WANO

WASAG USA INC.

PR Blackpowder PR

From the WANO brochure provided by WASAG USA.

WANO

Schwarzpulver GmbH & Co. Kunigunde KG

SCHWARZPULVER

BLACK POWDER

POUDRE NOIRE

POLVORA NEGRA

Portion of the cover

Black Powder

Black powder, the oldest and for a long time the only explosive, is still in use today for special fields of application for shooting and blasting purposes. This low explosive which only needs a weak confinement for its burning after ignition, is indispensable for many purposes, especially for the pyrotechnics. Black powder never detonates. The propagation velocity is max. 600 m/sec.

Due to its pushing effect, black powder is used for controlled blastings, for example for the winning of slate and in quarrying of dimension stones. It is employed for the manufacture of safety fuses, for shooting and hunting purposes and also used for military purposes.

Black powder is a mechanical mixture of potassium nitrate, sulfur and charcoal. The standard composition is 75 % potassium nitrate, 10 % sulfur and 15 % charcoal. The ingredients in given proportions will be intimately mixed, compacted and then broken in a corning mill. The black powder will be grain-classified and the resulting grades are glazed with or without graphite depending on the intended use.

The chemical composition, the compression, the granulation and the polish are decisive factors for the characteristics of every type of powder.

Our production program includes:

- Blasting powder for rock winning, etc.
- Black powder for pyrotechnics
- Sporting powder for the manufacture of sporting cartridges, for shooting with muzzle gun loader, as well as powder for cannon, mortar and for musket
- Black powder for safety fuse manufacture
- Black powder according to military specifications

We are in a position to offer black powder for all purposes. Our delivery program contains more than 150 different types.

Description of black powder and uses.

Wano black powder is produced by:
Schwarzpulver GmbH & Co.
Kunigunde KG
Kunigunde
D-3384 Liebenburg 5
Germany

At that time, 1992-93, the parent company of Schwarzpulver was WASAG CHEMIE in Germany. Later to become Wasag AG.

In 1993, the parent company in Germany, WASAG CHEMIE, decided to close the North American WASAG USA operation. The U.S. office had originally been set up to distribute WASAG CHEMIE's products in the U.S. and Canada.

Relative to black powder produced in Germany, when the "Iron Curtain" fell there was a flood of cheap explosives made in the former "Eastern Block" countries into the European markets. The U.S. was then looked to as a possible market to recover business lost in their traditional European markets.

Initially the writer's task was to determine if this German-made WANO black powder was acceptable for the U.S. shooting market. When the office manager of WASAG USA was informed that WASAG was pulling out of the U.S. market he had thoughts of investing most of his life savings in a North American distributorship. The task then became one of testing the powder against GOEX and Elephant brand black powders to see if such an investment would be a sound move.

The Office Manager of WASAG USA was a man by the name of R. Stewart Fisher. A retired Du Pont explosives man. But with no experience in black powder. In this business Stew Fisher stood out as being very honest and straightforward. Setting up a North American distributorship for WANO would have taken most of his life savings and pension monies.

Once the comparison testing was completed, the writer advised Stew not to invest his life's savings in such a venture. As time passed, it was clear that the advice had been sound.

The first container of WANO small-arms powder had arrived in the U.S. sometime early in 1992. Stored at Evenson Explosives, Inc., Morris, IL. Shipped into the U.S. packaged in 1 Kg plastic bottles. To be shipped in the U.S. the powder had to be repackaged into one pound cans.

From a flyer for prospective WANO customers provided by Evenson Explosives.

Dear Fellow Muzzleloader:

Our WANO black powder is currently packaged in plastic bottles and plastic is not approved for shipment via UPS. We are awaiting metal cans, at which time you will hear from me and your order can be processed. In addition, we will have printed literature explaining the standard of quality P series, F series, pan powder, recommended charges etc. (P is for the competition shooter and F for the sportsman). I should also note that it takes 20% less WANO powder to be comparable to a charge of GOEX.

We also handle GOEX and can mix cases in certain instances.

Current prices in case lots FOB Morris, Il.:

WANO:	F grades	$6.75/lb
	P grades	$8.95/lb
	Pan Powder	$8.95/lb
GOEX		$5.25/lb

The WANO plant in Germany had told Stew Fisher that their powder was a premium powder. That would justify the higher price, compared to GOEX's price.

Since 1972, GOEX had been the only source of black powder in the U.S. So U.S. shooters had 20 years of nothing but GOEX to shoot. That made GOEX the standard by which any other brand of black powder would be judged. Contrary to popular thinking, GOEX's production out of the Moosic, PA plant had its high points and low points in product quality as a shooter would perceive it.

The acceptability of an imported black powder would be a balance between price and quality as the shooter would perceive it. If the price is low enough, almost any black powder is acceptable to a segment of the shooters. Especially the re-enactment shooters who use mainly blank charges to make noise and smoke during battle re-enactments.

The WANO "F" grades were to be the equivalent of GOEX black powder.
The "P" grades were to be the premium grade, superior to GOEX's black powder.

The data below are the grain sizes of the “F” grades and the “P” grades of WANO black powder.

Black Powders for shooting and hunting

Sporting Powders

Sporting powders are used for the manufacture of sporting cartridges - particularly for shot guns - and for loading and shooting of muzzle loading guns.
They are produced with the following granulations:

0,2 - 1,2 mm (F)
0,2 - 0,70 mm (FFF)
0,2 - 1,04 mm (FF)
0,15 - 0,43 mm (FFFF)
0,44 - 0,70 mm (PPP)
0,70 - 0,93 mm (PP)
0,93 - 1,04 mm (P)

On account of their excellent uniformity our sporting powders enjoy a high reputation.

Cannon or Mortar Powder, granulation 0,2 - 2,0 mm

Musket Powder, granulation 0,2 - 1,0 mm

Note that with the “F” grades all of the sizes begin at 0.2 mm as the smallest size and then the top size changes to change the range of grain sizes within the mass of powder grains. This results in a 2F and a 3F with more “fines” than would be found acceptable. This concept of grain sizing was totally foreign to U.S. shooters who judged powder by uniformity of grain sizing and freedom from what would be viewed as dust and fines.

The “P” grades being screened to a more uniform grain size, claimed to promote superior accuracy with these “P” grades in the gun.

A quick look at the ballistic strength of the WANO powder compared to other brands in the 3Fg grain sizing.

Velocity data on 1993 WANO

Test rifle: .45 caliber, 40" barrel, flintlock ignition
.440 balls, .020" #40 cotton drill patches with Lehigh Valley Shooting Patch Lubricant
60 grain charges (volume measure)

1591 fps ave., WANO 3P
1625 fps ave., WANO 3F
1708 fps ave., Goex 3f, Moosic
1642 fps ave., Elephant 3f, 1998 production.

This data was run in 1998 during a comparison of Elephant to GOEX.

Prior to the 1999 shipment of Elephant powder the basic burn rate/ballistic strength of Elephant brand black powder was that of a musket type powder. With GOEX having the burn rate/ballistic strength of a rifle type powder.

Historically, 19th century, a musket type powder was 10% "weaker" than a rifle type powder. A fast-burning sporting type powder would be 10 to 15% "stronger" than a rifle type powder.

When shooting with a rifled gun the shooter must achieve a certain level of velocity to impart the desired degree of stability in the projectile being fired. The best accuracy usually being obtained within a range in muzzle velocity.

As an example of this. The writer's longrifle has a .45 caliber barrel rifled 1 turn in 56" inches. With GOEX's rifle type powder the tightest groups will be found with a charge of 60 grains of that powder. When switching to the slower musket burn rate Elephant brand black powder the charge volume must be raised to 70 grains to get the tightest groups. So with the Elephant brand black powder a pound of powder gave fewer shots from the can. The saving grace being that the Elephant brand cost about $1.00 to $1.50 less than a pound of GOEX brand black powder at that time.

So the U.S. black powder shooters will look at a powder in terms of cost per shot fired, or "bang for the buck".

In this respect, the WANO powders came up short. They were priced higher than GOEX powder and to obtain the same velocities, you had to use more of the WANO powder.

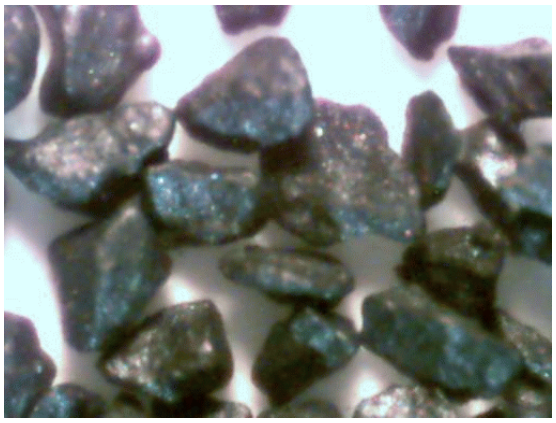
When shooting these WANO powders it was found that the “P” grades were dusty from an excess of graphite. In the patched ball rifles the powders burned rather dirty. A combination of excess graphite and the use of a high-fixed carbon content beech charcoal in the powder. The powders did burn a bit cleaner when used behind heavy conicals in the muzzleloading rifles.

The “F” grade powders showed no superiority over GOEX black powder in accuracy. The “P” grades appeared to be more accurate than GOEX until shot at high humidity. GOEX was noted for an occasional “flyer” in a string of shots. In a string of 5 shots you might see one or two flyers, depending on the particular lot and period of production being used. The “P” grades would throw a flyer or two in a string of shots when shooting at high relative humidity.

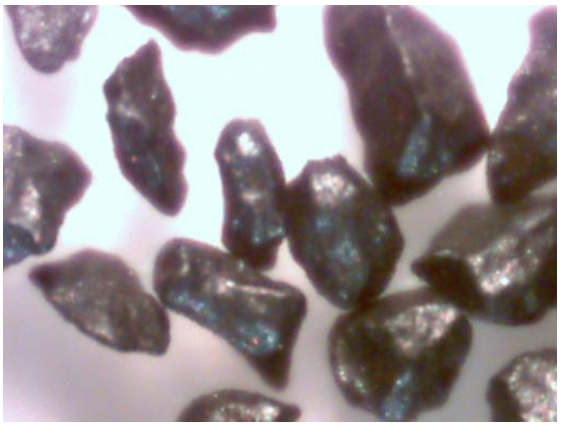
The 1993 WANO powders did not represent any noticeable improvement over GOEX black powder and cost the shooter more money to use.

Some of this 1992 shipment was still being offered for sale in the year 2002 at $6.50 per pound.

Microscope photographs of powder grains.



3Fg at a magnification of 60X.

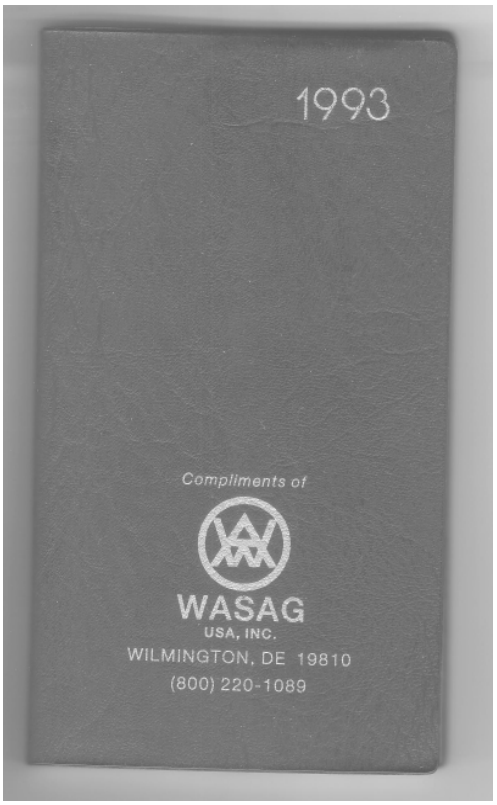


3P at a magnification of 60X.

