

NOTES ON THE GROWTH AND  
FRUITING OF ANDROPOGON SCOPARIUS WITH SOME  
REFERENCE TO ITS REACTION TO A CHANGED ENVIRONMENT

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By

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Bachelor of Science

Texas Agricultural and Mechanical College

College Station, Texas

1940

Submitted to the Department of Botany and Plant Pathology

Oklahoma Agricultural and Mechanical College

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

1941

OKLAHOMA  
AGRICULTURAL AND MECHANICAL  
COLLEGE

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## INTRODUCTION

This paper was initiated by wide differences in vegetative characters of Andropogon scoparius Michx. observed among plants from various states which had been transplanted to the Forest Nursery west of Stillwater, Oklahoma. The question was raised as to whether the differences were inherited characteristics or due to environment, and, if due to environment, to what extent had the plants retained their acquired characters after growing in a new environment for six years.

That most plants do respond and become accustomed to a certain length of day is a well established fact. This tendency of plants to respond to a change in the length of the day has been set forth in the form of a "bioclimatic law" by Hopkins (3)<sup>1</sup>, who states:

Other conditions being equal, the variation in time of occurrence of a given periodic event in the life activity of plants in temperate North America is at the general average rate of four days to each degree of latitude, five degrees of longitude, and four hundred feet of altitude, progressing northward, eastward and upward in spring and early summer and the reverse in late summer and early autumn.

That grasses retain the habit, or tendency, to grow and flower in response to day length, so that when plants are moved from north to south, the introduced individuals will flower earlier than native plants of the same species, or when the movement is northward the moved plants will flower later than the natives, has also been observed. (4)

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<sup>1</sup>Refers to literature cited.

The flowering time of accessions to the nursery has been accurately recorded to determine whether or not plants of A. scoparius retain this tendency after six years growth in their present location.

The recent wide-spread interest in grasses in general, brought on by a recognition of their importance in soil and water conservation and wild-life protection, has shown the need for more information concerning our more important range species of grasses. More data is especially needed on the seeding habits of the various grasses, vegetative characters which may indicate prolific seed producers, and the reaction of plants when moved to localities other than that in which they were collected.

According to Hitchcock (2) A. scoparius is distributed from Quebec to Alberta and Idaho, south to Florida and Arizona. It is of major importance, however, only in the tall grass or true prairie region. (1). Weaver and Fitzpatrick (5) rate it as the second most important species of the prairie, second only to its relative, Andropogon furcatus.

The fact that A. scoparius is a valuable forage grass over such a wide area makes a study of its characteristics important from an economic as well as a purely ecological view-point.

#### REVIEW OF LITERATURE

The importance of the relationship existing between light and plant growth and development have been so long

recognized and these relationships have been of so much interest to investigators that a very extensive literature on the subject has been developed. Since this relationship is only one phase of the present paper it is not considered necessary to attempt even a brief review of this literature. For a more extended discussion of the work in this field the writings of W. W. Garner and H. A. Allard of the United States Department of Agriculture may be consulted.

The literature on the variations within a species of plants according to environment is also extensive, but that concerning the variations among plants of Andropogon scoparius is rather limited.

Hitchcock (2) in his Manual of Grasses of the United States allows for quite a wide variation in his description of A. scoparius, as follows:

Plants green or glaucous, often purplish; culms tufted, from slender to robust, compressed, 50 to 150 cm. tall, erect, the upper freely branching; sheaths and blades commonly glabrous or nearly so, frequently sparsely pilose at their junction, rarely pubescent to villous throughout; the blades 3 to 6 mm. wide, flat; racemes 3 to 6 cm. long, mostly curved, the filiform peduncles mostly wholly or partly included in the sheaths, commonly spreading, the rachis slender, flexuous, pilose, sometimes copiously so; sessile spikelets 6 to 8 mm. long; pedicellate spikelet reduced, short awned, spreading, the pedicel pilose.

Savage (4), in discussing the importance of source of seed, makes the following statement:

When grown at Woodward, Oklahoma, the plants from the most southern locations were decidedly later in flowering but noticeably taller, more vigorous, and produced much more forage than those grown from seed harvested farther north. The growth was successively less and the plants earlier in maturity with each successive northerly acquisition.

