

N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE AS MUCH
INFORMATION AS POSSIBLE

AgRISTARS

FC-L0-04027
JSC-16847
JAN 0 8 1981

"Made available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
Program information and without liability
for any use made thereof."

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

September 1980

Foreign Commodity Production Forecasting

IDENTIFICATION OF U.S.S.R. INDICATOR REGIONS

81-10102

NASA CR#

160935

J. Disler and H. Breigh

(E81-10102) IDENTIFICATION OF USSR
INDICATOR REGIONS (Lockheed Engineering and
Management) 81 p HC A05/MF A01 CSCL 02C

N81-21419

Unclass

G3/43 00102

Lockheed Engineering and Management Services Company, Inc.
1830 NASA Road 1, Houston, Texas 77058



NASA



**Lyndon B. Johnson Space Center
Houston, Texas 77058**

Page intentionally left blank

IDENTIFICATION OF U.S.S.R. INDICATOR REGIONS

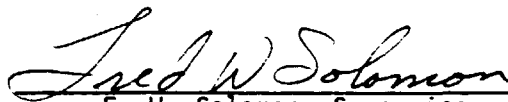
Job Order 74-422

This report describes Experiment Design activities of the
Foreign Commodity Production Forecasting project
of the AgRISTARS program.

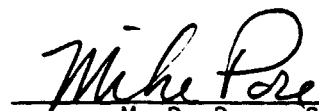
PREPARED BY

J. Disler and H. Breigh

APPROVED BY



F. W. Solomon, Supervisor
Systems Verification Section



M. D. Pore, Supervisor
Accuracy Assessment Section

LOCKHEED ENGINEERING AND MANAGEMENT SERVICES COMPANY, INC.

Under Contract NAS 9-15800

For

Earth Observations Division
Space and Life Sciences Directorate
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

September 1980

LEMSCO-15118

PREFACE

The research which is the subject of this report was conducted to support the Foreign Commodity Production Forecasting project of the Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing program. Under Contract NAS 9-15800, personnel of Lockheed Engineering and Management Services Company, Inc., completed this work for the Earth Observations Division, Space and Life Sciences Directorate, National Aeronautics and Space Administration, at the Lyndon B. Johnson Space Center.

PRECEDING PAGE BLANK NOT FILMED

CONTENTS

Section	Page
1. INTRODUCTION.....	1-1
1.1 <u>INDICATOR REGIONS</u>	1-1
1.2 <u>COUNTRY, CROPS OF INTEREST, AND AGRISTARS EXPERIMENTS SUPPORT</u>	1-1
1.3 <u>CROP STATISTICS (PRODUCTION, AREA, AND YIELD)</u>	1-2
1.3.1 METHODS OF REPORTING.....	1-2
1.3.2 AVAILABILITY OF CROP STATISTICS.....	1-3
1.3.2.1 <u>CIA Crop Statistics</u>	1-4
1.3.2.2 <u>Soviet-Published Crop Statistics</u>	1-4
1.3.3 RELIABILITY OF CROP STATISTICS.....	1-10
1.3.3.1 <u>CIA Crop Statistics</u>	1-10
1.3.3.2 <u>Soviet-Published Crop Statistics</u>	1-10
1.4 <u>CROP CALENDARS</u>	1-10
1.4.1 AVAILABILITY.....	1-10
1.4.2 RELIABILITY.....	1-11
2. SUMMARY AND RECOMMENDATIONS.....	2-1
3. SELECTION PROCEDURE.....	3-1
3.1 <u>POTENTIAL INDICATOR REGIONS</u>	3-1
3.2 <u>AGROPHYSICAL CHARACTERISTICS AFFECTING LABELING AND CLASSIFICATION ACCURACIES</u>	3-1
3.3 <u>DESCRIPTIONS OF THE 14 POTENTIAL INDICATOR REGIONS ACCORDING TO DATA AVAILABILITY AND FACTORS THAT COULD AFFECT LABELING AND CLASSIFICATION ACCURACIES</u>	3-10
3.3.1 HIGH BARLEY.....	3-10
3.3.1.1 <u>Belorussia SSR, LACIE Region 2</u>	3-10

Section	Page
3.3.1.2 <u>Central Region (RSFSR), LACIE Region 9</u>	3-13
3.3.2 <u>BARLEY AND SPRING WHEAT</u>	3-15
3.3.2.1 <u>Urals (RSFSR), LACIE Region 12</u>	3-15
3.3.2.2 <u>Kazakh SSR (New Lands), LACIE Region 13</u>	3-17
3.3.2.3 <u>East Siberia (RSFSR): Krasnoyarsk Kray, LACIE Region 17</u>	3-19
3.3.2.4 <u>Middle Volga (RSFSR), LACIE Region 11</u>	3-21
3.3.2.5 <u>Volga-Vyatka, LACIE Region 10</u>	3-23
3.3.3 <u>BARLEY AND WINTER WHEAT</u>	3-26
3.3.3.1 <u>North Caucasus (RSFSR), LACIE Region 7</u>	3-26
3.3.3.2 <u>Ukraine SSR, LACIE Regions 3, 4, and 5</u>	3-28
3.3.3.3 <u>Moldavia SSR, LACIE Region 6</u>	3-32
3.3.3.4 <u>Central Chernozem, LACIE Region 8</u>	3-35
3.3.3.5 <u>Central Asia: Uzbek SSR, LACIE Region 16</u>	3-38
3.3.3.6 <u>Transcaucasus Region: Azerbaijan SSR, LACIE Region 15</u>	3-41
3.3.3.7 <u>Baltic Region, LACIE Region 1</u>	3-42
4. FINAL INDICATOR REGION SELECTION.....	4-1
4.1 <u>REGIONAL SELECTIONS</u>	4-1
4.2 <u>OBLAST SELECTION</u>	4-1
5. AVAILABLE LITERATURE.....	5-1
5.1 <u>JSC/EOD LIBRARY</u>	5-1
5.2 <u>NATIONAL AGRICULTURAL LIBRARY</u>	5-2
6. REFERENCES.....	6-1

TABLES

Table	Page
1-1 LATEST PUBLISHED CIA CROP STATISTICS (PRODUCTION, AREA, AND YIELD) FOR BARLEY AT LOWEST ECONOMIC LEVEL.....	1-5
1-2 U.S.S.R. OBLASTS AND REPUBLICS WITH BARLEY AND OTHER SMALL-GRAIN STATISTICS FOR LACIE PHASE II HARVEST YEAR (1976).....	1-6
1-3 SOVIET-PUBLISHED CROP STATISTICS (SOWN AREA, THOUSANDS OF HECTARES) FOR MAJOR CROPS IN THE POTENTIAL INDICATOR REGIONS FOR THE LACIE PHASE III HARVEST YEAR (1977).....	1-7
1-4 OFFICIAL SOVIET GOVERNMENT STATISTICAL YEARBOOKS ACQUIRED.....	1-8
1-5 PRODUCTION, AREA, AND YIELD STATISTICS PUBLISHED IN 1977 FOR GRAIN CROPS IN THE UKRAINE SSR.....	1-9
1-6 CIA-PROVIDED CROP CALENDARS.....	1-12
3-1 LACIE PHASE III REGION NAMES WITH REGION AND ZONE NUMBERS.....	3-2
3-2 PERCENTAGES OF SOWN AREA BY CROP TYPES FOR U.S.S.R. REGIONS OR REPUBLICS (SSR'S) FOR HARVEST YEAR 1976.....	3-3
3-3 PERCENTAGES OF SOWN AREA BY CROP TYPES FOR U.S.S.R. REGIONS OR REPUBLICS (SSR'S) FOR HARVEST YEAR 1977.....	3-4
3-4 POTENTIAL INDICATOR REGIONS BASED ON RELATIVE BARLEY AND WHEAT PROPORTIONS.....	3-5
4-1 POTENTIAL INDICATOR REGIONS FOR THE U.S.S.R.....	4-2
4-2 FINAL U.S.S.R. INDICATOR REGION SELECTION.....	4-3
4-3 SELECTED INDICATOR REGION SEGMENT NUMBERS AND GEOGRAPHIC COORDINATES.....	4-4

FIGURES

Figure		Page
1-1	Geographic areas represented on available CIA crop calendars.....	1-14
3-1	Major U.S.S.R. winter wheat areas.....	3-6
3-2	Major U.S.S.R. spring wheat areas.....	3-7
3-3	Major U.S.S.R. barley areas.....	3-8
3-4	Fourteen potential U.S.S.R. indicator regions.....	3-9
4-1	Selected U.S.S.R. indicator regions.....	4-9

PRECEDING PAGE BLANK NOT FILMED

ABBREVIATIONS

AgRISTARS	Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing
AO	autonomous oblast
ASSR	autonomous SSR
CIA	Central Intelligence Agency
EOD	Earth Observations Division
FCPF	Foreign Commodity Production Forecasting
JSC	Lyndon B. Johnson Space Center
LACIE	Large Area Crop Inventory Experiment
NASA	National Aeronautics and Space Administration
NO	National Okrug
RSFSR	Russian Soviet Federated Socialist Republic
SSR	Soviet Socialist Republic
USDA	U.S. Department of Agriculture

PRECEDING PAGE BLANK NOT FILMED

1. INTRODUCTION

The Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS) program is an ongoing effort within the Earth Observations Division (EOD) at the National Aeronautics and Space Administration (NASA), Lyndon B. Johnson Space Center (JSC). The objective of the AgRISTARS program is to expand the technical knowledge and capabilities acquired during the Large Area Crop Inventory Experiment (LACIE) to include crops other than wheat.

This document describes the indicator regions and the methods of identifying the indicator regions for barley, barley and spring wheat, and barley and winter wheat in the U.S.S.R. The data obtained in this investigation will be used in support of the AgRISTARS 1981 exploratory and 1982 pilot experiments at NASA/JSC.

1.1 INDICATOR REGIONS

A part of the experiment design for the AgRISTARS program requires the identification of foreign areas of interest for exploratory experiments and pilot tests. Full foreign country estimates are not within the scope of the experiment objectives; therefore, indicator regions that are representative of important agronomic conditions are needed at subcountry levels.

The conditions are:

- a. Areas of high production for crops of interest
- b. Representative crop varieties and cropping practices encountered throughout the country
- c. Agronomic trends affecting national production

1.2 COUNTRY, CROPS OF INTEREST, AND AgRISTARS EXPERIMENTS SUPPORT

U.S.S.R. indicator regions for barley have been selected in support of the AgRISTARS Foreign Commodity Production Forecasting (FCPF) 1981 exploratory

and 1982 pilot experiments. Selections were based on high-barley and wheat producing regions as determined from available U.S.S.R. crop statistics and retrospective LACIE Phase II (1976) and Phase III (1977) data.

Characteristics that influenced the final selections for each potential indicator region are detailed in this report. The available crop statistics, crop calendars, Landsat acquisitions, and ancillary data, as major variables, are described. Potential indicator regions were reviewed according to agrophysical conditions that could influence labeling and classification accuracies. These conditions were identified in connection with regions that contain high proportions of barley, barley and winter wheat, and barley and spring wheat.

1.3 CROP STATISTICS (PRODUCTION, AREA, AND YIELD)

1.3.1 METHODS OF REPORTING

Crop statistics (production, area, and yield) are reported for the U.S.S.R. at four administrative levels: national, Soviet Socialist Republic (SSR), economic region, and oblast [Kray and autonomous SSR (ASSR) are included at this level]. At these four levels, crop statistics are available from two primary sources: official Soviet releases and unclassified U.S. Central Intelligence Agency (CIA) data. A conflict exists between the area crop statistics reported by the U.S.S.R. and the available CIA data.

Since 1958, crop statistics for the U.S.S.R. are available as follows:

- a. Production: thousands of metric tons
- b. Area: thousands of hectares
- c. Yield: centners per hectare¹

¹Some publications report quintals per hectare, a unit of measurement which is identical to centners per hectare.

U.S.S.R. analysts from the U.S. Department of Agriculture (USDA) state that crop area is reported in three phases: fall planted, spring standing, and summer harvested.

Available Soviet crop area statistics are translated as sown area, whereas CIA crop area statistics are given as harvested area. However, comparisons of CIA and Soviet area figures at national and regional levels reveal the data to be identical. It is speculated that the area figures that are referred to as spring standing would be sown area for spring and summer crops and, essentially, harvested area for winter crops (those remaining after winterkill).

Yield is derived from production and area data.

1.3.2 AVAILABILITY OF CROP STATISTICS

Complete crop statistics at the oblast level are available only on an intermittent basis, particularly for the years since 1975.² (Oblast-level crop statistics will be required by Accuracy Assessment personnel for evaluating potential indicator region experiments.)

Statistics at the republic and regional levels for sown area through 1978 are available from official Soviet sources. U.S.S.R. published crop area statistics for 1976 and 1977 were used for determining barley and wheat proportions throughout the U.S.S.R. Recent harvested crop area statistics are not available from official Soviet sources. Production and yield data are available only on an intermittent basis and are inadequate for the selection of the barley indicator regions. Soviet crop statistics have been acquired from three sources:

- a. CIA unclassified data
- b. Soviet published journals
- c. Official Soviet national and republic yearbooks

²Availability of crop statistics at the time the study was completed. More inclusive statistical data may be available at a future time.

