CR 151180

CROP STATUS EVALUATIONS AND YIELD PREDICTIONS

FINAL REPORT

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INTRODUCTION

This is a report of one phase of the Large Area Crop Inventory Project (LACIE) initiated by the National Aeronautics and Space Administration. The specific LACIE objective for which this phase was designed was to develop and demonstrate wheat yield models based on the input of environmental variables potentially obtainable through the use of space remote sensing.

The influence of weather factors on plant growth has been the subject of intensive research for several decades. Despite large expenditures for controlled environment research facilities (to evaluate specific variables) very little practical information has been obtained on crop-weather relationships. In contrast to these traditional procedures, the research described in this report is based on observations of plants in the field under conventional production practices and under natural weather conditions. By the use of a unique method for visually quantifying daily plant development and subsequent multifactor computer analyses it has been possible to develop practical models for predicting crop development and yield.

Development of wheat yield prediction models reported here was based on the discovery that morphological changes in plants could be detected and quantified on a daily basis (Haun 1973a), and that this change during a portion of the season was proportional to yield (Haun 1974). This description of morphological growth stages is similar, but should not be confused with those of Hanway on corn, Feeks and Large on wheat, and Vanderlip et.al. on sorghum, since their descriptions are used to identify the physiological (or phenological) events.

Year-to-year variations in crop yields are very important in the economies of many countries. The prospects for food shortages in various parts of the world and the effects of crop failures pose contiuning problems in future years. When it is realized that levels of fertilization and types of disease and insect control remain relatively constant (for given producing areas as determined by recommended practices and general economic trends), it is evident that major fluctuations in crop yields of areas such as states or countries will be primarily due to variations in weather. Accurate current information on crop conditions relative to weather will be of great value in management of crop production, economic considerations, and subsequent distribution of food.

Yield prediction systems developed in this project are based on the input of temperature and precipitation data, in contrast to subjective crop observations used by the Statistical Reporting Service of the USDA. Consequently predictions by these systems are potentially more economical and rapidly assembled.

SUMMARY AND CONCLUSIONS

1. Prediction models, based on input of weather data, for crop growth at daily intervals and for yield at weekly intervals during the major development portion of the season were developed for spring wheat and winter wheat.

2. Prediction models were successfully applied to the major wheat producing regions of the United States and the USSR.

3. A model was developed for predicting the date of planting (50 % of the crop) for spring wheat in North Dakota from weather data.

4. Quantitative morphological data from wheat, barley, oats and rye were compared by multiple regression analysis. Since only minor differences among species were evident in growth rates, the models developed for each species predicted growth of the others quite well. Thus, any differences in responses of these crops to weather may be considered insufficient to be evaluated by these procedures.

5. Since the basic approach of this research is still relatively new, various investigations were made of the method for quantifying morphological development. The most significant study indicated that a slight improvement could be made in the accuracy of growth rate determinations if physical measurements are used rather than visual quantitative morphological observations. However, since the quantitative morphological readings are much easier to make, it is considered that they are just as accurate providing the number of sample plants is sufficient, e.g. the average of 25 readings of this type is as good as the average of 10 physically measured plants and they take less time to accomplish. Primary validation of the visual method is provided by its highly significant correlation with various groupings of environmental factors in multiple regression analyses.

RECOMMENDATIONS

1. Since this project represents an extensive improvement and successful demonstration of a relatively new procedure for modeling crop-weather relationships, is is evident that the approach should be applied to other economically important crops, e.g. corn, soybeans, potatoes and cotton.

2. The developed spring and winter wheat models should be tested in an operational sense by another group.

3. Since experience with the initial application of models indicates that there are numerous ways in which the equations and/or methodology could be improved, it would be desirable for this project to be continued for another year.

SIGNIFICANT RESULTS AND APPLICATIONS

All of the work in this project prior to September 1, 1976 has been reported in detail in monthly reports. Many findings were significant, but rejected later in favor of improved procedures or increased ststistical significance of results. Some studies were performed as further justification and improvement of various procedures initially assumed to be valid. Thus, the following material is limited to results since September 1, 1976 and to documentation of the most advanced models, with statistical notation and the procedures utilized in their formulation. It is assumed that this material is sufficiently detailed for operational applications and/or testing by other investigators.

Data base for wheat models-

For the growth models reported here, daily morphological changes were obtained from 25-plant observations at each site. For spring wheat, data were obtained from four locations in North Dakota in each of two years, and from Clemson, South Carolina in one year. The spring wheat daily average growth rates at each site and the environmental variables were presented in table form in the February 4, 1976 monthly report. For the winter wheat model, data were obtained from four locations in Kansas in each of two years, and from one location for one year each in Oregon, England, Norway and Germany. The winter wheat daily average growth rates at each site and the environmental variables were presented in the September 6, 1976 monthly report. Estimated soil moisture was calculated by the method of Thornthwaite (1948).

For the yield models, yield data were obtained from state and USDA statistical reports. Weather data were obtained on magnetic tape from the National Weather Records Center in Asheville, North Carolina. North Dakota weather data for the period 1965-72 were used for the spring wheat model, and Kansas weather data for the period 1951-72 were used for the winter wheat model. Data from all stations in each crop reporting district were averaged by division to obtain daily values.

General methodology for analyses-

To obtain the growth rate prediction equations, growth rates were regressed on various combinations of environmental factors and their transformations. Computer programs for step-up and step-down multiple regression analyses designed by Barr and Goodnight (1971) were used to obtain prediction equations. From the relatively large number of potential variables used, only a few are represented in the ultimate selection of a prediction equation. Criteria used in selection of the best analysis were: level of overall F, R^2, Student's t values for coefficients, and the accuracy of predictions when the equation was applied to data from different locations and/or years (i.e. independent of the data from which the equation was obtained).

Similarly, to obtain the yield prediction equations involving the relationship of growth index (GRI = daily growth rate summed from planting to date of prediction) and several seasonal variables to yield of spring wheat, historical USDA crop reporting divisional yields were regressed on GRI, preseason precipitation, planting date, soil moisture at planting, fertilizer nitrogen, and the running sum of precipitation from planting to the time of the prediction. For winter wheat, yield was regressed on GRI, preseason precipitation(July1 to October 1), early season precipitation (September 1 to December 1), winter precipitation (December 1 to March 1); total preshooting precipitation (September 1 to March 1); snow accumulation in December, January, February and total for the three months, average minimum temperature in December, January, February and for the three months; monthly average of daily products of minimum temperature and snow depth for December, January, February and for the three months, fertilizer nitrogen; and the running sum of precipitation from planting to the time of the prediction. Due to the insignificant nature of many of these variables they did not appear in the final prediction models. This procedure was repeated twenty times with the appropriate changes in GRI (calculated for each week of each division of each year) to develop yield prediction equations for twenty weeks of the season. Overall flow diagrams of the equations in symbolic form are presented on the following pages. Subsequent pages give explanations for symbols, derivations and the necessary coefficients to execute the models (in the appendix). Coefficients and intercepts are presented as partial regression coefficients (b or B on computer printouts) in tables, along with other statistics associated with the analyses from which they were obtained, so that their relative statistical significance, and the overall significance of each analysis can be noted.

Test application of models -

For a given location or area where the prediction system is to be applied the following exogenous data (or averaged data if for more than one location) are needed on a daily basis·

- Maximum temperature
- Minimum temperature
- Precipitation
- Date prediction is intended

Other data needed for each prediction site:

- Latitude
- Long term monthly mean temperature
- Field capacity of soil (an estimate is used where this is not known)
- Fertilizer nitrogen per acre (last year's published level ,or value from a trend line may be substituted if value is not known)
- Preseason Precipitation

Planting date (a system for modeling this has been developed. However, this date will be available for all areas of the U.S. in current publications)

Since estimated soil moisture is defined as (centimeters in upper 2 feet) equal or less than field capacity, it is important to have an artificial limiting procedure on this equation to prevent ESM from exceeding this value.

The "soil moisture at planting" listed as an input item is endogenous to the system. It is calculated in advance of the planting date by beginning daily calculations as many months in advance of planting as is convenient.

Both spring and winter wheat models were tested on the current season for the major producing regions of the US and USSR. Results of these applications are presented on the following pages and figures comparing some of the predictions with USDA reports. Predictions for other countries were not possible because the necessary data were not available.

The spring wheat predictions on July 1, 1976 were based on coefficients reported January 8, 1976. Predictions for August 1, 1976and September 1, 1976 were based on improved coefficients presented in this report.

The winter wheat predictions on the following pages are based on coefficients reported in the November 5, 1975 and April 5, 1976 monthly reports. The final equations presented in this report are expected to produce better predictions since the growth equation is based on 12 location-years data rather than the 4 used earlier, however there has not been sufficient time since the analyses were finished for tests.

When the winter wheat model was first applied to the five-state major production region it was found that there was a distinct gradient of increasing yield from south to north. This indicated that adjustments would have to be made when the model was applied outside of Kansas, the state from which original data were used to construct the model. In order to obtain an adjustment for latitude the growth indices were regressed on latitude and the following equation applied to the April 1 growth indices: Adjusted GRI = Actual GRI + 1.495 (latitude - 38). This had the effect of standardizing GRI for approximately the mean latitude of Kansas. This adjustment was found to be inadequate to predict the current status of the crop (as indicated by USDA) and was abandoned. In subsequent reports the growth index was adjusted to a value for April 1 so that the predicted yields would be approximately the same as the USDA April 9 report. Beyond April 1 the any variations in GRI reflect the variations in weather among locations.

A slightly different type of adjustment was obtained for USSR winter wheat predictions by regressing on latitude the amount by which GRI on May 1 would have to be adjusted to approximate the 1969-71 average yields. Thus, GRI adjustment = -111.6 + 2.188 (latitude).

Fig. 1 Winter Wheat Prediction Model

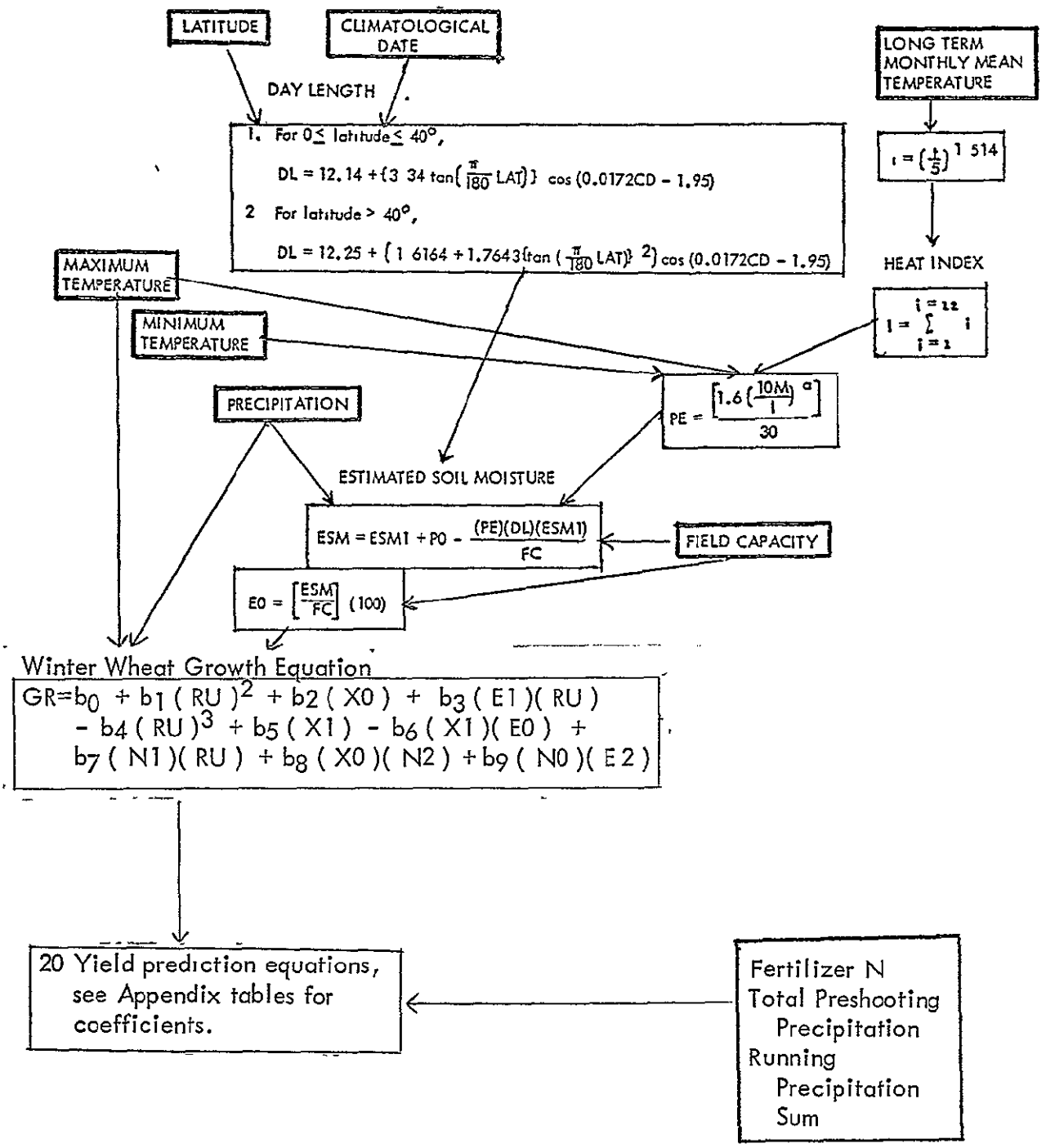

Table 1 Analysis of variance, regression coefficients, and statistics of fit for the dependent variable growth rate of winter wheat from emergence to boot stage based on four sites in Kansas, one site in Oregon, one site in Norway, one site in England, and one site in Germany. The Kansas data is for 1974-75 and 1975-76. The remaining data is for the 1975-76 crop year.

Source	df	MS	F	Prob. F	R^2
Regression	9	.5788792	620.3	.0001	.705
Error	2333	.0009332			
Corrected total	2342				

	Partial regression coefficients	Student's t for HO·B=0	Prob.>|t|
Intercept	0.012		
RU2	2.098×10^{-4}	6.83	0.0001
X0	1.436×10^{-3}	10.87	0.0001
E1RU	3.490×10^{-5}	11.57	0.0001
RU3	-1.571×10^{-5}	11.04	0.0001
X1	4.899×10^{-3}	16.25	0.0001
X1E0	-5.027×10^{-5}	14.28	0.0001
N1RU	1.256×10^{-4}	6.50	0.0001
X0N2	5.347×10^{-5}	4.92	0.0001
N0E2	8.820×10^{-6}	4.60	0.0001

RU - Seven day running average of mean air temperature (Degrees centigrade)
X - Maximum temperature (Degrees centigrade)
E - Estimated soil moisture (Percent in upper two feet)
N - Minimum temperature (Degrees centigrade)
The first number following each variable indicates the lag period in days.
When two abbreviations occur together, this indicates that the variables are to be multiplied.

