



Scanning or not scanning?

Sheep Ireland

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1 Abstract

In this test, all 2010 scanning were dropped for the Vendeen breed to outline the consequences.

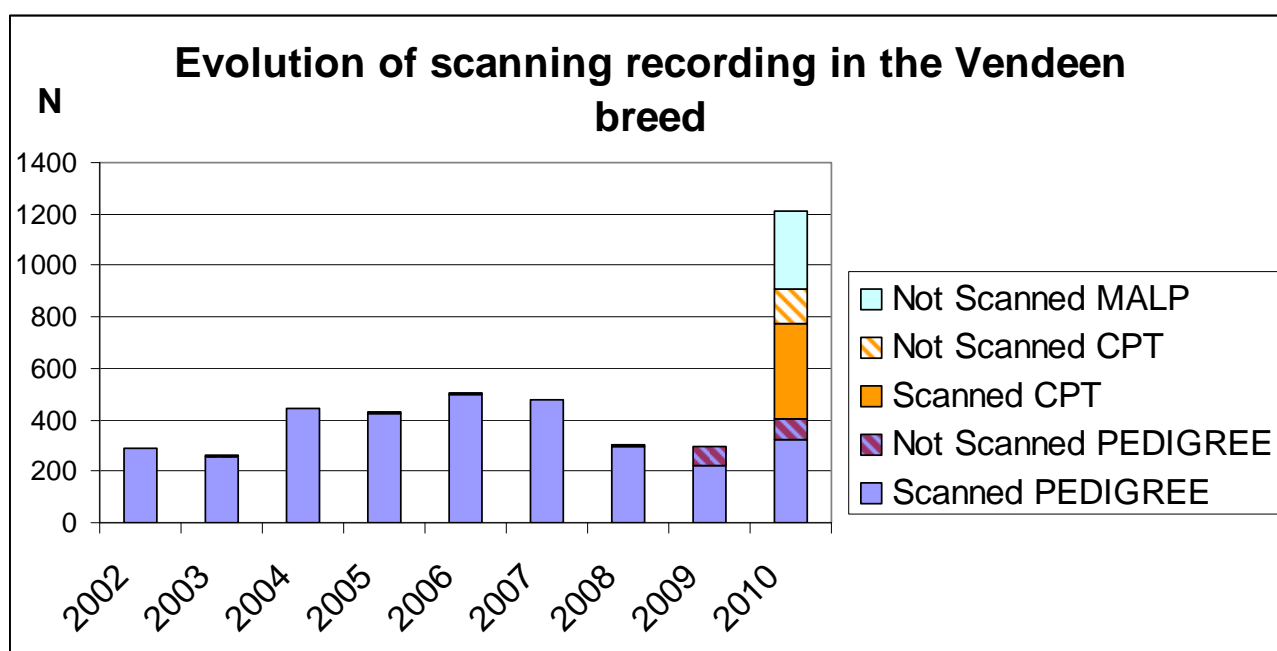
On overall, the main consequences are

- changes in the production subindex from -0.64 to + 0.64€for the Production subindex
- drop in reliability up to 17% in the Production subindex
- Slower genetic progress : -50% in lamb rams population on production subindex

2 Objective

The objective is to detect the effect of dropping all scanning recording for a given breed. As an example, the Vendeen animals were used.

3 Evolution of scanning recording in the Vendeen breed



4 Place of scanning in the genetic evaluation of production traits

The economic objective of production traits is to be able to produce lambs at an optimum weight, conformation, and fat score in a minimum period of time. The goal trait is the number of days to slaughter.

Scanning data is composed of live weight, ultrasound measurements of muscle and fat. Scanning is the latest live measurement currently recorded on lambs.

Table 1. Raw performances for scanning age per breed.

Breed	N	average	STD	min	max
BR	835	114	12.8	44	140
CL	8137	122	13.2	-20	200

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SU	19273	112	15.0	41	195
TX	28093	117	15.2	28	207
VN	4315	121	14.1	59	209

Scanning performances are used in a BLUP genetic evaluation to predict direct and maternal breeding values for live weight, and direct breeding values for ultrasound scanning for muscle and fat.

These traits are then used to derive predictor traits such as conformation scores for muscle and fat.

If scanning data are unavailable, other weights taken earlier in the lamb's life can be used to predict scanning breeding values. In that case, the maximum accuracy achievable equals R_g^2 , where R_g is the genetic correlation between the traits.

Table 2. Relation between trait measured and accuracy achievable.

Trait measured	R_g with scanning	Max accuracy achievable
Scanning perf.	1	1
Weaning weight	0.80	0.64
40 days weight	0.64	0.41

5 Test evaluation

5.1 Protocol

In this test, all 2010 scanning performances (live weight, ultrasound muscle, ultrasound fat) for the Vendeen pedigree animals were set to missing.

5.2 Overall Results

Results are presented as correlations between genetic evaluation outputs (breeding values & accuracy) with and without scanning performances.

NOTE:

1) In the following graphs, the sheep indexes are labelled as follow:

- Overall Sheep value => Total_index
- Production sub-index => Prodn_subindex
- Maternal sub-index => Mat_subindex
- Lambing sub-index => Lamb_subindex
- Accuracy of Overall Sheep value => acc_Total_index
- Accuracy of Production sub-index => acc_Prodn_subindex
- Accuracy of Maternal sub-index => acc_Mat_subindex
- Accuracy of Lambing sub-index => acc_Lamb_subindex

2) In the following graphs, xxxx_WITH = trait estimated with scanning records, and xxxx_NO = trait estimated without the scanning records.

Example:

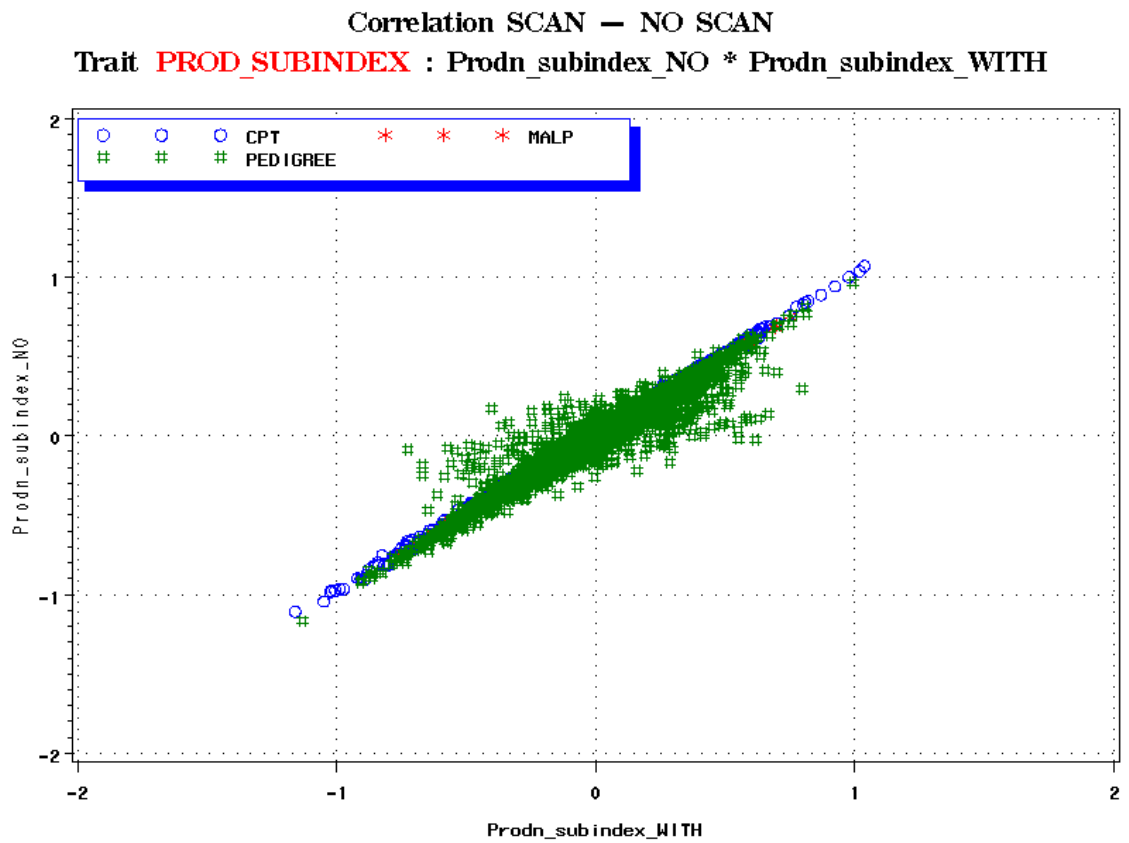
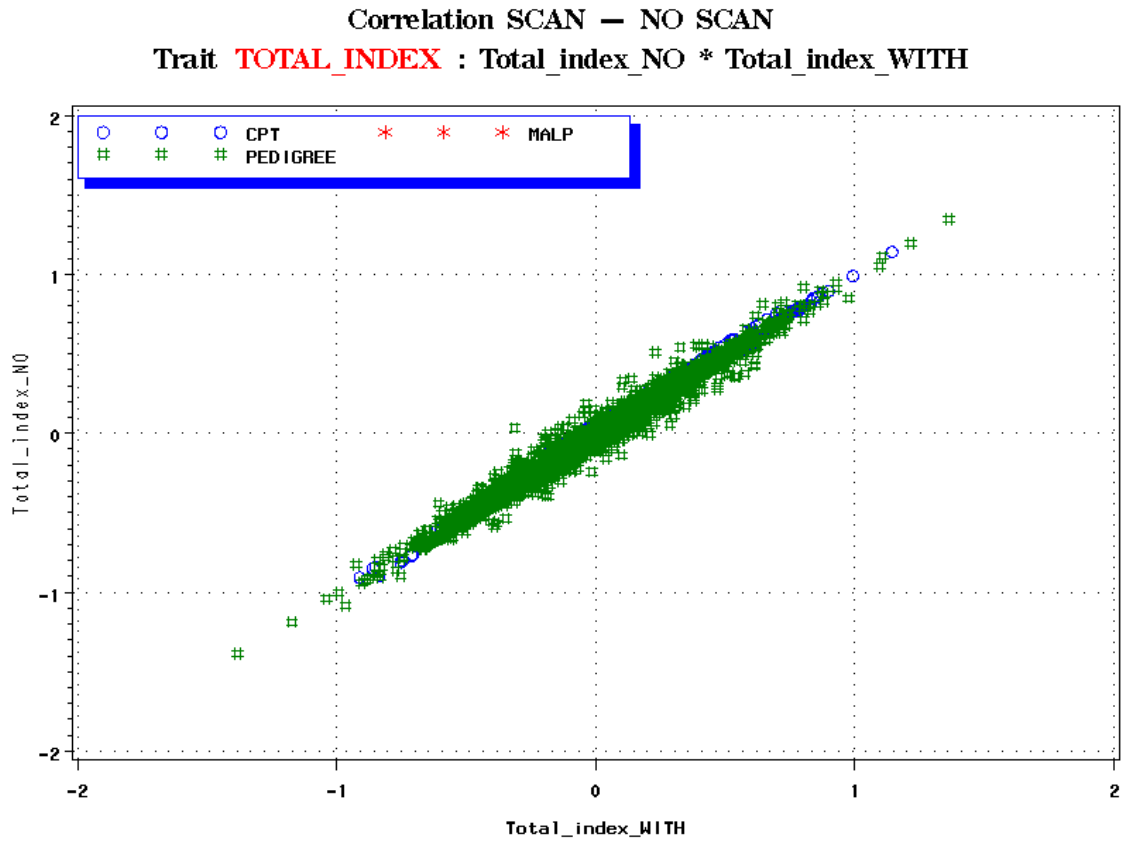
Total_index_WITH = Total index estimated from performances including scanning records

acc_Total_index_WITH = accuracy of 'Total_index_WITH'

