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Addendum to
LACIE-00430, Revision A

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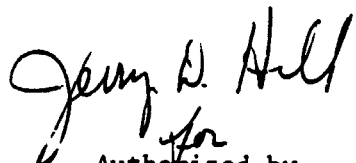
COLUMBIA, MISSOURI

TECHNICAL NOTE 78-4

USSR SPRING AND WINTER WHEAT MODELS

MAY 1977

REVISED NOVEMBER 1978



Authorized by
Norton D. Strommen
Acting Director, CEAS

(E79-10068) LARGE AREA CROP INVENTORY
EXPERIMENT (LACIE). USSR SPRING AND WINTER
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Technical Note 78-4

USSR Spring and Winter Wheat Models

Revised 1978

Clarence Sakamoto, Sharon LeDuc, and Arno Perlow¹

With the experience of LACIE (Large Area Crop Inventory Experiment), a joint project involving NASA, USDA, and NOAA, it was determined that some of the models (in CCEA Technical Note 77-2, "Wheat Yield Models for the USSR," May 1977) were not performing satisfactorily. Associated problems included: 1) misspecification of trend term and 2) revision of meteorological variables that were considered significant. Consequently, all the models were reviewed with the objective of improving the response of the model. In particular, the covariance models were separated, where possible, with the inclusion of additional data years.

The philosophy of this revision with respect to trends where they exist in the data series is that this surrogate for technology varies throughout the Soviet Union, with trends still increasing in some regions having stabilized in others.

The separation of the covariance models seems to have improved the performance of the estimated yield in the jackknife test. This is the test adopted by LACIE to test the yield model with a relatively short period of record. In this approach, one year from the data set is selected as the independent test year while the remaining years are used to develop the coefficients of the regression model. This procedure is done for ten consecutive years.

Detailed explanation of the variables and their derivation is provided in Technical Note 77-2. The reader is referred to this publication.

¹Respectively, Chief, Senior Statistician, Meteorological Technician, Climatic Impact Assessment Division/Models Branch, NOAA/EDIS/CEAS, 116 Federal Building, Columbia, Missouri 65201, November 1978.

Reference

Sakamoto, Clarence M. and Sharon K. LeDuc, "Wheat Yield Models for the USSR."
Technical Note 77-2, Center for Climatic and Environmental Assessment,
May 1977, Federal Building, Columbia, Missouri 65201.

BALTICS-BELORUSSIA WINTER WHEAT COVARIANCE MODEL

Region

Baltics - Crop Region 1
Belorussia - Crop Region 2

P.E.T. A = 0.946
P.E.T. I = 27.816

June Daylength = 1.4254

Latitude = 55°N

Crop Region 1 Constant = 1 if Data from Crop Region 1; Otherwise 0

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	3.84700	4.59940	4.75153	4.74727
Region Constant		1.00	3.01991	2.61262	2.05060	2.21393
Linear Trend (1958-1978)		21.00	1.17437	1.11661	1.13018	1.12203
Dec-Mar Avg Temp (°C)	DFN	-3.71		0.48875	0.44984	0.39161
May Temp (°C)	DFN	11.76				
Jun Prec - P.E.T. (mm)	DFN	-53.06			-0.33438	-0.33597
R Squared			0.85453	0.87871	0.88579	0.89225
Standard Error (Q/Ha)			2.70503	2.50829	2.47298	2.44167
Standard Variance (Q/Ha)			7.31720	6.29151	6.11563	5.96174

Standard Deviation of Yields = 6.88673 Q/Ha

DFN = Departure from Normal
SDFN = Squared Departure from Normal
Yields Measured in Quintals per Hectare

Yields and Climatic Data are Pooled Over Crop Regions 1 and 2
Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

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WEST UKRAINE WINTER WHEAT MODEL

Region

West Ukraine - Crop Region 3

Latitude = 50°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	13.10625	13.23230	14.19181	14.72625	13.86957
Linear Trend (1958-1973)		16.00	0.82692	0.81342	0.71061	0.65335	0.74512
Feb-Mar Temp (°C)	DFN	-0.64		0.07752	0.45378	0.50475	0.52668
May Temp (°C)	DFN	11.82			-0.67066	-0.43691	-0.55619
Jun Temp (°C)	DFN	14.44				-0.59687	-0.50570
Jul Prec (mm)	DFN	83.61					-0.03162
R Squared			0.69106	0.69226	0.75197	0.79078	0.80836
Standard Error (Q/Ha)			2.89941	2.98868	2.77728	2.64704	2.63688
Standard Variance (Q/Ha)			8.40659	8.93218	7.71331	7.00683	6.95313

Standard Deviation of Yields = 5.06067 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

NORTH CENTRAL UKRAINE WINTER WHEAT MODEL

Region:

North Central Ukraine - Crop Region 4

P.E.T. A = 1.075
P.E.T. I = 36.424

June Daylength = 1.3460

Latitude = 50°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>November</u>	<u>February</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	14.44168	15.70871	15.14566	16.37102	18.78432
Linear Trend (1958-1973)		16.00	0.91174	0.77598	0.83631	0.70502	0.44646
Sep-Nov Prec (mm)	DFN	126.50		0.03712	0.03233	0.04788	0.05860
Jan-Feb Temp (°C)	DFN	-4.53			0.70452	0.72336	0.51492
May Temp (°C)	DFN	14.94					-1.34671
Jun Prec - P.E.T. (mm)	DFN	-57.34				-0.82191	0.05655
R Squared			0.59827	0.66570	0.74803	0.79008	0.84933
Standard Error (Q/Ha)			3.91713	3.69093	3.31681	3.14168	2.77038
Standard Variance (Q/Ha)			15.34388	13.62294	11.00121	9.87018	7.67501

Standard Deviation of Yields = 5.99636 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

