Quantifying the use of and the genetic progress from advanced mating strategies in US dairy herds

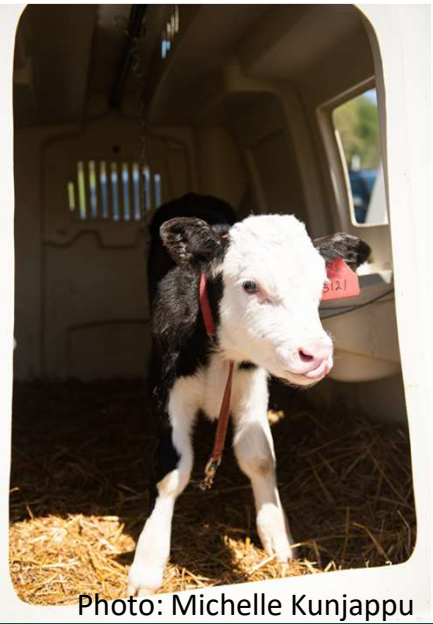

Photo: Michelle Kunjappu

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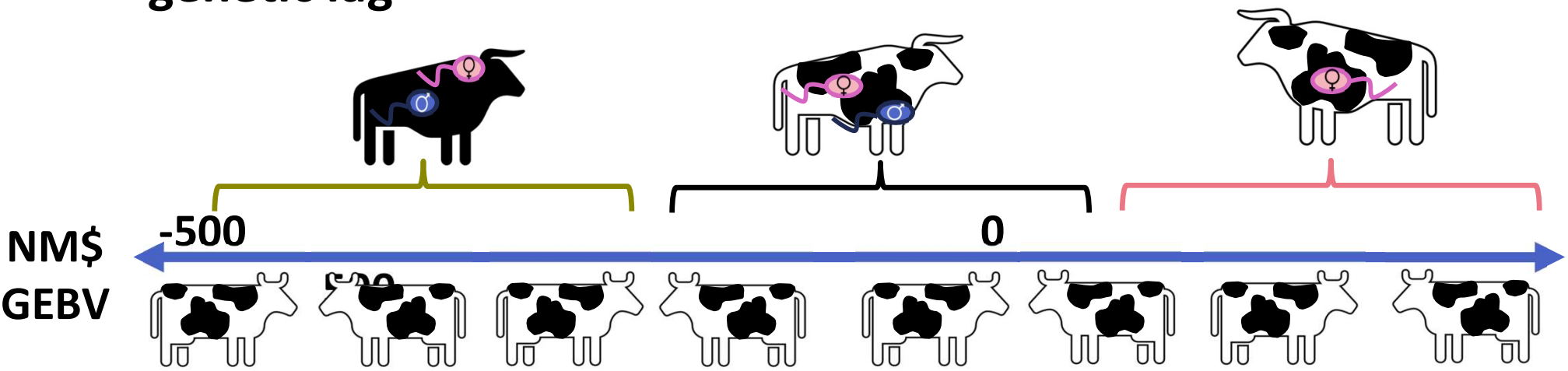
USDA Agricultural Research Service

CDCB® COUNCIL ON DAIRY CATTLE BREEDING

Background

- The use of female genomic testing and mating with sexed and beef semen is increasing in US dairy herds
- Models suggest that combining these technologies reduces genetic lag



