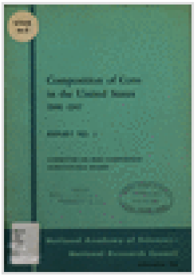

Composition of Corn in the United States, 1946-1947 (1953)

Pages
31

Size
6 x 9

ISBN
0309291003

Committee on Feed Composition; Agricultural Board; Division of Biology and Agriculture; National Research Council

COMPOSITION OF CORN
IN THE
UNITED STATES
1946–1947

REPORT NO. 2

N.R.C. COMMITTEE ON FEED COMPOSITION

PREPARED BY A SUBCOMMITTEE CONSISTING OF
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FOREWORD

The Committee on Feed Composition was set up under the Agricultural Board of the National Research Council at the instigation of the Committee on Animal Nutrition. The members of the new committee were selected to represent the American Institute of Nutrition, the American Society of Animal Production, the American Society of Agronomy, the American Dairy Science Association, the Poultry Science Association, the Association of American Feed Control Officials, and the American Feed Manufacturers Association. The Committee was established by a letter, dated May 10, 1946, written by Robert F. Griggs, chairman of the Division of Biology and Agriculture of the National Research Council. The objective of the Committee was to compile complete and accurate tables on the composition of all feeding stuffs (1, 2, 5).

Mr. Frank E. James was selected as the executive secretary of the Committee on Feed Composition. His services were made available for the work of the committee on a leave-of-absence basis through the courtesy of the Ralston-Purina Company. The major part of the collection of the data included in this publication was undertaken and compiled through the efforts of Mr. James. He diligently implemented the plans devised by the committee and took an active part in all of its work. The members of the committee were saddened to receive word of the tragic death of Mr. James from poliomyelitis on August 5, 1948. This great loss was felt deeply by the members of the committee. The delay in summarizing these data and preparing them for publication is attributed to the loss of the service previously given to this project by Mr. James. Report No. 1 of the National Research Council Committee on Feed Composition (1), covering the composition of the 1946 crop of corn, issued in September 1947, was prepared largely through his efforts.

It was recognized that the committee should sponsor the tabulation of published composition data on many feeds. Also, it was the consensus of the members that a study should be made of the sampling and current chemical composition of one or more annual crops of certain animal feeds. Accordingly, at the first meeting of the committee on August 15 and 16, 1946, a plan was initiated to study the chemical composition of the 1946 corn crop in the United States. This study was later extended to include the 1947 crop. Corn was selected because a large percentage of the total production is used for feeding, and more corn is fed to livestock in the United States than any other grain. Furthermore, evidence was presented indicating that the percentage of protein in corn had decreased over a period of years. One objective of this study was to determine the validity of, and possible reasons for, this alleged diminution.

COMPOSITION OF CORN IN THE UNITED STATES 1946–1947*

INTRODUCTION

The chemical composition of crops varies in relation to a number of factors, many of which are not clearly understood. Climate, species or variety, soil type, management practices including fertilization, and the storage or processing of the crop comprise the most important considerations. In launching a survey of the nutrient contents of corn in the United States, there were limitations to the number of factors that could be studied. For example, it was impractical in a nation-wide survey to attempt a detailed study of all of the varieties of corn, because several hundred varieties may be grown in any one state. The decision was made to ignore variety in the selection of samples but to record it at the time of sampling. Similar problems were encountered with regard to soil type and management practices, but no attempt was made to record data on these factors.

The number of samples collected in this survey was limited to the facilities that were available for analyses. It was estimated for 1946 that a maximum of 200 samples could be processed through the commercial, institutional, and state feed control chemical laboratories that might cooperate in the study. It was judged that this number of samples would give an average for the nation accurate to 1 per cent for proximate nutrients and certain mineral elements and 3 per cent for most of the micro-elements and vitamins.

PROCEDURE

Selection of Samples

The sampling plan was based primarily on climatic regions and on corn production data. The United States was divided into ten regions. These were so delineated that the climatic conditions of rainfall and temperature were somewhat similar throughout each region, and the effect of these factors on composition was assumed to be fairly uniform. A map showing the regions is given in Figure I. The percentage of the nation's total corn production contributed by each region, state, and county was computed and used as a basis for allocating samples. Within a state the counties were stratified according to production. The number of strata was equal to the number of samples to be taken in the state and the total production in all strata was equal. One county was then selected at random from each stratum.

Two hundred counties were designated to be sampled in each year, and one farm was sampled in each county in 1946. In 1947 an extra farm was designated in each of 50 counties, distributed among states and regions at a rate proportional to production. Sixteen states were not granted any samples because they did not produce enough corn. Two states that were allotted samples did not cooperate. In regions 9 and 10, no single state could be selected for a sample, but one state was chosen at random to represent each of these regions. Within states, the county corn production was the basis for allotting the samples. Where one county alone did not rate a sample by virtue of its own production, a county was chosen at random from a group of counties with sufficient corn production.

Selection of the sampling site within a county: County agents and extension personnel in the various states were enlisted to procure the samples. In those states from which five samples or less were taken, the Extension Agronomist was requested to collect all samples. In the more heavily sampled states, however, the help of the County Agents was enlisted.

In the selection of actual farms in the coun-

* Initial funds for this work were provided by Swift and Company. Later grants were made by the American Feed Manufacturers Association, the Gould Research Foundation, Merck and Company, Inc. and the Ralston Purina Company.

FIG. 1.—Regions from which corn samples were taken

ties listed, the Extension Agronomist solicited the aid of a statistician. In sections where statisticians were not available, the following plan was executed. The map of the county to be sampled was divided approximately in half by a single straight line. By the toss of a coin it was decided which of the two areas should be further divided. The second area chosen was divided approximately in half by a third line perpendicular to the second, and a choice made again by tossing a coin. This procedure was repeated eight times. Instead of dividing the area chosen on the eighth toss, however, the center point of that area was taken to locate the farm or delivery point to be sampled as indicated under (a) or (b) below.

(a) The sample was taken from the farm which was nearest to the center point of the area designated by the eighth coin toss.

(b) Instead of being taken from the farm nearest the center point prescribed under (a), the sample might be taken at the elevator, grinding mill, or any such point and in the same county. When this was done, the sample was taken from the first load of corn brought to the delivery point and arriving after a certain hour set by the sampler on a certain day.

It was stressed that, regardless of the method used, the sampler should place no restrictions on the sample other than

(a) that it be unground corn, and

(b) that it be of corn harvested (or to be harvested) as grain for feeding purposes.

The variety, color, type, or condition of the corn should in no way determine whether or not a particular field, crib, or load be sampled. The sampler was warned against making any discrimination against what might be deemed "nonrepresentative" samples. If the corn satisfied the two simple restrictions given above, it should be sampled. The sampler was encouraged to send any additional descriptive information about the sample along with the sample when forwarding it to Washington, D.C.

Sample size: It was decided that five to ten pounds of shelled corn or its equivalent in ear corn would be adequate for the final sample. If ear corn samples were taken, it was suggested that they should be shelled before sending them to Washington. Regardless of the size of sample, it was to be taken from the field, crib, or load in 15 to 20 approximately equal portions from well-distributed points in the field, crib, or load. If the final sample so taken was too unwieldy, it was to be mixed and quartered down to desirable size.

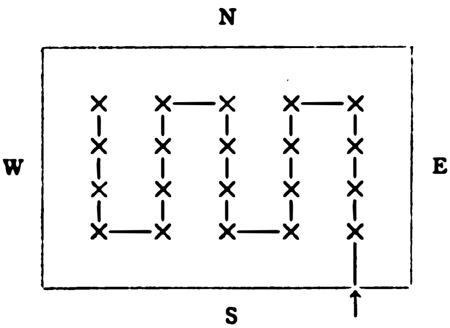
The year 1947 was an abnormal one for corn, and a large proportion of the harvested crop was soft. Since the corn harvested in 1946 was predominately well matured, the 1947 sampling was set up in such a way that an accurate contrast of the normal and abnormal crops might be obtained. It was decided to sample the same 178 farms that provided samples in 1946.

In order that the data might be more valuable in certain respects, it was planned to sample additional counties in certain states. Selection and sampling of the additional counties were the same as described above.

Selection of sample at the farm: In 1947 it was anticipated that there would be wide variation, even within a field, in maturity of corn at frost date. Many farms might have only soft corn. It was believed that some corn might not be cribbed at all, being fed from the field instead. Since it was desired to sample the corn crop that would be fed, it was important that a representative sample be obtained, not a sample of mature corn only. In view of this, it was highly desirable that samples be taken from the field. As far as possible, the time of sampling was between the date of the first killing frost and the husking date. A large enough sample was taken to yield 5 pounds of shelled corn.

It was desired that the selection of the sample on the farm be as objective as possible. Directions for sampling the field were therefore given as follows:

"Proceed to the southeast corner of the corn field and walk west along the south side a distance of 10 stalks or 10 hills. Walk north into the field 10 stalks or 10 hills, taking all ears from the 10th stalk or 10th hill. Now walk north 5 more stalks or hills and take all ears from the corresponding stalk or hill. Continue the sampling of every 5th stalk or hill, as indicated by the pattern in the diagram shown below. Proceed along the path indicated until enough ears have been collected to yield 5 pounds of shelled corn."



Field Diagram

In the event the corn raised on the farm designated for sampling had already been stored, the sample was taken from the cribs. In sampling from the cribs, an attempt was made to choose the sample in such a manner that the various grades of corn harvested were properly represented. For example, if the farmer's crop was 30 per cent soft corn and 70 per cent mature, then 30 per cent of the sample was taken from soft-corn cribs and 70 per cent from mature cribs.

In the sampling operation, no restriction was made on grade, color, variety, type, or condition of corn. For the two years combined, only 20 samples were white corn, and in 1946 very few samples graded other than U.S. No. 2.

Data Secured at Time of Sampling

Date
Name of owner and address (*including county*) of the farm from which the corn came
Type of corn:
 white or yellow
 flint or dent
 hybrid or open pollinated
Name of variety or hybrid
Stage of maturity (mature, soft, chaffy, etc.)
Yield per acre:
 the 1946 yield for field sampled in 1946
 the estimated 1947 yield for field sampled in 1947
Name and position of sampler

Chemical Analyses

Following collection, samples were shipped to the National Research Council offices in Washington, D.C., where they were dried and subsampled for vitamin, mineral, and proximate analyses. These subsamples were then shipped to the cooperating chemical laboratories. No attempt will be made to describe the methods of chemical analysis which were used. In most instances, they were standard accepted methods. Sufficient duplicate samples were sent out to different laboratories to verify the results obtained. The proximate analyses and calcium and phosphorus analyses are believed, on the basis of duplicate samples, to be very reliable. There has been no reason to question the other mineral and vitamin analyses, although in some instances, as, for example, the sodium determinations, the methods used lacked sensitivity. For all practical purposes, however, the analyses were satisfactory. With copper, the results for the two years were in disagreement with regard to both mean and variability. It is believed, however, that the discrepancies in the copper data are of no practical concern.

