Integrating of World Weather and Other Market Factors in Formulating U.S. Crop Forecasts by World Agricultural Outlook Board

by

Norton Strommen, Jim Matthews, and Raymond Motha

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Introduction

The gathering and analysis of market and weather data for crops is broadly distributed among various groups and agencies in the U.S. Department of Agriculture. Principal contributors to this effort include the Foreign Agricultural Service (FAS) and its network of agricultural attaches, Economic Research Service (ERS), Statistical Reporting Service (SRS), and the World Agricultural Outlook Board (WAOB) staff, including the Joint Agricultural Weather Facility (JAWF).[1] The World Agricultural Outlook Board coordinates and clears the preparation and release of crop and livestock outlook information.

These groups interact monthly or more often if conditions warrant to assess global agricultural commodity production and markets. Summaries of these assessments are released immediately following closed

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*The authors are with the World Agricultural Outlook Board of the U.S. Department of Agriculture.

review sessions under tight security on two concurrent work days. U.S. and world crop production forecasts followed by a global set of supply/ demand estimates for major crops are released initially. More comprehensive published reports are released later. These include circulars and situation reports issued by FAS, SRS, and ERS.

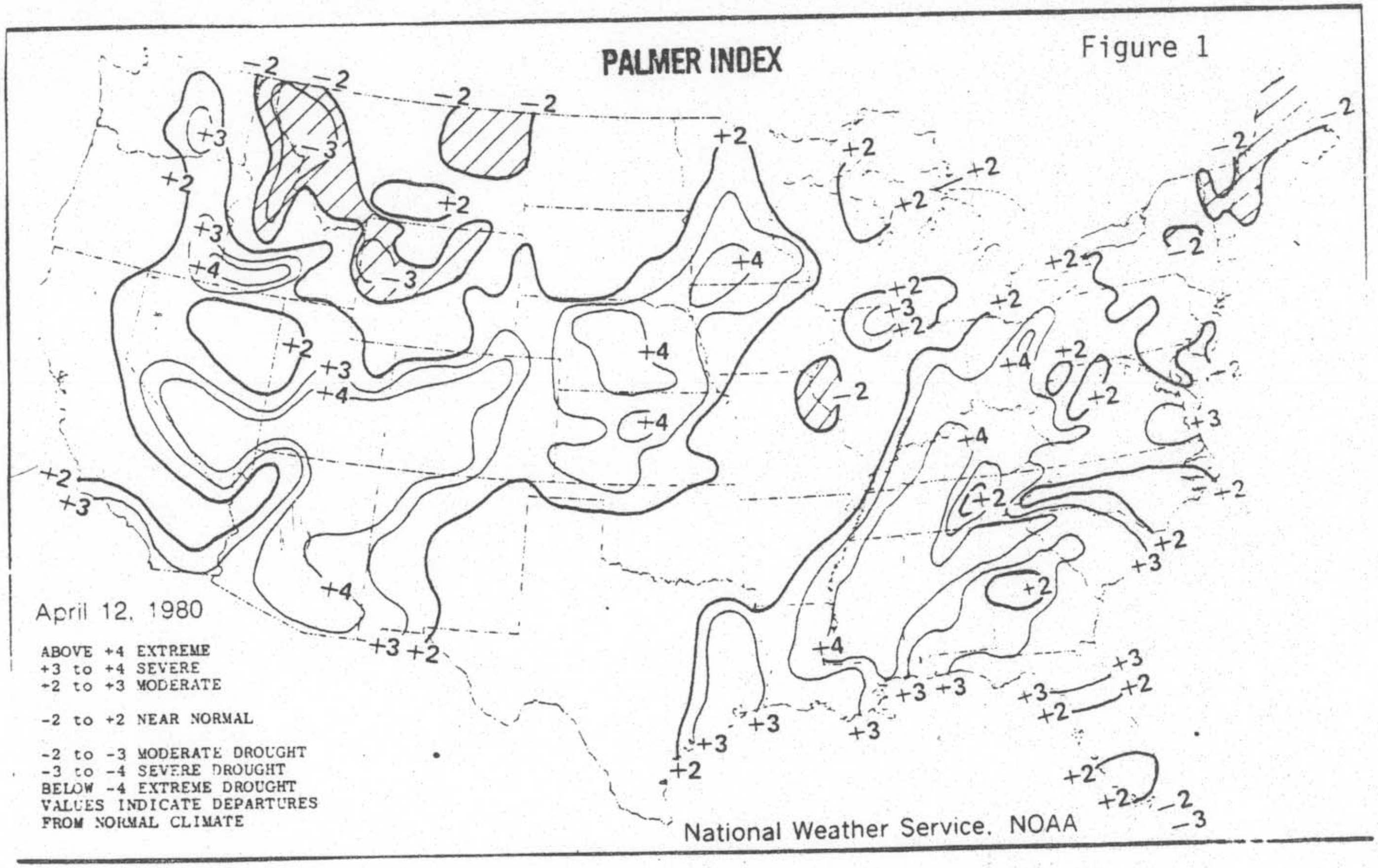
The more frequent shortages in regional crop production coupled with growing world trade and reduced global stocks in the 1970s revealed the need for improved weather assessments and a comprehensive knowledge of world commodity market factors in USDA. JAWF provides USDA with current weather data from around the globe and monitors weather events for early warning of potentially adverse impacts on crop production, while systematically evaluating crop yield potentials in all major producing regions.

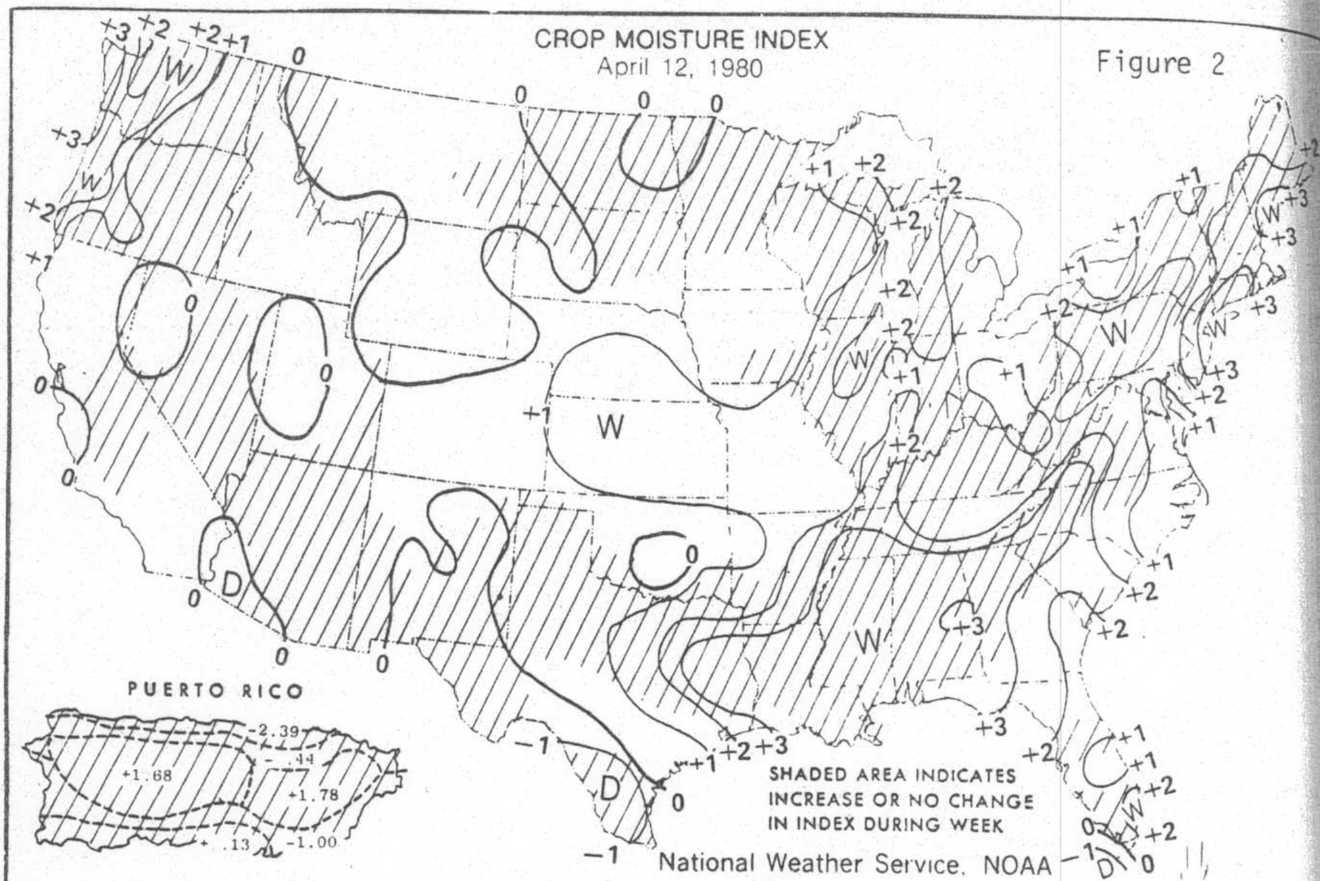
The analysis and integration of weather data with other market analysis procedures is still a relatively new and evolving process in USDA. This paper discusses the basic analytical and procedural framework used to prepare annual U.S. crop forecasts which are updated monthly. To illustrate the process, we will review the market assessments for soybeans and corn during 1980 when weather was of particular concern. Items to be considered include: actual and normal weather data with their implications in supply estimation, key international market factors for oilseeds and grains, and their export and price implications. The discussion concludes with identification of some key areas where additional work is needed to strengthen market analysis procedures.