In these 2 photos we see the basic differences between the “F” grades and the “P” grades of WANO. The “P” being more uniform in size range and the “P” grade grains have more polished grain surfaces.

1P at a magnification of 60X.

2P at a magnification of 60X.



An appointment book used as a hand out by WASAG USA in 1993.

WANO

Late 1999 Shipment To U.S.A.

During the 1999 Shot Show a representative of the WANO black powder manufacturing company approached the president of the Elephant Black Powder Company, based in Arlington, TX. The WANO representative wanted the Elephant Black Powder Company to become the North American importer and distributor for WANO black powder.

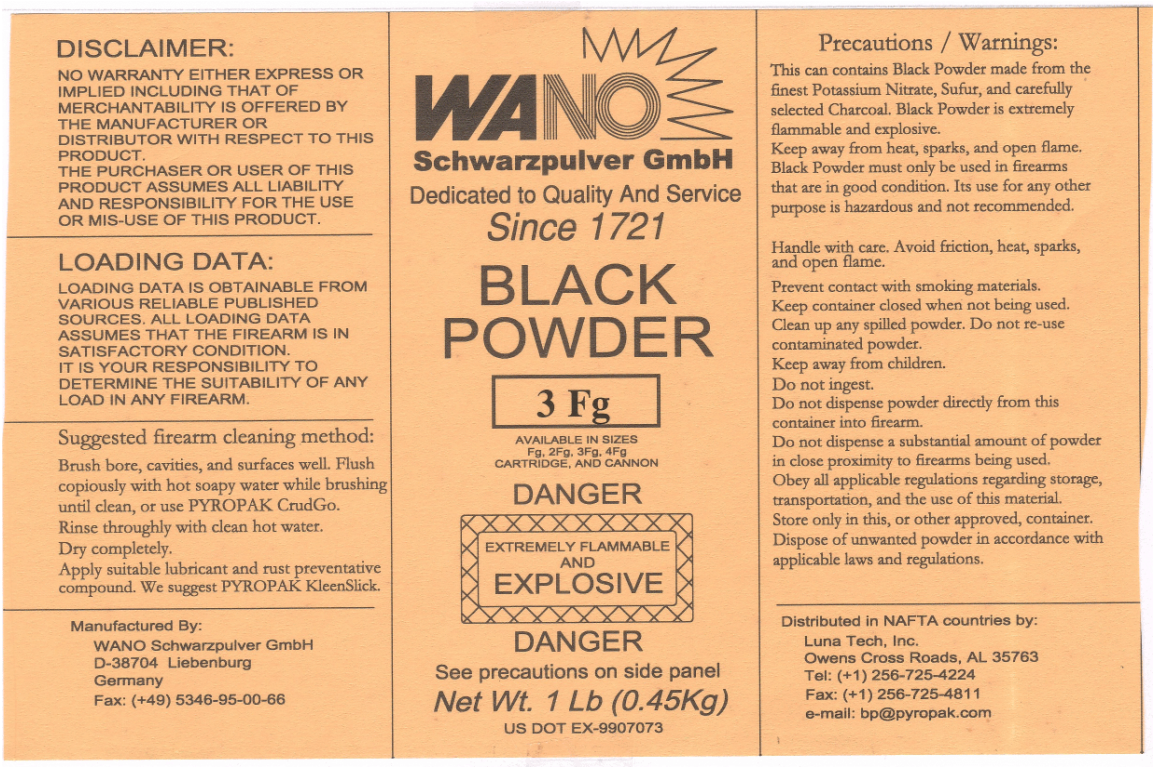
The WANO representative was informed about WANO's past experience in the U.S. market entry attempt in 1992-93. The WANO representative explained that WANO was preparing new powder for the U.S. market but that none had been shipped to the U.S. at that point in time.

In late 1999, WANO, in Germany, shipped a container of the new small-arms black powder to the U.S. To Luna Tech, Inc., Owens Cross Roads, Alabama. Luna Tech is a WANO customer using WANO black powder in Luna Tech's indoor fireworks products. Luna Tech, Inc. to act as WANO's North American distributor until one could be found.

By March, 2000, Luna Tech was able to supply samples of this "new" WANO for testing.

It was claimed that this "new" WANO small-arms black powder was better suited to the U.S. market, compared to that imported in 1992-93.

The powders were shipped to Luna Tech, Inc. in bulk packages. Luna Tech then had to locate a source of cans and have suitable labels printed and applied on the cans.

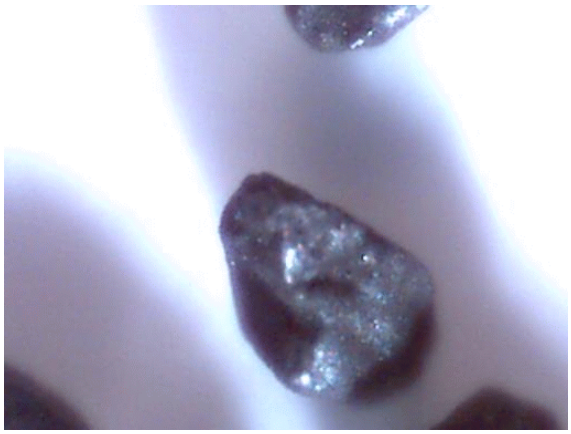


Luna Tech, Inc. can label.

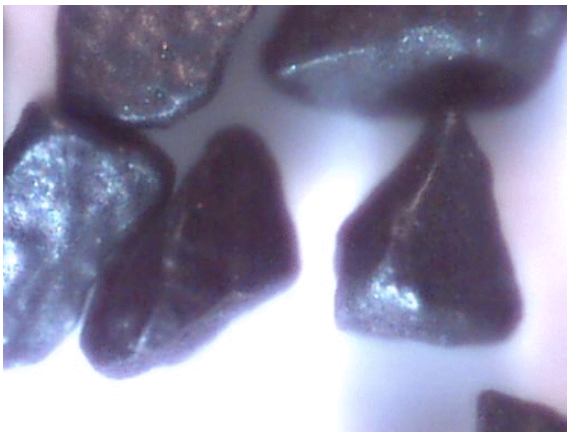
Luna Tech, Inc. advertisement in The Black Powder Cartridge News, Spring 2002.

Packed (25) 1-pound cans to a case, the $295 price comes out to $11.80 per pound. Or roughly $3 to $4 per pound more than GOEX or Elephant black powder delivered via UPS in the Lower 48 states. About $1 to $2 less per pound than Swiss black powder in 25 pound case lots via UPS.

WANO's first attempt to enter the U.S. black powder market failed for a variety of reasons, not the least of which was the quality of their powders as the shooter perceived powder quality at the time. So in looking at the WANO that went on sale in the year 2000the question is if they learned anything from the 1993 failure.



WANO 1Fg at a magnification of 60X.

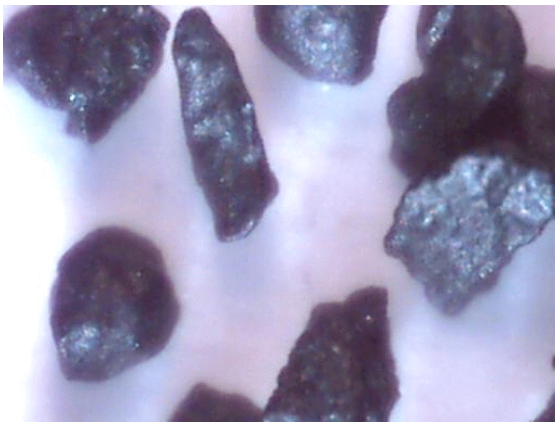


WANO 2Fg at a magnification of 60X.

Microscope photographs of powder grains.

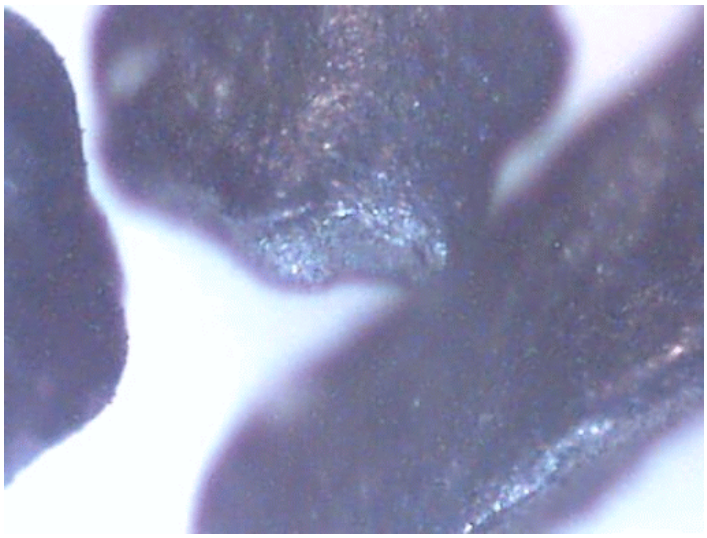
Visually, the powder is clean and free

WANO 3Fg at 10X magnification.



WANO 3Fg at 60X magnification.

of minute powder dust particles clinging to the grains' surfaces. The grains of powder are not as rounded and polished as they ought to be.



At a magnification of 200X the edges of the grains show a minimum of loose powder debris clinging to the surfaces of the powder grains.

This represents a marked improvement over the WANO that went on sale in 1993.

WANO 3Fg at 200X magnification.

Grain sizing.

Generally, 3Fg black powder is screened to pass thru a 20 mesh screen and stop on a 50 mesh screen.
WANO (2000) 3Fg.
16 mesh screen, 0% retained.
20 mesh screen, 0% retained
30 mesh screen, 55% retained. (45% thru the 30 mesh.)
40 mesh screen, 100% retained.
Nothing thru the 40 mesh screen.

This screen analysis comes fairly close to what U.S. black powder shooters would see in GOEX 3Fg.

Generally, 2Fg black powder is screened to pass thru a 16 mesh screen and stop on a 30 mesh screen.
WANO (2000) 2Fg.
16 mesh screen, 0% retained.
20 mesh screen, 33% retained. (67% thru the 20 mesh.)
30 mesh screen, 100% retained.

This screen analysis comes close to matching what U.S. black powder shooters would expect in a 2Fg grain size range.

Loading Density.

1.12 g/cc, Swiss 3Fg. (1997 production.)
1.10 g/cc, Elephant 3Fg. (1999 production.)
1.03 g/cc, WANO 3Fg. (1999 production.)

The loading density seen in the WANO 3Fg would closely match that found in GOEX 3Fg. The WANO powder would, however, benefit from better grain polishing which would raise this loading density value up closer to that seen in the Swiss and Elephant powders.

Moisture content.
Drying at 150 F to constant weight.
0.6%, WANO 3Fg.
0.5%, Swiss 3Fg.
0.2%, Elephant 3Fg.

The moisture content of the WANO powder is in the acceptable range, not to exceed about 0.75%.

Hygroscopic properties.
Increase in weight by percentage.

