## PROCHLORAZ (142)

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## EXPLANATION

Prochloraz is a broad-spectrum imidazole fungicide that is active against a range of diseases. It can be used in fruit, vegetables, field crops, mushrooms, as a post-harvest treatment of fruit and as a seed treatment on cereals. It was first evaluated by JMPR in 1983 for residues and toxicology, and subsequently six additional reviews of residues have been carried out between 1985 and 1992. Under the CCPR Periodic Review Programme the toxicology was re-evaluated in 2001, when an ADI of 0–0.01 mg/kg bw and an ARfD of 0.1 mg/kg bw were established. In 2004, a Periodic Review of the residue and analytical aspects of prochloraz was conducted.

The residue definition for prochloraz is 'Sum of prochloraz and its metabolites containing the 2,4,6-trichlorphenol moiety, expressed as prochloraz', for compliance with MRLs and for estimation of dietary intake from both animal and plant commodities. The residue is fat-soluble.

In the 2004 review the Meeting estimated a maximum residue level for mushrooms of 40 mg/kg and noted acute intake concerns relating to this level. As a consequence the 37$^{th}$ and 38$^{th}$ Sessions of the CCPR could not advance this level as an MRL. At its 39$^{th}$ Session the Committee was informed that the manufacturer would provide alternative GAP information on mushroom and corresponding trial data for evaluation by the 2009 JMPR (ALINORM 07/30/24 – Rev. 1).

The Meeting received new data on supervised trials on mushrooms in several European countries, as well as current European labels on mushroom uses.

## METHODS OF RESIDUE ANALYSIS

### *Analytical methods for plant materials used in study reports*

In the new supervised trials, residues were measured using the 'common moiety' method, involving hydrolysis of prochloraz and its metabolites to 2,4,6-trichlorophenol. In this method (RESID/88/72), reviewed by the 2004 JMPR, samples are Soxhlet-extracted with acetone, concentrated and hydrolysed with pyridine hydrochloride to break down all components to 2,4,6-trichlorophenol. This hydrolysate is then extracted into petroleum ether by steam distillation, with further clean-up by extraction into the aqueous layer with alkali and re-extraction into toluene after acidification. Total 2,4,6-trichlorophenol residues are determined by gas chromatography (with electron capture detection for plant material and soil and MS detection or mass spectrometry for milk and animal tissues), and the results are expressed as prochloraz equivalents by correcting the measured 2,4,6-trichlorophenol concentration for the molecular weight factor of 1.9

In the new supervised trials the final determination was performed using GC-MSD equipment instead of ECD.

Table 1 Validation of analytical method used in the supervised trials

| commodity | reported LOQ mg/kg | spike level mg/kg | no | % recovery mean range | RSDr | control samples mg/kg (n) | calibration | Reference, method |
|---|---|---|---|---|---|---|---|---|
| mushroom | 0.05 | control<br>0.05 | 1<br>1 | -<br>89 | -<br>- | - | Linear<br>R> 0.999 (8 data | 2008-1106188 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.499<br>4.982<br>49.820 | 2<br>2<br>1 | 64<br>88 | 63-66<br>82-94<br>87 | -<br>-<br>- | | points) | |
| mushroom | 0.05 | Control<br>0.0505<br>0.5050<br>5.0099 | 1<br>1<br>1<br>1 | -<br>88<br>92<br>94 | | -<br>-<br>-<br>- | - | Non-Linear<br>R> 0.999 (8 data points) | 2009-1012101 |

not available

***Stability of pesticide residues in stored analytical samples***

No storage stability studies on mushrooms are available. JMPR 2004 evaluated storage stability studies for the following plant commodities: wheat, barley, sugar beet roots and tops, maize plants, and rape seed. In these commodities, residues were stable for a period of 24–36 months.

## USE PATTERNS

JMPR 2004 recorded use patterns on mushroom in Australia, Belgium, China, Denmark, France, Germany, Italy, the Netherlands, New Zealand, Poland, Switzerland and the UK (JMPR 2004 Evaluation, Table 40, p 741–744).

The current Meeting received information on prochloraz registered uses in Belgium, France, Ireland, Italy, the Netherlands, Poland, Spain and the UK. In addition GAP information was received from The Netherlands.