Two hundred samples were requested and 178 received in 1946. In 1947, 251 samples were requested and 212 received. Proximate chemical composition data were obtained for 169 samples in 1946 and 197 samples in 1947. The distribution of the missing samples was such that the original allocation distribution was not greatly disturbed. Analyses were obtained for proximate nutrients on almost all samples received and for calcium and phosphorus on the majority of the samples. The number of samples on which it was possible to determine the other minerals and vitamins varied considerably and was limited in many instances. Insofar as was possible, the regional allocation proportions were maintained in selecting the limited samples.

The number of samples analyzed for each state for each year is shown in Figure 1. These numbers do not include samples for which calorie content alone was obtained.

RESULTS

Presentation of Data

In order to have the results of both 1946 and 1947 analyses in one publication, the 1946 results published in Report No. 1 are included in Table IA, and certain 1946 data not available until after the report was issued in Table IB. The results of the chemical analyses of the 1947 crop are shown in Table IC. The means, the 95 per cent fiducial limits, and the number of samples analyzed for year and region are given in Tables IIA and IIB. The same estimates are given for the entire United States, as well as the standard deviations and the coefficients of variability. These standard deviations and coefficients of variability are also applicable to any region. For each analysis, if it is stated that the population mean lies within the interval, sample mean $\pm$L, the probability of being wrong is only 5 per cent. This may be said in another way: If it is stated that the true mean value lies within the confidence limits, the risk of being wrong is 5 per cent, or conversely, the chance of being correct is 95 per cent. The data for the two years are presented separately. For each nutrient, the number of samples analyzed is indicated.

Variability of the Data

The standard errors of the means are not given but may be easily computed, either on the absolute basis or as coefficients of variation by dividing the standard deviations or the coefficients of variation, respectively, by the square roots of the numbers of samples.

In general, the data for the two years are in good agreement as regards both the means and the standard deviations. The only exception is copper, where both the mean and the standard deviation are relatively larger in 1946 than in 1947, but only 42 samples were analyzed in 1946 as compared with 197 in 1947.

In several other instances the differences between means for the two years are statistically significant. The nitrogen-free extract content was significantly lower in 1947 than in 1946, and the contents of protein, fiber, ash, and some of the minerals and vitamins were significantly higher in 1947 than in 1946. Most of these differences may be too small to be of practical importance, but they seem to be satisfactorily explained by the fact that much of the corn in 1947 was soft or immature. The 1946 data are no doubt better to use as representative of commercial corn, at least in normal years.

Notable are the small coefficients of variation for gross energy and the proximate nutrients. The low coefficient of variation for magnesium is striking as compared with those for most of the minerals, while that of fluorine is decidedly larger than that of the other minerals. The coefficients of variability for thiamine, niacin, riboflavin, and pantothenic and folic acids are not very large as compared with that for carotene.

Locational Variations in Composition

The relative importances of region and state-within-region variations in composition were studied by means of analysis of variance. Because of insufficient data this analysis was not made for folic acid. The results are summarized in Table III.

Some statistically significant regional and state-within-region effects were found. For most nutrients, however, these effects accounted for only a small portion of the total variance and are thus of questionable practical importance. Even where the regional and state variations were moderate or large, they may be of little practical nutritional importance. Thus copper, niacin, potassium, chlorine, and iron show moderate or large regional and state variations, but corn is not an important source of supply for these nutrients. Calories, nitrogen-free extract, and fat show moderate regional and state variation and are supplied in important amounts by corn. However, the total variability over the nation is so small (see Table II) that the variance attributable to region or state would seem of little concern.

Although of doubtful importance from the point of view of the practical nutritive value of corn, the magnitude and pattern of regional and state differences are of interest from the standpoint of nutrient composition of feeds in general. Although the size of the surveys was too limited to obtain a clear picture of the locational variations in nutritive value, certain findings seem worthy of brief mention.

Protein content was lower than average in a region approximately defined by the states of Illinois, Indiana, Ohio, Kentucky, West Virginia, and Tennessee. With the exception of West Virginia, these states were sampled relatively heavily. This low-protein region appeared to extend southward and southwestward to include Texas, Arkansas, Louisiana, Mississippi, Alabama, and Georgia. With the exception of Texas, however, the sampling rates in these states were relatively low. Corn of about average protein content was obtained from two regions. The first of these was defined roughly by Minnesota, Iowa, and Missouri, where the sampling rate was heavy. New York and Pennsylvania formed the second region, but these two states were not sampled heavily. Corn of above average protein content was obtained in three regions: (a) North and South Dakota, Nebraska, Kansas, and Oklahoma; (b) Wisconsin and Michigan; and (c) the Atlantic seaboard states from New Jersey to South Carolina inclusive. With the exception of Nebraska and Wisconsin the sampling rates in these states were relatively light. In general, regions of similar composition did not necessarily correspond to climatic regions.

The lowest fat content was observed in Indiana, Ohio, Kentucky, and West Virginia. This is roughly the lowest protein region, except that Illinois and Tennessee are not included. The southern states which appeared to be in the low-protein group did not fall in the low-fat group. Instead, it appeared that the southern states in general, including Texas and Oklahoma but excluding Virginia, Tennessee and Kentucky, produce corn of higher than average fat content. The remainder of the states in the East and Midwest, which produced corn of average or high protein content, in general showed average fat content although a few showed higher than average fat values. Location and variety (including color) were partially confounded in this study; hence the regional differences in fat content are possibly due to variety and color.

With respect to the other nutrients studied there were often rather marked differences between states, but in general no region having characteristic values could be discovered. One exception was iron content. The southern states in general showed low iron values and the midwestern, northern, and eastern states showed generally high values. There were exceptions, however. For most of the nutrients the number of analyses was too small to warrant attempts to define regions as was done for protein.

Effects of Soil Type on Proximate and Mineral Composition

The results of the locational analyses suggested that perhaps soil type was a factor affecting the composition of corn. To supplement the locational analysis, therefore, the samples were classified by Great Soil Groups and by soil associations. Analyses of variance were then conducted on the proximate nutrients and the minerals, it being considered that these would show greater effects from soil than would the vitamins. The results are summarized in Table IV.

As was true with location, soil classes were in general only slightly associated with variations in the composition of corn. Fat content was the only factor that appeared to be associated with differences in Soil Groups or soil associations in any marked way, but there was a suggestion that protein, potassium, and iron may bear a relation to the Great Soil Group classification. The minerals, which might be expected to vary considerably with soil classes, were in general for the two years associated only slightly with them, although soil classifications were significant in one of the years in several instances.

Differences between White and Yellow Corn

Analyses of variance were conducted to ascertain whether white and yellow corn differed in nutrient composition in any way other than carotene content. All of the samples of white corn were open-pollinated, but the yellow samples included both hybrid and open-pollinated varieties. The data were insufficient to make comparisons on cobalt and folic acid in 1946 and on calories, potassium, magnesium, sodium, chlorine, fluorine, thiamine, niacin, pantothenic acid, and folic acid in 1947.

For none of the nutrients was there a significant difference between white and yellow corn in 1946, and in 1947 significant differences existed for fat and iron only. In both years the fat content of white corn was higher and the iron content lower than in yellow corn. In general, however, it appeared that the only practical nutrient difference between white and yellow corn is carotene.

Varietal Variations in Composition

Because all varieties of white corn were designated simply as open-pollinated, varietal variation was studied only on yellow corn. Analyses of variance were conducted for each year separately, and only those varieties were included for which there were data on two or more samples, nearly all of which were hybrids, in the year being analyzed. Because of insufficient data, determinations of calcium in 1946, calories in 1947, and sodium, chlorine, fluorine, and folic acid in either year were not made. Location effects were disregarded in making these analyses because of the computational difficulties involved in adjusting for them.

The results are summarized in Table V. In few instances were varietal effects statistically significant in either year, and only for fat were they significant in both years. In general, varietal differences accounted for a small portion of the total variation in nutrient composition. It appears that, with the possible exception of fat, differences in nutrient composition among varieties grown in practice are not of practical nutritional importance. It is not intended to imply that nutritionally improved varieties cannot be developed by proper breeding and selection, but only that the more important commercial varieties appear to be genetically rather uniform with respect to factors determining nutritive value.

Correlations between Nutrients

The determination of certain micronutrient elements and vitamins is very difficult and tedious. If it were discovered that high correlations existed between various nutrients in certain feedstuffs, difficult-to-determine nutrient values could sometimes be predicted from easily determined nutrient values. Such a discovery could possibly eliminate the necessity for conducting many difficult determinations and could be of practical importance in nutrition as well as in sampling feeds.

In this study an effort was made to discover the existence of high correlations between various nutrients contained in corn, and over 200 correlation coefficients were computed for each of the two years. Simple correlation coefficients were computed for all pairs of nutrients for which there were sufficient data. Data were insufficient to compute correlations of folic acid with all other nutrients in both years, calories with all other nutrients in 1947, and fluorine with potassium, magnesium, sodium, and chlorine in 1947. Some correlations were found to be significant in each year, but the results for the two years were not consistent. The significant correlation coefficients were generally small and often did not agree in sign. Of 434 correlation coefficients computed for the two years, only 34 equalled or exceeded 0.5. It may therefore be concluded from this investigation that the correlations between nutrients are not very useful, and a knowledge of the composition of corn with respect to a few nutrients does not aid materially in assessing its composition in other nutrients. Thus, in feeding practice one must either use average data from tables to apply to a given lot of corn or, if greater precision is desired, determine the nutrient content for that lot. From the standpoint of sampling, it appears that each nutrient should be considered independently.

The negative correlations of nitrogen-free extract with protein, fat, and ash would be expected because the former is determined by subtracting these three nutrients and fiber from the total dry matter. No attempt is made to explain the other correlations shown. The relatively large number of nutrients with which fluorine and carotene are appreciably correlated should be noted.

The more significant correlation results which, after being averaged for the two years, equaled or exceeded 0.3 are presented in Table VI. This figure was selected because correlations of this size or less mean that 9 per cent or less of the variance in one factor is associated with variance in the other factor. The simple coefficients of correlation between all nutrients are given in Table VII.

