Shotshells

To the new shooter, the variety of shotgun ammunition available can be overwhelming. There are so many different brands, and so many different combinations of shot size, payload and velocity that is can be troubling, even for the seasoned shooter.

It is our hope that this segment will demystify the shotgun ammunition selection process.

Shot

The size of the individual shot pellet is described in the form of a number. For target shotshells, the most common pellet sizes are 7-1/2, 8, 8-1/2 and 9. 7-1/2 is the largest of the group, and 9 is the smallest. Shooters must decide whether they want a dense pattern (smaller shot) or more energy per pellet (larger shot). The general rule is that closer targets warrant smaller pellets while longer-range targets require the larger pellets.

Larger pellets provide the benefit of having more retained energy per pellet, and through the physics of momentum, retaining the higher energy levels over longer distances. Smaller pellets provide greater pattern density – there are simply more pellets spread across the pattern than one would expect to find with larger pellet sizes. The shooter is forced to choose between hitting the target harder with fewer pellets, or hitting the target not quite as hard but with more pellets.

The quality of the shot is also something that needs to be considered. Less expensive shotshells can sometimes have very soft pellets. Soft pellets tend not to pattern as well as harder pellets, which can present problems on longer targets. More expensive shotshells will usually have harder shot, alloyed lead shot, heat-treated lead shot or plated shot. Skeet shooters, for instance, are usually not too fussy about the quality of their shot because the ranges are so close, while International Trap, FITASC (International Sporting) and other shotgun target games that can present long shots at clay targets normally see the shooters with higher quality ammunition with hard or plated shot.

Some sporting clays shooters will carry several different kinds of shotshells – less expensive shotshells for close-in targets, and premium shotshells for the longer presentations. The general rule is softer shot will usually have more open patterns than harder shot, with all other factors being equal.

Velocity

The velocity of the shotshell refers to how fast the shot leaves the muzzle of the test gun at the ammunition factory, and it is usually fairly representative of the actual speed of the shot from most shotguns. In Canada, the velocity is expressed in feet

per second, or "fps". Typical shotgun target shotshells will usually generate velocities in the range of 1,150 fps to 1,350 fps. Having said that, some low recoil shotshells will produce velocities in the range of 975 fps, and some high-velocity target loads can be over 1,450 fps.

For the average shooter, normal target loads are more than adequate – the shooter needs to keep in mind they are trying to break a clay target within 40 yards in most instances. The most commonly purchased target load is a 1-1/8 oz of lead shot moving at speeds roughly around 1,250 fps. "Heavy Target" is a common term that refers to the combination of shot and a higher velocity. "Light" target loads are typically one ounce of lead shot and velocity in the 1,200 fps range, while the "Extra Light" target ammunition are 7/8 of an ounce of lead shot and speeds around 1,200 fps.

The maximum shot weight for sporting clays, trap and skeet for a 12 gauge ammunition is 1-1/8 ounces (32 grams) of lead shot, and the maximum shot size is 7-1/2. Some disciplines, such as International Sporting, known colloquially as "FITASC", have a maximum shot weight of one ounce (28 grams), while the International games of Trap (bunker) and skeet, as shot in the Olympics, allow shot payloads of no more than 7/8 of an ounce (24 grams) of shot. Sporting clays and International Sporting/FITASC have no velocity restrictions.

Some shooters believe that higher velocity ammunition reduces the amount of forward allowance required to break a clay targets. In the purest sense of the matter, this is true, but in reality, the forward allowance is reduced by inches rather than feet or yards. When one considers the ballistic properties of both the individual shot pellets as well the swarm of shot as it travels to the target, it soon becomes apparent that the higher velocity shotshells do not maintain their speed advantage throughout their entire flight. Studies have shown that shotshells with a 150 fps advantage over a comparable shotshell at the muzzle will have roughly an 80 fps advantage at 30 yards, and the advantage erodes further as the ranges increase. At approximately 45 yards, most of the velocity advantage will have vanished.[1]

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[1] While being beyond the scope of this paper, a brief discussion on the principles of exterior ballistics will shed some light on this phenomenon. Ballistic Coefficient (BC) is a term used to describe how efficiently an object passes through the air. A projectile with a high coefficient will retain its velocity better over the course of its flight.

Unfortunately, round balls do not have good flight characteristics, and they accordingly have low BCs. A generally accepted fact in the study of external ballistics is that a given projectile will have a lower BC at a higher velocity and a higher BC at a lower velocity. That is to say that a projectile will have a higher BC when it is travelling at a lower velocity, and it will therefore retain its velocity better. The same projectile, if moving at a higher velocity, will have a lower BC and it will consequently lose its velocity faster.

