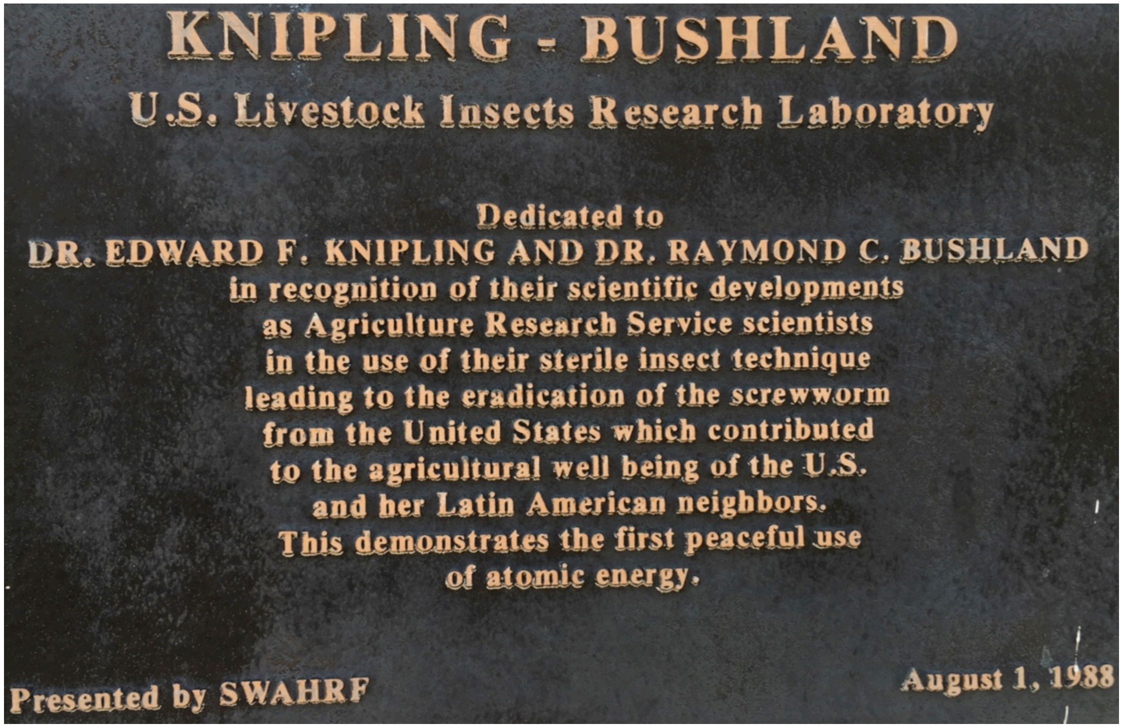
Advances in Integrated Tick Management for Area-wide Mitigation of Tick-borne Disease Burden

Dr. Adalberto Pérez de León

Third FAO/IAEA International Conference on Area-wide Management of Insect Pests: Integrating the Sterile Insect Technique and Related Nuclear and other Techniques

Vienna, Austria

22 May 2017


KNIPLING - BUSHLAND
U.S. Livestock Insects Research Laboratory
Dedicated to
DR. EDWARD F. KNIPLING AND DR. RAYMOND C. BUSHLAND
in recognition of their scientific developments
as Agriculture Research Service scientists
in the use of their sterile insect technique
leading to the eradication of the screwworm
from the United States which contributed
to the agricultural well being of the U.S.
and her Latin American neighbors.
This demonstrates the first peaceful use
of atomic energy.
Presented by SWAHRF
August 1, 1988


STATE HISTORICAL SURVEY COMMITTEE
TEXAS
SITE OF
ANIMAL HEALTH DISCOVERY
IN THIS BUILDING (AT MENARD) DURING LATE 1930s, DR. EDWARD F. KNIPLING (b.1909) ADVANCED THEORY SCREWWORMS MIGHT BE ERADICATED BY RELEASING STERILE MALE FLIES TO BREAK CHAIN OF REPRODUCTION AND SAVE LIVESTOCK FROM ROLE OF HOST TO PARASITIC LARVAE THAT DESTROY LIVESTOCK AND WILDLIFE.
DURING 1950-51, THIS LABORATORY (REMOVED TO KERRVILLE AREA) WAS SITE OF STERILIZATION OF MALE SCREWWORMS WITH IRRADIATION, IN PROCEDURES BY DR. R. C. BUSHLAND AND D. E. HOPKINS. THE OUTCOME: ERADICATION OF THE SCREWWORM AND SAVING OF DOMESTIC AND WILD ANIMALS OF THE UNITED STATES.
(1972)

USDA

Disclaimer

Agricultural Research Service

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USDA-ARS Livestock Arthropod Pest Research Unit at the Knipling-Bushland U.S. Livestock Insects Research Laboratory

- Launched 19 Mar 17
- Three research locations
  - Knipling-Bushland U.S. Livestock Insects Research Laboratory in Kerrville, Texas
  - Cattle Fever Tick Research Laboratory, Edinburg, Texas
  - Screwworm Research Laboratory in Pacora, Panama
- Three appropriated research projects
  - Cattle Fever Tick Control & Eradication
  - Genomics of Livestock Pests
  - Management of Flies Associated with Livestock

Get more information: www.ars.usda.g ov

Global Change Adds Complexity to TTBD Problem & Makes its Solution Challenging

USDA

Agricultural Research Service

Pérez de León et al. Parasites & Vectors 2010, 3:36
http://www.parasitesandvectors.com/content/3/1/36

Parasites & Vectors

MEETING REPORT · Open Access

One Health approach to identify research needs in bovine and human babesioses: workshop report

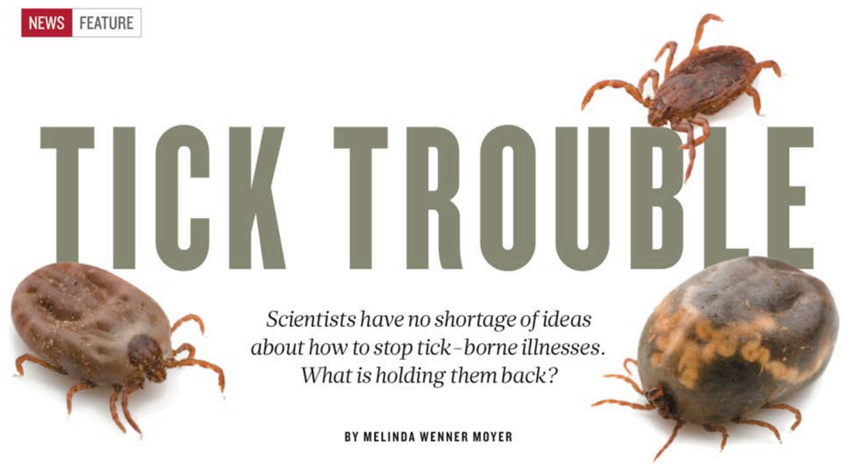
Adalberto A Pérez de León*[1], Daniel A Strickman[2], Donald P Knowles[3], Durland Fish[4], Eileen Thacker[2], José de la Fuente*[5,6], Peter J Krause[7], Stephen K Wikel[8], Ryan S Miller[9], Gale G Wagner[10], Consuelo Almazán[11], Robert Hillman[12], Matthew T Messenger[13], Paul O Ugstad[14], Roberta A Duhaime[15], Pete D Teel[16], Alfonso Ortega-Santos[17], David G Hewitt[17], Edwin J Bowers[18], Stephen J Bent[7], Matt H Cochran[12], Terry F McElwain[19,20], Glen A Scoles[21], Carlos E Suarez[19,20], Ronald Davey[1], Jeanne M Howell Freeman[1], Kimberly Lohmeyer[1], Andrew Y Li[1], Felix D Guerrero[1], Diane M Kammlah[1], Pamela Phillips[1], Joe M Pound[1] for the Group for Emerging Babesioses and One Health Research and Development in the U.S.

frontiers in PUBLIC HEALTH

REVIEW ARTICLE
published: 17 November 2014
doi: 10.3389/fpubh.2014.00177

Pathogenic landscape of transboundary zoonotic diseases in the Mexico–US border along the Rio Grande

Maria Dolores Esteve-Gassent[1†], Adalberto A. Pérez de León[2†], Dora Romero-Salas[3], Teresa P. Feria-Arroyo[4], Ramiro Patino[4], Ivan Castro-Arellano[5], Guadalupe Gordillo-Pérez[6], Allan Auclair[7], John Goolsby[8], Roger Ivan Rodriguez-Vivas[9] and Jose Guillermo Estrada-Franco[10]*



TRANSLATING ECOLOGY, PHYSIOLOGY, BIOCHEMISTRY, AND POPULATION GENETICS RESEARCH TO MEET THE CHALLENGE OF TICK AND TICK-BORNE DISEASES IN NORTH AMERICA

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ARCHIVES OF INSECT BIOCHEMISTRY AND PHYSIOLOGY, Vol. 92, No. 1, 38–64 (2016)

Feria-Arroyo et al. Parasites & Vectors 2014, 7:199
http://www.parasitesandvectors.com/content/7/1/199

RESEARCH · Open Access

Implications of climate change on the distribution of the tick vector *Ixodes scapularis* and risk for Lyme disease in the Texas-Mexico transboundary region

Teresa P Feria-Arroyo[1†], Ivan Castro-Arellano[2†], Guadalupe Gordillo-Perez[3†], Ana L Cavazos[1], Margarita Vargas-Sandoval[4], Abha Grover[5], Javier Torres[3], Raul F Medina[6], Adalberto A Pérez de León[7] and Maria D Esteve-Gassent[5*]

