5.10 FLUAZIFOP-P-BUTYL (283)

TOXICOLOGY

Fluazifop-P-butyl is the ISO-approved common name for the *R*-enantiomer of butyl-2-[4-(5-trifluoromethyl-2-pyridyloxy)phenoxy]propionate (IUPAC), with the CAS number 79241-46-6. It is a herbicide that acts by the inhibition of acetyl coenzyme A carboxylase.

Fluazifop-P-butyl has not been evaluated previously by JMPR and was reviewed by the present Meeting at the request of CCPR.

In the 1980s, fluazifop-butyl was developed and marketed as a racemic mixture of fluazifop-P-butyl, the *R*-enantiomer, and the *S*-enantiomer. It was subsequently discovered that the *R*-enantiomer is responsible for the herbicidal activity. Although this evaluation is on fluazifop-P-butyl, contained in the currently marketed products, studies on fluazifop-butyl and fluazifop acid, its main metabolite, have also been taken into consideration where appropriate.

All critical studies contained statements of compliance with GLP and were conducted in accordance with relevant national or international test guidelines, unless otherwise specified.

Biochemical aspects

At the low dose (1 mg/kg bw), absorption in rats calculated from radioactivity recovered in bile, urine and carcass was about 56% of the administered dose. At 1 mg/kg bw, the majority of the excretion in females (> 89% of the absorbed dose) occurred via urine, with less in faeces (3.5–8.2%); in males, urinary excretion accounted for 51% of the absorbed dose, and faecal excretion, 35–52%. The rate of urinary excretion was more rapid in females, being virtually complete within 2 days, compared with more than 3 days in males.

Biliary elimination was shown to be much more extensive in male rats than in females, which explains the sex differences observed in both the routes and rates of excretion. Male rats eliminated 41.5% of a fluazifop-butyl dose and 45.7% of a fluazifop-P-butyl dose in bile over 4 days as fluazifop acid (2-[4-(5-trifluoromethyl-2-pyridoxyloxy)phenoxy]propionic acid; metabolite II) and its taurine conjugate (2-[4-(5-trifluoromethyl-2-pyridoxyloxy)phenoxy]propionyl taurine). Predosing with the unlabelled compound over 14 days did not affect the metabolic fate of a single oral dose of 1 mg/kg bw. The data also suggest that in male rats, biliary excretion and, more specifically, taurine conjugation of fluazifop acid become saturated at high dose levels.

Comparative metabolism studies conducted on male and female rats have shown that fluazifop-butyl (*R*:*S* enantiomer ratio nominally 50:50) and fluazifop-P-butyl (*R*:*S* enantiomer ratio nominally 90:10), irrespective of the *R*:*S* enantiomer ratio, are predominantly metabolized to fluazifop acid in the blood, urine and faeces, with rapid and preferential formation of *R*-fluazifop acid. Other metabolites are produced only in minor proportions, including the plant and soil metabolite 2-(5-trifluoromethyl)pyridone. Following higher doses (a single oral dose of 200 mg/kg bw) of [^{14}C]fluazifop-butyl, significant levels of *S*-fluazifop acid were detected in the plasma of both male and female rats for up to 1 hour after dosing (*R*:*S* ratios of 82:18 in both male and female rats at 30 minutes after dosing).

Tissue concentrations of the absorbed dose were much lower in female rats than in males; following a dose of 1 mg/kg bw, males exhibited a slight tendency to accumulate radiolabel, as they retained 9.5% of the radioactive dose in tissues and carcass after 10 days, whereas females retained only 0.8% of the dose after 7 days. The highest residues were in fat, followed by kidney and liver. There was a similar profile of tissue levels following a high dose of 1000 mg/kg bw. The higher tissue concentrations in males are probably a consequence of the enterohepatic recirculation and slower excretion rates seen in male rats.

In mice given a single oral low dose (1 mg/kg bw of [^{14}C]fluazifop-butyl), almost 80% of the dose was eliminated within 48 hours, with females excreting a high proportion in urine. Tissue concentrations were slightly lower in males than in females, with fat showing the highest residues in both sexes. Also in mice, fluazifop-butyl was metabolized predominantly to fluazifop acid, which was conjugated with taurine in both sexes. At a higher dose level (150 mg/kg bw of [^{14}C]fluazifop-butyl), metabolism to fluazifop acid was similar, but a lower proportion was conjugated with taurine for excretion in urine and faeces. One of the minor metabolites, 2-(4-hydroxyphenoxy) propionic acid, accounted for 0.3–2.1% of radioactivity in urine, and a small amount (1.1%) appeared to correspond to 5-trifluoromethyl-pyrid-2-one (metabolite X; CF3-pyridone).

In hamsters, as in rats, a single oral dose of fluazifop-P-butyl was excreted rapidly, predominantly in urine, in both sexes. Following dietary administration, fluazifop-P-butyl was rapidly absorbed and distributed to almost all tissues. Except for abdominal fat, residue levels decreased rapidly after removal of the labelled diet. The levels of residues were generally lower in females than in males.

In dogs given a single oral low dose (1 mg/kg bw), [^{14}C]fluazifop-butyl was rapidly absorbed in both sexes, with a similar proportion of the dose excreted in urine and faeces. Fluazifop-butyl was metabolized to fluazifop acid and excreted in both urine and faeces and via bile as the unconjugated acid or as the taurine conjugate. After 5 days, tissue residues were very low.

In humans, the metabolic fate of fluazifop-butyl is very similar to that observed in the female rats and hamsters. The data reported for three male subjects showed rapid and extensive absorption (80–93% in urine), hydrolysis to fluazifop acid and its rapid and predominant elimination in urine.

Toxicological data

Where toxicological studies were performed only with fluazifop-butyl, not fluazifop-P-butyl, those studies are presented in this report. The Meeting considered this to be acceptable, as both produce very similar toxicology except in the area of developmental toxicity, where the adverse effects seen with fluazifop-butyl at high doses have not been reproduced with fluazifop-P-butyl.

The acute oral LD_{50} in rats was 2451 mg/kg bw, and the acute oral LD_{50} in mice was greater than 2000 mg/kg bw. The acute dermal LD_{50} in rabbits was greater than 2110 mg/kg bw, and the acute inhalation LC_{50} in rats was greater than 5.2 mg/L. Fluazifop-P-butyl is not irritating to the eyes or skin of rabbits, but it was sensitizing to the skin of mice, as determined by the local lymph node assay.

In short-term and long-term toxicity studies in the mouse, hamster, rat and dog, the primary target organs are testes, eyes, kidneys and liver, with associated clinical chemistry changes.

In a 90-day study in hamsters given fluazifop-P-butyl in the diet at 0, 250, 1000 or 4000 ppm (equal to 0, 19.5, 78.3 and 292 mg/kg bw per day for males and 0, 19.9, 79.0 and 320 mg/kg bw per day for females, respectively), the NOAEL was 1000 ppm (equal to 78.3 mg/kg bw per day) for significantly lower body weight, feed consumption and feed utilization in males, effects seen in the kidneys and liver (increased relative weights) of both sexes and haematological parameters (decreased red blood cells, haematocrit and haemoglobin) in males at 4000 ppm (equal to 292 mg/kg bw per day).

In a 90-day dietary study in which rats were given fluazifop-P-butyl at 0, 10, 100 or 2000 ppm (equivalent to 0, 1, 10 and 200 mg/kg bw per day, respectively), the NOAEL was 100 ppm (equivalent to 10 mg/kg bw per day) for decreased body weights in males, changes in blood clinical chemistry parameters in males (increased alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase), decreased cholesterol, increased relative liver weight, increased swelling and eosinophilia of centrilobular hepatocytes, and increased kidney weights at 2000 ppm (equivalent to 200 mg/kg bw per day) in males.

In a 90-day study in dogs dosed with fluazifop-butyl at 0, 5, 25 or 250 mg/kg bw per day via gelatine capsules, the top dose was reduced to 125 mg/kg bw per day after 4 weeks of dosing because of severe ocular lesions that necessitated the premature termination of three dogs. The NOAEL was 25 mg/kg bw per day, based on haematological effects in males and increased bromosulfophthalein retention time in both sexes at 250/125 mg/kg bw per day.

In a 1-year study in which dogs were given fluazifop-butyl at 0, 5, 25 or 125 mg/kg bw per day in gelatine capsules, seven dogs were prematurely sacrificed because of severe clinical signs at 125 mg/kg bw per day during the 55-week treatment period. The NOAEL was 25 mg/kg bw per day, based on changes in red blood cells, platelets and bone marrow (reduced number of megakaryocytes and hypercellularity of particles), cataract, reduced cholesterol, increased liver enzymes and increased bromosulfophthalein retention time at 125 mg/kg bw per day in those dogs completing the dosing period.

In an 18-month study in which mice were administered fluazifop-butyl via the diet at 0, 1, 5, 20 or 80 ppm (equivalent to 0, 0.15, 0.75, 3 and 12 mg/kg bw per day for both males and females, respectively), the NOAEL was 20 ppm (equivalent to 3 mg/kg bw per day), based on liver hypertrophy, pigmentation and vacuolation at 80 ppm (equivalent to 12 mg/kg bw per day). Respiratory infection in all groups led to low survival of animals. No treatment-related effects on tumour incidence were observed.

In an 81-week study, mice were given fluazifop acid via the diet at concentrations adjusted to achieve target doses of 0, 0.1, 0.3, 1.0 and 3.0 mg/kg bw per day. No effects were observed at termination, other than an increase in absolute liver weight at 3.0 mg/kg bw per day in females only. The NOAEL was 3.0 mg/kg bw per day, the highest dose tested. Because of the high mortality in all groups, including control, this study was not considered suitable for assessing the carcinogenic effects of fluazifop acid in mice.

In an 83-week study in which hamsters were given fluazifop-P-butyl via the diet at 0, 200, 750 or 3000 ppm (equal to 0, 12.5, 47.4 and 194 mg/kg bw per day for males and 0, 12.1, 45.5 and 184 mg/kg bw per day for females, respectively), the NOAEL was 200 ppm (equal to 12.1 mg/kg bw per day) for effects on gallbladder, eye (cataractous change) and testis (decreased weight, histopathological changes, reduced spermatozoa) at 750 ppm (equal to 45.5 mg/kg bw per day). No treatment-related effects on tumour incidence were observed.

In a 24-month study, rats were given fluazifop-butyl in the diet at 0, 2, 10, 80 or 250 ppm (equal to 0, 0.09, 0.44, 3.6 and 11 mg/kg bw per day for males and 0, 0.1, 1.3, 4.6 and 14 mg/kg bw per day for females, respectively). Because of the high mortality (due to respiratory infection) in this study, it is not considered suitable for identification of a NOAEL for general toxicity. No treatment-related increase in the incidence of tumours was observed; however, given the limitations of the study, no conclusions can be drawn.

In a 24-month study in which rats were given fluazifop acid at 0, 0.1, 0.3, 1.0 or 3.0 mg/kg bw per day, the NOAEL was 1.0 mg/kg bw per day, based on an equivocal increase in early mortality in males at 3.0 mg/kg bw per day. No treatment-related effects on tumour incidence were observed.

The Meeting concluded that fluazifop-P-butyl is not carcinogenic in mice, hamsters or rats.

Fluazifop-P-butyl was tested for genotoxicity in an adequate range of assays, both in vitro and in vivo. No evidence of genotoxicity was found.

The Meeting concluded that fluazifop-P-butyl is unlikely to be genotoxic.

In view of the lack of genotoxicity and the absence of carcinogenicity in mice, hamsters and rats, the Meeting concluded that fluazifop-P-butyl is unlikely to pose a carcinogenic risk to humans.

In a two-generation study in which rats were given fluazifop-butyl at 0, 10, 80 or 250 ppm (equal to 0, 0.4, 3.5 and 11.2 mg/kg bw per day for males and 0, 0.6, 4.7 and 15.2 mg/kg bw per day for females, respectively), the NOAEL for reproductive toxicity was 10 ppm (equal to 0.6 mg/kg bw

per day) for extended duration of gestation in the F_1 generation from 80 ppm (equal to 4.7 mg/kg bw per day). The NOAEL for parental toxicity was 10 ppm (equal to 0.4 mg/kg bw per day) for reduced relative testis weight in the F_1 and F_2 generations, reduced relative pituitary weight in females, reduced relative spleen weight in both sexes and reduced relative uterus weight in the F_2 generation, and pathological changes in the kidney in the F_1 generation at 80 ppm (equal to 3.5 mg/kg bw per day). The NOAEL for offspring toxicity was 80 ppm (equal to 4.7 mg/kg bw per day) for reduced F_1 pup weight on day 25 and reduced pup viability at 250 ppm (equal to 15.2 mg/kg bw per day).

In a three-generation study with a teratogenicity phase, rats were given fluazifop-butyl at 0, 10, 80 or 250 ppm (equal to 0, 0.44, 3.28 and 11.35 mg/kg bw per day for males and 0, 0.73, 5.78 and 17.8 mg/kg bw per day for females, respectively). The NOAEL for reproductive toxicity was 10 ppm (equal to 0.73 mg/kg bw per day) for extended gestation duration in F_0 second mating (F_{1B}) and F_1 first mating (F_{2A}) from 80 ppm (equal to 5.78 mg/kg bw per day). The NOAEL for parental toxicity was 10 ppm (equal to 0.44 mg/kg bw per day) for decreased body weight change between weeks 0 and 13 in F_2 males, prostate, testis and seminal vesicle weight changes in F_0 males, relative thyroid weight changes in F_2 males and relative pituitary weight changes in F_1 females at 80 ppm (equal to 3.28 mg/kg bw per day). The NOAEL for offspring toxicity was 10 ppm (equal to 0.73 mg/kg bw per day) for reduced pup weight on day 25 postpartum in the F_{2A} generation and hydronephrosis in F_{1A} males and females from 80 ppm (equal to 5.78 mg/kg bw per day). Developmental effects observed in the teratogenicity phase of this study are briefly described below.

The overall NOAEL for parental toxicity was 10 ppm (equal to 0.44 mg/kg bw per day), based on organ weight changes and decreased body weight at 80 ppm (equal to 3.28 mg/kg bw per day). The overall NOAEL for reproductive toxicity was 10 ppm (equal to 0.73 mg/kg bw per day), based on extended duration of gestation at 80 ppm (equal to 4.7 mg/kg bw per day). The overall NOAEL for offspring toxicity was 10 ppm (equal to 0.73 mg/kg bw per day), based on reduced pup weight and hydronephrosis at 80 ppm (equal to 5.78 mg/kg bw per day).

A number of short-term studies in male rats were conducted to evaluate the effects of fluazifop-butyl on testis weight. No indication of histopathological changes was observed that could explain the changes in testis weight. The intrinsic estrogenic, anti-estrogenic, androgenic and anti-androgenic activities of fluazifop-P-butyl, fluazifop-butyl and their predominant metabolites, fluazifop-P-acid and fluazifop acid, were assessed in recombinant yeast models that express either human estrogen or androgen receptor. None of these compounds had any effect on these receptors.

In two developmental toxicity studies, rats were administered fluazifop-P-butyl at 0, 2, 5 or 100 mg/kg bw per day (study A) or 0, 0.5, 1, 20 or 300 mg/kg bw per day (study B) from gestation days 7 to 16. The maternal toxicity NOAEL was 100 mg/kg bw per day, based on reduced body weight gain and feed consumption in study B at 300 mg/kg bw per day. The embryo and fetal toxicity NOAEL from the two studies was 5 mg/kg bw per day, based on fifth cervical arch partially ossified, parietals partially ossified and change in manus assessment score for delayed ossification at 20 mg/kg bw per day.

An additional developmental toxicity study was conducted on rats exposed to fluazifop-P-butyl at 0, 2, 5 or 100 mg/kg bw per day from gestation days 17 to 21. The NOAEL for maternal toxicity was 5 mg/kg bw per day, based on reduced body weight gain and feed consumption at 100 mg/kg bw per day. The embryo and fetal toxicity NOAEL was 5 mg/kg bw per day, based on odontoid not ossified at 100 mg/kg bw per day.

Another developmental toxicity study was conducted to investigate the fetal toxicity of fluazifop-P-butyl in rats from gestation days 7 to 21. Rats were administered fluazifop-P-butyl at 0, 2, 5 or 100 mg/kg bw per day. There was no maternal toxicity. The embryo and fetal toxicity NOAEL was 2 mg/kg bw per day, based on the occurrence of signs of delayed ossification at 5 mg/kg bw per day.

The overall NOAEL for maternal toxicity in the rat developmental toxicity studies was 20 mg/kg bw per day, based on reduced body weight gain and feed consumption at 100 mg/kg bw per

day. The overall embryo and fetal toxicity NOAEL was 2 mg/kg bw per day, based on delayed ossification at 5 mg/kg bw per day.

In a developmental toxicity study conducted in rabbits, fluazifop-P-butyl was administered by gavage at 0, 2, 10 or 50 mg/kg bw per day from gestation days 8 to 20. The maternal and embryo/fetal toxicity NOAELs were both 10 mg/kg bw per day, based on weight loss and inappetence in the dams and incomplete ossification of sternebrae in the fetuses at 50 mg/kg bw per day.

The results of the teratogenicity phase of the three-generation rat study with fluazifop-butyl as well as two developmental toxicity studies in rats showed increased malformations. These are attributed to the presence of the *S*-enantiomer of fluazifop-butyl. As studies have demonstrated that no epimerization from *R*- to *S*-enantiomer occurs in animals and plants, the Meeting concluded that only those developmental toxicity studies conducted with fluazifop-P-butyl are relevant for the evaluation of the developmental toxicity of this compound.

The Meeting concluded that fluazifop-P-butyl is not teratogenic.

In an acute neurotoxicity study in rats in which fluazifop-P-butyl was given orally by gavage at 0, 500, 1000 or 2000 mg/kg bw, the NOAEL was 2000 mg/kg bw, the highest dose tested. No NOAEL for systemic toxicity could be established owing to the occurrence of effects (body weight loss, clinical signs of toxicity, lower body temperature and decreased locomotor activity) at all dose levels.

In a subchronic (90-day) neurotoxicity study in which fluazifop-P-butyl was given to rats via the diet at 0, 100, 250 or 1000 ppm (males) or 4000 ppm (females) (equal to 0, 6.7, 16.8 and 69.5 mg/kg bw per day for males and 0, 7.9, 20.2 and 328.1 mg/kg bw per day for females, respectively), the NOAEL for neurotoxicity was 1000 ppm (equal to 69.5 mg/kg bw per day) for males and 4000 ppm (equal to 328.1 mg/kg bw per day) for females, the highest dose levels tested in this study. The NOAEL for systemic toxicity for males was 250 ppm (equal to 16.8 mg/kg bw per day), based on increased liver weights at 1000 ppm (equal to 69.5 mg/kg bw per day). The NOAEL for systemic toxicity for females was 4000 ppm (equal to 328.1 mg/kg bw per day), the highest dose level used in this study.

In an immunotoxicity study, fluazifop-P-butyl was administered to female rats in the diet at 0, 100, 500 or 2000 ppm (equal to 0, 9, 44 and 173 mg/kg bw per day, respectively). No signs of immunotoxicity were observed.

The Meeting concluded that fluazifop-P-butyl is not immunotoxic.

An in vitro test in which rat, mouse, hamster and human hepatocytes were dosed with fluazifop-P-butyl at 25–2000 µmol/L showed that peroxisomal enzyme activity was increased (in decreasing order of sensitivity) in mouse, rat and hamster hepatocytes in a dose-related manner. There was minimal response to fluazifop-P-butyl in human hepatocytes. Fluazifop-P-butyl did not increase cell division rates in rat, mouse, hamster or human hepatocyte cultures in vitro.

In an in vivo study, male and female rats, mice and hamsters were administered fluazifop-P-butyl in the diet at 0, 80, 250, 500, 1000, 1500 or 2000 ppm (equivalent to 0, 8, 25, 50, 100, 150 and 200 mg/kg bw per day, 0, 12, 37.5, 75, 150, 225 and 300 mg/kg bw per day and 0, 8, 25, 50, 100, 150 and 200 mg/kg bw per day for rats, mice and hamsters, respectively). There was a dose-related increase in peroxisome proliferation in male rats, ranging from 2.7-fold at 80 ppm to 12.4-fold at 2000 ppm; there was a marginal increase only (1.3-fold) in females fed 2000 ppm fluazifop-P-butyl. At dose levels of 250 ppm or higher, significant increases in peroxisome proliferation were seen in male and female mice. In female hamsters, a small (1.6-fold) but statistically significant increase was seen in the 2000 ppm group. No significant effects were observed in male hamsters at any dose level. A similar effect to that described above was seen when rats were treated for 56 days. No significant increases in hepatocyte S-phase (either early or sustained) were observed in the rats fed diets containing up to 2000 ppm fluazifop-P-butyl for up to 56 days.

Toxicological data on metabolites and/or degradates

Metabolite X (CF3-pyridone)

Metabolite X (R154719; 5-trifluoromethyl-pyrid-2-one; compound 10) is a plant and soil metabolite of fluazifop-P-butyl that is not found in the rat or dog but is present in the mouse to a limited extent, where it is excreted in small amounts (approximately 1.1% of the applied dose) in the urine. Toxicokinetics, acute oral toxicity, short-term toxicity and four genotoxicity studies were performed with this metabolite.

In an excretion and absorption study conducted in rats, metabolite X, after oral administration to rats, was completely absorbed from the gastrointestinal tract into the systemic circulation and thereafter rapidly excreted. The majority of the absorbed test substance was excreted as unchanged parent, mainly in the urine.

The acute oral LD_{50} in rats was 3417 mg/kg bw. In the mouse bone marrow micronucleus assay, clinical signs in both sexes and mortality in females were observed after a single oral dose of 250 or 375 mg/kg bw, but not at 150 mg/kg bw.

In a 28-day study in rats fed diets containing metabolite X at 0, 200, 600 or 1600 ppm (equal to 0, 22.2, 65.7 and 177 mg/kg bw per day for males and 0, 21.2, 66.4 and 176 mg/kg bw per day for females, respectively), the NOAEL was 1600 ppm (equal to 176 mg/kg bw per day), the highest dose tested.

Two vitro gene mutation assays on *Salmonella typhimurium* were positive in strains TA1535 and TA100 (only 1.6-fold increase at highest dose) in the presence and absence of S9 and negative in strains TA1537, TA1538 and TA98 in the presence and absence of S9. In a chromosome aberration assay in human lymphocytes in vitro, metabolite X was negative. In a mouse bone marrow micronucleus assay in vivo, it was negative. In an unscheduled DNA synthesis assay in vivo, metabolite X was negative. The Meeting concluded that metabolite X is unlikely to be genotoxic in vivo, but this requires confirmation.

