

Subject: **Evaluation of Potato Yield Forecast 2008**
 Region: **Europe**
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INTRODUCTION

The present document provides a forecast of the potato yield (tonnes/ha) and production (tonnes) as anticipated by FAST at the end of the 2008 potato growing season in Europe. The document describes the new method based on more detailed ground data and its evaluation results. A comparison between FAST results and the national Eurostat potato yields and productions is given in Table 1.

METHOD

FAST is the acronym of *Food Assessment by Satellite Technology*, a Meteosat based crop yield forecasting system developed and operated by EARS in Delft, the Netherlands. The assessment of crop growth conditions and the crop yield forecasts are based on visible and thermal infrared hourly data from geostationary meteorological satellites. The satellite data are processed in 3 steps:

- (1) Hourly Meteosat data are processed to daily average values of surface temperature, air temperature, global radiation, net radiation, potential and actual evapotranspiration.
- (2) Radiation and evapotranspiration data enter into a crop growth model, which simulates distributed crop yield on a daily basis.
- (3) Distributed crop yield results are integrated for crop growing areas, countries and provinces. Urban areas, forest, water and barren land are excluded.

CROP MODEL

The crop calendar in Figure 1 shows the vegetative period (green), the yield formation period (grey) and the harvesting period (yellow) for several potato producing countries in Europe. The yield response of potato to evapotranspiration deficits during the growing season is quantified by the yield response factor K_y , based on the relationship described by Doorenbos & Kassam (1986): $(1-RY) = K_y \cdot (1-RE)$. RY is the relative yield and RE the relative evapotranspiration. Drought sensitivity of a crop changes during the growing season. K_y is 0.8 during establishment, increases to 1.1 during the vegetative period, is kept constant at 1.1 during flowering and yield formation and decreases to 0.7 during ripening.

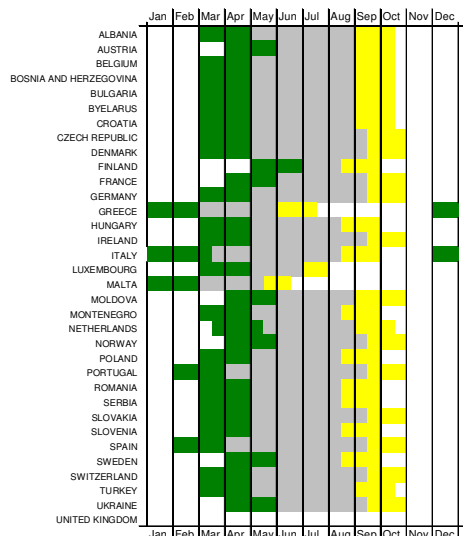


Figure 1: Potato Crop Calendar

The **relative yield *RY*** (%) in figure 2 presents the attained potato yield (actual yield) relative to the yield that would be obtained if water availability for the crop was unlimited during the growing season (potential yield). A relative yield of 76% means that if the potential yield of that location is 10 ton/ha, the expected actual yield by the end of the growing season on that location is 7,6 ton/ha.

The **difference yield *DY*** (%) in figure 3 presents the forecasted 2008 potato yield in terms of % deviation from a reference yield. The derived difference yield relative to the average of the previous five years is shown in figure 3. A difference yield of -10% means that if the average yield during the 5 previous years of a certain location is 40 ton/ha, the expected actual yield at the end of the growing season on that location is 36 ton/ha.