Braz. J. Vet. Parasitol., Jaboticabal, v. 23, n. 2, p. 150-156, abr.-jun. 2014

Reassessment of the potential economic impact of cattle parasites in Brazil

Reavaliação do potencial impacto econômico de parasitos de bovinos no Brasil

Laerte Grisi[1*]; Romário Cerqueira Leite[2]; João Ricardo de Souza Martins[3]; Antonio Thadeu Medeiros de Barros[4]; Renato Andreotti[4]; Paulo Henrique Duarte Cançado[4]; Adalberto Angel Pérez de León[5]; Jairo Barros Pereira[6]; Humberto Silva Villela[6]

Rev Mex Cienc Pecu 2017;8(1):61-74

http://dx.doi.org/10.22319/rmcp.v8i1.4305

Potential economic impact assessment for cattle parasites in Mexico. Review

Evaluación del impacto económico potencial de los parásitos del ganado bovino en México. Revisión

Roger Iván Rodríguez-Vivas[a*], Laerte Grisi[b†], Adalberto Angel Pérez de León[c], Humberto Silva Villela[d], Juan Felipe de Jesús Torres-Acosta[a], Hugo Fragoso Sánchez[e], Dora Romero Salas[f], Rodrigo Rosario Cruz[g], Fabián Saldierna[h], Dionisio García Carrasco[h]

Strategies to Mitigate Impact of Ticks on Livestock Production Systems

Parameter	Control	Eradication
Tolerance	Economic threshold	Zero
Surveillance	Optional, or reactive	Constant
Quarantine	No	Obligatory & sanctioned by laws
Treatment	Optional	Obligatory
Cost	Variable	High ROI, initial investment high
Duration	Seasonal	Continuous

Integrated control programs for ticks on cattle: an examination of some possible components

FAO animal production and health paper

Nicholas N. Jonsson
School of Veterinary Science,
University of Queensland, Q 4072
Australia
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CHAPTER 13

ACARICIDE RESEARCH AND DEVELOPMENT, RESISTANCE, AND RESISTANCE MONITORING

FELIX D. GUERRERO, ADALBERTO A. PÉREZ DE LEÓN, ROGER I. RODRIGUEZ-VIVAS, NICK JONSSON, ROBERT J. MILLER, AND RENATO ANDREOTTI

frontiers in Public Health

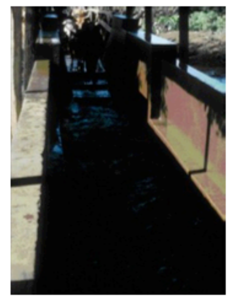
REVIEW
published: 09 November 2016
doi: 10.3389/fpubh.2016.00239

Check for updates

Experiences in Tick Control by Acaricide in the Traditional Cattle Sector in Zambia and Burkina Faso: Possible Environmental and Public Health Implications

*Daniele De Meneghi[1,2,3], Frédéric Stachurski[4,6] and Hassane Adakal[5,6]**

TABLE 1 | Comparative score attributed to the tick control methods described in case study 1 and case study 2: major advantages and disadvantages.




Control method	Dip-tank (case study 1)	Footbath (case study 2)	Portable manual sprayer[a]	Pour-on[a]
Initial investment	20 0000 US$	400 US$	80 US$	0 US$
Cost for the whole rainy season (per cattle head)	1.5 US$	0.2–0.25 US$	0.15–0.25 US$	3–5.5 US$
Usefulness to treat one/few animal(s)	*	*	**	***
Usefulness to treat many animals or more than one herd	***	**	*	**
Environmental implications/ hazards 1. volume of product to be used	***	*	**	*
Environmental implications/ hazards 2. risk of spilling/pouring/ dispersal on fallow land	***	*	***	from * to *** (depending on product used)
Public health implications/hazards 1. risk for the operators	**	*	***	*
Public health implications/hazards 2. residues in foods of animal origin	***	**	*	*

[a]*Other (most) common tick control methods used under field conditions in the study areas.*
*Key-legend of the score attributed: * low level; ** medium; *** high level*

Rev. Bras. Parasitol. Vet., Jaboticabal, v. 20, n. 2, p. 127-133, abr.-jun. 2011

Acaricide resistance of *Rhipicephalus* (*Boophilus*) *microplus* in State of Mato Grosso do Sul, Brazil

Resistência do *Rhipicephalus* (*Boophilus*) *microplus* aos acaricidas no Estado de Mato Grosso do Sul, Brasil

Renato Andreotti[1]*; Felix David Guerrero[2]; Mariana Aparecida Soares[1]; Jacqueline Cavalcante Barros[1]; Robert John Miller[3]; Adalberto Pérez de Léon[2]

Environmental Health Insights 2014:8(S2)

Reduced Efficacy of Commercial Acaricides Against Populations of Resistant Cattle Tick *Rhipicephalus microplus* from Two Municipalities of Antioquia, Colombia

Anderson Lopez-Arias[1], David Villar-Argaiz[1], Jenny J. Chaparro-Gutierrez[1], Robert J. Miller[2] and Adalberto A. Perez de Leon[3]

Veterinary Parasitology 200 (2014) 179–188

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Acaricide and ivermectin resistance in a field population of *Rhipicephalus microplus* (Acari: Ixodidae) collected from red deer (*Cervus elaphus*) in the Mexican tropics

R.I. Rodríguez-Vivas[a,*], R.J. Miller[b], M.M. Ojeda-Chi[a], J.A. Rosado-Aguilar[a], I.C. Trinidad-Martínez[a], A.A. Pérez de León[c]