Total_index_NO = Total index estimated from performances excluding scanning records

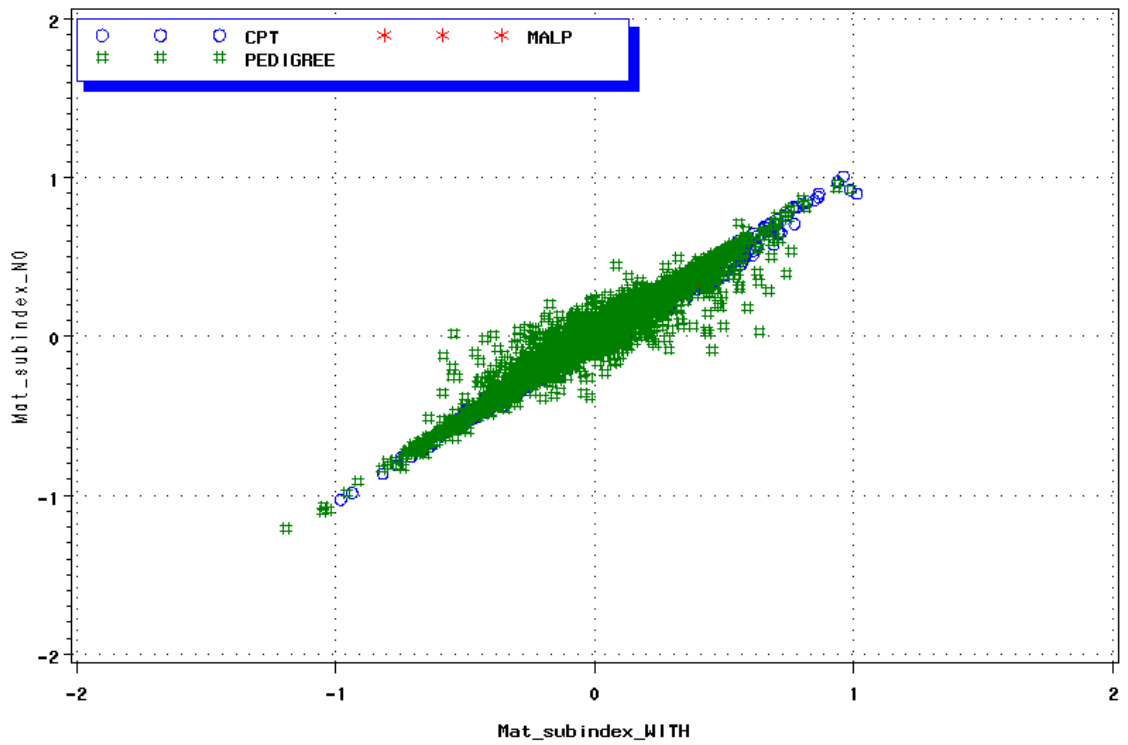
acc_Total_index_NO = accuracy of 'Total_index_NO'

5.2.1 Correlations between breeding values



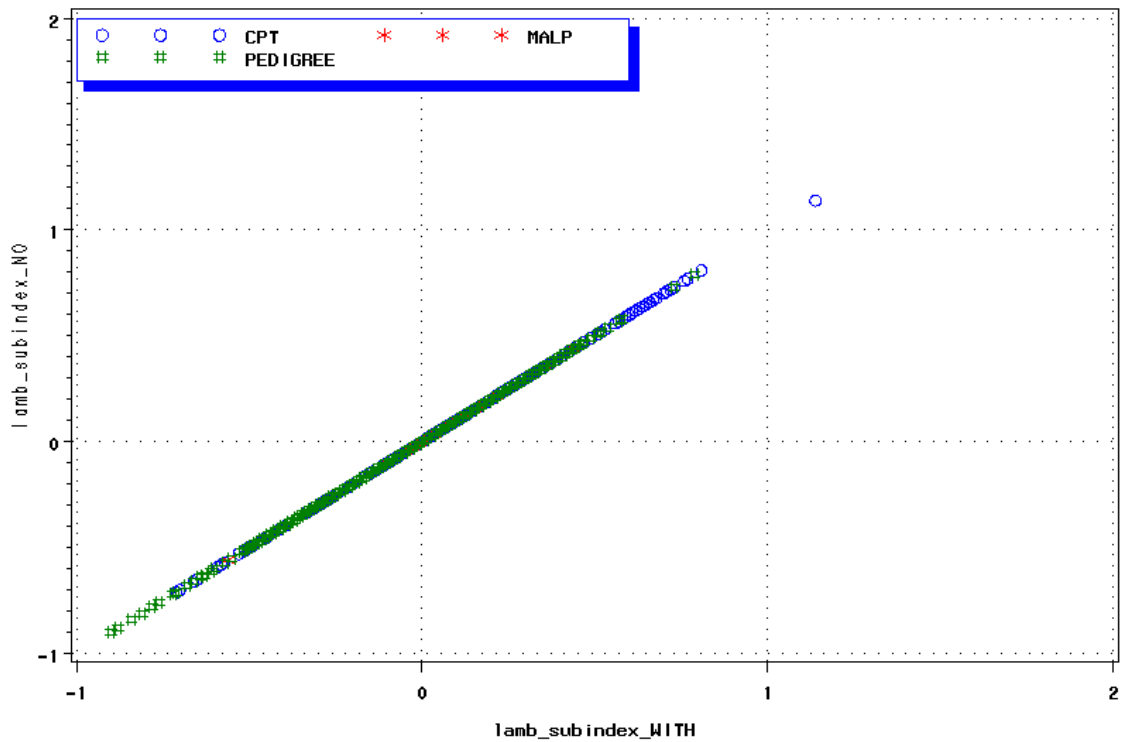
Correlation SCAN — NO SCAN

Trait **MAT_SUBINDEX** : Mat_subindex_NO * Mat_subindex_WITH



Correlation SCAN — NO SCAN

Trait **LAMB_SUBINDEX** : lamb_subindex_NO * lamb_subindex_WITH



In short:

1) When scanning records are not considered in the genetic evaluation, the Production subindex and Maternal subindex are the most affected trait. The lambing subindex is, as expected, not affected by the changes in records.

The production subindex is directly affected by the loss of scanning data: direct effect of live weight, ultrasound scan for muscle and fat.

The Maternal subindex is affected via the maternal components of live weight at scanning

The Total index is the resulting combination of production, maternal, and lambing subindexes.

2) The effect of losing the scanning data results, for the Vendeen breed, in Production subindexes getting closer to 0 because in most cases there are no substitute weights recorded at weaning or at a younger age to predict the day to slaughter trait.

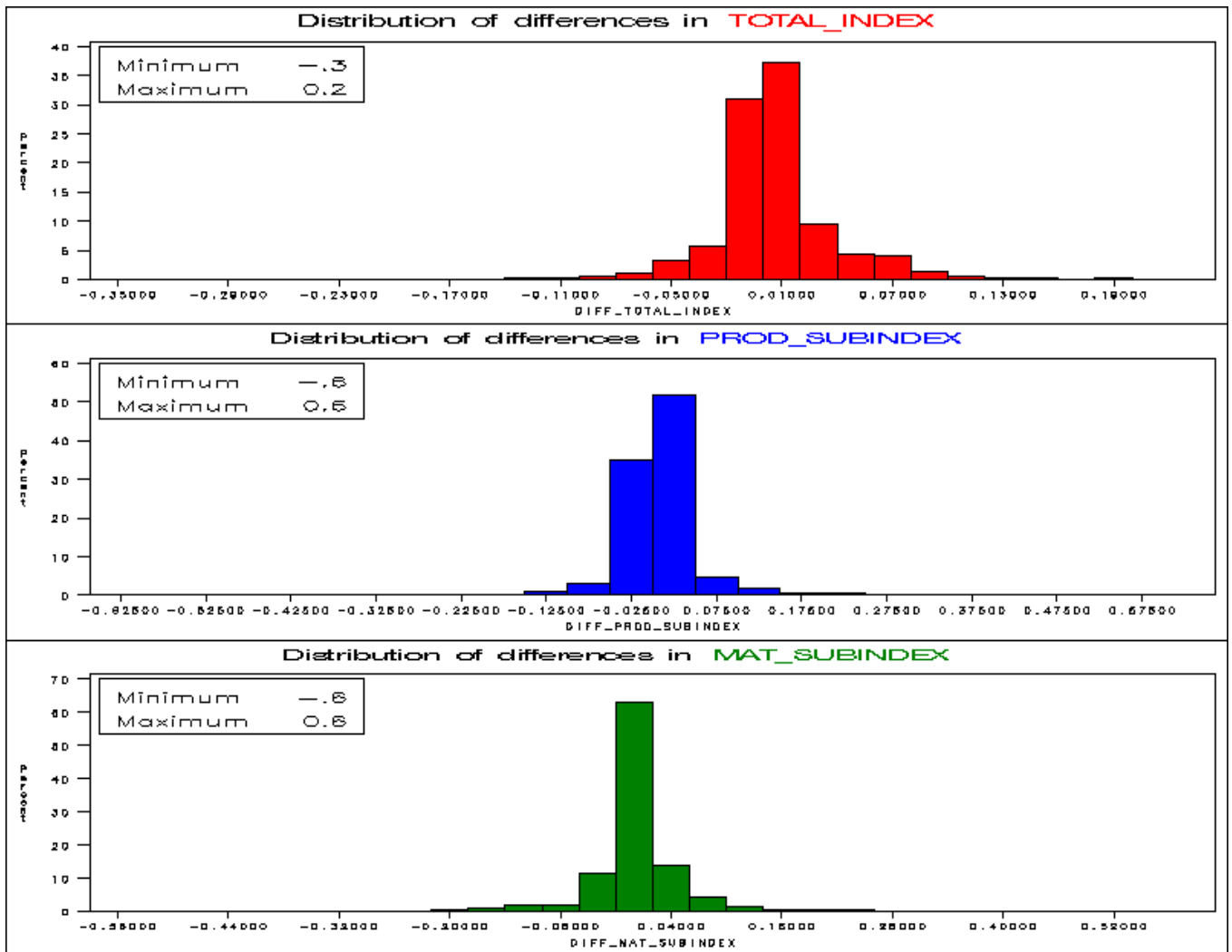
3) Even if scanning records were kept in for CPT flocks, the production subindexes of CPT animals were not immune to the loss of pedigree scanning data because the BLUP evaluation uses all available records through the pedigree to predict breeding values.

4) As expected from the graphs, the overall average difference in breeding value (= breeding value 'with scanning' - breeding value 'without scanning') for each of the SheepIreland index and subindexes is small:

	Difference between breeding value			
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	7135	7240	7534	7374
MEAN	0.01	0.00	0.00	0.00
STD	0.03	0.06	0.05	0.00
MIN	-0.35	-0.64	-0.56	0.00
MAX	0.24	0.64	0.60	0.00

but the spread (min & max) is larger.

