OSU
Collection

Evaluation of Winter Oat Varieties for Hay Production

by

Byrd C. Curtis, Dennis Peier, and
A. M. Schlehuber

Bulletin No. B-586
June, 1961

CONTENTS

Evaluation of Winter Oat Varieties for Hay Production

by

Byrd C. Curtis, Dennis Peier, and A. M. Schlehuber
Department of Agronomy

Oat hay is an important source of livestock feed in Oklahoma. During the 10 years 1951-1960, an estimated average of 160,000 acres, approximately 20 percent of the state's oat acreage, were harvested for hay[1].

This bulletin reports the results of an oat variety hay yield and quality study conducted during the 3-year period 1958-1960. Prior to this experiment little factual knowledge was available concerning the relative hay-producing capacity of the present commercially grown winter oat varieties. Specifically, the experiment was designed to answer two questions: (1) Are there important differences in hay yield potential among winter oat varieties? and (2) Do varieties differ significantly in quality of hay produced?

Procedure

Ten varieties, representative of the major winter oat types, were selected for this study. These included three presently recommended grain varieties (Forkedeer, Cimarron, and Bronco) four other named varieties of special interest (Arkwin, Atlantic, Arlington, and Nysel), and three unnamed varieties.

The tests were conducted on summer fallowed Norge loam or Kirkland silt loam soils. No irrigation was used. 10-20-0 or 16-20-0 fertilizer was applied at the rate of approximately 200 pounds per acre prior to

---

[1]Based on surveys made by the Oklahoma State Board of Agriculture and U.S.D.A. Marketing Service.

The research reported herein was done under Oklahoma Station Project 523.

seeding. The tests were sown September 23, 25, and October 12 in 1958, 1959, and 1960, respectively. In each test the varieties were seeded in triplicated plots at the rate of two bushels per acre. For additional information on procedures, see the appendix, page 9.

Results and Discussion

Hay Yield

The highly favorable climatic conditions during the test period resulted in outstanding hay yields. The varieties averaged 4.16 tons of hay (dry matter) per acre, which is somewhat higher than can be expected in more nearly normal seasons. Highly significant yield differences occurred among the varieties, as shown in Table 1. The five highest yielding varieties, Forkedeer, Bronco, Arkwin, and two unnamed varieties, can be considered as equals in hay-yielding ability in this test. Differences among these five varieties, which amount to less than 500 pounds from the highest to lowest, can be attributed to sampling error. Cimarron, an extremely early and short-statured variety, produced almost a ton less hay than the highest yielding variety.

Table 1.—Average Yields and Hay Component Percentages for 10 Winter Oat Varieties Grown at Stillwater, Oklahoma, During the Period, 1958-60.[1]

Variety	C.I. No.	Dry matter Tons/acre	Statistical significance[2]	Pct. of total dry matter in: blades[3]	heads[4]	stems[5]
Forkedeer	3170	4.44		19.4	37.7	42.9
Stanton Str. 1 Sel.	6902	4.43		16.1	42.0	41.9
Bronco	6571	4.42		18.2	40.2	41.6
Arkwin	5850	4.36		16.3	35.1	48.6
Stw. 553452[6]	____	4.20		18.9	35.4	45.7
Atlantic	4599	4.10		16.0	39.3	44.7
Colo X Wintok	5118	4.08		17.1	38.8	44.1
Nysel	5364	4.05		18.9	37.3	43.8
Arlington	4657	4.01		16.0	40.9	43.1
Cimarron	5106	3.46		14.6	45.5	39.9
Average		4.16		17.2	39.2	43.6

[1]Annual yield and component data are shown in Appendix Tables 1 and 2.
[2]Variety averages grouped by a continuous line are not significantly different.
[3]Does not include leaf sheath.
[4]Includes entire panicle cut off at apex of peduncle.
[5]Includes leaf sheaths.
[6]A selection from the cross (Hajira-Joanette × Bond-Rainbow) × Santa Fe.

Hay Quality

The leaf-blade:head:stem ratio was used as a measure of hay quality. The ratio of these components of hay yield has been reported to be a fairly reliable and practical index of feeding value (4)[2]. It has been shown that the leaves and heads contain approximately 80 percent of the total protein in hay harvested at the soft dough stage of maturity (3, 4). The conclusion drawn from these reports is that varieties having a high percentage of leaves and heads and a low percentage of stems would be the most desirable for hay purposes.

Table 1 shows the average percentage of leaf-blades, heads, and stems for each of the 10 varieties. Among the five highest yielding varieties, Arkwin and Stw. 553452[3] produced hay containing the highest percentage of stem tissue. This suggests that hay produced by these varieties would be inferior to that produced by the other high-yielding varieties—Forkedeer, C.I. 6902[4], and Bronco. Cimarron ranked lowest in stem content and had the most desirable ratio of components; however, the low yield potential of this variety would make it undesirable for hay production, unless high quality of hay is considered of equal or higher value than quantity of hay production.

The relative rank or position of the varieties with regard to stem content was less changeable from year to year than for the other two components. Generally, if a variety ranked high in stem content one year it ranked high the next year or vice versa. This is an important relationship, since the constancy of this trait should result in a shorter test period being required to determine the index of hay quality for a variety.