WANO 3Fg	Swiss 3Fg	Elephant 3Fg	Conditions of exposure
0.4%	0.4%	0.5%	82% R.H., 30 minutes.
0.6%	0.5%	0.9%	85% R.H., 1 hour.
0.9%	0.5%	1.0%	89% R.H., 2 hours.
1.1%	0.9%	1.4%	92% R.H., 3 hours.

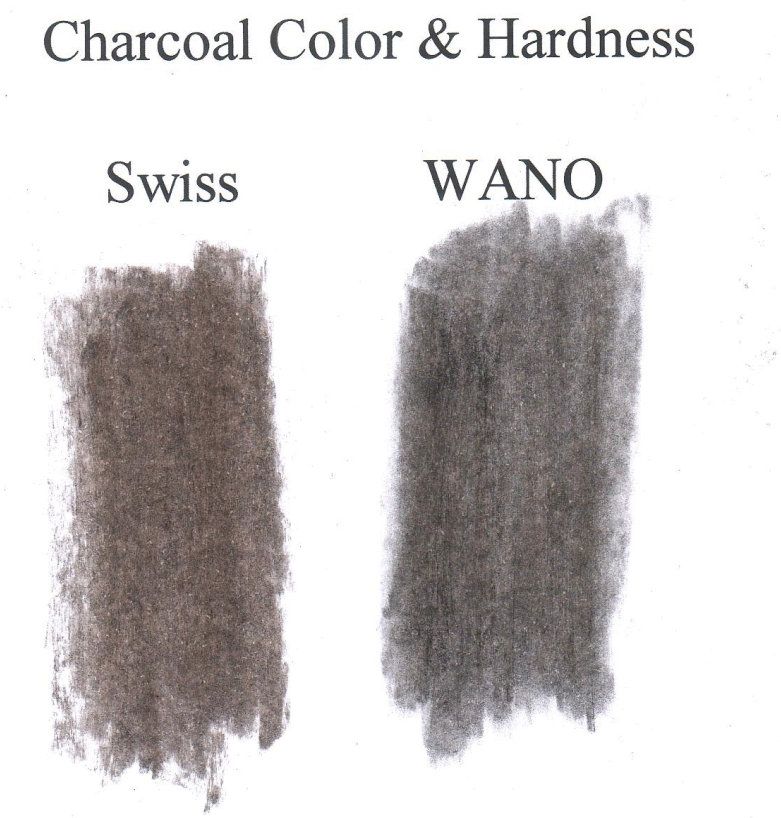
The data for the WANO is an improvement over the earlier production/shipment. This hygroscopic properties test indicates the purity of the potassium nitrate used in the preparation of a black powder along with the percentage of mineral matter associated with the charcoal ingredient.

Charcoal properties.

The WANO that went on sale in 1993 had been prepared with a beech wood charcoal. Charred to a high fixed carbon content ("over-burnt").

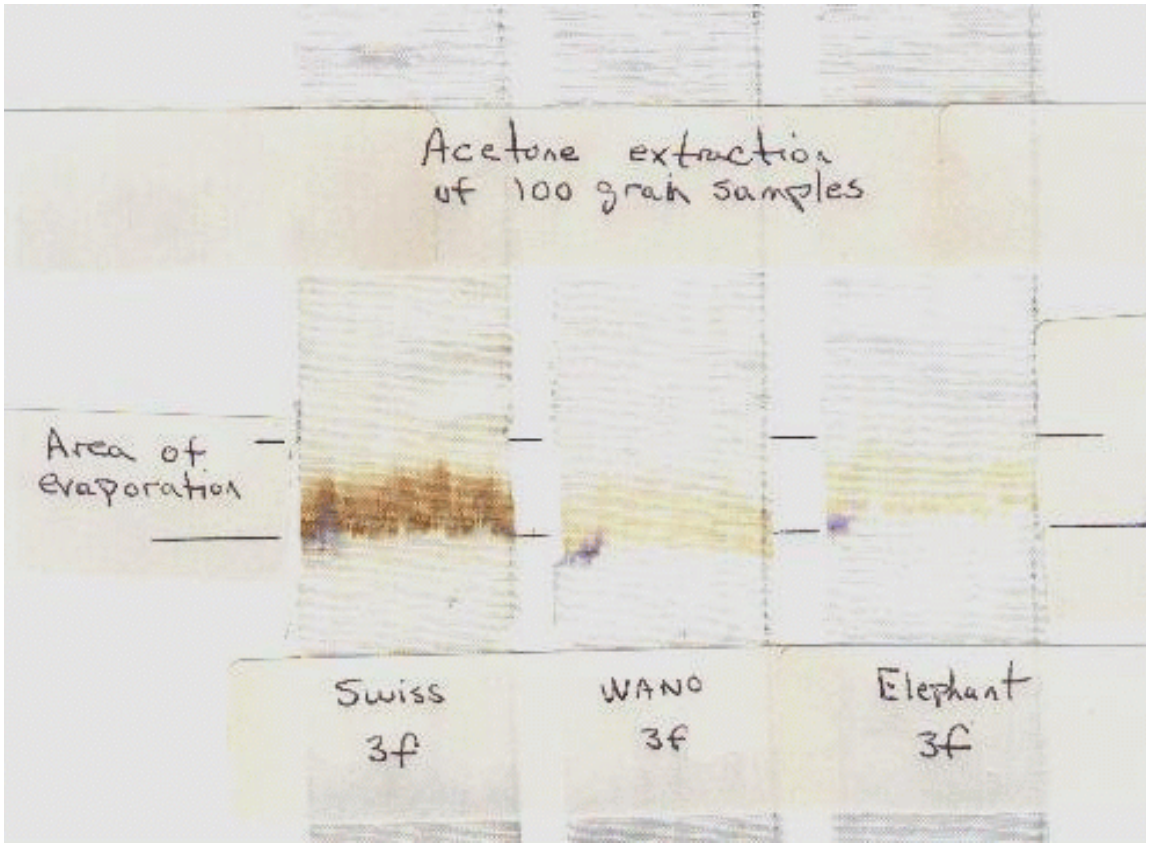
The WANO representative stated that the powder that was to go on sale in the U.S. in the year 2000 had been prepared using an alder charcoal.

There are ways of looking at this charcoal subject.



The sample of Swiss Glossy Buckthorn Alder charcoal was supplied by the Swiss black powder plant while the sample of WANO alder wood charcoal came from the WANO plant.

The Swiss char their wood to a low fixed carbon content. The charcoal is soft and



easily reduced to a very fine powder when rubbed on printer paper.

The WANO charcoal has a fairly high fixed carbon content as is seen by the black color. This high-fixed carbon char is hard and more difficult to reduce to a fine powder when rubbed on printer paper.

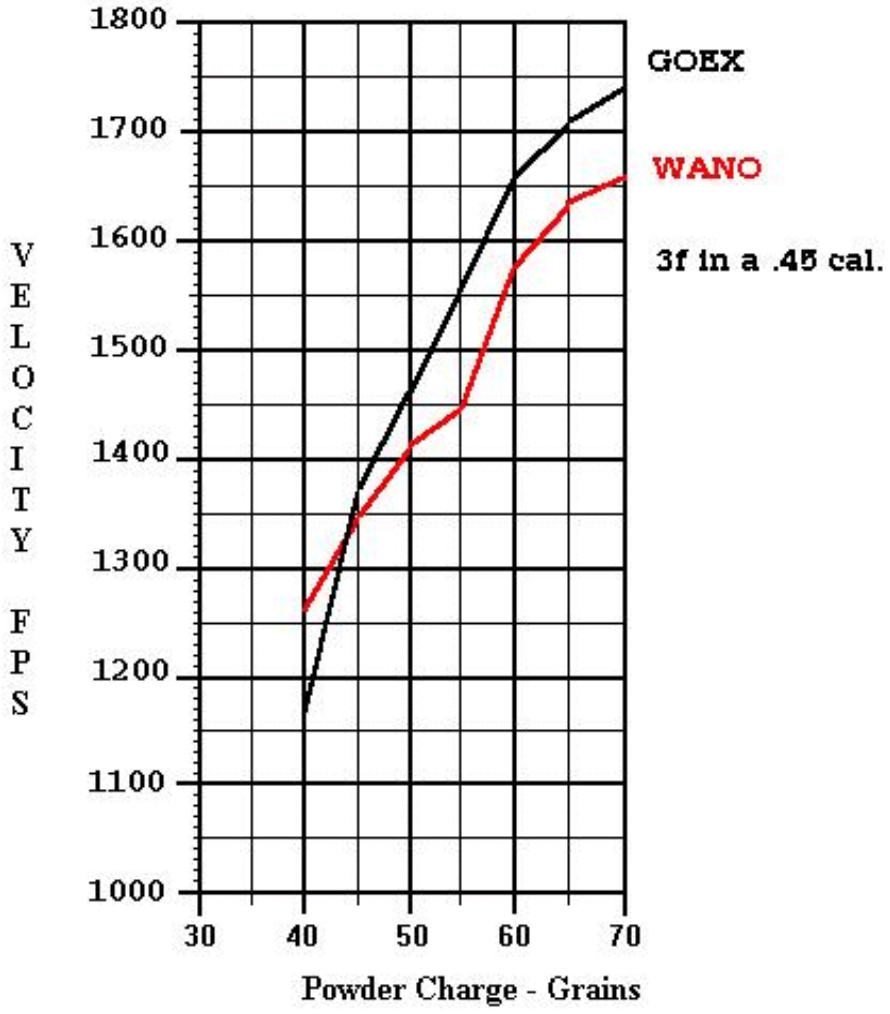
This acetone extraction test looks for oil of creosote in the powder that would be part of the charcoal ingredient if the wood used was of a certain variety and charred under very specific conditions. The creosote produced during the destructive distillation of the wood is the key to producing a "moist-burning" black powder.

If the Glossy Buckthorn Alder (Swiss powder) or European Black Alder (WANO) is charred at a high temperature (over 320 C) it will lack any measurable amount of oil of creosote and will therefore not produce water as a product of powder combustion.

