A SURVEY OF WHEAT, (*Triticum aestivum* L. em. Thell.), SEED QUALITY AND ITS EFFECT ON GRAIN YIELD

by

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INTRODUCTION

Production of winter wheat (Triticum aestivum L. em. Thell.) long has been of great importance in Kansas. Over one-fifth of all winter wheat produced in the United States comes from Kansas. About 12 million acres of wheat are planted in the state every year. Consequently increasing the quality and yield of grain produced could be of considerable economic importance.

One method of increasing yields is to improve the quality of seed being used. To the farmer, wheat seed generally has good quality if (1) the plant grown from the seed matures properly in its environment and is readily harvested and, particularly, (2) if it produces a good grain yield. Increasing concern has been expressed regarding the quality of wheat seed being used in the state. Only recently has emphasis been placed on the importance of seeding good quality seed, and the subsequent possibility of obtaining higher yields.

The major objective of this study was to evaluate the effect of seed quality on grain yield, and determine what aspects of seed quality most influence yield. If a determination of how seed quality affects yield could be made, then emphasis on growing and maintaining good quality seed could be increased, thus insuring that seed quality is not a limiting factor for maximum yield.

Varietal purity is considered a standard of good seed quality. Since most of the seed wheat used in Kansas is grown by the farmer for his own use, it was of interest to determine if varietal purity was being maintained. An additional study was conducted to determine varietal purity of samples collected in the 1974 Kansas wheat drill box survey. Varietal purity was related and compared to different areas of the state and variables defined in the survey.

REVIEW OF LITERATURE

Similar Surveys

Few experiments similar to this survey have been documented in the literature. A drill box survey was conducted in Georgia (22) to determine the quality and kind of small grain seed being planted by farmers in the state. South Carolina also published results of a similar survey conducted in 1958 (8). The Nebraska Crop Improvement Association (18) conducted a survey among certified wheat seed growers in the state to compare yields obtained from certified seed to state average yields.

Lowery (22) collected at least 25 samples of small grain seed out of 54 counties in Georgia. A questionnaire was completed at the time each sample was collected. A three-pound sample of seed was taken, part for laboratory analysis and the remainder for planting demonstration plots. Meetings with farmers, seedsmen, and other groups were held at the demonstration plots so those interested could see the type of small grain seed being planted.

Garrison, Squires, and Shelley (8) in South Carolina expressed concern that farmers were not following the best available recommendations on selection and planting of small grain seed. Consequently, a study was conducted to determine the source and quality of seed being planted. At least 100 samples were taken in 21 counties, with the samples being taken directly from the grain drill for laboratory analysis and field demonstration plots. Four hundred seeds of each sample were planted in the greenhouse for an emergence and disease study. Field days also were held to allow the public to see the type of grain grown from samples collected in the survey. The demonstration plots were harvested and yield data collected.

Lancaster and Mills (18) were interested in the magnitude of yield increase that could be expected from planting certified seed. Only certified wheat seed producers were included in the survey, with the acreage involved representing nearly half of the total certified acres of wheat in Nebraska. Four major points were stressed; 1) it does make a difference what seed you plant, 2) it does pay to fertilize wheat, 3) it does pay to irrigate where possible, and 4) wheat research does pay big dividends to the economy.

Das Gupta and Austenson (4,5) thought it would be useful to be able to identify seed characteristics that might produce inferior yields so that farmers could be advised to obtain better seed. Over 80 samples of hard red spring wheat were obtained from Saskatchewan, Canada farmers in the spring of 1968 and 1969. Laboratory determinations were made on germination at different temperatures, early seedling growth, seed weight, pericarp injury, respiration rate, and several chemical constituents. Yield tests of these samples were conducted at four locations in Canada. Correlation coefficients were calculated among seed and seedling characteristics, stand, and grain yield.

Jansonius and Schulte (12) summarized the quality of the 1975 Kansas wheat crop. Samples used for the report were collected proportional to the acreage grown in each area of the state. Two plots were laid out in 300 sample fields for observations during the growing season. Plant counts, head counts, and grain yield were taken on each plot. Approximately 454 grams of wheat were harvested from each field. Various quality indicators such as grain protein, test weight, 1,000 kernel weight, size of seed, and numerous milling indicators were determined from the samples collected and compiled in this report.

Yield Components

Grafius (11) represented yield in oats as a geometric representation, or more specifically as a rectangular parallelopiped whose three dimensions were determined by the three components of yield. Numerous researchers have recognized the three yield components of cereal crops as; 1) number of spikes per unit area, 2) number of kernels per spike, and 3) average weight per kernel. Damsteegt (3) reviewed the literature pertaining to yield components of cereal crops quite thoroughly.

Austenson and Walton (1) studied the relative effect of each yield component on grain yield of spring wheat. They found that number of heads per plant was by far the most important component of yield. Number of seeds per head was next important, and weight per seed was relatively unimportant. The number of heads per plant and number of seeds per head were essentially independent of each other in their variations. Interestingly enough, they found no negative correlations among these yield components.

Knott and Talukdar (17), also working with spring wheat, found a highly significant negative correlation between seed weight and the number of kernels per plot. Only small, non-significant, negative correlations between seed weight and either the number of kernels per spike or the number of spikes per plot, the two components making up the number of kernels per plot, were found. Thus, an increase in seed weight brought about a reduction in the number of kernels per plot as a result of changes in either or both of the number of kernels per spike and the number of spikes per plot.

No consistent changes were found in these two components, though.

Damsteegt (3) pointed out that many conflicting associations among yield components or between yield components and grain yield have been reported. Such factors as environmental conditions influence dramatically the kind of association obtained at a particular time and location.

Seed Weight or Size

The influence that seed weight or size has on grain yield has been recognized for many years. In 1924, Kiesselbach (16) in Nebraska showed significant gains in yield from winter wheat, spring wheat, and oats when large seed was used compared to small seed. Where tests were made with hand selected large and small seed, small seed yielded 18% less than large seed when spaced to permit maximum individual plant development, 10% less when equal numbers of seed were sown per acre at an optimum rate for the large seed, and 5% less when equal weights of seed were sown per acre at an optimum rate for the large seed.

The relationship between seed size, establishment, and final grain yield of barley has been thoroughly investigated (6,13,14,15). This work shows that plants derived from large seeds produced more tillers and greater yields than those from small, medium, or bulk seed. Yield differences of up to 4.5% in spring wheat have been attributed to differences in the size of seed planted as observed by Austenson and Walton (1). McNeal and Berg (23) found that seed lots of Thatcher, a spring wheat variety, from different sources had different bushel weights, but this did not cause a significant difference in yield. Geiszler and Hoag (9) separated a certified lot of spring wheat seed into large and small seeds by sieving first, and then using a gravity cleaner. Large well-filled seeds produced highest yields.

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Waldron (31) showed similar yield increases in spring wheat from planting larger seeds.

Gogerty (10) reported the results of seed size trials conducted on wheat in Washington. Four year tests were conducted on plots planted from a single seed source at several locations. The seed was screened into three sizes, with plots being planted at identical seeding rates with each seed size. The smallest seed yielded 719 Kg/ha less than the largest seed, based on the summary of all years and locations.

Seed Protein

Recent studies have shown that a relationship exists between seed protein and seedling vigor, which could conceivably lead to higher grain yields. Schweizer and Ries (28), working with oats, found that both seedling growth and grain yield were significantly correlated with protein content of the seed planted based on both total amino acids and Kjeldahl nitrogen. They also found that wheat seed, whether from Michigan, Illinois, or Mexico, that contained more protein as a result of field applications of chemicals or nitrogen developed into larger seedlings. The content of protein in the seed once again correlated with subsequent growth and grain yield, indicating that the amount of protein present in the seed could be an important factor in subsequent yield of agronomic crops.

