AgRISTARS

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

Early Warning and Crop Condition Assessment

February 1981

WHEAT STRESS INDICATOR MODEL, CROP CONDITION ASSESSMENT DIVISION (CCAD) DATA BASE INTERFACE DRIVER, USER'S MANUAL

~~Did not send to facility~~

NASA CR-161032

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(E82-10031) WHEAT STRESS INDICATOR MODEL, CROP CONDITION ASSESSMENT DIVISION (CCAD) DATA BASE INTERFACE DRIVER, USER'S MANUAL (Lockheed Engineering and Management) 15 p HC A02/MF A01 CSCL 02C G3/43

N82-19607

Unclas 00031

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
EW-L1-00711, JSC-17114		

4. Title and Subtitle	5. Report Date
Agristars: Early Warning & Crop Condition Assessment. Wheat Stress Indicator Model CCAD Data Base Interface Driver, User's Manual	February 1981
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
R. F. Hansen	LEMSCO - 16034, JSC-17114
	10. Work Unit No.

9. Performing Organization Name and Address	11. Contract or Grant No.
Lockheed Engineering and Management Services Company, Inc. 1830 NASA Road 1 Houston, Texas 77058	NAS 9-15800
	13. Type of Report and Period Covered
	User's Guide

12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code
National Aeronautics and Space Administration Lyndon P. Johnson Space Center Houston, Texas 77058 Tech Monitor: ~~F. Ravet~~ R. Roy Easton SH3	

15. Supplementary Notes

16. Abstract

This document gives detailed instructions on the use of the Wheat Stress Indicator Model CCAD Data Base Interface Driver. The purpose of this system is to interface the Wheat Stress Indicator Model with the CCAD operational data base. The interface driver routine decides what meteorological stations should be processed and calls the proper subroutines to process the stations.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Soil moisture model Wheat crop calendar Wheat stress indication	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified		

EW-L1-00711
JSC-17114

WHEAT STRESS INDICATOR MODEL CCAD DATA BASE INTERFACE DRIVER, USER'S MANUAL

Job Order 72-456

This report describes the Alarm Development activities of the Early Warning and Crop Condition Assessment project of the AgRISTARS project.

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LOCKHEED ENGINEERING AND MANAGEMENT SERVICES COMPANY, INC.

Under Contract NAS 9-15800

For

Earth Resources Research Division

Space and Life Sciences Directorate

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

February 1981

LEMSCO-16034

PREFACE

The Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing is a 6-year program of research, development, evaluation, and application of aerospace remote sensing for agricultural resources, which began in fiscal year 1980. This program is a cooperative effort of the National Aeronautics and Space Administration, the U.S. Agency for International Development, and the U.S. Departments of Agriculture, Commerce, and the Interior.

The work which is the subject of this document was performed within the Earth Resources (Research / Applications) Division, Space and Life Sciences Directorate, at the Lyndon B. Johnson Space Center, National Aeronautics and Space Administration. Under Contract NAS 9-15800, personnel of Lockheed Engineering and Management Services Company, Inc., performed the tasks which contributed to the completion of this research.

CONTENTS

1. GENERAL INFORMATION

1.1 SYSTEM NAME

This system is called Wheat Stress Indicator Model CCAD Data Base Interface Driver.

1.2 PRIMARY USER

The U.S. Department of Agriculture (USDA), Foreign Agriculture Service, Crop Condition Assessment Division (CCAD) personnel are the primary users of the system.

1.3 DEVELOPING ORGANIZATION

Personnel of the Lockheed Engineering and Management Services Company, Inc., developed the software that is reported in this document.

1.4 COMPUTER FACILITY DESCRIPTION

The Wheat Stress Indicator Model CCAD Data Base Interface Driver routine runs on a Programmed Data Processor, Model 11/70 (PDP 11/70) computer, with an Interactive Applications System (IAS) operating system and a Data Base Management System 11 (DBMS 11). It is implemented at the USDA Foreign Agricultural Service (FAS) in Houston, Texas.

