Assessment of the impact on crop protection in the UK of the 'cut-off criteria' and substitution provisions in the proposed Regulation of the European Parliament and of the Council concerning the placing of plant protection products in the market

This assessment has been prepared as a supplement to the regulatory impact assessment for this proposal

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Contents

Executive summary

This document presents an analysis of the potential impact of the Commission proposal on ‘cut-off criteria’ and substitution and an analysis of the amendments proposed by the European Parliament. The analysis is presented both in terms of substances affected and the impact on crop protection from their loss.

Nearly 300 substances have been assessed including the majority of conventional chemicals. Some of the impacts are difficult to establish because the criteria are not yet fully defined. This is particularly the case for endocrine disruption.

The Commission proposals could remove up to 15% of the substances assessed, some of which are particularly important in the UK for protection of minor crops such as carrots and parsnips. It is possible that the endocrine disruptor criteria could impact particularly on fungicide availability and might result in 20-30% yield losses in cereals.

The Parliament proposals include a single approval period for candidates for substitution of five years and could result in the loss of up to 85% of conventional chemical substances after that period. If the full potential impact of the current Parliament proposals were realised, conventional commercial agriculture in the UK (and much of the EC) as it is currently practised would not be achievable, with major impacts on crop yield and food quality.

1. Objective

To give an indicative impact for crop protection in the UK of the proposals of the European Commission and the amendments of the European Parliament.

2. Background

In Annex II to the proposed Regulation, the Commission sets out criteria for approval of active substances and candidates for substitution. The impact assessment published by the Commission did not address these criteria.

The Parliament proposed a range of amendments and additions to these criteria. It did not provide an impact assessment for these proposals.

Widely different (percentage) figures have been provided by the Commission, the industry and NGOs* on the impact of these proposals. These differences appear to depend on the number of substances analysed and the extent to which already established classification, rather than potential for classification, has been applied. These analyses do not address impact in terms of plant protection but simply numbers.

The UK has therefore attempted to produce a transparent assessment of both active substance availability and agronomic impact to inform the EC negotiations.

3. Approval criteria

3.1 The following is a summary of the key criteria in the Commission proposal:

- no category 1 or 2 CMR unless exposure ‘negligible’;
- no endocrine disruptor unless exposure ‘negligible’;
- no POPs;
- no PBT;
- no vPvB.

* See glossary for abbreviations

The following would be candidates for substitution:

- where the ADI, ARfD or AOEL is significantly lower than those for the majority of approved substances;

- it meets two criteria to be a PBT.

3.2 The following is a summary of the amendments proposed by the Parliament to the criteria for approval in addition to the Commission proposal:

- no substances considered to cause a risk of developmental neurotoxic or immunotoxic properties;

- changes to the POP criteria and taking each of the criteria separately rather than together as in the Commission proposal;

- inclusion of C and M category 3 as a reason to classify substances as T in the PBT criteria;

- hazard quotient for bees not higher than 50;

- no substances on priority list for water in Directive 2000/60/EC.

The following is a summary of the amendments proposed by the Parliament to the criteria for candidates for substitution in addition to the Commission proposal:

- it meets one criteria to be a PBT;

- it is prone to leaching to groundwater;

- it has potentially endocrine disrupting, neurotoxic or immunotoxic properties.

In addition, the Parliament proposed that candidates for substitution be approved once only for a period of five years.

4. <u>Methodology</u>

4.1 286 substances have been examined. These substances are those included in Annex I to Directive 91/414/EEC and existing substances currently being reviewed under the Directive, including those that are to be withdrawn voluntarily under Commission Regulation 1095/2007.

The following have been excluded:

- substances which are likely not to be included in Annex I and may be withdrawn immediately, as a result of the procedure in Commission Regulation 1095/2007;

- substances on list 4 of the review programme (these include micro-organisms, plant and animal extracts, attractants and repellents, rodenticides and commodity substances);

- new active substances not yet included in Annex I.

A full list of the substances analysed is provided in Annex I

4.2 With respect to each of the criteria, the following assessment has been made.

4.2.1 CMR – based on either agreed classification, EFSA conclusions, EFSA peer review expert meeting reports or the DAR.

4.2.2 Endocrine disruption. This criterion is very difficult to assess, given that no study guidelines or assessment criteria have been agreed. The substances identified here are those identified with endocrine disrupting properties in the Commission sponsored reports for the Community strategy on endocrine disruptors[1], all triazole fungicides and prochloraz based on a report published by the Danish Ministry of Environment [2] and in one case information from a DAR. DARs have, however, not been systematically examined for these effects, because the reporting is very variable given the lack of guidelines. It is clearly possible that, when the study guidelines and assessment criteria are developed, other substances may meet this criterion or that substances identified here would not.

4.2.3 Reference values (ADI, AOEL and ARfD) have been taken from Commission review reports, EFSA conclusions, end points in peer review or the DAR. Significantly lower has been interpreted as below or equal to ADI and AOEL of 0.001 and ARfD of 0.01, based on a proposal of the Portuguese Presidency in the Council.

4.2.4 POP, PBT and vPvB criteria are again difficult to assess without the full guidance in place. It is notable that the OECD Working Group Pesticides is to develop guidance on evaluation of PBT substances.

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[1] http://ec.europa.eu/environment/endocrine/documents/bkh_report.pdf#page=1
http://ec.europa.eu/environment/docum/pdf/bkh_main.pdf

[2]

http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publications/2007/978-87-7052-538-1/html/default.htm

Data for this assessment have again been taken from Commission review reports, EFSA conclusions, end points in peer review or the DAR.

4.2.5 Developmental neurotoxic or immunotoxic properties – it is assumed that no substances are affected.

4.2.6 Effects on bees. Where included the hazard quotient has been taken from Commission review reports, EFSA conclusions, end points in peer review or the DAR. Where the hazard quotient figure was not readily available high toxicity to bees has been taken as an indicator of a high hazard quotient. For some substances, bee toxicity information was not available if the representative use did not require such an assessment e.g. indoor use.

4.2.7 Groundwater concerns have been identified either through a requirement to pay special attention to groundwater as part of the Annex I inclusion or, for substances not in Annex I, the number of acceptable scenarios in the end points.

4.2.8 The Parliament proposal for additional criteria for candidates for substitution (potentially endocrine disrupting, neurotoxic or immunotoxic properties) has not been assessed. The majority of substances are caught by other criteria anyway.

5. Disclaimer

This assessment is intended to provide an indicative assessment of the impact of these proposals on crop protection in the UK. **It is not intended to be a definitive list of substances that will be affected by these criteria and this analysis is not a substitute for thorough evaluation using, where appropriate, new guideline studies and assessment criteria**. As can be seen in Section 4 above some of these criteria are not well defined and it is inevitable that, in analysing nearly 20 different criteria for nearly 300 substances, there is scope for different interpretations.

6. Overview

The potential impact on individual substances is set out in Annex 2 to 5:

Annex 2 Active substances that may not be approved according to the Commission criteria

Annex 3	Active substances that may be candidates for substitution according to the Commission criteria
Annex 4	Active substances that may not be approved according to the Parliament criteria
Annex 5	Active substances that may be candidates for substitution according to the Parliament criteria

The potential impact in terms of the percentage reductions in available active substances are summarised below.

<u>Commission proposal</u>

Cut-off criteria – the higher figure includes possible endocrine disruptors:

Insecticides	6 to 10 % not approved (UK 5 to 10%)
Fungicides	8 to 32 % not approved (UK 7 to 35%)
Herbicides	4 to 10 % not approved (UK 5 to 12%)

Overall impact (all ppps) 5 to 15% (EC figure)

Candidates for substitution – percentage of what remains assuming lower figure for losses through non-approval:

Insecticides	38%
Fungicides	20%
Herbicides	24%

Total candidates for substitution 24 % (EC figure)

<u>Parliament proposal</u>

Cut-off criteria – again, the higher figure includes possible endocrine disruptors:

Insecticides	65% not approved (UK 66%)
Fungicides	31 to 43 % not approved (UK 35 to 49%)
Herbicides	25 to 31 % not approved (UK 27 to 33%)

Overall impact (all ppps) 35 to 40% (EC figure)

Candidates for substitution – percentage of what remains (approved once only, for five years):

Insecticides	77%
Fungicides	64%
Herbicides	86%

Total candidates for substitution 71% (EC figure)

Overall impact (cut-off criteria or substitution):

Insecticides	92% (from total 62)
Fungicides	80% (from total 83)
Herbicides	91% (from total 113)

Overall impact (all ppps) 82% (EC figure)

Overall impact chemical ppps (excluding micro-organisms) 85% (EC figure)

7. <u>Implications for conventional crop protection in the UK</u>

7.1 Summary

The Commission proposals could remove some substances which are particularly important in the UK for protection of minor crops such as carrots and parsnips. It is possible that the endocrine disruptor criteria could impact particularly on fungicide availability and might result in 20-30% yield losses in cereals.

