

# **FIELD CONDITIONS AT THE MARICOPA AGRICULTURAL CENTER, PINAL COUNTY, ARIZONA, SEPTEMBER 28, 1989**

By Sandra J. Owen-Joyce

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MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY  
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## CONVERSION FACTORS

For readers who prefer to use inch-pound units rather than metric (International System) units, the conversion factors for the terms used in this report are listed below:

<u>Multiply inch-pound unit</u>	<u>By</u>	<u>To obtain metric unit</u>
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.2818	foot (ft)
kilometer (km)	0.6214	mile (mi)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

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ABSTRACT

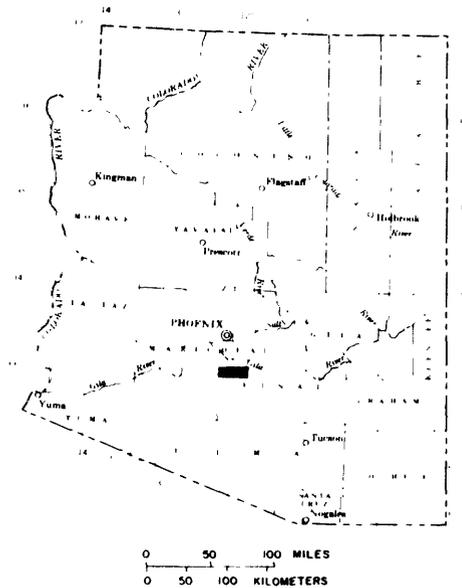
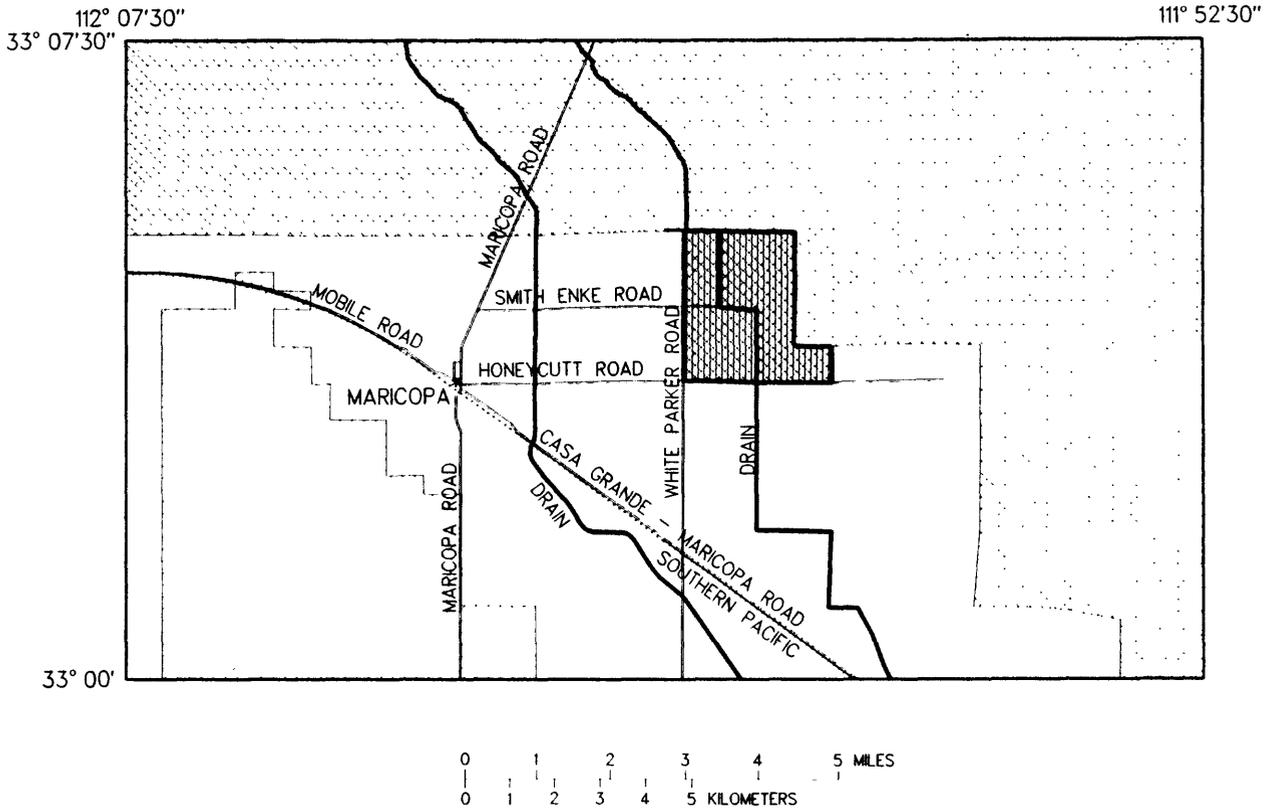
Field conditions were documented during the Landsat and SPOT satellite overpasses of the Maricopa Agricultural Center, Pinal County, Arizona, on September 28, 1989. Crop types were mapped and photographed for each demonstration farm field, and irrigation, cultivation, and orientation of rows are described. Field and photographic descriptions are presented in tabular and graphic form.

