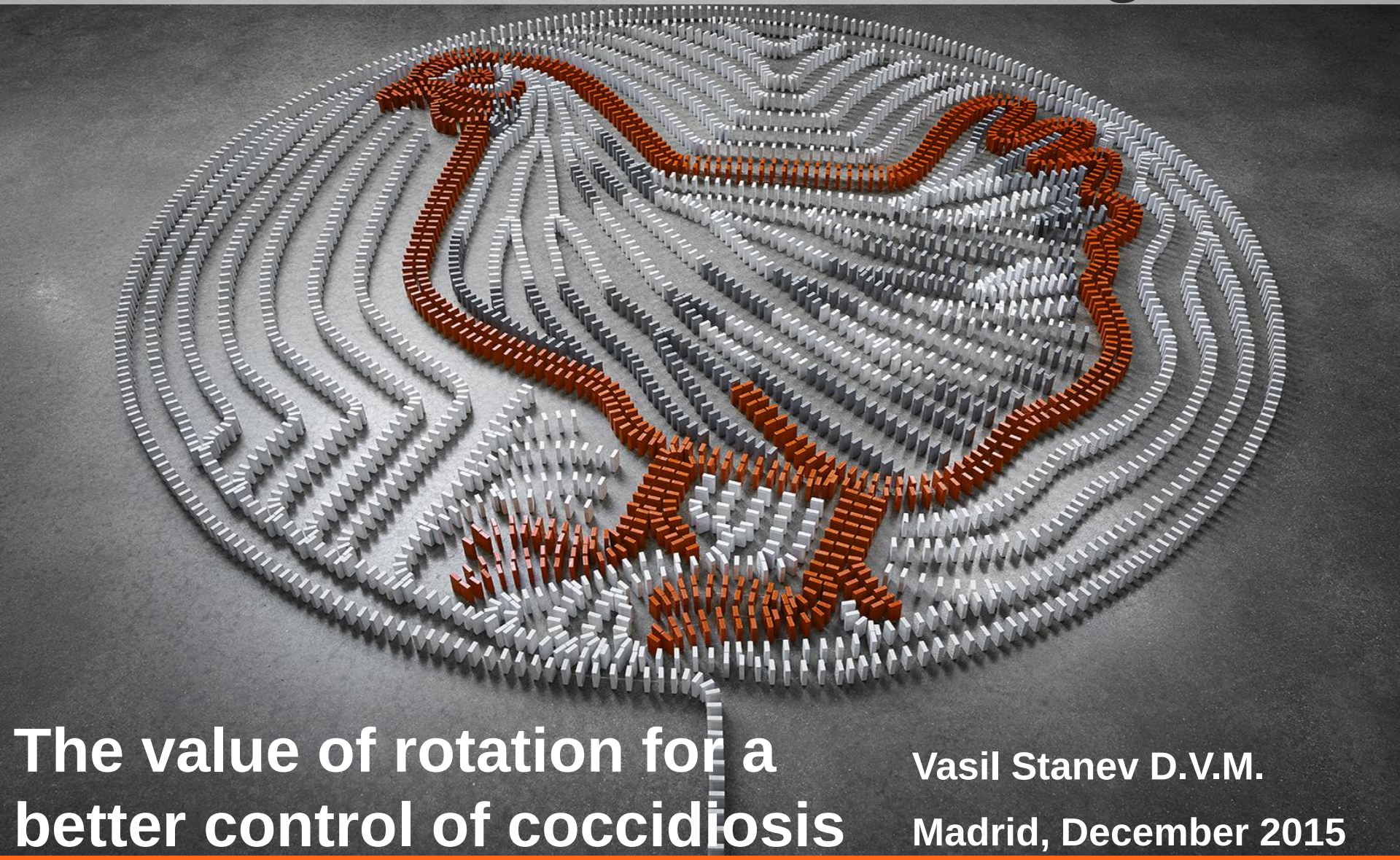
ROTECC™ coccidiosis management



The value of rotation for a better control of coccidiosis

Vasil Stanev D.V.M.

Madrid, December 2015

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Coccidiosis Overview

- Truly a global poultry disease; Same *Eimeria* causing the same problems in the Americas, Europe, Africa, Middle East, Asia Pacific
- Organism thrives in warm, humid environments but still a year-round problem in all regions[1] Causes microscopic intestinal lesions
- Makes flocks more susceptible to other diseases
- Eradication is not a realistic objective

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1. Overview of Coccidiosis in Poultry, *Merck Veterinary Manual*.

The Cost of Coccidiosis

- World poultry industry losses have been reported to be more than $3 billion a year to coccidiosis (2006)[1]
  - *How much is $3 billion to the poultry industry?*
  - *€ 0.05 per broiler grown*
- For a poultry house of 20 000 birds it means € 1000 loss

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1. Lillnoj H. Functional genomics approaches to study host pathogen interactions in mucosal pathogens, Proceedings of the Korean Society of Poultry Science Meeting, Nov. 10, 2006.

The Cost of Coccidiosis

- Clinical signs are only the visible part of a (much bigger) problem !
  - (Waldenstedt,2005; Williams,1999)

Clinical coccidiosis: mortality, blood in faeces,…

Subclinical coccidiosis: reduced weight gain, less performance, increased FCR, …

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Prevention Options

Global Coccidiosis Management Tools

Anticoccidial		
Ionophores	**Synthetic Anticoccidials**	**Vaccine**
Monovalent Salinomycin (Bio-Cox® /Salinomax® -Zoetis) Monensin Narasin	Decoquinate (Deccox® - Zoetis) Robenidine (Robenz®/Cycostat®Zoetis) Zoalene (Zoamix® Zoetis) Nicarbzin (Cycarb® - Zoetis) Sulfas (RofenAid® Zoetis) Amprolium Diclazuril Clopidol Clopidol+Methilbenzoquate Halofuginone	Advent® Coccivac® B HATCHPAK® COCCI III HIPRACOX® HUVEGUARD® Immucox® Inovocox® EM1 (Zoetis) Livacox® T Paracox® 5 Viracox®
Monovalent Glycoside Maduramicin (Cygro® - Zoetis) Semduramicin		
Divalent Lasalocid (Avatec® -Zoetis)		
Ionophore + Synthetic Combination Gromax® (Zoetis)* Nicarbazin + Monensin Nicarbazin + Narasin Nicarbazin + Semduramicin		

**Product and trademarks may vary by country*

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EU Coccidiosis Management Tools

<table>
<tr><th colspan="2">Anticoccidial drugs</th><th>Vaccines</th></tr>
<tr><th>Ionophores</th><th>Synthetic Anticoccidials</th><th></th></tr>
<tr><td><u>Monovalent</u>

Salinomycin (Bio-Cox® /Salinomax® -Zoetis)
Monensin
Narasin</td><td rowspan="3">Decoquinate (Deccox® - Zoetis)
Robenidine (Robenz®/Cycostat®Zoetis)
Nicarbzin
Diclazuril
Halofuginone</td><td rowspan="3">Paracox® 5
Hipracox®
Livacox® T</td></tr>
<tr><td><u>Monovalent Glycoside</u>

Maduramicin (Cygro® - Zoetis)
Semduramicin</td></tr>
<tr><td><u>Divalent</u>

Lasalocid (Avatec® -Zoetis)</td></tr>
<tr><td colspan="2"><u>Ionophore + Synthetic Combination</u>
Nicarbazin + Narasin</td><td></td></tr>
</table>

**Product and trademarks may vary by country*

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Vaccines

Advantages

- Give good coccidosis-control
- Restoration of Sensitivity:
  - after only one or two cycles for unattenuated vaccines
  - two to three cycles for attenuated vaccines
- No withdrawal period
- → As an addition to the anti-coccidial arsenal, usually problem solver

Disadvantages

- Expensive
  - cost of vaccine
  - cost of immunity
- Problems with NE, DB:
  - direct/indirect
- Application
- Immunity development takes time
  - short fattening period???
- Other possible issues:
  - species present in field but not in vaccine (E.mitis not in LivacoxT)
- → not frequently used in broilers

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Anticoccidial drugs

Advantages

- Gives very good coccidosis-control
- Applicable for various species
- Cost efficient
- Easy application
- Very good intestinal health
- → The most frequently used tool in broilers

Disadvantages

- Anticoccidial resistance and cross-resistance
- Anticoccidial safety

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RESISTANCE AND CROSSRESISTANCE

Anticoccidials: Resistance and Cross-resistance

- **Reduced sensitivity/resistance**

After some time of use

the efficacy of anticoccidials decreases

- **Cross-resistance**

If resistance to a product arises

other similar products will also work less efficient

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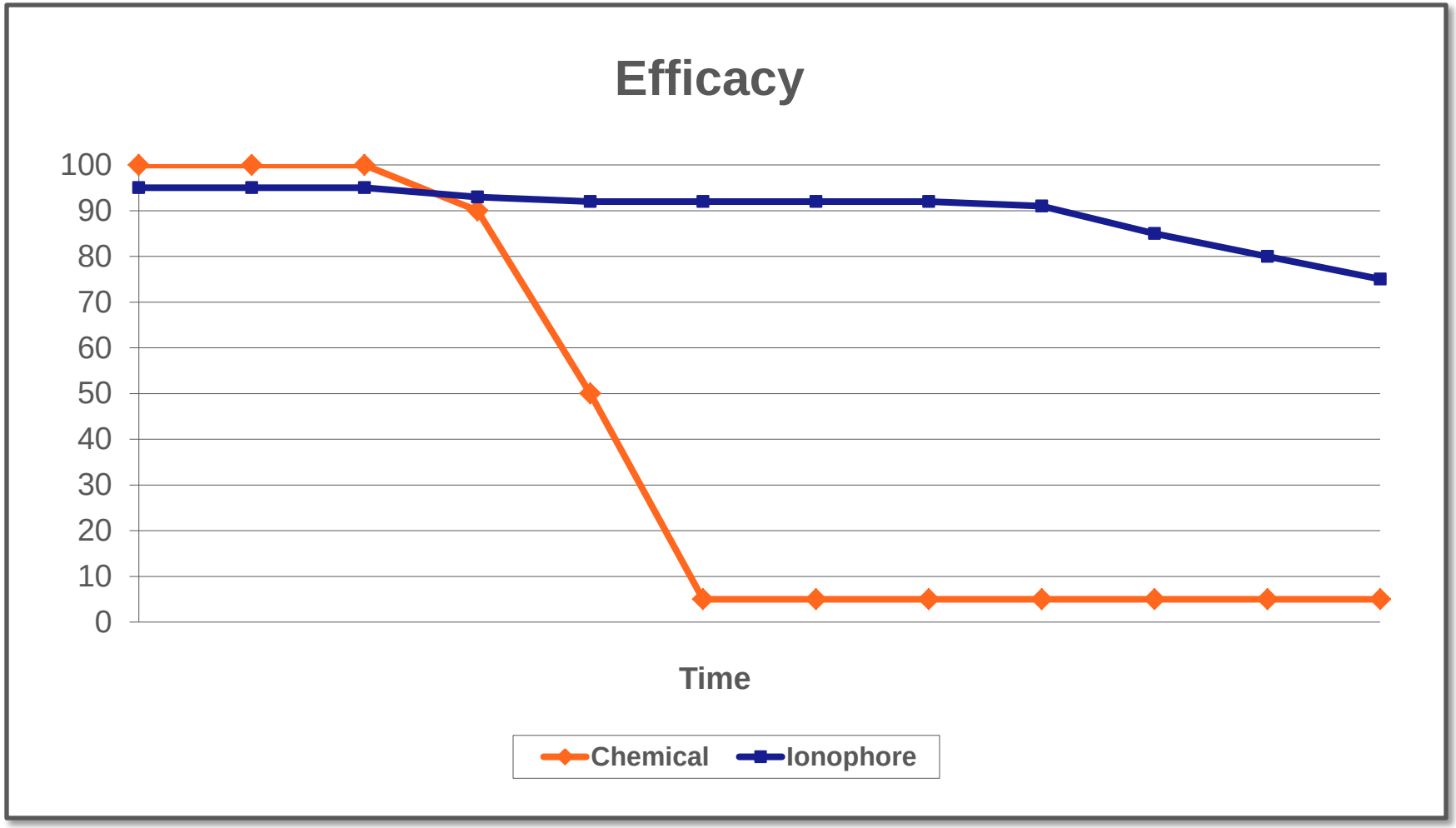
Timing of Resistance Development



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Cross-resistance - synthetic anticoccidials

