5.2 BENZOVINDIFLUPYR (261)

RESIDUE AND ANALYTICAL ASPECTS

Benzovindiflupyr is a broad-spectrum fungicide first evaluated by JMPR in 2013 (Toxicology) and 2014 (Residue). For the parent compound, an ADI of 0–0.05 mg/kg bw and an ARfD of 0.1 mg/kg bw were established.

The 2014 JMPR Meeting recommended that the residue definition for plant and animal commodities (for compliance with MRLs and for estimation of dietary intake) is: *benzovindiflupyr*. *The residue is fat soluble*.

In 2014 the JMPR evaluated uses for benzovindiflupyr in soya beans and livestock feeding studies.

The current Meeting received information on use patterns for benzovindiflupyr in multiple crops (including wheat, barley, grapes, apple, pear, pulses (peas and beans), soya bean, tomato, peppers, cucumber, summer squash, melons (cantaloupe), sweet corn, maize, cotton, peanuts, potatoes, sugarcane, rapeseed and coffee) and additional analytical methods and supervised field trials on these crops.

Methods of analysis

Analytical methods for benzovindiflupyr in food-feedstuffs of plant origin were evaluated by the 2014 JMPR. The Meeting received two new analytical methods for benzovindiflupyr, with its procedure improved upon method GRM042.03A. These methods were used in the supervised field trials on sugarcane and peanuts.

Method POPIT MET.125, applicable to sugarcane, cereal grains and their processed products, used homogenization with acetonitrile and water (80:20, v/v). Following solid phase extraction (SPE) clean-up or liquid-liquid partition clean-up, benzovindiflupyr was analyzed by high-performance liquid chromatography separation and triple-quadrupole mass spectrometry (LC-MS/MS). The method was successfully validated (70–110% recovery, RSD < 20%, typical LOQs at 0.01mg/kg) for sugarcane and its processed products, including cane juice, cane molasses, bagasse and sugar.

The second method POPIT MET.133 is applicable to peanuts and other matrices including beans, sunflower, cotton, coffee and its processed products, and used homogenization with acetonitrile and water (80:20 v/v). Following liquid-liquid partition clean-up, benzovindiflupyr was analyzed by high-performance liquid chromatography separation and triple-quadrupole mass spectrometry (LC-MS/MS). The method was successfully validated (70–110% recovery, RSD < 20%, typical LOQs at 0.01 mg/kg) for peanuts.

Stability of pesticide residues in stored analytical samples

The storage stability of benzovindiflupyr in raw and processed plant commodities and in animal commodities was evaluated by the 2014 JMPR. No additional storage stability data was submitted to the Meeting.

Storage stability studies showed that benzovindiflupyr, when stored at -18 °C was stable for at least 24 months in crop commodities representative of the high water, high acid, high starch, high protein and high oil commodity groups as well as in wheat straw. Benzovindiflupyr was stable for at least 24 months at -10 °C in various processed commodities: flour (maize, soya), meal (maize), oil (maize, soya), soymilk, dried fruits (grape, apple) and fruit juice (apple).

Results of supervised residue trials on crops

The Meeting received supervised trial data for applications of benzovindiflupyr on various fruit and vegetable crops, cereal grains, oil crops and coffee conducted in Brazil, Canada and the USA.

Pome fruits

Benzovindiflupyr is registered in Canada and USA on pome fruits with a rate of 4 × 0.05 kg ai/ha with a PHI of 30 days. Supervised field trials on apples from Canada and USA (13 trials) matching this GAP were submitted to the Meeting. Nine residue trials on pears from Canada and USA matching the GAP were submitted.

Residues of benzovindiflupyr in apple from trials following treatment according to Canada and USA GAP were (n = 13): 0.031, 0.034, 0.038, 0.039, 0.041, 0.042, 0.048, 0.061, 0.067, 0.069, 0.074, 0.096 and 0.16 mg/kg.

Residues of benzovindiflupyr in pear from trials following treatment according to Canada and USA GAP were (n = 9): 0.021, 0.040, 0.044, 0.057, 0.059, 0.062, 0.067, 0.087 and 0.10 mg/kg.

The Meeting noted that the median residues in apple and pear from the field trials were within a 5-fold range (0.048 vs 0.059). From the Mann-Whitney U-test statistical evaluation, it was found that the two residue data populations were not from different resources. A combined residue data set on pome fruit is: 0.021, 0.031, 0.034, 0.038, 0.039, 0.040, 0.041, 0.042, 0.044, 0.048, 0.057, 0.059, 0.061, 0.062, 0.067(2), 0.069, 0.074, 0.087, 0.096, 0.10 and 0.16 mg/kg.

The Meeting estimated a maximum residue level of 0.2 mg/kg, an HR of 0.17 mg/kg (individual highest residue) and an STMR of 0.058 mg/kg for benzovindiflupyr in pome fruits.

Small fruit vine climbing

Grapes

In Canada, the GAPs for benzovindiflupyr in grapes is for a maximum application rate of 0.075 kg ai/ha, a maximum of 4 applications with a spray interval of 7 days and a 21 day PHI. Twelve trials conducted in the USA matches the Canada cGAP.

