Influence of a Quality Deer Management Program on Hunter Knowledge, Perceptions and Satisfaction

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Abstract: It is well acknowledged that habitat management, herd management, and herd monitoring are necessary to best manage for white-tailed deer (*Odocoileus virginianus*). A fourth component that must be considered is hunter participation. Hunter knowledge, perceptions, and satisfaction influence the success of a deer management program, as hunters play a key role in meeting harvest objectives. We surveyed hunters involved in a Quality Deer Management (QDM) program at Ames Plantation in western Tennessee from 2005–2013 to determine how experience in a QDM program influenced hunter knowledge, perceptions, and satisfaction concerning deer management. We divided our survey data into two groups to measure program influence: new members (137), who had not hunted or participated in the QDM program at Ames, and experienced members (395), who had at least one year of hunting experience and exposure to annual educational presentations and outreach materials offered through the Ames program. Experienced members were 40% more confident in their knowledge of QDM than new members. Both new (97%) and experienced members (99%) believed collecting biological, habitat, observation, and hunter satisfaction data were important for a successful QDM program. Experienced members showed more support (96%) for antlerless deer harvest than new members (91%). Experienced members (84%) were more inclined to think QDM could influence the rut compared to new members (69%). A larger proportion of experienced members thought prescribed burning (84%) as well as timber harvesting (77%) was beneficial for deer habitat, versus new members (74% and 74%, respectively). When asked which factor was most important to QDM success, 71% of experienced members indicated age, whereas new members were split between age (50%), nutrition (24%), and genetics (22%). Our survey results suggest educational presentations and experience hunting in a QDM program can positively influence hunters' perceptions and increase their knowledge of deer and deer management according to QDM guidelines. We recommend state wildlife agencies survey hunters to learn their deficiencies in knowledge of deer biology and management and address areas where increased knowledge and understanding is needed by proactively providing educational opportunities and making themselves more accessible to private clubs such that biologists could conduct annual presentations on deer biology and management.

Key words: hunter knowledge, hunter perceptions, education, outreach, quality deer management, *Odocoileus virginianus*, white-tailed deer, Tennessee

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The white-tailed deer (*Odocoileus virginianus*; henceforth deer) is the most recognizable and hunted game species in the United States (U.S. Fish and Wildlife Service 2011). In the most recent National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, deer was selected as the most popular game animal pursued in United States, attracting 10.9 million hunters and accounting for 80% of all hunters (USFWS 2011). Along with the high rate of interest in deer hunting, deer hunters have increasingly expressed interest in quality deer management (QDM) (Collier and Krementz 2006)—a management strategy dedicated to protecting young bucks in order to increase buck age structure in the population, encouraging harvest of an appropriate number of does to achieve a more balanced sex ratio, and maintain deer density within habitat constraints (Brothers and Ray 1975, Miller and Marchinton 1995).

Along with increased interest in deer hunting and QDM, land acquired for hunting purposes in the United States has consistently risen (USFWS 2001, 2006, 2011), and the largest proportion of these properties are managed under some type of QDM strategy (Hamilton et al. 1995b, Dithcoff et al. 1997). A survey of attitudes and motivations of Tennessee deer hunters towards QDM showed the majority of hunters agreed that QDM was a sensible management philosophy (Harper et al. 2012). Woods et al. (1996) reported that management involvement influenced the satisfaction of hunters practicing QDM more than seeing bucks and buck sign.

Considering increased hunter interest in QDM and the biologi-

cal and ecological benefits of sound deer management, development and implementation of QDM programs and the provision of outreach to benefit management on private lands is an important consideration for all state wildlife agencies across the geographic range of white-tailed deer. Currently, a minimum of 22 state wildlife agencies implement some form of antler restrictions to protect younger (generally 1½ year olds) age classes of bucks (Adams et al. 2010). Additionally, every state with an open deer season provides hunters with opportunities to harvest does and more liberal regulations occur where deer densities have reached unacceptable levels in order to achieve the deer-management goals as set by the state agency (Adams et al. 2010). It is important to remember, not all deer hunters show interest in QDM and those with varying management philosophies can create challenges when managing a statewide deer program (Riley et al. 2003, Collier and Krementz 2006). However, this challenge should not deter state wildlife agencies from developing and implementing QDM programs and providing outreach to individuals or clubs managing private lands.

A QDM program is designed to maintain a healthy and productive deer herd with natural sex and age structures (Kroll and Jacobson 1995). Success of a QDM program is largely dependent on attitudes and satisfaction of participating hunters (Riley et al. 2003, Stedman et. al. 2004). Great importance is placed on ethics and educational efforts in a QDM program because QDM emphasizes developing hunters into managers (Hamilton et al. 1995a, Wegner 1995). However, limited information has been collected to determine the effects of QDM programs on the knowledge, perceptions, and satisfaction of participating hunters (Woods et al. 1996, Enck et al. 2003, Harper et al. 2012). Education and outreach may be an effective approach to encourage hunters to support and participate in meeting harvest objectives and influence the success of a deer management program. We surveyed members of a QDM hunting club at Ames Plantation in southwest Tennessee, 2005–2013. Our objective was to determine the influence of educational programming and experience in a QDM program on hunter knowledge, perceptions, and satisfaction concerning deer and deer management.

