final report

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Phenotypic Prediction – BeefSpecs Extension and Training

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Abstract

A project team has been established within NSW Department of Primary Industries comprising research and extension staff to develop the BeefSpecs training and extension methodology.

Producers from existing 'finished' beef supply networks in northern NSW and southern WA participated in training between mid September & late November 2011.

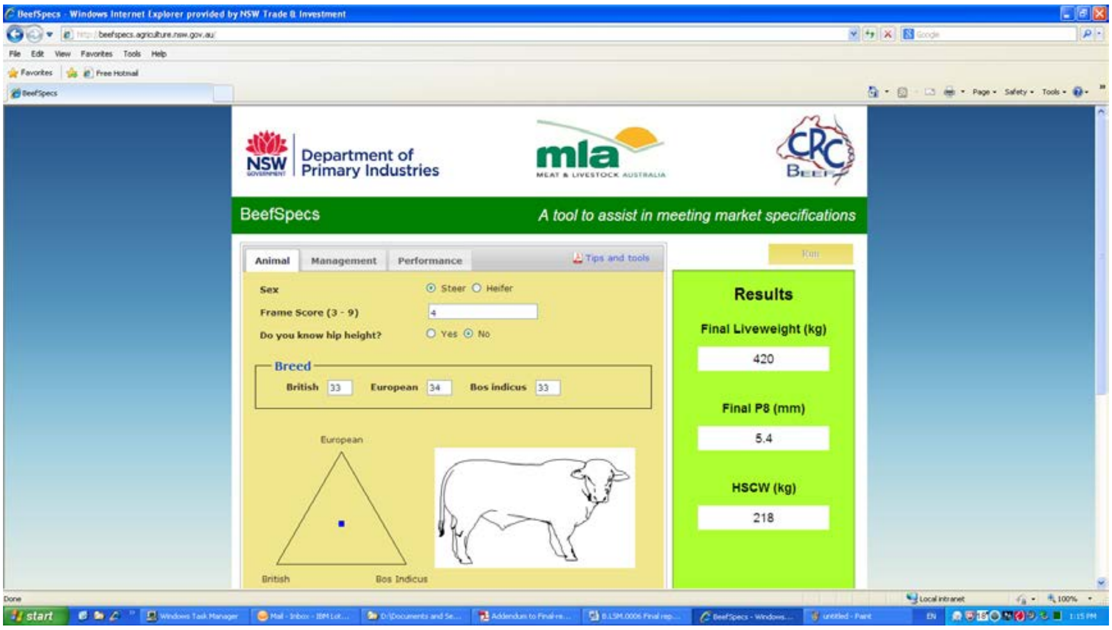
Milestone

No	Milestone	Date Due – Revised Date	% Complete	Status
8	Final report on delivery and evaluation of BeefSpecs extension and training program	30 November 2011	-	White

Green = Not due yet, Purple < 14 days, Orange < 7 days, Red = Overdue, White = Complete, RedWhite = Revised Due Date

Success in achieving milestone

The project is completed with BeefSpecs now released on the web – http://beefspecs.agriculture.nsw.gov.au/



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1 Project Context

The BeefSpecs calculator was developed by the Beef CRC for Genetic Technologies to enhance the ability of beef producers in managing livestock to meet carcase specifications. BeefSpecs is a decision support tool that incorporates a computer based model (MARC Model) that requires inputs including live animal measures and information concerning management practises to predict P8 fat and hot standard carcase weight. It was released through the Meat & Livestock Australia website in 2010 and has been exposed at field days and workshops by NSW Department of Primary Industries beef extension staff in the absence of a formal training and evaluation methodology.

2 Project Objectives

1. To investigate the options for technology transfer of the BeefSpecs calculator through beef industry stakeholder consultation.
2. To trial and evaluate a skills training program with cattle producers for the increased adoption of the BeefSpecs calculator in Southern Australia.

3 Project Outcomes

In late 2011, a team from NSW DPI conducted a pilot extension and training project to test the functionality of the BeefSpecs fat calculator and trial methods of delivery for the associated knowledge and skills related to input variables in the model. This project was conducted through a series of on farm workshops. The reaction from industry stakeholders was very positive with ALPA, AuctionsPlus, processors, lotfeeders and producers supporting the calculator in its current presentation format. There was also support for web based access and the development of a mobile phone application.

The aim of this project was to design and develop an industry training and adoption package for the BeefSpecs calculator. The skills to accurately assess live cattle and growth parameters as input to BeefSpecs were seen as critical to the accuracy of prediction.

Six BeefSpecs workshops were conducted in the Upper Hunter Valley, Northern Tablelands & North Coast of New South Wales as well as Southern Western Australia. These workshops were attended by 58 cattle producers and 10 industry advisors representing 27,600 head of cattle under production. A one day workshop program was developed in consultation with the Beef CRC Phenotypic Prediction Program team. The key topics are listed below.

Module 1 – Introduction to the BeefSpecs calculator

Module 2a – Live Animal Assessment - Theory

Module 2b – Live Animal Assessment - Practical

Module 3 – Cattle Growth

Module 4 – Cattle Nutrition – pasture or grain production

Module 5 – BeefSpecs outputs, marketing and management

Note: A train-the-trainer kit has been developed for the Beef CRC Champions program in June 2012.

