Extreme Selection - A Key Tool for Genetic Improvement

Seminar for the 2014 Bash at the Barn, San Luis Racing Pigeon Club

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Our Biases

- Mine -
  - Degree is in genetics.
  - Animal breeding and consulting for over 50 years in dozens of species including swine, cattle, sheep, horses, rabbits and racing pigeons.
  - Strong opinions based on these two frames of reference.
  - Here just to share and not to win converts - you can and should do it any way you want.
  - Pigeon Racing is a hobby – keep it relevant to what *you* enjoy.

Our Biases

- Yours -
  - You each have your own frames of reference based on your particular life experiences.
  - Everyone in this room has developed their own unique set of filters through which passes everything their brain receives.
  - Two of the keys to effective learning are to look at things from a new perspective and without our usual filters.

Our Biases

- Ours -
  - “If we keep doing what we have always done, we will keep getting the same results that we have always gotten.” (paraphrasing Albert Einstein)
  - Most of us are still making the same mistakes today that we were making when we were 20.

Some Background Information

- My web site (www.shewmaker.com) has some additional information that you may find helpful in sorting out some of the ideas we are going to talk about today.

The Rule of Seven

- There are seven factors which determine how well you and your birds will perform in pigeon racing.
- One is beyond your control.
- Five are so well perfected within the sport that they have become essentially pass/fail. You either cover them competently or you are virtually eliminated from the winning positions even before the race starts.
- One has almost no limit to its potential and is largely unrealized by most fanciers.

The Rule of Seven

1) Beyond our control – **luck**. Good luck, bad luck, hawks, wires, wind direction, basket position on the truck, bad weather along the course, good weather along the course when we entered a tough weather bird, and on and on and on. It affects us all and so we should just get over it and move on to what we can control.

2) **Condition** (pass/fail)

3) **Training** (pass/fail)

4) **Fuel** (pass/fail)

5) **Motivation** (pass/fail)

The Rule of Seven

6) **Health** (pass/fail though too many flyers are still failing on this one. We could have a week of seminars just on this topic alone.)

7) **Genetics**

When Louis Van Loon was asked “What methods do you use to get those kind of results?” he looked sternly at the gentleman and said, “Remember this, there is only one thing that is important – good pigeons, nothing else.”

Simple Genetics

- Pigeons have 40 pairs of unique chromosomes for a total of 80 chromosomes.
- On the chromosomes, reside genes. You can think of them as being like beads on a string. The individual bead are the genes and a particular string of these genes is a chromosome.
- The genes are the precise blueprint for every trait of an individual.
- These traits range from what we can easily observe (like the color of the eye) to less discrete and intangible things like mental attitude.

Simple Genetics

- During fertilization, each parent contributes one chromosome of each the 40 pairs.
  - One of these pairs (the Sex Chromosomes W and Z) is unique in that the W chromosome contains no genes. Cocks are ZZ and hens are WZ. So for a small number of genes (1/40th or 2.5%) hens did not receive a contribution from their mother. These are referred to as “sex linked traits”.
  - I do not subscribe to the theory that the hen contributes more significantly than the cock due to mitochondrial DNA (e.g. there is evidence of paternal contribution and the majority of mitochondrial processes are coded for by nuclear DNA). In the absence of data to support this claim, you should avoid placing any disproportionate value on the dam.
  - Due to cross over during meiosis, grandparents DO NOT equally contribute 25%).

Simple Genetics

- Each trait is coded for by one or more pairs of genes.
- A given gene resides on a specific location of a specific chromosome. This location is known as a locus (the plural form is loci.)
- While an individual will have exactly two genes for each locus (one coming from each parent), there are multiple versions of that gene within the gene pool (the breeding population). Each different version is known as an allele.

Simple Genetics

- For example, the trait “feather color pattern” has at least four alleles (Dark Check, Check, Bar and Barless) for which a given bird will have at most two.
- All four of these phenotypes are coded for by a single pair of genes on one of the chromosome pairs. If the parents both contributed the “Bar” gene (+) the resulting pigeon will have a Bar color pattern. However, if both parents contributed the “Check” gene, the resulting pigeon will have a Check color pattern.
- When genes for a given pair are of the same type (allele) the pair is said to be homozygous. If the pair consists of two different alleles the pair is said to be heterozygous.

