

5.11 FENBUCONAZOLE (197)

RESIDUE AND ANALYTICAL ASPECTS

Fenbuconazole was evaluated for residues and toxicology by the JMPR in 1997. An ADI of 0-0.03 mg/kg bw was established and a number of maximum residue levels were recommended.

Fenbuconazole was scheduled by the Fortieth Session of the CCPR for a residue evaluation for additional crops (ALINORM 08/31/24, Appendix X). Information on current GAPs and new supervised trial data were submitted to the 2009 JMPR for lemons, blueberry, cranberry, plums, peppers, almonds and peanuts and additional residue trial information was also provided for grapefruit, oranges and apples.

Results of supervised residue trials on crops

The NAFTA calculator was used as a tool in the estimation of the maximum residue levels from the selected residue data sets obtained from trials conducted according to GAP. As a first step, the Meeting reviewed all relevant factors related to each data set in arriving at a best estimate of the maximum residue level using expert judgement. Then, the NAFTA calculator was employed. If the statically calculation spreadsheet suggested a different value from that recommended by the JMPR, a brief explanation of the deviation was supplied. Some common factors that may lead to rejection of the statically estimate include when the number of data points in a data set is < 15 or when there are a large number of values < LOQ.

As the last application contributed most to the residues of fenbuconazole at harvest, the Meeting agreed to use the data from trials where the application number exceeded that specified in the matching GAP.

Citrus fruits

The GAP for citrus in the USA is 3×0.135 kg ai/ha with a PHI of 0 day. Information from nine trials on grapefruit, 16 trials on oranges and five trials on lemons were conducted in the USA (3×0.280 kg ai/ha, PHI 0 day). However, as the application rate did not match the US GAP the Meeting was unable to estimate a maximum residue level for fenbuconazole in citrus.

Pome fruits

The GAP on apples in France is 3×0.04 – 0.05 kg ai/ha and in Spain 4×0.05 kg ai/ha, with a PHI of 28 days. In Southern European trials conducted in accordance with French and Spanish GAP, fenbuconazole residues in rank order (n=18) were: 0.01, < 0.02, 0.02 (2), 0.03 (4), 0.04 (3), 0.05, 0.06 (2), 0.16, 0.17, 0.18 and 0.33 mg/kg.

The GAP on apples in the UK is 10×0.07 kg ai/ha with a PHI of 28 days. In Northern European trials conducted in accordance with the GAP of the UK, fenbuconazole residues in rank order (n=14) were: 0.02 (3), 0.03 (4), 0.04 (3), 0.05 (2) and 0.06 (2) mg/kg.

The GAP on apples in the USA is 4×0.105 – 0.13 kg ai/ha with a PHI of 14 days. In the US trials matching US GAP, fenbuconazole residues in rank order (n=16) were: 0.02, 0.05, 0.06 (2), 0.07, 0.08, 0.09, 0.12 (2), 0.13, 0.15, 0.17, 0.18, 0.20 (2) and 0.28 mg/kg.

The supervised residue trials for pears in Southern Europe submitted to the 1997 JMPR did not match Italian or Spanish GAP.

The residues in pears were lower than those in apples. The Meeting agreed that the dataset for apples could be used to estimate a maximum residue level for pome fruits.

Based on the US trials, which led to higher residues, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in pome fruits of 0.5, 0.12 and 0.28 mg/kg, respectively. The Meeting withdrew the previous recommendation of a maximum residue level of 0.1 mg/kg for pome fruits.

The maximum residue level estimate derived from use of the NAFTA calculator (95/99 Rule 99th percentile) was 0.5 mg/kg, which was in agreement with the estimate made by the Meeting.

Plums

The GAP on plums in France is $5 \times 0.05\text{--}0.075$ kg ai/ha with a PHI of 3 days. In trials from northern France, conducted in accordance with French GAP, fenbuconazole residues (n=5) in rank order were: 0.04, 0.06, 0.08, 0.10 and 0.17 mg/kg.

Based on the trials from northern France, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in plums of 0.3, 0.08 and 0.17 mg/kg, respectively.

The maximum residue level estimate derived from use of the NAFTA calculator (95/99 Rule 99th percentile) was 0.3 mg/kg, which agreed with the estimate made by the Meeting.

