

# Do historically popular sires still capture the genetic composition of the recent US Holstein generations?

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Hulleman

1880s

Neptune H

1960s



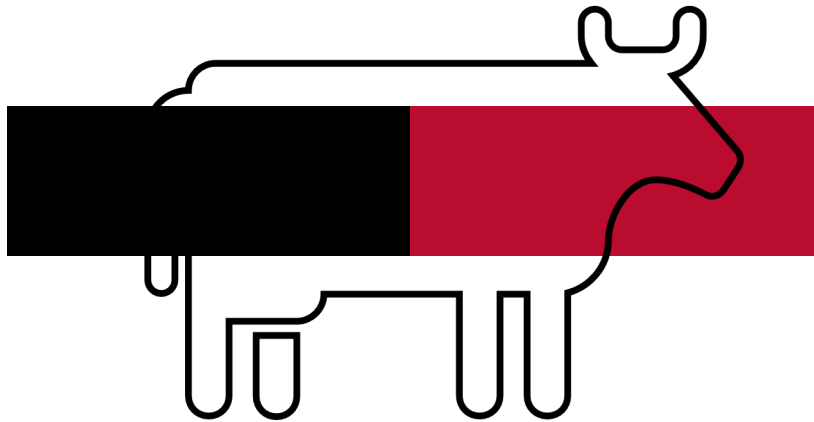
Round Oak Rag Apple **Elevation**  
51.06 %

