INFLUENCE OF VARIETY AND ENVIRONMENT ON KANSAS WHEAT QUALITY

by

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INTRODUCTION

Quality of wheat intended for bread production depends primarily on the environment under which it is grown and the inherited characteristics of the varieties.

To evaluate the influence of environment on wheat quality, varieties are grown at a number of locations, under comparable conditions. Several wheats which have been found acceptable in quality are commonly included in all the experimental plots. The term environment as here used includes all the factors of any locality which might tend to influence the growth of the plants, as for instance, climatics, soil, time of planting and harvesting. Climatic conditions mean temperature, rainfall, humidity of the atmosphere and prevailing winds. Variety is a type of wheat within a larger class. New varieties of wheat developed to replace older ones have to be studied extensively to establish inherited quality characteristics and their reactions to different environments.

Environmental effects on wheat quality concern the grain trade, which annually makes extensive surveys of quality characteristics for different uses. Bread wheat cultivars of good milling quality should have normal bolting or sifting properties and thereby should be neither unusually hard nor soft. The flour and products of these wheats should have a high water absorption, which is important to bakers because of bread yield, a medium to medium-long mixing requirement, satisfactory mixing tolerance and dough handling properties. On the other hand, the consumers demand bread with large loaf volumes and acceptable grain and texture. Accordingly, a better understanding of the factors, either environmental or genetic, governing the quality parameters of wheat is of prime importance.

LITERATURE REVIEW

Experiments to test the influence of environment on the composition of cereals were started many years ago. As far back as 1901, Wiley (61) concluded from his study that the length of the growing period was the determining factor in influencing the composition of wheat, a short period of growth and a cool climate producing a high protein content, and vice versa. Leclerc (30) in his trio-local experiment stated that "wheat of any one variety, from any one source, and absolutely alike in chemical and physical characteristics, when grown in different localities, possessing different climatic conditions yield crops of very widely different appearance and very different in chemical composition. These differences are due for the most part to climatic conditions prevailing at the time of growth."

The influence of environment on wheat quality has always been given the most credit by agronomist, plant breeders and cereal technologists. Wheat varieties from different classes and from different regions, having good milling and baking performance, have been extensively studied to determine the inheritability potential and the environmental influence on certain quality characteristics.

Some of the physical characteristics of wheat are widely used as quality criteria in the grading system of wheat. Test weight or weight per Winchester bushel has long been recognized as a general indication of the flour yielding capacity of wheat. Very low test weights generally indicate shriveling caused by adverse conditions during kernel maturation. Shriveled kernels produce less flour, when milled, because the proportion of endosperm to bran and germ is lower. The weight of 1000 kernels is another test which has been used to indicate flour yield from wheat. Many factors enter into and produce variations in the weight of the wheat kernel; climate, soil and variety each enter into the question.

Swanson (51, 52) reported that frequent rains accompanied by storms during the heading and ripening period of wheat, lowered the test weight, decreased the vitreous condition and increased the mealy condition. The detrimental effect of elevated temperatures on kernel weight during the fruiting period of wheat has been described in many studies. Chinoy (11) compared grain weight per plant and 1000 kernel weight of different wheat varieties. He reported that with delay in flowering, grain developed at increasingly higher temperatures and lower relative humidities, with the consequence that both 1000 kernel weight and grain yield per plant diminished progressively.

Pal and Butany (38) also concluded that 1000 kernel weight was reduced for late sowing because of high temperatures prevalent at the time of grain ripening.

Chinoy and Sharma (12) found that values for length, breadth and thickness of the grain of different varieties were inversely related to the length of the growing period. They postulated that external conditions, such as temperature, were mainly responsible for underdeveloped or empty grain and not genetic factors as previously held. Comparing the 1000 kernel weight as affected by temperature, for two wheat varieties, Asana and coworkers (34) stated that grain weight is a stable varietal character, but the interaction between temperature and variety leaves room for a possible differential effect of high temperatures on grain filling in wheat. Investigating the effect of moisture, temperature and nitrogen on wheat quality, Sosulski et al (45) reported that temperature was the only treatment to have a consistent effect on kernel weight. Wiegand and Cuellar (60) studied the duration of grain filling and kernel weight of wheat as affected by temperature and their results indicate that a temperature excursion of $5^{o}C$ above the long term normal during the grain filling can be expected to reduce kernel weight by 7 to 13 mg. They also pointed out that genetic factors dominate the rate of filling and that environment dominates the duration of filling.

Varietal or genetic effect on kernel weight has also been investigated by many researchers. Worzella (62) found that kernel weight in wheat was quantitatively inherited but greatly influenced by environmental factors. Copp and Wright (14) studied the inheritance of kernel weight in wheat crosses between widely different parents. They believed only a few major genes were involved since both parental types were recovered with ease. Jasnowski (26) postulated three pairs of genes for kernel weight.

Using a wheat cross between large-kerneled 'Selkirk' and small-kerneled 'Chagot,' Sharma and Knott (42) found that kernel weight was controlled by several genes, possibly four, and that Selkirk carried all the genes for heavy kernels. High heritability values for kernel weight were also reported by Sun, Shands and Forsberg (48).

In the evaluation of wheat for milling, hardness is given a prime consideration. Seeking optimum results, the miller has to adapt, according to the type of wheat (hard or soft), procedures for grain tempering, milling and bolting. The importance of grain hardness as a quality parameter lies in its effect on the milling properties of wheat and in particular on the amount of damaged starch produced during this operation. Hard grains are milled less easily into fine flour particles than are soft grains. The particles obtained from a hard grain are coarser and more regular in contrast to those obtained from soft grain.

Greenway (20) defined hardness as resistance of kernels to deformation by outside force. The forces required to fracture the grain, the manner in which grain opens under force, whether the constituent part of the grain separates cleanly under force or not, the particle size distribution during the grinding process and the sifting behavior of the resultant particles depend on a particular quality of grain which has traditionally been called hardness McRichtie (31). During the past years a considerable amount of research has been carried out on the physiological and biochemical processes governing the hardness of wheat and other cereals. It is generally recognized that hardness is a varietal characteristic greatly influenced by environmental factors.

Hardness of wheat varies from variety to variety, within the same variety and sometimes within kernels from the same plant. In reviewing the literature Aamodt et al. (1) were able to quote workers who postulated, one, two, and multiple genes responsible in the inheritance of grain hardness. Beard and Poehlman (9) using a pearling index concluded that the inheritance of wheat hardness was multigenic. Symes (53, 54) showed that the difference in hardness between a hard and soft wheat was due to a single major gene. Symes (55) also stated that the superiority of hard wheat in milling extraction, loaf texture, and dough handling characteristics is very strongly associated with the gene which causes it to be a hard wheat. He postulated that if the genetic background of two wheats are identical, except for hardness, soft wheats have higher loaf volume. Differences in kernel hardness have also been found by other workers (6) to be associated with differences in flour yield, mixing characteristics, and loaf volume. Baker (7) identified three genes causing difference in wheat hardness.

Working on wheat, Parish and Halse (39) reported that temperature and relative humidity during ripening have an effect on grain hardness. They found that altering the drying conditions during grain maturation produced wide variation in the proportion of vitreous kernels. Hard wheat becomes harder with a more humid atmosphere during the later stages of ripening, while all wheat becomes harder if the temperatures during this period are higher. Trupp (57) stated that hardness is mainly conditioned by environmental factors. Stenvert and Kingswood (46) postulated that the primary determinant of wheat hardness is genetically controlled and related to factors influencing the degree of compactness of endosperm cell content. They also stated that under the same environmental conditions, hardness should increase with increasing protein content until the threshold level for the laying down of a continuous matrix is reached.

Katz et al. (29) reported that the hardness of kernel section of hard red winter, soft white winter and durum wheat decreased with increasing moisture content. Miller et al. (35) pointed out that irrigation of wheat decreased its hardness as measured by the time of grinding.

During the past years, much effort has been made to increase the protein content of wheat, and various means including nitrogen fertilizer, breeding, improved cultural practices, and induced mutations have been used. Protein content of wheat is important for baking quality and nutrition. Wheat protein is almost a unique cereal protein due to its ability to form a sticky rubbery mass known as gluten upon mixing flour with water.

In many countries, cereal grains have always provided a portion of the protein needed in man's diet, and this source of protein may become increasingly important as the world population continues to increase. Therefore if improvement is to be made in increasing wheat protein content, which could aid in alleviating the world protein problem, an understanding of the physiological and genetical basis of its production is essential. Many studies have been made with wheat and other cereals to determine the mechanisms by which grain is produced.

It is generally recognized that environment is a very important factor in determining the protein content of wheat. A climate having dry winters, cool springs with moderate rainfall and hot, fairly dry summers usually produces a hard, strong wheat characterized by high protein content. A moist climate with a high rainfall in spring and summer produces a soft wheat or one characterized by yellowberry and relatively high starch content. As climatic conditions vary from year to year, higher or lower protein wheat, characterized by more or less strength may in different years be produced in the same area. One of the most apparent ways in which climate influences the protein content is by its effect on the rate of ripening.

Brenchley and Hall (10) showed in their experiment that a rapid rate of ripening results in a higher protein percentage. Shutt (43) found that a high water content of soil decreases protein content, prolonged vegetative growth and increased starch content. Early ripening, lessening of soil moisture, and high temperatures produced hard high gluten wheat.

Studying the environmental effect on wheat quality, Thatcher (56) found that climate was the chief factor in fixing the composition of wheat crop in any given season or locality. He reported that high temperature during ripening produced high protein wheat and concluded that the length of the period of kernel formation, rather than that of the whole growing period determines the composition of the grain. He also pointed out that the protein content of wheat is inversely related with the length of the period of kernel formation, and inversely related with the annual precipitation of the region.

Mangels (32) has shown in his work that the effect of high temperatures is to increase protein content and decrease test weight. High temperatures for the 10 days preheading period were found by Waldron et al. (59) to be associated with high protein and greater loaf volume.

Other environmental factors have also been found to affect protein content of wheat. In many studies, it has been reported that excess moisture caused low protein wheat.

Stewart and Hirst (47) found that the protein content of wheat grown on irrigated land is lower than that grown on dry land. The effect of irrigation on the protein content of wheat was also investigated by Greaves and Carter (19). They reported that wheat decreased in nitrogen content as the irrigation water used in their growth increased. Eva and Birchard (17) studied relations of protein content from commercial samples for a series of years and the weather during the growing season for eleven localities in the Canadian prairie provinces. They found an inverse relationship between protein content and precipitation during the April-July period. Shutt and Hamilton (44) presented data from two western and two maritimes provinces. The comparison, extending from 1912 to 1932, showed the western station to have a July and August temperature of $8^{o}F$ above the maritime provinces. With these differences, the western wheat had a protein content of 17.4 percent as against 13.3 percent for the maritime wheats.

Bayfield (8) investigated the influence of climate, soil and fertilizers upon quality of soft winter wheat for four years and has drawn the following conclusions.

1) Rainfall has an important role in lowering the protein content of wheat when it falls just preceding or during heading time.

2) High temperatures during the last 2 to 3 weeks before harvesting tends to decrease the weight per bushel.

3) Protein content in wheat increases as the soil becomes heavier in texture and also as the relative fertility of the soil increases.

4) Some varieties possess superior protein quality when compared with others and differ in their ability to produce large or small amount of protein.

As reported by Bayfield, soil type and condition seems to be an important factor influencing wheat quality. Available soil nitrogen has been found in several studies to be a limiting factor in the formation of wheat protein.

The bulk of soil nitrogen is in an insoluble or unavailable form, but it is slowly made soluble by the agencies existing in the soil. As soon as nitrogen is made available, it appears in the soil solution. The amount of this soil solution is determined by the moisture supply. Generally, available soil moisture during the weeks preceding maturity determines not only yield, but also the quality characteristics of the wheat. If the moisture is limiting, the yield normally will be low. If both soil moisture and nutrient are abundantly available, it is possible to have both high yield and high protein content (27).

Aspinal et al. (5) reported that soil moisture stress during the period between anthesis of the flowers and ripening of barley grain can result in a considerable reduction of grain size at harvest. This decrease in mature grain size is greater if the period of stress occurs early in grain development, and grain subjected to severe moisture stress shortly after anthesis is thin and shriveled when fully ripe.

Swanson (50) stated that concentration of soil solution in available nitrogen and the amount of this solution are the two most important factors which determine yield and protein percentage. Climate owes its importance to the fact that it is the greatest factor influencing the soil solution.

Worzella (63) investigated the effect of level of soil fertility on wheat quality. His results indicate that wheat produced on the well fertilized plots was found stronger in gluten, lower in caroteroid pigments and higher in flour yield than that grown on the low fertility plots. He also pointed out that variety or heredity caused the most influence in producing differences in the component of quality studied.

Many studies have also been conducted with wheat and other cereals to determine to which degree the production of grain protein is genetically controlled. Although it is well known that protein content is greatly influenced by environmental factors, some workers found a very high genetic effect involved in the inheritance of grain protein.

Inheritance of the 'Atlas 66' high protein trait in crosses with low protein wheat has been investigated by many researchers. Middleton et al. (33) first reported high protein content in Atlas 66, a soft red winter wheat. In their study Atlas 66 produced 3.2% more protein and was higher yielding than the control. Using the same variety Atlas 66, Davis et al. (15) obtained a heritability estimate for protein ranging from 54 to 69%. Morris et al. (37) indicated that chromosome 5D of Atlas 66 contribute to the production of high protein. Haunold et al. (24) also reported an heritability estimate for grain protein as high as 65%, whereas Sunderman et al. (49) found this inheritance varying only from 15 to 26%.

Several workers have implied that significant potential for improving grain protein through selection is possible. However, breeding studies have always been made difficult by environmental interactions. Chapman and McNeal (13) studied the gene effect for grain protein in five spring wheat crosses and found a highly significant genetic effect. Miezan et al. (34) reported that the genetic effect influenced grain protein as effectively as the environment. Siehl et al. (16) pointed out that high protein and high lysine appear to be inherited by the accumulation of recessive genes. Zillman and Bushuk (64) postulated that gliadin content of wheat cultivars is a true genotypic character, and is not affected by the area of growth.

Other investigators have examined the gene effects as related to flour quality, and it seems that some of the most important quality parameters of the flour are genetically controlled.

Heyne and Finney (25) studied the inheritance of the satisfactory dough handling and baking properties of the hard red winter variety 'Cheyenne'. They found a high heritability character for mixing time and loaf volume. The same variety of wheat was also studied by Morris and co-workers (36) who found that four chromosomes are responsible for the long mixing time, loaf volume, grain and texture characteristics. They also reported that the superior flour quality of the variety Cheyenne was attributed in large measure to the genes carried by certain chromosomes of the B genome with lesser contribution by some chromosomes of the D genome. Considerable research has also been carried out to determine if the flours with superior breadmaking characteristics are associated with some environmental factors.

Sandstedt and Ofelt (40) by diluting flour to a given protein content with starch, showed that within a variety, the baking quality seemed to decrease with an increase in protein content. However, they pointed out that this was not true for all varieties and that high protein samples grown in one particular locality had outstanding quality. This suggests that the quality of these high protein flours was due to environment under which they were grown.

Santstedt and Fortman (41) studying eight hard red winter wheats concluded that environment markedly affected protein content, absorption, handling properties, mixing requirement and loaf volume of wheat flours, although not all varieties were affected to the same degree.

Harris and co-workers (21, 22) studying North Dakota spring wheat found that protein content, loaf volume and crumb color were significantly affected by both cultivar and environment, with the latter exerting the major influence. They also stated that variety had more effect than environment in influencing physical dough properties.

Finney and Fryer (18) provided evidence that the quality of wheat for bread production can be influenced by high temperatures during the fruiting period. They reported that temperature (above $90^{o}F$) consistently decreased loaf volume and mixing time.

The importance of the environmental effect on wheat quality has also been emphasized by Johnson and co-workers (28). Working with hard red winter wheat cultivars grown in different localities in Kansas, they reported that environment had the greatest effect on all quality characteristics studied (protein, farinograph mixing time, loaf volume) except for bakery mixing time which was influenced to a greater extent by genetic factors.

Very little is reported in the literature on the effect of environment and variety on milling quality of wheat. Harris (23) investigated the relation between wheat variety and location of growth with the flour particle size. He reported that environment is more influential than the variety on flour particle size distribution. He also found that flour ash content varied very significantly among the stations.

Our objective in this study is to test and compare the variety and environmental effect on the physical characteristics, milling and baking quality of some Kansas wheat.

MATERIALS AND METHODS

Each year, Kansas agricultural experiment station agronomists grow wheat cultivars in replicated drill strips of varying size in different locations of the state. Qualities analysis are made on entries from all of those locations annually. The grain samples are composites of all replications of each entry from each location.

For this study, we received 400 samples from the 1981 crop (referred to as environmental series 1981). The wheat samples, weighing approximately 4 kg, consisted of 59 different varieties grown in 12 different locations in Kansas. Samples from irrigated plots were obtained only from three stations (Colby, Garden City and Tribune).

Method of cleaning

All the wheat samples were cleaned using laboratory cleaning equipment. These consisted of a Carter dockage tester, a Forster scourer and a Kice aspirator. The clean wheat is then submitted for analysis.

Methods of determination and calculations

A. Physical characteristics

Test weight Test weight is the weight per Winchester bushel with weight expressed to the nearest tenth of a pound. Determinations were made with a quart kettle using a beam scale according to the standard method outlined by the U. S. D. A. (58).

Weight per hectoliter Calculated using the following conversion formula: LBS/U.S. bu x 454 g/LG x 2.8379 bu/hectoliter x 1 kg ÷ 1000 g = kg/hectoliter.

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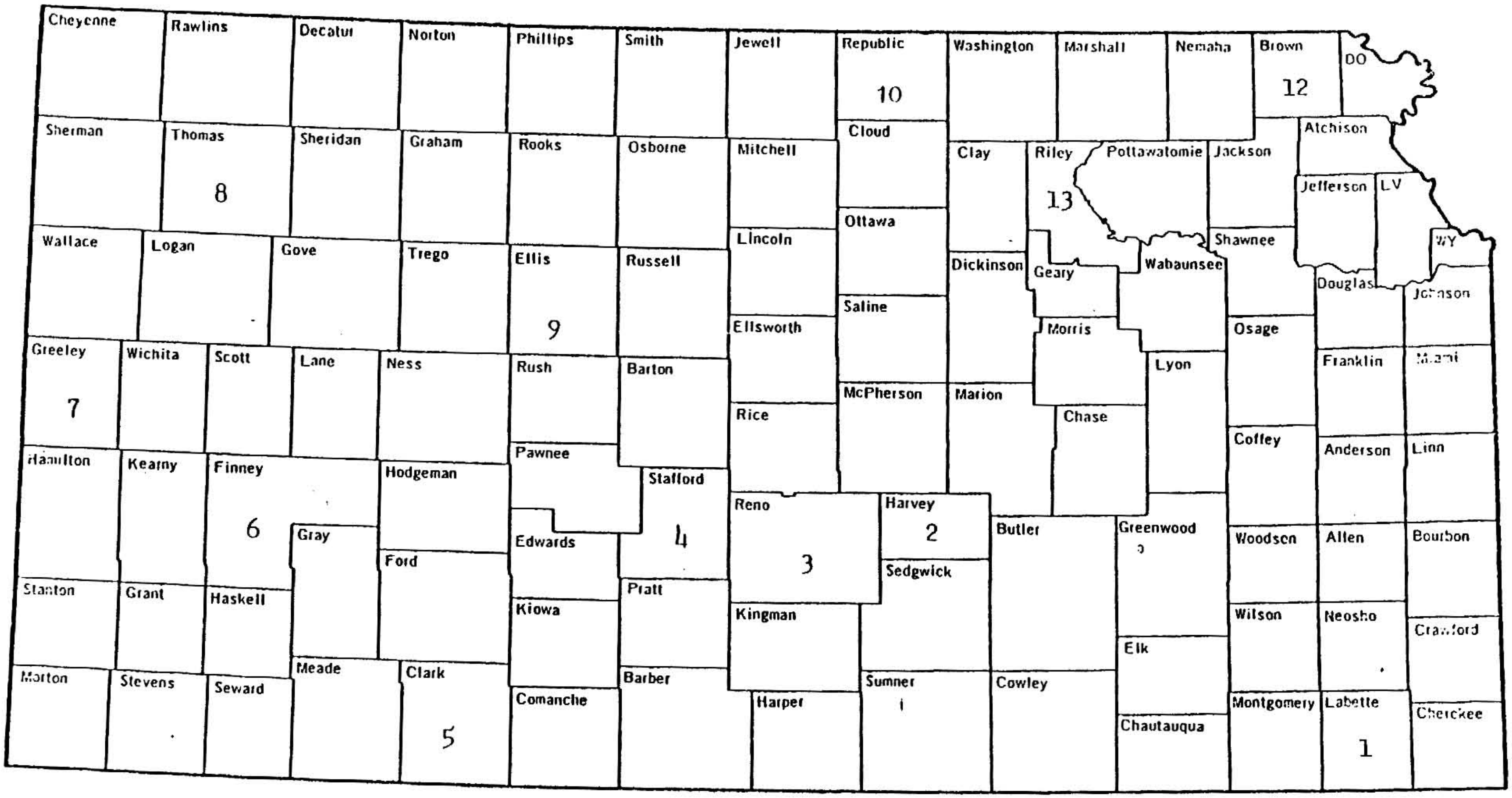


Fig. 1. Map of the state of Kansas showing the locations for the 1981 Kansas Plot Tests.

1. Parsons 2. Hesston 3. Hutchinson 4. St. John 5. Minneola 6. Garden City 7. Tribune 8. Colby 9. Hays 10. Belleville 12. Powhattan 13. Manhattan

<u>1000 kernel weight</u> One thousand kernel count weight was determined with an electronic seed counter using 40 gms of wheat and finding from it the weight of 1000 kernels.

<u>Density</u> The density was determined with a Beckman air pychnometer using a 14.4 gm sample.

$$\text{Density} = \frac{14.4 \text{ gms}}{\text{volume (c.c.)}}$$

<u>Wheat Hardness</u> There is no generally recognized objective method to measure wheat hardness. Each method or test is influenced by variables peculiar to the equipment used. No serious attempt has been made to standardize equipment and procedure.

