ACEPHATE (095)

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EXPLANATION

Acephate was last evaluated by the JMPR in 2003 and 2005 when an ADI of 0-0.03 mg/kg bw/day and an ARfD of 0.1 mg/kg bw/day were established, and a number of maximum residue levels were estimated.

The cranberry industry performed a number of supervised trials within the Interregional Research Project No. 4 to provide data for the establishment of US tolerances for acephate residues in cranberry. The relevant labels and reports of supervised trials were submitted for evaluation to the 2006 JMPR.

RESIDUE ANALYSIS

Analytical methods

The cranberry samples were analyzed according to analytical methods RM-12A-5 and RM 12A-6a for determining residues of acephate and methamidophos by gas chromatography/thermionic detection. The methods are based on ethyl acetate extraction, GPC or Silicagel cleanup and detection by GC with NPD. The stated limits of quantitation (LOQs) for both methods were 0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos. The average of concurrent recoveries of acephate from mature berries fortified at 0.25 mg/kg was 84.8% with a coefficient of variation of 8.9% (n=14). For methamidophos, the average of concurrent recoveries from mature berries fortified at 0.1 mg/kg was 80.6% with a coefficient of variation of 6.3% (n=15).

Stability of pesticide residues in stored analytical samples

Exact storage intervals were not reported for each sample in these studies. Samples were stored frozen from harvest to analysis for approximately 16 months or less.

Storage stability tests were reported by the 2003 JMPR for several crops and indicated that residues were stable for a number of months; e.g., beans and lettuce (15 months), peas (14 months) and bell peppers (13 months) (FAO, 2004).

USE PATTERN

In the USA, Orthene 75S and 75WG, containing 75% active substance, can be applied to protect cranberry as shown in Table 1.

Table 1. Registered uses of acephate.

	Application					PHI
Country	Method	Product	No	Water L/ha	Rate kg ai/ha	day
Canada	Broadcast	75S	2	225-1650	0.56	
USA	Broadcast foliar	75S	1	Min 7.6[1]	1.12	90
USA	Broadcast or chemigation	75WG	2[2]	Min 140	1.68	60

[1] For aerial application

[2] The minimum interval between applications is 10 days.

RESIDUES RESULTING FROM SUPERVISED TRIALS

During the 1976 to 1981 growing seasons, at 17 established trial locations, 64 tests were conducted on cranberries in three geographical regions of the USA.

For each test, single or multiple broadcast foliar applications of acephate were made using the 75% SC/S formulation (Daussin 2006). Single application rates were 0.56 to 3.36 kg ai/ha resulting in total application rates of 1.12 to 13.44 kg ai/ha/season. Ground equipment was used at all trial locations except four trials where applications were made aerially. Spray volumes ranged from 7.6-38 l/ha for the air applications and from 379 to 1136 l/ha for the ground applications. No use of adjuvants was indicated. Cranberry fruit samples were taken between 6 or 131 days following the last application.

In addition, berries from three trial locations were processed into cranberry cocktail. The procedure for preparing cocktails was not reported. The residues detected are summarized in Table 2.

Table 2. Residue data from field trials with acephate.

Trial ID	Location (City, State)	Trial Start Year	Variety	No. of Appl	Single Appl. Rate, kg ai/ha	DAT[1]	Residues (mg/kg)			
							Fruit			Cocktail
							A[2]	MA[3]	Ave[4]	Total
T-3534	East Wareham, MA	1976	Early Black	1	1.68	83	0.18 0.18	ND ND	0.18 (< 0.01)	
T-3538	E. Wareham, MA	1976	Early Black	1	2.52	38	0.68 0.58	0.02 0.02	0.63 (0.02)	
T-3539 [c]	E. Wareham, MA	1976	Howes	1	1.68	28	0.77 0.80	0.03 0.03	0.78 0.83	
						131	0.04 0.03	ND ND	0.04 (< 0.01)	
				1	2.52	28	1.4 1.6	0.05 0.05	1.5 (0.05)	
						131	0.05 0.04	ND ND	0.04 (< 0.01)	
				2	3.36	119	0.06 0.07	ND ND	0.06 (< 0.01)	
T-3665	Long Beach, WA	1976	McFarlin	1	2.52	30	1.2 1.05	0.06 0.05	1.1 (0.06)	
				1	3.36	30	1.6 1.1	0.07 0.06	1.4 (0.06)	
T-4033	Whitesbog, NJ	1977	Early Black	2	1.12	7	0.23 0.24	0.01 0.01	0.24 (0.01)	
						14	0.24 0.25	0.01 0.01	0.24 (0.01)	
						21	0.25 0.26	0.01 0.01	0.26 (0.01)	
				2	1.68	7	0.30 0.46	0.01 0.02	0.38 (0.02)	
						14	0.24 0.51	ND 0.02	0.36 (0.02)	
						21	0.47 0.49	0.02 0.02	0.48 (0.02)	
T-4034	Whitesbog, NJ	1977	Early Black	2	1.12	7	1.2 1.2	0.04 0.04	1.2 (0.04)	
						14	1.4 1.4	0.06 0.06	1.4 (0.06)	
						21	1.1 1.2	0.05 0.05	1.2 (0.05)	