Blueberries

The GAP on blueberries in the USA is $4 \times 0.11\text{--}0.14$ kg ai/ha with a PHI of 30 days. In the US trials conducted with foliar application in accordance with the US GAP, fenbuconazole residues in rank order (n=9) were 0.01, 0.03 (2), 0.06 (2), 0.07 (2), 0.10 and 0.20 mg/kg.

Based on the US trials, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in blueberries of 0.5, 0.06 and 0.20 mg/kg respectively.

The maximum residue level estimate derived from use of the NAFTA calculator was 0.4 mg/kg (95/99 Rule and UCLMedian95th). The Meeting noted that the maximum application rate in the trials was 25% less than that specified in the matching maximum GAP. The Meeting considered that the estimate derived from use of the NAFTA calculator may not accommodate all uses of fenbuconazole in blueberries and agreed that a higher maximum residue level recommendation was warranted.

Cranberries

The GAP on cranberries in the USA is $4 \times 0.105\text{--}0.211$ kg ai/ha with a PHI of 30 days. In the US trials conducted in accordance with the US GAP, fenbuconazole residues (n=5) in ranked order were: 0.09 (2), 0.13, 0.15 and 0.45 mg/kg.

Based on the US trials, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in cranberries of 1, 0.13 and 0.45 mg/kg respectively.

The maximum residue level estimate derived from use of the NAFTA calculator (95/99 Rule 99th percentile) of 0.7 mg/kg differed from the estimate of 1 mg/kg made by the Meeting. The Meeting considered that due to the level of uncertainty involved with estimates based on small datasets a higher estimate was more appropriate.

Peppers

The GAP on peppers in the USA is $4 \times 0.105\text{--}0.211$ kg ai/ha with a PHI of 7 days. In the US trials on bell peppers and non-bell peppers, conducted in accordance with the US GAP, fenbuconazole residues (n=6) in rank order were 0.04, 0.05, 0.12, 0.15 (2) and 0.20 mg/kg for bell peppers, and (n=3) 0.05, 0.20 and 0.21 mg/kg for non-bell peppers. As the residue populations from trials on bell peppers and non-bell peppers were not significantly different (Mann-Whitney U-test), the Meeting

agreed that they could be combined. The residues in peppers in rank order (n=9) were 0.04, 0.05 (2), 0.12, 0.15 (2), 0.20 (2) and 0.21 mg/kg.

Based on the US trials, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in peppers of 0.6, 0.15 and 0.21 mg/kg respectively.

The maximum residue level estimate derived from use of the NAFTA calculator (95/99 Rule 99th percentile) of 0.6 mg/kg corresponded to the estimate made by the Meeting.

Tree nuts (Almonds and Pecans)

The GAP on almonds in the USA is 3×0.067 –0.105 kg ai/ha with a PHI of 160 days. In the US trials conducted in accordance with the US GAP, fenbuconazole residues in nutmeat (n=5) were < 0.010 (5) mg/kg.

The 1997 JMPR recommended a maximum residue level of 0.05(*) mg/kg for pecan based on supervised residue trials from the USA conducted in 1990 and 1994. In ten US trials conducted in accordance with the US GAP, fenbuconazole residues were < 0.01 (10) mg/kg in pecan kernels.

Based on the US trials for almonds and pecans, the Meeting estimated a maximum residue level of 0.01(*) mg/kg, and an STMR value and HR value of 0 mg/kg for fenbuconazole in tree nuts. The Meeting withdrew the previous recommendation of 0.05(*) mg/kg for pecan.

The NAFTA calculator was not used to derive an estimate as all residue values were below the LOQ, making its application unsuitable.

Peanuts

The GAP on peanuts in the USA is 4×0.069 –0.135 kg ai/ha with a PHI of 14 days. In US trials, conducted with six or eight foliar applications at a rate of 0.140 kg ai/ha and a PHI of 14 days, fenbuconazole residues in peanuts in rank order (n=13) were: < 0.03 (11), 0.04 and 0.05 mg/kg.

Based on the US trials, the Meeting estimated a maximum residue level, an STMR value and an HR value for fenbuconazole in peanuts of 0.1, 0.03 and 0.05 mg/kg respectively.

The NAFTA calculator was not used to derive an estimate as the residues from eleven, of thirteen trials matching GAP, were below the LOQ, making its application unsuitable.

Animal feed commodities

Almond hulls

In US trials conducted in accordance with the GAP of the USA (0.105 kg ai/ha, PHI of 160 days), fenbuconazole residues in almond hulls, in rank order (n=5), were: 0.10, 0.13, 0.45, 0.51 and 0.77 mg/kg.