Several methods have been proposed to determine grain hardness. Some of the techniques widely used in the routine testing are those based on abrasion or on grinding. The pearling index or pearling resistance test is an example of the use of abrasion. This test would appear to be affected by grain size and shape and by the texture of its outer layer. It has been felt that the particle size index test involving the grinding of whole kernels and sieving of the meal is a better test of kernel texture than the pearling index test.

Hardness of wheat in our study was determined by using both methods, the particle size index (P.S.I.) and pearling resistance, also called pearling value.

<u>Pearling Index</u> 20 gms of clean sound wheat was pearled in a Strong Scott laboratory pearler for 60 sec. The remaining grain was handsifted on 20 wire Tyler standard sieve, weighed and recorded as a percentage of the

original sample and expressed as pearling value or pearling index. The higher the value, the harder the grain.

Particle Size Index (P. S. I.) 10 gms of clean wheat were ground on Brabender Quadrumat junior laboratory grinder and the whole meal sieved for 10 min on Ro-tap sieve shaker using 200-mesh stainless-steel with an aperature of 74 microns. The throughs were weighed and the results recorded as a percentage of the original sample, and is expressed as the particle size index. A high value signifies soft grain and low value signifies hard grain.

The flow sheet for the Brabender Quadrumat Junior is shown in Fig. (2) and the mill in Plate (I). The feed rate was set at 60 gms per minute for all the samples tested.

The corrugations per inch and the speed of the rolls used are as follows:

No. 1	12 corrugations per inch	1240 RPM
No. 2	25 corrugations per inch	540 RPM
No. 3	37 corrugations per inch	1200 RPM
No. 4	40 corrugations per inch	540 RPM

The differentials used were:

First break	(Rolls 1 x 2)	2.31:1
Second break	(Rolls 2 x 3)	2.22:1
Third break	(Rolls 3 x 4)	2.22:1

The 64 GG reel of the grinder was removed in order to collect the whole meal product.

Kernel size distribution and theoretical yield 200 gms of wheat are placed on the top sieve of a stack of 3 Tyler standard sieve (No. 7, 9, and 12) and sifted on a Ro-tap for 60 sec. The percentage remaining on each

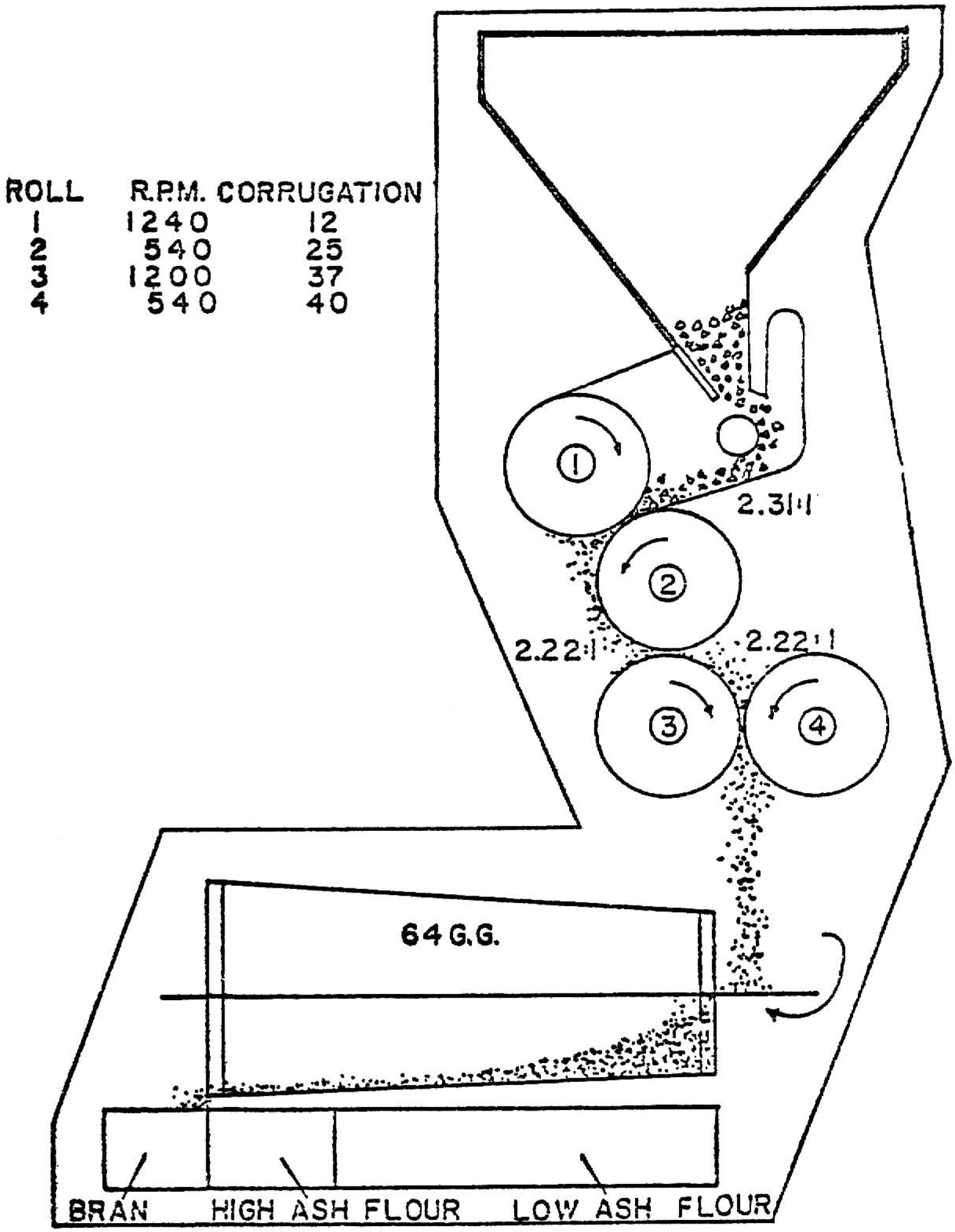
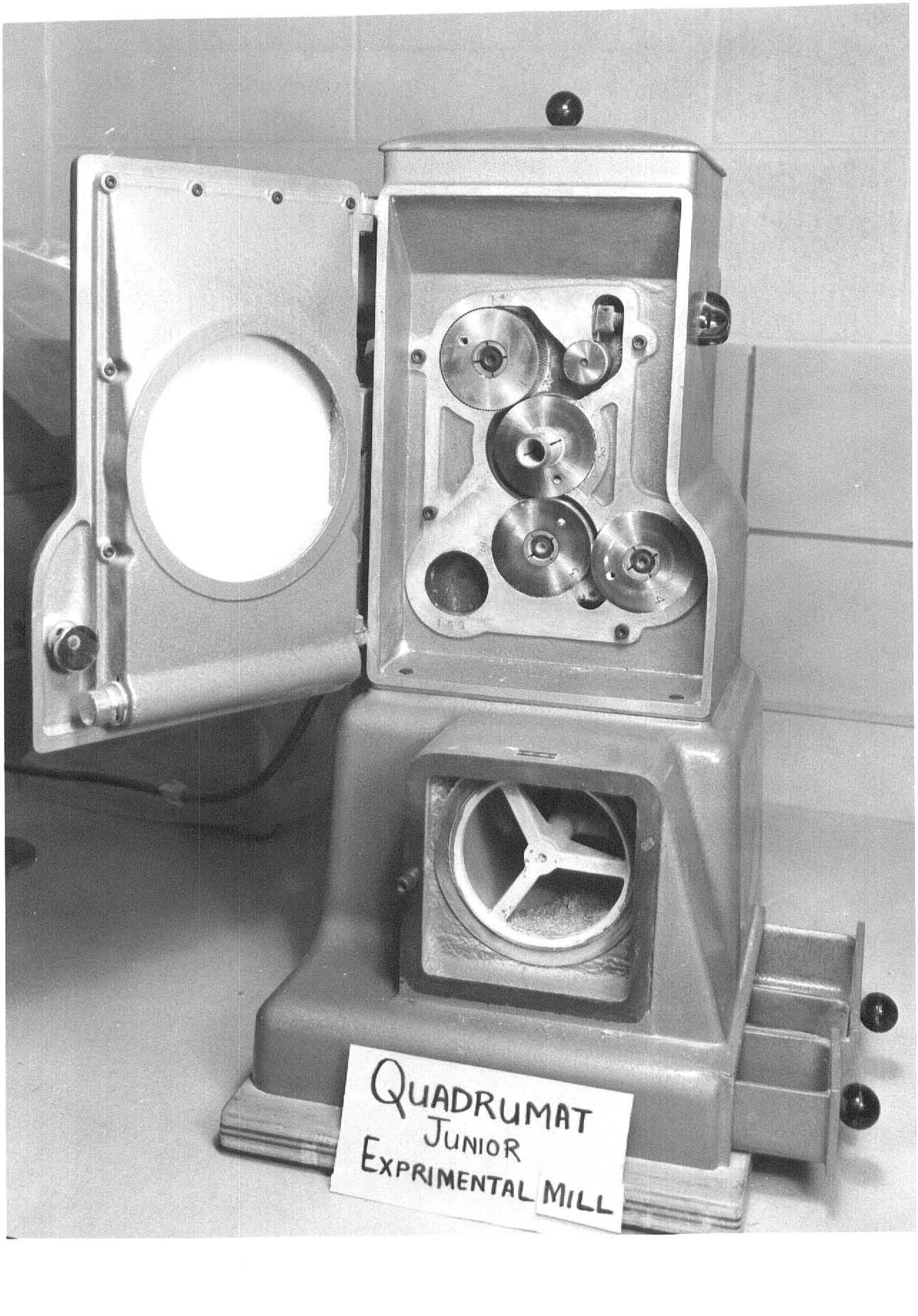


Fig. 2 **QUADRUMAT JUNIOR EXP. MILL**

PLATE I. Front view of Quadrumet Junior Experimental Mill.


QUADRUMAT
JUNIOR
EXPRIMENTAL MILL

sieve is then determined, multiplied by factors of 78, 73, and 67 respectively and summed to obtain the theoretical flour yield.

Protein, ash, and moisture of wheat as well as milled products were determined by the procedure as outlined in Cereal Laboratory Methods (2).

After all the physical characteristics of each variety were separately determined, the wheat was blended by location and variety. However, it must be pointed out that only twenty different varieties which were represented in all locations were selected for the rest of this study. Hesston location data was not considered because of missing samples.

Location blend 200 gms of wheat from each variety grown in the same location were composited and thoroughly mixed to have a uniform sample. Each blend is composed of 20 different mixes. A total of 14 samples resulted from this blend (11 locations and 3 irrigated plots).

Variety blends The blends consisted of 200 gms of the same variety grown in the different locations. Each of the 20 blends is the result of 14 different mixes.

Method of conditioning or tempering

All the wheat blend samples were tempered for 20 hours to 16.5 percent moisture except for Hutchinson blend which was tempered to 15 percent.

The amount of water required to bring up the moisture content of the wheat to the desired moisture was calculated by the formula:

$$D_1W_1 = D_2W_2$$

$$D_1 = (100-m_1)$$

where

D_1 = Dry weight of the wheat

m_1 = Moisture of the wheat

D_2 = Dry weight of the wheat at desired moisture

m_2 = Desired moisture

W_1 = Weight of wheat before addition of water

W_2 = Weight of wheat after addition of water

W_2 = W_1 + X) where X = amount of water added

$$\frac{(100 - m_1)}{(100 - m_2} W = (W_1 + X)$$

$$\text{or } X = \frac{(100 - m_1)}{(100 - m_2} W_1 - W_1$$

B. Milling

The samples (2500 gms each) were milled on the Buhler experimental mill. The mill was set as to have an extraction rate of 68 to 70 percent, and a feed rate of 120 gms per minute was used for all samples. The Buhler experimental mill (Plate II) used in this study was of the pneumatic type. The flow sheet (Fig. 3) consisted of three breaks and three reduction rolls, and the rolls had a differential of 2:1 with fast roll running at 540 RPM. The break rolls had the following corrugations:

First break	18 corrugations per inch
Second break	22 corrugation per inch
Third break	26 corrugations per inch

Each flour stream (three from the breaks and three from the reductions)

PLATE II. Front view of Buhler Experimental Mill.


QUADRUMAT
JUNIOR
EXPRIMENTAL MILL

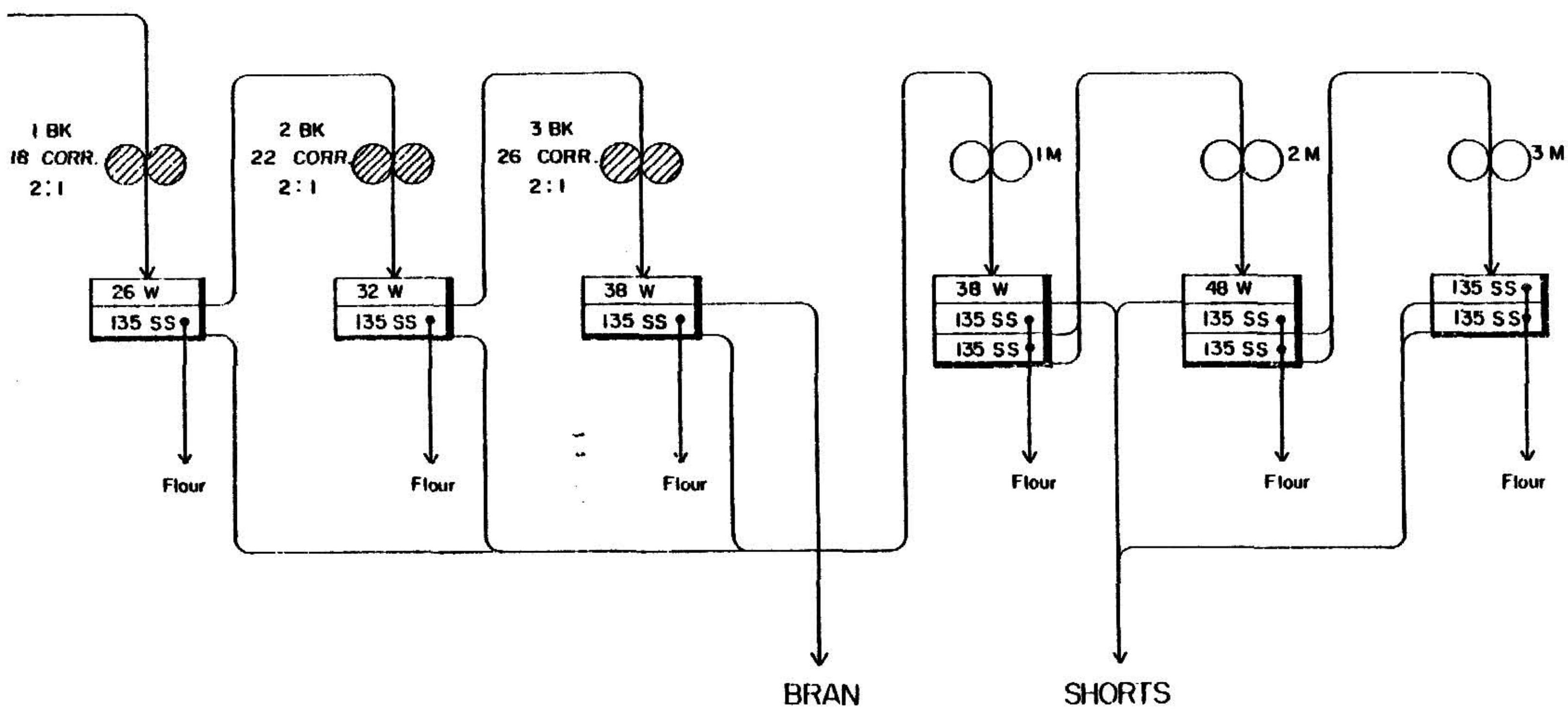


Fig. 3 BUHLER EXPERIMENTAL MILL

flowed into separate containers. The bran and shorts were also collected in separate containers.

The Straight Grade Flour was a blend of all the flour streams and it was rebolted on the great western laboratory sifter using a 9XX flour cloth. Each flour stream, bran and shorts were weighed separately and the percentage flour yield was calculated on the total product. Protein and ash values are reported on a 14% moisture basis.

Milling rating and ash value were calculated using the following formula:

Milling rating = Flour yield (%) - (Flour ash (%) X 100).

$$\text{Ash value figure} = \frac{\text{Flour Ash}}{\text{Flour Yield}} \times 100$$

Gluten Determination

This was done with the glutomatic gluten washer (Model 2200) manufactured by The Falling Number Company. The glutomatic is an automatic apparatus which develops the gluten from a wheat flour. Dough mixing and subsequent separation of starch and other solubles from the dough takes place in the same test chamber under controlled, standardized conditions.

The system consists of three separate components: 1) the combined dough mixer and washer (2200), 2) the centrifuge (2012), and 3) the glutork dryer (2020).

Procedure

Wet gluten 10 gms of flour are introduced in the glutomatic test chamber and 5.2 ml of 2% sodium chloride solution are added by means of a built-in pipette. During the first 20 sec. the dough is mixed, the glutomatic then switches automatically to the washing sequence which lasts 5 min. and separation in gluten and soluble starch products are obtained.

The gluten ball is then divided and placed in the centrifuge for 1 min. to remove excess water. The weight of the centrifuged gluten x 10 = percent wet gluten.

Dry gluten To remove the bound water, the gluten ball is placed between two teflon-coated heated plates for 4 min. The weight of the dry gluten x 10 = percent dry gluten.

Farinograms These were made with the 50 gm bowl Brabender Farinograph using a constant flour weight on a 14% moisture basis. The Brabender Farinograph measures plasticity and mobility of dough subjected to prolonged, relatively gentle, mixing action at constant temperature. Resistance offered by the dough to the mixing blades is transmitted through a dynamometer to a pen that traces a curve on a kymograph chart.

From the farinograms, we determined the absorption, mixing time, stability and valorimeter values of the flour samples.

Absorption This is the percentage of water required to center the curve on the 500 Brabender Unit (B. U.) line at the maximum consistency of the dough. This is expressed on a 14% moisture basis. The more water a flour can absorb at definite consistency of the dough, the greater the dough yield per sack of flour.

Mixing time This is the time required for the curve to reach its full developmental maximum consistency. Long peak times are usually associated with strong wheats.

Stability This is the time that the curve remains on the 500 B. U. line, and is measured from the arrival time to the departure time. The longer the stability the greater the abuse and the longer the fermentation this flour is able to withstand.

Valorimeter This is a numerical value based on a logarithmic function of the peak time in relation to the break down of the dough 12 min. after peak time. A higher figure indicates a stronger flour and a lower figure indicates a weaker flour.

C. Baking

All the flours were baked with bread using the straight dough procedure with the following formula:

	grams	%
Flour	300.0	100.0
Yeast Instant ADY	3.3	1.1
Salt	6.0	2.0
Sugar	15.0	5.0
Nonfat dry skim milk (N.F.D.M.)	6.0	2.0
Shortening	9.0	3.0
Malted barley flour	0.45	.15
Yeast food Arkady	0.9	.3
Ascorbic acid	50 ppm	
Water	Variable	

All doughs were mixed to optimum consistency in a national mixer with a 300 gms capacity mixer bowl. The absorption of each sample was adjusted to bring all doughs out of the mixer with the same consistency. Approximately 2 to 3% more water was added to the absorption values given by the farinograph. Optimum amount of mixing for each sample was determined by sight and feel of the dough. After the dough was mixed, it was placed in a greased bowl and put into fermentation cabinet adjusted to 86^{o}F and 85% relative humidity for 150 min (2½ hours).

The dough was then pre-sheeted using a national hand molder and after 20 minutes rest, the molding was completed on a laboratory molder. The loaves were panned and proofed at 105°F and 92% relative humidity to a height of 1.5 cm above pan. The loaves were baked at 425°F for 25 minutes. Loaf volume and weight were immediately recorded after the bread was removed from the oven. After approximately one hour rest on the shelves, it is then put in plastic bags and subjected to quality scores the next day. The loaves were scored for external appearance, grain, texture and crumb color. All the bake tests were duplicated from a different mix, since it was only possible to make one loaf from each mix.

RESULTS AND DISCUSSION

A statistical analysis has been done on all the data showing coefficients of variation and the different correlations for the varieties and locations.

Effect of Variety and Environment on:

1. The physical characteristics of wheat.

Coefficients of variation for the mean test weight, 1000 kernel weight, pearling value, particle size index, density and protein are summarized in Table 20 with the milling results. These figures show that in all cases, the location coefficients of variation are greater than those of the variety. This strongly suggests that the location effect is more important than that of the variety in the case of the wheat physical characteristics.

The theoretical yield calculated from the wheat size test appears to be more affected by the location than the variety, since the location coefficient of variation is 16% larger than that of the variety.

2. Milling.

The environmental and variety effect on the milling quality of the wheat has been essentially based on the flour yield, milling rating and ash-value figures. The coefficients of variation for these milling quality factors (Table 20) are in all the cases greater for the location than the variety. This also adds to the belief that the location has more effect than the variety in influencing the milling properties of wheat.

3. Gluten.

The correlation coefficients (Table 24) show that protein, dry gluten and wet gluten are highly correlated. Since wheat protein content is mostly controlled by the environment, it would thus be expected that the gluten quantity would be under the same control. The coefficients of variation for the gluten are presented in Table 21.

ENVIRONMENTAL SERIES 1981

Table 1. Effect of Variety and Environment on Mean Test Weight.

Variety	Test Weight Lbs/Bu	Location	Test Weight Lbs/Bu
SR 4685	56.9	Minneola	54.4
Dekalb H105	56.9	Manhattan	55.5
MG 201	57.2	Colby, Dry	55.5
TAM W101	57.7	Hays	56.7
Buckskin	58.4	Powhattan	58.4
KS 75216	58.4	Colby, Irrig.	58.4
Rocky	58.7	St. Johns	58.7
Bennett	58.9	Garden City, Dry	58.9
Centurk 78	58.9	Parsons	60.0
Vona	58.9	Belleville	60.4
TAM 105	59.0	Tribune, Dry	60.8
NAPB 200	59.1	Tribune, Irrig.	60.8
R-H 3004	59.1	Hutchinson	61.5
Newton	59.2	Garden City, Irrig.	61.7
Sage	59.4		
Wings	59.5		
Larned	59.5		
Scout 66	59.7		
KS 75210	59.7		
Eagle	59.8		

ENVIRONMENTAL SERIES 1981

Table 2. Effect of Variety and Environment on Mean 1000 Kernel Weight.

