

AN EVALUATION OF OAT VARIETIES FOR FORAGE

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Introduction

Of the small grains, oats is the one most commonly grown for forage. The North Dakota Crop and Livestock Reporting Service does not report the number of acres of oats used for hay, but the number of acres harvested for grain in proportion to acres planted is considerably lower than those of barley and wheat. Only 90.7 per cent of the oats planted was harvested for grain, while 96.7 and 98.0

per cent of barley and wheat (Durum and Hard Red Spring) acreages, respectively, were harvested (1970-1974 averages).¹ Six to 8 per cent of the acres planted to oats each year apparently are harvested as forage. Oats is used for hay primarily in emergency situations when other hay sources are scarce.

The objective of this experiment was to evaluate the performance of selected oat varieties for forage quantity and quality.

Procedure

The trial was initiated in 1972. Eleven (12 in 1972 only) commercially grown oat varieties were selected primarily on the basis of maturity and plant height. They were planted on fallow on the following dates: May 15, 1972; May 4, 1973; May

¹From North Dakota Crop and Livestock Reporting Service Statistics, 1970-1974, May 1976.

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Table 1.
Forage Yield Performance
of Selected Oat Varieties

Variety	Maturity Rating ^a	Hay Yield — lbs/A @ 12% Moisture				
		1972	1973	1974	1975	1972-75
Grundy ^b	E	3332				
Nodaway 70	E	3498	4046	590	2859	2748
Otter	ME	4254	4207	597	3044	3026
Chief	ME	3762	3982	636	2865	2811
Kota	M	5524	4568	681	3718	3623
Kelsey	ML	4442	4827	687	3851	3452
Russell	ML	5039	4564	726	3963	3573
Garry	ML	4854	4883	715	3971	3606
Random	ML	5568	4800	714	3415	3624
Dal	L	4587	4611	764	3694	3414
Lodi	L	4994	4589	734	3835	3538
Cayuse	L	5493	4416	760	3599	3567
LSD — 5%		694.5	415.0	83.1	349.0	469.1
C.V. %		10.5	6.4	8.3	6.8	9.4

^aE = Early, M = Medium, L = Late
^b 1972 only

29, 1974; and May 15, 1975. Planting rate was 48 pounds per acre. Four row plots with 12 inch row spacing in four replications were used throughout the study. Fertilizer was applied according to soil test results so that nitrogen, phosphate, and potassium were not limiting. Soil type was Williams loam. All varieties were harvested at late milk to early dough stage of growth as generally recommended (Larsen *et al.* 1970 and Smith, 1960). Dried forage samples were ground and sent to the Animal Science Laboratories at North Dakota State University for nutritional analysis.

Results and Discussion

Annual and average yields are shown in Table 1. Growing season precipitation recorded during the four years of the study is shown in Table 2. Late planting coupled with below normal June rainfall reduced forage yields drastically in 1974. Though yields were very low, variety yields were proportional to their performance in other years. Indi-

vidual variety performance does vary from year to year but no major yield shifts occurred among maturity groups. Maturity ratings were based on average heading dates (Table 3).

Table 2.

Precipitation Data Williston Experiment Station 1972-1975

Month	Precipitation — Inches				Average 1957-75
	1972	1973	1974	1975	
April	1.87	1.78	0.78	2.39	1.32
May	4.60	1.20	3.84	1.55	2.15
June	1.80	2.84	0.98	4.85	2.73
July	2.28	1.39	1.49	1.88	2.05
Total	10.55	7.21	7.18	10.67	8.25

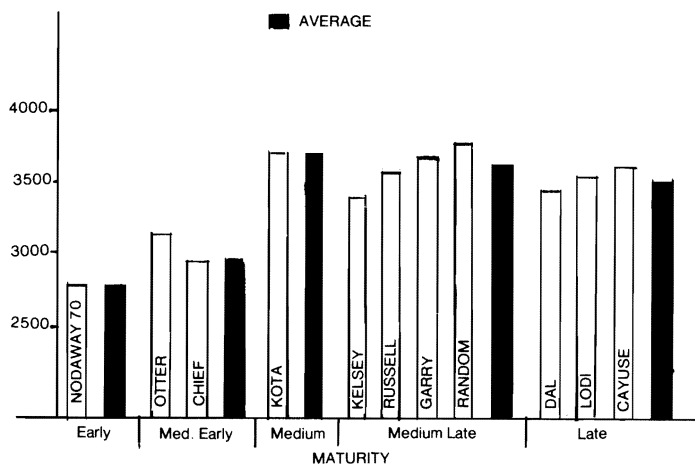


Figure 1. Average forage yield of 11 oat varieties as influenced by maturity; 1972, 1973, 1975.