If the full potential impact of the current Parliament proposals were realised, conventional commercial agriculture in the UK (and much of the EC) as it is currently practised would not be achievable, with major impacts on crop yield and food quality. The proposals would also have very significant impact in amenity and industrial situations where weed control is important.

7.2 General issues

This section presents examples of some of the potential implications of the different proposals for substances which are currently available in the UK. However, the breadth and scale of the potential losses of active substances, particularly from the Parliament proposals, are so large that clearly identifying all the potential and significant impacts is not possible without substantial further research. The text below therefore endeavours to provide illustrations of where some of the more significant impacts may be expected. Generally the impacts of specific pests, weeds or diseases are considered. However cumulative impacts would be experienced where fungicides, insecticides and herbicides are no longer available on a particular crop.

These proposals need to be considered against the background of substantial losses of active substances which have already occurred as a result of the EC review programme under Directive 91/414/EEC.

There is also a potentially severe impact on resistance management. Effective resistance management is reliant on having different modes of action (including non-chemical methods) incorporated into strategies to reduce selection pressure and thus minimise the likelihood of resistance development. With reliance on fewer active substances, opportunity for choice is reduced and risk of resistance substantially increased.

Similarly, integrated pest management (IPM) is reliant on having diversity of active substances so, where possible or appropriate, selective or short persistence compounds can be utilised. The scale and magnitude of the potential losses, particularly from the Parliament's proposals, would undermine both resistance management and IPM. The former could also have implications for pest management on a global scale if resistance strains selected as a result of intensive use of surviving active substances spread from Europe, either directly or via the transport of plant material or food produce.

The analysis conducted does not consider the impact on substances in list 4 of the current review programme. This list includes some compounds that can provide a useful contribution to pest control, particularly in the insecticide arena, with substances such as *Bacillus thuringiensis*, nicotine, fatty acids and pyrethrins. There are also insecticidal substances such as pheromones for moth control and fungi for aphid control. However they generally do not deliver the level, persistence or consistency of control delivered by conventional chemistry. As such they are commonly used in conjunction with conventional chemistry (to ensure populations are reduced sufficiently) or in partnership with biological control agents in protected situations (where control by introduction of parasites and predators can be more reliable due to the more consistent environmental conditions). Whilst an increase in frequency of their use might lead to higher levels of control of some pests, this would lead to increased problems with resistance, present already for many of these substances. In the herbicide and fungicide area, the diversity of list 4 compounds is much more limited, and (with the exception of sulphuric acid widely used for potato haulm desiccation and ethylene as a PGR) they only provide a small contribution to the control of weeds and diseases, or have very specific and limited application.

Further details of the impacts on plant protection are provided in Annex 6.

7.3 Implications of the Commission proposals for active substance approval criteria

Specific issues:

- non-approval of the triazole compounds (possible endocrine disruptors) would remove the foundation stone of control programmes for the major disease of wheat in the UK, *Septoria tritici*, with potential for 20-30% yield losses;

- significant implications for minor crops such as carrots, parsnips and onions because the majority of currently approved herbicides may no longer be available. For weed control the sensitivity of the crop to herbicides means that many active substances may be unsuitable on a particular crop even though they may control the target weed. Potential for up to 100% yield loss – estimated at £6,600/ha in maincrop carrots.

- pendimethalin is the mainstay (together with flufenacet) of pre-emergence blackgrass control in cereals. Blackgrass is the major grass weed species in England, and effective blackgrass control strategies rely on pre- and post- weed emergence sequences of a limited range of key herbicides. The non-approval of the pendimethalin pre-emergence option would jeopardise weed control, leading to yield losses, and would place increased risk of resistance on remaining active substances;

- assuming non-approval of potential endocrine disruptors, the proposals would not leave any fully effective compounds, for any of the major diseases of oilseed rape. Significant yield loss from stem canker and light leaf spot would result;

- loss of warfarin would have significant impact on amenity woodland and forestry, with increased native tree death

7.4 Implications of the Parliament proposals for active substance approval criteria

Specific issues:

- effectively no herbicide options for control of weeds in horticultural crops;

- chemical control of black-grass in cereals would become virtually impossible with severe economic impacts – potential for yield losses to the value of £850/ha or cereal crops no longer viable;

- metazachlor is critical to oilseed rape production, so its non-approval would lead to economic impacts;

- further undermining of cereal disease control with higher yield loss expected;

- disease control on crops such a strawberries significantly affected due to loss of options for control of black spot, botrytis and mildew;

- non-approval of pyrethroids, neonicotinoid seed treatments and various other (only recently approved) alternate mode of action chemicals would cause highly significant impact across all areas of arable and horticultural crops. Significant cereal yield losses would result. In certain areas it may not be economic to grow at all e.g. BYDV prevalent areas;

- potatoes – seed potato growing unlikely; ware potato yields severely reduced with pressure for PCN-free land (scarce), and very long rotation periods;

- many horticultural crops would be uneconomic to grow, particularly if supermarkets were unwilling to compromise on various quality requirements which currently result in crop rejection;

- there would be substantive impact on plant health strategy for management of invasive species. All compounds listed on treatment schedules for some pests (e.g. *Liriomyza huidobrensis* and Colorado beetle of potato) could become unavailable under the Parliament proposals.

7.5 Implications of the Parliament proposals including eventual non-approval of those compounds considered as candidates for substitution.

Specific issues:

- current UK arable and horticulture could be effectively unsustainable due to unacceptably high weed infestations;

- the long term storage of potatoes in the UK without chlorpropham would result in unacceptable loss of quality, especially for processed crops;

- the loss of herbicides would have significant impacts on the quality of natural, semi-natural and amenity areas. Weed invasion would jeopardise natural habitats through weed encroachment e.g. bracken, Japanese knotweed and potentially cause safety concerns through weed invasion onto railways and airports;

- control of the majority of insect pests and virus vectors would no longer be possible by chemical means. Some cultural controls and encouragement of natural predators, and use of biopesticides, may allow certain (but not all crops) to be grown, but the economics are likely to make many unviable because of reduced yields and quality. Even where such controls are possible (e.g. compounds on list 4 of the Directive 91/414/EEC review), the pest burden would build year on year because they are not as effective, particularly if the current trend of milder winters continues.

Glossary

ACCase	acetyl-coenzyme A carboxylase
ADI	acceptable daily intake (for consumers)
ALS	acetolactate synthase
AOEL	acceptable operator exposure level
ARfD	acute reference dose
BYDV	barley yellow dwarf virus
C	carcinogenic
CMR	carcinogenic, mutagenic or toxic to reproduction
DAR	draft assessment report
EC	European Community
EFSA	European Food Safety Authority
ha	hectare
IPM	integrated pest management
M	mutagenic
NGO	non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PBT	persistent, bioaccumulating, toxic
PCN	potato cyst nematode
PGR	plant growth regulator
POP	persistent organic pollutant
PPP	plant protection product
R	toxic to reproduction
vPvB	very persistent, very bioaccumulating
WRAG	Weed Resistance Action Group

Annex 1 List of substances assessed

Substance	Status#	Approved in UK	Function*
1-methylcyclopropene	AI	y	PGR
2,4-D	AI	y	H
2,4-DB	AI	y	H
abamectin	list 3	y	I
acetamiprid	AI	y	I
acetochlor	list 3	n	H
acibenzolar-s-methyl	AI	y	?
aclonifen	list 3	n	H
acrinathrin	list 3	n	I
alpha cypermethrin	AI	y	I
aluminium phosphide	list 3	y	I
amidosulfuron	list 3	y	H
amitrole	AI	y	H
ampelomyces quisqualis	AI	n	F
asulam	list 3	y	H
azimsulfuron	AI	n	H
azoxystrobin	AI	y	F
bacillus subtilis	AI	n	F
beflutamid	AI	n	H
benalaxyl	AI	y	F
benfluralin	list 3	n	H
bensulfuron	list 3	n	H
bentazone	AI	y	H
benzoic acid	AI	y	disinfect
beta-cyfluthrin	AI	y	I
bifenazate	AI	y	I
bifenox	list 3	y	H
bifenthrin	list 3	y	I
bitertanol	list 3	y	F
bromoxynil	AI	y	H
bromuconazole	list 3	y	F
bupirimate	list 3	y	F
buprofezin	list 3	y	I
calcium phosphide	list 3	n	R
captan	AI	y	F
carbendazim	AI	y	F
carbetamide	list 3	y	H
carboxin	list 3	y	H
carfentrazone ethyl	AI	y	H
chlorate	list 3	n	H
chloridazon	AI	y	H