Variety	1000 K. W. (14% M.B.) Grms	Location	1000 K. W. (14% M. B.) Grms
Centurk 78	28.03	Minneola	25.93
MG 201	28.18	Hays	29.09
Rocky	28.53	Colby, Dry	29.85
Vona	29.32	Manhattan	30.48
Wings	29.49	Tribune, Irrig.	30.82
Buckskin	30.31	Powhattan	31.14
R-H 3004	30.79	Garden City, Dry	31.85
SR 4685	31.21	Colby, Irrig.	32.42
Bennett	32.07	Parsons	32.75
TAM 105	32.49	Belleville	33.13
Sage	32.70	Garden City, Irrig.	33.59
Newton	32.71	St. Johns	33.95
KS 75216	32.75	Tribune, Dry	35.30
Dekalb H105	32.95	Hutchinson	36.45
KS 75210	33.65		
Scout 66	33.85		
Larned	34.10		
Eagle	34.46		
TAM W101	35.24		
NAPB 200	35.74		

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Table 3. Effect of Variety and Envirnment on Mean Density.

Variety	Density grms/c.c.	Location	Density grms/c.c.
SR 4685	1.373	St. Johns	1.359
KS 75210	1.379	Manhattan	1.361
Dekalb H105	1.381	Powhattan	1.370
Vona	1.382	Tribune, Dry	1.373
TAM W101	1.383	Parsons	1.382
Wings	1.384	Tribune, Irrig.	1.383
Centurk 78	1.384	Colby, Dry	1.385
Newton	1.386	Hays	1.389
TAM 105	1.386	Colby, Irrig.	1.390
Rocky	1.386	Hutchinson	1.395
Buckskin	1.387	Minneola	1.399
KS 75216	1.387	Belleville	1.403
MG 201	1.388	Garden City, Dry	1.408
Bennett	1.390	Garden City, Irrig.	1.410
Scout 66	1.390		
R-H 3004	1.390		
Sage	1.391		
Larned	1.392		
NAPB 200	1.393		
Eagle	1.394		

ENVIRONMENTAL SERIES 1981

Table 4. Effect of Variety and Environment on Mean Pearling Value.

Variety	Pearling Value %	Location	Pearling Value %
SR 4685	61.50	Tribune, Dry	56.15
KS 75210	64.54	Tribune, Irrig.	61.29
Eagle	64.72	Garden City, Dry	63.98
Dekalb H105	64.90	Powhattan	64.84
Larned	65.00	Minneola	65.05
R-H 3004	65.12	St. Johns	65.80
NAPB 200	65.36	Hutchinson	66.71
TAM W101	65.39	Colby, Irrig.	66.82
Scout 66	65.44	Colby, Dry	68.12
Sage	65.48	Garden City, Irrig.	68.12
Newton	66.32	Belleville	69.33
Bennett	66.64	Hays	70.51
Wings	66.67	Manhattan	71.07
KS 75216	67.25	Parsons	71.67
Buckskin	67.56		
Vona	67.86		
TAM 105	68.40		
Centurk 78	68.51		
MG 201	68.85		
Rocky	69.25		

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Table 5. Effect of Variety and Environment on Mean Particle Size Index (P.S.I.).

Variety	P. S. I. %	Location	P. S. I. %
KS 75216	19.22	Manhattan	18.64
SR 4685	19.35	Tribune, Dry	19.38
Dekalb H105	19.62	St. Johns	19.61
Eagle	20.67	Colby, Dry	20.04
Buckskin	20.71	Garden City, Dry	20.42
TAM 105	21.03	Minneola	21.23
Bennett	21.04	Tribune, Irrig.	21.36
Rocky	21.35	Hays	21.41
MG 201	21.35	Hutchinson	21.57
NAPB 200	21.40	Parsons	22.15
Scout 66	21.48	Colby, Irrig.	22.35
Sage	21.52	Belleville	22.42
TAM W101	21.55	Garden City, Irrig.	22.86
Centurk 78	21.65	Powhattan	23.94
R-H 3004	21.84		
Newton	21.87		
Vona	21.94		
Larned	21.98		
Wings	22.17		
KS 75210	22.30		

ENVIRONMENTAL SERIES 1981

Table 6. Effect of Variety and Environment on Mean Protein Content.

Variety	Protein (14% M.B.) %	Location	Protein (14% M.B.) %
Vona	14.50	Hutchinson	10.29
TAM 105	14.59	Tribune, Dry	12.90
Wings	14.67	Powhattan	13.17
Larned	14.68	Tribune, Irrig.	14.44
Centurk 78	14.75	Colby, Irrig.	14.58
R-H 3004	14.78	Garden City, Irrig.	15.51
Newton	14.84	Hays	15.66
MG 201	14.99	Colby, Dry	15.82
NAPB 200	15.00	Belleville	15.94
Buckskin	15.06	Parsons	15.95
Scout 66	15.10	St. Johns	16.25
Rocky	15.14	Garden City, Dry	17.36
Sage	15.39	Minneola	17.82
KS 75210	15.47	Manhattan	18.52
SR 4685	15.52		
Bennett	15.59		
KS 75216	15.65		
TAM W101	15.73		
Eagle	15.79		
Dekalb H105	16.74		

ENVIRONMENTAL SERIES 1981

Table 7. Effect of Variety and Environment on Mean Theoretical Yield.

Variety	Theoretical Yield %	Location	Theoretical Yield %
TAM W101	76.74	Hutchinson	76.94
NAPB 200	76.51	Tribune, Dry	76.89
KS 75210	76.39	St. Johns	76.50
Dekalb H105	76.26	Parsons	76.02
Larned	76.23	Belleville	76.02
Scout 66	76.14	Powhattan	75.88
SR 4685	76.12	Colby, Irrig.	75.81
Bennett	76.09	Garden City, Irrig.	75.80
TAM 105	76.09	Manhattan	75.66
Eagle	76.06	Garden City, Dry	75.62
Newton	76.00	Colby, Dry	75.55
KS 75216	75.88	Tribune, Irrig.	75.45
Sage	75.84	Hays	74.95
R-H 3004	75.59	Minneola	74.56
Buckskin	75.56		
Vona	75.29		
Wings	75.29		
MG 201	75.01		
Centurk 78	74.85		
Rocky	74.70		

ENVIRONMENTAL SERIES 1981

Table 8. Effect of Variety and Environment on Mean Flour Yield.

Variety	Flour Yield %	Location	Flour Yield %
Bennett	72.14	Belleville	72.17
Buckskin	71.40	Hutchinson	71.82
Larned	71.33	Tribune, Irrig.	71.49
NAPB 200	70.88	Powhattan	71.46
Eagle	70.82	Colby, Irrig.	71.42
Scout 66	70.57	Tribune, Dry	71.03
Rocky	69.81	Garden City, Irrig.	70.84
Centurk 78	69.66	St. Johns	70.68
Sage	69.58	Parsons	70.18
TAM 105	69.56	Hays	70.09
Vona	69.51	Colby, Dry	69.63
KS 75210	69.49	Manhattan	68.81
R-H 3004	69.46	Garden City, Dry	67.25
Newton	69.21	Minneola	66.17
KS 75216	68.79		
MG 201	68.44		
Wings	68.07		
TAM W101	68.00		
Dekalb H105	68.00		
SR 4685	67.31		

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Table 9. Effect of Variety and Environment on Mean Milling Rating.

Variety	Milling Rating	Location	Milling Rating
KS 75216	22.79	Minneola	15.17
TAM W101	23.00	Hutchinson	15.32
Dekalb H105	23.00	Garden City, Dry	17.25
MG 201	23.44	Manhattan	20.81
SR 4685	24.13	Hays	21.09
Sage	24.58	Colby, Dry	22.63
NAPB 200	24.88	St. Johns	24.68
Buckskin	25.40	Tribune, Dry	25.03
KS 75210	25.49	Colby, Irrig.	26.42
Newton	26.21	Parsons	28.18
Centurk 78	26.66	Garden City, Irrig.	28.88
R-H 3004	27.46	Tribune, Irrig.	29.49
TAM 105	27.56	Powhattan	30.46
Eagle	27.82	Belleville	31.17
Wings	28.07		
Larned	28.33		
Vona	28.51		
Rocky	29.81		
Bennett	30.14		
Scout 66	30.57		

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Table 10. Effect of Variety and Environment on Mean Ash-Value Figures.

Variety	Ash Value Figures	Location	Ash Value Figures
Scout 66	0.57	Powhattan	0.57
Rocky	0.57	Belleville	0.57
Bennett	0.58	Tribune, Irrig.	0.59
Vona	0.59	Garden City, Irrig.	0.59
Wings	0.59	Parsons	0.60
Larned	0.60	Colby, Irrig.	0.63
TAM 105	0.60	St. Johns	0.65
R-H 3004	0.60	Tribune, Dry	0.65
Eagle	0.61	Colby, Dry	0.67
Centurk 78	0.62	Manhattan	0.70
Newton	0.62	Hays	0.70
KS 75210	0.63	Garden City, Dry	0.74
Buckskin	0.64	Minneola	0.77
SR 4685	0.64	Hutchinson	0.78
NAPB 200	0.65		
Sage	0.65		
TAM W101	0.66		
Dekalb H105	0.66		
MG 201	0.66		
KS 75216			

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Table 11. Effect of Variety and Environment on Mean Gluten Content.

Variety	Wet Gluten %	Dry Gluten %	Location	Wet Gluten %	Dry Gluten %
Dekalb H105	37.85	14.61	Manhattan	48.60	17.03
TAM W101	37.80	14.12	Minneola	43.10	15.95
KS 75216	37.60	13.96	Garden City, Dry	40.60	15.80
SR 4685	37.50	13.60	Hays	38.80	13.90
MG 201	37.50	13.32	St. Johns	38.40	13.77
Bennett	37.42	13.85	Colby, Dry	28.20	13.98
Sage	37.40	13.60	Garden City, Irrig.	37.40	13.58
Scout 66	37.20	13.40	Parsons	37.20	13.60
KS 75210	37.00	13.60	Tribune, Irrig.	35.90	12.50
Larned	36.70	13.10	Colby, Irrig.	35.30	12.60
Buckskin	36.55	13.50	Belleville	34.20	13.40
Eagle	35.60	13.98	Powhattan	32.50	12.20
Vona	35.35	13.20	Tribune, Dry	31.80	11.80
R-H 3004	35.18	13.07	Hutchinson	24.50	9.74
Newton	35.10	13.08			
TAM 105	34.60	12.46			
Rocky	34.50	13.20			
NAPB 200	33.95	13.02			
Centurk 78	32.47	12.85			
Wings	32.34	12.54			

4. Farinograph Data.

All the Farinograph data showed a greater variation for the location than the variety, except the Farinograph dough stability (Table 21) which is affected to the same extent by both environment and variety. Although the variety exerted a significant effect on the Farinograph absorption, mixing time and valorimeter, the environment showed the greatest effect.

5. Bread-making Quality Characteristics.

Here also the location coefficients of variation (Table 21) are greater than those of the variety for all the bread-making quality factors (bakery mixing time, loaf volume and bread quality score). This also let us assume that the influence exerted by the environment on these bread-making quality characteristics is more important than the influence exerted by the variety.

Irrigation Effect

The irrigation was used only in three locations (Tribune, Colby and Garden City). The results are presented in Table 22. At two of the locations (Colby and Garden City), irrigation showed consistently a significant effect on some of the physical characteristics and milling properties of the wheat. Test weight, 1000 kernel weight, density and flour yield showed an increasing tendency with the use of irrigation, whereas protein and hardness as measured by the particle size index had a decreasing tendency.

The milling properties appear also to be improved by the use of irrigation as it is shown by the milling rating and ash-value figures for the three locations.

Blending Effect on the Physical Characteristics of Wheat

It is very important to the miller to know the changes undergone by the wheat quality parameters after blending. Seeking optimum results, a better

PLATE III. Farinograms for the location blend samples.

ILLEGIBLE DOCUMENT

THE FOLLOWING DOCUMENT(S) IS OF POOR LEGIBILITY IN THE ORIGINAL

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P-474

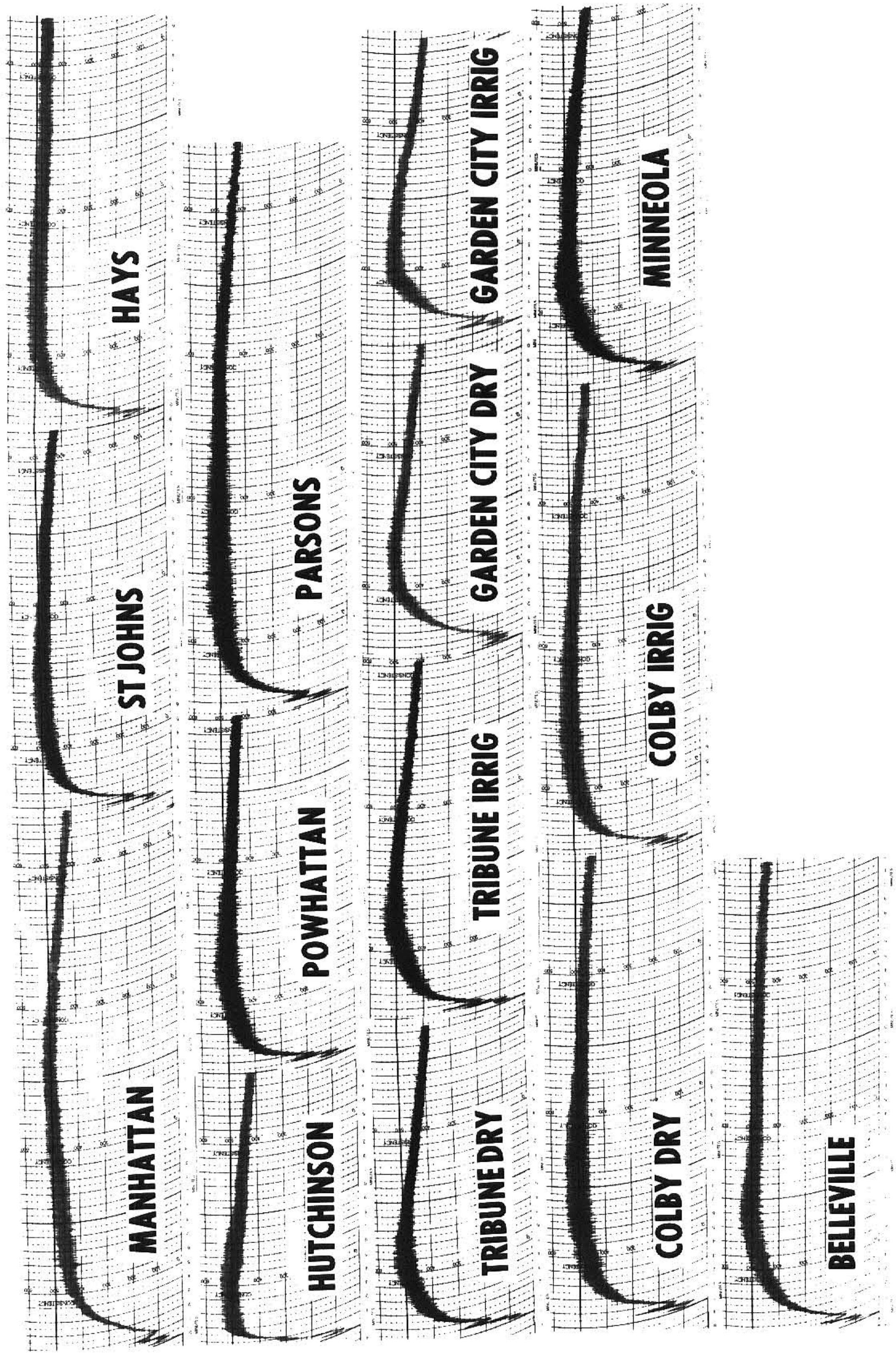
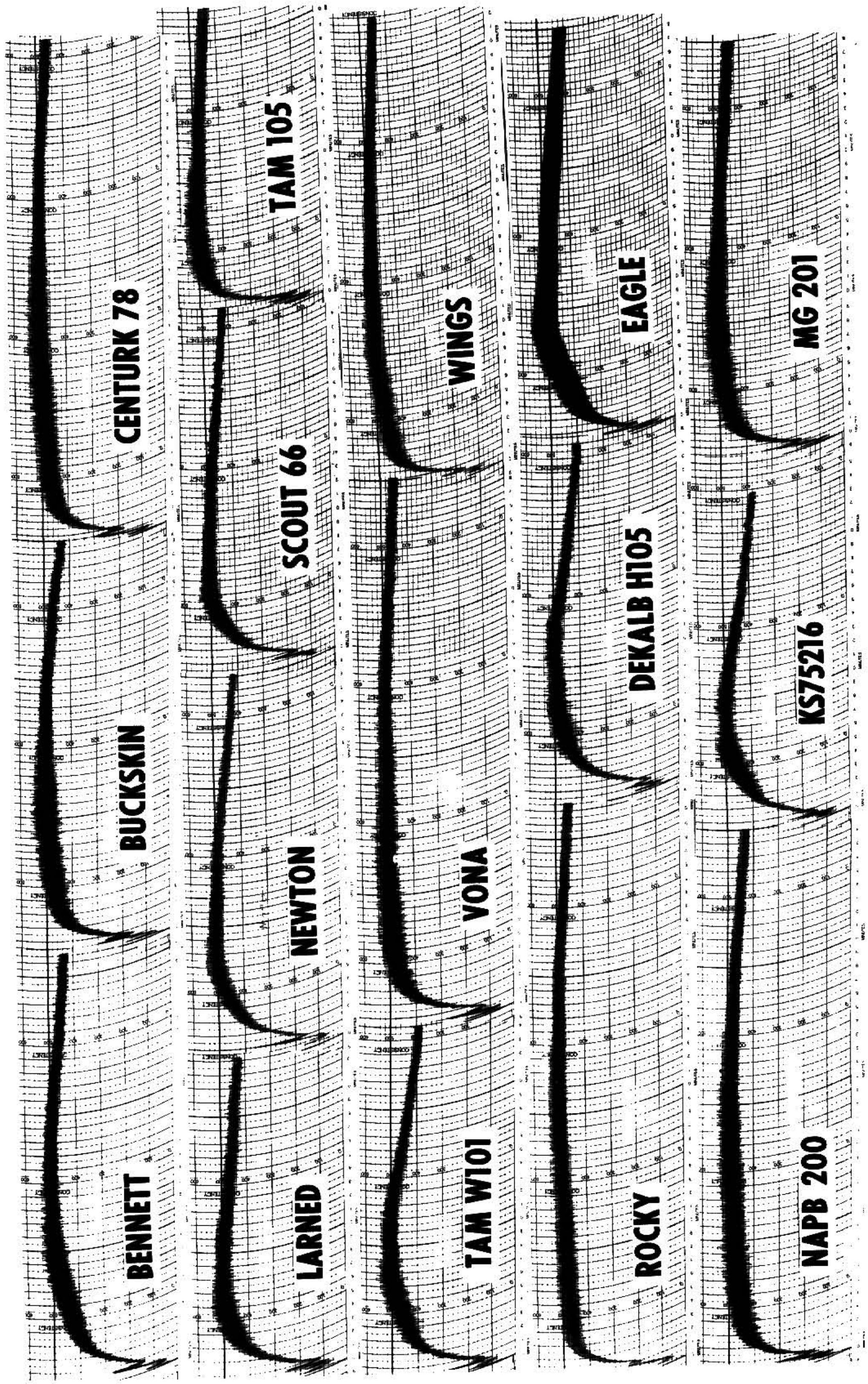

HAYS
ST JOHNS
MANHATTAN
PARSONS
POWHATTAN
HUTCHINSON
GARDEN CITY IRRIG
GARDEN CITY DRY
TRIBUNE IRRIG
TRIBUNE DRY
MINNEOLA
COLBY IRRIG
COLBY DRY
BELLEVILLE

PLATE IV. Farinograms for the variety blend samples.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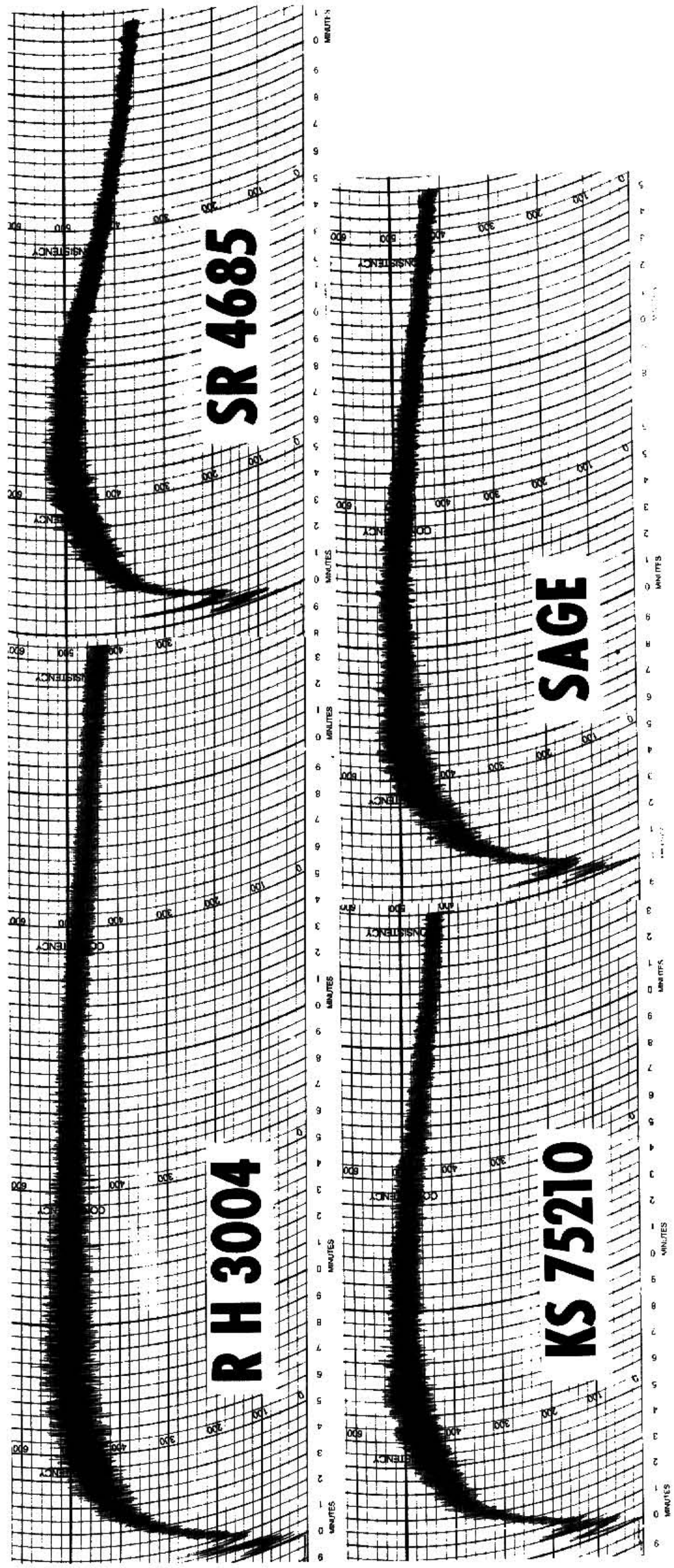
BUCKSKIN
BENNETT
TAM 105
SCOUT 66
NEWTON
LARNED
WINGS
VONA
TAM W101
EAGLE
DEKALB H105
ROCKY
MG 201
KS75216
NAPB 200

PLATE V. Farinograms for the variety blend samples.


