UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

Department of Dairy Husbandry

DAIRY HERD IMPROVEMENT THROUGH THE USE OF PROVED BULLS

By

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DAIRY HERD IMPROVEMENT THROUGH THE USE OF PROVED BULLS

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THE DAIRY FARMER who obtains the greatest returns from his enterprise not only must be a student of feeding and management but also must build for the future by using a constructive breeding program that will increase year by year the productive capacity of his herd. Efficiency in production makes possible greater returns from the dairy herd and creates greater interest in this unit of the farm.

HIGH PRODUCING COWS MORE PROFITABLE

High production usually is profitable production. The higher the production the greater is the profit over feed cost until extreme limits are reached where the additional pounds of butterfat are obtained through very expensive feeding and management. This is shown in Figure 1 made up from cow testing association records on 3,700 cows tested in Idaho.

As the production increased the feed cost increased but not nearly as rapidly as the total value of products, or the profits over feed cost. The feed cost per pound of fat rapidly decreased as the production increased up to 250 pounds of fat per cow. As the production further increased the feed cost per pound of fat was reduced more slowly.

The variation in the production of cows is due either to feeding and management or to hereditary producing ability of the cows, or to both. It is impossible to raise the production of a cow beyond her inherited ability to produce, but through proper feeding and care each cow can be given an opportunity to make good. Since profitable and economical operation are so dependent on high production, the dairyman must raise the standard of his herd. This can be accomplished by the use of dairy herd improvement association records and by eliminating the lower producing cows. Important as this step may be it gives only temporary relief. The farmer can continue to replenish his herd by buying cows but this is expensive, accompanied by many further disappointments; dangerous in regard to diseases, such as tuberculosis and abortion;

and, most important of all, it is not a constructive program that will make possible the elevation of the herd average.

Breeding up the herd through the use of high quality bulls is the best method of herd improvement. In spite of all that has been said and written on this subject, many dairymen do not fully appreciate the importance of the herd sire. The same men who will pay $150 for a good grade cow to add to their herd will often refuse to pay more than $75 for a bull to head their herd. Each cow, at best, can be expected to have only one heifer in two years. Every heifer calf dropped in the herd receives one-half of her inheritance from her sire. The maximum amount of herd improvement must come through the bull.

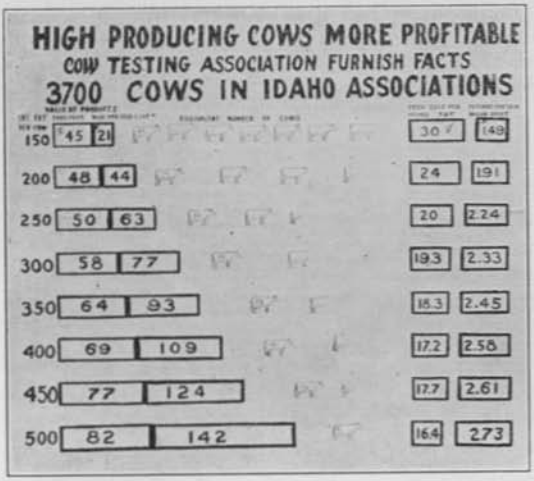


Fig. I. Summary of 3700 cows in Idaho cow testing asshociations grouped according to nearest 50-pound production standard.

Better Bulls Needed in Idaho

A survey was recently made of 293 representative farms in the Boise Valley for the purpose of determining the quality of bulls being used. Of the 293 farms represented, only 3 had ever done dairy herd improvement association work. This valley was reported in the 1925 census as having an average of 210 pounds of fat per cow, considerably above the state average of 178 pounds per cow, according to the same report. The average size of herds studied was 10.3 cows. One hundred sixty-eight farmers, or 57 per cent, of the 293 farmers did not own bulls. Information on the 125 bulls owned is shown in the following table:

Table I
Survey of Quality of Bulls Owned by Boise Valley Farmers

Quality of Bulls in Use	No.	Per Cent	Average Cost
Registered purebred bulls from dams with known yearly records of production	24	19	$125.66
Registered purebred bulls from dams with records but record not given or known	16	13	80.62
Registered purebred bulls from dams without production records	20	16	71.01
Bulls supposedly purebred but not registered	36	29	51.67
Grades	29	23	36.03
TOTAL	125	100	$8,683.00
Average cost per bull			$ 69.50

Only 48 per cent were registered purebred bulls, 23 per cent were grades and 29 per cent supposedly purebred but not registered. Among the 60 registered bulls 24, or 40 per cent, were known to be from dams with butterfat records which averaged 521 pounds of butterfat per year. The average investment for all the bulls was $69.50 per bull, the lowest average being $36.03 for the grades and the highest average being $125.66 for the registered bulls from tested dams. It is difficult to understand how many of these dairymen can hope for improvement in their herds with such poor quality bulls.

The age at which the bulls were obtained is shown in the following table:

Table II
Age of Bulls When Purchased by Boise Valley Farmers *

Age of Securing	Number of Grades	Number of Purebreds	Total Number
Raised	1	4	5
1 month or less	8	11	19
1 month — 6 months	9	28	37
6 months — 1 year	5	19	24
1 year — 2 years	8	9	17
2 years or over	2	4	6
TOTAL	33	75	108*

* This information was obtained on only 108 of the 125 bulls.

Of the 108 bulls, 56 per cent were purchased at six months of age or less and 79 per cent were purchased at one year of age or less. This would indicate a preference for young bulls.

Quality of Bull Compared With Returns Per Cow

Fifty farmers from whom complete information was obtained sold 93,300 pounds of butterfat valued at $44,858.64 from 513 cows in a year. The average size of herd was 10.3 cows and the butterfat sold averaged 181.8 pounds per cow which returned $87.30. The comparisons of herds with different quality of bulls are grouped and the returns per cow in each case is shown in the following table:

Table III
Returns Per Cow in Herds Grouped According to Quality of Bulls

Class of Bulls Being Used	Average Pounds of Butterfat Delivered Per Cow	Average Creamery Receipts Per Cow
Herds headed by purebred sires	192.8	$92.70
Herds headed by non-registered or grade bulls	165.5	79.57
Diference in favor of herds headed by registered purebred bulls	27.3	13.13

Note—Average price of butterfat, 48.04 cents per pound.

