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# The Relationship of Total Nitrogen Percentage to Yield, Test Weight and Groat Percentage of Oats Grown at Different Locations<sup>1</sup>

By SAMUEL C. WIGGANS<sup>2</sup>

With increased interest in crop quality, the effect of environmental factors on various species is becoming of major importance. One criterion of quality in the oat grain is nitrogen content. Frey (2) found that the average protein content of the oat grain varied as much as 25 percent from year to year, and that (3) environmental effects on the protein fractions seemed to be additive. Teply *et al.* (6) and Hunt *et al.* (4) concluded that environmental factors materially influenced the niacin and pantothenic acid contents of wheat and corn, respectively. Wiggins and Frey (7) showed that some varieties of oats were able to utilize limited amounts of soil nitrogen better than others. They also showed a marked increase in grain nitrogen with an increasing nitrogen level in the soil. Leong (5) found, however, that fertilizer had little effect on the thiamine content of wheat.

The present study was initiated to determine the effect of location on the nitrogen content of various strains of oats grown in the Uniform North Central States Oat Nursery.

## METHODS AND MATERIALS

Oat grain samples were obtained from each of the following 12 selections grown in the 1957 Uniform North Central States Oat Nursery in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, North Dakota, Ohio, South Dakota and Wisconsin<sup>3</sup>:

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<sup>3</sup>Appreciation is expressed to the following individuals for seed provided for this study: C. M. Brown, Illinois; F. L. Patterson, Indiana; K. J. Frey, Iowa; E. G. Heyne, Kansas; J. E. Grafius, Michigan; W. M. Myers, Minnesota; J. M. Poehlman, Missouri; D. Ebeltoft, North Dakota; D. A. Ray, Ohio; D. D. Harpstead, South Dakota; H. L. Shands, Wisconsin.

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**Table 1**  
Average Total Nitrogen Percentages of Oat Selections in 1957

C.I. No.	7107	6537	6701	7234	7267	7084	7199	6935	7154	6913	4988	7235
% N <sub>2</sub>	2.43	2.28	2.54	2.52	2.70	2.31	2.32	2.40	2.33	2.23	2.01	2.05

**Table 2**  
Average Total Nitrogen Percentages at Each Location in 1957

Location	Ill.	Ind.	Iowa	Kan.	Mich.	Minn.	Mo.	No. Dak.	Ohio	So. Dak.	Wis.
% N <sub>2</sub>	2.42	2.24	2.25	1.91	2.32	2.70	2.46	2.43	2.14	2.53	2.40

<i>C. I. Number</i>	<i>Variety of Parentage</i>
7107	Ajax x Hawkeye-Victoria
6537	Burnett
6701	Clintland
7234	Clintland 60
7267	Clintland x (Garry x Hawkeye-Victoria)
7084	[Landhafer x (Mindó x Hajira-Joanette)] x Andrew
7199	[Landhafer x (Mindó x Hajira-Joanette)] x Andrew
6935	[Landhafer x (Mindó x Hajira-Joanette)] x Clintland
7154	Markton-Rainbow x D69-Bond
6913	Minhafer
4988	Mo. 0-205
7235	Rodney x Landhafer-Forvic

Duplicate 2-gram samples from two replicates of each selection were analyzed for total nitrogen using the official A. O. A. C. Kjeldahl method (1). The grain yield, test weight and groat percentage, averaged by entry and by states, were correlated with total nitrogen percentages.

#### EXPERIMENTAL RESULTS AND DISCUSSION

The average total nitrogen percentage in the grain for each of the selections is presented in Table 1 and the location averages in Table 2. The total nitrogen percentage ranged from 2.01 percent for C.I. 4988 to 2.70 percent for C.I. 7267. There was considerable variation among locations, with Kansas samples ranking lowest, with an average of 1.91 percent, and Minnesota highest, with 2.70 percent. In general, there was a higher total nitrogen percentage in oats grown in the northern states, such as Minnesota, North Dakota, South Dakota and Wisconsin. This may be due to cooler prevailing temperatures and a longer growing season, which afforded a better opportunity for the grain to accumulate nitrogen. Differences in soil fertility also may have affected the total nitrogen content of the grain, as suggested by the results obtained by Wiggins and Frey (7).

The mean squares from the analysis of variance for total nitrogen percentages are given in Table 3. There were highly significant differences between locations and between selections. There also was a highly significant location x selection interaction. Both the location and selection mean squares were, however, significantly larger than the interaction, indicating that the selections tend to

**Table 3**  
Mean Squares from the Analyses of Variance for Total Nitrogen Percentages

Source of Variation	Degrees of Freedom	Mean Square
Locations	10	1.054**
Selections	11	0.841**
Locations x Selections	110	0.044**
Error	131	0.005

\*\*Significant at 1% level.

retain their relative rank in nitrogen percentage over a wide range of environmental conditions.

Correlations between total nitrogen percentage and yield, test weight and groat percentage on both a selection and location basis are shown in Table 4. None of them was significant.

**Table 4**

Correlations for State Means and Entry Means of Total Nitrogen Percentages and Grain Yield, Test Weight and Groat Percentage

Correlation	State Means	Entry Means
Yield and Total Nitrogen Percentage	+ .16	+ .35
Test Weight and Total Nitrogen Percentage	— .40	— .03
Groat Percentage and Total Nitrogen Percentage	— .34	+ .16

SUMMARY

Twelve oat selections from the 1957 Uniform North Central States Oat Nursery grown at 11 locations were analyzed for total nitrogen percentage. Highly significant differences were found in total nitrogen percentage among strains and among locations.

None of the correlations between total nitrogen percentage and yield, test weight and groat percentage was significant.

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