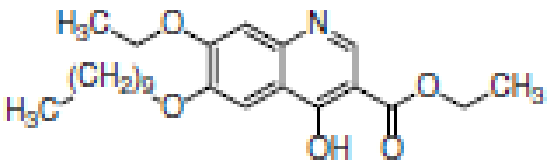


Figure 6.16. **Decoquinate.**

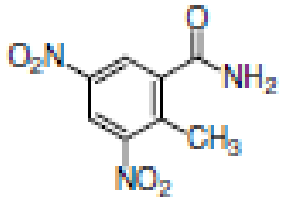
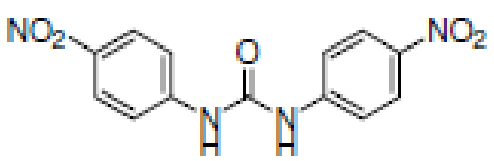


Figure 6.19. **Dinitolmide (zoalene).**



18. **Nicarbazin.**

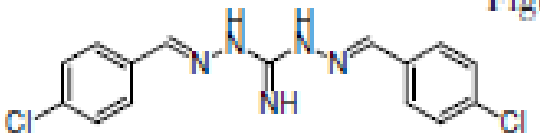


Figure 6.35. **Robenidine.**

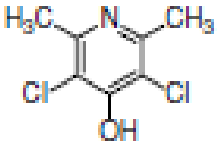


Figure 6.4. **Clopidol (meticlorpindol, clopindol).**

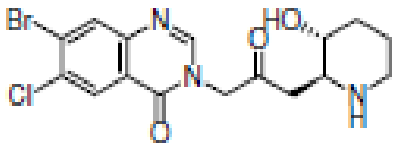


Figure 6.14. **Halofuginone hydrobromide.**

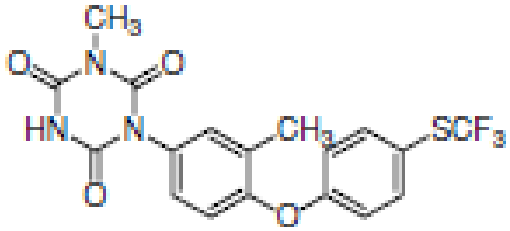


Figure 6.37. **Toltrazuril.**

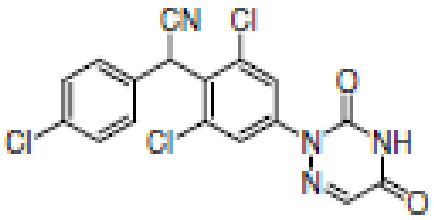


Figure 6.36. **Diclazuril.**

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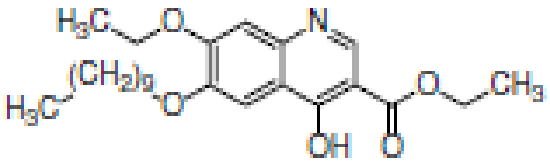
(*Conway, McKenzie, 2007*)

Cross-resistance - synthetic anticoccidials



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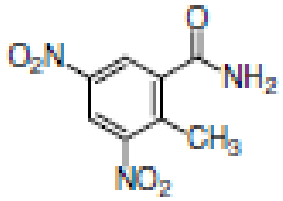

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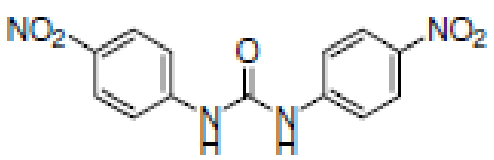
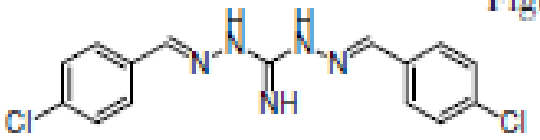


8. **Nicarbazin.**



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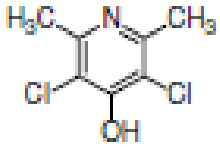

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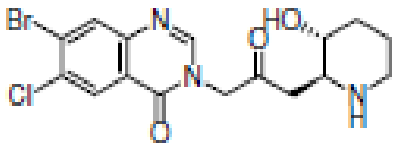


Figure 6.14. **Halofuginone hydrobromide.**

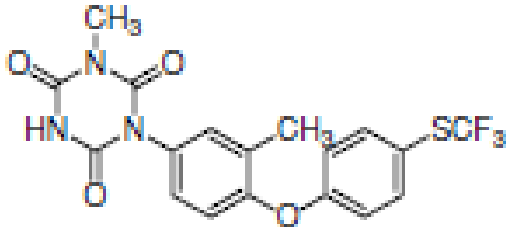
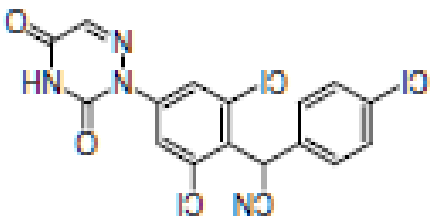


Figure 6.37. **Toltrazuril.**



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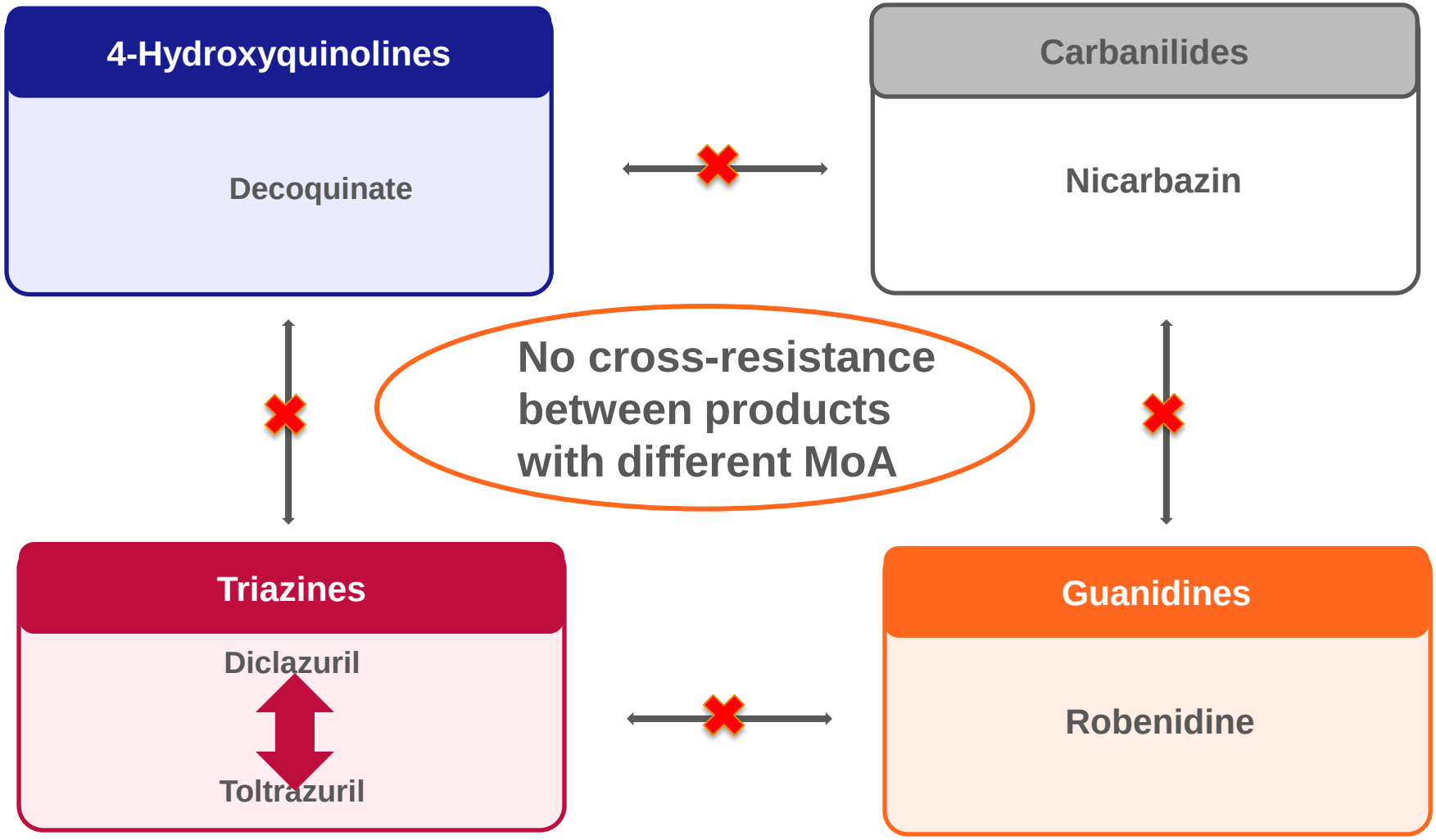
(*Conway, McKenzie, 2007*)

Cross-resistance - synthetic anticoccidials



(Weppelman et al., 1977; Bedrnik 1983, 1989; Hamet 1986; Mc Dougald 1981; Chapman 1994)

Ionophores - cross-resistance?

- Find the difference

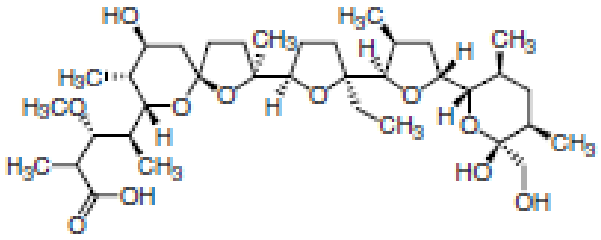


Figure 6.31. **Monensin.**

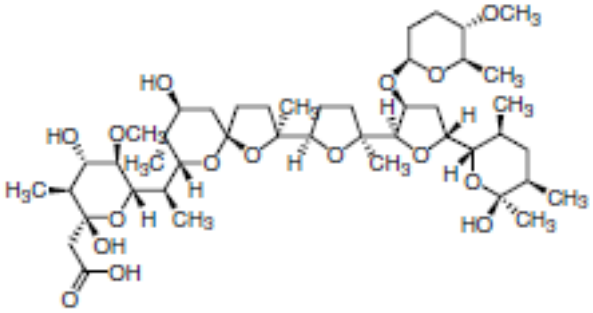


Figure 6.34. **Semduramicin.**

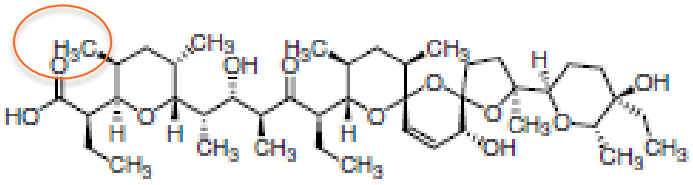
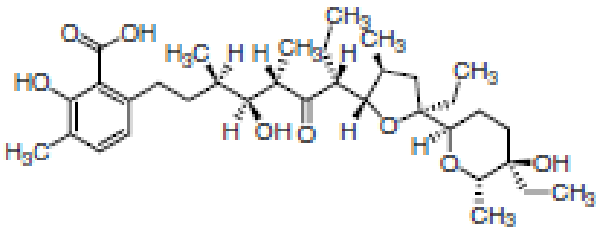