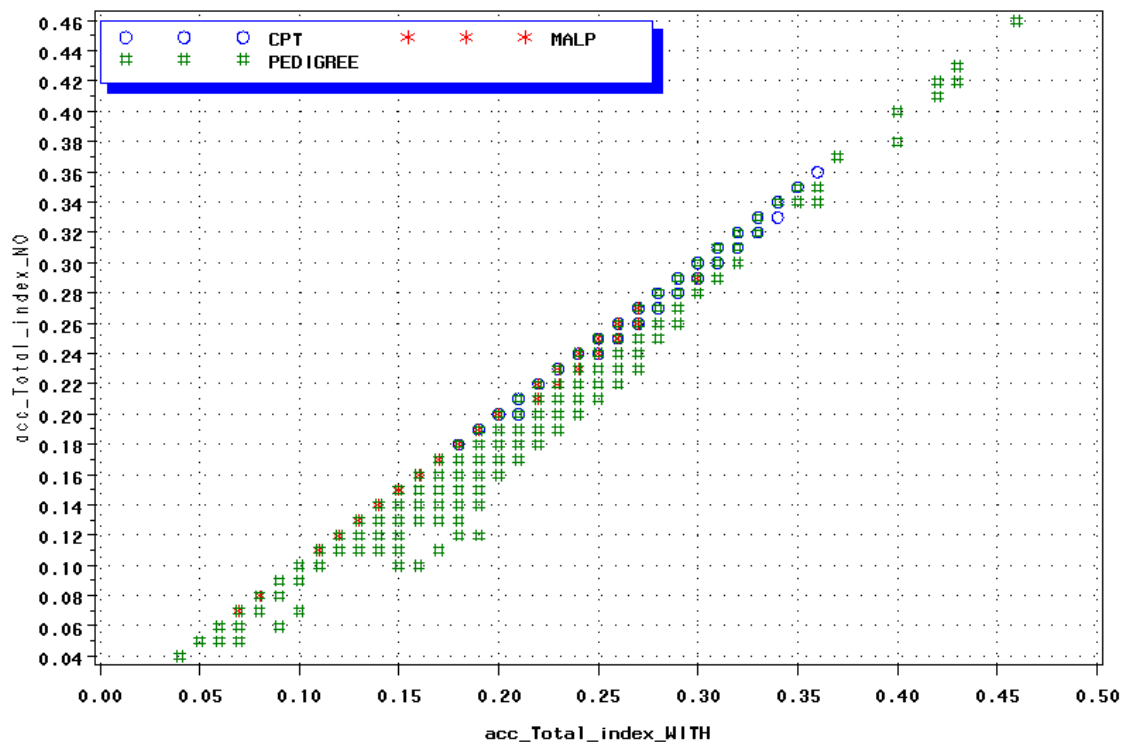
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5.2.2 Correlations between accuracies

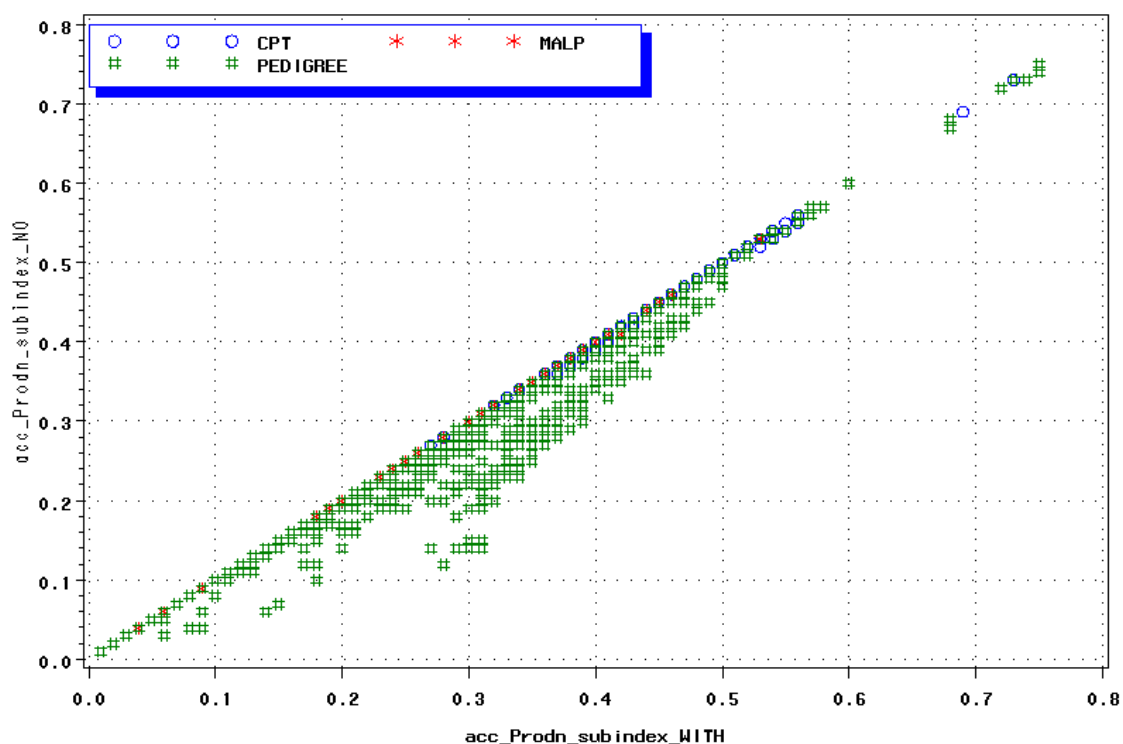
Correlation SCAN — NO SCAN

Trait **ACC_TOTAL_INDEX** : $acc_Total_index_NO * acc_Total_index_WITH$



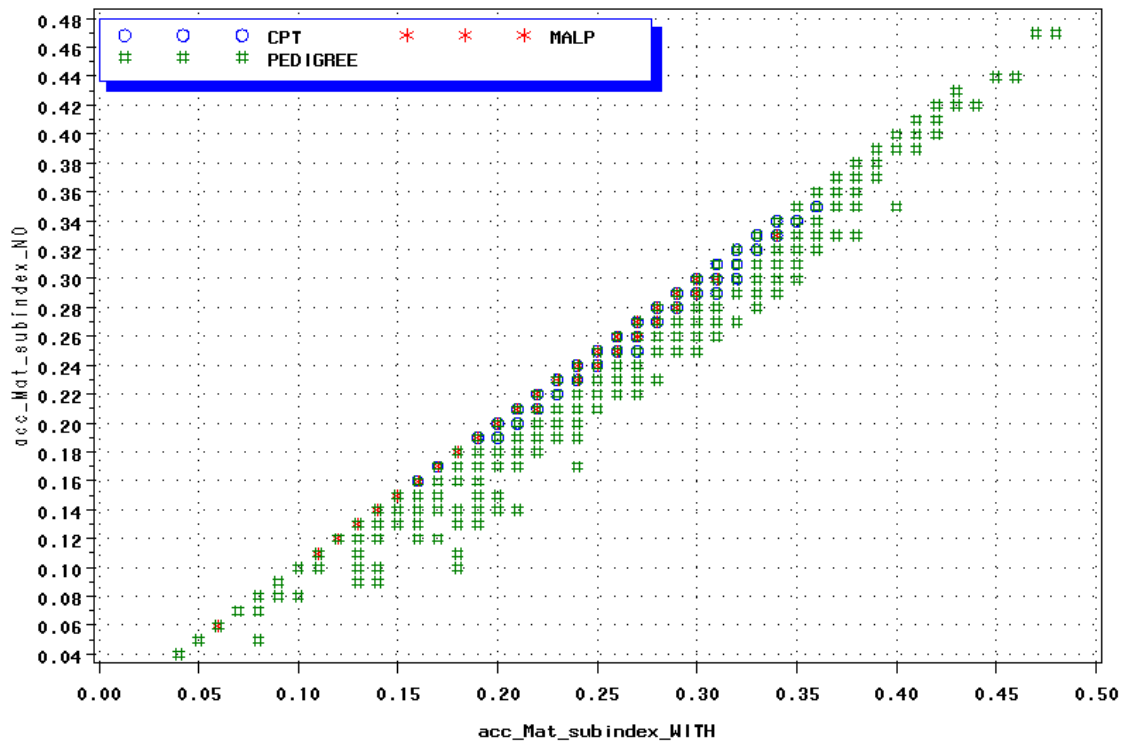
Correlation SCAN — NO SCAN

Trait **ACC_PROD_SUBINDEX** : $acc_Prodn_subindex_NO * acc_Prodn_subindex_WITH$



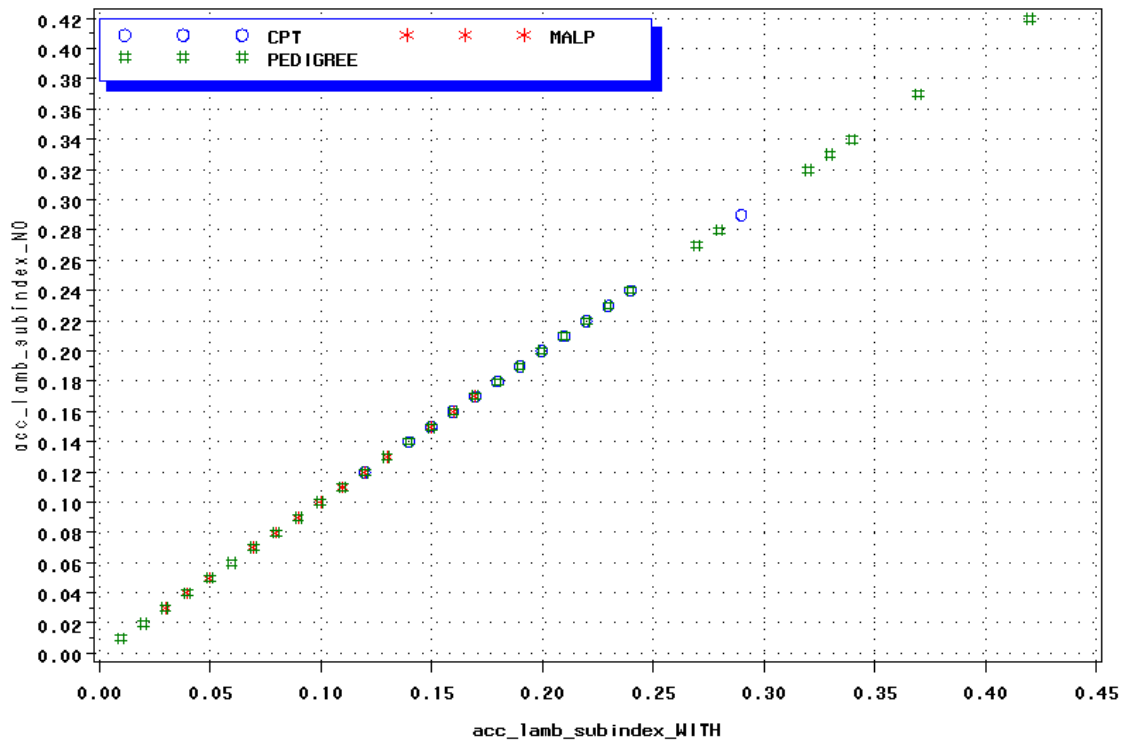
Correlation SCAN — NO SCAN

Trait **ACC_MAT_SUBINDEX** : acc_Mat_subindex_NO * acc_Mat_subindex_WITH



Correlation SCAN — NO SCAN

Trait **ACC_LAMB_SUBINDEX** : acc_lamb_subindex_NO * acc_lamb_subindex_WITH



In short:

1) Drop in accuracy for Total index, production Subindex, and maternal Subindex. As expected, the Lambing Subindex is untouched by the changes made in the scanning data recording.

