BENALAXYL (155)

EXPLANATION

Benalaxyl was first reviewed for residues by the 1986 JMPR which estimated Guideline Levels for several commodities and desired information on:

1. Residues in meat from pigs and cattle fed a diet containing benalaxyl
2. The effect of processing on residues in crops.
3. Information on national MRLs.
4. Additional information on levels of metabolites in plants after treatment with benalaxyl.

Guideline levels were changed to recommendations for MRLs when an ADI was allocated by the 1987 JMPR. Over several years CCPR delegations have questioned various limits, in particular in grapes (considered by some to be too high), potatoes (the 0.01 mg/kg limit of determination and the lack of a published method were questioned), hops, and tomatoes. The submission of data, including information on metabolites, was promised. The 1990 CCPR lowered the proposed grape limit from 0.5 to 0.2 mg/kg. Additional GAP information and summarized residue data were reviewed by the 1992 JMPR. The information was not adequate for revising limits, although it suggested the need for an increased limit for lettuce. The submission of additional unspecified data was promised.

Several submissions were made to the Meeting in response to the 1986 requests or the concerns expressed at the CCPR. These included current GAP information, national MRLs and residue data on several commodities (mainly on grapes, wine and must, but some on potatoes, tomatoes and cucumbers). Information was also provided on residues of conjugates in wine, and a published analytical method which had been considered desirable at the CCPR. Comments were provided on other items.

USE PATTERN

Information on current uses of benalaxyl on a number of crops is summarized in Table 1

Table 1. Nationally approved or registered uses of benalaxyl on selected crops.

Crop/ Country	Application			PHI (days)	Notes
	Formulation	Rate g ai/ha (g ai/hl)	No.		
Cucurbits					
Australia	WP ?[1]*	200 l. vol. (20) h. vol.	**	7	*Mixed formulation 80 g benalaxyl, 650 g mancozeb/kg. **2-spray sequence full coverage at 7-10-day intervals.
Austria	WP ?*	160		3*	*PHI for same mixed formulation as Australia
Hungary	?*	200-240		5* 15	*PHI for co-formulation with mancozeb
Spain					
melons, watermelon	WP*	160-240* (16-24)*			*Field or glasshouse
Grapes					
Australia	WP ?*	152-224 l. vol. (22.4) h. vol.	**	14	*See cucurbits **2-spray sequence at 7-21-day intervals. High vol. _500 l/ha before flower, 1000 l/ha at full foliage.
Greece	?	(12-16)	*	*	*Last treatment after blooming
Hungary	?	160-200	4*	30**	*At 14-day intervals **PHI for co-formulations with mancozeb
Italy	SC and ?	(16-20)	4*	7	*at 14-day intervals
Spain	WP*	160-240 (16-24)	-	30	*mixed formulation, 80 g benalaxyl, 650 g mancozeb/kg.
Pepper					
Spain	WP*	160-240 (16-24)	-	15	*mixed formulation, 80 g benalaxyl, 650 g mancozeb/kg.
Potatoes					
France	WP and ?	200 (20)	3*	-	*at 10-14-day intervals
Italy	SC and ?	(20-24)	3*	7	*at 14-day intervals
Greece	?	200-240	5*	28	*at 14-day intervals with co-formulation
Spain	WP*	160-240 (16-24)	-	30	*mixed formulation, 80 g benalaxyl, 650 g mancozeb/kg.
Tomatoes					
Italy	SC and ?	(20-24)	*	7	* at 12-14-day intervals
Spain	WP*	160-240 (16-24)	-	15	* mixed formulation, 80 g benalaxyl, 650 g mancozeb/kg

[1] Except for the Australian label which did not indicate the type of formulation a "?" indicates that labels were not in English and the summary translations did not include the type.

RESIDUES RESULTING FROM SUPERVISED TRIALS

In plants

The 1992 JMPR reviewed supervised trials data for several crops. It did not propose new or revised limits, but was informed that additional data would be provided. In addition to substantial supervised trials data on grapes, the present Meeting has received summary data on benalaxyl residues in cucumbers, potatoes and tomatoes. Because summary data without accompanying detailed reports are not suitable for estimating maximum residue levels, the Meeting did not further consider these summaries (ISAGRO, 1993). The Meeting also received additional information on levels of metabolites in plants.