In a developmental toxicity study in rats dosed with metabolite X at 0, 20, 60 or 200 mg/kg bw per day from gestation days 6 to 19, the NOAEL for maternal toxicity was 60 mg/kg bw per day for reduced body weight gain seen at 200 mg/kg bw per day from gestation days 6 through 14. The NOAEL for embryo and fetal toxicity was 200 mg/kg bw per day, the highest dose tested.

The Meeting concluded that metabolite X (R154719) is toxicologically relevant and is of no greater toxicity than the parent in rats, but may be more acutely toxic in mice.

Metabolite III (despyridinyl acid)

Metabolite III (R118106; 2-(4-hydroxyphenoxy)propionic acid) is a plant metabolite of fluazifop-P-butyl that is found in the rat and mouse, where it is excreted in small amounts (approximately 0.7% and 2% of the applied dose in rats and mice, respectively) in the urine. Acute oral, eye and skin irritation, acute inhalation, skin sensitization and three genotoxicity studies were performed with this metabolite.

The acute oral LD_{50} in rats was greater than 5000 mg/kg bw. The acute inhalation LC_{50} in rats was estimated to be greater than 1.84 mg/L (analytical value). Metabolite III is not irritating to the skin, but it did elicit severe ocular lesions and was a weak skin sensitizer in the guinea-pig (Magnusson and Kligman).

Results from an in vitro gene mutation assay on *Salmonella typhimurium* showed that metabolite III is not mutagenic, independent of the presence of an auxiliary metabolizing system. Results from a second gene mutation assay in *S. typhimurium* and *E. coli* showed that metabolite III did not induce gene mutations in the presence or absence of metabolic activation. Results from an in

vitro chromosome aberration test in Chinese hamster ovary cells showed that metabolite III is not clastogenic in the presence or absence of metabolic activation.

The Meeting concluded that metabolite III is not genotoxic in vitro.

On the basis of structural considerations, the Meeting concluded that metabolite III is unlikely to be of greater toxicity than the parent.

Metabolite XL (hydroxy fluazifop acid)

Metabolite XL is a plant metabolite of fluazifop-P-butyl that is not found in experimental animals. No toxicological information is available. However, owing to its structural similarity to the parent, the Meeting concluded that metabolite XL is unlikely to be of greater toxicity than the parent.

Human data

No information was provided or identified in the literature.

The Meeting concluded that the existing database on fluazifop-P-butyl was adequate to characterize the potential hazards to the general population, including fetuses, infants and children.

Toxicological evaluation

The Meeting established an ADI for fluazifop-P-butyl, expressed as fluazifop acid, of 0–0.004 mg/kg bw, based on an overall NOAEL of 0.44 mg/kg bw per day (for decreased body weight and organ weight changes) in two- and three-generation reproductive toxicity studies in rats performed with fluazifop-butyl, using a safety factor of 100.

The Meeting established an ARfD for fluazifop-P-butyl, expressed as fluazifop acid, of 0.4 mg/kg bw, based on systemic toxicity effects (body weight loss, clinical signs of toxicity, lower body temperature and decreased locomotor activity) in an acute neurotoxicity study in rats occurring at the lowest dose of 500 mg/kg bw, using a safety factor of 100 (for intraspecies and interspecies variability) and an additional safety factor of 10 for use of a LOAEL instead of a NOAEL and correcting for molecular weight.

The ADI and ARfD can be applied to fluazifop acid (metabolite II), metabolite III (despyridinyl acid), metabolite X (CF3-pyridone) and metabolite XL (hydroxy fluazifop acid). The Meeting noted that the ARfD provides a margin of 625-fold relative to the acute toxicity of metabolite X in mice.

Levels relevant to risk assessment of fluazifop-P-butyl

Species	Study	Effect	NOAEL	LOAEL
Mouse	Eighteen-month study of toxicity and carcinogenicity[a,b]	Toxicity	3.0 mg/kg bw per day[c]	–
Hamster	Twenty-month study of toxicity and carcinogenicity[a,d]	Toxicity	200 ppm, equal to 12.1 mg/kg bw per day	750 ppm, equal to 45.5 mg/kg bw per day
		Carcinogenicity	3 000 ppm, equal to 184 mg/kg bw per day[c]	–
Rat	Twenty-four-month study of toxicity and carcinogenicity[a,b]	Toxicity	1.0 mg/kg bw per day	3.0 mg/kg bw per day[e]
		Carcinogenicity	3.0 mg/kg bw per day[c]	–

Species	Study	Effect	NOAEL	LOAEL
	Two- and three-generation studies of reproductive toxicity[a,f,g]	Parental toxicity	10 ppm, equal to 0.44 mg/kg bw per day	80 ppm, equal to 3.28 mg/kg bw per day
		Offspring toxicity	10 ppm, equal to 0.73 mg/kg bw per day	80 ppm, equal to 5.78 mg/kg bw per day
		Reproductive toxicity	10 ppm, equal to 0.73 mg/kg bw per day	80 ppm, equal to 4.7 mg/kg bw per day
	Developmental toxicity studies[d,g]	Maternal toxicity	20 mg/kg bw per day	100 mg/kg bw per day
		Embryo and fetal toxicity	2 mg/kg bw per day	5 mg/kg bw per day[h]
	Acute neurotoxicity study[d,i]	Neurotoxicity	2 000 mg/kg bw[c]	–
		Toxicity	–	500 mg/kg bw[j]
	Subchronic neurotoxicity study[a,d]	Neurotoxicity	1 000 ppm, equal to 69.5 mg/kg bw per day[c]	–
		Toxicity	250 ppm, equal to 16.8 mg/kg bw per day	1 000 ppm, 69.5 mg/kg bw per day
Rabbit	Developmental toxicity study[d,i]	Maternal toxicity	10 mg/kg bw per day	50 mg/kg bw per day
		Embryo and fetal toxicity	10 mg/kg bw per day	50 mg/kg bw per day
Dog	One-year toxicity study[f,k]	Toxicity	25 mg/kg bw per day	125 mg/kg bw per day

[a] Dietary study.

[b] Study conducted with fluazifop acid.

[c] Highest dose tested.

[d] Study conducted with fluazifop-P-butyl.

[e] Marginal LOAEL.

[f] Study conducted with fluazifop butyl.

[g] Two or more studies combined.

[h] Not considered an acute effect.

[i] Gavage study.

[j] Lowest dose tested.

[k] Capsule administration.

Acceptable daily intake (ADI; applies to fluazifop-P-butyl, fluazifop acid [metabolite II], metabolite III [despyridinyl acid], metabolite X [CF3-pyridone] and metabolite XL [hydroxy fluazifop acid], expressed as fluazifop acid)

0–0.004 mg/kg bw

Acute reference dose (ARfD; applies to fluazifop-P-butyl, fluazifop acid [metabolite II], metabolite III [despyridinyl acid], metabolite X [CF3-pyridone] and metabolite XL [hydroxy fluazifop acid], expressed as fluazifop acid)

0.4 mg/kg bw

Information that would be useful for the continued evaluation of the compound

Results from epidemiological, occupational health and other such observational studies of human exposure

Studies on the mutagenicity of metabolite X in mammalian systems

Critical end-points for setting guidance values for exposure to fluazifop-P-butyl

Absorption, distribution, excretion and metabolism in mammals	
Rate and extent of oral absorption	More than 56%
Distribution	Fat, kidneys and liver; enterohepatic recirculation in male rat
Potential for accumulation	Slight tendency to accumulate in fat
Rate and extent of excretion	90% in female rats in urine, with half-life of 2.5 h; 90% in male rats via urine and bile, with half-life of 33–38 h
Metabolism in mammals	Extensively metabolized to the carboxylic acid metabolite fluazifop acid, further conjugated with taurine
Toxicologically significant compounds in animals and plants	Fluazifop-P-butyl, fluazifop acid (metabolite II), metabolite III (despyridinyl acid), metabolite X (CF3-pyridone) and metabolite XL (hydroxy fluazifop acid)
Acute toxicity	
Rat, LD_{50}, oral	> 2 451 mg/kg bw
Mouse, LD_{50}, oral	> 2 000 mg/kg bw
Rabbit, LD_{50}, dermal	> 2 110 mg/kg bw
Rat, LC_{50}, inhalation	> 5.2 mg/L (nose-only exposure)
Rabbit, dermal irritation	Non-irritating
Rabbit, ocular irritation	Non-irritating
Mouse, dermal sensitization	Sensitizing (local lymph node assay)
Short-term studies of toxicity	
Target/critical effect	Kidney and liver
Lowest relevant oral NOAEL	10 mg/kg bw per day (rat)
Lowest relevant dermal NOAEL	100 mg/kg bw per day (rabbit)
Lowest relevant inhalation NOAEC	No data
Long-term studies of toxicity and carcinogenicity	
Target/critical effect	Mortality
Lowest relevant NOAEL	1.0 mg/kg bw per day (rat)
Carcinogenicity	Not carcinogenic in hamsters or rats[a]
Genotoxicity	

	No evidence of genotoxicity[a]
Reproductive toxicity	
Target/critical effect	Parental: body weight and testis and other organ weights
	Reproductive: extended gestation
	Offspring: reduced pup weight and viability and hydronephrosis
Lowest relevant parental NOAEL	0.44 mg/kg bw per day
Lowest relevant offspring NOAEL	0.73 mg/kg bw per day
Lowest relevant reproductive NOAEL	0.73 mg/kg bw per day
Developmental toxicity	
Target/critical effect	Delayed ossification, reduced maternal body weight
Lowest relevant maternal NOAEL	10 mg/kg bw per day (rabbit)
Lowest relevant embryo/fetal NOAEL	2 mg/kg bw per day (rat)
Neurotoxicity	
Acute neurotoxicity NOAEL	2 000 mg/kg bw, highest dose tested (rat)
Subchronic neurotoxicity NOAEL	69.5 mg/kg bw per day, highest dose tested (rat)
Developmental neurotoxicity NOAEL	No data
Immunotoxicity	
	173 mg/kg bw per day, highest dose tested (rat)
Studies on toxicologically relevant metabolites	
Metabolite X	Complete absorption and rapid excretion in urine as unchanged parent
	LD_{50} (rat): 3 417 mg/kg bw
	28-day rat: NOAEL 176 mg/kg bw per day, highest dose tested
	Unlikely to be genotoxic in vivo, but needs confirmation
	Developmental toxicity (rat): maternal NOAEL 60 mg/kg bw per day; embryo and fetal toxicity NOAEL 200 mg/kg bw per day, highest dose tested
Metabolite III	LD_{50} (rat): > 5 000 mg/kg bw
	LC_{50} (rat): > 1.84 mg/L (analytical value)
	Not irritating to rabbit skin
	Severely irritating to rabbit eyes
	Weakly sensitizing in the guinea-pig
	Not genotoxic in vitro
Mechanistic/mode of action studies	In vivo and in vitro indications of peroxisome proliferation in mouse and male rat, mild effect in hamster and no effect in human hepatocytes (in vitro only)
	No estrogenic, anti-estrogenic, androgenic or anti-androgenic activity in vitro

[a] Unlikely to pose a carcinogenic risk to humans via exposure from the diet.

Summary

	Value	Study	Safety factor
ADI[a]	0–0.004 mg/kg bw	Multigeneration studies of reproductive toxicity (rat)	100
ARfD[a]	0.4 mg/kg bw	Acute neurotoxicity study (rat)	1 000

[a] Applies to fluazifop-P-butyl, fluazifop acid (metabolite II), metabolite III (despyridinyl acid), metabolite X (CF3-pyridone) and metabolite XL (hydroxy fluazifop acid), expressed as fluazifop acid.

RESIDUE AND ANALYTICAL ASPECTS

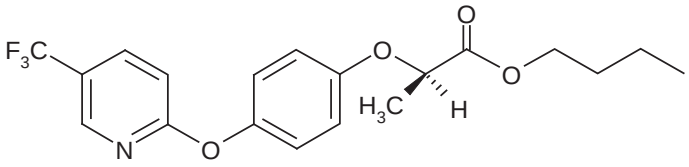
Fluazifop-P-butyl was scheduled for residue evaluation as a new compound by the 2015 JMPR at the 46th Session of the CCPR (2014). Because the dossier was considered incomplete at the start of the 2015 JMPR, the evaluation was postponed until the 2016 JMPR. Fluazifop-P-butyl is used for the post-emergence control of grass (graminaceous) weeds in a wide range of broad-leaved crops. Fluazifop-P-butyl is quickly absorbed across leaf surfaces. Its hydrolysis product, fluazifop-P-acid (or fluazifop-P), then distributes throughout the plant through both xylem and phloem transport and accumulates in the meristem tissue of the growing points of both shoots and roots. The speed of the herbicidal action increases with weed vigour.

The Meeting received information from the manufacturer on identity, metabolism, storage stability, residue analysis, use pattern, residues resulting from supervised trials on various crops, fate of residue during processing, and livestock feeding studies.

Chemical name

Fluazifop-P-butyl

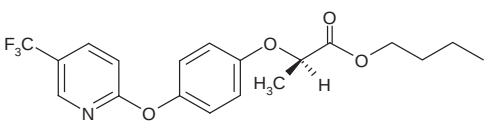
Butyl (R)-2-[4-(5-trifluoromethyl-2-pyridyloxy)phenoxy]propionate

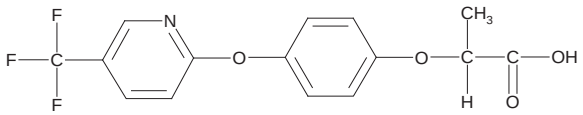
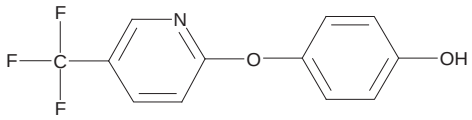
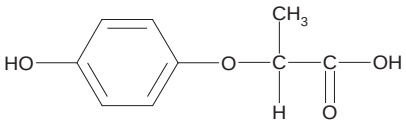
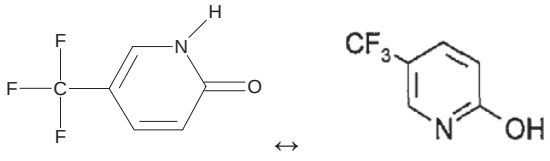
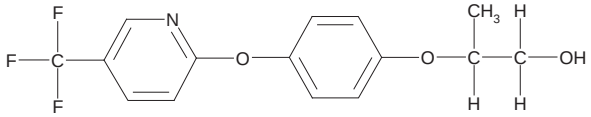
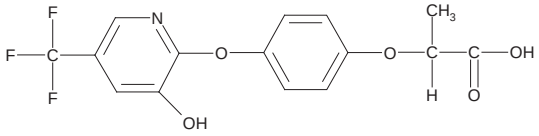


Fluazifop-P-butyl is the active purified (resolved) R-enantiomer of the racemate (RS)-fluazifop-butyl. This R-enantiomer possesses the majority of the herbicidal activity. The enantiomeric purity of fluazifop-P-butyl is 96–99% R-enantiomer and 1–4% S-enantiomer. The chiral carbon atom of the R-enantiomer is indicated in the figure above.

Fluazifop-butyl (racemate) contains R and S-enantiomers in a 50:50 w/w ratio. The biological activity of the racemate is due primarily to the R-enantiomer which gives equal herbicidal activity at half the rate of racemic (RS)-fluazifop-butyl. A formulation based on the racemate was marketed first and was replaced by a formulation based on the R-enantiomer in 1984. Several of the available studies have been performed with the racemate.

Compounds referred to in the appraisal:

Fluazifop-P-butyl (I) MW 383.4	

Fluazifop-P-acid (II) MW 327.3	
Pyr-Ph ether (IV) MW 255.20	
Despyridinyl acid (III) MW 182.17	
CF3-pyridone (X) MW 163.10	
Fluazifop alcohol (34, XXXIV)	
Hydroxyfluazifop acid (XL) MW 343.3	

Plant metabolism

The Meeting received plant metabolism studies for fluazifop-butyl after soil directed or foliar applications on fruits and fruiting vegetables (grapes and cucumbers), stem and leafy vegetables (lettuce, celery, and endive), cereals (maize), pulses and oilseeds (alfalfa, cotton, oilseed rape, and soya bean) and root and tuber vegetables (carrot, potato tubers, and sugar beet roots). All radioactive residue levels in the metabolism studies are expressed as fluazifop-butyl equivalents, and all percentages are expressed as %TRR (total radioactive residues) in the specified commodity. As a large number of metabolism studies were received, they were summarized together.

In most crop commodities, residues could be extracted sequentially by acetonitrile and acetonitrile/water at levels > 80%, except cotton forage 78–95%, carrot roots 61–88%, and carrot foliage 40–74%. Oilseed commodities were sequentially extracted by hexane, diethyl ether or dichloromethane, acetonitrile/water and methanol or water at levels > 80%, except cotton seeds 64–65% TRR.

Organo-soluble and polar conjugates present in the extracts were cleaved by alkaline or acid hydrolysis to investigate to which exocon they were attached. In some commodities the remaining solids were hydrolysed as well. The Meeting noted that harsh hydrolysis conditions can lead to degradation of fluazifop-butyl and its metabolites, and interpretation of the metabolism studies needs to take this into account. Studies showed that fluazifop acid remained intact (92–96% recovery) with 0.1 M NaOH for 1–3 hrs reflux or 6 M HCl for 6 hrs 60 ºC (90% recovery). Higher alkaline concentrations (1 M NaOH) or higher temperatures under acid conditions (reflux in 1–6 M HCl) resulted in degradation of fluazifop acid into CF3-pyridone (X) and despyridinyl acid (III). CF3-pyridone degraded under alkaline hydrolysis conditions, but remained intact with 6 M HCl for 1 hr

reflux (93% recovery). Stability of despyridinyl acid (III), Pyr-Ph ether (IV) and hydroxyfluazifop acid (XL) under these conditions has not been investigated, but is desirable.

Since fluazifop-P-butyl could possibly convert to S-enantiomeric forms during hydrolysis or metabolism, the Meeting considered epimerisation studies in plants. Epimerisation of [^{14}C]phenyl-fluazifop-butyl R- or S-enantiomers was studied in lettuce and cotton plants treated with a topical leaf and stem spot application. Plants were harvested 27 days later and then extracted and hydrolysed. The R/S ratio remained unchanged for fluazifop acid, indicating that no epimerisation occurred in the plant or during sample extraction and acid or alkaline hydrolysis. Contrary, analysis of samples from supervised trials treated with fluazifop-butyl (RS) showed an increase in the proportion of the fluazifop acid R-enantiomer with a crop to crop variation in the rate and content of conversion. The R-enantiomer proportion of the total fluazifop remained approximately the same in carrot roots at 21 days after treatment (46–54%), but increased to 74–82% in apple at 35–49 days after treatment, 78% in head cabbage at 49 days after treatment, 62% in kale at 27–41 days after treatment, 69–77% in dry peas at 54 days after treatment and 76–84% in oilseed rape seeds. Since fluazifop-P-butyl (96–99% R-enantiomer) is currently the only compound that is available in trade, it is unlikely that S-enantiomeric levels will be higher than specified for fluazifop-P-butyl in the FAO JMPS specifications.

Translocation studies showed that fluazifop-butyl derived residues translocated rapidly throughout the plants. In a study on cucumbers following a single foliar application, a high proportion of the residues (88%) was present on the peel of the fruit after 1 day, while residues had distributed evenly between the peel and flesh after 14 days. Whole plant autoradiograms of soyaplants following a topical leaf application or a topical stem injection showed very little translocation after 1 day, but the radiocarbon had spread throughout the soyaplants including the roots and the new growth after 7–14 days.

Fluazifop-P-butyl may be applied:

- to grass-like crops as a desiccant (grass seed production) or as a ripener to increase the sucrose concentration (sugar cane)
- as a weed directed spray application at the base of trees, shrubs or vines or a banded inter-row soil application to field crops
- as a broadcast or banded (over-the-top) foliar application to various crops.

Treatment of grass-like crops was studied in maize plants. Fluazifop-P-butyl is an herbicide effective against graminaceous weeds and is therefore phytotoxic to cereals and grasses. This was confirmed in a metabolism study on maize plants where maize plants died after 13–28 days after a topical leaf or stem application. In a study, where maize plants were stem injected with [^{14}C]phenyl-fluazifop-butyl (RS) at an unknown dose rate, only parent and fluazifop acid were identified in the extracts. Parent compound decreased from 15–40% AR at 1–7 days to 5% AR at 14–28 days. Free fluazifop acid decreased from 65% at Day 1 to 5% AR at Day 28. The presence of other compounds was not investigated and hydrolysis was not conducted. Fluazifop-butyl and fluazifop acid were the only compounds found in cereal forage.

Application around the base of trees or shrubs was studied on grape vines. Field grown grapes were sprayed at the base of the vine with a mixture of [^{14}C]phenyl- and [^{14}C]pyridyl-fluazifop-P-butyl (R-enantiomer). The vine was treated with 1–2 applications at 0.84 kg ai/ha with an interval of 71 days, whereby the first application was at early bunch formation. Total radioactive residues (TRR) in immature grape berries at DAT 21, 30, 45, 60 after a single treatment and mature grape berries at DAT 14, 30 after a double treatment were 0.004–0.009 mg/kg eq. Composition of the residue was not further investigated. This study indicates that application of fluazifop-P-butyl around the base of trees, shrubs or vines is not expected to result in significant residues in the fruits (or nuts) as long as the spray does not reach the fruits (or nuts).

Foliar applications to various crops were investigated in 21 different metabolism studies. These are summarized in the table below. Studies, where severe hydrolysis conditions are used are not taken into account for residue characterisation.

In addition, individual compounds were analysed in samples treated with fluazifop-butyl (RS) in supervised residue trials. Fluazifop-butyl (parent compound) is found at significant quantities at the day of application, but is found at low levels (up to 0.1 mg/kg) up to 8 days in fruits, up to 12 days in roots, up to 16 days in oilseed forage and up to 98 days in root forage. In trials on celery, where extraction conditions did not degrade fluazifop acid, low levels (0.06–0.08 mg/kg) of total CF3-pyridone (free and conjugates) were found up to 30 days after application. Total fluazifop (i.e. sum of fluazifop-butyl, fluazifop acid and its conjugates, expressed as fluazifop acid) levels ranged from 1.2–2.7 mg/kg for these samples. When corrected for molecular weight (× 327.3/163.10 = 2.01), levels of CF3-pyridone were equivalent to 5.2–13% of total fluazifop in celery stems. This is similar to levels found in the celery metabolism study.

