Research Reports

A Regional Survey of Deer Damage Throughout Northeast Nurseries and Orchards[1]

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Abstract

In order to quantify the regional perspective on deer damage, a survey was sent to growers throughout nine Northeast states (ME, NH, VT, MA, CT, RI, NY, NJ, and PA). The objective of the survey was to assess the extent of damage, economic impact, plants damaged, control methods used, and efficacy of control methods. After excluding those surveys that were returned as undeliverable mail (n = 103), a total of 341 (30%) responded. Of the respondents, 65% reported that deer damage was a problem at their nursery. Forty-seven (14%) respondents reported $10,000 or more in plant losses during 1996. The majority of the damage was due to browsing by deer (59%), while rubbing (33%) and trampling (8%) were less common. Plants damaged included yews (*Taxus* spp.), arborvitae (*Thuja* spp.), and fir (*Abies* spp.), various shade trees, hosta (*Hosta* spp.) and English ivy (*Hedera helix*). Most respondents (66%) with a deer damage problem utilized one or more methods of control. Repellents (66%) and fencing (56%) were the most common methods used to minimize damage. Forty percent of respondents using fencing reported fencing to be 'very' or 'somewhat' effective.

Index words: white-tailed deer (*Odocoileus virginianus*), repellents, growers, wildlife damage control.

Significance to the Nursery Industry

Despite available methods of control, deer damage at nurseries and orchards has traditionally been a serious problem (4, 7, 9). A survey was sent to 1,241 growers throughout the Northeast to obtain current estimates of deer damage. The majority of respondents (65%) reported having a problem with deer damage. Plants being damaged varied widely. A rank preference index was used to assess preference, and showed that narrowleaf evergreens were considered to be most preferred by deer. Repellents were the most common method of control used, but were considered to be only 'somewhat' effective. Fencing and hunting also were common methods of control. Information from this survey will help to focus future research efforts.

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Introduction

Due to burgeoning white-tailed deer populations and encroachment upon their habitat by development, deer are consuming cultivated plants for food (4, 7, 9, 14). The relative abundance of preferred plants in developed areas elevates the carrying capacity which, in turn, increases deer survival and population size, regardless of space limitations (12). The incidence of browsing, rubbing, and trampling on landscape and food crops has, in the past, resulted in significant economic losses in the nursery and landscape industry (9, 10).

There are several methods of deer control available, including repellents, fencing, hunting, scare tactics, and lure

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crops (3, 6, 10, 11). However, in order to determine effective methods of controlling damage by deer, information is needed on the current status of the problem. State surveys have been conducted in Ohio (10) and New York (9, 11). In order to get a regional perspective on damage by deer to nursery crops, a survey was sent to growers in nine Northeast states. The objectives of the survey were to assess the extent of damage, evaluate economic impact, document plant types being damaged, and census the efficacy of control methods being used.

Materials and Methods

A mailing list of wholesale and retail nurseries was compiled from nursery and landscape association directories of nurseries, orchards, and Christmas tree farms in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Pennsylvania. Directories were obtained through Cooperative Extension offices, professional associations, and trade show programs. This list was then cross checked with an internet query of relevant businesses in New England (www.bigyellow.com).

A self-administered, mail-back two part questionnaire was mailed to 1,241 firms in December, 1997. The first part asked questions about the firm such as: size of the nursery (acres); average annual sales (<$100K, $100–$500K, $500K–$1,000,000, >$1,000,000); location (rural, urban, suburban); type of plants grown (broadleaf evergreens, narrowleaf evergreens, groundcovers, deciduous tree/shrubs, perennials); and type of production (field, container) (Table 1). The second part of the survey consisted of specific questions about deer damage and requested information on: crops damaged, kinds of damage, estimated losses, methods of control, efficacy of control methods, and months that damage occurred. Survey responses were coded and totaled in File Maker Pro 4.0 (Claris Corp., Santa Clara, CA). Telephone interviews of 30 non-respondents were conducted to assess non-response bias. Non-respondents were asked if deer damage is a problem at their nursery. These results were compared to the survey results using a Yates' corrected chi-square analysis (8).

