PERFORMANCE AND AGRONOMIC CHARACTERISTICS OF THIRTY OAT VARIETIES AND LINES

By

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CHAPTER I

INTRODUCTION

In world production, oats rank fourth among all cereals, being exceeded only by wheat, rice, and corn. Over 90 percent of the crop is used for animal feed, and less than 5 percent is used for human consumption. For this reason much less attention has been paid by the breeders to quality in oats than in other cereals. The diversity of varietal types makes possible the successful culture of oats over a wider range of climatic conditions than is possible for any other cereal.

Winter oats appear to be the most productive and palatable of the cereals for hay and seems to offer an excellent source of high quality hay and grain. The amino acid composition of oats is nutritionally superior to that of other cereals. Study of the relationship between yield and yield components will help a plant breeder to make improvements in yield or other characters by selecting positively correlated characters.

A distinct advantage of winter oats is that winter pasture may be produced and then later a hay or grain crop harvested. In general, oats, because of their soft texture, are regarded as the most palatable of cereal hays. Oats were found to contain the highest percentage of leaves and a moderate amount of grain and stalk as compared to other cereals.

Much of the research involving small grains, expecially oats, concerns the best maturity stage for harvest. The primary objectives of this study are: (1) to determine the interrelationship between the yield components and some other characters in 30 varieties and selections, and (2) to determine the correlation between protein percentage and yield as well as other characters.

CHAPTER II

REVIEW OF LITERATURE

Love (22) concluded that there is a positive relationship between yield of grain and yield of straw for several different oat varieties. Musgrave (26), on the other hand, concluded that there is no absolute relation between yield of straw and grain, but, generally, the higher yields of straw are associated with lower yields of grain under normal conditions. Musgrave (26) concluded that the relationship between the yield of grain and straw may be dependent upon climatic conditions under which the comparison is made. With reference to oats, while the panicles are forming the crop must have cool and moderately wet weather to produce the best yields. Cool weather favors the ripening of grain, while the crop is often materially reduced by a few hot days when it is near maturity. Love's experiment was conducted in a cool climate, while Musgrave's was done in a hot climate.

Mehra et al. (23) reported that the fodder yield was positively correlated with plant height, tiller number, stem girth, leaf length, and leaf width. Plant height was correlated positively with leaf length and negatively with leaf-stem ratio. Tiller number and leaf width were positively correlated. In oats tiller number, leaf number, and stem girth exhibited high heritability (85-97 percent), while plant height, leaf length, leaf width, and leaf-stem ratio exhibited heritabilities of 61-98 percent. According to Stuthman and Marten (32) forage yield and grain yield were not associated. Forage yield was correlated with plant weight and heading date. Huffine et al. (14) reported that forage yield of all the small grains tested were higher in the spring (March through May) than any other season. Variations in growing conditions, mainly temperature, in the fall and spring apparently influenced forage yields as much as the crop or variety.

The result of a study by Anderson and Kaufmann (2) indicated that dry matter yields may vary appreciably among varieties and that the taller and later maturing varieties tend to be more productive. Biometrical studies by Immer and Stevenson (15) and Bolton et al. (4) showed that height of plants had very little influence on yield of oats. Pendleton and Brown (28) concluded that the height of the oat plants increased as the row width increased. Also, tillering increased directly with increased row width.

Murphy and Frey (25) explained that with oats, as with other crops, grain yield variation is due to an interaction of environment and genetic effects. One method proposed to increase grain yield is to select characteristics associated with or composing yield, e.g., yield components. Primary components of grain yield are number of panicles per plant, number of kernels per panicle, and kernel weight. Five varieties of oats were studied at different locations in Oklahoma (4), with grain yield and its components being determined. According to this experiment, the number of seeds per panicle was more closely associated with yield than the other components. The data suggested that kernel number per panicle may be an important selection criterion for higher yield. Panicle number per unit area was influenced more by environmental changes.

Lawes and Treharne (21) showed that there is no correlation between photosynthetic activity of individual leaves and total dry matter production at anthesis. Grain yield in cereals is derived from photosynthesis in vegetative tissues such as leaf blades, sheats, and the green tissues of the head itself. Jennings and Shibles (16) suggested that a high panicle capacity for photosynthesis would be beneficial because: a) panicle tissue may be more efficient than other tissues, b) panicle tissue would still photosynthesize under conditions of leaf disease epiphytotic, and c) panicle tissue may remain physiologically active longer than leaf tissue. There is some evidence (6) that specific leaf weight, leaf dry weight, or fresh weight per unit area might be used routinely in breeding programs to select for photosynthetic efficiency.

Although kernel weight certainly accounts for a portion of total yield, Bolton et al. (4) and Wiggans and Frey (35) stated that high kernel weights do not appear to be associated with the higher yielding varieties. The effect of premature harvesting of oats upon germination, moisture content, and kernel and seedling weight was determined for seven varieties of oats grown in the greenhouse and field (10). Near maximum seed weight was reached when the moisture content of the grain was approximately 45 percent, with only a slight increase thereafter.

Youngs (36), in an experiment with five cultivars, hand-dissected groats from each variety into the embryonic axis, scutellum, bran, and starchy endosperm. The embryonic axis accounts for 1.1 to 1.4 percent of the total groat weight, scutellum 1.6 to 2.6 percent, bran 28.7 to 41.4 percent, and endosperm 55.8 to 68.3 percent. Yielding ability and weight per 100 kernels were measured by Frey and Huang (9) in seven populations of oat lines, each derived from a different cross. The association between these two traits was curvilinear, with maximum yields occurring when 100-kernel weights were between 2.75 and 3.10 grams. The proportion of kernel to vegetative parts could be increased (7) by using short-stemmed cultivars. Little improvement of oats for forage could be attained by selection for morphological composition.

Other treatments influencing oat characteristics are the rate and date of planting. When oats were planted (34) at weekly intervals, beginning in early April, the number of panicle-bearing tillers per plant increased for the first five planting dates and then decreased. Wiggans and Frey (34,35), stated that increasing the planting rate tended to decrease the number of tillers per plant.

Oat varieties were planted at two different dates, mid-March and late April. As a result of this experiment, Pendleton and Dengan (29) concluded that protein content of the forage on a dry-matter basis averaged 11.7 percent for the early planting date and 12.7 percent for the late planting date.

Bolton et al. (4) concluded that for a particular variety within a given environment, a decrease in one component tends to be counter-balanced by an increase of one or more components. Grafius (13) interpreted yield components of oats geometrically. He showed that yield may be represented as a rectangular parallelepiped with the following edges: the number of panicles per unit area (X), the average number of kernels per panicle (Y), and the average kernel weight (Z). Changes in X, Y, and Z should tend to counterbalance. The edge subject to the most change should be the longest, and the edge subject to the least change should be the shortest.

