A Review of Transport Practices and Mortalities in Australia

Final Report
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Table of Contents

1. Acknowledgements

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2. Executive Summary

The rationalisation of the abattoir sector necessitates that pigs are transported over longer distances for slaughter. As the distance between farm and abattoir increases, the producer, consumer and community at large could consider transport as a developing welfare issue.
Currently, the industry has limited information to counteract adverse comment by the consumer and community regarding pig welfare in transit.

A survey was conducted on loads of pigs transported from farm to abattoir to examine the impact of transportation time, time of year, stocking density, genetic source, time off feed and transport arrangements on pig deaths between loading on farm and arrival at the abattoir destination.

The survey represented 197 451 market weight pigs sold in 2011/12 by 19 Australian producers representing 14 260 sows. The pigs were transported by six independent transport companies and nine owner operators to three abattoirs located in QLD, NSW and SA. Herd size of participating production units ranged from 220 sows to 4000 sows.

Across the survey there were 71 pig deaths out of 197451 pigs sent to abattoirs (0.036%). This level of mortality was low compared with previous investigations in Australia and other international studies. Shorthose & Dickinson (1982) reported an annual mortality loss of approximately 0.24% in Australia. Higher death rates have been reported in the Netherlands, Western Germany, Denmark and Belgium, occasionally exceeding 1.0%. Approximately 1.0% of all pigs transported in the USA either die or become non-ambulatory during transport from farm to abattoir (Ellis, 2003).

In this survey, deaths were reported by load. The overall percentage of loads with deaths was 5.4% (57 out of 1050 loads).

The average time in transit was 4.2hrs with only 23% of loads in transit for less than 2 hours.
The percentage of loads with deaths in transit increased from 2.04% for short trips (less than 2hrs) to 5.93% for medium trips and 6.74% for long trips (more than 4hrs).

The percentage of loads with deaths was significantly higher in summer (7.3%) compared with winter (3.5%).

Forty-two percent of loads were transported at a low stocking density, (>0.50m^2/pig) while 56% at a medium stocking density (0.35 – 0.50m^2/pig). At the low stocking density, the number of loads with deaths in transit was 2.3% compared to 8.0% of loads, where a medium stocking density was recorded.

The average time off feed was 10.16 hours. Overall there were 8.0% of the loads with deaths when pigs were off feed for short periods (<6.5 hrs), 7.0% of the loads with deaths for a medium time off feed (6.5 – 13 hrs) and 1.8% deaths for the loads with long times off feed (>13.5 hours).

In this survey of seven genetic sources, genetic source 1 had a significantly higher number of loads with deaths (20.4%) compared with other genetic sources. GS2 had the next highest percentage of loads with deaths (7.5%), then GS3 (1.8%), GS4 (1.6%), GS5 (1.4%) and other genetics not specified (0.8%).

Deaths in transit recorded in this survey were lower than in previous Australian and international surveys. Contributing factors to the lower death rate include producers participating in the Australian Pork Industry Quality Assurance Program (APIQ√®) which requires staff to be trained in animal welfare as well as moving and handling pigs. The use of species specific contractor's whose employees are trained in the movement of pigs may also be a contributing factor. In addition, the greater use of the APL 'Is It Fit to Load?' Guide, and the fact that all co-operating abattoirs were export accredited facilities could have contributed to the lower death rate.

APL should continue to encourage producers, transporters and lairage operators to undertake training programs to improve the welfare of pigs in transit.

The survey undertaken only recorded deaths in transit. Further work should investigate the level and reasons for condemnations in both export accredited and domestic abattoirs.

3. Background to Research

The increasing interest in the ethical production of food and in particular meat has resulted in the community and the consumer being more aware of animal welfare issues. The rationalisation of the abattoir sector has increased the distances that some pigs are transported from the farm to the abattoir. Society continues to debate animal welfare and it is imperative that industry can participate in the debate with data that is soundly based.

A research report by Context Marketing (March 2010) on the ethical claims that matter most to food shoppers and how ethical concerns influence food purchases indicated that women and young adults are more responsive to ethical claims. When asked to identify the meaning of ethical food more than 90% of respondents identified three main qualities:

- protection of the environment,
- high food quality and safety standards,
- humane treatment of farm animals.

The survey found that 69% of respondents stated they were willing to pay more for food produced to higher ethical standards. Sixty-five percent of respondents were more willing to believe brand claims about high quality when known that a food is ethically produced and 43% stated that they feel virtuous when purchasing ethically produced foods.

Promoting pork as an ethically produced product dictates that APL and the industry improve the understanding of community and consumer attitudes and responses to welfare. This project will help APL and the industry to improve their knowledge of transport practices and mortalities in Australian conditions. The outcome will benefit all parties: the producer, the consumer and community.

4. Objectives of the Research Report

This project set out to:

- collect accurate and meaningful data on transport mortalities that occur during transport and lairage.

- analyse and report deaths by abattoir, time of year, distance travelled and stocking density on the truck

5. Introductory Technical Information

The transport of market age pigs from farm to abattoir or saleyards is an essential link in the pork processing chain. The influence of transportation on animal welfare, meat quality and carcase yield has been well documented internationally.

Pig deaths as a result of pre-transport assembly/handling and the transportation process itself is a multi-factorial problem, involving pig factors (genetics, stress susceptibility, health status), facility design factors (pre-sorting and loading), people factors (human-animal interactions, handling), transportation factors (stocking rates, duration and length of journey, vehicle design), environmental factors (season, temperature and humidity) and the duration these various stressors are applied to a particular consignment of pigs.

Transport losses include pigs found dead on arrival at destination (died during transport), dead in yard/pen (died soon after unloading, usually in lairage pen) and non-ambulatory pigs (unable to move or keep up with contemporaries; downers, cripples, fatigued or injured).
It is important for individual farms to identify and manage the risk factors most likely responsible for the majority of its pig losses.

Shorthose & Dickinson (1982) reported an annual mortality loss of approximately 0.24% in Australia. Higher death rates have been reported in the Netherlands, Western Germany, Denmark and Belgium, occasionally exceeding 1.0%. Approximately 1.0% of all pigs transported in the USA either die or become non-ambulatory during transport from farm to abattoir (Ellis, 2003).

In a survey of 739 journeys to 37 different abattoir destinations in five EU countries, average mortality was 0.11% (Averos et al, 2008). Average temperature during journey, journey duration, average loading time per pig, pre-load pig injuries, time off-feed pre-transport and interaction between fasting and journey duration were recorded. Non-fasting doubled the risk of mortality, while average temperature during transport was a greater risk factor than duration of journey for fasted pigs. Risk of pig deaths decreased with average time taken to load/pig.

A recent study in 2011 by Gosalvez et al reported that the percentage of transports with at least one dead pig was 12.3% on journeys from farm to abattoir. In the study, the average duration of journeys from farm to abattoir was 3.4 hours. The average stocking rate for fattening pigs (15 – 150kg LW) was 0.53m^2/pig.