Figure 6.32. **Narasin.**



5.29. **Lasalocid.**

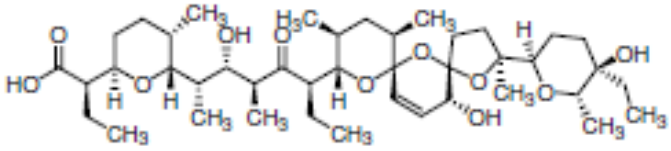


Figure 6.33. **Salinomycin.**

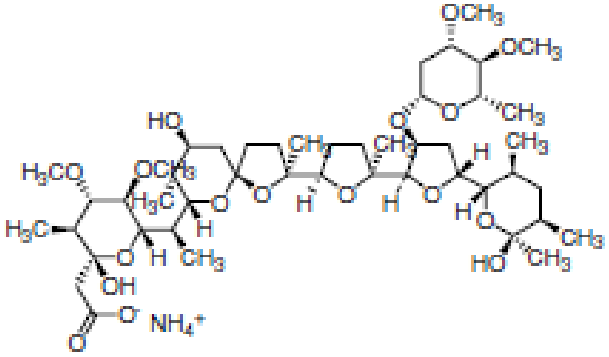
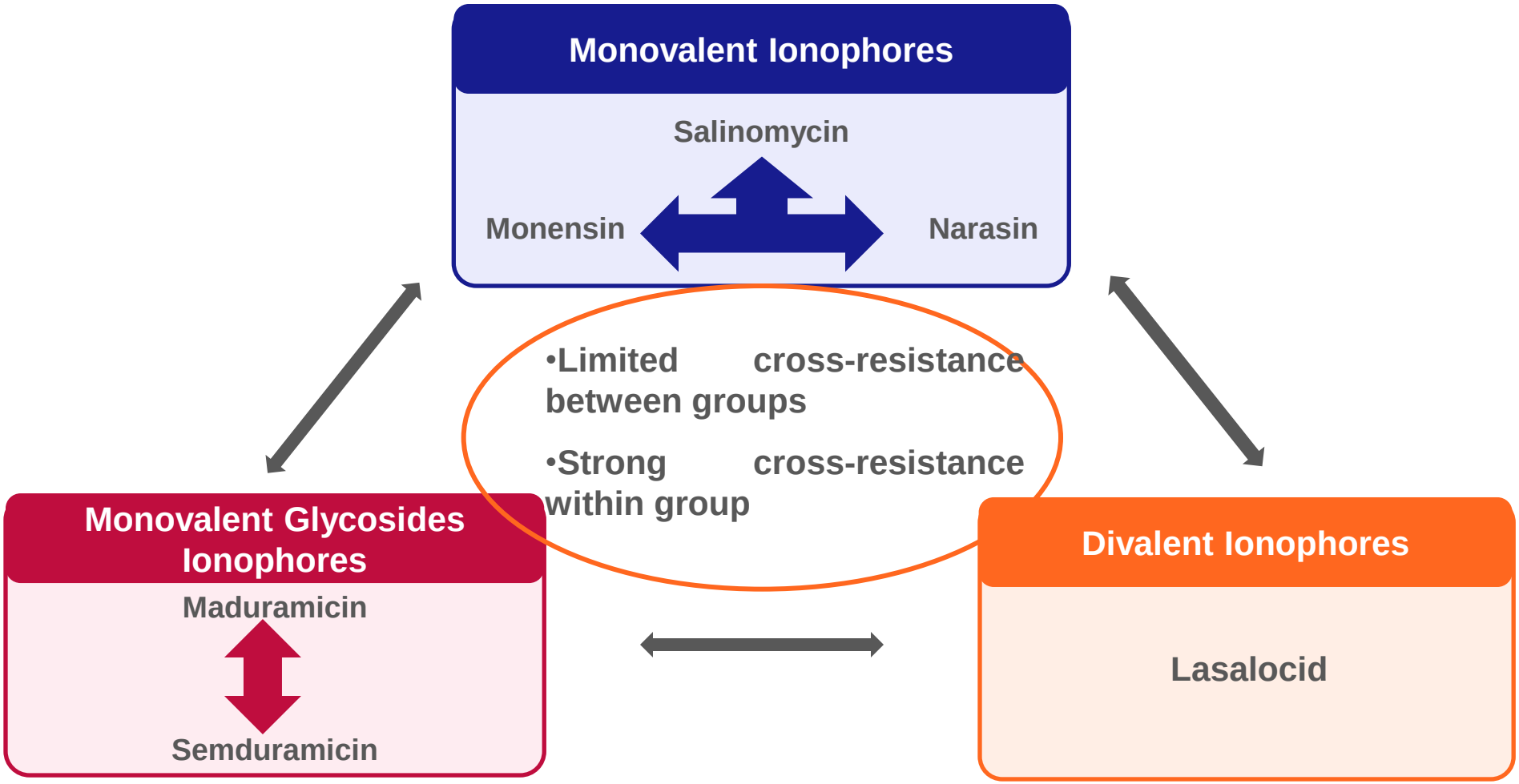


Figure 6.30. **Maduramicin.**

(*Conway, McKenzie, 2007*)

Potential for Cross-resistance Among Ionophores



(Weppelman et al., 1977; Bedrnik 1983, 1989; Hamet 1986; Mc Dougald 1981; Chapman 1994)

TO COPE WITH RESISTANCE

Anticoccidials: Resistance and Cross-resistance

- **Reduced sensitivity/resistance**

After some time of use

the efficacy of anticoccidials decreases

- **Cross-resistance**

If resistance to a product arises

other similar products will also work less efficient

ROTATION

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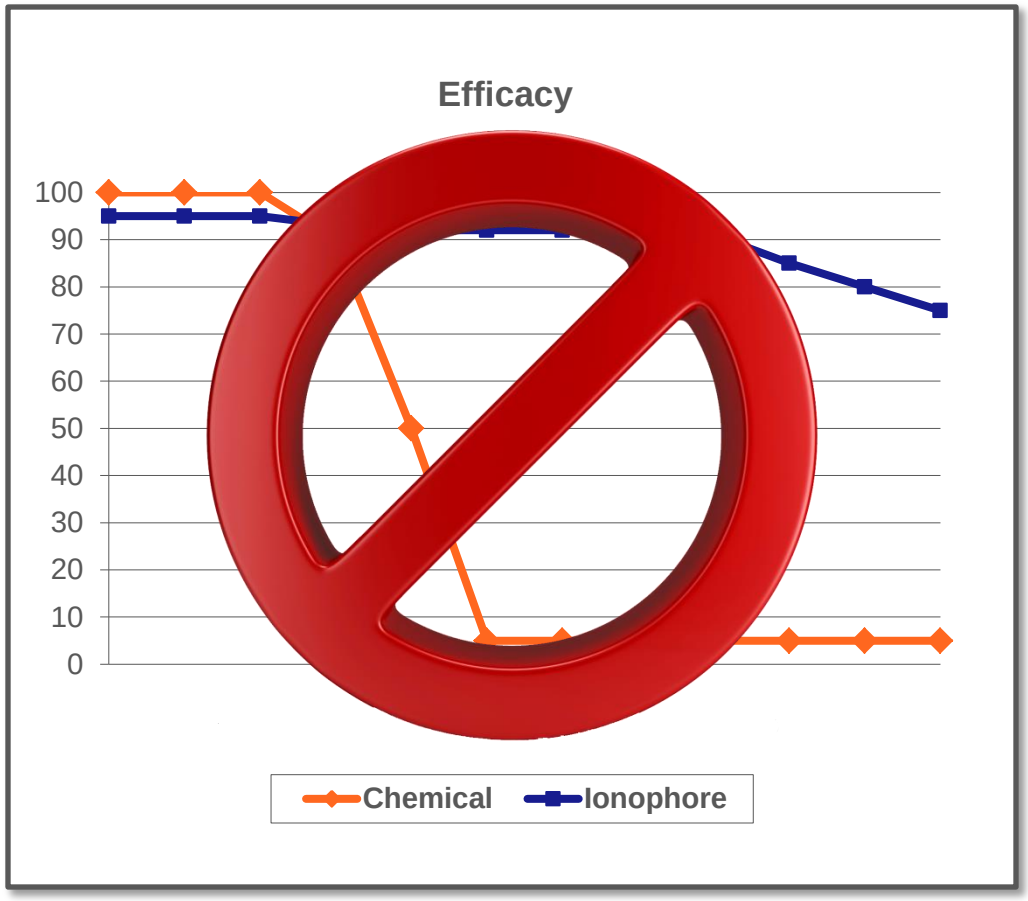
Rotation Helps with Resistance



Reduce the risk for development of resistance!!!

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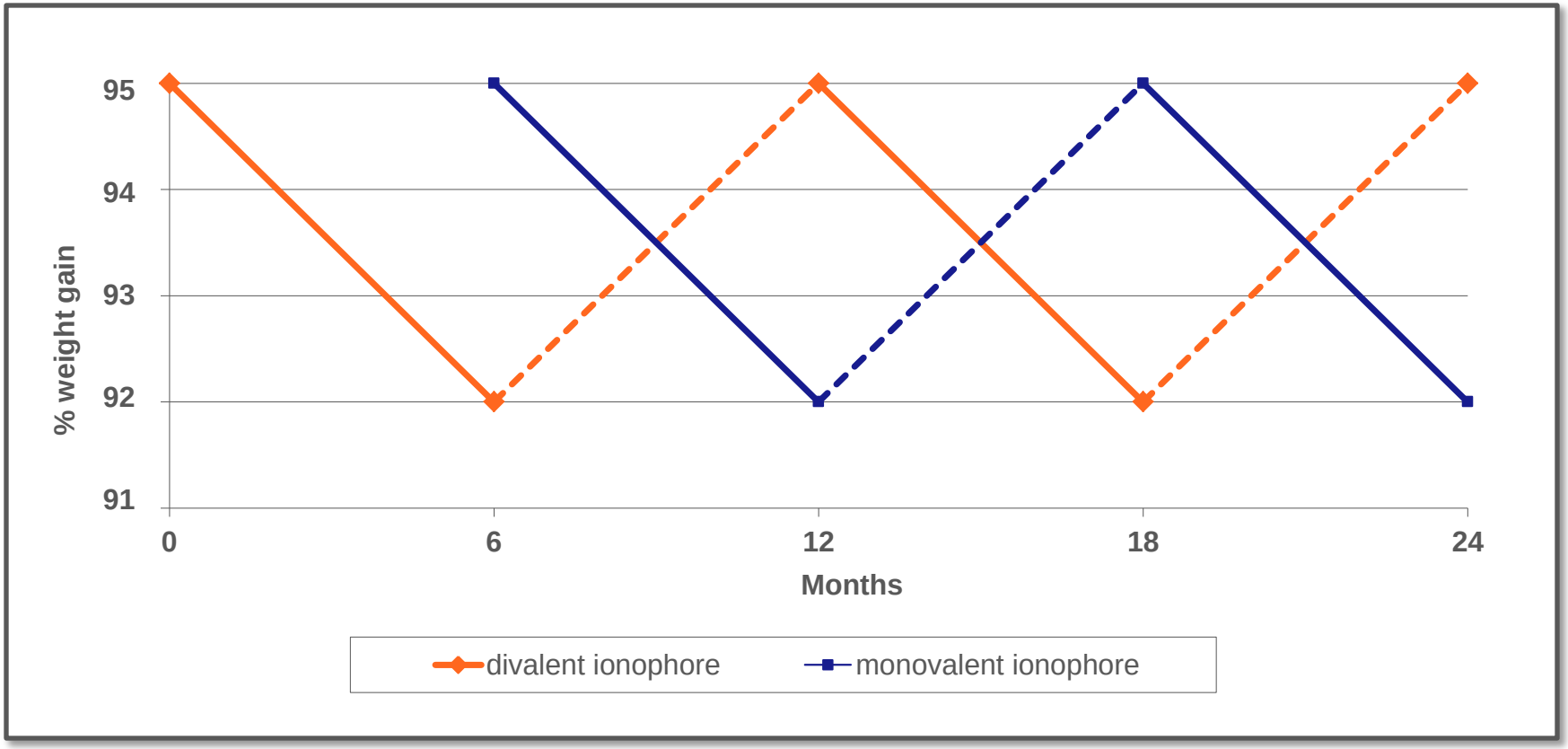
Rotation and Resting



Rotation (= resting) helps the anticoccidials to recover efficacy!!!

(Chapman and McFarland, 2003)

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But Alas, Sometimes the Wheels Come off the Wagon

Source: Punchstock

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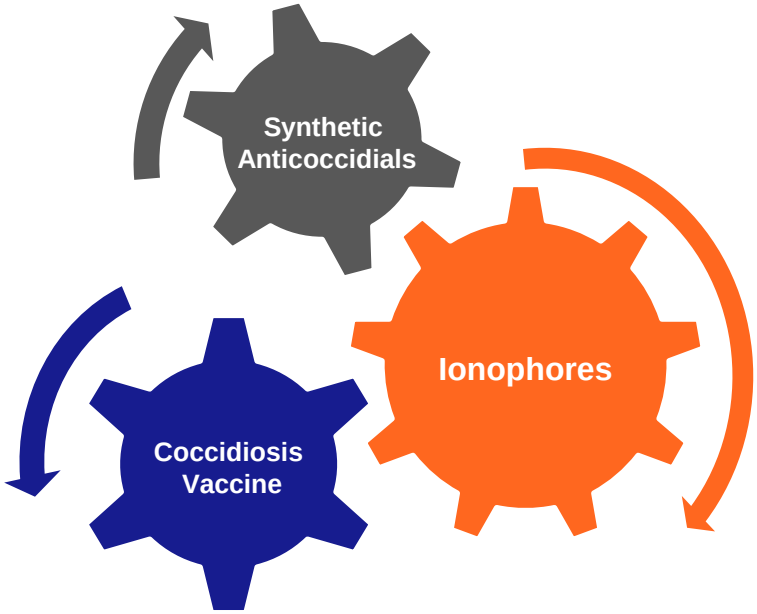
Common Mistakes

- Using same *type* of product too long, wearing it out
- Developing a long-term, strategic plan but not sticking to it
- Rotating to the same class of drug; not recognizing different classes within the widely used ionophore category

So What's A Poultry Producer to Do?