## HISTORY OF THE PLANTS STUDIED

The plants studied were located in the Forest Nursery two miles west of Stillwater, Oklahoma, on a very fine, sandy, loam soil. They were collected in various parts of Texas, Oklahoma, Arkansas, Kansas, Nebraska, and Colorado by employees of the Soil Conservation Service during the year 1934, and transplanted to the nursery. The plants were planted in rows, four bunches to the row, in the order in which they were received, without any effort being made to favor any group of plants. The rows were spaced about thirty inches apart with the bunches twenty-four inches apart in the row.

The ground between the rows has been hoed at least once each season to remove weeds; otherwise the plants have received no treatment that should affect their growth. The previous years growth was removed to a height of three to six inches before growth began in the spring of 1940 so that new growth could be observed more easily.

## METHOD OF STUDY

The plants were visited at about ten-day intervals from the time growth began in the spring until anthesis started, and notes were taken on the relative rate of growth, color of plants, degree of hairiness, and the relative size of stems and leaves. After anthesis began, the plants were visited at two or three-day intervals to get a record of when anthesis began on each group of plants.



Seed-heads were collected from each group of plants, after anthesis, and studied to see if all came within the description of Andropogon scoparius as given by Hitchcock. (2)

#### RESULTS AND DISCUSSION

All plants showed green shoots emerging on the same day, March 29, which indicates that, if the tendency to start growth on the beginning of a certain length of day is an acquired character of the plants, the tendency has been lost during the time they have been growing under the present conditions.

Table I shows the number assigned to the various plants in the nursery, the place where they were collected, color, degree of hairiness, relative size of stems, relative rate of growth, and the time of anthesis.

The division of the plants according to color was made on an arbitrary basis, there being an intergrading which often made a decision difficult. As the plants became older, and especially after they started taking on the characteristic bronze hue, it became more difficult to say whether a given plant should be classed as green or glaucous.

Table II shows that about fifty per cent of the plants were green and fifty per cent were glaucous. It is further noted, in Table I, that among the plants from each area there were some green and some glaucous. In fact, in a few cases, the two colors were found among the plants of a single row.

TABLE I

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a24	Payne Co. Okla.	Green	Glabrous	Medium	Slow	:10"	:44"	:7-22-40:
C5a25	" " "	"	"	"	"	:10	:45	:7-22-40:
C5a26	" " "	"	"	"	"	:10	:44	:7-22-40:
C5a27	Mayes Co. Okla.	Glaucous	Glabrous	Fine	Slow	:14	:40	:8-16-40:
C5a28	" " "	"	"	"	"	:16	:38	:8-18-40:
C5a30	" " "	"	Villous	Coarse	Rapid	:12	:52	:8-12-40:
C5a31	" " "	Green	Glabrous	Medium	Slow	:12	:29	:7-19-40:
C5a33	" " "	Glaucous	"	Fine	"	:20	:32	:8-18-40:
C5a34	Larner, Colorado	Green	Glabrous	Fine	Slow	:12	:29	:7-31-40:
C5a36	" "	Glaucous	Villous	Coarse	Slow	:14	:56	:8-12-40:
C5a37	" "	"	Glabrous	Medium	"	:14	:40	:7-22-40:
C5a38	" "	"	"	"	"	:14	:44	:7-19-40:

N<sup>1</sup> -- Number in nursery.

S<sup>2</sup> -- Size of stem.

R<sup>3</sup> -- Relative growth rate.

Ht. <sup>4</sup> -- Height when flower stalks started.

Ht. <sup>5</sup> -- Height of mature plants.

Date<sup>6</sup> -- Date of anthesis.

