Host Genetic Resistance Sustains HVT Protective Efficacy Comparable to CVI988/Rispens' in Lines of Chickens Relatively Resistant to Marek's Disease

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MD and Control of MD

- MD is caused by an α-herpesvirus known as Marek's disease virus (MDV).

- MD has being controlled by wide use of MD vaccines in commercial chickens since 1970

  (*Witter, 1987. Avian Dis. 31:752*).

Three Commonly Used Vaccines

- HVT has been used to prevent MD in US commercial chickens since 1970 (*Witter, 1987. Avian Dis. 31:752*).
- The HVT (FC126) + SB-1 bivalent vaccine has been licensed for use in US since 1983 (*Witter, 1987. Avian Dis. 31:752*).
- CVI988/Rispens was imported to US in 1990 (*Witter et al., 1995. Avian Dis. 39:269*).
- CVI988/Rispens remains as the gold standard of MD vaccines (*Witter et al., 1992. In: 4th Intl Symp. on MD. pp315*).

Factors Affecting Vaccine Efficacy

- Many factors affect vaccine efficacy, which include:
  - Vaccinal viruses (Serotypes 1, 2, and 3)
  - vaccine dosage
  - number of vaccinations
  - age at vaccination
  - the time interval between vaccination and infection
  - maternal antibody
  - host genetics

(*Chang et al., 2010*; *Gavora and Spencer, 1979; Gimeno, 2008; Islam et al., 2007; Sharma and Graham, 1982; Witter, 1997; Witter and Lee, 1984; Wu et al., 2009*).

MHC and Vaccine Efficacy

- *MHC B* haplotypes affect host immunoresponse to MD vaccines.
- Chickens with *B*2*, *B*13*, *B*15*, or *B*21* haplotype(s) respond to serotype 1 vaccines with a higher immunoresponse than chickens with other *B* haplotypes

  (Bacon and Witter, 1993, Avian Dis. 37:59;1994, Poult. Sci. 73:481).
- Chickens with *B*5* respond to serotype 2 vaccine better than serotype 1 vaccine

  (Bacon and Witter, 1994. Avian Dis. 38:65).

Non-MHC Genetic Background and Vaccine Efficacy

- vv+MDV challenge of HVT vaccinated chickens from two inbred progenitor lines (6_3 & 7_2) and a series of 19 recombinant congenic strains (RCS),

  line 6_3: PI = 72%

  line 7_2: PI = 0%

  RCS: PI ranged 43% – 82%

  (Chang et al., 2010. Poult. Sci. 89:2083-2091).

- Chicken line non-*MHC* genetic background by vaccine interaction may exist and affect vaccinal protective efficacy. *(Chang et al., 2012. World J. Vaccines, in press)*

This Study

- To re-examine host genetics effect on vaccine protective efficacy.
  - Using commercially recommended dosages.
  - Using experimental lines of chickens (same *B*2* haplotype).
  - Using commercial egg layers (While egg layers: *MHC B*2, B*15, B*21; Brown egg layers: MHC unknown)*
  - Vaccinated and challenged under controlled experimental conditions.

Vaccination and Infection

- **Vaccination:** Chickens from each line
  - unvaccinated (control)
  - vaccinated with a commercial dosage of HVT or CVI988/Rispens.
- **Infection:** Chickens of all trials were challenged on day 5 post hatch with 500 PFU of the vv+ 648A MDV intraabdominally.

Phenotype Observations

- **Chick mortality:** died between hatch day and 7 DPI and were removed from the data set prior to analyses.
- **MD:** Chickens died after 8 DPI or developed visceral gross tumors and/or nerve enlargement(s).
- **Non-MD:** Chickens euthanized at the end of trials without any gross tumor.