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Fig. 2 Spring Wheat Prediction Model

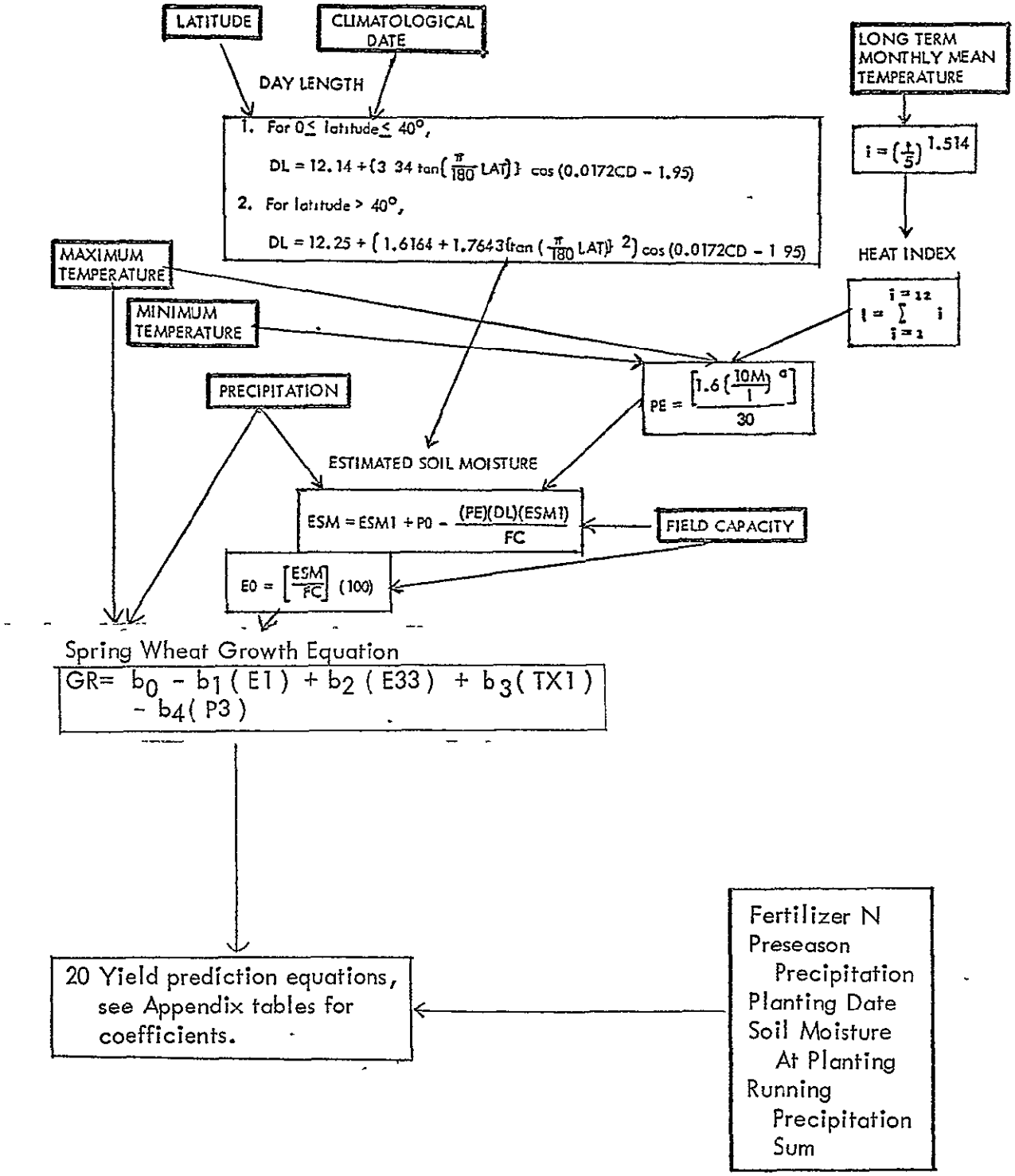

Table 2. Analysis of variance, regression coefficients, and statistics of fit for the dependent variable growth rate (2-day average) of spring wheat from emergence to boot stage based on four sites in 1974 and 1975 in North Dakota and one site in South Carolina in 1974.

Source	df	MS	F	Prob.>F	R^2
Regression	4	0 03969	40.33	0.0001	0 417
Error	225	0.00098			
Corrected Total	229				

	Partial regression coefficients	Student's t for H0·B = 0	Prob.>|t|
Intercept	0.255		
E1	-1.810×10^{-3}	7.54	0.0001
E33	8.657×10^{-8}	5.63	0.0001
TX1	1.972×10^{-3}	3 65	0.0006
P3	-8.404×10^{-3}	2.86	0.0049

E - Estimated soil moisture %
TX - Maximum temperature (C°)
P - Pricipitation (cm)
The first number following each variable indicates the lag period in days.
The second number indicates the power to which the variable is raised.

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ABBREVIATIONS

a= $4.92 \times 10^{-1} + 1.79 \times 10^{-2} I - 7.71 \times 10^{-5} I^2 + 6.75 \times 10^{-7} I^3$ (Thornthwaite 1948)

CD= Climatological date (Day of year beginning March 1)

CU= Cumulative Growth (From emergence in morphological units)

DL= Day length (12 hour units)

E= Estimated soil moisture (Percent in upper two feet)

ESM= Estimated soil moisture (Centimeters in upper two feet that are less than or equal to field capacity)

F= Nitrogen (Kilograms per hectare)

FC= Field capacity (Centimeters in upper two feet)

FN= Minimum temperature (Degrees Fahrenheit)

F X= Maximum temperature (Degrees Fahrenheit)

GR= Daily growth rate (Morphological units)

GRI= Growth index (Summation of daily growth rates for a given period)

I= Thornthwaite heat index- A constant for a given location and is the sum of twelve monthly index values i (Thornthwaite 1948)

i= $(t/5)^{1.514}$ (Thornthwaite 1948)

JD= Julian Date (Day of year beginning January 1)

L= Langleys (Gram calories / square centimeters / minute)

LAT= Latitude (Degrees North)

M= Mean temperature (Degrees Fahrenheit)

N= Minimum temperature (Degrees Centigrade)

P= Precipitation (cm.)

PD= Planting Date (As Julian date)

PE= Potential evapotranspiration (cm.)

PP= Preseason Precipitation - (a) For winter wheat - the total sum in cm. from July 1 to October 1 (b) For spring wheat- the total sum in cm. from September 1 to April 1 .

PSUM= Sum of precipitation from planting date to prediction date (cm.)

RU= Seven day running average of mean air temperature (Degrees centigrade)

S= Estimated soil moisture at planting date (Percent in upper two feet)

TP= Total preshooting precipitation (The total sum in cm. from September 1 to March 1)

t= Monthly mean temperature (Degrees centigrade)

X= Maximum Temperature (Degrees centigrade)

Y= Yield (Kilograms / hectare)

For growth rate equations the first single digit following a basic variable indicates the lag period in days, e.g. , N2 = minimum temperature 2 days before the growth observation or prediction, the second single digit, when present, indicates the power to which the variable was raised. (This notation was used, in contrast to standard mathematical notation, to provide for economy of reproduction in presentation of results through use of computer print-out in this and other reports.) When two abbreviations occur together, this indicates that the variables are to be multiplied.

For yield equations lags were not applicable, thus the single digit following a basic variable indicates the power to which the variable is raised.

COMPUTATION OF SOIL MOISTURE

Many methods could be used for this variable depending on the nature of input data available. Since input data for the models described here were to be limited to daily maximum and minimum temperature and precipitation, the Thornthwaite (1948) system was used. The operating procedure consists of three preliminary operations that are combined in the final estimation of soil moisture.

Computation of day length is the first step in the operating procedure. A method, developed by R. G. Stuff (1975), was selected for its simplicity and universal adaptation. By using only two variables, day length can be computed for any location in the world. The estimated relationship consists of two separate equations:

1. For $0 \leq$ latitude $\leq 40^{\circ}$,

$$DL = 12.14 + \{3.37 \tan\left(\frac{\pi}{180} LAT\right)\} \cos(0.0172CD - 1.95)$$

2. For latitude $> 40^{\circ}$,

$$DL = 12.25 + \left(1.6164 + 1.7643\{\tan\left(\frac{\pi}{180} LAT\right)\}^{2}\right) \cos(0.0172CD - 1.95)$$

where CD is obtained as follows·

If Month < 3 then let Month = Month + 12

then CD = Month · 30.6 + day of month − 91.3

(Stuff 1973). The value of day length obtained from these equations is divided by 12 so that the units are 12 hour periods. Day length is one variable that will be used in the final estimation of soil moisture.

The second stage of the analysis is the calculation of the Thornthwaite heat index, which is a function of monthly mean air temperature and is one variable used in the estimation of evapotranspiration. The procedure is as follows:

1. Obtain the monthly mean temperature (t) for the location in question.

2. Use the following emperical relationship to compute i.

$$i = \left(\frac{t}{5}\right)^{1.514}$$

There will be one i value for each month of the year.

3. The yearly Thornthwaite heat index is the sum of the monthly values.

$$I = \sum_{i=1}^{i=12} i$$

Depending upon location, the value of I varies from 0 to 160.

Potential evapotranspiration, the combined evaporation from the soil and transpiration from plants, is a function of the heat index and the mean daily air temperature. The equation for potential evapotranspiration is

$$PE = \frac{\left[1.6\left(\frac{10M}{I}\right)^{a}\right]}{30}$$

where $a = 0.49239 + 0.01792(I) - 0.0000771(I)^2 + 0.000000675(I)^3$

The next step is the actual computation of estimated soil moisture (percent in upper 2 feet). The data needed are the previously computed values of day length and potential evapotranspiration. Also needed are daily precipitation (in centimeters) and the field capacity (in centimeters) of the soil for the location in question. The equation for estimated soil moisture (in centimeters) is

$$ESM = ESM1 + PO - \frac{(PE)(DL)(ESM1)}{FC}$$

The initial value of ESM1 is assumed to be equal to the field capacity. The concluding step is to convert ESM to percent, and the relationship is

$$EO = \left[\frac{ESM}{FC}\right](100)$$

For this analysis, estimated soil moisture was computed with the initial estimate equal to field capacity on February 1 of each year. Ideally, the estimation would be continually updated 365 days a year in order to avoid the initial value problem.

WINTER WHEAT PREDICTIONS
DATE June 1, 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Nebraska	Northwest (1)	32.5	935*		
	Southwest (7)	33.9	725*		
	South (8)	30.8	347*		
	Southeast (9)	30.2	600*		
	State (1974-75)		3,200*		
	State (1975-76)	32.1	3,400	2950	94794
Kansas	Northwest (1)	24.4	1,224		
	North Central (2)	28.1	1,490		
	Northeast (3)	36.0	445		
	West Central (4)	22.1	1,375		
	Central (5)	27.8	2,024		
	East Central (6)	34.1	570		
	Southwest (7)	24.9	2,085		
	Sauth Central (8)	26.3	3,059		
	Southeast (9)	28.8	828		
	State	26.6	13,100	10800	287050
Colorado	Northeast (2)	19.6	535*		
	East Central (6)	18.5	1,646*		
	Southeast (9)	17.1	420*		

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Colorado	State (1974-75)		2,750*		
	State (1975-76)	18.5	2,830	1900	35164
Oklahoma	Panhandle (1)	17.0	1,298		
	North Central (4)	17.5	2,246		
	Northeast (7)	36.4	210		
	West Central (2)	20.3	1,156		
	Central (5)	21.2	934		
	Southwest (3)	22.8	1,510		
	State	20.0	7,550	5800	115721
Texas	N. High Plains (1-N)	17.9	2,680		
	S. High Plains (1-S)	11.5	360		
	N. Low Plains (2-N)	23.1	870		
	S. Low Plains (2-S)	19.3	850		
	Cross Timbers (3)	15.3	450		
	Blacklands (4)	18.8	550		
	State	18.4	6,300	3900	71666
Washington	Central Basin	42.7	1,600#		
	Southeast (9)	51.4	1,000#		
	State (1974-75)		2,850*		
	State (1975-76)	46 0	2,940	2885	132844

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Oregon	North Central (2)	47.4	490#		
	Northeast (3)	49.6	346#		
	State (1974-75)		1,150*		
	State (1975-76)	48.3	1,200	1180	57025
Idaho	North	48.7	397*		
	State (1974-75)		990*		
	State (1975-76)	48.7	1,010	920	44805
U.S. - Districts (listed above)		26.8	38,330	27765	745051
U.S. - States			57,227		

*Acreage 1974-75 crop
#Estimated acreage from 1974-75 percentage of "all wheat"

WINTER WHEAT PREDICTIONS
DATE July, 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Nebraska	Northwest (1)	32.5	935*	823	26741
	Southwest (7)	34.1	725*	638	21756
	South (8)	31.3	347*	305	9558
	Southeast (9)	30.9	600*	528	16315
	State (1974-75)		3,200*		
	State (1975-76)	32.4	3,400	3000	97200
Kansas	Northwest (1)	25.4	1,224	1028	26115
	North Central (2)	29.0	1,490	1252	36296
	Northeast (3)	36.6	445	374	13681
	West Central (4)	23.1	1,375	1155	26681
	Central (5)	29.0	2,024	1700	49305
	East Central (6)	34.9	570	479	16710
	Southwest (7)	26.0	2,085	1751	45536
	South Central (8)	27.5	3,059	2692	74028
	Southeast (9)	29.9	828	696	20796
	State	27.9	13,100	11100	309148
Colorado	Northeast (2)	19.6	535*	412	8075
	East Central (6)	18.2	1,646*	1267	23059
	Southeast (9)	16.9	420*	323	5459

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State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Colorado	State (1974-75)		2,750*		
	State (1975-76)	18.3	2,830	2200	40212
Oklahoma	Panhandle (1)	18.2	1,298	1077	19601
	North Central (4)	18.7	2,246	1864	34857
	Northeast (7)	36.6	210	174	6368
	West Central (2)	21.5	1,156	959	20619
	Central (5)	22.4	934	775	17360
	Southwest (3)	23.8	1,510	1253	35938
	State	22.1	7,550	6300	139115
Texas	N. High Plains (1-N)	18.9	2,680	1983	37482
	S. High Plains (1-S)	12.5	360	266	3330
	N. Low Plains (2-N)	24.0	870	644	15451
	S. Low Plains (2-S)	20.3	850	629	12769
	Cross Timbers (3)	16.6	450	333	5528
	Blacklands (4)	19.9	550	407	8099
	State	19.4	6,300	4700	91154
Washington	Central Basin	44.8	1,600#	1568	70246
	Southeast (9)	52.5	1,000#	980	51450
	State (1974-75)		2,850*		
	State (1975-76)	47.8	2,940	2885	137791

Winter Wheat Predictions - July 1, 1976 cont.