NORTHEAST UKRAINE WINTER WHEAT MODEL

Region

Northeast Ukraine - Crop Region 5

P.E.T. A = 1.095

P.E.T. I = 37.742

May Daylength = 1.2773

June Daylength = 1.3460

Latitude = 50°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>November</u>	<u>March</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	14.90086	18.33936	19.13115	17.98647	18.20154
Linear Trend (1958-1973)		16.00	0.79484	0.42643	0.34160	0.46425	0.44120
Sep-Nov Prec (mm)	DFN	122.11		0.08384	0.06885	0.03371	0.03434
Feb-Mar Temp (°C)	DFN	-2.83			0.86411	0.78344	0.63050
May Prec - P.E.T. (mm)	DFN	-49.14				0.08249	0.08138
Jun Prec - P.E.T. (mm)	DFN	-67.41					0.03754
R Squared			0.41818	0.69863	0.76254	0.85208	0.87041
Standard Error (Q/Ha)			4.91650	3.65447	3.35780	2.75016	2.67930
Standard Variance (Q/Ha)			24.17200	13.35516	11.27485	7.56339	7.17863

Standard Deviation of Yields = 6.25315 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
 Meteorological Normals Based on 1958-1975

EASTERN UKRAINE WINTER WHEAT MODEL

Region

Eastern Ukraine - Crop Region 6

P.E.T. A = 1.179
P.E.T. I = 43.315

April Daylength = 1.1297
May Daylength = 1.2573
June Daylength = 1.3201

Latitude = 48°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	16.68556	14.76521	13.97911	15.78751	16.55034
Linear Trend (1958-1972)		15.00	0.59340	0.80290	0.88865	0.69137	0.60815
Jan-Feb Temp (°C)	DFN	-4.06		1.25339	1.26616	0.98323	0.93925
Apr Prec - P.E.T. (mm)	DFN	-11.27			0.06070	0.04844	0.03882
May Prec - P.E.T. (mm)	DFN	-50.87				0.08099	0.07766
Jun Prec - P.E.T. (mm)	DFN	-78.49					0.03269
Q Squared			0.24711	0.51407	0.55129	0.71048	0.73156
Standard Error (Q/Ha)			5.19510	4.31050	4.28751	3.57401	3.58194
Standard Variance (Q/Ha)			26.98903	18.58044	18.38277	12.77352	12.83027

Standard Deviation of Yields = 5.80848 Q/Ha

DFN = Departure from Normal
SDFN = Squared Departure from Normal
Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

SOUTHERN UKRAINE WINTER WHEAT MODEL

Region

Southern Ukraine - Crop Region 7

P.E.T. A = 1.196

P.E.T. I = 44.447

May Daylength = 1.2479

June Daylength = 1.3081

Latitude = 47°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>March</u>	<u>May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	14.06902	12.87978	13.02610	13.55687	13.76189	14.12910
Linear Trend (1958-1972)		15.00	0.93826	1.06800	1.05203	0.99086	0.97176	0.93171
Jan-Feb Temp (°C)	DFN	-1.55		1.00890	0.95266	0.86855	0.73312	0.68250
Sep-Mar Prec (mm)	DFN	272.11			0.01517	0.01407	0.01223	0.00597
May Prec - P.E.T. (mm)	DFN	-46.89				0.03536	0.04230	0.04939
Jun Prec - P.E.T. (mm)	DFN	-67.98					0.03706	0.17909
Jul Prec (mm)	DFN	52.67						-0.17230

R Squared

Standard Error (Q/Ha)

Standard Variance (Q/Ha)

Standard Deviation of Yields = 5.69250 Q/Ha

0.64323	0.78161	0.80841	0.83373	0.85513
3.50481	2.83205	2.74566	2.65434	2.57888
12.28368	8.02048	7.53865	7.04550	6.65063

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

MOLDAVIA WINTER WHEAT MODEL

Region

Moldavia - Crop Region 8

P.E.T. A = 1.186

P.E.T. I = 43.795

April Daylength = 1.1251

Latitude = 47°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>April</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	13.44745	13.64203	13.40240	13.39651	12.12459
Linear Trend (1965-1974)		10.00	2.19231	2.14367	2.20357	2.20505	2.52303
Jan-Feb Avg Temp (°C)	DFN	-2.05		0.55124	0.53134	0.40683	0.16329
Apr Prec - P.E.T. (mm)	DFN	-13.23			0.05929	0.05454	0.07127
Jun Temp (°C)	DFN	18.87					-0.97775
Jul Prec (mm)	DFN	63.56				-1.09739	-0.05720
R Squared			0.73436	0.75560	0.78433	0.80408	0.82648
Standard Error (Q/Ha)			4.70815	4.66411	4.53521	4.48575	4.39392
Standard Variance (Q/Ha)			22.16669	21.75392	20.56813	20.12199	19.30649

Standard Deviation of Yields = 8.86215 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

KRASNODAR WINTER WHEAT MODEL

Region

Krasnodar - Crop Region 9

P.F.T. A = 1.249

P.F.T. I = 47.957

March Daylength = 0.9814

June Daylength = 1.2967

Latitude = 46° N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>March</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	21.71187	20.18773	19.52353	19.47939	18.70633
Linear Trend (1958-1972)		15.00	0.61892	0.78519	0.85765	0.86246	0.94680
Jan-Feb Temp (°C)	DFN	-0.86		1.12364	1.18429	1.03212	1.14733
Mar Prec - P.E.T. (mm)	DFN	36.22			0.08575	0.09588	0.09210
Jun Prec - P.E.T. (mm)	DFN	-58.98				0.02634	0.13618
Jul Prec (mm)	DFN	63.06					-0.12967
R Squared			0.31842	0.62356	0.68864	0.71307	0.78907
Standard Error (Q/Ha)			4.54175	3.48597	3.28166	3.26919	2.91745
Standard Variance (Q/Ha)			20.62746	12.15198	10.76930	10.68759	8.51150

Standard Deviation of Yields = 5.33702 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

