EXECUTIVE SUMMARY

THE EFFECT OF SPROUTED GRAIN SORGHUM (MILO) ON PERFORMANCE OF BROILER CHICKENS

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Untimely rains and inability to get harvesting equipment into muddy fields in the Rio Grande Valley and Southwest Texas in 1993 resulted in the production of sprouted and low grade grain sorghum of questionable feeding value for broiler chickens. A factorially designed experiment utilizing 1152 sexed broiler chickens was conducted by the Department of Poultry Science, Texas A&M University, to test the feeding value of USDA Grade 2, 3, 4 and Sample Grade milo from this region of Texas on performance of broilers to market age (49 days).

It was concluded that:

(1) Feeding either 1993 Southwest Texas/Rio Grande Valley USDA Grade 2, 3, 4, or Sample Grade grain sorghum as the sole grain source in the starter diet of commercial broiler chickens produced no statistically significant differences in body weight, feed conversion or livability at either two or four weeks of age. One grain sorghum sources was as good as the other in feeding value to this age.

(2) There were no statistically significant differences in body weight and livability in broilers when either USDA Grade 2, 3, 4, or Sample Grade grain sorghum was feed. The differences in body weight and livability at 49 days of age were small and followed no logical pattern related to milo grade.

(3) A significant difference in feed conversion was evident at 49 days of age. As the grade of milo went down one grade unit, the feed conversion decrease on the average 0.054 pounds of feed per pound of live broiler weight produced. Since this is the first published report in which commercial broiler chickens were carried to market age on diets containing weathered grain sorghum, additional research is needed to verify this observation. An experiment is in progress where this is being done using similar grades of milo.

(4) All four grades of grain sorghum harvested in Southwest Texas in 1993 and tested in our laboratories were free of four common mycotoxins and good grain sources for commercial broiler chickens. It may be necessary to adjust the calorie:protein ratio of the diet some during the feeding period from 4 to 7 weeks of age to obtain maximum feed conversion when feeding the lower grades of grain sorghum. Studies need to be designed to precisely determine nutrient values for low grade milos so dietary adjustments could be made with greater confidence. These nutrient values, if known, have not been published.

FINAL REPORT

THE EFFECT OF SPROUTED GRAIN SORGHUM (MILO) ON PERFORMANCE OF BROILER CHICKENS

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INTRODUCTION

Untimely rains, continued high humidity and fog, and the inability to get harvesting equipment into muddy fields can allow ready-to-harvest grain sorghum to sprout and mold in the head. This occurred in the Rio Grande Valley of Texas and Southwest Texas in 1993. Farmers and grain jobbers in the area have had difficulty marketing this grain since there is uncertainty about its feeding value when used in poultry and other animal diets. The economic loss to farmers in these areas could be devastating if this weather-damaged milo had to be sold well below contract or usual market price. It was the intent of this investigation to thoroughly evaluate the effects of four grades of milo coming out of The Valley and Southwest Texas to determine their effect on the performance of broiler chickens.

Very little is known about feeding weather-damaged grain sorghum to broiler chickens grown to market age. Rowland et al. (1977) fed weather-damaged milo as 0, 10, 25, 50 and 100% of the grain source to broilers chickens grown to three weeks of age; and to turkeys to six weeks of age. There was no effect of weather-damaged grain sorghum (severely sprouted) on growth rate, feed efficiency, or livability to these ages.

EXPERIMENTAL PROCEDURE

Commercial broiler chickens are grown in floor-type houses, usually on recycled (used) litter. It is well documented that used litter will provide some dietary nutrient recycling because birds do eat some litter particles. One must ask the question: Is nutrient recycling an important factor in overcoming detrimental effects of low-grade milo if indeed low-grade milo has some detrimental effects? This study was designed to answer that question as well as evaluate four grades (#2, #3, #4, and Sample Grade) of milo for their feeding value. Too, birds should be grown to term (market weight) and weights and feed conversion evaluated at different ages during the growing period to determine if and when detrimental effects occur.

A total of 1152 sexed commercial broiler chicks of one strain were used in this study. The chicks were grown in floor pens using both new and recycled pine wood shavings for floor litter. They received approximately 0.85 square feet of floor space per bird during the growing period, and were grown on a 23

hour light schedule per day. The floor plan, replication (block), and treatment assignments in the broiler house are presented in Figure 1.