Ries et al. (26) increased the protein content of seed wheat by application of nontoxic levels of Simazine and nitrogen treatments. Increases in seed protein due to both herbicide and N applications were reflected in higher yields the next generation. Yield was directly correlated with seed protein content. Lopez and Grabe (19), using wheat and barley seed with different protein levels obtained by N applications, found a positive relationship between seed protein content and plant performance.

Lowe, Ayers, and Ries (20,21), using wheat seed of differing protein content, showed significant differences in dry matter accumulation and a high positive correlation (r = 0.92) between seed protein content and total dry matter after three weeks' growth. Seedlings grown from high protein seed were shown to be more advanced in morphological development than seedlings from low protein seeds.

Seed Germination

It is a common belief that yield in part depends on quality seed. Bieberly (2) stated that "good wheat seed has a germination of at least 90 percent germination as the breaking point between acceptable and non-acceptable wheat seed. Peterson (25) reports that wheat seed should have a minimum germination of 85 percent. One criteria stated for good quality seed is the presence of plump kernels of high germination.

Das Gupta and Austenson (4,5) sampled hard red spring wheat from farmers in Canada and studied the effect of germination on grain yield. Significant positive correlations were found at two of three locations in 1968 and at all three locations in 1969 between seed germination and grain yield. Similar results were also found in 1970, although only one location was used. It was concluded that the most useful indicators of seed quality in wheat were the standard seed germination test and a seed weight or volume weight test.

Varietal Purity

Presence of mixtures of varieties in cereal crops is a common problem. Numerous investigators have suggested that varietal mixtures or blends may help stabilize and perhaps maximize production. Shaalan (29) theorized that blends may offer longer varietal lives, greater stability of production, broader adaptation to environmental conditions, and greater protection against disease, although realizing that blends constitute a problem to plant breeders as well as producers of pure seed.

As early as 1912, Montgomery (24) concluded that the best yielding variety when grown alone may not always dominate in mixtures, so a less productive variety could possibly be best able to survive competition in a mixture. He also states that "for some reason, in almost every case with both wheat and oats, two varieties in competition have given a greater yield than when either variety was grown alone."

On the other hand, several researchers have reported negative yield responses from mixtures as compared to pure strains. Frankel (7) compared the yield properties of mixtures and pure strains of wheat in nine separate trials in New Zealand. In only two of the nine trials was yield increased due to blending.

Schlehuber and Curtis (27) compared the grain yield of four varieties of hard red winter wheat in pure stands to a mixture of the four varieties. An average of 23 location-years showed that yield of the four varieties in pure stands exceeded the yield of the mixture by approximately 60 Kg/ha. A considerable shift in population of the varieties in the mixture was observed after the first year of the tests. The shifts in population were not consistent with location, indicating that the environment played a significant role in altering natural selection.

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METHODS AND MATERIALS

Initial Survey

Samples drawn in this survey were selected on a crop reporting district basis based on the number of wheat farmers in each district. An estimated number of wheat farmers in each district were sampled at a rate which gave an average of 15 farmers per county in the three western and three central crop reporting districts and 10 farmers per county in the three eastern districts. This led to a total of 1,524 sample names drawn.

Sample names were sent to the appropriate area extension agronomist for distribution. Most of the sampling done in each county was handled by county extension agents, who contacted the farmers and collected the samples. The agents were furnished questionnaires (see appendix) which were filled out when the samples were collected. Every effort was made to take the samples directly from the drill box at the time of planting. Since many of the samples were impossible to obtain or insufficient information was obtained at the time of sampling, a total of 532 samples were subsequently used for the survey.

A 2.3 kg sample was collected from the farmer, with part of the sample being sent to the State Seed Testing Laboratory in Topeka for analysis of germination, purity, inert material present, name and number of noxious weed seed present, and also the name of any common weed seed or other crop present.

Yield Plots

One hundred samples were picked from the original 532 with proportional numbers of random samples from each crop reporting district in accordance with the percent of total statewide seeded wheat acreage occurring in each crop reporting district.

These 100 samples were planted in field plots at Manhattan and Hutchinson in 1974. Each sample was planted in a 1.22 m X 3.96 m plot replicated four times. A 30.5 cm row spacing was used with a seeding rate of 83 Kg/ha at Manhattan and 66 Kg/ha at Hutchinson. These rates were approximate since all plots at each location were planted on an equal volume basis as planting is done by the farmer. Plots were planted at Manhattan on September 26 and 27 and at Hutchinson on October 11.

Stand and vigor ratings were taken at Manhattan on October 18 and December 3, respectively. Ratings were taken on a scale from one to six, with one and two regarded as good, three and four as fair, and five and six as poor. A quick visual overview of each plot was conducted on both dates to obtain the ratings, with such factors as stand density and general vigor of the plants considered as very important when determining the rating values for each plot.

Spike counts were taken at Manhattan approximately three weeks before harvest. The number of spikes was counted for a 60.96 cm section of row out of one of the two middle rows of each plot in the second and fourth replications and converted to number of spikes per total plot area.

Plots were trimmed to a length of 2.86 m, with all four rows of each plot being harvested (3.49 m^2). Plots were harvested at Hutchinson on July 2 and 3 and at Manhattan on July 7 and 8. Harvested grain was cleaned through a fanning mill, weighed, converted to yield in Kg/ha, and adjusted to 12.5% moisture.

A 1,000 kernel weight was taken on both the seed planted and two replications of the grain harvested by sorting intact kernels, weighing and counting 5 gm of kernels, and calculating gm per 1,000 kernels.

Protein contents were determined by the macro Kjeldahl method on both the seed planted and two replications of the grain harvested. Ground samples were dried in an oven at 65 C to dryness before protein contents were determined.

Data collected from the initial survey form and laboratory analysis were compiled in frequency tables (see appendix). Statistical analyses on yield, yield components, protein content, and varietal purity were calculated on results of the field plots.

Mean values of replications for spike counts, grain yield, grain weights, and protein contents were used to relate yield plot data to survey sample data.

Varietal Purity Plots

All 532 samples from the survey were planted in one row plots, 3.96 m long, at both locations. The samples were sorted by variety, with all samples of each variety being planted side by side along with samples of certified seed of each variety. Estimates of varietal purity were taken about three weeks before harvest. The estimates were made on a percent scale, with as many of the off types or incorrect varieties being identified as possible. Identification of incorrect varieties was based on morphological characteristics such as heighth, straw color, and spike characteristics.

RESULTS AND DISCUSSION

This study evaluated the effects of differing seed quality on yield of winter wheat, and also determined the varietal purity of the survey seed samples. Original survey results will not be discussed although they are included in the appendix.

Environmental differences among locations probably played an active role in determining growth and subsequent plot yields. Temperature and rainfall certainly could have affected yield considerably.

Conditions were dry at the time of planting at both locations, although substantial precipitation was received at both locations within two days after planting. Monthly precipitation totals (Table 1) were consistent between locations except for October, 1974, when Manhattan received almost twice the precipitation that Hutchinson received. Very high amounts of precipitation were reported in June, 1975 at both locations. Harvest was delayed at both locations due to wet conditions. Intensive precipitation in May and June, 1975 also caused severe lodging which reduced yields.

Average maximum and minimum temperatures (Table 1) were quite consistent between locations. Temperatures during the growing season were normal with few daily extreme maximum and minimum temperatures occurring at either location.

Table 1. Average maximum and minimum temperatures and precipitation recorded during the growing season at Manhattan and Hutchinson.