Relative preference of plant categories (broadleaf evergreens, narrowleaf evergreens, groundcovers, deciduous trees and shrubs, and perennials) was measured using a rank preference index (5). This method compares plants available (grown) to plants used (eaten). Crops that were reported as being damaged were grouped into plant categories and then compared to plants grown. By applying this method, it is assumed that all plants reported being grown are also available to the deer for browsing.

Results and Discussion

After adjusting for undeliverable mail (n = 103), 1,138 surveys were sent and 30% (n = 341) responded. Telephone interviews with 30 non-respondents indicated that the survey responses were not biased ($X^2 = 0.96$, df = 1, p = 0.05). It was also determined that 10% (n = 3) of respondents were either retail stores or garden supply shops and, therefore, were not likely to experience deer damage.

Nursery statistics. The majority of respondents considered their nurseries to be located in rural areas, followed by suburban locations. Narrowleaf evergreens and deciduous trees/shrubs were the most common plants grown, followed by broadleaf evergreens, perennials, and groundcovers (Table 2). The survey revealed that, 44% of respondents grew plant material in the field, 21% in containers, and 35% grew plants in both.

Deer damage. The majority (65%) of growers (n = 220) experienced deer damage at their nursery (Table 2). Plant losses reported by respondents during 1997 totalled $1,727,156, with a median loss of $3,700 (Fig. 1). The majority of damage by deer reported was due to browsing, while rubbing and trampling were not as common (Table 3). Yews (*Taxus* L. spp.), arborvitae (*Thuja* L. spp.), and fir (*Abies* Mill. spp.) were the most common evergreens damaged, and these taxa were damaged most commonly by browsing. Shade trees were commonly damaged by rubbing, and other deciduous trees were reported to be damaged by both rubbing and browsing. Trampling damage was rare (1%). Daylily (*Hemerocallis* L. spp.), Hosta (*Hosta* Tratt. spp.) and English ivy (*Hedera helix* L.) were the most common perennials damaged. A rank preference index placed narrowleaf evergreens as the plant group most preferred at the nurseries surveyed (Table 4). Deciduous trees/shrubs, groundcovers, and perennials were all equal when ranked. Broadleaf evergreens were considered to be least preferred.

Some plants that are generally thought to be less-preferred by deer (1, 2) were reported by survey respondents as having been damaged. These plants included garlic (*Allium* L. spp.), cotoneaster (*Cotoneaster* Medik. spp.), and hawthorne (*Crataegus* L. spp.). Although each of these taxa was mentioned only once, their occurrence exemplifies the complexity of the problem. If deer are sufficiently hungry, they may forage on what many consider to be less-preferred plants. A few growers (n = 3) reported that deer at their nurseries prefer plants that have been fertilized. It is possible that the ap-

Table 1. Survey questions asked of growers in the Northeast[z]. Categorical responses indicated in parentheses.

1. How many acres are under cultivation at your facility? (<5; 5–20; 20–100; >100)
2. What is your sales average? (optional) (<$100K; $100–$500K; $500K–$1,000,000; >$1,000,000)
3. How would you describe the location of your facility? (urban; suburban; rural)
4. What plant material is grown? (broadleaf evergreens; narrowleaf evergreens; groundcovers; deciduous trees/shrubs; perennials)
5. What is your primary growing method? (container; field; both)
6. Is deer damage a problem at your nursery? (yes; no)
7. What crops have been damaged and what kind of damage has occured? (Damage; Estimated plant loss; What is your estimated total financial loss from deer damage?)
8. Indicate below which control methods you have tried and rate their success. [Effectiveness; Method (list types: None, Slight, Somewhat, Very); Estimated Cost]
9. What month(s) of the year was damage the worst? (Jan; Feb; Mar; Apr; May; Jun; Jul; Aug; Sep; Oct; Nov; Dec)
10. Have you taken control measures for other wildlife? If so, what animal, what control and was it successful?

[z]Actual survey format differed.

Table 2. Response statistics of a deer survey administered to growers in nine northeastern states in 1998. Damage estimates refer to the 1997 production year.