The chicks were fed a commercial-type chick starter from 1 to 24 days of age. The diets were formulated a to meet all the nutrient requirements for broiler chickens when using USDA Grade 2 grain sorghum as the grain source. Since the energy and amino acid levels have not been established for the lower grades of milo, diets could not be made truly isonitrogenous and isocaloric. The starter and grower-finisher diets fed are presented in Tables 1 and 2. The experimental design for the study is presented in Table 3.

All birds were weighed at 14, 28 and 49 days of age. A record of feed consumed was kept in order to determine feed conversion on each treatment group. Mortality was low and no necropsy was necessary to determine cause of death. Various statistical procedures were applied to the data to determine if grades of milo fed indeed did produce significant differences in performance of the broilers to 49 days of age.

Mycotoxin analyses and protein analyses of grain sorghum samples were conducted by the Texas Veterinary Diagnostic Laboratory and the Department of Poultry Science respectively. We are still waiting for a report from the laboratory on energy determinations.

RESULTS AND DISCUSSION

We were extremely pleased with the conduct of the experiment. There were no problems that would make the data of questionable value. The broilers were grown during the warmest part of the summer which should have tended to reduce growth rate and feed conversion; however, both parameters met performance expectations.

The mold characteristics of the grain samples are presented in Table 4. The Mycotoxin Laboratory of the Texas Veterinary Diagnostic Laboratory tested the four grades of grain sorghum for aflatoxin, oohratoxin, vomitoxin, and zearalenone. Neither Grade 2, 3, 4, or Sample Grade grain sorghum provided to us for this study had a detectable amount of these mycotoxins. It is concluded that these four samples of milo were virtually free of mycotoxins of concern to most poultry nutritionists.

The crude protein content of each of the four grades of milo fed is presented in Table 5. Generally, as the grade of grain sorghum went down, the protein content went up. the difference in the crude protein content of Grade 2 vs. Sample Grade milo was 1.66% -- a significant difference when formulating poultry diets. For some reason the Grade 3 and 4 samples of milo used were not too different in protein content suggesting that there was actually little difference in the nutritive value of these two grades. They were, however, intermediate in crude protein

content when compared with the Grade 2 and Sample Grade milos fed. These crude protein differences did reflect themselves in the crude protein content of the mixed starter diets. Diets formulated from the lower grades of grain sorghum had a significantly higher protein content (Table 5). This will reflect itself in the growth rate of the broilers at two weeks of age.

Two Week Data. All birds were weighed at two weeks of age by sexes and feed conversion determined. There were no statistically significant differences in body weight, feed conversion or livability suggesting that Grade 4 and Sample Grade grain sorghum are as good as Grade 2 or 3 milo to this age (Table 6). Numerically, the broiler chicks receiving Grade 3, 4 and Sample Grade grain sorghum were 14 to 17 grams heavier than those on Grade 2 milo at two weeks of age. The higher levels of protein in the lower grades of milo may have given the chicks a slight growth advantage. From a statistical point of view, one must conclude that the differences observed at two weeks of age are not significantly different.

Four Week Data. When the data collected at four weeks of age were analyzed statistical there were no statistically significant differences in growth rate, feed conversion or livability among the treatment groups of broilers (Table 7). The four grades of milo had similar feeding values to four weeks of age. Only 10 grams difference separated the four treatment groups in body weight, 0.0519 units (lbs. feed/lb. of body weight) in feed conversion, and 0.40% in livability. All differences were not statistically significant and due to chance.

The birds grown on reused (old) litter were significantly heavier at four weeks of age (850 vs. 822 grams), and had significantly better feed conversion (1.6037 vs. 1.6579 grams of feed to produce a pound of live broiler) (Table 7). Using new pine shavings as litter was a disadvantage to four weeks of age. The important point is that there were no significant litter by grade of milo (treatment) interaction effects. This means that even though there are nutrient recycling benefits to growth and feed efficiency from the use of reused litter, an experiment of this type can be conducted on either new or old litter without concern over nutrient recycling changing the ranking of treatment results; i.e., giving an advantage to higher (or lower) grades of milo.

