

Sheep Industry Breeding Objectives 2022

SIL TECHNICAL NOTE

Relates to: SIL indexes, relative economic weights

Date: August 2022

Breeding Objectives Review

Our industry breeding objective needs to be updated periodically, to ensure that it aligns with contemporary and projected future market conditions. The previous review of the New Zealand sheep breeding objectives was conducted in 2016/17. The 2022 review reflects changes in sheep production practices, current and projected product prices and production costs.

The breeding objective review shows that the value of genetic improvement in nominal terms has increased by about 25% between 2017 and 2022, depending on index. The increase is driven largely by increases in lamb price and farm costs (farm input costs and the value of feed have increased). This reflects the greater value that higher merit rams deliver to their clients.

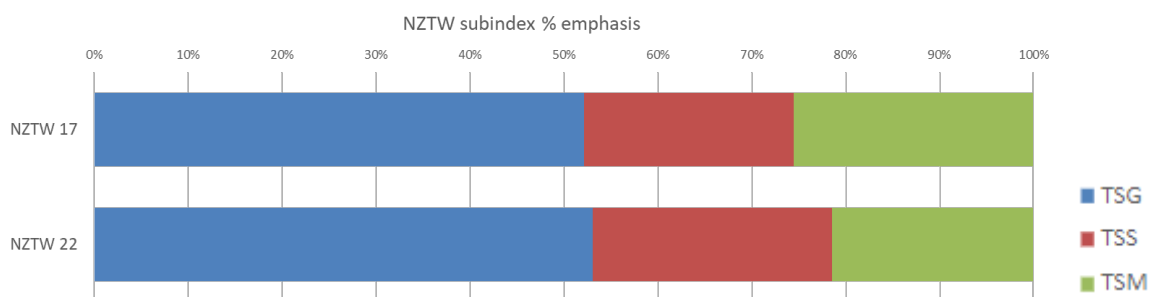
The 2022 updated breeding objectives have resulted in small adjustments between traits for both Maternal and Terminal breeds. The correlation between the 2017 and 2022 indexes is very high at over 99.9% for Terminals meaning little change in relative merit or rankings. The correlation for Maternals is 97.2% reflecting some adjustment in the economic merit of core traits and the removal of wool from the NZMW index. Although the correlation is high there will be some change in the relative merit and rankings for individuals compared to the previous NZMW indexes.

Responses to Selection

The relative economic weights determine the relative emphasis on each trait in the overall response to selection. The weight reflects income, costs of production and frequency and timing of the trait referred to as genetic expression.

Terminal Worth: Trait responses based on Index Selection

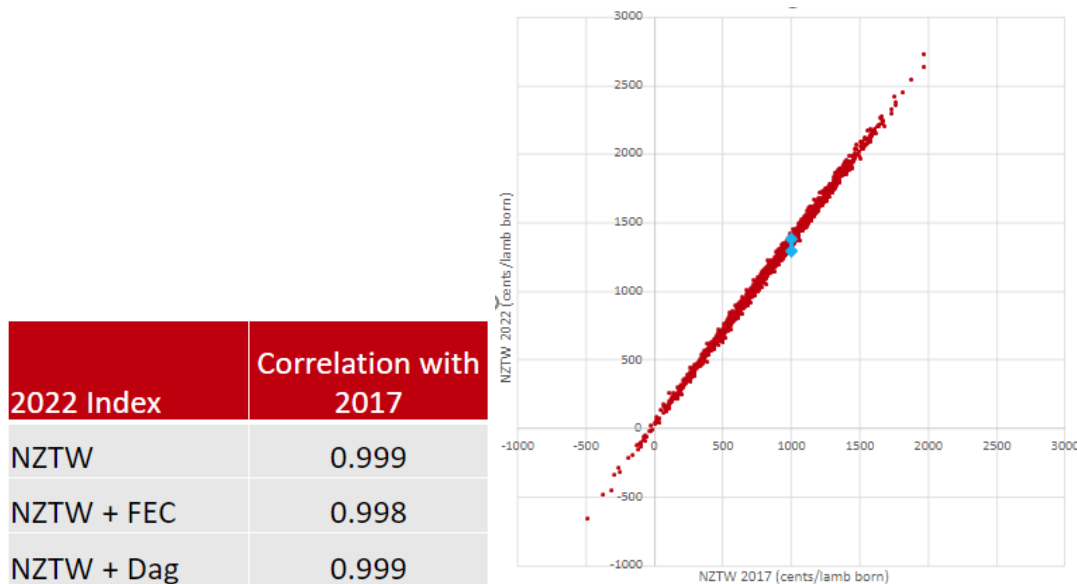
Table 1: Trait emphasis in NZTW index for 2017 and 2022 breeding objectives



Overall, there has been a slight increase in emphasis on Growth from 52 to 53%, an increase in emphasis on survival from 22 to 25% and a decline in emphasis on meat from 26 to 22%. Despite these changes in relative emphasis between goal trait groups, there is a very high correlation (0.999) between the 2017 and

2022 index (Figure 1). This means breeders will see only minor re-ranking of individual rams, but higher overall values reflecting increases in prices and costs.

