Immobilization of Captive White-tailed Deer with Mixtures of Telazol and Rompun[1]

Stephen R. Schultz, *School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803*

Mark K. Johnson, *School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803*

Will A. Forbes, *School of Forestry, Wildlife, and Fisheries, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, LA 70803*

Abstract: We evaluated mixtures of Telazol and Rompun for immobilizing captive white-tailed deer (*Odocoileus virginianus*). Three doses of Telazol and Rompun were used to immobilize adult male deer ($N = 32$), and 5 doses were used to immobilize yearling deer ($N = 78$). Mixtures of these agents immobilized deer quicker and with deeper sedation than previously experienced using Rompun alone. There were no differences in immobilization or recovery periods between doses of 250:150 mg versus 167:200 mg Telazol:Rompun in adult males. There were no differences in immobilization or recovery periods between doses of 100:100 mg versus 167:100 mg Telazol:Rompun in yearling deer, but effective immobilization took longer than with a dose of 100:200 mg.

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Many drugs have been used to immobilize deer (Day et al. 1980, Scanlon and Brunjak 1984). Scanlon and Brunjak (1984) listed the characteristics of the "ideal" drug for immobilizing white-tailed deer. Generally, the ideal agent should work quickly and effectively, place animals at low risk for complications or side effects, have a wide tolerance limit, and be reversible or have a short recovery phase. The agent should also be safe to handle and easy to administer.

Rompun® (xylazine; Mobay Corp., Shawnee, Kan.) is a nonnarcotic sedative, analgesic, and muscle relaxant (Day et al. 1980). Rompun dosages for immobilizing

[1]Rompun is a registered trademark of Mobay Corp., Shawnee, KS and Telazol is a registered trademark of A. H. Robins, Co., Richmond, VA.

white-tailed deer have ranged from 0.89–8.0 mg/kg body mass (Roughton 1975, Mautz et al. 1980, Gibson et al. 1982, Van Der Eems and Brown 1986). Rompun has also been combined with ketamine (Mech et al. 1985, Kreeger et al. 1986, Seal and Bush 1987) and etorphine (Presnell et al. 1973, Hertzog 1975, Rapley and Mehren 1975) to immobilize white-tailed deer. Yohimbine hydrochloride (Sigma Chemical Co., St. Louis, Mo.) is an effective antagonist to Rompun (Hsu and Shulaw 1984, Mech et al. 1985, Van Der Eems and Brown 1986). Animals immobilized with low doses of Rompun may overcome sedation if stimulated (Seal and Bush 1987). Additionally, there is a relatively long interval between injection and sedation and a long recovery phase without administration of an antagonist (Day et al. 1980).

Telazol® (CI-744, tiletamine and zolazepam; A. H. Robins Co., Richmond, Va.) is a nonnarcotic, nonbarbiturate, injectable general anesthetic agent that has been utilized to immobilize many wild and exotic animals (Franzmann and Arneson 1974, Gray et al. 1974, Smith et al. 1983, Schobert 1987, Gibeau and Paquet 1991). Dosages in white-tailed deer have ranged from 1.1–8.9 mg/kg body mass (Gray et al. 1974, Mautz et al. 1980). Kitchen et al. (1974) suggested a dose of 3 mg/kg body mass for immobilizing white-tailed deer and reported an average restraint time of 40 minutes, 53 seconds. Fowler (1978) recommended Telazol over Rompun or etorphine for immobilizing cervids. Telazol has an apparent wide safety margin with minimal side effects (Kitchen et al. 1974, Schobert 1987). However, Schobert (1987) reported that no antagonist to Telazol had been identified.

There are no published reports of white-tailed deer immobilization with combinations of Telazol and Rompun. Approximately a 2:1 ratio of Telazol:Rompun has been used to immobilize deer in Mississippi (H. A. Jacobson, pers. commun.). We studied effects among various doses of Telazol and Rompun on white-tailed deer sedation during fall 1991 to determine relative efficacy. Our objective was to conduct a preliminary investigation to identify Telazol and Rompun doses with lowest total drug levels for effective immobilization of captive, adult male and yearling deer.

