BENZOVINDIFLUPYR (261)

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EXPLANATION

Benzovindiflupyr is a broad-spectrum fungicide first evaluated by JMPR in 2013 (Toxicology) and 2014 (Residues). The toxicological review established an acceptable daily intake (ADI) of 0–0.05 mg/kg bw and an acute reference dose (ARfD) of 0.1 mg/kg bw. In 2016 the JMPR evaluated the compound for residues and recommended a number of maximum residue levels.

The definition of the residue for compliance with the MRL and for dietary risk assessment for plant and animal commodities is *benzovindiflupyr*. The residue is fat-soluble.

The 2019 Meeting received additional analytical methods, GAP information and residue trial data from uses on bulb onion, green onion and sugar cane and processing data for sugar cane

METHODS OF RESIDUE ANALYSIS

The Meeting received two new analytical methods for the determination of parent benzovindiflupyr and metabolite SYN546039.

Method PR# 11130 (Lennon, 2016, BENZOVINDI_001)

The method is a modified version of method GRM042.03A, as described in the 2014 JMPR. In brief, residues were extracted from onion by homogenization with acetonitrile/water (8+2, v/v). After centrifugation, an aliquot of the extract was diluted with acetonitrile/water (1+1, v/v) and analysed for benzovindiflupyr by LC-MS/MS, monitoring the transitions m/z 396→91 and 396→368. A separate aliquot was evaporated to the aqueous remainder and 2 mL 1 M HCl were added prior to liquid-liquid partitioning against hexane. The hexane phase was discarded and the acidic aqueous sample hydrolyzed at 100 °C for 6 hours to cleave conjugates of metabolite SYN546039. Clean-up was performed on a Varian Bond Elute-phenyl-modified SPE column (compared to an Oasis HLB SPE column of the original method), prior to analysis of SYN546039 by LC-MS/MS, monitoring the transition m/z 412→91 and 412→340.

Table 1 Recovery data for method PR# 11130 measuring benzovindiflupyr and metabolite SYN546039 in dry bulb onion and green onion using LC-MS/MS

Analyte	Matrix	Fortification level [mg/kg]	No of replicates	Mean recovery [%]	RSD [%]	Reference
Benzovindiflupyr	Dry bulb	0.01	3	100	8	Lennon, 2016, BENZOVINDI_001
		0.1	3	101	4	
		1.0	3	107	3	
	Green onion	0.01	3	94	4	
		0.1	3	101	3	
		1.0	3	113	3	
SYN546039	Dry bulb	0.01	3	68	6	
		0.1	3	84	7	
		1.0	3	85	4	
	Green onion	0.01	6	73	15	
		0.1	3	83	4	
		1.0	3	88	4	

Method GRM042.03A (Hampton, 2016, BENZOVINDI_002)

Method GRM042.03A was evaluated by the 2014 JMPR. The validation data included; apples, grapes, wheat (forage, grain, hay, straw, flour), spinach, lettuce, peanuts, coffee beans, carrot (roots and leaves), turnip (roots and leaves), radish (roots and leaves), orange juice and sugarcane. In this submission, the method was also used for the determination of benzovindiflupyr and metabolite SYN546039 residues in sugar cane and its processed commodities. The new method validation data to support these uses are presented in Table 2.

Table 2 Recovery data for method GRM042.03A measuring benzovindiflupyr and metabolite SYN546039 in sugar cane and its processed commodities using LC-MS/MS

Analyte	Matrix	Fortification level [mg/kg]	No of replicates	Mean recovery [%]	RSD [%]	Reference
Benzovindiflupyr	Sugar cane	0.01	3	100	4.6	Hampton, 2016, BENZOVINDI_002
		0.1	3	93	2.6	
	Refined sugar	0.01	3	79	5.0	
		1.0	3	77	2.1	
	Molasses	0.01	3	85	6.7	
		1.0	3	86	5.3	
SYN546039	Sugar cane	0.01	3	98	2.3	
		0.1	3	98	2.5	
	Refined sugar	0.01	3	87	2.0	
		1.0	3	97	2.7	
	Molasses	0.01	3	91	7.6	
		1.0	3	114	4.6	

USE PATTERN

In the following table GAP information on all crops supported with residue data are summarized.