DISCUSSION

The observation of the feed industry that the protein content of corn declined appreciably in the years prior to 1946 seems to have been verified by this study. Morrison (4) gives the mean protein content of No. 2 corn as 9.4 per cent. In contrast, a value of 8.7 per cent was obtained in the 1946 survey, and one of 9.1 per cent in the 1947 survey.

Earley and De Turk (3) concluded that "the decline in protein reported by the feed industry is not due to inherently low protein hybrids" and that "the decrease in corn protein is believed to be caused by both a decreased soil nitrogen at regular rates of planting and by an increased rate of planting on soils relatively low in nitrogen." These views were not contradicted by the results of the present work. At least, the heavier corn producing areas tended to yield corn of low protein content, and varietal differences in protein content accounted for a very small portion of the variance. Nothing conclusive on these points is offered by the present studies, however, because their design did not permit arriving at such conclusions.

Regional, state, and varietal differences were appreciable and statistically significant for some nutrients. For most of the nutrients, however, it appears that these factors *per se* have little to do with the nutrient content of commercial corn. To account for the major variability in nutrient composition of corn, one must look to other factors. Soil type and localized climatic effects are indicated, with attention directed particularly to some of the things, such as the micronutrient element content, which might vary within a given soil type. Other factors of possible importance are those associated with cultural practices such as fertilization. These factors seem especially worth consideration for those minerals and vitamins which have high coefficients of variation. In surveys designed to inquire into the causes of locational variations in composition, it appears that special emphasis would have to be placed on the above local factors in allocating samples, and intense sampling rates would have to be employed. Controlled experiments would possibly be helpful.

The change in protein content of corn through the years indicates the desirability of periodic checks on nutritive composition of feeds on a national scale. New varieties of crops and greater use of fertilizers, particularly the micronutrient elements, permit the production of many crops under new and different ecological conditions. Thus, different soil and climatic factors combined with the new varieties may change materially the composition of the normal plant. Relatively small nation-wide surveys, such as those reported here, appear to be adequate for such periodic checks.

It was hoped that the correlation study would show sufficiently significant relationships between the contents of various nutrients to be of practical use. A possible use envisaged was the estimation of the content of difficult-to-determine nutrients from the content of easily determined nutrients for samples on which complete analysis is not feasible. It appears, however, that the correlations are in general too low to be of value for this purpose.

SUMMARY

In 1946, 169 samples, and in 1947, 197 samples of corn were collected at harvest time from 30 states in 10 climatic regions in the United States. Chemical determinations were made of proximate nutrients, vitamins, and minerals. These data were used to calculate means, coefficients of variation, and other statistical information.

The variation between regions was significant (19 to 1) for fat in both years, and for a number of nutrients in one year but not the other. The large within-state variation for most nutrients casts doubt on the practical importance of regional differences. Regional variations in fat are possibly confounded with varietal and color differences.

Color of the corn could not be significantly related to any constituent except carotene and fat. Between varieties of yellow corn no significant differences were found except for fat.

No sufficiently high correlation was found between any nutrients to indicate a possible relationship useful in estimating the amounts of nutrients that are difficult to determine.

The mean protein content of No. 2 corn as found in this study is lower than that reported by Morrison in 1936. No direct explanation for these lower values was found as a result of this study.

ACKNOWLEDGMENT

The Committee is indebted to Miss Hazel Orcutt, who kept records and compiled the data, and to Mr. M. L. Richards, who was responsible for the statistical analyses. Great credit is due to the extension and research personnel of the colleges of agriculture, to the state feed control laboratories, and to the laboratories of the feed and associated industries whose help in collecting and analyzing samples made this survey possible.

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TABLE IA. CORN ANALYSES RESULTS

1946 Data Included in Report No. 1

(All figures are converted to 15 per cent moisture)

Sample No.	State	County	cals. per gm.	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
		Region #1								
111	N.Y.	Chemung		7.79	4.22	2.17	69.44	1.39	.037	.281
112	N.Y.	Washington		9.57	3.75	1.93	67.42	1.41	.027	.320
124	Pa.	Centre		8.26	4.03	1.81	69.40	1.40	.046	.317
131	N.J.	Burlington		8.93	4.65	1.78	68.72	1.34	.035	.190
141	W.Va.	Mineral		8.95	3.37	2.50	68.41	1.30	.009	.332
151	Mich.	Eaton		9.07	3.70	2.46	68.78	1.02	.041	.240
152	Mich.	Mecosta	3814	9.80	3.65	2.09	68.66	1.10	.021	.292
153	Mich.	St. Joseph	3701	9.72	4.27	2.00	68.39	1.29	.008	.280
Average			3758	9.01	3.96	2.09	68.66	1.28	.025	.282
		Region #2								
211	Ohio	Clinton		10.53	4.16	2.23	66.87	1.24	.060	.230
212	Ohio	Hardin		8.78	3.82	2.21	69.39	1.29	.013	.277
213	Ohio	Lake		8.60	3.54	1.87	70.25	2.30	.041	.148
214	Ohio	Lucas		8.02	3.61	1.89	68.34	1.52	.073	.271
215	Ohio	Mercer		8.01	3.34	2.13	70.35	1.05		.220
216	Ohio	Morrow		9.22	3.32	2.16	69.18	1.12	.018	.420
217	Ohio	Paulding		8.20	3.99	1.85	70.01	0.99	.005	.245
218	Ohio	Pickaway	3637	8.29	4.17	1.89	69.48	1.17		
219	Ohio	Sandusky	3746	7.55	3.09	2.48	71.33	1.04	.023	.260
2110	Ohio	Williams	3683	8.70	3.65	2.03	70.66	1.10	.018	.366
2111	Ohio	Wood		8.61	3.34	1.85	69.97	1.28	.009	.280
221	Ind.	Benton	3813	7.80	3.50	1.95	70.20	1.14	.008	.220
222	Ind.	Clinton		8.42	3.83	2.17	68.97	1.18	.005	.210
223	Ind.	DeKalb		9.69	4.03	1.97	68.29	1.12	.009	.268
224	Ind.	Elkhart		7.61	4.25	1.81	69.43	0.56	.019	.260
225	Ind.	Hamilton		7.79	3.47	2.67	69.93	1.14	.006	.259
226	Ind.	Huntington		7.77	3.03	1.90	69.74	2.56	.013	.154
227	Ind.	Johnson		9.22	3.92	1.94	68.71	1.33	.010	.280
229	Ind.	Morgan		8.88	3.47	2.84	68.47	1.34	.009	.250
2210	Ind.	Newton	3828	8.79	4.02	1.89	69.03	1.30	.021	.260
2211	Ind.	Orange	3853	9.27	3.51	2.03	68.70	1.08	.013	.280
2212	Ind.	Tippecanoe		9.07	4.00	2.27	68.44	1.21		.450
2213	Ind.	Vigo		8.31	4.21	1.95	69.26	1.28	.048	.270
2214	Ind.	Warren		7.88	3.80	1.88	70.42	1.04	.018	.310
Average			3760	8.54	3.71	2.04	69.39	1.27	.020	.252
		Region #3								
311	Md.	Queen Anne's		9.11	3.79	1.96	68.00	1.23	.019	.196
321	Va.	Montgomery		9.61	3.82	1.92	68.44	1.21	.036	.117
322	Va.	Pittsylvania	3902	10.15	3.36	2.38	67.72	1.25	.037	.230
331	N.C.	Duplin	4222	9.37	4.09	1.71	69.41	1.07	.010	.220
332	N.C.	Montgomery	3848	8.65	4.05	1.64	69.86	1.02	.009	.240
342	Ky.	Christian	3826	8.58	4.37	1.68	69.79	1.07	.006	.200
343	Ky.	Clinton		7.25	3.67	1.75	71.11	1.23	.007	.227
344	Ky.	Lincoln		8.53	3.86	1.90	69.70	1.01	.027	.195

TABLE IA—(*Continued*)

Sample No.	State	County	cals. per gm.	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
345	Ky.	Marshall		7.64	3.84	2.02	70.46	1.04	.040	.240
351	Tenn.	DeKalb	3824	7.52	4.17	2.25	69.86	1.23	.006	.284
352	Tenn.	Giles		9.26	3.91	1.94	68.77	1.14	.011	.232
353	Tenn.	Carroll	3800	7.13	3.79	2.42	70.94	1.04	.015	.254
354	Tenn.	Johnson	3775	8.27	4.16	1.81	69.89	1.28	.007	.330
Average			3885	8.54	3.91	1.95	69.53	1.14	.018	.228
				Region #4						
411	S.C.	Anderson		8.97	4.17	1.90	68.94	1.04	.021	.370
421	Ga.	Morgan		7.67	4.15	2.26	69.77	1.03	.054	.250
423	Ga.	Worth		8.03	4.02	1.84	68.96	0.94	.014	.280
431	Ala.	Coosa		8.60	4.22	2.00	68.95	1.23		
441	Miss.	Marshall		7.50	4.10	1.80	68.42	1.21	.046	.324
442	Miss.	Smith		9.26	3.31	2.17	69.09	1.18	.008	.273
Average				8.34	4.00	2.00	69.02	1.05	.029	.299
				Region #5						
511	Minn.	Cottonwood	3782	9.38	4.32	1.94	68.73	1.09	.007	.241
512	Minn.	Fairbault	3839	8.60	4.23	1.83	70.99	1.13	.007	.276
513	Minn.	Jackson	3672	9.69	3.54	2.06	68.48	1.14	.010	.280
514	Minn.	Kandiyohi	3646	7.76	4.09	1.95	70.94	1.30	.018	.270
515	Minn.	Meeker	3736	9.96	3.46	2.24	69.15	1.36		
516	Minn.	Mower	3688	8.13	4.05	2.75	70.77	1.14		
517	Minn.	Murray	3754	10.40	4.34	1.90	67.76	1.35		
518	Minn.	Lac qui Parle	3716	7.62	4.36	1.72	72.10	1.08		
519	Minn.	Polk	3843	9.93	4.15	1.97	68.24	1.09	.009	.490
5110	Minn.	Redwood	3777	9.69	4.22	2.04	68.90	0.84	.008	.230
5111	Minn.	Steele	3780	10.21	4.16	2.04	68.69	1.28		
5112	Minn.	Todd	3693	9.26	4.01	1.97	69.25	1.29		
5113	Minn.	Wright	3668	8.51	3.88	2.34	70.14	1.46		.600
5114	Minn.	Yellow Medicine	3732	8.86	4.45	1.85	69.70	1.14	.012	.274
523	Wis.	Pierce	3850	9.56	3.96	1.83	68.03	1.43	.017	.326
524	Wis.	Marquette	3799	10.06	4.45	2.03	68.03	1.26	.013	.290
525	Wis.	Waukesha	3740	9.87	4.33	2.06	68.51	1.30	.009	.290
531	Ia.	Benton	3716	8.14	3.75	2.09	69.74	1.28		
532	Ia.	Black Hawk		8.83	3.69	1.99	69.46	1.05	.023	.210
533	Ia.	Buena Vista	3840	9.31	4.10	1.75	68.94	1.25	.010	.250
534	Ia.	Carroll		9.13	4.48	1.73	68.42	1.23	.008	.290
535	Ia.	Cass	3716	8.42	4.48	1.99	68.97	1.18	.009	.270
536	Ia.	Cerro Gordo	3864	8.70	4.15	1.83	68.58	1.24	.008	.270
537	Ia.	Cherokee		10.07	4.38	1.82	67.35	1.33	.016	.244
538	Ia.	Clay		9.17	3.96	1.84	68.88	1.14		
539	Ia.	Crawford	3872	8.13	3.95	1.88	69.30	1.21	.004	.220
5310	Ia.	Dallas		7.28	3.77	2.05	70.43	2.19	.019	.222
5311	Ia.	Delaware	3760	8.63	4.35	1.88	70.52	0.97	.011	.200
5312	Ia.	Des Moines	3817	8.37	4.23	2.22	69.23	1.14	.011	.280
5313	Ia.	Dickinson		8.53	3.05	2.09	70.15	1.20	.009	.250
5314	Ia.	Greene	3865	7.95	3.85	2.26	69.10	1.12	.002	.240
5315	Ia.	Grundy	3633	9.12	3.50	1.89	70.59	1.14		.500
5316	Ia.	Hamilton		9.28	2.90	2.06	69.63	1.15	.027	.290