Study Area

Ames Plantation is a 7,536-ha property in Fayette and Hardeman Counties within the Coastal Plain physiographic region of Tennessee. Ames Plantation is a research partner with the University of Tennessee supporting research, education, and outreach involving agriculture, wildlife, and forestry. A large portion of the property consists of forest land with more than 1,400 ha of loblolly pine (*Pinus taeda*), almost 1,100 ha of bottomland hardwoods, and more than 3,400 ha of upland hardwoods. The remaining 1,600 ha consists of pastureland, cropland, and open ground managed primarily for northern bobwhite (*Colinus virginianus*).

Ames Plantation Hunting Club was created prior to the 2003–04 Tennessee deer season and included 52 hunters originally. Data (i.e., sex, age, weight, evidence of lactation, number of antler points, inside spread, main beam length and diameter, and gross antler score) were collected from all deer killed at Ames during the 2002–03 Tennessee deer season to determine average characteristics among sex and age classes. Data collection continued during the 2003–2004 season and was combined with data from 2002–03 to determine potential antler restrictions to protect bucks 2½ years old and younger. In the 2004–05 season, QDM guidelines were put in place that included a doe harvest quota (180) and a 110-inch gross antler score (following the Boone and Crockett Club) or minimum age of 5½ years for all bucks harvested. In 2006–07, membership in Ames Plantation Hunting Club increased to 125 hunters and buck harvest restrictions were modified to a 120-inch gross antler score or a minimum age of 4½ years requirement. In 2008, the minimum gross antler score restriction was increased to 125 inches based on results from prior harvest data to protect all 2½-year-old bucks.

In combination with implementing harvest requirements, hunter surveys and educational meetings have been conducted at Ames since 2005. We coordinated educational presentations for annual preseason meetings to provide biological justification for the guidelines and recommendations in place. Data were presented showing harvest age-class distribution and statistics related to hunter success in past years. Guest speakers have been deer researchers or professional deer managers who are Certified Wildlife Biologists. Presentations concentrated on specific topics related to deer management, such as principles of quality deer management, the effects of antler restrictions and high-grading, influence of genetics, aging-on-the-hoof, scoring antlers, and effects of harvest regulations on age structure and sex ratio. Multiple topics related to deer management were presented at each meeting, but educational programming was not the same every year.

Methods

We surveyed Ames Hunting Club members from 2005–2013 at the annual preseason meeting to determine how hunting experience under QDM guidelines and participation in QDM educational programs influenced hunter satisfaction along with their knowledge and perceptions of deer and deer management. At each preseason meeting, a written survey was distributed to each club member in attendance and all surveys were completed and collected before any educational presentation. Our survey instrument was developed based on discussions and experiences with Ames Plantation Deer Hunting Club members since its founding in 2003. Hunt-

Table 1. Number and proportions of a new and experienced members in Ames Plantation Deer Hunting Club preseason survey respondents and actual membership 2005–2013 in Tennessee.

Surveyed Participants	2005 n (%)	2006 n (%)	2007 n (%)	2008 n (%)	2009 n (%)	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	Total n (%)
New	31 (44)$_{A}$	35 (34)$_{A,B}$	20 (20)$_{B}$	7 (16)$_{A,B}$	8 (18)$_{A,B}$	14 (26)$_{A,B}$	7 (19)$_{A,B}$	5 (13)$_{B}$	10 (23)$_{A,B}$	137 (26)
Experienced	40 (56)$_{A}$	67 (66)$_{A,B}$	78 (80)$_{B}$	37 (84)$_{A,B}$	36 (82)$_{A,B}$	40 (74)$_{A,B}$	30 (81)$_{A,B}$	33 (87)$_{A,B}$	34 (77)$_{A,B}$	395 (74)
Total Participants	71 (66)	102 (82)	98 (78)	44 (44)	44 (49)	54 (65)	37 (55)	38 (54)	44 (57)	532 (63)
Actual Membership	107	125	125	100	89	83	67	70	77	843

a. Proportions of annual survey new or experienced participants sharing upper case subscripts are not statistically different at the 0.05 level.

ing club members and wildlife management professionals from the University of Tennessee and Tennessee Wildlife Resources Agency reviewed the instrument before administration. In addition, we field tested the survey instrument with members of three smaller hunting clubs in Tennessee before it was administered to hunting club members at Ames Plantation. We have adapted the survey slightly over time. Thus, a few questions have been added, deleted, or revised since we began collecting survey data.

