5.22 SPIROTETRAMAT (234)

TOXICOLOGY

Spirotetramat is the ISO approved name for *cis*-4-(ethoxycarbonyloxy)-8-methoxy-3-(2,5-xylyl)-1-azaspiro[4,5]dec-3-en-2-one (IUPAC). The CAS No. is 203313-25-1. Spirotetramat belongs to the chemical class of ketoenols, subclass tetramic acid derivatives, intended for use as an insecticide on a range of agricultural crops. The pesticidal mechanism of action is disruption of lipogenesis as a result of inhibition of acetyl CoA carboxylase.

The JMPR has not previously evaluated spirotetramat. Spirotetramat was reviewed by the present Meeting at the request of CCPR under the new compounds review programme.

The batches of spirotetramat used in studies of toxicity had a variable impurity profile. Some impurities were absent in the material used in long-term studies of toxicity and studies of genotoxicity, or were present at a low concentration. However, the results of studies with impurities indicated that this is not a critical issue in the toxicological evaluation. All critical studies complied with GLP.

Biochemical aspects

After oral administration at a dose of 2 or 100 mg/kg bw, spirotetramat was rapidly absorbed in rats. The extent of absorption in the single low-dose test was 95%. The maximum plasma concentration of radiolabel was reached 0.1–2.0 h after dosing. Concentrations of radiolabel in tissues and organs at 48 h were very low (< 0.2%). Excretion was mainly urinary and was very rapid (essentially complete within 24 h). Faecal excretion accounted for 2–11% of the administered dose in rats. No parent compound was detected in the excreta. Only very minor metabolites (< 0.7% of the administered dose) were not identified. The main metabolic reaction was cleavage of the ester group, producing the enol that is subsequently metabolized to a range of metabolites.

In male rats given a high dose of spirotetramat at 1000 mg/kg bw, it was found that only 27% of the administered dose was excreted in the urine after 24 h. In addition, concentrations of radiolabel in the plasma were slightly higher than in the liver and kidney, and the decline in concentrations of radiolabel found in the tissues was minimal from 1 h to 8 h after dosing, with considerable quantities still remaining at 24 h (approximately 25%). These findings were consistent with saturation of cellular transport mechanisms, which may result in decreased excretion via urine and faeces and a potential for the accumulation of spirotetramat metabolites in the body after repeated high doses. The results of physiologically based pharmacokinetic simulations supported this conclusion and suggested that repeated daily doses of spirotetramat at > 500 mg/kg bw lead to non-linear elimination kinetics, resulting in a higher-than-expected body burden in studies with repeated doses, despite some evidence of reduced absorption at such high doses.

In a comparative study of metabolism in vitro in hepatocytes from male rats, mice, and humans, differences in the proportions of several metabolites were observed; however, BYI 08330-enol was the first and most prominent metabolite detected and accounted for 66% and 100% of all metabolites in these studies, in mice and rats respectively. The relative efficiency of enol glucuronidation in isolated hepatocytes was: mouse > human > rat.

Toxicological data

Spirotetramat has low acute toxicity: oral and dermal LD_{50}s in rats were > 2000 mg/kg bw; the inhalation LC_{50} was > 4.18 mg/L of air. Spirotetramat is not a skin irritant in rabbits, although it is an irritant to rabbit eyes. Spirotetramat exhibited a skin sensitization potential in guinea-pigs (Magnussen & Kligman test) and mice (local lymph node assay).

In general, there were no target organs or effects that were common to all species. However, it should be noted that there were indications of immune-related effects in several species.

Mice appeared to be insensitive to toxicity caused by spirotetramat. In repeat-dose studies, mice given diets containing spirotetramat at the highest dose of 5000 ppm (equal to 1415 mg/kg bw per day), 7000 ppm (equal to 1305 mg/kg bw per day) or 7000 ppm (equal to 1022 mg/kg bw per day) for 4 weeks, 14 weeks or 18 months, respectively, showed no toxicological effects.

In a 14-week dietary study of toxicity in rats, the NOAEL was 2500 ppm (equal to 148 mg/kg bw) on the basis of decreased body-weight gain, an increased incidence of abnormal spermatozoa and hypospermia, an increased incidence of tubular degeneration, decreased absolute testicular weight, and accumulation of alveolar macrophages in the lungs of rats at 10 000 ppm (equal to 616 mg/kg bw per day). However these effects were reversible within 4 weeks in most rats after cessation of treatment. In the 1-year dietary study in rats, the NOAEL was 250 ppm (equal to 13.2 mg/kg bw per day) on the basis of an increased incidence of accumulation of alveolar macrophages in the lungs of males at 3500 ppm (equal to 189 mg/kg bw per day). Effects on body weight, and testes and sperm were observed at 7500 ppm.

The thymus and the thyroid were the main target organs in dogs. Reduced weight accompanied with histological evidence of involution and atrophy of the thymus were observed at 6400 ppm in the 4-week dose range-finding study, at 4000/2500 ppm in the 13-week study, and at 600 and 1800 ppm in the 1-year study. Although there was no clear dose–response relationship in the 1-year study, these findings were considered toxicologically significant because they occurred in all studies and because there were other indications that spirotetramat interferes with the immune system (skin sensitization, effect on lungs in rats, and allergic contact dermatitis in humans). Decreases in T4 and T3 concentrations were also observed, with an overall NOAEL of 600 ppm. Changes at this dose were inconsistent. Reduced body weight and haematological effects were observed at higher doses.

The occasional brain ventricular dilatation observed at 600 ppm (one male and one female) and at 1800 ppm (one male) in the 1-year study was not accompanied by any clear histopathological alterations. In addition, brain ventricular dilatation is occasionally reported to occur spontaneously in the strain of dogs used in the test. Consequently, the Meeting considered that this finding was of uncertain toxicological significance.

The Meeting concluded that the NOAEL in the 1-year study in dogs was 200 ppm, equal to 5 mg/kg bw per day, on the basis of effects on the thymus. This NOAEL is also protective for the equivocal findings of changes in thyroid hormones, and the brain ventricular dilatation of uncertain significance seen at 600 ppm.

Spirotetramat was tested in an extensive range of studies of genotoxicity. Negative results were found in studies in vivo and in vitro, except for one weakly and equivocally positive result in a study for chromosomal aberrations in vitro that was not reproduced in a second study using higher concentrations. The Meeting concluded that spirotetramat was unlikely to be genotoxic.

The carcinogenic potential of spirotetramat was studied in mice and rats. Spirotetramat was not found to be carcinogenic in either species. In rats, the NOAEL was 250 ppm, equal to 12.5 mg/kg bw per day, on the basis of structural changes in the kidney (renal tubular dilatation) at 3500 ppm. In this study, effects on the lungs were characterized by an increased incidence of accumulation of alveolar macrophages and of interstitial pneumonia at 7500 ppm and inconsistently at lower doses. These changes were of uncertain significance, possibly being indicative of effects of spirotetramat on the immune system. Effects on body-weight gain, the testes, epididymis and bile duct were also observed at 7500 ppm.

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

Further support for findings of testicular effects in rats given spirotetramat at a high dose was provided by the results of a dose range-finding one-generation study and a two-generation study of

reproductive toxicity. In the one-generation dietary study of reproductive toxicity in rats, severe toxicity was observed in sperm (motility and malformation) of parental males at 10 000 ppm (equal to 538 mg/kg bw per day), resulting in no pregnancies with a NOAEL of 6000 ppm (equal to 320 mg/kg bw per day). However, minimal effects on sperm parameters were observed in the F_1 generation at 6000 ppm (equivalent to 400 mg/kg bw per day in parents) with a NOAEL of 500 ppm (equal to 27.8 mg/kg bw per day in parents). At this dose, a significant (–14%) decline in pup weight gain, possibly secondary to decreases in maternal body weight was observed. In the two-generation study of reproductive toxicity, abnormal sperm cells were reported in the F_1 generation, but not in parental male rats at 6000 ppm (equal to 487 mg/kg bw per day) and decreased reproductive performance was also observed in one of these males. Offspring toxicity also included decreased body weight in F_1 and F_2 pups in both sexes during lactation at 6000 ppm (equal to 419 mg/kg, bw per day). Effects observed in parental generation were reduction of body weight and/or body-weight gain, reduced terminal body weight, reduced food consumption (females) and increased multifocal tubular dilatation in the kidneys in rats at 6000 ppm. The NOAEL for parental toxicity was 1000ppm (equal to 70.7 mg/kg bw per day) on the basis of decreases in body-weight gain in the parental generation. The NOAEL for reproductive toxicity was 1000 ppm (equal to 79.5 mg/kg bw in F_1 males) on the basis of abnormal sperm-cell morphology in the F_1 generation. The NOAEL for offspring toxicity was 1000 ppm on the basis of growth retardation at 6000 ppm.

Two studies of developmental toxicity in rats treated by gavage had been performed. Inconsistent and equivocal effects on the offspring, including retarded ossification and increased wavy ribs, were observed in one study at doses of 140 and 20 mg/kg bw per day. Maternal effects consisting mainly of reduced body-weight gain were observed at 1000 mg/kg bw per day and were associated with reduced offspring weight, reduced fetal weight, retarded ossification and a slight increase in the frequency of fetuses with any malformations. The overall NOAEL for maternal toxicity was 140 mg/kg bw per day and the overall NOAEL for developmental toxicity was 140 mg/kg bw per day.

In a study of developmental toxicity in rabbits treated by gavage, severe maternal toxicity was observed, including death and abortion, at 160 mg/kg bw per day. No effects were observed at 40 mg/kg bw per day, except one abortion, which was considered to be incidental. No significant effects were observed in the offspring and the NOAEL was 160 mg/kg bw per day, the highest dose tested. The NOAEL for maternal toxicity was 40 mg/kg bw per day.

