

Care of Needles

After drawing a sample the wire plunger should be placed in the used needle and the needle returned to the shipping container without washing. Unless the needles can be thoroughly cleansed and rinsed with alcohol it is best to return them without attempting to remove the clotted blood.

Shipment of Samples

During warm weather ice should be placed around the tall copper container of the shipping pail. In cold weather this space should be filled with paper or excelsior. Small lots of samples, where the use of our regular shipping container is not feasible, should be chilled immediately after drawing and left on ice until ready for mailing. Such samples should be carefully packed (each tube wrapped in paper) and the package marked "*perishable*" and "*fragile*". For small numbers of tubes an ordinary cigar box serves the purpose. It is highly important that the packages be sent to the laboratory by Special Mail Delivery or by messenger. In order to avoid delay or possible loss, all packages and correspondence intended for the laboratory should be addressed—

DEPARTMENT OF ANIMAL DISEASES

ATWATER LABORATORY, STORRS, CONNECTICUT.

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Information on the Blood Test

Questions regarding the method of conducting the tests and the interpretation of results will be answered gladly.

STORRS Agricultural Experiment Station

A Record of the Guernsey Herd at the Connecticut Agricultural College

GEORGE C. WHITE

AND

CHARLES OLIVER

CONNECTICUT AGRICULTURAL COLLEGE
STORRS, CONNECTICUT

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A Record of the Guernsey Herd at the Connecticut Agricultural College

GEORGE C. WHITE AND CHARLES OLIVER*

Introduction

It is always of interest to breeders of cattle to observe the efforts and results of other breeders, with a view to applying in their own herds the practices that are most likely to bring success. It is not often that herd records covering a third of a century are available to the public, as it is human nature to forget or stress lightly the factors that have not brought satisfaction and to make public only those that are most pleasant to dwell upon. Moreover, in the few herds where appropriate records are available the task of presenting a complete analysis of them is seldom undertaken.

This paper aims to present much of the production data of the College Guernsey herd covering a period of thirty-five years**. It is made possible by systematic herd records that have steadily accumulated year after year, and is the result of a study of this breed recently made by the junior author. Frankly, the study has been the means of correcting certain misconceptions that we have held with reference to some of the animals, and it is hoped that this contribution may give definite stimulus to others to undertake a similar analysis of their own herds. Probably in no other manner may one properly evaluate the influence of individuals, a matter of great importance as one considers the future. Our present knowledge of genetics and Mendelian inheritance compels us to recognize the dominant role of the progeny test in animal breeding.

Brief Historical Account of the Herd

No effort has been made to assess the influence of the environmental factors during this period. It goes without saying that some changes have been made in management practices. Dairymen have effected considerable improvement in environmental conditions of stabling, feeding, and watering, but such advance has probably been less marked

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**The records on this and the other breeds have been of inestimable value in other ways also, particularly in abortion studies and studies on variations in fat and solid tests.

in College herds where practices were more ahead of the times twenty to thirty years ago than now.

Up to 1913 the herd was housed in a wooden barn built against a dirt bank on one end and on one side, and consequently it was not too well lighted and ventilated. This barn provided very limited quarters for box stalls. In 1913 a modern well lighted stable with a capacity of 48 stanchion stalls was added and four box stalls and young stock pens were placed in the old barn. In 1919 the old barn was burned, and while a large storage barn was promptly erected at the end of the stable built in 1913, the young stock quarters and box stalls were again very limited for five years. In 1924 a young stock and maternity stable was erected at the end of the storage barn opposite the 1913 stable.

Tuberculosis eradication was early undertaken but losses occurred from this disease with varying severity until 1910. Between 1910 and 1921, during which time there were untested cattle on the farm, an occasional animal reacted and once a purchased animal reacted. No reactor to this disease has appeared since 1921.

Bang's abortion disease took its toll in the herd for many years, as reported in other studies (1), until the reactors were removed in 1925. Since then the herd has had a continuous record free from this disease.

Animals have been sold from time to time for various reasons and at various ages. In general it has not been the practice to dispose of heifers until after they have come into milk. However, for one reason or another this history does not constitute a complete progeny record. The herd has never been large, as it shares the barns with herds of three other breeds, and moreover it seems that fate has been rather more severe at critical times with this Guernsey herd than with the others in respect to proportion of female calves, etc. Perhaps also we have unwittingly been rather severe in culling our Guernsey and Jersey milking females with respect to performance in milk yield compared with the Holsteins and Ayrshires in the herd, with insufficient emphasis given to the total food value of the product. Since 1927 the total herd, all breeds, has numbered about 115. For fifteen years before that the total herd averaged about 75 in number. The Guernsey herd approximates in size many milking and breeding herds in Connecticut. An inventory of the herd will be found in Table 1. Comparatively few purebred herds anywhere in this country have been in continuous existence as long as this one.

The original animals were purchased by Dr. C. L. Beach, at the time head of the department. Since Mr. Beach's resignation in 1906 the department has had two heads, Professor J. M. Trueman from 1906 to 1913, and the present incumbent since 1913.

Although the foundation of the present Guernsey herd was laid in 1896, Guernseys were not unknown in the college barns before that.

In 1885 Charles M. Beach* of Elmwood, Connecticut, one of the pioneer dairymen of the state, presented to the Storrs Agricultural School a purebred Guernsey bull registered as Marion 706. About the same time the school purchased a purebred Guernsey heifer, Ethel of Mystic 2289, from Roswell Brown of Mystic, Connecticut. Marion's granddam, Imp. Bridget 311, had been imported by Charles M. Beach in 1877. The paternal great granddam of Marion, Imp. Gypsy of Brockton 969, had been imported in 1874 for the Massachusetts Society for the Promotion of Agriculture. Neither Marion nor Ethel of Mystic were more than four generations removed from imported Guernseys.

In the report of Professor L. P. Chamberlain (2) for the year ending November 30, 1888, is found the following statement. "We have now thirteen cows, and hope to increase our herd during the coming year by adding a number of animals that have been reared upon the farm. Nearly all are grades, and partially represent many of the various breeds. But little attention has been given to breeding, though we are now beginning to make the Guernsey our specialty. Of this class we have five thorough-bred animals and six half bloods. Of these, two are males and nine are females."

This small herd had been built up from the two original animals, Marion and Ethel of Mystic, except that another bull, Elmwood 1496, also from Mr. Beach's herd, had replaced Marion. Table 1 indicates the passing of the purebreds from this original foundation in 1892.

The report of Professor C. S. Phelps (3) dated December 1, 1896, contains the following statement. "During the past fall committees from the Ayrshire, the Guernsey and the Jersey Breeders' Associations, acting with the Professor of Agriculture (Professor Phelps) arranged to place thorough-bred animals in the college herd. Each association has selected from prominent herds four or five representative animals. These will doubtless become the foundation for a valuable herd of dairy stock, besides being of service to illustrate the characteristics of the leading dairy breeds. The products of these animals will be utilized in the practical instruction in dairying."

The Guernseys referred to were Francille 8,178, purchased from William H. Caldwell of Peterborough, New Hampshire, Secretary of the American Guernsey Cattle Club; Fairview Maid 3,810, and Eurotas 2,537, purchased from E. C. Freeman of Cornwall, Pennsylvania; and the bull Fill Pail's Star 4,295, purchased from Francis Shaw of Wayland, Massachusetts. Both Freeman and Shaw were leading breeders of that time.

Fairview Maid and Eurotas were sired by Imp. Pacific, one of the most noted Guernsey bulls of his day. Pacific was also the sire of Purity, the highest producing Guernsey cow and fifth high cow of all

*C. M. Beach was one of the founders of the American Guernsey Cattle Club in 1877. The office of the club was located at the home of Edward Norton, the first secretary, at Farmington, Connecticut.

breeds in the thirty-day butter test at the World's Columbian Exposition at Chicago in 1893. Purity won second prize in the aged cow class at that show, and received many first prizes and championships throughout the East and South over a period of four years.

Imp. Fillpail 4th 565, the dam of Fill Pail Star, was born on the Island of Guernsey in 1878 and was imported in 1880, dropping a heifer calf just a month after her arrival.

TABLE 1

Classification of the Herd by Years from Inventory Records

Year	Purebred			Grades		Year	Purebred			Grades	
	Bulls	Cows	Heifers	Cows	Heifers		Bulls	Cows	Heifers	Cows	Heifers
1885	1		1			1910	1	12	3		
1886	1	1	1			1911	1	9	2		
1887	1	1	4			1912	1	10	2		
1888	2	1	2		5	1913	1	7	1		
1889	1	3			15	1914	1	8	2		
1890	1	2			13	1915	5	8	4		
1891		2		6	6	1916	3	6	2		
1892					3	1917	2	6	1		
1893				6		1918	1	4	3		
1894				3		1919	3	5	6		
1895				4		1920	2	7	1		
1896	1	3		3	2	1921	1	6	3		
1897	1	3	2			1922	3	10	1		
1898	1	3	1			1923	1	10	2		
1899	1	6	1			1924	1	8	6		
1900	1	5	2			1925	1	15	2		
1901		7	2			1926	2	13	5		
1902		Inventories not listed by breeds				1927	3	11	4		
1907	to					1928	1	10	8		
1908	1	9	2			1929	3	12	6		
1909	1	8	5			1930	1	13	8		
						1931	3	12	6		

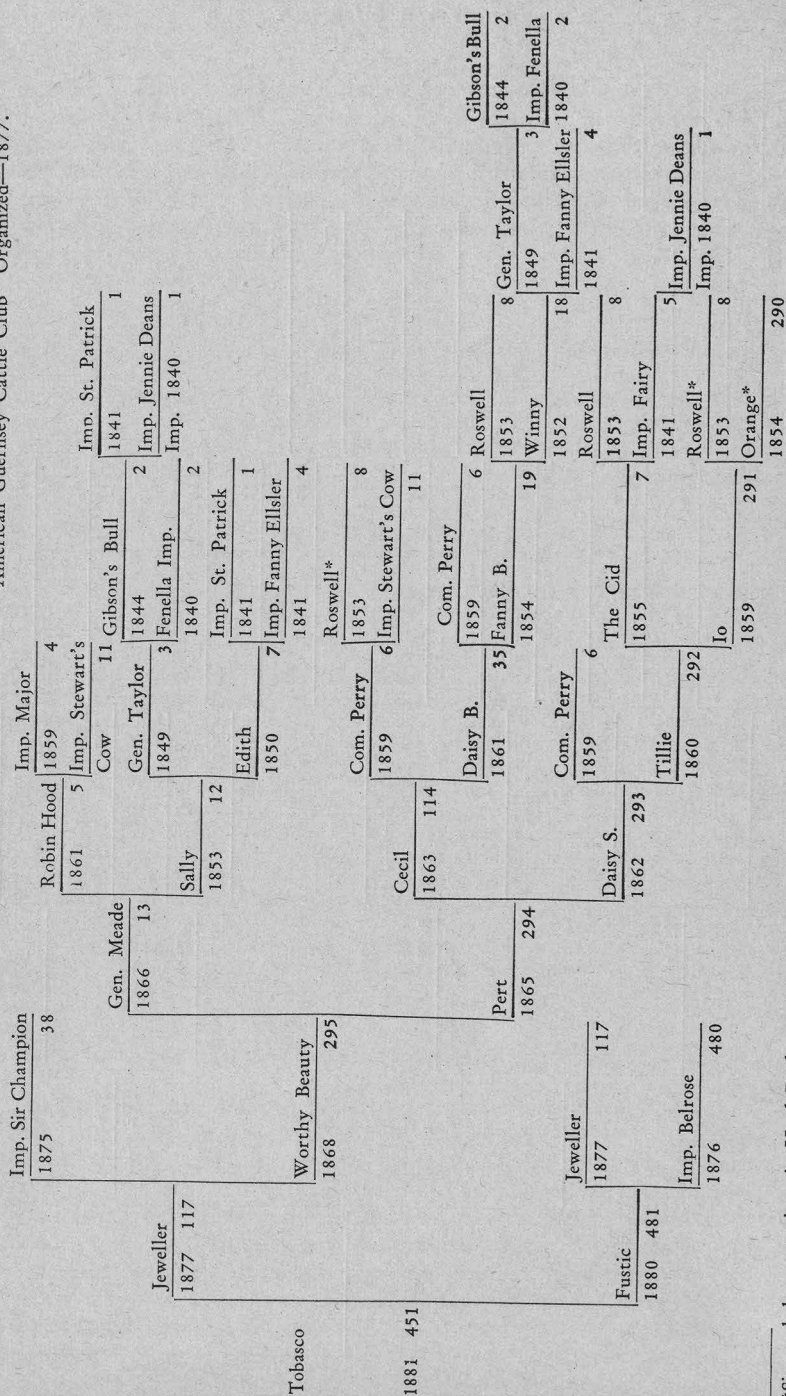
Fill Pail Star was dropped in 1894 when his dam was in her seventeenth year. Lily Alexandre's Son, the sire of Fill Pail Star, was out of Imp. Lily Alexandre, a cow with a private record of 12,856 pounds of milk, a high record for that day. Fill Pail Star, with Imp. Fillpail 4th and Imp. Lily Alexandre as his two nearest dams, should have carried a great inheritance but the records of his daughters would indicate that he failed to measure up to what must have been expected of him. He was killed while yet a young bull as a reactor to the tuberculin test, a fate common to many animals in the early years of the herd.

[illegible]

***See continuation of pedigree on following page.

PEDIGREE OF TOBASCO, 451

No. at left—Year of Birth. No. at right—Registration No.
American Guernsey Cattle Club Organized—1877.



*Sire and dam not given in Herd Book.

The pedigree charts of Storrs Eurotas which are typical for the family are of value in establishing the relationships involved, since in the earlier days of Guernsey breeding in the United States, on account of the small numbers of purebred Guernseys available, much close line breeding and inbreeding was practiced. The pedigree of Storrs Eurotas is easily made up in two parts since seven removes from the cow in question leads to imported animals in every case except that of Tobasco 451. The pedigree of Tobasco is most interesting because he traces to the first importations of Guernseys to be accepted for registry by the American Guernsey Cattle Club. Nicholas Biddle, who made this importation in 1840, kept accurate pedigree records of his herd, so that when the American Guernsey Cattle Club was founded in 1877 the animals in his herd were admitted to the Herd Register. This pedigree, together with that of animals descended from Storrs Eurotas or similar blood lines, reveals 23 generations of American bred Guernseys covering a period of 89 years.

Eurotas contributed two daughters to the herd, Eurotas 2nd and Lily Eurotas, full sisters sired by Fill Pail Star. These animals, with their descendants, are shown in Table 2.