According to Gardner and Wiggans (12), Kitcher and Troelsen (18), Klebesadel (19), and Lawes and Jones (20), the quality of whole-crop cereals is dependent on the stage of growth at which they are harvested. The digestibility and protein content are highest at the earlier stages, and as the crops approach maturity the percentage dry matter increases, and both digestibility and protein decrease. Three oat cultivars were harvested at different stages of maturity (18). Percentage leaves by weight for all cultivars varied from 6 to 90 percent over the nine cuttings, whereas that of stems went from 5 to 24 percent. Leaves had 20 percent more energy than did stems.

Kaufmann (17) used data obtained from the annual reports of the associate committee on plant breeding of the National Research Council of Canada and the Canada Department of Agriculture for 14 years (1945-1958). A total of 143 varieties were tested at 16 stations. Based on these data, a positive correlation between maturity and forage yield was reported when conditions were favorable for all maturity classes. Peier (27) stated that when a high quality nitrogenous forage is desired, cutting should be done in the early milk stage, when the whole plant is quite palatable. If a forage high in carbohydrates is desired, cutting at the beginning of the dough stage is necessary. Generally, the best stage for harvesting is the soft dough stage or sometime during the dough stage.

Recently, protein and 17 amino acids were determined in 289 samples of oats (30). The samples contained 12.4 to 24.4 percent crude protein (average 17.1 percent). Chemical analysis of the oat hydrolysates indicated that the amino acid composition was nutritionally superior to that of other cereal grains. The correlation coefficient between lysine and protein was low. This indicated that increased protein in oats need not be accompanied by a decreased lysine concentration in the protein as in other cereals, e.g., wheat and barley. When oat plants were cut at three levels from the ground, Bartlett (3) reported that the lower portion of the plant had very little nutrient value. The center section had about half as much protein as the top section, and its digestibility was lower.

Sotola (31) concluded that the physical composition (stem-leaf-head ratio) of the cereal plants is a fairly reliable and practical index of its feeding value. The ratio of stem, leaf, and head in a cereal plant affects both its nutritive value and its chemical composition. Campbell and Frey (5) and Forsberg et al. (8) concluded that protein percentage was significantly and negatively correlated with yield in oats. This important relationship between yield and protein percentage is influenced by the amount of nitrogen available and removed from the soil. Middleton et al. (24) reported that there is no significant correlation between yield and protein.

Welch (33) compared winter and spring sowing. He showed that there is an increase in oil and kernel content and 1,000-kernel weight in winter sowing. But protein content was higher from spring sowing. Forseberg et al. (8) showed that the wild oat species Avena sterilis L. contained high groat protein. Ahlgren (1) showed that often there is a favorable protein response in the grasses that are grown with legumes. The protein content of oats was increased from 7.93 to 8.94 percent by growing with peas. Analysis of groat fraction for protein by Youngs

(36) showed that the greatest concentration is in the embryonic axis. Since most of the groat weight is in the bran and endosperm, these fractions contained the greatest part of the total groat protein. Studies on protein inheritance by Frey et al. (11) indicated that it is inherited as a quantitative characteristic with dominance of low protein percentage.

CHAPTER III

MATERIALS AND METHODS

Composition of Entries and Field Layout

This study consisted of 30 different varieties and lines. Twenty-one of these were developed at the Oklahoma Agricultural Experiment Station. The experiment was carried out in the 1974-75 season at the Agronomy Research Station in Stillwater.

The experimental design was a randomized complete block design with three blocks, each block containing 30 entries. The plots were 8 feet long and 4 feet wide, with 4 rows. The plots were seeded at the rate of two bushels per acre, and planting was done on October 4, 1974. A preplant application of 100 pounds-per-acre ammonium phosphate (18-46-0) fertilizer was applied on September 9, 1974. A supplement of 150 pounds-per-acre ammonium nitrate (34-0-0) was applied on March 3, 1975. The soil was a Kirkland silt loam.

Characters Investigated

The following characters were observed and measured on all plots: the green and dry weight of leaf, stem, and panicle, total green and dry weight, number of panicles, leaf area (first and second leaf), height, and protein content. Height was measured a few days before harvesting, and corresponded to the distance in centimeters separating the soil surface from the tops of the plants. Leaf area was determined by the use of a portable area meter, model LI-3000. The first and second leaves were measured. Five measurements were taken for each leaf in each plot and then averaged.

Harvesting was done on May 30, 1975. One sample of one foot long was harvested from the first or fourth row of each plot during the soft dough stage of maturity. Plants were cut two inches above the ground. Leaves were separated at the ligule, the panicles were separated at the apex of the peduncle, and the remaining stems were cut into small sections to facilitate handling. The green weight of each component was determined. The number of panicles was determined by counting the number of panicle-bearing tillers from the one-foot section. Components in separate sacks were dried separately at 135^{o} F. for one week, and the dry weight of each component was measured.

Components belonging to each plot were mixed and ground for laboratory analysis. Protein content of mixed material was determined by the Kjeldahl method on one gram of ground dry matter. The analysis was performed in the Wheat Quality Laboratory, Oklahoma State University. One sample was used for each plot. The concentration of the chemicals used in the Kjeldahl procedure was such that the reading number in titration had to be multiplied by 1.1 as the feeding factor. The yield of dry matter was determined as the total of dry components in each sample from one square foot. Grain yield determination was based on the threshed and cleaned grain harvested from two center rows from each plot and was expressed in grams per 16 square feet.

Statistical Analysis

Statistical analysis was conducted on all characters measured. Computational analyses were made by the Statistical Analysis System (SAS) at the Oklahoma State University Computer Center. Analyses of variance were performed for each character. LSD was used to compare the means of the varieties for each character. To evaluate the possible relationship between different combinations of characters, a simple correlation was computed for each character with each of the other characters. The coefficent (r_{XY}) of simple correlation between two variables X and Y was determined by the formula:

$$r_{XY} = \frac{\Sigma xy}{\Sigma x^2 \ \Sigma y^2}$$

where Σx^2 is the error sum of squares of the deviations of the variable x; Σy^2 is the error sum of squares of the deviations of the variable y; and Σxy is the error sum of products of the deviations of X and Y.

CHAPTER IV

RESULTS AND DISCUSSION

Green Matter Yield

The results of the analyses of variance for total green weight and its components are presented in Table I. Total green matter, stems, and panicles showed significant differences due to varieties. Leaf green weight was not significant. Total green matter of thirty oat varieties and lines are compared in Table II. "Walken" had the highest green matter which was not significantly different from the following five varieties. "Lee," which was used as a check variety, was in the high ranking group. The overall average for total green matter was 246.11 $g/ft.^2$ The nineteen lowest varieties were not significantly different. Several lines of "Chilocco/Nora" recorded low green matter.