Relation of Other Plant Characters to Hay Yield

Grain yield and test weight

The ability of a hay-type variety to produce high yields of good test weight grain is important for two reasons. First, additional grain

---

[2]Numbers in parentheses refer to "Literature Cited", page 8.

[3]Stw. refers to a selection made at the Oklahoma Agricultural Experiment Station at Stillwater.

[4]C.I. refers to accession numbers assigned by the Division of Cereal Crops and Diseases, U.S. Department of Agriculture.

will enhance the nutritive value of hay cut at the soft dough stage; and, second, higher grain yields and test weight would be important in the event it is desirable to harvest a grain crop rather than hay. Although grain yields are not reported from this study, it is known from extensive yield testing that Bronco, Forkedeer, and C.I. 6902 are high yielding types, while Arkwin and Stw. 553452 produce only mediocre yields. Except for C.I. 6902, each of these varieties produces good test weights. The test weight of C.I. 6902 is low, perhaps too low to consider it as a good hay or grain variety.

Number of tillers

Tiller number alone showed little relationship to hay yield among varieties. For example, among the three highest yielding varieties, Forkedeer, C. I. 6902, and Bronco, the average number of tillers per square foot was 72, 65, and 50, respectively. Further, the variety with the most tillers, C. I. 5118 with 79, ranked seventh in yield. The relative number of tillers among the varieties varied greatly with seasons; consequently, it was concluded that tiller number is not a good trait to use in predicting hay yields. Other investigations (1, 2, 5) have shown that tiller number is also a poor character to use in predicting grain yield in oats.

Height of plants

The data obtained in this study indicate that plant height has little influence on hay yield, unless the plants are extremely short or tall. Nine of the 10 varieties had average heights of between 40 and 42 inches, yet average hay yields among the same varieties varied from 4.01 to 4.44 tons per acre. Only for the variety Cimarron was height considered to be of major importance. The extremely short stature of this variety (33-inch average) undoubtedly prevented it from competing favorably with the other varieties in yield.

Climatic differences among seasons greatly influence height of oat plants. The average varietal heights for 1958, 1959, and 1960 were 48.6, 34.8, and 37.8, inches, respectively. Hay yields were highest in 1958 when the plants were extremely tall; however, the second highest average was produced on the shortest plants (1959). This again implies that only extremes in plant height are important in affecting hay yields.

Maturity

Maturity differences among the varieties appeared to have little influence on their hay-yielding ability. All except two varieties were significantly different in date of heading. Among the five highest yielding varieties, the maturity-yield relationships were as follows:

Variety	Average tons/acre	Average heading date
Forkedeer	4.44	May 9
C.I. 6902	4.43	May 5
Bronco	4.42	May 13
Arkwin	4.36	May 7
Stw. 553452	4.20	May 8

Among the other varieties, average heading dates ranged within the limits of those shown above except for the extremely early variety, Cimarron, which averaged heading on May 1.

Heading date and height were closely associated among seasons. Average varietal heading dates for 1958, 1959, and 1960 were May 13, 5, and 7, respectively. Correspondingly, average heights were 48.6, 34.8, and 37.8 inches. This close relationship of maturity and height suggests that maturity, like height, affects hay yields only in years when varieties mature extremely early (lowest yields) or extremely late (highest yields).

Conclusions

These studies indicate that among the varieties tested, Forkedeer and Bronco are the most suitable for hay production. They produce high yields of good quality hay and, in the event a hay crop is not taken, can be expected to produce high yields of good test weight grain. Because of the similar hay production characteristics of Forkedeer and Bronco, the choice of variety should be based on preferences of other agronomic characteristics.

Unpublished experimental data shows that Forkedeer may have an advantage over Bronco from the standpoint of producing more winter grazing forage, particularly during the months of November-February. Bronco shows little ability to grow during cold, short-day periods. However, in March and April this variety generally exhibits extremely rapid growth and soon overtakes most other varieties. Both Forkedeer and Bronco have similar survival records and can be expected to withstand most winters in Oklahoma, except possibly for the Panhandle area. Each variety is deficient in resistance to certain diseases; however, they are no more deficient than other varieties of equal winter hardiness.

Summary

Hay yield and quality studies were conducted on 10 winter oat varieties during the period 1958-1960 at Stillwater, Oklahoma. Forkedeer and Bronco showed the best overall performance as hay types, both producing high yields of good quality hay. Cimarron produced the highest quality hay, but was consistently the lowest yielding variety. Because of the high stem content, the hay of Arkwin was considered to be of the lowest quality among the varieties tested.

Among all varieties, tiller number and plant height were found to be greatly influenced by climatic variations among the different years. Tiller number appeared to have no relationship to quantity of hay produced, and only when the plants were extremely tall or short did plant height appear to be associated with yield. The extreme short stature of Cimarron probably accounts for its low yield performance.

Except for Cimarron, there appeared to be little association of varietal maturity and yield.

Literature Cited

1. Bolton, F. E. Associations of the major plant characters which contribute to grain yield in five varieties of winter oats. Unpublished Masters Thesis. Oklahoma State University. 1961.

