.22-Caliber *Twist Rates*

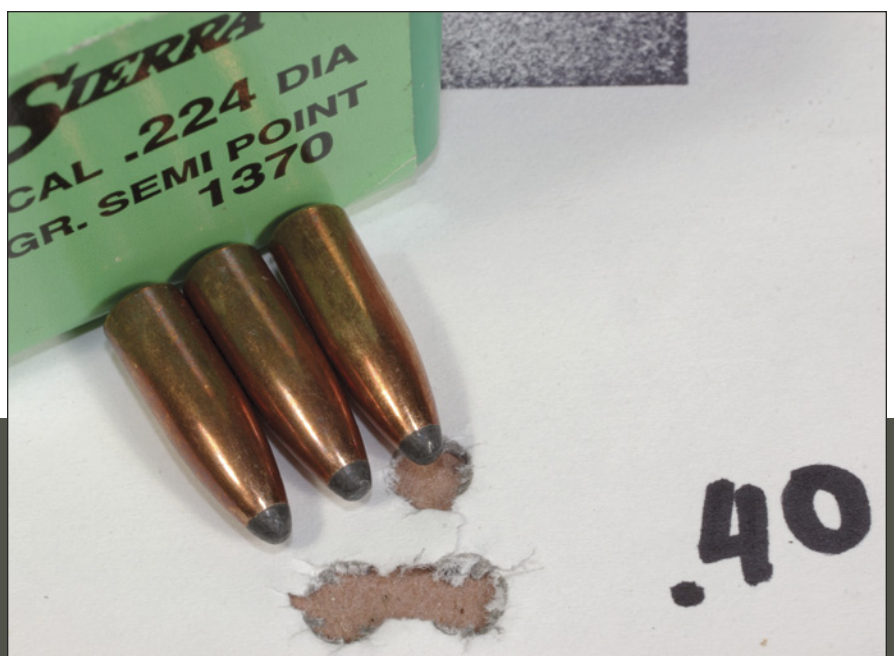
What's best, faster or slower?

