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## FOOTPRINT

Functional Tools for Pesticide Risk Assessment and Management

Specific Targeted Research Project

Thematic Priority: Policy-orientated research

Deliverable DL11

## Characteristics of European agronomic scenarios

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RE	Restricted to a group specified by the consortium (including the Commission Services)	
СО	Confidential, only for members of the consortium (including the Commission Services)	

# **Table of Contents**

FO	REWORD	2
EX	ECUTIVE SUMMARY	3
1		4
2	METHODOLOGY AND RESULTS	5
2	2.1 Template of crop growth stages	5
	2.1.1 Sources of data	5
	2.1.2 Description of the template	5
2	2.2 Identification of land use patterns in Europe using CORINE 2000	8
2	2.3 Analysis of cropping and other agricultural statistics at NUTS level 2	
r	resolution1	0
	2.3.1 Methodology1	0
	2.3.2 Statistical analysis1	0
3	CONCLUSIONS AND PERSPECTIVES1	2
4	REFERENCES 1	3
5	LIST OF ABBREVIATIONS1	3
Ap	pendix 1. Maps of NUTS level 216	6
Ар	pendix 2. Example of Soft wheat (winter) growth stages for Europe	51

# Foreword

The present report was prepared within the context of the work package WP2 ('High resolution scenario-based spatial zonation') of the FOOTPRINT project (http://www.eufootprint.org).

The preferred reference to the present document is as follows:

Centofanti T. & Hollis J. (2006). Characteristics of European agronomic scenarios. Report DL11 of the FP6 EU-funded FOOTPRINT project [www.eu-footprint.org], 36p.

Thanks are due to Patricia Bellamy, Ian Truckell, and Andrew Rayner (Natural Resources Department, School of Applied Sciences, Cranfield University, United Kingdom).

# **Executive summary**

The definition of agronomic scenarios for the EU is part of work package 2: high resolution scenario-based spatial zonation. The aim of this activity is to provide a set of generic scenarios that characterize the complete spectrum of European agricultural environments with respect of pesticides usage.

A list of FOOTPRINT crops of interest has been defined and templates for the critical crop growth stages required by the models to be used have been derived. When possible, application dates of pesticides have been included in the template. In order to identify areas homogeneous for selected agricultural practices, EU administrative areas at NUTS (Nomenclature of Territorial Units for Statistics) level 2 have been grouped together according to the similar crop growth stages.

Broad types of agriculture at a very fine spatial resolution (250 m x 250 m grid) have been identified using CORINE 2000. The CORINE-based land classes are currently being intersected with the NUTS level 2 maps and to each CORINE land cover-NUTS-2 combination attributes defining the crops present and their cover expressed as a percentage of the total agricultural area are being derived.

In addition a Principal Component Analysis has been carried out to define a set of socioagronomic zones within Europe that group together NUTS level 2 areas according to their similarity with respect to: i) different crops, ii) the size range of farm holdings, iii) economic size of farm holdings, iv) age of the holders, and v) type of labour force fully employed in the farm. At this stage it is envisaged that the information will most likely be used to inform the piloting and evaluation of the FOOTPRINT tools (work package 6) and to improve their communication and dissemination (work package 7).

#### 1 INTRODUCTION

FOOTPRINT aims at developing a suite of three pesticides risk prediction and management tools, for use by farmers and extension adviser at the farm scale, water managers at the catchment scale, and policy makers at the national scale. The tools are based on knowledge of processes, factors, and agricultural/landscape characteristics influencing pesticides fate and behaviour in the environment across Europe.

To provide estimates of pesticides concentrations in surface and groundwater FOOTPRINT will use refined pesticides fate models (MACRO and PRZM). The approach proposed in FOOTPRINT to characterize the spatial variation in model inputs is based on the identification of agro-environmental scenarios representing land areas that are homogeneous with respect to the critical factors that control pesticides fate. Within this context, the overall objective of work package 2 is to develop and apply a methodology for defining generic scenarios that characterize European agricultural environment that determine the fate of agriculturally applied pesticides within Europe. The agro-environmental scenarios are composed of a combination of four scenarios: soils scenarios, climatic scenarios, subsoil scenarios, and agronomic scenarios.