INTRODUCTION

The Remote Sensing Technology Transfer Experiment is being run at the University of Arizona Maricopa Agricultural Center (MAC) (fig. 1) by the University of Arizona to demonstrate the feasibility of remote-sensing techniques as an agricultural management tool. The purpose of the experiment is to investigate and implement potential commercial applications of this technology to agriculture with a long-term goal of providing the farmer with a "real time" management tool for (1) detection and early warning indicators of pest, water, and nutrient stress problems; (2) yield forecasting; and (3) efficient application of water, nutrients, and biologic pest-control substances.

The U.S. Geological Survey, in cooperation with the U.S. Bureau of Reclamation, is conducting research to evaluate the spatial and temporal variability of point data collected at weather stations for use with satellite-image data in estimating local evapotranspiration. The data collection at the weather stations is being done under contract with the University of Arizona. This work is being done at MAC during the Remote Sensing Technology Transfer Experiment under an umbrella agreement whereby scientists that work independently can cooperatively share the data collected. This report documents the field conditions at the time of the Landsat and SPOT overpasses on September 28, 1989.

Field conditions have been documented previously at MAC to correspond with the acquisition of satellite imagery. Data on crop types are available for June 1988 (Owen-Joyce, 1988), April 1989 (Owen-Joyce, 1989a), and June 1989 (Owen-Joyce, 1989b).



**EXPLANATION**

-  MARICOPA AGRICULTURAL CENTER, UNIVERSITY OF ARIZONA
-  GILA RIVER INDIAN RESERVATION
-  AK-CHIN INDIAN RESERVATION
-  PRIVATE OWNERSHIP

**INDEX MAP SHOWING STUDY AREA (SHADED)**

**Figure 1.--Location of the Maricopa Agricultural Center, Pinal County, Arizona.**

## FIELD CONDITIONS

Ground-truth data were collected to coincide with the Landsat and SPOT satellite overpasses on September 28, 1989. The data include crop type for each field on the demonstration farm, a description of the crop and field conditions, and photographs (35-millimeter slides) of the fields. Photographs were taken on September 28 to document field conditions and to provide ground truth for interpretation of the satellite data. Photographs were taken also on September 28 of participating scientists and their equipment during data collection.

Crop types and descriptions of the fields are presented in table 1. Field boundaries and the crop type in each demonstration farm field are shown in figure 2. The generalized location from which each photograph was taken, the direction of view, and a brief description of conditions that the photograph documents are listed in table 2. The location from which photographs documenting field conditions were taken are shown in figure 3; where possible, these photographs were taken viewing 180° away from the sun. Selected slides were duplicated and are available at the U.S. Water Conservation Laboratory, Phoenix, Arizona; these slides are footnoted in table 2.

Conditions were also noted in the fields outside the farm but immediately adjacent to boundary roads of the demonstration farm. Cotton is planted east of field 11, north of fields 25, 26, and 39, northwest of field 39, west of fields 37-39, and southeast of field 27. North of fields 19-22 is natural desert vegetation. Fields east of field 19 and north of field 23 are fallow. Southwest of field 27 is natural desert vegetation and houses. South of the west half of field 27, cotton is planted. South of the east half of field 27, cotton is planted in the east half and the west half is fallow. West of fields 27 to 3201, the land is planted with mature pecan trees. West of fields 33-36, the fallow land has some weeds.

