Issued: 12 June 2023

JRC MARS Bulletin – Global outlook
Ukraine, June 2023

European Commission

JRC MARS Bulletin - Global outlook

Crop monitoring European neighbourhood Ukraine

June 2023

High levels of winter crops production expected

Favourable weather conditions continued during spring, and sustained a positive yield outlook for winter crops in most regions. High yields are expected in the southern and eastern parts of the country. Production areas follow the 5-year average despite the Russian war against Ukraine. A record high rapeseed production is expected.

After a mild winter, winter crops restarted their vegetative growth under favourable conditions and the increased temperatures in March boosted their development. The wet conditions of April and the absence of thermal stress in May permitted a positive yield outlook for winter crops. Although field abondonment is observed in several parts of the country, remote sensing analysis suggests that the total acreage of winter crops is higher than in 2022, and is close to the 5-year average in government-controlled and non-controlled areas However, the share of rapeseed has significantly increased in the government-controlled areas, at the expense of soft wheat (see the Appendix for methodological description).

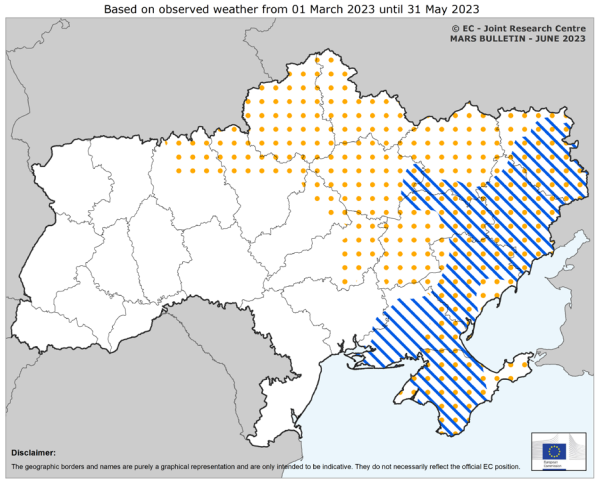
The JRC yield forecast for winter crops at country level is currently well above average and close to the record yields of 2021.

In terms of production, this translates into a forecast of 28.3 Mt of wheat, 3.7 Mt of winter barley and 5.5 Mt of rapeseed, of which 21 Mt of wheat, 2.9 Mt of winter barley and 5 Mt of rapeseed are in the government-controlled areas.

Spring and summer crops sowings were delayed due the wet conditions in April. The area with grain maize has decreased, whereas sunflowers present an increased area. Our yield forecasts for summer crops currently follow the 5-year average.

AREAS OF CONCERN - EXTREME WEATHER EVENTS

Based on observed weather from 01 March 2023 until 31 May 2023



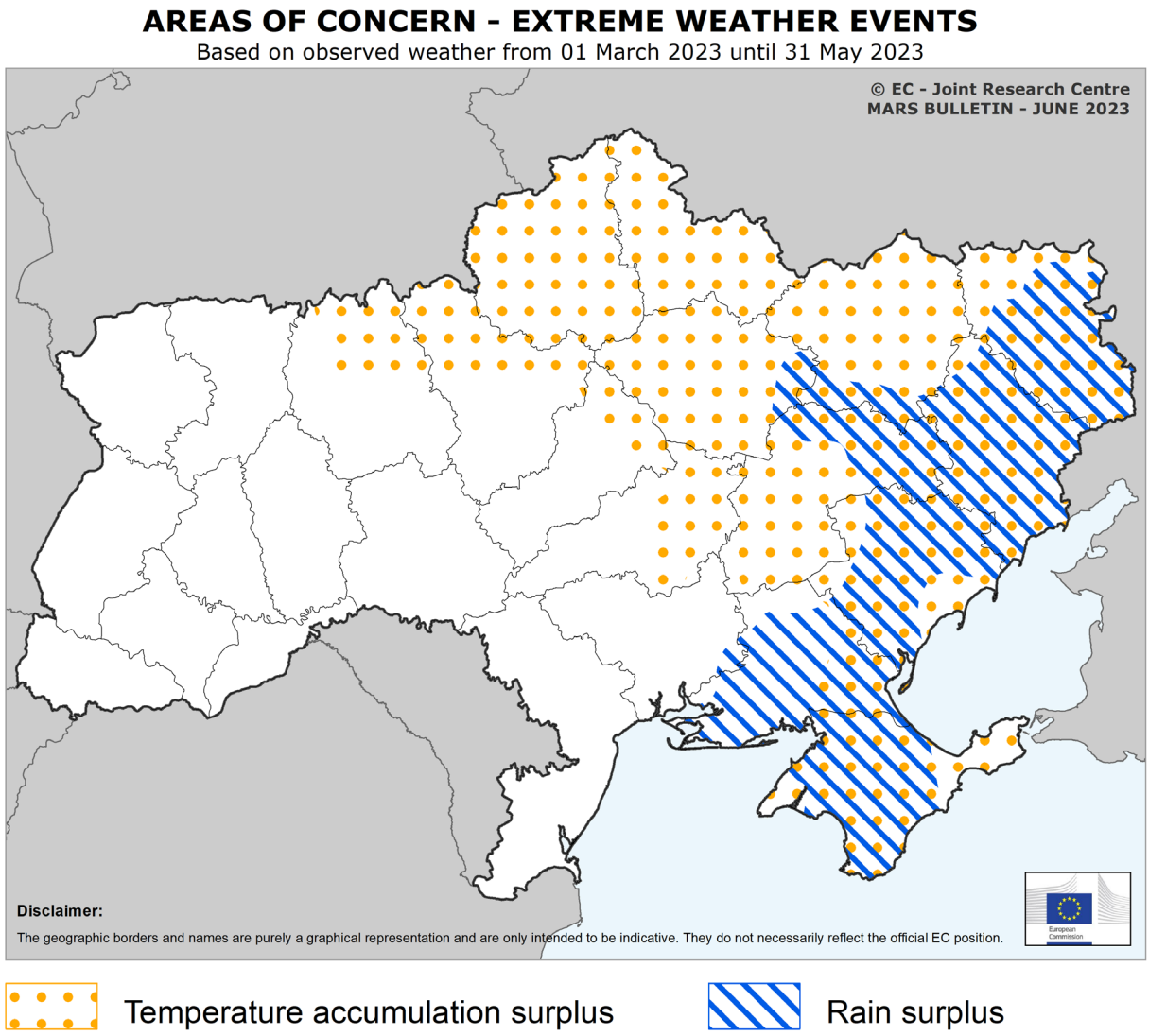
Yield forecasts for Ukraine - June 2023 Bulletin

Crop	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Wheat	6 684	7 090	**6 178**	– 8	– 13	4.07	4.53	**4.58**	+ 12	+ 1	27 222	32 152	**28 275**	+ 4	– 12
Barley	2 488	2 472	**1 981**	– 20	– 20	3.35	3.82	**3.59**	+ 7	– 6	8 324	9 437	**7 112**	– 15	– 25
Winter barley	992	1 137	**904**	– 9	– 21	3.63	4.27	**4.09**	+ 13	– 4	3 598	4 856	**3 701**	+ 3	– 24
Spring barley	1 496	1 335	**1 077**	– 28	– 19	3.16	3.43	**3.17**	+ 0	– 8	4 726	4 581	**3 410**	– 28	– 26
Grain maize	4 981	5 482	**4 099**	– 18	– 25	6.78	7.68	**7.10**	+ 5	– 8	33 749	42 109	**29 111**	– 14	– 31
Sunflower	6 266	6 665	**6 387**	+ 2	– 4	2.27	2.46	**2.36**	+ 4	– 4	14 232	16 398	**15 057**	+ 6	– 8
Soybean	1 602	1 322	**1 837**	+ 15	+ 39	2.29	2.64	**2.45**	+ 7	– 7	3 670	3 491	**4 495**	+ 23	+ 29
Rapeseed	1 044	999	**1 784**	+ 71	+ 79	2.63	2.93	**3.07**	+ 17	+ 5	2 745	2 931	**5 473**	+ 99	+ 87

Joint Research Centre

Meteorological overview

After an exceptionally wet autumn followed by an unusually mild winter, the spring season provided above-average temperatures (particularly in the eastern half of the country), and sufficient rainfall. A distinct rain surplus prevailed in the eastern parts, thanks to record-high precipitation in April. Near-seasonal temperatures are expected during the first half of June, but with drier-than-usual conditions in the north-east.



March

Rainfall disparities, but mild temperatures in most oblasts

- After drier-than-usual conditions in most oblasts during the first two dekads of March, substantial rainfall arrived during the third dekad.
- Overall, March rainfall was 50% or more above the LTA in the north-western oblasts (e.g. Zhytomyrs'ka, L'vivs'ka), while it was mostly 10% to 30% below the LTA in the rest of the country.
- Temperatures were 2-4°C above the LTA throughout the country. The third dekad was particularly warmer than usual (4-6°C above the LTA) in some central and northernmost oblasts (e.g. Chernihivs'ka, Cherkas'ka).
- The last 2 nights of March were characterised by freezing temperatures, but without dropping below -5°C.

April

Record-high rainfall combined with record-low sunshine

- Frequent and abundant rainfall prevailed during the entire month. Record-high monthly rainfall was registered in most oblasts, reaching more than twice the LTA in several regions (e.g. Zaporiz'ka, Odes'ka, Cherkas'ka).
- During the first two dekads of April, seasonal to slightly colder-than-usual temperatures were recorded in the western half of the country, while a temperature surplus of up to 2°C prevailed in the eastern half.
- During the third dekad, temperatures were up to 2°C below the LTA in most oblasts. Near seasonal temperatures were observed only in the easternmost oblasts.
- Solar radiation was exceptionally low in most parts of the country. The most distinct anomalies (30% or more below the LTA) were recorded in the south (e.g. Mykolayivs'ka).

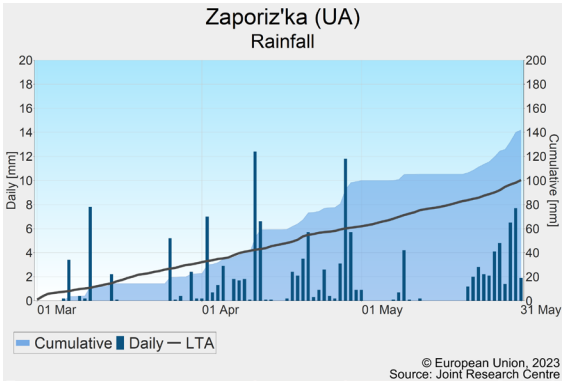
May

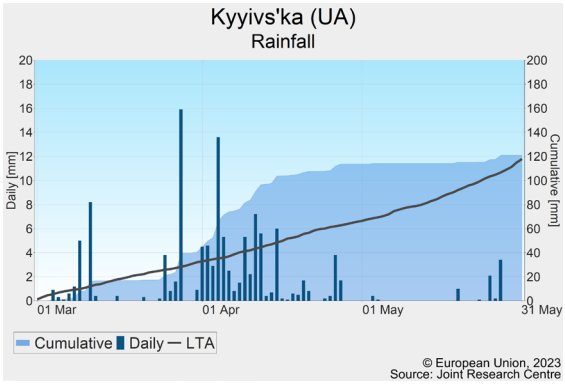
Moderately increasing temperatures, with distinct rain deficit in the western half

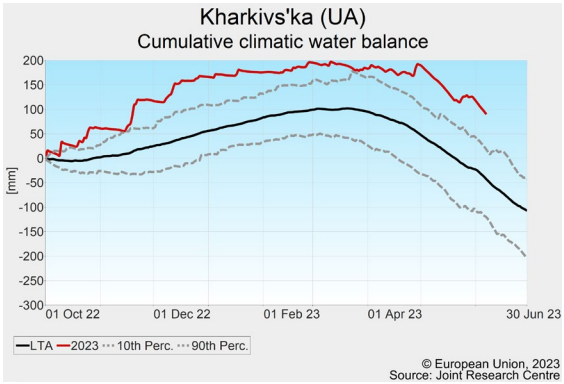
- During the first two dekads of May, rainfall was rare in most parts of the country (e.g. Kyyivs'ka, Dnipropertovs'ka) and was 30% to 50% below the LTA in the westernmost oblasts (e.g. L'vivs'ka, Volyns'ka).
- Rainfall returned to the eastern half of Ukraine during the third dekad of May, but drier-than-usual conditions continued in the western half.
- May started significantly cooler than usual (2°-4°C below the LTA) but temperatures in the second dekad were near seasonal to slightly above the LTA in most regions.
- During the third dekad, temperatures were mostly up to 2°C above the LTA in the central and western oblasts, while near-seasonal temperatures prevailed in the eastern oblasts.