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Methods

Thirty-two captive, adult (2.5–5.5 year age-classes), male, white-tailed deer on Idlewild Experiment Station (Idlewild) and 78 captive yearling (1.5 year age-class; 50 males, 28 females) white-tailed deer on Shades Plantation (Shades), East Feliciana Parish, Louisiana, were immobilized from 27 August–10 October 1991 for this study. Deer on Idlewild were enclosed in a 7-acre pen. Deer on Shades were enclosed in either a 3-acre or a 5-acre pen. The adult bucks had been immobilized during previous years using Rompun alone to facilitate antler removal. Yearlings had not previously been chemically immobilized.

Large-animal Rompun (3–6 cc) was injected into sterile vials containing 500 mg free base (powder) Telazol and withdrawn in 1, 1.5, 2, or 3 cc amounts for administration. Doses of 250:300 mg, 250:150 mg, and 167:200 mg of Telazol:Rompun were used to immobilize adult male deer. Doses of 167:200 mg, 167:100 mg, 100:200 mg, 100:100 mg, and 83:100 mg of Telazol:Rompun were used to immobilize yearling deer. Immobilization agents were injected into 1.0-, 2.0-, or 3.0-cc tranquilizing darts (Pneudarts®; Pneu-Dart, Inc., Williamsport, Pa.) and delivered via powder dart gun [Extra Long Range (Powder) Projector®; Palmer Chemical and Equipment Co., Inc., Douglasville, Ga.] or blow-gun (Blo-Jector®; Pneu-Dart, Inc.). An additional 0.5 cc of 5% saline was added to the 250:150 mg Telazol:Rompun to fill remaining space in 2-cc darts. Yearling deer darted using the blow-gun received only 100 mg Rompun (plus Telazol) because only 1-cc blow-gun darts were available. Generally, larger doses and higher Telazol:Rompun ratios were used initially, and total drug concentrations and Telazol:Rompun ratios were lowered as additional deer were sedated over the entire period. Yearling deer under sedation were weighed to the nearest 0.45 kg. Adult bucks were not weighed. Hardened antlers were removed from all immobilized bucks. Each deer was immobilized only once for this study.

Yohimbine hydrochloride was administered intramuscularly (48 mg) and intravenously (48 mg) to all deer under heavy sedation. This antagonist was administered only intramuscularly (48 mg) to deer under low or moderate sedation. Deer not responding to antagonist administration within 20 minutes and deer with severely labored respiration received additional intravenous injections (48 mg) as necessary.

Each deer was observed during immobilization and reversal periods and the hour, minute, and nearest second of the following events were recorded: darting, down (when deer lay or fell down under drug influence), out (when deer was able to be handled), antagonist administration, head up (when deer raised its head after antagonist administration), and up (when deer regained its feet after antagonist administration). Events were not recorded if exact time was not noted. Periods between darting and when a deer lay/fell down under drug influence (down) and between darting and when a deer was able to be handled (out) were calculated to describe immobilization. Periods between antagonist administration and when a deer raised its head (head-up) and between antagonist administration and when a deer regained its feet (up) were calculated to describe recovery. Reversal periods were from initial antagonist administration for deer receiving additional antagonist injections.

Effects of dose on immobilization and reversal periods for adult males were analyzed using analysis of variance blocking on age-class. Analysis of covariance (Steel and Torrie 1980, Ray 1982) was used to examine effects of dose for yearling deer with body mass serving as the covariable. However, further analyses were performed using analysis of variance to determine effects of dose and sex on immobilization and reversal periods of yearling deer because body mass proved to be a nonsignificant covariable. Orthogonal contrasts were employed to examine differ-

ences among doses (Steel and Torrie 1980). Differences between sexes were also examined using Student's *t*-tests within individual doses. All doses and ratios reported are Telazol:Rompun.

