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JRC MARS Bulletin – Global outlook
Ukraine, September 2022

European Commission

JRC MARS Bulletin - Global outlook

Crop monitoring European neighbourhood Ukraine

September 2022

Fair yield outlook, but reduced production areas

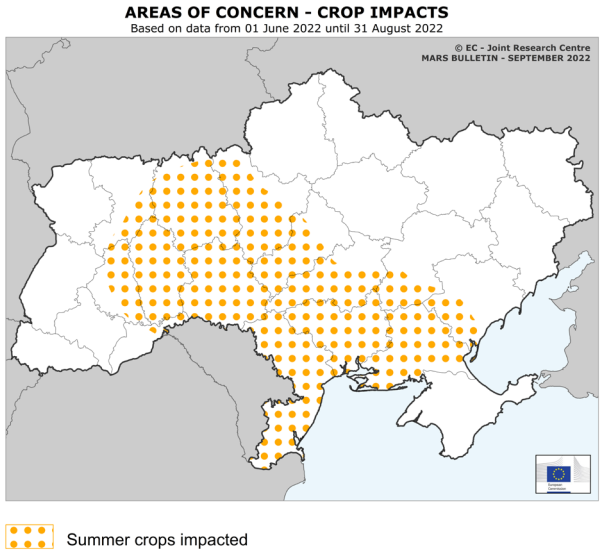
Throughout the summer of 2022, Ukraine experienced mixed weather conditions. In the southern and western oblasts long lasting rain deficits negatively affected yields, while timely rainfall in some central and northern oblasts led to increased yield forecasts in these regions. Eastern oblasts experienced above-average temperatures, but these did not cause any severe damage to summer crops.

Winter cereals' yield forecasts are below the historical trend but still around the 5-year average, albeit well below last year's record level. An increase in area under rapeseed led to significantly increased production of this crop.

Russia's war against Ukraine has seen a decrease in the area under grain maize and sunflowers. Consequently, our production forecasts for both crops is below the 5-year average, despite fair yield outlooks.

Fair yield outlooks, combined with stable planting area for soybean leads to near average production.

Based on our regional forecasts, we estimate that 22% of soft wheat production, 20% of the barley, 13% of the rapeseed, 4% of the grain maize, 10% of the sunflowers, and 7% of the soybean production at country level is in areas currently subject to hostilities due to Russia's military aggression against Ukraine, which is likely to reduce harvestable crops and thus final production figures.

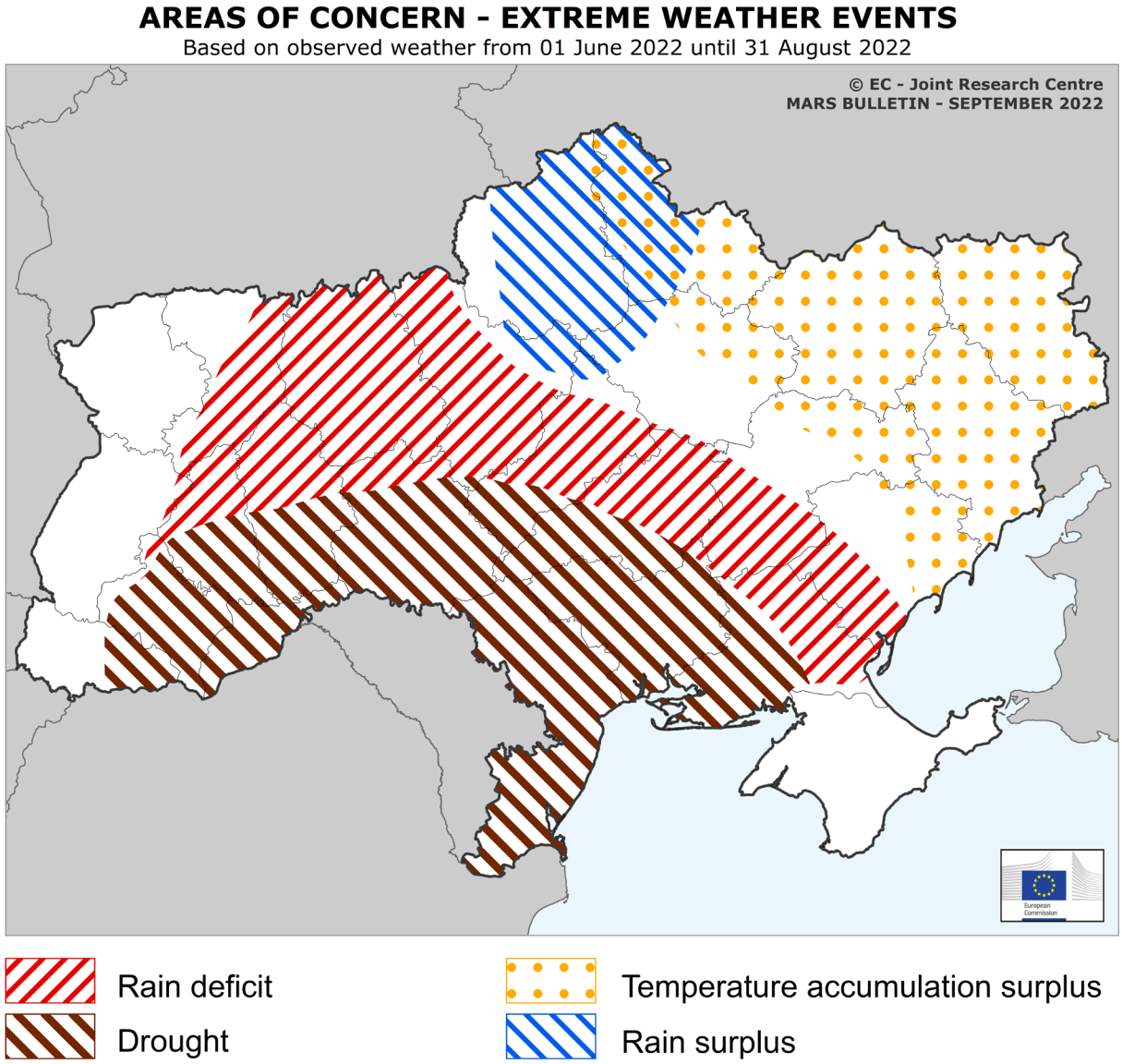


Crop	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Wheat	6 684	7 090	**6 539**	– 2	– 8	4.07	4.53	**4.01**	– 1	– 12	27 222	32 152	**26 240**	– 4	– 18
Barley	2 487	2 471	**1 995**	– 20	– 19	3.35	3.82	**3.40**	+ 2	– 11	8 321	9 434	**6 792**	– 18	– 28
Winter barley	992	1 137	**971**	– 2	– 15	3.63	4.27	**3.48**	– 4	– 18	3 598	4 856	**3 382**	– 6	– 30
Spring barley	1 495	1 334	**1 024**	– 32	– 23	3.16	3.43	**3.33**	+ 5	– 3	4 723	4 579	**3 410**	– 28	– 26
Grain maize	4 981	5 482	**4 528**	– 9	– 17	6.78	7.68	**7.07**	+ 4	– 8	33 749	42 109	**32 027**	– 5	– 24
Sunflower	6 266	6 665	**5 590**	– 11	– 16	2.27	2.46	**2.48**	+ 9	+ 1	14 232	16 398	**13 877**	– 2	– 15
Soybean	1 602	1 322	**1 572**	– 2	+ 19	2.29	2.64	**2.35**	+ 3	– 11	3 670	3 491	**3 699**	+ 1	+ 6
Rapeseed	1 043	998	**1 405**	+ 35	+ 41	2.63	2.94	**2.74**	+ 4	– 7	2 744	2 930	**3 846**	+ 40	+ 31

Joint Research Centre

Meteorological overview

The rainfall deficit in June and July was mostly offset by abundant precipitation in August, especially in the central and northern oblasts. However, the southern and western oblasts remained dry. Summer temperatures were slightly above the LTA in most of the country, and more distinctly in the eastern oblasts.



June

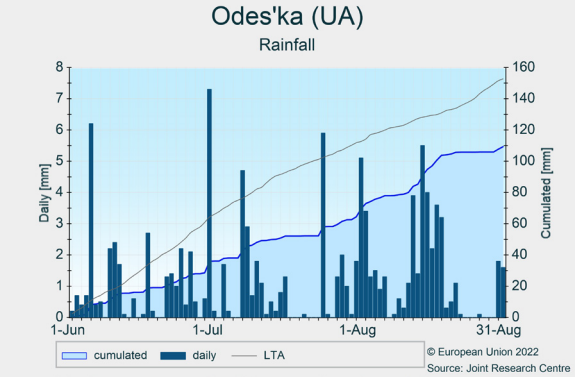
- Drier-than-usual conditions prevailed in most regions. Rainfall was 50% to 80% below the long term average (LTA) in the south-west (e.g., *Vinnyts'ka*, *Khmelnyts'ka*, *Ternopil'ska*), parts of central Ukraine (e.g., *Cherkas'ka*, *Poltavs'ka*) and in the eastern oblasts (e.g., *Donets'ka*, *Luhans'ka*). In the rest of country, a rainfall deficit ranging from 30% to 50% compared with the LTA was observed.
- Temperatures were above the LTA in most of the country, except in the central-southern oblasts (e.g., *Odes'ka*, *Kherson'ska)*, where they stayed near seasonal levels. The most distinct anomalies (up to 4°C above the LTA) occurred in the western oblasts (e.g., *Volyns'ka*, *Ternopil'ska*).

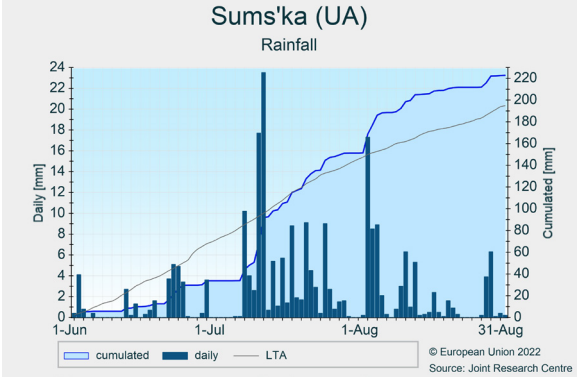
July

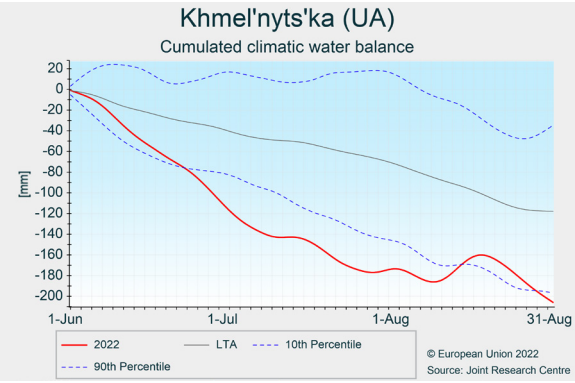
- In most parts of the country rainfall was below the LTA and poorly distributed. The most pronounced rainfall deficits (locally up to 80% below the LTA) were observed in the oblasts of *Vinnyts'ka*, *Odes'ka* and *Mykolayivs'ka*.
- The central oblasts experienced slightly below-average precipitation, whereas a rainfall surplus (locally up to 80% above the LTA) was registered in the northern oblasts of *Sums'ka* and *Chernihivs'ka*.
- Near seasonal temperatures prevailed in the southern and western oblasts, except in Odes'ka, where temperatures slightly exceeded the LTA. In the rest of the country, temperatures were mostly slightly below the LTA; most distinctly (up to 2°C below the LTA) in parts of *Poltavs'ka*, *Sums'ka* and *Chernihivs'ka*.

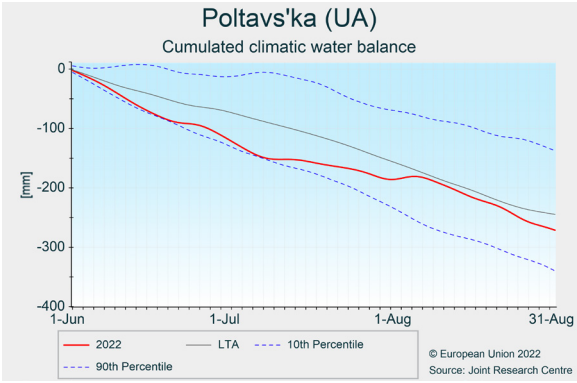
August

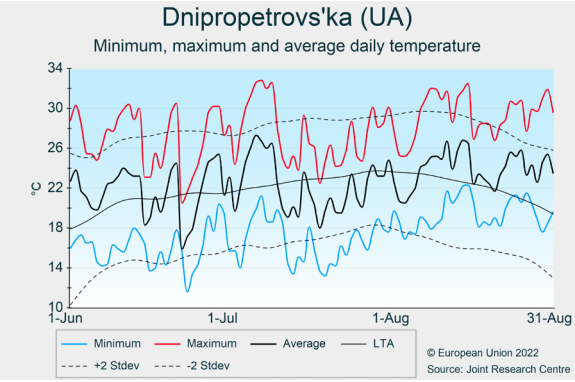
- Abundant and frequent rainfall, locally twice the LTA, occurred in the eastern half of the country. In the western oblasts, precipitation levels were around to somewhat below the LTA.
- Temperatures were on average 1°C to 2°C above the LTA in most of the country. The most distinct positive thermal anomalies were observed in the oblasts to the east (e.g., *Kharkivs'ka*, *Donets'ka*) and in those to the north (e.g., *Sums'ka*).
- Two heatwaves, each lasting 6 days, occurred in the second and third dekad of August in eastern parts of Ukraine, with daily maxima oscillating around 30°C, but rarely exceeding 35°C.