## REFERENCES

- Owen-Joyce, S.J., 1988, Field conditions at the Maricopa Agricultural Center, Maricopa County, Arizona, June 13, 1988: U.S. Geological Survey Open-File Report 88-708, 5 p.
- Owen-Joyce, S.J., 1989a, Field conditions at the Maricopa Agricultural Center, Pinal County, Arizona, April 9, 1989: U.S. Geological Survey Open-File Report 89-377, 14 p.
- Owen-Joyce, S.J., 1989b, Field conditions at the Maricopa Agricultural Center, Pinal County, Arizona, June 16, 1989: U.S. Geological Survey Open-File Report 89-392, 11 p.

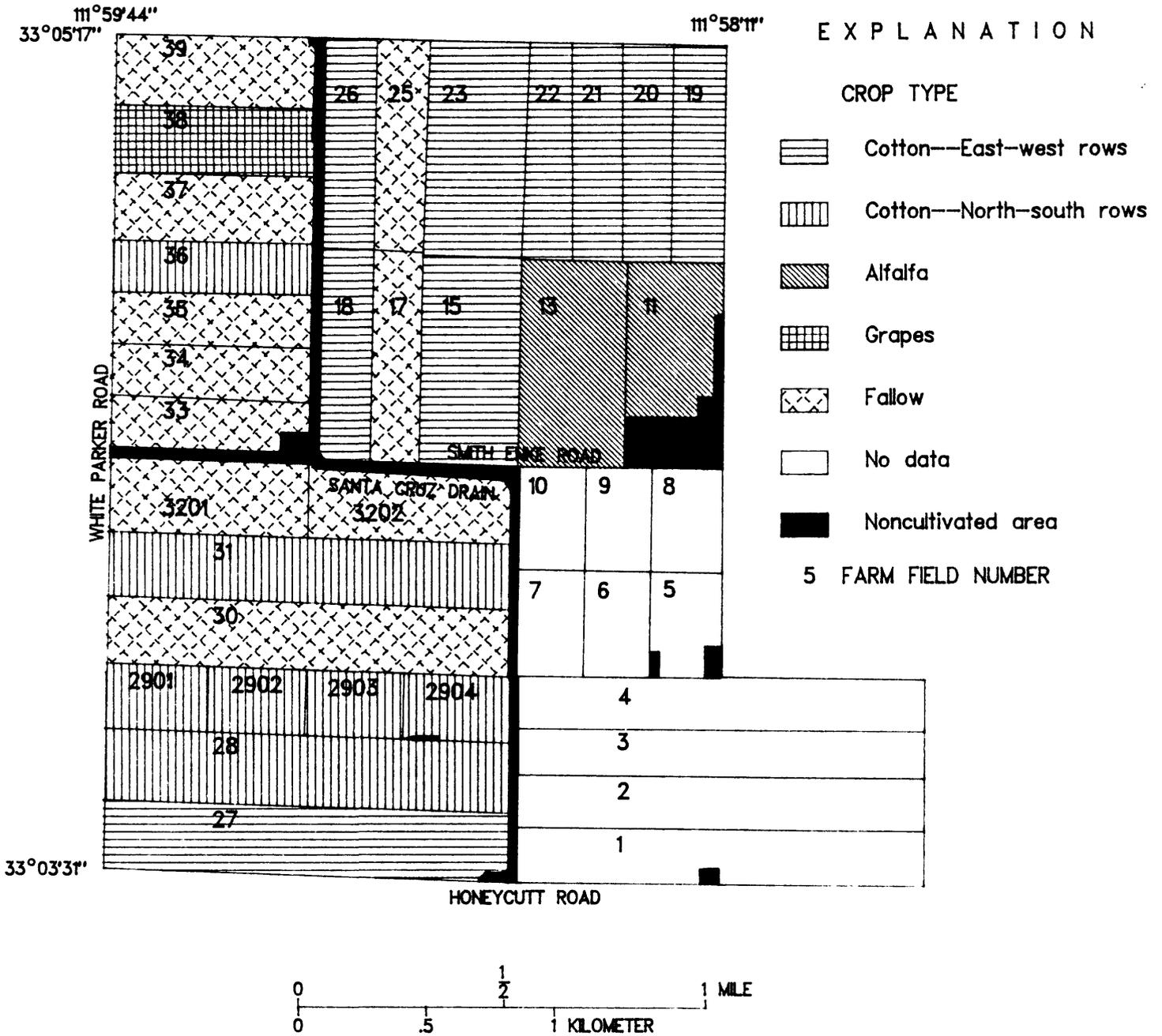


Figure 2.--Field boundaries for the Maricopa Agricultural Center and crop types on September 28, 1989.

