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## Kansas Wheat Seed: A Comparison of the Quality of Wheat Seed Planted in 1973 and 1984<sup>1</sup>

J.R. Stanelle, R.L. Vanderlip, L.A. Burchett and J.P. Shroyer<sup>2</sup>

### ABSTRACT

This study investigated the quality of 662 samples of wheat (*Triticum aestivum* L.) seed planted by Kansas farmers in 1984. Information on seed and farming practices was collected on a questionnaire and seed quality information was obtained through laboratory analysis. Results were compared to those of a similar survey conducted in 1973. Information gathered from the questionnaire showed that in 1984 wheat farmers were using better management practices, planting more varieties on their farms, and planting more seed that is certified or fewer generations from certified than in 1973. Seed analysis showed an increase in germination, mechanical purity, and seed weight; however, there was a more extensive weed problem than in 1973. Approximately one-half of the samples had some type of varietal impurity present and six percent were incorrectly reported as to variety. Newer varieties and varieties closer to certified status had highest varietal purity.

*Additional index words:* purity, weeds, inert matter, germination

### INTRODUCTION

There are many factors that affect yield potential of a crop, with quality of seed being a primary consideration. Tekrony (1984) listed five factors that determine seed quality: (1) genetic (varietal) purity, (2) mechanical integrity, (3) seed-borne disease infection, (4) germination and vigor, and (5) freedom from crop and weed seed contamination. These factors separate quality seed from bin-run seed. In spite of source and handling of bin-run seed, difference in quality between it and seed produced within established practices has been documented by Tekrony (1984). In the past decade, organizations within the U.S. have conducted surveys on wheat to determine the quality of the seed being planted.

In Oregon, Goetze (1976) found that of 99 wheat seed samples collected in 1976, most had a germination rate of at least 85%. The mechanical purity of the seed samples was not as encouraging, with inert material ranging from 0.09 to 5.12%. Thirty four of the samples contained weed seeds.

Ball et al., (1982) collected 325 samples of spring wheat in North Dakota and found that 59 did not pass minimum standards for certification because of excessive inert material and eight other samples had low germination or weed or other crop seeds in excess of acceptable limits. Fifty-two percent of the wheat samples were reproduced either one or two years from certification. All but three samples were reported to have been cleaned, and 69% of those were conditioned at a local elevator.

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<sup>2</sup>Former Graduate Research Assistant, Agronomist, Executive Director Kansas Crop Improvement Association and Extension Agronomist, respectively, Agronomy Department, Kansas State University, Manhattan, KS 66506.

In an attempt to discover the quality of seed being planted and how it affected yield, Jacques (1976) surveyed 534 Kansas wheat growers and found that 52% of farmers planted just one wheat variety. Ninety four percent of seed was home-grown or purchased from another farmer. Fifty-nine percent of samples received were two years or more from certification, with only 3.9% being of certified classes. Tests showed that only 64.8% of the seed received had a germination rate of 90% or greater, and 78% of the samples had been cleaned.

The primary emphasis of this study was to examine the quality of wheat (*Triticum aestivum* L.) seed currently being planted in Kansas (Stanelle et al., 1986). A secondary emphasis was to assess the changes that have occurred since a similar survey in 1973 (Jacques et al., 1976).

## MATERIALS AND METHODS

A random sample of wheat farmers was drawn by the Kansas Crop and Livestock Reporting Service. Growers were selected on a county basis proportional to the number of growers and number of acres of wheat within that county. Approximately 18 to 20 farmers were selected from each county in the Western and Central Crop Reporting Districts and 12 to 16 farmers per county in the three eastern Crop Reporting Districts. A total of 1,755 names were drawn from the nine Crop Reporting Districts in Kansas.

A questionnaire was developed to gather information about the quality of wheat seed being planted, management practices of farmers who plant the seed, and directions that farmers will choose in the future regarding seed use and management. These questionnaires, along with a list of the selected farmers' names and instructions, were sent to county agricultural extension agents for collection of seed samples. Agents were asked to contact each farmer on their list, explain the purpose of the survey, and collect a 2.3 kg sample of one wheat variety that was to be planted in the fall of 1984. Additionally, county agents assisted farmers with completion of the questionnaires. A total of 662 samples was collected.