Residues at 21 days PHI were: 0.10, 0.11, 0.15, 0.16, 0.17, 0.23, 0.35, 0.39, 0.41, 0.47, 0.55, and 0.77 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg, an HR of 0.81 mg/kg (highest residue of replicate samples) and an STMR of 0.29 mg/kg for benzovindiflupyr in grapes.

Fruiting vegetables, Cucurbits

Benzovindiflupyr is registered in the USA and Canada in cucurbits at 4 × 0.075 kg ai/ha with 7 days application interval and a 0-1 day PHI respectively.

Cucumber

Six trials conducted in the USA on cucumber according to the USA GAP gave residues of < 0.01, 0.01, 0.013, 0.018, 0.033 and 0.052 mg/kg.

Summer squash

Five trials were conducted in the USA on summer squash according to USA GAP gave residues of 0.017, 0.022(2), 0.023 and 0.050mg/kg.

Melons

Six trials were conducted in the USA according to USA GAP on melons (cantaloupe). The trials conducted in the USA on melons （cantaloupe） gave residues of < 0.01, 0.026, 0.049, 0.053, 0.12 and 0.14mg/kg.

The Meeting noted that the GAP covered the whole cucurbit crop group and decided to explore a group MRL for cucurbits.

The Meeting further noted that the median residues in cucumber, summer squash and melons from the field trials were within a 5-fold range (0.016–0.051). From the Kruskal-Wallis statistical evaluation, it was found that the three data population on cucumber, summer squash and melons could be combined to represent the whole cucurbits vegetable group. Therefore, a combined residue data set is: < 0.01, < 0.01, 0.01, 0.013, 0.017, 0.018, 0.022, 0.022, 0.023, 0.026, 0.033, 0.049, 0.05, 0.052, 0.053, 0.12 and 0.14 mg/kg.

The Meeting estimated a maximum residue level of 0.2 mg/kg, an HR of 0.16 mg/kg (highest individual residue) and an STMR of 0.023 mg/kg for benzovindiflupyr in the cucurbit crop group.

Fruiting vegetables other than Cucurbits

Benzovindiflupyr is registered in Canada and USA in fruiting vegetables other than cucurbits at 4 × 0.075 kg ai/ha with7 day application interval, and a PHI of 1 day for Canada,; the PHI is 0 days for the USA.

Peppers

Nine supervised field trials on peppers from the USA matching the GAP were submitted to the Meeting. In peppers following treatment with benzovindiflupyr according to USA GAP, residues were (n = 9): 0.04,0.054, 0.059, 0.061,0.093, 0.10, 0.35, 0.36,0.62 mg/kg.

Tomatoes

Eleven trials were conducted in the USA according to this GAP. In tomatoes following treatment according to USA GAP, benzovindiflupyr residues were < 0.01, 0.040, 0.044, 0.053, 0.061, 0.085, 0.11, 0.14, 0.20, 0.38 and 0.43 mg/kg.

The GAP in the US is for the fruiting vegetables crop group; the median residues in peppers and tomatoes from the field trials were within a 5-fold range (0.093 mg/kg vs 0.085 mg/kg) and the Kruskal-Wallis test indicated that the residues from field trials were not from different populations. The Meeting decided to estimate a group maximum residue level. The residues were combined as: < 0.01, 0.04, 0.04, 0.044, 0.053, 0.054, 0.059, 0.061, 0.061, 0.085, 0.093, 0.1, 0.11, 0.14, 0.2, 0.35, 0.36, 0.38, 0.43 and 0.62 mg/kg.

The Meeting estimated a maximum residue level of 0.9 mg/kg, an HR of 0.62 mg/kg (highest residue of replicate samples) and an STMR of 0.089 mg/kg for benzovindiflupyr in fruiting vegetables other than cucurbits (except sweet corn and mushrooms). The Meeting also agreed to recommend a maximum residue level, an HR and STMR of 9 mg/kg, 6.2 mg/kg and 0.89 mg/kg respectively for chili pepper dried, based a default processing factor of 10.

Sweet corn

Benzovindiflupyr is registered in Canada and USA in sweet corn at 2 × 0.075 kg ai/ha foliar application with 7 day interval for Canada and 14 day interval for the USA; the PHI is a 7 days. The Canadian GAP was considered as cGAP because of the shorter interval time. Fifteen trials were conducted in USA with 4 × 0.075 kg ai/ha foliar application with 7 day interval and a 7 day PHI.

In sweet corn, residue data from 15 trials in USA were: < 0.01 (15) mg/kg.

These trials were conducted with 4 applications of 0.075 kg ai/ha dose rather than 2 in Canada cGAP. Considering the residues were all below 0.01 mg/kg, the Meeting estimated a maximum residue level of 0.01* mg/kg, an HR of 0.01 mg/kg and an STMR of 0.01 mg/kg for benzovindiflupyr in sweet corn (corn-on-the-cob).

Pulses

Dry beans and dry peas

Benzovindiflupyr is registered in Canada in pulses (not including soya beans) at 2 × 0.075 kg ai/ha foliar application with a 7 day interval and a 15 day PHI. Thirteen trials were conducted in Canada and USA matching the GAP for dry beans. Eleven trials were conducted in Canada and USA matching the GAP for dry peas.