Data for green weight of stems ($g/ft.^2$) is presented in Table III. Varieties high in total green matter recorded high stem weights, indicating high correlation between these two traits. Entry numbers 1, 2, 6, 7, and 8, which recorded a high total green matter (Table II), were high in stem weights (Table III). Chilocco/Nora lines low in total green matter were in the lowest group in stem green weights. "2*Lec/Dbs//Tk/Cmr" was the lowest in stem green weight and total green weight (Tables II and III).

TABLE I

MEAN SQUARES FOR STEMS, LEAVES, PANICLES, AND TOTAL GREEN WEIGHT OF THIRTY OAT VARIETIES AND LINES

Source of Variation	d.f.	Green Weights: Stems	Leaves	Panicles	Total
Rep.	2	8034.14	2076.23	1289.74	26897.98
Var.	29	3773.73**	1587.13	332.79**	10129.43**
Rep. x Var.	58	1079.76	1050.77	114.34	3619.71
Corrected Totals	89	2113.85	1248.58	211.93	6263.96
F Value		3.49	1.51	2.91	2.79
OSL		.0001	.0908	.0004	.0006

*Significant at the .05 level of probability.
**Significant at the .01 level of probability.

TABLE II

TOTAL GREEN WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Total Green Weight (g/ft.^{2})
1	Walken	6	404.17
2	Compact	7	329.43
3	C.I.7162-3/Ballard	8	327.37
4	C.I.1897/Dbs//Tk/Cmr	13	318.40
5	Norline	2	312.10
6	Lee	1	307.40
7	KY56-302/C.I.4897	9	301.97
8	LeConte*4/Dubois	10	291.30
9	Chilocco/Nora	22	274.20
10	Chilocco	3	267.07
11	Bco//Arl/Wtk	5	260.27
12	Tk/Cmr//Nora	30	250.73
13	Chilocco/Ora	16	249.80
14	2*Lec/Dbs/Tk/Cmr	14	245.83
15	Chilocco/Nora	23	242.37
16	Tk/Cmr//W. Excel	29	239.03
17	Cmr//Arl/Wtk	4	234.20
18	Cmr//Wtks/Hc	15	222.93
19	Arkwin Seln	11	221.23
20	Nora	19	211.00
21	Chilocco/Nora	21	207.56
22	Chilocco/Nora	17	207.50
23	Chilocco/Nora	25	198.53
24	Chilocco/Nora	26	194.27
25	Chilocco/Nora	27	187.83
26	Cimarron/Checota	28	185.33
27	Tk/Cmr//Nora	18	180.60
28	Chilocco/Nora	20	179.73
29	Chilocco/Nora	24	173.50
30	2*Lec/Dbs//Tk/Cmr	12	157.53

Lsd .05 = 98.33

TABLE III

STEM GREEN WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Stem Green Weight (g/ft.^{2})
1	Walken	6	235.33
2	C.I.7162-3/Ballard	8	211.67
3	Norline	2	197.33
4	Compact	7	197.00
5	LeConte*4/Dubois	10	193.33
6	Lee	1	191.67
7	Chilocco/Nora	22	186.00
8	KY56-302/C.I.4897	9	180.33
9	Chilocco	3	175.00
10	2*Lec/Dbs/Tk/Cmr	14	162.67
11	Bco//Arl/Wtk	5	162.00
12	Chilocco/Ora	16	157.67
13	Arkwin Seln	11	154.00
14	Tk/Crm//W. Excel	29	152.00
15	C.I. 1897/Dbs//Tk/Cmr	13	151.33
16	Chilocco/Nora	23	150.33
17	Cmr//Arl/Wtk	4	150.33
18	Cmr//Wtks/Hc	15	144.00
19	Chilocco/Nora	17	135.00
20	Nora	19	133.00
21	Chilocco/Nora	25	124.67
22	Chilocco/Nora	27	123.33
23	Chilocco/Nora	26	120.00
24	Chilocco/Nora	21	115.67
25	Cimarron/Checota	28	114.33
26	Chilocco/Nora	24	111.33
27	Tk/Cmr//Nora	18	111.33
28	Chilocco/Nora	20	111.00
29	Tk/Cmr//Nora	30	110.33
30	2*Lec/Dbs//Tk/Cmr	12	96.33

Lsd .05 = 53.70

Leaf green weights (g/ft.^{2}) are compared in Table IV. Differences between varieties and lines were not as great as was recorded for stems and total green weights. Most of the high ranking entries in leaf green weight were high in stem and total green weight. Chilocco/Nora lines recorded low leaf green weight (Table IV). Walken was the highest; however, it was not significantly different from the next six entries. Besides several Chilocco/Nora lines, entry numbers 12, 15, 18, 19, and 28 were in the low ranking group in total green matter and stems and leaves (Tables II, III, and IV), showing the high correlation between these traits. Panicle green weights are shown in Table V. The overall average for panicle green weights was 51.26 g/ft.^{2} Seven lines of Chilocco/Nora were in the low ranking group. Entry 12 had the lowest panicle green weight; however, it was not significantly different from the last seventeen entries (Table V). Most of the entries with high panicle green weights recorded high total green matter, stem and leaf green weight (Tables II, III, IV, and V). This indicates that varieties with high panicle green weights tended to be high in total green matter, stems, and leaves. But entry 30, with low stem and panicle green weights (Tables III and IV) was the second highest entry in leaf green weight (Table IV).

Hay Yield

Entries showed a highly significant difference due to total dry matter and its components (Table VI). Because of the different maturities at the time of harvesting and consequently available water in the components, variability within the dry components is less than in the green components. Total dry matter expressed in grams per

TABLE IV

LEAF GREEN WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Leaf Green Weight (g/ft.^{2})
1	Walken	6	106.00
2	Tk/Cmr//Nora	30	101.33
3	C.I.1897/Dbs//Tk/Cmr	13	94.67
4	Compact	7	68.00
5	KY56-302/C.I.4897	9	64.00
6	LeConte*4/Dubois	10	56.00
7	Norline	2	53.67
8	C.I.7162-3/Ballard	8	51.00
9	Chilocco/Nora	23	45.00
10	Lee	1	44.67
11	Chilocco/Nora	25	38.33
12	Chilocco/Nora	21	37.00
13	Bco//Arl/Wtk	5	36.67
14	Tk/Cmr//W. Excel	29	36.66
15	Cmr//Wtks/Hc	15	36.33
16	Chilocco	3	35.67
17	2*Lec/Dbs/Tk/Cmr	14	34.33
18	Cmr//Arl/Wtk	4	32.67
19	Chilocco/Ora	16	30.00
20	Chilocco/Nora	22	29.00
21	Tk/Cmr//Nora	18	28.00
22	Nora	19	27.00
23	2*Lec/Dbs//Tk/Cmr	12	27.00
24	Chilocco/Nora	26	26.33
25	Arkwin Seln	11	26.33
26	Chilocco/Nora	17	26.33
27	Chilocco/Nora	20	24.33
28	Cimarron/Checota	28	24.00
29	Chilocco/Nora	27	23.33
30	Chilocco/Nora	24	22.33