Survey Questions

We divided our survey data into two groups to measure program influence: new members (first year in club) and experienced members (Table 1). New members were not exposed to any Ames Plantation QDM educational programming prior to completing surveys aside from information publicly available on the Ames Plantation website. As mentioned earlier, deer hunters have increasingly expressed interest in QDM (Collier and Krementz 2006). Thus, members may have accessed other sources of QDM education outside of the Ames Plantation QDM program for which we were unable to control for. Additionally, new members had not participated in the deer management program at Ames prior to completing surveys. First-year members who had prior experience in another QDM program were treated as new members, as we could not assume that all QDM programs operate under the same extension education approach as Ames Plantation. Experienced members were those that had been a member of Ames Plantation Deer Hunting Club for one or more years.

Hunter Demographics and Experience. We began the hunter survey with a hunting experience question to gather information on the differences in hunting experience among members of the club. The number of years as an Ames member and participation in other clubs or QDM programs were addressed along with hunter demographics.

Quality Deer Management and Hunting Knowledge. Seven survey questions were related to the knowledge and perceptions of hunters regarding QDM practices and the influences of QDM on a deer herd (Table 2).

Table 2. Opinions and perceptions of quality deer management for Ames Plantation Deer Hunting Club members from preseason surveys conducted 2005–2013 in Tennessee.

Question	Response	New n (%)[a]	Experienced n (%)[a]	Total n (%)
How would you rate your knowledge of QDM?	Not at all knowledgeable	8 (6)$_{A}$	4 (1)$_{B}$	12 (2)
	Somewhat knowledgeable	105 (77)$_{A}$	279 (71)$_{A}$	384 (73)
	Very knowledgeable	23 (17)$_{A}$	111 (28)$_{B}$	134 (25)
In your opinion is QDM the same as trophy deer management?	No	104 (76)$_{A}$	361 (92)$_{B}$	465 (88)
	Yes	18 (13)$_{A}$	17 (4)$_{B}$	35 (7)
	Don't know	15 (11)$_{A}$	14 (4)$_{B}$	29 (6)
How many years do you think it should take before QDM objectives are realized	1–3 years	18 (13)$_{A}$	91 (23)$_{B}$	109 (21)
	4–6 years	73 (53)$_{A}$	237 (60)$_{A}$	310 (58)
	>6 years	16 (12)$_{A}$	28 (7)$_{A}$	44 (8)
	Don't know	30 (22)$_{A}$	37 (9)$_{B}$	67 (13)
What is the largest buck (gross antler score) you think Ames is capable of producing now or ever?	120–149 in.	1 (1)$_{A}$	7 (2)$_{A}$	8 (2)
	150–159 in.	9 (7)$_{A}$	21 (5)$_{A}$	30 (6)
	160–169 in.	19 (14)$_{A}$	63 (16)$_{A}$	82 (16)
	170–179 in.	33 (24)$_{A}$	126 (32)$_{A}$	159 (30)
	180–189 in.	14 (10)$_{A}$	83 (21)$_{B}$	97 (18)
	>189 in.	8 (6)$_{A}$	41 (10)$_{A}$	49 (10)
	Don't know	51 (38)$_{A}$	53 (14)$_{B}$	104 (20)
Do you think a QDM program can influence the rut?	No	14 (10)$_{A}$	28 (7)$_{A}$	42 (8)
	Yes	94 (69)$_{A}$	331 (84)$_{B}$	425 (80)
	Don't know	29 (21)$_{A}$	33 (8)$_{B}$	62 (12)
Do you think it is possible to determine the age of a live buck while hunting?	No	24 (18)$_{A}$	35 (9)$_{B}$	59 (11)
	Yes	93 (68)$_{A}$	327 (84)$_{B}$	420 (80)
	Don't know	20 (15)$_{A}$	28 (7)$_{B}$	48 (9)
If yes, how would you rate your own ability to determine the age of a live buck?	Poor	10 (10)$_{A}$	23 (7)$_{A}$	33 (8)
	Fair	29 (30)$_{A}$	95 (29)$_{A}$	124 (29)
	Good	42 (43)$_{A}$	137 (41)$_{A}$	179 (42)
	Excellent	16 (17)$_{A}$	78 (23)$_{A}$	94 (22)

a. Proportions of annual survey new or experienced participants sharing upper case subscripts are not statistically different at the 0.05 level.

Deer and Habitat Management Perceptions. We devoted 14 survey questions to understanding hunters' perceptions of habitat management techniques and harvest guidelines implemented by the QDM program at Ames (Table 3).

Personal Hunting Preferences. The last portion of our survey consisted of 14 questions focused on evaluating harvest preferences, motivations for joining Ames Hunting Club, and satisfaction of members with the QDM program at Ames (Table 4).

Table 3. Quality deer management and habitat management knowledge for Ames Plantation Deer Hunting Club members from preseason surveys conducted 2005–2012 in Tennessee.