Question	N responses	Percentage[z]
Location		
urban	10	3
suburban	88	27
rural	229	70
Total[y]	327	100
Acres under cultivation		
<5	92	28
5–20	98	30
20–100	83	25
>100	55	17
Total	328	100
Plant material grown		
broadleaf evergreens	178	55
narrowleaf evergreens	231	71
groundcovers	79	24
deciduous trees/shrubs	242	74
perennials	144	44
Total	323	—[x]
Growing method		
container	69	21
field	147	44
both	115	35
Total	331	100
Deer damage		
yes	220	65
no	118	35
Total	338	100

[z]Percentages calculated by the number of responses to each question.

[y]Total number of respondents that answered the question.

[x]Sum of percentages of plant material grown exceeds 100 due to multiple responses.

Table 3. Most common plants reported being damaged by deer at nurseries from a survey of growers in the Northeast.

		Kind of damage[y]		
Type of plant	N responses[z]	browsing	rubbing	trampling
Taxus spp.	71	69	2	0
Thuja spp.	50	48	2	0
Abies spp.	38	26	15	0
Shade trees	52	15	50	0
Malus spp.	28	23	5	0
Prunus spp.	14	13	1	0
Fruit trees	14	8	5	3
Rhododendron spp.	23	23	0	0
Ilex spp.	14	14	0	0
Tsuga spp.	14	11	5	1
Pinus spp.	17	13	10	3
Hemerocallus spp.	8	7	0	2
Hosta spp.	6	6	0	1
Phlox spp.	4	4	0	0
Other[x]	308	219	206	56
Total	661	499	281	66

[z]Number of responses that reported having damage on plants indicated.

[y]Number of responses receiving type of damage indicated.

[x]Number of responses either not specifying species or listed as 'other'.

Table 4. Rank preference index (5) for plants reported being damaged (used) vs. plants reported being grown (available) from a survey of growers in the Northeast.

Preference	Plant category	Used[x]	Available[y]	Index value[z]
most	narrowleaf evergreens	70	148	–2
↓	deciduous trees/shrubs	48	156	0
	groundcover	4	50	0
	perennials	15	80	0
least	broadleaf evergreens	36	163	2

[z]Index value calculated using a rank preference index.

[y]Number of respondents growing plants within the category.

[x]Number of respondents that reported that plants within category had been damaged.

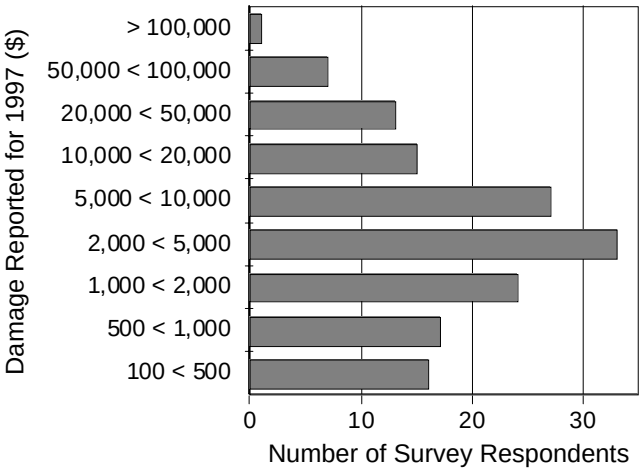

Fig. 1. Deer damage costs in 1997 in the Northeast, determined by a survey of growers (n = 153).

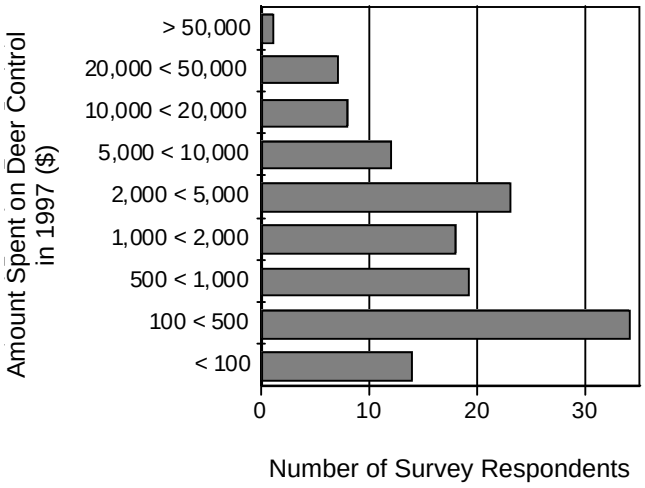

Fig. 2. Costs associated with control of deer damage in 1997 in the Northeast, determined by a survey of growers (n = 136).

