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Yield Model Development

CROP WEATHER MODELS OF CORN AND SOYBEANS FOR AGROPHYSICAL UNITS (APU's) IN IOWA USING MONTHLY METEOROLOGICAL PREDICTORS

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16. Abstract

Models based on multiple regression were developed to estimate corn and soybean yield from weather data for Agrophysical Units (APU) in Iowa. The predictor variables are derived from monthly average temperature and monthly total precipitation data at meteorological stations in the cooperative network. The models are similar in form to the previous models developed for Crop Reporting Districts (CRD). The trends and derived variables were the same and the approach to select the significant predictors was similar to that used in developing the CRD models. The APU's were selected to be more homogeneous with respect crop to production than the CRDs. The APU models are quite similar to the CRD models, similar explained variation and number of predictor variables. The APU models will be independently evaluated and compared to the previously evaluated CRD models. That comparison will indicate the preferred model area for this application, i.e., APU or CRD.

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CROP YIELD MODELS OF CORN AND SOYBEANS FOR AGROPHYSICIAL UNITS (APU's IN IOWA USING MONTHLY METEOROLOGICAL PREDICTORS

Sharon LeDuc

Introduction

Models were developed to investigate the hypothesis that prediction of yield from monthly weather parameters would improve if the basic area for the model became more homogeneous with respect to agricultural environment, soils and climate. The homogeneous areas, or agrophysical units (APU's), are groupings of counties. Models developed for APU's are compared with similar models previously developed for the crop reporting districts (CRD's). Eight APU's for Iowa, shown in Figure 1, were defined in a memorandum of understanding from Strommen and Dragg (January 10, 1980).

Data

The basic meteorological data were monthly average maximum and average minimum temperatures and total precipitation for all of the available cooperative stations. These data were used to estimate the monthly average temperature and monthly total precipitation for each county in the state. This task was completed at the University of Missouri - Columbia, Atmospheric Science Department, under the supervision of Professor Wayne Decker. The methods (Thiessen and inverse distance) were briefly described by LeDuc (1982). Since no significant difference in the values produced by the two methods was detected, the computationally simpler method, the inverse distance method was used. These county data were then averaged over all counties within each

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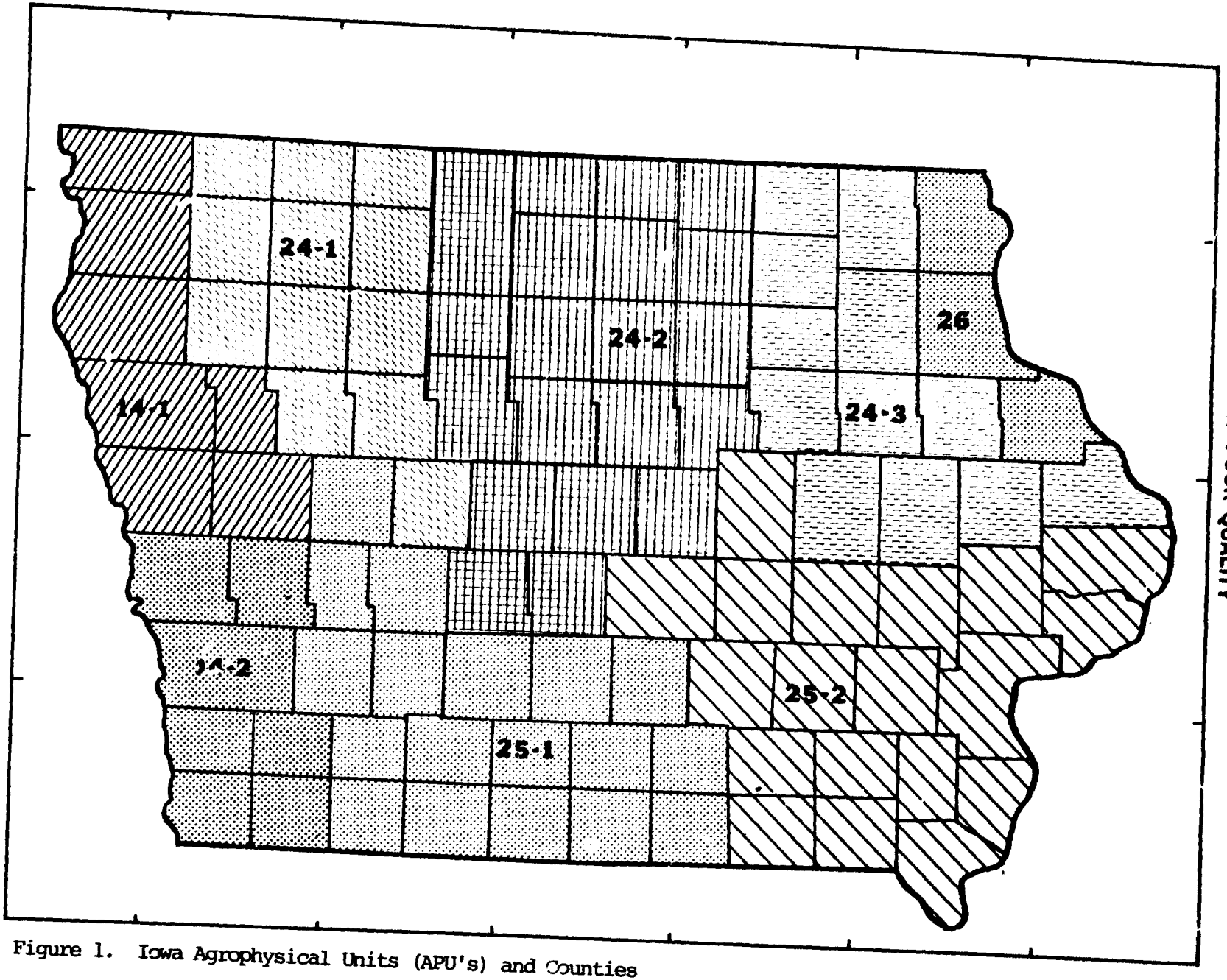

Figure 1. Iowa Agrophysical Units (APU's) and Counties

APU to obtain an average monthly temperature and total monthly precipitation for that APU.

Variables considered as predictor variables in the models are the same as those considered for the CRD's models (Motha, 1980; LeDuc, 1980). The trend variables are also the same. For the soybean models there are two linear trends; the change occurred in 1961. For the corn models there is a single linear trend.

Method

The method for selecting variables was similar to that used for the previously developed CRD models. A preliminary correlation analysis was done between the yield with trend removed and the predictor variables. This was used to determine which variables to consider. Stepwise regression with stepwise, backward and forward selection was used. The selected variables were examined with respect to the sign of the coefficient, the agreement of variables selected for adjacent APU's and the statistical significance and correlation among the predictor variables. In some cases variables not selected in stepwise were considered for subjective reasons and the results analyzed. These additional variables were considered because they were important in adjacent APU's. If no variable was included for a month, including a period when weather might have had a significant affect on yield, several additional variables for that month were tried. These variables were not included in the models unless the coefficients were statistically significant in the full season model. This full season model is developed separately from the truncated models, i.e. models which used variables only through a specified month for each of the APU's.

Discussion of the Models

The statistical details of each of the models are included in Appendix A. The truncated models, i.e., models using variables only through a specified month, for each of the APU's are included. There is also a separate model which incorporated observations from all of the separate APU's, cross sectional data. This increased the number of observations available to select the variables and to estimate the regression coefficients. In this model a dummy variable is considered for inclusion for each APU. This allows for a different level of yield for each APU, but assumes the same impact of the meterological variables on yield in all APU's. The statistical summaries of the end of season models for soybeans and corn are included in Tables 1 and 2, respectively.

The production and harvested area data were available for counties (Cotter, 1981). For soybeans data were from 1950 through 1979. For corn, the data for "corn for grain" did not begin until 1956. Prior to that production and harvested area data were only available for "corn for grain." Kestle (1982) used a statistical adjustment to provide the yield of "corn for grain" from the yield of "corn for all purposes" for six years, 1950-1955. The statistical adjustment was based on 1956, the only year both sets of statistics were available. These data increased the sample size by 25 percent. The calculated yield was the sum of the production over all counties in each APU divided by the sum of the harvested area for those same counties. The observation for 1970 was not used to develop the corn models in some areas because of the devastating impact of the corn blight on yield.

Development of the Models

The derived meteorological variables developed as potential predictors in the crop yield models are the same as those considered for the CRD models (Motha, 1980; LeDuc, 1980).

The variable PET (potential evapotranspiration) is calculated using Thornthwaite's method (1948).

The ET (evapotranspiration) and ETHAT (climatically appropriate evapotranspiration) are determined using a hydrologic accounting procedure developed by Palmer (1956). Software for calculating these variables is available for the Statistical Analysis System (SAS). Documentation and code for the software are available from Dr. Thomas Phillips at the Center for Environmental Assessment Services (CEAS). Restricting the variables considered as predictors was deliberate to allow evaluation of the difference in models (i.e. comparison Crop Reporting District (CRD, versus Agrophysical (APU) resulting from a change in the basic geographic unit for which yield was estimated. Other variables, such as monthly average maximum and minimum temperature were available for consideration in the models but were ignored when selecting variables for the models.

Models

The models are described in Tables in Appendix A. Figures displaying the yield and estimated yield from the model for the end of the season are included in Appendix B. Appendix C includes the data used in estimating the models.

Soybean Models

The soybean models (Appendix A) for the CRD's include variables for the weather in September in six of the nine CRD models, the southern, western and the north central models. September variables were included in models for 5 of the 8 APU's and also for the model which included all of the APU's.

The cumulative precipitation, the sum from September of the previous fall through April just prior to planting, was a variable in four of the CRD models. The coefficient was negative, indicating decreased yield is associated with too

much precipitation during that period. None of the APU models included this variable nor had April truncations. One of the APU models and the model for all APU's included the squared deviation from normal of the cumulative precipitation through May. The coefficient estimate was negative in both models.

Other variables for the month of May included in the APU models were precipitation and evapotranspiration. The CRD models used temperature and the squared precipitation. For the June truncation the APU models included variables which were functions of potential and/or estimated evapotranspiration. The CRD models used temperature in the June models. For both types of models, the July and August variables were largely functions of the evapotranspiration. August and September are important months in relating final yield to the weather. The variables included in the models are significant and explain much of the variability in the yields.

The explained variance (R^2) for the final truncation of the soybean APU models ranged from 77-95 percent (77-98 percent for final CRD models). In the models which combined all APU's there were three APU's found to have a significantly lower level of yield (APU 141, 243 and 260) as indicated by the negative coefficients for variables D1, D4 and D5. The coefficients for the trend variables changed with the various models. The estimated increase due to trend is similar for both APU and CRD models. The estimated increase due to trend from 1950 to 1979 ranged from 7.4 q/ha in APU 251 in the south central to 13.4 q/ha in APU 260 in the northeast. Comparably, the range for the CRD models is from 7.4 q/ha for the southeast CRD to 13.5 q/ha for the northeast CRD.

Corn Models

The statistics for the truncated corn models for the APU's are included in Appendix A. The models for the full season model are summarized in Table 2.

There were only two APU models with a May truncation. One indicated that high temperatures in May were associated with decreased yields; the other that decreased yield is observed when May precipitation is high. July is the most important month in both the APU and the CRD models. The July variables for the APU models are functions of potential and/or estimated evapotranspiration.

June potential and/or estimated evapotranspiration also appears to be significant in many of the models. The end of the season model for APU 242 had a variable for April, the ratio of precipitation to potential evapotranspiration for April, and three models had variables for August.

The CRD models also had emphasis on the July variables. Cumulative precipitation for September through June was included as a squared deviation from the mean in three CRD models and in one APU model. One CRD model contains cumulative precipitation, September through June. An April truncation is not included for any of the CRD models and for only one APU model.

The explained variance (R^2) is somewhat higher with the APU models (88-95 percent) than with CRD models (67-91 percent). The estimates of the trend coefficients appear to be higher with the CRD models although the differences are small. The increase in estimated yield due to trend ranges from 34.8 q/ha to 48.9 q/ha for the APU models for the period 1950 to 1980.

Three APU's (141, 142, 251) were found to have a significantly different level of yield as indicated by the significance of the coefficient of variable D1 in the model for all APU's.

Summary

The variables of the APU models found to be significant for the APU models are closely related to those found to be significant for the CRD models, temperature or evapotranspiration was determined to be significant for the same month in the same geographic area. The functional form varied slightly as did the amount of variation explained. Structurally the models are similar by construction with differences being in the predictor variables selected. The estimated contribution due to trend is similar for the two types of models. The amount of variation explained by the APU models for corn was somewhat higher than for the CRD models. Selection between these two types of models will be made after the APU models have been independently tested. Differences between the statistics of the models (APU vs CRD) developed from historic data are not significant and do not determine a preference toward one type of selection of one geographical unit as the basis for models. Models for both types can be improved. The initial attempts can possibly be improved by evaluation of the trend through use of different linear trends or through incorporation of estimates of the components of technology, such as crop type and fertilizer application. The extent of this improvement will need to be determined in future model development. The evaluation of the current APU models and the comparison of the two types of models will be determined on the predictive capability since this is the intended use. The comparison of the regressions for the two types will be based on a bootstrap test procedure. Results will be presented in a later report.

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Table 1. Summary of Variables and Coefficient Estimates for APU Soybean Models (Final Truncation)

APU	R^2	Trend		May		June		July		August		September		Dummy	
		1	2	Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.
141	.89	.18	.52					ET	.09	ET	.08				
142	.78	.39	.17	E	85.20	ETP	-32.34								
												E	3.35		
1	.92	.39	.28	DSQ	-.00005			ET	.04	ET	.06	XDD	.58		
												PDSQ	-.00007		
242	.92	.33	.35			ET	.09					ETP	5.27		
												XDD	47.93		
243	.95	.33	.47			PET	.05			ET	.09	ETHAT	-9.33		
251	.77	.33	.19	PDD	-.02	ET	.09			E	9.91				
												PSQ	-.00002		
252						ET	.06			E	4.84	XDD	56.83		
												ETHAT	-10.42		
												XDD	61.21		
260	.94	.34	.52			E	-30.46			ET	.06	E	5.63		
												ETHAT	-11.91		
				DSQ	-.00002	ET	.05	PD	.01	ET	.04	E	.03	D1	-.98
All	.84	.33	.36											D4	-1.16
														D5	-2.31

PDD, deviation from mean of monthly precipitation (mm);
ET, evapotranspiration (mm);
ETHAT, climatically appropriate evapotranspiration (mm);
E , ratio of ET to ETHAT;
PET, potential evapotranspiration (mm);
ETP, ratio of ET to PET;
DSQ, squared deviation from mean of cumulative precipitation since last September (mm^2);
PDSQ, squared deviation from mean of precipitation (mm^2);
XDD, deviation from mean of temperature (^{o}C);
TREND1, year minus 1930 prior to 1962, then 32;
TREND2, .1 prior to 1962, then year minus 1961;
D1 (D4, D5), zero for all APU's except 141 (2 + 3, 260), when value is one, respectively.

Table 2. Summary of Variables and Coefficient Estimates for APU Corn Models (Final Truncation)

APU	R^2	Trend	April		May		June		July		August		Dummy	
			Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.	Var.	Coef.
141	.88	1.41							E	62.20				
									DEF	.05				
142	.90	1.18					ET	.36	ETP	89.19	PD	-.05		
241	.93	1.57			XDD	-1.39			DEF	.08	E	19.12		
											XDD	1.41		
242	.95	1.63	MR	-1.34			XDD	.95	ETP	103.96				
243	.94	1.38					ET	.20	ETP	78.69	PD	.03		
251	.89	1.16					ET	.41	DEF	.07				
									E	51.47				
252	.94	1.46					DSQ	-.00009	E	61.07				
							ETHAT	.21						
260	.95	1.42			PD	-.05	ET	.20	E	57.85				
									MR	5.13				
All	.86	1.41					ET	.20	ETP	56.70			D1	-2.93

DEF, precipitation minus potential evapotranspiration (mm);
DSQ, squared deviation from mean of cumulative precipitation since last September (mm);
E, ratio of ET to ETHAT;
ET, evapotranspiration (mm);
ETHAT, climatically appropriate evapotranspiration (mm);
ETP, ratio of ET to PET;
MR, precipitation divided by PET;
PD, precipitation (mm);
XDD, temperature deviation from mean (°C);
D1, zero for all APU's except 141, 142, or 251 when it is one.

Appendix A

VARIABLE LABELS

TREND1 - YEAR-1930 IF YEAR<1952 OR 32 IF YEAR>1951
TREND2 - 0.1 IF YEAR<1962 OR YEAR-1961 IF YEAR>1961
E5 - ET/ETHAT FOR MAY
DSQ5 - SQUARED CUM PRECIP DEVIATION FOR MAY
PDD5 - PRECIP DEVIATION FOR MAY
E6 - ET/ETHAT FOR JUNE
ETP6 - ET/PET FOR JUNE
PET6 - POTENTIAL EVAPOTRANSPIRATION FOR JUNE
ET7 - EVAPOTRANSPIRATION FOR JULY
PD7 - PRECIP FOR JULY
ET8 - EVAPOTRANSPIRATION FOR AUGUST
E8 - ET/ETHAT FOR AUGUST
E9 - ET/ETHAT FOR SEPTEMBER
PDSQ9 - SQUARED PRECIP DEVIATION FOR SEPTEMBER
ETP9 - ET/PET FOR SEPTEMBER
ETHAT9 - CLIMATICALLY APPROPRIATE POTENTIAL
EVAPOTRANSPIRATION FOR SEPTEMBER
DSQ9 - SQUARED CUM PRECIP DEVIATION FOR SEPTEMBER
XDD9 - TEMPERATURE DEVIATION FOR SEPTEMBER
ET9 - EVAPOTRANSPIRATION FOR SEPTEMBER
D1 - 1 IF APU=141
D4 - 1 IF APU=243
D5 - 1 IF APU=260

IOWA SOYBEANS NORTHWESTERN ADJ 141

MODEL: TREND — SSE 145.528915 — F RATIO 29.07
DEP VAR: YIELD — DFE 22 — PROB>F 0.0001
MSE 6.626 33 — R-SQUARE 0.6749

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.366214	4.234671	2.0937	0.0455
TREND1	1	0.229144	0.153774	1.4901	0.1474
TREND2	1	0.451737	0.091169	4.9549	0.0001

MODEL: JULY — SSE 102.194459 — F RATIO 41.25
DEP VAR: YIELD — DFE 27 — PROB>F 0.0001
MSE 3.784980 — R-SQUARE 0.8209

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-10.103189	5.156265	-1.9594	0.0505
TREND1	1	0.206755	0.116317	1.7777	0.0367
TREND2	1	0.431990	0.069205	6.2445	0.0001
ET7	1	0.144093	0.030709	4.6922	0.0001

MODEL: AUGUST — SSE 64.651310 — F RATIO 50.88
DEP VAR: YIELD — DFE 25 — PROB>F 0.0001
MSE 2.586589 — R-SQUARE 0.8567

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-11.240329	4.149552	-2.6829	0.0125
TREND1	1	0.205390	0.094281	2.1838	0.0382
TREND2	1	0.482965	0.056695	8.6098	0.0001
ET7	1	0.092773	0.028178	3.2924	0.0029
ET8	1	0.073542	0.018927	3.8855	0.0006

IOWA SOYBEANS SOUTHWESTERN ABU 142

MODEL: TREND		SSE	127.230233	F RATIO	30.34
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	4.543937	R-SQUARE	0.5346

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	4.232843	3.506784	1.2070	0.2375
TREND1	1	0.479544	0.127342	3.7569	0.0008
TREND2	1	0.229084	0.075495	3.0343	0.0052

MODEL: MAY		SSE	109.236354	F RATIO	24.23
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	4.045791	R-SQUARE	0.7292

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-16.214575	10.244773	-1.5827	0.1251
TREND1	1	0.447453	0.121125	3.6941	0.0010
TREND2	1	0.226981	0.071247	3.1858	0.0036
ES	1	21.504967	10.197133	2.1089	0.0444

MODEL: JUNE		SSE	86.333167	F RATIO	23.87
		DFE	26	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.320506	R-SQUARE	0.7860

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-45.329305	14.604532	-3.1340	0.0042
TREND1	1	0.388159	0.112031	3.4648	0.0019
TREND2	1	0.178619	0.067121	2.6612	0.0132
ES	1	94.079124	25.554141	3.2902	0.0029
ETP6	1	-31.901868	12.147135	-2.6263	0.0143

IOWA SOYBEANS NORTHWESTERN CENTRAL APU 241

MODEL: TREND		SSE	131.208906	F RATIO	36.36
		DFE	28	PROB>F	0.0001
DEP VAR: YIELD		MSE	4.686032	R-SQUARE	0.7220
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.901801	3.561193	2.4997	0.0186
TREND1	1	0.281754	0.129315	2.1788	0.0379
TREND2	1	0.393413	0.076570	5.1373	0.0001
MODEL: MAY		SSE	115.540591	F RATIO	27.76
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	4.279281	R-SQUARE	0.7552
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.008395	3.435007	2.3314	0.0274
TREND1	1	0.344363	0.127936	2.6938	0.0120
TREND2	1	0.358593	0.075493	4.7500	0.0001
DSQ5	1	-0.000083928	.00004386125	-1.9135	0.0663
MODEL: JULY		SSE	82.698737	F RATIO	30.59
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.180721	R-SQUARE	0.8248
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-4.154903	4.806111	-0.8645	0.3952
TREND1	1	0.345721	0.110213	3.1368	0.0042
TREND2	1	0.345497	0.065213	5.2980	0.0001
DSQ5	1	-.0000684292	.00003812087	-1.7951	0.0843
ET7	1	0.090026	0.028017	3.2133	0.0035
MODEL: AUGUST		SSE	52.647863	F RATIO	39.82
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.105915	R-SQUARE	0.8984
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-7.157513	3.990634	-1.7936	0.0850
TREND1	1	0.350064	0.089586	3.9082	0.0006
TREND2	1	0.341470	0.053074	6.4339	0.0001
DSQ5	1	-.0000675296	.00003101939	-2.1770	0.0391
ET7	1	0.051198	0.025007	2.0474	0.0513
ET8	1	0.073093	0.019349	3.7775	0.0009