The Role of Meterologist

The Joint Agricultural Weather Facility (JAWF), provides a multidisciplinary team to monitor global weather events and assess their impact on crop development and yield potential. Currently, all assessments are qualitative in nature with emphasis on monitoring for adverse weather events that could cause significant crop yield reductions. The flow of surface weather observation from about 8,000 stations around the globe is integrated with available satellite imagery for areas of sparse data coverage and oceans. The current JAWF capability in providing systematic weather monitoring and analysis can be illustrated by describing the process used during the 1980 and 1981 growing seasons.

The JAWF data support for the United States is more comprehensive in coverage than for other major crop areas. However, the basic techniques used for global crop-weather assessments are the same. The primary difference is the detail of verifying crop data provided by the Statistical Reporting Service (SRS) in the United States. Early crop prospects are based on analysis of current temperature and precipitation data, or derived indices using these data, and comparisons with available historical data series. The first step in analysis is the review of antecedent moisture conditions. For the United States, the Palmer Drought Index (PDI) and the Crop Moisture Index (CMI), (Figures 1 and 2) are used. As shown in these figures, early season moisture-deficient areas in 1980 are limited to the Northern Rockies,


PALMER INDEX
Figure 1
April 12, 1980
ABOVE +4 EXTREME
+3 to +4 SEVERE
+2 to +3 MODERATE
-2 to +2 NEAR NORMAL
-2 to -3 MODERATE DROUGHT
-3 to -4 SEVERE DROUGHT
BELOW -4 EXTREME DROUGHT
VALUES INDICATE DEPARTURES
FROM NORMAL CLIMATE
National Weather Service, NOAA



The Crop Moistare Index measures the degree to which moisture requirements of growing crops were met during the previous week. The index is computed from average weekly values of temperature and precipitation. These values are used to calculate the potential moisture demand. Taking into account the previous soil moisture condition and current rainfall, the actual moisture loss is determined.

If the potential moisture demand, or potential evapotranspiration, exceeds available moisture supplies, actual evapotranspiration is reduced and the CMI gives a negative value. However, if moisture meets or exceeds demand the index is positive.

Shaded areas indicate the index was unchanged or increased from the previous week's value, soils dried in the unshaded areas. Centers of positive and negative areas are identified by W for wet and D for dry.

Local moisture conditions may vary because of differences in rainfall distribution or soil types. The type of agriculture and stage of crop development must be considered when assessing the impact of moisture conditions based on the Crop Moisture Index. Some general guidelines follow.

UNSHADED AREAS:			INDEX DECREASED
ABOVE		3.0	SOME DRYING BUT STILL EXCESSIVELY WET
2.0	to	3.0	MORE DRY WEATHER NEEDED, WORK DELAYED
1.0	to	2.0	FAVORABLE, EXCEPT STILL TOO WET IN SPOTS
0	to	1.0	FAVORABLE FOR NORMAL GROWTH AND FIELDWORK
0	to	-1.0	TOPSOIL MOISTURE SHORT, GERMINATION SLOW
-1.0	to	-2.0	ABNORMALLY DRY, PROSPECTS DETERIORATING
-2.0	to	-3.0	TOO DRY, YIELD PROSPECTS REDUCED
-3.0	to	-4.0	POTENTIAL YIELDS SEVERELY CUT BY DROUGHT
BELOW		-4.0	EXTREMELY DRY, MOST CROPS RUINED

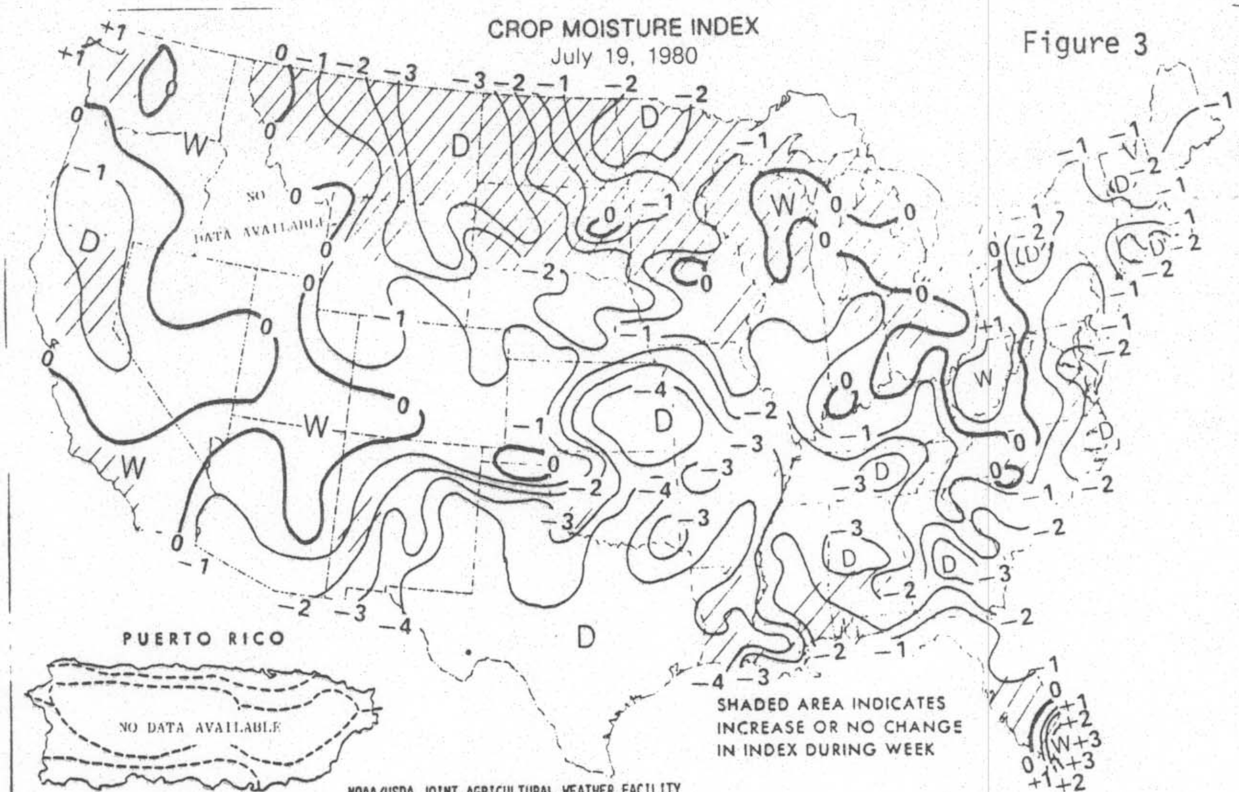
SHADED AREAS:			INDEX INCREASED OR DID NOT CHANGE
ABOVE		3.0	EXCESSIVELY WET, SOME FIELDS FLOODED
2.0	to	3.0	TOO WET, SOME STANDING WATER
1.0	to	2.0	PROSPECTS ABOVE NORMAL, SOME FIELDS TOO WET
0	to	1.0	MOISTURE ADEQUATE FOR PRESENT NEEDS
0	to	-1.0	PROSPECTS IMPROVED BUT RAIN STILL NEEDED
-1.0	to	-2.0	SOME IMPROVEMENT BUT STILL TOO DRY
-2.0	to	-3.0	DROUGHT EASED BUT STILL SERIOUS
-3.0	to	-4.0	DROUGHT CONTINUES, RAIN URGENTLY NEEDED
BELOW		-4.0	NOT ENOUGH RAIN, STILL EXTREMELY DRY

eastern Montana, and New England. The PDI and CMI values are updated weekly throughout the growing season. In 1980 the soil moisture situation changed dramatically from very favorable at the time of planting or emergence from dormancy on April 12 to very unfavorable by July 19, 1980 (Figure 3). While the drought continued to intensify through the remainder of the growing season, the yield reductions had already taken their toll.

