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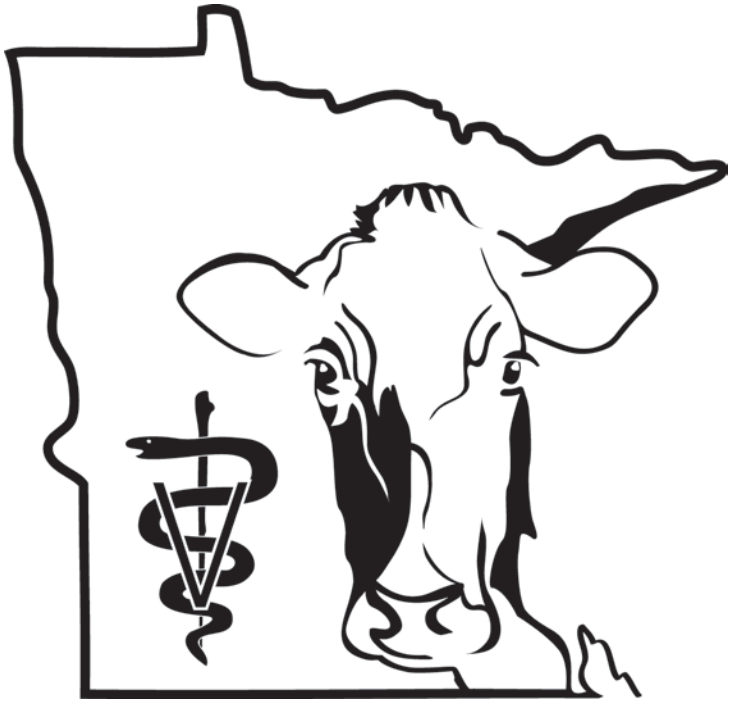

ST. PAUL, MINNESOTA
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Bull Management, Monitoring, and Economics

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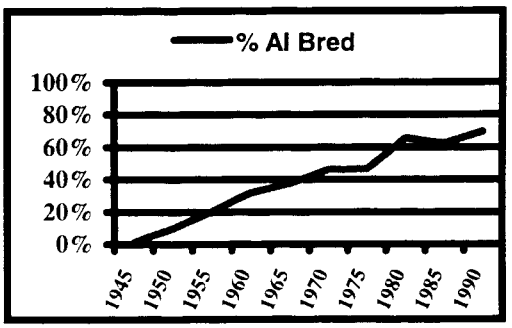
Natural service (NS) bulls are a common component of reproductive programs for many dairies, especially as the herd size grows. Figure 1 shows the percent of cows in the US which were bred by an AI bulls (12). The number after 1970 are estimated passed on semen sales and 1971 semen sales vs. milking cows.

Figure 1. Percent of pregnancies that was a result of AI breeding in the US.

Year	% AI
1950	9.7%
1955	20.2%
1960	31.8%
1965	37.4%
1970	46.1%
1975	46.6%
1980	65.7%
1985	62.1%
1990	69.7%



Another, indication of NS bull use is to look at the number of dairies using NS bulls. A 1984 survey of large Florida dairies (averaging 900 cows) showed 50% using mostly AI, 38% using a combination of AI and NS, and 12% using mostly NS (1). A survey of large dairies in New Mexico found 10% using mostly AI, 80% using a combination of AI and NS, and 10% using mostly NS. Figure 2 show the number of total pregnancies on eight New Mexico dairies each month and the percent of the pregnancies that were a result of an NS bull breeding. The percent of pregnancies that were a result of NS bulls as fluctuated around 40% for the last 2 years. We have no historic data from other parts of the country to compare AI versus NS bull pregnancy results. However, if 40% of the pregnancies on a dairy are the result of NS bulls and we has veterinarians want to be involved with reproductive program, we need to focus more energy on the bull management and monitoring.

Figure 2 Average number of pregnancies/month and percent that are a result of NS, from 8 New Mexico dairies.