1.5 REFERENCES

Data used for this manual were obtained from Wheat Stress Indicator Model documentation, at the CCAD Software Documentation Library, USDA FAS, Houston, Texas 77058.

2. SYSTEM DESCRIPTION

2.1 PURPOSE

The purpose of the system is to interface the Wheat Stress Indicator Model with the CCAD operational data base. The interface driver routine decides what

meteorological stations should be processed and calls the proper subroutines to process the stations.

2.2 USAGE

The system resides on the User Interface System (UIS) processor and must be executed on that processor. The PDS command is as follows.

PDS > RUN WHAZRD CR

The program will then be prepared for input from the terminal and will issue the statement:

INPUT 3 CHARACTER CROP CODE

XXX CR

INPUT RUN DEFINITION CARD. INPUT 0 TO STOP.

The run definition card is defined in figure 1. To end the run, a '0' (zero) must be input as an input card type.

3. INPUT

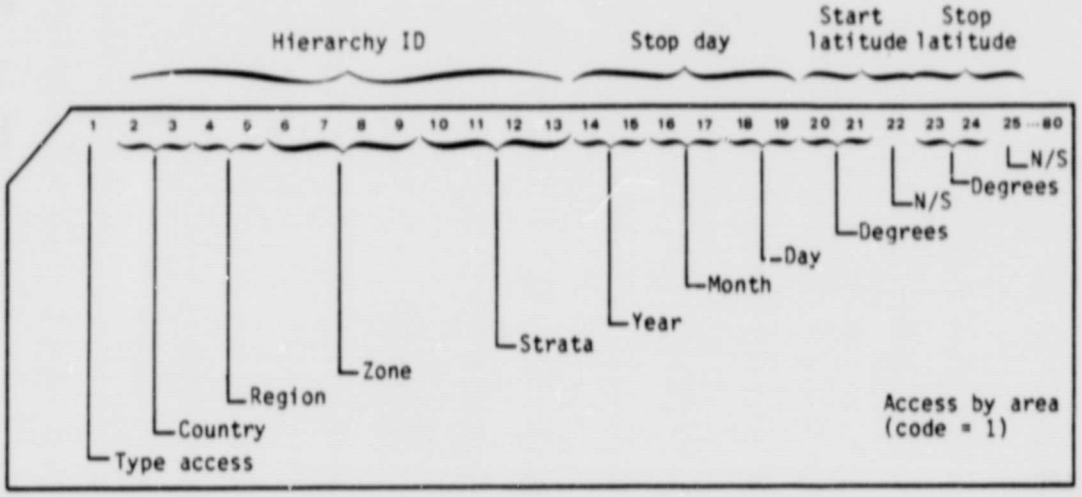
The model requires two types of input, disk and card, which are described as follows.

3.1 DISK

The model interfaces with the CCAD data base using the METS2P subschema. The formats used for the data and the methods of access are available from the CCAD Data Base administrator.

3.2 CARD

To run the model, two types of input cards are required, a crop card and a run definition card. The formats of the run definition cards are shown in figure 1. The format of the crop card is shown in figure 2.