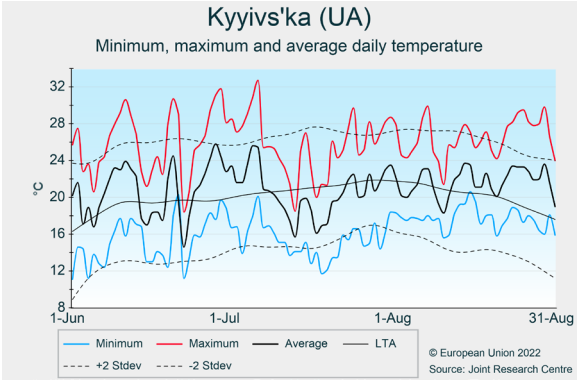


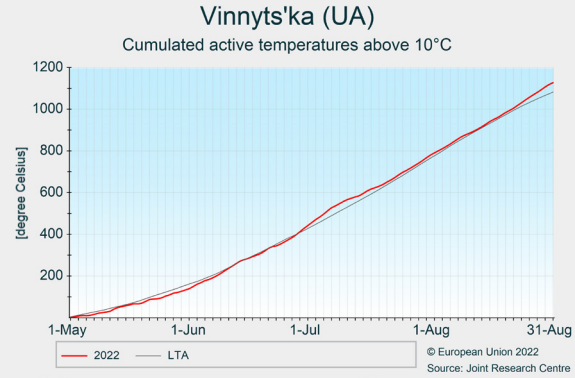


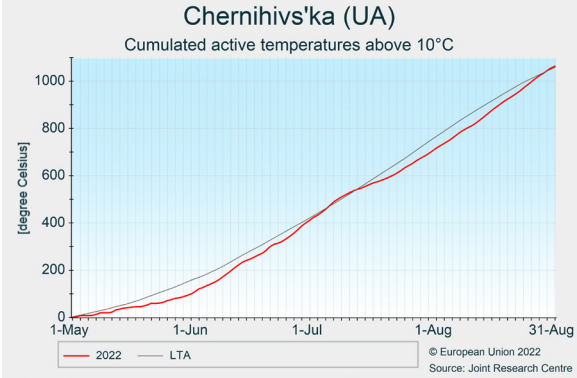




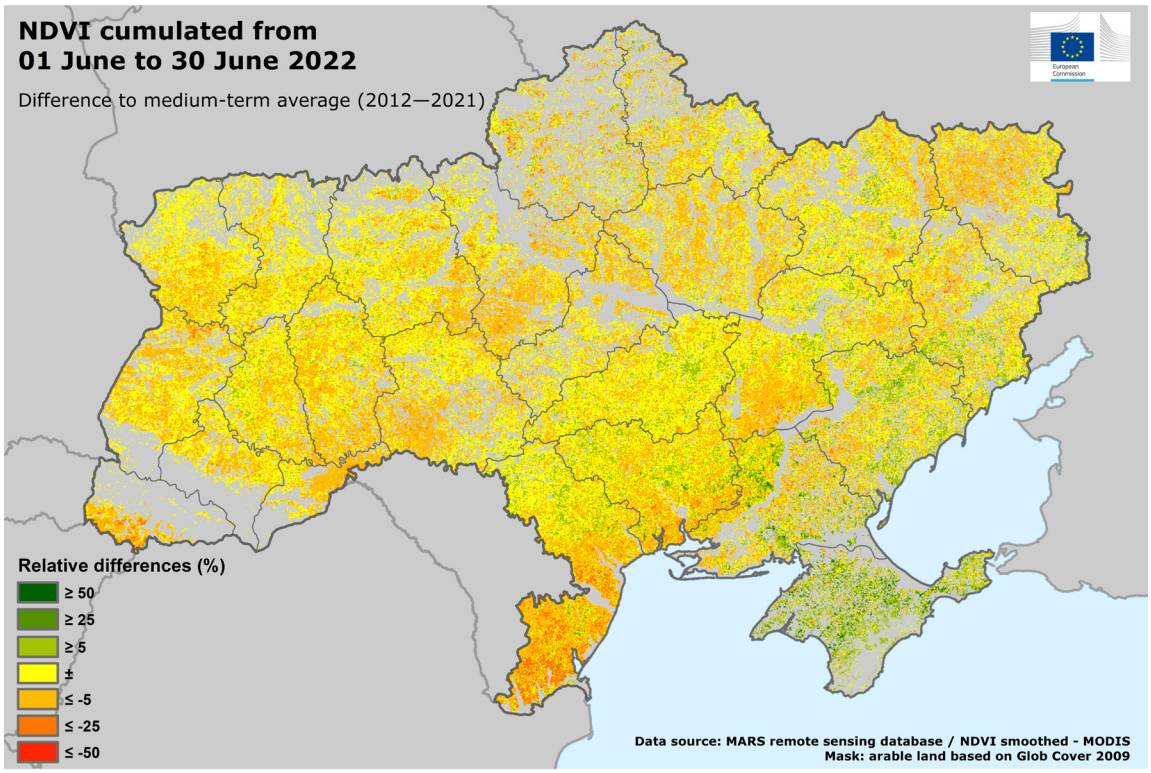

Dnipropetrovs'ka (UA)
Minimum, maximum and average daily temperature
°C
34
30
26
22
18
14
10
1-Jun
1-Jul
1-Aug
31-Aug
Minimum
Maximum
Average
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre

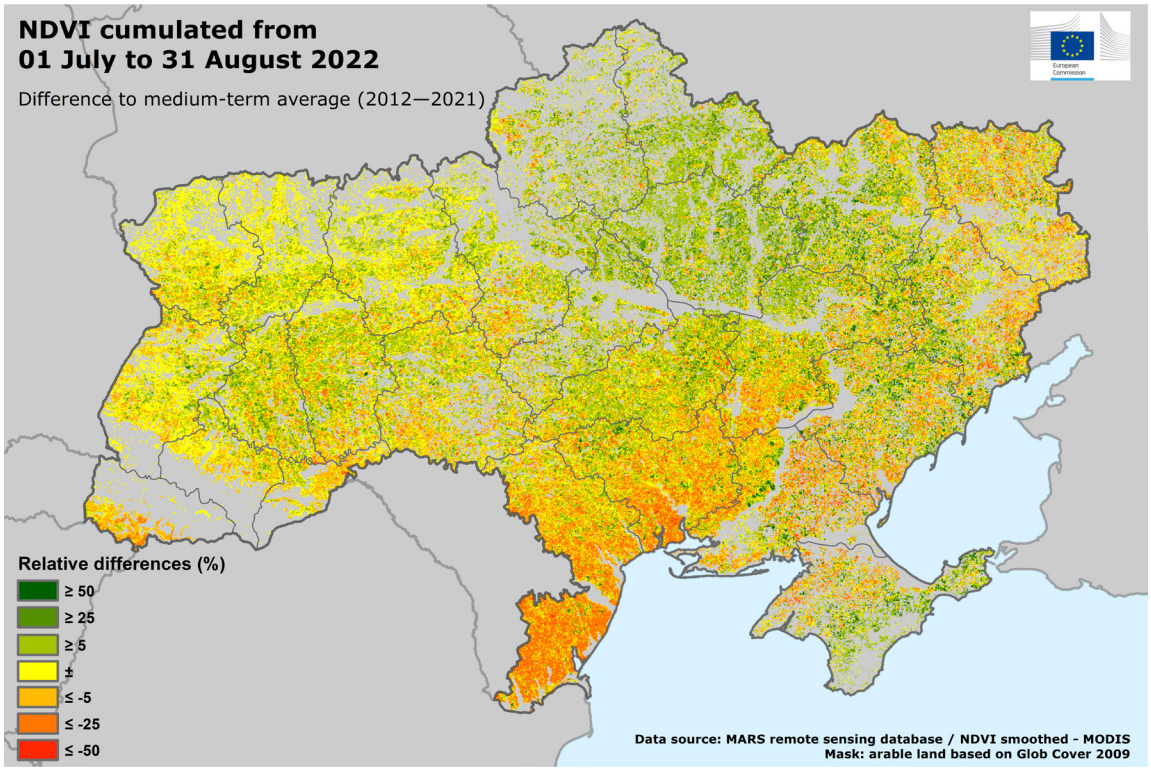

Kyyivs'ka (UA)
Minimum, maximum and average daily temperature
°C
32
28
24
20
16
12
8
1-Jun
1-Jul
1-Aug
31-Aug
Minimum
Maximum
Average
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre


Vinnyts'ka (UA)
Cumulated active temperatures above 10°C
[degree Celsius]
1200
1000
800
600
400
200
1-May
1-Jun
1-Jul
1-Aug
31-Aug
2022
LTA
© European Union 2022
Source: Joint Research Centre


Chernihivs'ka (UA)
Cumulated active temperatures above 10°C
[degree Celsius]
1000
800
600
400
200
0
1-May
1-Jun
1-Jul
1-Aug
31-Aug
2022
LTA
© European Union 2022
Source: Joint Research Centre

Crop canopy conditions





The maps above display the differences between the Normalised Difference Vegetation Index (NDVI) cumulated from 1 June to 30 June 2022 (top) and from 1 July to 31 August 2022 (bottom), and the medium-term average (MTA, 2012-2021) for the same periods, in arable land areas. Positive anomalies (in green) reflect above-average canopy density or early crop development while negative anomalies (in red) reflect below-average biomass accumulation or late crop development.

Winter and Spring Crops

The map above, referring to June, reflects predominately the condition of winter crops, as biomass accumulation for summer crops had just started and contributed little to NDVI values. Average to negative NDVI anomalies prevail in the western and southern half of the country, reflecting below-average biomass accumulation due to a persistent rain deficit that characterised the spring and beginning of summer. In the southern oblasts (particularly *Odes'ka, Mykolayivs'ka,* and *Vinnyts'ka*), the lack of precipitation, locally combined with warmer-than-usual conditions is expected to have shortened the grain-filling period for winter crops. Similarly, in eastern oblasts (*Dnipropetrovs'ka, Zaporiz'ka, Donets'ka*), mostly accounting for winter crop production, the same weather conditions were suboptimal for grain filling and led to an early ripening of winter crops. As a consequence, the NDVI values are less positive than those published in the June issue of this Bulletin[1], which covered the period from 1 to 31 May 2022.

Summer Crops

The map referring to July and August reflects predominately summer crop conditions, as winter crops were in senescence or had already been harvested. Positive NDVI anomalies prevail in northern oblasts (*Chernihivs'ka, Sums'ka, Poltavs'ka, Kharkivs'ka*), reflecting above-average biomass accumulation despite the late crop development due to the colder-than-usual conditions in the beginning of the summer crop season. These oblasts experienced above-average precipitation in summer, especially when summer crops entered flowering. The colder-than-usual temperatures registered in July resulted in a prolonged grain-filling period. Conversely, long-lasting dry conditions negatively affected summer crops in southern and western oblasts, resulting in below-average biomass accumulation. Here, rainfall was scarce throughout the analysis period, causing stress to summer crops; but temperatures remained close to or slightly below the LTA in July and the first half of August, thus preventing early ripening. As a consequence, in these oblasts the map predominately displays average (in the west) to negative (in the south) NDVI anomalies.

[1]https://publications.jrc.ec.europa.eu/repository/handle/JRC127973

Crop growth conditions

Winter and spring crops

Drier and warmer-than-usual weather during grain filling in eastern and northern oblasts negatively affected the yields of soft wheat, whereas the seasonal temperatures in the central-southern oblasts, where barley and rapeseed predominate, created a fair end of season. At national level, the yield forecast for soft wheat was revised slightly downward while the ones for barley and rapeseed were revised slightly upward.

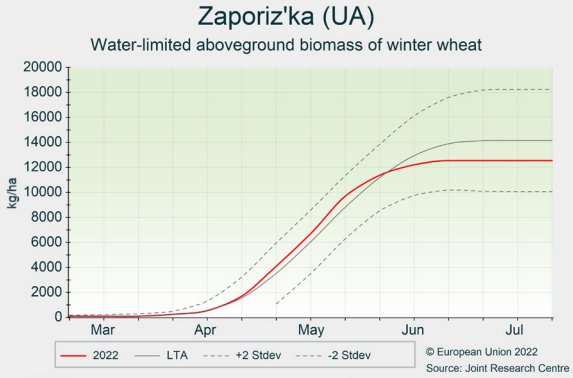
As reported in the June edition of the Bulletin, unfavourable agrometeorological conditions prevailed during spring and led to an irreversible loss of the yield potential of winter crops in the south-western oblasts, particularly in *Odes'ka*, *Vinnyts'ka* and *Mykolayivs'ka.*

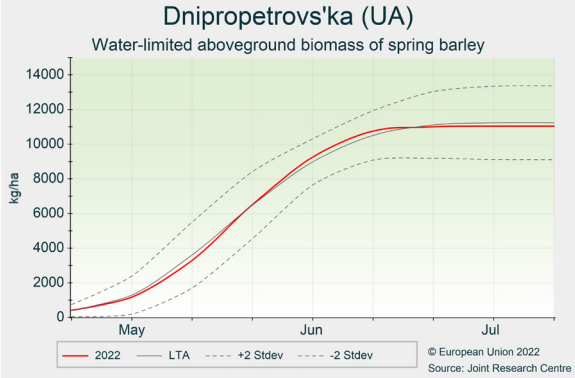
Fair yields were expected in the eastern half of the country. However, the absence of any significant rainfall during the first half of June combined with predominately warmer-than-usual temperatures is expected to have slightly negatively affected yields in the eastern and northern oblasts. However, in the south, the seasonal temperatures led to fair grain filling conditions for rapeseed and winter cereals.