NORTHEAST CAUCASUS WINTER WHEAT MODEL

Region

Northeast Caucasus - Crop Region 10

Latitude = 42°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	13.32736	12.71951	13.38007	13.48948	13.80081	14.23915
Linear Trend (1958-1973)		16.00	0.32468	0.45775	0.40854	0.40047	0.38291	0.36006
Jan-Feb Temp (°C)	DFN	-4.97		0.82772	0.73899	0.72807	0.67763	0.61549
Jan-Feb Temp (°C)	SDFN	-4.97		-0.05504	-0.07590	-0.07943	-0.09402	-0.11615
Sep-Mar Prec (mm)	DFN	239.59		0.01997	0.01955	0.01955	0.02442	0.02197
Apr Temp (°C)	DFN	10.05				0.07090	0.21513	0.30200
May Temp (°C)	DFN	16.55					-0.52864	-0.52561
Jun Prec (mm)	DFN	55.65						0.01802
R Squared			0.18605	0.77579	0.84763	0.84864	0.87071	0.87646
Standard Error (Q/Ha)			3.47576	1.95952	1.68133	1.75025	1.69661	1.74816
Standard Variance (Q/Ha)			12.08090	3.83970	2.82687	3.06339	2.87850	3.05606

Standard Deviation of Yields = 3.73024 Q/Ha

DFN = Departure from Normal
 SDFN = Squared Departure from Normal
 Yields Measured in Quintals per Hectare
 Yields Based on 1958-1974
 Meteorological Normals Based on 1958-1974

BLACK SOIL ZONE WINTER WHEAT COVARIANCE MODEL

Region

West Black Soil Zone - Crop Region 11
 East Black Soil Zone - Crop Region 12

P.E.T. A = 1.021
 P.E.T. I = 32.810

May Daylength = 1.2880

Latitude = 51°N

Crop Region 12 Constant = 1 if Data from Crop Region 12; Otherwise 0

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>
Overall Constant		1.00	11.63997	9.15309	9.45432	9.48007	9.77070
Region 12 Constant		1.00	0.65111	1.91738	1.89212	2.05333	1.97560
Linear Trend (1958-1978)		21.00	0.64588	0.85186	0.81868	0.81169	0.77426
Jan-Feb Temp (°C)	DFN	-7.85		0.95039	0.86940	0.82320	0.73080
Mar Temp (°C)	DFN	-2.84			0.14947	0.24307	0.24177
Apr Prec (mm)	DFN	37.18				0.02194	0.01737
Apr Prec (mm)	SDFN	37.18				0.00160	0.00203
Apr Temp (°C)	SDFN	6.82				-0.07261	-0.07291
May Prec - P.E.T. (mm)	DFN	-42.08					0.02131
R Squared			0.40527	0.76531	0.76779	0.79119	0.80691
Standard Error (Q/Ha)			4.03544	2.57691	2.60709	2.61096	2.56049
Standard Variance (Q/Ha)			16.28477	6.64047	6.79690	6.91710	6.55611

Standard Deviation of Yields = 5.07172 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields and Climatic Data are Pooled Over Crop Regions 11 and 12
 Yields based on 1958-1974

Meteorological Normals Based on 1958-1974

CENTRAL DISTRICT WINTER WHEAT MODEL

Region

Central District - Crop Region 13

P.E.T. A = .937

P.E.T. I = 27.226

May Daylength = 1.3517

Latitude = 56°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>April</u>	<u>May</u>
Overall Constant		1.00	6.75034	6.54897	7.23100	8.27600
Linear Trend (1958-1978)		21.00	0.69335	0.71572	0.71056	0.62064
Dec-Mar Temp (°C)	DFN	-7.22		0.37073	0.37528	0.25330
Apr Temp (°C)	SDFN	5.15			-0.17415	-0.23873
May Prec - P.E.T. (mm)	DFN	-34.40				0.03251
R Squared			0.76013	0.61818	0.85854	0.89128
Standard Error (Q/Ha)			2.03133	1.83063	1.67565	1.52900
Standard Variance (Q/Ha)			4.12630	3.35119	2.80780	2.33784

Standard Deviation of Yields = 4.01584 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

VOIGA-VYATSK WINTER WHEAT MODEL

Region

Volga-Vyatsk - Crop Region 14

P.E.T. A = .914

P.E.T. I = 25.737

May Daylength = 1.3517

June Daylength = 1.4448

Latitude = 56°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>Truncation</u>		
				<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	8.32910	9.62858	10.63846	11.17787
Linear Trend (1958-1978)		21.00	0.46397	0.48635	0.31345	0.24928
Apr Temp (°C)	DFN	3.73		0.16829	0.40265	0.51609
Apr Temp (°C)	SDFN	3.73		-0.30004	-0.19085	-0.02316
May Prec - P.E.T. (mm)	DFN	-37.93			0.05545	0.06455
Jun Prec - P.E.T. (mm)	DFN	-55.54				0.06192
Jun Prec - P.E.T. (mm)	SDFN	-55.54				-0.00110
R Squared			0.44824	0.64439	0.78198	0.86948
Standard Error (Q/Ha)			2.68467	2.31513	1.88679	1.59218
Standard Variance (Q/Ha)			7.20743	5.35983	3.55998	2.5736

Standard Deviation of Yields = 3.49947 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

UPPER VOLGA WINTER WHEAT MODEL

Region

Upper Volga - Crop Region 15

P.E.T. A = 0.965

P.E.T. I = 29.115

May Daylength = 1.3240

June Daylength = 1.4074

Latitude = 54°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	8.71399	9.25263	10.02774	11.03904
Linear Trend (1958-1971)		14.00	0.62359	0.55880	0.46555	0.44480
Apr Temp (°C)	DFN	4.14		0.44311	0.57567	0.75812
May Prec - P.E.T. (mm)	DFN	-53.43			0.03629	0.05362
Jun Prec - P.E.T. (mm)	DFN	-64.94				0.03586
Jun Prec - P.E.T. (mm)	SDFN	-64.94				-0.00122
R Squared			0.53704	0.60549	0.63648	0.72853
Standard Error (Q/Ha)			2.68660	2.57367	2.57139	2.43421
Standard Variance (Q/Ha)			7.21784	6.62378	6.61207	5.92538

Standard Deviation of Yields = 3.81462 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1971 and 1973-1974