	Manhattan			Hutchinson		
	Temp. (C)		Cm. of	Temp. (C)		Cm. of
Year	Ave. Max.	Ave. Min.	Ppt.	Ave. Max.	Ave. Min.	Ppt.
1974						
October	21.17	9.33	10.08	21.89	9.72	5.28
November	12.00	1.39	3.78	12.22	1.00	2.79
December	6.67	-4.00	2.11	7.61	-3.94	4.37
1975						
January	5.11	-5.89	3.58	6.94	-4.17	2.74
February	2.56	-6.11	4.32	3.83	-6.83	5.59
March	8.67	-2.50	3.94	10.44	-0.89	3.71
April	18.67	6.11	5.66	19.67	5.89	3.38
May	26.17	12.67	9.04	24.83	11.22	12.19
June	29.17	17.44	23.04	29.56	15.89	21.54

Yield Study

After the plots were harvested and yields calculated, it was evident that varietal differences in yield had to be eliminated before other factors affecting yield could be evaluated. Control plots of five major varieties grown in Kansas were included in the study. According to Kansas Farm Facts (30), these five varieties combined accounted for 80.2% of the total seeded wheat acreage for 1975. Scout, the leading variety, was seeded on 33.2% of the wheat acreage, Eagle on 22.6%, Centurk on 9.8%, Triumph on 8.2%, and Parker on 6.4%. Only plots of these five varieties were analyzed in this study, which reduced the number of entries from 100 to 82.

Varietal differences in yield were corrected by calculating the mean of the five control varieties for each location, dividing the mean yield by each control variety yield to obtain a varietal correction factor, and multiplying the correction factor times the plot yields for each appropriate variety (Table 2).

Although the control plots in this study showed greater varietal differences in yield at Manhattan than at Hutchinson, the 1975 variety performance tests (32) revealed more significant varietal differences in yield at Hutchinson than Manhattan.

Variety performance test results from Manhattan (32) showed a test average of all varieties tested of 3,158 Kg/ha, with a L.S.D. (.05) of 336 Kg/ha. None of the five varieties differed in yield by more than the L.S.D. When looking at the yields as percent of the test average, the range went from 94% for Parker to 102% for Centurk.

Hutchinson results (32) showed a test average of all varieties tested of 2,621 Kg/ha, with a L.S.D. (.05) of 134 Kg/ha. All of the five varieties differed in yield by more than the L.S.D. with at least one of the other five. The yields as percent of the test average ranged from 92% for Scout to 108% for Parker.

Table 2. Yields and correction factors for the five control varieties at Manhattan and Hutchinson.

	Manhattan		Hutchinson	
Variety	Yield Kg/ha	Varietal correction factor	Yield Kg/ha	Varietal correction factor
Scout	3111	.923	2871	.993
Eagle	2931	.980	2824	1.009
Centurk	2947	.974	2937	.971
Parker	2588	1.109	2898	.984
Triumph	2778	1.033	2724	1.046
	mean = 2871		mean = 2851	

Tables 3 and 4 give the analysis of variance computed on the yield plots at both locations. Neither location had significant sample differences in yield after varietal differences were removed. At Manhattan, significant sample differences were found in both the stand and vigor ratings, which should be good overall indicators of stand establishment and seedling growth and vigor. Of the three yield components commonly associated with wheat, only grain weight had significant sample differences. Sample differences in grain protein were significant at Hutchinson but not at Manhattan.

Simple correlations (Tables 5 and 6) between parameters studied were not consistent with locations. For example, 1,000 kernel weight of the grain was negatively correlated with grain yield at Manhattan and positively

Table 3. Analysis of variance for stand and vigor ratings at Manhattan and uncorrected grain yield at Manhattan and Hutchinson.

		Mean Squares			
		Manhattan			Hutchinson
Source	d.f.	Stand rating	Vigor rating	Yield	Yield
Replicates	3	3.36**	3.29**	31.77	34.53**
Varieties	4	15.79**	11.38**	165.06**	14.34
Samples/Varieties	82	2.34**	2.39**	20.61	9.12
Error	258	0.52	0.65	19.00	7.47

** Significant at the 1% level.

Table 4. Analysis of variance for spikes/m^2 and seeds/spike at Manhattan and 1,000 kernel wt. and protein content at Manhattan and Hutchinson.

		Mean Squares					
		Manhattan				Hutchinson	
Source	d.f.	Spikes/m^2	Seeds/ spike	1,000 Kernel Wt.	Protein	1,000 Kernel Wt.	Protein
Replicates	1	18619	19.31*	0.11	10.82**	10.79**	2.01*
Varieties	4	67332**	12.84**	172.81**	2.68*	230.07**	0.72
Samples/ Varieties	82	10199	3.60	2.63*	0.93	3.14**	0.51*
Error	86	8868	3.28	1.56	0.81	1.06	0.33

* Significant at the 5% level.
** Significant at the 1% level.

Table 5. Simple correlations among corrected grain yield at Manhattan and Hutchinson and several indicators of seed quality.

Variable	Manhattan yield	Hutchinson yield
Standard Germination	0.202	0.113
Protein Content - Seed	0.129	0.198
Protein Content - Grain	0.032	-0.105
1,000 Kernel Wt. - Seed	-0.172	0.245*
1,000 Kernel Wt. - Grain	-0.257*	0.421**
Years From Certification	-0.363**	0.067
Total % Off Type	-0.191	-0.031
Stand Rating	-0.419**	--
Vigor Rating	-0.432**	--
Spikes/m^2	0.208	--
Seeds/Spike	0.350**	--

* Significant at the 5% level.
** Significant at the 1% level.

Table 6. Simple correlations among several indicators of seed quality at Manhattan and Hutchinson.

	Manhattan				Hutchinson	
Variable	Stand rating	Vigor rating	Grain protein	1,000 Kernel Wt. - Grain	Grain protein	1,000 Kernel Wt. - Grain
Protein Content - Seed	0.051	0.043	0.153	-0.014	0.190	0.144
1,000 Kernel Wt. - Seed	0.226*	0.115	-0.096	0.602**	-0.069	0.543**
Standard Germination	-0.647**	-0.639**	---	---	---	---
Years From Certification	0.001	-0.035	---	---	---	---

* Significant at the 5% level.
** Significant at the 1% level.

correlated at Hutchinson. Stand and vigor ratings at Manhattan had highly significant negative correlations with both standard germination and grain yield. Significant positive correlations were obtained between seed weight and grain weight as would be expected. R^2 values were low for all comparisons except the correlations between stand and vigor ratings and germination and grain yield.

Table 7 shows that grain yields at Manhattan had a wider range than those at Hutchinson. Analysis of variance (Table 3) indicates that the greater variation at Manhattan was due to varietal differences and not sample differences. The smaller range of yields at Hutchinson could have been due to severe lodging that occurred, which tends to equalize extreme yields. A greater range of yields was also found in the control treatments at Manhattan. Consequently greater adjustments for varietal differences in yield were made (Table 2). Visual observations at earlier stages of growth also indicated that potential sample variations in yield were greater at Manhattan than Hutchinson.

Table 7. Frequency of values for corrected grain yield at Manhattan and Hutchinson.

	Manhattan		Hutchinson	
Yield, Kg/ha	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)
2300 - 2400	1	1.2	0	0.0
2401 - 2500	4	4.9	0	0.0
2501 - 2600	7	8.5	0	0.0
2601 - 2700	16	19.5	6	7.3
2701 - 2800	19	23.2	10	12.2
2801 - 2900	15	18.3	24	29.3
2901 - 3000	12	14.6	25	30.5
3001 - 3100	6	7.3	16	19.5
3101 - 3200	2	2.4	1	1.2
Total	82	100.0	82	100.0

Stand and vigor ratings (Table 8) taken at Manhattan were quite similar. Linear regression lines plotted in Figures 1 and 2 show very similar relationships between the two ratings and germination and grain yield. Few changes in plot appearance were visually detectable between the two dates when ratings were taken. Germination was inversely related with both ratings (Table 6), implying that germination greatly affected the appearance (stand and vigor) of the plots.

Table 8. Frequency of values for stand and vigor ratings at Manhattan.