Table 2 Registered uses of prochloraz on mushrooms - 2009

| Crop | Country | Form | Application | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Method | Rate g ai/$m^2$ | Spray conc., kg ai/hL | Number | PHI, days | |
| Mushrooms | Belgium | WP* | After casing or before scarification | 1.5 | | 1 | ns | |
| | Belgium | WP* | After scarification | 1-1.5 | | 1 | ns | |
| | Belgium | WP* | After casing and immediately after scarification | 0.7 | | 2 | ns | |
| | France | WP* | Before 'la marque' and after 2nd flush | 0.5 | | 2 | 8 | |
| | Ireland/UK | WP* | At casing and when needed after 1st or 2nd flush | 0.6 | | 1-2 | 4 | Disease anticipated before or during 1st flush |
| | Ireland/UK | WP* | 7 days after casing and after 1st and 3rd flush | 0.3 | | 3 | 4 | Disease anticipated in 2rd flush |
| | Ireland/UK | WP* | 7-9 days after casing and between 2nd and 3rd flush | 0.6 | | 2 | 4 | Disease anticipated in 3rd or later flushes |
| | Italy | WP* | Within 5-7 | 1.5 | | 1 | 10 | |

| Crop | Country | Form | Application | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Method | Rate g ai/$m^2$ | Spray conc., kg ai/hL | Number | PHI, days | |
| | | | days after casing | | | | | |
| | Netherlands | WP* | Within 5 days after casing | 1 | | 1 | 10 | |
| | Poland | WP* | Within 5 days after casing | 1.5 | | 1 | 10 | |
| | Spain | WP* | 2 d after casing and after 1st and/or 3rd harvest | 0.15 – 0. 25 | 0.015-0.025 | 2-3 | 2 | |

* = manganese complex

## RESIDUES RESULTING FROM SUPERVISED TRIALS ON CROPS

In the 2004 JMPR many trials on mushrooms are summarized which were performed in Australia, Germany, Greece, The Netherlands, Switzerland and the UK. The trials included a combination of growing media treatments (before inoculation or addition of the casing material) and one or more sprays of the mushroom beds after the addition of casing and between flushes. See (JMPR 2004 Evaluation, Table 58, p 761–764).

The 2009 JMPR received two reports with recently performed residue trials which were carried out in Germany, France, Ireland and Belgium. The test item prochloraz in all of these studies was of unknown complex.

In France two trials were performed at 2 different locations in Northern France. One treatment was applied on the day of casing and samples were harvested 3 days later (1st flush).

In Germany two trials were performed at one location. The first application was 9–10 days after casing and the second was applied 2 days after harvest of the 1st flush.

In Belgium two trials were performed at one location. In the first trial the application was at the day of casing and in the second trial the application was after roughening (i.e., 10 days after casing).

The studies performed in Ireland were efficacy studies, but samples were also analysed for residues. In Ireland also two trials were performed. In the first trial the treatment was on day 3 after casing and in the second trial the treatments were on day 3 and 21 after casing.

The results of supervised trials from these reports are shown in Table 3.

Underlined values were used for the estimation of MRLs and STMRs. Results have not been corrected for concurrent method recoveries.

Table 3 Residues of prochloraz in mushrooms after pre-harvest treatment (indoor)

| Location, year, (variety) Trial no. | Form | No | Interval (days) | g ai/$m^2$ | Method, timing | DAT | residues, mg/kg | Reference |
|---|---|---|---|---|---|---|---|---|
| France (N) a 2007 (Delta) 07-NF-046 | WP | 1 | - | 1.2 | Broadcast spray At day of casing; harvest 1st flush | 13 | 1.3 | 1006188 |