Table 3 Registered uses of benzovindiflupyr

Crop/ Commodity	Country	Formulation		Application				PHI (days)
		Active substance content	Type	Method	Rate	Water volume	No or Seasonal max. (interval)	
Dry bulb onion (Group 3-07A)[a]	USA	100 g ai/L	EC	Foliar spray	62–76 g ai/ha	Min. 93 L/ha Aerial: min 46 L/ha	4 (7–14 days)	7
Dry bulb onion (Group 3-07A)[a]	USA	150 g/kg	WG	Foliar spray	50–74 g ai/ha	Min. 93 L/ha Aerial: min 46 L/ha	4 (7–14 days)	7
Onions, green (Group 3-07B)[b]	USA	100 g ai/L	EC	Foliar spray	62–76 g ai/ha	Min. 93 L/ha Aerial: min 47 L/ha	4 (7–14 days)	7

Crop/ Commodity	Country	Formulation		Application				PHI (days)
		Active substance content	Type	Method	Rate	Water volume	No or Seasonal max. (interval)	
Onions, green (Group 3-07B)[b]	USA	150 g/kg	WG	Foliar spray	50–74 g ai/ha	Min. 93 L/ha Aerial: min 46 L/ha	4 (7–14 days)	7
Sugar cane	USA	100 g ai/L	EC	Foliar spray	21–76 g ai/ha	Not stated	3 (14–28 days)	30
Sugar cane	USA	150 g/kg	WG	Foliar spray	52–74 g ai/ha	Not stated	3 (14–28 days)	30

[a] Daylily, bulb; fritillaria, bulb; garlic, bulb; garlic, great-headed, bulb; garlic, serpent, bulb; lily, bulb; onion, bulb; onion, Chinese, bulb; onion, pearl; onion, potato, bulb; shallot, bulb; cultivars, varieties, and/or hybrids of these

[b] Chive, fresh leaves; chive, Chinese, fresh leaves; elegans hosta; fritillaria, leaves; kurrat; lady's leek; leek; leek, wild; onion, Beltsville bunching; onion, fresh; onion, green; onion, macrostem; onion, tree, tops; onion, Welsh, tops; shallot, fresh leaves; cultivars, varieties, and/or hybrids of these

RESULTS OF SUPERVISED RESIDUE TRIALS ON CROPS

Residue levels were reported as measured. Application rates were always reported as benzovindiflupyr equivalents. When residues were not detected they are shown as below the LOQ, e.g., < 0.01 mg/kg. Application rates, spray concentrations and mean residue results have generally been rounded to the even with two significant figures. HR and STMR values from the trials conducted according to maximum GAP have been used for the estimation of maximum residue levels. These results are underlined.

Laboratory reports included method validation including batch recoveries with spiking at residue levels similar to those occurring in samples from the supervised trials. Dates of analyses or duration of residue sample storage were also provided. Field reports provided data on the sprayers used and their calibration, plot size, residue sample size and sampling date. Although trials included control plots, no control data are recorded in the tables except where residues in control samples exceeded the LOQ. Residue data are recorded unadjusted for percent (%) recovery.

Benzovindiflupyr – supervised residue trials

Commodity	Indoor/Outdoor	Treatment	Countries	Table
Bulb onion	Outdoor	Foliar spray	United States	4
Green onion	Outdoor	Foliar spray	United States	5
Sugar cane	Outdoor	Foliar spray	United States	6

Bulb vegetables

Bulb onion

A total of 10 supervised residue trials were conducted on bulb onion in Canada and the USA during the 2013–2014 growing seasons (Lennon, 2016, BENZOVINDI_001). Plants received 4 foliar applications of benzovindiflupyr at rates of 69–96 g ai/ha with a 6–8 day interval between applications. Samples of bulb onions were collected at 6–8 DALT. Additionally at one trial, samples were also taken at 0, 2 and 14 DALT.