chlormequat	list 3	y	PGR
chloropicrin	list 3	y	F
chlorothalonil	AI	y	F
chlorotoluron	AI	y	H
chlorpropham	AI	y	PGR
chlorpyrifos	AI	y	I
chlorpyrifos methyl	AI	y	I
chlorsulfuron	list 3	n	H
cinidon ethyl	AI	y	H
clethodim	list 3	n	H
clodinafop	AI	y	H
clofentezine	list 3	y	I
clomazone	AI	y	H
clopyralid	AI	y	H
clothianidin	AI	y	I
coniothyrium minitans	AI	y	F
copper compounds	list 3	y	F
cyazofamid	AI	y	F
cyclanilide	AI	n	PGR
cycloxydim	list 3	y	H
cyfluthrin	AI	y	I
cyhalofop butyl	AI	n	H
cymoxanil	list 3	y	F
cypermethrin	AI	y	I
cyproconazole	list 3	y	F
cyprodinil	AI	y	F
cyromazine	list 3	n	I
daminozide	AI	y	PGR
dazomet	list 3	y	SS
deltamethrin	AI	y	I
desmedipham	AI	y	H
dicamba	list 3	y	H
dichlorobenzoic acid methylester	list 3	n	PGR
dichlorprop p	AI	y	H
diethfencarb	list 3	n	F
difenoconazole	list 3	y	F
diflubenzuron	list 3	y	I
diflufenican	list 3	y	H
dimethachlor	list 3	n	H
dimethanamid -p	AI	y	H
dimethoate	AI	y	I
dimethomorph	AI	y	F
dimoxystrobin	AI	y	F
dinocap	AI	n	F

diphenylamine	list 3	n	?
diquat	AI	y	H
dithianon	list 3	y	F
dodemorph	list 3	n	F
dodine	list 3	y	F
epoxiconazole	list 3	y	F
esfenvalerate	AI	y	I
ethalfluralin	list 3	n	H
ethephon	AI	y	PGR
ethofumesate	AI	y	H
ethoxysulfuron	AI	n	H
ethprophos	AI	y	I
etofenprox	list 3	n	I
etoxazole	AI	n	I
etridiazole	list 3	n	F
famoxadone	AI	y	F
fenamidone	AI	y	F
fenamiphos	AI	n	I
fenarimol	AI	y	F
fenazaquin	list 3	y	I
fenbuconazole	list 3	y	F
fenbutatin oxide	list 3	n	I
fenhexamid	AI	y	F
fenoxaprop p	list 3	y	H
fenoxycarb	list 3	y	I
fenpropidin	list 3	y	F
fenpropimorph	list 3	y	F
fenpyroximate	list 3	y	I
ferric phosphate	AI	y	M
fipronil	AI	n	I
flazasulfuron	AI	y	H
florasulam	AI	y	H
fluazifop-p	list 3	y	H
fluazinam	list 3	y	F
fludioxonil	AI	y	F
flufenacet	AI	y	H
flufenoxuron	list 3	n	I
flumioxazine	AI	y	H
fluometuron	list 3	n	H
flupyrsulfuron methyl	AI	y	H
fluquinconazole	list 3	y	F
flurochloridone	list 3	n	H
fluroxypyr	AI	y	H
flurprimidol	list 3	n	PGR

flurtamone	AI	y	H
flusilazole	AI	y	F
flutolanil	list 3	y	F
folpet	AI	n	F
foramsulfuron	AI	n	H
forchlorfenuron	AI	n	PGR
formetanate	AI	n	I
fostetyl	AI	y	F
fosthiazate	AI	y	I
fuberidazole	list 3	y	F
gliocaldium catenulatum	AI	n	F
glufosinate	AI	y	H
glyphosate	AI	y	H
guazatine	list 3	y	F
hexythiazox	list 3	n	I
hymexazol	list 3	y	F
imazalil	AI	y	F
imazamox	AI	y	H
imazaquin	list 3	y	PGR
imazosulfuron	AI	n	H
imidacloprid	list 3	y	I
indoxacarb	AI	y	I
iodosulfuron	AI	y	H
ioxynil	AI	y	H
iprodione	AI	y	F
iprovalicarb	AI	n	F
isoproturon	AI	y	H
isoxaben	list 3	y	H
isoxaflutole	AI	y	H
kresoxim methyl	AI	y	F
lambda cyhalothrin	AI	y	I
laminarin	AI	y	?
lenacil	list 3	y	H
linuron	AI	y	H
lufenuron	list 3	n	I
magnesium phosphide	list 3	y	I
maleic hydrazide	AI	y	PGR
mancozeb	AI	y	F
maneb	AI	y	F
MCPA	AI	y	H
MCPB	AI	y	H
mecoprop	AI	n	H
mecoprop-p	AI	y	H
mepanipyrim	AI	y	F

mepiquat	list 3	y	H
mesosulfuron	AI	y	H
mesotrione	AI	y	H
metalaxyl-M	AI	y	F
metaldehyde	list 3	y	M
metam	list 3	y	SS
metamitron	list 3	y	H
metazachlor	list 3	y	H
metconazole	AI	y	F
methamidophos	AI	n	I
methiocarb	AI	y	I
methoxyfenozide	AI	y	I
metiram	AI	y	F
metosulam	list 3	y	H
metrafenone	AI	y	F
metribuzin	AI	y	H
metsulfuron methyl	AI	y	H
milbemectin	AI	n	I
molinate	AI	n	H
myclobutanil	list 3	y	F
napropamide	list 3	y	H
nicosulfuron	AI	y	H
oryzalin	list 3	n	H
oxadiargyl	AI	n	H
oxadiazon	list 3	y	H
oxamyl	AI	y	I
oxasulfuron	AI	n	H
oxyfluorfen	list 3	n	H
paclobutrazol	list 3	y	H
paecilomyces fumosoroseus	AI	n	I
penconazole	list 3	y	F
pencycuron	list 3	y	F
pendimethalin	AI	y	H
pethoxamid	AI	n	H
phenmedipham	AI	y	H
phosmet	AI	n	I
picloram	list 3	y	H
picolinafen	AI	y	H
picoxystrobin	AI	y	F
pirimicarb	AI	y	I
pirimiphos-methyl	AI	y	I
prochloraz	list 3	y	F
procymidone	AI	n	F
prohexadione calcium	AI	y	PGR

propachlor	list 3	y	H
propamocarb	AI	y	F
propanil	list 3	n	H
propaquizafop	list 3	y	H
propargite	list 3	n	I
propiconazole	AI	y	F
propineb	AI	n	F
propoxycarbazone	AI	y	H
propyzamide	AI	y	H
prosulfocarb	AI	y	H
prosulfuron	AI	y	H
Pseudomonas chlororaphis	AI	n	F
pymetrozine	AI	y	I
pyraclostrobin	AI	y	F
pyraflufen ethyl	AI	y	H
pyridaben	list 3	n	I
pyridate	AI	n	H
pyrimethanil	AI	y	F
pyriproxyfen	list 3	n	I
quinmerac	list 3	y	H
quinoclamine	list 3	n	H
quinoxyfen	AI	y	F
quizalofop-p-ethyl	list 3	y	H
quizalofop-p-tefuryl	list 3	y	H
rimsulfuron	AI	y	H
silthiofam	AI	y	F
sintofen	list 3	n	HA
s-metolachlor	AI	n	H
sodium 5 nitroguaiacolate	list 3	n	PGR
sodium o nitrophenolate	list 3	n	PGR
sodium p nitrophenolate	list 3	n	PGR
spinosad	AI	y	I
spiroxamine	AI	y	F
spodotera exigua	AI	n	I
sulcotrione	list 3	n	H
sulfosulfuron	AI	y	H
tau fluvalinate	list 3	y	I
tebuconazole	list 3	y	F
tebufenozide	list 3	n	I
tebufenpyrad	list 3	y	I
teflubenzuron	list 3	y	I
tefluthrin	list 3	y	I
tepraloxydim	AI	y	H
terbuthylazine	list 3	y	H

tetraconazole	list 3	y	F
thiabendazole	AI	y	F
thiacloprid	AI	y	I
thifensulfuron methyl	AI	y	H
thimethoxam	AI	y	I
thiobencarb	list 3	n	H
thiophanate methyl	AI	y	F
thiram	AI	y	F
tolclofos methyl	AI	y	F
tralkoxydim	list 3	y	H
triadimenol	list 3	y	F
triallate	list 3	y	H
triasulfuron	AI	y	H
triazoxide	list 3	y	F
tribenuron	AI	y	H
triclopyr	AI	y	H
trifloxystrobin	AI	y	F
triflumuron	list 3	n	I
triflusulfuron	list 3	y	H
trinexapac	AI	y	PGR
triticonazole	AI	y	F
warfarin	AI	y	R
zeta-cypermethrin	list 3	y	I
ziram	AI	y	F
zoxamide	AI	y	F

Status
AI – included in Annex I to Directive 91/414/EEC
List 3 – under review as part of the third stage of the EC review programme

* Function
I
F
H
PGR
SS
M
? – other functions

Annex 2 Active substances that may not be approved according to the Commission criteria

Insecticides

Substance	Status	Approved in UK	Criteria failed
bifenthrin	list 3	y	PBT/ vPvB + Endocrine?
esfenvalerate	AI	y	PBT
flufenoxuron	list 3	n	C2/ PBT
lufenuron	list 3	n	PBT/ vPvB

deltamethrin	AI	y	Endocrine?
dimethoate	AI	y	Endocrine?