The crop yield reduction due to drought in 1980 was unlike most drought yield loss patterns in the United States during the 1930s and 1950s, because early season moisture was highly favorable. The 1980 drought featured the rapid withdrawal of the available soil moisture and an almost complete absence of rainfall in many areas during the critical periods for crop development through the late vegetative and reproductive stages.

Data for Wichita Falls, Texas, (Figure 4) vividly portrays the grimness of the pattern common to the hardest hit areas. After a near normal spring at Wichita Falls, rainfall during the key vegetative, reproductive stages was limited to 0.55 inches for June, July, and August combined--the driest summer since available records began in 1940. June was the driest, July second driest, and August the sixth driest, but the June-July and June-July-August periods were the driest since 1940.

For countries or regions where a systematic soil moisture index has not been developed, the antecedent moisture may be estimated and monitored by the cumulative precipitation maps expressed as total



NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

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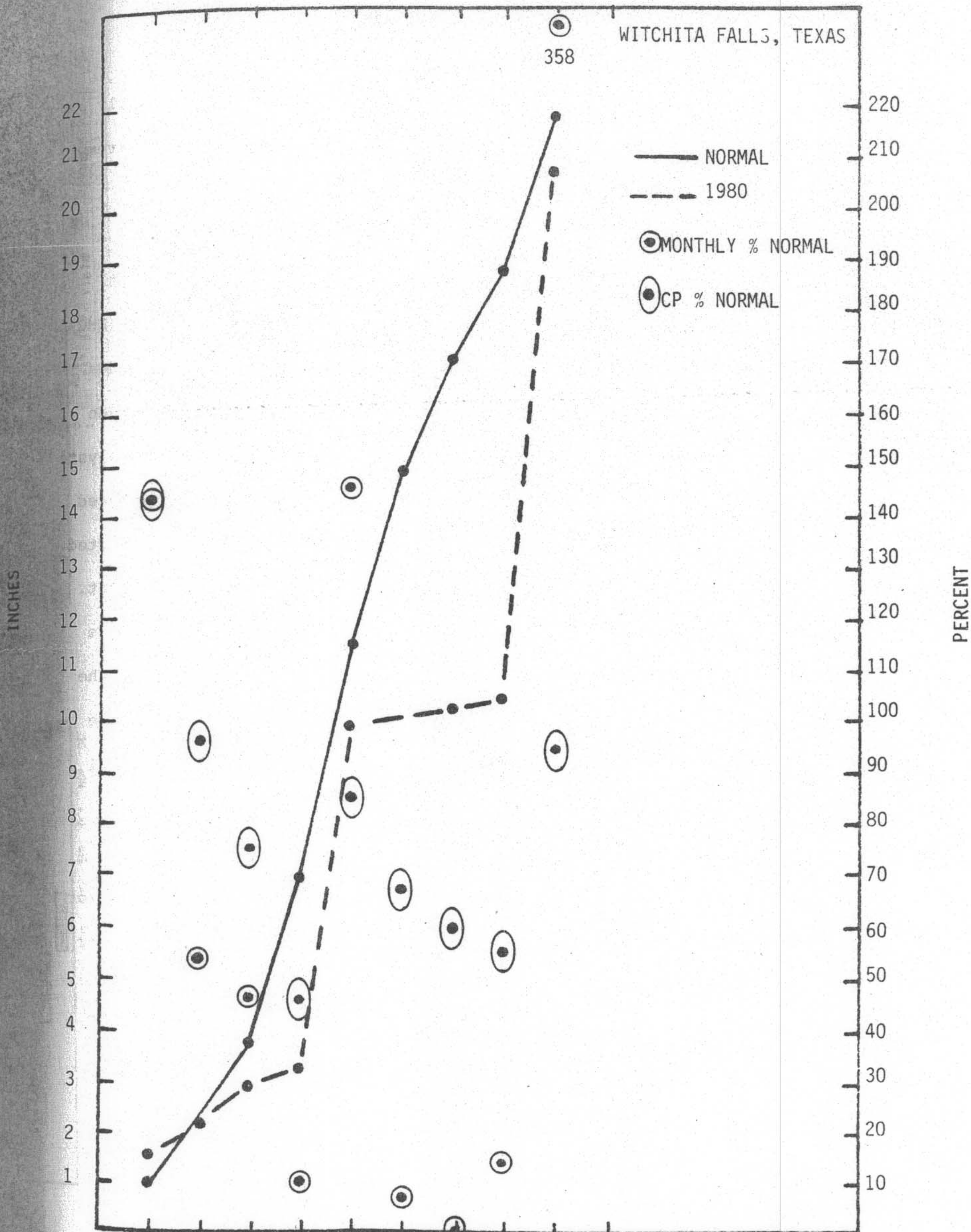
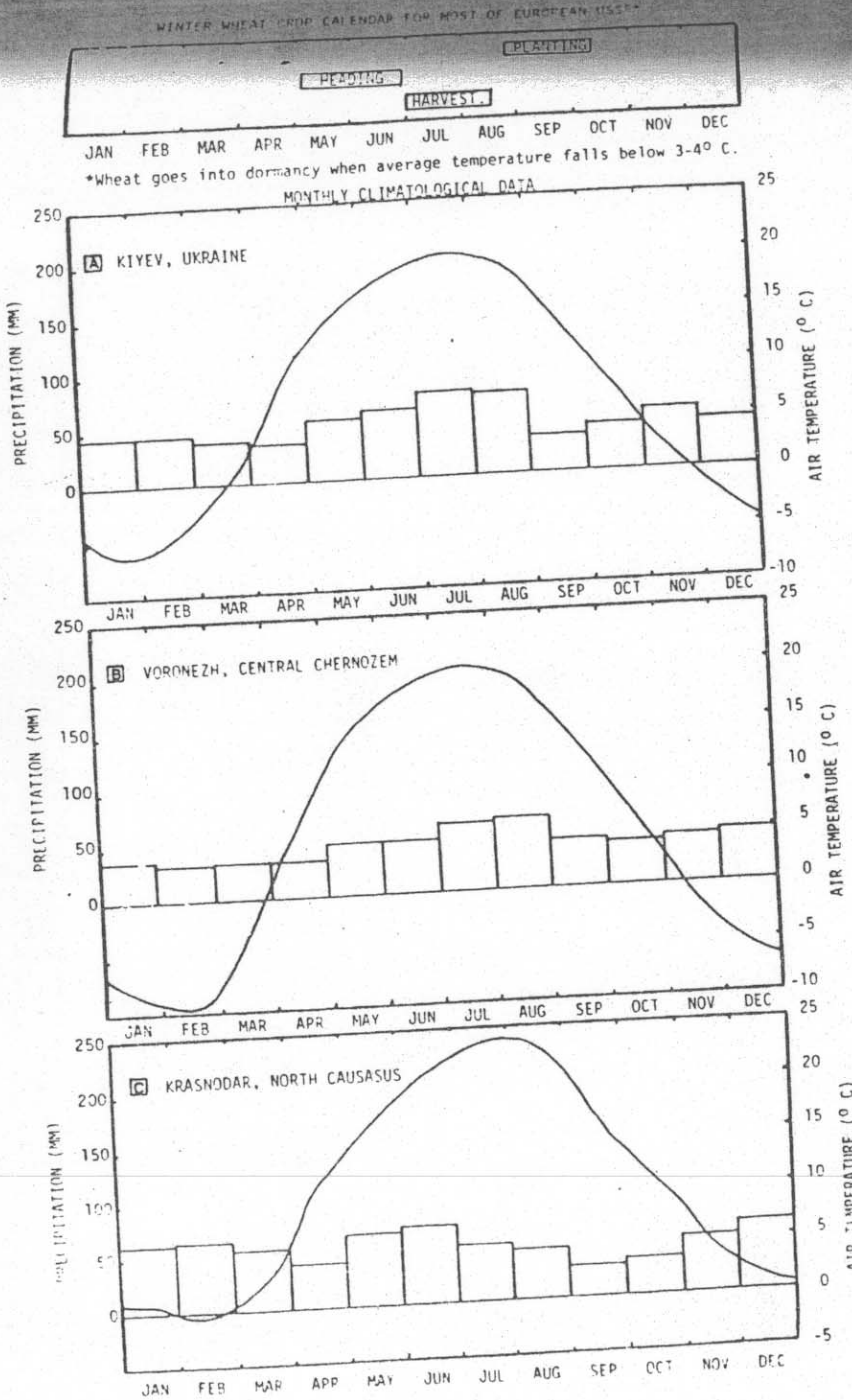
Figure 4


WITCHITA FALLS, TEXAS
358
NORMAL
1980
MONTHLY % NORMAL
CP % NORMAL
INCHES
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
PERCENT
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10

precipitation and/or percent departure from normal.

