

JRC MARS Bulletin

Crop monitoring in Europe

December 2024

Dry autumn overall favourable for winter cereals

In most parts of Europe, winter crops are in fair to good condition. They remain underdeveloped in parts of Romania and Bulgaria, and in eastern Ukraine and large parts of European Russia. In the Maghreb, rainfall is needed imminently to create suitable conditions for sowing.

Large parts of Europe experienced a considerable rain deficit during the reporting period, albeit with no negative impacts on crops. Following a very rainy September and October in the Iberian peninsula, the near-absence of precipitation in November combined with above-average temperatures created beneficial conditions for an extended sowing window and enabled farmers to advance sowing operations rapidly. In north-eastern Spain, particularly in Aragón, some overly wet fields could not be accessed on time; some farmers plan to sow shorter-cycle crop varieties in December and January to mitigate delays. In northern Italy too, dry conditions favoured the sowing and initial development of winter cereals. In western, Europe, weather conditions were adequate to complete the sowing of winter cereals; despite delays, overall conditions are positive. In central and northern Europe, where sowing had already been finished, mild cold spells had no negative impacts and soil water reserves remained well above critical levels.

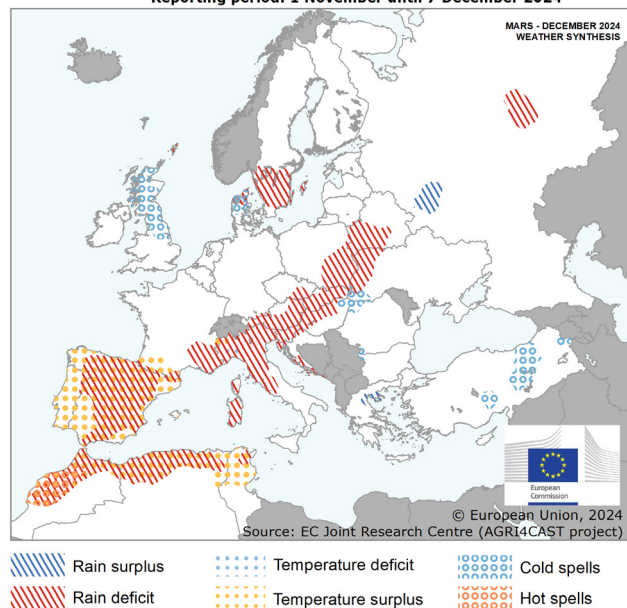
In Sicily, rainfall during the reporting period was sufficient to create suitable conditions for the sowing of durum

wheat. However, the situation remains delicate, as subsoils are still very dry.

In the Maghreb, unusually warm and drier-than-usual conditions continued. There is an immediate need for rainfall to create suitable conditions for sowing, most notably in Morocco and western Algeria.

In many parts of Europe, the build-up of cold tolerance to withstand freezing conditions during the winter dormancy period is slightly delayed in crops that were sown at the usual time. This is most markedly the case in Poland and the Baltic countries. However, winter crops' vulnerability is of particular concern in eastern Ukraine and European Russia, and in southern-central Romania and north-eastern Bulgaria, where sowing and initial development of winter wheat were seriously hampered due to very dry topsoils, resulting in crops that are currently underdeveloped and in poor condition.

WEATHER SYNTHESIS
Reporting period: 1 November until 7 December 2024



Contents:

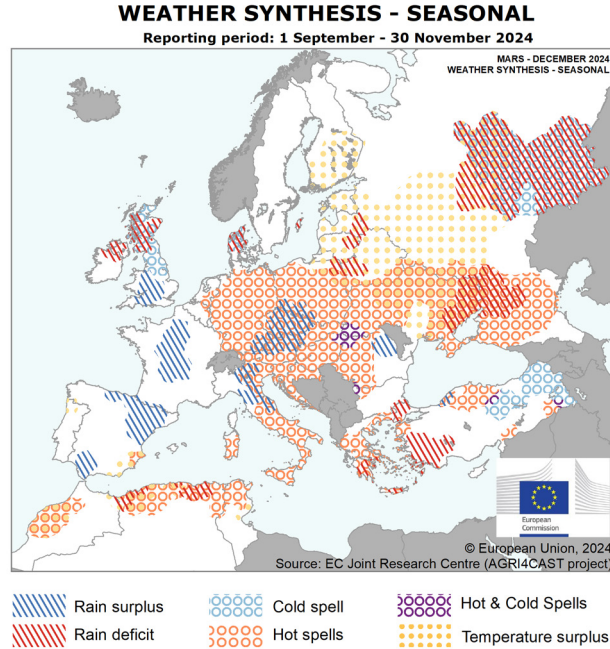
1. Agrometeorological overview
2. Winter hardening and frost kill
3. Atlas

Covers the period from 1 November until 7 December

1. Agrometeorological overview

1.1. Autumn Review (September, October, November)

While the start of autumn was warmer than usual with hot spells in central, southern and eastern Europe, intense storms brought heavy rain to many parts of central and western Europe.



The weather synthesis map above summarises the most distinct weather anomalies during autumn 2024 (1 September to 30 November) compared with the 1991–2023 long-term average (LTA) for the same period. Temperature and rainfall surplus and deficit are unusual absolute and relative deviations from the LTA, considering the entire reporting period. Hot and cold spells are 5-day periods with daily maximum temperatures above 30 °C and minimum temperatures below – 3 °C, respectively, and above the 90th and below the 10th percentile, respectively, of the years since 1991. The weather indicator maps below provide further context on each event.

A marked **rain surplus** was observed in eastern and parts of southern Spain, central France, the southern United Kingdom, parts of northern and central Italy, Czechia, neighbouring regions of Poland, Germany and Austria, and north-eastern Romania. In many of these regions, cumulative rainfall exceeded the LTA by between 50 % and 100 %, and up to 150 % in the aftermath of intense storms (such as Boris in central Europe¹, DANA in Spain²), and the autumn period ranked as the wettest in our records since 1991.