The purpose of the producer focus groups was to:-

1. Determine the potential interest from the livestock industry in BeefSpecs and gather feedback for improvement that may increase awareness and adoption.
2. Evaluate the level of skills and knowledge of BeefSpecs users, e.g. from a sample of commercial cattle producers trading ‘over-the-hooks’.
3. Benchmark the ability of users to interact with the BeefSpecs calculator and complete the data upload function, including assessment of the key variables – animals, management and performance.
4. Determine the effectiveness of BeefSpecs to improve the management of cattle to turnoff and meet target market specifications.

Participant evaluations were conducted via pre- and post-workshop questionnaires in conjunction with correlations of group live assessments pre-slaughter and post-slaughter. Oral feedback was provided in terms of program functionality. The workshop was perceived by participants as a valuable exercise as confidence in live assessment skills increased from 2.5 pre- to 5.0 post-workshop (Figure 1, scale: 1=low, 6=high).

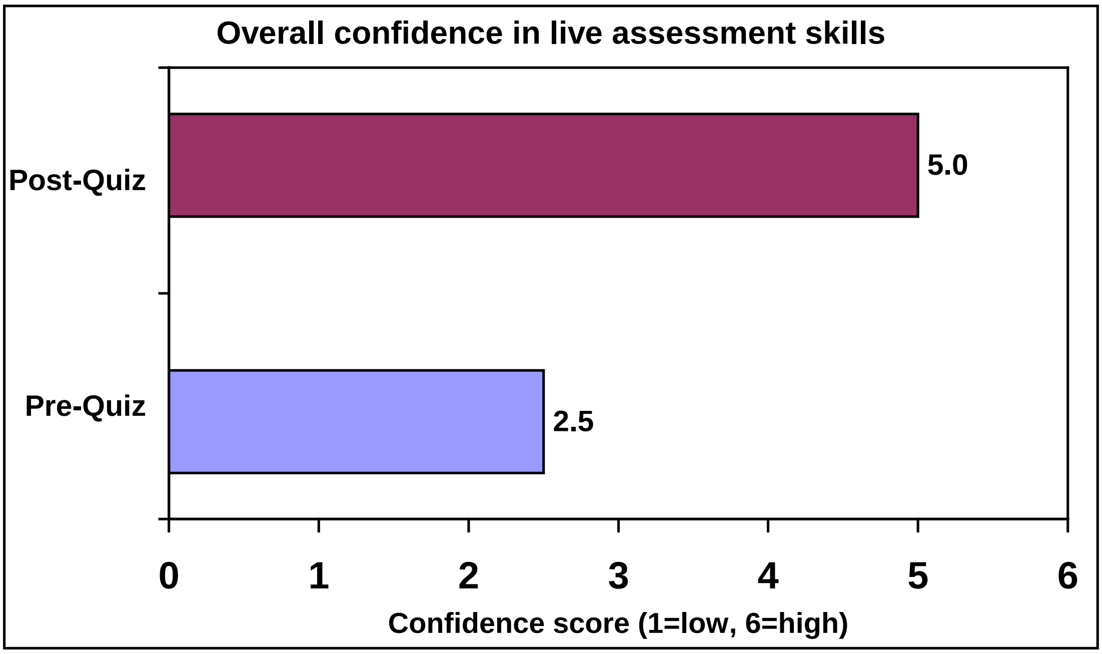

Figure 1: Pre- and Post-workshop live assessment skills of participants in the BeefSpecs pilot extension and training project.

3.1 Economic, Social and Environmental Impacts

3.1.1. Beef Market Compliance

It is estimated that up to 25 percent of Australian cattle fail to meet targets for hot standard carcase weight (HSCW) and fat specifications, at a cost of between $15 and $30 a head, depending on the target market. An important profit driver for beef businesses is the ability to increase compliance rates for carcase fatness and weight, especially those producers supplying feeder steers and finished cattle for high quality markets. Additionally, there are advantages in terms of improving production and cost efficiencies through the beef supply chain on-farm, at feedlot and at processing.

A study of feedlot cattle showed that in a 20,000 head sample of animals being finished for short-fed markets, 28 percent missed HSCW specifications, forfeiting $31,000 ($5.50/head) and 16 percent missed P8 fat specifications, forfeiting $54,000 ($17.50/head) (Slack-Smith et al. 2009).

3.1.2 Industry Perspective

The National RD&E strategy for beef identifies as key objectives:

- a competitive and sustainable beef industry, and
- being responsive and adaptable to a changing operating environment.

The BeefSpecs model has the potential to incorporate additional information such as Estimated Breeding Values (EBVs) and gene markers for predicting growth and body composition. Research and development is currently underway to produce a tool to optimise days on feed and another tool targeted at maternal productivity.

BeefSpecs can be integrated with industry systems including: - Meat Standards Australia Feedback & Benchmarking System, National Livestock Identification System Carcase Database, Livestock Data Link (LDL) and various miscellaneous commercial systems. These systems allow beef and sheep producers to benchmark their performance against target carcase specifications and support continuous improvement.

3.1.3 Big Hits

BeefSpecs has demonstrated the potential to predict future carcase performance of beef cattle with high accuracy (to within 1.5mm fat more than 80% of the time). As a prediction tool, BeefSpecs provides a unique opportunity to plan forward marketing and management for beef production and provides a tool for risk management.

A high proportion (80%, Figure 2) of producers who attended the workshops said they would make a change to their business as a result of attending the workshop. The level of satisfaction with the workshop content and presentation was rated highly (8.7 out of 10, Figure 3) with the majority of participants saying they would recommend the workshop to others.