	Manhattan			
	Stand Rating		Vigor Rating	
Rating	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)
1.0 - 2.0	9	11.0	11	13.4
2.1 - 3.0	33	40.2	36	43.9
3.1 - 4.0	31	37.8	29	35.4
4.1 - 5.0	7	8.5	4	4.9
5.1 - 6.0	2	2.4	2	2.4
Total	82	100.0	82	100.0

Seed and grain weights (grams per 1,000 seeds) are presented in Table 9. Analysis of variance (Table 4) showed significant sample differences in grain weights at both locations. Highly significant positive correlations (Table 6) were found between seed weight and grain weight at both locations. Thus large seed produced large grain, and vice versa. This relationship probably existed mainly because of inherent varietal differences in seed size and weight. Table 9 shows the grain weights from Manhattan to be higher than those from Hutchinson. Seed weights were the most variable as would be expected since the seed came from all parts of the state.

Table 10 gives the range of protein contents found in the seed and grain harvested. Higher percent protein was found in the Hutchinson grain. This

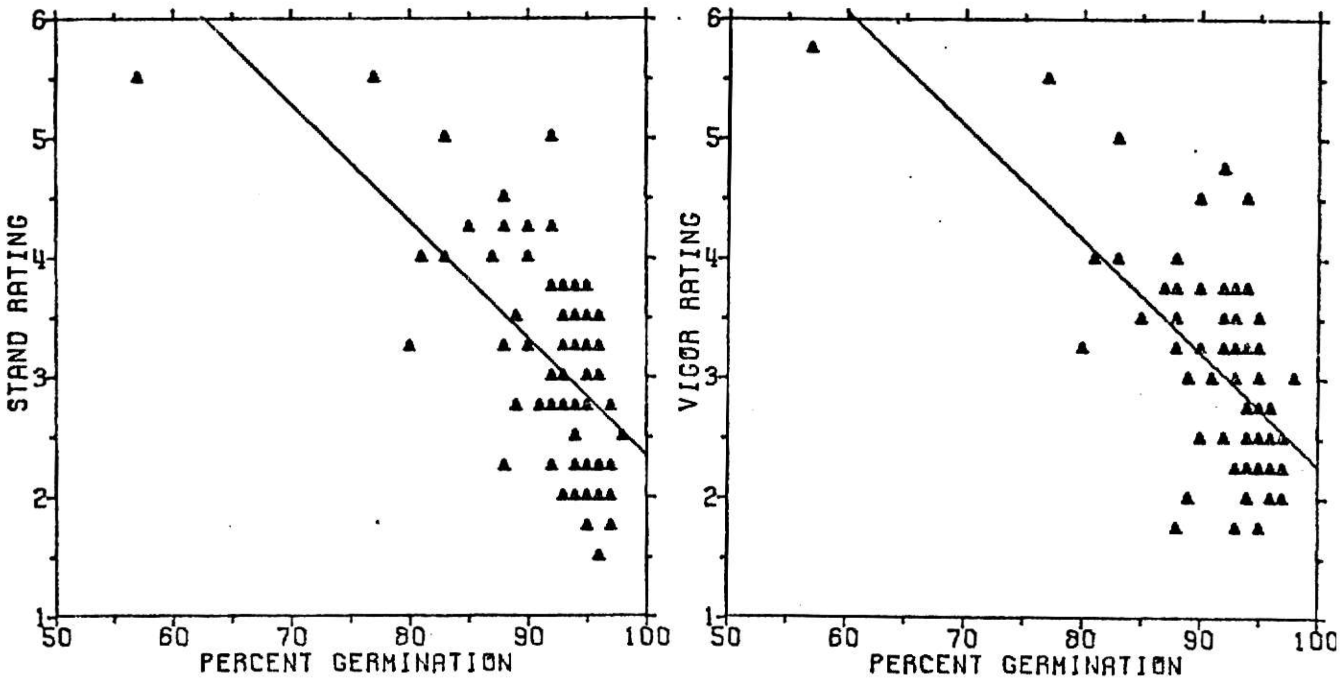

Figure 1. Stand and vigor ratings by percent germination at Manhattan.

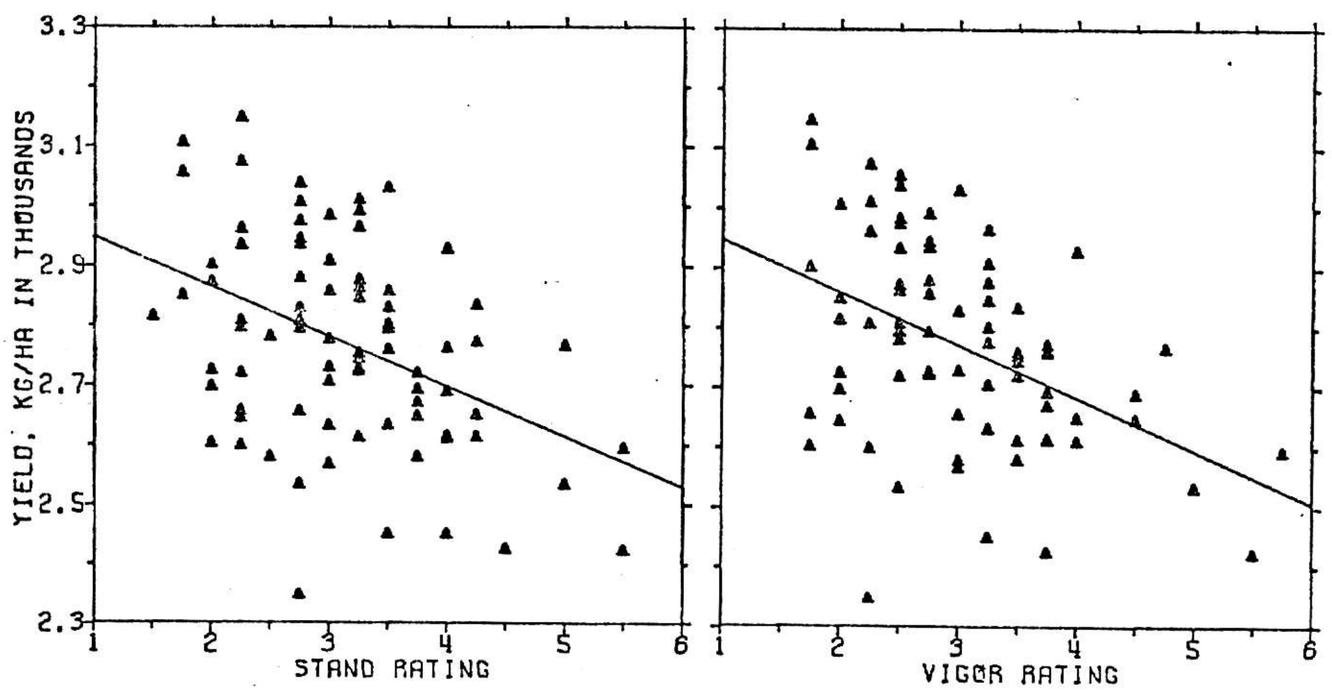

Figure 2. Corrected grain yield by stand and vigor ratings at Manhattan.

Table 9. Frequency of values for grams per 1000 seeds for seed and grain harvested at Manhattan and Hutchinson.

	Seed		Manhattan Grain		Hutchinson Grain	
Grams per 1000 seeds	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)
Low - 27.0	3	3.7	0	0.0	8	9.8
27.1 - 29.0	11	13.4	14	17.1	5	6.1
29.1 - 30.0	8	9.8	1	1.2	5	6.1
30.1 - 31.0	5	6.1	2	2.4	4	4.9
31.1 - 32.0	9	11.0	2	2.4	15	18.3
32.1 - 33.0	9	11.0	11	13.4	15	18.3
33.1 - 34.0	11	13.4	29	35.4	21	25.6
34.1 - 35.0	17	20.7	16	19.5	8	9.8
35.1 - UP	9	11.0	7	8.5	1	1.2
Total	82	100.0	82	100.0	82	100.0

Table 10. Frequency of values for protein content for seed and grain harvested at Manhattan and Hutchinson.