The effect on sperm, testes and epididymis were studied in more detail in rats given spirotetramat at a dose of 1000 mg/kg bw per day. It was observed that the decreased epididymal sperm counts occurred after 21 days and not after 10 days of treatment. In another study in rats given the enol metabolite, testicular/sperm toxicity similar to that caused by spirotetramat was observed. Thus these effects are unlikely to be due to the presence of the acyl chain of this compound.

The Meeting concluded that spirotetramat causes toxicity in the testes and sperm that, at higher doses, affects reproductive performance in rats. The NOAEL for testes and sperm effects was 169 mg/kg bw per day, with a LOAEL of 370 mg/kg bw per day in a 2-year study in adult rats, and a NOAEL of 79.5 mg/kg bw per day and a marginal LOAEL of 400 mg/kg bw per day in young rats, respectively. The Meeting observed that these effects occurred at dose higher than those causing other types of systemic toxicity, on which the ADI and ARfD were based.

Two studies of acute oral neurotoxicity in rats had been conducted. The overall NOAEL was 100 mg/kg bw per day on the basis of urine staining and slight declines in motor and locomotor activity in male rats at 200 mg/kg bw per day.

Studies with four metabolites found in animals and plants—BYI 08330-*cis*-ketohydroxy, BYI 08330-desmethyl-ketohydroxy, BYI 08330-mono-hydroxy and BYI 08330-di-hydroxy—showed that these substances were of low acute oral toxicity in female rats (LD_{50} > 2000 mg/kg bw) and not mutagenic in an assay for gene mutation in strains of *Salmonella typhimurium*. The plant-specific metabolite BYI 08330-enol-glucoside is rapidly absorbed from the gastrointestinal tract and

extensively metabolized and excreted within 24 h. The metabolites formed from this compound in rats do not differ from those found in the metabolism study with spirotetramat in rats.

Spirotetramat caused two proven cases of allergic contact dermatitis in workers handling undiluted active ingredient. Neither a questionnaire survey among staff exposed to spirotetramat nor yearly surveillance of 12 workers exposed to spirotetramat revealed any further cases of sensitization.

The Meeting concluded that the existing database on spirotetramat was adequate to characteri ze the potential hazards to fetuses, infants and children.

Toxicological evaluation

The Meeting established an ADI of 0–0.05 mg/kg bw per day based on a NOAEL of 200 ppm (equal to 5 mg/kg bw per day) identified on the basis of thymus involution in a 1-year study in dogs and with a safety factor of 100.

The Meeting established an ARfD of 1 mg/kg bw based on a NOAEL of 100 mg/kg bw identified on the basis of altered motor and locomotor activity and FOB changes in a single-dose study in rats treated by gavage and with a safety factor of 100. This ARfD provides adequate protection from maternal toxicity and abortion observed at 160 mg/kg bw per day in the study of developmental toxicity in rabbit, even in the unlikely event that the observed effect could be attributed to a single dose.

A toxicological monograph was prepared.

Levels relevant to risk assessment

Species	Study	Effect	NOAEL	LOAEL
Mouse	18-month study of carcinogenicity [a]	Toxicity and carcinogenicity	7000 ppm, equal to 1022 mg/kg bw per day[c]	—
Rat	Two-year study of carcinogenicity [a]	Toxicity	250 ppm, equal to 12.5 mg/kg bw per day	—
		Carcinogenicity	7500 ppm, equal to 373 mg/kg bw per day [c]	3500 ppm, equal to 169 mg/kg bw per day
	Multigeneration reproductive toxicity [a d]	Parental	1000 ppm, equal to 70.7 mg/kg bw per day	6000 ppm, equal to 419 mg/kg bw per day
		Offspring	1000 ppm, equal to 79.5 mg/kg bw per day	6000 ppm equivalent to 400 mg/kg bw per day
		Reproductive	1000 ppm, equal to 79.5 mg/kg bw per day	6000 ppm, equal to 486.7 mg/kg bw per day
	Developmental toxicity[b]	Maternal toxicity	140 mg/kg bw per day	1000 mg/kg bw per day
		Embryo and fetal toxicity	140 mg/kg bw per day	1000 mg/kg bw per day

Species	Study	Effect	NOAEL	LOAEL
	Acute oral neurotoxicity[b,d]		100 mg/kg bw (overall)	200 mg/kg bw
Rabbit	Developmental toxicity [b]	Maternal toxicity	40 mg/kg bw per day	160 mg/kg bw per day
		Embryo and fetal toxicity	160 mg/kg bw per day[c]	—
Dog	1-year study of toxicity [a]	Toxicity	200 ppm, equal to 5 mg/kg bw per day	600 ppm, equal to 19 mg/kg bw per day

[a] Dietary administration.

[b] Gavage administration.

[c] Highest dose tested.

[d] Two studies were combined.

Estimate of acceptable daily intake for humans

0–0.05 mg/kg bw

Estimate of acute reference dose

1 mg/kg bw

Information that would be useful for continued evaluation of the compound

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

Critical end-points for setting guidance values for exposure to spirotetramat

Absorption, distribution, excretion, and metabolism in mammals	
Rate and extent of oral absorption	Rapid and nearly complete absorption,
Distribution	Extensive, highest in liver and kidney
Potential for accumulation	No evidence of significant accumulation at low doses
Rate and extent of excretion	Very fast and almost complete within 48 h.
Metabolism in animals	Extensive. Main metabolite BYI08330-enol was formed by cleavage of ester bond. Other minor metabolites are formed by oxidative transformation or conjugation.
Toxicologically significant compounds (animals, plants and environment)	Spirotetramat and BYI08330-enol
Acute toxicity	
Rat, LD_{50}, oral	> 2000 mg/kg bw
Rat, LD_{50}, dermal	> 2000 mg/kg bw
Rat, LC_{50}, inhalation	> 4.18 mg/L air (nose only)
Rabbit, dermal irritation	Not irritating

Rabbit, ocular irritation	Irritating
Skin sensitization	Skin sensitization potential (Magnussen & Kligman test) in guinea-pigs and local lymph node assay in mice
Short-term studies of toxicity	
Target/critical effect	Thymus involution
Lowest relevant oral NOAEL	200 ppm (equal to 5 mg/kg bw per day) 1-year study in dogs
Lowest relevant dermal NOAEL	> 1000 mg/kg bw per day
Lowest relevant inhalation NOAEL	No data
Genotoxicity	
	No genotoxic potential
Long-term studies of toxicity and carcinogenicity	
Target/critical effect	Kidney (tubular dilatation), decreased absolute weight
Lowest relevant NOAEL	2-year, rat, 250 ppm (equal to 12.5 mg/kg bw per day)
Carcinogenicity	No carcinogenic potential in mice and rat
Reproductive toxicity	
Reproduction target/critical effect	Abnormal sperm in F_1 at parentally toxic dose
Lowest relevant reproductive NOAEL	Parental toxicity: 1000 ppm (equal to 70.7 mg/kg bw per day)
	Offspring toxicity: 1000 ppm (equal to 79.5 mg/kg bw per day)
	Reproductive toxicity: 1000 ppm (equal to 79.5 mg/kg bw per day)
Developmental target/critical effect	Increase incidence of retarded ossification in fetuses at maternally toxic doses in rats. None in rabbits.
Lowest relevant developmental NOAEL	Maternal toxicity: 40 mg/kg bw per day (rabbit)
	Developmental toxicity: 140 mg/kg bw per day (rat)
Neurotoxicity/delayed neurotoxicity	
Acute neurotoxicity	Based on behavioural effects, NOAEL was 100 mg/kg bw per day in rats
Medical data	
	Two proven cases of allergic contact dermatitis in workers handling undiluted active ingredient. No other effects were observed.

Summary

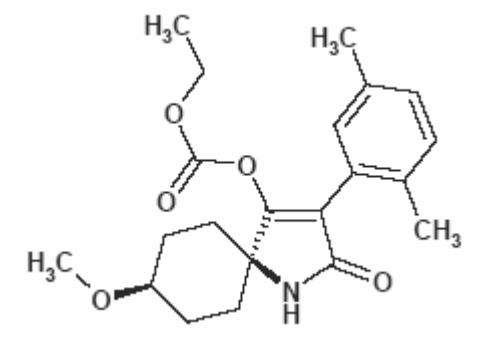
	Value	*Study*	*Safety factor*
ADI	0–0.05mg/kg bw	Dog, 1-year study of oral toxicity	100
ARfD	1 mg/kg bw	Rat, studies of acute oral neurotoxicity	100

RESIDUE AND ANALYTICAL ASPECTS

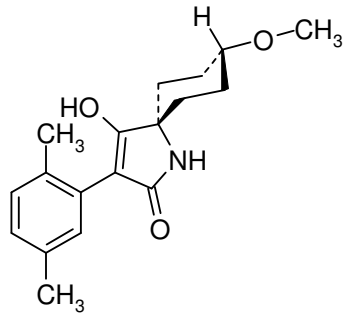
Spirotetramat belongs to the chemical class of ketoenols and acts as a systemic insecticide for the control of a broad spectrum of sucking insects. At the 39th session of the CCPR (ALINORM 07/30/24), it was listed as a candidate for evaluation of new compounds by the 2008 JMPR.