The Solution

- Make the most of what we've got
- Learn to use anticoccidials more wisely, efficiently, judiciously
- Focus on 'best practices' widely accepted by scientific community
- Rotate smarter — think before you switch
- Plan ahead…*way ahead*



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Rotecc™ Principles

1. Don’t use the same in-feed anticoccidial for extended periods
    1. Ionophores max 6 months
    2. Synthetic in full max 3 months and in shuttle max 4.5 months
2. Give the products sufficient rest periods
    1. Ionophores min 6 months
    2. Synthetic min 1 year
3. Rotate among different classes of products
4. Use a synthetic anticoccidial once yearly to clean up wild-type strains

In case of multiresistance, consider vaccination to rest all feed products and restore sensitivity, but have in mind the downsides as well

FIELD EXPERIENCE
EU – NL 2014

LUUK STOOKER

Case

- Two pillar farm, agriculture and poultry
- 1 house approximately 21500 broilers
- Call in January 2014 from the field technician feeding company
- Flock is not really performing for a couple of cycles, suspicion of coccidiosis
- Years of (over)use of Maxiban/Sacox shuttle

First visit

- Together with field technician and Koen mid-February 2014. Broilers 35 days of age, performed lesion scoring

- No E. *acervulina*, E. *tenella* (0,4) score a bit too high, high pressure E. *maxima*, score 1,4

Recommendation 1 for the coming cycles

- Cycle 1 chemical clean up Deccox at 30 ppm
- Cycle 2 until 5 full program Avatec at 90 ppm
- Cycle 6 until 8 Maxiban in starter followed by Salinomycine or Cygro
- Cycle 9 chemical clean up Robenz at 33 ppm

Recommendation 2 for the coming cycles

- Cycle 1 chemical clean up Robenz at 33 ppm
- Cycle 2 and 3 Deccox until day 18 at 30 ppm, followed by Avatec at 90 ppm
- Cycle 4 until 6 Maxiban until day 18, followed by Cygro at 6 ppm
- Cycle 7 chemical clean up Robenz at 33 ppm

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Eventual program

- Cycle 1 chemical clean up Deccox at 30 ppm
- Cycle 2 en 3 a shuttle program. Starter Robenz at 33 ppm until day 18, followed by Avatec at 90 ppm
- Cycle 4 full program Avatec at 105 ppm
- Cycle 5 back to old program Maxiban/Sacox

Cycle 2,3 and 4 started with a pre-starter with Maxiban until day 7

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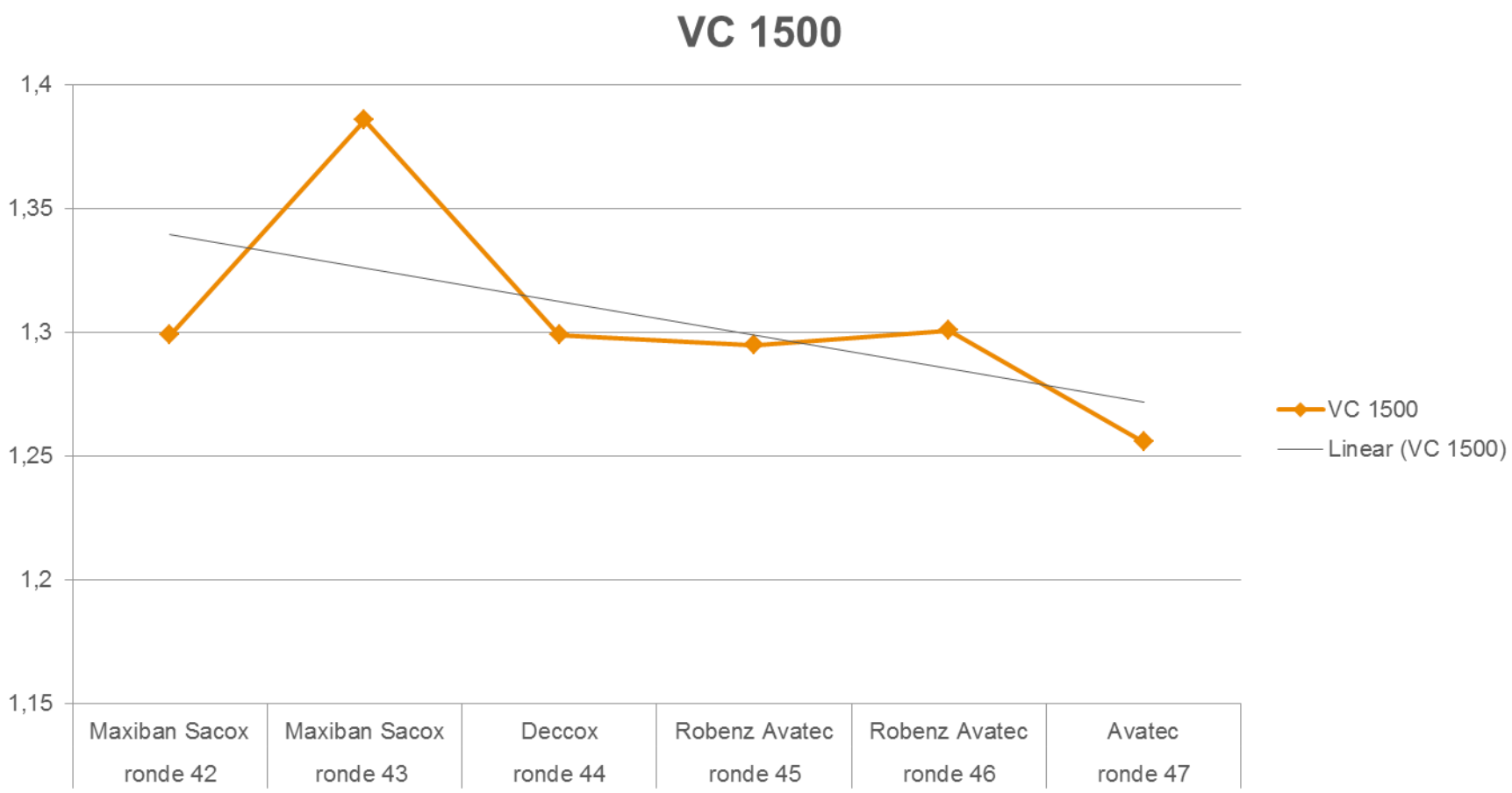
Follow up

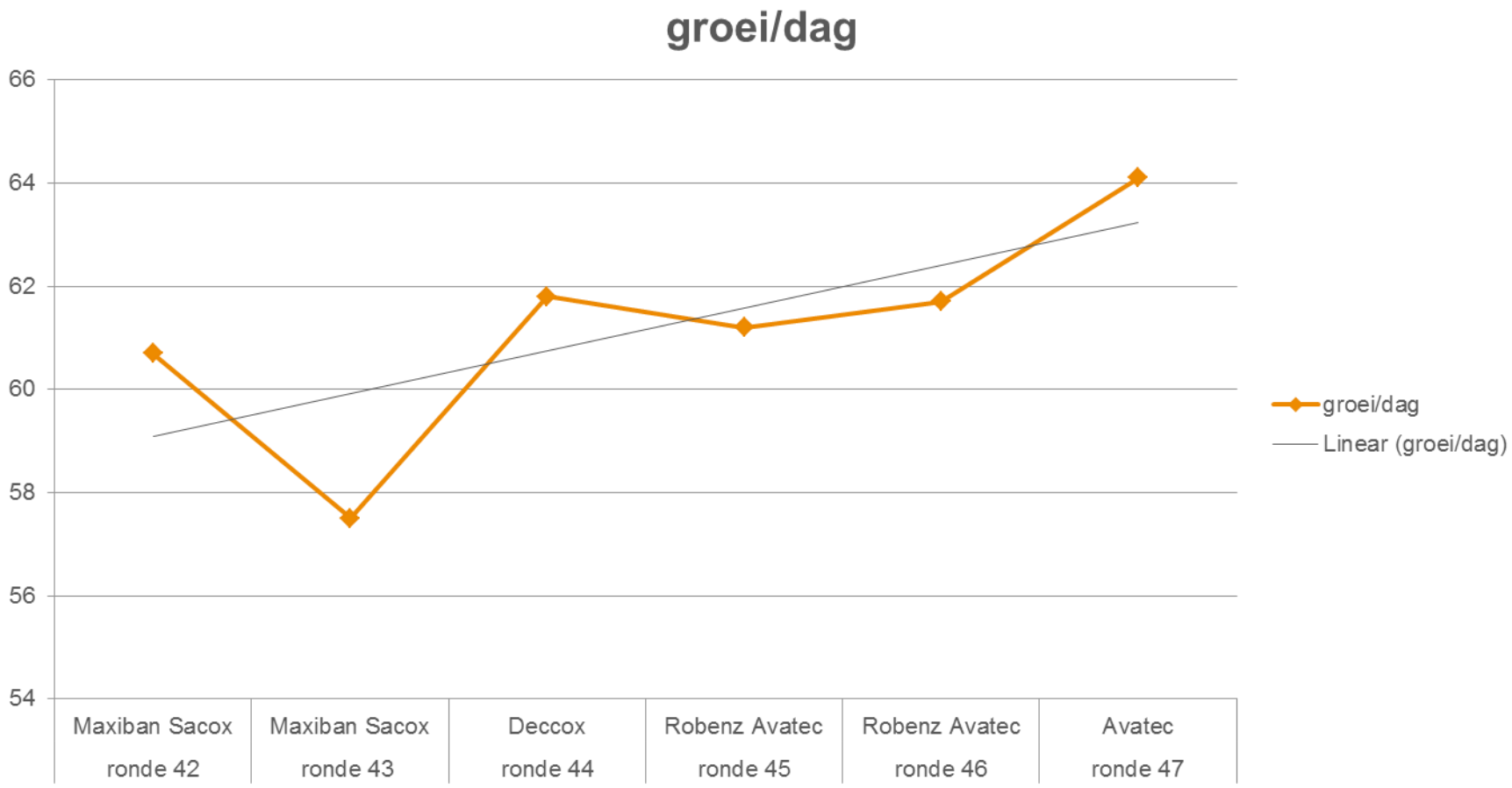
- Lesion scoring session every cycle around 35 days
- Two cycles laesion scoring sessions at 3 weeks by the vet plus oocyst counts with differentiation
- Collecting of all technical and financial data of the different cycles
- Historical data
- Analysis of the results
- Final meeting with all involved

RESULTS
2014

FCR 1500


VC 1500
1,4
1,35
1,3
1,25
1,2
1,15
Maxiban Sacox ronde 42
Maxiban Sacox ronde 43
Deccox ronde 44
Robenz Avatec ronde 45
Robenz Avatec ronde 46
Avatec ronde 47
VC 1500
Linear (VC 1500)