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a39	Larner, Colorado	Green	Glabrous	Medium	Slow	9	44	7-22-40
C5a40	" "	Glaucous	"	"	"	12	50	7-24-40
C5a41	" "	Green	"	"	"	10	44	7-19-40
C5a103	" "	Glaucous	Villous	Coarse	Rapid	12	40	7-29-40
C5a29	Kay Co. Oklahoma	"	Glabrous	Medium	"	11	43	7-19-40
C5a42	" " "	"	Villous	Coarse	Slow	20	46	7-19-40
C5a44	" " "	"	Glabrous	"	"	15	30	7-26-40
C5a45	" " "	"	"	Medium	"	15	38	7-22-40
C5a32	Garden City, Kansas	Glaucous	Glabrous	Medium	Slow	11	42	7-15-40
C5a51	" " "	"	"	"	Fair	10	43	7-24-40
C5c69	" " "	"	"	Fine	Rapid	10	42	7-19-40
C5a35	Noble Co. Oklahoma	Glaucous	Glabrous	Medium	Slow	14	45	7-24-40
C5a52	" " "	"	"	"	Fair	12	50	7-19-40
C5a54	" " "	"	"	"	"	18	36	7-19-40

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a55	Noble Co. Okla.	Green	Glabrous	Fine	Slow	15	30	7-15-40
C5a56	" " "	Glaucous	"	Medium	Fair	20	40	8-8-40
C5a57	" " "	"	"	"	Slow	11	34	7-29-40
C5a58	Lincoln Co. Okla.	Green	Villous	Fine	Fair	9	34	7-31-40
C5a59	" " "	"	"	"	"	12	32	7-19-40
C5a60	" " "	Glaucous	"	Coarse	Slow	12	27	7-29-40
C5a61	" " "	Green	"	"	"	16		
C5a62	" " "	Glaucous	"	"	Fair	11		8-18-40
C5a63	" " "	Green	"	Medium	Slow	9	32	8-6-40
C5a64	" " "	"	"	"	Fair	13		8-18-40
C5a65	" " "	"	"	Fine	V. Slow	9	36	8-14-40
C5a66	" " "	"	Glabrous	Medium	Fair	12	40	7-19-40
C5a67	" " "	"	Villous	"	V. Slow	10	38	8-12-40
C5c70	" " "	Glaucous	Glabrous	Fine	Rapid	10	42	7-19-40

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5c71	Lincoln Co. Okla.	Glaucous	Glabrous	Fine	Rapid	10	39	7-19-40
C5a47	Milano, Texas	Glaucous	Villous	Coarse	Rapid	18	54	8-12-40
C5c100	" "	"	Glabrous	"	Fair	22		
C5c101	" "	"	Villous	"	"	24		
C5a43	Pontotoc Co. Okla.	Green	Glabrous	Medium	Slow	20	48	8-14-40
C5a68	" " "	"	"	Fine	Fair	12	39	7-29-40
C5a69	" " "	Glaucous	Villous	Medium	Rapid	15	54	7-24-40
C5a70	" " "	"	"	Coarse	V. Slow	14	50	7-19-40
C5a71	" " "	"	"	"	Fair	15	58	8-6-40
C5a72	" " "	Green	Glabrous	Fine	V. Slow	16	38	7-17-40
C5a73	" " "	Glaucous	Villous	Medium	Fair	12	42	7-31-40
C5a74	" " "	Green	Glabrous	"	"	14	36	8-16-40
C5a75	" " "	"	"	Fine	"	8	30	7-26-40

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a76	Pontotoc Co. Okla.	Glaucous	Glabrous	Medium	Fair	8	40	7-31-40
C5c92	" " "	Green	"	Fine	V. Slow	11	36	8-18-40
C5c93	" " "	"	"	Medium	Fair	12		
C5a53	" " "	"	Villous	Coarse	Slow	8	38	7-15-40
C5a85	" " "	"	Glabrous	Medium	Fair	12	38	7-29-40
C5c75	" " "	"	Villous	Coarse	"	10	40	8-8-40
C5c84	" " "	"	Glabrous	Medium	V. Slow	14	44	8-20-40
C5c85	" " "	"	Villous	Coarse	V. Slow	17	40	8-18-40
C5c86	" " "	"	"	"	Fair	14	46	7-26-40
C5a86	" " "	"	Glabrous	Fine	"	17	42	8-8-40
C5a87	" " "	"	"	"	"	15	40	8-8-40
C5c82	" " "	"	"	"	Rapid	18	25	8-8-40
C5c83	" " "	Glaucous	Villous	Coarse	"	15		
C5a46	Leflore Co. Okla.	Green	"	"	"	16	30	7-29-40