The result is the slower pellet will eventually catch up with the fast one, and there will come a point in their flights that will see them acting the same.

There is another school of thought that believes that higher velocity rounds often produce patterns that are inferior to those rounds with a muzzle velocity of 1,200 fps or less.

Bargain shotshells versus Premium ammunition

The new shooter is often perplexed with the varying prices of shotshells. Some ammunition is relatively inexpensive, while others, appearing outwardly the same, can be significantly more costly. Why are some more costly and others so reasonable? Is the cost difference really worth it?

The difference between the bargain shotshells and the premium needs to be assessed on the needs of the shooter. Premium ammunition is usually made with higher-quality components – better, cleaner burning powder, a better hull, more suitable for reloading, harder shot and better quality wads. These improvements can result in better patterning, increased reliability and easier cleaning of the firearm afterwards. Some ammunition with superior components are said to have noticeably better cold-weather performance. This is likely as a result of a better quality powder as well as a wad that remains soft and pliable as the temperatures drop. Some of the higher quality propellants also have longer pressure curves, which can result in a softer recoil impulse.

Another important consideration is the recoil generated by the shotshell. As the payload of shot increases in weight, so will the apparent recoil from the shotshell. Another factor that will increase the felt recoil is the velocity of the ammunition. Faster loads will produce more recoil. For those who are insensitive to recoil, a heavy load of shot at high velocity is the go-to choice. For those wanting less recoil, they should look to both reduce the shot payload as well as the velocity of the ammunition.

Dram Equivalent

Fortunately, the nomenclature of Dram Equivalent, or Dr Eq, is slowly being phased out, and more manufacturers are starting to simply indicate the velocity of the ammunition on the box. But some manufacturers still cling stubbornly to the Dr Eq, and it is something that anyone buying ammunition should be familiar with.

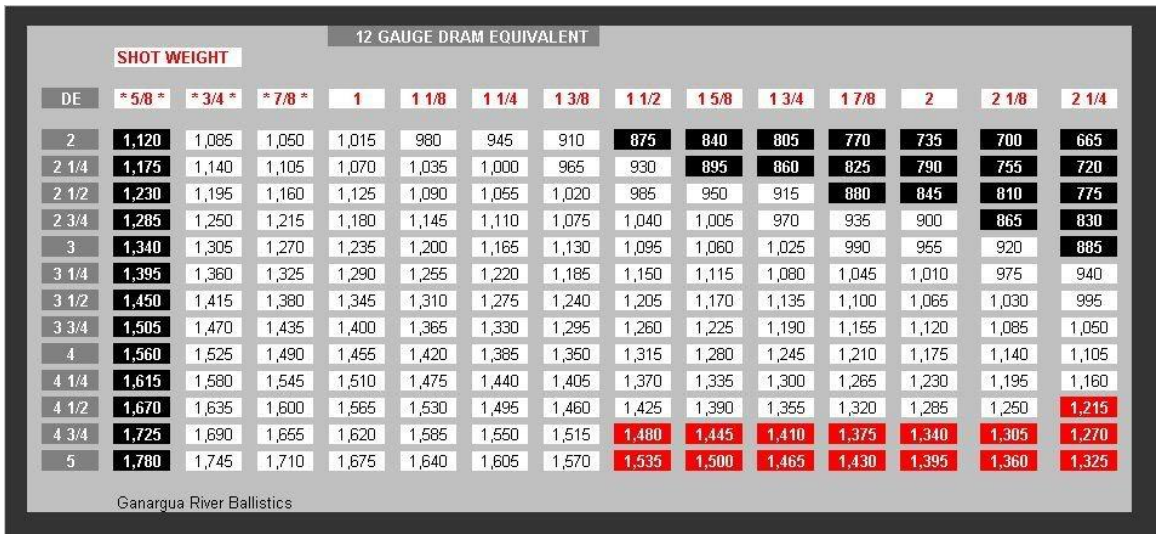
Dram Equivalent came into use when ammunition companies were making the shift from black powder shotshells to smokeless powder. Rather than put the weight of the smokeless powder used in the ammunition on the box, the industry instead decided to list the black powder equivalent on the box. That is to say that if the load with smokeless powder produced 1,250 feet per second of muzzle velocity, and in the old black powder loads it took 3-1/4 drams of black powder to produce the same velocity, the manufacturer would simply mark the box as “3-1/4 Dr Eq”, without any mention of velocity, and no mention of the actual weight of the smokeless powder in the shotshell.