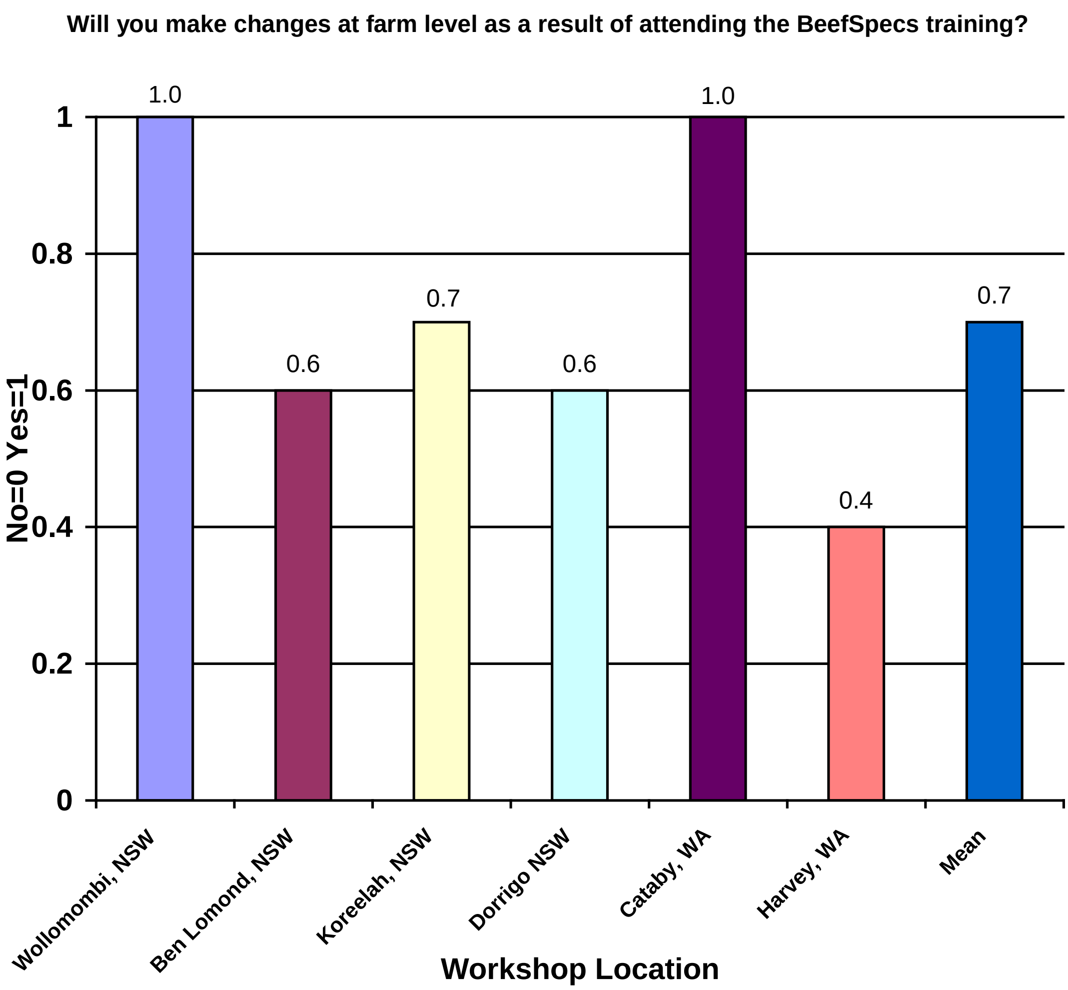

Figure 2: BeefSpecs pilot extension and training workshop participant aspiration rating.

