

Calf Mortality, Heifer Replacements and Vaccines: TI/59 Programmable Calculator Programs to Estimate the Costs

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Prewaning calfhood diseases such as diarrhea and pneumonia have a devastating effect on a dairyman's efforts to improve production. Losses of up to 30% of the live born calves are all too common. These losses reduce the dairyman's ability to cull cows for low production and may increase dairy expenses due to the purchase of heifer replacements. In some cases, vaccines are available to control these losses, however, these vaccines should be less expensive than the disease itself in order to justify their use. The purpose of this article is to present two programmable calculator programs which help to explain the economic impact of diseases such as calfhood diarrhea and pneumonia. The first program projects the availability of herd replacements while the other program compares the cost of preventing a disease by vaccination to the actual cost of the disease itself.

Heifer Replacements

The availability of heifer replacements for a dairy herd markedly affects the ability of the dairyman to increase production by culling low producing cows. When calf mortality is excessively high, culling for production may be impossible if herd numbers are to remain constant. This program calculates the effect of preweaning calf mortality on the number of available replacements. As a result of the calculations, the dairymen become increasingly aware of the devastating effect of calf mortality. They can also see the benefits of reducing the loss to a level of 5% mortality which is probably attainable in all dairy herds under veterinary supervision. The level is used as a conservative estimate for it is well known that many herds have losses under 1 to 2% and therefore the 5% goal can usually be exceeded with a conscientious effort by the dairyman and veterinarian.

The calculation assumes that all the cows are pregnant and that each cow carries one calf. This is the maximum potential calf yield. This number is then adjusted to reflect the average calving interval of the herd compared to a 12 month interval where all the cows would be expected to calve within the year. For example, with a 13 month calving interval, only 92% of the cows would calve within the year. Next the number of expected calves is reduced by the

average number of abortions per year and by an anticipated loss of 5% due to dystocia at birth. It is further assumed that the live born calves will be divided equally as to sex. The preweaning loss and an additional 5% loss from weaning to first calving is also subtracted to give the final number of calves which would be available as heifer replacements in the herd.

When the program is executed, an estimate of the value of a replacement heifer and a 3-day-old bull calf are entered into the calculation. The overall cull rate must also be entered into the calculation. *Example 1* illustrates the input variables and the outputs of this program. By comparing the present situation to the loss at a goal level of 5% preweaning mortality the dairyman can appreciate his economic loss above an acceptable level.

Example 1.

This is a 100 cow dairy herd with a 13 month calving interval. The herd had 5 abortions last year and culled 30 percent of the cows. They are presently losing 25 percent of the live born calves by weaning. Springing heifer replacement cost \$1000 and 3 day old bull calves are worth \$100 at the local sale barn.

<i>Inputs</i>	<i>Outputs</i>
Cows in herd, 100	HEIFER REPLACEMENTS 31.1
Calving interval, 13	SALE (-BUY) 1.1
Calf mortality, .25	BULL DOLLAR LOST 1091.34
Abortion per year, 5	
Overall cull rate, .30	+ HEIFERS 5% 8.2
Heifer value, 1000	DOLLAR SAVE HEIFERS 8294.23
Bull value, 100	DOLLAR SAVE BULLS 873.07
	TOTAL SAVINGS 9167.30

Presently the dairyman has 31 heifers to choose his 30 replacements from if the herd is to remain at 100 cows. He is losing over \$1000 to dying bull calves. If he improved his calf raising program to the point that only 5% of the live born calves died, he would have 8 more replacements to select the replacements from. The total savings would be over \$9100.

There are at least three major factors which influence the number of heifers available for replacements. A major factor is preweaning calf mortality. Each increase of 1% in mortality decreases the heifer replacements by about 0.33 heifers. Increasing the calving interval above 12 months will also reduce the potential calf crop. Increases in the calving

interval of one month will reduce the calf crop by about 8%. The overall cull rate for the herd affects the number of heifers needed for replacements. An increase of 1% in the overall cull rate decreases the heifers available for the herd or sale by nearly one animal. Controlling these factors will result in a maximum number of heifers being available.

Vaccination and Disease Costs

Dairymen and veterinarians often wonder whether the cost of vaccination to prevent a disease is less than the cost of the disease. A program is available that makes this comparison. The cost of vaccination is calculated as the cost of the

Table 1. Heifer Replacements.

Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol
000	76	LBL	051	55	‡	101	69	OP	151	42	STO	201	65	X
001	11	A	052	02	2	102	01	01	152	22	22	202	43	RCL
002	42	STO	053	95	=	103	03	3	153	43	RCL	203	16	16
003	10	10	054	42	STO	104	05	5	154	21	21	204	95	=
004	91	R/S	055	17	17	105	00	0	155	75	-	205	42	STO
005	76	LBL	056	43	RCL	106	00	0	156	43	RCL	206	24	24
006	12	B	057	17	17	107	03	3	157	22	22	207	69	OP
007	42	STO	058	65	X	108	05	5	158	95	=	208	00	00
008	11	11	059	43	RCL	109	01	1	159	42	STO	209	01	1
009	91	R/S	060	12	12	110	07	7	160	23	23	210	04	4
010	76	LBL	061	95	=	111	03	3	161	69	OP	211	04	4
011	13	C	062	42	STO	112	03	3	162	00	00	212	01	1
012	42	STO	063	18	18	113	69	OP	163	03	3	213	02	2
013	12	12	064	43	RCL	114	02	02	164	06	6	214	07	7
014	91	R/S	065	17	17	115	02	2	165	01	1	215	02	2
015	76	LBL	066	75	-	116	07	7	166	03	3	216	07	7
016	14	D	067	43	RCL	117	01	1	167	02	2	217	00	0
017	42	STO	068	18	18	118	03	3	168	07	7	218	00	0
018	13	13	069	95	=	119	01	1	169	01	1	219	69	OP
019	91	R/S	070	42	STO	120	05	5	170	07	7	220	01	01
020	76	LBL	071	19	19	121	03	3	171	05	5	221	01	1
021	16	A'	072	43	RCL	122	00	0	172	05	5	222	06	6
022	42	STO	073	19	19	123	03	3	173	69	OP	223	03	3
023	14	14	074	65	X	124	07	7	174	01	01	224	02	2
024	91	R/S	075	93	.	125	69	OP	175	02	2	225	02	2
025	76	LBL	076	00	0	126	03	03	176	00	0	226	07	7
026	17	B'	077	05	5	127	03	3	177	01	1	227	00	0
027	42	STO	078	95	=	128	06	6	178	04	4	228	00	0
028	15	15	079	42	STO	129	00	0	179	04	4	229	02	2
029	91	R/S	080	20	20	130	00	0	180	01	1	230	07	7
030	76	LBL	081	43	RCL	131	00	0	181	04	4	231	69	OP
031	18	C'	082	19	19	132	00	0	182	05	5	232	02	02
032	42	STO	083	75	-	133	00	0	183	05	5	233	03	3
033	16	16	084	43	RCL	134	00	0	184	06	6	234	02	2
034	91	R/S	085	20	20	135	00	0	185	69	OP	235	03	3
035	76	LBL	086	95	=	136	00	0	186	02	02	236	06	6
036	15	E	087	42	STO	137	69	OP	187	69	OP	237	03	3
037	01	1	088	21	21	138	04	04	188	05	05	238	07	7
038	02	2	089	69	OP	139	69	OP	189	43	RCL	239	00	0
039	55	‡	090	00	00	140	05	05	190	23	23	240	00	0
040	43	RCL	091	02	2	141	43	RCL	191	99	PRT	241	00	0
041	11	11	092	03	3	142	21	21	192	98	ADV	242	00	0
042	95	=	093	01	1	143	99	PRT	193	43	RCL	243	69	OP
043	65	X	094	07	7	144	98	ADV	194	23	23	244	03	03
044	43	RCL	095	02	2	145	43	RCL	195	65	X	245	69	OP
045	10	10	096	04	4	146	10	10	196	43	RCL	246	05	05
046	95	=	097	02	2	147	65	X	197	15	15	247	43	RCL
047	75	-	098	01	1	148	43	RCL	198	95	=	248	24	24
048	43	RCL	099	01	1	149	14	14	199	43	RCL	249	99	PRT
049	13	13	100	07	7	150	95	=	200	18	18	250	98	ADV
050	95	=												

Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol
251	43	RCL	301	01	1	351	00	0	401	75	-	451	43	RCL
252	17	17	302	07	7	352	00	0	402	43	RCL	452	31	31
253	65	X	303	02	2	353	03	3	403	25	25	453	99	PRT
254	93	.	304	04	4	354	06	6	404	95	=	454	98	ADV
255	00	0	305	69	OP	355	69	OP	405	65	X	455	85	+
256	05	5	306	01	01	356	01	01	406	43	RCL	456	43	RCL
257	95	=	307	02	2	357	01	1	407	16	16	457	30	30
258	42	STO	308	01	1	358	03	3	408	95	=	458	95	=
259	25	25	309	01	1	359	04	4	409	42	STO	459	42	STO
260	43	RCL	310	07	7	360	02	2	410	31	31	460	32	32
261	17	17	311	03	3	361	01	1	411	69	OP	461	69	OP
262	75	-	312	05	5	362	07	7	412	00	00	462	00	00
263	43	RCL	313	03	3	363	00	0	413	01	1	463	03	3
264	25	25	314	06	6	364	00	0	414	03	6	464	07	7
265	95	=	315	00	0	365	02	2	415	03	3	465	00	0
266	42	STO	316	00	0	366	03	3	416	02	2	466	00	0
267	26	26	317	69	OP	367	69	OP	417	02	2	467	03	3
268	43	RCL	318	02	02	368	02	02	418	07	7	468	06	6
269	26	26	319	00	0	369	01	1	419	00	0	469	01	1
270	65	X	320	05	6	370	07	7	420	00	0	470	03	3
271	93	.	321	06	6	371	02	2	421	03	3	471	04	4
272	00	0	322	01	1	372	04	4	422	06	6	472	02	2
273	05	5	323	00	0	373	02	2	423	69	OP	473	69	OP
274	95	=	324	00	0	374	01	1	424	01	01	474	01	01
275	42	STO	325	00	0	375	01	1	425	01	1	475	69	OP
276	27	27	326	00	0	376	07	7	426	03	3	476	05	05
277	43	RCL	327	00	0	377	03	3	427	04	4	477	43	RCL
278	26	26	328	00	0	378	05	5	428	02	2	478	32	32
279	75	-	329	69	OP	379	69	OP	429	01	1	479	99	PRT
280	43	RCL	330	03	03	380	03	03	430	07	7			
281	27	27	331	69	OP	381	03	3	431	00	0			
282	95	=	332	05	05	382	06	6	432	00	0			
283	42	STO	333	43	RCL	383	00	0	433	01	1			
284	28	28	334	29	29	384	00	0	434	04	4			
285	43	RCL	335	99	PRT	385	00	0	435	69	OP			
286	28	28	336	98	ADV	386	00	0	436	02	02			
287	75	-	337	65	X	387	00	0	437	04	4			
288	43	RCL	338	43	RCL	388	00	0	438	01	1			
289	21	21	339	15	15	389	00	0	439	02	2			
290	95	=	340	95	=	390	00	0	440	07	7			
291	42	STO	341	42	STO	391	69	OP	441	02	2			
292	29	29	342	30	30	392	04	04	442	07	7			
293	69	OP	343	69	OP	393	69	OP	443	03	3			
294	00	00	344	00	00	394	05	05	444	06	6			
295	04	4	345	01	1	395	43	RCL	445	00	0			
296	07	7	346	06	6	396	30	30	446	00	0			
297	00	0	347	03	3	397	99	PRT	447	69	OP			
298	00	0	348	02	2	398	98	ADV	448	03	03			
299	02	2	349	02	2	399	43	RCL	449	69	OP			
300	03	3	350	07	7	400	18	18	450	05	05			

vaccine per cow multiplied by the number of cows. The cost of the disease is calculated using the number of live born calves as derived in the previous heifer replacement program. The cost of mortality is calculated by multiplying the number of dying animals times their estimated value. The cost of treating sick but surviving calves is determined by the cost of treatment per day, the average number of days treated and the time per day to treat the sick calves. Labor is valued at \$3.50 per hour. *Example 2* illustrates the use of this program.

Example 2

This is a 100 cow dairy herd with a 13.5 month calving interval. The preweaning morbidity to diarrhea is 20 percent and the mortality is 10 percent. It costs \$10 per day to treat each sick calf; treatment lasts 5 days and takes 15 minutes per calf per day. Dying heifers are replaced with pregnant heifers due to calve which cost \$1500 and bull calves are valued at \$100 at the local sale barn. Corona virus was isolated from the dying calves and the vaccine to prevent this

Table 2. Calf Vaccination and Mortality Costs.

Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol
000	76	LBL	051	01	01	101	09	09	151	65	X
001	11	A	052	65	X	102	95	=	152	03	3
002	42	STO	053	43	RCL	103	42	STO	153	93	.
003	01	01	054	06	06	104	23	23	154	05	5
004	91	R/S	055	95	=	105	43	RCL	155	95	=
005	76	LBL	056	42	STO	106	14	14	156	42	STO
006	12	B	057	11	11	107	55	÷	157	20	20
007	42	STO	058	01	1	108	02	2	158	43	RCL
008	02	02	059	02	2	109	65	X	159	20	20
009	91	R/S	060	55	÷	110	43	RCL	160	65	X
010	76	LBL	061	43	RCL	111	04	04	161	43	RCL
011	13	C	062	02	02	112	65	X	162	14	14
012	42	STO	063	65	X	113	43	RCL	163	65	X
013	03	03	064	43	RCL	114	07	07	164	43	RCL
014	91	R/S	065	01	01	115	95	=	165	03	03
015	76	LBL	066	95	=	116	42	STO	166	95	=
016	14	D	067	42	STO	117	16	16	167	42	STO
017	42	STO	068	12	12	118	43	RCL	168	21	21
018	04	04	069	43	RCL	119	14	14	169	69	OP
019	91	R/S	070	12	12	120	55	÷	170	00	00
020	76	LBL	071	65	X	121	02	2	171	04	4
021	15	E	072	93	.	122	95	=	172	02	2
022	42	STO	073	00	0	123	42	STO	173	01	1
023	05	05	074	05	5	124	17	17	174	03	3
024	91	R/S	075	95	=	125	43	RCL	175	01	1
025	76	LBL	076	42	STO	126	04	04	176	05	5
026	16	A'	077	13	13	127	55	÷	177	01	1
027	42	STO	078	43	RCL	128	02	2	178	05	5
028	06	06	079	12	12	129	95	=	179	02	2
029	91	R/S	080	75	-	130	42	STO	180	04	4
030	76	LBL	081	43	RCL	131	18	18	181	69	OP
031	17	B'	082	13	13	132	43	RCL	182	01	01
032	42	STO	083	95	=	133	17	17	183	03	3
033	07	07	084	42	STO	134	65	X	184	01	1
034	91	R/S	085	14	14	135	43	RCL	185	01	1
035	76	LBL	086	43	RCL	136	18	18	186	07	7
036	18	C'	087	14	14	137	65	X	187	00	0
037	42	STO	088	65	X	138	43	RCL	188	00	0
038	08	08	089	43	RCL	139	08	08	189	01	1
039	91	R/S	090	03	03	140	95	=	190	05	5
040	76	LBL	091	65	X	141	42	STO	191	03	3
041	19	D'	092	43	RCL	142	19	19	192	02	2
042	42	STO	093	05	05	143	43	RCL	193	69	CP
043	09	09	094	95	=	144	10	10	194	02	02
044	91	R/S	095	42	STO	145	55	÷	195	03	3
045	76	LBL	096	15	15	146	06	6	196	06	6
046	10	E'	097	43	RCL	147	00	0	197	03	3
047	42	STO	098	15	15	148	65	X	198	07	7
048	10	10	099	65	X	149	43	RCL	199	00	0
049	91	R/S	100	43	RCL	150	09	09	200	00	0
050	43	RCL									

