THE EFFECT OF PLANT POPULATION ON SEED YIELDS OF LAHOMA AND PIPER SUDAN GRASS

By

DONALD JOSEPH HUTCHISON

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1957

Submitted to the faculty of the Graduate School of the Oklahoma State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE May, 1958

THE EFFECT OF PLANT POPULATION ON SEED YIELDS OF LAHOMA AND PIPER SUDAN GRASS

Thesis Approved:

Charles E. Denward
Thesis Adviser

Frank T. Davies

Robert MacVicar
Dean of the Graduate School

ACKNOWLEDGEMENTS

The writer wishes to express his appreciation to the staff of the Agronomy Department of Oklahoma State University for their helpful advice and criticisms.

Special appreciation is due Charles E. Denman, thesis adviser, for his encouragement, advice, and helpful criticisms during the course of this research study and during the preparation of this thesis. The writer also wishes to thank the other members of his committee, Frank F. Davies, W. C. Elder, Dr. J. Q. Lynd, Dr. James S. Brooks and Dr. Henry I. Featherly; Dr. Robert D. Morrison for his help in outlining the statistical analysis; and Mrs. Marilyn Jackson for typing the manuscript.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Observation has shown that the growth habits of plants are modified by the space available for their development. Various experiments conducted with cotton, corn, grain sorghums and small grains have demonstrated the effect of spacings between plants on their development and yield.

A need for more and newer information regarding varietal response to different spacings arises as new varieties are introduced or developed by agronomic research. The growers unacquainted with these new crops or varieties are also in need of information regarding date of seeding.

The primary purpose of this paper is to provide information leading to the optimum production of foundation seed from breeders seed of sudan grass. More specifically, the aim is to determine whether a thin stand or wide spacing rates will materially reduce or increase yields.

LITERATURE REVIEW

Georgeson in Kansas (6)[1/] stated that on experiments conducted with red kafir corn, the largest yield of grain was obtained when the rows were 32 inches apart and the stalks 4 inches apart within the row. One year later Georgeson (7) stated that for a maximum grain crop of kafir corn on soil of moderate fertility, the plants should stand 4 to 6 inches apart within the row and 9 inches apart within the row on high fertility soils.

Morrow and Bone in Oklahoma (21) in experiments using white-hulled kafir corn found the seed yields were greater from plots drilled in rows than plots seeded broadcast. The largest yields were obtained when the stalks were 3 inches apart in rows 3 feet apart.

Fields (5) showed that on average upland soils the kafir corn gave highest grain yields when planted in rows 3 inches apart with one stalk to each 3 or 4 inches. Ball and Leidigh in Texas (1) found that milo gave greater yields when plants were spaced 6 to 8 inches apart within the row.

Thick seeding rates of less than 2 inches between plants for milo appeared to be desirable in Texas, according to Hastings (8). This thicker seeding rate resulted in smaller and more easily handled plant stumps, gave better stands, insured earlier and more uniform maturity,

---

1/Numbers in parentheses refer to Literature Cited.

and produced better yields. A seeding rate of 5-6 pounds per acre was recommended.

In a series of experiments conducted in Texas, Edwards (3) stated that rate and date plantings of sorghums have shown, in general, that the grain sorghums produce highest yields of both forage and grain with a stand of one plant every 4 to 8 inches in the row. Sorgos produced the best yields, considering both quality and quantity of forage, with plants from 2 to 4 inches apart in the row. Karper (12), of Texas, said that spacings of 2 to 3 inches between plants gave highest yields when space testing milo, kafir and feterita.

Edwards (4), of Texas, reported the results of seed yields for five varieties of grain sorghums with various within row spacings of plants. The spacing of plants within rows that gave highest yields for each variety were as follows: 5.5 inches for feterita, 4.6 inches for Dwarf milo, 8.8 inches for Blackhull kafir, 4.9 inches for Sumac sorgo, and 7.0 inches for Freed sorgo.

Rothgeb (22), of Texas, stated that Dwarf milo in rows spaced $3\frac{1}{2}$ feet apart made highest yields when plants were spaced 12 inches apart. When rows were spaced 7 feet apart, the highest yield was obtained from plants spaced 8 to 12 inches apart. Dawn kafir in rows $3\frac{1}{2}$ feet apart produced highest yields from plants spaced 15 to 19 inches apart. When rows were 7 feet apart, plants spaced 4 to 5 inches apart gave greater yields.