Fungicides

bitertanol	list 3	y	R2+ Endocrine?
carbendazim	AI	y	M2/ R2 + Endocrine?
dinocap	AI	n	R2
fenarimol	AI	y	R2 + Endocrine?
flusilazole	AI	y	R2 + Endocrine?
procymidone	AI	n	R2 + Endocrine?
quinoxyfen	AI	y	vPvB

bromuconazole	list 3	y	Endocrine?
cyproconazole	list 3	y	Endocrine?
difenoconazole	list 3	y	Endocrine?
epoxiconazole	list 3	y	Endocrine?
fenbuconazole	list 3	y	Endocrine?
fluquinconazole	list 3	y	Endocrine?
iprodione	AI	y	Endocrine?
mancozeb	AI	y	Endocrine?
maneb	AI	y	Endocrine?
metconazole	AI	y	Endocrine?
metiram	AI	y	Endocrine?
myclobutanil	list 3	y	Endocrine?
penconazole	list 3	y	Endocrine?
prochloraz	list 3	y	Endocrine?
propiconazole	AI	y	Endocrine?
tebuconazole	list 3	y	Endocrine?

tetraconazole	list 3	y	Endocrine?
thiram	AI	y	Endocrine?
triticonazole	AI	y	Endocrine?
triademenol	list 3	y	Endocrine?

Herbicides

flumioxazine	AI	y	R2
glufosinate	AI	y	R2
linuron	AI	y	R2 + Endocrine?
pendimethalin	AI	y	PBT

2,4-D	AI	y	Endocrine?
amitrole	AI	y	Endocrine?
ioxynil	AI	y	Endocrine?
metribuzin	AI	y	Endocrine?
picloram	list 3	y	Endocrine?
propanil	list 3	n	Endocrine?
triflusulfuron	list 3	y	Endocrine?

In addition the following substances are classified but may be expected to have 'negligible' exposure, although without a definition of negligible this cannot be certain.

PGRs

1-methylcyclopropene	AI	y	M2

Rodenticides

warfarin	AI	y	R1

Annex 3 Active substances that may be candidates for substitution according to the Commission criteria

Excludes substances not approved according to Annex 2 apart from potential endocrine disruptors marked #

Insecticides

abamectin	List 3	y	ADI ≤ 0.001
acrinathrin	list 3	n	ADI ≤ 0.001 AOEL ≤ 0.001 ARfD ≤ 0.01
Deltamethrin #	AI	y	ARfD ≤ 0.01
Dimethoate #	AI	y	ADI ≤ 0.001 ARfD ≤ 0.01
ethprophos	AI	y	2 PBT ADI ≤ 0.001 AOEL ≤ 0.001 ARfD ≤ 0.01
etofenprox	list 3	n	2 PBT
etoxazole	AI	n	2 PBT
fenamiphos	AI	n	ADI ≤ 0.001 AOEL ≤ 0.001 ARfD ≤ 0.01
fenbutatin oxide	list 3	n	2 PBT
fenpyroximate	list 3	y	ARfD ≤ 0.01
fipronil	AI	n	2 PBT ADI ≤ 0.001 AOEL ≤ 0.001 ARfD ≤ 0.01
formetanate	AI	n	ARfD ≤ 0.01
fosthiazate	AI	y	2 PBT ARfD ≤ 0.01
imidacloprid	list 3	y	2 PBT
lambda cyhalothrin	AI	y	2 PBT ARfD ≤ 0.01
oxamyl	AI	y	ADI ≤ 0.001 AOEL ≤ 0.001 ARfD ≤ 0.01
pirimicarb	AI	y	2 PBT
pirimiphos-methyl	AI	y	ADI below 0.01 mg/kg
propargite	list 3	n	2 PBT
spinosad	AI	y	2 PBT
tau fluvalinate	list 3	y	ARfD ≤ 0.01
tefluthrin	list 3	y	ARfD ≤ 0.01

Fungicides

bromuconazole #	list 3	y	2 PBT
chloropicrin	list 3	y	ADI ≤ 0.001 ARfD ≤ 0.01
chlorothalonil	AI	y	2 PBT
cyproconazole #	list 3	y	2 PBT
cyprodinil	AI	y	2 PBT
dimoxystrobin	AI	y	ARfD ≤ 0.01
epoxiconazole #	list 3	y	2 PBT
famoxadone	AI	y	2 PBT
fenbuconazole #	list 3	y	2 PBT
fluquinconazole #	list 3	y	ADI ≤ 0.001 AOEL ≤ 0.001
metconazole #	AI	y	2 PBT ARfD ≤ 0.01
propiconazole #	AI	y	2 PBT
silthiofam	AI	y	2 PBT
tetraconazole #	list 3	y	ARfD ≤ 0.01
triazoxide	list 3	y	ADI ≤ 0.001

Herbicides

acetochlor	list 3	n	2 PBT
aclonifen	list 3	n	2 PBT
amidosulfuron	list 3	y	2 PBT
amitrole	AI	y	2 PBT ADI ≤ 0.001 AOEL ≤ 0.001
chlorotoluron	AI	y	2 PBT
chlorsulfuron	list 3	n	2 PBT
diflufenican	list 3	y	2 PBT
diquat	AI	y	2 PBT AOEL ≤ 0.001
flufenacet	AI	y	2 PBT
fluometuron	list 3	n	2 PBT
isoproturon	AI	y	2 PBT
lenacil	list 3	y	2 PBT
mecoprop	AI	n	2 PBT
mesosulfuron	AI	y	2 PBT
metazachlor	list 3	y	2 PBT
metribuzin #	AI	y	2 PBT
metsulfuron methyl	AI	y	2 PBT
nicosulfuron	AI	y	2 PBT

oxadiazon	list 3	y	2 PBT
oxyfluorfen	list 3	n	2 PBT
paclobutrazol	list 3	y	2 PBT
propoxycarbazone	AI	y	2 PBT
prosulfuron	AI	y	2 PBT
tepraloxydim	AI	y	2 PBT
terbuthylazine	list 3	y	ARfD ≤ 0.01
tralkoxydim	list 3	y	2 PBT ARfD ≤ 0.01

PGR

1-methylcyclopropene	AI	y	ADI ≤ 0.001

Soil sterilant

metam	list 3	y	ADI ≤ 0.001

Rodenticide

warfarin	AI	y	AOEL ≤ 0.001

Annex 4 Active substances that may not be approved according to the Parliament criteria

POP criteria include reduction in BCF threshold to 2000

PBT criteria includes C and M cat 3

Insecticides

abamectin	list 3	y	Bees
acrinathrin	list 3	n	Bees
alpha cypermethrin	AI	y	Bees
aluminium phosphide	list 3	y	Bees
beta-cyfluthrin	AI	y	Bees
bifenthrin	list 3	y	PBT/ vPvB + Endocrine?/ Bees
chlorpyrifos	AI	y	Bees/ Dir 2006/60
chlorpyrifos methyl	AI	y	Bees
clothianidin	AI	y	Bees
cyfluthrin	AI	y	Bees
cypermethrin	AI	y	Bees
deltamethrin	AI	y	Bees+ Endocrine?
dimethoate	AI	y	Bees + Endocrine?
esfenvalerate	AI	y	PBT/ Bees
ethprophos	AI	y	Bees
etofenprox	list 3	n	1 POP/ Bees
etoxazole	AI	n	1 POP
fenamiphos	AI	n	Bees
fenazaquin	list 3	y	Bees
fenbutatin oxide	list 3	n	1 POP
fipronil	AI	n	1 POP/ Bees
flufenoxuron	list 3	n	C2/ PBT
formetanate	AI	n	Bees
fosthiazate	AI	y	Bees
imidacloprid	list 3	y	1 POP/ Bees
indoxacarb	AI	y	Bees
lambda cyhalothrin	AI	y	1 POP/ Bees
lufenuron	list 3	n	PBT/ vPvB
methiocarb	AI	y	Bees
methoxyfenozide	AI	y	1 POP
milbemectin	AI	n	Bees
oxamyl	AI	y	Bees
phosmet	AI	n	Bees
pirimicarb	AI	y	Bees
propargite	list 3	n	1 POP

pyridaben	list 3	n	Bees
spinosad	AI	y	1 POP/ Bees
tefluthrin	list 3	y	Bees
thimethoxam	AI	y	Bees
zeta-cypermethrin	list 3	y	Bees

