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Scrapie in Sheep and Goats



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Outline

- *Disease features*
- *The NSP in GB and its impact*
- *Scrapie in Northern Ireland and NISP*
- *Atypical Scrapie*



Transmissible Spongiform Encephalopathies, or Prion Diseases

- *fatal neurodegenerative diseases affecting several mammalian species – man, cattle, sheep, goats, deer, cats*
- *disease usually transmissible, at least experimentally*
- *transmissible agent has unusual properties*
- *long preclinical period*
- *crucial involvement of the prion protein and its gene*



Scrapie - the main features in sheep

- a disease of adult sheep, typically 2-5 y.o.
- vague early signs, progressing over weeks - fleece discolouration, tremor, pruritus, loss of condition, ataxia, recumbency, death
- notifiable in EU since 1993
- no vaccine or treatment
- emerging antemortem diagnosis possibilities – prion protein detection in biopsy of third eyelid, tonsil, RAMALT
- Disease risk linked to PrP genotype
- appears to spread at lambing time



Scrapie - the main features in goats

- A disease of adult goats, typically over 2 years old
- vague early signs, altered demeanor, tremor, pruritus/hair loss, loss of condition, ataxia, recumbency, death
- notifiable in EU since 1993
- no vaccine or treatment
- linkage of disease risk to PrP genotype linkage unclear
- ? Spreads at kidding



Origins of the National Scrapie Plan

Increased interest in sheep TSEs post 1996

SEAC recommendation because of concern over various issues

- *MBM fed to sheep (and goats!): BSE confirmed in one French goat and strongly suspected in one British goat)*
- *BSE transmitted to sheep following experimental oral exposure*
- *infection widespread through carcase*
- *concern over under-reporting of scrapie*

Increasing confidence in PrP genotyping

Approach endorsed by EU SSC (now SCoFCAH), SEAC, FSA



The aim of the NSP

- *To reduce the risk of sheep TSEs in the national flock, thereby:*
 - *Eliminating scrapie*
 - *Protecting consumer from exposure to BSE (but SEAC have now concluded there is little/probably no risk from BSE in sheep)*



The NSP Strategy

By

Selective breeding with rams of known PrP genotype to reduce disease risk in the National Flock as a whole

And

targeting known affected flocks to eliminate sources of infection

(Voluntary and Compulsory Scrapie Flocks Schemes)



Main elements of the NSP breeding programme

- *Ram genotyping scheme*
- *Welsh Ewe Genotyping Scheme (WEGS II)*
- *Voluntary Scrapie Flocks Scheme*
- *Compulsory Scrapie Flocks Scheme*



NSP genotype groupings

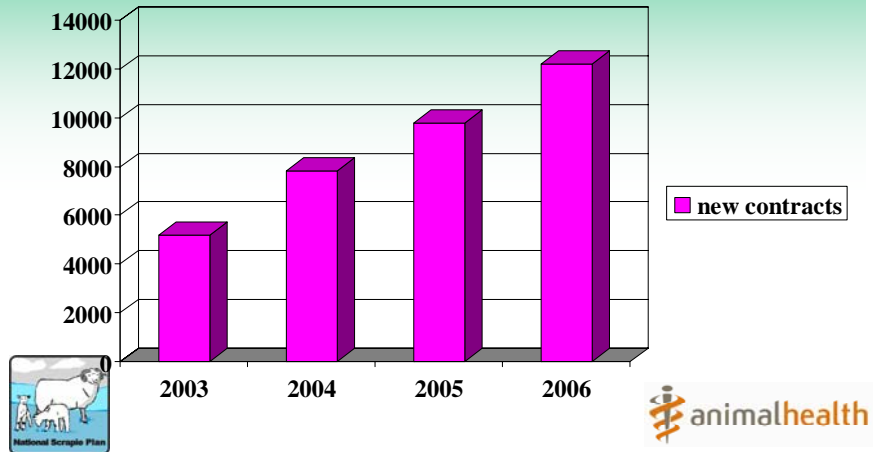
Genotype Result	Type	Degree of resistance / susceptibility
ARR/ARR	1	Sheep that are genetically most resistant to scrapie.
ARR/AHQ ARR/ARH ARR/ARO	2 2 2	Sheep that genetically resistant to scrapie, but will need careful selection when used for further breeding
AHQ/AHQ AHQ/ARH AHQ/ARO ARH/ARH ARH/ARO ARO/ARO	3 3 3 3 3 3	Sheep that genetically have little resistance to scrapie and will need careful selection when used for further breeding
ARR/VRO	4	Sheep that are genetically susceptible to scrapie and should not be used for breeding unless in the context of a controlled breeding programme approved by NSPAC.
AHQ/VRO ARH/VRO ARO/VRO VRO/VRO	5 5 5 5	Sheep that are highly susceptible to scrapie and should not be used for breeding.

