OCTOBER, 1935 BULLETIN 355

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
F. B. MUMFORD, *Director*

Estimating Condition in Dairy Cattle

S. BRODY AND A. C. RAGSDALE

COLUMBIA, MISSOURI

SUMMARY

Missouri Agricultural Experiment Station Bulletin 351 explained how to compute, from milk production and live weight records, the efficiency with which cows turn feed into milk. Since the efficiency or economy of milk production (as also of other processes such as growth, maintenance, health, etc.) is influenced by deviations from *ideal weights* (more concretely but less accurately, *average weights*), this bulletin gives a simple method for estimating the degree of overweight or underweight of cattle from average weights. The estimates are made by measuring the height at withers and comparing the weight of the given animal with the corresponding *average* weights in the tables given in this bulletin. When ages are not known comparisons are made with the average weights in Table 1. When ages are known, comparisons are made with the average weights in Table 2a (Jerseys) and 2b (Holsteins).

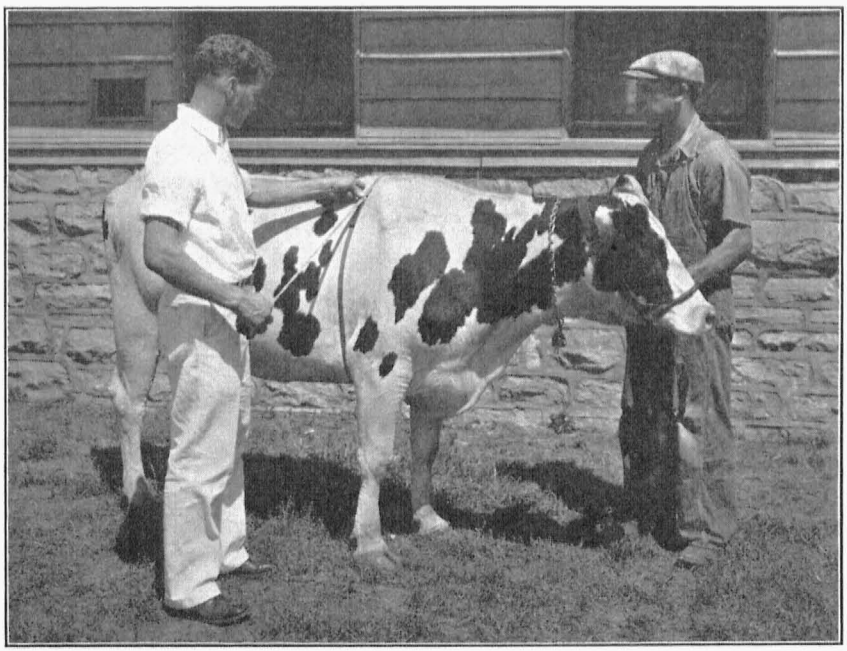

Fig. 1.—This photograph illustrates our method of measuring heart girth as used in Station Bulletin 354, "Estimating Live Weights of Dairy Cattle."

Estimating Condition in Dairy Cattle

S. BRODY AND A. C. RAGSDALE

Underfeeding and overfeeding both reduce the efficiency with which cows turn feed into milk. In other words, there is one, and only one, plane of feeding which gives maximum efficiency, or greatest economy, of milk production. (Missouri Agricultural Experiment Station Bulletin 351 explains a method for measuring efficiency.) The same may be said with regard to other life processes, such as growth, maintenance, work, reproduction, duration of life: There is an *ideal* condition of fleshiness associated with maximum efficiency.

How may the ideal condition for an animal be determined? Skillful feeders *judge* it. But is it possible to *measure* it? We think it is, as explained below.

A METHOD FOR MEASURING CONDITION (FATNESS) IN DAIRY CATTLE

Some linear measurements, such as heart girth, are closely connected with live weight. If live weight goes up for any reason at all, heart girth also goes up; if live weight goes down, heart girth goes down. The relation between weight and girth is so close that one can, so to speak, weigh a cow by measuring her heart girth (this method is explained in Missouri Agricultural Experiment Station Bulletin 354).