Daily growth



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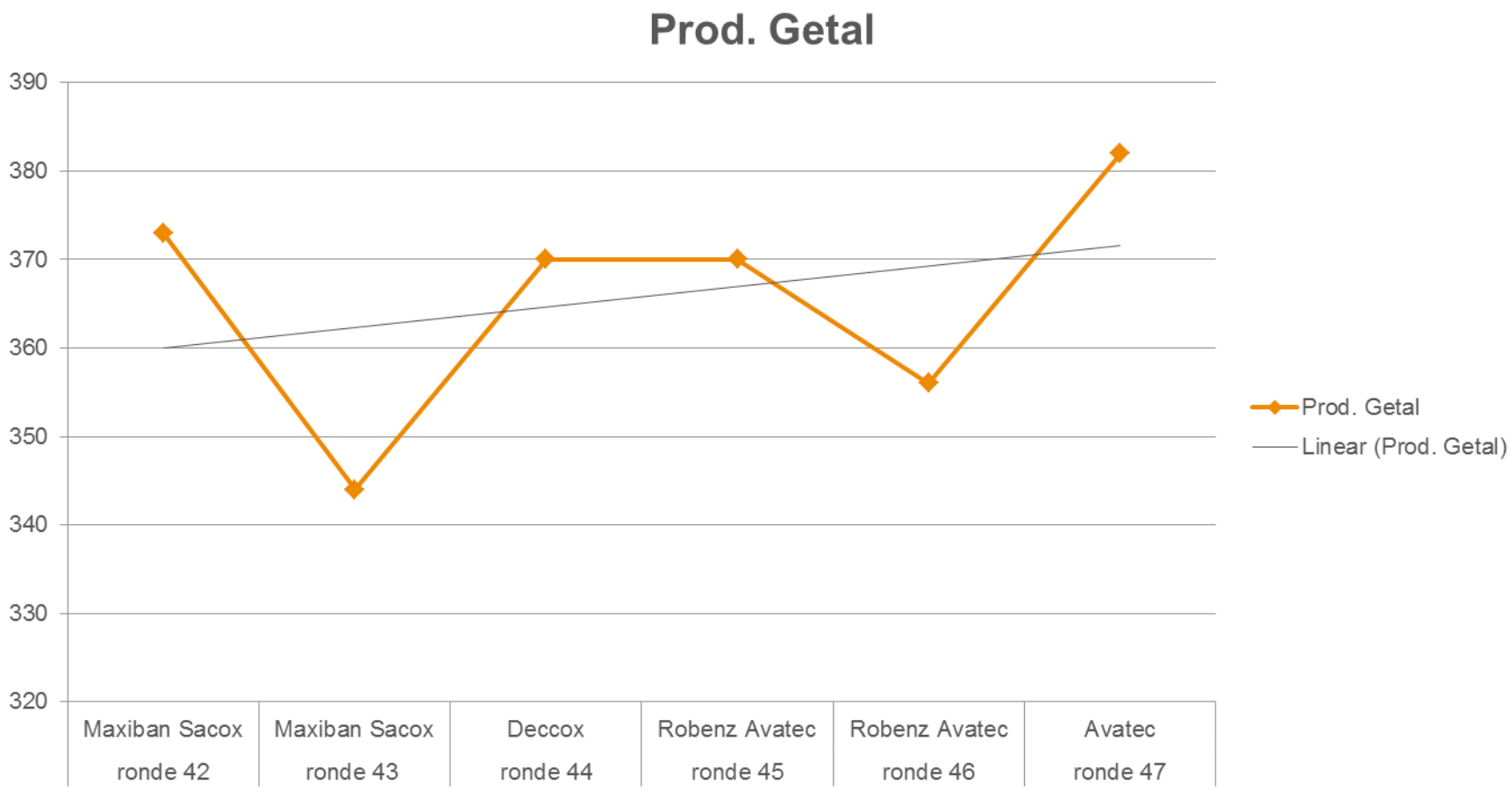
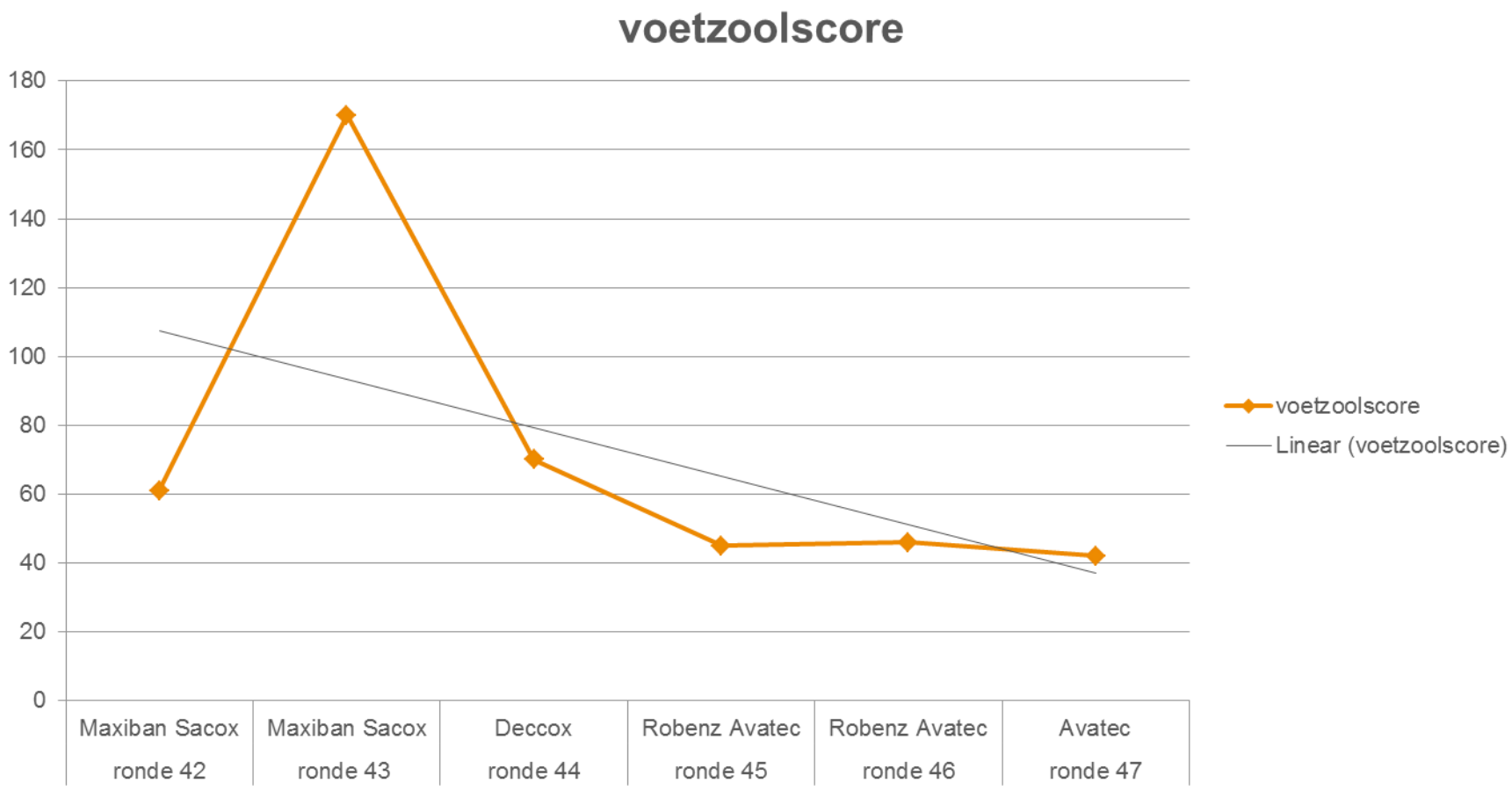


Footpad lesions



Laesion scoring sessions

		ronde 43	ronde 44	ronde 45	ronde 46	ronde 47	ronde 48	EUAfME gemiddelde 2006-2012
		Maxiban Sacox	Deccox	Robenz Avatec	Robenz Avatec	Avatec	Maxiban Sacox	
Aantal dieren		5	5	5	5	5	5	3837
Leeftijd		35	35	32	36	35	36	
E. acervulina	0-4	0	0	0	0	0	0	0,53
E. maxima	0-4	1,4	0	0,2	0,4	0,4	0,4	0,27
E. tenella	0-4	0,4	0	0	0	0	0	0,17
TMLS		1,8	0	0,2	0,4	0,4	0,4	0,97

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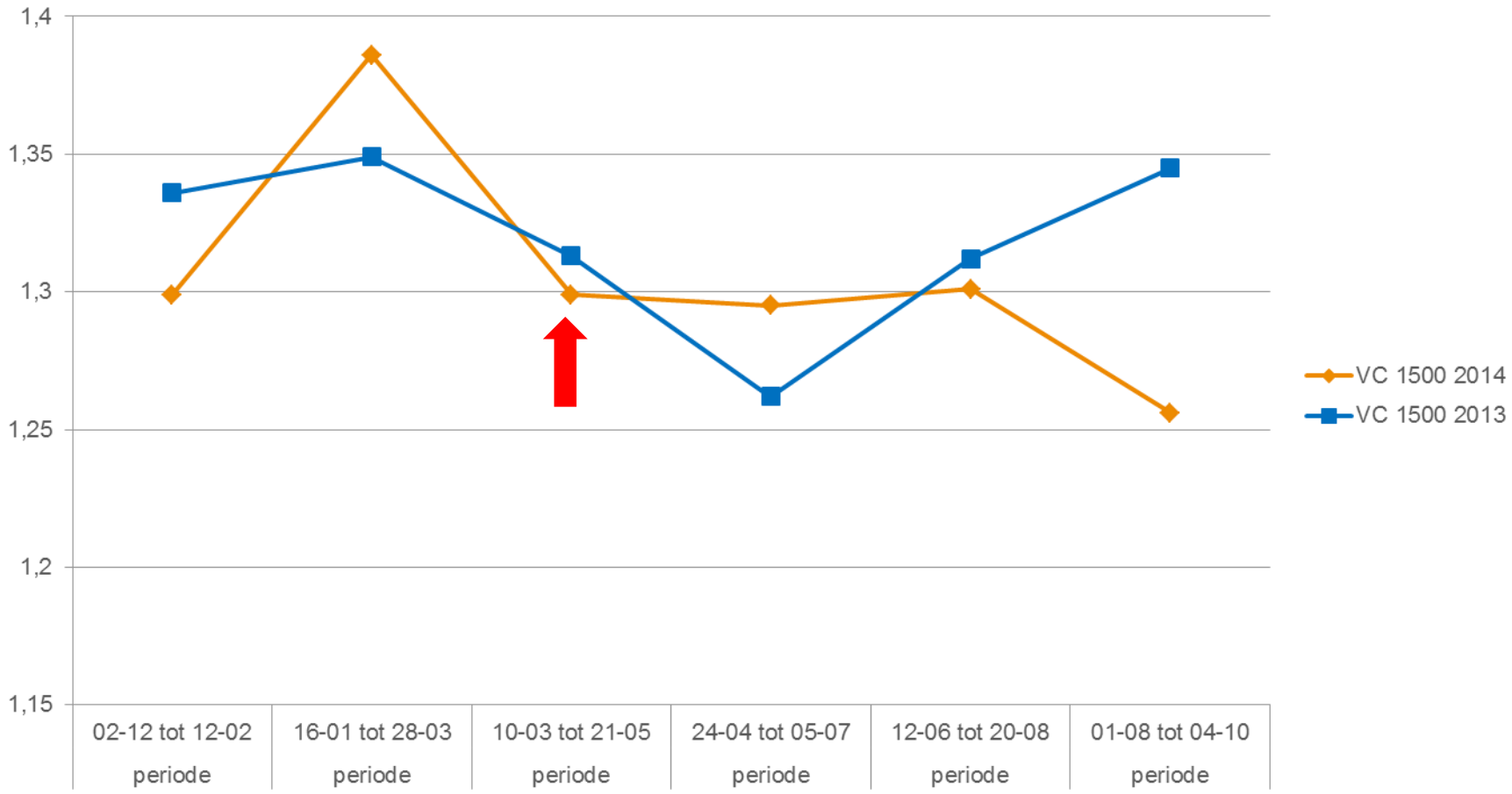
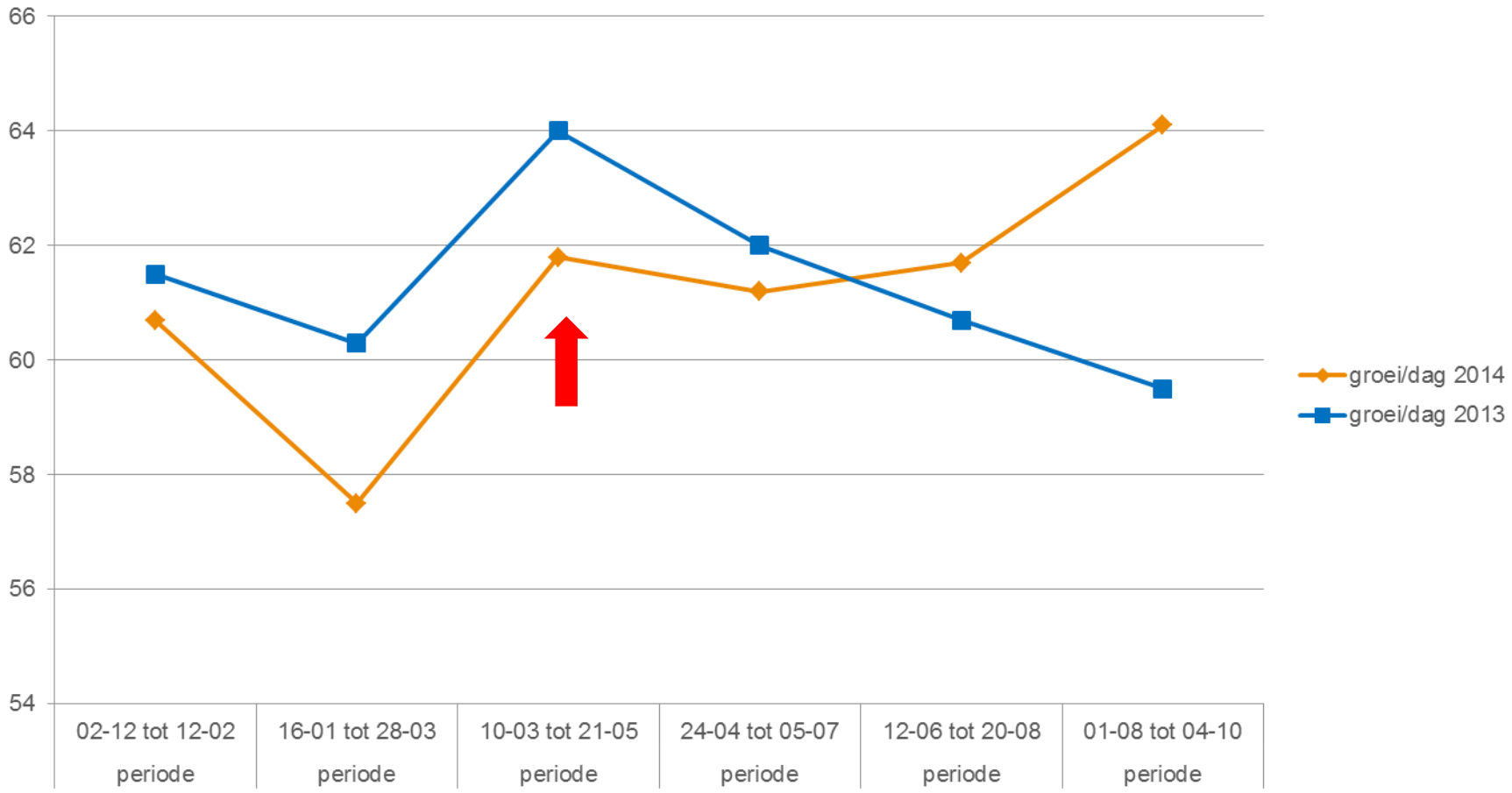
RESULTS COMPARED TO 2013