2. Frey, K. J. Yield components in oats. III: Their contribution to the variety X location interaction for grain yield. *Agronomy Journal.* 51:744-746. 1959.

3. Pendleton, J. W. and C. M. Brown. Effect of cultural treatments on the yield and protein content of oats cut for silage. *Agronomy Journal.* 53:41-42. 1961.

4. Sotola, J. The chemical composition and nutritive value of certain cereal hays as affected by plant maturity. *Journal of Agricultural Research,* 54:399-415. 1937.

5. Wallace, A. T., G. K. Middleton, R. E. Comstock, and H. F. Robinson. Genotypic variances and co-variances of six quantitative characters in oats. *Agronomy Journal* 46:484-488. 1954.

Appendix

Experimental Methods

The varieties were sown in randomized complete block tests with three replications. Plot size was six 10-foot rows spaced 12 inches apart.

Hay yields were obtained by harvesting a total of 16 square feet from the two center rows of each plot when the varieties reached the soft dough stage of maturity. This stage was determined by examining kernels in the central portion of the panicles. Dry matter per plot was computed, based on the percent dry matter in a 1000-gram sample dried at 140° F. for 48 hours. Yield component data were taken from a 600-gram sample harvested at ground level from four random locations in rows not harvested for yield. Leaf-blades, heads, and stems were separated in this sample. The leaf-blades were removed at the ligule and the panicles at the apex of the peduncle. Each component was weighed and placed in a small cotton sack to be dried (140° F. for 48 hours). The percentage of dry matter contributed by each component was obtained by dividing the dry weight of the component by the total dry weight of all the components and multiplying the quotient by 100.

Head-bearing tillers were counted in four one-foot sections of each plot. The average of these was reported as the tiller count per square

Appendix Table 1.—Average Yields of Oat Hay Produced by 10 Winter Oat Varieties Grown at Stillwater, Oklahoma During the Years 1958-60.

Variety	C.I. No.	Tons/acre—dry matter				Statistical Significance[1]
		1958	1959	1960	Average	
Forkedeer	3170	4.89	4.49	3.95	4.44	
Stanton Str. 1 Sel.	6902	5.08	4.47	3.74	4.43	
Bronco	6571	5.08	4.19	3.99	4.42	
Arkwin	5850	4.98	4.48	3.64	4.36	
Stw. 553452	----	4.92	3.93	3.76	4.20	
Atlantic	4599	4.84	3.94	3.51	4.10	
Colo X Wintok	5118	4.06	4.28	3.91	4.08	
Nysel	5364	4.61	3.57	3.96	4.05	
Arlington	4657	5.08	4.08	2.87	4.01	
Cimarron	5106	3.75	3.20	3.44	3.46	
Average		4.73	4.06	3.68	4.16	

[1]Variety averages grouped by a continuous line are not significantly different.

foot for each plot. Height, expressed in inches from the ground level to the top of the panicles, was based on an average of three random readings per plot. Heading date, a good index of relative maturity, was recorded when each plot was at least 75 percent headed.

Analyses of variance were calculated on the observations as follows: hay yield, numbers of tillers, maturity, and height.

Appendix Table 2.—Percentage of the Total Dry Weight Contributed by Each of the Plant Components for 10 Winter Oat Varieties Studied for the Year 1958-1960.

Variety	C.I. No.	1958			1959			1960			Average		
		Bls.*	Hd.	Stm.	Bls.	Hd.	Stm.	Bls.	Hd.	Stm.	Bls.	Hd.	Stm.
Forkedeer	3170	19.1	36.5	44.4	23.2	36.5	40.3	15.9	40.1	44.0	19.4	37.7	42.9
Stanton Str. 1 Sel	6902	13.9	41.2	44.9	21.6	40.6	37.8	12.8	44.3	42.9	16.1	42.0	41.9
Bronco	6571	12.8	42.2	45.0	27.9	33.6	38.5	13.9	44.7	41.4	18.2	40.2	41.6
Arkwin	5850	16.9	33.0	50.1	18.7	37.0	44.3	13.4	35.1	51.5	16.3	35.1	48.6
Stw. 553452	____	17.4	38.4	44.2	26.5	27.6	45.9	12.8	40.1	47.1	18.9	35.4	45.7
Atlantic	4599	14.6	41.3	44.1	20.2	38.4	41.4	13.2	38.2	48.6	16.0	39.3	44.7
Colo X Wintok	5118	18.5	38.2	43.3	20.6	35.8	43.6	12.1	42.4	45.5	17.1	38.8	44.1
Nysel	5364	15.5	36.2	48.3	26.8	32.1	41.1	14.3	43.7	42.0	18.9	37.3	43.8
Arlington	4657	15.2	41.2	43.6	22.2	37.3	40.5	10.7	44.1	45.2	16.0	40.9	43.1
Cimarron	5106	15.6	39.4	45.0	15.5	49.7	34.8	12.6	47.6	39.8	14.6	45.5	39.9

*Bls.=Leaf blades, Hd.=Heads, Stm.=Stems.