

Rodenticide Resistance Action Committee

Field Trials of Difenacoum against Norway rats carrying the Tyr139Cys anticoagulant resistance mutation in Germany

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Steered by RRAC: BASF, Bayer CropScience, Liphatech, Rentokil, Sorex, Syngenta, (Pelgar)

Aims

- **Confirm the Resistance Factor (RF) for difenacoum on farms in known resistance Tyr139Cys foci in Muensterland [Tyr139Cys = Y139C]**
- **Establish the effectiveness of difenacoum for the control of Tyr139Cys resistant rats in Muensterland**
- **Examine the relationship between resistance tests (BCR and genotyping) and treatment results**

Methods: Anticoagulant Resistance Testing

Number of field trials :

2 farms

Number of tested rats:

Trial # 1: 17

Trial # 2: 23



Investigation of the incidence and degree of difenacoum resistance on the farms

Trial # 1: **1.0 x ED₅₀** of the CD-strain (0.65 mg/kg males, 0.79 mg/kg females)
2.5 x ED₅₀ of the CD-strain (1.63 mg/kg males, 1.98 mg/kg females)

Trial # 2: **2.5 x ED₅₀** of the CD-strain (1.63 mg/kg males, 1.98 mg/kg females)

**Genotyping at the Federal Research Centre for Cultivated
Plants (JKI in Muenster, Germany)**

Methods: Field trials

Field trials structure (for protocol details: www.rrac.info):

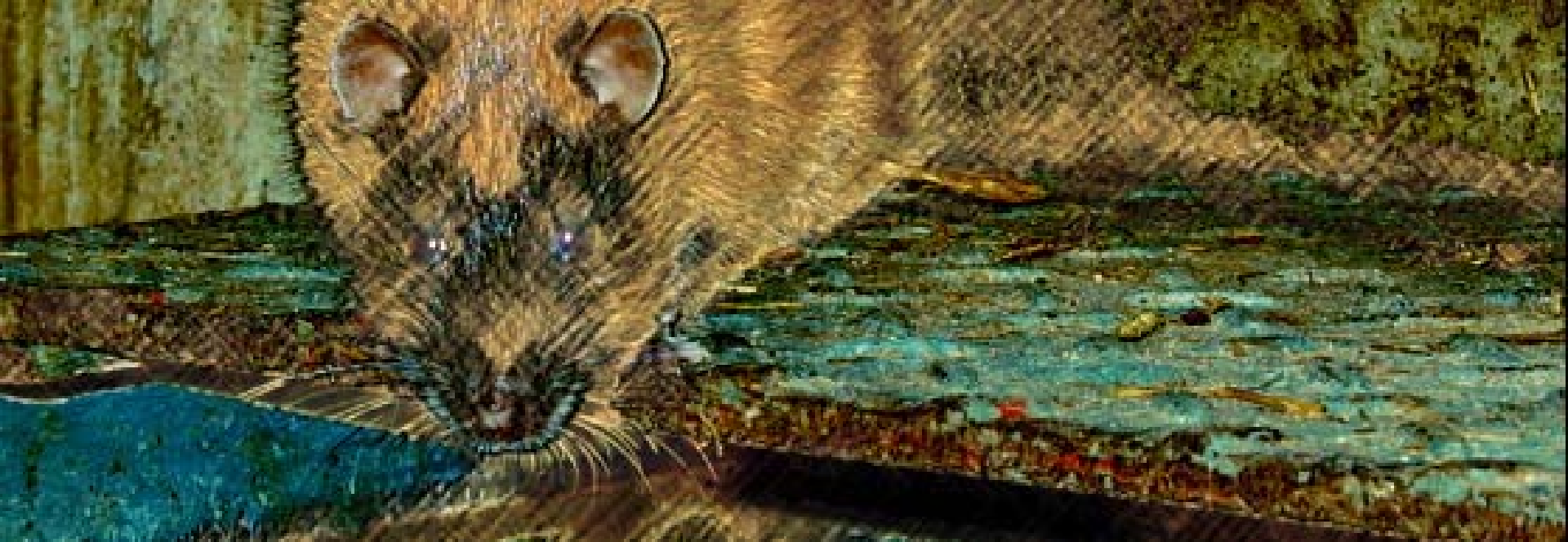
- a) Implementation;
- b) Pre-baiting census 5 days; 4 days break;
- c) Baiting period 50 and 43 days; 4 days break;
- d) Post-baiting census 5 days.

