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TABLE 11-D-2 (Continued)

Age in years and months	Holstein—Region 4				Holstein—Region 5				Holstein—Region 6			
	Factors by season of calving		Factors by season of calving		Factors by season of calving		Factors by season of calving		Factors by season of calving		Factors by season of calving	
	Nov. to June	July to Oct.	Nov. to June	July to Oct.	Nov. to June	July to Oct.	Nov. to June	July to Oct.	Nov. to June	July to Oct.	Nov. to June	July to Oct.
1-9	Milk 1.50	Fat 1.46	Milk 1.36	Fat 1.34	Milk 1.43	Fat 1.40	Milk 1.38	Fat 1.35	Milk 1.45	Fat 1.42	Milk 1.41	Fat 1.39
2-0	Milk 1.33	Fat 1.30	Milk 1.28	Fat 1.25	Milk 1.31	Fat 1.28	Milk 1.28	Fat 1.26	Milk 1.38	Fat 1.35	Milk 1.35	Fat 1.32
2-6	Milk 1.25	Fat 1.22	Milk 1.23	Fat 1.20	Milk 1.24	Fat 1.21	Milk 1.21	Fat 1.19	Milk 1.29	Fat 1.26	Milk 1.27	Fat 1.24
3-0	Milk 1.21	Fat 1.19	Milk 1.17	Fat 1.14	Milk 1.20	Fat 1.17	Milk 1.17	Fat 1.14	Milk 1.23	Fat 1.21	Milk 1.19	Fat 1.17
3-6	Milk 1.13	Fat 1.11	Milk 1.14	Fat 1.11	Milk 1.13	Fat 1.11	Milk 1.12	Fat 1.10	Milk 1.17	Fat 1.15	Milk 1.17	Fat 1.15
4-0	Milk 1.11	Fat 1.10	Milk 1.07	Fat 1.05	Milk 1.11	Fat 1.08	Milk 1.08	Fat 1.06	Milk 1.11	Fat 1.09	Milk 1.08	Fat 1.07
4-6	Milk 1.05	Fat 1.04	Milk 1.06	Fat 1.04	Milk 1.06	Fat 1.04	Milk 1.05	Fat 1.03	Milk 1.08	Fat 1.06	Milk 1.08	Fat 1.07
5-0	Milk 1.05	Fat 1.03	Milk 1.02	Fat 1.01	Milk 1.06	Fat 1.04	Milk 1.03	Fat 1.01	Milk 1.06	Fat 1.05	Milk 1.03	Fat 1.02
5-6	Milk 1.02	Fat 1.01	Milk 1.02	Fat 1.01	Milk 1.02	Fat 1.01	Milk 1.03	Fat 1.01	Milk 1.03	Fat 1.03	Milk 1.03	Fat 1.02
6-0	Milk 1.01	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.01	Fat 1.01	Milk 1.01	Fat 1.00	Milk 1.01	Fat 1.01	Milk 1.02	Fat 1.01
6-6	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.01	Fat 1.01
7-0	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00
8-0	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.01	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00	Milk 1.00	Fat 1.00
9-0	Milk 1.01	Fat 1.01	Milk 1.02	Fat 1.03	Milk 1.01	Fat 1.02	Milk 1.01	Fat 1.02	Milk 1.01	Fat 1.02	Milk 1.02	Fat 1.02
10-0	Milk 1.02	Fat 1.03	Milk 1.03	Fat 1.04	Milk 1.03	Fat 1.04	Milk 1.02	Fat 1.03	Milk 1.04	Fat 1.04	Milk 1.03	Fat 1.04
11-0	Milk 1.02	Fat 1.04	Milk 1.03	Fat 1.05	Milk 1.05	Fat 1.06	Milk 1.04	Fat 1.05	Milk 1.07	Fat 1.07	Milk 1.05	Fat 1.06
12-0	Milk 1.04	Fat 1.05	Milk 1.04	Fat 1.07	Milk 1.06	Fat 1.08	Milk 1.06	Fat 1.08	Milk 1.09	Fat 1.09	Milk 1.09	Fat 1.09
13-0	Milk 1.06	Fat 1.08	Milk 1.06	Fat 1.10	Milk 1.08	Fat 1.10	Milk 1.08	Fat 1.09	Milk 1.11	Fat 1.11	Milk 1.13	Fat 1.13
14-0	Milk 1.11	Fat 1.14	Milk 1.12	Fat 1.16	Milk 1.13	Fat 1.15	Milk 1.12	Fat 1.13	Milk 1.12	Fat 1.13	Milk 1.17	Fat 1.18