Figure 1: Correlation between the 2017 and 2022 NZTW index values for Proven Sires

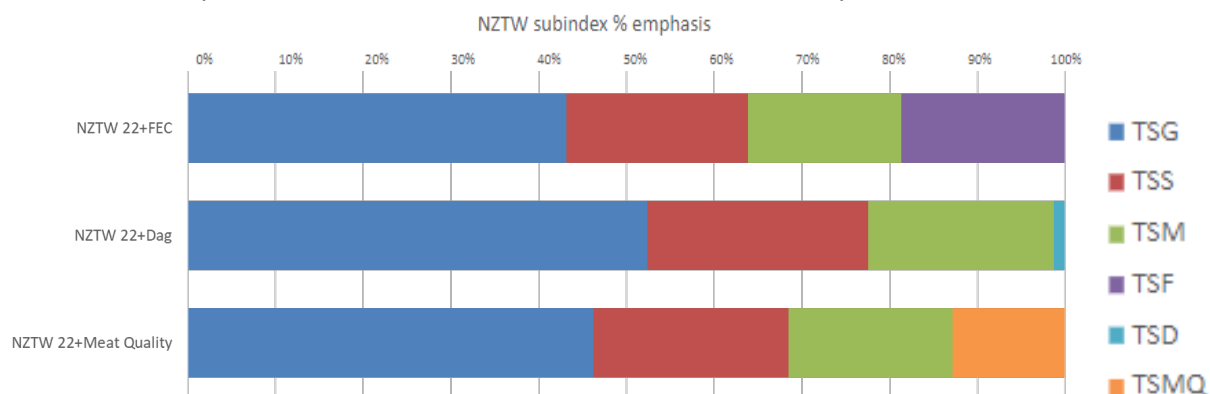


The blue dots in Figure 1 show the spread of 2022 index values for sires with a 2017 NZTW value of 1000 cents, indicating there will be some minor changes in rank between individuals with similar merit, but the change is small.

Additional terminal traits responses

Addition of extra traits adjusts the response across all traits depending on the value (economic weight) of the trait to the standardised production system.

Table 2: Trait emphasis with the addition of FEC, DAG and Meat Quality to the Terminal Worth index.



The new meat quality index is based on marbling score, shear force, meat colour and pH recorded in the SIGC progeny test flock and extended to relatives within flock, ideally through genotyping to increase the accuracy of prediction. As there is currently no payment system for meat quality, the values are set to have around 13% influence on the trait, for breeders that may want to future proof meat quality. Monitoring meat quality is likely to increase in importance in the future as researchers have demonstrated increased lean meat yield can be associated with reduced meat quality when carcasses become too lean.

Fat and NZTW

Fat still has a penalty in NZTW as the consensus is there is still upward pressure on carcass weights in future. There is a correlation between intramuscular fat (IMF) and subcutaneous fat of around 60%. While this is high, it is not 100%, meaning it is possible to select for an increase in IMF and not increase subcutaneous fat. Work is being done on the ability to include alternative IMF scores in future when the measures are calibrated relative to wet chemistry.

Maternal Worth: Responses to Selection based on Index Selection

The relative economic weights determine the emphasis on each trait in the overall response to selection. The weight reflects income, costs of production and frequency and timing of the trait referred to as the 'genetic expression'.

To reflect both the reduction in maternal flocks recording wool, the reduced contribution of wool income and the increased diversity of breeds, wool is no longer included in the NZMW. This enables considerably more maternal flocks to be able to be connected for NZMW increasing transparency of merit for core production traits. NZMW traits now consists of Growth, Adult size, Capped Reproduction and Survival (direct and maternal). As all sub-indexes are additive, wool can be added to NZMW plus any other relevant traits to recreate the same indexes as available in 2017.

To compare the impact of updated relative index weights with the previous weights, a comparison with the 2017 values was made with wool included and excluded.