The rain deficit during the summer is expected to have preserved the grain quality and allowed for a timely start of the harvest in most regions. The harvest of winter and spring crops was completed during the second dekad of August.

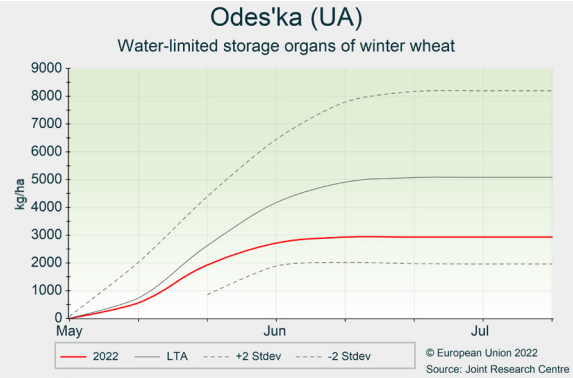
The Ukrainian Ministry of Agriculture reported a sharp drop in the harvested areas compared with previous years and with the areas that had been reported as sown areas at the beginning of the season[2]. This drop is attributed mainly to the loss of areas that, due to the Russia invasion in Ukraine, were not under the control of Ukraine. Even in government-controlled areas, some of the winter crops fields were not harvested because of the presence of mines and logistical issues (e.g. lack of fuel, machinery, human resources).

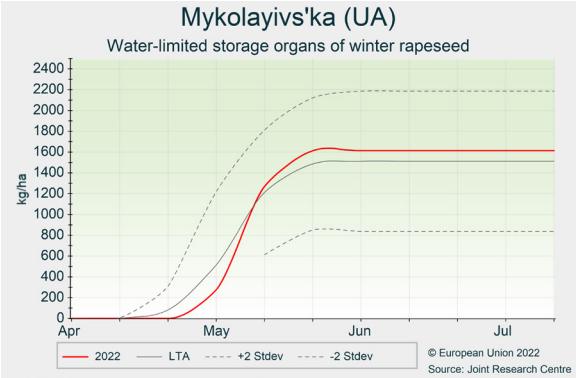
Our soft wheat yield forecast at country level was revised slightly downward. The yield loss in some of the eastern and northern oblasts (e.g., *Chernihivs'ka*, *Dnipropetrovs'ka*) was partly offset by an improvement in some of the south-western oblasts (e.g., *Khmelnyts'ka*, *Ternopil's'ka*), where the impact of dry spring conditions was over-estimated. For the same reasons, our yield forecast for barley and rapeseed were revised slightly upward.





[2] See June edition of this Bulletin and https://ukrstat.gov.ua/


Odes'ka (UA)
Water-limited storage organs of winter wheat
kg/ha
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
May
Jun
Jul
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre


Mykolayivs'ka (UA)
Water-limited storage organs of winter rapeseed
kg/ha
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Apr
May
Jun
Jul
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre

Summer crops

Sowing of summer crops progressed slowly and was completed in early June. The drought in southern oblasts and the rain deficit in parts of central and western Ukraine negatively affected the yield potential. In the eastern and northern regions, fair to above-average yields are expected thanks to timely and sufficient rainfall, despite the temperature surplus during summer.

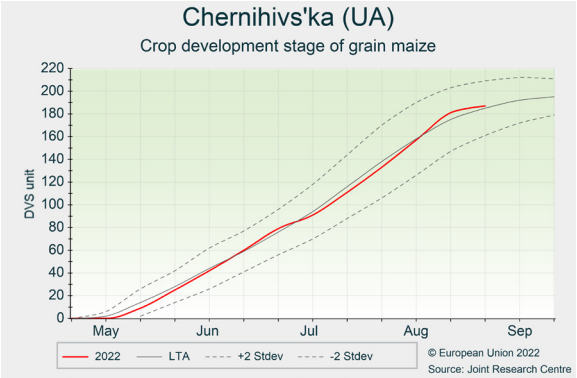
The sowing of summer crops started during the second week of April and progressed slowly until the beginning of May, due to the abundant and frequent rainfall. Drier-than-usual conditions since then allowed for an acceleration in jobs carried out in the field, which were completed during the first week of June. Due to the ongoing invasion of Russia on Ukraine's territory, considerable uncertainty remains regarding total area sown with summer crops. Compared with previous years, the Ukrainian Ministry of Agriculture reported a sharp drop in the area of sunflowers against an increase in the area of soybeans. Our analysis based on remote sensing data (see appendix) confirms this trend.

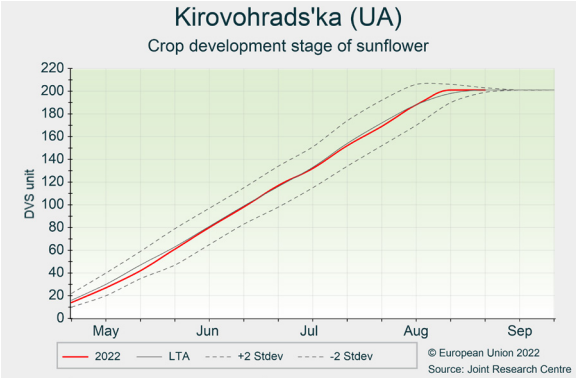
Grain maize production is concentrated in the central and northernmost parts of Ukraine. The below-average temperatures in July led to favourable conditions for flowering and early grain filling. In some of the central oblasts (e.g., *Poltav'ska*, *Kirohvohrad'ska*) and the northern oblasts (e.g., *Chernihivs'ka*, *Sums'ka*), rainfall from mid-July improved the soil moisture conditions and grain maize overall was not exposed to any water or thermal stress throughout the critical stages. In other parts of central Ukraine (e.g., *Kyiv'ska*), the rain deficit is expected to have negatively affected the yield potential. In the southern oblasts (e.g., *Vinnyts'ka*, *Odes'ka*), the persistently dry conditions led to severe deterioration of the yield potential. At country level, our yield forecast is below the historical trend and below last year's level.

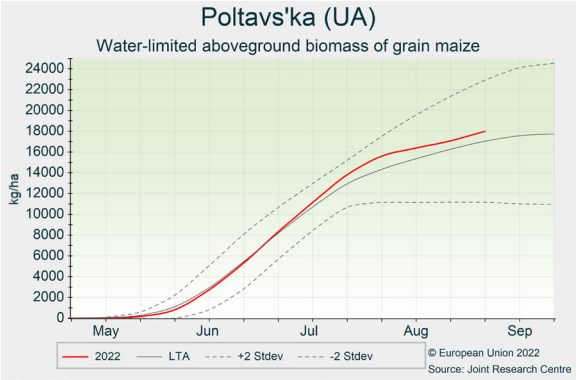
Production of sunflower seeds is concentrated in the eastern and south-eastern parts of the country, which experienced pronounced positive thermal anomalies in June and August. Nevertheless, the daily maxima rarely exceeded 35°C, which is considered a critical threshold for summer crops. Consequently, the above-average temperatures combined with below-average soil moisture conditions throughout the season are expected to have slightly negatively impacted sunflowers yields. Severe yield losses are expected in the areas hit by drought, where not so many sunflowers are produced. At country level, our yield forecast is slightly below the historical trend.

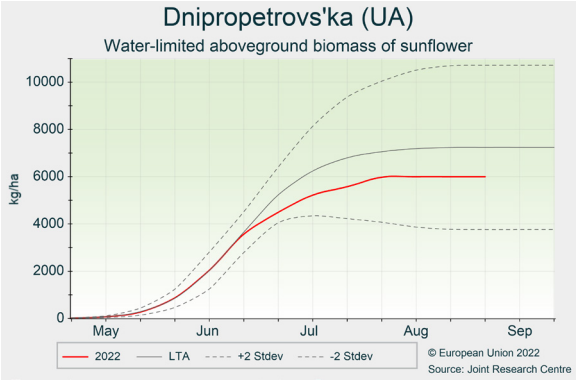
Soybeans are mainly produced in the western half of Ukraine, where drier-than-usual conditions prevailed throughout the season, particularly in June and July. This resulted in poor conditions for flowering and early grain filling. Rainfall in August prevented more severe losses of the yield potential. At national level, our yield forecast is below the historical trend.

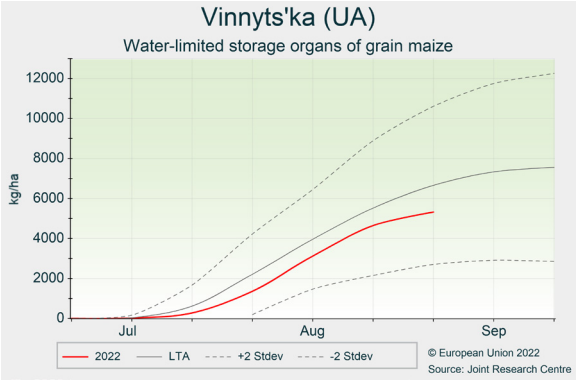
Harvest of summer crops started slowly in the southern oblasts since the end of August. Initial feedback shows poor yields in the drought-affected areas.

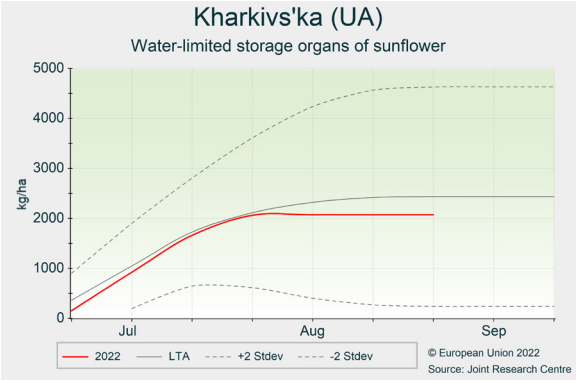





Poltavs'ka (UA)
Water-limited aboveground biomass of grain maize
kg/ha
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
May
Jun
Jul
Aug
Sep
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre


Dnipropetrovs'ka (UA)
Water-limited aboveground biomass of sunflower
kg/ha
10000
8000
6000
4000
2000
0
May
Jun
Jul
Aug
Sep
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre


Vinnyts'ka (UA)
Water-limited storage organs of grain maize
kg/ha
12000
10000
8000
6000
4000
2000
0
Jul
Aug
Sep
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre


Kharkivs'ka (UA)
Water-limited storage organs of sunflower
kg/ha
5000
4000
3000
2000
1000
0
Jul
Aug
Sep
2022
LTA
+2 Stdev
-2 Stdev
© European Union 2022
Source: Joint Research Centre

Crop yield forecast

Crop	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Wheat	6 684	7 090	**6 539**	– 2	– 8	4.07	4.53	**4.01**	– 1	– 12	27 222	32 152	**26 240**	– 4	– 18
Barley	2 487	2 471	**1 995**	– 20	– 19	3.35	3.82	**3.40**	+ 2	– 11	8 321	9 434	**6 792**	– 18	– 28
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Grain maize	4 981	5 482	**4 528**	– 9	– 17	6.78	7.68	**7.07**	+ 4	– 8	33 749	42 109	**32 027**	– 5	– 24
Sunflower	6 266	6 665	**5 590**	– 11	– 16	2.27	2.46	**2.48**	+ 9	+ 1	14 232	16 398	**13 877**	– 2	– 15
Soybean	1 602	1 322	**1 572**	– 2	+ 19	2.29	2.64	**2.35**	+ 3	– 11	3 670	3 491	**3 699**	+ 1	+ 6
Rapeseed	1 043	998	**1 405**	+ 35	+ 41	2.63	2.94	**2.74**	+ 4	– 7	2 744	2 930	**3 846**	+ 40	+ 31

NB: Yields are forecast for crops with sufficently long and coherent yield time series.

Sources: 2017-2021 data come from the State Statistics Service of Ukraine.

2022 winter and spring crops area data come from the Ukrainian Ministry of Agrarian Policy and Food (estimation).

2022 summer crops area data for all oblasts except those that are currently partly or totally non-government controlled (see below) come from UkrAgroConsult based on projections from the Ukrainian Ministry of Agrarian Policy and Food (estimation).

2022 summer crops areas in the oblasts of Donets'ka, Khersons'ka, Luhans'ka and Zaporiz'ka are JRC MARS estimates based on remote sensing.

2022 yields come from MARS Crop Yield Forecasting System (output up to 31.08.2022).

The column header '%22/5yrs' stands for the 2022 change with respect to the 5-year average(%). Similarly, '%22/21' stands for the 2022 change with respect to 2021(%).

