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Smooth Brome Grass Varieties

FOR WEST VIRGINIA

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WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS
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Smooth Brome Grass Varieties for West Virginia

O. J. BURGER and F. W. GLOVER, Jr.

Introduction

ADAPTED grasses are needed to supply forage for the important animal industry of West Virginia. High-producing species are needed to produce winter feed, since the winter feeding period for West Virginia is 150 to 180 days for beef cattle and sheep and even longer for dairy cattle. Smooth brome grass, *Bromus inermis* L., is highly palatable and is productive under a wide variety of conditions, however, it produces best on a fertile, well-drained soil.

During recent years several new strains and varieties have been developed by breeding and selection. Improved varieties and strains can be recognized and evaluated only by comparative testing; therefore, new releases need to be evaluated in comparison with well-known varieties. The purpose of this study was to compare yields of 11 varieties of smooth brome grass under a variety of conditions in West Virginia.

Experimental

Eleven varieties of smooth brome grass, *Bromus inermis* L., were seeded at five locations in West Virginia in the spring and summer of 1951. The names and descriptions of varieties are given below:¹

Achenbach is a typical southern strain developed by some selection in the late 1890's by the Achenbach Brothers of Washington, Kansas. This early work gave the foundation stock of what is now the Achenbach strain. Most of the brome grass in eastern Kansas and all of the certified brome in Kansas traces to this source. It may therefore be considered to be a "regional strain" developed under eastern Kansas conditions.

Elsberry is a southern early-maturing type of brome grass and is the best of several accessions tested in the Soil Conservation Service Nursery at Elsberry, Missouri. This variety of smooth brome grass is believed to be derived from an old field of brome grass located near the Missouri and Iowa border.

¹The description of varieties was taken from a report prepared by the Division of Forage Crops and Diseases, Agricultural Research Service, Beltsville, Maryland.

Fischer came originally from an old field established by E. A. Fischer in Shenandoah, Iowa in 1917. It is believed that the seed came from Ohio and it is possibly of a different origin from many of the other brome grasses. The original collection of seed (20 pounds) was made by the Soil Conservation Service Nursery on August 16, 1939. Tests of this strain have been conducted by the Iowa Agricultural Experiment Station and the Soil Conservation Service from 1940 to date.

Lancaster is a relatively new strain which has been developed over a 10-year period at the Nebraska Agricultural Experiment Station, Lincoln, Nebraska. It is a synthetic variety produced by the hybridization of several unrelated outstanding plants. These parental plants were selected over a period of years by means of progeny tests and were allowed to intercross in an isolated planting in 1942. Seed from this original hybridization was increased and tested in several trial plantings. This variety was known as Nebraska 44 before it was named Lancaster.

Lincoln is a naturalized strain of brome grass of Hungarian origin. It has proved particularly well adapted to the central latitudes of the United States and constitutes an excellent source of unselected material to be used in the production of selected new strains for the same region. Increase and foundation seed stocks are maintained at the Nebraska Agricultural Experiment Station, Lincoln, Nebraska.

Lyon, formerly known as Nebraska 36, is a selection of the Lincoln type which is being increased for farm use. It was produced by two generations of selection within a farmer's strain of Lincoln brome grass followed by one generation of outcrossing of this material to a wide source of carefully selected brome grass plants in a spaced plant nursery. The selection shows considerable refinement of plant characters over Lincoln brome grass. It is outstanding in production of high quality, relatively heavy seed, and it retains the adaptation of Lincoln for critical planting sites.

Manchar is a tall, leafy, semi-bunch type of brome grass introduced from Manchuria. It was subjected to mass selection at Pullman, Washington. Its outstanding characteristics are seedling vigor and high seed production. It is intermediate in growth habit between the southern type as exemplified by Achenbach and the northern type of smooth brome grass.

Martin was obtained from an old brome grass field in Martin County, Minnesota. Eighty-eight plants were selected after a 2-year study of a space-planted nursery. These were cloned and on the basis of yield, leafiness, and freedom from leaf-spotting diseases, 21 clones were allowed to reproduce by natural cross-pollination.