Dewey et al (2004) reporting on a 2001 survey of in-transit deaths in Ontario, Canada, revealed that the farm where the pigs originated explained 55% of the variation in loss seen with 0.17% (17 out of every 10,000 pigs marketed) dead during transport. Most losses occurred in summer in association with high ambient temperature and humidity; 25% of farms did not record any in-transit deaths.

Factors associated directly with transporters only explained 19% of the variation in losses; these included loading density, weather, microclimate within the vehicle, duration and route of transport, stopping frequency and truck design.

This current project aimed to quantify the extent to which a range of risk factors had contributed to pig deaths during transportation between farms and abattoir for a number of Queensland, NSW and SA commercial piggeries.

Consignments transported by their owner, or as the only group of pigs on the truck, experience fewer deaths in-transit than pigs transported by a 3rd party, or as one of a number of groups on the truck (Shorthose 1987). This benefit was attributed to less mixing of unfamiliar pigs and therefore less fighting, fewer stoppages and shorter transport durations.

Pigs that experience regular moving and handling during the finisher phase are easier to move and less likely to be subjected to aggressive handling during loading.
The most effective loading facilities provide a uniform environment and sensory experience that pigs will find less threatening. The elimination of sharp edges and turns, use of solid blocking gates and raceways, moving boards, raceway and ramp widths constructed to facilitate side-by-side loading, loading platforms level with the truck deck and ramps inclined at less than 20 degrees will encourage pigs to load with less need for aggressive, stressful handling.

The most important reasons for fasting pigs pre-transport are to lower the risk of deaths in-transit and to reduce post-mortem issues associated with gut content spillage and waste disposal. Fully-fed pigs may die from choking and suffocation through inhalation of vomit during transport. Losses are greater when pigs are fed on day of transport, regardless of distance travelled. However, fasted pigs should have access to water pre-transport to avoid weight loss due to dehydration. High ambient temperature and humidity during transport, poor vehicle ventilation and high pig body temperature increase the risk of deaths through dehydration.

Pigs genetically predisposed to stress during handling, loading and transport will increase death losses during transport. Murray and Johnson (1998) found 9.2% of pig's homozygous positive for the stress gene died during transport, compared to 0.27% death losses in heterozygous stress gene carriers and 0.05% in pigs that were stress gene free.

The risk of in-transit death is increased dramatically amongst pigs that are fatigued, injured or non-ambulatory at time of loading. Genetic lines can influence both percentage fatigued and percentage deaths in-transit (Benjamin, 2005). During loading, fatigued pigs show signs of acute stress, open-mouth breathing, bluish skin blotches and muscle tremors.

Major transportation factors related to risk of transit death include extent of mixing with unfamiliar pigs, time between drafting/sorting and loading, time between mixing and loading, time between loading and vehicle departure, vehicle stocking density, duration and length of journey, frequency and length of (any) stopping en-route, temperature and humidity throughout the journey, time between arrival at destination and unloading, pig position on vehicle and the number of loads carried by the same operator within the same day.
Because the main stressors on any pig during transportation are the loading and un-loading, journeys of shorter duration may be more detrimental to pig welfare than longer ones, provided other factors such as design of loading facilities, pig handling, stocking density of loads and pig health status have been well managed. Death loss due to transport was shown to be lowest for short durations

(10-25 minutes) compared to 45-80 minutes (Honkavaara,1989), suggesting that stress-sensitive pigs die within a short time of transport commencing.

Optimum scheduling of transport to fit with farm and abattoir priorities can influence the time and stress experienced by pigs during loading, total time spent in-transit and on-vehicle, and ultimately subsequent mortalities during transportation.

6. Research Methodology

Method/Process

Survey data was collected on loads of pigs, representing 197 451 pigs, marketed by 19 Australian producers owning approximately 14 000 sows to examine the impact of length of transportation time, time of year, stocking density, genetics, time off feed and transport arrangements on transport losses. The pigs were transported by six transport companies and 12 owner operators to three abattoirs located in QLD, NSW and SA. Herd size ranged from 220 sows to 4000 sows.

The transport system was either where the owner of the pigs also owned the truck or where the owner of the pigs engaged a contractor to transport the pigs from the farm to the abattoir.

Data was collected from 01/05/2011 to 30/06/12. In addition, four of the co-operating producers collected data from 01/03/12 as part of the survey trial exercise.

The survey questionnaire was in three sections:

- Information from loading staff
- Information from the transporter
- Information from lairage staff

Loading staff observations included the farm reference, loading date and time, time off feed and water, abattoir destination, number of pigs loaded, number of suspect pigs in the load, weight of the load, treatments used, genetic source and truck information.

Transporter staff observations included the farm reference**,** time of loading, time of arrival at abattoir, number of pigs loaded, number of suspect pgs, routine and non-routine stoppages. In addition, truck information including floor dimensions, number of decks and number of trailers.

Lairage staff observations included the farm reference, date and time of un-loading, number of alive and dead pigs on arrival (agreed to by both the truck driver and lairage staff), number condemned on arrival and number of emergency kills.

Loads were sent to three different abattoirs which will be referred to as destinations in this report:

- Destination 1: (n=231) in New South Wales
- Destination 2: (n=83) in South Australia
- Destination 3: (n=736) in Queensland

The time of year was summarised into winter (1 April to 30 September) and summer (1 October to 31 March).

Stocking density was categorised as low (> 0.5 m^2/pig), medium (0.35 m^2/pig - 0.5 m^2/pig) and high (< 0.35m^2/pig).

The length of transportation was divided into short (less than 2 hours), medium (between 2 and 4 hours) and long trips (greater than 4 hours).

Time off feed was categorised as short (<6.5 hours), medium (6.5 – 13 hours) and long (>13.5 hours) periods off feed.

Statistical Analyses Used

This data is from a survey and hence the factors that were examined are not controlled for other factors such as environment or other treatments applicable to the load of pigs that have been recorded. Caution is needed in interpreting the results as a factor may not have caused higher mortalities but may be confounded with other reasons that caused higher mortalities.

Chi-square tests on contingency tables were used to assess the distribution of counts across a factor, for example, the distribution of the number of loads with and without any deaths across abattoirs. To follow up on a significant results for a table, levels of a factor were explore in a pair-wise fashion. For 2x2 contingency tables a Yates correction for continuity was used.

To explore the number of loads with deaths or number of deaths per load a logistic regression was used. Significant results were further explored using pair-wise comparisons.
For continuous variables such as travel time (hours), an analysis of variance was used, with appropriated transformations used if necessary. Least significant differences (lsd) were used to explore significant results.

Regression trees were used to explore the percentage of deaths per load and percentage of loads with any deaths. Excel was used to analyse contingency tables. GenStat (version 14) was used for logistic regressions and analysis of variances. R (version 2.14.1) was used to conduct regression tree analyses.

7. Results

Across the whole survey there were 71 pig deaths out of 197451 pigs sent to the three destinations or 0.036%. The overall percentage of loads with deaths was 5.4% (57 out of 1050 loads).

Overall, there was a significant difference in the percentage of loads with any deaths across abattoir, with Destination 1 having a significantly higher percentage (14.7%) than Destination 2 (3.0%) and Destination 3 (1.2%), which were not significantly different from each other.