Agronomic scenarios are defined as areas in Europe where the dates of specific crop growth stages, and therefore the pesticide usage practices associated with them, are similar. The identification of such areas is based on EU administrative areas at NUTS level 2 because statistical data on specific crop coverage across Europe is available at this level of detail. Within these areas, the precise location of individual crops is identified using the CORINE 2000 land cover dataset. Although specific crops are not categorised in this dataset, it does identify classes of broad types of agricultural land at a very fine spatial resolution (250 m x 250 m grid cells). Integration of the CORINE 2000 land categories with the NUTS-2 crop statistics thus enables the identification of parcels of land on which a range of specific crops are likely to be grown.

A range of other agricultural statistics are available at NUTS level 2 resolution and these are currently being analysed to investigate whether they can provide useful information on factors other than cropping that may affect the usage of pesticides in different parts of Europe.

In addition we have produced a set of socio-agronomic zones within Europe that group together NUTS level 2 areas according to their similarity with respect to: i) different crops, ii)

the size range of farm holdings, iii) economic size of farm holdings, iv) age of the holders, and v) type of labour force fully employed in the farm.

Methods and results are presented in the following sections.

#### 2 METHODOLOGY AND RESULTS

#### 2.1 Template of crop growth stages

#### 2.1.1 Sources of data

Data for France, Sweden and Greece have been provided by Benoit Real (ARVALIS, France), Nick Jarvis (SLU, Sweden), and Evangelia Evavoulidou (NAGREF, Greece), respectively. Data for UK have been provided by Ian Holman (Cranfield University). Data for Czech Republic, Hungary, Estonia, Latvia, Lithuania, Slovenia, Poland, and Slovakia have been obtained from the studies in support to the Monitoring of Agriculture with Remote Sensing, MARS project (MOCA, 2003). Data for Portugal, Austria, Finland, and some regions in South-West England are based on Saur et al. (2001). Data for Denmark will be provided by Jeanne Kjaer (GEUS, Denmark). For Italy and Spain data are based on Narciso *et al.* (1992). Data for Germany have been obtained from the National Weather Information Office. The complete version of the template has been circulated both among FOOTPRINT project's partners and among some members of the Advisory Committee for a final cross-check and completion of the template.

#### 2.1.2 Description of the template

Templates of the growth stages for FOOTPRINT crops of interest (listed in Table 1) for the NUTS level 2 of the 23 European countries have been created as Excel files. Examples of the template for soft wheat are given in Appendix 2.

In the template all the 252 NUTS level 2 of the 23 EU countries are indicated although only the ones that have been highlighted (in bold and italic) produce the crop, i.e. have a crop cover area >0 according to the NUTS level 2 statistics. This information is provided in order to roughly estimate how relevant the crop production is in the country analysed. The following growth stages have been considered: sowing, germination, shooting or stem elongation, flowering, maturity, and harvest. These stages were selected because they relate

both to data required by the FOOTPRINT models and because of their relevance for pesticide usage. When the information was available, pre-emergence and the post-emergence application of pesticides have been indicated in the template. Early sowing and late sowing varieties have been taken into account.

The dates shown in the template indicate an average  $\pm$  2weeks of the whole crop growth time range. In some cases, there can be important differences in time between areas within one region (NUTS) and this results in an extended set of dates for a specific crop growth stage. All unique combinations of crop growth stages and NUTS level 2 have been identified and reported in a separate template and an example for the soya crop shown in Figure 1. Finally, a summary list of NUTS level 2 units with similar crop growth stages for each crop has been compiled to assist in the development of the FOOT tools during work package 5 (data not shown in the report).

The results show that the growth stages of the different crops vary considerably between regions within a country and between countries. Thus, combinations of unique NUTS level 2 and crop growth stages are possible only between some NUTS level 2 within a country.

List of crops used to define crop growth stages
Barley winter
Barley spring
Cotton
Durum wheat winter
Durum wheat spring
Flax
Tomatoes
Maize fodder
Maize grain spring
Maize grain summer
Rape
Sunflower
Olive plantation
Orchard
Potato winter
Potato main crop
Potato early
Field peas
Beans
Lentils
Soya late sowing

List of crops used to define crop growth stages		
Soya early sowing		
Rye		
Soft wheat winter		
Soft wheat spring		
Sugar beet winter		
Sugar beet spring		
Tobacco		
Vineyards		

Table 1. List of crops used for the definition of crop growth stagesEarly sowing and late sowing varieties have been taken into account.