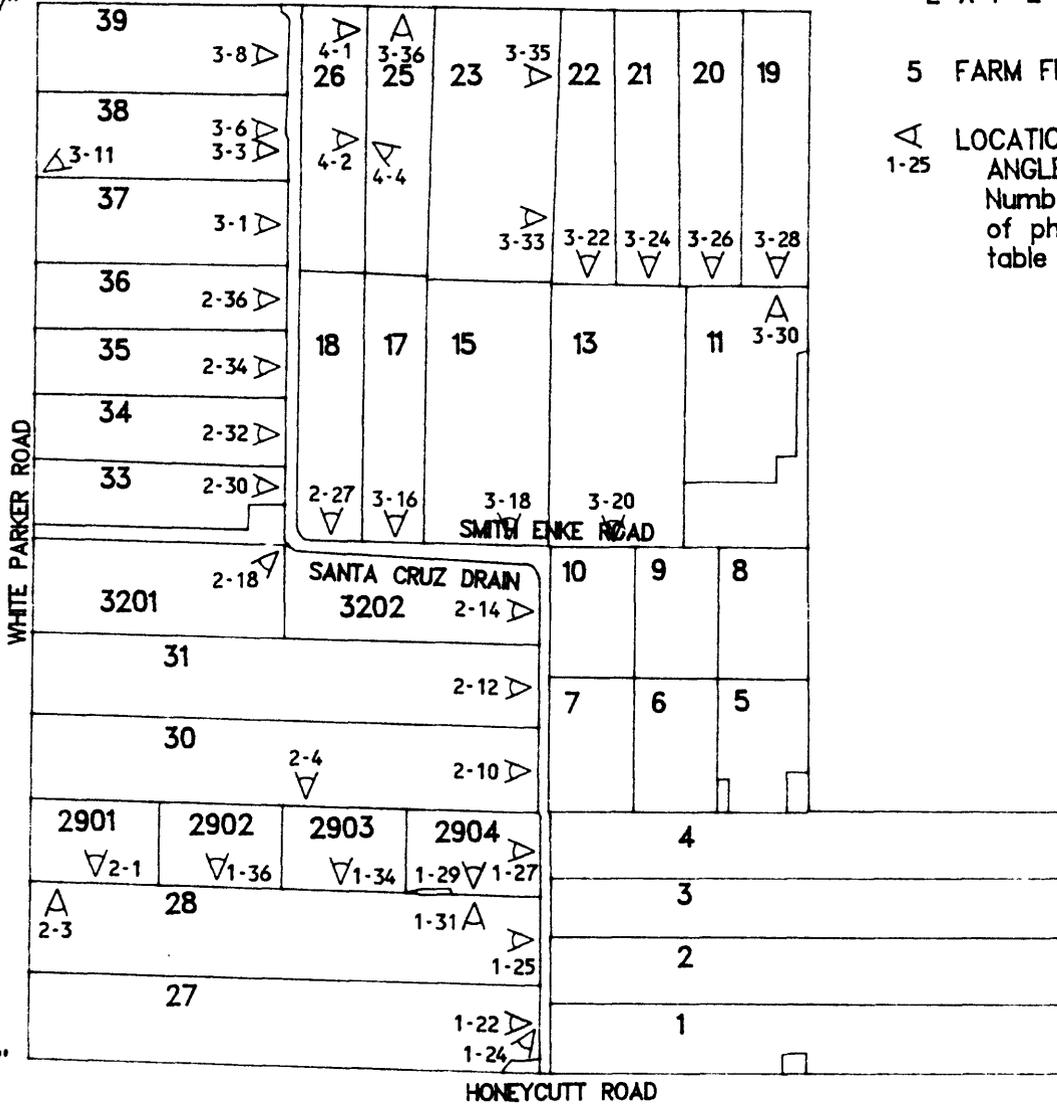
111°59'44"  
33°05'17"

111°58'11"

EXPLANATION

5 FARM FIELD NUMBER

▽ LOCATION AND VIEW  
1-25 ANGLE OF PHOTOGRAPH--  
Number, 1-25, is number  
of photograph listed in  
table 2.



