AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

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Batch #24

1. SUBJECT CLASSIFICATION

A. PRIMARY: Serials — Y-AF30-0170-0000

B. SECONDARY: Agriculture--Plant breeding--Cereals--Sorghum

2. TITLE AND SUBTITLE

Inheritance and improvement of protein quality and content in Sorghum vulgare Pers.; semi-annual report,July-Dec. 1966

3. AUTHOR(S)

(101) Purdue Univ. Dept.of Agronomy

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1967	10p.	ARC 633.174.P985

7. REFERENCE ORGANIZATION NAME AND ADDRESS

Purdue

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)

(Research summary)

9. ABSTRACT

10. CONTROL NUMBER	11. PRICE OF DOCUMENT
PN-RAB-392	
12. DESCRIPTORS	**13. PROJECT NUMBER**
Proteins	
Sorghum	**14. CONTRACT NUMBER** CSD-1175 Res.
	15. TYPE OF DOCUMENT

AID 590-1 (4-74)

Inheritance and Improvement of Protein Quality and Content in *Sorghum vulgare* Pers.

Semi-Annual Report No. 1
For Period
July 1, 1966 to December 31, 1966

Prepared by
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Contract No. 1175
U.S. Agency for International Development
Department of State
with
Purdue Research Foundation
Lafayette, Indiana

January 3, 1967

Not For Publication

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

Report for Period July 1, 1966 to December 31, 1966.

Screening to date of over 400 samples of the World Sorghum Collection has revealed crude protein variation of 7.4% to 25.9% and lysine values of 0.54 to 2.84 gm/100 gm protein. Twenty-nine lines with 18% protein or more have been found (Table 1). These may be of interest for ruminant nutrition regardless of amino acid composition. This is in striking contrast to the vast majority with 11 to 13% and the lowest six with less than 10% protein. About 47 relatively good combinations of protein and lysine content were found (Table 2). There are 14 low samples with about 1/3 to 1/2 of the "lysine amount" (Protein % x lysine %) of the high group. All seeds in these trials were grown in 1965 under good fertility at Lafayette, Indiana. The analyses of the 1966 trials are now beginning.

High and low lysine samples were found with 24 samples above 1.90 gm lysine/100 gm protein and 13 samples below 0.80 (Table 3).

Amino acid analysis facilities with a Beckman Model 120C Amino Acid Analyzer have been established. A trained technician now is running 2 1/2 samples per day. The accelerated system with 5 samples per day (2 hour run) will begin soon with a second technician needed for full time operation. Complete amino acid analyses to date ha e been on samples ranging in protein content from 10 to 16 percent protein and 1.43 to 2.28 gm lysine/100 gm protein. Threonine values vary from 2.95 to 3.41 and the highest threonine is associated with the highest lysine though the relationship may vary.

Methionine varied from 1.22 to 2.37 and tended to be positively associated with threonine though some exceptions were noted.

Leucine contents were 13.38 to 16.43 with considerable variation in isoleucine/leucine rations.

Larger numbers of samples should soon establish some of these relationships more clearly as well as uncover the exceptional, desirable amino acid compositions being sought. Desirable combinations now seem quite possible in view of the associations seen to date.

Two groups of material i.e., The lines with the highest yields and the highest protein and lysine contents will be analyzed for complete amino acid composition next.

The 1966 field nursery at Lafayette, Indiana included about six acres in the following trials.

Arden Campbell planted a trial of 176 entries of selfs, single crosses (both hand crosses and crosses onto male-steriles from 1965-66 greenhouse), and checks in 3 replications under uniform, good fertility (150# N/A with adequate P & K). A second trial had nitrogen treatments of 0 (50# N/A residual estimated), 100, and 200# N/A with 18 lines with RS 610 as a check in 3 replications. Lines and

[illegible]ments in both trials [illegible] for [illegible] chemical composition and these trials will be analyzed for yield and protein composition. Many lines and hybrids appeared to be very high in grain yield. The 1966 yields are now being calculated.

High fertility plots included 15 F_1 crosses and selfs in 4 replications and 22 crosses and selfs in 8 replications. Another trial had 18 self-pollinated entries selected for certain protein and lysine levels in 3 replications. The nitrogen application was 400# N/A with 1000#/A available P_2O_5 and K_2O with applications of B, Zn, and Mn. This plot has been kept at this level for over 6 years. The response of various genotypes in regard to chemical composition and yield will be measured.