Question	Response	New n (%)[a]	Experienced n (%)[a]	Total n (%)
Which of the following factors is most important to the success of a QDM program?	Age	66 (50)$_A$	271 (71)$_B$	337 (65)
	Nutrition	32 (24)$_A$	51 (13)$_B$	83 (16)
	Genetics	29 (22)$_A$	33 (9)$_B$	62 (12)
	Hunter satisfaction[b]	6 (5)$_A$	28 (7)$_A$	34 (7)
How old do you think a buck should be before it is "legal" to harvest in a QDM program?	1.5 years	1 (1)$_A$	0 (0)$_A$	1 (0)
	2.5 years	11 (8)$_A$	21 (5)$_A$	32 (6)
	3.5 years	95 (69)$_A$	282 (72)$_A$	377 (71)
	4.5 years	28 (20)$_A$	84 (22)$_A$	112 (21)
	>4.5 years	2 (2)$_A$	4 (1)$_A$	6 (1)
How many bucks should each hunt club member be allowed to harvest per season in the QDM program at Ames?	1	16 (12)$_A$	60 (15)$_A$	76 (14)
	2	89 (66)$_A$	283 (72)$_A$	372 (71)
	3+	13 (10)$_A$	35 (9)$_A$	48 (9)
	Don't know	17 (13)$_A$	13 (3)$_B$	30 (6)
In a QDM program, should antlerless deer be included in the harvest?	No	5 (4)$_A$	8 (2)$_A$	13 (2.5)
	Yes	124 (91)$_A$	378 (96)$_B$	502 (95)
	Don't know	7 (5)$_A$	6 (2)$_A$	13 (2.5)
Do you think spikes should be killed intentionally (culled) in a QDM program?	No	107 (79)$_A$	351 (89)$_B$	458 (86)
	Yes	11 (8)$_A$	14 (4)$_B$	25 (5)
	Don't know	18 (13)$_A$	29 (7)$_B$	47 (9)
Do you think buck fawns should be "legal for harvest" in a QDM program?	No	120 (88)$_A$	320 (81)$_A$	440 (83)
	Yes	6 (4)$_A$	49 (13)$_B$	55 (10)
	Don't know	10 (8)$_A$	24 (6)$_B$	34 (7)
Do you think doe fawns should be "legal for harvest" in a QDM program?	No	73 (54)$_A$	124 (32)$_B$	197 (37)
	Yes	53 (39)$_A$	242 (62)$_B$	295 (56)
	Don't know	10 (7)$_A$	26 (7)$_A$	36 (7)
Prescribed fire is good for deer/deer habitat.	Strongly disagree	2 (2)$_A$	11 (3)$_A$	13 (3)
	Somewhat disagree	6 (4)$_A$	12 (3)$_A$	18 (3)
	Neutral	27 (20)$_A$	40 (10)$_B$	67 (13)
	Somewhat agree	50 (37)$_A$	126 (32)$_A$	176 (33)
	Strongly agree	50 (37)$_A$	203 (52)$_B$	253 (48)
Harvesting timber is good for deer/deer habitat.	Strongly disagree	6 (4)$_A$	14 (4)$_A$	20 (4)
	Somewhat disagree	9 (7)$_A$	30 (8)$_A$	39 (7)
	Neutral	21 (15)$_A$	43 (11)$_A$	64 (12)
	Somewhat agree	56 (41)$_A$	131 (34)$_A$	187 (36)
	Strongly agree	44 (33)$_A$	172 (44)$_B$	216 (41)
Should food plots be incorporated into a QDM program?	No	2 (2)$_A$	34 (9)$_B$	36 (7)
	Yes	112 (82)$_A$	308 (79)$_A$	420 (80)
	Don't know	22 (16)$_A$	50 (13)$_A$	72 (14)
Should mineral/salt licks be incorporated into a QDM program?	No	16 (12)$_A$	56 (14)$_A$	72 (14)
	Yes	90 (66)$_A$	243 (62)$_A$	333 (63)
	Don't know	30 (22)$_A$	95 (24)$_A$	125 (24)
Should native vegetation be fertilized for increased browse in a QDM program?	No[c]	9 (7)$_A$	58 (15)$_B$	67 (13)
	Yes	93 (68)$_A$	251 (64)$_A$	344 (65)
	Don't know	34 (25)$_A$	85 (22)$_A$	119 (23)
Should oaks be fertilized in a QDM program?	No[c]	17 (13)$_A$	83 (21)$_B$	100 (19)
	Yes	66 (49)$_A$	189 (48)$_A$	255 (48)
	Don't know	53 (39)$_A$	123 (31)$_A$	176 (33)
Do you think genetics is a "problem" for deer herd on many properties in Tennessee, such as Ames, where QDM guidelines have been put in place?	No	58 (43)$_A$	255 (65)$_B$	313 (59)
	Yes	19 (14)$_A$	62 (16)$_A$	81 (15)
	Don't know	59 (43)$_A$	75 (19)$_B$	134 (25)

a. Proportions of annual survey new or experienced participants sharing upper case subscripts are not statistically different at the 0.05 level.

b. Category added in 2008.

c. Test for category was different at the 0.05 level, however, overall likelihood ratio test for question not significant.