Simple Genetics

- When heterozygous, there are two possible ways the trait might be expressed (though it will always be expressed the same way for a particular gene pair).
  - Complete dominance is when one allele determines the phenotype (dominant) and the other allele is completely masked (recessive) as if it didn't even exist. What we see is the phenotype and what is actually there in the genes of the cells is known as the genotype.
  - Incomplete dominance is when the gene expression is intermediate in the heterozygous state (the gene locus for Grizzle is one example).

Simple Genetics

- Lets look at our example of feather color pattern. There are four possible alleles.

Allele Symbol		Expression
C^T	(known as the T-pattern check)	Dark Check
C	(Uppercase)	Check
+		Bar
c	(lowercase)	Barless

- C^T > C > + > c or in other words -
  - Dark Check is dominant over Check, Bar and Barless
  - Check is dominant over Bar and Barless
  - Bar is dominant over Barless

Simple Genetics

These are all the possible ways the alleles can be paired up.

Genotype	Phenotype
$C^T\ C^T$	Dark Check
$C^T\ C$	Dark Check
$C^T\ +$	Dark Check
$C^T\ \underline{c}$	Dark Check
$C\ C$	Check
$C\ +$	Check
$C\ \underline{c}$	Check
$+\ +$	Bar
$+\ \underline{c}$	Bar
$\underline{c}\ \underline{c}$	Barless

Simple Genetics

- This is why you can't get a Check or a Dark Check when you mate two Bars together. If you see such a situation in a pedigree you might suspect there is a mistake somewhere (be careful though because people will sometimes call a light Check a Bar).

Dam \ Sire	+	+
+	+ +	+ +
+	+ +	+ +

Example of a Bar cock with the ++ genotype mated to a Bar hen also with the ++ genotype. The mating will produce 100% Bars.

Simple Genetics

- But you can get Bars from the mating of two Checks.

Dam \ Sire	C	+
C	C C	C +
+	+ C	+ +

Example of a Check cock with the C+ genotype mated to a Check hen also with the C+ genotype. The mating should produce 75% Checks and 25% Bars.

Simple Genetics

- Though some Checks when mated will not ever produce a single Barred offspring.

Dam \ Sire	C	C
C	C C	C C
C	C C	C C

Example of a Check cock with the CC genotype mated to a Check hen also with the CC genotype. The mating will produce 100% Checks.

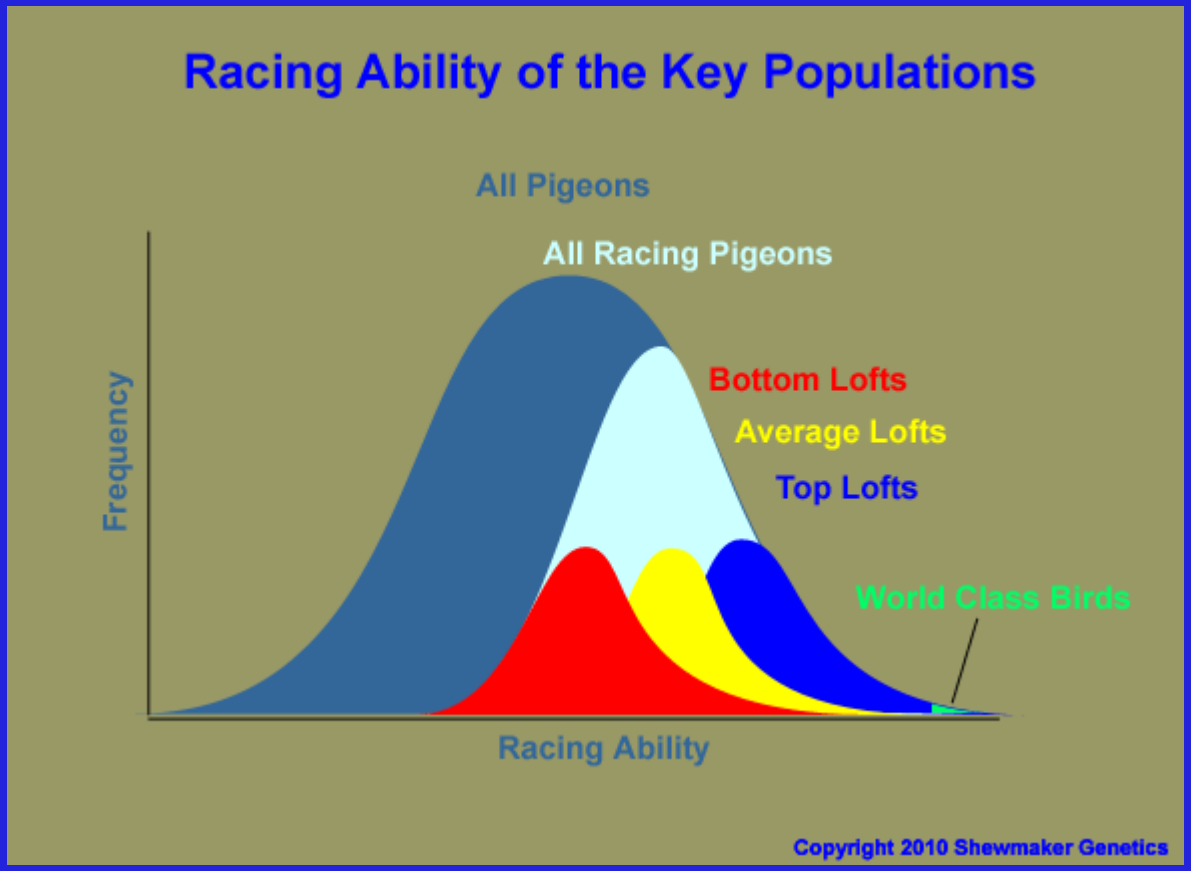
But Its Not That Simple!