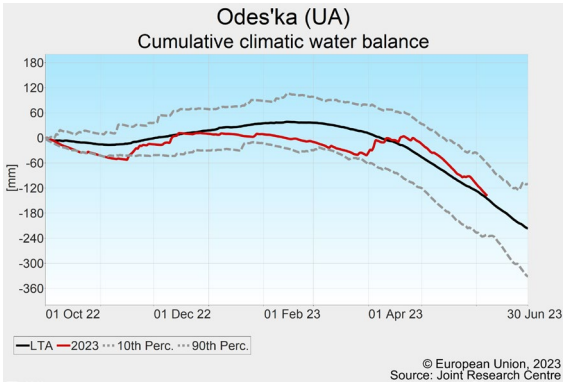
1-15 June

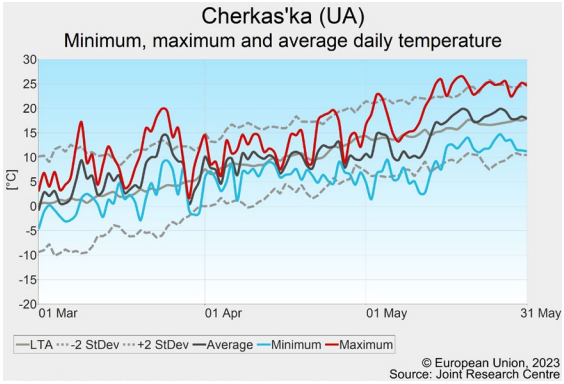
- Significantly drier-than-usual conditions and slightly below-average temperatures prevailed in large parts of the county during the first week of June.
- Abundant rainfall is forecast in the southern and western oblasts during the second week of June, but dry conditions are expected to continue in the with below-average temperature (mostly up to 2°C below the LTA). Temperatures would remain slightly below average levels.

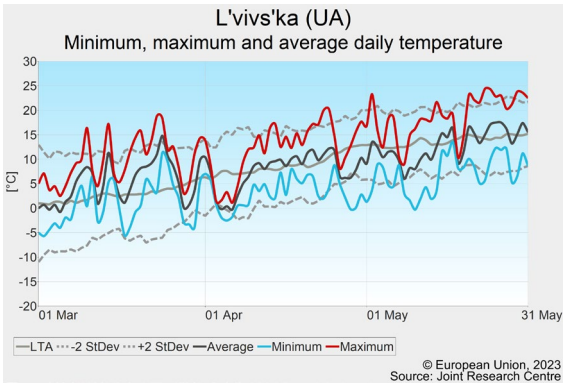


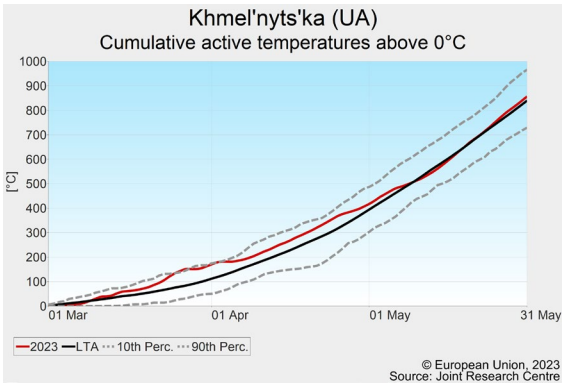


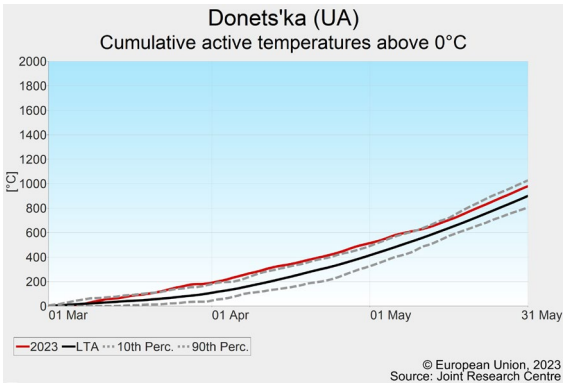

Kharkivs'ka (UA)
Cumulative climatic water balance
[mm]
01 Oct 22
01 Dec 22
01 Feb 23
01 Apr 23
30 Jun 23
LTA 2023 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre

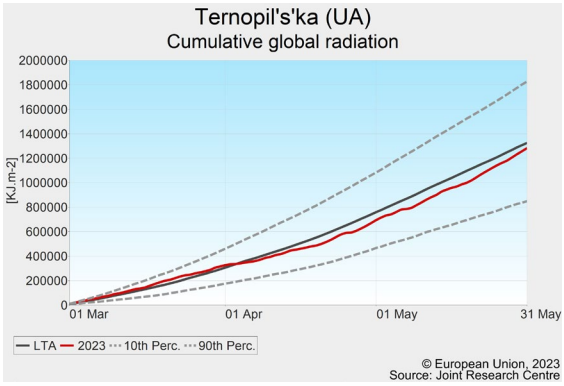

Odes'ka (UA)
Cumulative climatic water balance
[mm]
01 Oct 22
01 Dec 22
01 Feb 23
01 Apr 23
30 Jun 23
LTA 2023 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre

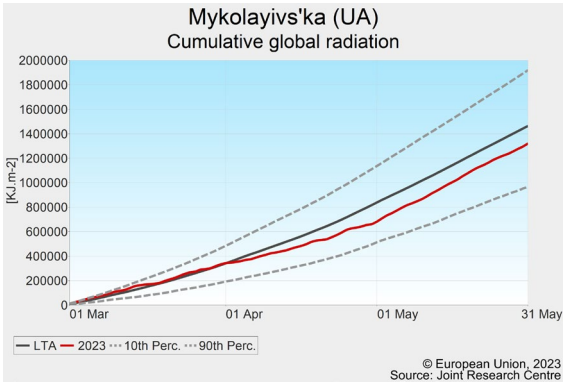

Cherkas'ka (UA)
Minimum, maximum and average daily temperature
[°C]
01 Mar
01 Apr
01 May
31 May
LTA -2 StDev +2 StDev Average Minimum Maximum
© European Union, 2023
Source: Joint Research Centre


L'vivs'ka (UA)
Minimum, maximum and average daily temperature
[°C]
01 Mar
01 Apr
01 May
31 May
LTA -2 StDev +2 StDev Average Minimum Maximum
© European Union, 2023
Source: Joint Research Centre


Khmel'nyts'ka (UA)
Cumulative active temperatures above 0°C
[°C]
01 Mar
01 Apr
01 May
31 May
2023 LTA 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre


Donets'ka (UA)
Cumulative active temperatures above 0°C
[°C]
01 Mar
01 Apr
01 May
31 May
2023 LTA 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre

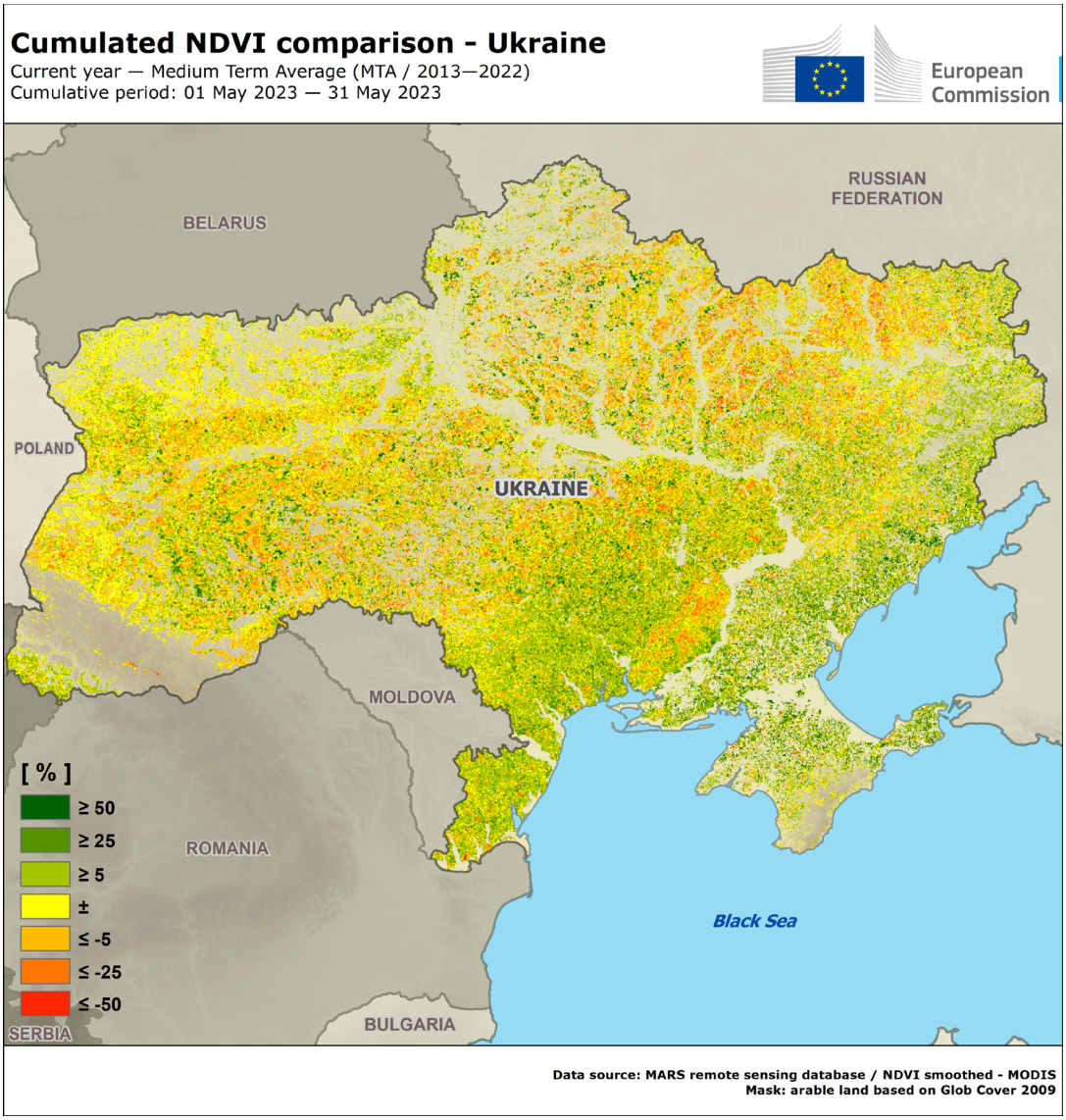

Ternopil's'ka (UA)
Cumulative global radiation
[KJ.m-2]
01 Mar
01 Apr
01 May
31 May
LTA 2023 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre


Mykolayivs'ka (UA)
Cumulative global radiation
[KJ.m-2]
01 Mar
01 Apr
01 May
31 May
LTA 2023 10th Perc. 90th Perc.
© European Union, 2023
Source: Joint Research Centre

Crop growth conditions

Winter crops restarted their vegetative growth under favourable conditions and profited from the overall mild spring temperatures to boost their development. The wet conditions in April delayed the sowing progress of spring and summer crops, but considerably improved soil moisture conditions in most regions. The absence of any thermal or hydric stress, sustains a continued positive yield outlook for winter crops. The overall slightly cooler-than-usual temperatures and the return of rainfall expected during the second week of June in the major producing areas provide good conditions for the grain filling of winter cereals.

Due to financial and logistical issues faced by the farmers due to the Russian war against Ukraine, a decrease in the cereals areas against an increase in oilseed crops (rapeseed, sunflowers, soybeans) is reported by the Ukrainian Ministry of Agrarian Policy and Food1 for the current season. This is also in line with the results of our crop-specific remote sensing analysis for winter crops (see Appendix).



The map displays the differences between the Normalised Difference Vegetation Index (NDVI) cumulated from 1 to 31 May 2023 and the medium-term average (MTA, 2013-2022) for the same period in arable land areas. Positive anomalies (in green) reflect above-average biomass accumulation, while negative anomalies (in red) reflect below-average biomass accumulation.