At the Woodward, Oklahoma Field Station, Sieglinger (23) found that Dwarf yellow milo in rows 44 inches apart made highest yields when plants were 24 inches apart within the row. In rows 88 inches apart, plants spaced 2 inches apart gave the highest yields. Sunrise

kafir in rows 44 inches apart gave highest yields when plants were spaced 12 inches apart, while in rows 88 inches apart, highest yields were obtained when plants were spaced 6 inches apart.

Blackhull kafir, studied by Klages (15) in Oklahoma, gave best yields when plants were planted in rows $3\frac{1}{2}$ feet apart and spaced 8-12 inches apart within rows.

Sieglinger (24) reporting on data from spacing experiments at Woodward, Oklahoma, stated that the milos, common feterita, shallu and Sunrise kafir all produced similar yields when the spacing of plants within rows was from 6 to 30 inches. Spur feterita, the kaoliangs and probably all the kafirs except Sunrise show progressive reductions in yield for every successive increase in within row spacing of plants from 6 inches up to 30 inches.

Swanson (25) conducted experiments at Fort Hays, Kansas, using Dawn kafir. Highest yields were obtained when plants were spaced 6 to 12 inches apart within the rows and 40 inches between rows. Klages (16) reporting on Blackhull kafir grown in Oklahoma, found that the highest yields were from plants 4 to 6 inches apart in rows $3\frac{1}{2}$ feet apart.

Martin and Sieglinger (19) reported the average optimum spacings between plants for the production of sorghum grain in the Great Plains in 1929. They stated that when rows were 40 to 44 inches apart, the optimum spacings within rows were 18 inches for Dwarf yellow milo, 12 inches for Sunrise kafir, 9 inches for feterita and 6 inches for Freed sorghum and for kafirs other than Sunrise. Wide spacing of plants in the rows increased the number of heads per plant and the size of heads, but decreased the number of heads per acre. There is a slight increase in the size of kernels with wide spacing. The best spacing for the

different varieties of grain sorghum depend largely upon the number of heads produced per plant under conditions favorable for tillering. Wide spacing delays maturity of the crop by an average of one to three days, but has no consistent effect upon the height of the crop.

Karper and coworkers (13) of Texas, stated that sparsely tillering types such as the kafirs, Darso, kaoliangs and sorghums of similar habit should be closely spaced, 6 to 8 inches within the row for greatest yields. Hegari and feterita tiller quite freely and should be planted so as to allow 6 to 12 inches between plants in the row. Free-tillering grain types such as the milos should, for best results, be given more row space per plant, such as 12 to 24 inches between plants.

Klitz and others (14), in Oklahoma, observed that the 40 to 44 inch row is satisfactory for sorghums and that the use of wide or alternate rows is seldom profitable. The best spacing in the row recommended is 6 to 9 inches for kafirs, Darso and Schrock; 9 inches for the feteritas; and 18 inches for Dwarf yellow milo.

Hood (10) reported on between row and within row spacings of Martin, Redlan, Kafir 44-14 and Resistant Wheatland milo. On between row spacings of 7, 14, 21 and 42 inches the spacing of 21 inches between rows gave highest yields. Within row plant spacings of 1, $1\frac{1}{2}$ and 2 inches between plants showed that the highest yield was from plants spaced $1\frac{1}{2}$ inches within the row in rows 21 inches apart.

Brandon (2) reported that the highest yield of corn in the west central Great Plains came when the plants were spaced 24 inches apart within the rows and the rows spaced 44 inches apart. For rows spaced $8\frac{1}{2}$ feet apart, Haynes (9) stated that highest yields came when plants were spaced 4 inches apart within the rows.

Results of millet spacing trials by Li and Meng (18) showed that highest yields are obtained when the rows are spaced 12 inches apart and the plants are spaced 2 to 4 inches apart within rows.

Kankis and Reitz (11) reported that the highest yields of Clinton oats were obtained when rows were spaced 7 inches apart and the plants spaced 5 inches apart within the rows.

Cotton spacing studies by Mayton (20) in Alabama showed that highest yields were obtained when plants were spaced 18 inches apart within rows and the rows spaced $2\frac{1}{2}$ to $4\frac{1}{2}$ feet apart. Lane (17) reported that yields in Oklahoma were increased when plants within rows were thinned to 15 to 20 inches apart.

MATERIALS AND METHODS

A within row spacing study on yields of sudan grass was conducted at the Oklahoma State University Agricultural Experiment Station near Perkins in the summer of 1957 on a Norge fine sandy loam upland soil.