SR 4685
SAGE
R H 3004
KS 75210

understanding of these changes will enable him to take the necessary measures for wheat tempering and conditioning, roll setting and bolting. Our results show that after blending, the test weight, density and hardness of the wheat as measured by the pearling value and the particle size index have increased. The 1000 kernel weight showed no increasing or decreasing trend and the change is not very significant. The wheat protein content decreased slightly. The physical characteristics of the wheat blends are presented in Tables 50 through 53, and the location and variety average in Tables 45 through 49.

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Table 12. Effect of Variety and Environment on Mean Farinograph Absorptions.

Variety	Farinograph Absorption[a] %	Location	Farinograph Absorption[a] %
Dekalb H105	70.6	Manhattan	72.0
SR 4685	70.6	Garden City, Dry	71.4
TAM W101	69.0	Minneola	70.6
KS 75216	67.0	Garden City, Irrig.	70.4
Sage	66.8	Colby, Dry	67.0
Bennett	66.8	Hays	67.0
KS 75210	66.4	Parsons	67.0
Scout 66	66.2	Belleville	66.8
Larned	66.0	Colby, Irrig.	66.8
Vona	66.0	St. Johns	66.5
R-H 3004	65.8	Tribune, Irrig.	65.0
Eagle	65.0	Tribune, Dry	64.2
Newton	64.8	Powhattan	64.0
Buckskin	64.7	Hutchinson	63.3
TAM 105	64.7		
Centurk 78	64.6		
Rocky	64.4		
MG 201	64.0		
Wings	62.8		
NAPB 200	61.8		

a = 14% moisture basis.

ENVIRONMENTAL SERIES 1981

Table 13. Effect of Variety and Environment on Mean Farinograph Mixing Time.

Variety	Farinograph Mixing Time min.	Location	Farinograph Mixing Time min.
Rocky	21.0	Manhattan	21.4
NAPB 200	15.5	Parsons	9.0
Centurk 78	14.0	Colby, Irrig.	9.0
Dekalb H105	10.5	Colby, Dry	9.0
Buckskin	10.4	St. Johns	8.6
Wings	10.0	Belleville	8.6
Bennett	9.8	Hays	8.5
MG 201	9.0	Powhattan	7.5
Eagle	8.7	Tribune, Irrig.	7.4
R-H 3004	8.5	Minneola	7.3
TAM W101	7.5	Hutchinson	5.5
Newton	7.0	Tribune, Dry	5.5
Vona	7.0	Garden City, Irrig.	5.0
KS 75210	6.7	Garden City, Dry	5.0
SR 4685	6.5		
KS 75216	6.5		
Larned	6.0		
TAM 105	6.0		
Sage	6.0		
Scout 66	5.7		

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Table 14. Effect of Variety and Environment on Mean Dough Stability.

Variety	Stability[b]	Location	Stability[b]
Rocky	31.6	Parsons	24.8
Vona	28.5	Colby, Irrig.	20.5
Centurk 78	27.6	Colby, Dry	19.8
NAPB 200	23.5	Manhattan	19.0
Wings	20.7	Hays	16.0
R-H 3004	20.5	Belleville	15.4
Buckskin	18.8	Minneola	12.3
Bennett	16.8	Powhattan	12.0
MG 201	16.5	St. Johns	11.0
Eagle	14.5	Tribune, Irrig.	10.5
Sage	13.0	Hutchinson	8.4
Newton	12.8	Tribune, Dry	7.0
Scout 66	12.0	Garden City, Irrig.	6.8
TAM 105	12.0	Garden City, Dry	6.1
KS 75210	11.8		
Larned	10.8		
TAM W101	10.4		
Dekalb H105	10.0		
KS 75216	8.5		
SR 4685	7.0		

b = minutes

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Table 15. Effect of Variety and Environment on Mean Valorimeter.

Variety	Valorimeter	Location	Valorimeter
Rocky	98	Manhattan	97
NAPB 200	91	Parsons	80
Centurk 78	90	Colby, Dry	78
Buckskin	82	Colby, Irrig.	78
Wings	82	Belleville	76
Bennett	80	St. Johns	75
Dekalb H105	78	Hays	74
MG 201	78	Powhattan	70
R-H 3004	78	Minneola	70
Eagle	76	Tribune, Irrig.	69
Vona	74	Hutchinson	64
Newton	70	Tribune, Dry	60
TAM W101	69	Garden City, Dry	60
KS 75210	68	Garden City, Irrig.	58
Sage	67		
Larned	66		
Scout 66	66		
TAM 105	66		
KS 75216	64		
SR 4685	61		

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Table 16. Effect of Variety and Environment on Mean Bakery Mixing Time.

Variety	Bakery Mixing Time min.	Location	Bakery Mixing Time min.
Rocky	6.0	Parsons	5.5
Centurk 78	5.0	Colby, Irrig.	5.5
Newton	4.5	Manhattan	5.2
NAPB 200	4.5	Colby, Dry	5.2
R-H 3004	4.5	Powhattan	5.0
Vona	4.2	Hays	4.0
Bennett	4.2	Tribune, Irrig.	3.5
Buckskin	4.0	Belleville	3.5
KS 75210	3.7	St. Johns	3.2
Eagle	3.7	Tribune, Dry	3.2
SR 4685	3.7	Minneola	3.2
Scout 66	3.5	Hutchinson	3.0
TAM 105	3.5	Garden City, Irrig.	2.7
Dekalb H105	3.5	Garden City, Dry	2.7
Sage	3.5		
TAM W101	3.2		
Wings	3.2		
MG 201	3.2		
Larned	2.7		
KS 75216	2.7		

ENVIRONMENTAL SERIES 1981

Table 17. Effect of Variety and Environment on Mean Loaf Volume.

Variety	Loaf Volume c.c.	Location	Loaf Volume c.c.
Dekalb H105	3400	Manhattan	3500
KS 75210	3300	Belleville	3400
TAM W101	3300	Hays	3175
Newton	3200	Garden City, Dry	3125
Bennett	3150	St. Johns	3050
Eagle	3150	Colby, Dry	3050
Vona	3100	Tribune, Irrig.	3000
Buckskin	3075	Parsons	3000
KS 75216	3050	Minneola	2950
Larned	3025	Colby, Irrig.	2900
Scout 66	3000	Powhattan	2850
Wings	3000	Garden City, Irrig.	2800
Sage	3000	Tribune, Dry	2500
Rocky	2900	Hutchinson	
SR 4685	2900		
MG 201	2900		
R-H 3004	2900		
NAPB 200	2800		
Centurk 78	2700		
TAM 105	2700		

ENVIRONMENTAL SERIES 1981

Table 18. Effect of Variety and Environment on Mean Qualtiy Score.

Variety	Quality Score %	Location	%
KS 75210	88	St. Johns	84
Larned	86	Belleville	84
MG 201	84	Minneola	82
Sage	84	Colby, Irrig.	82
Buckskin	82	Colby, Dry	82
Eagle	82	Manhattan	80
TAM 101	80	Hays	80
Rocky	80	Garden City, Dry	80
Dekalb H105	80	Powhattan	76
Bennett	78	Tribune, Irrig.	76
Newton	78	Tribune, Dry	74
TAM 105	78	Parsons	70
Vona	78	Garden City, Irrig.	70
KS 75216	78	Hutchinson	
Centurk 78	76		
Scout 66	76		
Wings	76		
SR 4685	74		
NAPB 200	72		
R-H 3004	72		

PLATE VI. Loaf volume variation for the location blend samples.


MANHATTAN
BELLEVILLE
HAYS
GARDEN CITY, DRY
ST. JOHNS
COLBY, DRY
TRIBUNE, IRRIG.
PARSONS
MINNEOLA
COLBY, IRRIG.
POWHATTAN
GARDEN CITY, IRRIG.
TRIBUNE, DRY

PLATE VII. Loaf volume variation for the variety blend samples.

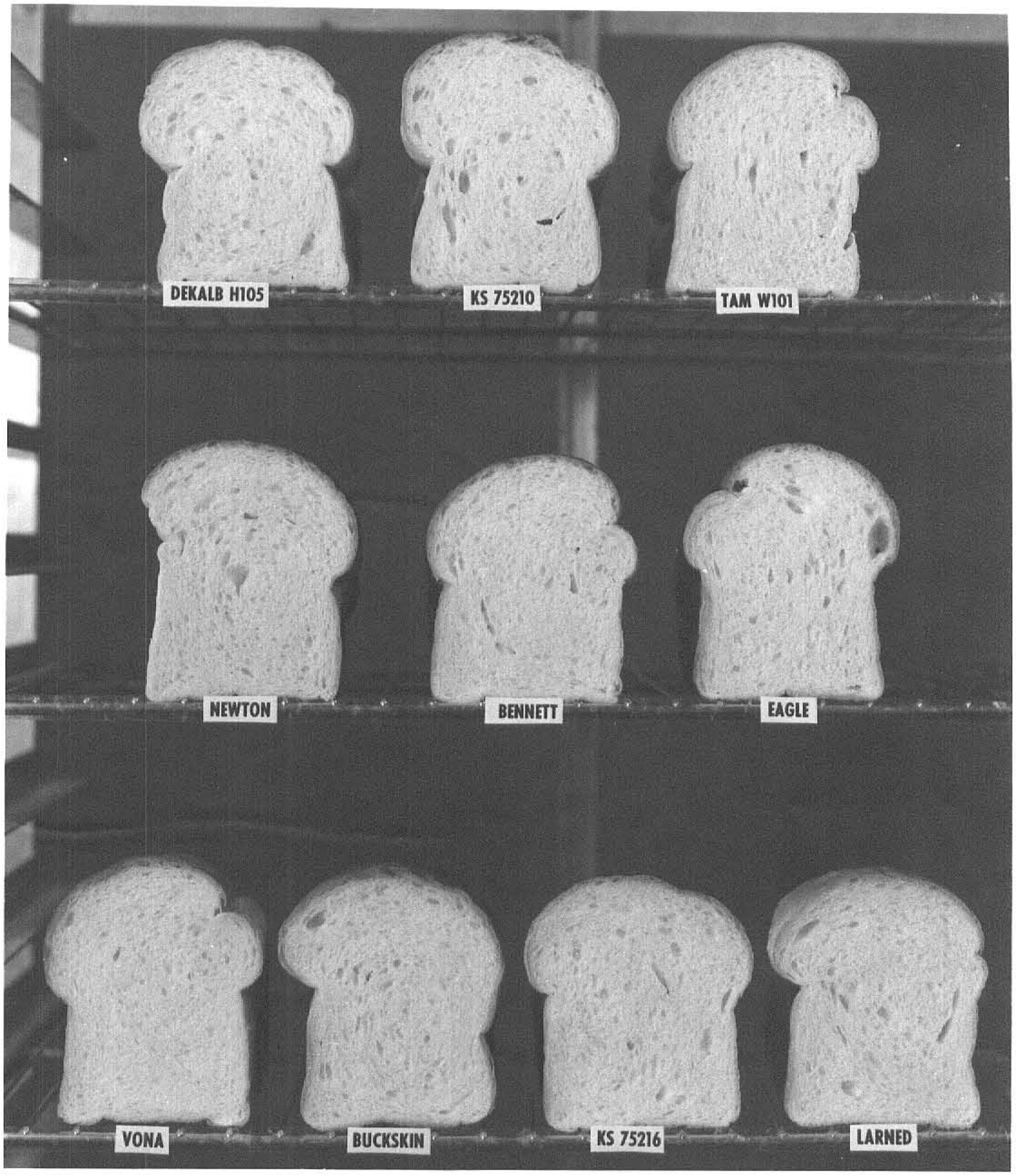
DEKALB H105
KS 75210
TAM W101
NEWTON
BENNETT
EAGLE
VONA
BUCKSKIN
KS 75216
LARNED

PLATE VIII. Loaf volume variation for the variety blend samples.


SAGE
WINGS
SCOUT 66
ROCKY
R—H 3004
MG 201
SR 4685
NAPB 200
CENTURK 78
TAM 105

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Table 19. Climatological Data During the Active Growing Period.

	RAINFALL[a] (Total)			TEMPERATURES[b]					
Location	April	May	June	April Aver.	April Max.	May Aver.	May Max.	June Aver.	June Max.
Manhattan	2.21	7.06	6.54	63.5	75.1	55.5	65.7	76.1	86.5
St. Johns	1.20	6.19	5.13	64.6	78.8	61.6	72.5	78.3	90.8
Hutchinson	1.49	6.46	2.95	64.6	79.0	61.8	72.5	78.8	91.7
Powhattan	--	--	--	--	--	--	--	--	--
Tribune	1.36	3.70	.42	57.2	74.5	57.6	70.4	75.0	92.6
Hays	2.12	5.01	1.16	60.8	74.7	58.7	69.5	75.3	88.3
Minneola	--	--	--	--	--	--	--	--	--
Parsons	2.77	4.70	4.96	63.0	74.6	62.5	73.5	75.7	85.5
Belleville	2.34	6.05	2.29	60.2	74.9	59.9	71.5	74.0	87.5
Colby	3.50	8.92	.15	55.1	69.7	55.5	65.7	72.5	86.7
Garden City	.96	3.87	.28	60.0	76.0	58.6	71.5	75.5	91.3

a = rainfall in inches

b = temperature in degree Fahrenheit

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Table 20. Coefficients of Variation (%) For The Wheat Physical Characteristics and Milling Properties.

Laboratory Tests	Location	Variety
Test weight	4.049	1.544
1000 kernel weight	8.396	7.346
Pearling value	6.237	2.822
P. S. I.	6.972	4.215
Density	1.171	0.369
Protein	14.017	3.574
Theoretical yield	0.860	0.740
Flour yield	2.49	1.86
Milling rating	22.821	9.365
Ash-value figures	10.899	4.991

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Table 21. Coefficients of Variation (%) for the Flour Data.

Laboratory Tests	Location	Variety
Dry gluten	13.677	4.083
Wet gluten	16.683	4.825
Farinograph:		
-Absorption	4.175	3.408
-Mixing time	48.325	42.349
-Stability	43.120	43.017
-Valorimeter	14.165	13.281
Bakery mixing time	26.914	20.132
Loaf volume	8.430	6.288
Quality score	6.170	5.471

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Table 22. Irrigation Effect on Wheat and Flour Quality Characteristics.

Laboratory Tests	Tribune Dry	Tribune Irrig.	Colby Dry	Colby Irrig.	Garden City Dry	Garden City Irrig.
Test weight	60.8	60.8	55.5	58.4	58.9	61.7
1000 Kernel weight (Grms) (14% M.B.)	35.30	30.82	29.85	32.42	31.85	33.59
Density	1.373	1.383	1.385	1.390	1.408	1.410
Pearling value (%)	56.15	61.29	66.82	68.12	63.98	68.12
P. S. I. (%)	19.38	21.36	20.04	22.35	20.42	23.94
Protein (%) (14% M.B.)	12.90	14.44	15.82	14.58	17.36	15.51
Theoretical yield (%)	76.89	75.45	75.55	75.81	75.62	75.80
Flour yield (%)	71.03	71.49	69.63	71.42	67.25	70.84
Milling rating	25.03	29.49	22.63	26.42	17.25	28.88
Ash-value figures	0.65	0.59	0.67	0.63	0.74	0.59
Dry gluten (%)	11.80	12.50	13.98	12.60	15.80	13.58
Wet gluten (%)	31.80	35.90	28.20	35.30	40.60	37.40
Farinograph:						
-Absorption (%)	64.20	65.00	67.00	66.80	71.40	70.40
-Mixing time (mn)	5.5	7.4	9.0	9.0	5.0	5.0
-Stability (mn)	7.0	10.5	19.8	20.5	6.1	6.8
-Valorimeter	60	69	78	78	60	58
Bakery mixing time (mn)	3.2	3.5	5.2	5.5	2.7	2.7
Loaf volume (c.c.)	2500	3000	3050	2900	3125	2800
Quality score (%)	74	76	82	82	80	70

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Table 23. Correlation Coefficients Between the Mean Wheat Physical Characteristics and the Milling Properties.

	1000 kernel weight	Pearling Value	P. S. I.	Density	Protein	Theoretical Yield	Flour Yield	Milling Rating	Ash-value Figures
Test weight	0.225	0.079	0.622	0.548	-0.460	0.020	0.590	0.637	-0.577
1000 K. w.		-0.582	-0.090	0.249	0.392	0.935	0.209	-0.169	0.219
Pearling value			0.241	0.260	-0.424	-0.683	0.178	0.224	-0.273
P. S. I.				0.260	-0.632	-0.169	0.255	0.456	-0.334
Density					-0.207	-0.015	0.700	0.332	-0.217
Protein						-0.671	-0.676	-0.462	0.440
Theoretical yield							0.613	-0.266	0.312
Flour yield								0.582	-0.413
Milling rating									-0.979

Correlation coefficient of r > 0.562 is required for 0.01 level of significance.

Correlation coefficient of r > 0.217 is required for 0.05 level of significance.

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Table 24. Correlation Coefficients Between the Mean Wheat Physical Characteristics and Some Flour Quality Parameters.

			FARINOGRAPH				BAKERY TEST		
	Dry Gluten	Wet Gluten	Absorption	Peak Time	Stability	Valorimeter	Mixing Time	Loaf Volume	Quality Score
Test weight	-0.665	-0.431	-0.387	0.057	0.131	0.227	0.300	-0.210	-0.106
1000 K. w.	-0.500	0.814	0.342	0.453	-0.445	0.207	0.207	0.364	0.121
Pearling value	0.385	-0.386	-0.556	0.413	0.598	0.500	0.318	-0.340	0.079
P. S. I.	-0.577	-0.441	-0.543	0.045	0.434	0.213	0.222	-0.075	0.173
Density	-0.168	-0.148	-0.558	0.127	0.185	0.253	0.013	-0.229	0.314
Protein	0.922	0.613	0.678	0.965	-0.579	-0.240	-0.356	0.707	0.301

Correlation coefficient of $r > 0.562$ is required for 0.01 level of significance.

Correlation coefficient of $r > 0.217$ is required for 0.05 level of significance.

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Table 25. Correlation Coefficients Between Certain Flour Quality Factors and the Baking Properties.

		FARINOGRAPH				BAKERY TEST		
	Wet Gluten	Absorption	Peak Time	Stability	Valorimeter	Mixing Time	Loaf Volume	Quality Score
Dry gluten	0.767	0.715	-0.414	0.560	-0.208	-0.257	0.741	0.277
Wet gluten		0.704	-0.411	-0.687	-0.650	-0.502	0.550	0.467
Absorption			-0.545	-0.306	-0.428	-0.306	0.512	0.100
Peak time				0.741	0.927	0.719	-0.304	-0.386
Stability					0.839	0.764	-0.403	-0.367
Valorimeter						0.729	-0.270	-0.336
Mixing time							-0.283	-0.458
Loaf volume								0.467

Correlation coefficient of $r > 0.562$ is required for 0.01 level of significance.

Correlation coefficient of $r > 0.217$ is required for 0.05 level of significance.

ENVIRONMENTAL SERIES 1981

Table 26. Correlation Coefficients Between Rainfall, Wheat Physical Characteristics and Milling Properties.

	RAINFALL		
	April	May	June
Test weight	-0.475	-0.544	-0.077
1000 kernel weight	-0.533	-0.294	0.090
Pearling value	0.584	0.458	0.498
P. S. I.	0.221	-0.167	-0.139
Density	-0.011	-0.213	-0.613
Protein	0.212	0.092	0.284
Theoretical yield	-0.438	-0.152	0.145
Flour yield	0.082	0.113	0.077
Milling rating	0.387	-0.055	0.158
Ash-value figures	-0.412	0.044	-0.152

Correlation coefficient of r > 0.798 is required for 0.01 level of significance.

Correlation coefficient of r > 0.374 is required for 0.05 level of significance.

ENVIRONMENTAL SERIES 1981

Table 27. Correlation Coefficient Between Rainfall and Certain Flour Quality Parameters.

	RAINFALL		
	April	May	June
Farinograph:			
-Absorption	0.026	0.027	0.236
-Peak time	0.336	0.436	0.680
-Stability	0.866	0.426	0.417
-Valorimeter	0.575	0.556	0.703
Bakery mixing time	0.847	0.470	0.380
Loaf volume	0.245	0.453	0.443
Quality score	-0.080	0.529	-0.073

Correlation coefficient of $r > 0.798$ is required for 0.01 level of significance.

Correlation coefficient of $r > 0.374$ is required for 0.05 level of significance.

ENVIRONMENTAL SERIES 1981

Table 28. Correlation Coefficients Between Temperature and Some Wheat Quality Characteristics.

	TEMPERATURES					
	Average April	Maximum April	Average May	Maximum May	Average June	Maximum June
Test weight	0.240	0.544	0.715	0.841	0.396	0.527
1000 Kernel wt.	0.316	0.626	0.579	0.653	0.573	0.644
Pearling value	0.387	-0.115	0.116	-0.153	-0.043	-0.828
P. S. I.	0.132	0.076	0.637	0.584	0.052	-0.233
Density	-0.256	0.083	0.159	0.280	-0.278	-0.084
Protein	-0.028	-0.306	-0.382	-0.382	-0.352	-0.554
Theoretical yield	0.242	0.517	0.435	0.485	0.520	0.596
Flour yield	0.141	0.232	0.455	0.361	0.179	0.107
Milling rating	-0.171	-0.287	0.166	0.172	-0.416	-0.439
Ash-value figures	0.195	0.327	-0.142	-0.150	0.449	0.470

Correlation coefficient of $r > 0.798$ is required for 0.01 level of significance.