Grapes. The current 0.2 mg/kg CXL for grapes was proposed by the 1990 CCPR, although the 1986 JMPR had estimated a 0.5 mg/kg Guideline Level. The change was based on the observation that German data (0.7 mg/kg maximum residue after 14 days) did not reflect GAP because the use was not approved in Germany. Other residues were ≤0.22 mg/kg after 7 days. Substantial additional data from more recent supervised trials were provided to the Meeting, although many of the results do not strictly reflect GAP. Residue data from supervised trials on grapes are summarized in Table 2.

Of the 35 trials summarized in Table 2, 17 were Italian, 8 German, 2 Greek, 6 Australian and 2 Hungarian. Only two of the Italian trials were fully within GAP in terms of the number of applications and spray concentrations and these were at longer PHIs than the 7-day Italian GAP PHI (the shortest PHI in any of the trials was 11 days). The highest residue in these two trials was 0.2 mg/kg after 21 days. Using these results with a residue decline curve provided, a maximum residue of approximately 1.8 mg/kg after 7 days can be estimated. Other Italian trials involving 5 applications (instead of the 4 allowed by GAP) at GAP rates resulted in maximum residues of 0.6 mg/kg after 11 days (1.3 mg/kg after 7 days can be estimated from a residue decline curve). In other Italian trials with 4 applications, but at 32 g ai/hl instead of the approved maximum of 20 g/hl, the maximum residues were 0.09 mg/kg after 14 days (1.2-1.3 mg/kg after 7 days can be estimated from a residue decline curve).

Only two of the German trials approximated Italian GAP in terms of spray concentration (all the trials were at a higher rate/ha than is allowed by the GAP of other countries), with maximum residues of 0.5 and 0.6 mg/kg after 27/28 days (0.9-1 mg/kg after 7 days was estimated from a residue decline curve). The Meeting was not told whether this use is now GAP in Germany, although as noted above the 1990 CCPR was informed that it was not at that time.

The Australian trials do not reflect Australian GAP (1, 7 or 8 applications compared with the 4 approved). The highest residues at the Australian 14-day PHI were 0.2 mg/kg. In the Hungarian trials the highest residues after the longest sampling interval of 21 days were only 0.01 mg/kg. The approved Hungarian PHI is 30 days.

In the Table 2 trials in which wine, juice or must samples were also analyzed the maximum residues were 0.02 mg/kg in juice and must and 0.01 mg/kg in wine. In addition to the wine data summarized in Table 2, the Meeting was provided with the results of 6 other trials in which wine was made from similarly treated grapes. The residue levels in the treated grapes were not given; those in the wine ranged from not detected (<0.01 mg/kg) to 0.02 mg/kg. The interval from grape sampling to wine analysis was 1 to 2 years in these studies.

Table 2. Residues of benalaxyl in grapes and grape products resulting from application of a WP formulation in supervised trials.

Country/ Year/(Variety)	Application	Residues, mg/kg at intervals (days) after last application	Ref.

