off / 1" Rack / Eye S/S off	Frozen	
8 Leg Chump On Tipped (6mm trim)	Chilled		Frozen	
8 Leg Aitch Bone Removed. Bone in	Chilled	Chilled	Trimmings	
8 Boneless Leg Chump on Shank Off	Chilled	Chilled	Trimmings	$1.07

Figure 9: The selection of downgraded cuts can be nominated for each GSEED grade using the drop down menus. The highlighted rows are the cuts selected within the calculator and the underlined downgraded cuts shows the GSEED grade that has been selected for that primal region.

The value of the original primal cut ($/kg) is recalculated based on the revenue that would be received from the down grade cut. The revenue lost due to the down grade is shown in the last column of the table (Figure 10).

Primal Price Reduction($/kg)*

Primal Cut	Base Price	Grass Seed Incidence Light	Medium	Heavy	Lost Revenue ($)
1 Square Cut Shoulder (6mm fat)	$4.20	$4.20	$3.90	$3.90	$1.30
5 Short Loin Trimmed 25 mm tail max 6mm fat	$7.00	$7.00	$7.00	$4.09	$5.09
5 Short Loin No Tail	$7.50	$7.50	$7.20	$4.61	
6 Rack Trimmed (6mm trim)	$8.50	$8.50	$9.09	$9.09	
6 Frenched Rack Cap On (8 Rib) Frenched 50mm	$16.50	$16.50	$16.50	$16.20	$0.43
6 Frenched Rack Cap Off (8 Rib) Frenched 50mm	$19.00	$19.00	$18.70	$18.70	
8 Leg Chump On Tipped (6mm trim)	$6.20	$6.20	$6.20	$5.90	
8 Leg Aitch Bone Removed. Bone in	$7.20	$7.20	$7.20	$7.93	
8 Boneless Leg Chump on Shank Off	$8.20	$8.20	$8.20	$7.13	$4.84

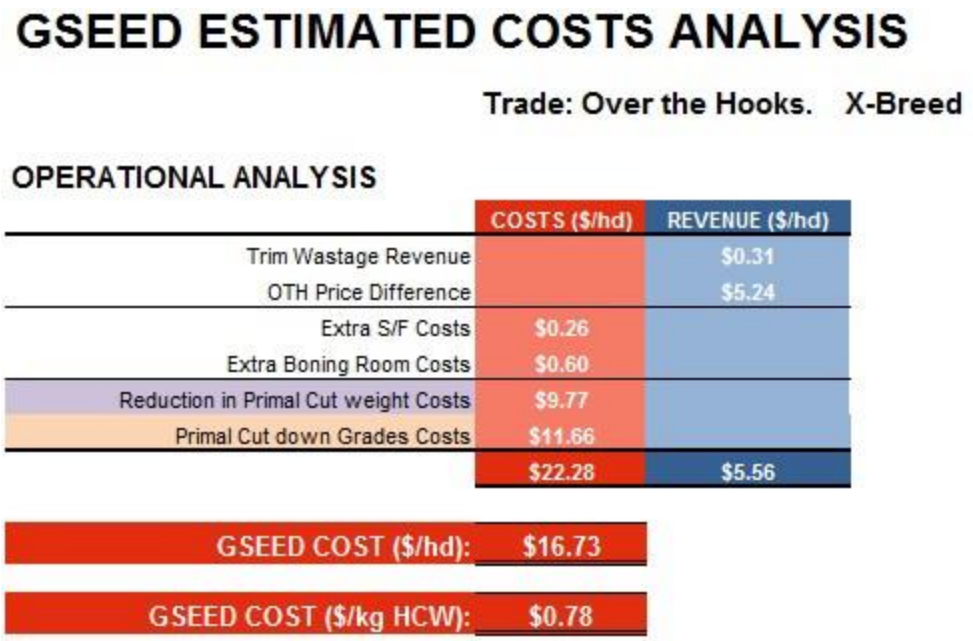
Figure 10: The recalculation of the primal price based on revenue that was derived from the downgraded cut. The price reduction also takes into account the boning cost.

5.6 GSEED summary tables

The costs and revenue associated with grass seed infestation are tabulated in the "GSEED Analysis" worksheet. There are three tables:

- Operational Analysis
- Primal Region Summary
- Primal Summary

The Operation Analysis table tabulates any costs and revenue associated with the GSEED infestation. The final cost of GSEED is calculated on a per head basis and a per kg of HSCW (Figure 11).



GSEED ESTIMATED COSTS ANALYSIS

Trade: Over the Hooks. X-Breed

OPERATIONAL ANALYSIS

	COSTS ($/hd)	REVENUE ($/hd)
Trim Wastage Revenue		$0.31
OTH Price Difference		$5.24
Extra S/F Costs	$0.26	
Extra Boning Room Costs	$0.60	
Reduction in Primal Cut weight Costs	$9.77	
Primal Cut down Grades Costs	$11.66	
	$22.28	$5.56

GSEED COST ($/hd):	$16.73
GSEED COST ($/kg HCW):	$0.78

Figure 11: The Operational Analysis table summarises any costs and revenue associated with GSEED damage and calculates the final cost on a per head basis and per kg of HSCW.

The GSEED analysis is further broken down into primal region and individual primals, so the user can assess the effects of incidence and location of GSEED damage on costs and determine lost revenue (Figure 12).

5.7 User manual

A comprehensive user manual has been written outlining the functionality of the Lamb Value Calculator. Please refer to “B.SCC.0179 - Lamb Value Calculator User Manual V6.2.docx”.