Fungicides

bitertanol	list 3	y	R2
bromuconazole	list 3	y	1 POP + Endocrine?
carbendazim	AI	y	M2/ R2 + Endocrine?
chloropicrin	list 3	y	1 POP
chlorothalonil	AI	y	1 POP
copper compounds	list 3	y	Bees
cyproconazole	list 3	y	1 POP + Endocrine?
cyprodinil	AI	y	1 POP
dinocap	AI	n	R2
epoxiconazole	list 3	y	1 POP + Endocrine?
famoxadone	AI	y	1 POP
fenarimol	AI	y	R2 + Endocrine? 1 POP
fenbuconazole	list 3	y	Bees+ Endocrine?
fluquinconazole	list 3	y	1 POP + Endocrine?
flusilazole	AI	y	R2 + Endocrine?
flutolanil	list 3	y	1 POP
metconazole	AI	y	1 POP + Endocrine?
metrafenone	AI	y	1 POP
prochloraz	list 3	y	1 POP + Endocrine?
procymidone	AI	n	R2 + Endocrine? 1 POP
propiconazole	AI	y	1 POP + Endocrine?
quinoxyfen	AI	y	vPvB 1 POP
silthiofam	AI	y	1 POP
spiroxamine	AI	y	Bees
thiabendazole	AI	y	1 POP
triadimenol	list 3	y	1 POP+ Endocrine?
triticonazole	AI	y	1 POP+ Endocrine?

difenoconazole	list 3	y	Endocrine?
iprodione	AI	y	Endocrine?
mancozeb	AI	y	Endocrine?

maneb	AI	y	Endocrine?
metiram	AI	y	Endocrine?
myclobutanil	list 3	y	Endocrine?
penconazole	list 3	y	Endocrine?
tebuconazole	list 3	y	Endocrine?
tetraconazole	list 3	y	Endocrine?
thiram	AI	y	Endocrine?

Herbicides

aclonifen	list 3	n	1 POP
amidosulfuron	list 3	y	1 POP
amitrole	AI	y	1 POP + Endocrine?
chlorate	list 3	n	Bees
chloridazon	AI	y	1 POP
chlorotoluron	AI	y	1 POP
chlorsulfuron	list 3	n	1 POP
clopyralid	AI	y	1 POP
diflufenican	list 3	y	1 POP
diquat	AI	y	1 POP
flumioxazine	AI	y	R2
fluometuron	list 3	n	1 POP/ Bees
glufosinate	AI	y	R2
isoproturon	AI	y	Dir 2006/60
lenacil	list 3	y	1 POP
linuron	AI	y	R2 + Endocrine?
mesosulfuron	AI	y	1 POP
metazachlor	list 3	y	1 POP
metsulfuron methyl	AI	y	1 POP
nicosulfuron	AI	y	1 POP
oxadiazon	list 3	y	1 POP
oxyfluorfen	list 3	n	1 POP
paclobutrazol	list 3	y	1 POP
pendimethalin	AI	y	PBT
propoxycarbazone	AI	y	1 POP
quinoclamine	list 3	n	Bees
tepraloxydim	AI	y	1 POP
tralkoxydim	list 3	y	1 POP
triallate	list 3	y	1 POP

2,4-D	AI	y	Endocrine?
ioxynil	AI	y	Endocrine?
metribuzin	AI	y	Endocrine?

picloram	list 3	y	Endocrine?
propanil	list 3	n	Endocrine?
triflusulfuron	list 3	y	Endocrine?

PGRs

flurprimidol	list 3	n	1 POP
forchlorfenuron	AI	n	1 POP
imazaquin	list 3	y	1 POP

Hybridising agent

sintofen	list 3	n	1 POP

In addition the following substances are classified but may be expected to have 'negligible' exposure, although without a definition of negligible this cannot be certain.

PGRs

1-methylcyclopropene	AI	y	M2

Rodenticides

warfarin	AI	y	R1

Annex 5 Active substances that may be candidates for substitution according to the Parliament criteria

Excludes substances not approved according to Annex 2 including possible endocrine disruptors

According to the amendments proposed by the European Parliament such substances would be approved once for a period of 5 years

Insecticides

acetamiprid	AI	y	1 PBT
clofentezine	list 3	y	1 PBT
clothianidin	AI	y	1 PBT/ Gw
diflubenzuron	list 3	y	1 PBT
fenoxycarb	list 3	y	1 PBT
fenpyroximate	list 3	y	1 PBT
hexythiazox	list 3	n	1 PBT
magnesium phosphide	list 3	y	1 PBT
pirimiphos-methyl	AI	y	1 PBT
pymetrozine	AI	y	1 PBT
pyriproxyfen	list 3	n	1 PBT
tau fluvalinate	list 3	y	1 PBT
tebufenozide	list 3	n	1 PBT
tebufenpyrad	list 3	y	1 PBT
teflubenzuron	list 3	y	1 PBT
thiacloprid	AI	y	1 PBT/ Gw
triflumuron	list 3	n	1 PBT

Fungicides

azoxystrobin	AI	y	1 PBT
benalaxyl	AI	y	1 PBT/ Gw
captan	AI	y	1 PBT
cymoxanil	list 3	y	1 PBT
diethfencarb	list 3	n	1 PBT
dimoxystrobin	AI	y	1 PBT/ Gw
dithianon	list 3	y	1 PBT
dodemorph	list 3	n	1 PBT
dodine	list 3	y	1 PBT
etridiazole	list 3	n	1 PBT
fenamidone	AI	y	Gw
fenpropidin	list 3	y	1 PBT

fenpropimorph	list 3	y	1 PBT
fluazinam	list 3	y	1 PBT
fludioxonil	AI	y	1 PBT/ Gw
folpet	AI	n	1 PBT
fuberidazole	list 3	y	1 PBT
guazatine	list 3	y	1 PBT
hymexazol	list 3	y	1 PBT
iprovalicarb	AI	n	1 PBT
kresoxim methyl	AI	y	1 PBT
mepanipyrim	AI	y	1 PBT
metalaxyl-M	AI	y	1 PBT/ Gw
picoxystrobin	AI	y	1 PBT/ Gw
propineb	AI	n	1 PBT/ Gw
pyraclostrobin	AI	y	1 PBT
thiophanate methyl	AI	y	1 PBT
triazoxide	list 3	y	1 PBT
trifloxystrobin	AI	y	1 PBT/ Gw
zoxamide	AI	y	1 PBT

Herbicides

2,4-DB	AI	y	Gw
acetochlor	list 3	n	1 PBT
acetochlor	list 3	n	Gw
asulam	list 3	y	1 PBT
azimsulfuron	AI	n	1 PBT
beflutamid	AI	n	1 PBT
benfluralin	list 3	n	1 PBT
bensulfuron	list 3	n	1 PBT
bifenox	list 3	y	1 PBT/ Gw
bromoxynil	AI	y	1 PBT
carbetamide	list 3	y	1 PBT/ Gw
carboxin	list 3	y	1 PBT/ Gw
carfentrazone ethyl	AI	y	1 PBT/ Gw
cinidon ethyl	AI	y	1 PBT/ Gw
clethodim	list 3	n	Gw
cycloxydim	list 3	y	1 PBT/ Gw
desmedipham	AI	y	1 PBT
dicamba	list 3	y	1 PBT
dimethachlor	list 3	n	1 PBT/ Gw
dimethanamid -p	AI	y	Gw
ethalfluralin	list 3	n	1 PBT/ Gw
ethofumesate	AI	y	1 PBT/ Gw
ethoxysulfuron	AI	n	1 PBT

fenoxaprop p	list 3	y	1 PBT
flazasulfuron	AI	y	1 PBT/ Gw
florasulam	AI	y	1 PBT/ Gw
fluazifop-p	list 3	y	1 PBT
flufenacet	AI	y	1 PBT/ Gw
flupyrsulfuron methyl	AI	y	1 PBT/ Gw
flurochloridone	list 3	n	1 PBT
flurtamone	AI	y	1 PBT/ Gw
foramsulfuron	AI	n	1 PBT
glyphosate	AI	y	Gw
imazamox	AI	y	1 PBT/ Gw
imazosulfuron	AI	n	1 PBT
iodosulfuron	AI	y	1 PBT/ Gw
isoxaben	list 3	y	1 PBT/ Gw
isoxaflutole	AI	y	1 PBT/ Gw
MCPA	AI	y	Gw
MCPB	AI	y	Gw
mecoprop	AI	n	1 PBT/ Gw
mecoprop-p	AI	y	1 PBT/ Gw
mesotrione	AI	y	1 PBT
metosulam	list 3	y	1 PBT
molinate	AI	n	1 PBT/ Gw
oryzalin	list 3	n	1 PBT
oxadiargyl	AI	n	1 PBT
oxasulfuron	AI	n	1 PBT/ Gw
pethoxamid	AI	n	1 PBT/ Gw
picolinafen	AI	y	1 PBT
propachlor	list 3	y	1 PBT/ Gw
propaquizafop	list 3	y	1 PBT
propyzamide	AI	y	1 PBT
prosulfuron	AI	y	1 PBT/ Gw
pyraflufen ethyl	AI	y	1 PBT/ Gw
pyridate	AI	n	Gw
quinmerac	list 3	y	Gw
quizalofop-p-tefuryl	list 3	y	1 PBT
rimsulfuron	AI	y	1 PBT/ Gw
s-metolachlor	AI	n	1 PBT
sulcotrione	list 3	n	Gw
sulfosulfuron	AI	y	Gw
terbuthylazine	list 3	y	1 PBT/ Gw
thifensulfuron methyl	AI	y	1 PBT/ Gw
thiobencarb	list 3	n	1 PBT
triasulfuron	AI	y	1 PBT/ Gw
tribenuron	AI	y	Gw