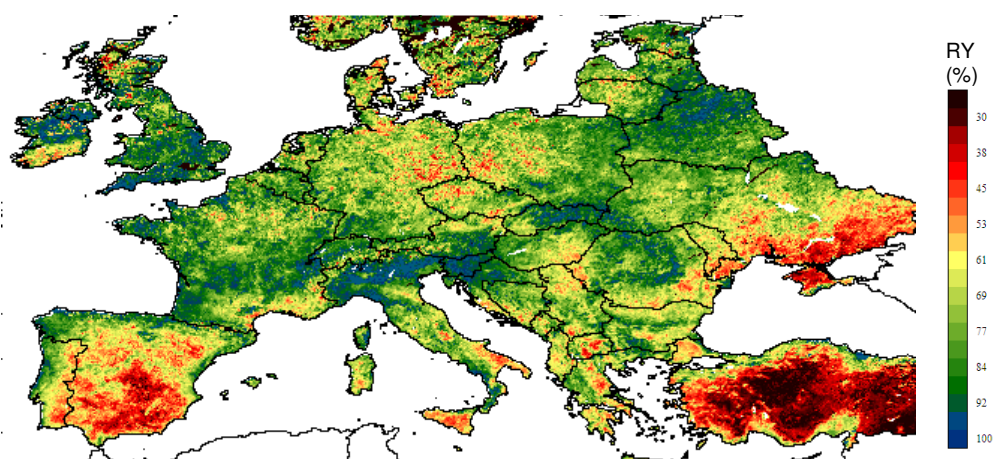


Figure 2: Potato relative yield *RY* (%)

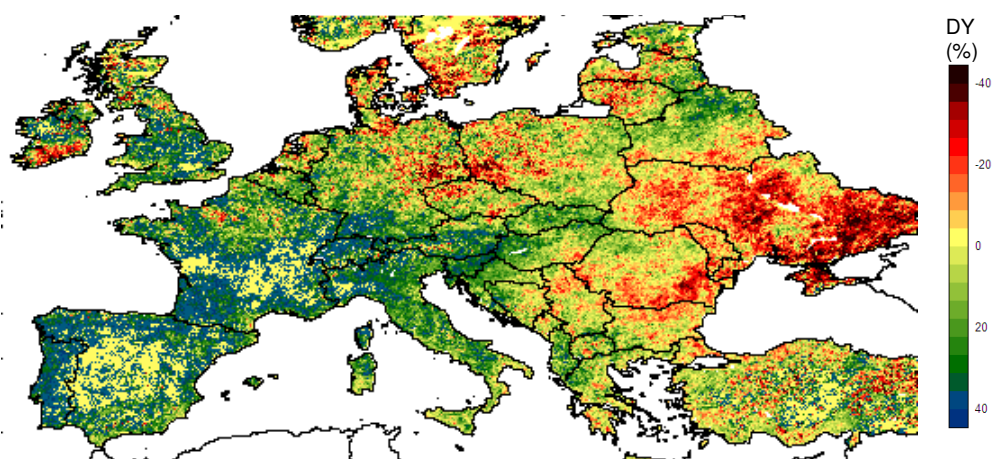


Figure 3: Potato difference yield *DY* (%) forecast for Europe relative to the 5 years average

YIELD AND PRODUCTION FORECAST

The forecasts combine historic ground data from the European Statistical Office (*Eurostat, 2008*) with most recent Meteosat data. The forecasts are made at the lower administrative region (NUTS2) level. The final national average yield of each country is calculated as the weighed average of the yield predictions of a country's administrative regions.

At the lower administrative region level, the **forecasted yield** FY_i (t/ha) is calculated with NUTS 2 Eurostat historic yields Y_{HIST} (t) and the provincial average of most recent Meteosat based difference yield:

$$FY_i = Y_{HIST} \left(1 + f_w \frac{DY_i}{100}\right) \quad (\text{eq. 1})$$

The historic yield is the average of the previous five years (2003-2007) of Eurostat NUTS 2 yield data. The difference yields DY_i of each province/country are determined by spatial integration of Meteosat difference yields (figure 3) within the agricultural crop growing areas.

The weighing factor f_w in equation 1 quantifies the influence of difference yield, *i.e.* weather and drought conditions on the yield. The value of f_w is crop specific and determined by minimizing the difference between reported Eurostat potato yields and FAST yield forecasts at provincial level.