Two types of sudan grass, both of which are adapted and recommended for Oklahoma, were selected for study. A sweet sudan grass variety, Lahoma, was planted using breeders seed furnished by the Experiment Station. The other type planted was a common variety, Piper, of commercial grade seed purchased from a local seed dealer.

The field layout consisted of two main plots each of which was subdivided into four replications in a randomized block design. The two main plots had two continuous border rows on each side. Each replication consisted of 8 treatments in rows 20 feet long and 3 feet between rows. Alley width between replications was 3 feet. Each treatment was placed in each replication at random. The treatments were composed of 3, 6, 12 and 18 inches within row spacings of plants of both Lahoma and Piper sudan grass. The field layout plan is shown in Figure 1.

A study of clipping the plants of one main plot after they were well established to determine the effect on seed yields was added to the experiment.

A Planet junior single-row, push-type planter was used to seed the plots. Seed was planted very thick in order to assure that thin-

CLIPPED				UNCLIPPED			
Lahoma Border Row							
Lahoma Border Row							
Rep IV	Rep III	Rep II	Rep I	Rep IV	Rep III	Rep II	Rep I
6 Lahoma	6 Lahoma	18 Piper	3 Lahoma	6 Lahoma	6 Lahoma	18 Piper	3 Lahoma
18 Piper	6 Piper	3 Piper	3 Piper	18 Piper	6 Piper	3 Piper	3 Piper
12 Piper	18 Piper	3 Lahoma	18 Piper	12 Piper	18 Piper	3 Lahoma	18 Piper
18 Lahoma	3 Lahoma	6 Lahoma	6 Piper	18 Lahoma	3 Lahoma	6 Lahoma	6 Piper
3 Lahoma	12 Lahoma	12 Lahoma	6 Lahoma	3 Lahoma	12 Lahoma	12 Lahoma	6 Lahoma
3 Piper	12 Piper	12 Piper	12 Lahoma	3 Piper	12 Piper	12 Piper	12 Lahoma
6 Piper	3 Piper	18 Lahoma	12 Piper	6 Piper	3 Piper	18 Lahoma	12 Piper
12 Lahoma	18 Lahoma	6 Piper	18 Lahoma	12 Lahoma	18 Lahoma	6 Piper	18 Lahoma
Lahoma Border Row							
Lahoma Border Row							

Figure 1. Field lay-out showing randomization of spacings and locations of varieties within blocks for non-clipped and clipped plots. Numbers in front of Lahoma and Piper refer to the 3, 6, 12 and 18 inch within row plant spacings.

ning to the desired within row plant spacings might be accomplished. The seeding date was May 29, which was later than the recommended seeding date for seed production in Oklahoma of May 1 to May 15. This late seeding date was necessary because of the heavy, continuous rain through May.

On June 17 when the seedlings were approximately 6 inches high, each row was thinned to its predetermined spacing between plants. The spacings between plants within the row of 3, 6, 12, and 18 inches was attained through the use of a yardstick and removing seedlings between spacings, making sure the entire plant was removed. Assuming 100 per cent germination, the rates of seeding in pounds per acre to get a stand equal to the 3, 6, 12 and 18 inch within row spacings are as follows: for the Lahoma 1.01, 0.50, 0.25, and 0.18 pounds per acre respectively; and for Piper 1.39, 0.69, 0.35, and 0.23 pounds per acre respectively.

The plants of one of the main plots were clipped to a height of 6 inches on July 10, at which time they had become approximately 18 inches tall. This was accomplished by the use of a hand sickle.

General cultural methods common to the area were practiced during the growing season.

An abundance of rain fell during the spring and early summer of 1957, the total rainfall being 31.18 inches from January through May. Following planting, a dry period occurred in late June and July (see Table I.). A supplemental irrigation of $1\frac{1}{2}$ inches of water was applied July 30. There was ample rainfall in August and September.

The plots were harvested at a time of maturity when the moisture content had decreased sufficiently to allow safe storage of the heads. The treatments containing Piper sudan were harvested on September 20.