North Commercial is a variety of the northern type and not adapted in the southern latitudes.

Oklahoma No. 1 is a selection made in 1942 from an old field of brome grass established at the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma in 1936. The original planting was made with commercial seed obtained from Kansas. This selection was grown in a brome grass nursery from 1942 to 1948, inclusive. It is a tall, vigorous, late, leafy, medium heavy seed producer and moderately free of disease.

Southland is a recently released variety with the same breeding history as that of *Oklahoma No. 1* brome grass, except that it is a composite of eight of the best lines made in 1948. The lines which make up this synthetic are heavy seed producers under Oklahoma conditions, medium late, leafy, and moderately free of disease.

The seed of these varieties, except *Oklahoma No. 1* and *Southland*, was obtained from the U. S. Department of Agriculture, Soil Conservation Service Nursery Division, Big Flats, New York. The seed of *Oklahoma No. 1* and *Southland* was obtained from the Oklahoma Crop Improvement Association, Stillwater, Oklahoma.

Experimental Sites

The locations and seeding dates were as follows:

Spring-seeded plots:

Point Pleasant	April 17, 1951
Moundsville	April 27, 1951
Reedsville	April 28, 1951

Summer-seeded plots:

Point Pleasant	July 31, 1951
Ronceverte	August 9, 1951

Rainfall for weather stations at or near the various locations for the summer months is shown in Figure 1. The horizontal line indicates the long-time average (normal) rainfall and the vertical lines indicate above or below normal rainfall for the period of the experiment.

RODRIQUEZ FARM, MOUNDSVILLE

On the Rodriques farm at Moundsville, the soil is Westmoreland silt loam which is moderately deep, well-drained, moderately permeable, medium textured, upland soil from interbedded shale, sandstone and limestone or calcareous shale. This is good soil for the production of orange crops.

During the four years of this study, rainfall was below normal for 1952 and 1953 (Figure 1). Rainfall for June, July, and August 1953 was 4.79 inches below normal for this location.

