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for period
January 1, 1968 to December 31, 1968

Prepared by
R. C. Pickett

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INHERITANCE AND IMPROVEMENT OF PROTEIN QUALITY
AND CONTENT IN SORGHUM VULGARE PERS.

Report for Period January 1, 1968 to December 31, 1968

Studies on the genetic control of protein quantity and quality and grain yield and the relationships among them were conducted by Fred Collins in 1967 and 1968. The results from an incomplete diallel group in four replications in 1967 are presented in Tables 1 and . Yield varied from 3088 to 9286 kg/ha, protein varied from 10.23 to 15.53%, and lysine varied from 1.17 to 1.99%. The check variety, RS610, yielded 5469 kg/ha with 12.35% protein and 1.52% protein. The correlation between yield and percent protein was -.19. The correlation between percent protein and percent lysine was -.34. There was essentially no correlation between yield and percent lysine.

The results of a 9 parent diallel group in 1968 are presented in Tables 3 and 4. Grain yield varied from 3143 to 15863 kg/ha, protein varied from 9.18 to 18.22%, and lysine varied from 1.74 to 2.74%. The check variety, RS610, yielded 6595 kg/ha with 10.98% protein and 2.18% lysine. The correlation between yield and percent protein was -.57. The correlation between percent protein and percent lysine was -.51. There was essentially no correlation between yield and percent lysine. Correlations of +.90 or higher occurred between protein yield and grain yield, lysine yield and grain yield, and protein yield and lysine yield. The correlations between percent protein and date of flowering and between percent protein and plant height were above +.60.

The majority of the F_1 hybrids exhibited heterosis for grain yield. Heterosis is used here to describe the performance of the hybrids which were superior to the best parent. There were a few crosses which showed heterosis for percent protein while there were none showing heterosis for percent lysine. Heterosis was occasionally found in crosses whose parents were superior for either grain yield or percent protein. The highest grain yield came from a cross between two lines which had approximately 14% protein. Martin and IS.lines 1220, 0075, and 2319 were the best combiners for protein yield. Lines 3935, 0508, and 2319 were the best combiners for percent lysine.

Gene action for percent protein was almost entirely due to additive genes, however, there was also a significant amount of non-additive gene action which was apparently caused by dominance and epistasis. The genetic variation in grain yield and percent lysine was caused by nearly equal amounts of additive and non-additive gene action. These results suggest that superior homozygous lines can be developed by combining the additive genes for each character. These lines should have a lot of potential for those areas in the world which lack a hybrid seed industry. However, the full utilization of the genetic variability exhibited in the crosses depends on the use of hybrids because a significant proportion of the genetic variability was due to non-additive gene action.

Additional studies (Tables 5 and 6) showed that the percent protein in the seed decreases and becomes stabilized shortly after the milk stage and that weathering during the late fall and winter does not decrease protein percent.

Studies with 11 sorghum genotypes grown at three locations (Tables 7-11) for two years showed differences between genotypes and between years for yield, percent protein and protein yield. An interaction occurred between years and locations for protein percent and protein yield. Genotypes did not interact with years or locations, however, the genotype x location x year interaction was highly significant for yield, percent protein and protein yield. This suggests that testing over both years and locations is needed to give reliable estimates for protein as well as yield.

Studies were conducted to determine the effect of bagging and flag leaf removal (both normal pollinating procedures) on grain yield percent protein and seed size (Tables 12-15). Either of these procedures reduced grain yield and a combination of these procedures further reduced yield. A slight but significant increase in percent protein accompanied the reduction in yield. Seed weight did not change significantly. The variety x treatment interaction was significant for yield.

Additional protein and lysine determinations were made in 1960. Those of particular interest (high or low protein, high or low lysine and high or low protein x lysine) from the World Collection are presented in Table 16. Those from thesis studies will be presented later.

Complete amino acid analyses have been made on more than 400 lines. These analyses were made on a Beckman 120C automatic amino acid analyzer. Currently the accelerated (2 hour) system is being used. The results obtained for amino acids of importance in human nutrition are presented in Table 17. Since tryptophan is destroyed in the hydrolysis process used for the analysis of the other amino acids, the tryptophan values presented are from separate hydrolysis.

Biological assays for availability of amino acids provide standards against which the results obtained by other methods must be compared to determine nutritional quality. Each of 14 samples of sorghum was fed to six young rats. The results are reported in Table 18. Mean gains per group of six rats varied from 2.8 to 15.8. The protein efficiency ratio (PER) varied from 0.18 to 0.41 indicating a wide range of nutritional quality.

Thesis studies by Fernando Rodrigues involving endosperm embryo composition relationships and studies by A. O. Abifarin involving protein and lysine combining ability among many diverse lines from the World Collection are presently being analyzed and will be presented in the next report.

Table 1. Mean values of eight characters measured from 65 sorghum genotypes of the incomplete diallel grown in 1967.

Genotype IS.No.	Date 50% Heading	Leaf No.	Height (cms.)	Grain Yield (kg/ha)	% Protein	% Lysine	Protein yield (kg/ha)	Lysine yield (kg/ha)
8168	8-18	13.3	142.5	5697	12.53	1.66	711.3	11.82
LRT x 8168	8-10	13.5	176.3	7989	12.58	1.45	1005.7	14.62
CK60 x 8168	8-11	13.8	187.8	7515	11.93	1.53	893.7	13.73
WHT x 8168	8-9	11.8	166.3	8500	11.98	1.42	1017.2	14.51
RDL x 8168	8-10	13.0	163.8	9286	12.03	1.43	1118.5	15.85
8120	7-25	12.0	168.8	4326	15.53	1.26	690.1	7.66
LRT x 8120	7-20	10.0	165.0	5686	15.43	1.25	879.7	11.04
CK60 x 8120	7-21	12.0	175.0	6694	13.68	1.56	914.1	14.13
WHT x 8120	8-2	13.5	198.8	7776	14.30	1.42	1121.4	15.60
RDL x 8120	8-1	13.8	206.3	7902	14.00	1.38	1106.5	15.26
2319	8-5	14.5	176.3	6734	14.05	1.97	923.2	18.19
LRT x 2319	8-9	14.3	231.3	7166	14.25	1.61	1139.4	18.58
CK60 x 2319	8-8	13.0	240.0	7568	12.43	1.65	939.6	15.23
WHT x 2319	8-10	13.0	215.0	7588	13.05	1.67	967.0	15.75
RDL x 2319	8-10	13.3	242.5	7861	12.88	1.34	1012.0	11.29
1220	8-2	12.8	238.8	8143	11.23	1.99	915.3	17.91
LRT x 1220	7-26	12.3	233.8	7329	14.28	1.75	1041.6	18.23
CK60 x 1220	7-26	12.8	231.3	8765	12.58	1.67	1101.0	17.72
WHT x 1220	8-2	13.5	235.8	8919	12.83	1.56	1144.5	18.20
RDL x 1220	8-2	13.5	262.5	8952	13.38	1.74	1192.5	17.34
8255	7-29	10.5	250.0	5394	12.05	1.61	651.5	10.22
LRT x 8255	7-21	11.3	197.5	5356	15.28	1.42	817.3	11.51
CK60 x 8255	7-23	11.0	201.3	4838	13.20	1.33	649.5	9.22
WHT x 8255	7-25	12.5	183.8	7076	12.50	1.48	883.4	13.24
RDL x 8255	7-31	11.8	181.3	6389	13.35	1.54	854.7	13.16
0718	8-17	14.3	217.5	5290	11.78	1.55	625.0	9.77
LRT x 0718	8-2	10.8	205.0	7526	12.40	1.55	938.0	14.74
CK60 x 0718	8-3	13.0	216.3	6810	12.15	1.43	822.1	11.55
WHT x 0718	8-6	13.0	205.0	7946	12.05	1.35	963.5	13.17
RDL x 0718	8-3	13.0	231.3	7747	12.08	1.64	934.4	15.00
0271	7-9	11.8	170.0	3592	13.45	1.63	485.2	7.76
LRT x 0271	7-12	9.8	161.3	5130	13.45	1.55	689.0	10.70
CK60 x 0271	7-13	8.8	191.3	6475	12.35	1.43	798.3	11.31

Table 1. Continued

Genotype IS. No.	Date 50% Heading	Leaf No.	Height (cms.)	Grain Yield (kg/ha)	% Protein	Lysine	Protein yield (kg/ha)	Lysine Yield (kg/ha)
WHT x 0271	7-14	10.8	172.5	6763	12.18	1.49	841.9	12.17
RIL x 0271	7-17	11.8	186.3	7181	12.58	1 47	894.5	14.02
0508	8-7	12.3	152.5	5736	11.30	1.51	641.5	8.41
MRT x 0508	7-26	10.3	158 8	6922	11.48	1.68	796.0	13.70
CK60 x 0508	7-27	11.3	153.8	7750	10.23	1.69	792.2	13 39
WHT x 0508	7-31	11.3	152.5	7907	10.43	1 71	822.8	14.62
RIL x 0508	8-3	12.0	170.0	8197	10.65	1.71	874 2	14 69
3935	7-30	11.5	97.5	4410	13.18	1.65	573.9	10.00
MRT x 3935	7-21	9.8	128 8	7230	13.08	1.64	940.3	15.20
CK60 x 3935	7-21	10.5	141.3	7724	12.15	1.72	943.2	16.17
WHT x 3935	7-27	11.8	106.3	7085	12.03	1.67	852.3	14.33
RIL x 3935	7-25	10 8	141.3	7742	11.83	1.83	916.2	16 61
8005	8-19	10.5	267 5	3088	13.35	1.36	413.1	12.44
MRT x 8005	8-13	11.5	271.3	6698	14.60	1 45	974 4	13.87
CK60 x 8005	8-11	12.5	285.8	6975	13.18	1.70	919.3	15 76
WHT x 8005	8-10	12.5	265.0	6839	14.23	1.45	980.2	14.21
RIL x 8005	8-10	11.8	260.0	6470	13.60	1.72	894.0	15.30
8301	7-31	10.8	132.5	3832	14.93	1.47	575.3	10.37
MRT x 8301	7-20	10.0	128.8	4786	13.40	1.55	640.6	9.85
CK60 x 8301	7-21	11.3	136.3	5856	12.38	1.59	721.8	11.55
WHT x 8301	7-24	11.8	121.3	6517	12.45	1.58	816.4	10.67
RIL x 8301	7-27	11.3	136.3	6968	12.40	1.79	861.5	15.34
6898	7-30	11.0	166.3	5189	13.85	1.63	719.1	11.71
MRT x 6898	7-21	10.3	157.5	5791	12.55	1.45	723.5	10.82
CK60 x 6898	7-20	10.0	160.0	6764	12.05	1.56	814.6	12.95
WHT x 6898	7-28	12.3	187.5	6756	12.75	1.29	862.2	11.41
RIL x 6898	7-25	11.5	196.3	7575	13.30	1.17	1009.3	11.82
Martin	7-23	10.3	92.5	4946	14.95	1.37	678.8	10.46
CK60	7-24	11.0	105.0	5081	11.33	1.66	574.5	9.24
Wheatland	7-31	11.5	82.5	5353	13.25	1.41	711.0	9.53
Reelan	8-3	11.3	110.0	5665	12.18	1.72	685.8	9.82
RS610	7-16	9.5	115.0	5469	12.35	1.52	675.6	11.30
LSD_{05}				1720.4	0.968	0.346	116.66	3.120
LSD_{01}				1905.7	1.273	0.454	153.32	4.101

Table 2. Simple correlation coefficients among five characters of 6 5 sorghum genotypes of the incomplete diallel grown in 1967.

Characters correlated	Correlation Coefficient
Grain yield with percentage protein	-0.1945 **
Grain yield with protein yield	0.8046 **
Grain yield with percentage lysine	0.0486
Grain yield with lysine yield	0.6291 **
Percentage protein with protein yield	0.1417 *
Percentage protein with percentage lysine	-0.3400 **
Percentage protein with lysine yield	-0.0316
Protein yield with percentage lysine	-0.0565
Protein yield with lysine yield	
Percentage lysine with lysine yield	0.0590

* Significant at the .05 level.

** Significant at the .01 level.

Table 3a. Means[1] of seven characters measured from the sorghum diallel of nine parents and 36 F_1 hybrids grown in 1968.