Pawnee Farm Arlinda **Chief**  
48.78%

Pennstate **Ivanhoe Star**  
0.16%

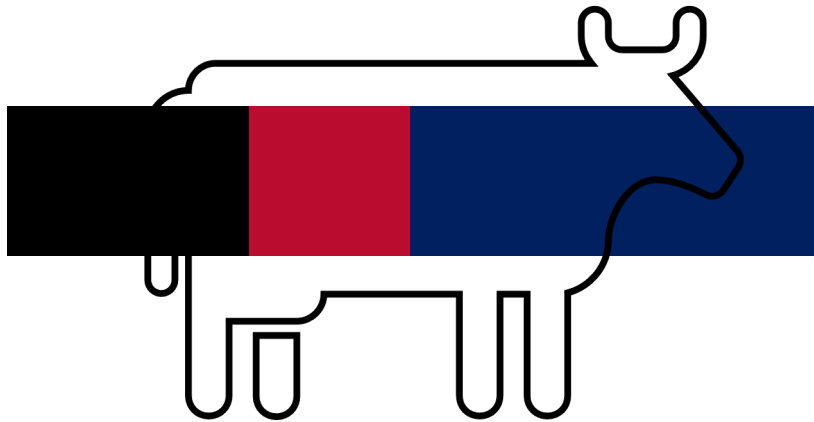
# Parental contribution

**F0**



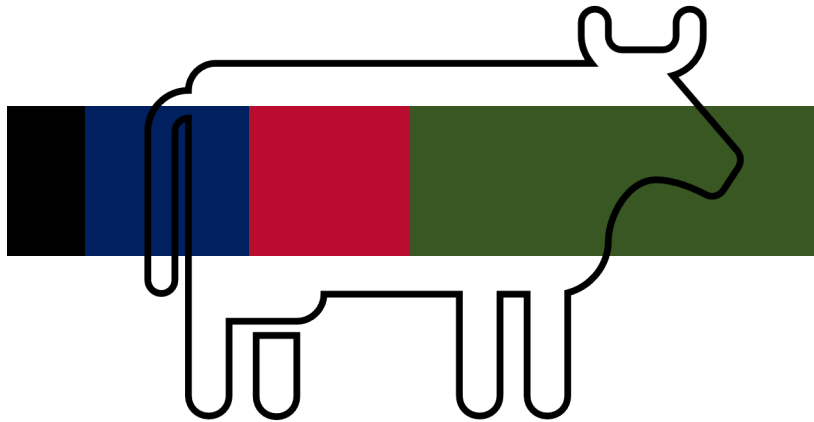
# Parental contribution

**F1**



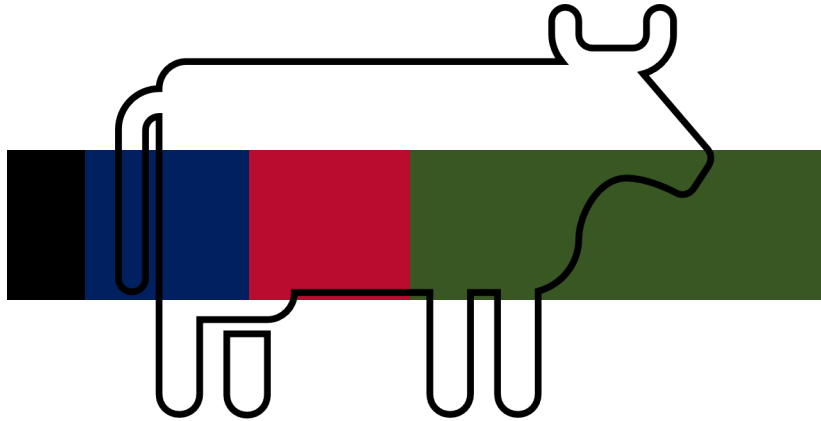
# Parental contribution

F2



# Parental contribution

**F3**



**F0**



# Toystory

Born 2001

2.4 million doses

> 500,000 daughters

> 50 countries



*Over 1 Million Units Produced and Sold!*

## **Achieving Nearly Unimaginable Heights**

"This amazing bull has surpassed our very lofty expectations," explains Doug Wilson, Chief Executive Officer, CRI. "He has and is making his mark on the dairy industry throughout the United States and around the world. His impact will not be soon forgotten."

Adding to TOYSTORY's remarkable impact on the Holstein breed is his extraordinary semen production capability. In April 2009, just shy of his eighth birthday, TOYSTORY produced his one millionth unit of frozen semen. This semen production record was attained just as his second-crop daughters began to enter the milking strings of dairy herds across the world.

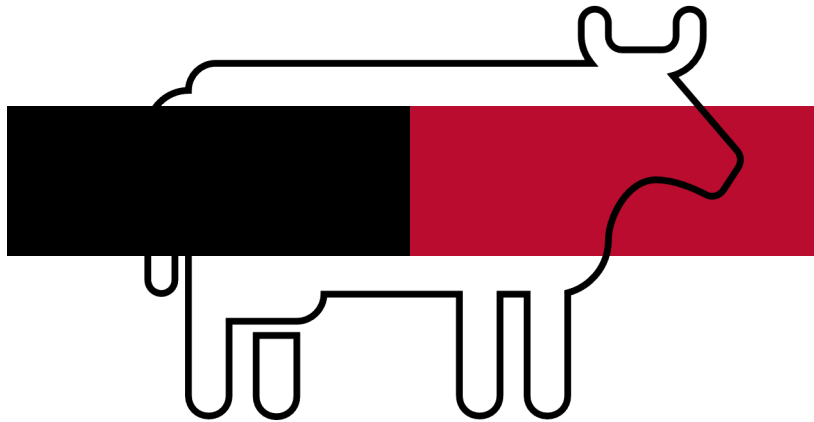
Three months later, he achieved another major accomplishment as CRI members and customers have purchased one million doses of TOYSTORY semen. Over one million doses produced and sold! This is nearly unimaginable as the last CRI sire to reach such an extraordinary level did so at the age of 13. This illustrious sire is only eight years young.



