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ECONOMIC EFFICIENCIES IN REPRODUCTIVE PROGRAMS

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ECONOMIC EFFICIENCIES IN REPRODUCTIVE PROGRAMS

Getting heifers and cows bred at the optimum time to the preferable bulls challenges every dairy farmer. Measures of the effectiveness of the reproductive program include the average conception rate, average heat detection rate, genetic potential of heifers coming into the milking herd, and the reproductive program's costs. Improvement in the reproductive program affects both the short-run and long-run profitability of the dairy enterprise.

The general purpose of this paper is to provide guidelines for reproductive program decisions. Specific objectives are to (1) present means for evaluating the reproductive program, (2) present methods for analyzing various options for improving the reproductive program, and (3) analyze elements common to most good reproductive programs. When evaluating the above issues, few recommendations are given. Success of reproductive programs depends on each farm's practices. Therefore, a need to analyze each farm exists.

What is a Reproductive Program?

This paper uses a fairly restrictive definition of the reproductive program. It is defined simply to encompass decisions related to sire selection and the mechanics of breeding cows and heifers. As such, the reproductive program is divided into two sets of practices: mating and breeding practices.

Mating practices involve determining which sires should be used to breed which cows and heifers. These practices determine the long-run genetic potential of the herd.

Breeding practices involve catching cows in heat, and then servicing them such that they settle. Factors impacting the success of breeding practices include herd nutrition and health, time spent observing cows for heats, skills of artificial inseminators, and facilities affecting the ability to detect heat and breed cows and heifers. Breeding practices determine the number of services per conception, days open, and the calving interval, which then affect the costs associated with breeding practices. Breeding practices also may influence mating practice success. For example, use of a bull to breed cows may increase breeding efficiency, but may negatively impact on the long-run genetic potential of the herd.

How Do I Know If I Have a Poor Reproductive Program?

Only the dairy farmer can determine the success of the reproductive program. When evaluating the reproductive program, all aspects of the farming operation should be considered. Other practices, such as overall nutrition and health, influence the reproductive program. Moreover, tradeoffs generally exist between increasing the reproductive program's efficiency or some other aspect of the farming operation. For example, heat detection can be increased by spending additional time observing for heats. Taking this additional time, however, reduces time available for other uses, whether that be for managing, feeding, field work, maintenance, or spending time with the family.

With this caveat in mind, the reproductive program can be judged by analyzing both mating and breeding practices, and the attitude of the farmer towards the breeding program.

Mating

Poor mating practices result in:

1. low genetic growth, and
2. persistent genetic problems.

Low genetic growth manifests itself in low increases in herd milk production over time. In Ohio, average milk production per cow has increased by approximately 200 pounds per year over the last twenty years. Not maintaining this growth rate may be an indicator of poor mating practices. (It also may be an indicator of deficiencies in feeding or health practices.) Maintaining the average increase, however, does not necessarily imply that mating practices are sufficient. Economic principles indicate that farmers producing below breed averages tend to be unprofitable, those producing at the average break even, and those producing above the average are profitable. Therefore, maintaining the average increase may mean that you are "holding your own" relative to other farmers.

Breeding

Poor breeding practices yield:

1. low heat detection rates, and
2. low conception rates.

The combination of the above two factors determines probabilities of breeding a cow per heat, services per conception, days open, calving interval lengths, and, to a certain degree, reproductive cullings. Panel A of figure 1 shows per heat probabilities of having a cow pregnant given differing detection and conception rates. A .35 per heat pregnancy probability, for example, results from a .70 detection rate and a .50 conception rate. This means that pregnancy will occur 35 percent of the time after a heat, given that attempts are being made to bred the cow.

Based on the per heat probability, the probability of having a cow pregnant within 115 days can be calculated (panel B). For example, a 70 percent heat

Figure 1. Breeding Probabilities and Services Per Conception for Differing Heat Detection and Conception Rates.

