

Cornell 4-Poster Deer and Tick Control Project: Investigation of Permethrin Residues

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Background

The 4-Poster device is a passive feeding station designed to control ticks that utilize white-tailed deer (*Odocoileus virginianus*) as a host. As deer feed on bait (corn grain) at the station, tickicide-treated rollers brush against the animal's neck, head, and ears where many adult ticks feed. Deer are a key host for adult blacklegged (*Ixodes scapularis*) and for immature and adult lone star ticks (*Amblyomma americanum*). Several studies (Carroll et al 2002, Pound et al 2000a, Pound et al 2000b, Solberg et al 2003) have shown large reductions in tick populations in the years following use of 4-Poster devices. The work is being conducted on Shelter Island (SI) and Fire Island (FI), where 4-Posters are being deployed, and in the Village of North Haven (NH), which is included as a control site (no 4-Poster devices) for comparison.

The 4-Poster project addresses technical concerns held by the New York State Department of Environmental Conservation (DEC) and Department of Health (DOH) regarding 4-Poster registration and use in New York State. One of the study objectives is designed to investigate permethrin residues in and on white-tailed deer harvested from 4-Poster treatment areas. A goal of these investigations is to identify the sources of permethrin hunters and their families may potentially be exposed to through handling and consuming deer harvested from areas where 4-Poster devices are deployed.

Permethrin Residue Sampling: July – August 2009

Three deer were harvested and sampled for permethrin residues on Shelter Island during late July and early August 2009 using an amended sampling protocol devised by Cornell with input from NYSDOH, Suffolk County Department of Health Services, and NYSDEC. This sampling protocol outlines methods for assessing permethrin residues that hunters and their families may be exposed to via handling harvested deer and consuming deer meat and organs. Camera survey photos documenting device use by each sampled deer, harvest photos of each deer, information regarding device use by each deer, and tickicide application history for each device used by sampled deer are provided (Appendix 1).

Samples collected during July – August were submitted to Cornell Animal Health Diagnostic Center (AHDC) on August 7, 2009. Analytical reports were received by Cornell during late September and presented to the NYSDOH for evaluation. The NYSDOH will provide a summary to the Town of Shelter Island after a thorough review and assessment of the most recent residue data.

The Cornell AHDC reported no detection of permethrin residues (minimum detection level of 10 ppb) within the neck muscles, hindquarter muscles, or the livers collected from the 3 deer harvested prior to regular fall deer harvest season (Table 1). Permethrin residues were detected on the coat swabs collected from the neck pelage of each of the 3 pre-season deer (Table 1). These swab results indicate the 3 deer were contacting permethrin on 4-Poster devices and photo documentation of device use by these deer also verifies contact with devices (Appendix 1).

Permethrin Residue Sampling: October – December 2009

Regular fall permethrin residue sampling will begin October 1, 2009. Ten deer from Shelter Island and 6 deer from North Haven will be sampled during the regular fall permethrin residue

sampling. Individual hunters will be contacted during October – December 2009 to obtain samples from harvested deer on Shelter Island and North Haven. The Town of Shelter Island and the Shelter Island Deer Management Program are assisting by providing the first deer harvested each month (October – December) from 5 designated nuisance deer management properties.

Samples will be collected by mid-December, prior to the seasonal removal of 4-Poster devices on Shelter Island, and submitted to Cornell AHDC for permethrin residue analysis.

Cornell Recommendations

Based on initial permethrin residue investigation results obtained from Cornell Animal Health Diagnostic Center during 2008, the presence of low level residues in 3 of 16 deer neck muscle samples collected from Shelter Island stimulated reassessment of the sampling protocol used by Cornell to collect residue samples (Table 1 and 2). The current protocol reviewed by NYSDOH, NYSDEC, and Cornell intends to ensure sampling mimics deer handling and processing methods practiced by hunters. The goal of sampling is to adequately identify potential sources of permethrin exposure hunters and their families may encounter as a result of 4-Poster tick control technology use on Shelter Island. The revised study objective and sampling protocol, as well as statements from the NYSDOH regarding the 2008 permethrin residue investigation results, can be reviewed by visiting Cornell's webpage

(<http://wildlifecontrol.info/TickStudy/Pages/PermethrinResidueInvestigations.aspx>).

Based on the first year of permethrin residue investigations, Cornell has issued a fact sheet regarding deer harvest and safe handling for hunters (Appendix 2). Hunters are encouraged to follow these guidelines when handling and processing each deer harvested from 4-Poster treatment areas. These recommendations are also helpful for processing any harvested deer. Copies of these guidelines have been made available through the Shelter Island Town Clerk's office and at local sporting goods retailers. Those interested in providing deer for sampling during 2009 can refer to sample submission guidelines (Appendix 3). The NYSDOH will also provide their assessment of the pre-season sampling results in conjunction with 2008 sampling results to provide the community with a comprehensive summary of permethrin residue investigations conducted during 2008 and pre-season 2009.