Results

Six (24.0%) adult males darted with a dose of 167:200 mg had to be re-darted for adequate immobilization. Seven (16.7%) yearling deer darted with a dose of 100:200 mg, and 3 (8.6%) darted with a dose of 100:100 mg had to be re-darted for adequate immobilization. Times recorded for these deer are not reported and were excluded from dose analyses. Of deer darted once for immobilization, only 2 adult males received a dose of 250:300 mg, and only 2 yearling deer received each of 83:100 mg and 167:200 mg doses. Averages for these deer are reported (Table 1) but were excluded in analyses of dose effects.

Age-class did not effect down ($P = 0.29$), out ($P = 0.82$), head-up ($P = 0.74$), or up ($P = 0.52$) periods of adult males. Although there was a trend toward shorter immobilization and recovery times for adult males receiving a dose of 167:200 mg versus 250:150 mg, neither down ($P = 0.22$), out ($P = 0.13$), head-up ($P = 0.40$) nor up ($P = 0.88$) periods differed statistically between doses.

Body mass was not a significant covariable in analyses of down ($P = 0.63$), out ($P = 0.38$), head-up ($P = 0.79$), or up ($P = 0.26$) periods of yearling deer. Neither down ($P = 0.69$), out ($P = 0.10$), head-up ($P = 0.32$), nor up ($P = 0.62$) periods differed between sexes of yearling deer when included in analyses with dose effects. Similarly, there were no effects due to sex of deer ($P \geq 0.21$) on any dosage variable.

Dose influenced down ($P = 0.09$) and out ($P = 0.06$) periods of yearling deer. Doses of 100:100 mg and 167:100 mg had similar effects on down ($P = 0.54$) and out ($P = 0.76$) periods. However, deer immobilized with a dose of 100:200 mg took longer to go down ($P = 0.03$) and out ($P = 0.03$) than deer immobilized with a dose of 100:100 mg and longer to go out ($P = 0.09$) than deer immobilized with a dose of 167:100 mg. There was no difference between a dose of 100:200 mg versus 167:100 mg on down period ($P = 0.41$). There were no dose effects on either head-up ($P = 0.93$) or up ($P = 0.51$) periods.

Discussion

The combination of Telazol and Rompun immobilized captive white-tailed deer much quicker and with deeper sedation than we have experienced using Rompun alone. Therefore, potential for injury to deer or handlers was significantly reduced. Although yohimbine hydrochloride was used as an antagonist to Rompun but not Telazol, deer recovered within an acceptable period without loss of a single animal or symptoms of capture myopathy.

Although there were no differences in immobilization or recovery periods

Table 1. Average time (minutes:seconds) between darting captive, adult male, and yearling white-tailed deer with doses of Telazol and Rompun and when deer lay/fell down under drug influence (down), between darting and when deer were able to be handled (out), between antagonist (yohimbine hydrochloride) administration and when deer raised their heads (head-up), and between antagonist administration and when deer regained their feet (up).

		Down			Out			Head-up			Up		
Group	Dose[a]	*N*	$\bar{x}$ time	SE	*N*	$\bar{x}$ time	SE	*N*	$\bar{x}$ time	SE	*N*	$\bar{x}$ time	SE
Adult	250:300	2	6:00	1:34	2	14:35	6:40	2	4:37	3:03	1	7:53	
males	250:150	5	12:46A[b]	5:51	5	23:49A	9:25	5	12:54A	7:31	4	11:15A	6:44
	167:200	16	7:47A	1:20	18	15:48A	1:06	17	7:44A	2:27	19	10:18A	2:38
Yearlings	167:200	2	10.05	1:55	2	18:50	2:40	2	3:42	2:42	2	3:42	2:42
	167:100	7	4:44BC	0:35	7	10:25B	1:17	7	8:33B	2:59	7	21:49B	6:51
	100:200	22	5:30B	0:36	22	16:39C	2:22	20	10:44B	3:28	19	14:21B	4:36
	100:100	32	4:12C	0:17	35	11:30B	1:12	34	9:37B	2:31	34	12:45B	3:08
	83:100	2	2:53	0:37	2	8:25	2:35	2	1:48	0:18	2	2:43	0:28

[a]Doses are mg Telazol:mg Rompun.