TABLE I

DAILY RAINFALL AT PERKINS, OKLAHOMA, JANUARY 1, 1957 TO SEPTEMBER 30, 1957

Day	Months								
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
1					.33	.51	.81		
2			.31	.74	.90	.25			
3				.24	.12	.32		1.48	.09
4	.32	.01	.33		.06	.09			
5									
6	.02		.03						.35
7		.58		.15					
8					.70				
9						2.26			
10			.01		.01				
11					1.41	.21			1.88
12				.22		.01			
13					.48				
14									3.06
15		.06						1.15	2.26
16								.05	
17			.05		1.07	2.20		.05	
18		.17		.14	.14	.02		.10	
19				1.52					
20			.68	1.44	3.19				
21	.08		.35						.17
22	.01	.29		1.39	.49	.57	.04		
23			.27	.03		1.59			
24	.06	.08	.26		1.60				
25			.01	.19					
26	.01			.01					
27						.65			
28									
29				.07					
30	.31			.16	.88				
31			.25		.27				
Totals	.81	1.19	2.55	6.30	11.65	8.68	.85	2.83	7.81

The plots of Lahoma sudan grass, which matures approximately three weeks later than Piper, were harvested October 15. The heads were hand harvested and placed in paper bags. The entire 20 feet of each row was harvested.

The heads were threshed with a small hammer mill, the speed of which was reduced whereby no visible cracking of kernels was evident. The material was then run through a Clipper cleaner No. 2B.

Grain yields were weighed on a grams per plot basis and then converted to a pounds per acre basis. The yields were then analyzed statistically.

RESULTS AND DISCUSSION

As the plants reached maturity, lodging was observed in all the plots having 18 inch within row plant spacing and in some of the plots with 12 inch within row spacing.

Through observation of the clipped and unclipped plots, it was found that there was less tillering in the clipped plots. Thus there were fewer heads on the clipped plots and maturity was somewhat delayed. The unclipped plots of both Lahoma and Piper had higher average grain yields than those of the clipped plots.

Pests were no problem during the growing season. Chinch bugs were present in nearby pearl millet plots where they did considerable damage. They did not reach large enough populations in the sudan plots to become troublesome. Damage from birds was negligible.

The main purpose of the experiment was to test whether within row plant spacings had an effect on seed production. Therefore, clipped and non-clipped plots for each variety were also analyzed separately.

Due to unequal spacings, the sum of squares for the linear, quadric and cubic trends of the treatments were obtained by using the abbreviated Doolittle procedure.

The grain yields for different within row spacings of the non-clipped Lahoma plots are shown in Table II. These data showed that the 6 inch and 18 inch within row spacings gave the highest yields followed in order by the 12 inch and 3 inch spacings. The average grain yields

TABLE II

GRAIN YIELDS IN POUNDS PER ACRE OF NON-CLIPPED LAHOMA SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Spacing	Blocks 1	2	3	4	Spacing Averages
3 inches	811	624	949	1128	878
6 inches	781	938	1126	1221	1017
12 inches	920	880	965	854	905
18 inches	1226	934	867	1037	1016

TABLE III

ANALYSIS OF VARIANCE OF THE GRAIN YIELD DATA FROM NON-CLIPPED LAHOMA SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Source of Variation	D. F.	Sum of squares	Mean square	F value
Total	15	396,302.4		
Blocks	3	96,934.7		
Spacings	3	63,806.70		
Linear (1)		(13,904.79)	13,904.79	
Quadric (1)		(191.58)	191.58	
Cubic (1)		(49,710.33)	49,710.33	1.899
Error	9	235,561.0	26,173.44	

C. V. = 16.8%

for the above spacings were 1017, 1016, 905 and 878 pounds per acre respectively. The linear, quadric and cubic trends were not statistically significant (Table III).

For the clipped Lahoma plots the grain yields are shown in Table IV. The 12 inch within row plant spacing gave the greatest yields followed by the 18 inch and 6 inch spacings with the 3 inch spacing giving the lowest yield. The average grain yields for the above spacings were 843, 716, 713 and 678 pounds per acre respectively. These trends were not statistically different (Table V).

Grain yields of the non-clipped Piper plots are given in Table VI. The 12 inch within row spacing had the highest yields followed by the 6 inch, 3 inch and 18 inch spacings in that order. The average grain yields for the above spacings were 1660, 1595, 1287 and 1112 pounds per acre respectively. There was no statistically significant difference in these yields (Table VII).

Table VIII shows the seed yields of the clipped Piper plots. The spacings giving the highest yields were the 12 inch and 18 inch within row plant spacings followed by the 6 inch and 3 inch spacings in that order. The average grain yields for the above spacings were 1147, 1145, 1024 and 893 pounds per acre respectively. These data, when analyzed, showed a positive linear trend which was significant at the 5% level (Table IX).