Genotype IS. No.	Grain Yield (kg/ha)	Yield/head (gm)	100 Seed Wt. (gm)	% Protein	Protein Yield (kg/ha)	% Lysine[2]	Lysine Yld. (kg/ha)
1259	3143 q	16 n	1.20 u	17.35 a	545.9 m	2.04 f-m	11.1 l
0075	8497 c-g	50 f-h	3.71 a-c	13.45 c	1144.0 a-c	1.87 j-m	21.3 b-f
2319	6725 i-k	38 j	3.27 d-f	13.42 cd	900.0 e-h	2.64 ab	23.9 a-c
0503	7623 f-j	38 jk	2.44 l-p	10.13 m-p	771.2 g-k	2.74 a	21.2 b-f
8364	5455 k-o	28 lm	2.26 m-q	10.70 j-n	579.9 lm	2.20 d-j	12.6 i-l
Martin	6252 j-n	32 j-m	2.23 m-q	12.82 c-l	799.4 f-k	1.91 i-m	15.3 g-l
CK60	6403 j-n	33 j-l	2.44 l-p	10.45 k-o	666.1 i-m	2.45 c-e	16.6 g-j
Wheatland	7033 g-j	38 jk	2.58 k-l	10.42 k-o	731.9 h-l	2.21 d-j	16.2 g-j
Redlan	7168 g-j	38 jk	2.47 l-o	10.83 i-m	777.0 g-k	2.02 f-m	15.6 g-l
1259 x 0075	4243 o-q	22 mn	2.16 p-s	16.20 b	690.1 i-m	1.90 i-m	13.1 i-l
1259 x 2319	4917 l-p	25 l-n	2.23 o-r	16.07 b	790.3 g-k	1.88 j-m	14.9 g-l
1259 x 0503	4838 n-p	26 lm	1.27 u	16.42 b	794.9 g-k	1.92 i-m	15.3 g-l
1259 x 8364	4999 l-p	25 l-n	1.80 t	16.27 b	813.1 f-k	1.82 j-m	14.7 g-l
1259 x MRT	4225 o-q	26 lm	1.97 r-t	18.22	770.0 g-k	1.74 lm	13.4 g-l
1259 x CK60	5102 l-p	30 jk	1.89 s-t	16.22 b	826.5 f-j	1.78 k-m	14.7 h-l
1259 x WHT	3915 po	24 l-n	2.07 q-t	16.70 ab	653.0 j-m	1.74 m	11.4 g-l
1259 x RDL	4739 n-p	31 j-m	2.15 p-s	16.25 b	769.5 g-k	1.74 m	13.4 h-l
0075 x 2319	15063	100	3.65 a-c	11.63 f-j	1341.0	2.11 l-k	33.9
0075 x 0503	11369 a	59 b-f	3.43 ed	10.75 j-n	1178.2 ab	2.18 d-j	25.7 ab
0075 x 8364	9945 a-c	51 d-h	3.86 ab	11.23 h-l	1117.0 a-d	1.93 g-m	22.2 b-e
0075 x MRT	9654 b-f	43 h-i	3.55 cd	11.92 l-h	1010.2 a-d	2.09 f-m	22.4 b-e
0075 x CK60	9684 a-d	49 g-i	3.62 a-c	10.77 j-n	1039.1 b-e	2.02 f-m	20.9 d-f
0075 x WHT	9361 b-l	56 c-h	3.62 a-c	10.45 k-o	978.6 c-f	2.30 c-h	22.7 b-d
0075 x RDL	10176 ab	59 b-f	3.38 a	11.45 g-k	1165.9 ab	2.16 d-j	25.2 a-c
2319 x 0503	12396	75 a	3.47 cd	11.98 e-h	1542.2	2.16 d-j	33.3
2319 x 8364	10049 ab	67 ab	3.53 b-c	11.88 e-h	1192.4 ab	2.15 d-j	25.7 ab
2319 x MRT	9613 a-d	59 b-g	3.13 e-g	12.80 o-l	1224.2 a	2.22 c-j	27.1 a
2319 x CK60	9279 b-l	53 c-h	3.42 de	11.95 e-h	1109.2 a-d	2.20 c-i	24.7 a-c
2319 x WHT	9451 a-e	60 b-d	3.51 cd	12.32 e-g	1162.1 ab	1.94 h-m	22.5 b-d
2319 x RDL	10116 ab	62 bc	3.44 c-e	11.80 e-i	1192.0 ab	2.11 e-k	25.2 a-c
0503 x 8364	8022 e-i	50 f-h	2.63 j-k	9.33 op	748.6 h-l	2.43 a-d	18.5 d-h
0503 x MRT	8230 e-h	40 ij	2.81 h-k	10.30 l-o	848.4 f-j	2.07 f-m	17.5 f-i
0503 x CK60	9032 b-f	48 g-i	2.99 gh	9.50 op	857.4 f-i	2.56 a-c	21.8 b-f

Table 3a. Means[1] of seven characters measured from the sorghum diallel of nine parents and 36 F_1 hybrids grown in 1968. (continued)

Genotype IS. No.	Grain Yield (kg/ha)	Yield/Head (gm)	100 seed wt. (gm)	% Protein	Protein Yield (kg/ha)	% Lysine[2]	Lysine Yield (kg/ha)
0508 x WHT	9604 a-d	60 b-c	2.87 h-j	9.80 n-p	941.5 d-g	2.32 b-g	21.8 b-f
0508 x RDL	10369 ab	57 c-h	2.91 g-i	9.16 p	952.2 d-g	2.37 b-f	22.4 b-e
8364 x MRT	5820 k-n	30 j-m	2.99 gh	13.52 c	783.5 g-k	2.01 f-m	15.6 g-l
8364 x CK60	5311 k-p	33 j-l	2.55 k-m	11.65 e-h	621.1 k-m	1.98 g-m	12.3 j-l
9364 x WHT	6267 j-n	37 jk	2.79 h-k	11.33 g-k	709.7 h-m	2.10 e-m	14.8 g-l
8364 x RDL	6151 j-n	31 j-m	3.04 f-h	12.57 c-f	774.6 g-k	1.98 g-m	16.0 g-k
MRT x CK60	7228 g-j	39 ij	2.53 k-n	11.65 f-i	843.4 f-j	2.13 d-k	18.0 e-i
MRT x WHT	5949 k-n	33 j-l	2.40 l-p	12.20 e-h	725.8 h-m	1.93 h-m	13.8 g-l
MRT x RDL	6338 j-m	33 j-l	2.25 n-q	12.48 ef	787.1 g-k	1.95 g-m	15.5 g-l
CK60 x WHT	6136 j-n	33 j-l	2.38 l-p	11.40 g-k	700.9 h-m	1.95 g-m	13.6 h-l
CK60 x rdl	6798 h-j	37 jk	2.60 kl	11.18 h-l	764.3 g-l	1.95 g-m	15.0 g-l
WHT x RDL	6452 j-l	34 j-l	2.34 l-q	10.57 k-n	681.3 i-n	2.01 f-m	13.7 h-l
RS 610	6595	34	2.33	10.93	723.5	2.18	16.0

1 Duncan's new multiple range test was used to compare means; any two means followed by the same letter are not significantly different at the .05 level; any two means not followed by the same letter, or any letter, are significantly different at the .05 level.

2 Percentage lysine as a proportion of protein.

Table 3b. Means of six characters measured from the sorghum diallel of nine parents and 36 F_1 hybrids grown in 1968.

Genotype IS. No.	Flowering[1]	Leaf No.	Height (cm)	L.A.I.[2] (cm)	Head Exert. (cm)	Head Length (cm)
1259	31	14.0	348	191	22.7	34.6
0075	17	15.4	214	193	12.2	19.0
2319	26	16.1	271	113	11.8	13.4
0503	29	16.7	109	96	23.4	26.4
8364	13	11.0	83	143	12.5	23.5
Martin	10	10.7	140	151	25.3	26.8
CK60	10	11.2	136	124	16.1	23.2
Wheatland	19	12.4	109	175	15.2	27.0
Reclan	15	11.6	150	123	13.3	24.4
1259 x 0075	29	16.7	363	205	18.0	27.4
1259 x 2319	23	15.3	375	166	21.2	24.8
1259 x 0503	45	19.0	414	116	22.5	35.7
1259 x 8364	30	15.2	364	176	29.1	26.5
1259 x MRT	28	13.2	335	215	24.2	34.3
1259 x CK60	29	14.6	363	190	22.5	31.3
1259 x WHT	29	15.0	345	177	24.7	30.5
1259 x RDL	28	13.9	363	120	25.9	27.9
0075 x 2319	24	17.2	293	215	10.4	20.5
0075 x 0503	18	14.8	276	181	18.7	25.7
0075 x 8364	8	12.3	240	172	23.7	18.3
0075 x MRT	6	12.3	255	162	25.2	23.2
0075 x CK60	7	11.7	253	153	18.9	22.5
0075 x WHT	10	13.7	261	190	22.6	23.0
0075 x RDL	10	12.8	266	156	21.1	21.7
2319 x 0503	29	17.8	379	135	21.4	22.9
2319 x 8364	20	14.8	293	156	13.7	21.4
2319 x MRT	18	14.9	309	149	20.8	21.6
2319 x CK60	16	14.4	291	100	17.3	21.2
2319 x WHT	27	15.7	304	132	19.7	19.7
2319 x RDL	20	15.1	321	129	16.4	20.1

Table 3b. continued

Genotype IS. No.	Flowering[1]	Leaf No.	Height (cm)	L.A.I.[2] (cm)	Head Exert. (cm)	Head Length (cm)
0508 x 8364	19	13.2	170	149	11.7	29.5
0508 x MRT	12	12.5	210	174	26.9	30.5
0508 x CK60	13	12.6	204	129	16.7	31.3
0508 x WHT	24	13.8	190	168	18.3	29.8
0508 x RDL	19	13.1	213	145	19.1	32.2
8364 x MRT	13	10.5	126	158	20.3	25.8
8364 x CK60	12	10.6	111	157	14.7	25.5
8364 x WHT	14	10.7	103	174	17.5	26.3
8364 x RDL	15	10.7	119	132	15.6	24.0
MRT x CK60	8	10.9	181	151	22.9	25.7
MRT x WHT	12	11.3	126	195	20.2	28.0
MRT x RDL	9	10.6	144	155	22.2	25.5
CK60 x WHT	7	10.3	124	173	21.1	25.2
CK60 x RDL	10	10.6	143	118	18.5	22.9
WHT x RDL	11	11.1	134	171	16.8	23.3
RS610	5	10.3	141	154	19.5	25.3
LSD_{05}	3.0	1.1	23.0	38.9	4.6	3.2
LSD_{01}	4.2	1.6	32.5	55.1	6.5	4.6

1 July 1 was used as the base date for flowering.

2 Leaf area index of flag leaf only.

Table 4. Simple correlation coefficients among 13 characters measured from the diallel of nine parents grown in 1968.[1]

Character	Leaf Number	Height	L.A.I.	Head Exertion	Head Length	Grain Yield	Yield per head	100 seed weight	% Protein	Protein Yield	% Lysine	Lysine Yield
Flowering	.79**	.70**	-.30**	.10	.32*	-.20*	-.09	-.39**	.61**	.03	-.11	-.01
Leaf Number		.77**	-.02*	-.01	-.01	.21**	.29**	.04	.34	.40**	.05	.39**
Height			.08	.29**	.11	.05	.14	-.07	.62**	.33**	-.21**	.23**
L.A.I.				.01	.18*	-.04	-.03	.08	.22**	.05	-.24**	-.05
Head Exertion					.40**	-.24**	-.29**	-.28**	.33**	-.14	-.28**	-.23**
Head Length						-.40**	-.36**	-.63**	.28**	-.41**	-.14	-.42**
Grain Yield							.93**	.77**	-.57**	.90**	.27**	.91**
Yield/head								.73**	-.48**	.86**	.22**	.86**
100 seed wt.									-.52**	.69**	.23**	.70**
% Protein										-.18*	-.51**	-.35**
Protein yield											.05	.92**
% Lysine												.43**

* Significant at the .05 level.
** Significant at the .01 level.
[1] All correlation coefficients have 178 degrees freedom.

Table 5. Means of percentage protein of four sorghum genotypes harvested at seven stages of maturity in 1967.

Harvest Stage	% Protein Genotype R3610	AKS614	2319	0508	Harvest Stage Means
1	13.29	13.70	14.20	12.90	13.52
2	12.20	12.21	13.71	11.85	12.49
3	11.90	12.16	13.53	11.20	12.20
4	11.93	12.55	13.95	10.71	12.29
5	11.95	12.26	14.43	10.13	12.19
6	12.32	12.14	14.14	10.38	12.24
7	12.30	12.16	14.62	10.50	12.39
Genotype Means	12.27	12.45	14.08	11.10	

	Harvest stages	Genotypes
LSD_{05}	0.304	0.230
LSD_{01}	0.403	0.305

Table 6. Analysis of variance for percentage protein of four sorghum genotypes harvested at seven different stages of maturity in 1967.

Source of Variation	d.f.	Mean Square
Blocks	3	0.5689 *
Genotypes	3	42.2459 **
Harvest Stages	6	3.5798 *
V x H.S.	18	1.0225 **
Error	81	0.1867
C.V. = 3.46%		

* Significant at the .05 level

** Significant at the .01 level

Table 7. Means of grain yield (kg/ha) of 11 sorghum genotypes grown at three locations in 1967 and 1968.

Genotype	Sand Farm[1] 1967	Sand Farm[1] 1968	Sand Farm[1] Mean	Hi-Fertility[2] 1967	Hi-Fertility[2] 1968	Hi-Fertility[2] mean	Lafayette Nursery[3] 1967	Lafayette Nursery[3] 1968	Lafayette Nursery[3] Mean	Mean of all tests
3216	2729	4395	3563	5961	7626	6795	6491	6593	6543	5634
1259	1085	1335	1220	2951	1894	2423	3638	3106	3373	2339
0075	3046	6606	4827	6634	7538	7088	6818	8497	7659	6525
2319	2777	6600	4684	4495	6927	5712	6630	6726	6679	5692
0508	2865	6225	4546	4258	6126	5193	6209	7629	6920	5553
8364	3445	2457	2951	3235	2553	2895	4413	5455	4935	3594
Martin	3916	3250	3583	4674	4863	4769	5238	6251	5746	4700
CK60	4236	4875	4556	4251	4856	4554	6181	6446	6314	5142
Wheatland	4077	3605	3842	5253	5333	5294	4650	7033	5843	4993
Redlan	4738	4392	4566	6091	6273	6183	5831	7168	6501	5750
RS610	5318	5868	5594	5754	5933	5845	6307	6325	6317	5919
Mean	3477	4511	3993	4870	5448	5158	5674	6476	6074	5074
LSD_{05}	643	812		962	1223		800	1265		
LSD_{01}	866	1093		1295	1646		1077	1702		
C.V.	12.8%	5.9%		13.7%	7.8%		9.7%	6.8%		

1/ The Sand Farm has a very sandy soil. Two hundred pounds of 0-0-60 was plowed down per acre; 150 lbs/acre of 8-32-16 was used as a starter; and 150 lbs/acre of ammonium nitrate was applied three times during the growing season.