Since there were type of litter differences, the four week data were analyzed as though there were two experiments being conduced (Table 7). There were no statistically significant difference in feed efficiency, growth rate, or livability within either litter type when using this statistical analysis approach. There also were no significant block (replication) differences. One would expect highly significant sex difference, and there were major sex differences. However, the sex by treatment interactions were very small suggesting that the two sexes responded the same to the four grain sorghum diets fed.

Seven Week Data. At 49 days of age the birds on used litter were still 27 grams heavier on the average than those grown on new litter; however, the difference of 27 grams (2,123 vs. 2,096 grams) was no longer statistically significant (Tables 8 and 9). Similarly, the treatment by litter interaction was not statistically significant. Hence, the data were analyzed as a factorial which was the intent when originally designing the experiment.

There were no statistically significant differences in body weight among treatments at 49 days of age (Tables 8 and 9). The heaviest weight was 2,124 grams for those broilers grown on Grade 3 milo, 2,113 grams for those grown on Sample Grade milo, 2,102 grams for those receiving Grade 2 milo, and 2,096 grams for the Grade 3 milo fed birds. There is no logical pattern to these weights, and only 26 grams difference separate the highest and lowest mean weight. One must conclude that grade of grain sorghum had no effect on growth rate of commercial broiler chickens through seven weeks of age.

The pattern for feed conversion changed during the period from four to seven weeks of age. There were no significant differences in feed conversion among the treatment groups of broilers to four weeks of age. At seven weeks there was a significant negative trend in feed conversion. As the grade of milo went down, feed conversion became poorer. A linear regression of feed conversion on grade of milo suggests that as the grade changed one unit from Grade 2 through Sample Grade (numerical 5), feed conversion changed on the average 0.054 pounds of feed per pound of live broiler produced.

Normally when one formulates a growing diet for broilers during the period from four to seven weeks, one lowers the protein level of the diet and increases the energy level. These four grower diets were set at the protein and energy levels for Grade 2 milo since the nutrient values are not reported in standard nutrient tables for the lower grades of grain sorghum. A substitution for Grade 2 milo was made using a lower grade of milo when mixing the diets. Since lower grades of milo have a higher protein level (Table 5), and presumably a lower energy level, the authors conclude that when using low grade grain sorghum, one should increase the energy level of the grower diet to maintain the recommended calorie : protein ratio for birds this age. The amount of energy (fat) to add to maintain the proper calorie : protein ratio is difficult to estimate. These adjustments need to be precise and determined experimentally in subsequent experiments.

There were no statistically significant differences in livability in this experiment (Table 8). Block differences were also nonsignificant as were all interactions involving blocks. Differences between the sexes were highly significant as would be expected; however, interactions involving sexes were not statistically significant.

CONCLUSIONS

1. Feeding 1993 Southwest Texas/Rio Grande Valley Grade 2, 3, 4, and Sample Grade grain sorghum (milo) as the only grain source in the starter diet of commercial broiler chickens had no effect on growth rate, feed conversion, or livability when the broilers were grown to two weeks of age in a litter floored broiler house.

2. There were no significant differences in growth rate, feed conversion, or livability in commercial broilers grown to four weeks of age when the broilers received either Grade 2, 3, 4, or Sample Grade milo as the only grain source in the starter diet.

3. The use of old (reused) litter gave the birds an added body weight and feed conversion advantage to four weeks when compared with similar commercial broilers grown on new pine shavings litter. Since there were no significant interactions between types of milo fed and type of litter used, one must conclude that type of litter used will not affect the outcome of the experiment. Nutrient recycling from old (reused) litter should not be overlooked as a variable in a study of this type.

4. There were no significant differences in body weight and livability of commercial broiler chickens at 49 days age (market age). Only 26 grams difference in body weight and 0.73% livability separating the highest and lowest treatment groups with no evidence of a trend in body weight or livability related to grade of grain sorghum fed.

5. Between 28 and 49 days of age a significant difference in feed conversion became apparent. As the grade of milo went down the feed conversion went down by a regression value (average) of 0.054 pounds of feed per pound of broiler produced. It is concluded that additional research is needed to verify this observation; and if found correct, adjustments may be needed in the diet to obtain the proper calorie:protein ratio for broilers in this age bracket.

6. Floor litter type (old vs. new) still favored the use of used or old litter through 49 days of age; however, differences in body weight, feed conversion, and livability between the two litter types were not statistically significant as was noted at four weeks. Nutrient recycling probably had begun to occur in the new litter groups.