A **rain deficit** with cumulative precipitation between 30 % and 50 % below the LTA (in some regions more) was observed in northern parts of Ireland and the United Kingdom, northern Denmark, eastern parts of the Baltic countries, north-eastern Poland, south-western Belarus, central and southern European Russia, eastern Ukraine, southern Greece and southern and western Türkiye.

A distinct **temperature surplus** was observed in eastern and north-eastern Europe, from northern Poland and Ukraine to Finland and large parts of European Russia, and in south-eastern parts of the Iberian peninsula. In most of these regions, average daily temperatures were between 1 °C and 3 °C above the LTA, and autumn ranked among the three warmest since 1991 (the warmest in northern Ukraine, parts of European Russia and south-eastern Finland). **Cold spells** were limited to parts of the United Kingdom and eastern Türkiye.

Unusual **hot spells** were observed in September and the first dekad of October in most of central and eastern Europe. However, temperatures in large parts of central Europe dropped by more than 15 °C during storm Boris in mid September. Both **hot and cold spells** occurred in the region where Hungary, Romania, Ukraine and Slovakia border on each other.

¹ See section 1.4 on storm Boris in the [September edition of the Bulletin](#)

² See textbox on page 4 of the [November edition of the Bulletin](#)

AVERAGE DAILY TEMPERATURE

Averaged values

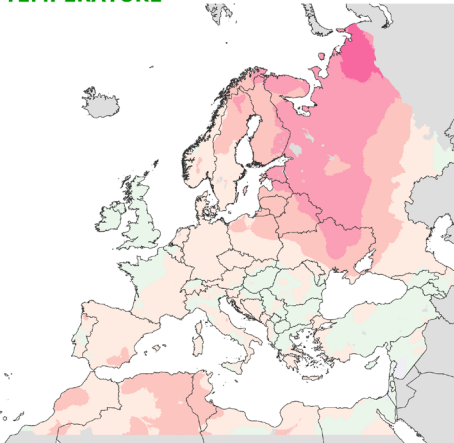
from: **01 September 2024**
to: **30 November 2024**

Deviation:

Year of interest - LTA

Units: °C

- 1 - -0.5 (cooler in YOI)
- 0.5 - 0.5
- 0.5 - 1 (warmer in YOI)
- 1 - 2 (warmer in YOI)
- 2 - 3 (warmer in YOI)
- 3 - 4 (warmer in YOI)



09/12/2024
Resolution: 10 x 10 km



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Source: EC Joint Research Centre (AGRI4CAST project)

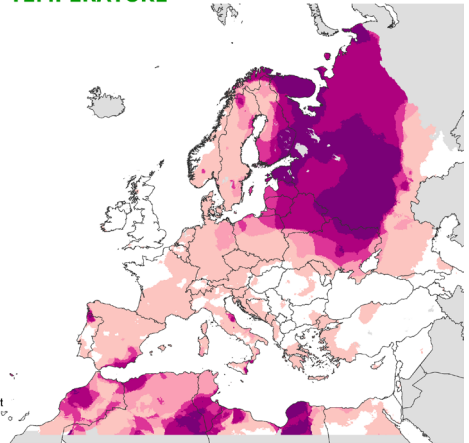
AVERAGE DAILY TEMPERATURE

Ranking since 1991

from: **01 September 2024**
to: **30 November 2024**

Ranking since 1991

- Warmest year
- Second warmest
- Third warmest
- Fourth warmest
- From fifth to tenth warmest
- Others



09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

RAINFALL

Cumulative values

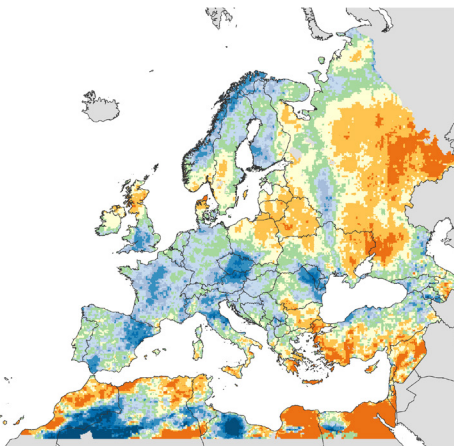
from: **01 September 2024**
to: **30 November 2024**

Deviation:

Year of interest - LTA

Units: %

- >= -100 - < -50
- >= -50 - < -30
- >= -30 - < -10
- >= -10 - < 10
- >= 10 - < 30
- >= 30 - < 50
- >= 50 - < 100
- >= 100 - < 150
- >= 150



09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

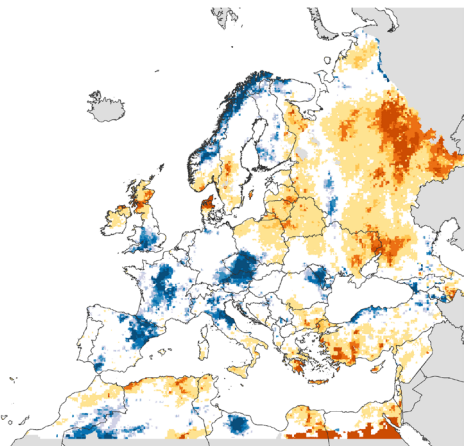
RAINFALL

Cumulative values

from: **01 September 2024**
to: **30 November 2024**

Ranking since 1991

- Driest year
- Second driest
- Third driest
- Fourth driest
- From fifth to tenth driest
- Others
- From fifth to tenth wettest
- Fourth wettest
- Third wettest
- Second wettest
- Wettest year



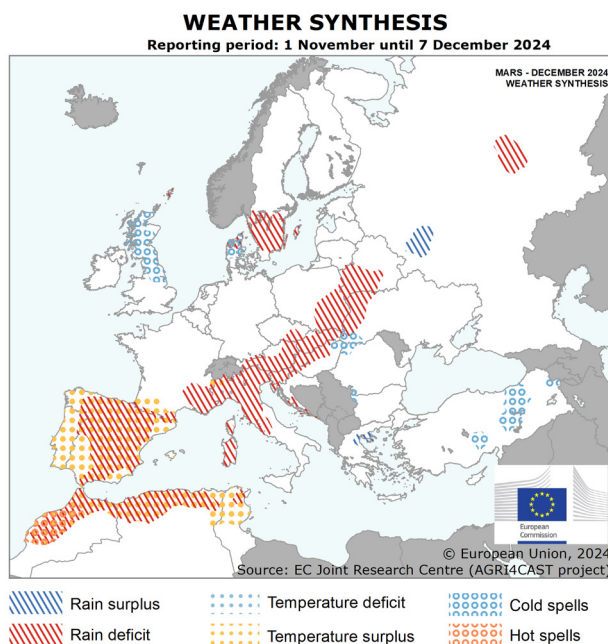
09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

1.2. Meteorological review (1 November – 7 December)

The review period was drier than usual in many parts of Europe, and exceptionally warm in the Iberian peninsula and the Maghreb.