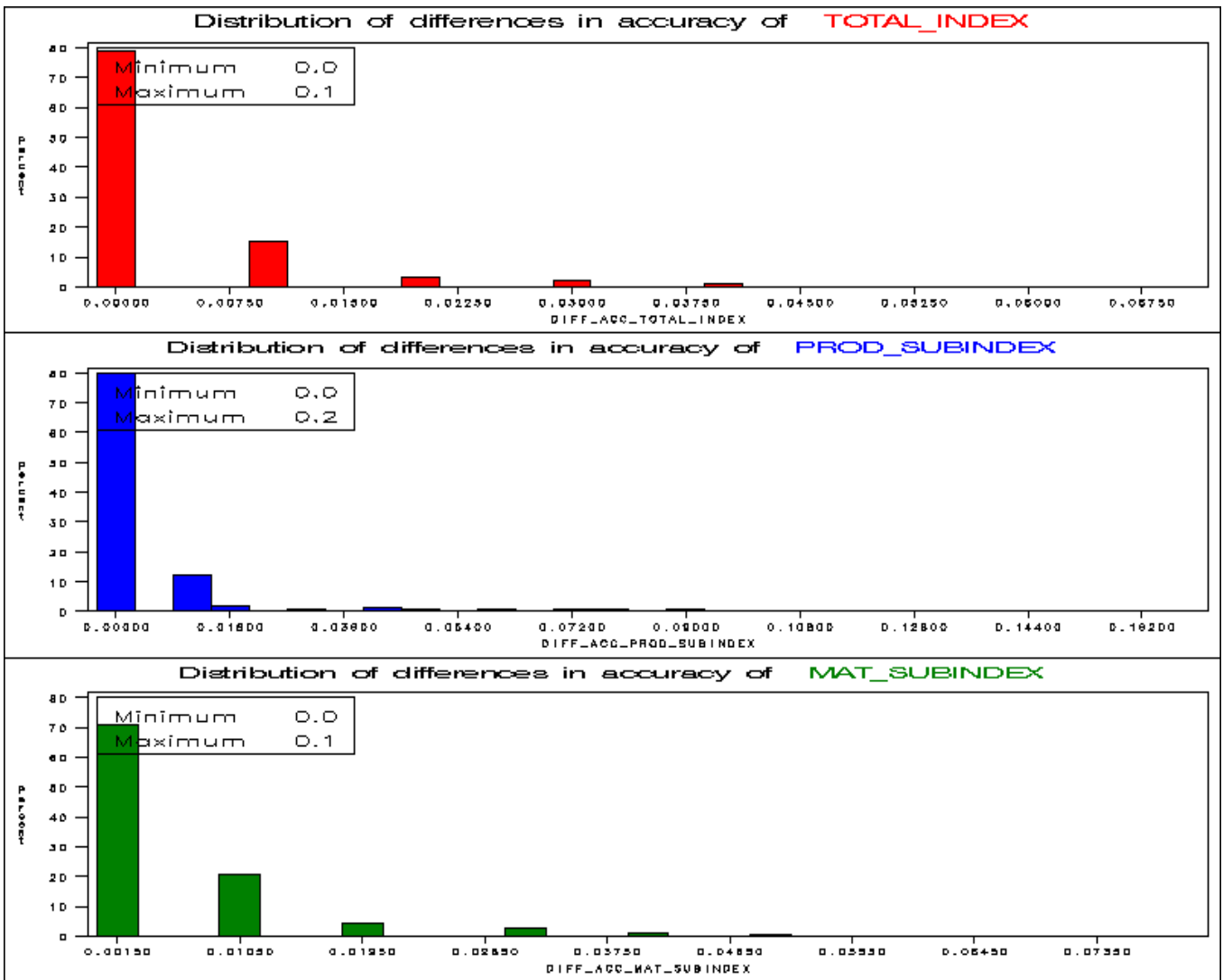
2) Because the changes in the phenotypes collected were only made in the pedigree records, the largest loss of accuracy impacted pedigree animals. Nonetheless, because of the BLUP methodology used in the genetic evaluation, to a lesser extent, drop in accuracy also impacted MALP & CPT animals.

3) The average drop in accuracy is relatively more important in accuracy compared to breeding values; difference in accuracy (= accuracy 'with scanning' - accuracy 'without scanning') can be calculated:

	Difference between accuracy			
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	7135	7240	7534	7374
MEAN	0.00	0.01	0.00	0.00
STD	0.01	0.02	0.01	0.00
MIN	0.00	0.00	0.00	0.00
MAX	0.07	0.17	0.08	0.00

and the spread of the difference in accuracy :

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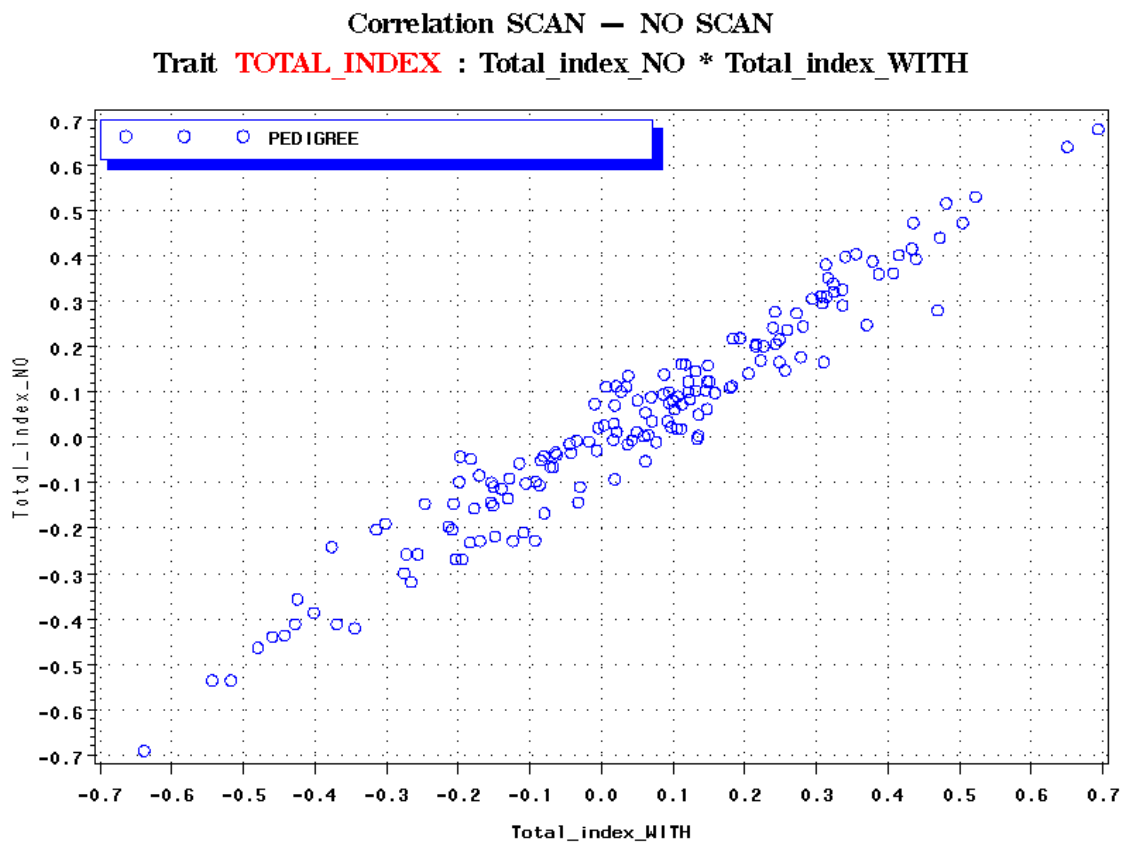
5.3 Results Young Rams

Young rams are key in the diffusion of genetic progress. This short section will present the consequences of dropping scanning recording on young ram results.

Young rams are selected as male lambs born in 2010 and with scanning results (dropped in the test evaluation).

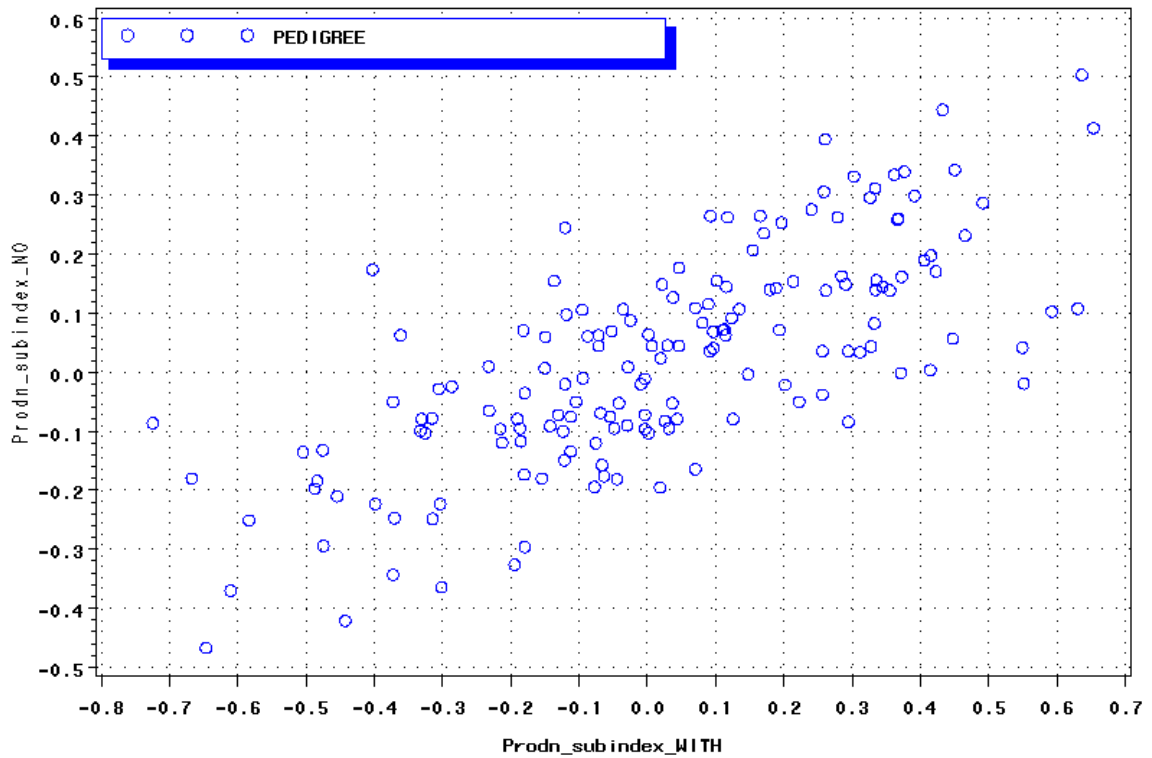
Difference in breeding values are calculated as breeding values 'with scanning' - breeding values 'without scanning' ; as the same for the differences in accuracy.