Data from the questionnaire received were transferred to computer files. Approximately 500 g of seed from each sample were sent to the State Seed Testing Laboratory, Topeka, Kansas for analysis of germination, mechanical purity, presence of inert material, name and number of noxious weed seeds present, and name of other common weed or crop seed contaminants. Also included on each report was a notification if the seed sample as submitted was in compliance with the Kansas State Seed Law (Kansas Department of Agriculture, 1985).

Determination of test weight of the remaining seed was made by filling a 0.473 l container and weighing it on an electronic scale, which converted the weight to  $\text{kg m}^{-3}$ . The same subsample was separated on a mechanical screen shaker for 1 minute, and weights and percentages of total weight were found for three fractions: seed that remained on top of a 2.4 mm x 19.1 mm screen (6/64 in. x 3/4 in.), seed that passed that screen but remained on a 2.0 mm x 19.1 mm (5/64 in. x 3/4 in.) screen, and seed that passed through both screens.

Another subsample of approximately 40 g was removed from the main sample. One thousand kernels were mechanically counted from this subsample, dried at 65° C, and weighed. The same subsample was ground and used for nitrogen determination. Total N was multiplied by 5.7 to convert to protein percentage.

## RESULTS

The 662 samples received in the survey included 50 varieties, two hybrids, and two samples reported to be mixtures of two varieties. 'Newton' was the most frequently reported variety, with 175 samples or 26.4% of the total. It was also the most used variety in five of the nine Crop Reporting Districts (Figure 1) and second in popularity in the East Central and South Central. 'Hawk' was the second most used variety with 114 samples or 17.2%. Hawk was planted mostly in the central one-third of the state, where it was the variety of choice of 16.8% to 28.0% of participants, and was also popular in the West Central and South West Crop Reporting Districts.

'Tam 105' was the third most used variety with 96 samples or 14.5%. It was primarily used in the central and western Crop Reporting Districts and was equal to Hawk in the West Central Crop Reporting District. 'Larned' and 'Arkan' were equal in popularity in the survey, with 45 samples or 6.8%. Larned is more adapted to the western portion of the state, as evidenced by 33 samples from the western three districts and no samples from the eastern one-third of the state. Since Arkan's adaptation region is further east, all Arkan samples originated from the eastern two-thirds of the state. Arkan was the most used variety in the East Central District.

In 1984, 'Eagle' was seventh with 24 samples and 3.6% of the total, and 'Scout' was ninth on the list of varieties, with 13 samples and 1.9%. In the 1973 Kansas Drill Box Survey (Jacques et al., 1976), Scout was the leading variety with 30.6% of samples received, and Eagle was second with 20.1%.

Kansas farmers were planting more varieties of wheat per farm in 1984 than in 1973. Forty one percent were planting one variety, 32% planted two varieties, and

nearly 27% planted three or more varieties (Figure 2). This is in contrast to 1973 (Jacques et al., 1976), when 52% planted just one variety. A possible explanation for this trend is an increase in the number of available varieties with more diverse characteristics, which gives the farmer the opportunity to spread his risk over different wheat types.

Kansas farmers planted more seed that was certified or closer to certified status than in 1973. Seventeen percent of samples received were in one of the certified classes or a hybrid (Figure 3), whereas in 1973 (Jacques et al., 1976), only 3.9% of seed planted was in one of those classes. The eastern three crop reporting districts showed the highest use of certified seed. The western districts showed the highest use of seed that was further from certification.

For this survey, four sources of seed were considered: 1) home-grown, 2) another-farmer, 3) farmer-dealer, and 4) commercial dealer. Home-grown seed is normally bin-run grain used for seed, but can be certified seed produced on the farmer's own land and used to plant his next year's crop. Another-farmer seed is merely bin-run grain purchased from another farmer and used as seed. Seed from a farmer dealer is either a private variety or certified seed that has been handled as seed from the production field through final conditioning. A commercial dealer is one whose main business is the retail sale of seed and/or other farm supplies.