This may have been fine in 1904, when people were getting used to the new smokeless powder shotshells; it is of little use to today's shooters.

As can be seen from the accompanying chart, Dram Equivalent numbers are rather complex and they change with the weight of the shot payload as well as the velocity.

Please keep in mind that this table is only for 12 gauge rounds – there are similar tables available for the other gauges, with differing values. A 4 dram load could have a velocity of 1,560 fps if the shot payload was 5/8 ounces, and it would have a velocity of 1,175 if the shot load was 2 ounces.

Thankfully, most ammunition manufacturers have moved away from the Dr. Eq. and have instead listed the velocity of the ammunition on the box.



12 GAUGE DRAM EQUIVALENT

DE / SHOT WEIGHT	* 5/8 *	* 3/4 *	* 7/8 *	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4
2	1,120	1,085	1,050	1,015	980	945	910	875	840	805	770	735	700	665
2 1/4	1,175	1,140	1,105	1,070	1,035	1,000	965	930	895	860	825	790	755	720
2 1/2	1,230	1,195	1,160	1,125	1,090	1,055	1,020	985	950	915	880	845	810	775
2 3/4	1,285	1,250	1,215	1,180	1,145	1,110	1,075	1,040	1,005	970	935	900	865	830
3	1,340	1,305	1,270	1,235	1,200	1,165	1,130	1,095	1,060	1,025	990	955	920	885
3 1/4	1,395	1,360	1,325	1,290	1,255	1,220	1,185	1,150	1,115	1,080	1,045	1,010	975	940
3 1/2	1,450	1,415	1,380	1,345	1,310	1,275	1,240	1,205	1,170	1,135	1,100	1,065	1,030	995
3 3/4	1,505	1,470	1,435	1,400	1,365	1,330	1,295	1,260	1,225	1,190	1,155	1,120	1,085	1,050
4	1,560	1,525	1,490	1,455	1,420	1,385	1,350	1,315	1,280	1,245	1,210	1,175	1,140	1,105
4 1/4	1,615	1,580	1,545	1,510	1,475	1,440	1,405	1,370	1,335	1,300	1,265	1,230	1,195	1,160
4 1/2	1,670	1,635	1,600	1,565	1,530	1,495	1,460	1,425	1,390	1,355	1,320	1,285	1,250	1,215
4 3/4	1,725	1,690	1,655	1,620	1,585	1,550	1,515	1,480	1,445	1,410	1,375	1,340	1,305	1,270
5	1,780	1,745	1,710	1,675	1,640	1,605	1,570	1,535	1,500	1,465	1,430	1,395	1,360	1,325

Ganargua River Ballistics

The following is an extract from an older Winchester Reloader's Manual[2]:

> DRAM EQUIVALENT: A dram is a measure used for black powder and is normally used as a volume measure (although strictly speaking it is a weight measure equivalent to 1/16 oz. or 1/256 lb). A certain dram charge of black powder imparts a certain velocity to a given weight of shot. For example, three drams of black powder with 1 1/8 oz. shot in a 12 gauge gun gives about 1,200 ft./sec. muzzle velocity.
>
> When the change to smokeless powder was made, the dram equivalent designation was used as a measure of the approximate velocity and shot weight of commercial loads to the dram equivalent system, but modern loadings depart from the system in a number of instances.

[2] Winchester Reloader's Manual, 15th Edition (1997) Winchester Group, Olin Corporation, East Alton, Il., 62024

Some shooters mistakenly believe a low dram equivalent is synonymous with low pressure. This is not so, as all modern shotshells regardless of dram equivalent marking, gauge, brand, powder or shot charge are loaded to approximately the same pressure level. Therefore, those who attach significance to the term “dram equivalent” in respect to chamber pressure are in error.

The main problem is that people still confuse a “dram equivalent” designation with a “dram measure” of powder and this may be serious in the case of modern fast burning shotshell powders. Taking the density of black and smokeless powders into account, a volumetric 3-dram measure of such modern fast powders is approximately 40 grains (where a grain equals 1/7000 lb.) or about a double charge.

Dram Equivalent – WARNING – Never use the dram equivalent measure as a weight for smokeless powders in reloading. Dangerously high pressures can occur and result in personal injury, property damage, or death.

Eventually, after having spoken with enough other shooters and having shot enough shotshells, almost every shooter will settle on either a shotshell or a range of shotshells that they feel are best for them.

For most shooters in Sporting Clays, where the targets are within 40 yards, just about any target shotshell will work just fine. 7/8 ounce of shot at 1,200 fps will break any clay target within this range with ease.