IOWA SOYBEANS NORTHWESTERN CENTRAL APU 241

MODEL: SEPT
DEP VAR: YIELD

		SSE	34.448269	F RATIO	41.73
		DFE	23	PROB>F	0.0001
		MSE	1.497751	R-SQUARE	0.9270

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-8.151966	3.414369	-2.3875	0.0256
TREND1	1	0.373889	0.077547	4.8214	0.0001
TREND2	1	0.298544	0.046427	6.4305	0.0001
DS05	1	-.0000434136	.0000274015	-1.5843	0.1268
ET7	1	0.041727	0.021599	1.9230	0.0670
ET8	1	0.056087	0.018949	2.9755	0.0068
XD09	1	0.598013	0.179157	3.3379	0.0029
E9	1	3.504807	1.734866	2.0202	0.0552

IOWA SOYBEANS NORTHERN CENTRAL APU 242

MODEL: TREND		SSE	70.954573	F RATIO	63.21
		DFE	28	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.534095	R-SQUARE	0.8187
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	7.224666	2.618812	2.7588	0.0101
TREND1	1	0.356923	0.095097	3.7533	0.0008
TREND2	1	0.338749	0.056381	6.0082	0.0001

MODEL: JUNE		SSE	57.756527	F RATIO	51.98
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.139134	R-SQUARE	0.8524
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-0.454469	3.917520	-0.1160	0.9085
TREND1	1	0.354560	0.087377	4.0578	0.0004
TREND2	1	0.342606	0.051825	6.6109	0.0001
ET6	1	0.062361	0.025106	2.4839	0.0195

MODEL: AUGUST		SSE	37.715752	F RATIO	60.94
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	1.450606	R-SQUARE	0.9036
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-8.699990	3.915147	-2.2221	0.0352
TREND1	1	0.323202	0.072447	4.4612	0.0001
TREND2	1	0.365831	0.043132	8.4817	0.0001
ET6	1	0.071913	0.020834	3.4521	0.0019
ET8	1	0.068417	0.018407	3.7169	0.0010

MODEL: SEPT		SSE	27.246535	F RATIO	53.45
		DFE	24	PROB>F	0.0001
DEP VAR: YIELD		MSE	1.135272	R-SQUARE	0.9304
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-11.670862	3.608822	-3.2340	0.0035
TREND1	1	0.324175	0.066006	4.9113	0.0001
TREND2	1	0.367668	0.038535	9.5409	0.0001
ET6	1	0.086894	0.019120	4.5446	0.0001
ET8	1	0.036364	0.019846	1.8323	0.0793
PDSQ9	1	-.0000603855	.00002969343	-2.0336	0.0532
ET9	1	5.450705	2.075977	2.6256	0.0148

IOWA SOYBEANS NORTHEASTERN CENTRAL APU 243

MODEL: TREND
DEP VAR: YIELD

	SSE	64.630002	F RATIO	97.94
	DFE	24	PROB>F	0.0001
	MSE	2.3[illegible]214	R-SQUARE	0.8[illegible]49

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	5.421748	2.499372	2.1692	0.0387
TREND1	1	0.351425	0.090750	3.8720	0.0006
TREND2	1	0.439887	0.053510	8.1749	0.0001

MODEL: JUNE
DEP VAR: YIELD

	SSE	55.648[illegible]47	F RATIO	74.58
	DFE	27	PROB>F	0.0001
	MSE	2.061[illegible]39	R-SQUARE	0.8923

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-1.648753	4.129[illegible]79	-0.3993	0.6928
TREND1	1	0.358389	0.085[illegible]27	4.1757	0.0003
TREND2	1	0.430524	0.051[illegible]44	8.4343	0.0001
PET6	1	0.055824	0.026[illegible]41	2.[illegible]876	0.0464

MODEL: AUGUST
DEP VAR: YIELD

	SSE	35.808[illegible]85	F RATIO	87.30
	DFE	25	PROB>F	0.0001
	MSE	1.377265	R-SQUARE	0.9307

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-11.618538	4.277[illegible]52	-2.7165	0.0116
TREND1	1	0.326467	0.070563	4.6[illegible]01	0.0001
TREND2	1	0.456312	0.042275	10.7935	0.0001
PET6	1	0.063230	0.021[illegible]47	2.[illegible]811	0.0078
ET8	1	0.085597	0.022[illegible]53	3.79[illegible]4	0.000[illegible]

MODEL: SEPT
DEP VAR: YIELD

	SSE	23.454332	F RATIO	94.13
	DFE	24	PROB>F	0.0001
	MSE	0.977264	R-SQUARE	0.9[illegible]46

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	680.478564	250.078[illegible]45	2.7211	0.011[illegible]
TREND1	1	0.327891	0.060[illegible]55	5.4058	0.0001
TREND2	1	0.473077	0.038199	12.3845	0.0001
PET6	1	0.048580	0.019[illegible]3	2.5284	0.0184
ET8	1	0.088424	0.019[illegible]55	4.5[illegible]53	0.0001
XDD9	1	49.941264	17.952[illegible]2[illegible]	2.7819	0.0104
ETHAT9	1	-9.729454	3.522[illegible]49	-2.7621	0.010[illegible]

IOWA SOYBEANS SOUTHERN CENTRAL APU 251

MODEL: TREND		SSE	108.048518	F RATIO	22.76
		DFE	28	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.858979	R-SQUARE	0.6192
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.580604	3.231643	2.6552	0.0129
TREND1	1	0.288593	0.117351	2.4592	0.0204
TREND2	1	0.237713	0.069575	3.4167	0.0020

MODEL: MAY		SSE	106.045039	F RATIO	15.08
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.927594	R-SQUARE	0.6262
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.395031	3.270526	2.5668	0.0161
TREND1	1	0.296820	0.118950	2.4953	0.0190
TREND2	1	0.229958	0.071027	3.2376	0.0032
PDD5	1	-0.00673008	0.009422912	-0.7142	0.4812

MODEL: JUNE		SSE	92.122438	F RATIO	13.52
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.543171	R-SQUARE	0.6753
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	0.932164	4.880952	0.1910	0.8500
TREND1	1	0.308481	0.113132	2.7267	0.0113
TREND2	1	0.223226	0.067546	3.3048	0.0028
PDD5	1	-0.00824873	0.008982529	-0.9183	0.3669
ET6	1	0.057518	0.029016	1.9823	0.0581

MODEL: AUGUST		SSE	60.693266	F RATIO	18.37
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.427731	R-SQUARE	0.7861
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-13.070348	5.609725	-2.3299	0.0282
TREND1	1	0.322396	0.093726	3.4398	0.0021
TREND2	1	0.204107	0.056164	3.6341	0.0013
PDD5	1	-0.019557	0.008072323	-2.4227	0.0230
ET6	1	0.086143	0.025302	3.4046	0.0023
E8	1	10.118020	2.812091	3.5980	0.0014

IOWA SOYBEANS SOUTHEASTERN APU 252

MODEL: TREND		SSE	89.427939	F RATIO	47.33
		DFE	28	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.193355	R-SQUARE	0.7717
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	11.113158	2.940021	3.7800	0.0008
TREND1	1	0.236766	0.106761	2.2177	0.0349
TREND2	1	0.384410	0.063296	5.0732	0.0001

MODEL: JUNE		SSE	79.821775	F RATIO	35.17
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.956362	R-SQUARE	0.7963
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	4.109556	4.805891	0.8551	0.4000
TREND1	1	0.253519	0.103135	2.4581	0.0207
TREND2	1	0.372398	0.061261	6.0789	0.0001
ET6	1	0.051996	0.028845	1.8026	0.0826

MODEL: AUGUST		SSE	69.651056	F RATIO	30.06
		DFE	26	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.678987	R-SQUARE	0.8222
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-2.734247	5.767523	-0.4741	0.6394
TREND1	1	0.259036	0.098215	2.6374	0.0139
TREND2	1	0.344679	0.060025	5.7422	0.0001
ET6	1	0.068373	0.028715	2.3810	0.0249
E8	1	4.784751	2.455519	1.9485	0.0622

MODEL: SEPT		SSE	26.036296	F RATIO	46.15
		DFE	23	PROB>F	0.0001
DEP VAR: YIELD		MSE	1.132013	R-SQUARE	0.9335
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	810.252357	186.026921	4.3556	0.0002
TREND1	1	0.244408	0.064569	3.7793	0.0010
TREND2	1	0.384775	0.040728	9.4475	0.0001
ET6	1	0.054720	0.019492	2.8074	0.0100
E8	1	4.944258	1.606127	3.0784	0.0053
DSQ9	1	-0.000021304	.000006113558	-3.4836	0.0020
XDQ9	1	57.792325	13.173579	4.3870	0.0002
ETHAT9	1	-10.602992	2.432430	-4.3590	0.0002

IOWA SOYBEANS NORTHEASTERN APU 260

MODEL: TREND

		SSE	104.114579	F RATIO	75.97
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.716949	R-SQUARE	0.9401
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	1.739341	3.172539	0.5484	0.5877
TREND1	1	0.427905	0.115197	3.7145	0.0009
TREND2	1	0.478471	0.066295	7.2136	0.0001

MODEL: JUNE

		SSE	83.895470	F RATIO	45.92
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	3.356779	R-SQUARE	0.8760
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	23.173452	11.593717	1.9988	0.0562
TREND1	1	0.393458	0.108497	3.6264	0.0012
TREND2	1	0.433351	0.061573	7.0381	0.0001
E6	1	-25.754215	10.839725	-2.3759	0.0252
ET6	1	0.046037	0.034335	1.3408	0.1916

MODEL: AUGUST

		SSE	62.592570	F RATIO	49.04
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	2.503703	R-SQUARE	0.9075
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	20.719245	10.247355	2.0220	0.0540
TREND1	1	0.374452	0.095784	3.9135	0.0006
TREND2	1	0.495352	0.056253	8.8064	0.0001
E6	1	-33.163543	9.880414	-3.3565	0.0025
ET6	1	0.057293	0.030490	1.8791	0.0715
ET8	1	0.079264	0.027173	2.9169	0.0074

MODEL: SEPT

		SSE	33.966452	F RATIO	52.02
		DFE	22	PROB>F	0.0001
DEP VAR: YIELD		MSE	1.544 43	R-SQUARE	0.9492
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	922.338452	332.381421	2.7747	0.0110
TREND1	1	0.325813	0.077 85	4.2565	0.0003
TREND2	1	0.532227	0.047224	11.2630	0.0001
E6	1	-29.619828	7.994478	-3.7057	0.0013
ET6	1	0.041524	0.024524	1.6932	0.1045
ET8	1	0.058481	0.023753	2.4619	0.0222
X009	1	-35.333537	23.924 89	-2.7339	0.0122
E8	1	5.644159	2.314224	2.4515	0.0221
ETHAT9	1	-12.721655	4.689193	-2.7130	0.0127

IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE

MODEL: TREND — SSE 1032.304 — F RATIO 136.28
DEP VAR: YIELD — DFE 242 — PROB>F 0.0001
MSE 4.265718 — R-SQUARE 0.7379

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	7.604698	1.205567	6.3080	0.0001
TREND1	1	0.331520	0.043522	7.5998	0.0001
TREND2	1	0.369184	0.025963	14.2748	0.0001
D1	1	-1.247751	0.406355	-3.0706	0.0024
D4	1	-1.159973	0.406355	-2.8546	0.0047
D5	1	-2.348986	0.406355	-5.7806	0.0001

MODEL: MAY — SSE 970.702365 — F RATIO 122.82
DEP VAR: YIELD — DFE 241 — PROB>F 0.0001
MSE 4.027811 — R-SQUARE 0.7536

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	7.274524	1.174505	6.1937	0.0001
TREND1	1	0.355269	0.042921	8.2966	0.0001
TREND2	1	0.363373	0.025175	14.4339	0.0001
D1	1	-1.395621	0.396567	-3.5184	0.0005
D4	1	-1.176990	0.394885	-2.9806	0.0032
D5	1	-2.356031	0.394865	-5.9667	0.0001
DSQ5	1	-.0000238353	0.0000060948	-3.9108	0.0001

MODEL: JUNE — SSE 905.250269 — F RATIO 114.90
DEP VAR: YIELD — DFE 240 — PROB>F 0.0001
MSE 3.771876 — R-SQUARE 0.7702

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	1.479321	1.796444	0.8235	0.4111
TREND1	1	0.354652	0.041438	8.5585	0.0001
TREND2	1	0.360990	0.024369	14.8136	0.0001
D1	1	-1.319412	0.384294	-3.4333	0.0007
D4	1	-1.058348	0.383193	-2.7619	0.0062
D5	1	-2.205112	0.383929	-5.7451	0.0001
DSQ5	1	-.0000207142	.0000059538	-3.4841	0.0006
ET6	1	0.046284	0.011111	4.1657	0.0001

IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE

MODEL: JULY
DEP VAR: YIELD

SSE	717.074726	F RATIO	134.23
DFE	239	PROB>F	0.0001
MSE	3.000313	R-SQUARE	0.8180

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-2.505497	1.679356	-1.4919	0.1370
TREND1	1	0.342998	0.036987	9.2734	0.0001
TREND2	1	0.365890	0.021743	16.8282	0.0001
D1	1	-1.043534	0.344508	-3.0291	0.0027
D4	1	-1.179072	0.342101	-3.4466	0.0007
D5	1	-2.339976	0.342750	-6.8271	0.0001
DSQ5	1	-.0000243233	.00000532209	-4.5702	0.0001
ET6	1	0.065346	0.010198	6.4079	0.0001
PD7	1	0.019444	0.002455247	7.9195	0.0001

MODEL: AUGUST
DEP VAR: YIELD

SSE	583.152945	F RATIO	152.18
DFE	238	PROB>F	0.0001
MSE	2.450222	R-SQUARE	0.8520

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-7.909702	1.684489	-4.6956	0.0001
TREND1	1	0.333466	0.033450	9.9691	0.0001
TREND2	1	0.372518	0.019569	18.9392	0.0001
D1	1	-0.784686	0.313291	-2.5047	0.0129
D4	1	-1.100649	0.309335	-3.5581	0.0005
D5	1	-2.218937	0.310172	-7.1539	0.0001
DSQ5	1	-.0000257423	.00000481335	-5.3481	0.0001
ET6	1	0.063956	0.009217377	6.9387	0.0001
PD7	1	0.015919	0.002269452	7.0144	0.0001
ET8	1	0.053462	0.007231397	7.3930	0.0001

MODEL: SEPT
DEP VAR: YIELD

SSE	564.548417	F RATIO	141.66
DFE	237	PROB>F	0.0001
MSE	2.382061	R-SQUARE	0.8567

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-7.805361	1.661313	-4.6983	0.0001
TREND1	1	0.326006	0.033089	9.8524	0.0001
TREND2	1	0.368393	0.019450	18.9408	0.0001
D1	1	-0.708538	0.310102	-2.2849	0.0232
D4	1	-1.071661	0.305178	-3.5116	0.0005
D5	1	-2.187475	0.306035	-7.1478	0.0001
DSQ5	1	-0.000024533	.000004765361	-5.1479	0.0001
ET6	1	0.059074	0.009254834	6.3827	0.0001
PD7	1	0.013927	0.002348464	2.9301	0.0001
ET8	1	0.045031	0.007742013	5.8165	0.0001
ET9	1	0.025623	0.009168437	2.7947	0.0056

VARIABLE LABELS

TREND - 1 IF YEAR <=1949 OR YEAR-1949 IF YEAR>1949
MR4 - PRECIPITATION/PET FOR APRIL
PD5 - PRECIPITATION FOR MAY
XDD5 - TEMPERATURE DEVIATION FOR MAY
ETHAT6 - CLIMATICALLY APPROPRIATE POTENTIAL EVAPOTRANSPIRATION FOR JUNE
XDD6 - TEMPERATURE DEVIATION FOR JUNE
DSQ6 - SQUARED PRECIPITATION DEVIATION FOR JUNE
ET6 - EVAPOTRANSPIRATION FOR JUNE
MR7 - PRECIPITATION/PET FOR JULY
E7 - ET/ETHAT FOR JULY
DEF7 - TEMPERATURE DEVIATION-PET FOR JULY
ETP7 - ET/PET FOR JULY
PD8 - PRECIPITATION FOR AUGUST
E8 - ET/ETHAT FOR AUGUST
XDD8 - TEMPERATURE DEVIATION FOR AUGUST
PD8 - PRECIPITATION FOR AUGUST
D1 - DUMMY VARIABLE. 1 IF APU=141 OR APU=142 OR APJ=251

IOWA CORN NORTHWESTERN APD 141

MODEL: TREND

		SSE	2054.393	F RATIO	45.30
		DFE	23	PROB>F	0.0001
DEP VAR: YIELD		MSE	73.728307	R-SQUARE	0.6242
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-28.137471	5.161331	-5.4524	0.0001
TREND	1	1.121349	0.173327	6.4712	0.0001

MODEL: JULY

		SSE	645.7591[illegible]	F RATIO	50.75
		DFE	23	PROB>F	0.0001
DEP VAR: YIELD		MSE	28.076347	R-SQUARE	0.8752
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-35.017233	13.433181	-2.6314	0.0177
TREND	1	1.402412	0.109303	12.8302	0.0001
E7	1	62.197196	12.763409	4.8727	0.0001
DEF7	1	0.050301	0.025700	1.9570	0.0502

IOWA CORN SOUTHWESTERN AGD 142

MODEL: TREND			SSE	2552.722	F RATIO	40.24
			DFE	28	PROB>F	0.0001
DEP VAR: YIELD			MSE	94.740 61	R-SQUARE	0.5900
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	26.734100	3.582702	7.4773	0.0001
TREND	1	1.247112	0.196473	6.3473	0.0001

MODEL: JUNE			SSE	2443.753	F RATIO	22.64
			DFE	27	PROB>F	0.0001
DEP VAR: YIELD			MSE	90.509301	R-SQUARE	0.6223
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	1.175176	17.217370	0.0683	0.9461
TREND	1	1.241170	0.192082	6.4617	0.0001
ET6	1	0.201755	0.132783	1.5194	0.1403

MODEL: JULY			SSE	797.035145	F RATIO	51.68
			DFE	25	PROB>F	0.0001
DEP VAR: YIELD			MSE	30.655198	R-SQUARE	0.8758
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-98.362753	16.877511	-5.8291	0.0001
TREND	1	1.295423	0.112035	11.5662	0.0001
ET6	1	0.307758	0.078518	3.9192	0.0006
ETD7	1	92.149720	12.572355	7.3292	0.0001

MODEL: AUGUST			SSE	539.846+40	F RATIO	50.95
			DFE	25	PROB>F	0.0001
DEP VAR: YIELD			MSE	25.5[illegible]58	R-SQUARE	0.9011
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-95.205382	15.473770	-6.1527	0.0001
TREND	1	1.184729	0.111734	10.5012	0.0001
ET6	1	0.355838	0.074015	4.8078	0.0001
ETD7	1	89.181227	11.551+45	7.7210	0.0001
POB	1	-0.04[illegible]	0.018[illegible]	-2.4742	0.0203

IOWA CORN NORTHWEST CENTRAL ADD 241

MODEL: TREND — SSE 1312.391 — F RATIO 129.30
DF 69 — PROB>F 0.0001
DEP VAR: YIELD — MSE 46.871107 — R-SQUARE 0.5149

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	25.338472	2.514775	10.0711	0.0001
TREND	1	1.234523	0.135193	11.1035	0.0001

MODEL: MAY — SSE 1214.946 — F RATIO 99.04
DF 67 — PROB>F 0.0001
DEP VAR: YIELD — MSE 45.143754 — R-SQUARE 0.5251

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	26.395202	2.478459	10.6477	0.0001
TREND	1	1.545797	0.135399	11.3620	0.0001
XDD5	1	-1.026331	0.713360	-1.4387	0.1517

MODEL: JULY — SSE 655.0045809 — F RATIO 49.02
DF 65 — PROB>F 0.0001
DEP VAR: YIELD — MSE 25.230447 — R-SQUARE 0.9075

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	30.311486	2.033697	14.9240	0.0001
TREND	1	1.391783	0.102340	13.5995	0.0001
XDD5	1	-1.267412	0.535740	-2.3657	0.0237
DEF7	1	0.091478	0.019367	4.7235	0.0001

MODEL: AUGUST — SSE 445.4482602 — F RATIO 55.32
DF 64 — PROB>F 0.0001
DEP VAR: YIELD — MSE 20.227003 — R-SQUARE 0.9315

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	11.189912	7.153424	1.5639	0.1311
TREND	1	1.358775	0.092347	15.7512	0.0001
XDD5	1	-1.391542	0.484200	-2.8742	0.0056
DEF7	1	0.083465	0.017981	4.6426	0.0002
ER	1	19.121737	6.885487	2.7769	0.0103
XDD8	1	1.411204	0.754800	1.8698	0.0674