The difference in the production per cow was 27 pounds of butterfat in favor of those herds headed by a registered bull. This amounted to $13.13 per cow per year for butterfat sold from the average herd of 10.3 cows, making a total for the herd of $135.00. Although the bulls in use at present have no influence on the cows now being milked, the data indicate that the farmers with the better bulls get more returns per cow. This must be due to the fact that they have used better bulls in the past and practiced better management throughout.

Bull's Value Measured by Production of His Daughters

The breeding value of a dairy bull depends on his ability to transmit high production of milk and butterfat to his offspring. The reason so many low producing cows are constantly being developed is because the great mass of dairymen still depend on unproved sires. When the bulls that are failures are discovered it is too late and the damage has already been done. Present knowledge of the inheritance of milk and butterfat production indicates that the only sure method of herd improvement is through the use of sires of proved merit as measured by the records of their daughters compared with those of their dams.

Results Obtained From a Study of 76 Bulls in Idaho

A study has been made of bulls that have been proved in Idaho. Only bulls with five or more dam and daughter comparisons have been used. In a study of Register of Merit records of Jerseys, Davidson, (1), 1925, concluded that records on at least six daughters were necessary in order to measure the approximate breeding value of the sire. Official records are somewhat selective due to the fact that only cows meeting the standard of production are recorded. Therefore, probably fewer tested daughters might be reliable when the records are made in dairy herd improvement associations due to less selective influence, as all cows in the herd are usually tested and recorded regardless of production. The Bureau of Dairy Industry, United States Department of Agriculture, considers a bull proved when he has five or more unselected daughters from dams with production records. (2) (3). All immature production records used are adjusted to a mature equivalent basis by using a standard of 70 per cent for two-year-olds, 80 per cent for three-year-olds, 90 per cent for four-year-olds, and 100 per cent for five-year-olds or over. Fractions of these percentages were used when exact ages were known. In the case of advanced registry records, the production is adjusted to a yearly basis by adding one-fifth to the ten-month records since most of the official records are on a yearly basis. (4). This adjustment, although fair to the individual bull, has a tendency to elevate the average production for official records since most of the dairy herd improvement association records represent ten months. Where several records were made by either dam or daughter, the records which seemed most representative were used.

Results obtained from a study of 76 proved bulls in Idaho are presented in Table IV. In addition to these bulls there are many partially proved bulls in the state.

The bulls are listed in the order of the average fat production of their daughters. If they were listed in the order of pounds of increase, or in per cent of increase, the order would not be the same in any of the three cases. Also the percentage of the daughters that exceed the production of the dams is important. R. R. Graves (5), 1926, in a study of 23 Holstein-Friesian sires concluded that all of these factors must be considered in attempting to determine the transmitting ability of a dairy sire. Therefore readers are cautioned not to place too much importance on the relative rank of the bulls. Presenting the bulls with their names and registration number seemed to be a valuable contribution to the dairy breeds' history of the state and also to furnish more specific information for herd improvement than had the bulls been listed by index only.

Table IV

Proved Dairy Sires in Idaho Listed According to Average Butterfat Production of Their Daughters