Residues of benzovindiflupyr and metabolite SYN546039 were determined using method PR# 11130 (a modification of method GRM042.03A) with a limit of quantification of 0.01 mg/kg. Procedural recoveries in bulb onions spiked with benzovindiflupyr at 0.01–0.2 mg/kg were all within the acceptable range of 70–120%. However, procedural recoveries for metabolite SYN546039 spiked at 0.01 mg/kg were as low as 49% and therefore frequently outside of the acceptable range. Storage stability was demonstrated for at least 15 months.

Table 4 Residues of benzovindiflupyr and metabolite SYN546039 in bulb onions (bulbs) following foliar treatment (cGAP: USA, 4×76 g ai/ha; 7 day PHI)

Location, Year (variety)	Application				Residue (mg/kg)[a]			Report/Trial No., Reference Storage period
	Method	Rate (g ai/ha)	Interval (days)	Growth stage at final appl.	DALT	Benzovindi-flupyr	SYN546039	
USA Holtville, CA 2014 (Koda)	Foliar spray (WG)	74 75 73 75	6-7	Mature bulbs (2-4" diameter)	6	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 CA72 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 6.6 months
	Foliar spray (EC)	76 76 73 76	6-7	Mature bulbs (2-4" diameter)	6	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	
USA Parlier, CA 2013 (Candy)	Foliar spray	77 76 76 77	7	Vegetative	0 2 7 14	0.014 0.014 (0.014) 0.011 <0.01 (0.010) 0.014 <0.01 (0.012) <0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01) <0.01 <0.01 (<0.01) <0.01 <0.01 (<0.01) <0.01 <0.01 (<0.01)	IR-4 PR No. 11130 CA73 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 16 months
USA Las Cruces, NM 2013 (Texas Yellow Grano)	Foliar spray	73 77 75 77	6-7	Mature bulb	6	0.012 0.011 (0.011)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 NM13 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 17 months
USA Willard, OH 2013 (Candy)	Foliar spray	75 78 75 77	6-8	Vegetative	8	0.015 0.014 (0.015)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 OH*10 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 15 months
Canada[b] Harrow, ON 2013 (Lasalle)	Foliar spray	74 76 76 74	6-7	7 leaves	8	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 ON05 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 15 months

Location, Year (variety)	Application				Residue (mg/kg)[a]			Report/Trial No., Reference Storage period
	Method	Rate (g ai/ha)	Interval (days)	Growth stage at final appl.	DALT	Benzovindi-flupyr	SYN546039	
Canada[b] Harrow, ON 2013 (Pulsar)	Foliar spray	74 78 85 76	6-7	~8 leaves	8	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 ON06 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 15 months
Canada[b] Ste. Clotilde, QC 2013 (Trailblazer)	Foliar spray	72 75 73 68	6-8	8+ leaves; bulb almost at size	8	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 QC08 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 15 months
Canada[b] Ste. Clotilde, QC 2013 (Frontier)	Foliar spray	74 74 83 76	6-8	8+ leaves; bulb almost at size	8	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 QC09 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 15 months
USA Weslaco, TX 2014 (Sierra Blanca)	Foliar spray (WG)	75 74 74 74	7	Vegetative	7	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 TX11 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 8.0 months
	Foliar spray (EC)	77 75 76 76	7	Vegetative	7	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	
USA Moxee, WA 2013 (Candy)	Foliar spray (WG)	77 76 74 75	6-7	Vegetative	7	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 WA*19 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 14 months
	Foliar spray (EC)	77 77 76 76	6-7	Vegetative	7	<0.01 <0.01 (<0.01)	<0.01 <0.01 (<0.01)	

[a] Mean of replicate field samples [individual values]

[b] It was noted that trial ON5 and ON6, as well as QC8 and QC9 were performed at the same location and year and therefore could not be considered as independent. Hence, the highest residue value from each of these locations was selected.

Green onion

A total of 4 supervised residue trials were conducted on green onion in Canada and the USA during the 2013-2014 growing seasons (Lennon, 2016, BENZOVINDI_001). Plants received 4 foliar applications of benzovindiflupyr at rates of 74–96 g ai/ha with a 6–8 day interval between applications. Samples of green onions were collected at 6–7 DALT.