Calus et al., 2015; Hjortø et al., 2015; De Vries, 2020; Clasen et al., 2021

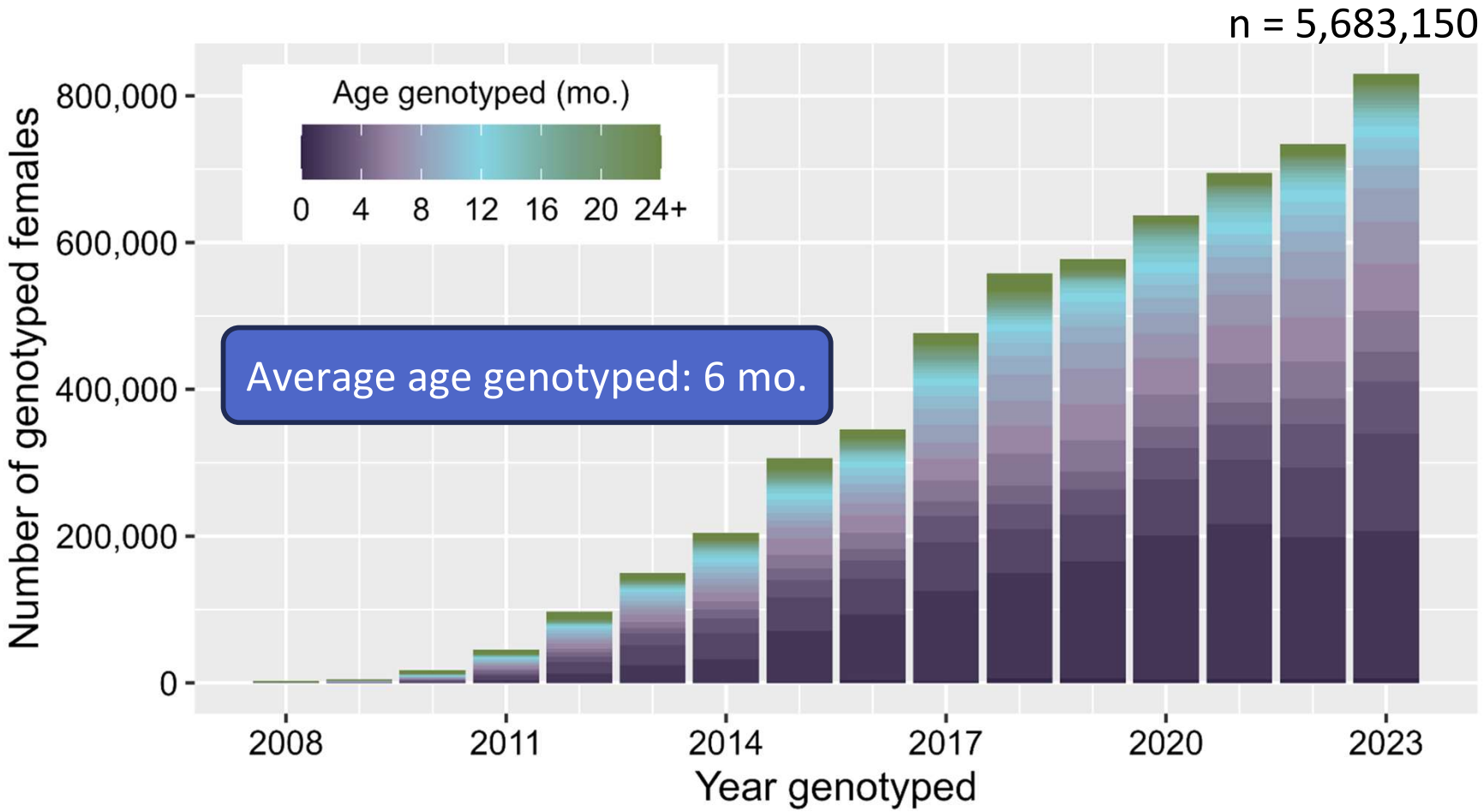
Objectives:

- Quantify the advanced mating strategies utilized in US dairy herds
  - Replacement heifer genotyping
  - Beef semen
  - Sexed semen
- Compare the genetic merit of replacement heifers by herd mating strategy

Data

- National Cooperator Database
- Genotypes of individual US females from 2008-2023
  - Subset of GTd heifers born prior to 2022 in herds on DHI test in 2023 and 2024
- Format 5 breeding records verified by calving between 2008-2023
  - Service sire NAAB to determine breed and sex sorted status
- Heifer EBV from Aug. 2024 national evaluation

Age of US dairy females at the time of GT submission

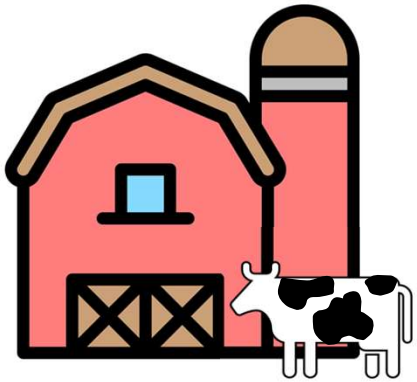


Culling genotyped heifers

982,536 genotyped heifers

NM: $563 ± 511

63% stayed



NM$: $582 ± 511

For every SD increase ($511) in a GTd heifer's NM$ EBV, the odds she remained in the herd she was born in through first calving increased by **13.6%**

37% left

NM$: $533 ± 509

Classifying herds by mating strategy

CON

Within a given herd-year, calves born were conceived only w/ **conventional** dairy semen

BC

≥ 1 calf born was conceived w/ **beef** semen, the remainder were conceived w/ **conventional** dairy semen