No.	Name of Sire	Reg. No.	Breed	Daughters No.	Daughters Reg. or Grade	MILK Dams (Lbs.)	MILK Daught. (Lbs.)	MILK Inc or Dec. (Lbs.)	MILK Inc or Dec. (Per Ct.)	BUTTERFAT Dams (Lbs.)	BUTTERFAT Daught. (Lbs.)	BUTTERFAT Inc. or Dec. (Lbs.)	BUTTERFAT Inc. or Dec. (Per Ct.)
1 § *	Masterpiece's Ultra King of Edgemoor	69741	G	8	Reg.	13,996	16,387	+2,391	+17.1	719	769	+ 50	+ 7.0
2 §	King Segis Matador Walker	172052	H	12	Reg.	15,907	22,321	+6,414	+40.3	542	749	+207	+38.2
3 § *	Pogis Torono Investigator	177267	J	5	Reg.	10,551	13,854	+3,303	+31.3	553	710	+157	+28.4
4 §	Matador Violet Idaho	273447	H	10	Reg.	17,578	20,145	+2,567	+14.6	601	674	+ 73	+12.1
5 § *	King Piebe Pontiac Segis	174303	H	10	Reg.	17,184	19,302	+2,118	+12.3	600	624	+ 24	+ 4.0
6 †	Weston of Thorn Hill	78563	G	5	Reg.	9,602	12,903	+3,301	+34.4	460	613	+153	+33.3
7 § °	Adelaide's Sultan	123005	J	13	Reg.	11,922	10,887	—1,035	— 8.7	600	589	— 11	— 1.8
8 § *	Carnation McKinley Rag Apple	183077	H	5	Reg.	13,726	16,287	+2,561	+18.7	460	576	+116	+25.2
9 *	St. Mawes of Larkspur	207657	J	5	Gr.	9,119	9,952	+ 833	+ 9.1	422	574	+152	+36.0
10 §	Prince Segis Hartog DeKol	267120	H	5	Reg.	20,857	19,433	—1,424	— 6.8	663	568	— 95	—14.3
11 § °	Friend Hengerveld Pontiac Aaggie	258625	H	10	Reg.	18,220	16,772	—1,448	— 7.9	634	561	— 73	—11.5
12 †	Judge of Birchwood	22505	G	6	Reg.	9,771	10,942	+1,171	+12.0	484	554	+ 70	+14.5
13 † *	Lapwai Segis Walker	235655	H	9	Reg.	13,166	15,777	+2,611	+19.8	423	539	+116	+27.4
14	Doede Red Cross	232978	H	6	2R-4Gr.	13,447	13,792	+ 345	+ 2.6	500	513	+ 13	+ 2.6
15 § °	Teton Sir Segis	406805	H	5	Reg.	16,328	14,116	—2,212	—13.6	539	509	— 30	— 5.6
16 *	Maiden's Chief Baronet	172216	J	6	3R-3Gr.	8,700	9,446	+ 746	+ 8.6	451	504	+ 53	+11.8
17 † °	Distinction's Noble Pioneer	112896	J	6	Reg.	7,692	9,401	+1,709	+22.2	422	503	+ 81	+19.2
18 °	Gallant of Lavaland	92773	G	5	Gr.	8,659	11,541	+2,882	+33.3	396	502	+106	+26.8
19 †	Rosette's Gamboge Lad	153398	J	5	Reg.	9,505	7,920	—1,585	—16.7	495	491	— 4	— 0.8
20 *	Walcowis Pontiac Inka	240667	H	5	Reg.	10,424	13,451	+3,117	+29.9	358	490	+132	+36.9
21	Beauty's Lord Sully	66871	G	5	Reg.	10,073	9,894	— 179	— 1.8	437	489	+ 52	+11.9
22	Segis Colantha Erastus	320039	H	10	Reg.	14,420	13,632	— 788	— 5.5	501	479	— 22	— 4.4
23	Garfield Johanna Burke	226934	H	5	Reg.	16,047	14,288	—1,759	—11.0	539	476	— 63	—11.7
24	Castilian Boy	137516	J	6	5R-1Gr.	6,853	9,636	+2,783	+40.6	366	471	+105	+28.7
25	Marigold's Emperor	181586	J	6	3R-3Gr	8,629	8,642	+ 13	+ 0.15	444	457	+ 13	+ 2.9
26 *	Belle Victoria's Joe	163102	J	5	Gr.	8,644	9,043	+ 399	+ 4.6	426	455	+ 29	+ 6.8
27 °	Blossom's Count	147725	J	8	5R-3Gr.	7,474	8,194	+ 720	+ 9.6	380	449	+ 69	+18.2
28 *	Model Fobes Paula	256099	H	16	8R-8Gr.	12,417	13,371	+ 954	+ 7.7	400	447	+ 47	+11.8
29 *	Sir Ormsby Hengerfeld Korndyke Lad	354077	H	5	Reg.	11,569	12,485	+ 916	+ 7.9	416	442	+ 26	+ 6.2
30 *	Fair Acres Dancing Master	177546	J	7	2R-5Gr.	6,031	8,570	+2,539	+42.1	317	441	+124	+39.1
31 *	La Creole's Cicero's Chief	161236	J	17	Reg.	8,243	8,094	— 149	— 1.8	428	436	+ 8	+ 1.9
32 *	Idaho Silver Tip	208141	J	5	1R-4Gr.	7,455	8,521	+1,066	+14.3	346	435	+ 89	+25.7
33	Colantha Doede	234224	H	7	3R-4Gr.	9,979	11,520	+1,541	+15.4	371	435	+ 64	+17.3
34	Doede Alban DeKol	192874	H	5	Gr.	6,978	12,237	+5,259	+75.4	247	424	+177	+71.7
35	Gertie's Noble Peer	157014	J	6	Gr.	8,562	7,576	—1,086	—12.7	456	423	— 33	— 7.2
36	Boomer Segis Clyde Palmyra	368321	H	7	Reg.	13,762	13,120	— 642	— 4.7	486	423	— 63	—13.0
37	Knight's Black Jack	169750	J	6	Gr.	12,002	9,962	—2,040	—17.0	444	422	— 22	— 5.0
38	Beauty Segis Pietertje Prince	183239	H	6	4R-2Gr.	15,554	13,931	—1,623	—10.4	509	420	— 89	—17.5

39	*	Guernsey Boy of Mountain View	57730	G	6	Gr.	8,148	8,840	+ 692	+ 8.5	375	417	+ 42	+11.2
40	*	DeKol Colantha of Ida U	337496	H	7	1R-6Gr.	9,033	9,868	+ 835	+ 9.2	322	415	+ 93	+28.9
41	°	Segis Walker Pietertje Lad 7th	190288	H	5	Gr.	10,056	12,102	+2,046	+20.3	317	414	+ 97	+30.6
42	*	Idagem Aviator	96527	G	5	Gr.	7,409	7,899	+ 490	+ 6.6	372	413	+ 41	+11.0
43	*	Dora's Big Boy Pogis	200054	J	9	Gr.	6,717	7,983	+1,266	+18.8	331	411	+ 80	+24.1
44		Sybil's Noble Bachelor	182730	J	5	2R-3Gr.	6,825	6,931	+ 106	+ 1.6	364	410	+ 46	+12.7
45	†	Segis DeKol Erastus	181118	H	5	Reg.	9,893	11,818	+1,925	+19.5	338	408	+ 70	+20.7
46		Segis Walker Pioneer	225287	H	5	Reg.	12,533	12,665	+ 132	+ 1.1	422	404	− 18	− 4.3
47	°	King Cornucopia Segis Ormsby	211060	H	5	Reg.	14.601	11,811	−2,790	−19.1	495	399	− 96	−19.4
48	°	Sybil's Noble Majesty	151222	J	5	Reg.	9,841	7,537	−2,304	−23.4	547	395	−152	−27.8
49	*	Challenger of Lavaland	63589	G	5	Gr.	7,485	8,379	+ 894	+11.9	307	393	+ 86	+28.0
50	*	Lulu's Ashburn Chief	126214	J	7	Reg.	6,039	7,436	+1,397	+23.1	314	392	+ 78	+24.8
51		Snow White Imperial Ormsby	227151	H	7	3R-4Gr.	8,687	11,230	+2,543	+29.3	289	390	+101	+34.9
52		Don Lincoln	95524	J	5	Gr.	5,546	8,632	+3,086	+55.6	266	387	+121	+45.5
53	*	Roberta's King Pogis	200053	J	7	Gr.	5,809	7,725	+1,916	+33.0	291	387	+ 96	+33.0
54	*	Paul of Mountain View	49608	G	8	Gr.	7,024	7,714	+ 790	+11.2	290	380	+ 90	+31.0
55	*	Superba De Spofford Rag Apple	236905	H	5	Reg.	7,129	10,584	+3,455	+48.5	267	379	+112	+41.9
56		Bright Duke's Noble Prince	192063	J	7	Gr.	7,685	6,923	− 762	− 9.9	359	376	+ 17	+ 4.7
57	*	DeKol Korndyke Gamma of Ida U	328423	H	5	Gr.	6,356	9,629	+3,273	+51.4	278	371	+ 93	+33.5
58	°	Star's Lad of Oregon	148736	J	7	Reg.	5,648	7,386	+1,738	+30.8	264	365	+101	+38.3
59		Mutual Pietertje	260663	H	5	Reg.	13,383	10,765	−2,618	−19.6	459	363	− 96	−20.9
60		King Rancho Mercedes Netherland	297185	H	6	Gr.	10,201	10,218	+ 17	+ 0.2	352	362	+ 10	+ 0.3
61		Von Kedah's Thelma's Boy	169974	J	5	2R-3Gr.	6,965	7,482	+ 517	+ 7.4	341	357	+ 16	+ 4.7
62		Bright Light's Knight	103741	J	5	Reg.	6,354	6,454	+ 100	+ 1.6	343	349	+ 6	+ 1.8
63	*	Lava Rock Big Chief Mercedes Doede	383159	H	7	Reg.	8.353	9,567	+1,214	+14.5	284	348	+ 64	+22.5
64		Intermountain Prince Soldene	385389	H	7	5R-2Gr.	9,763	10,924	+1,161	+11.9	318	342	+ 24	+ 7.5
65		Brown LaValle's Jolly Knight	182007	J	5	Gr.	7,617	8,102	+ 485	+ 6.4	352	342	− 10	− 2.8
66		Segis Buckeye Ramoua	240511	H	5	Reg.	15,428	9,863	−5,565	−36.1	540	341	−199	−36.9
67	°	Sweet Alice's Billy of Maple Heights	52742	G	5	Reg.	6,870	6,454	− 416	− 6.1	330	340	+ 10	+ 3.0
68		Mutual Pietertje Colantha	113453	H	5	Reg.	9,875	12,331	+2,456	+25.0	288	338	+ 50	+17.4
69	§ °	St. Mawes Baronet	146613	J	5	Reg.	8,499	5,943	−2,556	−30.1	514	336	−178	−34.6
70		Ensign Doede Johanna	366181	H	5	Gr.	10,101	9,430	− 671	− 6.6	370	326	− 44	−11.9
71	°	Private Pontiac DeKol	311512	H	5	Reg.	9,757	9,088	− 669	− 6.9	324	324	0	0.0
72		Majesty of Rose Lawn	189136	J	5	Gr.	5,968	5,504	− 464	− 7.8	325	309	− 16	− 5.0
73		Rose's Bright Knight	180100	J	7	Gr.	5,449	6,131	+ 682	+12.5	270	308	+ 38	+14.1
74	°	Prince Pietertje Albert	205349	H	5	Gr.	11,442	7,500	+3,942	−34.5	376	288	− 88	−23.4
75	*	Segis Violet Daisy of Ida U	296655	H	5	1R-4Gr.	7,600	8,675	+1,075	+14.1	258	283	+ 25	+ 9.7
76		Duke Parthenea Buffalo	365829	H	5	Gr.	6,929	7,820	+ 891	+12.9	225	278	+ 53	+23.6