[1] https://minagro.gov.ua/news/olijnih-kultur-posiyut-bilshe-virobnictvo-zernovih-zmenshitsya-taras-visockij

The map above reflects predominantly winter crop conditions, as the summer crop season has just started and contributes little to NDVI values. In the western regions of the country, the map indicates a reduced advance in growth of winter crops compared with the previous analysis in March[2], which is mainly attributed to the lack of radiation in April, but delayed development of spring and summer crops (due to sowing delays) may also have contributed. Moving to the central parts of the country, the overall situation is positive, with slightly higher than average NDVI values due to the favourable soil moisture and thermal conditions.

In the southern and south-eastern regions, the conditions for crop development have ranged from favourable to very favourable. However, there is a clearly visible reddish band from *Khersons'ka* to *Donets'ka*, which corresponds to areas where crop cultivation has been significantly reduced due to hazardous conditions near the front line of the Russian war in Ukraine, that prevented farmers from accessing their fields. In the easternmost parts of the country, specifically the non-government controlled areas of *Luhans'ka* and *Donets'ka*, the map shows slightly above-average NDVI values, reflecting favourable weather conditions since March. More to the west (e.g. *Kharkivs'ka*, *Poltavs'ka*, *Sums'ka*), the map highlights a significantly below-average NDVI for the given period despite favourable weather conditions since March. This was already observed (to a lesser extent) in the April edition of the Bulletin on Ukraine, and was explained by the possible sub-optimal management practices near the war zone. The delayed sowing of summer crops, especially grain maize, also explains part of the below-average NDVI in these regions.

Winter crops

After a delayed start of the season due to the wetter-than-usual conditions during autumn, winter crops entered the winter under favourable conditions for germination and early development. These positive conditions continued throughout the winter, since mild temperatures and close-to-average precipitation prevailed.

The mild temperatures since early March allowed winter cereals to break dormancy and restart their vegetative growth under fair-to-good conditions and earlier than in the spring of 2022. They also resulted in the absence of any detrimental late frost damage across the country.

The abundant and frequent rainfall in April restored soil moisture to adequate levels in most oblasts, and relieved concerns in the areas that had been affected by rainfall deficit at the beginning of the season as reported in the April edition of the Ukraine Bulletin (i.e. southern parts of *Odes'ka*, *Mykolayivs'ka* and *Khersons'ka*). It also permitted winter crops to avoid any hydric stress in the following weeks. However, the exceptionally low levels of sunshine during this period limited photosynthetic activity. In the western oblasts (e.g. *L'vivs'ka*, *Khmel'nyts'ka*) where the solar radiation deficit was most pronounced, our crop model indicates deteriorated conditions for winter rapeseed during the flowering phase.

The absence of any significant rainfall in May was predominantly positive, since it prevented the occurrence of water excess during the flowering of winter cereals, and limited the spread of pest and diseases. Moreover, the overall cooler-than-usual temperatures during this month permitted winter crops to enter the reproductive phase without any thermal stress.

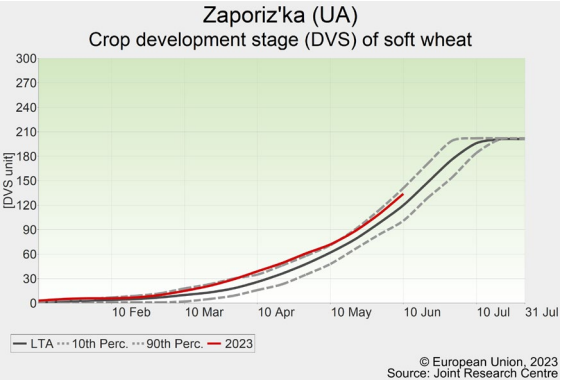
Near-seasonal to cooler-than-usual temperatures and a return of rainfall are expected during the first half of June in the major winter cereals producing regions. This would maintain favourable thermal conditions for the grain formation process.

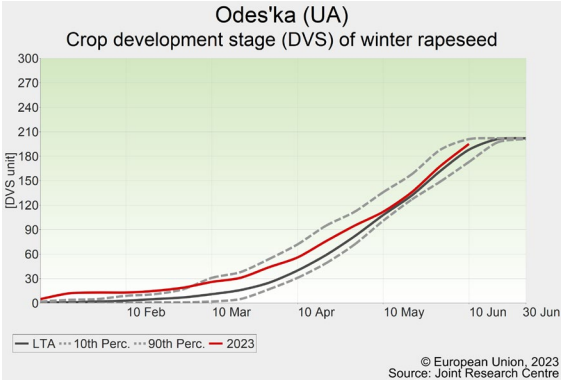
Based on the above-mentioned predominantly favourable weather conditions and positive remote sensing indicators, our yield forecasts for winter cereals were revised upwards and are now above the historical trends and well above the 5-year average. In the southern and eastern oblasts (e.g. *Odes'ka*, *Khersons'ka*, *Zaporiz'ka*), new record high yields could be achieved if the weather remains favourable in early summer.

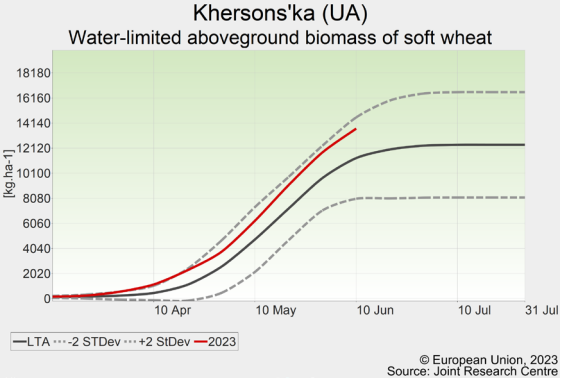
Our forecast for winter rapeseed was also revised upwards in most parts, but remains close to the historical trend in the western oblasts. It is noted that these forecasts do not explicitly account for sub-optimal management due to the logistical and financial issues faced by Ukrainian farmers. For example, a decrease of nitrogen fertilisation or phytosanitary measures may lead to a reduction in the yield potential that we cannot quantify using our yield forecasting system. This could explain the deterioration of the remote sensing indicators

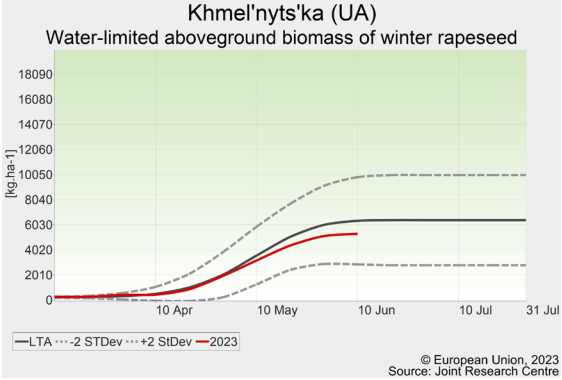
[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC133091

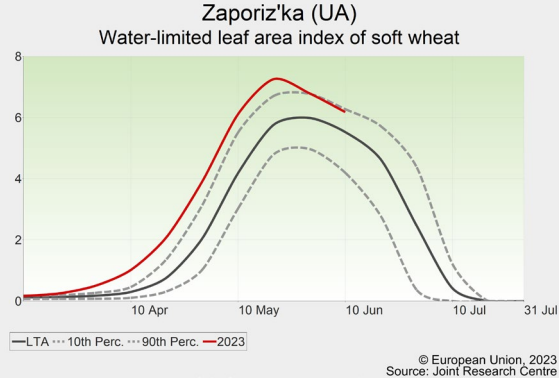
in recent weeks. which, however, are still above the 10-year average in several oblasts. Moreover, the fields to be actually harvested remain subject to a high uncertainty, depending on how the war develops in the coming months.

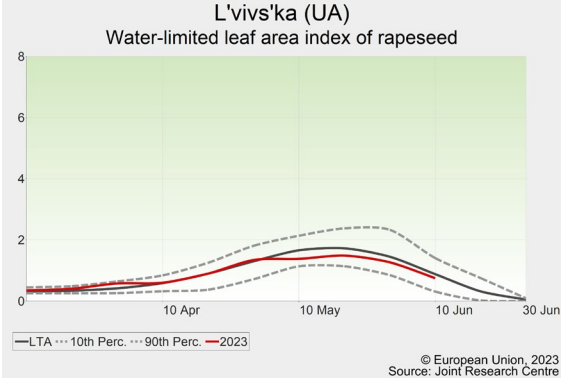


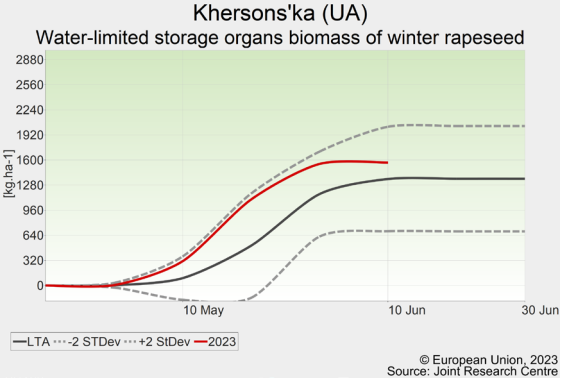


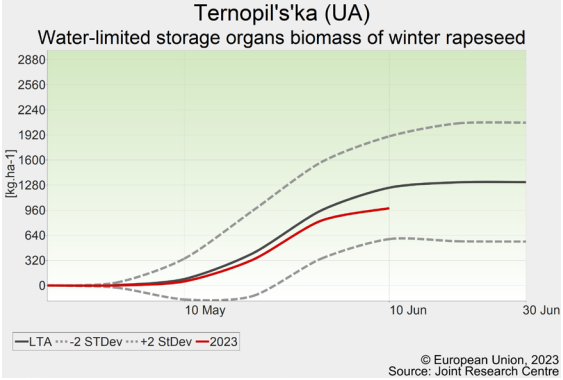


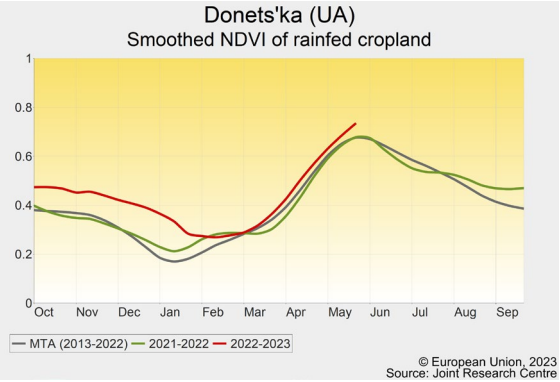


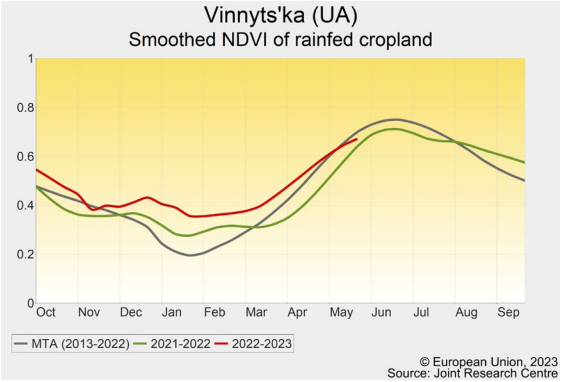


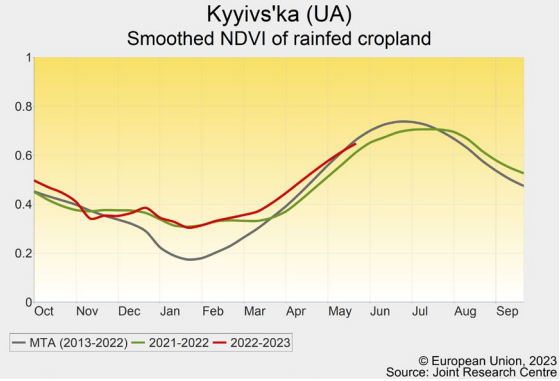


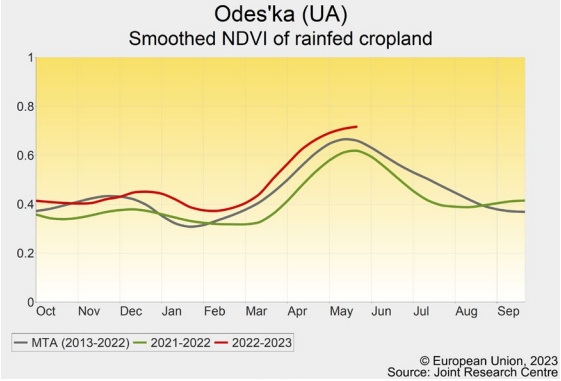





Donets'ka (UA)
Smoothed NDVI of rainfed cropland
1
0.8
0.6
0.4
0.2
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
MTA (2013-2022) 2021-2022 2022-2023
© European Union, 2023
Source: Joint Research Centre