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a77	Leflore Co. Okla.	Green	Villous	Fine	Fair	18		
C5a78	" " "	"	"	Coarse	"	15	32	8-16-40
C5c72	" " "	"	Glabrous	Fine	Slow	18		
C5c90	" " "	"	Villous	Coarse	Fair	14		
C5c91	" " "	"	"	Medium	"	17	44	8-20-40
C5a48	Muskogee Co. Okla.	Glaucous	"	Coarse	Rapid	16	52	8-18-40
C5a49	" " "	"	"	"	"	16	56	8-22-40
C5a79	" " "	Green	Glabrous	Fine	"	17	42	8-22-40
C5a80	" " "	Glaucous	Villous	Coarse	Fair	17	36	7-22-40
C5a81	" " "	Green	Glabrous	Medium	Rapid	18	40	8-18-40
C5c73	" " "	"	"	"	Slow	18	36	7-17-40
C5c74	" " "	"	"	Fine	Fair	18	38	8-18-40
C5c89	" " "	Glaucous	Villous	Coarse	"	20		

TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. <sup>4</sup>	Ht. <sup>5</sup>	Date <sup>6</sup>
C5a50	Garvin Co. Okla.	Green	Glabrous	Medium	Slow	12	40	7-15-40
C5a82	" " "	"	"	Coarse	Fair	6	46	7-24-40
C5a83	" " "	"	"	"	"	16	48	7-26-40
C5a84	" " "	"	"	Medium	Slow	14	48	8-14-40
C5c87	" " "	"	"	"	Fair	15	46	7-31-40
C5c88	" " "	"	"	"	V. Slow	20	40	8-14-40
C5a88	Major Co. Oklahoma	Glaucous	"	"	V. Slow	20		
C5a89	" " "	"	"	Fine	V. Slow	20		
C5c76	" " "	Green	"	"	Fair	15	42	8-8-40
C5c79	" " "	"	"	Medium	"	25		
C5c80	" " "	Glaucous	Villous	"	Slow	20		
C5a90	" " "	"	Glabrous	Fine	V. Slow	12	36	8-14-40
C5c81	" " "	"	Villous	Medium	Slow	12	36	7-17-40



TABLE I (Cont.)

N <sup>1</sup>	Origin of Plants	Color	Hairiness	S <sup>2</sup>	R <sup>3</sup>	Ht. 4	Ht. 5	Date <sup>6</sup>
C5a91	Major Co. Oklahoma	Glaucous	Glabrous	Fine	V. Slow	14	41	7-19-40
C5a92	" " "	"	"	"	Slow	14	44	8-14-40
C5a93	" " "	"	"	"	Fair	15	46	8-12-40
C5c77	" " "	"	"	"	"	15	54	7-19-40
C5c78	" " "	Green	Villous	Medium	"	16	46	8-18-40
C4a88	Wilbarger, Texas	"	Glabrous	"	Slow	14	44	7-22-40
C4a87	Liberal, Kansas	Glaucous	"	"	"	12	40	7-19-40
C4a93	Dardenella, Ark.	Green	"	"	V. Slow	16	48	7-29-40
C4e78	Cherokee Co. Texas	"	Villous	Coarse	V. Slow	24	54	8-12-40
C4a86	Garden City, Kansas	Glaucous	"	Medium	Fair	13	42	7-17-40
C4a90	Hebbronville, Tex. Jim Hogg Co.	Green	Glabrous	"	V. Slow	18	48	7-31-40
C4e83	Logan Co. Oklahoma	"	"	Fine	Slow	16	40	7-17-40
C4e84	Pittsburg Co. Okla.	"	Villous	Medium	Fair	17	38	7-26-40

TABLE I (Cont.)