33°03'31"

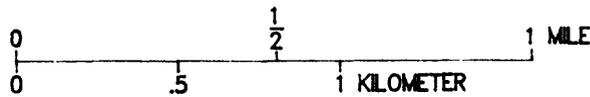


Figure 3.--Location and view direction of photographs taken to document field conditions on the demonstration farm, Maricopa Agricultural Center, September 28, 1989.

Table 1.--Ground-truth data for fields on the demonstration farm, Maricopa Agricultural Center, on September 28, 1989

Maricopa Agricultural Center Field Number <sup>1</sup>	Crop	Description
11	Alfalfa	Soil damp. Buildings in south half.
13	Alfalfa	Soil damp.
15	Cotton	East-west rows. Dry.
17	Fallow	Dry.
18	Cotton	East-west rows. Dry.
19	Cotton	East-west rows. Dry.
20	Cotton	East-west rows. Dry.
21	Cotton	East-west rows. Dry.
22	Cotton	East-west rows. Dry.
23	Cotton	East-west rows. Dry.
25	Fallow	Dry.
26	Cotton	East-west rows. Dry. North 45 m fallow.
27	Cotton	East-west rows. Dry. Drip irrigated field. East end has carbon dioxide rings set up.
28	Cotton	North-south rows. Dry.
2901	Cotton	North-south rows. Dry.
2902	Cotton	North-south rows. Dry.
2903	Cotton	North-south rows. Dry.
2904	Cotton	North-south rows. Dry.
30	Fallow	Plowed, clods. Dry.
31	Cotton	North-south rows. Dry.
3201	Fallow	Plowed, rounded clods, some stubble. Dry.
3202	Fallow	Same as field 3201.
33	Fallow	Plowed, some stubble, clods. Dry.
34	Fallow	Plowed, clods, some stubble. Dry.
35	Fallow	Plowed, clods, some stubble. Dry.
36	Cotton	North-south rows. Dry.
37	Fallow	Plowed, clods, some stubble. Dry.
38	Grapes	North-south rows. Not cultivated. Dry. Many weeds around plants and between rows. Any grapes on vines are dried.
39	Fallow	Plowed, clods, some stubble. Dry.

<sup>1</sup>Fields plotted on figure 2.

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989

[Location, View direction, and Description: SE, Southeast; SW, Southwest; NE, Northeast; NW, Northwest; ESE, East southeast; ENE, East northeast; NNW, North northwest; WNW, West northwest. Description: MAC, Maricopa Agricultural Center]

Date	Time	Slide	Field number	Location	View direction	Description
9/20/89	0930	1-1	20	Middle	NNW	Weather station in cotton field. Bruce Russell and James Brown.
"	0930	1-2	20	Middle	NNW	Weather station.
"	0937	1-3	20	Middle	Close up	Cotton.
"	--	1-4	20	Middle	Close up	Cotton.
"	--	1-5	20	Middle	Close up	Cotton.
"	0948	1-6	20	West side	East	Weather station in cotton field.
"	1004	1-7	--	West side	East	Weather station in cotton field with east-west rows. Murphy Farm. Bruce Russell and James Brown.
"	--	1-8	--	Middle	West	Same as 1-7.
"	--	1-9	--	Middle	West	Same as 1-7.
"	1010	1-10	--	Middle	SW	Infrared sensor on weather station. Murphy Farm. James Brown.
"	--	1-11	--	Middle	WNW	Cotton. Murphy Farm.
"	1015	1-12	--	West side	East	Weather station in cotton field. Murphy Farm.
"	--	1-13	--	Middle	South	Weather station in cotton field with north-south rows. Smith Farm.
"	1031	1-14	--	"	West	Same as 1-13.
"	1031	1-15	--	"	West	Same as 1-13.
"	1039	1-16	--	"	NW	Cotton plant and weather station. Smith Farm.
"	1039	1-17	--	"	NE	Cotton plant. Smith Farm.
"	1043	1-18	--	"	Close up	Cotton flower. Smith Farm.
"	1043	1-19	--	"	Close up	Cotton flower. Smith Farm.
"	--	1-20	--	West side	East	Weather station in cotton field with east-west rows. Ak-Chin Farm.
"	--	1-21	--	West side	East	Same as 1-20.
9/28/89	0924	<sup>1</sup> 1-22	27	East side	West	Cotton. Dry. Crop duster plane-no spraying.