TABLE 2
Pedigree Chart

Showing Descendants of Eurotas (Female Line)

EUROTAS

- Lily Eurotas
- Lily Eurotas 2nd
- Lily Eurotas 2nd's Rose
- Eurotas Rose
- Lily Rock
- Lorin Masher
- Lute Storrs Masher
- Lighting Storrs Masher
- Laureate Lightning Storrs
- Lassie Lute Storrs
- Buoyant Lassie Storrs
- Carmine Lorin Storrs

Eurotas 2nd

- Eurotas Mansfield
- Wolf Rock's Eurotas
- Winifred of Storrs
- Eurotas Mansfield 2nd
- Emerald Joffre
- Ellen Emerald Storrs
- Julia Ellen Storrs

Storrs Eurotas

- Storrs Eurotas 2nd
- Simple Eurotas
- Storrs Sunbeam
- Salient Sunbeam Storrs
- Sagacious Storrs Sunbeam
- Genial Eurotas Storrs

An addition was made to the females of the herd in 1903 by the purchase from E. T. Gill of Haddonfield, New Jersey, veteran Guernsey breeder and famous for his Glenwood strain of Guernseys, of Naomi's Beauty 9,914, and Lady Naomi 9,913. These cows had been bred, however, by Alexander Warner of Baxter Springs, Kansas.

Royal Rose 7,405, a bull, was purchased from H. F. Dimock of South Coventry, Connecticut, in 1902. Mr. Dimock was the breeder of Miss Sharon, the granddam of Gerar Pearl, one of the great dams of the Guernsey breed for the number and quality of her sons and daughters. Royal Rose was by Maids Victor, a son of Fairview Maid and out of Margaret Truth, a daughter of Esquire Fill Pail, another son of Imp. Fill Pail 4th. It is interesting to note that Truth, the granddam of Margaret Truth, was by Imp. Malbrook, the maternal grandsire of Marion, the bull of the earlier, but extinct, herd. Wolf Rock 13,082, another bull of Mr. Dimock's breeding, was added to the herd in 1908 to follow Royal Eurotas, a son of Royal Rose and out of Eurotas 2nd, a daughter of Eurotas, one of the foundation cows. Simple Septimus, a son of Masher's Sequel was purchased in 1909 from Grassland's Farm, Taconic, Connecticut, to follow Wolf Rock. The bulls later used in the herd: Eva's Sequel, leased from Grassland's Farm; General Joffre of Greenway, purchased from Greenway Farm, South Manchester, Connecticut; Grassland's Comet, purchased from Grassland's Farm; Albamont Jupiter, leased from the University of New Hampshire; and Foremost's Excelsior, Foremost's Marshall, Princess' May Royal, Royal Supreme, and Caroline's May Royal, all leased from Emmadine Farms, Hopewell Junction, New York, have followed in succession. The present policy of the College of leasing outstanding bulls from large breeding establishments is illustrated by the last five service bulls mentioned.

Some of the bulls leased from Emmadine Farms have been used only a short period because in most instances they were returned for service or for the Emmadine Farm show herd. It is possible to report on the daughters of only one of the bulls, Foremost's Excelsior, and for him on only two daughters. This bull was in service for one year, but all except three of his progeny were males, and one heifer calf was lost. Six daughters of the next bull, Foremost's Marshall, were obtained from one year of service. One of these failed to conceive and one of the five aborted in the first gestation, so it is impossible to report on this bull at present. The daughters of Princess' May Royal, seven in number, are just now coming into milk. The next bull, Royal Supreme, became inactive shortly after reaching the College and this most promising bull was returned with great reluctance. Two heifers were born to this bull. The present sire, Caroline's May Royal, is of exceptionally fine type and is the Junior Champion of the 1929 National Dairy Show and Grand Champion of the 1931 Eastern States Exposition.

TABLE 3.
Vital Statistics and Production Data of the Guernsey Herd

Cow	Reg. No.	Dam	Sire	Year of Birth	Year of Death or Sale	No. of Lactations	Total Production while in herd		
							Milk	Fat	Fat
1. Francille (P)	8,178	Minelle	M	1893	1899	2	9,207	5.00	460.7
2. Franconia	10,389	Francille	C	1897	1901	2	3,881	4.62	179.4
3. Fairview Maid (P)	3,810	Imp. Robinette 2nd	N	1888	1901	5	26,452	4.64	1227.4
4. Eurotas (P)	2,537	Beautiful Star	N	1885	1900	4	21,245	4.13	878.4
5. Lily Eurotas	10,388	Eurotas	C	1897	1901	2	5,692	4.81	273.7
6. Eurotas 2nd	14,067	Eurotas	C	1900	1909	5	44,893	4.50	2042.0
7. Lily Eurotas 2nd	14,131	Lily Eurotas	F	1900	1908	5	27,374	5.20	1425.0
8. Naomi's Beauty (P)	9,914	Peter's Naomi	O	1897	1910	6	36,984	4.23	1565.0
9. Lady Naomi (P)	9,913	Naomi H.	O	1897	1907	3	15,981	4.62	738.0
10. Lily Eurotas 2nd's Rose	18,211	Lily Eurotas 2nd	D	1903	1912	6	30,878	4.48	1385.2
11. Storrs Naomi	21,558	Lady Naomi	D	1905	1916	7	55,091	4.43	2444.1
12. Eurotas Mansfield	21,560	Eurotas 2nd	E	1906	1911	2	9,386	4.28	402.1
13. Eurotas Naomi	21,559	Naomi's Beauty	E	1906	1912	3	25,184	4.59	1157.6
14. Eurotas Rose	23,500	Lily Eurotas 2nd's Rose	E	1906	1911	2	8,312	4.68	389.5
15. Naomi's Beauty 2nd	23,501	Naomi's Beauty	E	1907	1912	1	9,756	4.61	450.1
16. Storrs Eurotas	24,705	Eurotas 2nd	E	1908	1914	2	8,842	4.67	412.9
17. Lily Rock	27,397	Lily Eurotas 2nd's Rose	G	1909	1915	4	28,655	4.66	1335.5
18. Wolf Rock's Eurotas	30,904	Eurotas Mansfield	G	1909	1916	4	25,299	4.48	1135.9
19. Eurotas Naomi 3rd	35,173	Eurotas Naomi	Q	1910	1916	2	11,402	4.91	559.7
20. Eurotas Mansfield 2nd	35,289	Eurotas Mansfield	Q	1910	1920	6	46,601	4.06	1819.1
21. Storrs Naomi 2nd	35,290	Storrs Naomi	Q	1910	1915	3	15,931	4.25	678.0
22. Simple Eurotas	38,350	Storrs Eurotas	H	1911	1923	8	70,939	4.32	3064.6
23. Storrs Eurotas 2nd	44,708	Storrs Eurotas	H	1913	1917	2	11,805	4.62	545.7
24. Lorin Masher	61,496	Lily Rock	I	1914	1927	10	71,585	4.92	3523.1
25. Eva of Storrs	71,049	Storrs Naomi	I	1915	1920	2	12,641	4.75	600.1

TABLE 3. (Continued.)
Vital Statistics and Production Data of the Guernsey Herd

Cow	Reg. No.	Dam	Sire	Year of Birth	Year of Death or Sale	No. of Lactations	Total Production while in herd	% Fat	Fat
							Milk		
26. Winifred of Storrs	61,497	Wolf Rock's Eurotas	I	1914	1918	1	6,009	4.55	273.9
27. Lute Storrs Masher	87,066	Lorin Masher	J	1916	1929	12	87,803	4.83	4242.4
28. Emerald Joffre	95,420	Eurotas Mansfield 2nd	J	1917	1921	2	7,091	4.20	298.4
29. Lola of Green Lodge (P)	78,025	Imp. Lizette III of the Bourg de Bas	R	1917	1926	2	10,263	5.72	587.0
30. Lighting Storrs Masher	95,422	Lute Storrs Masher	J	1918	1923	2	14,786	4.12	609.0
31. Storrs Sunbeam	95,421	Simple Eurotas	J	1918	1923	4	18,087	4.13	747.6
32. Ella of Green Lodge (P)	70,103	Eve of Green Lodge	S	1915	1928	4	18,954	4.64	880.2
33. Doris of Green Lodge (P)	92,834	Dorothy of Green Valley	R	1919	1925	2	4,610	4.98	229.8
34. Moorland Margaret (P)	136,275	Omega Margaret	T	1920	1926	4	18,309	4.64	849.6
35. Ellen Emerald Storrs	118,516	Emerald Joffre	K	1921	1925	2	6,365	4.76	303.1
36. Ernestine of Green Lodge (P)	119,016	Evelyn of Green Lodge 2nd	U	1921	1928	3	14,757	4.80	708.4
37. Salient Sunbeam Storrs	123,078	Storrs Sunbeam	K	1921	1928	4	30,721	4.60	1415.4
38. Genial Eurotas Storrs	145,552	Simple Eurotas	K	1922	1929	4	41,922	4.54	1902.2
39. Lassie Lute Storrs	134,118	Lute Storrs Masher	K	1922	1925	1	8,092	5.27	428.3
40. Doris of Green Lodge 3rd (P)	147,155	Doris of Green Lodge	U	1923	1927	2	9,366	4.27	400.8
41. Laureate Lightning Storrs	148,284	Lighting Storrs Masher	K	1923	1930	6	37,860	4.53	1713.2
42. Sagacious Storrs Sunbeam	156,775	Storrs Sunbeam	K	1923	*	6	50,697	4.54	2304.1
43. Buoyant Lassie Storrs	171,217	Lassie Lute Storrs	L	1924	*	5	37,548	5.55	2084.6
44. Amiable Lola Storrs	180,143	Lola of Green Lodge	L	1924	1930	5	28,046	4.80	1347.4
45. Julia Ellen Storrs	197,711	Ellen Emerald Storrs	L	1925	1931	3	24,102	5.03	1213.3
46. Carmine Lorin Storrs	208,607	Lorin Masher	L	1926	1929	2	13,215	4.90	648.0
47. Orchid Ella Storrs	211,838	Ella of Green Lodge	L	1926	1930	2	10,703	5.68	608.1
48. Melodant Margaret Storrs	220,172	Radiant Margaret Storrs	V	1926	*	2	10,396	5.27	548.5
49. Sprightly Lola Storrs	225,056	Lola of Green Lodge	V	1926	*	2	14,369	5.42	778.9

*Still in Herd.
(P) Purchased.

More recent purchases of females were made as follows: Imp. Green Meadow Peeress, of Mr. G. A. Cluett, Williamstown, Mass. and Moorland Margaret of Mr. E. A. Moore of Moorland Farms, Kensington, Conn., in 1922; Ella of Green Lodge, Lola of Green Lodge, Doris of Green Lodge, Doris of Green Lodge 3rd and Ernestine of Green Lodge, from Mr. E. D. Codman of Dedham, Massachusetts, in 1924.

It is interesting to observe that of the cows originally purchased the descendants of but one, Eurotas, are found in the herd today. Thirteen of the nineteen females in the present Guernsey herd (1931) are direct descendants of Eurotas, and it seems probable that this proportion will increase unless new females should again be introduced, as the more recent purchases have not yet made impressive contributions. Fairview Maid, the half sister of Eurotas, produced five bulls; but as none of these were retained for use in the herd she left no descendants.

The blood of Eurotas entered the Naomi family by the mating of Royal Eurotas, a son of Eurotas 2nd, to Lady Naomi and Naomi's Beauty, but the offspring from these matings extended in the herd through only two generations.

Presentation of Production Data

Table 3 gives a list of the lactating females of the herd since its foundation in 1896, with dam, sire, date of birth, date of death or sale, number of lactations while in the herd, total milk and butter fat production while in the herd, and average percentage of butter fat based on total production of milk and butter fat while in the herd. The butter fat percentage, derived as indicated in the preceding statement, and found in this table, is used throughout, in the belief that the average of the total production will be more exact than the percentage for any one year. No cow has been considered that has not milked 200 days or more. A key to the code letter for bulls is to be found in Table 4.

TABLE 4

Key to Bulls Represented by Daughters

Key	Name	Reg. No.	Key	Name	Reg. No.
C	Fill Pail Star	4,295	M	Preservers Fancy	3,028
D	Royal Rose	7,405	N	Imp. Pacific	282
E	Royal Eurotas	9,831	O	Lord Baxter	4,278
F	Maid's Victor	4,855	Q	Young Truth	11,631
G	Wolf Rock	13,082	R	Noble Merger	31,341
H	Simple Septimus	15,224	S	Jokastus	17,320
I	Eva's Sequel	21,588	T	Langwater Soldier	43,379
J	General Joffre of Greenway	31,313	U	St. Ita's Planet	54,954
K	Grassland's Comet	55,931	V	Foremost's Excelsior	113,350
L	Albmont Jupiter	79,919			

TABLE 5
Advanced Registry Records of the Guernsey Herd

No.	Name	Lbs. Milk	Lbs. Fat	Days	Year of Birth	Age	Sire	Generation removed from Eurotas through daughter indicated
6	Eurotas 2nd	8640	392.7	365	1901	Sr. 4	C	1st generation
11	Storrs Naomi	10557	475.2	"	1905	8	D	
	"	10145	413.9	"	"	10		
13	Eurotas Naomi	9388	451.9	"	1906	Sr. 4	E	3rd, through son of Eurotas 2nd
17	Lily Rock	7694	356.6	"	1909	" "	G	4th, " Lily Eurotas
20	Eurotas Mansfield 2nd	6911	294.8	"	1910	Sr. 2	"	3rd, " Eurotas 2nd
	"	9225	359.5	"	"	Sr. 4		
22	Simple Eurotas	7499	327.1	"	1911	Jr. 2	H	3rd, " " "
	"	10850	470.9	"	"	5		
	"	12756	539.6	"	"	6		
24	Lorin Masher	10632	529.3	"	1914	Sr. 3	I	5th, " Lily Eurotas
	"	11475	534.9	"	"	5		
	"	11357	558.7	"	"	6		
25	Eva of Storrs	9781	476.4	"	1915	Sr. 3	I	
27	Lute Storrs Masher	7067	356.6	"	1916	Jr. 2	J	6th, " " "
	"	8030	433.3	358	"	Jr. 3		
	"	10328	492.7	365	"	5		
	"	10982	529.0	"	"	7		
	"	11318	557.4	"	"	9		
	"	10681	509.0	"	"	10		
	"	8913	417.4	"	"	11		
	"	8740	424.7	360	"	12		
29	Lola of Green Lodge	9339	530.5	365	1917	7	R	
31	Storrs Sunbeam	8655	370.8	"	1918	Jr. 3	J	4th, " Eurotas 2nd
30	Lighting Storrs Masher	10094	416.5	"	"	" "	"	7th, " Lily Eurotas
36	Ernestine of Green Lodge	7913	395.7	"	1921	" "	U	
37	Salient Sunbeam Storrs	12835	560.4	"	"	Jr. 2	K	5th, " Eurotas 2nd

TABLE 5 (Continued)

No.	Name	Lbs. Milk	Lbs. Fat	Days	Year of Birth	Age	Sire	Generation removed from Eurotas through daughter indicated
39	Lassie Lute Storrs	8093	448.0	365	1922	Jr. 2	U	7th, through Lily Eurotas
38	Genial Eurotas Storrs	11116	503.5	"	"	Sr. 2	U	4th, " Eurotas 2nd
	"	12587	565.5	"	"	Jr. 4		
	"	10451	470.1	263	"	5		
41	Laureate Lightning Storrs	8144	359.5	318	1923	Sr. 2	U	8th, " Lily Eurotas
	"	8678	400.0	290	"	Sr. 4		
42	Sagacious Storrs Sunbeam	10058	457.2	365	"	Jr. 2	U	5th, " Eurotas 2nd
	"	12086	565.9	"	"	Jr. 4		
	"	14098	640.4	"	"	6		
43	Buoyant Lassie Storrs	10568	596.8	"	1924	Sr. 2	L	8th, " Lily Eurotas
	"	12226	657.1	"	"	5		
45	Julia Ellen Storrs	9127	457.3	"	1925	Jr. 2	"	6th, " Eurotas 2nd
46	Carmine Lorin Storrs	6983	361.1	"	1926	" "	"	6th, " Lily Eurotas

NOTE: It will be noted that the second name of the cow is the first name of the dam for cows named in recent years.