The Meeting estimated a maximum residue level and an STMR value for fenbuconazole in almond hulls of 3 and 0.45 mg/kg respectively.

The maximum residue level estimate derived from use of the NAFTA calculator was 2.5 mg/kg (95/99 Rule 99th percentile). The normal JMPR procedure is to use one significant figure for maximum residue levels below 10 mg/kg. Rounding up the value derived from use of the calculator corresponded to the Meeting's recommendation.

Peanut fodder

In US trials conducted in accordance with the GAP of the USA, i.e., 0.135 kg ai/ha with a PHI of 14 days, fenbuconazole residues in peanut hay, in rank order (n=13), were: 0.78, 1.1, 1.2 (2), 1.3, 1.6, 2.3, 3.9, 4.1, 4.4, 4.7, 5.8 and 7.1 mg/kg.

The Meeting estimated a maximum residue level, an STMR value and a highest residue value for fenbuconazole in peanut fodder of 15, 2.3 and 7.1 mg/kg respectively.

The normal JMPR procedure is to round the value to the nearest 5 for maximum residue levels between 10 and 30 mg/kg. Rounding up the value obtained from NAFTA calculator of 14 mg/kg (95/99 Rule and UCLMedian 95th) results in an estimate of 15 mg/kg, corresponding to the recommendation of the current Meeting.

Fate of residues during processing

The Meeting received information on the fate of incurred residues of fenbuconazole during the processing of citrus (grapefruit and oranges), apples and peanuts. Based on the results of processing studies processing factors were calculated for apples and peanuts and are shown in the Table below. As no maximum residue level for citrus was estimated, processing factors are not reported.

Processing (Transfer) factors from the processing of Raw Agricultural Commodities (RACs) with field-incurred residues from foliar treatment with fenbuconazole

Commodity	Processing factor	STMR-P mg/kg
Apple		
Unwashed fruit	-	0.12 (STMR for RAC)
Wet pomace	2.5	0.30
Unpasteurized juice	0.06	0.01
Pasteurized juice	< 0.16	0.02
Peanut		
Nutmeat		0.03 (STMR for RAC)
Meal	0.50	0.02
Refined oil	1.3	0.04

As the STMR-P value of unpasteurized apple juice is higher than that of pasteurized juice, the value for unpasteurized juice is used for dietary risk assessment

The Meeting estimated a maximum residue level of 1 mg/kg ($0.12 \times 2.5 \times 100/40 = 0.75$ mg/kg) on a dry weight basis for apple pomace, dry.

On the basis of the STMR and HR for bell peppers and the default dehydration factor of 10, the Meeting estimated an STMR value and an HR value for dried chilli peppers of 1.5 and 2.0 mg/kg respectively. Based on the HR value, the Meeting recommended a maximum residue level of 2 mg/kg for chilli peppers (dry).

*Residues in animal commodities**Farm animal feeding studies*

A lactating dairy cow feeding study and a laying hen feeding study were previously submitted to the 1997 JMPR.

Farm animal dietary burden

The Meeting estimated the dietary burden of fenbuconazole in livestock on the basis of the diets listed in Annex 6 of the 2006 JMPR Report (OECD Feedstuffs Derived from Field Crops), and the

STMR or highest residue levels estimated at the present Meeting. Calculation from highest residue, STMR (some bulk commodities) and STMR-P values provides the levels in feed suitable for estimating MRLs, while calculation from STMR and STMR-P values for feed is suitable for estimating STMR values for animal commodities. The percentage dry matter is taken as 100% when the highest residue levels and STMRs are already expressed in a dry weight basis.

Estimated maximum and mean dietary burdens of farm animals

Dietary burden calculations for beef cattle, dairy cattle, broilers and layers are provided in Annex 6 of the 2009 Report of the JMPR. The calculations were made according to the livestock diets from US-Canada, EU and Australia in the OECD Table (Annex 6 of the 2006 JMPR Report).

