CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
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Project Number
S0216

Project Title
Petite or Prodigious? Is Bigger Really Better?

Abstract

Objectives/Goals
We decided to find out how the length of the barrel in a simple combustion based potato gun affects the guns range.

Methods/Materials
A potato gun is basically two pipes and reduction pieces glued together. It consists of a large combustion chamber, a barrel, a potato, an ignition system, and some sort of flammable aerosol. There is a cap on the end of the combustion chamber where the fuel is sprayed in, and a bolt through the barrel right where it meets the chamber to stop the potatoes from being pushed down too far. Each gun has some sort of fuel igniter. This can be either a flint lighter or a long ended lighter or a barbeque starter or even a taser. The lighters are inserted into the chamber and then sealed with silicone gel. The taser is connected to two bolts that span the inside of the chamber. The spark from the taser jumps the gap between them and ignites the fuel.

We made 4 separate potato guns out of ABS piping, all with identical combustion chambers and ignition systems, but varied barrel sizes, to see how much the length of the barrel affected the range that they could fire. The barrels were sized at 1 foot, 3 feet, 6 feet, and 9 feet.

Results
The 9 foot gun fired the farthest, followed by the 6 foot gun. The 1 footer and the 3 footer were both about equal.

The scientific explanation of why the biggest gun fired the farthest lies in the balance between the amount of propulsion produced in the chamber and the length of the barrel. If the barrel is too small (in the case of the one and three foot guns), then most of the propulsion is not used in accelerating the potato, but instead gets blown out of the end of the barrel and into the air. This is the reason that the smallest gun was the loudest. If the barrel is too big, the potato will receive all of the energy from the explosion, but it will not be enough to propel it past the internal friction of the barrel.

Conclusions/Discussion
The largest gun worked the best and our tests tell us that a longer barrel length is most effective.

Summary Statement
We decided to find out how the length of the barrel in a simple combustion based potato gun affects the guns range.

Help Received
Mentor helped with safety aspects, Physics teacher helped with the math equations.