Table 12.2
Age Adjustment Factors for Different Breeds*

Age (months)	Breed				
	Ayrshire	Guernsey	Holstein	Jersey	Brown Swiss
23	1.30	1.24	1.38	1.34	1.54
24	1.28	1.22	1.35	1.31	1.51
25	1.25	1.20	1.33	1.29	1.48
26	1.22	1.18	1.31	1.28	1.45
27	1.20	1.17	1.29	1.27	1.43
28	1.19	1.16	1.27	1.27	1.40
29	1.19	1.15	1.26	1.27	1.38
30	1.18	1.15	1.25	1.27	1.36
31	1.17	1.15	1.24	1.26	1.34
32	1.17	1.14	1.23	1.24	1.32
33	1.16	1.13	1.23	1.23	1.31
34	1.14	1.13	1.22	1.21	1.30
35	1.14	1.13	1.22	1.20	1.23
36	1.14	1.12	1.21	1.18	1.26
38	1.15	1.10	1.19	1.16	1.22
40	1.14	1.08	1.16	1.13	1.19
42	1.11	1.07	1.14	1.11	1.17
44	1.10	1.06	1.12	1.10	1.15
46	1.10	1.06	1.11	1.08	1.14
48	1.10	1.06	1.10	1.07	1.12
50	1.08	1.04	1.08	1.06	1.11
52	1.06	1.03	1.06	1.05	1.10
54	1.05	1.02	1.05	1.04	1.08
56	1.04	1.01	1.04	1.04	1.07
58	1.03	1.01	1.04	1.03	1.06
60	1.02	1.01	1.02	1.02	1.05
66	1.00	1.00	1.00	1.00	1.02
72	1.00	1.00	1.00	1.00	1.00
78	1.00	1.00	1.00	1.00	1.00
84	1.00	1.00	1.00	1.00	1.00
90	1.03	1.00	1.01	1.02	1.00
96	1.03	1.00	1.01	1.02	1.00
102	1.03	1.01	1.02	1.03	1.01
108	1.03	1.01	1.02	1.03	1.01
114	1.03	1.01	1.04	1.05	1.03
120	1.03	1.01	1.04	1.05	1.03

*Partial set of age adjustment factors used in New York State before different age adjustment factors were developed for different seasons of freshening.

Table 12.3
 Multiplicative Factors for Joint Adjustment of Milk Yield for Month and Age of Calving

Age (months)	Month of calving											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
24	1.34	1.36	1.37	1.39	1.40	1.40	1.40	1.37	1.35	1.33	1.32	1.35
25	1.31	1.32	1.34	1.35	1.37	1.36	1.37	1.36	1.33	1.30	1.30	1.31
26	1.29	1.30	1.31	1.32	1.35	1.33	1.34	1.34	1.31	1.28	1.28	1.28
27	1.27	1.29	1.29	1.31	1.33	1.32	1.33	1.32	1.30	1.26	1.26	1.26
28	1.25	1.27	1.28	1.29	1.31	1.30	1.32	1.30	1.28	1.25	1.24	1.24
29	1.23	1.25	1.26	1.27	1.29	1.29	1.30	1.29	1.26	1.23	1.23	1.22
30	1.22	1.24	1.24	1.26	1.27	1.28	1.28	1.27	1.25	1.22	1.21	1.20
31	1.21	1.22	1.23	1.24	1.26	1.26	1.27	1.26	1.23	1.20	1.20	1.19
32	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.25	1.22	1.19	1.19	1.19
55	0.96	0.97	0.97	0.99	1.01	1.03	1.04	1.04	1.01	0.97	0.96	0.97

Source: Miller, P. D., et al. 1970. *J. Dairy Sci.* 53:351-357.