- While Genetics is much more complicated than what we have explained for a simple pair of genes,
- there is an important trick that can make it very easily understood.
- Here is the key – don't think in terms of individual genes, individual chromosomes or even individual birds. Everything should be approached from the point of view of the *population* of racing pigeons – specifically those in your loft and those in the rest of the sport.

The Bell Curve

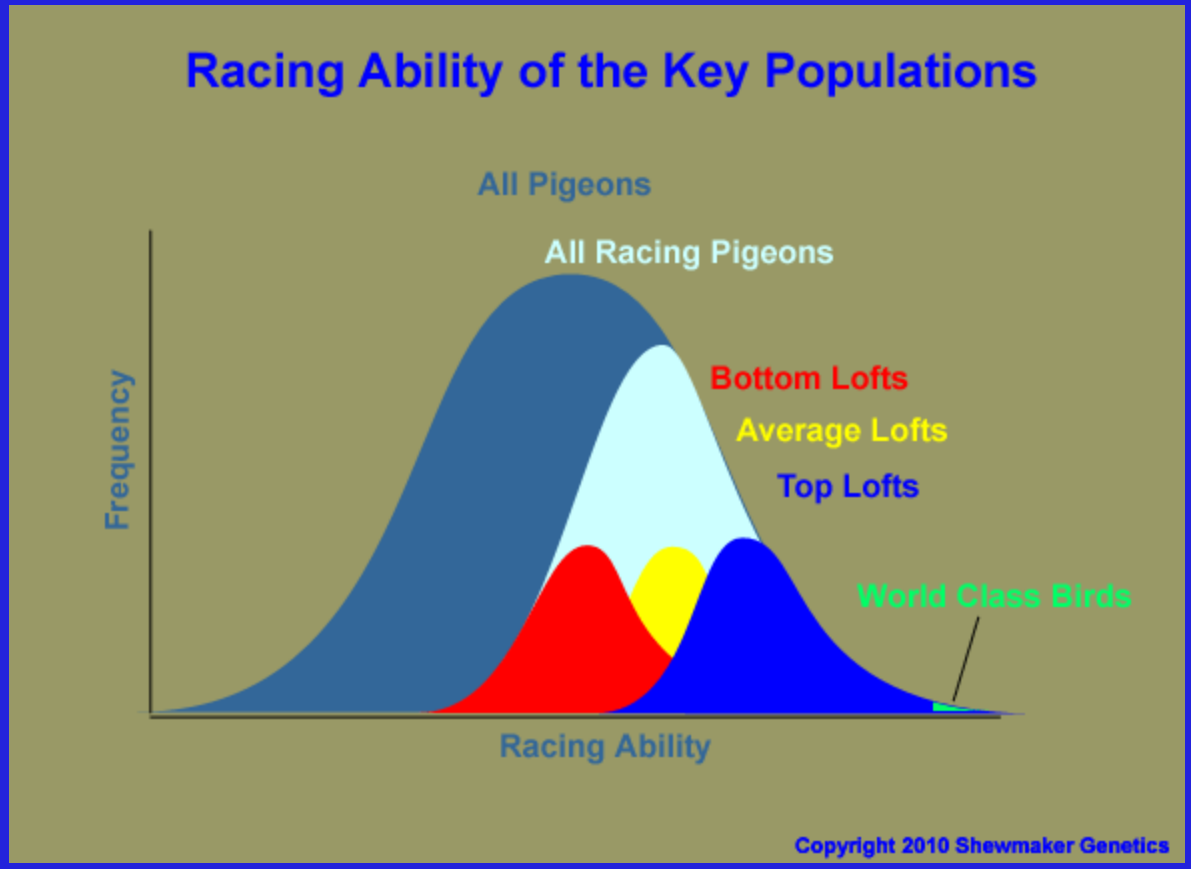
- For many traits, the genetic expression is actually determined not by the action of a single pair of genes but multiple pairs – two, three, dozens and perhaps even hundreds for those non-discrete traits like “height” or “body weight” or in our case “racing ability”.
- If you do the math and graph outcomes of various matings using many genes, instead of a box where 75% are Checks and 25% are Blues (as on Slide 18), we get a distribution that is known as a bell curve.
- The next five slides are really the whole seminar