Meteorological Normals Based on 1958-1971 and 1973-1974

MIDDLE VOLGA WINTER WHEAT MODEL

Region

Middle Volga - Crop Region 16

P.E.T. A = 1.058
P.E.T. I = 35.238

May Daylength = 1.2994

Latitude = 52°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>May</u>
Overall Constant		1.00	10.44620	12.30867	16.15648
Linear Trend (1958-1973)		16.00	0.53564	0.51523	0.14469
Apr Temp (°C)	DFN	6.60		0.61324	1.38337
Apr Temp (°C)	SDFN	6.60		-0.32708	-0.43119
May Prec - P.E.T. (mm)	DFN	-60.11			0.15873
R Squared			0.31693	0.50420	0.85543
Standard Error (Q/Ha)			4.02475	3.68325	2.07017
Standard Variance (Q/Ha)			16.19859	13.56636	4.28561

Standard Deviation of Yields = 4.71511 Q/Ha

DFN = Departure from Normal
SDFN = Squared Departure from Normal
Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
Meteorological Normals Based on 1958-1974

LOWER VOLGA WINTER WHEAT MODEL

Region

Lower Volga - Crop Region 17

Latitude = 48°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	11.25708	9.60335	10.18725	11.11293	12.83481	12.90914
Linear Trend (1958-1973)		16.00	0.44105	0.67612	0.57760	0.50386	0.37474	0.47754
Jan-Feb Temp (°C)	DFN	-8.14		1.05030	1.00725	0.92801	0.72158	0.73898
Jan-Feb Temp (°C)	SDFN	-8.14		-0.04740	-0.01598	-0.04415	-0.10419	-0.13465
Sep-Mar Prec (mm)	DFN	228.00			0.02260	0.02230	0.02526	0.03018
Apr Temp (°C)	DFN	8.67				0.49578	1.15869	1.18065
May Temp (°C)	DFN	16.04					-1.08712	-0.85379
Jun Temp (°C)	DFN	20.08						1.29695
Jun Temp (°C)	SDFN	20.08						-0.45764
R Squared			0.18731	0.62512	0.67750	0.71434	0.77203	0.82500
Standard Error (Q/Ha)			4.70203	3.43041	3.31162	3.25534	3.05009	2.98777
Standard Variance (Q/Ha)			22.10910	11.76771	10.96685	10.59726	9.30302	8.92674

Standard Deviation of Yields = 5.05021 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

TRANSCAUCASUS WINTER WHEAT MODEL

Region

Transcaucasus - Crop Region 28

P.E.T. A = 1.441

P.E.T. I = 60.315

June Daylength = 1.2463

Latitude = 41°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	7.03465	7.43554	7.53137	7.54780
Linear Trend (1958-1978)		21.00	0.49505	0.49899	0.47699	0.49033
Apr Prec (mm)	DFN	26.28		-0.02082	-0.02808	-0.03799
Apr Prec (mm)	SDFN	26.28		-0.00340	-0.00252	-0.00199
May Temp (°C)	DFN	18.16			-0.31528	-0.06292
Jun Prec - P.E.T. (mm)	DFN	-107.88				0.02619
Jun Prec - P.E.T. (mm)	SDFN	-107.88				-0.00067
R Squared			0.80062	0.83763	0.84964	0.89445
Standard Error (Q/Ha)			1.35944	1.31150	1.30972	1.19295
Standard Variance (Q/Ha)			1.84807	1.72003	1.71536	1.42313

Standard Deviation of Yields = 2.95365 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

SOUTH KAZAKHSTAN WINTER WHEAT MODEL

Region

South Kazakhstan - Crop Region 29

P.E.T. A = 1.365
P.E.T. I = 55.497

May Daylength = 1.2066

Latitude = 42°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	8.58371	8.17614	8.15510	9.74026	9.65853
Linear Trend (1965-1972)		8.00	0.53920	0.65664	0.66271	0.42174	0.42279
Dec-Mar Temp (°C)	DFN	0.44		0.46618	0.41506	0.34373	0.39741
Apr Temp (°C)	DFN	12.86			-0.72049	-0.32495	-0.36496
May Prec - P.E.T. (mm)	DFN	-47.79				0.04940	0.04686
May Prec - P.E.T. (mm)	SDFN	-47.79				-0.00065	-0.00058
Jun Temp (°C)	DFN	23.21					-0.50355
R Squared			0.26999	0.38442	0.50072	0.75591	0.77366
Standard Error (Q/Ha)			2.65237	2.52112	2.35623	1.79097	1.80883
Standard Variance (Q/Ha)			7.03505	6.35604	5.55180	3.20758	3.27188

Standard Deviation of Yields = 3.00576 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
Meteorological Normals Based on 1958-1974

CENTRAL ASIA WINTER WHEAT MODEL

Region

Central Asia - Crop Region 30

P.E.T. A = 1.421

P.E.T. I = 59.091

April Daylength = 1.0977

May Daylength = 1.1921

Latitude = 40°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	5.79247	5.35699	5.29893	5.50535	5.35953
Linear Trend (1958-1978)		21.00	0.27110	0.31694	0.32305	0.30132	0.31667
Nov-Mar Prec (mm)	DFN	240.56		0.01232	0.01150	0.00601	0.00733
Apr Prec - P.E.T. (mm)	DFN	20.33			0.00959	0.00168	0.00140
May Prec - P.E.T. (mm)	DFN	-54.61				0.01937	0.01844
Jun Temp (°C)	DFN	24.23					-0.16023
R Squared			0.55031	0.66511	0.70009	0.75951	0.76291
Standard Error (Q/Ha)			1.34856	1.20193	1.17735	1.09408	1.13068
Standard Variance (Q/Ha)			1.81862	1.44463	1.38616	1.19702	1.27843

Standard Deviation of Yields = 1.95097 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