TABLE IV

GRAIN YIELDS IN POUNDS PER ACRE OF CLIPPED LAHOMA SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Spacing	Blocks 1	2	3	4	Spacing Averages
3 inches	760	477	781	693	678
6 inches	712	648	736	754	713
12 inches	674	874	957	866	843
18 inches	635	632	726	870	716

TABLE V

ANALYSIS OF VARIANCE OF THE GRAIN YIELD DATA FROM CLIPPED LAHOMA SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Source of Variation	D. F.	Sum of squares	Mean square	F value
Total	15	207,854.4		
Blocks	3	61,776.2		
Spacings	3	62,981.20		
Linear (1)		(9,262.61)	9,262.61	
Quadric (1)		(43,369.81)	43,369.81	4.697
Cubic (1)		(10,348.78)	10,348.78	
Error	9	83,097.0	9,233.0	

C. V. = 13.0%

TABLE VI

GRAIN YIELDS IN POUNDS PER ACRE OF NON-CLIPPED PIPER SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Spacing	Blocks 1	2	3	4	Spacing Averages
3 inches	1000	1202	1501	1445	1287
6 inches	1883	1938	1238	1320	1595
12 inches	2555	1574	1333	1178	1660
18 inches	1112	963	1026	1347	1112

TABLE VII

ANALYSIS OF VARIANCE OF THE GRAIN YIELD DATA FROM NON-CLIPPED PIPER SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Source of Variation	D. F.	Sum of squares	Mean square	F value
Total	15	2,598,589.9		
Blocks	3	311,244.2		
Spacings	3	802,073.21		
Linear (1)		(93,183.95)	93,183.95	
Quadric (1)		(707,577.68)	707,577.68	4.288
Cubic (1)		(1,311.58)	1,311.58	
Error	9	1,485,272.5	165,030.3	

C. V. = 28.7%

TABLE VIII

GRAIN YIELDS IN POUNDS PER ACRE OF CLIPPED PIPER SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Spacing	Blocks 1	2	3	4	Spacing Averages
3 inches	818	1003	885	864	893
6 inches	995	1102	1078	920	1024
12 inches	1259	1101	1090	1139	1147
18 inches	1346	976	1011	1246	1145

TABLE IX

ANALYSIS OF VARIANCE OF THE GRAIN YIELD DATA FROM CLIPPED PIPER SUDAN GRASS SPACING STUDIES AT PERKINS, OKLAHOMA IN 1957

Source of Variation	D. F.	Sum of squares	Mean square	F value
Total	15	320,030.9		
Blocks	3	16,758.2		
Spacings	3	175,653.70		
Linear (1)		(140,851.57)	140,851.57	9.933*
Quadric (1)		(34,483.68)	34,483.68	
Cubic (1)		(318.45)	318.45	
Error	9	127,619.0	14,179.89	

C. V. = 11.3%

* Indicates significance at the 5% level

SUMMARY AND CONCLUSIONS

This experiment was conducted in 1957 at the Oklahoma State University Agricultural Experiment Station near Perkins, Oklahoma. The study was concerned with the effect of different within row plant spacings on seed production of sudan grass. The different within row spacings used were 3, 6, 12 and 18 inches.

Only limited conclusions, which may be modified by future results, can be drawn.

Clipped and non-clipped plots of Lahoma sudan grass showed no significant difference between yields in the different within row spacing treatments.

Non-clipped plots of Piper sudan grass showed no significant difference between yields in the different within row spacing treatments. Clipped plots of Piper, however, showed a positive regression between within row spacings and grain yields.

LITERATURE CITED

1. Ball, C. R. and A. H. Leidigh. Milo as a dry-land grain crop. U.S.D.A. Farmers Bull. 322. 1908.

2. Brandon, J. F. The spacing of corn in the West Central Great Plains. Agron. Jour. 29:584-599. 1937.

3. Edwards, R. W. Progress Report of Substation No. 12, Chillicothe, Texas. Tex. Agr. Exp. Sta. Bull. 202. 1916.

4. _____. Report of Experiments at Substation No. 12, Chillicothe, Texas. Tex. Agr. Exp. Sta. Bull. 253. 1919.

5. Fields, J. Summary of Results of Experiments. Okla. Agr. Exp. Sta. Bull. 59. 1903.

6. Georgeson, C. C., et. al. Experiments with Corn. Exp. Sta. of the Kan. St. Agr. Coll., Manhattan, Bull. 56. 1895.

7. _____. Kafir Corn: Characteristics, Culture and Uses. U.S.D.A. Farmers Bull. 37. 1896.