	Seed		Manhattan Grain		Hutchinson Grain	
Percent Protein	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)	No. of Samples	Frequency (Pct.)
Low - 10.0	13	15.9	0	0.0	0	0.0
10.1 - 10.5	6	7.3	4	4.9	0	0.0
10.6 - 11.0	8	9.8	22	26.8	1	1.2
11.1 - 11.5	12	14.6	20	24.4	1	1.2
11.6 - 12.0	9	11.0	19	23.2	23	28.0
12.1 - 12.5	8	9.8	10	12.2	34	41.5
12.6 - 13.5	12	14.6	7	8.5	22	26.8
13.6 - UP	14	17.1	0	0.0	1	1.2
Total	82	100.0	82	100.0	82	100.0

was expected since grain harvested in central Kansas will usually have a higher protein content than grain from the eastern part of the state. Seed protein was the most variable since the seed came from all parts of the state. Positive but non-significant correlations were found between seed protein and grain protein at both locations (Table 6). Neither seed or grain protein was significantly correlated with yield (Table 5). Significant sample differences in protein content were found at Hutchinson but not Manhattan (Table 3).

Yield components were calculated for the Manhattan results. Table 11 gives the range of values for spikes/m^2 and seeds/spike while grain weight is given in Table 9. Neither spikes/m^2 or seeds/spike had significant sample differences (Table 3). A significant positive correlation was found between seeds/spike and grain yield (Table 5).

Figure 3 shows the relationship between grain yield at both locations and the number of years from certification. A significant negative correlation between grain yield and years from certification was found at Manhattan (Table 5). The same relationship at Hutchinson was positive but non-significant. A drop of approximately 300 Kg/ha occurred at Manhattan when going from zero to ten years from certification. Essentially no difference was found at Hutchinson, possibly because of the severe lodging that tended to equalize yields.

Table 11. Frequency of values for spikes/m^2 and seeds/spike at Manhattan.

Spikes/m^2	Manhattan No. of Samples	Manhattan Frequency (Pct.)	Seeds/spike	Manhattan No. of Samples	Manhattan Frequency (Pct.)
500 - 550	1	1.2	9.0 - 10.0	3	3.7
551 - 600	5	6.1	10.1 - 11.0	9	11.0
601 - 650	8	9.8	11.1 - 12.0	21	25.6
651 - 700	24	29.3	12.1 - 13.0	21	25.6
701 - 750	15	18.3	13.1 - 14.0	20	24.4
751 - 800	16	19.5	14.1 - 15.0	5	6.1
801 - 850	7	8.5	15.1 - 16.0	2	2.4
851 - 900	6	7.3	16.1 - 17.0	1	1.2
Total	82	100.0	Total	82	100.0

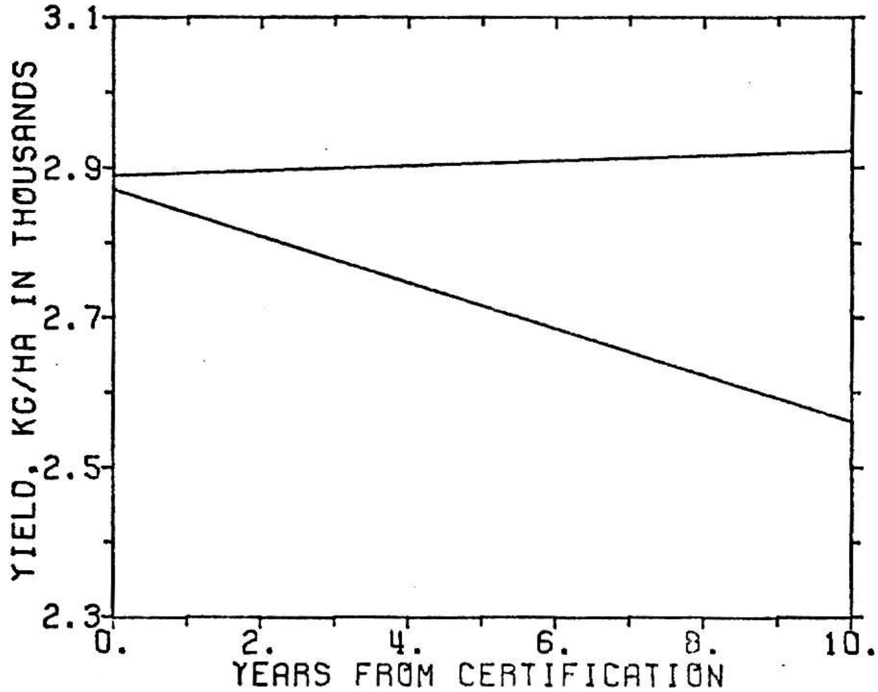

Figure 3. Corrected grain yield by years from certification at Manhattan and Hutchinson. Top line is Hutchinson, bottom line is Manhattan.

Varietal Purity Study

All 532 survey samples were included in this part of the study. Purity percentages were represented as percent of other or incorrect varieties present in each plot. Figure 4 and Tables 12-14 list the variety reported to us by the farmer as either pure, a mixture, or incorrect, along with the percent of other or incorrect varieties present for each category.

Table 12 shows purity by the class of seed; certified or not certified. The certified class includes foundation, registered, and certified seed. A considerably higher percentage of samples in the certified class were pure. About the same percentage of incorrectly reported samples was found in each class of seed. Varietal impurities found in certified seed could have easily came from the method and care with which the seed was handled by the farmer after purchase instead of being sold to the farmer with impurities present.

Table 13 shows purity by seed source; either home grown, from another farmer, or bought from a dealer. The highest percentage of pure samples occurred with the seed bought from a dealer. No samples coming from a dealer were incorrectly reported. Varietal impurities present in dealer bought seed also could have come from the method and care in which the farmer handled the seed after purchase.

Maintenance of varietal purity becomes increasingly more difficult as the time a particular variety is on the market increases. Table 14 gives the relationship between five selected varieties and varietal purity. Scout and Eagle are two closely related varieties. Scout was released seven years before Eagle. The data shows the varietal purity of Eagle to be much better than that of Scout. A similar relationship exists between Parker and Centurk. Chanute is included to show the difficulty encountered in maintaining

Table 12. Varietal purity as affected by class of seed.

Variety reported	% Other variety	Class of Seed Certified	Class of Seed Not Certified
		% of Samples	
Pure	0	81.3	57.9
Mixture	1 - 50	12.5	35.7
Incorrect	51 - 100	6.2	6.4

Table 13. Varietal purity as affected by seed source.

Variety reported	% Other variety	Seed Source: Home grown	Seed Source: Another farmer	Seed Source: Dealer
		% of Samples		
Pure	0	53.7	57.1	71.4
Mixture	1 - 50	38.1	36.3	28.6
Incorrect	51 - 100	8.2	6.6	0.0

Table 14. Varietal purity of five varieties of wheat grown in Kansas and their release dates.

Variety	Year released	Variety Reported		
		Pure	Mixture	Incorrect
		% of Samples		
Scout	1963	44.4	49.4	6.2
Eagle	1970	74.3	21.0	4.7
Parker	1966	61.4	28.1	10.5
Centurk	1971	77.4	20.8	1.9
Chanute	1969	29.4	64.7	5.9

varietal purity of a semidwarf variety.

Figure 4 gives a statewide picture of varietal purity by crop reporting districts. The greatest percentage of pure samples came from the North Central CRD, with the smallest percentage from the South East CRD. No consistent pattern across the state was obtained for any of the three categories.

