# Effect of Variety, Location, and Irrigation on Selected Criteria for Evaluating Wheat as a Feed for Ruminants

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## Summary

There were no significant differences in in vitro digestibility between wheat varieties, but there was a trend for differences due to locations. Location differences were much wider for test weight, 1000 kernel weight, hardness score and crude protein level than variety differences. Wheat from irrigated plots had higher grain yields and crude protein content, but lower test weights, 1000 kernel weights, and hardness values than wheat from fallow plots at the same location. There were no differences in digestibilites between fallow and irrigated wheat.

## Introduction

A better understanding of wheat as a feed is needed to increase its potential use in livestock rations. This study was designed to identify wheat varieties that might have superior feeding qualities and to find improved methods of screening wheat for potential feeding value.

## Experimental Procedures

In 1984, a total of 347 individual samples representing 32 hard red winter wheat varieties were grown in Agronomy Department test plots across Kansas. From those 32 varieties, 15 common varieties were selected from each of the 11 different locations. A least squares statistical analysis was done to determine differences caused by variety, location, and fallow vs. irrigated. A 48-hour, first stage, in vitro dry matter disappearance (IVDMD) method was used to estimate digestibility of the 32 varieties. Data for crude protein, test weight, 1000 kernel weight, and hardness were provided by the Grain Marketing Research Laboratory and the Agronomy Department.

## Results and Discussion

In vitro digestibilities were not statistically different between the 15 selected varieties, ranging from 77.4 to 80.1%, but IVDMD values ranged from 76.1 to 81.4% for the 11 locations. Crude protein values (dry matter basis) ranged from 11.8 to 12.8% among varieties and from 10.7 to 14.8% among locations. Bushel weights ranged from 56.0 to 59.2 lb for the 15 selected varieties and from 53.2 to 62.4 lb across the 11 locations. Weight of 1000 kernels varied from 22.4 to 26.7 gm. among varieties and from 18.5 to 28.0 gm. among the locations. Hardness indexes of the 15 varieties ranged from 206 to 240 between varieties and from 210

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to 248 between locations. Soft red winter wheats have hardness indexes of around 150. Yields ranged from 56.6 to 71.3 bushels per acre among the varieties and from 44.6 to 92.0 bushels per acre between locations. Irrigated plots were compared with fallow plots at three locations for the 15 selected varieties, and IVDMD values were similar. However, irrigated plots had higher yields (79.2 vs. 60.5 bu/acre) and crude protein levels (12.0% vs. 11.3%). Irrigated plots had lower test weights, 1000 kernel weights, and hardness values (Table 1.1). Further research is needed to determine how these differences affect wheat's feeding value.

Table 1.1. Effect of Variety, Location, and Irrigation on Selected Criteria for Evaluating Wheat as a Feed for Ruminants

| Criteria: | 15 Varieties | | 14 Locations | Fallow | Irrigated |
|---|---|---|---|---|---|
| | Average[1] | (Range) | (Range) | Average | Average |
| Yield bu/ac. | 61.1 | (56.8-71.3) | (44.8-92.0) | 60.5 | 79.2 |
| Bushel Wt., lb | 58.0 | (56.0-59.2) | (53.2-62.4) | 59.6 | 57.6 |
| 1000 Kernal Wt., gm | 24.7 | (22.3-26.7) | (18.5-28.0) | 25.7 | 23.0 |
| Hardness Index | 227 | (206-240) | (210-248) | 238 | 223 |
| IVDMD, %[2] | 78.0 | (77.4-80.1) | (76.0-81.4) | 79.0 | 79.0 |
| Crude Protein, % | 12.3 | (11.8-12.8) | (10.7-14.8) | 11.3 | 12.0 |

[1]Least Squares Means.
[2]In Vitro Dry Matter Disappearance.