Veterinary Parasitology 233 (2017) 9–13

Contents lists available at ScienceDirect

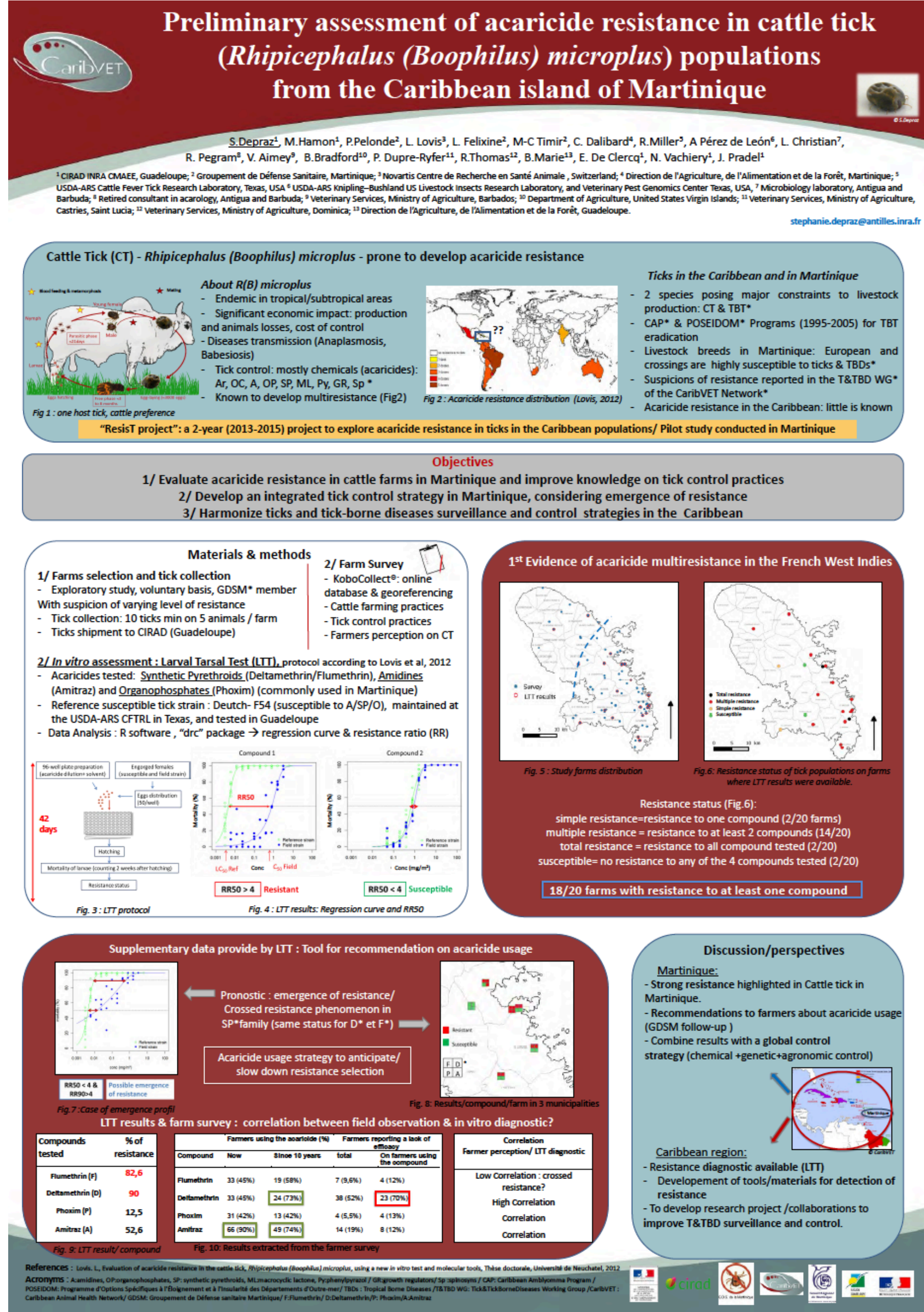
Veterinary Parasitology

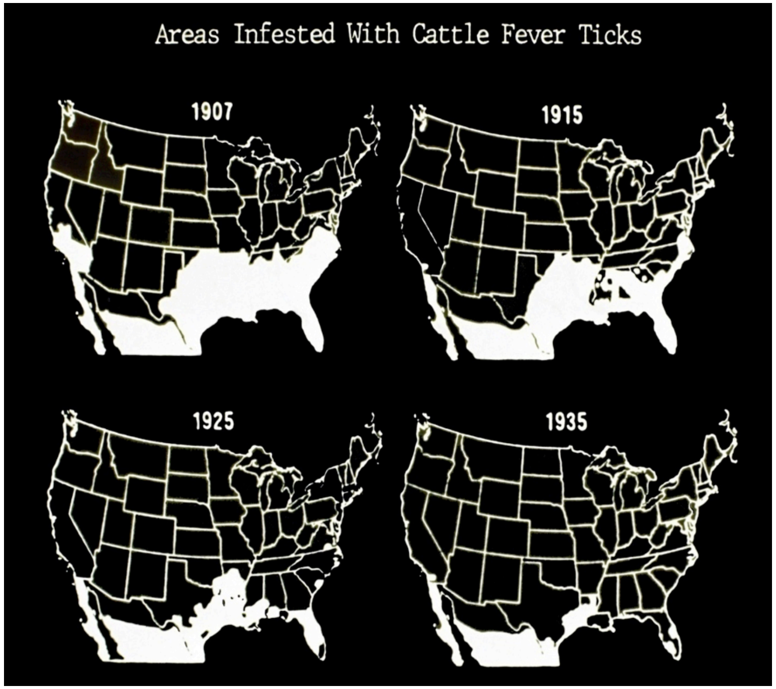
journal homepage: www.elsevier.com/locate/vetpar

Research paper

First documentation of ivermectin resistance in *Rhipicephalus sanguineus* sensu lato (Acari: Ixodidae)

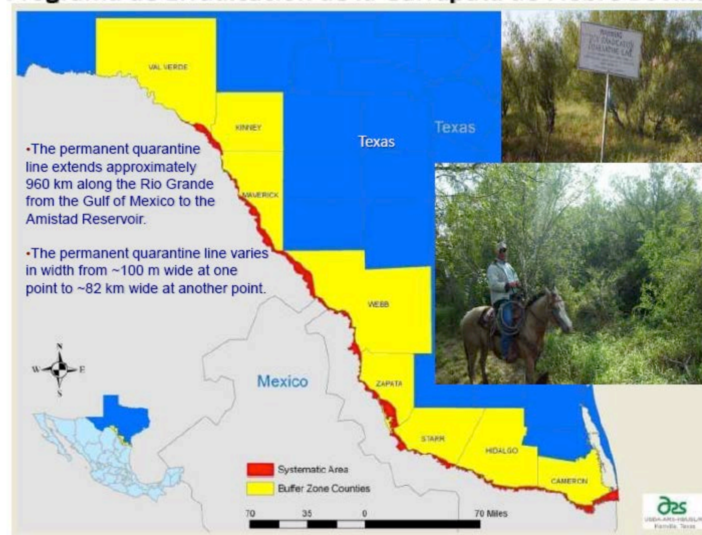
R.I. Rodriguez-Vivas[a,*], M.M. Ojeda-Chi[a], I. Trinidad-Martinez[a], A.A. Pérez de León[b]





Graham and Hourigan 1977

Zona de Cuarentena Permanente en los E.U.A.
Programa de Erradicacion de la Garrapata de Fiebre Bovina



Distribution of *Rhipicephalus* (*Boophilus*) *microplus* and *Rhipicephalus* (*Boophilus*) *annulatus* (Acari: Ixodidae) Infestations Detected in the United States Along the Texas/Mexico Border

K. H. Lohmeyer,[1,2] J. M. Pound,[1] M. A. May,[1] D. M. Kammlah,[1] and R. B. Davey[3]

J. Med. Entomol. 48(4): 770–774 (2011); DOI: 10.1603/ME10209

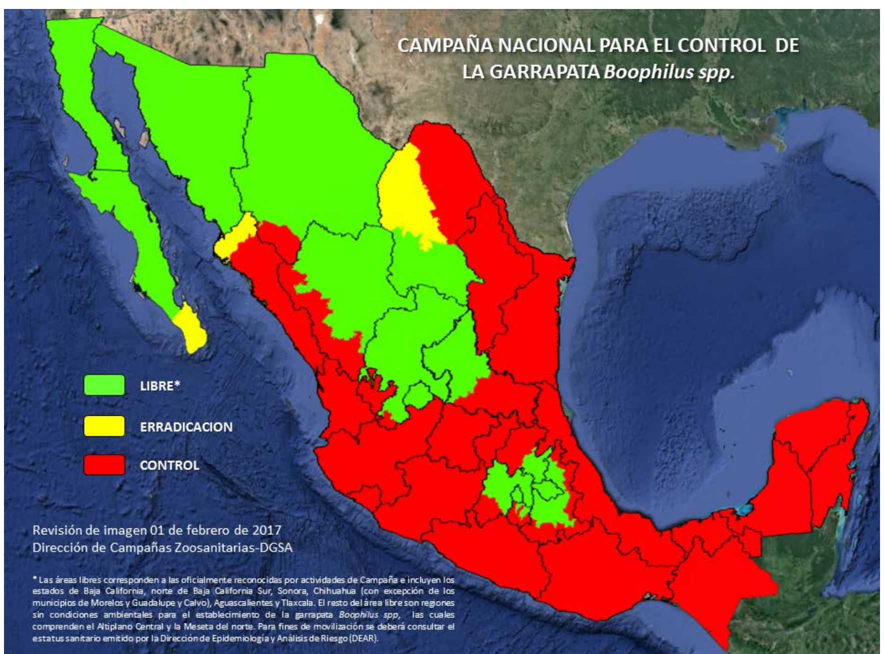
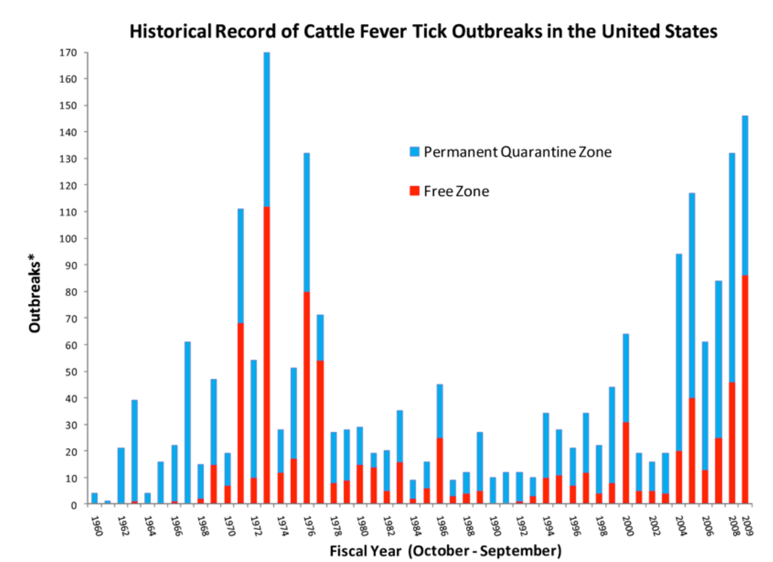
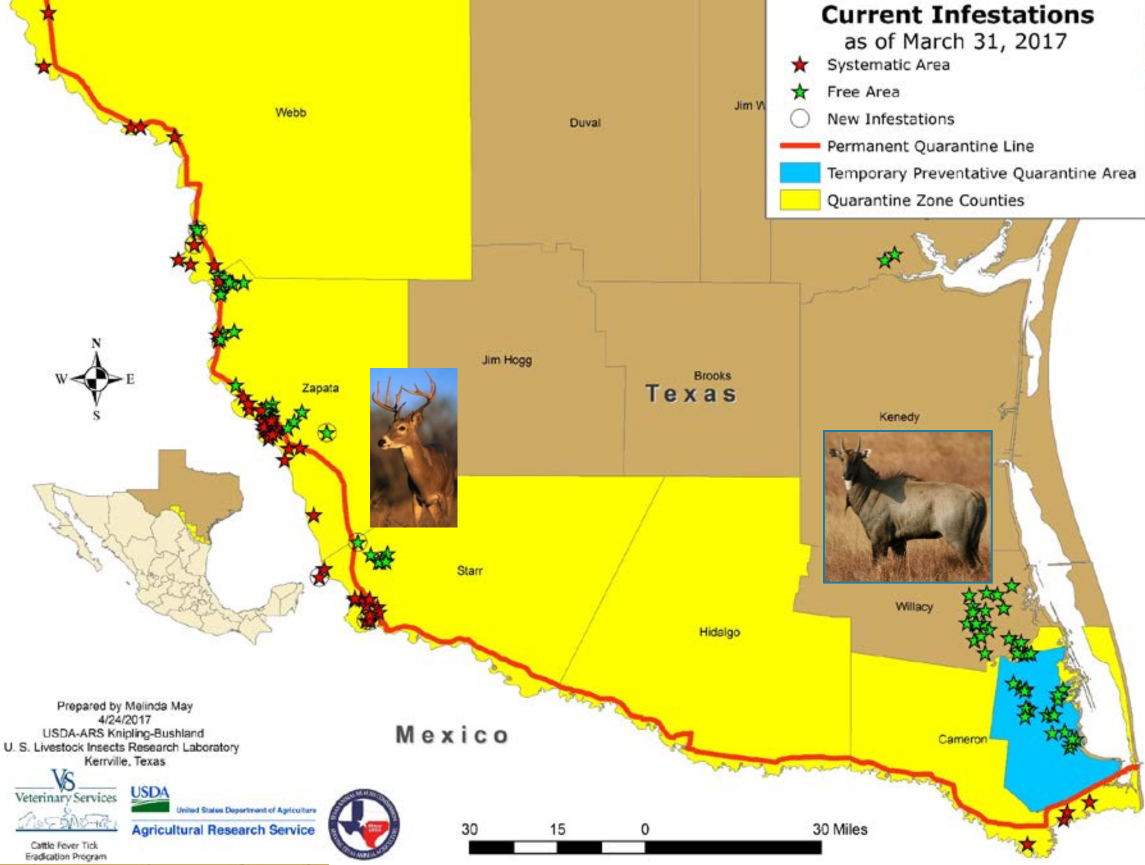