Other linear measurements, such as height at withers, are practically unaffected by changes in live weight. The live weight of a cow may go up or down (for any reason, such as over or underfeeding, pregnancy, etc.), yet the height at withers remains practically the same. Moreover, since so much of the height-at-withers growth is completed before birth, overfeeding or underfeeding during growth can not greatly influence this measurement. In other words, height at withers, unlike heart girth, is nearly independent of environmental conditions and so is an almost pure expression of the hereditary size of the animal.

Since height at withers is practically unaffected by feeding conditions, it may be employed in the following manner as a reference base for figuring the degree of overweight or underweight of a given animal.

The basic data used for the estimates presented in this bulletin are 4513 sets of live weight—height-at-withers measurements collected by A. C. Ragsdale during the past 14 years on cattle belonging to the Department of Dairy Husbandry, Missouri College of Agriculture.

Paper 103 in the Herman Frasch Foundation Series.

Let us suppose that the height at withers of a Holstein heifer is 52 inches and the live weight is 1100 pounds. (The live weight may be estimated from the heart girth as explained in Missouri Station Bulletin 354.) Suppose further that nutritional studies have shown that a 52-inch heifer makes most efficient growth (grows with greatest economy) when she is fed to weigh 1000 and not 1100 pounds for a height at withers of 52 inches. Our heifer is, therefore, 100 pounds, or 10%, overweight in comparison to the weight she should *ideally* have.

WEIGHTS FOR HEIGHTS AT WITHERS WHEN AGE IS NOT KNOWN

Table 1 gives weight-height pairs of Jersey and Holstein cattle (females) of all ages between birth and old age, but disregarding age. That is, the data were grouped in accordance with height at withers regardless of the ages of the animals, and their average weights computed. In this way it was found that the average live weight of all Jersey females (regardless of age) having a height at withers of 49 inches is 898 pounds; so we put in the first column of Table 1, 898 pounds opposite 49 inches.

In Table 1 the first column is for Jerseys, the second for Holsteins, the third is the average for the two breeds.

TABLE 1.—THE RELATION BETWEEN LIVE WEIGHT AND HEIGHT AT WITHERS OF CATTLE

Heights at Withers in Inches	Live weights in pounds		
	Jersey	Holstein	Average
23½	37		
24	40		
24½	44		
25	48		
25½	52		
26	57	58	58
26½	62	63	62
27	67	69	68
27½	73	74	74
28	78	80	79
28½	85	86	86
29	91	93	92
29½	98	99	98
30	106	107	106
30½	114	115	114
31	122	122	122
31½	131	131	131
32	140	140	140
32½	150	150	150
33	160	160	160
33½	171	170	170
34	183	181	182
34½	194	192	193
35	207	204	206

TABLE 1 (CONTINUED).—THE RELATION BETWEEN LIVE WEIGHT AND HEIGHT AT WITHERS OF CATTLE.

Heights at Withers in Inches	Live weights in pounds		
	Jersey	Holstein	Average
35½	211	217	219
36	234	229	232
36½	248	244	246
37	264	258	261
37½	279	272	276
38	296	288	292
38½	314	304	309
39	332	321	326
39½	350	338	344
40	370	357	364
40½	391	376	384
41	412	395	404
41½	435	416	426
42	458	438	448
42½	483	461	472
43	505	483	494
43½	534	508	521
44	562	533	548
44½	589	557	573
45	619	585	602
45½	650	613	632
46	680	640	660
46½	714	671	692
47	748	702	725
47½	782	733	758
48	819	766	792
48½	858	801	830
49	898	837	868
49½	936	872	904
50	979	910	944
50½	1024	950	987
51	1066	987	1026
51½	1114	1030	1072
52	1150	1074	1112
52½	1213	1118	1166
53	1262	1161	1212
53½	1316	1209	1262
54	1371	1258	1314
54½	1424	1305	1364
55	1484	1357	1420
55½	1545	1411	1478
56	----	1465	----
56½	----	1519	----
57	----	1578	----
57½	----	1633	----
58	----	1695	----
58½	----	1759	----
59	----	1824	----