Panel A. Per Heat Pregnancy Probabilities

heat detection rate	conception rate 0.30	0.40	0.50	0.60	0.70	0.80	0.90
0.20	0.06	0.08	0.10	0.12	0.14	0.16	0.18
0.30	0.09	0.12	0.15	0.18	0.21	0.24	0.27
0.40	0.12	0.16	0.20	0.24	0.28	0.32	0.36
0.50	0.15	0.20	0.25	0.30	0.35	0.40	0.45
0.60	0.18	0.24	0.30	0.36	0.42	0.48	0.54
0.70	0.21	0.28	0.35	0.42	0.49	0.56	0.63
0.80	0.24	0.32	0.40	0.48	0.56	0.64	0.72
0.90	0.27	0.36	0.45	0.54	0.63	0.72	0.81

Panel B. Probability of Having a Cow Pregnant in 115 Days from Beginning Breeding Date

heat detection rate	conception rate 0.30	0.40	0.50	0.60	0.70	0.80	0.90
0.20	0.27	0.34	0.41	0.47	0.53	0.58	0.63
0.30	0.38	0.47	0.56	0.63	0.69	0.75	0.79
0.40	0.47	0.58	0.67	0.75	0.81	0.85	0.89
0.50	0.56	0.67	0.76	0.83	0.88	0.92	0.95
0.60	0.63	0.75	0.83	0.89	0.93	0.96	0.98
0.70	0.69	0.81	0.88	0.93	0.97	0.98	0.99
0.80	0.75	0.85	0.92	0.96	0.98	0.99	1.00
0.90	0.79	0.89	0.95	0.98	0.99	1.00	1.00

Panel C. Services Per Conception

heat detection rate	conception rate 0.30	0.40	0.50	0.60	0.70	0.80	0.90
0.20	6.34	4.85	3.95	3.36	2.94	2.63	2.38
0.30	5.20	3.98	3.26	2.78	2.44	2.19	1.99
0.40	4.60	3.53	2.89	2.47	2.17	1.95	1.78
0.50	4.23	3.24	2.66	2.27	1.99	1.79	1.64
0.60	3.97	3.04	2.48	2.11	1.86	1.67	1.52
0.70	3.77	2.87	2.34	1.99	1.74	1.56	1.41
0.80	3.60	2.73	2.22	1.87	1.63	1.45	1.31
0.90	3.46	2.61	2.11	1.77	1.53	1.35	1.21

detection rate and a 50 percent conception rate results in an 88 percent chance of having a cow pregnant within 115 days. If attempts to breed the cow begin at 60 days into the lactation, this means that 88 percent of the time a cow will be pregnant by the 175 day of the lactation.

The probabilities in panel B abstract away from many problems associated with breeding certain cows. For example, some research suggests that heat detection problems increase with higher milk production levels. However, they do suggest that many "problem breeders" may in fact be due to poor breeding practices. "Normal" cows will be culled from the herd if reproductive culling is based on not having a cow bred after a certain number of days. In the above example, 12 percent of normal cows will be culled, assuming that attempts to breed the cow end after 115 days. Reproductive culling increases as either heat detection rate or conception rate decreases.

Panel C shows services per conception for differing detection and conception rates. For example, a .70 detection rate and a .50 conception rate yields an average of 2.34 services per conception. Note that services per conception increase as either the heat detection rate or the conception rate decreases.

Likewise, days open increases as the per heat probability of breeding decreases. Presuming that breeding occurs after some beginning breeding date, days open for cows eventually bred equal:

Per heat pregnancy probability	Days open from beginning breeding date
.30	44
.40	39
.50	34
.60	28
.70	19
.80	16

If breeding begins after the 60th day in milk, days open equals 104 days (60 days plus 44 days) for the .30 pregnancy probability, 99th days for a .40 pregnancy probability, and so on.

Direct measures of heat detection and conception rates are difficult to obtain. However, indicators can be obtained from Dairy Herd Improvement records. These include services per conception, services per cow, average days open, and calving intervals. For example, average services per conception for Ohio dairy farms was 2.08 in 1988. Although this measure understates true services per conception, because all bull services are not recorded, the 2.08 serves as a useful benchmark for comparing a farm to the average. The solid lines in figure 1 indicate the range of conception and heat detection rates consistent with 2.08 services per conception. As with mating practices, obtaining the state average does not necessarily indicate that problems with breeding practices do not exist.

Attitude

Even though many factors influence reproductive performance, poor reproductive program performance ultimately is the farmer's responsibility. As such, attitude towards the reproductive program is important. Attitudes hindering improvement include:

1. Low importance. This attitude manifests itself in statements such as "just get it done." Not giving thought to the goals of the reproductive program, methods of accomplishing the goals, and evaluating the methods most likely will result in an inefficient reproductive program.