Chemical name

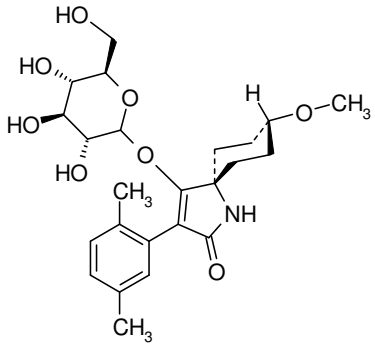
cis-3-(2,5-dimethylphenyl)-8-methoxy-2-oxo-1-azaspiro[4.5]dec-3-en-4-yl ethyl carbonate



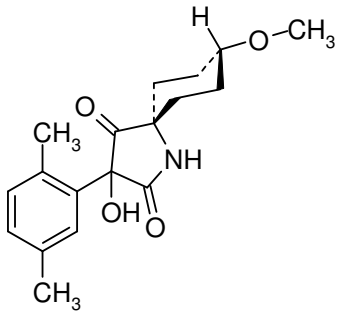
Chemical structures of major metabolites:



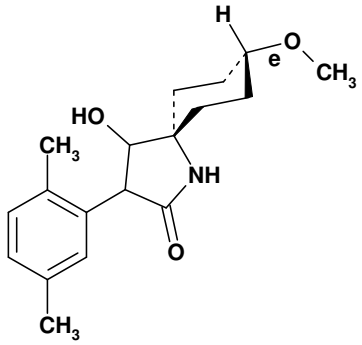
Spirotetramat Enol



Spirotetramat Enol Glucoside (Glc)



Spirotetramat Ketohydroxy



Spirotetramat Monohydroxy

Animal metabolism

The Meeting reviewed studies on the metabolism of [azaspirodecenyl-3-^{14}C]spirotetramat in goats and hens. A lactating goat received 4 daily oral administrations of spirotetramat at a mean dose rate of 2.22 mg/kg bw/day (73.0 ppm in the diet). The urine and faeces contained about 90% of the

administered dose of radioactivity. The levels of radioactive residue in milk and tissues were as follows: milk (day 4), 0.008 mg/kg; muscle, 0.011 mg/kg; fat, 0.003 mg/kg; liver 0.050 mg/kg; and kidney 0.184 mg/kg. Spirotetramat was absent in all samples. The major metabolites in all matrices were spirotetramat-enol (34–72% TRR) and spirotetramat-enol GA (glucuronic acid conjugate of 3-(2,5-dimethylphenyl)-4-hydroxy-8-methoxy-1-azaspiro[4.5]dec-3-en-2-one , 14–37% TRR). Minor metabolites were spirotetramat desmethyl enol (3-(2,5-dimethylphenyl)-4,8-dihydroxy-1-azaspiro[4.5]dec-3-en-2-one, 0–8% TRR), spirotetramat ketohydroxy (0–10% TRR) and spirotetramat monohydroxy (0–4% TRR). The degree of identification ranged from 79% TRR in fat to 99% TRR in kidney.

Six laying hens were administered 14 oral doses of [azaspirodecenyl-3-^{14}C]spirotetramat at a daily dose rate of 1.01 mg/kg bw/day (12.86 ppm in the diet). The TRR levels were as follows: eggs (pool day 2–14), 0.015 mg/kg, fat, 0.0038 mg/kg; kidney, 0.039 mg/kg; liver, 0.017 mg/kg; and muscle, 0.0034 mg/kg. The residue level in eggs appears to reach a plateau by day 10. The residue profile was qualitatively similar to that of the goat. Spirotetramat was not found in any matrix. The major metabolites were spirotetramat enol (18–84% TRR) and spirotetramat enol GA (4–15% TRR), with no other metabolites identified. The identifications ranged from 18% TRR (fat, with low TRR) to 84% (egg). About 30% of the TRR in liver was not released after exhaustive extractions.

Spirotetramat was completely metabolized by the rat, with no parent compound found in the excreta. Identified metabolites accounted for ≥ 87% of the administered dose. The major metabolite was spirotetramat-enol, accounting for about 53–87% of the administered dose. The second most abundant metabolite was spirotetramat-desmethyl-enol, at 5–37% of the administered dose. Minor metabolites included spirotetramat-ketohydroxy, spirotetramat-desmethyl-ketohydroxy (3-(2,5-dimethylphenyl)-3,8-dihydroxy-1-azaspiro[4.5]decane-2,4-dione), spirotetramat-enol-GA, and spirotetramat-enol-alcohol (4-hydroxy-3-[5-(hydroxymethyl)-2-methylphenyl]-8-methoxy-1-azaspiro[4.5]dec-3-en-2-one).

The metabolism in ruminants and poultry is adequately defined. The biodegradation of spirotetramat in livestock can be characterized as cleavage of the carbonate ester group to the primary metabolite spirotetramat-enol followed by conjugation of the enol hydroxy group with glucuronic acid to spirotetramat-enol-GA. Oxidation of the azaspirodecenyl moiety to spirotetramat-ketohydroxy and demethylation of the methoxy group to spirotetramat-desmethyl-enol were minor metabolic reactions in ruminants as well as reduction of the azaspirodecenyl moiety to spirotetramat-monohydroxy. This pathway is consistent with the metabolism found in the rat.

Plant metabolism

The metabolism of [azaspirodecenyl-3-^{14}C]spirotetramat on four distinct crop types was reported to the Meeting: apple, cotton, lettuce and potato. The metabolism results were qualitatively similar across the crops studied. The major metabolic reaction involves the hydrolytic cleavage of the carbonate ester parent bond of the parent compound to form spirotetramat-enol. Further reduction of the enol moiety double bond of spirotetramat-enol occurs to form the spirotetramat-mono-hydroxy metabolite. Hydroxylation of spirotetramat enol results in spirotetramat-ketohydroxy. Demethylation of the methoxy group of the cyclohexyl ring results, via a proposed intermediate (spirotetramat-desmethyl-enol), in spirotetramat-desmethyl-ketohydroxy (after the corresponding hydroxylation). Partly, metabolites bearing a hydroxy group were conjugated with glucose.

Spirotetramat occurs at various concentration levels: 51% TRR apple fruit, 56% TRR head lettuce, 0% TRR potato tuber, 0% cotton seed, 49% potato foliage, 32% cotton lint, 47% immature cotton plant. Spirotetramat-enol varied from 2% TRR in apple fruit to 66% TRR in the potato tuber and 40% in cotton seed. Spirotetramat enol glucoside was found only in cotton lint (5% TRR), lettuce (11% TRR), and potato tuber (2% TRR). Spirotetramat monohydroxy was 16% TRR in apple fruit, but insignificant in other commodities. Spirotetramat ketohydroxy was more widely distributed: 6% TRR lettuce, 9% TRR cottonseed and 8% TRR in apple. Other metabolites were consistently below 10% TRR in raw agricultural commodities. More extensive metabolism of spirotetramat was noted in cotton lint.

Environmental fate

Soil

Aerobic degradation in various soil types was rapid, with 90% of the applied spirotetramat degraded within one day of application. Spirotetramat enol and/or spirotetramat ketohydroxy were the major identified degradates. Carbon dioxide was a maximum of 15% of applied radioactivity at 50–86 days after application to the soil. Additional studies with radiolabelled spirotetramat-enol showed that spirotetramat-enol dissipated in soil and was mineralized, with $^{14}CO_2$ accounting for about 40% of applied radioactivity at day 100.

Anaerobic degradation was equally rapid, with 90% of the applied spirotetramat degraded within one day of application. The major identified degradates were spirotetramat-enol and spirotetramat ketohydroxy. Carbon dioxide was 20% of applied radioactivity at day 50 after application.

Under soil photolysis conditions, the dark control degraded more rapidly than the illuminated soil. It is speculated that the light inhibited bacteria that facilitate the breakdown of spirotetramat.

Water

Spirotetramat is hydrolytically labile under neutral and alkaline conditions at ambient temperature, with half-lives at 25 °C of 9 days and 8 h, respectively. One major degradation product occurred: spirotetramat-enol. Under acidic conditions, degradation was slower (half life 32 days), but spirotetramat-enol was again the degradate.

Under photolysis in sterile buffer at pH 5, 85% of the spirotetramat is degraded within 7 days. The major degradates are a cyclopentyl derivative (35% applied radioactivity), a methyl carbonate derivative (17% applied radioactivity), and a 2-hydroxymethyl derivative (15% applied radioactivity). Under control (dark) conditions, only spirotetramat-enol forms. These degradates are not observed when the photolysis is conducted with sterile natural water.

In water/sediment systems maintained under aerobic conditions, radiolabelled spirotetramat degraded rapidly, with 60% (water fraction) lost within one day. The major degradate was spirotetramat-enol (> 40% of applied radioactivity).

Spirotetramat degrades rapidly in soil and water, with the initial product being spirotetramat-enol.

Rotational crops

The metabolism in rotational crops (spring wheat, Swiss chard and turnips) was investigated following spray application of [azaspirodecenyl-3-^{14}C]spirotetramat onto bare soil (day 0) at an application rate of 406 g ai/ha. Significant TRRs (≥ 0.01 mg/kg) persisted in wheat matrices, Swiss chard, and turnip tops at a 135 day plantback interval. Significant TRRs were found in wheat hay (0.014 mg/kg) and straw (0.036 mg/kg) at a 260 day plantback interval.

At a 31 day plantback interval, parent spirotetramat was not found in any commodity (at maturity). Two of the principle degradates/metabolites were spirotetramat ketohydroxy in wheat forage (31% TRR), Swiss chard (17% TRR) and turnip root (30% TRR) and spirotetramat desmethyl ketohydroxy Glc in wheat forage (32% TRR), hay (18% TRR), and Swiss chard (24% TRR). Spirotetramat-enol was not found, except at 3% TRR in wheat grain.

A field rotational crop study was conducted in three sites applying spirotetramat formulated as 100 g/kg OD (oil dispersion) to a primary crop (leafy, *Brassica*, or fruiting vegetables) at a total rate of 172–180 g ai/ha. After primary crops were removed, rotational crops (mustard greens, turnips and wheat) were planted at a 30-day plant-back interval (PBI). At maturity, samples of mustard greens, turnip (tops and roots), wheat (forage, hay, straw and grain) were collected and analysed for residues of spirotetramat, spirotetramat-ketohydroxy, spirotetramat-desmethyl-ketohydroxy, spirotetramat-desmethyl-di-hydroxy and spirotetramat-ketohydroxy-alcohol. The analytical method included an acid hydrolysis step to release metabolite conjugates, such as glucosides. None of the target compounds were found at the LOQ of 0.01–0.02 mg/kg per component.