The weather synthesis map summarises the most distinct anomalies during the review period compared with the 1991–2023 LTA for the same period

A distinct **temperature surplus** was observed in most of the Iberian peninsula, neighbouring regions of south-western France and the Maghreb, with average daily temperatures between 2 °C and 3 °C above the LTA. In these regions, the review period was the warmest in our records (since 1991). **Hot spells** were observed in Morocco in the second half of November.

Unusual, yet moderate, **cold spells** were observed in northern parts of the United Kingdom, northern Denmark and the regions where Hungary, Romania and Ukraine border on each other, whereas a more severe cold spell (with minimum temperatures reaching values below – 10 °C) occurred in central Türkiye in early December.

An unusual **rain surplus** with cumulative rainfall between 50 % and 100 % above the LTA was observed in a small region of European Russia (*Moskovskaya, Kaluzhskaya, Smolenskaya*) and in north-eastern Greece.

A marked **rain deficit** occurred in a large region extending from southern Belarus through south-eastern Poland and western Ukraine, Slovakia, parts of Czechia and Hungary, Austria, Slovenia and Croatia, to northern and central Italy, south-eastern France and most of Spain; as well as in southern Sweden and northern Denmark. Cumulative rainfall in these regions was between 50 % and 100 % below the LTA. In several of these regions, the review period was among the three driest in our records since 1991.

AVERAGE DAILY TEMPERATURE

Averaged values

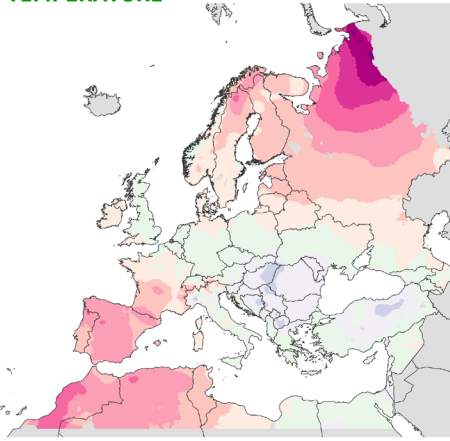
from: **01 November 2024**
to: **07 December 2024**

Deviation:

Year of interest - LTA

Units: °C

- 2 - -1 (cooler in YOI)
- 1 - -0.5 (cooler in YOI)
- 0.5 - 0.5
- 0.5 - 1 (warmer in YOI)
- 1 - 2 (warmer in YOI)
- 2 - 3 (warmer in YOI)
- 3 - 4 (warmer in YOI)
- 4 - 5 (warmer in YOI)
- 5 - 6 (warmer in YOI)
- > 6 (warmer in YOI)



12/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

NUMBER OF COLD DAYS

from: **01 November 2024**
to: **07 December 2024**

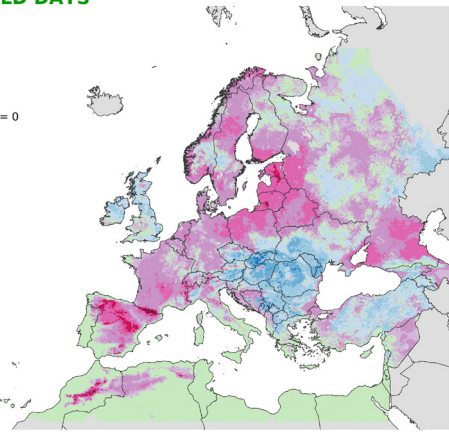
Deviation:

Year of interest - LTA

Minimum temperature (°C) <= 0

Units: days

- <= -15
- > -15 - <= -10
- > -10 - <= -5
- > -5 - <= -2
- > -2 - < 0
- no difference
- > 0 - <= 2
- > 2 - <= 5
- > 5 - <= 10
- > 10 - <= 15



12/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

RAINFALL

Cumulative values

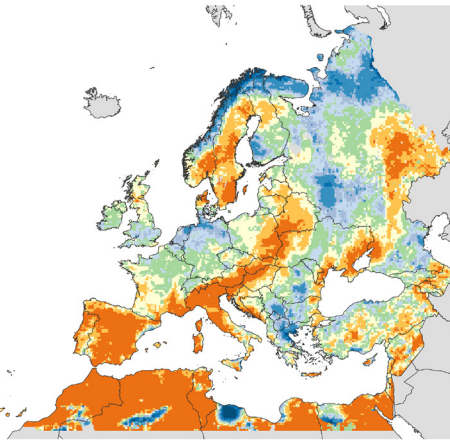
from: **01 November 2024**
to: **07 December 2024**

Deviation:

Year of interest - LTA

Units: %

- >= -100 - < -50
- >= -50 - < -30
- >= -30 - < -10
- >= -10 - < 10
- >= 10 - < 30
- >= 30 - < 50
- >= 50 - < 100
- >= 100 - < 150
- >= 150



12/12/2024
Resolution: 10 x 10 km



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Source: EC Joint Research Centre (AGRI4CAST project)

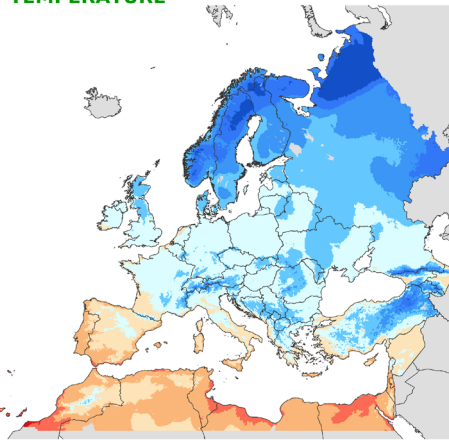
MINIMUM DAILY TEMPERATURE

Minimum values

from: **01 November 2024**
to: **07 December 2024**

Units: °C

- <= -20
- > -20 - <= -15
- > -15 - <= -10
- > -10 - <= -5
- > -5 - <= 0
- > 0 - <= 5
- > 5 - <= 10
- > 10 - <= 15
- > 15 - <= 20



12/12/2024
Resolution: 10 x 10 km



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Source: EC Joint Research Centre (AGRI4CAST project)

1.3. Weather forecast (12 - 21 December)

While warmer-than-usual conditions are forecast for most of Europe, cold air brings rain to parts of northern Europe and the eastern Black Sea region.