Vinnyts'ka (UA)
Smoothed NDVI of rainfed cropland
1
0.8
0.6
0.4
0.2
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
MTA (2013-2022) 2021-2022 2022-2023
© European Union, 2023
Source: Joint Research Centre


Kyyivs'ka (UA)
Smoothed NDVI of rainfed cropland
1
0.8
0.6
0.4
0.2
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
MTA (2013-2022) 2021-2022 2022-2023
© European Union, 2023
Source: Joint Research Centre

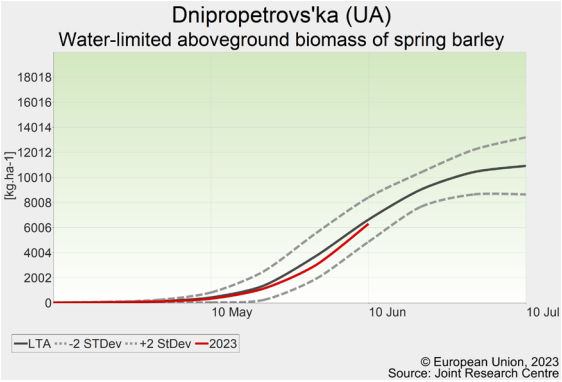

Odes'ka (UA)
Smoothed NDVI of rainfed cropland
1
0.8
0.6
0.4
0.2
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
MTA (2013-2022) 2021-2022 2022-2023
© European Union, 2023
Source: Joint Research Centre

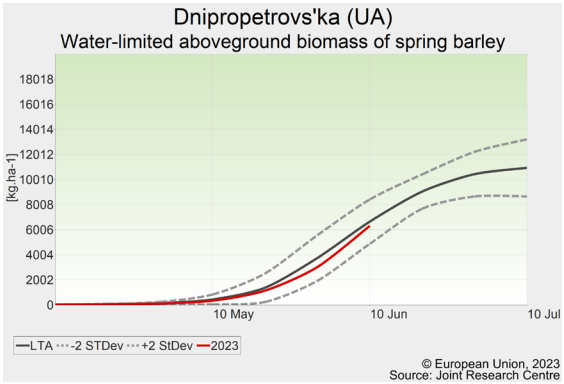
Summer crops

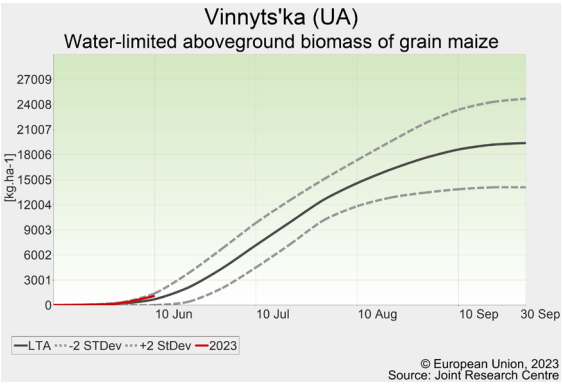
The 2023 spring crops sowing started in the second dekad of March, whereas field operations for summer crops were hampered by the frequent and abundant rainfall of April, and started slowly in the second dekad of April. The first fields of sunflowers were sown around 15 April, while the grain maize and soybean sowings could not start before 25 April. Consequently, the sowing campaign was delayed, despite a reported acceleration in the second and third dekad of May. Sowings are expected to be completed by mid-June. According to the Ukrainian Ministry of Agrarian Policy and Food[3], an increase of the sunflowers area and a decrease in the grain maize area is reported in the government-controlled areas compared with the 2022 crop season.

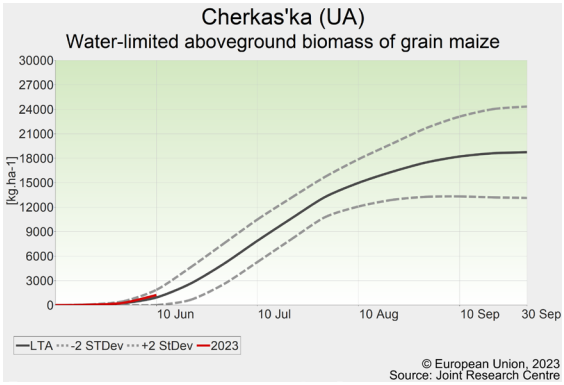
The warmer-than-usual conditions in the eastern and northern oblasts (e.g. *Chernihivs'ka*) have allowed normal development of summer crops so far. However, in oblasts without any distinct temperature accumulation surplus (e.g. *Cherkas'ka*, *Vinnyts'ka*), the delayed sowing combined with the cooler-than-usual temperature in May resulted in delayed development of spring and summer crops, as indicated by our crop model simulation and remote sensing images.

Our yield forecast for spring and summer crops currently follows the 5-year average. However, it is acknowledged that the current delayed crop development, implies a higher-than-usual risk of negative impacts of unfavourable dry and hot conditions during summer. With the destruction of the Nova Kahkvoka dam the irrigation of around 300.000 ha has been jeopardized that were mainly devoted to spring and summer crops.









[3] https://minagro.gov.ua/news/v-ukrayini-posiyano-ponad-12-mln-ga-yarih-zernovih-ta-olijnih-kultur

Crop yield forecast

Yield forecasts for Ukraine - June 2023 Bulletin

Crop	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Wheat	6 684	7 090	**6 178**	– 8	– 13	4.07	4.53	**4.58**	+ 12	+ 1	27 222	32 152	**28 275**	+ 4	– 12
Barley	2 488	2 472	**1 981**	– 20	– 20	3.35	3.82	**3.59**	+ 7	– 6	8 324	9 437	**7 112**	– 15	– 25
Winter barley	992	1 137	**904**	– 9	– 21	3.63	4.27	**4.09**	+ 13	– 4	3 598	4 856	**3 701**	+ 3	– 24
Spring barley	1 496	1 335	**1 077**	– 28	– 19	3.16	3.43	**3.17**	+ 0	– 8	4 726	4 581	**3 410**	– 28	– 26
Grain maize	4 981	5 482	**4 099**	– 18	– 25	6.78	7.68	**7.10**	+ 5	– 8	33 749	42 109	**29 111**	– 14	– 31
Sunflower	6 266	6 665	**6 387**	+ 2	– 4	2.27	2.46	**2.36**	+ 4	– 4	14 232	16 398	**15 057**	+ 6	– 8
Soybean	1 602	1 322	**1 837**	+ 15	+ 39	2.29	2.64	**2.45**	+ 7	– 7	3 670	3 491	**4 495**	+ 23	+ 29
Rapeseed	1 044	999	**1 784**	+ 71	+ 79	2.63	2.93	**3.07**	+ 17	+ 5	2 745	2 931	**5 473**	+ 99	+ 87

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.

2023 winter crops area come from JRC MARS analysis.

2023 summer crops area in the government-controlled oblasts come for the Ukrainian Ministry of Agrarian Policy and Food.

2023 summer crops area in the non government-controlled oblasts follow the 5-year average.

2023 yields come from MARS Crop Yield Forecasting System (output up to 31.05.2023).

The column header '%23/5yrs' stands for the 2023 change with respect to the 5-year average(%). Similarly, '%23/21' stands for the 2023 change with respect to 2021

Ukraine yield forecasts for total wheat - June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	6 684	7 090	**6 178**	– 8	– 13	4.07	4.53	**4.58**	+ 12	+ 1	27 222	32 152	**28 275**	+ 4	– 12
Ukraine (Government-controlled oblasts)	4 921	5 218	**4 379**	– 11	– 16	4.29	4.74	**4.80**	+ 12	+ 1	21 095	24 732	**21 001**	– 0	– 15
Cherkas'ka	202	228	**163**	– 20	– 29	4.78	5.39	**5.50**	+ 15	+ 2	965	1 228	**894**	– 7	– 27
Chernihivs'ka	183	186	**156**	– 15	– 16	4.63	4.97	**5.24**	+ 13	+ 6	845	924	**818**	– 3	– 11
Chernivets'ka	41	35	**20**	– 50	– 41	4.44	5.01	**5.16**	+ 16	+ 3	182	173	**106**	– 42	– 39
Dnipropetrovs'ka	520	561	**417**	– 20	– 26	3.72	4.40	**4.06**	+ 9	– 8	1 936	2 469	**1 694**	– 13	– 31
Donets'ka	*349*	*381*	***305***	*– 13*	*– 20*	*3.70*	*4.07*	***4.24***	*+ 15*	*+ 4*	*1 289*	*1 550*	***1 290***	*+ 0*	*– 17*
Ivano-frankivs'ka	60	47	**50**	– 17	+ 5	4.69	4.97	**5.23**	+ 12	+ 5	280	236	**261**	– 7	+ 11
Kharkivs'ka	536	589	**546**	+ 2	– 7	4.43	4.80	**4.38**	– 1	– 9	2 370	2 829	**2 391**	+ 1	– 16
Khersons'ka	*484*	*504*	***536***	*+ 11*	*+ 7*	*3.48*	*4.12*	***4.09***	*+ 18*	*– 1*	*1 684*	*2 075*	***2 195***	*+ 30*	+ 6
Khmel'nyts'ka	231	219	**187**	– 19	– 15	5.53	6.01	**6.61**	+ 20	+ 10	1 278	1 318	**1 236**	– 3	– 6
Kirovohrads'ka	318	384	**340**	+ 7	– 11	4.03	4.87	**4.80**	+ 19	– 1	1 281	1 868	**1 632**	+ 27	– 13
Kyyivs'ka	196	208	**159**	– 19	– 23	4.54	5.06	**4.98**	+ 10	– 2	891	1 054	**794**	– 11	– 25
Luhans'ka	*270*	*282*	***255***	*– 6*	*– 10*	*3.61*	*3.84*	***4.37***	*+ 21*	*+ 14*	*973*	*1 081*	***1 111***	*+ 14*	*+ 3*
L'vivs'ka	171	167	**161**	– 6	– 4	4.72	4.93	**5.02**	+ 6	+ 2	806	824	**807**	+ 0	– 2
Mykolayivs'ka	439	480	**387**	– 12	– 19	3.45	4.23	**4.13**	+ 20	– 2	1 514	2 032	**1 597**	+ 6	– 21
Odes'ka	621	679	**505**	– 19	– 26	3.31	3.90	**3.85**	+ 16	– 1	2 055	2 646	**1 944**	– 5	– 27
Poltavs'ka	237	250	**215**	– 9	– 14	4.48	4.83	**5.03**	+ 12	+ 4	1 062	1 205	**1 084**	+ 2	– 10
Rivnens'ka	109	115	**126**	+ 15	+ 10	4.52	4.70	**5.01**	+ 11	+ 7	492	539	**629**	+ 28	+ 17
Sums'ka	188	196	**158**	– 16	– 19	4.99	4.75	**5.77**	+ 16	+ 22	937	929	**913**	– 3	– 2
Ternopil's'ka	211	206	**224**	+ 7	+ 9	5.19	5.54	**5.82**	+ 12	+ 5	1 093	1 138	**1 306**	+ 20	+ 15
Vinnyts'ka	326	317	**214**	– 34	– 33	5.12	5.57	**5.65**	+ 10	+ 2	1 671	1 768	**1 210**	– 28	– 32
Volyns'ka	161	165	**156**	– 3	– 6	4.39	4.34	**4.84**	+ 10	+ 12	704	718	**757**	+ 8	+ 5
Zakarpats'ka	27	24	**25**	– 6	+ 3	3.30	3.36	**3.61**	+ 9	+ 7	88	81	**90**	+ 3	+ 11
Zaporiz'ka	*661*	*707*	***703***	*+ 6*	*– 1*	*3.30*	*3.84*	***3.81***	*+ 15*	*– 1*	*2 180*	*2 714*	***2 678***	*+ 23*	*– 1*
Zhytomyrs'ka	147	162	**169**	+ 15	+ 4	4.41	4.65	**4.96**	+ 13	+ 7	647	754	**838**	+ 30	+ 11

