ROTATION

Avoid resistance development and cross-resistance

In order to maximize the effect of the anticoccidial program and achieve its best performance one should mitigate the risk of resistance development. In this respect the duration of exposure of the *Eimeria* population to a given drug should be minimized (Peek and Landman 2011). In order to achieve this a rotation program should be established. **Rotation** - changing the anticoccidial tools to one of the **other classes** after a few cycles.

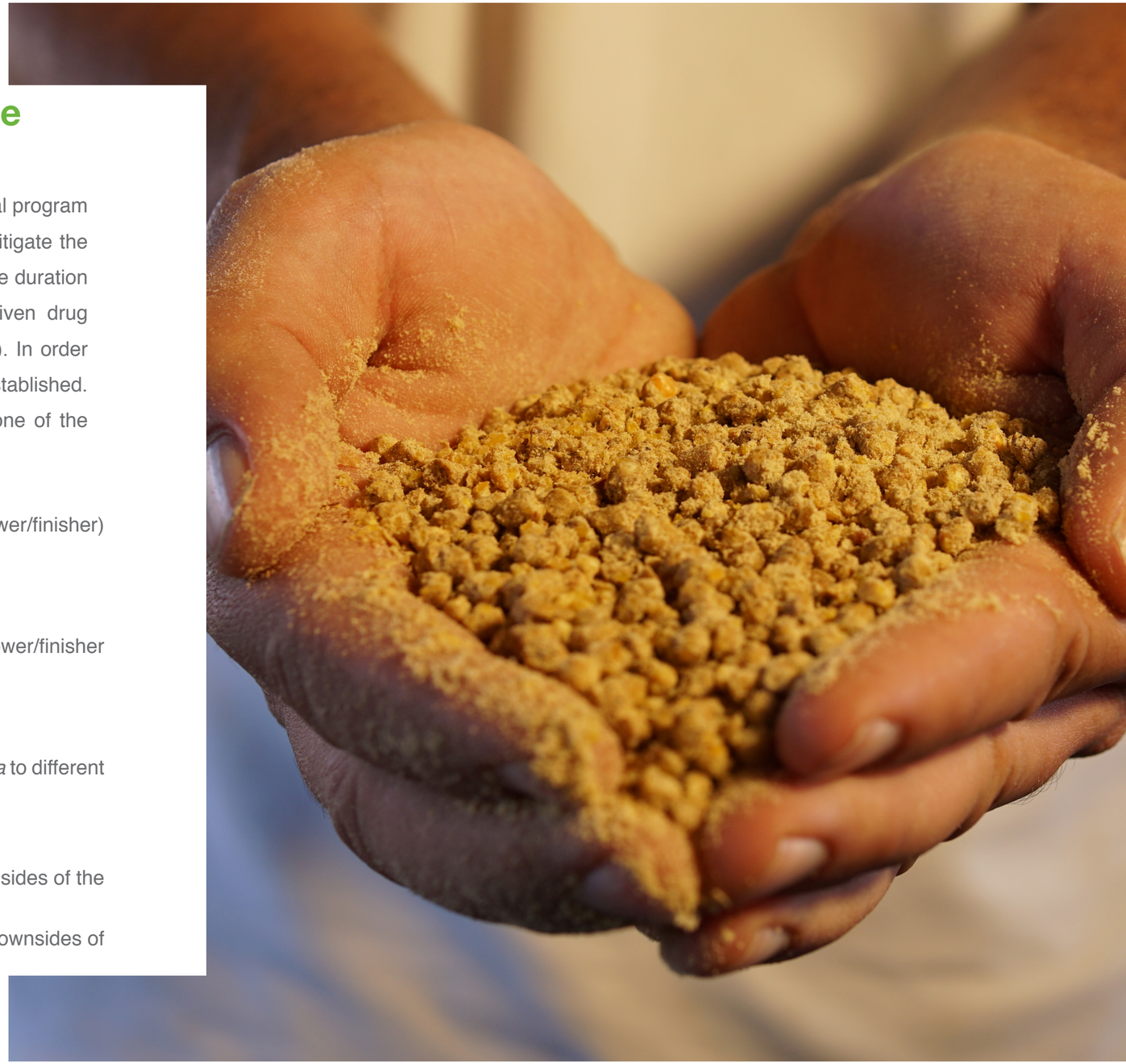
Full (straight) program - same anticoccidial from day one to withdrawal (starter/grower/finisher)

Shuttle program - one anticoccidial in the starter/grower and another anticoccidial in the grower/finisher

Vaccination could be a part of the rotation program and helps to restore sensitivity of field *Eimeria* to different anticoccidial drugs (Peek and Landman, 2011).