Table 4. Personal harvest preferences for Ames Plantation Deer Hunting Club members from a preseason surveys conducted 2005–2012 in Tennessee.

Question	Response	New n (%)[a]	Experienced n (%)[a]	Total n (%)
Do you prefer to shoot bucks, does or fawns? (check all that apply)	Bucks	114 (83)$_A$	334 (85)$_A$	448 (84)
	Does	56 (41)$_A$	168 (43)$_A$	224 (42)
	Fawns	1 (1)$_A$	9 (2)$_A$	10 (2)
	No preference	19 (14)$_A$	49 (12)$_A$	68 (13)
How important are antler size/characteristics for you as part of Ames Hunting Club?	Not at all important	0 (0)$_A$	1 (0)$_A$	1 (0)
	Slightly important	1 (1)$_A$	15 (4)$_A$	16 (3)
	Moderately important	35 (26)$_A$	99 (25)$_A$	134 (26)
	Very important	99 (73)$_A$	275 (71)$_A$	374 (71)
How important is the opportunity to manage a deer herd to you as part of Ames Hunting Club?	Not at all important	1 (1)$_A$	4 (1)$_A$	5 (1)
	Slightly important	3 (2)$_A$	26 (7)$_A$	29 (5)
	Moderately important	40 (30)$_A$	93 (24)$_A$	133 (26)
	Very important	91 (67)$_A$	263 (68)$_A$	354 (68)
How important is being a part of a hunting group with a shared management objective to you as part of Ames Hunting Club?	Not at all important	1 (1)$_A$	1 (0)$_A$	2 (0)
	Slightly important	3 (2)$_A$	15 (4)$_A$	18 (4)
	Moderately important[b]	20 (12)$_A$	86 (21)$_B$	106 (19)
	Very important[b]	110(82)$_A$	286 (74)$_B$	396 (76)
How important is hunting on a controlled property to you as part of Ames Hunting Club?	Not at all important	1 (1)$_A$	0 (0)$_A$	1 (0)
	Slightly important	2 (2)$_A$	8 (2)$_A$	10 (2)
	Moderately important	13 (10)$_A$	47 (12)$_A$	60 (12)
	Very important	119 (88)$_A$	333 (86)$_A$	452 (86)
How important is social interaction as part of Ames Hunting Club to you?	Not at all important	4 (3)$_A$	30 (8)$_A$	34 (7)
	Slightly important	25 (19)$_A$	63 (16)$_A$	88 (17)
	Moderately important	56 (42)$_A$	142 (37)$_A$	198 (38)
	Very important	50 (37)$_A$	151 (39)$_A$	201 (39)
How important is hunting under management guidelines to you as part of Ames Hunting Club?	Not at all important	1 (1)$_A$	2 (1)$_A$	3 (1)
	Slightly important	5 (4)$_A$	20 (5)$_A$	25 (5)
	Moderately important	34 (25)$_A$	102 (26)$_A$	136 (26)
	Very important	96 (71)$_A$	263 (68)$_A$	359 (69)
How important are overall deer sightings to you as part of Ames Hunting Club?	Not at all important	2 (2)$_A$	3 (1)$_A$	5 (1)
	Slightly important	10 (7)$_A$	14 (4)$_A$	24 (5)
	Moderately important	31 (23)$_A$	102 (26)$_A$	133 (25)
	Very important	93 (68)$_A$	269 (69)$_A$	362 (69)
How important is it to be with friends as part of Ames Hunting Club?	Not at all important	5 (4)$_A$	31 (8)$_A$	36 (7)
	Slightly important	27 (20)$_A$	61 (16)$_A$	88 (17)
	Moderately important	46 (34)$_A$	121 (31)$_A$	167 (32)
	Very important	57 (42)$_A$	176 (45)$_A$	233 (45)
How important is it to experience nature as part of Ames Hunting Club?	Not at all important	0 (0)$_A$	2 (1)$_A$	2 (0)
	Slightly important[b]	8 (6)$_A$	9 (2)$_B$	17 (3)
	Moderately important	22 (16)$_A$	63 (16)$_A$	85 (16)
	Very important	105 (78)$_A$	317 (81)$_A$	422 (80)
How important is the challenge of the hunt to you as part of Ames Hunting Club?	Not at all important	1 (1)$_A$	2 (1)$_A$	3 (1)
	Slightly important[b]	6 (4)$_A$	4 (1)$_B$	10 (2)
	Moderately important	21 (16)$_A$	57 (15)$_A$	78 (15)
	Very important	107 (79)$_A$	327 (84)$_A$	434 (83)
How important is a place to hunt to you as part of Ames Hunting Club?	Not at all important	0 (0)$_A$	3 (1)$_A$	3 (1)
	Slightly important	10 (7)$_A$	23 (6)$_A$	33 (6)
	Moderately important	26 (19)$_A$	53 (14)$_A$	79 (15)
	Very important	99 (73)$_A$	312 (80)$_A$	411 (78)
How important is solitude when hunting to you as part of Ames Hunting Club?	Not at all important	2 (2)$_A$	4 (1)$_A$	6 (1)
	Slightly important	12 (9)$_A$	26 (7)$_A$	38 (7)
	Moderately important	31 (23)$_A$	67 (17)$_A$	98 (19)
	Very important	89 (66)$_A$	290 (75)$_A$	379 (73)
How important is venison for food to you as part of Ames Hunting Club?	Not at all important	13 (10)$_A$	42 (11)$_A$	55 (11)
	Slightly important	31 (23)$_A$	76 (19)$_A$	107 (20)
	Moderately important	47 (35)$_A$	151 (39)$_A$	198 (38)
	Very important	44 (33)$_A$	122 (31)$_A$	166 (32)