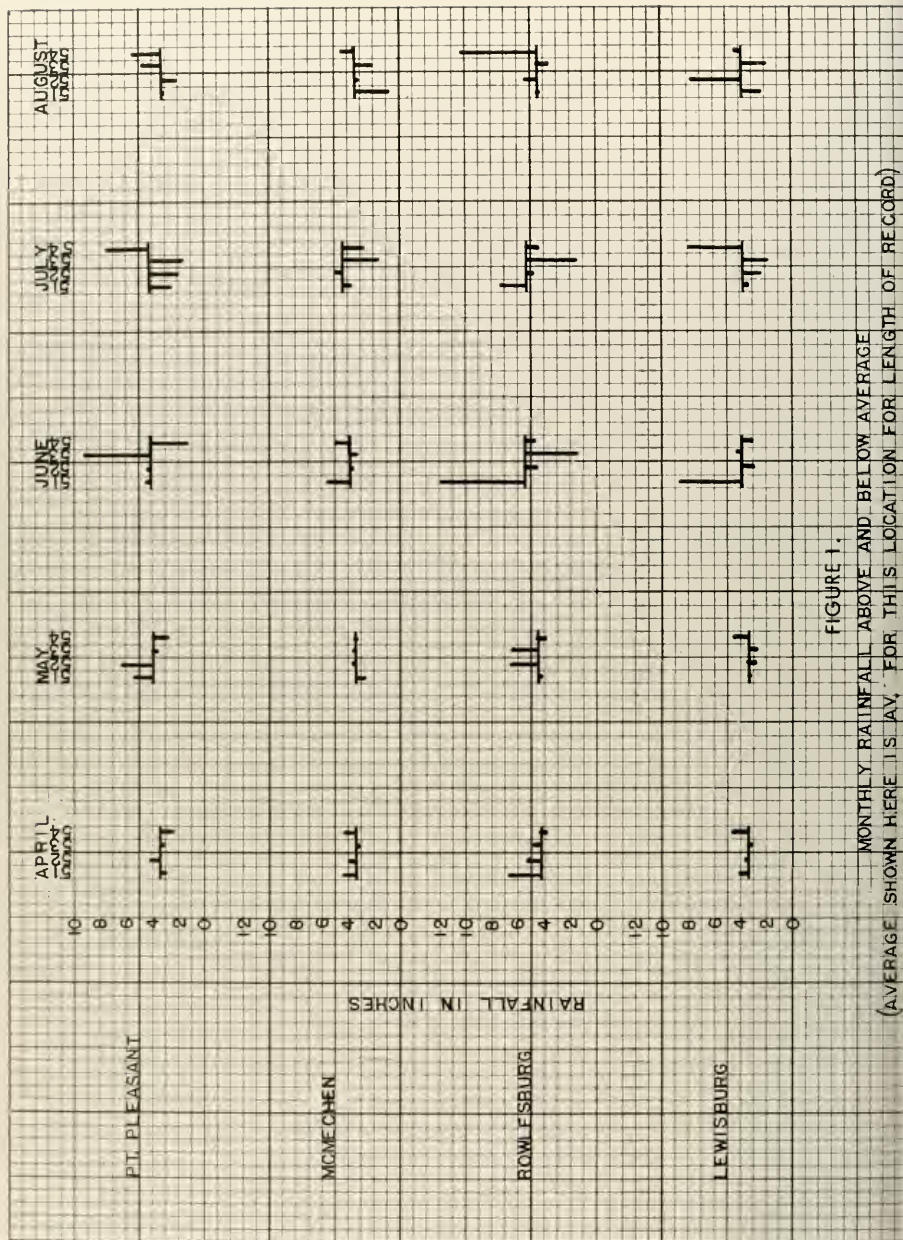


FIGURE 1.

MONTHLY RAINFALL ABOVE AND BELOW AVERAGE
(AVERAGE SHOWN HERE IS AV. FOR THIS LOCATION FOR LENGTH OF RECORD)

OHIO VALLEY EXPERIMENTAL FARM, WEST VIRGINIA UNIVERSITY, POINT PLEASANT

On the Ohio Valley Experimental Farm at Point Pleasant the soil is Wheeling fine sandy loam, a well-drained, rapidly permeable, deep, light-textured soil on acid glacial outwash material. The soil profile below three to four feet is underlain by stratified sand and gravel. This soil is fairly high in inherent fertility.

Rainfall was below normal for this location during 1952 and 1953. Rainfall for July and August, 1952 was 3.10 inches below normal, while it was only 0.80 inches below normal for these months in 1953 (Figure 1).

WEST VIRGINIA UNIVERSITY EXPERIMENT FARM, REEDSVILLE

The soil at the Experimental Farm at Reedsville is Gilpin silt loam, which is shallow to moderately deep, medium-textured, moderately permeable well-drained upland soil from acid shale and sandstone. This soil is normally low to medium in inherent fertility.

Rainfall data for Reedsville was taken from the Rowlesburg weather station. Rainfall at this location was above normal for the years 1952 and 1954 of this study. Rainfall during June, July, and August, 1953 was 8.87 inches below normal (Figure 1).

E. L. CRICKENBERGER FARM, RONCEVERTE

On the E. L. Crickenberger farm near Ronceverte, West Virginia, the soil is Frederick silt loam, a deep, well-drained, medium-textured, moderately permeable soil developed from cherty limestone. This soil is normally low to medium in exchangeable bases and inherent fertility.

Rainfall data for Ronceverte was taken from the Lewisburg weather station. Rainfall was below average for three of the four years included in this study. The most serious moisture deficiency occurred in July and August, 1953 when rainfall was 4.24 inches below normal (Figure 1).

Experimental Methods

Smooth brome grass was seeded at the rate of 10 lbs. per acre with 10 lbs of Canadian Variegated Alfalfa and 0.5 lbs of Ladino clover per acre at all locations. Germination tests were made and the amount of seed was adjusted to equal the above rate of viable seed.

Lime and fertilizer were applied uniformly over each trial area. The rates for lime and fertilizer were based on current soil tests for pH, available phosphorus and potash. The lime was applied before plowing. Fertilizer was applied after plowing and mixed with soil by disking.