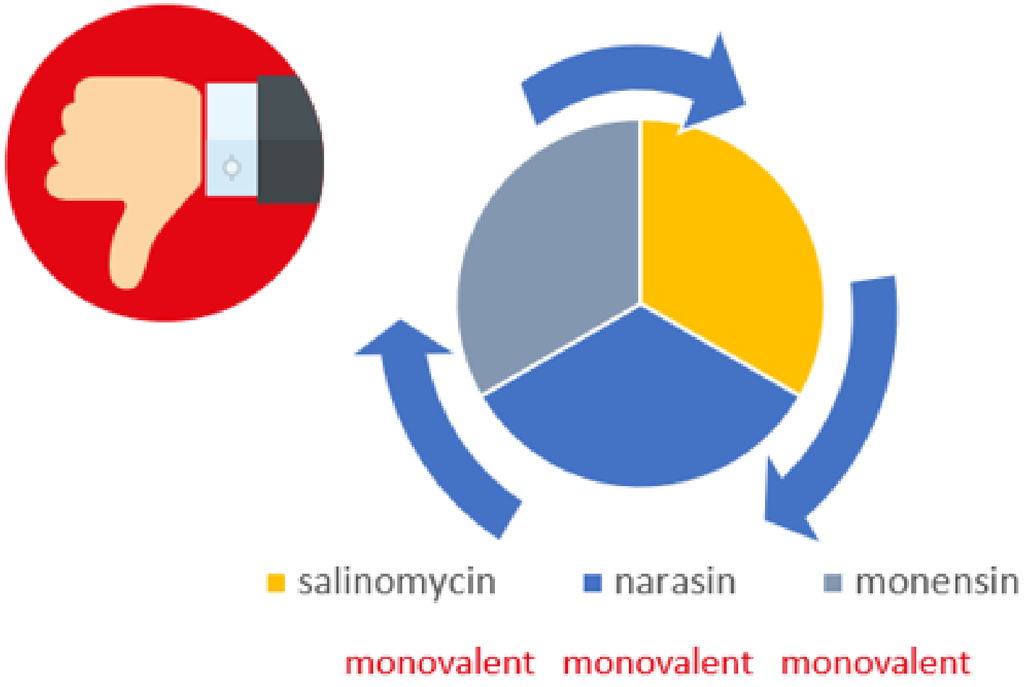
- **Stand-alone**
- **Bio-shuttle** – vaccination followed by a low dose of an ionophore to alleviate the downsides of the vaccine
- **Bio-Phyto shuttle** – vaccination followed by phytogenic product which alleviates the downsides of the vaccine

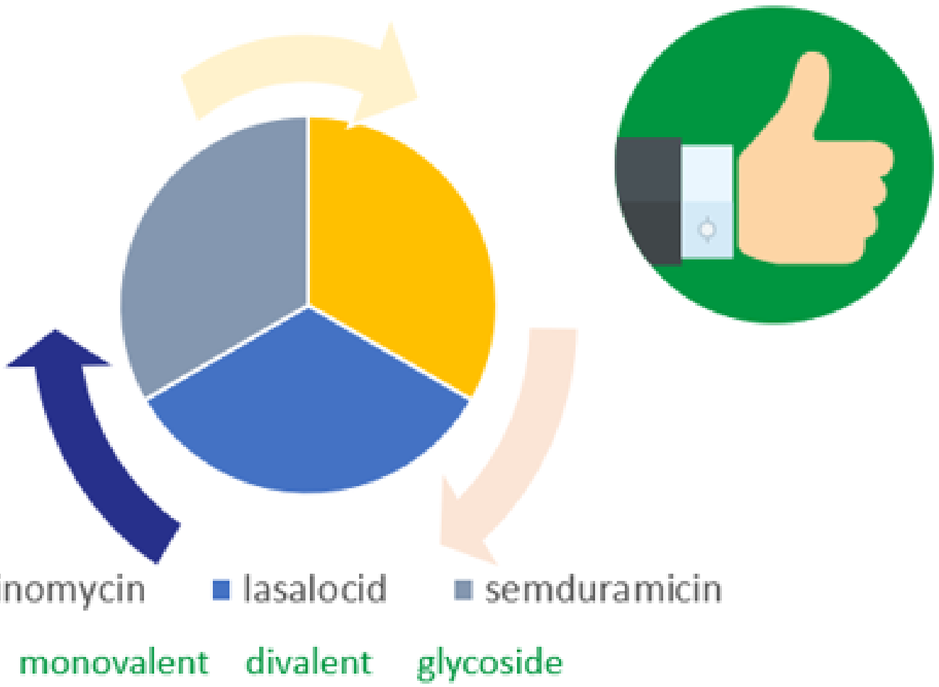
Rotations have helped prolong the effective life of anticoccidials in the face of constant selection for drug resistance (Chapman, 2014)



Using drugs from the same class and same mode of action one after another increases the risk of resistance being developed toward the class.