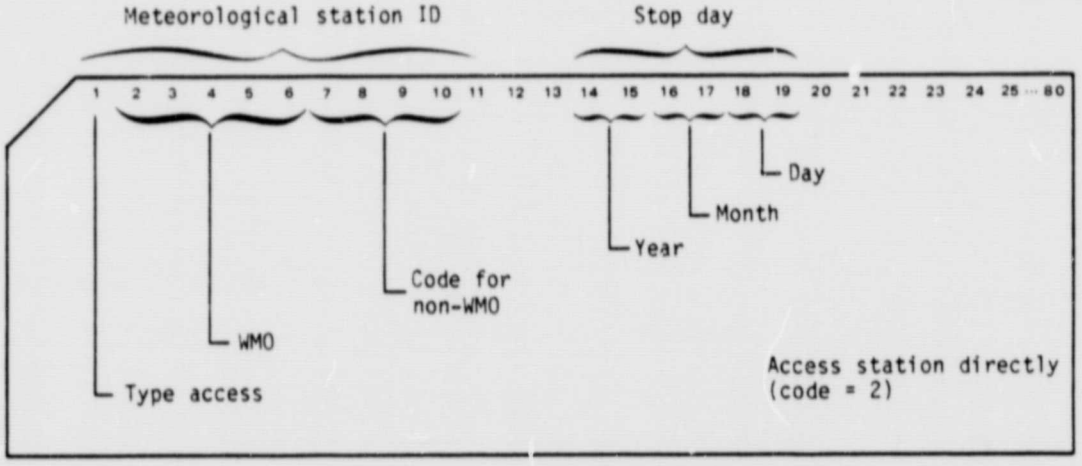


Hierarchy ID: Country only - Process all stations in country.
Country and region only - Process all stations in region.
Country, region, and zone - Process all stations in zone.
Country, region, zone, and strata - Process all stations in strata.

Stop day: Blanks - Use all meteorological data.
Date - Use meteorological data prior to date.

Start-stop latitudes: Blanks - Process all stations between 30° and 60°.
Latitudes - Process stations between input latitudes.

(a) Card and rules where code = 1



Meteorological station ID: Station ID - Process only this station.

Stop day: Blanks - Process all meteorological data.
Date - Process meteorological data prior to date.

(b) Card and rules where code = 2

Figure 1.- Run definition card formats for the Wheat Stress Indicator Model.

CROP CARD

The first card of the deck must be a crop card in the following format.

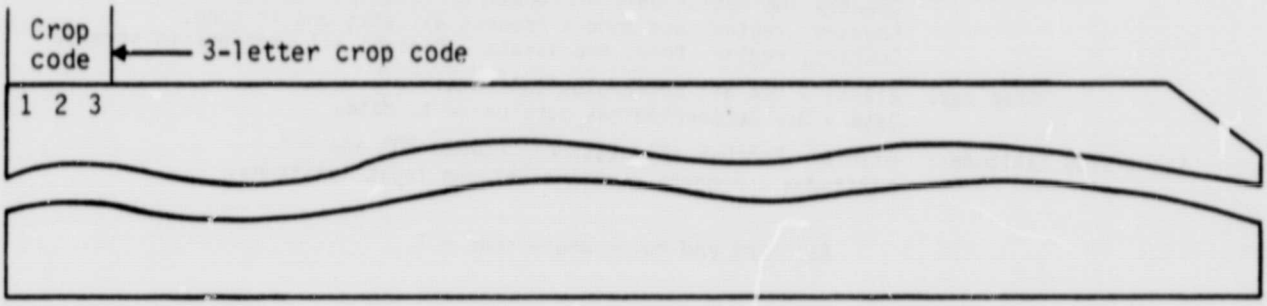


Figure 2.- Crop card format.

4. PROCESSING

4.1 INTERACTIVE

The model is designed to be operated in an interactive mode. All error messages are displayed on the cathode ray tube (CRT) terminal on which the run was initiated and will be displayed during execution. The output reports are written in files that are sent to the line printer immediately after the completion of the model run. The procedure for running the model is presented in paragraph 2.2.

4.2 BATCH

The model is not presently configured to run in a batch environment. A simple modification to the driver routine and task builder command file would be required in order to provide a batch capability.

4.3 EXECUTION FLOW

A flow chart of the model is provided in figure 3.

5. OUTPUT

Two types of output are provided from the model: disk and hard copy. They are described as follows.

5.1 DISK

For each day of meteorological data, the model creates a STN-PRODUCTS record for the day and stores it in the CCAD data base. The record contains the results of the model run for that day. The format for the STN-PRODUCTS record is available from the CCAD Data Base administrator.