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Oregon	North Central (2)	48.4	490#	490	23716
	Northeast (3)	50.4	346#	346	17438
	State (1974-75)		1,150*		
	State (1975-76)	49.2	1,200	1200	59073
Idaho	North	48.9	397*	349	17084
	State (1974-75)		990*		
	State (1975-76)	48.9	1,010	890	43566
U.S. - Districts (listed above)		27.2	38,330	30034	817441
U.S. - States			57,227		

* Acreage 1974-75 crop
#Estimated acreage from 1974-75 percentage of "all wheat"

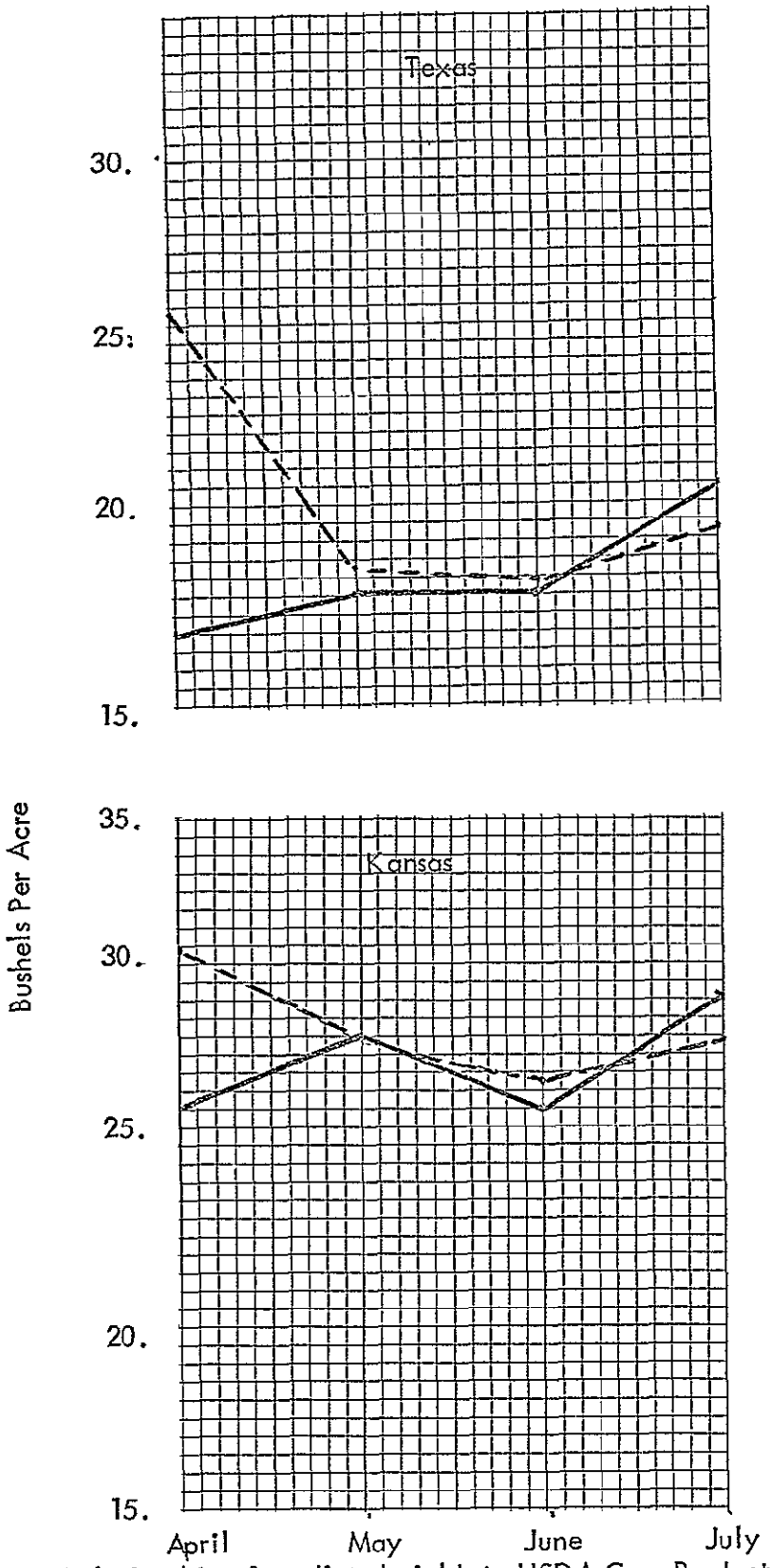

Fig. Relationship of predicted yields to USDA Crop Production reports
____ = USDA. ------ = Predicted.

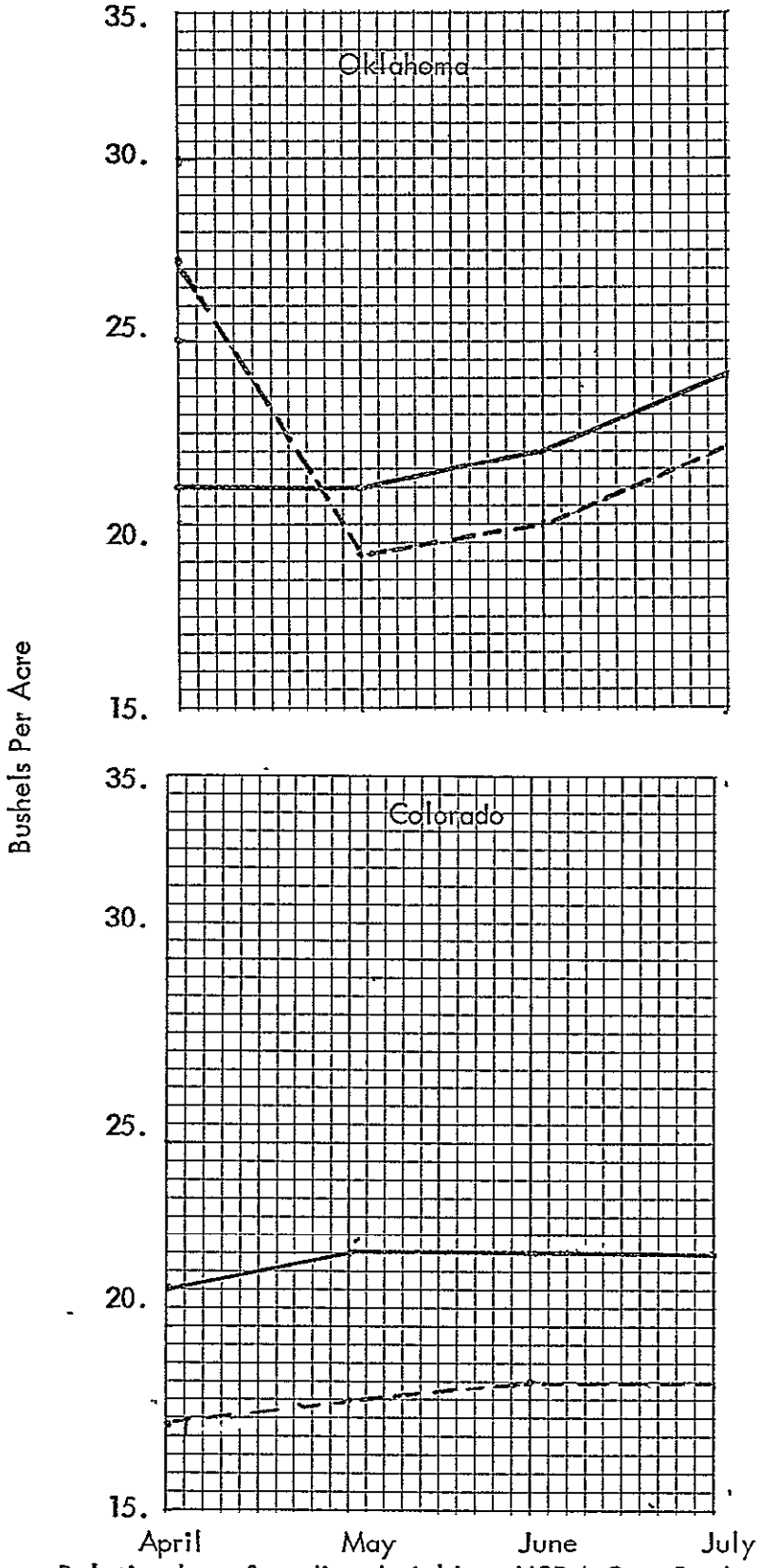

Fig. Relationship of predicted yields to USDA Crop Production reports
—— = USDA. ---- = Predicted.

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SPRING WHEAT PREDICTIONS
DATE June 1, 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Montana	North Central (3)	24.3			
	Northeastern (6)	20.0			
	State				
North Dakota	Northwest (1)	29.6			
	North Central (2)	30.6			
	Northeast (3)	35.8			
	West Central (4)	30.6			
	Central (5)	31.0			
	East Central (6)	30.5			
	Southwest (7)	31.3			
	South Central (8)	29.6			
	Southeast (9)	26.4			
	State				
South Dakota	North Central (2)	26.6			
	Northeast (3)	20.7			
	State				
Minnesota	Northwest (1)	24.3			
	West Central (4)	20.0			
	State				
U.S. - Districts (listed above)					
U.S. - States					

SPRING WHEAT PREDICTIONS
DATE July, 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a.)	Predicted production, (1000 bu.)
Montana	North Central (3)	12.1	523*	507	6138
	Northeastern (6)	18.0	1287*	1248	22471
	State	16.3	2380	2315	37737
North Dakota	Northwest (1)	23.3	1619*	1570	36591
	North Central (2)	23.8	1127 *	1093	26018
	Northeast (3)	16.7	2006*	1946	32495
	West Central (4)	23.3	819*	794	18510
	Central (5)	11.9	1178*	1143	13598
	East Central (6)	7.2	1247*	1210	8709
	Southwest (7)	19.2	872*	846	16240
	South Central (8)	12.0	682*	662	7938
	Southeast (9)	4 7	1077*	1045	4910
	State	16.0	11790	11440	183112
South Dakota	North Central (2)	23.2	932*	699	16217
	Northeast (3)	17.1	500*	375	6413
	State	21.1	2750	2050	43195
Minnesota	Northwest (1)	18.1	1202**	1130	20451
	West Central (4)	20.9	609**	572	11964
	State	19.0	3975	3726	70962
U.S. - Districts (listed above)					
U.S. - States					

* Division values form 1975 used to obtain weighting for acreage
** Division values from 1973 used to obtain weighting for acreage

SPRING WHEAT PREDICTIONS
DATE August, 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a)	Estimated acres to be harvested (1000 a)	Predicted production, (1000 bu)
Montana	North Central (3)	21.8	523*	601	13102
	Northeastern (6)	24.6	1287*	1462	35965
	State	23 8	2380	2315	55061
North Dakota	Northwest (1)	28.9	1619*	1748	50517
	North Central (2)	29.1	1127*	1265	36812
	Northeast (3)	25 1	2006*	2222	55772
	West Central (4)	27.7	819*	879	24348
	Central (5)	16 8	1178*	1316	22109
	East Central (6)	17.8	1247*	1261	22446
	Southwest (7)	19.6	872*	866	16974
	South Central (8)	13.2	682*	758	10006
	Southeast (9)	19.0	1077*	1120	21280
	State	21 9	11790	11440	260264
South Dakota	North Central (2)	13.7	932*	836	11453
	Northeasr (3)	5 6	500*	431	2414
	State	10 9	2750	2050	22437
Minnesota	Northwest (1)	26 8	1202**	2347	62900
	West Central (4)	22.6	609**	1192	26939
	State	25.4	3975	3726	94586

U.S. - Districts (listed above)

U.S. - States

* Division values for 1975 used to obtain weighting for acreage
* Division values for 1973 used to obtain weighting for acreage

SPRING WHEAT PREDICTIONS
DATE September 1976

State	District	Predicted yield per acre, bushels	Acres planted (1000 a.)	Estimated acres to be harvested (1000 a)	Predicted production, (1000 bu)
Montana	North Central (3)	23.0	523*	601	13823
	Northeastern (6)	24.5	1287*	1462	35819
	State	24.1	2380	2315	55706
North Dakota	Northwest (1)	24.5	1619*	1743	42826
	North Central (2)	23.8	1127*	1265	30107
	Northeast (3)	23.7	2006*	2222	52661
	West Central (4)	24.3	819*	879	21360
	Central (5)	22.0	1178*	1316	28952
	East Central (6)	20.9	1247*	1261	26355
	Southwest (7)	27.8	872*	866	24075
	South Central (8)	21.3	682*	758	16145
	Southeast (9)	19.0	1077*	1120	21280
	State	23.1	11790	11440	263876
South Dakota	North Central (2)	13.7	932*	836	11453
	Northeast (3)	5.6	500*	431	2414
	State	10.9	2750	2050	22437
Minnesota	Northwest (1)	29.6	1202**	2347	69471
	West Central (4)	28.6	609**	1192	34091
	State	29.3	3975	3726	109034

U.S. - Districts (listed above)