Warmer-than-usual conditions (up to 3 °C above the LTA) are forecast for the United Kingdom, southern Scandinavia, most of central and eastern Europe, and the Balkan peninsula. More substantial positive temperature anomalies (up to 5 °C above the LTA, and locally more) are forecast for north-eastern Romania, southern Norway and central eastern European Russia (*Bashkortostan, Orenburgskaya*).

Colder-than-usual conditions, with average daily temperatures up to 2 °C below the LTA, are forecast for most of the Iberian peninsula and France, parts of northern Italy, most of Türkiye and southernmost European Russia. **Much colder-than-usual conditions** are forecast for northernmost European Russia, where minimum daily temperatures will drop below – 20 °C.

Wet conditions (precipitation above 10 mm and up to 70 mm) are forecast for most of Europe. **Very wet**

conditions (above 70 mm) are forecast for western Scotland and coastal Norway, and along the eastern coast of the Black Sea, with between 4 and 9 days with rainfall above the 5-mm threshold.

Dry conditions (total precipitation below 3 mm) are forecast for most of Spain, parts of northern Italy, south-eastern Austria, northern Hungary, eastern and southern Romania, northern and eastern Bulgaria, most of Greece and parts of south-eastern Türkiye.

The long-range weather forecast points to a moderate likelihood of warm conditions, exceeding the 24-year climatological median in January–February by up to 1 °C west of the 10 ° meridian and by up to 2 °C east of it; and by up to 2 °C in north-eastern Europe in March. Albeit with high uncertainty, precipitation is forecast to be up to 50 mm above average for Scandinavia.

AVERAGE DAILY TEMPERATURE

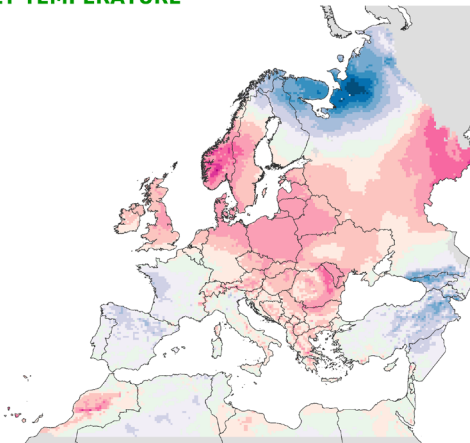
Averaged values

from: 12 December 2024
to: 21 December 2024

Deviation:

Year of interest - LTA

Units: °C



12/12/2024
Resolution: 25 x 25 km



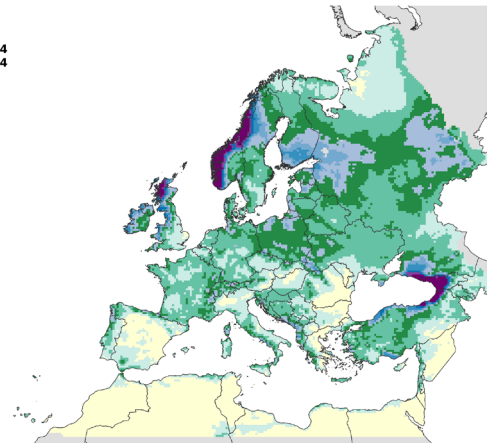
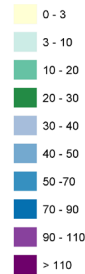
© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

RAINFALL

Cumulative values

from: 12 December 2024
to: 21 December 2024

Units: mm



12/12/2024
Resolution: 25 x 25 km



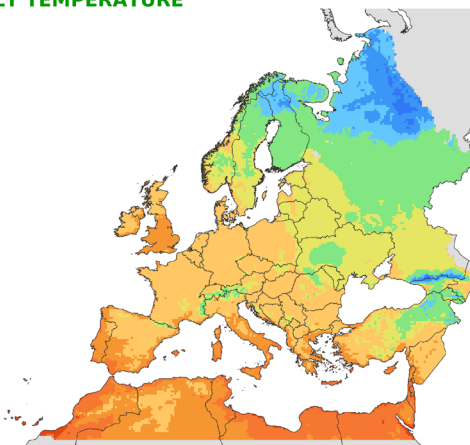
© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

MINIMUM DAILY TEMPERATURE

Minimum values

from: 12 December 2024
to: 21 December 2024

Units: °C



12/12/2024
Resolution: 25 x 25 km



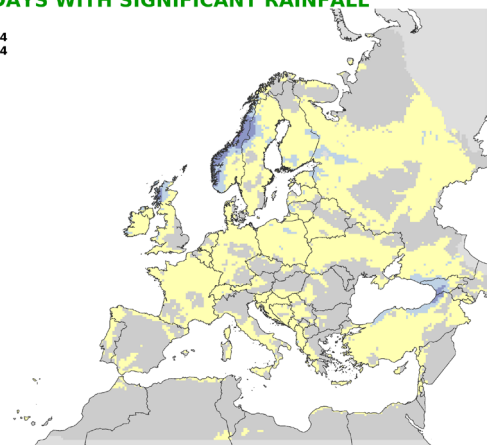
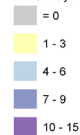
© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