2. Quick fix mentality. The quick fix mentality results when a problem is realized, but the solution to the problem is not carefully planned. An example is to employ a breeding service without considering other components of the mating program. Another example is to use heat detection aids to remedy a missing heats problem without giving consideration to record-keeping or time spent observing cows for heats. Either a breeding service or heat detection aids may be appropriate for the particular situation. However, blindly applying the technology may not be appropriate. The net result of a quick fix mentality is an attempt to shift blame for a poor reproductive program from the manager to some technology or service.

3. **Enamored with "hot" bulls.** Use of a particular bull's semen simply because one person making recommendations is enamored with the bull may not be a good idea. Semen use should be determined based on an analysis of herd needs.

4. **Misconceptions related to artificial insemination use.** Some individuals feel that breeding using all artificial insemination (A.I.) is an indicator of a good reproduction program, while using a bull is an indicator of a poor program. In 1987, breeding practices of a random sample of U.S. dairy farmers subscribing to Hoard's Dairyman were analyzed[1]. Farms using 100 percent A.I. were compared to farms using mostly A.I. but still using some natural services. No difference in milk production per cow was found between the two groups. However, those farms using 100 percent A.I. had smaller herds than those using a combination of A.I. and bulls. This may indicate that there are size economies in having a bull on the farm.

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[1]Erven, Bernard L. and Dale Arbaugh, Artificial Insemination on U.S. Dairy Farms, Department of Agricultural Economics and Rural Sociology, ESO. 1379, August 1987.

Costs Associated With the Reproductive Program

Poor reproductive program performance translates into foregone profitability. Most of the foregone profitability is not immediately evident, because few cash costs are incurred. For example, poor mating practices can result in lower growth in milk production per cow over time. Slower increases in milk production does not increase costs. Rather, profitability from higher milk production is foregone.

Generally, mating practices should be geared towards increasing milk production over time without introducing genetic defects into the herd. Higher milk production is rather strongly related to higher profitability. As of yet, higher milk production levels resulting in lower profitability have not been found. Furthermore, increasing genetic potential can be obtained at relatively low cash outlays.

Inefficient breeding practices affect several costs:

A. Breeding costs include semen and bull costs, veterinary costs related to the reproductive program, heat detection aid costs, and reproductive drug costs.

B. Replacement costs are associated with procuring replacements needed for reproductive culling.

C. Costs from excess days open. These costs are associated with extended lactations due to poor breeding practices. In general, cows give less milk during the later part of the lactation than they do during the early part of the lactation. This can result in less income over feed costs. The value of these costs can vary substantially. Various studies have suggested that these costs can range from $1.50 per day to $3.00 per day. Worksheet 1 can be used to approximate costs of an excess day open.

D. **Calf costs** are associated with fewer calves born due to excessive days open.

E. **Labor costs** are incurred when time is spent observing cows for heat and breeding cows.

Yearly estimates of breeding practice costs can be obtained using worksheets 2 and 3. Worksheet 2 lists items needed to calculate the costs. It also contains "per cow measures" useful for evaluating the efficiency of breeding practices. Worksheet 3 then calculates breeding practice costs using items listed in worksheet 2. Note that some of the calculations are based on a days open goal (line 2 of worksheet 2). This requires a realistic goal, which should not change when comparing alternatives.

The purpose of worksheets 1 through 3 is to compare alternative breeding practices. Without the comparison, the costs have little meaning. Two examples dealing respectively with detecting heats and increasing conception rates are presented below.

Costs of Detecting Heats

Generally, increases in heat detection rates result in declining semen costs, replacements, excess days open, breeding, and calf costs. Various methods can be used to detect heats including heat mount detectors, prostaglandins, prostaglandins with heat mount detectors, and visual observations. Figure 2 shows heat detection rates associated with differing methods. Note that one of the most effective heat detection methods is to increase observation time.

While observation time appears to be key in detecting heats, over 50 percent of the dairy farms in the mid-west do not observe cows for heat on a regular basis (figure 3). Furthermore, over 50 percent of the dairy farms have

Worksheet 1. Calculating the Costs of an Excess Day Open[1].