The progress of the growing season is then followed on a daily basis by monitoring for any significant weather event such as extreme seasonal hot or cold temperatures, heavy rainfall, extended dry periods, unseasonable frost, high winds, flooding, and the like. A series of critical meteorological data, adjusted for the different crop states, is maintained in the National Meteorological Center (NMC). Computers automatically monitor the flow of incoming data for values exceeding these stated limits. These selected observations are then printed out as episodal events and used as indicators to alert analysts of potential problem areas. These can then be reviewed and evaluated against any other available information to ascertain the area affected and likely impact on crops at their respective stages of development. In 1980, these problems included not only a record-setting heat wave over the United States but an extended drought in Australia. In the USSR, the problem was excessive moisture. The weather events can be related to crop stage of development, initially using the historical crop calendar data as a reference for normal crop progress by area (Figures 5-6).[2] Adjustments to the normal crop development pattern can be estimated using the concept of Growing Degree Days (GDD) and/or field reports that indicate areas where crop progress may be early or late (Figures 7-8). Similarly, the monitoring of daily temperatures may be used to indicate when winter grains likely begin their spring growth (Figure 9). Thus, temperature, which is also used to compute GDD, is a critical parameter for analysis of crop conditions.

Figure 5



USSR WINTER WHEAT STATISTICS BY REGION 1)
(1970/71 to 1974/75 Crop Year Average)

	Area Harvested (1,000 ha)	Yield (T/ha.)	Production (1,000 T)	Production (%)
Ukraine	6,539	2.94	19,194	48
North Caucasus	4,513	2.46	11,100	28
Volga	1,557	1.82	2,832	7
Central Chernozem	965	2.23	2,148	6
Central	870	1.73	1,501	4
Baltics	284	2.67	759	2
Moldavia	236	3.18	750	2
Belorussia	344	2.13	731	2
Volga-Vyatka	260	1.57	407	1
Total	15,568	2.53	39,422	100

These regions produce about 90 of total USSR winter wheat crop.

1) Based on unofficial data; thus, totals may not exactly agree with data in table below.

USSR HISTORICAL CROP YEAR WHEAT* STATISTICS

Crop Year	Area Harvested (1,000 ha.)	Yield (T/ha.)	Production (1,000 T)	Ending Stocks (1,000 T)	Exports (1,000 T)
1970/71	65,230	1.53	99,734	6,000	7,203
1971/72	64,035	1.54	98,760	9,000	5,828
1972/73	58,492	1.47	85,993	11,000	1,300
1973/74	63,155	1.74	109,784	24,000	5,000
1974/75	59,676	1.41	83,913	13,000	4,000
1975/76	61,985	1.07	66,224	2,000	500
1976/77	59,467	1.63	96,882	10,000	1,000
1977/78	62,030	1.49	92,161	1,000	1,000
1978/79	62,898	1.92	120,820	19,000	4,000
1979/80	57,682	1.56	90,100	4,000	500
Average (1970/71-1979/80)	61,465	1.54	94,437	9,900	2,783

*Winter wheat comprises about 40 to 50% of total USSR wheat production (based on 1965-1974 figures) depending upon weather conditions in winter and spring wheat areas.

Figure 6

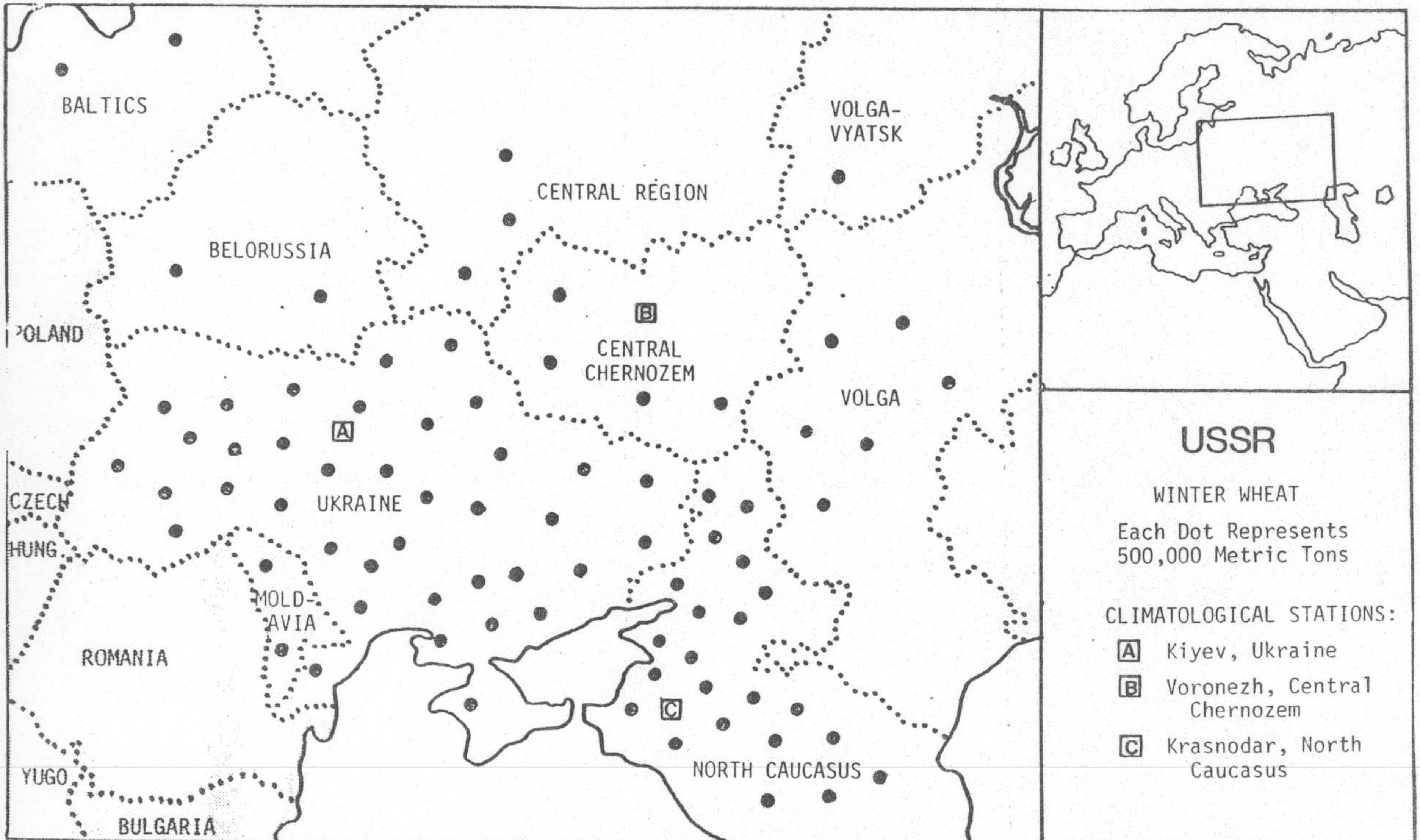

BALTICS
BELORUSSIA
POLAND
CZECH
HUNG.
ROMANIA
YUGO.
BULGARIA
MOLD-
AVIA
UKRAINE
CENTRAL REGION
CENTRAL
CHERNOZEM
VOLGA-
VYATSK
VOLGA
NORTH CAUCASUS
A
B
C
USSR
WINTER WHEAT
Each Dot Represents
500,000 Metric Tons
CLIMATOLOGICAL STATIONS:
A Kiyev, Ukraine
B Voronezh, Central Chernozem
C Krasnodar, North Caucasus