triclopyr	AI	y	1 PBT/ Gw

PGRs

chlorpropham	AI	y	1 PBT
cyclanilide	AI	n	1 PBT
maleic hydrazide	AI	y	Gw

Rodenticides

calcium phosphide	list 3	n	1 PBT

Moluscicide

metaldehyde	list 3	y	1 PBT

Soil sterilants

dazomet	list 3	y	Gw
metam	list 3	y	1 PBT/ Gw

Annex 6 Implications for conventional crop protection in the UK – further details

1 Implications of the Commission proposals for active substance approval criteria

1.1 Insecticides

The impact based on the Commission proposals is limited and not particularly significant in terms of non-approval of the three pyrethroids identified. Although individual actives within this group have strengths and weaknesses in terms of pest spectrum, provided other pyrethroids were maintained, along with neonicotinoids, the impact would be minimal. The caveat to this is that having to use neonicotinoids in a broader context would continue to increase the resistance pressure. The UK has implemented an active resistance management strategy for this group designed to limit the exposure on key label pests. Any actions that increased the frequency of use of specific modes of action would increase the risk of, and undermine attempts to prevent the development of resistance.

Dimethoate has various authorised uses, many of them on brassicas, and alternative active substances are generally available. The biggest impact of its non-approval, however, is likely to be in the control of wheat bulb fly in wheat. This pest infests cereals after break crops, fallow or set aside, laying eggs where bare soil is available in late summer/early autumn. Control relies on a combination of pyrethroid seed treatment (tefluthrin), followed by chlorpyrifos to target egg stages, and finally dimethoate 'deadheart sprays' applied at the peak invasion of first instar larvae. The pest is most prevalent in eastern and north-eastern England, with significant yield losses in recent years particularly where previous crops or set aside have allowed significant egg laying to take place. Early sown winter crops and late sown spring crops can avoid damage; but under conditions where manipulating the sowing date is not possible, there would be yield losses from not being able to target the early larval stages. The extent of losses would depend on when the cereal was attacked, with crops at the single shoot stage possibly destroyed, whereas well-tillered crops can withstand large populations (up to 100 m^2) without economic impact.

1.2 Fungicides

The Commission proposals may entail the non-approval of the triazole group of compounds, as endocrine disruptors. Whilst this would leave a range of compounds, these include no fully effective fungicides for the control of the major disease of wheat in the UK, *Septoria tritici*. The non-approval of important triazole compounds would remove the foundation stone of control programmes for this major disease, with potential for 20-30% yield losses. These compounds are also important for the control of many other diseases of wheat which on average reduce yields by at least 20% in the absence of fungicide use.

The non-approval of quinoxyfen would reduce the options available for managing resistance in powdery mildew. As mildews are perhaps the most likely diseases in cereals to develop resistance this would be of some concern. Mildew alone can reduce yields by 10%.

As well as causing reductions in yield, fungi are important causes of losses during storage and can result in the contamination of food with highly toxic and carcinogenic mycotoxins. By reducing disease in growing crops, fungicides also play an important role in ensuring the availability of high quality produce that stores well and is free from contaminating mycotoxins. Food Standards Agency advice is to consider an ear spray to control fusarium ear blight. Many of the more effective products for fusarium ear blight are potentially affected by the Commission proposals; tebuconazole, metconazole, epoxiconazole and carbendazim.

The situation in oilseed rape would be worse than that in cereals due to the smaller number of compounds currently available. Assuming the non-approval of the potential endocrine disruptors, the proposals would not leave any effective compounds, other than sulphur and copper compounds which have only limited efficacy, for any of the major diseases . The two main diseases of oilseed rape, stem canker and light leaf spot, can each reduce yields by up to 50% in the UK.

The non-approval of mancozeb would have considerable significance as this active is of important in resistance management strategies as well as for control of *Phytophthora* root and fruit rot in various fruit crops and late blight in potatoes.

1.3 Herbicides

The Commission proposals could have significant implications for minor crops such as carrots and parsnips, where the majority of the currently approved herbicides would no longer be available, and the control of some major weed species (e.g.mayweeds) would not be possible. These include pendimethalin, linuron, metribuzin and ioxynil. This is brought into stark focus by the withdrawal of other herbicides during the review under Directive 91/414/EEC, such as trifluralin, metoxuron, prometryn and pentanochlor, for which any essential use derogations expired in December 2007. Weeds affect quality in terms of size, grade and uniformity. This is particularly important for baby carrots for quick-freezing or canning and fresh market. Failure to meet specifications can result in crop rejection or no sales. Yield loss is dependent on the numbers and species of weeds. There is the potential for up to 100% yield loss and in maincrop carrots the loss could be in the region of £6,600/ha (Nix, 2005).

The impact on weed control in onions would also be significant owing to the non-approval of ioxynil and linuron, particularly in the context of the end of the essential use derogations for the use of cyanazine and prometryn. Ioxynil is approved for the control of broad-leaved weeds in onions, leeks, shallots and garlic. These are poorly competitive crops where good weed control is essential to maintain yield and quality. The availability of herbicides for use in these crops is exceptionally limited and ioxynil forms the basis of many of post-emergence broad-leaved weed control programmes. Its non-approval would be highly significant.

The impact on cereal crops would also be important owing to the non-approval of pendimethalin. With flufenacet, pendimethalin is the mainstay of pre-emergence black-grass control and is used for the control of grass and broad-leaved weeds in various cereal crops. The primary target has generally been black-grass, one of the most economically important weed species in cereals. 2-10 plants/m^2 can lead to a 5-10% yield reduction. Assuming an average yield loss of 7.5%, the loss on 10 tonnes/ha would be 0.75 tonne/hectare. This equates to £127/ha (at a grain price of £170/tonne). In the UK, populations of 250 plants/m^2 are no longer uncommon so yield losses would be even higher, up to £850/ha in severe infestations. Typically a strategy for control, necessary to prevent yield loss and seed return, involves a combination of both pre- and post-emergence treatments of different active substances. Non-approval of active substances is thus critical in the context of effective control of this highly important weed and in terms of resistance. Effectively, all UK growers with significant black-grass populations face problems of resistance to the major herbicides used for its control. This resistance to the 'fop' and 'dim' group of herbicides is widespread and to the ALS herbicides is increasing. The use of tank/product mixes or sequences of herbicides with different modes of action within individual crops, or successive crops is a key component of resistance management strategies and widely advocated through published WRAG Guidelines.

The non-approval of 2,4-D and amitrole would have an impact on weed control in the amenity sector, but under the Commission proposals glyphosate would still be available and this would effectively be the single option for weed control in these situations.

In potato crops, cyanazine, monolinuron, sethoxydim and terbutryn were unsupported in the review under Directive 91/414/EEC and are no longer available. The withdrawal of these herbicides did not have any significant impact on the agronomy of potato crops. However, linuron is now the single most important potato herbicide, so non-approval of this active substance would be serious, especially combined with the non-approval of pendimethalin and metribuzin, and that also of paraquat. Linuron is used on over 29% of the total treated potato area. In Scotland it is applied on 80% of the seed crop treated area, reflecting the limited range of other herbicides that can be used on the seed crop. Only limited options would remain, based on clomazone, bentazone, rimsulfuron and prosulfocarb. The impact of weed competition in potatoes is primarily on yield and a wide range of trials has shown yield losses attributable to weeds can be very high, with some research citing from 36 to 54% (Knott, 2002)[3]. On an average yield of 44.5 tonnes/ha, this equates to a yield reduction of at least 16 tonnes/ha with a potential value of £2,080/ha (at £130/tonne). Actual yield losses from weed competition depend on many factors, but they are greatest from early emerging weeds. In addition to yields, weeds also influence tuber size and quality and affect the ease of harvesting. Certain weed species act as hosts for migratory nematode pests, *Rhizoctonia* and *Colletorichum coccodes* and weeds may also be implicated in the survival of pathogenic *Erwinia* spp.