TABLE IA—(*Continued*)

Sample No.	State	County	cals. per gm.	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
5317	Ia.	Harrison	3685	8.93	4.17	1.95	69.88	1.20	.018	.28
5318	Ia.	Howard		8.99	3.38	1.91	69.59	1.15	.023	.19
5319	Ia.	Ida	3669	8.11	4.91	2.24	69.00	1.51		.38
5320	Ia.	Jackson		9.65	4.51	2.24	67.49	1.13	.013	.20
5321	Ia.	Keokuk		9.23	3.35	1.87	69.62	0.92	.005	.193
5322	Ia.	Kossuth		8.67	3.81	2.03	69.51	1.00	.013	.23
5323	Ia.	Linn		7.87	4.39	1.24	70.55	0.96	.016	.23
5324	Ia.	Madison	3861	7.90	3.48	2.11	71.86	1.22	.009	.267
5325	Ia.	Mills		8.37	3.45	1.79	70.24	1.15	.020	
5326	Ia.	Mitchell		9.04	3.51	2.58	68.62	1.26	.005	.50
5327	Ia.	Muscatine		9.16	2.83	1.92	69.96	1.15	.015	.253
5328	Ia.	Osceola		8.89	4.06	2.03	69.16	0.80	.015	.16
5329	Ia.	Palo Alto	3803	8.49	4.71	2.17	69.18	1.28		.26
5330	Ia.	Pocahontas	3844	9.41	4.38	2.01	68.64	1.23	.041	.18
5331	Ia.	Polk	3725	7.18	3.78	1.63	73.13	1.08	.013	.21
5333	Ia.	Poweshiek	3702	7.68	2.92	1.96	72.35	1.37	.031	.24
5334	Ia.	Sac		8.70	3.57	1.65	70.06	1.03	.110	.119
5335	Ia.	Sioux	3689	9.28	4.20	1.81	69.61	1.22	.009	.320
5336	Ia.	Story		7.98	3.68	1.80	70.51	1.04	.102	.22
5337	Ia.	Van Buren	3791	6.98	4.20	1.92	71.75	1.26		.23
5338	Ia.	Webster	3805	6.57	3.85	1.91	71.94	0.98	.007	.204
5339	Ia.	Winneshiek		9.21	3.90	2.01	68.60	1.29	.028	.176
5340	Ia.	Wright	3814	8.15	3.13	2.10	70.43	0.99	.012	.221
541	Mo.	Caldwell	3820	8.63	3.96	1.82	69.60	1.27	.027	.36
542	Mo.	Cooper		7.95	4.23	1.74	69.80	1.30	.018	.43
544	Mo.	Lafayette		9.52	4.13	2.00	68.09	1.26		
545	Mo.	Linn		8.75	4.65	2.64	67.50	1.46	.009	.27
546	Mo.	Macon		8.74	3.30	2.29	69.39	1.28	.021	.238
548	Mo.	Ralls		9.26	4.63	1.97	67.97	1.20	.009	.17
5410	Mo.	Saline	3843							
Average			3765	8.79	3.90	1.99	69.12	1.20	.018	.270
		Region #6								
611	Ark.	Crittenden		7.15	4.12	1.92	71.45	1.37	.018	.302
612	Ark.	Washington	3842	10.29	4.69	1.90	68.05	0.84	.028	.222
Average			3842	8.72	4.40	1.91	68.87	1.10	.023	.262
		Region #7								
712	N.D.	Sargent		9.92	3.52	1.90	68.37	1.30	.026	.20
731	Neb.	Cass		8.23	4.14	2.07	69.28	1.29	.017	.337
732	Neb.	Cedar		9.29	3.42	2.30	68.86	1.14	.027	.222
733	Neb.	Chase		9.45	3.97	2.12	68.07	1.42	.020	.370
734	Neb.	Dakota		8.67	3.35	1.72	70.11	1.15	.016	.254
735	Neb.	Douglas		10.15	3.75	2.83	67.63	1.39	.048	.298
736	Neb.	Gage		8.57	4.05	1.96	71.69	1.39	.018	.309
737	Neb.	Hayes		8.21	3.63	2.02	69.81	1.32	.013	.311
738	Neb.	Jefferson		8.42	3.62	1.90	69.79	1.26	.016	.210
739	Neb.	Lancaster		8.31	3.78	1.67	69.99	1.24	.009	.282
7310	Neb.	Lincoln		9.73	2.78	2.41	68.78	1.30	.020	.171
7311	Neb.	Madison		10.27	4.08	1.95	67.58	1.36	.042	.29
7312	Neb.	Otoe		8.21	4.10	1.82	69.54	1.13	.005	.260

TABLE IA—(*Continued*)

Sample No.	State	County	cals. per gm.	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
7313	Neb.	Saline		9.15	3.63	2.03	69.08	1.13	.014	.383
7314	Neb.	Webster		10.56	4.44	1.81	66.99	1.22	.027	.21
741	Kans.	Jackson		7.39	4.38	1.92	70.23	1.39	.007	.246
742	Kans.	Marion		8.78	3.64	2.24	69.19	1.18	.017	.225
743	Kans.	Pottawatomie		10.69	3.96	2.18	66.85	1.32		.641
751	Colo.	Otero		6.99	4.18	1.67	71.03	1.09	.009	.248
Average				9.00	3.81	2.03	69.10	1.26	.020	.288
				Region #8						
811	Tex.	Cass		7.87	4.18	1.92	69.38	1.64	.119	.23
812	Tex.	Ellis		8.79	4.17	2.18	68.49	1.38	.095	.280
813	Tex.	Milam		7.82	4.62	2.52	69.06	0.97	.009	.21
814	Tex.	Polk		8.45	4.41	1.94	68.94	1.51	.074	.264
Average				8.23	4.35	2.14	68.90	1.38	.074	.246
				Region #9						
911	Ore.	Clackamas	3749	9.75	4.30	2.00	68.60	1.26	.009	.30
Average			3749	9.75	4.30	2.00	68.60	1.26	.009	.30
				Region #10						
1011	Ariz.	Pinal		10.93	5.83	2.05	68.73	1.52	.014	.32
Average				10.93	5.83	2.05	68.73	1.52	.014	.32

TABLE IB. CORN ANALYSES RESULTS (*Continued*)

1946 Data Not Included in Report No. 1

(All figures are converted to 15 per cent moisture)

Sample no.	State and county	Variety	cals. per gm	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
2	PENNSYLVANIA									
	Franklin	U.S. 13	4045	8.76	3.83	1.79	69.34	1.28	.015	.27
3	NORTH CAROLINA									
	Stokes		3966							
6	WISCONSIN									
	St. Croix		3828	10.54	3.23	3.06	66.64	1.53	.010	.32
32	IOWA									
	Pottawattamie	DeKalb 847	3885							
	ILLINOIS									
1	Bureau	Moews 14	3788	8.25	3.83	1.45	70.36	1.11	.014	.25
2	Carroll	Ace High 607	3762	9.10	3.40	1.96	69.26	1.28	.008	.27
3	Champaign	Pioneer 336	3966	7.99	4.17	1.70	69.78	1.32	.010	.30
4	Clark	Lowe	3792							
5	Coles	Crow 608	3780	8.25	4.17	1.79	69.60	1.19	.014	.26
6	DeKalb	Hybrid, mixed	3818	10.63	3.06	1.70	66.89	2.72		.45
7	DeWitt	Funk's 894	3826	7.91	3.57	2.30	69.86	1.36	.043	.23
8	Effingham	Producers FCXX	3981	6.38	4.00	1.79	71.47	1.40	.011	.34
9	Fulton	Pfister 1897	3737	9.01	3.32	1.79	69.43	1.45		
10	Gallatin	Funk's G80	3972	8.84	4.08	1.87	68.85	1.41	.053	.18
11	Henry	Holmes 39	3814							
12	Iroquois	Pfister 360	3781	8.50	3.74	2.04	69.61	1.11		.21
13	Jasper	Funk's G94	3700	6.82	3.74	2.00	70.99	1.45	.053	.20
14	Knox	Hulting	3869	7.74	3.83	1.96	70.19	1.17	.080	.26
15	LaSalle	Pfister	3791	7.31	3.57	1.87	71.06	1.19	.011	.12
16	Livingston	Pfister's 360	3748	7.82	3.57	2.38	70.12	1.11	.043	.21
17	McDonough	Pfister	3785	8.76	3.91	1.53	69.61	1.19	.009	.29
18	McLean	Pfister 368	4018	7.40	4.00	2.04	70.20	1.24		.25
19	Macoupin	U.S. 13	3762	8.50	3.66	1.79	69.35	1.70		.37
20	Mason	Funk's G80	3862	8.76	4.76	1.87	68.42	1.19	.008	.15
21	Massac	Funk's mixed	3897	9.18	4.76	1.70	68.25	1.11		
22	Mercer	Siebon S-450	3760							
23	Piatt	Funk's G94	3932	8.25	4.42	2.04	69.13	1.16	.080	.23
24	Shelby	U.S. 13	3809	8.59	3.06	1.87	70.37	1.11	.008	.48
25	Stephenson	Pioneer, mixed	3799	9.01	3.74	1.96	68.93	1.36	.025	.26
26	Tazewell	Crow	4004	8.59	3.66	1.62	70.02	1.12	.009	.26
27	Vermilion	DeKalb 628A	3777	6.46	3.49	2.13	71.47	1.45		
28	Whiteside	DeKalb 458	3725	8.16	4.34	1.87	69.44	1.19		
29	Will	Hybrid, mixed	3801	7.91	3.49	1.96	70.53	1.11	.013	.19
30	Winnebago	Hybrid, mixed	3788	9.35	2.47	1.87	70.03	1.28	.034	.56
31	Woodford	Sullivan	3557							