Ukraine yield forecasts for total wheat – September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	6 684	7 090	**6 539**	– 2	– 8	4.07	4.53	**4.01**	– 1	– 12	27 222	32 152	**26 240**	– 4	– 18
Cherkas'ka	202	228	**194**	– 4	– 15	4.78	5.39	**5.03**	+ 5	– 7	965	1 228	**976**	+ 1	– 21
Chernihivs'ka	183	186	**155**	– 15	– 17	4.63	4.97	**4.73**	+ 2	– 5	845	924	**733**	– 13	– 21
Chernivets'ka	41	35	**33**	– 19	– 5	4.44	5.01	**4.20**	– 5	– 16	182	173	**139**	– 24	– 20
Dnipropetrovs'ka	520	561	**519**	– 0	– 8	3.72	4.40	**3.30**	– 11	– 25	1 936	2 469	**1 713**	– 12	– 31
Donets'ka	*349*	*381*	***381***	*+ 9*	*+ 0*	*3.70*	*4.07*	***3.90***	*+ 5*	*– 4*	*1 289*	*1 550*	***1 486***	*+ 15*	*– 4*
Ivano-frankivs'ka	60	47	**47**	– 21	– 1	4.69	4.97	**5.55**	+ 18	+ 12	280	236	**261**	– 7	+ 11
Kharkivs'ka	536	589	**575**	+ 7	– 2	4.43	4.80	**4.15**	– 6	– 14	2 370	2 829	**2 386**	+ 1	– 16
Khersons'ka	*484*	*504*	***456***	*– 6*	*– 9*	*3.48*	*4.12*	***3.86***	*+ 11*	*– 6*	*1 684*	*2 075*	***1 760***	*+ 4*	*– 15*
Khmel'nyts'ka	231	219	**208**	– 10	– 5	5.53	6.01	**6.16**	+ 11	+ 2	1 278	1 318	**1 281**	+ 0	– 3
Kirovohrads'ka	318	384	**379**	+ 19	– 1	4.03	4.87	**4.15**	+ 3	– 15	1 281	1 868	**1 573**	+ 23	– 16
Kyyivs'ka	196	208	**181**	– 8	– 13	4.54	5.06	**3.66**	– 19	– 28	891	1 054	**662**	– 26	– 37
Luhans'ka	*270*	*282*	***324***	*+ 20*	*+ 15*	*3.61*	*3.84*	***4.08***	*+ 13*	*+ 6*	*973*	*1 081*	***1 322***	*+ 36*	*+ 22*
L'vivs'ka	171	167	**152**	– 11	– 9	4.72	4.93	**4.66**	– 1	– 5	806	824	**708**	– 12	– 14
Mykolayivs'ka	439	480	**436**	– 1	– 9	3.45	4.23	**3.09**	– 10	– 27	1 514	2 032	**1 347**	– 11	– 34
Odes'ka	621	679	**551**	– 11	– 19	3.31	3.90	**2.60**	– 21	– 33	2 055	2 646	**1 433**	– 30	– 46
Poltavs'ka	237	250	**257**	+ 8	+ 3	4.48	4.83	**4.57**	+ 2	– 5	1 062	1 205	**1 174**	+ 11	– 3
Rivnens'ka	109	115	**103**	– 5	– 10	4.52	4.70	**4.87**	+ 8	+ 4	492	539	**502**	+ 2	– 7
Sums'ka	188	196	**168**	– 11	– 14	4.99	4.75	**5.16**	+ 3	+ 9	937	929	**867**	– 8	– 7
Ternopil's'ka	211	206	**191**	– 9	– 7	5.19	5.54	**5.40**	+ 4	– 3	1 093	1 138	**1 031**	– 6	– 9
Vinnyts'ka	326	317	**292**	– 10	– 8	5.12	5.57	**4.60**	– 10	– 17	1 671	1 768	**1 343**	– 20	– 24
Volyns'ka	161	165	**149**	– 7	– 10	4.39	4.34	**4.96**	+ 13	+ 14	704	718	**739**	+ 5	+ 3
Zakarpats'ka	27	24	**17**	– 36	– 30	3.30	3.36	**3.88**	+ 18	+ 15	88	81	**66**	– 25	– 19
Zaporiz'ka	*661*	*707*	***651***	*– 1*	*– 8*	*3.30*	*3.84*	***3.40***	*+ 3*	*– 11*	*2 180*	*2 714*	***2 213***	*+ 2*	*– 18*
Zhytomyrs'ka	147	162	**120**	– 18	– 26	4.41	4.65	**4.37**	– 1	– 6	647	754	**524**	– 19	– 30

Ukraine yield forecasts for winter barley - September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	992	1 137	**971**	– 2	– 15	3.63	4.27	**3.48**	– 4	– 18	3 598	4 856	**3 382**	– 6	– 30
Cherkas'ka	14	15	**12**	– 13	– 21	4.50	4.93	**4.68**	+ 4	– 5	62	74	**56**	– 9	– 25
Chernihivs'ka	1	2	**3**	+ 233	+ 67	4.74	4.79	**4.21**	– 11	– 12	4	9	**13**	+ 196	+ 46
Chernivets'ka	6	5	**6**	– 2	+ 22	4.18	4.66	**3.69**	– 12	– 21	26	23	**22**	– 14	– 3
Dnipropetrovs'ka	88	106	**88**	+ 0	– 17	3.35	3.99	**3.32**	– 1	– 17	294	425	**292**	– 1	– 31
Donets'ka	*10*	*14*	***12***	*+ 22*	*– 15*	*3.50*	*3.43*	***3.29***	*– 6*	*– 4*	*34*	*48*	***39***	*+ 15*	*– 18*
Ivano-frankivs'ka	10	9	**10**	+ 0	+ 16	5.08	5.21	**5.62**	+ 11	+ 8	51	45	**56**	+ 11	+ 25
Kharkivs'ka	10	15	**13**	+ 26	– 14	4.42	4.38	**3.88**	– 12	– 11	46	66	**50**	+ 11	– 24
Khersons'ka	*88*	*118*	***105***	*+ 19*	*– 11*	*3.78*	*4.33*	***4.08***	*+ 8*	*– 6*	*332*	*509*	***428***	*+ 29*	*– 16*
Khmel'nyts'ka	15	13	**18**	+ 20	+ 42	4.58	4.97	**5.13**	+ 12	+ 3	69	63	**92**	+ 34	+ 46
Kirovohrads'ka	68	79	**66**	– 2	– 17	3.66	4.62	**3.92**	+ 7	– 15	248	365	**259**	+ 4	– 29
Kyyivs'ka	9	9	**8**	– 6	– 10	4.22	4.76	**4.11**	– 3	– 14	36	42	**33**	– 8	– 22
Luhans'ka	*7*	*7*	***5***	*– 26*	*– 25*	*3.03*	*2.67*	***3.83***	*+ 26*	*+ 43*	*21*	*18*	***19***	*– 7*	*+ 7*
L'vivs'ka	25	22	**22**	– 14	– 1	5.59	5.64	**4.73**	– 15	– 16	142	125	**104**	– 27	– 17
Mykolayivs'ka	209	228	**193**	– 7	– 15	3.22	4.03	**3.00**	– 7	– 26	671	918	**579**	– 14	– 37
Odes'ka	286	317	**244**	– 15	– 23	3.29	4.12	**2.75**	– 16	– 33	939	1 305	**671**	– 29	– 49
Poltavs'ka	8	10	**11**	+ 40	+ 7	4.29	4.86	**4.30**	+ 0	– 12	34	50	**47**	+ 41	– 6
Rivnens'ka	5	5	**6**	+ 29	+ 18	4.47	4.50	**4.77**	+ 7	+ 6	21	23	**29**	+ 38	+ 25
Sums'ka	2	3	**4**	+ 104	+ 33	4.77	5.53	**4.13**	– 13	– 25	9	17	**17**	+ 77	– 0
Ternopil's'ka	20	17	**15**	– 23	– 11	5.33	5.47	**5.63**	+ 6	+ 3	104	92	**84**	– 19	– 8
Vinnyts'ka	33	35	**30**	– 9	– 14	4.71	5.08	**4.66**	– 1	– 8	155	178	**140**	– 10	– 21
Volyns'ka	6	8	**8**	+ 32	+ 0	4.71	4.84	**4.98**	+ 6	+ 3	29	39	**40**	+ 39	+ 3
Zakarpats'ka	2	1	**1**	– 44	+ 0	3.01	2.91	**3.23**	+ 7	+ 11	5	3	**3**	– 40	+ 11
Zaporiz'ka	*63*	*88*	***80***	*+ 27*	*– 9*	*3.63*	*4.14*	***3.30***	*– 9*	*– 20*	*229*	*363*	***264***	*+ 15*	*– 27*
Zhytomyrs'ka	9	13	**11**	+ 18	– 12	3.94	4.44	**3.97**	+ 1	– 11	37	56	**44**	+ 19	– 21

Ukraine yield forecasts for spring barley - September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	1 495	1 334	**1 024**	-32	-23	3.16	3.43	**3.33**	+ 5	– 3	4 723	4 579	**3 410**	– 28	– 26
Cherkas'ka	40	40	**28**	-30	-29	3.62	3.88	**3.86**	+ 7	– 1	146	154	**108**	– 26	– 30
Chernihivs'ka	23	20	**16**	-31	-19	4.07	3.86	**4.12**	+ 1	+ 7	94	76	**66**	– 30	– 13
Chernivets'ka	14	13	**9**	-34	-33	3.25	3.29	**3.31**	+ 2	+ 1	45	44	**30**	– 33	– 32
Dnipropetrovs'ka	162	143	**111**	-32	-22	2.53	2.71	**2.62**	+ 4	– 3	410	387	**291**	– 29	– 25
Donets'ka	*108*	*103*	***74***	*-32*	*-28*	*2.63*	*2.95*	***2.85***	*+ 9*	*– 3*	*285*	*302*	***211***	*– 26*	*– 30*
Ivano-frankivs'ka	18	17	**12**	-33	-28	3.85	3.91	**4.54**	+ 18	+ 16	69	65	**54**	– 20	– 17
Kharkivs'ka	135	121	**93**	-31	-23	3.42	3.60	**3.52**	+ 3	– 2	462	436	**327**	– 29	– 25
Khersons'ka	*100*	*92*	***69***	*-31*	*-25*	*2.58*	*3.29*	***2.82***	*+ 9*	*– 14*	*259*	*304*	***195***	*– 25*	*– 36*
Khmel'nyts'ka	73	59	**50**	-31	-15	4.39	4.36	**4.97**	+ 13	+ 14	319	256	**249**	– 22	– 3.1
Kirovohrads'ka	56	53	**38**	-32	-29	2.76	3.19	**2.89**	+ 5	– 9	155	170	**110**	– 29	– 35
Kyyivs'ka	62	62	**43**	-31	-30	3.83	3.94	**3.55**	– 7	– 10	238	242	**153**	– 36	– 37
Luhans'ka	*39*	*34*	***27***	*-31*	*-21*	*2.33*	*2.79*	***2.97***	*+ 27*	*+ 6*	*91*	*95*	***80***	*– 12*	*– 15*
L'vivs'ka	22	16	**15**	-31	-7	3.61	3.60	**3.41**	– 6	– 5	78	58	**51**	– 35	– 12
Mykolayivs'ka	85	79	**58**	-32	-27	2.43	3.03	**2.46**	+ 1	– 19	207	240	**143**	– 31	– 41
Odes'ka	59	54	**40**	-32	-25	2.55	3.64	**2.21**	– 13	– 39	150	195	**88**	– 41	– 55
Poltavs'ka	83	79	**57**	-31	-28	3.39	3.49	**3.73**	+ 10	+ 7	282	276	**213**	– 25	– 23
Rivnens'ka	43	40	**29**	-32	-28	3.80	3.73	**3.97**	+ 4	+ 6	162	150	**115**	– 29	– 23
Sums'ka	40	30	**27**	-32	-8	3.94	3.74	**4.14**	+ 5	+ 11	156	110	**112**	– 28	+ 1
Ternopil's'ka	84	67	**58**	-31	-13	4.39	4.23	**4.76**	+ 9	+ 13	370	283	**276**	– 25	– 2.3
Vinnyts'ka	68	59	**46**	-32	-22	4.01	4.34	**4.35**	+ 9	+ 0	271	255	**200**	– 26	– 22
Volyns'ka	27	25	**18**	-32	-27	3.08	2.93	**3.39**	+ 10	+ 16	82	73	**61**	– 26	– 16
Zakarpats'ka	—	—	**—**	—	—	—	—	**—**	—	—	—	—	**—**	—	—
Zaporiz'ka	*133*	*107*	***91***	*-32*	*-15*	*2.40*	*3.00*	***2.46***	*+ 2*	*– 18*	*320*	*321*	***224***	*– 30*	*– 30*
Zhytomyrs'ka	22	23	**15**	-32	-35	3.43	3.72	**3.59**	+ 5	– 3	75	86	**54**	– 29	– 37