* Living to date.
° Proved before death.
§ Records made on official test.
† Records made on official test and D. H. I. A.
All other records Dairy Herd Improvement Associations only.

Gr. - Grade.
Reg. - Registered.
G. - Guernsey.
J. - Jersey.
H. - Holstein.

Masterpiece's Ultra King of Edgemoor. Highest ranking production for his daughters of any bull in Idaho. Senior herd sire at Thousand Springs Farm, owned by Mrs. Minnie W. Miller, Wendell, Idaho.

The 76 bulls studied represented a total of 490 dam and daughter comparisons. The dams averaged 10,340 pounds of milk in a year while the daughters averaged 11,073 pounds of milk. Therefore, the daughters excelled the dams by 733 pounds of milk, or 7.0 per cent. The dams averaged 417 pounds of butterfat and the daughters 453 pounds, making an increase for the daughters of 36 pounds of fat, or 8.6 per cent. Considering the high average of the dams the increase is very good. These average production figures seem very high when the average production of the state is estimated at 178 pounds of fat. However, the data used for this study were derived from herds that had necessarily been in dairy herd improvement associations for several years in order to get dam and daughter comparisons. The dairy herd improvement association herds average higher than ordinary herds and the longer the herds are in the dairy herd improvement associations the more they tend to improve. Several officially tested herds were included but intimate knowledge of the herds used indicated very little selective influence due to the advanced registry standards of production. In very few instances have dairy herd improvement association records been compared with official records in dam and daughter comparisons.

Of the 76 herds studied 33 were purebred and 16 others included some purebred females. Of the 490 comparisons for fat production the daughters excelled the dams 303 times while the dams excelled 179 times, or 37 per cent of the total. Of the 179 daughters below their dams, 61 per cent were from dams with over 400 pounds of fat, and 35 per cent were from dams making over 500 pounds of fat. The fact that over one-third of the dams exceed the production of the daughters was due either to some poor breeding bulls in the group, or to the high standard of production of the dams.

Of the 76 bulls studied 54, or 71 per cent, increased production of butterfat as measured by the average of their daughters compared with their dams, while 22 bulls, or about 29 per cent, decreased production. The change in production due to the sire varied from an average increase of 207 pounds of fat per daughter down to a decrease of 199 pounds per

daughter compared with the dams. Eighteen of the 76 bulls changed the production more than 100 pounds of fat per daughter. As the limited number of dam and daughter comparisons on many of the sires makes it impossible to eliminate all other factors such as feeding and management, the comparison must be taken as quite relative. It is probable that unless a bull makes more than an average of 20 pounds of butterfat change for his daughters, he should be considered to be just maintaining production, except when used on very high producing dams when a slight increase is creditable. Closer calulation is of doubtful value due to the variations in conditions, and to the limitations of mathematical adjustments for the age factor. This assumption is borne out by the fact that 46 of the bulls, or 61 per cent, increased the production 20 pounds of fat or more, while 16 bulls or 21 per cent decreased production 20 pounds of fat or more, thereby making 82 per cent, or about four-fifths, of the bulls that changed the average production of their daughters from that of their dams at least 20 pounds of butterfat. Stated in another way, the change in fat production would be more than five per cent either up or down before a bull with a limited number of daughters would be considered doing other than maintaining production. Further justification for this statement is indicated by a study of 5,217 dam and daughter records by McDowell and Wintermeyer (3), 1927, which showed an average increase of 18 pounds of fat for the daughters over the average of 352 pounds of fat for the dams, equivalent to 5.1 per cent. In their report, comparisons of the daughters of 250 proved sires showed an increase of 38 pounds of fat, or 10.9 per cent, over the average production of 353 pounds of fat for the dams. In studying the data reported by McDowell and Parker (2), 1926, on 58 proved sires, we find 45 of the bulls, or 78 per cent, made more than 20 pounds of fat change, either up or down, on their daughters' average production compared with their dams. The change in production expressed in percentage was more than five per cent in the case of 47 of the 58 bulls. As the importance of the sire is amply indicated by the great variation in results obtained from the 76 sires studied in Idaho and from the results of other investigators, it behooves the farmer to consider very seriously the problem of bull selection.