By John Haviland

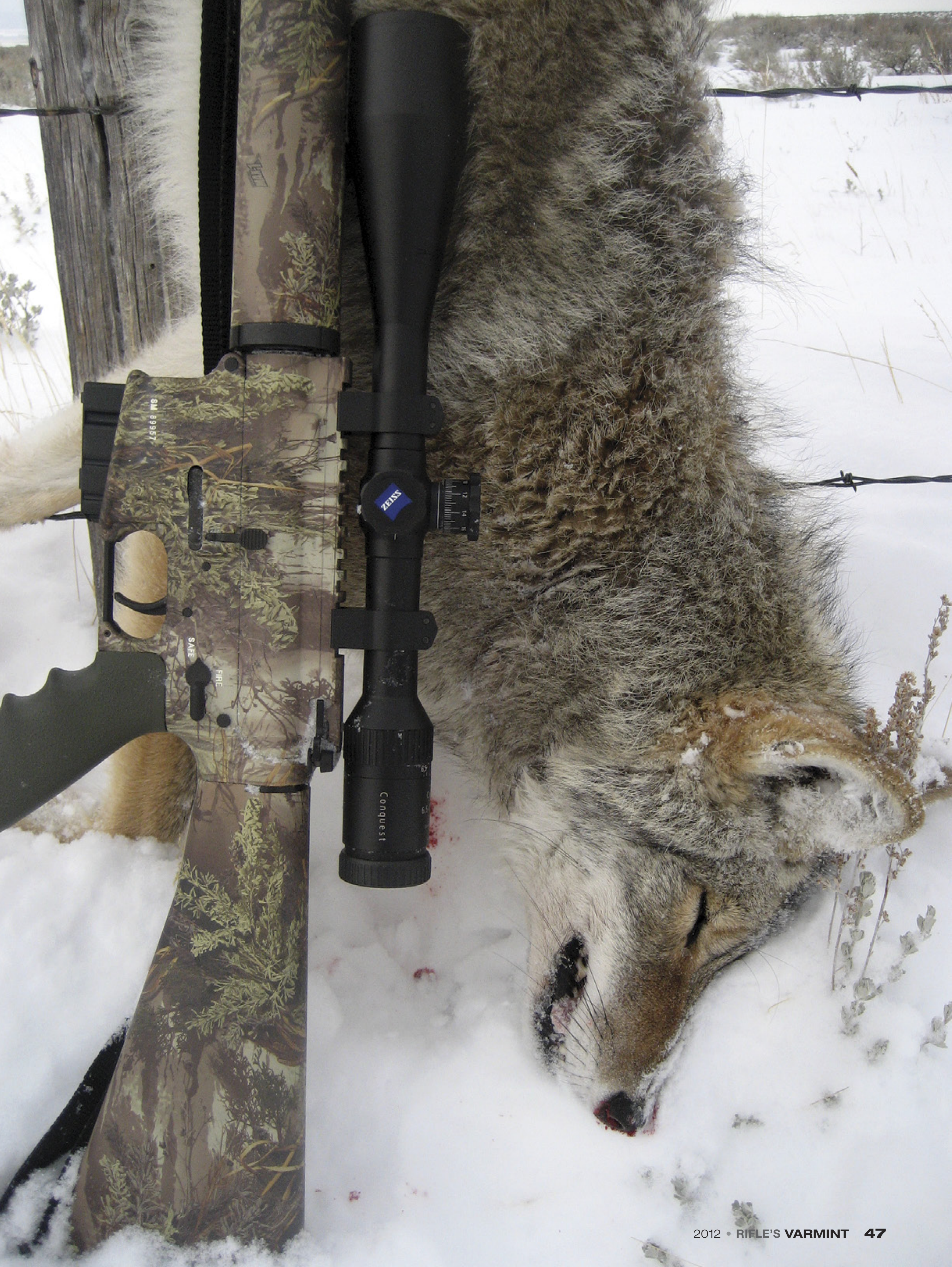
Varmint hunters shooting .22-caliber cartridges face the dilemma of which rifling twist to choose. Should they select a rifle barrel with a twist rate on the slow side for standard weight bullets, go with a sharper twist to accurately shoot heavy, sleek bullets or meet in the middle in an attempt to shoot the majority of bullet styles and weights?

This predicament is pretty much limited to .22-caliber cartridges too. A twist rate of one turn in 9 inches in a 6mm Remington or a one-in-10-inch twist in a .243 Winchester will stabilize all common .24-caliber bullets from 55 to 100 grains. The same goes for the one-in-10-inch twist in .25-caliber rifles shooting 70- to 120-grain bullets. The popularity of .22-caliber cartridges for hunting and target shooting, however, has resulted in an array of bullets weighing from 30 to 90 grains. Add bullets with spiked plastic tips and bullets comprised of copper, iron or tin that result in bullets long for their weight, and choosing a rifling twist becomes even more complex.

The "Exterior Ballistics" section of the *Sierra Reloading Manual 5th Edition* states, "It is well known that bullet stability is critical for accuracy, but it is not well understood that there are different degrees of bullet stability." Sierra ballisticians conducted a test of ballistic coefficient (BC) measurements to provide some insight into varying degrees of bullet stability and accuracy. They fired Sierra .22-caliber, 69-grain hollow-point boat-tail MatchKing bullets at a velocity of 2,800 fps, about the