MODEL: TREND		SSE	1091.152	F RATIO	147.92
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	37.522544	R-SQUARE	0.8361
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	24.525976	4.257716	13.1220	0.0001
TREND	1	1.449015	0.119159	12.1623	0.0001
MODEL: APRIL		SSE	1078.481	F RATIO	72.37
		DFE	24	PROB>F	0.0001
DEP VAR: YIELD		MSE	38.534263	R-SQUARE	0.8379
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	30.954215	3.292527	9.4019	0.0001
TREND	1	1.489267	0.129929	11.4594	0.0001
MR4	1	-0.360168	0.999394	-0.3604	0.3797
MODEL: JUNE		SSE	1074.905	F RATIO	48.73
		DFE	27	PROB>F	0.0001
DEP VAR: YIELD		MSE	39.811317	R-SQUARE	0.8385
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	30.784114	3.383559	9.0944	0.0001
TREND	1	1.489078	0.127591	11.6615	0.0001
MR4	1	-0.475515	1.047735	-0.4537	0.6515
XDD6	1	0.263057	0.824193	0.3192	0.7521
MODEL: JULY		SSE	307.841793	F RATIO	134.05
		DFE	25	PROB>F	0.0001
DEP VAR: YIELD		MSE	11.840069	R-SQUARE	0.9554
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-58.903440	12.523215	-5.0025	0.0001
TREND	1	1.823505	0.071733	22.5943	0.0001
MR4	1	-1.335419	0.581229	-2.2974	0.0297
XDD6	1	0.955044	0.457307	2.0882	0.0474
ETP7	1	103.957172	12.915237	8.0494	0.0001

IOWA CORN NORTHEAST CENTRAL AND EAST

MODEL: TREND — SSE 722.991430 — F RATIO 191.34
DEP VAR: YIELD — DFE 24 — PROB>F 0.0001
MSE 24.430755 — R-SQUARE 0.8885

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	37.099105	1.337755	15.3751	0.0001
TREND	1	1.387749	0.100253	13.8415	0.0001

MODEL: JUNE — SSE 530.021434 — F RATIO 107.05
DEP VAR: YIELD — DFE 23 — PROB>F 0.0001
MSE 22.713536 — R-SQUARE 0.8543

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	8.892917	10.975591	0.8102	0.4247
TREND	1	1.384549	0.095719	14.4645	0.0001
ET6	1	0.173530	0.088735	1.9557	0.0504

MODEL: JULY — SSE 409.306255 — F RATIO 111.92
DEP VAR: YIELD — DFE 27 — PROB>F 0.0001
MSE 15.159492 — R-SQUARE 0.9256

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-59.448145	22.151327	-3.1347	0.0041
TREND	1	1.429102	0.079340	18.0104	0.0001
ET6	1	0.137189	0.072575	2.5752	0.0157
ETP7	1	74.305721	20.248542	3.6572	0.0005

MODEL: AUGUST — SSE 350.669727 — F RATIO 95.44
DEP VAR: YIELD — DFE 25 — PROB>F 0.0001
MSE 13.442297 — R-SQUARE 0.9302

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-73.557052	20.997769	-3.5032	0.0017
TREND	1	1.391552	0.077947	17.7655	0.0001
ET6	1	0.200141	0.069748	2.8701	0.0077
ETP7	1	73.554135	19.100150	3.8511	0.0008
P08	1	0.025955	0.013357	1.9431	0.0479

IOWA CORN SOUTHERN CENTRAL AND 251

MODEL: TREND SSE 2154.033 F RATIO 42.71
DF 25 PROB>F 0.0001
DEP VAR: YIELD MSE 77.429733 R-SQUARE 0.5040

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	25.[illegible]	3.[illegible]	[illegible]	0.0001
TREND	1	1.15[illegible]	0.17[illegible]	6.[illegible]	0.0001

MODEL: JUNE SSE 1697.915 F RATIO 25.45
DF 27 PROB>F 0.0001
DEP VAR: YIELD MSE 70.245147 R-SQUARE 0.[illegible]

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-5.235503	15.244744	-1.3283	0.7497
TREND	1	1.156319	0.154633	5.3313	0.0001
ET6	1	0.251550	0.125323	1.4503	0.0504

MODEL: JULY SSE 545.2047[illegible] F RATIO 51.15
DF 25 PROB>F 0.0001
DEP VAR: YIELD MSE 23.[illegible] R-SQUARE 0.8911

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-72.521161	17.[illegible]	-4.2133	0.0003
TREND	1	1.151243	0.[illegible]	11.[illegible]	0.0001
ET6	1	0.[illegible]	0.[illegible]	3.1350	0.0001
DEF7	1	0.056700	0.[illegible]	3.[illegible]	0.0012
E7	1	51.[illegible]	13.[illegible]	3.[illegible]	0.0011

MODEL: TREND

DEP VAR: YIELD

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	[illegible]	[illegible]	[illegible]	[illegible]
TREND	1	[illegible]	[illegible]	[illegible]	[illegible]

MODEL: JUNE

DEP VAR: YIELD

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	[illegible]	[illegible]	[illegible]	[illegible]
TREND	1	[illegible]	[illegible]	[illegible]	[illegible]
DS06	1	[illegible]	[illegible]	[illegible]	[illegible]
ETHAT6	1	[illegible]	[illegible]	[illegible]	[illegible]

MODEL: JULY

DEP VAR: YIELD

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-57.151214	17.2[illegible]	-3.[illegible]	[illegible]
TREND	1	1.[illegible]	[illegible]	[illegible]	[illegible]
DS06	1	-.[illegible]	.[illegible]	-[illegible]	[illegible]
ETHAT6	1	[illegible]	[illegible]	[illegible]	[illegible]
E7	1	61.074154	11.[illegible]	[illegible]	[illegible]

MODEL: TREND
DEP VAR: YIELD

		SSE	571.535455	F RATIO	232.03
		DF	29	PROB>F	0.0001
		MSE	20.397337	R-SQUARE	0.8889
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	30.135334	1.332401	15.1284	0.0001
TREND	1	1.351843	0.040591	15.2345	0.0001

MODEL: MAY
DEP VAR: YIELD

		SSE	559.196715	F RATIO	119.33
		DF	28	PROB>F	0.0001
		MSE	19.971311	R-SQUARE	0.8950
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	33.091743	2.845751	11.6284	0.0001
TREND	1	1.359245	0.040268	15.1581	0.0001
PD5	1	-0.027472	0.021393	-1.2725	0.2137

MODEL: JUNE
DEP VAR: YIELD

		SSE	484.572750	F RATIO	54.89
		DF	27	PROB>F	0.0001
		MSE	17.950843	R-SQUARE	0.9096
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	13.82[illegible]633	[illegible].835359	[illegible].4852	0.1714
TREND	1	1.3[illegible]1057	0.[illegible]5577[illegible]	15.1012	0.0001
PD5	1	-0.033477	0.020853	-1.6[illegible]5	0.1172
ET6	1	0.161782	0.07[illegible]401	2.1375	0.0315

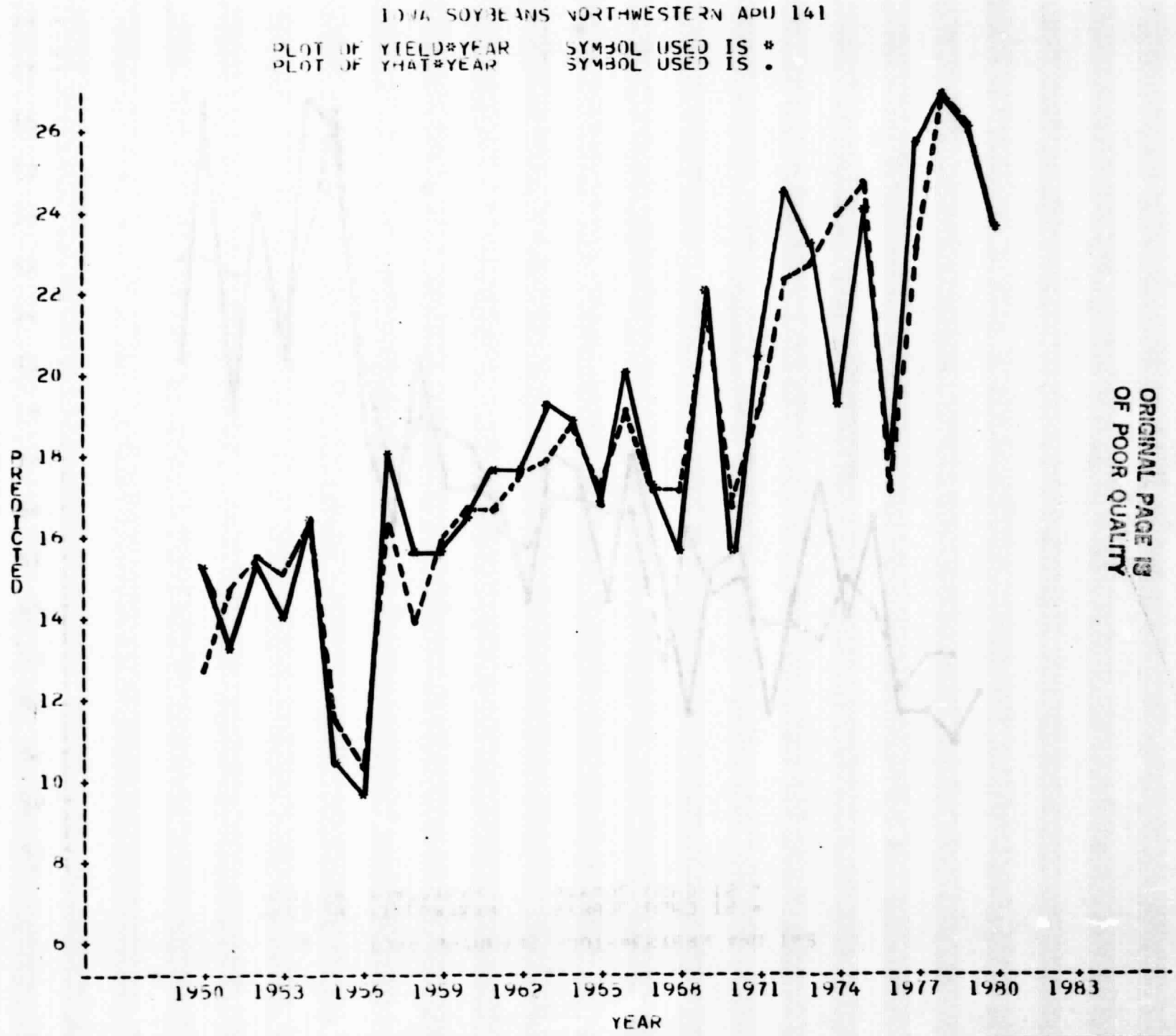
MODEL: JULY
DEP VAR: YIELD

		SSE	274.695394	F RATIO	119.32
		DF	28	PROB>F	0.0001
		MSE	10.953207	R-SQUARE	0.9404
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-[illegible].74[illegible]455	10.[illegible]33229	-3.[illegible]51	0.0051
TREND	1	1.[illegible]24232	0.056531[illegible]	21.[illegible]131	0.0001
PD5	1	-0.[illegible]4[illegible]4[illegible]	0.[illegible]15291	-3.0849	0.0050
ET6	1	[illegible].19[illegible]4[illegible]	0.[illegible]51[illegible]10	[illegible].1493	0.0035
E7	1	57.[illegible]4753[illegible]	12.[illegible]75705	[illegible].[illegible]5[illegible]1	0.0001

[illegible] STATE MODEL FOR ALL AREAS IN STATE

MODEL: TREND		SSE	14[illegible].97	F RATIO	313.65
DEP VAR: YIELD		DFE	240	PROB>F	0.0001
		MSE	58.370715	R-SQUARE	0.7240
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	24.931394	1.011543	25.3012	0.0001
TREND	1	1.352124	0.054413	24.8479	0.0001
D1	1	-5.407938	1.489582	-3.6310	0.0003
MODEL: JUNE		SSE	13094.17	F RATIO	229.79
DEP VAR: YIELD		DFE	234	PROB>F	0.0001
		MSE	54.787399	R-SQUARE	0.7425
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	7.869372	5.246173	1.4998	0.1350
TREND	1	1.347987	0.052769	25.5543	0.0001
D1	1	-5.339309	1.443757	-3.6975	0.0003
ETS	1	0.170236	0.041561	4.0952	0.0001
MODEL: JULY		SSE	7079.043	F RATIO	293.14
DEP VAR: YIELD		DFE	237	PROB>F	0.0001
		MSE	29.871910	R-SQUARE	0.8308
VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T RATIO	PROB>|T|
INTERCEPT	1	-34.[illegible]	8.542[illegible]	-4.3260	0.0001
TREND	1	1.414370	0.039253	36.0384	0.0001
D1	1	-2.[illegible]	1.079396	-2.7378	0.0067
ETS	1	0.201307	0.032415	5.2190	0.0001
[illegible]	1	5.134723	1.279572	4.0125	0.0001
[illegible]	1	22.703300	5.525245	[illegible]	0.0001

Appendix B



IOWA SOYBEANS SOUTHWESTERN APU 142

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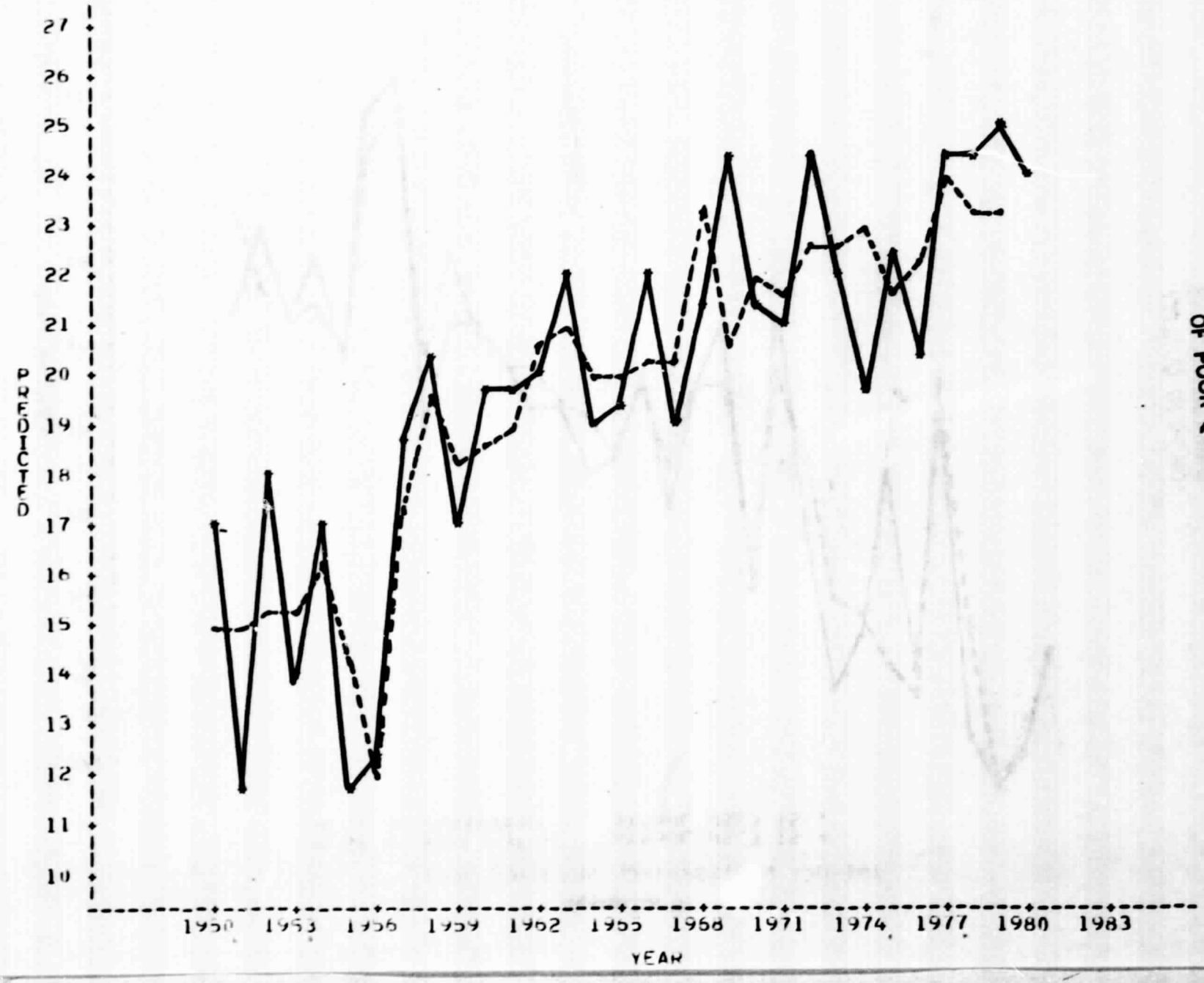

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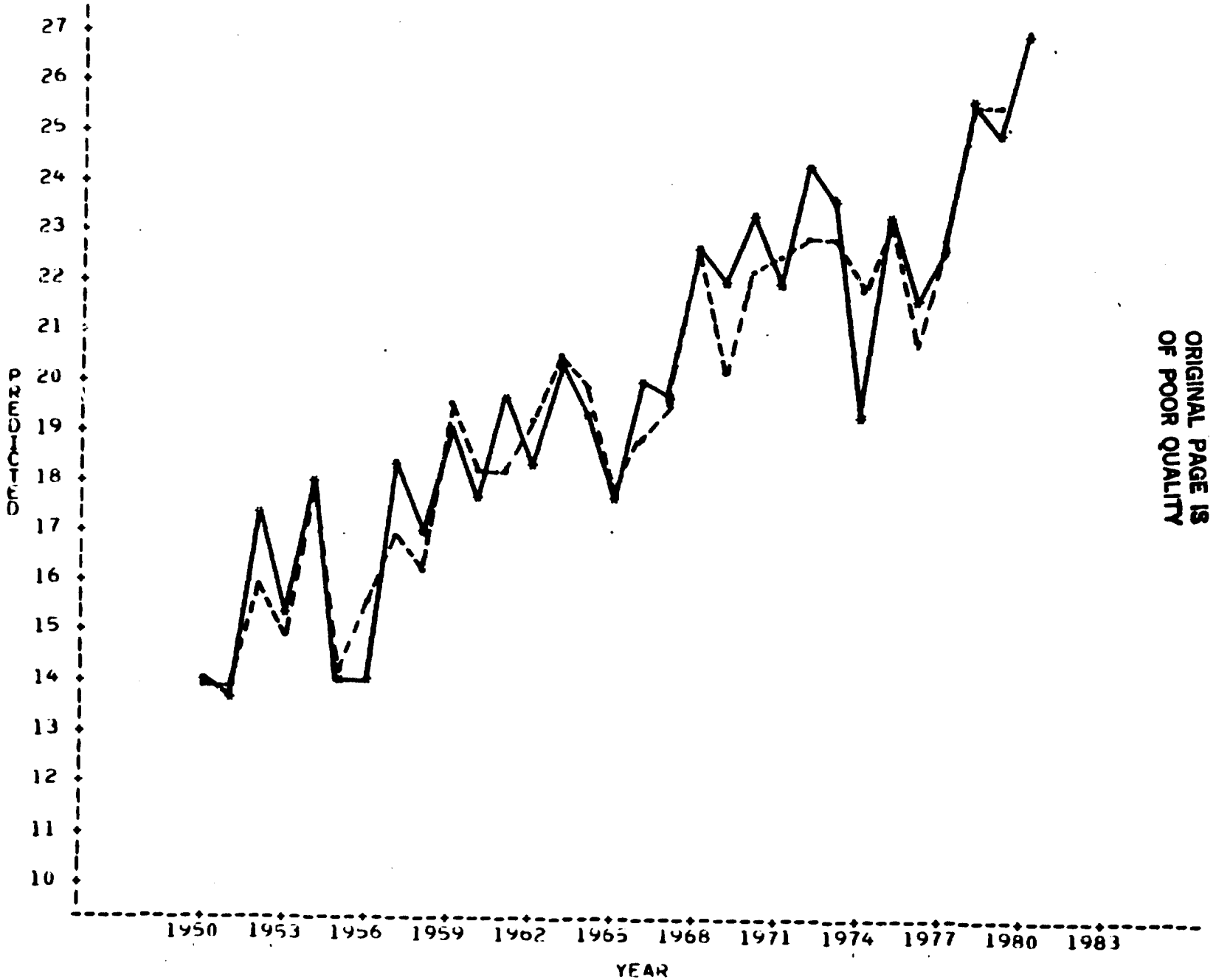