Figure II presents graphically the results obtained from the bulls arranged according to the relative rank in average production of the cows with which they were mated, ranging from the highest to the lowest.

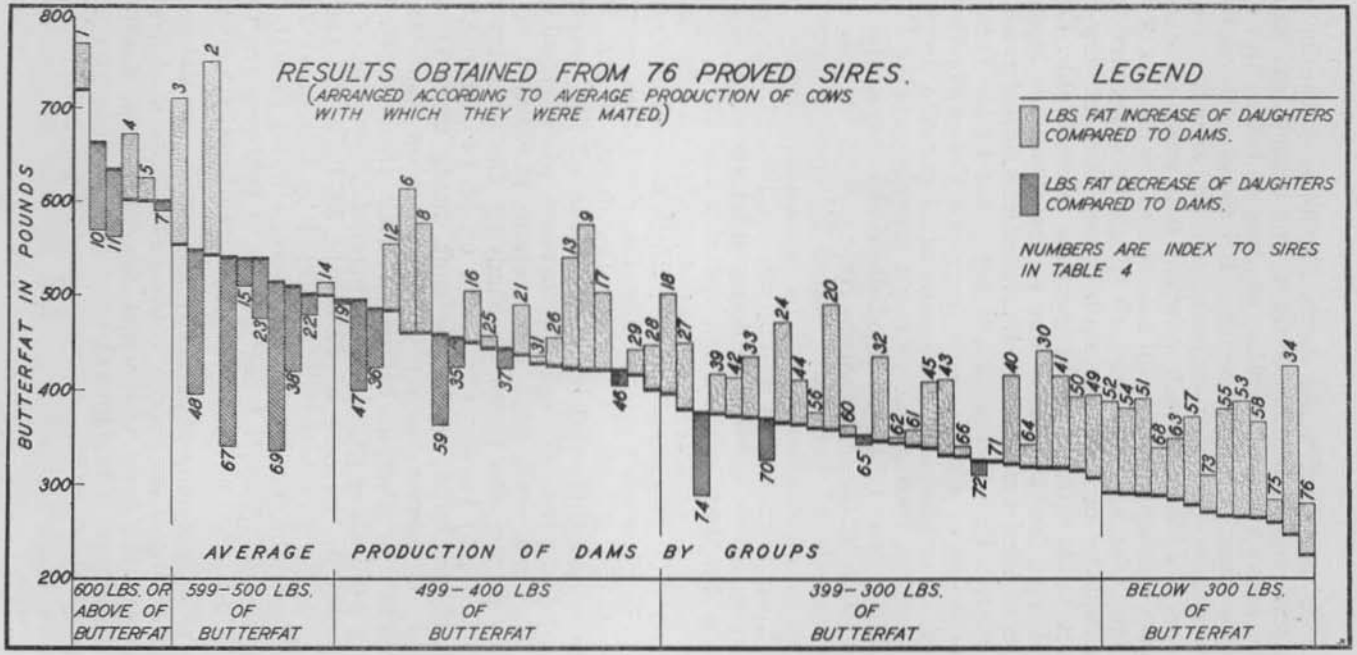
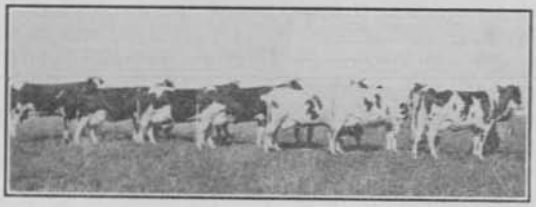


Fig. II. Study of the results obtained from 76 proved sires in Idaho, arranged according to average production of cows with which they were mated.

The short, heavy, black horizontal lines extending diagonally across the chart represent the average production of the dams with which the bulls were mated, arranged according to production. Each shaded bar extension above the black line represents the average pounds of fat increase for the daughters of a bull, and each double cross-hatched bar extension below the line represents the average pounds of fat decrease for the daughters of a bull. The number at the end of each bar is the index number of the bull as listed in Table IV. For example, the first bull represented on the extreme left of the chart is No. 1, Masterpiece's Ultra King of Edgemoor. According to the scale of production on the left of the chart,



King Segis Matador Walker and seven of his daughters. Bull No. 2 in Table IV. Official records on these cows averaged 23,479 pounds milk and 815 pounds of fat at an average age of 4 years, 10 months, 12 days. All bred and developed at the University of Idaho.

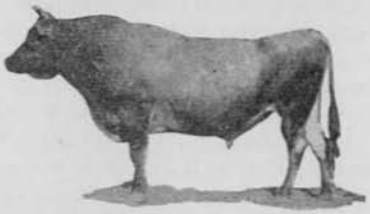
the short heavy line (representing the average butterfat production of the dams) is above 700 pounds of fat. Table IV shows that this black line represents 716 pounds of fat. When bull No. 1 was mated with these cows his daughters averaged in production 769 pounds of fat, or an increase of 50 pounds. Therefore, the distance from the heavy, black line up to the top of the shaded bar extension indicates 50 pounds average increase for the daughters. The increase of the daughters plus the production of the dams equals the total production of the daughters. Taking another example, that of bull No. 10 at the left of the chart, the short, heavy, black line is somewhere above 650 pounds, which Table IV shows to be ex-

actly 663 pounds of fat. When bull No. 10 was mated with cows of this average production, the daughters produced 95 pounds less than the dams. Therefore, the double cross-hatched bar extension below the black line equals 95 pounds, and the average production of the daughters is 568 pounds which is indicated by the distance from the base of 200 pounds of fat up to the lower extremity of the cross-hatched bar extension.