1.4 Vertebrate control agents

The grey squirrel is an introduced species that has displaced the native red squirrel in much of the UK. Trees 10-40 years old are most vulnerable to damage through bark stripping. All tree species, including native broadleaved species, are vulnerable. Damaged trees may die, or suffer from loss of timber quality. Damaged bark also provides entry points for other pathogens. Damage varies in its severity, and in some circumstances planting more resistant tree species can mitigate the problem. However, where damage pressure is high, remedial control measures are usually required. Poisoning with warfarin coated wheat bait placed in specially designed hoppers to prevent access by non target species is the most effective method. Other methods such as shooting or live trapping are usually either ineffective, or uneconomic. Warfarin is therefore currently essential to protect woodlands in the UK from damage from the introduced (alien invasive) grey squirrel.

In completing this section, no assessment of the potential subsequent impact of active substances that would be candidates for substitution has been made. This is because these substances would be approved for seven years and authorisation could subsequently be renewed

[3] KNOTT CM (2002) Weed control in arable and field vegetable crops. In: *BCPC Weed Management Handbook*, 359 – 398. Ed. R L Naylor. Blackwell Science Ltd, Oxford. UK.

2 Implications of the Parliament proposals for active substance approval criteria

2.1 Insecticides

The key impacts of the Parliament proposals are that they would potentially remove:

a) all pyrethroids, foliar or seed treatments;
b) neonicotinoid seed treatments;
c) pirimicarb, a very widely used aphicide both for arable and horticultural (vegetables, fruit) uses;
d) other insecticides with different modes of action (indoxacarb, spinosad, methoxyfenozide) that have been approved in recent years, often for uses where older chemistry is no longer available;
e) oxamyl and fosthiazate, which would leave no chemical control available for PCN.

Some of these pest problems described below, for arable crops in particular, could in part be overcome by cultural techniques such as encouraging beneficial insects and having longer rotation. The latter have steadily been shortened over the years because of demand, particularly wheat and oilseed rape. Lengthening them would impact on the total yields grown. It may also be possible to manipulate sowing times where weather conditions permit. But the net result of not being able to control a particular pest would be a steady build up of populations over the seasons. The result would be more common occurrences of severe attacks and significant yield losses. Many cultural techniques rely on ideal weather conditions, and the combined loss of most if not all chemical options would make it unlikely that in any one year all the potential pests could be controlled by non-chemical means alone. Yield losses would result, their extent being dependent on which pest was the prevalent problem.

In the horticultural sector, an additional factor would be the reluctance of some retailers to accept vegetables and fruit that have superficial damage, or the presence of the occasional insect e.g. in pre-packed salads. This may extend to beneficial insect populations that have been encouraged to reduce insecticide use. Several insecticide sprays are currently used to keep the crop completely ‘clean’ or prevent cosmetic damage. Unless these retailers changed their criteria for acceptability, greater quantities of produce would be rejected which could make the growing of such crops uneconomic for producers.

Plant health strategies for the eradication of outbreaks of invasive species generally rely on PPP intervention. The non-approval of large numbers of active substances could seriously undermine current strategies and the additional Parliament proposals would make many impossible to implement. All compounds listed on treatment schedules for some pests, e.g. *Liriomyza huidobrensis* and Colorado beetle of potato, would become unavailable under the Parliament proposals, reducing the options for eradication.

Below are highlighted some of the problems the proposals would cause. This is far from exhaustive and all agricultural/horticultural crops would probably be affected.

- Cereals – BYDV control relies on foliar pyrethroid and neonicotinoid seed treatment. Even very low virus infected aphid populations can cause major economic losses, up to 2.5 t/ha. Summer aphids can cause yield losses of typically 0.25 – 1 t/ha. Control generally relies on pyrethroids and pirimicarb. In recent years, however, understanding of the role of natural predators and their contribution to controlling populations has increased, and pirimicarb is now the active substance of choice in such situations. Chlorpyrifos is used to control leatherjackets and frit fly. These tend to be rotational problems. Leatherjacket damage can lead to complete or severe crop loss. If it is possible to plough in mid- to late summer, before main egg laying, this can reduce attacks, as do dry Septembers, which desiccate eggs and young. Wheat bulb fly is controlled using a strategy of pyrethroid seed treatment, followed by chlorpyrifos and then dimethoate. None of these would be available.

  It should also be noted that other pests are becoming more of a problem because of milder winters and earlier drilling. This is the case with the increased prevalence in recent years of gout fly, controlled up to now by pyrethroids. It is an example of where manipulating the sowing date to avoid one pest may increase the risk to another. There can be serious damage to autumn crops, but yield losses are most significant from spring attacks (up to 30% grain yield). The status of orange blossom midge has changed from sporadic to potential high risk, because of warmer/wetter summer conditions. Each midge larva reduces grain size by 30-50%. In high risk years losses can be significant (e.g. 2005 yield losses reached £6 million in value). Chlorpyrifos and lambda-cyhalothrin are both approved, although chlorpyrifos is more effective and has less impact on beneficial organisms, the importance of which in control is becoming better understood. Resistant varieties are also being developed.

- Brassicas – caterpillar control is largely reliant on pyrethroid sprays, and more recently indoxacarb, so their non-approval would have a major impact, although *Bacillus thuringiensis* would still be available. Cabbage root fly control has been dependent on chlorpyrifos, and the possibility of using spinosad as an alternative would be excluded under these proposals. Aphid control would rely on neonicotinoid and pymetrozine foliar sprays, because pyrethroids and pirmicarb would not be available.

- Sugar beet – a range of soil pests is controlled using pyrethroids and neonicotinoids as seed treatments, as well as pyrethroid and pirmicarb sprays for aphid control, and chlorpyrifos for leatherjacket control. Aphids spread virus yellows, with early infection causing up to 50% yield losses. Control is dependent on imidacloprid seed treatements. Nematodes are also an important pest, causing stunted plants in sandy/sandy peat soils, which represent 15% of sugar beet growing area. Where large proportions of plants are affected, particularly in wet years, yield losses can be as high as 30%. The only chemical control method is oxamyl, which would not be approved under these proposals.

- Potato – aphid control has alternatives and in ware crops is not now considered to cause significant yield losses. However the situation is different in seed potatoes because of the need to prevent virus transmission. This would be significantly affected because pyrethroids provide very rapid knockdown, which prevents the transmission of various viruses. Alternatives are slower acting, increasing the likelihood that seed potatoes will not reach the requirements to be virtually virus free. Of even greater impact would be the non-approval of oxamyl, which would exclude the option to control PCN by chemical means. Fields with even low/moderate populations could cause yield losses around 6t/ha, costing industry £15 million per year. Potato growing would have to rely on much longer rotation periods (probably in excess of 10 years), or the development of cultural techniques which are not at present deemed viable. The amount of PCN-free land available is already limited.

- Carrots – carrot fly control is currently dependent on pyrethroids as seed and foliar sprays. Lack of control may result in yield reduction and crop rejection.

- Peas and beans– pea aphid, pea and bean weevil and pea moth are controlled largely by pyrethroid sprays and pirimicarb (aphids). Pea aphids cause significant losses if not controlled; beneficial pests can control low populations. Pea moth is significant not because of yield losses but because of contamination of peas grown for human consumption. The caterpillars feed inside the pod, affecting quality and resulting in crop rejection.

- Oilseed rape – there are several pests, all of which can cause severe crop losses. Pyrethroids are extensively used as both seed treatments and foliar sprays. Pollen beetle could still be controlled by thiacloprid.

- Leeks/onions – non-approval of dimethoate and spinosad would remove the ability to control onion thrips in leeks and onions. This would directly affect both yield and also the quality standards because of the visual feeding damage.

- Top fruit – spinosad, methoxyfenozide and indoxacarb are all used for caterpillar control in top fruit, along with chlorpyrifos. Spinosad is also used for aphid control. Chlorpyrifos is important because of its IPM compatibility, and the encouragement of natural predators is now an important part of pest control. However, chemical inputs are still needed and it is noted that the use of more specific insecticides has also resulted in the increased prevalence of what were previously considered minor pests. There are other specific products, such as CpGV granulovirus and pheromones for controlling codling moth, and *B. thuringiensis* for caterpillar control. But relying on only one technique would increase the potential for resistance to develop. It should be noted that over-use of CpGV in organic orchards in Europe, where pest pressure is greater, has led to resistance development.

2.2 Fungicides

On cereals there would be further undermining of disease control with the loss of chlorothalonil, a multi-site fungicide currently used as a mixture partner with triazoles in most disease control programmes.

On wheat (and other cereals), the additional loss of the strobilurins in particular would leave no effective compounds against rusts. These diseases, whilst sporadic, can reduce wheat yields by up to 70% in some years.