a. Proportions of annual survey new or experienced participants sharing upper case subscripts are not statistically different at the 0.05 level.

b. Test for category was different at the 0.05 level, however, overall likelihood ratio test for question not significant.

Statistical Analysis

We used IBM SPSS 20 to analyze our survey data and concluded statistical significance at $P \leq 0.05$ for all tests. We used likelihood ratio (G) with z-tests and a Bonferroni correction to compare proportions of responses between new and experienced members. We tested to see if there were differences between new and experienced member responses for each survey question.

Results

We collected 532 completed surveys during the study period (Table 1). We experienced 100% total survey participation of members attending each annual pre-season meeting. Participation in the annual pre-season meeting across our nine-year study period was 63% (532 out of 843 members). New members and experienced members accounted for 26% (n = 137) and 74% (n = 395) of completed surveys respectively. Proportions of total surveyed members varied over the study period as a result of participation in the pre-season meeting. Participation was higher during 2005 (66%, n = 71), 2006 (82%, n = 107), 2007 (78%, n = 98), and 2010 (65%, n = 65) compared to 2008 (44%, n = 44), 2009 (49%, n = 44), 2011 (55%, n = 37), 2012 (54%, n = 38), and 2013 (57%, n = 44).

Quality Deer Management and Hunting Knowledge

Compared to experienced members (1%), a higher proportion of new members (6%) considered themselves "not at all knowledgeable" about QDM. Experienced members (71%) and new members (77%) similarly considered themselves "somewhat knowledgeable" about QDM, but a higher proportion of experienced members (28%) than new members (17%) considered themselves "very knowledgeable" about QDM (G = 14.95, df = 7, $P \leq 0.001$, n = 530). New members did not know (11%) or thought QDM was the same (13%) as trophy deer management more often than experienced members (4% and 4%, respectively; $G = 22.21$, df = 2, $P \leq 0.001$, n = 529). Experienced members (23%) indicated they thought QDM objectives could be realized in one to three years more often than new members (13%; $G = 19.84$, df = 3, $P = 0.001$, n = 530). Experienced members (63%) were more likely to expect Ames Plantation to produce larger bucks (≥170" Boone and Crockett) than new members (40%; $G = 39.243$, df = 7, $P < 0.001$, n = 529). Fewer new members (69%) than experienced members (84%) thought QDM affected the rut, whereas more new members (21%) than experienced members (8%) indicated they did not know ($G = 16.87$, df = 2, $P < 0.001$, n = 529). Higher proportions of experienced hunters (84%) indicated they thought it was possible to determine the age of a live buck while hunting than new members (68%; $G = 14.91$, df = 2, $P = 0.001$, n = 527). Of those who thought it possible to determine buck age while hunting, proportions of new and experienced members were similar in their assessment of their personal ability to age bucks when hunting ($G = 3.44$, df = 3, $P = 0.488$, n = 430), with the plurality of new (43%) and experienced members (41%) reporting their ability was "good" (Table 2).

Deer and Habitat Management Perceptions

Experienced members considered age (71%) the most important characteristic of a successful deer management program more often than new members (50%; $G = 27.55$, df = 3, $P \leq 0.001$, n = 516; Table 3). Both new (69%) and experienced (72%) members thought bucks should be at least 3.5 years old to be considered "legal" to harvest in a QDM program ($G = 4.14$, df = 4, $P = 0.388$, n = 528). Although new members (13%) responded "don't know" more frequently than experienced members (3%) concerning how many bucks should be harvested per hunter on Ames Plantation ($G = 19.90$, df = 4, $P = 0.001$, n = 526), they did not differ on their opinions of harvest per hunter, with 66% of new and 70% of experienced members indicating members should be allowed two bucks per season. The majority of new (91%) and experienced (96%) members thought antlerless deer should be included in the harvest ($G = 5.92$, df = 2, $P = 0.052$, n = 528). Fewer experienced members (4%) than new members (8%) thought spikes should be "culled" ($G = 8.83$, df = 2, $P = 0.012$ n = 530). A higher proportion of experienced members (13%) thought buck fawns should be "legal" to harvest than new members (4%; $G = 8.64$, df = 2, $P = 0.013$, n = 530). Similarly, new members (54%) were more likely than experienced members (32%) to indicate that doe fawns should not be harvestable ($G = 22.35$, $df = 2$, $P \leq 0.001$, $n = 528$).