5.3.1 Correlation between breeding values



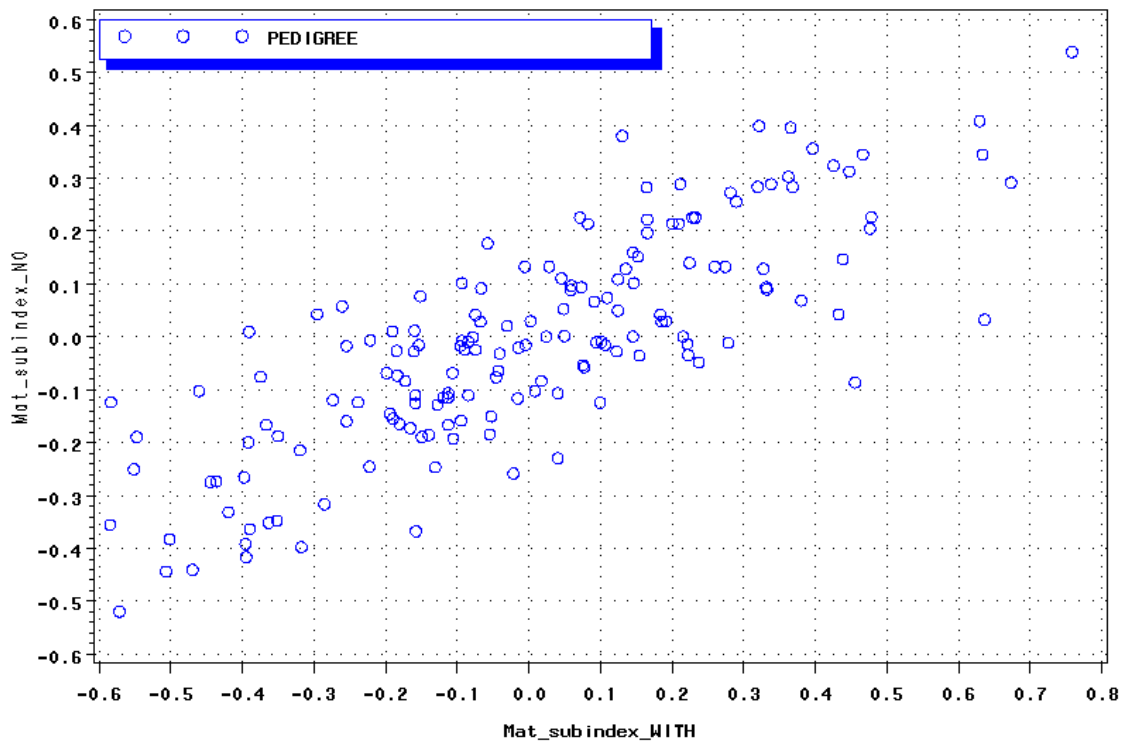
Correlation SCAN — NO SCAN

Trait **PROD_SUBINDEX** : Prodn_subindex_NO * Prodn_subindex_WITH



Correlation SCAN — NO SCAN

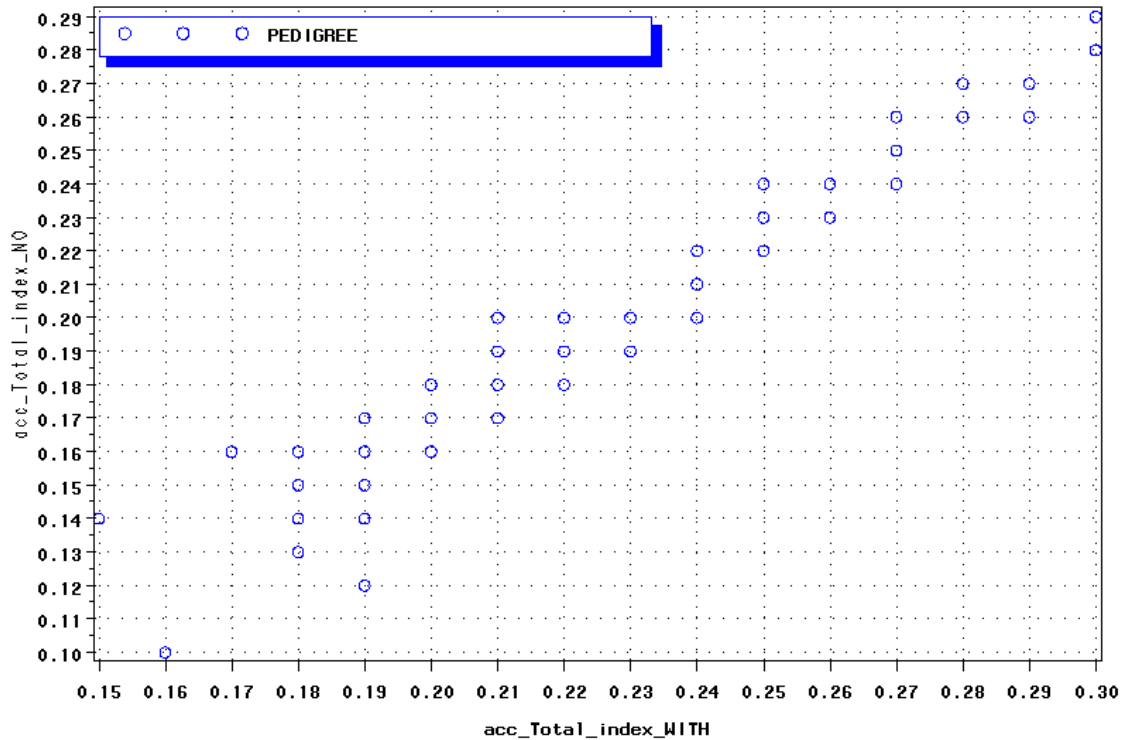
Trait **MAT_SUBINDEX** : Mat_subindex_NO * Mat_subindex_WITH