Lsd .05 = 52.98

TABLE V

PANICLE GREEN WEIGHTS FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Panicle Green Weight (g/ft.^{2})
1	C.I. 1897/Dbs//Tk/Cmr	13	72.40
2	Lee	1	71.07
3	C.I.7162-3/Ballard	8	64.70
4	Compact	7	64.43
5	Walken	6	62.83
6	Chilocco/Ora	16	62.13
7	Bco//Arl/Wtk	5	61.60
8	Norline	2	61.10
9	Chilocco/Nora	22	59.20
10	KY56-302/C.I.4897	9	57.63
11	Chilocco	3	56.40
12	Chilocco/Nora	21	54.90
13	Cmr//Arl/Wtk	4	51.20
14	Nora	19	51.00
15	Tk/Cmr//W. Excel	29	50.37
16	2*Lec/Dbs/Tk/Cmr	14	48.83
17	Chilocco/Nora	26	47.93
18	Cimarron/Checota	28	47.00
19	Chilocco/Nora	17	46.17
20	Chilocco/Nora	23	46.03
21	Chilocco/Nora	20	44.40
22	Cmr//Wtks/Hc	15	42.60
23	LeConte*4/Dubois	10	41.97
24	Tk/Cmr//Nora	18	41.27
25	Chilocco/Nora	27	41.17
26	Arkwin Seln	11	40.90
27	Chilocco/Nora	24	39.83
28	Tk/Cmr//Nora	30	39.07
29	Chilocco/Nora	25	35.53
30	2*Lec/Dbs//Tk/Cmr	12	34.20

Lsd .05 = 17.476

TABLE VI

MEAN SQUARES FOR STEMS, LEAVES, PANICLES, AND TOTAL DRY WEIGHT OF THIRTY OAT VARIETIES AND LINES

Source of Variation	d.f.	Dry Weight			
		Stems	Leaves	Panicles	Total
Rep.	2	485.23	433.33	178.72	3050.33
Var.	29	160.84**	77.42**	68.37*	535.09**
Rep. x Var.	58	34.49	20.09	37.94	194.82
Corrected Totals	89	85.79	48.06	51.02	369.86
F Value		4.66	3.85	1.80	2.74
OSL		.0001	.0001	.0282	.0007

*Significant at the .05 level of probability.
**Significant at the .01 level of probability.

square foot is presented in Table VII. Lee had the highest yield, 120 grams per square foot; however, it was not significantly different from the ten following varieties and lines. The overall average for dry matter was 92.70 $g/ft.^2$ Entries with high hay yield were high in total green matter (Tables II and VII), indicating positive correlation among these two traits. "KY56-302/C.I.4897" ranked 25th in total dry matter (Table VII), but it ranked 7th in total green matter (Table II). KY56-302/C.I.4897 has the latest maturity. "Tk/Cmr//Nora" (entry 30) had a similar situation (Tables II and VII). Entries 1, 2, 6, 7, and 8 were in the high ranking group in total green matter and hay yield (Tables II and VII).

Stem dry weights are presented in Table VIII. Entries 1, 2, 6, 8, 10, and 22, which recorded high in hay yield, are in the high ranking group. Most of the Chilocco/Nora lines except entry 22 showed low stem weights. All of the entries in the low ranking group (Table VIII) were also in the low ranking group in total dry weights (Table VII). This indicates the large contribution of stems to total dry matter. Entry 9 was ranked 18th (Table VIII), but Table II shows that this entry is 8th in stem green weight.

Leaf dry weight comparisons are presented in Table IX. Walken and "Compact" were the leading varieties in leaf dry weight, indicating a better hay quality. Entry 30 ranked 28th in leaf dry weight (Table IX), but it was in the high ranking group in leaf green weight (Table IV). Entry 9 behaved similarly. Tables IV and IX show that the rest of the varieties and lines were more or less in the same position. Panicle dry weights showed a significant difference at the 0.05 level of probability (Table VI). Fifteen top varieties and lines did not show

TABLE VII

TOTAL DRY MATTER OF THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Total Dry Matter (g/ft.^{2})
1	Lee	1	120.000
2	Walken	6	114.667
3	C.I.7162-3/Ballard	8	114.199
4	Chilocco/Nora	22	111.500
5	Norline	2	107.567
6	Compact	7	103.333
7	Chilocco	3	102.499
8	2*Lec/Dbs/Tk/Cmr	14	102.233
9	Chilocco/Ora	16	102.165
10	LeConte*4/Dubois	10	101.633
11	Bco//Arl/Wtk	5	101.300
12	Tk/Cmr//W. Excel	29	96.396
13	Chilocco/Nora	23	94.993
14	C.I.1897/Dbs//Tk/Cmr	13	90.967
15	Chilocco/Nora	25	89.933
16	Chilocco/Nora	17	87.999
17	Chilocco/Nora	21	87.999
18	Cimarron/Checota	28	87.833
19	Cmr//Arl/Wtk	4	87.600
20	Arkwin Seln	11	86.999
21	Cmr//Wtks/Hc	15	86.999
22	Chilocco/Nora	26	85.833
23	Nora	19	85.399
24	Chilocco/Nora	24	81.133
25	KY56-302/C.I.4897	9	81.066
26	2*Lec/Dbs//Tk/Cmr	12	75.567
27	Tk/Cmr//Nora	18	75.500
28	Chilocco/Nora	27	74.367
29	Chilocco/Nora	20	73.300
30	Tk/Cmr//Nora	30	70.233

Lsd .05 = 22.81

TABLE VIII

STEM DRY WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Stem Dry Weight (g/ft.^{2})
1	Lee	1	56.83
2	Walken	6	52.17
3	C.I.7162-3/Ballard	8	50.43
4	Chilocco/Nora	22	49.83
5	LeConte*4/Dubois	10	49.13
6	Norline	2	48.00
7	2*Lec/Dbs/Tk/Cmr	14	46.57
8	Chilocco	3	46.17
9	Chilocco/Ora	16	44.00
10	Arkwin Seln	11	43.83
11	Compact	7	43.67
12	Bco//Arl/Wtk	5	43.67
13	Chilocco/Nora	23	40.23
14	Chilocco/Nora	17	39.50
15	Tk/Cmr//W.Excel	29	38.33
16	C.I.1897/Dbs//Tk/Cmr	13	38.00
17	Cmr//Wtks/Hc	15	37.67
18	KY56-302/C.I.4897	9	37.17
19	Chilocco/Nora	25	36.83
20	Cimarron/Checota	28	36.00
21	Chilocco/Nora	26	36.00
22	Chilocco/Nora	24	35.17
23	Cmr//Arl/Wtk	4	35.17
24	Nora	19	35.00
25	Chilocco/Nora	21	33.00
26	Chilocco/Nora	27	32.70
27	2*Lec/Dbs//Tk/Cmr	12	31.73
28	Tk/Cmr//Nora	18	31.43
29	Chilocco/Nora	20	29.30
30	Tk/Cmr//Nora	30	28.17