Ukraine yield forecasts for spring barley – June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	1 496	1 335	**1 077**	– 28	– 19	3.16	3.43	**3.17**	+ 0	– 8	4 726	4 581	**3 410**	– 28	– 26
Ukraine (Government-controlled oblasts)	1 115	999	**730**	– 35	– 27	3.38	3.56	**3.47**	+ 3	– 3	3 772	3 559	**2 532**	– 33	– 29
Cherkas'ka	40	40	**36**	– 10	– 9	3.62	3.88	**3.63**	+ 0	– 6	146	154	**131**	– 10	– 15
Chernihivs'ka	23	20	**13**	– 44	– 34	4.07	3.86	**4.07**	+ 0	+ 5	94	76	**53**	– 44	– 30
Chernivets'ka	14	13	**10**	– 27	– 25	3.25	3.29	**3.23**	– 1	– 2	45	44	**32**	– 27	– 27
Dnipropetrovs'ka	162	143	**66**	– 59	– 54	2.53	2.71	**2.55**	+ 1	– 6	410	387	**168**	– 59	– 57
Donets'ka	*108*	*103*	***101***	*– 7*	*– 2*	*2.63*	*2.95*	***2.64***	*+ 1*	*– 10*	*285*	*302*	***267***	*– 6*	*– 12*
Ivano-frankivs'ka	18	17	**15**	– 16	– 10	3.85	3.91	**3.85**	– 0	– 2	69	65	**58**	– 16	– 12
Kharkivs'ka	135	121	**58**	– 57	– 52	3.42	3.60	**3.43**	+ 1	– 5	462	436	**199**	– 57	– 54
Khersons'ka	*100*	*92*	***91***	*– 9*	*– 1*	*2.58*	*3.29*	***2.59***	*+ 0*	*– 21*	*259*	*304*	***236***	*– 9*	*– 22*
Khmel'nyts'ka	73	59	**52**	– 28	– 12	4.39	4.36	**4.39**	– 0	+ 1	319	256	**228**	– 29	– 11
Kirovohrads'ka	56	53	**47**	– 16	– 12	2.76	3.19	**2.78**	+ 1	– 13	155	170	**131**	– 16	– 23
Kyyivs'ka	62	62	**28**	– 55	– 55	3.83	3.94	**3.81**	– 0	– 3	238	242	**107**	– 55	– 56
Luhans'ka	*39*	*34*	***36***	*– 8*	*+ 6*	*2.33*	*2.79*	***2.36***	*+ 1*	*– 15*	*91*	*95*	***85***	*– 7*	*– 10*
L'vivs'ka	22	16	**12**	– 45	– 26	3.61	3.60	**3.59**	– 1	– 0	78	58	**43**	– 45	– 26
Mykolayivs'ka	85	79	**35**	– 59	– 56	2.43	3.03	**2.44**	+ 1	– 19	207	240	**85**	– 59	– 64
Odes'ka	59	54	**46**	– 22	– 14	2.55	3.64	**2.50**	– 2	– 31	150	195	**115**	– 24	– 41
Poltavs'ka	83	79	**85**	+ 2	+ 7	3.39	3.49	**3.40**	+ 0	– 3	282	276	**289**	+ 2	+ 4
Rivnens'ka	43	40	**38**	– 11	– 5	3.80	3.73	**3.80**	+ 0	+ 2	162	150	**144**	– 11	– 3
Sums'ka	40	30	**29**	– 27	– 2	3.94	3.74	**3.93**	– 0	+ 5	156	110	**114**	– 27	+ 3
Ternopil's'ka	84	67	**62**	– 26	– 7	4.39	4.23	**4.38**	– 0	+ 4	370	283	**271**	– 27	– 4
Vinnyts'ka	68	59	**61**	– 10	+ 4	4.01	4.34	**4.01**	– 0	– 8	271	255	**244**	– 10	– 4
Volyns'ka	27	25	**20**	– 25	– 19	3.08	2.93	**3.08**	– 0	+ 5	82	73	**62**	– 25	– 15
Zakarpats'ka	1	1	**1**	– 17	+ 11	2.54	2.95	**2.60**	+ 2	– 12	3	3	**3**	– 15	– 2
Zaporiz'ka	*133*	*107*	***119***	*– 11*	*+ 11*	*2.40*	*3.00*	***2.44***	*+ 2*	*– 19*	*320*	*321*	***291***	*– 9*	*– 9*
Zhytomyrs'ka	22	23	**16**	– 27	– 30	3.43	3.72	**3.43**	+ 0	– 8	75	86	**55**	– 27	– 36

Ukraine yield forecasts for winter barley - June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	992	1 137	**904**	– 9	– 21	3.63	4.27	**4.09**	+ 13	– 4	3 598	4 856	**3 701**	+ 3	– 24
Ukraine (Government-controlled oblasts)	824	911	**708**	– 14	– 22	3.62	4.30	**4.06**	+ 12	– 6	2 981	3 918	**2 874**	– 4	– 27
Cherkas'ka	14	15	**11**	– 23	– 30	4.50	4.93	**5.00**	+ 11	+ 2	62	74	**53**	– 14	– 29
Chernihivs'ka	1	2	**1**	+ 33	– 34	4.74	4.79	**4.68**	– 1	– 2	4	9	**6**	+ 31	– 35
Chernivets'ka	6	5	**3**	– 47	– 34	4.18	4.66	**4.77**	+ 14	+ 2	26	23	**15**	– 40	– 33
Dnipropetrovs'ka	88	106	**73**	– 17	– 31	3.35	3.99	**3.86**	+ 15	– 3	294	425	**282**	– 4	– 34
Donets'ka	*10*	*14*	***9***	*– 9*	*– 37*	*3.50*	*3.43*	***4.08***	*+ 16*	*+ 19*	*34*	*48*	***36***	*+ 5*	*– 25*
Ivano-frankivs'ka	10	9	**9**	– 11	+ 3	5.08	5.21	**5.74**	+ 13	+ 10	51	45	**51**	+ 0	+ 13
Kharkivs'ka	10	15	**13**	+ 29	– 12	4.42	4.38	**4.27**	– 3	– 3	46	66	**57**	+ 25	– 14
Khersons'ka	*88*	*118*	***106***	*+ 21*	*– 10*	*3.78*	*4.33*	***4.25***	*+ 13*	*– 2*	*332*	*509*	***451***	*+ 36*	*– 11*
Khmel'nyts'ka	15	13	**12**	– 17	– 2	4.58	4.97	**4.84**	+ 6	– 3	69	63	**60**	– 13	– 5
Kirovohrads'ka	68	79	**69**	+ 2	– 13	3.66	4.62	**3.95**	+ 8	– 15	248	365	**273**	+ 10	– 25
Kyyivs'ka	9	9	**7**	– 19	– 23	4.22	4.76	**4.81**	+ 14	+ 1	36	42	**33**	– 8	– 22
Luhans'ka	*7*	*7*	***6***	*– 7*	*– 6*	*3.03*	*2.67*	***4.06***	*+ 34*	*+ 52*	*21*	*18*	***26***	*+ 24*	*+ 43*
L'vivs'ka	25	22	**22**	– 12	+ 1	5.59	5.64	**5.58**	– 0	– 1	142	125	**125**	– 13	– 1
Mykolayivs'ka	209	228	**188**	– 10	– 18	3.22	4.03	**3.61**	+ 12	– 11	671	918	**677**	+ 1	– 26
Odes'ka	286	317	**223**	– 22	– 30	3.29	4.12	**3.80**	+ 16	– 8	939	1 305	**846**	– 10	– 35
Poltavs'ka	8	10	**8**	+ 2	– 22	4.29	4.86	**4.63**	+ 8	– 5	34	50	**37**	+ 10	– 26
Rivnens'ka	5	5	**5**	+ 18	+ 8	4.47	4.50	**5.01**	+ 12	+ 11	21	23	**27**	+ 32	+ 20
Sums'ka	2	3	**2**	+ 12	– 27	4.77	5.53	**4.62**	– 3	– 16	9	17	**10**	+ 9	– 39
Ternopil's'ka	20	17	**20**	+ 1	+ 17	5.33	5.47	**5.92**	+ 11	+ 8	104	92	**116**	+ 12	+ 27
Vinnyts'ka	33	35	**22**	– 34	– 38	4.71	5.08	**5.37**	+ 14	+ 6	155	178	**116**	– 25	– 35
Volyns'ka	6	8	**6**	+ 6	– 20	4.71	4.84	**5.11**	+ 9	+ 6	29	39	**33**	+ 15	– 15
Zakarpats'ka	2	1	**2**	+ 11	+ 100	3.01	2.91	**3.20**	+ 6	+ 10	5	3	**6**	+ 18	+ 120
Zaporiz'ka	*63*	*88*	***75***	*+ 18*	*– 15*	*3.63*	*4.14*	***4.22***	*+ 16*	*+ 2*	*229*	*363*	***315***	*+ 37*	*– 13*
Zhytomyrs'ka	9	13	**11**	+ 18	– 12	3.94	4.44	**4.53**	+ 15	+ 2	37	56	**50**	+ 36	– 10

Ukraine yield forecasts for grain maize - June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	4 981	5 482	**4 099**	– 18	– 25	6.78	7.68	**7.10**	+ 5	– 8	33 749	42 109	**29 111**	– 14	– 31
Ukraine (Government-controlled oblasts)	4 770	5 274	**3 876**	– 19	– 27	6.87	7.75	**7.25**	+ 6	– 7	32 778	40 898	**28 103**	– 14	– 31
Cherkas'ka	395	406	**366**	– 7	– 10	6.96	8.95	**8.01**	+ 15	– 11	2 751	3 635	**2 933**	+ 7	– 19
Chernihivs'ka	479	556	**351**	– 27	– 37	8.21	8.55	**8.07**	– 2	– 6	3 939	4 752	**2 833**	– 28	– 40
Chernivets'ka	58	64	**65**	+ 11	+ 2	6.30	7.47	**6.52**	+ 4	– 13	368	478	**424**	+ 15	– 11
Dnipropetrovs'ka	312	304	**197**	– 37	– 35	3.99	5.19	**4.21**	+ 6	– 19	1 243	1 575	**829**	– 33	– 47
Donets'ka	*62*	*56*	***64***	*+ 4*	*+ 14*	*3.28*	*4.25*	***3.23***	*– 2*	*– 24*	*203*	*238*	***207***	*+ 2*	*– 13*
Ivano-frankivs'ka	51	71	**53**	+ 5	– 25	7.78	9.02	**7.66**	– 2	– 15	393	637	**406**	+ 3	– 36
Kharkivs'ka	274	287	**159**	– 42	– 45	4.93	5.14	**5.28**	+ 7	+ 3	1 351	1 474	**840**	– 38	– 43
Khersons'ka	*47*	*59*	***48***	*+ 1*	*– 19*	*8.09*	*9.03*	***8.00***	*– 1*	*– 11*	*383*	*533*	***384***	*+ 0*	*– 28*
Khmel'nyts'ka	236	303	**213**	– 10	– 30	9.43	10.28	**9.50**	+ 1	– 8	2 225	3 116	**2 024**	– 9	– 35
Kirovohrads'ka	380	354	**320**	– 16	– 10	5.17	7.03	**6.01**	+ 16	– 15	1 966	2 485	**1 922**	– 2	– 23
Kyyivs'ka	326	358	**267**	– 18	– 25	7.45	8.67	**7.65**	+ 3	– 12	2 430	3 103	**2 042**	– 16	– 34
Luhans'ka	*66*	*56*	***70***	*+ 7*	*+ 25*	*3.15*	*2.88*	***3.20***	*+ 2*	*+ 11*	*206*	*161*	***224***	*+ 9*	*+ 39*
L'vivs'ka	57	83	**73**	+ 27	– 13	8.47	9.06	**8.64**	+ 2	– 5	486	756	**631**	+ 30	– 17
Mykolayivs'ka	117	121	**82**	– 30	– 33	4.12	5.23	**4.29**	+ 4	– 18	483	635	**352**	– 27	– 45
Odes'ka	143	137	**155**	+ 8	+ 13	4.26	6.10	**3.99**	– 6	– 35	611	838	**619**	+ 1	– 26
Poltavs'ka	629	643	**528**	– 16	– 18	6.51	6.79	**7.33**	+ 13	+ 8	4 092	4 365	**3 870**	– 5	– 11
Rivnens'ka	78	110	**69**	– 12	– 37	8.02	8.12	**8.22**	+ 2	+ 1	629	892	**567**	– 10	– 37
Sums'ka	399	460	**259**	– 35	– 44	7.84	6.77	**8.05**	+ 3	+ 19	3 128	3 114	**2 084**	– 33	– 33
Ternopil's'ka	128	176	**122**	– 4	– 31	9.20	9.87	**9.32**	+ 1	– 6	1 173	1 737	**1 137**	– 3	– 35
Vinnyts'ka	411	457	**293**	– 29	– 36	8.00	9.37	**7.94**	– 1	– 15	3 287	4 279	**2 327**	– 29	– 46
Volyns'ka	36	58	**51**	+ 43	– 12	9.07	8.61	**9.06**	– 0	+ 5	325	501	**462**	+ 42	– 8
Zakarpats'ka	50	53	**52**	+ 4	– 2	5.27	5.04	**5.05**	– 4	+ 0	265	267	**263**	– 1	– 2
Zaporiz'ka	*37*	*37*	***41***	*+ 12*	*+ 11*	*4.84*	*7.54*	***4.72***	*– 3*	*– 37*	*178*	*278*	***193***	*+ 9*	*– 31*
Zhytomyrs'ka	209	274	**201**	– 4	– 27	7.81	8.25	**7.66**	– 2	– 7	1 637	2 260	**1 539**	– 6	– 32