Quantifiable residues from the foliar application of spirotetramat are unlikely to occur in succeeding (rotational crops) at a minimum plantback interval of 30 days after the final application of spirotetramat to the primary crop at typical current application rates.

Methods of analysis

The methods used for data collection and proposed for enforcement for plant matrices and livestock commodities are based on HPLC/MS-MS. All methods involve extraction with acetonitrile/water and clean-up with solid phase extraction columns. Analytical method 00857 was developed for the determination of residues of spirotetramat, the metabolites spirotetramat -enol, spirotetramat -ketohydroxy, spirotetramat -mono-hydroxy and spirotetramat enol-Glc in plant matrices by HPLC-MS/MS. The analytical method 00966 was developed for the determination of residues of spirotetramat and the metabolites spirotetramat -enol and spirotetramat -enol-GA in livestock matrices by HPLC-MS/MS. These methods were used as the data-collection methods in the analysis of samples for residues from the various studies submitted to the Meeting. These methods used isotopically labelled internal standards, whereas variants of the methods were developed (and validated) with external standards. Each method has been adequately validated by the manufacturer as well as by independent laboratories Method 00857 was also adequately radiovalidated using samples obtained from metabolism studies.

The limits of quantitation (LOQ) for plant commodities are as follows:

For hops: spirotetramat: 0.1 mg/kg; -enol: 0.12 mg/kg; -ketohydroxy: 0.12 mg/kg; monohydroxy: 0.12 mg/kg; -enol-glucoside: 0.08 mg/kg; total residue calc: 0.55 mg/kg

All other matrices: spirotetramat: 0.01 mg/kg; -enol: 0.012 mg/kg; -ketohydroxy: 0.012 mg/kg; -monohydroxy: 0.012 mg/kg; -enol-glucoside: 0.008 mg/kg; total residue calc.: 0.055 mg/kg.

The limits of quantitation (LOQ) for animal commodities are as follows:

For milk: spirotetramat: 0.005 mg/kg; -enol: 0.005 mg/kg; -enol-glucuronide: 0.005 mg/kg

For tissues and eggs: spirotetramat: 0.01 mg/kg; enol: 0.01 mg/kg; -enol-glucuronide: 0.01 mg/kg.

Multiresidue methods were tested and found not applicable to spirotetramat.

The methods are suitable for data collection and for enforcement of MRLs for plant and animal commodities.

Stability of pesticide residues in stored analytical samples

The stability of spirotetramat in frozen (–18 °C) samples of various commodities was reported. Spirotetramat including its enol metabolite was stable (≥ 80%) remaining for about 2 years in tomato, potato, lettuce, almond nutmeat, climbing French beans and tomato paste. A stability of up to 5 months was demonstrated for orange juice and dried prunes. The Meeting noted that in certain commodities spirotetramat did convert to the enol during storage. For example, in potatoes about 50% of the residue was enol and 50% spirotetramat after 6 months' storage. A similar situation occurs in lettuce at one year and in almonds in 26 days. No other metabolites were found in any commodity accept beans, where up to 8% of the remaining residue was spirotetramat ketohydroxy.

The stability of various metabolites (spirotetramat enol, spirotetramat ketohydroxy, spirotetramat monohydroxy, spirotetramat enol Glc) was reported for the above commodities for the above intervals. All metabolites were stable (≥ 70% remaining) except for spirotetramat enol glucoside on dried prunes, where recovery was only 60% for intervals above 30 days.

Spirotetramat, when determined as the sum of spirotetramat and its enol, is stable on various commodities stored frozen for intervals typical of storage prior to analysis. Considered alone, however, spirotetramat may show significant loss (to spirotetramat enol). Likewise, the metabolites spirotetramat enol, spirotetramat ketohydroxy, spirotetramat monohydroxy, spirotetramat enol Glc (glucuronide) are stable.

Stability of the spirotetramat residue in frozen livestock commodity samples was not demonstrated, but all livestock commodity samples were analysed within 30 days of collection.

Residue definition

The plant metabolism studies indicate that significant portions of spirotetramat are converted to spirotetramat enol, and in some cases there may be no measurable parent (e.g., potato tubers). The analytical methods, all based on HPLC/MS-MS, are capable of determining spirotetramat, and the metabolites enol, ketohydroxy, enol glucoside, and monohydroxy. With the exception of the enol, the metabolites were not distributed through all plant metabolism studies and where present, were typically ≤ 15% TRR each.

In the field trials (see below), spirotetramat and the four metabolites mentioned were always determined.

The Meeting concluded that the residue definition for plant commodities for purposes of enforcement is spirotetramat plus its enol metabolite, expressed as spirotetramat. The Meeting also concluded that for purposes of dietary intake considerations, the residue definition is spirotetramat plus the metabolites enol, ketohydroxy, enol glucoside, and monohydroxy, expressed as spirotetramat.

The ruminant and poultry metabolism studies indicated that spirotetramat was totally converted to the enol metabolite. Significant quantities of the glucuronide conjugate of the enol were also found; other metabolites were minor (goat) or absent (hen). The ruminant feeding study conducted at levels up to 30 ppm for 29 days revealed only the enol metabolite, except for low levels of the enol glucuronide in liver and kidney (0.030 mg/kg maximum).

The Meeting concluded that the residue definition for animal commodities for purposes of enforcement and dietary intake considerations is spirotetramat enol, expressed as spirotetramat.

The log of the octanol/water partition coefficient for spirotetramat is 2.5. The log of the octanol/water partition coefficient for spirotetramat enol varies from 2.0 at pH 5 to –1.3 at pH 9. The spirotetramat enol showed no propensity to concentrate in ruminant or poultry fat. Therefore, the Meeting concluded that spirotetramat/spirotetramat enol are not fat soluble.

Residue for enforcement plant commodities: spirotetramat plus spirotetramat enol, expressed as spirotetramat.

Residue for dietary intake plant commodities: *spirotetramat plus the metabolites enol, ketohydroxy, enol glucoside, and monohydroxy, expressed as spirotetramat*.

Residue for enforcement and dietary intake animal commodities: *spirotetramat enol, expressed as spirotetramat*.

The residue is not fat soluble.

Results of supervised residue trials on crops

The Meeting received supervised trials data for the foliar application of spirotetramat as a suspension concentrate formulation (SC) or oil dispersion (OD) to a variety of fruit, vegetable, nut crops and hops.

Citrus

Field trials were conducted on oranges and mandarins in South Europe. No applicable GAP was available.

Field trials were conducted on oranges, lemons, and grapefruits in the USA. The GAP is 0.18 kg ai/ha/application, 0.36 kg ai/ha/season, 1 day PHI, SC and OD formulations. The ranked order of residues (spirotetramat plus enol, whole orange) from 12 trials on oranges were: < 0.10 (3), 0.10, 0.17, 0.19 (2), 0.20, 0.23, 0.26 (2), 0.27 mg/kg.

The ranked order of residues (spirotetramat plus four metabolites, whole orange) from 12 trials on oranges, median underlined, were: < 0.25 (3), 0.25, 0.32, <u>0.34</u> (2), 0.35, 0.38, 0.41, 0.42, 0.43 mg/kg.

The ranked order of residues (spirotetramat plus enol, whole lemon) from five trials on lemons were: 0.13, 0.18, 0.19, 0.21, 0.32 mg/kg.

The ranked order of residues (spirotetramat plus 4 metabolites, whole lemon) found from five trials were: 0.28, 0.33, 0.34, 0.36, 0.47 mg/kg.

The ranked order of residues (spirotetramat plus enol, whole grapefruit) found from six trials were: < 0.10 (3), < 0.11, 0.11, 0.20 mg/kg.

The ranked orders of residues (spirotetramat plus 4 metabolites, whole grapefruit) from six trials were: < 0.25 (3), < 0.26, 0.26, 0.35 mg/kg.

The residues on the various citrus from US trials were considered to be from similar populations and were combined. The ranked order of residues (parent plus enol) found on citrus were:

The ranked order of residues (spirotetramat plus enol, n = 23) on citrus were: 0.10 (7), 0.11 (2), 0.13, 0.17, 0.18, 0.19 (3), 0.20 (2), 0.21, 0.23, 0.26 (2), 0.27, 0.32 mg/kg. The Meeting estimated a maximum residue level maximum residue level of 0.5mg/kg.

The ranked order of residues (spirotetramat plus 4 metabolites, n = 23), median underlined, found on whole citrus fruit were: 0.25 (7), 0.26 (2), 0.28, 0.32, <u>0.33,</u> 0.34 (3), 0.35 (2), 0.36, 0.38, 0.41, 0.42, 0.43, 0.47 mg/kg. The Meeting estimated an STMR of 0.33 mg/kg and an HR of 0.47 mg/kg.

Pome fruit

The Meeting received supervised field trial studies for apples and pears in Europe. No relevant GAP was available.

Supervised field trials on apples and pears were reported from Canada and the USA. Twelve apple trials were reported, including one in Canada, and six pear trials were reported, with all trials

conducted at the GAP of 0.14 kg ai/ha (Canada) or 0.16 kg ai/ha (US), with a maximum seasonal rate of 0.45 kg ai/ha and a PHI of 7 days. Both OD and SC formulations and high and low spray volumes were tested.

The ranked order of residues (spirotetramat plus enol, *n* = 12) on apples were: 0.038, 0.042, 0.051, 0.072 (2), 0.077, 0.13 (2), 0.14, 0.21, 0.33, 0.49 mg/kg.