Statewide, home-grown seed was most popular, accounting for almost 68% of all plantings (Figure 4). In contrast, 13.5% was purchased from farmer-dealers, 12.5% from another farmer, and only 6.1% from commercial dealers. Home-grown seed use was highest in the west where acreages are largest, and seed purchased from a farmer-dealer was highest in the east where acreages and field sizes are smallest.

Home-grown seed had the greatest usage in both surveys, with 9% fewer farmers using home-grown seed in 1984. Combining that 9% with a 6% decrease in another-farmer seed, there was approximately a 15% increase in purchases of the normally higher quality farmer-dealer and commercial dealer seed in 1984 compared to 1973.

Eighty-three percent of samples received in this survey was cleaned before planting. This was an increase of 4.3% from 1973 (Jacques et al., 1976) when 78.2% was cleaned prior to planting. Commercial cleaners accounted for 63%. Seed cleaned by the farmer at home was 14% and that cleaned by another farmer was 6% of the total (Figure 5).

The central part of the state, especially North Central and Central districts, showed the highest percent of seed cleaned (87%). There was no difference in percent of samples cleaned between the eastern one-third (78%)

and the western one-third of the state (79%). In the west, the larger amount of seed cleaned at home resulted in a proportional decrease in seed cleaned commercially.

Over 56% of the seed cleaned by someone other than the farmer was cleaned within 16 km (10 miles) of the farmer's home. Fifteen (5%) of the sample lots were transported more than 48 km (30 miles) to be cleaned. There were no major differences in distance traveled to clean seed among the nine crop reporting districts.

Fungicide was used as a seed treatment on 36% of the samples, almost identical to the 37% in 1973 (Jacques et al., 1976). The western part of the state, with its lower rainfall and humidity, showed lowest fungicide use. The rest of the state showed nearly a 50% use of fungicide. Central Kansas fungicide use paralleled that of 1973, but use in the east nearly doubled in the span of 11 years.

Only 18% of samples had been laboratory tested for germination and/or mechanical purity before planting. Laboratory testing before planting was lowest in the west and highest in the eastern parts of the state. Some farmers did indicate that even though they did not have their seed laboratory-tested, a home test was performed to determine germination percentage.

Only six samples were found to have a germination, or less than 80% (Figure 6). Sixty-four percent of samples had germination rates between 95% and 100%, and another 27 percent was between 90% and 95%. This is in contrast to the 1973 survey (Jacques et al., 1976), when only 65% had germination rates of 90% or greater.

Mechanical purity of the seed ranged from near 100% to less than 75%. Over 44% of samples were between 99% and 100% pure, whereas 48 samples (7.1%), were less than 95% pure and 7 samples were below 90% (Figure 7). The highest purity seed came from eastern Kansas. In 1973, 59-74% and in 1984, 75-90% of the seed from that area was 98.5% pure or better.

Higher mechanical purity is largely due to absence of inert material, and the 1984 survey showed a trend toward cleaner seed with less inert material than in 1973. Sixty-two percent of the 1984 samples contained less than 1.5% inert material, whereas in 1973 (Jacques et al., 1976), only 40% contained inert material of 1.5% or less. The eastern one-third of the state had the lowest amount of inert material, since mechanical purity and inert material normally behave inversely. The Northeast District had the lowest amount of inert material, with 64% of its samples having 0.5% or less inert material.

Weed seed is a second component of mechanical purity. Weed seeds appeared in 14% more samples in 1984 than 1973. In the 1973 survey (Jacques et al., 1976) 15% of all samples contained weed seeds. In 1984, 17% of the samples in the west, 39% in the central and 34% in the eastern part of the state contained weed seeds. All three areas showed increases over the 1973 survey. Chess

Note: areas outlined on maps are Crop Reporting Districts.