FCR 1500


1,4
1,35
1,3
1,25
1,2
1,15
02-12 tot 12-02 periode
16-01 tot 28-03 periode
10-03 tot 21-05 periode
24-04 tot 05-07 periode
12-06 tot 20-08 periode
01-08 tot 04-10 periode
VC 1500 2014
VC 1500 2013

Daily growth



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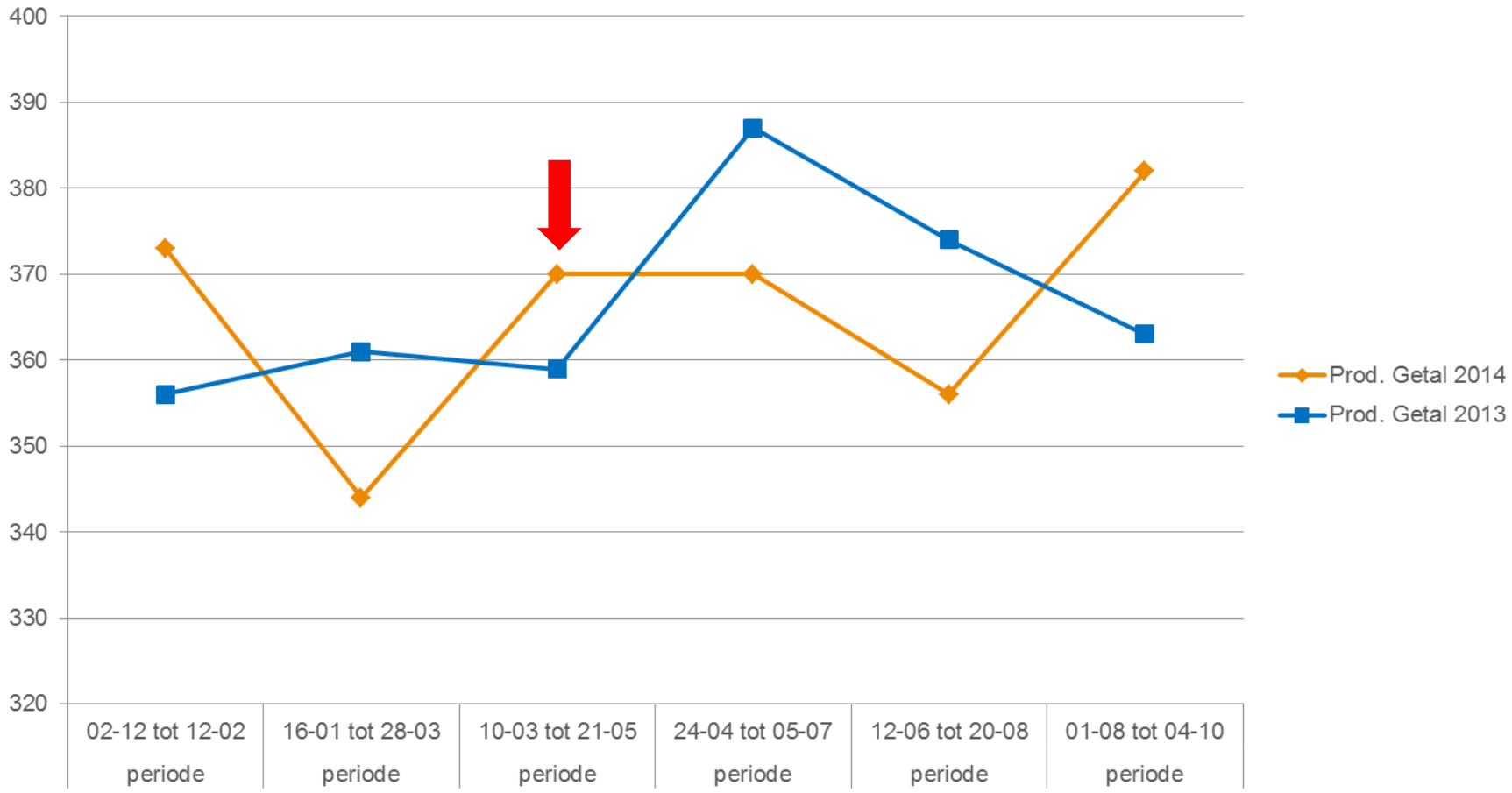
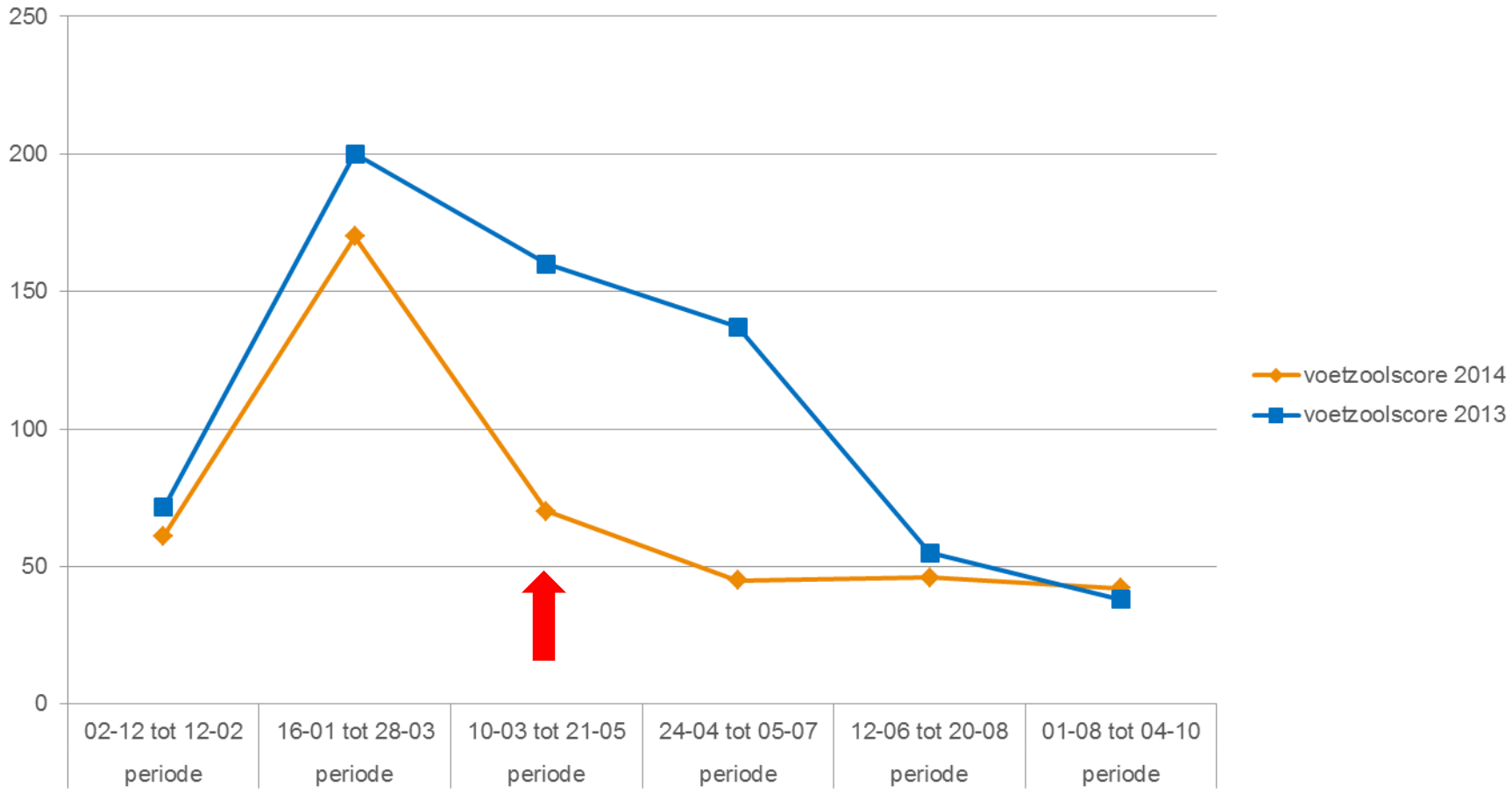


Footpad lesions



CONCLUSIONS

Comparison before/after rotation

Cox program	Average before rotation	Average After rotation	Improvement
FCR	1,606	1,612	-0,006
FCR 1500	1,325	1,288	0,037
Thinning weight	1757	1835	78
Final slaughterweight	2364	2483	119
Daily growth	60,8	62,2	1,4
Daily growth before thinning	54,1	56,4	2,3
Daily growth after thinning	93	83,9	-9,1
mortality%	3,7	4,3	-0,6
Prod. number	365	370	5
Footpad lesions	112	51	61

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Financial results

With approximately the same FCR, 119 grams higher final slaughterweight and 78 grams higher thinning weights.

Suppose average gain of 108 grams (25% of 78 grams plus 75% of 119 grams minus o,5 points) :

- 0,108 kilograms * 1,01 Euro per kg meat (average price calculated over all cycles) * 21120 chicks (placements minus average mortality of 4%) =

Average extra financial gain per cycle Euro 2304,-

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Comparison first cycle Maxiban Sacox after period of rest with its use before rotation

	Average before rotation	Last cycle Maxiban Sacox before rotation	First cycle Maxiban Sacox after rotation	Improvement compared to average before rotation	Improvement compared to last cycle before rotation
FCR	1,606	1,625	1,568	0,038	0,057
VFCR1500	1,325	1,386	1,216	0,109	0,17
Thinning weight	1757	1698	1836	79	138
Final slaughterweight	2364	2236	2628	264	392
Daily growth	60,8	57,5	63,5	2,7	6
Daily growth before thinning	54,1	51,5	55,6	1,5	4,1
Daily growth after thinning	93	89,6	99,1	6,1	9,5
mortality%	3,7	2,8	2	1,7	0,8
Prod. number	365	344	397	32	53
Footpad lesions	112	170	82	30	88

SENSITIVITY TESTING (AST)

AST methodology

AST is a single, high dose challenge test of *Eimeria* free birds provided with different in-feed anticoccidial products, with a given field *Eimeria* isolate.

Each test consists of uninfected untreated control group (UUC), infected untreated control group (IUC) and treatment groups supplemented with various anticoccidial drugs according to their registered dose.

The efficacy of the different anticoccidial treatment is measured on the base of improvement in respect to the infected non treated animals.

Zootechnical performance is expressed as anticoccidial improvement (%), being the difference in daily growth in comparison with the control groups where the negative control group would be 100 % and the positive control group 0%.