There was also a similar result with the percentage of deaths per load, with Destination 1 having an average of 0.102% of pig deaths which was significantly higher than Destination 2 (0.021%) and Destination 3 (0.006%), which were not significantly different from each other. The overall average death rate per load was 0.041%.

Transport Time

The overall average time of transportation to an abattoir was 4.2 hours. The average time to Destination 1 was 4.5 hours and to Destination 3, 4.9 hours, which was significantly higher than Destination 2 (4.0 hours).The length of transportation was divided into short (less than 2 hours), medium (between 2 and 4 hours) and long trips (greater than 4 hours).

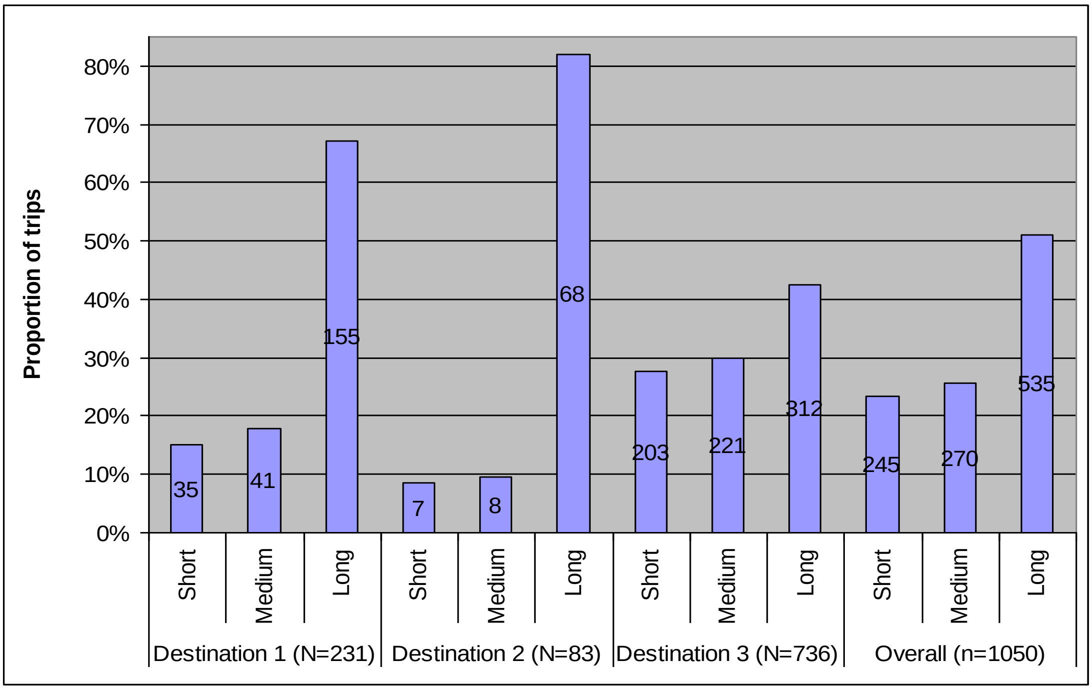

Figure 1: The proportion of short (<=2 hours), medium (2<hours<=4) and long (>4 hours) trips (with number of trips on bars) to 3 abattoir destinations

Across all abattoirs there were 23.3% short, 25.7% medium and 51.0% long trips. There was a significant difference in the proportion of short, medium and long trips across abattoirs (Fig 1).

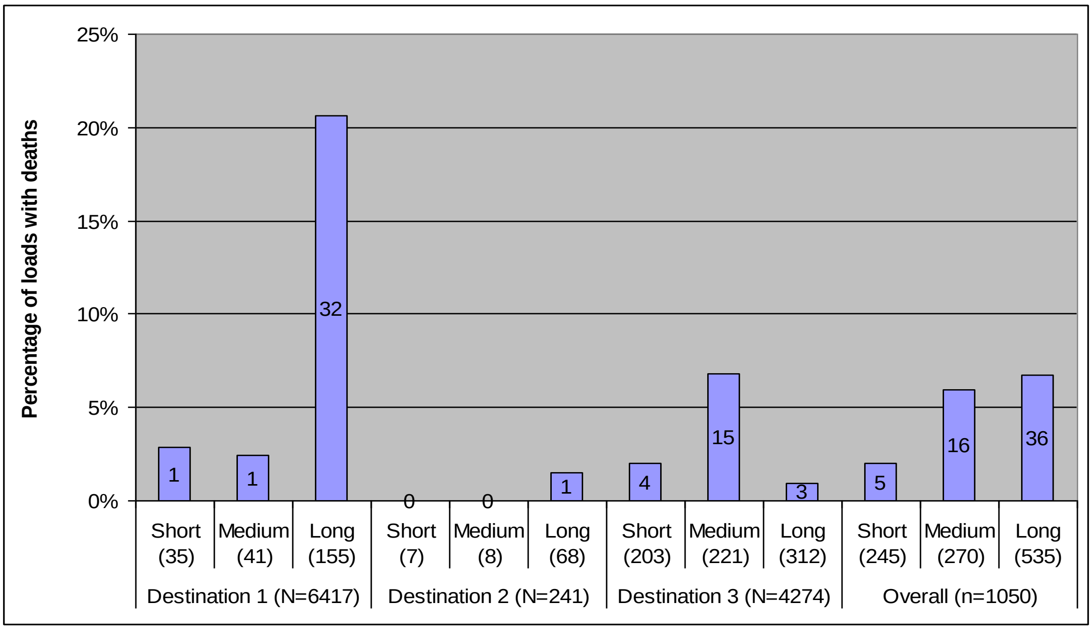

Figure 2: The proportion of loads with deaths for short (<=2 hours), medium (2<hours<=4) and long (>4 hours) trips (with number of trips on bars)

The percentages of loads with deaths were 2.04% for short trips, 5.93% for medium trips and 6.73% for long trips (Fig 2). The percentage of loads with deaths was significantly lower for short trips than for medium or long trips (which weren't significantly different from each other). There was a significant interaction between destination and length of trip (short/medium/long).

Time of Year (Summer/Winter)

Time of transportation was categorised into summer (1st October to 31 March) and winter (1st April to 30 September). Figures 3 to 5 show the monthly mean maximum and minimum temperatures for the three abattoir destinations from the nearest Bureau of Meteorology weather station for the recording period.