Ukraine yield forecasts for rapeseed – September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	1 043	998	**1 405**	+ 35	+ 41	2.63	2.94	**2.74**	+ 4	– 7	2 744	2 930	**3 846**	+ 40	+ 31
Cherkas'ka	30	17	**47**	+ 57	+ 172	2.90	3.14	**3.49**	+ 20	+ 11	88	55	**165**	+ 88	+ 202
Chernihivs'ka	33	34	**39**	+ 15	+ 13	2.76	3.30	**2.78**	+ 1	– 16	92	113	**107**	+ 16	– 5
Chernivets'ka	12	12	**11**	– 5	– 1	2.66	2.75	**3.00**	+ 13	+ 9	32	32	**34**	+ 8	+ 8
Dnipropetrovs'ka	91	84	**142**	+ 56	+ 69	2.44	2.39	**2.50**	+ 2	+ 5	222	200	**354**	+ 59	+ 77
Donets'ka	*26*	—	***36***	*+ 39*	—	*2.26*	—	***2.39***	*+ 6*	—	*59*	—	***87***	*+ 47*	—
Ivano-frankivs'ka	26	20	**18**	– 30	– 8	2.93	3.46	**3.23**	+ 10	– 7	75	68	**58**	– 23	– 14
Kharkivs'ka	11	4	**15**	+ 36	+ 314	2.22	2.28	**2.47**	+ 11	+ 8	24	8	**37**	+ 51	+ 348
Khersons'ka	*77*	*95*	***102***	*+ 32*	*+ 7*	*2.36*	*2.56*	***2.65***	*+ 13*	*+ 4*	*182*	*244*	***271***	*+ 49*	*+ 11*
Khmel'nyts'ka	70	83	**80**	+ 16	– 3	3.19	3.59	**3.69**	+ 16	+ 3	222	298	**296**	+ 34	– 1
Kirovohrads'ka	42	28	**69**	+ 63	+ 145	2.39	2.39	**2.60**	+ 9	+ 9	101	68	**180**	+ 78	+ 167
Kyyivs'ka	37	33	**51**	+ 36	+ 51	2.80	3.06	**2.75**	– 2	– 10	104	102	**139**	+ 34	+ 36
Luhans'ka	—	—	**—**	—	—	—	—	**—**	—	—	—	—	**—**	—	—
L'vivs'ka	62	52	**46**	– 26	– 12	2.96	3.39	**3.25**	+ 10	– 4	184	177	**150**	– 19	– 16
Mykolayivs'ka	59	62	**118**	+ 99	+ 90	2.21	2.64	**2.08**	– 6	– 21	130	163	**245**	+ 88	+ 50
Odes'ka	137	119	**187**	+ 36	+ 58	2.05	2.55	**2.06**	+ 0	– 19	282	302	**386**	+ 37	+ 28
Poltavs'ka	10	11	**24**	+ 143	+ 110	2.87	3.07	**3.05**	+ 6	– 1	28	34	**72**	+ 158	+ 108
Rivnens'ka	28	29	**26**	– 10	– 12	2.91	2.98	**3.30**	+ 13	+ 11	83	87	**85**	+ 2	– 3
Sums'ka	16	22	**29**	+ 76	+ 29	3.04	3.19	**3.09**	+ 1	– 3	50	71	**88**	+ 79	+ 25
Ternopil's'ka	66	69	**73**	+ 11	+ 6	3.24	3.82	**3.52**	+ 9	– 8	213	262	**256**	+ 20	– 2
Vinnyts'ka	66	61	**82**	+ 25	+ 35	3.08	3.31	**3.22**	+ 5	– 3	202	202	**265**	+ 31	+ 31
Volyns'ka	44	49	**48**	+ 9	– 2	3.12	3.16	**3.58**	+ 15	+ 13	137	155	**171**	+ 25	+ 11
Zakarpats'ka	—	—	**—**	—	—	—	—	**—**	—	—	—	—	**—**	—	—
Zaporiz'ka	*60*	*73*	***125***	*+ 108*	*+ 71*	*2.19*	*2.46*	***2.38***	*+ 8*	*– 3*	*131*	*179*	***297***	*+ 126*	*+ 66*
Zhytomyrs'ka	40	41	**38**	– 4	– 8	2.58	2.64	**2.69**	+ 4	+ 2	102	108	**102**	– 0	– 6

Ukraine yield forecasts for grain maize - September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	4 981	5 482	**4 528**	– 9	– 17	6.78	7.68	**7.07**	+ 4	– 8	33 749	42 109	**32 027**	– 5	– 24
Cherkas'ka	395	406	**371**	– 6	– 9	6.96	8.95	**7.57**	+ 9	– 16	2 751	3 635	**2 805**	+ 2	– 23
Chernihivs'ka	479	556	**395**	– 18	– 29	8.21	8.55	**8.87**	+ 8	+ 4	3 939	4 752	**3 508**	– 11	– 26
Chernivets'ka	58	64	**63**	+ 8	– 1	6.30	7.47	**6.16**	– 2	– 18	368	478	**389**	+ 6	– 19
Dnipropetrovs'ka	312	304	**292**	– 6	– 4	3.99	5.19	**3.96**	– 1	– 24	1 243	1 575	**1 157**	– 7	– 27
Donets'ka	*62*	*56*	***85***	*+ 38*	*+ 52*	*3.28*	*4.25*	***3.22***	*– 2*	*– 24*	*203*	*238*	***274***	*+ 35*	*+ 15*
Ivano-frankivs'ka	51	71	**56**	+ 10	– 21	7.78	9.02	**9.05**	+ 16	+ 0	393	637	**502**	+ 28	– 21
Kharkivs'ka	274	287	**129**	– 53	– 55	4.93	5.14	**5.72**	+ 16	+ 11	1 351	1 474	**737**	– 45	– 50
Khersons'ka	*47*	*59*	***48***	*+ 1*	*– 19*	*8.09*	*9.03*	***8.26***	*+ 2*	*– 9*	*383*	*533*	***396***	*+ 3*	*– 26*
Khmel'nyts'ka	236	303	**230**	– 2	– 24	9.43	10.28	**9.23**	– 2	– 10	2 225	3 116	**2 127**	– 4	– 32
Kirovohrads'ka	380	354	**332**	– 13	– 6	5.17	7.03	**5.61**	+ 9	– 20	1 966	2 485	**1 860**	– 5	– 25
Kyyivs'ka	326	358	**330**	+ 1	– 8	7.45	8.67	**6.76**	– 9	– 22	2 430	3 103	**2 227**	– 8	– 28
Luhans'ka	*66*	*56*	***104***	*+ 59*	*+ 86*	*3.15*	*2.88*	***3.92***	*+ 25*	*+ 36*	*206*	*161*	***408***	*+ 98*	*+ 153*
L'vivs'ka	57	83	**89**	+ 55	+ 7	8.47	9.06	**8.48**	+ 0	– 6	486	756	**755**	+ 55	– 0
Mykolayivs'ka	117	121	**82**	– 30	– 32	4.12	5.23	**4.03**	– 2	– 23	483	635	**332**	– 31	– 48
Odes'ka	143	137	**147**	+ 3	+ 7	4.26	6.10	**3.33**	– 22	– 45	611	838	**491**	– 20	– 42
Poltavs'ka	629	643	**529**	– 16	– 18	6.51	6.79	**7.51**	+ 16	+ 11	4 092	4 365	**3 976**	– 3	– 9
Rivnens'ka	78	110	**82**	+ 4	– 26	8.02	8.12	**8.85**	+ 10	+ 9	629	892	**724**	+ 15	– 19
Sums'ka	399	460	**285**	– 29	– 38	7.84	6.77	**8.95**	+ 14	+ 32	3 128	3 114	**2 555**	– 18	– 18
Ternopil's'ka	128	176	**122**	– 4	– 31	9.20	9.87	**9.71**	+ 6	– 2	1 173	1 737	**1 183**	+ 1	– 32
Vinnyts'ka	411	457	**392**	– 4	– 14	8.00	9.37	**7.76**	– 3	– 17	3 287	4 279	**3 045**	– 7	– 29
Volyns'ka	36	58	**55**	+ 53	– 6	9.07	8.61	**9.44**	+ 4	+ 10	325	501	**516**	+ 59	+ 3
Zakarpats'ka	50	53	**50**	– 2	– 7	5.27	5.04	**4.97**	– 6	– 2	265	267	**246**	– 7	– 8
Zaporiz'ka	*37*	*37*	***66***	*+ 79*	*+ 79*	*4.84*	*7.54*	***4.85***	*+ 0*	*– 36*	*178*	*278*	***320***	*+ 80*	*+ 15*
Zhytomyrs'ka	209	274	**194**	– 8	– 29	7.81	8.25	**7.72**	– 1	– 7	1 637	2 260	**1 495**	– 9	– 34

Ukraine yield forecasts for sunflower - September 2022 Bulletin

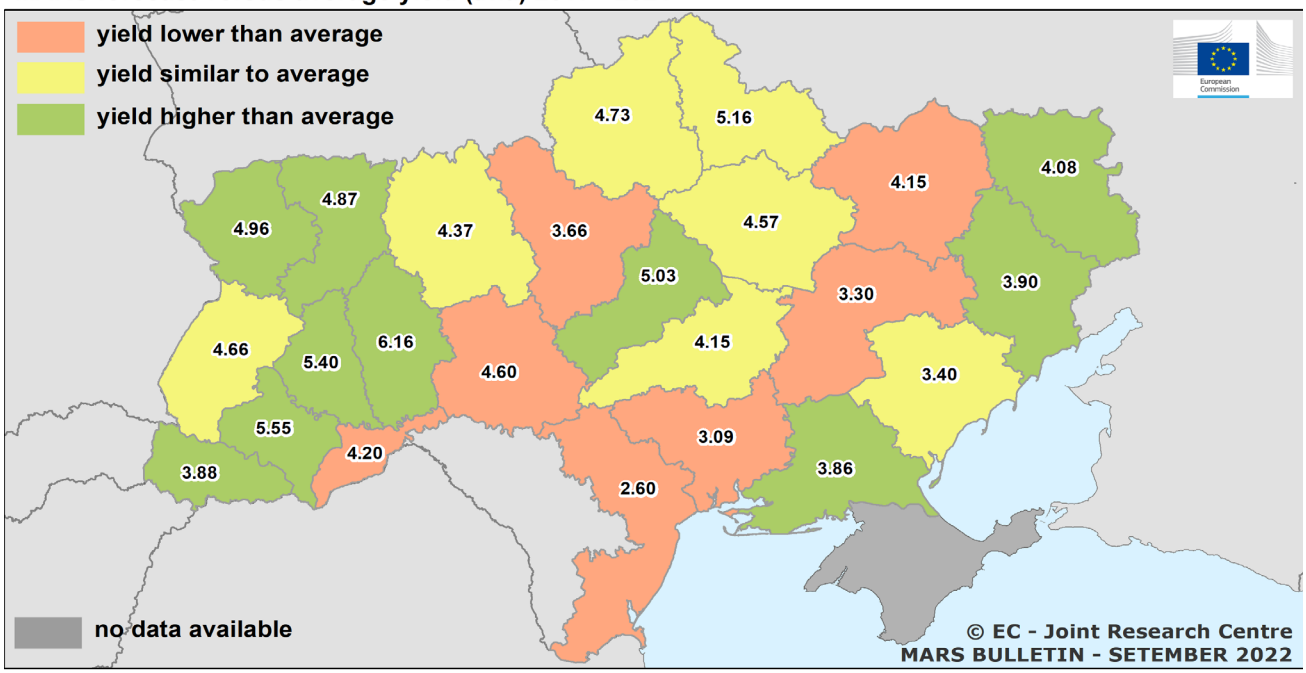
Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	6 266	6 665	**5 590**	– 11	– 16	2.27	2.46	**2.48**	+ 9	+ 1	14 232	16 398	**13 877**	– 2	– 15
Cherkas'ka	219	257	**248**	+ 13	– 3.7	2.92	3.15	**3.06**	+ 5	– 3	639	811	**758**	+ 19	– 7
Chernihivs'ka	218	243	**290**	+ 33	+ 20	2.82	2.91	**2.89**	+ 2	– 1	615	706	**837**	+ 36	+ 19
Chernivets'ka	18	22	**19**	+ 3	– 14	2.69	2.84	**2.93**	+ 9	+ 3	49	62	**55**	+ 12	– 12
Dnipropetrovs'ka	608	608	**589**	– 3	– 3	2.09	2.33	**2.16**	+ 3	– 7	1 272	1 417	**1 271**	– 0	– 10
Donets'ka	*330*	*358*	***159***	*– 52*	*– 56*	*1.89*	*2.18*	***1.97***	*+ 4*	*– 9*	*625*	*780*	***314***	*– 50*	*– 60*
Ivano-frankivs'ka	27	32	**41**	+ 51	+ 29	2.59	2.85	**2.76**	+ 7	– 3	70	91	**113**	+ 61	+ 25
Kharkivs'ka	546	582	**246**	– 55	– 58	2.50	2.44	**2.93**	+ 17	+ 20	1 365	1 420	**722**	– 47	– 49
Khersons'ka	*347*	*349*	***201***	*– 42*	*– 42*	*1.67*	*1.93*	***1.61***	*– 3*	*– 16*	*580*	*673*	***324***	*– 44*	*– 52*
Khmel'nyts'ka	156	163	**199**	+ 27	+ 22	3.22	3.14	**3.30**	+ 3	+ 5	503	510	**657**	+ 31	+ 29
Kirovohrads'ka	587	608	**603**	+ 3	– 1	2.29	2.63	**2.65**	+ 15	+ 1	1 344	1 599	**1 594**	+ 19	– 0
Kyyivs'ka	182	209	**198**	+ 9	– 5	2.77	2.85	**2.92**	+ 5	+ 2	505	595	**578**	+ 15	– 3
Luhans'ka	*389*	*442*	***193***	*– 50*	*– 56*	*1.87*	*1.83*	***1.92***	*+ 2*	*+ 5*	*727*	*809*	***370***	*– 49*	*– 54*
L'vivs'ka	33	41	**40**	+ 20	– 1	2.48	2.52	**2.60**	+ 5	+ 3	83	102	**104**	+ 26	+ 2
Mykolayivs'ka	525	518	**364**	– 31	– 30	1.86	2.24	**1.66**	– 11	– 26	975	1 160	**605**	– 38	– 48
Odes'ka	401	416	**399**	– 0	– 4	1.94	2.32	**1.49**	– 23	– 36	780	965	**595**	– 24	– 38
Poltavs'ka	347	388	**434**	+ 25	+ 12	2.66	2.57	**2.99**	+ 12	+ 16	925	996	**1 300**	+ 41	+ 31
Rivnens'ka	31	41	**56**	+ 82	+ 38	2.66	2.62	**2.56**	– 4	– 2	82	107	**144**	+ 75	+ 34
Sums'ka	240	266	**331**	+ 38	+ 24	2.98	2.94	**3.32**	+ 11	+ 13	716	783	**1 099**	+ 54	+ 40
Ternopil's'ka	77	83	**105**	+ 36	+ 26	3.12	3.34	**3.91**	+ 25	+ 17	241	278	**408**	+ 70	+ 47
Vinnyts'ka	270	308	**328**	+ 21	+ 7	3.06	3.20	**2.80**	– 9	– 12	828	984	**919**	+ 11	– 7
Volyns'ka	30	40	**42**	+ 39	+ 5	2.70	2.54	**2.69**	– 0	+ 6	81	101	**112**	+ 39	+ 11
Zakarpats'ka	3	4	**5**	+ 49	+ 36	2.04	1.87	**2.18**	+ 7	+ 17	7	7	**11**	+ 60	+ 59
Zaporiz'ka	*548*	*535*	***341***	*– 38*	*– 36*	*1.65*	*2.00*	***1.72***	*+ 4*	*– 14*	*902*	*1 071*	***586***	*– 35*	*– 45*
Zhytomyrs'ka	134	155	**159**	+ 19	+ 3	2.38	2.40	**2.52**	+ 6	+ 5	318	372	**401**	+ 26	+ 8