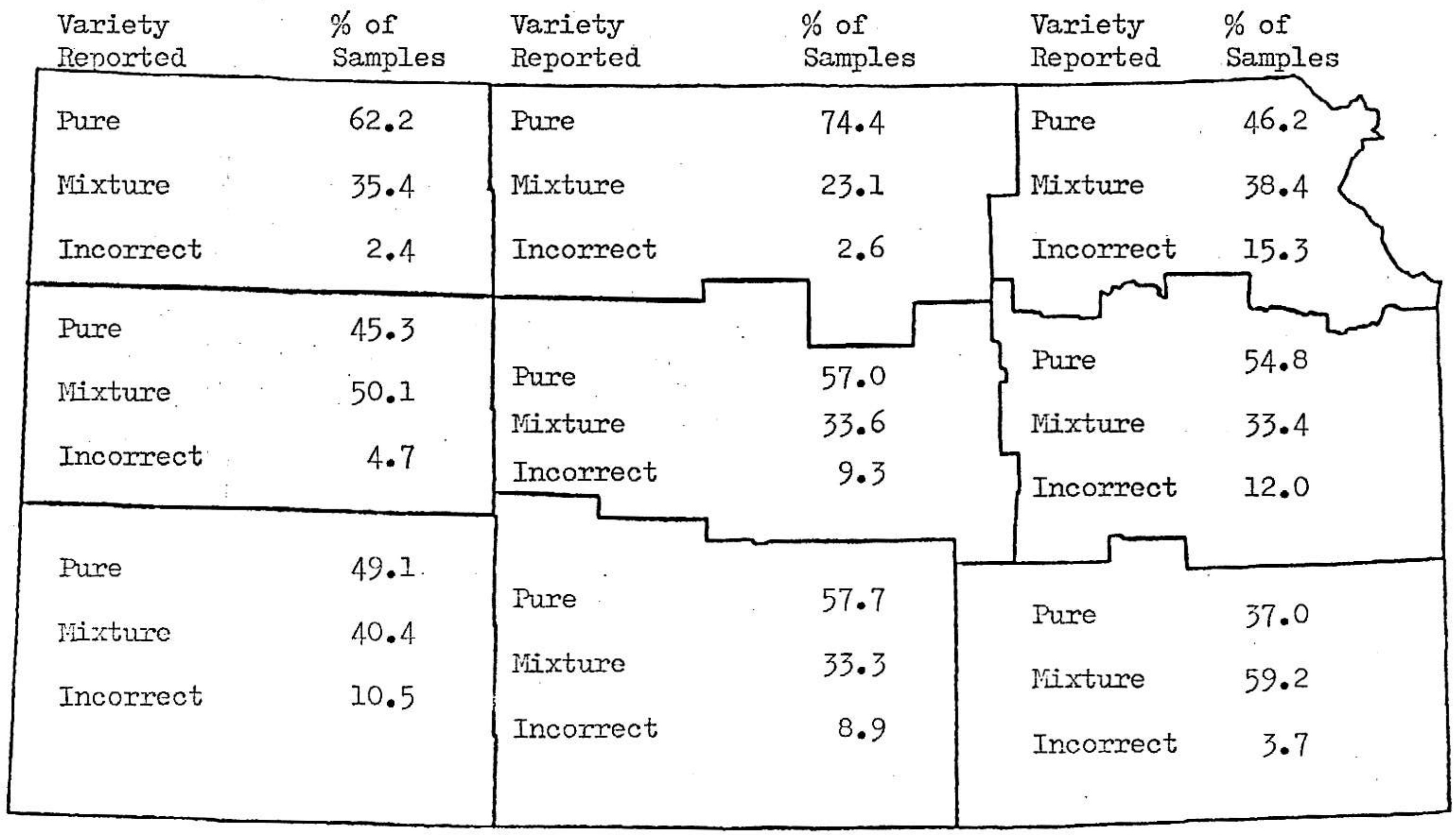

Figure 4. Varietal purity by crop reporting districts in Kansas.

SUMMARY AND CONCLUSIONS

The original intention of the yield study was to relate the results back to the survey results. After realizing this was not possible with only 100 samples, the emphasis was shifted to relating differing seed quality to subsequent grain yield. Consequently our selection of samples should have probably been based on seed quality and not a random sampling based on the percentage of wheat acreage in each crop reporting district.

No significant sample differences were found in grain yield at either location after varietal differences were removed. This does not necessarily mean that differing seed quality produced no significant differences in yield. When removing the variation in grain yield due to varieties, other differences due to differing seed quality factors could have easily been removed along with it. Since the samples were picked at random, none of the seed quality factors analyzed were controlled in any way. Therefore it was virtually impossible to separate the effect of one factor from another.

Few significant correlations between seed quality factors and grain yield were found. Significant correlations that were found were not consistent between locations, possibly because of an environmental effect on expression of seed quality differences. Once again, the problem of separating the effect of one factor from another made it difficult to get significant simple correlations.

Stand and vigor ratings taken at Manhattan had good negative relationships with both germination and grain yield. Since the ratings were based on the general appearance of each plot, they should have been good overall indicators of seed quality. According to multiple regression, the two ratings were by far the best indicators of grain yield. Germination was highly correlated with the two ratings, and was probably the one seed quality factor that best predicted eventual grain yield, although germination itself was not significantly correlated with yield.

The varietal purity study revealed that approximately one half of the survey samples had at least some type of varietal impurity present. The wrong variety was reported by the farmer in 7.5% of the total samples. Over 10% of the samples were incorrectly reported in three crop reporting districts. Varietal mixtures or simply planting a different variety than expected may be deleterious because of possible lower yield potentials, varying maturity, or differences in disease resistance.

Foundation, registered, or certified seed coming from a dealer had the best varietal purity. Newer varieties had better varietal purity than similar varieties with an earlier release date. The poorest varietal purity occurred when the farmer grew his own seed. Maintenance of varietal purity is essential to the production of top quality seed. Maintaining seed close to certification is one good way of helping maintain good varietal purity.

Yield can be increased by improving the quality of the seed in basically two ways; either add desirable characteristics by genetic manipulation or simply improve the quality or vigor of the seed being planted. Farmers in Kansas are quite conscious and receptive of new varieties developed that have the potential for higher yields. But good quality seed also provides the potential for higher yields. Improving the overall quality of wheat seed planted in the state could potentially increase statewide yield averages. With approximately 12 million acres of wheat planted in the state, a small increase could provide substantial economic returns.

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APPENDIX

SURVEY FORM

1973 KANSAS DRILL BOX SURVEY

(One form to be filled out for each sample taken)

1. Identification number ____________________
   (Three part number must match number on sample bag)

2. Variety planted ____________________

3. Acres planted with this seed ____________________

4. Total farm acres wheat ____________________

5. Other varieties planted this year ____________________

6. Seed Source: Home grown _____ Another farmer _____ Dealer _____

7. Seed Treatment: Insecticide Yes ____ No ____ Don't know _____

   Fungicide Yes ____ No ____ Don't know _____

8. Was seed cleaned? Yes ____ No ____

   If cleaned -- At home ____ Another farmer ____ Commercial ____

   If not cleaned at home -- how many miles to cleaner _____

9. Seeding rate _____ lbs/acre

10. Seeding on fallow _____ or continuous cropped land _____

11. Was seed laboratory tested? Yes ____ No ____

    Reported germination ___________ Purity ___________ Inert ___________.

12. Is this seed: Certified ____ Registered ____ Foundation ____
    (send analysis tag if possible)

13. If not certified, registered or foundation, number of years away from certified seed _____.

* * * * * *

Samples to be gathered and analyzed at State Seed Laboratory.