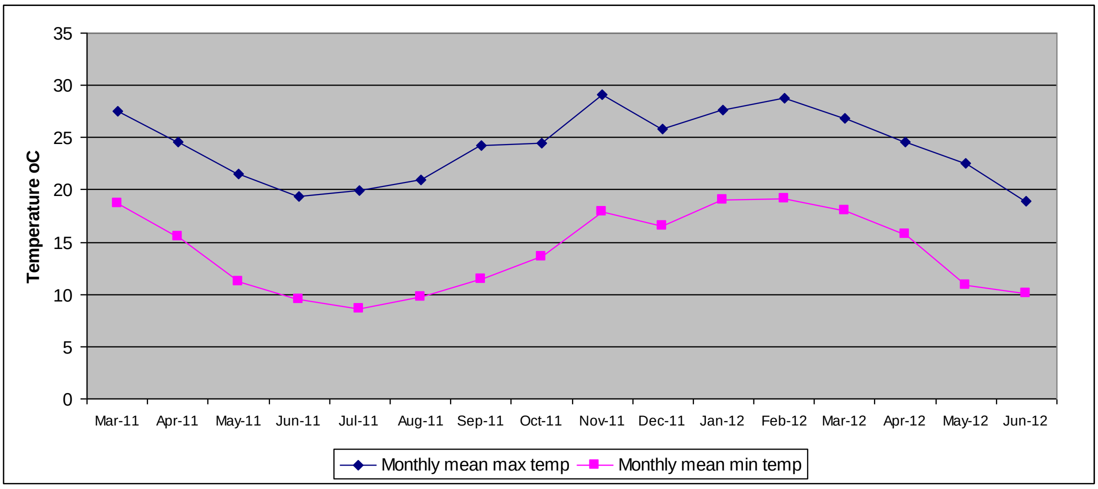

Figure 3: Monthly mean maximum and minimum temperatures for Destination 1 from the nearest Bureau of Meteorology weather station

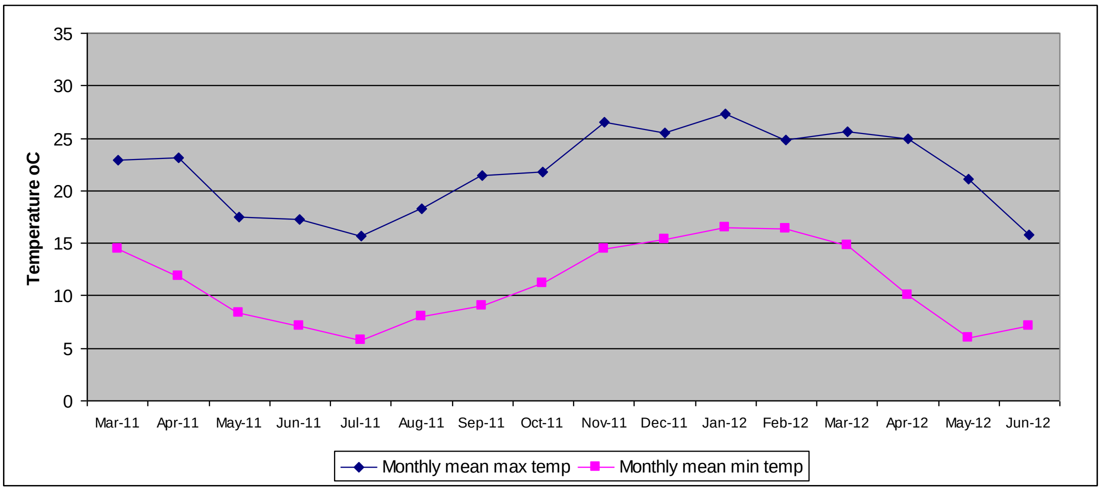

Figure 4: Monthly mean maximum and minimum temperatures for Destination 2 from the nearest Bureau of Meteorology weather station

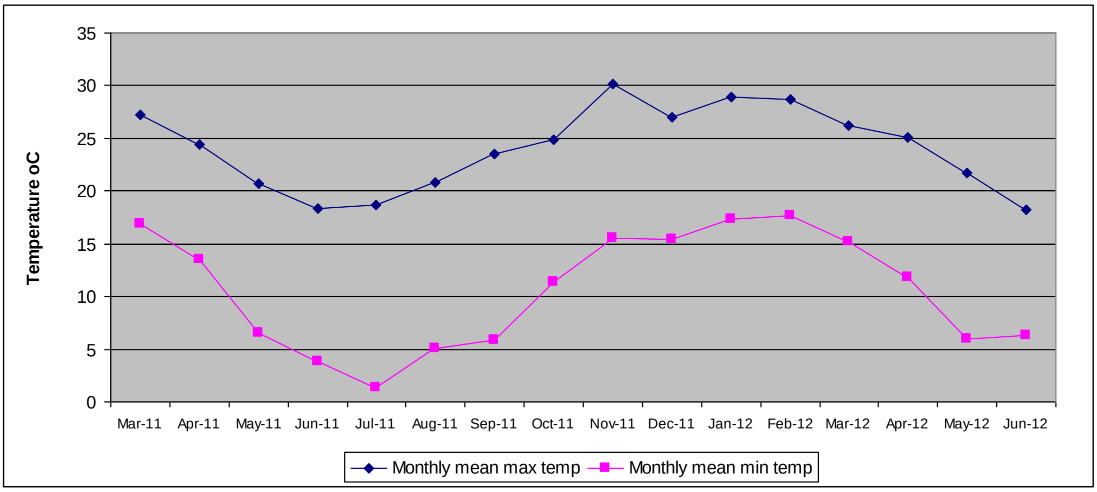

Figure 5: Monthly mean maximum and minimum temperatures for Destination 3 from the nearest Bureau of Meteorology weather station

The proportion of trips between summer and winter were significantly different across abattoirs (Fig 6).

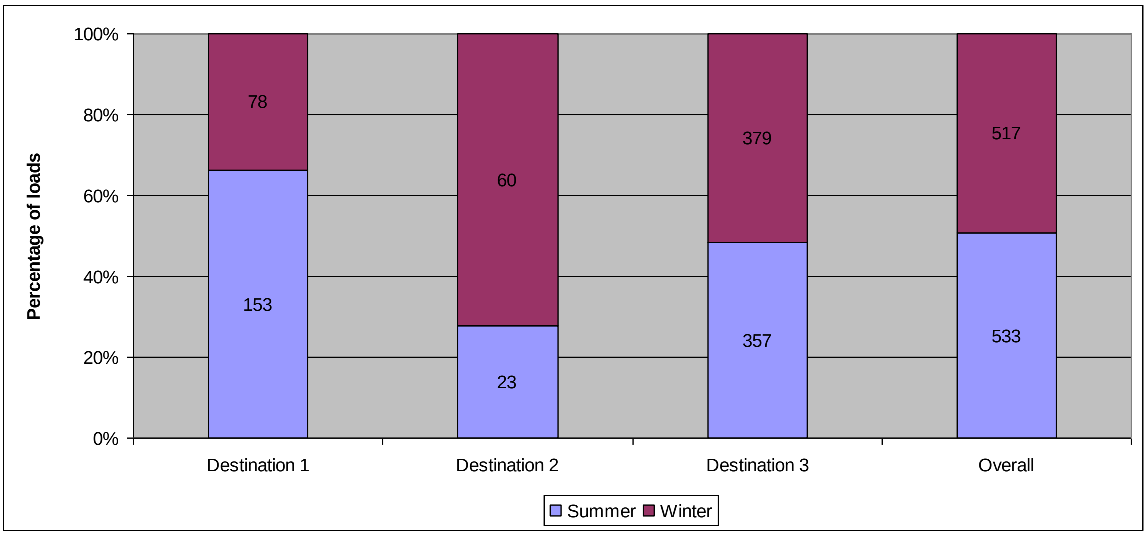

Figure 6: Percentage of loads sent to 3 destinations across seasons

The percentage of loads with deaths was significantly higher during summer (7.3%, n=533) than winter (3.5%, n=517) when combined across abattoirs (Fig 7). There was also a significant difference in percentage of loads with deaths across abattoirs (but not significant interaction between abattoir and season).