Seed was broadcast and each area was cultipacked after seeding. The spring-seeded plots were mowed in August for weed control. No companion crop was seeded.

The plots, 12 x 30 feet in size, were arranged in random blocks with four replications at Point Pleasant and three replications at all other locations.

The smooth brome grass plots were harvested as hay for three years at all locations except Moundsville where only two years data are available. The first cutting was made when grass heads were exposed but before bloom. The second and third cuttings were made when alfalfa was $\frac{1}{2}$ to full bloom. Either two or three cuttings were made depending on locations as shown in Tables 1 and 2.

Yields were determined by cutting a 30-inch swath lengthwise through the center of the experimental plot. The forage from the cut area was weighed, dried, and yields reported in tons dry matter per acre.

To determine the contribution of smooth brome grass to the total forage yield, botanical estimates were made on all dry matter samples. In this procedure the dry matter samples were taken from the sample bag, spread out on a table, and the percentages of smooth brome grass and legume fractions were estimated. These estimations were then used to calculate the final yields of the smooth brome grass fraction.

Discussion of Results

Tables 1 and 2 show the total yield of smooth brome grass plus legumes and the yield of smooth brome grass fraction as well as the relative ranking of both spring and summer seedings at all locations. These data show that the southern varieties of smooth brome grass are generally better adapted to West Virginia conditions than the northern or intermediate varieties. Achenbach, Elsberry, Fischer, Lincoln, Oklahoma No. 1, and Southland were the high producing southern varieties.

Yield differences, when significant, were generally between the southern and northern varieties. Lancaster, a southern variety, frequently produced significantly less than the other southern varieties. Manchar was the best of the intermediate varieties and produced well at Point Pleasant and Reedsville. Observations indicate that Manchar recovers well after harvest and may be used to advantage for pasture. North Commercial, a northern variety, and Martin, an intermediate variety, were consistently low in yield.

No significant differences were found at Reedsville, a high-altitude location, between varieties for yield of smooth brome grass fraction. One possible explanation for this is that the northern and intermediate varieties are better adapted at higher altitudes than at lower altitudes.

A. SMOOTH BROME GRASS PLUS LEGUMES

LOCATION	POINT PLEASANT						REEDSVILLE						MOUNDSVILLE					
	1952		1953		1954		3 Yr. Avg.		RANK		1952		1953		2 Yr. Avg.		RANK	
	No. of Cuts		3		3		3		Avg.		2		2		2		2	
VARIETY																		
Achenbach	1.80	2.45	3.34	2.53	4	2.22	2.30	2.64	2.35	9	1.11	2.06	1.59	3				
Elisbury	1.85	2.67	3.11	2.54	3	2.35	1.99	2.88	2.41	8	1.18	1.86	1.52	4				
Fischer	1.64	2.35	3.10	2.40	3	2.56	2.37	2.86	2.60	1	1.17	2.24	1.70	1				
Lancaster	1.71	2.35	3.03	2.36	11	2.02	2.03	2.69	2.45	6	0.92	1.66	1.29	7				
Lincold	1.79	2.57	3.22	2.52	5	2.35	2.08	2.88	2.44	7	0.89	1.88	1.38	6				
Lyon	1.69	2.46	3.09	2.41	8	2.30	2.10	3.10	2.50	4	0.73	1.54	1.14	10				
Manchar	1.69	2.84	3.25	2.59	2	2.55	2.07	2.78	2.47	5	0.66	1.91	1.28	8				
Martin	1.57	2.36	3.16	2.37	10	2.34	2.06	2.43	2.23	10	0.64	1.62	1.13	11				
North Commercial	1.79	2.33	3.29	2.44	7	1.96	1.90	2.63	2.16	11	0.77	1.77	1.27	9				
Oklahoma No. 1	1.71	2.50	3.24	2.48	6	2.19	2.05	3.01	2.52	3	0.94	2.03	1.48	5				
Southland	1.98	2.77	3.53	2.76	1	2.50	2.23	2.91	2.55	2	1.33	2.05	1.69	2				
Average	1.75	2.51	3.21	2.49		2.38	2.10	2.80	2.43		0.94	1.88	1.41					
.05 Significant Difference*	0.18	0.26	0.20	0.13		0.34	0.25	0.40	0.19		0.30	0.38	0.23					