See footnotes at end of table.

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989--Continued

Date	Time	Slide	Field number	Location	View direction	Description
9/28/89	0924	<sup>1</sup> 1-23	27	East side	West	Same as 1-22, closer view.
"	0924	1-24	27	" "	SW	Cotton, carbon dioxide rings in bench <sup>2</sup> 2 at east end of field.
"	0928	<sup>1</sup> 1-25	28	" "	West	Cotton. Dry.
"	9028	<sup>1</sup> 1-26	28	" "	West	Same as 1-25, closer view.
"	0931	<sup>1</sup> 1-27	2904	" "	West	Cotton. Dry.
"	0931	<sup>1</sup> 1-28	2904	" "	West	Same as 1-27, closer view.
"	0933	<sup>1</sup> 1-29	2904	South side	North	Cotton. Dry.
"	0933	<sup>1</sup> 1-30	2904	" "	North	Same as 1-29, closer view.
"	0935	<sup>1</sup> 1-31	28	North side	South	Cotton. Dry.
"	0935	<sup>1</sup> 1-32	28	" "	South	Same as 1-31, closer view.
"	0938	1-33	2904	SE corner	NW	Well.
"	0942	<sup>1</sup> 1-34	2903	South side	North	Cotton. Dry.
"	0942	<sup>1</sup> 1-35	2903	" "	North	Same as 1-34, closer view.
"	0945	<sup>1</sup> 1-36	2902	" "	North	Cotton. Dry.
"	0945	<sup>1</sup> 1-37	2902	" "	North	Same as 1-36, closer view.
"	0952	<sup>1</sup> 2-1	2901	" "	North	Cotton. Dry.
"	0952	<sup>1</sup> 2-2	2901	" "	North	Same as 2-1, closer view.
"	0954	<sup>1</sup> 2-3	28	North side	South	Cotton, alternating groups of rows of different heights at west end.
"	1000	2-4	30	South side	North	Weather station in fallow field, plowed, clods, some stubble.
"	1000	2-5	30	South side	North	Same as 2-3, closer view.
"	1000	2-6	30	" "	NE	Paul Pinter walking sensors.
"	1002	<sup>1</sup> 2-7	30	" "	North	Same as 2-6.
"	1004	<sup>1</sup> 2-8	30	" "	NW	Same as 2-6.
"	1006	2-9	30	SE corner	NW	Well.
"	1008	<sup>1</sup> 2-10	30	East side	West	Fallow, plowed, clods.
"	1008	<sup>1</sup> 2-11	30	" "	West	Same as 2-10, closer view.
"	1012	<sup>1</sup> 2-12	31	" "	West	Cotton. Dry.
"	1012	<sup>1</sup> 2-13	31	" "	West	Same as 2-12, closer view.

See footnotes at end of table.

