

Elite Performance Test

HORSE DETAILS

NAME: Unnamed
 SIRE: Quality Road
 DAM: Vargas Girl
 BROODMARE SIRE: Deputy Minister
 SEX: Filly
 DOB: 03/12/2014
 DATE OF MEASUREMENT: 09/18/2015



CLASS SCORE

77.5



DISTANCE

33.5
1200-1600



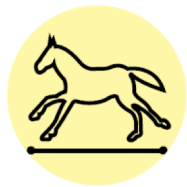
CARDIOVASCULAR
TYPE

Backmarker/Classic



PRECOCITY
INDEX

1.22
Spring 3YO



PROJECTED
STRIDE LENGTH

7.35m



ESTIMATED
WEIGHT

470 kg
+1.10



RLN RISK

Not Measured



GENETIC
INBREEDING
SCORE

+0.25

Understanding your Report

Class Score

This is a predictive score of the racing class of the horse. The Class score considers all parameters measured – genetic markers, cardiovascular and biomechanical parameters and weighs each variable to generate an overall score. The score is a number from 1 to 100 with predicted elite horses scoring 70 or above and predicted non-elite horses scoring 30 or below

Distance Score

This is a determination of a range of performance in terms of optimal distance. This is determined by genetic variations associated with muscle fiber type. The score is converted into a distance range that the horse should optimally perform over.

Cardiovascular Type

This is a description of the cardiovascular measurements of the horse as it relates to the type of cardiovascular system that it is. Variations in wall thickness and internal diameter can influence the best racing pattern of the horse. Horses with thicker external walls and larger internal diameters tend to be horses that are able to be raced on the pace in their races while those with thinner than normal walls tend to be those that are best ridden off the speed and are somewhat pace sensitive. Horses that have a 'bullseye' cardiovascular system will be able to race effectively with any riding style and are usually high class racehorses.

Precocity Index

The precocity index is based on the genetic markers and cardiovascular parameters of the horse. In examining over 3500 racehorses with known racing outcomes and comparing their date of birth to the date of their first start and the date of their win with the highest prize money we have developed a precocity index that is based on genetic and cardiovascular parameters to predict this outcome. This number varies from -3.00 (extremely precocious) to +3.00 (late maturing) with a horse of average precocity having a score of 0.00.

Projected Stride Length

The projected stride length is based on biomechanical properties taken at rest. Using a high speed (500fps) camera we captured maximal stride length of 2yo's in training and then after measuring the same horses at rest were able to create a prediction model that predicts maximal stride length. Variation of predicted stride length falls between 6.5m to 8m with an average maximal stride length of 7.2m.

Estimated Weight

Based on a scientific model of weight prediction we are able to determine the approximate weight of the horse. This weight is then compared to all other

horses in our database of the same sex and within 30 days of the date of birth of the subject horse. A Standard Score is then assigned to the horse whereby if the subject horse has the average weight of similar horses their score is 0.00. Horses with a weight that is one standard deviation above the average will have a score of +1.00 and those with a weight one standard deviation below the average will have a score of -1.00. A distribution of Standard Scores is as follows

Standard Score	Elite	Non Elite
+1.00 or greater	47%	19%
0.00 to +0.99	31%	22%
0.00 to -0.99	14%	31%
-1.00 or less	8%	28%

RLN Risk

Recurrent laryngeal neuropathy (RLN) is a common disease of horses that has been recognized for centuries. The disorder usually affects the left side of the larynx (voice box) and occurs most commonly in larger horses. We have identified two genetic SNPs that are associated with risk of RLN and the model predicts risk as low, medium and high. Please note, this is not a diagnosis of RLN and horses with low risk can still have RLN occur.

Genetic Inbreeding Score

On pedigree, a horse can appear to be highly inbred, but because of the vagaries of inheritance and genetic recombination, own a genotype that has far less inbreeding than the pedigree suggests. The Genetic Inbreeding Score is a measure of the relative proportion of the genetic markers that we test for where the same variant was inherited from both parents (i.e they are homozygous for that allele). The score is from -3.00 (low inbreeding) to +3.00 (highly inbred) with the average being 0.00. The Genetic Inbreeding Score has a small effect on racing class but can also be used in breeding outcomes to allow for management of inbreeding and mating plans.

How it Works

The Matchem Performance Test is a prediction model that is based on a combination of genetic variations, cardiovascular and biomechanical measurements that are weighted appropriately to predict the racing outcome of a horse. As this model uses DNA markers, cardiovascular parameters and biomechanical measurements, all themselves independent predictors of performance, the combined model is significantly more predictive of performance than each of these as standalone tests.

DNA alone is not destiny, and the measurement of cardiovascular and biomechanical parameters allows us to measure how the genetic variants that we do associate with performance may have reacted to the environment that they were raised under. Capturing the cardiovascular and biomechanical data has a significant effect on error metrics of the model

Method	Root-Mean-Square-Error (normalized)
DNA alone	25%
DNA + Cardio	17%
Cardio + Biomechanics	20%
DNA/Cardio/Biomechanics	9%

From the above table you can see that the NRMSE for DNA markers alone is 25%. This means that the difference between the prediction and actual can be as much as 25 points so a horse in our model that we give a class score of 70 (predicted to be Listed/G3 level) could be as low as 45 (actual midweek metropolitan level) or as high as 95 (actual G1 winner). Use of cardiovascular and biomechanical parameters along with DNA markers significantly reduces the error giving a more accurate prediction of outcome.

Our model, which is based on known racing outcomes of some 3500 horses measured at yearling and two year old in training sales, uses a Random Forest machine learning method that operates by constructing a multitude of decision trees, thus allowing for the fact that there is more than one way to be an elite racehorse, to generate a class score.

The Random Forest is continually learning so as new data is added into the database and known racing outcomes are confirmed the model increases its accuracy.

What does my Class Score Mean?

To better understand the scores and the relative risk for these scores, below is a matrix to explain the observed vs. predicted ratios as of the date of the report.

	Actual Elite	Actual Non-Elite
Predicted Elite	73.20%	34.78%
Predicted Non Elite	26.80%	65.21%
	<i>True Positive Rate</i>	<i>False Positive Rate</i>
	<i>False Negative Rate</i>	<i>True Negative Rate</i>

Below is a chart that gives a rough equivalent of what the score attained by the horse should result in.

Please keep in mind two important factors – depending on the test there is an error rate (see left column data) and trainer effect (ie. the quality of the trainer). These will have a large impact on the variance between predicted and observed outcomes.

Predicted Score	Australia	England	North America
90-100	Multiple G1 Winner		
85-90	G1 Winner; Multiple GSW		
80-85	Age only Group 2 SW; WFA G3+		
75-80	Multiple Listed/G3 SW		
70-75	Listed/G3 Stakes Winner		
60-70	Sat Metro	Class 2	Allowance
50-60	Midweek Metro	Class 3	Allowance
40-50	Provincial	Class 4	Claiming
30-40	Country	Class 5	Claiming
20-30	Country	Class 6	Maiden Claim
10-20	Placed		
0-10	Unplaced		

Disclaimer: The Performance Genetics Elite Test is for the sole determination of athletic potential in the racehorse. This is in no way to be construed as a test of general health or fitness and is not a veterinary procedure to determine any health state in the racehorse.