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SUMMARY OF SRS SORGHUM RESEARCH

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Statistical Reporting Service sponsored sorghum research during 1959-64 to collect information for objective yield procedures. Work was carried on during 1959-64 in Iowa as cooperative Statistical Reporting Service and Iowa State University projects. A separate study was conducted in Oklahoma in 1964.

IOWA STATE WORK

1959

The first problem considered was the estimation of the number of kernels per sample sorghum head. Three methods of estimation were tried. (1) The first was the number of kernels counted on a randomly selected branch times the number of branches on the head. This method gave a very poor estimate since there was a large difference in sizes of branches. (2) The second method involved stratifying branches into three strata and counting kernels on two branches from each stratum and multiplying by the number of branches in that stratum. Then sum these three totals and divide by two. This seemed to be a good estimation. (3) The third method used was the average weight of two samples of 200 kernels divided into the total weight of all kernels multiplied by 200. This estimate was found to be as good as method 2 and easier to use.

Optimum plot size was the next consideration. On the last visit, two heads were harvested from each of four adjacent 25 ft. by 3 row plots. Plants were counted in each of these plots. The optimum found was 80 feet by 3 rows.

1960

The 1960 study looked into the problem of optimum plot size (for estimating weight per head) for completely harvested plots. On the last visit a six foot plot was set up. Each was divided into two foot subplots. The computed optimum plot size was four feet by two rows.

Another problem considered was the estimation of harvesting loss. It was determined that a four row harvester leaves more grain in one row center than the three adjacent centers. The row centers were stratified and a sample taken of both heavy and light centers. The estimate of loss had a C.V. of 18%. It was stated that the stratification was 10% more efficient than a simple random sample would have been. About 30% of the total loss was accounted for by loose kernels. The big problem found in this portion of the study was how to pick up and weight loose kernels. The method used was to sweep up loose kernels and necessarily some dirt and trash. The process of picking up individual kernels would be extremely time consuming. An attempt

was made to separate kernels from foreign matter, with metallic sieves. The sieves did not do a good job.

1961

Multiple linear regress was used to attempt to predict average dry kernel weight per head. Some results are summarized in tables 1 and 2.

TABLE 1. -- Correlations of Independent Factors With

Dry kernel weight using $Y = \bar{y} + \sum_i B_i \ (X_{ih} - X_h)$

Variable	August r	September r
Height of plant	.42	.38
Diameter at plant base	.75	.68
Diameter at head base	.41	.53
Length of head	-.35	-.59
Circumference of head	.40	.49
Eye estimate of no. of branches	.39	.46
Eye estimate of no. of kernels	.57	.23
No. of plants in row	-.34	-.33
No. of heads in row	.02	.31
Multiple R^2	.69	.52

n (August) = 35

n (September) = 43

TABLE 2. -- Correlation of Independent factors with dry kernel weight using $Y = \bar{y} + \sum_i a_i (Z_{ih} + Z_h)$

Variable	August r	September r	Mid Oct r
Height of plant	.04	.17	.44
Diameter of base of plant	.23	.52	.75
Diameter of base of head	.22	.55	.78
Length of head	.14	.49	.62
Circumference of head	.19	.45	.77
Eye estimate of no. of branches	.06	.48	.67
Eye estimate of no. of kernels	.32	.49	.82
No. of plants in row	-.42	-.35	.36
No of heads in row	-.21	-.33	.36
Width of head	.21	.48	.80
Wet head weight	.37	.59	.89
Wet kernel weight	.38	.58	.90
Dry kernel weight	.35	.48	
Multiple R^2	.32	.42	.84

More methods of estimating the number of kernels per head were examined. These were (1) Eye estimation, (2) Weight estimation and (3) Count estimation. Eye estimation involved visually comparing a head with a known number of kernels and the head to be estimated. Weight estimate involved weights of two samples of 100 kernels compared to the weight of all kernels on the head. Count estimate involved counting the number of kernels in a three gram sample. The weight estimation was good after the first visit, but even a combination of weight estimator and count estimators did not do very good on the first visit.

Additional analyses of optimum plot size, number of plots, and number of heads were completed. Plots of two rows by 20 feet were laid out. These were divided into sub-plots of one row by 10 feet. Various combinations of the 1 X 10 plots were studied. Optimum plot size was found to be 1 X 10. The analysis indicated five was the optimum number of plots. For predicting dry kernel weight per head the optimum number

of heads was two and for estimating the optimum number of heads was three. The best estimator of heads was the September plant count. The August plant count was not as good since there was a problem in making exact plant counts. Soughum was not very well headed and volunteer corn and foxtail looked much like the sorghum plants on August 1.

1962

Two plots of four (18 foot) rows were randomly selected. The first three rows of each plot were sub-divided into six foot sub-plots. The fourth row was sub-divided into nine foot sub-plots. The analysis of variance is based on pounds per acre (obtained by number of heads times dry kernel weight times expansion factor). This analysis indicated that the six foot unit gave a smaller variance of the mean per head (this assumes an equal cost per head under the different sampling plans and an equal number of heads).

Some work was done on dry kernel weight prediction. Variables considered were:

(1) August plants per foot

(2) August per cent heads

(3) September heads per foot

(4) August dry kernel weight per head

(5) August percent dry matter

(6) August dry kernel weight times August percent dry matter

(7) September dry kernel weight

(8) September percent dry matter

(10) September dry kernel weight X September percent dry matter

The highest multiple R^2 obtained for August was .66 with 44 observations. The highest multiple R^2 obtained for September was .73 with 26 observations.

1963

Plots were four rows by 15 feet with each row subdivided into 5 foot subrows. Two rows were observed only once in August and September, and October).

The following table gives the simple correlation of some selected variables with the harvested dry kernel weight per hear (For years 1961, 1962,1963).

TABLE 3. -- Correlations of Independent Variables with dry kernel weight

Variable	1961	1962	1963
August plants per foot	-.3994	.6650	-.7234
August % heads	.4244	.4243	.3467
August DKW per head	.5167	.6310	.4445
August % dry matter	.2746	.3476	-.0324
August DKW X % dry matter	.4222	.6289	.3414
September heads per foot	-.3820	-.5547	-.7641
September DKW per head	.7198	.7593	.7449
September % dry matter	.2025	.3098	.0995
September DKW X % dry matter	.6071	.7082	.6697

The above variables and an estimating equation were used to predict dry kernel weight. This prediction overestimated the actual average by 17%. The prediction of number of heads by using August plant counts was very close to that estimated at harvest (5.29 compared to 5.30).

In 1963 sorghum seemed head early and it turned dry the last part of the growing season.

A gleaning study conducted produced no important results.

1964

The results of work completed in 1964 was very similar to those for 1963. A prediction of number of heads at harvest using August plant counts was very good. The prediction of dry kernel weight still left much to be desired. A gleaning was again performed but no advancements in methods of obtaining to the sample were implemented. It was recommended in this report that any future work be undertaken in a state producing more sorghum. The poor results of the equation for predicting dry kernel weight may have been due to the wide range of planting dates and the short Iowa season.

OKLAHOMA STUDY

A sample of three subjectively selected farms with four observation units was used. Each unit was two rows by 15 feet and the unit was divided into subunits of one row by five feet.

An analysis of optimum plot size, comparing plots 1 x 15, 2 x 15, 1 x 5 and 2 x 5 was performed. This analysis indicated that two rows by

five feet is the optimum plot size using a specified cost function.

Of the characteristics measured, length of head and diameter of culm (one and one-half inches below the head) had the best correlations with final head weight.