A replicated grain sorghum trial was conducted under regular, good fertility included 834 entries with parents and crosses onto male-steriles CK 60, Martin, Redlan, and Wheatland. Selections for lodging resistance and high yield potential included 27% of the nursery. Detailed notes were taken on these and yield, and chemical composition will be determined. Three replications of single row plots revealed yields of 18,000 to 20,000 pounds of seed per acre on several single crosses. Every effort will be made to get improved protein types into such high yielding combinations and to analyze the best of the present high yielding hybrids and their parents. The highest yields are in intermediate height (5-8 ft.) hybrids.

Fred Collins and others made over 100 crosses among various selected inbred lines in 1966. Fifty-six lines selected for protein and lysine characteristics were crossed onto male-steriles CK-60, Martin, Wheatland, and Redlan. These crosses will be the basis of inheritance studies of protein content and amino acid compositions.

Twenty-five seed increases had yields of 50 to 500 pounds of seed which will be used for biological tests with rats, chickens, or swine. Various levels of protein and lysine are included in this material. Selfed seed of these lines is also available in amounts from 2 to 13 pounds for further increases and distribution as desired. As soon as chemical composition is determined on the current crop the composition and seed will be made available to cooperators.

A four acre nursery with over 4,000 entries in Puerto Rico was established by November 30, 1966 by contract with the University of Puerto Rico Agricultural Experiment Station. This nursery will include increases of select lines, parents for additional crosses and the portion of the World Collection that will not head in the temperate U. S.

Table 1. [illegible]

[illegible]

LAFAYETTE, INDIANA

HIGHEST PROTEIN (above 18%)

	Sample No.	% Protein NX 6.25	Lysine gm/100 gm Prot.
1.	34	19.3, 16.65	1.53, 1.61
2.	75	20.6	1.61
3.	87	18.6	1.44
4.	111	18.5, 17.41	1.17
5.	121	18.9, 17.91	1.11
6.	124	19.3, 18.72	1.10
7.	132	19.7, 19.22	1.44
8.	148	25.7, 25.66	0.89
9.	170	18.0	0.86
10.	176	18.7, 18.03	1.23
11.	192	20.0	1.11
12.	211	22.6	1.91
13.	227	18.0	0.96
14.	244	18.0	0.80
15.	266	24.9	0.91
16.	269	22.3	0.84
17.	274	19.3	1.18
18.	279	19.9	0.76
19.	280	21.4	1.17
20.	281	25.9	0.69
21.	284	18.5	1.22
22.	286	19.4	0.97
23.	291	21.0	0.93
24.	295	19.8	0.83
25.	304	18.5	1.13
26.	311	19.2	1.10
27.	319	19.0	0.79
28.	338	18.8	
29.	345	18.3	1.61

Table 1 (con't.)

LOWEST PROTEIN [illegible]
(Under 10%)

	Sample No.	% Protein NX 6.25	Lysine gm/100 gm Prot.
1.	320	7.4	1.50
2.	297	8.5	1.06
3.	201	9.7	1.65
4.	115	9.9	1.68
5.	89	9.6	1.62
6.	53	9.6	2.70

Table 2. COMBINATIONS OF PROTEIN AND LYSINE CONTENTS OF SORGHUM SEED SAMPLES GROWN IN 1963 AT LAFAYETTE, [illegible]

HIGH IN SAMPLES 1-76 (above 32 - Prot. % x Lys. %)

	Sample No.	% Prot. NX 6.25	Lysine gm/100 gm Prot.	Prot. % x Lys. % index of (relative amount)
1.	16	14.6	2.63	38.4
2.	20	14.4	2.46	35.4
3.	29	14.2	2.32	32.9
4.	31	15.7	2.08	32.7
5.	33	13.9	2.69	37.4
6.	38	12.9	2.64	34.1
7.	47	15.5	2.16	33.5
8.	49	14.1	2.34	33.0
9.	59	14.2	2.42	34.4
10.	64	12.3	2.66	32.7
11.	65	17.1	2.28	39.0
12.	67	12.3	2.84	34.9
13.	75	20.6	1.61	33.2

HIGH IN SAMPLES 77 TO 364 (above 23 - Prot. % x Lys. %)

1.	87	18.6	1.44	26.8
2.	93	11.0	2.47	27.2
3.	109	16.3	1.76	28.7
4.	122	14.5	1.80	26.1
5.	126	10.7	2.67	28.6
6.	130	15.8	1.6[illegible]	26.7
7.	132	19.7	1.4[illegible]	28.4
8.	164	14.5	1.70	24.7
9.	167	15.3	1.85	28.3
10.	176	18.7	1.23	23.0
11.	202	17.9	1.79	32.0
12.	205	14.9	1.56	23.2
13.	206	14.9	2.10	31.3
14.	209	12.9	1.87	24.1
15.	211	22.6	1.91	43.2

Table 2 (con't.)