1.3.2.1 CIA Crop Statistics

Table 1-1 provides the latest year crop statistics (production, area, and yield) for barley at the lowest economic levels, as published by the CIA. Statistics for other crops (identical regions) are not presented but are available at JSC/EOD (ref. 1).

CIA crop statistics for the U.S.S.R. republics and krais showing barley and other small grains available for LACIE Phase II harvest year (1976) are provided in table 1-2. Note that production and yield data are not available for 1976. Barley area data for 1976 are available only for a limited number of potential indicator regions.

CIA crop statistics for 1977 (LACIE Phase III) are not currently available but have been requested through the USDA (Houston).

1.3.2.2 Soviet-Published Crop Statistics

1.3.2.2.1 Vestnik Statistiki

Sown area crop statistics have been acquired at the SSR (republic) level from the Soviet journal Vestnik Statistiki for the years 1974 through 1978 (ref. 2). Production and yield data are not provided.

Table 1-3 gives the sown area (in hectares) for major crops in the potential indicator regions for the LACIE Phase III harvest year (1977), as published in Vestnik Statistiki.

1.3.2.2.2 Soviet National Economic Statistical Yearbooks

Table 1-4 lists, by region and harvest year, the official Soviet national statistical yearbooks that have been acquired. Production, area, and yield data are not provided in the U.S.S.R. and Russian Soviet Federated Socialist Republic (RSFSR) yearbooks at subregional levels that would be applicable to potential indicator regions (refs. 3-7). Similarly, the Kazakh, Uzbek, and Ukraine SSR yearbooks (refs. 8-11) are inadequate because of the absence of subregional crop statistics. Table 1-5 is a translation from the National

TABLE 1-1.- LATEST PUBLISHED CIA CROP STATISTICS (PRODUCTION, AREA, AND YIELD)¹
FOR BARLEY AT LOWEST ECONOMIC LEVEL

[As reported in reference 1]

Growing condition	Region	Subregion	SSR or Oblast	Latest year	Production, thousands of metric tons	Area, thousands of hectares	Yield, centners per hectare
High barley	Belarusia	Central	Belarusia SSR	1974	3442.1	1132.9	30.4
				1971	948.8	280.5	19.6
			Tula Oblast	1971	948.8	290.5	19.6
Barley and spring wheat	Ural	Northwest Ural		1969	(a)	(a)	12.5
		South Ural		1969	(a)	(a)	13.0
		South Ural	Orenburg Oblast	1969	(a)	(a)	9.9
		Northeast Ural		1969	57.9	40.0	14.5
	Kazakh	South Kazakh		1971	3518.3	3661.1	9.6
		East Siberia		1969	37.4	50.0	7.5
	Krasnoyarsk	Krasnoyarsk	Krasnoyarsk Krai	1969	(a)	(a)	7.2
			Krasnoyarsk Krai	1976	(a)	656.0	(a)
				1969	(a)	(a)	(a)
	Volga	Upper Volga		1969	(a)	(a)	17.4
		Middle Volga		1969	40.0	30.0	13.3
		Lower Volga		1969	(a)	(a)	3.8
	Volga-Vyatka			1969	91.5	50.0	18.3
			1969	40.1	60.0	6.7	
Barley and winter wheat	North Caucasus		Rostov Oblast	1969	(a)	(a)	10.3
			Stavropol Krai	1969	(a)	(a)	6.2
Ukraine	West Ukraine		1976	1274.0	724.0	17.6	
			Volyn Oblast	1975	152.0	91.8	14.6
			Zakarpatskaya Oblast	1975	25.0	14.6	17.5
			Ivano Oblast	1975	60.0	42.7	14.1
			Lvov Oblast	1975	184.0	109.0	16.9
			Povna Oblast	1975	180.0	83.1	21.7
			1975	1816.0	936.1	19.4	
			Vinograd Oblast	1975	340.0	208.0	16.3
			Vinnitsa Oblast	1975	346.0	177.2	19.5
			1975	1435.0	692.1	20.8	
	North-central Ukraine	Poltava Oblast	1975	516.0	252.5	20.4	
		Sumy Oblast	1975	411.0	191.8	21.4	
			1975	1404.0	827.7	17.0	
			1975	453.0	257.1	17.6	
	East Ukraine	Dnepropetrovsk Oblast	1975	481.0	238.4	20.2	
		Donetsk Oblast	1975	609.0	305.8	15.8	
		Kharkov Oblast	1975	246.0	150.4	16.3	
		Kherson Oblast	1975	202.0	138.9	14.5	
	South Ukraine		1974	129.8	45.0	28.8	
			1969	75.3	30.0	25.1	
Central Chernozem	Western Black Soil		1969	66.3	30.0	22.1	
	Eastern Black Soil		1969	66.3	30.0	22.1	
Central Asia			1974	720.0	778.8	9.2	
			1974	231.6	443.6	5.2	
Transcaucasus			1974	445.7	305.4	14.6	
			1974	236.0	180.7	13.0	
Baltic			1974	3092.3	1078.5	28.7	
			1974	1439.8	497.8	28.9	

^aNo reported data.

TABLE 1-2.- U.S.S.R. OBLASTS AND REPUBLICS WITH BARLEY AND OTHER SMALL-GRAIN STATISTICS^a
FOR LACIE PHASE II HARVEST YEAR (1976)

[As reported in reference 1]

Administrative division	Area, thousands of hectares				LACIE Phase II segments allocated
	Winter wheat	Spring wheat	Spring barley	Winter rye	
Winter wheat and spring barley sites					
Estonia SSR	50.0	5.0	250.0	48.0	3
Kaliningrad Oblast	47.0	(b)	71.0	31.0	2
Latvia SSR	106.0	.2	356.0	123.0	6
Lithuania SSR	193.0	.1	534.0	176.0	8
Belorussia SSR	143.0	8.0	1212.0	895.0	26
Moldavia SSR	214.0	(b)	71.0	4.0	8
Armenia SSR	87.0	3.0	65.0	.2	2
Uzbek SSR	418.0	111.0	435.0	6.0	2
Spring wheat and spring barley sites					
Tadzhik SSR	138.0	18.0	71.0	1.0	1
Krasnoyarsk Kray	(b)	2862.0	656.0	15.0	2

^aProduction and yield crop statistics for 1976 are not available.

^bNo data are reported.

TABLE 1-3.- SOVIET-PUBLISHED CROP STATISTICS (SOWN AREA, THOUSANDS OF HECTARES) FOR MAJOR CROPS IN THE POTENTIAL INDICATOR REGIONS FOR THE LACIE PHASE III HARVEST YEAR (1977)

[As reported in reference 2]

Type of crop	High barley		Barley and spring wheat					Barley and winter wheat						
	Moloussia SSR	Central (RSFSR)	Urals (RSFSR)	Kazakh SSR	East Siberia: Krasnoyarsk (RSFSR)	Volga	Volga-Vyatka	North Caucasus (RSFSR)	Ukraine SSR: Donetsk-Dnepr	Moldavia SSR	Central Chernozem (RSFSR)	Uzbek SSR	Azerbaijan SSR	Baltics: Lithuania SSR
Total sown area	6248	11 592	16 565	35 533	8428	28 557	7184	15 275	13 830	1819	11 000	3818	1309	2387
Grain crops:	2858	7 816	11 472	25 400	5267	19 481	4333	9 060	7 478	912	6 337	1153	612	1112
Winter wheat	138	817	58	1 083	(a)	1 445	119	5 032	3 764	392	1 073	486	414	203
Spring wheat	14	404	5 830	16 392	2842	6 553	356	25	12	(a)	405	63	.2	.1
Rye (all)	887	1 009	596	266	.9	1 245	754	145	157	7	201	3	.3	141
Corn for grain	(a)	(a)	(a)	93	(a)	6	--	826	1 025	342	31	137	12	(a)
Barley (all)	1254	3 131	2 462	5 703	691	5 999	1372	2 263	1 626	119	3 147	372	175	564
Oats	344	1 818	1 726	440	1510	1 387	1392	165	305	10	512	1	3	97
Millet	.2	46	258	858	15	1 014	11	150	170	.2	33	.1	.1	(a)
Buckwheat	44	267	115	246	57	302	74	23	140	.1	121	(a)	(a)	(a)
Rice	(a)	(a)	(a)	111	(a)	50	(a)	212	(a)	(a)	(a)	83	1	(a)
Legumes	174	325	428	165	134	1 477	254	184	258	39	507	5	5	96
Industrial crops:	306	572	145	350	12	1 421	120	1 503	1 848	400	1 481	1829	238	78
Cotton	(a)	(a)	(a)	111	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1797	218	(a)
Sugar beets	52	166	(a)	75	(a)	236	36	264	575	115	864	(a)	(a)	35
Flax fibers	250	364	33	(a)	5	.02	60	(a)	4	(a)	(a)	(a)	(a)	42
Sunflowers	(a)	.02	106	90	.07	881	1	1 040	1 131	181	498	1	2	(a)
Potatoes	823	1 156	374	176	188	537	443	166	434	41	349	22	18	145
Vegetables	46	95	47	56	27	108	30	178	210	70	66	87	42	18
Forage crops:	2215	4 948	4 518	9 511	2934	6 928	2257	4 268	3 770	381	2 747	675	387	1034
Annual and perennial grasses	1760	3 768	2 833	7 097	1915	4 032	1756	2 467	1 980	269	1 408	524	276	737
Corn for silage	128	559	987	2 032	725	2 324	194	1 464	1 468	84	1 148	131	99	108

^aNo reported data.

TABLE 1-4.- OFFICIAL SOVIET GOVERNMENT STATISTICAL YEAKBOOKS ACQUIRED

<u>Title</u>	<u>Edition</u>
National Economic Statistical Yearbook for the U.S.S.R.	1975
National Economic Statistical Yearbook for the U.S.S.R.	1977
National Economic Statistical Yearbook for RSFSR	1975
National Economic Statistical Yearbook for RSFSR	1976
National Economic Statistical Yearbook for RSFSR	1977
National Economic Statistical Yearbook for Belorussia	1976
National Economic Statistical Yearbook for Ukraine	1976
National Economic Statistical Yearbook for Kazakh	1977
National Economic Statistical Yearbook for Uzbek	1977
National Economic Statistical Yearbook for Ukraine	1977

TABLE 1-5.- PRODUCTION, AREA, AND YIELD STATISTICS PUBLISHED
IN 1977 FOR GRAIN CROPS IN THE UKRAINE SSR

[Translation of crop statistics as reported in reference 11]

Type of crop	Production, thousands of metric tons	Area, thousands of hectares	Yield, centners per hectare
Total area planted		33 424	
Winter grains:	(a)	9 776	27.9
Wheat	27 570	8 637	31.9
Rye	1 416	790	17.9
Barley	997	349	28.5
Spring grains:	(a)	7 578	(a)
Wheat	51	21	24.6
Barley	8 223	3 330	24.7
Oats	1 537	732	21.0
Corn	5 053	1 700	29.5
Millet	450	290	15.2
Buckwheat	325	329	9.8
Rice	147	39	37.7
Beans	2 678	1 098	23.8
Peas	2 293	886	25.8

^aNo reported data.

Economic Statistical Yearbook for Ukraine (1977 edition, ref. 11). Production, area, and yield (derived) statistics are provided for grain crops at the SSR level.

The 1976 Belorussia SSR yearbook contains crop statistics on the state purchase of grain cultures but is not inclusive for all grains. Other crop types are not provided (ref. 12).

1.3.3 RELIABILITY OF CROP STATISTICS

1.3.3.1 CIA Crop Statistics

Problems have been noted in the CIA crop statistics. Oblast-level crop statistics are, in some instances, identical to the regional or groups of oblast figures. This indicates that, when summing to larger areas, all oblasts were not included. Also, the oblast-level crop statistics may contain values for summer harvested crops as compared to the regional and national crop statistics. Spot-checking indicates that these values are identical to the Soviet-published sown-area figures (ref. 2).

1.3.3.2 Soviet-Published Crop Statistics

The reliability of the officially published Soviet crop statistics (refs. 2-12) is unknown, but these are assumed to be the most accurate data available. (It is known that the Soviet reports contain inflated "bunker" weights rather than the more accurate dry weights used in the United States.)

1.4 CROP CALENDARS

1.4.1 AVAILABILITY

Nominal crop calendars are available for less than 20 percent of the U.S.S.R. at subregional and oblast levels (ref. 13). The 22 nominal crop calendars that are available were prepared by the CIA. Generally, oblast-level calendars of Soviet origin have not been obtained.

Table 1-6 lists the 22 available CIA crop calendars by region, map number, and crop types. Figure 1-1 shows the U.S.S.R. geographic areas represented by these calendars.

1.4.2 RELIABILITY

The reliability of the CIA crop calendars is unknown.