U.S. - States

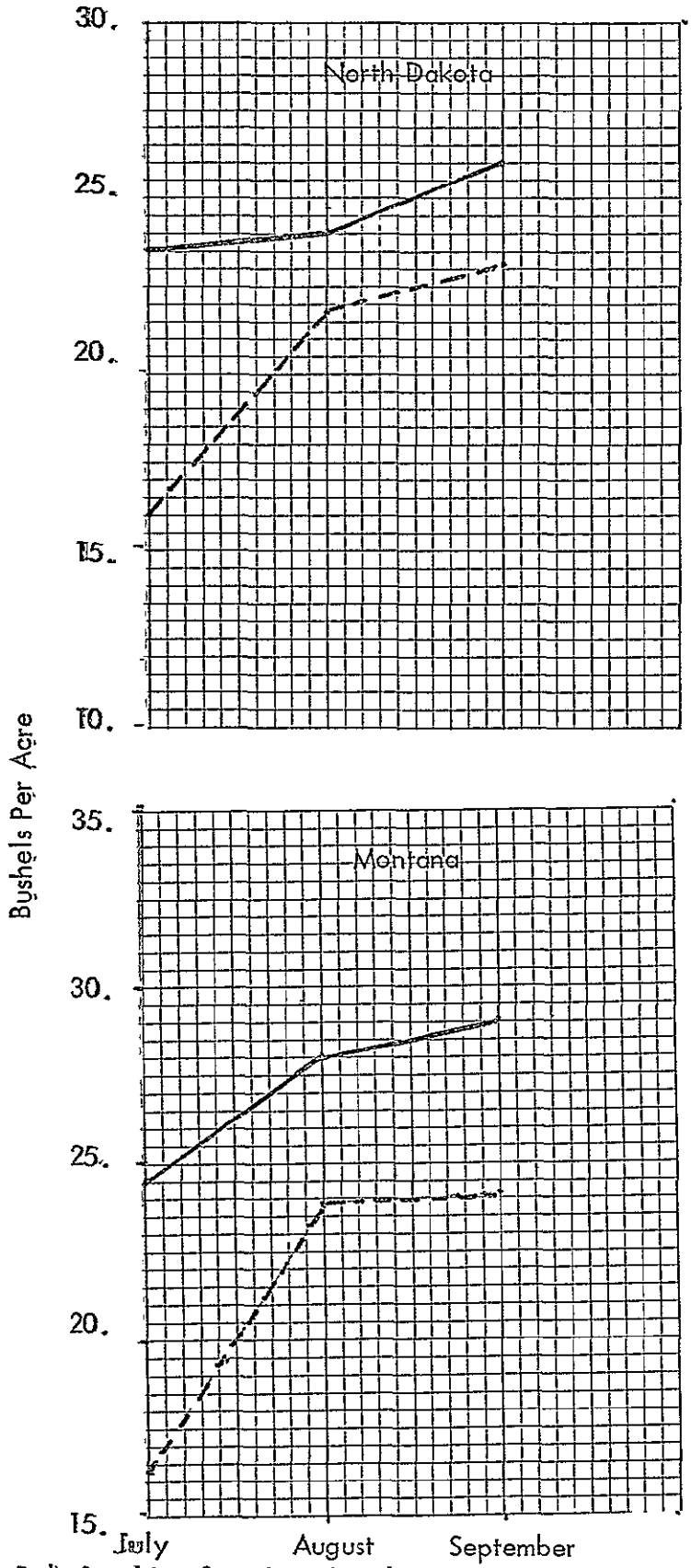

Fig. Relationship of predicted yields to USDA Crop Production reports
——— = USDA. ----- = Predicted.

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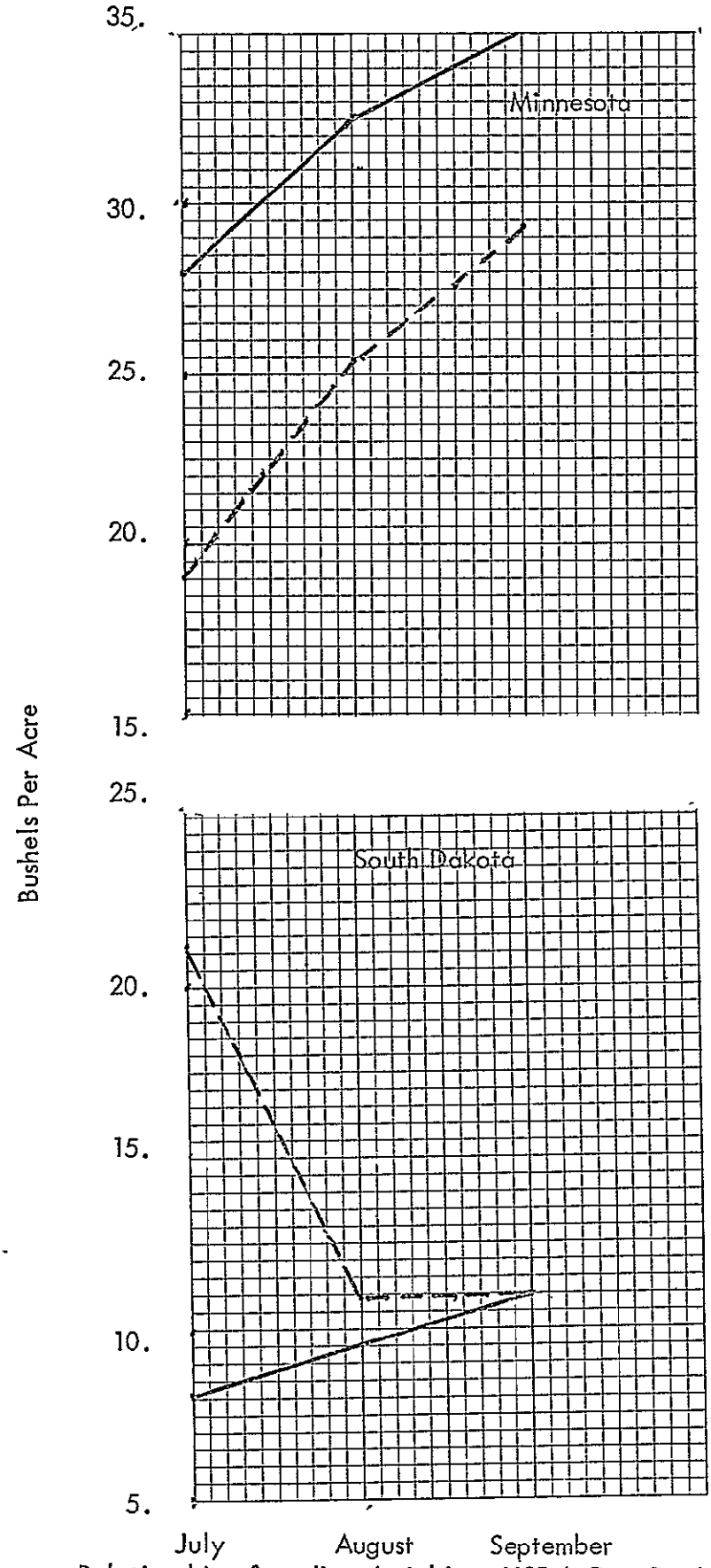

Fig. Relationship of predicted yields to USDA Crop Production reports

——— = USDA. ----- = Predicted.

USSR WINTER WHEAT PREDICTIONS
DATE June 1, 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha	1974 Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Baltic Plain	41.2	27.7	322	892
Belo Russia	47.3	31.8	217	690
Central Region	42.2	28.4	714	2028
Central Chernozem	43.9	29.5	1087	3207
S.W. Ukraine	40.5	27.2	2175	5916
Moldavia/South UKR/ Crimea	40.7	27.4	1314	3600
Donets Dnepr (E. UKR)	43.8	29.4	2576	7573
Volga Vyatica	41.4	27.8	314	873
Central Volga Region	43.3	29.2 } 30.3	2485	7530
Lower Volga Region	46.6	31.3 }		
Ural Region	41.0	27.6	62	171
North Caucasus	31.3	21.1	4591	9687
Trans Caucasus	19.4	13.1	610	799
Total of regions listed above -			16467	42966

USSR WINTER WHEAT PREDICTIONS
DATE July, 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha	Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Baltic Plain	41.1	27.7	322	892
Belo Russia	46.5	31.3	217	679
Central Region	41.5	27.9	714	1992
Central Chernozem	42 8	28.8	1087	3131
S.W. Ukraine	39.6	26.7	2175	5807
Moldavia/South UKR/ Crimea	39.8	26.8	1314	3522
Donets Dnepr (E. UKR)	42.7	28.7	2576	7393
Volga Vyatica	40.8	27.5	314	864
Central Volga Region	42.2	28.4 } 29.3	2485	7281
Lower Volga Region	44.9	30.2 }		
Ural Region	40.1.	26.9	62	167
North Caucasus	31.4	21.1	4991	10531
Trans Caucasus	19.9	13.4	610	817
			16467	43076

USSR SPRING WHEAT PREDICTIONS
DATE June 1, 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha		1974 Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Western Siberia	24.9	16.8		7698	12933
Eastern Siberia	24.9	16.7		2863	4781
Western Kazakhstan	18.2	12.3			
Southern Kazakhstan	17.0	11.4	12.1	16327	19756
Northeast Kazakhstan	18.9	12.7			
Volga	18.2	12.2		6176	7535
Ural	15.9	10.7		6135	6564
Total of regions listed above -				39199	51569

USSR SPRING WHEAT PREDICTIONS
DATE July, 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha		Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Western Siberia	25.4	17.1		7698	13164
Eastern Siberia	24 3	16.4		2863	4695
Western Kazakhstan	18.6	12.5			
Southern Kazakhstan	17.0	11.4	10.6	16327	17307
Northeast Kazakhstan	11.6	7.8			
Volga	20.3	13.7		6176	8461
Ural	19.0	12.8		6135	7853
				39199	51480

USSR SPRING WHEAT PREDICTIONS
DATE August 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha	Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Western Siberia	25.4	17.0	7698	13087
Eastern Siberia	20.6	13.9	2863	3980
Western Kazakhstan	10.6	7.1		
Southern Kazakhstan	9.9	6.7 } 8 2	16327	13334
Northeast Kazakhstan	15.9	10.7		
Volga	21.0	14.1	6176	8708
Ural	15.2	10.2	6135	6258
				45367

USSR SPRING WHEAT PREDICTIONS
DATE September 1976

Region	Predicted Yield bu/a	Predicted Yield q/ha		Est. Area for harvest 1000 ha	Indicated Production 1000 m t
Western Siberia	25.4	17.1		7698	13163
Eastern Siberia	24.6	16.6		2863	4752
Western Kazakhstan	17.2	11.6			
Southern Kazakhstan	18.5	12.5	12.7	16327	20736
Northeast Kazakhstan	20.7	14.0			
Volga	16.6	11.2		6176	6917
Ural	15.1	10.2		6135	6258
					51826

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WEEK 1 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y .

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	4276901.23207884	534612.65400985	14.18244	0.0001	0.65034870	11.16656 %
ERROR	61	2299418.92288592	37695.39217846				
						STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				194.15301228	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2253614.76912977	59.78489	0.0001	671796.20865137	17.82171	0.0001
PSUM2	1	57027.09739553	1.51284	0.2234	687450.91619287	18.23700	0.0001
PPPSUM	1	378313.23884646	10.03606	0.0024	611992.81112147	16.23522	0.0002
PSUM3	1	323098.30477323	8.57129	0.0048	441749.67509733	11.71893	0.0011
PP	1	310950.61769195	8.24904	0.0056	804506.54229444	21.34230	0.0001
PP2	1	562203.61989647	14.91439	0.0003	578008.34374369	15.33366	0.0002
GRI	1	308.21343590	0.00818	0.9282	391629.39710740	10.38932	0.0020
GRI2	1	391385.37090951	10.38284	0.0020	391385.37090951	10.38284	0.0020

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-18620.24515353	-3.14640	0.0026	5917.94450557	0.0
FPP	2.17410764	4.22158	0.0001	0.51499902	0.61928698
PSUM2	131.15251140	4.27048	0.0001	30.71141995	2.64329222
PPPSUM	-17.89886840	-4.02929	0.0002	4.44218404	-1.33559043
PSUM3	-13.96964043	-3.42329	0.0011	4.08076176	-1.44037326
PP	135.05188760	4.61977	0.0001	29.23344527	2.24896443
PP2	-3.41890326	-3.91582	0.0002	0.87309981	-1.87423540
GRI	24346.20969759	3.22325	0.0020	7553.31939378	7.19656736
GRI2	-7766.29288056	-3.22224	0.0020	2410.21399124	-7.15496340

See preceding list for abbreviations

WEEK 2 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	9	4557978.06740767	506442.00748974	15.57103	0.0001	0.70372498	10.34546 %
ERROR	59	1918952.79335367	32524.62361616				
CORRECTED TOTAL	68	6476930.86076134				STD DEV	Y MEAN
						180.34584447	1743.23696

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2270614.01605564	69.81215	0.0001	660037 80514297	20 29348	0.0001
GRI3	1	404788.84624660	12.44561	0.0008	1045088.15065418	32.13221	0.0001
FS	1	57700.43362206	1.77405	0.1880	132980.42510684	4.08861	0.0477
PP2	1	163389.61304579	5.02357	0.0288	1050297.18167842	32.29237	0.0001
PDPP	1	802317.91308435	24.66802	0.0001	721722.25567499	22.19003	0.0001
PD3	1	159103.14187629	4.89178	0.0309	235141.05485731	7.22963	0 0093
F3	1	19595.81927765	0.60249	0 4407	129420.12064097	3.97914	0.0507
GRIF	1	79378.83178688	2.44058	0.1236	680207.54715486	20.91362	0.0001
FPD	1	601089.45241239	18.48106	0.0001	601089.45241239	18.48106	0.0001

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1331.17617471	6.05747	0.0001	219.75766418	0.0
FPP	6.40880657	4.50483	0.0001	1.42265272	1.83920668
GRI3	-67.98569083	-5.66853	0.0001	11.99353461	-0.80808600
FS	-0.56910110	-2.02203	0.0477	0.28145030	-0.59177341
PP2	-5.79441758	-5.68264	0.0001	1.01967044	-3.19672263
PDPP	1.08793539	4.71063	0.0001	0.23095331	2.79544658
PD3	0.00035307	2.68880	0.0093	0.00013131	0.76069052
F3	-0.27629046	-1.99478	0.0507	0.13850681	-0.80823252
GRIF	157.55723682	4.57314	0.0001	34.45274044	5.79819119
FPD	-3.12866947	-4.29896	0.0001	0.72777355	-5.34053698

See preceding list for abbreviations

WEEK 3 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	9	4431959.83915981	492439.98212887	14.20752	0.0001	0.68426851	10.67975 %
ERROR	59	2044971.02160154	34660.52578986				
CORRECTED TOTAL	68	6476930.86076134				STD DEV	Y MEAN
						186.17337562	1743.23696