Table 5 presents in addition the list of Advanced Registry records completed and accepted by the American Guernsey Cattle Club to July 1, 1931, for cows that have been admitted. The numbers at the left correspond to the serial numbers in Table 3.

Twenty-one of the 49 cows have been admitted to the Advanced Registry. Of this number all except three are direct descendants of Eurotas.

A record of 500 pounds of fat first appeared in the third generation; and a 600 pound fat record has been obtained from two cows, one in the fifth and the other in the eighth generation removed from Eurotas. The Advanced Registry records, it should be pointed out, are not corrected for age but are presented here just as they are recorded.

Daughter-dam Comparisons

The first lactation of a cow in the herd not affected by abortion or other accident is used to compute the records in Table 6. The conversion factors are the same as those used by White et al. (4). These corrective factors are for age as follows: under 2 years = 1.48; 2 to 2½ years = 1.4; 2½ to 3 years = 1.3; 3 to 3½ years = 1.2; 3½ to 4 years = 1.15; 4 to 4½ years = 1.1; 4½ to 5 years = 1.07; 5 to 5½ years = 1.05; 5½ to 6 years = 1.03; 6 to 6½ years = 1.02; 6½ to 7 years = 1.01; 7 to 10 years = 1.00; and 10 to 13 years = 1.05. The factor used to convert Advanced Registry tests to regular herd yield was .70. This factor was applied, however, only when the cows were milked more than twice daily. The three columns under "Cow's Record" of Table 6 show the milk and butter fat records of each cow corrected to standard conditions as explained above. The next three columns under "Dam's Record" show data similarly computed for the dam of each cow in the same horizontal line. The three columns under "Difference" show the difference between the production of daughters and dams. When the daughter's record is greater than the dam's record, it is indicated by a plus sign; when the daughter's record is less it is indicated by a minus sign.

Thus after thirty-one years of breeding (females born in the last four years not being listed) no claim can be made to great accomplishment. To be sure improvement has been made. The appearance of the animals is more pleasing. The heavy, winged shoulders, the weak loin, the drooping eyes and ears and the rough shaggy coat so common twenty years ago have disappeared. Also there is evidence of improved yield, and the appearance of low grade producers is less frequent than formerly in spite of the fact that the daughter-dam comparisons in Table 6 reveal 20 decreases against 21 increases in milk yield, the same number in fat yield, and 25 increases against 16 decreases in percentage of fat in the individual cases.

TABLE 6
Comparison of the Records of Guernsey Cows with the Records of Their Dams

	Cow's Record*			Dam's Record*			Difference		
	Milk	% Fat	Fat	Milk	% Fat	Fat	Milk	% Fat	Fat
1. Francille	6102	5.00	302.4	6102	5.00	302.4	—	.38	—
2. Franconia	3750	4.62	181.0						—
3. Fairview Maid	6455	4.64	309.0						—
4. Eurotas	6455	4.13	289.0						—
5. Lily Eurotas	3675	4.81	182.0	6455	4.13	289.0	—2780	.68	—107.0
6. Eurotas 2nd	6705	4.50	295.0	6455	4.13	289.0	+250	.37	+6.0
7. Lily Eurotas 2nd	6511	5.20	293.0	3675	4.81	182.0	+2836	.39	+110.0
8. Naomi's Beauty	5565	4.23	239.0						
9. Lady Naomi	5090	4.62	234.0						
10. Lily Eurotas 2nd's Rose	6110	4.48	296.0	6511	5.20	293.0	—401	.72	+3.0
11. Storrs Naomi	7863	4.43	346.8	5090	4.62	234.0	+2773	.19	+112.8
12. Eurotas Mansfield	6587	4.24	280.6	6705	4.50	295.0	+118	.26	+14.4
13. Eurotas Naomi	6216	4.59	281.4	5565	4.23	239.0	+651	.36	+42.4
14. Eurotas Rose	5097	4.68	243.8	6110	4.48	296.0	—1013	.20	—52.2
15. Naomi's Beauty 2nd	7540	4.61	347.2	5565	4.23	239.0	+1975	.38	+108.2
16. Storrs Eurotas	5887	4.67	268.3	6705	4.50	295.0	—818	.17	—26.7
17. Lily Rock	8331	4.66	372.0	6110	4.48	296.0	+2221	.18	+76.0
18. Wolf Rock's Eurotas	8638	4.48	390.2	6587	4.24	280.6	+2051	.24	+109.6
19. Eurotas Naomi 3rd	6448	4.91	320.1	6216	4.59	281.4	+232	.32	+38.7
20. Eurotas Mansfield 2nd	6488	4.06	265.3	6587	4.24	280.6	+99	.18	+15.3
21. Storrs Naomi 2nd	5569	4.25	232.0	7863	4.43	346.8	—2294	.18	—114.8
22. Simple Eurotas	7300	4.32	328.9	5887	4.67	268.3	+1413	.35	+60.6
23. Storrs Eurotas 2nd	7561	4.62	349.3	5887	4.67	268.3	+1674	.05	+81.0
24. Lorin Masher	7376	4.92	369.5	8331	4.66	372.0	—955	.26	—2.5
25. Eva of Storrs	7141	4.75	335.4	7863	4.43	346.8	—722	.32	—11.4

TABLE 6 (Continued)

	Cow's Record*			Dam's Record*			Difference		
	Milk	% Fat	Fat	Milk	% Fat	Fat	Milk	% Fat	Fat
26. Winifred of Storrs	7812	4.55	356.1	8638	4.48	390.2	-826	+.07	-34.1
27. Lute Storrs Masher	9894	4.83	499.2	7376	4.92	369.5	+2518	+.09	+129.7
28. Emerald Joffre	6118	4.20	257.6	6488	4.06	265.3	-370	+.14	-7.7
29. Lola of Green Lodge	6537	5.72	361.4	8170	4.71	393.1	-1633	+.01	-31.7
30. Lightning Storrs Masher	8479	4.12	349.9	9894	4.86	499.2	-1415	-.74	-149.3
31. Storrs Sunbeam	6492	4.13	296.2	7300	4.32	328.9	-808	-.19	-32.7
32. Ella of Green Lodge	7120	4.64	339.1	7032	4.87	342.5	+88	-.23	-3.4
33. Doris of Green Lodge	4610	4.98	229.8	9958	4.20	418.4	-4380	+.44	-151.0
34. Moorland Margaret	5578	4.64	267.4	6118	4.20	257.6	+764	+.56	+71.9
35. Ellen Emerald Storrs	6882	4.76	329.5	6492	4.13	296.2	+4485	+.47	+219.7
36. Ernestine of Green Lodge	6647	4.80	332.4	7300	4.32	328.9	+2816	+.22	+129.3
37. Salient Sunbeam Storrs	10977	4.60	515.9	9894	4.86	499.2	-1963	+.41	-60.2
38. Genial Eurotas Storrs	10116	4.54	438.2	9894	4.86	499.2	-1963	+.41	-60.2
39. Lassie Lute Storrs	7931	5.27	439.0	4610	4.98	229.8	+4714	-.71	-175.9
40. Doris of Green Lodge	9324	4.27	405.7	8479	4.12	349.9	+1068	+.41	-22.7
41. Laureate Lightning Storrs	7411	4.53	327.2	6492	4.13	296.2	+3365	+.41	-151.9
42. Sagacious Storrs Sunbeam	9857	4.54	448.1	7931	5.27	439.0	+1702	+.28	+104.1
43. Buoyant Lassie Storrs	9633	5.55	543.1	6537	5.72	361.4	-985	-.92	-104.1
44. Amiable Lola Storrs	5552	4.80	237.3	6882	4.76	329.5	+2063	+.27	+118.7
45. Julia Ellen Storrs	8945	5.03	448.2	7376	4.92	369.5	+533	-.02	-15.6
46. Carmine Lorin Storrs	6843	4.90	353.9	7120	4.68	339.1	+328	+.00	+93.6
47. Orchid Ella Storrs	7448	5.68	432.7	6537	5.72	361.4	+2875	-.30	+136.1
48. Melodant Margaret Storrs	5925	5.27	315.7						
49. Sprightly Lola Storrs	9412	5.42	497.5						

*See explanation preceding this table for method used to convert records to mature equivalent. Fat percentage is based upon "Total Production" in Table 3 and not upon single record given in this table.

The accomplishments, or rather lack of rapid accomplishments over this long period, we fear are characteristic in the majority of herds. It is of extreme economic importance that breeders find some means for more rapid and definite improvement of herds, if such are to be had. In the first place it is possible today to start higher in the scale for certain desirable characteristics than the original foundation animals possessed thirty-five years ago. A few attempts have been made to bring about improvement by the introduction of females, but of the two introduced in 1903 no trace remains; and of seven females introduced since 1921 it is not at present evident that any one will leave a permanent imprint upon the herd.

It is realized that this fact in a measure constitutes an indictment against judgment in purchases, but it may be pointed out that the ordinary breeder has faced the same difficulties on account of the very high prices commanded by Guernsey breeders. This experience, common to those seeking a foundation in Guernseys, also presents an indictment against breeders who have been so reluctant to offer for this purpose animals that could lay claim to merit and who have been content to sell female discards at prices considerably above their value.

The ray of light is found in the fact that the herd has been developed from one original foundation cow introduced in 1897, through the introduction of sires. The sire therefore constitutes the second factor for improvement, and in the following pages we shall recount the contributions of these animals.

Analysis of the Influence of Bulls

Table 7 is compiled from Table 6 and is an arrangement of the daughters of the different herd sires according to sires. The plus figures in the column "Difference" of Table 6 are arranged in the column "Under Dam." The last column "Average Difference," is the average net difference of all the daughters of a sire and represents the average increase or decrease of all the daughters of a bull in the production of milk and butter fat and percentage of butter fat when compared with the records of their dams.

A study of Table 7 reveals the fact that Fill Pail Star with three daughters in the herd lowered the milk production an average of 1627 pounds under their dams, lowered the butter fat production an average of 74.1 pounds, but increased the butter fat percentage an average of 0.22. He got two daughters out of Eurotas, the foundation cow, one of which, Eurotas 2nd, showed a slight increase over her dam's production in milk, butter fat, and butter fat percentage. The other daughter, Lily Eurotas, full sister to Eurotas 2nd, gave 2780 pounds less milk and 107 pounds less butter fat than her dam but had a butter fat percentage 0.38 higher.

TABLE 7
Summary of Daughter-Dam Comparison Arranged According to Sires

	Over Dam			Under Dam			Average Difference of Sires' Daughters from Dams		
	Milk	%	Fat	Milk	%	Fat	Milk	%	Fat
<i>Fill Pail Star</i>									
1. Eurotas 2nd	250	.37	6.0	2780		107.0			
2. Lily Eurotas		.67		2352	.38	121.4			
3. Franconia				5132	.38	228.4	-1627	+ .22	-74.1
	250	1.04	6.0						
<i>Royal Rose</i>									
1. Storrs Naomi	2773		112.8		.19				
2. Lily Eurotas 2nd Rose			3.0	401	.72				
	2773		115.8	401	.91		+1186	- .45	+57.9
<i>Royal Eurotas</i>									
1. Eurotas Mansfield				118	.26	14.4			
2. Eurotas Naomi	651	.36	42.4						
3. Eurotas Rose		.20		1013		52.2			
4. Naomi's Beauty	1975	.38	108.2						
5. Storrs Eurotas		.17		818		26.7			
	2626	1.11	150.6	1949	.26	93.3	+ 135	+ .17	+11.5
<i>Wolf Rock</i>									
1. Lily Rock	2221	.18	76.0						
2. Wolf Rock's Eurotas	2054	.24	109.6	99	.18	15.3			
3. Eurotas Mansfield 2nd				99	.18	15.3	+1392	+ .08	+56.8
	4275	.42	185.6						
<i>Simple Septimus</i>									
1. Simple Eurotas	1413		60.6		.35				
2. Storrs Eurotas 2nd	1674		81.0		.05				
	3087		141.6		.40		+1544	- .20	+70.8

TABLE 7 (Continued)

	Over Dam			Under Dam			Average Difference of Sires' Daughters from Dams		
	Milk	%	Fat	Milk	%	Fat	Milk	%	Fat
<i>Eva's Sequel</i>									
1. Lorin Masher		.26		955		2.5			
2. Eva of Storrs		.32		722		11.4			
3. Winifred of Storrs		.07		826		34.1			
		.65		2503		48.0	- 834	+ .22	-16
<i>General Joffre of Greenway</i>									
1. Lute Storrs Masher	2518		129.7		.06				
2. Emerald Joffre		.14		370		7.7			
3. Lighting Storrs Masher				1415	.74	149.3			
4. Storrs Sunbeam				808	.19	32.7			
	2518	.14	129.7	2593	.99	189.7	- 19	- .21	-15.0
<i>Grassland's Comet</i>									
1. Ellen Emerald Storrs	764	.56	71.9						
2. Salient Sunbeam Storrs	4485	.47	219.7						
3. Genial Eurotas Storrs	2816	.24	129.3						
4. Lassie Lute Storrs		.41		1963		60.2			
5. Laureate Lightning Storrs		.37		1068		22.7			
6. Sagacious Storrs Sunbeam	3365	.36	151.9						
	11430	2.41	572.8	3031		82.9	+1400	+ .40	+81.7
<i>Albamount Jupiter</i>									
1. Buoyant Lassie Storrs	1702	.46	104.1						
2. Julia Ellen Storrs	2063	.22	118.7						
3. Carmine Lorin Storrs				533	.06	15.6			
4. Orchid Ella Storrs	328	1.13	93.6						
	4093	1.81	316.4	533	.06	15.6	+ 890	+ .45	+75.2
<i>Foremost's Excelsior</i>									
1. Melodant Margaret Storrs					.30				
2. Sprightly Lola Storrs	2875		136.1						

Royal Rose and his son Royal Eurotas, out of Eurotas 2nd, seem to have some characteristics in common. When bred to the Naomi family they increased the milk production but when bred to the Eurotas family they lowered it. Royal Eurotas raised the butter fat percentage on all but one daughter.