Residues of benzovindiflupyr and metabolite SYN546039 were determined using method PR# 11130 (a modification of method GRM042.03A) with a limit of quantification of 0.01 mg/kg. Procedural recoveries in green onion spiked with benzovindiflupyr and metabolite SYN546039 at

0.01–0.1 mg/kg were mostly within the acceptable range of 70-120%. Two procedural recoveries were just below the lower limit at 66-67%. Storage stability was demonstrated for at least 15 months.

Table 5 Residues of benzovindiflupyr and metabolite SYN546039 in green onions (whole plant) following foliar treatment (cGAP: USA, 4×76 g ai/ha; 7 day PHI)

Location, Year (variety)	Application				Residue (mg/kg)[a]			Report/Trial No., Reference Storage period
	Method	Rate (g ai/ha)	Interval (days)	Growth stage at final appl.	DALT	Benzovindiflupyr	SYN546039	
USA Willard, OH 2013 (Evergreen white bunching)	Foliar spray	96 74 78 76	6-8	Vegetative	7	0.060 0.053 (0.056)	0.012 0.010 (0.011)	IR-4 PR No. 11130 OH*17 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 16 months
USA Willard, OH 2013 (Ishikura Improved bunching)	Foliar spray (WG)	81 75 81 76	6-8	Vegetative	6	0.042 0.060 (0.051)	<0.01 <0.01 (<0.01)	IR-4 PR No. 11130 OH*18 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 16 months
	Foliar spray (EC)	78 75 75 83	6-8	Vegetative	6	0.14 0.17 (0.16)	0.038 0.043 (0.041)	
USA Aurora, OR 2013 (Green Banner)	Foliar spray	77 77 77 78	6-8	Vegetative	7	0.11 0.11 (0.11)	0.011 0.010 (0.011)	IR-4 PR No. 11130 OR16 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 17 months
Canada Ste. Clotilde, QC 2013 (Tokyo long white)	Foliar spray	74 75 74 76	7-8	5 leaves	7	0.20 0.20 (0.20)	0.047 0.049 (0.048)	IR-4 PR No. 11130 QC20 Lennon, 2016, BENZOVINDI_001 Max. frozen storage: 16 months

[a] Mean of replicate field samples [individual values]

[b] It was noted that trial OH17 and OH18 were performed at the same location and year and therefore could not be considered as independent. Hence, the highest residue value from this location was selected.

Grasses for sugar or syrup production

Sugar cane

A total of eight supervised residue trials were conducted on sugar cane in the USA during the 2014-15 growing seasons (Hampton, 2016, BENZOVINDI_002). Sugar cane plants received 3 foliar applications of benzovindiflupyr at rates of 72–87 g ai/ha with a 12–16 day interval. Samples of sugar cane were collected at 28–31 DALT. In two trials, samples were also taken at 20, 25, 28/29, 35 and 38/40 DALT.

Residues of benzovindiflupyr and metabolite SYN546039 were determined using method GRM042.03A, previously evaluated by the 2014 JMPR, with a limit of quantification at 0.01 mg/kg. Procedural recoveries in sugar cane spiked with benzovindiflupyr and metabolite SYN546039 at

0.01–1.0 mg/kg were all within the acceptable range of 70-120%. Storage stability was demonstrated in high water content matrices for at least 24 months (JMPR 2014).

Table 6 Residues of benzovindiflupyr and metabolite SYN546039 in sugar cane (canes) following foliar treatment (cGAP: USA, 3×76 g ai/ha; 30 day PHI)