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2270614.01605564	65.51009	0.0001	918292.38499969	26.49390	0.0001
GRI3	1	353027.11558982	10.18528	0.0023	326105.16182257	9.40855	0.0033
GRI2	1	234275.78084327	6.75915	0.0118	324751.01051941	9.36948	0.0033
FPSUM	1	54750.09275759	1.57961	0.2138	327777.08178879	9.45678	0.0032
PP3	1	125327.18481018	3.61585	0.0621	328889.46133265	9.48888	0.0031
PP	1	462472.55810510	13.34292	0.0006	651469.73099079	18.79573	0.0001
PP2	1	288108.50981956	8.31229	0.0055	441594.12002050	12.74055	0.0007
SPSUM	1	121172.05997734	3.49597	0.0665	431220.94273616	12.44127	0.0008
PPS	1	522212.52120129	15.06649	0.0003	522212.52120129	15.06649	0.0003

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-14169.52384264	-3.24890	0.0019	4361.33404959	0.0
FPP	4.15413057	5.14722	0.0001	0.80706260	1.19215717
GRI3	-316.21069619	-3.06734	0.0033	103.08970409	-11.33864134
GRI2	2058.53996406	3.06096	0.0033	672.51445026	11.32176406
FPSUM	-7.77403161	-3.07519	0.0032	2.52798553	-0.68800391
PP3	0.50170135	3.08040	0.0031	0.16266879	7.51782890
PP	554.15453572	4.33540	0.0001	127.82074500	9.29169569
PP2	-28.86041563	-3.56939	0.0007	8.08553038	-15.92200464
SPSUM	0.92970859	3.52722	0.0008	0.26358124	0.66274932
PPS	-0.71890491	-3.88156	0.0003	0.18521041	-1.11314051

See preceding list for abbreviations

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WEEK 4 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	9	4254358.45789798	472706.49532200	15.60139	0.0001	0.70413091	10.02277 %
ERROR	59	1787640.84445760	30298.99736369				
						STD DEV	Y MEAN
CORRECTED TOTAL	68	6041999.30235558				174.06607183	1736.70688

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	1930650.85795312	63.71996	0.0001	1312253.70406066	43.31014	0.0001
PP3	1	95601.39224752	3.15527	0.0808	180748.83555507	5.96551	0.0176
PP	1	649364.92440408	21.43189	0.0001	1028594.26891642	33.94813	0.0001
PP2	1	265822.02006147	8.77329	0.0044	298665.98948297	9.85729	0 0026
PPS	1	206973.62321592	6.83104	0.0114	574620.14553077	18.96499	0.0001
SPSUM	1	233588.92228903	7.70946	0.0074	537626.72371470	17.74404	0.0001
FPSUM	1	397802.88687052	13.12924	0.0006	725261.90881219	23.93683	0.0001
PD	1	150098.71638876	4.95392	0.0299	473884.62365019	15.64027	0.0002
GRIPP	1	324455.11446754	10.70844	0.0018	324455.11446754	10.70844	0.0018

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-3075.33321177	-4.24806	0.0001	723.93837104	0.0
FPP	5.86223597	6.58104	0.0001	0.89077603	1.73443701
PP3	0.36876121	2.44244	0.0176	0.15098076	5.73291452
PP	777.49043457	5.82650	0.0001	133.44033795	13.50252106
PP2	-23.46248200	-3.13963	0.0026	7.47300368	-13.42150469
PPS	-0.76215630	-4.35488	0.0001	0.17501197	-1.22190504
SPSUM	0.88960119	4.21237	0.0001	0.21118791	0.72056143
FPSUM	-10.35273490	-4.89253	0.0001	2.11602984	-1.19186872
PD	15.52048760	3.95478	0.0002	3.92448959	0.65785068
GRIPP	-51.17209417	-3.27238	0.0018	15.63759665	-5.30574522

See preceding list for abbreviations

WEEK 5 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	4604372.56052264	575546.57006533	18.13263	0.0001	0.70397122	10.19882 %
ERROR	61	1936196.73787968	31740.93012918				
						STD DEV	Y MEAN
CORRECTED TOTAL	69	6540569.29840232				178.15984432	1746.86679

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2170394.75976191	68.37842	0.0001	826345.34793760	26.03406	0.0001
GRI2	1	355838.75794311	11.21072	0.0014	881397.76182758	27.76849	0.0001
GRIPD	1	133635.28789046	4.21019	0.0445	368400.76684625	11.60649	0.0012
F3	1	8298.25656629	0.26144	0.6110	284109.82456956	8.95090	0.0040
PP2	1	267923.28665369	8.44094	0.0051	1182499.37449218	37.25472	0.0001
PDPP	1	1033396.93427403	32.55724	0.0001	792666.74352626	24.97302	0.0001
GRIF	1	38817.43672362	1.22295	0.2731	633249.57730769	19.95057	0.0001
FPD	1	596067.84070951	18.77915	0.0001	596067.84070951	18.77915	0.0001

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2625.55168954	7.79602	0.0001	336.78117421	0.0
FPP	6.91287847	5.10236	0.0001	1.35483982	1.98456129
GRI2	-112.57424399	-5.26958	0.0001	21.36303205	-1.42539607
GRIPD	3.65336765	3.40683	0.0012	1.07236577	1.42247046
F3	-0.40407062	-2.99181	0.0040	0.13505914	-1.18303076
PP2	-6.15351825	-6.10366	0.0001	1.00816788	-3.39201291
PDPP	1.12741156	4.99730	0.0001	0.22560410	2.89074483
GRIF	60.79575199	4.46661	0.0001	13.61117460	5.35592964
FPD	-3.10539946	-4.33349	0.0001	0.71660437	-5.29594272

See preceding list for abbreviations

WEEK 6 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	9	4788849.85399411	532094.42822157	16.08607	0.0001	0.70355918	10.36799 %
ERROR	61	2017755.76197469	33077.96331106				
						STD DEV	Y MEAN
CORRECTED TOTAL	70	6806605.61596880				181.87348160	1754.18310

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2103650.79842925	63.59675	0.0001	543405.94856156	16.42804	0.0001
SPSUM	1	473402.24317215	14.31171	0.0004	197487.37127803	5.97036	0.0175
S	1	593370.13184284	17.93853	0.0001	359881.90471718	10.87981	0.0016
PDPSUM	1	255693.06184779	7.73001	0.0072	137175.93618589	4.14705	0.0461
FPD	1	78518.37931447	2.37374	0.1286	245797.73230879	7.43086	0.0084
PP2	1	242045.77214985	7.31743	0.0088	1089389.78273008	32.93400	0.0001
PP	1	511745.84848922	15.47090	0.0002	783368.40071856	23.68249	0.0001
PD3	1	116079.63980680	3.50927	0.0658	520889.28874966	15.74732	0.0002
GRIPD	1	414343.97894171	12.52628	0.0008	414343.97894171	12.52628	0.0008

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	3950.13902120	4.78113	0.0001	826.19320669	0.0
FPP	5.30824726	4.05315	0.0001	1.30965930	1.49512803
SPSUM	1.59010292	2.44343	0.0175	0.65076614	1.46992952
S	-22.22329134	-3.29846	0.0016	6.73748413	-0.66507801
PDPSUM	-0.88373838	-2.03643	0.0461	0.43396443	-1.24662075
FPD	-0.44453524	-2.72596	0.0084	0.16307472	-0.74543390
PP2	-5.50692248	-5.73882	0.0001	0.95959217	-2.97578394
PP	146.72274714	4.86647	0.0001	30.14975628	2.41110636
PD3	0.00102337	3.96829	0.0002	0.00025789	2.17528806
GRIPD	-3.42359892	-3.53925	0.0008	0.96732351	-1.60101958

See preceding list for abbreviations

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

WEEK 7 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5285278.48982684	528527.84898268	20.84474	0.0001	0.77649254	9.07739 %
ERROR	60	1521327.12614196	25355.45210237			STD DEV	Y MEAN
CORRECTED TOTAL	70	6806605.61596880				159.23395399	1754.18310

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2103650.79842925	82.96641	0.0001	479383.74975058	18.90654	0.0001
GRI3	1	964945.45274430	38.05672	0.0001	401840.51838183	15.84829	0.0002
PDPSUM	1	623449.67068489	24.58839	0.0001	153482.61093722	6.05324	0.0168
S	1	391623.82084572	15.44535	0.0002	389695.55460612	15.36930	0.0002
SPSUM	1	65961.36501995	2.60147	0.1120	228955.67058455	9.02984	0.0039
PD3	1	237864.99346869	9.38122	0.0033	622694.30411995	24.55860	0.0001
PP2	1	79439.13201722	3.13302	0.0818	619479.76347689	24.43182	0.0001
PP	1	495369.87687239	19.53702	0.0001	341471.08022490	13.46736	0.0005
FPD	1	136862.50790619	5.39775	0.0236	277937.88855135	10.96166	0.0016
F	1	186110.87183822	7.34007	0.0088	186110.87183822	7.34007	0.0088

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2737.10205594	4.68819	0.0001	583.82869514	0.0
FPP	5.33173694	4.34816	0.0001	1.22620403	1.50174417
GRI3	-1.38639308	-3.98099	0.0002	0.34825327	-0.57022468
PDPSUM	-0.84928877	-2.46033	0.0168	0.34519259	-1.35859951
S	-24.33708674	-3.92037	0.0002	6.20785470	-0.72833771
SPSUM	1.50705356	3.00497	0.0039	0.50152047	1.60763071
PD3	0.00066557	4.95566	0.0001	0.00013431	1.41475922
PP2	-4.13812591	-4.94286	0.0001	0.83719344	-2.23612529
PP	100.69623138	3.66979	0.0005	27.43923077	1.65474903
FPD	-1.59699957	-3.31084	0.0016	0.48235480	-2.67798253
F	163.84746221	2.70926	0.0088	60.47690072	1.93623821

See preceding list for abbreviations

WEEK 8 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5531920.32999755	553192.03299976	30.20851	0.0001	0.83892695	7.75454 %
ERROR	58	1062122.61442324	18312.45886937			STD DEV	Y MEAN
CORRECTED TOTAL	68	6594042.94442080				135.32353406	1745.08877

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2273947.13970198	124.17487	0.0001	517050.20418730	28.23489	0.0001
GRIPSUM	1	1567764.66278727	85.61191	0.0001	97651.77007018	5.33253	0.0245
GRIS	1	377875.36235425	20.63488	0.0001	363329.00812606	19.84054	0.0001
SPSUM	1	334392.88063322	18.26040	0.0001	235199.23904164	12.84367	0.0007
PD2	1	111432.46057573	6.08506	0.0166	544300.99977284	29.72299	0.0001
PP2	1	88178.23407870	4.81520	0.0322	529524.90297524	28.91610	0.0001
PP	1	440065.15748476	24.03092	0.0001	267094.77115941	14.58541	0.0003
FPD	1	126403.75937307	6.90261	0.0110	251915.75505602	13.75652	0.0005
F	1	152742.04897625	8.34088	0.0054	208243.68090022	11.37169	0.0013
F2	1	59118.62403231	3.22833	0.0776	59118.62403231	3.22833	0.0776

SOURCE	B VALUES	T FOR HO B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	687.88819805	1.48864	0.1420	462.09275998	0.0
FPP	5.77445184	5.31365	0.0001	1.08672019	1.64118272
GRIPSUM	-6.54601841	-2.30923	0.0245	2.83472213	-0.90303027
GRIS	-1.76806322	-4.45427	0.0001	0.39693654	-0.64317286
SPSUM	1.18978495	3.58381	0.0007	0.33198912	1.40189481
PD2	0.08575043	5.45188	0.0001	0.01572860	0.92324010
PP2	-3.72568327	-5.37737	0.0001	0.69284497	-2.03543551
PP	87.23332108	3.81909	0.0003	22.84141713	1.44915299
FPD	-1.56361627	-3.70898	0.0005	0.42157597	-2.64677449
F	232.17205660	3.37219	0.0013	68.84895672	2.76789471
F2	-4.76832190	-1.79675	0.0776	2.65385224	-0.97708682

See preceding list for abbreviations

WEEK 9 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5415638.63608160	541563.86360816	29.59666	0.0001	0.83614273	7.75974 %
ERROR	58	1061292.22467974	18298.14180482				
CORRECTED TOTAL	68	6476930.86076134				STD DEV	Y MEAN
						135.27062432	1743.23696

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
PPPSUM	1	2458047.94668260	134.33320	0.0001	264208.55458558	14.43909	0.0003
F	1	692009.96004730	37.81859	0.0001	190477.04637791	10.40964	0.0021
PP3	1	693113.89548993	37.87892	0.0001	777728.25141608	42.50313	0.0001
FPP	1	624085.27395280	34.10648	0.0001	557459.74277734	30.46537	0.0001
S	1	134944.41556394	7.37476	0.0087	89523.40933147	4.89249	0.0309
GRIPD	1	2213.57929539	0.12097	0.7292	585642.64507403	32.00558	0.0001
GRI	1	306197.77895109	16.73382	0.0001	652206.60568299	35.64332	0.0001
FPD	1	371013.15654927	20.27600	0.0001	270059.79573384	14.75886	0.0003
PDPSUM	1	89226.81432785	4.87628	0.0312	94046.15253556	5.13966	0.0271
SPSUM	1	44785.81522140	2.44756	0.1231	44785.81522140	2.44756	0.1231

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	7578.01877233	6.21665	0.0001	1218.98671224	0.0
PPPSUM	2.61834060	3.79988	0.0003	0.68905866	0.88237281
F	184.56821410	3.22640	0.0021	57.20567051	2.22017793
PP3	-0.08840457	-6.51944	0.0001	0.01356014	-1.32471327
FPP	5.03446296	5.51954	0.0001	0.91211561	1.44479597
S	-12.70584361	-2.21190	0.0309	5.74432090	-0.38356479
GRIPD	2.92676285	5.65735	0.0001	0.51733836	2.16991380
GRI	-760.74438526	-5.97020	0.0001	127.42353630	-1.53655334
FPD	-1.68842647	-3.84173	0.0003	0.43949676	-2.88208904
PDPSUM	-0.55185455	-2.26708	0.0271	0.24342075	-1.07310134
SPSUM	0.53253116	1.56447	0.1231	0.34039116	0.67036165