Correlation coefficient of $r > 0.374$ is required for 0.05 level of significance.

ENVIRONMENTAL SERIES 1981

Table 29. Correlation Coefficients Between Temperatures and Certain Flour Quality Parameters.

	TEMPERATURES					
	Average April	Maximum April	Average May	Maximum May	Average June	Maximum June
Farinograph:						
-Absorption	0.049	-0.175	-0.458	-0.418	-0.208	-0.382
-Peak time	0.266	-0.152	-0.466	-0.625	-0.036	-0.597
-Stability	0.011	-0.525	-0.074	-0.298	-0.382	-0.965
-Valorimeter	0.258	-0.253	-0.296	-0.528	-0.126	-0.813
Bakery mixing time	-0.107	-0.625	-0.317	-0.514	-0.412	-0.887
Loaf volume	0.430	0.081	-0.116	-0.286	-0.018	-0.592
Quality score	-0.004	0.116	-0.241	-0.296	-0.017	0.089

Correlation coefficient of $r > 0.798$ is required for 0.01 level of significance.

Correlation coefficient of $r > 0.374$ is required for 0.05 level of significance.

SUMMARY AND CONCLUSIONS

The physical, milling and baking quality characteristics of the major hard red winter wheat varieties grown at twelve locations in Kansas were evaluated. Samples from irrigated plots were received only from three locations (Tribune, Colby, Garden City). The composite samples from replicated plots were submitted for the physical characteristics analysis and then blended by location and variety. After milling the wheat blends, the flour is analyzed and baked into bread by standard procedures.

Coefficients of variation for the locations and varieties have been statistically computed to show the influence of these two factors on the quality characteristics of wheat and flour.

Both environment and variety had a significant effect on all the quality characteristics but, the former exerted far more the greatest influence, especially for the test weight, wheat hardness, protein content, milling properties, Farinograph and bakery mixing time, and loaf volume.

Although the coefficients of variations were slightly larger for the location than the variety for the 1000 kernel weight, theoretical yield, Farionograph absorption, valorimeter and bread quality score, we may assume that the influence of the environment on these quality characteristics is as important as the varietal effect.

Farinograph dough stability was affected to the same extent by both the variety and location. Correlations coefficients between wheat and flour quality characteristics and the climatological data are presented in Tables 24, 25, 26, and 27.

These coefficients show that Farinograph dough stability, valorimeter, and bakery mixing time are significantly correlated (either at 0.01 or 0.05

level) with April, May and June rainfall. These same quality characteristics are also highly and negatively correlated with the maximum June temperatures.

Test weight, 1000 kernel weight, theoretical yield appeared to be significantly correlated (0.05 level) with April maximum temperature, May and June average and maximum temperature. The results also indicate that the wheat protein content and the milling properties are significantly correlated (0.05 level) with the June temperatures.

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APPENDIX

ENVIRONMENTAL SERIES 1981

TABLE 30. LOCATION: Manhattan

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	56.1	72.28	29.34	71.80	19.00	1.351	52.58	46.78	0.64	75.58	11.03	19.20
Buckskin	55.3	71.25	24.97	72.95	17.20	1.350	60.42	39.18	0.40	76.00	11.75	19.13
Centurk 78	54.8	70.60	29.74	72.95	20.00	1.362	21.17	76.80	1.95	73.94	7.80	18.97
Larned	57.4	73.95	33.75	68.65	20.10	1.378	56.30	43.12	0.58	75.78	8.53	17.73
Newton	55.9	72.02	31.29	71.30	18.50	1.358	62.60	37.13	0.27	76.10	11.60	18.14
Scout 66	56.7	73.05	31.79	70.75	19.00	1.385	55.05	44.41	0.54	75.71	11.70	18.64
TAM W101	54.4	70.09	37.02	67.75	19.60	1.375	81.63	18.30	0.06	77.07	11.50	20.30
TAM 105	56.4	72.66	29.25	74.15	17.50	1.348	55.16	44.11	0.73	75.70	11.41	17.79
Trison	59.2	76.27	41.36	60.35	19.20	1.370	91.67	8.23	0.09	77.57	11.36	16.84
Vona	56.9	73.31	28.30	72.20	19.10	1.360	40.92	58.32	0.75	74.99	8.63	15.51
Triumph 64	58.9	75.88	35.82	62.50	20.20	1.362	80.89	18.84	0.26	77.01	11.27	16.95
Rocky	53.2	68.54	33.98	74.00	20.30	1.353	25.31	73.42	1.27	74.18	8.10	19.90
Wings	58.2	74.98	28.78	71.25	19.50	1.365	39.32	59.37	1.31	74.89	11.75	17.03
Parker 76	58.0	74.73	30.36	72.15	18.30	1.358	66.16	33.57	0.26	76.28	11.70	21.45
Dekalb H105	55.2	71.12	33.39	66.55	18.00	1.352	71.94	27.54	0.51	76.55	11.22	19.97

*Moisture 'as is' basis

TABLE 30. Manhattan (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	55.5	71.51	31.04	69.20	19.50	1.336	67.91	31.78	0.31	76.37	11.32	20.26
KS 75216	56.1	72.28	30.22	74.80	15.50	1.383	52.57	46.64	0.78	75.57	11.55	19.30
KS 79H69	55.6	71.63	30.78	69.50	16.90	1.357	73.47	26.29	0.23	76.64	11.56	17.66
KS 79H70	55.1	70.99	31.58	68.85	17.40	1.348	76.33	23.44	0.23	76.80	11.22	16.39
SR 4624	55.3	71.25	29.72	67.60	18.20	1.371	64.26	35.46	0.28	76.20	11.70	20.69
SR 4685	53.7	69.19	27.40	67.15	18.60	1.366	56.62	42.18	1.19	75.74	11.80	16.95
SR 5221	55.3	71.25	32.50	67.40	18.20	1.350	72.22	27.40	0.37	76.57	11.22	19.26
SR 5415	56.3	72.54	30.75	68.00	18.70	1.347	56.39	42.70	0.90	75.75	11.37	20.02
MG 201	53.3	68.67	23.39	72.90	18.30	1.341	35.70	63.17	1.13	74.70	11.50	19.18
NAPB 200	57.5	74.08	36.20	70.55	16.60	1.383	78.22	21.61	0.17	76.89	11.80	18.92
PL 145	54.6	70.35	28.37	72.80	18.40	1.373	49.62	49.56	0.81	75.42	11.12	17.12
R-H 3004	54.6	70.35	28.78	70.35	19.20	1.356	45.63	53.63	0.73	75.23	11.85	16.43
R-H 5006	56.6	72.92	28.47	72.10	18.80	1.373	54.36	44.94	0.68	75.65	11.37	17.78
Hart	53.4	68.80	32.46	63.60	25.00	1.353	76.80	22.95	0.24	76.81	11.80	16.87
Pike	54.4	70.09	30.01	63.95	26.20	1.391	61.73	37.45	0.82	76.03	11.85	16.41

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 31. LOCATION: St. Johns

WHEAT DATA

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Kernel Size Distrib. OV 7W %	OV 9W %	OV 12W %	Theor. Yield %	% Moist. %	Protein 14% M.B. %
Bennett	59.7	76.92	33.65	65.75	19.90	1.358	70.13	29.80	0.07	76.50	11.22	15.41
Buckskin	58.9	75.89	31.93	68.10	18.90	1.374	64.49	35.43	0.08	76.22	11.27	15.89
Centurk 78	58.6	75.50	29.74	66.60	20.00	1.348	55.39	44.52	0.08	75.75	10.88	15.60
Larned	59.0	76.01	30.24	66.30	20.20	1.366	58.68	41.24	0.08	75.93	11.32	14.67
Newton	58.9	75.89	34.40	65.80	20.30	1.360	75.79	24.14	0.07	76.78	11.46	14.68
Scout 66	59.8	77.05	35.98	63.90	19.20	1.374	73.56	26.39	0.05	76.67	11.32	14.99
TAM W101	57.1	73.57	36.58	66.10	19.80	1.347	84.28	15.70	0.02	77.21	10.74	16.05
TAM 105	59.1	76.14	32.08	69.90	19.10	1.366	64.80	35.07	0.13	76.22	11.51	14.35
Trison	58.2	74.98	37.25	60.85	19.50	1.351	90.15	9.85	--	77.50	11.22	15.97
Vona	59.7	76.92	31.35	67.05	20.50	1.355	61.79	38.15	0.06	76.08	11.51	15.02
Triumph 64	57.8	74.47	32.88	59.70	21.10	1.338	75.89	24.11	--	76.79	9.87	17.49
Rocky	58.4	75.24	28.94	68.00	20.90	1.337	50.31	49.58	0.11	75.51	10.74	15.90
Wings	59.7	76.92	37.69	63.70	20.30	1.374	80.18	19.78	0.04	77.00	11.27	16.32
Parker 76	61.0	78.59	33.19	65.95	20.00	1.371	76.08	23.89	0.03	76.80	10.83	17.68
Dekalb H105	56.5	72.79	35.39	68.40	18.80	1.369	83.21	16.77	0.02	77.16	10.98	16.26

*Moisture 'as is' basis

TABLE 31. St. Johns (Continued)

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Kernel Size Distrib. OV 7W %	OV 9W %	OV 12W %	Theor. Yield %	Moist. %	Protein 14% M.B. %
KS 75210	58.8	75.76	36.59	63.15	19.90	1.342	83.66	16.31	0.03	77.18	11.03	16.66
KS 75216	57.5	74.08	34.66	67.45	16.40	1.364	73.41	26.52	0.07	76.67	11.50	14.73
KS 79H69	57.6	74.21	32.46	61.05	18.20	1.342	82.52	17.43	0.05	77.12	11.41	15.61
KS 79H70	58.1	74.86	32.55	60.40	19.10	1.341	83.48	16.47	0.05	77.17	11.41	15.71
SR 4624	56.0	72.15	31.47	65.95	15.50	1.351	76.80	23.14	0.06	76.84	10.88	18.24
SR 4685	57.2	73.70	34.53	59.95	18.90	1.358	77.13	22.79	0.08	76.85	11.12	15.47
SR 5232	56.7	73.05	31.36	67.30	18.40	1.369	70.50	29.43	0.07	76.52	11.08	16.84
SR 5466	56.5	72.79	30.54	63.85	16.10	1.338	70.84	29.10	0.06	76.54	11.28	19.00
MG 201	57.6	74.21	31.65	68.75	19.40	1.347	56.75	42.14	0.11	75.88	11.41	14.94
NAPB 200	59.5	76.66	39.57	62.55	20.30	1.365	84.88	15.08	0.04	77.24	10.74	14.36
R-H 3004	59.9	77.17	34.89	65.00	20.40	1.364	68.77	31.17	0.06	76.43	11.13	14.89
R-H 5006	58.2	74.98	30.85	67.20	19.70	1.353	64.59	35.29	0.11	76.21	11.51	14.57
Eagle	59.2	76.27	36.35	63.55	18.90	1.364	76.65	23.34	0.01	76.82	10.03	16.70
Sage	58.2	74.98	32.76	66.10	20.10	1.352	57.63	42.27	0.10	75.87	10.36	16.09

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 32. LOCATION: Hutchinson

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	61.4	79.11	35.48	69.40	20.20	1.413	80.24	19.60	0.16	77.00	10.30	11.36
Buckskin	60.5	79.95	33.72	64.40	21.90	1.395	73.11	26.79	0.10	76.65	7.32	9.90
Centurk 78	61.3	78.98	33.24	65.60	23.00	1.370	70.59	29.18	0.23	76.52	7.47	9.74
Larned	61.9	79.75	39.08	64.95	22.20	1.410	84.93	14.84	0.23	77.23	10.88	10.03
Newton	61.9	79.75	36.26	66.55	23.30	1.386	75.98	20.89	0.13	76.94	10.78	10.27
Scout 66	61.8	79.62	38.09	66.55	21.50	1.391	80.09	19.83	0.08	77.00	10.30	10.34
TAM W101	61.3	68.98	42.75	67.95	20.30	1.403	92.73	7.24	0.03	77.63	9.05	11.68
TAM 105	61.8	79.62	37.90	69.15	22.90	1.387	83.14	16.67	0.18	77.14	10.83	9.36
Trison	61.3	78.98	40.96	62.00	21.40	1.397	93.06	6.89	0.05	77.65	10.63	11.09
Vona	60.5	77.95	33.80	69.45	21.70	1.395	75.22	24.47	0.31	76.74	10.73	9.72
Triumph 64	62.3	80.27	38.35	61.75	21.90	1.399	87.07	12.87	0.06	77.35	9.34	10.59
Rocky	61.3	78.98	33.67	66.55	22.10	1.385	68.08	31.67	0.25	76.39	8.43	10.62
Wings	62.2	80.14	32.71	68,85	22.30	1.390	75.69	24.04	0.27	76.77	10.44	10.30
Parker 76	63.5	81.81	34.02	68.40	20.80	1.402	82.65	17.21	0.14	77.12	10.22	10.87
Dekalb H105	61.3	78.98	37.66	67.35	18.40	1.406	80.53	19.28	0.19	77.01	10.22	11.23

*Moisture 'as is' basis

TABLE 32. Hutchinson (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	62.2	80.14	39.65	64.85	23.40	1.378	84.59	15.35	0.06	77.23	10.54	9.89
KS 75216	61.6	79.36	36.17	68.35	20.20	1.393	75.71	23.92	0.37	76.76	10.73	9.99
KS 79H69	60.0	77.30	33.97	61.25	22.10	1.387	82.96	16.87	0.17	77.14	10.54	10.28
KS 79H70	60.7	78.21	35.35	62.40	22.00	1.379	84.12	15.74	0.14	77.20	10.16	10.97
SR 4624	61.9	79.75	38.12	67.25	16.90	1.392	89.88	10.04	0.08	77.49	10.93	11.97
SR 4685	61.9	79.75	36.46	63.85	20.50	1.396	81.70	18.09	0.21	77.07	9.49	10.13
SR 5471	61.3	68.98	35.87	63.45	19.90	1.371	79.22	20.63	0.15	76.95	10.40	11.93
SR 5466	61.4	79.11	36.22	65.50	19.50	1.390	78.84	21.05	0.11	76.93	10.78	12.99
MG 201	60.6	78.08	30.91	69.35	21.40	1.403	71.25	28.36	0.38	76.53	11.26	10.38
NAPB 200	62.3	80.27	41.96	63.25	21.50	1.401	91.25	8.60	0.15	77.55	10.44	9.32
Eagle	61.2	78.85	38.04	65.85	20.80	1.394	81.37	18.52	0.11	77.03	10.63	11.30
R-H 3004	61.8	79.62	35.76	63.45	23.10	1.414	79.62	20.13	0.25	76.96	8.19	9.82
R-H 5006	61.3	78.98	34.50	67.20	22.20	1.383	76.63	23.01	0.36	76.80	10.44	9.72
BRP Pioneer	60.4	77.82	36.58	66.65	21.20	1.399	76.37	23.36	0.27	76.80	10.73	10.08
Sage	61.4	79.11	35.79	68.45	20.70	1.398	72.03	27.91	0.06	76.60	9.97	10.48
NK 75W 355	62.9	81.04	37.05	72.15	20.70	1.401	83.85	16.10	0.05	77.19	10.40	10.38

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 33. LOCATION: Powhattan

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield	Moist.	Protein 14% M.B.
							OV 7W	OV 9W	OV 12W			
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	58.2	74.98	32.40	61.65	24.00	1.376	74.57	24.98	0.45	76.70	11.12	12.98
Buckskin	57.9	74.60	29.91	66.95	24.00	1.378	50.21	49.19	0.60	75.47	10.45	13.28
Centurk 78	59.5	76.66	28.38	63.55	24.90	1.371	36.59	62.07	1.34	74.74	7.90	12.58
Larned	59.4	76.53	32.85	61.60	25.00	1.375	66.61	39.91	0.48	76.30	10.50	12.29
Newton	58.0	74.73	30.76	61.00	27.40	1.377	47.12	52.01	0.87	75.30	7.81	13.13
Scout 66	58.7	75.63	30.98	62.60	23.80	1.370	68.28	30.98	0.64	76.30	10.95	12.83
TAM W101	59.0	76.02	38.77	64.50	24.50	1.386	80.19	19.67	0.14	77.00	10.54	13.30
TAM 105	57.6	74.21	30.34	67.30	24.20	1.363	64.30	35.15	0.55	76.18	12.08	12.83
Trison	58.4	75.24	35.04	57.05	23.50	1.354	78.93	20.83	0.24	76.93	11.41	15.55
Vona	59.1	76.14	28.58	66.65	24.40	1.369	46.50	52.71	0.78	75.27	10.88	13.90
Triumph 64	60.1	77.43	36.45	46.70	24.50	1.365	76.25	23.52	0.23	76.80	7.76	14.40
Rocky	59.2	76.27	28.23	68.80	23.80	1.380	41.05	57.94	1.10	75.05	10.45	12.66
Wings	60.4	77.82	30.49	65.30	24.70	1.353	61.36	38.12	0.52	76.04	11.80	12.24
Parker 76	60.9	78.46	33.18	66.05	22.00	1.374	71.88	27.74	0.38	76.57	10.78	14.72
Dekalb H105	57.5	74.08	33.04	64.60	19.90	1.356	71.22	28.55	0.23	76.55	11.31	14.67

*Moisture 'as is' basis

TABLE 33. Powhattan (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	59.1	76.14	32.62	64.05	27.00	1.366	60.84	38.76	0.40	76.02	11.50	12.08
KS 75216	55.9	72.02	27.90	67.40	23.00	1.372	31.18	67.14	1.68	74.45	10.93	12.90
KS 79H69	58.0	74.72	30.88	59.50	21.30	1.353	76.65	23.11	0.24	76.82	11.45	15.46
KS 79H70	58.1	74.86	32.79	60.35	21.00	1.357	74.36	25.38	0.26	76.70	11.03	15.75
SR 818	58.0	74.72	34.20	57.35	23.50	1.360	70.11	29.49	9.40	76.46	9.82	14.73
SR 4685	57.0	73.44	33.01	60.90	19.70	1.360	75.48	24.28	0.24	76.76	11.27	15.86
SR 84	58.4	75.24	35.83	59.75	22.20	1.361	77.98	21.80	0.22	76.89	11.17	14.88
SR 81	57.7	74.34	35.27	61.40	21.70	1.353	76.68	23.07	0.25	76.82	11.80	15.96
MG 201	56.3	72.54	27.13	70.00	23.60	1.374	44.33	53.83	1.84	75.11	11.46	13.85
NAPB 200	58.2	74.98	34.47	67.70	23.50	1.373	73.77	25.79	0.44	76.66	11.65	12.50
R-H 3004	59.7	76.92	30.59	62.65	23.60	1.371	58.80	40.73	0.47	75.91	10.50	13.24
Pike	56.5	72.79	30.02	57.95	37.00	1.360	60.44	38.64	0.92	75.97	11.70	12.26
Hart	56.2	72.41	33.62	50.40	31.60	1.355	67.89	31.82	0.29	76.38	10.59	13.85
Dekalb H97	58.1	74.86	32.84	66.85	22.10	1.368	61.13	38.39	0.48	76.02	11.46	14.14

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 34. LOCATION: Parsons

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	59.6	76.79	35.25	70.05	21.80	1.389	73.95	25.97	0.08	76.68	7.66	16.99
Buckskin	60.2	77.56	35.43	73.90	20.23	1.386	45.42	54.22	0.36	75.25	8.81	16.64
Centurk 78	60.4	77.82	28.47	71.75	21.50	1.386	68.22	31.60	0.18	76.40	7.66	15.56
Larned	60.4	77.82	36.79	71.35	22.90	1.389	70.40	29.55	0.05	76.52	8.52	15.64
Newton	60.0	77.30	32.76	74.50	22.30	1.374	60.66	39.04	0.30	76.01	8.71	15.50
Scout 66	60.4	77.82	36.66	70.65	21.30	1.377	76.02	23.85	0.13	76.79	10.44	15.91
TAM W101	60.3	77.69	33.00	70.30	23.50	1.390	82.40	17.59	0.01	77.12	8.50	15.47
TAM 105	60.3	77.69	32.71	73.30	22.40	1.390	59.77	39.99	0.24	75.97	8.71	14.63
Trison	61.3	78.98	41.22	61.30	24.73	1.375	89.95	10.01	0.04	77.49	7.70	15.54
Vona	60.3	77.69	28.33	72.20	21.60	1.362	46.67	52.35	0.98	75.27	9.00	17.14
Triumph 64	61.5	79.50	36.84	65.30	24.06	1.374	78.47	21.41	0.12	76.92	9.49	15.51
Rocky	60.3	77.69	30.24	74.45	21.80	1.382	46.03	53.76	0.21	75.28	8.24	16.43
Wings	61.4	79.11	28.00	71.20	25.00	1.383	44.17	55.07	0.76	75.16	10.44	15.06
Parker 76	62.1	80.00	33.68	69.85	22.40	1.389	70.27	29.58	0.15	76.50	9.97	17.39
Dekalb H105	58.4	75.24	34.54	70.00	21.00	1.373	67.30	32.45	0.25	76.34	10.16	17.49