NUMBER OF DAYS WITH SIGNIFICANT RAINFALL

from: 12 December 2024
to: 21 December 2024

Rain (mm) > 5

Units: days

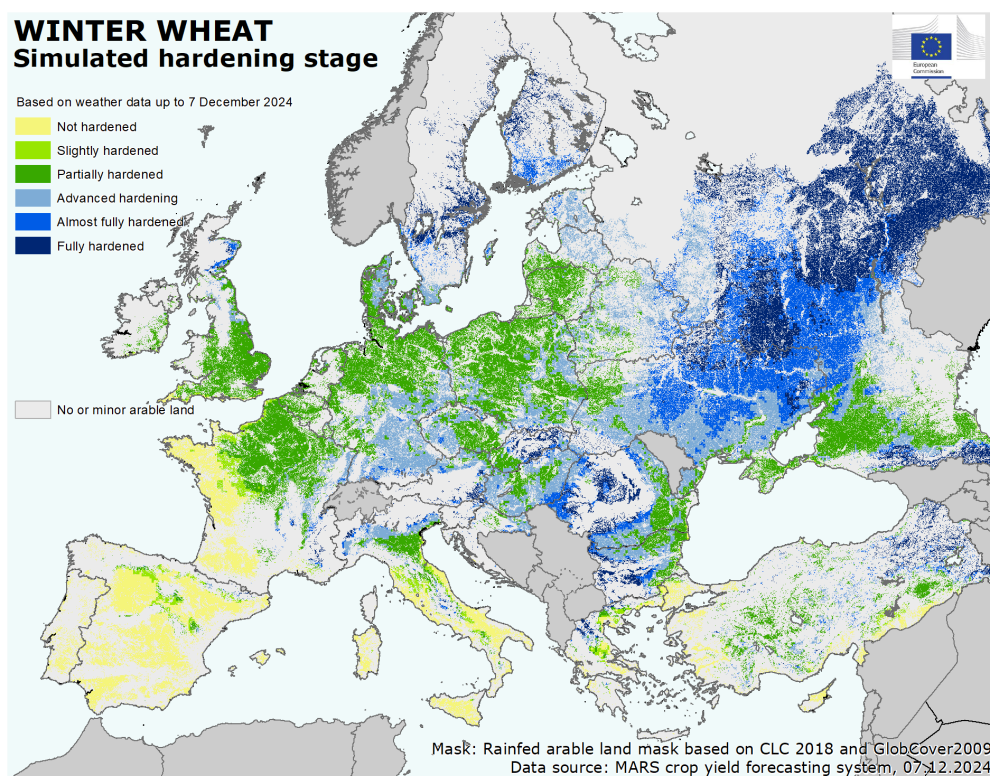


12/12/2024
Resolution: 25 x 25 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

2. Winter hardening and frost kill



Hardening is the bio-physiological process whereby winter cereals gain tolerance to low temperatures so they can withstand freezing conditions that occur during the winter dormancy period

During the reporting period, warmer-than-usual temperatures prevailed in parts of Denmark and Sweden, the Baltic countries, Finland and European Russia, resulting in a reduced build-up of frost tolerance before the start of winter. Meanwhile, two distinct cold spells had already occurred in Russia, in mid-October and late November, when daily minimum temperatures fell to $-8\text{ }^{\circ}\text{C}$ and $-12\text{ }^{\circ}\text{C}$ in southern parts of the Volga okrug. Most of central and western Europe experienced average temperatures during the reporting period, whereas areas towards the east, namely Slovakia, Hungary, Croatia, Romania, Bulgaria and Türkiye, experienced a minor cold spell in November that accelerated the progress of winter hardening. A more significant cold spell occurred in late November and early December in eastern Türkiye, with minimum temperatures ranging from $-12\text{ }^{\circ}\text{C}$ to $-20\text{ }^{\circ}\text{C}$. Currently, our models indicate that winter cereals are in a partial to advanced hardening stage in northern France, Germany, Poland, Denmark, southern Sweden, the Baltic countries, most other parts of central Europe, Türkiye and southern Russia. Compared with last year, the hardening is delayed, most notably in the warmer-than-usual areas in Poland and towards northern and north-eastern Europe. Winter crops are in an advanced to almost fully hardened

stage in most of Ukraine and the Central okrug of Russia. Near or full hardening has been reached in central Sweden, Finland and eastern parts of European Russia. It is worth noting that our models do not account for late sowing, and could hence overestimate the build-up of frost tolerance in late-sown or underdeveloped winter crops. This is of particular concern in eastern Ukraine and European Russia, where sowing and initial development of winter wheat were seriously hampered due to very dry topsoils, resulting in crops that are currently underdeveloped and in poor condition. In large parts of Romania and Bulgaria too, winter crops are delayed in development (see November edition of the Bulletin), but mostly in fair condition (except in southern central Romania and north-eastern Bulgaria), and subject to a much smaller risk of severe frost.

While the temperatures (in the presence of a snow layer) associated with the cold spells in central Europe are unlikely to have caused significant damage to crops, we expect that the cold spells in south-eastern Russia and eastern Türkiye may have caused minor to moderate damage in late-sown winter crops.

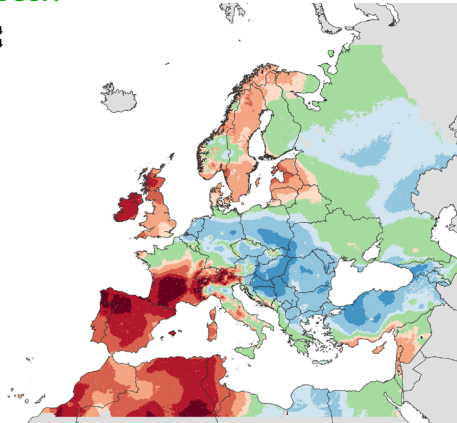
3. Atlas

Temperature regime

TEMPERATURE SUM

from: 01 November 2024
to: 10 November 2024

Deviation:
Year of interest - LTA
Base temperature: 0 °C
Units: °C



09/12/2024
Resolution: 10 x 10 km

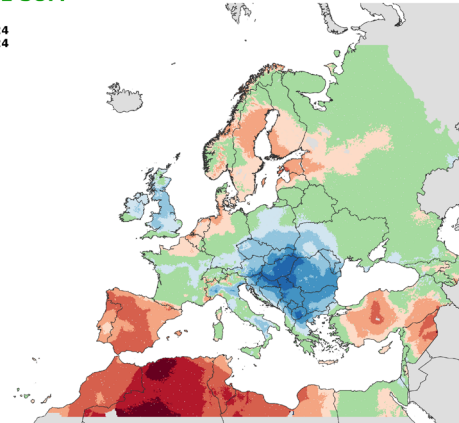
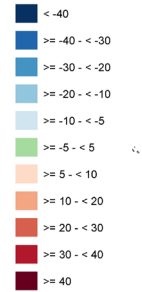