Left: A heavy bullet, like Sierra's 63-grain Semi Point, fired from a .22-250 with a one-in-12-inch twist covers a lot of varmint shooting. **Right:** Coyote hunters are increasingly using ARs for their dog hunting. This one is a Smith & Wesson .223 Remington shooting 69-grain bullets.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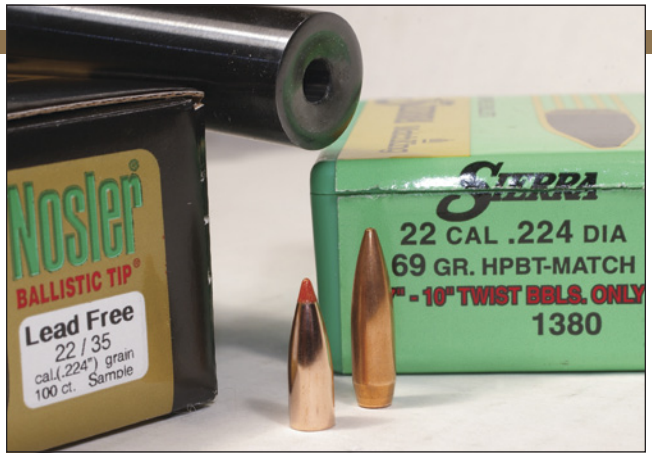
maximum velocity from a .223 cartridge, through barrels with one-in-7- to one-in-12-inch rifling twists. All BC measurements were determined by initial velocity and time of flight.

The one-in-7- and one-in-8-inch twists both had a BC value of .297. BC values began decreasing slightly with one-in-9- and one-in-10-inch twist rates. A significant decrease in BC value of .245 occurred with the one-in-12-inch twist rate. "We attribute these changes to a decrease in stability of the bullets fired from barrels with the slower rifling twist rates," the manual states. None of the bullets tumbled in flight and all hit point-first on paper, but accuracy of the MatchKing bullets declined with the slower twist rates.

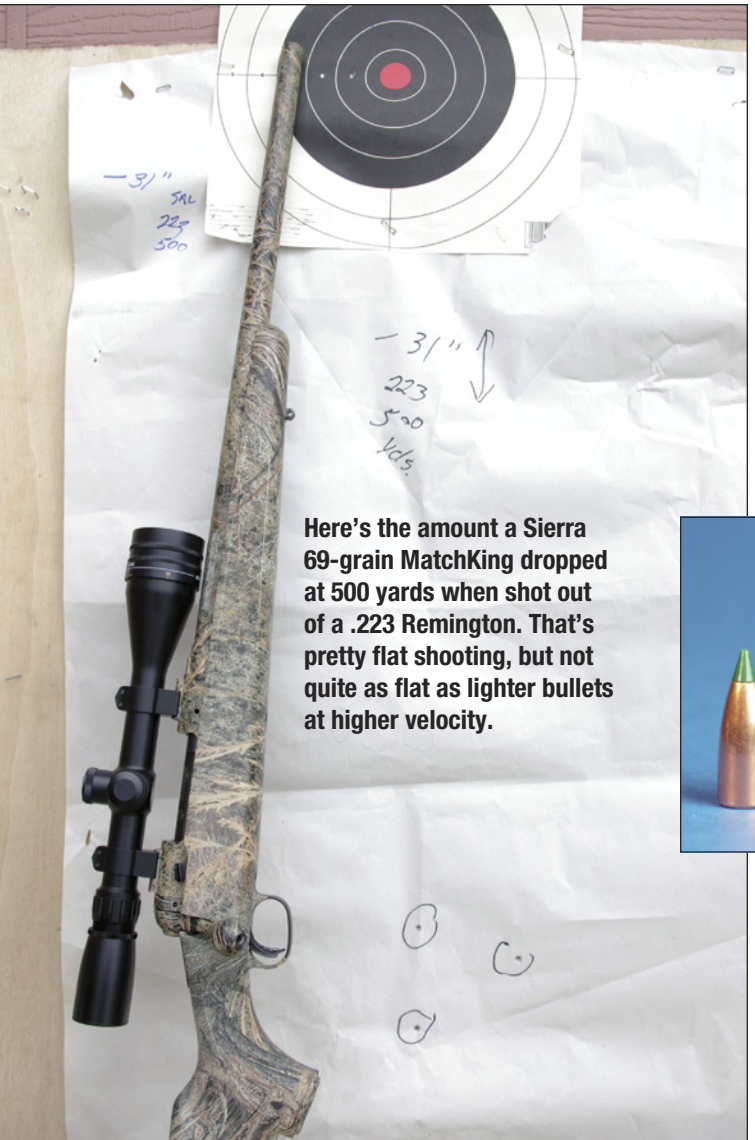
This accuracy decline was caused by an increase in the bullets' points rotating in a circular arc as they flew. This coning motion, or yaw, was minimal with a one-in-7- or one-in-8-inch twist rate. Yaw increased with one-in-9- and one-in-10-inch twist rates, and multiplied dramatically with a one-in-12-inch twist rate. "In this situation," the Sierra manual stated, "fired bullets are only marginally stable, and accuracy is usually very poor. When long, slender, heavy bullets are used in any caliber, fast rifling twist rates are necessary for good bullet ballistic performance and accuracy."