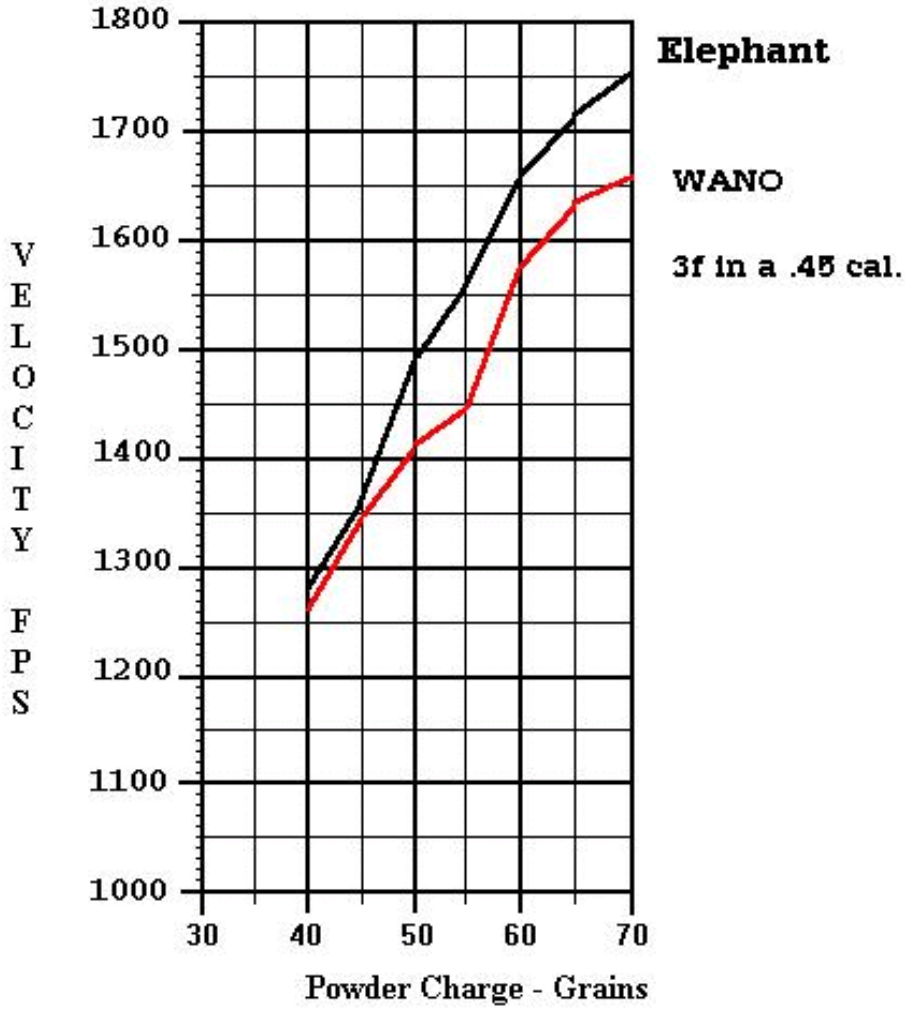
The cotton "wicks" show the presence of oil of creosote in the Swiss powder but none in the WANO charcoal and none in the Elephant charcoal. The faint color bands with WANO and Elephant being traces of dyes found in the wood.

Essentially, the WANO powder would benefit from the charring of the alder wood at a lower temperature and to a lower fixed carbon content. But this "over-burnt" alder charcoal is still considerably superior to the "over-burnt" beech wood charcoal used in the

earlie r WANO
shipm ent to the
U.S.



Test rifle:
.45 caliber TVM Southern Mountain Rifle (Jack Garner built), flintlock ignition.
35.5" barrel, 1 turn in 56 inch twist.
.440 Speer balls, .020" #40 cotton drill.
Lehigh Valley Shooting Patch Lubricant. (Lestom Laboratories, Inc. production.)



The Elephant3Fg used in this shooting was Date Code 25/99. This was the first shipment of Elephant that exhibited a rifle burn rate/ballistic strength. It took Elephant 5 years to accomplish this feat. Until Elephant matched GOEX in ballistic strength it was said to be a cheap inferior black powder. Once made up as a rifle burn rate powder it was suddenly considered to be equal to GOEX though still cheaper in price.

In essence, for this 1999 production WANO the plant made the changes suggested after the 1993 market failure but failed to correct the musket powder burn rate as had been suggested.

In the year 2000 WANO was trying to get a U.S. distributor for their black powder. After shipping the 2000 production powder to LunaTech they spoke with the people at the Elephant Black Powder Company in Texas. Given the history of the WANO powders in the U.S. it simply did not make sense to attempt to sell black powder that was lower in velocity when compared to GOEX at a price higher than that of GOEX.

With the closure of the S/A Pernambuco Powder Factory, in Brazil, in 2001 the U. S. importer of Elephant black powder had to look for another source.

WANO again contacted the U.S. based Elephant Black Powder Company. WANO had recently had a change in management. The new managers were willing to make changes in their powder to make it competitive with GOEX on the U.S. market.

It was then agreed that they would produce a black powder equal in ballistic strength to GOEX while preparing it with an alder wood charcoal that would give it something of an edge over GOEX in bore fouling characteristics.

The author then began to work with the importer in guiding WANO in what changes were required and what specifications would have to be adhered to.

In early 2001 GOEX was able to find a charcoal supplier that could supply them with an acceptable charcoal equal to that which had been supplied to them up until 1997 by the Roseville Charcoal Company. GOEX velocities took a jump up with the change in charcoal suppliers. This powder did not reach shooters until later in that year. This added a bit of complications to working up a powder for the U.S. market with WANO. The small-scale production samples matched GOEX production before the change in charcoal suppliers at GOEX. WANO had to increase the velocities in their powder for the first full-scale production run that reached the U.S. in 2003.

To digress a bit here.

There is a body of U.S. shooters who subscribe to the Buy American idea. This ignores events that are hidden from public view.

The black powder shooting sports are fairly large in the U.S. Given GOEX's history over the years the idea of GOEX being the only source for black powder in the U.S. is a little unsettling.

Gearhart-Owen purchased the black powder from duPont in 1972. Gearhart and Owen split and GOEX ended up in Pengo Industries that came out of the split.

During the early 1980's Pengo fell on hard times when crude oil prices plunged. Pengo was concentrated in the oil extraction field. In 1985 the SEC halted all trading of Pengo stocks. By 1988 Pengo was forced into bankruptcy. Pengo being bailed out by a group of investors calling themselves the Woods Group. A bankruptcy court watched over GOEX until 1996.

In 1997 GOEX shut down the Moosic, PA black powder production facility and moved the operation to an old privatized military munitions facility near Minden, LA. Setting the plant up, in part, with some used production machinery salvaged out of an idled black powder plant in South Africa.

In January of 2000 GOEX was sold to yet another investment company based in New York. In 2001 GOEX was up for sale. The business being offered to WANO, in Germany, but at a price WANO was unwilling to pay.

In 2002, the New York investment company asked WANO if they would be willing to manufacture black powder for GOEX which would then be sold under the GOEX label. WANO turned down this offer also.

The current thinking in some shooting circles is that as long as the U.S. military uses black powder they will insure that GOEX continues in business. That there is no danger in having GOEX as the only U.S. producer and supplier to the shooting sports crowd.

In truth. The U.S. military and military contractors would sell GOEX up the river in the blink of an eye. Which is why GOEX had a rider passed in congress requiring the military to use only U.S. made black powder as long as their was an operating plant in the U.S. Of course GOEX operates the only black powder production facility in the U.S. Charging the military $30 per pound for black powder. Then charging an even higher price for the “proof samples” that are in effect pre-shipment samples of lots of powder to be shipped to the military or their contractors. The main reason that GOEX had the purchase U.S. made powder only rider run through congress was that military contractors were about to switch over to WANO imported from Germany.

When one reads technical papers published by the various U.S. military groups as far back as the 1960's one sees comments on having only one supplier and the dangers of that fact.

Back to the main subject.

This will consist of 3 reports. The first being the small-scale production working up of what would become the Schuetzen Powder. The second report being the first full-scale production run. The third being a check of production the following year to see if it differed from the first run.


Schuetzen
Black Powder
Supreme Black Powder
FOR BLACK POWDER FIREARMS
DANGER!
EXPLOSIVES
KEEP OUT OF REACH OF CHILDREN
KEEP AWAY FROM HEAT, SPARKS
AND OPEN FLAME
SEE PRECAUTIONS ON BACK OF CAN
NET WT. 16 OZ (454g)
Made in Germany

William A. Knight
541&1/2 Moss Street
Reading, PA 19604-2708
Oct. 2, 2002

REPORT ON WANO BLACK POWDER SEPTEMBER 2002 SHIPMENT

1. Packaging:

Plastic Bottles.

Plastic bottles are marked “RP”, “Finland” on bottom of bottle. The bottles appear to be identical to those used by the Swiss black powder plant and are from the same source.

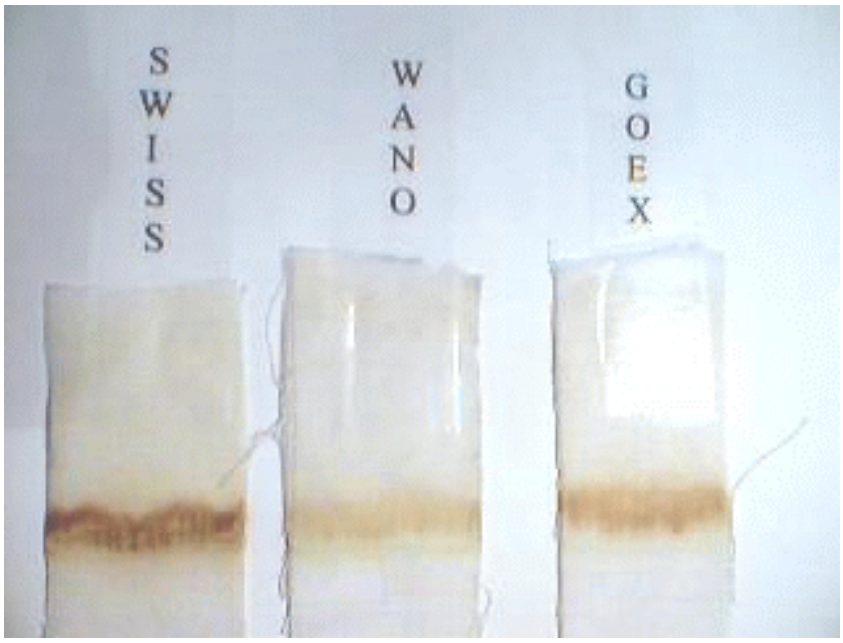
One full bottle of WANO 3Fg was placed in the freezer for 5 hours. Then removed and dropped from a height of 6 feet onto a concrete walkway. No damage to the bottle.

One bottle was sectioned into pieces with a hacksaw.
A piece of the plastic placed in water will sink to the bottom. This means that the HDPE used to blow mold the bottles has a specific gravity greater than 1.00 (sp.gr.. of water) Same as that seen in the Swiss powder bottles.

Using a micrometer, there is very little variation in the thickness of the bottles, top to bottom and on the corners.

Essentially, the bottles are of the same quality as those used by the Swiss black powder plant.

2. Acetone extraction for creosote.



Acetone extraction evaporation wicks.

Test Method.

500 grains of sample powder are oven dried for 2 hours at 150 F and then are placed in a 4-ounce glass jar. The jar is then filled with "dry" acetone. The powder is then allowed to soak in the acetone for a period of 2 hours. During this 2 hour period the mass of powder will be agitated by gently shaking the jars.

At the end of the 2 hour "soak" the contents of the jar are poured into a filter where filter paper retains all of the acetone-insoluble materials. The filtered acetone being collected in another jar. The material on the filter paper is washed with 2 ounces of acetone. Thin cotton fabric wicks cut from handerkerchief material. This are suspended with the lower edge resting on the bottom of the jar. The entire contents of the jar are allowed to evaporate from the wicks. The jars are covered with slotted lids for the filtrate evaporation. The bands of acetone-soluble fractions form on the wicks at the point where the acetone evaporates and is carried away in moving air.

Conclusions:

The Swiss black powder produces a dark-colored band that gives a strong odor of wood creosote.

The Goex filtrate produces a less intense colored band lacking an creosote odor. The band produced by Goex is simply coloring matter found in maple wood charcoal.