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Source: EC Joint Research Centre (AGRI4CAST project)

TEMPERATURE SUM

from: 11 November 2024
to: 20 November 2024

Deviation:
Year of interest - LTA
Base temperature: 0 °C
Units: °C



09/12/2024
Resolution: 10 x 10 km

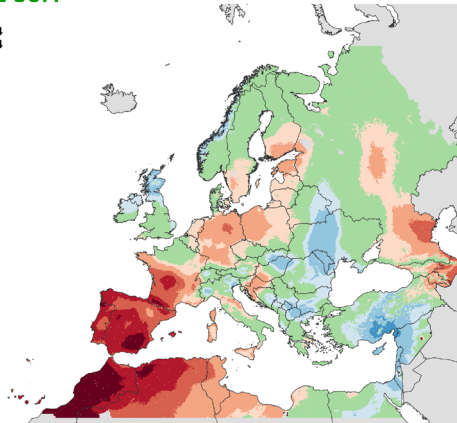
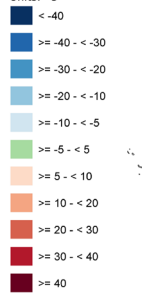


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Source: EC Joint Research Centre (AGRI4CAST project)

TEMPERATURE SUM

from: 21 November 2024
to: 30 November 2024

Deviation:
Year of interest - LTA
Base temperature: 0 °C
Units: °C



09/12/2024
Resolution: 10 x 10 km

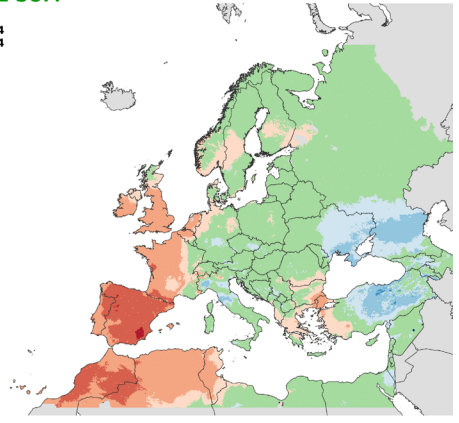


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Source: EC Joint Research Centre (AGRI4CAST project)

TEMPERATURE SUM

from: 01 December 2024
to: 07 December 2024

Deviation:
Year of interest - LTA
Base temperature: 0 °C



09/12/2024
Resolution: 10 x 10 km

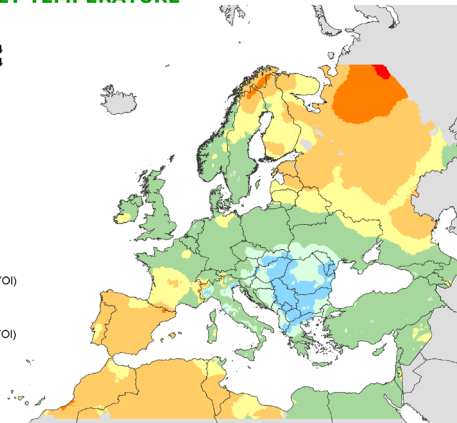
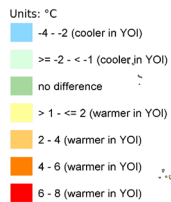


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Source: EC Joint Research Centre (AGRI4CAST project)

MINIMUM DAILY TEMPERATURE Averaged values

from: 01 November 2024
to: 30 November 2024

Deviation:
Year of interest - LTA



09/12/2024
Resolution: 10 x 10 km

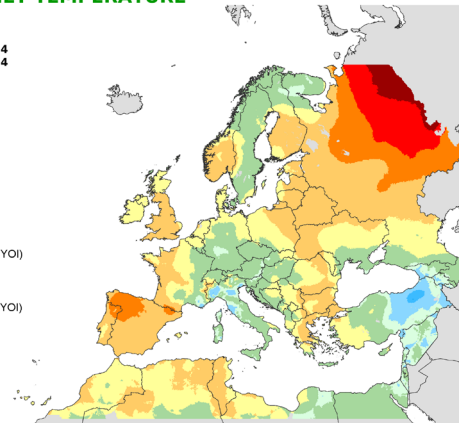


© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

MINIMUM DAILY TEMPERATURE Averaged values

from: 01 December 2024
to: 07 December 2024

Deviation:
Year of interest - LTA



09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

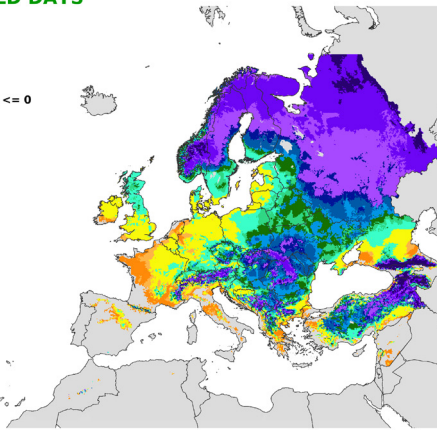
NUMBER OF COLD DAYS

from: **01 November 2024**
to: **30 November 2024**

Period of interest

Minimum temperature (°C) <= 0

Units: days



09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

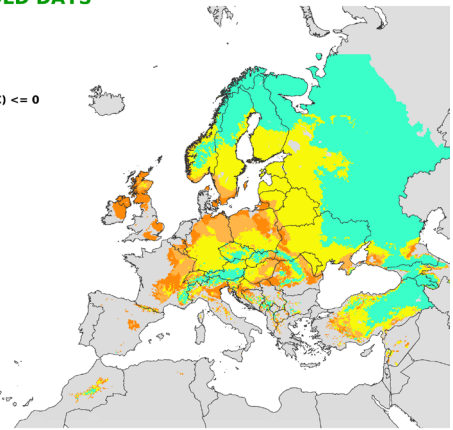
NUMBER OF COLD DAYS

from: **01 December 2024**
to: **07 December 2024**

Period of interest

Minimum temperature (°C) <= 0

Units: days



09/12/2024
Resolution: 10 x 10 km



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Source: EC Joint Research Centre (AGRI4CAST project)