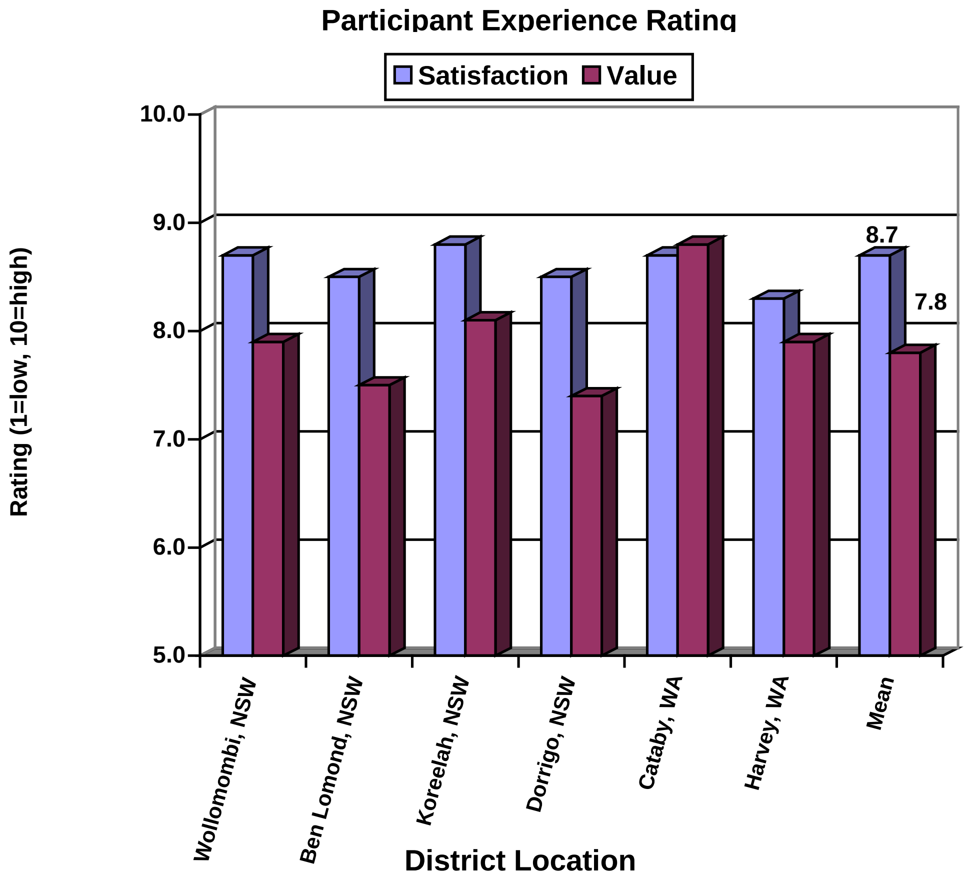

Figure 3: BeefSpecs pilot extension and training project workshop participant rating.

The accuracy of BeefSpecs predictions using information collected during the pilot extension and training project is shown in Table 1. This data demonstrates that BeefSpecs predictions were on average (mean bias) within 1.0 mm of that observed in the datasets.

Table 1: Output from BeefSpecs – assessment of the differences between observed and predicted P8 fat depths for BeefSpecs pilot study datasets.

Item	Ben Lomond (heifers)	Wollomombi (heifers)	Dorrigo[3] (heifers)	Dorrigo[3] (steers)
N	97	12	17	36
Mean observed (Obs.)[1], mm	9.59	14.17	6.41	6.78
Mean predicted (Pred.)[1], mm	9.99	14.70	6.48	5.97
Mean bias, mm	-0.41	-0.53	-0.06	0.81
Slope of Obs. on Pred., b	0.63	1.06	0.50	0.91
Correlation between Obs. and Pred., r	0.54	0.86	0.67	0.76
MSEP[2]	6.81	7.19	3.37	3.08
Root-MSEP, mm	2.61	2.68	1.84	1.75
Bias, %	2.44	3.96	0.12	21.39

Slope, %	12.19	0.96	44.33	0.99
Random, %	85.37	95.08	55.54	77.62

[1]Obs. = Mean observed P8 fat, Pred. = Mean predicted P8 fat
[2]MSEP = mean square prediction error; Bias = MSEP decomposed into error due to overall bias of prediction; Slope = MSEP decomposed into error due to deviation of the regression slope from unity; Random = MSEP decomposed into error due to the random variation.
[3]Dorrigo data analysis was conducted using ultrasound fat scans pre-slaughter.

Note: A more detailed analysis of the accuracy of BeefSpecs predictions in the datasets collected during the pilot extension and training project is contained in Attachment 1.

Efficiency of production through the supply chain is at the heart of our industry's future prosperity.

4 Industry Delivery Beyond the Beef CRC

4.1 Delivery of Training Program

Feedback from the BeefSpecs pilot has indicated that the workshop training program works best when the format of the day/order of modules is tailored to the individual producer group. For example, the cattle nutrition module has the greatest ability to be flexible in delivery, based on the feedbase skills and knowledge of the audience i.e. theory session, paddock session or combination.

The six completed workshops demonstrated that there is a need to ensure:-

- Trainers delivering the workshop have the required level of skills and knowledge needed to use and understand the functions of the BeefSpecs calculator. They need to have the following skills and knowledge: live animal assessment, cattle growth estimation, understand the role nutrition plays in cattle growth and fat deposition, marketing and management.

4.2 Plans for the Future

1. Package resource material including: Power Point presentations, fact sheets and a recommended format for presentation. **Completed**
2. Release of the calculator on the NSW DPI website. **Completed**
3. Identify the need for “train the trainer” workshops for other extension officers, consultants and businesses.
4. Potential for inclusion of the BeefSpecs calculator in existing industry training programs, e.g. module 8 More Beef from Pastures.
5. Build on the interest shown by the processing sector to target producers in supply chains to improve compliance rates of over-the-hooks cattle.
6. Develop an “App” for use on smart phones and tablets.
7. Development of new tools to assist in the training of livestock assessors.
8. Development of a livestock image library organised by fat and muscle scores with short videos to demonstrate reference points.

5 Acknowledgements

The following staff from NSW Department of Primary Industries collaborated in conducting the fields that formed the central component of this pilot study: - Brett Littler, Jason Siddell, Todd Andrews and Trevor Rose. Hutton Oddy and Brad Walmsley are also thanked for their contribution to the writing of this final report as part, and on behalf on the Beef Co-operative Research Centre for Genetic Technologies.

6 Bibliography

Slack-Smith, A. R., G. R. Griffith and J. M. Thompson (2009). "The cost of non-compliance to beef market specifications " Australasian Agribusiness Review **17**: 178-190.

Attachment 1 – Statistical Analysis

The following analysis was conducted on cattle that were assessed as part of the BeefSpecs pilot extension and training project. The data collect by NSW DPI extension staff included live animal measurements such as liveweight (iBW), P8 fat depth (iP8) and frame score (FS), animal characteristics such as breed and sex, management attributes such as feed type, HGP use, growth rate (ADG) and feeding period (DOF). These inputs were used by BeefSpecs to predict final P8 fat depth which was in turn compared to P8 fat (fP8) depth either scanned prior to market endpoint or measured in the abattoir at slaughter. The statistical analysis was conducted by Dr Brad Walmsley, NSW DPI.