Figure 1. Example of unique combination of NUTS level 2 and crop (Soya) growth stages

### 2.2 Identification of land use patterns in Europe using CORINE 2000

Data on crop cover area and agricultural area at the NUTS level 2 have been obtained from the EUROSTAT dataset (EUROSTAT, 2006). The relative crop cover area expressed as a percentage of the agricultural area for each NUTS2 has been calculated and an example is shown in Figure 2. For some NUTS2 regions the data from Eurostat are not consistent because the crop cover area is higher than the agricultural area. Thus, these data are currently being cross-checked by the project partners.



Figure 2. Example of soft wheat cover area expressed as percentage of agricultural area of NUTS level 2 Bold black lines indicate NUTS level 2 where the crop cover area is higher than the agricultural area

The CORINE 2000 land cover dataset has been used to define a precise spatial location of cropped areas within each NUTS level 2. CORINE 2000 identifies land cover at three levels of detail. Agricultural areas are differentiated at level 1 and are separated into Arable land, Permanent crops, Pastures and Heterogeneous Areas at level 2. At the third and most detailed level, Arable land is divided into:

Non (permanently) -irrigated arable land; permanently irrigated land; rice fields; vineyards; fruit trees & berry plantations; olive groves; pastures; annual crops associated with permanent crops; complex cultivation patterns; land principally occupied by agriculture with significant areas of natural vegetation; Agro-forestry areas.

The CORINE data allow the identification of broad types of agriculture at a very fine spatial resolution (250 m x 250 m) and the detection of land use patterns (i.e. extensive areas used for arable crops with adjacent areas of permanent crops) across Europe.

Using GIS, the CORINE-based land classes are currently being intersected with the NUTS level 2 maps and, to each CORINE land cover-NUTS-2 combination, attributes defining the crops present and their cover expressed as a percentage of the CORINE land category are being derived. An example of this derivation is shown in Table 2.

Crop type	Crop cover area as % of agricultural area (EUROSTAT)	CORINE 2000 land classes (level 3)	% cover in CORINE class
Barley	8.81		17.5
Durum wheat	2.01		4.8
Fresh vegetables	0.62		1.6
Maize fodder	1.44		3.1
Maize grain	11.13		24.2
Oilseed	9.64		27.7
Potato	0.21	Non-irrigated arable land	0.6
Pulse	3.3		8.9
Rape seed	3.92		11.6
Rye	1.91		6.4
Soya	2.94		10.5
Sugar beet	2.42		2.5
Sunflower	1.91		2.0
		Permanently irrigated land	0
		Rice fields	0
Vineyards	7.94	Vineyards	100
Fruit trees and	0.67	Fruit trees and berry plantations	
berry plantations			100
		Olive groves	0
Pastures	12.01	Pastures	100
		Annual crops associated with permanent crops	0
		Complex cultivation patterns	0
		Land principally occupied by agriculture, with significant areas of natural vegetation	0
		Agro-forestry areas	0

# Table 2. Example of derivation of the percentage crop cover per CORINE land cover category for NUTS2 unit AT 11 (Burgenland)

## 2.3 Analysis of cropping and other agricultural statistics at NUTS level 2 resolution

## 2.3.1 Methodology

The following variables have been used to define a set of socio-agronomic areas:

- Crop coverage (1000 ha)
- Size of holding (1000 ha) (Holding: technical-economic unit under single management engaged in agricultural production)
- Economic size of holding (ESU, European Size Unit, 1 ESU=1200 €of Standard Gross Margin)
- Type of Labour force (AWU, Annual Work Unit, equivalent to fulltime employment)
- Holder's age (years)
- Standard Gross Margin of the holding (Million  $\oplus$

Data have been obtained from EUROSTAT (2006) but wherever possible have been crosschecked with regional agricultural statistics from national census data.

Principal Component Analysis and K-means cluster analysis were then carried out to define a set of socio-agronomic zones within Europe that group together NUTS level 2 areas according to their similarity with respect to the above mentioned variables.

#### 2.3.2 Statistical analysis

All data expressed in ha (crops, AA of holdings, and economic size) were square roottransformed, while the rest of data were log-transformed.