Early and medium early maturing varieties generally yield less than later maturing varieties (Fig. 1). This is in general agreement with Stuthman and Marten, (1972). The 1974 data for height and heading date comparisons with yields were excluded because of the confounding effects of late planting and droughty conditions. Plant height had no significant effect on yield of varieties within the medium to late maturity group (Fig. 2). Cayuse, the shortest variety in the trial, yielded as much as Lodi, the tallest variety (Table 3). This is contrary to findings by Stuthman and Marten, 1972, who found a positive correlation between plant height and forage yields.

All varieties were ready to harvest (milk to early dough stage) 16 to 20 days after heading. Medium to late maturing varieties were ready for harvest 18 to 20 days after heading (Table 3). Days from heading to harvest does vary slightly from year to

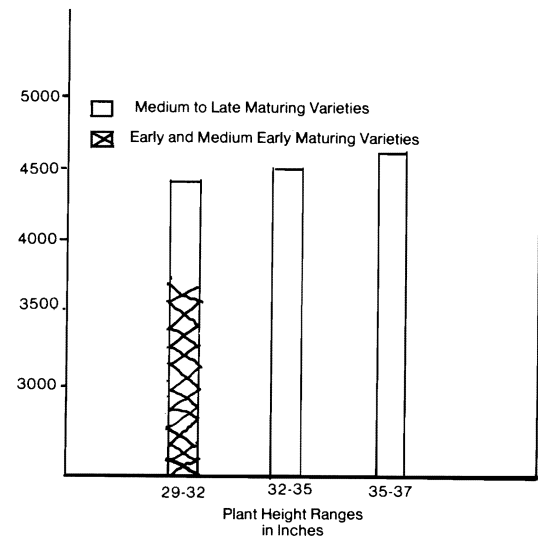


Figure 2. Average forage yield of medium to late maturing oat varieties as influenced by plant height; 1972, 1973, 1975.

year depending on temperatures and rainfall distribution from heading to harvest. Cool, wet weather would prolong days from heading to harvest, while dry weather and especially above normal temperatures would decrease days from heading to harvest. Moisture content of the forage at harvest generally ranged from 60 to 70 per cent.

An attempt was made in 1972 to visually evaluate the varieties for forage quality in terms of leafiness and steminess of the plants. In general early and medium early varieties appeared to have finer stems but a lower leafiness rating than medium to late maturing varieties. Random and Cayuse received the highest leafiness rating and Lodi the highest steminess rating. Assuming that a high leafiness rating coupled with a low steminess rating would be ideal, then the varieties Kelsey and Russell offer the best compromise.

Table 3
Summary of Agronomic Data
Collected on 11 Oat Varieties
1972, 1973, 1975

Variety	Plant Height Inches	Heading Date*	Days From Heading to Harvest	% Moisture of Harvested Forage	Forage Yield lb/A @ 12% moisture
Nodaway 70	31.8	27.7	16.3	66.9	3468
Otter	30.4	30.3	17.4	65.6	3835
Chief	31.3	29.0	18.0	64.4	3536
Kota	34.8	32.3	18.4	63.6	4603
Kelsey	33.5	34.3	18.4	64.0	4373
Russell	34.1	35.0	20.0	60.2	4522
Garry	35.6	35.0	20.7	60.1	4569
Random	30.2	34.5	19.5	63.4	4594
Dal	31.5	36.7	18.0	64.6	4297
Lodi	37.5	36.0	20.0	61.7	4473
Cayuse	29.0	36.0	19.7	60.3	4503
LSD 5%					476.1

* Days from June 1st

Table 4
Varietal Comparisons of Oat Hay Harvested at Milk Stage*

Variety	Observ.	Per cent (100% DM)			
		Protein	Fiber	Lignin	Ash
Grundya	8	10.8	33.2	4.47	5.80
Nodaway 70	17	11.8	31.9	5.44	5.77
Kota	17	11.5	33.9	4.17	6.07
Otter	16	12.0	31.2	4.26	6.20
Dal	24	13.2	34.9	4.65	6.85
Kelsey	26	11.4	33.3	4.10	6.39
Chief	16	12.7	31.7	4.41	6.00
Random	17	11.7	31.8	3.99	6.65
Garry	17	11.6	33.0	4.14	6.22
Russell	17	11.5	33.0	3.98	6.02
Cayuse	17	11.3	32.3	4.20	6.18
Lodi	16	12.0	34.3	4.00	6.43
CV		14.6	7.19	16.7	11.2
P		.01	.01	.01	.01
LSD .05		1.17	1.60	.49	.47
LSD .01		1.55	2.12	.64	.62