Trial ID	Location (City, State)	Trial Start Year	Variety	No. of Appl	Single Appl. Rate, kg ai/ha	DAT[1]	Residues (mg/kg)			
							Fruit			Cocktail
							A[2]	MA[3]	Ave[4]	Total
T-4034 (cont.)	Whitesbog, NJ	1977	Early Black	2	1.68	7	2.2 2.4	0.07 0.08	2.4 (0.08)	
						14	2.0 2.3	0.07 0.07	2.2 (0.07)	
						21	1.9 1.9	0.07 0.06	1.9 (0.06)	
T-4035	East Wareham, MA	1977	Bergman	3	1.68	7	0.83 0.49	0.05 0.04	0.62 (0.04)	
						14	0.41 0.40	0.03 0.03	0.40 (0.03)	
						22	0.49 0.48	0.04 0.04	0.48 (0.04)	
T-4036 [c]	E. Wareham, MA	1977	Early Black	4	1.68	6	4.5 6.3	0.17 0.22	5.4 (0.2)	
						14	2.5 3.2	0.11 0.13	2.8 (0.12)	
						21	1.9 1.9	0.08 0.08	1.9 (0.08)	
T-4037 [c]	E. Wareham, MA	1977	Early Black	4	1.68	6	7.1 6.9	0.23 0.20	7.0 (0.22)	
						14	6.2 4.9	0.14 0.13	5.6 (0.14)	
						21	5.6 8.3	0.12 0.15	7.0 (0.14)	
T-4038	E. Wareham, MA	1977	Early Black	3	1.68	7	0.51 0.54	0.04 0.04	0.52 (0.04)	
						14	0.49 0.55	0.05 0.05	0.53 (0.05)	
						22	0.26 0.24	0.03 0.02	0.25 (0.02)	
T-4046 [c]	Whitesbog, NJ	1977	Early Black	2	1.12	7	0.09	ND	0.09, (< 0.01)	
						14	0.49 0.47	0.02 0.01	0.48 (0.02)	
						21	0.30 0.29	ND ND	0.30 (< 0.01)	
				2	1.68	7	0.27	ND	0.27 (< 0.01)	
						14	0.20 0.32	0.01 ND	0.26 (0.01)	
						21	0.22 0.15	ND ND	0.18 (< 0.01)	
T-4047	Long Beach, WA	1977	McFarlin	3	1.12	21	0.30 0.27	0.03 0.03	0.28 (0.03)	
				3	1.68	21	0.39 0.39	0.06 0.06	0.39 (0.06)	
T-5006	E. Wareham, MA	1979	Early Black	3	0.84	21	0.41	0.01	0.42[5]	0.15
				3	1.68	21	0.71	0.03	0.74[5]	0.26
				3	3.36	21	2.4	0.06	2.5[5]	0.71
				3	0.84	14	1.06	0.04	1.1[5]	
				4	1.68	14	1.1	0.04	1.1[5]	0.26
				4	3.36	14	1.8	0.06	1.9[5]	0.62

Trial ID	Location (City, State)	Trial Start Year	Variety	No. of Appl	Single Appl. Rate, kg ai/ha	DAT[1]	Residues (mg/kg)			
							Fruit			Cocktail
							A[2]	MA[3]	Ave[4]	Total
T-5055	E. Wareham, MA	1980	Early Black	2	0.56	88	ND ND	ND ND	< 0.01 (< 0.01)	
				2	1.12	88	0.07 0.05	ND ND	0.06 (< 0.01)	
				2	2.24	88	0.13 0.11	ND ND	0.12 (< 0.01)	
				4	0.56	46	0.32 0.31	0.02 0.02	0.32 (0.02)	
				4	1.12	46	1.2 0.82	0.05 0.04	1.1[5]	0.13
				4	2.24	46	2.6 2.8	0.1 0.11	2.7 (0.10)	
				4	0.56	28	1.4 0.66	0.04 0.06	1.03 (0.05)	
				5	1.12	28	1.2 0.49	0.05 0.02	1.4 (0.04)	
				5	2.24	28	2.8 3.3	0.10 0.12	2.2[5]	0.59
T-5056	Chatsworth, NJ	1980	Early Black	3	1.68	30	1.3 1.4 1.1	0.05 0.05 0.05	1.4 1.2 (0.05)	
T-5155	Warrens, WI	1980	Not Specified	3	1.12	34	0.33 0.35 0.29	0.03 0.03 0.02	0.32 (0.03)	
				2	1.12	45	0.22 0.18 0.20	0.02 0.01 0.02	0.20 (0.02)	
						66	0.11 0.13 0.12	ND ND ND	0.12 (< 0.01)	
T-5456	Coos County, OR	1981	Stevens	5	1.12	30	0.45 0.42	0.03 0.03	0.44 (0.03)	
						50	0.42 0.47	0.03 0.03	0.44 (0.03)	
				5	2.24	30	0.80 0.81	0.06 0.05	0.80 (0.06)	
						30	0.80 0.80	0.06 0.06	0.80 (0.06)	

1. DAT: days after last application; 2. A: acephate; 3. MA: methamidophos; 4. Ave: average acephate residues in replicate samples with average methamidophos residues in brackets; 5. Fruits used for preparing cocktail.