Assessment of ram genotyping

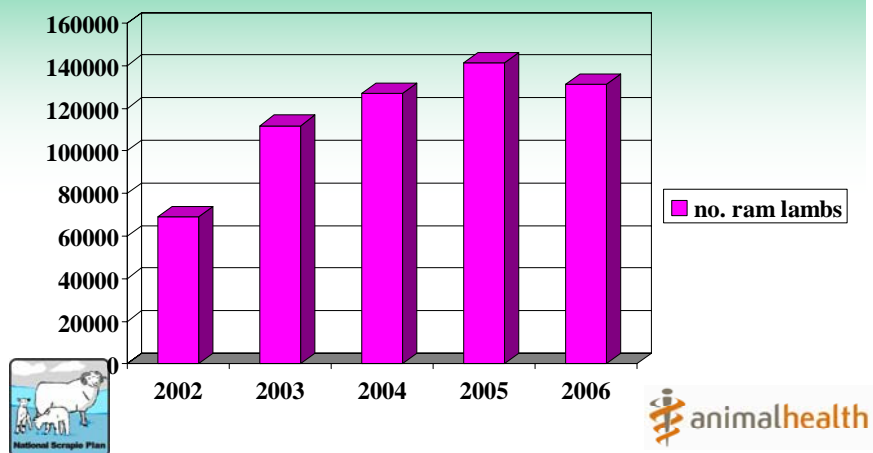
- *Scheme uptake*
- *Numbers of rams genotyped*
- *Shift in genotype profile*
- *Shift in allele percentage frequencies*



RGS: Membership growth 2003 -2006

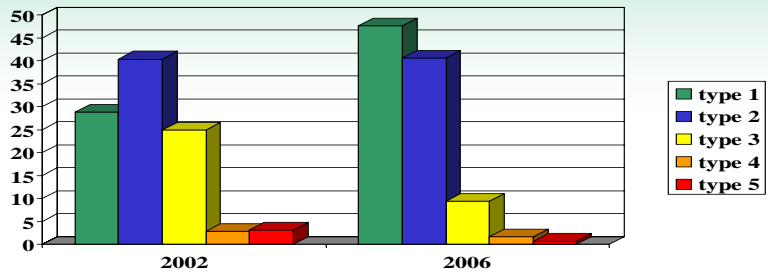


Ram lambs tested 2002 - 2006



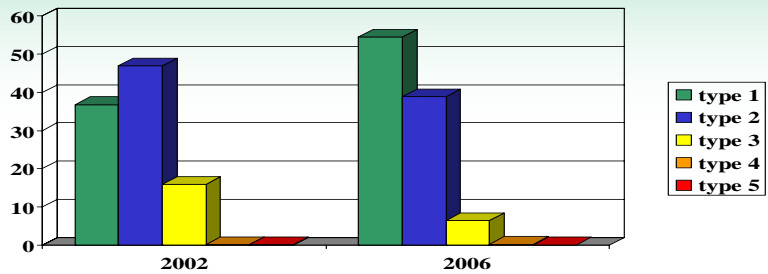
**Movements in the NSP genotypes
of all ram lambs between 2002 and 2006**

2002 = 69040; 2003 = 111801; 2004 = 126912; 2005 = 141276; 2006 = 131110



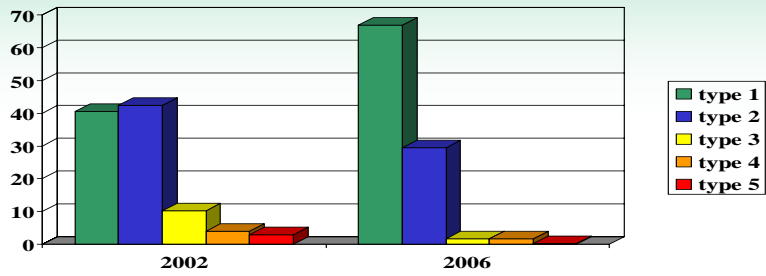
**Movements in the NSP genotypes
of Bluefaced Leicester ram lambs between 2002 and 2006**