The **national forecasted yield** NFY (t/ha) is the average of lower administrative level yield forecasts FY_i , weighed according to the potato growing area of each level. The NUTS 2 contributions to the national yield forecast are weighed according to the relative potato growing area of each lower level. The formula is:

$$NFY = \frac{A_1}{A} FY_1 + \frac{A_2}{A} FY_2 + \dots + \frac{A_N}{A} FY_N \quad (2)$$

A (ha) is the total potato growing area of a country, A_i (ha) is the potato growing area of the respective lower administrative level as reported by Eurostat.

The **forecasted production** FP_i (t) is calculated with:

$$FP_i = A_i \times FY_i \quad (3)$$

If the potato growing area A_i of the respective lower administrative level is not available at the time of forecasting, the reported growing area of the previous year is used.

The **national forecasted production NFP** (t) is calculated with:

$$NFP = A \times NFY \quad (4)$$

If the total potato growing area A of the country is not available at the time of forecasting, the reported national growing area of the previous year is used.

VALIDATION OF POTATO FORECAST

The resulting NUTS2 FAST yield forecasts over the period 2002-2007 are plotted against Eurostat potato yields in figure 5. The graph shows that the satellite derived yield forecasts and the values reported by Eurostat are quite consistent. The relationship exhibits a Pearson correlation of 0.96 and an absolute RMSE of 3 tonnes/ha.

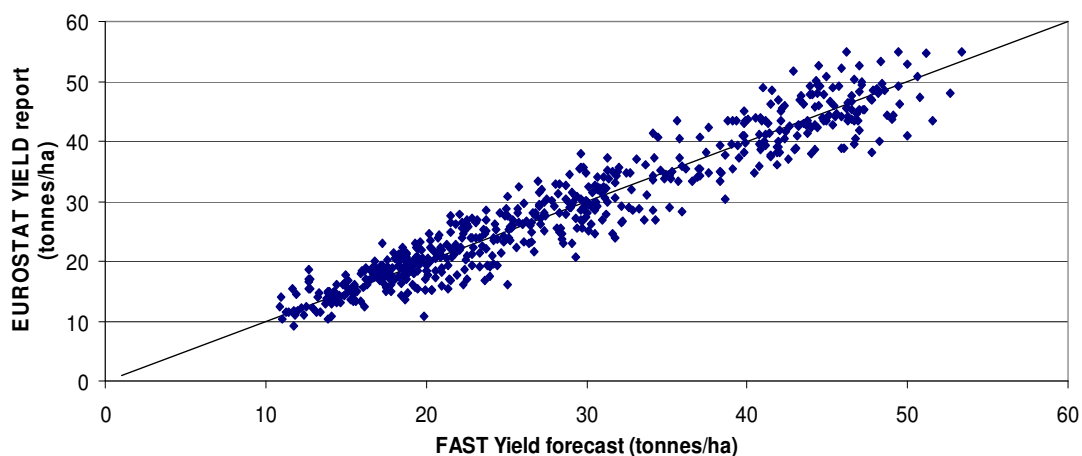


Figure 5: Provincial FAST yield forecast versus Eurostat reports for period 2002-2007

NOTE : uncertainties in the yield and area Eurostat reports can be quite large, especially at the lower administrative regions (NUTS2). The Eurostat yields were therefore carefully quality checked and regions with unlikely reports or regions with less than 3 years of data available were excluded from analysis and forecasting.

TABLES

The following tabulated data on potato production and yield in 2008 are provided on next pages:

- Table 1 : National yield and production FAST forecast and Eurostat reports
- Table 2 : NUTS 1 yield and production FAST forecasts

CONTACT

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REFERENCE

Doorenbos, J., Kassam, A. H. (1986). Yield response to water. FAO irrigation and drainage paper 33. Food and Agricultural Organization of the United Nations, Rome.

Eurostat (2008). European Regional and Urban Statistics - Reference guide, Office for official publications of the European Communities, Luxembourg.