7. It is concluded that all four grades of grain sorghum harvested in Southwest Texas in 1993 were free of four of the common mycotoxins and where good grain sources for commercial broiler chickens. It may be necessary to adjust the calorie:protein ratio of the diet some during the period from four to seven weeks of age to obtain maximum feed conversion when feeding the lower grades of milo.

This study was conducted at the Poultry Science Research and Teaching Center, Poultry Science Department, Texas A&M University, College Station, Texas. The experiment was conducted during the period from July 23, 1993 through September 10, 1993.

REFERENCES

Rowland, L. O., Jr., J. E. Plyler and J. W. Bradley, 1977. The feeding value of weathered grain sorghum for poultry. Technical Article No. 13441, Texas Agricultural Experiment Station, College Station, TX. pp. 1-6.

Respectfully Submitted,

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TABLE 1

Texas A & M - STARTER DIET USED IN THE WEATHERED MILO STUDY.
PRODUCT NO..... 21
PRODUCT NAME...wfk BS
DATE.....07-20-1993

DATE/TIME STORED..07-20-1993 08:24:55 # 3391

ROUNDED AMOUNT	INGREDIENT NUM	NAME	PERCENT OF MIX	COST/ 100LB	LOW RANGE	HIGH RANGE	REST.$/ 100LB	INGREDIENT MIN.	INGREDIENT MAX.
547.56	120	MILO 9%	54.756	99900	99900				
349.71	200	SOYBEAN 48 ML	34.971	99900	99900				
57.57	400	FAT A&V BLEND	5.757	99900	99900				
20.71	755	MONO-CALCIUM P	2.071	99900	99900				
14.14	710	OYSTERSHELL-GR	1.414	99900					
3.54	760	SALT	0.354	99900	99900				
2.50	600	VITAMINS-BROIL	0.250	99900				0.250	0.250
2.45	500	METHIONINE 98%	0.245	99900	99900				
0.75	802	COBAN 60	0.075	99900				0.075	0.075
0.58	520	LYSINE HCL 98%	0.058	99900	99900				
0.50	700	TRACE MINERALS	0.050	99900				0.050	0.050

1000.00 TOTAL WEIGHT $1998000.12 PER TON $99900.01 PER 100LB

NUM	RESTRICTION		MINIMUM	ACTUAL	MAXIMUM	NUTRIENT COST
1	WEIGHT	LBS	1.00	1.0000	1.00	
2	POULTRY ME/LB	KCAL/L	1400.00	1400.00		
9	CRUDE PROTEIN	PCT	22.00	22.00	22.00	
12	ARGININE	PCT		1.50		
13	GLYCINE	PCT		0.95		
14	SERINE	PCT		1.19		
15	HISTIDINE	PCT		0.55		
16	ISOLEUCINE	PCT		7.57		
17	LYSINE	PCT	1.25	1.25		0.00022
18	METHIONINE	PCT		0.57		
19	CYSTINE	PCT		0.36		
20	MET + CYS	PCT	0.93	0.93		
21	PHENYLALANINE	PCT		1.07		
22	TYROSINE	PCT		0.86		
23	THREONINE	PCT		0.83		
24	TRYPTOPHAN	PCT		0.70		
25	VALINE	PCT		1.00		
26	CRUDE FIBER	PCT		2.59		
27	CRUDE FAT	PCT		7.36		
30	CALCIUM	PCT	0.95	0.95	0.95	
31	TOTAL PHOS	PCT	0.81	0.81	0.81	
32	AVAIL-PHOS	PCT		0.54		
35	SODIUM	PCT	0.16	0.16	0.18	0.00047
36	CHLORIDE	PCT		0.27		
40	LINOLEIC ACID	PCT		1.94		

TABLE 2

Texas A & M - GROWER FINISHER DIET USED IN THE WEATHERED MILO STUDY.
PRODUCT NO....G
PRODUCT NAME...wfk BS
DATE.....08-30-1993
COMMENTS.....HOUSE 12 KRUGER G. S. COUNCIL