Perhaps one-in-10-inch rifling would be the best compromise for a .22-250, providing accuracy with bullets from 35 to 69 grains. The rotational force placed on bullets by that twist at .22-250 velocities might not tear them apart in flight.

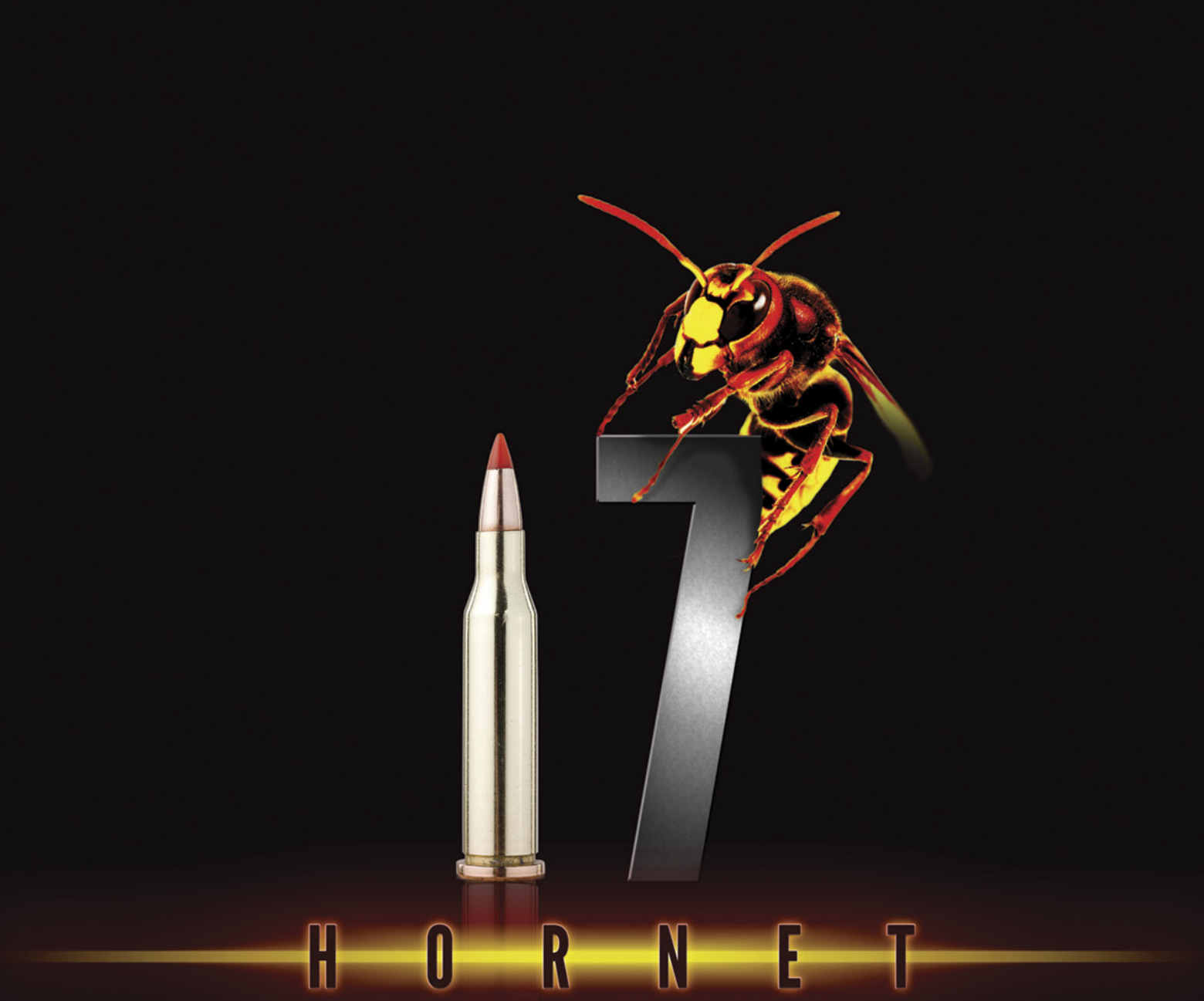
So a fast rate of twist is the way to go? Well, yes, but no. "There are upper and lower bounds to the amount of spin that can be employed in the stabilization of projectiles," according to *Military Ballistics* by G.M. Moss, D.W. Leeming and C.L. Farrar. A bullet with too little spin will tumble in flight. A bullet with an excessive amount of spin ". . . produces a round flying at larger yaw angles than are necessary. . . . Eventually, as the spin rate is made greater and greater, the response of the round to a yaw disturbance is entirely inhibited . . ." A bullet in this "superstable" condition flies point-forward for a distance, but the point turns upward to the extent the bullet eventually flies sideways.