2/ The Hi-Fertility area has a Chalmers silty clay loam and has been maintained for many years at a very high level of fertility.

3/ The Nursery plots have been on a Chalmers silty clay loam and they received moderate to high levels of fertilization.

Table 8. Means of percentage protein of 11 sorghum genotypes grown at three locations in 1967 and 1968.

Genotype IS. No.	Sand Farm 1967	Sand Farm 1968	Sand Farm Mean	High-Fertility 1967	High-Fertility 1968	High-Fertility Mean	Lafayette Nursery 1967	Lafayette Nursery 1968	Lafayette Nursery Mean	Mean of all tests
3126	14.3	13.2	13.7	14.5	13.6	14.0	15.7	14.9	15.3	14.3
1259	16.4	16.4	16.4	18.8	17.0	17.9	18.6	17.4	18.0	17.4
0075	14.0	12.5	13.2	15.0	12.4	13.7	15.3	13.5	14.4	13.8
2319	13.4	12.3	12.8	15.2	11.8	13.5	14.6	13.4	14.0	13.4
0508	11.4	9.8	10.6	11.1	9.8	10.5	11.3	10.1	10.7	10.6
8364	10.2	10.5	10.3	12.0	10.7	11.3	12.1	10.7	11.4	11.0
Martin	12.1	13.4	12.8	14.5	12.4	13.4	15.1	12.8	14.0	13.4
CK60	9.6	9.7	9.6	11.7	9.8	10.8	11.7	10.5	11.1	10.5
Wheatland	11.1	11.7	11.4	12.4	10.3	11.3	13.2	10.4	11.8	11.5
Redlan	10.2	11.6	10.9	12.1	10.6	11.3	12.8	10.8	11.8	11.3
RS610	10.5	10.6	10.6	12.0	10.4	11.2	12.6	11.0	11.8	11.2
Mean	12.1	12.0	12.0	13.6	11.7	12.6	13.9	12.3	13.1	12.6
LSD_{05}	1.22	0.59		0.58	0.93		0.57	0.69		
LSD_{01}	1.64	0.79		0.78	1.25		0.77	0.93		
C.V.	7.0%	1.7%		3.0%	2.8%		2.8%	2.0%		

Table 9. Means of protein yield (kg/ha) of 11 sorghum genotypes grown at three locations in 1967 and 1968.

Genotype IS. No.	Sand Farm 1967	Sand Farm 1968	Sand Farm Mean	Hi-Fertility 1967	Hi-Fertility 1968	Hi-Fertility Mean	Lafayette Nursery 1967	Lafayette Nursery 1968	Lafayette Nursery Mean	Mean of all tests
3126	389	612	500	909	867	888	1075	819	948	779
1259	178	234	206	587	267	427	714	541	583	405
C075	427	868	648	1049	782	915	1106	953	1029	864
2319	373	853	613	718	679	699	1023	750	887	733
0508	326	647	486	500	502	501	737	642	690	559
8364	348	271	310	409	225	317	564	483	524	384
Martin	473	460	467	712	502	607	835	666	751	605
CK60	400	497	449	527	398	462	765	555	660	524
Wheatland	453	441	447	686	457	572	647	610	628	549
Redlan	483	540	512	777	554	665	784	647	716	631
RS610	562	658	610	726	515	621	839	576	707	646
Mean	401	553	477	691	522	607	826	650	738	607
LSD_{05}	81	99		135	122		127	123		
LSD_{01}	110	133		181	164		171	165		
C.V.	7.0%	6.2%		6.8%	8.1%		5.3%	6.5%		

Table 10. Yearly means of grain yield, percentage protein, and protein yield of 11 sorghum genotypes grown in 1967 and 1968 at three locations.

Genotype IS. No.	Grain yield (kg/ha) 1967	1968	% Protein 1967	1968	Protein yield (kg/ha) 1967	1968
3126	5062	6206	14.3	13.9	791	766
1259	2559	2119	17.9	16.9	493	317
0075	5501	7549	14.8	12.8	861	868
2319	4635	6749	14.4	12.5	705	761
0508	4445	6661	11.3	9.9	521	597
8364	3699	3459	11.4	10.6	440	327
Martin	4610	4789	13.9	12.9	673	543
CK60	4890	5393	11.9	10.0	564	403
Wheatland	4661	5325	12.2	10.8	595	503
Redlan	5555	5946	11.7	11.0	682	580
RS610	5794	6043	11.7	10.6	709	533
Mean	4672	5478	13.2	12.0	639	575

Table 11. Pooled analyses of variances for grain yield percentage protein, and protein yield of 11 sorghum genotypes grown in three locations in 1967 and 1968.

Source of Variation	d.f.	Mean Squares: Grain yield	% Protein	Protein yield
Years	1	9,550,713 **	86.0114 **	59,031 **
Locations	2	20,360,678 **	26.5164 **	324,793 **
Varieties	10	7,307,737 **	107.9268 **	112,499 **
Blocks in Loc. and Yrs.	18	112,466	10.5782 **	20,724 **
Year x Loc.	2	101,572	22.6966 **	166,644 **
Var. x Year	10	1,129,345	1.8931	8,618
Var. x Loc.	20	136,566	0.7582	8,557
Var. x Loc. x Yr.	20	909,296 **	0.9915 **	7,198 **
Error	160	269,141	0.0607	1,817

** Significant at the .01 level.

Table 12. Means for grain yield, percentage protein, and 100 seed weight of five varieties subjected to four bagging treatments which were carried out in 1967 and 1968.

Variety	Treatment	Grain yield (kg/ha)			% Protein			100 seed weight (gms)		
		1967	1968	Mean	1967	1968	Mean	1967	1968	Mean
RS610	1	5612	7023	6318	11.88	10.80	11.34	2.30	2.33	2.32
	2	4818	6006	5412	11.96	11.06	11.51	2.23	2.38	2.31
	3	4103	3876	3990	12.93	12.16	12.55	2.55	2.52	2.54
	4	4416	3633	4025	13.19	12.23	12.71	2.55	2.24	2.40
2319	1	6627	7467	7047	14.42	12.26	13.34	3.18	3.27	3.23
	2	5296	8646	6971	14.07	12.07	13.07	3.15	3.23	3.19
	3	4780	7106	5943	14.90	12.19	13.55	3.33	3.24	3.29
	4	5305	7673	6489	14.58	12.20	13.39	3.28	3.27	3.28
Redlan x 2319	1	9991	11231	10611	12.14	11.13	11.64	2.95	3.44	3.20
	2	8905	9501	9203	12.24	11.25	11.75	3.08	3.54	3.31
	3	9291	8709	9000	12.28	11.43	11.86	3.10	3.44	3.27
	4	5293	7703	6498	12.47	10.79	11.63	3.20	3.19	3.20
0508	1	6505	8470	7488	10.55	9.71	10.13	2.45	2.44	2.45
	2	6783	7609	7196	10.13	9.96	10.05	2.43	2.44	2.44
	3	5353	4457	4905	10.57	10.59	10.58	2.73	2.73	2.73
	4	5126	4915	5021	9.91	11.09	10.50	2.70	2.75	2.73
Redlan x 0508	1	9262	11512	10387	9.99	8.87	9.43	2.75	2.91	2.83
	2	8956	8946	8951	9.85	9.14	9.50	2.73	2.92	2.83
	3	7066	7465	7266	10.57	9.52	10.05	2.68	2.80	2.74
	4	6026	6565	6300	11.23	9.83	10.53	2.75	2.81	2.78

Treatment no.	Treatment:
1	Control
2	Flag leaf removed only
3	Head bagged only
4	Flag leaf removed and head bagged

Table 13. Treatment means for grain yield, percentage protein and 100 seed weight of the "Bagging Effects" experiment grown in 1967 and 1968.

Treatment	Grain Yield (kg/ha) 1967	1968	Mean	% Protein 1967	1968	Mean	100 seed Wt. (gms) 1967	1968	Mean
1	7600	9141	8371	11.80	10.56	11.13	2.73	2.88	2.81
2	6951	8142	7547	11.65	10.69	11.17	2.70	2.90	2.80
3	6118	6322	6220	12.25	11.18	11.72	2.88	2.95	2.92
4	5076	6096	5587	12.27	11.23	11.75	2.90	2.85	2.88
LSD_{05}	469	871	399	0.281	0.168	0.	0.115		
LSD_{01}	625	1160	527	0.374	0.223	0.			

Table 14. Varietial means for grain yield, percentage protein and 100 seed weight of the "Bagging Effects" experiment grown in 1967 and 1968.

Variety	Grain Yield (kg/ha) 1967	1968	Mean	% Protein 1967	1968	Mean	100 seed Wt. (gms) 1967	1968	Mean
RC610	4757	5128	4933	12.49	11.56	12.03	2.41	2.37	2.39
2319	5385	7714	6510	14.49	12.18	13.34	3.23	3.25	3.24
Redlan x 2319	8370	9274	8822	12.28	11.16	11.72	3.05	3.40	3.24
0503	5942	6354	6146	10.29	10.33	10.31	2.58	2.59	2.59
Redlan x 0503	7628	8611	8220	10.41	9.34	9.88	2.70	2.86	2.78
LSD_{05}	525	974	446	0.314	0.187	0.153	0.130	0.117	0.074
LSD_{01}	699	1297	589	0.418	0.249	0.203	0.173	0.156	0.098

Table 15. Pooled analyses of variance for yield, percentage protein, and 100 seed weight of the bagging effects experiment grown in 1967 and 1968.

Sources of Variation	d.f.	Mean Squares		
		Yield	% Protein	100 seed wt.
Years	1	18,236,472 **	46.537 **	0.3572 **
Blocks in years	6	1,053,054	0.118	0.1305
Varieties	4	20,175,738 **	17.303 **	4.8020 **
Treatments	3	15,307,303 **	4.152 **	0.1203
V x T	12	910,666 **	0.669	0.0603
V x Y	3	2,341,721 **	50.234 **	0.6898 **
T x Y	3	454,571	0.142	0.1140
V x T x Y	12	637,672	1.189 **	0.0253
Error	116	351,025	0.193	0.0468

* Significant at the .05 level.

** Significant at the .01 level.

Table 16. Extreme Values for Protein, Lysine and Protein x Lysine

I.D.No.	Prot.	Lys.	P:L	I.D.No.	Prot.	Lys.	P:L
			--High Protein--				
1033	17.6	1.21	21.30	0039	23.2	1.13	26.22
7286	18.2	1.17	21.29	2199	20.6	0.88	18.13
0204	18.2	1.17	21.41	0395	18.9	1.41	26.61
3865	18.2	1.01	18.36	3646	17.8	0.31	05.52
3836	18.8	1.48	[illegible]	5242	19.6	1.45	28.42
3065	17.7	1.12	19.74	3923	17.9	1.29	23.07
1250	17.9	1.54	27.57	2413	17.5	1.18	20.65
7834	18.3	0.81	14.82	2280	19.6	0.62	12.1
6771	17.9	1.44	25.78	7466	17.5	1.44	25.2
3780	17.5	1.32	23.10	6028	17.9	1.27	22.72
6784	18.9	1.25	23.62	6944	19.5	1.60	31.20
7551	18.5	1.27	23.50	7911	17.6	0.92	16.19
2414	18.6	1.14	21.20	3872	20.2	1.06	21.41
4924	17.6	1.28	22.53	3922	18.4	0.68	12.51
5387	17.7	0.82	14.51	3703	19.7	0.65	13.40
3486	17.8	1.30	23.14	0195	18.2	0.86	15.65
5364	17.8	1.30	23.14	0815	18.1	1.22	22.07
2841	17.9	1.34	23.99	3911	17.5	0.66	11.57
7410	19.9	0.86	17.11	2059	18.3	1.10	20.13
6367	17.8	1.47	26.17	4884	19.3	1.47	28.37
2939	17.7	1.03	18.23				
			--High Lysine--				
2227	12.8	2.06	26.37	6915	12.0	2.51	30.12
7524	11.0	2.03	22.38	2615	09.5	2.15	20.42
0102	09.3	2.01	18.69	7724	11.6	2.00	23.20
2277	11.5	2.00	23.00	2144	11.9	2.10	25.99
2368	11.7	2.07	24.22	2475	10.7	2.00	21.40
2726	12.3	2.15	26.32	7330	11.7	2.41	28.20
7093	09.6	2.89	27.74	6286	10.2	2.00	20.40
5732	12.8	2.17	27.78	1991	13.7	2.13	29.18
2433	10.3	2.48	25.54	7223	13.8	2.02	27.85
6426	11.1	2.14	23.75	0516	12.7	2.22	28.19
3817	06.2	2.15	13.33	7282	14.4	2.09	30.10
5488	16.9	2.06	34.81	3548	10.1	2.08	21.01
2699	10.3	2.22	22.87	7452	10.9	2.12	23.11
2341	10.0	2.26	22.60	2285	10.3	2.08	21.42
0682	09.1	2.42	22.02	8159	13.2	2.01	26.53
2151	11.4	2.12	24.17	7461	13.1	2.06	26.92
7096	14.1	2.25	31.73	0125	11.0	2.15	23.65
7513	11.7	2.66	31.12	8797	11.6	2.08	24.13
2677	13.0	2.02	26.26	7142	11.9	2.90	34.53
0657	15.1	2.08	31.41	0936	10.6	2.18	23.11