NORTHWEST WINTER WHEAT MODEL

Region

Northwest - Crop Region 33

P.E.T. A = .897

P.E.T. I = 24.646

May Daylength = 1.3834

June Daylength = 1.4885

July Daylength = 1.4247

Latitude = 58°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>March</u>	<u>May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	8.25333	8.50337	8.43766	8.83545	8.96148
Linear Trend (1958-1971)		14.00	0.32739	0.29187	0.30068	0.24955	0.23697
Sep-Nov Prec (mm)	DFN	143.33		0.01185	0.01288	0.01717	0.02157
May Prec - P.E.T. (mm)	DFN	-33.90			-0.00908	-0.01192	-0.01159
Jun Prec - P.E.T. (mm)	DFN	-66.10				-0.01057	-0.01239
Jul Prec - P.E.T. (mm)	DFN	-70.43					-0.01830
R Squared			0.63863	0.66396	0.68594	0.70970	0.81284
Standard Error (Q/Ha)			1.15886	1.16721	1.18345	1.19936	1.02143
Standard Variance (Q/Ha)			1.34296	1.36237	1.40055	1.43846	1.04333

Standard Deviation of Yields = 1.85214 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1965 and 1967-1972
 Meteorological Normals Based on 1958-1972

NORTHEASTERN CAUCASUS SPRING WHEAT MODEL

Region

Northeastern Caucasus - Crop Region 10

P.E.T. A = 1.218

P.E.T. I = 45.894

June Daylength = 1.2856

Latitude = 45°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>May</u>	<u>June</u>
Overall Constant		1.00	7.97905	8.11335	8.91876	8.78881
Linear Trend (1967-1978)		12.00	1.05132	1.00058	0.69631	0.74541
Apr Temp (°C)	DFN	10.05		0.45290	0.52654	0.49722
May Prec (mm)	DFN	43.47			0.13978	0.10551
Jun Prec - P.E.T. (mm)	DFN	-69.84				0.06045
R Squared			0.30989	0.34581	0.64973	0.75879
Standard Error (Q/Ha)			3.92496	3.95557	3.00365	2.59434
Standard Variance (Q/Ha)			15.40534	15.64652	9.02190	6.73060

Standard Deviation of Yields = 4.57469 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

WESTERN BLACK SOIL ZONE SPRING WHEAT MODEL

Region

West Black Soil Zone - Crop Region 11

Latitude = 51° N

May Daylength = 1.2880
June Daylength = 1.3600

P.E.T. A = 1.024
P.E.T. I = 32.975

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	6.17711	6.28438	6.54084	6.73774	7.21145
Linear Trend (1958-1974)		17.00	0.87772	0.86581	0.83731	0.81543	0.76279
Apr Temp (°C)	DFN	6.98		0.17616	0.22273	0.26601	0.30338
May Prec - P.E.T. (mm)	DFN	-40.85			0.01964	0.01991	0.01485
Jun Prec - P.E.T. (mm)	DFN	-55.35				0.00834	0.01413
Jul Prec (mm)	DFN	64.41					0.01519
R Squared			0.71995	0.72433	0.73852	0.74079	0.74315
Standard Error (Q/Ha)			2.85502	2.93204	2.96339	3.07096	3.19286
Standard Variance (Q/Ha)			8.15116	8.59686	8.78165	9.43078	10.19438

Standard Deviation of Yields = 5.22368 Q/Ha

DFN = Departure from Normal
SDFN = Squared Departure from Normal
Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
Meteorological Normals Based on 1958-1974

EASTERN BLACK SOIL ZONE SPRING WHEAT MODEL

Region

East Black Soil Zone - Crop Region 12

P.E.T. A = 1.025
P.E.T. I = 33.089

June Daylength = 1.3600

Latitude = 51°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>October</u>	<u>April</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	7.92236	8.19458	8.76405	9.41907	10.23076
Linear Trend (1958-1974)		17.00	0.67574	0.64549	0.58222	0.50944	0.41924
Sep-Oct Prec (mm)	DFN	88.77		0.00924	0.01109	0.01815	0.01670
Apr Temp (°C)	DFN	6.67			0.34947	0.35794	0.37381
Jun Prec - P.E.T. (mm)	DFN	-63.26				0.04876	0.04026
Jul Prec (mm)	DFN	60.59					0.04050
R Squared			0.59688	0.60159	0.63817	0.79426	0.84090
Standard Error (Q/Ha)			2.89624	2.98035	2.94743	2.31328	2.12469
Standard Variance (Q/Ha)			8.38820	8.88248	8.68735	5.35128	4.51432

Standard Deviation of Yields = 4.41677 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

CENTRAL DISTRICT SPRING WHEAT MODEL

Region

Central District - Crop Region 13

Latitude = 56°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>Truncation</u>		
				<u>April</u>	<u>June</u>	<u>August</u>
Overall Constant		1.00	4.48488	5.20174	5.86205	5.91333
Linear Trend 1958-1978		21.00	0.73048	0.72549	0.68221	0.74890
Apr Mean Temp (°C)	DFN	5.15		0.01551	0.15118	0.12868
Apr Mean Temp (°C)	SDFN	5.15		-0.18411	-0.13702	-0.14573
Jun Prec (mm)	DFN	64.35			0.02800	0.02281
Jun Prec (mm)	SDFN	64.35			-0.00076	-0.00088
Aug Prec (mm)	DFN	63.00				0.04434
Aug Prec (mm)	SDFN	63.00				-0.00156
R Squared			0.76699	0.80763	0.83201	0.89040
Standard Error (Q/Ha)			2.09985	2.04947	2.08203	1.85918
Standard Variance (Q/Ha)			4.40938	4.20033	4.33486	3.45656

Standard Deviation of Yields = 4.21197 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
Meteorological Normals Based on 1958-1974

April 1978

VOLGA-VYATSK SPRING WHEAT MODEL

Region

Volga-Vyatsk - Crop Region 14

P.E.T. A = .916

P.E.T. I = 25.860

May Daylength = 1.3517

June Daylength = 1.4448

Latitude = 56°N

Variable	Deviation	Normal	Trend	Truncation		
				April	May	June
Overall Constant		1.00	5.12920	2.40203	3.59559	3.88015
Linear Trend 1958-1978		21.00	0.56058	0.86360	0.80080	0.77672
Sep-Apr Prec (mm)	DFN	329.29		-0.02485	-0.02131	-0.01458
May Prec - P.E.T. (mm)	DFN	-37.93			0.02513	0.01815
May Prec - P.E.T. (mm)	SDFN	-37.93			-0.00075	-0.00087
Jun Prec - P.E.T. (mm)	DFN	-55.54				0.02509
Jun Prec - P.E.T. (mm)	SDFN	-55.54				0.00004
R Squared			0.61295	0.71167	0.78146	0.81112
Standard Error (Q/Ha)			2.32326	2.07556	1.95179	1.98773
Standard Variance (Q/Ha)			5.39752	4.30796	3.80947	3.95106