Literature

Carroll, J.F., Allen, P.C., Hill, D.E., Pound, J., Miller, J., George, J. 2002. Control of *Ixodes scapularis* and *Amblyomma americanum* using the '4-poster' treatment device on deer in Maryland. *Experimental and Applied Acarology*. 28:289-296.

Pound, J. M., J. A. Miller, and C. A. Lemeilleur. 2000a. The '4-Poster' passive topical treatment device to apply acaricide for controlling ticks (Acari: Ixodidae) feeding on white-tailed deer. *Journal of Medical Entomology* 37: 588-594.

Pound, J. M., J. A. Miller, and J. E. George. 2000b. Efficacy of Amitraz applied to white-tailed deer by the '4-Poster' topical treatment device in controlling free-living lone star ticks (Acari: Ixodidae). *Journal of Medical Entomology* 37: 878-884.

Solberg, V. B., J. A. Miller, T. Hadfield, R. Burge, J. M. Schech, and J. M. Pound. 2003. Control of *Ixodes scapularis* (Acari: Ixodidae) with topical self-application of permethrin by white-tailed deer inhabiting NASA, Beltsville, Maryland. *Journal of Vector Ecology* 28: 117-134.

Table 1. Permethrin residues detected in coat swabs (micrograms (mcg) per swab), muscle (ppb), and liver (ppb) samples taken from deer on Shelter Island, New York during 2008 and prior to hunting season during 2009. Permethrin residue analysis was conducted by Cornell Animal Health Diagnostic Center (AHDC) using a minimum detection level (MDL) of 0.010 mcg/coat swab and 10 ppb for muscle and liver analysis. Residues results falling below MDLs are reported as no detections (ND). Hindquarter muscle samples were not collected during 2008 sampling and reflect a modification to the 2009 sampling protocol.

Deer ID	Neck Muscle	Hindquarter Muscle	Liver	Coat Swab	Harvest and Sample Collection Date	Hunting Method	Sex	Approximate Age	Approximate Weight	Observations of 4-Poster Use
SI1	ND	—	ND	ND *	9/13/2008	Not Applicable	F	2.5	110	—
SI2	ND	—	ND	ND *	9/17/2008	Shotgun	F	8.5	130	—
SI3	ND	—	ND	ND *	9/17/2008	Shotgun	M	4 months	40	—
SI5	11.2	—	ND	16.28	10/3/2008	Regular Bow	M	5 months	60	Corn present in rumen
SI6	ND	—	ND	0.06	10/6/2008	Regular Bow	F	5 months	45	
SI7	ND	—	ND	0.02	10/6/2008	Not Applicable	F	5 months	40	Corn present in rumen
SI8	ND	—	ND	0.02	10/10/2008	Not Applicable	F	5 months	45	—
SI9	ND	—	ND	0.02	10/10/2008	Regular Bow	F	3.5	120	—
SI11	ND	—	ND	2.6	10/10/2008	Regular Bow	M	1.5	120	Verified use of 4-Poster
SI14	ND	—	ND	68.4	10/17/2008	Nuisance Shotgun	M	1.5	125	Verified use of 4-Poster
SI15	55.9	—	ND	704	10/18/2008	Regular Bow	M	2.5	150	Verified use of 4-Poster
SI20	ND	—	ND	71.3	11/3/2008	Regular Bow	F	2.5	120	Tagged (B12) Verified use of 4-Poster
SI21	270.3	—	ND	5110.3	11/6/2008	Regular Bow	M	1.7	125	Verified use of 4-Poster
SI22	ND	—	ND	107.2	11/8/2008	Regular Bow	M	2.7	140	Tagged (B052) Verified use of 4-Poster
SI23	ND	—	ND	610.7	11/11/2008	Regular Bow	M	2.7	135	Tagged (A55) Corn in rumen. Verified use of 4-Poster
SI24	ND	—	ND	258.8	11/11/2008	Nuisance Shotgun	M	1.7	125	Tagged (A57) Verified use of 4-Poster
M1	ND	ND	ND	7.2	7/28/2009	Shotgun	M	1.2	120	Verified use of 4-Poster
M2	ND	ND	ND	108.1	7/30/2009	Shotgun	M	2.2	155	Verified use of 4-Poster
L3	ND	ND	ND	24.93	8/4/2009	Shotgun	M	Unknown Adult	90	Verified use of 4-Poster

* Denotes lab analysis procedures for coat swabs conducted by the NYSDEC Division of Solid and Hazardous Materials Laboratory using a MDL of 3.0 mcg while all others were conducted by Cornell AHDC using a MDL of 0.010 mcg/swab.
 ND = No Detect

Table 2. Permethrin residues detected in coat swabs (micrograms (mcg) per swab), muscle (ppb), and liver (ppb) samples taken from deer on North Haven, New York during 2008. Permethrin residue analysis was conducted by Cornell Animal Health Diagnostic Center (AHDC) using a MDL of 0.010 mcg/coat swab and 10 ppb for muscle and liver analysis. Residues results falling below MDLs are reported as no detections (ND). Hindquarter muscle samples were not collected during 2008 sampling and reflect a modification to the 2009 sampling protocol.