| Location, year, (variety) Trial no. | Form | No | Interval (days) | g ai/$m^2$ | Method, timing | DAT | residues, mg/kg | Reference |
|---|---|---|---|---|---|---|---|---|
| France (N) 2007 (Delta) 07-NF-047 | WP | 1 | - | 1.2 | Broadcast spray At day of casing; harvest 1st flush | 13 | 1.4 | 1006188 |
| Germany a 2007 (R856) 07-DE-048 | WP | 1 | - | 0.8 | Broadcast spray 9-10 d after casing; harvest 1st flush | 8 | 0.20 | 1006188 |
| Germany 2007 (A15) 07-DE-049 | WP | 2 | - | 0.8 | Broadcast spray 5-9 d after casing; harvest 1st flush | 8 | 0.25 | 1006188 |
| Germany 2007 (R856) 07-DE-048 | WP | 2 | - | 0.8 + 0.4 | Broadcast spray 9-10 d after casing and 1-3 d after harvest of 1st flush; harvest of 2nd flush | 6 | 0.64 | 1006188 |
| Germany 2007 (A15) 07-DE-049 | WP | 2 | - | 0.8 + 0.4 | Broadcast spray 5-9 d after casing and 1-3 d after harvest of 1st flush; harvest of 2nd flush | 6 | 0.39 | 1006188 |
| Ireland b | WP | 1 | | 0.6 | Drench application 3 days after casing; harvest 1st flush | 11 | < 0.05 | 1012101 |
| Ireland | WP | 2 | - | 0.6 + 0.6 | Drench application 3 days after casing and 21 d after casing; harvest 2nd flush | 2<br>3<br>4 | 0.46<br>0.27<br>0.15 | 1012101 |
| Belgium b | WP | 1 | | 1.38 | Broadcast spray Directly after casing; harvest 1st flush | 17 | 0.05 | 1012101 |
| Belgium | WP | 1 | | 1.38 | Broadcast spray 10 d after casing; harvest 1st flush | 14 | < 0.05 | 1012101 |

[a] France /Germany: Storage days samples at -20 °C 26-78d; plot sizes 3.4–5 $m^2$; harvest sample wt: 1 kg; analytical method: RESID/88/72 but detected with GC-MSD; average recovery 80.2 (remark: procedural recoveries range from 63–94% )

[b] Ireland/Belgium: Efficacy studies - Ireland: plot size 0.6 $m^2$ (per treatment 4 replicate plots); harvest sample wt: 0.25 kg per plot and the 4 replicate samples were pooled to one sample of 1 kg; storage at -80 °C.

Belgium: plot size 0.2 $m^2$ (per treatment 4 replicate plots); harvest sample wt: 1 kg (total); storage temperature not mentioned.

Harvested samples from both Ireland and Belgium were shipped to the analytical laboratory in Germany. Storage temperature is unknown. Storage of samples at the analytical laboratory: during a period of 91–150 d; analytical method: RESID/88/72 but detected with GC-MSD; average recovery 91.3% (procedural recoveries range from 88–94%).

## APPRAISAL

Prochloraz is a broad-spectrum imidazole fungicide that is active against a range of diseases in field crops, fruit and vegetables and is also used on mushrooms, as a post-harvest treatment of fruit and as a seed treatment on cereals. It was first evaluated in 1983 for residues and toxicology, and subsequently six additional reviews of residues were carried out between 1985 and 1992. Under the CCPR Periodic Review Programme the toxicology was re-evaluated in 2001, when an ADI of 0-0.01 mg/kg bw and an ARfD of 0.1 mg/kg bw were established. In 2004, a Periodic Review of the residue and -analytical aspects of prochloraz was conducted.

In the 2004 review the Meeting estimated a maximum residue level for mushrooms of 40 mg/kg and noted acute intake concerns relating to this level. As a consequence the 37th and 38th Sessions of the CCPR could not advance this level as an MRL. In 2007, the Committee was informed that the manufacturer would provide alternative GAP information on mushroom and corresponding trial data for evaluation by the 2009 JMPR (ALINORM 07/30/24 – Rev. 1).

The Meeting received new data on supervised trials on mushrooms in several European countries, as well as current European labels on mushrooms.

***Methods of analysis***

The Meeting received descriptions and validation data for an analytical method for residues of prochloraz in mushrooms. Mushrooms were analysed for the total prochloraz derived residue by analytical method RESID/88/72 which was evaluated before in the 2004 JMPR. All results were expressed as a total prochloraz derived residue by correcting the measured 2,4,6-trichlorophenol concentration for the molecular weight factor of 1.9

The method performed satisfactorily, and was validated in the range of 0.05–50 mg/kg.

***Results of supervised trials on crops***

The 2004 JMPR noted two distinct patterns of use of prochloraz on mushrooms: one established in the United Kingdom, involving two to three casing sprays of 0.3–0.6 g ai/$m^2$, with a PHI of 2 days, and the other common in a number of other European countries, Australia and New Zealand, involving one or more treatments at 1.5 g ai/$m^2$ and a PHI of 10–14 days.

JMPR 2004 identified seven trials in The Netherlands, Switzerland and the United Kingdom matching GAP in Denmark, Italy, The Netherlands, New Zealand and Poland (one or two treatments at 1.5 g ai/$m^2$, 10-day PHI), the residue levels were: 0.21, 0.25, 0.48, 0.71 and 0.74 mg/kg.