Table 16. Extreme Values for Protein, Lysine and Protein x Lysine (continued)

IG.No.	Prot.	Lys.	P*L	IG.No.	Prot.	Lys.	P*L
			--High Lysine (continued)--				
2316	11.8	2.06	24.31	7384	11.7	2.12	24.80
1317	12.7	2.07	26.29	6916	09.4	2.07	19.46
7051	12.6	2.68	33.77	2805	11.4	2.05	23.37
7454	13.0	2.07	26.91				
			--High Protein x Lysine--				
5342	19.6	1.45	28.42	6915	12.0	2.51	30.12
7114	15.6	1.97	30.73	3589	16.2	1.86	30.13
7363	16.3	1.96	31.90	3813	15.5	1.89	29.30
7330	11.7	2.41	28.20	6944	19.5	1.60	31.20
1991	13.7	2.13	29.18	0059	14.7	1.98	29.11
0516	12.7	2.22	28.19	5559	14.4	1.95	28.08
3553	15.6	1.98	30.89	3791	16.9	1.82	30.76
7096	14.1	2.25	31.73	7518	11.7	2.66	31.12
7142	11.9	2.90	34.51	0657	15.1	2.08	31.41
7051	12.6	2.68	33.77	7282	14.4	2.09	30.10
5488	16.9	2.06	34.81	4884	19.3	1.47	28.37
			--Low Protein--				
2615	09.5	2.15	20.43	0102	09.3	2.01	18.69
5147	09.6	1.79	17.18	6368	09.7	1.81	17.56
5690	09.6	1.92	18.43	7093	09.6	2.89	27.74
1220	09.9	1.65	16.34	3141	09.4	1.27	11.94
3758	09.0	1.56	14.04	0192	09.1	1.26	11.47
2832	09.8	1.18	11.56	3758	08.9	1.15	10.24
7755	08.8	1.80	15.84	7577	09.6	1.05	10.08
2274	09.8	1.30	12.74	6916	09.4	2.07	19.46
2493	08.7	1.73	15.05	2309	09.4	1.16	10.90
0682	09.1	2.42	22.02	0617	09.2	1.72	15.82
2556	09.9	1.66	16.43	3223	09.4	0.87	08.18
3817	06.2	2.15	13.33	2402	09.1	1.33	12.10
7906	09.6	1.78	17.09	0642	09.9	1.20	11.88
7461	09.5	1.99	18.91	2766	09.2	1.30	11.96
2936	07.4	1.62	11.99				
			--Low Lysine--				
6947	12.3	0.44	05.41	0191	12.3	0.60	07.38
7520	12.2	0.50	06.10	5340	14.6	0.47	06.86
3848	17.8	0.31	05.52	7303	15.0	0.60	09.00
7895	12.3	0.54	06.64	0641	10.9	0.50	05.45
5849	12.4	0.52	06.45	5040	13.4	0.51	06.83

Table 16. Extreme Values for Protein, Lysine and Protein x Lysine (continued)

IS.No.	Prot.	Lys.	P:L	IS.No.	Prot.	Lys.	P:L
			--Low Lysine (continued)--				
7143	13.3	0.39	05.19	4288	14.2	0.57	08.09
3461	14.5	0.54	07.83	0082	15.8	0.56	08.85
2537	14.5	0.59	08.56	8136	13.6	0.36	04.90
3729	14.2	0.51	07.24	8006	12.6	0.60	07.56
5760	14.7	0.56	08.23	7096	16.3	0.49	07.99
2297	11.5	0.43	04.95	2948	11.6	0.42	04.87
			--Low Protein x Lysine--				
6947	12.3	0.44	05.41	2046	13.3	0.50	06.65
5340	14.6	0.47	06.86	3848	17.8	0.31	05.52
7895	12.3	0.54	06.64	0641	10.9	0.50	05.45
5040	13.4	0.51	06.83	7143	13.3	0.39	05.19
0207	11.0	0.63	06.93	2948	11.6	0.42	04.87
5849	12.4	0.52	06.45				

Table 17. Complete amino acid analyses

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PrL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
						1965 Purdue Nursery								
0075	19.50	1.90	37.01	3.16	0.58				4.47	14.93	.299	5.67	4.66	5.36
0121	13.22	1.96	25.91	3.12		1.00			4.20	14.07	.298	5.62	4.51	5.06
0175	15.64	1.68	26.63	2.99	0.34	1.08	0.73	1.86	4.14	14.34	.289	5.41	4.42	4.93
0176	10.53	1.97	20.72	3.05	1.09	1.12	1.15	2.27	3.89	12.92	.301	5.00	4.26	4.60
0184	10.31	2.28	23.49	3.19		1.25	1.11	2.35	4.01	12.91	.310	5.09	4.26	5.01
0194	10.56	2.03	21.46	3.15		1.15	1.10	2.25	4.07	13.70	.297	5.21	4.24	5.10
0196	13.09	1.96	25.64	3.06		0.96	0.98	1.94	4.24	14.11	.301	5.63	4.44	5.07
0213	15.50	1.60	24.85	2.78		1.26	1.03	2.28	3.75	12.94	.290	4.92	4.08	4.48
0306	11.34	1.92	21.75	3.23		1.21	1.08	2.29	4.02	13.79	.292	5.36	4.53	4.91
0339	16.16	1.58	25.55	3.05	2.03	1.15	1.29	2.44	4.17	14.26	.293	5.46	4.49	4.84
0345	14.72	1.81	26.56	3.06	1.50	1.34	1.23	2.56	4.04	13.65	.296	5.39	4.44	4.34
0470	15.47	1.93	29.86	2.94	1.09	0.84	0.84	1.68	3.80	12.77	.380	5.69	4.07	4.62
0514	21.94	1.56	34.12	2.90	0.81	0.99	0.73	1.72	4.14	14.29	.290	5.42	4.31	4.89
0517	14.31	1.82	26.10	3.28		1.01	1.27	2.28	4.16	14.50	.287	5.43	4.59	5.21
0532	12.78	1.99	25.46	3.27	1.04	0.80	0.92	1.72	4.20	13.35	.315	5.35	4.21	4.89
0619	12.72	1.93	24.51	3.33	0.61	1.06	1.04	2.11	4.30	14.03	.306	5.39	4.40	5.10
0639	13.03	1.91	24.93	3.16	0.86	1.47	0.87	2.34	4.11	13.49	.305	5.33	4.27	4.87
0645	10.66	1.89	20.16	3.06		1.35	1.01	2.36	3.87	12.46	.310	5.20	4.16	4.52
0671	12.25	1.72	21.01	3.03	1.52	1.22	1.01	2.23	4.01	14.03	.286	5.10	4.42	5.03
0719	11.25	1.96	22.02	3.09		0.96	0.82	1.78	4.22	13.73	.307	5.63	4.35	4.91
0725	10.41	1.81	18.81	3.13		1.25	1.04	2.29	3.96	13.22	.300	5.36	4.35	4.68
0854	10.41	1.83	19.03	3.06	1.21	1.49	1.22	2.71	3.96	13.26	.298	5.06	4.28	4.75
0916	13.25	1.62	21.44	2.90	0.86	0.95	0.99	1.94	3.75	12.86	.292	4.98	4.12	4.53
0954	13.59	1.85	25.18	3.11	1.30	1.07	0.71	1.78	4.35	14.63	.297	5.41	4.48	5.28
1084	16.66	1.46	24.39	3.13	1.22	1.58	1.41	2.99	4.12	14.68	.281	5.52	4.79	5.04

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PhL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
1149	12.94	1.81	23.45	3.14		1.14	1.19	3.33	4.06	13.89	.292	5.48	4.47	4.92
1213	12.22	1.85	22.63	3.10	1.10	1.63	1.02	2.65	4.08	13.67	.299	5.29	4.32	4.89
1259	17.41	1.54	26.79	2.95	1.07	1.35	0.83	2.19	4.25	15.02	.283	5.51	4.60	4.94
1295	13.94	1.78	24.84	3.07		1.41	1.36	2.78	3.89	13.26	.293	5.10	4.33	4.80
1333	10.16	2.04	20.76	3.12		1.05	0.94	1.98	4.01	13.21	.303	5.26	4.26	4.83
1596	16.65	1.65	27.51	3.07	0.58	1.46	0.76	2.28	4.06	14.03	.289	5.36	4.37	
2109	10.22	3.36	24.31	3.31		1.12	0.57	1.69	3.73	10.22	.365	4.31	3.59	4.91
2213	10.34	2.84	30.82	3.40		0.81	0.66	1.47	4.00	11.98	.334	4.64	4.10	5.24
2225	14.13	1.77	24.97	2.97		0.96	0.97	1.93	3.80	12.99	.292	4.98	4.20	4.76
2226	13.75	1.89	25.94	3.04		0.61	1.00	1.62	4.02	13.61	.295	5.12	4.35	4.97
2233	13.16	1.96	25.78	3.23	1.07	1.50	1.55	3.05	4.24	14.45	.294	5.38	4.59	5.21
2445	17.81	1.90	33.79	3.26		1.11	0.89	2.00	4.21	14.11	.298	5.49	4.54	5.04
2446	14.66	3.19	46.82	3.43		1.20	0.83	2.04	3.64	09.95	.366	4.35	3.66	4.76
2448	09.91	2.07	30.48	3.06	4.51	1.27	0.87	2.14	4.00	13.02	.307	4.99	4.16	4.66
2466	10.75	2.21	23.80	3.36					4.56	14.93	.306	5.94	4.70	5.29
2498	09.97	2.13	21.20	3.25		1.36	1.01	2.37	4.34	14.05	.309	5.18	4.52	5.69
2524	13.81	1.89	21.96	3.11		1.21	1.12	2.33	4.27	15.02	.284	5.62	4.70	5.11
2573	10.69	2.08	22.28	3.28		1.18	1.04	2.22	4.23	14.41	.294	5.31	4.57	5.22
2581	11.47	2.05	23.56	3.28		0.93	0.91	1.83	4.38	14.50	.302	5.70	4.61	5.23
2585	10.44	2.26	23.60	3.04	0.60	1.17	0.98	2.15	3.90	12.59	.310	4.68	3.89	4.80
2727	11.00	2.04	22.44	3.05		1.01	0.81	1.82	3.97	13.23	.300	4.93	4.08	4.88
2816	09.81	1.98	19.46	3.21		1.23	1.09	2.32	4.10	13.60	.301	5.23	4.43	5.07
2853	11.38	1.88	21.39	2.94		1.28	0.97	2.24	3.90	13.25	.295	4.88	4.20	4.83
2859	11.56	2.22	25.65	3.29		1.28	0.90	2.18	4.21	13.80	.305	5.03	4.44	5.08
2862	15.53	1.88	29.23	3.10	1.24	0.77	0.81	1.58	4.07	13.90	.293	5.26	4.41	4.99
2866	11.78	1.96	23.12	3.08	2.25	1.44	1.29	2.73	3.99	12.97	.308	5.06	4.17	4.77
2881	11.84	2.07	24.56	3.13		1.31	0.83	2.14	4.27	14.04	.304	5.63	4.60	5.03
2936	10.06	2.03	20.42	3.26	1.43	1.32	0.91	2.23	4.12	13.60	.303	5.27	4.40	5.14
2937	18.09	2.31	41.72	3.15		0.66	0.81	1.46	4.28	13.41	.319	5.39	4.24	4.93
2942	18.72	1.86	34.76	3.03	1.43	0.88	0.69	1.57	3.98	12.92	.308	4.97	4.03	4.81