2002 = 4508; 2003 = 6251; 2004 = 7962; 2005 = 9232; 2006 = 9302



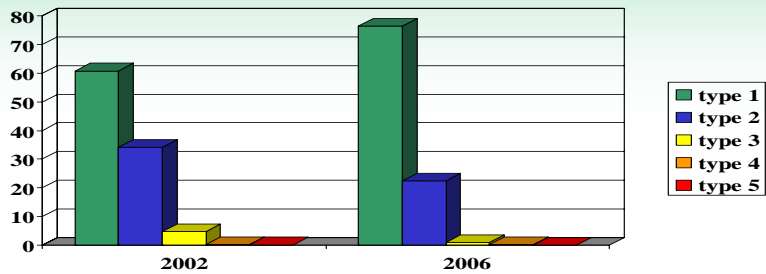
Movements in the NSP genotypes of Charollais ram lambs between 2002 and 2006

2002 = 3142; 2003 = 4949; 2004 = 6156; 2005 = 7501; 2006 = 8009



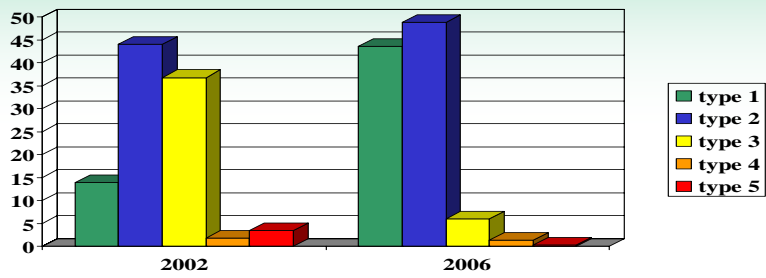
Movements in the NSP genotypes of Suffolk ram lambs between 2002 and 2006

2002 = 11393; 2003 = 14539; 2004 = 16732; 2005 = 18163; 2006 = 15724



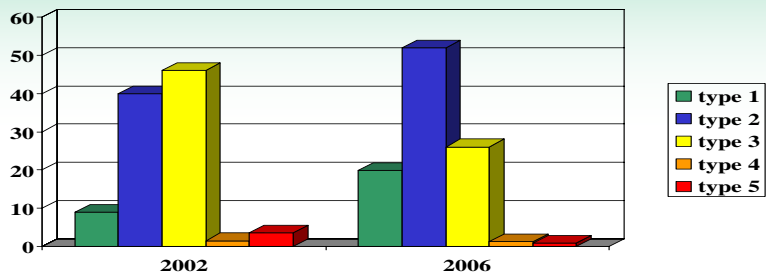
**Movements in the NSP genotypes
of Texel ram lambs between 2002 and 2006**

2002 = 15053; 2003 = 22952; 2004 = 27724; 2005 = 31487; 2006 = 29278



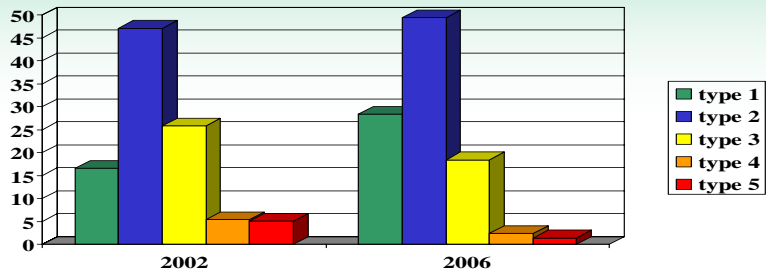
**Movements in the NSP genotypes
of Blackface ram lambs between 2002 and 2006**

2002 = 10617; 2003 = 17100; 2004 = 17318; 2005 = 16987; 2006 = 14943



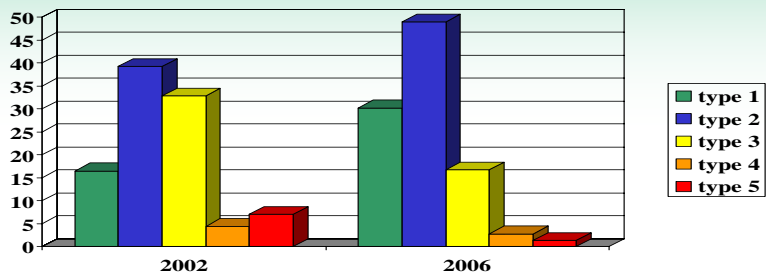
***Movements in the NSP genotypes
of Swaledale ram lambs between 2002 and 2006***