LANDUSE

U.S. Geological Survey, Global Land Cover characteristics data base (<http://edc2.usgs.gov/glcc>)

ADMINISTRATIVE BOUNDARIES

National, regional or provincial averages are calculated based on the administrative boundary layers from the Global Administrative Unit Layers (**GAUL**) system.

LEGAL NOTICE & DISCLAIMER

The crop yield forecasts are issued to the best of our knowledge and the hypothesis that the remaining part of the season will not face additional extreme events. EARS bv is not responsible or liable, directly or indirectly, for any damage or loss caused or alleged to be caused in connection with your use of the information. The geographic borders are purely a graphical representation and are only intended to be indicative.

TABLE 1 : COMPARISON OF 2008 FAST POTATO FORECASTS WITH EUROSTAT REPORTED NATIONAL PRODUCTIONS

EUROPE	YIELD FORECAST	AREA EUROSTAT 2008	HARVEST FORECAST	HARVEST EUROSTAT	DIFFERENCE (FAST-EUROSTAT)	
	(t/ha)	(10 ³ ha)	(10 ³ t)	(10 ³ t)	(10 ³ t)	(%)
AUSTRIA	32	22,8	730	756 ^(p)	-26	-3
BELGIUM	45	63,6	2862	2804	58	2
BULGARIA	15	22	330	-	-	-
CROATIA	24	15	360	-	-	-
FRANCE	44	158,1	6956	7183	-227	-3
HUNGARY	24	25,3	607	658	-51	-8
IRELAND	37	11,6	429	-	-	-
LITHUANIA	14	48	672	706 ^(p)	-34	-5
NETHERLANDS	44	151,9	6684	6993	-309	-4
POLAND	19	529,5	10061	10005 ^(p)	56	1
PORTUGAL	16	40	640	592	48	8
ROMANIA	15	258,4	3876	3683 ^(p)	193	5
SLOVAKIA	20	14,2	284	323 ^(p)	-39	-12
SLOVENIA	21	4,4	92	102	-9	-9
SPAIN	29	85,3	2474	2325	148	6
SWEDEN	31	27	837	853	-16	-2
AVERAGE ABSOLUTE DIFFERENCE						5.2 %

^(p) Provisional value

TABLE 2: POTATO YIELD FORECASTS AT NUTS 2 LEVEL

AUSTRIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
BURGENLAND (A)	33	0,7	23
NIEDEROSTERREICH	32	18,4	588
OBEROSTERREICH	31	1,9	60
SALZBURG	33	0,1	3
STEIERMARK	27	0,6	16

BELGIUM	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
PROV. ANTWERPEN	45	3,3	150
PROV. BRABANT WALLON	45	3,3	148
PROV. HAINAUT	46	17,4	795
PROV. LIEGE	40	1,8	72
PROV. LIMBURG (B)	49	2	99
PROV. LUXEMBOURG (B)	29	0,5	14
PROV. NAMUR	45	2,6	117
PROV. OOST-VLAANDEREN	47	10,3	482
PROV. VLAAMS-BRABANT	48	4,8	232
PROV. WEST-VLAANDEREN	43	22	943

BULGARIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
SUD - MUNTENIA	15	25	373

CROATIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
DEL-DUNANTUL	24	1	26

FRANCE	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
ALSACE	33	1,5	49
AQUITAINE	33	2,3	76
AUVERGNE	29	0,6	17
BASSE-NORMANDIE	31	1,6	50
BOURGOGNE	37	0,8	30
BRETAGNE	30	10,7	316
CENTRE	44	10,1	442
CHAMPAGNE-ARDENNE	48	15,9	766
HAUTE-NORMANDIE	42	11	458
ILE DE FRANCE	42	3,7	156
LANGUEDOC-ROUSSILLON	24	1,5	36
LIMOUSIN	33	0,3	10
LORRAINE	29	0,4	12
MIDI-PYRENEES	24	0,5	12
NORD - PAS-DE-CALAIS	47	46	2155
PAYS DE LA LOIRE	28	1,2	33
PICARDIE	48	45,5	2180
POITOU-CHARENTES	25	0,6	15
PROVENCE-ALPES-COTE D'AZUR	30	1,1	33
RHONE-ALPES	24	2,6	64