Ukraine yield forecasts for rapeseed - June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	1 044	999	**1 784**	+ 71	+ 79	2.63	2.93	**3.07**	+ 17	+ 5	2 745	2 931	**5 473**	+ 99	+ 87
Ukraine (Government-controlled oblasts)	880	830	**1 612**	+ 83	+ 94	2.69	3.02	**3.11**	+ 16	+ 3	2 371	2 506	**5 017**	+ 112	+ 100
Cherkas'ka	30	17	**75**	+ 149	+ 331	2.90	3.14	**3.69**	+ 27	+ 17	88	55	**277**	+ 215	+ 406
Chernihivs'ka	33	34	**56**	+ 68	+ 64	2.76	3.30	**3.31**	+ 20	+ 0	92	113	**186**	+ 101	+ 65
Chernivets'ka	12	12	**21**	+ 77	+ 84	2.66	2.75	**2.81**	+ 6	+ 2	32	32	**59**	+ 87	+ 88
Dnipropetrovs'ka	91	84	**186**	+ 104	+ 122	2.44	2.39	**2.77**	+ 14	+ 16	222	200	**514**	+ 131	+ 157
Donets'ka	*26*	—	***18***	*– 33*	—	*2.26*	—	***2.53***	*+ 12*	—	*59*	—	***44***	*– 25*	—
Ivano-frankivs'ka	26	20	**21**	– 17	+ 9	2.93	3.46	**3.52**	+ 20	+ 2	75	68	**76**	+ 0	+ 11
Kharkivs'ka	11	4	**5**	– 58	+ 28	2.22	2.28	**2.27**	+ 2	– 0	24	8	**10**	– 57	+ 27
Khersons'ka	*77*	*95*	***63***	*– 19*	*– 34*	*2.36*	*2.56*	***2.73***	*+ 16*	+ 7	*182*	*244*	***172***	*– 6*	*-29.5*
Khmel'nyts'ka	70	83	**94**	+ 36	+ 14	3.19	3.59	**3.57**	+ 12	– 1	222	298	**337**	+ 52	+ 13
Kirovohrads'ka	42	28	**79**	+ 86	+ 180	2.39	2.39	**2.91**	+ 22	+ 22	101	68	**230**	+ 127	+ 240
Kyyivs'ka	37	33	**71**	+ 93	+ 114	2.80	3.06	**3.55**	+ 27	+ 16	104	102	**253**	+ 144	+ 148
Luhans'ka	*1*	*1*	***3***	*+ 253*	*+ 253*	*1.07*	*1.07*	***2.64***	*+ 147*	*+ 147*	*1*	*1*	***8***	*+ 771*	*+ 771*
L'vivs'ka	62	52	**73**	+ 19	+ 41	2.96	3.39	**3.70**	+ 25	+ 9	184	177	**272**	+ 48	+ 53
Mykolayivs'ka	59	62	**153**	+ 159	+ 148	2.21	2.64	**2.84**	+ 29	+ 8	130	163	**434**	+ 234	+ 166
Odes'ka	137	119	**347**	+ 153	+ 193	2.05	2.55	**2.42**	+ 18	– 5	282	302	**842**	+ 198	+ 178
Poltavs'ka	10	11	**43**	+ 347	+ 287	2.87	3.07	**3.39**	+ 18	+ 10	28	34	**147**	+ 428	+ 327
Rivnens'ka	28	29	**23**	– 19	– 21	2.91	2.98	**3.45**	+ 19	+ 16	83	87	**80**	– 4	– 9
Sums'ka	16	22	**54**	+ 231	+ 142	3.04	3.19	**3.50**	+ 15	+ 10	50	71	**188**	+ 280	+ 166
Ternopil's'ka	66	69	**42**	– 36	– 39	3.24	3.82	**3.83**	+ 18	+ 0	213	262	**161**	– 24	– 39
Vinnyts'ka	66	61	**127**	+ 94	+ 108	3.08	3.31	**3.49**	+ 14	+ 6	202	202	**444**	+ 120	+ 120
Volyns'ka	44	49	**73**	+ 67	+ 50	3.12	3.16	**3.87**	+ 24	+ 22	137	155	**283**	+ 106	+ 83
Zakarpats'ka	—	—	**30**	—	—	—	—	**3.80**	—	—	—	—	**114**	—	—
Zaporiz'ka	*60*	*73*	***89***	*+ 48*	*+ 22*	*2.19*	*2.46*	***2.61***	*+ 19*	*+ 6*	*131*	*179*	***231***	*+ 76*	*+ 29*
Zhytomyrs'ka	40	41	**36**	– 9	– 12	2.58	2.64	**3.03**	+ 17	+ 15	102	108	**109**	+ 7	+ 1

Ukraine yield forecasts for sunflower - June 2023 Bulletin

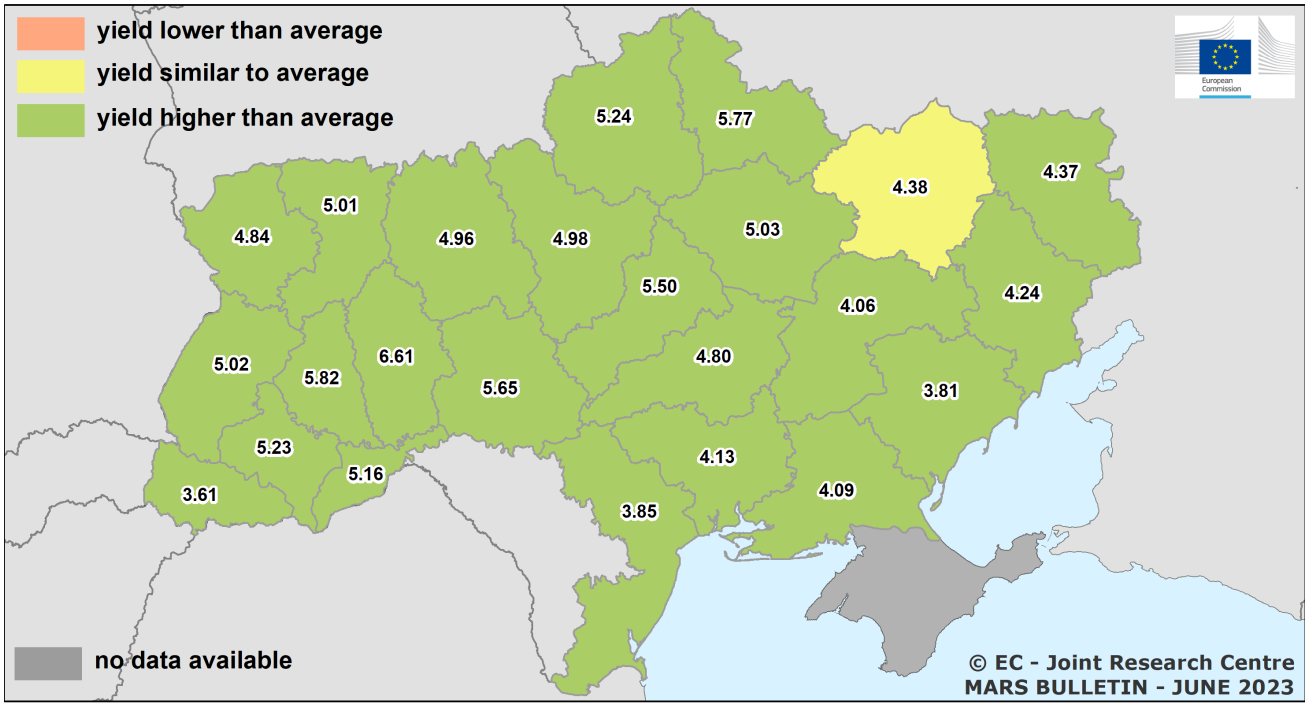
Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	6 266	6 665	**6 387**	+ 2	– 4	2.27	2.46	**2.36**	+ 4	– 4	14 232	16 398	**15 057**	+ 6	– 8
Ukraine (Government-controlled oblasts)	4 653	4 981	**4 920**	+ 6	– 1	2.45	2.62	**2.52**	+ 3	– 4	11 397	13 065	**12 389**	+ 9	– 5
Cherkas'ka	219	257	**261**	+ 19	+ 1	2.92	3.15	**2.99**	+ 3	– 5	639	811	**781**	+ 22	– 4
Chernihivs'ka	218	243	**325**	+ 49	+ 34	2.82	2.91	**2.88**	+ 2	– 1	615	706	**936**	+ 52	+ 33
Chernivets'ka	18	22	**19**	+ 4	– 13	2.69	2.84	**2.68**	– 0	– 6	49	62	**51**	+ 4	– 18
Dnipropetrovs'ka	608	608	**532**	– 13	– 13	2.09	2.33	**2.11**	+ 1	– 10	1 272	1 417	**1 121**	– 12	– 21
Donets'ka	*330*	*358*	***295***	*– 11*	*– 18*	*1.89*	*2.18*	***1.89***	*+ 0*	*– 13*	*625*	*780*	***558***	*– 11*	*– 28*
Ivano-frankivs'ka	27	32	**41**	+ 51	+ 29	2.59	2.85	**2.59**	+ 0	– 9	70	91	**106**	+ 51	+ 17
Kharkivs'ka	546	582	**327**	– 40	– 44	2.50	2.44	**2.49**	– 1	+ 2	1 365	1 420	**813**	– 40	– 43
Khersons'ka	*347*	*349*	***316***	*– 9*	*– 9*	*1.67*	*1.93*	***1.67***	*+ 0*	*– 13*	*580*	*673*	***528***	*– 9*	*– 22*
Khmel'nyts'ka	156	163	**218**	+ 39	+ 34	3.22	3.14	**3.15**	– 2	+ 0	503	510	**687**	+ 37	+ 35
Kirovohrads'ka	587	608	**633**	+ 8	+ 4	2.29	2.63	**2.42**	+ 6	– 8	1 344	1 599	**1 532**	+ 14	– 4
Kyyivs'ka	182	209	**195**	+ 7	– 7	2.77	2.85	**2.76**	– 1	– 3	505	595	**538**	+ 7	– 10
Luhans'ka	*389*	*442*	***355***	*– 9*	*– 20*	*1.87*	*1.83*	***1.87***	*+ 0*	*+ 2*	*727*	*809*	***665***	*– 9*	*– 18*
L'vivs'ka	33	41	**29**	– 13	– 28	2.48	2.52	**2.52**	+ 2	+ 0	83	102	**73**	– 12	– 28
Mykolayivs'ka	525	518	**460**	– 12	– 11	1.86	2.24	**1.87**	+ 1	– 17	975	1 160	**860**	– 12	– 26
Odes'ka	401	416	**420**	+ 5	+ 1	1.94	2.32	**1.83**	– 6	– 21	780	965	**769**	– 1	– 20
Poltavs'ka	347	388	**435**	+ 25	+ 12	2.66	2.57	**2.71**	+ 2	+ 5	925	996	**1 178**	+ 27	+ 18
Rivnens'ka	31	41	**49**	+ 58	+ 20	2.66	2.62	**2.57**	– 3	– 2	82	107	**126**	+ 53	+ 17
Sums'ka	240	266	**310**	+ 29	+ 16	2.98	2.94	**2.99**	+ 0	+ 2	716	783	**928**	+ 30	+ 19
Ternopil's'ka	77	83	**117**	+ 52	+ 41	3.12	3.34	**3.22**	+ 3	– 4	241	278	**377**	+ 57	+ 36
Vinnyts'ka	270	308	**339**	+ 26	+ 10	3.06	3.20	**3.00**	– 2	– 6	828	984	**1 016**	+ 23	+ 3
Volyns'ka	30	40	**42**	+ 40	+ 6	2.70	2.54	**2.73**	+ 1	+ 8	81	101	**115**	+ 42	+ 13
Zakarpats'ka	3	4	**3**	– 9	– 17	2.04	1.87	**1.96**	– 4	+ 5	7	7	**6**	– 12	– 13
Zaporiz'ka	*548*	*535*	***501***	*– 9*	*– 6*	*1.65*	*2.00*	***1.83***	*+ 11*	*– 9*	*902*	*1 071*	***915***	*+ 2*	*– 15*
Zhytomyrs'ka	134	155	**165**	+ 23	+ 7	2.38	2.40	**2.29**	– 4	– 5	318	372	**378**	+ 19	+ 2