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# Parental contribution

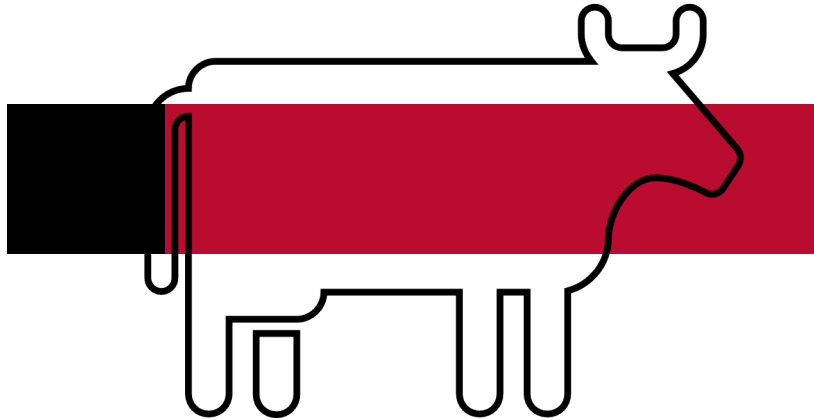
**F0**





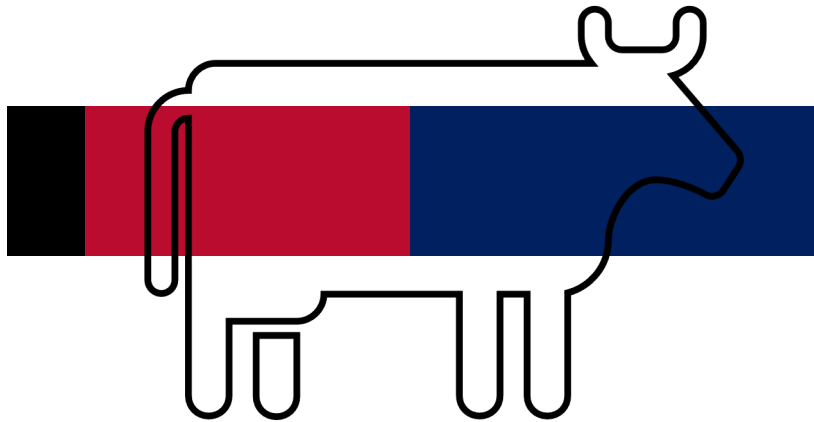
# Parental contribution

**F1**



# Parental contribution

F2

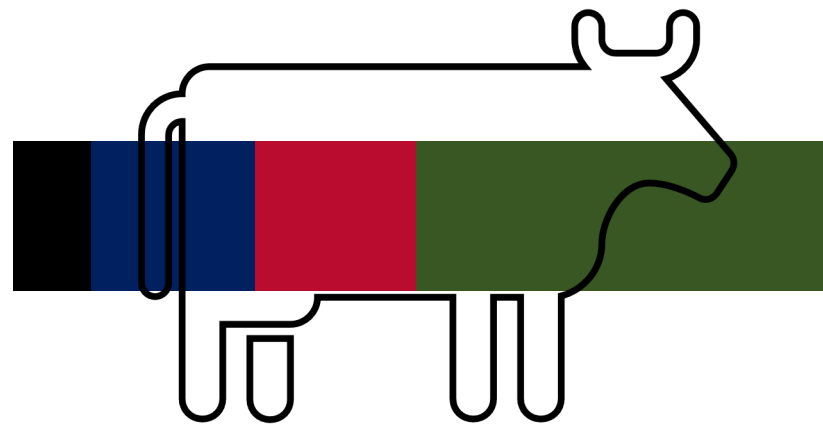
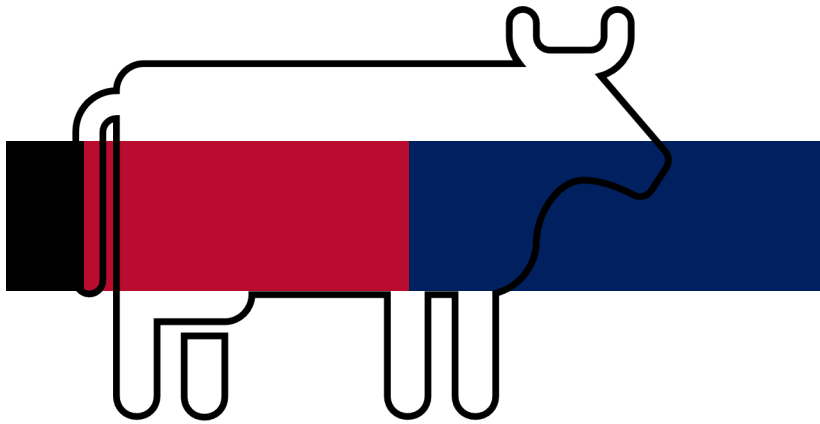


# Parental contribution

**F0**



**F3**



# Data

Traits: Stature (heritability 0.45), FUA (heritability 0.23)

Up to 2014

Type	Number of records
Pedigree	9,817,252
Data	10,067,745 (6,550,442 animals)
Genotypes	569,404
Genotyped males	121,634
Genotyped sires	21,824

# Materials and Methods

- Single-step GBLUP
- BLUPf90 software packages (Misztal et al. 2014a)
- $\mathbf{G} = \frac{\mathbf{MM}'}{2 \sum p_i (1-p_i)}$  (VanRaden et al., 2008)
- Algorithm for Proven and Young (Misztal et al., 2014b)



# Material and Methods

- $Accuracy = \frac{cor(GEBV, y_{adj})}{h}$
- Validation populations: 10,153 animals with measurements after 2010
- Relatedness between core animals and:
  - Phenotyped animals
  - Validation animals
- Recursion coefficients in APY