Wolf Rock raised the milk production, butter fat production and butter fat percentage very materially on Lily Rock and Wolf Rock's Eurotas over that of their dams, but lowered all three slightly in the case of Eurotas Mansfield 2nd, a full sister to Wolf Rock's Eurotas.

It is to be regretted that Simple Septimus got but two daughters to have records, as he increased the production of his two daughters by an average of 1544 pounds of milk and 70.8 pounds of butter fat. He lowered the butter fat test an average of 0.20%. Since he had but these two daughters, Simple Eurotas and Storrs Eurotas 2nd, both out of the same cow, Storrs Eurotas, a true measure of his ability is not shown.

Following the first bull, Fill Pail Star, the next bull, Royal Rose, contributed a marked increase. Then came Royal Eurotas to lower the production slightly, followed by another sharp increase through Wolf Rock, with Eva's Sequel and General Joffre of Greenway to offset partially the advance of their immediate predecessors.

Eva's Sequel with three daughters lowered the milk production of each of them an average of 834 pounds, lowered the butter fat production of each an average of 16 pounds, but increased the butter fat percentage of the three by an average of 0.22.

The influence of Gen. Joffre of Greenway on his daughters is interesting but is difficult to measure. He increased the milk production of Lute Storrs Masher 2518 pounds and the butter fat production 129.7 pounds over that of her dam, but lowered the butter fat percentage 0.06. Lighting Storrs Masher, the result of breeding Gen. Joffre of Greenway back to his own daughter, Lute Storrs Masher, produced 1415 pounds of milk and 149.3 pounds of butter fat less than her dam, while her butter fat percentage was 0.74 less than that of her dam. The effect from the use of General Joffre of Greenway was to increase the production of one daughter over the dam and to decrease the production in three other cases. The net result upon the four daughters seemingly was to effect a slight decrease in milk and test, although the values in the table perhaps do not measure fully the true adverse effects contributed by this bull, since the gain attributed to his daughter Lute Storrs Masher may be over-rated, as one may judge by comparing her Advanced Registry records with those of her dam, Lorin Masher, in Table 5.

Grassland's Comet increased the butter fat percentage of all his daughters an average of 0.40, the smallest increase being 0.24%. This bull increased the milk production of his daughters an average of 1400 pounds and the butter fat production an average of 81.7 pounds. He lowered the milk and butter fat production on Lassie Lute Storrs

TABLE 8
A Table Showing the Effect of Sires on the Herd Production

	Number of Daughters	Average of Production of Daughters of Herd Sires			Average Differences Between Daughters' Records and Records of Dams		
		Milk	% Fat	Fat	Milk	% Fat	Fat
Fill Pail Star	3	4710	4.64	219.3	-1627	+ .22	-74.1
Royal Rose	2	6987	4.46	321.4	+1186	- .45	+57.9
Royal Eurotas	5	6265	4.56	284.5	+135	+ .17	+11.5
Wolf Rock	3	7819	4.40	342.5	+1392	+ .08	+56.8
Simple Septimus	2	7431	4.47	339.1	+1544	- .20	+70.8
Eva's Sequel	3	7443	4.74	353.7	- 834	+ .22	-16
General Joffre of Greenway	4	7746	4.33	350.7	- 19	- .21	-15.0
Grassland's Comet	6	8862	4.70	419.7	+1400	+ .40	+81.7
Albmont Jupiter	4	8217	5.35	444.5	+ 890	+ .45	+75.2
Foremost's Excelsior*	2	7668	5.16	406.6	+1131	- .56	+45.2

*Only two daughters and record of one dam available.

and Laureate Lightning Storrs, the former a daughter of Lute Storrs Masher and the latter a daughter of Lighting Storrs Masher and granddaughter of Lute Storrs Masher. Ellen Emerald Storrs, a daughter of Grassland's Comet and out of Emerald Joffre, shows an increase of 764 pounds in milk production over that of her dam; and the increase in her butter fat percentage, 0.56, and butter fat production, 71.9 pounds, are particularly significant. Grassland's Comet got two daughters from Storrs Sunbeam, also a daughter of Gen. Joffre of Greenway. One of these, Salient Sunbeam Storrs, increased the milk production over her dam by 4485 pounds, the butter fat production by 219.7 pounds and the butter fat percentage by 0.47. The other, Sagacious Storrs Sunbeam, increased the milk production over her dam by 3365 pounds, the butter fat production by 151.9 pounds and the butter fat percentage by 0.36.

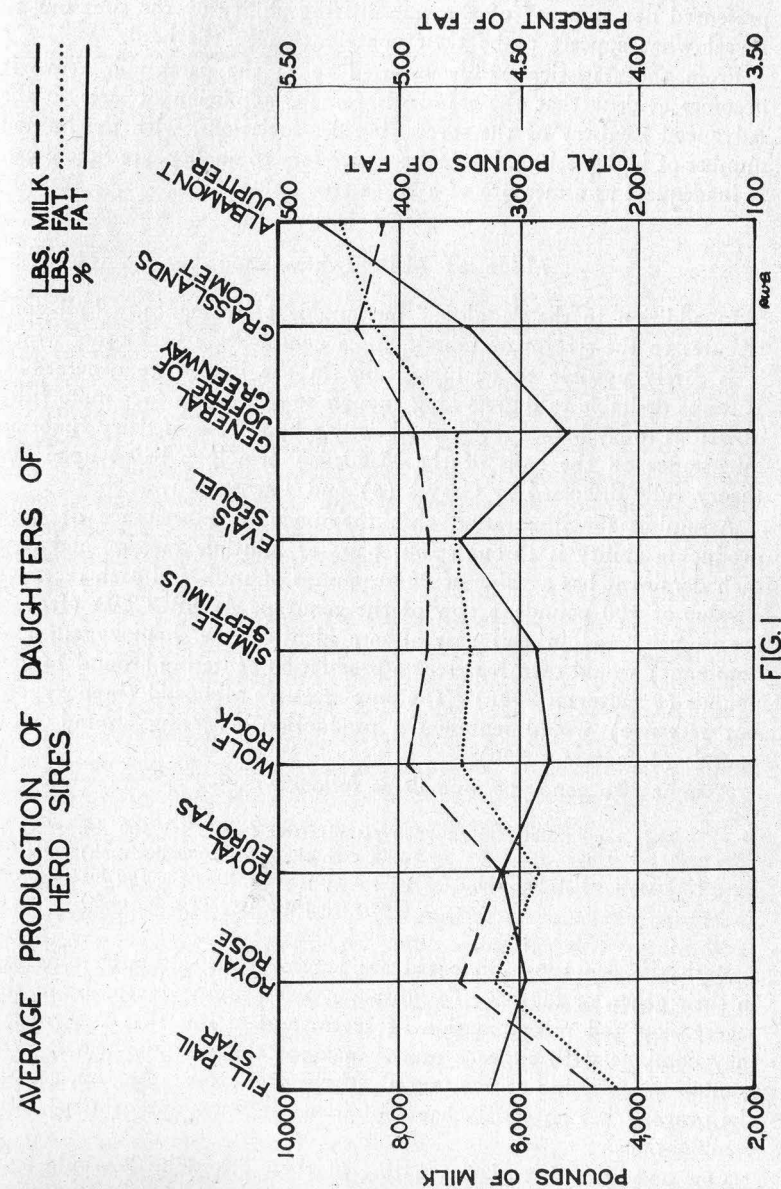
Albamount Jupiter has three daughters from the Eurotas family and one from a family more recently added to the herd. Carmine Lorin Storrs, a daughter of Lorin Masher, is lower in milk production by 53.3 pounds, lower in the production of butter fat by 15.6 pounds and lower in butter fat percentage by 0.06 than her dam. The other three daughters of Albamount Jupiter have enough increase over their dams so that the average increase for the four daughters is 890 pounds of milk, 75.2 pounds of butter fat and 0.45% butter fat.

Foremost's Excelsior left two daughters, but the records of only one dam are available. Since this represents his final direct contribution to the herd the data are presented even though too scant for conclusions. Neither of his daughters carry the blood of the Eurotas family.

Other bulls appearing in Table 4 were not used in the herd but enter in simply as sires of females introduced into the herd.

Table 8 presents in condensed form the production data on daughters of the sires, with the difference in yield compared with their dam's record. Figure 1 illustrates the daughters' production graphically. This table and graph in particular show a definite increase in yield since the beginning and at the same time emphasize that only two bulls out of nine, Wolf Rock and Grassland Comet, furnished the stepping stones for higher levels of production.

It is realized that the number of daughters is too limited to evaluate correctly the transmitting qualities of most of the sires. Davidson (5) in a statistical comparison of daughter-dam production concludes that fifteen daughters of a sire are fairly representative of any larger group and that six pairs are the minimum number of comparisons upon which the probable transmitting ability of a bull may be safely based. The Bureau of Dairy Industry, U. S. D. A., has adopted five pairs as a basis for study of sires in cow testing associations. Grassland's Comet is the only bull to qualify for measurement by the minimum Davidson standard, and Royal Eurotas is the only other to meet the U. S. D. A.



standard. These facts are fully appreciated, and the data are here presented not as proof of the transmitting ability of the sires but to reveal what appears to be their contribution to the herd.

From the statistical study referred to in the paragraph above it becomes evident that the standards for the admission of sires to the Advanced Registry of the several breed associations, with the limited number of highly selected daughters necessary to qualify, are ridiculously inadequate as a measure of a bull's true value.

Mode of Milk Inheritance

In addition to the daughters' measurable performance, a bull contributes to the stream of inheritance a combination of factors which it is rarely possible to evaluate fully in the immediate generations. It seems desirable to digress long enough to reveal this fact more fully as well as to lay before the reader briefly a hypothesis of dairy function inheritance on the basis of the Mendelian principle, based upon the theory fully discussed by Graves (6) and Turner (7).

Assuming for illustration that the mode of inheritance of milk producing ability is through four pairs of multiple factors, and that each dominant has a value of 2000 pounds of milk and each recessive a value of 300 pounds, a cow of the genotype AABBCcDd (factors are in pairs and in this case all are identical, i.e. homozygous and dominant) would then represent a production centering around 16,000 pounds (8 factors x 2000). The pure recessive aabbccdd (homozygous but recessive) would represent a production centering around 2400 pounds (8 factors x 300).

Assume two genotype animals as follows:

Male — aaBbCcDd = 7500 pounds (five factors for 300 lbs.
milk each three for 2000 lbs. each)
Female — AaBbCcdd = 7500 pounds (five factors for 300 lbs.
milk each three for 2000 lbs. each)

Both the genotypes presented are heterozygous, although differing in their genes, or factors. To illustrate with the first factor Aa in the segregation and recombination of sperm and ovum, the A (female) may combine with either *a* of the male, or the *a* of the female may combine with either of the two *a*'s of the male thus: Aa, Aa, aa, aa; the progeny has an equal chance of inheriting any one of these four combinations.

One possible result of the mating of these two animals would be a cow with the genotype AaBbCcDd representing a production centering around 9200 pounds. This cow bred back to her sire would make

possible 128 different combinations of these factors, distributed as follows:

1 centering around 14,000 pounds of milk					
7	"	"	12,600	"	"
21	"	"	10,900	"	"
35	"	"	9,200	"	"
35	"	"	7,500	"	"
21	"	"	5,800	"	"
7	"	"	4,100	"	"
1	"	"	2,400	"	"

This can be expressed in a different manner which will perhaps throw a little more light upon what actually happens. If we assume, in the second mating, the same bull—aaBbCcDd—whose sperm cells, after reduction, could vary as follows: aBCD, aBCd, aBcD, aBcd, abCD, abCd, abcD, abcd; and his daughter—AaBbCcDd—whose egg cells could vary as follows: ABCD, ABCd, ABcD, ABcd, AbCD, AbCd, AbcD, Abcd, aBCD, aBCd, aBcD, aBcd, abCD, abCd, abcd; it will be seen, then, that the bull with one factor pair being pure recessives can have but eight possible combinations of factors while the cow having all factor pairs heterozygous can have sixteen possible combinations. The mating of these two animals makes it possible for any one of the bull's eight possible combinations to unite with any one of the cow's sixteen possible combinations, making a total of 128 possibilities genotypically but not 128 levels of production, as the production would be controlled by the number of dominant and recessive factors present. If the bull's sperm cell aBCD should unite with the cow's egg cell ABCD, the resulting animal, AaBBCCDD, if a cow, would have a productive ability centering around 14,300 pounds of milk, or if a bull, the ability to transmit to his daughters a productive ability centering around 14,300 pounds of milk.

This theory could be applied to the case of Lute Storrs Masher to illustrate why we often do not get what we expect in breeding. Lute Storrs Masher's dam's record was 7376 pounds of milk and her sire's daughters averaged 7746 pounds of milk, while her own record was 9894 pounds of milk. Lute Storrs Masher, bred back to her sire, General Joffre of Greenway, produced Lighting Storrs Masher, with a record of 8479 pounds of milk. Lighting Storrs Masher, bred to Grassland's Comet, whose daughters averaged 8862 pounds of milk, produced Laureate Lightning Storrs, with a record of 7411 pounds of milk. Lute Storrs Masher, bred to Grassland's Comet, produced Lassie Lute Storrs, with a record of 7931 pounds of milk. Lassie Lute Storrs in turn when bred to Albamont Jupiter, whose daughters averaged 8217 pounds of milk, produced Buoyant Lassie Storrs with a record of 9633 pounds of milk.