Table A1: Summary of data from the BeefSpecs pilot extension and training field days at Ben Lomond and Wollomombi involving heifers that was input into the BeefSpecs fat calculator for evaluating prediction accuracy.

	iBW	FS	iP8	fP8	DOF	ADG
Ben Lomond						
n	97	97	97	97	97	97
Maximum	452	7	11	17	112	1.32
Minimum	230	3	1	3	102	0.49
Mean, mm	352.36	4.58	4.72	9.59	108.60	0.81
SD	34.84	0.81	2.15	2.89	4.76	0.17
Wollomombi						
n	12	12	12	12	12	12
Maximum	518	6	16	25	96	1.04
Minimum	430	4	4	7	96	0.10
Mean, mm	486.17	5.75	8.58	14.17	96	0.75
SD	29.25	0.62	3.85	5.42	0	0.24

Table A2: Output from the BeefSpecs fat calculator – assessment of the differences between observed and predicted P8 fat depths in heifers for the Ben Lomond and Wollomombi datasets from the BeefSpecs pilot extension and training project.

Item	Ben Lomond	Wollomombi
n	97	12
Mean observed, mm	9.59	14.17
Mean predicted, mm	9.99	14.70
Mean bias, mm	-0.41	-0.53
b coefficient	0.63	1.06
r	0.54	0.86
P[1]	0.12	0.51
MSEP[2]	6.81	7.19
Root-MSEP, mm	2.61	2.68
Bias, %	2.44	3.96
Slope, %	12.19	0.96
Random, %	85.37	95.08

[1]Paired t-test of mean bias
[2]MSEP = mean square prediction error, Bias = MSEP decomposed into error due to overall bias of prediction; Slope = MSEP decomposed into error due to deviation of the regression slope from unity, Random = MSEP decomposed into error due to the random variation.

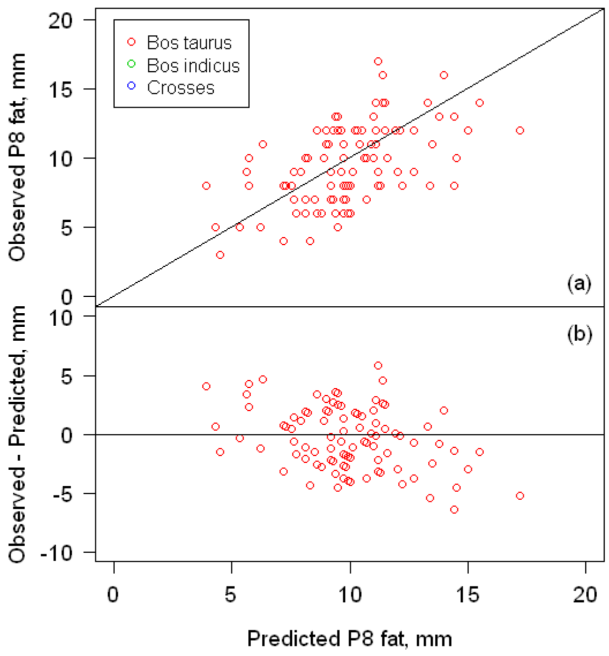

Figure A1: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in heifers from the Ben Lomond dataset from the BeefSpecs pilot extension and training project.

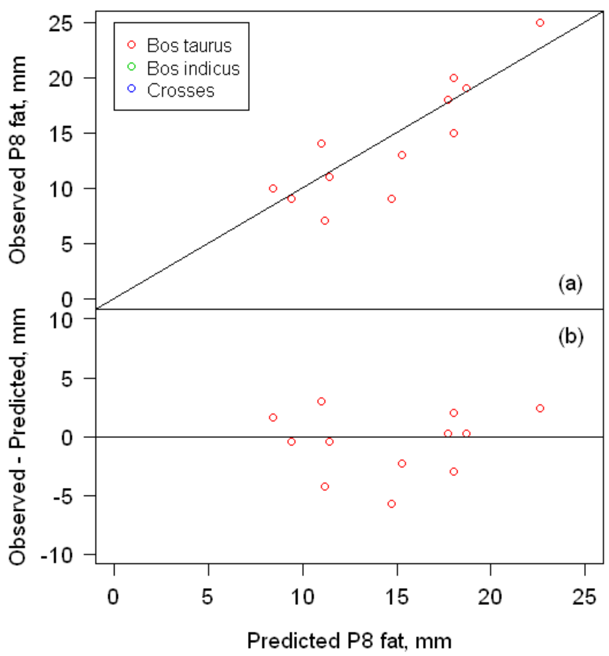

Figure A2: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in heifers from the Wollomombi dataset from the BeefSpecs pilot extension and training project.

Table A3: Summary of data from the BeefSpecs pilot extension and training field day at Dorrigo involving both steers and heifers that was input into the BeefSpecs fat calculator for evaluating prediction accuracy.