TABLE 1-6.- CIA-PROVIDED CROP CALENDARS

[From reference 13]

Region	Map number	Crops included
Southern Steppe of Ukraine SSR	517625	Winter wheat, winter rye, barley, oats, corn, and millet
Central Forest Steppe of Ukraine SSR	517626	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Eastern Forest Steppe of Ukraine SSR	517627	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Northern Steppe of Ukraine SSR	517628	Winter wheat, winter rye, barley, oats, corn, and millet
Western Forest Steppe of Ukraine SSR	517629	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Eastern Forest Zone of Ukraine SSR	517630	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Carpathian Zone of Ukraine SSR	517631	Winter wheat, winter rye, barley, oats, and corn
Central Forest Zone of Ukraine SSR	517632	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Western Forest Zone of Ukraine SSR	517633	Winter wheat, winter rye, barley, oats, corn, buckwheat, and millet
Bashkir ASSR	517634	Winter wheat, spring wheat, winter rye, oats, and barley
Chelyabinsk Oblast	517635	Winter rye, spring wheat, oats, and barley
Kirovograd Oblast	517850	Winter wheat, winter rye, spring wheat, barley, oats, corn, millet, sunflowers, sugar beets, potatoes, cabbage, tomatoes, cucumbers, melons, apples, pears, plums, and cherries
Kursk Oblast	517636	Winter wheat, spring wheat, barley, winter rye, and oats

TABLE 1-6.- Concluded.

Region	Map number	Crops included
Kurgan Oblast	517637	Spring wheat, winter rye, oats, barley, corn, buckwheat, and millet
Kustanay Oblast	517638	Spring wheat, winter rye, oats, and barley
Northern Altay Kray	517639	Spring wheat, barley, oats, winter rye, corn, buckwheat, and millet
Novosibirsk Oblast	517640	Winter rye, spring wheat, barley, oats, corn, buckwheat, and millet
Omsk Oblast	517641	Spring wheat, oats, barley, winter rye, corn, and millet
Orenburg Oblast	517642	Spring wheat, oats, and winter rye
Rostov Oblast	517643	Winter wheat, spring wheat, barley, oats, corn, and millet
Stavropol Kray	517644	Winter wheat, spring wheat, barley, oats, corn, and millet
Voronezh Oblast	517645	Winter wheat, spring wheat, winter rye, barley, oats, corn, buckwheat, and millet

1-14



Figure 1-1.- Geographic areas represented on available CIA crop calendars. [From reference 13.]

2. SUMMARY AND RECOMMENDATIONS

This document describes the indicator regions and the methods of identifying the indicator regions for barley, barley and spring wheat, and barley and winter wheat in the U.S.S.R. The data obtained in this investigation will be used in support of the AgRISTARS 1981 exploratory and 1982 pilot experiments at NASA/JSC. Selections of indicator regions were based on high barley and wheat producing regions as determined from available U.S.S.R. crop statistics and available retrospective data from LACIE Phase II (1976) and Phase III (1977). Initially, potential indicator regions were determined by comparing the statistics for barley and wheat at the lowest administrative levels for which published statistics were available. Fourteen were selected for detailed review based on their relative abundances of wheat and barley. These potential indicator regions were grouped according to the following conditions that could affect labeling and classification accuracies:

- a. High barley content
- b. Presence of barley and spring wheat
- c. Presence of barley and winter wheat

Each region was evaluated based on the availability of crop statistics, crop calendars, Landsat acquisitions, and ancillary data.

The fact that complete crop statistics (production, area, and yield) were not available at the oblast level for the years since 1975 was a major constraint in this investigation. However, republic and economic regional level statistics (for sown area only) through 1978 were obtained from official Soviet publications (ref. 2). Other constraints included the sparse availability of grain crop calendars and of imagery acquisitions that were sufficient for small-grain separation.

Based on the availability of data, the following were recommended as indicator regions.

- a. For high barley: Belorussia SSR
- b. For barley and spring wheat: Ural Region
- c. For barley and winter wheat: North Caucasus Region

Within each of the three regions, individual oblasts were selected according to segment availability and segment acquisition histories for potential barley separation. This was done even though no recent oblast-level crop statistics are available for production, area, and yield at the present time. The following oblasts were recommended:

- a. In Belorussia SSR (high barley), Gomel and Mogilev Oblasts
- b. In the Ural Region (barley and spring wheat), Orenburg Oblast
- c. In the North Caucasus Region (barley and winter wheat), Rostov Oblast and Stavropol Kray

3. SELECTION PROCEDURE

3.1 POTENTIAL INDICATOR REGIONS

Potential indicator regions were determined by comparing the statistics for barley and wheat at the lowest administrative levels for which published statistics were available. Figures 3-1, 3-2, and 3-3 show the major wheat and barley growing areas within the U.S.S.R. Based on their relative abundances of wheat and barley, 14 Soviet economic regions with published crop statistics were selected for detailed review as potential indicator regions. (These economic regions are among those selected for LACIE Phase III, which are shown in table 3-1.) Figure 3-4 depicts the geographic boundaries of the 14 potential indicator regions. Tables 3-2 and 3-3 provide the relative percentages of sown area for wheat, barley, and other crops for the economic regions published in Vestnik Statistiki during harvest years 1976 and 1977. The relative percentages of barley area to the total-country barley-planted area for each region or SSR are also given.

3.2 AGROPHYSICAL CHARACTERISTICS AFFECTING LABELING AND CLASSIFICATION ACCURACIES

A major agrophysical characteristic affecting labeling and classification accuracies is the relative proportions of similar crop types to be separated. In accordance with a task objective to separate barley from spectrally similar wheat, the 14 potential indicator regions have been grouped according to their relative proportions of these grains.

Three agrophysical characteristics in the U.S.S.R. affecting labeling and classification accuracies have been identified:

- a. High-barley regions
- b. Barley and spring wheat regions
- c. Barley and winter wheat regions

Table 3-4 lists the 14 potential indicator regions based on relative barley and wheat proportions.

TABLE 3-1.- LACIE PHASE III REGION NAMES WITH
REGION AND ZONE NUMBERS

Region		Zone
Name	Number	
Baltic	1	10
Belorussia	2	20
Southwest Ukraine	3	30, 40
Donets-Dnepr	4	41, 50, 60
South Ukraine	5	70
Moldavia	6	80
North Caucasus	7	90, 100
Central Chernozem	8	110, 120
Central	9	111, 130
Volga-Vyatka	10	140
Volga	11	101, 150, 160, 170, 191
Ural	12	180, 190, 200
Kazakh	13	210, 220, 230, 240, 250, 290
West Siberia	14	201, 260, 270
Transcaucasus	15	280
Central Asia	16	300
East Siberia	17	310
Far East	18	320
Northwest	19	330

TABLE 3-2.- PERCENTAGES OF SOWN AREA BY CROP TYPES FOR U.S.S.R. REGIONS
OR REPUBLICS (SSR'S) FOR HARVEST YEAR 1976

[As reported in reference 2]

Region or SSR	Percentage of total-country barley-sown area	Percentage of total sown area						
		Barley (a) ¹	Winter wheat	Spring wheat	Oats	Rye (all)	Other grains ^a	Other crops ^b
RSFSR:	56.3	15.3	7.5	19.4	7.4	5.5	2.4	42.4
Northwest Region	1.2	13.3	1.4	1.2	9.7	8.2	(c)	65.2
Volga-Vyatka Region	2.6	12.3	4.9	4.1	13.5	20.2	1.0	43.9
Central Region	7.8	18.6	6.1	3.0	11.0	9.5	2.1	49.8
Central Chernozem Region	6.8	21.0	16.1	3.3	4.3	3.3	3.7	48.0
Volga Region	15.6	18.6	8.3	20.5	3.1	7.9	4.2	37.1
North Caucasus Region	8.8	19.7	25.5	.2	1.1	.5	2.6	49.1
Ural Region	6.1	12.5	.9	36.8	8.4	5.2	2.2	34.1
West Siberia Region	4.4	8.2	.1	43.6	8.9	1.4	.8	37.0
East Siberia Region	1.9	7.9	(c)	34.3	18.7	.2	.7	36.3
Far East Region	1.0	11.8	(c)	15.7	12.1	.2	2.5	57.7
Ukraine SSR:	17.4	17.8	13.8	.1	2.7	2.1	2.2	60.5
Donets-Dnepr Region	7.5	18.5	14.8	.1	2.6	1.0	2.6	59.3
Southwest Region	6.0	15.7	13.1	.1	3.0	4.1	2.0	61.8
South Region	3.9	20.5	13.1	(c)	2.3	.3	1.8	60.5
Baltic Region:	3.5	22.7	7.4	.1	4.8	7.1	(c)	57.1
Lithuania SSR	1.6	22.5	8.1	(c)	3.4	7.4	(c)	58.1
Latvia SSR	1.0	22.1	6.6	(c)	6.1	7.6	(c)	56.8
Estonia SSR	.7	26.5	5.3	.5	6.4	5.1	(c)	54.3
Kaliningrad Oblast (to RSFSR)	.2	17.4	11.6	(c)	4.4	7.6	(c)	59.0
Georgia SSR	.2	7.5	17.9	.1	2.7	(c)	(c)	71.0
Armenia SSR	.2	15.5	20.8	.7	1.2	(c)	(c)	59.7
Azerbaijan SSR	.5	13.6	32.1	(c)	.3	(c)	.2	52.7
Uzbek SSR	1.3	11.6	11.2	3.0	(c)	.1	2.1	70.5
Kirgiz SSR	.9	23.2	18.9	.6	.6	(c)	.1	56.2
Tadzhik SSR	.2	9.2	17.8	2.3	1.4	.1	.8	67.1
Turkmen SSR	.2	6.6	3.2	.2	(c)	(c)	1.1	85.5
Kazakh SSR	15.6	15.1	2.6	48.9	1.0	.4	2.9	28.8
Belorussia SSR	3.5	19.6	2.3	.1	5.1	14.4	.5	57.9
Moldavia SSR	.2	3.9	11.7	(c)	.7	.2	.1	81.6

^aIncludes millet, buckwheat, and rice.

^bIncludes corn for grain, cotton, sugar beets, flax fiber, sunflowers, potatoes, legumes, vegetables, and forage crops.

^cNo reported data.

TABLE 3-3.- PERCENTAGES OF SOWN AREA BY CROP TYPES FOR U.S.S.R. REGIONS
OR REPUBLICS (SSR'S) FOR HARVEST YEAR 1977

[As reported in reference 2]

Region or SSR	Percentage of total-country barley-sown area	Percentage of total sown area						
		Barley (all)	Winter wheat	Spring wheat	Oats	Rye (all)	Other grains ^a	Other crops ^b
RSFSR:	62.2	17.0	6.8	19.6	8.9	3.6	2.6	41.4
Northwest Region	1.4	15.8	1.2	.7	10.7	7.1	(c)	64.2
Volga-Vyatka Region	4.0	19.1	1.7	5.0	19.4	10.5	1.2	43.2
Central Region	9.1	21.5	5.6	2.8	12.5	6.9	2.2	48.6
Central Chernozem Region	9.1	28.6	9.8	3.7	4.7	1.8	3.9	47.2
Volga Region	17.4	21.0	5.1	22.9	4.9	4.4	4.8	36.7
North Caucasus Region	6.6	14.8	32.9	.2	1.1	1.0	2.5	46.6
Ural Region	7.1	14.9	.4	35.2	10.4	3.6	2.3	33.3
West Siberia Region	4.3	8.0	(c)	42.8	10.8	1.5	1.1	34.4
East Siberia Region	2.0	8.2	(c)	33.7	17.9	.2	.9	39.1
Far East Region	1.0	12.2	(c)	15.2	11.7	.2	2.7	58.0
Ukraine SSR:	10.7	11.0	25.8	.1	2.2	2.4	2.0	55.9
Donets-Dnepr Region	4.7	11.8	27.2	.1	2.2	1.1	2.2	54.6
Southwest Region	4.2	11.2	19.2	(c)	2.6	4.6	2.0	60.1
South Region	1.7	9.1	36.2	.1	1.3	.5	1.2	50.2
Baltic Region:	3.9	24.9	7.0	.3	5.3	4.9	(c)	56.7
Lithuania SSR	1.6	23.6	8.5	(c)	4.1	5.9	(c)	57.4
Latvia SSR	1.2	25.4	5.7	(c)	6.8	4.9	(c)	56.2
Estonia SSR	.3	30.6	3.6	1.6	6.3	1.9	(c)	54.1
Kaliningrad Oblast (to RSFSR)	.2	17.2	12.0	(c)	3.9	5.9	(c)	60.9
Georgia SSR	.1	6.7	18.9	.1	2.3	.1	(c)	71.2
Armenia SSR	.2	14.4	21.5	.7	.9	.1	(c)	61.0
Azerbaijan SSR	.5	13.4	31.6	(c)	.2	(c)	.1	53.6
Uzbek SSR	1.1	9.7	12.7	1.7	(c)	.1	2.2	72.2
Kirgiz SSR	.8	20.8	19.3	.5	.6	(c)	.1	58.3
Tadzhik SSR	.2	7.4	12.7	1.5	1.0	.1	1.3	75.4
Turkmen SSR	.1	5.7	3.4	.1	(c)	(c)	1.0	86.6
Kazakh SSR	16.5	16.1	3.0	46.1	1.2	.7	3.4	29.1
Belorussia SSR	3.6	20.1	2.2	.2	5.5	14.2	.7	57.0
Moldavia SSR	.3	6.5	21.6	(c)	.6	.4	(c)	70.0

^aIncludes millet, buckwheat, and rice.