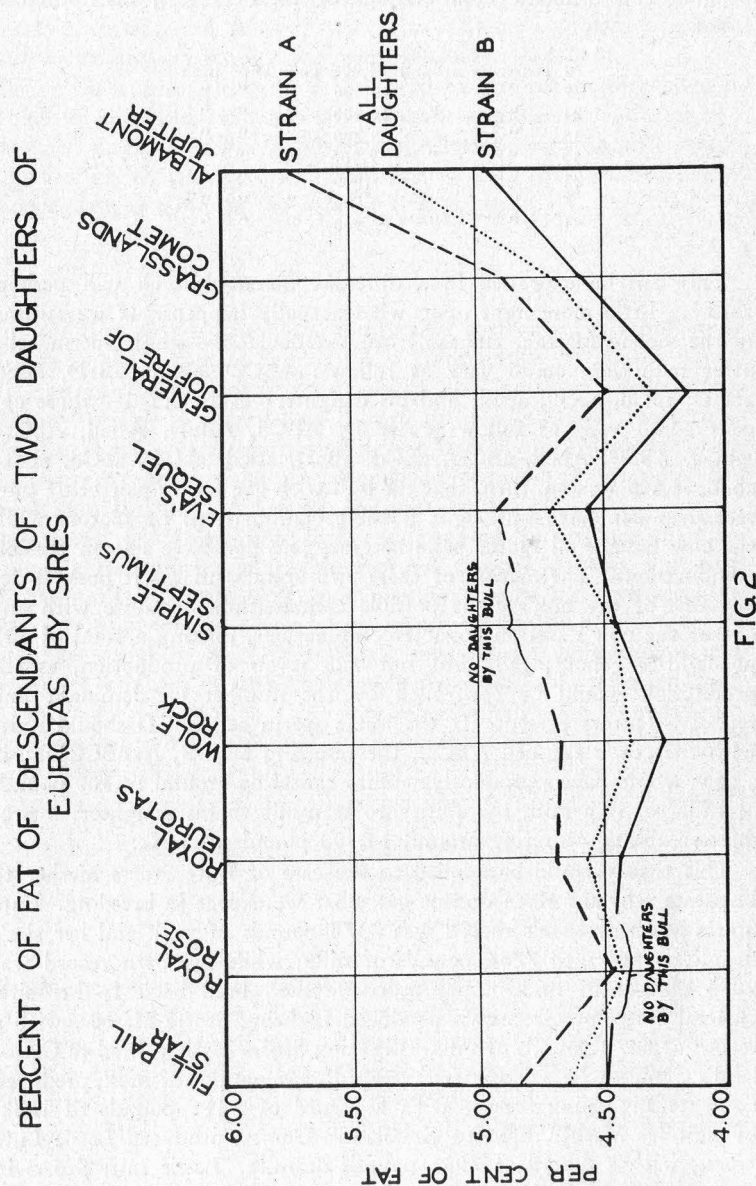


FIG 2

The butter fat percentages may be observed in the same way. The butter fat percentage of Lute Storrs Masher's dam was 4.92 and that of her sire's daughters averaged 4.33, while her own percentage was 4.86. A daughter, Emerald Joffre, resulting from mating Lute Storrs Masher to her own sire, General Joffre of Greenway, had a butter fat percentage of 4.12, while another daughter of Lute Storrs Masher by Grassland's Comet had a butter fat percentage of 5.27.

Further Observations on Full Sisters and Half Sisters

Figure 2 shows in graphic form the influence of both male and female parents on the butter fat percentage of the offspring. The upper broken line (Strain A) represents the average butter fat percentage of the descendants of Lily Eurotas, whose butter fat percentage was 4.81. The lower solid line (Strain B) represents the average butter fat percentage of the descendants of Eurotas 2nd, full sister to Lily Eurotas, whose test was 4.50 percent.

The fat percentage (4.13) of the original cow, Eurotas, was exceedingly low for the Guernsey breed (4.98), although undoubtedly she must have transmitted factors for a higher test than she herself revealed. Although the herd bulls were used in common in both strains, the average butter fat percentage of the daughters of each generation have kept well apart, and following the use of Albamont Jupiter are still farther apart than at the beginning. The fact that the butter fat percentages of the two strains have kept well apart indicates the decided influence of the female parent, while the tendency of the two lines to remain parallel, at the same time indicates the decided influence of the male parent. This is in close agreement with the findings of Burrington and White (8) in a study of two Holstein strains in the College herd. The dotted line representing the fat percentages of all the daughters of the various herd sires parallels the other lines, keeping nearly equidistant from the lines representing the percentages of Strain A and Strain B, which is to be expected, with the small number of daughters of each bull that were not from cows of either strain A or strain B. The figures are given in Table 9.

Table 10 shows some rather striking comparisons of the records of half sisters and full sisters. The record of Lily Eurotas more nearly approaches the record of her half sister Franconia than it does that of her full sister Eurotas 2nd. The inbred full sister daughters of Eurotas 2nd have records that are very close together except in fat percentage. Storrs Eurotas, one of these inbred full sisters, had full sister daughters whose records should approximate each other. This has happened in the production of milk, but the fat percentage shows a difference of 0.3. Eurotas Mansfield, the other inbred full sister, also had full sister daughters, one of which, Wolf Rock's Eurotas, is considerably above either of the daughters of Storrs Eurotas in both

TABLE 9
Butter Fat Percentages of Herd Sires on Two Strains Originating
From One Cow

	Fill Pail Star	Royal Rose	Royal Eurotas	Wolf Rock	Simple Septimus	Eva's Sequel	General Joffre of Greenway	Grass- land's Comet	Albmont Jupiter
Eurotas 4.13	4.81	4.48	4.68	4.66		4.92	4.49	4.88	5.73
Descendants of Lily Eurotas 4.81 Strain A									
Average all Daughters of Herd Sires	4.64	4.46	4.56	4.40	4.47	4.74	4.33	4.70	5.35
Eurotas 4.13	4.50		4.46	4.27	4.47	4.55	4.17	4.60	4.98
Descendants of Eurotas 2nd 4.50 Strain B									

milk and butter fat production and midway between them in the percentage of butter fat. The other, Eurotas Mansfield, produced considerably less milk and butter fat and had a very much lower butter fat percentage than either of the daughters of Storrs Eurotas. The half sister daughters of Storrs Eurotas, Genial Eurotas and Storrs

TABLE 10
Comparison of Some Records of Full Sisters and Half Sisters

Dam	Daughters	Sire*	Milk	% Fat	Fat
Eurotas	Eurotas 2nd	C	6705	4.50	295.0
"	Lily Eurotas	"	3675	4.81	182.0
	Difference		3030	.31	113.0
Eurotas	Lily Eurotas	C	3675	4.81	182.0
Francille	Franconia	"	3750	4.62	181.0
	Difference		75	.19	1.0
Eurotas 2nd	Eurotas Mansfield	E	6587	4.24	280.6
"	Storrs Eurotas	"	5887	4.67	268.3
	Difference		700	.43	12.3
Storrs Eurotas	Storrs Eurotas 2nd	H	7561	4.62	349.3
"	Simple Eurotas	"	7300	4.32	328.9
	Difference		261	.30	20.4
Eurotas Mansfield	Wolf Rock's Eurotas	G	8638	4.48	390.2
"	Eurotas Mansfield 2nd	"	6488	4.06	265.3
	Difference		2150	.42	124.9
Simple Eurotas	Genial Eurotas Storrs	K	10116	4.56	458.2
"	Storrs Sunbeam	J	6492	4.13	296.2
	Difference		3624	.43	162.0
Storrs Sunbeam	Salient Sunbeam Storrs	K	10977	4.60	515.9
"	Sagacious Storrs Sunbeam	"	9857	4.49	448.1
	Difference		1120	.11	67.8
Naomi's Beauty	Naomi's Beauty 2nd	E	7540	4.61	347.2
"	Eurotas Naomi	"	6216	4.59	281.4
	Difference		1324	.02	65.8

Sunbeam, show an extreme variation in the production of milk and butter fat as well as in butter fat percentage. Grassland's Comet is the sire of Genial Eurotas Storrs, and General Joffre of Greenway is the sire of Storrs Sunbeam; and when the effect of these two sires is observed, in Table 7, the reason for the variation can be seen. Storrs Sunbeam, the poorer producer of the two daughters of Simple Eurotas,

*Refer to Key to Bulls, Table 6.

NOTE: The sire of Eurotas Mansfield and Storrs Eurotas also has Eurotas 2nd for his dam.

when twice bred to Grassland's Comet, the sire of Genial Eurotas Storrs, the better producing daughter of Simple Eurotas, produced Salient Sunbeam Storrs and Sagacious Storrs Sunbeam, whose records of production are about on the same level as that of Genial Eurotas Storrs, their dam's half sister, rather than that of their own dam. Naomi's Beauty 2nd and Eurotas Naomi, also full sisters, have production records that vary from each other by 1324 pounds in milk and 65.8 pounds in fat but only .02 in butter fat percentage.

Discussion

The data herewith presented show the effect of single females used as foundation animals in establishing a herd of pure-bred cattle. Eurotas alone, of the three females first purchased in 1896, in the second attempt to establish the College Guernsey herd, has descendants in the herd today. That the present herd contains thirteen female descendants of Eurotas in contrast to seven the result of other purchases, reveals the dominating influence of this one cow. The two cows purchased in 1903 have left no descendants. Seven cows purchased from 1922 to 1924 have not as yet left a strong, favorable imprint.

Twelve service bulls have been used in the herd over a period of thirty-five years, ten of which have daughters old enough to have records of production. These ten sires left thirty-four cows that produced milk in the herd for two hundred days or more. Ten of the other 49 cows with records were purchased and the other five were carried by dam into the herd. It will be noticed that 34 is an average of one daughter for each year of the herd's existence. Tuberculosis, contagious abortion, accidents and the production of bull calves have all been contributing causes in limiting the female increase. Fairview Maid, for example, a sister of Eurotas, produced five bull calves in succession which was her entire produce while in the herd.

Table 11 presents an interesting breeding record of Lute Storrs Masher. This cow was of acceptable type, possessing an unusually well shaped udder and was a good producer. She was considered to be a very desirable cow, and yet it is remarkable that she could have made so little contribution to the herd after eleven years of regular breeding. The final possibility for any permanent contribution from this cow rests upon her last daughter, born in 1928, and her single granddaughter, Buoyant Lassie Storrs.

The information in Table 11 is introduced merely as an illustration of the effect of circumstance in the development of a dairy herd. A similar occurrence might have wrecked the contribution of the best sire of all, Grassland's Comet. This bull was purchased as a calf at a time, when for one reason and another the herd was cut down to five milking cows. Comet's first two crops of calves from these cows were all bulls; his third crop consisted of three bulls, a pair of twins

of opposite sex (the heifer was infertile) and one heifer which died. Thus the herd was at a complete standstill for three years and Comet was six years of age before his first daughter freshened.

TABLE 11

Lute Storrs Masher 87066. Born, August 23, 1916. Sire—General Joffre of Greenway 31313. Dam—Lorin Masher 61496.

Produce	Sire
Oct. 18, 1918—Female—Lighting Storrs Masher*	General Joffre of Greenway
Dec. 6, 1919—Male	Grassland's Comet
Jan. 4, 1921—Male	Twins
Female (non-breeder)	
Feb. 19, 1922—Female—Lassie Lute Storrs (eradicated as abortion reactor)	Grassland's Comet
Apr. 5, 1923—Male	Grassland's Comet
July 9, 1924—Male	Albmont Jupiter
Oct. 20, 1925—Male	Albmont Jupiter
Dec. 14, 1926—Male	Foremost's Excelsior
Jan. 2, 1927—Male	Foremost's Marshall
Nov. 20, 1928—Female—Grateful Lute Storrs	Princess' May Royal

*Sold as producer after one lactation. Extremely weak loin.

Another illustration in connection with Grassland's Comet is interesting. He was sired by Jethro Bass and out of Alice for Short, with a record of 14,874 pounds of milk and 736.05 pounds of fat, testing 4.95%. Naturally a good deal was expected of this bull, but as related above, a long wait ensued before his daughters came into milk.

It was soon noticed that his daughters tested a little lower than the breed average, 4.70%. He was regarded as a capable sire for milk production but as one inclined to lower the test. It was not until the present dam-daughter study was made that it was realized that he had been bred to cows with low tests, his immediate predecessor having lowered his own daughters 0.21%, which following others was the lowest point in the whole career of a rather low testing herd. When it was observed that Comet's daughters tested .40% higher than their own dams Comet won the place that he deserved in our estimation.

Possibly Comet's true worth as a sire can be more correctly measured by the application of the Mount Hope Farm bull index.* Applying this formula the transmitting capacity of Comet for milk

*Mount Hope Farm, Williamstown, Mass. The milk transmitting power of the sire when the daughters exceed the dams equals daughters' milk $+0.4286 \times$ the difference between dams' and daughters' milk; the percentage of fat equals daughters' test $+1.5 \times$ the difference between dams' and daughters' test.

is found to be 9,462 instead of 8,862, the average of his daughters; and for percentage of fat 5.30 instead of 4.70, the average of his daughters.

Grassland's Comet was sent to the University of New Hampshire in exchange for Albamont Jupiter and upon his return to Connecticut was sold to a Connecticut breeder where he was finally lost as a tuberculosis reactor. He was sold as a proved sire but even so his true ability was not fully appreciated at that time.

In the daughter and dam comparisons, in some cases an increase in milk production was accompanied by a reduction in butter fat percentage, while in other cases it was accompanied by an increase. Reductions in milk production were accompanied either by increases or decreases in butter fat percentages. These facts indicate what is already quite well known, that milk producing ability and butter fat percentages are inherited separately and that a single sire or dam may increase or decrease one or both or may increase one and decrease the other.

Summary

This bulletin is a history of the Guernsey herd of the Connecticut Agricultural College covering a period of thirty-five years since its foundation in 1896. The production records kept over this period have been converted to a comparable basis for a study of the contribution of the various individuals.

This is one of four breeds maintained in the dairy herd. The numbers have not been large but in this respect it is comparable to the majority of dairy herds. Forty-nine cows have contributed to the production records. Ten sires used in the herd have contributed through milking daughters. In the appendix are presented the pictures of many of these animals.

An attempt was made to establish a Guernsey herd in the late eighties. This trial met with failure on account of tuberculosis. In 1896 three females and a bull were purchased. Other female purchases were made as follows: two in 1903, two in 1922, and five in 1924. The sires, ten in number, brought into the herd are to be found in Table 8. The complete list of sires represented by daughters including purchased females, will be found in Table 4.

Only one of the three original (1896) cows has left descendants in the herd. This cow, Eurotas, has contributed to the herd through two daughters, one to the ninth and the other to the seventh generation. The two cows purchased in 1903 have left no trace and it is still uncertain whether or not the seven purchased in 1922 and 1924 will leave their permanent stamp. Thirteen of the present twenty females are descended from the cow Eurotas. This illustrates emphatically how few cows, for one reason or another, make permanent contributions

to a herd through the female line, and hence the very great importance of carefully selecting foundation cows.

All of the sires except Albamont Jupiter were brought in while young. The breeding behind them, in most cases, appeared promising. The influence of the first sire upon the yield of his daughters was unfavorable; the daughters of the next two produced about the same as the original cows; while the fourth brought about a distinct improvement in milk and net fat increase in spite of a lowered test. The next three sires held the production at the level of their predecessor and the eighth brought the milk and fat test up sharply. The ninth sire further increased the fat while slightly lowering the milk. The tenth sire has two daughters but only one daughter-dam for comparison. The net influence of all these sires has been an increase in both the milk and the percentage of fat, brought about chiefly by two, possibly three, of the nine sires. This again emphasizes the great need to find and employ some better means than ordinarily used in the selection of sires.

As mentioned, one of the original cows, Eurotas, produced two daughters, descendants of both of which are at present in the herd. One of these daughters tested 0.31% lower than the other. The descendants of the higher testing sister have continued to test higher than those of the other (Table 9). Sires have been used in common on both strains and their influence is also apparent as both groups move in the same direction under their influence, yet remaining apart. This same fact was observed in an earlier study of the College Holstein herd (8).

In the daughter-dam comparisons, even with full sisters and half sisters from the same dam, it was observed that the percentage of fat might decrease or increase in conjunction with either an increase or decrease in milk. This demonstrates what has already been established, that the precise level of percentage of fat and quantity of milk are inherited independently of each other. It is impossible to tell simply by the character of the product of a cow what may be the range of her transmitting capacity.