DATE/TIME STORED..08-30-1993 14:03:25 # 3442

ROUNDED AMOUNT	INGREDIENT NUM	NAME	PERCENT OF MIX	COST/ 100LB	LOW RANGE	HIGH RANGE	REST.$/ 100LB	INGREDIENT MIN.	INGREDIENT MAX.
596.45	120	MILO 9%	59.645	6.00	4.25	9.51			
300.64	200	SOYBEAN 48 ML	30.064	10.00		11.87			
66.26	400	FAT A&V BLEND	6.626	16.00	5.42	31.23			
16.58	755	MONO-CALCIUM P	1.658	9.00					
12.42	710	OYSTERSHELL-GR	1.242	6.00					
2.50	600	VITAMINS-BROIL	0.250	125.00				0.250	0.250
2.50	760	SALT	0.250	10.00				0.250	0.250
1.68	500	METHIONINE 98%	0.168	175.00	4.61				
0.50	700	TRACE MINERALS	0.050	50.00				0.050	0.050
0.47	520	LYSINE HCL 98%	0.047	150.00	98.52	875.01			

1000.00 TOTAL WEIGHT $171.90 PER TON $8.59 PER 100LB

NUM	RESTRICTION		MINIMUM	ACTUAL	MAXIMUM	NUTRIENT COST
1	WEIGHT	LBS	1.00	1.0000	1.00	
2	POULTRY ME/LB	KCAL/L	1450.00	1450.00	1450.00	
9	CRUDE PROTEIN	PCT	19.80	20.00	20.00	0.05435
12	ARGININE	PCT		1.34		
13	GLYCINE	PCT		0.86		
14	SERINE	PCT		1.07		
15	HISTIDINE	PCT		0.49		
16	ISOLEUCINE	PCT		6.56		
17	LYSINE	PCT	1.10	1.10		1.97536
18	METHIONINE	PCT		0.47		
19	CYSTINE	PCT		0.33		
20	MET + CYS	PCT	0.80	0.80		1.85410
21	PHENYLALANINE	PCT		0.97		
22	TYROSINE	PCT		0.80		
23	THREONINE	PCT		0.76		
24	TRYPTOPHAN	PCT		0.71		
25	VALINE	PCT		0.92		
26	CRUDE FIBER	PCT		2.54		
27	CRUDE FAT	PCT		8.29		
30	CALCIUM	PCT	0.81	0.81	0.90	0.19410
31	TOTAL PHOS	PCT		0.70		
32	AVAIL-PHOS	PCT	0.45	0.45	0.45	
35	SODIUM	PCT		0.12		
36	CHLORIDE	PCT		0.21		
40	LINOLEIC ACID	PCT		2.16		

TABLE 3

THE EXPERIMENTAL DESIGN OF THE GRAIN SORGHUM STUDY.

Replication Number	"Clean Litter" Pens				"Recycled Litter" Pens			
	Sample Grade	# 4 Milo	# 3 Milo	# 2 Milo	Sample Grade	# 4 Milo	# 3 Milo	# 2 Milo
	No. Chicks							
1	36	36	36	36	36	36	36	36
2	36	36	36	36	36	36	36	36
3	36	36	36	36	36	36	36	36
4	36	36	36	36	36	36	36	36
Total Birds	144	144	144	144	144	144	144	144

TABLE 4

Accession #: C932043

***TOXICOLOGY - LAB RESULTS
7/29/93

ANIMAL/SPECIMEN ID: #1

SPECIMEN	TEST/ID	QUANTITY	UNITS	INTERPRETATION
FEED	AFLATOXIN			NONE DETECTED
	OCHRATOXIN			NONE DETECTED
	VOMITOXIN			NONE DETECTED
	ZEARALENONE			NONE DETECTED

ANIMAL/SPECIMEN ID: #2

SPECIMEN	TEST/ID	QUANTITY	UNITS	INTERPRETATION
FEED	AFLATOXIN			NONE DETECTED
	OCHRATOXIN			NONE DETECTED
	VOMITOXIN			NONE DETECTED
	ZEARALENONE			NONE DETECTED

ANIMAL/SPECIMEN ID: #3

SPECIMEN	TEST/ID	QUANTITY	UNITS	INTERPRETATION
FEED	AFLATOXIN			NONE DETECTED
	OCHRATOXIN			NONE DETECTED
	VOMITOXIN			NONE DETECTED
	ZEARALENONE			NONE DETECTED

ANIMAL/SPECIMEN ID: #4

SPECIMEN	TEST/ID	QUANTITY	UNITS	INTERPRETATION
FEED	AFLATOXIN			NONE DETECTED
	OCHRATOXIN			NONE DETECTED
	OCHRATOXIN			NONE DETECTED
	ZEARALENONE			NONE DETECTED

COMMENTS:
Dr. Reagor/mb

TABLE 5

PROTEIN ANALYSES OF THE FOUR GRADES OF MILO USED IN THE BROILER CHICKEN STUDY. THE REPORT ALSO INCLUDES PROTEIN ANALYSES OF THE FOUR STARTER DIETS.