*Moisture 'as is' basis

TABLE 34. Parsons (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	60.7	78.21	34.45	72.35	23.20	1.381	62.18	37.50	0.32	76.08	9.53	15.51
KS 75216	57.7	74.34	32.82	73.95	20.20	1.382	56.95	42.86	0.19	75.84	10.25	16.13
KS 79H69	58.6	75.50	31.81	69.30	23.20	1.382	59.92	39.89	0.19	75.98	7.47	15.48
KS 79H70	58.8	75.76	32.27	71.30	21.60	1.358	68.16	31.64	0.20	76.40	10.16	15.69
Payne	58.1	74.86	29.82	75.00	19.90	1.374	34.42	64.56	1.02	74.66	9.39	16.59
SR 4685	59.2	76.27	35.65	65.80	22.50	1.385	68.12	31.81	0.07	76.40	8.14	15.76
SR 5466	58.9	75.89	33.17	66.40	21.60	1.351	59.79	39.99	0.22	75.98	7.66	20.40
SR 4714	60.7	78.21	28.12	71.50	24.70	1.391	37.20	61.90	0.90	74.80	9.00	15.37
MG 201	59.0	76.02	28.41	74.05	20.50	1.377	53.12	46.14	0.73	75.60	10.63	15.64
NAPB 200	61.4	79.11	35.99	70.15	21.60	1.390	71.07	28.68	0.25	76.53	8.90	16.29
PL 145 Pioneer	58.1	74.86	33.10	75.10	19.60	1.374	48.83	50.66	0.51	75.41	9.97	15.35
R-H 3004	60.8	78.33	30.09	70.15	25.30	1.377	44.75	54.20	1.05	75.17	7.90	15.34
R-H 5006	61.4	79.11	30.59	72.75	22.60	1.387	57.91	41.57	0.52	75.86	9.00	14.72
Hart	58.7	75.63	36.57	64.70	27.30	1.365	73.92	26.02	0.06	76.69	10.26	15.33
Pike	60.2	77.56	35.54	57.10	32.90	1.395	72.20	27.51	0.29	76.59	7.37	14.63
SR 5471	58.7	75.63	34.40	66.45	21.50	1.355	71.09	28.81	0.10	76.54	9.29	20.99

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 35. LOCATION: Hays

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	56.8	73.18	28.32	70.95	20.00	1.385	41.37	58.02	0.61	75.02	9.44	16.50
Buckskin	55.0	70.86	28.22	69.85	21.00	1.378	35.58	63.43	0.99	74.72	8.04	16.09
Centurk 68	55.4	71.38	23.46	74.00	21.50	1.399	12.33	84.94	2.73	73.44	8.34	16.16
Larned	52.5	67.64	32.05	67.40	21.80	1.399	50.38	49.09	0.53	75.49	8.48	15.40
Newton	58.2	74.98	30.01	71.60	21.80	1.389	39.93	59.34	0.73	74.95	9.40	14.32
Scout 66	59.6	76.79	31.68	67.15	22.50	1.398	50.94	48.10	0.96	75.48	7.90	15.59
TAM W101	57.8	74.47	35.50	67.65	21.90	1.385	72.24	27.64	0.12	76.60	9.05	15.65
TAM 105	57.3	73.82	28.40	72.30	22.00	1.399	40.83	58.07	1.10	74.98	7.66	14.87
Trison	57.4	73.95	32.85	62.75	21.10	1.364	63.56	36.22	0.22	76.16	8.67	16.57
Vona	57.1	73.57	25.33	69.80	23.50	1.382	19.69	77.82	2.49	73.83	7.57	15.03
Triumph 64	58.0	74.73	31.71	61.00	21.50	1.379	63.08	36.81	0.11	76.15	8.77	16.76
Rocky	55.5	71.51	24.26	74.10	21.50	1.410	15.37	83.17	1.46	73.68	8.39	15.89
Wings	58.2	74.98	25.06	73.30	22.90	1.377	15.25	82.82	1.93	73.65	7.90	14.73
Parker 76	58.4	74.24	26.71	74.10	22.90	1.394	20.33	78.30	1.37	73.93	8.00	17.33
Dekalb H105	54.6	70.35	31.23	77.70	20.50	1.385	59.06	40.66	0.28	75.94	7.32	17.16

*Moisture 'as is' basis

TABLE 35. Hays (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	Kernel Size Distrib. OV 9W	Kernel Size Distrib. OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	60.1	77.43	33.12	67.05	22.60	1.382	52.92	46.85	0.23	76.63	7.62	15.22
KS 75216	55.4	71.38	28.33	74.35	18.60	1.387	32.57	65.58	1.85	74.51	7.90	14.98
KS 79H69	52.8	68.03	25.12	64.80	21.00	1.391	35.88	63.28	0.84	74.74	7.04	16.20
KS 79H70	54.9	70.73	26.17	66.55	20.90	1.385	40.94	58.08	0.98	74.99	8.53	16.88
SR 816	55.7	71.76	30.15	61.30	20.60	1.378	55.70	43.85	0.45	75.75	8.24	17.54
SR 4685	56.9	73.31	31.47	61.50	18.50	1.375	61.55	38.24	0.21	76.06	8.09	16.65
Dekalb H104	56.6	72.92	29.12	68.75	21.00	1.440	51.56	47.80	0.64	75.54	7.81	16.42
SR 82	56.0	72.15	30.30	62.30	20.60	1.375	57.18	42.42	0.40	75.84	8.91	17.37
MG 201	53.9	69.44	25.35	70.30	21.60	1.395	25.38	72.74	1.88	74.15	7.28	15.62
NAPB 200	56.6	72.92	30.10	71.45	21.40	1.387	40.34	58.97	0.69	74.96	7.90	15.77
NK 75W 171	56.2	73.41	27.92	72.15	21.50	1.382	27.32	71.70	0.98	74.31	9.92	16.33
R-H 3004	57.5	74.08	27.13	70.10	20.80	1.384	31.83	67.04	1.13	74.52	9.30	15.09
SR 84	57.2	73.70	33.00	60.20	20.60	1.398	67.16	32.61	0.23	76.34	8.69	17.81
NK 75W 355	58.1	74.86	28.36	72.10	20.00	1.398	33.92	65.43	0.65	74.66	7.90	16.76
Sage	56.9	73.31	29.04	72.15	22.40	1.386	37.66	61.65	0.69	74.83	8.43	16.17
Eagle	58.9	75.89	33.68	67.55	21.40	1.403	53.38	46.20	0.42	75.64	7.23	16.42

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 36. LOCATION: Minneola

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	55.6	71.63	25.67	66.80	21.40	1.405	28.09	70.59	1.32	74.32	7.51	17.28
Buckskin	53.2	68.54	23.97	64.65	21.20	1.403	25.53	72.88	1.59	74.17	6.36	18.76
Centurk 68	54.5	70.22	21.91	69.30	21.30	1.402	13.49	82.77	2.74	73.51	7.03	18.07
Larned	56.0	72.15	28.95	62.00	22.70	1.413	40.72	58.62	0.66	74.99	7.47	17.47
Newton	55.3	71.25	27.27	64.30	21.30	1.405	43.15	56.16	0.69	75.11	7.42	17.48
Scout 66	55.7	71.76	29.01	62.30	22.70	1.402	36.42	62.50	1.08	74.75	7.22	16.99
TAM W101	51.3	66.09	25.64	64.70	21.20	1.374	32.90	66.30	0.80	74.60	6.55	17.65
TAM 105	55.4	71.38	28.13	68.70	20.00	1.409	47.05	52.02	0.93	75.29	7.90	17.56
Trison	54.6	70.35	28.88	56.75	21.80	1.371	48.45	50.67	0.88	75.36	6.65	17.79
Vona	54.7	70.47	23.26	65.35	22.30	1.413	19.79	77.61	2.60	73.83	7.51	17.01
Dekalb H104	52.4	67.51	22.96	67.40	18.90	1.394	36.73	62.18	1.09	74.77	8.00	18.43
Rocky	55.0	70.86	24.11	70.55	20.60	1.403	13.10	84.26	2.64	73.50	7.70	18.16
Wings	54.5	70.22	21.69	65.60	22.40	1.397	13.40	82.50	3.10	73.48	6.55	17.33
Parker 76	57.1	73.57	24.26	69.90	21.20	1.402	16.58	82.46	0.96	73.77	8.28	18.87
Dekalb H105	52.0	67.00	25.24	64.55	18.90	1.393	47.85	50.98	1.17	75,32	7.80	18.99

*Moisture 'as is' basis

TABLE 36. Minneola (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	56.2	72.41	28.01	63.80	22.10	1.394	47.11	52.18	0.71	75.31	8.09	18.26
KS 75216	53.8	69.32	27.03	64.85	19.60	1.394	40.99	57.75	1.26	74.97	7.76	19.65
Sage	54.8	70.60	27.77	64.90	22.20	1.409	29.21	69.57	0.72	74.05	7.12	18.01
Eagle	56.6	72.92	29.50	61.65	21.20	1.412	40.77	58.24	0.99	74.97	7.12	17.39
SR 81	52.8	68.03	25.35	60.20	22.10	1.387	38.49	60.10	1.41	74.84	7.22	18.94
SR 4685	51.5	66.35	24.93	59.85	19.40	1.362	46.90	51.30	1.80	75.24	8.00	17.67
SR 5232	50.3	64.81	23.92	65.75	19.60	1.397	45.76	53.07	1.17	75.21	8.19	19.00
SR 818	52.2	67.25	25.40	61.20	22.00	1.373	37.68	60.65	1.67	74.78	7.51	19.30
MG 201	52.8	68.03	24.03	65.45	21.40	1.401	29.13	69.45	1.42	74.37	7.12	17.69
NAPB 200	55.2	71.12	28.97	64.80	20.90	1.390	47.50	51.93	0.57	75.34	8.28	17.81
R-H 3004	54.5	70.22	23.57	66.85	21.80	1.401	25.82	72.11	2.07	74.16	8.14	17.26
R-H 5006	54.3	69.96	25.03	70.05	21.30	1.406	27.31	70.87	1.82	74.26	8.72	17.92
Hart	53.2	68.54	26.63	59.65	25.10	1.385	31.61	66.99	1.40	74.49	7.86	18.42

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 37. LOCATION: Belleville

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	Kernel Size Distrib. OV 9W	Kernel Size Distrib. OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	60.6	78.08	34.98	67.85	21.20	1.408	79.18	20.77	0.05	76.96	11.07	16.06
Buckskin	59.8	77.05	31.71	--	--	--	--	--	--	--	--	15.28
Centurk 78	60.9	78.46	28.36	72.65	22.90	1.409	36.99	62.32	0.69	74.81	10.93	15.52
Larned	60.9	78.46	34.90	68.80	21.80	1.402	66.83	32.89	0.28	76.32	11.17	15.47
Newton	61.0	78.59	32.96	70.50	23.30	1.412	57.09	42.75	0.16	75.84	10.97	14.35
Scout 66	61.5	79.24	36.16	68.85	21.90	1.409	71.57	28.19	0.24	76.56	11.21	15.63
TAM W101	60.1	77.43	29.24	--	--	--	--	--	--	--	--	17.10
TAM 105	60.5	77.95	34.22	--	--	--	--	--	--	--	--	15.69
Sage	61.0	78.59	35.03	66.55	24.00	1.406	67.28	32.56	0.15	76.36	7.37	16.38
Vona	61.2	78.85	32.03	70.20	22.50	1.395	53.23	46.39	0.38	75.64	11.17	15.42
Dekalb H104	60.7	78.21	34.48	68.80	20.30	1.402	69.84	29.88	0.28	76.47	11.02	15.67
Rocky	60.1	77.43	28.65	72.50	22.00	1.401	31.96	67.72	0.31	74.57	10.88	16.26
Wings	61.4	79.11	31.82	69.85	22.30	1.390	55.62	44.11	0.27	75.76	11.21	15.19
Parker 76	62.4	80.40	33.38	68.60	21.90	1.414	63.71	36.24	0.05	76.18	7.37	17.70
Dekalb H105	57.6	74.21	34.51	66.55	20.50	1.387	76.37	23.44	0.19	76.81	10.78	18.94

*Moisture 'as is' basis

TABLE 37. Belleville (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield	Moist.	Protein 14% M.B.
							OV 7W	OV 9W	OV 12W			
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	62.0	79.89	37.64	67.55	23.20	1.403	75.94	23.94	0.12	76.87	11.26	15.51
KS 75216	59.9	77.17	33.87	--	--	--	--	--	--	--	--	15.57
KS 79H69	59.3	76.40	33.12	64.40	20.90	1.382	77.11	22.83	0.06	76.85	10.88	17.53
KS 79H70	58.8	75.76	31.91	62.10	22.40	1.397	67.99	31.81	0.20	76.39	7.03	18.65
SR 5210	58.7	75.63	34.71	63.55	21.40	1,402	81,78	18.15	0.07	77.08	10.68	19.50
SR 4685	58.5	75.37	34.14	--	--	--	--	--	--	--	--	17.20
Eagle	60,6	78,08	35.63	70.85	21,80	1.401	66,21	33.52	0.27	76.29	10.78	16.80
SR 5415	59.4	76.53	32.88	--	--	--	--	--	--	--	--	20.09
MG 201	58.9	75.89	27.74	69.40	23.90	1.410	37.70	61.92	0.38	74.86	7.32	14.84
NAPB 200	60.5	77.95	35.84	68.50	22.60	1.405	73.56	26.32	0.12	76.67	10.78	15.77
SR 5221	58.4	75.24	35.34	--	--	--	--	--	--	--	--	18.54
R-H 3004	61.1	78.72	33.96	--	--	--	--	--	--	--	--	15.78

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 38. LOCATION: Hesston

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	56.2	72.41	26.56	--	--	--	--	--	--	--	--	16.31
Buckskin	56.0	72.15	25.58	70.80	20.20	1.341	34.36	64.70	0.94	74.66	10.64	15.89
Centurk 78	55.8	71.89	24.98	--	--	--	--	--	--	--	--	16.01
Larned	56.4	72.67	28.94	57.80	19.80	1.342	47.46	51.68	0.86	75.32	10.54	15.91
Newton	54.8	70.60	25.63	--	--	--	--	--	--	--	--	14.79
Scout 66	56.1	72.28	28.50	--	--	--	--	--	--	--	--	16.02
TAM W101	55.1	70.99	33.02	--	--	--	--	--	--	--	--	15.83
TAM 105	53.9	69.44	25.84	71.60	19.80	1.337	43.27	55.36	1.37	75.08	10.54	15.05
Trison	57.8	74.47	34.84	--	--	--	--	--	--	--	--	16.19
Vona	56.1	72.28	26.42	--	--	--	--	--	--	--	--	15.73
Triumph 64	57.2	73.70	32.41	--	--	--	--	--	--	--	--	16.65
Rocky	56.2	72.41	25.19	72.15	20.70	1.339	27.47	71.99	0.54	74.34	10.83	16.21
Wings	55.5	71.51	24.09	--	--	--	--	--	--	--	--	15.45
Parker 76	58.2	74.98	27.11	71.00	18.80	1.339	40.38	58.69	0.93	74.96	10.93	17.05
Dekalb H105	55.2	71.12	30.79	68.35	16.70	1.348	66.18	33.46	0.36	76.28	10.73	17.73

*Moisture 'as is' basis

TABLE 38. Hesston (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield	Moist.	Protein 14% M.B.
							OV 7W	OV 9W	OV 12W			
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	57.3	73.82	28.69	--	--	--	--	--	--	--	--	14.40
KS 75216	54.1	69.70	25.50	71.20	19.00	1.347	24.69	73.24	2.07	74.11	10.53	16.23
KS 79H69	54.8	70.60	28.75	67.00	18.00	1.336	59.06	40.66	0.28	75.93	10.68	16.23
Sage	55.8	71.89	31.15	67.75	19.40	1.337	51.48	47.97	0.55	75.54	10.64	16.89
KS 79H79	54.4	70.09	27.63	--	--	--	--	--	--	--	--	16.95
SR 4685	57.8	74.47	33.48	61.80	18.80	1.353	72.57	27.27	0.16	76.62	11.12	16.03
SR 818	55.3	71.25	31.55	--	--	--	--	--	--	--	--	15.22
SR 816	55.0	70.86	29.33	66.80	18.70	1.344	47.10	52.38	0.52	75.32	10.53	17.39
MG 201	52.1	67.12	22.05	73.74	20.50	1.343	18.58	78.30	3.12	73.70	10.73	15.09
NAPB 200	54.2	69.83	28.59	69.60	19.10	1.333	39.68	59.31	1.01	74.92	10.73	15.33
Eagle	54.7	70.47	29.18	--	--	--	--	--	--	--	--	16.86
R-H 3004	57.3	73.82	28.72	--	--	--	--	--	--	--	--	15.24
R-H 5006	56.7	73.05	26.63	72.55	19.80	1.348	31.73	66.84	1.43	74.50	10.78	15.71
SR 817	55.1	70.99	32.19	64.55	19.10	1.346	56.90	42.65	0.45	75.81	10.30	17.54

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 39. LOCATION: Colby, Irrigated

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield	Moist.	Protein 14% M.B.
							OV 7W	OV 9W	OV 12W			
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	57.8	74.47	30.98	68.40	22.30	1.394	53.24	45.65	1.11	75.59	10.40	15.10
Buckskin	58.4	75.24	30.65	71.30	21.20	1.395	53.54	45.08	1.37	75.59	10.73	13.73
Centurk 78	58.1	74.86	27.00	71.20	21.80	1.398	38.21	59.56	2.23	74.78	10.54	14.11
Larned	60.6	78.08	35.81	64.40	22.70	1.400	70.14	29.14	0.72	76.46	10.73	14.21
Newton	59.2	76.27	35.73	64.80	23.00	1.382	69.2	30.21	0.57	76.42	10.54	14.60
Scout 66	59.9	77.17	34.54	65.10	22.60	1.391	66.18	32.87	0.95	76.25	10.88	14.40
TAM W101	56.5	72.79	36.80	63.80	23.70	1.378	70.32	29.26	0.42	76.48	10.54	15.14
TAM 105	58.4	75.24	35.49	68.00	22.50	1.386	65.92	33.33	0.75	76.25	10.45	14.52
SR 84	56.1	72.28	35.22	61.05	23.20	1.366	68.58	30.77	0.65	76.39	10.45	17.09
Vona	56.4	72.67	28.03	69.10	22.80	1.382	41.43	56.31	2.26	74.94	10.45	14.58
SR 83	56.3	72.54	33.26	61.65	23.20	1.375	64.93	34.40	0.67	76.21	10.35	17.03
Rocky	58.5	75.37	27.61	73.50	20.60	1.394	36.72	60.80	2.48	74.69	10.93	14.32
Wings	57.1	73.57	27.39	69.20	23.20	1.383	44.64	53.16	2.20	75.10	10.83	13.76
Dekalb H104	57.9	74.60	32.51	67.40	20.90	1.379	59.90	38.94	1.16	75.92	10.64	14.77
Dekalb H105	56.1	72.28	31.10	66.80	20.60	1.377	59.65	39.15	1.20	75.90	10.26	15.69

*Moisture 'as is' basis

TABLE 39. Colby, Irrigated (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	60.3	77.69	37.10	62.90	22.60	1.385	75.34	24.10	0.56	76.73	10.78	14.85
KS 75216	60.3	77.69	35.37	60.40	22.90	1.403	67.95	31.30	0.75	76.35	8.04	14.73
NK 75W 355	58.9	75.89	30.78	71.30	20.00	1.397	54.60	44.32	1.08	75.66	10.73	15.21
Sage	60.1	77.43	33.26	67.20	22.40	1.399	62.45	36.83	0.72	76.08	10.88	14.63
NK 75W 171	58.8	75.76	29.46	71.85	21.00	1.389	43.74	53.60	2.66	75.02	10.35	14.30
SR 4685	57.9	74.60	34.25	62.05	22.60	1.378	60.38	38.75	0.87	75.97	10.45	14.49
MG 201	56.0	72.15	27.07	70.90	21.80	1.398	43.74	53.60	2.66	75.03	10.64	13.97
NAPB 200	58.4	75.24	35.79	66.70	22.00	1.398	62.93	36.17	0.90	76.09	10.59	14.21
Eagle	59.9	77.17	35.68	66.80	21.80	1.387	67.84	31.63	0.53	76.36	10.54	15.66
R-H 3004	57.5	74.08	28.69	63.80	23.90	1.398	47.35	50.54	2.11	75.24	8.34	14.84
SR 817	55.7	71.76	31.84	60.50	22.70	1.377	61.89	37.16	0.95	76.04	10.21	17.05

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 40. LOCATION: Colby, dry

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	55.4	71.38	30.15	68.50	20.20	1.385	50.18	49.55	0.27	75.49	10.16	16.59
Buckskin	55.5	71.50	27.95	71.00	19.50	1.390	46.27	52.56	1.17	74.71	10.54	15.09
Centurk 78	56.5	72.29	26.94	71.80	19.40	1.395	35.71	62.98	1.31	76.09	10.40	14.35
Larned	58.4	75.24	33.25	70.80	21.50	1.397	62.42	37.03	0.55	76.13	10.54	14.78
Newton	56.4	72.67	32.52	66.45	19.20	1.371	63.38	36.06	0.56	75.89	10.73	15.87
Scout 66	56.7	73.05	31.39	65.00	21.30	1.390	58.65	40.69	0.66	75.68	10.40	15.73
TAM 101	52.0	67.00	29.67	66.30	20.50	1.378	54.42	44.93	0.65	75.43	10.26	16.93
TAM 105	54.3	69.96	28.54	69.45	20.00	1.382	49.89	48.97	1.14	75.29	10.45	15.55
NK 75W 355	56.1	72.28	29.39	70.75	18.70	1.389	46.99	52.18	0.82	75.22	10.45	16.29
Vona	54.1	69.70	27.12	68.50	20.10	1.382	46.02	52.58	1.40	75.43	10.35	15.82
SR 5210	53.9	69.44	27.20	68.30	19.80	1.385	49.48	49.75	0.77	74.60	10.45	16.86
Rocky	57.6	74.21	27.96	72.15	19.80	1.391	33.55	65.11	1.34	74.77	9.78	13.59
Wings	55.4	71.38	26.72	68.40	20.50	1.382	37.89	60.10	2.01	75.93	10.49	15.64
Dekalb H104	54.8	60.60	28.81	67.25	18.00	1.382	59.25	40.19	0.56	75.60	10.54	16.46
Dekalb H105	52.8	68.03	28.43	67.50	18.40	1.389	53.14	45.90	0.96	76.05	9.87	17.10