Table 12.7
 Mature Equivalent 305-day Milk Production Adjustment Factors for Days Open, by Breed^a

Days open	Breed				
	Ayrshire	Guernsey	Holstein	Jersey	Brown Swiss
20-29	1.20	1.17	1.20	1.22	1.20
30-39	1.15	1.15	1.17	1.16	1.15
40-49	1.12	1.12	1.12	1.14	1.14
50-59	1.10	1.07	1.08	1.09	1.08
60-69	1.06	1.06	1.05	1.06	1.05
70-79	1.03	1.02	1.03	1.03	1.02
80-89	1.00	1.00	1.01	1.01	1.00
90-99	1.00	1.00	1.00	1.00	1.00
100-109	.98	.99	.99	.99	1.00
110-119	.97	.99	.98	.99	.99
120-129	.96	.99	.98	.98	.99
130-139	.96	.97	.97	.97	.99
140-149	.96	.95	.97	.97	.97
150-159	.96	.95	.96	.97	.96
160-169	.94	.95	.96	.96	.95
170-179	.94	.95	.96	.95	.95
180-189	.94	.95	.95	.95	.95
190-199	.94	.94	.95	.94	.94
200-209	.93	.94	.95	.94	.94
210-219	.93	.93	.94	.94	.93

^aSource: Schaeffer, L. R., R. W. Everett, and C. R. Henderson. 1973. *J. Dairy Sci.* 56:602-607.
^bBase equals the M.E. 305-day milk yield of a cow open between 90 and 99 days.

Table 13.1
Weighting Factors to Be Used for Estimating Real Producing Ability from a Cow's Own Records and the Proof of Her Sire When Repeatability is 50%

Number of records on cow	Number of daughters in sire proof ^a													
	0		10		20		40		70		100		200 or more	
	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2
1	.50	.00	.49	.21	.48	.30	.48	.38	.47	.43	.47	.46	.47	.49
2	.67	.00	.66	.14	.65	.20	.65	.26	.64	.29	.64	.31	.64	.34
3	.75	.00	.74	.10	.74	.15	.73	.20	.73	.22	.73	.24	.73	.25
4	.80	.00	.79	.08	.79	.12	.78	.16	.78	.18	.78	.19	.78	.21
5	.83	.00	.83	.07	.82	.10	.82	.13	.82	.15	.82	.16	.82	.17
6	.86	.00	.85	.06	.85	.09	.85	.11	.84	.13	.84	.14	.84	.15
7	.88	.00	.87	.05	.87	.08	.86	.10	.86	.11	.86	.12	.86	.13
8	.88	.00	.88	.05	.88	.07	.88	.09	.88	.10	.88	.11	.88	.12
9	.89	.00	.90	.04	.89	.06	.89	.08	.89	.09	.89	.10	.89	.10
10	.90	.00	.90	.04	.90	.06	.90	.07	.90	.08	.90	.09	.90	.09

^a b_1 is the weight given to the cow's average difference from the herd average, b_2 is the weight given to the sire's daughter average expressed as a difference from the herd average.

Table 13.2
Weighting Factors for Estimating the Genetic Value of a Cow for Milk Yield from Her Own Records plus Records on Her Dam or Her Daughters, or the Daughter Proof of Her Sire^a

Number of records on her dam	Number of own records											
	1		2		3		4		5		6	
	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2
0	.25	.00	.33	.00	.38	.00	.40	.00	.42	.00	.43	.00
1	.24	.10	.32	.09	.36	.08	.38	.08	.40	.07	.41	.07
2	.23	.13	.31	.11	.35	.11	.38	.10	.40	.10	.41	.10
3	.23	.14	.31	.13	.35	.12	.38	.12	.39	.11	.40	.11
4 or more	.23	.16	.31	.14	.35	.14	.38	.13	.39	.12	.40	.12

Number of daughters with single records	Number of records in sire's proof											
	0		1		2		3		4		5	
	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2
0	.25	.00	.33	.00	.38	.00	.40	.00	.42	.00	.43	.00
1	.24	.10	.32	.09	.36	.08	.38	.08	.40	.07	.41	.07
2	.23	.18	.31	.16	.35	.15	.37	.14	.39	.14	.40	.14
3	.22	.26	.29	.24	.33	.22	.36	.21	.37	.21	.38	.21
4	.21	.33	.28	.30	.32	.29	.34	.28	.36	.27	.37	.26
5	.20	.40	.26	.42	.31	.34	.33	.33	.35	.33	.36	.32