Principal Component Analysis (PCA) was performed using STATISTICA (Release 7, Statsoft, Inc., 2006). NUTS were first divided into Northern and Southern regions by using Olive plantation as a discriminatory crop. PCA was performed twice in order to reduce the number of variables from 45 to 24: 16 variables for the Southern region and 18 variables for the Northern region. This obtained a clear distinction of the NUTS into homogeneous groups (4 groups for the Southern European countries and 6 groups for the Northern European countries), which need to be indicated in the k-means cluster analysis.

The k-means cluster analysis showed that 3 groups define the variability within Southern European countries and 6 groups define the variability between Northern European countries (Figure 3).



Figure 3. Initial set of 9 socio-agronomic zones across Europe resulting from the k-means cluster analysis of NUTS level 2 units

Following the initial k-means cluster analysis, NUTS level 2 units within each of the 9 clusters were further grouped using a tree-clustering technique: 70 homogeneous areas across Europe were identified. An example of the 4 homogeneous areas classified within cluster 1 is shown in Figure 4 and a description of their unique characteristics is shown in Table 3.



Figure 4. Subdivision of cluster 1 (Northern Europe) following tree cluster analysis.

Sub-group area	Crop cover area (ha)	Size of farm holding (ha)	Economic size of farm holding (ESU)	Type of labour Force (AWU)	Standard gross margin (Million €)
1	Soft wheat, maize fodder, maize grain, Oilseed, sugar beet, vineyards	Large (30 to > 50 ha)	Large areas with 40 to >100 ESU	Farms employing half external labour force (ELF), few holders working full-time (age 44- 54 years)	Highest
2	Soft wheat, maize grain, Oilseed	>50ha but half area of Sub- group1	Some 2 to 4 ESU and some >100ESU	Farms employing 30% ELF, holders working full-time (age 44- 54 years)	lowest
3	Oilseed, rye, maize fodder, soft wheat, sugar beet	Almost all >50 ha	>100ESU	Sub-contracted farms employing 80% ELF	Medium (half of sub- group 1)
4	Soft wheat, vineyards, sugar beet, rye	From 10 to >50ha, equally distributed	40 to 100 ESU, 2 to 4 ESU	Farms employing 10% ELF, holders working full-time (age 44- 54 years)	Medium (half of sub- group 1)

Table 3. Summary of the characteristics of the 4 homogeneous areas (sub-groups) shown in Figure 4

#### 3 CONCLUSIONS AND PERSPECTIVES

The data compiled in the crop growth stage templates is clearly generalised as there are many uncertainties related to farmers' decisions and their dependence on suppliers/contractors, yearly weather variations, soil type, crop varieties used and other unknown factors. It is designed specifically for use in developing the MACRO and PRZM meta-modelling data and, if used outside the FOOTPRINT project, should be carefully cross-checked with local data.

The current dataset of unique combinations of NUTS level 2 and crop growth stages should be considered as a  $\beta$  version as all the data is being cross-checked with the FOOTPRINT project's partners.

Use of the set of socio-agronomic zones is currently under discussion. Because of the crude resolution of the data and its limited number of variables, the zones will not be used to try and modify pesticide applications used in the modelling or to refine the final agro-environmental scenarios that will be the end product of work package 2. Following discussion with the project's partners and stakeholders it is envisaged that the information will most likely be

used to inform the piloting and evaluation of the FOOTPRINT tools (work package 6) and to improve their communication and dissemination (work package 7). Further work to investigate the possibility of refining the zones and integrating the data with other studies on the socio-agronomic aspects of farm holdings in European countries will continue following completion of work package 2.

### 4 **REFERENCES**

EUROSTAT (2006). www.epp.eurostat.ec.europa.eu.

- MOCA study. Crop Monographies on Candidate Countries. 2003. Final report. European Commission, Joint Research Centre, 440p.
- Narciso G., Ragni P., and Venturi A. 1992. Agro meteorological aspect of crops in Italy, Spain and Greece. ECSC-EEC-EAEC, Brussels, Luxembourg.
- Saur R., Strobel D., Stammler G., and Scherer M. 2001. Development of Growth Stages of Crops in Different European Regions for the FOCUS Groundwater scenarios. Final report. BASF Aktiengesellschaft, AP Agricultural Products Division, 67114 Limburgerhof, Germany, 25p.