| Variety | % of Samples | Variety | % of Samples | Variety | % of Samples |
|---------|--------------|---------|--------------|---------|--------------|
| Newton  | 25           | Newton  | 30           | Newton  | 30           |
| Lained  | 13           | TAM 105 | 21           | Hawk    | 15           |
| Eagle   | 9            | Hawk    | 17           | TAM 105 | 13           |
| Hawk    | 7            | Arkan   | 9            | Mustang | 8            |
| TAM 105 | 10           | Vona    | 9            | Wings   | 8            |
| Others  | 38           | Others  | 14           | Others  | 20           |
| Hawk    | 18           | Newton  | 38           | Arkan   | 24           |
| TAM 105 | 15           | Hawk    | 22           | Newton  | 22           |
| Lained  | 11           | Arkan   | 12           | TAM 105 | 14           |
| Newton  | 13           | TAM 105 | 10           | Hawk    | 11           |
| Eagle   | 10           | Lained  | 7            | Wings   | 11           |
| Others  | 28           | Others  | 11           | Others  | 18           |
| TAM 105 | 12           | Hawk    | 28           | Newton  | 32           |
| Hawk    | 15           | Newton  | 26           | TAM 105 | 21           |
| Lained  | 13           | TAM 105 | 10           | Arkan   | 16           |
| Newton  | 12           | Lained  | 5            | Mustang | 3            |
| Eagle   | 10           | Arkan   | 5            | Wings   | 3            |
| Others  | 27           | Others  | 26           | Others  | 23           |

Figure 1. Wheat varieties planted in Kansas in 1984.

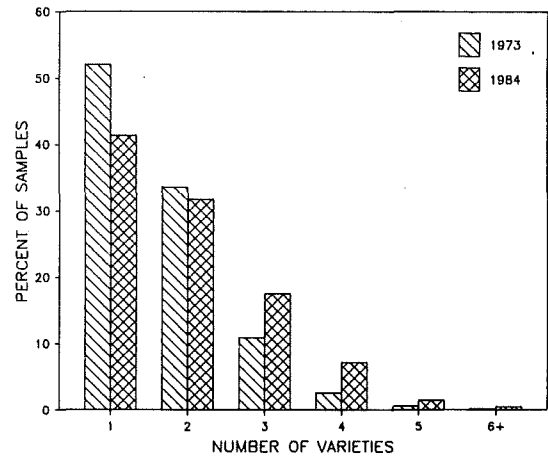


Figure 2. Number of varieties planted per farm 1984 and 1973.

| Years from Certification | % of Samples | Years from Certification | % of Samples | Years from Certification | % of Samples |
|--------------------------|--------------|--------------------------|--------------|--------------------------|--------------|
| Cert                     | 9            | Cert                     | 12           | Cert                     | 43           |
| 1 year                   | 42           | 1 year                   | 37           | 1 year                   | 27           |
| 2 years                  | 13           | 2 years                  | 34           | 2 years                  | 11           |
| 3-5 years                | 31           | 3-5 years                | 14           | 3-5 years                | 14           |
| 6+ years                 | 5            | 6+ years                 | 3            | 6+ years                 | 3            |
| Cert                     | 5            | Cert                     | 20           | Cert                     | 31           |
| 1 year                   | 35           | 1 year                   | 41           | 1 year                   | 37           |
| 2 years                  | 25           | 2 years                  | 19           | 2 years                  | 23           |
| 3-5 years                | 30           | 3-5 years                | 16           | 3-5 years                | 9            |
| 6+ years                 | 5            | 6+ years                 | 4            | 6+ years                 | 0            |
| Cert                     | 13           | Cert                     | 10           | Cert                     | 32           |
| 1 year                   | 28           | 1 year                   | 44           | 1 year                   | 34           |
| 2 years                  | 20           | 2 years                  | 27           | 2 years                  | 20           |
| 3-5 years                | 25           | 3-5 years                | 18           | 3-5 years                | 14           |
| 6+ years                 | 14           | 6+ years                 | 1            | 6+ years                 | 0            |

Figure 3. Class of wheat planted in Kansas in 1984.