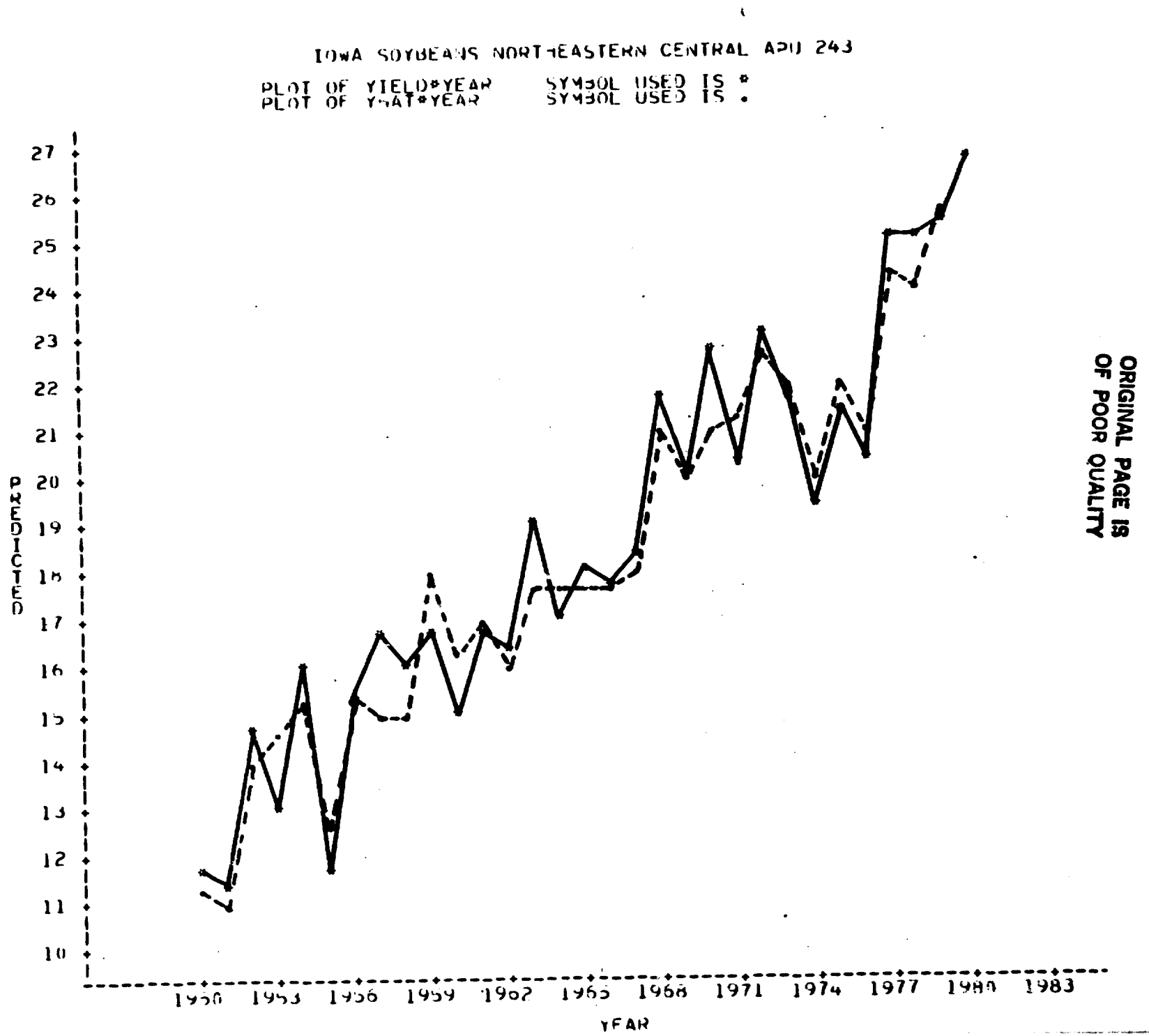

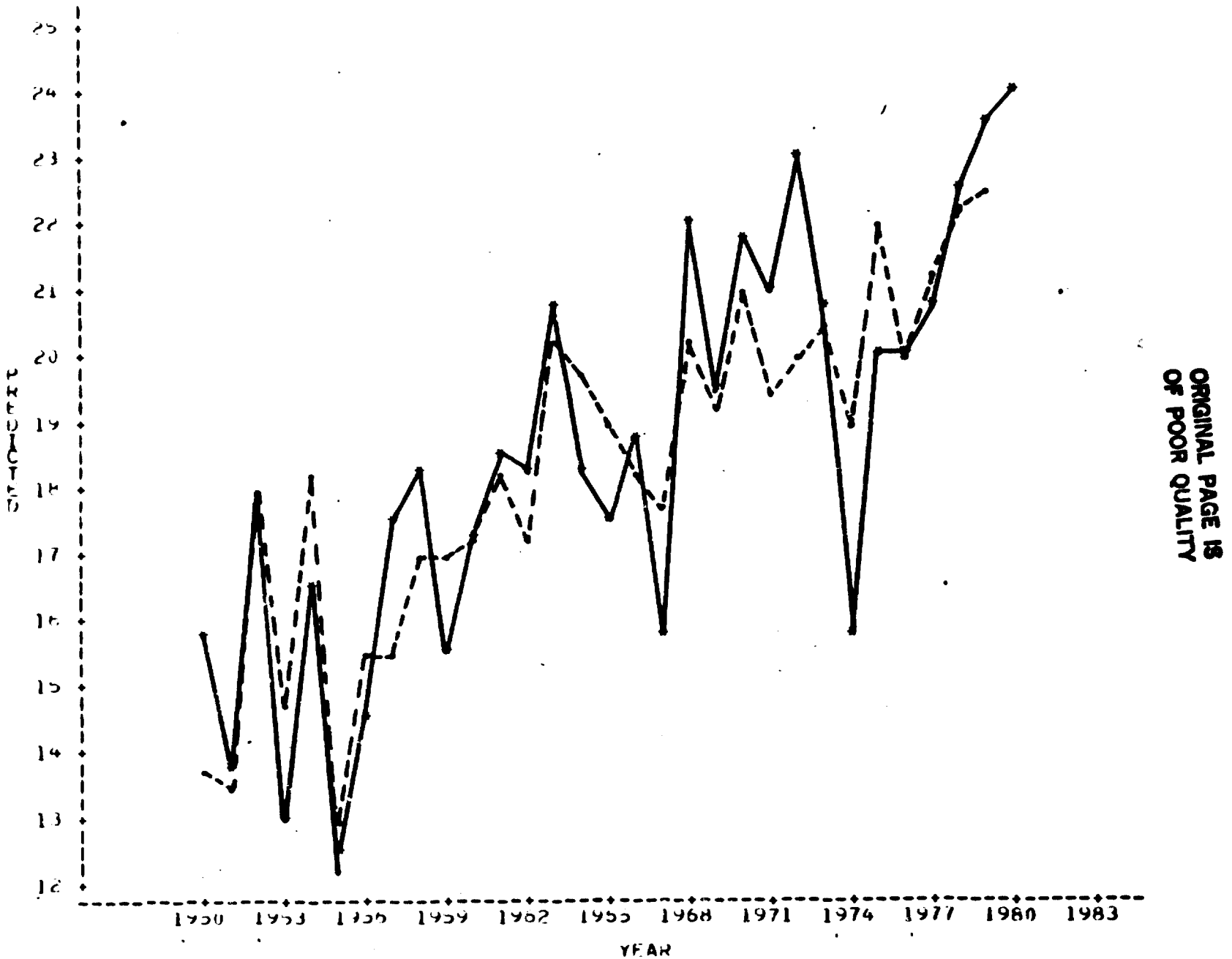

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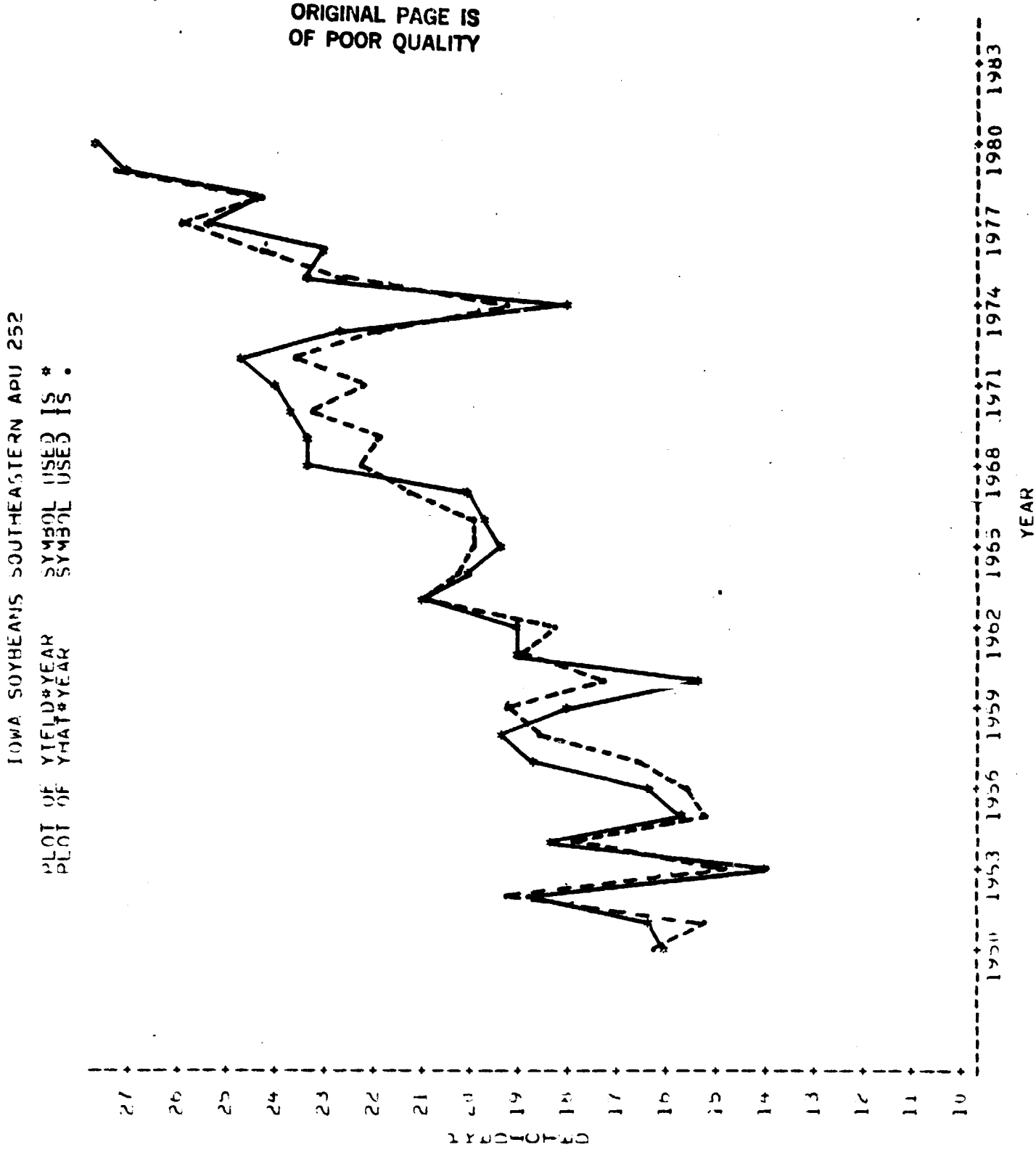

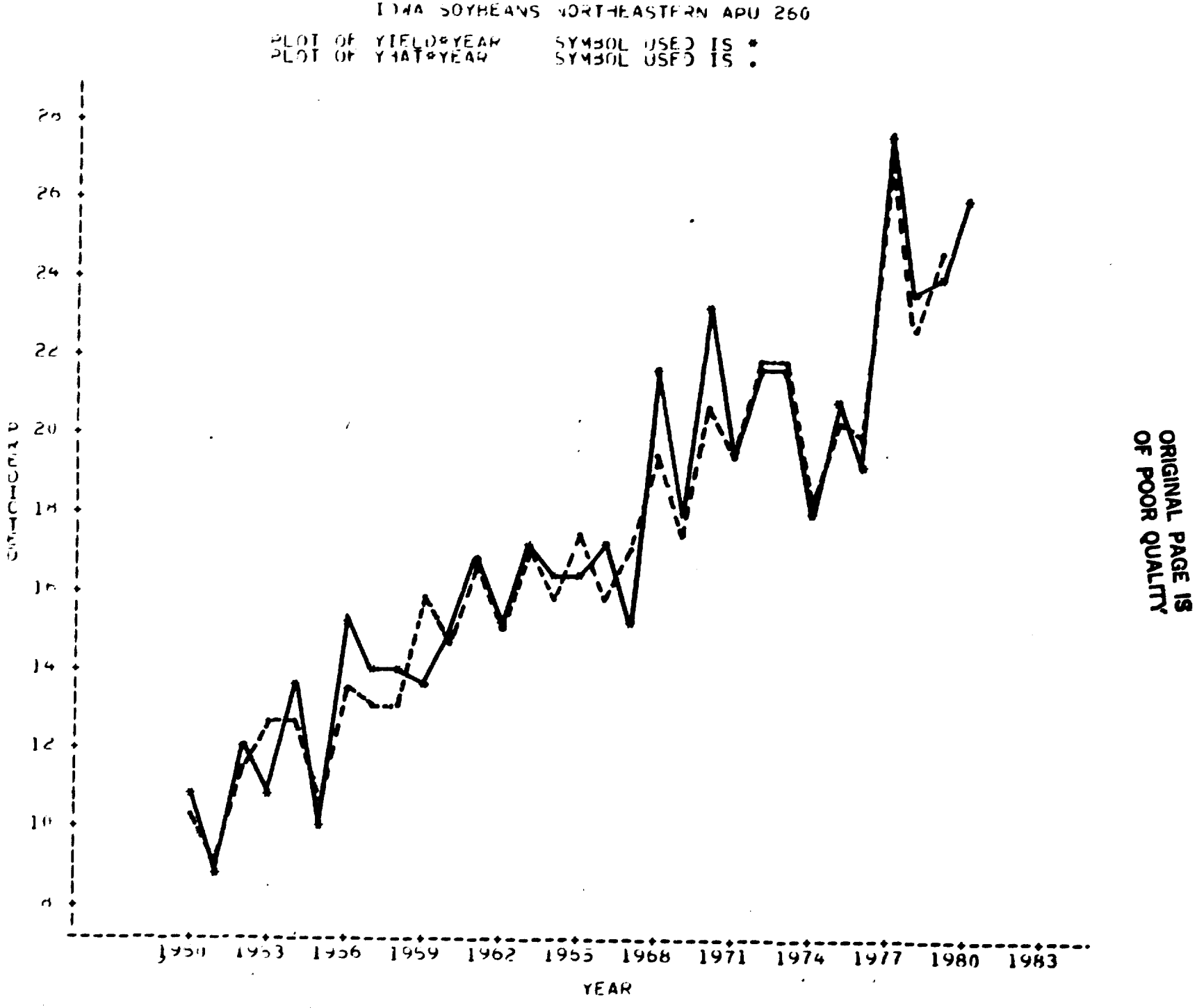

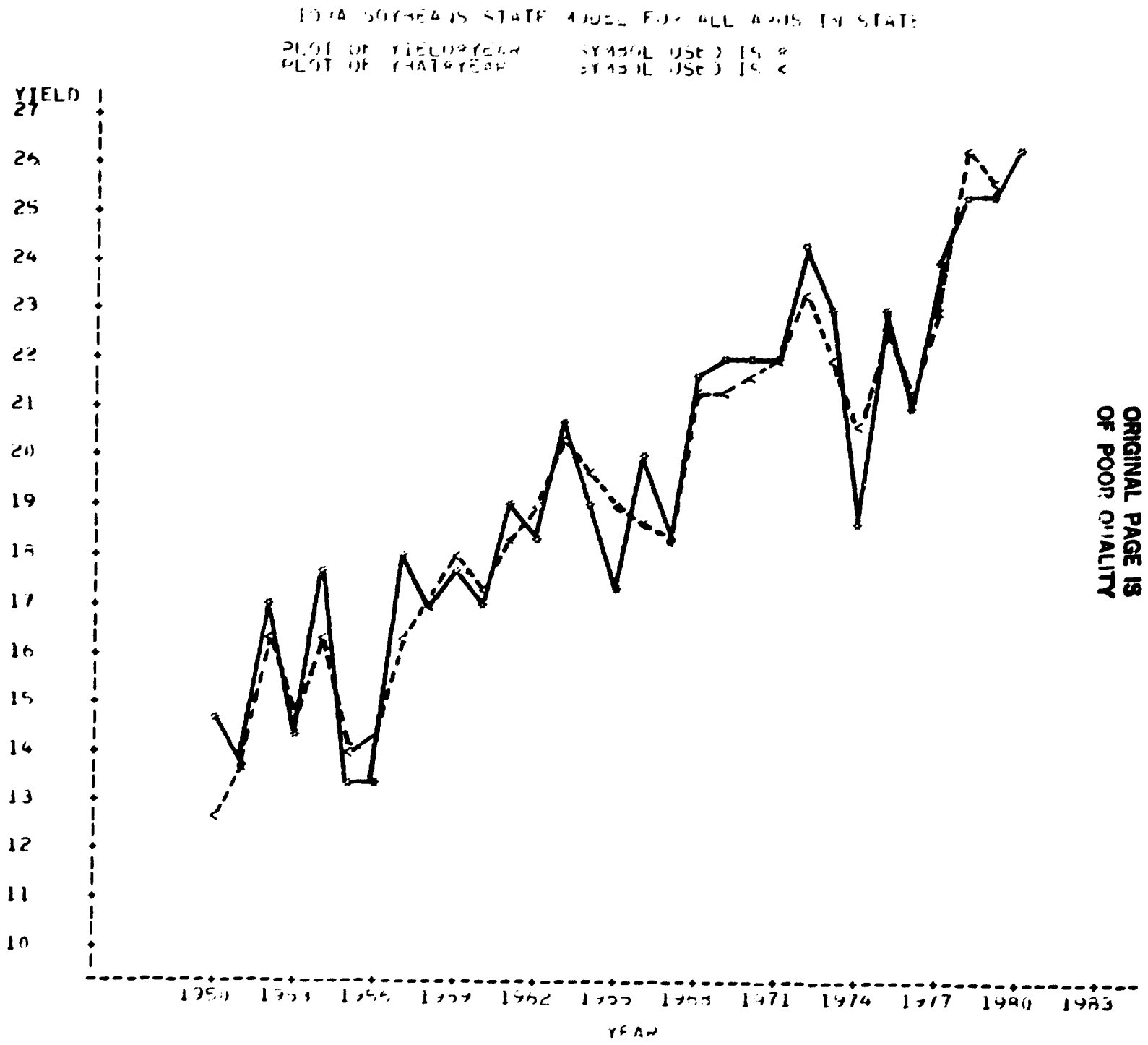

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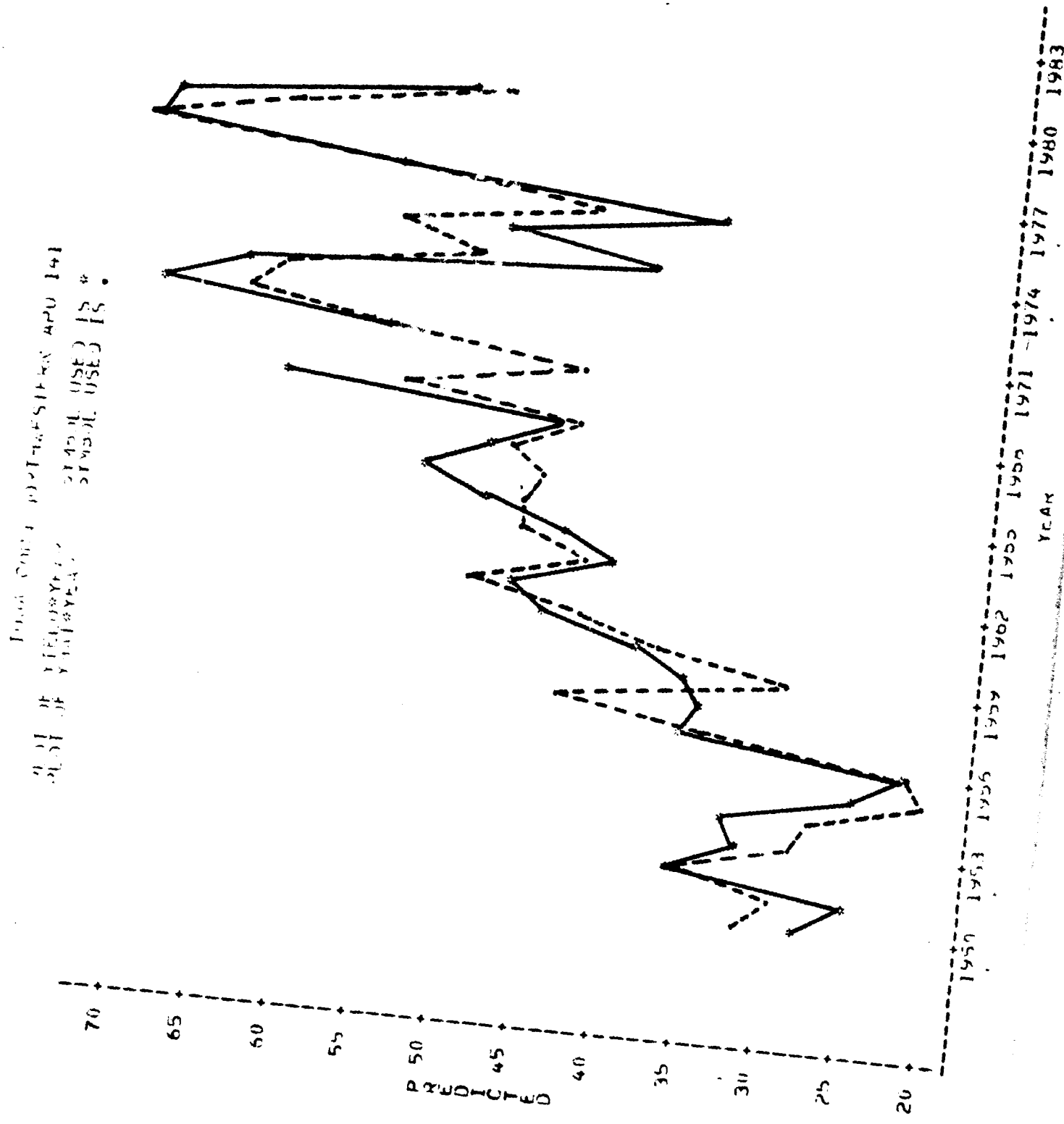