There are few opportunities for reducing disease pressure. Additional crop rotation is not possible if the production area is not to be reduced. Later planting would reduce carry over of disease from one crop to the next, but would also be likely to have an adverse effect on yield. More plant resistance might be bred into varieties, but it difficult to breed high yielding varieties resistant to all the major diseases because of the range attacking cereals. Historically, many pathogens have overcome the resistance mechanisms breeders have introduced. Resistance to rusts in particular have shown rapid and widespread breakdown, which could be very damaging in an epidemic year if no chemical controls were available.

As an example, strawberries are a major soft fruit crop in the UK grown on around 3,700 ha, with major diseases being black spot, Botrytis and powdery mildew. Both Botrytis and powdery mildew present a high risk of developing resistance. The Parliament proposals would potentially leave no products for the control of black spot, only fenhexamid and pyrimethanil for Botrytis, and bupirimate against powdery mildew. Both Botrytis and powdery mildew are organisms that have developed resistance to a wide range of pesticides and the availability of multiple modes of action is critical to sustainable disease control. Black spot can cause losses of up to 80%. While cultural control helps prevent spread of the disease, it is very difficult to detect before fruiting. This makes fungicides vital to prevent severe losses in infected crops. Although precise figures are unavailable, Botrytis can also cause severe losses, killing flowers, destroying fruit and reducing shelf life. While cultural methods can reduce losses, the ubiquitous nature of the organism generally makes it impossible to avoid infection.

2.3 Herbicides and PGRs

The impact of the Parliament proposals would be very significant, especially in terms of weed control in minor crops. Herbicides previously seen as alternatives to existing products, such as aclonifen for use in carrots and parsnips, would no longer be options and effective weed control in these crops would be impossible by chemical means. In addition, the impacts would become more wide-ranging in terms of crops and on rotations.

Weed control in sugar beet would become more difficult with the loss of both chloridazon and triflusulfuron-methyl.

Black-grass control in cereals would become very difficult by chemical means in the UK with the loss of pendimethalin and mesosulfuron-methyl, especially in light of the withdrawal of trifluralin under the Directive 91/414/EEC review. Mesosulfuron-methyl is critically important in the UK for post-emergence control of black-grass. In the absence of these active substances, pre-emergence control would rely totally on flufenacet and post-emergence control on ACCase inhibitor herbicides, e.g 'fops' and 'dims' such as clodinafop-propargyl, and other ALS inhibitors, e.g. flupyrsulfuron-methyl. Both modes of action are significantly affected by enhanced metabolism and target site resistance. Hence, it is essential that they are used as part of a resistance management strategy with other herbicides with a different mode of action e.g. flufenacet.

In oilseed rape, cleavers are very highly competitive and yield losses of 5% can be caused by less than 10 cleavers/m^2. Cleavers also cause crop contamination and fewer than 5 plants/m^2 can result in more than 4% admixture and expensive cleaning. Chickweed, which grows vigorously in winter, has a large effect on yield, with 10-20 chickweed plants/m^2 in the autumn reducing yields by 5% or more. Weed control in winter oilseed rape would be severely affected with the non-approval of metazachlor. Currently there are few herbicides available for winter oilseed rape and even fewer for the spring crop, especially with the loss of cyanazine and trifluralin under the Directive 91/414/EEC review. Metazachlor is typically used alone pre-emergence and was used in tank-mix with trifluralin. Common poppy is only controlled pre-emergence with metazachlor, and its non-approval would lead to increasing reliance on herbicides such as propyzamide, quinmerac and clomazone. Many herbicides commonly used in winter oilseed rape are not approved for use in spring-sown rape (propyzamide, carbetamide, clopyralid/picloram, metazachlor/quinmerac). This is partly because of the risk of damage (e.g. propyzamide) where there is a shorter interval before the following winter wheat is sown, or because the small area of spring rape does not warrant the cost of development. Spring oilseed rape would probably no longer be a viable crop in the UK.

In all crops, cultural techniques are very important for growers as part of integrated weed management and can provide high levels of control. For grass weed management in cereals the main emphasis should be on cultural options – rotation, cultivation and preventing weed spread – to both control resistant populations and prevent resistance developing. There are, however, other drivers at work; for example, the loss of active substances for use in break crops may limit the use of rotations. Increased emphasis on integrated management approaches will increase the importance of a balanced approach to pest, weed and disease control. Cultural and mechanical options are critical components of any strategy, but without herbicide options are unlikely to offer the levels of weed control required for many crops, especially those where quality parameters are paramount.

3 Implications of the Parliament proposals including eventual non-approval of those compounds considered as candidates for substitution.

3.1 Insecticides

These additional proposals would remove virtually the rest of the chemical control options, principally neonicotinoid sprays and other foliar sprays such as pymetrozine for aphid control.

The impact of the combined withdrawals from Annex 4 and 5 would essentially mean the end of insecticides for use in arable and horticultural crops, except for some specialised areas. Control would depend on cultural techniques or some biological/biopesticides. Because these tend to be more variable in the level of control achieved, there would be a general increase in pest population levels season on season. Having to use them in isolation would also increase the risk of resistance developing to e.g CpGV or *B. thuringiensis*. Breeding plants with resistance would an option but, even if it could be done, reliance on this option increases the risk that plant resistance mechanisms may break down. Ultimately, it is likely that the UK would rely more heavily on crop commodities from outside of the EC, which may well continue to be treated with insecticides withdrawn under these proposals, or previously withdrawn under the Directive 91/414/EEC review programme. .

In protected situations, the primary control option would be using biological control. However insecticides such as spinosad are still seen as an important tool in supplementing biological agents.

3.2 Fungicides

The Parliament proposals would leave no fungicides available for use on cereals once the five year substitution period had passed. This would have a very significant impact on cereal production. The currently recommended wheat varieties in the UK give, on average, a 20% increase in yield in response to fungicide use. This value assumes a context of overall generally good disease control and relates to the best currently available varieties. Economically, assuming wheat sells at £150/tonne and yields of 8 tonnes/ha, this would cause financial losses approaching £0.5 billion.

Without effective disease control, average yields would therefore drop by at least 20% from the non-approval of fungicides alone. In bad disease years, the situation would be far worse. Furthermore, where host plant resistance broke down, individual diseases could cause losses of 50% or more as they would be effectively unchecked.

Fungicides also prevent diseases carrying over from one year to the next. Seed-borne diseases such as bunt, smuts and fusarium would become increasingly common, as it would become almost impossible to ensure that seed was uninfected. Some foliar diseases, such as rusts, would also become more common. Yield losses would therefore increase over time.

3.3 Herbicides and PGRs

The additional withdrawal of these active substances could make chemical weed control economically unviable in UK crops. Current UK arable rotations would be effectively unsustainable. The control of black-grass in arable crop rotations would not be achievable with the non-approval of all current pre-emergence options and grass weed ALS inhibitors for use post-emergence. All that would remain would be ACCase inhibitors and these are severely affected by resistance. Control of black-grass in oilseed rape would be without a solution with the non-approval of propyzamide. The only chemical option for broad-leaved weed control in cereals would be fluroxypyr and in oilseed rape clomazone. There would be no viable chemical options for broad-leaved weed control in peas or beans. In sugar beet, only phenmedipham and metamitron would be available, severely affecting weed control in sugar beet. The same would also be true of potatoes. Potato storage would also be unviable in the absence of chlorpropham, particularly on potatoes stored for processing (crisps and chips).

In addition to the impacts on specific crops, the non-approval of glyphosate would have major impacts on weed control across all sectors. The use of glyphosate ranges from pre-sowing and pre-harvest weed control in field crops, to weed control in aquatic environments and in amenity sectors, including railways and airports.

Aquatic weed control is currently very difficult owing to the withdrawal for this purpose of diquat, an active substance capable of controlling submerged aquatics in slowly moving water, and terbutryn. Asulam, 2,4-D and glyphosate are very important for controlling emergent aquatic weeds and these would no longer be available under the Parliament proposals. In some circumstances, certain weeds can only be controlled satisfactorily by using herbicides. Poor weed control increases the risks of flooding from choked drains, suffocation of desirable aquatics and other pond life either physically or by light exclusion, disruption of leisure activities (fishing, sailing etc) and the continued spread of invasive exotic species. Mechanical control methods would increase, but may have adverse consequences to aquatic organisms. The non-approval of glyphosate particularly would also have significant implications in areas such as railways and airports, where effective weed control is essential for safety (improving visibility by removal of weeds, reducing fire risk, ensuring effective working of signals, points, etc). There are no chemical alternatives in these situations.

The overall impact on the non-approval of herbicides would be highly significant for conventional commercial crop production. The impacts would also be felt in amenity sectors and in conservation areas, where herbicides play a key role in managing invasive species and maintaining the landscape for environmental and social benefit.