The same applies in the selection of the sire on the basis of his pedigree indications. The Advanced Registry, as generally operated by breeders, permits too much discrimination in choosing the animals to be tested to furnish a basis for predicting accurately the transmitting range of either a cow or a bull. Relatively unselected daughter-dam and daughter-sire comparisons are necessary for this, furnished only by a complete record of all animals in the herd. An estimate of the genetic makeup of a dairy animal can be arrived at, even though the number of individuals is small, if comparable records are available and the records of all animals of varying relationships are compared.

As has been often said, a study made of the records of dead bulls is belated. But this study has been the means of correcting some mis-

conceptions held concerning the bulls used in this herd, and anyone who makes a similar study of his herd will be convinced beyond doubt of the importance of such an analysis as a guide to progress in herd improvement.

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Pictorial Record

of the

GUERNSEY HERD

At the Connecticut Agricultural College

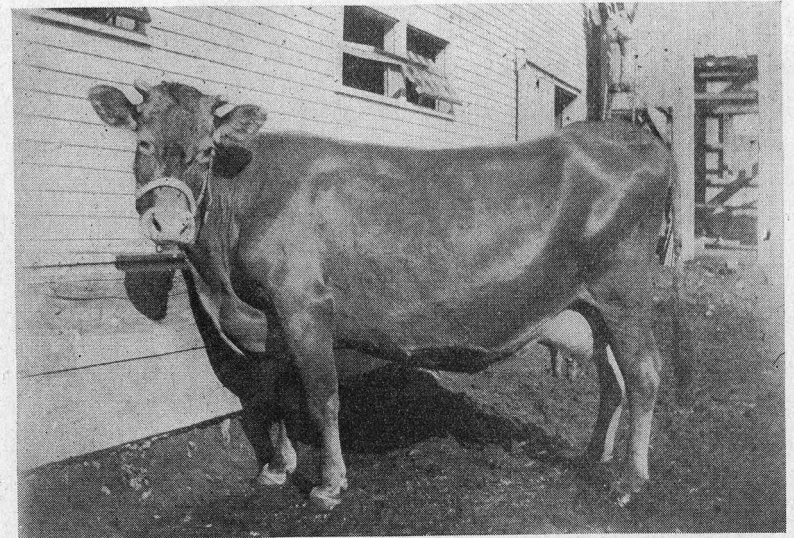


FIG. 3. EUROTAS, FOUNDATION COW OF HERD.

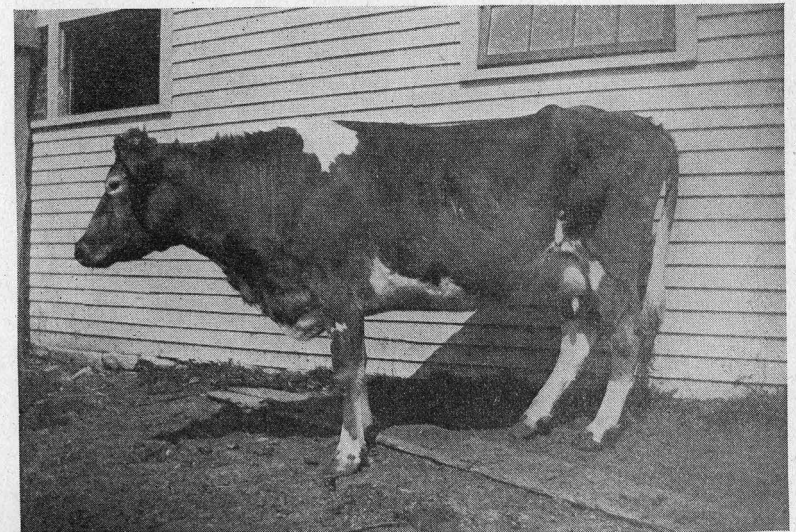


FIG. 4. FRANCILLE, PURCHASED WITH EUROTAS BUT LEFT NO DESCENDANTS.



FIG. 5. FILL PAI L STAR.

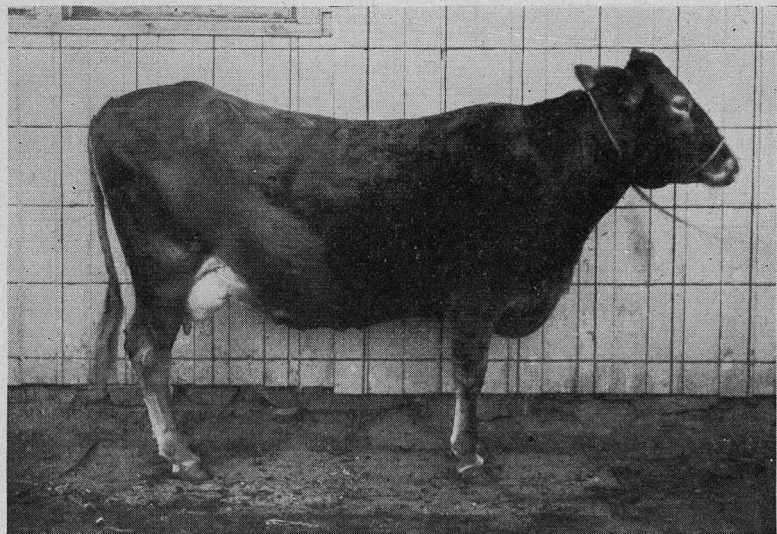


FIG. 6. EUROTAS 2ND, DAUGHTER OF EUROTAS AND FILL PAI L STAR.

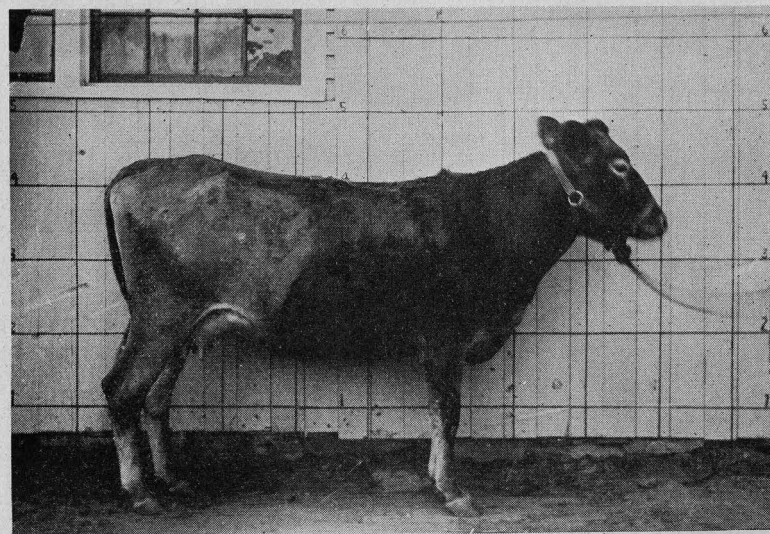


FIG. 7. STORRS EUROTAS, DAUGHTER OF EUROTAS 2ND AND HER HALF BROTHER, ROYAL EUROTAS.



FIG. 8. SIMPLE EUROTAS, DAUGHTER OF STORRS EUROTAS AND SIMPLE SEPTIMUS.

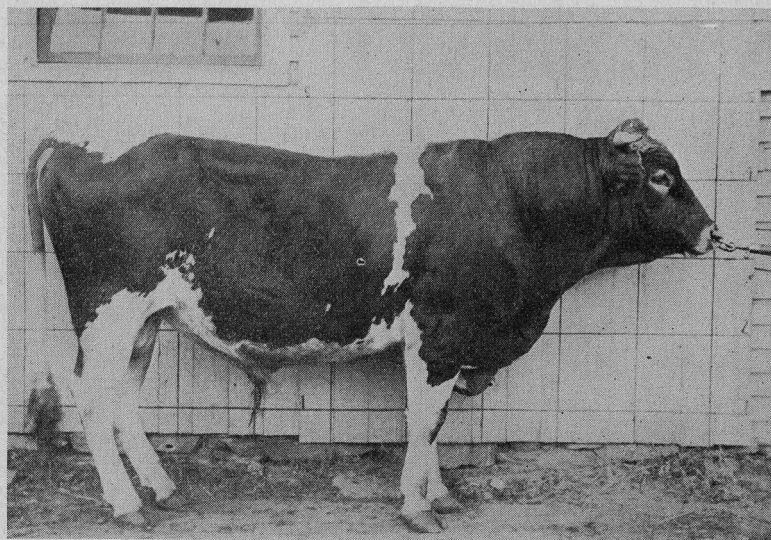


FIG. 9. SIMPLE SEPTIMUS.

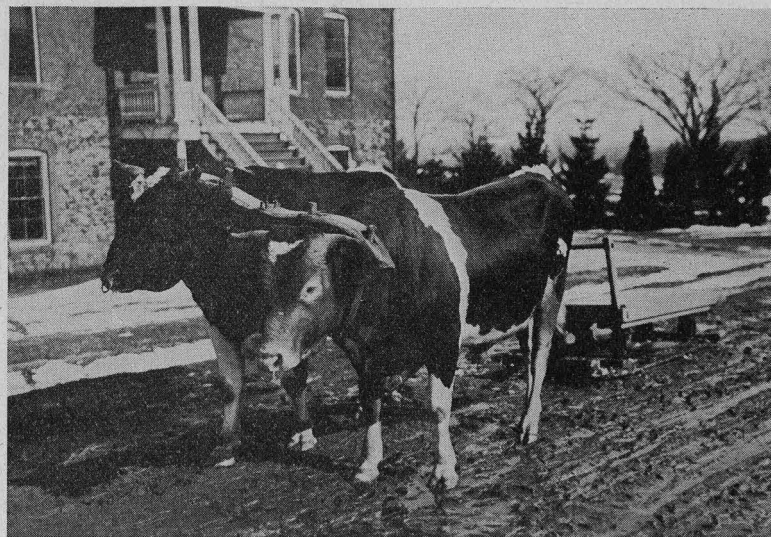


FIG. 9a. SIMPLE SEPTIMUS IN YOKE, 1911.

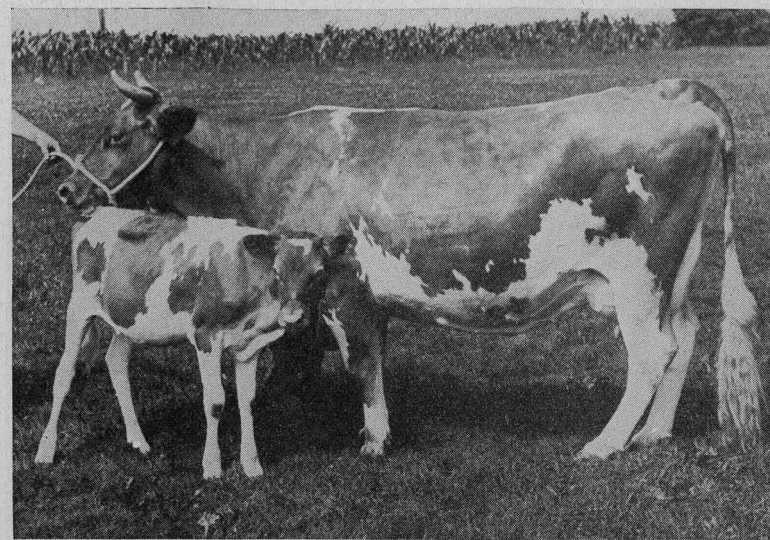


FIG. 10. GENIAL EUROTAS STORRS WITH HER CALF, DAUGHTER OF SIMPLE EUROTAS AND GRASSLAND'S COMET.

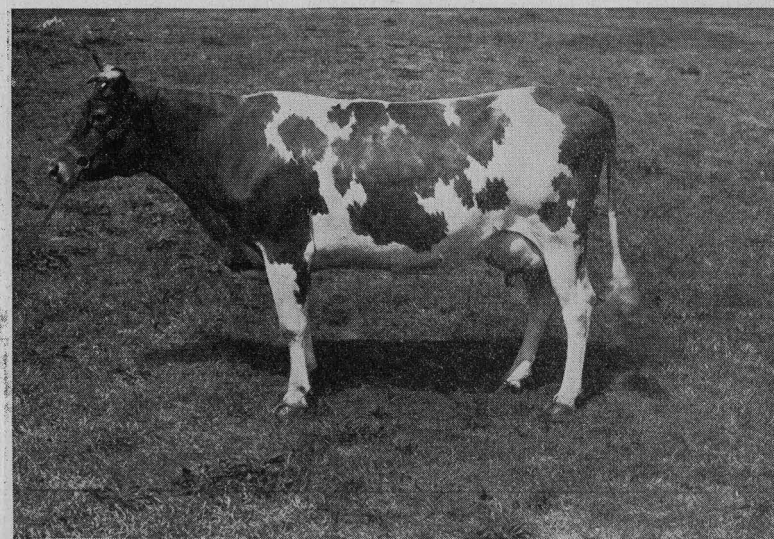


FIG. 11. SALIENT SUNBEAM STORRS, GRANDDAUGHTER OF SIMPLE EUROTAS, THROUGH STORRS SUNBEAM, AND BY GRASSLAND'S COMET.



FIG. 12. SAGACIOUS STORRS SUNBEAM, FULL SISTER TO SALIENT SUNBEAM STORRS.

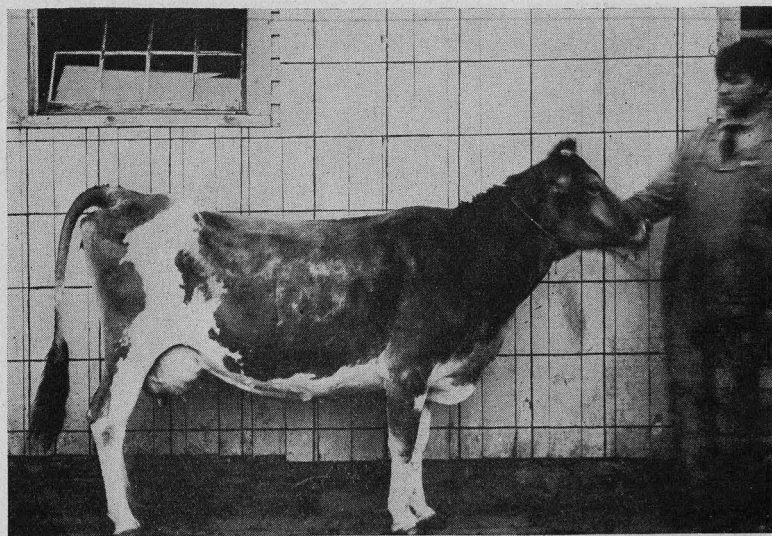


FIG. 13. LILY EUROTAS 2ND'S ROSE, GRANDDAUGHTER OF LILY EUROTAS (OUT OF EUROTAS) AND BY ROYAL ROSE.