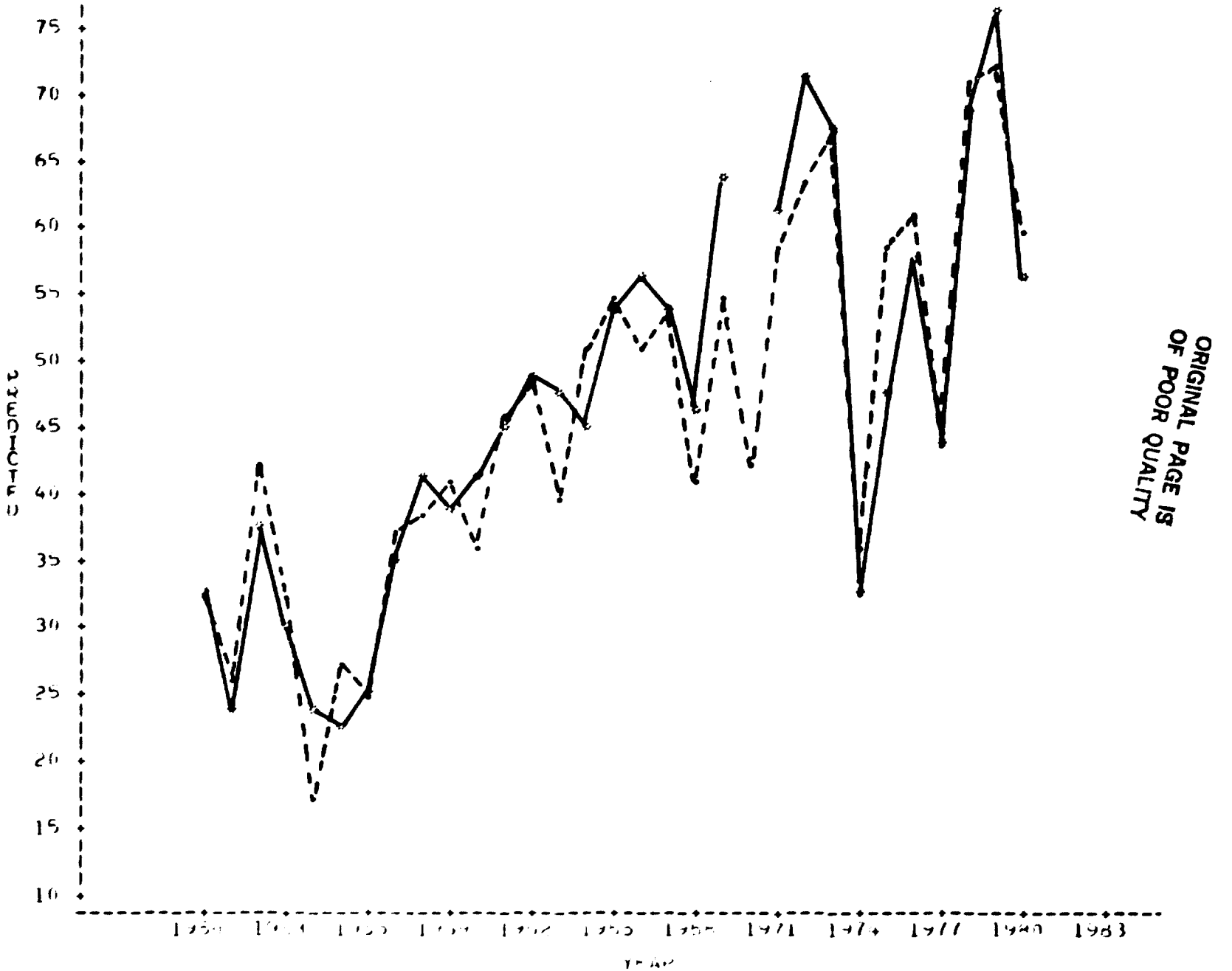

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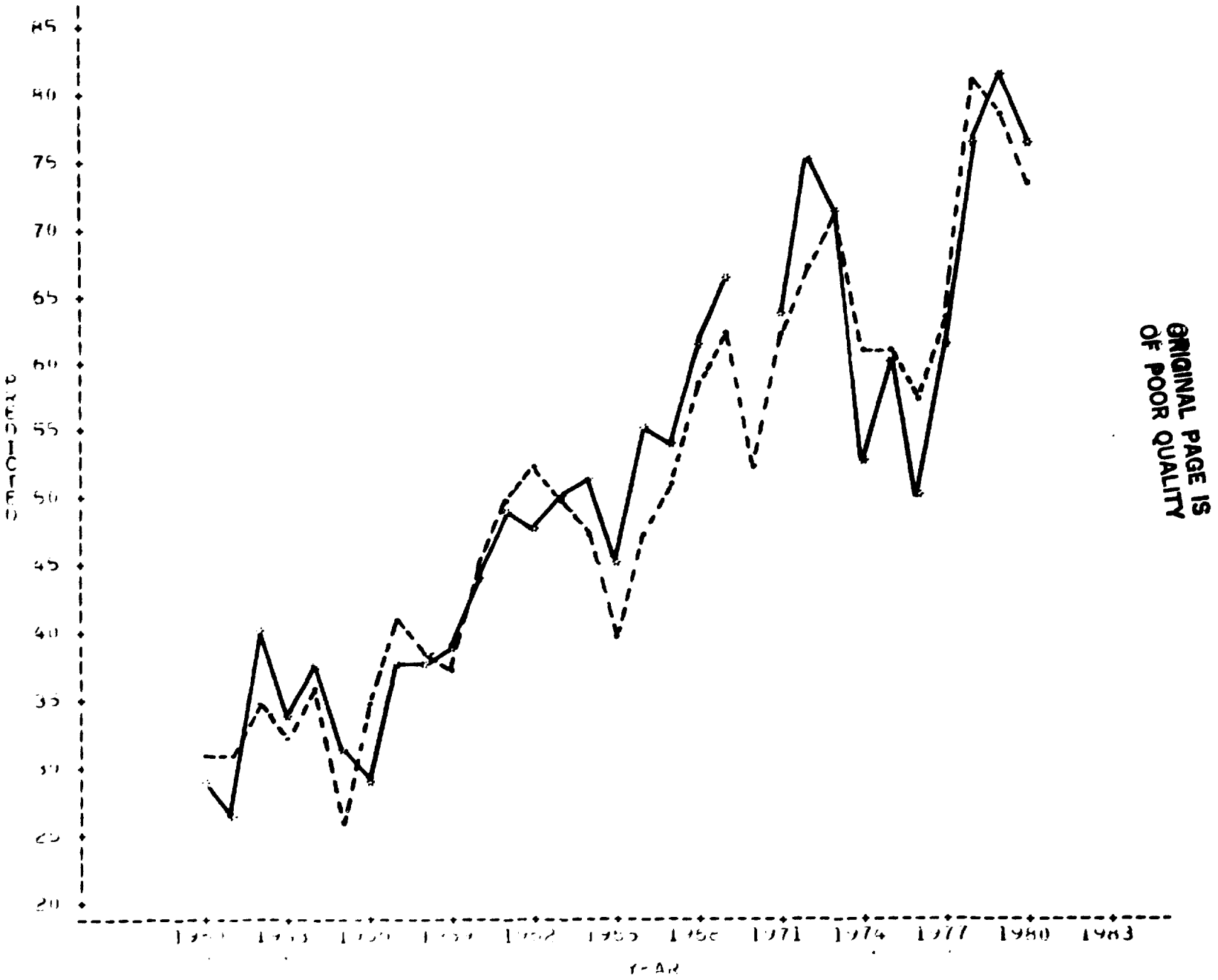

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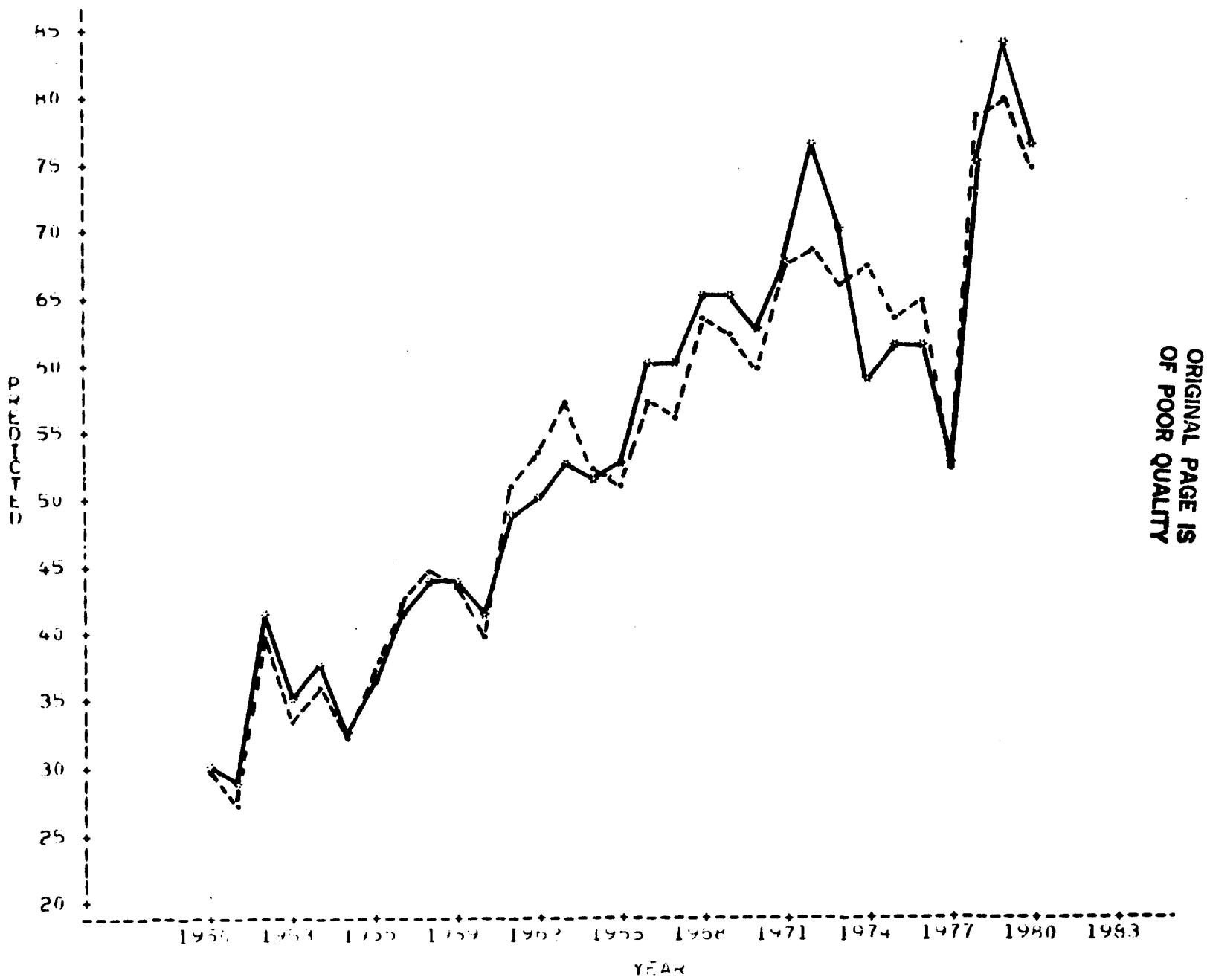

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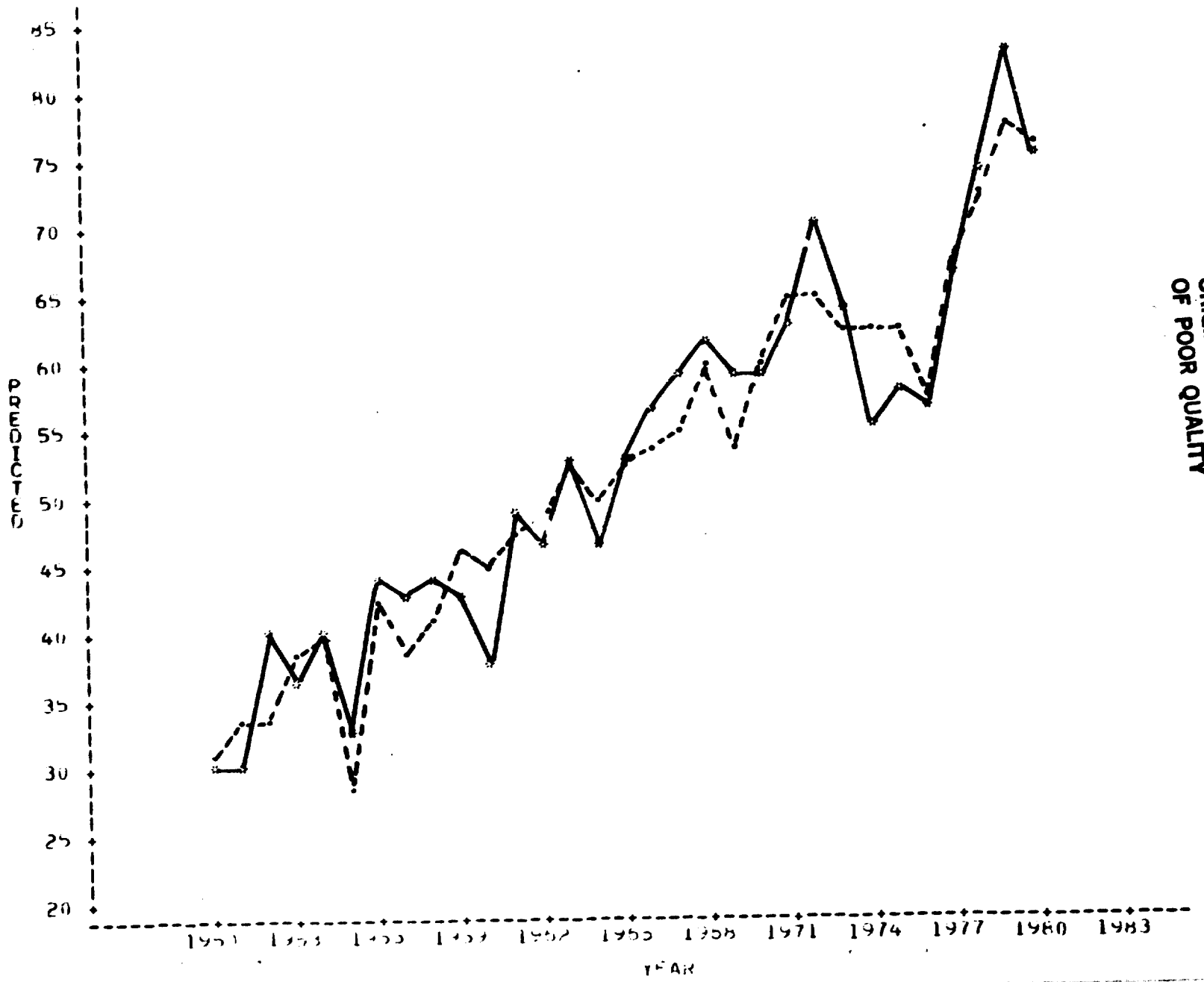

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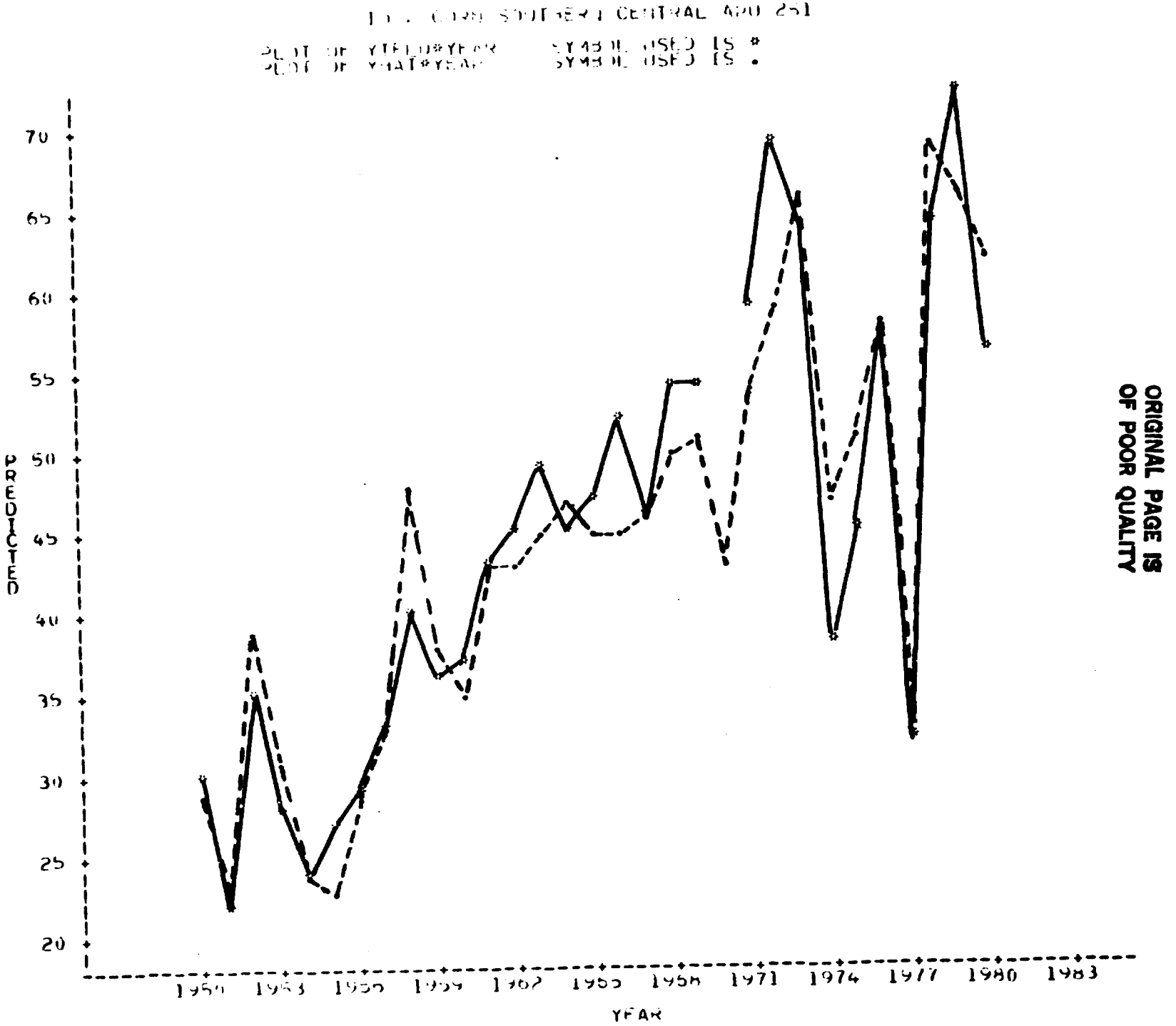