C4e85	Mays Co. Oklahoma	Green	Glabrous	Medium	Fair	18	40	7-26-40
C4e86	Okmulgee Co. Okla.	Glaucous	"	"	"	17	36	8-14-40
C4e91	Anderson Co. Kansas	Green	"	Fine	"	14	36	7-17-40
C4e92	Manhattan, Kan.	"	"	"	"	13	48	7-17-40
C4e93	O'neil, Nebraska	"	Villous	"	Slow	12	36	7-19-40

TABLE II  
 NUMERICAL DISTRIBUTION OF INDIVIDUAL ROWS  
 ACCORDING TO COLOR, HAIRINESS, AND STEM SIZE

GREEN						GLAUCOUS						
VILLOUS			GLABROUS			VILLOUS			GLABROUS			
F.	MED.	COR.	F.	MED.	COR.	F.	MED.	COR.	F.	MED.	COR.	
5	6	8	16	23	2	0	5	16	12	17	2	
Sub-totals #1			19	41			21			31		
Sub-totals #2			60						52			
Total plants studied											112	

While the plants were young, it was not difficult to say whether a given individual was villous or glabrous. This seemed to be a rather definite character, each plant being definitely villous or entirely glabrous. The villous plants were found in about the same proportion among the plants of the different colors, about one-third of each being hairy, as shown in Sub-total #1, Table II.

In all cases, where a number of plants came from a given locality, some were found which were green and hairy, some green and glabrous, others were glaucous and hairy, and still others were glaucous and glabrous. This seems to indicate that habitat has no significant influence on these characters.

The question of size of stems also had to be settled arbitrarily, based on observation rather than actual measurement.

As with color, there seemed to be no relation between the size of stem and the source of the plants.

Table II gives the number of plants in each size classification among the green and glaucous plants and also according to whether they were villous or glabrous. In general, the glaucous plants tended to have larger stems and coarser foliage. This seemed especially true of the glaucous, villous plants, which in practically every case were found to have coarse stems. The number of stems per bunch, although not shown in Table I, seemed to be directly related to the size of stems. The coarse-stemmed plants had fewer stems, fewer leaves, and reached a greater height than those with fine or medium sized stems.

The relative rate of growth was based, not only on the height attained, but also on the number and length of leaves and the general vigor of the individual plants as compared with the group as a whole. The place from which the plants came apparently had no effect on the rate of growth, as is shown in Table I; rapid, fair, slow, and very slow plants being found in the groups from practically all localities and among all colors and size of stems. The one exception was found among the plants from Texas which were all vigorous, robust, individuals. However, this exception could possibly be due to the small number of plants from Texas. If a larger number were present, the entire range might be obtained.

Table III shows the relation between hairiness and rate of growth. Seventeen and one-half per cent of the villous

plants were classed as rapid growers while less than ten per cent of the glabrous plants were classed as such. Among those classed as "fair" was found almost fifty per cent of the villous plants and only twenty-nine per cent of the glabrous plants. This seems to indicate that hairiness is an indication of vegetative vigor without reference to environment.

TABLE III  
RELATION BETWEEN RATE OF GROWTH AND HAIRINESS

VILLOUS PLANTS				GLABROUS PLANTS			
RAPID	FAIR	SLOW	VERY SLOW	RAPID	FAIR	SLOW	VERY SLOW
7	19	8	6	7	25	29	11
40				72			

Table IV shows the relation of growth rate to size of stems. Twenty-five per cent of the coarse plants were found in the rapid and forty-three per cent in the fair classification while only fifteen per cent of the fine stemmed plants were rapid and thirty-eight per cent were fair growers. This seems to indicate that there is some relation between growth rate and size of stem; however when the medium stem column is examined, it is seen that only four per cent are rapid growers and thirty-five per cent are fair. This, and the fact that the medium stemmed group has a preponderance of slow growers is contradictory to the theory. This deviation is possibly due

to the number of plants studied or there may be some limiting factor which was not observed.

TABLE IV  
RELATION BETWEEN SIZE OF STEM AND GROWTH RATE

FINE				MEDIUM				COARSE			
R.	F.	S.	V. S.	R.	F.	S.	V. S.	R.	F.	S.	V. S.*
5	13	9	6	4	19	22	6	7	12	6	3
Totals			33				51				28

In comparing the rate of growth of plants of different colors, as shown in Table V, it was found that the glaucous plants were more vigorous. Twenty-one per cent of the glaucous plants were classed as rapid growers as compared with only six and one-half per cent of the green plants. However, the relation here was not quite so evident, as only thirty-four per cent of the glaucous plants were "fair" against forty-five per cent of the green plants in this classification.