							Parent (I) and metabolites as %TRR								
No	Crop	Treatment	Label		PHI	TRR Mg/kg	I	II	I + II	IV	III	X	34	XL	NH
2	Cucumber	1 × 0.50 kg ai/ha foliar spray	Ph	RS	1	1.3	7.3	69	76	-	–	Nr	Na	Na	24
2	Cucumber	1 × 0.50 kg ai/ha foliar spray	Ph	RS	14	4.9	–	72	72	–	3.3	Nr	Na	Na	17
2	Cucumber	1 × 0.52 kg ai/ha foliar spray	Py	RS	14	2.4	–	69	69	–	Nr	–	Na	Na	11
9	Rape seeds	1 × 0.84 kg ai/ha; topical leaf and stem and soil	Py	RS	70–91	0.65	–	69	69	–	Nr	D (–)	Na	Na	6
15	Soyaseeds	1 × 1.0 kg ai/ha; Broadcast pods present	Ph	RS	63	11	–	77	77	Na	3.7	Nr	Na	Na	10
15	Soyaseeds	1 × 1.0 kg ai/ha; Broadcast pods present	Ph	RS	43	6.0	–	81	81	Na	Na	Nr	Na	Na	13
16	Soyaseeds	1 × 0.56 kg ai/ha; Broadcast BBCH 15	Ph	R	104	0.04	–	50	50	–	2.3	Nr	Na	Na	19
16	Soyaseeds	1 × 0.56 kg ai/ha; Broadcast BBCH 15	Py	R	104	0.09	–	40	40	–	Nr	D (–)	Na	Na	24
16	Soyaseeds	0.56 + 0.21 kg ai/ha; Broadcast BBCH 69	Ph	R	82	0.57	–	57	57	–	3.9	Nr	Na	Na	13
16	Soyaseeds	0.56 + 0.21 kg ai/ha; Broadcast BBCH 69	Py	R	82	1.0	0.2	59	60	–	Nr	D 0.9	Na	Na	16
17	Carrot roots	1 × 0.25 kg ai/ha; broadcast	Ph	R	45	0.15	–	63	63	–	6.4	Nr	–	Na	12
17	Carrot roots	1 × 0.53 kg ai/ha; broadcast	Ph	RS	45	0.18	–	46	46	–	4.8	Nr	13	Na	23
17	Carrot roots	1 × 0.51 kg ai/ha; broadcast	Py	RS	45	0.33	–	44	44	–	Nr	1.0	11	Na	25
18	Carrot roots	1 × 0.42 kg ai/ha; broadcast	Ph	R	20	0.38	0.5	62	62	–	13	Nr	Na	Na	25
18	Carrot roots	1 × 0.43 kg ai/ha broadcast	Py	R	20	0.54	–	49	49	–	Nr	37	Na	Na	14
18	Carrot roots	0.42 + 0.42 kg ai/ha; broadcast	Ph	R	45	0.091	–	64	64	–	18	Nr	Na	Na	19
18	Carrot roots	0.42 + 0.42 kg ai/ha; broadcast	Py	R	45	0.13	–	59	59	–	Nr	29	Na	Na	12
19	Potato	1 × 0.86 kg ai/ha;	Ph	RS	56	0.37	–	42	42	–	18	Nr	Na	13	15

							Parent (I) and metabolites as %TRR								
No	Crop	Treatment	Label		PHI	TRR Mg/kg	I	II	I + II	IV	III	X	34	XL	NH
	tubers	topical leaf and soil													
19	Potato tubers	1 × 0.84 kg ai/ha; topical leaf and soil	Py	RS	56	0.29	–	25	25	–	Nr	–	Na	15	30
20	Sugar beet roots	1 × 2.8 kg ai/ha; topical leaf and soil	Ph	RS	87	0.049	–	25	25	–	18	Nr	Na	Na	4
21	Sugar beet roots	1 × 0.25 kg ai/ha; broadcast	Ph	R	90	0.09	–	52	52	–	17	Nr	–	Na	18
21	Sugar beet roots	1 × 0.52 kg ai/ha; broadcast	Ph	RS	90	0.08	–	40	40	–	15	Nr	–	Na	17
21	Sugar beet roots	1 × 0.51 kg ai/ha; broadcast	Py	RS	90	0.20	–	34	34	–	NR	IC 3.4	–	Na	18
4	Celery stems	0.45 + 0.18 kg ai/ha; broadcast	Ph	R	30	0.05	–	43	43	Na	18	Nr	1.0	4.4	1
4	Celery stems	0.42 + 0.36 kg ai/ha; broadcast	Py	R	30	0.08	–	39	39	Na	Nr	2.7	–	1.2	8
3	Lettuce	1 × 0.45 kg ai/ha; topical leaf and stem	Ph	R	27	NA	52	19	71	0.4	8.7	Nr	–	Na	5
3	Lettuce	1 × 0.45 kg ai/ha; Topical leaf and stem	Ph	S	27	NA	49	19	68	1.7	4.1	Nr	5.3	Na	7
5	Endive	1 × 0.42 kg ai/ha; broadcast	Ph	R	20	0.65	–	48	48	11	25	Nr	Na	Na	3
5	Endive	1 × 0.42 kg ai/ha; broadcast	Py	R	20	0.88	–	37	37	25	Nr	14	Na	Na	12
5	Endive	0.42 + 0.42 kg ai/ha; broadcast	Ph	R	28	1.4	–	49	49	0.5	40	Nr	Na	Na	1
5	Endive	0.42 + 0.42 kg ai/ha; broadcast	Py	R	28	1.8	–	43	43	–	Nr	11	Na	Na	2
4	Celery leaves	0.45 + 0.18 kg ai/ha; broadcast	Ph	R	30	0.31	2.4	52	54	Na	7.1	Nr	0.3	1.6	–
4	Celery leaves	0.42 + 0.36 kg ai/ha; broadcast	Py	R	30	0.64	–	63	63	Na	Nr	14	–	0.7	6
11	Maize forage	Dose rate ns; topical stem injection	Ph	RS	1	NA	15	65 fr	80	Na	Na	Nr	Na	Na	20
11	Maize forage	Dose rate ns; topical stem injection	Ph	RS	7	NA	40	25 fr	65	Na	Na	Nr	Na	Na	35
6	Alfalfa forage	1 × 0.49 kg ai/ha; foliar spray	Ph	RS	20	3.2	–	70	70	–	–	Nr	Na	Na	6
6	Alfalfa forage	1 × 0.49 kg ai/ha; foliar spray	Py	RS	20	2.5	–	70	70	–	Nr	Na	Na	Na	6
6	Alfalfa forage	1 × 0.49 kg ai/ha; foliar spray	Ph	RS	87	0.13	–	37	37	–	–	Nr	Na	Na	13
7	Cotton forage	1 × 0.45 kg ai/ha; topical leaf and stem	Ph	R	27	NA	24	38	61	2.7	7.3	Nr	–	Na	11
7	Cotton forage	1 × 0.45 kg ai/ha; topical leaf and stem	Ph	S	27	NA	23	56	79	2.5	1.5	Nr	–	Na	6
10	Soyaforage	1 × 0.75 kg ai/ha; topical leaf and stem	Ph	RS	1	NA	15	40 fr	55	Na	Na	Nr	Na	Na	45
10	Soyaforage	1 × 0.75 kg ai/ha; topical leaf and stem	Ph	RS	2	NA	1.0	50 fr	51	Na	Na	Nr	Na	Na	49
10	Soyaforage in nutrient	1 × 0.75 kg ai/ha; topical leaf and stem	Ph	RS	6	NA	–	76	76	Na	Na	Nr	Na	Na	12
10	Soyaforage in nutrient	1 × 0.75 kg ai/ha; topical leaf and stem	Ph	RS	29	NA	–	15	15	Na	Na	Nr	Na	Na	85
11	Soyaforage	Dose rate ns; topical stem injection	Ph	RS	1	NA	65	15 fr	80	Na	Na	Nr	Na	Na	20
16	Soyaforage	1 × 0.56 kg ai/ha; Broadcast BBCH 15	Ph	R	22	5.2	0.2	71	72	0.3	–	Nr	Na	Na	2

							Parent (I) and metabolites as %TRR								
No	Crop	Treatment	Label		PHI	TRR Mg/kg	I	II	I + II	IV	III	X	34	XL	NH
16	Soyaforage	1 × 0.56 kg ai/ha; Broadcast BBCH 15	Py	R	22	4.3	–	70	70	0.2	Nr	D 0.2	Na	Na	3
18	Carrot foliage	1 × 0.42 kg ai/ha; broadcast	Ph	R	20	0.86	–	82	82	–	1.7	Nr	Na	Na	16
18	Carrot foliage	1 × 0.42 kg ai/ha; broadcast	Py	R	20	1.3	–	42	42	–	Nr	48	Na	Na	10
18	Carrot foliage	0.42 + 0.42 kg ai/ha; broadcast	Ph	R	45	1.0	–	82	82	–	5.9	Nr	Na	Na	13
18	Carrot foliage	0.42 + 0.42 kg ai/ha;Broadcast	Py	R	45	1.5	–	47	47	–	Nr	31	Na	Na	22

No = number of the study, referring to the study number in the evaluation

I = parent, II = fluazifop acid, IV = Pyr-Ph ether; III = despyridinyl acid, X = CF3-pyridone, 34 = fluazifop alcohol, XL = hydroxyfluazifop acid

NH = extracted or solid fractions not subjected to hydrolysis, may contain some additional II, IV, III, X conjugates

IC = incomplete hydrolysis

fr = free fluazifop acid only—no hydrolysis conducted

D = degraded

nr = not relevant (compound doesn't contain the label)

na = not analysed (presence not verified)

– = not detected

Py = pyridinyl label

Ph = phenyl label

R = R-enantiomer

S = S-enantiomer

RS = racemate

bold indicates > 0% TRR

These studies show that metabolism is similar in all five crop categories, but the quantity of the different metabolites is different between fruits, seeds, roots, stems or leaves of the crops.

Significant residues appear in fruits after foliar application (cucumbers). Fluazifop acid and its conjugates comprise the major residue (69–72%). Fluazifop-butyl (I) and despyridinyl acid (III) are found at low levels (7.3% and 3.3%, respectively). Residues are distributed evenly throughout the peel and the pulp within 14 days of treatment. Samples from supervised residue trials show that fluazifop-butyl may be present up to 8 days after treatment in strawberries.

Significant residues appear in the seeds of pulses and oilseeds (oilseed rape seeds and soyaseeds), when the application is performed at pod formation stage. Residues are lower when application is performed at 3–6 trifoliate stage. The principal component of the residue is fluazifop acid in free or conjugated form (40–81%). Fluazifop-butyl (I) and despyridinyl acid (III) are found at low levels (0.2% and < 4%, respectively) up to 82 days after treatment. Fluazifop conjugates were identified as glyceride esters (glycerol dioleate, glycerol dilinoleate and a hybrid oleate-palmitate ester of glycerol) in soya bean seeds.

Significant residues appear in root and tuber vegetables (carrots, potatoes, and sugar beet roots). The principal component of the residue is fluazifop acid in free or conjugated form (25–64%). Despyridinyl acid (conjugates) and CF3-pyridone (free and conjugates) were found at significant levels (4.8–18% and 1–37%, respectively). CF3-pyridone was found at higher levels than its despyridinyl counterpart in some root crops and could indicate additional uptake from soil. Fluazifop

alcohol (free and conjugates) was only found in carrot roots (11–13%) treated with fluazifop-butyl (RS) and is thought to be derived from the S-enantiomer. Hydroxyfluazifop acid (XL, free) was found in potatoes at significant levels (13–15%). The fluazifop acid, despiridinyl acid and CF3-pyridone conjugates were identified as hexosides and/or malonylhexosides. Fluazifop-butyl was found at low levels (0.5%) up to 20 days after treatment.

Low residues appear in stem vegetables (celery). The principal component of the residue is fluazifop acid in free or conjugated form (39–43%). Despyridinyl acid (free and conjugates) is found at significant levels (18%). CF3-pyridone (free and conjugated) is found at low levels (2.7% TRR). Supervised residue trials show that CF3-pyridone is present up to 30 days after application at levels equivalent to 13% total fluazifop in celery stems. Hydroxyfluazifop acid (XL) was found at low levels (< 5%). Parent compound was not detected.

Significant residues appear in leafy vegetables (lettuce, endive, and celery leaves) with fluazifop-butyl or fluazifop acid (free and conjugated) as the main compound (up to 52% and 19–63%, respectively). Parent compound was found at significant levels (49–52%) in lettuce leaves at 27 days after treatment, and at low levels (2.4%) in celery leaves at 30 days after treatment. Pyr-Ph ether (IV) (free and conjugated) was found at significant levels (11–25%) in immature endive (DAT 20) and at lower levels in lettuce and mature endive (< 2%). Despyridinyl acid (III) conjugates and CF3-pyridone (free and conjugated) were found at significant levels in endive, lettuce and celery leaves (7.1–41% and 11–14%, respectively). The fluazifop acid, despiridinyl acid and CF3-pyridone conjugates were identified as hexosides, malonylhexosides or pyridinyl N-sugars.

Significant residues appear in forage of pulses and oilseeds. The principal components of the residue are parent (up to 25%) and fluazifop acid in free or conjugated form (37–76%). Pyr-Ph ether (IV) (free and conjugated) and despyridinyl acid (III) conjugates were found at low levels (< 3% and < 8% TRR, respectively). Supervised residue trials show that fluazifop-butyl may be present up to 16 days after treatment in oilseed rape forage.

Significant residues appear in forage of roots and tubers. The principal component of the residue was fluazifop acid in free or conjugated form (42–82%). Despyridinyl acid (conjugates) were found at low levels (< 6% TRR). CF3-pyridone (conjugates) was found at higher levels (31–48% TRR) than its despyridinyl counterpart (< 6% TRR) and could indicate additional uptake from soil. Pyr-Ph ether (IV) was not detected. The fluazifop acid, despiridinyl acid and CF3-pyridone conjugates were identified as hexosides and/or malonylhexosides. Supervised residue trials show that fluazifop-butyl may be present up to 98 days after treatment in sugar beet forage.

Fate in rotational crops

Metabolism of fluazifop-butyl was investigated in two confined rotational crops following a single bare soil treatment.

In the first confined rotational crop study, [^{14}C]phenyl- or [^{14}C]pyridyl-fluazifop-butyl (RS) was applied to a bare sandy loam soil at 1 × 0.25 kg ai/ha under greenhouse conditions. Rotational crops (lettuce, wheat and sugar beet) were sown at 30, 120 and 327 Day plant back intervals for the phenyl label and 60, 120 and 365 day PBI for the pyridyl label. Total radioactive residues were < 0.01 mg/kg eq in the phenyl-labelled crop samples at all plant back intervals. Total radioactive residues were < 0.01 mg/kg eq in the pyridyl-labelled sugar beet roots and lettuce leaves at all plant back intervals. Total radioactive residues were 0.011–< 0.01–< 0.01 mg/kg in wheat grain, 0.10–0.080–0.031 mg/kg eq in wheat straw and 0.027–0.018–< 0.01 mg/kg eq in sugar beet tops, respectively for the three PBIs. The radioactive residues were not further characterised.

In the second confined rotational crop study, [^{14}C]phenyl- or [^{14}C]pyridyl-fluazifop-P-butyl (R-enantiomer) was applied to a bare sandy loam soil at 0.44–0.50 kg ai/ha under indoor conditions. Rotational crops (lettuce, wheat and carrot) were sown at 30, 60 and 270 Day plant back intervals (PBI).

Analysis of the soil samples showed that only 1.2%AR remained as parent compound after 30 days. In soil treated with [^{14}C]phenyl-labelled fluazifop-P-butyl, free fluazifop-P-acid were the main compounds. In soil treated with [^{14}C]pyridyl labelled fluazifop-P-butyl, free CF3-pyridone was the main compound.

Crops grown in soil treated with [^{14}C]phenyl-labelled fluazifop-P-butyl had very low residues. Total radioactive residues in lettuce leaves and carrot roots were below 0.01 mg eq/kg at all plant back intervals. Residues in wheat grains and feed crops were below 0.04 mg/kg eq except wheat straw at the 60 Day plant back interval (PBI) where the residue was 0.1 mg/kg eq. In wheat straw of the 60 Day PBI 60% TRR was organo- and/or acid soluble. Individual extracted components of wheat straw did not exceed 0.014 mg/kg eq, post extraction solids represented a residue of 0.03 mg/kg eq. No known metabolites were found.

Crops grown in soil treated with [^{14}C]pyridyl-fluazifop-P-butyl had radioactive residues > 0.01 mg/kg eq at all plant back intervals. Total radioactivity in edible crop commodities ranged from 0.01–0.25 mg/kg eq at 30 Day PBI, 0.03–0.46 mg/kg eq at 60 Day PBI and 0.02–0.34 mg/kg eq at 270 Day PBI, while residues up to 1.5 mg/kg were found in forage (PBI 60) and up to 6.7 mg/kg eq were found in wheat straw (PBI 270). Characterisation and identification was carried out on all crops grown after a 60-day rotation period. Fluazifop-P-butyl, fluazifop acid and Pyr-Ph ether (IV) were not detected. CF3-pyridone (X) including its conjugates represented > 60% TRR in most crop commodities.

The Meeting noted that analyses in soil and rotational crops indicate that fluazifop-P-butyl and fluazifop acid are not taken up from the soil and concluded that total fluazifop residues are therefore not expected in rotational crops. CF3-pyridone is the only residue that is taken up from the soil under confined conditions at all plant back intervals (30, 60, and 270 Days).

Animal metabolism

The Meeting received results of metabolism studies in laboratory animals, humans, lactating goats and laying hens. Metabolism in laboratory animals and humans was summarized and evaluated by the WHO panel of the 2016 JMPR.

One lactating cow was dosed orally twice daily for 7 consecutive days with a gelatin capsule containing a 50:50 mixture of [^{14}C]phenyl and [^{14}C]pyridyl-fluazifop-butyl (racemate). The equivalent actual mean daily dose in the dry feed was 2.5 ppm (or 0.075 mg/kg bw). The cow was sacrificed 4 hours after the last dose. Total recovered radioactivity amounted to 82% of the administered dose. The majority of the radioactivity was recovered in urine (80%) with small amounts recovered in faeces (1.7%) and milk (1.1%).

The highest radioactivity concentrations were found in kidney (0.039 mg/kg eq) and liver (0.024 mg/kg eq), followed by fat (0.002–0.005 mg/kg eq) and muscle (0.001 mg/kg eq). Total radioactive residues in milk reached a plateau concentration of approximately 0.034 mg/kg eq following 2 days of dosing.

Following solvent extraction, residue extractabilities were > 89% TRR for milk and all tissues of cow. In milk, the majority of the residues (94% TRR) were extracted with hexane, representing the residues in the milkfat fraction. Extracts from milk and liver were hydrolysed to cleave possible conjugates.

Parent was not detected in milk or tissues of cow. The most significant metabolite (including conjugates) identified in all tissues and milk was fluazifop acid (32–68% TRR). Pyr-Ph ether (IV) (including conjugates) was identified in liver and kidney (10–12% TRR, < 0.01 mg/kg eq). These levels must be seen as minimum levels, since several extracted or solid fractions of these commodities were not subjected to hydrolysis and may contain additional amounts of metabolites. These unhydrolysed fractions accounted for 16%, 19%, 26%, 63% and 68% TRR in milk, liver,

kidney, muscle and fat, respectively. Muscle and fat residue characterisation was not pursued further because of the low total radioactive residue levels (< 0.01 mg/kg eq).

Two lactating goats (one per label) were dosed orally twice daily for 7 consecutive days with a gelatin capsule containing [^{14}C]phenyl or [^{14}C]pyridyl-fluazifop-P-butyl (R-enantiomer). The equivalent actual mean daily doses in the dry feed were 9.6 or 9.7 ppm (or 0.28 or 0.23 mg/kg bw) for the phenyl or pyridyl label, respectively. Goats were sacrificed 16 hours after the last dose. Total recovered radioactivity amounted to 87% and 99% of the administered dose for the phenyl and pyridyl radiolabelled forms, respectively. The majority of the radioactivity was recovered in urine (70–82% AR) with lower amounts recovered in recovered in faeces (10–11% AR), milk (0.8–0.9% AR) and tissues (< 0.2% in total).

The highest radioactivity concentrations were found in kidney (0.62/0.46 mg/kg eq) and liver (0.060/0.045 mg/kg eq), followed by fat (0.006–0.015/0.005–0.011 mg/kg eq) and muscle (0.004/0.002–0.003 mg/kg eq). Total radioactive residues in milk reached a plateau concentration of approximately 0.15–0.16 mg/kg eq following 96–104 hours dosing.

Following solvent extraction, residue extractabilities were 54–55% TRR for kidney and 62–66% TRR for liver. A further 9–11% TRR and 37–43% TRR could be extracted from kidney and liver, respectively, with mild alkaline and/or acid solutions at room temperature. Milk was separated into skimmed milk (30%/1% TRR, phenyl/pyridyl label) and milk fat (70%/92% TRR, phenyl/pyridyl label). Muscle and fat were not analysed further. Extracted residues from kidney and milk were subjected to more severe hydrolysis conditions to release the exocons from the conjugates, but these conditions were too harsh for an acceptable residue characterisation.

Parent was not detected in milk or tissues of goat. The most significant metabolite identified in liver was free fluazifop acid (21–25% TRR). Pyr-Ph ether (IV) (including conjugates) was not detected in liver.

Two laying hens (one per radiolabel) were dosed orally once daily for 14 consecutive days with a gelatin capsule containing [^{14}C]phenyl or [^{14}C]pyridyl-fluazifop-butyl (racemate). The equivalent actual mean daily doses in the dry feed were 3.1 or 2.6 ppm dry feed (0.22 or 0.18 mg/kg bw) for the phenyl or pyridyl label, respectively. Hens were sacrificed 4 hours after the last dose. The majority of the radioactivity was recovered in excreta (97–98% AR).

The highest radioactivity concentrations were found in kidney (0.056/0.44 mg/kg eq, phenyl/pyridyl) and liver (0.027/0.077 mg/kg eq), followed by fat (0.040–0.045/0.029–0.039 mg/kg eq) and muscle (0.004–0.005/0.008–0.011 mg/kg eq). Total radioactive residues in egg yolks achieved a plateau concentration of 0.02 mg/kg eq after 6–7 days of dosing. Total radioactive residues in egg whites achieved a plateau concentration of 0.002–0.003 mg/kg eq after 3 days of dosing. Following solvent extraction, residue extractabilities were ≥ 82% TRR for eggs and tissues.