As the production of the dams became higher fewer of the bulls were able to increase production. All the bulls mated with cows averaging 322 pounds of fat or less made an increase in production. However, the 76 sires studied were as a group, rather high quality bulls. Because none of the bulls decreased production until the average of the original cows was over 322 pounds, it must not be inferred that the dairyman using scrub, grade, or even low-quality purebred sires can be assured of increasing even low producing herds such as 200 pounds of fat standard. Such a herd average is evidence in itself that no such bulls as even those in the lower herds of this study had been used in the past or the herd average of 200 pounds of fat would not exist. Most of the bulls such as reported in Tables I and III could hardly be expected to increase the production of even the lower herds represented in this study.

In the case of dams with average production of 450 pounds of fat or more, many of the bulls failed to maintain the production of their daughters. In fact, some herds with very high average production were decreased in production through only one bull cross to such an extent that the herd ranked in the lower third of those studied. For example, bull No. 48 was mated with cows averaging 547 pounds of fat and the daughters resulting averaged only 395 pounds of fat, an average reduction of 152 pounds per daughter. The original cows ranked eighth in average production in the entire list while the daughters only equaled the cows ranking thirty-eighth in the list. Listed just to the left of the data on bull No. 48 a bull is represented that raised the production 157 pounds for his daughters; and to the right of No. 48 is represented bull No. 2 whose daughters produced 207 pounds more than their dams. Even though all the bulls that were mated with original cows averaging 322 pounds of fat or less sired daughters with an increase in production over that of their dams, nevertheless the evidence in favor of a proved sire under such conditions is ample. If a farmer were certain of increasing production through his herd sire, why should he be satisfied with a slight increase when the right bull would create two or three times as much increase? For example, bull No. 75 represented at the right of the chart, increased the produc-

tion of his daughters 25 pounds of fat, but just next to this bull is shown bull No. 34 that increased the production of the daughters 177 pounds of fat from dams of similar quality. The great variation in the pounds of increase of butterfat in the daughters of each of the bulls regardless of the standard of production of the original cows shows very emphatically the importance of the bull to the future herd. It also shows the uncertainty of trying to increase production by selecting an unproved bull.



Pogis Torono Investigator, bull No. 3 in Table IV. This sire was mated with cows averaging 553 pounds of fat, yet in spite of that high average he increased the production of his daughters 157 pounds of fat, or up to 710 pounds.

The fact that a bull decreased production does not mean that he has no value as a dairy sire. It does mean, however, that he is a failure on that particular herd. He might be successful if mated with lower producing cows. Some of the bulls that made good increases on cows of relatively low production might have reduced production had they been used on higher producing cows. The better the herd the more difficult becomes the selection of the herd sire.

The average increase in the production of a bull's daughters may not tell the whole story about his ability to transmit high production. Analysis of the records of any one bull may show one or two outstanding daughters with sufficient production to offset several other instances of decreases, thereby indicating better breeding qualities, based on averages, than he really possessed. The following table presents detailed data on three bulls which illustrates this point:

Table V

Difference in Transmitting Ability of Three Bulls

Bull "A" Butterfat Production		Bull "B" Butterfat Production		Bull "C" Butterfat Production	
Dams Pounds	Daughters Pounds	Dams Pounds	Daughters Pounds	Dams Pounds	Daughters Pounds
284	411	586	472	350	317
267	499	472	361	347	460
249	423	586	326	354	307
226	461	639	239	315	407
212	327	411	305	350	255
Ave. 247	424	Ave. 540	341	Ave. 343	349
Difference	+177	Difference	−199	Difference	+6

Bull "A" was an exceptionally good breeder since he increased production in every instance and maintained a high standard of production among his daughters. Bull "B" was undoubtedly a poor bull for that particular herd as in every instance the daughters are poorer than the dams. Bull "C" was bred to cows of a rather uniform plane of production yet his daughters varied greatly in production. Two of the daughters increased production while three decreased production. The average of the daughters compared with the dams indicates that bull "C" maintained production but such an irregular breeding bull is undesirable in a breeding program. Occasionally even some of the best breeding bulls will have daughters with records less than their dams but as long as such are exceptions the bull should not be condemned. The best kind of bull is the one that transmits quite uniformly a rather definite plane of production to his daughters and shows an increase on the average.

Easy to Backslide in Production

There is no sure way to select a herd sire that will transmit high production to his daughters except by choosing a bull that has proved his ability to sire high producing cows. A herd may become outstanding for high production due to one bull and then, due to the very next bull used, become quite mediocre. The following table shows how easy it is to backslide in production:

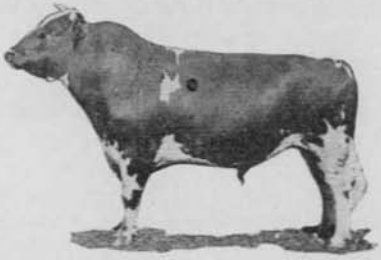
Table VI

The Herd Sire is the Pendulum of Herd Progress

	Herd "A" Butterfat Production			Herd "B" Butterfat Production			Herd "C" Butterfat Production		
	Dams Ave. Lbs.	Daughters Ave. Lbs.	Increase or Decrease Ave. Lbs.	Dams Ave. Lbs	Daughters Ave. Lbs.	Increase or Decrease Ave. Lbs.	Dams Ave. Lbs.	Daughters Ave. Lbs.	Increase or Decrease Ave. Lbs.
1st Bull	542	749	+207	422	503	+ 81	531	331	−200
2nd Bull	634	561	− 73	547	395	−152	556	691	+135
3rd Bull	600	624	+ 24						

In herd "A" the first bull was mated with cows averaging 542 pounds of fat. He raised the production 207 pounds per cow giving his daughters the exceptional average of 749 pounds of fat. The next bull used was mated with cows that averaged 634 pounds of fat. He decreased production an average of 73 pounds of fat or down to 561 pounds per cow. The next bull selected was a proved sire. He raised the production from 600 pounds per cow back to 624 pounds per cow. Although this production is very high, making it difficult to maintain such a standard, nevertheless the same is true in

more moderate production. For example, in herd "B" the first sire used raised the production from 422 pounds of fat per cow to an average of 503 pounds. The next bull used reduced the production from 547 pounds of fat per cow to 395 pounds. The first bull put the herd on a high standard and in one cross the second bull pulled the herd down below the average in the beginning. In other words, after about six years of effort the dairyman had a poorer herd than he started with. Another example is in herd "C." The first bull reduced the herd average from 531 pounds of fat per cow down to 331 pounds, but fortunately the next bull was an exceptional breeder and used on practically the same foundation cows left daughters averaging 691 pounds of fat. A good bull can make a herd, and a poor bull can almost ruin it.