Location, Year (variety)	Application				Residue (mg/kg)[a]			Report/Trial No., Reference Storage period
	Method	Rate (g ai/ha)	Interval (days)	Growth stage at final appl.	DALT	Benzovindi-flupyr	SYN546039	
USA Oviedo, FL 2014 (1446)	Foliar spray (EC)	78 72 85	14	BBCH 3	29	0.10 0.10 (0.10)	<0.01 <0.01 (<0.01)	TK0161217-01 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 11 months
	Foliar spray (WG)	77 78 81	14	BBCH 3	29	0.25 0.17 (0.21)	<0.01 <0.01 (<0.01)	
USA Okeechobee, FL 2014 (CP731547K)	Foliar spray	77 80 78	14	BBCH 4	20 25 29 35 40	0.078 0.056 0.11 0.11 (0.11) 0.14 0.12	<0.01 <0.01 <0.01 <0.01 (<0.01) <0.01 <0.01	TK0161217-02 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 12 months
USA Hobe Sound, FL 2014 (CP881762K)	Foliar spray	77 78 76	14	BBCH 4 (reaching crop maturity)	31	0.084 0.052 (0.068)	<0.01 <0.01 (<0.01)	TK0161217-03 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 12 months
USA Washington, LA 2014 (LCP-85-384)	Foliar spray (EC)	76 80 77	14	130 to 140 inches	30	0.081 0.046 (0.064)	<0.01 <0.01 (<0.01)	TK0161217-04 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 13 months
	Foliar spray (WG)	77 80 78	14	130 to 140 inches	30	0.16 0.089 (0.13)	<0.01 <0.01 (<0.01)	
USA Cheneyville, LA 2014 (HoCP540)	Foliar spray	76 81 80	14	BBCH 8 (~16 node)	20 28 35 38	0.061 0.065 0.059 (0.062) 0.040 0.043	<0.01 <0.01 <0.01 (<0.01) <0.01 <0.01	TK0161217-05 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 12 months
USA Morrow, LA 2014 (L01-299)	Foliar spray	82 87 76	14	15 to 16 nodes	30	0.033 0.028 (0.031)	<0.01 <0.01 (<0.01)	TK0161217-06 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 13 months
USA Raymondville, TX 2015 (1210)	Foliar spray (EC)	81 78 78	12-16	BBCH 39 (max stem length)	30	0.068 0.072 (0.070)	<0.01 <0.01 (<0.01)	TK0161217-07 Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 6.8 months
	Foliar spray (WG)	80 77 78	12-16	BBCH 39 (max stem length)	30	0.045 0.029 (0.037)	<0.01 <0.01 (<0.01)	
USA	Foliar	76	14	BBCH 4	31	<0.01	<0.01	TK0161217-08

Location, Year (variety)	Application				Residue (mg/kg)[a]			Report/Trial No., Reference Storage period
	Method	Rate (g ai/ha)	Interval (days)	Growth stage at final appl.	DALT	Benzovindi-flupyr	SYN546039	
Puunene, HI 2014 (78-4135)	spray	76 76		Mature Stalks		0.016 (0.013)	<0.01 (<0.01)	Hampton, 2016, BENZOVINDI_002 Max. frozen storage: 14 months

[a] Mean of replicate field samples [individual values]

FATE OF RESIDUES IN STORAGE AND PROCESSING

Residues after processing

The Meeting received new information on the fate of benzovindiflupyr residues during the processing of sugar cane.

As a measure of the transfer of residues into processed products, a processing factor was used, which is defined as:

Processing factor = Residue in processed product (mg/kg) ÷ Residue in raw agricultural commodity (mg/kg)

If residues in the RAC were below the LOQ, no processing factor could be derived. In case of residues below the LOQ, but above the LOD in the processed product, the numeric value of the LOQ was used for the calculation. If residues in the processed product were below the LOD, the numeric value of the LOQ was used for the calculation but the PF was expressed as "less than" (e.g. <0.5).

The transfer of residues of benzovindiflupyr was investigated in sugar cane from two supervised field trial conducted in the USA (Hampton, 2016, BENZOVINDI_002). The trials were performed with 3 treatments at exaggerated rates of 377-390 g ai/ha with harvest at 30-31 DALT. Sugar cane was processed into refined sugar and molasses using common commercial practices. Residues of benzovindiflupyr and metabolite SYN546039 were determined by method GRM042.03A.