2002 = 1260; 2003 = 5963; 2004 = 5314; 2005 = 7316; 2006 = 6824



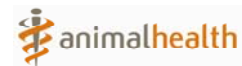
***Movements in the NSP genotypes
of Welsh Mountain ram lambs between 2002 and 2006***

2002 = 3693; 2003 = 6956; 2004 = 8040; 2005 = 7732; 2006 = 6511



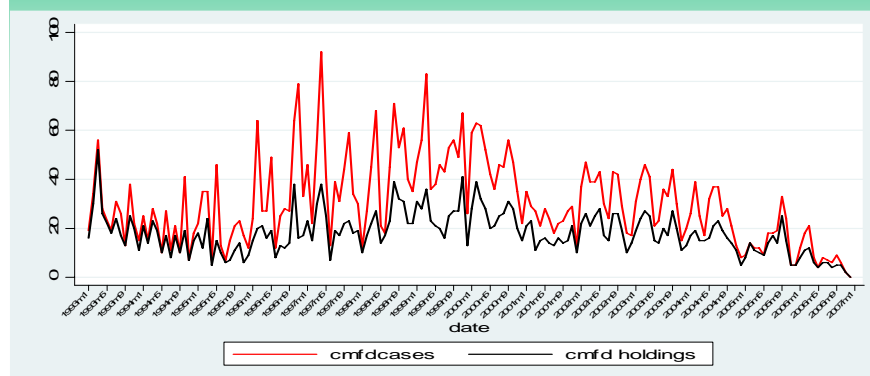
Changes in allele frequencies: 2002 - 2006

	2002	2006	% change
ARR	50.4	68.8	+ 36.5
AHQ	7.4	5.5	-25.7
ARH	9.9	5.6	-43.4
ARQ	29.2	18.9	-35.3
VRQ	3.0	1.2	-60.0