Ukraine yield forecasts for soybean - June 2023 Bulletin

Oblast	Area (x 1000 ha)					Yield (t/ha)					Production (x 1000 t)				
	Avg 5yrs	2021	2023	%23/5yrs	%23/21	Avg 5yrs	2021	MARS 2023 forecasts	%23/5yrs	%23/21	Avg 5yrs	2021	2023	%23/5yrs	%23/21
Ukraine	1 602	1 322	**1 837**	+ 15	+ 39	2.29	2.64	**2.45**	+ 7	– 7	3 670	3 491	**4 495**	+ 23	+ 29
Ukraine (Government-controlled oblasts)	1 493	1 228	**1 740**	+ 17	+ 42	2.23	2.58	**2.41**	+ 8	– 7	3 324	3 170	**4 187**	+ 26	+ 32
Cherkas'ka	100	79	**110**	+ 10	+ 39	1.97	2.45	**2.32**	+ 18	– 5	197	194	**255**	+ 29	+ 32
Chernihivs'ka	78	41	**82**	+ 5	+ 99	2.24	2.55	**2.25**	+ 0	– 12	175	105	**185**	+ 6	+ 75
Chernivets'ka	58	58	**60**	+ 3	+ 4	2.26	2.68	**2.26**	+ 0	– 16	131	155	**136**	+ 3	– 13
Dnipropetrovs'ka	4	6	**7**	+ 58	+ 17	1.60	1.73	**1.67**	+ 5	– 4	7	10	**12**	+ 65	+ 13
Donets'ka	*1*	—	***1***	*+ 48*	—	*0.65*	—	***0.69***	*+ 7*	—	*1*	—	***1***	*+ 19*	—
Ivano-frankivs'ka	33	41	**48**	+ 46	+ 18	2.71	2.92	**2.72**	+ 0	– 7	89	119	**130**	+ 47	+ 10
Kharkivs'ka	36	23	**23**	– 36	– 2	1.49	1.79	**1.76**	+ 18	– 2	53	42	**40**	– 24	– 4
Khersons'ka	*95*	*82*	***82***	*– 14*	*+ 0*	*3.21*	*3.42*	***3.22***	*+ 0*	– 6	*305*	*280*	***264***	*– 13*	– 6
Khmel'nyts'ka	163	139	**192**	+ 18	+ 38	2.72	3.07	**2.84**	+ 5	– 8	442	427	**545**	+ 23	+ 28
Kirovohrads'ka	101	65	**88**	– 13	+ 36	1.50	2.21	**1.75**	+ 17	– 21	152	143	**154**	+ 1	+ 8
Kyyivs'ka	128	98	**142**	+ 11	+ 45	2.04	2.36	**2.15**	+ 5	– 9	261	232	**305**	+ 17	+ 32
Luhans'ka	*0*	—	***0***	*– 100*	—	*1.11*	—	***1.08***	*– 3*	—	*0*	—	***0***	*– 100*	—
L'vivs'ka	67	88	**103**	+ 53	+ 17	2.79	2.99	**2.84**	+ 2	– 5	188	264	**293**	+ 56	+ 11
Mykolayivs'ka	9	6	**5**	– 46	– 9	1.27	2.05	**1.26**	– 1	– 38	12	11	**6**	– 46	– 44
Odes'ka	7	5	**6**	– 12	+ 33	2.00	2.45	**1.92**	– 4	– 22	14	11	**12**	– 16	+ 5
Poltavs'ka	162	122	**150**	– 7	+ 23	1.86	2.03	**2.08**	+ 12	+ 3	300	248	**312**	+ 4	+ 26
Rivnens'ka	62	54	**83**	+ 34	+ 54	2.58	2.60	**2.59**	+ 1	– 1	159	140	**215**	+ 35	+ 53
Sums'ka	107	72	**96**	– 10	+ 33	2.10	1.96	**2.24**	+ 7	+ 14	224	142	**215**	– 4	+ 52
Ternopil's'ka	81	84	**149**	+ 84	+ 78	2.78	3.05	**2.89**	+ 4	– 5	225	255	**431**	+ 91	+ 69
Vinnyts'ka	112	81	**151**	+ 35	+ 86	2.27	2.84	**2.41**	+ 6	– 15	254	231	**364**	+ 43	+ 58
Volyns'ka	36	38	**47**	+ 30	+ 24	2.56	2.72	**2.71**	+ 6	– 0	93	103	**127**	+ 37	+ 24
Zakarpats'ka	11	12	**18**	+ 68	+ 50	2.72	2.26	**2.21**	– 19	– 2	29	27	**40**	+ 36	+ 47
Zaporiz'ka	*13*	*12*	***14***	*+ 11*	*+ 20*	*3.14*	*3.47*	***3.10***	*– 2*	*– 11*	*40*	*41*	***43***	*+ 9*	*+ 7*
Zhytomyrs'ka	138	116	**180**	+ 30	+ 55	2.30	2.67	**2.28**	– 1	– 15	319	310	**410**	+ 29	+ 32

Total wheat - yield forecast 2023

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



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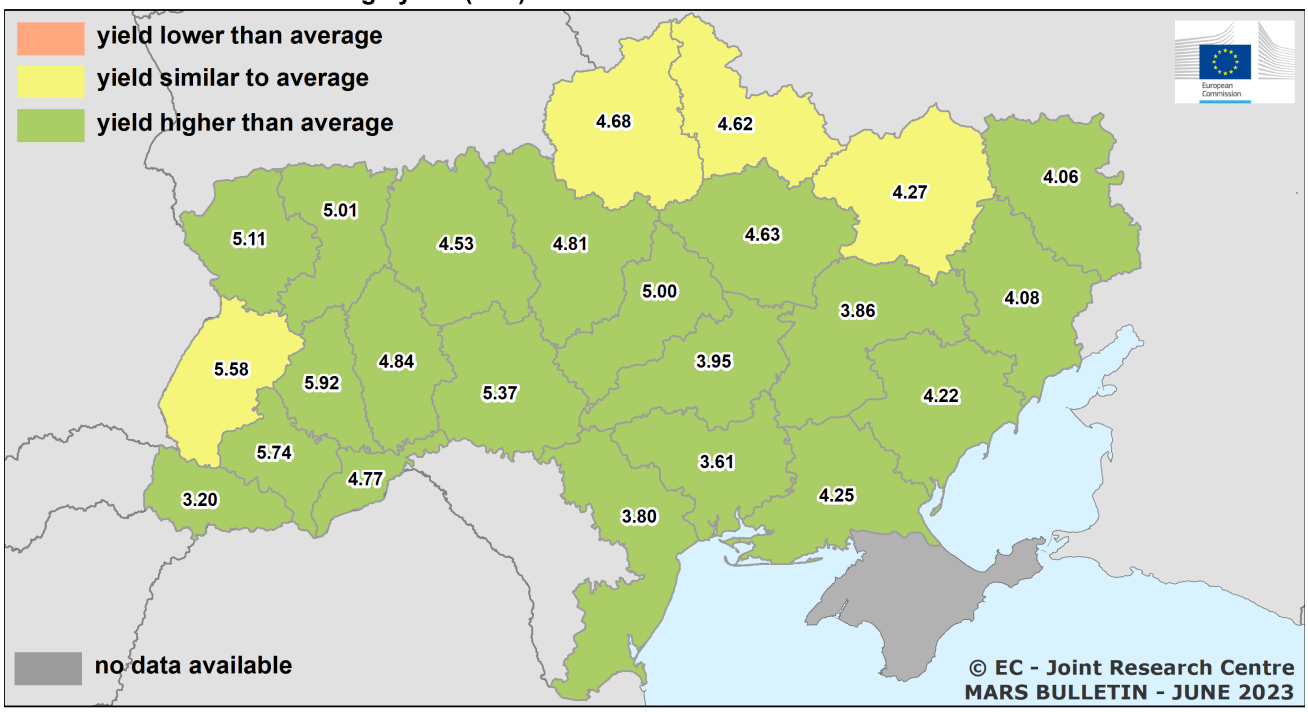
Winter barley - yield forecast 2023

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



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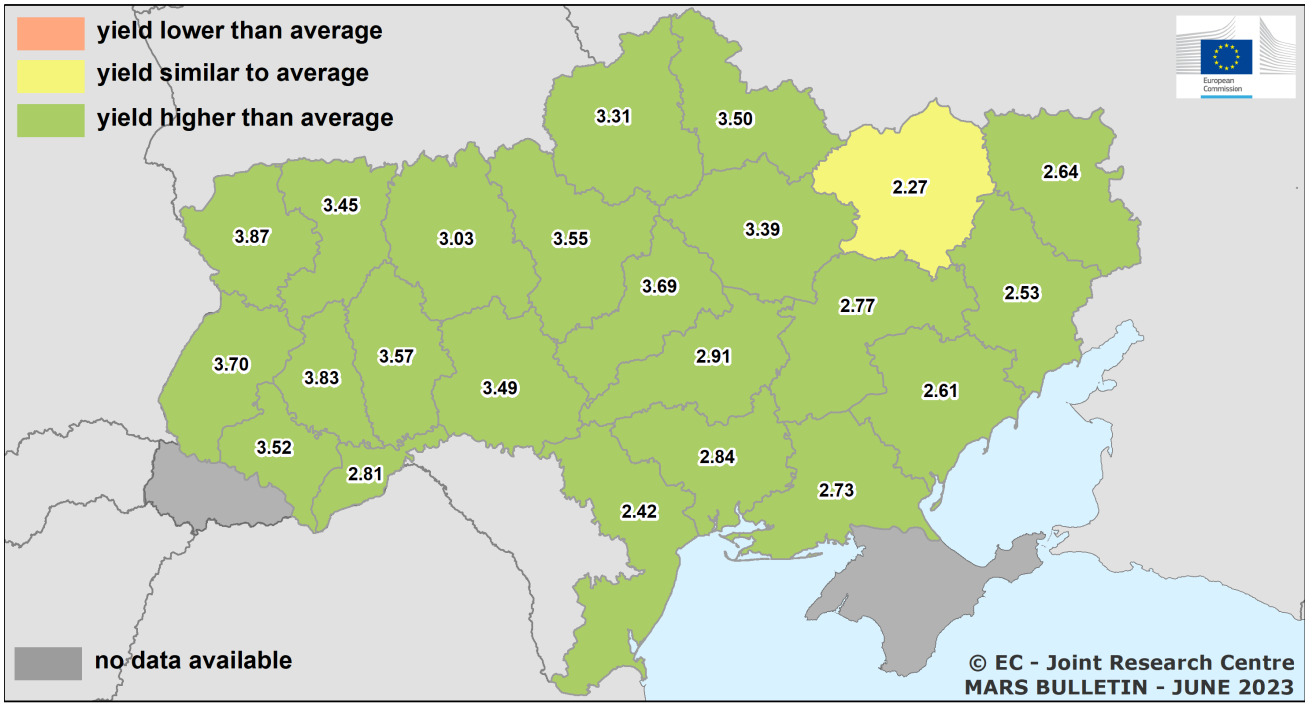
Rapeseed - yield forecast 2023