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989--Continued

Date	Time	Slide	Field number	Location	View direction	Description
9/28/89	1015	<sup>1</sup> 2-14	3202	East side	West	Fallow, plowed, rounded clods, wheat stubble.
"	1015	<sup>1</sup> 2-15	3202	" "	West	Same as 2-14, closer view.
"	1018	2-16	15	South side	North	People working.
"	1018	<sup>1</sup> 2-17	15	" "	NW	Cessna <sup>3</sup> and people working. Santa Cruz drain in foreground.
"	1023	<sup>1</sup> 2-18	3201	NE corner	SW	Fallow, same as field 3202.
"	1023	<sup>1</sup> 2-19	3201	West side	East	Same as 2-18, closer view.
"	1027	<sup>1</sup> 2-20	17	West side	ENE	Ron Seay and Susan Moran programing sensors.
"	1027	<sup>1</sup> 2-21	18	East side	--	Cessna over field 18.
"	1028	2-22	17	West side	--	Cessna over field 17.
"	1030	<sup>1</sup> 2-23	17	" "	East	Ron Seay and Susan Moran walking sensors.
"	1032	<sup>1</sup> 2-24	17	" "	East	Ron Seay and Susan Moran walking sensors in field 17 with Cessna and people working near plane parking area.
"	1033	<sup>1</sup> 2-25	17	" "	--	Sky condition, clear, hot, and breezy.
"	1037	<sup>1</sup> 2-26	17	West side	North	Susan Moran, Ian Perry, and Karen Scott calibrating sensors over white plate.
"	1037	<sup>1</sup> 2-27	18	South side	North	Cotton, open areas in field. Dry.
"	1037	<sup>1</sup> 2-28	18	" "	North	Same as 2-27, closer view.
"	1040	2-29	33	SE corner	NW	Well.
"	1042	<sup>1</sup> 2-30	33	East side	West	Fallow, plowed, clods, some stubble. Dry.
"	1042	<sup>1</sup> 2-31	33	" "	West	Same as 2-30, closer view.
"	1044	<sup>1</sup> 2-32	34	" "	West	Fallow, plowed, clods, some stubble. Dry.
"	1044	<sup>1</sup> 2-33	34	" "	West	Same as 2-32, closer view.
"	1050	<sup>1</sup> 2-34	35	" "	West	Fallow, plowed, clods, some stubble. Dry.
"	1050	<sup>1</sup> 2-35	35	" "	West	Same as 2-34, closer view.
"	1056	<sup>1</sup> 2-36	36	" "	West	Cotton. Dry.
"	1056	<sup>1</sup> 2-37	36	" "	West	Same as 2-36, closer view.

See footnotes at end of table

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989--Continued

Date	Time	Slide	Field number	Location	View direction	Description
9/28/89	1101	<sup>1</sup> 3-1	37	East side	West	Fallow, plowed, clods, some stubble. Dry.
"	1101	<sup>1</sup> 3-2	37	" "	West	Same as 3-1, closer view.
"	1105	<sup>1</sup> 3-3	38	" "	West	Grapes with weeds. Dry.
"	1105	<sup>1</sup> 3-4	38	" "	West	Same as 3-3, closer view.
"	1105	3-5	38	" "	NW	Well.
"	1106	<sup>1</sup> 3-6	38	" "	West	Open area in center of grapes with weeds.
"	1108	<sup>1</sup> 3-7	38	NE corner	SW	Grapes.
"	1110	<sup>1</sup> 3-8	39	East side	West	Fallow, plowed, clods, some stubble. Dry.
"	1110	<sup>1</sup> 3-9	39	" "	West	Same as 3-8, closer view.
"	1118	<sup>1</sup> 3-10	39	NW corner	--	Sky condition, clear, hot, light breeze, hazy dust.
"	1124	<sup>1</sup> 3-11	38	West side	NE	Grapes. Evidence of irrigation but soil dry at surface.
"	1126	3-12	--	NE corner	SW	Pecan trees.
"	--	3-13	--	--	East	Sign on west side of MAC and plane.
"	--	3-14	--	--	East	Sign on west side of MAC.
"	--	3-15	--	--	East	Sign by SE corner of field 33.
"	1133	<sup>1</sup> 3-16	17	South side	North	Fallow, plowed, clods. Dry.
"	1133	<sup>1</sup> 3-17	17	" "	North	Same as 3-16, closer view.
"	1135	<sup>1</sup> 3-18	15	" "	North	Cotton. Dry.
"	1135	<sup>1</sup> 3-19	15	" "	North	Same as 3-18, closer view.
"	1137	<sup>1</sup> 3-20	13	" "	North	Alfalfa. Sparser at west side. Soil damp at surface. Humid.
"	1137	<sup>1</sup> 3-21	13	" "	North	Same as 3-20, closer view.
"	1143	<sup>1</sup> 3-22	22	" "	North	Cotton. Dry.
"	1143	<sup>1</sup> 3-23	22	" "	North	Same as 3-22, closer view.
"	1146	<sup>1</sup> 3-24	21	" "	North	Cotton. Dry.
"	1146	<sup>1</sup> 3-25	21	" "	North	Same as 3-24, closer view.
"	1149	<sup>1</sup> 3-26	20	" "	North	Cotton. Dry.