Figure 7

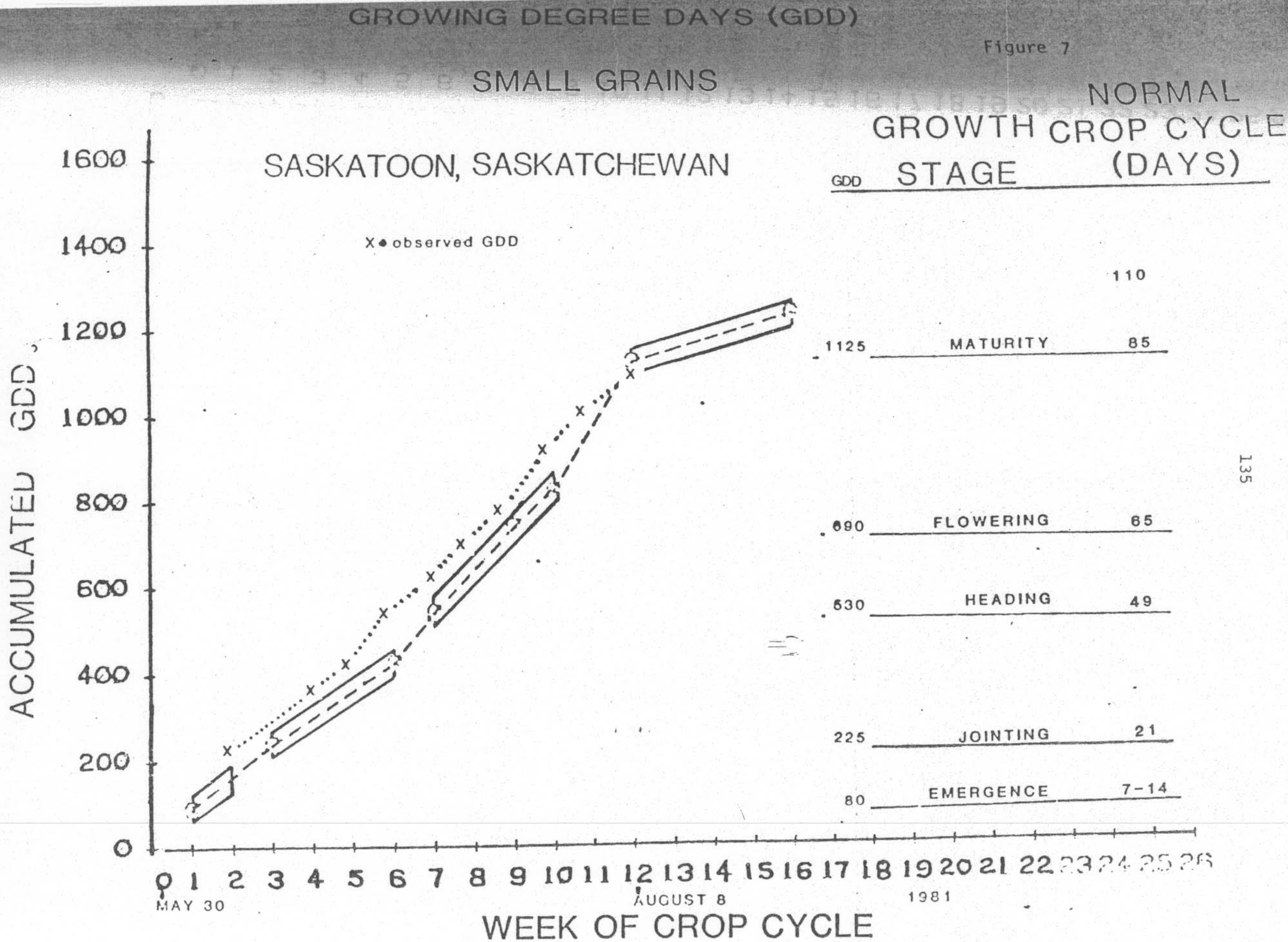

GROWING DEGREE DAYS (GDD)
SMALL GRAINS
SASKATOON, SASKATCHEWAN
X• observed GDD
ACCUMULATED GDD
1600
1400
1200
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
MAY 30
AUGUST 8
1981
WEEK OF CROP CYCLE
GDD
GROWTH STAGE
NORMAL CROP CYCLE (DAYS)
110
1125
MATURITY
85
690
FLOWERING
65
530
HEADING
49
225
JOINTING
21
80
EMERGENCE
7-14

Figure 8

GROWING DEGREE DAYS (GDD)

Indianapolis, Indiana

CORN

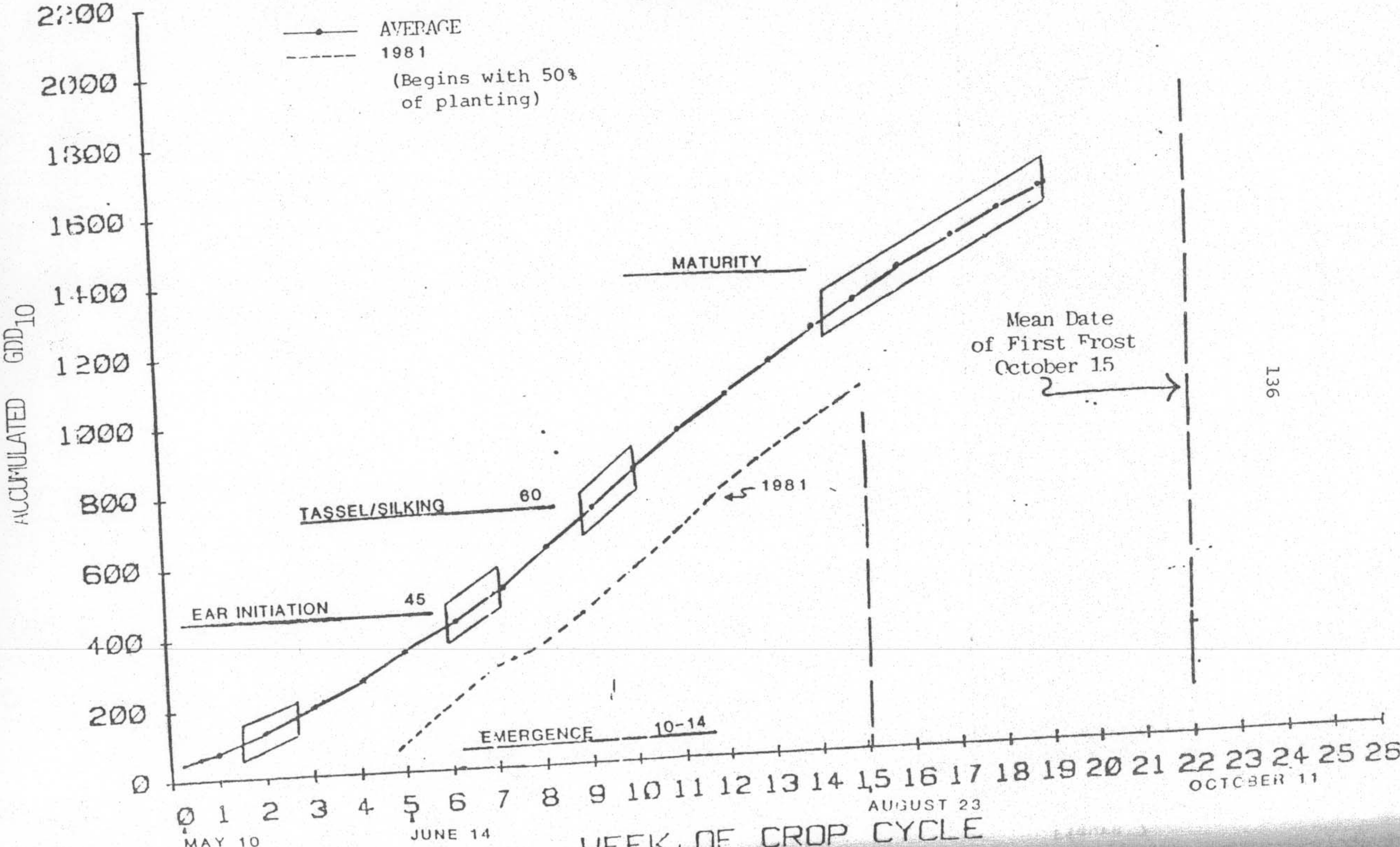
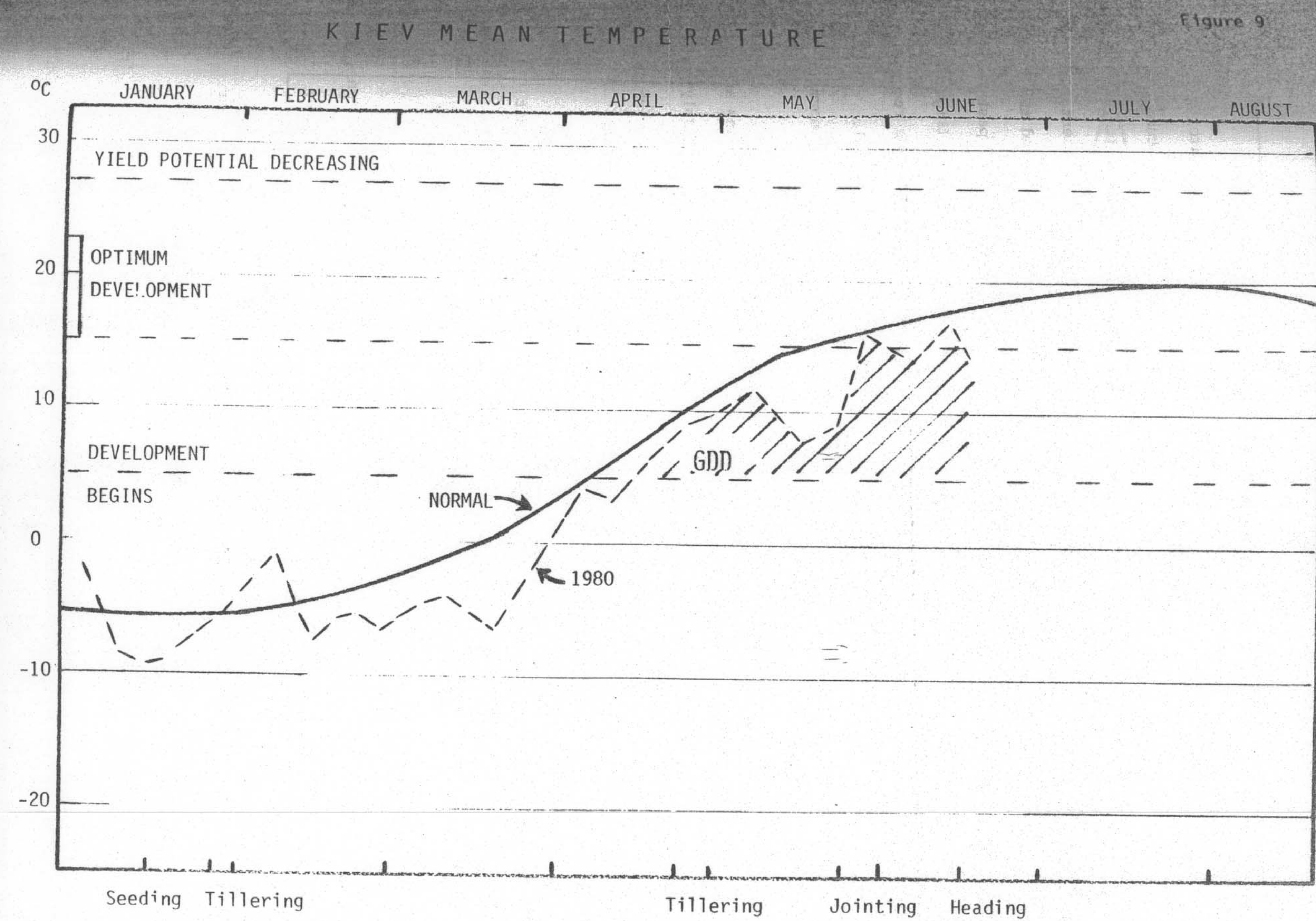