Ukraine yield forecasts for soybean - September 2022 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2022	%22/5yrs	%22/21	Avg 5yrs	2021	MARS 2022 forecasts	%22/5yrs	%22/21	Avg 5yrs	2021	2022	%22/5yrs	%22/21
Ukraine	1 602	1 322	**1 572**	– 2	+ 19	2.29	2.64	**2.35**	+ 3	– 11	3 670	3 491	**3 699**	+ 1	+ 6
Cherkas'ka	100	79	**100**	+ 0	+ 27	1.97	2.45	**2.12**	+ 8	– 13	197	194	**213**	+ 8	+ 10
Chernihivs'ka	78	41	**78**	+ 0	+ 89	2.24	2.55	**2.60**	+ 16	+ 2	175	105	**203**	+ 16	+ 93
Chernivets'ka	58	58	**58**	+ 0	+ 0	2.26	2.68	**2.18**	– 3	– 19	131	155	**127**	– 3	– 18
Dnipropetrovs'ka	4	6	**4**	+ 0	– 26	1.60	1.73	**1.58**	– 1	– 9	7	10	**7**	– 1	– 33
Donets'ka	*1*	—	***4***	*+ 493*	—	*0.65*	—	***0.74***	*+ 15*	—	*1*	—	***3***	*+ 412*	—
Ivano-frankivs'ka	33	41	**33**	+ 0	– 19	2.71	2.92	**2.67**	– 1	– 9	89	119	**88**	– 1	– 26
Kharkivs'ka	36	23	**36**	+ 0	+ 52	1.49	1.79	**1.89**	+ 27	+ 6	53	42	**67**	+ 27	+ 61
Khersons'ka	*95*	*82*	***54***	*– 43*	*– 34*	*3.21*	*3.42*	***3.20***	*– 0*	*– 6*	*305*	*280*	***173***	*– 43*	*– 38*
Khmel'nyts'ka	163	139	**163**	+ 0	+ 17	2.72	3.07	**2.78**	+ 2	– 10	442	427	**452**	+ 2	+ 6
Kirovohrads'ka	101	65	**101**	+ 0	+ 56	1.50	2.21	**1.90**	+ 26	– 14	152	143	**192**	+ 26	+ 34
Kyyivs'ka	128	98	**128**	+ 0	+ 30	2.04	2.36	**1.97**	– 4	– 17	261	232	**251**	– 4	+ 8
Luhans'ka	—	—	**—**	—	—	—	—	**—**	—	—	—	—	**—**	—	—
L'vivs'ka	67	88	**67**	+ 0	– 24	2.79	2.99	**2.50**	– 10	– 16	188	264	**169**	– 10	– 36
Mykolayivs'ka	9	6	**9**	+ 0	+ 68	1.27	2.05	**1.18**	– 7	– 42	12	11	**11**	– 7	– 3
Odes'ka	7	5	**7**	+ 0	+ 52	2.00	2.45	**1.84**	– 8	– 25	14	11	**13**	– 8	+ 14
Poltavs'ka	162	122	**162**	+ 0	+ 32	1.86	2.03	**2.22**	+ 19	+ 9	300	248	**359**	+ 19	+ 44
Rivnens'ka	62	54	**62**	+ 0	+ 14	2.58	2.60	**2.52**	– 2	– 3	159	140	**156**	– 2	+ 11
Sums'ka	107	72	**107**	+ 0	+ 48	2.10	1.96	**2.14**	+ 2	+ 9	224	142	**229**	+ 2	+ 61
Ternopil's'ka	81	84	**81**	+ 0	– 3	2.78	3.05	**2.64**	– 5	– 13	225	255	**214**	– 5	– 16
Vinnyts'ka	112	81	**112**	+ 0	+ 38	2.27	2.84	**2.23**	– 2	– 21	254	231	**250**	– 2	+ 8
Volyns'ka	36	38	**36**	+ 0	– 4	2.56	2.72	**2.39**	– 7	– 12	93	103	**87**	– 7	– 16
Zakarpats'ka	11	12	**11**	+ 0	– 11	2.72	2.26	**2.51**	– 8	+ 11	29	27	**27**	– 8	– 1
Zaporiz'ka	*13*	*12*	***21***	*+ 66*	*+ 79*	*3.14*	*3.47*	***3.41***	*+ 9*	*– 2*	*40*	*41*	***72***	*+ 80*	*+ 77*
Zhytomyrs'ka	138	116	**138**	+ 0	+ 19	2.30	2.67	**2.45**	+ 6	– 8	319	310	**339**	+ 6	+ 9

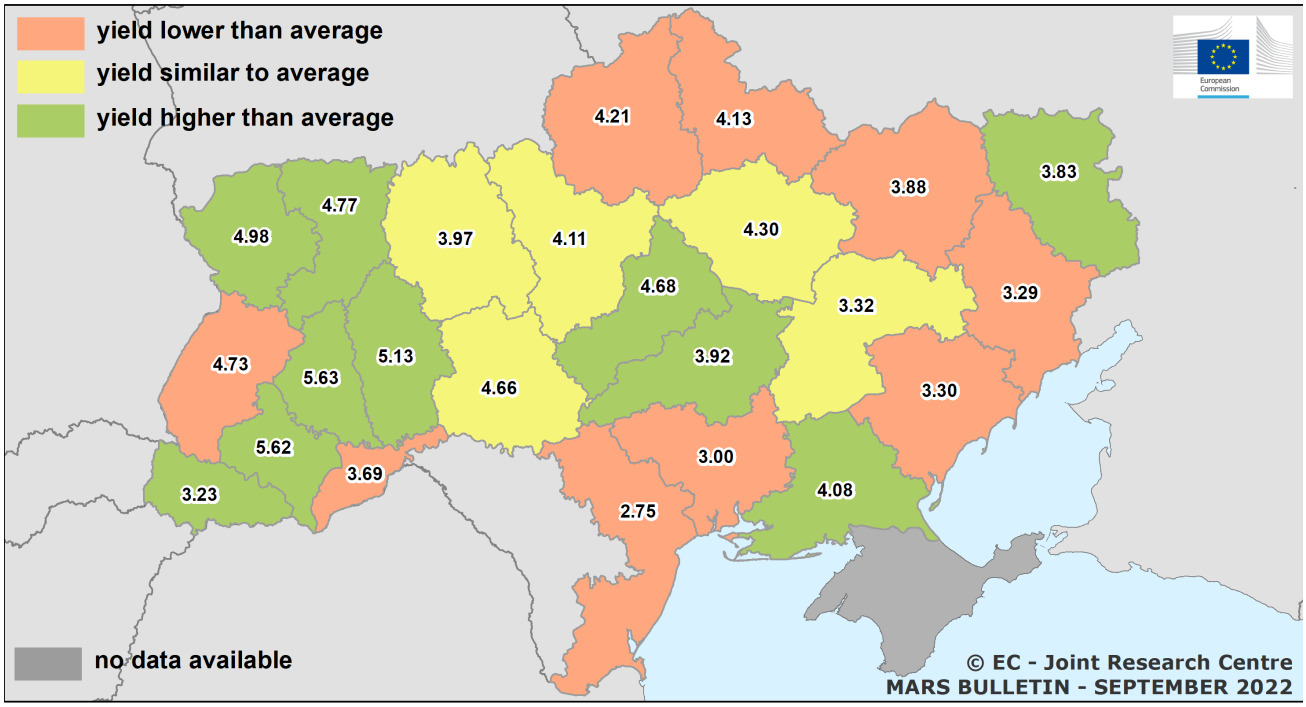
Total wheat - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



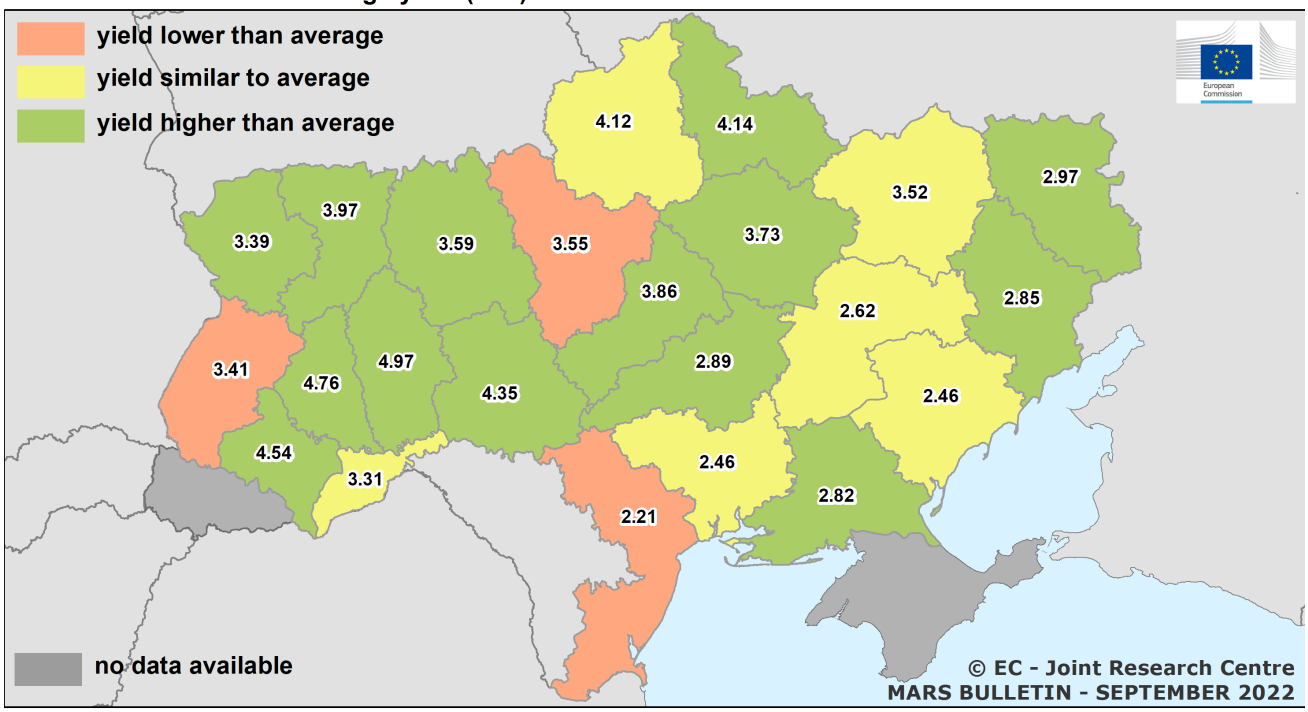
Winter barley - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