Precipitation

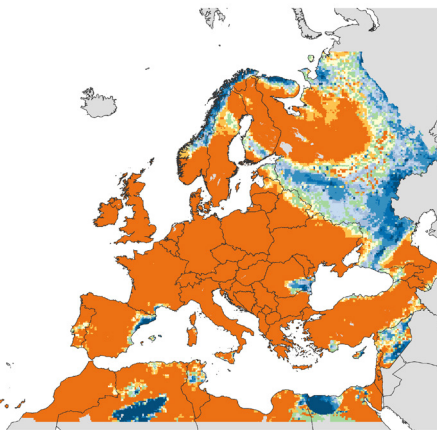
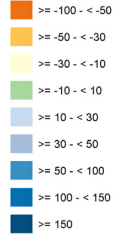
RAINFALL
Cumulative values

from: **01 November 2024**
to: **10 November 2024**

Deviation:

Year of interest - LTA

Units: %



09/12/2024
Resolution: 10 x 10 km

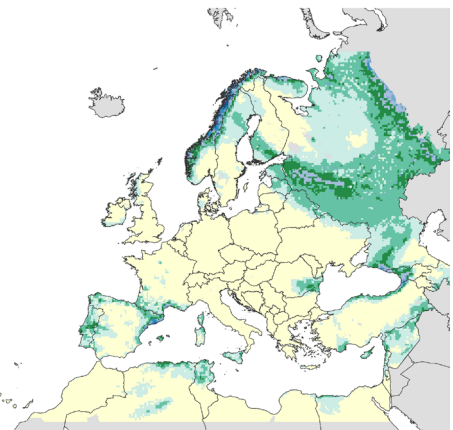
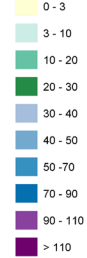


© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

RAINFALL
Cumulative values

from: **01 November 2024**
to: **10 November 2024**

Units: mm



09/12/2024
Resolution: 10 x 10 km



© European Union, 2024
Source: EC Joint Research Centre (AGRI4CAST project)

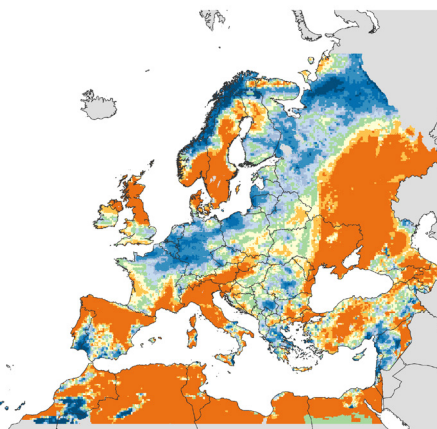
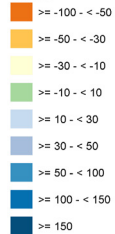
RAINFALL
Cumulative values

from: **11 November 2024**
to: **20 November 2024**

Deviation:

Year of interest - LTA

Units: %



09/12/2024
Resolution: 10 x 10 km

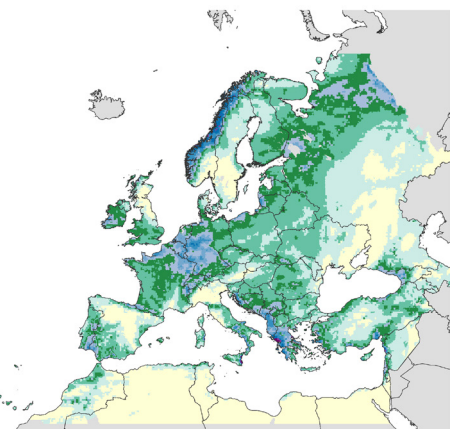
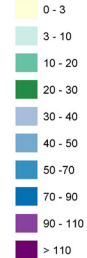


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RAINFALL
Cumulative values

from: **11 November 2024**
to: **20 November 2024**

Units: mm



09/12/2024
Resolution: 10 x 10 km

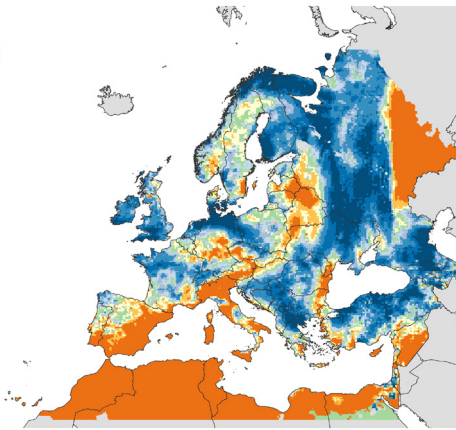
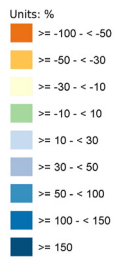


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RAINFALL
Cumulative values

from: 21 November 2024
to: 30 November 2024

Deviation:
Year of interest - LTA



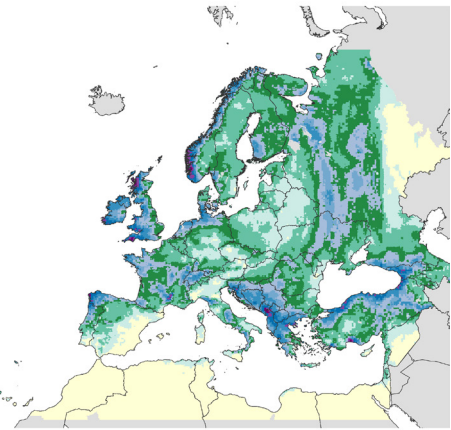
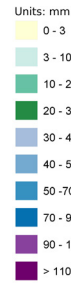
09/12/2024
Resolution: 10 x 10 km