8. Hastings, S. H. The Importance of Thick Seeding in the Production of Milo in the San Antonio Region. U.S.D.A. Bull. 188. 1915.

9. Haynes, J. L. and J. D. Sayre. Response of Corn to Within-Row Competition. Agron. Jour. 48:362-364. 1956.

10. Hood, Eldon L. Effects of Row Spacing and Seeding Rates on Yield in Grain Sorghums. Unpublished Master of Science Thesis, Okla. A. and M. College. 1951.

11. Kankis, K. and L. P. Reitz. Tillering and Yield of Oat Plants Grown at Different Spacings. Agron. Jour. 47:147. 1955.

12. Karper, R. E. Progress Report, Substation No. 8, Lubbock, Texas. Tex. Agr. Exp. Sta. Bull. 219. 1917.

13. _____, J. R. Quinby, D. L. Jones and R. E. Dickson. Grain Sorghum Date of Planting and Spacing Experiments. Tex. Agr. Exp. Sta. Bull. 424. 1931.

14. Kiltz, B. F., et. al. Sorghums for Grain and Forage. Okla. Agr. Exp. Sta. Bull. 210. 1933.

15. Klages, K. H. A Report on Investigations of Farm Problems. Biennial Report of the Okla. Agr. Exp. Sta. for 1924-1926.

16. _____. Yields of Adjacent Rows of Sorghums in Variety and Spacing Tests. Agron. Jour. 20:582-598. 1928.

17. Lane, H. C. Cotton Spacing - A Review and Discussion. Tex. Agr. Exp. Sta. Misc. Pub. 170. 1956.

18. Li, H. W. and C. J. Meng. Experiments on the Planting Distance in Varietal Trials with Millet. Agron. Jour. 29:577-583. 1937.

19. Martin, J. H. and J. B. Sieglinger. Spacing and Date of Seeding Experiments with Grain Sorghums. U.S.D.A. Tech. Bull. 131. 1929.

20. Mayton, E. L. Cotton Spacing. Ala. Agr. Exp. Sta. Circular 76. 1937.

21. Morrow, G. E. and J. H. Bone. Field Crop Experiments, 1897. Okla. Agr. Exp. Sta. Bull. 33. 1898.

22. Rothgeb, B. E. Cultural Experiments with Grain Sorghums in the Texas Panhandle. U.S.D.A. Bull. 976. 1922.

23. Sieglinger, J. B. Grain Sorghum Experiments at the Woodward Field Station in Oklahoma. U.S.D.A. Bull. 1175. 1923.

24. _____. The Spacing of Grain Sorghums. Agron. Jour. 18:525. 1926.

25. Swanson, A. F. Cereal Experiments at the Fort Hays Branch Station, Hays, Kansas, 1912-1923. U.S.D.A. Tech. Bull. 14. 1927.

VITA

Donald Joseph Hutchison

Candidate for the Degree of

Master of Science

Thesis: THE EFFECT OF PLANT POPULATION ON SEED YIELDS OF PIPER AND LAHOMA SUDAN GRASS

Major Field: Field Crops

Biographical:

Personal data: Born October 30, 1930 at Thomas, Oklahoma, the son of Leonard J. and Edith Mae Hutchison.

Education: Attended elementary school at Thomas, Oklahoma. Received a high school diploma at Thomas High School, Thomas Oklahoma, 1948. Undergraduate work at Southwestern State College, Weatherford, Oklahoma, 1950 and 1955; Oklahoma Agricultural and Mechanical College, 1948-1950 and 1955-1957. Graduate study at Oklahoma State University, 1957-1958.

Experiences: Reared on farm; worked for Agronomy Department at Oklahoma State University summer of 1956 and 1957 and school year of 1957-1958; military service, U. S. Air Force 1951-1954, Korea 1952-1953.

Date of Final Examination: May, 1958

THESIS TITLE: THE EFFECT OF PLANT POPULATION ON SEED YIELDS OF PIPER AND LAHOMA SUDAN GRASS

NAME OF AUTHOR: DONALD JOSEPH HUTCHISON

THESIS ADVISER: CHARLES E. DENMAN

The content and form have been checked and approved by the author and thesis adviser. "Instructions for Typing and Arranging the Thesis" are available in the Graduate School office. Changes or corrections in the thesis are not made by the Graduate School office or by any committee. The copies are sent to the bindery just as they are approved by the author and faculty adviser.

NAME OF TYPIST: MRS. MARILYN JACKSON