5.3.2 Correlation between accuracies

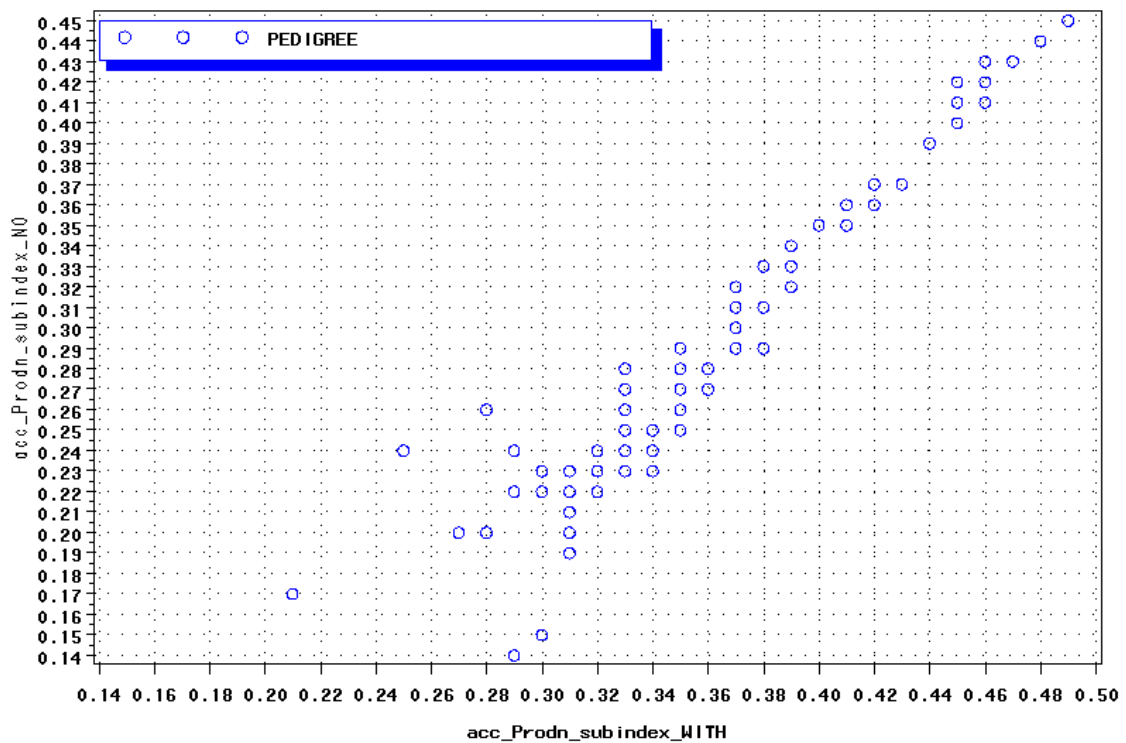
Correlation SCAN — NO SCAN

Trait **ACC_TOTAL_INDEX** : $acc_Total_index_NO * acc_Total_index_WITH$



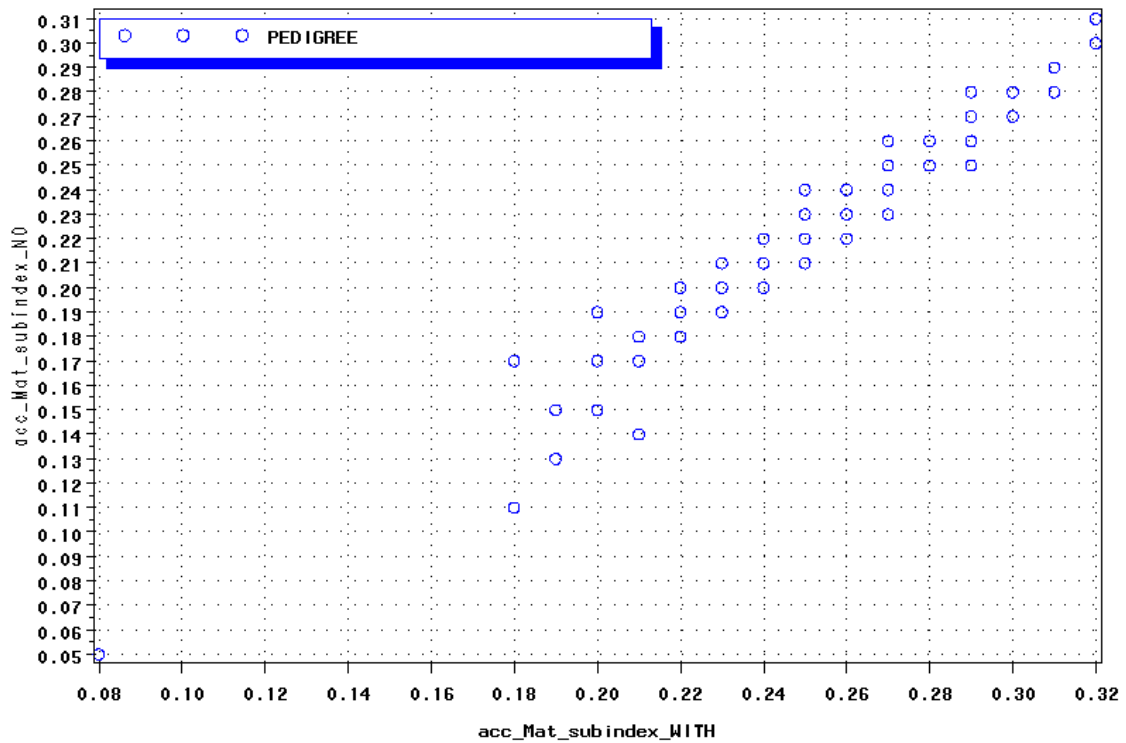
Correlation SCAN — NO SCAN

Trait **ACC_PROD_SUBINDEX** : $acc_Prodn_subindex_NO * acc_Prodn_subindex_WITH$



Correlation SCAN – NO SCAN

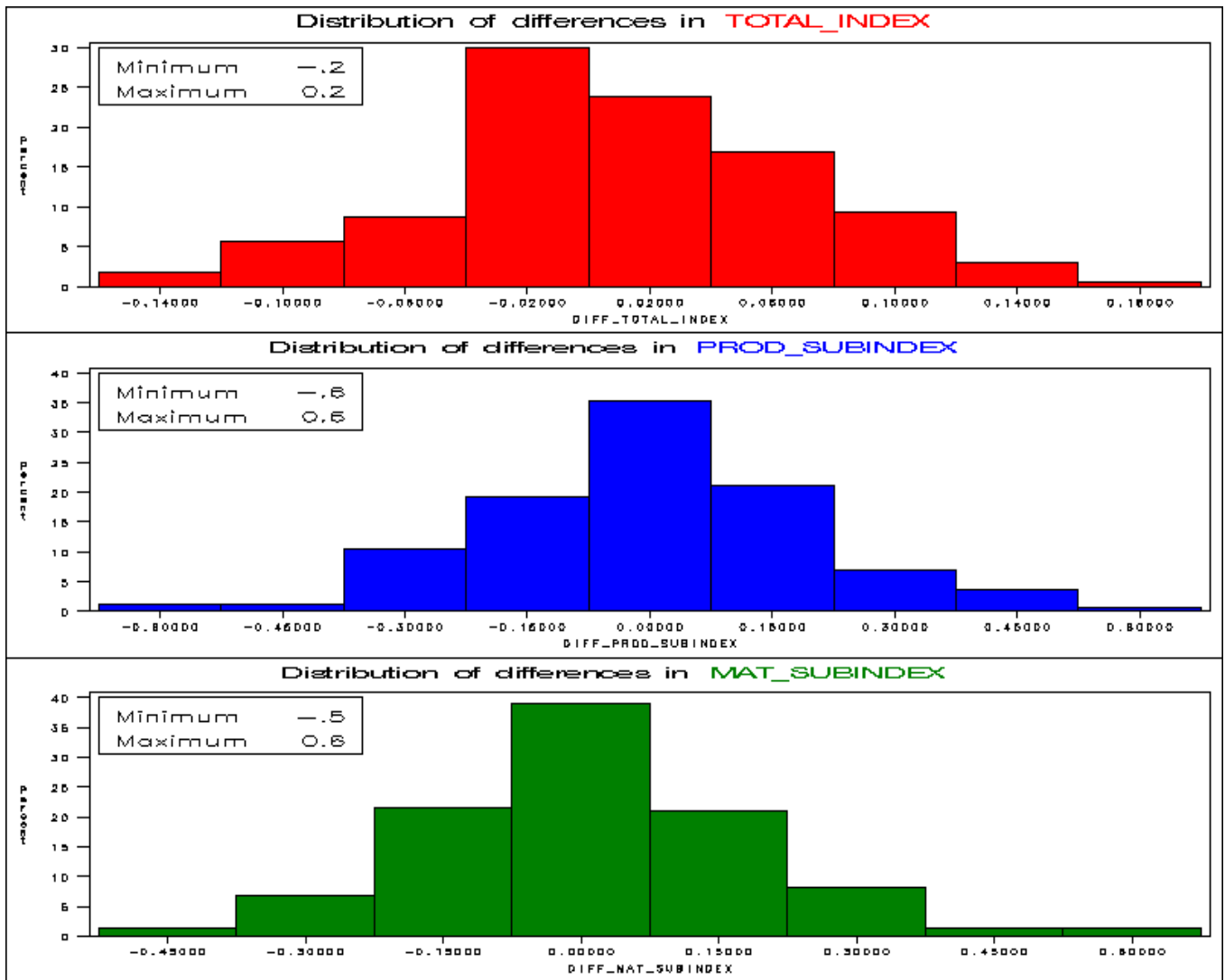
Trait **ACC_MAT_SUBINDEX** : acc_Mat_subindex_NO * acc_Mat_subindex_WITH



5.3.3 Differences in breeding values

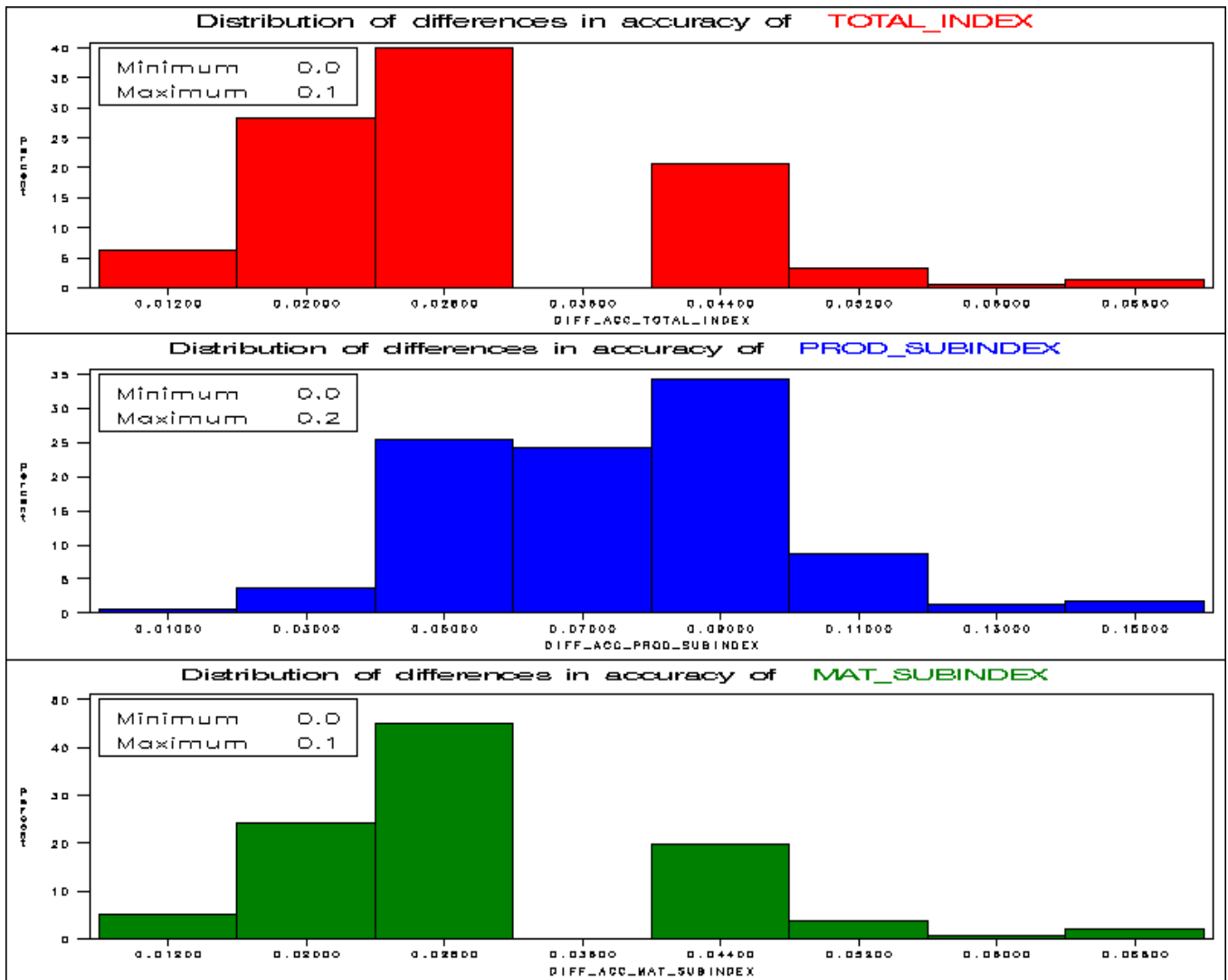
	Difference between breeding values			
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	160	161	162	160
MEAN	0.01	0.00	0.01	0.00
STD	0.06	0.20	0.17	0.00
MIN	-0.16	-0.64	-0.46	0.00
MAX	0.19	0.57	0.60	0.00

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5.3.4 Differences in accuracy

	Difference between accuracy			
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	160	161	162	160
MEAN	0.03	0.07	0.03	0.00
STD	0.01	0.02	0.01	0.00
MIN	0.01	0.01	0.01	0.00
MAX	0.07	0.15	0.07	0.00



5.4 Results Proven Rams

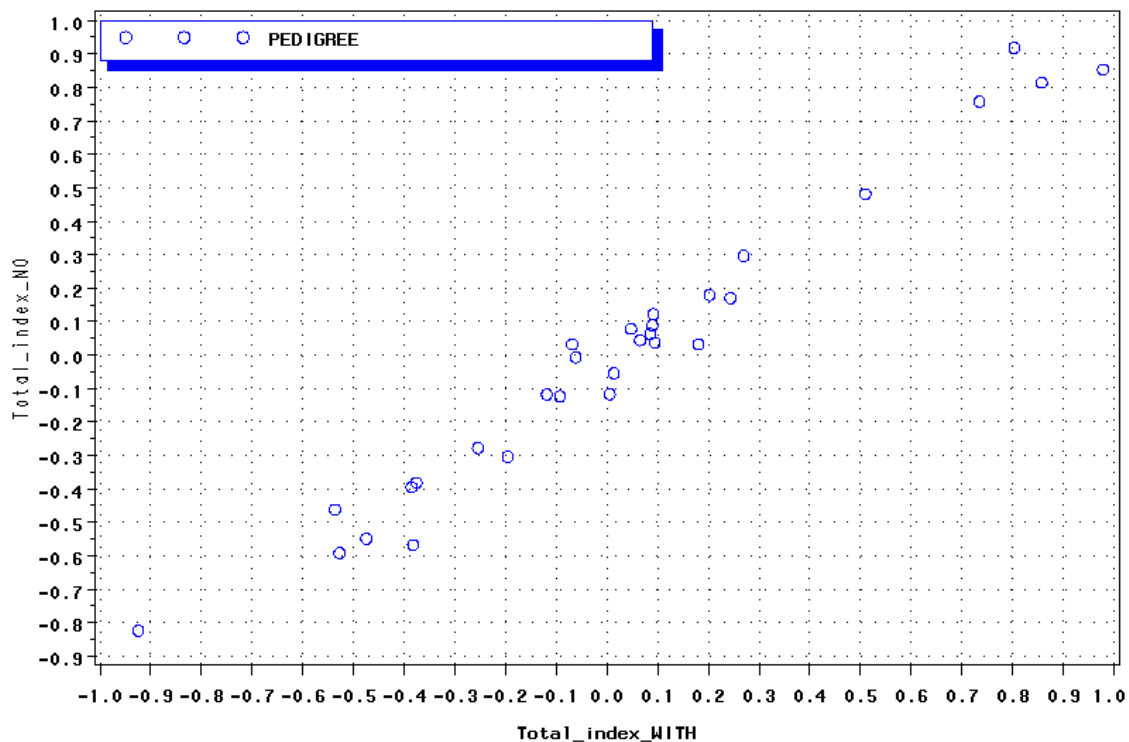
Proven rams are also key in the diffusion of genetic progress. This short section will be restricted to rams with 15 progenies or more, and present the consequences of dropping scanning recording on the progenies of rams.

Difference in breeding values are calculated as breeding values 'with scanning' - breeding values 'without scanning' ; as the same for the differences in accuracy.