Deer ID	Muscle	Hindquarter Muscle	Liver	Coat Swab	Harvest and Sample Collection Date	Hunting Method	Sex	Approximate Age	Approximate Weight	Observations of 4-Poster Use
NH1	ND	—	ND	0.02	10/4/08	Nuisance	F	4.5	115	Not Applicable
NH2	ND	—	ND	0.04	10/4/08	Nuisance	F	5 months	50	Not Applicable
NH3	ND	—	ND	0.05	10/4/08	Nuisance	M	5 months	50	Not Applicable
NH4	ND	—	ND	ND	10/27/08	Nuisance	M	1.5	125	Not Applicable

Appendix 1. Detailed information regarding sampled deer identification and 4-Poster device use for permethrin residue investigations conducted during July-August 2009.

M1: 6-point Buck (1.2 year old)

Harvest Date: July 28, 2009

Unique Identification: This 6-point buck was identified based on unique antler development including a brow tine and a small fork on both the right and left side of his rack. The rack was still in velvet at the time of harvest. Photos provided below provide a means of comparison between antler development observed in trail camera photos and deer harvest photos. These photos allow adequate verification of sampled deer identity.

Device Visitation: M1 was observed using 1 4-Poster device (12 instances of photo documentation) during a camera survey period from July 20-24. Photo documentation indicates 6 temporally distinct visits during this time period. On average, M1 was present at the device for 6 minutes per visit. M1 visited the device 3 of 5 days during the July camera survey. During the survey period, M1 was last observed visiting the device on July 23rd. Based on known device use by M1, the animal likely visited the device again prior to harvest (7/28) and after device tickicide application (7/25) although no camera survey data is available to document this.

Device Tickicide Application History: Device #38 was treated on July 25th with 28 ml of tickicide per post. This device has received an average application of 29 ml of tickicide per post each week.

Camera Survey Photos: M1



Harvest Photos: M1



M2: 7-point buck (2.2 year old)

Harvest Date: July 30, 2009

Unique Identification: This 7-point buck was identified based on unique antler development including 4 points on his left side and 3 points on his right side including his brow tine. The rack was still in velvet at the time of harvest. Photos are provided below to facilitate identification.

Device Visitation: M2 was observed using 1 4-Poster device (15 instances of photo documentation) during a camera survey period from July 20-24. Photo documentation indicates 5 temporally distinct visits during this time period. On average, M2 was present at the device for 13 minutes per visit. During the survey period, M2 was last observed visiting the device on July 24th. Based on known device use by M2, the animal likely visited the device again prior to harvest (7/30) and after device tickicide application (7/25) although no camera survey data is available to document this.

Device Tickicide Application History: Device #35 was treated on July 25th with 28 ml of tickicide per post. This device has received an average application of 22 ml of tickicide per post each week.

Camera Survey Photos: M2



Harvest Photos: M2



L3: 3-point buck (Unknown Age)

Harvest Date: August 4, 2009

Unique Identification: This 3-point buck was identified based on unique antler development such as 2 points on his right side including a brow tine and a deformed spike on his left side. The rack was still in velvet at the time of harvest. Photos are provided below to facilitate identification.

Device Visitation: L3 was observed using 1 4-Poster device (66 instances of photo documentation) during the April (20-27), June (17-22), and July (20-24) 2009 camera survey periods. Photo documentation indicates L3 visited the device 3 of the 5 July survey days and made 6 temporally distinct visits. On average during July, L3 was present at the device for 10 minutes per visit. L3 was last observed visiting the device on July 23rd. During April, June, and July, L3 was present at the device for an average of 14.5 minutes per visit and observed visiting the device roughly 60-65% of each monthly camera survey period. Based on this known device use, it is likely that L3 visited the device a minimum of 7 of the 12 days between the last day observed on camera (7/23) and date of harvest (8/4). The device was treated with tickicide one day prior to harvest of L3 thus due to variable use, it is difficult to know if L3 came in contact with a newly treated device.

Device Tickicide Application History: Device #22 was treated on 8/3/09 with 40 ml of tickicide per post. This device has received an average application of 9 ml of tickicide per post twice each week.