^bIncludes corn for grain, cotton, sugar beets, flax fiber, sunflowers, potatoes, legumes, vegetables, and forage crops.

^cNo reported data.

TABLE 3-4.- POTENTIAL INDICATOR REGIONS BASED ON
RELATIVE BARLEY AND WHEAT PROPORTIONS

High barley:

Belorussia SSR
Central Region (RSFSR)

Barley and spring wheat:

Ural Region (RSFSR)
Kazakh SSR
East Siberia Region: Krasnoyarsk Kray (RSFSR)
Middle Volga Region (RSFSR)
Volga-Vyatka Region (RSFSR)

Barley and winter wheat:

North Caucasus Region (RSFSR)
Ukraine SSR: Donetsk-Dnepr Region
Moldavia SSR
Central Chernozem Region (RSFSR)
Central Asia Region: Uzbek SSR
Transcaucasus Region: Azerbaijan SSR
Baltic Region: Lithuania SSR



Figure 3-1.- Major U.S.S.R. winter wheat areas.



Figure 3-2.- Major U.S.S.R. spring wheat areas.



Figure 3-3.- Major U.S.S.R. barley areas.

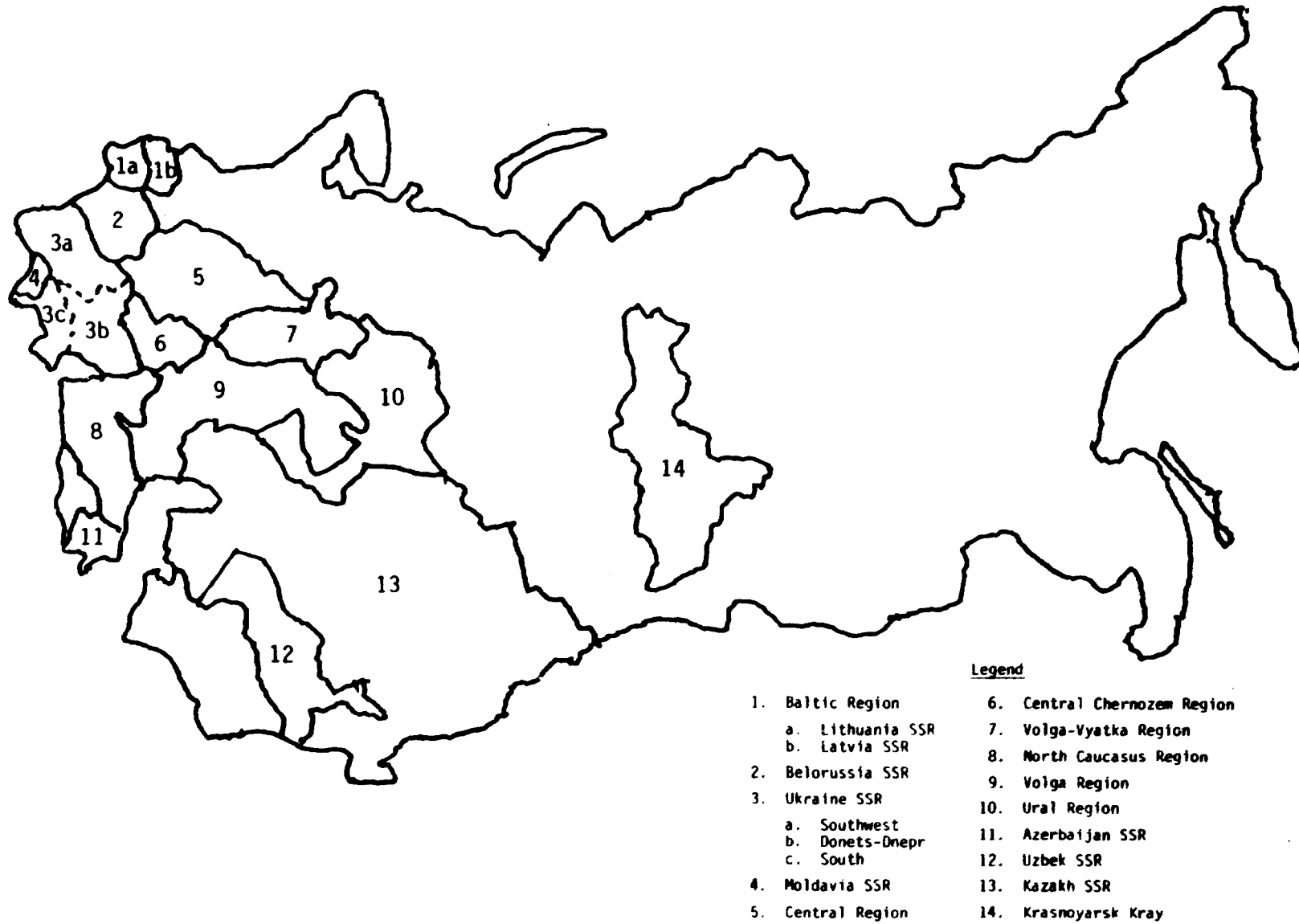


Figure 3-4.- Fourteen potential U.S.S.R. indicator regions.

3.3 DESCRIPTIONS OF THE 14 POTENTIAL INDICATOR REGIONS ACCORDING TO DATA AVAILABILITY AND FACTORS THAT COULD AFFECT LABELING AND CLASSIFICATION ACCURACIES

The characteristics of the 14 potential indicator regions as they relate to data availability and labeling and classification accuracies are described in the following sections. The characteristics include:

- a. Crop statistics availability
- b. Crop calendar availability
- c. Retrospective sample segment data availability
- d. Biowindows
- e. Climate
- f. Agronomy
- g. Imagery description and regional summary

3.3.1 HIGH BARLEY

3.3.1.1 Belorussia SSR, LACIE Region 2

Brest, Gomel, Grodno, Minsk, Mogilev, and Vitebsk Oblasts are included in Belorussia SSR.

3.3.1.1.1 Crop Statistics

The following crop statistics are available for Belorussia SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-74
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78
- c. National Economic Statistical Yearbook for Belorussia (1976 edition, ref. 12): state purchases of grain cultures but not inclusive for all grains

3.3.1.1.2 Crop Calendars (Ref. 13)

CIA grain crop calendars are not available for Belorussia SSR. Crop calendars are available, however, for the Central, Eastern, and Western Forest regions of the Ukraine for extrapolation. Table 1-6 lists the crops included on the Ukrainian crop calendars.

3.3.1.1.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Belorussia SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	26	24
III	42	31

3.3.1.1.4 Biowindows (Ref. 18)

Biowindows established for Belorussia SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	October 5 — November 24, 1975 May 3 — August 15, 1976
III	August 20 — November 23, 1976 May 4 — August 16, 1977

3.3.1.1.5 Climate (Ref. 19)

Belorussia SSR is climatically similar to Nebraska and South Dakota. The summers are cool, moist, and cloudy. Landsat acquisitions are poor under these conditions.

3.3.1.1.6 Agronomy (Ref. 20)

Approximately 3.6 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Belorussia SSR. Spring barley and winter wheat

are the major crops, with grains occupying approximately 40 percent of the seeded area. Strong emphasis has been placed on industrial crops and livestock. (See tables 1-3, 3-2, and 3-3.)

3.3.1.1.7 Preliminary Imagery Review

A preliminary review of the imagery for Belorussia SSR shows a terrain which is mostly meadows, woods, and peat bogs with small, complex field patterns. Interpretation of the imagery is difficult. Crop calendars and spectral responses indicate that different winter grains and different spring grains cannot be separated without ratioing.

The key Landsat acquisition periods are as follows:

<u>Period</u>	<u>Crop stage/condition</u>
Fall	Winter grain planting
April/May	Spring grain planting
June/July	Spring grains developing behind winter grains
Mid-July	All grains harvested
Mid-August/September	Separation of summer crops

Approximately 70 percent of the spring grains is barley. The major confusion crop is oats.

Ten LACIE Phase II segments and nine Phase III segments were noted to have sufficient acquisition histories to attempt a wheat and barley separation study.

3.3.1.1.8 Regional Summary

Crop statistics, adjacent crop calendars, and segment data are adequate for use in a high-barley regional experiment. The Belorussian Oblasts of Gomel and Mogilev have been selected tentatively for use as a high-barley indicator

region. These two oblasts have adequate segments available, and their acquisition histories potentially are suitable for barley separation.

3.3.1.2 Central Region (RSFSR), LACIE Region 9

Oblasts within the Central Region include Bryansk, Ivanovo, Kalinin, Kaluga, Kostroma, Moscow, Orel, Ryazan, Smolensk, Tula, Vladimir, and Yaroslavl.

3.3.1.2.1 Crop Statistics

The following crop statistics are available for the Central Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-71
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.1.2.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for the Central Region are not available. The segment-level crop calendar provided in the LACIE packets is extrapolated from the CIA agriculture atlas for the U.S.S.R. (ref. 19). Spring barley is included on this calendar, but spring wheat is not. The reliability of the calendar is considered low.

3.3.1.2.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for the Central Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	44	37
III	103	63

3.3.1.2.4 Biowindows (Ref. 18)

Biowindows established for the Central Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	September 19 — November 8, 1975 April 30 — August 2, 1976
III	August 4 — November 7, 1976 May 1 — August 3, 1977

3.3.1.2.5 Climate (Refs. 19, 20)

The Central Region is climatically similar to the States of Minnesota and Montana and the Province of Manitoba, Canada. The annual precipitation ranges from 58 to 64 centimeters (23 to 25 inches), with 50 percent occurring during the growing season. Snowfall is ample. The probability of grain damage by drought is low. The mean winter temperature is -6° celsius (21° fahrenheit), and the mean summer temperature is 21.5° celsius (69° fahrenheit).

3.3.1.2.6 Agronomy (Ref. 20)

Approximately 9.1 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the Central Region, where barley is the major small-grain crop. Oats is a significant confusion crop. Annual and perennial grasses are grown extensively for forage. Winter rye and potatoes are other major crops. (See tables 1-3, 3-2, and 3-3.)

3.3.1.2.7 Preliminary Imagery Review

Problems with available crop statistics and crop calendars precluded the determination of the suitability of the Central Region segment imagery for potential barley separation.

3.3.1.2.8 Regional Summary

Incomplete crop statistics (sown area only) are available at the regional level only. Ancillary data at a smaller economic level or oblast level are not available. The existing crop calendars are not adequate for an indicator region experiment. Thus, the Central Region is not considered as a potential indicator region for barley separation.

3.3.2 BARLEY AND SPRING WHEAT

3.3.2.1 Urals (RSFSR), LACIE Region 12

Chelyabinsk, Kurgan, Orenburg, Perm, Sverdlovsk, and Tyumen Oblasts and Bashkir and Udmurt ASSR's are included in the Ural Region.

3.3.2.1.1 Crop Statistics

The following crop statistics are available for the Ural Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-69 for the Urals
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.2.1.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for Bashkir ASSR and Chelyabinsk, Kurgan, and Orenburg Oblasts are available. The crop types included on each of the oblast-level crop calendars are listed in table 1-6.

3.3.2.1.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for the Ural Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	100	88
III	141	128

3.3.2.1.4 Biowindows (Ref. 18)

No fall acquisitions of the Ural Region are available. Biowindows established for this region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	None
III	April 14 — September 10, 1977

3.3.2.1.5 Climate (Refs. 19, 20)

The Ural Region is climatically similar to the State of North Dakota and the Canadian Provinces of Alberta, British Columbia, and Saskatchewan. The annual precipitation ranges from 23 to 33 centimeters (9 to 13 inches), occurring mostly in the summer. Snowfall is light.

3.3.2.1.6 Agronomy (Ref. 20)

Wheat, as well as dairy and beef cattle, is produced on a large scale in the Urals. Agriculture occurs in the prairie grain farm zone, along with wooded and grass steppe. Soils are Chestnut. Large-scale mechanized state farms are in existence, and strip farming is considerable. Irregularly shaped fields ranging in size from 40 to 800 hectares are present in the foothills of the Ural Mountains.

Spring wheat and spring barley are the predominant grain crops; oats and winter rye follow in importance. Table 1-3 provides the sown area (in hectares) for the major crop types planted in the Urals in 1977.

As shown in table 3-3, approximately 7.1 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the Ural Region.

3.3.2.1.7 Preliminary Imagery Review

Key acquisitions for the potential separation of barley and spring wheat were not found. The growth cycle of these two crops is compressed between May planting and late August harvesting. The crop calendars do not show a

significant difference in the growth stages of barley and spring wheat; oats are shown to be developing slightly behind barley and spring wheat.