TABLE IC. CORN ANALYSES RESULTS (*Continued*)

1947

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
			Region #1					
NEW YORK								
Chemung	Funk's hybrid	8.67	3.66	1.70	69.52	1.45	.019	.31
Washington	Cornell 29-3	10.37	4.08	1.87	67.15	1.53	.042	.33
PENNSYLVANIA								
Centre	U.S. 13	9.18	4.17	1.87	68.50	1.28		
NEW JERSEY								
Burlington	U.S. 13	9.78	3.74	1.78	68.17	1.53	.038	.35
WEST VIRGINIA								
Mineral	U.S. 13	8.33	3.32	2.29	70.00	1.11		
MICHIGAN								
Eaton	DeKalb 90	10.12	3.74	2.47	67.14	1.53	.019	.42
Mecosta	Open pollinated	8.67	4.67	2.13	68.17	1.36	.011	.29
St. Joseph	DeKalb 404A	9.95	3.83	2.04	67.73	1.45	.064	.37
Lenawee	DeKalb 65	8.33	3.40	1.79	70.12	1.36	.014	.08
Average...........................		9.27	3.85	1.99	68.49	1.40	.029	.31
			Region #2					
OHIO								
Clinton	Iowa 939	8.84	3.40	2.55	68.93	1.28	.012	.36
Hardin	DeKalb 458	8.50	3.32	2.00	69.65	1.53	.083	.28
Lake	DeKalb 404A	8.50	4.17	2.13	69.01	1.19	.008	.09
Mercer	Farmcraft 425	8.84	4.08	2.00	68.63	1.45	.016	.30
Morrow	DeKalb	8.76	3.23	2.30	69.43	1.28		
Paulding	Indiana 608	9.18	2.98	2.21	69.01	1.62	.042	.27
Pickaway	DeKalb 450	8.59	4.25	1.87	68.93	1.36	.026	.56
Sandusky	Indiana 608	9.35	4.17	1.87	68.25	1.36	.003	.30
Williams	DeKalb 62	8.07	2.80	1.87	71.07	1.19	.020	.31
Wood	Iowa 939	9.35	3.06	1.87	69.44	1.28	.007	.29
Fairfield	Ohio W-4059	7.31	2.89	2.13	71.39	1.28	.013	.32
INDIANA								
Benton	Indiana 608	8.58	3.32	1.87	70.00	1.28	.062	.25
Clinton	Todd's 77	7.57	3.23	2.13	71.00	1.11		
DeKalb	Pioneer 240	8.33	2.81	2.00	70.24	1.62	.042	
Elkhart	Hybrid	9.86	3.91	2.38	67.32	1.53	.013	.29
Hamilton	Indiana 813	8.76	4.00	1.62	69.34	1.28	.093	.27
Johnson	Indiana 844	9.44	3.49	2.00	68.71	1.36	.008	.35
LaPorte	DeKalb 404A							
Orange	Indiana 813	9.61	3.57	2.04	68.51	1.27	.015	.35
Vigo	Indiana 813	9.78	3.23	2.04	68.59	1.36	.013	.23
Warren	DeKalb 638	7.74	3.23	2.13	70.80	1.11	.011	.14

TABLE IC—(*Continued*)

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
INDIANA (cont.)								
Fayette	Indiana 844	8.42	3.49	1.79	70.02	1.28	.004	.24
Montgomery	Indiana 608	8.84	3.57	2.00	69.57	1.02		.21
Knox	Corn Belt 90	7.48	3.57	2.00	70.67	1.28	.016	.23
Average		8.68	3.47	2.03	69.50	1.32	.025	.28
	Region #3							
MARYLAND								
Queen Anne's	U.S. 13	9.78	3.74	2.47	67.73	1.28	.004	.31
VIRGINIA								
Montgomery	U.S. 99	8.93	4.00	2.30	68.24	1.53	.006	.26
Pittsylvania	DeKalb 888	9.69	4.42	2.30	67.14	1.45	.005	.32
NORTH CAROLINA								
Duplin	N.C. 23	9.52	4.68	1.87	67.74	1.19	.009	.10
Montgomery	Open pollinated	9.27	4.08	2.00	68.54	1.11		.22
Stokes	N.C. T20	9.86	4.00	1.87	68.16	1.11		.27
Edgecomb	Open pollinated	9.35	4.85	2.00	67.61	1.19	.003	.27
KENTUCKY								
Bourbon	U.S. 13							
Christian	DeKalb 817A	8.67	3.83	2.30	69.18	1.02		
Clinton	Kentucky 203	7.06	3.66	2.04	71.13	1.11	.009	.17
Lincoln	Kentucky 102	10.12	4.85	1.70	66.97	1.36	.025	.08
Nelson	U.S. 13	8.84	3.32	2.21	69.52	1.11	.045	.20
Ohio	U.S. 13	7.57	3.40	2.81	70.03	1.19	.025	.21
Russell	Hybrid, 203	7.40	3.57	1.70				.24
TENNESSEE								
Giles	Funk's G515W	8.58	3.23	2.00	69.83	1.36	.009	.31
Carroll	Open pollinated	8.84	3.83	2.00	68.88	1.45	.005	.38
Johnson	U.S. 13	7.91	3.66	2.21	70.11	1.11	.028	.31
Robertson	Funk's G711	8.84	4.68	2.00	68.46	1.02		
Average		8.84	3.99	2.10	68.85	1.22	.014	.24
	Region #4							
SOUTH CAROLINA								
Anderson	Open pollinated	10.20	4.76	2.13	66.80	1.11	.005	.29
GEORGIA								
Morgan	Open pollinated	9.86	4.42	1.87	67.74	1.11	.036	.13
Worth	Florida W-1	8.67	4.00	1.70	69.70	0.94		
ALABAMA								
Coosa	Funk's G714	10.46	5.34	1.70	66.22	1.28	.036	
Marshall	Open pollinated	8.76	5.10	1.96	68.07	1.11	.010	.28
Average		9.59	4.72	1.87	67.71	1.11	.022	.23

TABLE IC—(*Continued*)

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
			Region #5					
MINNESOTA								
Cottonwood	DeKalb 404	9.01	3.49	2.38	68.84	1.28	.013	.20
Faribault	DeKalb 241	10.03	4.25	1.87	67.57	1.28	.031	.22
Jackson	Minhybrid 403	9.35	4.00	1.79	68.84	1.02	.014	.21
Kandiyohi	Kingcrost	8.08	4.08	1.87	69.69	1.28	.018	.29
Meeker	Wisconsin 341							
Mower	Pioneer 355	8.16	3.66	2.30	69.60	1.28	.025	.27
Murray	Minhybrid 503	9.61	3.91	2.00	68.03	1.45	.032	
Lac Qui Parle	DeKalb 240	8.42	3.91	1.96	69.52	1.19	.034	.27
Polk	Hybrid, mixed	9.52	3.49	2.38	68.33	1.28	.009	.27
Redwood	DeKalb 239	8.84	4.17	1.96	68.84	1.19	.033	.29
Steele	Minhybrid 403	9.69	4.85	1.79	67.31	1.36	.011	.29
Todd	Kingcrost 85 d.	11.39	4.00	2.13	65.95	1.53		
Wright	Minhybrid 602	9.35	4.25	1.79	68.16	1.45	.017	.32
Medicine	DeKalb 241	9.35	3.91	2.13	68.42	1.19	.011	.23
Blue Earth	DeKalb 240	8.33	3.83	1.62	69.94	1.28		
Ottertail	Kingcrost KE1	9.69	3.74	1.70	68.85	1.02	.019	.21
Renville	Minhybrid 403	6.89	4.08	2.13	70.71	1.19	.009	.26
Watowan	Pioneer 55							
WISCONSIN								
Dane	?	9.35	4.85	2.13	67.14	1.53		.30
Pierce	Wisconsin 464	10.29	4.17	2.21	66.71	1.62		
Marquette	Wisconsin 464	10.03	4.50	1.96	67.23	1.28	.011	.26
Waukesha	Wisconsin 525	9.01	4.76	2.47	67.48	1.28	.060	.29
Branch Exp. Sta.	Wisconsin 279	8.58	4.17	1.79	69.10	1.36	.012	.34
LaCrosse	Pioneer 322	9.18	3.91	2.30	68.25	1.36	.038	.27
Green	Wisconsin 641A	10.29	3.74	2.30	67.31	1.36	.061	.33
IOWA								
Benton	Pioneer 300	10.37	4.17	2.04	67.23	1.19		
Black Hawk	Pioneer 340	9.27	3.75	2.00	68.83	1.15	.015	.27
Buena Vista	Pioneer, mixed	9.01	3.91	1.70	69.27	1.11	.026	.47
Carroll	Pioneer 340	10.03	4.34	1.53	67.91	1.19	.037	.12
Cass	?	10.97	3.49	2.04	67.14	1.36		
Cerro Gordo	DeKalb 404A	9.61	4.34	2.38	67.31	1.36	.010	.25
Cherokee	?	9.27	4.00	2.13	68.58	1.02	.010	.16
Clay	Pioneer 615	9.95	3.83	1.87	67.99	1.36	.022	.32
Crawford	Pfister 280	8.25	3.66	2.47	69.51	1.11	.045	
Dallas	Farmer's 555	9.35	3.66	1.87	68.84	1.28	.037	.13
Delaware	DeKalb 404A	7.74	4.25	2.04	69.78	1.19	.038	.24
Des Moines	?	8.93	3.57	1.87	69.35	1.28		
Dickinson	Hybrid, mixed	9.44	3.83	3.40	67.14	1.19	.027	.20

TABLE IC—(*Continued*)