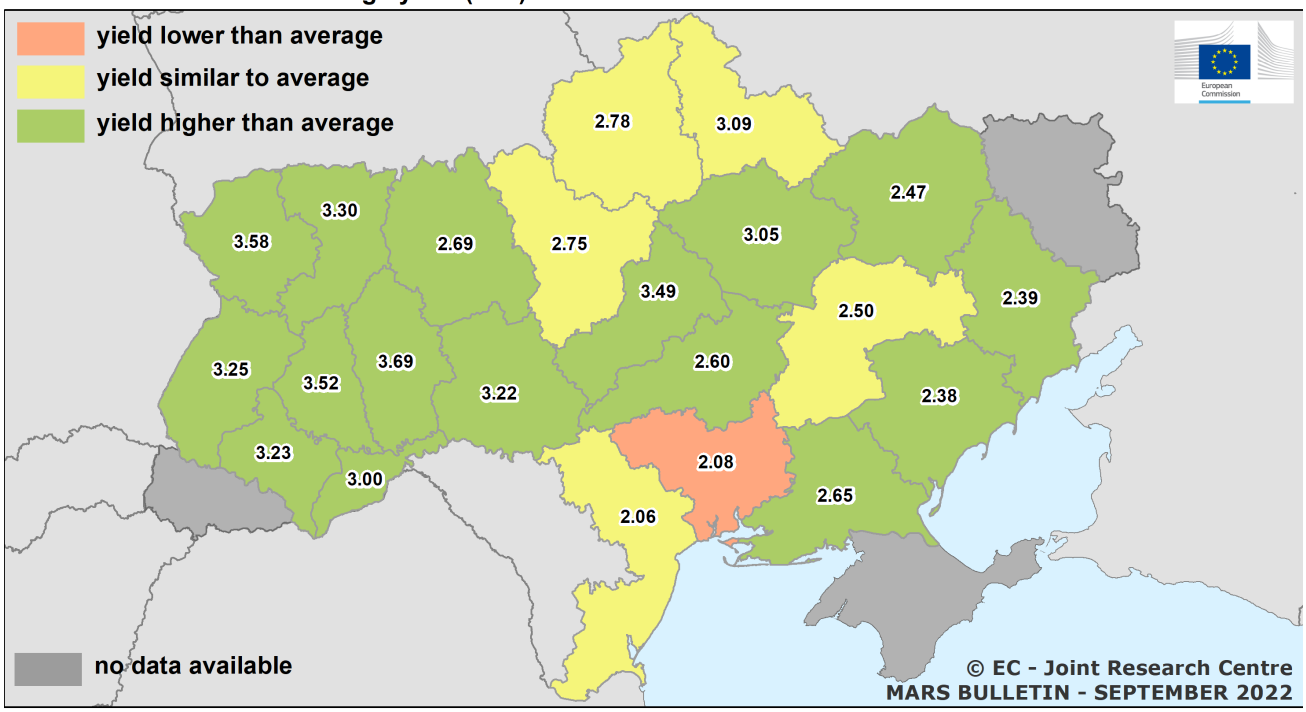
Spring barley - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



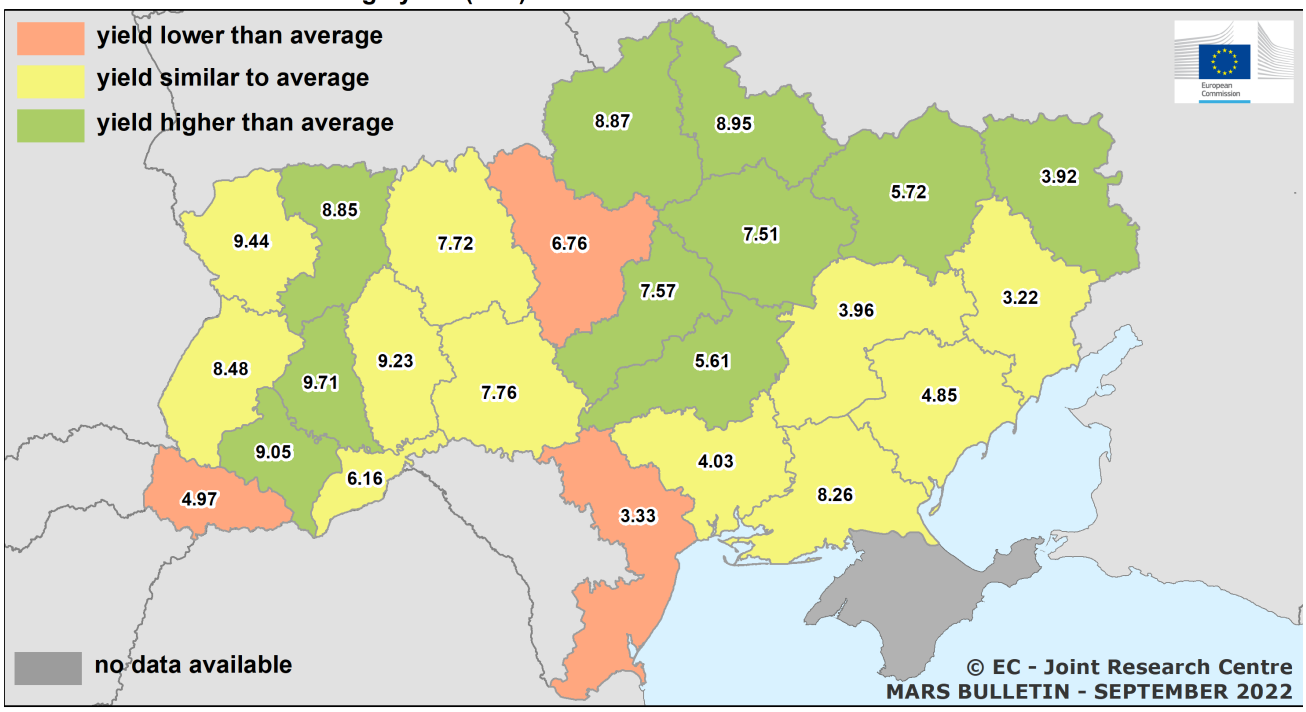
Rapeseed - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



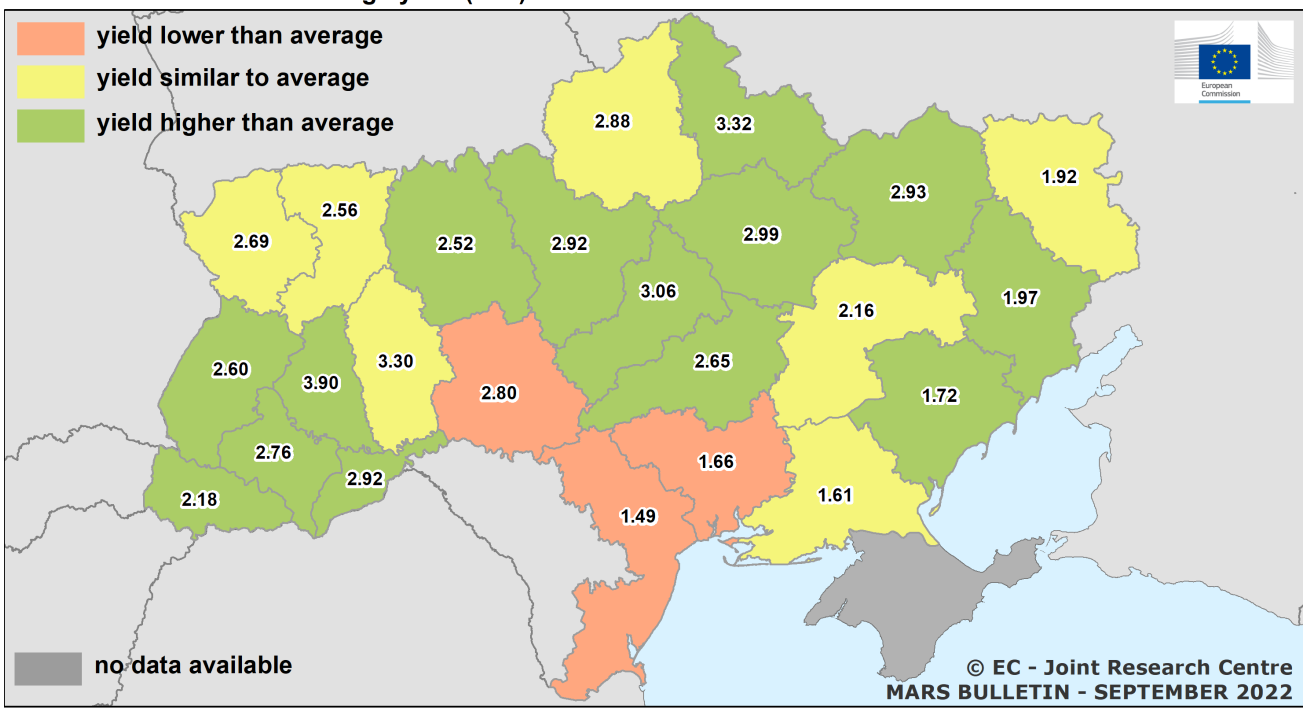
Grain maize - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



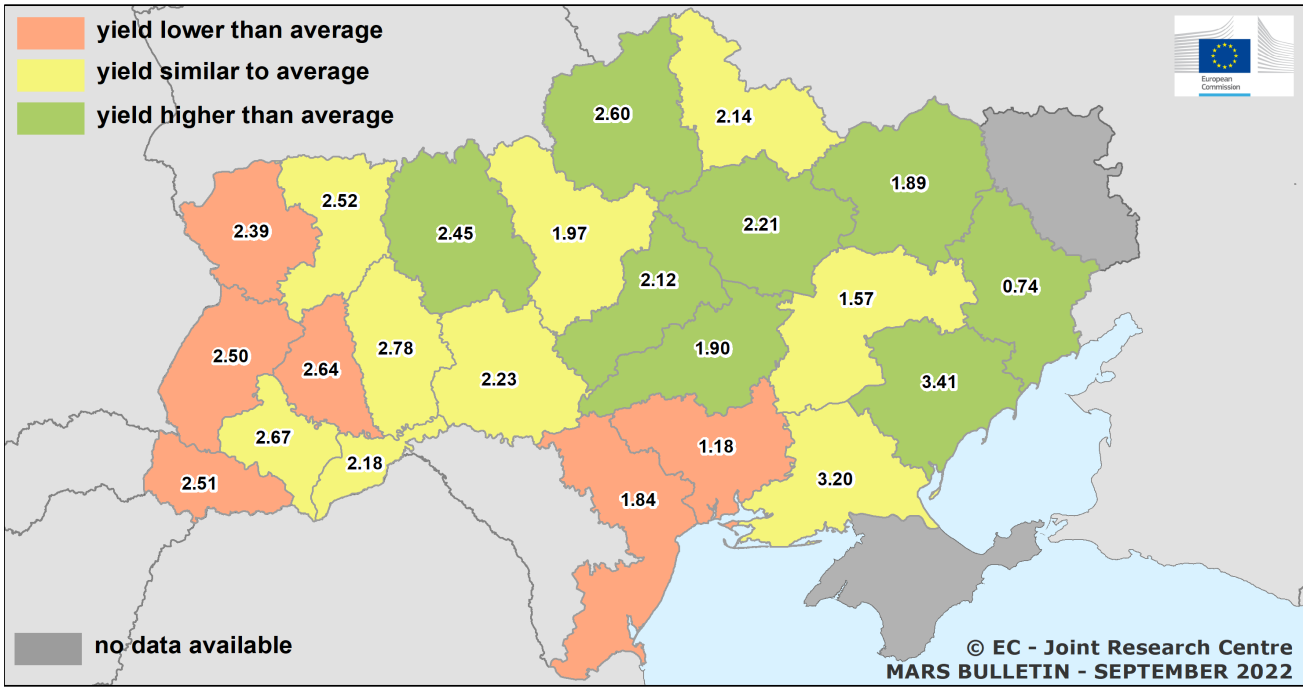
Sunflower - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



Soybean - yield forecast 2022

MARS forecast versus average yield (t/ha) 2017 - 2021



Appendix

Separating crop area and crop phenology effects using high resolution Copernicus Sentinel data

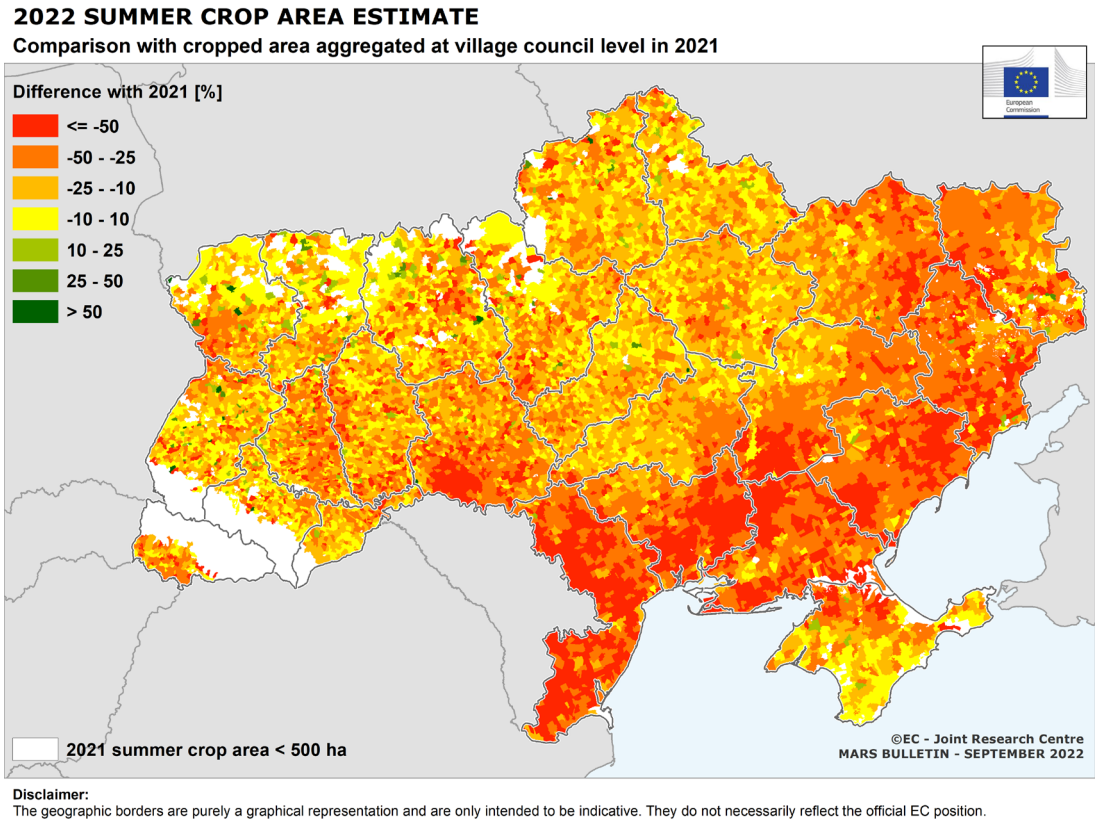


Figure 1. Relative change in utilized summer crop area in 2022 vis-à-vis 2021, aggregated at village council administrative level.