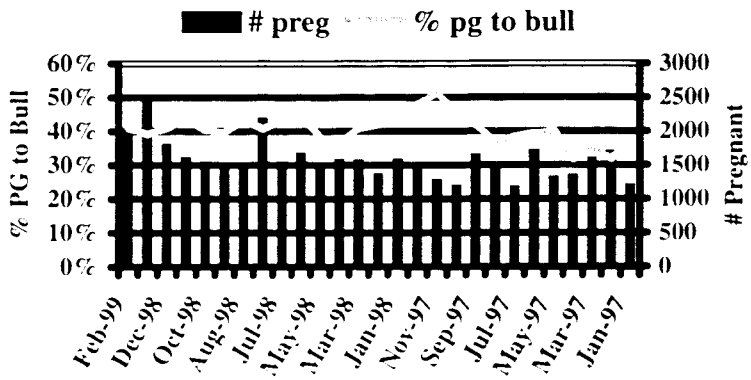
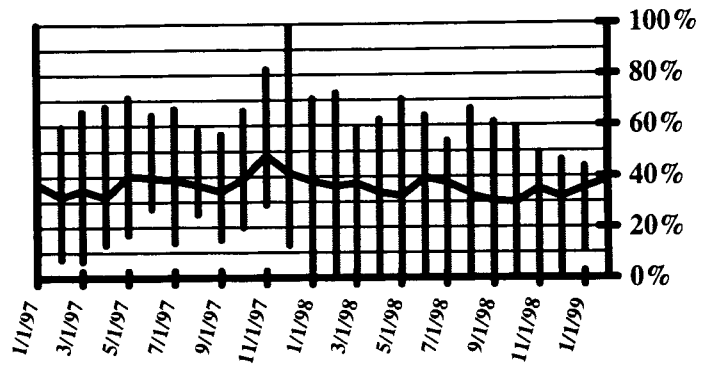


Figure 3 shows the range in percent of pregnancies from NS bulls found on eight New Mexico dairies in 1997 and 1998. The dairies generally had between 20-60% of the pregnancies as a result of NS bull. The summary of this information is that NS bulls are used at relatively high rate across the US. And, that larger dairies appear more likely to have bulls on the dairy and have a significant number of pregnancies that are a result of NS bulls.

Figure 3. The high, average, and low values for % of pregnancies as a result of NS from 8 New Mexico dairies.

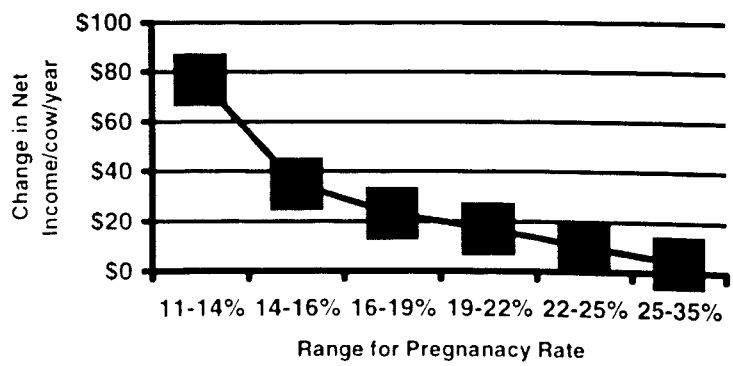


The questions we need to understand as dairy advisors is: why are dairy managers choosing to use NS versus AI bulls and what are the financial implications of the choices made. The major reasons NS bulls are used on a dairy are:

1. Poor AI pregnancy rate.
2. Inadequate management skills or time.
3. Inadequate source of skilled and motivated labor.
4. No youngstock program.
5. Poor facilities for heat detection and/or AI breeding.
6. Short breeding season.

As you go down this list it becomes apparent poor AI pregnancy rate is the major reason NS bulls are used on a dairy and other reasons are factors resulting in a low pregnancy rate. If low pregnancy rate is a reason to bring NS bulls onto a dairy, what is the financial cost of having a low pregnancy rate. One model estimated a 1% change in PR between 15-25% results in a change in net income of $14/cow/yr, and $4/cow/yr change with a 1% change in PR between 25-35%(1). Figure 4 and table 1 shows a more detailed estimate of

Figure 4. Change in Net Income/cow/year for a 1% change in pregnancy rate.



Risco and others, 1998

the impact a 1% change in PR has on milk production, mean calving interval, culling rate, and net income/cow/yr (15). Table 1 and Figure 4 contain several important concepts:

Table 1. Pregnancy Rate and its estimated impact on profit per cow.

HDR	PR	Mean CI days	Milk cow/yr	Cull rate	Net Income per cow	Diff. Net income
34%	11%	414	20,607	44%	$837	
						$233
43%	14%	406	21,110	38%	$1,070	
						$71
51%	16%	399	21,455	34%	$1,141	
						$70
60%	19%	391	21,810	32%	$1,211	
						$50
70%	22%	384	21,953	29%	$1,265	
						$31
80%	25%	377	22,116	28%	$1,296	

Risco and others, 1998

1) The conception rate was held constant, yet the PR can be raised dramatically, with excellent heat detection.
2) As the pregnancy rate increases in a dairy the impact is translated to all portions of the dairy (calving interval, milk production, culling rate, and net income).
3) The marginal return of a 1% marginal increase in PR is very high, $77/cow/year at a relative low PR (11-14%). The marginal return for the same marginal 1% increase in PR is relatively low when the PR is high (25-35%).