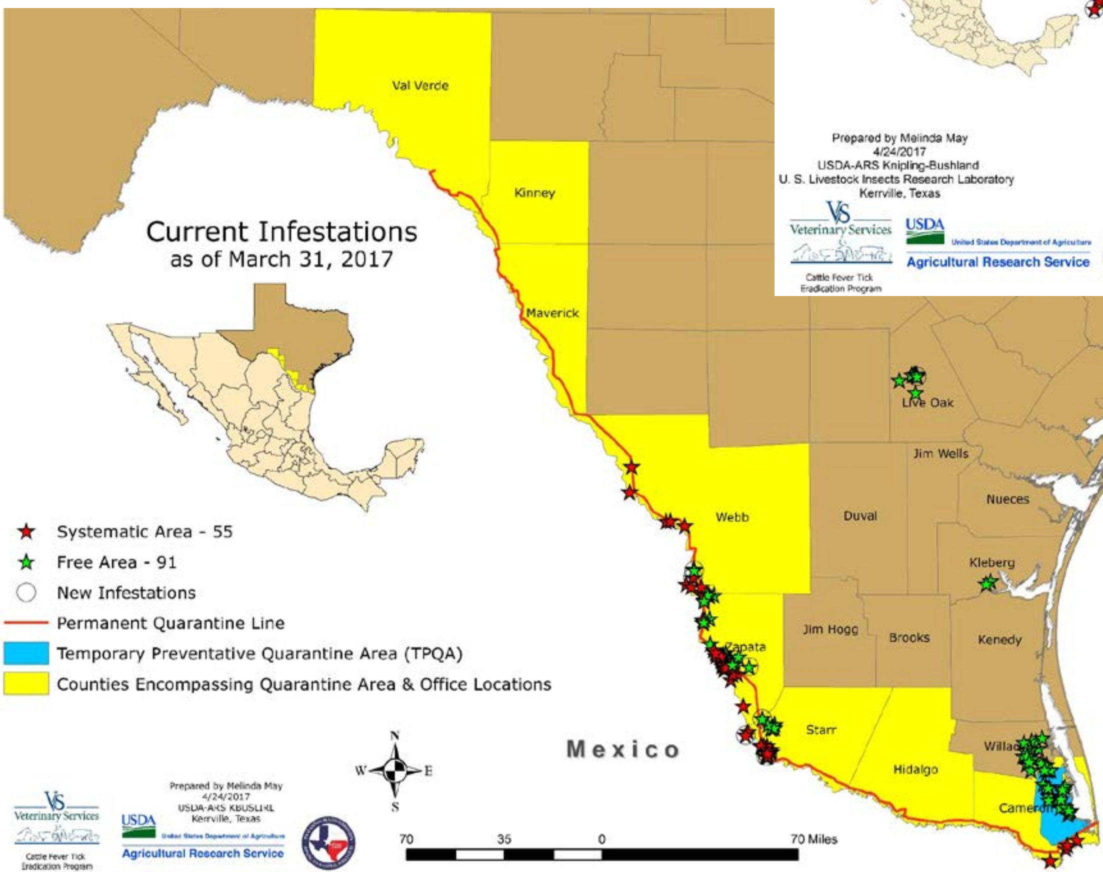
Fig. 1. Verified infestations of *R.* (*B.*) *annulatus* and *R.* (*B.*) *microplus* in south Texas from 1 October 1999 to 30 September 2010. (Online figure in color.)



Historical Record of Cattle Fever Tick Outbreaks in the United States
Permanent Quarantine Zone
Free Zone
Outbreaks*
Fiscal Year (October - September)



Current Infestations
as of March 31, 2017
Systematic Area
Free Area
New Infestations
Permanent Quarantine Line
Temporary Preventative Quarantine Area
Quarantine Zone Counties
Webb
Duval
Jim Hogg
Brooks
Texas
Zapata
Kenedy
Starr
Hidalgo
Willacy
Cameron
Mexico
N
S
E
W
Prepared by Melinda May
4/24/2017
USDA-ARS Knipling-Bushland
U. S. Livestock Insects Research Laboratory
Kerrville, Texas
Veterinary Services
Cattle Fever Tick Eradication Program
USDA
United States Department of Agriculture
Agricultural Research Service
30
15
0
30 Miles



Current Infestations
as of March 31, 2017
Val Verde
Kinney
Maverick
Live Oak
Jim Wells
Nueces
Webb
Duval
Kleberg
Jim Hogg
Brooks
Kenedy
Zapata
Starr
Hidalgo
Willacy
Cameron
Mexico
Systematic Area - 55
Free Area - 91
New Infestations
Permanent Quarantine Line
Temporary Preventative Quarantine Area (TPQA)
Counties Encompassing Quarantine Area & Office Locations
N
S
E
W
Prepared by Melinda May
4/24/2017
Kerrville, Texas
Veterinary Services
Cattle Fever Tick Eradication Program
USDA
Agricultural Research Service
70
35
0
70 Miles

frontiers in
PHYSIOLOGY

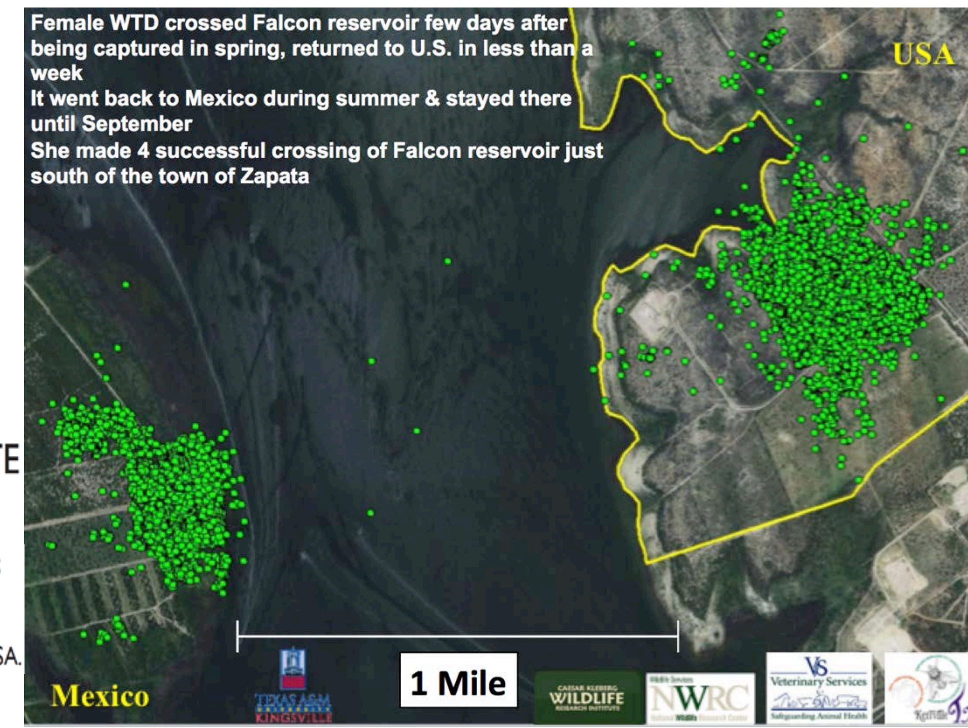
ORIGINAL RESEARCH ARTICLE
published: 14 June 2012
doi: 10.3389/fphys.2012.00195

Integrated strategy for sustainable cattle fever tick eradication in USA is required to mitigate the impact of global change

Adalberto A. Pérez de León[1]†, Pete D. Teel[2]†, Allan N. Auclair[3], Matthew T. Messenger[4], Felix D. Guerrero[1], Greta Schuster[5] and Robert J. Miller[6]*

ADVANCING INTEGRATED TICK MANAGEMENT TO MITIGATE BURDEN OF TICK-BORNE DISEASES*

Adalberto A. Pérez de León[1], USDA-ARS Knipling-Bushland U.S. Livestock Insects Research Laboratory, USA; Pete D. Teel, Entomology Department, Texas A&M AgriLife Research , USA; Andrew Li, USDA-ARS Invasive Insect Biocontrol and Behavior Laboratory, USA; Loganathan Ponnusamy, Entomology Department, North Carolina State University, USA; R. Michael Roe, Entomology Department, North Carolina State University, USA.