Country, year (variety)	No.	Rate kg ai/ha (g ai/hl)	Days	Residue	Ref.
Italy 1991 (Merlot)	5	0.28 (**20**)	0, 7[1], 11, 38, 56, 82	3, 1.3[2], 0.6, 0.08, 0.05, 0.03	9/91/VIN
(Chardonnay)	**4**	0.22 (100)	0, 22, 44, 66, 77	0.9, 0.05, 0.02, ≤0.01, ≤0.01	7/91/VIN
1990 (Barbera)	4	0.2 (50)	27, 37, 94	0.1, 0.08, ≤0.01 Must and wine ≤0.01	11/90/WIN
(Barbera)	4	0.16 (40)	54, 114	0.03, ≤0.01 Must and wine ≤0.01	12/90/WIN
1991 (Barbera)	4	2X 0.11 (20) + 2X 0.22 (20)	0, 7[1], 21, 43, 65, 90	2.5, 1.6, 0.1, 0.08, 0.03, ≤0.01 Must and wine ≤0.01	1/91/WIN
1990 (Riesling)	4	0.2 (50)	27, 37, 80	0.3, 0.2, 0.02 Must and wine ≤0.01	13/90/WIN
(Riesling)	4	0.16 (40)	54, 106	≤0.01, ≤0.01 Must and wine ≤0.01	14/90/WIN
1991 (Riesling)	4	2X 0.11 (20) + 2X 0.22 (20)	0, 7[1], 21, 43, 65, 90	2.8, 1.8, 0.2, 0.1, 0.04, 0.03 Must and wine ≤0.01	2/91/WIN
1990 (Merlot)	4	3X 0.15 (16) + 0.18 (16)	78	0.06 Must and wine ≤0.01	7/90/WIN
1991 (Merlot)	5	0.28 (20)	0, 7[1], 11, 38, 56, 82	2.2, 0.9, 0.4, 0.05, 0.03, 0.02 Must and wine ≤0.01	8/91/VIN
1990 (M. Palieri)	2	0.16 (40)	79	≤0.01	8/90/VIN
1991 (M. Palieri)	4	0.16 (32)	0, 7[1], 14, 30, 48, 69	2.8, 1.3, 0.09, ≤0.01, ≤0.01, ≤0.01	3/91/VIN
1990 (Italia)	2	0.16 (40)	79	≤0.01	9/90/VIN
1991 (Italia)	4	0.16 (32)	0, 7[1], 14, 30, 48, 69	1.4, 0.7, 0.04, 0.01, 0.01, ≤0.01	4/91/VIN
1990 (Regina)	2	0.16 (40)	79	≤0.01	10/90/VIN

Table 2 (contd.)

Country/ Year/ (Variety)	Application No.	Application Rate, kg ai/ha (g ai/hl)	Residues, mg/kg at intervals (days) after last application Days Residue	Ref.
Italy contd 1991 (Regina)	4	0.16 (32)	0 7[1] 14 30 48 69 2.6 1.2 0.09 0.01 ≤0.01 nd (<0.01)	5/91/VIN
(Chardonnay)	4	0.22 (100)	0 22 44 66 77 0.6 0.07 0.02 ≤0.01 ≤0.01 Must and wine ≤0.01	6/91/VIN
Germany 1986 (Portugieser)	4	0.32-0.48 (20)[3]	0 7[1] 27/28 42 56-59 69 1.1 1 0.6 0.3 0.14 Juice or past. juice 0.01 Wine ≤0.01 Pasteurized wine ≤0.01(95 days)	8/86/VIN 9/86/VIN
(Huxelrebe)	4	0.32-0.48 (80)[3]	2.3 0.6 0.3 0.04	10/86/VIN
(Müller-Thurgau)	4	0.32-0.48 (80)[3]	1.3 0.6 0.3 0.4	11/86/VIN
(Ruländer)	4	0.32-0.48 (80)[3]	2 0.41 0.3 0.2 Juice or past.juice 0.02 84 days Wine or past. wine ≤0.01	12/86/VIN 13/86/VIN
1987 (Müller-Thurgau)	4	0.32-0.48 (20)[3]	1.1 0.9 0.5 0.2 0.2 63 days 0.2 Must or past. must ≤0.01 Wine ≤0.01 (94 days) Past. wine ≤0.01 (83 days)	1/87/VIN 2/87/VIN
(Lemberger)	4	0.32-0.48 (80)[3]	2.3 0.5 0.4 0.3 Must or past. must 0.02 Wine or past. wine 0.01 (92 days)	3/87/VIN 4/87/VIN
(Morio-Muskat)	4	0.32-0.48 (80)[3]	1.8 0.3 0.2 0.3 0.2 (68 days)	5/87/VIN
(Ehrenfelser)	4	0.32-0.48 (80)[3]	1.5 0.5 0.5 0.3	6/87/VIN

Table 2 (contd.).