		Example	
A.	Average daily milk production in the first month of the lactation (lbs.)	60 lbs.	________
B.	Average daily milk production in the last month of the lactation (lbs.)	40 lbs.	________
C.	Difference in production (A - B)	20 lbs.	________
D.	Milk price per pound	$.1175	________
E.	Loss in milk revenue (C x D)	$2.35	________
F.	Daily feed ration cost the first month of the lactation	$2.18	________
G.	Daily feed ration cost the last month of the lactation	$1.98	________
H.	Costs of an excess day open[2] (E + F - G)	$2.15	________

[1]This worksheet only considers feed costs when calculating the costs of an excess day open.

[2]This value represents a reasonable approximation of the costs of an excess day open. The actual cost is a complex relationship among many factors.

Worksheet 2. Inputs for Calculating Yearly Costs of Alternative Breeding Practices.

NECESSARY INPUTS	Example	Current Herd Average	Alter-native
PHYSICAL MEASURES			
a. days in milk at first breeding	77	______	______
b. total A.I. services per year	166	______	______
c. calving interval in months	13.5	______	______
d. yearly reproductive culls	10	______	______
e. number of cows	80	______	______
f. number of bulls	1	______	______
LABOR			
g. employee hours per week	3	______	______
h. operator hours per week	2	______	______
RETURNS AND COSTS			
i. A.I. costs per service	$7	______	______
j. yearly bull costs	1553	______	______
k. heifer replacement costs	1000	______	______
l. cull cow value	540	______	______
m. weekly veterinary reproductive costs	30	______	______
n. yearly heat detection aids costs	0	______	______
o. yearly reproductive drug costs	0	______	______
p. costs of an excess day open	2.50	______	______
q. costs per hour of employee labor	5	______	______
r. costs per hour of operator labor	10	______	______
s. calf value at birth	75	______	______
PER COW MEASURES			
1. Avg. days open ((line c) x 30.5) - 275	137	______	______
2. Excessive days open (line 1) - days open goal _110_	27	______	______
3. Per heat pregnancy probability 21 / (line 2)	.35	______	______

Worksheet 3. Costs of Alternative Breeding Practices.

	Example	Current Herd Average	Alter-native
BREEDING COSTS			
A.1. Semen costs (line b) x (line i)	$1,162	______	______
A.2. Bull costs (line f) x (line j)	1,553	______	______
A.3. Veterinary costs (line m) x 52	1,560	______	______
A.4. Heat detection aid costs (line n)	0	______	______
A.5. Reproductive drug costs (line o)	0	______	______
A. TOTAL BREEDING COSTS (sum of A.1 through A.5)	4,275	______	______
B. REPLACEMENT COSTS ((line k) - (line l)) x (line d)	4,600	______	______
C. COSTS FROM EXCESS DAYS OPEN (line e) x (line p) x (line 2)	5,200	______	______
D. CALF COST (line e) x (line s) x (line 2) / 365	444	______	______
E. COSTS OTHER THAN LABOR (A + B + C + D)	14,719	______	______
LABOR COSTS			
F.1. Hired labor costs (line g) x (line q) x 52	780	______	______
F.2. Operator labor cost (line h) x (line r) x 52	1,040	______	______
F. TOTAL LABOR COSTS (F.1 + F.2)	1,820	______	______
TOTAL COSTS (E + F)	16,539	______	______

Figure 2. Heat Detection Rates for Differing Methods.

Detection Method	Frequency of Observation	Expected Detection Rate (%)
Teaser bull	3x/day	85-100
	2x/day	80-90
Heat mount detector or tail paint	3x/day	72-81
	2x/day	67-76
	routine chores	49-58
Prostaglandins	3x/day	80-90
	2x/day	75-85
Prostaglandins with heat mount detectors	3x/day	80-90
	2x/day	75-85
Visual observation	3x/day	70-80
	2x/day	65-75

Source: Hoard's Dairyman, July, 1987.

Figure 3. Heat Detection Methods on Dairy Farms in Two Regions of the United States, 1987[1].