	iBW	FS	iP8	fP8	DOF	ADG
Heifer – 1st Kill						
n	13	13	13	13	13	13
Maximum	384	7	10	13	28	2.19
Minimum	308	4	3	5	28	0.36
Mean, mm	342.46	5.15	5.08	7.46	28	1.03
SD	20.92	0.80	2.06	2.44	0	0.47
Heifer – 2nd Scan						
n	17	17	17	17	17	17
Maximum	334	6	9	9	45	1.56
Minimum	236	3	2	3	45	0.44
Mean, mm	288.94	4.59	4.06	6.41	45	1.07
SD	28.51	0.80	1.89	1.91	0	0.29
Heifer – 2nd Kill						
n	12	12	12	12	12	12
Maximum	334	6	9	15	56	1.56
Minimum	244	4	2	4	56	0.44
Mean, mm	294.67	4.67	4.42	9.67	56	1.07
SD	29.24	0.65	2.02	2.87	0	0.34
Heifer - Compare 2nd Scan and 2nd Kill						
n	12	12	12	12	12	12
Maximum	334	6	9	9	45	1.56
Minimum	244	4	2	5	45	0.44
Mean, mm	294.67	4.67	4.42	6.92	45	1.07
SD	29.24	0.65	2.02	1.62	0	0.34
Steer – 1st Kill						
n	13	13	13	13	13	13
Maximum	456	6	9	16	28	2.15
Minimum	336	3	2	4	28	0.65
Mean, mm	404.08	5.15	4.46	8.08	28	1.33
SD	33.49	0.99	1.85	3.57	0	0.45
Steer – 2nd Scan						
n	36	36	36	36	36	36
Maximum	444	7	9	12	45	2.36
Minimum	302	4	2	3	45	0.49
Mean, mm	380.72	4.94	4.03	6.78	45	1.32
SD	29.95	0.75	1.92	2.43	0	0.40
Steer – 2nd Kill						
n	27	27	27	27	27	27
Maximum	444	6	9	19	129	2.36
Minimum	302	4	2	5	65	0.49
Mean, mm	382.30	4.81	4.37	11.00	83.96	1.19
SD	29.66	0.68	2.08	3.83	17.47	0.40
Steer - Compare 2nd Scan and 2nd Kill						

n	27	27	27	27	27	27
Maximum	444	6	9	12	45	2.36
Minimum	302	4	2	3	45	0.49
Mean, mm	382.30	4.81	4.37	7.22	45	1.25
SD	29.66	0.68	2.08	2.50	0	0.40

Table A4: Output from the BeefSpecs fat calculator – assessment of the differences between observed and predicted P8 fat depths in heifers for the Dorrigo dataset from the BeefSpecs pilot extension and training project.

Item	1st Kill	2nd Scan	2nd Kill	Compare S & K
n	13	17	12	12
Mean observed, mm	7.46	6.41	9.67	6.92
Mean predicted, mm	6.55	6.48	7.55	6.87
Mean bias, mm	0.92	-0.06	2.12	0.05
b coefficient	0.54	0.50	0.08	0.38
r	0.45	0.67	0.08	0.63
P[1]	0.19	0.89	0.09	0.94
MSEP[2]	6.04	3.37	18.70	4.06
Root-MSEP, mm	2.46	1.84	4.32	2.02
Bias, %	13.88	0.12	23.95	0.06
Slope, %	13.75	44.33	35.93	64.20
Random, %	72.37	55.54	40.12	35.74

[1]Paired t-test of mean bias
[2]MSEP = mean square prediction error, Bias = MSEP decomposed into error due to overall bias of prediction; Slope = MSEP decomposed into error due to deviation of the regression slope from unity, Random = MSEP decomposed into error due to the random variation.

Tables A4 and A5 contain a column titled “Compare S & K.” This column compares the predictions made by the BeefSpecs fat calculator on a group of steers and heifers that were both scanned at the 2nd scanning and killed during the 2nd slaughter. Although, the time period between the 1st and 2nd scans is different to the time period between the 1st scan and 2nd kill they provide a comparison between manually recorded and abattoir recorded P8 fat measurements.

Table A5: Output from the BeefSpecs fat calculator – assessment of the differences between observed and predicted P8 fat depths in steers for the Dorrigo dataset from the BeefSpecs pilot extension and training project.

Item	1st Kill	2nd Scan	2nd Kill	Compare S & K
n	13	36	27	27
Mean observed, mm	8.08	6.78	11.00	7.22
Mean predicted, mm	5.61	5.97	8.05	6.26
Mean bias, mm	2.47	0.81	2.95	0.96
b coefficient	1.28	0.91	1.12	0.91
r	0.70	0.76	0.65	0.80
P[1]	0.0051	0.0039	1.71e-5	0.0027
MSEP[2]	12.38	3.08	16.87	3.13
Root-MSEP, mm	3.52	1.75	4.11	1.77
Bias, %	49.26	21.39	51.53	29.64
Slope, %	2.27	0.99	0.38	1.30

Random, %	48.47	77.62	48.09	69.06

[1]Paired t-test of mean bias
[2]MSEP = mean square prediction error, Bias = MSEP decomposed into error due to overall bias of prediction; Slope = MSEP decomposed into error due to deviation of the regression slope from unity, Random = MSEP decomposed into error due to the random variation.

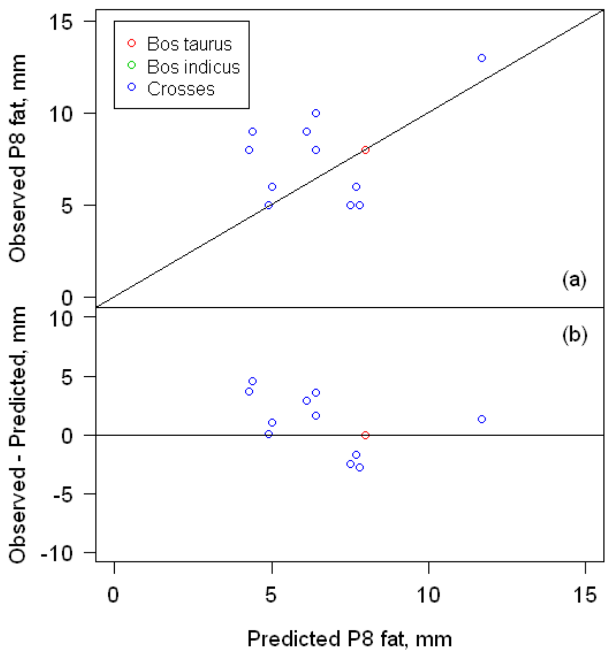

Figure A3: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Heifers at the 1st kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

