



BRIEFING DOCUMENT (Revised November 2017)

Pesticide Residues in Wheat and Flour

Summary

Flour customers and consumers are increasingly aware of the potential for agrochemical (pesticide) residues to enter the food chain. As part of the AHDB Contaminants Monitoring Project, each year flour millers submit milling wheat samples to Campden BRI for pesticide residue analyses. Defra's Expert Committee PRiF also conducts a survey of pesticide residues in food. Residues of pesticides used late in the life of the crop or during storage continue to remain well below statutory Maximum Residue Levels (MRLs). The pesticides that are currently of greatest concern are bifenthrin, chlormequat, mepiquat, chlorpyrifos-methyl, deltamethrin, glyphosate, pirimiphos-methyl and piperonyl butoxide.

Background

The EU sets the limit of agrochemicals (pesticides) that are legally allowed to remain in food. These are called MRLs. MRLs are based on good controls and practice during production and reflect the amount of pesticide that may reside in the product if it has been applied correctly. MRLs are not safety limits, they are usually well below the levels that could cause an unacceptable risk to human health.

Farmers, importers, distributors and retailers are responsible for ensuring that food conforms to all statutory MRLs set. MRLs are set for each pesticide for a wide range of foodstuffs. The Food Standards Agency has a policy to reduce all pesticide levels as far as is practical and certainly below MRL levels. This policy has been embraced by the wider agricultural industry. The Red Tractor Assurance Scheme continues with an initiative, directed at farmers, contractors and agronomists, to reduce levels of certain agrochemicals of concern from entering the food chain.

Agrochemical types

The agrochemicals of greatest concern to millers and their customers are those that are applied late in the life of the growing crop (after growth stage 59), those that are applied to stored grain and those that have a long half-life (degrade slowly). They can be categorised as follows:

- i) Agrochemicals applied late in the life of the wheat crop (GS59 -71)
There are approximately thirty-five active ingredients; mainly fungicides (see Appendix)
- ii) Plant growth regulators (PGRs)
These are applied to reduce the height of the plant. There are three actives – chlormequat, mepiquat and trinexapac-ethyl.
- iii) Desiccant herbicides
Usually applied to hasten harvest when the crop is slow to dry in wet harvest years – glyphosate.
- iv) Storage insecticides
Applied to stored grain e.g. bifenthrin, chlorpyrifos-methyl, deltamethrin.
- v) Synergists
Piperonyl butoxide is used as a synergist with pyrethroid insecticides to improve the 'knockdown' effect.

Residue data

Each year, as part of the AHDB Contaminants Monitoring Project, analyses are made on approximately 50 milling wheat samples for potential contaminants including pesticide residues. Results are sent to **nabim** members and appear on the AHDB website. Results show that milling wheat is not a significant source of pesticide residues. A summary of the pesticides found in the survey since 2006 is as follows:

Year	Pesticide	% of samples containing residue	Max level (mg/kg)	Min level (mg/kg)
2006	Pirimiphos-methyl	22	1.80	0.01
	Chlorpyrifos-methyl	6	0.40	0.03
	Malathion	2	0.04	0.04
	Chlormequat	87	0.52	0.12 *
	Glyphosate	10	1.18	0.08 *
2007	Pirimiphos-methyl	8	0.74	0.03
	Glyphosate	60	1.25	0.22 *
2008	Pirimiphos-methyl	22	0.37	0.01
	Glyphosate	20	0.10	0.05 *
2009	Pirimiphos-methyl	23	0.37	0.01
2010	None tested	-	-	-
2011	Pirimiphos-methyl	19	0.19	0.03
	Phosphamidon	4	0.03	0.03
	Chlorpyrifos-methyl	4	0.03	0.03
	Malathion	4	0.16	0.16
	Chlormequat	80	1.23	0.05
	Glyphosate	55	1.55	0.04
	Mepiquat	0	-	-
2012	Pirimiphos-methyl	6	0.42	0.03
	Chlormequat	90	0.80	0.05
	Mepiquat	15	0.07	0.02
2013	Glyphosate	40	2.20	0.06
	Chlormequat	95	1.06	0.01
	Mepiquat	10	0.05	0.02
	Pirimiphos-methyl	6	0.20	0.07
	Deltamethrin	2	0.03	0.03
	Malathion	2	0.05	0.05
	Chlorpyrifos-methyl	4	0.02	0.02
	Chlorpropham	4	0.23	0.02
2014	Pirimiphos methyl	4	1.08	0.04
	Deltamethrin	10	0.07	0.02
	Malathion	2	0.03	0.03
	Chlorpyrifos-methyl	6	0.24	0.02
	Chlormequat	95	0.52	0.07
	Mepiquat	0	0.08	0.01
	Glyphosate	95	1.40	0.01
	Piperonyl butoxide	24	0.98	0.01
2015	Pirimiphos methyl	6	0.38	0.02
	Chlorpyrifos-methyl	6	0.02	0.01
	Deltamethrin	14	0.23	0.01
	Cypermethrin	4	0.36	0.05
	Malathion	2	0.03	0.03
	Chlormequat	100	0.89	0.02
	Mepiquat	0	-	-
	Glyphosate	30	0.92	0.05