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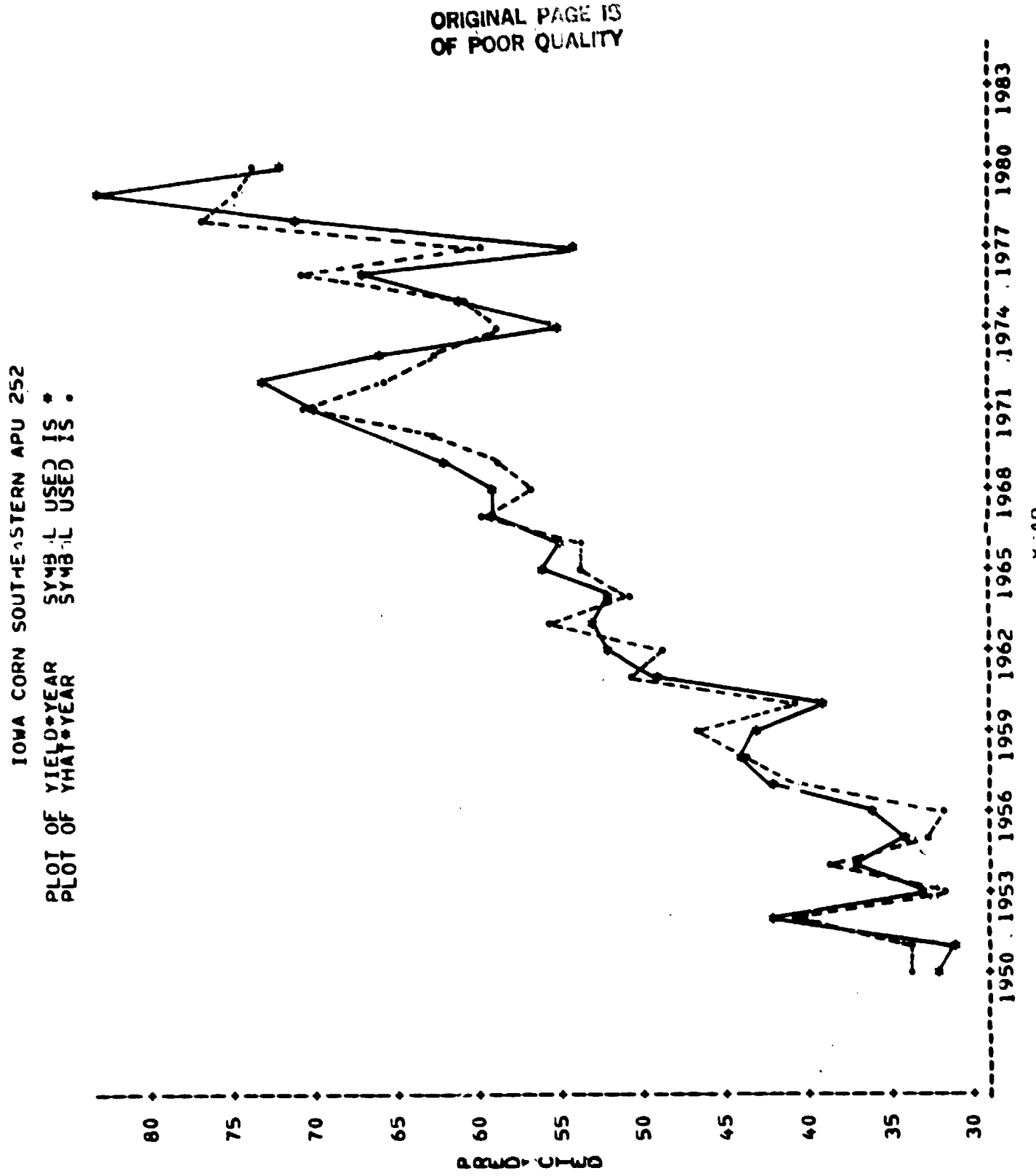

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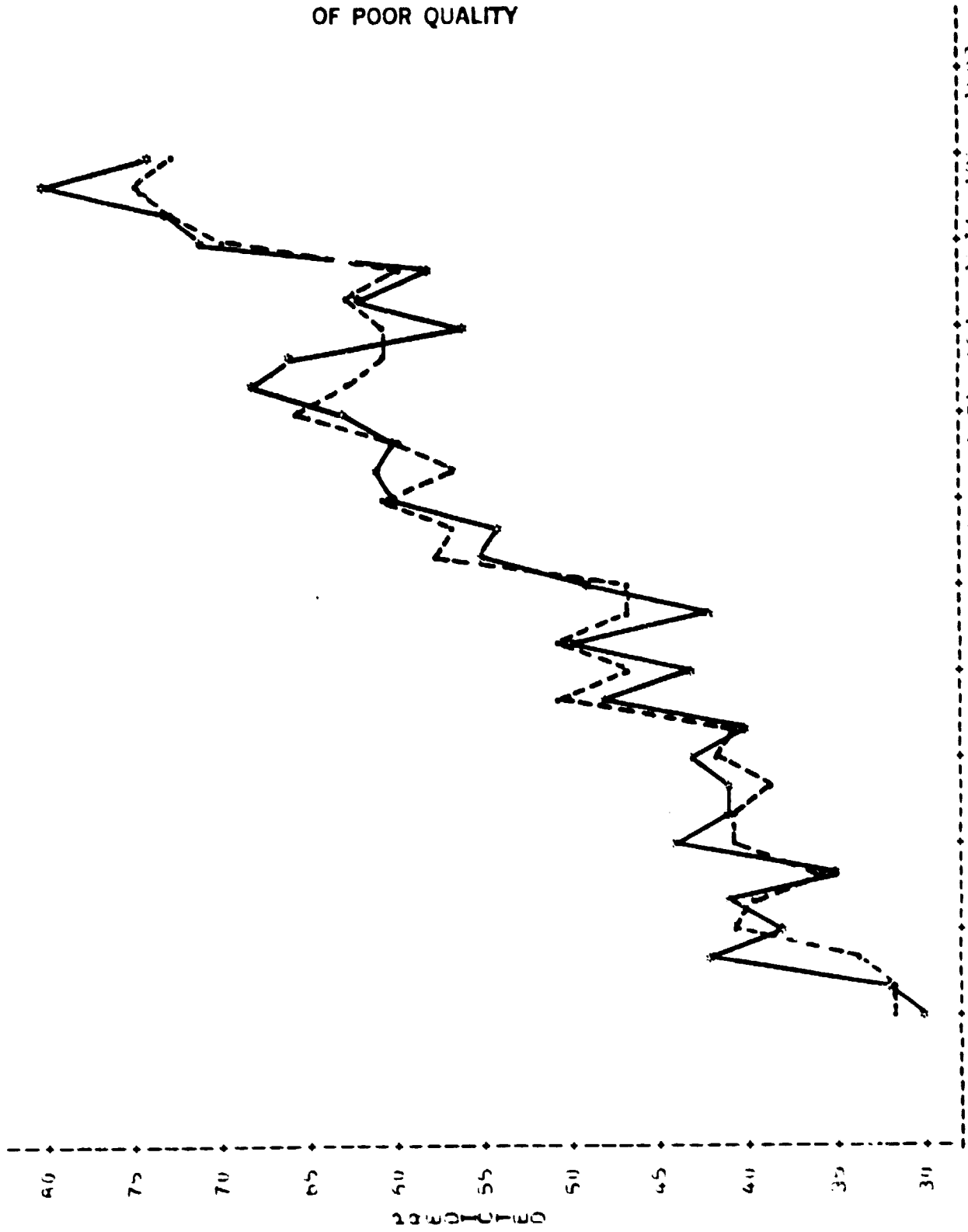

IOWA CORN STATE MODEL FOR ALL AREAS IN STATE

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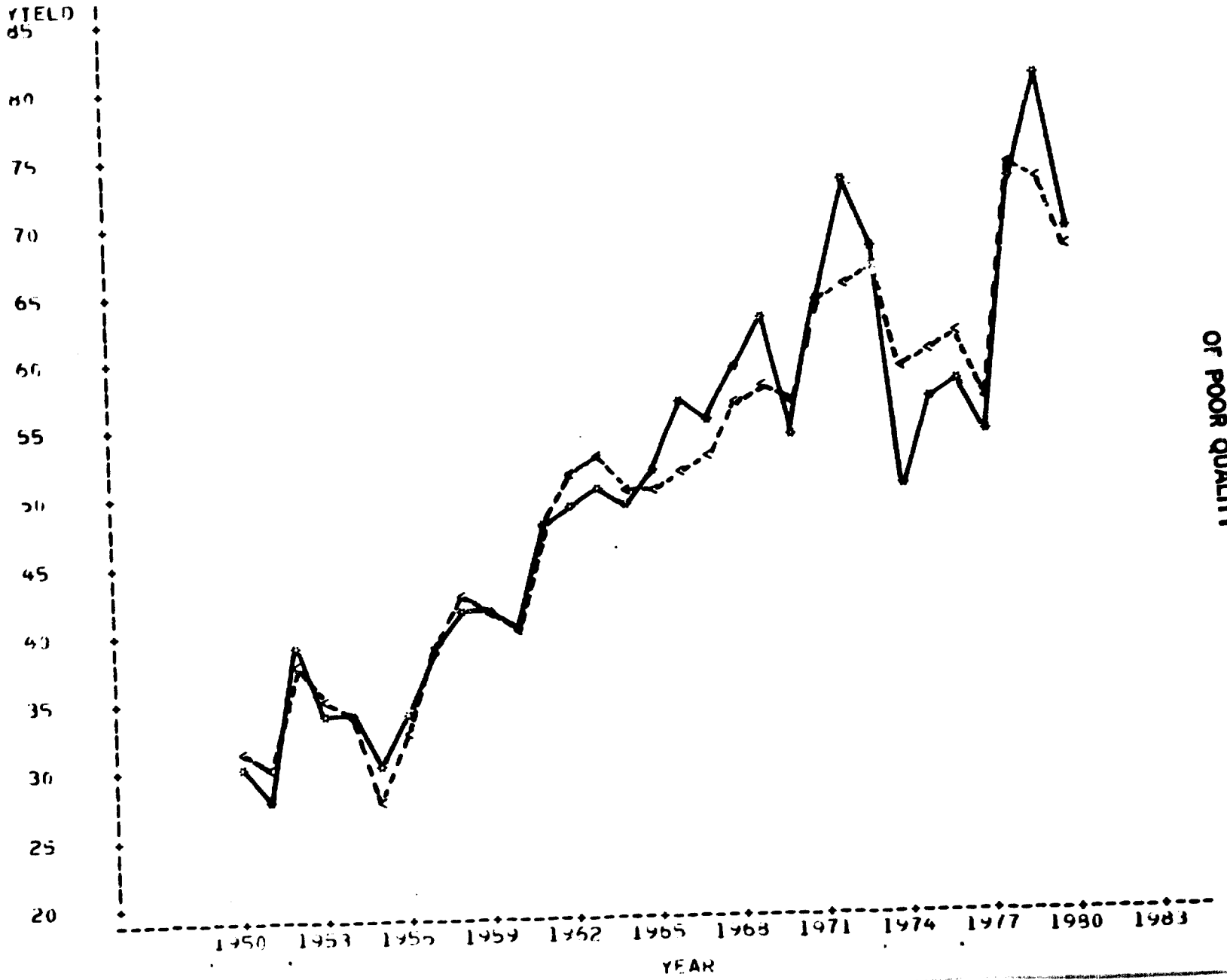

Appendix C

IOWA SOYBEANS NORTHWESTERN AGU 141

OBS	YEAR	TREND1	TREND2	ET7	ET8	X009
1	1950	20	0.1	126.653	104.203	-0.0156
2	1951	21	0.1	134.127	121.286	-2.3156
3	1952	22	0.1	145.015	118.543	1.1844
4	1953	23	0.1	141.644	113.735	0.7844
5	1954	24	0.1	152.460	114.821	1.3844
6	1955	25	0.1	133.902	77.294	1.9844
7	1956	26	0.1	105.370	90.100	0.4844
8	1957	27	0.1	152.194	111.166	-1.4156
9	1958	28	0.1	129.680	102.525	1.3844
10	1959	29	0.1	114.355	133.543	-0.3156
11	1960	30	0.1	133.015	130.486	0.7844
12	1961	31	0.1	136.841	123.493	-1.1156
13	1962	32	1.0	136.541	125.516	-1.5156
14	1963	32	2.0	142.016	116.105	1.6844
15	1964	32	3.0	151.831	112.151	-0.5156
16	1965	32	4.0	136.224	100.436	-3.7156
17	1966	32	5.0	147.524	108.444	-1.0156
18	1967	32	6.0	129.916	93.706	-0.8156
19	1968	32	7.0	118.411	102.026	-0.3156
20	1969	32	8.0	145.015	120.835	0.4844
21	1970	32	9.0	122.766	76.890	0.5844
22	1971	32	10.0	127.537	98.014	0.6844
23	1972	32	11.0	137.307	119.393	-0.3156
24	1973	32	12.0	143.026	111.270	-0.3156
25	1974	32	13.0	146.442	114.293	-1.8156
26	1975	32	14.0	140.792	126.890	-1.8156
27	1976	32	15.0	112.125	57.043	1.1844
28	1977	32	16.0	129.062	103.105	0.8844
29	1978	32	17.0	145.790	125.001	2.8844
30	1979	32	18.0	129.868	125.233	1.3844
31	1980	32	19.0	129.868	125.233	1.3844

IOWA SOYBEANS SOUTHWESTERN AREA 142

OBS	YEAR	TREND1	TREND2	ES	ETP6
1	1950	20	0.1	1.00688	0.99682
2	1951	21	0.1	1.00688	1.00000
3	1952	22	0.1	1.00688	1.00000
4	1953	23	0.1	0.98778	0.95870
5	1954	24	0.1	1.00688	1.00000
6	1955	25	0.1	0.97924	1.00600
7	1956	26	0.1	0.81462	0.84680
8	1957	27	0.1	1.00688	1.00000
9	1958	28	0.1	0.98452	0.98812
10	1959	29	0.1	1.00688	1.00000
11	1960	30	0.1	1.00688	1.00000
12	1961	31	0.1	1.00688	1.00000
13	1962	32	1.0	1.00688	0.96945
14	1963	32	2.0	1.00586	0.95400
15	1964	32	3.0	1.00688	1.00000
16	1965	32	4.0	1.00688	1.00000
17	1966	32	5.0	1.00688	1.00000
18	1967	32	6.0	1.00688	1.00000
19	1968	32	7.0	1.00688	0.91352
20	1969	32	8.0	1.00688	1.00000
21	1970	32	9.0	0.99051	0.92603
22	1971	32	10.0	1.00688	0.97770
23	1972	32	11.0	1.00688	0.96135
24	1973	32	12.0	1.00688	0.95962
25	1974	32	13.0	1.00688	0.95718
26	1975	32	14.0	1.00688	1.00000
27	1976	32	15.0	1.00688	0.98470
28	1977	32	16.0	0.93446	0.75476
29	1978	32	17.0	1.00688	0.96998
30	1979	32	18.0	1.00688	0.97327
31	1980	32	19.0	1.00688	0.97327

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IOWA SOYBEANS NORTHWESTERN CENTRAL APU 241

IOWA SOYBEANS NORTHERN CENTRAL APU 242

OBS	YEAR	TREND1	TREND2	ET5	ET8	POS29	ETP9
1	1950	20	0.1	119.971	100.567	176.4	0.93411
2	1951	21	0.1	106.935	117.302	371.8	1.00000
3	1952	22	0.1	142.239	114.589	4799.9	0.81504
4	1953	23	0.1	136.245	113.383	4004.5	0.64616
5	1954	24	0.1	136.985	123.515	371.8	0.99715
6	1955	25	0.1	110.117	101.123	68.6	0.86495
7	1956	26	0.1	124.871	107.718	857.4	0.77903
8	1957	27	0.1	122.168	119.887	690.7	0.30645
9	1958	28	0.1	108.370	124.314	298.6	0.92986
10	1959	29	0.1	133.254	138.569	1006.1	1.00000
11	1960	30	0.1	114.732	129.782	188.2	1.00000
12	1961	31	0.1	120.439	114.665	2001.1	1.00000
13	1962	32	1.0	119.491	123.515	744.3	1.00000
14	1963	32	2.0	138.201	118.290	979.5	0.90359
15	1964	32	3.0	125.706	111.884	2674.8	1.00000
16	1965	32	4.0	123.013	110.671	3305.8	1.00000
17	1966	32	5.0	125.845	102.293	3395.7	0.71379
18	1967	32	6.0	122.168	100.196	1175.2	0.83864
19	1968	32	7.0	131.024	124.253	1006.1	1.00000
20	1969	32	8.0	104.074	123.558	371.8	0.93613
21	1970	32	9.0	127.361	106.345	1577.6	1.00000
22	1971	32	10.0	147.458	90.426	542.0	0.79736
23	1972	32	11.0	121.435	124.903	2143.6	1.00000
24	1973	32	12.0	131.510	108.434	11388.9	1.00000
25	1974	32	13.0	116.324	110.588	1873.3	0.82429
26	1975	32	14.0	126.582	130.016	2142.0	0.76072
27	1976	32	15.0	123.429	81.606	3055.0	0.54571
28	1977	32	16.0	103.232	112.509	763.3	1.00000
29	1978	32	17.0	127.321	123.080	3685.8	1.00000
30	1979	32	18.0	123.834	122.822	2050.4	0.96939
31	1980	32	19.0	123.834	122.822	2050.4	0.96939
32	1981	32	20.0	.	.	.	.
33	1982	32	21.0	.	.	.	.
34	1983	32	22.0	.	.	.	.

IOWA SOYBEANS SOUTHERN CENTRAL APU 251

OBS	YEAR	TREND1	TREND2	PDD5	ET6	E8
1	1950	1	0	40	1.63	1.98
2	1951	2	0	34	1.36	1.02
3	1952	3	0	-6	1.79	1.02
4	1953	4	0	-29	1.43	1.26
5	1954	5	0	-30	1.41	1.02
6	1955	6	0	-35	1.25	1.13
7	1956	7	0	-1	1.54	1.02
8	1957	8	0	-35	1.40	1.26
9	1958	9	0	10	1.02	1.02
10	1959	10	0	-6	1.28	1.02
11	1960	11	0	-45	1.13	1.02
12	1961	12	0	-5	1.30	1.02
13	1962	13	0	-2	1.04	1.02
14	1963	14	0	-14	1.40	1.02
15	1964	15	0	-14	1.45	1.02
16	1965	16	0	-1	1.24	1.02
17	1966	17	0	36	1.56	1.02
18	1967	18	0	55	1.46	1.02
19	1968	19	0	-14	1.26	1.02
20	1969	20	0	-46	1.04	1.02
21	1970	21	0	-1	1.20	1.02
22	1971	22	0	-44	1.04	1.02
23	1972	23	0	-44	1.15	1.02
24	1973	24	0	1	1.56	1.02
25	1974	25	0	1	1.45	1.02
26	1975	26	0	1	1.25	1.02
27	1976	27	0	1	1.50	1.02
28	1977	28	0	1	1.50	1.02
29	1978	29	0	1	1.50	1.02
30	1979	30	0	1	1.50	1.02
31	1980	31	0	1	1.50	1.02
32	1981	32	0	1	1.50	1.02
33	1982	33	0	1	1.50	1.02
34	1983	34	0	1	1.50	1.02

IOWA SOYBEANS SOUTHEASTERN APU 252

OBS	YEAR	TREND1	TREND2	ET6	E8	DSQ9	XDD9	ETHAT9
1	1950	20	0.1	123.297	0.97920	20932	-0.15	75.5812
2	1951	21	0.1	113.402	1.10102	245	-1.65	67.5634
3	1952	22	0.1	150.837	1.09128	3561	0.45	78.8449
4	1953	23	0.1	140.181	0.59256	68999	0.95	81.5884
5	1954	24	0.1	146.027	1.10102	23923	1.75	86.0221
6	1955	25	0.1	114.483	0.71637	12249	1.55	84.9086
7	1956	26	0.1	99.939	1.10102	86246	0.15	77.2091
8	1957	27	0.1	126.874	0.95226	37511	-1.15	70.2131
9	1958	28	0.1	114.156	1.07951	766	0.25	77.7535
10	1959	29	0.1	132.496	0.97612	8523	0.65	79.9397
11	1960	30	0.1	119.469	1.01494	46364	1.65	85.4650
12	1961	31	0.1	119.495	0.97945	3061	-0.15	75.5812
13	1962	32	1.0	124.472	0.97558	34344	-1.25	69.6813
14	1963	32	2.0	132.908	1.07438	20932	0.65	79.9397
15	1964	32	3.0	131.815	0.90857	23006	-0.05	76.1230
16	1965	32	4.0	121.870	1.10102	56798	-0.85	71.8141
17	1966	32	5.0	125.507	0.83596	335	-1.25	69.6813
18	1967	32	6.0	128.702	1.03911	3443	-1.35	69.1505
19	1968	32	7.0	135.518	0.85086	4055	-0.15	75.5812
20	1969	32	8.0	111.145	1.07951	20829	0.15	77.2091
21	1970	32	9.0	129.479	1.10102	35465	0.35	78.2987
22	1971	32	10.0	146.514	0.77447	1203	1.95	87.1388
23	1972	32	11.0	123.297	1.08907	17509	1.05	82.1397
24	1973	32	12.0	134.696	0.999915	146171	0.25	77.7535
25	1974	32	13.0	114.912	1.10102	74160	-2.65	62.3352
26	1975	32	14.0	129.417	1.10102	18681	-2.25	64.4149
27	1976	32	15.0	127.574	0.87329	12472	-0.65	72.8859
28	1977	32	16.0	120.670	1.10102	2568	0.65	79.9397
29	1978	32	17.0	132.596	1.06769	25066	2.55	90.5087
30	1979	32	18.0	126.567	1.10102	1110	0.65	79.9397
31	1980	32	19.0	126.667	1.10102	10136	0.65	79.9397
32	1981	32	20.0	.	.	.	.	.
33	1982	32	21.0	.	.	.	.	.
34	1983	32	22.0	.	.	.	.	.