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



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Appendix

Crop area and crop phenology – an analysis using Copernicus Sentinel data

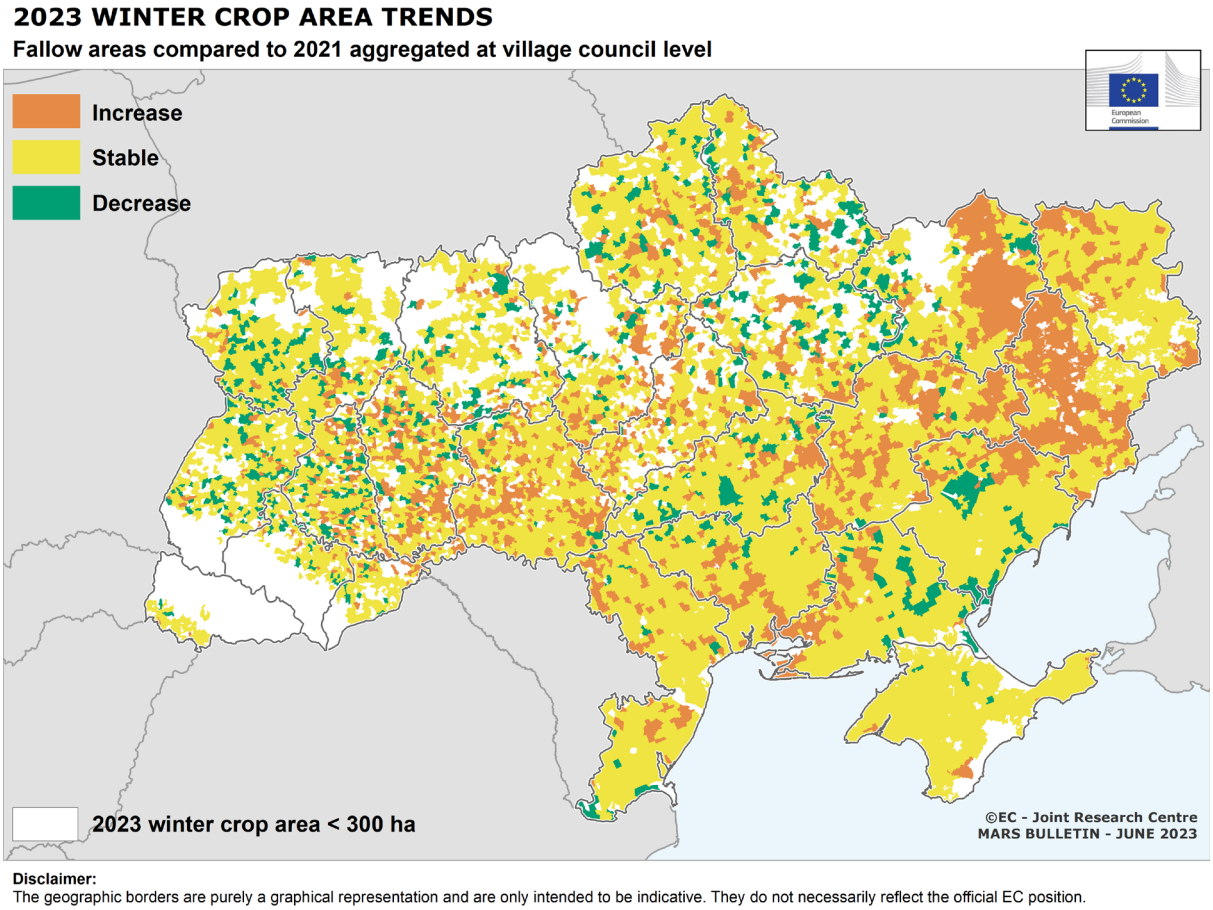

Figure 1. Change in green fallow ratio in winter crop cover estimates for 2023 relative to 2021 aggregated at village council (3rd administrative) level. The shift towards the higher ratio levels in 2023 is particularly evident in the conflict zone and the immediate neighboring areas.

Winter crops detection

In the April 2023 edition of the Bulletin[4], we described our method to estimate winter crop cover using Copernicus Sentinel data. Our initial estimate used a cut-off date of 26 March 2023, which, while providing a reasonable trend, was considered too early for a more reliable area figure. The method was first refined by integrating Growing Degree Day (GDD) normalization at Oblast level [1] before applying the NDVI threshold. This regional refinement provides winter cover estimates at comparable phenological stage rather than the same, fixed date range. Using GDD normalization is especially important in Ukraine, which presents a strong GDD gradient in spring, roughly from South (warmest) to North (coldest). We used the annual crop maps produced by KPI to regress spring and winter crop area estimates against the final official winter crop area estimates for previous years and found GDD = 350 as the most suitable cutoff GDD.

Abandoned fields (green fallow)

One issue causing uncertainty in the winter crop cover estimate was the effect of abandonment. The analysis described in the April was extended with the use of maximum value composites of Sentinel-1 coherence data [2] for both the periods 1 September to 1 December 2022 and 15 April to 31 May 2023. High values of coherence on arable land are linked to the detection of fallow soil status. True winter crops should appear in our GDD normalized winter crop delineation and should show a bare soil phase

[4] https://publications.jrc.ec.europa.eu/repository/handle/JRC133091

in autumn but not in spring. Applying this logic to the 3 data layers is straightforward and can be done retro-actively to the 2021 and 2022 data for cross-comparison. A green fallow effect (no bare soil phase in autumn nor in spring) is distinct in 2023. At national level, approximately 7% of winter crop cover was green fallow in 2021 (8% in 2022), whereas it rises to 11.5% in 2023, which corresponds to an increase of almost 600 kha. However, the spatial pattern is more explicit, with Oblasts in and near the military conflict zone showing a significant increase in green fallow (e.g., *Kharkivs'ka*, from 5 to 20% of winter crop cover) while others show little change (e.g., *Rivnens'ka*). Nevertheless, regional patterns at village council level (Figure 1) suggest abandoned cultivation also in the government-controlled areas.

Rapeseed detection

The winter crop estimates are used to distinguish rapeseed from winter cereals by determining the so-called "yellow index" [3], using a threshold during the expected flowering period of rapeseed. Flowering is expected in the GDD range 400-450 (counting from 1 January, with Tbase=0°C), which corresponds to late April in Southern oblasts and mid-May in Northern oblasts. The length of the flowering period depends on temperature and solar radiation. Cloud-free Sentinel-2 data for the relevant periods are used to isolate rapeseed.

Winter Cereal Split

The residual winter crop estimate, after deduction of the green fallow and rapeseed classes, is expected to represent the winter cereals, predominantly winter soft wheat and winter barley. These two crop types are not easily separable before the ripening stage (later in June). Therefore, we use the 5-year average share at oblast level to estimate the winter soft wheat and winter barley specific areas.

LAI crop-specific analysis

We extracted the leaf area index (LAI) profiles for winter cereals and rapeseed parcels that were detected following the previously introduced method. We compared their patterns to the parcels depicted in previous years' crop maps. This method, which utilizes high-resolution Sentinel data, provides a significant advantage compared with the method normally used in the Bulletin, based on non-crop specific MODIS observations.

At the oblast level, we aggregated the LAI profiles for distinct winter cereals and winter rapeseed parcels. Figure 2 displays some of the main oblasts where these crops are extensively cultivated. In most regions, the onset of spring green-up occurred earlier than in previous years. In some of the eastern oblasts, the LAI reached a five-year high, surpassing the level of 2021 (e.g., *Zaporiz'ka*). In the Black Sea region, the LAI levels are also in the high range, albeit slightly lower than in 2021 (e.g. *Odes'ka*). This qualitative analysis of the Sentinel-2 LAI time series overall confirms the excellent growth conditions for winter crops.

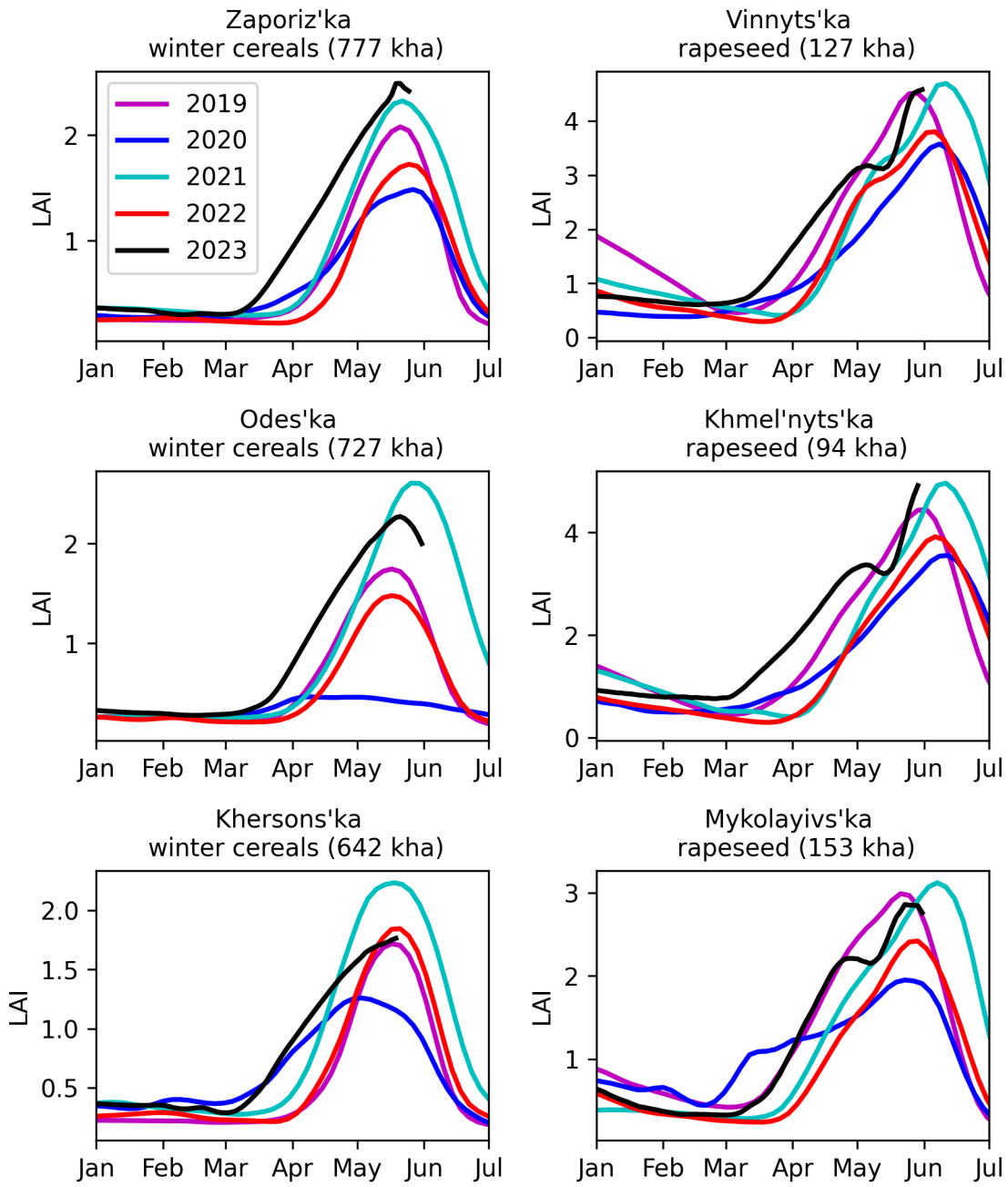

Figure 2. Leaf area index (LAI) profiles for winter cereals and winter rapeseed in selected major producing oblasts. Time series are extracted for parcels identified for both crop types and compared to previous years.

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[1] Cintas, J., Franch, B., Van-Tricht, K., Boogaard, H., Degerickx, J., Becker-Reshef, I., Moletto-Lobos, I., Mollà-Bononad, B., Sobrino, J. A., Gilliams, S., and Szantoi, Z. (2023). TRANCO: Thermo radiometric normalization of crop observations. *International Journal of Applied Earth Observation and Geoinformation* **118**, 103283. https://doi.org/10.1016/j.jag.2023.103283

[2] Lemoine, G., 2022. 12 day Sentinel-1 coherence: a test case for Ukraine. https://medium.com/@gglemoine62/12-day-sentinel-1-coherence-a-test-case-for-ukraine-998488bf589

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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 2012-2022.

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