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
L.No.	Prot.	Lys.	PhL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
2952	13.88	1.96	27.20	2.86		0.81	0.75	1.55	3.94	12.90	.306	5.07	4.03	4.75
3126	19.22	1.64	31.58	2.80		0.88	0.58	1.46	3.97	13.75	.288	5.11	4.10	4.83
3138	10.41	1.94	20.23	3.03		1.29	1.18	2.47	3.85	12.82	.300	4.86	4.20	4.86
3169	11.16	1.94	21.68	3.09		1.17	1.14	2.31	3.96	13.48	.294	5.12	4.04	4.92
3436	11.47	1.87	21.44	2.97		1.15	0.94	2.09	4.03	13.49	.299	5.19	4.23	4.72
3441	12.09	1.91	23.04	3.18		1.00	1.31	2.31	4.24	14.31	.296	5.61	4.53	5.09
3452	13.44	2.08	27.90	3.29		1.16	1.17	2.33	4.83	13.97	.292	5.28	4.10	5.17
3462	11.63	1.84	21.45	3.23		1.17	1.44	2.61	4.72	14.86	.318	5.99	5.01	5.03
3485	12.94	2.04	26.38	3.30	0.53	1.12	0.84	1.95	4.33	14.23	.304	5.44	4.58	5.24
3485	14.91	2.16	22.80	3.29	1.27	1.26	1.28	2.54	4.09	13.54	.302	5.23	4.50	5.18
3528	11.38	2.07	23.58	3.40		1.10	1.23	2.34	4.44	14.45	.307	5.73	4.66	5.22
3538	11.35	2.11	23.75	3.20		1.11	1.28	2.40	4.16	13.58	.306	5.25	4.39	5.22
3552	12.38	1.75	23.68	3.11	0.66	1.32	1.14	2.46	4.09	13.79	.297	5.39	4.30	4.90
3555	13.31	2.05	27.67	3.11	1.07	1.27	1.00	2.28	4.10	13.46	.304	5.09	4.10	5.13
3568	10.54	2.22	24.05	3.26		1.04	1.50	2.54	4.55	14.07	.324	5.79	4.68	5.09
3569	11.84	2.25	26.62	3.38	0.62	1.44	1.21	2.65	4.44	14.27	.311	5.69	4.78	5.14
3572	10.63	2.12	22.57	3.12		1.34	0.98	2.02	4.03	13.23	.305	5.25	4.30	4.88
3573	09.84	2.24	22.01	3.25		1.43	1.30	2.72	4.16	13.56	.307	5.48	4.45	4.99
3666	14.16	2.19	30.95	3.28	1.15	0.77	1.07	1.84	4.16	13.38	.311	5.42	4.40	5.32
3762	13.91	1.58	22.01	3.15		1.04	0.97	2.01	4.25	15.19	.280	5.53	4.69	5.18
3804	14.66	2.07	30.36	3.14	0.88	1.12	0.88	2.01	4.23	13.62	.310	5.21	4.30	5.22
3922	14.31	2.02	28.99	3.13	1.10	0.75	0.84	1.59	4.34	14.26	.302	5.70	4.75	5.23
3925	16.63	1.90	32.59	3.21	0.57	1.23	0.91	2.14	4.23	14.24	.297	5.40	4.53	5.33
3932	12.50	2.27	26.34	3.27		1.75	1.26	3.01	4.41	14.04	.314	5.27	4.06	5.16
3941	16.78	1.85	30.93	3.16	0.97	0.97	0.62	1.61	4.20	14.08	.299	5.25	4.35	5.23
3977	14.34	1.95	27.91	3.02	0.72	1.06	0.78	1.85	4.34	14.22	.305	5.58	4.41	4.56
4328	12.66	1.91	24.16	3.40	1.13	2.36	0.97	3.33	4.86	16.17	.301	6.45	5.46	6.09
4540	10.28	2.43	25.50	3.60		1.33	0.92	2.27	4.31	13.88	.310	5.44	4.50	5.13
4748	18.03	1.67	30.13	3.11	0.97	1.34	0.83	2.17	4.43	15.28	.290	5.65	4.65	5.18
5075	13.84	1.86	25.71	3.12		1.06	1.27	2.33	4.27	14.58	.293	5.68	4.59	5.19

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
I.No.	Prot.	Lys.	PrL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
5437	13.16	2.08	27.40	3.21		1.15		1.12	4.09	13.42	.305	5.44	4.48	5.04
6164	12.19	2.11	25.67	3.20	2.20	1.45	0.92	2.37	4.13	13.92	.297	5.30	4.37	5.14
6908	11.16	2.03	22.65	3.30		1.29	1.29	2.58	4.47	14.79	.302	5.95	4.68	5.29
6911	14.09	1.99	28.01	3.09	1.07	1.36	1.47	2.83	4.31	13.76	.313	5.16	4.33	4.98
6922	13.84	1.61	22.34	3.09	1.17	1.48	1.27	2.75	4.41	14.92	.295	5.74	4.51	5.16
6926	09.34	2.25	21.02	3.27		1.43	0.95	2.38	4.48	14.59	.307	5.70	4.70	5.35
6958	13.60	1.94	26.32	3.21	1.13	1.95	0.93	2.87	4.50	14.50	.311	5.75	4.79	5.52
6960	13.75	2.06	28.39	3.17	0.84	1.27	1.30	2.57	4.22	14.27	.296	5.48	4.52	5.21
7050	10.94	2.08	22.72	3.37		1.10	1.33	2.42	4.41	14.50	.304	5.75	4.79	5.30
7093	11.81	2.07	24.48	3.31	1.39	1.47	1.68	3.15	4.17	13.92	.300	5.50	4.55	5.22
7118	13.31	2.02	26.95	2.89	3.00	1.07	0.94	2.01	3.91	13.15	.297	5.00	4.01	4.77
7979	15.31	2.13	32.66	3.30		1.09	0.76	1.84	4.03	13.22	.305	4.95	4.27	4.87
8005	11.91	2.14	25.45	3.47		1.70	1.15	2.85	4.37	14.11	.310	5.50	4.55	5.79
8067	11.03	1.94	21.45	3.08		1.06	0.89	1.94	4.16	13.66	.305	5.33	4.33	4.91
8093	10.91	2.23	24.35	3.11	0.77	1.30	0.87	2.16	3.98	12.70	.314	4.98	4.15	4.91
8112	12.47	1.94	24.19	3.18		0.93	1.01	1.93	4.40	14.66	.300	5.44	4.44	5.21
8166	11.31	2.04	23.04	3.06		1.23	1.07	2.30	4.13	13.67	.302	5.38	4.13	4.99
8167	10.09	2.11	21.28	3.23		0.70	0.80	1.50	4.21	13.75	.306	5.28	4.39	5.16
8218	12.31	1.76	21.64	3.07		1.21	0.71	1.92	4.10	14.38	.285	5.34	4.33	4.83
8263	12.75	3.00	38.25	3.14		0.90	0.72	1.62	3.71	10.56	.351	4.38	3.67	4.63
8298	15.09	1.71	25.82	3.10		1.23	1.45	2.68	4.24	14.40	.294	5.61	4.45	5.09
8300	14.34	1.78	25.60	3.20		1.33	1.21	2.53	4.30	14.46	.297	5.48	4.38	4.99
8302	16.13	1.75	28.18	2.99		1.16	0.82	1.97	4.13	13.81	.299	5.18	4.26	4.95
8307	13.59	1.84	25.03	3.15	1.17	1.47	0.87	2.35	4.25	14.35	.297	5.29	4.57	5.25
8330	09.81	2.28	22.38	3.35		0.72	1.25	1.97	4.38	13.49	.324	5.31	4.44	5.15
8336	13.97	1.59	23.24	3.07	1.03	1.23	0.68	1.91	4.31	14.99	.288	5.45	4.59	5.11
8353	17.47	1.73	30.24	2.91		0.69	0.87	1.56	3.87	13.03	.297	5.03	4.07	4.73
8354	16.53	1.80	29.69	3.21	1.18	1.01	1.00	2.01	4.42	15.32	.288	5.74	4.70	5.29
8361	25.31	1.82	46.11	3.17	0.28	0.95	1.22	2.17	4.32	14.97	.289	5.61	4.57	5.10
8364	15.56	1.72	26.75	2.92	1.05	1.36	1.07	2.43	3.94	13.76	.286	5.10	4.32	4.82

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IC.No.	Prot.	Lys.	PHL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
8364	12.19	1.83	22.36	3.30	1.04	1.55	1.67	3.22	4.06	13.81	.294	5.37	4.73	4.95
8375	12.47	1.93	24.13	3.19	2.05	1.03	1.12	2.15	4.15	14.02	.296	5.56	4.50	5.14
8382	12.13	1.91	23.19	3.42		1.07	0.99	2.06	4.37	14.85	.294	5.57	4.68	5.40
1966 Purdue Nursery														
0075	14.53	1.68	24.35	3.04	0.86	0.72	1.03	1.75	4.49	14.96	.300	6.18	4.84	5.15
0083	14.50	2.09	30.25	3.28	2.08	0.71	1.35	2.06	4.37	14.34	.305	5.92	4.61	5.06
0101	11.44	2.30	26.33	3.20		0.97	0.96	1.93	4.13	12.85	.321	5.12	4.17	5.00
0113	13.25	2.33	30.87	3.19		0.97	0.96	1.94	3.86	13.31	.290	4.89	4.37	5.13
0115	13.69	1.80	24.63	3.01	1.21	1.02	0.85	1.87	4.11	14.01	.293	5.30	4.49	5.12
0129	14.75	2.13	31.46	3.12	1.08	0.62	0.92	1.54	4.25	14.10	.302	5.20	4.48	5.13
0176	14.25	1.79	25.45	2.99	1.09	0.85	0.81	1.66	4.02	13.97	.292	5.07	4.30	4.96
0185	13.34	2.54	33.92	3.05		0.47	0.69	1.16	3.84	13.55	.332	4.54	3.88	4.80
0187	10.66	2.12	22.61	5.53		1.77	1.26	3.02	4.16	13.91	.299	5.33	4.61	5.45
0190	12.66	1.83	23.12	3.17	0.98	1.01	0.85	1.86	4.21	14.60	.303	5.30	4.46	5.46
0194	11.63	2.19	25.49	3.18		1.08	0.94	2.02	4.02	13.75	.292	5.00	4.52	5.31
0199	12.41	2.14	26.56	3.26		1.39	1.06	2.45	4.18	14.02	.298	5.19	4.54	5.56
0219	11.83	1.89	22.44	3.13		1.46	1.70	2.63	4.14	13.59	.305	5.43	4.41	5.11
0271	13.56	1.98	26.79	3.15	1.17	1.49	1.14	2.63	3.55	12.50	.284	4.93	4.29	4.95
0271	13.38	2.06	27.52	3.35	0.95	1.50	1.02	2.52	4.22	13.69	.308	5.76	4.83	5.16
0271	11.91	1.97	23.44	3.30		1.56	1.13	2.69	4.25	13.85	.307	5.71	4.60	5.28
0315	13.94	2.34	32.95	3.13		1.15	0.58	1.73	3.96	12.75	.310	4.81	4.14	5.21
0470	10.66	2.23	23.75	3.31	0.95	1.19	1.20	2.30	4.29	14.51	.296	5.47	4.72	5.42
0508	10.44	2.21	23.05	3.31	1.05	1.17	1.32	2.49	4.34	13.74	.315	5.87	4.68	5.22
0508	10.84	2.09	29.61	3.36	1.10	0.89	1.19	2.08	4.34	13.83	.314	5.87	4.65	5.11
0526	13.81	1.67	23.08	2.98	1.19	0.52	1.01	1.54	3.87	13.74	.281	4.91	4.43	5.06
0532	14.63	2.04	29.85	3.14	1.04	1.30	1.12	2.42	4.09	13.27	.308	5.16	4.24	4.96
0535	14.78	2.20	32.50	3.25	1.05	1.05	0.96	2.01	4.07	13.53	.300	5.04	4.37	5.15
0616	15.31	1.44	22.05	3.03	1.00	1.69	1.34	3.03	3.80	13.38	.284	4.99	4.30	5.09
0616	15.63	1.99	31.13	3.13		1.76	1.05	2.81	4.27	13.88	.308	5.48	4.55	5.24

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PxL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
0616	14.53	1.96	28.51	3.45		1.26	1.23	2.49	4.55	14.99	.304	6.01	4.83	5.29
0633	14.31	2.12	30.31	3.25	1.27	1.26	3.70	2.13	4.62	13.83	.308	5.13	4.28	5.31
0638	13.40	1.41	18.89	2.90	0.86	1.33	1.00	2.34	3.56	12.60	.282	4.64	4.04	4.83
0639	11.94	2.05	29.47	3.46	0.86	0.91	1.13	2.04	4.49	13.81	.325	6.05	4.77	5.36
0692	12.19	1.94	23.60	5.63		1.14	1.20	2.34	4.27	14.82	.288	5.51	4.75	5.63
0704	19.53	1.65	32.22	3.17	0.63	1.74	1.07	2.81	4.23	15.10	.280	5.28	4.79	5.48
0705	15.31	1.85	28.37	3.18	1.36	1.29	1.06	2.34	4.09	13.98	.292	5.24	4.63	5.20
0718	10.19	1.63	16.66	3.15	0.70	1.42	1.28	2.70	3.69	13.21	.280	4.68	4.25	5.18
0718	10.88	1.95	21.25	3.40		1.26	1.32	2.58	4.32	14.66	.294	5.63	4.73	5.25
0719	11.97	1.91	22.92	3.26		1.12	0.95	2.06	4.41	14.21	.301	5.60	4.62	5.40
0831	11.03	1.93	21.28	3.01		1.13	0.73	1.86	4.13	13.82	.299	5.25	4.32	5.19
0854	12.50	1.86	23.22	3.08	1.21	1.06	0.90	1.96	4.15	14.22	.292	5.18	4.54	5.21
0859	15.85	1.71	27.00	3.04	1.12	1.02	0.98	2.00	3.79	13.79	.275	4.99	4.37	5.14
0859	12.38	2.03	25.09	3.41		1.26	1.71	2.97	4.37	14.46	.302	5.74	4.73	5.34
0868	12.09	1.86	22.52	3.12	1.00	0.92	0.93	1.85	4.01	14.21	.282	5.25	4.43	5.14
0925	13.75	1.84	25.23	3.18	1.00	1.43	1.05	2.47	4.15	14.45	.287	5.14	4.62	5.37
0954	13.53	1.86	25.18	2.99	1.30	0.81	0.90	1.70	3.76	13.13	.286	4.73	4.19	4.91
0957	13.22	2.14	28.29	3.20	1.36	0.99	0.96	1.95	4.21	13.61	.310	5.48	4.58	5.00
1025	14.03	2.06	28.96	3.07	0.95	0.73	0.62	1.36	3.76	13.92	.270	4.97	4.29	5.11
1030	13.25	2.41	31.96	3.28		1.27	0.88	2.15	4.24	13.38	.317	5.31	4.36	5.19
1032	16.75	1.93	32.31	3.05	1.10		0.97		3.68	13.51	.273	5.10	4.40	5.07
1213	13.38	1.88	25.14	3.16		1.53	0.96	2.50	4.08	13.81	.295	5.24	4.38	5.19
1220	10.75	2.31	24.84	3.52	2.70	1.39	1.58	2.93	4.26	12.87	.331	5.51	4.33	5.41
1220	11.00	2.26	24.84	3.33		1.54	1.17	2.71	4.11	13.65	.301	5.27	4.63	5.40
1259	18.44	1.75	32.21	3.02	0.87	1.11	0.37	1.97	4.18	14.19	.295	5.29	4.37	5.04
1333	11.13	2.44	27.13	3.25		1.47	0.37	2.34	3.94	12.84	.307	5.00	4.31	5.13
1333	14.31	1.81	25.87	3.08		0.63	0.91	1.54	3.95	13.59	.291	5.00	4.39	5.08
1475	11.34	2.23	25.28	3.03		1.12	0.85	1.12	4.01	12.65	.317	4.80	4.04	4.88
1530	13.22	2.11	27.88	2.93	2.47	1.21	0.78	1.99	4.14	13.54	.305	5.11	4.20	5.05
1596	13.41	2.11	38.90	3.08	0.86	1.68	0.91	2.59	3.99	13.20	.302	4.92	4.30	5.16