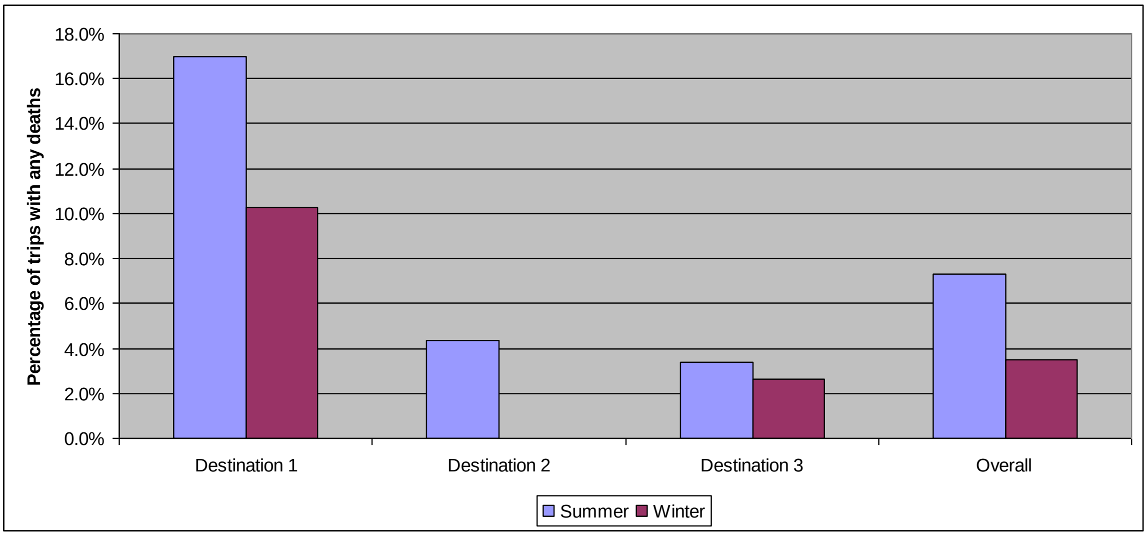

Figure 7: The proportion of deaths in winter and summer

Fig 8 shows the number of loads with deaths by calendar month. The highest death rates were in the summer months of November and February where the highest temperatures were recorded at all three destinations. The lowest number of loads with deaths was recorded in June**.**

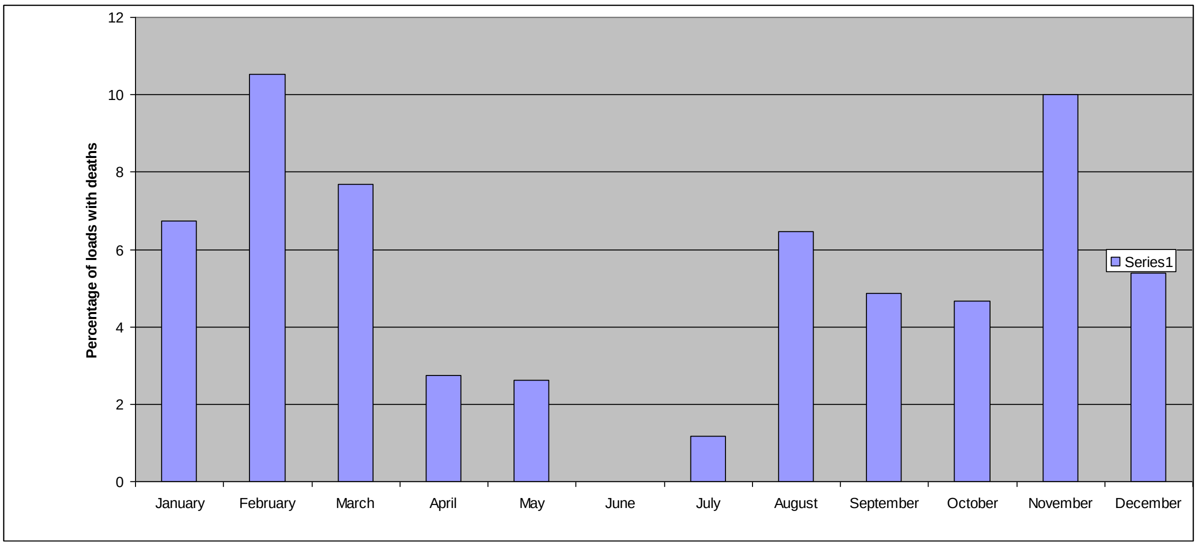

Figure 8: The percentage of loads with deaths by month

Stocking Density

The overall mean stocking density was 0.64 m^2/pig (Fig 9). For loads sent to Destination 1,the average was 0.46 m^2/pig, to Destination 2; 0.38 m^2/pig and Destination 3; 0.73 m^2/pig. The data was quite skewed so these means do not accurately describe the median of the data (0.45 m^2/pig).

The proportion of low, medium and high stocking densities was significantly different across abattoirs (Fig 10). The majority of the loads were at medium stocking density for Destination 1 (84.8%) and Destination 2 (80.7%). For Destination 3, half the loads (43.6%) were medium while 54.8% of the loads sent had low stocking density.

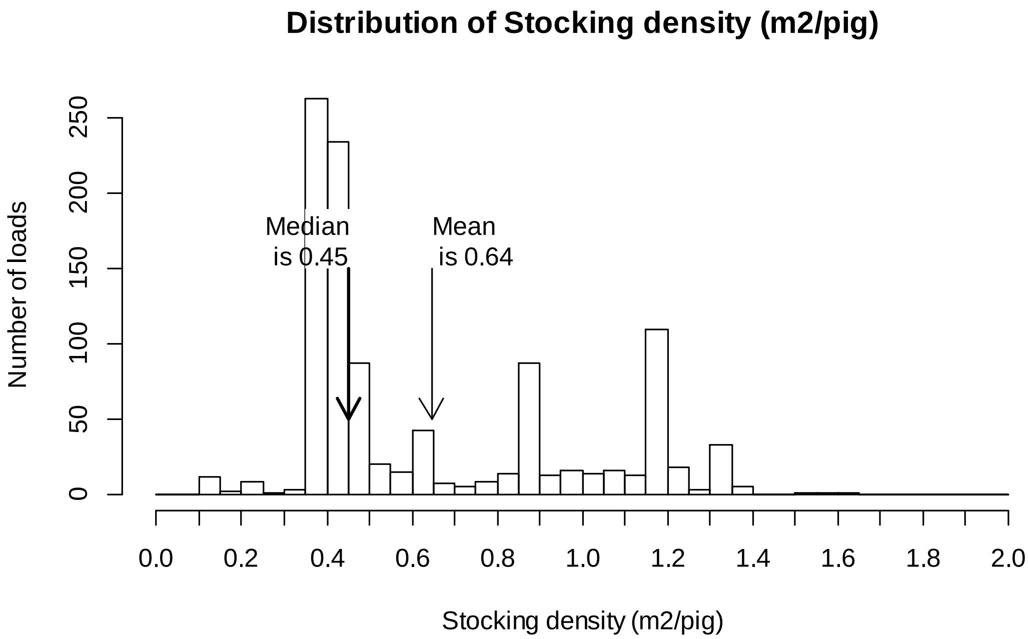

Figure 9: Distribution of stocking density (m^2/pig)