In thirteen trials conducted in Canada and USA for beans (dry seeds), residues at 14 day PHI were: < 0.01(6), 0.011, 0.011, 0.016, 0.020, 0.044, 0.045 and 0.078mg/kg.

In 11 trials conducted in Canada and USA for peas (dry seeds), residues at mature stages were: < 0.01 (5), 0.011, 0.017, 0.028, 0.033, 0.049 and 0.11 mg/kg.

The Meeting estimated a maximum residue level of 0.15 mg/kg and an STMR of 0.011 mg/kg for benzovindiflupyr in beans (dry).

The Meeting estimated a maximum residue level of 0.2 mg/kg and an STMR of 0.011 mg/kg for benzovindiflupyr in peas (dry).

Soya beans (dry)

Six residue trials in Brazil were evaluated by 2014 JMPR. The Brazil trials (3 × 0.045 kg ai/ha, interval 19-59 and 14 days, DALA 21-28 days, with adjuvant added), matched the critical GAP of Paraguay (three foliar applications without adjuvant at 0.045 kg ai/ha at 14 day intervals with a PHI of 21 days). Benzovindiflupyr residues were: < 0.01, < 0.01, < 0.01, < 0.01, 0.01, 0.03 mg/kg (n = 6).

The current Meeting received 18 trials from USA. The USA GAP for benzovindiflupyr is 2 ×0.050 kg ai/ha, 14 day interval and a PHI of 14 days. The Canada GAP is also available, which is 2 ×0.075 kg ai/ha, 7 day interval and a PHI of 14 days. Considering a higher application rate and same PHIs, the Canada GAP was selected as the critical GAP.

Eighteen trials from USA matching Canada GAP gave residues at 14 days PHI: < 0.01 (n = 15), 0.012, 0.018 and 0.064 mg/kg.

The Meeting estimated a maximum residue level of 0.08 mg/kg to replace its previous recommendation (0.05 mg/kg) and an STMR of 0.01 mg/kg for benzovindiflupyr in soya beans (dry).

Potatoes

The USA GAP for benzovindiflupyr on potatoes is in-furrow use at planting at 1 ×0.10 kg ai/ha, and a PHI of 14 days. The Canada GAP is for foliar use, which is 4 ×0.075 kg ai/ha, 7 day interval and a PHI of 15 days. The Canada GAP was selected as the critical GAP. Twelve trials were conducted in the USA matching the cGAP with less than 25% deviation. Several trials were conducted with EC and WG formulations for residue comparison. Only the highest residue was selected from these trials at one site.

Benzovindiflupyr residues at 14 days PHI were: < 0.01 (n = 8), 0.01, 0.014（2）and 0.015 mg/kg.

The Meeting estimated a maximum residue level of 0.02 mg/kg, an HR of 0.015 mg/kg and an STMR of 0.01 mg/kg for benzovindiflupyr in potatoes.

Barley

Benzovindiflupyr is registered in Canada for use on cereals at 2 × 0.075 kg ai/ha (interval 14 days, not later than Feekes 10.5.4). In the USA, the WG formulation was registered on cereals for foliar use, with 2 ×0.050 kg ai/ha (not later than Feekes 10.5 full flower). Several trials from Canada and the USA on barley were received. One trial was not considered in the evaluation as benzovindiflupyr residues above the LOQ were detected in the control sample. Trials conducted with the last application after BBCH 71 were considered as not matching the cGAP.

In three trials conducted in Canada and nine trials conducted in USA according to Canada GAPs, benzovindiflupyr residues in barley were: 0.014, 0.029, 0.061, 0.079, 0.096, 0.14, 0.21, 0.26, 0.32, 0.42, 0.54 and 0.59 mg/kg.

Based on the trials matching the critical GAP (Canada), the Meeting estimated a maximum residue level of 1 mg/kg, an STMR of 0.175 mg/kg for benzovindiflupyr in barley. The Meeting agreed to extrapolate these estimations to oats.

Maize (corn)

Benzovindiflupyr is registered in Canada at GAP of 2 × 0.075 kg ai/ha (interval 14 days), and a 7 day PHI. In 2010, 19 trials (two of which were also decline studies) were conducted in the USA for field maize, using 4 × 0.075 kg ai/ha (interval 14 days), and a 7 day PHI.

None of the trials matched the critical GAP.

Wheat

Benzovindiflupyr is registered in Canada on cereals at GAP of 2 × 0.075 kg ai/ha (interval 14 days, not later than FK 10.5.4). In USA, the WG formulation was registered on cereals for foliar use, with 2 ×0.050 kg ai/ha (not later than FK 10.5 full flower). Trials from Canada and USA on wheat were received. Trials conducted at the last application after BBCH 71 were considered as not matching the cGAP.

In 12 trials conducted in Canada and 18 trials conducted in USA matching Canada cGAP, benzovindiflupyr residues in wheat were: < 0.01 (9), 0.012(2), 0.015, 0.017, 0.020, 0.021, 0.025 (2), 0.026(2), 0.027(1), 0.031, 0.032, 0.035, 0.041(2), 0.042, 0.046, 0.059, 0.067 and 0.072 mg/kg.

Based on the trials matching the critical GAP (Canada), the Meeting estimated a maximum residue level of 0.1 mg/kg, and an STMR of 0.023 mg/kg for benzovindiflupyr in wheat grain. The Meeting agreed to extrapolate these estimations to rye and triticale.