HUNGARY	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
ESZAK-ALFOLD	24	4,4	105
ESZAK-MAGYARORSZAG	23	2,4	55
KOZEP-DUNANTUL	25	1,2	30
KOZEP-MAGYARORSZAG	22	5,1	111
NYUGAT-DUNANTUL	28	2,8	78

IRELAND	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
BORDER, MIDLAND AND WESTERN	36	3,6	131
SOUTHERN AND EASTERN	37	8,1	297

LITHUANIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
LIETUVA	14	52	738

NETHERLANDS	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
DRENTH	42	29,1	1214
FLEVOLAND	47	20,7	976
FRIESLAND (NL)	38	8	306
GELDERLAND	43	4,6	198
GRONINGEN	41	25	1022
LIMBURG (NL)	51	7,2	367
NOORD-BRABANT	48	16,6	792
NOORD-HOLLAND	41	10,1	416
OVERIJSEL	41	6,3	258
UTRECHT	44	0,2	9
ZEELAND	45	18,4	822
ZUID-HOLLAND	45	11	497

POLAND	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
DOLNOSLASKIE	22	28,9	623
KUJAWSKO-POMORSKIE	21	24	497
LODZKIE	19	62,6	1167
LUBELSKIE	19	44,1	852
LUBUSKIE	19	12,2	227
MALOPOLSKIE	18	46,8	859
MAZOWIECKIE	18	80,7	1472
OPOLSKIE	21	11,4	244
PODKARPACKIE	19	50,9	970
PODLASKIE	19	24,8	461
POMORSKIE	21	30,4	646
SWIETOKRZYSKIE	18	29,3	524
WARMINSKO-MAZURSKIE	20	13,4	266
WIELKOPOLSKIE	20	49,4	997
ZACHODNIOPOMORSKIE	21	24,3	504

PORTUGAL	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
ALENTEJO	20	2,5	50
ALGARVE	16	0,8	13
CENTRO (P)	17	17,9	306
LISBOA	19	2,4	47
NORTE	12	16,3	203

ROMANIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
CENTRU	16	76,8	1241
NORD-EST	15	59,5	891
NORD-VEST	15	60,5	916
SUD-EST	15	8,3	125
SUD-VEST OLTENIA	13	7,9	103
VEST	16	29,4	459

SLOVAKIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
SLASKIE	20	16,2	330

SLOVENIA	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
KARNTEN	21	0,4	9

SPAIN	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
ANDALUCIA	25	19,9	505
ARAGON	27	0,5	13
CANTABRIA	19	0,4	8
CASTILLA Y LEON	39	20,8	820
CASTILLA-LA MANCHA	28	3,7	103
CATALUNA	23	2,5	58
COMUNIDAD DE MADRID	28	0,7	20
COMUNIDAD FORAL DE NAVARRA	22	0,9	20
COMUNIDAD VALENCIANA	22	2,2	49
EXTREMADURA	31	1,7	52
GALICIA	23	18,9	440
ILLES BALEARS	29	1,5	44
LA RIOJA	47	1,9	88
PAIS VASCO	32	2,3	74
PRINCIPADO DE ASTURIAS	23	2,7	61
REGION DE MURCIA	21	2,2	45

SWEDEN	YIELD FORECAST	REPORTED AREA	PRODUCTION FORECAST
	2008 (tonnes/ha)	2007 (1000 ha)	2008 (1000 tonnes)
OSTRA MELLANSVERIGE	29	2,9	85
SMALAND MED OARNA	30	2,5	76
SYDSVERIGE	32	13,8	446
VASTSVERIGE	29	5,8	171