Samples Tested	Protein Content (Percent) Sample 1	Sample 2	Sample 3	Average
Grades of Milo				
Grade # 2 Milo	9.424	8.852	8.499	8.925
Grade # 3 Milo	9.512	9.957	9.655	9.709
Grade # 4 Milo	9.105	9.643	9.475	9.408
Sample Grade Milo	11.606	10.069	9.780	10.485
Feed Analysis				
Starter # 1 (Used Grade 2 Milo as Grain Source)	24.268	22.090	22.219	22.859
Starter # 2 (Used Grade 3 Milo as Grain Source)	24.034	23.763	22.751	23.516
Starter # 3 (Used Grade 4 Milo as Grain Source)	23.807	22.396	23.746	23.316
Starter # 4 (Used Sample Grade Milo as Grain Source)	23.449	23.185	22.788	23.141

Interpretation of Analyses:

1. All protein analyses were run in triplicate and an average protein content calculated. There will always be variation in sample to sample analysis, and these data are no exception. This is why three samples where drawn and run.

2. Grade 3 and Grade 4 milo samples did not analyze out as expected. We would have expected Grade 4 milo to have a higher protein content than Grade 3 milo. As expected, Grade 2 milo had the lowest and Sample Grade the highest protein content.

3. When the four Starter diets where analyzed for protein content, Starter 1 formulated from Grade 2 milo had the lowest protein content. Using Grade 3, 4, or Sample Grade milo as the grain source only raised the protein content of the other three starter diets by 0.3 to 0.7 percent which resulted in nonsignificant improvements in growth and feed conversion to 2-weeks of age (See Tables 1 & 2).

TABLE 6

THE EFFECT OF FOUR GRADES OF SOUTHWEST TEXAS GRAIN SORGHUM (MILO) ON THE PERFORMANCE OF BROILER CHICKENS THROUGH TWO WEEKS OF AGE.

Number of Birds	Grades of Grain Sorghum			
	No. 2	No. 3	No. 4	Sample Grade
Number of Chicks	288	288	288	288
Body Weight (gms.)				
Males	290	301	302	297
Females	268	291	283	290
Sexes Combined	**279a**	**296a**	**293a**	**294a**
Feed Conversion (Feed/Wt.)	1.205a	1.203a	1.214a	1.240a
Livability (%)	98.96a	100.00a	98.96a	99.96a

[a] Averages followed by similar letters do not differ significantly (P= .05).

TABLE 7

THE EFFECT OF FOUR GRADES OF SOUTHWEST TEXAS GRAIN SORGHUM (MILO) ON PERFORMANCE OF BROILER CHICKENS TO 4 WEEKS OF AGE.

Variables	Type of Litter	USDA Grades of Grain Sorghum No. 2	No. 3	No. 4	Sample	Litter Means
Number of Birds		288	288	288	288	288
Body Weight (gms.)	Old	871a	844a	846a	839a	850x
	New	812a	820a	823a	832a	822y
	O+N	**842k**	**832k**	**835k**	**836k**	**836**
Feed Conversion (Feed/Body Wt.)	Old	1.5757a	1.6136a	1.5836a	1.6419a	1.6037x
	New	1.6367a	1.7026a	1.6440a	1.6484a	1.6579y
	O+N	**1.6062k**	**1.6581k**	**1.6138k**	**1.6452k**	**1.6308**
Livability (%)	Old	100.0a	99.3a	100.0a	99.3a	99.7x
	New	98.6a	97.9a	98.6a	99.3a	98.6x
	O+N	**99.3k**	**98.9k**	**99.3k**	**99.3k**	**99.2**

Legend:

a -- Means within types of litter followed by the same letter (a) do not differ significantly at P=.05.

xy - Litter means followed by different letters (x,y) differ significantly at P=.05.

k -- Combined treatment means (grades of grain sorghum means) followed by the same letter do not differ significantly at P=.05.