* * * * * *

VARIETY SURVEYED By State and Crop Reporting District

Variety	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Scout	38* 46.3**	32 49.2	23 38.3	12 30.0	30 27.5	21 26.9	3 11.1	3 7.0	1 3.6	163 30.6
Triumph	0 0.0	0 0.0	0 0.0	2 5.0	5 4.6	11 14.1	6 22.2	7 16.3	8 28.6	39 7.3
Eagle	17 20.7	16 24.6	20 33.3	12 30.0	31 28.4	9 11.5	1 3.7	1 2.3	0 0.0	107 20.1
Parker	0 0.0	0 0.0	1 1.7	5 12.5	23 21.1	7 9.0	5 18.5	14 32.6	2 7.1	57 10.7
Satanta	9 11.0	2 3.1	3 5.0	1 2.5	7 6.4	1 1.3	0 0.0	0 0.0	1 3.6	24 4.5
Centurk	9 11.0	6 9.2	2 3.3	5 12.5	7 6.4	17 21.8	6 22.2	2 4.7	0 0.0	54 10.2
Chanute	0 0.0	0 0.0	0 0.0	0 0.0	1 0.9	1 1.3	2 7.4	8 18.6	5 17.9	17 3.2
Gage	0 0.0	0 0.0	0 0.0	0 0.0	1 0.9	0 0.0	2 7.4	4 9.3	1 3.6	8 1.5
Wichita	0 0.0	3 4.6	3 5.0	0 0.0	1 0.9	0 0.0	0 0.0	0 0.0	0 0.0	7 1.3

(continued)

(Continued)

VARIETY SURVEYED By State and Crop Reporting District

Variety	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Apache	1 1.2	0 0.0	1 1.7	0 0.0	1 0.9	3 3.8	0 0.0	0 0.0	0 0.0	6 1.1
Bison	1 1.2	2 3.1	3 5.0	0 0.0	0 0.0	1 1.3	0 0.0	0 0.0	0 0.0	7 1.3
Sturdy	0 0.0	0 0.0	1 1.7	1 2.5	0 0.0	1 1.3	0 0.0	2 4.7	3 10.7	8 1.5
Lancer	3 3.7	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	3 0.6
Kaw	0 0.0	3 4.6	1 1.7	0 0.0	0 0.0	1 1.3	0 0.0	0 0.0	0 0.0	5 0.9
Danne	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 1.3	0 0.0	0 0.0	1 3.6	2 0.4
Kiowa	1 1.2	1 1.5	0 0.0	0 0.0	1 0.9	0 0.0	0 0.0	0 0.0	0 0.0	3 0.6
Pronto	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 1.3	0 0.0	0 0.0	0 0.0	1 0.2
Other	3 3.7	0 0.0	2 3.3	2 5.0	1 0.9	3 3.8	1 3.7	1 2.3	6 21.4	19 3.6
Column Total	82 15.4	65 12.2	60 11.3	40 7.5	109 20.5	78 14.7	27 5.1	43 8.1	28 5.3	532 100.0

* No. of Samples
** Percent of Column Total

NUMBER OF PLANTED VARIETIES By State and Crop Reporting District

Number of Planted Varieties	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
1	28* 34.1**	44 67.7	31 51.7	16 40.0	52 47.7	32 41.0	21 77.8	35 81.4	18 64.3	277 52.1
2	45 54.9	16 24.6	23 38.3	10 25.0	40 36.7	26 33.3	6 22.2	6 14.0	7 25.0	179 33.6
3	6 7.3	4 6.2	6 10.0	10 25.0	13 11.9	16 20.5	0 0.0	2 4.7	1 3.6	58 10.9
4	1 1.2	1 1.5	0 0.0	3 7.5	3 2.8	4 5.1	0 0.0	0 0.0	2 7.1	14 2.6
5	2 2.4	0 0.0	0 0.0	1 2.5	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	3 0.6
6	0 0.0	0 0.0	0 0.0	0 0.0	1 0.9	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Column Total	82 15.4	65 12.2	60 11.3	40 7.5	109 20.5	78 14.7	27 5.1	43 8.1	28 5.3	532 100.0

* No. of Samples
** Percent of column Total

YEARS FROM CERTIFICATION By State and Crop Reporting District

Class of Seed	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Foundation	1*	1	0	1	0	0	0	0	0	2
	0.0**	2.2	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.5
Registered	1	2	0	1	0	0	0	0	0	4
	1.5	4.4	0.0	3.3	0.0	0.0	0.0	0.0	0.0	1.0
Certified	1	1	0	0	1	2	1	3	1	10
	1.5	2.2	0.0	0.0	1.1	3.2	4.8	11.1	4.8	2.4
Years from Certification										
1	11	5	6	12	16	14	1	7	4	76
	16.2	11.1	13.3	40.0	17.2	22.2	4.8	25.9	19.1	18.4
2	19	11	16	7	20	15	7	5	4	104
	27.9	24.4	35.6	23.3	21.5	23.8	33.3	18.5	19.1	25.2
3	17	7	6	4	23	10	6	4	8	85
	25.0	15.6	13.3	13.3	24.2	15.9	28.6	14.8	38.1	20.6
4	8	9	6	3	12	7	2	4	2	53
	11.8	20.0	13.3	10.0	12.9	11.1	9.5	14.8	9.5	12.8
5	3	6	5	0	6	6	2	2	1	31
	4.4	13.3	11.1	0.0	6.5	9.5	9.5	7.4	4.8	7.5
6-10	8	2	5	2	15	9	2	2	1	46
	11.8	4.4	11.1	6.7	16.1	14.3	9.5	7.4	4.8	11.1
More than 10	0	1	1	0	0	0	0	0	0	2
	0.0	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Column Total	68	45	45	30	93	63	21	27	21	413
	16.5	10.9	10.9	7.3	22.5	15.3	5.1	6.5	5.1	100.0

* No. of Samples
** % of Column Total

SEED SOURCE By State and Crop Reporting District

Seed Source	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Home Grown	64* 78.0**	55 84.6	48 80.0	27 69.2	77 70.6	69 88.5	18 69.2	30 69.8	21 75.0	409 77.2
Another Farmer	16 19.5	9 13.8	12 20.0	10 25.6	25 22.9	8 10.3	5 19.2	5 11.6	3 10.7	93 17.5
Dealer	2 2.4	1 1.5	0 0.0	2 5.1	7 6.4	1 1.3	3 11.5	8 18.6	4 14.3	28 5.3
Column Total	82 15.5	65 12.3	60 11.3	39 7.4	109 20.6	78 14.7	26 4.9	43 8.1	28 5.3	530 100.0

* No. of Samples
** Percent of Column Total

SEED CLEANING By State and Crop Reporting District

Cleaned	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
No	14*	3	14	8	21	16	10	19	10	115
	17.1**	4.6	23.3	20.5	19.4	20.8	37.0	46.3	35.7	21.8
At Home	11	12	15	0	18	9	6	7	1	79
	13.4	18.5	25.0	0.0	16.7	11.7	22.2	17.1	3.6	15.0
Another Farmer	4	1	3	4	6	0	0	0	0	18
	4.9	1.5	5.0	10.3	5.6	0.0	0.0	0.0	0.0	3.4
Commercial	53	49	28	27	63	52	11	15	17	315
	64.6	75.4	46.7	69.2	58.3	67.5	40.7	36.6	60.7	59.8
Column Total	82	65	60	39	108	77	27	41	28	527
	15.6	12.3	11.4	7.4	20.5	14.6	5.1	7.8	5.3	100.0