The lack of fall acquisitions may contribute to the confusion between winter grains and spring grains; however, sufficient imagery data exist for retrospective foreign indicator region experiments in the Urals.

3.3.2.1.8 Regional Summary

The best available crop statistics are for sown area only at the Ural regional level. Adequate crop calendars at the oblast level are available.

Although, ultimately, barley separation may be difficult or impossible, sufficient imagery data exist to consider the Ural Region as a potential barley and spring wheat indicator region. The Ural Region is selected tentatively as a potential barley and spring wheat indicator region, using Orenburg Oblast.

3.3.2.2 Kazakh SSR (New Lands), LACIE Region 13

Aktyubinsk, Alma-Ata, Chimkent, Dzhambul, Dzhzhkazgan, Gur'yev, Karaganda, Kokchetav, Kustanay, Kzyl-Orda, Mangyshlak, Pavlodar, Semipalatinsk, Severo-Kazakhstan, Taldy-Kurgan, Tselinograd, Turgay, Ural'sk, and Vostochno Oblasts are included in Kazakh SSR.

3.3.2.2.1 Crop Statistics

The following crop statistics are available for Kazakh SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-61 and 1965-68 for the Aktyubinsk, Gur'yev, Kokchetav, Kustanay, Mangyshlak, Pavlodar, Severo-Kazakhstan, Tselinograd, Turgay, and Ural'sk Oblasts
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

c. National Economic Statistical Yearbook for Kazakh (1977 edition, ref. 9): planted area of "stockfeed cultures" by oblast for 1960, 1965, 1970, and 1975-77 (no specific crop types given); production (thousands of metric tons) for the major crop types for 1960, 1965, 1970, and 1975-77

3.3.2.2.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for Kustanay Oblast and northern Altay Kray, West Siberia Region, have been acquired. Other oblasts would have to be extrapolated. Crop types included on the crop calendar are listed in table 1-6.

3.3.2.2.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Kazakh SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	211	182
III	436	231

3.3.2.2.4 Biowindows (Ref. 18)

Biowindows established for Kazakh SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	April 7 — August 30, 1976
III	April 8 — August 31, 1977

3.3.2.2.5 Climate (Refs. 19, 20)

The Kazakh SSR is climatically similar to the Canadian Provinces of Alberta and Saskatchewan. Large areas were abnormally dry during the summer of 1977, resulting in vegetation stress.

3.3.2.2.6 Agronomy (Ref. 20)

As shown in table 3-3, approximately 16.5 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Kazakh SSR. (See section 3.3.2.2.8.)

3.3.2.2.7 Preliminary Imagery Review

Problems with available crop statistics and crop calendars precluded the determination of the suitability of the Kazakh SSR segment imagery for potential barley separation.

3.3.2.2.8 Regional Summary

Incomplete crop statistics (sown area only) are available at the immense Kazakh Republic level only. Ancillary data at a smaller economic level or oblast level are not available. In addition, the Kazakh drought during LACIE Phase III and the availability of only one oblast-level crop calendar (Kustanay) precluded the selection of this republic as a potential indicator region for barley separation.

3.3.2.3 East Siberia (RSFSR): Krasnoyarsk Kray, LACIE Region 17

Krasnoyarsk Kray; Chita and Irkutsk Oblasts; and Buryat and Tuva ASSR's are included in the East Siberia Region.

3.3.2.3.1 Crop Statistics

The following crop statistics are available for the East Siberia Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley at the regional level for 1958-69 (Kray- and oblast-level statistics are not available.)
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78 (Crop statistics are not available at the kray level.)

3.3.2.3.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for East Siberia are not available. The Omsk and Novosibirsk (West Siberia) crop calendars were used during LACIE to extrapolate segment-level crop calendars in East Siberia. Table 1-6 lists the crops included on the Omsk and Novosibirsk crop calendars.

3.3.2.3.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Krasnoyarsk Kray in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	0	0
III	14	9

Barley separation is possible for approximately three segments.

3.3.2.3.4 Biowindows (Ref. 18)

Biowindows established for Krasnoyarsk Kray in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	None
III	September 4, 1976 — August 2, 1977

3.3.2.3.5 Climate (Ref. 19)

Krasnoyarsk Kray is climatically similar to Saskatchewan Province, Canada.

3.3.2.3.6 Agronomy (Ref. 20)

As shown in table 3-3, only 2 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the East Siberia Region. Krasnoyarsk Kray is not in the major U.S.S.R. agricultural area for small grains. Grains occupy 64 percent of the seeded area in Krasnoyarsk Kray, with wheat accounting for 77 percent in 1970.

The major crops are spring wheat, spring barley, oats, and winter rye. Table 1-3 provides the sown area (in hectares) for the major crop types planted in East Siberia in 1977. The major areas of spring wheat production are in the southern portion of Krasnoyarsk Kray.

Most of the land is boggy-type Podzolic soil, which is of little use except for livestock. The area is densely forested with windbreaks and strip-cropping.

3.3.2.3.7 Preliminary Imagery Review

A preliminary review of the imagery shows prominent fields with distinct patterns. Indications of the separation of barley and wheat could not be detected.

3.3.2.3.8 Regional Summary

Krasnoyarsk Kray is not considered a suitable candidate as a potential indicator region because of the lack of crop statistics, crop calendars, and suitable segment data.

3.3.2.4 Middle Volga (RSFSR), LACIE Region 11

Kuybyshev, Penza, and Saratov Oblasts are included in the Middle Volga Region.

3.3.2.4.1 Crop Statistics

The following crop statistics are available for the Middle Volga Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-69 at the regional level (Oblast-level crop statistics are not available.)
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78 at the Volga economic regional level (Major crop and barley statistics are not available for the Middle Volga Region or for the individual oblasts.)

3.3.2.4.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for the Middle Volga Region are not available. The extrapolated crop calendars used during LACIE for Saratov and Kuybyshev Oblasts do not include barley. The Penza crop calendar used during LACIE includes barley and was extrapolated from the CIA grain crop calendar for Voronezh Oblast (Central Chernozem Region). Table 1-6 lists the crops included on the CIA grain crop calendar for Voronezh.

3.3.2.4.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for the Middle Volga Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II:		
Kuybyshev	1	0
Penza	6	0
Saratov	<u>0</u>	<u>0</u>
Total	7	0
III:		
Kuybyshev	35	22
Penza	27	14
Saratov	<u>72</u>	<u>31</u>
Total	134	67

3.3.2.4.4 Biowindows (Ref. 18)

Biowindows established for the Middle Volga Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	September 19 — November 8, 1975 May 8 — August 16, 1976
III	August 20 — November 23, 1976 April 15 — August 18, 1977

3.3.2.4.5 Climate (Ref. 19)

The Middle Volga Region is climatically similar to North Dakota.

3.3.2.4.6 Agronomy (Ref. 20)

The Middle Volga is a leading region in the production of barley in the U.S.S.R. The other major crop in this region is wheat. Table 1-3 provides the sown area (in hectares) for the major crop types planted in the Volga Region in 1977.

Approximately 17.4 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the Volga Region (see table 3-3).

3.3.2.4.7 Preliminary Imagery Review

A preliminary review of the Penza segment imagery indicates that barley separation may be possible in a few instances. Overall, the segment acquisition histories for June, July, and August 1977 are poor, prohibiting any attempt to separate spring small grains. Further analysis of the acquisition histories is required to determine the extent of this problem.

Good acquisition histories were observed for 1978 imagery in the Penza segment packets. Field patterns were noted to be large and distinct in appearance.

3.3.2.4.8 Regional Summary

From an agronomic standpoint, the Middle Volga Region would make an excellent indicator region for the U.S.S.R. barley exploratory and pilot experiments. However, inadequate crop statistics, inadequate crop calendars, and indications of acquisition history problems eliminate this region.

3.3.2.5 Volga-Vyatka, LACIE Region 10

Gor'kiy and Kirov Oblasts and Mari, Chuvash, and Mordva ASSR's are included in the Volga-Vyatka Region.

3.3.2.5.1 Crop Statistics

The following crop statistics are available for the Volga-Vyatka Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-69
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.2.5.2 Crop Calendars (Ref. 13)

CIA grain crop calendars are not available for Volga-Vyatka. Table 1-6 lists the crops included on each of the oblast-level crop calendars.

3.3.2.5.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Volga-Vyatka in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	0	0
III	34	27

3.3.2.5.4 Biowindows (Ref. 18)

Biowindows established for Volga-Vyatka in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	None
III	August 21 — November 24, 1976 April 19 — September 7, 1977

3.3.2.5.5 Climate (Refs. 19, 20)

Volga-Vyatka is climatically similar to North Dakota. The annual precipitation ranges from 51 to 61 centimeters (20 to 24 inches), with 46 percent

occurring from May to September. Snowfall, which lasts for 160 to 240 days, accumulates at depths of 53 to 58 centimeters (21 to 23 inches).

3.3.2.5.6 Agronomy (Ref. 20)

The major crops grown in Volga-Vyatka are potatoes, grains (rye, oats, wheat, and barley), hay, pulses, corn, and sugar beets. Most of the agriculture is in irregularly shaped fields interspered in coniferous forest. Some larger scale farming occurs to the south of the Volga River where the forests do not interfere.

Both winter and spring grains are grown in this area. The dominant grain crop is winter rye; spring barley, spring oats, and spring wheat follow in importance. Table 1-3 provides the sown area (in hectares) for the major crop types planted in Volga-Vyatka in 1977.

As shown in table 3-3, approximately 4.0 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Volga-Vyatka.

3.3.2.5.7 Preliminary Imagery Review

Key acquisitions for the potential separation of barley and spring wheat were not found. The growth cycle of these crops is compressed between May planting and late August harvesting. The crop calendars do not show a significant difference in the growth stages of barley and spring wheat; spring oats are shown to be developing slightly behind spring barley and spring wheat.

The lack of key fall acquisitions may contribute to the confusion between winter grains and spring grains. Insufficient imagery data exist for retrospective indicator region experiments in Volga-Vyatka.

3.3.2.5.8 Regional Summary

The available crop calendars are not considered adequate for an indicator experiment in the Volga-Vyatka Region, and insufficient imagery data exist for

retrospective analysis. Volga-Vyatka, therefore, is not considered as a potential indicator region for barley and spring wheat separation.

3.3.3 BARLEY AND WINTER WHEAT

3.3.3.1 North Caucasus (RSFSR), LACIE Region 7

Rostov Oblast; Checheno, Dagestan, Kabardino, and Severo ASSR's; and Krasnodar and Stavropol Krays are included in the North Caucasus Region.

3.3.3.1.1 Crop Statistics

The following crop statistics are available for the North Caucasus Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley in the North Caucasus economic region for 1958-69 (Oblast-level crop statistics are not available.)
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops in the North Caucasus economic region for 1974-78

3.3.3.1.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for Rostov Oblast and Stavropol Kray have been acquired. Table 1-6 lists the crops included on these crop calendars.

3.3.3.1.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for the North Caucasus Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	103	81
III	153	87

3.3.3.1.4 Biowindows (Ref. 18)

Biowindows established for the North Caucasus in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	October 2 — November 21, 1975 May 3 — June 1, 1976
III	August 17, 1976 — August 19, 1977

3.3.3.1.5 Climate (Refs. 19, 20)

The North Caucasus Region is climatically similar to Nebraska. The annual precipitation ranges from 48 to 53 centimeters (19 to 21 inches), with slightly less precipitation occurring in the summer than during the winter. Snow cover is usually thin. The possibility of a drought occurs during the summer months.

3.3.3.1.6 Agronomy (Ref. 20)

The major crops grown in the North Caucasus are winter wheat, barley, and sunflowers, along with forage crops. Table 1-3 provides the sown area (in hectares) for the major crop types planted in this region in 1977. Based on the proportions of sown area for barley and spring wheat, the confusion between these two crops should be insignificant.

Approximately 6.6 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the North Caucasus Region (see table 3-3).

3.3.3.1.7 Preliminary Imagery Review

During the preliminary review of the North Caucasus segment imagery, the field patterns were found to be large and distinct. Generally, the acquisition histories proved to be adequate to support a potential indicator region

experiment. Key acquisition periods for winter grain and spring grain separation are as follows:

<u>Period</u>	<u>Crop stage/condition</u>
September/October	Winter grain planting
April	Sowing of spring grains; winter grains out of dormancy
Early June	Spring grains in the jointing stage; winter grains headed
Late June	Winter grains ripe
July	Spring grains ripe

The potential for barley separation is high because of the small amount of spring wheat that is reported for the North Caucasus.

3.3.3.1.8 Regional Summary

Crop statistics for sown area only are available at the regional level. CIA crop calendars for Rostov Oblast and Stavropol Kray and segment acquisition histories are generally adequate for winter wheat and spring barley separation. Therefore, the North Caucasus Region is selected tentatively as a potential barley and winter wheat indicator region, using Rostov Oblast and Stavropol Kray.