Standard Deviation of Yields = 3.61575 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974

Meteorological Normals Based on 1958-1974

April 1978

UPPER VOLGA SPRING WHEAT MODEL

Region

Upper Volga - Crop Region 15

P.E.T. A = .970

P.E.T. I = 29.391

July Daylength = 1.4074

Latitude = 54°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>July</u>
Overall Constant		1.00	7.45685	4.86423	5.80243
Linear Trend (1958-1971)		14.00	0.64984	0.94966	0.84116
Sep-Apr Prec (mm)	DFN	299.94		-0.02600	-0.02789
Jul Prec - P.E.T. (mm)	DFN	-77.37			0.03376

R Squared

0.71011

0.82519

0.90386

Standard Error (Q/Ha)

1.22302

1.56983

1.20812

Standard Variance (Q/Ha)

3.61430

2.46435

1.45955

Standard Deviation of Yields = 3.51217 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
 Meteorological Normals Based on 1958-1974

MIDDLE VOLGA SPRING WHEAT MODEL

Region

Middle Volga - Crop Region 16

P.E.T. A = 1.061

P.E.T. I = 35.486

June Daylength = 1.3748

July Daylength = 1.3296

Latitude = 52°N

Variable	Deviation	Normal	Constant	April	Truncation		
					May	June	July
Overall Constant		1.00	10.12181	10.12180	10.12180	10.12181	10.12181
Sep-Apr Prec (mm)	DFN	279.53		0.02599	0.01887	0.01612	0.01683
May Prec (mm)	DFN	35.88			0.04454	0.04143	
Jun Prec - P.E.T. (mm)	DFN	-73.31					0.02222
Jul Prec - P.E.T. (mm)	DFN	-94.11				0.03626	0.03575
R Squared			0.00000	0.39632	0.45954	0.54850	0.65230
Standard Error (Q/Ha)			2.67001	2.14255	2.09842	1.99034	1.74663
Standard Variance (Q/Ha)			7.12894	4.59050	4.40335	3.96146	3.05071

Standard Deviation of Yields = 2.67001 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1974
Meteorological Normals Based on 1958-1974

April 1978

LOWER VOLGA SPRING WHEAT MODEL

Region

Lower Volga - Crop Region 17

Latitude = 49°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>April</u>	<u>Truncation May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	8.09623	8.67695	8.98868	8.90932	8.37248
Linear Trend 1969-1978		10.00	1.21181	0.89892	0.67864	0.83420	1.19080
Sep-Apr Prec (mm)	DFN	250.65		0.03318	0.03079	0.03631	0.03937
Apr Mean Temp (°C)	DFN	8.67		0.41497	0.50447	0.59993	0.61277
May Prec (mm)	DFN	36.41			0.07074	0.07067	0.08640
Jun Temp (°C)	DFN	20.08				0.88159	1.24789
Jul Prec (mm)	DFN	33.82					-0.05236
R Squared			0.26770	0.65464	0.77443	0.80963	0.83484
Standard Error (Q/Ha)			3.25830	2.41689	2.04014	1.96567	1.92993
Standard Variance (Q/Ha)			10.61650	5.84135	4.16217	3.86386	3.72461

Standard Deviation of Yields = 3.67846 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1971 and 1973-1974
Meteorological Normals Based on 1958-1974

April 1978

NORTHWEST URALS SPRING WHEAT MODEL

Region

Northwest Urals - Crop Region 18

P.E.T. A = .880

P.E.T. I = 23.550

April Daylength = 1.1882

May Daylength = 1.3834

June Daylength = 1.4885

Latitude = 58°N

Variable	Deviation	Normal	Trend	Truncation		
				April	May	June
Overall Constant		1.00	6.40865	8.47573	8.01511	8.18875
Linear Trend 1958-1978		21.00	0.24950	0.03190	0.08039	0.10109
Apr Prec - P.E.T. (mm)	DFN	8.07		0.09551	0.09178	0.06411
Apr Mean Temp (°C)	DFN	3.19		0.85683	0.70325	0.52106
May Prec - P.E.T. (mm)	DFN	-46.88		-0.01402		-0.02576
Jun Prec - P.E.T. (mm)	DFN	-62.53				0.04464
Jun Prec - P.E.T. (mm)	SDFN	-62.53				-0.00041
R Squared			0.33790	0.57094	0.58724	0.77496
Standard Error (Q/Ha)			1.92182	1.65390	1.68341	1.35127
Standard Variance (Q/Ha)			3.69340	2.73537	2.83388	1.82592

Standard Deviation of Yields = 2.29133 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

SOUTHERN URALS-WESTERN KAZAKHSTAN SPRING WHEAT COVARIANCE MODEL

Region

Southern Urals - Crop Region 19
Western Kazakhstan - Crop Region 21

P.E.T. A = 1.081
P.E.T. I = 36.787

June Daylength = 1.5135

Latitude = 59°N

Variable	Deviation	Normal	Constant	April	Truncation		
					May	June	July
Overall Constant		1.00	10.96864	10.22263	10.25942	10.02296	9.54555
Crop Region 21 Constant		1.00	-3.75073	-2.28936	-2.43987	-2.05297	-1.18051
Nov-Apr Prec (mm)	DFN	141.64		0.05030	0.05304	0.03086	0.02671
May Prec (mm)	DFN	26.94			-0.02533	-0.05137	-0.04897
Jun Prec - P.E.T. (mm)	DFN	-106.89				0.05818	0.04297
Jul Mean Temp (°C)	DFN	21.82					-0.67335
R Squared			0.24483	0.52905	0.53333	0.62022	0.69751
Standard Error (Q/Ha)			3.36236	2.70585	2.74688	2.52908	2.30567
Standard Variance (Q/Ha)			11.30546	7.32163	7.54533	6.39626	5.31612