Table 7 Summary of benzovindiflupyr and metabolite SYN546039 residues in sugar cane and processed commodities

Trial Identification (City, State/ Region, Country, Year)	Crop/ Variety	Commodity or Matrix	Total Rate (g ai/ha)	PHI (days)	Benzovindiflupyr		SYN546039	
					mg/kg	PF	mg/kg	PF
TK0161217-03 (Hobe Sound, FL, USA, 2014)	Sugar cane/ CP881762K	Sugar cane RAC	390	31	0.28[a]	-	<0.01	-
		Refined sugar	382		<0.01[b]	<0.04	<0.01[b]	N/A
		Molasses	382		0.024[b]	0.09	<0.01[b]	N/A
TK0161217-06 (Morrow, LA, USA, 2014)	Sugar cane/ L01-299	Sugar cane RAC	389	30	0.11[a]	-	0.011[a]	-
		Refined sugar	386		<0.01[b]	<0.09	<0.01[b]	<0.9
		Molasses	377		<0.01[b]	<0.09	<0.01[b]	<0.9

[a] Mean of triplicate sample

[b] Mean of duplicate analysis

APPRAISAL

Benzovindiflupyr is a broad-spectrum fungicide first evaluated by JMPR in 2013 (Toxicology) and 2014 (Residues). The toxicological review established an acceptable daily intake (ADI) of 0–0.05 mg/kg bw and an acute reference dose (ARfD) of 0.1 mg/kg bw. The definition of the residue for compliance with the MRL and for dietary risk assessment for plant and animal commodities is *benzovindiflupyr*. The residue is fat-soluble.

In 2016 the JMPR evaluated the compound for residues and recommended a number of maximum residue levels.

At the Fiftieth Session of the CCPR, benzovindiflupyr was scheduled for evaluation of additional uses by the 2019 JMPR

The current Meeting received additional analytical methods, GAP information and residue trial data from uses on bulb onion, green onion and sugar cane and processing data for sugar cane

Analytical methods

The Meeting received additional validation information on analytical methods evaluated by the 2014 JMPR for benzovindiflupyr and metabolite SYN546039 in bulb and green onion, as well as in sugar cane, refined sugar and molasses.

The Meeting concluded that the presented methods were sufficiently validated and are suitable to measure benzovindiflupyr and metabolite SYN546039 in bulb and green onion, as well as in sugar cane, refined sugar and molasses.

Results of supervised residue trials on crops

Supervised trials were available for the use of benzovindiflupyr on bulb and green onion and sugar cane.

Bulb vegetables

The critical GAP for the use on bulb vegetables in the USA allows for 4 foliar applications at a rate of 76 g ai/ha with a 7 day interval between applications and a 7 day PHI.

Bulb onion

In independent field trials with bulb onion from Canada and he USA, residues of benzovindiflupyr following GAP treatment (±25%) were (n=8): <0.01(5), 0.011, 0.012 and 0.015 mg/kg.

The Meeting estimated a maximum residue level of 0.02 mg/kg, a STMR of 0.01 mg/kg and a HR of 0.015 mg/kg for benzovindiflupyr in bulb onion (extrapolated to subgroup 009A).

Green onion

In independent field trials on green onion from Canada and the USA, residues of benzovindiflupyr following GAP treatment (±25%) were (n=3): 0.11, 0.16 and 0.20 mg/kg.

The Meeting noted that green onions fall under category 3 of the minor crop classification, requiring a minimum of five supervised field trials to estimate maximum residue levels. Hence, the Meeting concluded that no maximum residue level could be estimated for benzovindiflupyr in green onion.

Grasses for sugar or syrup production

Sugar cane

Sugar cane was previously evaluated by the 2016 JMPR when a maximum residue level of 0.04 mg/kg was recommended based on a GAP from Brazil.

The Meeting received a more critical GAP for the use of benzovindiflupyr on sugar cane in the USA, allowing for 3 foliar applications at a rate of 76 g ai/ha with a 14 day interval between applications and a 30 day PHI.

In field trials on sugar cane from the USA, residues of benzovindiflupyr following GAP treatment (±25%) were (n=8): 0.013, 0.031, 0.062, 0.068, 0.070, 0.13, 0.14 and 0.21 mg/kg (highest individual value: 0.25 mg/kg).

The Meeting estimated a maximum residue level of 0.4 mg/kg, a STMR of 0.069 mg/kg and a HR of 0.25 mg/kg for benzovindiflupyr in sugar cane, to replace the previous recommendation of 0.04 mg/kg.

Fate of residues during processing

The Meeting received new information on the fate of benzovindiflupyr residues during processing in sugar cane.