TABLE 7 Continued

STATISTICAL ANALYSIS OF DATA ON GROWTH RATE AND FEED CONVERSION OF 4 WEEK OLD BROILERS ON 4 GRADES OF 1993 MILO.

Sources of Variation	Mean Squares and F-Test df	Weight	F-Test	df	Feed Conv.	F-Test
Total Variance	63	5,171	----	31	.0030	
Between Litter Types	1	12,715	8.56*	1	.0235	6.35*
Milo Grades/Litters	6	1,485	0.28	6	.0037	1.54
Replications/Litters	6	1,089	0.20	6	.0010	0.42
Sexes/Litters	2	72,185	13.49**	-	----	
MxR Interaction/Litters	18	5,351	2.21	18	.0024	
MxS Interaction/Litters	6	922	0.38	-	----	
RxS Interaction/Litters	6	1,292	0.53	-	----	
MxRxS/Litters	18	2,422	----	-	----	

TABLE 8

THE EFFECT OF FOUR GRADES OF SOUTHWEST TEXAS GRAIN SORGHUM (MILO) ON PERFORMANCE OF BROILER CHICKENS THROUGH FOUR WEEKS OF AGE

Variables	Type of Litter	USDA Grades of Grain Sorghum No. 2	No. 3	No. 4	Sample	Litter Means
No. Birds Started		288	288	288	288	576
Body Weight (gm.)	Used	2,118a	2,170a	2,095a	2,108a	2,123x
	New	2,086a	2,078a	2,101a	2,118a	2,096x
	U+N/2	**2,102m**	**2,124m**	**2,098m**	**2,113m**	**2,109**
Body Wt. by Sexes (lb.)	Males	5.03a	5.07a	4.99a	4.98a	5.02x
	Females	4.23a	4.29a	4.25a	4.32a	4.27y
	M+F/2	**4.63m**	**4.68m**	**4.62m**	**4.65m**	**4.65**
Feed Conversion (Feed/Body Wt.)	Used	1.980a	2.015b	2.043c	2.144d	2.046x
	New	1.977a	2.019b	2.048c	2.157d	2.050x
	U+N/2	**1.979m**	**2.017n**	**2.045o**	**2.151p**	**2.048**
Livability (%)	Used	97.90a	97.16a	97.87a	97.20a	97.54x
	New	97.92a	97.92a	96.50a	97.22a	97.39x
	U+N/2	**97.91m**	**97.54m**	**97.18m**	**97.21m**	**97.46**

Legend:
- abcd -- Means within types of litter or sex followed by different letters differ significantly at P = .05.
- xy -- Litter or sex means followed by different letters differ significantly at P = .05.
- mnop -- Treatment means followed by different letters differ significantly at P =.05.