* Williston 1972-73-74-75

a 1972 only

The nutritional value of these varieties were determined by the Animal Science Laboratories and are shown in Tables 4 through 6. Dal contained 13.2 per cent protein, which was higher ($P < .05$) than all of the other varieties except Chief, which has 12.7 per cent protein and was not significantly lower. Dal also was the highest in fiber and second highest in lignin, which indicates it would probably be lower in digestibility. Dal also contained more ash than eight of the other varieties. Phosphorus levels were similar among all of the varieties with most of them being just below the required phosphorus level of .18 per cent (NRC-NAS for Beef

Cattle 1976) for gestating beef cows. Calcium concentrations varied ($P < .01$) among varieties with Random at .334 per cent and Grundy at .184 per cent. Magnesium and potassium levels were different ($P < .01$) among varieties. Garry was highest in magnesium and Dal the highest in potassium. Maryland, Grunes and Lazar (1976) suggest small grains may have K/Ca + Mg ratios of over 2.2 which may cause grass tetany. The results of the levels of Ca, Mg, and K expressed in milli-equivalents are shown in Table 5 for the twelve oat varieties. None of the ratios even approached a toxic level, with Kelsey having the highest ratio of 1.30.

Table 5

Varietal Comparisons of Oat Hay Harvested at Milk Stage*

Variety	Observ.	Per cent (100% DM)			
		P	Ca	Mg	K
Grundya	8	.196	.184	.235	.81
Nodaway 70	17	.190	.214	.225	1.09
Kota	17	.180	.236	.247	1.37
Otter	16	.196	.294	.247	1.43
Dal	24	.195	.285	.250	1.69
Kelsey	26	.188	.261	.218	1.57
Chief	16	.206	.305	.275	1.24
Random	17	.209	.334	.275	1.54
Garry	17	.192	.311	.304	1.56
Russell	17	.202	.263	.262	1.44
Cayuse	17	.178	.263	.248	1.38
Lodi	16	.205	.298	.273	1.66
CV		20.8	20.1	22.8	27.3
P		NS	.01	.01	.01
LSD .05		.027	.037	.039	.276
LSD .01		.036	.049	.052	.364

* Williston 1972-73-74-75

a 1972 only

Table 6 The Concentrations of Calcium, Magnesium, and Potassium and The Ratios of Potassium to Calcium Plus Magnesium

	Milli-equivalents/Kilogram			Ratio K/Ca & Mg
	Ca(a)	Mg(b)	K(c)	
Grundya	92	193	207	.73
Nodaway 70	107	185	279	.96
Kota	118	203	350	1.09
Otter	147	225	336	.98
Dal	142	206	432	1.24
Kelsey	130	179	402	1.30
Chief	102	226	317	.97
Random	117	226	394	1.15
Garry	155	168	399	1.24
Russell	131	216	368	1.06
Cayuse	131	204	353	1.05
Lodi	149	224	425	1.14

(a) $1/40.08 (1000 \times 100 \times 2) = 499 \text{ X \%} = \text{meq. of Ca}$ (b) $1/24.32 (1000 \times 100 \times 2) = 822.4 \text{ X \%} = \text{Meq. of Mg}$ (c) $1/39.1 (1000 \times 100) = 255.8 \text{ X \%} = \text{meq. of K}$

Summary

Medium to late maturing oat varieties yield more forage than earlier maturing varieties. Within the medium to late maturing varieties, tall and short varieties generally yielded the same amount of forage, and harvest occurred 18 to 20 days after heading when the moisture content of the forage was approximately 65 per cent.

All these oat varieties are nutritionally acceptable and competitive with good quality tame grass hays. It appears that the variety of choice would be the one that would produce the most hay per acre. Oat hay does have a potential of possibly toxic levels of nitrates and nitrites. An analysis to determine the levels of these is recommended before feeding the hays.

Based on agronomic data collected from this experiment, North Dakota's recommendation that a tall, late maturing variety such as Lodi be grown for forage production (Wilkins, 1976) is valid but not entirely complete. Medium maturing varieties, such as Kota, and short statured varieties, such as Cayuse and Random, can be grown for forage with equal success in northwestern North Dakota.

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