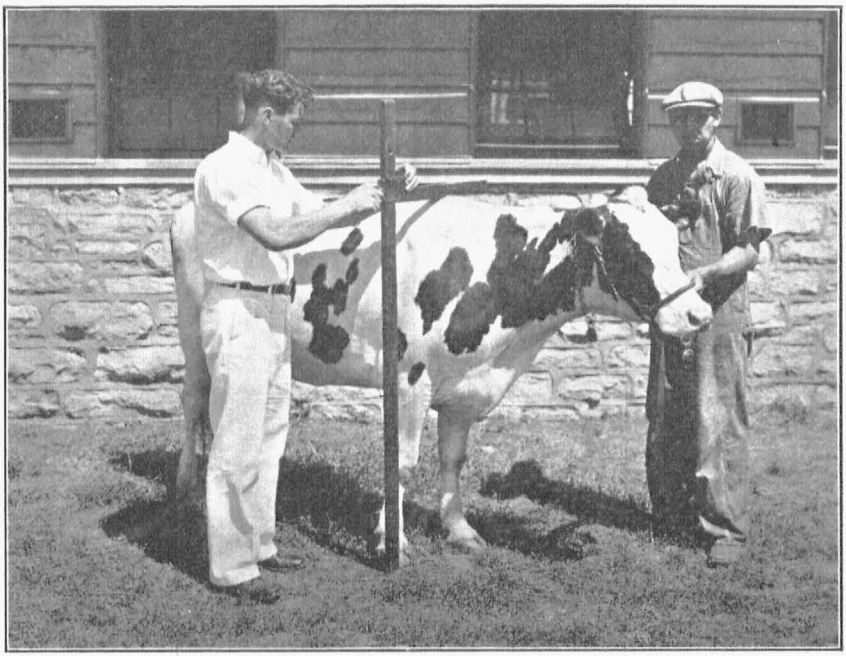

Fig. 2.—This photograph illustrates our method of measuring the height at withers at the highest point. The horizontal arm and vertical arm of the measuring device are equipped with built-in spirit levels to help keep the measuring rod in strictly vertical position.

WEIGHTS FOR HEIGHTS AT WITHERS WHEN AGE IS KNOWN

Table 1 was designed to be used when age is not known; Table 2 (2a for Jerseys and 2b for Holsteins) was designed to be used when age is known. Table 2 (which takes age into account) will naturally give more nearly ideal weights for corresponding heights than Table 1 (which does not take age into account) since age is one of the important factors influencing the relation between weight and height (older animals tend to be stockier, that is heavier in relation to height than younger).

To use Table 2, locate the height at withers in the left column corresponding to age in the upper row. The value in the intersection is the corresponding *average* live weight (some day we hope to have *ideal* weights). Thus from Table 2a a Jersey heifer 2 months old with a height of 28½ inches has an average live weight of 89 pounds; a Jersey cow 61 to 72 months (5-6 years) old with a height at withers of 48 inches has an average live weight of 966 pounds. The blackface figures represent the approximate average heights at withers for corresponding ages.

Needless to say, for given weights pregnant cows will weigh more, and heavily lactating cows will tend to weigh less than the weights given in Table 2, because pregnancy and lactation were discounted in the construction of this table.