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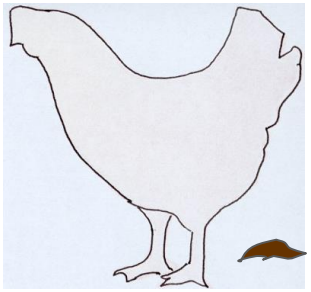
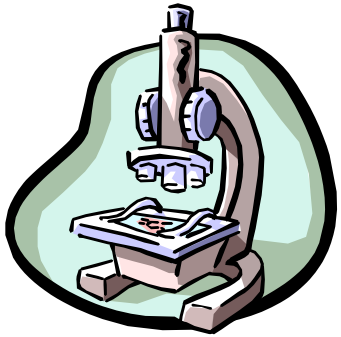
AST methodology

Collect droppings

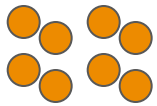


Identification oocysts



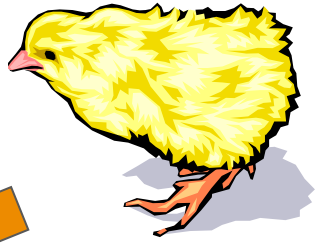
Multiplication oocysts

+ titration



Coccidiostats incorporated in the feed

Challenge D15



Weight gain, FCR,

lesion scoring

until D22

Final report

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AST RESULTS OVER THE LAST DECADE

Anticoccidial improvement (AST 1-134)

Only one ionophore product (lasalocid), two synthetic products (robenidine and decoquinate and the combination of narasin-nicarbazin resulted in an average weight gain improvement of more than 40 %.

The most persistent effect between them showed lasalocid (SD 19.6).

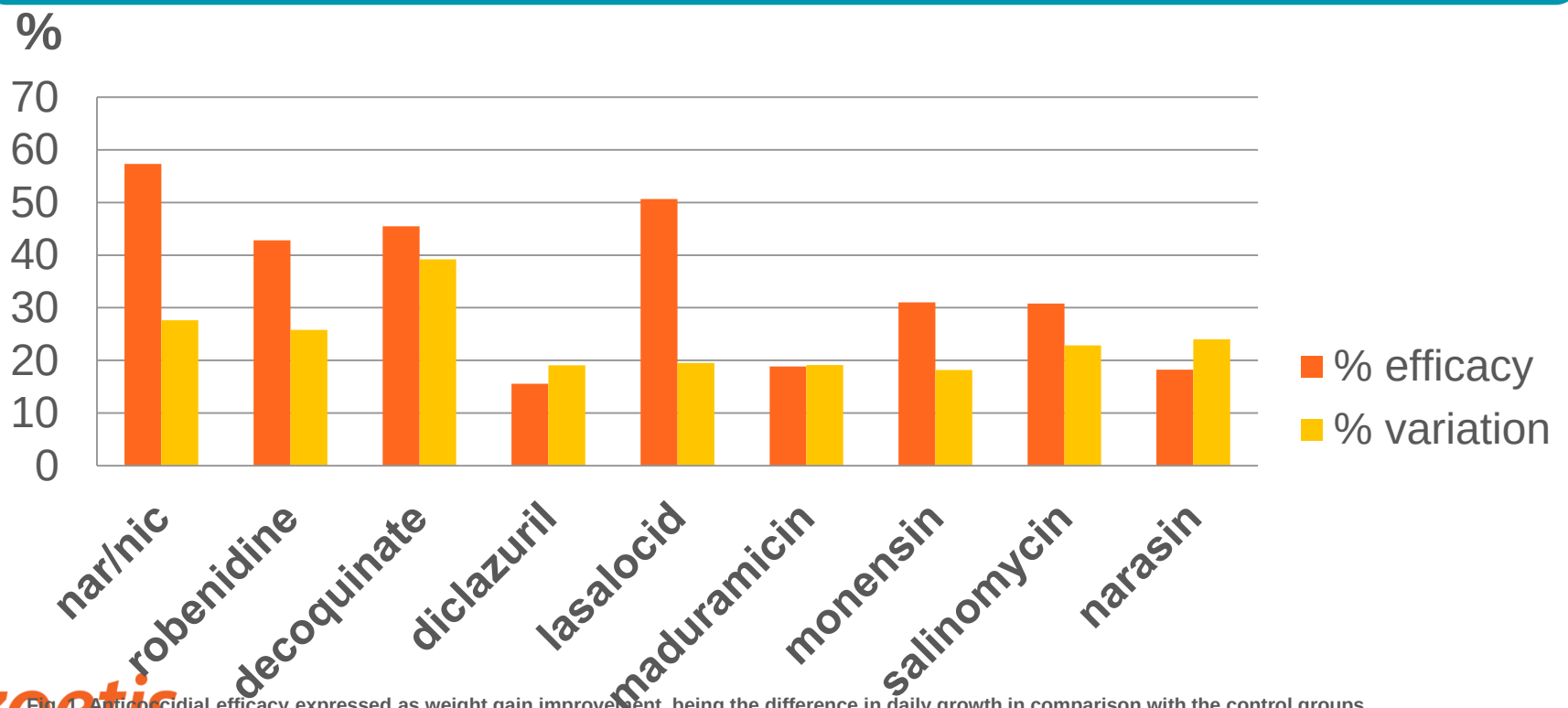
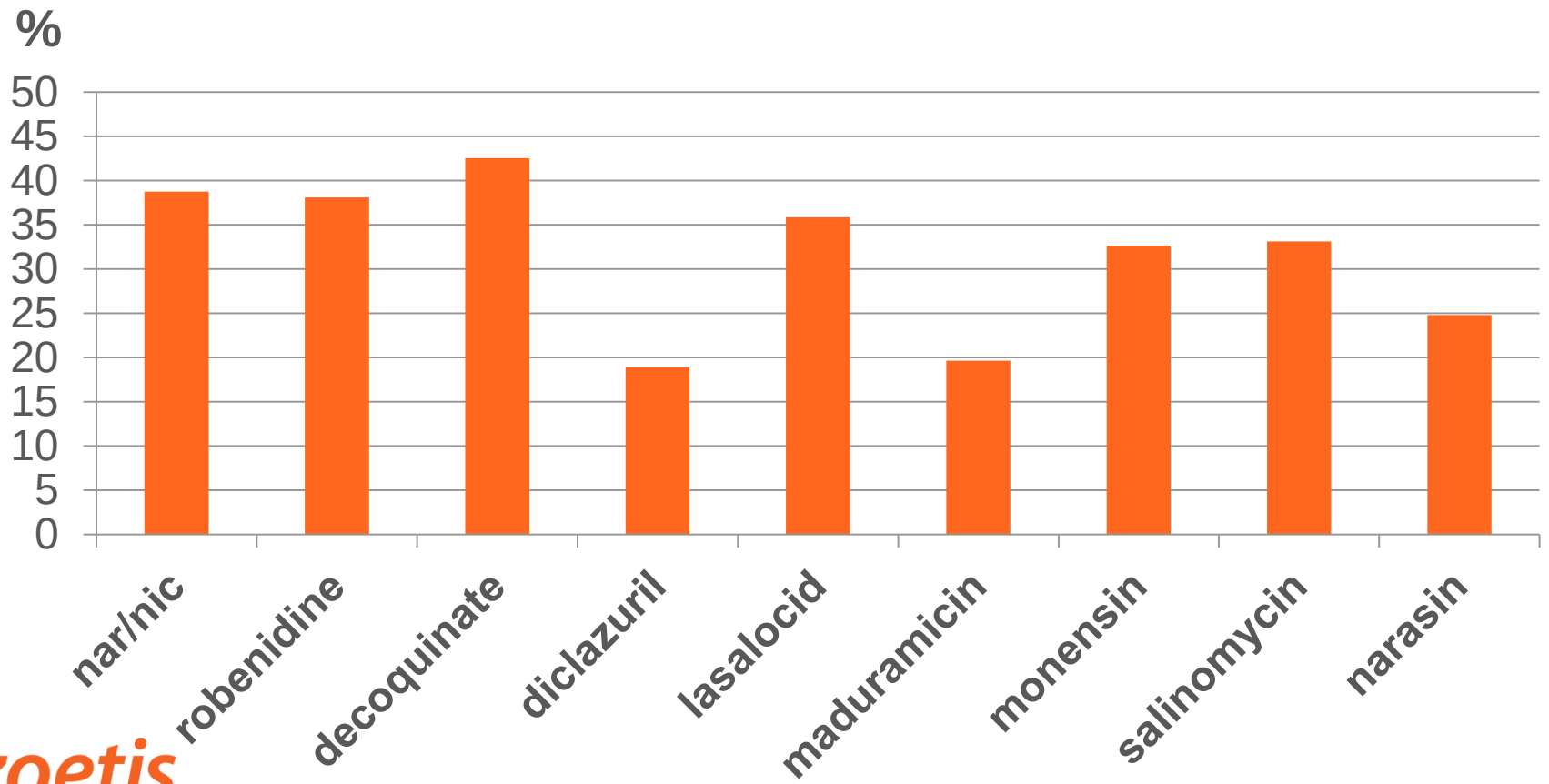


Fig. 1. Anticoccidial efficacy expressed as weight gain improvement, being the difference in daily growth in comparison with the control groups.

V.Stanev1, M. Naciri2, A. Niepceron2, G. Fort², D. Vancraeynest3WVPA 2013

E.acervulina lesion reduction(AST 1-134)

E. acervulina strains showed highest sensitivity to decoquinate – lesion score reduction in comparison with infected untreated control groups (IUCGs) of 42.5%, followed by the combination of narasin-nicarbazin and robenidine (38.8% and 38.1% respectively).

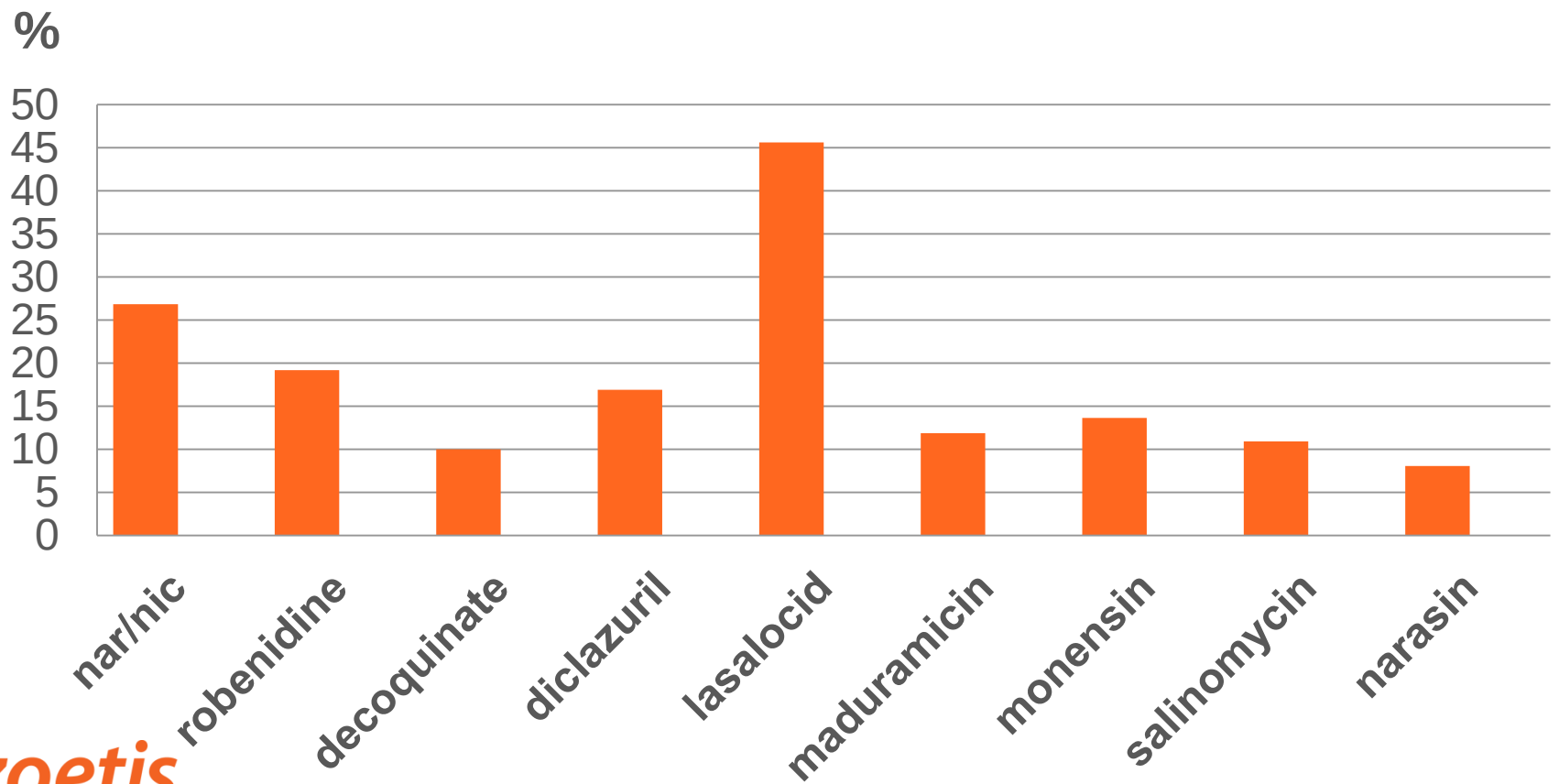


V.Stanev[1], M. Naciri[2], A. Niepceron[2], G. Fort[2], D. Vancraeynest[3]WVPA 2013

Fig. 2. Reduction of *E. acervulina* lesions

E.maxima lesion reduction(AST 1-134)

E.maxima strains showed highest sensitivity to lasalocid –lesion score reduction of 45.6 %, followed by the combination of narasin-nicarbazin and robenidine with reduction of 26.8% and 19.2% respectively.