See preceding list for abbreviations

WEEK 10 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5397172.06001287	539717.20600129	27.00536	0.0001	0.82069789	8.13080 %
ERROR	59	1179148.09495189	19985.56093139				
CORRECTED TOTAL	69	6576320.15496476				STD DEV	Y MEAN
						141.37029720	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
PPPSUM	1	2379708.34245187	119.07138	0.0001	314318.86464779	15.72730	0.0002
F	1	640217.63461851	32.03401	0.0001	176695.23241393	8.84114	0.0043
PP3	1	510624.47895954	25.54967	0.0001	903266.15452894	45.19594	0.0001
FPP	1	643469.90957675	32.19674	0.0001	598617.74534318	29.95251	0.0001
S	1	105565.24815423	5.28208	0.0251	91868.79010460	4.59676	0.0362
GRIPD	1	23055.63530631	1.15361	0.2872	732263.70403566	36.63964	0.0001
GRI	1	484728.35894183	24.25393	0.0001	917254.13884396	45.89584	0.0001
FPD	1	376880.61243060	18.85764	0.0001	264126.93272948	13.21589	0.0006
PDPSUM	1	180617.65256065	9.03741	0.0039	129641.32368725	6.48675	0.0135
SPSUM	1	52304.18701255	2.61710	0.1111	52304.18701255	2.61710	0.1111

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	8450.74099106	6.96355	0.0001	1213.56767759	0.0
PPPSUM	2.58626284	3.96577	0.0002	0.65214716	0.91698920
F	182.99702656	2.97341	0.0043	61.54457661	2.19327598
PP3	-0.09374272	-6.72279	0.0001	0.01394402	-1.39620616
FPP	5.15583915	5.47289	0.0001	0.94206905	1.46862280
S	-13.41955159	-2.14401	0.0362	6.25910413	-0.40550703
GRIPD	2.95758199	6.05307	0.0001	0.48860872	2.44060174
GRI	-771.34871542	-6.77465	0.0001	113.85814177	-1.79579630
FPD	-1.70995570	-3.63537	0.0006	0.47036683	-2.90548613
PDPSUM	-0.62289443	-2.54691	0.0135	0.24456871	-1.23013616
SPSUM	0.55529729	1.61774	0.1111	0.34325391	0.73888496

See preceding list for abbreviations

WEEK 11 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	11	5515157.16637180	501377.92421562	31.79044	0.0001	0.85984579	7.24702 %
ERROR	57	898966.44380985	15771.34111947				
CORRECTED TOTAL	68	6414123.61018165				STD DEV	Y MEAN
						125.58400025	1732.90580

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPSUM	1	2917133.03973707	184.96417	0.0001	209875.44191133	13.30739	0.0006
PPPSUM	1	554026.84449663	35.12871	0.0001	226525.19761286	14.36309	0.0004
PP3	1	177545.75310331	11.25749	0.0014	692383.28912114	43 90136	0.0001
FPP	1	413771.76855984	26.23567	0.0001	558824.89186921	35.43293	0.0001
GRIPD	1	31430.59018915	1.99289	0.1635	1255195.75591301	79.58713	0.0001
GRI	1	567925.23916886	36.00995	0.0001	1212294.88667512	76.86695	0.0001
FPD	1	217862.81359786	13.81384	0.0005	322968.25753749	20.47817	0.0001
SPSUM	1	330117.32111824	20.93147	0.0001	48839.78956024	3.09674	0.0838
PSUM2	1	23995.42397908	1.52146	0.2225	223928.32674145	14.19843	0.0004
PSUM3	1	215250.40324000	13.64820	0.0005	257118.51566204	16.30289	0.0002
S	1	66097.96918173	4.19102	0.0453	66097.96918173	4.19102	0.0453

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	8279.46631560	8.77890	0.0001	943.10979877	0.0
FPSUM	4.66304342	3.64793	0.0006	1.27827107	1.21867845
PPPSUM	2.28528389	3.78987	0.0004	0.60299847	0.89557875
PP3	-0.09025269	-6.62581	0.0001	0.01362138	-1.35948878
FPP	4.98911662	5.95256	0.0001	0.83814681	1.43650679
GRIPD	1.64815948	8.92116	0.0001	0.18474718	1.51418013
GRI	-529.47312602	-8.76738	0.0001	60.39126098	-1.41546959
FPD	-0.98704986	-4.52528	0.0001	0.21811899	-1.69350445
SPSUM	0.72278078	1.75976	0.0838	0.41072772	0.99889094
PSUM2	-9.08104913	-3.76808	0.0004	2.40999322	-4.62090407
PSUM3	0.20066836	4.03768	0.0002	0.04969887	2.85661894
S	-16.16402394	-2.04720	0.0453	7.89568365	-0.49418862

See preceding list for abbreviations

WEEK 12 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5166521.24854359	516652.12485436	21.62186	0.0001	0.78562496	8.89053 %
ERROR	59	1409798.90642117	23894.89671900				
						STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				154.57974227	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPSUM	1	2491391.82411914	104.26460	0.0001	11360.33981735	0.47543	0.4932
F	1	104311.08003263	4.36541	0.0410	62498.72451342	2.61557	0.1112
FPP	1	455320.49931106	19.05514	0.0001	209421.18020897	8.76426	0.0044
PP3	1	248883.92729913	10.41578	0.0020	942730.95776816	39.45323	0.0001
PDPP	1	624420.64178354	26.13197	0.0001	485064.80943149	20.29993	0.0001
F2	1	100962.03285534	4.22526	0.0443	58498.62419476	2.44816	0.1230
GRIPSUM	1	81756.95326895	3.42152	0.0694	961000.27783132	40.21780	0.0001
PSUM	1	605496.44900762	25.33999	0.0001	952589.23028019	39.86580	0.0001
PD	1	375538.44763229	15.71626	0.0002	325497.20530701	13.62204	0.0005
FPD	1	78439.39323387	3.28268	0.0751	78439.39323387	3.28268	0.0751

SOURCE	B VALUES	T FOR HO B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-1687.83789931	-2.16744	0.0342	778.72437661	0.0
FPSUM	1.11726448	0.68951	0.4932	1.62036520	0.31407697
F	169.58186497	1.61727	0.1112	104.85675387	2.03249112
FPP	3.49245269	2.96045	0.0044	1.17970334	0.99481297
PP3	-0.10938803	-6.28118	0.0001	0.01741520	-1.62922772
PDPP	0.52830706	4.50554	0.0001	0.11725709	1.34821352
F2	-4.84433260	-1.56466	0.1230	3.09609092	-0.99690881
GRIPSUM	-17.77837084	-6.34175	0.0001	2.80338525	-4.88258644
PSUM	299.45221732	6.31394	0.0001	47.42717738	5.10065234
PD	19.20666531	3.69080	0.0005	5.20392364	0.78278098
FPD	-0.97009052	-1.81182	0.0751	0.53542387	-1.64833776

See preceding list for abbreviations

WEEK 13 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	5249764.38494494	524976.43849449	23.34889	0.0001	0.79828297	8.62406 %
ERROR	59	1326555.77001982	22483.99610203			STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				149.94664418	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2253614.76912977	100.23195	0.0001	805271.28804039	35.81531	0.0001
GRI	1	1150802.12847772	51.18317	0.0001	259463.30609729	11.53991	0.0012
GRIPD	1	242349.36823197	10.77875	0.0017	196147.84475081	8.72389	0.0045
PD2	1	310767.21458594	13.82171	0.0004	328945.99323472	14.63023	0.0003
PP2	1	80908.35957945	3.59849	0.0627	1148589.31891072	51.08475	0.0001
PPPSUM	1	9727.35086362	0.43263	0.5133	914374.54251053	40.66779	0.0001
PSUM	1	673344.20604534	29.94771	0.0001	848775.06862505	37.75019	0.0001
FPD	1	156477.44111981	6.95950	0.0106	393049.76517039	17.48131	0.0001
PD3	1	82281.19001416	3.65954	0.0606	322828.72864698	14.35816	0.0004
PD	1	289492.35689714	12.87549	0.0007	289492.35689714	12.87549	0.0007

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-35832.85063140	-2.16011	0.0348	16588.46869233	0.0
FPP	7.80222407	5.98459	0.0001	1.30371920	2.22243632
GRI	-1868.85588923	-3.39704	0.0012	550.14173191	-6.25104632
GRIPD	11.73008404	2.95362	0.0045	3.97142261	12.83469808
PD2	-11.93887744	-3.82495	0.0003	3.12131748	-128.08739638
PP2	-5.86204846	-7.14736	0.0001	0.82016979	-3.21356234
PPPSUM	5.56754415	6.37713	0.0001	0.87304847	2.65324805
PSUM	-73.55781783	-6.14412	0.0001	11.97207091	-1.29789964
FPD	-0.63081706	-4.18107	0.0001	0.15087470	-1.07185831
PD3	0.02950534	3.78922	0.0004	0.00778666	63.11142314
PD	1399.69351937	3.58824	0.0007	390.07772533	57.04548127

See preceding list for abbreviations

WEEK 14 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	5130118.99255105	641264.87406888	27.04821	0.0001	0.78008961	8.85573 %
ERROR	61	1446201.16241371	23708.21577727			STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				153.97472448	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2253614.76912977	95.05628	0.0001	186910.65381840	7.88379	0.0067
PDS	1	190090.88139856	8.01793	0.0063	193449.04515262	8.15958	0.0058
GRIF	1	110380.04749541	4.65577	0.0349	1846259.33677393	77.87424	0.0001
F	1	1183115.36043274	49.90318	0.0001	1208960.73997302	50.99332	0.0001
PP3	1	97459.14770123	4.11078	0.0470	790717.87079086	33.35206	0.0001
PDPP	1	976940.42293704	41.20683	0.0001	1249579.04258161	52.70658	0.0001
PPS	1	273089.66830894	11.51878	0.0012	297527.51422022	12.54955	0.0008
F2	1	45428.69514733	1.91616	0.1713	45428.69514733	1.91616	0.1713

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	264.39924410	0.86645	0.3896	305.15252936	0.0
FPP	2.94746055	2.80781	0.0067	1.04973677	0.83957386
PDS	0.04865443	2.85650	0.0058	0.01703290	0.26195194
GRIF	-23.78431067	-8.82464	0.0001	2.69521647	-6.04081406
F	557.87092352	7.14096	0.0001	78.12266737	6.68625562
PP3	-0.09903723	-5.77512	0.0001	0.01714894	-1.47506273
PDPP	0.75502264	7.25993	0.0001	0.10399861	1.92678046
PPS	-0.51664244	-3.54253	0.0008	0.14583976	-0.79575016
F2	-4.18666160	-1.38425	0.1713	3.02449007	-0.86156757

See preceding list for abbreviations

WEEK 15 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	9	4796974.11036559	532997.12337395	20.52968	0.0001	0.75796572	9.26947 %
ERROR	59	1531774.00691752	25962.27130369				
CORRECTED TOTAL	68	6328748.11728310				STD DEV	Y MEAN
						161.12812077	1738.26630

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	1944822.62024525	74.90957	0.0001	199435.01301824	7.68172	0.0075
PDS	1	179290.81335782	6.90582	0.0109	194066.32304867	7.47494	0.0082
GRIF	1	121132.90469386	4.66573	0.0348	1218015.04913822	46.91481	0.0001
F	1	1139799.11972896	43.90213	0.0001	1326660.15325618	51.09954	0.0001
PP3	1	81870.02673871	3.15342	0.0809	833868.30782587	32.11847	0.0001
PDPP	1	972027.84709404	37.44002	0.0001	1051365.12504232	40.49588	0.0001
PPS	1	156043.18020195	6.01038	0.0172	270806.75335955	10.43078	0.0020
FPD	1	72802.43245529	2.80416	0.0993	85017.67646558	3.27466	0.0755
F2	1	129185.16584969	4.97588	0.0295	129185.16584969	4.97588	0.0295

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-196.43692102	-0.50846	0.6130	386.33476917	0.0
FPP	3.23093796	2.77159	0.0075	1.16573345	0.93020759
PDS	0.07329649	2.73403	0.0082	0.02680893	0.39574754
GRIF	-18.77678995	-6.84944	0.0001	2.74136184	-5.22991465
F	633.46176272	7.14839	0.0001	88.61595137	7.67123485
PP3	-0.10180136	-5.66732	0.0001	0.01796289	-1.54229605
PDPP	0.88374975	6.36364	0.0001	0.13887493	2.29380189
PPS	-0.69523891	-3.22967	0.0020	0.21526611	-1.08690100
FPD	-0.78691914	-1.80960	0.0755	0.43485737	-1.36121647
F2	-7.00293807	-2.23067	0.0295	3.13939024	-1.45853346

See preceding list for abbreviations

WEEK 16 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	7	4857869.67121434	693981.38160205	25.03816	0.0001	0.73869118	9.57520 %
ERROR	62	1718450.48375042	27716.94328630			STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				166.48406316	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2253614.76912977	81.30820	0.0001	865211.35967075	31.21597	0.0001
PP3	1	93614.61985268	3.37752	0.0709	1405297.37332092	50.70174	0.0001
PDPP	1	534859.85615534	19.29722	0.0001	2114226.71443213	76.27922	0.0001
FPD	1	416940.65172780	15.04281	0.0003	1550081.61232013	55.92542	0.0001
GRIPP	1	387193.13849833	13.96955	0.0004	1316629.37058175	47.50269	0.0001
F	1	1022489.76572390	36.89042	0.0001	961199.97315088	34.67915	0.0001
F2	1	149156.87012649	5.38143	0.0237	149156.87012649	5.38143	0.0237

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	736.90084530	3.30391	0.0016	223.03904871	0.0
FPP	6.13297685	5.58713	0.0001	1.09769803	1.74695707
PP3	-0.13392691	-7.12052	0.0001	0.01880860	-1.99471041
PDPP	1.98272290	8.73380	0.0001	0.22701728	5.05981088
FPD	-2.16670786	-7.47833	0.0001	0.28973152	-3.68158056
GRIPP	-8.70941103	-6.89222	0.0001	1.26365839	-3.41453697
F	360.83435379	5.88890	0.0001	61.27363851	4.32471137
F2	-7.38200114	-2.31979	0.0237	3.18218294	-1.51913228

See preceding list for abbreviations

WEEK 17 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	4841632.06077682	605204.00759710	21.28189	0.0001	0.73622207	9.69887 %
ERROR	61	1734688.09418794	28437.50974079				
						STD DEV	Y MEAN
CORRECTED TOTAL	69	6576320.15496476				168.63424842	1738.70071