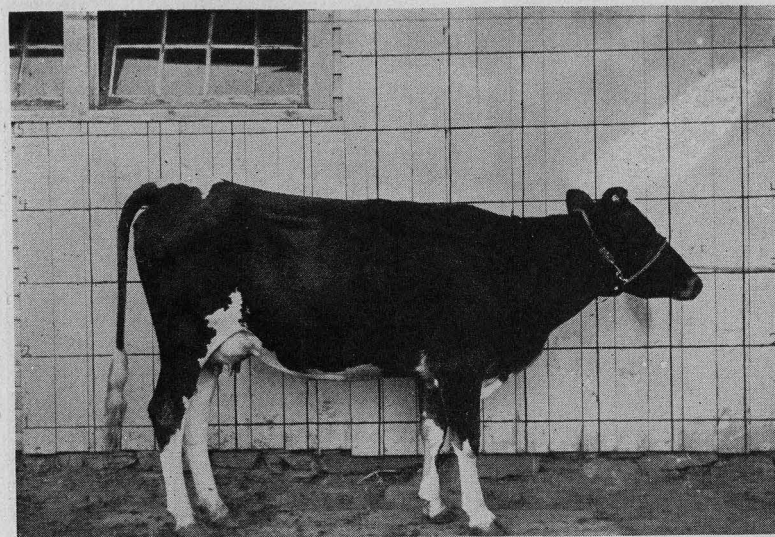


FIG. 14. EUROTAS ROSE, DAUGHTER OF LILY EUROTAS 2ND'S ROSE AND ROYAL EUROTAS.

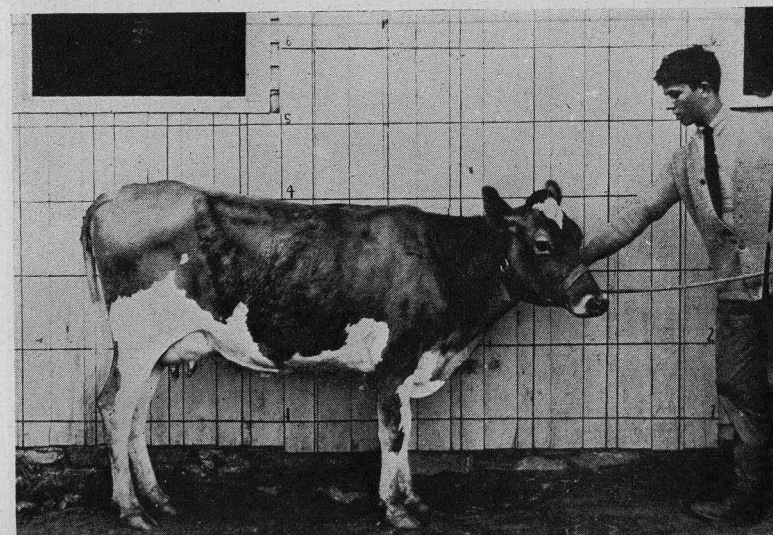


FIG. 15. LILY ROCK, DAUGHTER OF LILY EUROTAS 2ND'S ROSE AND WOLF ROCK.



FIG. 16. LORIN MASHER, DAUGHTER OF LILY ROCK AND EVA'S SEQUEL.



FIG. 17. LUTE STORRS MASHER, DAUGHTER OF LORIN MASHER AND GENERAL JOFFRE OF GREENWAY.

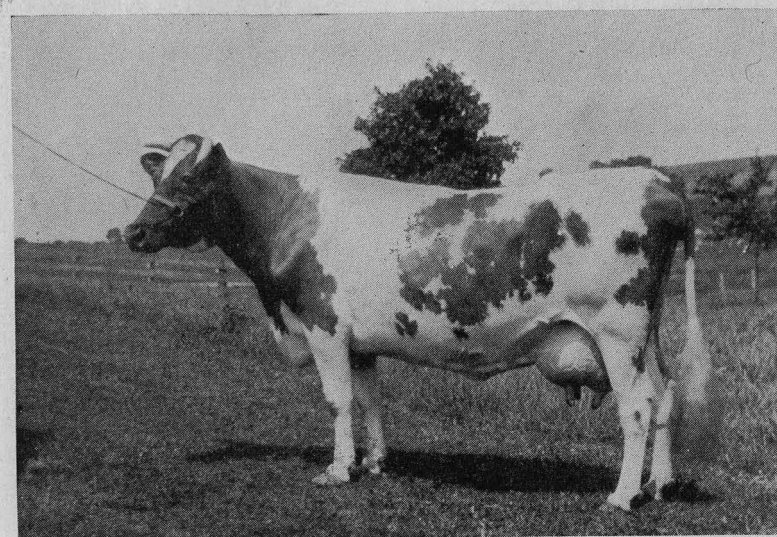


FIG. 18. BUOYANT LASSIE STORRS, GRANDDAUGHTER OF LUTE STORRS MASHER AND BY ALBAMONT JUPITER.



FIG. 19. WOLF ROCK.

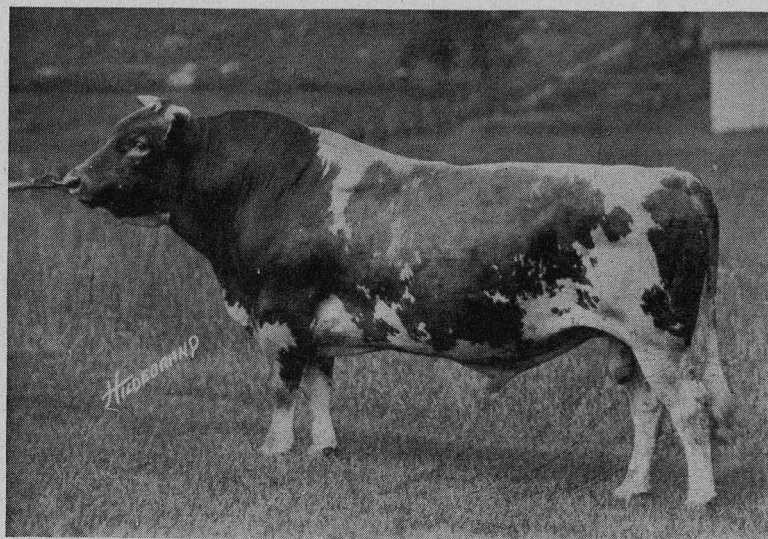


FIG. 20. GRASSLAND'S COMET.

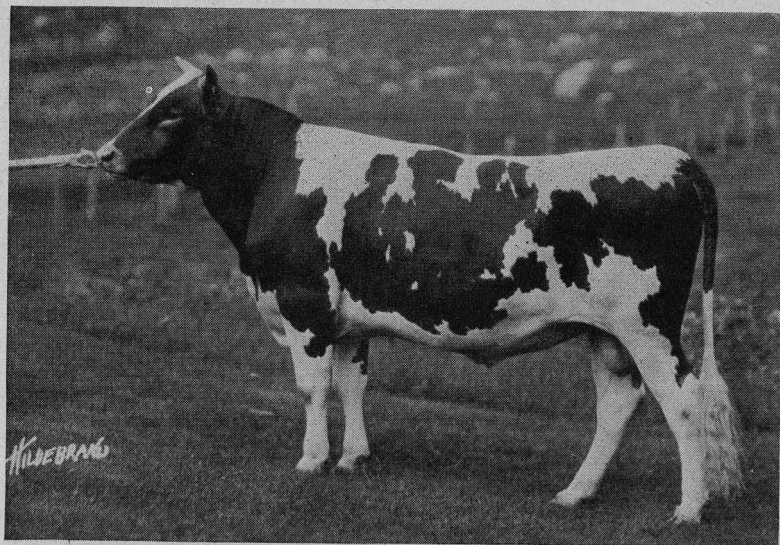


FIG. 21. ALBAMONT'S JUPITER.

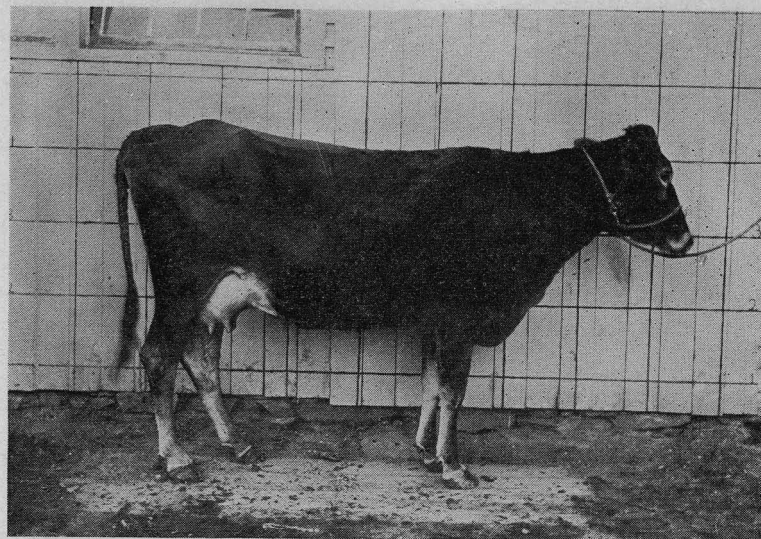


FIG. 22. EUROTAS MANSFIELD, DAUGHTER OF EUROTAS 2ND AND HER HALF BROTHER, ROYAL EUROTAS. FULL SISTER TO STORRS EUROTAS. THIS LINE HAS PRODUCED NO ANIMALS OF MERIT.

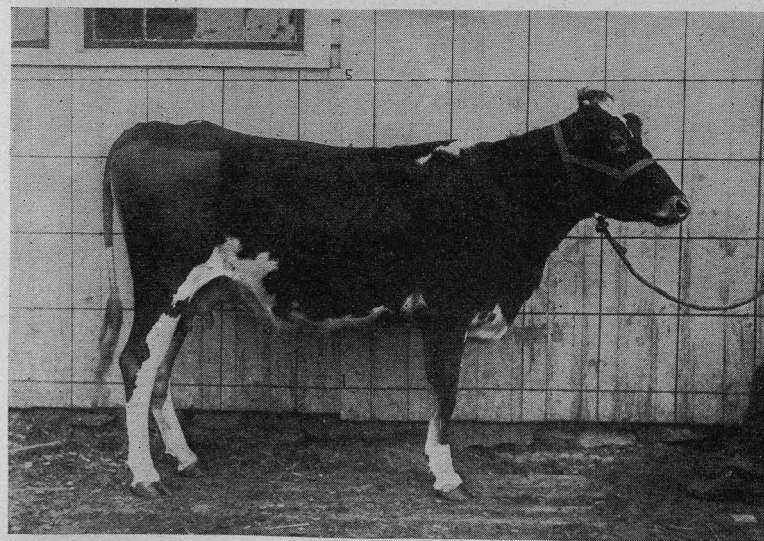


FIG. 23. WOLF ROCK'S EUROTAS, DAUGHTER OF EUROTAS MANSFIELD AND WOLF ROCK.

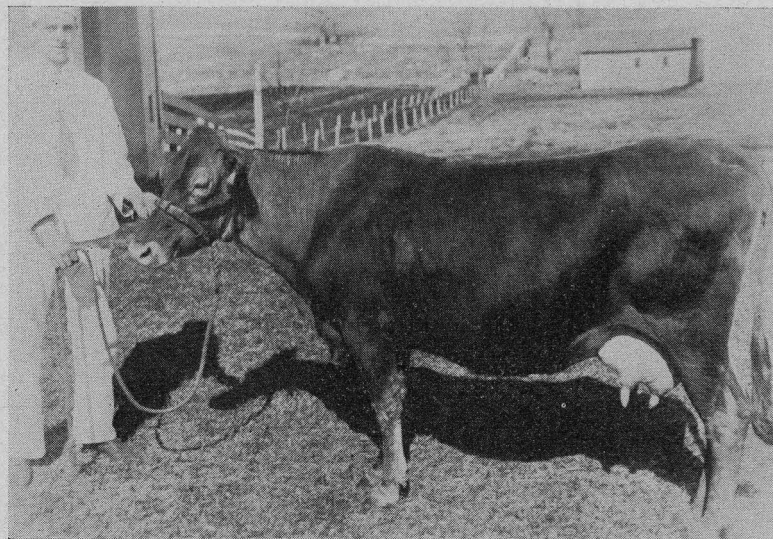


FIG. 24. EUROTAS MANSFIELD 2ND, FULL SISTER TO WOLF ROCK'S EUROTAS.

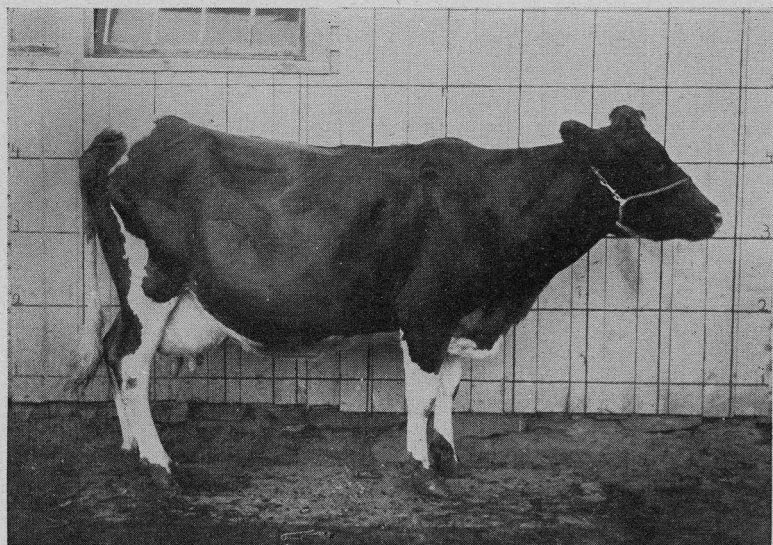


FIG. 25. NAOMI'S BEAUTY, PURCHASED IN 1903.

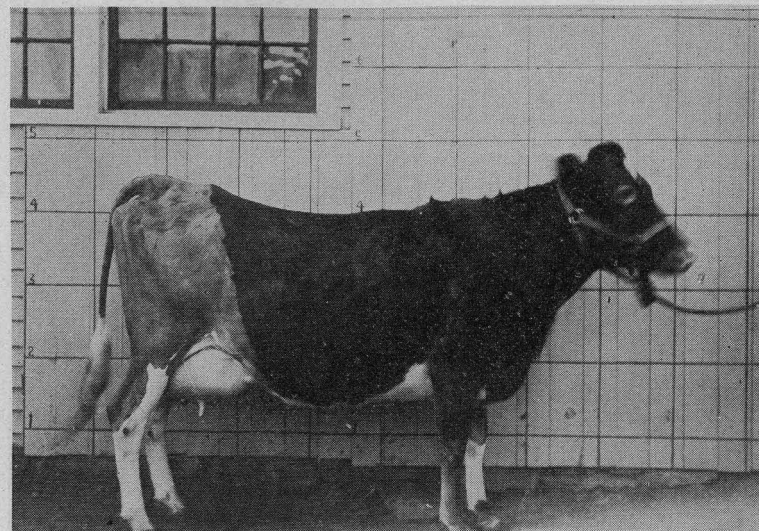


FIG. 26. EUROTAS NAOMI, DAUGHTER OF NAOMI'S BEAUTY AND ROYAL EUROTAS.