The ranked order of residues (spirotetramat plus 4 metabolites, *n* =12) on apples were: 0.073, 0.076, 0.085, 0.11 (2), 0.13, 0.17 (2), 0.18, 0.37, 0.38, 0.55 mg/kg.

The ranked order of residues (spirotetramat plus enol, *n* =6) on pears were: 0.075, 0.084, 0.16, 0.17, 0.22, 0.32 mg/kg.

Residues, in ranked order, of (spirotetramat plus 4 metabolites, *n* = 6) found on pears were: 0.10, 0.16, 0.20, 0.21, 0.26, 0.37 mg/kg.

The Meeting considered that the residue values for apples and for pears are from similar populations and combined them for estimation of pome fruit.

Residues in ranked order of (spirotetramat plus enol, *n* = 18) found on pome fruit were: 0.038, 0.042, 0.051, 0.072 (2), 0.075, 0.077, 0.084, 0.13 (2), 0.14, 0.16, 0.17 (2), 0.21, 0.23, 0.31, 0.33, 0.49 mg/kg. The Meeting estimated a maximum residue level of 0.7 mg/kg for pome fruit.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites, *n* = 18) found on pome fruit were: 0.073, 0.076, 0.085, 0.10, 0.11 (2), 0.13, 0.16, 0.17, 0.18, 0.20, 0.21, 0.26, 0.37 (2), 0.38, 0.55 mg/kg. The Meeting estimated an STMR of 0.17 mg/kg and an HR of 0.55 mg/kg for pome fruit.

Stone fruit

The Meeting received Stone Fruit trial data from Europe for apricots, plums and cherries. No relevant GAP was available. The Meeting also received Stone fruit trials from Canada and the USA for peaches, plums and cherries. The Canada/US GAP were: OD and SC formulations, 0.14 kg ai/ha (Canada) or 0.16 kg ai/ha (USA), 0.27 kg ai/ha/season, with a 7 day PHI.

Nine peach trials at maximum GAP were reported, including one trial from Canada. Both OD and SC formulations and low volume and high volume foliar applications were tested in side-by-side plots at several locations.

Residues in ranked order of (spirotetramat plus enol, *n* = 9) found on peaches were: 0.38, 0.49, 0.53, 0.55, 0.58, 0.60, 0.68, 0.72, 1.0 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites, *n* = 9) found on peaches were: 0.51, 0.56, 0.69 (2), 0.70, 0.77, 0.81, 0.82, 1.2 mg/kg.

The Canada and USA GAPs for plums are the same as for peaches. Six trials were conducted at maximum GAP in the USA, with both low volume and high volume foliar applications in side-by-side plots.

The ranked order of residues (spirotetramat plus enol, *n* = 6) for plums were: 0.066, 0.16, 0.26, 0.32, 0.34, 0.59 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites, *n* = 6) found on plums were: 0.11, 0.36, 0.37, 0.46, 0.57, 0.84 mg/kg.

The Canada and USA GAPs for cherries (sweet and sour) are the same as for peaches. Six trials were conducted at the maximum GAP, including one trial from Canada.

The ranked order of residues (spirotetramat plus enol, *n* = 6) for cherries were: 0.68, 1.3 (3), 1.4, 1.6 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites, *n* = 6) found on cherries were: 0.74, 1.6 (3), 2.1 (2) mg/kg.

The Meeting noted that the residue population for cherries is not from the same population as peaches and plums and therefore did not combine the various stone fruit data sets.

The Meeting decided to use the residue data set with highest residues (cherry, *n* = 6) to estimate a stone fruit group maximum residue level. The Meeting estimated a maximum residue level of 3 mg/kg for stone fruit, an STMR of 1.6 mg/kg and an HR of 2.1 mg/kg.

Small berries and grapes

Supervised trials were reported from Europe for the foliar treatment of strawberries in glasshouses, but no GAP was available.

Supervised trials were reported from Europe (South) for the foliar treatment of grapes, but no GAP was available

Supervised trials for grapes were also reported from the USA. The GAP of the USA and of Canada were: OD or SC, 0.14 kg ai/ha, 0.22 kg ai/ha/season, with a 7 day PHI.

The ranked order of residues (spirotetramat plus enol, *n* = 15) for grapes were: 0.057, 0.14, 0.21, 0.23, 0.24, 0.26, 0.31, 0.32, 0.34, 0.36, 0.44, 0.49, 0.58, 0.62, 1.0 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites *n* = 15) found on grapes were: 0.11, 0.26, 0.29, 0.32 (2), 0.36, 0.40, 0.41, 0.48 (2), 0.55, 0.65, 0.79, 0.85, 1.3 mg/kg.

The Meeting estimated for grapes an STMR of 0.41 mg/kg, an HR of 1.3 mg/kg, and a maximum residue level of 2 mg/kg.

Bulb vegetables

The Meeting received field trial reports for bulb onions in Europe. However, as no GAP information was provided the Meeting was unable to estimate a maximum residue level for Bulb vegetables.

Brassica vegetables

The Meeting received field trial reports for head cabbage in Europe. None of the trials were at the maximum GAP of Austria (OD; 0.075 kg ai/ha, 0.015 kg ai/ha, 2 applications at 14 day interval, PHI 3 days).

The Meeting also received field trial reports for head cabbage in Australia. There was no finalized GAP in Australia.

The Meeting received field trial reports for head cabbage in the USA. The GAPs for brassica vegetables, including cabbage, in Canada and the USA are: SC, OD; 0.088 kg ai/ha/application, 0.175 kg ai/ha per season, 1 day PHI. Six trials were conducted at maximum GAP in the USA.

The ranked order of residues of (spirotetramat plus enol, *n* = 7) for cabbage was: 0.020, 0.023, 0.095, 0.15, 0.27, 0.50, 0.89 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites *n* = 7) found on cabbage were: 0.060, 0.067, 0.19, 0.23, 0.45, 0.64, 0.92 mg/kg.

The Meeting estimated for cabbage heads a maximum residue level of 2 mg/kg, an STMR of 0.23 mg/kg, and an HR of 0.92 mg/kg.

The Meeting received field trial reports for broccoli and cauliflower in Europe, but no GAPs were available. The Meeting also received field trial reports for broccoli and Brussels sprouts in

Australia, but no GAP was available. The Meeting received field trial reports for kohlrabi in Europe, but no GAPs were available.

The Meeting received field trial reports for cauliflower and broccoli from the USA. The GAPs in Canada and the USA are: OD, SC; 0.088 kg ai/ha/application, 0.175 kg ai/ha per season, 1 day PHI. Four trials on broccoli and four trials on cauliflower were conducted at the maximum GAP.

The ranked order of residues of (spirotetramat plus enol, n = 4) for broccoli were: 0.095, 0.21, 0.28, 0.39 mg/kg.

The ranked order of residues of (spirotetramat plus 4 metabolites n =4) for broccoli were: 0.17, 0.54, 0.84, 0.87 mg/kg.

The ranked order of residues of (spirotetramat plus enol, n = 4) for cauliflower were: 0.076, 0.10, 0.11, 0.28 mg/kg.

The ranked order of residues of (spirotetramat plus 4 metabolites n = 4) for cauliflower were: 0.22, 0.34, 0.45, 0.54 mg/kg.

The Meeting decided to combine the broccoli and cauliflower results for mutual support. The ranked order of residues (spirotetramat plus enol, n = 8) for flowerhead brassica were: 0.076, 0.095, 0.10, 0.11, 0.21, 0.28 (2), 0.39 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites n = 8) for flowerhead brassica were: 0.17, 0.22, 0.34, <u>0.45, 0.54</u> (2), 0.84, 0.87 mg/kg.

The Meeting estimated for flowerhead brassica a maximum residue level of 1 mg/kg, an HR of 0.87 mg/kg, and STMR of 0.50 mg/kg.

Fruiting vegetables, Cucurbits

The Meeting received supervised trial data for both glasshouse and field sites for melons in Europe. There was no relevant GAP.

The Meeting also received field trial data for melons in the USA. The GAPs in Canada and the USA for cucurbits are: OD and SC, 0.088 kg ai/ha, 0.175 kg ai/ha/season, 1 day PHI. Eight trials in the USA were conducted at the maximum GAP.

The ranked order of results (spirotetramat plus enol, n = 8) for melons were: < 0.02 (2), 0.023, 0.026, 0.027, 0.053, 0.10, 0.13 mg/kg.

The ranked order of results (spirotetramat plus 4 metabolites, n = 8) for melons were: < 0.05 (2), 0.056, 0.057 (2), 0.083, 0.13, 0.16 mg/kg.

The Meeting received reports of trials in glasshouses and the fields for cucumbers in Europe. There was no relevant GAP.

The Meeting also received field trial data for cucumbers from the USA. The GAPs in Canada and the USA for cucurbits are: OD and SC, 0.088 kg ai/ha, 0.175 kg ai/ha/season, 1 day PHI. Eight trials were conducted at the maximum GAP.

The ranked order of results (spirotetramat plus enol, n = 8) for cucumbers were: < 0.02 (7), 0.044 mg/kg.

The ranked order of results (spirotetramat plus 4 metabolites, n = 8) for cucumbers were: < 0.050 (6), 0.073, 0.076 mg/kg.

Field trials were conducted on summer squash (zucchini) in the USA. The GAPs in Canada and the USA for cucurbits are: OD and SC, 0.088 kg ai/ha, 0.175 kg ai/ha/season, 1 day PHI.

The ranked order of results (spirotetramat plus enol, n = 5) for summer squash were: < 0.020 (3), 0.088, 0.13 mg/kg.