TABLE 9

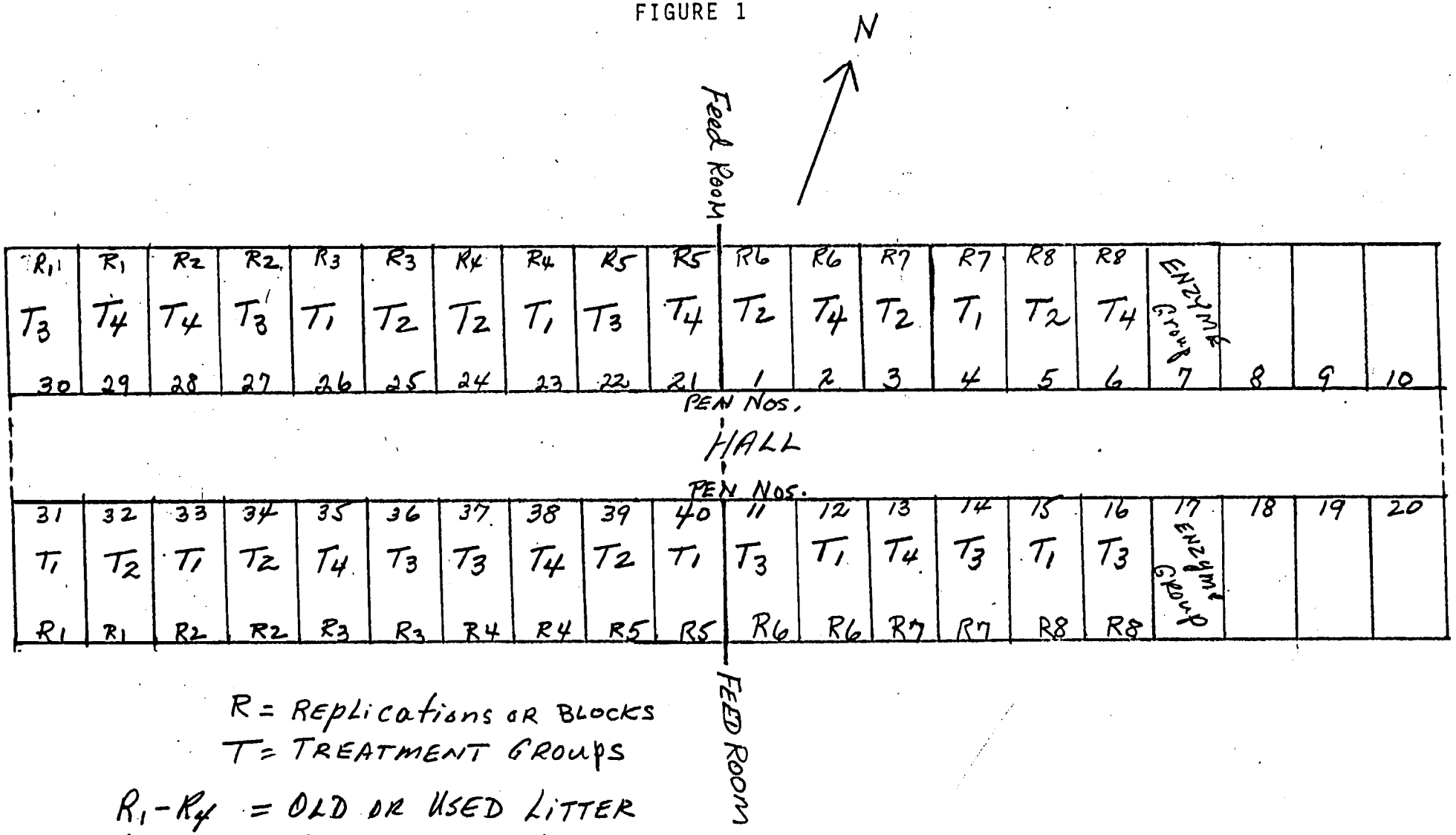
STATISTICAL ANALYSIS OF DATA ON GROWTH RATE AND FEED CONVERSION ON SEVEN WEEK OLD BROILER CHICKENS FED FOUR GRADES OF SOUTHWEST TEXAS WEATHERED MILO.1

Sources of Variation	Mean Squares and F-Test				
	df	Weight	F-Test	df	Feed Conv.	F-Test
Total Variance	63	0.02600		31	0.0058	
Between Treatment (T)	3	0.00223	0.48ns	3	0.0434	24.11**
Between Blocks (B)	3	0.00960	2.05ns	7	0.0015	0.83ns
Between Litters (L)	1	0.01190	2.54ns	1	0.0006	0.33ns
Between Sexes (S)	1	1.83060	390 **	-	------	------
T X B Interactions	9	0.00629	1.34ns	-	------	------
T X L Interactions	3	0.00887	1.89ns	-	------	------
T X S Interactions	1	0.00323	0.69ns	-	------	------
Residual (error)	40	0.00469		20	0.0018	

1 -- Statistical analysis is based on analysis of group means. The unit of measure for body weight was kilograms. The unit of measure for feed conversion was the ratio of total pounds of feed eaten divided by total pounds live broiler produced.

Statistical Significance Legend:
ns -- Mean differences for the variable are not statistically significant.
** -- Mean differences are highly significant.

FIGURE 1



R = Replications or Blocks

T = Treatment Groups

R_1-R_4 = Old or Used Litter

R5-R8 = Fresh or New Litter

Pen Numbers and Treatment Assignment

(Broiler - Grades of Milo Study)

Texas Grain Sorghum Producers Board

Start-up: 7/23/93

FIGURE 2

THE EFFECT OF FOUR GRADES OF SOUTHWEST TEXAS GRAIN SORGHUM (MILO) ON PERFORMANCE OF BROILER CHICKEN THROUGH FOUR WEEKS OF AGE