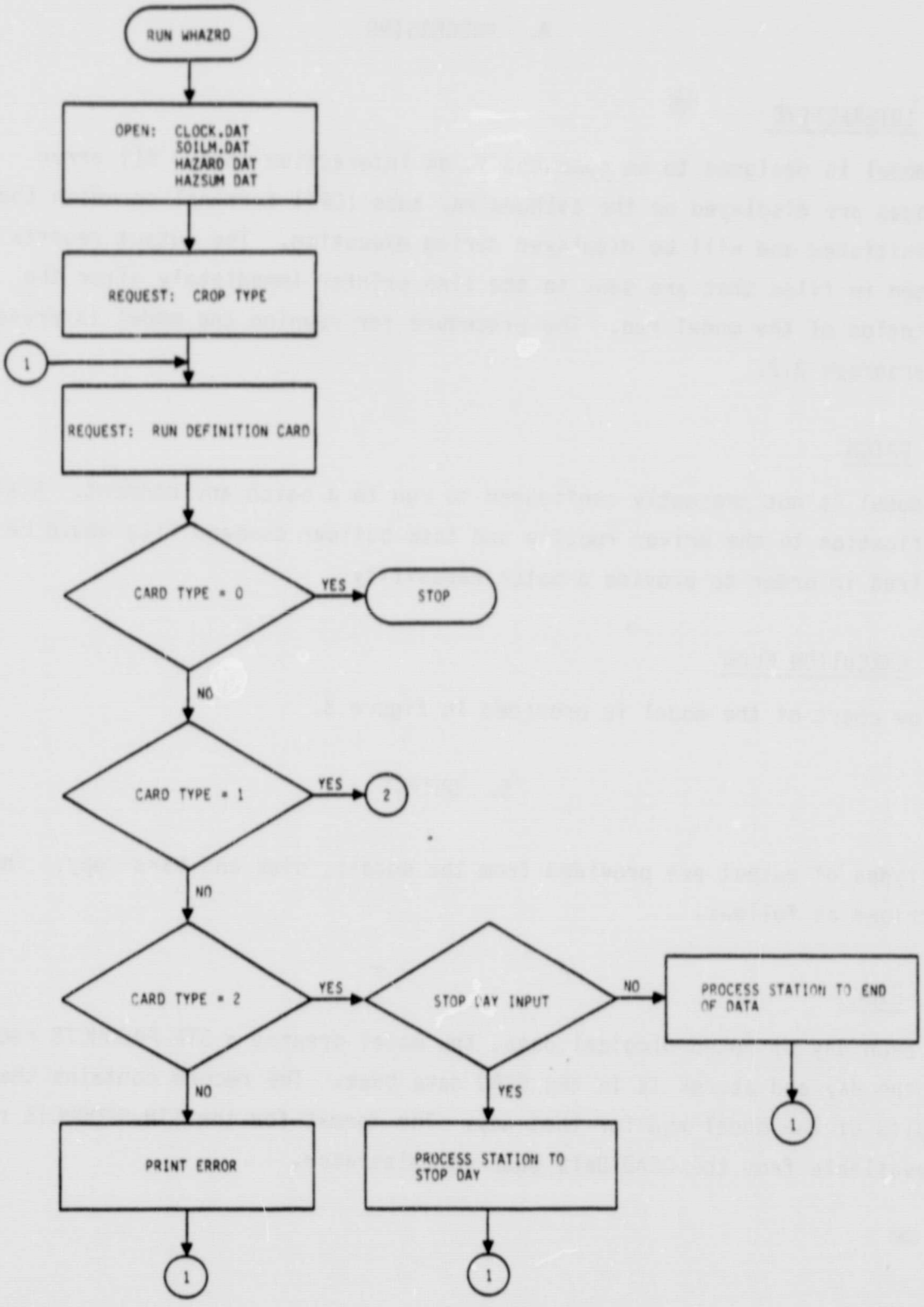


Figure 3.- Execution flow diagram.