Standard Deviation of Yields = 3.79948 Q/Ha

DFN = Departure from Normal
SDFN = Squared Departure from Normal
Yields Measured in Quintals per Hectare

Yields for Region 19 Based on 1958-1966, 1968-1975; for Region 21
Based on 1958-1961, 1965-1968, 1971-1974
Meteorological Normals Based on 1958-1975

April 1978

NORTHEASTERN URALS SPRING WHEAT MODEL

Region

Northeastern Urals - Crop Region 20

P.E.T. A = .903
P.E.T. I = 25.038

May Daylength = 1.3517
June Daylength = 1.4448

Latitude = 56°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Constant</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>
Overall Constant		1.00	12.58073	12.58074	12.58074	12.58076	12.58076
May Prec - P.E.T. (mm)	DFN	-85.75		0.07761	0.01273	0.02600	0.02347
Jun Prec - P.E.T. (mm)	DFN	-62.64			0.08635	0.07786	0.09208
Jul Temp (°C)	DFN	18.28				-0.68823	-0.61183
Aug Prec (mm)	DFN	52.22					-0.03975
R Squared			0.00000	0.19120	0.62183	0.68981	0.73050
Standard Error (Q/Ha)			3.71319	3.44217	2.43092	2.27887	2.20434
Standard Variance (Q/Ha)			13.78779	11.84851	5.90937	5.19325	4.85912

Standard Deviation of Yields = 3.71319 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

NORTHEAST KAZAKH SPRING WHEAT COVARIANCE MODEL

Region

Kustanay - Crop Region 22
 Tselinograd - Crop Region 23
 Northern Kazakhstan - Crop Region 24
 Pavlodar - Crop Region 25

P.E.T. A = .983
 P.E.T. I = 30.291

May Daylength = 1.3113
 June Daylength = 1.3906
 July Daylength = 1.3431

Latitude = 53°N

Variable	Deviation	Normal	Constant	Truncation		
				April	May	June
Overall Constant		1.00	8.35056	8.44517	8.79911	9.02472
Crop Region 25 Constant		1.00	-1.88219	-1.88656	-2.24495	-2.27004
Apr Prec (mm)	DFN	24.88	0.06563	0.03290	0.03290	0.02560
May Prec - P.E.T. (mm)	DFN	-56.54		0.05077	0.04365	0.04997
Jun Prec - P.E.T. (mm)	DFN	-89.53			0.05498	0.04060
Jul Prec - P.E.T. (mm)	DFN	-83.41				0.05564
Jul Prec - P.E.T. (mm)	SDFN	-83.41				-0.03671
Jul Mean Temp (°C)	DFN	19.96				-0.00074
						-1.05169
R Squared			0.08405	0.15394	0.39397	0.53829
Standard Error (Q/Ha)			2.76041	2.68862	2.30689	2.04210
Standard Variance (Q/Ha)			7.61987	7.22867	5.32174	4.17019
Standard Deviation of Yields = 2.84706 Q/Ha						
DFN = Departure from Normal						0.71051
SDFN = Squared Departure from Normal						1.69111
Yields Measured in Quintals per Hectare						2.85985

Yields Based on 1958-1961, 1965-1968, 1971, and 1974
 Meteorological Normals Based on 1958-1961 and 1965-1974

WEST SIBERIA SPRING WHEAT MODEL

Region

West Siberia - Crop Region 26

P.E.T. A = .891

P.E.T. I = 24.206

June Daylength = 1.4448

July Daylength = 1.3887

Latitude = 56°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Constant</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>
Overall Constant		1.00	10.15170	10.15170	10.15171	10.15171	10.15171
May Prec (mm)	DFN	36.72		0.10870	0.06150	0.06999	0.09354
Jun Prec - P.E.T. (mm)	DFN	-71.84			0.09549	0.08008	0.08745
Jul Prec - P.E.T. (mm)	DFN	-75.99				0.02949	0.02920
Aug Prec (mm)	DFN	54.33					-0.06326
R Squared			0.00000	0.22255	0.62547	0.69186	0.78442
Standard Error (Q/Ha)			3.46572	3.14989	2.25796	2.11997	1.84016
Standard Variance (Q/Ha)			12.01125	9.92182	5.09838	4.49426	3.38618

Standard Deviation of Yields = 3.46572 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

ALTAY KRAY SPRING WHEAT MODEL

Region

Altay Kray - Crop Region 27

P.E.T. A = .952

P.E.T. I = 28.224

June Daylength = 1.3906

Latitude = 53°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Constant</u>	<u>May</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	10.36720	10.36720	10.36720	11.89353
May Prec (mm)	DFN	38.72		0.13302	0.10977	0.09228
Jun Prec - P.E.T. (mm)	DFN	-69.94			0.04589	0.06647
Jul Prec (mm)	DFN	57.22				0.03394
Jul Prec (mm)	SDFN	57.22				-0.00141
R Squared			0.00000	0.47633	0.56219	0.74365
Standard Error (Q/Ha)			3.94383	2.94178	2.77805	2.28342
Standard Variance (Q/Ha)			15.55380	8.65406	7.71754	5.21400

Standard Deviation of Yields = 3.94383 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
 Meteorological Normals Based on 1958-1975

SOUTH KAZAKHSTAN SPRING WHEAT MODEL

Region

South Kazakhstan - Crop Region 29

P.E.T. A = 1.015

P.E.T. I = 32.393

June Daylength = 1.3460

July Daylength = 1.3049

Latitude = 50°N

Variable	Deviation	Normal	Constant	April	Truncation			August
					May	June	July	
Overall Constant		1.00	8.20883	8.22386	8.35113	8.09220	8.07709	7.88205
Sep-Apr Prec (mm)	DFN	170.12		0.03913	0.04524	0.06256	0.06507	0.05346
May Temp (°C)	DFN	13.19			-0.62806	-0.21515	-0.17299	-0.18741
Jun Prec - P.E.T. (mm)	DFN	-94.93				0.10224	0.10043	0.09599
Jul Prec - P.E.T. (mm)	DFN	-97.29					0.00757	0.00658
Aug Prec (mm)	DFN	32.61						-0.05057
R Squared			0.00000	0.21318	0.55796	0.78559	0.79261	0.81376
Standard Error (Q/Ha)			2.79059	2.56877	2.00400	1.45777	1.50366	1.50203
Standard Variance (Q/Ha)			7.78739	6.59859	4.01602	2.12510	2.26098	2.25608