# Algorithm for Proven and Young

$G_{cc}$	$G_{cn}$
$G_{nc}$	$G_{nn}$

# Algorithm for Proven and Young

	$G_{cn}$

Relatedness =  
Sum of off diagonals



# Algorithm for Proven and Young

	$G_{APY_{cn}}^{-1}$

Importance =  
Absolute sum of off diagonals

Relative importance = Importance of individual / Absolute sum of all importance

# 100 with most progeny

- Top 100
- Before 1981
- 1981 to 1990
- 1991 to 2000
- 2001 to 2010

Overall comparison: All 400 combined



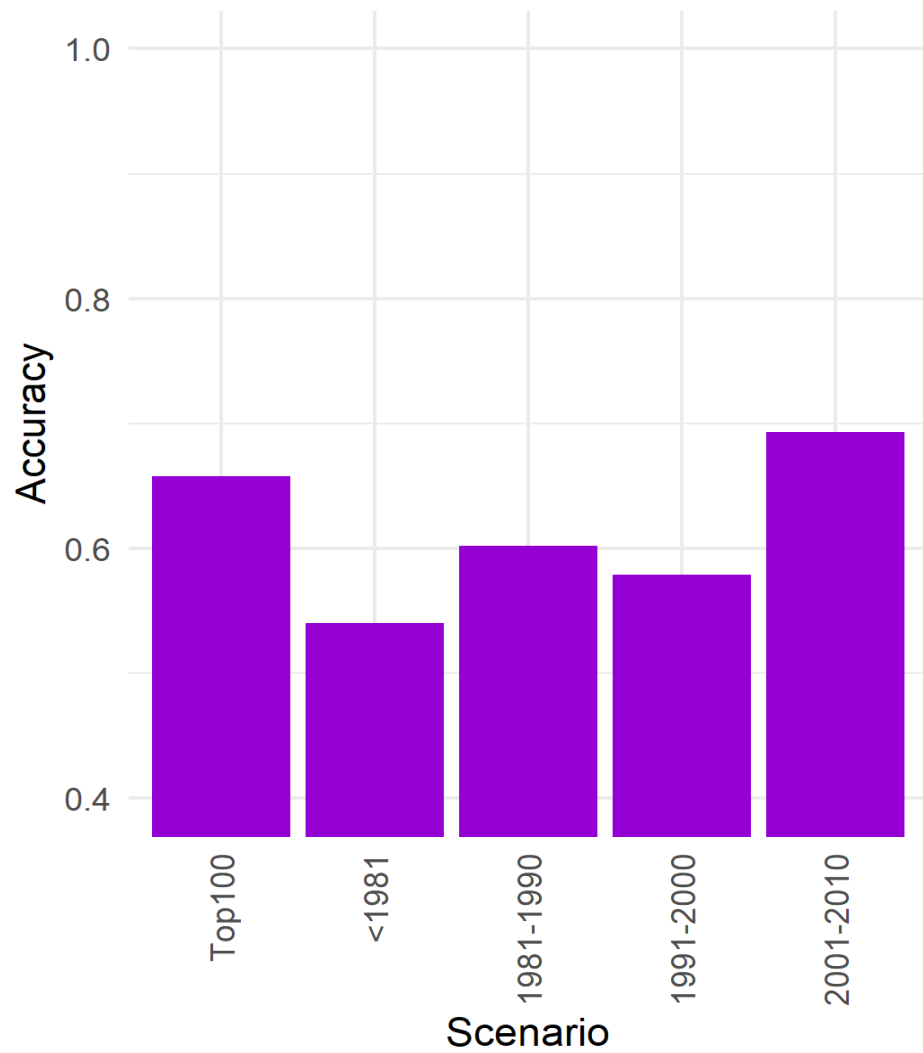
# Larger core size (469)

Random	Randomly selected
LPF	Females with known parents but no phenotypes or progeny
LPM	Males with known parents but without progeny
MPA	Males with the most progeny
Before 1995	Males born before 1995 that have the most progeny
1995 to 2004	Males born from 1995 to 2004 that have the most progeny
2005 to 2014	Males born from 1995 to 2014 that have the most progeny