Number of records in sire's proof	Number of records on her dam													
	0		10		20		40		70		100		200 or more	
	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2
0	.25	.00	.33	.00	.38	.00	.40	.00	.42	.00	.43	.00		
10	.23	.31	.31	.28	.35	.26	.38	.25	.39	.24	.40	.24		
20	.22	.44	.30	.40	.34	.38	.36	.36	.38	.35	.39	.35		
40	.21	.57	.29	.52	.33	.49	.35	.47	.37	.46	.38	.45		
70	.21	.65	.28	.59	.32	.56	.35	.54	.36	.53	.37	.52		
100	.21	.69	.28	.62	.32	.59	.34	.57	.36	.56	.37	.55		
200	.20	.74	.28	.67	.32	.64	.34	.62	.35	.60	.37	.59		

^a b_1 is the weight for the average of the cow's own records, b_2 is the weight for the average of records of her relative.

TABLE 6.1 Approximate Heritability of Some Traits in Dairy Cattle

Trait	Approximate heritability
Yield:	
M.E. milk	.30
M.E. fat	.25
Milk (deviation from herd mates)	.25
Fat (deviation from herd mates)	.25
Protein	.25
Solids-not-fat	.25
Fat percent	.50
Protein percent	.50
Solids-not-fat percent	.50
Disease Susceptibility:	
Mastitis	.10
Milk fever	.05
Ketosis	.05
Breeding problems	.05
Cystic ovaries	.05
Intensity of edema	.05
Persistency of edema	.10
Milking Characteristics:	
Milking speed	.30
Milk leak	.20
Body Characteristics:	
Final type score	.30
Body weight	.35
Upstandingness	.50
Dairy character	.25
Levelness of rump	.25
Height of tail setting	.25
Height of thurls	.25
Depth of body	.25
Tightness of shoulders	.25
Straightness of hocks	.20
Strength of pasterns	.15
Typical head	.15
Strength of head	.45
Arch of back	.15
Straightness of legs (rear view)	.15
Smoothness of pelvic arch	.15
Heel depth	.10

TABLE 6.1 Approximate Heritability of Some Traits in Dairy Cattle (Continued)

Trait	Approximate heritability
Udder Characteristics:	
Rear udder length	.15
Rear udder bulginess	.10
Rear udder funnelness	.10
Fore udder length	.15
Fore udder bulginess	.10
Fore udder funnelness	.10
Udder quality	.05
Depth of udder	.15
Forward slope of udder	.10
Height of rear udder	.20
Strength of rear udder attachment	.15
Strength of forward udder attachment	.15
Udder halving	.15
Udder quartering	.10
Rear teats forward	.10
Rear teats sideways	.30
Forward teats forward	.25
Forward teats sideways	.15
Rear teat spacing	.25
Forward teat spacing	.25
Rear to fore teat spacing	.30
Behavioral Characteristics:	
Excitability	.25
Feeding speed	.15

Source: Research by H. D. Norman, R. L. Powell, L. D. Van Vleck, J. M. White, W. E. Vinson, and other sources.

conditions. However, the heritability values shown in Table 6.1 should be in the range of the effective heritabilities that exist in the United States and will be useful for calculating selection indexes.

Standard deviations are shown in Table 6.2 for the same traits whose heritabilities were given in Table 6.1. The scale of measurement is also given for each trait. This scale must be known to determine the merit of each cow and the economic value of a unit of change in regard to the

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TABLE 6.2 Phenotypic Standard Deviations of Some Traits in Dairy Cattle