As reported by JMPR 2004, the maximum GAP of two sprays of 0.6 g ai/$m^2$ (2-day PHI) in the United Kingdom was supported by the results of trials in Germany and the United Kingdom, with residue levels of: 0.81, 3.6, 6.2 and 37 mg/kg.

The 2004 Meeting noted that these two residue populations are different and, on the basis of the data supporting the United Kingdom GAP (with a PHI of 2 days), estimated a maximum residue level of 40 mg/kg for prochloraz in mushrooms, an STMR of 4.9 mg/kg and a highest residue level of 37 mg/kg.

The 2009 Meeting noted, that still two distinct patterns of use of prochloraz on mushrooms exist; one with a relatively low dose and a short (2-4 day) PHI, and one with a higher dose and a PHI of 10 days.

For this years evaluation another set of trials conducted in Germany, France, Ireland and Belgium was provided together with current GAP from Belgium, France, Ireland, Italy, the Netherlands, Poland, Spain and the UK. Trials agreeing with the 'alternative GAP' (see for explanation the JMPR 2006 report, general considerations 2.3) involving one or more treatments at 1.5 g ai/$m^2$ and a PHI of 10 days (GAP in Italy and Poland) yielded residues of 1.3, 1.4 mg/kg.

Together with the data set of 2004 matching the same GAP, the total data set was : 0.21, 0.25, 0.48, 0.71, 0.74, 1.3, 1.4 mg/kg; the Meeting estimated a maximum residue level of 3 mg/kg for prochloraz in mushroom, an STMR of 0.71 and a highest residue level of 1.4 mg/kg.

Use of the NAFTA calculator resulted in an estimated maximum residue level of 3.5 mg/kg. The Meeting noted that the trials yielding the high residues were exactly at GAP, and over-all the distribution was rather uniform.

### *Farm animal dietary burden*

This Meeting estimated a maximum residue level for mushrooms. This is not a feed item. Therefore the Meeting decided that it was unnecessary to revisit the farm animal dietary burden.

## RECOMMENDATIONS

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 IEDI assessment.

Definition of the residue for compliance with MRL and for estimation of dietary intake, for plant and animal commodities: *Sum of prochloraz and its metabolites containing the 2,4,6-trichlorphenol moiety, expressed as prochloraz*

The residue is fat-soluble.

| CCN | Commodity | MRL (mg/kg) | | STMR, STMR-P (mg/kg) | HR, HR-P (mg/kg) |
|---|---|---|---|---|---|
| | | New | Previous | | |
| VO 0450 | Mushrooms | 3 | 40 | 0.71 | 1.4 |

## DIETARY RISK ASSESSMENT

### *Long-term intake*

Due to the low contribution of mushrooms in the entire diet, no revision of the chronic dietary exposure assessment has been carried out.

In 2004 the Meeting concluded that the long term intake of residues of prochloraz from uses that have been considered by the JMPR is unlikely to present a public health concern. The IEDI in the five GEMS/Food regional diets, on the basis of the estimated STMRs, represented 7–10% of the maximum ADI of 0.01 mg/kg bw.

### *Short-term intake*

The International Estimated Short-term Intake (IESTI) was calculated for mushrooms. The short-term intake of mushrooms represented 10% of the ARfD for children ≤ 6 years and 7% of the ARfD for the general population. The Meeting concluded that the short-term intake of residues of prochloraz from its uses on mushroom was unlikely to present a public health concern.

## REFERENCES


| Code | Author | Year | Title, Institute & report number, Submitting manufacturer and report code, GLP/Non-GLP. Published/Unpublished |
|---|---|---|---|
| | Klaas P., Meyer M. | 2008 | Study on the residue behaviour of BAS 590 F in mushrooms (indoor) after treatment with BAS 590 02 F in Germany and Northern France, 2007<br>SGS Institut Fresenius GmbH, Taunusstein, Germany<br>BASF DocID: 2008/1006188<br>GLP / GEP: Yes<br>Unpublished |

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| | Meyer M. | 2009 | Determination of the residues of BAS 590 F in mushrooms grown in GEP-trials in Ireland and Belgium in 2008<br>BASF DocID:2009/1012101<br>SGS Institut Fresenius GmbH, Taunusstein, Germany<br>GLP / GEP: Yes<br>Unpublished |