TABLE 2A.—AVERAGE WEIGHTS FOR DIFFERENT HEIGHTS AT WITHERS AND FOR DIFFERENT AGES OF JERSEY CATTLE

Height at Withers in Inches	Age in Months																											
	Birth	1	2	3	4	5	6	7	8	9	10	11	12	13 & 14	15 & 16	17 & 18	19 & 20	21 & 22	23 & 24	25 to 28	29 to 32	33 to 36	37 to 42	43 to 48	49 to 54	55 to 60	61 to 72	73 & over
21½	38																											
22	40																											
22½	42	48																										
23	44	50																										
23½	46	52																										
24	49	55	63																									
24½	51	57	66																									
25	53	60	69	77																								
25½	55	63	72	81																								
26	58	65	76	84							Live	We	ight	in	Pou	nds												
26½	60	68	79	88	99																							
27	63	71	82	92	104																							
27½	65	74	86	96	108																							
28	68	77	89	100	113	120																						
28½	70	80	93	104	118	125																						
29	73	83	97	109	123	131																						
29½	76	86	101	113	128	136	147																					
30		90	105	117	133	142	154																					
30½		93	109	122	138	148	160																					
31	96	113	126	144	154	166	177																					
31½	100	117	131	149	160	173	184																					
32		121	136	155	166	180	192																					
32½		125	141	161	173	188	199	205																				
33		130	146	167	179	195	207	213																				
33½		134	151	173	186	202	215	221	225																			
34		139	157	179	193	210	223	230	234																			
34½		----	162	185	199	217	231	239	243	248																		
35		----	168	192	206	225	240	248	252	258																		
35½		----	173	198	214	233	249	257	261	268	274																	
36			179	205	221	241	258	266	271	278	284																	
36½			185	212	228	250	267	276	281	288	295	299																
37			191	219	236	259	276	286	291	299	306	310	316															
37½			----	226	244	267	285	295	301	309	317	321	328															
38			----	233	252	276	295	305	312	320	329	333	341	347														
38½			----	----	260	285	305	316	323	332	341	345	354	360														
39			----	----	269	295	315	327	334	344	353	358	367	373	389													
39½			----	----	277	304	325	338	345	355	365	370	380	386	403													
40			----	----	285	314	336	349	356	367	377	383	393	401	418	430												
40½			----	----	----	324	347	360	368	379	390	396	407	415	433	446												

41					380	391	403	409	421	429	448	461	481												
41½					392	404	416	423	435	444	464	478	498												
42					405	418	430	437	450	460	480	495	515	534											
42½					418	431	444	452	465	476	497	512	532	552	573										
43					430	444	458	466	480	491	513	528	549	569	591	621									
43½					443	458	473	481	495	507	530	546	568	587	609	641	669								
44					457	472	488	496	511	524	548	564	586	606	628	660	689	717	732	741	743	748	755		
44½					470	486	502	511	527	541	566	582	605	625	647	680	709	737	753	764	766	772	782		
45					484	501	517	527	544	558	584	601	624	644	666	700	730	759	776	788	791	798	809		
45½					498	515	533	543	561	576	603	620	643	664	686	721	751	781	799	812	816	825	837		
46					512	530	549	559	578	593	622	639	663	684	706	741	772	803	822	836	841	851	865		
46½					527	546	565	576	595	611	641	659	683	704	727	762	794	826	845	861	866	879	893		
47					542	562	582	593	613	630	661	679	704	725	748	784	816	850	869	887	892	907	923		
47½						578	598	610	631	649	681	699	724	746	769	805	838	873	893	912	918	936	953		
48	Live Weight in Pounds					594	615	627	649	668	701	721	746	768	790	827	862	897	918	938	946	966	983		
48½							633	646	668	688	722	743	768	790	813	850	886	922	944	965	974	996	1015		
49							651	664	688	709	744	765	790	813	836	873	910	947	970	993	1003	1027	1047		
49½								682	707	729	765	787	812	835	859	896	934	972	996	1020	1031	1058	1079		
50								701	727	750	787	810	836	858	882	920	958	997	1022	1047	1060	1090	1113		
50½								721	747	771	810	833	859	882	906	945	982	1023	1049	1075	1090	1123	1147		
51									767	793	833	856	882	906	929	969	1007	1049	1076	1104	1120	1156	1181		
51½									788	815	856	880	907	930	953	994	1033	1076	1104	1134	1151	1189	1217		
52									----	838	880	905	932	955	979	1020	1059	1103	1133	1165	1183	1224	1254		
52½									----	----	905	930	957	981	1004	1046	1085	1130	1163	1196	1215	1259	1291		
53									----	----	929	955	982	1006	1029	1071	1113	1158	1192	1227	1247	1294	1328		
53½									----	----	----	981	1009	1032	1056	1098	1141	1187	1221	1258	1280	1331	1367		
54									----	----	----	----	1036	1059	1083	1125	1169	1216	1251	1290	1314	1369	1406		
54½									----	----	----	----	----	1085	1109	1151	1196	1244	1281	1322	1348	1407	1445		
55									----	----	----	----	----	----	1136	1180	1225	1275	1312	1355	1383	1445	1486		
55½									----	----	----	----	----	----	----	1209	1254	1305	1344	1388	1418	1485	1528		
56									----	----	----	----	----	----	----	----	1282	1366	1374	1421	1453	1524	1568		