Table 2.2. Comparative Nutritional Composition of 15 Selected Wheat Varieties From 14 Locations[1]

| Variety | Crude Protein (%) | IVDMD[2] (%) | 1000 Kernel Wt. (gm.) | Test Wt. (lb/bu) | Yield/ Acre (Bu.) | Hardness Index |
|---|---|---|---|---|---|---|
| Mustang | 11.8 | 78.8 | 26.7 | 58.5 | 59.6 | 233 |
| Hawk | 12.2 | 79.6 | 25.3 | 57.5 | 56.6 | 232 |
| Arkan | 12.6 | 79.1 | 24.3 | 58.7 | 60.6 | 223 |
| Bounty 203 | 12.5 | 79.4 | 26.4 | 58.5 | 71.3 | 214 |
| Bounty 310 | 12.8 | 79.0 | 25.2 | 58.0 | 65.6 | 240 |
| Garst HR64 | 12.5 | 79.1 | 22.3 | 57.1 | 59.5 | 231 |
| Garst 428402 | 12.4 | 78.8 | 25.0 | 57.1 | 59.0 | 231 |
| Hybrex HW1010 | 12.0 | 78.9 | 24.3 | 58.8 | 61.0 | 221 |
| Hybrex HW1019 | 12.7 | 79.4 | 25.7 | 59.2 | 58.9 | 231 |
| Hybrex HW1030 | 12.3 | 79.6 | 24.3 | 58.2 | 59.8 | 232 |
| Newton | 12.1 | 77.4 | 24.2 | 58.5 | 57.5 | 226 |
| Tam 105 | 12.2 | 80.1 | 24.6 | 57.5 | 61.8 | 229 |
| Tam 107 | 12.1 | 78.8 | 25.8 | 58.0 | 67.1 | 239 |
| Tam 108 | 11.8 | 77.5 | 23.8 | 56.0 | 62.0 | 206 |
| Vona | 12.0 | 79.1 | 22.4 | 58.0 | 56.7 | 221 |

[1]Least Squares Means.
[2]In Vitro Dry Matter Disappearance.

Table 3.3. Average Nutritional Composition of Wheat Varieties at 14 Locations[1]

| Variety | Crude Protein (%) | IVDMD[2] (%) | 1000 Kernel Wt. (gm.) | Test Wt. (lb/bu) | Yield/ Acre (Bu.) | Hardness Index |
|---|---|---|---|---|---|---|
| Manhattan | 12.6 | 80.6 | 24.7 | 56.8 | 71.2 | 210 |
| Ottawa | 11.8 | 78.6 | 23.3 | 53.2 | 50.7 | 220 |
| Parsons | 12.3 | 79.1 | 26.5 | 58.0 | 59.4 | 245 |
| Ft. Hays | 13.6 | 79.1 | 26.6 | 59.4 | 44.6 | 229 |
| Belleville | 13.4 | 76.5 | 26.1 | 56.4 | 55.1 | 238 |
| Heston | 12.2 | 79.9 | 24.0 | 58.1 | 44.8 | 225 |
| Hutchinson | 11.2 | 80.4 | 28.0 | 60.4 | 48.4 | 212 |
| St. John (Fal) | 10.7 | 79.2 | 27.7 | 62.4 | 67.8 | 229 |
| St. John (Irr) | 11.8 | 81.4 | 27.4 | 61.4 | 92.0 | 223 |
| Colby (Fal) | 11.5 | 78.9 | 22.4 | 57.8 | 50.4 | 236 |
| Colby (Irr) | 12.0 | 79.4 | 18.5 | 55.9 | 66.4 | 230 |
| Tribune (Irr) | 14.8 | 77.7 | 20.4 | 57.8 | 62.5 | 222 |
| Garden City (Fal) | 11.6 | 78.9 | 26.9 | 58.7 | 63.4 | 248 |
| Garden City (Irr) | 12.1 | 76.1 | 23.2 | 55.6 | 79.3 | 214 |

[1] Least Squares Means.

[2] In Vitro Dry Matter Disappearance.