| Source            | % of Samples | Source            | % of Samples | Source            | % of Samples |
|-------------------|--------------|-------------------|--------------|-------------------|--------------|
| Homegrown         | 75           | Homegrown         | 74           | Homegrown         | 50           |
| Another farmer    | 11           | Another farmer    | 9            | Another farmer    | 13           |
| Farmer/dealer     | 12           | Farmer/dealer     | 11           | Farmer/dealer     | 24           |
| Commercial/dealer | 2            | Commercial/dealer | 6            | Commercial/dealer | 13           |
| Homegrown         | 77           | Homegrown         | 69           | Homegrown         | 58           |
| Another farmer    | 14           | Another farmer    | 10           | Another farmer    | 17           |
| Farmer/dealer     | 4            | Farmer/dealer     | 16           | Farmer/dealer     | 14           |
| Commercial/dealer | 5            | Commercial/dealer | 5            | Commercial/dealer | 11           |
| Homegrown         | 62           | Homegrown         | 65           | Homegrown         | 68           |
| Another farmer    | 15           | Another farmer    | 19           | Another farmer    | 3            |
| Farmer/dealer     | 19           | Farmer/dealer     | 12           | Farmer/dealer     | 11           |
| Commercial/dealer | 4            | Commercial/dealer | 4            | Commercial/dealer | 18           |

Figure 4. Source of wheat seed planted in Kansas, 1984.

| Management Practice | % of Farmers | Management Practice | % of Farmers | Management Practice | % of Farmers |
|---------------------|--------------|---------------------|--------------|---------------------|--------------|
| Cleaned             | 80           | Cleaned             | 91           | Cleaned             | 81           |
| Fungicide           | 28           | Fungicide           | 51           | Fungicide           | 36           |
| Insecticide         | 25           | Insecticide         | 10           | Insecticide         | 11           |
| Seed test           | 7            | Seed test           | 18           | Seed test           | 38           |
| Cleaned             | 80           | Cleaned             | 91           | Cleaned             | 74           |
| Fungicide           | 28           | Fungicide           | 55           | Fungicide           | 58           |
| Insecticide         | 8            | Insecticide         | 13           | Insecticide         | 26           |
| Seed test           | 4            | Seed test           | 18           | Seed test           | 43           |
| Cleaned             | 75           | Cleaned             | 82           | Cleaned             | 78           |
| Fungicide           | 12           | Fungicide           | 26           | Fungicide           | 52           |
| Insecticide         | 8            | Insecticide         | 10           | Insecticide         | 29           |
| Seed test           | 16           | Seed test           | 14           | Seed test           | 29           |

Figure 5. Seed management practices of samples farmers, 1984.

| Germination % | % of Samples | Germination % | % of Samples | Germination % | % of Samples |
|---------------|--------------|---------------|--------------|---------------|--------------|
| 95-100        | 80           | 95-100        | 52           | 95-100        | 59           |
| 90-94.9       | 10           | 90-94.9       | 37           | 90-94.9       | 28           |
| 80-89.9       | 8            | 80-89.9       | 11           | 80-89.9       | 3            |
| <80           | 2            | <80           | 0            | <80           | 3            |
| 95-100        | 65           | 95-100        | 54           | 95-100        | 59           |
| 90-94.9       | 25           | 90-94.9       | 33           | 90-94.9       | 30           |
| 80-89.9       | 8            | 80-89.9       | 13           | 80-89.9       | 8            |
| <80           | 2            | <80           | 0            | <80           | 3            |
| 95-100        | 71           | 95-100        | 75           | 95-100        | 58           |
| 90-94.9       | 26           | 90-94.9       | 20           | 90-94.9       | 23           |
| 80-89.9       | 2            | 80-89.9       | 5            | 80-89.9       | 8            |
| <80           | 1            | <80           | 0            | <80           | 2            |

Figure 6. Laboratory germination rate of seed samples, 1984.