Year	Pesticide	% of samples containing residue	Max level (mg/kg)	Min level (mg/kg)
2016	Chlormequat	88	0.08	0.01
	Mepiquat	2	0.10	0.01
	Glyphosate	37	1.40	0.1
	Imazaquin	0	-	-
	Trinexapac-ethyl	35	0.05	0.01
	Chlorpropham	0	-	-
	Chlorpyrifos	3	0.01	0.01
	Chlorpyrifos-methyl	13	0.06	0.01
	Cypermethrin	10	0.13	0.04
	Deltamethrin	16.	0.16	0.02
	Malathion	3	0.04	0.04
	Pirimiphos-methyl	7	0.63	0.28
2017	Chlormequat	90	0.80	0.01
	Mepiquat	4	0.14	0.01
	Glyphosate	28	0.91	0.1
	Imazaquin	0	-	-
	Trinexapac-ethyl	24	0.07	0.01

* mean (mg/kg) rather than minimum (mg/kg)

Piperonyl butoxide

For the first time in 2015, samples (from harvest 2014) were also analysed for the presence of piperonyl butoxide (pb) residues. This material is added to some pyrethroid insecticides to improve their activity. It is not itself an insecticide or active ingredient but enhances the performance of some insecticides. In the USA there have been concerns about exposure in the home to this material (insecticide sprays and dusts) but the US Environmental Protection Agency (USEPA) determined that there were "no risks of concern" for householders mixing, loading, handling, or applying PBO-containing products. Some customers of UK flour have sought more information about this compound and may overestimate risks associated with it being applied to stored grain. In the 2015 sampling, 12 of the 50 samples tested contained low level residues.

PRiF information

The Defra Expert Committee on Pesticide Residues in Food (PRiF), previously the Pesticide Residues Committee (PRC), produces a report each quarter that looks at levels of pesticide residues in various food stuffs. They look at pesticide residue levels in staple foods, including bread, every year (flour and wheat are tested less regularly). Below is a table of their results since 2000. All of their reports can be accessed on [their website](#).

Year	Food	No. of samples analysed	No. of samples containing residues at or below MRL	No of samples containing residues above MRL	No. of samples containing more than one residue
2000	Bread	216	96 *	None set	15
2001	Bread	144	55 *	None set	1
2001	Bread (savory)	72	6 *	None set	1
2002	Bread (part baked)	48	27 *	None set	1
2002	Bread	145	58 *	None set	23
2002	Bread (savory)	71	30 *	None set	7
2002	Flour	72	52 *	None set	13
2003	Bread	144	88 *	None set	17
2003	Wheat	68	54 *	None set	7
2004	Bread	144	96	None set	26
2004	Bread (speciality)	72	35	None set	10

2005	Bread	143	129	None set	29
2005	Bread (savoury)	71	40	None set	3
2006	Bread	145	91	0	12
2006	Bread (speciality)	71	40	0	4
2006	Wheat	70	59	0	14
2006	Wheat flour	70	52	1	1
2007	Bread	216	152	0	45
2008	Bread	216	111	0	33
2009	Wheat	72	64	1	15
2010	Bread	216	140	0	49
2011	Bread	216	159	0	49
2011	Flour	72	64	0	12
2012	Bread	216	134	0	57
2013	Bread	216	137	0	56
2014	Bread	204	84	0	17
2014	Bread (part baked)	12	9	0	0
2014	Flour	67	2	0	16
2015	Bread	140	78	0	20
2015	Bread (gluten free)	12	0	0	0
2015	Wheat	66	63	0	43
2016	Bread	216	187	0	55

* These are 'No. of samples containing residues' rather than 'No. of samples containing residues at or below MRL'

Since 2006 only two samples, of wheat flour and wheat, have been found to contain a pesticide residue greater than the MRL. The residue found in the wheat flour was glyphosate in 2006. The residue found in wheat in 2009 was chlorpropham (often referred to as CIPC), a pesticide that is not approved for use on wheat but on potatoes; the wheat had been stored in a potato store. Despite these two samples having residue levels above the MRL, in both cases the PRiF concluded from their risk assessments that the residues found were below the acceptable daily intake (ADI) and acute reference dose (ARfD) and therefore did not pose a risk to health. The residues most commonly detected in bread and flour in the PRiF's annual reports are chlormequat, glyphosate, mepiquat and pirimiphos-methyl.