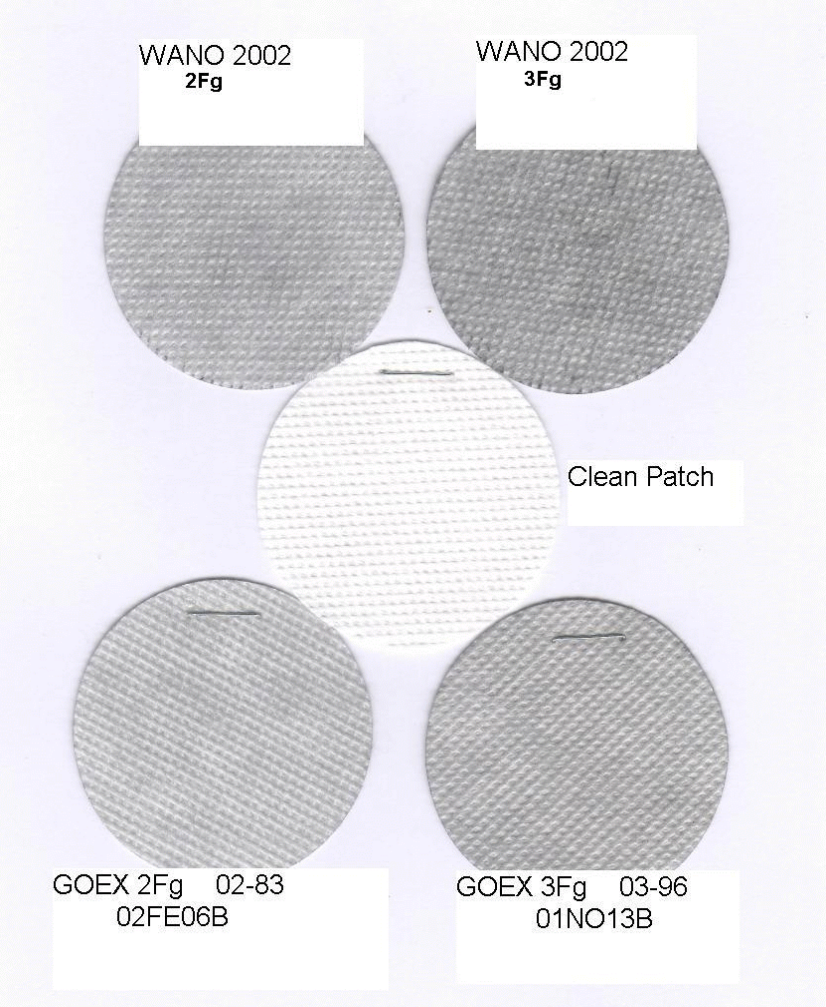
The pale yellow band seen with the Goex filtrate represents coloring matter found in alder wood charcoal. The wick gives no odor of creosote. The band shows a lack of even trace amounts of creosote.

3. For Excess Graphite.

Test method.

Four ounces of the powder to be tested are placed in a round plastic peanut butter bottle. A clean, new, white bore cleaning patch is placed in the bottle with the powder. The bottle is then tumbled, gently, end over end for a period of 2 minutes. The bottle is then opened and the cleaning patch is removed and mounted on white paper. The patches will pick up and retain and loose graphite in the powder sample. The information so provided is comparative in nature.

When pouring the WANO powder from the container it will produce a slightly visible cloud of graphite dust. The powder also leaves a coating of graphite on the funnel. Goex does not do this to the extent seen with the WANO samples.



We went through this with Elephant and the bp cartridge shooters loading cartridges from a hopper fed powder measuring device. One of the driving forces behind the "factory socking" of the Elephant brand black powder.

With the "du Pont" process (Goex) the graphite is somewhat bonded to the surfaces of the grains during the rotary tumbling drying/polishing step in the process. Toward the end of the drying/polishing cycle, in the polishing barrel, a "puff" of steam is injected into the polishing barrel which bonds to graphite to the "glaze" formed on the grains during drying/polishing in the polishing barrel. While Goex uses a rather large amount of graphite, compared to the Swiss powder, the "bonding" of the graphite to the grains' surfaces hides the actual amount used.

Results.

The cleaning patches for the WANO powders are only slightly darker than those with the Goex powders. Mainly due to the fact that the graphite found on the WANO grains is not bonded to the surfaces of the grains as is the case with Goex. The color of the patches also reflect differences between 2Fg and 3Fg in respect to surface area to mass ratios between grain sizes. For a given mass of powder, 3Fg will have a greater amount of surface area that is coated with graphite. The difference between 2Fg and 3Fg is then normal because of differences in surface area to mass ratios.

4. Moisture content.

2 hours at 150 degrees F.
2Fg, 0.5%
3Fg, 0.5%

Results.

The data shows a moisture content that would be normal for most brands of black powder.

5. Screens, or grain sizing.

2Fg.

	WANO	GOEX	KIK	Elephant
	2002	99NO03B	00.04	S-09, 22/00
20 mesh retained	50%	79.2%	35.0%	39.0%
Thru 20 mesh	50%	20.8%	65.0%	61.0%

3Fg.

	2002	99JY20C	00.04	S-10, 22/00
30 mesh retained	49%	70.8%	14.4%	58.7%
40 mesh retained	25%	26.2%	42.6%	35.1%
Thru 40 mesh	26%	3.0%	43.0%	6.2%

Results.

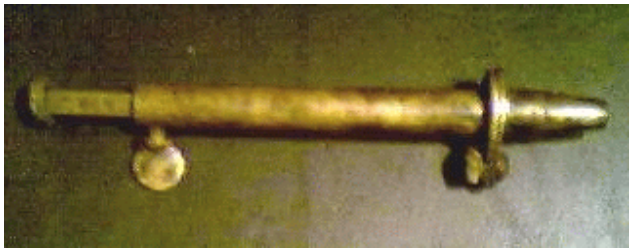
Nothing in these data would be cause for concern relative to the WANO powders.

6. Loading Density.

Test method.

Treso adjustable powder measure calibrated to throw 100 grains weight of water at the 100 setting. Internal diameter, 7/16 inch.
Lyman 500 Beam Balance reloading scale.

Calculations: 0.0648 times grains equal grams, divided by 6.4 equals grams per cubic centimeter loading density.


Treso adjustable powder measure (30 yrs. Old).

"As poured" being powder simply poured from the bottle, or can, into the measure and then leveled off with the hinged funnel attached to the measure.

"Settled" being; while the powder is poured from the container, into the measure, the measure is gently tapped to settle the powder in the measure. The attached funnel then being used to level to powder with the mouth of the measure.

GOEX

Goex, 3Fg, 03-96, packing date code 01NO14B ("old" Goex)

As poured	Settled
93.7 grains	100.9 grains
93.7 grains	101.2 grains
93.8 grains	100.3 grains
94.4 grains	100.8 grains
95.0 grains	100.4 grains
94.1 grains ave.	100.7 grains ave.
1.3 spread	0.7 grains spread
0.95 g/cc loading density	1.02 g/cc loading density

6.8% increase between as poured and settled.

Goex 2Fg, 02-84, packing date code 02MA04B ("new" Goex)

As poured	Settled
101.7 grains	103.3 grains
99.2 grains	103.3 grains
97.2 grains	103.0 grains
99.5 grains	103.3 grains
97.7 grains	103.4 grains
99.1 grains ave.	103.3 grains ave.
4.5 grains spread	0.4 grains spread
1.00 g/cc loading density	1.05 g/cc loading density

4.8% increase between as poured and settled.

Purchased two cans of Goex bp at the local Army & Navy Store at $11.95 per pound.

3Fg, 03-96, 01NO13B

As poured	Settled
98.6 grains	104.0 grains
98.8 grains	104.1 grains
97.4 grains	104.8 grains
98.3 grains	104.8 grains
98.0 grains	104.5 grains
98.2 grains ave.	104.4 grains ave.
1.4 grains spread	0.8 grains spread
0.99 g/cc loading density	1.06 g/cc loading density

10% difference between as poured and settled.

2Fg, 02-83, 02FE06B

As poured	Settled
93.2 grains	98.0 grains
93.3 grains	98.0 grains
93.4 grains	98.6 grains
93.7 grains	98.6 grains
93.8 grains	98.2 grains
93.5 grains ave.	98.3 grains ave.
0.6 grains spread	0.6 grains spread
0.95 g/cc loading density	1.00 g/cc loading density

4% difference between as poured and settled.

Purchased Sept 22, 2002 at Dixons Muzzleloading Shop
GOEX CTG, 05-35, Packing date code 02MA08B

As poured	Settled
97.3 grain	101.9 grains
98.7 grains	100.5 grains
98.5 grains	101.1 grains
95.5 grains	100.5 grains
98.2 grains	100.3 grains
97.6 grains ave.	100.9 grains ave.
3.2 grain spread	1.6 grain spread
0.99 g/cc loading density	1.02 g/cc loading density

3.3% increase between as poured and settled.

WANO

3Fg

As poured	Settled
90.0 grains	95.5 grains
90.0 grains	97.1 grains
89.1 grains	97.3 grains
91.2 grains	97.3 grains
90.5 grains	95.3 grains
90.16 grains ave.	96.50 grains ave
2.1 grains spread	2.0 grains spread
0.91 g/cc	0.98 g/cc

7.0% increase between as poured and settled

2Fg

As poured	Settled
95.5 grains	97.5 grains
95.5 grains	98.5 grains
97.3 grains	97.2 grains
94.7 grains	97.2 grains
95.0 grains	99.0 grains
95.62 grains ave.	97.88 grains ave.
2.6 grains spread	1.8 grains spread
0.97 g/cc	0.99 g/cc

2.3% increase between as poured and settled.

Summary.

3Fg WANO (2002) 0.98 g/cc, 7% settling.
2Fg WANO (2002) 0.99 g/cc, 2.3% settling.

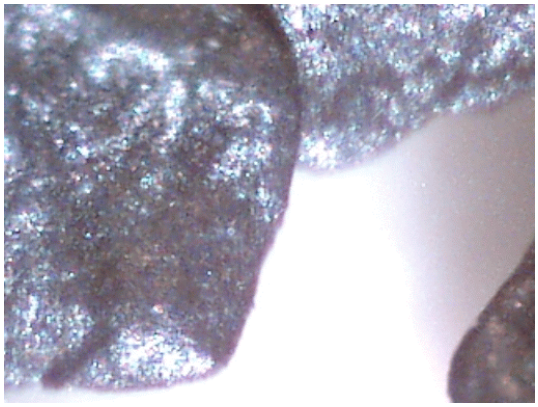
3Fg GOEX (01NO13B) 1.06 g/cc, 10.0% settling.
3Fg GOEX (01NO14B) 1.02 g/cc, 6.8% settling.
2Fg GOEX (02FE06B) 1.00 g/cc, 10% settling.
2Fg GOEX (02MA04B) 1.05 g/cc, 4.8% settling.
CTG GOEX (02MA08B) 1.02 g/cc, 3.3% settling.

While the data sets are long and boring, this point of percentage settling has an influence on accuracy in the gun relative to shot to shot uniformity.

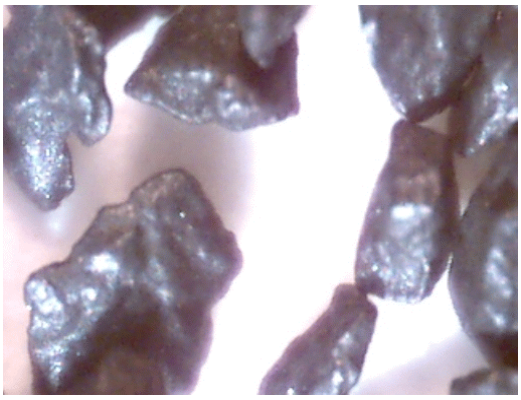
7. Microscope photos of powder grains.