The Bell Curve



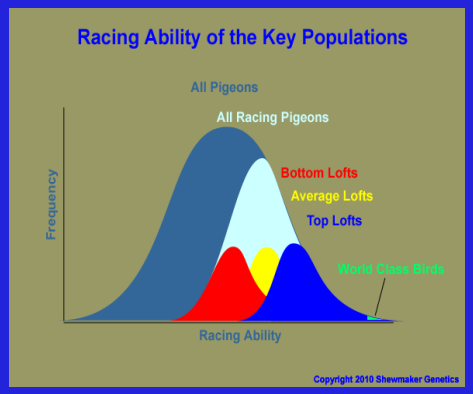
- Notice that the “Bottom Lofts” and most of the “Average Lofts” may not even have the necessary genes in their pool to breed world class birds.

The Bell Curve



- But also notice that in the “Top Lofts”, few of the birds are “World Class” and many are on a par with the “Low” and “Average” lofts.

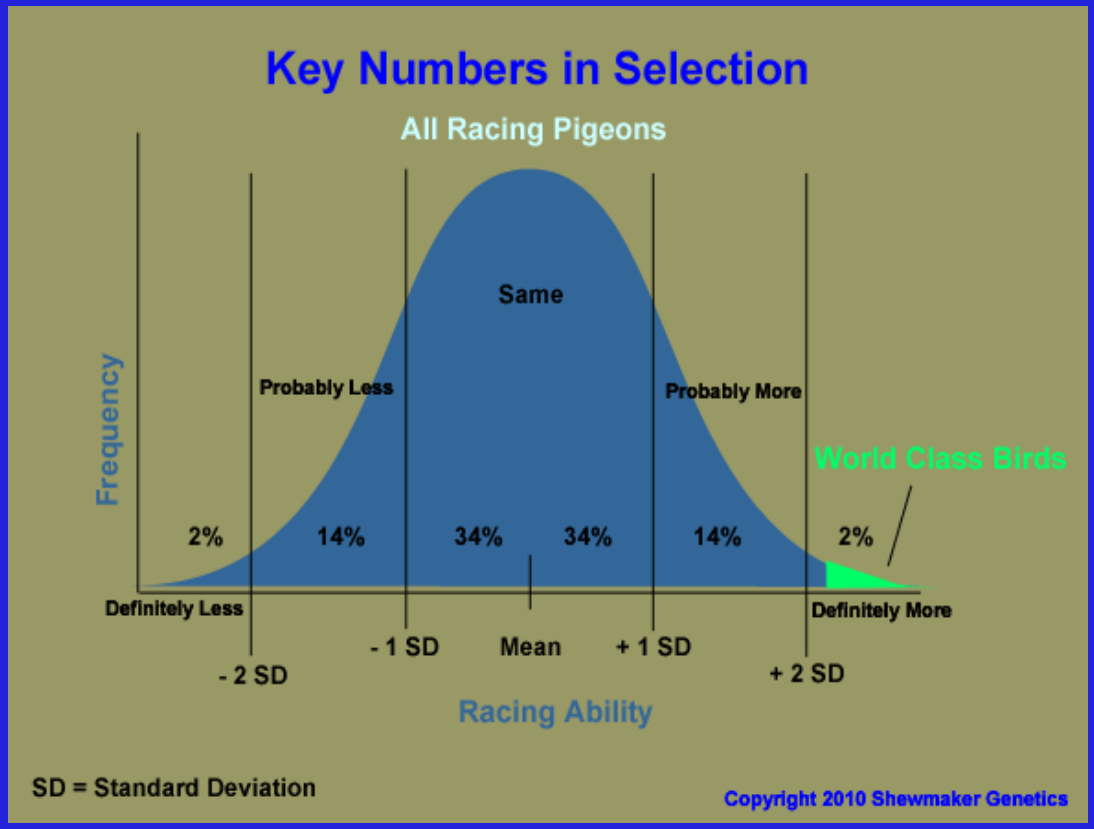
The Bell Curve – The Rule of Ten



- Here is the hard cold fact – most of our pigeons are not genetically up to our assumptions and expectations.
- ***IF*** you have a "Top Loft" complete with a few "World Class" pigeons, you ***MIGHT*** produce **1 in 10** birds which should be kept to breed the next generation.
- If you are in the "Average Loft" category it is probably closer to 1 in 100 and in the "Bottom Lofts" it is closer to 1 in 1000 or maybe even 1 in 10,000.

The Bell Curve

- And apart from this “Rule of Ten”, if you aren't selecting at least the top 16% *you probably aren't selecting at all*.



- If you really want to make progress you need to be selecting at least the top 2%.

Progress is a function of Selective Pressure & Time

- Your ability to make genetic progress and the speed at which you make this progress is **absolutely** related to these three factors (memorize this slide!):
  - The **accuracy** of your selection
    - *So if you think toe color is related to superior racing and this is what you select for, you are probably not really doing any selection at all with respect to racing ability. In my view the most accurate selection criteria (by a wide wide margin) are race results to the same loft. Nothing else comes close.*
  - The **intensity** of your selection
    - *Selecting from the top 16% is far less intense than selection from the top 2% which in turn is far less intense than selecting from the top 1%*
  - The **time** interval over which you do the selection
    - *One season is not enough, but two or three will surprise you. Changing to a new fad (or a new family) every few years will doom any real progress.*