#### 5 LIST OF ABBREVIATIONS

AWU	Annual Work Unit (equivalent to full employment)
ESU	European Size Unit (1 ESU=1200€of Standard Gross Margin)
NUTS	Nomenclature of Territorial Units for Statistics
PCA	Principal Component Analysis
ELF	External (non-family) labour force

## Appendix 1

Maps of NUTS level 2 administrative units and their associated NUTS level 2 codes.

## Austria and Slovenia



AT	Austria
A T 4 4	<b>D</b>

- Burgenland Niederoesterreich AT11
- AT12
- AT13 Wien
- AT21 Kaernten
- AT22 Steiermark
- AT31 Oberoesterreich Salzburg
- AT32
- AT33 Tirol
- AT34 Vorarlberg
- SI Slovenia Slovenija SI00

## **Belgium and the Netherlands**



- BE Belgium
- BE00 Belgique / Belgie
- BE10 Reg.bruxelles-cap./brussels Hfdst. Gew.
- BE21 Antwerpen
- BE22 Limburg (b)
- BE23 Oost-vlaanderen
- BE24 Vlaams Brabant
- BE25 West-vlaanderen
- BE31 Brabant Wallon
- BE32 Hainaut
- BE33 Liege
- BE34 Luxembourg (b)
- BE35 Namur
- NL The Netherlands
- NL11 Groningen
- NL12 Friesland
- NL13 Drenthe
- NL21 Overijssel
- NL22 Gelderland
- NL23 Flevoland
- NL31 Utrecht
- NL32 Noord-holland
- NL33 Zuid-holland
- NL34 Zeeland
- NL41 Noord-brabant
- NL42 Limburg (nl)
- LU Luxembourg
- LU00 Luxembourg (grand-duche)

## Czech Republic



Czech Republic
Praha
Stredni Cechy
Jihozapad
Severozapad
Severovychod
Jihovychod
Stredni Morava
Moravskoslezsko

## Denmark



DKDenmarkDK00Denmark

## Estonia, Latvia, and Lithuania



EE	Estonia
EE00	Eesti
LV	Latvia
LV00	Latvija
LT	Lithuania
LT00	Lietuva

#### France



- FR France
- Ile De France FR10
- FR21 Champagne-ardenne
- FR22 Picardie
- FR23 Haute-normandie
- FR24 Centre
- FR25 Basse-normandie
- FR26 Bourgogne
- Nord-pas-de-calais FR30
- FR41 Lorraine
- FR42 Alsace
- FR43 Franche-comte
- FR51 Pays De La Loire
- FR52
- Bretagne Poitou-charentes FR53
- Aquitaine FR61
- FR62 Midi-pyrenees
- FR63 Limousin
- FR71 Rhone-alpes
- FR72 Auvergne
- FR81 Languedoc-roussillon
- FR82 Provence-alpes-cote D'azur
- FR83 Corse
- FR91 Guadeloupe
- Martinique FR92
- FR93 Guyane
- FR94 Reunion

## Germany



DE	Germany
DE11	Stuttgart
DE12	Karlsruhe
DE13	Freiburg
DE14	Tuebingen
DE21	Oberbayern
DE22	Niederbayern
DE23	Oberpfalz
DE24	Oberfranken
DE25	Mittelfranken
DE26	Unterfranken
DE27	Schwaben
DE30	Berlin
DE40	Brandenburg
DE50	Bremen
DE60	Hamburg
DE71	Darmstadt
DE72	Giessen
DE73	Kassel
DE80	Mecklenburg-vorpommern
DE91	Braunschweig
DE92	Hannover
DE93	Lueneburg
DE94	Weser-Ems
DEA1	Duesseldorf
DEA2	Koeln
DEA3	Muenster
DEA4	Detmold
DEA5	Arnsberg
DEB1	Koblenz
DEB2	Trier

DEB3	Rheinhessen-pfalz
DEC0	Saarland
DED1	Chemnitz
DED2	Dresden
DED3	Leipzig
DEE1	Dessau
DEE2	Halle
DEE3	Magdeburg
DEF0	Schleswig-holstein
DEG0	Thueringen