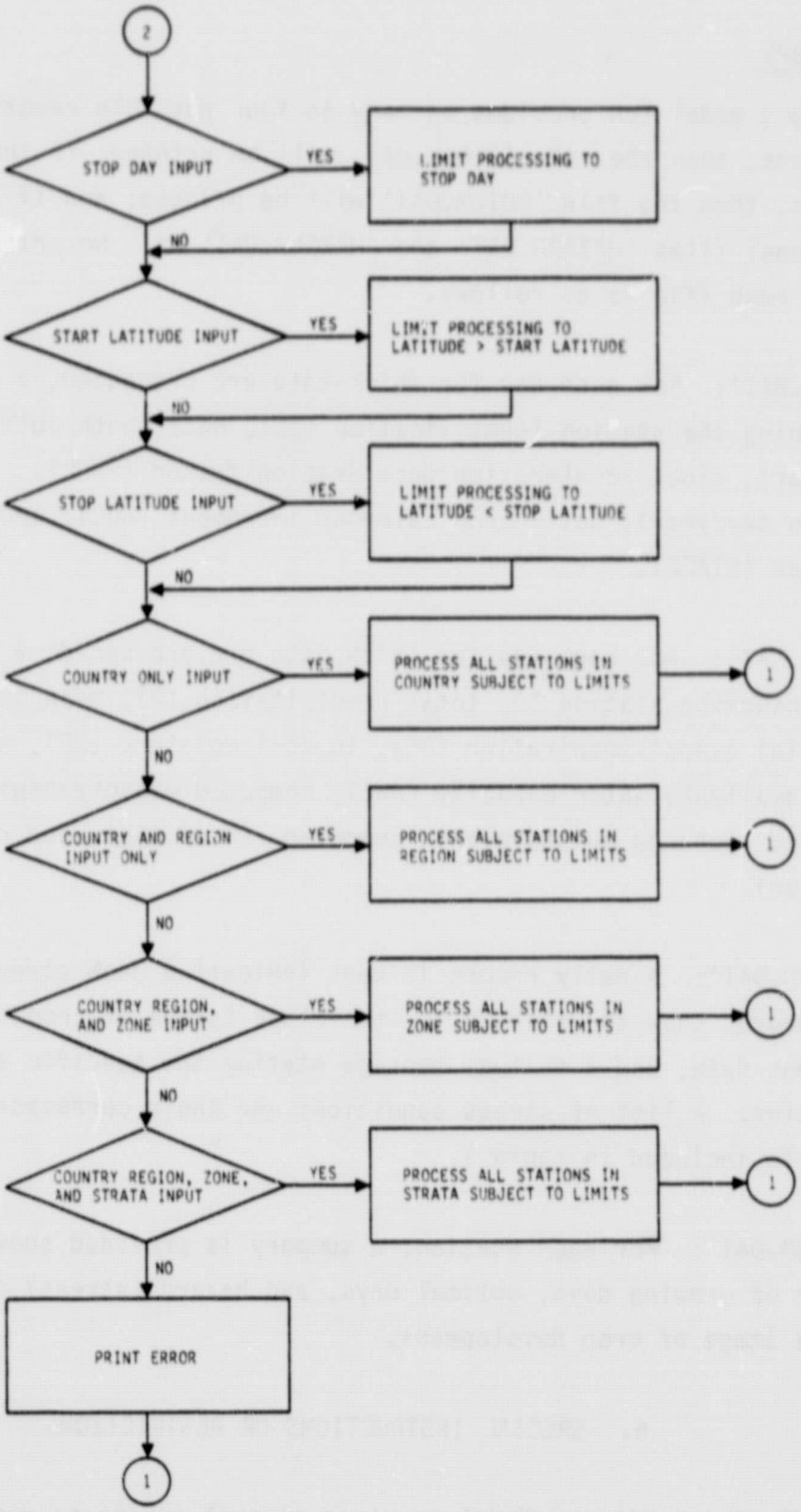


Figure 3.- Concluded.

5.2 HARDCOPY

Output from a model run provides as many as four possible reports. If the crop calendar runs, then the file 'CLOCK.DAT' will be printed; if the soil moisture budget runs, then the file 'SOILM.DAT' will be printed; and if both run, then the additional files 'HAZARD.DAT' and 'HAZSUM.DAT' will be printed. The content of each file is as follows.