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
IOWA (cont.)								
Greene	Farmer's	9.01	3.40	2.04	69.19	1.36	.009	.24
Grundy	?	8.84	3.32	1.70	69.95	1.19	.009	.24
Hamilton	DeKalb 404A	9.78	3.91	2.04	67.48	1.79	.026	.32
Harrison	Pioneer 300	9.10	3.91	1.96	68.92	1.11	.007	.28
Howard	DeKalb 65	10.12	3.83	2.21	67.65	1.19		
Ida	Thompson	6.80	3.40	1.70	71.82	1.28		
Jackson	Hybrid, mixed	9.44	3.23	2.30	67.56	2.47	.010	.25
Kossuth	Farmer's 327A	8.67	3.23	1.53	70.63	0.94	.019	.18
Linn	Hybrid, mixed	9.61	4.08	2.38	67.65	1.28		
Madison	Funk's 94	8.93	3.91	1.62	69.43	1.11		
Mills	Hybrid	9.69	4.00	1.70	68.16	1.45	.015	.33
Muscatine	Moews 15	9.35	3.83	1.87	68.84	1.11		
Osceola	DeKalb 404A	8.67	3.83	3.06	68.42	1.02		
Pocahontas	DeKalb, mixed	10.03	4.42	2.04	67.32	1.19		.26
Polk	Hybrid	8.00	4.17	1.70	70.02	1.11	.042	.26
E. Pottawattamie	DeKalb 847	9.18	3.32	1.96	69.43	1.11		
Poweshiek	Pfister 1897	7.48	3.57	2.47	70.29	1.19	.019	.26
Sac	Pfister	9.27	3.49	1.96	69.17	1.11		.23
Sioux	Joslyn	9.61	4.25	1.96	67.90	1.28	.009	.25
Story	?	8.08	3.15	3.15	69.60	1.02	.060	.22
Webster	Turner's S-57	9.52	3.74	2.64	68.08	1.02	.009	.28
Winneshiek	Pioneer	9.52	4.08	1.87	68.17	1.36		
Adair	Pioneer 333	9.10	3.74	2.04	69.01	1.11	.049	.23
Cedar	DeKalb 609	8.41	3.83	1.87	69.44	1.45	.010	.27
Clarke	Pfister 280	9.27	3.57	2.47	68.41	1.28	.078	
Dubuque	Pioneer 330	8.76	3.23	1.96	69.77	1.28		
Jasper	?	8.25	4.00	2.04	69.52	1.19	.034	.24
Lyon	DeKalb 403	10.29	4.51	2.09	67.08	1.03	.012	.19
O'Brien	DeKalb 404A	9.61	4.08	2.21	68.09	1.02		
Ringgold	Farmer's Hybrid	9.52	3.83	1.96	68.33	1.36	.018	.31
Wapello	DeKalb 728A	8.67	3.91	3.06	68.17	1.19		
MISSOURI								
Caldwell	Funk's G56	8.67	3.74	2.30	69.01	1.28	.026	.30
Cooper	Hybrid, mixed	8.25	3.32	1.96	70.19	1.28		.26
Dade	U.S. 13	9.61	3.91	2.04	68.08	1.36	.027	
Lafayette	DeKalb 840	9.86	3.32	1.70	69.10	1.02	.026	.17
Linn	DeKalb	8.42	3.49	1.87	70.11	1.11	.012	.23
Macon	Pfister 1897	7.40	3.57	1.79	70.96	1.28		
Miller	Missouri 8	9.61	4.25	1.96	67.99	1.19	.065	.14
Ralls	U.S. 13	8.67	3.57	2.13	69.27	1.36		
Randolph	U.S. 13	8.59	3.83	2.38	69.01	1.19	.013	.31
Saline	Illinois 200	9.61	3.66	1.87	68.84	1.02		

TABLE IC—(*Continued*)

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
MISSOURI (cont.)								
Vernon	Missouri 313	8.93	3.74	1.79	69.35	1.19	.008	.22
Pettis	Kellogg 77	9.01	3.66	1.96	68.67	1.70	.029	.29
Marion	Funk's G80							
Holt	DeKalb 800A	10.20	3.83	1.87	67.74	1.36	.037	.13
ILLINOIS								
Bureau	Hybrid, mixed	8.76	3.49	1.62	70.19	0.94	.012	.17
Carroll	DeKalb 404A	7.82	3.23	1.96	70.63	1.36	.011	.28
Champaign	Pfister 360	7.74	3.91	2.04	70.12	1.19	.008	.27
Clark	Hoosier Crost	9.01	3.83	2.13	68.75	1.28	.020	.26
DeWitt	Funk's G94	7.23	3.74	2.04	71.05	0.94	.028	
Fulton	Pfister 1897	10.29	3.49	1.96	67.73	1.53	.037	
Gallatin	Illinois 2119	9.95	4.00	1.79	67.81	1.45	.021	.29
Iroquois	Pfister 360	8.67	4.08	1.87	69.10	1.28	.037	.29
Knox	Hybrid	7.65	3.40	1.87	70.89	1.19		.22
Livingston	Pfister 260	8.67	4.00	2.04	69.27	1.02	.012	.23
McLean	Pfister 390	8.25	4.04	1.79	69.81	1.11	.014	.28
Mason	?	9.35	3.70	2.04	68.72	1.19	.011	
Mercer	Siebens 140S	9.01	3.74	1.87	69.02	1.36		
Piatt	Funk's G94	9.52	3.83	1.87	68.59	1.19	.022	.27
Shelby	Hybrid, mixed	8.50	4.00	1.96	69.43	1.11	.001	.22
Vermillion	DeKalb 638	8.00	3.57	1.70	70.62	1.11	.034	.23
Whiteside	DeKalb 628A	9.10	3.49	1.79	69.34	1.28	.033	.35
Winnebago	Producers	9.95	4.34	2.85	66.58	1.28	.043	.27
Woodford	Pfister 260	8.08	3.83	1.70	70.28	1.11	.045	.24
Douglas	Pioneer, mixed	9.78	4.76	1.87	67.23	1.36	.012	.27
Grundy	Producers 909	8.00	3.74	1.79	70.36	1.11	.010	.20
Kane	DeKalb 410	9.52	4.17	1.79	68.16	1.36	.031	.25
Macon	Bear's OK 40							
Ogle	DeKalb 410	9.44	4.51	1.96	67.73	1.36		
Sangamon	Hybrid, mixed	10.12	3.66	2.64	67.22	1.36	.010	.29
White	Hybrid, mixed	9.61	3.32	2.04	68.67	1.36	.022	.30
Average		9.09	3.86	2.04	68.76	1.25	.024	.26
Region #6								
ARKANSAS								
Crittenden	Funk's G244	8.00	3.74	1.62	70.36	1.28		.26
Washington	Pioneer 332	9.44	4.59	1.87	67.99	1.11	.030	.36
Average		8.72	4.17	1.75	69.16	1.20	.030	.31
Region #7								
NORTH DAKOTA								
Foster	Jacques	10.46	3.74	2.30	67.05	1.45	.008	.27
Sargent	Kingcrost 85	8.76	4.34	1.96	68.83	1.11		

TABLE IC—(*Continued*)

State and county	Variety	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %
NEBRASKA								
Cass	?	9.69	3.83	2.64	67.56	1.28	.014	.34
Cedar	DeKalb	10.12	3.40	1.53	68.50	1.45	.013	.30
Chase	?	9.78	3.40	2.13	68.33	1.36		
Douglas	Hybrid	10.42	3.62	1.88	67.72	1.36	.010	.17
Gage	Funk's 94	9.86	3.91	1.96	67.91	1.36	.028	.15
Hayes	?	7.14	3.91	2.72	69.95	1.28	.008	.35
Jefferson	Carlson 27A	8.76	4.17	1.87	68.84	1.36	.008	.29
Lancaster	U.S. 13	10.29	3.74	3.67	65.85	1.45	.018	.32
Lincoln	Open pollinated	10.12	3.66	2.55	67.14	1.53	.070	.43
Madison	DeKalb 800							
Otoe	Funk's 94	8.59	3.49	2.30	69.34	1.28		
Saline	Cornhusker	10.20	3.66	2.30	67.39	1.45	.032	.29
Webster	Hybrid	10.46	4.17	2.13	66.88	1.36	.053	.39
Custer	Cornhusker	10.12	4.68	1.79	66.62	1.79		.31
Pierce	Hybrid, mixed							
Sarpy	Hybrid, mixed						.019	.29
Kearney	?	9.61	3.57	1.79	68.84	1.19	.070	.23
KANSAS								
Jackson	Steckley	9.95	4.08	1.87	67.91	1.19	.010	.27
Marion	Kans. Sunflower	10.80	4.08	1.70	67.14	1.28	.006	.26
Pottawatomie	K2234							
Lyon	Funk's G711	9.69	4.00	1.96	68.16	1.19	.004	.28
COLORADO								
Otero	Colorado 322	9.10	4.00	1.87	68.84	1.19	.063	.23
Average		9.70	3.87	2.15	67.93	1.35	.026	.30
	Region #8							
TEXAS								
Cass	Open pollinated	7.74	4.42	2.13	69.60	1.11	.020	.31
Ellis	Texas Yellow 8	8.16	4.42	1.96	69.35	1.11	.008	.21
Milam	Funk's G711	8.16	4.25	3.74	67.74	1.11		.22
Polk	Open pollinated	8.59	4.42	1.79	68.75	1.45	.091	.11
Jim Wells	Texas Yellow 8	9.44	3.32	3.06	67.65	1.53	.007	.12
OKLAHOMA								
Beekham	Open pollinated	9.10	4.08	3.40	67.14	1.28	.013	.33
McCurtain	Open pollinated	9.61	4.25	2.30	67.73	1.11	.013	.22
Average		8.69	4.17	2.63	68.27	1.24	.025	.22
	Region #9							
OREGON								
Clackamas	Oregon 355	7.82	4.42	1.70	69.70	1.36	.019	.31
Average		7.82	4.42	1.70	69.70	1.36	.019	.31