Some folks believe relatively long bullets may be unstable until they have flown a couple hundred yards, and that groups with these bullets shot at longer distances might be comparatively tighter than groups shot



Here's the amount a Sierra 69-grain MatchKing dropped at 500 yards when shot out of a .223 Remington. That's pretty flat shooting, but not quite as flat as lighter bullets at higher velocity.

From left, bullets that shoot accurately in a .223 Remington with a barrel twist of one in 9 inches: Sierra 40-grain BlitzKing, Barnes 50-grain Varmint Grenade, Sierra 55-grain BlitzKing, Barnes 55-grain Tipped Triple-Shock, Nosler 60-grain Partition, Sierra 65-grain BTSP, Sierra 69-grain HPBT MatchKing and Nosler 77-grain HPBT.



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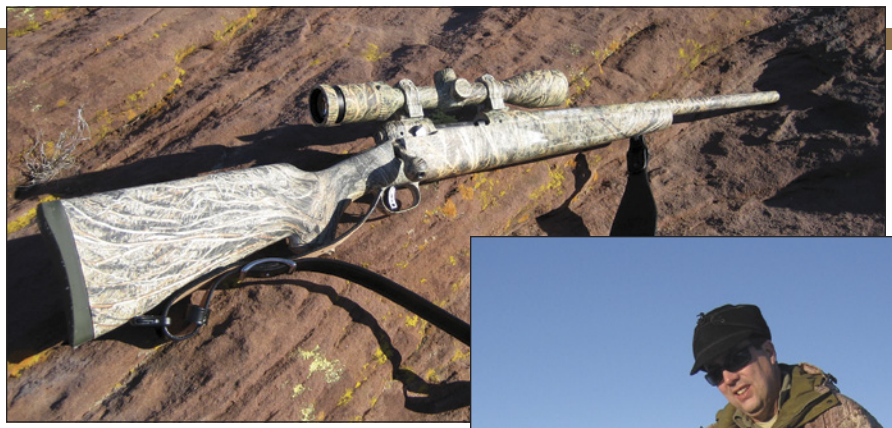
at shorter distances. According to Sierra, "Bullet coning motions usually tend to damp out as the bullet travels downrange. That is, the coning motion of a bullet is largest when it leaves the muzzle and grows smaller as the bullet flies downrange, basically because of air friction. Some shooters refer to this effect as the bullet 'going to sleep.'"