Matador Violet Idaho, bull No. 4 in Table IV. This bull increased the production of his daughters 73 pounds of fat when mated with cows averaging 601 pounds. He is a son of bull No. 2 in the list. Bred and developed by University of Idaho.

GOOD BULLS ADD DOLLARS TO DAIRYING

What is a bull worth? It all depends on how he breeds, and his scope of opportunity. The following table shows the differences that can exist in the value of herd sires. All these bulls were selected from Table IV and were purposely chosen to show varying changes in production of the daughters in comparison with the dams. However, extreme examples were not selected and in most instances the bulls selected were used on grade herds.

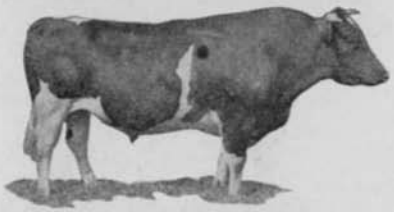
Table VII

Present Herd Sire Affects Future Profits

No. Sire	Daughter Reg. or Grade	Ave. Butterfat Production		Ave. Gain or Loss Lbs.	Ave. Value of Product at 44c Per Lb. Fat		Average Feed Cost *		Ave. Return Over Feed Cost		Profit or Loss Over Feed Cost Per Cow Due to Bull	Estimated Yearly Profit or Loss Due to Bull With 10 Daughters
		Dams Lbs.	Daughters Lbs.		Dams	Daughters	Dams	Daughters	Dams	Daughters		
Bulls Which Increased Production												
A	5 Gr.	422	574	+152	$186	$253	$73	$94	$113	$159	+$46	+$460
B	9 Gr.	331	411	+ 80	$146	$181	$63	$71	$ 83	$110	+$27	+$270
C	5 Gr.	258	283	+ 25	$114	$125	$52	$57	$ 62	$ 68	+$ 6	+$ 60
Bulls Which Decreased Production												
X	6 Gr.	456	423	— 33	$201	$186	$78	$73	$123	$113	—$10	—$100
Y	5 Gr.	376	288	— 88	$165	$127	$69	$58	$ 96	$ 69	—$17	—$170
Z	5 Reg.	459	363	— 96	$202	$160	$79	$66	$123	$ 94	—$29	—$290

* Average feed cost estimated from data in Fig. I.

Bull "A" was used on a very high grade herd. By improving the average production of his daughters 152 pounds of fat, the yearly income per cow was increased from $186 to $253, a difference of $67.00. Although because of lower production it cost less to feed the dams, the yearly profit over feed cost was $46.00 higher per cow from the daughters than from the dams due to a good sire. On 10 daughters this would amount to $460.00 and on 20 daughters it would be $920.00. This greater profit is due to the bull for one year's milking period of his daughters. When it is conservatively estimated that each daughter would milk four years the extra returns over feed cost due to the good bull would be $179.40 for each daughter.



King Piebe Pontiac Segis, bull No. 5 in Table IV. This bull increased the production of his daughters 24 pounds of fat, even though bred to cows that averaged 600 pounds of fat.

Bull "B" did not make as much increase in butterfat but the profit over feed cost from his daughters was $27.00 more per cow than was received from the dams. Bull "C" made only a 25-pound increase in butterfat but even then the yearly return per daughter over feed cost was $6.00 more than from the dams. This would mean $24.00 for a four-year milking period for one daughter or $60.00 for one milking period on ten daughters.

The bulls decreasing production caused losses which were just as outstanding. Bull "X" caused a yearly loss of $10.00 per daughter in profits over feed cost, while bull "Y" had a similar loss of $17.00, and the loss from the use of bull "Z" was $29.00 yearly per daughter. These results clearly show that a bull can greatly influence the profit over feed cost obtained from his daughters depending on his ability to transmit production. Likewise the gain or loss due to a bull would be multiplied according to the number of daughters he sired. It appears that a good bull can bring in large returns over the lifetime of his daughters in proportion to what the average good bull costs. The owner of a poor breeding bull pays a very high price for his bull in the form of losses. Why should breeders gamble with such high stakes over such long periods by using an unproved sire when they can play safe with a good proved sire?

Save the Bull Until His True Value is Known

The most rapid improvement in production of dairy herds must come through the use of proved sires. Too many of the good breeding bulls have gone to the butcher before their breeding value was known due to the owners getting through with them and making no provision for their preservation. Of the 76 bulls represented in this study, only 26 are living today. Fourteen others were proved before their death and 36 were dead before their value was known. In many instances the farmer would be willing to pay a very good price to get back a bull that has died. The daughters of bull No. 2 listed in Table IV averaged 749 pounds of fat and produced 207 pounds of fat more than their dams. Unfortunately this remarkable breeding bull was sold to the butcher before his daughters were tested. Bull No. 19 in the list made the remarkable average increase of 132 pounds of fat on his daughters, even though mated with cows averaging 358 pounds of fat. The owner sold the bull before he began testing the daughters. Dairymen must soon adopt some policy to make available more proved sires. This can be done by selling their old bull to a neighbor with the privilege of buying him back at the end of two years, or by leasing him out for a nominal fee. The cooperative bull association (6), has proved to be one of the most effective methods of retaining the use of a sire until proved, and then utilizing him to the maximum if proved a successful breeder. Proved bulls are scarce and even among the proved bulls the good ones are not too numerous. Any bull good enough to head a herd and on which to risk the future of the herd is worthy of saving until his true breeding qualities are known.