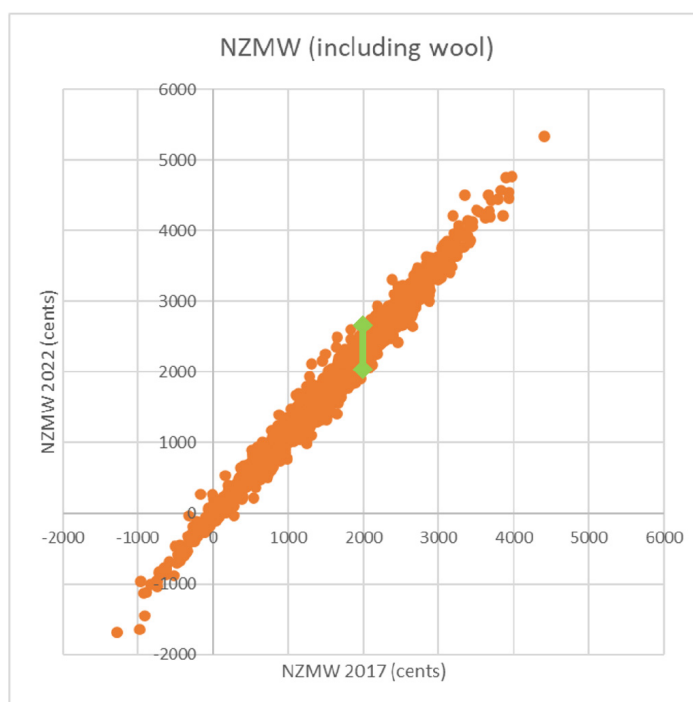
Table 3: Trait emphasis in NZMW index for 2017 and 2022 breeding objectives



NZ Maternal worth 22 + Wool gives the direct comparison with the 2017 index. The weight for wool has halved and almost all of that change has gone into an increase in emphasis on survival. Growth, adult size and capped reproduction have effectively the same relative emphasis in the 2017 and 2022 breeding objective. Removing wool from the NZMW index (the bottom line in Table 3) results in an increase in emphasis shared equally over all the remaining traits.

Figure 2: Correlation between the 2017 and 2022 NZMW index values for Proven Sires

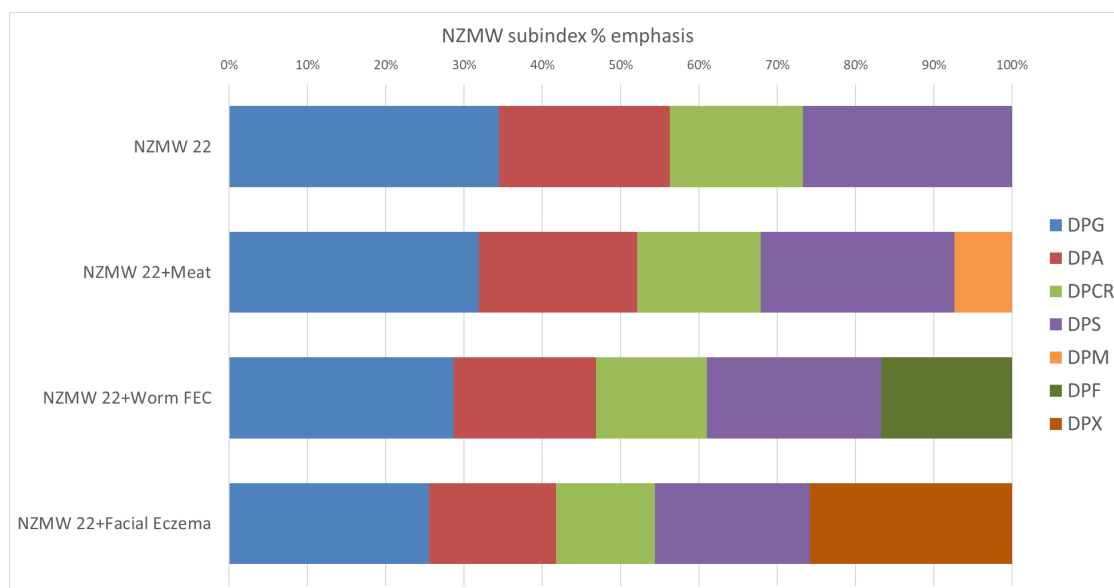
2022 Index	Correlation with 2017
NZMW	0.978
NZMW + Wool*	0.992
NZMW + Meat	0.980
NZMW + Twinning	0.978
NZMW + Hogget Lambing	0.979
NZMW + FEC	0.978
NZMW + Resilience	0.978
NZMW + Dag	0.978
NZMW + Facial Eczema	0.988
NZMW + BCS	0.966
NZMW + Wool Fibre Diameter	0.977
NZMW + Wool Colour	0.978