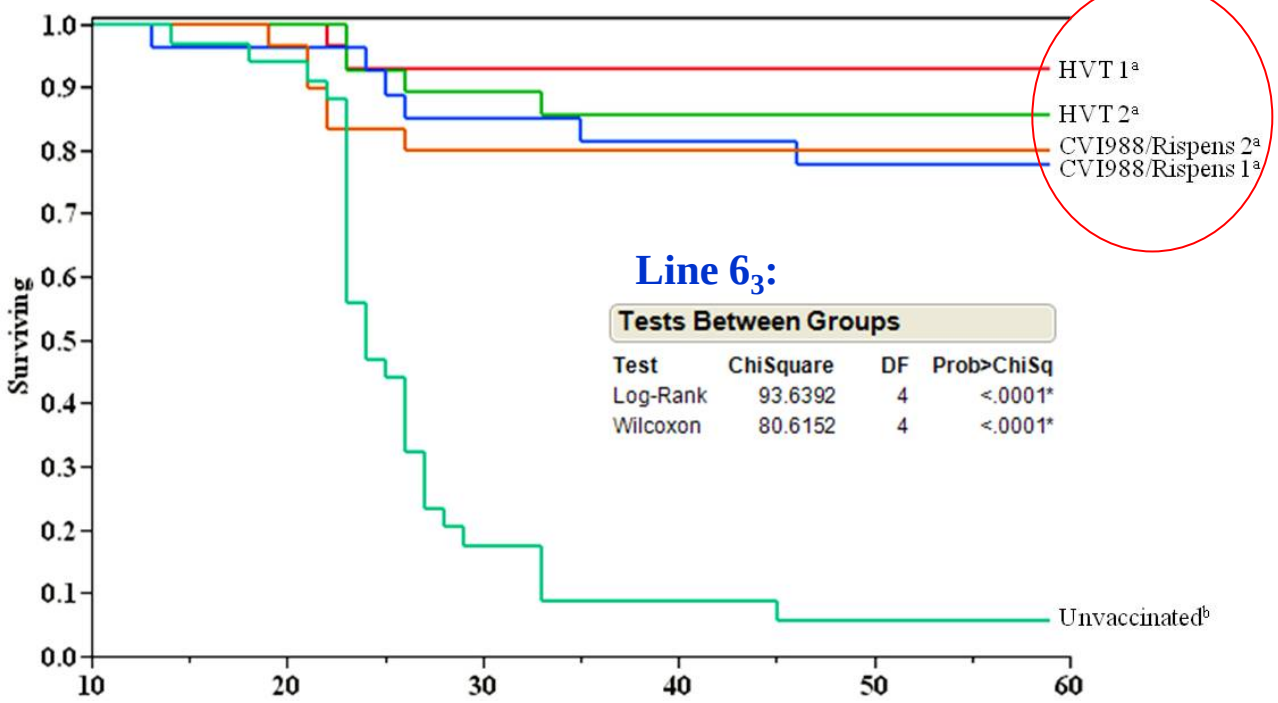
MD% and PI under commercial PFU dosages

Experimental chickens:

Line	Vaccine	MD%	PI
Line 6_3 *(B*2)*	Rispens 1	33 9^{b}	66
	Rispens 2	27 8^{b}	72
	HVT 1	17 7^{b}	82
	HVT 2	14 7^{b}	86
	Unvac.	97 3^{a}	0
Line 7_2 *(B*2)*	Rispens 1	73 8^{b}	27
	Rispens 2	31 9^{c}	69
	HVT 1	100 0^{a}	0
	HVT 2	90 6^{ab}	10
	Unvac	100 0^{a}	0

Commercial Chickens:

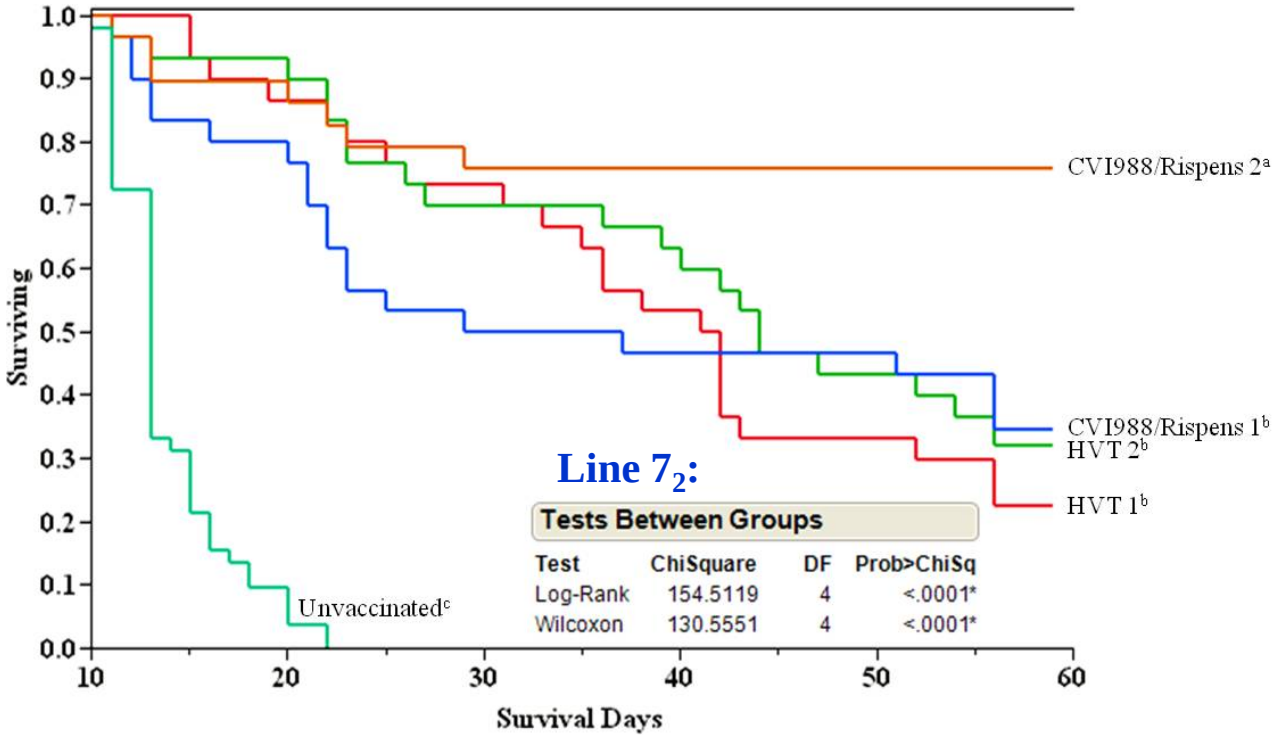
Line	Vaccine	MD%	PI
White egg layers *(B*2, B*15, B*21)*	Rispens 1	54 8^{b}	46
	Rispens 2	24 7^{c}	76
	HVT 1	60 8^{b}	40
	HVT 2	46 8^{bc}	54
	Unvac.	100 0^{a}	0
Brown egg layers *(MHC B*?)*	Rispens 1	49 8^{b}	50
	Rispens 2	8 4^{c}	92
	HVT 1	42 8^{b}	57
	HVT 2	53 8^{b}	46
	Unvac	97 3^{a}	0