	Livestock dietary burden, fenbuconazole, ppm of dry matter diet					
	US-Canada		EU		Australia	
	max	mean	max	mean	max	mean
Beef cattle	2.6	1.0	1.0	0.48	6.2 ^a	2.1 ^b
Dairy cattle	2.1	0.80	0.93	0.41	5.7	2.0 ^c
Poultry – broiler	0.03	0.03	0.03	0.03	0.02	0.02
Poultry – layer	0.03	0.03	0.31 ^d	0.13 ^e	0.02	0.02

^a Highest maximum beef or dairy cattle dietary burden suitable for MRL estimates for mammalian meat and milk

^b Highest mean beef or dairy cattle dietary burden suitable for STMR estimates for mammalian meat

^c Highest mean dairy cattle dietary burden suitable for STMR estimates for milk

^d Highest maximum poultry dietary burden suitable for MRL estimates for poultry meat and eggs

^e Highest mean poultry dietary burden suitable for STMR estimates for poultry meat and eggs

Animal commodity maximum residue levels

Because of the changes in the animal dietary burden, the residue concentrations in animal products were re-calculated by the current Meeting.

The calculated maximum dietary burden for beef and dairy cattle was 6.2 ppm. In the cattle feeding study described in the 1997 JMPR Monograph, no residues were found above the LOQ of 0.01 mg/kg in milk at feeding level of 6.5 ppm.

Residues of fenbuconazole in muscle were < 0.01 (2) and 0.01 mg/kg at dose level of 6.5 ppm. Residues in kidneys were below the LOQ of 0.01 mg/kg for all dose groups. Residues in liver were 0.04, 0.06 and 0.09 mg/kg at dose level of 6.5 ppm.

Summary of residues corresponding to the estimated dietary burden

Dietary burden (ppm) Feeding level [ppm]	Muscle	Liver
MRL	highest	highest
MRL beef or dairy cattle (6.2) [6.5]	(0.01) [0.01]	(0.09) [0.09]
STMR	mean	mean
STMR beef or dairy cattle (2.1) [6.5]	(0.003) [0.01]	(0.02) [0.06]

The Meeting estimated a maximum residue level of 0.01 mg/kg in mammalian meat, 0.1 mg/kg in mammalian edible offal and 0.01(*) mg/kg in milks, and an HR of 0.01 mg/kg in mammalian meat and 0.09 mg/kg in mammalian edible offal. The Meeting withdrew the previous

recommendations of maximum residue levels of 0.05(*) mg/kg for cattle meat, cattle fats, cattle kidney and cattle milk.

The mean estimated dietary burden for dairy cattle was 2.0 ppm. No detectable fenbuconazole residues (< 0.01 mg/kg) were found in any sample of milk at the 6.5 ppm feeding level. The Meeting therefore estimated an STMR of 0 mg/kg in milk.

The mean estimated dietary burden for beef cattle was 2.1 ppm. In kidney, no fenbuconazole residues were detected at the 6.5 ppm feeding level. Since residues above the LOQ were found in muscle and liver at a dose of 6.5 ppm, detectable residues of fenbuconazole were expected in muscle and liver at the mean dietary burden of 2.1 ppm. The Meeting estimated an STMR of 0.003 mg/kg in meat, 0.02 mg/kg in offal.

The calculated maximum dietary burden for poultry was 0.31 ppm. In the poultry feeding study, residues of fenbuconazole were below the LOQ of 0.01 mg/kg in muscle, liver and eggs at all feeding level tested (0.12–1.13 ppm).

The Meeting estimated a maximum residue level of 0.01(*) mg/kg in poultry meat, poultry edible offal and eggs. The Meeting withdrew the previous recommendations of 0.05(*) mg/kg in poultry meat, poultry fats, poultry edible offal and eggs.

The mean estimated dietary burden for poultry was 0.13 ppm. The Meeting estimated STMRs and HRs of 0 mg/kg in poultry meat, offal and eggs.

DIETARY RISK ASSESSMENT

Long-term intake

In the current evaluation STMRs were estimated for 17 commodities. Where consumption data were available the STMRs were used in dietary intake estimates together with previous MRL recommendations for 18 other food commodities. The results are shown in Annex 3.

The estimated daily intakes for the 13 GEMS/Food Consumption Cluster Diets were in the range of 0 to 2% of the maximum ADI (0.03 mg/kg bw). The Meeting concluded that the long-term intake of residues of fenbuconazole resulting from uses that have been considered by the JMPR is unlikely to present a public health concern.

Short-term intake

The International Estimated Short Term Intake (IESTI) for fenbuconazole was calculated for 16 food commodities (and their processed fractions) for which maximum residue levels were estimated at the present meeting and for which consumption data were available. The results are shown in Annex 4.

As the Meeting has not yet considered the need of an ARfD, the acute risk assessment for fenbuconazole was not finalized