Rotate between products from diffferent classes to avoid cross-resistance and provide restoration of sensitivity.





Don’t use any product for too long

The safe duration of use depends on the pace of resistance development inherent for each drug

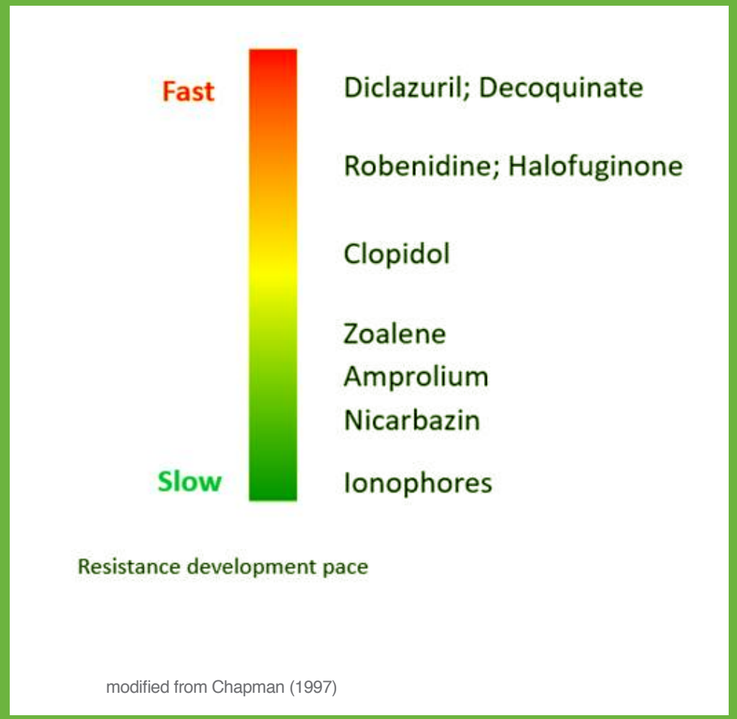
- **Ionophores in full/shuttle – up to 4-6 months**
- **Nicarbazin combos in shuttle – up to 6 months**
- **Other chemicals in full – up to 2-3 months.**
- **Other chemicals in shuttle – up to 3-4 months**

Give as long a resting period as possible for each class

Ionophores at least 6 months

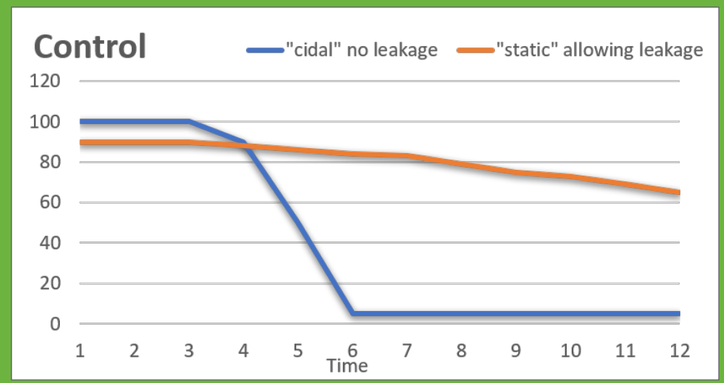
Chemicals at least 12 months

***to be able to give the whole class of a resting period one should combine in shuttle programs nicarbazin-ionophore combos with ionophores from the same class (e.g. Aviax Plus/Aviax or Maxiban/Salinomycin or Maxiban/Narasin)**



modified from Chapman (1997)

Do not use a certain product for too long.



To avoid loss of performance or management issues the side effects of some of the anticoccidials should be considered.

Safety margin – some anticoccidials have rather narrow safety margins (all ionophores, halofuginone, nicarbazin) – for this reason they should be carefully dosed, properly mixed and special attention should be paid to avoid de-mixing (segregation) of the feed in case of mash feed, poor pellet quality etc.