Lsd .05 = 9.60

TABLE IX

LEAF DRY WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Leaf Dry Weight (g/ft.^{2})
1	Walken	6	35.83
2	Compact	7	29.83
3	LeConte*4/Dubois	10	28.17
4	C.I.7162-3/Ballard	8	27.83
5	Norline	2	26.33
6	Chilocco/Nora	23	24.83
7	C.I.1897/Dbs//Tk/Cmr	13	23.50
8	Chilocco/Nora	25	23.33
9	Lee	1	23.33
10	Tk/Cmr//W. Excel	29	23.07
11	2*Lec/Dbs/Tk/Cmr	14	22.67
12	Bco//Arl/Wtk	5	22.50
13	Cmr//Wtks/Hc	15	21.67
14	KY56-302/C.I.4897	9	20.90
15	Chilocco	3	20.33
16	Chilocco/Nora	22	19.67
17	Chilocco/Nora	21	19.00
18	2*Lec/Dbs//Tk/Cmr	12	18.83
19	Cmr//Arl/Wtk	4	18.77
20	Chilocco/Nora	16	18.67
21	Cimarron/Checota	28	17.00
22	Chilocco/Nora	26	17.00
23	Chilocco/Nora	24	16.73
24	Tk/Cmr//Nora	18	16.57
25	Chilocco/Ora	17	16.33
26	Nora	19	16.17
27	Arkwin Seln	11	16.00
28	Tk/Cmr//Nora	30	15.83
29	Chilocco/Nora	20	15.50
30	Chilocco/Nora	27	13.00

Lsd .05 = 7.32

significant differences in panicle dry weights (Table X). KY56-302/C.I.4897, ranking 30th in panicle dry weight, was in the high ranking group in panicle green weights. Walken, with high stem and leaf dry weight, recorded a low panicle dry weight. Tables III and VIII, IV, and IX, and V and X show that a higher percentage of water in Tk/Cmr//Nora (entry 30) is located in leaves than in stems and panicles.

Hay Quality

The contribution of each component to total dry weight is presented in Table XI. Averages for stem, leaf, and panicle are 43.18, 22.5, and 34.30 percent, respectively. The main component for every variety was stems. Varieties with a high percentage of stems had the poorest quality, while increasing leaf and/or panicle indicates a better quality. Kitcher and Troelsen (18) suggested that a high percentage of leaves produced a better quality forage than stems. Leaves were reported to have 20 percent more energy than stems. Peier (27) stated that when the percentage of stems is high, quality is poor. However, height of different oat varieties is a very important characteristic determining hay yield. Varieties and lines with entry numbers 7, 13, 23, and 25 were high in leaf percentage coupled with high corresponding protein percentages (Tables XI and XVI). "Nora," with the second highest panicle percentage (Table XI) had the highest protein content. Entry 21 recorded the highest panicle percentage and was in the high ranking group in protein content (Table XVI). "LeConte*4/Dubois" and Lee, with the second and third highest stem percentages, respectively, were in the low ranking group in protein

TABLE X

PANICLE DRY WEIGHT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Panicle Dry Weight (g/ft.^{2})
1	Chilocco/Nora	22	42.00
2	Lee	1	39.83
3	Chilocco/Ora	16	39.50
4	Chilocco	3	36.00
5	Chilocco/Nora	21	36.00
6	C.I.7162-3/Ballard	8	35.93
7	Bco//Arl/Wtk	5	35.13
8	Tk/Cmr//W. Excel	29	35.00
9	Cimarron/Checota	28	34.83
10	Nora	19	34.23
11	Cmr//Arl/Wtk	4	33.67
12	Norline	2	33.23
13	2*Lec/Dbs/Tk/Cmr	14	33.00
14	Chilocco/Nora	26	32.83
15	Chilocco/Nora	17	32.17
16	Chilocco/Nora	23	29.93
17	Compact	7	29.83
18	Chilocco/Nora	25	29.77
19	C.I.1897/Dbs//Tk/Cmr	13	29.47
20	Chilocco/Nora	24	29.23
21	Chilocco/Nora	27	28.67
22	Chilocco/Nora	20	28.50
23	Cmr//Wtks/Hc	15	27.67
24	Tk/Cmr//Nora	18	27.50
25	Arkwin Seln	11	27.17
26	Walken	6	26.67
27	Tk/Cmr//Nora	30	26.23
28	2*Lec/Dbs//Tk/Cmr	12	25.00
29	LeConte*4/Dubois	10	24.33
30	KY56-302/C.I.4897	9	23.00

Lsd .05 = 10.07

TABLE XI

PERCENTAGE CONTRIBUTION OF EACH COMPONENT TO TOTAL DRY WEIGHT

Variety	Entry Number	Stem	Leaf	Panicle
Lee	1	47.36	19.44	33.19
Norline	2	44 62	24.48	30.89
Chilocco	3	45.04	19.84	35.12
Cmr//Arl/Wtk	4	40.14	21.42	38.42
Bco//Arl/Wtk	5	43.12	22.21	34.68
Walken	6	45.44	31.25	23.25
Compact	7	42.26	28.87	28.87
C.I.7162-3/Ballard	8	44.16	24.37	31.46
KY56-302/C.I.4897	9	45.85	25.78	28.37
LeConte*4/Dubois	10	48.34	27.71	23.94
Arkwin Seln	11	50.35	18.39	31.23
2*Lec/Dbs//Tk/Cmr	12	41.99	24.92	33.08
C.I.1897/Dbs//Tk/Cmr	13	41.77	25.83	32.39
2*Lec/Dbs/Tk/Cmr	14	45.55	22.17	32.28
Cmr//Wtks/Hc	15	43.29	24.90	31.80
Chilocco/Ora	16	43.07	18.27	38.66
Chilocco/Nora	17	44.88	18.56	36.55
Tk/Cmr//Nora	18	41.63	21.94	36.42
Nora	19	40.98	18.93	40.08
Chilocco/Nora	20	39.97	21.14	38.88
Chilocco/Nora	21	37.50	21.59	40.91
Chilocco/Nora	22	44.69	17.64	37.67
Chilocco/Nora	23	42.35	26.14	31.51
Chilocco/Nora	24	43.34	20.62	36.03
Chilocco/Nora	25	40.95	25.94	33.10
Chilocco/Nora	26	41.94	19.80	38.25
Chilocco/Nora	27	43.97	17.48	38.55
Cimarron/Checota	28	40.99	19.35	39.66
Tk/Cmr//W. Excel	29	39.76	23.93	36.31
Tk/Cmr//Nora	30	40.10	22.54	37.35

content (Tables XI and XVI). Entry 22, with the second lowest leaf percentage, ranked 29th in protein percentage, indicating the negative correlation between these two traits (Table XVI). Entries 20 and 21 (Chilocco/Nora) had the lowest stem percentage and high panicle percentage, indicating good quality lines.