B. SMOOTH BROME GRASS FRACTION

Achenbach	1.01	1.03	1.53	1.19	2	1.44	0.79	2.50	1.58	3	0.89	1.05	0.97	2
Elisbury	1.02	1.18	1.38	1.20	1	1.36	0.58	2.64	1.53	5	0.88	0.94	0.91	4
Fischer	0.94	1.10	1.22	1.09	1	1.78	0.95	2.74	1.82	1	0.96	0.96	0.96	3
Lancaster	0.80	0.62	0.84	0.75	9	1.30	0.51	2.39	1.40	9	0.70	0.72	0.71	7
Lincold	0.86	1.02	1.46	1.11	3	1.08	0.60	2.78	1.49	8	0.72	1.06	0.89	5
Lyon	0.88	1.00	1.30	1.06	5	1.27	0.57	2.79	1.54	4	0.58	0.70	0.64	8
Manchar	0.88	1.16	0.84	0.96	7	1.37	0.64	2.51	1.51	6	0.40	0.71	0.56	9
Martin	0.73	0.68	0.78	0.73	10	1.08	0.48	2.17	1.21	11	0.37	0.61	0.49	10
North Commercial	0.72	0.34	0.60	0.55	11	1.05	0.45	2.48	1.33	10	0.32	0.47	0.40	11
Oklahoma No. 1	0.98	0.67	1.04	0.90	8	1.34	0.56	2.59	1.50	7	0.73	0.95	0.84	6
Southland	1.06	1.12	0.92	1.03	6	1.33	0.78	2.66	1.59	2	1.04	1.01	1.02	1
Average	0.90	0.90	1.08	0.96		1.31	0.63	2.57	1.50		0.69	0.83	0.76	
.05 Significant Difference*	0.15	0.18	0.28	0.13		0.63	0.48	0.43	0.33		0.20	0.26	0.16	

*From Steedee, 5th Edition.

TABLE 2. YIELD IN TONS DRY MATTER PER ACRE (T/A) OF ELEVEN SMOOTH BROME GRASS VARIETIES SUMMER-SEEDED WITH ALFAFA AND LADINO CLOVER AT TWO LOCATIONS

VARIETY	LOCATION				POINT PLEASANT				RONCEVERTE						
	YEARS				3 Yr. Avg.				3 Yr. Avg.						
	NO. OF CUTS				RANK				RANK						
	1952	1953	1954	3	1952	1953	1954	2	1952	1953	1954	3	1954	3	RANK
Achenbach	2.43	2.58	2.99	10	2.67	2.55	2.83	10	2.81	2.73	2.81	3	2.81	2.73	3
Elsberry	2.45	2.75	2.87	8	2.69	2.29	2.88	8	2.64	2.60	2.64	3	2.64	2.60	7
Fischer	2.51	2.99	3.10	2	2.87	2.45	2.64	2	2.96	2.68	2.96	3	2.96	2.68	5
Lancaster	2.39	2.86	2.70	7	2.70	2.48	2.94	7	2.43	2.62	2.43	3	2.43	2.62	6
Lincold	2.54	2.90	3.36	1	2.93	2.48	3.03	1	2.71	2.70	2.71	3	2.71	2.70	4
Lyon	2.45	2.94	3.10	3	2.83	2.16	2.86	3	2.34	2.45	2.34	3	2.34	2.45	10
Manchar	2.44	2.78	2.93	6	2.72	1.83	2.89	6	2.82	2.51	2.82	3	2.82	2.51	9
Martin	2.27	2.98	3.14	4	2.80	2.08	2.90	4	2.67	2.55	2.67	3	2.67	2.55	8
North Commercial	1.71	2.54	2.42	11	2.22	1.35	2.65	11	2.33	2.11	2.33	3	2.33	2.11	11
Oklahoma No. 1	2.36	2.99	2.94	5	2.76	3.38	3.05	5	2.91	3.11	2.91	3	2.91	3.11	1
Southland	2.35	2.84	2.82	9	2.68	2.22	2.96	9	3.15	2.78	3.15	3	3.15	2.78	2
Average	2.35	2.83	2.96		2.71	2.28	2.71		2.71	2.62	2.71		2.71	2.62	
.05 Significant Difference*	0.31	0.23	0.22		0.17	0.72	0.27		0.18	0.22	0.18		0.18	0.22	