Item[2]	West Coast[3]	Mid-West[4]
Heat Detection Observation Period for Cows	----- Percent ----	
Casual daily observation during routine jobs	34.7	53.4
Once daily for at least 15 minutes	12.2	12.1
Twice daily for at least 15 minutes each time	24.5	20.9
More than three times daily for at least 15 minuter per time	28.6	13.6
Use of Heat Detection Aids[5]		
Currently using	58.8	35.4
Previously used	10.0	11.2
Never used	31.2	53.4
Satisfaction with Performance of Detection Aids		
Very satisfied	20.0	19.7
Satisfied	56.7	54.0
Somewhat satisfied	23.3	26.3
Not satisfied	0.0	0.0
Use of Estrus Control Drugs		
Currently using	28.0	16.0
Previously used	32.0	23.4
Never used	40.0	60.6
Satisfaction With Estrus Control Drugs		
Very satisfied	25.0	17.4
Satisfied	28.6	46.5
Somewhat satisfied	28.6	23.3
Not satisfied	17.8	12.8

[1]Source: Erven, Bernard L. and Dale Arbaugh. Artificial Insemination on U.S. Dairy Farms. Department of Agricultural Economics and Rural Sociology. ESO. 1379. August 1987.

[2]Data taken from a representative sample of subscribers to Hoard's Dairyman.

[3]States include California, Oregon, and Washington.

[4]States include Indiana, Illinois, Michigan, and Ohio.

[5]Includes use of chalk, KMAR mount detectors, and chin balls.

never used heat detection aids or estrus control drugs. This suggests that potential gains can be made by using practices currently available.

To illustrate this possibility, suppose a farm is currently observing cows for heats two times a day and is considering increasing observations to three times a day. Each observation period takes approximately 15 minutes. Currently, the farm has inputs and costs similar to those shown in the example contained in the first column of figures 4 and 5: an 80 cow herd, 166 A.I. services per year, and a 13.5 month calving interval. Based on these inputs, the per heat pregnancy probability is .35 (line 3 of figure 4), which is consistent with a .70 heat detection rate and a .50 conception rate (figure 1).

The additional 15 minute heat detection observation will be performed by the farmer, who values labor at $10 per hour. The expected increase in the conception rate is from 70 percent to 75 percent, which corresponds roughly to a 13.3 calving interval presuming that the conception rate equals .50 and that first breeding occurs 77 days into the lactation. Increasing observation time also is expected to reduce yearly reproductive culls from 10 to 9, and reduce A.I. services from 166 to 160. The second column of figure 4 shows inputs for this alternative.

Based on these inputs, total breeding practice costs are expected to decline from $16,539 to $15,778 (figure 5). Shifting in costs, however, occurs. Replacement costs and costs from excess days open decline while labor costs increase.

There are several items to note about this example. First, observing cows for heats will be more economical for larger farms. Larger cow numbers spread labor costs over more animals. Second, this example shifts costs from

Figure 4. Inputs for Calculating Yearly Costs of Alternative Breeding Practices.

NECESSARY INPUTS	Current Herd Average	Increasing Heat Obs. Time	Sell the Bull
PHYSICAL MEASURES			
a. days in milk at first breeding	77	77	77
b. total A.I. services per year	166	160	190
c. calving interval in months	13.5	13.3	13.5
d. yearly reproductive culls	10	9	13
e. number of cows	80	80	80
f. number of bulls	1	1	0
LABOR			
g. employee hours per week	3	3	3
h. operator hours per week	2	4	4
RETURNS AND COSTS			
i. A.I. costs per service	$7	$7	$7
j. yearly bull costs	1553	1553	1553
k. heifer replacement costs	1000	1000	1000
l. cull cow value	540	540	540
m. weekly veterinary reproductive costs	30	30	30
n. yearly heat detection aids costs	0	0	0
o. yearly reproductive drug costs	0	0	0
p. costs of an excess day open	2.50	2.50	2.50
q. costs per hour of employee labor	5	5	5
r. costs per hour of operator labor	10	10	10
s. calf value at birth	75	75	75
PER COW MEASURES			
1. Avg. days open ((line c) x 30.5) - 275	137	131	137
2. Excessive days open (line 1) - days open goal 110	27	21	27
3. Per heat pregnancy probability 21 / (line 2)	0.35	0.39	0.35

Figure 5. Costs of Alternative Breeding Practices.