Vaccine 30 (2012) 5682–5687

Contents lists available at SciVerse ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

ELSEVIER

Exploring the use of an anti-tick vaccine as a tool for the integrated eradication of the cattle fever tick, *Rhipicephalus* (*Boophilus*) *annulatus*

Robert Miller[a,*], Agustín Estrada-Peña[b], Consuelo Almazán[c], Andrew Allen[d], Lauren Jory[d], Kathleen Yeater[e], Matthew Messenger[f], Dee Ellis[g], Adalberto A. Pérez de León[h]

Guerrero *et al. Parasites & Vectors* 2014, **7**:475
http://www.parasitesandvectors.com/content/7/1/475

Parasites & Vectors

RESEARCH Open Access

Rhipicephalus (*Boophilus*) *microplus* aquaporin as an effective vaccine antigen to protect against cattle tick infestations

Felix D Guerrero[1*], Renato Andreotti[2], Kylie G Bendele[1], Rodrigo C Cunha[2], Robert J Miller[3], Kathleen Yeater[4] and Adalberto A Pérez de León[1]

Fever Tick Vaccine Fact Sheet

USDA APHIS

About the Fever Tick Vaccine

Bm86 immunomodulator by Zoetis is a new vaccine that is being used in the Cattle Fever Tick Eradication Program. The vaccine targets and kills both species of cattle fever ticks: *Rhipicephalus* (formerly *Boophilus*) *annulatus* and *R. microplus*.

How the Vaccine Works

After cattle have been vaccinated, their immune system will produce antibodies in the blood that will fight against a protein found in the lining of the tick's gut. The tick will take in the antibodies when it consumes the blood of vaccinated cattle.

The antibodies bind to the lining of the intestines in the tick, which prevent the tick from absorbing nutrients. The vaccine will kill or weaken ticks as they feed on vaccinated cattle and weak surviving ticks will not be able to reproduce.

Vaccine Use

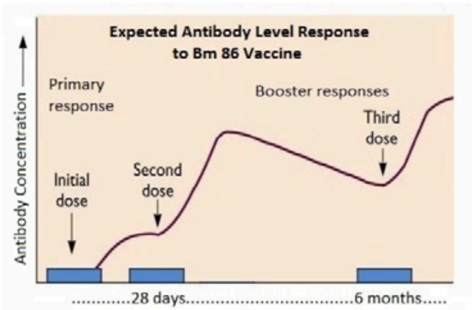
The vaccine will be used in addition to eradication practices already in place for the Cattle Fever Tick Eradication Program. **It will not replace systematic treatments.** Vaccines will only be administered by USDA/APHIS/Veterinary Services, Texas Animal Health Commission employees or authorized agents.

Cattle That Should be Vaccinated

- **Cattle in Permanent Quarantine:** Beef cattle over two months of age are required to be vaccinated at least once a year.
- **Cattle in Temporary Preventative and Control Quarantine Areas:** Beef cattle over two months of age may be required to be vaccinated if there is an elevated risk determined by USDA/TAHC epidemiologists.
- **Cattle in the Free Area:** Cattle should not be vaccinated at this time.

Vaccination Schedule

Cattle should receive an initial dose, a booster four weeks later, followed by additional boosters every six months. This schedule is important because one dose will not produce enough antibodies to be effective. Vaccination every six months after the initial dose and booster is needed to keep the concentration of antibodies in the blood high enough to be effective.

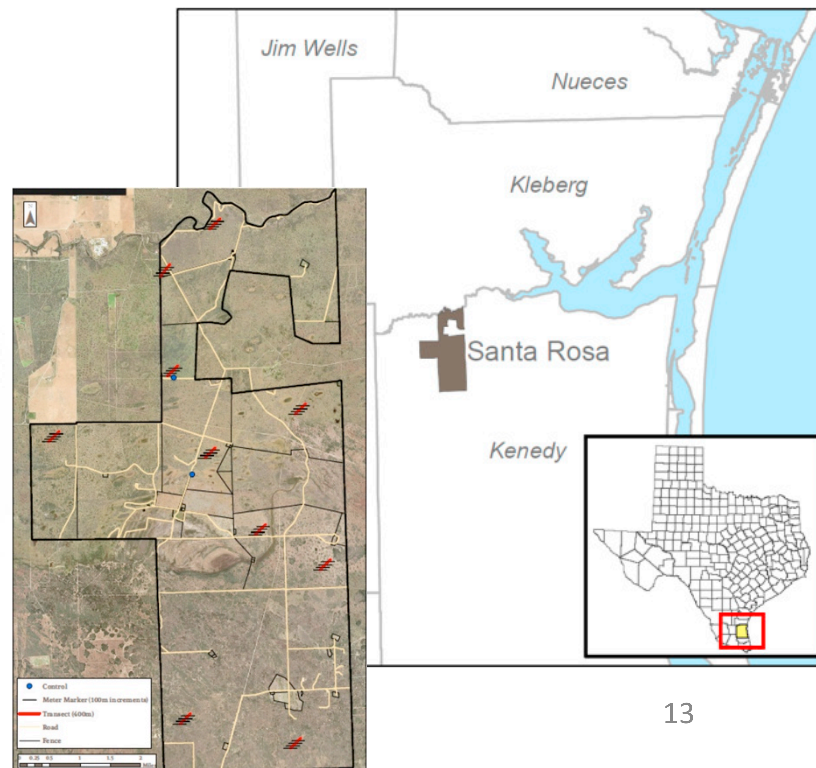


Comparison of natural and artificial odor lures for nilgai (*Boselaphus tragocamelus*) and white-tailed deer (*Odocoileus virginianus*) in South Texas: Developing treatment for cattle fever tick eradication

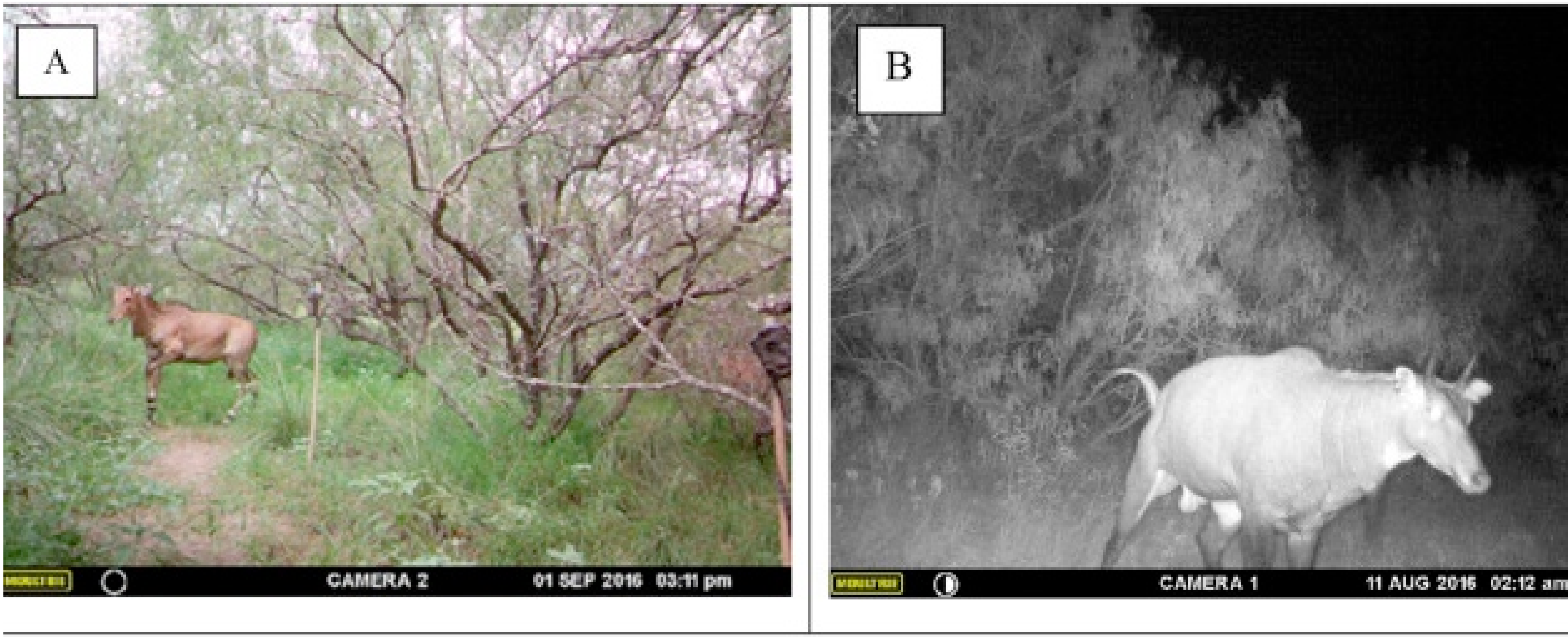
John A. Goolsby, Nirbhay K. Singh, Alfonso Ortega-S Jr., David G. Hewitt, Tyler A. Campbell, David Wester, Adalberto A. Pérez de León

International Journal for Parasitology: Parasites and Wildlife, 2017

Attract Nilgai &Treat Ticks



Goolsby et al. 2017. International Journal for Parasitology: Parasites & Wildlife, in press.