*Moisture 'as is' basis

TABLE 40. Colby, dry (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	55.7	71.76	31.23	66.10	20.10	1.379	61.79	37.59	0.62	76.05	10.64	16.40
KS 75216	57.2	73.70	32.80	67.75	18.50	1.386	63.59	35.84	0.57	76.14	10.64	16.06
Sandy	60.4	77.82	31.40	71.55	19.00	1.401	53.97	45.41	0.62	75.66	10.78	17.75
Sage	56.9	73.31	31.72	67.00	21.10	1.389	54.10	45.15	0.75	75.66	10.49	15.76
NK 75W 171	55.5	71.51	28.92	70.80	19.80	1.390	37.75	61.37	0.88	74.83	10.16	15.85
SR 4685	55.0	70.86	31.43	64.30	19.40	1.378	58.38	40.90	0.72	75.88	10.54	17.05
SR 5221	53.1	68.41	27.90	66.60	20.40	1.377	56.21	42.89	0.90	75.76	10.45	16.99
SR 4714	52.5	67.64	25.53	68.80	20.20	1.382	42.94	55.85	1.21	75.07	9.97	17.46
MG 201	55.1	70.99	27.50	70.80	20.10	1.386	52.58	46.31	1.11	75.56	10.31	14.68
NAPB 200	55.0	70.86	31.94	65.95	21.10	1.389	59.01	40.28	0.71	75.91	9.72	16.20
Eagle	57.2	73.70	32.98	66.90	19.60	1.389	59.91	39.65	0.44	75.96	10.26	16.73
R-H 3004	53.1	68.41	26.86	67.75	20.60	1.379	41.50	56.95	1.55	74.98	9.72	16.60
Dekalb 554	50.5	65.06	25.63	72.05	18.00	1.386	34.47	63.75	1.77	74.61	10.64	16.35
Duke	55.5	71.51	24.81	72.30	19.00	1.385	24.20	71.86	4.04	74.04	10.02	15.67

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 41. LOCATION: Garden City, Irrigated

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	Kernel Size Distrib. OV 9W	Kernel Size Distrib. OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	61.5	79.24	33.75	67.65	22.70	1.414	67.20	32.74	0.06	76.35	8.72	15.85
Buckskin	61.9	79.75	32.49	72.10	22.50	1.410	56.07	43.85	0.08	75.80	9.20	15.20
Centurk 78	61.2	78.85	27.78	71.50	23.40	1.405	21.54	77.70	0.76	74.03	7.18	15.49
Larned	62.3	80.27	36.50	66.50	23.60	1.403	69.40	30.51	0.09	76.46	7.67	14.98
Newton	62.7	80.78	34.78	67.70	23.60	1.412	64.09	35.69	0.22	76.19	7.70	14.79
Scout 66	62.1	80.00	34.39	67.75	23.50	1.402	57.80	42.04	0.16	75.88	7.96	15.64
TAM 101	60.7	78.20	39.41	64.80	23.20	1.403	85.02	14.97	0.05	77.25	7.57	15.74
TAM 105	61.9	79.75	35.60	71.55	22.40	1.408	69.00	30.80	0.20	76.44	8.05	14.30
NK 75W 355	62.5	80.53	32.82	71.50	23.50	1.414	55.13	44.51	0.36	75.73	8.92	16.09
Vona	62.3	80.26	29.29	69.45	23.80	1.419	34.96	64.33	0.70	74.70	7.86	14.65
Eagle	62.0	79.88	35.06	62.50	21.60	1.406	50.22	49.58	0.70	75.83	9.05	16.10
Rocky	61.6	79.36	27.47	72.40	23.70	1.405	20.77	78.66	0.57	74.00	8.62	15.77
Wings	62.1	80.00	29.81	68.50	24.50	1.410	26.67	73.14	0.19	74.32	7.95	15.40
Sage	61.9	79.75	35.87	66.90	22.90	1.417	68.74	31.07	0.19	76.43	7.95	15.96
Dekalb H105	60.0	77.30	35.38	64.70	20.50	1.403	74.06	25.87	0.07	76.70	8.44	17.58

*Moisture 'as is' basis

TABLE 41. Garden City, Irrigated (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	62.9	81.04	35.87	67.50	23.80	1.402	74.26	25.68	0.06	76.61	8.67	15.60
KS 75216	61.6	79.36	36.46	70.00	21.40	1.412	59.95	39.78	0.27	75.98	7.67	16.36
NK 75W 171	61.9	79.75	33.75	68.35	23.40	1.413	36.72	63.03	0.24	74.81	7.32	15.95
SR 4685	60.4	77.82	33.39	64.30	19.80	1.395	62.54	36.90	0.56	76.09	7.67	15.99
Dekalb 104	61.9	79.75	32.67	63.90	21.80	1.433	52.54	47.06	0.40	75.60	6.79	15.93
Pioneer	61.7	79.49	35.20	67.85	21.40	1.403	72.85	27.01	0.14	76.63	9.01	16.33
MG 201	60.3	77.69	27.93	70.40	23.70	1.424	28.97	28.97	1.10	74.38	7.51	15.23
NAPB 200	62.0	79.88	38.16	66.35	23.40	1.426	78.25	78.25	0.05	76.91	7.90	14.98
R-H 3004	62.6	80.65	32.51	69.85	23.20	1.419	51.58	51.58	0.35	75.55	8.34	14.57

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 42. LOCATION: Garden City, dry

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	60.0	77.30	33.34	65.15	22.00	1.416	67.26	32.52	0.22	76.35	8.81	17.52
Buckskin	60.7	78.20	32.11	65.00	21.50	1.417	57.14	42.41	0.45	75.83	6.89	16.99
Centurk 78	60.7	78.20	29.11	64.70	21.60	1.409	32.47	66.87	0.66	74.58	7.58	17.54
Larned	61.5	79.24	37.42	62.55	21.20	1.390	73.31	26.45	0.24	76.64	8.73	16.46
Newton	60.6	78.08	32.93	63.60	21.30	1.420	65.24	34.47	0.29	76.24	8.67	17.35
Scout 66	60.8	78.33	35.50	63.70	20.80	1.394	61.00	38.89	0.10	76.04	7.72	17.05
TAM 101	55.5	71.51	33.17	65.40	21.20	1.412	56.63	43.15	0.22	75.81	7.80	17.39
TAM 105	61.2	78.85	35.40	67.75	20.20	1.429	73.69	25.73	0.58	76.65	8.81	16.03
NK 75W 355	58.9	75.89	30.63	65.60	20.70	1.410	47.02	51.38	1.60	75.25	9.08	18.33
SR 817	50.3	64.81	24.75	66.75	15.90	1.373	23.71	75.28	1.01	74.12	6.61	18.72
Eagle	60.0	77.30	34.46	67.05	19.80	1.414	51.49	48.40	0.11	75.56	8.19	18.33
Rocky	60.3	77.69	27.06	66.40	21.80	1.414	22.43	76.62	0.95	74.06	6.79	17.33
Wings	60.0	77.30	29.83	64.40	20.80	1.405	39.48	59.77	0.75	74.92	9.00	16.56
Sage	59.9	77.15	33.79	64.85	21.50	1.410	60.50	39.36	0.14	76.02	8.52	17.88
Dakalb H105	54.4	70.09	30.29	57.50	17.80	1.403	32.47	66.87	0.66	74.58	6.60	18.90

*Moisture 'as is' basis

TABLE 42. Garden City, dry (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	59.5	76.66	29.45	61.50	21.80	1.413	46.72	52.00	1.28	75.26	7.94	16.65
KS 75216	59.9	77.17	34.13	68.25	16.90	1.409	60.63	38.57	0.80	75.98	8.48	18.86
NK 75W 171	60.3	77.69	31.60	63.10	22.20	1.423	33.92	65.89	0.19	74.68	7.22	17.88
Buckskin Extra	60.8	78.33	35.42	60.60	22.10	1.413	67.07	32.90	0.03	76.35	7.20	18.03
SR 83	49.9	64.29	23.45	65.10	17.20	1.369	26.68	72.36	0.46	74.33	6.60	19.17
SR 4685	47.3	60.94	20.87	61.60	13.40	1.358	34.27	64.62	1.11	74.65	7.95	17.31
Dekalb H104	58.7	75.63	31.96	62.90	19.30	1.408	59.43	40.42	0.15	75.96	8.45	16.99
Pioneer	58.2	74.98	32.21	63.55	17.80	1.412	62.37	37.41	0.22	76.10	7.75	18.13
MG 201	58.2	74.98	27.25	66.45	20.60	1.416	40.76	57.95	1.29	74.96	7.66	17.59
NAPB 200	58.3	75.11	36.70	60.55	22.30	1.412	75.69	23.80	0.51	76.75	8.33	17.86
R-H 3004	59.8	77.05	32.42	59.20	21.50	1.417	59.21	40.55	0.24	75.95	7.00	16.17

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 43. LOCATION: Tribune Dryland

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	60.9	78.46	35.61	57.00	18.80	1.383	81.10	18.36	0.54	77.02	9.92	13.16
Buckskin	61.1	78.72	35.20	57.65	19.20	1.383	74.40	25.46	0.14	76.71	9.53	12.27
Centurk 78	60.9	78.46	32.69	57.15	20.80	1.365	69.84	30.00	0.16	76.48	7.80	11.75
Larned	61.1	68.72	34.30	53.95	19.80	1.375	80.16	19.15	0.69	76.96	10.11	12.61
Newton	60.9	78.46	36.43	55.00	19.50	1.374	79.95	19.60	0.45	76.97	10.11	13.35
Scout 66	61.2	78.85	36.93	54.15	19.70	1.378	95.77	24.07	0.16	76.77	10.25	13.44
TAM W101	60.2	77.56	37.82	59.70	19.40	1.367	85.47	14.20	0.33	77.25	9.97	13.52
TAM 105	60.9	78.46	35.58	54.85	19.00	1.370	83.24	16.39	0.37	77.13	9.77	12.28
Dekalb H104	60.5	77.95	35.46	50.00	19.10	1.375	76.90	22.64	0.46	76.82	9.87	14.09
Vona	61.7	79.49	35.61	59.35	19.70	1.374	79.68	20.15	0.16	76.97	9.82	11.42
Eagle	61.0	78.59	35.48	56.60	19.40	1.382	74.41	25.43	0.16	76.71	9.10	13.22
Rocky	60.9	78.46	31.69	62.90	19.10	1.361	66.94	32.46	0.60	76.31	10.45	10.87
Wings	61.6	79.36	33.30	55.45	20.40	1.371	73.13	26.78	0.90	76.65	10.31	11.99
Dekalb 554	60.7	78.21	36.50	56.00	19.40	1.383	81.45	18.47	0.08	77.06	9.63	11.96
Dekalb H105	59.5	76.66	37.43	51.90	18.50	1.375	82.38	17.37	0.25	77.10	11.02	14.71

*Moisture 'as is' basis

TABLE 43. Tribune Dryland (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	60.6	78.08	35.18	54.50	20.30	1.367	81.94	17.87	0.19	77.09	10.11	14.73
KS 75216	60.3	77.69	35.68	53.65	17.50	1.373	77.77	21.76	0.47	76.86	9.10	14.52
Sage	60.8	78.33	36.79	53.95	18.90	1.373	79.83	19.99	0.18	76.98	10.35	13.33
NK 75W 171	69.9	78.46	33.70	57.95	20.10	1.373	70.64	29.17	0.19	76.52	10.20	12.72
SR 4685	59.1	76.14	31.58	54.35	18.20	1.367	76.40	23.46	0.14	76.81	10.06	14.14
NK 75W 355	62.1	80.00	37.92	58.55	18.30	1.387	83.22	16.73	0.05	77.15	9.97	13.67
Duke	62.0	79.88	38.35	60.60	18.30	1.382	64.46	24.42	0.12	76.26	10.25	12.16
MG 201	60.2	77.56	32.12	59.25	20.10	1.365	74.83	24.97	0.20	76.73	10.45	11.78
NAPB 200	61.2	78.85	40.57	55.80	20.00	1.369	87.23	12.32	0.45	77.33	10.30	12.15
Sandy	62.1	80.00	35.01	58.85	18.80	1.370	76.83	22.65	0.52	76.81	10.45	10.54
R-H 3004	61.7	79.49	36.10	55.85	19.30	1.383	81.44	18.34	0.22	77.06	10.11	12.80
R-H 5006	60.7	78.21	33.45	55.65	19.00	1.369	74.51	25.15	0.34	76.71	10.16	11.39

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 44. LOCATION: Tribune Irrigated

WHEAT DATA

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
Bennett	60.7	78.21	30.01	62.00	21.00	1.385	53.92	45.36	0.72	75.65	8.91	14.28
Buckskin	59.8	77.05	25.74	62.55	20.80	1.379	35.84	62.93	1.23	74.72	8.72	14.24
Centurk 78	61.1	78.72	25.66	65.00	21.00	1.385	25.30	73.63	1.07	74.20	8.63	14.22
Larned	61.4	79.11	31.65	60.75	22.20	1.393	62.57	36.98	0.45	76.10	9.49	13.74
Newton	60.1	77.43	29.81	65.40	21.40	1.378	40.41	58.43	1.16	74.95	9.87	13.68
Scout 66	60.4	77.82	30.78	67.75	20.90	1.402	57.80	42.04	0.16	75.88	7.96	14.27
TAM W101	61.2	78.85	37.80	61.10	21.30	1.383	73.85	25.70	0.45	76.66	7.92	14.35
TAM 105	60.2	77.56	30.77	62.75	21.10	1.382	56.38	42.98	0.64	75.78	8.63	14.52
Dekalb H104	60.9	78.46	29.65	58.00	21.00	1.371	57.52	41.90	0.58	75.83	9.40	14.54
Vona	62.1	80.00	30.14	62.85	23.20	1.379	47.25	51.95	0.80	75.31	8.68	13.38
Eagle	61.3	78.98	31.72	62.70	21.10	1.379	50.14	49.23	0.63	75.47	9.25	15.11
Rocky	60.2	77.56	25.57	53.25	20.90	1.385	22.46	75.99	1.55	74.03	8.82	15.01
Wings	61.3	78.98	29.65	58.85	21.60	1.391	51.00	48.19	0.81	75.49	9.49	13.76
Dekalb H105	60.1	77.43	33.72	54.55	21.10	1.374	63.38	35.94	0.68	76.12	7.95	15.64

*Moisture 'as is' basis

TABLE 44. Tribune Irrigated (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib. OV 7W	OV 9W	OV 12W	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%	%	%	%
KS 75210	61.6	79.36	31.93	59.00	22.70	1.373	58.13	41.32	0.55	75.87	8.89	14.95
KS 75216	60.6	78.08	32.57	63.00	19.20	1.371	47.78	51.56	0.66	75.34	9.59	15.41
Sage	61.1	78.72	29.58	62.20	21.50	1.365	49.96	49.43	0.61	75.45	9.20	14.60
NK 75W 171	61.8	79.62	28.64	65.95	21.60	1.375	43.20	56.20	0.60	75.12	9.78	14.44
SR 4685	60.3	77.69	31.16	53.75	20.00	1.366	62.60	36.30	1.10	76.06	9.30	15.19
NK 75W 355	62.1	80.00	30.01	65.30	20.80	1.378	51.00	48.13	0.87	75.50	9.55	14.73
SR 82	60.3	77.69	32.59	51.80	22.40	1.369	62.19	37.03	0.78	76.06	8.49	16.57
MG 201	57.9	74.60	33.98	66.00	22.40	1.391	21.76	76.34	1.90	73.97	9.10	14.51
NAPB 200	61.8	79.62	34.06	60.75	22.50	1.389	67.18	32.29	0.53	76.33	9.16	13.78
R-H 3004	62.3	80.27	30.18	61.55	21.40	1.409	52.07	47.28	0.65	75.56	8.55	14.14
R-H 5006	60.6	78.08	28.57	66.00	21.30	1.356	36.78	62.04	1.14	74.74	9.20	14.32

*Moisture 'as is' basis

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TABLE 45. VARIETY AVERAGES

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
Bennett	58.3	75.11	31.70	66.64	21.04	1.351	76.09	9.74	15.64
Buckskin	58.3	75.11	29.97	67.79	20.67	1.384	75.50	9.22	15.12
Centurk 78	58.6	75.50	27.83	68.51	21.64	1.386	74.85	8.66	14.83
Larned	59.4	76.53	33.76	65.19	21.83	1.389	76.17	9.64	14.76
Newton	58.9	75.89	32.24	66.32	21.87	1.386	76.00	9.70	14.84
Scout 66	59.4	76.53	33.49	65.44	21.48	1.390	76.14	9.73	15.16
TAM W101	57.5	74.08	35.08	65.39	21.55	1.383	76.64	9.23	15.74
TAM 105	58.6	75.50	32.02	68.62	20.94	1.383	76.02	9.77	14.62
Vona	58.9	75.89	29.11	67.86	21.94	1.382	75.29	9.55	14.59
Rocky	58.6	75.50	28.31	69.44	21.31	1.383	74.68	9.28	15.21
Wings	59.3	76.40	29.13	66.67	22.17	1.384	75.29	9.96	14.72
Dekalb H105	56.7	72.54	32.81	65.13	19.43	1.379	76.26	9.65	16.81
KS 75210	59.5	76.66	33.32	64.54	22.30	1.379	76.39	9.85	15.40
KS 75216	58.1	74.86	32.33	67.53	19.21	1.384	75.75	9.62	15.69
SR 4685	56.9	73.31	31.37	61.52	19.31	1.369	76.16	9.64	15.56
MG 201	56.5	72.79	27.77	69.18	21.29	1.385	75.03	9.63	15.00
NAPB 200	58.8	75.76	35.26	65.64	21.25	1.389	76.40	9.69	15.02
R-H 3004	58.9	75.89	30.64	65.12	21.84	1.390	75.59	9.16	14.81

*Moisture 'as is' basis

TABLE 45. VARIETY AVERAGES (Continued)

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
Sage	59.1	76.14	32.57	65.67	21.34	1.387	75.82	9.27	15.52
Eagle	59.4	76.53	33.98	64.72	20.76	1.394	76.06	9.29	15.89
R-H 5006	58.7	75.63	29.76	67.94	20.59	1.372	75.59	10.15	14.51
Dekalb H104	58.2	74.98	30.85	63.82	20.03	1.398	75.87	9.17	15.92
Parker 76	60.2	77.56	30.65	69.56	20.92	1.383	75.79	9.79	17.00
KS 74 H69	57.0	73.44	30.86	64.63	20.20	1.369	76.40	10.13	15.56
KS 74 H70	57.4	73.95	31.28	64.56	20.63	1.366	76.52	9.93	15.87
Triumph 64	59.4	76.53	34.92	59.49	22.21	1.369	76.84	9.42	15.46
NK 75W 171	59.3	76.40	30.54	59.02	21.37	1.390	75.04	9.23	15.35
NK 75W 355	60.2	77.56	32.12	68.41	20.64	1.397	75.80	9.37	15.18
Trison	58.6	75.50	36.55	60.15	21.60	1.368	76.95	9.67	15.69
SR 4624	57.5	74.08	33.10	66.93	16.87	1.371	76.84	11.17	16.97
SR 5232	53.5	68.93	27.64	66.52	19.00	1.383	75.86	9.63	17.92
SR 5466	58.9	75.89	33.31	65.25	19.07	1.360	76.48	11.03	17.46
SR 5471	60.0	77.30	35.13	64.95	20.70	1.363	76.74	9.84	16.46
SR 5415	57.8	74.47	31.81	68.00	18.70	1.347	75.75	11.37	20.05
SR 5221	55.6	71.63	31.91	67.00	19.30	1.363	76.16	10.82	18.12
SR 5210	56.3	72.54	30.95	65.92	21.60	1.393	76.25	10.56	18.18

*Moisture 'as is' basis

TABLE 45. VARIETY AVERAGES (Continued)

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%
SR 81	55.3	71.25	30.31	60.80	21.90	1.370	75.83	9.51	17.45
SR 82	58.2	74.98	31.44	57.05	21.60	1.372	75.95	8.70	16.97
SR 83	53.1	73.70	28.35	63.37	20.20	1.372	75.27	8.47	18.10
SR 84	57.2	73.70	34.68	60.33	22.00	1.375	76.54	10.10	16.59
SR 816	55.4	71.38	29.74	64.05	19.65	1.361	75.53	9.38	17.46
SR 817	55.4	71.38	29.59	62.52	19.23	1.361	75.92	10.25	17.29
SR 818	55.1	70.99	30.38	59.29	22.75	1.366	75.62	8.66	17.01
Pioneer	60.1	79.43	34.66	66.02	20.13	1.405	76.57	9.16	14.85
PL 145	56.4	72.66	30.73	73.95	19.00	1.373	75.42	10.54	16.23
Duke	58.8	75.76	31.68	66.45	18.65	1.383	75.15	10.13	13.91
Sandy	61.2	78.85	33.20	65.20	18.90	1.385	76.24	10.61	14.14
Dekalb 554	55.6	71.63	31.06	64.02	18.70	1.384	75.83	10.13	14.15
Payne	58.1	74.86	29.82	75.00	19.90	1.374	74.66	9.39	16.59
Dekalb H97	58.1	74.86	32.84	68.85	22.10	1.368	76.02	11.46	14.14
SR 4714	56.6	72.92	26.82	70.15	22.45	1.386	74.95	9.48	16.41
Pike	57.0	73.44	31.86	59.67	32.03	1.382	76.20	10.30	14.43
Hart	55.4	71.38	32.32	59.59	27.25	1.364	76.09	10.13	16.12

*Moisture 'as is' basis

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TABLE 46. LOCATION AVERAGES

Location	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
Manhattan	55.8	71.89	31.03	69.60	19.03	1.362	75.92	11.08	18.36
St. Johns	58.4	75.24	33.50	65.12	19.30	1.356	76.60	11.07	15.86
Hutchinson	61.5	79.24	36.45	66.20	21.29	1.394	77.01	10.44	10.54
Powhattan	58.3	75.11	32.09	62.43	24.19	1.367	76.14	10.76	13.75
Tribune Dry	60.9	78.46	35.42	56.32	19.28	1.374	76.86	9.97	12.76
Tribune Irrig.	60.8	78.33	30.64	61.31	21.38	1.380	75.45	8.98	14.53
Hays	56.8	73.18	29.13	68.91	21.29	1.389	75.08	8.25	16.11
Hesston	55.7	61.76	28.39	69.11	19.23	1.342	75.14	10.68	16.06
Minneola	54.1	69.70	25.75	64.70	21.31	1.396	74.60	7.54	18.04
Parsons	59.9	77.17	33.12	70.20	22.73	1.378	76.07	9.00	16.10
Belleville	60.2	77.56	33.28	68.32	22.15	1.402	76.17	10.20	16.53
Colby Irrig.	58.1	74.86	32.36	66.54	22.23	1.388	75.83	10.39	14.88
Colby Dry	55.3	71.25	29.19	68.65	19.79	1.386	75.43	10.34	16.06
Garden City Irrig.	61.7	79.49	33.60	68.04	22.80	1.411	75.78	8.07	15.60
Garden City Dry	58.3	75.11	31.36	63.97	20.12	1.406	75.52	7.78	17.62