TABLE 2B.—AVERAGE WEIGHTS FOR DIFFERENT HEIGHTS AT WITHERS AND FOR DIFFERENT AGES OF HOLSTEIN CATTLE

Height at Withers in Inches	Age in Months																											
	Birth	1	2	3	4	5	6	7	8	9	10	11	12	13 & 14	15 & 16	17 & 18	19 & 20	21 & 22	23 & 24	25 to 28	29 to 32	33 to 36	37 to 42	43 to 48	49 to 54	55 to 60	61 to 72	73 & over
22	48																											
22½	50																											
23	53																											
23½	55																											
24	58																											
24½	61																											
25	64	72																										
25½	67	75																										
26	70	78																										
26½	73	82																										
27	76	86	99																									
27½	80	90	103																									
28	83	93	107	119																								
28½	87	97	112	124																								
29	**90**	101	117	129																								
29½	94	105	121	135																								
30	98	110	126	140	156																							
30½	101	**114**	131	146	162																							
31	105	118	136	152	168																							
31½	109	123	142	158	175																							
													Live	We	ight	in	Pou	nds										
32	113	127	**147**	164	182	199																						
32½	118	132	153	170	189	206																						
33	122	137	158	176	195	214																						
33½	126	142	164	182	203	222																						
34		147	170	189	210	230	243																					
34½		152	175	**195**	217	238	251																					
35		157	182	202	225	246	260																					
35½		162	188	209	233	255	270																					
36		167	194	216	**240**	264	279	297																				
36½			200	223	248	273	288	308																				
37			207	231	257	282	298	318	324																			
37½			213	238	265	291	308	329	334																			
38			220	246	273	**300**	318	340	346	352																		
38½			----	254	282	310	329	351	358	365																		
39			----	262	291	320	339	363	370	377	380																	
39½			----	269	300	330	**350**	374	381	389	392	399																
40			----	277	309	340	361	386	394	402	406	413	420															
40½			----	286	319	351	372	398	406	415	420	427	434	446														
41			----	294	328	361	383	**410**	419	428	433	441	448	460														
41½			----	----	337	372	395	423	243	442	447	455	463	475	491													