Country/Year/ Variey	Application No.	Application Rate kg ai/ha (g ai/hl)	Residues, mg/kg at intervals (days) after last application Days Residue	Ref.
Greece 1986 (Savatiano)	4	0.04-0.125 (16)	Days: 100, 106 100: 0.01 106: 0.03	7/86/VIN 8/87/VIN
Australia 85 (Semillon)	7[4]	0.23 (15)	Days: 0, 2, 7, 10, 14 14: 0.2 Wine 14: 0.01	1/86/VIN
	7[4]	0.3 (20)	14: 0.2 Wine 14: 0.02	2/86/VIN
1986-87 (Cabernet Sauvignon)	8[4]	0.3 (20)	7: 0.07 Wine must 0.02	5/86/VIN,3/86/VIN
	8[4]	0.36 (24)	7: 0.2 Wine must 0.02	6/86/VIN, 4/86/VIN
1985 (b. Muscat)	1	0.6 (55)	0: 0.8; 2: 0.6; 7: 0.4; 10: 0.2; 14: 0.09	1/85/VIN
	1	0.28 (28)	0: 0.4; 2: 0.3; 7: 0.2; 10: 0.1; 14: 0.05	2/85/VIN
Hungary 1983	1	0.26 (32)	Days: 0, 1, 3, 5, 7/8, 10/12, 15/16, 21 0.7 0.6 0.2 0.09 0.05 0.02 0.01 (Limit of detection 0.01)	2/83/VIN
	1	0.22 (28)	0.6 0.5 0.4 0.1 0.06 0.03 0.01 (Limit of detection 0.005)	3/83/VIN

1 No 7-day results were provided. Levels listed were interpolated from residue decline curves from the subject trial.

2 Only references 1/91/WIN and 2/91/WIN of the Italian trials and the Greek and Hungarian trials closely reflect GAP. Results from these trials and from other trials most closely reflecting GAP are underlined, although in some cases the number of applications or the application rate exceeds GAP at least slightly. The 7-day interpolated values which would approximately reflect GAP are also underlined.

3 Exaggerated rates and/or concentrations.

4 Exaggerated number (GAP is 4).

Metabolite levels in plants. The manufacturer commented on unsuccessful efforts to determine the GX1a and GX1b glucoside metabolites in crops in response to a 1986 JMPR request. In plants these are formed by oxidation of a xylyl methyl group to $-CH_2OH$ and subsequent conjugation with glucose. Information was provided on a method for the determination of residues of benalaxyl GX1 (unresolved mixture of GX1a and GX1b) glucosides in white wine by liquid chromatography (Agrimont, 1991). The method was not successful with red wine owing to interferences. See Methods of residue analysis for a description of the method. No data were provided except results of recovery studies.

In animals

The 1986 JMPR listed as desirable information on residues in meat from pigs and cattle fed a diet containing benalaxyl. No data were provided. The manufacturer expressed the view that residues in the meat of cattle and pigs are extremely unlikely, on the basis of the results of metabolism studies and the low residues likely to be in potential feed items (tomato MRL 1 mg/kg, grape MRL 0.1 mg/kg). In metabolism studies reviewed by the 1986 JMPR residues of the parent compound and metabolites were ≤0.1 mg/kg in muscle tissues of hens and goats fed with 50 ppm benalaxyl in the feed, up to 1.8 and 1 mg/kg in the respective livers and up to 1 and 0.4 mg/kg in the kidneys. Residues were up to 0.05 and 0.3 mg/kg in egg white and yolk respectively and <0.01 mg/kg in goat milk.

FATE OF RESIDUES

In storage and processing

The 1986 JMPR listed information on the effect of processing on crops as desirable. No information was provided except on residues in wine and must from supervised trials on grapes.

METHODS OF RESIDUE ANALYSIS

The 1986 monograph described a method by Farmoplant for the determination of benalaxyl *per se* based on acetone extraction, clean-up by liquid-liquid partitioning and column chromatography, and GLC with detection by an AFID. The method was applied to a number of commodities and a 0.01 mg/kg limit of determination was reported, although recoveries were determined only at 0.05 to 0.1 mg/kg. Concern was expressed at the CCPR at the lack of a published method suitable for enforcement, and the reported limit of determination was questioned. In response to these comments the manufacturer provided a recently published method for the determination of benalaxyl in crops and water (Crisippi and Zini, 1993).

The published method is similar to that previously described. Chopped crops are extracted with acetone and the residues partitioned into hexane. Filtered must and wine are eluted through an "Extrelut" column with hexane. Filtrates from both types of sample are further cleaned up by elution through an alumina column with 9:1 hexane:acetone and analyzed by GLC with NP detection. Recoveries of ≥95% with SDs of ≤6.5 were reported for several sample types at the following fortification levels:

Sample	Fortification Level (mg/kg)
grape	0.04-1.1
tomato	0.11-0.22
potato	0.01-0.3
tobacco	0.11-1.1
rapeseed	0.11-1.1
pineapple	0.04
	mg/l
wine	0.01-0.8
must	0.04-0.42
water	0.001-0.1

Blank contributions ranged from non-detectable (<0.003 mg/kg) in potatoes to 0.01 mg/kg in pineapples. Detection was possible at 0.003 mg/kg in potatoes and down to 0.1 ìg/l in water. The authors considered the limit of quantification to be 0.01 mg/kg in crops (0.01 mg/l in wine or must) and 0.1 ìg/l in water.