The correlations between the index merit based on the 2017 versus 2022 are high for maternal worth at 0.992 (99.2%) for 2017 NZMW (with wool included) and 2022 MW+W. The green line in Figure 2 shows the spread of NZMW index values under the 2022 index for rams that had a value of 2000- cents for the 2017 NZMW (both including wool). With Wool out of the core NZMW traits this reduces to 0.978 or 97.8% correlation. The relatively small changes in the weighting do result in some adjustments to values and hence rankings particularly for individuals in the mid zone of the index.

Additional Maternal trait responses

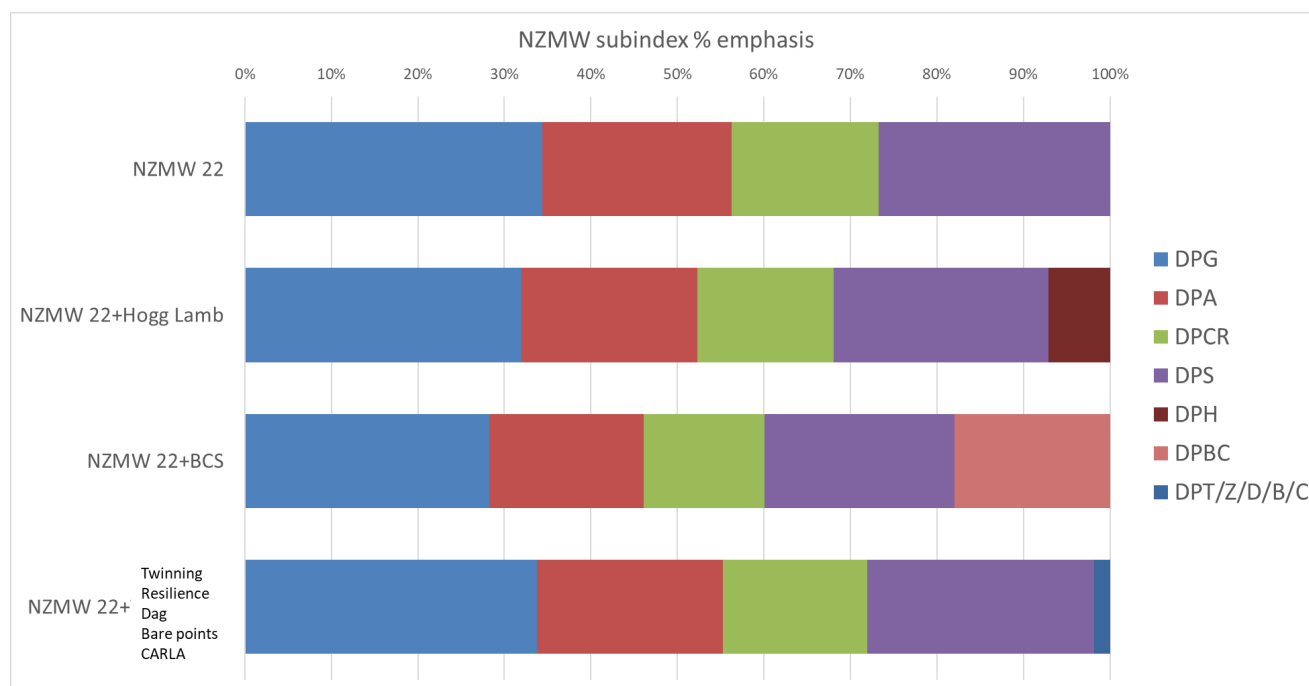
Table 4: Trait emphasis in NZMW index with the addition of WormFEC and Facial Eczema



Adult size

The bio-economic model for adult ewe weight suggested that the penalty for adult size should be increased in the 2022 index. However, consultation with focus groups revealed that most breeders believed the new weighting was too harsh. As such, the economic weight for adult size has been adjusted down to maintain the same relativity between early growth and adult size as it was in the 2017 index.

Table 5. Trait emphasis in NZMW index with the addition of hogget lambing, body condition score and minor traits



Overall

Most individual economic weightings have increased reflecting changes in product prices and costs relative to 2017. There are only minor adjustments to the relative emphasis between traits for both Maternal and Terminal sires. This means that although index values have a greater range of values, the responses of individual traits to selection using the Maternal Worth and Terminal Worth indexes are very similar to the responses achieved under selection using the 2017 indexes.