Grain Yield

Grain yield expressed in grams per square foot is the average of three blocks. Differences among entries in grain yield were significant at the .01 level (Table XII). The average grain yields are compared and presented in Table XIII. "Chilocco/Ora" had the highest yield which was significantly different from the other varieties and lines. Entries 2, 4, 5, 8, 16, 21, and 28 were high in grain yield and panicle dry weights (Tables X and XIII). On the other hand, KY56-302/C.I.4897, Compact, and Walken, with the lowest grain yield, were low in panicle dry weights (Tables X and XIII). This indicates the positive correlation between grain yield and panicle dry weights. The simple correlation coefficient between grain yield and total dry matter was not significant. Musgrave (26) and Stuthman and Marten (32) concluded that there is no absolute relation between yield of straw and grain. Love (22), on the other hand, claimed that there is a positive relationship between these two traits.

Number of Panicles

The entry effect on the number of panicles was highly significant (Table XII). Lee had the highest number of panicles which was not significantly different from the next three varieties and lines.

TABLE XII

MEAN SQUARES FOR GRAIN YIELD, NUMBER OF PANICLES, HEIGHT, PROTEIN PERCENTAGE, AND FIRST AND SECOND LEAF AREA FOR THIRTY OAT VARIETIES AND LINES

Source of Variation	d.f.	Grain Yield	Number of Panicles	Height	Protein %	Leaf Area #1	Leaf Area #2
Rep.	2	56.19	410.01	270.04	1.29	14.18	12.87
Var.	29	68.06**	540.99**	159.42**	1.74*	9.54**	65.88**
Rep. x Var.	58	4.88	119.42	15.12	1.04	3.21	13.56
Corrected Totals	89	26.62	263.29	67.87	1.27	5.52	30.59
F Value		13.93	4.53	10.54	1.68	2.97	4.86
OSL		.0001	.0001	.0001	.0470	.0004	.0001

*Significant at the .05 level of probability.
**Significant at the .01 level of probability.

TABLE XIII

AVERAGE GRAIN YIELD OF THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA 1975

Rank	Variety	Entry Number	Grain Yield
1	Chilocco/Ora	16	80.3
2	Chilocco/Nora	21	69.1
3	C.I.7162-3/Ballard	8	68.8
4	Bco//Arl/Wtk	5	68.1
5	Cimarron/Checota	28	66.9
6	Norline	2	63.8
7	Cmr//Arl/Wtk	4	61.9
8	Chilocco/Nora	24	61.3
9	Chilocco/Nora	27	61.0
10	Lee	1	58.5
11	Chilocco/Nora	20	55.6
12	Chilocco/Nora	22	55.6
13	2*Lec/Dbs/Tk/Cmr	14	54.4
14	Chilocco/Nora	17	54.4
15	Chilocco	3	51.9
16	Chilocco/Nora	26	51.6
17	Chilocco/Nora	25	51.0
18	Arkwin Seln	11	49.7
19	Cmr//Wtks/Hc	15	47.8
20	Nora	19	46.9
21	Tk/Cmr//Nora	30	44.1
22	Tk/Cmr//Nora	18	43.5
23	Chilocco/Nora	23	43.1
24	Tk/Cmr//W. Excel	29	42.5
25	LeConte*4/Dubois	10	40.6
26	2*Lec/Dbs//Tk/Cmr	12	39.1
27	C.I.1897/Dbs//Tk/Cmr	13	35.94
28	Walken	6	28.1
29	Compact	7	19.7
30	KY56-302/C.I.4897	9	19.1

Lsd .05 = 3.60

KY56-302/C.I.4897, with the lowest panicle dry weight (Table X), had the lowest number of panicles. Wiggans and Frey (35) stated that high tillering capacity is important in the production of better oat varieties. All the seven varieties and lines in the low ranking group were low in total dry matter (Tables XII and XIV), expressing the high contribution of panicle number to total dry matter. The four entries highest in panicle number (1, 3, 23, and 29) tended to be in the low ranking group in first leaf area (Tables XIV and XVII). Jennings and Shibles (16) reported that a high panicle capacity would be beneficial for photosynthesis. However, high tillering ability alone does not appear to indicate high hay yield. Panicle number per unit area was reported by Bolton et al. (4) to be influenced by environmental changes.

Height

The entry effect on height was significant at the .01 level of confidence (Table XII). Average heights are compared in Table XV. "Norline," Lee, and "C.I.7162-3/Ballard," the tallest entries were in the high ranking group in hay yield (Table VI). Tables II, III, and V show that these varieties are high in total green weight, and stem and panicle green weights. Anderson and Kaufmann (2) also reported that taller varieties tended to be more productive. The three shortest entries (15, 19, and 23) recorded a high protein content but the three tallest entries (1, 2, and 8) were in the low ranking group in protein content (Tables XV and XVI). These data show that taller varieties may tend to produce low protein. The average height of all entries was 75.71 centimeters.

TABLE XIV

NUMBER OF PANICLES PER SQUARE FOOT FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Number of Panicles
1	Lee	1	111.33
2	Chilocco	3	101.00
3	Chilocco/Nora	23	96.67
4	Tk/Cmr//W. Excel	29	95.00
5	Chilocco/Nora	24	90.67
6	2*Lec/Dbs//Tk/Cmr	12	89.67
7	Cmr//Wtks/Hc	15	88.33
8	LeConte*4/Dubois	10	84.67
9	Chilocco/Nora	21	84.00
10	2*Lec/Dbs/Tk/Cmr	14	80.33
11	Norline	2	80.33
12	Bco//Arl/Wtk	5	79.67
13	Chilocco/Nora	22	79.00
14	Chilocco/Nora	26	78.67
15	C.I.7162-3/Ballard	8	78.67
16	Compact	7	78.00
17	Chilocco/Ora	16	76.67
18	Chilocco/Nora	25	76.67
19	Tk/Cmr//Nora	30	74.67
20	Arkwin Seln	11	74.00
21	Chilocco/Nora	27	73.33
22	Cimarron/Checota	28	72.00
23	Walken	6	71.33
24	C.I.1897/Dbs//Tk/Cmr	13	64.67
25	Chilocco/Nora	17	63.67
26	Chilocco/Nora	20	63.00
27	Tk/Cmr//Nora	18	62.67
28	Nora	19	61.67
29	Cmr//Arl/Wtk	4	59.33
30	KY56-302/C.I.4897	9	48.67