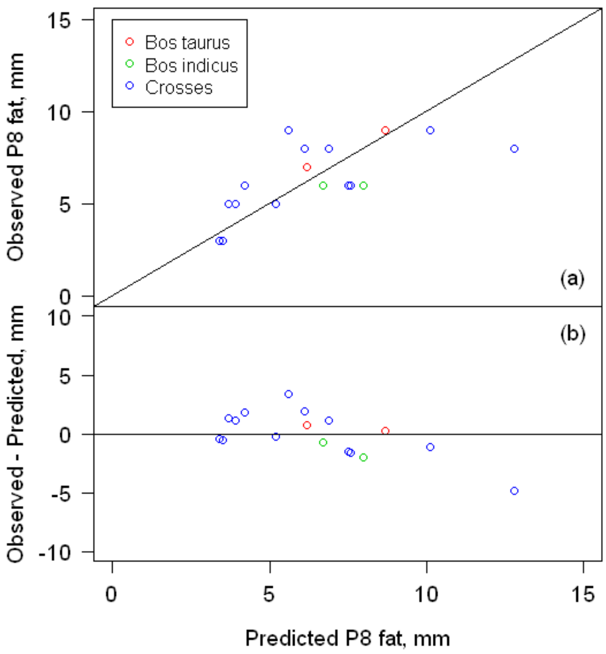

Figure A4: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Heifers at the 2nd scan in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

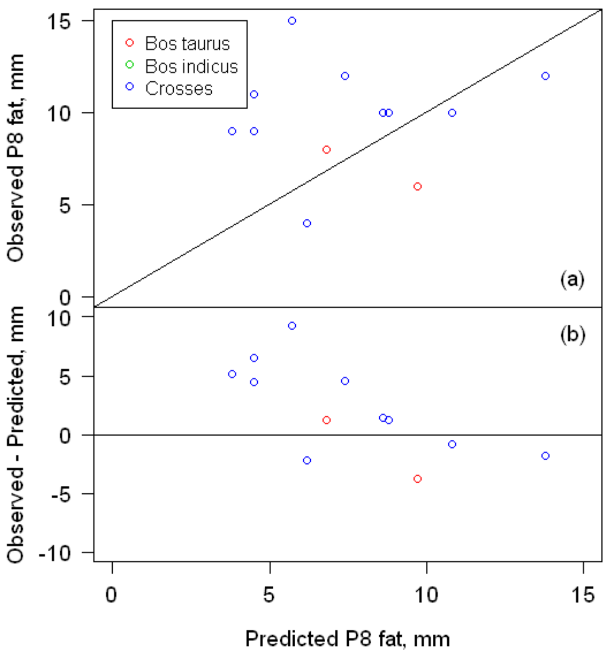

Figure A5: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Heifers at the 2nd kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

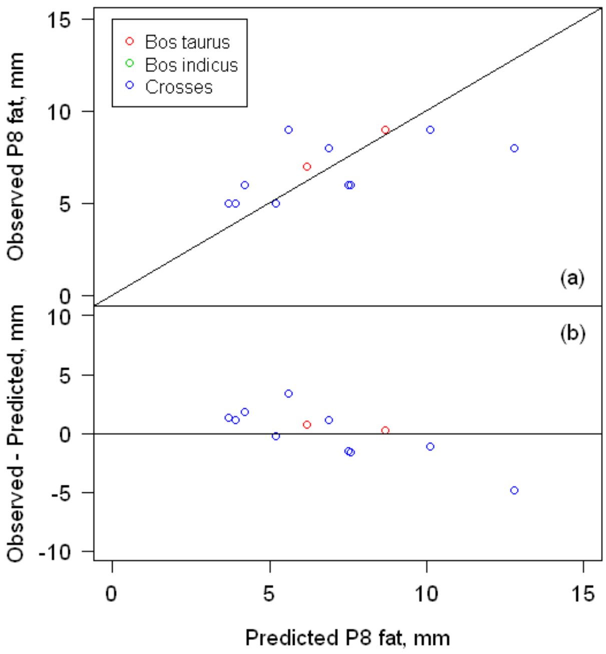

Figure A6: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Heifers at the 2nd scan which were also killed in the 2nd kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

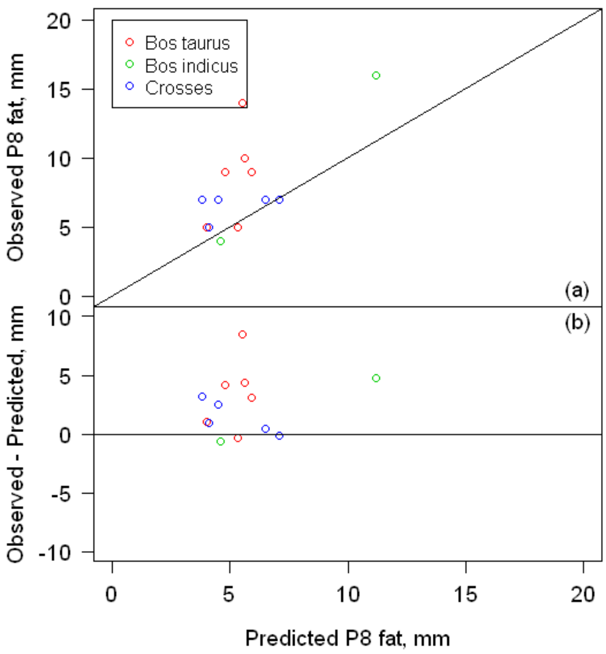

Figure A7: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Steers at the 1st kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