Subtropical Agriculture and Environments 66:7-15.2015

Rationale for Classical Biological Control of Cattle Fever Ticks and Proposed Methods for Field Collection of Natural Enemies

John A. Goolsby[1*], Dennis T. Mays[2], Greta L. Schuster[2], Javid Kashefi[3], L. Smith[3], D. Amalin[4], M. Cruz-Flores[4], A. Racelis[5], and A.A Pérez de León[6]

VOL. 41, NO. 3 SOUTHWESTERN ENTOMOLOGIST SEP. 2016

Molecular Comparison of Cattle Fever Ticks from Native and Introduced Ranges, with Insights into Optimal Search Areas for Classical Biological Control Agents

J. A. Goolsby[1], F. D. Guerrero[2], J. Gaskin[3], K. G. Bendele[2], P. Azhahianambi[4], D. Amalin[5], M. Flores-Cruz[5], J. Kashefi[6], L. Smith[6], A. Racelis[7], R. K. Saini[8], and A. Perez de Leon[2]

ICE 2016 XXV International Congress of Entomology
Orlando, Florida, USA | September 25-30

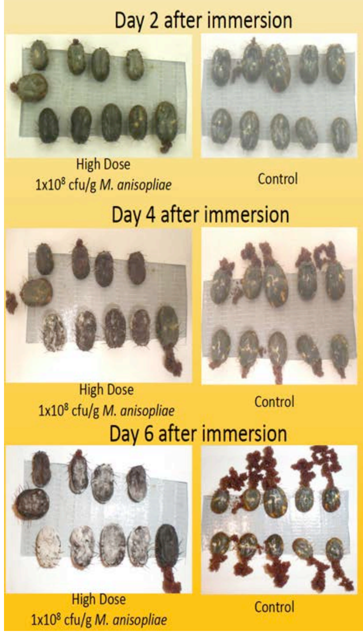
D3439: Commercial formulation of acaropathogenic fungus ,*Metarhizium anisopliae*, as a possible biocontrol tool for cattle fever ticks

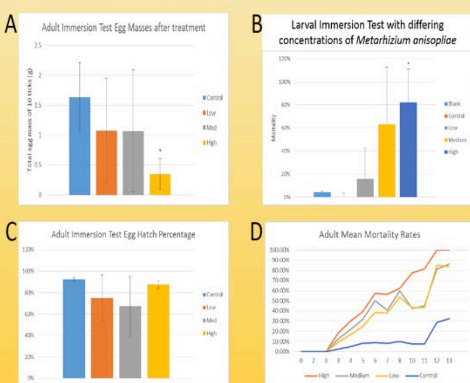
Introduction: An off the shelf formulation of the insecticidal fungus, *Metarhizium anisopliae* was tested against the southern cattle tick for efficacy in controlled laboratory tests.

Methods: Exposures ranked as low, medium, and high, at 10x serial dilutions were applied based on previously published effective dosages. The methodology was the standard Shaw immersion test.

Results/Conclusion: Against the larval stages mortalities ranged from 25-51% at the highest dosages tested. Mortality was much higher against adult stages with nearly all treatments reaching 100% within seven days (opposed to 12% mortality in controls). However, most of the mortality occurred after egg-laying had begun. We therefore measured egg mass production and hatchability of exposed egg masses. Hatchability was not significantly affected with 80-90% hatch in both treatments and controls. However, egg mass weight was significantly reduced in the high dosage treatment groups compared to controls.

Results



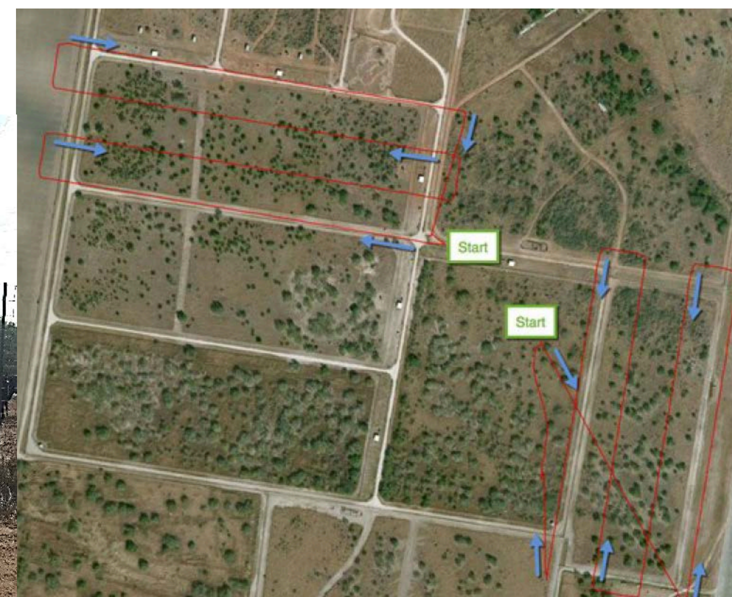


A) There is a statistically significant difference between the control and the amount of eggs produced by engorged females treated with the highest concentration of *M. anisopliae* (1x10^8 cfu/g). B) With the larval immersion test, there was only a statistically significant difference in mortality between the control and the highest concentration of *M. anisopliae*. C) Although, once an engorged females starts laying eggs, those eggs are viable. We didn't see any statistical difference between treatments for egg hatch. D) After the 3rd day of immersion, a difference in the mortality between the control and the conidial suspension can be seen. The highest concentration of *M. anisopliae* reached 100% mortality after 12 days from immersion and had higher mortality rates than the other suspension concentrations during that time period.

Subtropical Agriculture and Environments 67:24-27.2016

Evaluation of Unmanned Aerial Vehicles (UAVs) for detection of cattle in the Cattle Fever Tick Permanent Quarantine Zone

Goolsby[1], J. A., J. Jung [2], J. Landivar[3], W. McCutcheon[4], R. Lacewell[4], R. Duhaime[5], D. Baca[5], R. Puhger[5], H. Hasel[5], K. Varner[5], B. Miller[6], A. Schwartz[6] & A. Perez de Leon[7]

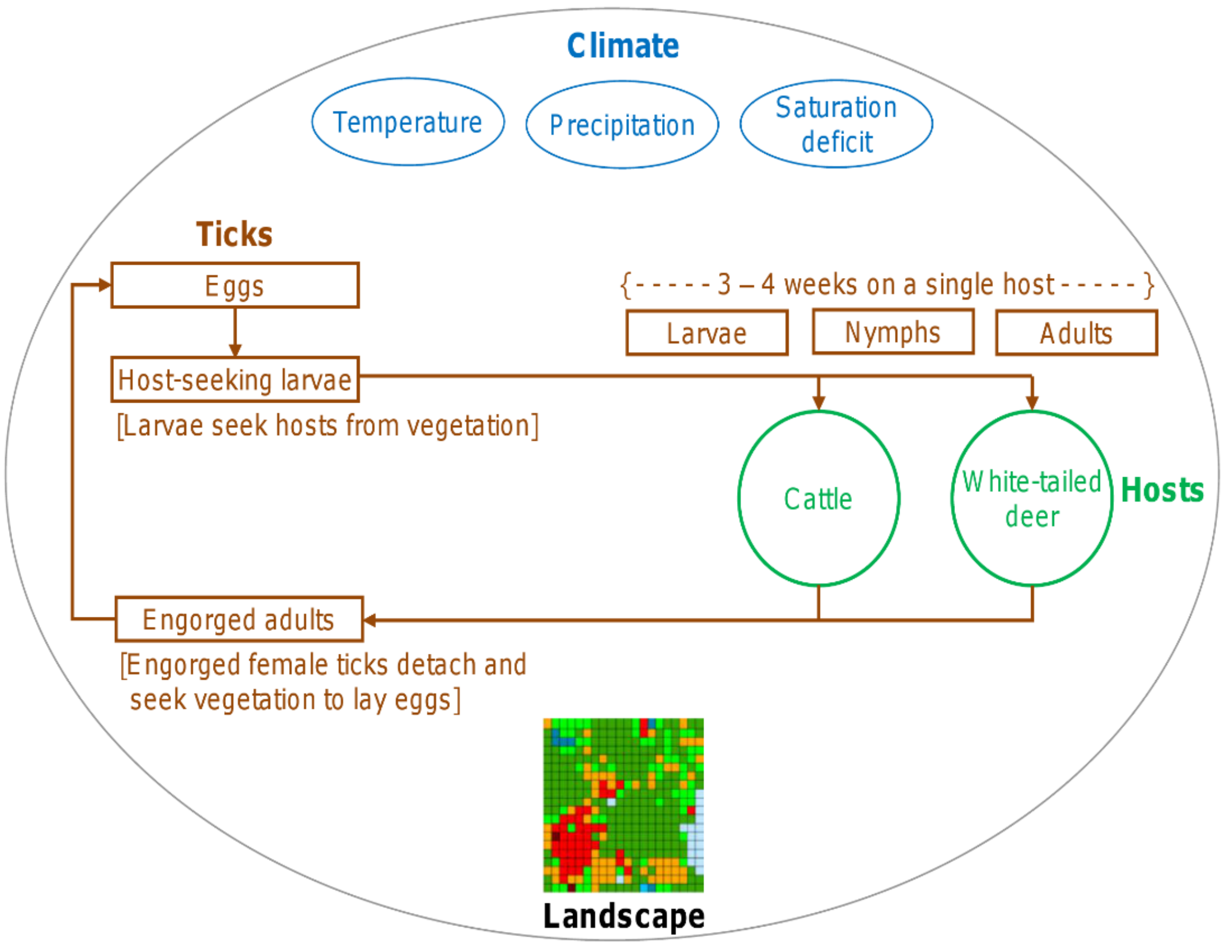


Ecological Modelling 342 (2016) 82–96

Simulated interactions of white-tailed deer (*Odocoileus virginianus*), climate variation and habitat heterogeneity on southern cattle tick (*Rhipicephalus* (*Boophilus*) *microplus*) eradication methods in south Texas, USA

Hsiao-Hsuan Wang[a,*], Pete D. Teel[b], William E. Grant[a], Greta Schuster[c], A.A. Pérez de León[d]

- Help assess CFT outbreak dynamics & spatial attributes in tick-host-landscape systems involving diverse hosts
- Allow testing treatment efficacy & integration of strategies for sustainable eradication
- Approach adapted for economic decisions on integrated tick control



Research Project for Integrated Control of the Southern Cattle Fever Tick in Puerto Rico

Collaboration between Puerto Rico Department of Agriculture and USDA-ARS, in association with USDA-APHIS-VS, & supported by University of Puerto Rico–Mayagüez

2014-2017

Objective

Create science-based knowledge to integrate technologies for sustainable control of the southern cattle fever tick (SCFT), *Rhipicephalus microplus*, infesting dairy farms and cattle in Puerto Rico

Phase 1. Epidemiological assessment of CFT infestations

Phase 2. Laboratory and field testing for efficacy against CFT of commercially available technologies with tick control claims in the label that can be used in dairy cattle.