[b]Means within a group and column followed by different letters are different ($P < 0.10$). Means not followed by a letter were not examined statistically because of small sample sizes.

between a dose of 250:150 mg (a 1.67:1 ratio) versus 167:200 mg (a 1:1.2 ratio) in adult males, there was a trend toward quicker immobilization and recovery for deer immobilized with a dose of 167:200 mg. However, 6 (24.0%) adult males darted with a dose of 167:200 mg had to be re-darted for adequate immobilization. The necessity for re-darting may have been higher in this group versus those darted with a dose of 250:150 mg (0.0% re-darted) due to dose, ineffective drug injection, or smaller sample size in the latter group. There were no differences in immobilization or recovery periods between yearling deer that received 100:100 mg versus 167:100 mg doses, but yearlings immobilized with 100:200 mg took longer for effective immobilization than either of those groups. Additionally, 7 (16.7%) yearlings darted with a dose of 100:200 mg had to be re-darted for adequate immobilization, but only 3 (7.9%) yearlings darted with a dose of 100:100 mg and none of those darted with a dose of 167:100 mg had to be re-darted. Yearlings darted using a blow-gun [1 cc (100 mg) capacity darts] were generally the more sedate animals. Yearlings with a more nervous demeanor immobilized using the powder gun with 2-cc darts (100:200 mg) took longer for effective immobilization and required a greater percentage of re-darts than yearlings receiving either 100:100 mg or 167:100 mg doses. This may have been due to drug ratio (1:2) or demeanor.

Variables other than drug dose can profoundly affect immobilization and recovery in deer. We have noticed effects from temperature and weather conditions, deer demeanor, time of day, and herd activity pattern. Deer with a sedate demeanor and high tolerance for people generally require lower drug doses for rapid immobilization. However, these deer may take longer to regain their feet during recovery because they have little fear resulting from close proximity of people. Immobilization also generally takes longer and may require larger doses of sedation agents in herds that have been active prior to darting. Our experience has been that chemical immobilization and subsequent recovery of deer is best under cool environmental conditions. Immobilization during the early morning, late evening, night, or even in rain are preferable during the hotter portions of the year.

Recommendations

We recommend mixtures of Telazol and Rompun over Rompun alone for immobilizing captive white-tailed deer and dose ratios of approximately 2:1 or 1:1 over a ratio of 1:2. Although we did not examine all of the following doses during our study, we suggest doses of either 100:100 mg or 167:100 mg for sedate yearling deer and doses of 150:150 mg or 200:200 mg for more nervous yearling deer based upon our results. Similarly, doses of 200:200 mg or 250:250 mg should effectively immobilize captive, adult, male white-tailed deer. Doses with larger amounts of Telazol than reported here could lead to longer recovery times because there is no effective antagonist to Telazol.

We noticed that effective immobilization often took longer as events progressed during a sampling effort. We suspect that effectiveness ("potency") of the Tel-

azol:Rompun mixture may decrease with time after mixing. We suggest use within 1–2 hours after mixing although further investigation is needed.

Literature Cited

Day, G. I., S. D. Schemnitz, and R. D. Taber. 1980. Capturing and marking wild animals. Pages 61–88 *in* S. D. Schemnitz, ed. Wildlife management techniques manual. The Wildl. Soc., Inc., Washington, D.C.

Fowler, M. E. 1978. Restraint and handling of wild and domestic animals. The Iowa State Univ. Press, Ames, Iowa. 332pp.