Lsd .05 = 17.86

TABLE XV

HEIGHT OF THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Average Height
1	Norline	2	93.00
2	Lee	1	89.33
3	C.I.7162-3/Ballard	8	89.33
4	Bco//Arl/Wtk	5	84.66
5	Cimarron/Checota	28	80.67
6	Chilocco/Nora	26	80.67
7	LeConte*4/Dubois	10	80.00
8	Cmr//Arl/Wtk	4	80.00
9	Chilocco/Nora	17	80.00
10	Walken	6	79.33
11	C.I.1897/Dbs//Tk/Cmr	13	78.67
12	KY56-302/C.I.4897	9	78.33
13	Chilocco/Ora	16	77.33
14	2*Lec/Dbs/Tk/Cmr	14	75.33
15	Chilocco/Nora	20	74.67
16	Chilocco	3	74.00
17	Tk/Cmr//W. Excel	29	74.00
18	Tk/Cmr//Nora	30	73.33
19	Chilocco/Nora	22	72.67
20	Tk/Cmr//Nora	18	72.00
21	Chilocco/Nora	21	71.67
22	Compact	7	71.33
23	Chilocco/Nora	24	70.68
24	Arkwin Seln	11	70.67
25	Chilocco/Nora	25	68.67
26	Chilocco/Nora	27	68.00
27	2*Lec/Dbs//Tk/Cmr	12	68.00
28	Cmr//Wtks/Hc	15	67.00
29	Chilocco/Nora	23	66.67
30	Nora	19	61.33

Lsd .05 = 6.35

Protein Content

Protein percentage showed a mean square of 1.74 which was significant at .05 level of probability (Table XII). The percentages as presented in Table XVI varied from 9.42 to 12.65, with an average of 11.04. Pendleton and Dengan (29) reported an average of 11.7 percent protein content. Nora had the highest protein percentage of 12.65 which was not significantly different from the next 13 varieties and lines. Chilocco/Nora lines (entries 21, 25, and 27), which were high in protein content, recorded a low total dry matter (Tables VII and XVI). This relationship between yield and protein content was reported by Forsberg et al. (8) to be influenced by the amount of nitrogen available and removed from the soil. Pomeranz (30), working with 289 samples of oats, reported 12.4 to 24.4 percent crude protein. Variety Lee, which was high in hay yield, recorded the lowest protein content.

Leaf Area

Significant differences among varieties and lines were found for both first and second leaf area (Table XII). Comparisons of first leaf area are presented in Table XVII. Maturity influences leaf area. Entries 2, 6, 7, 9, and 13, with high first leaf area, are the latest maturing varieties and lines (May 1 to May 13). Second leaf area is shown in Table XVIII. The averages for first and second leaf areas were 6.39 and 13.18, respectively. KY56-302/C.I.4897 and some following varieties and lines had a higher difference between first and second leaf area than those in the low group. Varieties with high first leaf

TABLE XVI

PERCENT PROTEIN OF THE HAY FROM THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Protein Percentage
1	Nora	19	12.650
2	Compact	7	12.283
3	Chilocco/Nora	27	12.027
4	Tk/Cmr//W. Excel	29	11.990
5	Chilocco/Ora	16	11.807
6	Arkwin Seln	11	11.697
7	KY56-302/C.I.4897	9	11.660
8	C.I.1897/Dbs//Tk/Cmr	13	11.623
9	Cmr//Wtks/Hc	15	11.587
10	Chilocco/Nora	21	11.550
11	Chilocco/Nora	25	11.477
12	Chilocco/Nora	23	11.293
13	Tk/Cmr//Nora	30	11.220
14	Cimarron/Checota	28	11.110
15	Chilocco/Nora	24	10.853
16	Norline	2	10.817
17	Walken	6	10.817
18	C.I.7162-3/Ballard	8	10.817
19	Tk/Cmr//Nora	18	10.780
20	Chilocco/Nora	20	10.780
21	2*Lec/Dbs//Tk/Cmr	12	10.780
22	Chilocco/Nora	17	10.637
23	Cmr//Arl/Wtk	4	10.633
24	Bco//Arl/Wtk	5	10.377
25	Chilocco	3	10.267
26	Chilocco/Nora	26	10.230
27	2*Lec/Dbs/Tk/Cmr	14	10.083
28	LeConte*4/Dubois	10	10.083
29	Chilocco/Nora	22	9.863
30	Lee	1	9.423

Lsd .05 = 1.67

TABLE XVII

FIRST LEAF AREA FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	First Leaf Area (cm^2)
1	KY56-302/C.I.4897	9	10.29
2	Walken	6	9.63
3	Bco//Arl/Wtk	5	9.09
4	Compact	7	8.79
5	Norline	2	8.37
6	Cmr//Arl/Wtk	4	8.23
7	Chilocco/Ora	16	8.12
8	C.I.1897/Dbs//Tk/Cmr	13	7.92
9	Arkwin Seln	11	7.87
10	Nora	19	7.35
11	Chilocco/Nora	26	6.70
12	C.I.7162-3/Ballard	8	6.70
13	Chilocco/Nora	20	6.59
14	Cmr//Wtks/Hc	15	6.15
15	Chilocco/Nora	25	6.09
16	Lee	1	5.70
17	Chilocco/Nora	24	5.60
18	Chilocco/Nora	27	5.58
19	Chilocco/Nora	21	5.48
20	Tk/Cmr//Nora	30	5.26
21	Chilocco/Nora	22	5.22
22	LeConte*4/Dubois	10	5.18
23	2*Lec/Dbs/Tk/Cmr	14	5.14
24	Chilocco/Nora	17	4.84
25	Chilocco	3	4.51
26	Cimarron/Checota	28	4.41
27	Tk/Cmr//Nora	18	4.37
28	Chilocco/Nora	23	4.34
29	Tk/Cmr//W. Excel	29	4.20
30	2*Lec/Dbs//Tk/Cmr	12	3.91

Lsd .05 = 2.93

TABLE XVIII

SECOND LEAF AREA FOR THIRTY OAT VARIETIES AND LINES GROWN AT STILLWATER, OKLAHOMA IN 1975

Rank	Variety	Entry Number	Second Leaf Area (cm^2)
1	KY56-302/C.I.4897	9	24.90
2	Walken	6	24.13
3	Norline	2	22.19
4	Compact	7	18.02
5	Chilocco/Nora	20	17.45
6	Cmr//Arl/Wtk	4	15.61
7	Arkwin Seln	11	15.29
8	Nora	19	14.75
9	Chilocco/Ora	16	14.56
10	Chilocco/Nora	26	14.51
11	Bco//Arl/Wtk	5	14.31
12	LeConte*4/Dubois	10	13.95
13	C.I.7162-3/Ballard	8	13.70
14	Lee	1	13.25
15	Tk/Cmr//Nora	30	12.97
16	2*Lec/Dbs/Tk/Cmr	14	12.93
17	C.I.1897/Dbs//Tk/Cmr	13	12.60
18	Chilocco/Nora	25	12.13
19	Chilocco	3	11.33
20	Cmr//Wtks/Hc	15	11.17
21	Chilocco/Nora	23	10.12
22	Tk/Cmr//W. Excel	29	9.76
23	Chilocco/Nora	24	9.29
24	Chilocco/Nora	21	9.16
25	Chilocco/Nora	17	9.16
26	Chilocco/Nora	22	8.64
27	Cimarron/Checota	28	8.58
28	Chilocco/Nora	27	8.33
29	2*Lec/Dbs//Tk/Cmr	12	6.84
30	Tk/Cmr//Nora	18	5.75

Lsd .05 = 6.02

area tended to be high in second leaf area (Tables XVII and XVIII).