2Fg powders

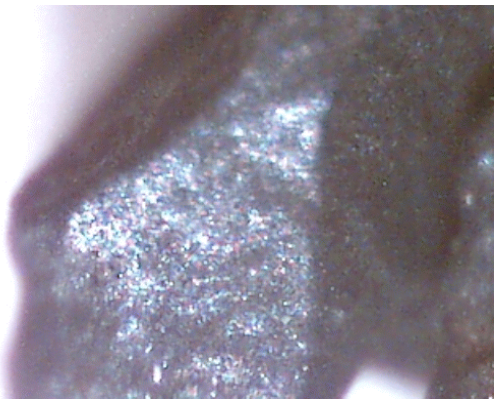
WANO 2002 2Fg, at 60X



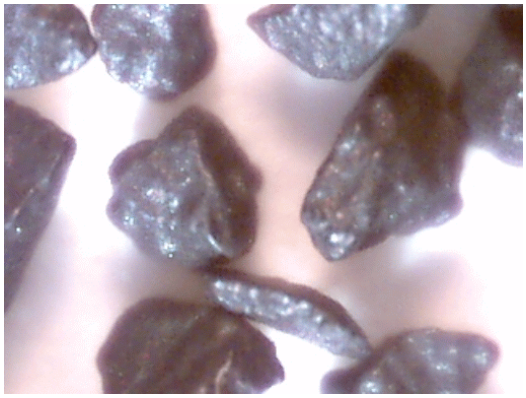
At 200X



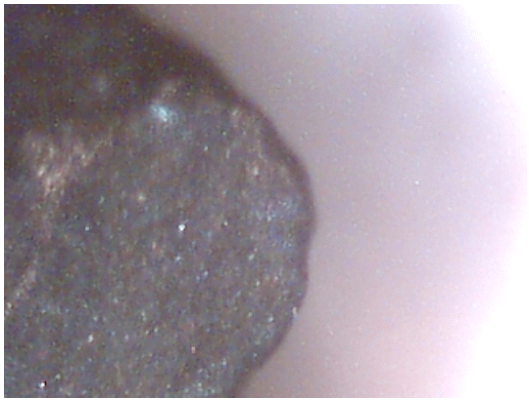
Goex, 02FE06B, at 60X



At 200X

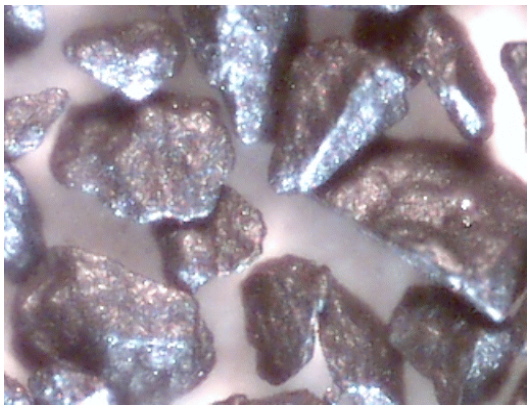


Goex, 02MA04B, at 60X

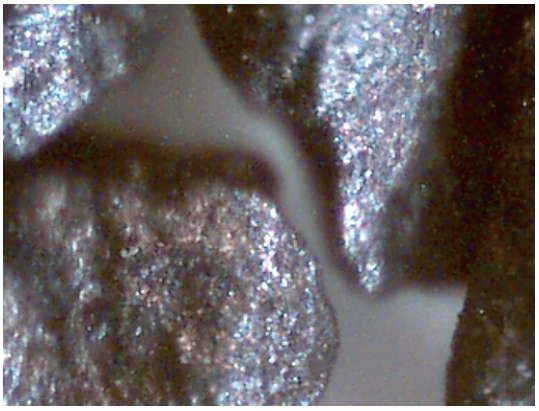


At 200X

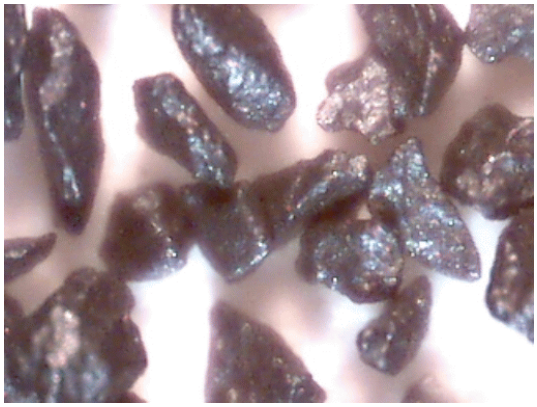
3Fg powders



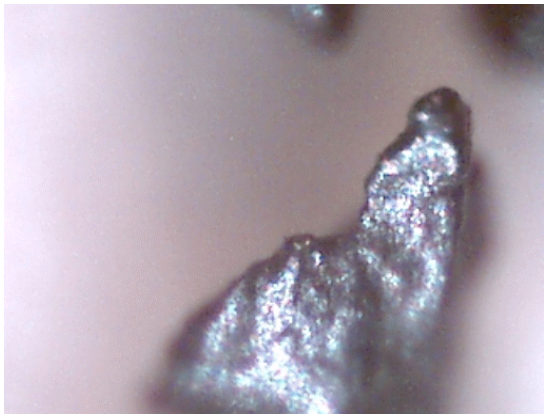
WANO 3Fg, 2002, at 60X



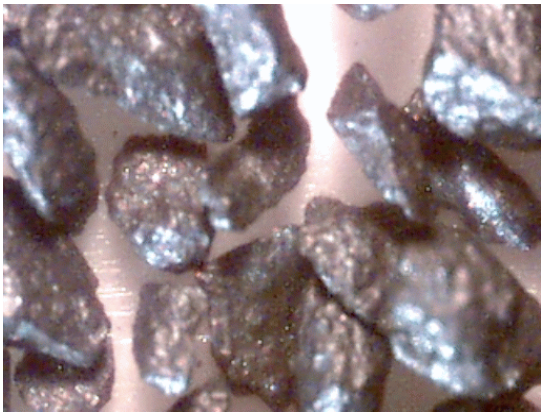
At 200X



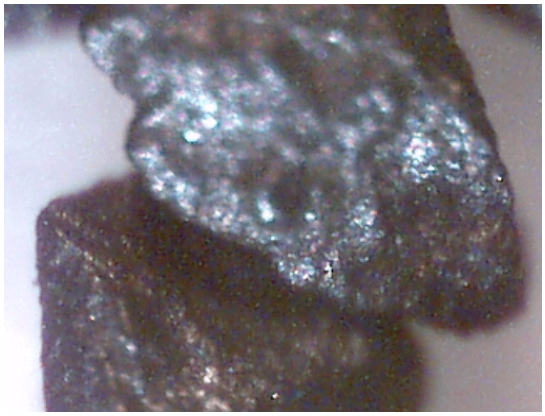
Goex,3Fg, 01NO13B at 60X



At 200X



Goex, 3Fg, 01NO14B at 60X



At 200X

Summary.

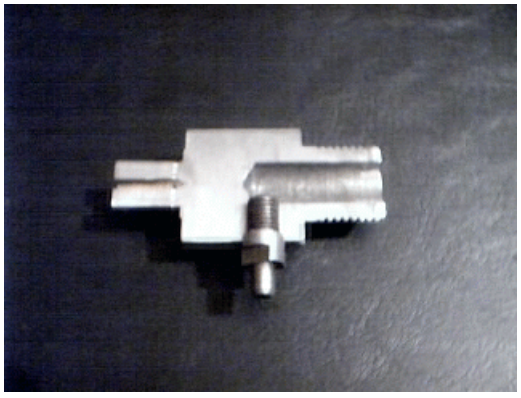
The page layout used with this microscope photos was designed to give a rapid visual comparison between the WANO powders and the Goex powders relative to how well each was polished.

When you look at the photos you see that the WANO powders are almost indistinguishable from Goex powders.

8. Velocity

Shooting on Monday, September 30, 2002.
Weather conditions during the 6 hours of shooting. Relative humidity at the start was nearly 100%, dropping to about 70% as the morning air was warmed by the sun. The temperature at the start of shooting was 65 degrees F, rising to 75 degrees F during the shooting.

Mule ear lock and percussion nipple.



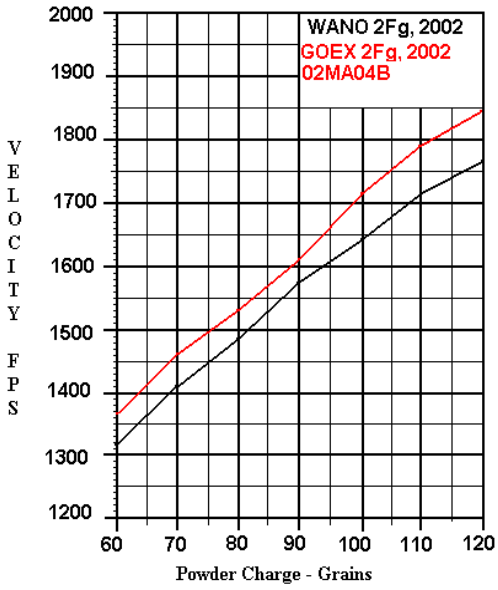
Breech plug and nipple.

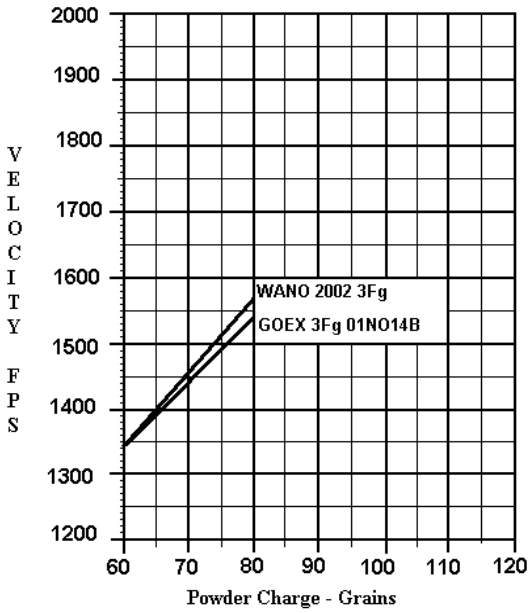
Test rifle: Lyman .50 caliber Great Plains Rifle. Thirty two inch barrel rifled 1 turn in 56 inches. Originally a flintlock ignition rifle, now a mule ear percussion lock system.
Using .490 Speer swedged balls with .020" #40 cotton drill patching. Lehigh Valley Shooting Patch Lubricant, Ox-Yoke produced.
Pact Professional chronograph, 15 feet from the muzzle of the rifle.

All charges measured by volume using a 30 year old Treso adjustable powder measure that calibrates at 100 grains weight of water at the 100 setting on the stem.

During shooting. Following the firing of a shot, the bore would be wiped with a wet cleaning patch, followed by a dry cleaning patch. The idea being that a clean bore would give more accurate Extreme Spread data.
The Mule ear percussion system has the nipple threaded directly into the side flat of the barrel. The cap then firing directly into the rear of the charge in the powder chamber in the breech plug.
This eliminates ignition variations found in the traditional “side lock” percussion system.

The first question that had to be addressed: does the 2002 WANO produce velocities close to the "new" Goex. The "new" Goex being Goex black powder lots made since January 2002 when Goex changed charcoal suppliers.





Data.