The most robust, vigorous growing individuals were found to be both villous and glaucous, the original source of the plants having little, if any, effect.

The rate of growth of all plants was not consistent, some developing rapidly in the first part of the season and some later. Here again the original source of the plants apparently was not the determining factor, nor did the time

of the most rapid growth have any apparent effect upon the time of anthesis. The plants from Pontotoc County, Oklahoma are cited as examples. Among these plants are found both rapid and slow growers, some of which flowered as early as July seventeenth and others which had not flowered when the present study was brought to a close, August 24, 1940.

TABLE V  
THE RELATION OF COLOR TO RATE OF GROWTH

GREEN				GLAUCOUS			
RAPID	FAIR	SLOW	VERY SLOW	RAPID	FAIR	SLOW	VERY SLOW
4	27	19	10	11	18	18	5
Totals			60	Totals			52

Anthesis began on July fifteenth and increased rapidly for four days, then as rapidly decreased until only a few additional plants were found in flower at each succeeding visit. Table VI gives the dates on which the plots were visited and the total number of plants which had started anthesis since the preceding visit.

The lull in the number of plants blooming during the first few days of August, followed by renewed activity, apparently was a direct result of the weather. During the extremely hot weather, the first week of August, many plants were wilted and growth was at a stand-still. With the beginning of rainy weather, the plants revived and a new wave of flowering took place.

In checking the time of anthesis with the source of the plants, in Table I, no conclusive evidence was found to support the theory that plants moved from south to north bloom later than northern plants. If Andropogon scoparius has this tendency, it apparently has been lost during the time they have been growing in the nursery. It is true that some of the plants from Texas were late in blooming, though no later than some plants from Oklahoma, but these plants are coarse, villous individuals which in general are later than the average for the entire group.

Time and circumstances would not permit the gathering of seed to determine what type of plant would produce the greatest number, but based on general observation of the plants, it seemed that those with fine to medium stems would give the greatest yield. The coarse stemmed plants had relatively few stems per bunch and these did not branch as freely as the fine to medium stemmed ones.



TABLE VI  
TOTAL NUMBER OF PLANTS FLOWERING ON GIVEN DATES

DATE OF VISIT	NUMBER OF PLANTS													T*
	GREEN						GLAUCOUS							
	VILLOUS			GLABROUS			VILLOUS			GLABROUS				
	F.	M.	C.	F.	M.	C.	F.	M.	C.	F.	M.	C.		
July 15			1	1	1						1			4
17				4	1			2						7
19	2			2	3				2	3	6			18
22					5				1		2			8
24						1		1			3			5
26		2	1	1		1						1		6
29			1	1	2				1		1			6
31	1			1	1			1			1			5
Aug. 2														0
4														0
6		1							1					2
8		1		4							1			6
10		1								1				2
12	1								3					4
14	1				3					2	1			7
16			1		1						1			3
18		1	1	1	1				1	3				8
20		1			1									2
22				1					1					2

\* F -- Fine  
M -- Medium

C -- Coarse  
T -- Total

## SUMMARY AND CONCLUSIONS

The outstanding characters of one hundred and twelve plants of Andropogon scoparius, gathered by employees of the Soil Conservation Service in various parts of six states and transplanted to the Forest Nursery west of Stillwater during 1934, were studied during one growing season in an attempt to determine what characters were associated with vegetative vigor and prolific seed production, and, whether or not these plants had retained the tendency to flower earlier when moved from north to south than when moved from south to north.

From the evidence gathered, it seems that the origin of the plant has no significant effect on the color, degree of hairiness, the rate of growth, or the size of stems.

Glaucous color and hairiness are apparently associated with vegetative vigor; the most robust, consistently rapid growers being of this type.

Fine stemmed plants appear to produce more seed because of the greater number of stems per bunch.

If Andropogon scoparius has the tendency to bloom earlier or later when moved, depending upon whether the movement is northward or southward, the tendency apparently has been lost by the plants in the nursery within the past six years.

More conclusive evidence of this tendency would necessitate carrying the study over a number of years, starting at the time the plants were transplanted.

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