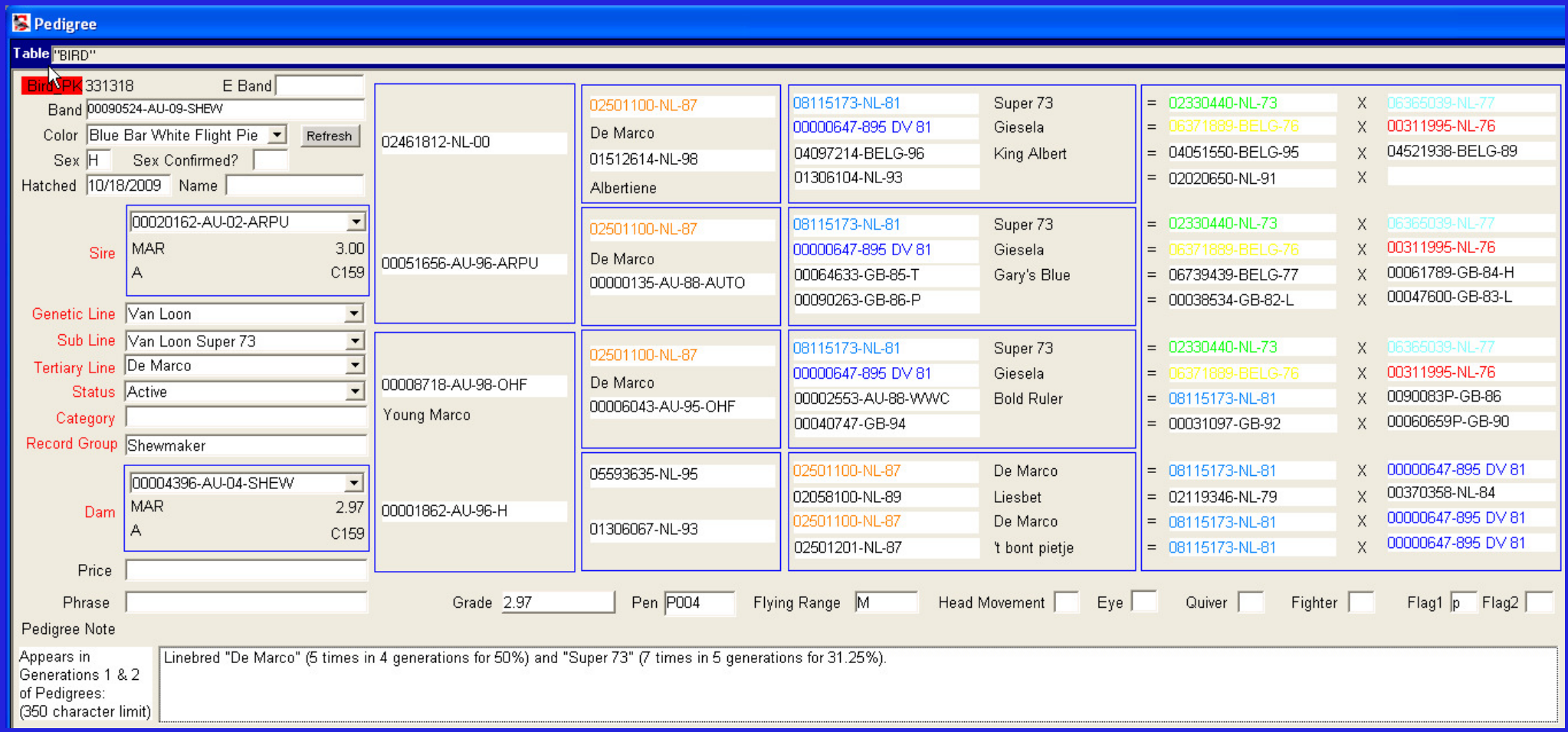
Tools and Strategies for Extreme Selection

1. Assemble an appropriate gene pool. Don't assume though that you have to go buy new birds. While we all probably need to cull out most of what we have, the American Racing Pigeon Gene Pool is very deep and until you conduct a fair test you really can't say you don't already have the right genes.
2. Roll, roll, roll the dice!!!
    - If the genes are in the pool, your job is to assemble them all in one bird.
        - Breed, test and cull until you get it. Then do it again to get another one.
        - Change the matings and do it again.
        - Use linebreeding to try to concentrate the genes of elite birds.

Tools and Strategies for Extreme Selection

2. Roll, roll, roll the dice!!! (continued)

- Here is a good example of linebreeding (DeMarco and Super 73):



Tools and Strategies for Extreme Selection

2. Roll, roll, roll the dice!!! (continued)

- Another good example of linebreeding (Super 73):

Strategic Loft (DSN: SGC/11/PGN_PRD; DB Info: Dev & Prd PGN)

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Ancestors By Percentage

Table "LINEBREEDING PC"