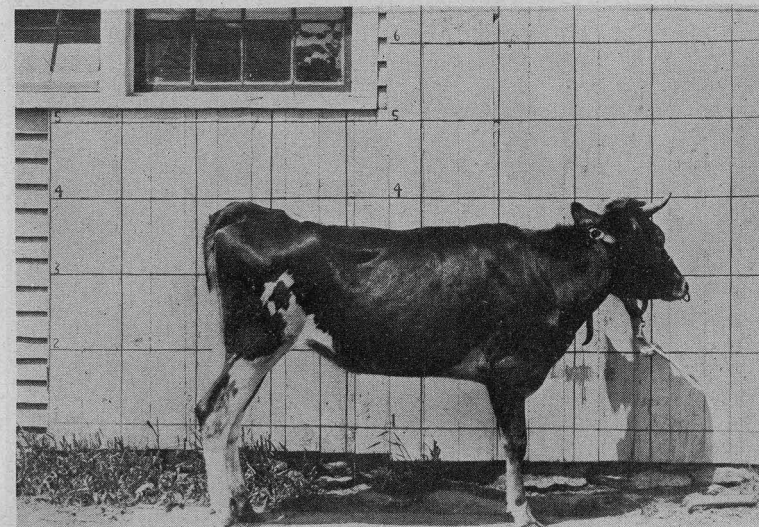


FIG. 27. EUROTAS NAOMI 3RD, DAUGHTER OF EUROTAS NAOMI AND YOUNG TRUTH.

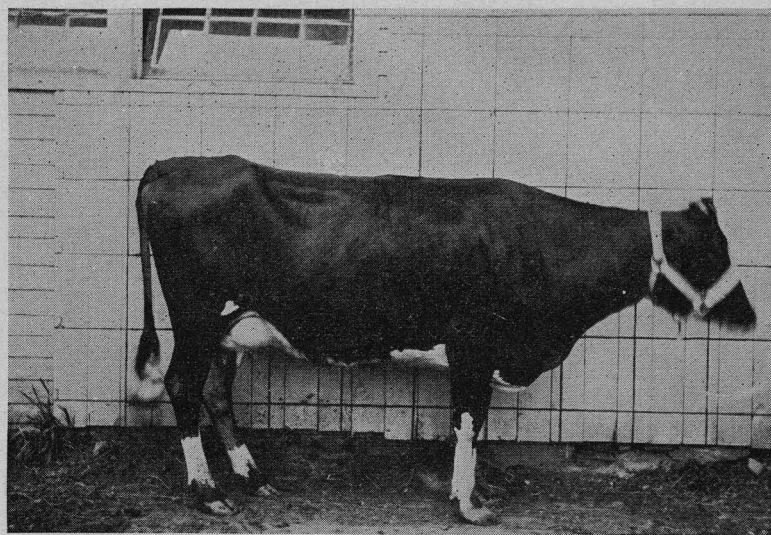


FIG. 28. STORRS NAOMI, DAUGHTER OF LADY NAOMI, PURCHASED IN 1903, AND ROYAL ROSE.

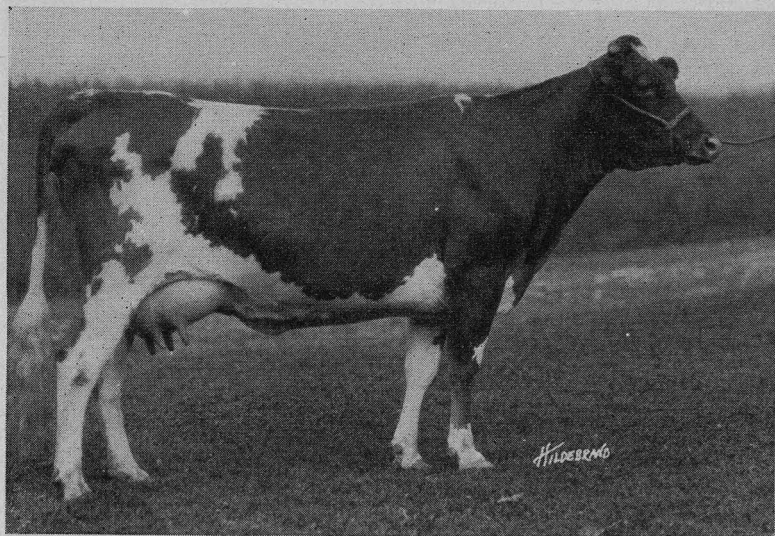


FIG. 29. EVA OF STORRS, DAUGHTER OF STORRS NAOMI AND EVA'S SEQUEL. EVA PASSED IN 1920, THE LAST SURVIVOR OF THE NAOMI GROUP.



FIG. 30. YEARLING DAUGHTERS OF FOREMOST'S MARSHALL, 115,243, TAKEN IN 1929. FROM LEFT TO RIGHT THEY ARE OUT OF CARMINE LORIN STORRS, GENIAL EUROTAS STORRS, ERNESTINE OF GREEN LODGE, JULIA ELLEN STORRS, SALIENT SUNBEAM STORRS AND SAGACIOUS STORRS SUNBEAM.

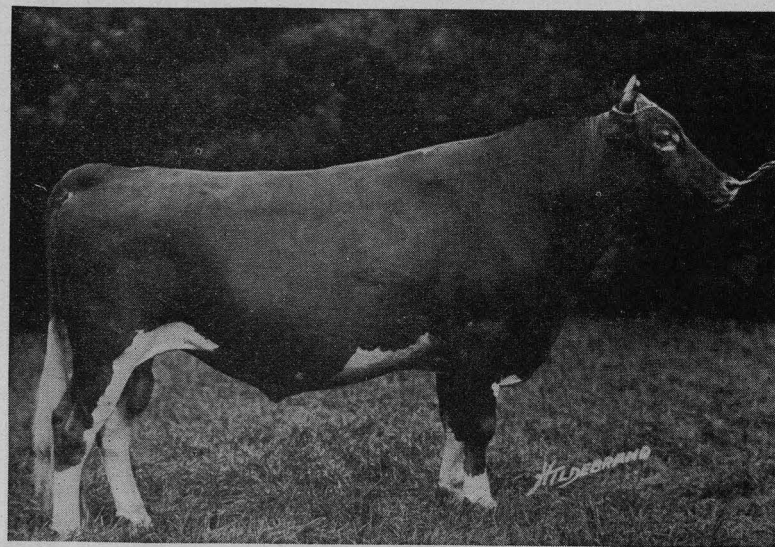


FIG. 31. CAROLINE'S MAY ROYAL, 162,143, PRESENT HERD SIRE. JUNIOR CHAMPION AT THE NATIONAL DAIRY SHOW, 1929. GRAND CHAMPION EASTERN STATES EXPOSITION, 1931.

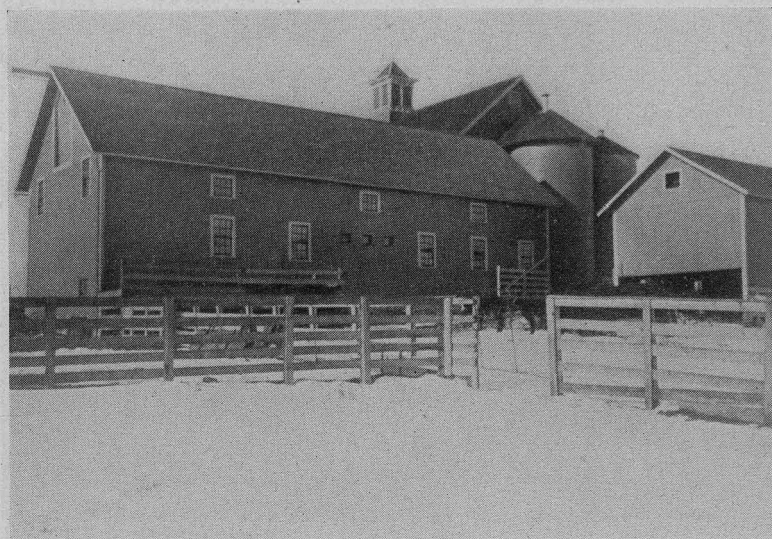


FIG. 32. REAR VIEW OF BARNS WITH PADDOCKS, 1911.



FIG. 33. VIEW OF BARNS FROM MAIN ROAD, 1911.



FIG. 34. VIEW OF BARN FROM DAIRY BUILDING, 1911.

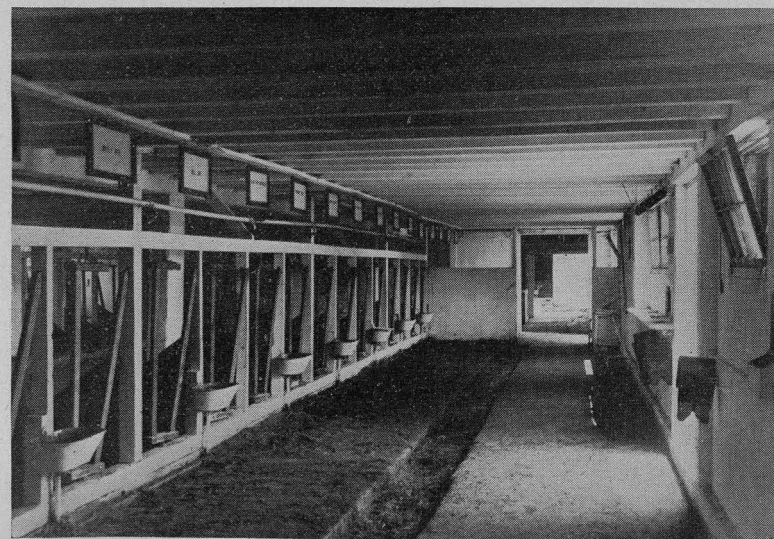


FIG. 35. INTERIOR VIEW, SHOWING PLATFORMS AND STANCHIONS, 1909.



FIG. 36. INTERIOR VIEW, SHOWING FEED ALLEY, 1909.

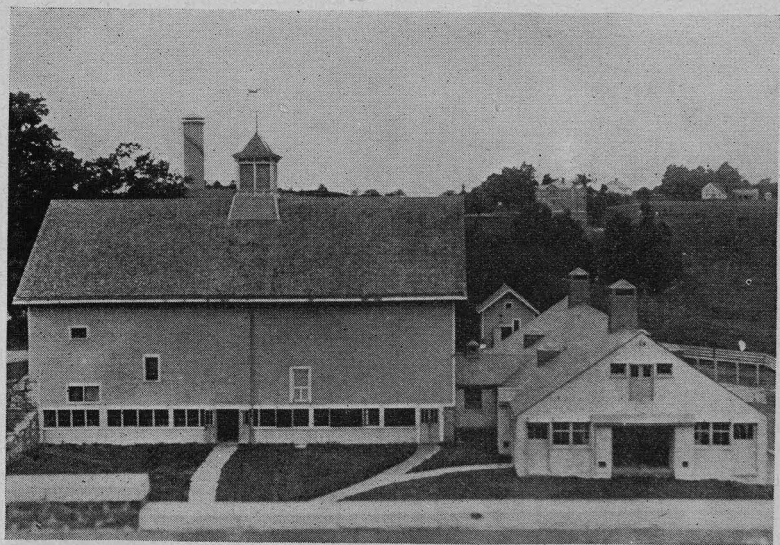


FIG. 37. VIEW OF BARN FROM DAIRY BUILDING, 1915, SHOWING NEW ADDITION AND OLD BARN REMODELED.

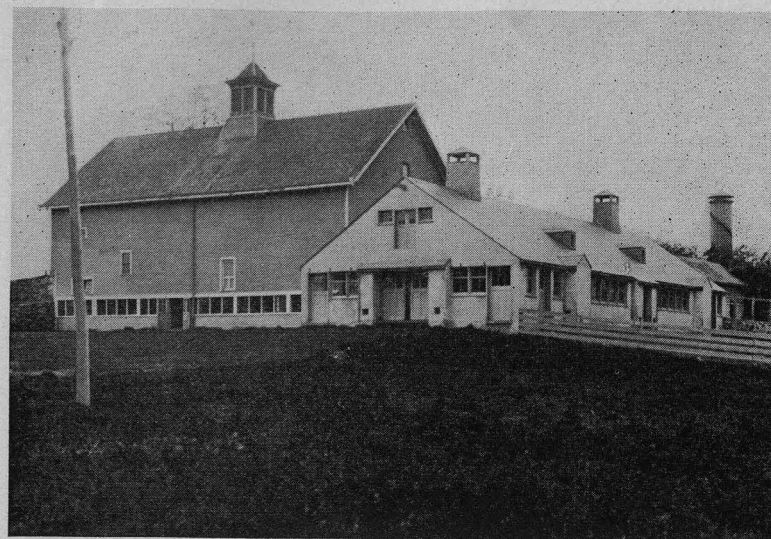


FIG. 38. VIEW OF BARN IN 1916.

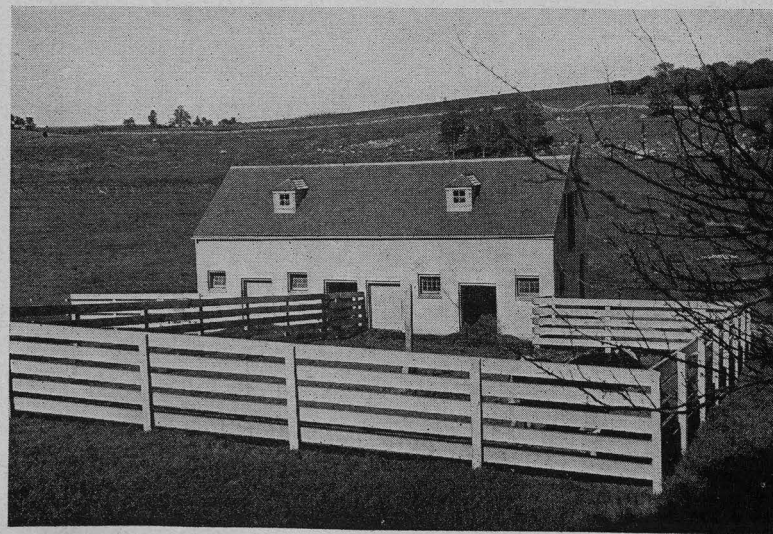


FIG. 39. BULL BARN BUILT IN 1918.



FIG. 40. VIEW FROM MAIN ROAD IN 1922. STORAGE BARN COMPLETED IN 1920.



FIG. 41. SHOWING 1913 BARN, 1920 BARN, 1924 BARN, AND MANURE SHED BUILT IN 1915. WATER TOWERS, NOT SILOS, BEYOND. PHOTO IN 1929.



FIG. 42. SHOWING BULL BARN IN FOREGROUND, AND NEW PADDOCKS COMPLETED IN 1930.