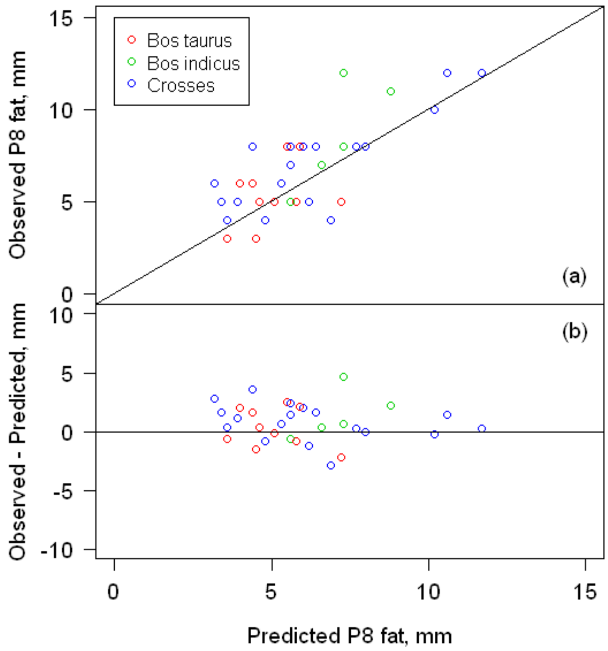

Figure A8: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Steers at the 2nd scan in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

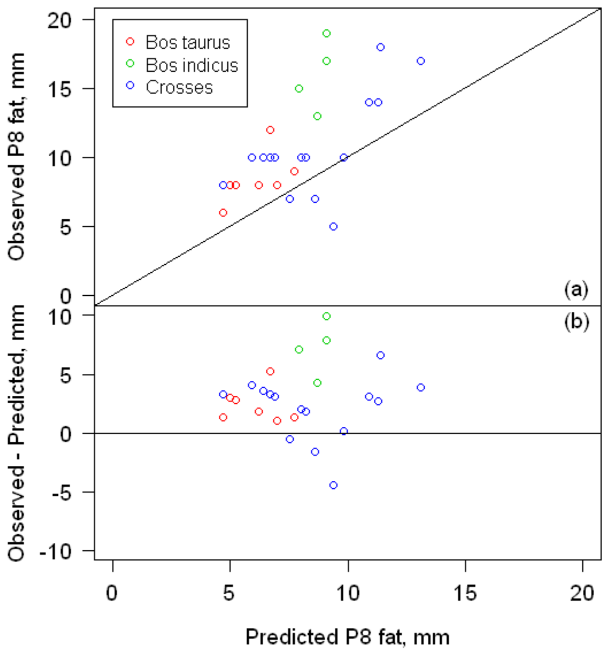

Figure A9: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Steers at the 2nd kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

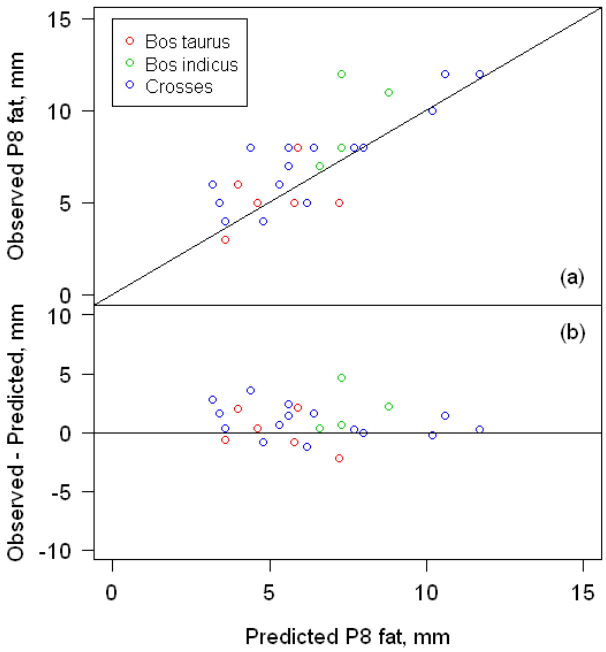

Figure A10: Plot of (a) observed vs predicted and (b) the residual (observed – predicted) for P8 fat depth in Steers at the 2nd scan which were also killed in the 2nd kill in the Dorrigo dataset from the BeefSpecs pilot extension and training project.

Attachment 2 – Workshop survey questions (MER)

1. How confident are you now in being able to frame score cattle after attending this BeefSpecs workshop?
2. How confident are you now in differentiating between fat and muscle after attending this BeefSpecs workshop?
3. How confident are you now in understanding the impact of nutrition on growth rate and fatness in cattle, after attending this BeefSpecs workshop?
4. How confident are you now in using the BeefSpecs Tool after attending this BeefSpecs workshop?
5. How much improvement in live weight gain would you expect in your herd, if you applied what was discussed today?
6. How confident are you that you can increase the market compliance of your cattle after attending this BeefSpecs workshop?