Opportunities for selection to improve steer and cow productivity in northern Australia

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I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis and all sources used have been acknowledged in this thesis.

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ABSTRACT

This thesis analysed carcass records from 2180 tropically adapted, steers (986 Brahman (BRAH) and 1194 Tropical Composite (TCOMP)) describing weight, eye muscle area, P8 and 12/13th rib fat depth, percent intramuscular fat and retail beef yield, with tenderness assessed as shear force. All steers were feedlot finished with a subset (680 BRAH and 783 TCOMP) recorded for individual feed intake. Female reproductive performance in the half-sib sisters of these steers (1007 BRAH and 1108 TCOMP) was evaluated as outcomes of their first (Mating 1: when females averaged 27 months of age) and second (Mating 2) annual matings, and averaged over up to 6 matings (termed 'lifetime' reproduction traits). Heifer and cow weight, eye muscle area, P8 and 12/13th rib fat depth, body condition score and hip height were recorded at 18 months of age, immediately prior to first calving and at Mating 2. The maternal genetic component of weaning weight (Maternal WWT) was estimated based on weaning weight records available for these steers and females and the progeny of females (N = 12528).

Key results of genetic analysis showed that carcass weight, composition and meat quality traits displayed moderate heritability (h^2) for both genotypes (h^2 = 0.17 to 0.64). Genetic correlations (r_g) of steer carcass weight and eye muscle area with female reproductive performance were consistently not different from zero. Lower carcass P8 fat depth was genetically associated with higher Mating 2 weaning rates (r_g = -0.28 and -0.76 for BRAH and TCOMP), though for TCOMP, this was reversed for Mating 1 weaning rate (r_g = 0.43). Lower residual feed intake in BRAH steers was genetically associated with lower Mating 1 weaning rate (r_g = 0.76) and higher days to calving (r_g = -0.50), though this did not significantly impact lifetime annual calving or weaning rate (r_g = 0.10 and 0.29 respectively). For TCOMP, lower shear force also displayed a significant genetic association with higher Mating 1 days to calving (r_g = -0.56) and tended to be unfavourably associated with other

measures of female reproduction. Cow growth and body composition traits measured at pre-calving and mating 2 had moderate to high heritability in BRAH (h^2 = 0.27 to 0.67) and TCOMP (h^2 = 0.25 to 0.87). Lactating cows of both genotypes lost substantial weight and body condition during this period and, with the exception of hip height, these changes were also moderately heritable (h^2 = 0.17 to 0.54). Greater loss of cow liveweight, body condition score and eye muscle area was genetically related to higher Maternal WWT (r_g = -0.40 to -0.85) in both genotypes. Higher Maternal WWT was also genetically related to lower lifetime annual weaning rate (r_g = -0.50) in BRAH, and with lower mating 2 calving and weaning rate (r_g = -0.72 and -0.59) in TCOMP.

Steer growth, carcass composition, meat quality and residual feed intake, and female reproduction could be improved by selection without major antagonisms to female reproductive performance. Important exceptions to this were for tenderness in TCOMP and residual feed in take in BRAH, though these could be managed by recording both traits and included them in the breeding objective. Selection to reduce Maternal WWT in tropically adapted females, particularly in TCOMP, is expected to produce correlated responses of lower fat and muscle mobilization in lactating first calf cows, and higher female reproductive performance.

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