WANO 2Fg, 2002 shipment, arrived early Sept. 2002

60 grs. - 1304, 1334, 1303, 1316, 1318 = 1315 fps ave., ES 31
70 grs. - 1404, 1385, 1409, 1424, 1439 = 1412 fps ave., ES 54 (+97 fps)
80 grs. - 1489, 1483, 1471, 1474, 1502 = 1484 fps ave., ES 31 (+72 fps)
90 grs. - 1591, 1586, 1567, 1583, 1554 = 1576 fps ave., ES 37 (+92 fps)
100 grs. - 1654, 1660, 1631, 1642, 1628 = 1643 fps ave., ES 14 (+67 fps)
110 grs. - 1708, 1714, 1724, 1711, 1701 = 1712 fps ave., ES 23 (+69 fps)
120 grs. - 1740, 1733, 1772, 1787, 1798 = 1766 fps ave., ES 65 (+54 fps)

Goex 2Fg, Batch 02-84, Packing Date Code 02MA04B ("New" Goex)

60 grs. - 1371, 1362, 1370, 1357, 1366 = 1365 fps ave., ES 14
70 grs. - 1466, 1482, 1434, 1477, 1484 = 1469 fps ave., ES 50 (+104 fps)
80 grs. - 1512, 1537, 1533, 1532, 1543 = 1531 fps ave., ES 31 (+ 62 fps)
90 grs. - 1622, 1603, 1615, 1620, 1595 = 1611 fps ave., ES 27 (+ 80 fps)
100 grs. - 1705, 1736, 1741, 1692, 1717 = 1718 fps ave., ES 49 (+ 107 fps)
110 grs. - 1787, 1764, 1811, 1770, 1802 = 1787 fps ave., ES 47 (+ 69 fps)
120 grs. - 1837, 1866, 1815, 1841, 1864 = 1845 fps ave., ES 51 (+ 58 fps)

Comparing WANO to the Goex.

60 grs. +50 fps in favor of Goex.
70 grs. +57 fps in favor of Goex.
80 grs. +47 fps in favor of Goex.
90 grs. +35 fps in favor of Goex.
100 grs. + 75 fps in favor of Goex.
110 grs. + 75 fps in favor of Goex.
120 grs. + 85 fps in favor of Goex.

A note regarding this data.

Those who shoot muzzleloading rifles on a regular basis would normally use between 70 and 90 grains of powder in a .50 caliber bore such as this. It is in this range that one expects to see optimum accuracy. The lower figure for target shooting and the higher figure for hunting. The difference in velocity seen in this data is no greater than the lot to lot variation in velocity one could expect to see in Goex powder production. As additional data will show.

Comparative data in the .50 caliber GPR.

Charge	WANO 2Fg, 2002	GOEX 2Fg 02MA04B	GOEX 2Fg 02FE06B	GOEX CTG 02MA08B
60 grs.	1315 fps	1365 fps	1353 fps	1296 fps
90 grs.	1576 fps	1611 fps	1616 fps	1572 fps
120 grs.	1766 fps	1845 fps	1852 fps	1796 fps

Again we see that in the ranges a .50 caliber patched ball shooter would use we do not see any great difference between the WANO 2F and the two lots of Goex 2F and one of CTG.

A considerable number of muzzleloaders will shoot 3Fg powder in the larger caliber bores in charge volumes somewhat reduced compared to the charges of 2Fg that would be used.

Data.

WANO 3Fg, 2002
60 grs. = 1356, 1352, 1327, 1346, 1346 = 1345 fps ave., ES 29
80 grs. = 1563, 1564, 1572, 1587, 1565 = 1570 fps ave., ES 24 (+ 225 fps)

Goex 3Fg, Batch 03-96, Packing Date Code 01NO14B ("Old Goex")
60 grs. = 1365, 1347, 1337, 1340, 1348 = 1347 fps ave., ES 28
80 grs. = 1538, 1550, 1542, 1534, 1541 = 1541 fps ave., ES 16 (+ 194 fps)

When you compare the velocity data on the 3Fg samples the WANO is a bit faster in the 80 grain charge range and almost identical at the lower charge volume.

Given the high humidity during the shooting the fouling with both brands of black powder was "moist" following the discharge of the rifle. In some charge ranges the two powders appeared to be identical in bore fouling properties. In the larger charge volumes the WANO appeared to have a slight edge in the "texture" or consistency of the bore residue. A wet cleaning patch would more easily dissolve the WANO residue. The heavy cleaning rod almost falling down the bore under its own weight.

Of particular interest was the fact that the sample of CTG, "new" Goex, produced an almost tar-like bore fouling when 120 grains was fired in the .50 caliber. The 120 grain charges of WANO 2F did not give this type of bore fouling.

In another matter.

When testing the late 1999 shipment of WANO I had found that when large charges were used in the .45 caliber rifle or the .50 caliber rifle it would form narrow rings of a hard baked bore fouling. This shipment of WANO did not do that at any time during the shooting for this day's data.

Summary:

In Dec. 2001, Goex went back to a maple wood charcoal that resulted in a powder exhibiting the ballistic strength of the powder produced at the now abandoned Moosic, PA powder plant. The 3Fg ballistic data shows that this latest shipment of WANO matches the ballistic strength of the Minden Goex produced up until Dec. 2001. The 2Fg ballistic data shows the latest WANO to be just a bit slower than the so-called "new" Goex made with maple wood charcoal.

To raise the WANO velocities to those of “new” Goex would require an increase in the wheel-milling time of the WANO powder. Note the velocity graph (page 12) comparing the “new” Goex and WANO 2Fg powders. The alder wood charcoal used in the WANO powders shows good “strength” through the range of charges used. Increasing the wheel-milling time for the WANO powder would simply bump the entire line up to that seen with Goex. The graph showing the 3Fg velocities supports the idea that WANO’s present alder charcoal is capable of faster burn rates simply through increased wheel-milling times.

Referring to the comparative velocity data presented on page 13. Note the data with the Goex CTG powder. This is Goex CTG made with the maple wood charcoal. CTG is nothing more than regular production 2Fg that has been given an additional, or second coating, of graphite and an additional screening to remove dust and excess “fines”. Normally Goex CTG would produce velocities very close to the regular 2Fg lots. The data suggests that Goex’s Minden plant may still have problems with lot to lot uniformity. The type of fouling produced by this particular lot of CTG bordered on being somewhat asphalt-like in consistency in the bore. This hints at differences in lots of charcoal from their new charcoal supplier.

William A. Knight
541&1/2 Moss Street
Reading, PA 19604-2708
U.S.A.
April 5, 2003

Arrived here on March 25, 2003:
13 pounds, Schuetzen 3Fg
12 pounds, Schuetzen 2Fg

Introduction.

In Sept. 2002 the pre-production samples of this Schuetzen brand black powder were tested. Suggestions were made to improve upon the powder.

It is important to understand that U.S. black powder shooters use Goex black powder as something of a standard by which other brands are judged. This is due to the fact that from 1972 until the early 1990's this was the only brand of black powder readily available to black powder shooters in the U.S. Goex being a rifle type, i.e. rifle burn rate, powder.

With the arrival of the full-scale Schuetzen production, this work is directed at comparing the Schuetzen powder to recent Goex production.

The original concept behind this Schuetzen brand powder was to produce a powder that matches the ballistic strength of Goex while bettering Goex in other powder properties.

Loading Density.

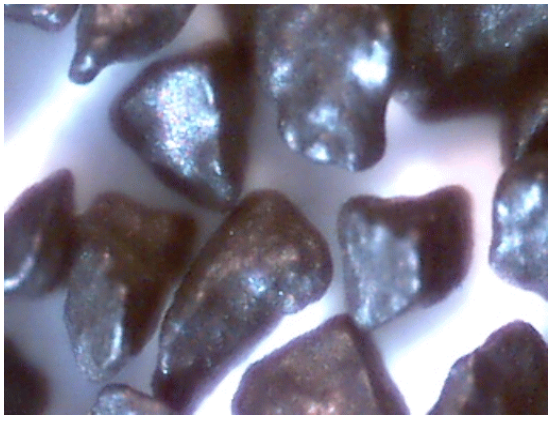
Pre-production samples.
0.99 g/cc, 2Fg
0.98 g/cc, 3Fg

Full-scale production.
3Fg = 1.05 g/cc, settled, average of 5 throws from the measure.
2Fg = 1.06 g/cc, settled, average of 5 throws from the measure.

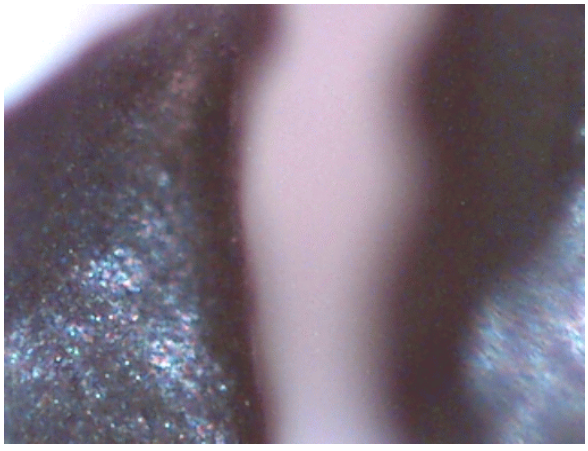
The increase in loading density is ideal. This gives the Schuetzen powders a weight to volume relationship more in line with that seen in recent (2002) Goex production lots. Black powder cartridge shooters desire a powder that comes close to the loading density seen in Goex.

The increase in loading density is reflected in the degree of polishing of the powder grains. The report on the pre-production samples of Schuetzen powder showed that while the Schuetzen loading density was below that of Goex, the degree of polish on the powder grains matched. Now with the full-scale production Schuetzen the polish is somewhat better than that seen with Goex powder grains.

Microscope photos.

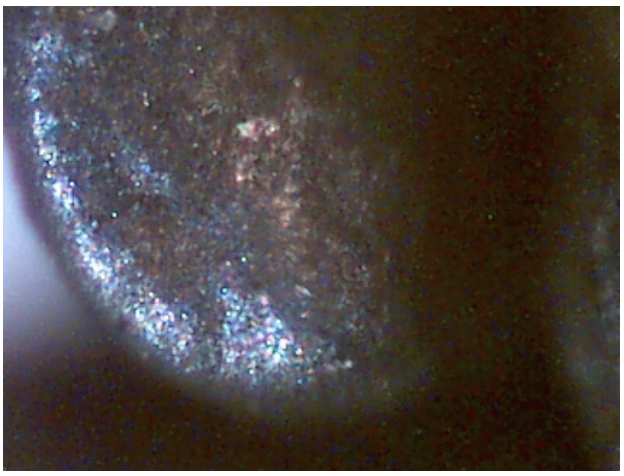


Schuetzen 3Fg at 60X.



Schuetzen 3Fg at 200X.