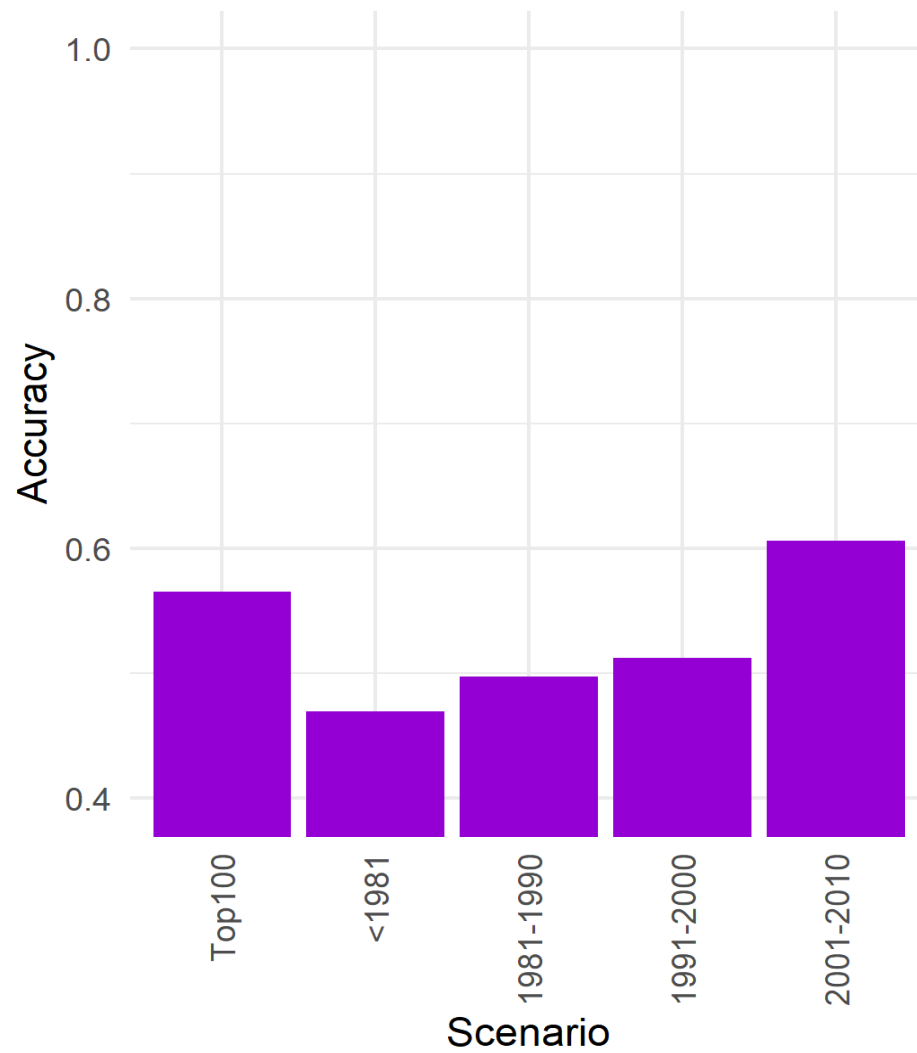


# Accuracy using 100 sires with most progeny

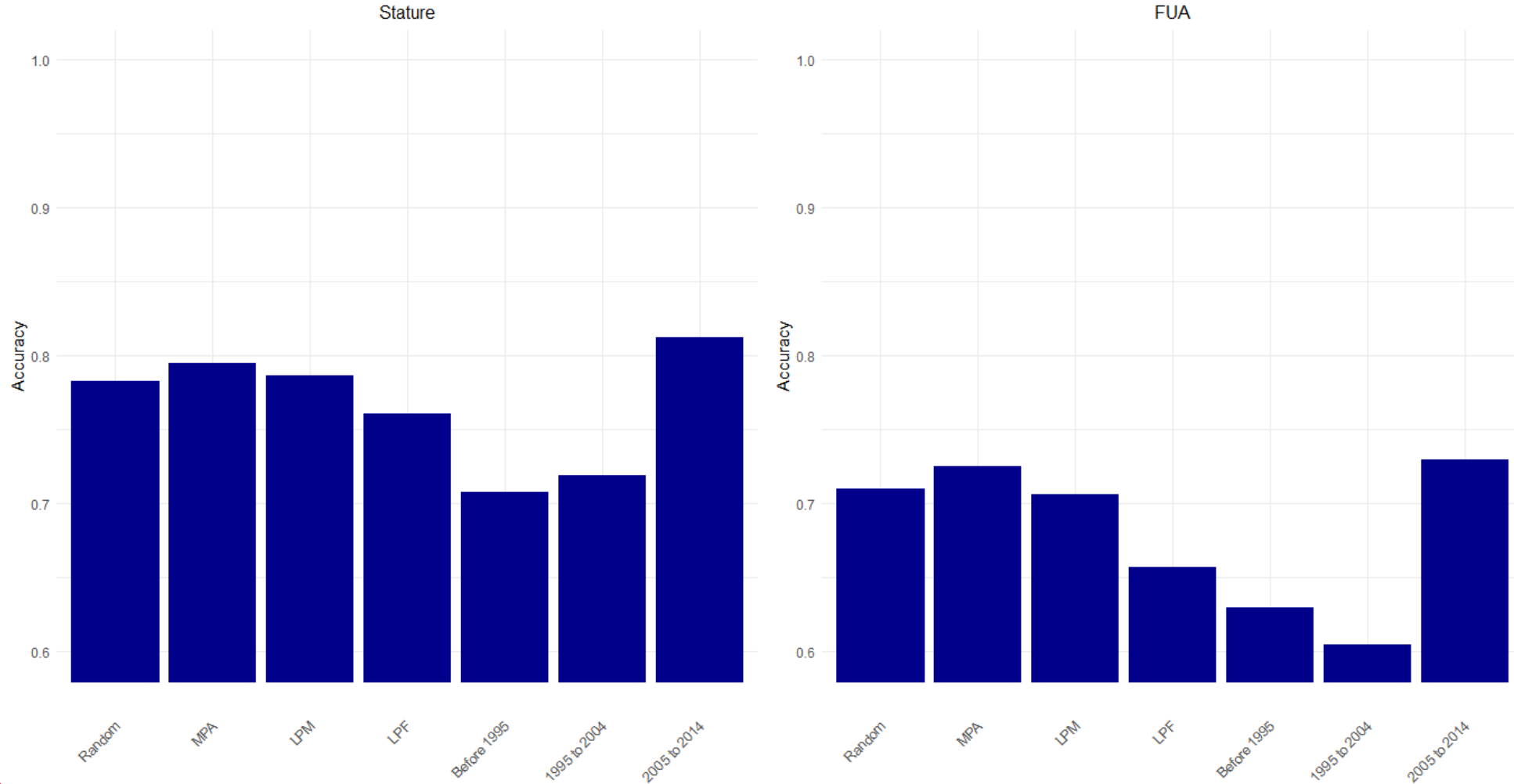
## Stature



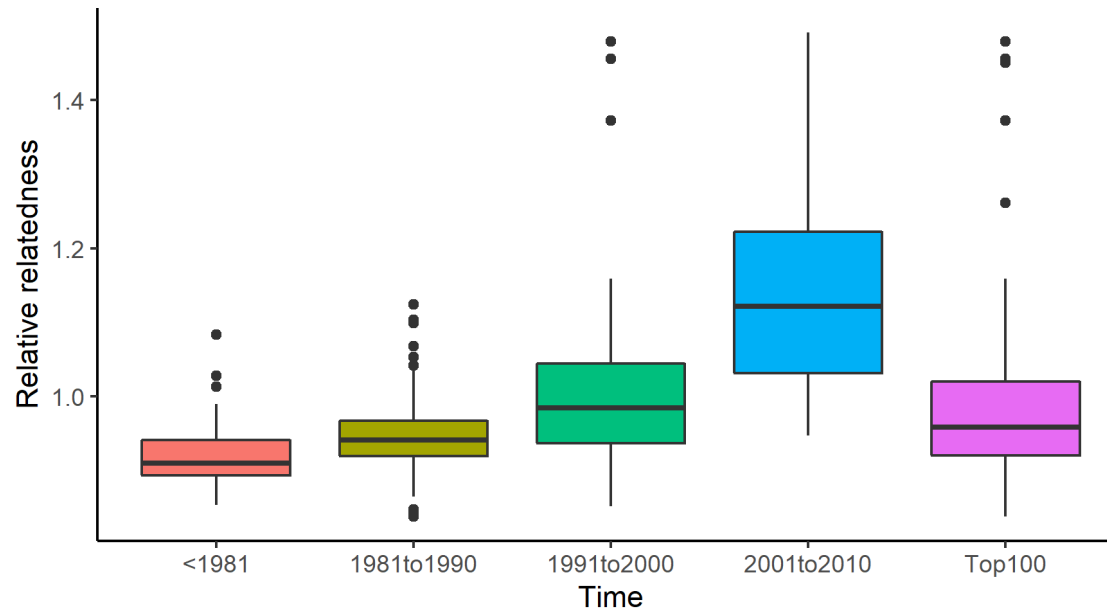
## FUA



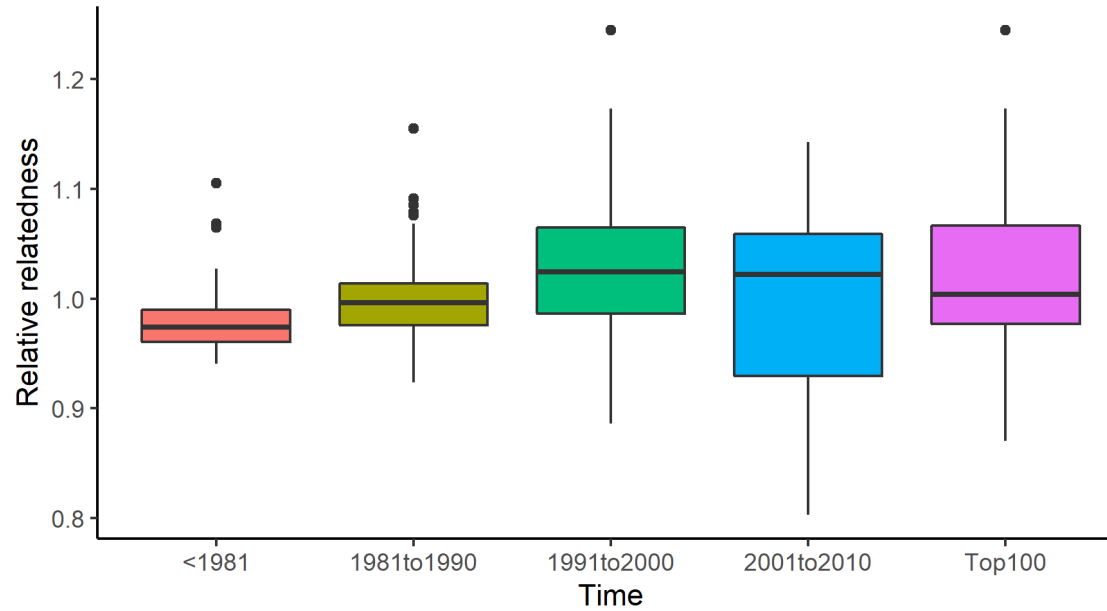
# Accuracy



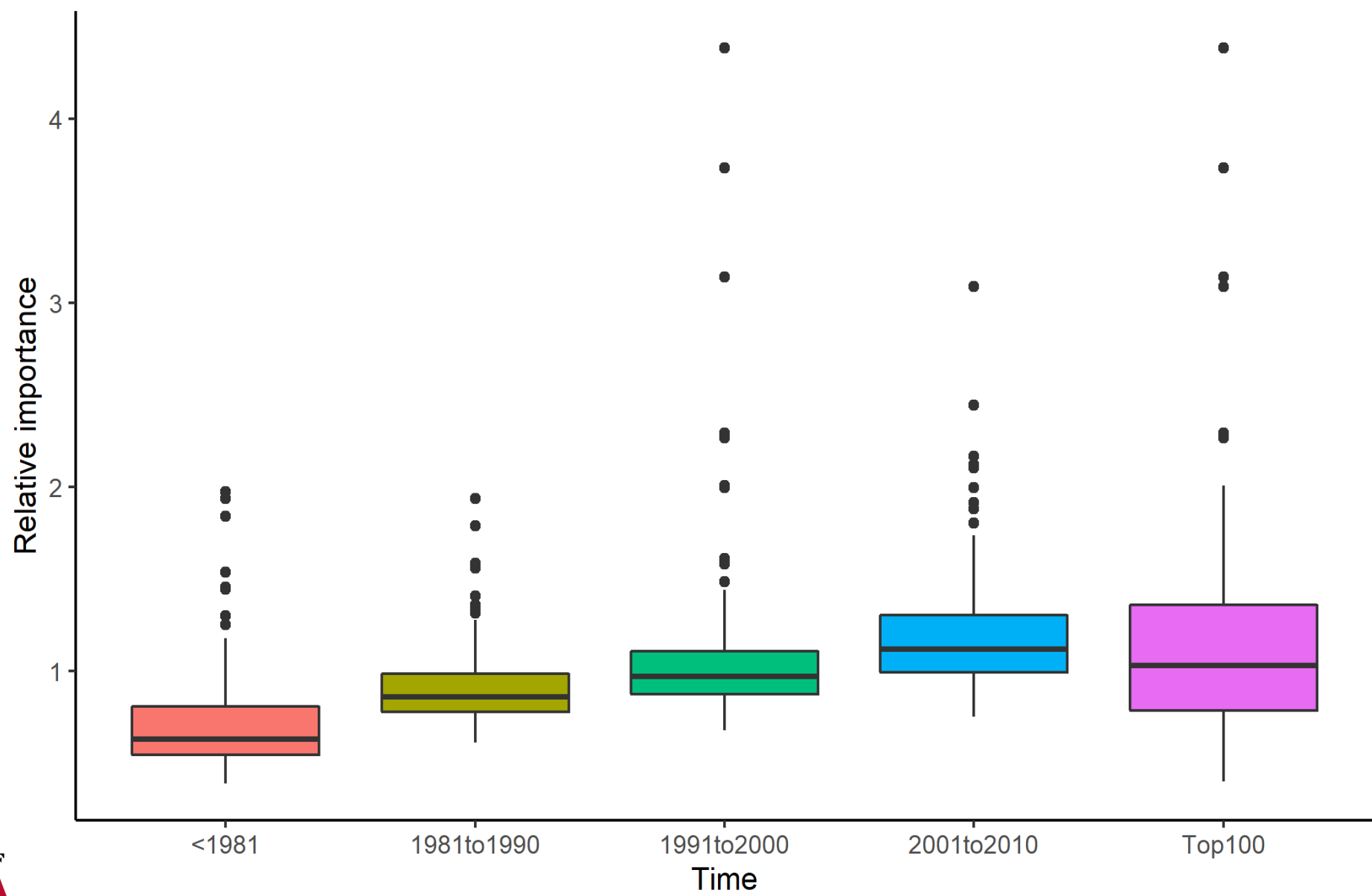
Relationships to validation animals



Relationships to phenotyped animals: Stature



# Relative impact among all 400 sires



# Before 1981

Name	Sire	MGS	Impact	Progeny
SWD <b>Valiant</b>	Chief	Admiral	1.97	37,939