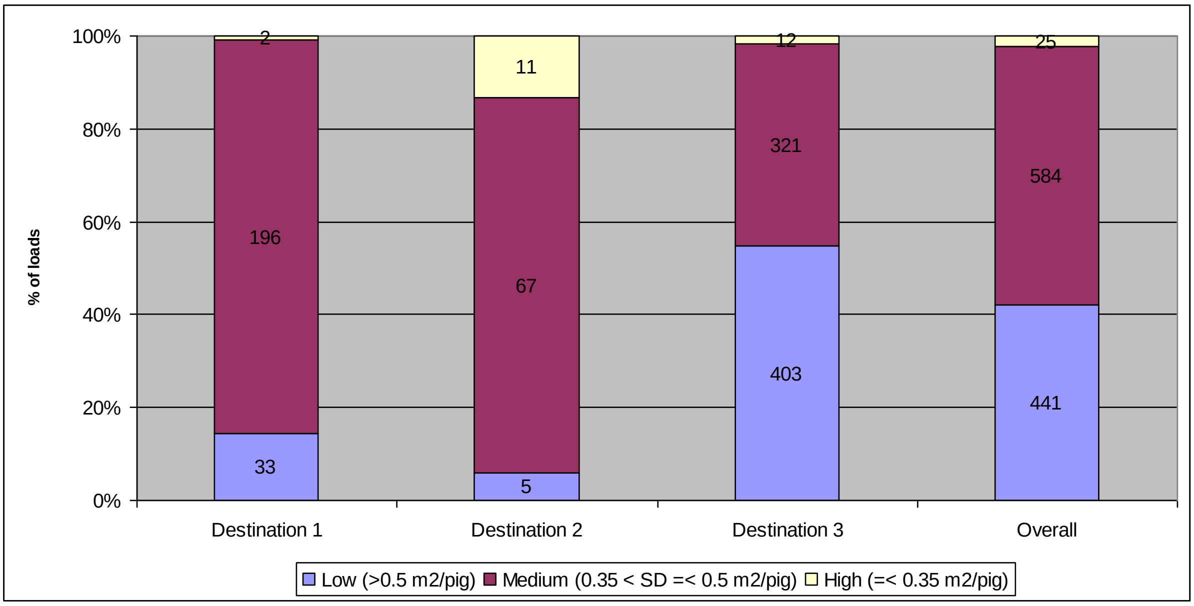

Figure 10: Percentage of loads with low (>0.5m²/pig), medium (0.35 – 0.5m²/pig), or high (=<0.35m²/pig)

Overall there were 2.3% of the loads with deaths for low stocking rates, 8.0% of the loads with deaths for medium stocking rate. There were no deaths recorded in the small sample of 25 loads with a high stocking density (Fig 11).

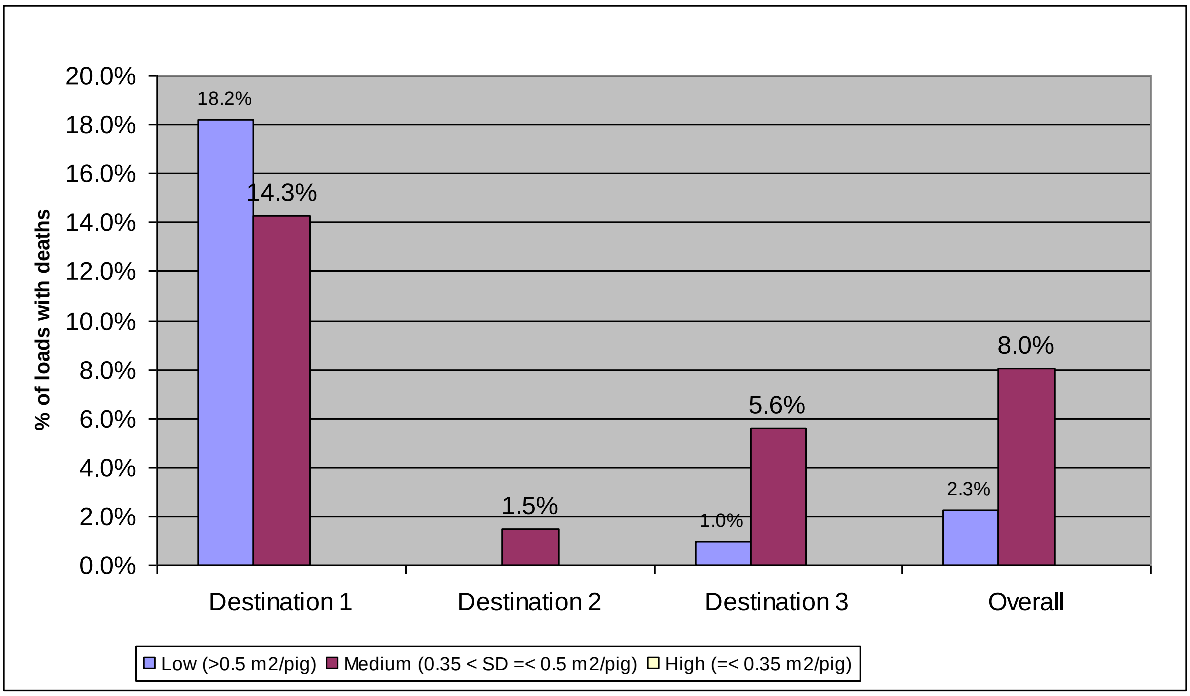

Figure 11: Percentage of loads with deaths across low (>0.50m²/pig) and medium (0.35 – 0.50m²/pig) stocking densities

Transporter (Owner/Contractor)

The proportion of loads sent by independent contractors (as opposed to owners) was significantly different across abattoirs (Fig 12). Destination 2 had 91.6% of the loads transported by independent contractors, which was significantly higher than Destination 3 (40.4%), which was significantly higher than Destination 1 (32.0%).

The transporter, owner or contractor did not have any significant effect on the percentage of loads with deaths. Independent transporters had 4.9% of loads with deaths, and owner transporters had 5.8% of loads with deaths.