In the June edition of this Bulletin (ref), we introduced the use of high-resolution remote sensing imagery in the context of crop area estimation. The European Union's Copernicus Sentinel satellites have been providing high-resolution imagery since 2015. The sensors on board the Sentinel-1 (S-1) and Sentinel-2 (S-2) can provide spatial detail at a resolution of 10 m, which makes it possible to map individual agricultural parcels and to monitor crop growth and some crop management practices, both in the microwave (S-1) and the optical visual and infrared (S-2) wavelengths. The regular revisiting of Sentinel sensors (5 days for S-2, 6 days for S-1[3]) provide regular sampling over the season, in particular for S-1, which is not hindered by atmospheric conditions such as clouds or rain.

In this edition of the Bulletin, the focus has shifted from winter crops to summer crops. Separation of summer crops is more challenging because the phenological cycles of Ukraine's major summer crops (maize, sunflowers, and soybeans) are similar within this group as well as to those of minor crops such as sugar beet and potatoes. However, simple indicators such as maximum NDVI in a 2-week period in early July, are especially useful to separate the ensemble of summer crops from winter crops and uncultivated land.

To this extent, we used the crop maps produced by the team from the Kyiv Polytechnic Institute (KPI, led by Prof. Kussel and Prof. Shelestov) for 2019-2021 to filter out non-arable land. We then masked the area that was identified as winter crops, to produce the arable crop area that is available for summer crop cultivation. The threshold $NDVI_{max}$ (> 0.6) then provides the proportion that is actually under summer crops. These figures were aggregated at village council level, the third administrative unit level in Ukraine (with oblast and rajon

3 One of the sensors, Sentinel 1B, failed at the end of 2021 and the time between visits of the remaining Sentinel 1A is 12 days.

as the first and second administration levels). The result is shown in Figure 1, which shows the relative change of the utilized area for summer crops in 2022 vis-à-vis 2022. Red areas have experienced a significant drop in summer crop cultivation. The southern parts of the *Odes'ka* and *Mykolayivs'ka* oblasts stand out, as these are most affected by the dry conditions. The clear decrease in the eastern *Kharkivs'ka*, *Luhans'ka* and *Donets'ka* oblasts is more likely linked to the impact from Russia's war against Ukraine. The decrease in the Khersons'ka, Zaporis'ka and the southern part of the Dnipropetrovs'ka oblasts, is likely due to a combination of drought and impact from the war. Most other oblasts show less severe decreases, which could be explained by a combination of adverse weather conditions and/or economic and logistical difficulties inflicted by the war. From this analysis, we have estimated a significant decrease in overall summer crop cultivation, compared with 2021. This reduction is strongest in the oblasts where sunflowers make up the prevalent summer crop (e.g. *Odes'ka* and *Mykolayivs'ka* and *Khersons'ka*).

These findings are roughly in line with the estimates from the Ukrainian government. However, the area change estimates derived with our method are significantly higher. Part of the discrepancy between the government estimate and our findings is linked to the choice of the $NDVI_{max}$ threshold and might be due to areas marked as uncultivated that were actually sown to summer crops, but where the crops did not develop significantly due to adverse conditions.

Further separation of summer crop types requires integration of a more diverse set of input data, such as multi-temporal S-2 composites and S-1 backscattering coefficients. This is routinely done by the KPI team through the deployment of machine learning techniques which are partially trained with collected ground truth samples.

A new recent development enables us to integrate parcel boundaries which have been generated for the entire Ukrainian territory using instance segmentation of S-2 image stacks. This machine learning method has been implemented by Sinergise (as open source software) and applied to imagery from the May 15-July 15 period for each year from 2016 – 2022, with funding from the European Space Agency. Each year, around 3.4 million parcels are delineated. These parcel sets facilitate deep learning methods that can be applied to parcel averaged signatures extracted from hybrid S-1 and S-2 imagery to derive more precise crop area estimates. Here we have used the delineated parcels to majority filter the KPI team's pixel-based crop map to derive crop-specific change estimates for the four oblasts that are currently partly or totally non-government controlled, for which the Ukrainian government does not provide official area estimates.

We can derive the profiles for selected summer crop parcels and analyse the temporal dynamic in comparison to previous years profiles from the same regions and the same crops. For this analysis, Leaf Area Index (LAI) is derived from S-2 data and distinguished between maize, sunflower and soybean. We can do this on a per parcel basis, combining the high-resolution 2022 crop map from the KPI team with the parcel delineations. The LAI profiles for individual parcels are than aggregated at oblast level.

In Figure 2, the aggregated profiles for some major producing oblasts are shown. We have chosen the oblast to illustrate the large geographical variability that is related to the agro-meteorological conditions. The *Zaporiz'ka*, *Odes'ka* and *Vinnyts'ka* oblasts (left column) are in the drought-affected areas (see "meteorological overview" of the main text). The LAI profiles for these three samples suggest reduced crop biomass development and, therefore, expected yields below the 5-year average. The *Poltavs'ka*, *Kharkivs'ka* and *Sums'ka* oblast (right column) are much less affected by the drought conditions and demonstrate LAI profiles that suggest yields above the 5-year average.

In another development, we have set up a fast operational processing chain for S-1 coherence generation, using the open-source GPU-accelerated CGI ALUs software. With this software, we have been able to generate 12-day coherence for S-1A from September 2020 to the present. Both the sets of Sinergise parcels and the 12-day coherence sets are shared via the eo4ua initiative, complementing other application ready data sets. The eo4ua initiative aims at supporting collaborative Ukraine analyses with the involvement of Ukrainian scientists.

Our next steps include the consolidation of the crop mapping results of the KPI team and a comparative analysis of the relative accuracy gains that result from integrating different information layers. We will then proceed with monitoring conditions and progress for winter crop sowing which have already started in Southern Ukraine.

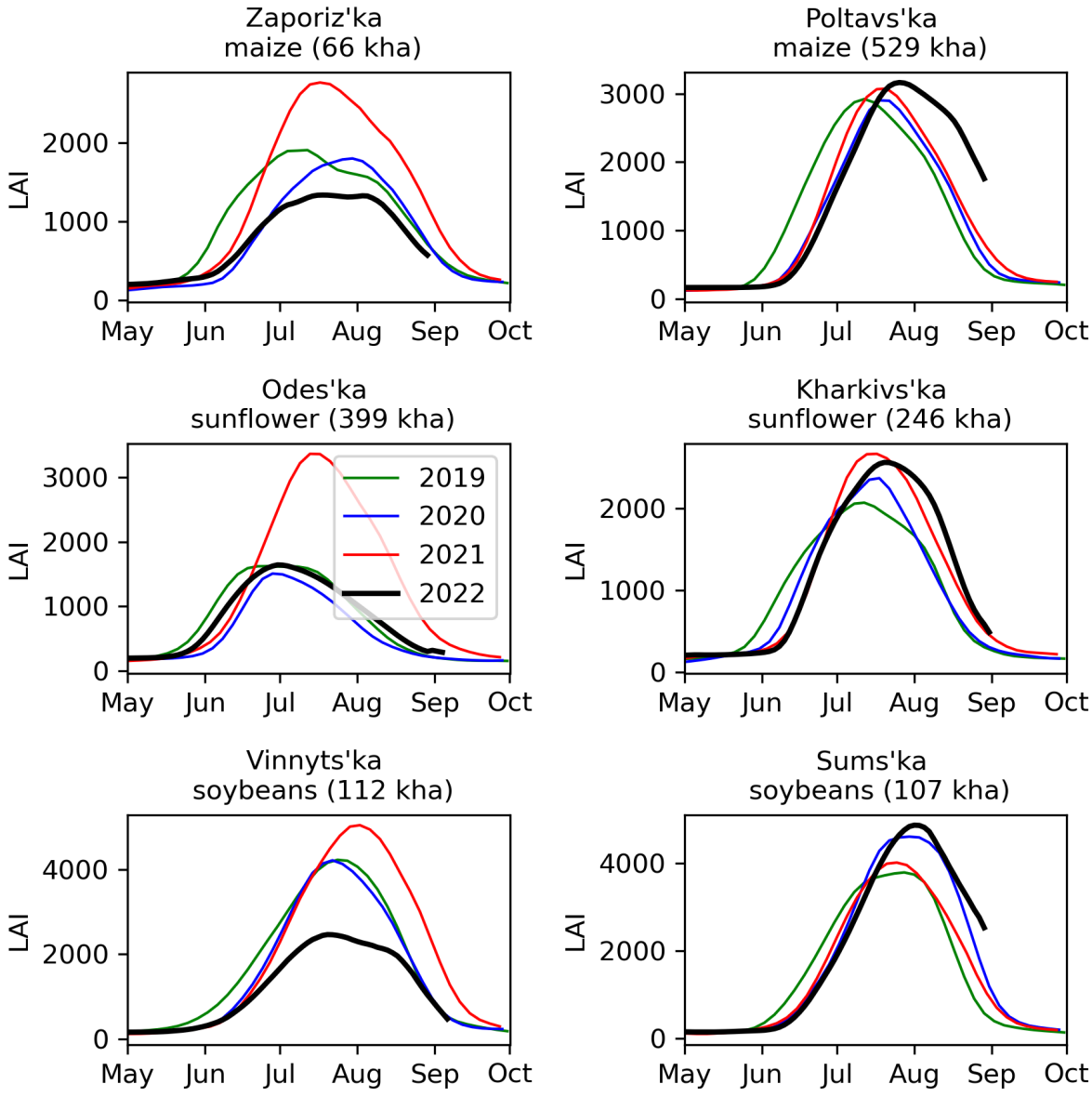


Figure 2. Leaf Area Index (LAI) profiles for maize, sunflower and soybean in selected oblasts. Trends are extracted for parcels identified for given crop type and compared to previous years.

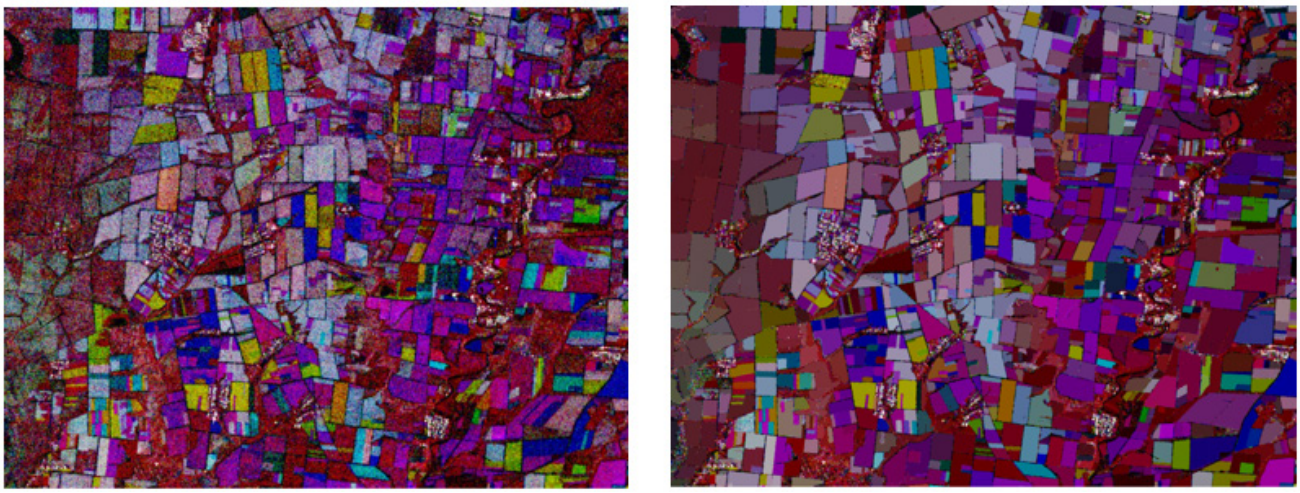


Figure 3. A multi-date 12-day coherence composite in the period March 16 – April 21 without (left) and with (right) mean filtering based on delineated parcels. The filtered values are used in object based machine learning for crop identification.

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Disclaimer
The geographic borders are purely a graphical representation and are only intended to be indicative. The boundaries do not necessarily reflect the official European Commission position.

Technical note
The long-term average (LTA) used within this Bulletin as a reference is based on an archive of data covering 1991-2021. The medium-term average (MTA) used within this Bulletin as a reference is based on an archive of data covering 2012-2021.

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