Figure 9



K I E V M E A N T E M P E R A T U R E
°C
30
20
10
0
-10
-20
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
YIELD POTENTIAL DECREASING
OPTIMUM
DEVELOPMENT
DEVELOPMENT
BEGINS
NORMAL
1980
GDD
Seeding
Tillering
Tillering
Jointing
Heading

Precipitation is another important potential yield indicator at critical stages of plant development. Given favorable temperatures, the key factor in 1980 for corn yields in Argentina was precipitation during January and February. The yield series for the most recent 10 years provides an estimate of technology levels (Figure 10), and the key monthly totals of precipitation can be related to observed past yields as an indicator of potential yield for the current year (Figure 11). In this case, January is a critical month and the previous record yields of 1977 were in part related to generous January rainfall. Similarly, the low yields of 1975 and 1979 are related to below-normal rainfall in January of these years.

For the United States, the key elements for corn and soybeans are soil moisture during the growing season and temperatures during July and August. The 1980 heat wave reached into the Corn Belt about the time of tasseling, and even where soil moisture levels were still adequate, pollination was adversely impacted, particularly in the South and West sections of the corn and soybean regions with lowest yields.

Economic Considerations

For 1980, early indications of potential crop-weather impacts on yields and production for the major crops was particularly important in making adjustments of probable price and commodity utilization prospects. The economic setting in the late spring and early summer was characterized generally by expectations of weak economic growth,

Figure 10

ARGENTINA CORN--YIELDS

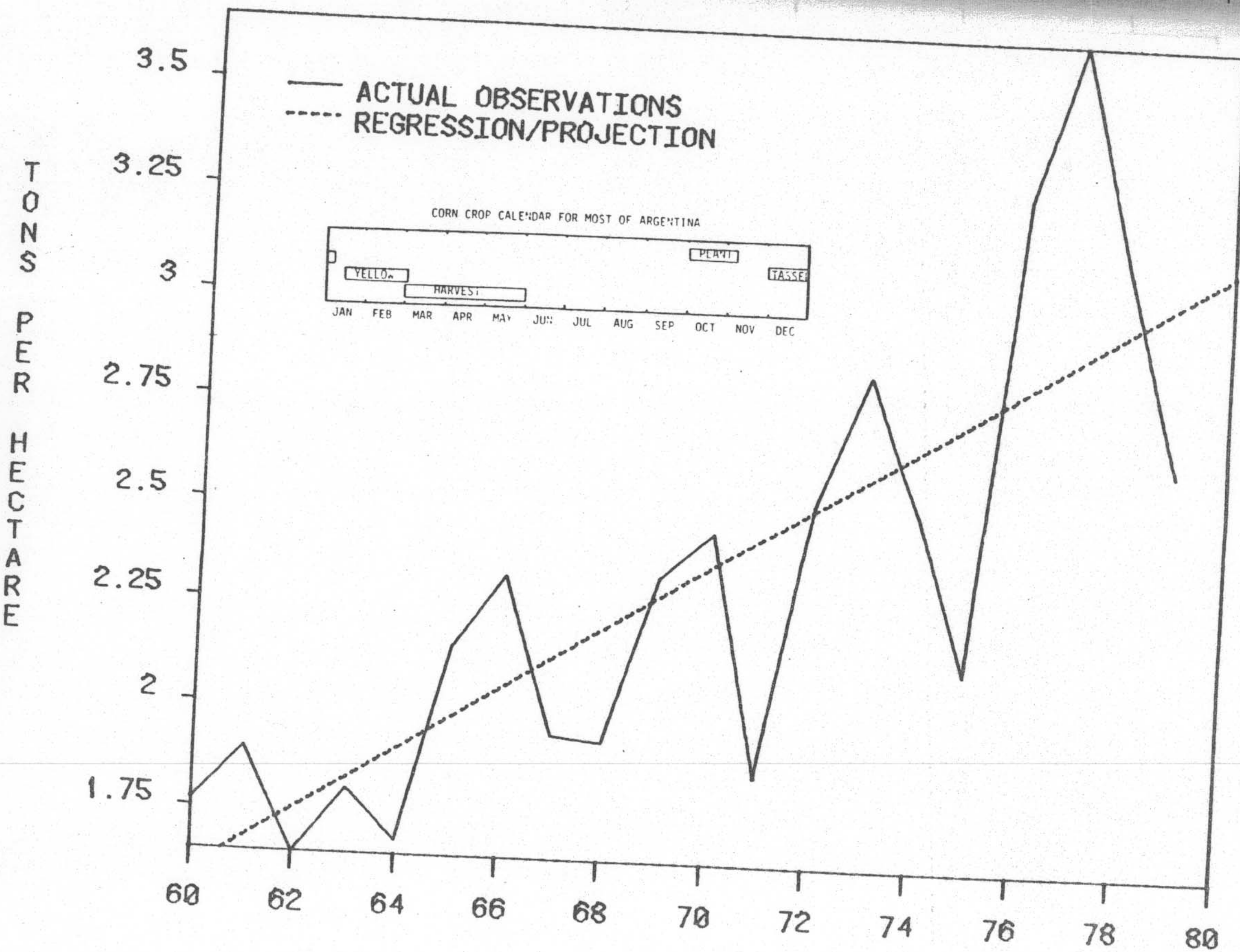
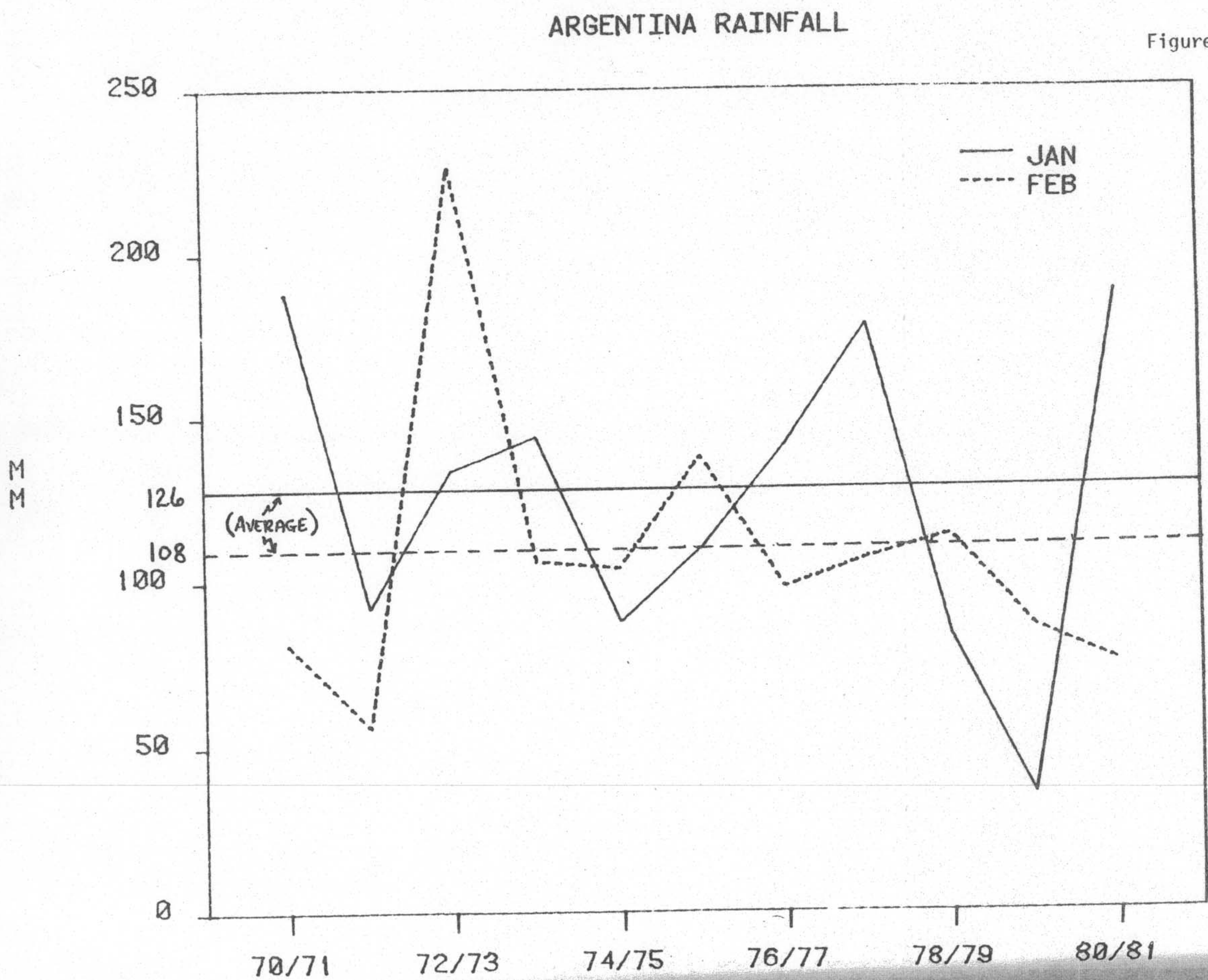