Franzmann, A. W. and P. D. Arneson. 1974. Immobilization of Alaskan moose. J. Zoo Anim. Med. 5:26–32.

Gibeau, M. L. and P. G. Paquet. 1991. Evaluation of Telazol for immobilization of black bears. Wildl. Soc. Bul. 19:400–402.

Gibson, D. F., P. F. Scanlon, and R. J. Warren. 1982. Xylazine hydrochloride for immobilizing captive white-tailed deer (*Odocoileus virginianus*). Zoo Biol. 1:311–322.

Gray, C. W., M. Bush, and C. C. Beck. 1974. Clinical experience using CI-744 in chemical restraint and anesthesia of exotic specimens. J. Zoo Anim. Med. 5:12–21.

Hertzog, R. E. 1975. Xylazine in exotic animals. Proc. Am. Assoc. Zoo Vet. 40–42.

Hsu, W. H. and W. P. Shulaw. 1984. Effect of yohimbine on xylazine-induced immobilization in white-tailed deer. J. Am. Vet. Med. Assoc. 185:1301–1303.

Kitchen, H., D. E. Ullrey, L. D. Fay, and W. G. Youatt. 1974. Immobilizing deer with CI-744. Proc. Am. Assoc. Zoo Vet. Pages 155–156.

Kreeger, T. J., G. D. Del Guidice, U. S. Seal, and P. D. Karns. 1986. Immobilization of white-tailed deer with xylazine hydrochloride and ketamine hydrochloride and antagonism by tolazoline hydrochloride. J. Wildl. Disease 22:407–412.

Mautz, W. W., U. S. Seal, and C. B. Boardman. 1980. Blood serum analyses of chemically and physically restrained white-tailed deer. J. Wildl. Manage. 44:343–351.

Mech, L. D., G. D. Del Guidice, P. D. Karns, and U. S. Seal. 1985. Yohimbine hydrochloride as an antagonist to xylazine hydrochloride-ketamine hydrochloride immobilization of white-tailed deer. J. Wildl. Disease 21:405–410.

Presnell, K. R., P. J. A. Presidente, and W. A. Rapley. 1973. Combination of etorphine and xylazine in captive white-tailed deer: I. Sedative and immobilization properties. J. Wildl. Disease 9:336–341.

Rapley, W. A. and K. G. Mehren. 1975. The clinical usage of Rompun (xylazine) in captive ungulates at the Metropolitan Toronto Zoo. Proc. Am. Assoc. Zoo Vet. 16–39.

Ray, A. A., ed. 1982. SAS users guide: statistics. SAS Inst., Cary, N.C. 584pp.

Roughton, R. D. 1975. Xylazine as an immobilizing agent for captive white-tailed deer. J. Am. Vet. Med. Assoc. 167:574–576.

Scanlon, P. F. and P. Brunjak. 1984. Drug immobilization methods. Pages 677–686 *in* L. K. Halls, ed. White-tailed deer: ecology and management. Stackpole Books, Harrisburg, Pa.

Schobert, E. 1987. Telazol use in wild and exotic animals. Vet. Med. 82:1080–1088.

Seal, U. S. and M. Bush. 1987. Capture and chemical immobilization of cervids. Pages 480–504 *in* C. M. Wemmer, ed. Biology and management of the Cervidae. Smithsonian Inst. Press, Washington, D.C.

Smith, J. L. D., M. E. Sunquist, K. M. Tamang, and P. B. Rai. 1983. A techinque for capturing and immobilizing tigers. J. Wildl. Manage. 47:255–259.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and practices of statistics: a biometrical approach. McGraw-Hill Book Co., New York, N.Y. 633pp.

Van Der Eems, K. and R. D. Brown. 1986. Effect of caffeine sodium benzoate, ketamine hydrochloride, and yohimbine hydrochloride on xylazine hydrochloride-induced anorexia in white-tailed deer. J. Wildl. Disease 22:403–406.