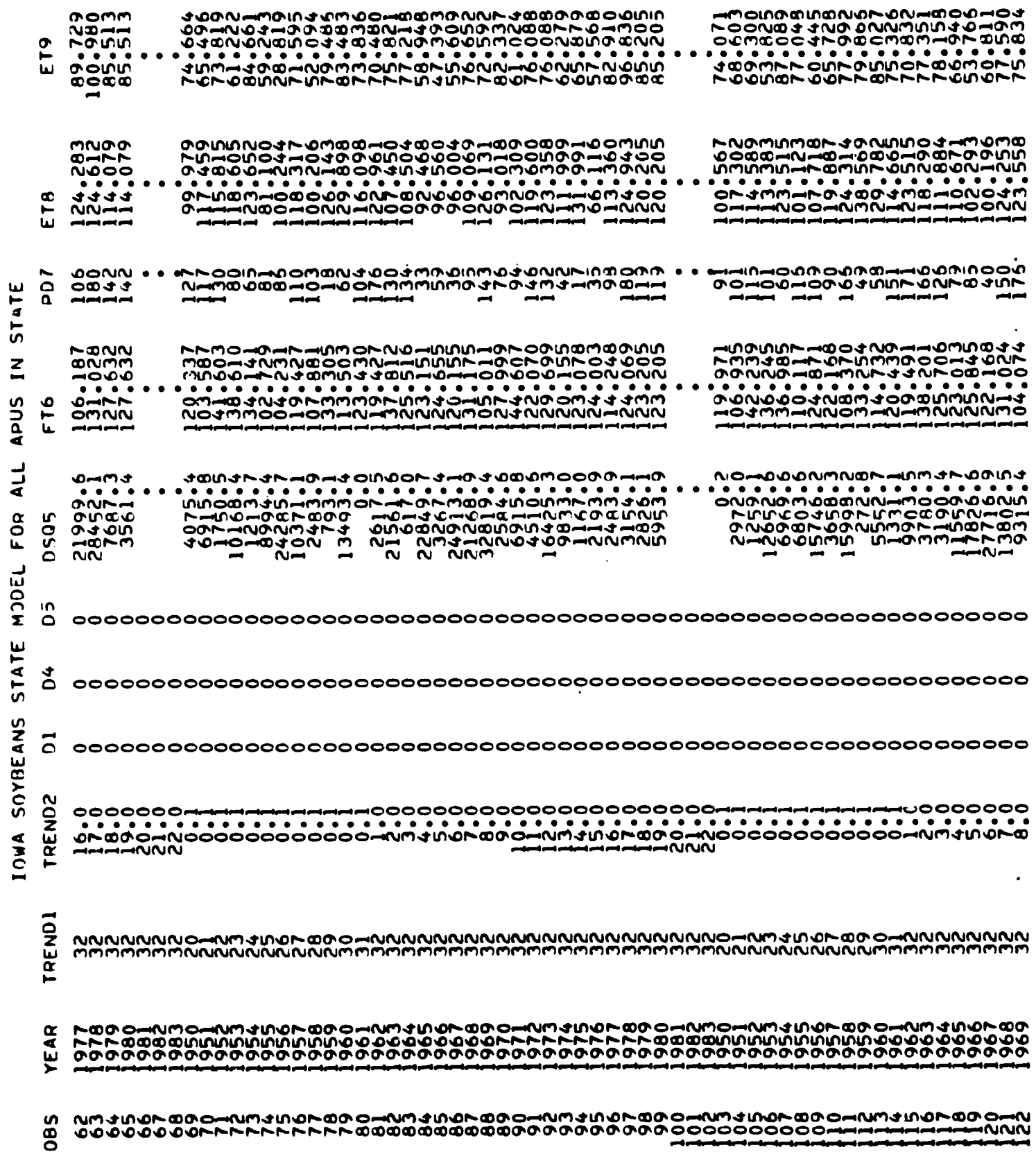
IOWA SOYBEANS NORTHEASTERN APU 260

OBS	YEAR	[illegible]	[illegible]	[illegible]	[illegible]	FT8	[illegible]	E9	ETHAT9
1	1950	20	0.1	1.02885	[illegible]	103.512	-0.225	1.08974	70.0465
2	1951	21	0.1	1.02885	105.934	112.474	-1.825	1.10423	61.9813
3	1952	22	0.1	1.00905	132.555	116.451	0.275	0.82263	72.5986
4	1953	23	0.1	1.02885	133.245	124.366	0.175	0.97942	72.0870
5	1954	24	0.1	1.02885	136.946	112.254	1.375	1.04232	78.2640
6	1955	25	0.1	1.01293	113.887	105.171	1.675	0.89163	79.8208
7	1956	26	0.1	0.93140	133.467	112.912	-0.925	0.95533	66.4985
8	1957	27	0.1	1.02885	120.788	123.546	-0.925	1.03819	66.4985
9	1958	28	0.1	1.01015	105.161	112.651	0.575	0.94157	74.1369
10	1959	29	0.1	1.02885	128.826	138.647	0.875	1.10789	75.6804
11	1960	30	0.1	1.02885	112.116	124.159	1.375	1.10789	78.2640
12	1961	31	0.1	0.96489	116.596	117.166	-0.125	1.10789	70.5557
13	1962	32	1.0	0.99700	117.049	120.643	-1.625	1.10789	62.9807
14	1963	32	2.0	0.95473	125.705	97.942	0.475	0.96899	73.6236
15	1964	32	3.0	1.02623	126.303	105.976	-0.225	1.03987	70.0465
16	1965	32	4.0	0.99365	120.071	120.643	-1.125	1.10789	65.4903
17	1966	32	5.0	1.02885	125.594	105.426	-0.425	0.84529	69.0297
18	1967	32	6.0	1.02885	126.526	94.067	-0.725	1.10789	67.5092
19	1968	32	7.0	1.02885	126.526	124.193	0.075	1.10789	71.5760
20	1969	32	8.0	1.02885	101.427	113.750	0.375	0.94213	73.1108
21	1970	32	9.0	1.02885	128.092	119.757	0.275	1.10789	72.5986
22	1971	32	10.0	1.02885	143.548	97.293	1.875	1.02995	80.8615
23	1972	32	11.0	1.01149	115.186	127.520	0.575	1.10789	74.1369
24	1973	32	12.0	1.02566	132.097	112.749	0.275	1.10789	72.5986
25	1974	32	13.0	1.02885	110.581	113.829	-2.125	0.97218	60.4871
26	1975	32	14.0	1.01625	122.908	129.595	-2.125	0.93610	60.4871
27	1976	32	15.0	0.96914	119.278	86.590	-0.525	0.61655	68.5223
28	1977	32	16.0	0.88487	105.763	111.122	0.375	1.10789	73.1108
29	1978	32	17.0	1.02885	123.701	117.814	2.775	1.10789	85.5706
30	1979	32	18.0	1.02885	121.515	118.592	0.875	1.04388	75.6804
31	1980	32	19.0	1.02885	121.515	118.592	0.875	1.04388	75.6804

IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE

OBS	YEAR	TREND1	TREND2	D1	D4	D5	DSQ5	ET6	PD7	ET8	ET9
1	1950	20	0.1	1	0	0	1407	122.539	123	108.203	73.7799
2	1951	21	0.1	1	0	0	755	104.915	87	121.286	66.9601
3	1952	22	0.1	1	0	0	755	145.174	149	118.543	79.0169
4	1953	23	0.1	1	0	0	6009	142.956	62	113.735	57.1347
5	1954	24	0.1	1	0	0	182	135.325	43	114.821	72.6338
6	1955	25	0.1	1	0	0	15255	94.055	104	77.294	55.0182
7	1956	26	0.1	1	0	0	29418	100.098	97	90.100	27.1893
8	1957	27	0.1	1	0	0	12886	119.566	108	111.166	72.0205
9	1958	28	0.1	1	0	0	132	104.024	132	102.525	54.9634
10	1959	29	0.1	1	0	0	462	135.285	25	133.549	63.4391
11	1960	30	0.1	1	0	0	11987	114.959	58	130.486	84.6729
12	1961	31	0.1	1	0	0	1407	123.284	80	123.493	73.7225
13	1962	32	1.0	1	0	0	7138	120.308	138	125.516	71.4549
14	1963	32	2.0	1	0	0	21467	142.479	95	116.105	81.6345
15	1964	32	3.0	1	0	0	73	126.274	105	112.151	77.1495
16	1965	32	4.0	1	0	0	5400	124.713	82	100.430	59.2318
17	1966	32	5.0	1	0	0	649	124.863	71	108.444	64.7640
18	1967	32	6.0	1	0	0	22355	120.308	39	93.700	53.8447
19	1968	32	7.0	1	0	0	19465	135.325	85	102.026	78.2983
20	1969	32	8.0	1	0	0	19735	106.363	100	120.836	66.8448
21	1970	32	9.0	1	0	0	1724	129.449	55	76.890	83.5069
22	1971	32	10.0	1	0	0	6318	146.030	71	98.014	57.1940
23	1972	32	11.0	1	0	0	5110	127.090	164	119.393	78.2983
24	1973	32	12.0	1	0	0	11339	131.530	134	111.270	78.2983
25	1974	32	13.0	1	0	0	8369	121.125	30	114.298	55.1213
26	1975	32	14.0	1	0	0	871	124.030	30	126.890	55.7788
27	1976	32	15.0	1	0	0	601	125.533	35	57.048	46.4452
28	1977	32	16.0	1	0	0	3194	110.065	110	103.105	85.2571
29	1978	32	17.0	1	0	0	4828	125.121	152	125.001	97.0960
30	1979	32	18.0	1	0	0	4690	126.690	66	125.238	79.1441
31	1980	32	19.0	1	0	0	18356	126.690	66	125.238	79.1441
32	1981	32	20.0	1	0	0	.	.	.	.	.
33	1982	32	21.0	1	0	0	.	.	.	.	.
34	1983	32	22.0	1	0	0	.	.	.	.	.
35	1950	20	0.1	0	0	0	2145	123.714	165	111.117	76.8688
36	1951	21	0.1	0	0	0	11168	108.745	97	130.998	72.3095
37	1952	22	0.1	0	0	0	1964	156.964	88	122.803	87.1873
38	1953	23	0.1	0	0	0	18584	147.278	50	91.976	43.1245
39	1954	24	0.1	0	0	0	15706	145.527	17	137.796	87.2369
40	1955	25	0.1	0	0	0	18043	115.585	47	88.823	86.7865
41	1956	26	0.1	0	0	0	67768	98.338	137	130.442	63.0377
42	1957	27	0.1	0	0	0	1964	124.860	58	126.695	75.2474
43	1958	28	0.1	0	0	0	3402	106.752	332	132.028	90.9632
44	1959	29	0.1	0	0	0	8775	137.488	37	149.308	83.0155
45	1960	30	0.1	0	0	0	3682	121.749	61	135.521	90.9632
46	1961	31	0.1	0	0	0	2054	124.080	100	125.282	75.8384
47	1962	32	1.0	0	0	0	31926	124.130	152	125.336	76.4669
48	1963	32	2.0	0	0	0	5524	142.706	78	131.334	91.5819
49	1964	32	3.0	0	0	0	0	127.205	112	116.208	83.6205
50	1965	32	4.0	0	0	0	1737	127.989	162	124.071	71.7253
51	1966	32	5.0	0	0	0	1393	128.774	65	107.738	68.1491
52	1967	32	6.0	0	0	0	28332	123.302	46	92.400	75.8384
53	1968	32	7.0	0	0	0	12616	129.257	80	111.890	80.6934
54	1969	32	8.0	0	0	0	9154	115.585	145	129.362	76.3801
55	1970	32	9.0	0	0	0	18043	125.104	76	109.866	87.2733
56	1971	32	10.0	0	0	0	1068	150.247	53	97.680	57.3474
57	1972	32	11.0	0	0	0	2273	129.113	161	118.641	89.1137
58	1973	32	12.0	0	0	0	143397	134.239	174	125.921	82.4114
59	1974	32	13.0	0	0	0	29817	119.514	15	119.121	57.6699
60	1975	32	14.0	0	0	0	54	130.348	23	140.779	72.8948
61	1976	32	15.0	0	0	0	2881	128.353	63	85.536	65.9121

IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE



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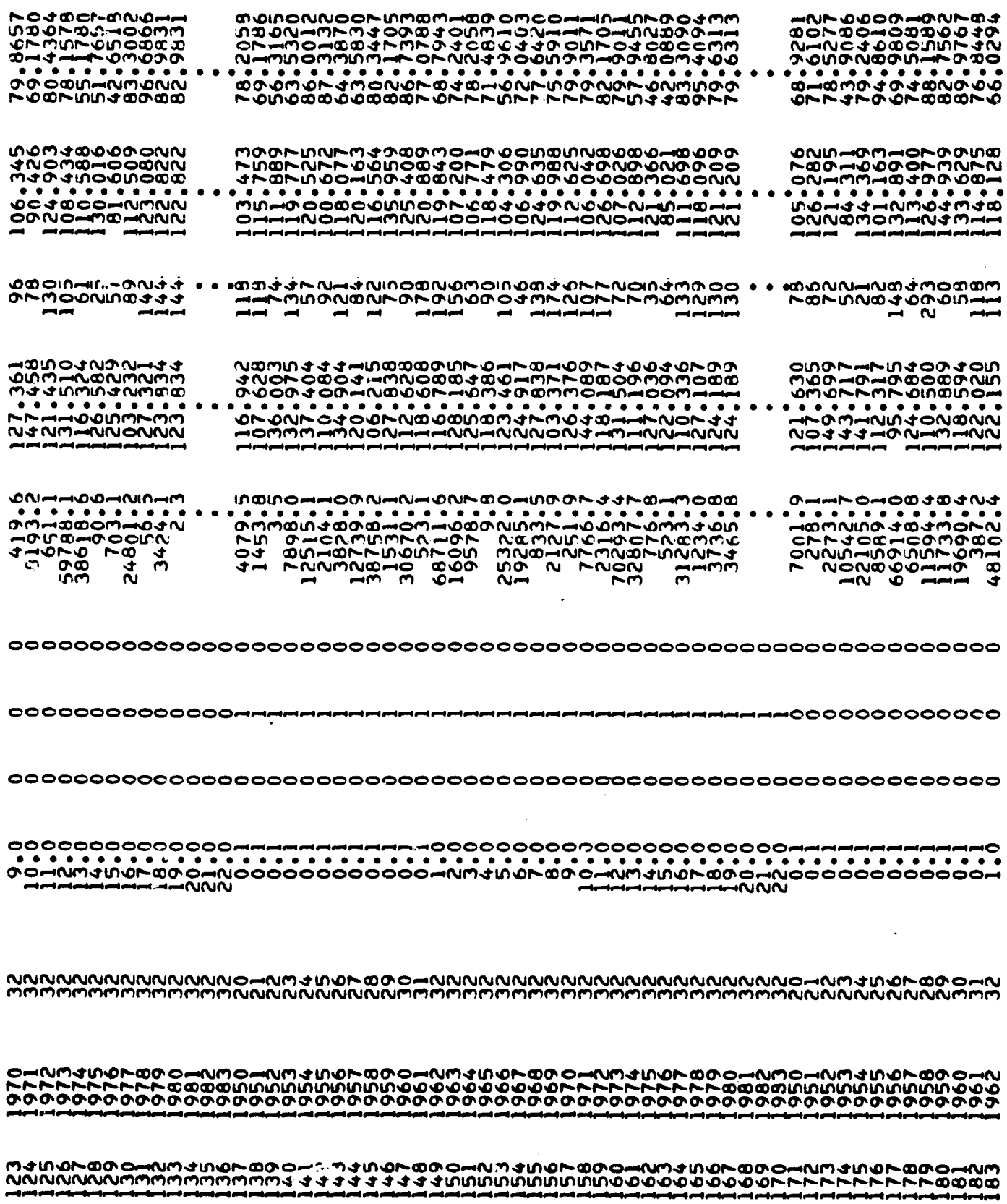
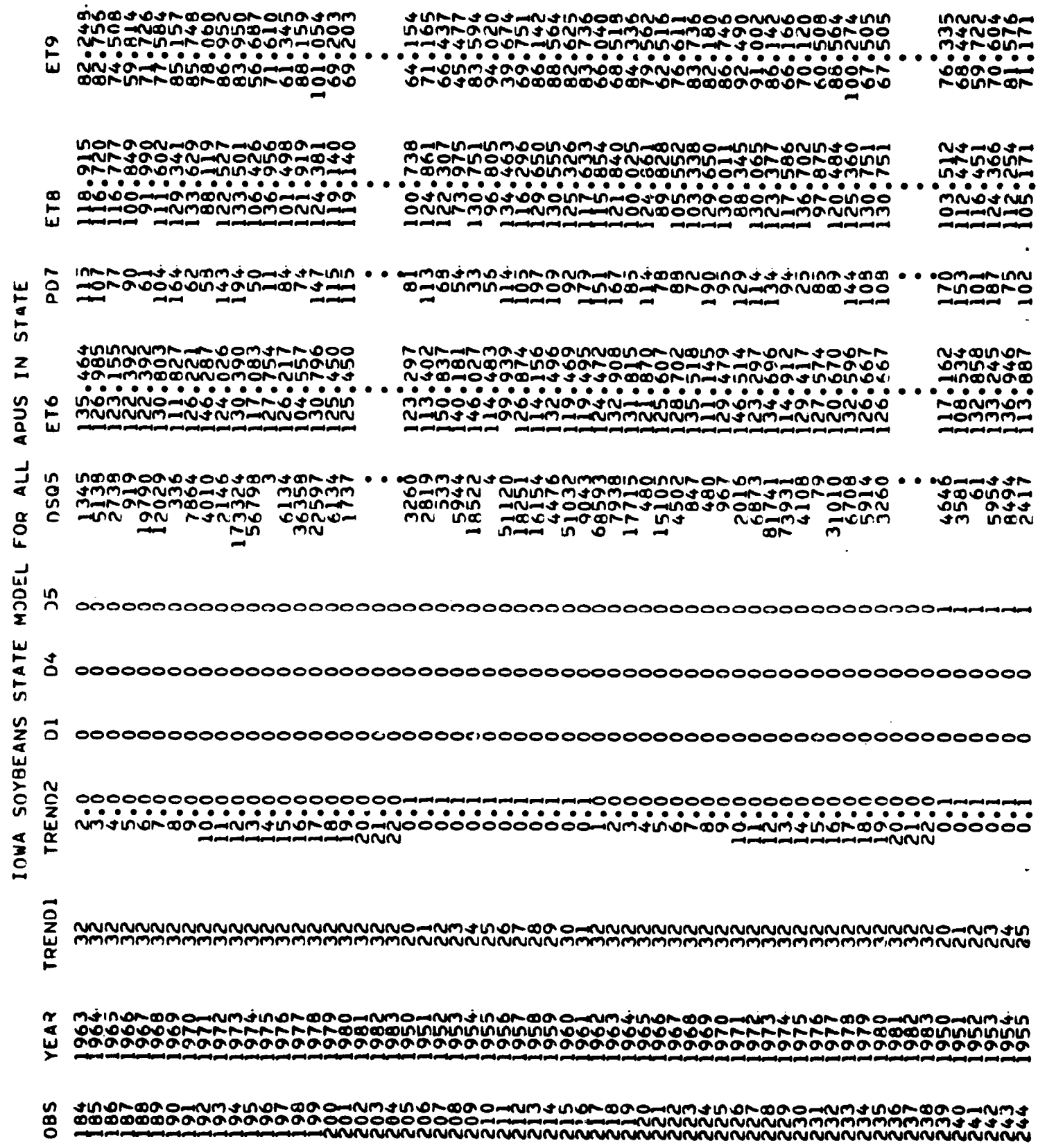
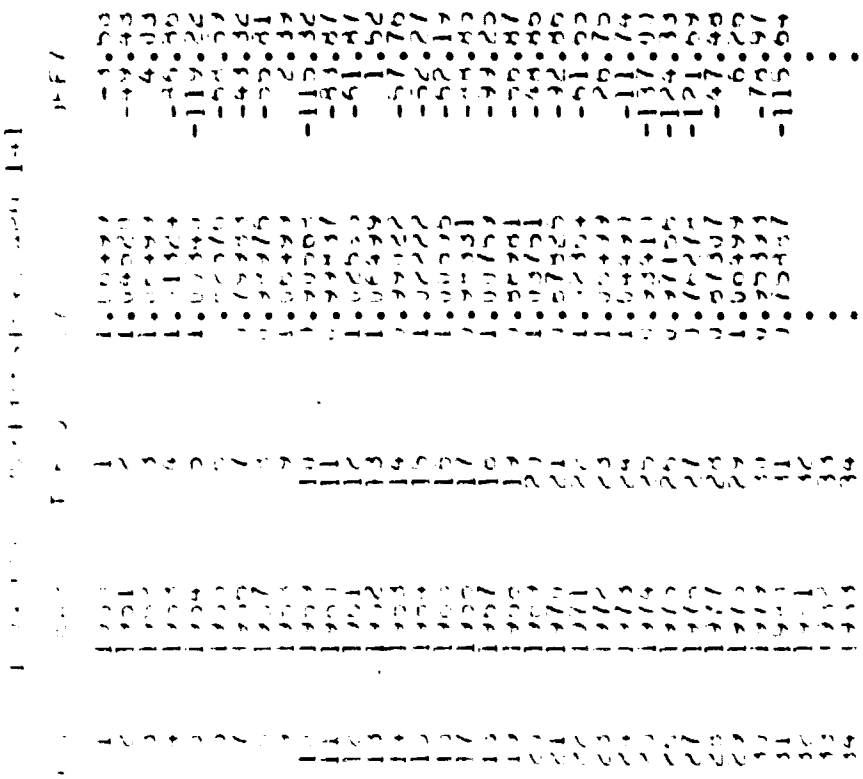
IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE





IOWA SOYBEANS STATE MODEL FOR ALL APUS IN STATE

OBS	YEAR	TREND1	TREND2	D3	D4	D5	DS05	ET6	PD7	ET8	ET9
245	1956	26	0.1	0	0	1	5953.9	133.467	115	112.912	63.5280
246	1957	27	0.1	0	0	1	7597.1	120.788	136	123.546	69.0378
247	1958	28	0.1	0	0	1	41681.8	105.161	85	112.651	69.8048
248	1959	29	0.1	0	0	1	1835.2	128.826	70	138.647	83.8455
249	1960	30	0.1	0	0	1	39536.8	112.116	79	124.159	86.7079
250	1961	31	0.1	0	0	1	633.1	116.696	166	117.166	78.1680
251	1962	32	1.0	0	0	1	96000.0	117.049	189	120.643	69.7757
252	1963	32	2.0	0	0	1	21951.8	125.705	119	97.942	71.3340
253	1964	32	3.0	0	0	1	2933.4	126.303	39	105.976	72.8394
254	1965	32	4.0	0	0	1	909.7	120.071	79	120.643	72.5560
255	1966	32	5.0	0	0	1	19276.2	125.894	104	105.426	58.3499
256	1967	32	6.0	0	0	1	24386.3	126.626	40	94.067	74.7927
257	1968	32	7.0	0	0	1	1431.8	126.626	132	124.193	79.2983
258	1969	32	8.0	0	0	1	476.9	101.427	106	113.750	68.8790
259	1970	32	9.0	0	0	1	1236.3	128.092	137	119.757	80.4313
260	1971	32	10.0	0	0	1	4877.4	143.648	88	97.293	83.2833
261	1972	32	11.0	0	0	1	2483.9	115.186	169	127.520	82.1355
262	1973	32	12.0	0	0	1	81133.1	132.097	64	112.749	80.4313
263	1974	32	13.0	0	0	1	14122.6	110.681	81	113.829	58.8045
264	1975	32	14.0	0	0	1	971.0	122.908	40	129.595	56.6218
265	1976	32	15.0	0	0	1	1533.6	119.278	70	86.590	42.2492
266	1977	32	16.0	0	0	1	22249.1	105.763	189	111.122	80.9987
267	1978	32	17.0	0	0	1	617.0	123.701	114	117.814	94.8029
268	1979	32	18.0	0	0	1	1013.7	121.515	125	118.592	79.0010
269	1980	32	19.0	0	0	1	5499.9	121.515	125	118.592	79.0010
270	1981	32	20.0	0	0	1	.	.	.	.	.
271	1982	32	21.0	0	0	1	.	.	.	.	.
272	1983	32	22.0	0	0	1	.	.	.	.	.