TABLE IIA. MEANS AND 95 PER CENT FIDUCIAL LIMITS (L) OF CORN NUTRIENTS, 1946,* BY REGIONS

Region	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %	K %	Fe %	Mg %	Na %
1. Mean	8.97	3.92	2.06	68.74	1.284	.0274	.281				
±L†	.60	.29	.16	.71	.140	.0110	.054				
n	9	9	9	9	9	9	9				
2. Mean	8.60	3.72	2.06	69.36	1.234	.0160	.270	.214	.00232	.0990	
±L	.37	.18	.10	.44	.086	.0071	.035	.152	.00031	.0100	
n	24	24	24	24	24	20	22	5	12	8	
3. Mean	8.54	3.89	2.00	69.42	1.155	.0192	.242	.350	.00234	.0920	
±L	.50	.24	.14	.59	.117	.0090	.045	.152	.00048	.0130	
n	13	13	13	13	13	13	13	5	5	5	
4. Mean	8.34	4.08	2.00	69.47	1.120	.0254	.296				
±L	.73	.36	.20	.87	.172	.0141	.073				
n	6	6	6	6	6	5	5				
5. Mean	8.61	3.89	1.96	69.30	1.222	.0180	.272	.300	.00218	.1070	.01400
±L	.19	.09	.05	.23	.044	.0040	.019	.091	.00018	.0070	.00510
n	90	90	90	90	90	67	77	14	35	17	13
7. Mean	8.97	3.83	2.02	68.97	1.248	.0190	.295		.00241		
±L	.41	.20	.12	.49	.097	.0080	.037		.00036		
n	19	19	19	19	19	18	19		9		
United States											
Mean	8.66	3.89	1.99	69.22	1.225	.0194	.273	.285	.00226	.1020	.01000
±L‡	.14	.07	.04	.16	.032	.0030	.013	.061	.00013	.0050	.00400
N	169	169	169	169	169	169	153	31	66	37	26
S.D.	.91	.45	.25	1.08	.213	.0160	.082	.170	.00054	.0144	.00903
C.V.%	10	11	12	1.6	17	82	30	59	24	14	90

* Data are not recorded for the regions where there were less than five determinations.
† $\pm L = t \times S.D./\sqrt{n}$ where t is Student's t at the 95% level with N-1 degrees of freedom.
‡ $\pm L = t \times S.D./\sqrt{N}$.

TABLE IIA. MEANS AND 95 PER CENT FIDUCIAL LIMITS (L) OF CORN NUTRIENTS, 1946, BY REGIONS (*Continued*)

Region	Cl %	Mn mg/lb	Cu mg/lb	Co mg/lb	F mg/lb	Carotene mγ/lb	Thiamine mγ/lb	Niacin mγ/lb	Riboflavin mγ/lb	Pantothenic acid mγ/lb	Folic acid mγ/lb	Iodine %	Energy cal/gm
1. Mean		2.41				1.53			.470				3852.11
±L		.97				.72			.111				65.99
n		6				5			6				9
2. Mean		2.28	2.230	.0125		1.48	1.76	9.71	.514	2.45			3865.06
±L		.64	1.030	.0063		.57	.17	1.11	.075	.35			49.49
n		14	8	6		8	10	10	13	10			16
3. Mean		1.98	1.174				1.44	8.33	.544	2.43			3862.43
±L		.90	1.303				.25	1.58	.103	.50			52.91
n		7	5				5	5	7	5			14
4. Mean		2.50	2.030	.0101	2.4	1.34	1.68	9.86	.542	2.51			3848.22
±L		.38	.621	.0046	2.0	.32	.10	.61	.044	.20			20.21
n		41	22	11	14	25	33	33	38	33			96
5. Mean		2.55				1.24	1.96	10.24	.474	2.31			3938.94
±L		.72				.61	.19	1.25	.082	.40			46.66
n		11				7	8	8	11	8			18
7.													
United States													
Mean	.0410	2.43	1.820	.0112	2.3	1.33	1.72	9.75	.514	2.44	.034	.00006	3863.96
±L	.0062	.26	.450	.0031	1.4	.22	.07	.45	.030	.14	.008	.00006	15.65
N	26	87	42	24	27	52	61	60	83	61	5	4	160
S.D.	.0154	1.20	1.444	.0075	3.6	.81	.28	1.76	.137	.56	.007	.00005	100.24
C.V.%	38	49	80	67	155	.61	16	18	27	23	19	72	2.6

TABLE IIB. MEANS AND 95 PER CENT FIDUCIAL LIMITS (L) OF CORN NUTRIENTS, 1947,* BY REGIONS

Region	Protein %	Fat %	Fiber %	N.F.E. %	Ash %	Ca %	P %	K %	Fe %	Mg %	Na %
1. Mean	9.27	3.85	1.99	68.50	1.400	.0296	.307		.00199		
±L†	.57	.29	.24	.77	.122	.0142	.054		.00035		
n	9	9	9	9	9	7	7		9		
2. Mean	8.68	3.47	2.04	69.50	1.317	.0254	.282		.00177		
±L	.36	.18	.15	.48	.076	.0034	.032		.00022		
n	23	23	23	23	23	20	20		24		
3. Mean	8.84	3.99	2.11	68.70	1.224	.0144	.243		.00160		
±L	.41	.21	.18	.58	.091	.0108	.037		.00025		
n	17	17	17	16	16	12	15		18		
4. Mean	9.59	4.72	1.87	67.71	1.110				.00134		
±L	.76	.39	.33	1.04	.163				.00048		
n	5	5	5	5	5				5		
5. Mean	9.09	3.86	2.04	68.76	1.254	.0241	.255	.221	.00191	.1110	
±L	.17	.09	.07	.23	.036	.0043	.016	.058	.00010	.0061	
n	105	105	105	105	105	78	76	8	107	8	
7. Mean	9.70	3.87	2.15	67.94	1.346	.0255	.287		.00203		
±L	.38	.20	.16	.52	.082	.0091	.034		.00022		
n	20	20	20	20	20	17	18		24		
8. Mean	8.69	4.17	2.63	68.28	1.243	.0253	.217		.00133		
±L	.65	.33	.27	.88	.138	.0153	.054		.00040		
n	7	7	7	7	7	6	7		7		
United States											
Mean	9.08	3.86	2.07	68.71	1.271	.0239	.262	.282	.00185	.1109	.00939
±L‡	.12	.06	.05	.17	.027	.0031	.012	.036	.00008	.0038	.00302
N	189	189	189	188	188	146	149	21	197	21	12
S.D.	.87	.45	.37	1.18	.185	.0190	.072	.078	.00054	.0083	.00303
C.V.%	10	12	18	1.7	15	80	28	28	.29	7.5	.31

* Data are not recorded for the regions where there were less than five determinations.

† $\pm L = t \times S.D./\sqrt{n}$ where t is Student's t at the 95% level with N-1 degrees of freedom.

‡ $\pm L = t \times S.D./\sqrt{N}$.

TABLE IIB. MEANS AND 95 PER CENT FIDUCIAL LIMITS (L) OF CORN NUTRIENTS, 1947, BY REGIONS (*Continued*)

Region	Cl %	Mn mg/lb	Cu mg/lb	Co mg/lb	F mg/lb	Carotene mg/lb	Thiamine mg/lb	Niacin mg/lb	Riboflavin mg/lb	Pantothenic acid mg/lb	Folic acid mg/lb
1. Mean		2.13	.679	.0067							
±L		.33	.114	.0039							
n		9	9	9							
2. Mean		1.94	.768	.0080	2.8	1.35			.525		
±L		.20	.070	.0024	2.4	.56			.087		
n		24	24	24	8	8			8		
3. Mean		2.25	.765	.0092		.98			.543		
±L		.23	.081	.0027		.71			.093		
n		18	18	18		5			7		
4. Mean		2.78	.622	.0086							
±L		.44	.155	.0052							
n		5	5	5							
5. Mean	.0538	2.14	.731	.0076	2.2	1.47	1.54	9.68	.577	2.67	.047
±L	.0099	.10	.033	.0011	2.0	.46	.22	.72	.071	.64	.014
n	9	107	107	107	12	12	11	11	12	10	5
7. Mean		2.50	.731	.0093							
±L		.20	.070	.0024							
n		24	24	24							
8. Mean		2.09	.726	.0096							
±L		.37	.130	.0044							
n		7	7	7							
United States											
Mean	.0450	2.19	.734	.0081	2.6	1.34	1.63	9.92	.570	3.08	.047
±L	.0064	.07	.024	.0008	1.3	.26	.13	.46	.039	.40	.014
N	22	197	197	197	26	36	28	27	40	26	5
S.D.	.0144	.50	.174	.0059	3.3	.78	.35	1.16	.122	.98	.011
C.V.%	32	23	24	73	128	58	21	12	21	32	23

TABLE III. PER CENT OF TOTAL VARIANCE ACCOUNTED FOR JOINTLY BY REGION AND STATE-WITHIN-REGION VARIATION, AVERAGE OF 1946–1947*

Nutrients For Which State and Region Effects Accounted For:

10% of variance	15–30% of variance	50–65% of variance
Protein (r, s)	Calories (r, s)	Potassium (r, s)
Fiber (r)	Fat (R, s)	Chlorine (r)
Ash (r)	N-free extract (R, s)	Iron (r, S)
Phosphorus (0)	Copper (S)	
Calcium (r)	Niacin (0)	
Magnesium (s)		
Sodium (0)		
Cobalt (s)		
Manganese (s)		
Fluorine (0)		
Carotene (0)		
Thiamine (r)		
Riboflavin (0)		
Pantothenic acid (0)		

* r indicates significant regional effects in one year; R indicates significant regional effects in both years. s indicates significant state-within-region effects in one year; S indicates significant state-within-region effects in both years; 0 indicates no significant effects in either year.

TABLE IV. PER CENT OF TOTAL VARIANCE IN PROXIMATE AND MINERAL COMPOSITION ACCOUNTED FOR JOINTLY BY GREAT SOIL GROUPS AND SOIL ASSOCIATIONS, AVERAGE OF 1946–1947*

Nutrients For Which Soil Type Accounted For:		
10% of variance	15–30% of variance	50% of variance
Calories (0)	Protein (m)	Fat (M, S)
Fiber (m)	Potassium (0)	
N-free extract (m, s)	Iron (s)	
Ash (s)		
Calcium (0)		
Phosphorus (0)		
Manganese (m, s)		
Copper (m, s)		
Cobalt (m, s)		

* m indicates significant Great Soil Group effects in one year; M indicates significant Great Soil Group effects in both years; s indicates significant soil association effects in one year; S indicates significant soil association effects in both years; 0 indicates no significant effects in either year.

TABLE V. PER CENT OF TOTAL VARIANCE ACCOUNTED FOR BY VARIETIES—AVERAGE OF 1946–1947*

Nutrients For Which Varietal Effects Accounted For:		
10% of variance	10–20% of variance	30–40% of variance
Calories (o)	Calcium (v)	Fat (V)
Protein (o)	Magnesium (o)	Niacin (o)
Fiber (o)	Manganese (v)	
N-free extract (o)	Carotene (o)	
Ash (o)		
Phosphorus (o)		
Potassium (o)		
Iron (v)		
Copper (o)		
Cobalt (o)		
Thiamine (o)		
Riboflavin (o)		
Pantothenic Acid (o)		

* v indicates significant varietal effects in one year; V indicates significant varietal effects in both years; o indicates no significant varietal effects in either year.