This bird has	this ancestor who appears			this many times	in this # of generations	with this genetic percentage.
00004647-AU-14-SHEW	00050444-AU-05-ARPU		VAN	1	1	50.0000
00004647-AU-14-SHEW	00070267-AU-07-SHEW			1	1	50.0000
00004647-AU-14-SHEW	08115173-NL-81	Super 73		24	9	31.4453
00004647-AU-14-SHEW	02436201-NL-01	Super Marco	VAN	1	2	25.0000
00004647-AU-14-SHEW	00000016-AU-97-GSF	Sweet 16	VAN	1	2	25.0000
00004647-AU-14-SHEW	00005953-AU-95-OHF	Java - He's Hot!	VAN	1	2	25.0000
00004647-AU-14-SHEW	00003395-AU-03-SHEW		VAN	1	2	25.0000
00004647-AU-14-SHEW	02501100-NL-87	De Marco	VAN	8	8	24.2188
00004647-AU-14-SHEW	02330440-NL-73	De Olieman	JV	20	9	16.7969
00004647-AU-14-SHEW	06365039-NL-77	Crackske		18	9	15.2344
00004647-AU-14-SHEW	00002778-AU-88-WWC	Super 2778	VAN	3	8	13.6719
00004647-AU-14-SHEW	00000647-895 DV 81	Giesela	VAN	9	9	12.8906
00004647-AU-14-SHEW	02591102-NL-98	Evita	VAN	1	3	12.5000
00004647-AU-14-SHEW	00001084-AU-96-GSF		VAN	1	3	12.5000
00004647-AU-14-SHEW	00004484-AU-96-FRC		VAN	1	3	12.5000
00004647-AU-14-SHEW	00000132-AU-88-AUTO		VAN	1	3	12.5000
00004647-AU-14-SHEW	00008303-AU-98-SHEW	Gold Mine	VAN	1	3	12.5000
00004647-AU-14-SHEW	00020163-AU-02-ARPU	Top Marco	VAN	1	3	12.5000