Standard Deviation of Yields = 2.79059 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1968 and 1971-1974

Meteorological Normals Based on 1957-1974

CENTRAL ASIA SPRING WHEAT MODEL

Region

Central Asia - Crop Region 30

P.E.T. A = 1.426
P.E.T. I = 59.378

April Daylength = 1.0977
May Daylength = 1.1921
June Daylength = 1.2373

Latitude = 40°N

Variable	Deviation	Normal	Constant	April	Truncation		
					May	June	July
Overall Constant		1.00	5.69606	6.27611	6.64537	7.14425	7.13095
Apr Prec - P.E.T. (mm)	DFN	20.33		0.01866	0.00759	0.00612	0.00620
Apr Prec - P.E.T. (mm)	SDFN	20.33		-0.00041	-0.00036	-0.00038	-0.00037
May Prec - P.E.T. (mm)	DFN	-54.61			0.02162	0.02301	0.02258
May Prec - P.E.T. (mm)	SDFN	-54.61			-0.00041	-0.00052	-0.00052
Jun Prec - P.E.T. (mm)	DFN	-122.46				-0.00625	-0.00666
Jun Prec - P.E.T. (mm)	SDFN	-122.46				-0.00156	-0.00155
Jul Temp (°C)	DFN	26.03					-0.03344
R Squared			0.00000	0.46757	0.71794	0.85024	0.85069
Standard Error (Q/Ha)			1.31950	1.02499	0.80137	0.63479	0.66479
Standard Variance (Q/Ha)			1.74109	1.05061	0.64219	0.40296	0.44194

Standard Deviation of Yields = 1.31950 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975
Meteorological Normals Based on 1958-1975

April 1978

EASTERN SIBERIA SPRING WHEAT MODEL

Region

Eastern Siberia - Crop Region 31

P.E.T. A = .905

P.E.T. I = 25.171

June Daylength = 1.3906

Latitude = 53°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>
Overall Constant		1.00	9.85397	9.97675	10.74707	10.75838	10.65061
Linear Trend (1958-1978)		21.00	0.15917	0.14625	0.06516	0.06397	0.07531
Mar-May Prec (mm)	DFN	69.56		0.01725	0.02499	0.02421	0.02680
Jun Prec - P.E.T. (mm)	DFN	-67.37			0.07871	0.05714	0.05680
Jul Temp (°C)	DFN	19.12				-0.52082	-0.37096
Aug Prec (mm)	DFN	58.56					-0.01935
R Squared			0.16615	0.19593	0.62880	0.69738	0.74027
Standard Error (Q/Ha)			1.96221	1.99004	1.39958	1.31140	1.26455
Standard Variance (Q/Ha)			3.85026	3.96026	1.95883	1.71977	1.59908

Standard Deviation of Yields = 2.08467 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

FAR EAST SPRING WHEAT MODEL

Region

Far East - Crop Region 32

P.E.T. A = 1.006

P.E.T. I = 31.786

June Daylength = 1.3460

July Daylength = 1.3049

Latitude = 50°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>Day</u>	<u>Truncation</u> <u>June</u>	<u>July</u>	<u>September</u>
Overall Constant		1.00	5.73784	4.96996	5.96272	6.08446	6.07263
Linear Trend 1958-1978		21.00	0.33757	0.41840	0.40837	0.42197	0.41765
May Temp (°C)	DFN	11.92		-0.52993	-0.42558	-0.49986	-0.59718
Jun Prec - P.E.T. (mm)	DFN	-36.01			0.02430	0.02851	0.02749
Jun Prec - P.E.T. (mm)	SDFN	-36.01			-0.00036	-0.00046	-0.00044
Jul Prec - P.E.T. (mm)	DFN	-16.61				0.01071	0.01071
Sep Prec (mm)	DFN	74.50					-0.01633
R Squared			0.45284	0.57999	0.77647	0.81771	0.84187
Standard Error (Q/Ha)			2.04190	1.84767	1.44788	1.36090	1.32389
Standard Variance (Q/Ha)			4.16938	3.41389	2.09637	1.85205	1.75269

Standard Deviation of Yields = 2.67802 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 1958-1975

Meteorological Normals Based on 1958-1975

April 1978

NORTHWEST SPRING WHEAT MODEL

Region

Northwest - Crop Region 33

P.E.T. A = .900

P.E.T. I = 24.846

June Daylength = 1.4885

Latitude = 58°N

<u>Variable</u>	<u>Deviation</u>	<u>Normal</u>	<u>Trend</u>	<u>June</u>	<u>July</u>
Overall Constant		1.00	6.12338	8.13657	7.81458
Linear Trend (1965-1972)		8.00	0.6558 ²	0.51004	0.56964
May Prec (mm)	DFN	52.06		-0.00453	-0.02049
Jun Prec - P.E.T. (mm)	DFN	-66.38		-0.00975	-0.02131
Jun Prec - P.E.T. (mm)	SDFN	-66.38		-0.00142	-0.00132
Jul Temp (°C)	DFN	17.63			-0.65084
R Squared			0.37525	0.56317	0.64379
Standard Error (Q/Ha)			2.62196	2.43230	2.28612
Standard Variance (Q/Ha)			6.87470	5.91607	5.22633

Standard Deviation of Yields = 3.21817 Q/Ha

DFN = Departure from Normal

SDFN = Squared Departure from Normal

Yields Measured in Quintals per Hectare

Yields Based on 195°-1975
Meteorological Normals Based on 1958-1975