An analytical method was also provided for the determination of the glucoside metabolites GX1a and GX1b in white wines (Agrimont, 1991). It is based on passing the wine through an "Extrelut" column, elution of the residues with methylene chloride, concentration of the sample and clean-up on a Florisil column by successive elution with acetone, 90:10 acetone:methanol and finally 80:20 acetone:methanol. The last eluate is concentrated and analyzed by HPLC with UV detection. Recoveries ranged from 78 to 86% from fortifications at 0.25 and 0.025 mg/l. A limit of detection of 0.01 mg/l was reported. Chromatograms suggest that routine analyses down to 0.05 mg/kg should be feasible.

A method has also been described for the determination of benalaxyl in wine (Agrimont, 1990). It is based on adsorbtion on an "Extrelut" column, elution with n-hexane, evaporation of solvent, application of the redissolved sample to an alumina column, elution with n-hexane:acetone (9:1 v/v), concentration and GLC determination with an AFID. Analytical recoveries were ≥92% from 0.01 to 1 mg/kg fortification levels. Sample chromatograms suggest that routine analyses at 0.02 to 0.05 mg/kg should be feasible, with detection down to 0.01 mg/kg.

NATIONAL MAXIMUM RESIDUE LIMITS

The following national MRLs were reported to the Meeting.

Commodity/Country	MRL (mg/kg)
All commodities	
The Netherlands	0* (0.02) Under consideration
Grapes	
France, Switzerland	0.1
Australia, Italy, Spain, Venezuela	0.5
Portugal	7.5
Lettuce	
Australia	0.01
Spain	0.1
Venezuela	0.5
Peru	1
Melons	
Australia	0.2
Italy, Spain, Venezuela	0.5
Onions	
Switzerland	0.01
Australia	0.1
Italy, Spain, Venezuela	0.5
Peru	1
Peppers	
Australia	0.2
Hungary, Italy, Spain, Venezuela	0.5
Potatoes	
Belgium, Great Britain, Hungary, Switzerland	0.01
France, Germany	0.02
Italy, Spain, Venezuela	0.05
Peru	1
Portugal	7.5
Strawberry	
Hungary, Italy	0.1
Tomato	
Hungary, Italy, Spain	0.5
Peru	1

APPRAISAL

Benalaxyl was first reviewed for residues by the 1986 JMPR, which estimated Guideline Levels and listed desirable information. Guideline Levels were changed to MRLs when an ADI was allocated by the 1987 JMPR. Over several years various limits (in particular on grapes) were questioned at the CCPR. Submission of additional unspecified data has been promised. Several submissions were made to the Meeting in response to requests of the 1986 JMPR or concerns expressed at the CCPR, some with and some without the detailed reports.

Grapes. The 0.5 mg/kg limit estimated by the 1986 JMPR was lowered to 0.2 mg/kg by the 1990 CCPR. Although no outstanding issues remained, extensive recent data from the use of benalaxyl on grapes were provided to the Meeting. Much of the summarized information could not readily be related to the more detailed reports provided owing to its code numbering format, except in the case of the Italian data.

Most of the submitted grape data do not closely reflect reported current GAP. In particular, most of the results (except at day 0) were at intervals significantly longer than the reported 7-day Italian GAP PHI (the shortest non-0-day PHI was 11 days and most PHIs were longer). The few results within GAP (GAP rates and ≥ 11 day PHI) were consistent with the current 0.2 mg/kg CXL. However, extrapolation from Italian residue decline curves strongly suggests that residues exceeding 1 mg/kg are likely to occur from Italian GAP at a 7-day PHI. Extrapolation of previously provided and additional data from German supervised trials also suggests that residues may approach 1 mg/kg when related to Italian GAP. However, the Meeting was informed that the manufacturer is to request that the 7-day Italian PHI be revised to 10-28 days. With that revision residues would be within the current limit. The Meeting was also informed that applications are only on small immature fruit.