Carlin-M Ivanhoe <b>Bell</b>	Ivanhoe Star	Heilo Bell	1.94	51,364
Walkway Chief <b>Mark</b>	Chief	Fond Matt	1.84	44,553
Round Oak Apple <b>Elevation</b>	B. Elevation	Ivanhoe SH	1.54	39,438





# 1981 to 1990

Name	Sire	MGS	Impact	Progeny
To-mar <b>Blackstar</b>	Chairman	Wayne	1.94	42,291
Madawaska <b>Aerostar</b>	Starbuck	Majesty	1.79	9,805
Emprise Bell <b>Elton</b>	<b>Bell</b>	Arlinda	1.59	11,395
MJR Blackstar <b>Emory</b>	Blackstar	<b>Mark</b>	1.56	18,443



# 1991 to 2000

Name	Sire	MGS	Impact	Progeny
Picston <b>Shottle*</b>	Mtoto	<i>Aerostar</i>	4.38	14,935
Braedale <b>Goldwyn*</b>	James	<i>Aerostar</i>	3.73	11,291
O-Bee Manfred Justice ( <b>O Man</b> )*	Manfred	<i>Elton</i>	3.13	15,515
Regancrest Elton <b>Durham</b>	<i>Elton</i>	<i>Mark</i>	2.29	34,267



# 2001 to 2010

Name	Sire	MGS	Impact	Progeny
Ensenada Taboo <b>Planet*</b>	Taboo	Amel	3.09	14,038
Lady's Manor PL <b>Shamrock</b>	<b>Planet</b>	<b>Shottle</b>	2.17	7,880
Desu <b>Observer</b>	<b>Planet</b>	<b>O Man</b>	2.12	4,670