Figure 11


ARGENTINA RAINFALL
JAN
FEB
250
200
150
126
108
100
50
0
M
M
(AVERAGE)
70/71
72/73
74/75
76/77
78/79
80/81

high inflation, high interest rates, and very ample supplies of agricultural commodities, particularly in the United States. Inventories of corn and soybeans were at record high levels and the winter wheat crop certainly was as likely to be as large as the very large 1979-80 crop. It also was an election year adding to uncertainty about the path of monetary and fiscal variables in the year ahead outlook.

The USDA's initial supply-demand forecasts in May for major crop commodity prices and use for 1980-81 reflected the general pessimism about demand prospects and expected large crop supplies. Forecasts for season average prices for both soybeans and corn were essentially unchanged from the previous year average prices which were at the lowest level in 10 years on an inflation-adjusted basis. The only thing certain about 1980-81 forecasts, as the season progressed, was that they would be wrong.

As part of the USDA effort to understand sources of forecast errors, objective analysis of USDA's commodity forecasts, including those for 1980-81, is needed periodically if the market assessment work is to show continued improvement, but that is too large a task for this paper. However, the 1980-81 experience does highlight many of the most difficult areas in terms of improving our commodity forecasts. These are illustrated by the 1980-81 forecasts for soybeans summarized in Tables 1 and 2.

The annual forecasts for U.S. soybean supply, price, and use for the marketing year beginning in September are initiated in May, and extended to world forecasts in July. Initiation of forecasts for

Table 1. Forecast Track Record: Oilseed Production

	Annual Forecasts as of:									
	May	July	Aug.	Sept.	Oct.	Nov.	Feb.	May	July	FINAL
Soybeans										
United States										
1978-79	47.0	49.0	48.04	48.24	48.77	49.27	50.15	50.15	50.15	50.86
1979-80	52.65	55.32	57.95	59.17	60.24	60.85	61.72	61.72	61.72	61.72
1980-81	56.70	55.50	51.18	49.84	47.82	48.30	49.45	49.45	49.45	48.77
Major foreign exporters										
1978-79	-	-	-	-	-	-	14.88	14.88	15.18	14.48
1979-80	-	18.55	18.55	18.55	18.55	18.65	19.35	20.10	19.25	19.44
1980-81	-	20.21	20.21	20.21	20.10	19.80	20.00	20.45	20.35	19.90
World less U.S.										
1978-79	-	-	-	-	-	-	29.35	29.67	29.94	26.45
1979-80	-	33.64	34.14	34.14	34.12	34.22	34.88	33.56	32.65	31.97
1980-81	-	33.84	33.74	33.56	33.37	33.31	32.32	33.02	32.88	32.54
Other oilseeds										
United States										
1979-80	-	9.8	10.0	10.2	11.1	10.6	10.6	10.5	10.5	10.9
1980-81	-	9.5	8.4	7.8	7.3	7.0	6.8	7.0	7.0	7.2
Difference	-	-1.4	-2.5	-3.1	-3.6	-3.9	-4.1	-3.9	-3.9	-3.9
World less U.S.										
1979-80	-	76.1	74.7	73.4	72.7	72.6	76.7	72.5	72.8	69.1
1980-81	-	73.2	73.5	73.0	73.2	72.6	76.8	73.8	73.4	72.1
Difference	-	4.1	4.4	3.9	4.1	3.5	3.7	4.7	4.3	3.0

Table 2. Soybean Forecast Track Record: United States Supply, Use and Price

SOYBEANS	Unit	Forecasts as of: May[a]	July	Aug.	Sept.	Oct.	Nov.	Feb.	May	July	FINAL
Yield	Bu./acre										
1978-79		-	28.5	27.9	28.0	28.3	28.6	29.2	29.2	29.2	29.5
1979-80		-	28.8	30.3	30.9	31.5	31.8	32.2	32.2	32.2	32.1
1980-81		-	29.5	27.4	27.0	26.1	26.5	26.8	26.8	26.8	26.8
Production	Mil. bu.										
1978-79		1,725	1,800	1,765	1,772	1,792	1,810	1,843	1,843	1,834	1,870
1979-80		1,935	2,032	2,129	2,174	2,213	2,236	2,268	2,268	2,268	2,268
1980-81		2,082	2,040	1,880	1,831	1,757	1,775	1,817	1,817	1,817	1,792
Beg. Stocks	Mil bu.										
1979-80		-	150	155	160	173	173	174	174	174	174
1980-81		400	380	400	370	359	359	359	359	359	359
1981-82		275	295	345	345	320	-	-	-	-	320
Crush	Mil. bu.										
1978-79		930	975	965	960	970	980	1,000	1,010	1,020	1,018
1979-80		980	1,060	1,080	1,090	1,090	1,090	1,100	1,120	1,130	1,123
1980-81		1,120	1,105	1,050	1,050	1,040	1,040	1,065	1,050	1,040	1,020
Exports	Mil. bu.										
1978-79		650	730	720	720	730	740	775	800	770	739
1979-80		825	800	825	825	825	825	820	825	850	875
1980-81		838	862	835	835	825	825	800	760	750	724
Prices	$/bu.										
1978-79		6.25	6.00	6.00	6.00	6.25	6.50	6.50	6.75	6.75	6.66
1979-80		7.50	7.50	6.25	6.12	6.12	6.12	6.20	6.10	6.19	6.28
1980-81		6.38	6.75	7.75	8.20	8.60	8.60	7.75	7.55	7.55	7.61

[a] First forecast of marketing year.

soybeans in May or July is increasingly more difficult because of the growing influence of the South American crop which is not planted until November and December and harvested the next April and May or about midway through the U.S. crop year. In addition, soybeans have substantial competition from other oilseeds and oils. Considerable effort has been made to compile data bases and improve the monitoring of the current supply, price and utilization rates of these competitors. Other oilseeds and oils, including palm, have been quite influential at times in affecting price and utilization changes for soybean oil. While these factors require considerable attention, production estimates for other oilseeds outside the United States were on target in 1980-81. However, palm oil supply and export availabilities were generally much greater than anticipated in those early soybean and soybean product supply and use estimates. Ultimately, more comprehensive accounts for total vegetable oils and parameters for assessing their market price impacts are needed.