Residues in must and wine were ≤0.02 mg/kg, mostly ≤0.01 mg/kg. No data were provided for grape pomace, a possible animal feed item.

Potatoes. The adequacy of previously submitted analytical methods to support the current 0.01 mg/kg CXL for potatoes has repeatedly been questioned at the CCPR. The Meeting concluded (see below) that 0.02 mg/kg is a reasonable limit of determination for the new analytical method reported, and noted that the limit of "detection" for much of the additional summary data reported (but not reviewed) is 0.02 mg/kg. The Meeting therefore proposed that the MRL should be increased to 0.02 mg/kg.

In addition to substantial supervised trials data for grapes, the Meeting received summary data on benalaxyl residues in cucumber, potatoes and tomatoes. Because summary data without accompanying detailed reports are not suitable for estimating maximum residue levels the Meeting did not review these summaries apart from considering the limit of determination for potatoes. The Meeting was informed that the detailed reports would be submitted for review at a future meeting.

The Meeting also received a limited response to the 1986 request for additional information on levels of metabolites in plants. Noting unsuccessful efforts to analyze the GX1a and GX1b glucoside metabolites in crops, the Meeting was informed of a method for the determination of these metabolites in white wine (unsuccessful in red wine). No data were provided except the results of recovery studies.

Residues in animal products. In response to a JMPR request for information on residues in cattle and pigs the manufacturer expressed the view that metabolism studies and the low residues expected in feed items would make residues in meat from cattle and pigs unlikely. Since (1) significant residues could occur: they have been found in the offal of goats and hens in metabolism studies (e.g. up to 1 and 1.8 mg/kg in the liver of goats and hens fed at 50 ppm in the feed); (2) information on the possible concentration of residues in feed items derived from processing was lacking; and (3) the duration of the metabolism study feeding periods (7 days for cattle, 14 days for hens) was relatively short, the Meeting could not with certainty come to the same conclusion. While the Meeting agreed that residues in animals would be likely to be low, there is the potential for finite residues.

Processing. Apart from data on residues of benalaxyl in wine and must, no information was provided in response to the 1986 JMPR request for information on the effect of processing on residues in crops. Processing studies would also provide insight into the likelihood of residues in animal products. The Meeting was informed that processing studies would be scheduled for 1994.

Analytical methods. A published analytical method based on acetone extraction, liquid-liquid partitioning, alumina clean-up and GLC with NPD detection was provided in response to CCPR concerns that no published enforcement method was available and doubt concerning the reported 0.01 mg/kg limit of determination in potatoes in the method previously reviewed. The published method was tested on several crops, wine, must and water. Recoveries of ≥95% were reported.

The Meeting received excellent documentation of what appears to be a suitable enforcement method. While the reported limits of determination (0.01 mg/kg in crops and 0.01 mg/l in wine and must) may be attainable in the author's laboratory, on the basis of sample chromatograms, reported control values and fortification levels, the Meeting concluded that a more realistic limit of determination for Codex purposes would be of the order of 0.05 mg/kg in crops (0.02 mg/kg in potatoes) and 0.05 mg/l in wine and must. Detection is possible at lower levels.

A description of an analytical method for the determination of the glucoside metabolites GX1a and GX1b in white wines was also provided (chromatograms suggest that routine analyses down to 0.05 mg/kg should be feasible). An analytical method based on column chromatography clean-up and GLC with AFID detection for determining benalaxyl in wine was also provided, with the capability of analyses at 0.02 to 0.05 mg/kg.

RECOMMENDATIONS

On the basis of the reported data on analytical methods the Meeting concluded that the residue level is suitable for establishing an MRL.

Definition of the residue: benalaxyl

Commodity		Recommended MRL (mg/kg)	
CCN	Name	New	Previous
VR 0589	Potato	0.02*	0.01*

*At or about the limit of determination.

FURTHER WORK OR INFORMATION

Desirable

1. Submission of revised Italian GAP for grapes for the next scheduled review.

2. Submission of detailed reports of trials on cucumber, potato and tomato corresponding to summary data provided to the 1993 Meeting, reported in a manner to permit easy comparison of the summary data and the detailed reports and in the working language of the Meeting.