### Greece



- Page 22 -

- Anatoliki Makedonia, Thraki Kentriki Makedonia GR11
- GR12
- Dytiki Makedonia Thessalia
- GR13 GR14
- GR21 Ipeiros
- GR22
- GR23
- Ionia Nisia Dytiki Ellada Sterea Ellada GR24
- Peloponnisos Attiki GR25
- GR30
- GR41
- Voreio Aigaio Notio Aigaio GR42
- GR43 Kriti

## Hungary and Slovakia



- Kozep-magyarorszag Kozep-dunantul HU01
- HU02
- HU03 HU04
- Nyugat-dunantul Del-dunantul Eszak-magyarorszag Eszak-alfold Del-alfold HU05
- HU06 HU07
- SK Slovakia
- SK01
- Bratislavsky Zapadne Slovensko SK02
- SK03 Stredne Slovensko
- SK04 Vychodne Slovensko

## Italy and Malta



- Italy IT
- IT11 Piemonte
- Valle D'aosta IT12
- IT13 Liguria
- IT20 Lombardia
- Trentino-alto Adige IT31
- IT32 Veneto
- IT33 Friuli-venezia Giulia
- IT40 Emilia-romagna
- IT51 Toscana
- IT52 Umbria
- Marche IT53
- IT60 Lazio
- IT71 Abruzzo
- IT72 Molise
- IT80 Campania
- Puglia Basilicata IT91
- IT92
- Calabria IT93
- ITA0 Sicilia
- Sardegna ITB0
- Malta МΤ
- MT00 Malta

## Poland



PL	Poland

- PL01 Dolnoslaskie
- PL02 Kujawsko-pomorskie
- PL03 Lubelskie
- PL04 Lubuskie
- PL05 Lodzkie
- PL06 Malopolskie
- PL07 Mazowieckie
- PL08 Opolskie
- PL09 Podkarpackie
- PL0A Podlaskie
- Pomorskie PL0B
- PL0C Slaskie
- PL0D
- Swietokrzyskie Warminsko-mazurskie **PL0E**
- PL0F Wielkopolskie
- PL0G Zachodniopomorskie

## Spain and Portugal



ES	Spain	PT
ES11	Galicia	PT11
ES12	Asturias	PT12
ES13	Cantabria	PT13
ES21	Pais Vasco	PT14
ES22	Navarra	PT15
ES23	La Rioja	PT20
ES24	Aragon	PT30
ES30	Comunidad De Madrid	
ES41	Castilla Y Leon	
ES42	Castilla-la Mancha	
ES43	Extremadura	
ES51	Cataluna	
ES52	Comunidad Valenciana	
ES53	Illes Balears	
ES61	Andalucia	
ES62	Region De Murcia	
ES63	Ceuta Y Melilla	
ES70	Canarias	

## Portugal

Norte
Centro (p)
Lisboa E Vale Do Tejo
Alentejo
Algarve
Acores
Madeira

## Sweden and Finland



#### SE Sweden

- SE01 Stockholm
- SE02 Oestra Mellansverige
- SE04
- Sydsverige Norra Mellansverige SE06
- SE07 Mellersta Norrland
- SE08 **Oevre Norrland**
- SE09 Smaaland Med Oearna
- SE0A Vaestsverige
- FI Finland
- FI13 Ita-suomi
- Vali-suomi FI14
- FI15 Pohjois-suomi
- Uusimaa FI16
- Etela-suomi FI17
- FI20 Aaland

## **United Kingdom and Ireland**



#### UK **United Kingdom**

- UKC1 Tees Valley & Durham
- UKC2 Northumberland And Tyne & Wear
- UKD1 Cumbria
- UKD2 Cheshire
- Greater Manchester UKD3
- UKD4 Lancashire
- UKD5 Merseyside
- East Riding & North Lincolnshire UKE1
- UKE2 North Yorkshire
- UKE3 South Yorkshire
- UKE4 West Yorkshire
- UKF1 Derbyshire & Nottinghamshire
- UKF2 Leicestershire, Rutland & Northants
- UKF3 Lincolnshire
- UKG1 Herefordshire, Worcestershire & Warks
- UKG2 Shropshire & Staffordshire
- West Midlands UKG3
- East Anglia UKH1
- UKH2 Bedfordshire & Hertfordshire
- UKH3 Essex
- UKI1 Inner London
- UKI2 Outer London
- UKJ1 Berkshire, Bucks & Oxfordshire
- UKJ2 Surrey, East & West Sussex
- UKJ3 Hampshire & Isle Of Wight
- UKJ4 Kent
- UKK1 Gloucestershire, Wiltshire & North Somerset
- UKK2 **Dorset & Somerset**
- Cornwall & Isles Of Scilly UKK3