	Sample No.	% Prot. NX 6.25	Lysine gm/100 gm Prot.	Prot. % x Lys. % index of (relative amount)
16.	212	16.7	1.43	23.9
17.	280	21.4	1.17	25.0
18.	285	16.9	1.65	27.9
19.	314	11.0	2.30	25.3
20.	325	15.9	1.45	23.1
21.	332	16.9	1.72	29.1
22.	339	16.2	1.61	26.1
23.	345	18.3	1.61	29.5
24.	346	12.7	1.88	23.9
25.	348	14.7	1.99	29.3
26.	349	15.7	1.83	28.7
27.	352	17.3	1.88	32.5
28.	353	14.8	1.62	24.0
29.	364	16.5	2.00	33.0
30.	355	13.1	1.81	23.7
31.	358	15.3	2.22	34.0
32.	360	12.5	1.98	24.8
33.	362	16.0	1.80	28.8
34.	363	16.6	1.87	31.0 (7 above 30)
		LOW (below 11 - Prot. % x Lys. %)		
1.	91	13.1	0.82	10.7
2.	180	15.1	0.72	10.9
3.	187	12.4	0.71	8.8
4.	230	15.3	0.69	10.6
5.	232	10.5	1.00	10.5
6.	236	12.7	0.86	10.9
7.	238	14.0	0.78	10.9
8.	249	12.3	0.87	10.7
9.	254	11.1	0.88	9.8
10.	258	12.7	0.84	10.7
11.	259	13.7	0.54	7.4
12.	263	13.2	0.57	7.5
13.	264	11.5	0.87	10.0
14.	297	8.5	1.06	9.0

Table 3. LYSINE LEVELS IN LINES OF SORGHUM - GROWN IN 1965 AT LAFAYETTE, INDIANA

HIGHEST IN 1st 76 (above 2.5)

	Sample No.	Lysine gm/100 gm Prot.	Protein %	Prot. % x Lys. %
1.	16	2.63	14.6	38.4
2.	18	2.57	12.3	31.6
3.	21	2.66	10.9	29.0
4.	33	2.69	13.9	37.4
5.	37	2.71	14.6	39.6
6.	38	2.64	12.9	34.1
7.	53	2.70	9.6	25.9
8.	64	2.66	12.3	32.7
9.	67	2.84	12.3	34.9
10.	76	2.70	11.4	30.8

HIGHEST IN SAMPLES 77 TO 364 (above 1. 0)

11.	93	2.47	11.0	27.2
12.	97	2.03	11.0	22.3
13.	126	2.67	10.7	28.6
14.	127	1.93	10.9	21.0
15.	128	2.09	10.3	21.5
16.	199	2.01	11.0	22.1
17.	206	2.10	14.9	31.3
18.	211	1.91	22.6	43.2
19.	314	2.30	11.0	25.3
20.	349	1.99	14.7	29.3
21.	354	2.00	16.5	33.0
22.	356	2.04	11.1	22.6
23.	358	2.22	15.3	34.0
24.	360	1.98	12.5	24.8

Table 3 (con't.) LOWEST LYSINE (below 0.60)

	Sample No.	Lysine gm/100 gm Prot.	Protein %	Prot. % x Lys. %
1.	114	0.74	17.3	12.8
2.	137	0.71	12.4	8.8
3.	218	0.78	15.7	12.3
4.	230	0.69	15.3	10.6
5.	237	0.78	16.0	12.5
6.	238	0.78	14.0	10.9
7.	248	0.77	14.4	11.1
8.	252	0.73	16.0	11.7
9.	253	0.72	15.6	11.2
10.	259	0.54	13.7	7.4
11.	263	0.57	13.2	7.5
12.	279	0.76	19.9	15.1
13.	281	0.69	25.9	17.9