SC

≥ 1 calf born was conceived w/ **sexed** dairy semen, the remainder were conceived w/ **conventional** dairy semen

GT-SC

SC *AND* ≥ 1 heifer (≤24 mo. old) **genotyped** within a given herd-year

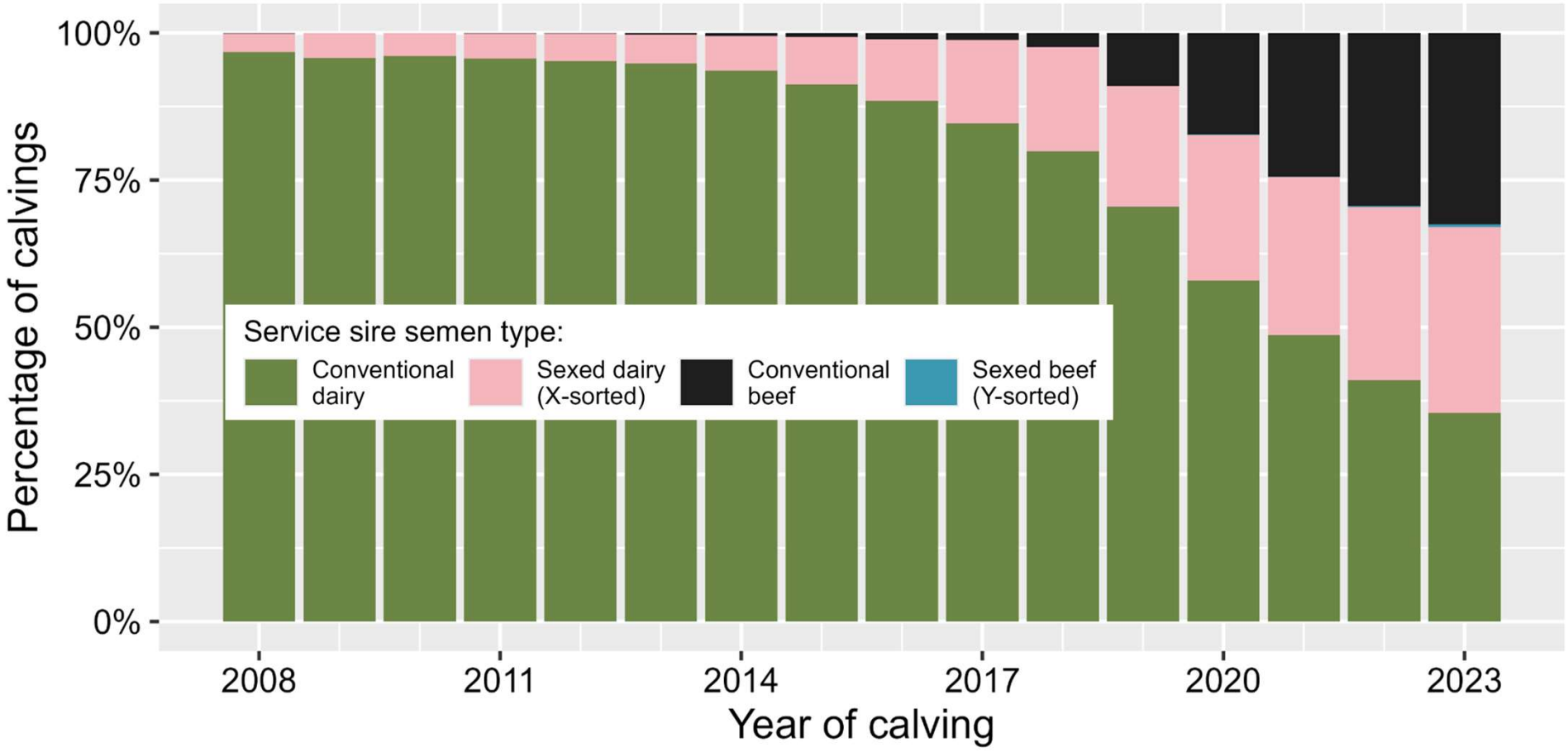
BSC

≥ 1 calf born was conceived w/ **beef** semen and ≥ 1 calf born was conceived w/ **sexed** dairy semen