*Moisture 'as is' basis

ENVIRONMENTAL SERIES 1981

TABLE 47. LOCATION AVERAGES
(Soft wheat varieties excluded)

Location	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
Manhattan	55.9	72.02	31.01	70.02	18.56	1.361	75.88	11.03	18.48
St. Johns	58.4	75.24	33.50	65.12	19.30	1.356	76.60	11.07	15.86
Hutchinson	61.5	79.24	36.45	66.20	21.29	1.394	77.01	10.44	10.54
Powhattan	58.5	75.37	32.11	63.04	23.44	1.368	76.14	10.73	13.80
Tribune Dry	60.9	78.46	35.42	56.32	19.28	1.374	76.86	9.97	12.76
Tribune Irrig.	60.8	78.33	30.64	61.31	21.38	1.380	75.45	8.98	14.53
Hays	56.80	73.18	29.13	68.91	21.29	1.389	75.08	8.25	16.11
Hesston	55.7	71.76	28.39	69.11	19.23	1.342	75.14	10.68	16.06
Minneola	54.1	79.70	25.72	64.89	21.17	1.396	74.60	7.53	18.03
Parsons	60.0	77.30	32.92	70.84	22.22	1.378	76.37	9.01	16,18
Belleville	60.2	77.56	33.28	68.32	22.15	1.402	76.17	10.20	16.53
Colby, Irrig.	58.1	74.86	32.36	66.54	22.23	1.388	75.83	10.39	14.88
Colby, Dry	55.3	71.25	29.19	68.65	19.79	1.386	75.43	10.34	16.06
Garden City Irrig.	61.7	79.49	33.60	68.04	22.80	1.411	75.78	8.07	15.60
Garden City Dry	58.3	75.11	31.36	63.97	20.12	1.406	75.52	7.78	17.62

*Moisture 'as is' basis

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TABLE 48. VARIETY AVERAGES[1]

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
Bennett	58.9	75.89	32.07	66.64	21.04	1.390	76.09	9.74	15.59
Buckskin	58.4	75.24	30.31	67.56	20.71	1.387	75.56	9.11	15.06
Centurk 78	58.9	75.89	28.03	68.51	21.65	1.386	74.85	8.66	14.75
Larned	59.5	76.66	34.10	65.00	21.98	1.392	76.23	9.58	14.68
Newton	59.2	76.27	32.71	66.32	21.87	1.386	76.00	9.70	14.84
Scout 66	59.7	76.92	33.85	65.44	21.48	1.390	76.14	9.73	15.10
TAM W101	57.7	74.34	35.24	65.39	21.55	1.383	76.74	9.23	15.73
TAM 105	59.0	76.02	32.49	68.40	21.03	1.386	76.09	9.71	14.59
Vona	58.9	75.89	29.32	67.86	21.94	1.382	75.29	9.55	14.50
Rocky	58.7	75.63	28.53	69.25	21.35	1.386	74.70	9.17	15.14
Wings	59.5	76.66	29.49	66.67	22.17	1.384	75.29	9.96	14.67
Dekalb H105	56.9	73.31	32.95	64.90	19.62	1.381	76.26	9.56	16.74
KS 75210	59.7	76.92	33.65	64.54	22.30	1.379	76.39	9.85	15.47
KS 75216	58.4	70.60	32.75	67.25	19.22	1.387	75.88	9.55	15.65
SR 4685	56.9	73.31	31.21	61.50	19.35	1.373	76.12	9.53	15.52

*Moisture 'as is' basis

1 = Varieties grown in all the locations.

TABLE 48. VARIETY AVERAGES (Continued)

Variety	Test Weight lbs/bu	Hectol. Weight kg	1000 K.W. 14% M.B. gms	Pearling Value % *	P.S.I. % *	Density gms/cc	Theor. Yield %	Moist. %	Protein 14% M.B. %
MG 201	57.2	73.70	28.18	68.85	21.35	1.388	75.01	9.55	14.99
NAPB 200	59.1	76.14	35.74	65.36	21.40	1.393	76.51	9.62	15.00
R-H 3004	59.1	76.14	30.79	65.12	21.84	1.390	75.59	9.16	14.78
Sage	59.4	76.53	32.70	65.48	21.52	1.391	75.84	9.14	15.39
Eagle	59.8	77.05	34.46	64.72	20.67	1.394	76.06	9.29	15.79

*Moisture 'as is' basis

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TABLE 49. LOCATION AVERAGES[2]

Location	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Theor. Yield	Moist.	Protein 14% M.B.
	lbs/bu	kg	gms	% *	% *	gms/cc	%	%	%
Manhattan	55.5	71.51	30.48	71.07	18.64	1.361	75.66	10.82	18.52
St. Johns	58.7	75.63	33.95	65.80	19.61	1.359	76.50	11.08	16.25
Hutchinson	61.5	79.24	36.45	66.71	21.57	1.395	76.94	9.90	10.29
Powhattan	58.4	75.24	31.14	64.84	23.94	1.370	75.88	10.73	13.17
Tribune, Dry	60.8	78.33	35.30	56.15	19.38	1.373	76.89	9.93	12.90
Tribune, Irrig.	60.8	78.33	30.82	61.29	21.36	1.383	75.45	8.90	14.44
Hays	56.7	73.05	29.09	70.51	21.41	1.389	74.95	8.16	15.66
Minneola	54.4	70.09	25.93	65.05	21.23	1.399	74.56	7.43	17.82
Parsons	60.0	77.30	32.75	71.67	22.15	1.382	76.02	9.01	15.95
Belleville	60.4	77.82	33.13	69.33	22.42	1.403	76.02	10.49	15.94
Colby, Irrig.	58.4	75.24	32.42	66.82	22.35	1.390	75.81	10.38	14.58
Colby, Dry	55.5	71.51	29.85	68.12	20.04	1.385	75.55	10.31	15.82
Garden City, Irrig.	61.7	79.49	33.59	68.12	22.86	1.410	75.80	8.08	15.51
Garden City, Dry	58.9	75.89	31.85	63.98	20.42	1.408	75.62	7.97	17.36

*Moisture 'as is' basis

2 = Locations where the 20 representative varieties are grown.

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Wheat Blends Data

TABLE 50. Location Blends

Location	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield
	lbs/bu	kg	gms	% *	% *	gms/cc	OV 7W%	OV 9W%	OV 12W%	%
Manhattan	58.3	75.11	30.35	72.75	16.00	1.383	55.65	44.15	0.20	75.77
St. Johns	59.8	77.05	33.89	68.20	17.00	1.383	68.57	31.40	0.03	76.43
Hutchinson	64.3	82.84	35.69	68.95	18.50	1.403	78.20	21.61	0.19	76.90
Powhattan	59.9	77.17	30.91	66.75	22.10	1.385	59.80	40.06	0.14	75.98
Tribune, Dry	62.1	80.01	36.81	58.75	18.60	1.391	50.67	49.15	0.18	75.52
Tribune, Irrig.	62.9	81.04	30.93	63.70	20.00	1.398	78.00	21.95	0.05	76.90
Hays	58.0	74.73	29.19	60.60	19.90	1.417	37.76	61.90	0.34	74.87
Minneola	55.8	71.89	26.75	66.90	17.90	1.401	32.99	66.58	0.43	74.62
Parsons	63.4	81.68	29.93	73.25	19.60	1.405	61.08	38.71	0.21	76.04
Belleville	62.0	79.88	32.22	71.40	20.20	1.414	60.58	39.32	0.10	76.02
Colby, Irrig.	59.6	76.79	33.30	68.40	19.20	1.410	59.87	39.86	0.27	75.98
Colby, Dry	56.2	72.41	30.07	68.50	20.30	1.385	50.24	49.44	0.32	75.49
Garden City, Irrig.	63.8	82.20	33.16	69.90	19.60	1.427	55.45	44.38	0.17	75.76
Garden City, Dry	61.6	79.36	33.26	66.30	18.10	1.414	54.48	45.25	0.27	75.71

*Moisture 'as is' basis

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Wheat Blends Data

TABLE 51. Variety Blends

Variety	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield
	lbs/bu	kg	gms	% *	% *	gms/cc	OV 7W%	OV 9W%	OV 12W%	%
Bennett	59.5	76.66	32.06	67.45	19.20	1.405	64.10	35.49	0.41	76.18
Buckskin	59.3	76.40	30.92	69.00	18.80	1.405	54.92	44.78	0.30	75.73
Centurk 78	59.3	76.40	26.86	69.80	19.20	1.397	36.11	62.98	0.91	74.75
Larned	60.4	77.82	34.45	66.00	19.80	1.412	67.76	32.14	0.09	76.37
Newton	60.9	78.46	33.08	68.50	19.50	1.395	62.68	37.19	0.13	76.13
Scout 66	60.5	77.95	33.70	66.00	19.50	1.405	64.63	35.24	0.13	76.22
TAM W101	58.1	74.86	35.61	66.85	19.90	1.395	74.73	25.23	0.04	76.73
TAM 105	60.4	77.82	32.85	69.50	18.70	1.406	64.19	35.66	0.15	76.20
Vona	59.9	77.17	28.77	69.10	19.90	1.399	48.26	51.52	0.22	75.40
Rocky	60.4	77.82	27.65	71.40	19.30	1.405	36.18	63.54	0.28	74.79
Wings	60.3	77.69	28.94	67.85	20.20	1.398	48.50	51.25	0.25	75.41
Dekalb H105	58.4	75.24	33.70	65.75	17.80	1.391	67.60	32.32	0.08	76.37
KS 75210	60.4	77.82	34.51	65.75	20.10	1.395	70.90	28.96	0.14	76.54
KS 75216	58.7	75.63	33.01	68.60	17.10	1.397	59.60	40.27	0.13	75.97
SR 4685	58.3	75.11	32.17	63.50	17.30	1.389	65.41	34.44	0.15	76.26

*Moisture 'as is' basis

TABLE 51. Variety Blends (Continued)

	Test Weight	Hectol. Weight	1000 K.W. 14% M.B.	Pearling Value	P.S.I.	Density	Kernel Size Distrib.			Theor. Yield
Variety	lbs/bu	kg	gms	% *	% *	gms/cc	OV 7W%	OV 9W%	OV 12W%	%
MG 201	58.1	74.86	27.79	70.50	19.50	1.398	45.18	54.44	0.38	75.23
NAPB 200	59.8	77.05	35.18	66.40	18.90	1.405	70.50	29.38	0.12	76.52
R-H 3004	60.3	77.69	30.78	67.00	19.80	1.402	54.86	44.97	0.17	75.73
Sage	60.0	77.3	32.48	67.25	18.70	1.405	60.20	39.73	0.07	76.00
Eagle	61.2	78.85	33.52	66.80	19.10	1.405	63.49	36.37	0.14	76.16

*Moisture 'as is' basis

ENVIRONMENTAL SOILS 1981

Wheat Blends Data

TABLE 52. Location Blends

Location	Moisture %	Protein 14% M.B. %	Ash 14% M.B. %
Manhattan	10.5	17.58	1.54
St. Johns	10.9	14.96	1.64
Hutchinson	10.0	10.32	1.53
Powhattan	10.6	12.70	1.63
Tribune, Dry	10.0	12.33	1.62
Tribune, Irrigated	8.8	13.67	1.60
Hays	8.2	14.99	1.78
Minneola	7.6	16.19	2.05
Parsons	9.2	14.68	1.42
Belleville	10.3	14.76	1.53
Colby, Irrigated	10.2	13.60	1.72
Colby, Dry	10.1	14.83	1.82
Garden City, Irrigated	8.3	14.25	1.59
Garden City, Dry	8.1	15.72	1.78

ENVIRONMENTAL SERIES 1981

Wheat Blends Data

TABLE 53. Variety Blends

Variety	Moisture %	Protein 14% M.B. %	Ash 14% M.B. %
Bennett	9.6	14.36	1.71
Buckskin	8.9	13.97	1.60
Centurk 78	8.7	13.75	1.60
Larned	9.6	13.79	1.71
Newton	9.8	14.11	1.72
Scout 66	9.8	14.30	1.62
TAM W101	9.2	14.60	1.70
TAM 105	9.8	13.73	1.62
Vona	9.9	13.65	1.72
Rocky	9.3	13.94	1.61
Wings	9.8	14.01	1.72
Dekalb H105	9.7	15.62	1.81
KS 75210	9.9	14.51	1.72
KS 75216	9.9	14.60	1.72
SR 4685	9.8	14.59	1.72
MG 201	9.4	14.05	1.71
NAPB 200	9.7	14.09	1.62
R-H 3004	9.2	13.73	1.61
Sage	9.3	14.41	1.71
Eagle	9.4	14.81	1.71

ENVIRONMENTAL SERIES 1981

Table 54. Milling Data for the Location Blends

Location	Flour-Yield %	Bran %	Shorts %	Protein (14% M.B.) %	Ash (14% M.B.) %	Milling-Rating	Ash-Value
Manhattan	68.81	19.67	11.72	16.61	0.48	20.81	0.70
St. Johns	70.68	18.40	10.92	13.50	0.46	24.68	0.65
Hutchinson	71.82	19.22	8.96	9.41	0.56	15.32	0.78
Powhattan	71.46	18.66	9.88	11.95	0.41	30.46	0.57
Tribune, Dry	71.03	17.47	11.50	11.68	0.46	25.03	0.65
Tribune, Irrig.	71.49	18.67	9.84	12.72	0.42	29.49	0.59
Hays	70.09	19.04	10.87	13.88	0.49	21.09	0.70
Minneola	66.17	21.12	12.21	15.70	0.51	15.17	0.77
Parsons	70.18	18.80	11.02	13.55	0.42	28.18	0.60
Belleville	72.17	18.72	9.10	13.60	0.41	31.17	0.57
Colby, Irrig.	71.42	18.37	10.23	12.31	0.45	26.42	0.63
Colby, Dry	69.63	19.73	10.65	13.60	0.47	22.63	0.67
Garden City, Irrig.	70.84	18.72	10.44	13.20	0.42	28.84	0.59
Garden City, Dry	67.25	19.18	13.57	15.10	0.50	17.25	0.74

ENVIRONMENTAL SERIES 1981

Table 55. Milling Data for the Variety Blends

Variety	Flour-Yield %	Bran %	Shorts %	Protein (14% M.B.) %	Ash (14% M.B.) %	Milling-Rating	Ash-Value
Bennett	72.14	19.54	8.32	13.71	0.42	30.14	0.58
Buckskin	71.40	19.37	9.23	13.27	0.46	25.40	0.64
Centurk 78	69.66	20.79	9.55	12.80	0.43	26.66	0.62
Larned	71.33	19.56	9.11	13.02	0.43	28.33	0.60
Newton	69.21	21.55	9.24	13.09	0.43	26.21	0.62
Scout 66	70.57	19.49	9.94	13.35	0.40	30.57	0.57
TAM W101	68.00	21.44	11.40	13.91	0.45	23.00	0.66
TAM 105	69.56	20.56	9.88	12.38	0.42	27.56	0.60
Vona	69.51	21.37	9.11	12.91	0.41	28.51	0.59
Rocky	69.81	20.70	9.49	13.06	0.40	29.81	0.57
Wings	68.07	21.63	10.30	12.54	0.40	28.07	0.59
Dekalb H105	68.00	21.26	10.74	14.97	0.45	23.00	0.66
KS 75210	69.49	20.44	10.07	13.31	0.44	25.49	0.63
KS 75216	68.79	19.82	11.39	13.61	0.46	22.79	0.67
SR 4685	67.31	21.67	11.20	13.41	0.43	24.13	0.64
MG 201	68.44	20.80	10.75	13.22	0.45	23.44	0.66
NAPB 200	70.88	19.41	9.71	12.95	0.46	24.88	0.65
R-H 3004	69.46	20.91	9.63	12.86	0.42	27.46	0.60
Sage	69.58	19.85	10.57	13.74	0.45	24.58	0.65
Eagle	70.82	19.61	9.57	13.70	0.43	27.82	0.61

ENVIRONMENTAL SERIES 1981

Table 56. Flour Quality Analysis for the Variety Wheat Blends.

Variety	Protein 14% M.B. %	Wet Gluten %	Dry Gluten %	FARINOGRAPH DATA: Absorption 14% M.B. %	Peak time min.	Stability min.	Valorimeter	BAKING TEST: Mixing time min.	Loaf Volume c.c.	Score %
Bennett	13.42	37.42	13.85	66.8	9.8	16.8	80	4 1/4	3150	78
Buckskin	13.27	36.55	13.50	64.7	10.4	18.8	82	4.0	3075	82
Centurk 78	12.80	32.47	12.85	64.6	14.0	27.6	90	5.0	2700	76
Larned	13.02	36.70	13.10	66.0	6.0	10.8	66	2 3/5	3025	86
Newton	13.09	35.10	13.08	64.0	7.0	12.8	70	4 1/2	3200	78
Scout 66	13.35	37.20	13.40	63.2	5.7	12.0	66	3 1/2	3000	76
TAM W101	13.91	37.80	14.12	69.0	7.5	10.4	69	3 1/4	3300	80
TAM 105	12.38	34.60	12.46	65.0	6.0	12.0	66	3 1/2	2700	78
Vona	12.91	35.35	13.20	70.6	7.0	28.5	74	4 1/4	3100	78
Rocky	13.06	34.50	13.20	64.4	21.0	31.6	98	6.0	2900	76
Wings	12.54	32.34	12.54	62.8	10.0	20.7	82	3 1/4	3000	76
Dekalb H105	14.97	37.05	14.61	70.6	10.5	10.0	78	3 1/2	3400	80
KS 75210	13.31	37.00	13.60	66.8	6.5	11.8	68	3 3/4	3300	88
KS 75216	13.61	39.60	13.96	67.0	6.5	8.5	64	2 3/4	3050	78
SR 4685	13.41	37.50	13.60	70.6	6.5	7.0	61	3 3/4	2900	74
MG 201	13.22	37.50	13.32	64.0	9.0	16.5	78	3 1/4	2900	84
NAPB 200	12.95	33.95	13.02	61.8	15.5	23.5	91	4 1/2	2800	72
R-H 3004	12.68	35.18	13.07	65.8	8.5	20.5	78	4 1/2	2900	72
Sage	13.74	38.40	13.60	66.8	6.0	13.0	67	3 1/2	3000	84
Eagle	13.70	35.60	13.98	64.0	7.0	14.50	76	3 3/4	3150	82

ENVIRONMENTAL SERIES 1981

Table 57. Flour Quality Analysis for the Location Wheat Blends.

Location	Protein %14% M.B.	Wet %Gluten	Dry %Gluten	FARINOGRAPH DATA Absorption %14% M.B.	Peak time min.	Stability min.	Valorimeter	BAKING TEST Mixing time min.	Loaf Volume c.c.	Score %
Manhattan	16.61	48.60	17.03	72.0	21.4	19.0	97	5 1/4	3500	80
St. Johns	13.50	38.40	13.77	66.5	8.6	11.0	75	3 1/4	3050	84
Hutchinson	9.41	24.50	8.74	63.3	5.5	8.4	64	3.0	--	--
Powhattan	11.95	32.50	12.20	64.0	7.5	12.0	70	5.0	2850	76
Tribune, Dry	11.68	31.80	11.80	64.2	5.5	7.0	60	3 1/4	2500	74
Tribune, Irrig.	12.72	35.90	12.50	65.0	7.4	10.5	69	3 1/2	3000	76
Hays	13.88	38.80	13.90	67.0	8.0	16.0	74	4.0	3175	80
Minneola	15.70	43.10	15.95	69.6	7.3	12.3	70	3 1/4	2350	82
Parsons	13.55	37.20	13.60	67.0	9.0	24.8	80	5 1/2	3000	70
Belleville	13.60	34.20	13.40	66.8	8.6	15.4	76	3 1/2	3400	84
Colby, Irrig.	12.31	35.30	12.60	66.8	9.0	20.5	78	5 1/2	2900	82
Colby, Dry	13.60	38.20	14.10	67.00	9.0	19.8	78	5 1/4	3050	82
Garden City, Irrig.	13.20	37.40	13.58	70.4	5.0	6.8	58	2 3/4	2800	70
Garden City, Dry	15.10	40.60	15.80	71.4	5.0	6.1	60	2 3/4	3125	80

INFLUENCE OF VARIETY AND ENVIRONMENT ON KANSAS WHEAT QUALITY

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AN ABSTRACT OF A MASTER'S THESIS

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ABSTRACT

It is well known that wheat varies in quality from season to season and from one locality to another. For many years experiments have been conducted regularly in Kansas to compare the properties of different varieties when grown under the influence of different environments.

The objective of the present study is to test and compare the influence of the environment and variety on the physical characteristics, milling and baking quality of Kansas hard red winter wheat for 1981 wheat crop.

Fifty-nine different varieties grown at 12 different locations in Kansas were evaluated. In order to study the influence of irrigation on wheat quality characteristics, samples from irrigated plots at three different locations, were analyzed.

After the wheat has been submitted for the physical characteristics analysis, it was blended by location and by variety.

After all the data were statistically analyzed, the results show that the magnitude of variation for all the physical characteristics and milling properties is far more greater for the location than the variety. Protein, milling rating and ash value figures showed the most important variation difference. Thus, according to the coefficient of variation obtained from the statistical analysis, we may assume that the environment exerts much more influence on the physical characteristics and milling properties of wheat than the varieties.

Gluten quantity, which is shown by the correlation coefficients to be highly correlated with protein, is also more influenced by the environment than the variety.

The coefficient of variations for Farinograph absorption, mixing time and valorimeter are larger for the location than the variety. This also adds to

the belief that the environment has a greater effect than the variety on the Farinograph absorption, mixing time and valorimeter, whereas Farinograph dough stability is affected to the same extent by both environment and variety.

The bakery mixing time, loaf volume and quality score of the bread, all seem to be more influenced by the environment than the variety and this according to the magnitude of variation showed by the location and variety.

Significant correlations were found between April, May and June rainfall and Farinograph dough stability, valorimeter and bakery mixing. These flour quality characteristics also showed a high and negative correlation with the maximum June temperature.

Test weight, 1000 kernel weight and theoretical yield appeared to be significantly correlated with April, May and June maximum temperature.

The wheat protein content and its milling properties showed a significant correlation with the June average and maximum temperatures.