Table 17. Complete amino acid analyses (continued)

		Amino acids as % Protein												
IS.No.	Prot.	Lys.	ArL	Threo.	Tryp.	Meth.	Half Cyst.	Total T.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
1996	10.09	2.33	42.38	3.25	1.06	1.21	1.17	2.39	4.27	13.91	.307	5.37	4.39	5.17
2031	13.81	1.94	26.83	3.10	0.91	1.19	0.90	2.09	3.93	13.05	.301	5.12	4.26	4.68
2031	12.38	2.05	26.40	3.31		0.87	0.89	1.76	4.15	13.06	.299	5.42	4.44	5.40
2213	12.56	2.21	28.03	3.00		1.35	0.75	2.10	3.86	12.57	.307	4.68	4.05	5.00
2225	14.22	2.02	28.78	3.28		1.73	1.22	2.95	4.07	14.21	.286	5.27	4.69	5.50
2234	13.78	1.71	23.52	3.05	1.04	0.80	1.10	1.90	3.93	13.54	.290	4.97	4.40	5.19
2274	11.36	2.04	23.83	3.28		1.51	1.10	2.61	4.08	13.47	.303	4.93	4.48	5.13
2288	13.78	2.59	35.62	3.18	1.12	0.49	0.77	1.26	3.92	13.17	.297	4.78	4.22	5.04
2310	13.59	2.22	30.18	3.19	1.92	1.10	1.05	2.16	3.88	13.07	.297	4.97	4.36	5.08
2319	16.25	2.31	37.60	3.25	0.96	1.25	1.03	2.28	4.12	13.53	.304	5.18	4.47	5.33
2319	15.28	2.52	38.43	3.16		0.17	0.91	1.08	3.89	12.73	.305	4.73	4.32	5.06
2377	12.94	1.82	23.50	3.01		1.44	0.73	2.17	3.95	13.53	.292	4.77	4.21	5.19
2486	11.53	2.44	23.11	3.27			0.82		4.01	13.55	.296	5.30	4.52	5.56
2562	10.25	2.06	21.15	3.26		1.52	1.25	2.77	4.01	13.46	.298	5.10	4.47	5.19
2581	11.78	2.34	26.43	3.15		0.56	0.91	1.48	4.17	13.54	.308	5.04	4.35	5.28
2639	13.34	2.22	29.64	3.28	1.10	1.35	0.89	2.24	4.50	14.17	.317	5.19	4.50	5.68
2727	13.53	2.34	31.70	3.20		1.48	0.94	2.42	4.13	13.73	.309	4.79	4.23	5.42
2740	14.06	2.15	30.17	3.00	1.02	1.53	0.80	2.33	4.20	13.82	.304	5.34	4.55	5.33
2818	11.91	2.03	24.12	3.09		1.09	0.87	1.96	3.73	12.97	.288	4.79	4.27	4.97
2818	11.75	2.03	24.46	3.26		1.16	0.73	1.89	3.93	13.43	.292	5.01	4.45	5.20
2822	10.44	1.97	20.56	3.16		1.08	1.06	2.14	4.14	14.00	.296	5.17	4.48	5.14
2822	11.28	2.07	22.72	3.11		1.38	1.10	2.48	4.07	14.00	.290	5.25	4.53	5.16
2861	11.03	2.16	23.82	3.22		1.36	1.01	2.37	3.94	13.15	.300	4.91	4.31	5.24
2871	14.28	1.98	28.25	3.02	0.92	0.40	0.73	1.13	4.18	14.18	.295	5.23	4.36	5.07
2934	11.13	1.85	20.53	3.12		1.03	0.75	1.78	4.18	14.27	.293	5.25	4.53	5.11
3067	11.53	2.19	25.26	3.05	1.07	1.09	1.07	2.16	4.20	13.98	.300	5.17	4.52	5.28
3067	11.39	1.91	22.18	3.01		1.15	1.10	2.14	3.90	13.33	.293	5.24	4.42	5.00
3120	15.94	1.95	31.00	3.10	0.66	0.94	0.93	1.88	4.37	14.33	.305	5.84	4.73	5.22
3120	10.41	2.19	22.81	3.13		1.14	0.79	1.93	4.01	12.65	.317	4.63	4.05	4.93
3169	12.97	1.51	23.28	3.01		1.13	0.95	2.01	4.10	14.03	.292	5.13	4.41	5.09

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PxL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
3201	14.06	1.91	26.81	3.34	0.57	1.45	1.40	2.85	4.16	14.13	.294	5.23	4.72	5.62
3290	12.41	2.01	24.89	3.36	1.12	1.50	1.47	2.97	4.23	13.83	.306	5.74	4.85	5.27
3290	12.97	1.98	25.72	3.25	0.57	1.25	1.34	2.59	3.89	14.26	.272	5.15	4.59	5.18
3340	14.22	1.92	27.36	3.12	0.91	0.72	1.21	1.94	3.92	13.05	.300	4.89	4.28	4.92
3351	12.97	1.83	23.80	3.27	0.60	1.79	1.34	3.13	4.19	14.31	.293	5.36	4.59	5.38
3462	11.97	2.27	27.22	3.16		0.30	0.82	1.11	4.06	13.30	.305	5.21	4.39	4.91
3485	11.34	2.30	26.12	3.10	0.53	1.16	0.74	1.90	4.13	13.33	.310	5.15	4.38	5.17
3485	13.97	1.93	26.96	3.25	1.27	1.76	1.22	2.98	4.31	14.01	.308	5.30	4.71	5.30
3513	13.03	2.35	30.62	3.25	1.41	0.49	0.73	1.22	4.36	13.98	.312	4.82	4.48	5.37
3513	12.81	1.77	22.62	3.09	1.20	1.25	0.92	2.17	4.06	13.80	.294	3.40	4.33	5.30
3513[a]	13.69	1.07	14.70	2.79		1.01	0.82	1.83	4.32	15.55	.278	5.77	4.66	4.89
3513[a]	14.63	1.67	24.36	3.06		1.23	0.96	2.19	4.27	14.75	.290	5.62	4.58	5.12
3513[b]	21.75	4.11	09.44	3.44		1.53	0.96	2.50	3.54	09.50	.372	4.57	3.71	5.34
3528	11.94	2.52	30.08	3.41		0.38	0.96	1.34	4.15	12.79	.324	5.02	4.41	5.42
3538	11.50	2.34	26.85	3.27		0.75	0.88	1.63	4.06	13.32	.305	4.96	4.46	5.29
3542	12.59	1.98	24.95	3.27	1.25	1.32	0.86	2.18	4.22	14.41	.293	5.44	4.56	5.25
3542	14.78	2.82	41.64	3.34	0.92	0.91	0.97	1.88	3.96	11.84	.335	4.75	4.03	5.04
3547	15.19	1.83	27.72	2.96	0.96	0.38	0.67	1.05	3.98	13.20	.301	4.98	4.14	4.98
3552	13.06	2.08	27.22	3.13	0.89	1.03	0.83	1.86	3.86	12.93	.298	4.80	4.17	4.87
3552	13.63	2.34	30.52	3.30	0.78	1.30	0.97	2.27	4.14	14.10	.294	5.35	4.85	5.26
3555	13.41	1.47	26.39	3.16	1.07	0.81	1.12	1.92	4.12	13.56	.304	5.02	4.57	5.38
3566	10.63	2.35	24.96	3.36	1.29	1.15	1.05	2.20	3.91	14.29	.274	5.28	4.62	5.55
3573	11.00	2.39	26.30	3.25		1.10	1.04	2.14	4.27	13.92	.307	5.38	4.54	5.44
3688	14.53	1.88	27.35	3.05	1.15	1.42	0.97	2.40	3.92	13.37	.293	4.88	4.25	5.05
3693	11.78	1.81	21.98	3.17		1.16	1.20	2.36	4.10	14.32	.286	5.20	4.61	5.38
3704	19.53	1.65	32.22	3.17		1.74	1.07	2.81	4.23	15.10	.280	5.28	4.79	5.48
3762	11.97	1.86	22.24	2.90		1.15	0.65	1.80	4.09	13.61	.300	4.81	4.13	4.87
3796	12.41	2.12	26.33	3.11		0.84	1.10	1.94	4.19	13.01	.322	5.18	4.14	4.94
3922	12.88	2.13	27.49	3.18	1.10	1.17	1.13	2.30	4.22	14.12	.299	5.43	4.41	5.46
3928	13.56	1.82	24.73	3.09	0.89	1.30	1.03	2.33	4.10	13.71	.299	5.24	4.27	

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PhL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Waline
3928	13.34	2.14	28.49	3.32	0.91	1.02	1.41	3.43	4.43	13.87	.320	5.68	4.66	5.51
3935	14.84	2.09	30.94	3.09	0.89	1.29	1.02	2.30	4.26	13.62	.313	5.60	4.54	5.13
3941	16.13	1.83	29.52	2.96	0.97	0.99	1.04	2.03	4.20	13.83	.303	5.62	4.51	5.07
3977	15.72	1.77	27.81	3.18	0.72	1.19	0.98	2.17	4.08	14.60	.280	5.47	4.61	5.16
3977	11.91	2.10	25.03	3.12		0.98	1.07	2.05	4.45	13.92	.320	5.98	4.66	5.13
3981	12.63	2.30	29.06	3.34		1.50	1.15	2.65	4.14	13.13	.316	5.07	4.42	5.61
3981	12.91	1.97	25.39	3.14	1.15	1.10	0.82	1.93	4.32	13.85	.312	5.37	4.34	4.83
4404	15.91	2.22	35.26	2.97	1.05	1.14	0.75	1.88	4.03	12.26	.329	4.82	4.05	5.13
4447	16.56	2.13	35.27	3.09		1.50	0.81	2.31	3.85	12.14	.317	4.75	4.05	4.88
4498	13.56	1.94	26.24	3.33	1.03	1.25	1.05	2.30	4.41	15.07	.293	5.31	4.79	5.65
4540	11.91	2.17	25.89	3.33		1.24	0.93	2.17	4.28	14.15	.302	5.60	4.46	5.04
4572	15.34	1.70	26.09	3.00	0.93	1.53	1.16	2.69	4.03	13.94	.293	5.43	4.58	5.08
4575	11.13	1.87	20.78	3.09		1.11	1.01	2.11	4.15	14.28	.291	5.42	4.49	5.04
4582	11.78	1.94	22.84	3.21		1.18	0.67	1.85	4.03	14.02	.288	5.30	4.40	5.15
4748	16.47	1.73	28.54	2.98	0.90	1.02	0.91	1 93	4.33	14.34	.302	5.89	4.73	4.99
4815	11.81	2.01	23.79	3.18		0.36	0.62	0.98	4.13	14.13	.292	5.34	4.35	4.93
4917	16.41	2.23	36.63	3.03	0.74	1.48	0.86	2.34	3.97	11.96	.332	4.78	3.98	4.97
5257	13.44	2.06	27.69	3.26	0.92	1.48	1.13	2.61	4.34	14.48	.299	5.56	4.59	5.60
5273	11.63	2.06	23.98	3.06		0.31	0.85	1.15	3.86	13.21	.292	5.40	4.44	5.04
5440	14.16	2.06	29.14	2.91	3.81	0.95	0.60	1.54	3.96	12.85	.308	4.81	4.09	4.90
5475	13.53	2.10	28.40	3.05	0.68	1.34	0.89	2.23	4.30	13.86	.310	5.13	4.31	5.13
5533	14.09	2.32	32.72	3.23	2.65	1.37	0.78	2.14	4.07	13.33	.305	5.04	4.36	5.29
5590	10.94	2.00	21.87	3.03		1.25	0.77	2.02	4.04	13.27	.304	5.03	4.31	5.18
5602	10.06	2.08	20.97	3.28		1.22	1.35	2.58	4.12	13.58	.303	4.90	4.44	5.32
5624	11.28	2.09	23.60	3.31		1.50	1.15	2.66	4.31	14.41	.299	5.51	4.58	5.48
5631	13.47	2.18	29.32	3.12	1.18	1.42	0.87	2.29	4.20	13.51	.311	5.15	4.37	5.45
5631	10.03	2.31	23.19	3.41		1.61	1.07	2.69	4.55	14.75	.308	5.66	4.81	6.19
5699	15.28	2.35	35.97	3.29	1.22	1.53	1.07	2.60	4.25	13.48	.315	4.88	4.41	5.58
5803	11.19	1.98	22.17	3.22		1.08	0.73	1.81	4.04	13.91	.290	5.29	4.43	5.07
5818	13.31	1.92	25.56	3.18	1.11	1.56	0.96	2.53	4.11	13.98	.294	5.36	4.56	5.30