Sugar cane

Benzovindiflupyr was registered in Brazil on sugar cane, with a GAP of 5 ×0.030 kg ai/ha, 30 day spray interval and a 30 day PHI. In 2010-2011, trials were conducted in seven sites in Brazil. Among them, four trials on processing were also conducted. Three trials were with 3-5 times exaggerated rates and were given consideration in this evaluation using proportionality principles.

Benzovindiflupyr residues in the seven Brazilian trials matching the critical GAP and scaled to the GAP rate were: < 0.01(3), 0.02 (4) mg/kg.

The Meeting estimated a maximum residue level of 0.04 mg/kg, an HR of 0.02 mg/kg and an STMR of 0.02 mg/kg for benzovindiflupyr in sugar cane.

Cotton seed

Benzovindiflupyr was registered in the USA on cotton, with a GAP of 2 ×0.075 kg ai/ha, 14 day spray interval and a 45 day PHI as the cGAP. In 2010-2011, 16 trials were conducted in USA, with 3 ×0.075 kg ai/ha application rate, 14 day spray interval and a 45 day PHI.

No trials matched the critical GAP.

Peanut

Benzovindiflupyr was registered in Brazil on peanut, with a GAP of 4 ×0.045 kg ai/ha, 14 day spray interval and a 7 day PHI.

Six trials conducted in Brazil matched this cGAP within 25% (based on rates). Benzovindiflupyr residues in the 6 trials were: < 0.01 (4), 0.02, 0.02 mg/kg.

The Meeting estimated a maximum residue level of 0.04 mg/kg, and an STMR of 0.01 mg/kg for benzovindiflupyr in peanut.

Rape seed

Benzovindiflupyr was registered in Canada and the USA on rape seed, with foliar application of 1 ×0.075 kg ai/ha and a 30 day PHI. In 2011, nine independent residue trials matching the GAP were conducted in Canada.

Benzovindiflupyr residues in the nine trials matching the critical GAP were: < 0.01 (2), 0.011, 0.019, 0.023, 0.031, 0.045, 0.062 and 0.10 mg/kg.

The Meeting estimated a maximum residue level of 0.2 mg/kg, and an STMR of 0.023 mg/kg for benzovindiflupyr in rape seed.

Coffee beans

Benzovindiflupyr was registered in Brazil on coffee, with foliar application of 3 ×0.060 kg ai/ha, spray interval of 60 days and a 21 day PHI. In 2010, six trials were conducted in Brazil.

Benzovindiflupyr residues in the six trials matching the critical GAP were: < 0.01 (3), 0.02 (2), and 0.07 mg/kg.

The Meeting estimated a maximum residue level of 0.15 mg/kg, and an STMR of 0.015 mg/kg for benzovindiflupyr in coffee beans.

Animal feed commodities

Feed commodities were analyzed in the studies described previously for the edible commodities. Only the trials conducted according to GAP as described before were summarized herein. Maximum residue levels were not estimated for forage. Highest and/or medium residues were estimated for commodities listed in the OECD feeding table for dietary burden calculation purposes.

Forage

In the trials, the forage samples (described as forage, green material or rest of the plant) were harvested at different PHIs. Whenever data was available, the residues at cGAP PHI (or any day later that gave a higher residue) were chosen to represent the level of residues to which animals would be exposed. In cases where this data point was not available, the highest value from any PHI available (up to the grain PHI) would be taken, including from 0 day PHI.

Maize forage

Twenty trials were conducted on maize in Canada and USA according to 4 × 0.075 kg ai/ha foliar application with 7 days interval and a 7 day DALA. The Canada cGAP is 2 × 0.075 kg ai/ha rate, with a 7 day PHI.

The Meeting considered the trials did not match the cGAP.

Pea vines

In five trials conducted in peas in the USA according to GAP (2 applications at 0.075 kg ai/ha, 7 day interval and a 15 day PHI), benzovindiflupyr residues in pea vines were: 0.28, 0.29, 0.43, 0.51 and 0.96 mg/kg.

The Meeting estimated a median and a highest residue of 0.43 mg/kg (as received) and 0.96 mg/kg (as received), respectively, for benzovindiflupyr in pea vines.

Wheat, barley, oat, rye and triticale forage

Thirty two trials conducted on maize in Canada and USA matching Canada cGAP on cereals (2 applications at 0.075 kg ai/ha foliar application with 14 day spray interval, 7 day PHI for forage), gave benzovindiflupyr residues in wheat forage (n = 32) : < 0.01, 0.38, 0.40, 0.45, 0.48, 0.55 (2), 0.63, 0.67, 0.71, 0.73, 0.74, 0.82, 0.90, 0.95, 1.0, 1.1, 1.2 (2), 1.3(3), 1.4, 1.5(3), 1.8(1), 1.9(2), 2.1, 2.2 and 3.4 mg/kg.

The Meeting estimated a median and a highest residue of 1.1 mg/kg (as received) and 3.7 mg/kg (as received; based on the highest individual residue), respectively, for benzovindiflupyr in wheat forage. The Meeting agreed to extrapolate these estimations to barley, oat, rye and triticale.

Soya beans forage

According to the Canadian label, soya bean forage may be fed or harvested 1 day after the last application. No residue trials data were available to support a 1 day PHI.