5.4.1 Correlations between breeding values

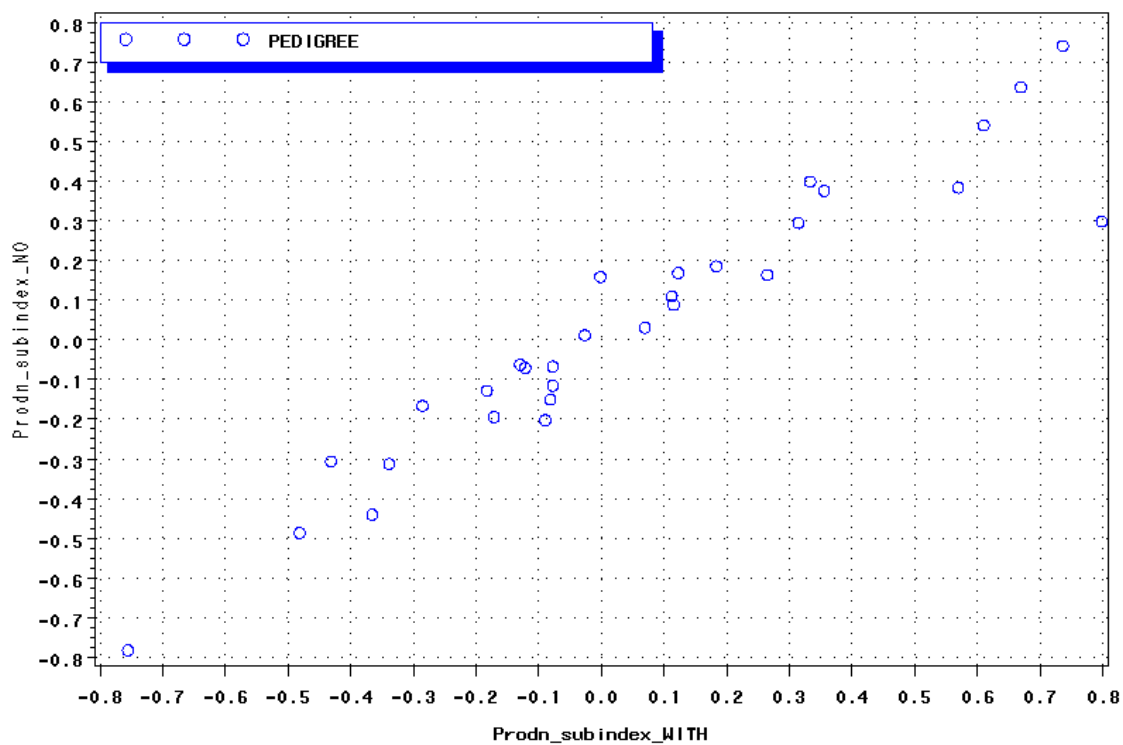
Correlation SCAN — NO SCAN

Trait **TOTAL_INDEX** : Total_index_NO * Total_index_WITH



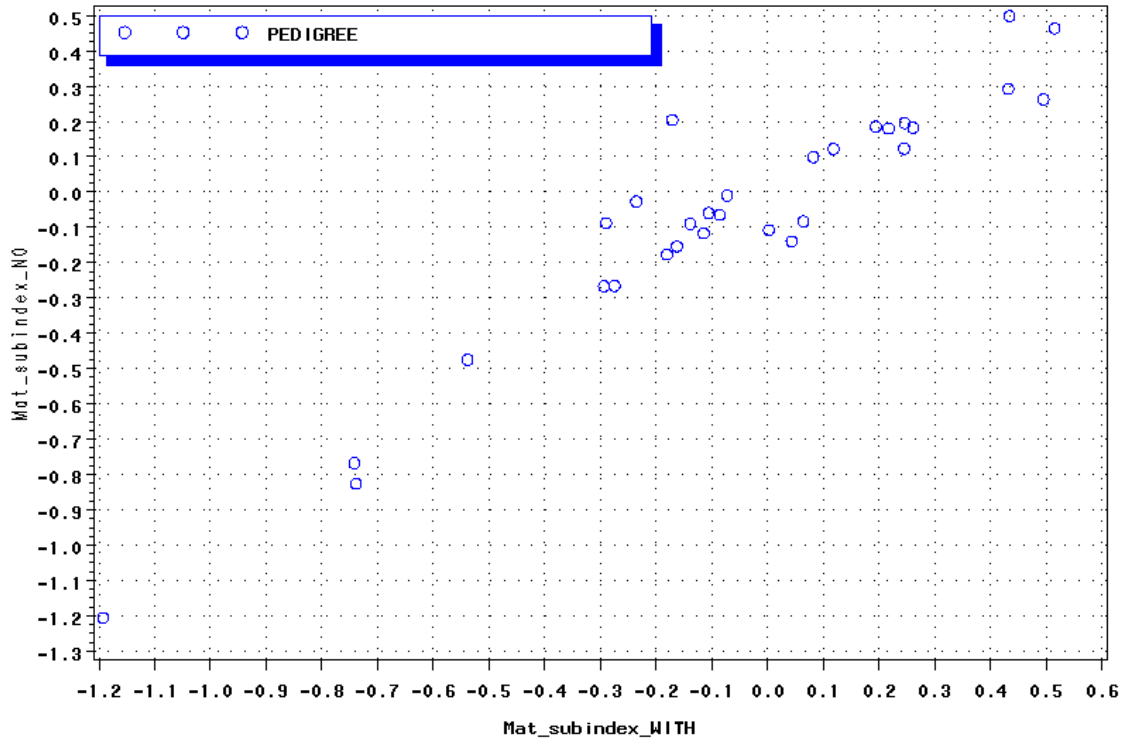
Correlation SCAN — NO SCAN

Trait **PROD_SUBINDEX** : Prodn_subindex_NO * Prodn_subindex_WITH



Correlation SCAN — NO SCAN

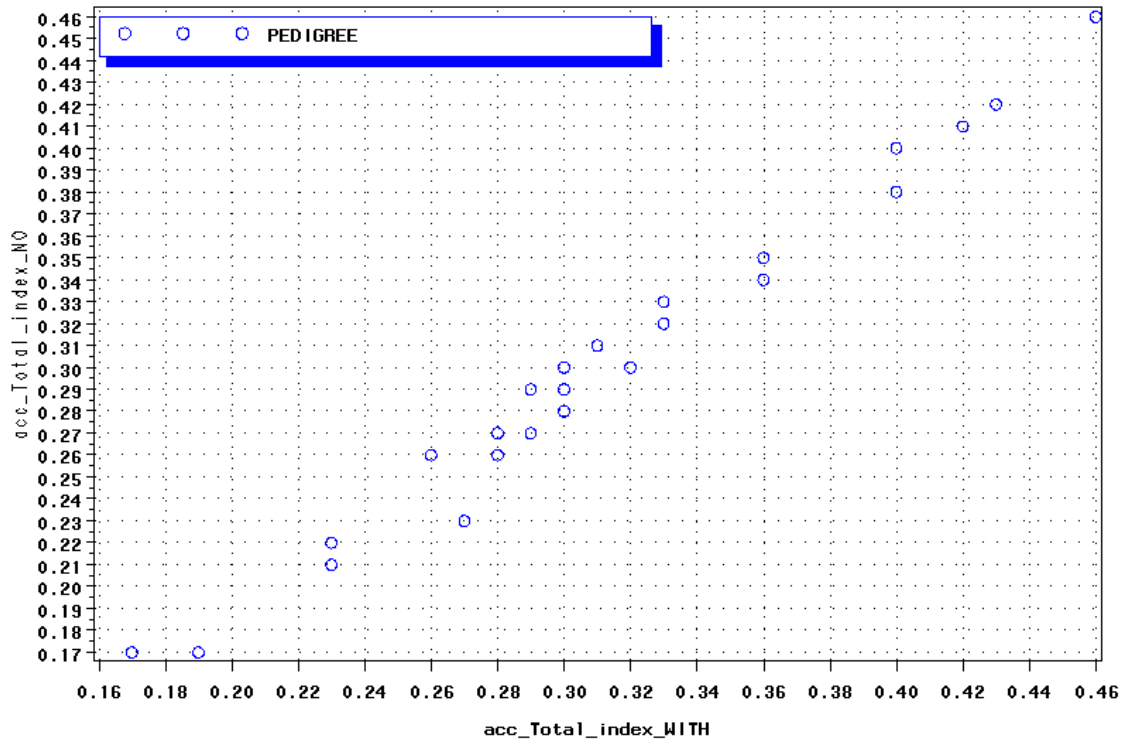
Trait **MAT_SUBINDEX** : Mat_subindex_NO * Mat_subindex_WITH