#### UKK4 Devon UKL1 West Wales & The Valleys UKL2 East Wales UKM1 North East Scotland

- Eastern Scotland
- UKM2
- South Western Scotland UKM3
- UKM4 **Highlands And Islands** Northern Ireland
- UKN0
- IE Ireland
- IE01 Border, Midlands And Western
- IE02 Southern And Eastern

## Appendix 2

Example of Soft wheat (winter) growth stages for Europe

Sowing, germination, shooting or stem elongation, flowering, maturity, and harvest have been considered; application dates of pesticides are also included.

## Czech Republic

	septe	mber	1		octo	ber			no	ven	aber	8		dec	amb	er		jan	uary	6		Fel	brua	y .		n	ard	î			Apri	il			may	1			jun	e			jul	1			aut	ust		
cz	1wk	ZWK 3V	nk i	4wk	1wk	2wk	3wk	4:45	c 1w	k [2	wk 3	wk	4wk	1wk	2wk	3wk	4w4	1₩5	2w	3w4	444	( 1wi	k 2w	k 3w	k 4w	rk 11	wk 2	WK 3	łwk	4wk	1wk	24%	3wk	4wk	Twk	24%	3wk	4wk	1w1	21	k 3w	( 4w	k Iw	x 2w	k 3wk	4w/	< 1ws	2wk	3wk	4wk
CZ01						-		1	Г	Т						1	1	<b>—</b>	1	1		Г	1	1	T	Т							1	1										T						
CZ02																										Т																								
CZ03													-																-									1												
CZ04		-										_	-																																					
CZ05										Т																																								
CZ06		-									-																																		-					
CZ07												-																																						
CZ08																																																		

	SOWING
	GERMINATION
	SHOOTING
	FLOWERING
	MATURITY
	HARVEST
uui,	PRE-EMERGENCE APPLICATION (HERBICIDES)
	POST-EMERGENCE APPLICATION (HERBICIDES)
	OVERLAY OF SOWING AND GERMINATION
	OVERLAY OF MATURITY AND HARVEST
	OVERLAY OF SOWING, GEMINATION, AND PRE-EMERGENCE APPLICATION
	OVERLAY OF SOWING, GERMINATION AND POST-EMERGENCE APPLICATION
	OVERLAY OF SOWING, GERMINATION, PRE-EMERGENCE AND POST-EMERGENCE APPLICAT
	OVERLAY OF SOMING, BRE EMERGENCE AND ROST EMERGENCE ARRIVATION

## Germany

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OVERLAY OF SOWING AND GERMINATION
OVERLAY OF MATURITY AND HARVEST
OVERLAY OF SOWING, GEMINATION, AND PRE-EMERGENCE APPLICATION
OVERLAY OF SOWING, GERMINATION AND POST-EMERGENCE APPLICATION
OVERLAY OF SOWING, GERMINATION, PRE-EMERGENCE AND POST-EMERGENCE APPLICAT
OVERLAY OF SOWING, PRE-EMERGENCE AND POST-EMERGENCE APPLICATION

## Spain

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OVERLAY OF SOWING, GERMINATION, PRE-EMERGENCE AND POST-EMERGENCE APPLICAT OVERLAY OF SOWING, PRE-EMERGENCE AND POST-EMERGENCE APPLICATION

#### Greece

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PRE-EMERGENCE APPLICATION (HERBICIDES)
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OVERLAY OF SOWING AND GERMINATION
OVERLAY OF MATURITY AND HARVEST
OVERLAY OF SOWING, GEMINATION, AND PRE-EMERGENCE APPLICATION
OVERLAY OF SOWING, GERMINATION AND POST-EMERGENCE APPLICATION
OVERLAY OF SOWING, GERMINATION, PRE-EMERGENCE AND POST-EMERGENCE APPLICAT
OVERLAY OF SOWING, PRE-EMERGENCE AND POST-EMERGENCE APPLICATION

## Hungary

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### Latvia

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#### OVERLAY OF SOWING, PRE-EMERGENCE AND POST-EMERGENCE APPLICATION

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## United Kingdom



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