Phase 3. Research and development of anti-CFT vaccine for dairy cattle in Puerto Rico

Phase 4. Pilot field testing of integrated CFT control program.

Phase 5. Partnership with stakeholder groups for deployment of integrated CFT control program in Puerto Rico dairy farms.

Treatment options for integrated cattle fever tick control research in Puerto Rico

Objective: Develop a safer and sustainable tick control management program for the island.

Methods: Epidemiological survey followed by treatment. Main effort against ticks. Fly and internal parasite control needed for holistic strategy.

Alternative Products Available for Field Testing

Newer chemistry uses in ear tags
Tolfenpyrad 15%
Labeled for fly control, but active against ticks.
Abamectin 8%.
Labeled for fly control and aids in the control of *R. microplus*

Essential oils
GRAS product. Killed 100% of larvae and engorged adult ticks in laboratory bioassays when applied at the label rate.

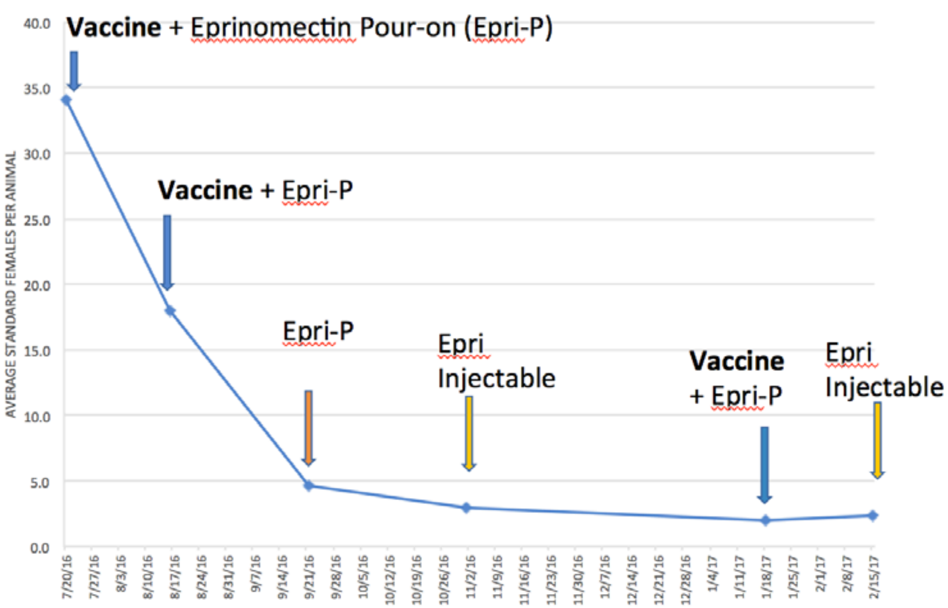
Diflubenzuron
Labeled for fly control. Active in formulations as tick growth regulator.

Eprinomectin
Pour-on
Killed 95% of ticks in laboratory stall and field trials. (Davey et al. 2002; Aguirre et al. 2005)
Long-acting injectable
For grazing beef cattle only
Novel use vs ticks

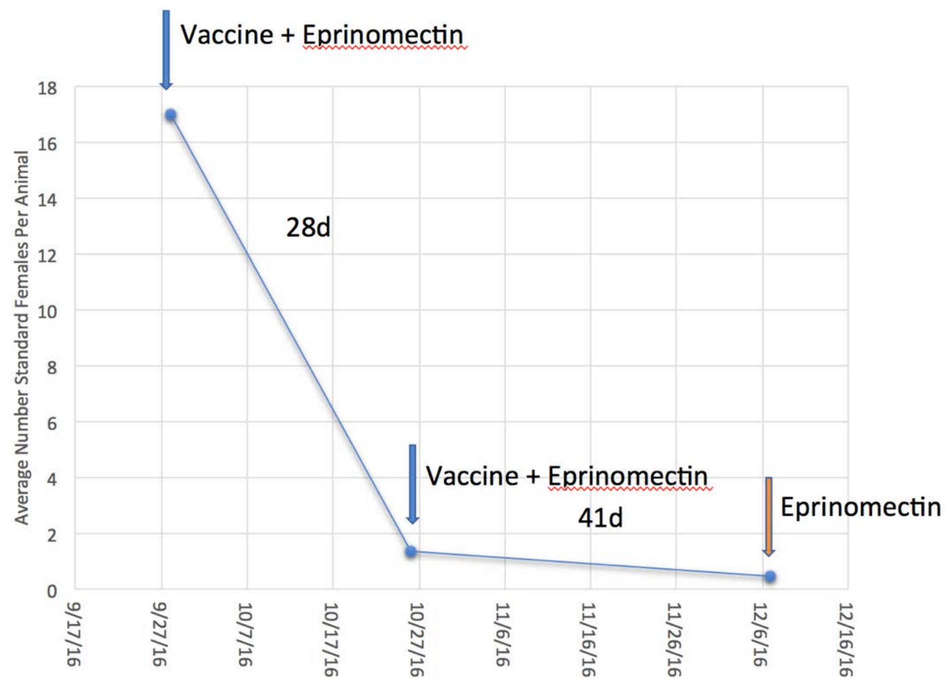
Anti-tick Vaccine

Integrated use of anti-cattle fever tick vaccine + acaricide under field conditions in Puerto Rico

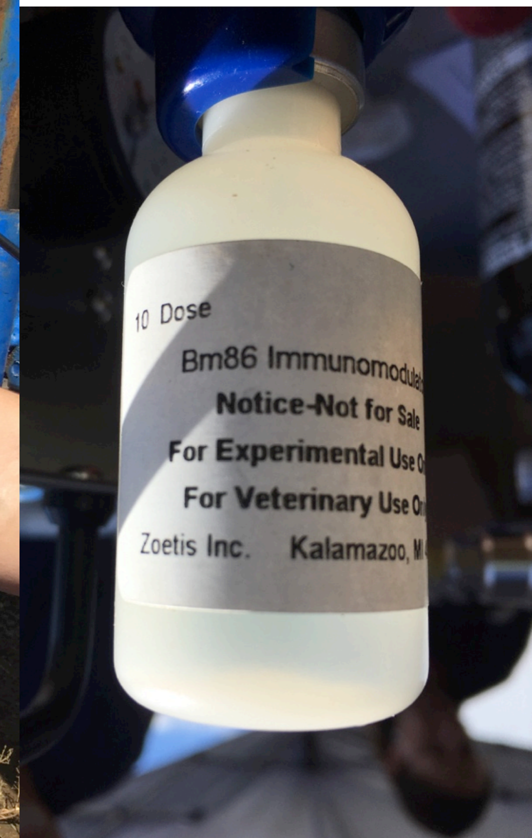
Beef Cattle Farm



Dairy Farm



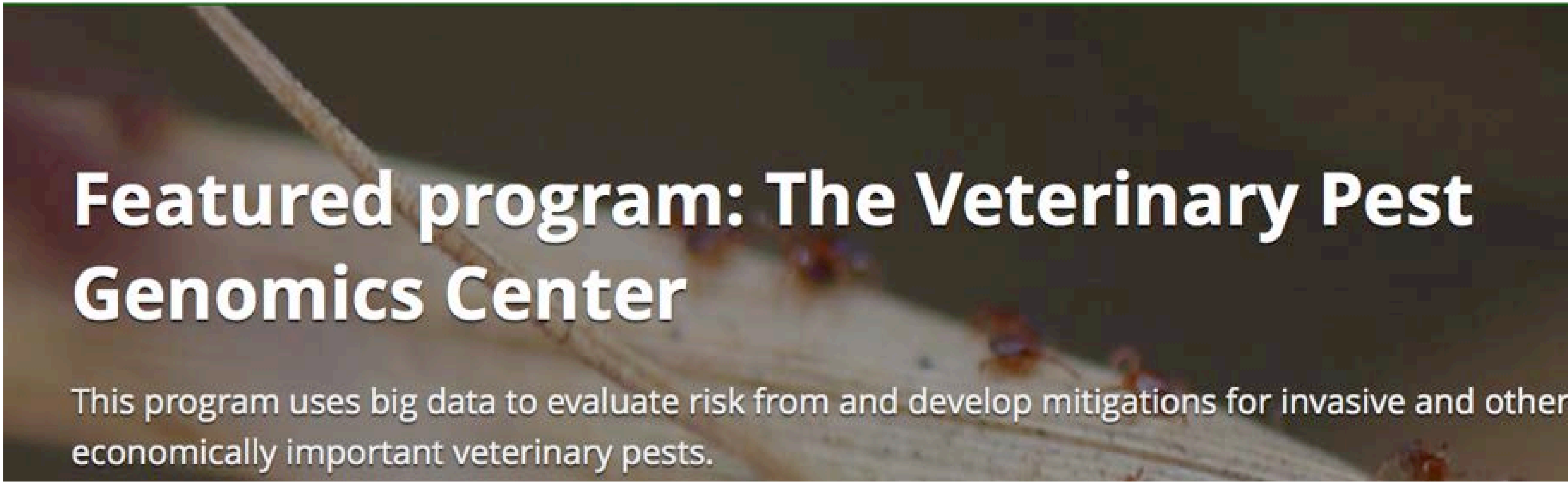
Integrated Cattle Fever Tick Management Research
Needleless Application of Anti-Tick Vaccine



USDA

Ag Data Commons Beta

ARS National Agricultural Library



ARS initiative addresses introduction of invasive veterinary pests, which is accelerated by global change, including anomalies related to climate variability

Fosters an innovation ecosystem involving the network of laboratories directly linked to ARS National Program 104 (Veterinary, Medical, and Urban Entomology), and other collaborators

Allows ARS to leverage its scientific talent and other research assets.