| % Mechanical Purity | % of Samples | % Mechanical Purity | % of Samples | % Mechanical Purity | % of Samples |
|---------------------|--------------|---------------------|--------------|---------------------|--------------|
| 99-100              | 33           | 99-100              | 34           | 99-100              | 79           |
| 97-98.9             | 51           | 97-98.9             | 40           | 97-98.9             | 18           |
| 95-96.9             | 8            | 95-96.9             | 16           | 95-96.9             | 3            |
| <95                 | 8            | <95                 | 10           | <95                 | 0            |
| 99-100              | 22           | 99-100              | 59           | 99-100              | 73           |
| 97-98.9             | 48           | 97-98.9             | 24           | 97-98.9             | 16           |
| 95-96.9             | 23           | 95-96.9             | 12           | 95-96.9             | 8            |
| <95                 | 7            | <95                 | 5            | <95                 | 3            |
| 99-100              | 38           | 99-100              | 45           | 99-100              | 55           |
| 97-98.9             | 38           | 97-98.9             | 38           | 97-98.9             | 32           |
| 95-96.9             | 15           | 95-96.9             | 7            | 95-96.9             | 5            |
| <95                 | 9            | <95                 | 10           | <95                 | 8            |

Figure 7. Mechanical purity of seed samples, 1984.

(*Bromus commutatus* Schrod), was found in 15.8% of all samples. Chess was the most common weed seed in all crop reporting districts except the Northwest, where downy brome (*Bromus tectorum* L.) was most common. Chess was found in 10% of all samples in the 1973 survey. Cheat (*Bromus secalinus* L.) was found in 7.7% of samples but only in those from the eastern two-thirds of the state. The third most common weed (7.1%), pennycress (*Thlaspi arvense* L.), was also found mainly in eastern districts. Twelve samples contained seed of the prohibited noxious weed, field bindweed (*Convolvulus arvensis* L.), but none was found in the eastern one-third of the state. One sample from the North Central District contained a seed of the prohibited noxious weed, musk thistle (*Carduus nutans* L.).

The third component of mechanical purity is the presence of seed of other crops. Almost 10% of the samples contained other crop seeds, with sorghum (*Sorghum bicolor* (L.) Moench) being the most predominant (in 30 samples or 4.5%). Rye (*Secale cereale* L.), which can be a problem in wheat seed, was found in only two samples, from the North Central District. The main method by which other crop seeds are introduced into wheat seed is not from growth of those crops in fields, but from contamination within seed cleaners, storage bins, and other handling equipment.

The Kansas State Seed Law (Kansas Department of Agriculture, 1985) prohibits sale of seed if it contains any prohibited noxious weed seeds, excessive amounts of restricted noxious weed seeds, or 2% or more of any combination of weed seeds. Thirty samples received in the 1984 survey fell into one of those three categories. Twelve samples contained prohibited noxious weed seeds, 17 contained excessive amounts of restricted noxious weed seeds, and one sample contained more than 2% of total weed seeds. Of the 30 unsaleable samples, 20 were from the three Central Crop Reporting Districts, eight from the East, and only two from the West.

Seed size and density are very important factors in seedling vigor and ultimate grain yield. Test weight is one method of measuring seed density. Over 20% of samples received had a test weight between 769 and 782 kg m<sup>-3</sup>, and 56% of all samples were at or above 769 kg m<sup>-3</sup>.

A method of determining seed size is to look at the three screening fractions. Seed falling into the large (>2.4 x 19.1 mm) category ranged from 62% in northeast Kansas to 74% in the northwest. The middle fraction comprised between 20% and 31% and the small (<2.0 x 19.1 mm) between 5% and 9% with no major differences among districts.

Analysis of the samples for protein showed levels that centered around 11-12%, with a range from 9 to 14%.

Mean values for several seed variables for the seven most popular varieties received in the survey are presented in Table 1. Mean protein values were mainly between 11.4 and 11.8%, except for Arkan, which had a mean value of 12.0%. Mean test weights ranged from 756 to 782 kg m<sup>-3</sup>, with varieties more commonly used in the western part of the state having heavier test weights. Since Arkan was developed to have kernels that are more plump, it, therefore, had higher mean values for the top screening fractions. Conversely, Vona, a small-seeded variety, had higher mean values in the middle and bottom fractions. Seed weight, like test weight, was somewhat greater for varieties used in western Kansas. Germination and purity showed no real differences, probably because these variables are more a function of management than variety.