A. 'CLOCK.DAT': For each day for which data are processed, a record is kept containing the station identification (ID), date (both Julian and calendar), clock acceleration/deceleration factor (FMULT), planting day (Julian day/year), daily crop calendar increment (ACC), and cumulative crop calendar (STAGE).

B. 'SOILM.DAT': For each day for which data are processed, a record is kept containing the station ID, total precipitation (P), mean temperature (T), potential evapotranspiration (PE), topsoil moisture (SS), subsoil moisture (SU), available water capacity (AWC), computed evapotranspiration (ET), computed recharge moisture (R), computed runoff (RO), and date (Julian and calendar).

C. 'HAZARD.DAT': A daily record is kept indicating each stress condition. The records show the station ID, the clock (stage of crop development), calendar date, and a textual message stating the specific stress condition. A list of stress conditions and their corresponding data base flags is included in table 1.

D. 'HAZSUM.DAT': For each station, a summary is provided showing the total number of growing days, optimal days, and hazard (stress) days with respect to the stage of crop development.

6. SPECIAL INSTRUCTIONS OR RESTRICTIONS

The Wheat Stress Indicator Model requires several inputs to run. The following rules have been implemented in the driver program.

TABLE 1.- HAZARD MATRIX

Stage	Stage description	Flag	Stress condition
Preplanting	Up to 10 days before planting	A1	Surface moisture < .12 in. (poor reseeding moisture)
Preplanting and Postplanting	From 10 days before planting to 12 days after planting	A2	Surface Moisture > .8 in. or precipitation > .2 in. (tractability problem-planting delay
Preemergence	0 ≤ Stage < 1.0	B1	Surface moisture < .12 in. (poor germination possible)
		B2	Minimum temperature < 37° F (poor germination possible)
Emergence	1 ≤ Stage < 1.2	C1	Surface moisture < .12 in.
		C2	Minimum temperature < 19° F (severe frost damage possible)
Tillering	1.2 ≤ Stage < 2.0	D1	Subsurface moisture < 25% of a capacity (AWC)
		D2	Minimum temperature < 19° F (severe frost damage possible)
Jointing	2.0 ≤ Stage < 3.0	E1	Subsurface moisture < 40% of capacity (AWC)
		E2	Minimum temperature < 19° F (severe frost damage possible
Heading	3.0 ≤ Stage < 3.6	F1	Subsurface moisture < 40% of capacity < (AWC)
		F2	Minimum temperature < 32° F (frost damage possible)
		F3	Maximum temperature ≥ 107° F (sterilization possible)
Soft dough	36 ≤ Stage < 4.0	G1	Subsurface moisture < 25% of capacity (AWC)
		G2	Minimum temperature < 32° F (frost damage possible)
		G3	Maximum temperature ≥ 107° F (sterilization possible)
Ripening	4.0 ≤ Stage < 4.5	H1	Subsurface Moisture < 10% of capacity (AWC)
		H2	Minimum temperature < 19° F (severe frost damage possible)

a. If any of the following data items are missing from the crop-station record (STN-PRODUCTS record), the soil moisture portion of the model will not process that station.

   COEFF1-COFB (CONB)

   COEFF2-COFI (CONI)

   COEFF3-FMULT (FMULT)

   WHC-S-COMPOSITE (AWC)

b. If the planting date (DATE-PLANTING) is missing from the crop-station record, the crop calendar portion of the model will not process that station.

c. At least one STN-PRODUCTS record per station must be stored in the data base to initialize the model for the run. If the STN-PRODUCTS record for a station is missing, the station will not be processed.

d. If any of the following data items are missing from the STN-PRODUCTS record, the soil moisture portion of the model will not process that station.

   EST-CDS (CROP STAGE)

   EST1-SOIL-MST (SURFACE MOISTURE)

   EST2-SOIL-MST (SUBSURFACE SOIL MOISTURE)