Table 5. Methods of control used, as reported by growers surveyed in the Northeast. Respondents were asked to rate the effectiveness of control methods that they have used.

Method	Effectiveness				Total	No response[z]
	none	slight	somewhat	very		
Repellents	34[y]	63	77	23	209[x]	12
Fencing	9	20	39	52	127	7
Lure crops	6	8	7	3	2	27
Hunting	18	43	36	20	118	1
Scare tactics	15	20	20	13	69	1

[z]Number of respondents that did not rate the effectiveness of control methods being used.

[y]Number of respondents that reported effectiveness of indicated control method.

[x]Total number of respondents using indicated control method.

plication of fertilizer may affect feeding preference of deer (13).

The total amount expended on deer control by respondents was $528,348, with a median expense of $1,000 (Fig. 2). Use of repellents (66%; n = 145) was the most common method of control (Table 5). Commercial repellents listed included Tree Guard™ (Nortech Forest Technologies, Inc., St. Louis Park, MN), Hinder™ (Pace International, Kirkland, WA), Deer Away™ (Integra Inc., Minneapolis, MN), urine products, and Ropel™ (Burlington Scientific Corp., Farmingdale, NY). Homemade repellents listed included soap, hot sauce, and hair. When asked to rate the effectiveness (none, slight, somewhat, very) of repellents they had used, most respondents (39%) reported 'somewhat.'

Hunting (53%) and fencing (56%) also were common methods of control reported by survey respondents. The majority of growers using fencing reported it to be 'very' effective. Types of fencing used included electric, deer netting, and woven wire. Hunting was not viewed as being extremely effective. Of those that reported practicing hunting for control, 36% reported it to be only 'slightly' effective. Scare tactics (lights, sprinklers, radios, pie pans, etc.) (30%) and lure tactics (use of desirable foods such as yew or apple to draw deer away from valuable crops) (12%) were used less frequently by those growers with a deer problem. The reports of efficacy of each of these methods varied widely.

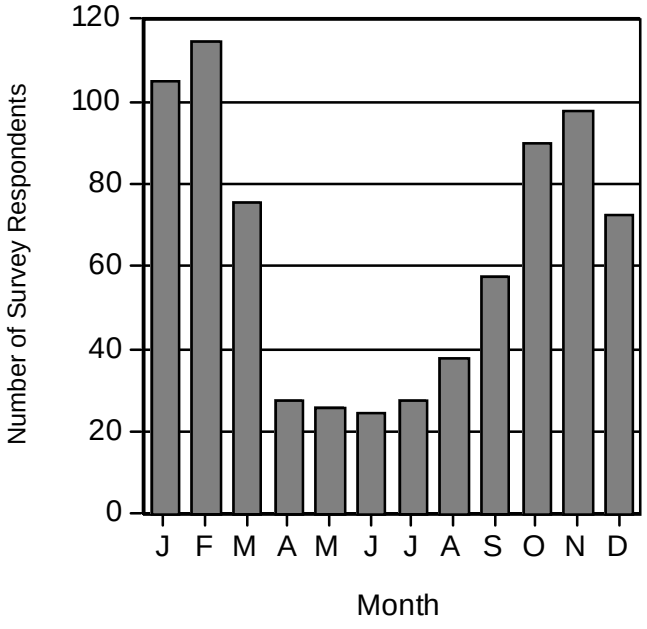

Fig. 3. Seasonal variation of deer damage in 1997 in the Northeast determined by a survey of growers. Frequency is equal to the number of respondents that reported receiving damage during indicated months.

Respondents reported that most damage occurred during the months of October through February (Fig. 3). This might be due to the high availability of plant material in woodland areas during warmer months when perennials in production are actively growing and available as food. The increase in human activity during the growing season also might keep deer away.

In addition to answering the questions provided, many respondents wrote in the margins of the survey, or attached letters to share comments and concerns. Many expressed a high level of frustration with deer damage. These comments were additional evidence that deer damage is an important problem in the nursery and landscape industry. Research is needed to test the efficacy of available control methods, develop new methods, and to evaluate the integration of control methods using Integrated Pest Management (IPM) principles.

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