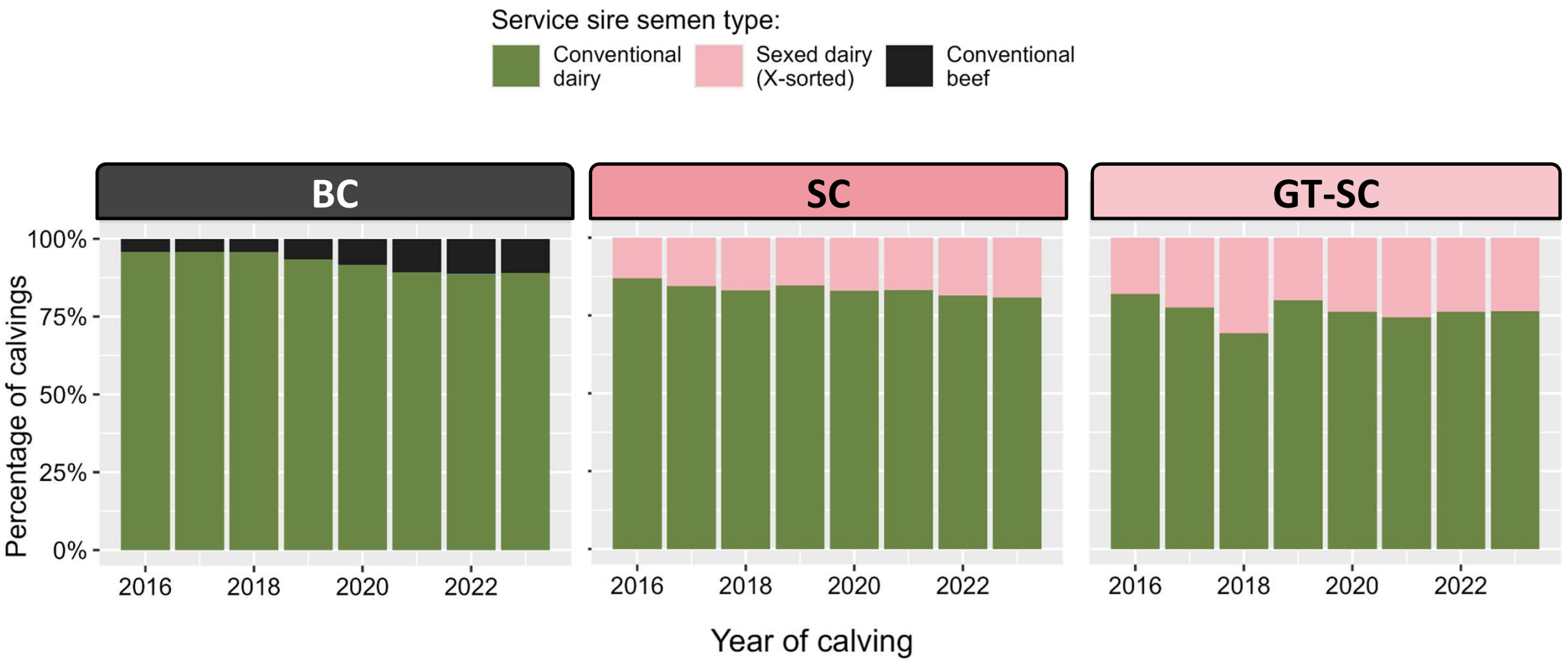
GT-BSC

BSC *AND* ≥ 1 heifer (≤24 mo. old) **genotyped** within a given herd-year

Proportion of annual calvings by semen type



Calvings by semen type and herd mating strategy



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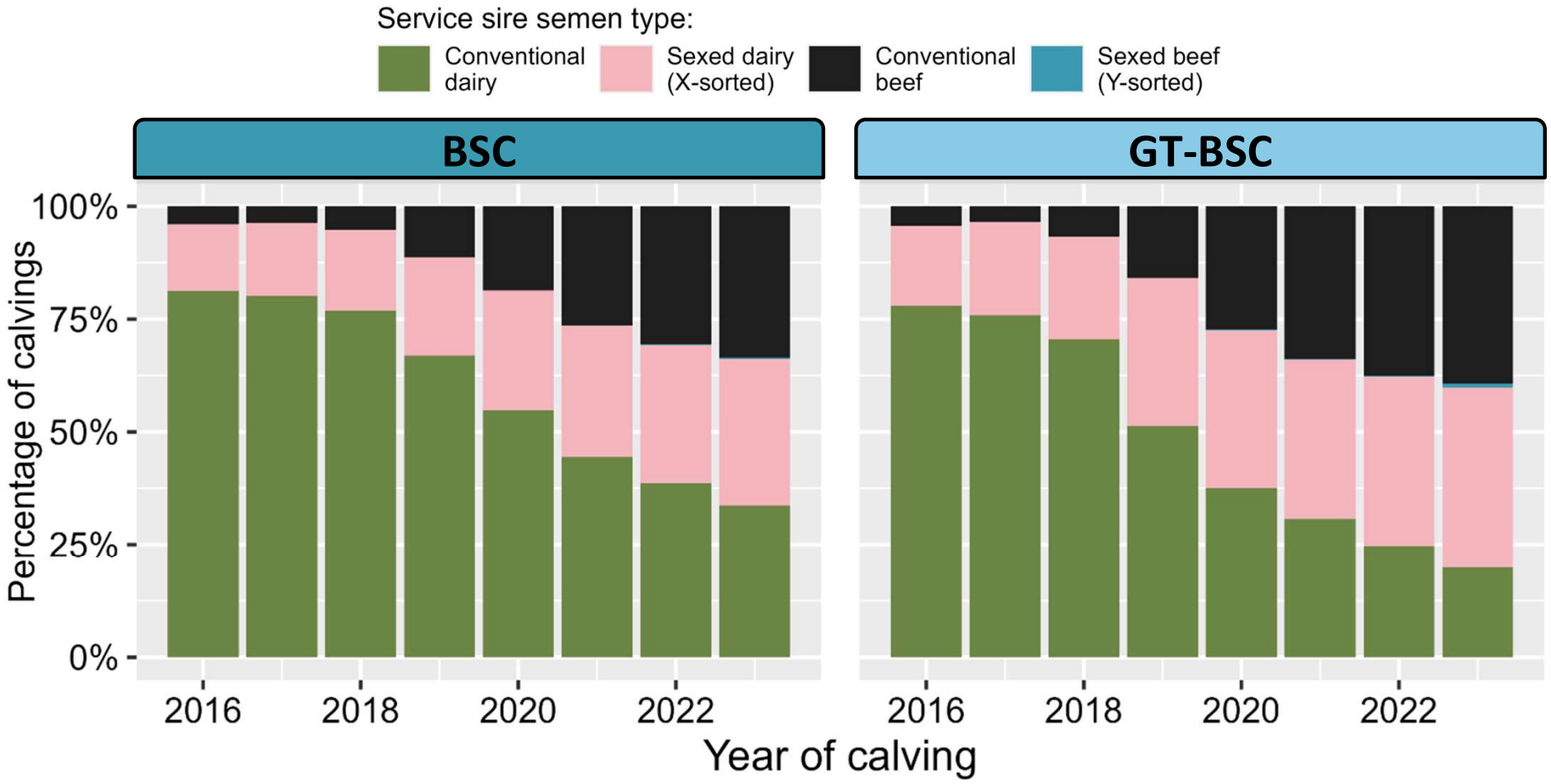

EBVs of heifer calves born in 2023 by herd mating strategy

	CON	BC	SC	BSC	GT-SC	GT-BSC
n heifers (n herds)	25,264 (1,117)	26,684 (786)	32,902 (891)	279,271 (1,810)	17,604 (231)	296,335 (778)
Production traits						
NM$	678^{d}	857^{c}	532^{e} 	963^{b}	678^{d}	1,203^{a} 
Milk	849^{c}	991^{b}	689^{d}	1,019^{b}	714^{d}	1,091^{a}
Fat	30.4^{d}	37.1^{c}	25.1^{e}	42.1^{b}	31.4^{d}	51.6^{a}
Protein	27.7^{d}	32.7^{c}	23.1^{e}	35.2^{b}	25.9^{de}	40.1^{a}

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Longevity traits						
SCS	2.90^{b}	2.87^{c}	2.93^{a}	2.86^{c}	2.90^{b}	2.82^{d}
PL	3.01^{d}	3.80^{c}	2.57^{e}	4.44^{b}	3.53^{c}	6.01^{a}
LIV	-0.13^{c}	0.53^{b}	-1.19^{d}	0.62^{b}	-1.04^{d}	1.26^{a}

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Fertility traits						
DPR	-0.97^{bc}	-0.85^{ab}	-1.21^{d}	-0.81^{a}	-1.23^{cd}	-0.71^{a}
CCR	-0.50^{d}	-0.17^{c}	-0.98^{e}	0.10^{b}	-0.86^{e}	0.60^{a}
HCR	1.83^{d}	2.01^{c}	1.78^{d}	2.35^{b}	1.85^{cd}	2.82^{a}
EFC	8.34^{d}	9.63^{c}	6.97^{e}	10.19^{b}	6.83^{e}	11.36^{a}