Trait	Phenotypic standard deviation	Scale of measurement
Yield:		
M.E. milk yield (Holstein, Brown Swiss)	2,500	lb
M.E. milk yield (Other breeds)	2,000	lb
M.E. fat yield (Holstein, Brown Swiss)	100	lb
M.E. fat yield (Other breeds)	80	lb
Milk, deviation from herd mates (Holstein, Brown Swiss)	2.4%	lb
Milk, deviation from herd mates (Other breeds)	1.9%	lb
Fat, deviation from herd mates (Holstein, Brown Swiss)	.96	lb
Fat, deviation from herd mates (Other breeds)	.76	lb
Protein yield	.63	lb
Solids-not-fat yield	.125	lb
Fat content	0.4	%
Protein content	0.3	%
Solids-not-fat content	0.5	%
Disease Susceptibility:		
Mastitis	0.4	1) No Mastitis (2) Mastitis
Milk fever	0.2	1) No milk fever (2) Milk fever
Ketosis	0.3	1) No ketosis (2) Ketosis
Breeding problems	.08	1) None (2) Breeding problems
Cystic ovaries	.03	1) None (2) Cystic ovaries
Intensity of edema	.05	1) None to slight (2) Moderate (3) Severe
Persistency of edema	.05	1) One week (2) Two weeks (3) More than 2 weeks
Milking Characteristics:		
Milking speed	0.6	1) Slow (2) Average (3) Fast
Milk leak	0.3	1) Non-leaker (2) Leaks milk (no injury)
Body Characteristics:		
Body weight	100	lb
Upstandingness	0.6	1) Low set (2) Medium (3) Tall
Dairy character	0.3	1) Thick (2) Moderate (3) Sharp
Levelness of rump	0.5	1) Sloping (2) Slight slope (3) Nearly level
Height of tail setting	0.4	1) Low (2) Intermediate (3) High
Height of thurls	0.4	1) Low (2) Intermediate (3) High
Depth of body	0.2	1) Shallow (2) Intermediate for age (3) Deep

TABLE 6.2 Phenotypic Standard Deviations of Some Traits in Dairy Cattle (Continued)

Trait	Phenotypic standard deviation	Scale of measurement
Body Characteristics (Continued)		
Tightness of shoulder	0.5	1) Severely winged (2) Loose (3) Tight
Straightness of hocks	0.6	1) Slicked (2) Intermediate (3) Nearly straight (4) Too straight
Strength of pasterns	0.6	1) Weak (2) Intermediate (3) Strong
Typical head	0.4	1) Not typical (2) Typical
Strength of head	0.2	1) Weak (2) Intermediate (3) Coarse
Arch of back	0.6	1) Severely swayed (2) Low back (3) Straight (4) High back
Straightness of legs (rear view)	0.6	1) Severe fore-out (2) Moderate fore-out (3) None to slight fore-out
Smoothness of pelvic arch	0.4	1) Not smooth (2) Smooth
Heel depth	0.6	1) Shallow (2) Intermediate (3) Deep
Udder Characteristics:		
Rear udder length	0.6	1) Short (2) Intermediate (3) Long
Rear udder bulginess	0.2	1) Not bulgy (2) Bulgy
Rear udder funnelness	0.2	1) Not funnelled (2) Funnel-shaped
Fore udder length	0.6	1) Short (2) Intermediate (3) Long
Fore udder bulginess	0.3	1) Not bulgy (2) Bulgy
Fore udder funnelness	0.2	1) Not funnelled (2) Funnel-shaped
Udder quality	0.6	1) None (2) Intermediate (3) Collapsed after milking (4) Too deep
Depth of udder	0.5	1) Shallow (2) Intermediate (3) Deep
Forward slope of udder	0.6	1) Rear higher than fore (2) Nearly level (3) Slight forward tilt (4) Fore higher than rear (5) Pronounced tilt
Height of rear udder	0.6	1) Low (2) Intermediate (3) High
Strength of rear udder attachment	0.7	1) Broken away (2) Loose (3) Intermediate (4) Strong
Strength of forward udder attachment	0.6	1) Broken away (2) Loose (3) Intermediate (4) Strong
Udder halving	0.5	1) Poor nearly flat (2) Cleft 1-2 F.W. (3) Cleft 2-3 F.W. (4) Cleft more than 3 F.W.
Udder quartering	0.5	1) Poor nearly flat (2) Cleft 1-2 F.W. (3) Cleft 2-3 F.W. (4) Cleft more than 3 F.W.
Rear teats forward	0.2	1) Not forward (2) Pointing forward
Rear teats sideways	0.2	1) Not sideways (2) Pointing sideways
Forward teats forward	0.2	1) Not forward (2) Pointing forward
Forward teats sideways	0.3	1) Not sideways (2) Pointing sideways
Rear teat spacing	0.4	1) Too close (2) Well-spaced (3) The wide
Forward teat spacing	0.3	1) Too close (2) Well-spaced (3) The wide
Rear-to-fore teat spacing	0.2	1) Too close (2) Well-spaced (3) The wide

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