Parent was not detected in eggs and tissues of hens. The most significant metabolite (including conjugates) identified in eggs and all tissues was fluazifop acid (51–71% TRR). Despyridinyl acid (III), Pyr-Ph ether (IV) and CF3-pyridone (X) were not detected. These levels must be seen as minimum levels, since several extracted or solid fractions of these commodities were not subjected to hydrolysis and may contain additional amounts of metabolites. These unhydrolysed fractions accounted for 38.9% TRR (eggs), 25–27% (liver), 22–40% (kidney), 33–49% (muscle), 8.9–25% (fat) TRR.

In a second metabolism study on hens, ten laying hens (five per radiolabel) were dosed orally twice daily for 10 consecutive days with a gelatin capsule containing [^{14}C]phenyl or [^{14}C]pyridyl-fluazifop-P-butyl (R-enantiomer). The equivalent actual mean daily dose in the dry feed was 9 ppm (or 0.84 mg/kg bw). Hens were sacrificed 24 hours after the last dose. Total recovered radioactivity amounted to 93% and 95% of the administered dose for the phenyl and pyridyl radiolabelled forms, respectively. The majority of the radioactivity was recovered in excreta (90%/93%, phenyl/pyridyl).

The highest radioactivity concentrations were found in abdominal fat (0.14/0.24 mg/kg eq, phenyl/pyridyl), followed by skin with fat (0.041/0.064 mg/kg eq), liver (0.007/0.028 mg/kg eq) and muscle (0.002–0.009/0.005–0.012 mg/kg eq). Total radioactive residues in egg yolks achieved a plateau concentration of 0.072 mg/kg eq after 144 hrs of dosing. Total radioactive residues in egg whites achieved a plateau concentration of 0.033 mg/kg eq after 120–168 hrs of dosing.

Following solvent extraction, residue extractabilities were ≥ 88% TRR for egg yolk and egg white, fat or skin with fat, 48% TRR for liver and 23% TRR for muscle. Selected extracts were treated under hydrolytic conditions to cleave the conjugates. Hydrolysis conditions in liver were too soft for an acceptable residue characterisation.

Parent was only detected as a minor component in liver (0.7% TRR). The most significant metabolite (including conjugates) identified in fat and eggs was fluazifop acid (56–86% TRR). Pyr-Ph ether (IV) was only detected in pyridyl-labelled egg white (1.1% TRR). These levels must be seen as minimum levels, since several extracted or solid fractions of these commodities were not subjected to hydrolysis and may contain additional amounts of metabolites. These unhydrolysed fractions accounted for 7.4–20.1% TRR (eggs), 1.0–2.7% (abdominal fat), 11–22% (fat with skin).

In summary, metabolism between cows, goats, hens, laboratory animals and humans is similar. Fluazifop-butyl is metabolised via hydrolysis to form fluazifop acid (all tissues, milk, and eggs) and further conjugation of fluazifop- acid possibly to lipids. Pyr-Ph ether was detected at significant levels in cow liver and kidney (10–12%). Since extracts of milk, eggs and tissues contained significant amounts of compounds that were not subjected to hydrolysis, the absence or presence of other significant metabolites could not be confirmed.

In general, metabolism between plants and animals is similar. Despyridinyl acid (III) was detected in minor quantities in rats and mice, and CF3-pyridone was detected in minor quantities in rats. Pyr-Ph ether (IV) was not detected in laboratory animals, but it was detected in livestock. Hydroxyfluazifop acid (XL) was not detected in animals.

Although fluazifop acid or its conjugates are the main residues in plants, no livestock metabolism and/or feeding studies were conducted with fluazifop acid. However, since fluazifop-butyl is rapidly absorbed and de-esterified into fluazifop acid, studies with fluazifop-butyl are satisfactory.

Environmental fate in soil

The Meeting received information on soil photolysis, aerobic degradation and field dissipation.

Soil photolysis of [^{14}C]phenyl or [^{14}C]-pyridyl-fluazifop-P-butyl (i.e. R-enantiomer) indicated that photo-degradation is not a major route of degradation for fluazifop-P-butyl. The average DT_{50} for fluazifop-P-butyl in the irradiated soils was 116 days, whereas it was 272 days for the dark controls.

Soil studies with fluazifop-butyl (RS) showed that the metabolite fluazifop acid largely comprised of the R-enantiomer and that the proportion of the R-enantiomer increased with time. This was confirmed in a supplemental study with the separate R- and S-enantiomers of [^{14}C]phenyl-fluazifop-butyl. These studies indicate that fluazifop-P-butyl degradation products will remain as R-enantiomer when applied to soil.

Aerobic degradation of [^{14}C]-phenyl and/or [^{14}C]pyridyl-fluazifop-butyl (racemate) under laboratory conditions indicated that fluazifop-butyl (RS) degraded rapidly to 1.2–3.7% AR after 3 weeks. The major metabolites identified were fluazifop acid and CF3-pyridone. Fluazifop acid reached a maximum of 45–83% AR (phenyl label) after 2 days of incubation in most soils, except 72% AR after 21 weeks in the sandy soil. CF3-pyridone (X) reached a maximum of 22–25% AR after 12 weeks of incubation (pyridyl label only). Pyr-Ph ether (IV) was found as a minor metabolite (< 4% AR at all time points, except in the sandy soil with 8.9% AR at 21 weeks). Carbon dioxide was formed from Day 1 onwards and these levels increased with time (up to 25–36% AR after 45 weeks of incubation). An additional study confirmed that fluazifop-P-butyl degrades similar to fluazifop-

butyl (racemate). Half-lives for fluazifop-butyl, fluazifop acid, Pyr-Ph ether (IV) and CF3-pyridone (X) are listed in the table below.

Compound	Geometric DT_{50} (days) Aerobic laboratory conditions	Geometric DT_{90} (days) Aerobic laboratory conditions
Fluazifop-butyl (RS)	1.0	3.4
Fluazifop-P-acid	6.5–8.3 From different kinetic endpoint studies	32–35 From different kinetic endpoint studies
CF3-pyridone (X)	12	134
Pyr-Ph ether (IV)	31	42–348 (individual, mean not calculated)

Aerobic degradation under less favourable laboratory conditions indicates that the degradation of fluazifop acid is mediated by microbial activity. This is evidenced by the virtual absence of degradation in sterilised soils.

Field dissipation studies on bare soil or cotton and soyaplots indicated that the CF3-pyridone levels in soil were very low (< 0.01–0.05 mg/kg) and were < 0.01 mg/kg at 75–270 days after the last application. When more sensitive analytical methods were used, CF3-pyridone could be detected at levels of < 0.001–0.01 mg/kg for a longer period (359–373 days after the last application). CF3-pyridone levels resulting from sequential application of fluazifop-butyl do not differ from single fluazifop-butyl applications. Half-lives for CF3-pyridone in the field dissipation studies were estimated between 100–241 days; these are longer than those estimated in the aerobic field studies (12–134 days).

In conclusion, aerobic soil degradation studies demonstrate that fluazifop-butyl and fluazifop acid degrade in soil, but that CF3-pyridone and Pyr-Ph ether are semi-persistent. Under standardized aerobic soil conditions, CF3-pyridone reaches a maximum after 4–12 weeks of fluazifop-butyl treatment, while Pyr-Ph ether is present at constant low levels. Considering a worst case DT_{90} of 255 days (36 weeks) for CF3-pyridone obtained in the aerobic soil studies, and peak appearance after 12 weeks of fluazifop-butyl treatment, most of the CF3-pyridone compound has disappeared by 48 weeks. CF3-pyridone levels in soil resulting from sequential application of fluazifop-butyl do not differ from single fluazifop-butyl applications. CF3-pyridone is expected to degrade in soils within a year after application and field dissipation studies confirm this. CF3-pyridone is not expected to accumulate to a soil plateau level equivalent to 125% (or higher) of the residue level following the maximal seasonal application rate for fluazifop-butyl. Thus, no adjustment is needed for crop residues obtained in the rotational crop studies.

Methods of analysis

The Meeting received description and validation data for analytical methods for the determination of total fluazifop (i.e. sum of fluazifop-butyl, fluazifop acid and its conjugates, expressed as fluazifop acid) in plant and animal commodities. Total fluazifop is not determined by the existing multi-residue method, since hydrolysis is needed to release fluazifop acid from its conjugates.

Fluazifop-butyl and fluazifop acid occur in two isomeric forms–the R- and S-enantiomer. The R- and S-enantiomers are not separated by the chromatographic techniques applied in the analytical methods.

HPLC-MS/MS method GRM44.02A was submitted as the enforcement/monitoring method for the determination of total fluazifop in plant commodities. Plant commodities were extracted with acetonitrile/concentrated HCl (plants with > 60% water content) or acetonitrile/1 M HCl (grains, pulses, oilseeds, and dry crops) after soaking for at least 2 hrs in 1 M HCl or overnight in water. Residues in the extracts were then hydrolysed in 6 M HCl (1 hr, 60 ºC) to convert fluazifop-P-butyl and fluazifop conjugates to fluazifop acid. Samples were cleaned-up by SPE prior to quantification by HPLC-MS/MS. Radio-validation confirmed that total fluazifop is adequately extracted from

endive (69%) and carrots (99%) under these conditions. The Meeting considers validation sufficient for all plant commodities. The LOQ was 0.01 mg/kg, expressed as fluazifop acid, in each matrix.

GC-MS method RAM 331/01 was submitted as the enforcement/monitoring method for the determination of total fluazifop in animal commodities. Animal commodities were extracted with dichloromethane/methanol and the residues in the extract were then hydrolysed with 0.2 M NaOH in methanol (1 hr at 60 ºC) to convert fluazifop-P-butyl and fluazifop conjugates to fluazifop acid. The hydrolysate is cleaned-up by liquid-liquid partition and solid phase extraction (SPE). The fluazifop acid residues are then derivatised to the methyl ester, followed by clean-up on SPE and determination by GC-MS. Radio-validation confirmed that total fluazifop is quantitatively extracted from milk (102%), liver (87%), and eggs (89%) under these conditions. The Meeting considers validation sufficient for all animal commodities (meat, liver, kidney, fat, milk and eggs). The LOQ was 0.01 mg/kg, expressed as fluazifop acid, in each matrix.

Several other analytical methods were submitted for the determination of total fluazifop in plant and animal material. The extraction and hydrolysis conditions for most of the methods were the same as described above for plant or animal commodities. Radio-validation was available for alternative hydrolysis conditions. Further, the methods differed in their clean-up procedures and detection techniques. Various detection techniques were used: HPLC-UV, 19F-NMR, HPLC-MS/MS, GC-NPD or GC-MS. The LOQs were 0.01–0.05 mg/kg. Methods were not fully validated according to current guidelines and in some cases the valid LOQ is higher than reported. The Meeting considered these methods adequate for the residue trials, unless specified otherwise in the supervised trials section.

A few analytical methods were submitted for the determination of despyridinyl acid or CF3-pyridone and its conjugates in plant material. Extracts were hydrolysed with 1 M HCl (1 hr reflux) to convert CF3-pyridone conjugates into CF3-pyridone or 6 M HCl (1 hr reflux) to convert despyridinyl acid to its conjugates. Since fluazifop acid partly degrades under these conditions, the levels of despyridinyl acid and CF3-pyridone are overestimated. The Meeting considers these analytical methods not acceptable.

Stability of pesticide residues in stored analytical samples

The Meeting received information on storage stability in plant, animal or soil commodities fortified with fluazifop-P-butyl, fluazifop acid or CF3-pyridone (X) and on storage stability of total fluazifop in plant and animal commodities with incurred residues.

Parent fluazifop-P-butyl is stable for at least 28 months at -18 ºC in onions.

Fluazifop acid is stable for at least 27 months at -1 °C, 8 months at -15 ºC and for 31 months at -20 °C in raspberries, blueberries, strawberries, sweet potatoes, rhubarb, macadamia nuts, and green coffee beans. Studies with incurred residues to assess the stability of total fluazifop residues (including conjugates) were inconclusive, since the samples were not analysed immediately after harvest. Since fluazifop conjugates are converted to fluazifop acid by hydrolysis in the analytical method and fluazifop acid is resistant to a whole range of hydrolysis conditions (acid, alkaline, and enzymatic), it is likely that any degradation of the fluazifop conjugates proceeds through formation of fluazifop acid upon frozen storage.

CF3-pyridone is stable for at least 24–28 months at -18 ºC in apples, onions, lettuce, and peanut kernels.

Fluazifop acid is stable for at least 12–18 months at -16 ºC in various processed commodities: soya bean meal, soya bean hulls, soya bean oil, soya bean milk, potato flakes, potato wet peel, potato chips, wheat flour, wheat middlings, wheat shorts, tomato paste and tomato puree.

Fluazifop acid is stable for at least 12 months at -20 ºC in milk, eggs and tissues.

The Meeting concluded that total fluazifop and CF3-pyridone (X) is stable during frozen storage in all plant and animal commodities as long as the samples stay frozen.

Definition of the residue

In primary crops, parent compound was detected at significant levels in fruits and edible leaves and represented 7.3% (0.092 mg/kg) in cucumbers and 49–52% TRR in lettuce.

Fluazifop acid and its sugar or glyceride conjugates represented the principal part of the residue in most edible crop commodities (25–77% TRR).

Despyridinyl acid (III) and its conjugates were detected in all crop categories investigated, but were only found at levels above 10% TRR or above 0.01 mg/kg eq in cucumbers, celery leaves, endive, soya bean seeds, carrot roots, and potato tubers).

CF3-pyridone (X) and its conjugates are expected in all crop categories, but were often not identified because only the phenyl label was investigated or alkaline hydrolysis conditions were used to release conjugates. CF3-pyridone and its conjugates were found at levels above 10% TRR or above 0.01 mg/kg eq in celery leaves, endive and carrot roots.

Pyr-Ph ether (IV) and its conjugates were detected in various leafy commodities at low levels, but were found at levels above 10% TRR in immature endive.

Hydroxyfluazifop acid (XL) was found at levels above 10% TRR in potato tubers.

Fluazifop alcohol (XXXIV) was only found at levels above 10% TRR or 0.01 mg/kg eq in crops treated with fluazifop-butyl (RS) and is considered to be derived from the S-enantiomer of fluazifop-butyl. Since fluazifop-butyl (RS) is replaced by fluazifop-P-butyl since 1984, this compound is not expected to appear in crops.

In rotational crops CF3-pyridone and its conjugates were the principal components in all crop categories. No residues above the LOQ (0.02 or 0.05 mg/kg) of CF3-pyridone were found in edible crops in the field rotational crop studies submitted.

Fluazifop-P-butyl belongs to the aryloxyphenoxypropionate herbicides, and despyridinyl acid (III) may be a common metabolite to all compounds belonging to this group: chlorazifop, clodinafop, clofop, clofop-iso-butyl, cyhalofop, cyhalofop-butyl, diclofop, fenoxaprop-, fenoxaprop-ethyl, fenthiaprop, fenthiaprop-ethyl, fluazifop-methyl, haloxyfop-, haloxyfop-methyl, haloxyfop-etotyl, kuicaoxi, propaquizafop, quizalofop, trifop and trifop-methyl. CF3-pyridone (X) may be a common metabolite to fluazifop-methyl, trifop and trifop-methyl. Despyridinyl acid (III) and CF3-pyridone (X) are therefore not suitable for markers of fluazifop-butyl in primary crop commodities.

Analytical methods for enforcement have been validated for the common moiety fluazifop acid, which is released from fluazifop-butyl and fluazifop conjugates. Since a hydrolysis procedure is required to be able to release fluazifop acid from its conjugates, the residue is unlikely to be measured by a multi-residue method.

The Meeting concluded that fluazifop-butyl, fluazifop acid and its conjugates represent the major residue and these compounds are suitable for markers for MRL compliance in primary crops.

Regarding the inclusion of metabolites for dietary risk assessment, the Meeting decided to estimate the overall toxicological burden of relevant metabolites. Apart from fluazifop acid, metabolites found at levels > 10% TRR or > 0.01 mg/kg eq in plant commodities were: despyridinyl acid (III), Pyr-Ph ether (IV), CF3-pyridone (X), hydroxyfluazifop acid (XL) and their conjugates. The Meeting made some conservative dietary exposure estimates to decide whether these metabolites need to be selected for inclusion in the residue definition for dietary risk assessment. Since the supervised residue trials only analysed total fluazifop, residue levels for these metabolites are estimated based on the ratio of this metabolite relative to total fluazifop residues obtained from the metabolism studies. The median and maximum ratios are listed in Table 1 below.

Potential dietary exposure to total fluazifop was calculated assuming 0.01 mg/kg total fluazifop in fruits and tree nuts, 0.02 mg/kg in sugar cane, 0.03 mg/kg in cucurbits and seeds for beverages, 0.05 mg/kg in leafy vegetables, 0.2 mg/kg in berries and fruiting vegetables other than cucurbits, 0.3 mg/kg in bulb, stalk and stem vegetables, 0.8 mg/kg in Brassicas, 1.5 mg/kg in legumes, roots and tubers, 5 mg/kg in pulses and 9 mg/kg in oilseeds and using the average consumption in the GEMS/Food 17 cluster diets.

Potential long-term dietary exposure to each metabolite is calculated by multiplication of the total fluazifop residues by the median ratio metabolite/total fluazifop listed in the table below for each individual metabolite and using the GEMS/Food 17 Cluster diet. Results are presented in Table 2 below. For the potential short-term dietary exposure, the ratios between total fluazifop residues and the respective metabolites is taken into account.

Despyridinyl acid (III) and CF3-pyridone (X) individually contribute significantly to the total long-term dietary exposure (7.5–17% and 7.6–19%, expressed as fluazifop acid equivalents, respectively). Percentages of despyridinyl acid (III) or CF3-pyridone (X) to total fluazifop were up to 76% in roots crops and up to 110% in leafy crops, suggesting significant contribution to the short-term dietary exposure. Additional uptake from soil is expected for CF3-pyridone (X), but not for despyridinyl acid (III).

Despyridinyl acid (III) is found in rats and mice, where it is excreted in small amounts (approximately 0.7% and 2% of the applied dose in rats and mice, respectively) in the urine. Based on toxicity studies, the Meeting concluded that despyridinyl acid (III) is not genotoxic in vitro. On the basis of structural considerations, the Meeting concluded that despyridinyl acid (III) is unlikely to be of greater toxicity than the parent.

CF3-pyridone (X) is not found in rats or dogs but is present in mice to a limited extent, where it is excreted in small amounts (approximately 1.1% of the applied dose) in the urine. Based on toxicity studies conducted with CF3-pyridone, the Meeting concluded that CF3-pyridone (X) is covered by the ADI and ARfD for fluazifop-P-butyl.

The Meeting noted that despyridinyl acid (III) and CF3-pyridone (X) are counter pieces, resulting from cleavage of fluazifop acid. Therefore, adjustment of molecular weights to fluazifop acid equivalents for the sum of both cleavage products would result in an overestimation of the total toxicological burden. Both compounds were present in comparable relative amounts in primary treated crops. For CF3-pyridone (X), additional uptake from soil into plant commodities is expected, making it a conservative indicator for the combined residue of both counter pieces, when expressed as fluazifop acid equivalents.

The Meeting considered that if CF3-pyridone (X) is included into the residue definition for dietary intake purposes, this would also accommodate for residues of despyridinyl acid (III), when expressed as fluazifop acid equivalents.

Pyr-Ph ether (IV) was estimated to contribute insignificantly (0–0.03%, expressed as fluazifop acid equivalents) to the total long-term dietary exposure. Percentages of Pyr-Ph ether (IV)/total fluazifop found in specific crop commodities were generally below 5%, except for immature endive with percentage of 68% while the mature plant was present at 4.4%. Pyr-Ph ether (IV) was not found in laboratory animals and no toxicity studies are available. Its estimated exposure based on uses considered by the present Meeting is below the threshold of toxicological concern for Cramer Class III (1.5 µg/kg bw/day). Therefore, Pyr-Ph ether (IV) does not need to be considered further.

Hydroxyfluazifop acid (XL) gives significant contribution to the total long term-intake (6–31% compared to total fluazifop and expressed as fluazifop acid equivalents), primarily based on root crops, for which only one plant metabolism study included analysis of this metabolite. Percentages of hydroxyfluazifop acid (XL)/total fluazifop found in specific crop commodities (in metabolism studies) were low in leafy crops (3%) but significant in root crops (62%), suggesting potential contribution to the short-term dietary exposure. Hydroxyfluazifop acid (XL) was not found in

laboratory animals. No toxicological information is available. However, owing to its structural similarity with the parent, the Meeting concluded that hydroxyfluazifop acid XL is unlikely to be of greater toxicity than the parent. The Meeting decided to include hydroxyfluazifop acid (XL) into the residue definition for dietary intake purposes.

The Meeting decided to include fluazifop-butyl, fluazifop acid, CF3-pyridone (X) and hydroxyfluazifop acid (XL) and their conjugates in the residue definition for dietary risk assessment for plant commodities.

The major compounds identified in cow or hen tissues, milk or eggs is fluazifop acid in free or conjugated form. Parent compound was only detected at trace levels in hen liver. Fluazifop acid and its lipophilic conjugates were identified at levels of 32–37% TRR (< 0.01 mg/kg eq) in cow muscle and fat, 61–68% (0.015–0.032 mg/kg eq) in cow milk, liver and kidney, 51–85% (< 0.01–0.012 mg/kg eq) in hen muscle, egg yolks, egg whites and whole eggs and 51–74% (0.019–0.24 mg/kg eq) in hen kidney, liver and fat.

Since animal feeds contain fluazifop acid conjugates as well as despyridinyl acid (III), Pyr-Ph ether (IV), CF3-pyridone (X), and hydroxyfluazifop acid (XL), animal feeding studies with these compounds are considered desirable to investigate whether any of these metabolites accumulate in tissues.

Analytical methods for enforcement of animal commodities have been validated for the common moiety fluazifop acid, which is released from fluazifop-butyl and fluazifop conjugates. Since a hydrolysis procedure is required to be able to release fluazifop acid from its conjugates, the residue is unlikely to be measured by a multi-residue method.

Since fluazifop-butyl, fluazifop acid and fluazifop conjugates represent the major part of the residue in all livestock commodities and no other metabolites have been identified in significant quantities, the Meeting decided to define the residue for enforcement and for dietary risk assessment in animal commodities as total fluazifop (i.e. the sum of fluazifop-butyl, fluazifop acid and its conjugates).