B. SMOOTH BROME GRASS FRACTION

Achenbach	1.24	1.10	1.17	4	1.17	1.06	0.64	4	1.19	0.96	1.19	3	1.19	0.96	5
Elsberry	1.34	1.10	1.20	2	1.21	1.08	0.80	2	1.34	1.07	1.34	3	1.34	1.07	3
Fischer	1.45	1.09	0.98	3	1.18	1.33	0.64	3	1.15	1.04	1.15	4	1.15	1.04	4
Lancaster	1.05	0.88	0.68	9	0.87	1.09	0.30	9	0.29	0.56	0.29	8	0.29	0.56	8
Lincold	1.22	1.19	1.28	1	1.23	1.18	0.65	1	0.96	0.93	0.96	6	0.96	0.93	6
Lyon	1.22	0.99	0.75	7	0.99	1.01	0.51	7	0.63	0.72	0.63	7	0.63	0.72	7
Manchar	1.12	1.02	0.58	8	0.91	0.58	0.28	8	0.66	0.51	0.66	9	0.66	0.51	9
Martin	0.88	0.86	0.60	11	0.78	0.60	0.25	11	0.47	0.44	0.47	10	0.47	0.44	10
North Commercial	0.76	0.78	0.92	10	0.82	0.24	0.11	10	0.04	0.13	0.04	11	0.04	0.13	11
Oklahoma No. 1	1.19	1.07	0.96	5	1.07	1.69	0.79	5	0.96	1.15	0.96	1	0.96	1.15	1
Southland	1.28	1.14	0.75	6	1.06	1.13	0.72	6	1.38	1.08	1.38	2	1.38	1.08	2
Average	1.16	1.02	0.90		1.03	1.00	0.52		0.82	0.78	0.82		0.82	0.78	
.05 Significant Difference*	0.27	0.21	0.30		0.15	0.42	0.20		0.27	0.17	0.27		0.27	0.17	

The percentage of smooth brome grass fraction of the total yield of the smooth brome grass-legume mixture for spring and summer seedings is shown in Table 3. It is evident that the contribution of the fraction of smooth brome grass varieties is not the same at all locations. Achenbach, Elsberry, Lincoln, and Southland in general contributed the most to the total yield. The average percentage of smooth brome grass fraction was lowest in 1953 at Ronceverte, Reedsville, and Moundsville, whereas the contribution of smooth brome grass to total yield at Point Pleasant became progressively less each year and was the lowest in 1954.

The yield in tons dry matter per acre of smooth brome grass varieties grown with alfalfa and Ladino clover combined for all locations and percentage of contribution of smooth brome grass fraction to yield of the mixture are given in Table 4. This is shown graphically in Figure 2 which shows that Southland with alfalfa and Ladino clover produced the highest average total yield at five locations in West Virginia. Fischer was the top producer based on estimates of smooth brome grass fraction. North Commercial produced the lowest average total yield and lowest smooth brome grass fraction yield of any of the varieties studied.

Five of the eight southern varieties produced higher than average total yields. One intermediate variety, Manchar, was average and another intermediate variety, Martin, was below average. The contribution of smooth brome grass fraction to total yield was above average for six of eight southern varieties. The contribution of smooth brome grass fraction of intermediate and northern varieties was below average. In general, alfalfa contributed less by weight to total yields where smooth brome grass yields were high.

Low yields of smooth brome grass in 1953 were apparently due to low rainfall during the growing season.