Sweetcorn forage

Twelve trials in sweet corn were conducted in Canada and the USA according to 4 ×0.075 kg ai/ha foliar application with 7 day interval and forage samples were collected at 7-14 day DALA. The cGAP is 2 × 0.075 kg ai/ha rate, with a 7 days PHI.

No trials matched the cGAP.

Cotton gin trash

Five trials on cotton were conducted in the USA according to USA GAP 3 ×0.075 kg ai/ha, 14 days interval and a 45 days DALA). The cGAP is 2 ×0.075 kg ai/ha rate, with a 45 days PHI.

No trials matched the cGAP.

Straw, hay and/or fodder, stover

Barley and wheat

Trials conducted in barley in Canada and the USA according to Canada GAP (2 ×0.075 kg ai/ha, a 14 day interval, not later than BBCH 71 and 7 days PHI for hay), gave benzovindiflupyr residues in barley hay (n = 20) : 1.5, 1.6, 1.7, 2.3, 2.5, 2.6, 3.8, 4.0, 4.0, 4.7, 5.0, 5.1, 5.2， 5.4, 5.5, 6.1(2), 6.3,

7.9(2) mg/kg; and benzovindiflupyr residues in barley straw (as received, n = 18): 0.21, 0.40, 0.83, 1.6, 1.8, 1.9(2), 2.2, 2.4, 3.2, 3.3, 3.5, 3.7, 4.6, 5.0, 7.1, 7.8(2) mg/kg.

In 33 trials conducted in wheat in the Canada and the USA according to Canada GAP (2 ×0.075 kg ai/ha, a 14 days interval), benzovindiflupyr residues in wheat hay were: 0.54, 0.72, 0.78, 1.1, 1.5, 1.6, 1.7(2), 1.9, 2.0(2), 2.2(2), 2.5, 2.7, 2.9(2), 3.4, 3.8, 3.9(2), 4.1, 5.2, 5.4, 6.0, 6.2, 6.6, 6.9, 7.1, 7.2, 8.5, 8.6, 12 mg/kg and 28 trials on benzovindiflupyr residues in wheat straw were: < 0.01, 0.11, 0.17, 0.23, 0.38, 0.41, 0.54, 0.72, 0.96, 1.0, 1.3(2), 2.0, 2.2, 2.3(2), 2.9, 3.0, 3.7, 3.9, 4.1, 4.4(2), 4.7(2), 6.2,6.9, 8.4 mg/kg.

The medians for the residue data of wheat and barley hay and those for wheat and barley straw are within 5-fold range, and the Mann-Whitney U-test results also indicated they both came from the same population, the data sets for barley and wheat hay (as received) can be combined: 0.54, 0.72, 0.78, 1.1, 1.45, 1.5, 1.6(2), 1.65(2), 1.7, 1.9, 2,2(3), 2.3, 2.5(2), 2.6, 2.7, 2.9(2) , 3.4, 3.8(2), 3.9(2), 4 (2), 4.1, 4.7, 5, 5.1, 5.2 (2), 5.4(2) , 5.5, 6, 6.1(2) , 6.2, 6.3, 6.6, 6.9, 7.1, 7.2, 7.9(2), 8.5, 8.6, and 12 mg/kg.

Similarly, the combined data set for wheat and barley straw (fresh weight） are: 0.01, 0.11, 0.17, 0.21, 0.23, 0.38, 0.4, 0.41, 0.54, 0.72, 0.83, 0.96, 1, 1.3(2), 1.6, 1.8, 1.9(2), 2, 2.2(2) 2.3(2), 2.4, 2.9, 3, 3.2, 3.3, 3.5, 3.7(2) , 3.9, 4.05, 4.4(2), 4.6, 4.7(2), 5, 6.2, 6.85, 7.1, 7.8(2) and 8.4 mg/kg.

The Meeting noted that it is hard to distinguish straw and fodder of barley and wheat moving in trade due to their similarity in appearance. It also noted that there are common or similar GAPs existing for wheat and barley in Canada and the USA. The Meeting decided to recommend the maximum residue level, STMR and HR for barley straw and fodder based on the higher residue in hay. The Meeting then agreed to estimate median and highest residue for barley/wheat straw and fodder, dry at 3.9, 12 mg/kg for animal dietary burden evaluation. The Meeting agreed to recommend maximum residue level for barley/wheat straw and fodder, dry at 15 mg/kg (based on dry matter). The Meeting also agreed to extrapolate these estimates to oat, rye, and triticale.

Maize stover

Maize GAP in USA was available as 2 ×0.075 kg ai/ha, with 7 days PHI and 7 days application interval. 20 trials on maize were conducted in Canada and the USA according to 4 ×0.075 kg ai/ha and a 7 day PHI).

No trials matched the cGAP.