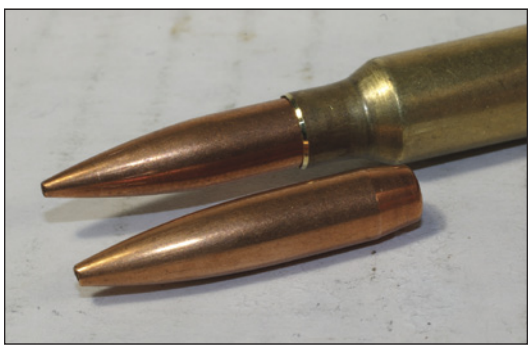
One such bullet is the .22-caliber Nosler 69-grain HPBT. It shot adequately at 100 yards with groups of about 1.50 inches from a Smith & Wesson M&P15 5.56 NATO/.223 Remington with a one-in-8-inch twist. To see how well the bullets shot at longer distances, they were also shot at 200 and 300 yards. The 200-yard group measured 1.57 inches and the 300-yard group, 2.67 inches, with three of the bullets in .87 inch. A few groups shot with one bullet fail to prove or disprove this theory of bullet stability, but there appears to be something to the premise.



Above: A .223 Remington with a one-in-9-inch barrel twist, like the Savage Predator, is useful on both prairie dogs and coyotes. Right: John took this coyote with a .223 Remington rifle shooting Combined Technology 50-grain Ballistic Silvertips. The Savage's one-in-9-inch twist could have also allowed shooting heavier bullets.

A quick rate of twist also increases a bullet's rotational spin and the centrifugal force acting on a bullet. Combine that with the higher velocity obtained with bullets of lighter weight and the resulting rotational speed can cause bullets to tear apart in flight. The M&P15 with a one-in-8-inch twist shot very well with 69- to 80-grain bullets. When I shot Sierra 50-grain BlitzKing and Hornady 50-grain Super Explosive bullets through the M&P, I could not find any bullet holes in the 100-yard target, nor a target at 25 yards. I shot a few more cartridges and happened to see a puff of black – like a handful of thrown pepper – for a split second in front of the muzzle. The spin from the one-in-8-inch twist and 3,200 fps velocity put too much rotational strain on the bullets' thin jackets, and bullets were coming apart in flight. Put that same twist in a .22-250 barrel, with 500 fps of additional velocity, and lots of thin-jacketed bullets will gyrate themselves into flecks of lead and copper.

A one-in-9-inch twist is a good choice for all-around shooting with a .223. My Savage Predator Hunter has that twist and shoots well with 40- to 80-grain bullets. Thin-jacketed, 50-grain bullets, like the Super Explosive and Sierra BlitzKing, held together and shot well as fast as I could make them fly. The Savage's one-in-9-inch twist also shot well



The only problem with long bullets in the .223 Remington, like Nosler's Competition 80-grain HPBT, is that they must be seated out of the case quite a ways and will not fit in a magazine.

with the Sierra 69-grain MatchKing with its boat-tail and long taper to nose. With 26.5 grains of Vihtavuori N540, the MatchKing bullets had a muzzle velocity of 3,022 fps. Groups were .66 inch at 100 yards, 1.08 inches at 300 yards, 3.30 inches at 400 yards and 4.00 inches at 500 yards. The copper Barnes 55-grain Tipped Triple-Shock is nearly the same length as the 69-grain MatchKing and also shot fairly well from the Savage.

Nosler recommends a minimum of a one-in-8-inch twist for its 77-grain HPBT bullets. The *Hornady Handbook of Cartridge Reloading, Sixth Edition* states a one-in-9-inch twist was used to shoot its 75-grain A-MAX bullets. So I thought the Nosler might stabilize in the Savage's one-in-9-inch twist. It did, with five of the bullets, pushed by 23.0 grains of H-4895, grouping in .73 inch at 100 yards. But there was no way NoslerCustom Competition 80-grain hollowpoint boat-tail bullets should shoot worth a hoot from the Savage, but I gave them a try with 23.0 grains of Reloder 15. To my delight, they grouped in .92 inch at 100 yards.

As the accompanying load table shows, a Cooper .22-250 with a one-in-12-inch twist shot some great groups with pointed 35-grain bullets to 63-grain semipointed bullets. Barnes's 55-grain Tipped Triple-Shock, with a length of .899 inch, was too much for the one-in-12-inch rifling. Accuracy with this bullet was nonexistent, as five of them failed to hit a three-foot square target at 100 yards. After that dismal performance, there was no sense trying Nosler or Sierra 69-grain bullets.