	Current Herd Average	Increasing Heat Obs. Time	Sell the Bull
BREEDING COSTS			
A.1. Semen costs (line b) x (line i)	$1,162	$1,120	$1,330
A.2. Bull costs (line f) x (line j)	1,553	1,553	0
A.3. Veterinary costs (line m) x 52	1,560	1,560	1,560
A.4. Heat detection aid costs (line n)	0	0	0
A.5. Reproductive drug costs (line o)	0	0	0
A. TOTAL BREEDING COSTS (sum of A.1 through A.5)	4,275	4,233	2,890
B. REPLACEMENT COSTS ((line k) - (line l)) x (line d)	4,600	4,140	5,980
C. COSTS FROM EXCESS DAYS OPEN (line e) x (line p) x (line 2)	5,400	4,200	5,400
D. CALF COST (line e) x (line s) x (line 2) / 365	444	345	444
E. COSTS OTHER THAN LABOR (A + B + C + D)	14,719	12,918	14,714
LABOR COSTS			
F.1. Hired labor costs (line g) x (line q) x 52	780	780	780
F.2. Operator labor cost (line h) x (line r) x 52	1,040	2,080	2,080
F. TOTAL LABOR COSTS (F.1 + F.2)	1,820	2,860	2,860
TOTAL COSTS (E + F)	16,539	15,778	17,574

the cash replacement costs and the cash costs of excess days open to the non-cash, opportunity costs of operator labor. This shifting is fairly typical of many reproductive practices. Although not a cash cost, labor is still a real cost to the farm. Operator time spent in checking cows for heat means that there is less operator time for some other use. Third, the example suggests measuresfor evaluating performance of breeding practice changes. These include calving intervals, average days open, and reproductive cullings. If these measures do not decline after implementing an increased observation period, the practice should be questioned. Finally, costs associated with alternative breeding practices will vary from farm to farm. Therefore, there is a need for farmers to evaluate their own situations.

Costs Associated with Bulls

Conception rates are usually higher when a bull is used. In the 1987 study of U.S. dairy farmers mentioned previously, dairy farmers were asked to rate reasons for using a bull on cows. Conception problems with A.I. was the highest ranked reason for using bulls. Using a bull comes at the costs of maintaining a bull. Figure 6 shows a budget detailing bull maintenance costs. These costs will be foregone if A.I. is used to breed all cows. However, relying totally on A.I. likely will increase other breeding practice costs including semen costs, costs from excess days open, calf costs, and labor costs.

As an example, the case farm shown in the first column of figures 4 and 5 is completed when the bull is sold presuming that:

1. hours spent observing cows per week will increase from 5 hours to 7 hours in order to maintain the same calving interval,

Figure 6. Yearly Bull Maintenance Costs.

ITEM	1989 ESTIMATES	YOUR BUDGET
VARIABLE COSTS		
Feed		
Hay (4.65 tons @ $90/ton)	419	______
Supplement (1095 lbs. @.07/lbs.)	77	______
TOTAL FEED COSTS	495	______
Other Variable Costs		
Vet. & Medicine	25	______
Utilities	17	______
Bedding	32	______
Misc. and Supplies	89	______
Int. on operating capital 1/	33	______
TOTAL OTHER VARIABLE COSTS	196	______
TOTAL VARIABLE COSTS	691	______
FIXED COSTS		
Labor Charge (70 hours @ $5.00 per hour)	350	______
Interest and Insurance on Bull 2/	52	______
Building and Equipment Charge 3/	360	______
Bull Replacement Costs 4/	100	______
TOTAL FIXED COSTS	862	______
TOTAL COSTS	1553	______

1/ Taken on 1/2 the value of variable costs at a 10% interest rate.

2/ Assumes interest and insurance equals 10% and .43% per year. The bulls value is assumed to be $500. Thus, int. and ins. equals $500 x .1043 = 52

3/ Building and equipment charge equals 20% of new building and equipment costs. New building and equipment costs equal $1,800.

2. total A.I. services will increase from 166 per year to 190 per year, and

3. reproductive culls will increase from 10 per year to 13 per year. Reproductive culling presumably will occur after the 115th days from the first breeding, or 191 days into the lactation.

The third column of figures 4 and 5 respectively show inputs and costs given that the bull is sold. Costs other than labor are approximately the same between keeping the bull and selling the bull -- $14,719 versus $14,714. However, total costs are higher when the bull is sold because more labor is used.

There are several items to note about this example. First, the "sell the bull" alternative does not account for increased genetic potential which may be gained from the total use of A.I. Second, larger numbers of cows allow costs to be spread over more animals. Third, as with the previous example, costs will vary from farm to farm. Thus, there is a need to analyze each farm individually.