5.4.2 Correlations between accuracies

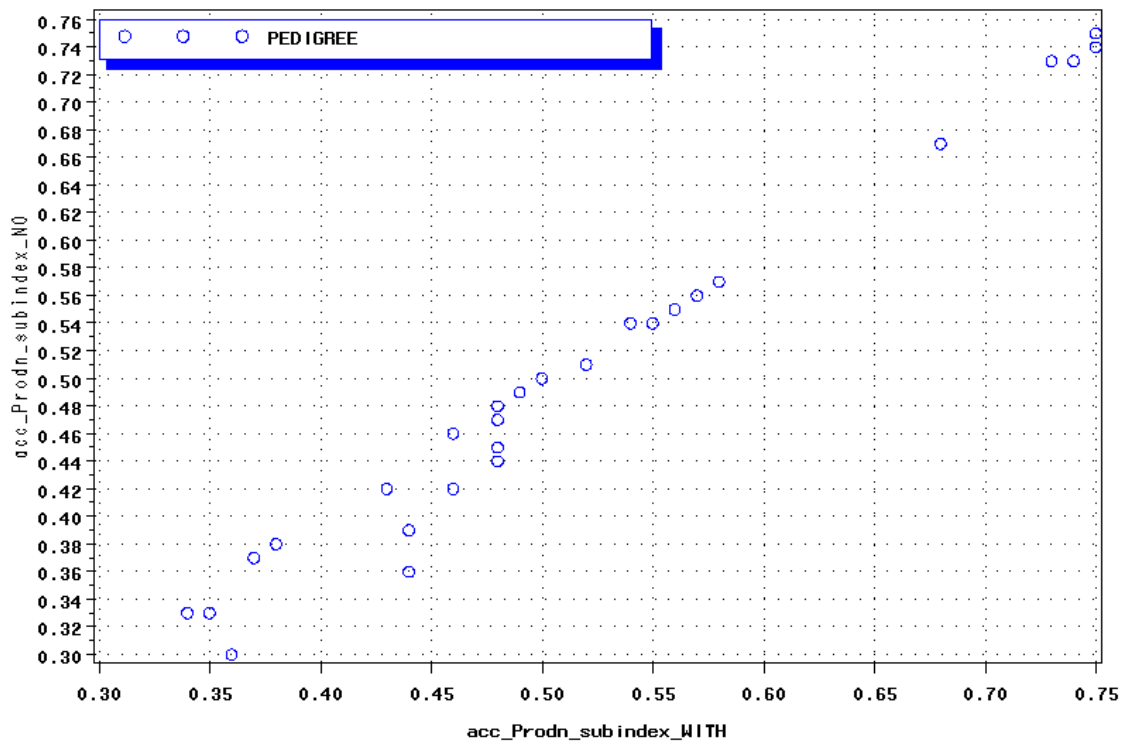
Correlation SCAN – NO SCAN

Trait **ACC_TOTAL_INDEX** : $acc_Total_index_NO * acc_Total_index_WITH$



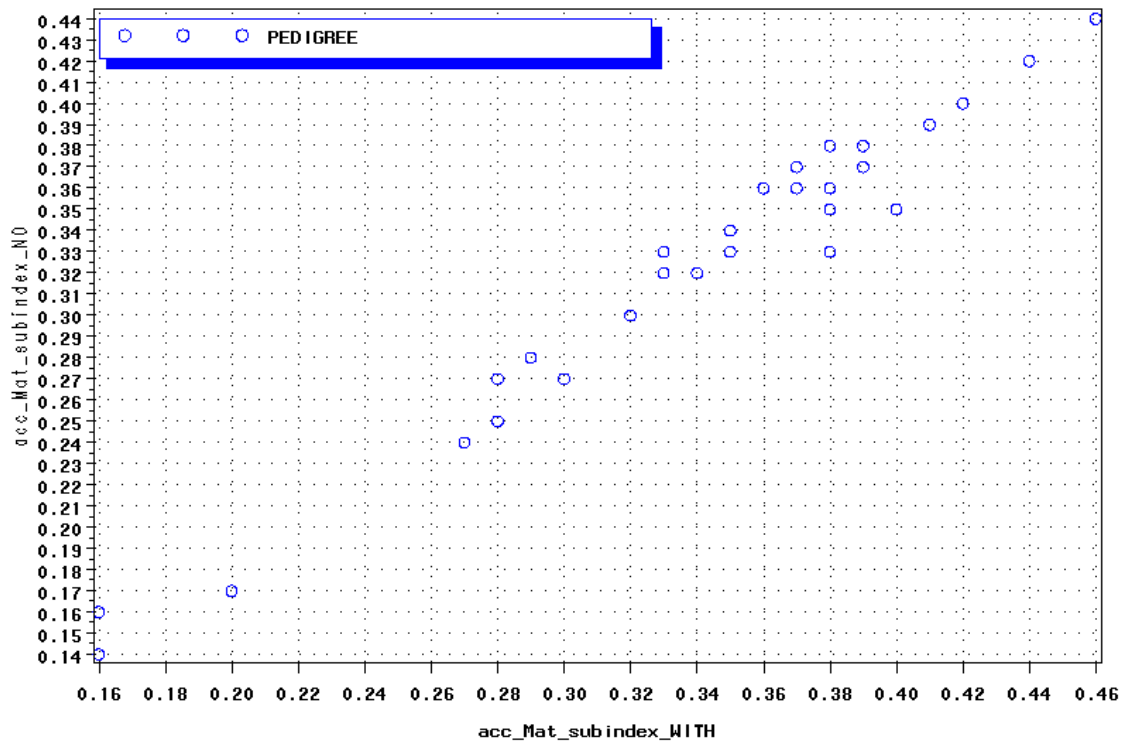
Correlation SCAN – NO SCAN

Trait **ACC_PROD_SUBINDEX** : $acc_Prodn_subindex_NO * acc_Prodn_subindex_WITH$



Correlation SCAN – NO SCAN

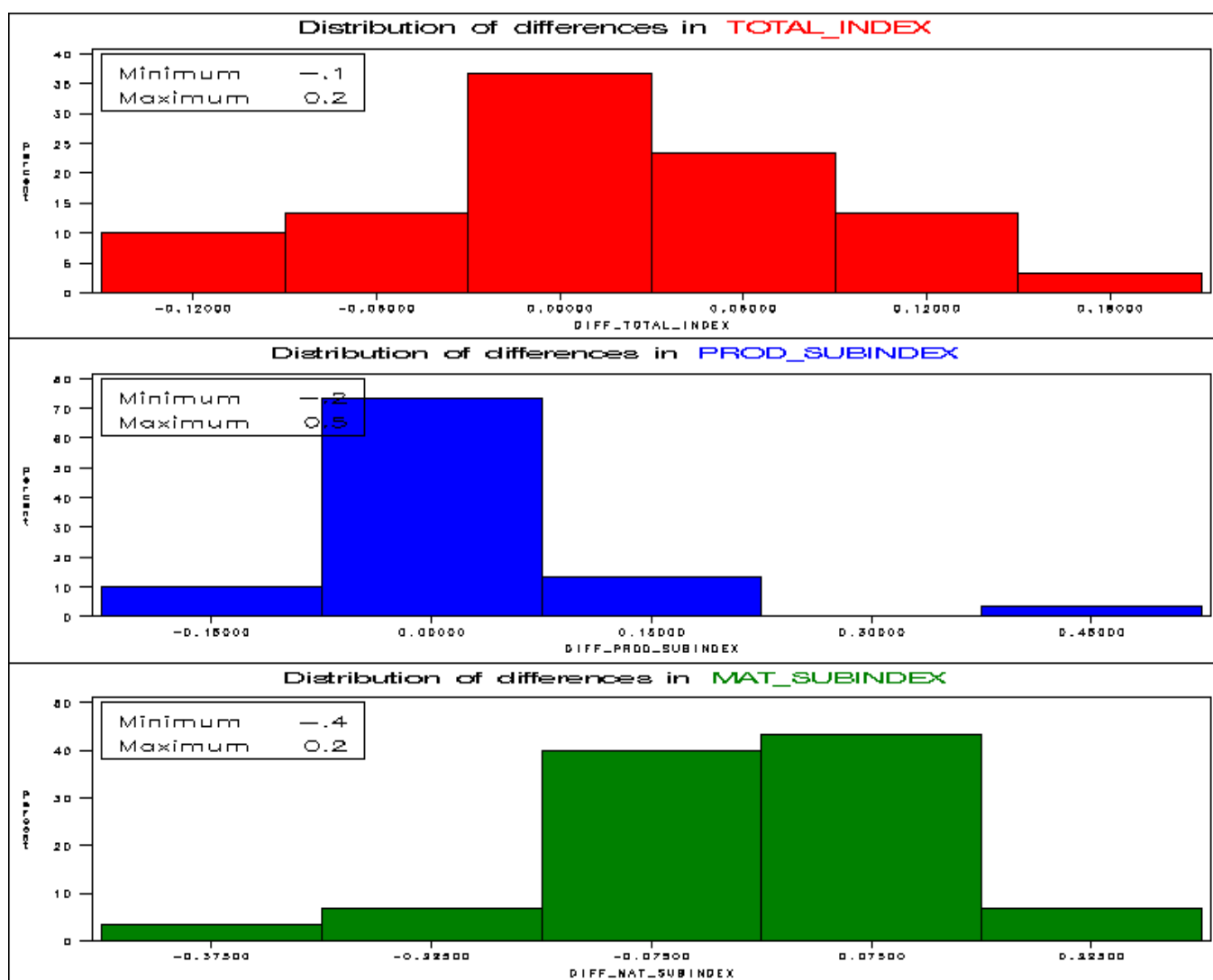
Trait **ACC_MAT_SUBINDEX** : acc_Mat_subindex_NO * acc_Mat_subindex_WITH



5.4.3 Differences in breeding values

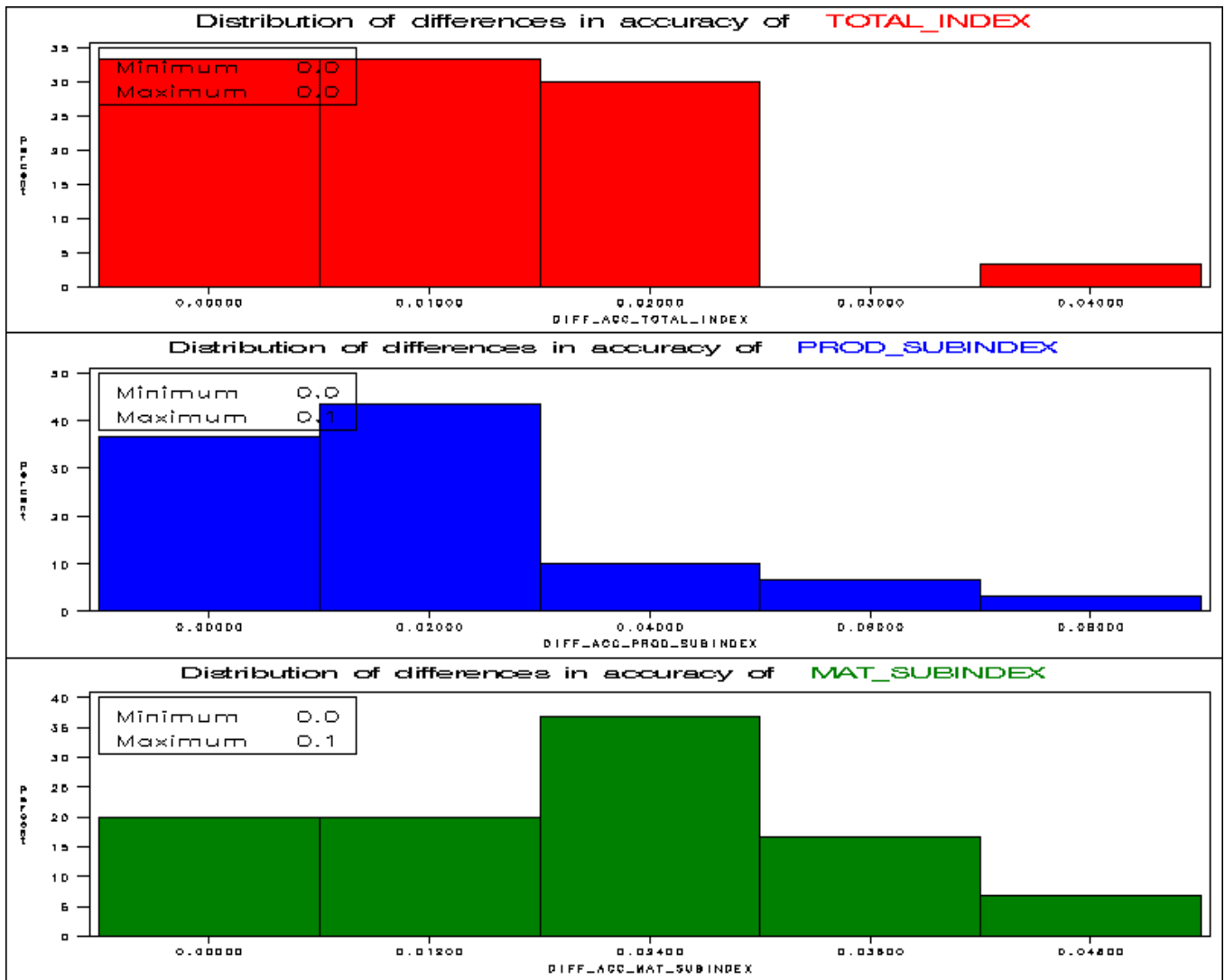
	Difference between breeding values			
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	30	30	30	30
MEAN	0.02	0.02	0.00	0.00
STD	0.07	0.12	0.12	0.00
MIN	-0.12	-0.16	-0.38	0.00
MAX	0.19	0.50	0.23	0.00

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5.4.4 4-4-4) Differences in accuracy

Difference between accuracy				
	TOTAL_INDEX	PROD_SUBINDEX	MAT_SUBINDEX	LAMB_SUBINDEX
N	30	30	30	30
MEAN	0.01	0.01	0.02	0.00
STD	0.01	0.02	0.01	0.00
MIN	0.00	0.00	0.00	0.00
MAX	0.04	0.08	0.05	0.00



6 Genetic Progress

The regression slope in each of the correlation graph is an indicator of the genetic progress achieved by using scanning measures in the genetic evaluation. In a correlation graph between 'with' and 'without' scanning, a slope equals to 1 indicates there is no advantage in term of genetic progress in recording and using scanning events. Any slope deviation from 1 would quantify the effect of dropping scanning recordings in term of genetic progress.

	Regression slope (b)		
	Model : 'no scan' = a + b.'with scan'		
	All	Young rams	Proven rams
Total_index	1.00	0.94	0.99
Prodn_subindex	0.94	0.45	0.86
Mat_subindex	0.97	0.57	0.90
Lamb_subindex	1.00	1.00	1.00

Key to lecture : Prodn_subindex / Proven rams : $b = 0.86$; the production subindex calculated without scanning data can only achieve 86% of the production subindex calculated with scanning data.

In short:

Maximum genetic gain is achieved by using scanning data in the Total index, Production subindex, and Maternal subindex. Should scanning recording be dropped, genetic progress will be slower.

The effect of not recording scanning events has, as expected, a biggest impact on the production subindex, then on the maternal subindex, and on the total index.

By sub-populations, the young rams are the most sensitive to any change in production event recordings, and dropping scanning would reduce genetic progress by half on the production subindex and the maternal subindex.

Genetic progress on proven rams populations would be slow down by 14% on the production subindex, and by 10% on the maternal subindex.

7 Conclusion

In this test, all 2010 scanning were dropped for the Vendeen breed to outline the consequences.

On overall, the main consequences are

- changes in the production subindex from -0.64 to + 0.64€ for the Production subindex
- drop in reliability up to 17% in the Production subindex

The key animals driving genetic progress and so profitability are the young rams and proven rams. In both sub-populations, dropping scanning event recordings would slow down the genetic progress driven by these 2 sub-populations. The young rams sub-population is the most sensitive to any changes in production recordings.

Scanning records is an important source of information for the genetic evaluation of sheep performances. To this date, live weight and ultrasound measurements taken at scanning are the latest measurements taken in a lamb's life ; thus giving the best predictors for slaughter traits.