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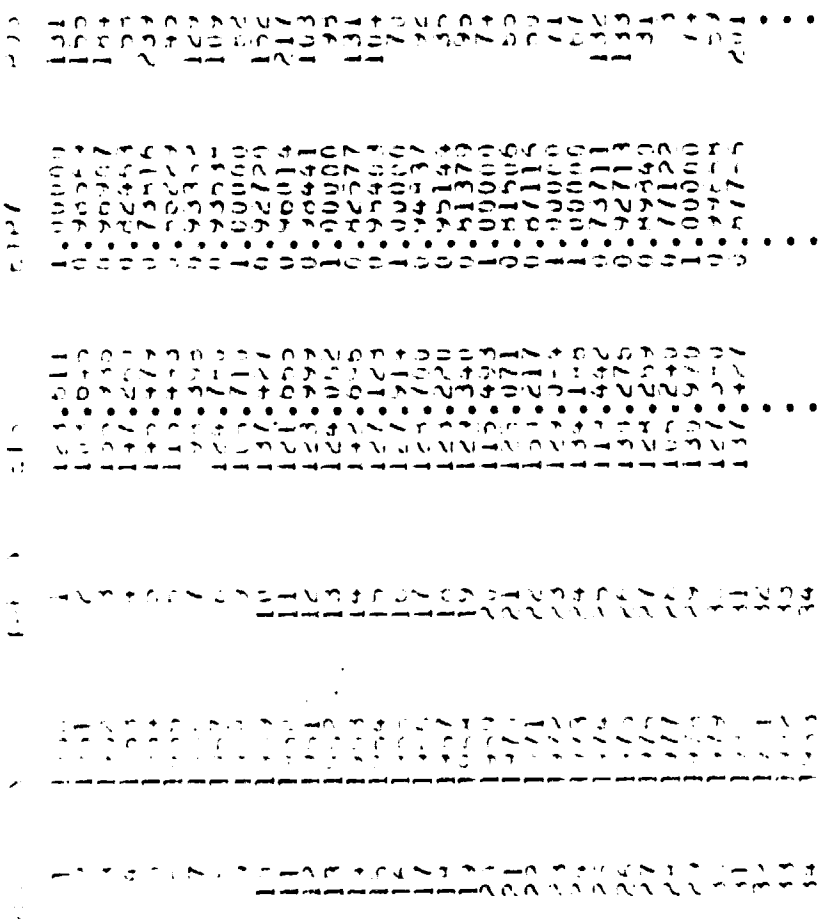

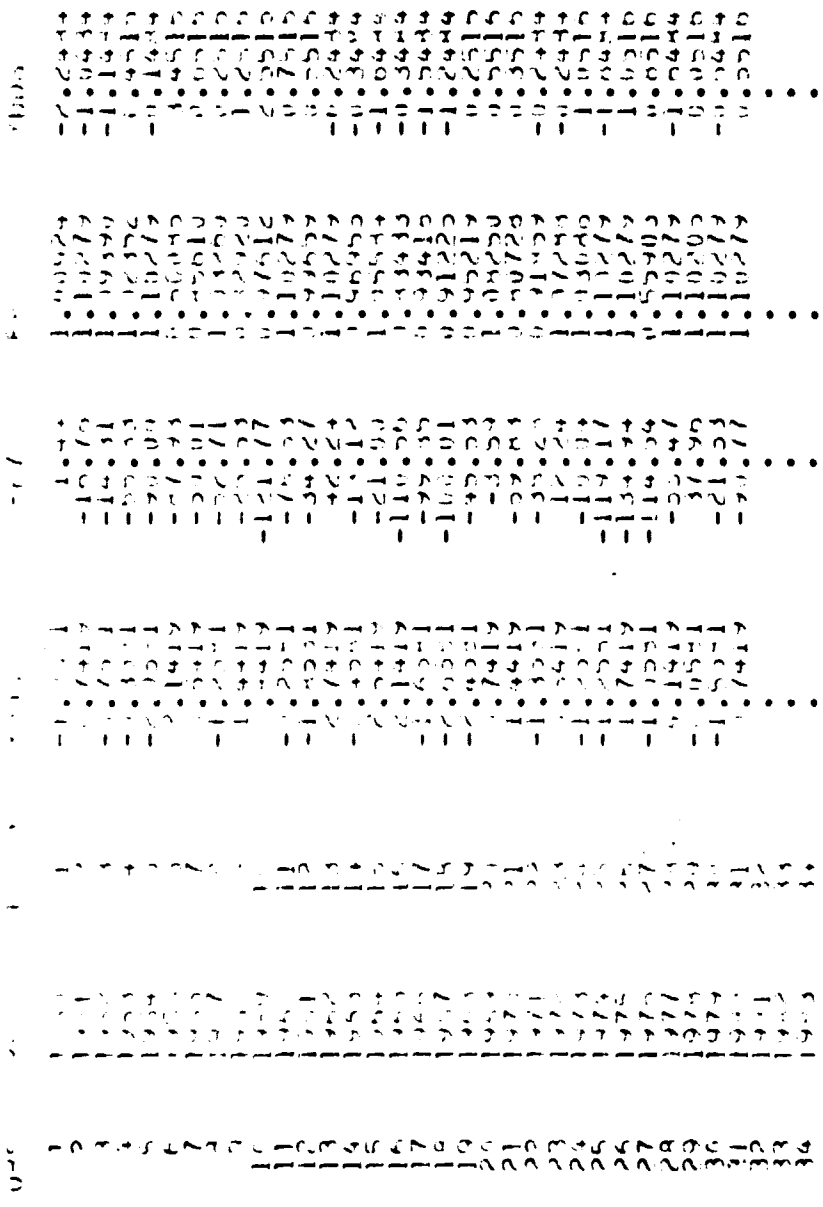

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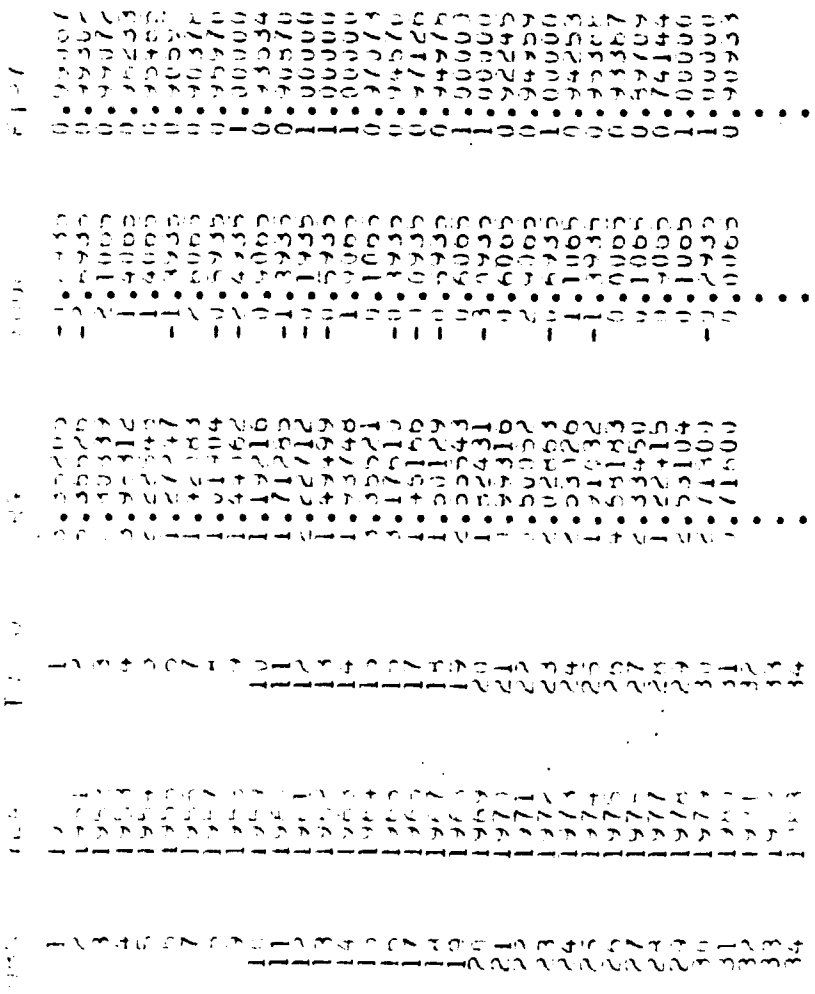

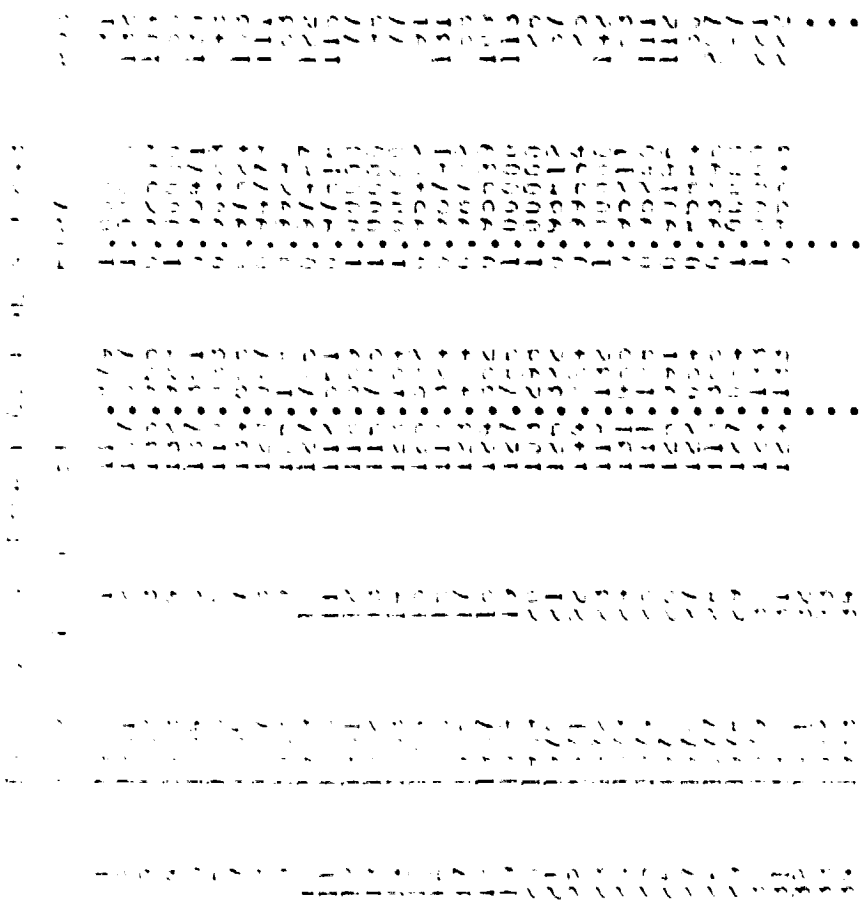

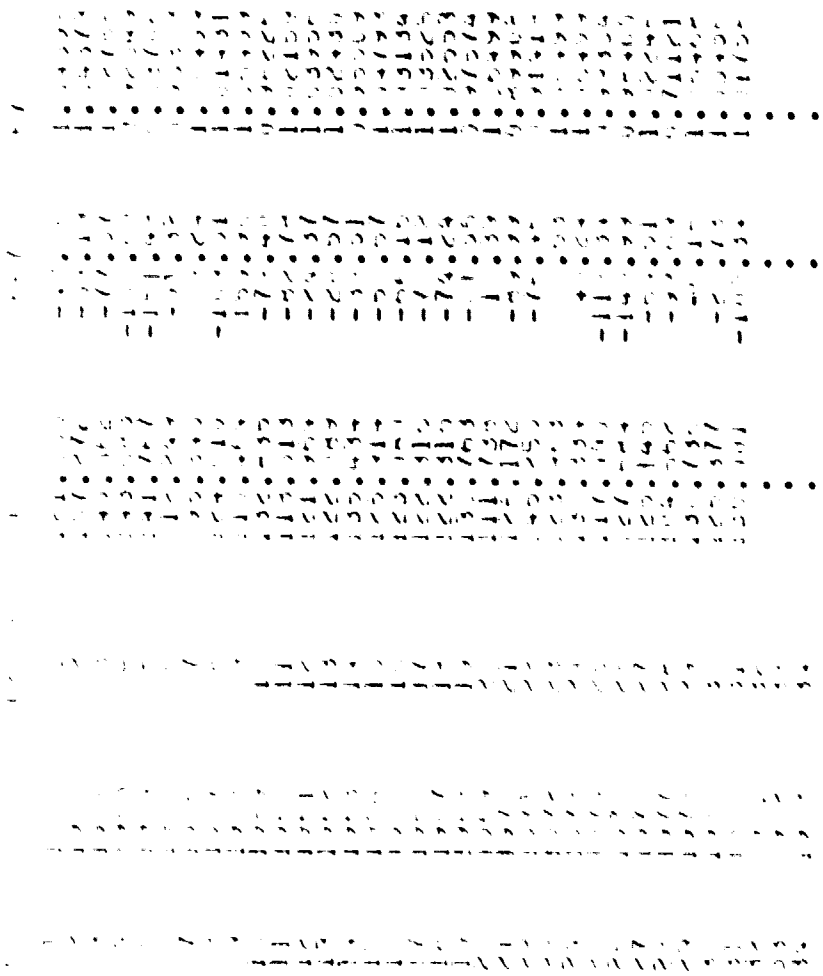

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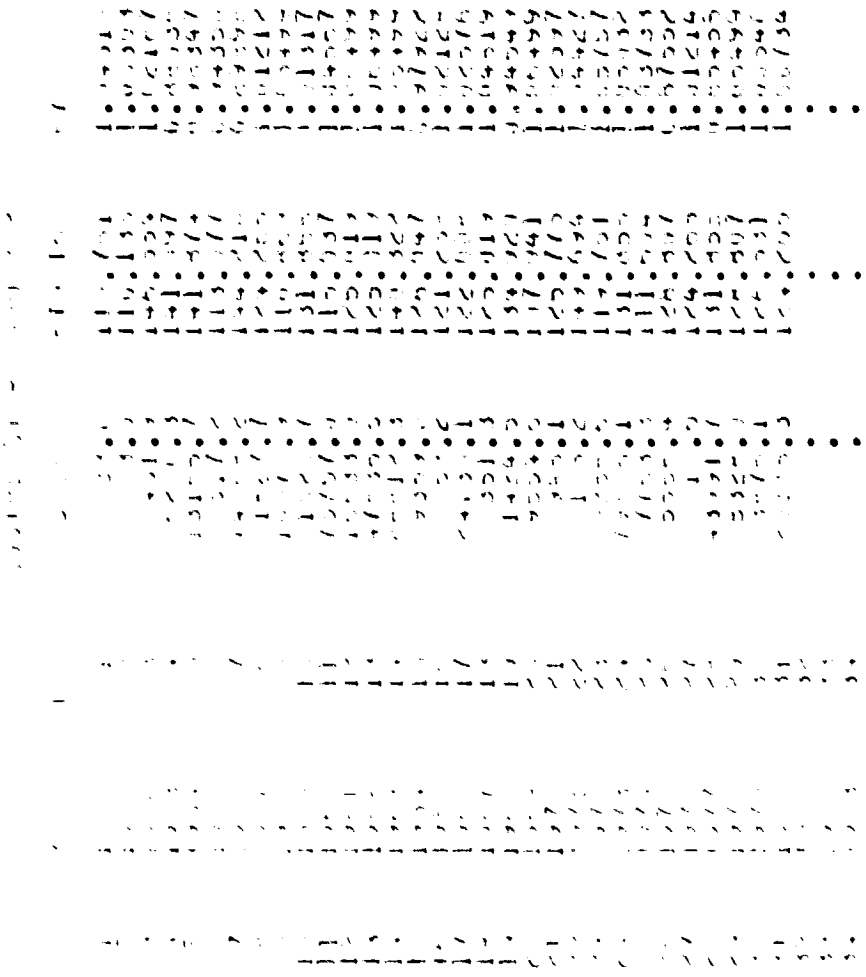

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IOWA CORN STATE MODEL FOR ALL AREAS IN STATE

OBS	YEAR	TREND	DI	ETO	RF	ETRF
123	1970	21	0	127.309	0.05220	0.92245
124	1971	22	0	147.446	0.00757	0.94959
125	1972	23	0	121.365	0.95745	1.00000
126	1973	24	0	131.402	0.73196	0.94253
127	1974	25	0	116.249	0.38042	0.95386
128	1975	26	0	126.519	0.15802	0.93387
129	1976	27	0	125.372	0.38309	0.89709
130	1977	28	0	103.284	0.30321	0.74144
131	1978	29	0	127.238	1.01679	1.00000
132	1979	30	0	123.785	1.04240	1.00000
133	1980	31	0	125.075	0.40017	0.90933
134	1981	32	0	.	.	.
135	1982	33	0	.	.	.
136	1983	34	0	.	.	.
137	1950	1	0	116.879	0.93133	1.00000
138	1951	2	0	107.557	0.87994	1.00000
139	1952	3	0	135.965	0.49884	0.92509
140	1953	4	0	132.928	0.94654	1.00000
141	1954	5	0	137.361	0.37845	0.95471
142	1955	6	0	110.033	0.55461	0.90423
143	1956	7	0	134.868	0.90733	0.97524
144	1957	8	0	120.087	0.54401	0.94778
145	1958	9	0	106.158	0.96290	0.99290
146	1959	10	0	127.736	0.55928	0.97487
147	1960	11	0	112.551	0.67114	0.97818
148	1961	12	0	118.589	1.33476	1.00000
149	1962	13	0	116.735	1.51539	1.00000
150	1963	14	0	128.154	1.11373	1.00000
151	1964	15	0	125.592	0.41207	0.95482
152	1965	16	0	118.324	0.86377	0.96791
153	1966	17	0	123.404	0.70067	0.98702
154	1967	18	0	124.562	0.35583	0.95539
155	1968	19	0	127.786	0.99586	1.00000
156	1969	20	0	103.298	1.21620	1.00000
157	1970	21	0	126.322	0.88069	0.98812
158	1971	22	0	144.054	0.84945	0.99554
159	1972	23	0	118.132	1.32726	1.00000
160	1973	24	0	131.455	0.50062	0.95211
161	1974	25	0	111.128	0.45745	0.96240
162	1975	26	0	126.591	0.24336	0.90196
163	1976	27	0	122.054	0.43512	0.85884
164	1977	28	0	110.366	0.66992	0.93496
165	1978	29	0	127.054	0.93596	1.00000
166	1979	30	0	124.133	0.94322	1.00000
167	1980	31	0	124.133	0.45131	0.95543
168	1981	32	0	.	.	.
169	1982	33	0	.	.	.
170	1983	34	0	.	.	.
171	1950	1	1	121.553	0.81965	0.98214
172	1951	2	1	107.272	0.81786	0.98003
173	1952	3	1	149.662	0.48138	0.96512
174	1953	4	1	143.683	0.34032	0.86995
175	1954	5	1	141.767	0.12175	0.78599
176	1955	6	1	112.249	0.47313	0.90031
177	1956	7	1	95.846	1.02238	1.00000
178	1957	8	1	124.610	0.38206	0.95241
179	1958	9	1	110.464	2.21037	1.00000
180	1959	10	1	132.635	0.43353	0.92231
181	1960	11	1	119.513	0.41200	0.95924
182	1961	12	1	121.954	0.82884	0.97012
183	1962	13	1	122.844	0.74218	0.96170

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