More experienced members (52%) "strongly agreed" more often than new members (37%) that prescribed fire was good for deer habitat than new members ($G = 13.72$, df = 4, $P = 0.008$, n = 527; Table 3). We did not detect differences between members regarding their perception of timber harvesting as being good for deer habitat, with new members (74%) and experienced members (78%) agreeing that it is good ($G = 7.019$, df = 4, $P = 0.135$, n = 526). More experienced members (9%) did not think food plots should be included in a QDM program than new members (2%); however, the majority of both groups (79% and 82% respectively) thought food plots should be included ($G = 11.23$, df = 2, $P = 0.004$, n = 528). Respondents were similar in opinions about mineral/salt licks ($G = 0.97$, df = 2, $P = 0.617$, n = 530) being included in a QDM program with most indicating they should be included (Table 3). More experienced members believed native vegetation (15%, $G = 6.87$, df = 2, $P = 0.032$, n = 530) and oak trees (21%, $G = 6.07$, df = 2, $P = 0.048$, n = 531) should not be fertilized than new members (7% and 13%; respectively). When asked if genetics is a "prob-

lem" in deer herds under QDM, experienced members responded "no" more often (65%) than new members (43%; $G = 30.29$, df = 2, $P \leq 0.001$, n = 528).

Personal Hunting Preferences

Both experienced (85%) and new members (83%) preferred to hunt bucks ($G = 0.185$, df = 1, $P = 0.667$, n = 531). Similar proportions of experienced members (43%) and new members (41%) preferred to hunt does ($G = 0.13$, df = 1, $P = 0.719$, n = 531). A similar proportion of experienced members (12%) and new members (14%) reported that they had no harvest preferences ($G = 0.184$, df = 1, $P = 0.668$, n = 531). New and experienced members were similar when asked a battery of questions about their perceived importance of 13 factors related to their hunting preferences (Table 4). With all respondents combined, "hunting on a controlled property" (86%), "challenge of the hunt" (83%), and "experiencing nature" (80%) were selected as "very important" and the most important reasons for hunters being a part of the Ames Hunting Club. The least important reasons were "to be with friends," "social interaction," and "venison for food," which were "very important" to 45%, 39% and 32% of combined members, respectively.

Discussion

We found differences and similarities in knowledge, perceptions, and satisfaction pertaining to deer and deer management between new and experienced members of the Ames Plantation Deer Hunting Club. By compiling and analyzing the responses from nine years of survey data, we were able to detect the influence of educational presentations and experience in a QDM program.

Quality Deer Management and Hunting Knowledge

Results from our study suggest that experience in a QDM program and exposure to science-based educational programming increases personal knowledge of QDM. These findings support those of Harper et al. (2012), which reported QDM hunt club members rated themselves "somewhat knowledgeable" and "very knowledgeable" more often than QDM Wildlife Management Area hunters and sportsmen license holders in Tennessee. The higher confidence levels of experienced members from Ames in their personal knowledge of QDM corresponded with their responses concerning other topics related to QDM and hunting knowledge. Exposure to QDM presentations along with experience hunting under QDM guidelines could explain the higher confidence levels of experienced members at Ames.

QDM is not about "trophies" (Van Brackle and McDonald 1995) but is more so a management strategy that enables hunters to hunt older age-class animals (Miller and Marchinton 1995). Understanding this is important because the image portrayed by trophy deer management is more likely opposed by the nonhunting public (Kellert 1996, Green and Stowe 2000). Although most new members recognized QDM and trophy deer management as two distinct management philosophies, the higher proportion of experienced members that made the distinction suggests that experience in a QDM program helps hunters better distinguish QDM from trophy deer management as a result of increased hunter knowledge and understanding of QDM.

Establishing more even sex ratios with doe harvest and allowing bucks to survive to maturity to establish hierarchical dominance can result in a shortened more intense rut with increased signpost rubs and scrapes, providing hunters with more opportunity to experience a more pronounced and active rut while improving the timing of the following fawning season (Miller et al. 1991). The higher proportion of experienced members who recognized that QDM can affect the timing and intensity of the rut suggests that experience and educational programming did increase hunter knowledge pertaining to the influence of QDM on the rut.

Deer and Habitat Management Perceptions

Key concepts of QDM that promote increased age structure, more balanced sex ratios, and developing hunters as managers have been established and embraced by deer hunters at large (Brothers and Ray 1975, Halls 1984, Jacobson 1992, Miller and Marchinton 1995, Woods et al. 1996, Harper et al. 2012). These concepts deviate from traditional deer management paradigms, where harvesting does is often discouraged regardless of deer density and young bucks make up the majority of the harvest (Waller and Alverson 1997, Adams et al. 2010). Age, rather than antler size, has been identified as the most appropriate factor for defining bucks acceptable for harvest in a QDM program (Strickland et al. 2001, Demarais et al. 2005). A large proportion of both hunter groups in our study believed that does should be included in a QDM program and agreed that the appropriate minimum harvest age of bucks should be 3.5 years old, suggesting that experience in a QDM program and exposure to QDM educational programming is not necessary for hunters to support antlerless deer harvest and restraint in harvesting young bucks. As hunter support for QDM has increased over time, promotion of QDM has increased. Advances in technology have made information regarding general concepts of QDM readily accessible and could explain the similarities regarding hunter support for the two most fundamental practices involved in QDM: restraint in harvesting younger bucks and an appropriate antlerless deer harvest. However, fewer new members supported harvest of doe fawns, suggesting educational programming and experience hunting under QDM guidelines helps members better understand

the biological justification of antlerless deer harvest and become more comfortable with the management practice.