3. Submission on completion of processing studies which are scheduled for 1994.

(From 1986 JMPR)

4. Information on residues in meat from pigs and cattle fed a diet containing benalaxyl.

REFERENCES

Agrimont, 1990. Determination of Benalaxyl Residue in Wine. Unpublished Agrimont report, July 16, 1990. Appendix E to ISAGRO report Annex 4, Fabbrini, 1992b (see below).

Agrimont, 1991. Determination of Residues of the Main Glucoside Conjugates of Benalaxyl in Wine. Report ZINI-13:X1VINO. ISAGRO Annex 12, July 29, 1991. The diasterioisomer GX1, i.e. methyl *N*-phenylacetyl-*N*-(2-glucopyranosylmethyl-6-methyl)phenyl-DL-alaninate was analysed.

Crisippi, T and Zini, G. 1993. Gas Chromatographic Determination of Benalaxyl Residues in Different Crops and Water. JAOAC International, *76*, 650-6.

Fabbrini, R. 1992a. Benalaxyl Residue Determination in Grape and Must Samples. Larpest 1992 Project AG-04/91. Enichem Final Report. May 28, 1992. ISAGRO Annex 3. Includes data for monograph Table 2 references 5/86/VIN (?), 1/91/WIN, 2/91/WIN and 7/90/WIN.

Fabbrini, R. 1992b. Benalaxyl Residue Determination in Wine Samples. Larpest 1992 Project IS-01/92. ISAGRO Final Report. July 21, 1992. Annex 4.

Fabbrini, R. 1993a. Benalaxyl Residue Determination in Grape Samples, Volume I. Larpest Project IS-02/92, January 25, 1993. ISAGRO Annex 1. Includes data for monograph Table 2 references 3/91/VIN and 4/91/VIN.

Fabbrini, R. 1993b. Benalaxyl Residue Determination in Grape Samples, Volume II Parts I and II (gas chromatograms of the Annex 1 study), Larpest Project IS-02/92. January 25, 1993. ISAGRO Annex 2.

ISAGRO*, 1993. (* Formerly Farmoplant, Agrimont, Enichem Agricoltura). Several volumes of Benalaxyl Unpublished information and data (some with and some without cited dates or authors) provided to the 1993 JMPR:

Report on Benalaxyl. Comments on various JMPR required and desirable information. 12/2/93 ISAGRO fax to FAO.

Analysis of Benalaxyl Residues in Wine. ISAGRO Final Report 2083, February 9, 1993. Includes Data references 10/91/WIN; 11/91/WIN; 12/91/WIN and 13/91/WIN (not included in Monograph Table 2 references).

Analysis of Benalaxyl Residues in Vine (grapes). ISAGRO Final Report 2085, February 9, 1993. Includes data for Monograph Table 2 references 8/91/VIN and 9/91/VIN.

Analysis of Benalaxyl Residues in Vine (grapes). ISAGRO Final Report 2087, February 9, 1993. Includes data for Monograph Table 2 references 6/91/VIN and 7/91/VIN.

Benalaxyl Residues Resulting from Supervised Trials - Grapes, Wine - (1) Italy (3) Germany (4) Greece (6) Australia (7) Hungary. ISAGRO Annex 5 Report. Summary Tables for monograph Table 2 references, plus wine sample references 1/89/VIN, 2/89/VIN, 6/90/VIN, 3/90/WIN, 4/90/WIN and 5/90/WIN (residues <0.01 to 0.018 mg/kg after 82 to 90 days) not included in monograph Table 2. Summarizes data from ISAGRO reports 2083, 2085, 2087, Annex 1, Annex 3 and probably others, although this was not readily discernible from the reports provided.

Benalaxyl Residues Resulting from Supervised Trials - Potatoes - (1) Italy (2) France (4) Greece. ISAGRO Annex 7.

Benalaxyl Residues Resulting from Supervised Trials - Tomatoes - (1) Italy (2) Greece. ISAGRO Annex 8.

Benalaxyl Residues Resulting from Supervised Trials - Tobacco - (3) Poland. ISAGRO Annex 10.

Benalaxyl Residues Resulting from Supervised Trials - Cucumber - (1) Austria (2) Australia (3) Hungary. ISAGRO Annex 11.

National MRLs. ISAGRO Annex 6.