PRIMAL REGION SUMMARY: REVENUE LOSS

PRIMAL REGION	GSEED DAMAGE	S/F Wastage (kg)	Boning PreTrim Wastage (kg)	Total Trim Wastage (kg)	Reduction in Primal Wt. Costs	Primal Downgrades	Primal Cut Down grades Costs
FLAP	Heavy	0.568		0.568	$1.99		
FQ	Heavy	0.305	0.071	0.375	$1.51	Frozen	$1.30
HQ	Heavy	0.194	0.072	0.266	$2.14	Trimmings	$4.84
RACK	Heavy	0.157	0.020	0.176	$2.91	Frozen	$0.43
SHORTLOIN	Heavy	0.157	0.017	0.174	$1.22	Eye S/S off	$5.09
TOTALS PER HEAD:		1.380	0.180	1.560	$9.77		$11.66

Reduction in Product Revenue:	$21.42

PRIMAL SUMMARY

				COST OF LOWER PRIMAL WEIGHT DUE TO EXTRA TRIM WASTAGE			CUT DOWN GRADES		
Primals Cuts	Original Weight (kg)	GSEED DAMAGE	Total Trim Wastage (kg)	S/F Lost revenue	Boning Rm Lost Revenue	Reduction in Primal Wt. Costs	Primal Downgrades	Downgrade Costs	Lost Product Revenue
1 Square Cut Shoulder (6mm fat)	4.327	Heavy	0.315	$1.07	$0.25	$1.32	Frozen	$1.30	$2.62
2 Fore shank Tipped	1.065	Heavy	0.015	$0.07	$0.02	$0.09			$0.09
3 Breast	0.673	Heavy	0.019	$0.02	$0.00	$0.02			$0.02
4 Trimmed Neck	0.629	Heavy	0.026	$0.06	$0.01	$0.08			$0.08
5 Short Loin Trimmed 25 mm tail max 6mm fat	1.751	Heavy	0.174	$1.10	$0.12	$1.22	Eye S/S off	$5.09	$6.31
6 Frenched Rack Cap On (8 Rib) Frenched 50mr	1.435	Heavy	0.176	$2.58	$0.33	$2.91	Frozen	$0.43	$3.34
7 Boneless Flap (untrimmed)	1.399	Heavy	0.568	$1.99		$1.99			$1.99
8 Boneless Leg Chump on Shank Off	4.544	Heavy	0.240	$1.43	$0.53	$1.96	Trimmings	$4.84	$6.80
8.1 Hind Shank B/I	0.984	Heavy	0.027	$0.13	$0.05	$0.17			$0.17
9 Total Lean Trim	0.576								
			TOTAL	TOTAL	TOTAL	TOTAL		TOTAL	
Total	17.384		1.560	$8.45	$1.31	$9.77		$11.66	$21.42

Figure 12: The summary of cost and lost revenue due to GSEED damage, based on primal region and individual primals.

6. Discussion

6.1 Overall progress

The GSEED module has had limited “road testing” by individual processors, but has been demonstrated to industry representatives (DEPI, CRC, MLA) and processors (JBS, Herds, Coles, TFI) in a presentation format.

6.2 Consultation with industry

The GSEED module has been demonstrated at 4 meetings from June to October. The audience has consisted of MLA and Sheep CRC, DEPI, and Processors.

- **LSCG Presentation – June 24th Attwood**
  The functionality of the LVC and the GSEED module was demonstrated to the LSCG group members along with JBS representatives. From the discussion there suggested improvements to the GSEED module which have been implemented

- **Grass Seeds Action Plan Leadership Group**
  The GSEED module was demonstrated to a range of industry representatives from DEPI, Processors, and consultants. The presentation generated a lot of discussion about the application of the module and how it would fit within industry, and the estimated costing of GSEED to industry.

- **MLA/Sheep CRC Lamb Supply Chain Group / JBS Australia**
  The general functionality of the GSEED module was demonstrated and also modifications implemented from the earlier consultation with JBS. The module was given the green light to be released to sheep CRC partners to demonstrated and used by the wider lamb industry.

- **Lamb Supply Chain - MLA and Sheep CRC**
  The functionality of the reverse engineered grid and GSEED module was demonstrated.

6.3 Implications of the research findings to industry

The benefit of the GSEED module is that it is able to be configured to suit the user’s enterprise, and inputs can easily be revised to match the current trading environment. The revision of GSEED costs through the annual production cycle will help establish a benchmark which then can be used to underpin the discounts for infested carcases. This will assist in communicating to producers why the discounts are justified, and explain the proportion of costs occurring at each stage of processing relative to the incidence and location of GSEED damage.

From a resource management view point, the GSEED modules will provide the user a better understanding of what stage of processing extra costs are incurred. This may in turn assist with better utilisation of staff and other resources helping minimise additional costs.

7. Conclusion

The Lamb Value Calculator GSEED module is underpinned by models and assumptions collected from a trial conducted within an Australian abattoir, that attempted to establish the relationship between the extra cost of processing and the incidence and proximity of GSEED damage.

The next stage following on from this project would involve individual companies configuring the LVC and GSEED module to suit their enterprises. This would enable the GSEED modules assumptions and modelling to be further “ground truthed” against actual production figures. Additionally, it would provide them a platform to better understand the critical cost points in their enterprise to help minimise lost revenue. It would at the same time provide a benchmark for the seed discounts of infested carcases traded over the hooks.