Appendix 1: Index 2022 traits and weightings

Table 6. Dual Purpose (Maternal) index August 2022 traits and weightings

Sub-index	Sub-index short name	Goal trait breeding value full name	Breeding value short name	Economic weight (cents per lamb born)
NZ Standard Maternal Worth	NZMW	DPCR + DPS + DPG + DPA		
Lamb Growth	DPG	Weaning weight – direct	WWT	153
	"	Weaning weight – maternal	WWTM	145
	"	Carcass weight	CW	480
Adult Size	DPA	Ewe weight	EWT	-158
Capped Reproduction	DPCR	Number of lambs born (litter size)	NLB	non-linear index
Survival	DPS	Survival to weaning – direct	SUR	16049
		Survival to weaning – maternal	SURM	15008
Reproduction	DPR	Number of lambs born (litter size)	NLB	3367
Wool	DPW	Lamb fleece weight	LFW	190
		Hogget fleece weight	FW12	82
		Adult fleece weight	EFW	246
Wool Colour	DPWQC	Wool colour score	COLSC	-73
Wool Fineness	DPWQF	Hogget fibre diameter	FDIAM	Non-linear index
		Adult fibre diameter	AFDIAM	
Meat Yield	DPM	Hindquarter lean yield	HQLY	579
		Loin lean yield	LNLY	724
		Shoulder lean yield	SHLY	435
		Carcass Weight Yield	CWY	480
		Fat yield	FATY ¹	0
Twinning Rate	DPT	Twinning rate adjusted for NLB	TWIN	6097
Hogget	DPH	Hogget fertility	HFER	1067
Lambing		Hogget litter size	HNLB	621
WormFEC	DPF	FEC1%	FEC1	-6.80
		FEC2%	FEC2	-6.80
		Adult FEC%	AFEC	-5.20
Resilience	DPZ	Age when first drenched	DRAGE	2.26
		Live weight gain under parasite challenge	RGAIN	16.65
Dag Score	DPD	Lamb Dag Score	LDAG	-64
		Adult Dag Score	ADAG	-64
Facial Eczema	DPX	GGT21	GGT21	-2228
Body Condition	DPBC	Body condition score	BCS	3292
Bare Points	DPB	Bare breech	BBREECH	35
		Bare Belly	BBELLY	46
Carla	DPC	Carla	CARLA	2.27

¹ There is no (zero) weighting on FATY for Dual Purpose

Notes:

- Indexes highlighted green included in NZMW (wool removed in 2022)
- Dual Purpose Indexes are in cents per ewe lambing
- Carla (DPC) and WormFEC (DPF) sub-indexes should not be combined into an overall index as parasite resistance would be double counted

Table 7. Terminal Sire Index August 2022 traits and weightings

Sub-index	Sub-index short name	Goal trait breeding value full name	Breeding value short name	Economic weight (cents per lamb born)
NZ Standard Terminal Worth	NZTW	TSG + TSM + TSS		
Lamb Growth	TSG	Weaning weight – direct	WWT	87
	"	Carcass weight	CW	275
Meat Yield	TSM	Hindquarter lean yield	HQLY	332
		Loin lean yield	LNLY	415
		Shoulder lean yield	SHLY	249
		Carcass Weight Yield	CWY	275
		Fat yield	FATY	-119
Survival	TSS	Survival to weaning – direct	SUR	8385
Lean Yield	TSLY	Terminal Sire Lean Yield		
		Hindquarter lean yield	HQLY	332
		Loin lean yield	LNLY	415
		Shoulder lean yield	SHLY	249
		Carcass Weight Yield	CWY	275
Fat Yield	TSFY	Terminal Sire Fat Yield		
		Fat yield	FATY	-119
Carla	TSC	Carla Note: TSC should not be combined with TSF (to avoid double counting parasite resistance).	CARLA	1.1
Dag Score	TSD	Lamb Dag Score	LDAG	-25
Meat Quality	TSMQ	Shear force	SHF	-29
		Marble score	CMARB	310
		Meat colour (a*)	COLA24	28
		Meat pH	CPH	-1153
WormFEC	TSF	FEC1%	FEC1	-3.2
		FEC2%	FEC2	-3.2

Notes:

- Indexes highlighted green included in NZTW
- Index is in cents per lamb born
- Breeding values for reproduction, hogget lambing, facial eczema, body condition score and wool can be reported for terminal breeds if the traits are recorded.
- Carla (DPC) and WormFEC (DPF) sub-indexes should not be combined into an overall index as parasite resistance would be double counted