With this information we start to understand the financial incentive a dairy manager intuitively has for using making the decision to use NS bulls, in hopes of improving the pregnancy rate on a dairy. The question then becomes when is the PR rate low enough to justify the risks and costs of using NS bulls on the dairy. We'll start by looking at the cost related to a reduction in genetic gain of NS bulls versus AI bulls. Table 2 shows the difference in average predicted difference in milk between AI bulls and non-AI bulls between 1974-1984 (12,14). Using PD milk difference, $12/cwt, 45% freshening we can estimate the additional revenue from an AI bull breeding versus an NS bull breeding. However, that additional revenue is not seen for 3-6 years and will require additional feed cost. If a 15% discount is used, removal of 25%, 30%, 30%, and 15% at 1, 2, 3, and 4th lactation, respectfully, and a 30% cost for additional feed to produce the additional milk, then we can estimate

Table 2. The net present value of an AI pregnancy versus a bull pregnancy on the first generation production.

Year	Average PD milk difference AI bulls vs non-AI bulls	Dollar Value ($12.00) 45% Freshen	Net Present Value (with 30% cost for feed)
1974	399	$ 22	$ 12
1976	432	$ 23	$ 13
1978	488	$ 27	$ 15
1980	450	$ 24	$ 14
1982	516	$ 28	$ 16
1984	549	$ 30	$ 17

Modified from Powell and Norman, 1989

the net present value of genetic difference relative to milk production for the first generation.

The next question to answer is the estimated the cost for each AI bull pregnancy and each NS bull pregnancy. Table 3 shows the results of the analysis from 6 New Mexico dairies using AI and bull pregnancy data and financial cost estimates for 1998. Included in financial cost for AI pregnancies was semen cost, personnel, AI supplies; included for NS pregnancies was bull purchase cost, salvage value, number of bulls, $2/day feed cost, 1 year average life on dairy, and handling costs. No additional facility costs were included. The total annual cost for the AI and NS programs on each dairy were divided by the respective number of AI and NS pregnancies for each dairy. The average cost for an AI pregnancy was $46 with a minimum of $40 and a maximum of $63. The average cost for an NS pregnancy was $28 with a minimum of $24 (all NS herd) and a maximum of $32. An NS pregnancy is estimated to cost $18 less than an AI pregnancy. Or an AI pregnancy must return (in present value dollars) $18 more in genetic improvement, increased pregnancy rates, and/or reduced disease risk to justify the AI program. The genetic advantage is estimated to be close to the $18 per pregnancy, from table 2. Therefore, the choice to use NS versus AI is dependent on the issues related marginal improvement in genetics versus cost, pregnancy rates, disease risk, bull safety, and management issues.

Table 3. The average, minimum, and maximum cost for AI and NS pregnancies on 6 New Mexico dairies for 1998.

	Average Cost/pregnancy	Minimum Cost/pregnancy	Maximum Cost/pregnancy
AI Pregnancy	$46	$40	$63
NS Pregnancy	$28	$24	$32

Part of choosing to use NS bulls is understanding the management requirements of having bulls on a dairy. Several decisions need to be made, some of the major choices are:

1. Human safety must become a priority.
2. How many bulls are needed?
3. What will be the source for bulls? Biosecurity issues?
4. How will bulls be evaluated for fertility?
5. Will the bulls be housed with cows, which group of cows, how will cows be grouped and moved, when will NS breeding begin?

Most of these choices are made in combination, but background information helps to determine the correct decisions for each dairy.

Human safety is a difficult issue to set standards for. Some factors that will reduce the risk are using younger bulls, more than one bull/pen, immediate removal of bulls showing aggression, facility design, and training employees to be aware and not to provoke aggression.

How many bulls are needed? A commonly used active bull to open female ratio is 1:25. If bulls are cycled through rest pens or lots additional bulls will be needed. The average number of pregnancies/bull/year for the 6 large New Mexico dairies used above was 41/year with a

minimum of 37 and maximum of 46. This corresponds to 3-4 pregnancies/month/bull, not very many.

What is the best source for bulls? A high production herd, using only high genetic AI bulls, with no bulls used for breeding. This type of source will result in NS bulls with higher genetic potential and low likelihood of having a sexually transmitted disease. At a minimum no bull coming onto a dairy should have been in contact with female animals older than 12 months of age to minimize the chance of sexually transmitted diseases. In addition all bulls arriving onto the dairy should included in the vaccination program. As a precaution we have included two vibrio vaccinations and three vaccinations for footwarts (I have no idea on the efficacy of the footwart vaccine, but the bulls do not travel through the footbaths. Currently, we do not vaccine the cows for footwarts.).