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Source: EC Joint Research Centre (AGRI4CAST project)

RAINFALL
Cumulative values

from: 21 November 2024
to: 30 November 2024



09/12/2024
Resolution: 10 x 10 km

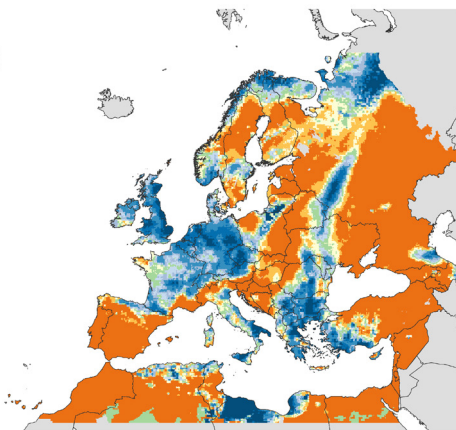
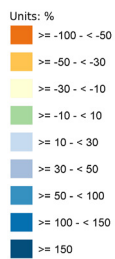


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RAINFALL
Cumulative values

from: 01 December 2024
to: 07 December 2024

Deviation:
Year of interest - LTA



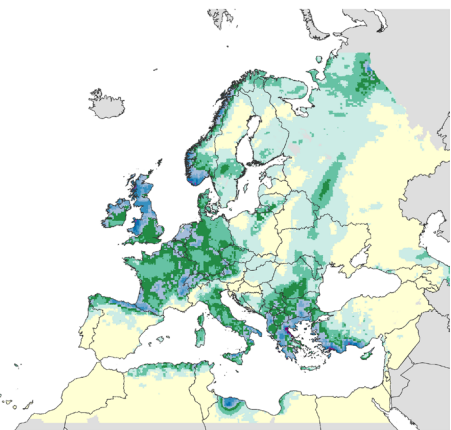
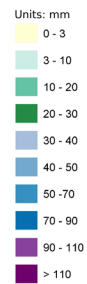
09/12/2024
Resolution: 10 x 10 km



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RAINFALL
Cumulative values

from: 01 December 2024
to: 07 December 2024



09/12/2024
Resolution: 10 x 10 km



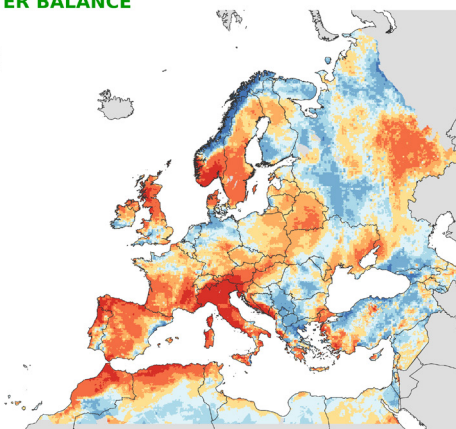
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Climatic water balance

CLIMATIC WATER BALANCE
Cumulative values

from: 01 November 2024
to: 30 November 2024

Deviation:
Year of interest - LTA



09/12/2024
Resolution: 10 x 10 km

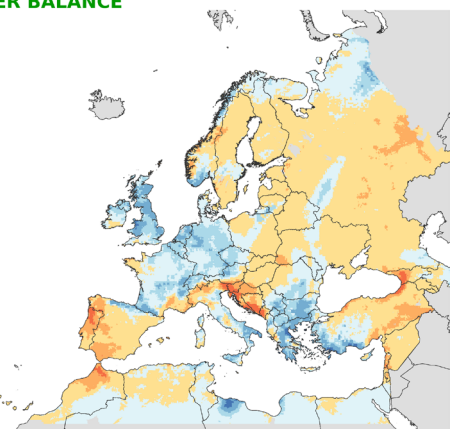


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CLIMATIC WATER BALANCE
Cumulative values

from: 01 December 2024
to: 07 December 2024

Deviation:
Year of interest - LTA



09/12/2024
Resolution: 10 x 10 km



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JRC MARS Bulletin 2024

Date	Publication	Reference
22 Jan	Agromet analysis	Vol. 32 No 1
26 Feb	Agromet analysis	Vol. 32 No 2
25 Mar	Agromet analysis, yield forecast	Vol. 32 No 3
22 Apr	Agromet analysis, remote sensing, pasture analysis, sowing conditions, yield forecast	Vol. 32 No 4
27 May	Agromet analysis, remote sensing, pasture analysis, sowing update, yield forecast	Vol. 32 No 5
24 Jun	Agromet analysis, remote sensing, pasture analysis, rice analysis, yield forecast	Vol. 32 No 6
22 Jul	Agromet analysis, remote sensing, pasture analysis, harvesting conditions, yield forecast	Vol. 32 No 7
26 Aug	Agromet analysis, remote sensing, pasture update, harvesting update, yield forecast	Vol. 32 No 8
23 Sep	Agromet analysis, remote sensing, pasture analysis, rice analysis, harvesting update, yield forecast	Vol. 32 No 9
28 Oct	Agromet analysis, pasture update, sowing conditions, harvesting update, yield forecast	Vol. 32 No 10
25 Nov	Agromet analysis, sowing update, harvesting update	Vol. 32 No 11
16 Dec	Agromet analysis	Vol. 32 No 12

Mission statement

The Joint Research Centre provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society.

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Analysis and reports

Biavetti, I., Bussay, A., Cerrani, I., Claverie, M., De Palma, P., Fumagalli, D., Henin, R., Luque Reyes, J., Manfron, G., Morel, J., Nisini, L., Ozalp, O., Panarello, L., Rossi, M., Seguíni, L., Tarnavsky, E., Todoroff, P., van den Berg, M., Zucchini, A.

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Technical note

The long-term average (LTA) used within this Bulletin as a reference is calculated on the basis of weather data from 1991-2023.

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