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPP	1	2253614.76912977	79.24796	0.0001	626518.61923834	22.03142	0.0001
GRI3	1	946063.92517434	33.26817	0.0001	1053510.75625468	37.04652	0.0001
PP2	1	132320.76627235	4.65304	0.0349	718339.99379782	25.26030	0.0001
PDPP	1	512020.27558220	18.00510	0.0001	428318.61386935	15.06175	0.0003
PD	1	253482.86736635	8.91368	0.0041	216490.93525380	7.61287	0.0076
FPD	1	79074.84848481	2.78065	0.1005	610425.13093396	21.46549	0.0001
F	1	488850.72968798	17.19035	0.0001	653381.61828655	22.97605	0.0001
F2	1	176203.87907900	6.19618	0.0155	176203.87907900	6.19618	0.0155

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-879.16648609	-1.26095	0.2121	697.22342774	0.0
FPP	5.71728872	4.69376	0.0001	1.21806065	1.62854976
GRI3	-0.04588774	-6.08659	0.0001	0.00753916	-0.46965188
PP2	-4.83936115	-5.02596	0.0001	0.96287252	-2.65292736
PDPP	0.84244158	3.88095	0.0003	0.21707115	2.14986928
PD	16.12269276	2.75914	0.0076	5.84337154	0.65709154
FPD	-2.39899022	-4.63309	0.0001	0.51779524	-4.07626515
F	407.19401319	4.79333	0.0001	84.95006380	4.88034623
F2	-8.12262514	-2.48921	0.0155	3.26313063	-1.67154431

See preceding list for abbreviations

WEEK 18 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	4553148.35375831	569143.54421979	19.78291	0.0001	0.72510262	9.79950 %
ERROR	60	1726167.49995597	28769.45833260			STD DEV	Y MEAN
CORRECTED TOTAL	68	6279315.85371428				169.61561937	1730.85906

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPSUM	1	2558157.47419269	88.91921	0.0001	761840.16331664	26.48087	0.0001
FPD	1	207541.99612767	7.21397	0.0093	1219222.12653391	42.37904	0.0001
PDPP	1	399533.22111982	13.88741	0.0004	1314755.33512181	45.69969	0.0001
PP3	1	482083.35872079	16.75678	0.0001	621277.97983622	21.59505	0.0001
FPP	1	275155.05248947	9.56414	0.0030	308060.86842029	10.70791	0.0018
PPS	1	158855.98069283	5.52169	0.0221	553798.24754352	19.24952	0.0001
SPSUM	1	1539.78201097	0.05352	0.8178	418262.40734156	14.53842	0.0003
GRIPSUM	1	470281.48840407	16.34655	0.0002	470281.48840407	16.34655	0.0002

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1731.32847976	7.48358	0.0001	231.35030798	0.0
FPSUM	4.99056200	5.14596	0.0001	0.96980265	1.76830981
FPD	-1.07684763	-6.50992	0.0001	0.16541644	-1.87102457
PDPP	1.07097419	6.76015	0.0001	0.15842451	2.79664617
PP3	-0.08885870	-4.64705	0.0001	0.01912154	-1.35436548
FPP	3.53451114	3.27229	0.0018	1.08013224	1.02941077
PPS	-1.10007575	-4.38743	0.0001	0.25073366	-1.73359019
SPSUM	0.56684780	3.81293	0.0003	0.14866471	1.19881913
GRIPSUM	-2.74592532	-4.04309	0.0002	0.67916551	-1.44494149

See preceding list for abbreviations

WEEK 19 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	8	4401847.87866736	550230.98483342	13.80420	0.0001	0.63674855	11.41098 %
ERROR	63	2511160.25633319	39859.68660846				
CORRECTED TOTAL	71	6913008.13500055				STD DEV	Y MEAN
						199.64890836	1749.62083

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPSUM	1	2418298.24874477	60.67028	0.0001	660898.92952135	16.58064	0.0001
FPD	1	193623.21961043	4.85762	0.0312	1120045.44752201	28.09971	0.0001
PCPP	1	402604.08908254	10.10053	0.0023	1237621.59185452	31.04946	0.0001
FP3	1	605073.63953659	15.18009	0.0002	735891.39854970	18.46205	0.0001
FPP	1	333118.74691740	8.35728	0.0053	303194.93907890	7.60656	0.0076
PPS	1	86154.85542732	2.16145	0.1465	361685.74261955	9.07397	0.0037
SPSUM	1	63.17668701	0.00158	0.9684	299135.45838805	7.50471	0.0080
GRIPSUM	1	362911.90266126	9.10474	0.0037	362911.90266126	9.10474	0.0037

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1654.69363384	5.75284	0.0001	287.63055177	0.0
FPSUM	4.47803314	4.07193	0.0001	1.09973164	1.55570584
FPD	-1.03296528	-5.30092	0.0001	0.19486545	-1.72424326
PCPP	0.95427101	5.57220	0.0001	0.17125558	2.38242363
PP3	-0.09612766	-4.29675	0.0001	0.02237219	-1.40125805
FPP	3.49076241	2.75800	0.0076	1.26568682	0.97579598
PPS	-0.81594453	-3.01230	0.0037	0.27087061	-1.23359253
SPSUM	0.42425821	2.73947	0.0080	0.15486856	0.85866460
GRIPSUM	-2.09137963	-3.01741	0.0037	0.69310528	-1.11584634

See preceding list for abbreviations

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

WEEK 20 SPRING WHEAT YIELD ANALYSIS

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	10	4742059.11361988	474205.91136199	17.89157	0.0001	0.75518722	9.40584 %
ERROR	58	1537256.74009440	26504.42655335				
						STD DEV	Y MEAN
CORRECTED TOTAL	68	6279315.85371428				162.80180144	1730.85906

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
FPSUM	1	2734968.03271894	103.18910	0.0001	97660.64839091	3.68469	0.0598
F	1	328319.55997522	12.38735	0.0008	361995.85354933	13.65794	0.0005
FPP	1	375860.98056037	14.18106	0.0004	580844.39808777	21.91500	0.0001
F2	1	38365.35588751	1.44751	0.2338	156835.17542957	5.91732	0.0181
GRIPD	1	11410.82381612	0.43053	0.5143	188289.32765176	7.10407	0.0099
PP2	1	57263.95088401	2.16054	0.1470	594992.19920932	22.44879	0.0001
PDPP	1	708760.13207068	26.74120	0.0001	322550.17769695	12.16967	0.0009
FPD	1	162999.25431043	6.14989	0.0161	466067.20772145	17.58450	0.0001
GRI2	1	271254.87906784	10.23432	0.0022	84689.22397805	3.19529	0.0791
GRI	1	52856.14432875	1.99424	0.1632	52856.14432875	1.99424	0.1632

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	-5921.08177428	-1.33875	0.1859	4422.83999068	0.0
FPSUM	1.23732621	1.91956	0.0598	0.64459008	0.46298138
F	356.09767780	3.69566	0.0005	96.35550896	4.36096298
FPP	5.92982789	4.60135	0.0001	1.26669306	1.72703619
F2	-7.97492349	-2.43255	0.0181	3.27841550	-1.67850050
GRIPD	0.54323910	2.66535	0.0099	0.20381558	0.87663492
PP2	-4.44108934	-4.73801	0.0001	0.93733121	-2.49134559
PDPP	0.74695320	3.48851	0.0009	0.21411838	1.95052675
FPD	-2.35011524	-4.19339	0.0001	0.56043351	-4.08332918
GRI2	-8.52102036	-1.78754	0.0791	4.76690759	-3.17936725
GRI	401.88061890	1.41218	0.1632	284.58272180	2.42700863

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK1

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	31130134.78282040	10376711.59427347	94.25065	0.0001	0.59936572	20.66747 %
ERROR	189	20808329.26727116	110096.98025011				
CORRECTED TOTAL	192	51938464.05009156				STD DEV	Y MEAN
						331.80865005	1605.46308

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16768642.24685024	152.30792	0.0001	8566622.84753578	77.80979	0.0001
GRI	1	12386895.86343888	112.50895	0.0001	9606038.03218880	87.25069	0.0001
GRIPSUM	1	1974596.67253119	17.93507	0.0001	1974596.67253119	17.93507	0.0001

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2240.29698919	13.73464	0.0001	163.11289307	0.0
F	23.99187412	8.82099	0.0001	2.71986316	0.43108383
GRI	-133.40709716	-9.34081	0.0001	14.28217950	-0.46575516
GRIPSUM	1.89191254	4.23498	0.0001	0.44673457	0.20064131

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK2

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	30677529.75444576	10225843.25148192	98.67182	0.0001	0.61412027	20.02431 %
ERROR	186	19276088.95834788	103634.88687284			STD DEV	Y MEAN
CORRECTED TOTAL	189	49953618.71279364				321.92372835	1607.66434

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	18477530.34851766	178.29450	0.0001	10558110.88488587	101.87796	0.0001
GRI	1	10030136.85107172	96.78340	0.0001	7803873.12012186	75.30160	0.0001
GRIPSUM	1	2169862.55485625	20.93757	0.0001	2169862.55485625	20.93757	0.0001

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2065.96482829	13.25111	0.0001	155.90883491	0.0
F	26.81195012	10.09346	0.0001	2.65636826	0.48689341
GRI	-114.56172742	-8.67765	0.0001	13.20193051	-0.42505496
GRIPSUM	1.84475538	4.57576	0.0001	0.40315835	0.21330537

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK3

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	30768352.47031123	10256117.49010374	100.25310	0.0001	0.61788096	20.00305 %
ERROR	186	19028217.87937383	102302.24666330			STD DEV	Y MEAN
CORRECTED TOTAL	189	49796570.34968507				319.84722394	1598.99263

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17862505.38387724	174.60521	0.0001	11798707.14335095	115.33185	0.0001
GRI	1	9954593.20960905	97.30571	0.0001	7743615.32471748	75.69350	0.0001
GRIPSUM	1	2951253.87682482	28.84838	0.0001	2951253.87682482	28.84838	0.0001

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1971.09541989	13.20219	0.0001	149.30062177	0.0
F	27.74792895	10.73927	0.0001	2.58378248	0.50747556
GRI	-106.27249154	-8.70020	0.0001	12.21494633	-0.41559211
GRIPSUM	1.94417920	5.37107	0.0001	0.36197251	0.24828736

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK4

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	31095793.13350679	10365264.37783560	103.09407	0.0001	0.62445652	19.83019 %
ERROR	186	18700777.21617828	100541.81299021			STD DEV	Y MEAN
CORRECTED TOTAL	189	49796570.34968507				317.08329030	1598.99263

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17862505.38387724	177.66246	0.0001	12664047.56499416	125.95802	0.0001
GRI	1	10196006.94393851	101.41061	0.0001	8410759.49729802	83.65434	0.0001
GRIPSUM	1	3037280.80569091	30.20913	0.0001	3037280.80569091	30.20913	0.0001

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1979.44948991	13.70109	0.0001	144.47385430	0.0
F	28.56133199	11.22310	0.0001	2.54486968	0.52235171
GRI	-104.45226483	-9.14627	0.0001	11.42019738	-0.42719467
GRIPSUM	1.78674923	5.49628	0.0001	0.32508317	0.25072796

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK5

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	31189585.77778855	10396528.59259618	102.35520	0.0001	0.62150776	19.97243 %
ERROR	187	18994157.64063509	101573.03551142			STD DEV	Y MEAN
CORRECTED TOTAL	190	50183743.41842365				318.70524864	1595.72631

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17566633.57757868	172.94584	0.0001	12626616.89754937	124.31072	0.0001
GRI	1	10618537.92095312	104.54091	0.0001	8896904.61055990	87.59121	0.0001
GRIPSUM	1	3004414.27925662	29.57886	0.0001	3004414.27925662	29.57886	0.0001

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2017.79824344	13.85597	0.0001	145.62660298	0.0
F	28.38808153	11.14947	0.0001	2.54613694	0.51778576
GRI	-102.70916372	-9.35902	0.0001	10.97435341	-0.43593072
GRIPSUM	1.57106336	5.43864	0.0001	0.28887038	0.24810369

See preceding list for abbreviations

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WINTER WHEAT YIELD ANALYSIS WEEK6

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	3	30917241.28846700	10305747.09615567	99.30201	0.0001	0.61309392	20.15581 %
ERROR	188	19510988.85945057	103781.85563538			STD DEV	Y MEAN
CORRECTED TOTAL	191	50428230.14791756				322.15191391	1598.30833

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17508395.83416695	168.70382	0.0001	13888203.45225881	133.82111	0.0001
GRI	1	10061380.61948231	96.94740	0.0001	8625612.13919407	83.11291	0.0001
GRIPSUM	1	3347464.83481764	32.25482	0.0001	3347464.83481764	32.25482	0.0001

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1990.61731711	13.29522	0.0001	149.72432218	0.0
F	29.75068308	11.56811	0.0001	2.57178478	0.54136995
GRI	-98.05093826	-9.11663	0.0001	10.75517563	-0.42451928
GRIPSUM	1.51550749	5.67933	0.0001	0.26684606	0.26172080

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK7

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31755116.32090316	7938779.08022579	79.50210	0.0001	0.62970912	19.77093 %
ERROR	187	18673113.82701441	99856.22367387			STD DEV	Y MEAN
CORRECTED TOTAL	191	50428230.14791756				316.00035391	1598.30833

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17508395.83416695	175.33605	0.0001	12927163.57019666	129.45777	0.0001
TP	1	9980822.97872602	99.95194	0.0001	1355337.25995591	13.57289	0.0003
GRI	1	3540348.00694331	35.45446	0.0001	4032193.20965420	40.37999	0.0001
GRIPSUM	1	725549.50106678	7.26594	0.0077	725549.50106678	7.26594	0.0077

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1693.19830208	9.87443	0.0001	171.47303579	0.0
F	28.46763805	11.37795	0.0001	2.50200044	0.51802252
TP	11.14531584	3.68414	0.0003	3.02521511	0.22366914
GRI	-74.19830268	-6.35453	0.0001	11.67645131	-0.32526507
GRIPSUM	0.77076170	2.69554	0.0077	0.28593951	0.14599020

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK8

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31615125.69979536	7903781.42494884	82.54613	0.0001	0.64090536	19.26656 %
ERROR	185	17713725.99673176	95749.87025260				
CORRECTED TOTAL	189	49328851.69652712				STD DEV	Y MEAN
						309.43475928	1606.07158