Census: 1) Consumption of rolled oats,
 2) Tracking plates with sand.

Bait: 0.005% difenacoum wheat bait (Neokil™)

Bait distribution: www.baytool.info (Endepols et al. 2003)

Results



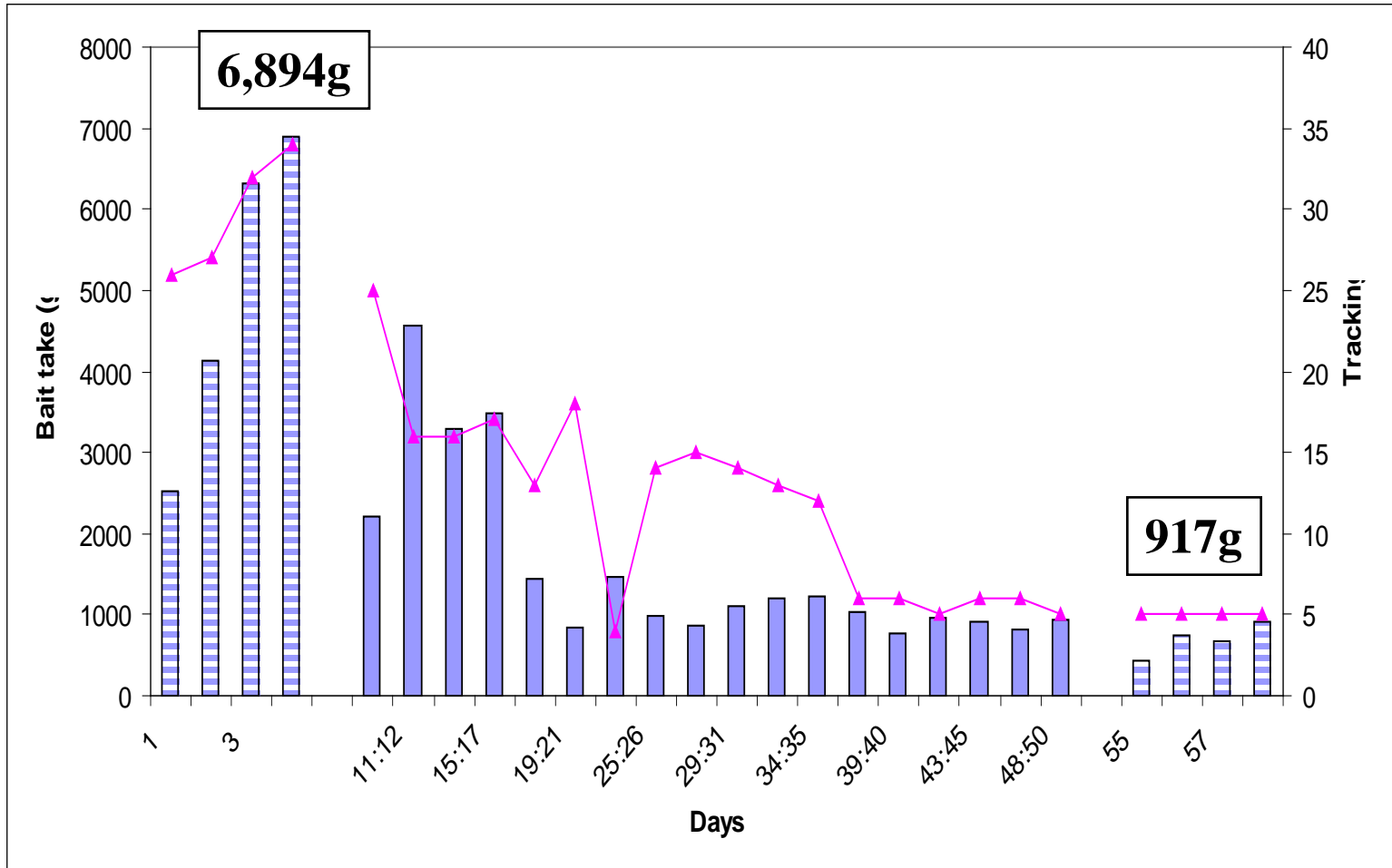
Trial # 1

BCR Testing Results: Trial # 1

Incidence of difenacoum resistance	Degree of resistance 2.5x ED₅₀
min 25% (42%)	3/12 (25%): INR ≤ 5.0 2/12 (17%): INR 5.0-7.0 7/12 (58%): INR >10

- **Difenacoum BCR tests suggest a resistance factor of about 2.5 in this population.**

Field Trial Results : Trial # 1



Bait take (histogram) and tracking score (line). Hatched bars - census bait takes; solid bars - rodenticide bait takes.

Results: Trial # 1

BCR test	Incidence of resistance	Degree of resistance 2.5 x ED₅₀
	42% (min 25%)	3/12 (25%): INR ≤ 5.0 2/12 (17%): INR 5.0-7.0 7/12 (58%): INR >10

Field trial

Bait consumption: 28.10 kg

% survivors 13.3 %

- **The Incidence of Resistance from BCR tests (58-75% susceptible) does not appear to reflect trial success rate (86.7%) very well**