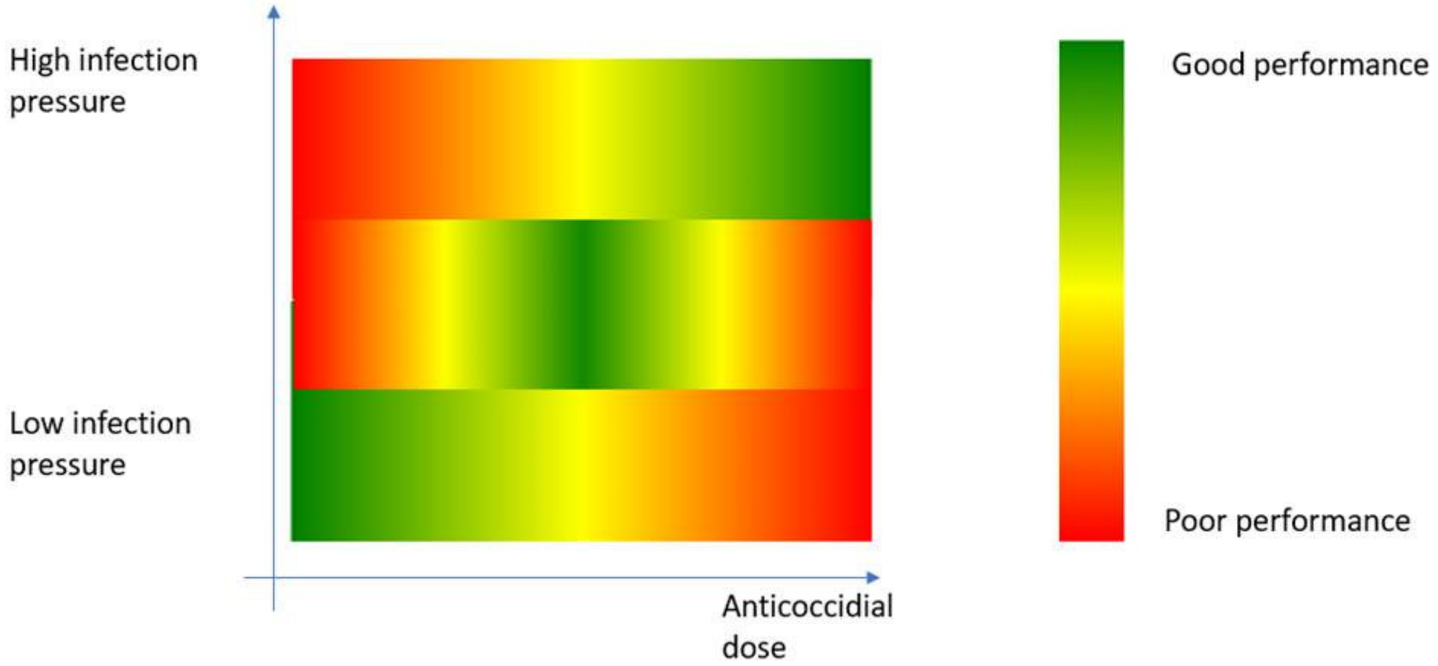
The dose of the above products should be reflecting the infection pressure – **low infection pressure low end dose, moderate to high infection pressure mid range dose and only in very high infection pressure high end dose.**

Nicarbazin increases the heat production and sensitivity towards heat stress from 40ppm (Fowler 1995) – limit the use of nicarbazin/nicarbazin containing products to the first 21/28d of age and avoid use in heat stress risk periods if the poultry house temperature cannot be maintained below 21^{0}C.

Lasalocid increases water intake and respectively water excretion – limit the use during cold and humid periods of the year when excessive humidity cannot be evacuated from the house.

Monensin limits the feed and water intake, especially under high temperature conditions – avoid using it during summer.

Consider side effects of different anticocidials



When possible, the dose should reflect the infection pressure

Basic and important points in a well-designed anticoccidial program:

1.

Do not use any given product for too long

Consider the rate of resistance development for different products.

- Ionophores in full program/ nicarbazin-ionophore shuttles or combo/ - 4 to 6 months.
- Other chemicals in full 2 to 3 months of in shuttle 3 to 4 months.

2.

Rotate between different classes (not between products or molecules from same class).

3.

After each period of use give a sufficient resting period to the used molecule and avoid using all other molecules from the same class.

- Ionophores (all products from a given class) at least six months
- Chemicals at least 12 months (preferably 24 months for products with rapid and very rapid resistance development pace)

4.

Consider chemical clean-up and use of vaccines to restore sensitivity toward anticoccidial drugs.

5.

Strictly follow the registered dose ranges and follow the established and required withdrawal periods. If there is a dose range registered, consider the infection pressure when choosing the actual dose.