3.3.3.2 Ukraine SSR, LACIE Regions 3, 4, and 5

Three economic regions within the Ukraine SSR were considered for evaluation: region 3, Southwest; region 4, Donets-Dnepr; and region 5, South. Donets-Dnepr was chosen as being representative of the Ukraine SSR since it is the only region for which an oblast-level crop calendar is available.

Oblasts within Donets-Dnepr include Donetsk, Dnepropetrovsk, Khar'kov, Kirovograd, Poltava, Sumy, Voroshilovgrad, and Zaporozh.

3.3.3.2.1 Crop Statistics

The following crop statistics are available for the Ukraine SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley in Donets-Dnepr for 1958-75
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops in the Donets-Dnepr economic region for 1974-78
- c. National Economic Statistical Yearbook for the Ukraine (1976 and 1977 editions; refs. 8, 11): production, area, and yield for the major crops at the Ukraine SSR level for 1965, 1970, and 1975-77 (Statistics for the Donets-Dnepr economic region are not provided.)

The data sources listed above were cross-checked to determine agreement on common data points. Barley area statistics at the Ukraine SSR level for the 1975 harvest year were examined. All three sources were found to agree.

Data source	Barley type	Area, thousands of hectares
CIA	Spring	3565.7
Vestnik Statistiki	All	3993
Ukraine yearbooks	Spring	3566
	All	3994

In this instance, it appears that the three sources are reporting spring-standing values. (See section 1.3.1, Methods of Reporting, and section 1.3.3, Reliability of Crop Statistics.)

3.3.3.2.2 Crop Calendars (Ref. 13)

CIA grain crop calendars are available for nine agrophysical regions and one oblast:

- a. Southern Steppe
- b. Central Forest Steppe

- c. Eastern Forest Steppe
- d. Northern Steppe
- e. Western Forest Steppe
- f. Eastern Forest Zone
- g. Carpathian Zone
- h. Central Forest Zone
- i. Western Forest Zone
- j. Kirovograd Oblast

Table 1-6 lists the crops included on these crop calendars.

3.3.3.2.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Donets-Dnepr in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	65	42
III	130	70

3.3.3.2.4 Biowindows (Ref. 18)

Biowindows established for Donets-Dnepr in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	September 27 — November 16, 1975 April 30 — August 3, 1976
III	August 12 — November 15, 1976 May 1 — August 4, 1977

3.3.3.2.5 Climate (Ref. 19)

The Ukraine is climatically similar to Montana, western Nebraska, and South Dakota.

3.3.3.2.6 Agronomy (Ref. 20)

The major crops grown in the Donets-Dnepr economic region of the Ukraine are winter wheat, barley, rye, oats, corn, sunflowers, and sugar beets. Table 1-3 provides the sown area (in hectares) for the major crop types planted in the Donets-Dnepr economic region in 1977. Based on the sown area proportions of barley and spring wheat, the confusion between these two crops should be insignificant.

Approximately 4.7 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Donets-Dnepr (see table 3-3).

3.3.3.2.7 Preliminary Imagery Review

In the preliminary review of the Donets-Dnepr segment imagery, the field patterns were noted to be large and distinct. The segment imagery was correlated with the CIA crop calendars, and the following key acquisition periods for separation of winter grains and spring grains were determined.

<u>Period</u>	<u>Crop stage/condition</u>
September	Winter grain planting
April	Spring grain planting; winter grains jointing
May	Winter grains heading; spring grains jointing
June/July	Winter grains and spring grains turning and being harvested
August	Other crops being harvested

Substantial gaps were noted in the segment acquisition histories for the months of June and July which seriously threatens the data usability for potential indicator region experiments.

3.3.3.2.8 Regional Summary

The available crop statistics and crop calendars for the Ukraine are the most extensive of the potential indicator regions considered for this study. The potential for barley separation is high based on the relative proportions of barley and spring wheat.

However, the Ukraine SSR and the Donetsk-Dnepr economic region are considered marginal as a potential barley and winter wheat indicator region for retrospective LACIE Phase II or Phase III analysis because of poor acquisition histories during the key crop separation periods.

3.3.3.3 Moldavia SSR, LACIE Region 6

3.3.3.3.1 Crop Statistics

The following crop statistics are available for Moldavia SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-74
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.3.3.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for Moldavia SSR are not available. The CIA grain crop calendar for the southwest Ukraine could be extrapolated to Moldavia.

3.3.3.3.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Moldavia SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	8	7
III	16	14

3.3.3.3.4 Biowindows (Ref. 18)

Biowindows established for Moldavia SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	October 3 — November 22, 1975 April 16 — August 1, 1976
III	August 18, 1976 — August 2, 1977

3.3.3.3.5 Climate (Ref. 19)

Moldavia SSR is climatically similar to Nebraska and South Dakota.

3.3.3.3.6 Agronomy (Ref. 20)

Moldavia SSR is in a highly productive agricultural area. The major crops are winter wheat, corn, and sunflowers; secondary crops are barley, oats, rye, and flax. Table 1-3 provides the sown area (in hectares) for the major crop types planted in Moldavia SSR in 1977. Based on the sown-area proportions of barley and other spring grains, the confusion between barley and other crops should be insignificant. The agricultural practices in this republic are modern and highly mechanized, and collective farming is utilized. Harvest year 1976 has been reported to be an exceptionally good year for barley production in this republic.

During the 1976 and 1977 harvest years, approximately 0.2 percent and 0.3 percent, respectively, of the total barley area sown in the U.S.S.R. was in Moldavia SSR (see tables 3-2 and 3-3).

3.3.3.3.7 Preliminary Imagery Review

During a preliminary review of the Moldavia 1976 and 1977 segment imagery, gaps in the acquisition histories were noted. The majority of the LACIE Phase III segments have skips in the acquisition histories from mid-July to early September; therefore, acquisitions depicting most of the barley and spring grain harvest are not available.

From two to five Phase II segments were found to have sufficient acquisition histories for use in indicator region experiments. Six to ten Phase III segments were similarly noted for potential indicator analysis based on suitable acquisition histories.

Key acquisition periods for Moldavia SSR data are as follows:

<u>Period</u>	<u>Crop stage/condition</u>
Fall	Winter grain planting
March	Barley planting
August/September	Barley harvest

Other summer crops appear to be separable from barley using signature responses and crop calendars.

3.3.3.3.8 Regional Summary

Moldavia's relatively small geographic area (3 366 937 hectares) would be a strong advantage when considering potential indicator regions. Existing SSR-level crop statistics could be applied directly to an indicator region experiment without the requirement for oblast-level crop statistical data. Although no CIA grain crop calendar for Moldavia SSR exists, the adjoining Ukraine crop calendars may be adequate.

A disadvantage of a retrospective indicator region experiment on Moldavia data is the small number of segments available that have potentially adequate acquisition histories for spring barley and spring grain separation based on signature responses. However, the crops confused with barley should be insignificant because of their relative proportions, as published in the Soviet area statistics (ref. 2).

Moldavia SSR was excluded as the primary barley and winter wheat indicator region because of the small number of allocated segments and the marginal acquisition histories, but this republic could be considered as an alternate choice.

3.3.3.4 Central Chernozem, LACIE Region 8

The Central Chernozem Region includes the Western and Eastern Black Soil regions. Oblasts within this region include Belgorod, Kursk, Lipetsk, Tambov, and Voronezh.

3.3.3.4.1 Crop Statistics

The following crop statistics are available for the Central Chernozem Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1958-69
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.3.4.2 Crop Calendars (Ref. 13)

A CIA grain crop calendar for Kursk Oblast has been acquired. The crop types included on this crop calendar are listed in table 1-6.

3.3.3.4.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for the Central Chernozem Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	8	2
III	101	17

3.3.3.4.4 Biowindows (Ref. 18)

Biowindows established for the Central Chernozem Region in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	September 26 — November 15, 1975 May 13 — August 20, 1976
III	August 11 — November 14, 1976 May 14 — August 21, 1977

3.3.3.4.5 Climate (Refs. 19, 20)

The Central Chernozem Region is climatically similar to Montana, North Dakota, and South Dakota. (NASA and the Soviet Academy of Sciences selected Hand County, South Dakota, as an analogous region for the Kursk Oblast intensive test site.) The annual precipitation ranges between 46 and 56 centimeters (18 and 22 inches). The winters are severe with a potential for heavy winterkill.

3.3.3.4.6 Agronomy (Ref. 20)

The Central Chernozem Region is in a heavy agricultural area with rich black soils. The major crops are winter wheat and barley; secondary crops include rye, oats, millet, buckwheat, sunflowers, and sugar beets. Table 1-3 provides the sown area (in hectares) for the major crop types planted in the Central Chernozem Region in 1977.

Dairy and beef cattle are important. Very little of the area is given to forest.

Approximately 9.1 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in the Central Chernozem Region (see table 3-3).

3.3.3.4.7 Preliminary Imagery Review

A preliminary review of the Central Chernozem 1976 and 1977 imagery was conducted. The Kursk crop calendar was correlated with the imagery, and the following key acquisition periods for labeling small grains were determined.

<u>Period</u>	<u>Crop stage/condition</u>
September	Winter grain planting
April	Spring wheat planting
May	Spring barley planting; winter wheat jointing

<u>Period</u>	<u>Crop stage/condition</u>
June	Spring grains jointing; winter grains headed
July	Spring wheat and winter wheat in soft dough stage; barley headed to jointing

Serious problems can be anticipated in separating barley from spring grains using the retrospective LACIE Phase II and III data because of poor acquisition histories. Many of the Phase II and III segments are missing most or all acquisitions in June, July, and August, which are key periods for the separation of small grains. During Phase III, only 17 percent of the allocated segments had sufficient acquisition data for classification.

Central Chernozem segment packets in the custody of the USDA (Agena Building) contain 1978 imagery with, on cursory inspection, good acquisition histories.

3.3.3.4.8 Ground Truth

The only U.S.S.R. ground-truth segment (9499) is located in Kursk Oblast. The ground truth is for the 1975-76 harvest year (LACIE Phase II). Several barley fields are labeled for this site. Two segments in Hand County, South Dakota, had been selected previously as analogous to the Kursk intensive test site.

3.3.3.4.9 Regional Summary

The intensive test site segment and the available crop calendar for Kursk Oblast would make the Central Chernozem Region a good candidate as a potential indicator region. Labeling barley in a retrospective analysis would be difficult, however, because of the poor acquisition histories for the LACIE Phase II and III segments in this region.

3.3.3.5 Central Asia: Uzbek SSR, LACIE Region 16

Andizhan, Bukhara, Dzhizak, Fergana, Kashkadar'ya, Khorezm, Namangan, Samarkand, Surkhandar'ya, Syrdar'ya, and Tashkent Oblasts are included in the Uzbek SSR.

3.3.3.5.1 Crop Statistics

The following crop statistics are available for Uzbek SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1971-74
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78
- c. National Economic Statistical Yearbook for Uzbek SSR (1977 edition, ref. 10): total planted area for the major crops at the Uzbek SSR level for 1940, 1965, 1970, and 1975-77

3.3.3.5.2 Crop Calendars (Ref. 13)

A CIA grain crop calendar for Uzbek SSR is not available. During LACIE, CIA crop calendars for other regions were used to extrapolate segment-level crop calendars for this republic. Barley is not shown on these crop calendars, and their reliability is unknown.

3.3.3.5.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Uzbek SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	1	1
III	13	5

3.3.3.5.4 Biowindows (Ref. 18)

Biowindows established for Uzbek SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	November 10, 1975 — June 24, 1976
III	October 16, 1976 — July 17, 1977

3.3.3.5.5 Climate (Refs. 19, 20)

Uzbek SSR is climatically similar to New Mexico. The annual precipitation is only 15 centimeters (6 inches), with 53 percent occurring during the growing season. Little snow falls in the winter. Streams, which provide the water needed for irrigation, are fed by melting glaciers. Uzbek SSR suffers from violent dust storms, shifting sand dunes, flash floods, and landslides in mountainous areas. Occasional droughts and "sukhovey" occur.

A decrease in spring barley area in 1977 from that of 1976 and previous years may be correlated to the drought during the summer of 1977 in the New Lands (Kazakh SSR).

3.3.3.5.6 Agronomy (Ref. 20)

Cotton is the most dominant crop in Uzbek SSR, although considerable amounts of irrigated wheat, barley, and spring oats are grown. Rice also is grown in Tashkent Oblast. Table 1-3 provides the sown area (in hectares) for the major crop types planted in this republic in 1977.

As shown in table 3-3, approximately 1.1 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Uzbek SSR.

3.3.3.5.7 Preliminary Imagery Review

A preliminary review of the Uzbek SSR imagery was conducted. Correlation of the imagery with the segment-level crop calendars provided the following key acquisition periods:

<u>Period</u>	<u>Crop stage/condition</u>
Fall	Winter grain planting
April	Spring grain planting; winter grains jointing
May/June	Spring grains developing behind winter grains
Late June	Winter grain harvest
August	Spring grain harvest

In some areas in order to take advantage of the spring rains, winter grains are sown during February and March and then are harvested in May.