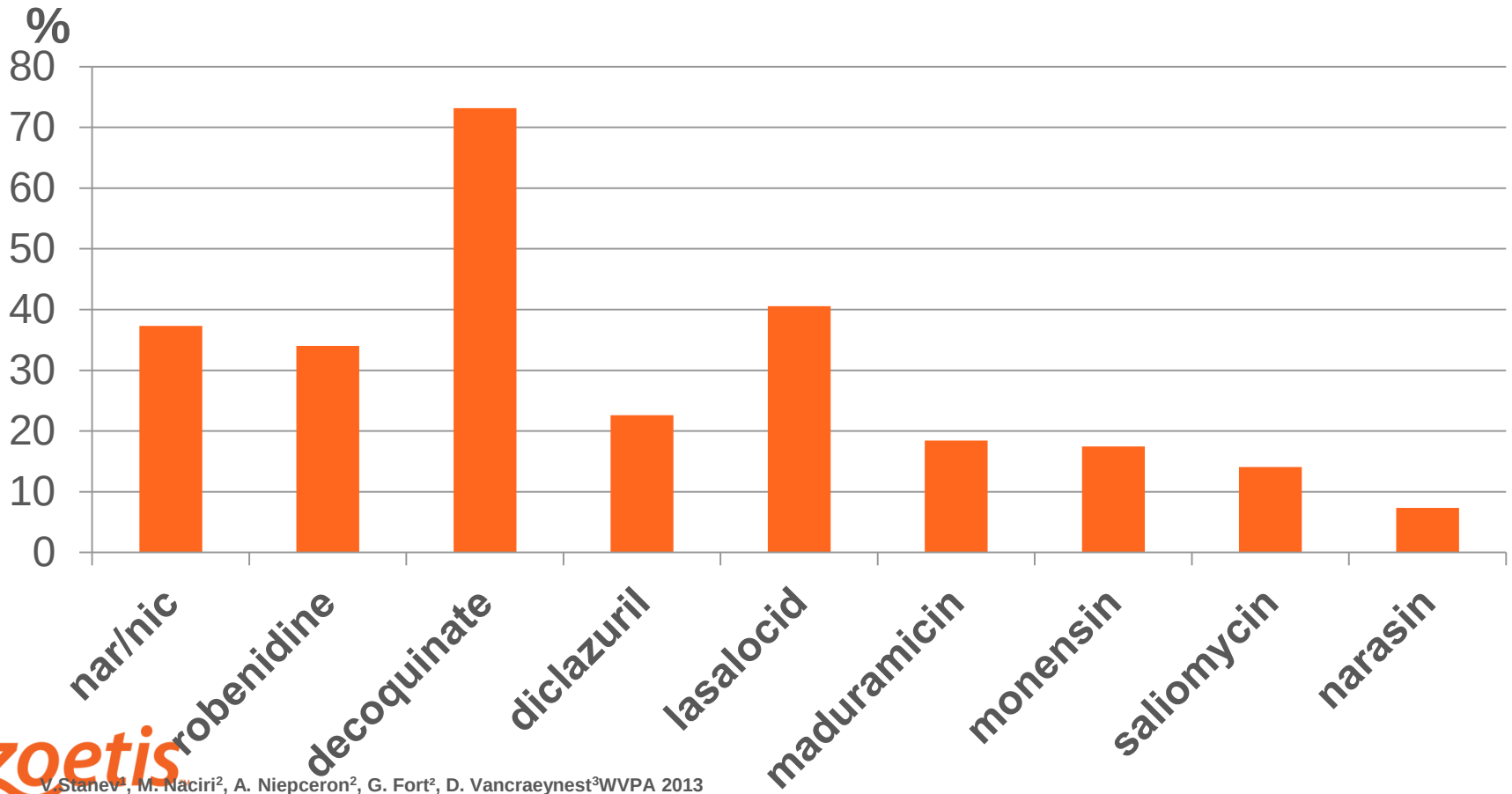


V.Stanev[1], M. Naciri[2], A. Niepceron[2], G. Fort[2], D. Vancraeynest[3]WVPA 2013

Fig. 3. Reduction of E. maxima lesions

E.tenella lesion reduction(AST 1-134)

E.tenella strains showed highest sensitivity to decoquinate –lesion score reduction of 73.2%, followed by lasalocid and the combination of narasin-nicarbazin (40.5 and 37.3% respectively)



V.Stanev[1], M. Naciri[2], A. Niepceron[2], G. Fort[2], D. Vancraeynest[3]WVPA 2013

Fig. 4. Reduction of *E. tenella* lesions

TAKE HOME MESSAGE

Conclusions

- One of the most costly diseases for the poultry industry, mainly due to subclinical coccidiosis
- There are different prevention tools available
- Be aware of loss of efficacy – resistance development (tools are limited)
  - It is a natural process
  - You can determine the sensitivity upfront (AST)
- The only way to cope with resistance is Rotation

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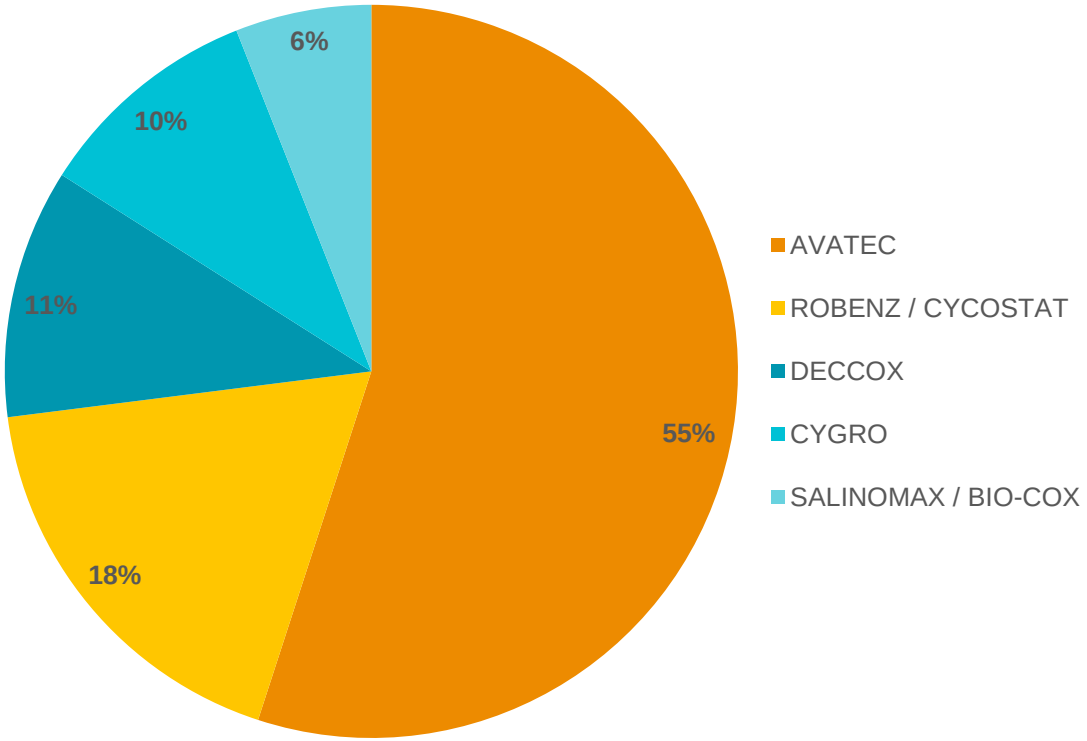
ANTICOCCIDIALS EUAFME 2014

COCCIDIOSIS CONTROL

by effective rotation



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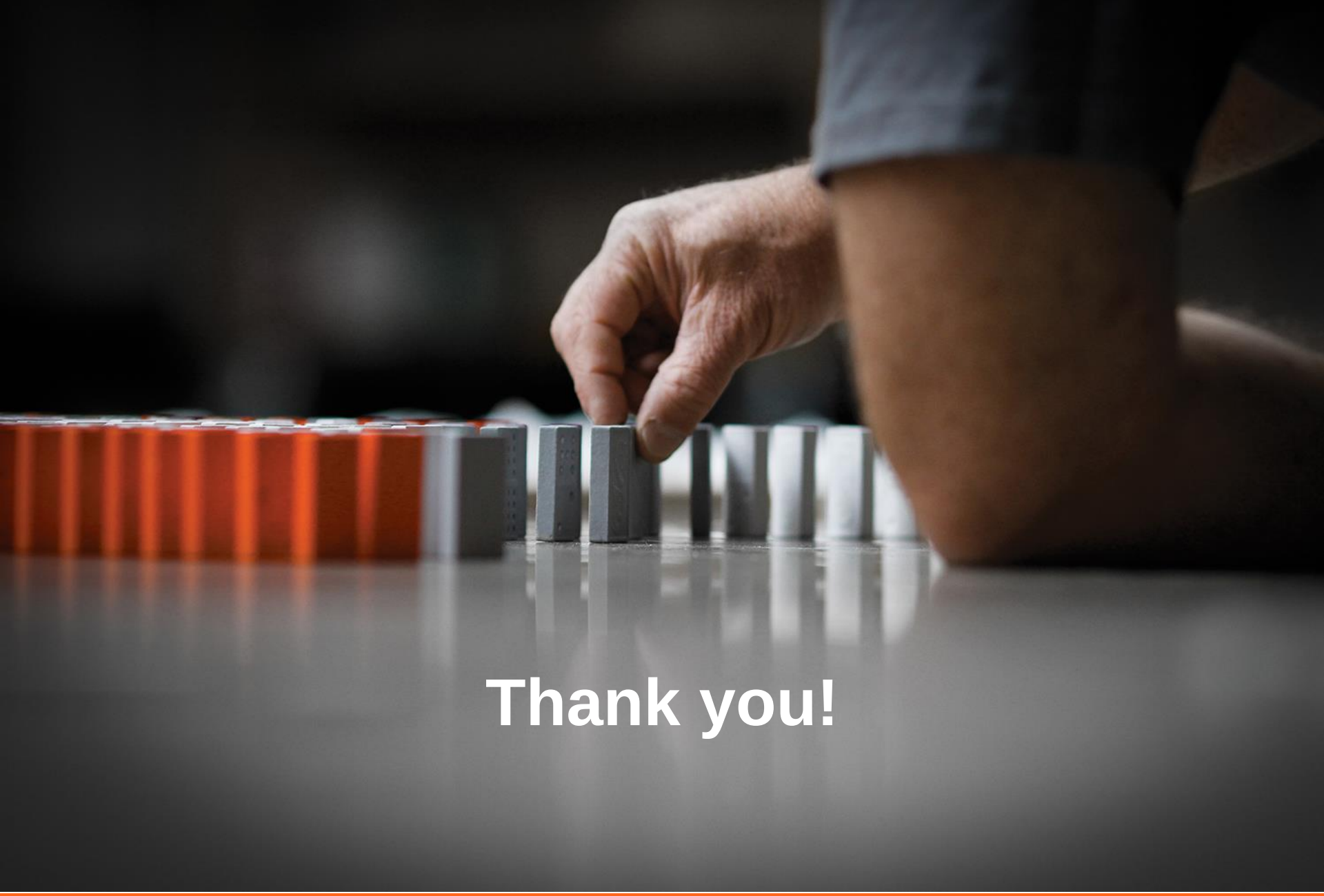
Thank you!