Results



Trial # 2

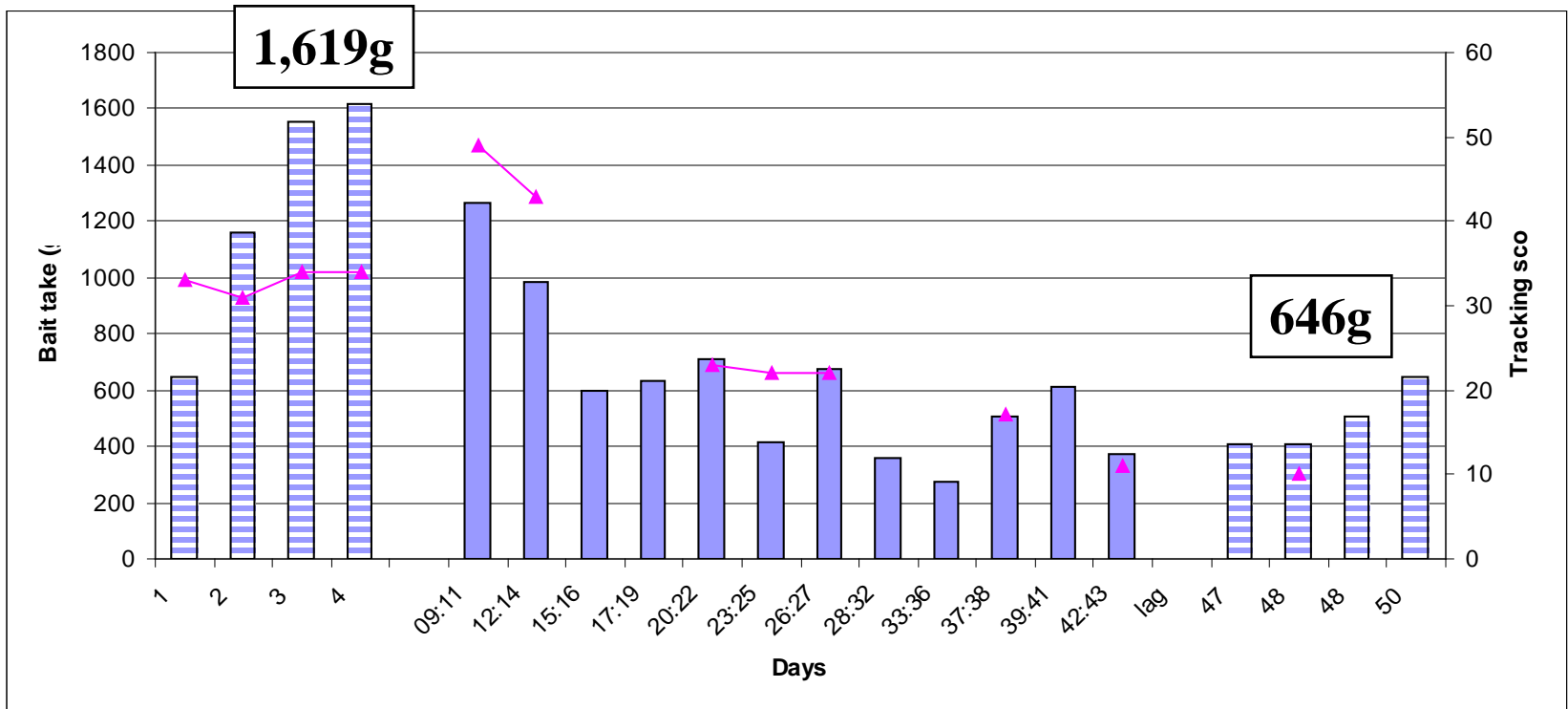
Resistance Testing Results: Trial # 2

BCR test	Incidence of resistance	Degree of resistance 2.5 x ED₅₀
	43% (min 14%)	3/21 (14%): INR ≤ 5.0 9/21 (43%): INR 5.0-10.0 12/21 (57%): INR >10

Genotyping	Incidence of resistance	
	75%	11/20 (55%) homozygous 4/20 (20%) heterozygous wild type 5/20 (25%)

- Agreement between the difenacoum BCR tests (14-43% resistant) and genotyping (75% resistant) is weak. BCR appears to miss some animals carrying Tyr139Cys

Field Trial Results: Trial # 2



Bait take (histogram) and tracking score (line). Hatched bars - census bait takes; solid bars - rodenticide bait takes.

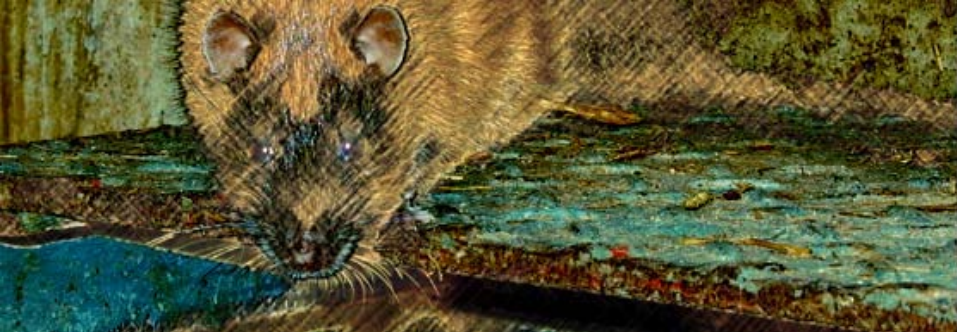
Summary Results: Trial # 2

Incidence of resistance	
BCR Testing	Genotyping
14-43%	75%

Field trial

Bait consumption:	7.40 kg
Survivors	39.9 %

- **Difenacoum BCR tests suggest a resistance factor of about 2.5 in this population**
- **Agreement between the difenacoum BCR tests and genotyping is poor**
- **Incidence of resistance by genotyping is not directly reflected in trial outcome**



Conclusions

Conclusions

- **RF is about 2.5 in Tyr139Cys mutation for difenacoum**
- **RF of about 2.5 are not normally associated with control failure but at these sites significant numbers of rats survived the difenacoum treatments**
- **Difenacoum BCR tests underestimated the incidence of resistance**
- **Significant numbers of rats carrying the Tyr139Cys mutation were controlled using 50 ppm difenacoum (heterozygotes ?)**
- **Continued use of difenacoum at these foci would be expected to exacerbate resistance problems in future**
- **Tyr139Cys occurs i.e. Belgium, Denmark, France, Hungary, Netherlands, UK – are results applicable?**

Confirmation of feeding census by tracking census

Index evaluation of tracking plates:

Index	Foot prints
0	No footprints
1	<20%
2	20-40%
3	40-60%
4	60-80%
5	>80%