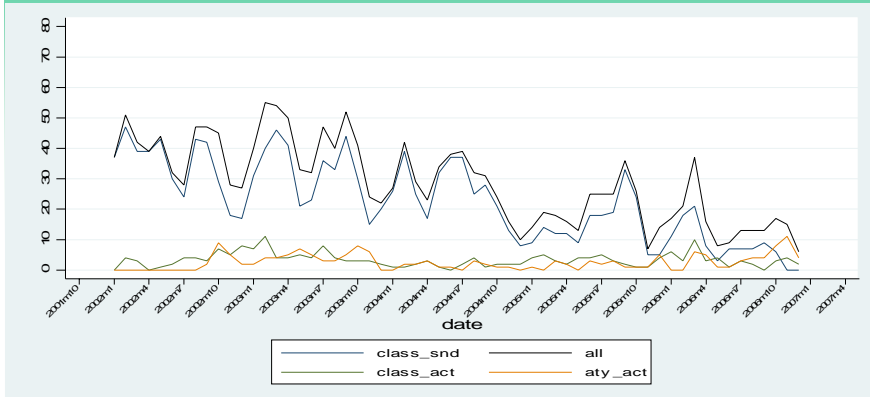
Scrapie trends 1993 - 2002

Source: Victor del Rio Vilas, VLA

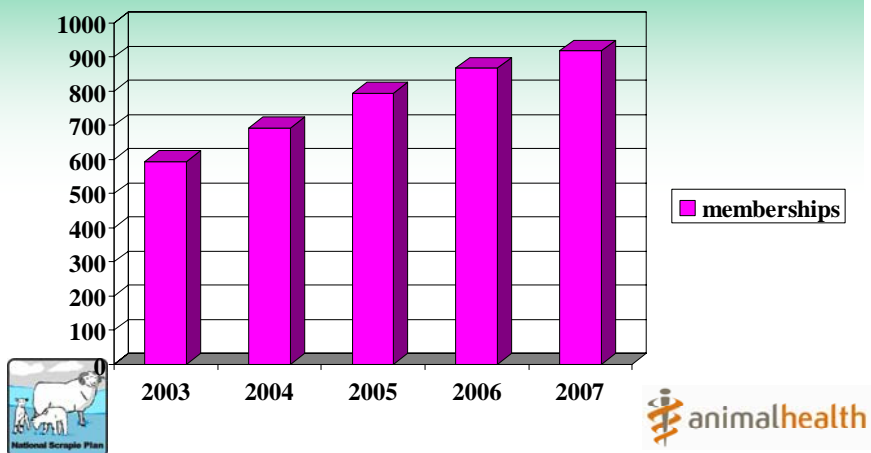


Scrapie trends since 2002

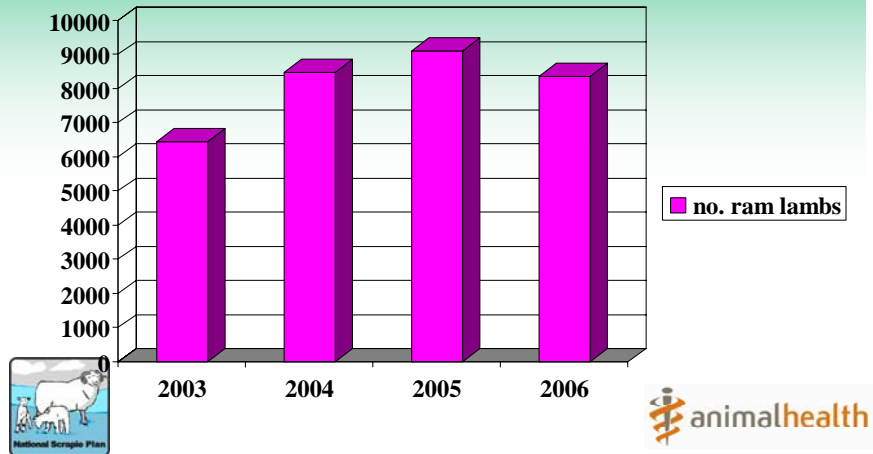
Source: Victor del Rio Vilas, VLA



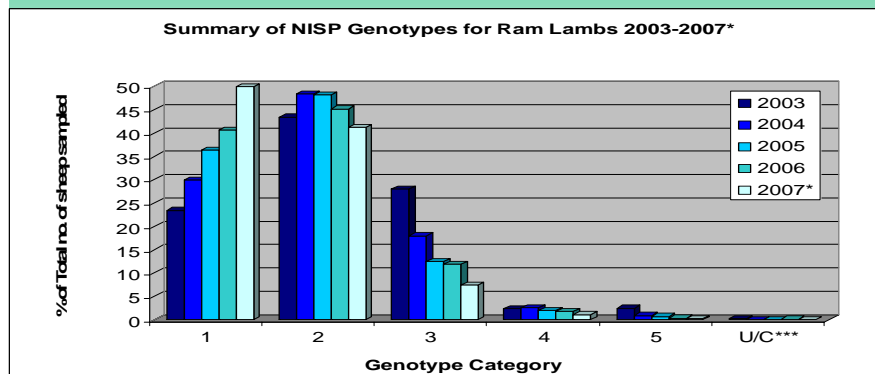
NISP: Membership growth 2003 -2007



NISP: ram lambs tested 2003 - 2006



NISP – genotype profile change 2003 -2007



Atypical Scrapie

- *A sheep TSE, distinct from classical scrapie*
- *Not BSE in sheep*
- *Identified following use of new, more sensitive diagnostic tests*
- *~ 170 cases identified since 2002, most in the abattoir survey*
- *Does it spread in/between flocks?*
- *Is it a hazard to public or a significant animal health risk?*
- *Is it spontaneous?*



Genotypes of Atypical Scrapie Cases

source: Victor del Rio Vilas, VLA

- *47.5% type 3*
- *41.5% type 2*
- *10.5% type 1*
- *Link to AHQ and AF141RQ*
- *Clinical cases rare - 6 in GB to date – none ARR/ARR*



Overall Impact of NSP Ram Genotyping Scheme

- *Achieved genotyping of rams/ram lambs in vast majority of tup producing flocks **and genotype/allele frequencies have moved significantly towards reduction of disease risk***
- *Percentage frequency of **VRQ** reduced **60%***
- *Percentage frequency of **ARQ** reduced **35%***
- *Percentage frequency of **ARR** in ram lambs increased **37%***
- *Consequent reduction of disease risk in progeny*
- *Evidence that scrapie in decline*



Overall Impact of NSP Ram Genotyping Scheme

- *Brought confidence to ram sales*
- *Good supply of type 1 rams for VSFS and CSFS flocks (over 450 holdings)*
- *Not responsible for emergence of atypical scrapie*
- *Have there been adverse consequences for health and production traits? – growing evidence suggests not*



Future of NSP Ram Genotyping Scheme

- *SEAC have now concluded that risk of BSE in national flock is negligible*
- *Full government funding no longer justifiable*
- *Consultation on future of RGS as part of “Responsibility and Cost Sharing” agenda*
- *RGS will close, or may continue with substantial industry funding*