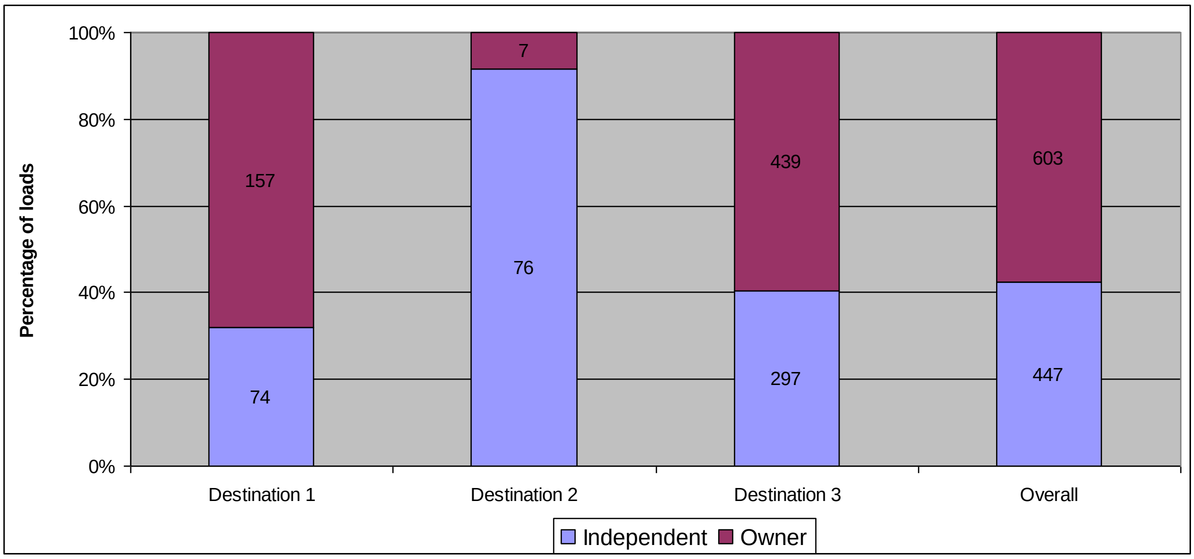

Figure 12: Percentage of loads transported by independent or contractor transporters

Genetics of Sire and Dam

Seven genetic sources (GS) were identified within the survey for sire and dam lines. The majority of the loads had the same genetics for sire and dam (937 out of 1050 loads, 89.2%).

There was a significant difference between sires used in the percentage of loads with deaths. GS1 had the highest percentage of loads with deaths 20.4% (n=157) which was significantly higher than all other genetic lines indicated below. GS2 had the next highest percentage of loads with deaths (7.5%, n=288), then GS3 (1.8%, n=109), GS4 (1.6%, n=183), GS5 (1.4%, n=71) and other genetics not specified (0.8%, n=240).

A minority of loads were of mixed genetics. Loads of pigs with GS3/GS7 (n=38), GS3 / GS2 (n=15) and GS6 /GS7 (n=9) did not have any deaths.

Time Off Feed

The overall average time off feed was 10.16 hours (Fig 13). For loads sent to Destination 1 the average was 11.3 hours, to Destination 2; 9.8 hours and Destination 3; 9.9 hours. Destination 1 had a significantly longer time off feed than Destination 3, and both were not significantly different to Destination 2.

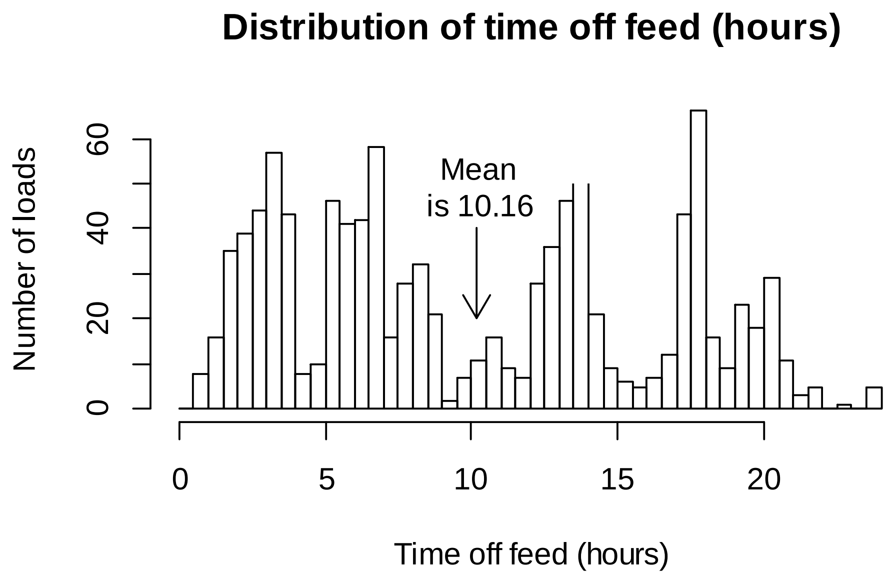

Figure 13: Distribution of time off feed

The proportion of short, medium and long times off feed was significantly different across destinations, with each destination having a significantly different distribution from the other destinations. This can be particularly seen in Fig 14 in the differences of proportions of short and medium times off feeds.

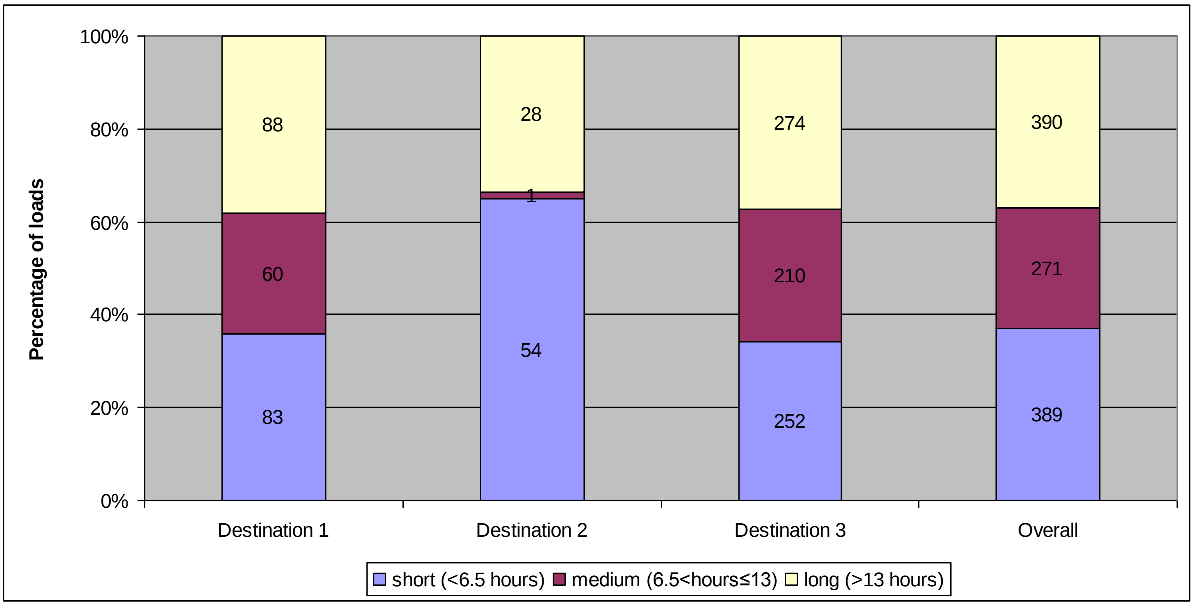

Figure 14: Percentage of loads with deaths from low (>6.5hours), medium (6.5 – 13 hours), or high (> 13 hours) times off feed

Overall there were 8.0% (n=389) of the loads with deaths for short periods off feed, 7.0% (n=271) of the loads with deaths for medium time off feed and 1.8% (n=390) deaths for the loads with long times off feed.