* No. of Samples
** Percent of Column Total

INSECTICIDE By State and Crop Reporting District

Insecticide	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Yes	14* 19.4**	10 17.5	5 9.3	4 13.8	28 34.1	16 26.7	1 4.0	6 17.1	5 22.7	89 20.4
No	54 75.0	45 78.9	48 88.9	20 69.0	51 62.2	41 68.3	22 88.0	28 80.0	17 77.3	326 74.8
Don't Know	4 5.6	2 3.5	1 1.9	5 17.2	3 3.7	3 5.0	2 8.0	1 2.9	0 0.0	21 4.8
Column Total	72 16.5	57 13.1	54 12.4	29 6.7	82 18.8	60 13.8	25 5.7	35 8.0	22 5.0	436 100.0

* No. of Samples
** Percent of Column Total

FUNGICIDE By State and Crop Reporting District

Fungicide	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Yes	16*	20	13	21	47	39	5	10	6	177
	23.2**	32.8	22.4	61.8	47.0	59.1	19.2	26.3	26.1	37.3
No	48	39	43	12	48	24	20	27	14	275
	69.6	63.9	74.1	35.3	48.0	36.4	76.9	71.1	60.9	57.9
Don't Know	5	2	2	1	5	3	1	1	3	23
	7.2	3.3	3.4	2.9	5.0	4.5	3.8	2.6	13.0	4.8
Column Total	69	61	58	34	100	66	26	38	23	475
	14.5	12.8	12.2	7.2	21.1	13.9	5.5	8.0	4.8	100.0

* No. of Samples
** Percent of Column Total

LABORATORY GERMINATION By State and Crop Reporting District

Germination Range %	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
24-50	0* 0.0**	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 3.7	1 2.3	1 3.6	3 0.6
51-70	2 2.4	1 1.5	2 3.3	0 0.0	0 0.0	0 0.0	0 0.0	4 9.3	0 0.0	9 1.7
71-75	0 0.0	0 0.0	0 0.0	1 2.5	1 0.9	2 2.6	0 0.0	1 2.3	0 0.0	5 0.9
76-80	0 0.0	4 6.2	0 0.0	3 7.5	5 4.6	2 2.6	1 3.7	1 2.3	4 14.3	20 3.8
81-85	1 1.2	6 9.2	4 6.7	1 2.5	8 7.3	5 6.4	1 3.7	6 14.0	5 17.9	37 7.0
86-90	23 28.0	10 15.4	9 15.0	11 27.5	31 28.4	11 14.1	6 22.2	7 16.3	5 17.9	113 21.2
91-95	36 43.9	38 58.5	30 50.0	19 47.5	49 45.0	43 55.1	14 51.9	15 34.9	10 35.7	254 47.7
96-100	20 24.4	6 9.2	15 25.0	5 12.5	15 13.8	15 19.2	4 14.8	8 18.6	3 10.7	91 17.1
Column Total	82 15.4	65 12.2	60 11.3	40 7.5	109 20.5	78 14.7	27 5.1	43 8.1	28 5.3	532 100.0

* No. of Samples
** Percent of Column Total

MECHANICAL PURITY By State and Crop Reporting District

Mechanical Purity %	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
Less than 90.4	0* 0.0**	1 1.6	1 1.8	1 2.6	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	3 0.6
90.5-95.4	12 16.2	13 21.0	8 14.3	7 17.9	15 14.4	6 8.1	0 0.0	3 7.0	1 4.2	65 12.9
95.5-96.4	9 12.2	5 8.1	6 10.7	2 5.1	17 16.3	7 9.5	1 3.7	1 2.3	3 12.5	51 10.1
96.5-97.4	10 13.5	10 16.1	6 10.7	10 25.6	14 13.5	7 9.5	2 7.4	6 14.0	2 8.3	67 13.3
97.5-98.4	20 27.0	23 37.1	20 35.7	6 15.4	21 20.2	20 27.0	8 29.6	6 14.0	0 0.0	124 24.7
98.5-99.4	17 23.0	9 14.5	13 23.2	12 30.8	33 31.7	31 41.9	13 48.1	17 39.5	10 41.7	155 30.8
99.5-100.0	6 8.1	1 1.6	2 3.6	1 2.6	4 3.8	3 4.1	3 11.1	10 23.3	8 33.3	38 7.6
Column Total	74 14.7	62 12.3	56 11.1	39 7.8	104 20.7	74 14.7	27 5.4	43 8.5	24 4.8	503 100.0

* No. of Samples
** % of Column Total

INERT MATERIAL By State and Crop Reporting District

Inert %	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East	Entire State
0 to .4%	11* 13.4**	5 7.7	3 5.0	2 5.0	8 7.3	6 7.7	3 11.1	9 20.9	13 46.4	60 11.3
.5 to 1.4%	18 22.0	8 12.3	15 25.0	11 27.5	32 29.4	33 42.3	14 51.9	19 44.2	6 21.4	156 29.3
1.5 to 2.4%	20 24.4	22 33.8	20 33.3	7 17.5	23 21.1	20 25.6	8 29.6	7 16.3	3 10.7	130 24.4
2.5 to 3.4%	10 12.2	10 15.4	5 8.3	9 22.5	13 11.9	6 7.7	1 3.7	6 14.0	2 7.1	62 11.7
3.5 to 4.4%	9 11.0	6 9.2	7 11.7	3 7.5	18 16.5	7 9.0	1 3.7	0 0.0	3 10.7	54 10.2
4.5 to 5.4%	4 4.9	3 4.6	4 6.7	3 7.5	4 3.7	4 5.1	0 0.0	0 0.0	1 3.6	23 4.3
5.5 to 10%	8 9.8	11 16.9	5 8.3	5 12.5	11 10.1	2 2.6	0 0.0	2 4.7	0 0.0	44 8.3
Greater than 10%	2 2.4	0 0.0	1 1.7	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	3 0.6
Column Total	82 15.4	65 12.2	60 11.3	40 7.5	109 20.5	78 14.7	27 5.1	43 8.1	28 5.3	532 100.0

* No. of Samples
** % of Column Total

A SURVEY OF WHEAT, (*Triticum aestivum* L. em. Thell.), SEED QUALITY AND IT'S EFFECT ON GRAIN YIELD

by

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B. S., Kansas State University, 1974

AN ABSTRACT OF A MASTER'S THESIS

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ABSTRACT

Production of winter wheat (Triticum aestivum L. em. Thell.) has long been of great importance in Kansas. With the large amount of wheat acreage planted in the state, increasing the quality and yield of wheat grain produced could be of considerable economic importance.

This study was conducted to investigate the effect that seed quality might have on grain yield of winter wheat, and also determine the varietal purity of the samples collected in the 1974 Kansas wheat drill box survey.

Replicated yield trials of 100 selected survey samples were conducted at Manhattan and Hutchinson in 1975. One row plots of all 532 survey samples were also planted at both locations to take varietal purity notes on.

Analysis of variance showed no significant sample differences in grain yield after varietal differences were removed at either location. A greater range of grain yields was found at Manhattan than at Hutchinson. Severe lodging which occurred at Hutchinson tended to equalize yields. Difficulty was encountered in separating the effect of one seed quality factor from another, thus making it hard to get consistent sample differences in yield due to one factor.

Few significant correlations between seed quality factors and grain yield were found. Significant correlations that were found were not consistent between locations.

Stand and vigor ratings taken at Manhattan had good negative relationships with both germination and grain yield. Since the ratings were based on the general appearance of each plot, they should have been good overall indicators of seed quality. Germination was probably the one seed quality factor that best predicted eventual grain yield, although it was not

significantly correlated with yield.

Grain weights from Manhattan were higher than those from Hutchinson, with seed weights being the most variable. Higher protein contents were found at Hutchinson, with seed protein being quite variable since the seed came from all parts of the state. Neither spikes/m^2 or seeds/spike at Manhattan had significant sample differences, although seeds/spike was positively correlated with grain yield.

Approximately one-half of the survey samples had at least some type of varietal impurity present. Foundation, registered, or certified seed coming from a dealer had the best varietal purity. Newer varieties had better varietal purity than similar varieties with an earlier release date.