Most hunters obtain information on deer and deer management through magazines, television, and the internet, not through biologists providing science-based information (Harper et al. 2012). General concepts of QDM are conveyed through media resources, but topics important to better understanding and implementing QDM such as appropriate habitat management, the differences between QDM and Trophy Deer Management, and the role of age, nutrition, and genetics in deer management are often misrepresented or not presented at all. Scientific research provides support for the QDM philosophy. Research has shown that genetic characteristics are not determined only by the largest antlered bucks (Sorin 2004) and that spikes are able to grow respectable antlers upon maturity (McCullough 1984, DeYoung 1990, Brothers and Ray 1998).

Knowledge gained from educational presentations addressing these topics along with experience hunting on a property practicing appropriate habitat management under guidelines that restrict the harvest of young bucks could explain why experienced members in our study better understood that genetics is not a "problem" for the deer herd in Tennessee, were less likely to support "culling" spikes, and selected age as the most important factor contributing to the success of a QDM program. Similar results have been found in a study of hunters from multiple private QDM clubs in Tennessee who were less likely to support culling spikes and older bucks with "poor" racks compared to public hunters (Harper et al. 2012).

Personal Hunting Preferences

The similarities between experienced members and new members in their personal hunting preferences as they pertain to hunting bucks, does, or fawns suggest that most hunters, regardless of QDM experience or exposure to educational programming, would prefer to hunt bucks. Although harvest preference was the same among both groups, the harvest preference of hunters does not determine the success of a QDM program, but it can influence harvest levels of deer which are critical to QDM success. Experienced hunters in our study showed higher levels of knowledge and understanding concerning QDM, which suggests that their experience has developed them into better practitioners of QDM, ultimately affecting success of the QDM program.

Factors that contribute to hunter satisfaction and motivation may vary according to location and/or hunting method (Potter et al. 1973, Hammitt et al. 1990, Hayslette et al. 2001). The motivations for being a part of Ames Deer Hunting Club did not differ between the two hunter groups. It is important to note that "Antler size/characteristics" was on the list of motivations to choose from, but was ranked seventh of 13. The focus of members on nonharvest motivations for being in the QDM program is consistent with other hunter surveys across the country (Gigliotti 2000, Grilliot and Armstrong 2005, Harper et al. 2012). Our survey results also suggest that hunters in a QDM program, regardless of experience, are largely appreciative-oriented hunters and have a strong commitment to deer hunting (Kellert 1978, Decker and Connelly 1989, Harper et al. 2012). Providing opportunities for education and increasing knowledge of QDM principles and practices could effectively encourage unfamiliar hunters to consider adhering to recommended QDM guidelines.

Our results should be interpreted carefully for several reasons. Although we could detect differences between new and experienced members, we were not able to detect when the separation occurred. Survey participants were not uniquely identified, thus, we did not track survey responses for particular individuals over the study period to determine if hunters only need just one year of experience to change their perspectives and gain knowledge or if multiple years of experience were required. While the likelihood is that experienced members had previously participated in educational programming and hunted at Ames Plantation, we did not track the previous hunting effort of experienced members or the number of educational presentations experienced members had attended prior to participating in the study. Also, we acknowledge the possibility of nonresponse bias, considering that not all members participated in the study.

Management Implications

Our survey clearly shows hunters are able to grasp and absorb science-based information when it is presented to them. We recommend state wildlife agencies proactively provide educational opportunities to hunters. State wildlife agencies should first ensure that their employees are knowledgeable of the appropriate deer management practices to meet their agency deer management objectives, then make themselves accessible to private clubs such that biologists could conduct annual presentations on deer biology and management. We recommend incorporating QDM information into hunter education courses, as they present an ideal opportunity to inform new hunters about QDM. We also recommend state agencies survey hunters to learn their deficiencies in knowledge of deer biology and management and to use the survey information to address areas where increased knowledge and understanding is needed. Annual field seminars and workshop events should be used in areas implementing deer management regulations to provide the deer hunting public with data to support management decisions and to make them aware of management progress. Deer hunters are the most effective tool we have to properly manage deer herds. Presenting science-based information regarding deer

management to hunters can positively influence hunters' perceptions and increase their knowledge of deer and deer management resulting in increased success in meeting regional or statewide deer management objectives.

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