Live Weight in Pounds																								
42	347	383	406	436	445	456	461	470	479	491	508													
42½	357	394	419	449	**459**	470	476	485	494	507	524	541												
43	367	405	430	462	472	484	490	500	509	523	540	557												
43½		416	443	475	486	**499**	505	516	526	539	557	574	596											
44		428	456	489	500	514	521	532	542	556	575	592	614	648										
44½			468	503	514	528	**536**	548	558	573	592	609	631	665	697									
45			481	517	529	544	552	564	575	590	610	627	649	684	715	755								
45½			494	532	545	560	568	**581**	592	608	628	646	667	703	734	773	825							
46			507	546	559	575	584	598	**609**	626	646	664	685	721	752	791	843	886						
46½			521	561	575	591	601	615	627	644	665	683	704	740	771	810	862	905	934					
47			535	576	591	608	618	633	646	**663**	685	702	724	760	790	829	881	924	952	986	1012	1044	1074	1100
47½				590	606	624	635	651	663	682	704	721	743	779	809	848	900	942	970	1004	1029	1062	1091	1117
48				606	622	641	653	669	682	702	**724**	741	763	799	829	868	919	961	989	1022	1047	1080	1109	1135
48½					639	659	671	688	702	722	744	762	783	819	850	888	938	981	1008	1041	1066	1098	1127	1153
49					656	677	690	707	722	742	765	**783**	804	840	870	908	958	1001	1027	1059	1084	1116	1145	1171
49½						694	708	726	742	762	785	804	824	861	890	928	978	1020	1046	1077	1102	1134	1163	1189
50							727	745	762	783	807	825	**845**	882	911	949	998	1040	1065	1096	1121	1152	1181	1207
50½								765	782	804	829	847	867	**904**	932	970	1018	1060	1084	1115	1140	1171	1199	1225
51								785	802	825	851	868	888	**925**	953	990	1038	1079	1103	1134	1158	1189	1217	1243
51½									823	847	873	890	910	947	**975**	1012	1059	1100	1123	1153	1177	1208	1236	1262
52									845	870	896	912	933	969	998	**1034**	1080	1121	1143	1173	1196	1227	1255	1281
52½									----	893	919	936	956	992	1020	1056	**1101**	1142	1163	1193	1215	1246	1273	1299
53									----	915	942	959	979	1014	1042	1078	1122	**1162**	**1183**	**1212**	1234	1265	1291	1317
53½									----	----	966	983	1002	1038	1065	1100	1143	1183	1203	1232	**1253**	**1284**	**1310**	**1336**
54									----	----	991	1007	1026	1062	1088	1123	1165	1205	1223	1252	1272	1304	1329	1355
54½									----	----	----	1031	1049	1085	1111	1144	1187	1225	1243	1272	1291	1323	1348	1374
55									----	----	----	1057	1074	1109	1134	1168	1209	1247	1264	1292	1311	1342	1367	1393
55½									----	----	----	----	1099	1134	1158	1191	1231	1269	1285	1312	1331	1362	1386	1412
56									----	----	----	----	1123	1159	1182	1214	1253	1291	1306	1332	1351	1381	1405	1431
56½									----	----	----	----	----	1184	1207	1238	1276	1313	1327	1353	1371	1401	1425	1450
57															1232	1262	1299	1335	1349	1374	1391	1420	1444	1469
57½															----	1286	1321	1357	1370	1394	1411	1440	1463	1488
58															----	1310	1344	1380	1391	1415	1431	1461	1483	1508
58½															----	----	1368	1403	1413	1436	1452	1481	1503	1528
59															----	----	----	1427	1435	1457	1473	1502	1523	1548
59½															----	----	----	----	1456	1478	1493	1522	1543	1567
60															----	----	----	----	----	1500	1514	1542	1563	1587

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

Agricultural Experiment Station

STATION STAFF, OCTOBER, 1935

FREDEBICK A. MIDDLEBUSH Ph.D., President

F. B. MUMFORD, M. S., D. Agr., Director S. B. SHIRKY, A. M., Asst. to Director

MISS ELLA PAHMEIER, Secretary

AGRICULTURAL CHEMISTRY

A. G. Hogan, Ph.D.
L. D. Haigh, Ph.D.
E. W. Cowan, A.M.
Luther R. Richardson, Ph.D.
S. R. Johnson, Ph.D.
Virgil Herring, B.S.