International Journal for Parasitology 42 (2012) 161–169

Contents lists available at SciVerse ScienceDirect

International Journal for Parasitology

journal homepage: www.elsevier.com/locate/ijpara

CattleTickBase: An integrated Internet-based bioinformatics resource for *Rhipicephalus* (*Boophilus*) *microplus* ☆

Matthew I. Bellgard[a,b,1], Paula M. Moolhuijzen[a,b,1], Felix D. Guerrero[c,*], David Schibeci[a], Manuel Rodriguez-Valle[b,d], Daniel G. Peterson[e], Scot E. Dowd[f], Roberto Barrero[a], Adam Hunter[a], Robert J. Miller[g], Ala E. Lew-Tabor[a,b,d]

Horn fly (*Haematobia irritans*) genome sequencing project

Felix Guerrero, KBUSLIRL (Kerrville)

>Horn fly genome has been sequenced and assembled

>Data from 18 tissue-specific transcriptomes available

>Differential expression studies conducted

>Manuscript in preparation

Stable fly genome sequencing funded by NIH

USDA-ARS Lead: Dr. Pia Olafson

Stomoxys_calcitrans-1.0.1 Assembly

May 2015, Wes Warren (McDonnel Genome Institute, Washington Univ.)

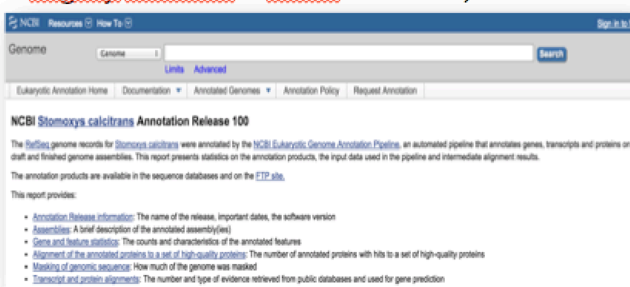
Stomoxys_calcitrans-1.0.1 Gene Prediction Pipeline

July 2015, Terrence Murphy, NCBI

Stomoxys calcitrans OrthoDB8 Analysis

November/December 2015

Evgeny Zdobnov & Panos Ioannidis, Swiss Bioinformatics Institute



NCBI Resources How To

Genome | Genome | Search

Limits Advanced

Eukaryotic Annotation Home | Documentation | Annotated Genomes | Annotation Policy | Request Annotation

NCBI Stomoxys calcitrans Annotation Release 100

The RefSeq genome records for Stomoxys calcitrans were annotated by the NCBI Eukaryotic Genome Annotation Pipeline, an automated pipeline that annotates genes, transcripts and proteins on draft and finished genome assemblies. This report presents statistics on the annotation products, the input data used in the pipeline and intermediate alignment results.

The annotation products are available in the sequence databases and on the FTP site.

This report provides:

- Annotation Release information: The name of the release, important dates, the software version
- Assemblies: A brief description of the annotated assembly(ies)
- Gene and feature statistics: The counts and characteristics of the annotated features
- Alignment of the annotated proteins to a set of high-quality proteins: The number of annotated proteins with hits to a set of high-quality proteins
- Masking of genomic sequence: How much of the genome was masked
- Transcript and protein alignments: The number and type of evidence retrieved from public databases and used for gene prediction

New World Screwworm Genome Sequencing Project

Steve Skoda, USDA-ARS-LAPRU

Mac Scott, NCSU

Highly inbred line –
10 generations of single pair, sibling matings done in Panama.

Genome –
80X Pacbio and 50X Hiseq. combined assembly, Adam Phillippy (NIH)

Pacbio 20kb and >30kb libraries made, Yale Univ. doing PacBio seq.

Transcriptome:
>Cellular blastoderm -Hiseq, Nextseq and Miseq reads for *de novo* transcriptome assembly.
>All other stages Hiseq reads for mapping back to genome.

USDA

Agricultural Research Service

Advancing Integrated Management through Sustainable Approaches to Mitigate Burden of TTBD

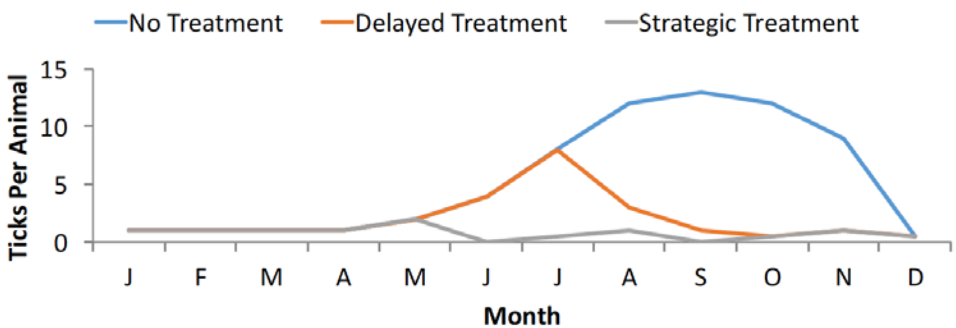
Research Opportunity to Address Global Change Challenges for Integrated Cattle Fever Tick Eradication in the U.S.

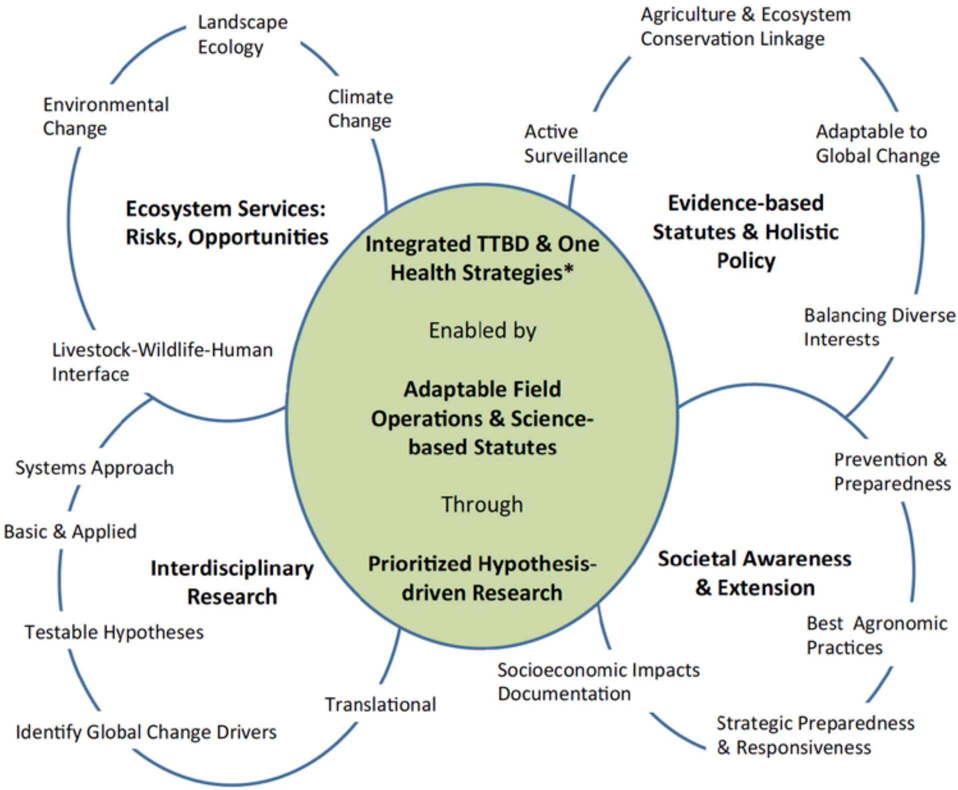
- **Vaccine + other technologies=**

  synergistic effect

  - **Time & operational cost savings**
  - **Enhanced environmental health**
  - **Mitigate risk for acaricide resistance**

Vaccination
Vacunación
Safer Pesticides
Pesticidas más seguros
Electrostatic Spray
Aerosol electrostático





Acknowledgments

- Thanks to the livestock producers, & other stakeholders for their continued support and cooperation
- Our gratitude to all the ARS colleagues, academic & animal health industry cooperators for the productive translational research efforts
- Private-public partnerships, including the Cattle Fever Tick Eradication Program, enabled the outcomes on integrated tick management reported here

Thank you!

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