Summary and Conclusions

1. Smooth brome grass made satisfactory production for hay in association with alfalfa at five locations in West Virginia.
2. Southern varieties produced consistently higher yields than intermediate or northern varieties.
3. Achenbach, Elsberry, Fischer, Lincoln, Oklahoma No. 1 and Southland were the high producing southern varieties.
4. Smooth brome grass can be established satisfactorily when seeded either in the spring or summer.

TABLE 3. PERCENTAGE SMOOTH BROMIE GRASS FRACTION OF THE TOTAL YIELD OF THE SMOOTH BROMIE GRASS-LEGUME MIXTURE FOR SPRING AND SUMMER SEEDINGS*

SPRING-SEEDED

LOCATION	POINT PLEASANT						REEDSVILLE						MOUNDSVILLE					
	1952		1953		1954		1953		1954		1955		1952		1953		2 Yr. Avg.	
	2	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
VARIETY																		
Years																		
No. of cuts																		
Achenbach	56	42	46	48	1	1	65	36	95	65	2	2	80	51	66	2	2	
Elsberry	55	44	44	47	2	2	58	29	92	61	3	3	74	50	62	6	6	
Fischer	54	47	39	46	3	3	70	40	96	69	1	1	82	43	63	5	5	
Lancaster	47	26	28	34	9	9	50	25	89	54	10	10	76	43	60	8	8	
Lincoln	48	40	45	44	5	5	46	29	96	56	8	8	81	56	68	1	1	
Lyon	52	41	42	45	4	4	55	27	90	58	6	6	80	47	64	4	4	
Manchar	52	41	26	39	7	7	54	31	90	59	5	5	61	37	49	9	9	
Martin	46	29	25	33	10	10	48	23	89	53	11	11	58	38	48	10	10	
North Commercial	42	14	18	25	11	11	54	24	94	57	7	7	42	26	34	11	11	
Oklahoma No. 1	57	27	32	38	8	8	54	27	86	55	9	9	77	46	61	7	7	
Southland	54	40	26	40	6	6	53	35	91	60	4	4	79	50	65	3	3	
Average	51	36	34	40			55	30	92	59			73	44	58			

SUMMER-SEEDED

LOCATION	POINT PLEASANT						RONCEVERTE									
	1952		1953		1954		1952		1953		1954		3 Yr. Avg.		RANK	
	2	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
VARIETY																
Years																
No. of cuts																
Achenbach	51	43	39	41	4	4	42	23	42	35	6	6				
Elsberry	55	40	42	46	1	1	47	28	51	42	1	1				
Fischer	58	36	32	42	3	3	54	24	39	39	3	3				
Lancaster	44	31	24	33	10	10	44	10	12	23	8	8				
Lincoln	48	41	38	43	2	2	50	24	35	37	4	4				
Lyon	50	34	24	36	8	8	47	22	27	32	7	7				
Manchar	46	37	20	34	9	9	32	10	23	22	9	9				
Martin	39	29	19	29	11	11	29	9	18	19	10	10				
North Commercial	44	31	38	38	7	7	18	4	2	8	11	11				
Oklahoma No. 1	50	36	33	39	6	6	50	26	33	36	5	5				
Southland	54	40	26	40	5	5	51	24	44	40	2	2				

TABLE 4. YIELD IN TONS DRY MATTER PER ACRE (T/A) OF SMOOTH BROME GRASS VARIETIES GROWN WITH ALFALFA AND LADINO CLOVER AND PERCENTAGE CONTRIBUTION OF SMOOTH BROME GRASS FRACTION TO YIELD OF THE MIXTURE. SPRING AND SUMMER SEEDINGS COMBINED FOR EACH OF THREE YEARS