The ranked order of results (spirotetramat plus 4 metabolites, *n* = 5) for summer squash were: < 0.05, 0.059, 0.060, 0.16, 0.18 mg/kg.

The Meeting considered the data for summer squash, cucumber, and melons not to be from different populations and combined the data to make estimates for the cucurbit vegetable group.

The ranked order of results (spirotetramat plus enol, *n* = 21) for cucurbits were: < 0.020 (12), 0.023, 0.026, 0.027, 0.044, 0.053, 0.088, 0.10, 0.13 (2) mg/kg.

The ranked order of results (spirotetramat + 4 metabolites, *n* = 21) for cucurbits were: < 0.050 (9), 0.056, 0.057 (2), 0.059, 0.060, 0.073, 0.076, 0.083, 0.13, 0.16 (2), 0.18 mg/kg.

For cucurbit vegetables, the Meeting estimated an STMR of 0.057 mg/kg, an HR of 0.18 mg/kg, and a maximum residue level of 0.20 mg/kg.

Fruiting vegetables other than Cucurbits

Supervised trials were conducted on tomatoes in both glasshouses and the field in Europe. The GAP of Austria is for glass house use and specifies: OD; 0.075 kg ai/ha, 0.01 kg ai/ha per 1 metre plant height, 4 applications at 7 day interval, 3 day PHI. Eight trials in glass house were conducted at this GAP.

The ranked order of residue results (spirotetramat plus enol, *n* = 8) for tomato were: 0.16, 0.19, 0.26, 0.28, 0.32, 0.45, 0.48, 0.49 mg/kg.

The ranked order of residue results (spirotetramat plus 4 metabolites, *n* = 8) for tomato were: 0.22, 0.29, 0.34, 0.44 (2), 0.51, 0.68, 0.70 mg/kg.

Additionally, field trials were conducted on tomatoes in the USA. The GAPs for Canada and the USA are OD and SC, 0.088 kg ai/ha, 0.18 kg ai/ha/season, 1 day PHI. Thirteen trials were conducted at maximum GAP. Also, both OD and SC formulations were tested in side-by-side plots at some trial locations.

The ranked order of residue results (spirotetramat plus enol, *n* = 15) for tomato were: 0.040, 0.046, 0.078, 0.096, 0.12 (2), 0.14 (2), 0.17, 0.20 (2), 0.21, 0.22, 0.23, 0.24 mg/kg.

The ranked order of residue results (spirotetramat plus 4 metabolites, *n* = 15) for tomato were: 0.070, 0.081, 0.12, 0.14, 0.15, 0.16, 0.17, 0.19, 0.21, 0.23, 0.24 (2), 0.25, 0.27, 0.30 mg/kg.

Supervised trial data were received for foliar application of spirotetramat to sweet peppers in both glasshouses and the field in Europe. The GAP of Austria is for glass house use and specifies: OD; 0.075 kg ai/ha, 0.01 kg ai/ha per 1 meter plant height, 4 applications at 7 day interval, 3 day PHI.

The ranked order of residue values (spirotetramat plus enol, *n* = 12) for sweet peppers in (EU glass houses) were: 0.23, 0.25, 0.27, 0.30, 0.36, 0.40, 0.42, 0.46, 0.47, 0.49, 0.50 (2) mg/kg.

The ranked order of residue values (spirotetramat plus 4 metabolites, *n* = 12) for sweet peppers were: 0.27, 0.29, 0.31, 0.35, 0.43, 0.48 (2), 0.54, 0.55, 0.56, 0.57, 0.58 mg/kg.

Also, supervised field trial data were received for peppers from the USA. The GAPs in Canada and the USA for fruiting vegetables are: OD and SC, 0.088 kg ai/ha, 0.18 kg ai/ha/season, 1 day PHI.

The ranked order of residue values (spirotetramat plus enol, *n* = 8) for sweet peppers were: 0.20, 0.27, 0.29, 0.33, 0.40, 0.44, 0.51, 0.76 mg/kg.

The ranked order of residue values (spirotetramat plus enol, *n* = 4) for Chilli (non-bell) peppers were: 0.67, 0.75, 0.82, 1.3 mg/kg.

The ranked order of residue values (spirotetramat plus 4 metabolites, *n* = 8) for sweet peppers were: 0.29, 0.36, 0.39, 0.43, 0.49, 0.55, 0.78, 1.1 mg/kg.

Residues in ranked order, median underlined, of (spirotetramat plus 4 metabolites, *n* = 4) found on Chilli (non-bell) peppers were: 0.72, 0.92, 0.97, 1.5 mg/kg.

The Meeting concluded that the US residue values for sweet peppers and for Chilli peppers are not from the same population. The Meeting further concluded that the residue values for tomatoes and for sweet peppers in the US are not from the same population. The Meeting concluded that the EU glasshouse values for peppers and for tomatoes are from similar populations and therefore combined them.

The combined residue values (spirotetramat plus enol, *n* = 20) for fruiting vegetables (non-cucurbit) for glass houses (EU) in ranked order were: 0.16, 0.19, 0.23, 0.25, 0.26, 0.27, 0.28, 0.30, 0.32, 0.36, 0.40, 0.42, 0.45, 0.46, 0.47, 0.48, 0.49 (2), 0.50 (2) mg/kg.

The combined residue values (spirotetramat plus 4 metabolites, *n* = 20) for fruiting vegetables (non-cucurbit) for glass houses (EU) in ranked order were: 0.22, 0.27, 0.29 (2), 0.31, 0.34, 0.35, 0.43, 0.44 (2), 0.48 (2), 0.51, 0.54, 0.55, 0.56, 0.57, 0.58, 0.68, 0.70 mg/kg.

However, the Meeting noted that the highest residue set, excluding the limited data set (*n* = 3) for non-bell peppers, was that for US sweet peppers. Using this set, the Meeting estimated for fruiting vegetables (non-cucurbit) an STMR of 0.43 mg/kg, an HR of 1.1 mg/kg, and a maximum residue level of 1 mg/kg for fruiting vegetables, except Chilli peppers, except mushrooms, except sweet corn.

The Meeting estimated an STMR 0.95 mg/kg, an HR of 1.5 mg/kg, and a maximum residue level of 2 mg/kg for Chilli peppers. The Meeting also estimated a maximum residue level of 15 mg/kg for dried Chilli peppers based on a standard dehydration factor of 7 (General Considerations, 2008 JMPR).

Leafy vegetables (including Brassica leafy)

Lettuce trials from both glasshouses and fields were reported for Europe. Four glasshouse trials were conducted at the maximum GAP of Austria: OD; 0.075 kg ai/ha, 2 applications at 14 day interval, 7 day PHI.

The residue values (spirotetramat plus enol, *n* = 4) in ranked order for head lettuce were: 0.11, 1.3, 1.6, 1.7 mg/kg, and for leaf lettuce (*n* = 4): 0.27, 0.29, 0.96, 2.2mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 4) in ranked order for head lettuce were: 0.16, 1.4, 1.8, 1.9 mg/kg, and for leaf lettuce (*n* = 4): 0.37, 0.39, 1.0, 2.4 mg/kg.

Also, lettuce trials were reported from the USA. The GAPs in Canada and the USA for non-Brassica leafy vegetables were: SC, OD; 0.088 kg ai/ha, 0.175 kg ai/ha/season, 3 day PHI. Six trials were conducted at maximum GAP on head lettuce, and six trials were conducted at maximum GAP on leaf lettuce.

The residue values (spirotetramat plus enol, *n* = 8) in ranked order for head lettuce were: 0.14, 0.15, 0.18, 0.60 (2), 0.66, 0.69, 0.84 mg/kg, and for leaf lettuce (*n* = 7): 0.11, 0.14, 0.53, 0.60, 0.66, 0.96, 1.5 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 8) in ranked order for head lettuce were: 0.26, 0.29, 0.33, 0.73, 0.82, 0.84, 0.92, 1.0 mg/kg, and for leaf lettuce (*n* = 7): 0.21, 0.23, 0.73, 0.75, 1.0, 1.2, 1.7 mg/kg.

The Meeting received trials for spinach conducted in the USA. Seven trials were conducted at the maximum GAP for leafy vegetables (excluding Brassica).

The residue values for (spirotetramat plus enol, *n* = 7) in ranked order for spinach were: 0.13, 0.82, 1.1, 1.2, 1.4, 1.5, 3.0 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 7) in ranked order for spinach were: 0.24, 1.0, 1.2, 1.5, 1.6 (2), 3.4 mg/kg.

Residue trials were reported from Europe from several leafy vegetables: curly kale, Chinese cabbage, Chinese kale. However, no GAP was available.

Residue trials were reported from the USA for mustard greens. Ten trials were conducted at the maximum GAP for Brassica vegetables (including leafy), where the application rate is the same as for leafy vegetables, but the PHI is 1 day.

The residue values (spirotetramat plus enol, *n* = 10) in ranked order for mustard greens were: 0.61, 0.63, 1.3, 1.6, 2.6, 3.0 (2), 3.3, 4.2, 5.0 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 10) in ranked order for mustard greens were: 0.85, 0.86, 1.7, 2.0, 3.4, 4.0, 4.4, 4.5, 4.6, 5.5 mg/kg.

The Meeting decided to combine the residue values for head lettuce and leaf lettuce from the EU (glass house). The residue values (spirotetramat plus enol, *n* = 8) in ranked order for lettuce were: 0.11, 0.27, 0.29, 0.96, 1.3, 1.6, 1.7, 2.2 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 8) in ranked order for lettuce from the EU were: 0.16, 0.37, 0.39, 1.0, 1.4, 1.8, 1.9, 2.4 mg/kg.