Learn the Value of the Bull Early

It is important to learn as early as possible the real merit of a bull. His first daughters to freshen should be tested. If he proves to be an undesirable breeder he can be butchered and thus prevent further damage. If he proves a successful breeder his period of usefulness should be extended. On the average, bulls probably do not remain useful past eight years of age. For example, sire No. 11 in Table IV was proved by the earliest possible date. This bull reduced production 73 pounds of fat per daughter and although he was used in a large herd the damage done to the herd was limited since he was used sparingly and was removed from the herd as soon as he was proved a detriment. Sire No. 1 was well preserved when proved and was about to be partially retired from ser-

vice due to the large number of his daughters in the herd. When his daughters completed their first lactation records and started out with their second lactation it became apparent that he was an exceptional breeding bull. Therefore the owner wisely decided to build the entire breeding program around this bull, even buying some cows in order to get additional daughters from him. Five or six years of breeding from this bull were available after he was proved. Think what a loss would have occurred if he had gone the way of many bulls (to the butcher), due to the owner needing another bull to use on his daughters. Bulls that have the transmitting ability to raise the average production of cows from 716 pounds of fat up to 769 pounds for their daughters are very scarce. Bulls No. 17 and No. 26 increased production 81 pounds, and 69 pounds of fat per daughter respectively. These bulls lived to a ripe old age and their period of usefulness was extended to at least three times that of the average bull due to the fact that they were proved early. Bull No. 26 was saved only because he was in a co-operative bull association where the bulls were exchanged. Some bulls live too long. For example bull No. 47 and bull No. 59 each reduced production 96 pounds of fat, yet the story of their transmitting ability was never known until after they were dead. Table IV contains many stories of regret in the loss of valuable bulls and likewise relates several tragedies caused by certain bulls almost ruining good herds.

Some purebred breeders are adopting the wise policy of using a bull as early as possible on enough cows to get a few daughters for early testing. The bull is then retired from service in that herd, by leasing out, or some such arrangement, and brought back into heavy service if his two-year-old daughters prove productive and of good type.

Proved Sires Usually Not Appreciated

Proved sires must necessarily be old bulls, at least 5 or 6 years of age, and most dairymen do not like to keep an old bull. The old bull is usually more likely to be dangerous, is not liable to be as active or as sure in service, and cannot be resold as easily. However, these are slight handicaps considering the great risk of losses in time and money over a period of years caused by using a young bull of unknown merit. Many times at auction sales of herds, either grade or purebred, the visiting dairymen will express their satisfaction regarding the breeding qualities of a mature proved bull by paying good prices for his daughters in milk. Then when the bull is brought in he is sold at a sacrifice because he is ma-

ture. In fact, many times yearling sons of the bull will sell for more money than the old bull. The preference for young bulls is shown in Table II where we find 79 per cent of the bulls purchased at one year of age or less. An example of the lack of appreciation for proved bulls is found in bull No. 9 in Table IV. This bull was mated with cows averaging 422 pounds of butterfat, yet he increased the production of his grade daughters 152 pounds per cow. This bull was sold at public auction and was about to be sold to the butcher when the manager of the local creamery bid him in at $145.00. Such a bull is worth several thousand dollars to a community in increased production for even grade herds if given the proper opportunity.

Breeders of purebred dairy cattle seeking show ring type in addition to dairy production can nearly always find something undesirable about the offspring of a proved bull because few bulls beget all desired characters. Nevertheless the same purebred breeders that turn the old bull down, will select an absolutely unknown quantity in a yearling bull that has no better possibilities in type or pedigree than the old bull had as a yearling. They will take a chance on all characters including dairy production rather than use the old bull proved for high production but found to transmit some minor undesirable character. In a few cases the great transmitting ability of an old bull has become so recognized by a whole community, even among the owners of grade herds, that his services are at a premium and he could be easily sold at a good price. More appreciation for proved bulls of merit will make possible more rapid improvement in dairy herds.

SUMMARY AND CONCLUSIONS

Herd improvement is attained by (1) proper feeding and management, (2) culling out the low producers, and (3) using a sire that transmits high production.

A study of 3,700 Idaho cows with dairy herd improvement records showed that cows producing 200 pounds of butterfat returned twice as much profit over feed cost as cows producing 150 pounds of fat. A 400-pound fat record cow equaled five 150-pound cows, and a 500-pound cow equaled seven 150-pound cows in profit over feed cost.

Of 125 bulls represented in a dairy sire survey only 48 per cent were registered purebred bulls. The average investment was $69.50 per bull, varying according to quality. Those farmers with registered dairy bulls sold 27 pounds more butterfat annually per cow than did those owning grade or

unregistered bulls. This amounted to $13.00 per cow per year.

A study has been made of the results obtained from 76 proved sires in Idaho. In comparing 490 pairs of dams and daughters, the dams averaged 10,340 pounds of milk and 417 pounds of fat, while the daughters averaged 11,073 pounds of milk and 453 pounds of fat. The daughters exceeded the dams by 733 pounds of milk, or 7.0 per cent, and 36 pounds of fat, or 8.6 per cent. Approximately one-third of the dams excelled the daughters, but in such instances 61 per cent were dams with records of 400 pounds of fat or more.

Of the 76 bulls studied 54, or 71 per cent, increased production in their daughters compared to the original cows. All bulls mated with cows that averaged 322 pounds of fat or less caused an increase in production in their daughters. As production of the original cows became higher, fewer of the bulls were able to increase production in their daughters, and the bulls mated with cows averaging 450 pounds of fat or more caused decreases in many cases, although there were some very outstanding exceptions. The great irregularity found in the transmitting ability of the 76 bulls is convincing evidence that an unproved sire is undependable as a means of increasing the average production of a herd. The results varied from an average increase of 207 pounds of fat per daughter down to an average decrease of 199 pounds of fat per daughter compared to that of the dams.

A comparison of six typical sires of varying transmitting ability showed that the difference in the profit over feed cost for the daughters compared to their dams varied from $46.00 increase to $29.00 decrease per daughter. The number of daughters and number of years of production influence the total financial effect of each bull.

Only 26 of the 76 proved bulls are alive today, and 36 were dead before they were proved. Some system of exchange should be considered in order to preserve the usfulness of the bulls until their true value as dairy sires is known.

A more general recognition of the merit of good proved sires as the surest method of herd improvement, together with concerted effort by dairymen to save all herd bulls until their value is known, and to prove the bulls as early as possible, would be the most constructive program in dairy cattle breeding that could be undertaken.

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