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16870596.78414518	176.19446	0.0001	12125695.09353845	126.63928	0.0001
TP	1	9936394.13440053	103.77449	0.0001	1162966.14461156	12.14588	0.0006
GRI	1	3641383.41933263	38.03017	0.0001	4345779.50478184	45.38679	0.0001
GRIPSUM	1	1166751.36191694	12.18541	0.0006	1166751.36191694	12.18541	0.0006

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1768.64968205	10.15190	0.0001	174.21854075	0.0
F	27.66097048	11.25341	0.0001	2.45800741	0.50690837
TP	10.21198794	3.48509	0.0006	2.93019049	0.20715149
GRI	-75.97540240	-6.73697	0.0001	11.27738124	-0.33949515
GRIPSUM	0.83935579	3.49076	0.0006	0.24045069	0.18662765

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK9

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31783980.84542151	7945995.21135538	83.78569	0.0001	0.64432842	19.17451 %
ERROR	185	17544870.85110561	94837.13973571				
						STD DEV	Y MEAN
CORRECTED TOTAL	189	49328851.69652712				307.95639259	1606.07158

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16870596.78414518	177.89019	0.0001	11659202.17331704	122.93920	0.0001
TP	1	9936394.13440053	104.77324	0.0001	1297787.28522480	13.68438	0.0003
GRI	1	3870749.69149947	40.81470	0.0001	4575034.71915794	48.24096	0.0001
GRIPSUM	1	1106240.23537626	11.66463	0.0008	1106240.23537626	11.66463	0.0008

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1844.12289004	10.31789	0.0001	178.73062214	0.0
F	27.16242772	11.08780	0.0001	2.44975916	0.49777220
TP	10.59817694	3.69924	0.0003	2.86496046	0.21498538
GRI	-76.03457561	-6.94557	0.0001	10.94720253	-0.34794736
GRIPSUM	0.68939189	3.41535	0.0008	0.20185089	0.17915104

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK10

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32242564.12500726	8060641.03125182	88.02425	0.0001	0.65677853	18.87182 %
ERROR	184	16849424.44230176	91572.95892555			STD DEV	Y MEAN
CORRECTED TOTAL	188	49091988.56730902				302.61024260	1603.50331

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16930054.80855969	184.88050	0.0001	11634786.94966280	127.05483	0.0001
TP	1	10057551.35411869	109.83102	0.0001	1539415.19183878	16.81081	0.0001
GRI	1	4304891.66890697	47.01051	0.0001	4776829.78439517	52.16420	0.0001
GRIPSUM	1	950066.29342180	10.37497	0.0015	950066.29342180	10.37497	0.0015

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1904.85951377	10.46219	0.0001	182.07084202	0.0
F	27.16977317	11.27186	0.0001	2.41040722	0.49905743
TP	11.35073983	4.10010	0.0001	2.76840681	0.23067422
GRI	-75.67337961	-7.22248	0.0001	10.47748073	-0.34845845
GRIPSUM	0.55374747	3.22102	0.0015	0.17191684	0.16591710

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK11

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32247503.32599643	8061875.83149911	85.69972	0.0001	0.64948771	19.17468 %
ERROR	185	17403172.01379385	94071.20007456				
CORRECTED TOTAL	189	49650675.33979028				STD DEV	Y MEAN
						306.71028687	1599.55895

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	17252636.65163072	183.39977	0.0001	11581562.91791662	123.11486	0.0001
TP	1	10068236.39689405	107.02783	0.0001	2112620.69771049	22.45768	0.0001
GRI	1	4169297.74328983	44.32066	0.0001	4563953.19858288	48.51595	0.0001
GRIPSUH	1	757332.53418176	8.05063	0.0051	757332.53418176	8.05063	0.0051

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	1929.10167428	10.02425	0.0001	192.44345066	0.0
F	27.10524154	11.09571	0.0001	2.44285696	0.49605481
TP	12.75346678	4.73895	0.0001	2.69119912	0.25773752
GRI	-73.17384379	-6.96534	0.0001	10.50542484	-0.33764256
GRIPSUH	0.42468032	2.83736	0.0051	0.14987428	0.14164405

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK12

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31819133.33124588	7954783.33281147	84.73875	0.0001	0.64815328	19.10747 %
ERROR	184	17272855.23606313	93874.21323947				
CORRECTED TOTAL	188	49091988.56730902				STD DEV	Y MEAN
						306.38899008	1603.50331

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16930054.80855969	180.34830	0.0001	11212538.33429143	119.44216	0.0001
TP	1	10057551.35411869	107.13860	0.0001	2594929.88790071	27.64263	0.0001
GRI	1	4319098.66268914	46.00943	0.0001	4550342.67200785	48.47276	0.0001
GRIPSUM	1	512428.50587826	5.45867	0.0205	512428.50587826	5.45867	0.0205

SOURCE	B VALUES	T FOR HO B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT.	1995.57580349	9.91629	0.0001	201.24223575	0.0
F	26.88667753	10.92896	0.0001	2.46013151	0.49385750
TP	13.78529783	5.25763	0.0001	2.62196261	0.28015027
GRI	-71.87193550	-6.96224	0.0001	10.32310736	-0.33597643
GRIPSUM	0.30694474	2.33638	0.0205	0.13137620	0.11535646

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK13

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31980778.11554570	7995194.52888643	85.97380	0.0001	0.65144597	19.01786 %
ERROR	184	17111210.45176331	92995.70897697				
						STD DEV	Y MEAN
CORRECTED TOTAL	188	49091988.56730902				304.95197815	1603.50331

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16930054.80855969	182.05200	0.0001	11132673.54399639	119.71169	0.0001
TP	1	10057551.35411869	108.15070	0.0001	2318983.41721252	24.93646	0.0001
GRI	1	4392940.85068032	47.23810	0.0001	4738723.61777613	50.95637	0.0001
GRIPSUM	1	600231.10218690	6.45440	0.0119	600231.10218690	6.45440	0.0119

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2079.37196127	9.99129	0.0001	208.11842184	0.0
F	26.77783616	10.94128	0.0001	2.44741264	0.49185829
TP	13.27341144	4.99364	0.0001	2.65806251	0.26974751
GRI	-72.93825539	-7.13837	0.0001	10.21777032	-0.34432041
GRIPSUM	0.30238852	2.54055	0.0119	0.11902481	0.12694671

See preceding list for abbreviations

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WINTER WHEAT YIELD ANALYSIS WEEK14

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31978069.82903149	7994517.45725787	85.95292	0.0001	0.65139080	19.01936 %
ERROR	184	17113918.73827753	93010.42792542			STD DEV	Y MEAN
CORRECTED TOTAL	188	49091988.56730902				304.97611042	1603.50331

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16930054.80855969	182.02319	0.0001	11141700.25513800	119.78980	0.0001
TP	1	10057551.35411869	108.13359	0.0001	2427457.63974579	26.09877	0.0001
GRI	1	4442536.53128548	47.76385	0.0001	4730754.35973004	50.86262	0.0001
GRIPSUM	1	547927.13506753	5.89103	0.0162	547927.13506753	5.89103	0.0162

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2137.56019607	9.82886	0.0001	217.47792586	0.0
F	26.87977237	10.94485	0.0001	2.45592824	0.49373066
TP	13.54666397	5.10870	0.0001	2.65168755	0.27530066
GRI	-72.26183147	-7.13180	0.0001	10.13233608	-0.34185186
GRIPSUM	0.26260785	2.42714	0.0162	0.10819623	0.12176885

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK15

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31558395.17765173	7889598.79441293	82.13496	0.0001	0.63975532	19.29739 %
ERROR	185	17770456.51887539	96056.52172365				
						STD DEV	Y MEAN
CORRECTED TOTAL	189	49328851.69652712				309.92986581	1606.07158

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16870596.78414518	175.63198	0.0001	11032541.31525602	114.85468	0.0001
TP	1	9936394.13440053	103.44320	0.0001	2508218.12338596	26.11190	0.0001
GRI	1	4179584.40415577	43.51172	0.0001	4443429.44177993	46.25849	0.0001
GRIPSUM	1	571819.85495018	5.95295	0.0156	571819.85495018	5.95295	0.0156

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2166.75683903	9.35491	0.0001	231.61719108	0.0
F	26.63209416	10.71703	0.0001	2.48502616	0.48805343
TP	13.59691084	5.10990	0.0001	2.66085309	0.27501508
GRI	-69.54319809	-6.80136	0.0001	10.22489714	-0.33137498
GRIPSUM	0.23435163	2.43987	0.0156	0.09605098	0.12202816

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK16

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32297705.18205325	8074426.29551331	88.33687	0.0001	0.65880328	18.83834 %
ERROR	183	16727103.97899480	91404.93977593				
CORRECTED TOTAL	187	49024809.16104805				STD DEV	Y MEAN
						302.33249871	1604.87832

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16866710.74780705	184.52734	0.0001	10199409.12351794	111.58488	0.0001
TP	1	10328442.25940776	112.99654	0.0001	3027066.66138116	33.11710	0.0001
GRI	1	4718886.95221943	51.62617	0.0001	4926116.84474106	53.89333	0.0001
GRIPSUM	1	383665.22261889	4.19742	0.0419	383665.22261889	4.19742	0.0419

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2333.78002664	9.84870	0.0001	236.96337471	0.0
F	25.59214848	10.56337	0.0001	2.42272474	0.46986013
TP	14.83505884	5.75475	0.0001	2.57802149	0.29890363
GRI	-73.44692589	-7.34121	0.0001	10.00474680	-0.34845904
GRIPSUM	0.17730252	2.04876	0.0419	0.08654132	0.09887956

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK17

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32122852.52606202	8030713.13151551	86.94973	0.0001	0.65523667	18.93655 %
ERROR	183	16901956.63498603	92360.41877042				
						STD DEV	Y MEAN
CORRECTED TOTAL	187	49024809.16104805				303.90856975	1604.87832

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16866710.74780705	182.61839	0.0001	10219014.70131336	110.64279	0.0001
TP	1	10328442.25940776	111.82758	0.0001	3498449.23233903	37.87823	0.0001
GRI	1	4752124.05987219	51.45195	0.0001	4848326.85121506	52.49356	0.0001
GRIPSUM	1	175575.45897490	1.90098	0.1697	175575.45897490	1.90098	0.1697

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2420.55081253	9.74853	0.0001	248.29893182	0.0
F	25.61804149	10.51869	0.0001	2.43547883	0.47033552
TP	15.70693457	6.15453	0.0001	2.55209357	0.31645352
GRI	-72.36182967	-7.24524	0.0001	9.98749422	-0.34439915
GRIPSUM	0.10460143	1.37876	0.1697	0.07586626	0.06600039

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK18

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32041635.71130776	8010408.92782694	86.31513	0.0001	0.65358002	18.98199 %
ERROR	183	16983173.44974029	92804.22650131				
CORRECTED TOTAL	187	49024809.16104805				STD DEV	Y MEAN
						304.63786124	1604.87832

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16866710.74780705	181.74507	0.0001	10241763.20710765	110.35880	0.0001
TP	1	10328442.25940776	111.29280	0.0001	3648126.32588398	39.30992	0.0001
GRI	1	4704624.84992373	50.69408	0.0001	4769171.82251846	51.38960	0.0001
GRIPSUM	1	141857.85416909	1.52857	0.2179	141857.85416909	1.52857	0.2179

SOURCE	B VALUES	T FOR H0:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2493.19710507	9.56857	0.0001	260.56112375	0.0
F	25.69097352	10.50518	0.0001	2.44555297	0.47167451
TP	15.90737359	6.26976	0.0001	2.53715748	0.32049184
GRI	-71.73969986	-7.16865	0.0001	10.00741588	-0.34149698
GRIPSUM	0.08418242	1.23635	0.2179	0.06808926	0.05888743

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK19

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	32001454.66008769	8000363.66502192	86.00341	0.0001	0.65276041	19.00443 %
ERROR	183	17023354.50096036	93023.79508722				
						STD DEV	Y MEAN
CORRECTED TOTAL	187	49024809.16104805				304.99802473	1604.87832

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16866710.74780705	181.31609	0.0001	10370753.17422581	111.48495	0.0001
TP	1	10328442.25940776	111.03011	0.0001	3737227.92739083	40.17497	0.0001
GRI	1	4716033.00007313	50.69706	0.0001	4743031.63980931	50.98729	0.0001
GRIPSUM	1	90268.65279962	0.97038	0.3259	90268.65279962	0.97038	0.3259

SOURCE	B VALUES	T FOR HO:B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2572.09589428	9.45914	0.0001	271.91654179	0.0
F	25.81178295	10.55864	0.0001	2.44461168	0.47389252
TP	16.05310100	6.33837	0.0001	2.53268496	0.32342787
GRI	-71.37759914	-7.14054	0.0001	9.99610828	-0.34057794
GRIPSUM	0.06211629	0.98508	0.3259	0.06305711	0.04681197

See preceding list for abbreviations

WINTER WHEAT YIELD ANALYSIS WEEK20

ANALYSIS OF VARIANCE TABLE , REGRESSION COEFFICIENTS , AND STATISTICS OF FIT FOR DEPENDENT VARIABLE Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F	R-SQUARE	C.V.
REGRESSION	4	31993961.03402025	7998490.25850506	85.94544	0.0001	0.65260756	19.00862 %
ERROR	183	17030848.12702780	93064.74386354			STD DEV	Y MEAN
CORRECTED TOTAL	187	49024809.16104805				305.06514692	1604.87832

SOURCE	DF	SEQUENTIAL SS	F VALUE	PROB > F	PARTIAL SS	F VALUE	PROB > F
F	1	16866710.74780705	181.23631	0.0001	10344514.05138022	111.15395	0.0001
TP	1	10328442.25940776	110.98126	0.0001	3579664.12538277	38.46423	0.0001
GRI	1	4692220.65540327	50.41889	0.0001	4713778.86723128	50.65053	0.0001
GRIPSUM	1	106587.37140204	1.14530	0.2859	106587.37140204	1.14530	0.2859

SOURCE	B VALUES	T FOR HO B=0	PROB > |T|	STD ERR B	STD B VALUES
INTERCEPT	2657.01260095	9.29059	0.0001	285.98962911	0.0
F	25.88471971	10.54296	0.0001	2.45516686	0.47523161
TP	15.81438044	6.20195	0.0001	2.54990286	0.31861827
GRI	-71.85233917	-7.11692	0.0001	10.09598977	-0.34073110
GRIPSUM	0.06361635	1.07019	0.2859	0.05944406	0.05120745

See preceding list for abbreviations