Regancrest <b>Altoiota</b>	<b>O Man</b>	Ito	2.11	5,248

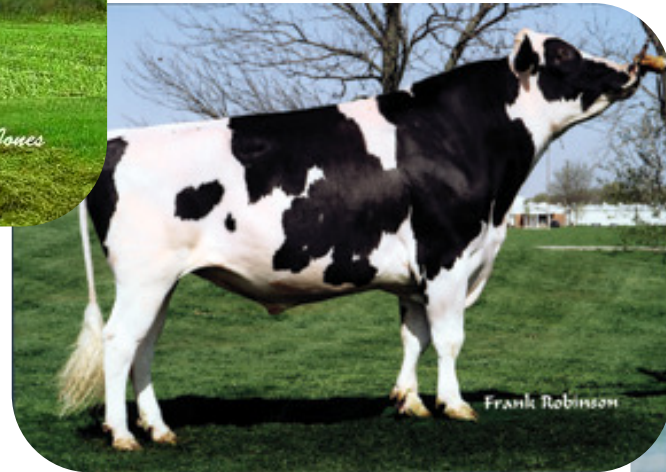




Shottle (4.38)



Goldwyn (3.73)



O Man (3.13)



Planet (3.09)



# Toystory

14,726

Ranks at 90

Relative importance = 1.67



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# Conclusion

- Historically popular sires still influential
- Recent sires contribute more to accuracy
- Progeny  $\neq$  importance
- Large, uncaptured commercial population



Thank you



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