Acquisitions covering the harvest of spring grains during August are not available because of the early biowindow closing date. The fields were noted to be large and distinct in appearance. Acquisitions for two LACIE Phase III segments appear adequate to attempt a spring grain analysis.

3.3.3.5.8 Regional Summary

Uzbek SSR would make an unlikely candidate as a potential indicator region. The region is not climatically similar to the U.S. Great Plains areas worked during the LACIE phases. Crop calendars are inadequate, oblast-level crop statistics are not available, and only a few sample segments are available for a 1976-77 retrospective analysis.

3.3.3.6 Transcaucasus Region: Azerbaijan SSR, LACIE Region 15

3.3.3.6.1 Crop Statistics

The following crop statistics are available for Azerbaijan SSR.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley for 1971-74
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops for 1974-78

3.3.3.6.2 Crop Calendars (Ref. 13)

A CIA grain crop calendar for Azerbaijan SSR is not available. A generalized crop calendar is provided in the CIA agriculture atlas for the U.S.S.R. (ref. 19); however, spring grains are not included.

3.3.3.6.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Azerbaijan SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	0	0
III	23	12

3.3.3.6.4 Biowindows (Ref. 18)

Biowindows established for Azerbaijan SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	None
III	October 16, 1976 — July 18, 1977

3.3.3.6.5 Climate (Ref. 19)

Azerbaijan SSR is climatically similar to southern California.

3.3.3.6.6 Agronomy (Ref. 20)

Major crops in Azerbaijan SSR include wheat, barley, corn, cotton, vegetables, and rice. Table 1-3 provides the sown area (in hectares) for the major crop types planted in this republic in 1977.

As shown in table 3-3, approximately 0.5 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Azerbaijan SSR.

3.3.3.6.7 Preliminary Imagery Review

A preliminary review of the Azerbaijan SSR imagery was conducted. The segment-level acquisition history from February through June appears to be inadequate for the separation of spring grains.

3.3.3.6.8 Regional Summary

Azerbaijan SSR is not acceptable as a potential indicator region because an adequate crop calendar and segment acquisitions for retrospective analysis are not available. This region is not climatically equivalent to the U.S. Great Plains areas worked during LACIE Phases II and III.

3.3.3.7 Baltic Region, LACIE Region 1

The Lithuania, Latvia,³ and Estonia³ SSR's are included within the Baltic Region.

3.3.3.7.1 Crop Statistics

The following crop statistics are available for the Baltic Region.

- a. CIA (ref. 1): production, area, and yield for the major crops and barley at the regional and SSR levels for 1958-74
- b. Vestnik Statistiki (ref. 2): sown area only for the major crops at the SSR level for 1974-78

³Latvia and Estonia were not considered as potential indicator regions because of the small number of LACIE segments allocated to these republics.

3.3.3.7.2 Crop Calendars (Ref. 13)

CIA grain crop calendars for Lithuania, Latvia, and Estonia SSR's are not available. A generalized crop calendar for Lithuania is provided in the CIA agriculture atlas for the U.S.S.R. (ref. 19). Because of a lack of detail, this calendar is not considered acceptable for use in a potential indicator region exploratory experiment.

3.3.3.7.3 Sample Segments (Refs. 14-17)

Retrospective sample segments allocated and aggregated for Lithuania SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Allocated</u>	<u>Aggregated</u>
II	8	4
III	16	6

3.3.3.7.4 Biowindows (Ref. 18)

Biowindows established for Lithuania SSR in LACIE Phases II and III are as follows:

<u>Phase</u>	<u>Date</u>
II	October 5 — November 24, 1975 May 3 — August 15, 1976
III	August 20 — November 23, 1976 May 4 — August 16, 1977

3.3.3.7.5 Climate (Ref. 19)

Lithuania SSR is climatically similar to Minnesota.

3.3.3.7.6 Agronomy (Ref. 20)

The major crops in Lithuania SSR are barley, winter wheat, winter rye, and potatoes, along with forage crops. Table 1-3 provides the sown area (in hectares) for the major crop types planted in this republic in 1977. Barley far

exceeds the spring grains in planted area, which decreases the potential for crop confusion.

As shown in table 3-3, approximately 1.6 percent of the total barley area sown in the U.S.S.R. during the 1977 harvest year was in Lithuania SSR.

3.3.3.7.7 Preliminary Imagery Review

A preliminary review of the Lithuania SSR imagery was conducted. The landscape is composed of small agricultural fields, woods, and meadows. The relatively small field sizes and adjoining meadows tend to blend together, making interpretation of the imagery difficult. Many acquisitions are affected by haze and cloud cover, reflecting the damp climate of this region.

One LACIE Phase II segment was noted to have a sufficient acquisition history for possible small-grain separation. Five Phase III segments were found that exhibit some potential for small-grain separation based on available acquisitions.

3.3.3.7.8 Regional Summary

Lithuania SSR is not acceptable as a potential indicator region because of the lack of adequate crop calendars and the limited segment acquisition histories.

4. FINAL INDICATOR REGION SELECTION

The selection of the final indicator regions and the individual oblasts selected within each of the three indicator regions are discussed in the following subsections.

4.1 REGIONAL SELECTIONS

The final indicator region selections are as follows:

- a. For high barley: Belorussia SSR
- b. For barley and spring wheat: Ural Region
- c. For barley and winter wheat: North Caucasus Region

Figure 4-1 provides the geographic locations of the selected regions. The major reasons for excluding the other potential indicator regions are summarized in table 4-1.

4.2 OBLAST SELECTION

Individual oblasts were selected within each of the three indicator regions according to segment availability and segment acquisition histories for potential barley separation. This was done even though no recent oblast-level (complete) crop statistics are available at the present time.

The oblasts selected within Belorussia SSR, the Ural Region, and the North Caucasus Region, along with the number of segments allocated to each oblast, are given in table 4-2. The geographic coordinates for each segment within the selected oblasts are provided in table 4-3.

TABLE 4-1.- POTENTIAL INDICATOR REGIONS FOR THE U.S.S.R.

Region	Primary reasons for exclusion
High barley	
Belorussia SSR ^a Central Region (RSFSR)	Inadequate crop calendars
Barley and spring wheat	
Ural Region (RSFSR) ^a Kazakh SSR East Siberia Region: Krasnoyarsk Kray (RSFSR) Middle Volga Region (RSFSR) Volga-Vyatka Region (RSFSR)	Crop statistics not available at sub-regional levels; inadequate crop calendars Crop statistics not available at kray level; inadequate crop calendars; barley separation potential difficult to impossible Inadequate crop statistics at subregional levels; inadequate crop calendars Insufficient imagery data; inadequate crop calendars
Barley and winter wheat	
North Caucasus Region (RSFSR) ^a Ukraine SSR: Donets-Dnepr Region Moldavia SSR Central Chernozem Region (RSFSR) Central Asia Region: Uzbek SSR Transcaucacus Region: Azerbaijan SSR Baltic Region: Lithuania SSR	Inadequate acquisition histories Limited number of segments; marginal acquisition history Serious gaps in acquisition histories Climatically similar to New Mexico; limited available segments with gaps in acquisition histories; crop calendar reliability unknown Climatically and agronomically similar to southern California; limited number of available segments with gaps in acquisition histories; barley not shown on crop calendars Inadequate crop calendar (barley not shown); limited number of segments with marginal acquisition history; difficult area to interpret

^aSelected as a U.S.S.R. indicator region.

TABLE 4-2.- FINAL U.S.S.R. INDICATOR REGION SELECTION

Region	Oblasts selected	Number of allocated segments
High barley: Belorussia SSR	Gome1 Oblast Mogilev Oblast	8 7
Barley and spring wheat: Ural Region (RSFSR)	Orenburg Oblast	92
Barley and winter wheat: North Caucasus Region (RSFSR)	Rostov Oblast Stravropol Kray	61 45

TABLE 4-3.- SELECTED INDICATOR REGION SEGMENT NUMBERS
AND GEOGRAPHIC COORDINATES

Region and oblast	Segment number	Region	Zone	Stratum	Geographic coordinates		Wheat type ^a
					North latitude	East longitude	
Belorussia SSR:							
Gomel Oblast (8 segments)	7043	2	20	201	52°58'	30°07'	W
	7044	2	20	201	53°10'	29°43'	W
	7045	2	20	201	52°24'	31°26'	W
	7088	2	20	201	52°05'	29°35'	W
	7089	2	20	201	52°18'	28°23'	W
	7094	2	20	201	51°45'	29°12'	W
	7095	2	20	201	52°22'	27°54'	W
	7096	2	20	201	52°41'	30°43'	W
Mogilev Oblast (7 segments)	7020	2	20	204	53°29'	32°11'	W
	7024	2	20	204	53°44'	30°15'	W
	7114	2	20	204	53°13'	28°53'	W
	7142	2	20	204	53°15'	32°28'	W
	7177	2	20	204	53°30'	30°48'	W
	7178	2	20	204	52°55'	28°27'	W
	7179	2	20	204	53°35'	29°15'	W
Ural Region (RSFSR):							
Orenburg Oblast (92 segments)	7935	12	190	1900	52°15'	56°23'	S
	7950	12	190	1900	53°16'	54°51'	S
	7951	12	190	1900	51°51'	52°57'	S
	7952	12	190	1900	51°30'	58°46'	S
	7953	12	190	1900	51°13'	55°04'	S
	7954	12	190	1900	51°46'	56°12'	S
	7955	12	190	1900	51°09'	59°55'	S
	7956	12	190	1900	50°41'	60°44'	S
	7957	12	190	1900	51°12'	55°53'	S
	7958	12	190	1900	50°58'	56°18'	S
	7959	12	190	1900	52°06'	51°52'	S
	7960	12	190	1900	50°55'	59°51'	S
	7961	12	190	1900	52°56'	54°45'	S
	7962	12	190	1900	50°50'	54°38'	S
	7963	12	190	1900	53°13'	53°38'	S
	7964	12	190	1900	51°30'	54°01'	S
	7965	12	190	1900	51°27'	56°37'	S
	7966	12	190	1900	51°22'	54°28'	S
	7967	12	190	1900	51°08'	60°36'	S
	7968	12	190	1900	51°55'	54°07'	S
7969	12	190	1900	52°43'	51°41'	S	
7971	12	190	1900	53°01'	52°55'	S	
7972	12	190	1900	53°53'	52°47'	S	
7973	12	190	1900	51°43'	57°50'	S	
7974	12	190	1900	52°11'	59°11'	S	
7975	12	190	1900	51°05'	58°37'	S	

^aW = winter wheat; S = spring wheat.

TABLE 4-3.- Continued.

Region and oblast	Segment number	Region	Zone	Stratum	Geographic coordinates		Wheat type
					North latitude	East longitude	
	7976	12	190	1900	52°55'	52°03'	S
	7977	12	190	1900	51°45'	55°33'	S
	7978	12	190	1900	51°15'	53°48'	S
	7979	12	190	1900	51°21'	61°20'	S
	7980	12	190	1900	52°10'	53°52'	S
	7981	12	190	1900	52°20'	55°34'	S
	7982	12	190	1900	52°39'	55°00'	S
	7983	12	190	1900	51°29'	58°16'	S
	7984	12	190	1900	51°42'	58°31'	S
	7985	12	190	1900	52°43'	52°41'	S
	7986	12	190	1900	52°22'	53°05'	S
	7987	12	190	1900	52°01'	56°10'	S
	7988	12	190	1900	51°07'	59°25'	S
	7989	12	190	1900	52°24'	59°37'	S
	7990	12	190	1900	53°40'	53°45'	S
	7991	12	190	1900	52°46'	52°21'	S
	7992	12	190	1900	51°14'	56°23'	S
	7993	12	190	1900	52°16'	59°54'	S
	7994	12	190	1900	50°55'	55°20'	S
	7995	12	190	1900	50°46'	55°54'	S
	7996	12	190	1900	52°23'	55°11'	S
	7997	12	190	1900	52°06'	55°31'	S
	8180	12	190	1900	51°45'	52°19'	S
	8331	12	190	1900	51°51'	51°34'	S
	8468	12	190	1900	51°38'	52°49'	S
	8712	12	190	1900	51°40'	54°59'	S
	8713	12	190	1900	51°42'	59°57'	S
	8721	12	190	1900	52°17'	53°32'	S
	8723	12	190	1900	51°03'	57°42'	S
	8727	12	190	1900	51°23'	55°26'	S
	8735	12	190	1900	51°30'	59°11'	S
	8744	12	190	1900	51°08'	54°23'	S
	8749	12	190	1900	51°04'	61°15'	S
	8752	12	190	1900	52°26'	52°28'	S
	8754	12	190	1900	51°23'	57°35'	S
	8755	12	190	1900	52°01'	52°28'	S
	8760	12	190	1900	50°39'	59°46'	S
	8761	12	190	1900	50°53'	60°59'	S
	8762	12	190	1900	51°27'	59°31'	S
	8764	12	190	1900	51°28'	60°20'	S
	8766	12	190	1900	50°54'	60°30'	S
	8767	12	190	1900	51°55'	54°53'	S
	8768	12	190	1900	52°15'	54°45'	S
	8769	12	190	1900	51°16'	58°06'	S
	8770	12	190	1900	50°34'	54°38'	S
	8773	12	190	1900	53°03'	54°02'	S
	8776	12	190	1900	53°14'	52°34'	S
	8778	12	190	1900	52°46'	53°19'	S
	8780	12	190	1900	52°42'	54°32'	S
	8786	12	190	1900	51°21'	60°51'	S
	8791	12	190	1900	53°29'	52°26'	S
	8793	12	190	1900	51°35'	54°30'	S

TABLE 4-3.- Continued.