Nevertheless, a review of Table 1 does indicate that USDA's world soybean production estimates outside the United States were not a source of error in the 1979-80 or 1980-81 forecasts for soybeans. The largest single forecast error for the soybean complex in 1980-81 was the shortfall in U.S. production of all oilseeds, and closely competing crops such as corn. The full implications of U.S. crop problems for soybeans were not indicated in USDA forecasts until August following the objective yield survey on August 1.

Earlier season estimates were based largely on trend with little or no allowance for weather-related factors. Hopefully, weather inputs in our current yield modeling efforts should provide greater early season crop estimation capability and lead to more timely adjustments to assessments about price and use prospects in the future. The importance of such crop production assessments are indicated in Table 4 for 1980-81 by examining sources of probable variation in soybean prices attributed to various economic and physical factor changes. The price parameters used are based on various econometric studies supplemented by qualitative judgments where specific quantitative results are not available (1, 2, 3, 4, 5).

The results summarized in Table 4 indicate that initial price forecasts for soybeans in May were subsequently changed over the May-October period, principally because of U.S. crop production changes. The big change for forecasted soybean prices occurred in the May-August revision following a reduction of 202 million bushels in soybean production, a 540-million-bushel decline in corn production and over a 1-million-metric-ton decline in other oilseeds production in the U.S. Large corn stocks held in the farmer-owned reserve and significant corn holdings by the Commodity Credit Corporation (CCC) were offsetting factors which moderated price increases for corn as well as for soybeans.

The $1.37 per bushel increase in the soybean price forecast between May and August was due primarily to the reduced crop estimates. Significant upward revisions in livestock price prospects for 1981 also was a factor in higher price forecasts for soybean meal and soybeans

Table 3. Corn: U.S. Supply-Demand Forecasts for 1980-81

	May 1980	July 1980	Aug. 1980	Sept. 1980	Oct. 24 1980	Nov. 1980	Feb. 1981	May 1981	July 1981	FINAL
Beginning stocks	1686	1676	1701	1701	1597	1597	1617	1617	1617	1617
Production	6500-7900	7284	6646	6534	6467	6461	6648	6648	6648	6648
Feed use	4000-4500	4350	4150	4150	4200	4200	4350	4100	4150	4112
Exports	2350-2700	2600	2500	2500	2550	2600	2600	2550	2500	2370
Ending stocks	900-1700	1261	983	871	600	544	566	866	866	1034
F.O.R.	-	450	150	-	-	-	-	-	100	190
CCC	-	300	260	260	-	-	50	240	240	240
Farm price	2.60	2.65	3.15	3.25	3.50	3.55	3.40	3.20	3.15	3.10

Table 4. U.S. Soybeans: Estimated Annual Price Changes for 1980-81 in Response to New Data on Supply and Demand

	Assumed unit change	Estimated price impact	May to Aug. change	Estimated Price impact[a]	May to Aug. change	Estimated price impact[a]	Oct. to final change	Estimated price impact[a]
Soybean								
U.S. production	100 Mil. bu.	-.65	-202	1.31	-1.23	0.80	35	-0.23
Other exporter production (SME)	1 Mil. Met. Ton	-.10	-	0.00	-.11	0.01	-.30	0.03
Oilseeds less soybean								
U.S. production	"	-.10	-1.1	0.11	-1.1	0.11	-0.2	0.02
Other world production	"	-.05	0.3	-0.02	-0.3	0.02	-1.1	0.06
Corn								
Farmer reserve	100 Mil. bu.	.08	-300	-0.24	0	0.00	175	0.14
Gov. purchase	"	.08	-40	-0.03	-269	-0.21	240	0.19
Exports	"	.11	-100	-0.11	50	0.06	-200	-0.22
Supply	"	-.12	-540	0.65	-283	0.34	201	-0.24
Livestock numbers	10%	.75	-1.4	-0.11	1.2	0.09	3.2	0.24
Livestock prices	10%	.10	16.5	0.17	-1.5	-0.02	-21.0	-0.21
Dollar exchange rate	10%	-.45	-0.6	0.03	0.4	-0.02	17.1	-0.77
Soybean price ($/bu.) Initial 1980-81 estimate = $6.38 Final price for 1980-81 = 7.61			1.37	1.76	0.85	1.18	-0.99	-0.99

[a] Estimated component price impacts based on parameters from various models and are not necessarily used in the preparation of the actual price forecast.

in August. Further upward revisions in soybean price forecasts through October also were principally attributed to a further reduction in U.S. supply estimates for soybeans and corn.

While the potential payoff for improved earlier season crop yield assessments in the United States is quite clear, other significant areas of concern are revealed particularly in the price forecast updates after October. These concerns are primarily demand oriented. The big factors in the case of soybeans were a combination of interest rate and exchange rate impacts along with trade policies particularly in major importing countries. Exchange rate adjustments over the full forecast period were considerable. A soybean trade weighted exchange rate for the U.S. dollar rose about 17 percent from October 1980 through July 1981 and reduced soybean prices perhaps by around 75 cents per bushel. Such an estimate is a very soft figure as exchange rate impacts are still quite uncertain despite estimates developed by various analysts. Quantitative estimates of interest rate impacts also are very rough. Their impacts were thought to be quite substantial in 1981 on soybean prices and may have accounted for around 50-cents-lower soybean prices in 1980-81. The incorporation of interest rate effects in the USDA price forecasts for corn and soybeans was done mostly by moderating the price forecasts based on anticipated interest rate changes.

In conclusion, the weather data did provide an effective indicator of areas where significant reduction in crop yields could be expected in the United States, Australia and USSR in 1980. Because the crop-weather assessment process is still evolving, much work remains to be accomplished to achieve full integration of weather data into the commodity analysis-projection work. Perhaps the largest single hurdle to be overcome is assembling high quality historic data bases for all major world crop regions. All known crop index concepts need further operational testing, but this approach has performed well as an indicator of production problems. Translating weather data into good yield forecasts still has to be done, and the researcher must, however, keep in mind that useful operational yield models will require extensive, timely data and computational support services. Models also must be relatively simple and incorporate known cause and effect relationships to enhance its credibility and usefulness. This is the focus of the next stage of our program development that we are now undertaking.

Footnotes

[1]JAWF meteorologists working in USDA's South Building are part of the NMC's support to Agriculture.

[2]Major World Crop Areas and Climatic Profiles, USDA/WAOB/JAWF, September 1981.

References

1. Baumes, Harry S., Jr. and W. H. Meyers. The Crops Model: Structural Equations, Definitions, and Selected Impact Multipliers. N.E.D. staff paper, ESCS, USDA, Mar. 1980.

2. Bredahl, Maury E., W. Meyers and Keith Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity", American Journal of Agriculture Economists, Vol. 61, No. 1, Feb., 1979, pp. 58 to 63.

3. Houck, J. P., M. E. Ryan and Abraham Subotnik. Soybeans and their Products. Minnesota: University of Minnesota Press, 1972.

4. Paarlberg, Philip L., The World Soybeans and Products Model: A Documentation. I.E.D. staff paper, ERS, USDA, June, 1981.

5. Womack, Abner. Feed Grain Outlook. 1981 Midwest Outlook Conference, Aug., 1981.

6. U.S. Department of Agriculture. Major World Crop Areas and Climatic Profiles. World Agriculture Outlook Board, Sept., 1981.