The Meeting decided to combine the residue values for head lettuce and leaf lettuce from the USA. The residue values (spirotetramat plus enol, *n* = 15) in ranked order for lettuce were: 0.11, 0.14 (2), 0.15, 0.18, 0.53, 0.60 (3), 0.66 (2), 0.69, 0.84, 0.96, 1.5 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 15) in ranked order for lettuce were: 0.21, 0.23, 0.26, 0.29, 0.33, 0.73 (2), 0.75, 0.82, 0.84, 0.92, 1.0 (2), 1.2, 1.7 mg/kg.

The Meeting decided that the trials from the EU and the USA should not be combined because of substantial differences in the GAPs (glass house vs field, 7 day PHI vs 3 day PHI).

Using the trial data for mustard greens, the Meeting estimated for leafy vegetables an HR of 5.5 mg/kg, an STMR of 3.7 m/kg, and a maximum residue level of 7 mg/kg.

Legume vegetables

The Meeting received a study on field trials for French climbing beans conducted in glasshouses in Europe. However, no GAP was available.

Root and tuber vegetables

Trials on potatoes were reported from the USA. The GAPs in Canada and the USA for tuberous and corm vegetables were: OD, SC; 0.088 kg ai/ha, 0.175 kg ai/ha/season, 7 day PHI. Seventeen trials were conducted at the maximum GAP.

The residue values (spirotetramat plus enol, *n* = 20) in ranked order for potato were: 0.020, 0.034, 0.039, 0.041, 0.046 (2), 0.050, 0.052, 0.053, 0.080, 0.091, 0.11 (2), 0.16, 0.17, 0.18, 0.23, 0.30, 0.37 (2) mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 20) in ranked order for potato were: 0.055, 0.064, 0.069, 0.071, 0.076 (2), 0.080, 0.082, 0.083, 0.11, 0.12 (2), 0.14 (2), 0.19, 0.22, 0.29, 0.36, 0.43, 0.46 mg/kg.

The Meeting estimated an STMR of 0.12 mg/kg for potato, an HR of 0.46 mg/kg and a maximum residue level of 0.8 mg/kg.

Stalk and stem vegetables

Supervised field trials for celery were reported from the USA. The GAPs for leafy vegetables, which include celery in the NAFTA classification, were: OD, SC; 0.088 kg ai/ha, 0.75 kg ai/ha/season, 3 day PHI.

Six trials were conducted at the maximum GAP. The residue values (spirotetramat plus enol, *n* = 8) in ranked order for celery were: 0.26, 0.29, 0.33, 0.38, 0.45, 0.46, 1.9, 2.4 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 8) in ranked order for celery were: 0.40, 0.41, 0.49 (2), 0.66, 0.76, 2.2, 2.6 mg/kg.

The Meeting estimated for celery an STMR of 0.58 mg/kg, an HR of 2.6 mg/kg, and a maximum residue level of 4.

Tree nuts

Supervised field trials were reported from the USA for almonds and pecans. The GAPs in Canada and the USA are: SC, OD; 0.14 kg ai/ha, 0.38 kg ai/ha/season, 7 day PHI.

Six trials on almonds were conducted at the maximum GAP. The residue values (spirotetramat plus enol, *n* = 6) in ranked order for almond nutmeats were: 0.020, 0.031, 0.054, 0.082, 0.089, 0.094 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 6) in ranked order for almond nutmeats were: 0.050, 0.061, 0.084, 0.14 (3) mg/kg.

Five trials on pecans were conducted at the maximum GAP. The residue values (spirotetramat plus enol, *n* = 5) in ranked order for pecan nutmeats were: 0.020 (2), 0.048, 0.13, 0.25 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 5) in ranked order for pecan nutmeats were: 0.050 (2), 0.076, 0.16, 0.29 mg/kg. The Meeting combined the residue values for pecan and almond nutmeats. The residue values (spirotetramat plus enol, *n* = 11) in ranked order for tree nut nutmeats were: 0.020 (3), 0.031, 0.048, 0.054, 0.082, 0.089, 0.094, 0.13, 0.25 mg/kg. The residue values (spirotetramat plus 4 metabolites, *n* = 11) in ranked order for tree nut nutmeats were: 0.050 (3), 0.061, 0.076, 0.084, 0.14 (3), 0.16, 0.29 mg/kg.

The Meeting estimated for the tree nuts group an STMR of 0.084 mg/kg, an HR of 0.29 mg/kg and a maximum residue level of 0.5 mg/kg.

Secondary food commodities of plant origin – Dried Hops

Supervised field trials were received from France and Germany for green hops and dried cones. The GAP of Austria specifies for hops: OD; 0.15 kg ai/ha, 0.005 kg ai/hL, 1 application, 14 day PHI. Four trials were conducted according to this GAP. The residue values (spirotetramat plus enol, *n* = 4) in ranked order for dried hops cones were: 0.73, 1.1, 1.7, 1.8 mg/kg.

The residue values (spirotetramat plus 4 metabolites, *n* = 4) in ranked order dried hops cones were: 1.1, 1.8, 2.0, 3.1 mg/kg.

Supervised field trials were received from the USA for dried hops cones. The GAPs in Canada and the USA are: OD, SC; 0.105 kg ai/ha, 0.220 kg ai/ha/season, 7 day PHI. Four trials were conducted at maximum GAP.

The residue values (spirotetramat plus enol, *n* =4) in ranked order for dried hops cones were: 2.2, 3.7, 4.8, 4.9 mg/kg. The residue values (spirotetramat plus 4 metabolites, *n* = 4) in ranked order dried hops cones were: 2.8, ~~4.5~~, ~~5.8~~ (2) mg/kg.

Based on the US trial data, the Meeting estimated for dried hops cones an STMR of 5.2 mg/kg and a maximum residue level of 15 mg/kg.

Almond hulls

Supervised field trials were reported from the USA for almonds. The GAPs in Canada and the USA are: SC, OD; 0.14 kg ai/ha, 0.38 kg ai/ha/season, 7 day PHI. Six trials on almonds were conducted at the maximum GAP. The residue values (spirotetramat plus enol, $n = 6$) in ranked order for almond hulls were: 1.3, 2.0, 3.9, 4.2, 4.4, 4.7 mg/kg. . The residue values (spirotetramat plus 4 metabolites, $n = 6$) in ranked order for almond hulls were: 1.9, 2.6, 4.8, 5.0, 5.2, 5.3 mg/kg.

The Meeting estimated for almond hulls an STMR of 4.9 mg/kg. The Meeting estimated a maximum residue level of 10 mg/kg for almond hulls.

Fate of residues during processing

The Meeting received processing studies for apple, bean with pod, cheery, orange, grape, hops, plum, potato and tomato. Some information was supplied on the fate of radiolabelled spirotetramat under general processing conditions.

The nature of the residue under simulated processing conditions was reported for radiolabelled spirotetramat and radiolabelled metabolites spirotetramat-enol, spirotetramat-enol-glucoside, spirotetramat-ketohydroxy and spirotetramat-monohydroxy.

Spirotetramat was resistant to hydrolysis under conditions being representative for pasteurization. Under conditions representative for baking, boiling and brewing 15% of spirotetramat degraded to spirotetramat-enol. Under conditions of sterilization the active substance was nearly completely hydrolysed to spirotetramat-enol. Spirotetramat-enol was detected as the only hydrolysis product.

Spirotetramat-enol was resistant to hydrolysis under all test conditions.

Spirotetramat-enol-glucoside was resistant to hydrolysis under conditions representative for pasteurisation. Under conditions representative for baking, brewing and boiling ca.10% of the test substance was hydrolysed to spirotetramat-enol. Under conditions of sterilization ca. 40% of the spirotetramat-enol-glucoside was hydrolysed to the enol metabolite.

Spirotetramat-ketohydroxy was resistant to hydrolysis under conditions of pasteurisation. Under conditions of baking, brewing and boiling a slight (5%) degradation occurred; under conditions of sterilisation spirotetramat-ketohydroxy was completely hydrolysed.

Spirotetramat-monohydroxy was resistant under all test conditions.

Spirotetramat is unstable under some processing conditions, yielding the enol metabolite. Likewise, the spirotetramat enol glucoside metabolite may hydrolyse to the enol under some processing conditions. Additionally, the spirotetramat ketohydroxy metabolite is unstable under sterilization conditions. However, this metabolite is generally a very small portion of the residue. The residue definitions recommended for plant commodities will suffice for processed plant commodities.

The processing (or transfer) factors derived from the processing studies and the resulting recommendations for STMR-Ps, HR-Ps, and/or maximum residue levels are summarized in the table below. The factors are the ratio of the total residue in the processed commodity divided by the total residue in the raw agricultural commodity (RAC). Where the apparent factor was > 1, the factor was also calculated based on the ratio of parent plus enol metabolite in the processed fraction to the parent plus enol metabolite in the RAC. These were generally comparable.