The cow and hen metabolism studies indicated that total fluazifop residues are a Factor 5 higher in fat than in muscle and a Factor 5 higher in egg yolk than in egg white. Fluazifop acid is found as lipophilic conjugates in the fat fraction of the milk and in hen fat and egg yolk. The Meeting considers total fluazifop fat soluble.

The Meeting recommended the following residue definition for fluazifop-P-butyl:

Definition of the residue for compliance with the MRL in plant commodities: *total fluazifop, defined as the sum of fluazifop-P-butyl, fluazifop-P-acid (II) and their conjugates, expressed as fluazifop-P-acid.*

Definition of the residue for dietary risk assessment in plant commodities: *the sum of fluazifop-P-butyl, fluazifop-P-acid (II), 2-[4-(3-hydroxy-5-trifluoromethyl-2-phenoxy)pyridyloxy] propionic acid (XL), 5-trifluoromethyl-2-pyridone (X) and their conjugates, expressed as fluazifop-P-acid.*

Definition of the residue for compliance with the MRL and for dietary risk assessment in animal commodities: *total fluazifop, defined as the sum of fluazifop-P-butyl, fluazifop-P-acid (II) and their conjugates, expressed as fluazifop-P-acid*.

The Meeting considers the residue fat soluble.

Since CF3-pyridone (X) and hydroxyfluazifop acid (XL) have not been analysed in the supervised residue trials it is proposed to use an adjustment factor to correct for the additional contribution of these metabolites to the total residue by multiplying the median and highest residues of total fluazifop residues with the factors for the various plant groups as indicated in Table 1 below.

Table 1 Median and maximum ratios between metabolite and total fluazifop

	Median ratios metabolite/total fluazifop from metabolism				Median residue
Crop group	Pyr-Ph ether	Despyridinyl acid	CF3-pyridone	Hydroxyfluazifop acid	multiplication factor
	IV	III	X	XL	1.00 + (III or X) + XL [a]
Fruits and fruiting vegetables; cereals, tree nuts; seeds for beverages; sugar cane, oil fruits, fruit and bud and tree spices, hops, tea from shrubs	0	0.046	0	0	1.05
Leafy vegetables, Brassicas, fresh herbs, saffron, herb tea	0.01	0.12	0.235	0.03	1.27
Bulb, stalk and stem vegetables	0	0.43	0.07	0.10	1.53
Legume vegetables, oilseeds and pulses, seed spices	0	0.05	0.05	0	1.05
Roots and tubers, root spices, herbal root tea	0	0.28	0.33	0.62	1.95
	Maximum ratios metabolite/total fluazifop from metabolism				Highest residue
Crop group	Pyr-Ph ether	Despyridinyl acid	CF3-pyridone	Hydroxyfluazifop acid	multiplication factor
	IV	III	X	XL	1.00 + (III or X) + XL [a]
Fruits and fruiting vegetables; cereals, tree nuts; seeds for beverages; sugar cane, oil fruits, fruit and bud and tree spices, hops, tea from shrubs	0	0.046	0	0	1.05
Leafy vegetables, Brassicas, fresh herbs, saffron, herb tea	0.044	0.82	1.13	0.03	2.16
Bulb, stalk and stem vegetables	0	0.43	0.07	0.10	1.53
Legume vegetables, oilseeds and pulses, seed spices	0	0.07	0.07	0	1.07
Roots and tubers, root spices, herbal root tea	0	0.44	0.76	0.62	2.38

[a] Contribution for CF3-pyridone (X) is also estimated from despyridinyl acid (III). Both compounds were present in comparable relative amounts in primary treated crops and therefore CF3-pyridone levels were taken from despyridinyl acid (III) levels for crop commodities, where the presence of CF3-pyridone (III) was not investigated or where CF3-pyridone levels were lower.

Table 2 TMDI using median multiplication factors and assumed residue levels in crop commodities [a]

Compound	GEMS/food Cluster with maximum intake	Residue intake (ug/person/day) as fluazifop acid	Residue intake (ug/kg bw/day) as fluazifop acid	Percentage of total fluazifop G01–G17
Total fluazifop	G11 (bw 60 kg)	2364.9	39.4	100%
Pyr-Ph ether (IV)	G15 (bw 60 kg)	0.5	0.0083	0.00–0.03%
Despyridinyl acid (III)	G03 (bw 60 kg)	335.0	5.58	7.5–17%
CF3-pyridone (X)	G03 (bw 60 kg)	383.7	6.39	7.6–19%
Hydroxyfluazifop acid (XL)	G03 (bw 60 kg)	622.4	10.4	6.0–31%

[a] Assumed residue levels of 0.01 mg/kg total fluazifop in fruits and tree nuts, 0.02 mg/kg in sugar cane, 0.03 mg/kg in cucurbits and seeds for beverages, 0.05 mg/kg in leafy vegetables, 0.2 mg/kg in berries and fruiting vegetables other than cucurbits, 0.3 mg/kg in bulb, stalk and stem vegetables, 0.8 mg/kg in Brassicas, 1.5 mg/kg in legumes, roots and tubers, 5 mg/kg pulses, 9 mg/kg in oilseeds.

Results of supervised residue trials on crops

Trials submitted to the Meeting were conducted from 1979 to 2014 and the quality of these trials differed considerably. The older trials were conducted when no guidelines existed. Only trials that were conducted according to current standards were taken into account for maximum residue level estimation.

Fluazifop-P-butyl is phytotoxic to grass-like crops (cereals, grasses, and sugar cane), but other crops do not show phytotoxicity at any growth stage. Proportionality from high to low dose rates is therefore used in the selection of data for estimation of maximum residue levels in crops other than grasses.

Weed directed spray applications at the base of trees or vines

Since metabolism studies indicated that no residues are expected above 0.01 mg/kg for weed directed spray applications at the base of trees, shrubs or vines, the Meeting decided to evaluate all supervised residue trials with weed directed spray applications at the base of trees together.

Field trials involving citrus fruit were performed in the USA (grapefruits, lemons, and oranges), Southern France and Martinique (lemon and lime) and Italy (oranges).

Critical GAP for citrus fruit is the US GAP with three applications at the base of the tree at 0.42 kg ai/ha with a PHI of 14 days.

One grapefruit trial from the USA (3 ×0.42–0.43 kg ai/ha, PHI 12 days) matched the US cGAP within 25%. Five additional grapefruit trials from the USA at a higher dose (3 ×0.56 kg ai/ha, PHI 14 days) confirmed the non-residue situation. Total fluazifop residues were: < 0.01 and < 0.05 (5) mg/kg (n = 6).

Four lemon trials from the USA at a higher dose (3 × 0.56 kg ai/ha, PHI 14 days) indicated a non-residue situation. Total fluazifop residues were: < 0.05 (4) mg/kg (n = 4).

Six orange trials from the USA (3 × 0.41–0.43 kg ai/ha, PHI 12–14 days) matched the US cGAP within 25%. Five additional orange trials from the USA at higher dose (3 × 0.56 kg ai/ha, PHI 14 days) confirmed the non-residue situation. Total fluazifop residues were:< 0.01 (6) and < 0.05 (5) mg/kg (n = 11).

Additional grapefruit (5), lemon (4) and orange (5) trials from the USA (3 × 0.84 kg ai/ha, PHI 14 days), confirmed residues were below LOQ (< 0.05 mg/kg for each). One trial on oranges from the USA with a 5 × higher dose rate (3 × 2.1 kg ai/ha, PHI 14 days), indicated residues at 0.015 mg/kg. One trial on oranges from Brazil (2 × 2.0 kg ai/ha, PHI 7 days), where the sample size was insufficient to generate a representative sample, indicated residues at 0.068 mg/kg.

Field trials involving pome fruit were performed in Germany (apples and pears), France (apples), Italy (apples) and the USA (apples).

Critical GAP for apples and pears in the Netherlands or Belgium is one application at the base of the tree at 0.38 kg ai/ha and a PHI of 28 days.

Two apple trials from Southern France and Italy (1 × 0.38–0.39 kg ai/ha, PHI 28 days) matched the Dutch or Belgian cGAP within 25%. Total fluazifop residues were: < 0.01 and < 0.01 mg/kg (n = 2).

Three apple trials from the USA (2 × 0.42 kg ai/ha, PHI 14 days) confirmed residues below LOQ: < 0.05 (3) mg/kg. Two apple trials from Northern France (1 × 0.75–0.96 kg ai/ha, PHI 7 days) confirmed residues below LOQ: < 0.01 and < 0.03 mg/kg (n = 2). However, one apple trial and three pear trials in Germany did not confirm the non-residue situation. One apple trial from Germany (1 × 1.0 kg ai/ha, PHI 0 days), which was inadequately described, indicated total fluazifop residues at 0.07 mg/kg. Three pear trials from Germany (1 × 1.0 kg ai/ha, PHI 7, 7, 13 days), which were inadequately described, indicated total fluazifop residues at 0.05, 0.05 and 0.07 mg/kg, respectively.

Field trials involving stone fruits were performed in Germany (cherries, plums, and peaches), Italy (peaches) and the USA (cherries, plums, and peaches).

The cGAP for cherries, plums, apricots, peaches and nectarines is the US cGAP with weed directed applications at the base of the tree at 3 × 0.42 kg ai/ha with a PHI of 14 days.

Four cherry trials from the USA (3 × 0.42 kg ai/ha, PHI 14–15 days) matched the US cGAP within 25%. Total fluazifop residues were: < 0.05 (4) mg/kg.

Four plum trials from the USA (3 × 0.42 kg ai/ha, PHI 14–15 days) matched the US cGAP within 25%. Total fluazifop residues were: < 0.05 (4) mg/kg (n = 4)

Three peach trials from the USA (3 × 0.42 kg ai/ha, PHI 14 days) matched the US cGAP within 25%. Total fluazifop residues were: < 0.05 (3) mg/kg.

One plum trial from the USA (3 × 2.1 kg ai/ha, PHI 14 days) confirmed residues were below LOQ (< 0.05 mg/kg). One peach trial from the USA (3 × 0.42 kg ai/ha, PHI 9 days) also confirmed residues were below LOQ (< 0.05 mg/kg).

Field trials involving grapes were performed in Germany, Spain, Greece and the USA.

The cGAP for grapes in Belgium is one application at 0.38 kg ai/ha and PHI of 28 days. Three grape trials from Spain and Greece (1 × 0.75 kg ai/ha with PHI 27–28 days) indicated a non-residue situation. Total fluazifop residues were: < 0.01, < 0.01 and < 0.01 mg/kg (n = 3).

The cGAP for grapes in the USA is 3 × 0.42 kg ai/ha and PHI of 50 days. Grape trials from the USA (3 × 0.42 kg ai/ha with PHI 50 days) could be matched to this GAP within 25%. Total fluazifop residues were: < 0.01, < 0.01, < 0.01, < 0.01, < 0.01, and < 0.01 mg/kg (n = 6).

Furthermore, one grape trial from the USA (3 × 2.1 kg ai/ha, PHI 50 days) confirmed residues were below LOQ (< 0.01 mg/kg). Three trials from Germany (1 × 1.0 kg ai/ha, PHI 0, 7, 22), which were poorly described, could not confirm the non-residue situation for grapes, as residues of fluazifop found were: 0.05, 0.06 and 0.14 mg/kg.

Field trials involving olives were performed in Italy.

The cGAP for olives is the French cGAP with one application at 0.25 kg ai/ha with PHI of 21 days. None of the trials could be matched to this GAP. One olive trial in Italy (1 × 0.75 kg ai/ha, PHI 28 days) at a higher dose confirmed the non-residue situation: < 0.01 mg/kg.

Field trials involving bananas were performed in the USA, Australia, Honduras and Martinique (i.e. French overseas territory).

Critical GAP for bananas is the US GAP with 3 × 0.42 kg ai/ha with a PHI of 0 days. Trials from the USA (3 × 0.42 kg ai/ha, PHI 0 days) matched this cGAP within 25%. Residues from bagged and unbagged bananas were equal. Total fluazifop residues were: < 0.01, < 0.01, < 0.01 and < 0.01 mg/kg (n = 4).

Field trials involving tree nuts were performed in the USA (almonds, macadamia nuts, pecans, and walnuts), UK (hazelnuts) and Italy (hazelnuts).

Critical GAP for macadamia nuts and pecans in the USA is three applications at the base of the trees at 3 × 0.42 kg ai/ha and PHI of 1 day. None of the trials could be matched to the USA cGAP.

Critical GAP for almonds, chestnuts, hazelnuts, macadamia nuts and walnuts in France is one application at the base of the trees with 1 × 0.25 kg ai/ha and PHI of 21 days. None of the trials could be matched to the cGAP from France.

Four almond trials from the USA at higher dose rate and shorter PHI (1 × 0.84 kg ai/ha, PHI 14 days) indicated residues below the LOQ for the French cGAP. Total fluazifop residues were: < 0.01, < 0.01, < 0.01 and < 0.01 mg/kg (n = 4).

Three walnut trials from the USA at higher dose rate and shorter PHI (1 × 0.84 kg ai/ha, PHI 14 days) indicated residues below the LOQ for the French cGAP. Total fluazifop residues were < 0.01, < 0.01 and < 0.01 mg/kg (n = 3).

One hazelnut trial from the UK at a higher dose rate but longer PHI (1 × 0.75 kg ai/ha, PHI 28 days) did not confirm the non-residue situation. Total fluazifop residues were: 0.01 mg/kg (n = 1) for nuts sampled by hand. Furthermore, one hazelnut trial from Italy (1 × 2.5 kg ai/ha, PHI 49, 73 days) did not confirm the non-residue situation. Total fluazifop residues were: 0.07 and 0.08 mg/kg (n = 2). Since the non-residue situation could not be confirmed for hazelnuts, the Meeting did not estimate a maximum residue level for hazelnuts.

Field trials involving coffee beans were performed in Brazil and the USA (Hawaii).

Critical GAP for coffee beans is the GAP from the USA with a weed directed application at 2 × 0.42 kg ai/ha with a PHI of 1 day. None of the trials could be matched to the USA GAP.

One trial from the USA (3 × 1.4 kg ai/ha, PHI 1 day) confirmed that no residues are to be expected in green coffee beans. Total fluazifop residues were < 0.05 mg/kg (n = 1).

The Meeting concluded that incidental residues that were found on citrus fruit, pome fruit and grapes are likely to result from unintentional sprays onto fruit due to spray drift, and these do not represent good agricultural practice. Furthermore, the Meeting concluded that the trials on citrus fruit, pome fruit, stone fruit, tree nuts, grapes, olives, bananas, and coffee beans mutually supported each other. Taking into account the LOQ of 0.01 mg/kg for the enforcement method, the Meeting estimated a maximum residue level of 0.01* mg/kg for citrus fruit, pome fruit, stone fruit, grapes, table olives and olives for oil production, bananas, macadamia nuts, pecans, almonds, walnuts and coffee beans. The Meeting estimated a median and highest residue of 0.01 mg/kg.

Using multiplication factors of 1.05 and 1.05 for the median and highest residues, the Meeting estimated an STMR and HR of 0.011and 0.011 mg/kg eq.

Cane berries

Field trials on cane berries were performed in Germany (blackberries and raspberries), the UK (raspberries), Southern France (raspberries) and the USA (blackberries and raspberries).

The cGAP for raspberries and blackberries in the Netherlands is 1 × 0.38 kg ai/ha and PHI of 45 days for a weed directed spray between bushes.

Blackberry trials did not match the Dutch GAP. Raspberry trials from the UK (1 × 0.38 kg ai/ha, PHI 56 days, base application) matched the Dutch cGAP within 25%. Total fluazifop residues were: < 0.05 and < 0.05 mg/kg (n = 2).

The Meeting estimated a maximum residue level of 0.01* mg/kg for cane berries based on the non-residue situation for weed directed sprays and the LOQ of 0.01 mg/kg for the enforcement method. The Meeting estimated a median and highest residue of 0.01 mg/kg.

Using multiplication factors of 1.05 and 1.05 median and highest residues, the Meeting estimated an STMR and HR of 0.011 and 0.011 mg/kg eq.

Bush berries

Field trials were performed in Germany (bilberries), USA (blueberries) and the UK (gooseberries and currants).

The only cGAP for bilberries and blueberries is the French GAP with one application at 0.25 kg ai/ha and PHI of 42 days. None of the trials could be matched to this GAP. The Meeting decided not to derive maximum residue levels for bilberries and blueberries.

The cGAP for currants and gooseberries is the cGAP from the UK at 1 × 0.38 kg ai/ha for a weed directed spray (where possible) before bloom or after harvest.

Currant trials from the UK (1 × 0.38 kg ai/ha, leaves unfolding to bud burst, over the top spray) matched the UK cGAP within 25%. Total fluazifop residues were: < 0.05 and < 0.05 mg/kg (n = 2).

Gooseberry trials from the UK (1 × 0.38 kg ai/ha, leaves unfolding to bud burst, over the top spray) matched the UK cGAP within 25%. Total fluazifop residues were: < 0.05 mg/kg (n = 1).

Since the cGAP applications are applied early in the growing season or after harvest, no residues are expected. The Meeting estimated a maximum residue level of 0.01* mg/kg for currants and gooseberries. The Meeting estimated a median and highest residue of 0.01 mg/kg.

Using multiplication factors of 1.05 and 1.05 for median and highest residues, the Meeting estimated an STMR and HR of 0.011and 0.011 mg/kg eq.

Strawberries

Field trials involving strawberries were performed in Germany, Sweden, the UK, Southern France, Italy and Spain.

The cGAP for strawberries in the Netherlands and France is 1 × 0.38 kg ai/ha with a PHI of 42 days.

Strawberry trials from Sweden, the UK, Southern France, Spain and Italy (1 × 0.36–0.39 kg ai/ha, PHI 39–43 days) matched the French and Dutch cGAP within 25%. Additional trials from Southern France (1 × 0.18–0.19 kg ai/ha, PHI 42 days) could be matched to this cGAP using proportionality. Two additional trials from the UK (1 × 0.38 kg ai/ha, PHI 55–57 days) were taken into account, since significant residues were found at these longer PHIs. Total fluazifop residues were: 0.02, 0.02, 0.02, 0.01 × 0.38/0.18, 0.01 × 0.38/0.18, < 0.05, 0.06, 0.06, 0.03 × 0.38/0.19, 0.07, 0.08, 0.11, 0.11, 0.12, 0.12 mg/kg, which becomes 0.02, 0.02, 0.02, 0.021, 0.021, < 0.05, 0.06, 0.06, 0.06, 0.07, 0.08, 0.11, 0.11, 0.12 and 0.12 mg/kg (n = 15).

The Meeting estimated a maximum residue level of 0.3 mg/kg for strawberries, based on the cGAP for the Netherlands and France. The Meeting estimated a median residue of 0.06 mg/kg and a highest residue of 0.12 mg/kg.

Using multiplication factors of 1.05 and 1.05 for median and highest residues, the Meeting estimated an STMR and HR of 0.063 and 0.13 mg/kg eq.

Onion, bulb (dry harvested)

Field trials involving bulb onions were performed in the United Kingdom, the Netherlands, Spain, Italy, Southern France, USA and Brazil.

Critical GAP for onions in the USA is for 2 × 0.42 kg ai/ha with a PHI of 45 days. Trials from the USA (2 × 0.42 kg ai/ha, PHI 39–46 days) matched this GAP within 25%. Additional trials from the USA (2 × 1.1 kg ai/ha, PHI 45–46 days) could be matched to this GAP through proportionality. Total fluazifop residues were: < 0.05, < 0.05, < 0.05, < 0.06, 0.06, 0.26 × 0.42/1.1, 0.11, 0.34 × 0.42/1.1, 0.18, 0.48 × 0.42/1.1 mg/kg (n = 10), which becomes < 0.05 (3), < 0.06, 0.06, 0.099, 0.11, 0.13, 0.18 and 0.18 mg/kg (n = 10).

The Meeting estimated a maximum residue level of 0.3 mg/kg on bulb onion (dry harvested) on the basis of the cGAP for the USA. The Meeting estimated a median residue of 0.080 and a highest residue of 0.18 mg/kg.

Using multiplication factors of 1.53 and 1.53 for median and highest residues, the Meeting estimated an STMR and HR of 0.12and 0.28 mg/kg eq.

The Meeting decided to extrapolate the maximum residue level, STMR and HR to shallots (dry harvested) and garlic.

Leeks

Field trials involving leeks were performed in the Netherlands, UK and Northern France.

cGAP for leeks is the GAP from France with one application at 0.38 kg ai/ha with a PHI of 42 days. Trials from the Netherlands (1 × 0.38 kg ai/ha, PHI 43 days) matched this GAP within 25%. Total fluazifop residues were: < 0.05 and < 0.05 mg/kg (n = 2). The non-residue situation could not be confirmed, since trials in the UK at 1 × 0.38 kg ai/ha at longer PHIs of 76–108 days showed residues of 0.02–0.06 mg/kg. The Meeting considered two trials insufficient.

Cabbages, Head

Field trials involving head cabbages were performed in Northern France, Germany, Greece, Spain and Brazil.

Critical GAP for head cabbages is the GAP from Brazil with one foliar application at 0.25 kg ai/ha with a PHI of 28 days. Trials from Brazil (1 × 0.19 kg ai/ha, PHI 28 days) matched this GAP within 25%. Total fluazifop residues were: 0.27, 0.29, 0.29 and 0.51 mg/kg (n = 4). The Meeting considered four trials insufficient.

Critical GAP for head cabbages in France is for one foliar application at 0.19 kg ai/ha with a PHI of 42 days. Trials from Northern France and Germany (1 × 0.19 kg ai/ha, PHI 42–49 days) matched this GAP within 25%. Total fluazifop residues were: 0.06, 0.12, 0.15, 0.16, 0.56 and 1.7 mg/kg (n = 6).

The Meeting estimated a maximum residue level of 3 mg/kg on head cabbages, based on the French GAP. The Meeting estimated a median residue of 0.155 mg/kg and a highest residue of 1.7 mg/kg.

Using multiplication factors of 1.27 and 2.16 for median and highest residues, the Meeting estimated an STMR and HR of 0.20 and 3.7 mg/kg eq.

Cucumbers and summer squash

Field trials involving cucumbers were performed under outdoor and indoor conditions in Italy and Spain. Field trials involving summer squash were performed under outdoor conditions in Italy and South Africa.

Critical GAP for cucumber, summer squash and gherkins is the GAP from France with one foliar application of 0.19 kg ai/ha with a PHI of 28 days.