See footnotes at end of table.

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989--Continued

Date	Time	Slide	Field number	Location	View direction	Description
9/28/89	1149	1 <sup>3</sup> -27	20	South side	North	Same as 3-26, closer view.
"	1151	1 <sup>3</sup> -28	19	" "	North	Cotton. Dry.
"	1151	1 <sup>3</sup> -29	19	" "	North	Same as 3-28, closer view.
"	--	1 <sup>3</sup> -30	11	North side	South	Alfalfa. Soil damp.
"	--	1 <sup>3</sup> -31	11	" "	South	Same as 3-30, closer view.
"	1156	3-32	19	East side	SW	Well.
"	1200	1 <sup>3</sup> -33	23	" "	West	Cotton. Dry.
"	1202	3-34	22	West side	East	Cotton. Dry.
"	--	1 <sup>3</sup> -35	23	East side	West	Cotton. Dry.
"	1207	1 <sup>3</sup> -36	25	North side	South	Fallow, plowed, clods, some rounded clods. Dry.
"	1207	1 <sup>3</sup> -37	25	" "	South	Same as 3-36, closer view.
"	--	1 <sup>4</sup> -1	26	East side	West	Fallow at north end of field. Dry.
"	1214	1 <sup>4</sup> -2	26	" "	West	Cotton. Dry.
"	1214	1 <sup>4</sup> -3	26	" "	West	Same as 4-2, closer view.
"	1216	1 <sup>4</sup> -4	25	West side	SE	Fallow with different surfaces. Dry.
"	1225	4-5	11	Middle	--	Weather station in alfalfa field. Soil damp, humid. Flowers on alfalfa.
"	1225	4-6	11	"	--	Same as 4-5, wider view.
"	--	4-7	11	"	--	Alfalfa.
"	--	4-8	11	"	--	Weather-station radiometer.
"	--	4-9	11	"	North	Weather station in alfalfa field.
"	--	4-10	11	"	SE	Weather station in alfalfa field.
"	1230	4-11	11	"	Close up	Alfalfa with flowers.
"	--	1 <sup>4</sup> -12	--	Plane park	--	People packing equipment. Paul Pinter, Ray Jackson, and Bob Anderson.
"	--	1 <sup>4</sup> -13	--	" "	--	People calibrating and packing equipment. Tom Clarke, Stephanie Johnson, Susan Moran, and Ray Jackson.
"	--	1 <sup>4</sup> -14	--	" "	--	Same as 4-13.
"	--	1 <sup>4</sup> -15	--	" "	--	Same as 4-13. Tom Clarke, Stephanie Johnson, and Susan Moran.

See footnotes at end of table.

Table 2.--Photographs (35-millimeter slides) taken of fields on the demonstration farm, Maricopa Agricultural Center, and of scientists and equipment on September 28, 1989--Continued

Date	Time	Slide	Field number	Location	View direction	Description
9/28/89	1700	4-16	--	Middle	SE	Weather station in mowed (but not baled) alfalfa field. Murphy Farm.
"	1700	4-17	--	Middle	SE	Same as 4-16.
"	1700	4-18	--	"	SE	Same as 4-16.
"	1700	4-19	--	"	ESE	Same as 4-16.
"	1757	4-20	--	"	NE	Weather station in alfalfa field. Ak-Chin Farm.
"	1757	4-21	--	"	NE	Same as 4-20.
"	1757	4-22	--	"	NE	Same as 4-20.
"	1757	4-23	--	"	NE	Same as 4-20.
"	1757	4-24	--	"	NE	Same as 4-20.
"	1758	4-25	--	West side	ENE	Same as 4-20.

<sup>1</sup>Duplicate slides at the U.S. Water Conservation Laboratory, Phoenix, AZ.

<sup>2</sup>One-mile wide fields are divided into 8 parts called benches. Benches differ in altitude and are numbered from east to west.

<sup>3</sup>Use of brand names in this report is for identification only and does not constitute endorsement by the U.S. Geological Survey.