Shade Covering of Trucks

The percentage of loads with shade covering was significantly higher for Destination 1 (98.7%) than for Destination 2 (94.6%), and both were significantly higher than Destination 3 (73.5%). There were no deaths recorded on any loads to any of the destinations where no shade covering was used (Fig 15).

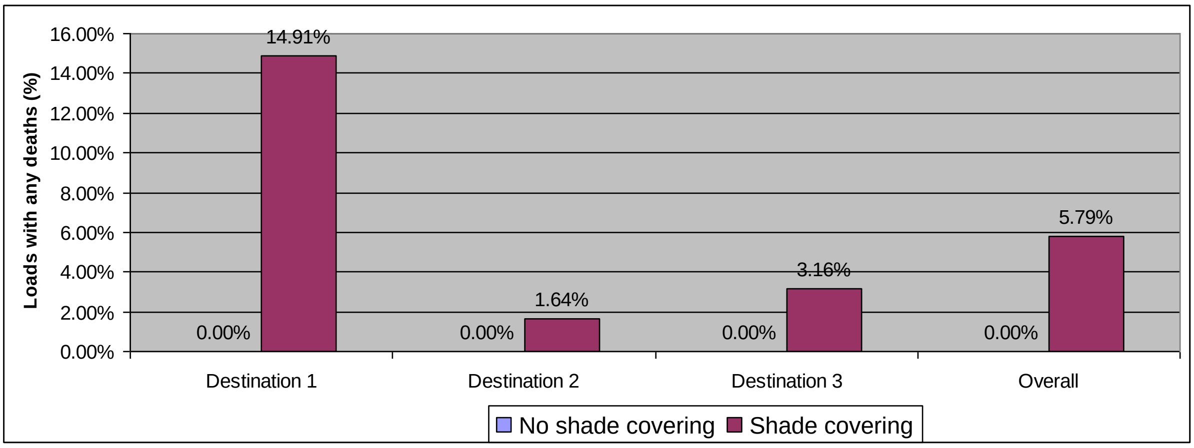

Figure 15: Percentage of covered loads with deaths

8. Discussion

The level of mortality in transit from farm to lairage recorded in the survey (0.036%) was low compared with previous investigations in Australia (Shorthose & Dickinson 1982) and other international studies (Ellis., 2003; Averos et al., 2008; Dewey et al., 2004). A possible reason for the difference in the results obtained in this survey is that all co-operating units were members of the Australian Pork Industry Quality Assurance Program (APIQ√®). The program sets standards for the movement and handling of pigs aimed at reducing stress and improving animal welfare. In other investigations, the practices implemented could have had an influence on the results because handling practices did not necessarily conform to the APIQ standards. All producers participating in the APIQ√® program have to produce training records for their staff to meet the 3rd party audit. In addition, a number of the transport contractors were in a QA scheme such as Truck Care. All the abattoirs stated that their staff had received formal training on the movement and handling of pigs. Also all three destinations were export accredited abattoirs and it is probable that the producers and transporters were more rigorously interpreting the APL 'Is It Fit to Load?' Guide, in selecting pigs for processing.

There was no significant difference in loads with deaths between pigs transported by the owner or the transport contractor. Earlier Australian studies (Shorthose 1987) indicated that deaths in transit were higher when pigs were moved by a 3rd party or where pigs were in mixed loads. The major contracted transporters who participated in this survey were species specific and only transported pigs. It could be assumed that the drivers had considerable experience in the handling and movement of pigs. In the survey, whilst there were instances of pigs being loaded from units within a business there were no instances of pigs from different ownership being mixed on the truck on route to the abattoir. Both these factors could have contributed to lower deaths in transit compared with previous studies.

With the rationalisation of the abattoir sector, it is inevitable that animals will be transported greater distances than previously. In the survey, time of transit was recorded rather than distance travelled. The average time that the pigs were in transit was 4.2 hours, with only 23% of loads in transit for less than 2 hours. The percentage of loads with deaths in transit increased from 2.04% (less than 2hrs) to 5.93% for medium trips and 6.74% for long trips (more than 4hrs). Previous Australian studies (Shorthose 1987) also showed that deaths in transit increased as distance travelled increased.

Of the loads delivered to the destinations, 42% were transported at a low stocking density, (>0.50m^2/pig) while 56% had a medium stocking density (0.35 – 0.50m^2/pig). At the low stocking density, the number of loads with deaths in transit was 2.3% compared to 8.0% of loads, where a medium stocking density was recorded. This indicates that almost half the producers co-operating in the survey stock their pigs at a lower density than that recommended by the Model Code of Practice for the Welfare of Animals – Land Transport of Pigs (SCARM Report 63).

In the survey, 50.7% of the loads were transported during the summer period and 49% in the winter period. The percentage of loads with deaths was significantly higher in summer (7.3%) compared with winter (3.5%). In this study, the losses in transport were in line with the findings reported by Shorthose (1982) who found that deaths in winter (May) in Qld totalled 0.26% compared to 0.41% in summer (January).

As in previous studies, genetics had an influence on deaths in transit. In this survey Genetic Source 1 had a significantly higher number of loads with deaths compared with other genetic sources.

The average time off feed in this study was 10.6 hours. Overall, there were 8% of loads with deaths where pigs were off feed for a short period of time (<6.5hours), 7% of loads with deaths for medium of time off feed and 1.8% of loads had death where a long (>13 hours) period of time off feed was recorded. In the Australian Pork Industry Quality Assurance Program (APIQ√®), the recommended practice is that pigs are removed from feed 6 hours before slaughter.

In this survey, the interacting factors which contributed to deaths in transit included:

- Distance travelled
- Climatic temperature
- Stocking density
- Genetics
- Time off feed

9. Implications & Recommendations

The survey showed that the level of deaths in transit were very low. If the number of deaths was mirrored nationally a total of 1704 pigs would have been lost based on the number of slaughterings in the 12 months ending October 2012. The reduction in losses compared with the previous Australian investigation carried out by Shorthose (1987) could be attributed to the uptake of quality assurance programs by producers, the transport sector and the abattoirs. The APIQ√® program has been a contributing factor in the reduction of deaths in transit. It is recognised that not all producers, transporters and abattoirs have quality assurance programs in place and therefore the level of deaths in transit nationally could be higher than reported. It is recommended that APL continue to increase the number of producers participating in the APIQ√® program and continue to encourage transporters and abattoirs to adopt best practice management.

The survey results provide factual data allowing APL to answer criticism by the consumer and community of transport practices in the Australian industry.

APL through its technical leaflets should continue to make producers aware that

1. Losses in summer are higher than in winter
2. Losses decrease as space allowance per pig increases.
3. Deaths in transit increase as time in transit increases.
4. Deaths in transit decrease as time off feed increases

APL should also encourage the uptake of training programs by producers, transporters and lairage operators to improve still further the welfare of pigs in transit. The outcome would be greater returns to the producer by reduced deaths in transit.

10. Intellectual Property

There is no intellectual property arising from this project.

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