TABLE VI. SIMPLE CORRELATION COEFFICIENTS BETWEEN NUTRIENTS WHICH ON THE AVERAGE FOR THE TWO YEARS EQUALED OR EXCEEDED .30*

	N-free extract	K	Mg	Cl	Fe	F	Carotene	Thiamine	Calories
Protein	−.88 (S)	.33 (s)	.38 (s)						
Fat	−.46 (S)								
Ash	−.32 (S)								
Ca				.36 (0)					
P			.34 (s)						
K	−.30 (s)								
Mg	−.38 (s)								
Na		−.33 (0)				.80 (s)	.42 (s)		
Cl							.36 (0)		
Mn	−.30 (S)				.32 (s)	.60 (s)	.43 (s)		
Cu						.39 (s)			
Co		−.56 (s)			.36 (s)	.52 (0)			−.41 (0)
F		−.41 (0)	−.61 (s)	.35 (0)	.42 (s)		.75 (s)		
Thiamine							.60 (s)		.50 (s)
Niacin					−.30 (s)	−.32 (0)	.42 (s)	.38 (s)	.51 (s)
Riboflavin					.37 (s)	.30 (s)			−.48 (s)
Panthothenic acid		.37 (s)		−.47 (0)			−.42 (s)		

* S indicates significant correlation in both years; s indicates a significant correlation in one year; 0 indicates no significant correlation in either year.

TABLE VII. SIMPLE CORRELATION COEFFICIENTS BETWEEN THE NUTRIENTS IN CORN, 1946*

	Fat	Fiber	N.F.E.	Ash	Ca	P	K	Fe	Mg	Na	Cl
Protein	$.05^{100}$	$.12^{100}$	$-.87^{*100}$	$.12^{100}$	$-.07^{140}$	$.18^{*158}$	$.18^{31}$	$.32^{*60}$	$.44^{*87}$	$.33^{30}$	$-.24^{30}$
Fat		$-.17^{*100}$	$-.38^{*100}$	$-.12^{100}$	$-.02^{140}$	$-.13^{158}$	$.15^{31}$	$.04^{60}$	$.31^{87}$	$-.24^{30}$	$.12^{30}$
Fiber			$-.26^{*100}$	$.05^{100}$	$.11^{140}$	$.09^{158}$	$-.07^{31}$	$.15^{60}$	$.29^{87}$	$.07^{30}$	$-.28^{30}$
N.F.E.				$-.28^{*100}$	$-.01^{140}$	$-.13^{158}$	$-.15^{31}$	$.05^{60}$	$-.56^{*87}$	$-.34^{30}$	$.24^{30}$
Ash					$.29^{*140}$	$.19^{*158}$	$-.16^{31}$	$.25^{*66}$	$-.12^{87}$	$.59^{*30}$	$.11^{30}$
Ca						$-.04^{140}$	$-.26^{26}$	$.13^{53}$	$-.36^{*31}$	$.33^{30}$	$.37^{30}$
P							$.03^{28}$	$-.01^{60}$	$.41^{*84}$	$.22^{30}$	$-.43^{*30}$
K								$.03^{31}$	$.10^{81}$	$-.41^{30}$	$-.20^{30}$
Fe									$-.07^{87}$	$.53^{*30}$	$.25^{30}$
Mg										$.07^{30}$	$-.35^{30}$
Na											$-.24^{30}$

	Mn	Cu	Co	F	Carotene	Thiamine	Niacin	Riboflavin	Pantothenic acid	Calories
Protein	$.17^{87}$	$-.13^{42}$	$-.14^{24}$	$-.11^{27}$	$.13^{63}$	$.13^{61}$	$-.32^{*60}$	$-.17^{88}$	$-.16^{61}$	$.18^{*160}$
Fat	$.16^{87}$	$-.04^{42}$	$-.10^{24}$	$-.13^{27}$	$-.16^{63}$	$-.07^{61}$	$-.34^{*60}$	$.06^{88}$	$-.09^{61}$	$.18^{*158}$
Fiber	$-.03^{87}$	$-.23^{42}$	$.11^{24}$	$-.14^{27}$	$.05^{63}$	$.17^{61}$	$-.10^{60}$	$-.36^{*88}$	$.07^{61}$	$.04^{158}$
N.F.E.	$-.23^{*87}$	$.24^{42}$	$-.10^{24}$	$.11^{27}$	$-.07^{62}$	$-.16^{61}$	$.45^{*60}$	$.19^{88}$	$-.14^{61}$	$-.17^{*158}$
Ash	$.24^{*87}$	$-.18^{42}$	$.06^{24}$	$.28^{27}$	$.33^{*63}$	$-.06^{61}$	$-.13^{60}$	$.08^{88}$	$.12^{64}$	$-.06^{150}$
Ca	$.03^{71}$	$.09^{30}$	$-.04^{24}$	$.25^{26}$	$.30^{*46}$	$.21^{40}$	$.11^{47}$	$-.21^{60}$	$.01^{40}$	$.01^{125}$
P	$-.02^{78}$	$-.07^{40}$	$-.24^{24}$	$-.06^{30}$	$-.14^{40}$	$.13^{46}$	$.25^{65}$	$-.03^{78}$	$.08^{66}$	$-.01^{137}$
K	$-.24^{81}$	$.19^{31}$	$-.84^{*18}$	$-.41^{11}$	$-.70^{*22}$	$-.10^{27}$	$.02^{26}$	$.04^{30}$	$.01^{27}$	$.03^{30}$
Fe	$.50^{*66}$	$-.35^{*42}$	$.67^{*24}$	$.61^{*13}$	$.25^{24}$	$-.11^{61}$	$-.42^{*64}$	$.46^{*66}$	$-.01^{61}$	$-.01^{87}$
Mg	$-.30^{37}$	$-.13^{30}$	$-.10^{10}$	$-.61^{*11}$	$-.39^{*27}$	$.17^{33}$	$-.22^{23}$	$-.03^{37}$	$.09^{30}$	$-.23^{30}$
Na	$.65^{*30}$	$-.40^{*26}$	$.39^{18}$	$.80^{*10}$	$.76^{*22}$	$-.37^{22}$	$-.46^{*21}$	$.43^{*30}$	$.54^{*30}$	$-.04^{30}$
Cl	$.32^{30}$	$-.17^{28}$	$-.13^{18}$	$.35^{10}$	$.40^{22}$	$.47^{*22}$	$.50^{*21}$	$.22^{30}$	$-.62^{*30}$	$.22^{25}$
Mn		$-.17^{42}$	$.47^{*24}$	$.96^{*18}$	$.67^{*63}$	$.22^{61}$	$.07^{60}$	$.22^{*83}$	$-.11^{64}$	$-.10^{63}$
Cu			$-.67^{*24}$	$-.74^{*11}$	$.30^{22}$	$.22^{27}$	$.47^{*36}$	$-.27^{41}$	$-.28^{37}$	$.22^{60}$
Co				$.72^{8}$	$-.05^{22}$	$.43^{10}$	$-.29^{18}$	$.40^{23}$	$-.22^{10}$	$-.41^{23}$
F					$.90^{*11}$	$-.05^{10}$	$-.32^{10}$	$.53^{*10}$	$.13^{10}$	$-.19^{26}$
Carotene						$.34^{30}$	$.67^{*30}$	$-.12^{49}$	$-.31^{30}$	$.09^{50}$
Thiamine							$.41^{*64}$	$-.45^{*61}$	$-.26^{*61}$	$.50^{*60}$
Niacin								$-.38^{*60}$	$-.17^{60}$	$.51^{*60}$
Riboflavin									$-.04^{61}$	$-.48^{70}$
Pantothenic acid										$-.02^{60}$

* Note: The exponent indicates the number of determinations in the coefficient. The asterisk indicates that the coefficient is significant.

TABLE VII—(*Continued*)

SIMPLE CORRELATION COEFFICIENTS BETWEEN THE NUTRIENTS IN CORN, 1947

	Fat	Fiber	N.F.E.	Ash	Ca	P	K	Fe	Mg	Na	Cl
Protein	.27*	.02	−.88*	.30*	.05	.07	.49*	.18*	.33	−.36	.03
Fat		.08	−.54*	−.06	−.04	.02	.28	−.06	.15	.17	.02
Fiber			−.29*	.04	−.02	.10	.03	−.02	−.16	−.61*	−.26
N.F.E.				−.37*	−.02	−.14	−.46*	−.10	−.21	.49	.09
Ash					.07	.29*	.48*	.08	.18	−.25	−.07
Ca						−.01	.05	.10	.29	−.11	.33
P							.18	.04	.27	−.16	.02
K								.30	.02	−.25	−.35
Fe									.35	−.24	.16
Mg										−.43	.22
Na											.30

	Mn	Cu	Co	F	Carotene	Thiamine	Niacin	Riboflavin	Pantothenic acid
Protein	.19*	−.04	−.17*	.10	.10	.42*	.23	.41*	.10
Fat	.19*	−.18*	.02	.04	−.06	−.06	.23	.14	.21
Fiber	−.01	.13	.02	.33	−.31	−.15	.06	.27	.32
N.F.E.	−.36*	.06	.12	−.23	.08	−.19	−.26	−.44*	−.27
Ash	.16*	−.05	.03	.32	−.01	.07	.09	.33*	.09
Ca	−.05	−.12	−.15	.55*	.19	.09	.16	.09	−.20
P	.12	−.03	.03	.54*	.14	.01	.03	−.08	.22
K	.47*	.05	−.27		.47	.47*	.39	−.15	.73*
Fe	.13	.10	.06	.24	.25	.19	−.19	.28	.08
Mg	−.08	−.40	−.17		.32	.19	.04	.05	−.12
Na	−.11	.15	.15		.09	.13	.22	−.12	−.57
Cl	−.12	−.19	.19		.31	−.37	.01	−.16	−.32
Mn		.21*	.07	.24	.19	.21	.18	−.24	.34
Cu			.23*	−.04	−.03	.08	−.06	−.19	.01
Co				.31	.18	−.15	−.12	−.11	−.13
F					.59			.07	
Carotene						.87*	.17	−.01	−.54*
Thiamine							.34	.36	−.22
Niacin								−.07	−.05
Riboflavin									−.36