APPRAISAL

Acephate was last evaluated by the JMPR in 2005 and 2003 when an ADI of 0-0.03 mg/kg bw/day, an ARfD of 0.1 mg/kg bw/day were established and a number of maximum residue levels were estimated. The residue for compliance with MRLs was defined as acephate, but for dietary intake estimation it was decided that methamidophos residues should also be taken into consideration.

Results of supervised trials carried out on cranberry according the US registered uses were submitted for evaluation.

Results of supervised residue trials

The compound can be applied either as broadcast treatment at a rate of 1.12 kg ai/ha with a 90 day PHI, or as two chemigation (applied in irrigation) treatments at a rate of 1.68 kg ai/ha with a PHI of 60 days.

During the 1976 to 1981 growing seasons 39 field trials were conducted on cranberries in three geographical regions of USA. For each test, single or multiple broadcast foliar applications of acephate were made with individual application rates of 0.56–3.36 kg ai/ha resulting in total application rates of 1.12 to 13.4 kg ai/ha/season. Cranberry fruit samples were taken between 6 and 131 days following the last application.

Exact storage intervals were not reported for each sample in these studies. Samples were stored frozen from harvest to analysis for up to 16 months. Storage stability tests for various intervals were reported by the 2003 JMPR for several crops. The results suggest that the decrease in residues during storage was not significant.

The cranberry samples were extracted with ethyl acetate, cleaned up on GPC column and detected with NPD. The stated limits of quantification were 0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos. Average of concurrent recoveries of acephate and methamidophos from mature berries fortified at 0.25 mg/kg and 0.1 mg/kg were 84.8% and 80.6%, respectively.

Three trials were performed at approximate US GAP. The average acephate residues in replicate samples were 0.06, 0.18 and 0.2 mg/kg (methamidophos residue was not detectable).

The Meeting estimated a maximum residue level of 0.5, HR of 0.2 and STMR of 0.18.

The Methamidophos residues in cranberry fruits should be below 0.01 mg/kg.

In seven trials, performed with 3 to 5 applications of 0.84–3.36 kg ai/ha at each timing, cranberry cocktail (cranberry juice) was prepared from the fruits harvested between 14–46 days after the last application. The total residues (sum of acephate and methamidophos) in fruit and cocktail (juice) were:

	Total residues mg/kg						
Fruit	0.425	0.745	1.15	1.15	1.15	1.95	2.25
Cocktail	0.15	0.26	0.26	0.13	0.62	0.59	0.71
Fp	0.35	0.35	0.23	0.11	0.32	0.26	0.28
Estimated processing factor			median:	0.28	average:	0.27	

RECOMMENDATION

On the basis of the data from supervised trials, the Meeting concluded that the residue levels listed below are suitable for establishing maximum residue limits and for dietary intake assessment.

Summary of recommendations for MRLs, STMRs and HRs for acephate

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg	HR or HR/P mg/kg
		New	Previous		
FB 0265	Cranberry	0.5		0.18	0.2

DIETARY RISK ASSESSMENT

Long-term intake

The GEMS/Food regional diets specify the following long-term cranberry consumption (g/day/person) for various cluster diets: A (0.1); D (0.3); F (0.6); M (2.5). The consumption of cranberry in other regions is nil.

The highest IEDI in the 13 GEMS/Food regional diets, based on estimated STMR, was 0.03% of the maximum ADI (0.03 mg/kg bw).

The Meeting concluded that the long-term intake of residues of acephate from use on cranberry will not practically increase the intake of residues from other uses considered earlier by the JMPR.

Short-term intake

The GEMS/Food regional diet specifies the large portion sizes of cranberry of 3.53 g/kg bw for adults and 6.78 g/kg bw for children (both are from the USA).

The IESTIs of acephate calculated on the basis of the large portion size and the estimated HR of 0.2 mg/kg are 0.71% and 1.4% of the ARfD for adults and children, respectively.

The Meeting concluded that the short-term intake of residues resulting from the use of acephate on cranberry that have been considered by the JMPR is unlikely to present a public health concern.

REFERENCES

Author, Date, Title, Institute, Report Reference, Document No.

Daussin, S. 2006. JMPR Format of Petition Proposing a Tolerance for Acephate Use in Cranberry Production. Interregional Project No. 4. MRID 0089

Elliott, E.J. and J.B. Leary.1978. Residue analysis of acephate and methamidophs in crops, soil, water and milk, Chevron Chemical Company RM-12A-5

FAO 2004. Pesticide residues in food, Evaluations 2003, Plant Production and Protection Paper Plant Production and Protection Paper No. 177

Slagowski, J.L and J.B. Leary. 1980. Determination of acephate and methamidophs in crops, Chevron Chemical Company RM-12A-6a