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Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol	Program Location	Key Code	Key Symbol
201	00	0	251	01	1	301	02	2	351	00	0
202	00	0	252	07	7	302	07	7	352	00	0
203	00	0	253	04	4	303	03	3	353	69	OP
204	00	0	254	04	4	304	02	2	354	02	02
205	69	OP	255	00	0	305	03	3	355	69	OP
206	03	03	256	00	0	306	06	6	356	05	05
207	69	OP	257	02	2	307	69	OP	357	98	ADV
208	05	05	258	07	7	308	02	02	358	43	RCL
209	98	ADV	259	01	1	309	03	3	359	19	19
210	43	RCL	260	03	3	310	06	6	360	99	PRT
211	11	11	261	69	OP	311	00	0	361	98	ADV
212	99	PRT	262	01	01	312	00	0	362	98	ADV
213	98	ADV	263	01	1	313	00	0	363	43	RCL
214	98	ADV	264	04	4	314	00	0	364	23	23
215	69	OP	265	03	3	315	00	0	365	85	+
216	00	00	266	02	2	316	00	0	366	43	RCL
217	03	3	267	03	3	317	00	0	367	21	21
218	07	7	268	05	5	318	00	0	368	85	+
219	04	4	269	00	0	319	69	OP	369	43	RCL
220	04	4	270	00	0	320	03	03	370	16	16
221	00	0	271	00	0	321	69	OP	371	85	+
222	00	0	272	00	0	322	05	05	372	43	RCL
223	01	1	273	69	OP	323	98	ADV	373	19	19
224	05	5	274	02	02	324	43	RCL	374	95	=
225	03	3	275	69	OP	325	16	16	375	42	STO
226	02	2	276	05	05	326	99	PRT	376	22	22
227	69	OP	277	98	ADV	327	98	ADV	377	69	OP
228	01	01	278	43	RCL	328	98	ADV	378	00	00
229	03	3	279	21	21	329	69	OP	379	01	1
230	06	6	280	99	PRT	330	00	00	380	06	6
231	03	3	281	98	ADV	331	01	1	381	02	2
232	07	7	282	98	ADV	332	04	4	382	04	4
233	00	0	283	69	OP	333	04	4	383	03	3
234	00	0	284	00	00	334	01	1	384	06	6
235	00	0	285	02	2	335	02	2	385	01	1
236	00	0	286	03	3	336	07	7	386	07	7
237	00	0	287	01	1	337	02	2	387	01	1
238	00	0	288	07	7	338	07	7	388	03	3
239	69	OP	289	02	2	339	00	0	389	69	OP
240	02	02	290	04	4	340	00	0	390	01	01
241	69	OP	291	02	2	341	69	OP	391	03	3
242	05	05	292	01	1	342	01	01	392	06	6
243	98	ADV	293	01	1	343	02	2	393	01	1
244	43	RCL	294	07	7	344	07	7	394	07	7
245	23	23	295	69	OP	345	03	3	395	00	0
246	99	PRT	296	01	01	346	02	2	396	00	0
247	98	ADV	297	03	3	347	03	3	397	01	1
248	98	ADV	298	05	5	348	06	6	398	05	5
249	69	OP	299	00	0	349	03	3	399	03	3
250	00	00	300	00	0	350	06	6	400	02	2

disease cost \$10 per cow.

<i>Inputs</i>	<i>Outputs</i>
Number of cows, 100	VACCINE COST 1000
Calving interval, 13.5	TX COST 844.44
Percent morbidity, .20	EX LABOR 78.88
Percent mortality, .10	HEIFER LOSS 6333.33
Calf treatment cost per day, 10	BULL LOSS 211.11
Vaccine cost per cow, 10	DISEASE COST 7462.77
Heifer cost, 1500	
Bull cost, 100	
Days treatment per calf, 5	
Time per day to treat calf, 15	

In this case, the cost of the vaccine is much less than the cost of the disease. Even if the dying heifers were replaced with young calves valued at \$150, the cost of vaccination (\$10.00 per cow) would still be justified over the cost of the disease (\$17.62 per cow). Actually the dairyman could afford to pay \$17.62 per cow for vaccination and break even on cost.

Calculator Programming

The programs presented in this article are designed for use with the Texas Instrument Programmable 59 calculator and PC-100C printer. The heifer replacement program is listed in *Table 1* while the calf vaccination and mortality cost program is presented in *Table 2*. Changes in the programs to suit the user's particular situation can be made as the programs are keyed into the calculator. Programs can be saved on magnetic cards for later use. The example situations can be used to check the accuracy of the programs once they are keyed into the calculator. *Tables 3 & 4* list the steps for entering the variables into the replacement program and the calf vaccination and mortality cost program respectively.

Conclusions

Inability to raise replacement heifers can greatly reduce the dairyman's ability to increase his herd production.

Calfhood mortality, overall cull rate and calving interval may influence the number of replacements necessary to maintain herd numbers and yet allow for culling of poor producing cows. Vaccines are available to control some calfhood diseases; however, the cost of vaccinating should be less than the actual cost of the disease. Two programs are presented to aid the veterinarian and his dairy clients in evaluating the economic considerations of heifer replacements and vaccination programs while becoming more aware of the cost of calfhood diseases.

TABLE 3. Entering Variables for Replacement Program

<u>Enter</u>	<u>Press Key</u>
Cows in herd	A
Calving interval	B
Calf mortality (.00)	C
Abortions per year	D
Overall cull rate (.00)	2nd, A
Heifer value	2nd, B
Bull value	2nd, C
Run program	E

TABLE 4. Entering Variables for Calf Vaccination and Mortality Cost Program.

<u>Enter</u>	<u>Press Key</u>
Cows in herd	A
Calving interval	B
Morbidity (.00)	C
Mortality (.00)	D
Calf treatment cost per day	E
Vaccine cost per cow	2nd, A
Heifer cost	2nd, B
Bull cost	2nd, C
Days treatment per calf	2nd, D
Time per day to treat calf	2nd, E
Run program	R/S