Region and oblast	Segment number	Region	Zone	Stratum	Geographic coordinates		Wheat type
					North latitude	East longitude	
	8794	12	190	1900	51°10'	56°50'	S
	8796	12	190	1900	52°28'	54°08'	S
	8798	12	190	1900	52°00'	59°41'	S
	8799	12	190	1900	53°27'	53°19'	S
	8804	12	190	1900	51°53'	53°43'	S
	8807	12	190	1900	52°25'	51°47'	S
	8816	12	190	1900	53°48'	53°20'	S
	8820	12	190	1900	54°05'	53°01'	S
	8821	12	190	1900	51°30'	56°12'	S
	8830	12	190	1900	50°49'	59°14'	S
	8831	12	190	1900	52°31'	56°08'	S
	9435	12	190	1900	54°10'	52°27'	S
	9436	12	190	1900	53°16'	54°18'	S
	9437	12	190	1900	52°39'	53°43'	S
North Caucasus Region (RSFSR):							
Rostov Oblast							
(61 segments)							
	7325	7	100	1001	46°30'	40°18'	W
	7368	7	100	1001	47°03'	42°09'	W
	7369	7	100	1001	48°26'	40°54'	S
	7370	7	100	1001	46°45'	43°02'	W
	7371	7	100	1001	46°36'	41°01'	W
	7372	7	100	1001	47°42'	39°00'	W
	7373	7	100	1001	47°20'	43°45'	W
	7374	7	100	1001	47°06'	41°08'	W
	7375	7	100	1001	46°43'	41°53'	W
	7376	7	100	1001	47°42'	41°05'	W
	7377	7	100	1001	47°10'	43°19'	W
	7378	7	100	1001	47°26'	40°32'	W
	7379	7	100	1001	47°50'	40°10'	W
	7380	7	100	1001	48°33'	40°19'	W
	7381	7	100	1001	48°03'	41°40'	W
	7382	7	100	1001	48°11'	40°37'	W
	7383	7	100	1001	47°24'	39°39'	W
	7384	7	100	1001	46°52'	39°13'	W
	7385	7	100	1001	46°30'	43°20'	W
	7386	7	100	1001	46°55'	43°46'	W
	7387	7	100	1001	47°43'	39°37'	W
	7388	7	100	1001	46°58'	41°43'	W
	7389	7	100	1001	48°54'	42°26'	W
	7390	7	100	1001	47°54'	42°05'	W
	7391	7	100	1001	47°12'	41°34'	W
	7392	7	100	1001	47°21'	38°45'	W
	7393	7	100	1001	47°01'	40°33'	W
	7394	7	100	1001	48°35'	42°17'	W
	7395	7	100	1001	46°12'	41°20'	W
	7396	7	100	1001	48°54'	40°56'	W
	7397	7	100	1001	49°34'	41°03'	W
	7398	7	100	1001	48°59'	41°50'	W
	7855	7	100	1001	49°26'	40°21'	W
	7856	7	100	1001	46°40'	39°01'	W
	7857	7	100	1001	47°45'	41°32'	W

TABLE 4-3.- Continued.

Region and oblast	Segment number	Region	Zone	Stratum	Geographic coordinates		Wheat type
					North latitude	East longitude	
	7858	7	100	1001	47°24'	42°41'	S
	7859	7	100	1001	47°04'	39°25'	W
	7860	7	100	1001	47°52'	40°40'	W
	7861	7	100	1001	48°38'	39°57'	W
	7862	7	100	1001	47°20'	38°15'	S
	7863	7	100	1001	47°03'	40°02'	W
	7864	7	100	1001	49°04'	40°07'	W
	7865	7	100	1001	47°31'	41°41'	W
	7866	7	100	1001	47°15'	42°57'	W
	7867	7	100	1001	46°15'	40°43'	W
	7868	7	100	1001	48°42'	41°35'	W
	7869	7	100	1001	48°09'	40°09'	W
	7870	7	100	1001	47°21'	39°14'	W
	7871	7	100	1001	49°00'	42°47'	W
	7872	7	100	1001	49°21'	41°36'	W
	7873	7	100	1001	47°22'	41°08'	S
	7874	7	100	1001	49°08'	40°35'	W
	7875	7	100	1001	49°18'	41°07'	W
	7876	7	100	1001	48°25'	41°17'	W
	7877	7	100	1001	46°53'	40°58'	W
	7878	7	100	1001	46°13'	43°31'	W
	7879	7	100	1001	47°31'	40°05'	W
	7880	7	100	1001	46°41'	40°38'	W
	7881	7	100	1001	47°24'	42°14'	W
	7882	7	100	1001	46°24'	41°34'	W
	7883	7	100	1001	46°47'	42°16'	W
Stavropol Kray (45 segments)	7340	7	100	1000	45°44'	42°13'	W
	7341	7	100	1000	44°40'	44°14'	W
	7342	7	100	1000	45°28'	42°14'	W
	7343	7	100	1000	44°48'	42°24'	W
	7344	7	100	1000	45°15'	43°57'	W
	7345	7	100	1000	43°59'	43°00'	W
	7346	7	100	1000	44°14'	42°43'	W
	7347	7	100	1000	45°10'	45°05'	W
	7348	7	100	1000	45°30'	44°05'	W
	7349	7	100	1000	44°54'	43°56'	W
	7350	7	100	1000	45°34'	43°05'	W
	7351	7	100	1000	45°53'	41°47'	W
	7352	7	100	1000	45°27'	41°15'	W
	7353	7	100	1000	44°37'	41°43'	W
	7354	7	100	1000	45°27'	41°40'	W
	7355	7	100	1000	43°59'	42°35'	W
	7356	7	100	1000	45°07'	41°24'	W
	7357	7	100	1000	45°00'	44°22'	W
	7359	7	100	1000	45°58'	42°13'	W
	7360	7	100	1000	45°15'	43°31'	W
	7361	7	100	1000	44°58'	41°42'	W
	7362	7	100	1000	44°34'	43°15'	W
	7363	7	100	1000	44°33'	42°17'	W

TABLE 4-3.- Concluded.

Region and oblast	Segment number	Region	Zone	Stratum	Geographic coordinates		Wheat type
					North latitude	East longitude	
	7791	7	100	1000	44°07'	43°36'	W
	7792	7	100	1000	44°15'	43°04'	W
	7793	7	100	1000	46°02'	43°10'	W
	7794	7	100	1000	44°26'	44°10'	W
	7798	7	100	1000	44°13'	44°24'	W
	7799	7	100	1000	45°57'	43°32'	W
	7804	7	100	1000	44°01'	43°56'	W
	7805	7	100	1000	44°51'	45°00'	W
	7806	7	100	1000	44°56'	43°00'	W
	7807	7	100	1000	45°10'	44°40'	W
	7808	7	100	1000	45°46'	44°05'	W
	7809	7	100	1000	45°39'	42°47'	W
	7848	7	100	1000	45°36'	43°32'	W
	7849	7	100	1000	44°04'	44°47'	W
	7850	7	100	1000	44°36'	44°49'	W
	7851	7	100	1000	43°58'	45°26'	W
	7852	7	100	1000	45°55'	41°12'	W
	7853	7	100	1000	44°30'	45°11'	W
	7854	7	100	1000	43°47'	45°05'	W
	9430	7	100	1000	45°12'	42°06'	W
	9431	7	100	1000	44°26'	43°34'	W
	9432	7	100	1000	44°43'	43°34'	W



Figure 4-1.- Selected U.S.S.R. indicator regions. [Individual oblasts selected within the indicator regions are: Belorussia SSR (high barley region), Gomel and Mogilev Oblasts; the Ural Region (spring wheat and barley region), Orenburg Oblast; and the North Caucasus Region (winter wheat and barley), Rostov Oblast and Stavropol Kray.]

5. AVAILABLE LITERATURE

An inventory of available documentation to support the FCPF exploratory and pilot experiments in the U.S.S.R. disclosed the following applicable literature.

5.1 JSC/EOD LIBRARY

Copies of all the references listed in section 6 are retained in the JSC/EOD Library. The following documents or data items are available in the JSC Building 17 Data Library or from the authors.

1. Agricultural Situation (Supplement 1 to WAS-21). USDA Economics, Statistics, and Cooperatives Service, April 1980.
2. Agrometeorological Conditions of Wintering of the Winter Rye in the Territory of the Udmurt ASSR. Meteorology and Hydrology, no. 1, 1974.
3. Atlas of Northern Kazakh SSR. In Russian; separate contents translated in English.
4. Cotton Production in Soviet Union. FAS M-254 (Data Library control number 12-00340), USDA Foreign Agricultural Service, 1973.
5. Crop Calendar, Soil Moisture, and Climatic Data for Various Oblasts of the Soviet Union. CIA unclassified data.
6. Crop calendars showing the percentage of area in development stage by specified date.
7. Estimating Wintering Conditions for Winter Crops in the Southeast European USSR. NASA technical translation TT F-17, 218, September 1976.
8. Facts About the Russian Grain Sale. Document 11-00083, USDA, 1972.
9. Livestock Feed Balances for the USSR. ERS-Foreign 355 (Data Library control number 12-00226), USDA Economic Research Service, 1975.
10. Newspaper and magazine clippings on U.S.S.R. agriculture for 1974-80.
11. Spring and Winter Wheat Varieties. JPRS 60420 (Data Library control number T74-14733), Department of Commerce, Joint Publications Research Service, 1966.

12. U.S.S.R. agricultural data for segments 7000-9477. 1976.
13. USSR Agriculture Data (Crop Data for USSR by Region: 1958-1974). NASA/JSC computer printout, 1974.
14. U.S.S.R. Ancillary Summaries (Segments 7081-9499). NASA/JSC (approximately 29 volumes).
15. U.S.S.R. Canceled Segments. File folder containing two ancillary summaries for segments 7068 and 7069 (canceled January 15, 1976).
16. U.S.S.R. Crop Calendar Stations. National Oceanic and Atmospheric Administration, June 1976.
17. U.S.S.R. crop production, area, and yield harvested statistics (1958-74).
18. USSR Grain Statistics: National and Regional, 1955-75. Statistical Bulletin 564, USDA Economic Research Service, January 1977.
19. U.S.S.R. Universal Strata Descriptors. NASA/JSC (four volumes covering segments 6920-6999).
20. U.S.S.R. Winter and Spring Wheat Area by Union Republic (1973-74).
21. Winter and Spring Wheat Yield Statistics for the U.S.S.R. USDA control number 00017, 1975.

5.2 NATIONAL AGRICULTURAL LIBRARY

The AGRICOLA data base at the USDA National Agricultural Library in Beltsville, Maryland, contains 925 references (in Russian) pertaining to Soviet crop statistics and small-grain cultures. A listing of these references is available.

6. REFERENCES

1. USSR: Crop Data. CIA, June 17, 1977.
2. Vestnik Statistiki, Soviet Statistical Journal. 1973-78 editions.
3. National Economic Statistical Yearbook for the U.S.S.R. 1975 edition.
4. National Economic Statistical Yearbook for the U.S.S.R. 1977 edition.
5. National Economic Statistical Yearbook for RSFSR. 1975 edition.
6. National Economic Statistical Yearbook for RSFSR. 1976 edition.
7. National Economic Statistical Yearbook for RSFSR. 1977 edition.
8. National Economic Statistical Yearbook for Ukraine. 1976 edition.
9. National Economic Statistical Yearbook for Kazakh. 1977 edition.
10. National Economic Statistical Yearbook for Uzbek. 1977 edition.
11. National Economic Statistical Yearbook for Ukraine. 1977 edition.
12. National Economic Statistical Yearbook for Belorussia. 1976 edition.
13. Crop Calendars USSR. CIA, 1975.
14. LACIE Phase II, CAS Annual Report 1. USSR Winter Wheat Indicator Region and Spring Wheat Indicator Region; LACIE Estimates of Area, Yield, and Production, May 16, 1977.
15. LACIE Phase III, CAS Unscheduled Report, USSR Wheat, Nov. 4, 1977.
16. LACIE Phase III, CAS Monthly Report, USSR Winter Wheat, Sept. 7, 1977.
17. LACIE Phase III, CAS Monthly Report, USSR Spring Wheat, Sept. 7, 1977.
18. LACIE Phase II and III Biowindow Printout. NASA/JSC, 1977.
19. USSR Agriculture Atlas. CIA, 1974.
20. USSR Ancillary Summaries. NASA/JSC, 1975.