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
I.D.No.	Prot.	Lys.	PrL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
5818	13.78	2.22	30.55	3.17	2.21	1.49	1.12	2.61	4.16	14.09	.295	5.38	4.53	5.50
5818	13.06	1.85	24.13	3.18	4.07	1.52	1.20	2.72	4.15	14.12	.294	5.43	5.60	5.32
5972	13.19	1.97	25.92	3.19	1.03	1.86	0.87	2.73	4.12	13.47	.306	5.17	4.33	5.01
5983	17.81	2.53	45.02	3.08	1.09	1.23	0.83	2.06	4.01	12.21	.328	4.70	4.14	5.29
6117	15.94	1.92	30.57	3.09	0.93	1.09	1.00	2.09	4.24	14.60	.291	5.47	4.61	5.30
6330	12.72	2.08	26.42	3.10	0.47	1.20	0.61	1.81	3.99	13.95	.286	5.04	4.31	5.23
6776	11.75	2.67	31.42	3.35		0.35	0.73	1.08	4.04	12.51	.323	4.54	3.81	5.33
6898	11.34	2.09	23.72	3.33	1.26	0.99	0.84	1.83	4.18	14.77	.283	5.51	4.68	5.51
6898	12.56	2.16	27.12	3.13	1.90	2.02	0.95	2.97	4.38	13.81	.317	5.32	4.58	4.64
6898	13.16	1.92	25.31	3.26		0.97	1.22	2.20	4.35	14.52	.300	5.90	4.64	5.10
6908	10.91	2.26	24.62	3.14		1.10	1.00	2.10	4.25	13.44	.316	5.17	4.11	5.32
6909	12.31	2.40	30.69	3.04	0.68	1.24	1.09	2.33	3.62	13.20	.274	4.76	4.24	5.13
6911	14.25	2.12	30.24	3.10	1.07	0.60	0.85	1.43	4.07	13.67	.298	5.00	4.42	5.27
6917	12.34	2.12	26.19	3.15	1.26	0.43	0.73	1.16	4.25	14.43	.295	5.37	4.60	5.33
6918	14.53	2.26	32.78	3.12	1.25	0.76	0.86	1.63	3.98	13.25	.300	4.73	4.33	5.15
6922	14.31	2.00	28.59	2.99	1.17	1.33	0.90	2.23	3.97	13.71	.290	5.17	4.36	4.95
6922	11.81	2.62	30.95	3.64		1.06	0.81	1.88	5.03	15.88	.317	5.97	5.09	6.00
6926	11.84	2.22	26.33	3.11		1.05	0.76	1.81	4.24	13.82	.307	5.03	4.31	5.08
6946	13.09	2.44	31.93	3.18	0.99	1.55	0.99	2.54	3.89	12.48	.312	4.62	4.06	4.72
6957	12.16	2.08	25.26	3.07		0.89	0.83	1.71	3.98	14.03	.283	5.30	4.54	5.34
6958	11.00	2.30	25.26	3.53	1.13	0.84	1.36	2.20	4.55	13.88	.328	5.78	4.77	5.56
6974	13.31	1.80	23.97	3.09	1.03	0.95	0.98	1.93	4.02	13.91	.289	5.10	4.44	5.24
6974	13.94	1.85	25.79	3.10	1.20	0.47	1.17	1.64	4.09	14.05	.291	5.13	4.48	5.10
7041	12.31	2.29	28.13	3.22		0.78	0.73	1.51	4.01	12.49	.321	4.82	4.14	4.96
7049	13.94	2.17	30.21	3.02	0.72	1.25	0.85	2.10	3.99	13.39	.293	4.85	4.31	5.13
7072	15.53	1.93	30.00	3.02	0.75	1.13	1.03	2.16	3.83	13.36	.287	4.90	4.26	5.06
7080	13.78	2.41	33.24	3.06	0.78	1.26	0.88	2.14	3.78	13.62	.278	4.83	4.32	5.20
7088	14.16	1.54	21.76	3.14		0.81	0.97	1.78	3.95	14.22	.278	5.00	4.46	5.36
7088	14.28	2.22	31.63	2.90	1.01	1.06	0.91	1.96	4.27	13.96	.306	5.25	4.41	5.35

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	FxL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
7093	13.59	2.93	39.76	3.33	1.39	1.19	1.00	2.19	3.98	12.26	.325	4.75	4.21	5.30
7125	18.34	1.86	34.06	2.97	1.03	1.09	0.82	1.90	3.67	15.06	.244	5.26	4.53	5.22
7243	11.56	2.34	27.02	3.14		1.40	0.83	2.23	3.95	12.60	.314	4.74	4.27	5.28
8003	11.66	1.89	22.03	3.18		1.31	0.86	2.16	4.15	13.55	.306	5.34	4.35	5.02
8004	10.63	2.18	23.18	3.41		1.26	0.90	2.16	4.49	14.35	.312	5.48	4.58	5.64
8005	11.88	1.46	17.31	3.07		1.76	1.16	2.92	3.69	13.82	.267	4.95	4.36	4.97
8005	13.56	2.06	27.96	3.02	0.82	1.07	0.92	1.99	4.20	13.21	.318	5.66	4.41	4.77
8005	13.31	2.23	29.61	3.36		1.17	1.15	2.31	4.40	13.77	.320	5.46	4.35	5.16
8112	12.66	2.33	29.50	3.33		0.83	0.73	1.56	4.56	14.09	.323	5.25	4.50	5.49
8120	14.41	1.85	26.63	3.25	0.78	1.01	1.02	2.03	4.60	15.84	.290	5.95	4.92	5.51
8160	13.68	2.72	37.80	3.63	0.80	1.14	1.25	2.39	4.39	13.56	.324	5.31	4.51	5.42
8160	12.06	2.62	31.65	5.30		1.09	0.78	1.87	4.17	13.26	.314	4.99	4.35	5.59
8163	13.16	2.52	33.12	3.19	0.18	1.16	0.66	1.82	4.02	12.94	.311	4.80	4.20	5.31
8164	11.44	2.42	27.65	3.04		1.34	0.90	2.23	3.89	12.57	.310	4.75	4.24	5.11
8165	12.44	2.54	31.50	3.22		0.92	0.70	1.61	4.03	12.71	.317	4.93	4.25	5.30
8166	12.50	1.83	22.89	2.96		1.24	0.75	1.99	4.03	13.56	.297	5.04	4.36	4.99
8167	11.34	2.32	26.26	3.19		1.22	0.81	2.03	4.14	13.26	.312	5.10	4.34	5.40
8168	10.91	2.26	24.70	3.14		1.28	0.87	2.15	4.12	13.34	.309	4.99	4.36	5.10
8168	13.03	2.17	28.33	3.07		1.33	1.00	2.33	4.24	13.49	.314	5.51	4.65	5.17
8168	12.72	2.36	30.01	3.29		1.05	0.80	1.85	4.22	12.96	.325	5.46	4.59	5.07
8168	12.28	2.17	26.60	3.22		1.38	1.15	2.57	4.15	14.30	.290	5.46	4.75	5.77
8179	16.03	2.69	43.15	3.00		0.96	0.80	1.76	3.41	10.27	.332	3.86	3.62	4.57
8231	12.44	2.26	28.13	3.34		1.23	1.03	2.25	4.20	13.60	.309	5.21	4.32	5.17
8231	12.97	2.43	31.45	3.02		1.18	0.72	1.89	3.97	12.63	.314	4.73	4.08	4.97
8232	11.25	2.18	24.56	3.09		1.06	0.80	1.86	4.01	12.98	.309	4.90	4.24	5.05
8237	11.53	2.24	25.85	4.31		1.01	0.62	1.63	3.79	12.97	.293	4.86	4.13	5.17
8237	14.16	2.60	36.69	3.03	0.59	0.93	0.81	1.74	3.53	11.47	.307	4.29	3.85	4.89
8238	13.63	2.14	29.10	3.14	1.09	1.00	0.79	1.79	4.10	13.44	.305	4.99	4.27	5.00
8266	12.81	3.11	39.90	3.23		0.89	0.59	1.48	3.69	10.10	.365	4.01	3.55	5.10
8266	12.81	3.25	41.61	3.23		0.89	0.59	1.48	3.69	10.10	.365	4.01	3.55	5.10

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
I.D.No.	Prot.	Lys.	PhE	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
8295	13.06	2.09	27.23	2.98	1.29	1.27	0.80	2.07	4.04	13.84	.292	5.04	4.48	5.13
8296	13.88	1.82	25.26	3.13		1.27	1.19	2.45	4.09	14.04	.291	5.28	4.56	5.40
8299	15.34	1.77	27.11	3.30		1.29	1.06	2.34	4.33	14.35	.302	5.64	4.64	5.29
8302	15.53	1.84	28.50	3.43		0.79	1.33	2.13	4.44	14.99	.296	5.79	4.78	5.37
8307	13.47	1.88	25.34	3.16		0.85	0.82	1.67	3.95	13.18	.300	5.03	4.46	5.32
8309	11.69	2.24	26.16	3.14		0.40	1.20	1.59	4.04	13.54	.299	5.24	4.51	5.15
8322	15.97	1.63	26.08	3.00		1.57	0.86	2.43	4.07	14.14	.288	5.08	4.38	4.98
8330	11.28	2.05	23.07	3.12		1.15	1.12	2.27	3.80	13.05	.291	5.01	4.44	5.09
8336	14.25	1.77	25.19	2.99	1.08	0.78	0.93	1.71	3.68	13.37	.275	4.98	4.37	4.93
8358	13.06	1.75	22.88	3.11	2.02	0.65	0.87	1.52	3.90	13.83	.282	5.06	4.41	5.07
8364	14.28	1.78	25.48	2.97	1.05	1.31	1.39	2.69	3.98	13.25	.301	5.44	4.46	4.83
8382	11.03	2.11	23.26	3.33		0.54	0.97	1.50	3.96	13.36	.296	5.11	4.36	5.17
						1967 Purdue Nursery								
0075	13.69	1.74	23.77	3.07	0.93	0.52	0.63	1.15	4.22	14.76	.286	5.43	4.56	5.35
0075	13.56	1.61	21.76	2.67	1.00	0.54	0.55	1.39	4.05	14.57	.278	5.34	4.51	5.17
0083	12.22	2.04	24.87	3.16	0.96	0.83	0.76	1.59	3.93	13.85	.296	5.15	4.23	4.89
0102	12.47	1.66	20.73	2.93	2.29	1.37	0.92	2.29	4.09	14.32	.285	5.36	4.42	4.85
0271	12.34	2.00	24.66	3.25		0.75	0.68	1.43	3.95	13.30	.299	4.95	4.37	5.03
0302	12.66	1.79	22.60	2.95	0.92	1.17	1.16	2.33	3.82	13.64	.280	4.89	4.28	4.97
0508	09.64	2.07	20.38	3.17	0.53	0.78	1.20	1.97	3.72	13.74	.271	5.05	4.28	5.14
0508	09.81	2.20	21.53	3.17	0.90		1.37		3.67	13.51	.271	5.05	4.25	5.14
0508	09.44	2.22	20.98	3.32	1.05	0.46	1.13	1.59	4.04	14.04	.288	5.11	4.42	5.27
0508	09.66	2.06	19.93	3.21	1.10	0.45	1.26	1.72	3.60	13.33	.285	5.01	4.30	5.10
0514	14.97	2.05	30.72	3.08	0.85	1.01	0.96	1.97	3.82	13.64	.280	5.19	4.24	5.12
0616	15.25	1.73	26.37	2.97	0.51	1.35	0.76	2.11	4.04	13.69	.295	5.17	4.33	4.92
0639	12.00	1.83	21.92	3.22		1.02	0.76	1.78	3.87	13.60	.285	5.14	4.38	5.02
0705	13.72	1.94	26.59	3.08		1.66	0.88	2.54	5.51	12.84	.283	5.51	4.60	4.79
0718	11.06	1.94	21.40	2.97	0.70	1.07	0.69	1.76	3.86	13.26	.291	4.76	4.21	5.06