One indoor trial on cucumber from Spain (1 × 0.31 kg ai/ha, PHI 28 days, broadcast foliar application) could be matched to this GAP through proportionality. Total fluazifop residues were: 0.02 × 0.19/0.31 mg/kg (n = 1) which following the application of proportionality becomes 0.012 mg/kg (n = 1).

Outdoor trials on cucumber from Spain and Italy (1 × 0.31 kg ai/ha, PHI 27 days) could be matched to this GAP through proportionality. Total fluazifop residues were: < 0.01 mg/kg (n = 1).

One outdoor trial on summer squash from Italy (1 × 0.31 kg ai/ha, PHI 29) could be matched to this GAP through proportionality. Total fluazifop residues were: < 0.01 mg/kg (n = 1).

The Meeting considered three trials insufficient.

Tomato

Field trials involving tomatoes were performed under outdoor conditions in Spain, Italy and France.

Critical GAP for tomatoes is the French GAP for tomatoes, aubergines and peppers with one foliar application at 0.38 kg ai/ha with a PHI of 35 days. Trials from Spain, Italy and Southern France (1 × 0.31 kg ai/ha, PHI 35–42 days) matched this GAP within 25%. Total fluazifop residues were: < 0.01, < 0.01, < 0.01, < 0.05, < 0.05, 0.06, 0.12 and 0.25 mg/kg (= 8).

The Meeting estimated a maximum residue level of 0.4 mg/kg on tomatoes based on the cGAP from France. The Meeting estimated a median residue of 0.05 mg/kg and a highest residue of 0.25 mg/kg.

Using multiplication factors of 1.05 and 1.05 for median and highest residues, the Meeting estimated an STMR and HR of 0.053and 0.26 mg/kg eq.

The Meeting decided to extrapolate the maximum residue level, STMR and HR to eggplants.

Kale

Field trials involving kale were performed under outdoor conditions in the UK.

Critical GAP for kale for human consumption in France is 1 × 0.19 kg ai/ha with a PHI of 42 days. One trial from Germany (1 × 0.19 kg ai/ha, PHI 42 days) matched this GAP within 25%. Total fluazifop residues were 0.95 mg/kg (n = 1). The Meeting considered one trial insufficient.

Lettuce

Field trials involving head lettuce, leaf lettuce and Cos lettuce were performed under outdoor conditions in Greece, Spain, Italy, Southern and Northern France, Brazil, and the USA.

The cGAP for lettuces is the GAP from Brazil with one foliar application at 0.25 kg ai/ha with a PHI of 28 days. Trials from Northern France, Italy, Spain and Brazil (1 × 0.25–0.31 kg ai/ha, PHI 28–31 days) matched this GAP within 25%. Total fluazifop residues in head lettuce were < 0.01 and 0.66 mg/kg (n = 2). None of the Cos lettuce trials matched the GAP. Total fluazifop residues in leaf lettuce were: < 0.01 (7) mg/kg (n = 7).

Since head lettuce contained one high residue, the Meeting decided to estimate maximum residue levels for leaf lettuce only. The Meeting estimated a maximum residue level of 0.01* mg/kg for leaf lettuce. The Meeting estimated a median and highest residue of 0.01 mg/kg.

Using multiplication factors of 1.27 and 2.16 for long- and short-term dietary exposure, the Meeting estimated an STMR and HR of 0.013 and 0.022 mg/kg eq.

Turnip greens

Field trials involving turnips were performed in the United Kingdom.

Critical GAP for turnips in Belgium is 1 × 0.38 kg ai/ha and a PHI of 56 days. Trials from the UK (1 × 0.38 kg ai/ha, PHI 62–68 days) on turnip tops matched this cGAP within 25%. Total fluazifop residues were 1.3 and 1.6 mg/kg (n = 2). The Meeting considered two trials insufficient.

Common bean (pods and/or immature seeds) (Phaseolus spp)

Field trials involving green beans with pods were performed in Canada, Germany, the Netherlands, UK, France, Italy, and Spain.

Critical GAP for green beans with pods is the Belgium GAP with one foliar application at 0.38 kg ai/ha with a PHI of 28 days. Trials from Germany, the Netherlands, UK, France and Spain (1 × 0.30–0.38 kg ai/ha, PHI 27–35 days) matched this cGAP within 25%. Total fluazifop residues in

green beans with pods were: 0.06, 0.08, 0.17, 0.23, 0.25, 0.27, 0.29, 0.32, 0.35, 0.38, 0.48, 0.84, 1.6 and 4.6 mg/kg (n = 14).

The Meeting estimated a maximum residue level of 6 mg/kg on beans (green pods and immature seeds, *Phaseolus* spp) based on the cGAP from Belgium. The Meeting estimated a median residue of 0.305 mg/kg and a highest residue of 4.6 mg/kg.

Using multiplication factors of 1.05 and 1.07 for median and highest residues, the Meeting estimated an STMR and HR of 0.32 and 4.9 mg/kg eq.

Peas (pods and succulent = immature seeds) (Pisum spp, Vigna spp)

Field trials involving green peas with pods were performed in the Netherlands, Germany, Denmark, UK, Northern France, Spain and Canada.

Critical GAP for green peas with pods is the Belgium GAP with one foliar application at 0.38 kg ai/ha with a PHI of 28 days. Trials from the UK and Northern France (1 × 0.37–0.38 kg ai/ha, PHI 34–35 days) matched this cGAP within 25%. Total fluazifop residues in green peas with pods were: 0.08, 0.23, 0.42, 0.85 and 0.90 mg/kg (n = 5).

The Meeting estimated a maximum residue level of 2 mg/kg on peas, pods and succulent immature peas (*Pisum spp, Vigna spp*) based on the cGAP from Belgium. The Meeting estimated a median residue of 0.42 mg/kg and a highest residue of 0.90 mg/kg.

Using multiplication factors of 1.05 and 1.07 for median and highest residues, the Meeting estimated an STMR and HR of 0.44 and 1.0 mg/kg eq.

Peas, shelled (succulent seeds) (Pisum spp, Vigna spp)

Field trials involving green pea seeds were performed in the Netherlands, Germany, UK, France, Italy, Spain and Canada.

Critical GAP for green peas without pods in Belgium is one foliar application at 0.38 kg ai/ha with a PHI of 28 days. However, since higher residues were observed at longer pre-harvest intervals, this cGAP was not explored further.

Critical GAP for green peas without pods in the Netherlands is one foliar application at 0.38 kg ai/ha with a PHI of 56 days. Trials from Canada, Germany, the UK (1 × 0.38–0.40 kg ai/ha, PHI 42–66 days) matched this GAP within 25%. Total fluazifop residues in green pea seeds were: < 0.05, 0.16, 0.27, 0.53, 3.8 and 7.6 mg/kg (n = 6)

The Meeting noted that despite the longer pre-harvest interval, residues according to the Dutch cGAP were higher than those for the Belgian cGAP. The Meeting estimated a maximum residue level of 15 mg/kg on peas, shelled (succulent seeds) (*Pisum spp, Vigna spp*) based on the cGAP from the Netherlands. The Meeting estimated a median residue of 0.40 mg/kg and a highest residue of 7.6 mg/kg.

Using multiplication factors of 1.05 and 1.07 for median and highest residues, the Meeting estimated an STMR and HR of 0.42and 8.1 mg/kg eq.

Pulses

Since the processing study on dry peas has shown that soaking is essential for quantitative analysis of total fluazifop, trials were not taken into account when the soaking step was omitted or when it is not clear whether soaking was performed.

Beans (dry) (Phaseolus spp)

Field trials involving dry beans were performed in the USA, Canada, Brazil and Spain.

Critical GAP for dry beans is the USA GAP for dry beans with two foliar applications at 0.42 kg ai/ha with a PHI of 60 days. Trials from the USA with dry beans (2 × 0.42 kg ai/ha, PHI 59–75 days) matched this cGAP within 25%. Total fluazifop residues in dry beans, where a pre-extraction soaking step was included in the analytical method, were: 0.32, 0.46, 0.76, 0.82, 1.1, 1.2, 3.4, 3.6, 5.0, 9.4, 16 and 20 mg/kg (n = 12).

The Meeting estimated a maximum residue level of 40 mg/kg on beans (dry, *Phaseolus* spp). The Meeting estimated a median residue of 2.3 mg/kg.

Using multiplication factors of 1.05 for median residues, the Meeting estimated an STMR of 2.4 mg/kg eq.

Broad bean (dry) (Vicia spp)

Field trials involving dry broad beans were performed in UK, Germany, Southern France, Spain and Italy.

Critical GAP for dry broad beans is the French GAP with one foliar application at 0.38 kg ai/ha with a PHI of 56 days. Only one trial, which was not conducted to current standards, could be matched to this cGAP.

Critical GAP for pulses in the Netherlands is one foliar application at 0.38 kg ai/ha with PHI 90 days. Trials from UK with dry broad beans (1 × 0.38 kg ai/ha, PHI 97–98 days) matched the cGAP from the Netherlands within 25%. Total fluazifop residues in dry broad beans, where a pre-extraction soaking step was included in the analytical method, were: 0.08 and 0.09, mg/kg (n = 2). The Meeting considered two trials insufficient upon which to base a maximum residue level estimation.

Field pea (dry) (Pisum spp)

Field trials involving dry peas and dry field peas were performed in Netherlands, UK, Germany, and France.

Critical GAP for dry peas in France is one foliar application at 0.38 kg ai/ha with PHI 56 days. Trials from the UK, Northern France with dry peas, dry field peas or dry fodder peas (1 × 0.38 kg ai/ha, PHI 46–68 days) matched the cGAP from France within 25%. Total fluazifop residues in dry field peas were: 0.26 (no soaking step included), 0.59, 0.91 × 0.38/0.31, 2.0, mg/kg (n = 4), which becomes 0.59, 1.1 and 2.0 mg/kg (n = 3). The Meeting considered three trials insufficient upon which to base a maximum residue level estimation.

Critical GAP for dry peas in Belgium is 1 × 0.38 kg ai/ha with an application just before bloom. Trials from Germany, the UK, Northern France (1 × 0.31–0.38 kg ai/ha, BBCH 35–39) matched the cGAP from Belgium within 25%. Total fluazifop residues in dry field peas, where a pre-extraction soaking step was included in the analytical method, were: 0.02, 0.10, 0.10, 0.17, 0.18, 0.24, 0.27, 0.49, 0.54, 0.59, 0.91, 1.0, 1.1 and 2.0 mg/kg (n = 14).

The Meeting estimated a maximum residue level of 3 mg/kg on peas (dry, Pisum spp). The Meeting estimated a median residue of 0.38 mg/kg.

Using multiplication factors of 1.05 for median residues, the Meeting estimated an STMR of 0.40 mg/kg eq.

Soya bean (dry)

Field trials involving soya beans (dry) were performed in the USA, Canada, Brazil, Switzerland, Italy and France.

Critical GAP for dry soya beans in Brazil consists of one broadcast application of 0.25 kg ai/ha with a PHI of 60 days. Trials from Brazil, Italy and Northern France (0.24–0.31 kg ai/ha with PHI 56–68 days) matched the cGAP from Brazil within 25%. Additional trials from Italy and

Southern France (0.38 kg ai/ha with PHI 57–60 days) could be matched to the Brazilian GAP using the proportionality principle. The Meeting decided to apply the proportionality principle on all residues where the dose rate deviated from 0.25 kg ai/ha. Total fluazifop residues in dry soya beans, where a pre-soaking step was included in the analytical method, were: 0.49, 0.93, 1.2, 1.7, 2.1, 2.4 × 0.25/0.26, 3.2 × 0.25/0.24, 4.7 × 0.25/0.31, 6.3 × 0.25/0.38^{BF}, 5.4 × 0.25/0.31, 9.8 × 0.25/0.38 and 11 × 0.25/0.31 mg/kg (n = 12), which resulted in the following dataset: 0.49, 0.93, 1.2, 1.7, 2.1, 2.3, 3.3, 3.8, 4.1^{BF}, 4.4, 6.4 and 8.9 mg/kg (n = 12), where BF indicates a banded foliar application.

The Meeting estimated a maximum residue level of 15 mg/kg on soya beans (dry, Glycine spp). The Meeting estimated a median residue of 2.8 mg/kg.

Using multiplication factors of 1.05 for median residues, the Meeting estimated an STMR of 2.9 mg/kg eq.

Carrots

Field trials involving carrots were performed in the UK, Spain, Italy, France, Brazil and the USA in different growing seasons. As it is not clear which GAP leads to the highest residues, the Meeting evaluated the residues matching the different cGAPs.

Critical GAP for carrots in the USA is 2 × 0.42 kg ai/ha with a PHI of 45 days. Trials from the USA (2 × 0.42 kg ai/ha, PHI 44–48 days) matched this GAP within 25%. Additional trials from the USA (2 × 0.56 kg ai/ha, PHI 45 days) could be matched to the US GAP using the proportionality principle. Total fluazifop residues were 0.019, 0.027, < 0.05, < 0.05, < 0.05, < 0.05, < 0.05, < 0.05 and 0.072 mg/kg (n = 9).

Critical GAP for carrots in Brazil is 1 × 0.25 kg ai/ha with a PHI of 30 days. Trials from Brazil (1 × 0.25 kg ai/ha, PHI 30 days) matched this GAP within 25%. Additional trials from Southern France, Italy and Spain with carrots (1 × 0.31–0.32 kg ai/ha with PHI 28–29 days) could be matched to the Brazilian GAP using the proportionality principle. The Meeting decided to apply the proportionality principle on all residues where the dose rate deviated from 0.25 kg ai/ha. Total fluazifop residues were: 0.02 × 0.25/0.33^{BF}, 0.03 × 0.25/0.32^{BF}, 0.04, 0.04, 0.05 × 0.25/0.31, 0.05, 0.07 × 0.25/0.31, 0.07 × 0.25/0.31, 0.19 × 0.25/0.31, 0.17, mg/kg, which becomes 0.015, 0.023, 0.04, 0.04, 0.040, 0.05, 0.056, 0.056, 0.15 and 0.17 mg/kg (n = 10), where BF indicates a banded foliar application.

Critical GAP for carrots in France is 1 × 0.38 kg ai/ha with a PHI of 42 days. Two trials from the UK and Southern France (1 × 0.38 kg ai/ha, PHI 34–42 days) matched this GAP within 25%. Total fluazifop residue levels were < 0.05 and 0.29 mg/kg. The Meeting considered two trials insufficient.

Critical GAP for the Netherlands, UK and Belgium is 1 × 0.38 kg ai/ha with a PHI of 56 days. Trials from the UK, Southern France (1 × 0.38 kg ai/ha, PHI 42–64 days) matched this GAP within 25%. Total fluazifop residues in trials using an adjuvant were < 0.05, < 0.05, 0.09, 0.09, 0.21, 0.23 and 0.29 mg/kg (n = 7).

These data show that the residue levels based on the Dutch, UK and Belgian GAP are higher than those from the US and Brazilian GAPs. The Meeting estimated a maximum residue level of 0.6 mg/kg on carrots based on the GAP applied in the Netherlands, the United Kingdom and Belgium. The Meeting estimated a median residue of 0.09 mg/kg and a highest of 0.29 mg/kg.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 0.18, 0.69 mg/kg eq.

Celeriac

Field trials involving celeriac were performed in Northern France in two growing seasons.

Critical GAP for celeriac is the GAP from Belgium and the Netherlands with 1 × 0.38 kg ai/ha with a PHI of 56 days. Four trials from Northern France (1 × 0.38 kg ai/ha, PHI 50-56 days) matched this GAP within 25%. Total fluazifop residues were < 0.01[BF], ≤ 0.01[BF], 0.11, and 0.17 mg/kg, where BF indicates a banded foliar application.

The Meeting estimated a maximum residue level of 0.4 mg/kg on celeriac based on the Belgian and Dutch GAP. The Meeting estimated a median residue of 0.060 mg/kg and a highest residue of 0.17 mg/kg.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 0.12 and 0.40 mg/kg eq.

Potato

Field trials involving potatoes were performed in Brazil, Canada and Europe in various growing seasons.

Critical GAP for potatoes in Brazil is 1 × 0.25 kg ai/ha with a PHI of 28 days. Trials from Brazil and Southern France (1 × 0.25 kg ai/ha, PHI 27–29 days) matched this GAP within 25%. Additional trials from Germany (1 × 0.38 kg ai/ha with PHI 27–29 days) could be matched to the Brazilian GAP using the proportionality principle. The Meeting decided to apply the proportionality principle on all residues where the dose rate deviated from 0.25 kg ai/ha. Total fluazifop residues were: < 0.01 (3), 0.06 × 0.25/0.38, < 0.05 (3), 0.07, 0.11 and 0.44 mg/kg (n = 10), which becomes < 0.01, < 0.01, < 0.01, 0.039, ≤ 0.05, ≤ 0.05, < 0.05, 0.07, 0.11 and 0.44 mg/kg (n = 10).

The Meeting estimated a maximum residue level of 0.6 mg/kg on potato based on the Brazilian GAP. The Meeting estimated a median residue of 0.05 mg/kg and a highest residue of 0.44 mg/kg.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 0.10, 1.0 mg/kg eq.

Radish

Field trials involving radish were performed in the UK.

Critical GAP for radishes for France is 1 × 0.38 kg ai/ha with a PHI of 42 days. None of the trials could be matched to this GAP.

Critical GAP for radishes from Belgium is 1 × 0.38 kg ai/ha with a PHI of 56 days. One trial of poor quality from the UK (1 × 1.0 kg ai/ha, PHI 55 days) could be matched to this GAP using proportionality. The Meeting considered the data insufficient.

Sugar beet

Field trials involving sugar beets were performed in the United Kingdom, Germany, Spain, Italy, France, Greece, Canada and the USA. Trials from fodder beets can be used to derive maximum residue levels for sugar beets and vice versa.

Critical GAP for sugar beets in the USA is 2 × 0.42 kg ai/ha and a PHI of 90 days. Trials from the USA (2 × 0.42 kg ai/ha, PHI 89–90 days) on sugar beets matched this GAP within 25%. Total fluazifop residues were: < 0.01, 0.02, 0.06, 0.06, 0.06, 0.06, 0.08, 0.08, 0.10, 0.10, 0.11, 0.22 mg/kg (n = 12).

Critical GAP for sugar beets and fodder beets in the UK is 1 × 0.38 kg ai/ha and a PHI of 56 days. Trials on sugar beets from Germany, Greece, Italy, Spain (1 × 0.37–0.43 kg ai/ha, PHI 47–60 days) matched this GAP within 25%. Total fluazifop residues were: 0.08, 0.08[BF], 0.09, 0.09, 0.09, 0.10, 0.12[BF], 0.14[BF], 0.26 and 0.32 mg/kg (n = 10), where BF indicates a banded foliar spray.

The Meeting estimated a maximum residue level of 0.5 mg/kg on sugar beets based on the GAP in the United Kingdom. The Meeting estimated a median residue of 0.095 mg/kg and a highest residue of 0.32 mg/kg in roots of sugar beets and fodder beets.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 0.19 and 0.76 mg/kg eq.

Swede and Turnip

Field trials involving swedes were performed in the UK. Field trials involving turnips were performed in the United Kingdom and Canada.

Critical GAP for swedes and turnips in France is 1 × 0.38 kg ai/ha with PHI of 42 days. None of the swede trials and only one turnip trial, which was inadequately reported, could be matched to this GAP using proportionality.

Critical GAP for swedes and turnips in Belgium is 1 × 0.38 kg ai/ha with a PHI of 56 days. Two swede trials from the UK (1 × 0.38 kg ai/ha, PHI 56–70 days) matched this GAP within 25%. Total fluazifop residues were: 0.43 and 0.55 mg/kg (n = 2).

Two turnip trials from the UK (1 × 0.38 kg ai/ha, PHI 62–68 days) could be matched to this cGAP within 25%. Total fluazifop residues were: 0.74 and 2.0 mg/kg (n = 2).

The Meeting considered the trials on swedes and turnips mutually supportive and decided to combine the trials. Total fluazifop residues were: 0.43, 0.55, 0.74 and 2.0 mg/kg (n = 4).

The Meeting estimated a maximum residue level of 4 mg/kg on turnips and swedes based on the GAP in Belgium. The Meeting estimated a median residue of 0.645 mg/kg and a highest residue of 2.0 mg/kg.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 1.3 and 4.8 mg/kg eq.

Sweet potato

Field trials involving sweet potatoes were performed in the USA in the 2008 growing season.

Critical GAP for sweet potato and yam is from the USA with 4 × 0.21 kg ai/ha and a PHI of 14 days. Trials from the USA (4 × 0.21 kg ai/ha, PHI 12–16 days) matched this GAP within 25%. Total fluazifop residues were: 0.11, 0.12, 0.51, 0.52, 0.57 and 0.85 mg/kg (n = 6).

The Meeting estimated a maximum residue level of 2 mg/kg on sweet potato based on the GAP in the USA. The Meeting estimated a median residue of 0.515 mg/kg and a highest residue of 0.85 mg/kg.

Using multiplication factors of 1.95 and 2.38 for median and highest residues, the Meeting estimated an STMR and HR of 1.0, and 2.0 mg/kg eq.

The Meeting decided to extrapolate the maximum residue level, STMR and HR to yams.

Asparagus

Field trials involving asparagus were performed in the USA, Northern France and Spain.

Critical GAP for asparagus in the USA is 2 × 0.42 kg ai/ha and a PHI of 1 day. Trials from the USA (2 × 0.42 kg ai/ha, PHI 1 days) on asparagus matched this GAP within 25%. Total fluazifop residues were 1.7, 1.8 and 3.9 mg/kg (n = 3). The Meeting considered three trials insufficient.

Rhubarb

Field trials involving rhubarb were performed in the USA.

Critical GAP for rhubarb is the GAP from France with 1 × 0.19 kg ai/ha with a PHI of 42 days. None of the trials could be matched to this GAP. The Meeting considered the data insufficient.

Witlof chicory (sprouts)

Field trials involving witlof roots and sprouts were performed in Northern France and the Netherlands.

Critical GAP for witlof roots for sprout production is the GAP from Belgium, France or the Netherlands with 1 × 0.38 kg ai/ha with a PHI of 56 days for the roots. Trials from the Netherlands and Northern France (1 × 0.38 kg ai/ha, PHI 55–57 days for the roots) matched this GAP within 25%. Total fluazifop residues in the sprouts (endives) grown from these roots on hydroponic solutions were: < 0.01 and < 0.01 mg/kg (n = 2).

Trials from the Netherlands (1 × 0.38 or 0.75 kg ai/ha, PHI 101 days for the roots) with a much longer PHI, could not confirm the non-residue situation in the sprouts, since total fluazifop residues of 0.02 and 0.03 mg/kg were found in the sprouts grown from these roots. Since the non-residue situation in sprouts could not be confirmed, the Meeting considered two trials insufficient.