Simple Correlations

The results of computation for simple correlation coefficients for all possible pairs of characters are presented in Table XIX. There is a positive significant correlation between total green weight and all its components. Panicle green weight showed a simple correlation of .405 with leaf green weight which was significant only at .05 level of probability. Stem green weight and total green weight had a positive significant correlation with all the characters except panicle dry weight, number of panicles, and protein content.

Total dry weight did not show a significant correlation with leaf area, but the positive correlation with height, leaf, stem, and panicle dry weights were significant. Mehra et al. (23) reported positive correlations of total dry weight with height, number of panicles, and leaf area. Anderson and Kaufmann (2) claimed that dry matter varies among varieties and that tall varieties tend to be more productive than short. The number of panicles showed positive correlations with straw dry weight and total dry weight, which were significant at the .05 level of probability. Simple correlation between number of panicles and leaf area was significant and negative.

Height of the plants had an important association with traits, showing a significant correlation with nine characters (Table XIX). As the height of plants increased, protein content decreased (Tables XV and XVI), but the hay yield increased (Table VII). Norline, the tallest variety, with 93.00 centimeters height (Table XV), was in the high ranking group in hay yield (Table VII). Height had a highly

TABLE XIX

SIMPLE CORRELATIONS BETWEEN ALL POSSIBLE PAIRS OF CHARACTERS

	1 Straw Green Weight	2 Leaf Green Weight	3 Panicle Green Weight	4 Total Green Weight	5 Straw Dry Weight	6 Leaf Dry Weight	7 Panicle Dry Weight	8 Total Dry Weight	9 Number of Panicles	10 Height	11 Protein %	12 Leaf Area #1	13 Leaf Area #2
1	1	.468**	.693**	.921**	.881**	.806**	.190	.858**	.130	.514**	-.216	.486**	.603**
2		1	.405*	.755**	.207	.610**	-.336	.225	-.120	.230	.090	.405*	.508**
3			1	.765**	.619**	.505**	.517**	.716**	.047	.576**	-.101	.525**	.437*
4				1	.732**	.825**	.077	.743**	.040	.509**	-.114	.552**	.649**
5					1	.671**	.409*	.950**	.404*	.540**	-.448*	.225	.330
6						1	-.050	.730**	.232	.365*	-.120	.347	.490**
7							1	.563**	.330	.304	-.255	-.111	-.211
8								1	.428*	.544**	-.382*	.215	.291
9									1	.038	-.333	-.484**	-.345
10										1	-.537**	.306	.395*
11											1	.250	.084
12												1	.847**
13													1

*Significant at the 0.05 level of probability
**Significant at the 0.01 level of probability
The degrees of freedom associated was 28.

significant negative correlation with protein content. Traits showing a positive correlation with hay yield had a negative correlation with protein (Table XIX). The simple correlation coefficient between protein content and hay yield was -.382, significant at the .05 level of probability. Lee had the lowest protein content, 9.42 (Table XVI), and the highest total dry weight (Table VII). Nora had the highest protein percentage, 12.65, but was in the low ranking group in hay yield (Table VII). This indicates that the higher yielding entries produced hay with lower protein content.

Campbell and Frey (5) and Forsberg et al. (8) suggested that protein percentage was significantly and negatively correlated with oat hay yield. Middleton et al. (24), on the other hand, claimed that there is no correlation between these two traits.

First leaf area recorded positive significant correlations with total green weight and its components (Table XIX). Second leaf area showed the same result, but it recorded a highly positive correlation with leaf dry weight. Simple correlation between height and leaf area was significant. Mehra et al. (23) reported that plant height was correlated positively with leaf length and negatively with leaf-stem ratio. Correlation between leaf area and number of panicles was negative.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary objectives of this experiment were: (1) to determine the interrelationship between the hay yield components and some other characters in thirty oat varieties and selections, and (2) to determine the correlation between protein percentage and dry matter as well as the other characters. The majority of varieties were developed in Oklahoma. The experiment was conducted in 1974 through the 1975 season, and it contained three replications.

Data were collected on total green and dry weights as well as their components (stems, leaves, panicles), number of panicles, height, leaf area (first and second leaves), and protein content. Analyses of variance were calculated for the data. Simple correlations were computed between all possible pairs of characters.

Analyses of variance indicated that there were significant differences due to varieties for all characters investigated except leaf green weight. Protein content and panicle dry weights were significantly different due to varieties at the 0.05 level of probability, and the rest of the characters at the 0.01 level of probability. The least significant difference was used for the comparison of the means. The total dry matter expressed in grams per square foot ranged from 70.23 to 120.00.

The variety Lee had the highest hay yield which was not significantly different from the following 10 varieties. The variety Lee, on the other hand, had the lowest protein percentage, indicating a negative correlation between these two traits. Simple correlation coefficient between protein content and total dry yield was -.382, significantly different at the 0.05 level of probability. The protein percentage ranged from 9.42 to 12.65; the variety Nora had the highest amount of protein but was not significantly different from the following 13 varieties.

Total dry matter was partitioned into components, and the correlations were compared with protein content. Straw dry weight and height were more closely associated with protein content. Both had negative correlations significant at the 0.01 level of probability. The total dry and green weights had positive correlations with their components. The protein content and green components did not show significant relationships. Height was significantly correlated with most of the characters. The contribution of each component to total dry weight indicated that the stem had the largest contribution, and the leaf the smallest. The grain yield was averaged from three replications and was expressed in grams per square foot. It ranged from 19.10 to 80.30, with an average of 51.14. Analyses of variance showed a highly significant difference among varieties in grain yield. Grain yield and total dry matter showed a non-significant correlation of -.142.

In conclusion, total dry matter is positively correlated with height, number of panicles, and hay yield components in oat plants. As the amount of hay yield increases, protein percentage decreases. The hay yield components and other characters showing a positive correlation with total dry matter were negatively correlated with protein content. Height and straw dry weight seemed to be more closely associated with the quality in oat plants. Grain yield did not seem to be related to total dry weight.

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