Mean values for certification status are related to number of years since variety release. Arkan, which is a new variety, has a value of 0.43, which means that the average of all Arkan samples is slightly less than one-half year from certified. Older varieties, such as Larned, show a mean value of more than 2.5. Scout, which has been grown for 20 years, had a mean value of 5.8 years from certified.

Soil testing can be an aid in achieving higher yields, and 37% of those responding indicated that they followed a regular program of soil testing. Three contiguous districts, Northwest, West Central, and North Central, had the lowest percent of farmers in soil test programs. In the Southwest and South Central districts, about 50% followed soil testing programs. Of farmers who indicated a regular soil test program, 78% used a private laboratory and 22% used the Kansas State University Soil Testing Laboratory. University lab use was highest in the eastern three crop reporting districts.

Drill row spacing is a general indication of precipitation expected in the area. The western three crop reporting districts normally receive the lowest amount of precipitation and their row spacings were either 25.4, 30.5, or 35.6 cm. The central part of the state, which has more rainfall, drill spacings were 20.3 and 25.4 cm. Spacings of 17.8 and 20.3 cm were the most popular in the east, where moisture is generally more plentiful.

## SUMMARY AND CONCLUSIONS

Newton was the most reported variety in the survey with Hawk, Tam 105, Larned, and Arkan also very popular. Fifty nine percent of the farmers surveyed planted more than one wheat variety, and the seedlot was more likely to be certified than in 1973. More seed was purchased from dealers in 1984, but home-grown seed accounted for 68% of the samples. Eighty three percent of lots sampled were cleaned before planting, of which 63%

**Table 1. Seed mean values for most common wheat varieties grown in Kansas, 1984.**

| Variable                          | Arkan | Hawk  | Larned | Newton | Scout | Tam 105 | Vona  |
|-----------------------------------|-------|-------|--------|--------|-------|---------|-------|
| Protein (%)                       | 12.02 | 11.67 | 11.67  | 11.63  | 11.84 | 11.46   | 11.81 |
| Test Weight (kg m <sup>-3</sup> ) | 759   | 768   | 792    | 775    | 784   | 762     | 767   |
| Fraction (%)                      |       |       |        |        |       |         |       |
| Over 6/64                         | 82.89 | 67.59 | 73.50  | 62.30  | 74.55 | 63.08   | 37.02 |
| Over 5/64                         | 14.55 | 28.55 | 20.98  | 32.14  | 19.75 | 27.98   | 48.48 |
| Thru 5/64                         | 2.55  | 7.37  | 5.35   | 7.33   | 5.69  | 9.01    | 14.47 |
| Seed Weight (gm/1000 kernels)     | 24.60 | 28.51 | 29.06  | 25.60  | 28.10 | 25.94   | 23.22 |
| Germination (%)                   | 94.10 | 95.35 | 92.93  | 93.64  | 94.09 | 94.37   | 93.91 |
| Purity (%)                        | 99.37 | 98.12 | 97.93  | 98.02  | 97.53 | 96.93   | 98.32 |
| Certification Status <sup>1</sup> | .43   | 1.52  | 2.58   | 1.73   | 5.81  | 1.65    | 1.60  |
| Number of samples                 | 45    | 114   | 45     | 175    | 13    | 96      | 26    |

<sup>1</sup>Number of generations reproduction from certification

were by commercial cleaners. Ninety-one percent of samples had a germination of 90% or better. Quality factors such as germination, mechanical purity, and seed size were generally better than in 1973. Seed from the western part of Kansas had the highest ratings for these factors. Many of the differences in seed size, weight, certified status, and protein among the samples could be attributed to either varietal or location differences.

Quality of seed planted and wheat management factors were improved in 1984 over those of 1973. Even with the observed increase of quality, there still is need for improvement. Many seedlots still contain too many impurities, have too low a germination rate, or contain seed that is too small or too light to have maximum potential for producing a healthy, strong wheat plant. In addition, approximately twice as many samples contained weed seeds in 1984.

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