Sugar cane

Field trials involving sugar cane were performed in Brazil and the USA.

Critical GAP for sugar cane is the Brazilian GAP with one foliar spray with 1 × 0.075 kg ai/ha and a PHI of 42 days. This spray application is used as a desiccant to increase the sucrose content of the sugar cane.

Sugar cane trials from Brazil (1 × 0.075 kg ai/ha, PHI 35 days) could be matched to the Brazilian GAP within 25%. Total fluazifop residues were: < 0.01, < 0.01, < 0.01 and < 0.01 mg/kg (n = 4).

Since all trials were below the LOQ, the Meeting considered four trials sufficient. The Meeting estimated a maximum residue level of 0.01* mg/kg for sugar cane based on the Brazilian cGAP. The Meeting estimated a median and highest residue of 0.01 mg/kg.

Using multiplication factors of 1.05 and 1.05 for median and highest residues, the Meeting estimated an STMR and HR of 0.011 and 0.011 mg/kg eq.

Oilseed

Cotton seed

Field trials involving cotton were performed in the USA, Brazil and Spain.

Critical GAP for cotton in Brazil is 1 × 0.25 kg ai/ha with a PHI of 60 days. Trials from Brazil (1 × 0.25 kg ai/ha with PHI 60 days) matched this GAP within 25%. Total fluazifop residues were: < 0.01 (4 ×) mg/kg (n = 4). The Meeting considered four trials insufficient.

Critical GAP for cotton in the USA is 2 × 0.42 kg ai/ha and a PHI of 90 days. Trials from the USA (2 × 0.41–0.43 kg ai/ha with PHI 88–97 days) matched this GAP within 25%. Total fluazifop residues were: < 0.01 (6), 0.016, 0.044, 0.046, < 0.05 (8), 0.08, 0.089 and 0.71 mg/kg mg/kg (n = 20).

The Meeting estimated a maximum residue level of 0.7 mg/kg on cotton seed, based on the USA GAP. The Meeting estimated a median residue of 0.05 mg/kg.

Using multiplication factors of 1.05 for median residues, the Meeting estimated an STMR of 0.053 mg/kg eq.

Rape seed

Field trials involving rape seed were performed in the UK, Germany, Spain, Southern France and Italy.

Critical GAP for oilseed rape in Brazil and the UK is 1 × 0.19 kg ai/ha with a PHI of 14 days. None of the trials could be matched to this GAP.

Critical GAP for oilseed rape in France is 1 × 0.38 kg ai/ha with a PHI of 90 days. Trials from Germany, Spain, Southern France (1 × 0.37–0.39 kg ai/ha, PHI 81–112 days) matched this GAP within 25%. Total fluazifop residues in the seeds were: 1.5, 2.0, 2.2, 2.2 and 2.3 mg/kg (n = 5). The Meeting considered five trials insufficient.

Sunflower seeds

Field trials involving sunflower seed were performed in Brazil, Germany, France, Italy, Spain, Hungary, and the USA.

Critical GAP for sunflower seed in France is 1 × 0.38 kg ai/ha with a PHI of 90 days. Trials from Germany and France (1 × 0.37–0.38 kg ai/ha, PHI 83–109 days) matched this GAP within 25%. One additional trial from Northern France (1 × 0.38 kg ai/ha, PHI 113 days) was taken into account, since significant residues were found at this longer PHI. Total fluazifop residues were: < 0.01, < 0.01, < 0.01^{BF}, 0.02, 0.04, < 0.05, < 0.05, < 0.05, < 0.05 and 0.06 mg/kg (n = 9), where BF indicates a banded foliar spray.

Critical GAP for sunflower seed in Brazil is 1 × 0.25 kg ai/ha and a PHI of 59 days. Trials from Brazil (1 × 0.25 kg ai/ha, PHI 59–67 days) matched this GAP within 25%. Additional trials from Italy and Spain (1 × 0.34–0.40 kg ai/ha, PHI 60 days) could be matched to this GAP using proportionality. Total fluazifop residues were: < 0.02, < 0.02, < 0.02, < 0.02, 0.90 × 0.25/0.40, 2.2 × 0.25/0.38, 4.0 × 0.25/0.34, 5.6 × 0.25/0.38 mg/kg, which becomes < 0.02, < 0.02, < 0.02, < 0.02, 0.56, 1.4, 2.9 and 3.7 mg/kg (n = 8).

The Meeting estimated a maximum residue level of 7 mg/kg on sunflower seed, based on the Brazilian GAP. The Meeting estimated a median residue of 0.29 mg/kg.

Using multiplication factors of 1.05 for median residues, the Meeting estimated an STMR of 0.30 mg/kg eq.

Bean forage (green)

Field trials involving green Phaseolus bean forage (haulms) were performed in southern France and Spain. The bean haulms in these trials were harvested at BBCH 49–79 and can be considered as forage.

Critical GAP for green *Phaseolus* beans in Belgium is 1 × 0.38 kg ai/ha and PHI of 28 days. Phaseolus bean forage is not grazed and is harvested at the same time as the green beans with or without pods as a by-product. Trials from Southern France and Spain (1 × 0.30–0.32 kg ai/ha, PHI 27–28 days) matched this GAP within 25%. Total fluazifop residues in green bean forage were: 0.19, 1.0, 2.1 and 2.3 mg/kg (n = 4) on an as received basis.

The Meeting estimated a median and highest residue level on the cGAP in Belgium of 1.55 mg/kg and 2.3 mg/kg, on an as received basis, respectively, for green *Phaseolus* bean forage.

Bean fodder

Three field trials involving Phaseolus bean straw were performed in Southern France and Spain. Bean straws were harvested at BBCH 89 and should be considered as fodder.

Critical GAP for dry Phaseolus beans in the USA or Brazil is 2 × 0.42 kg ai/ha with a PHI of 60 days or 1 × 0.25 kg ai/ha with a PHI of 60 days, respectively. Bean fodder is harvested at the same time as the dry Phaseolus beans. No trials matched these GAPs.

Five field trials involving Vicia bean straw were performed in Southern France, Spain and Italy in 2006. Fava bean straw was harvested at BBCH 89 and should be considered as fodder.

Critical GAP for dry Vicia beans in the Netherlands is 1 × 0.38 kg ai/ha and PHI of 90 days. Bean fodder is harvested at the same time as the dry Vicia beans. Trials from Southern France, Spain and Italy (1 × 0.31–0.32 kg ai/ha, PHI 90–93 days) matched this GAP within 25%. Total fluazifop residue levels in bean straw (PHI 90–93 days) were: 0.05, 0.37, 0.38, 1.6 and 3.1 mg/kg (n = 5) on an as received basis. On a dry-weight basis (DM = 88%), total fluazifop residue levels in bean straw were: 0.057, 0.42, 0.43, 1.8 and 3.5 mg/kg (n = 5).

The Meeting estimated a maximum residue level of 7 mg/kg (dry weight). The Meeting estimated a median and highest residue based on the cGAP in the Netherlands of 0.43 mg/kg and 3.5 mg/kg (dry weight), respectively.

Pea forage

Field trials involving green pea forage were performed in the United Kingdom, Denmark, France, Spain, and Canada. Since the GAPs do not have grazing restrictions, pea forage can be harvested at any time after treatment of either peas intended for green pea pods, green pea seeds or dry peas. According to the FAO manual green pea vines are ready for harvest from any time after pods begin to form (BBCH 70–79).

Critical GAP for dry peas in France is 1 × 0.38 kg ai/ha and critical GAP for green peas in Belgium is 1 × 0.38 kg ai/ha. Trials from the UK and Northern France matched this GAP (1 × 0.31–0.39 kg ai/ha) within 25% of the dose rate. Total fluazifop residue levels in pea forage (BBCH 77–79) were: 0.06, 0.18^{BF}, 0.31, 0.49, 0.65, 0.68, 0.92, 1.0^{BF}, 1.3, 1.8, 1.8, 2.2 and 2.3 mg/kg (n = 13) on an as received basis, where BF indicates banded foliar spray.

The Meeting estimated a median and highest residue of 0.92 and 2.3 mg/kg on pea forage an as received basis, respectively, based on the cGAP of green peas from Belgium and dry peas from France.

Pea fodder (dry)

Field trials involving dry straw or haulms from dry peas were performed in the Netherlands, Denmark, Germany, UK, Southern France, Italy, and Spain. Pea fodder is harvested at the same time as the dry pea seeds.

Critical GAP for dry peas from France is 1 × 0.38 kg ai/ha and PHI 56 of days. Field trials performed in the UK, the Netherlands, Southern France (1 × 0.31–0.38 kg ai/ha, PHI 54–65 days) matched this GAP within 25%. Total fluazifop residue levels in pea straw were: 1.1, 1.2 and 6.1 mg/kg (n = 3) on an as received basis. On a dry-weight basis (DM = 88%), total fluazifop residue levels in pea straw/haulms were: 1.3, 1.4 and 6.9 mg/kg (n = 3). The Meeting considered three trials insufficient.

Soya bean forage (green)

Field trials involving soya bean forage were performed in Canada and in South Africa. Since the GAPs do not have grazing restrictions, soya bean forage can be harvested at any time after treatment.

Soya bean forage can be grazed. According to the FAO manual soya bean forage can be harvested when plants are 15–20 cm tall (sixth node) to beginning of pod formation (i.e., BBCH 16–69 or V6–R2).

Critical GAP for dry soya beans in Brazil is 1 × 0.25 kg ai/ha. Trials from Canada and South Africa (1 × 0.24–0.27 kg ai/ha) matched the GAP for Brazil within 25% of the dose rate. Total fluazifop residue levels in soya bean forage (BBCH 59–69 or V6–R2) were: 0.21, 0.53, 1.4, 1.6^{CDM}, 1.9 and 4.0 mg/kg (n = 6) on an as received basis The dry matter content of the sample with superscript CDM was 35%, confirming the default value for DM content in forage.

The Meeting estimated a median and highest residue of 1.5 mg/kg and 4.0 mg/kg, respectively, for green soya bean forage on as received basis.

Soya bean hay and straw

Field trials involving soya bean hay (as dried forage) were performed in Canada. Since the GAP does not have grazing restrictions, soya bean forage for hay can be harvested at any time after treatment. According to the FAO manual soya bean forage for hay is harvested from mid-to-full bloom and before bottom leaves begin to fall or when pods are approximately 50% developed (BBCH 65–75 or R2–R3)

Critical GAP for dry soya bean in Brazil is 1 × 0.25 kg ai/ha. Trials from Canada and South Africa (1 × 0.25–0.26 kg ai/ha) matched the GAP for Brazil within 25% of the dose rate. Total fluazifop residue levels in soya bean hay (BBCH 67–75) were: 0.072^{CDM}, 0.27, 0.28, 0.58 and 1.7^{CDM} mg/kg (n = 5) on an as received basis. Drying forage to hay is expected to lead to a content of about 88% DM (default for fodder). This is confirmed in some soya bean hay samples indicated with superscript [CDM]. Forage was left to dry to hay to a moisture content between 10–20%. On a dry-weight basis (DM = 88% or study specific value), fluazifop residue levels in soya bean hay 0.085, 0.31, 0.32, 0.66 and 2.1 mg/kg (n = 5).

The Meeting estimated a maximum residue level of 4 mg/kg (dry weight) for soya bean fodder based on the cGAP in Belgium. The Meeting estimated a median and highest residue of 0.32 kg and 2.1 mg/kg, (dry weight), respectively,

One field trial involving soya bean fodder was performed in South Africa (1991). Soya bean fodder is harvested at the same time as the dry soya bean seeds.

Critical GAP for dry soya beans in Brazil is 1 × 0.25 kg ai/ha and a PHI of 60 days. One trial from South Africa matched the cGAP for Brazil. Total fluazifop residues were: 0.23 mg/kg (n = 1). The Meeting considered one trial insufficient.

Alfalfa forage (green)

Field trials involving medic pasture were performed in South Africa. Medic pastures are the *Medicago* species, commonly known as medick of burclover. This family covers over 87 species. *Medicago sativa* (alfalfa) is the best known member, which grows to 1 metre in height. Most members are low, creeping herbs, resembling clover, but with burs (seed or dry fruit). The creeping members are often used as forage crops (e.g. ***M. lupulina*** and ***M. trunculata***). Only alfalfa (M. sativa) is in the Codex Classification.

Critical GAP from Belgium for clover and lucerne (also known as alfalfa) is 1 × 0.38 kg ai/ha with a PHI of 28 days. Trials from Saudi Arabia (1 × 0.25 kg ai/ha, PHI 28 days) could be matched to the Belgium GAP through proportionality. Total fluazifop residues were: 3.7 × 0.38/0.25, 5.1 × 0.38/0.25 and 5.3 × 0.38/0.25 mg/kg (n = 3), which becomes 5.6, 7.7 and 8.0 mg/kg (n = 3). The Meeting considered three trials insufficient.

Fodder beet

Trials from sugar beets can be used to derive maximum residue levels for fodder beet. As the Meeting estimated an STMR of 0.095 mg/kg and an HR of 0.32 mg/kg on an as received basis in roots of sugar beets, these STMR and HR values it was agreed to also apply these values to fodder beet.

Sugar beet/Fodder beet leaves or tops

Field trials involving sugar beet and fodder beet tops were performed in the United Kingdom, Denmark, Germany, Spain, Italy, France, Greece, Canada and the USA. Trials from fodder beets tops can be used to derive maximum residue levels for sugar beet tops and vice versa.

Critical GAP for sugar beets and fodder beets is the GAP from the UK with 1 × 0.38 kg ai/ha and a PHI of 56 days. Trials from Germany (1 × 0.37–0.43 kg ai/ha, PHI 47–56 days) matched this GAP within 25%. Total fluazifop residues in sugar beet tops were: 0.36, 0.37, 0.47, 0.83, 0.89^{BF}, 1.1 and 1.7 mg/kg (n = 7) on an as received basis, where BF indicates a banded foliar application.

The Meeting estimated a median and highest residue of 0.83 mg/kg and 1.7 mg/kg, respectively, on an as received basis.

Swede/Turnip leaves or tops

Field trials involving swede tops were performed in the UK. Field trials involving turnip tops were performed in the United Kingdom.

Critical GAP for swedes and turnips Belgium is 1 × 0.38 kg ai/ha and a PHI of 56 days.

Residue trials from the UK (1 × 0.38–0.42 kg ai/ha, PHI 56–70 days) on swede tops matched this cGAP within 25%. Total fluazifop residues in swede tops were: 0.75 and 0.98 mg/kg (n = 2) on an as received basis.

Trials from the UK (1 × 0.38 kg ai/ha, PHI 62–68 days) on turnip tops matched this cGAP within 25%. Total fluazifop residues in turnip tops were 1.3 and 1.6 mg/kg (n = 2) on an as received basis.

The Meeting considered the trials on swede tops and turnip tops mutually supportive and decided to combine the data. Total fluazifop residues were 0.75, 0.98, 1.3 and 1.6 mg/kg (n = 4).

The Meeting estimated a median and highest residue of 1.1 and 1.6 mg/kg, respectively, on an as received basis for swede and turnip tops for animal fodder only.

Kale forage

Field trials involving kale were performed under outdoor conditions in the UK.

Critical GAP for kale for animal fodder in the UK is one foliar application at 0.38 kg ai/ha with a PHI of 56 days. Trials from the UK (1 × 0.38 kg ai/ha, PHI 49–56 days) matched this GAP within 25%. Total fluazifop residues were: 0.10, 0.16, 0.22, 0.33, 0.97 and 0.97 mg/kg (n = 6) on an as received basis.

The authorised use in the UK for kale is for animal fodder. As animal forages are not traded, the Meeting decided not to propose a maximum residue level. The Meeting estimated a median residue of 0.275 mg/kg and a highest residue of 0.97 mg/kg on an as received basis for kale for animal fodder only.

Forage of oilseed rape

Field trials involving rape forage were performed in Germany. Canola (oilseed rape) can be grazed when the canopy height is 15–20 cm tall.

On the Dutch label it is stated that the growth of the weeds stops within 1–2 days, the weeds start dying within 1 week, and will be completed in 3–5 weeks. Immature crops used for forage will not be treated with pesticides unless they are expected to survive. After two weeks the success of application of the pesticide on crop survival will be evident. Therefore, the residue levels observed at a PHI of 14 days are used for estimation of maximum residue levels. Note that the Australian label (not submitted) includes a grazing restriction of 21 days.

Critical GAP for rape forage is from France with 1 × 0.38 kg ai/ha (leaving about 14 days for the pesticide to kill the weeds). Trials from Germany (1 × 0.38 kg ai/ha, PHI 12–18 days) matched this GAP within 25%. Total fluazifop residues were: 3.8, 4.6 and 10 mg/kg (n = 3) on an as received basis. The Meeting considered three trials insufficient.

Forage and fodder of grasses

Field trials involving grasses were performed in the Netherlands, Germany (red fescue) and the USA (fine fescue).

Critical GAP for grasses is the GAP from the Netherlands with 1 × 0.25 kg ai/ha and a PHI of 49 days. Only one trial from the Netherlands on grass forage (1 × 0.19 kg ai/ha, PHI 47 days, BBCH 47 at harvest) matched the GAP within 25%. Total fluazifop residues were: 0.09 mg/kg (n = 1) on as received basis. The Meeting considered one trial insufficient.

Two trials from Germany on grass hay (1 × 0.19 kg ai/ha, PHI 47–51, BBCH 89 at harvest) matched the GAP within 25%. Total fluazifop residues were: 0.50 and 0.94 mg/kg (n = 2) on as received basis. The Meeting considered two trials insufficient.

The Meeting did not estimate a maximum residue level, or a median and highest residue level for grasses (forage or hay).

Almond hulls

Field trials involving almond hulls were performed in the USA.

Critical GAP from France for almonds is one application at the base of the trees with 1 × 0.25 kg ai/ha and PHI of 21 days. None of the trials could be matched to the cGAP from France.

Cotton gin trash

Field trials involving cotton gin trash were performed in the USA. Cotton gin trash is harvested as a by-product at the same time as the harvest of the cotton seeds.

Critical GAP for cotton is the GAP from the USA with 2 × 0.42 kg ai/ha and a PHI of 90 days. Trials from the USA (2 × 0.41–0.43 kg ai/ha with PHI 88–97 days) matched this GAP within 25%. Total fluazifop residues in cotton gin trash were: 0.018, 0.043, 0.080, 0.16, 0.57 and 0.63 mg/kg (n = 6) on as received basis.

The Meeting estimated a median and highest residue level of 0.12 mg/kg and 0.63 mg/kg, respectively for dry cotton fodder (gin trash), based on the USA GAP.

Rotational crops

The meeting received two field rotational crop studies to investigate the actual uptake of residues from soil.

In the first field rotational crop study at four different locations in the USA fluazifop-butyl (RS) was applied onto a fallow plot at a single application of 1.1 kg ai/ha. Various rotational crops were planted at 15, 30, 60, 90 and120 days after soil treatment. Soil samples were not analysed.

No residues above the LOQ (0.02 or 0.05 mg/kg) of total fluazifop were found in any of the crop commodities at any of the plant back intervals. CF3-pyridone was not analysed.

In the second field rotational crop study at two different locations in the UK, fluazifop-P-butyl was applied onto bare soil or to oilseed rape plants at a single application of 0.38 or 0.48 kg ai/ha. Rotational crops (lettuce, wheat and carrots) were sown 1, 2, 4 or 6 months after application.

No residues above the LOQ (0.01 or 0.05 mg/kg) of total fluazifop were found in any of the crop commodities at any of the plant back intervals. CF3-pyridone was only found in carrot tops at levels < 0.01–0.13 mg/kg (at all plant back intervals) and in wheat forage at < 0.01–0.02 mg/kg wheat forage at the 4-month plant back interval.

The Meeting concluded that CF3-pyridone is the only residue that is taken up from the soil under field conditions. The Meeting concluded that it was not necessary to estimate maximum residue levels for total fluazifop in rotational crops.

CF3-pyridone is a relevant metabolite for dietary risk assessment. The dose rates as used in the field rotational crop studies (1 × 0.38 kg ai/ha or 1 × 0.48 kg ai/ha) are equal to or higher than the maximum seasonal rate listed in the GAP information for field crops (0.19–0.38 kg ai/ha) in the EU and Brazil, but they are lower than the maximum seasonal rate listed in the GAP information for field crops (0.42–0.84 kg ai/ha) or fruiting vegetables (0.84 kg ai/ha) in the USA. Therefore, dose rates as used in the available field rotational crop studies are too low to estimate CF3-pyridone levels in rotational crops. In addition, proportionality cannot be used to correct the CF3-pyridone levels found in the crop commodities, since many of the residue levels are below the LOQ. A field rotational crop study at the maximum seasonal rate for the USA, where CF3-pyridone is quantified in rotational crops is desirable.

Fate of residues during processing

Studies on the fate of residues under conditions simulation boiling, pasteurisation or sterilisation were not conducted.

Hydrolysis studies at ambient temperatures indicated that fluazifop-P-butyl was stable at pH 5 but degraded at pH 7 (DT_{50} = 78 days) and pH 9 (DT_{50} = 29 hrs). The only degradation product was fluazifop acid. Hydrolysis studies at ambient temperature indicated that the fluazifop acid is stable at pH 5, 7 and 9.

Stability of fluazifop acid was investigated under various hydrolysis conditions. Fluazifop acid is stable after 1–3 hr reflux in 0.1 M HCl or 0.1 M NaOH, which reflect more stringent conditions than normally met during cooking, pasteurisation or sterilisation.

Processing studies were undertaken for oranges, apples, cherries, plums, grapes, cauliflower, Brussels sprouts, Savoy head cabbage, kale, green pea seeds, dry harvested peas, dry harvested soya beans, potatoes, sugar beets, asparagus, cotton seed, oilseed rape seed, sunflower seed and coffee beans. Acceptable processing factors based on total fluazifop are listed in the table below. Using the $STMR_{RAC}$ values obtained from fluazifop-butyl use, the Meeting estimated STMR-Ps for processed commodities for use in the livestock dietary burden calculations and/or dietary intake calculations.

The Meeting decided to extrapolate processing factors derived from oranges to the whole group of citrus fruits,

No processing factors could be derived for commodities where the residue in the RAC was below the LOQ (apples, cherries, plums, grapes, cauliflower, Savoy head cabbage and coffee beans). Dried plums (prunes), dried grapes (raisins), roasted coffee beans and freeze-dried coffee powder had residues below the LOQ.