So, would a varmint hunter gain a ballistic advantage with a faster-twist .22-250? Not a whole lot if comparing Sierra 55-grain BlitzKings (3,600 fps) to 69- (3,250 fps) and 80-grain (3,050 fps) MatchKings. With the same sight setting at 100 yards, the 55-grain bullet drops about 2.0 inches less at 300 yards and 8.0 inches less at 500 yards than the 69- and 80-grain MatchKings. The heavier bullets do pack 100 to 300 more foot-pounds of energy at 300 and 500 yards compared to the 55-grain bullet. The 55- and 69-grain bullets drift about the same amount in a 10-mph crosswind out to 500 yards. The 80-grain bullet's drift is about 5.0 inches less at 400 yards and 8.0 inches less at 500 yards.

A one-in-12-inch twist for the .22-250 and a one-in-9-inch twist for the .223 Remington offers the most versatility and solves the dilemma of which rifling twist to shoot .22-caliber bullets. Nearly all .22-caliber bullets fired through a one-in-12-inch twist will withstand the .22-250's high velocity. If a varmint is so large it can't be terminated with a 55-grain bullet from a .22-250, it's time to contemplate retreat. A faster-than-standard twist also increases the .223's usefulness given its slower bullet velocities. ●

.22 Caliber Twist Considerations

bullet (*grains*)	powder	charge (*grains*)	velocity (*fps*)	group (*inches*)
Cooper Model 22 .22-250, One-in-12-Inch Twist, 24-Inch Barrel				
35 Nosler Custom Lead-Free Ballistic Tip factory load			3,961	.65
35 Nosler Lead-Free Ballistic Tip	Benchmark	36.3	4,193	.90
	IMR-8208 XBR	38.5	4,257	1.00
	IMR-4320	39.5	4,157	.70
40 Nosler Ballistic Tip	RL-15	37.0	3,799	.37
	TAC	38.5	4,090	1.00
	Varget	39.5	4,147	1.04
55 Barnes Tipped Triple-Shock	Big Game	38.5	–	disintegrated
55 Sierra BlitzKing	Big Game	39.0	3,566	.31
	IMR-3031	34.0	3,610	.65
	VV-N140	36.5	3,603	.56
60 Nosler Partition	IMR-4350	38.0	3,289	.98
	SUPERFORMANCE	42.0	3,495	.75
63 Sierra Semi Point	Big Game	35.0	3,132	.72
	IMR-4350	38.0	3,335	.62
	SUPERFORMANCE	42.5	3,517	.87
Savage Predator Hunter .223 Remington, One-in-9-Inch Twist, 22-Inch Barrel				
35 Winchester Supreme Lead-Free Ballistic Silvertip factory load			3,610	.40
40 Berger FB Varmint	Power Pro Varmint	27.5	3,254	.54
50 Sierra BlitzKing	Benchmark	26.3	3,381	1.31
55 Barnes Tipped Triple-Shock	TAC	26.0	3,038	1.62
55 Norma Oryx	Benchmark	25.0	3,109	1.17
	TAC	25.0	2,893	.92
	Varget	27.0	3,072	1.30
60 Hornady Spire Point	AA-2460	24.2	2,951	.54
	AA-2520	27.1	2,987	.35
63 Sierra Semi Point	X-Terminator	25.0	3,028	.72
	TAC	25.0	2,936	.78
69 Sierra HPBT MatchKing	TAC	25.0	2,862	.94
	W-748	26.0	2,883	1.14
	AA-2460	23.4	2,907	.45
	AA-2520	24.4	2,661	1.06
77 Nosler Custom Competition HPBT	RL-15	23.5	2,633	.94
	H-4895	23.0	2,711	.73
	Varget	23.5	2,622	.60
80 Nosler Custom Competition HPBT	H-4895	23.0	2,708	.81
	RL-15	23.5	2,665	.92
	TAC	23.0	2,603	.73

Notes: All five-shot groups were fired at 100 yards.

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