Peanut fodder

The USA registered use was 3 ×0.075 kg ai/ spray and a 30 day PHI with 14 day spray interval, or 2 applications at 0.1 kg ai/ha rate with 21 day interval and 30 days PHI. The 3 times application at 0.075 mg/kg dose from USA was used as cGAP. Fifteen trials conducted in the USA could not match this cGAP due to higher spray rates. The Meeting decided to use proportionality to scale the residues. A proportionality factor of 0.75 was applied to scale down terminal residues in peanut fodder. In 13 trials conducted in peanut in the USA according to 3 applications at 0.1 kg ai/ha, 14 days interval and a 30 day PHI, unscaled residues were: 0.43, 1.8, 2.7, 2.8, 2.9, 2.9, 3.0, 3.7, 6.3, 7.0, 7.1, 7.7 and 9.0 mg/kg; scaled benzovindiflupyr residues in peanut hay (n = 13) were: 0.32, 1.3, 2.1, 2.1, 2.1, 2.1, 2.2, 2.8, 4.7, 5.3, 5.3, 5.7 and 6.8 mg/kg.

The Meeting estimated a maximum residue level, a median and a highest residue of 15 mg/kg, 2.2 mg/kg (as received) and 7.6 mg/kg (as received, highest individual residue), respectively, for benzovindiflupyr in peanut fodder.

Pea hay

In 5 trials conducted in peas in the USA according to GAP (2 applications at 0.075 kg ai/ha, 7 day interval and a 15 day PHI), benzovindiflupyr residues in pea hay at DALA 14 days were: 1.2, 1.8, 2.2, 3.1 and 3.8 mg/kg.

The Meeting estimated maximum residue level, a median and a highest residue of 8 mg/kg, 2.2 mg/kg and 3.8 mg/kg, respectively, for benzovindiflupyr in pea hay or fodder, dry.

Soya beans hay

According to the Canadian label, soya bean hay may be fed or harvested 1 day after the last application. As no residue trial data are available to support a 1 day PHI, the Meeting made no recommendations.

Sweetcorn stover

Twelve trials in sweet corn were conducted in Canada and USA with 4 × 0.075 kg ai/ha foliar applications, with a 7 day interval and 7-14 day DALA. The Canada cGAP is : 2 × 0.075 kg ai/ha and 7 day PHI. The Meeting agreed that the trials don't match the cGAP.

Fate of residues during processing

In 2014 the JMPR Meeting concluded that benzovindiflupyr is stable under the conditions simulating pasteurization, baking/brewing/boiling and sterilization. 2014 JMPR also estimated the processing factors for soya beans products. The current Meeting received processing studies on apple, grape, potato, tomato, cotton seed, peanut, rapeseed, soya bean, barley, corn, wheat, coffee and sugarcane. Processing factors based on the residue for parent only are listed in the table below. Using the STMRs for raw agricultural commodities evaluated by the Current Meeting and considering 2014 JMPR evaluation results on soya bean processing factors, the Meeting estimated STMR-Ps for processed commodities to be used in the livestock dietary burden calculations and/or dietary risk assessment.

Raw commodity $STMR_{RAC}$, HR_{RAC} mg/kg	Processed commodity	Individual processing factors	Mean or best estimated processing factor (PF)	STMR-P = $STMR_{RAC}$ x PF (mg/kg)	HR-P = HR_{RAC} x PF (mg/kg)
Apple	Wet pomace	2.1,2.9, 4.0, 4.2	3.5	0.20	
	Dry pomace	11.4, 15.0, 15.9, 20.8	15.5	0.90	
	Juice	< 0.05,< 0.06,< 0.06, < 0.07	< 0.06	0.003	
	Sauce	0.12,0.22,0.67,1.0	0.45	0.026	
	Dried fruit	6.6, 6.8, 18.9, 22.2	12.9	0.75	2.19
	Jelly	0.04, 0.13	0.09	0.005	
	Canned fruit	< 0.03, < 0.06, < 0.06, 0.08	< 0.06	0.003	
Grape	Must	0.18, 0.49, 0.50, 0.62, 0.70,1.1, 1.5, 1.6	0.66	0.38	
	Wet pomace	1.1, 1.9, 1.9, 2,2, 2.4, 2.4, 2.5, 3, 3.1, 3.6, 4.2, 4.3, 4.4	2.5	1.20	
	Dry pomace	3.2, 3.5,4.4, 4.9, 5.2, 5.9, 6.8,7.1, 11.6,11.7, 17.2, 19.7	6.4	4.2	
	Grape juice	0.06, 0.06, 0.07, 0.08, 0.10, 0.19	0.075	0.022	
	White wine	0.02, 0.03, 0.05, 0.07	0.04	0.012	
	Red wine	0.03, 0.08, 0.08, 0.13	0.08	0.023	
	Dried grapes (Raisins)	4.0, 3.1, 2.5, 2.2, 1.9, 1.4	2.4	0.70	1.9
Potato	Peel	4.8	4.8	0.048	