Improving a Reproductive Program

Means of improving reproductive programs vary from farm to farm, This section presents some ideas which may aid in improving the reproductive program. Although means vary from farm to farm, one constant is the need for good management.

Managing for Improvement

Managing for improvement involves three steps: planning, staffing, and control. **Planning** involves first determining the goals of the reproductive program. Basic questions to answer include: What rate of genetic improvement do I wish to achieve, what conception rate and heat detection rate am I aiming for, and how many reproductive culls am I willing to tolerate? These questions should be answered in specific terms rather than in vague terms or with a "Let's wait and see how things turn out" attitude. Be realistic when answering these questions. Setting unachievable goals serves no useful purpose. Moreover, as stated before, improving the reproductive program comes at costs to other parts of the dairy operation. In other words, something must be given up in order to improve the reproductive program.

Next, the methods necessary to meet these objectives should be detailed. Elements of the method may include additional labor, use of heat detection aids or estrus control drugs, use of a breeding service, or heavier reliance on a veterinarian. Ramifications of the methods should be analyzed. These include determining physical performance measures such as calving intervals, services per cow, services per conception, and days open. Physical measures serve as means for evaluating the reproductive program once changes are instituted. In addition, changes in costs should be evaluated, using a framework similar to that presented in worksheets 1 through 3. Estimating costs allows determination of the economic advisability of the plan.

Staffing involves determining individuals who are responsible for various aspects of the reproductive program. For example, who is going to determine mating decisions, who is going to be responsible for heat detection, and who is going to inseminate cows? Defining responsibility allows evaluation of individual performance.

Reasonableness when assigning responsibilities needs to be maintained. For example, having one person responsible for all heat detection and breeding is not likely to be effective. That person likely will require off-time for weekends and vacations. During off-time, the person should not be held responsible for any deficiencies. As much as possible, responsibilities should be assigned such that individuals are fully in control of results.

Training of people involved in the reproductive program is an important part of staffing. New employees who are going to have any involvement with the reproductive program should be carefully oriented so that they understand the importance of their responsibilities. Those with A.I. responsibilities should be trained through a formal program. Learning by doing can lead to disastrous results. Even personnel experienced with A.I. should have a refresher course from time to time.

Labor supervisors should work with everyone involved in the reproductive program to build enthusiasm for the importance of this part of the dairy operation. To be done well, many facets of the reproductive program require discipline and patience (e.g., observing cows for heat). Self-discipline is much more effective than a supervisor watching over the shoulder of each employee. Patience comes much easier to people who understand what they are doing, why they are doing it, and the importance of doing it well.

Control functions, involving the evaluation of the reproductive program, should be performed once the reproductive program has been implemented. Have the goals outlined in the planning stage been met? Each question raised in the planning process should be incorporated into the evaluation of performance of the reproductive program. Good yardsticks are the physical measures, particularly if Dairy Herd Improvement records are received. If the goals are not being met, corrective action must be taken. This may involve re-evaluating individual responsibilities or re-examining the entire reproductive program.

Record-keeping

On some farms, heat detection can be improved by knowing which cows should be coming into heat. Targeting cows for heat detection can be aided by simple record-keeping. For example, a weekly calendar listing all targeted breeding dates and projected heats will be helpful. While many farmers can remember many of these dates, keeping a calendar adds structure to the process. Moreover, missing a heat significantly lowers per heat breeding probabilities and extends average calving intervals.

Facilities

The quality and location of facilities can influence the reproductive program. Heifers located at the milking facility rather than on a neighboring or remote farm likely increases the time heifers are observed for heat. Having a head chute or other restraining equipment at heifer locations is likely to improve A.I. effectiveness and convenience. Bull facilities need to be sturdy and constructed to that bulls can be handled safely.

Concluding Comments

Managing the reproductive program offers unique challenges: measures of reproductive performance are difficult to interpret, costs and returns of reproductive practices are difficult to quantify, and solutions to reproductive problems can vary dramatically from farm to farm. While difficult, potential returns from better management may be high. In the final analysis, the most important tool for managing the reproductive program is a clearly defined strategy which will be implemented, whether that be to do nothing, knowing then that improvements are not likely, or to use of more sophisticated means. Once implemented, evaluations and revisions of the strategy will be relatively easy.