Line 6_3:

Tests Between Groups

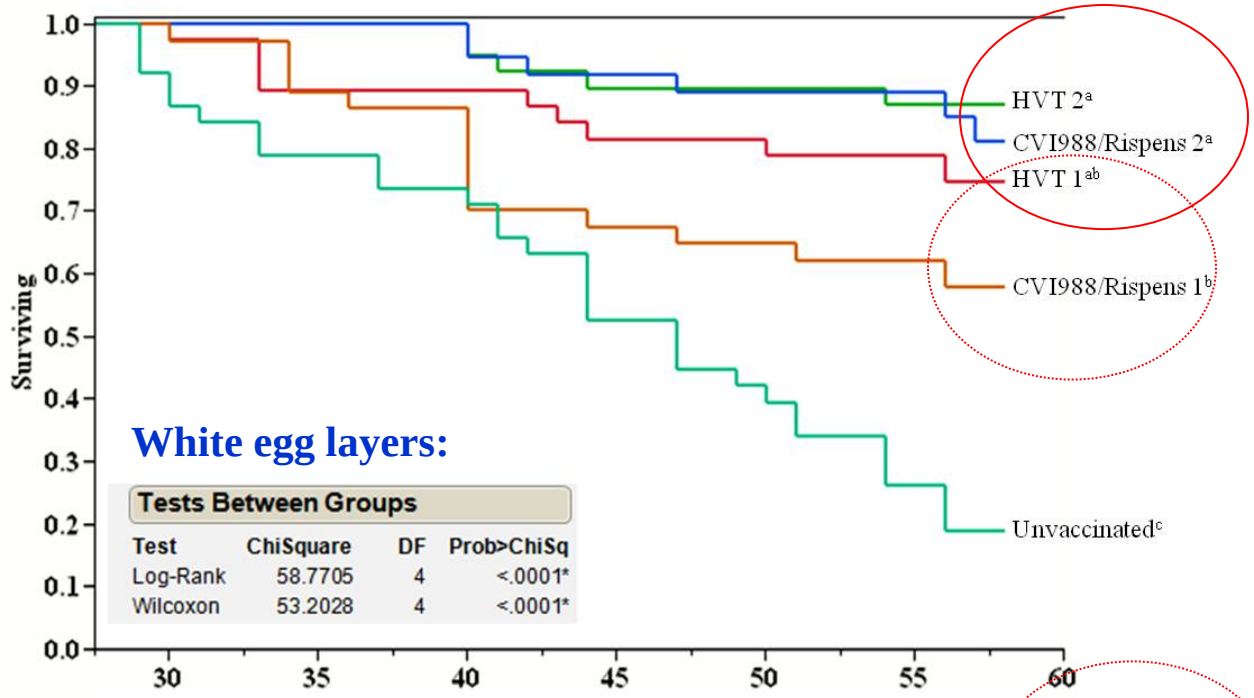
Test	ChiSquare	DF	Prob>ChiSq
Log-Rank	93.6392	4	<.0001*
Wilcoxon	80.6152	4	<.0001*



Line 7_2:

Tests Between Groups

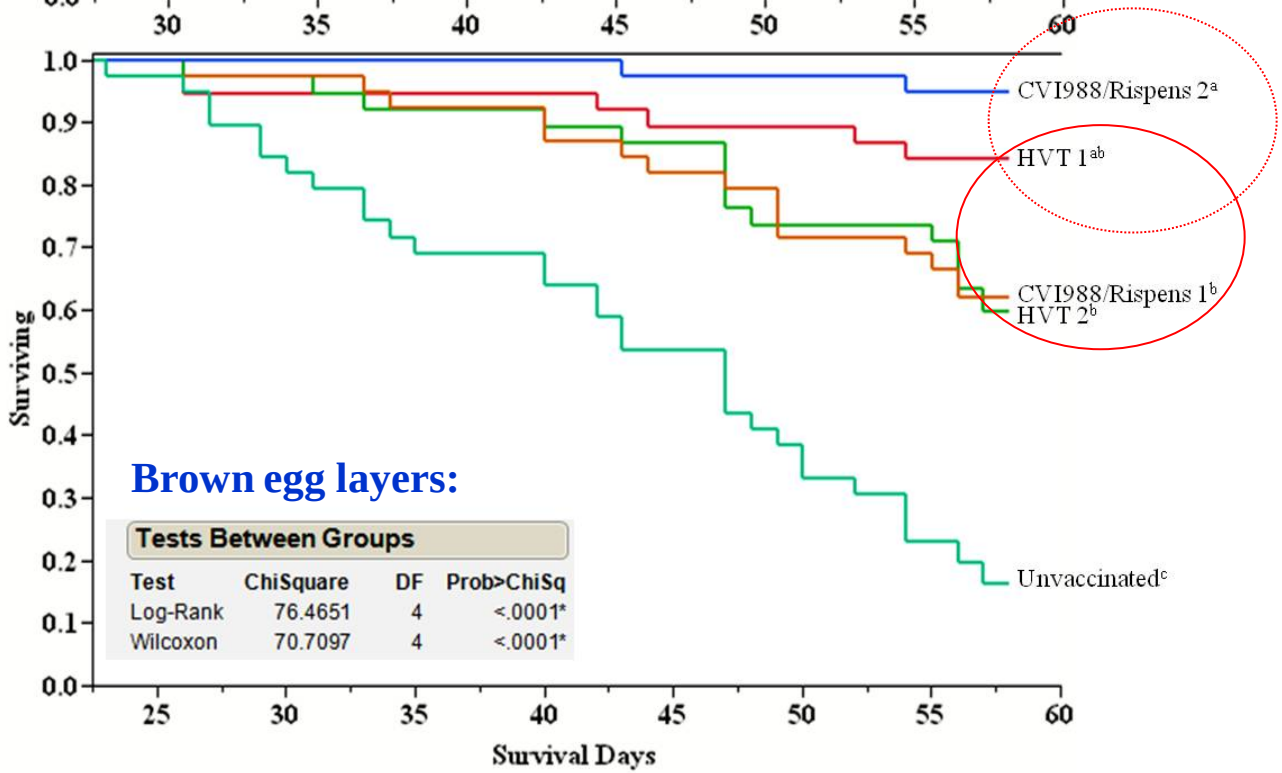
Test	ChiSquare	DF	Prob>ChiSq
Log-Rank	154.5119	4	<.0001*
Wilcoxon	130.5551	4	<.0001*



White egg layers:

Tests Between Groups

Test	ChiSquare	DF	Prob>ChiSq
Log-Rank	58.7705	4	<.0001*
Wilcoxon	53.2028	4	<.0001*



Brown egg layers:

Tests Between Groups

Test	ChiSquare	DF	Prob>ChiSq
Log-Rank	76.4651	4	<.0001*
Wilcoxon	70.7097	4	<.0001*

Summary

- Both HVT 1 and HVT 2 conveyed comparable protective efficacy as did the CVI988/Rispens 1 and 2, in chickens from the highly inbred experimental line 6_3, based on MD%, PI and survival days.

Summary *(Continued)*

Similar results were observed in chickens from the two commercial egg layer flocks except:

- CVI988/Rispens 2 protected White egg layers and Brown egg layers significantly better than CVI988/Rispens 1 and the HVTs.

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Discussions

- HVT protective efficacy was strikingly different between the lines 6_3 and 7_2 chickens.

- The good protective efficacy of HVT in MD resistant lines (6_3, white egg layers, and brown egg layers) was highly likely attributable to the host genetic resistance to MD.

Discussions *(Continued)*

- HVT is relatively less expensive
- HVT should be used to protect chickens like line 6_3, but not something like line 7_2.
- The observed superior protection of CVI988/Rispens 2 - due to higher titers of vaccinal viruses in a single (commercial) dosage and host *MHC B haplotypes*?

Thank you for your attention!