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
ID.No.	Prot.	Lys.	PhL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
0059	11.44	1.83	20.92	3.21	1.12	1.02	0.62	1.64	3.93	14.11	.279	5.29	4.53	5.16
0059	12.66	1.84	23.33	3.18		2.04	1.16	3.19	4.34	14.42	.301	5.58	4.73	5.78
0957	12.19	2.40	29.22	3.24	1.36	1.10	0.56	1.65	3.74	12.60	.296	4.63	4.15	5.03
1030	12.72	2.74	34.90	3.11	0.92	1.15	0.54	1.69	3.45	10.51	.328	4.32	3.73	4.95
1084	10.69	2.54	27.20	3.14	1.40	1.43	0.33	2.23	4.23	13.50	.313	4.50	4.31	5.57
1220	10.50	2.03	21.31	3.13		1.37	0.31	2.18	3.47	12.10	.287	4.66	4.18	4.84
2232	12.56	1.79	22.53	3.24	1.10	1.20	1.13	2.32	4.16	14.60	.285	5.34	4.60	5.11
2319	13.69	2.17	29.64	3.19	1.07	1.35	0.71	2.05	3.80	13.28	.286	4.92	4.47	5.24
2319	12.16	1.88	22.37	3.07		1.23	0.50	1.73	3.82	13.63	.280	4.95	4.38	5.10
2319	13.01	2.34	32.36	3.47	1.00	1.63	1.26	2.89	4.31	14.27	.302	5.50	4.77	6.09
2319 [a]	13.66	1.48	20.20	3.47		1.52	0.92	2.44	4.78	17.11	.279	6.23	5.29	5.68
2935	14.13	1.97	27.39	3.10	0.90	0.68	0.97	1.65	3.90	14.28	.273	5.07	4.44	5.23
2942	12.69	2.10	27.71	3.11	1.00	0.59	1.04	1.63	3.62	13.23	.273	4.90	4.25	5.13
2942	13.31	2.01	26.73	3.23	0.88	0.62	1.13	1.75	3.81	13.61	.280	5.06	4.32	5.23
3126	13.47	1.76	23.76	3.07		0.94	0.51	1.45	4.03	14.12	.286	5.17	4.45	5.27
3290	11.81	2.03	23.99	3.26	0.57	0.68	0.94	1.62	3.77	14.29	.264	5.10	4.56	5.28
3290	12.72	1.88	23.88	3.28		1.94	0.90	2.84	4.80	15.69	.306	6.09	5.16	4.90
3925	13.53	2.06	27.83	3.29	0.87	0.47	0.95	1.42	3.38	13.49	.288	5.05	4.29	5.15
3928	12.78	2.10	26.80	3.06	1.18		1.06		3.98	14.42	.276	5.17	4.36	5.18
3935	11.50	2.24	25.73	3.23	1.02	0.46	0.92	1.38	3.89	13.72	.283	5.04	4.34	5.33
3941	13.31	1.88	25.01	2.94	0.81	0.88	0.91	1.79	3.59	13.21	.272	4.79	4.03	4.95
4438	11.91	3.05	36.33	3.25	1.23	0.40	0.72	1.19	3.73	11.93	.313	4.71	4.11	5.19
4572	14.31	1.86	26.53	3.07	0.95	0.51	1.05	1.56	3.90	14.71	.265	5.31	4.52	5.19
4748	15.13	1.86	28.10	3.13	1.04	0.07	0.95		4.23	15.94	.272	5.71	4.81	5.38
4917	12.09	3.20	38.74	3.56	1.05	1.24	0.82	2.06	4.11	12.09	.340	4.88	4.22	5.33
4923	11.41	2.76	31.50	4.77		1.33	0.87	2.20	4.32	13.57	.318	5.31	4.52	5.41
8005	11.47	2.16	24.83	3.35		1.05	0.64	1.69	4.16	14.04	.296	5.20	4.44	5.30
8120	13.91	1.66	23.02	3.07	0.92	0.40	0.60	1.21	4.19	14.56	.288	5.64	4.97	5.11
8168	11.64	2.45	29.02	2.98	0.92	0.94	0.50	1.45	3.44	11.61	.296	4.53	4.01	5.12
8231	11.81	2.73	32.23	3.18		1.00	0.46	1.45	3.66	11.65	.314	4.47	3.96	5.05

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PhL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
8260	12.22	2.85	34.80	3.28		1.15	0.56	1.72	3.56	11.06	.322	4.34	3.86	5.07
8303	13.50	1.88	25.38	3.05		0.59	0.48	1.07	4.20	14.08	.299	5.13	4.39	5.20
8322	14.69	1.79	26.28	3.12		1.21	0.68	1.90	4.01	14.69	.273	5.07	4.48	5.27
*8364	10.78	2.12	22.82	3.24	1.00	0.98	1.17	2.16	3.95	14.02	.282	5.08	4.47	5.27
					1968 Purdue Nursery									
0229	10.70	1.68	17.98	3.08		0.89	1.35	2.24	3.67	13.35	.275	4.78	4.29	5.47
0511	10.44	2.02	21.09	3.07		0.99	1.02	2.01	3.39	11.94	.284	4.76	3.89	4.92
0534	10.59	2.10	22.19	3.28		0.15	1.25	1.39	3.95	13.09	.302	4.77	4.32	5.25
0659	12.81	1.61	20.61	3.00		0.43	1.12	1.55	3.92	14.06	.279	5.18	4.34	5.17
1220	12.69	1.62	20.55	2.95		1.57	1.35	2.91	3.73	13.07	.286	4.60	4.14	5.13
2010	11.78	1.77	20.83	3.04		0.95	1.15	2.10	3.51	12.64	.277	4.73	3.94	4.90
2278	11.63	1.62	18.84	3.11		0.21	1.36	1.57	4.00	14.00	.285	5.09	4.50	5.29
2322	11.78	1.81	21.29	3.01		1.03	1.21	2.24	3.91	13.80	.284		4.43	5.10
2319	18.63	1.84	34.30	2.92	1.00	1.09	0.88	1.97	3.89	13.32	.292	4.83	4.37	5.43
2630	17.03	1.90	32.43	3.17		0.83	1.15	1.99	3.94	13.83	.285	5.06	4.40	5.41
2941	11.12	1.96	21.80	3.09		1.27	0.82	2.09	3.26	11.99	.272	4.59	4.20	4.95
3290	14.88	1.48	21.99	2.92	1.12	1.03	1.00	2.03	3.72	13.33	.279	4.53	4.23	5.14
3796	10.53	2.21	23.26	3.39		0.71	1.61	2.32	3.96	13.11	.302	5.10	4.22	5.38
3806	11.25	2.05	23.01	3.16		0.80	1.36	2.15	3.73	12.96	.288	4.74	4.21	4.99
3922	11.56	1.97	22.42	3.01	0.94	1.02	1.00	2.02	3.87	13.37	.275	4.87	4.07	4.93
3922	11.06	2.12	23.46	3.12		0.92	1.33	2.25	3.72	13.56	.279	5.00	4.14	5.25
3922	12.13	2.03	24.64	3.23		0.88	1.09	1.97	4.17	13.42	.311		4.18	5.39
3928	13.69	1.64	22.44	3.09	0.91	0.98	1.26	2.24	3.96	14.37	.275	5.13	4.38	5.47
4131	13.41	1.88	25.20	3.10		0.61	1.29	1.91	3.95	13.64	.290	5.30	4.26	5.15
6896	13.47	1.67	22.47	3.04	1.90	0.96	1.23	2.19	4.10	13.56	.302	5.06	4.24	5.09

Table 17. Complete amino acid analyses (continued)

		Amino Acids as % Protein												
IS.No.	Prot.	Lys.	PrL	Threo.	Tryp.	Meth.	Half Cyst.	Total S.A.A.	Isol.	Leu.	Isol. Leu. Ratio	Phen.	Tyro.	Valine
6969	11.41	1.76	20.05	2.84	0.80	0.56	0.93	1.49	3.72	13.10	.284	4.71	4.04	4.88
8106	15.81	1.57	24.82	3.00		0.22	0.80	0.21	3.78	13.87	.273	4.87	4.39	5.17
8321	12.16	1.73	21.60	2.86		0.45	0.97	1.42	3.70	13.06	.283	4.78	4.03	4.80
8545	09.78	1.86	18.16	3.01		0.37	1.00	1.37	3.86	12.91	.299	4.66	4.04	5.21
8556	11.44	2.00	22.90	3.12		1.33	1.33	2.66	3.59	12.69	.283	4.57	4.13	5.20
8618	10.44	2.09	21.79	3.12		0.38	1.30	1.68	3.85	13.14	.293	4.96	4.19	5.27
8623	08.41	2.40	20.15	3.35		0.57	1.43	1.99	3.88	12.40	.312	4.70	4.20	5.27
8850	10.13	1.79	18.15	3.07		0.22	1.19	1.41	3.95	13.48	.293	4.98	4.29	5.17
8878	10.53	1.93	20.23	2.98			1.02		3.73	13.03	.286	4.60	4.05	5.47
8879	09.44	2.14	20.22	3.17		0.35	1.14	1.49	3.91	13.19	.297	4.79	4.28	5.21
8916	10.53	1.97	20.74	3.07			1.23		3.83	13.14	.292	4.62	4.22	5.49
9198	10.94	1.93	21.13	3.06		1.15	0.56	1.71	3.78	13.28	.285	4.90	4.14	5.11
9198	10.94	1.95	21.33	3.09		1.17	0.55	1.72	3.70	13.38	.276	4.97	4.17	5.07
9278	09.50	2.24	21.27	3.13		0.61	1.00	1.60	3.78	12.86	.294	4.77	4.20	5.01

[a] Endosperm analysis

[b] Embryo analysis

Table 18. Rat Feeding Tests on Sorghum

IS, No.	Formulation of Feeds: Sorghum[1] % Protein	Sorghum[1] Grams used	Corn starch grams	Results: Gain g	Protein eaten g	PER[2]
2319	14.1	319	125	15.3	17.3	0.91
0083	11.4	395	49	13.1	19.2	0.68
7088	13.95	322	122	11.3	17.9	0.63
1220-1966	10.1	444	0	9.9	16.9	0.59
69580P-1966	11.0	408	36	8.2	16.8	0.49
Redlan x 2319	11.2	402	42	7.4	18.2	0.41
RS610	12.0	375	69	5.4	13.6	0.40
2935	13.3	338	106	6.0	16.9	0.35
4572	13.3	338	106	5.2	15.7	0.33
0503	9.3	444	0	4.1	12.3	0.33
8322	14.45	311	133	6.0	18.5	0.33
Redlan x 05030P	9.6	444	0	4.5	14.3	0.32
4748	15.0	300	144	4.4	17.4	0.25
8301	13.8	326	118	2.8	16.1	0.18

[1] Ground sorghum in amount to supply protein equal to 9.0%
Corn oil in amount equal to.....5.0%
Hawk-Oser salt mixture in amount equal to 4.0%
Vitamin mixture in amount equal to 2.2%
Corn starch in amount to make total of 100%

[2] PER stands for Protein Efficiency Ratio, obtained by dividing the weight gain in grams during the 28 day feeding period by the protein eaten in grams during the period.

Fractionation of Sorghum Endosperm Protein

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Nine selections of sorghum were obtained from Dr. R. C. Pickett, Department of Agronomy in the spring of 1968. The seeds were soaked in distilled water for three hours in the cold. The endosperms were separated by manual dissection, ground with a mortar and pestle, then powdered in a small ball mill, defatted for 36 hours in petroleum ether, air dried and stored in glass bottles. Total nitrogen was determined by microkjeldahl, and amino acid content of protein fractions with a Spinco automatic amino acid analyzer.

One gram samples of endosperm were fractionated by a modifcation of the Hertz copper method (Hertz, E.T. Lloyd, N.E. and Bressani, R. Cereal Chem. 35 146 (1958)). The modification is the separation of the alcohol-soluble and glutelin fractions by extraction with 70% alcohol at 60° C, rather than by solution in an alcohol medium at high pH and isoelectric precipitation of the glutelin fraction. Three soluble fractions are obtained from sorghum: acid soluble (Fraction II), alcohol-soluble or kafirin (Fraction III) and glutelin (Fraction IV).

Results. Table 1 shows that 88 to 97.5% of the nitrogen of the sorghum endosperm samples was recovered as soluble nitrogen. Of the total soluble nitrogen, 11 to 19% (average, 15%) was present as acid-soluble protein, 55 to 66% (average, 61%) as alcohol soluble protein, and 18 to 28% (average, 23%) as glutelin. Sorghum endosperm therefore contains about 10% more alcohol-soluble protein than normal maize endosperm. The alcohol-soluble protein is increased at the expense of the acid-soluble protein, which is about 10% lower than in normal maize. (See Bressani, R. and Hertz, E.T. Cereal Chem. 35 227 (1958)).

The soluble fractions of three samples of sorghum endosperm were analyzed for lysine (Table 2). The acid-soluble fractions contained 1.4 to 2.7 grams of lysine, the alcohol-soluble fractions 0.1 to 0.2 grams of lysine, and the glutelin fractions 2.5 to 3.2 grams of lysine per 100 grams of protein. These are similar to the levels found in maize endosperm composites by Bressani and Hertz (see footnote to Table 2).

Conclusions. Sorghum endosperms can be successfully fractionated using the Hertz copper method. The average values for 9 samples was 15% acid-soluble protein, 61% alcohol-soluble protein and 23% glutelin. Sorghum endosperms have about 10% lower acid-soluble and 10% higher alcohol soluble values than normal maize. However, the level of lysine in the three protein fractions is similar to that found in normal maize.

Table 1: Protein Fractions of Sorghum Endosperm

IS.No.	Endosperm Protein (%)	Per Cent Recovered	Per Cent Acid-Soluble	Per Cent Alcohol-Soluble	Per Cent Glutelin
2319	13.2	97.2	12.7	59.3	28.0
0508	9.5	91.0	17.0	54.7	28.3
RS610	12.0	94.7	16.8	59.7	23.5
8336	12.1	97.0	16.6	65.6	17.8
6922	14.0	97.5	15.9	66.4	17.7
8263	9.6	97.0	18.7	58.2	23.1
0201	9.8	93.4	15.5	61.6	22.9
2862	12.0	88.0	13.4	62.0	24.6
2375	17.8	89.9	10.8	65.9	23.3

Table 2. Lysine Content of Soluble Endosperm Fractions

IS.No.	Soluble Fraction	Lysine (gm/100gm.Protein)*
0508	Acid-soluble	2.3
	Alcohol-soluble	0.1
	Glutelin	2.5
6922	Acid-soluble	1.4
	Alcohol-soluble	0.2
	Glutelin	2.6
2862	Acid-soluble	2.7
	Alcohol-soluble	0.2
	Glutelin	3.2

* Values in maize endosperm composites were: acid-soluble:2.9, alcohol-soluble: 0.1 and glutelin: 2.2 (Bressani, R. and Hertz, E.T. Cereal Chem. 35 227 (1958).