Raw commodity $STMR_{RAC}$, HR_{RAC} mg/kg	Processed commodity	Individual processing factors	Mean or best estimated processing factor (PF)	STMR-P = $STMR_{RAC}$ x PF (mg/kg)	HR-P = HR_{RAC} x PF (mg/kg)
	Peeled tubers	0.25	0.25	0.003	0.004
	Baked tubers	2.2	2.2	0.022	0.033
	Boiled/peeled tubers	0.25	0.25	0.003	0.004
	Flakes	0.50	0.50	0.005	
	Chips	< 0.25	< 0.25	0.003	
	Fried potatoes	< 0.25	< 0.25	0.003	0.004
Tomato	Paste	0.33, 0.50	0.42	0.037	
	Puree	0.15, 0.18	0.17	0.015	
	Canned fruit	0.02, 0.04	0.03	0.003	0.019
	Wet pomace	2.4, 12.5	7.5	0.67	
	Dried fruit	6.3, 11.4	8.9	0.79	5.52
	Juice	0.06, 0.11	0.09	0.008	
	Dried pomace	17.0, 53.6	35.3	3.14	
Peanut	Pressed meal	< 0.053, < 0.17, 1.3, 1.9	0.74	0.007	
	Refined oil	< 0.053, < 0.17, 3.0, 3.8	1.6	0.016	
	Peanut Butter	< 0.05, < 0.14, 1.0, 1.0	< 0.57	0.006	
Rapeseed (canola), seed	Meal	0.42, 0.63	0.53	0.012	
	Refined oil	0.72, 1.2	0.98	0.023	
Soya bean, seed	Meal	< 0.13,< 0.13, < 0.38, < 0.40	< 0.26	0.0026	
	Hulls	1.1, 2.5, 10,11	6.3	0.0063	
	fat flour	< 0.13, 0.13, < 0.34, < 0.44	< 0.24	0.0024	
	Soyamilk	< 0.13,< 0.13, < 0.32, < 0.44	< 0.23	0.0023	
	Tofu	< 0.13, < 0.13, 0.52, 0.58	0.33	0.0033	
	Soya sauce	< 0.13, < 0.13, < 0.34, < 0.36	< 0.23	0.0023	
	Crude oil	0.63, 0.77, 0.96, 2.0,	0.86	0.0086	
	Refined oil	0.38, 0.63, 0.65, 0.68	0.64	0.0064	
	Aspirated grain	7.4, 7.6, 7.7, 7.9, 8.3, 9.6, 11, 14, 191	8.3	0.083	
Barley, grain	Pearl barley	0.27, 0.64	0.46	0.083	
	Barley flour	0.24, 0.55	0.40	0.072	
	Bran	0.32, 0.45	0.39	0.070	
Wheat, grain	Bran, unprocessed	1.0, 1.3, 3.3, 4.0,	2.3	0.053	
	White flour	0.33, 0.33, 0.33, 0.50,	0.33	0.008	
	Wholemeal flour	0.33, 0.33, 1.0, 1.5,	0.67	0.015	
	Wholemeal bread	0.33, 0.33, 0.67, 1.0	0.50	0.012	
	Wheat germs	1.0, 1.0, 1.0, 1.0	1.0	0.023	
	Aspirated grain	22.7, 121.6	72	1.66	
	Flour	0.10, < 0.17	< 0.14	0.003	
	Middlings	0.16, < 0.17	< 0.17	0.004	
	Shorts	0.13, 0.17	0.15	0.003	
	Germ	< 0.17, 0.74	0.74	0.017	
Coffee, green beans	Roasted beans	< 0.33, < 0.50	< 0.42	0.006	
	Instant coffee	< 0.50	< 0.50	0.008	
Sugarcane, stalk	Bagasse	4.9, 5.6, 7.3, 8.25, 9.5, 10.4, 11, 12	8.9	0.18	
	Crystal sugar	0.1, 0.14,0.2, 0.25, 0.25, 0.33, 0.33, 0.5	< 0.25	0.005	
	Molasses	< 0.25, < 0.29, 0.3, < 0.33, < 0.33, < 0.4, < 0.5, 0.5	< 0.33	0.007	

For dried grape (raisins), a maximum reidue level, an STMR and HR of 3 mg/kg, 0.7 mg/kg, 1.9 mg/kg, respectively, are recommended by the Meeting.

Residues in animal commodities

The current Meeting received several field trial studies on benzovindiflupyr residues including those on feed commodities of sweet corn (forage and stover), pulses including peas and beans (hay and vines), soyabean (forage and hay), barley (hay and straw), maize (corn forage and stover), wheat (forage, hay and straw), peanut (hay).

The Meeting estimated the dietary burden of benzovindiflupyr residues on the basis of the livestock diets listed in the FAO manual appendix IX (OECD feedstuff table). For bulk commodities, calculation from STMR provides the levels in feed suitable for estimating maximum residue levels as well as STMR values for animal commodities. Commodities used in the dietary burden calculation are soya bean hay and hulls, wheat forage, barley grain and processed products, corn grain and corn gluten, pea seed, canola, rapeseed and peanut meal, and bean seed.

Dietary burden calculations for beef cattle, dairy cattle, broilers and laying poultry are provided in Annex 6 to the 2016 Report. A mean and maximum dietary burden for livestock, based on benzovindiflupyr use, is shown in the table below.

Livestock dietary burden for benzovindiflupyr residues, expressed as ppm of dry matter diet

		Animal dietary burden, benzovindiflupyr residues, ppm of dry matter diet			
		US-Canada	EU	Australia	Japan
Beef cattle	max	2.38	5.54	14.8 A	0.15
	mean	1.00	2.10	5.15 C	0.15
Dairy cattle	max	5.78	5.72	13.8 B	0.09
	mean	1.85	2.18	5.12 D	0.09
Poultry - broiler	max	0.16	0.15	0.04	0.02
	mean	0.16	0.15	0.04	0.02
Poultry - layer	max	0.16	2.1 E	0.04	0.01
	mean	0.16	0.85 F	0.04	0.01

[A] Highest maximum beef or dairy cattle dietary burden suitable for maximum residue level estimates for mammalian tissues

[B] Highest maximum dairy cattle dietary burden suitable for maximum residue level estimates for mammalian milk

[C] Highest mean beef or dairy cattle dietary burden suitable for STMR estimates for mammalian tissues.