Tools and Strategies for Extreme Selection

3. For selection purposes, use only contemporary group test results (Contemporary Groups are groups of birds where the environmental factors for every member of the group are as equal as possible).
    - Loft results for YB and OB races (Combine wins are great for bragging rights and marketing, but useless for genetic selection)
    - Training tosses
    - One Loft Races
    - Your own Contemporary Group Tests

Tools and Strategies for Extreme Selection

4.Perform tough but fair tests. The ideal test is one where only one bird comes in first and is followed over a reasonable period of time with small drops, culminating in all (or at least most) of the birds coming home on the day.

- The worst possible test is a smash where no one comes home.
- The second worst test is where the vast majority of the birds come home in the first drop. (It would be an excellent result for YB or OB race or even a training toss but not for a test. A drop of 16 birds for example that score 1-16 in the club or combine speak highly of the handler, but it is really difficult to known whether you had 1 leader and 15 followers or even if you had a flock of 16 and no one bird capable of doing the same on their own.)

Tools and Strategies for Extreme Selection

5. Form your conclusions on patterns, not individual results. In general, don't treat anything as significant until you have three or more noteworthy results.
   - Don't get attached to the pretty ones or the expensive ones or even the ones with a single win. If the results aren't repeatable, they probably aren't statistically significant from a genetic perspective.
   - Two noteworthy results and you may have something.
   - Three noteworthy results and you probably do.
   - Multiple noteworthy results among relatives is the gold standard!

Tools and Strategies for Extreme Selection

6. Shoot for 2% and 1% if possible

- Of course, not every bird you stock will be in the top 2%. There are many reasons for exceptions, just don't make these exceptions without well thought out and solid reasons.
- The message here is not to make it seem impossible, but to emphasize that most of the pigeons we produce and keep are not suitable for moving the flock forward, so be (much) more selective.

Tools and Strategies for Extreme Selection

7. When you get one of the 1% birds, know it is special and do everything you can to breed (and test) as many of its youngsters as you can.
    - For 1% cocks:
        - Polygamous breeding
        - Artificial Insemination – 300 youngsters a year possible from a single cock
    - For 1% hens:
        - Foster off the eggs to pumper pairs
        - Breed to multiple cocks
    - Repeat the mating and variations of the mating using relatives

Tools and Strategies for Extreme Selection

8. Artificial Insemination is an incredibly powerful tool for the proliferation of the elite birds.
   - Fresh semen can typically be collected three times a week, year round.
     - One collection can typically inseminate six to ten hens when used fresh and about three when frozen.
     - Once frozen the semen can be stored indefinitely (literally for decades).

Tools and Strategies for Extreme Selection

8. Artificial Insemination Advantages (continued).

- Semen can be collected and frozen from race team cocks during and between race seasons. This is huge.
  - It allows us to preserve the genetics of the elite birds while continuing to race them and gather data. In the past we have often had to chose between stocking and racing which resulted in some birds being either
    - stocked too early before their true racing value was accurately established, or
    - sent to one too many races wherein a valuable bird was lost.

Closing Thoughts

- Remember genes determine the potential. Environment limits how much of that potential is realized. As people get better and better at perfecting the environmental factors (condition, training, fuel, motivation, health and luck) genetics is the one remaining but unlimited area in which improvement can still be made.
- Figure out what *you* are trying to accomplish.
- Remember it is a hobby and it is *your* hobby. Do it your way.
- Keep it fun.