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**Review of Aspects of Breeding Herd Performance
from Beef Cattle Projects on the Arid Rangelands
of the Alice Springs District**

by
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This thesis is presented for the degree of
Master of Philosophy,
of Murdoch University, WA
in the year of 2013

DECLARATION

I declare that this thesis is my own account of my research.

The main content is based on review of data from three primary beef cattle projects.

Published and unpublished reports from these primary beef cattle projects have been cited where used for summaries and analyses.

.....

(Jocelyn Coventry

date)

ABSTRACT

To effectively record the variability that is a feature of beef cattle herds on arid rangelands, sustained periods of objective data collection are required. This has been infrequently achieved on pastoral properties in the Alice Springs district of the Northern Territory. In this thesis, historical data are analysed from three primary beef cattle projects with breeding herds north of Alice Springs. Each of these projects involved data and sample collections during a 4- to 5-year period. Publications from each project were reviewed to identify summaries on breeding herd performance and gaps in data analyses. Where gaps were identified and data were available, new summaries and analyses were undertaken. The results of those analyses enabled comparison with existing knowledge about beef cattle production on arid rangelands, and provided new information on reproductive performance, mortality, nutritional deficiencies, infestations and infections in continuously-mated herds of the Alice Springs district. Information on reproductive performance and mortality was provided for different age and gender groups respectively. The aged cow group had the highest percentage of conception losses before branding (10.3%). Heifers had the highest peri-/ post-natal conception losses (4.5%), with suspected dystocia and mortality in up to 20% of some heifer groups. For lactating individuals in 'forward store' body condition at muster, the pregnancy percentage of heifers (45%) was similar to that of other cow age-groups (48–53%). Extrapolated (unconfirmed) annual mortality was 6.5% in herd bulls and up to 3.1% in cows.

Information on specific cattle health issues was provided about potential dietary deficiencies in phosphorus (P), vitamin A and nitrogen (N), as well as about intestinal parasite infestations and infection with bovine viral diarrhoea virus (BVDV).

Phosphorus deficiency, as defined by serum P (≤ 1.1 mmol/L) and faecal P ($\leq 0.19\%$),

was associated with low rainfall, dry grass, absence of pasture germination, landsystems with low soil P, and lactating or aged cows. Sub-optimal levels of serum vitamin A (< 0.26 mg/L) were associated with dry seasonal conditions, low body condition and aged cows. A fall in cattle nutrition based on faecal N below 1.23% was related to the presence of lactation and pasture germination. Clinical intestinal nematodiasis (faecal egg counts over 700 eggs per gram) in weaned calves was correlated with a large rainfall event after a long dry period. In one herd endemically infected with BVDV, individual cows became seronegative during a 3-year period.

Results of the thesis study provided benchmarks to establish and validate measures of cattle health and reproductive performance in the Alice Springs district. Regional reference ranges were established for albumin (cows: 32–43 g/L) and haemoglobin (cows: 125–153 g/L). Averages over 3- to 5-year periods were provided for annual branding (range: 64–87%) and weaning (range: 79–84%) percentages. The highest mean annual number of branded calves per herd bull was calculated at the lowest examined bull percentage (24.6 calves at 4.1% bulls). The average weight of weaned calves per 100 kg of mated cows was established under varied herd and seasonal conditions (range of averages: 37–64 kg).

The challenges of collecting and analysing data from extensively-managed cattle herds can necessitate the use of default measures, extrapolations and estimations. In this thesis, the use of default measures helped to define conception losses, measures of body mass-at-conception, annual mortality, arid rangeland pasture conditions for ‘optimal’ cattle nutrition, variable seasonal conditions, and diseased sub-groups.

In summary, this study contributes to the knowledge about cattle grazing on arid rangelands. The key contributions are in the analyses that establish and validate benchmarks, as well as in the discussions on reproductive performance and ‘best practice’ management.

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ABBREVIATIONS

Term	Abbreviation
Australian Bureau of Agricultural and Resource Economics and Sciences	ABARES
agar gel immunodiffusion	AGID
analysis of variance	ANOVA
animal (cattle) equivalents	AE
artificial insemination	AI
aspartate-A-transferase	AST
Australian agricultural and grazing industries survey	AAGIS
blood glutathione peroxidase	GSH-Px
body condition score	BCS
bovine herpes virus type 1	BHV1
bovine viral diarrhoea virus	BVDV
BVDV disease complex, including mucosal disease	BVD/MD
Brucellosis and Tuberculosis Eradication Campaign	BTEC
bull breeding soundness examination	BBSE
calcium	Ca
carbon 3 plant	C3 plant
chloride	Cl
copper	Cu
creatine phosphokinase	CPK
crude protein	CP
deoxyribonucleic acid	DNA
dry matter digestibility	DMD
eggs per gram (of faeces)	epg
enzyme-linked immunosorbent assay	ELISA
estimated breeding value	EBV
Faecal Near Infra-red Spectroscopy	F-NIRS
faecal percentage of dry matter	Faecal %DM
faecal percentage of nitrogen	Faecal %N
faecal percentage of phosphorus	Faecal %P
gamma glutamyl transferase	GGT
haemoglobin	Hb
infectious balanoposthitis	IBP
infectious bovine rhinotracheitis	IBR
infectious pustular vulvovaginitis	IPV
iron	Fe
magnesium	Mg
manganese	Mn
micro-agglutination test	MAT
nitrogen	N
Northern Territory Government	NTG
oocysts per gram (of faeces)	opg
persistently infected cattle (with BVDV)	PI cattle
phosphorus	P
polymerase chain reaction (amplification assay)	PCR
potassium	K

Term	Abbreviation
Rangeland Condition Assessment	RCA
red blood cells	RBC
selenium	Se
serum neutralisation	SN
sodium	Na
sulphur	S
United States of America	USA
zinc	Zn
95% confidence interval	95% CI