[D] Highest mean dairy cattle dietary burden suitable for STMR estimates for milk.

[E] Highest maximum poultry dietary burden suitable for maximum residue level estimates for poultry tissues and eggs.

[F] Highest mean poultry dietary burden suitable for STMR estimates for poultry tissues and eggs.

Farm animal feeding studies

The 2014 JMPR evaluated and reported the farm animal feeding studies on dairy cows. The Meeting received no further information on feeding studies. Animal dietary burden were calculated using median and highest residue of related commodities estimated by the 2014 and current Meeting..

Animal commodities maximum residue levels

For MRL estimation in animal commodities, the residue definition is benzovindiflupyr, the residue is fat soluble.

Estimated residues in tissues and milk at the dietary burden are shown in the table below.

	Feed level (ppm) for milk residues	Residues (mg/kg) in milk	Feed level (ppm) for tissue residues	Residues (mg/kg) in			
				Muscle	Liver	Kidney	Fat
MRL beef or dairy cattle							
Feeding study [A] 	 3.5 16	 < 0.01 < 0.01	3.5 16	< 0.01 < 0.01	< 0.01 0.07	< 0.01 0.01	< 0.01 0.02
Dietary burden and high residue	13.77	0.01	14.80	0.01	0.064	0.010	0.019
STMR beef or dairy cattle							
Feeding study [B] 	 3.5 16	 < 0.01 < 0.01	3.5 16	< 0.01 < 0.01	< 0.01 0.037	< 0.01 0.01	< 0.01 0.013
Dietary burden and median residue estimate	5.12	< 0.01	5.15	0.01	0.014	0.01	0.010

[A] highest residues for tissues and mean residues for milk

[B] mean residues for tissues and mean residues for milk

The Meeting estimated maximum residue levels of 0.03 (fat), 0.1, 0.03, and *0.01 mg/kg in mammalian meat, mammalian edible offal, mammalian fat, and milk, respectively.

The Meeting estimated an STMR of 0 mg/kg in milk, as no residues from any milk samples at any experimental dose levels were found above the LOQ of 0.01 mg/kg. The Meeting estimated an STMR and HR of 0.01, 0.01 mg/kg, respectively, in mammalian muscle; 0.01 and 0.019 mg/kg, respectively, in mammalian fats; and 0.014 and 0.064 mg/kg, respectively, in mammalian edible offal. The residue in animal commodities is considered fat soluble.

The Meeting noted that no feeding study was conducted on poultry. From the metabolism study results on laying hens according to 2014 JMPR evaluation, at 17–20 ppm in the diets, benzovindiflupyr residues were found in egg yolk (0.0224 mg/kg), egg white (0.00374 mg/kg), poultry fat (0.00125–0.0189 mg/kg), poultry muscle (0.0008–0.0012 mg/kg) and poultry liver (0.0004–0.0005 mg/kg). At the maximum and mean dietary burden of 2.1 ppm and 0.85 ppm, residues of benzovindiflupyr were calculated using division factors of 8 and 20, to be all below 0.001 mg/kg. From these findings, the Meeting concluded that no potential residues are expected in poultry commodities.

The Meeting estimated maximum residue levels of 0.01* for eggs, poultry fat, poultry meat and poultry edible offal. The Meeting recommended an STMR and HR of 0 and 0 for eggs, poultry fat, poultry meat and poultry edible offal.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting concluded that the residue levels listed in Annex 1 are suitable for establishing maximum residue limits and for IEDI and IESTI assessments.

Definition of the residue for compliance with the MRL and for dietary risk assessment for plant and animal commodities: *benzovindiflupyr*.

The residue is fat soluble.

DIETARY RISK ASSESSMENT

Long-term dietary exposure

The International Estimated Daily Intakes (IEDI) for benzovindiflupyr were calculated using STMRs estimated by the current and the 2014 Meeting, in combination with consumption data for corresponding food commodities. The results are shown in Annex 3 to the 2016 Report.

The IEDI of the 17 GEMS/Food cluster diets, represented 0–2% of the maximum ADI of 0.05 mg/kg bw.

The Meeting concluded that the long-term exposure to residues of benzovindiflupyr from uses considered by the Meeting is unlikely to present a public health concern.

Short-term dietary exposure

2013 JMPR established an ARfD of 0.1 mg/kg bw. The International Estimated Short Term Intake (IESTI) for benzovindiflupyr were calculated using STMRs/HRs estimated by the current and the 2014 Meeting, in combination with consumption data for corresponding food commodities. The results are shown in Annex 4 to the 2016 Report.

The calculated IESTI represented 0–70% of the ARfD (0.1 mg/kg bw) for the general population, and for children 0–60% of the ARfD. The Meeting concluded that the short-term dietary exposure to residues of benzovindiflupyr from uses considered by the Meeting is unlikely to present a public health concern.