Processing (Transfer) Factors from the Processing of Raw Agricultural Commodities (RACs) with Field-Incurred Residues from Foliar Treatment with Spirotetramat

RAC	Processed Commodity	Processing Factor[a]	RAC mrl	Processed Commodity mrl	RAC STMR	Processed Commodity STMR-P	RAC HR	Processed Commodity HR-P
Orange	Juice	< 0.86 < 0.83 < 0.56 < 0.56 < 0.30 < 0.40 MEDIAN 0.56	0.5		0.33	0.18	0.47	
Orange	Marmalade	< 0.83 < 0.83 < 0.56 0.37 MEDIAN 0.56	0.5		0.33	0.19	0.47	
Orange (citrus)	Pulp, dry	1.3	0.5		0.33	0.43	0.47	
Orange (citrus)	Oil	14	0.5		0.33	4.8	0.47	
Apple	Juice	< 0.57 < 0.87 0.39 0.40 MEDIAN 0.48	0.7		0.17	0.082	0.55	
	Sauce	0.78 < 0.87 0.65 0.13 MEDIAN 0.72	0.7		0.17	0.12		
	Pomace, dried	6.8 4.5 6.0 6.8 6.4 1.9 (wet) [calc 4.8 dry] MEDIAN 6.2	0.7	5	0.17	1.1	0.55	
Cherry	Preserve (canned)	0.46 0.48 0.58 0.46 MEDIAN 0.47	3		1.6	0.75	2.1	

RAC	Processed Commodity	Processing Factor[a]	RAC mrl	Processed Commodity mrl	RAC STMR	Processed Commodity STMR-P	RAC HR	Processed Commodity HR-P
Grapes	Raisin	1.5 3.1 2.6 MEDIAN 2.6	2	4	0.41	1.1	1.3	3.4
	Juice	0.66	2		0.41	0.27	1.3	
	Jelly	0.27	2		0.41	0.11	1.3	
	Pomace	1.7 1.8 1.9 1.9 MEDIAN 1.8	2	4	0.41	0.74		
	Wine	0.68 0.76 0.44 0.38 MEDIAN 0.56	2		0.41	0.23	1.3	
Plums	Dried plums (“prunes”)	2.2	3	5	1.6	3.5	2.1	4.6
Tomatoes	Juice	0.63 0.58 0.48 0.67 0.91 MEDIAN 0.63	1		0.43	0.27	1.1	
	Preserve (canned)	0.72 0.46 0.39 0.71 1.1 MEDIAN 0.58	1		0.43	0.25	1.1	
	Puree	1.2 0.92 0.58 0.71 3.4 MEDIAN 0.92	1		0.43	0.40	1.1	
	Paste	7.4	1		0.43	3.2	1.1	
	Dried	12	1		0.43	5	1.1	
French Climbing Bean	Cooked bean	0.39 0.30 0.54 0.82 MEDIAN 0.46						

RAC	Processed Commodity	Processing Factor[a]	RAC mrl	Processed Commodity mrl	RAC STMR	Processed Commodity STMR-P	RAC HR	Processed Commodity HR-P
Potato	Chips (crisps, not frits)	1.2	0.8		0.12	0.14	0.46	
	Flakes	3.5	0.8		0.12	0.42	0.46	
	Tuber, peeled and cooked	1.3	0.8					
	Peel	0.95	0.8		0.12	0.11	0.46	0.44
Hops	Beer	< 0.034 < 0.030 < 0.014 < 0.013 MEDIAN 0.022	15	N/A	5.2	0.11		

[a] Each value represents a separate study. The factor is the ratio of the total residue in the processed item divided by the total residue in the RAC. The total residue is the parent spirotetramat plus four metabolites, calculated as spirotetramat.

Estimated maximum and mean dietary burdens of farm animals

Dietary burden calculations for beef cattle and dairy cattle are provided below. The calculations were made according to the animal diets from Canada-USA, EU, and Australia in the *Table of OECD Feedstuffs Derived from Field Crop* (Annex 6 of the 2006 JMPR Report).

A poultry feeding study was not provided. However, there are no poultry feed items resulting from the RACs for which the 2008 Meeting made maximum residue level recommendations, and the results of the poultry metabolism (for which the dosing phase was 14 days) could be used to estimate the poultry dietary burden if relevant new RAC commodity MRLs were to occur in the future.

Potential cattle feed items include: almond hulls, apple pomace, citrus pulp, grape pomace, potato culls and pulp and waste and cabbage heads.

Animal dietary burden, spirotetramat total residue, ppm of dry matter diet				
		US-Canada	EU	Australia
Beef cattle	max	1.86	2.91[a]	1.71
	mean	1.04	0.89	1.57[b]
Dairy cattle	max	1.02	2.41[a]	1.53
	mean	0.66	0.42	1.53[b]

[a] Highest maximum beef or dairy cattle dietary burden suitable for maximum residue level estimates for mammalian meat and milk. Values rounded up to 3 ppm.

[b] Highest mean beef or dairy cattle dietary burden suitable for STMR estimates for mammalian meat and milk. Values rounded up to 2 ppm.

Animal commodity maximum residue levels

The Meeting received a report on a feeding study with lactating dairy cows. Ten lactating Holstein dairy cows (*Bos taurus*; three cows/treatment group and one control cow) were dosed orally, *via* capsule, for 29 consecutive days with spirotetramat at target dose rates (based on feed dry weight) of either 0 ppm day (control), 3.0 ppm /day, 9.0 ppm/day, or 30 ppm /day. Analytes determined in milk and tissues were: spirotetramat, spirotetramat enol and spirotetramat enol glucuronide (enol-GA). The demonstrated limit of quantitation (LOQ) was 0.005 mg/kg for each analyte in milk matrices and was 0.010 mg/kg for each analyte in the tissue matrices. The limits of detection (LOD) for each

compound were in the range of 0.002–0.005 mg/kg for tissues and 0.0007–0.001 mg/kg for milk matrices.

At the 3 ppm feeding level, each analyte was below the LOD in all tissues except kidney. For kidney, spirotetramat enol was quantified at 0.019–0.024 mg/kg, average 0.021 mg/kg.

At the 9 ppm feeding level, all analytes except spirotetramat enol were absent at the LOD in all tissues. Spirotetramat enol was measured at 0.013 mg/kg in the fat of one of three animals, average 0.008 mg/kg. The metabolite was absent in muscle, but was found at levels of 0.049–0.10 mg/kg in kidney, average 0.094 mg/kg, and at levels of 0.009 (< LOQ)–0.014 mg/kg in liver, average 0.094 mg/kg.

At the 30 ppm feeding level, all analytes were absent in milk at the LOQ (0.005 mg/kg) except for spirotetramat enol at 0.005 mg/kg in one of three cows. Residues of spirotetramat and spirotetramat enol GA were below the LOD in all milk samples, except in one milk sample at 0.0008 mg/kg. Residues of parent equivalents did not concentrate in samples of skim milk or milk fat separated mechanically from whole milk.

At the 30 ppm feeding level, spirotetramat enol was quantifiable in fat (< 0.005–0.032 mg/kg), muscle (0.0043–0.014 mg/kg), kidney (0.17–0.41 mg/kg), and liver (0.025–0.038 mg/kg). Additionally, spirotetramat enol GA was quantifiable in liver (maximum 0.018 mg/kg) and kidney (maximum 0.030 mg/kg).

Dietary burden (ppm) Feeding level ppm]		Cream	Milk	Muscle		Liver		Kidney		Fat	
		Mean	Mean	Highest	Mean	Highest	Mean	Highest	Mean	Highest	Mean
mrl beef cattle	(3) [3.0]			(< 0.003) [< 0.003[3]]		(0.006) [0.006]		(0.024) [0.024]		(< 0.005) [< 0.005[3]]	
mrl, dairy cattle	(3) [3.0/30[2]]		(0.0005) [≤ 0.005[2]]	(< 0.003) [< 0.003[3]]		(0.006)) [0.006]		(0.024) [0.024]		(< 0.005) [< 0.005[3]]	
STMR beet cattle	(2) [3.0]				(< 0.0.002) [< 0.003[3]]		(0.004) [0.006]		(0.014) [0.021]		(< 0.004) [< 0.005[3]]
STMR dairy cattle	(2.) [3.0/30[2]]		(0.0004) [< 0.005[2]]		(< 0.002) [< 0.003[3]]		(< 0.004) [0.006]		(0.014) [0.021]		(< 0.004) [< 0.005[3]]

[1] Defined as spirotetramat enol and expressed as spirotetramat equivalents. The LOQs of spirotetramat and its enol are 0.005 mg/kg each in milk and 0.01 mg/kg each in the various tissues. The estimated LODs of spirotetramat are 0.005 mg/kg in fat, 0.003 mg/kg in muscle, 0.001 mg/kg in kidney, 0.002 mg/kg in liver, and 0.0007 mg/kg in milk. The estimated LODs of spirotetramat enol are 0.005 mg/kg in fat, 0.003 mg/kg in muscle, 0.003 mg/kg in kidney, 0.005 mg/kg in liver, and 0.001 mg/kg in milk.

[2] 30 ppm feeding study only for the milk samples

[3] Limit of detection.

The Meeting estimated the following STMR values: milk 0 mg/kg; muscle 0 mg/kg; edible offal (based on kidney) 0.014 mg/kg; fat 0 mg/kg.

The Meeting estimated the following HR values: milk 0 mg/kg; muscle 0 mg/kg; edible offal (based on kidney) 0.024 mg/kg; fat 0 mg/kg.

The Meeting estimated the following maximum residue levels: milk 0.005 (*) mg/kg; meat (mammalian except marine) 0.01 (*) mg/kg; edible offal 0.03 mg/kg.

DIETARY RISK ASSESSMENT

Long-term intake

The evaluation of spirotetramat has resulted in recommendations for MRLs and STMRs for raw and processed commodities. Consumption data were available for 32 food commodities and were used in the dietary intake calculation. The results are shown in Annex 3. The International Estimated Daily Intakes for the 13 GEMS/Food regional diets, based on estimated STMRs were in the range 1–10% of the maximum ADI of 0.05 mg/kg bw (Annex 3).

The Meeting concluded that the long-term intake of residues of spirotetramat from uses that have been considered by the JMPR is unlikely to present a public health concern.

Short-term intake

The International Estimated Short-term Intake (IESTI) for spirotetramat was calculated for the food commodities (and their processing fractions) for which maximum residue levels and HRs were estimated and for which consumption data were available. The results are shown in Annex 4. For the general population the IESTI varied from 0–10% of the ARfD (1.0 mg/kg bw) while for children the IESTI varied from 0–40% of the ARfD.

The Meeting concluded that the short-term intake of residues of spirotetramat from uses that have been considered by the JMPR is unlikely to present a public health concern.