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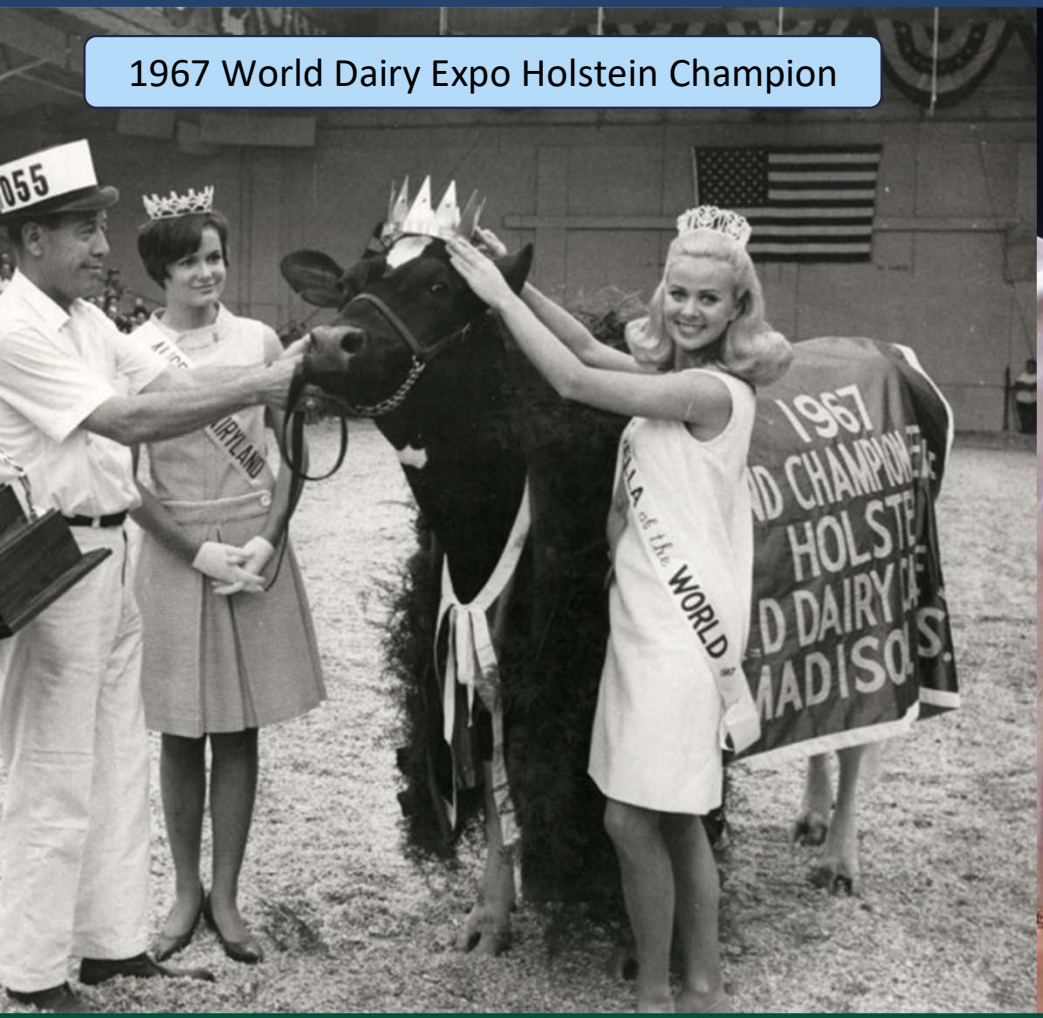
Type composites						
BWC	0.51^{b}	0.29^{c}	0.86^{a} 	0.26^{c}	0.87^{a} 	0.00^{d} 
UDC	0.90^{d}	0.85^{d}	1.39^{b} 	1.03^{c}	1.69^{a} 	1.11^{c}
FLC	0.54^{b}	0.42^{c}	0.90^{a}	0.48^{bc}	1.05^{a}	0.42^{c}

Big cows win modern shows



1967 World Dairy Expo Holstein Champion

2023 World Dairy Expo Holstein Champion

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Breeding objectives of SC and GT-SC herds likely differ from herds that use other mating strategies

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Conclusions

- US dairy herds are rapidly adopting advanced mating strategies
- Herds that adopt all tools have heifers with greatest genetic merit across production, longevity, and fertility traits
- Herds that use a combination of sexed and conventional semen have heifers with the greatest genetic merit for type traits

Thanks! Questions?

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