

Table 1. (Continued) Anticoccidial drugs used in the poultry industry.

Chemical group (approx. dose, ppm ^a); relevant information	Non proprietary name, *brand name (manu- facturer, company); other information	Characteristics^b and miscellaneous comments
(75–125) in broiler chickens; (75–125) in layer replacement chickens up to 16 weeks of age; (90–125) in turkeys up to 12 weeks of age; ^{c15} 1974	^{c15} lasalocid *Avatec (Roche) may be used (90–120) in pheasants, and partridges up to 12 weeks of age;	Chemistry differs from that of other ionophores; it has stronger affinity to divalent cations than monovalent ions, and this may be the reason for differences in effects on birds and coccidia compared to other ionophores; in birds, it possibly alters the water excretion via dietary electrolytes to the extent that wet litter may be a problem at higher drug concentrations; at lower concentrations (75ppm) activity against <i>E. acervulina</i> is insufficient and strongest against <i>E. tenella</i> ; in the field, lasalocid may improve control of coccidiosis where <i>E. tenella</i> strains reveal tolerance to other ionophores; like other ionophores, lasalocid shows activity against coccidia in sheep and cattle when given prophylactically in feed; equines are very sensitive to the drug
(50–70) in broiler chickens ^{c16} 1978	^{c16} salinomycin-Na *Coxistac (Pfizer) *Usten (Kaken: patente) *Eustin (Bayer) *Bio-Cox (earlier Robins; now Agri-Bio, American Home Products Corp.) **Sacox 120 [®] micro-Granulate (Invervet) other companies/brand names	Approved levels (44–70), and animal species licensed may differ in various countries; salinomycin has broad-spectrum activity (including coccidia of rabbits) and better activity against <i>E. tenella</i> and <i>E. acervulina</i> than other related ionophores; this is also true in case of drug-tolerant <i>Eimeria</i> spp. in the field; it may cause severe toxicity (growth depression, excitement followed by paralysis with head and legs extended, mortality) if feed containing recommended or lower doses is fed to turkeys for longer periods; growing turkeys tolerate the drug better than adult ones, and toxicity of salinomycin to equines is less than that of monensin; Salinomycin derivatives with increased lipophilicity were obtained by acylation of the hydroxyl moiety at C-20; the 3-methyl propanoyl ester was about six times more active than the parent compound; many derivatives of the series proved to be toxic very similar to salinomycin in chemistry (“methyl-salinomycin”) have affinity to monovalent cations; their anticoccidial effect and performance in field proved not as good as that of salinomycin; to enhance activity, narasin has been combined with nicarbazin ; synergism of both drugs improved coccidiosis control; drug combination may be used in starter phase of shuttle programs followed by a different ionophore in grower-finisher phase; broiler feed containing 70ppm or lower (subnormal) concentrations of narasin may cause mortality if fed to adult turkeys and growing turkeys (mortality to a lesser degree); equines are very sensitive to the drug (see: monensin and salinomycin)
**(50–70) in broiler chickens; **(30–50) in replacement chickens, **(20–25) in fattening rabbits		
*(60–70 in broiler chickens) ^{c17a} 1983	^{c17a} narasin , *Monteban (Elanco; Eli Lilly)	
**(80–100 in broiler chickens) ^{c17b} 1988	^{c17b} narasin +nicarbazin (1:1 mixture), **Maxiban (Elanco; Eli Lilly)	
(5) in broiler chickens ^{c18} 1984	^{c18} maduramicin ammonium, *Cygro (earlier Cyanamid, now Roche)	is fermented from <i>Actinomadura yumaensis</i> and has a sugar moiety as side chain (monoglycoside polyether); it has affinity to both monovalent and divalent cations and exhibits at extreme low concentrations similar anticoccidial activity like other ionophores in birds; however, soon after introduction into the market cross-resistance between maduramicin and other polyether antibiotics has been found in field strains isolated in the Netherlands and Western areas of Germany; various birds (turkeys, guinea fowl, pheasants, geese, ducks) and mammals (cattle, sheep, horses, pigs, rabbits) tolerate 5 ppm in feed without showing adverse effects; to take the advantage of synergistic effects between drugs, maduramicin has been combined with nicarbazin; the combination may have favorable influence on performance of chickens
(3.75+40) in broiler chickens ^{c18a} 1992	^{c18a} maduramicin +nicarbazin *Gromax (Roche)	