AGRICULTURAL ECONOMICS

O. R. Johnson, A.M.
Ben H. Frame, A.M.
F. L. Thomsen, Ph.D.
†C. H. Hammar, Ph.D.

AGRICULTURAL ENGINEERING

J. C. Wooley, M.S.
Mack M. Jones, M.S.
G. W. Giles, M.S. in A. E.

ANIMAL HUSBANDRY

E. A. Trowbridge, B.S. in Agr.
L. A. Weaver, B.S. in Agr.
A. G. Hogan, Ph.D.
F. B. Mumford, M.S., D. Agr.
F. F. McKenzie, Ph.D.*
J. E. Comfort, A.M.*
H. C. Moffett, A.M.
Victor Berliner, M.S.
C. S. Williams, B.S.
C. E. Murphey, B.S.

BOTANY AND PATHOLOGY

W. J. Robbins, Ph.D.
C. M. Tucker, Ph.D.
C. G. Schmitt, A.B.

DAIRY HUSBANDRY

A. C. Ragsdale, M.S.
Wm. H. E. Reid, A.M.
Samuel Brody, Ph.D.
C. W. Turner, Ph.D.
H. A. Herman, A.M.
E. R. Garrison, A.M.
Warren C. Hall, A.M.
E. P. Reineke, B.S.
E. T. Gomez, A.M.
C. W. McIntyre, M.S.
Lloyd E. Washburn, M.S.
Ralph P. Reece, M.S.
R. C. Cunningham, B.S. in E.E.
W. R. Graham, Ph.D.

ENTOMOLOGY

Leonard Haseman, Ph.D.
T. E. Birkett, A.M.
H. L. Koch, B.S.
Lee Jenkins, B.S.
C. H. Baldwin, B.S.

FIELD CROPS

W. C. Etheridge, Ph.D.
C. A. Helm, A.M.*
L. J. Stadler, Ph.D.*
B. M. King, A.M.*
E. Marion Brown, A.M.*
Miss Clara Fuhr, M.S *

HOME ECONOMICS

Mabel Campbell, A.M.
Jessie Alice Cline, A.M.
Adella Epple Ginter, M.S.
Bertha Bisbey, Ph.D.
Jessie V. Coles, PhD..
Bertha K. Whipple, M.S.
Minerva Grace, A.M.
Mary I. Shell, A.M.
Adelia Weis, A.M.
Elizabeth Dyer, A.M.

HORTICULTURE

T. J. Talbert, A.M.
A. E. Murneek, Ph.D.
H. G. Swartwout, A.M.
Geo. Carl Vinson, Ph.D.
H. F. Major, B.S.
R. A. Schroeder, B.S. in Agr.
George E. Smith, B.S. in Agr.
Aubrey D. Hibbard, M.A.

POULTRY HUSBANDRY

H. L. Kempster, M.S.
E. M. Funk, A.M.

RURAL SOCIOLOGY

E. L. Morgan, Ph.D.
Melvin W. Sneed, B.S. in B.A.

SOILS

M. F. Miller, M.S.A.
H. H. Krusekopf, A.M.
W. A. Albrecht, Ph.D.
Hans Jenny, Ph.D.
L. D. Baver, Ph.D.
H. F. Winterkorn, Ph.D.

VETERINARY SCIENCE

A. J. Durant, A.M., D.V.M.
J. W. Connaway, D.V.M., M.D.
Cecil Elder, A.M., D.V.M.
O. S. Crisler, D.V.M.
Andrew Uren, A. M., D.V.M.
Harold C. McDougle, A.M.
P. L. Piercy, D.V.M.

OTHER OFFICERS

R. B. Price, B.L., Treasurer
Leslie Cowan, B.S., Sec'y of University
A. A. Jeffrey, A.B., Agricultural Editor
L. R. Grinstead, B.J., Ass't. Agr. Editor
J. F. Barham, Photographer
Leon Waughtal, Assistant Photographer
Jane Frodsham, Librarian

*In cooperative service with the U. S. Department of Agriculture.

†On leave of absence.