SMOOTH BROME GRASS PLUS LEGUMES

VARIETY	YEAR			AVERAGE 3-YEAR	RANK
	1952 5 SITES	1953 5 SITES	1954 4 SITES		
	T/A	T/A	T/A	T/A	
Chenbach	2.02	2.42	2.91	2.46	5
Isberry	2.02	2.43	2.87	2.43	6
Sischer	2.00	2.52	3.00	2.51	3
Winchester	2.02	2.37	2.75	2.38	9
Lincoln	1.99	2.49	3.04	2.51	4
Wagon	1.87	2.38	2.91	2.39	8
Anchor	1.83	2.50	2.94	2.42	7
Artin	1.76	2.38	2.85	2.33	10
North Commercial	1.50	2.24	2.67	2.14	11
Oklahoma No. 1	2.18	2.52	3.02	2.57	2
Outland	2.08	2.57	3.10	2.58	1
Average	1.94	2.44	2.92	2.43	

SMOOTH BROME GRASS FRACTION

Chenbach	1.13	0.92	1.60	1.22	3
Isberry	1.14	0.92	1.64	1.23	2
Sischer	1.29	0.95	1.52	1.25	1
Winchester	0.99	0.61	1.05	0.88	9
Lincoln	1.01	0.90	1.62	1.18	5
Wagon	0.99	0.75	1.37	1.04	7
Anchor	0.87	0.76	1.15	0.93	8
Artin	0.73	0.58	1.00	0.77	10
North Commercial	0.62	0.54	1.01	0.72	11
Oklahoma No. 1	1.19	0.81	1.39	1.13	6
Outland	1.17	0.95	1.43	1.19	4
Average	1.01	0.79	1.34	1.05	

PERCENTAGE SMOOTH BROME GRASS FRACTION OF SMOOTH BROME GRASS PLUS LEGUMES

Chenbach	59	39	57	52	1
Isberry	58	38	57	50	3
Sischer	64	38	52	51	2
Winchester	52	27	38	39	9
Lincoln	55	38	51	49	4
Wagon	57	34	47	46	6
Anchor	49	31	40	40	8
Artin	14	26	38	36	10
North Commercial	40	20	38	33	11
Oklahoma No. 1	58	32	46	45	7
Outland	58	38	47	48	5
Average	54	33	46	44	

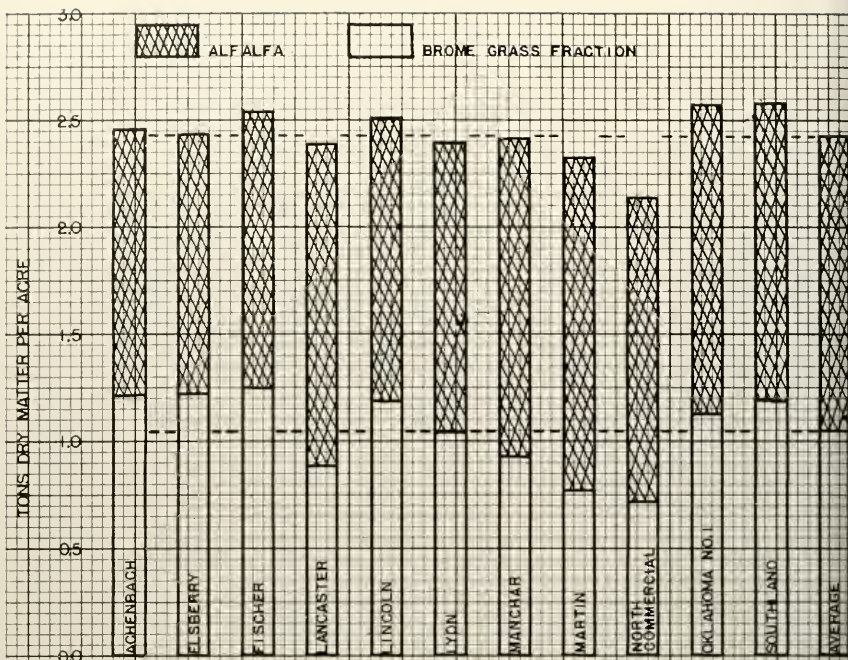


FIGURE 2.
COMPARATIVE YIELDS OF ELEVEN VARIETIES OF SMOOTH BROME GRASS
GROWN WITH ALFALFA UNDER HAY MANAGEMENT AT FIVE LOCATIONS IN
WEST VIRGINIA. (THREE-YEAR AVERAGES)