Table 1 Estimated processing factors for the commodities considered at this Meeting according to the residue definition (benzovindiflupyr)

Raw commodity [STMR/HR]	Processed commodity	Individual processing factors	Mean or best estimate processing factor	STMR-P = $STMR_{RAC}$ × PF (mg/kg)
Sugar cane	Refined sugar	<0.04, <0.09	0.04	0.003
	Molasses	<0.09, 0.09,	0.09	0.006

Residues in animal commodities

Farm animal dietary burden

Dietary burdens were calculated for beef cattle, dairy cattle, broilers and laying poultry based on feed items evaluated by the JMPR in 2014, 2016 and the current Meeting. The dietary burdens, estimated using the OECD diets listed in Appendix IX of the 2016 edition of the FAO manual, are presented in Annex 6.

Previous evaluations included the following potential feed items: cereal (barley, oat, rye, triticale, wheat) forage, straw and grain, pea vines and seeds, peanut hay and meal, sugar cane tops, molasses and bagasse, potatoes, beans seeds, soya bean seeds and processing fractions (aspirated grain fraction, meal, hulls, okara, pollard), apple pomace, canola meal, grape pomace and tomato pomace. Additionally, the current Meeting considered higher STMRs for sugar cane tops and molasses.

Residues of benzovindiflupyr in the crops considered by the current Meeting do not significantly increase the livestock dietary burden of a maximum of 15 ppm for beef cattle, 14 ppm for dairy cattle and 2.1 ppm for laying hens using the 2018 update of the OECD Feed Calculator, and do not have an impact on the previous recommendations for residues in animal commodities made by the 2016 JMPR.

RECOMMENDATIONS

On the basis of the data obtained from supervised trials, the Meeting concluded that the residue levels listed below 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

Table 2 Residue levels suitable for establishing maximum residue limits and for IEDI and IESTI assessments

CCN	Commodity	Recommended Maximum residue level (mg/kg)		STMR or STMR-P mg/kg	HR or HR-P mg/kg
		New	Previous		
VA 2031	Bulb onion, Subgroup of	0.02	-	0.01	0.015
GS 0659	Sugar cane	0.4	0.04	0.069	0.25
DM 0659	Sugar cane, molasses	-	-	0.006	-
	Sugar cane refined sugar	-	-	0.003	-

DIETARY RISK ASSESSMENT

Long-term dietary exposure

The ADI for benzovindiflupyr is 0–0.05 mg/kg bw. The International Estimated Daily Intakes (IEDIs) for benzovindiflupyr were estimated for the 17 GEMS/Food Consumption Cluster Diets using the STMR or STMR-P values estimated by the JMPR. The results are shown in Annex 3 of the 2019 JMPR Report.

The IEDIs ranged from 0–2% of the maximum ADI. The Meeting concluded that long-term dietary exposure to residues of benzovindiflupyr from uses considered by the JMPR is unlikely to present a public health concern.

Acute dietary exposure

The ARfD for benzovindiflupyr is 0.1 mg/kg bw. The International Estimate of Short Term Intakes (IESTIs) for benzovindiflupyr were calculated for the food commodities and their processed commodities for which HRs/HR-Ps or STMRs/STMR-Ps were estimated by the present Meeting and for which consumption data were available. The results are shown in Annex 4 of the 2019 JMPR Report.

The IESTIs varied from 0-1% of the ARfD for children and 0–2% of the ARfD for the general population. The Meeting concluded that acute dietary exposure to residues of benzovindiflupyr from uses considered by the present Meeting is unlikely to present a public health concern.

REFERENCES

Code	Author	Year	Title, Institute, Report reference
BENZOVINDI_001	Lennon, G.	2016	Benzovindiflupyr-Magnitude of the residue on Onion (Dry Bulb and Green) Report No. PR 11130 GLP, Unpublished Syngenta File No. A15457B_50114
BENZOVINDI_002	Hampton, M.M.	2016	Benzovindiflupyr EC (A15457B) and Benzovindiflupyr+Azoxystrobin WG (A18126B)-Magnitude of the residues in or on Sugarcane raw agricultural and processed commodities resulting from Foliar Applications of EC and WG formulations (USA, 2014) Report No. TK0161217 GLP, Unpublished Syngenta File No. A15457B_50113