No processing factors could be derived for dry harvested peas, because total fluazifop residues increased after steeping and cooking, which indicates that the original RAC sample was not soaked sufficiently long before extraction and hydrolysis to release all fluazifop conjugates. Soaking is therefore a critical parameter for the analysis of pulses.

No processing factors could be derived for several soya bean oils, cottonseed oil and rape seed oil, because the hydrolysis step used in the analytical method was not radio-validated.

Commodity	Processing factors (PF) Residue: total fluazifop	PF	STMR-P (mg/kg)	HR-P (mg/kg)	Median-P residue (mg/kg)	Highest-P residue (mg/kg)
Oranges			Citrus fruit			
–orange juice	< 0.7	< 0.7 (n = 1)	= 0.011*0.7 = 0.0077	–	–	–
–orange oil	5.0	5.0 (n = 1)	= 0.011*5.0 = 0.055	–	= 0.01*5.0 = 0.05	–
–dried pulp	6.0	6.0 (n = 1)	–	–	= 0.01*6.0 = 0.06	–
Green pea seeds						
–cooked green peas	0.83, 0.86, 0.94	0.86 (median, n = 3)	0.42 × 0.86 = 0.36	8.1 × 0.86 = 7.0	–	–
–canned green peas	0.58, 0.71, 0.81	0.71 (median, n = 3)	0.42 × 0.71 = 0.30	8.1 × 0.71 = 5.8	–	–
Dry harvested soya bean seeds	–					
–soya bean hulls	0.22, 0.37, 0.38, 0.51, 0.52, 0.65, 0.70	0.51 (median, n = 7)	–	–	2.8 × 0.51 = 1.4	–
–soya bean oil, crude	0.83	0.83 (n = 1)	2.9 × 0.83 = 2.4			–
–soya bean oil extracted meal	0.94, 0.98, 1.1, 1.2, 1.2, 1.3. 1.4	1.2 (median, n = 7)	–	–	2.8 ×1.2 = 3.4	–
–soya bean flour	0.80, 1.1, 1.1, 1.1, 1.1, 1.2	1.1 (median, n = 6)	2.9 × 1.1 = 3.2			–
–soya bean milk	0.090, 0.14, 0.18, 0.21	0.16 (median, n = 4)	2.9 × 0.16 = 0.46			–
Potatoes						
–raw potato peels	0.28, 0.34, 0.53, 0.64, 0.92	0.53 (median, n = 5)	–	–	0.05 × 0.53 = 0.026	0.44 × 0.53 = 0.23
–raw potato flesh	1.0, 1.1, 1.1, 1.1, 1.1	1.1 (median, n = 5)	0.10 × 1.1 = 0.11	1.0 × 1.1 = 1.1		
–cooked potato without peel	0.79, 0.80	0.80 (mean, n = 2)	0.10 × 0.80 = 0.080	1.0 × 0.80 = 0.80		
Sugar beet roots						
–sugar beet sugar (refined)	0.043, 0.36	0.36 (best estimate)	0.19 × 0.36 = 0.068			–
–sugar beet molasses	14	14 (n = 1)			0.095 × 14 = 1.33	–
–sugar beet dry pulp	40	40 (n = 1)			0.095 × 40 = 3.8	–
–sugar beet wet pulp (pressed pulp)	0.087	0.087 (n = 1)			0.095 × 0.087 = 0.0083	–
Sunflower seed						
–oil extracted	3.1	3.1 (n = 1)			0.29 × 3.1 = 0.90	–

Commodity	Processing factors (PF) Residue: total fluazifop	PF	STMR-P (mg/kg)	HR-P (mg/kg)	Median-P residue (mg/kg)	Highest-P residue (mg/kg)
meal (cold press)						
–hulls	0.14	0.14 (n = 1)			0.29 × 0.14 = 0.041	–
–sunflower refined oil	< 0.03	< 0.03 (n = 1)	0.30 × 0.03 = 0.0090			–

NR = no recommendation

PF based on total fluazifop only

Median-P and highest-P residues based on total fluazifop only, are used for dietary burden calculations and maximum residue level estimation)

STMR-P and HR-P are used for the long-term and short-term dietary exposure estimates and are based on the residue definition for dietary risk assessment.

Total fluazifop was shown to concentrate in orange oil (PF = 5.0, n = 1), orange dried pulp (PF = 6.0, n = 1), sugar beet molasses (PF = 14, n = 1), sugar beet dry pulp (PF = 40, n = 1) and oil extracted meal from sunflower seed (PF = 3.1, n = 1). Oil extracted meal from sunflower seed is not a commodity in trade.

The Meeting estimated a maximum residue level of 0.01 × 5 = 0.05* mg/kg for orange oil, 0.01 × 6 = 0.06* mg/kg for orange dried pulp, 0.5 × 14 = 7 mg/kg for sugar beet molasses, 0.5 × 40 = 20 mg/kg for sugar beet dry pulp. A dry matter conversion was not considered necessary.

Livestock dietary burden

The Meeting estimated the dietary burden of fluazifop-P-butyl in livestock on the basis of diets listed in the OECD Feed table 2009. Calculation from highest residue, and median-P values (some bulk commodities) provide the levels in feed suitable for estimating maximum and highest residue levels, while calculation from median and median-P values for feed is suitable for estimating STMR values for animal commodities.

The dietary burden calculation of fluazifop for beef cattle, dairy cattle, broilers and laying poultry are provided in Annex 6. The calculations were made according to the livestock diets from US/CAN, EU, Australia and Japan in the OECD Feed Table 2009.

Some processed and forage commodities do not appear in the Recommendations Table (because no maximum residue level is needed) but they are used in estimating livestock dietary burdens. Those commodities are listed below.

Codex classification	Commodity	Median residue (-P) (mg/kg)	Highest residue (-P) (mg/kg)
AB 0660	Almond hulls	NR	
AB 0226	Apple pomace, dry (no suitable PF available; 0.05 (highest loqs) used)	0.05	–
VD 0071	Beans (pulses)	2.3	–
AL 1030	Bean forage (green)	1.55	2.3
AL 0061	Bean fodder	0.43 (dw)	3.5 (dw)
VB 0041	Cabbages, head	0.155	1.7
no code	Carrot, culls (root values are used)	0.09	0.29
AB 0001	Citrus pulp (0.01* × PF 6)	0.06	–
AB1203	Cotton meal (no reliable PF, 0.05 used)	0.05	–
SO 0691	Cotton undelinted seed (no reliable PF, 0.05 used)	0.05	–
AB 0691	Cotton hulls (no reliable PF, 0.05 used)	0.05	–

Codex classification	Commodity	Median residue (-P) (mg/kg)	Highest residue (-P) (mg/kg)
AM 0691	Cotton gin by products (cotton gin trash) = fodder	0.12	0.63
VD 0561	Field pea (dry)	0.38	
AB 0269	Grape pomace, dry (no reliable PF, 0.01* used)	0.01	0.01
AV 0480	Kale, as animal fodder	0.275	0.97
AL 0528	Pea, vines (green) = forage	0.92	2.3
AL 0072	Pea, hay or fodder	NR	NR
VR 0589	Potato, culls (tuber values are used)	0.05	0.44
no code	Potato dried pulp (STMR 0.05 × PF 4.4 = 0.22, PF assumed based on dry matter in dried pulp and whole potato (88/20 = 4.4)	0.22	
no code	Potato process waste (0.05 × PF 0.53 = 0.277; wet peel values are used)	0.0277	
AV 0495	Rape greens (rape forage is considered here)	NR	NR
no code	Rape seed meal	NR	
AL 1265	Soya bean, forage (green)	1.5	4.0
AL 0541	Soya bean hay	0.32 (dw)	2.1 (dw)
VD0541	Soya bean (dry)	2.8	–
no code	Soya bean, aspirated grain fractions (soya bean values used)	2.8	–
AB 1265	Soya bean, meal (2.8 × PF 1.2 = 4.7, values for oil extracted meal used)	3.4	–
AB 0541	Soya bean, hulls (2.8 × PF 0.51 = 1.4)	1.4	–
no code	Soya bean okara (pulp or tofu, fibrous part of the bean, data for oil extracted meal used)	3.4	–
DM 0659	Sugar cane, molasses (no PF 0.01* used)	0.01	–
no code	Sugar cane, bagasse (no PF 0.01* used)	0.01	–
no code	Sugar cane tops (sugar cane values used)	0.01	
no code	Sugar beet, mangel* (values of tops used)	0.83	1.7
AV 0596	Sugar beet tops	0.83	1.7
AB 0596 (dry)	Sugar beet, pulp, dry (0.095 × 40)	3.8	
AB 1201 (wet)	Sugar beet, ensilaged pulp (v residue for sugar beet root is used)	0.095	–
DM 0596	Sugar beet, molasses (0.095 × PF 14 = 1.33)	1.33	
no code	Sunflower meal (0.29 × PF 3.1 = 0.90)	0.90	
VR0497	Swede, roots	0.645	2.0
VW 0448 (paste)	Tomato, pomace, wet (no processing data, residue for tomato used)	0.05	–
VR 0506	Turnip, roots	0.645	2.0
AV 0506	Turnip, leaves or tops	1.1	1.6

		Livestock dietary burden for fluazifop-P-butyl (based on total fluazifop, expressed as fluazifop acid), ppm of dry matter diet			
		US/CAN	EU	Australia	Japan
Max	beef cattle	1.92	13.8 [A]	9.66	8.94
	dairy cattle	5.90	10.3 [C]	8.97	6.55
	poultry—broiler	1.00	4.03	2.79	1.28
	poultry—layer	1.00	4.76 [E]	2.79	1.10
Mean	beef cattle	1.28	6.63	4.40	8.94 [B]
	dairy cattle	3.41	6.13	4.42	6.55 [D]
	poultry—broiler	1.00	2.68	2.79	1.28
	poultry—layer	1.00	3.05 [F]	2.79	1.10

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

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

[C] Highest maximum dairy cattle dietary burden suitable for maximum residue level estimates for milk.

[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 meat and eggs.

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

Residues in animal commodities

The Meeting received a lactating dairy cow feeding study, which provided information on likely residue resulting in animal tissues and milk from fluazifop-butyl residues in animal diets.

Fifteen lactating Friesian cows were fed a basal diet or a diet containing fluazifop-butyl (RS) at nominal levels of 0.2, 0.8, 3.0 and 12.0 ppm dry feed, twice daily, for 29 consecutive days, corresponding to 0.17, 0.68, 2.55 and 10.2 ppm fluazifop acid.

Parent fluazifop-butyl was not found (< 0.01 mg/L fluazifop acid eq) in individual and bulk samples of milk at any of the feeding levels. Free fluazifop acid was found at levels of 0.01 mg/L in 4 out of 14 bulk milk samples at the 12 ppm feeding level, while the individual milk samples showed no residues (< 0.01 mg/L). Lipophilic fluazifop conjugates reached mean plateau levels of 0.042 and 0.15 mg/L fluazifop acid eq within three days at the 3 and 12 ppm fluazifop-butyl feeding levels, respectively, corresponding to 2.55 and 10.2 ppm fluazifop acid in dry feed, respectively.

Lipophilic fluazifop conjugates were not found (< 0.02 mg/kg fluazifop acid eq) in the tissue samples at any of the feeding levels. Polar fluazifop related residues (fluazifop-butyl, fluazifop acid and polar fluazifop conjugates) were only found in the highest dose group with maxima of 0.13, 0.03, 0.03 and 0.06 mg/kg total fluazifop in kidney, liver, cardiac muscle or peritoneal fat, respectively. Residues in fat represent total fluazifop residues with unknown composition. The results further indicate that the total fluazifop residues do not accumulate and rapidly decline after the application of the fluazifop-butyl containing diet has stopped.

Laying hens were fed with a basal diet or with a diet containing fluazifop-butyl (RS), once daily, for 28 days. The actual amounts of fluazifop-butyl in the feed of the four groups were 0, 0.4, 2.5 and 10.3 ppm dry feed, corresponding to 0, 0.32, 2.1 and 8.8 ppm fluazifop acid in dry feed, respectively.

Residue levels in eggs were only measurable in eggs from hens treated with the highest dose at 10.3 ppm fluazifop-butyl and the plateau level reached was 0.04 mg/kg total fluazifop at Day 7. After separation of yolk and albumen, residues were detected only in the yolk (maximum of 0.11 mg/kg total fluazifop). The mixed tissues (muscle, fat and skin) and the liver samples of hens treated with the highest dose of 10.3 ppm contained total fluazifop residues in the range of 0.01–0.04 mg/kg and 0.03–0.13 mg/kg, respectively. Total fluazifop residues declined rapidly when the birds returned to an untreated diet.

Animal commodities maximum residue levels

The animal feeding studies were performed using fluazifop-butyl, but for the estimation of the maximum residue levels in animal commodities, the feeding levels are expressed in ppm fluazifop acid dry feed.

Mammals

For maximum residue level estimation, the high residues in the tissues were calculated by extrapolating the maximum dietary burden (13.8 ppm) from the relevant feeding level (10.2 ppm fluazifop acid eq) from the dairy cow feeding study and using the highest tissue concentration from the individual animal within this feeding group.

The STMR values for the tissues would usually be calculated by interpolating the mean dietary burden (8.95 ppm) between the relevant feeding levels (2.55 and 10.2 ppm fluazifop acid eq) from the dairy cow feeding study and using the mean tissue concentrations from those feeding groups. Because residue levels at 2.55 ppm fluazifop acid eq are below LOQ, the dietary level of 0 ppm was used to establish the linear relationship, rather than the 2.55 ppm level.

For whole milk maximum residue level estimation, the high residues in the milk were calculated by extrapolating the maximum dietary burden (10.3 ppm) from the relevant feeding level (10.2 ppm fluazifop acid eq) from the dairy cow feeding study and using the highest mean milk concentration from this feeding group.

The STMR value for whole milk was calculated by interpolating the calculated mean dietary burden (6.55 ppm) between the relevant feeding levels (2.55 and 10.2 ppm fluazifop acid eq) from the dairy cow feeding study and using the mean milk concentration from those feeding groups (0.042 mg/L and 0.16 mg/L).

Dietary burden (ppm total fluazifop)	Total fluazifop (mg/kg)				
Feeding level [ppm, fluazifop acid eq]	Milk	Muscle	Liver	Kidney	Fat
Maximum residue level					
	Mean	Highest	Highest	Highest	Highest
Beef cattle (13.8) [0, 10.2]	–	0.027 [0, 0.02]	0.041 [0, 0.03]	0.18 [0, 0.13]	0.081 [0, 0.06]
Dairy cattle (10.3) [2.55, 10.2]	0.19 [0.07, 0.19 mg/L]	–	–	–	–
STMR					
	Mean	Mean	Mean	Mean	Mean
Beef cattle (8.94) [0, 10.2]	–	0.018 [0, 0.02]	0.026 [0, 0.03]	0.088 [0, 0.10]	0.048 [0, 0.055]
Dairy cattle (6.55) [2.55, 10.2]	0.10 [0.042, 0.16 mg/L]	–	–	–	–

The data from the cattle feeding studies were used to support the estimation of maximum residue levels for mammalian meat and whole milk.

Residues in whole milk were estimated as 0.19 and 0.10 mg/kg, resulting from the maximum (10.3 ppm) and mean (6.55 ppm) dietary burdens, respectively.

The Meeting estimated a maximum residue level for total fluazifop in whole milk of 0.2 mg/kg. The Meeting also estimated an STMR for whole milk of 0.10 mg/kg.

Based on the mean (8.95 ppm) dietary burden, median residues were estimated as 0.018, 0.026, 0.088 and 0.048 mg/kg, respectively for mammalian muscle, liver, kidney and fat. Resulting from the maximum (13.8 ppm) dietary burden, highest residues in tissues were estimated as 0.027, 0.041, 0.18 and 0.081 mg/kg for mammalian muscle, liver, kidney and fat, respectively.

Since the residue is fat soluble, the maximum residue level for meat is based on residues in fat tissues. The Meeting estimated a maximum residue level for total fluazifop in mammalian meat, edible offal and fat of 0.09, 0.2 and 0.09 mg/kg, respectively. The Meeting estimated an STMR of 0.024 (= 0.8 × 0.018 + 0.2 × 0.048), 0.088 and 0.048 mg/kg and an HR of 0.038 (= 0.8 × 0.027 + 0.2 × 0.081), 0.18 and 0.081 mg/kg in mammalian meat, edible offal and fat, respectively.

Poultry

The fluazifop-P-butyl maximum dietary burden for poultry is 4.76 mg/kg and the mean dietary burden is 3.05 ppm.

For maximum residue level estimation in eggs, the high residues in eggs were calculated by interpolating the maximum dietary burden (4.76 ppm) between the relevant feeding levels (2.1 and 8.8 ppm) from the poultry study and using the highest residue concentrations in eggs from those feeding groups. Because residue levels at 2.1 ppm and 8.8 ppm feeding levels are below LOQ or near the LOQ of the method, the dietary level of 0 ppm was used to establish the linear relationship, rather than the 2.1 ppm level.

The STMR value for eggs was calculated by interpolating the STMR dietary burden (3.05 ppm) between the relevant feeding levels (2.1 and 8.8 ppm) from the poultry study and using the mean egg concentrations from those feeding groups. Because residue levels at 2.1 ppm and 8.8 ppm feeding levels are below LOQ or near the LOQ of the method, the dietary level of 0 ppm was used to establish the linear relationship, rather than the 2.1 ppm level.

For maximum residue level estimation in tissues, the high residues in mixed and liver poultry tissues were calculated by interpolating the maximum dietary burden (4.76 ppm) between the relevant feeding levels (2.1 and 8.8 ppm) from the poultry study and using the highest residue concentrations in tissues from those feeding groups.

The STMR value for poultry tissues was calculated by interpolating the STMR dietary burden (3.05 ppm) between the relevant feeding levels (2.1 and 8.8 ppm) from the poultry study and using the mean tissue concentrations from those feeding groups.

Dietary burden (ppm total fluazifop)	Total fluazifop residues		
Feeding level [ppm, fluazifop acid eq]	Eggs	Mixed tissues Of fat and muscle	Liver
Maximum residue level	Highest	Highest	Highest
Poultry (4.76) [0, 8.8] [2.1, 8.8]	 0.027 [0, 0.05]	 0.025 [0.015, 0.04]	 0.082 [0.05, 0.13]
STMR	Mean	Mean	Mean
Poultry (3.05) [0, 8.8] [2.1, 8.8]	 0.014 [0, 0.04]	 0.016 [0.015, 0.020]	 0.054 [0.05, 0.075]

The data from the poultry study were used to support the estimation of maximum residue levels for poultry meat and eggs.

Residues in whole eggs were estimated as 0.027 and 0.014 mg/kg, resulting from the maximum (4.76 ppm) and mean (3.05 ppm) dietary burden respectively.

The Meeting estimated a maximum residue level in eggs of 0.03 mg/kg total fluazifop. The Meeting also estimated an STMR and HR of 0.014 and 0.027 mg/kg, respectively for poultry eggs.

Total fluazifop residues estimated from the mean dietary burden (3.05 ppm) were 0.016 and 0.054 mg/kg, respectively for mixed tissues (of fat and muscle) and liver. Total fluazifop residues in mixed tissues and liver were estimated as 0.025 and 0.082 mg/kg, respectively resulting from the maximum (4.76 ppm) dietary burden.

Since the residue is fat soluble, the maximum residue level for meat is based on residues in fat tissues. The Meeting estimated a maximum residue level for poultry meat, edible offal, and fat of 0.03, 0.09, and 0.03 mg/kg, respectively. The meeting estimated an STMR of 0.016, 0.054 and 0.016 mg/kg and an HR of 0.025, 0.082 and 0.025 mg/kg, respectively, for poultry meat, edible offal and fat tissue.

RECOMMENDATIONS

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

The Meeting recommended the following residue definition for fluazifop-P-butyl:

Definition of the residue for compliance with the MRL in plant commodities: *total fluazifop, defined as the sum of fluazifop-P-butyl, fluazifop-P-acid (II) and their conjugates, expressed as fluazifop-P-acid.*

Definition of the residue for dietary risk assessment in plant commodities: *the sum of fluazifop-P-butyl, fluazifop-P-acid (II), 2-[4-(3-hydroxy-5-trifluoromethyl-2-phenoxy)pyridyloxy] propionic acid (XL), 5-trifluoromethyl-2-pyridone (X) and their conjugates, expressed as fluazifop-P-acid.*

Definition of the residue for compliance with the MRL and for dietary risk assessment in animal commodities: *total fluazifop, defined as the sum of fluazifop-P-butyl, fluazifop-P-acid (II) and their conjugates, expressed as fluazifop-P-acid*.

The residue is fat soluble.

FURTHER WORK OR INFORMATION

Desirable:

- A field rotational crop study at the maximum seasonal rate according to cGAP in the USA, where CF3-pyridone is quantified in rotational crops
- Supervised residue trials where hydroxyfluazifop acid (XL) is quantified using validated analytical methods.

DIETARY RISK ASSESSMENT

Long-term dietary exposure

The International Estimated Daily Intakes (IEDI) for fluazifop-P-butyl were calculated from recommendations for STMRs for raw and processed commodities in combination with consumption data for corresponding food commodities. The results are shown in Annex 3.

The IEDIs of the 17 GEMS/Food cluster diets, based on the estimated STMRs represented 40–160% of the maximum ADI of 0.004 mg/kg bw, expressed as fluazifop acid. The estimate of acceptable daily intake applies to fluazifop-P-butyl and its metabolites fluazifop acid (II), despyridinyl acid (III), CF3-pyridone (X) and hydroxyfluazifop acid (XL). An exceedance was found for GEMS/Food cluster diet G16 (160%).

The Meeting concluded that the long-term dietary exposure to residues of fluazifop-P-butyl from uses considered by the Meeting may present a public health concern.

Short-term dietary exposure

The International Estimated Short Term Intake (IESTI) for fluazifop-p-butyl was calculated from recommendations for STMRs/HRs for raw and processed commodities in combination with consumption data for corresponding food commodities. The results are shown in Annex 4.

For fluazifop-P-butyl the IESTI represented 40% of the ARfD (0.4 mg/kg bw, expressed as fluazifop acid). The ARfD applies to fluazifop-P-butyl and its metabolites fluazifop acid (II), despyridinyl acid (III), CF3-pyridone (X) and hydroxyfluazifop acid (XL).

On the basis of the information provided, the Meeting concluded that the short-term dietary exposure to residues of fluazifop-P-butyl, from uses considered by the Meeting, is unlikely to present a public health concern.