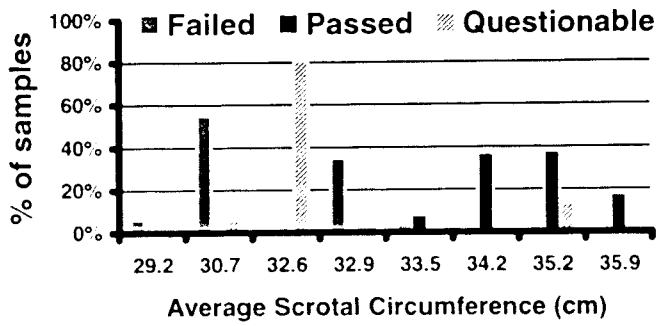
What should be the fertility exam performed on bulls entering the dairy? If only 1-4 bulls are used on a dairy I would recommend the full fertility exam recommended by the Society of Theriogenology (Chenoweth and others, 1992, 1994). If 3 or more bulls are present in each pen using only scrotal circumference measurements and palpation of the reproductive tract may be sufficient. What is this recommendation based on? Kasari and others (1996) reported that 5% of bulls with scrotal circumference =>34 cm fail a breeding soundness exam due to questionable semen quality (4,11,13,16,17). Table 4 shows the result of 862 bull fertility exams (16). One of eight bulls failed the exam (12.6%), indicating a large percent of bulls are likely to have fertility problems. However, only 2.8% of the failures (3 of 862 bulls) were due to poor semen quality. 41% had no ejaculate after 4 ejaculate attempts. Most of the bulls, which did not respond to electoejaculation, had a scrotal circumference <30cm. The remainder of failures could be detected with palpation or visual examination. Figure 5 gives a graphical representation of the average scrotal circumference for bulls that failed, passed, or were questionable for the breeding soundness exam from four studies, weighted by the number of bulls in each group.

Table 4.

- 109 of 862 bulls failed 12.6%
- 2.8% (3) failed poor semen quality only
- 41.3% No ejaculate (many low SC)
- 22.3% Reproductive tract infections
- 25.5% Penile abnormalities
- 8.3% Unilateral hypoplasia

Spitzer and others, 1988

Figure 5. Average Scrotal Circumference from 4 studies divided based on a failed, passed, or questionable score for the breeding soundness exam for each study.



Modified from Spitzer and others, 1988

Therefore, if a dairy is depending on one to four bulls, a full breeding soundness exam is advisable because using only scrotal circumference >34cm will miss an occasional bad bull (<5%). However,

when several bulls are breeding an individual pen, using scrotal circumference with palpation and visual exam will give a correct assessment of breeding soundness >95% of the time.

Miscellaneous Considerations

Which is a better choice to use on a dairy, a dairy-young bulls versus old bulls? Bull age 14-15 months (assuming normal growth and size) have been shown to have similar conception rates as 2 year olds or better conception (5%) (5,10). The only concern would be the first 30 days when younger bulls will have reduced pregnancy rates due to inexperience. Younger bulls will have better feet and legs, lower BCS, and lower weights; which should result in reduced injuries to cows and potentially less danger to humans.

What are some socialization factors to consider when using bulls? Multiple sires in a group of cows will result in more cows exhibiting estrus being mounted, reduced bull agitation (reduced human danger), and protect against poor fertility in a single bull (6). However, if younger bulls are mixed with older, larger bulls, the potential for reduced pregnancy rates exist. Similarly, if undersized bulls <1,000 lb. are placed with large females, the large females can intimidate the younger bull resulting in reduced pregnancy rates.

Bulls consuming high energy, lactating cow rations results in rapid growth and increased body condition score. Fat bulls have reduced libido and poor semen quality. The poor semen quality is a result of fat deposits interfering with thermoregulation, suggesting fertility in fat bulls during the summer/fall months is likely to be lower. Even after reducing the body condition back to normal, fat deposits in testicle tend to remain and semen quality is impaired. Using bulls in mid to low lactation ration groups, cycling bulls to pens feed low energy rations, or limiting the time a bull is kept on the dairy will reduce the impact high body condition scores have on fertility.

Good footing surfaces, which reduce slipping for both bulls and cows will improve pregnancy rates due to reduced injuries and increase willingness for a bull to mount and a cow to allow mounting. Dirt footing is best, but unlikely in freestall conditions. Sand bedding which results in sand being present in the walk and feed lanes improves footing. Grooved concrete is preferable over smooth concrete, but is a poor alternative.

Summary

Bulls do have a place on some dairies based on management limitations and can result in a positive financial return to the dairy if pregnancy rates were low and are improved. However, like all other aspects of a dairy operation, using bulls requires an understanding of issues surrounding the use bulls on a dairy and active management to maximize the return to the dairy and minimize the risk. When a veterinarian approaches a dairy with poor reproductive performance the use of bulls should be in the bag of tools that may be used to solve the low pregnancy rate problem and improve the financial returns to the dairy.

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