EU monitoring of pesticide residues

The European Food Safety Authority (EFSA) carried out an EU-wide monitoring programme of pesticide residues in a range of food stuffs in 2011 and 2014. The programme found that for wheat flour, the number of samples containing pesticide residues exceeding the MRL is very low. In 2014, 702 samples of wheat flour were analysed, of which 639 samples were refined white flour and 63 samples were wholemeal flour. In 413 samples (58.8%), no pesticide residues were detected. Only three samples (0.4% of the total) were found to contain a pesticide residue greater than the MRL. Two of the MRL exceedances were for permethrin and one was for cyfluthrin. All three of the exceeding samples originated from Poland. In 2011, 605 samples of wheat flour were analysed. Two MRL exceedances were recorded, one for chlorpropham, with the sample originating from Rwanda and another for chlorpyrifos, where the origin of the sample was unknown. All of the reports can be found on the EFSA website: <https://www.efsa.europa.eu/en/topics/topic/pesticides>

Legislative Levels

Customers sometimes seek MRL information for all of the agrochemicals likely to be used on milling wheat. A full list of these appears in the appendix.

Future Actions

nabim will continue to monitor and report on MRLs in milling wheat (as part of the AHDB Contaminants Monitoring Project), thereby providing its members with the latest data and information.

Appendix –Maximum limits (MLs) for agrochemicals used on milling wheat

*indicates lower limit of analytical determination

Fungicides (for the control of late foliar and/or ear diseases)

Many are applied either as formulated mixed products or in tank mixes made by the operator. They are applied late in the life of the crop (after Growth stage 59 and before GS71)

	<u>MRL (mg/kg)</u>
azoxystrobin	0.30
bixafen	0.05
boscalid	0.50
chlorothalonil	0.10
cyflufenamid	0.05
cyproconazole	0.10
cyprodinil	0.50
difenoconazole	0.10
dimoxystrobin	0.10
epoxiconazole	0.60
fenpropidin	0.50
fenpropimorph	0.50
fluoxastrobin	0.05*
flutriafol	0.50
fluxapyroxad	0.40
kresoxim-methyl	0.10
metconazole	0.15
metrafenone	0.50
picoxystrobin	0.05*
prochloraz	0.50
propiconazole	0.05*
proquinazid	0.02*
prothioconazole	0.10
pyraclostrobin	0.20
spiroxamine	0.05*
tebuconazole	0.20
thiophanate–methyl	0.05
triadimenol	0.20
trifloxystrobin	0.05

Insecticides (applied to control aphids or wheat blossom midge)

	<u>MRL (mg/kg)</u>
chlorpyrifos	0.05*
cypermethrin	2.00
deltamethrin	2.00
esfenvalerate	0.20
lambda –cyhalothrin	0.05
pirimicarb	0.05
tau-fluvalinate	0.05
thiacloprid	0.10
cypermethrin	2.00

Plant Growth Regulators (PGRs)

	<u>MRL (mg/kg)</u>
chlormequat	4.00
mepiquat	2.00
trinexapac-ethyl	0.50

Herbicides (applied as desiccants to hasten harvest) MRL (mg/kg)

glyphosate	10.00
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Others

These are not applied to cereal crops growing in the field. The stored product insecticides are used only within stores either applied to the fabric of the store or to the grain itself. Chlorpropham (CIPC) is a sprout suppressant applied to potatoes in store. Its significance is that residues may then contaminate grain stored in the same facilities.

	<u>MRL (mg/kg)</u>
chlorpropham (potato sprout suppressant)	0.01
chlorpyrifos-methyl (stored product insecticide)	3.00
pirimiphos-methyl (stored product insecticide)	5.00
deltamethrin (stored product insecticide)	2.00
malathion (stored product insecticide – no longer in use)	8.00

Notes

Fungicides

All the above chemicals are included in the PRiF multi-residue test screen with a few limited exceptions. All are included in the multi-residue test screen used in the AHDB Contaminants Monitoring Project. Very few samples contain fungicide residues above the LOQ and if residues are present they are well below the MRLs. Very few are now ever used alone since they are usually co-formulated as 2-3 active ingredients (ai's) to improve efficacy and resistance management. The key message from this is that very few of the ai's in these mixtures are applied at the rate if they were used alone.

It is very unlikely that any residues (>LOD) would normally be found from these products unless a gross breach of Good Agricultural Practice had occurred.

Insecticides

All of the insecticides listed are included in the PRiF multi-residue test screen and a review of PRIF results indicates that none are reported. This may be because insect attacks are very variable season to season and so the use of such products also varies greatly. Again, although usually used alone the full label rate may not be applied.

PGRs

Chlormequat continues to be found very regularly despite efforts to reduce both levels and incidences. Mepiquat levels do seem to have significantly reduced in the last 5-6 years. This may be because it is now only used in co-formulated products.