Camera Survey Photos: L3



Harvest Photos: L3



Appendix 2. Recommendation offered by Cornell for deer harvest and safe handling within 4-Poster treatment areas based on the first year of permethrin residue investigations. Hunters are encouraged to follow these guidelines when handling and processing each deer harvest from 4-Poster treatment areas.



Cornell University

White-tailed Deer: Harvest & Safe Handling

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White-tailed deer on Shelter Island may have contacted permethrin present on 4-Poster devices that are being used by Cornell as a method for tick control. Any permethrin present will likely be on the deer hide, specifically on the head and neck. Based on permethrin residue sampling from hunter harvested deer during 2008, Cornell is providing the following recommendations for handling and processing deer harvested from Shelter Island. As an informed sportsman, you will find that many of these handling suggestions are standard protective measures recommended each time you handle and process a deer. Please visit the NYSDEC's deer and bear hunting webpage to review more information regarding deer harvest throughout NYS as well as information from the NYSDOH about lead in venison (<http://www.dec.ny.gov/outdoor/7857.html>).

*** ALWAYS WEAR PROTECTIVE RUBBER OR PLASTIC GLOVES WHEN HANDLING, FIELD DRESSING, AND PROCESSING YOUR DEER. CHANGE GLOVES BETWEEN EACH OF THESE STEPS.**

*** SKIN YOUR DEER STARTING FROM THE TAIL END AND MOVING TOWARD THE HEAD TO MINIMIZE CONTACT WITH THE FUR ON THE NECK.**

*** AVOID CONTACT BETWEEN THE HIDE AND THE MEAT YOU INTEND TO PROCESS FOR CONSUMPTION.**

*** DURING THE SKINNING PROCESS, REPLACE OR CLEAN YOUR KNIFE BETWEEN INITIAL INCISIONS THROUGH THE SKIN AND WHEN YOU USE THE KNIFE TO ASSIST PULLING THE SKIN DOWN.**

*** WASH YOUR HANDS THOROUGHLY AFTER FIELD DRESSING AND PROCESSING YOUR DEER.**

AS ALWAYS:

- Field dress your deer ASAP to speed the loss of body heat, especially in warm weather. This will slow bacterial growth and improve the quality of the meat.
- Clean out the body cavity with a damp cloth or paper towel to remove dirt, feces, hair, and bloodshot areas.
- Prop the body cavity open with sticks to allow for adequate air circulation.
- Minimize meat contact with the brain, spinal cord, spleen, and lymph nodes.
- You may be able to age your deer in a temperature-controlled room, set between 35 and 40°F, for up to a week.
- Wrap your venison tightly with heavily waxed paper, freezer wrap, heavy-duty aluminum foil, or plastic freezer bags before freezing or refrigerating. Take care to remove all excess air from the package. Deer venison will keep 9-12 months in a freezer when properly wrapped.
- Thoroughly clean and sanitize equipment and work areas with a 10% bleach solution (one part bleach in nine parts water) after processing.

For more information and/or interest in providing samples, please contact Cornell (631-749-0896). Also, visit our website <http://wildlifecontrol.info/TickStudy/Pages/default.aspx>.

Appendix 3. Permethrin residue sampling submission guidelines for hunters interested in providing samples during the 2009 season. Samples will be collect by Cornell between October 1, 2009 and December 15, 2009.



Cornell University

Cornell 4-Poster Deer & Tick Control Study

Deer Sampling: Permethrin Residue Investigation

Sample Submission:

After harvesting your deer:

(A)

- **Please Contact Cornell Staff Immediately (contact numbers are provided below).** Be prepared to meet Cornell staff with your deer in order for them to obtain samples. Please **DO NOT** gut or skin your deer before samples can be collected.
- Your deer can be taken with you and processed as normal after all necessary samples have been collected.

If you are unable to provide samples immediately you should follow the instructions below:

(B)

- **Contact Cornell staff immediately.** Be prepared to meet Cornell staff with your deer no more than 12-24 hours post-harvest for sample collection.
- Gut the deer and keep it in a cool location. **SAVE** the liver and refrigerate it ASAP. The liver should only be stored in a non-plastic container (aluminum foil works good). Please carefully collect the liver wearing gloves. **DO NOT SKIN THE DEER** prior to sample collection.
- Your deer can be taken with you and processed as normal after all necessary samples have been collected.

Cornell Staff Phone Numbers:

631-566-7896

631-603-1664

*** Always wear gloves when handling and field dressing a deer.**

*** Samples may include coat swabs and sections of neck muscle, hindquarter muscle, and liver.**

PLEASE REMEMBER: Do NOT harvest collared deer.

PLEASE follow the directions provided for proper submission.

Your assistance is greatly appreciated. Please contact us with questions, comments, and concerns.