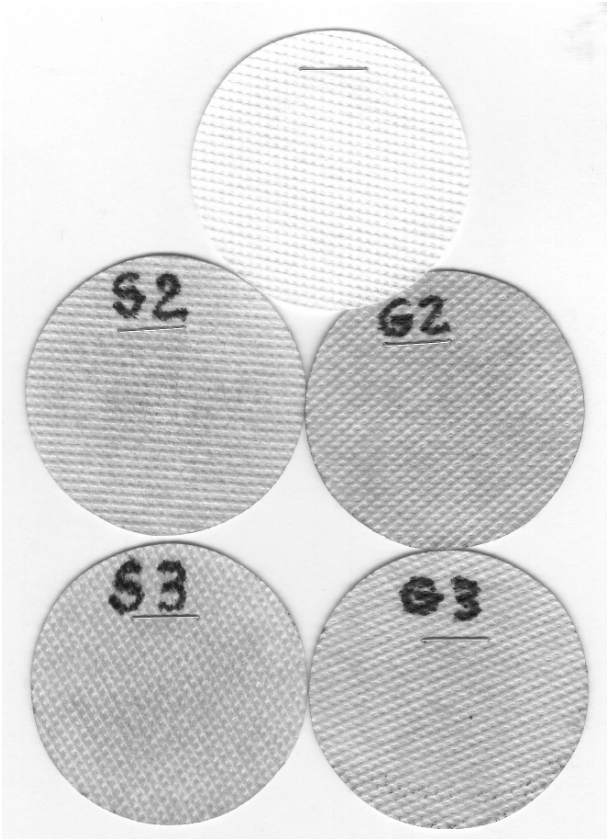
Schuetzen 2Fg at 60X.



Schuetzen 2Fg at 200X.

In the full-scale production Schuetzen powder we see a greater degree of grain edge rounded and more smoothly polished grain surfaces.

For dust and excess graphite.



In this test clean white patches are tumbled with the powder sample in a plastic bottle. The patches picking up any loose dust or graphite adhering to the surfaces of the powder grains.

Comparing “S2" (Schuetzen 2Fg) to Goex 2Fg we see that the Schuetzen is a bit cleaner than Goex.

Comparing Schuetzen 3Fg to Goex 3Fg, there is little difference.

In shooting these powders at the range. The full-scale production Schuetzen did not produce graphite dust that sparkled in the sun when the powder charge is poured into the muzzle of the test rifles. Dusting had been noted in the pre-production Schuetzen tested in Sept. 2002.

Corrosion testing for chlorides.

Samples of Goex and Schuetzen were open flashed on pieces of sheet brass and sheet copper. Then placed outside overnight to subject them to high humidity. The following days the plates were washed, dried and examined under the microscope. The residue from both powders gave surface leaching and discoloration but no pit corrosion of the metals.

Humidification of the powders.

Samples of Goex 2Fg and Schuetzen 2Fg were placed in paper trays and placed outside when the Relative Humidity rose to 90%. After two hours exposure the samples were weighed.

Both brands picked up very little moisture from the air.

In this affinity for moisture, both powders are closely matched and do not show any meaningful affinity for moisture in the air at, or below, 90% R.H.

Screens.

2Fg:
34.2% retained on the 20 mesh screen
65.8% through the 20 mesh screen.

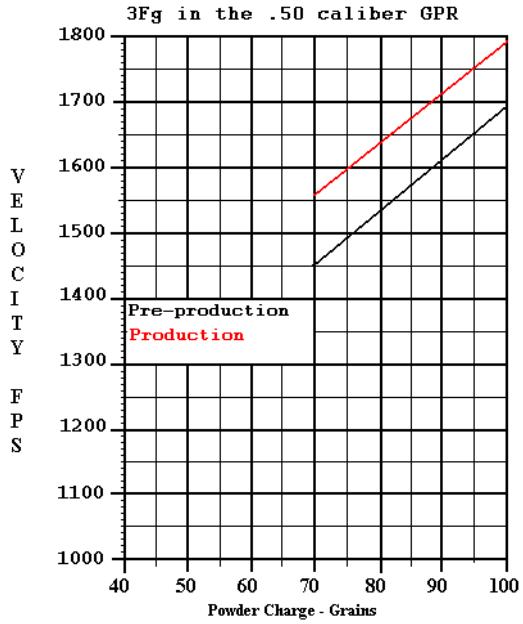
3Fg:
54.3% retained on the 30 mesh screen.
19.1% retained on the 40 mesh screen.
26.6% through the 40 mesh screen.

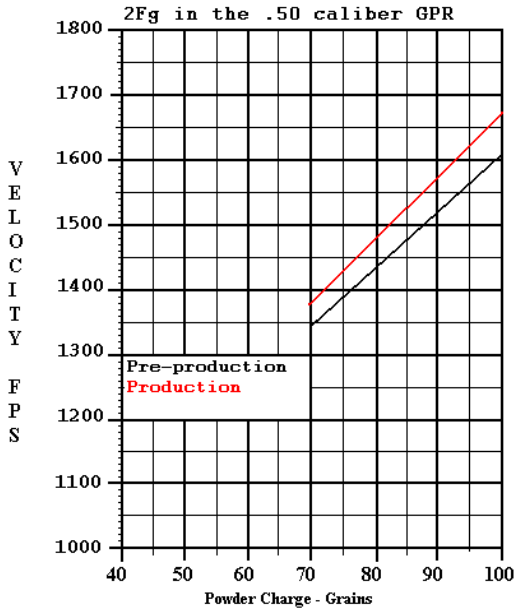
This data shows nothing unusual or unwanted in these powders. The data is in line with what had been seen in both Goex and Elephant powder lots.

Velocities.

Test rifle:
.50 caliber Lyman Great Plains Rifle, 32" barrel with a 1 turn in 56" twist.
Using .490" Speer balls, .020" #40 cotton drill patching with Lehigh Valley Shooting Patch Lubricant.
Powder charges measured by volume using a Treso adjustable powder measure calibrated to "throw" 100 grains weight of water at the 100 setting.
Pact Professional Chronograph set up 15 feet from the muzzle of the rifle.
Five shot strings with the bore damp wiped between shots.

The first issue to be addressed in this velocity testing was to compare the velocity of the full-scale production to the pre-production samples.

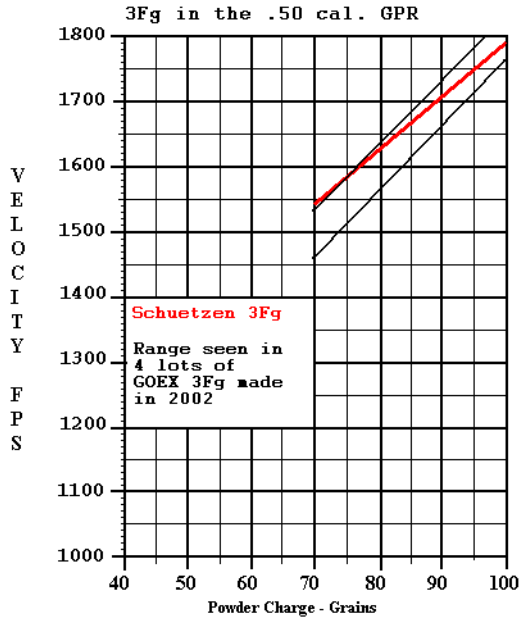


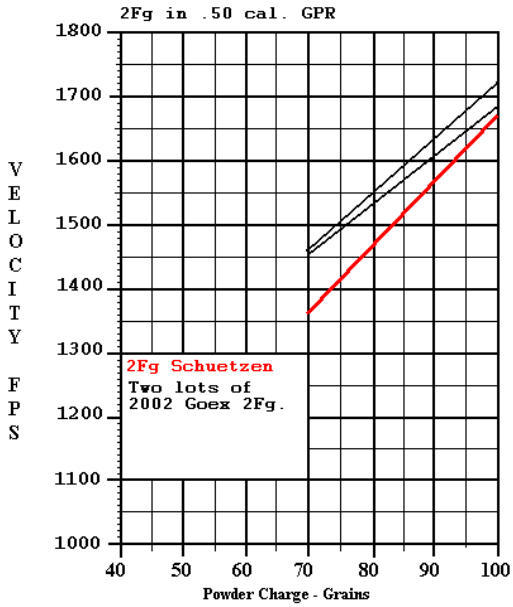


Numerical data:

3Fg	Pre-production	Full-scale	Increase
70 grs.	1450 fps ave.	1559 fps ave.	+109 fps
100 grs.	1698 fps ave.	1792 fps ave.	+103 fps
2Fg			
70 grs.	1347 fps ave.	1354 fps ave.	+ 7 fps
100 grs.	1598 fps ave.	1665 fps ave.	+ 67 fps

Initial comparison to recent GOEX production.





The initial work with the Great Plains Rifle formed the basis for additional work with another .50 caliber test rifle with a greater number of GOEX powder lots.

Test rifle:
.50 caliber Lyman Trade Rifle.
Loading with 80 grain charges, loading configuration same as with previous testing.

3Fg powders.

1860 fps ave., Swiss 3Fg, packed in plastic bottles

1403 fps ave., Elephant 3Fg, Lote 055, Date Code 25/99
1366 fps ave., Elephant 3Fg, Lote S-040, Date Code 005/01

1622 fps ave., **Schuetzen** 3Fg

1536 fps ave., GOEX 3Fg, 01NO13B packing date code (Nov. 13, 2001, B shift)
1426 fps ave., GOEX 3Fg, 01NO14B packing date code (Nov. 14, 2001, B shift)
1490 fps ave., GOEX 3Fg, 02AU01B packing date code (Aug. 01, 2002, B shift)
1663 fps ave., GOEX 3Fg, 02SE10B packing date code (Sept. 10, 2002, B shift)
(Note that this represents a 237 fps variation in one year's production!)

2Fg powders.

1658 fps ave., Swiss 2Fg, packed in tin cans

1275 fps ave., Elephant 2Fg, Lote 049, Date Code 25/99
1363 fps ave., Elephant 2Fg, Lote S-032, Date Code 004/01

1423 fps ave., **Schuetzen** 2Fg

1411 fps ave., GOEX 2Fg, 02FE06B packing date code (Feb. 6, 2002, B shift)
1485 fps ave., GOEX 2Fg, 02SE16B packing date code (Sept. 16, 2002, B shift)
1511 fps ave., GOEX 2Fg, 02OC07B packing date code (Oct. 7, 2002, B shift)
(Note that this represents a 100 fps variation in an 8 month period of production.)

How a black powder shooter will view results with Schuetzen powder will depend a great deal on what lots of Goex the shooter has been using in the past.

In Feb. 2002, GOEX changed charcoal suppliers. There was some increase in GOEX velocities as a result of this change. Which I will explain in detail.

GOEX charcoal supplier problems.

GOEX ceased operations at the Moosic, PA black powder facility in June of 1997. Their safety record precluded continued operations at that plant which had formerly been owned and operated by Du Pont.

From 1973 until 1997, GOEX's Moosic, PA black powder plant had been supplied with charcoal by the Roseville Charcoal Company. Roseville Charcoal Company owned and operated a small wood charring operation in the state of West Virginia. Charring mainly maple wood specifically for sale to GOEX. Roseville being GOEX's only supplier and GOEX being Roseville's primary customer. When GOEX closed the Moosic, PA powder plant in June of 1997 it sealed the fate of the Roseville Charcoal Company. GOEX did not start up their then new Minden, LA powder plant until early March 1998. The Roseville Charcoal Company ceased operation shortly after GOEX closed the Moosic, PA powder plant.

So GOEX began operations at Minden with Roseville Charcoal Company maple charcoal that had been in stores when the Moosic, PA plant had been closed. When that supply was exhausted, GOEX had to search for other charcoal suppliers. As a result, the quality of their black powder plummeted. Minden produced powder was considerably slower than powder produced at Moosic.

At the time this was going on the main competitor to GOEX was Elephant. The plant in Brazil using a palm tree wood (imbauba) to manufacture their charcoal. This imbauba palm tree would could not be used to prepare a rifle burn rate powder with any degree of consistency.

In early 1998, GOEX agreed to distribute the Swiss sporting type black powder in the U.S. But GOEX would not market this powder in anything akin to an aggressive manner. GOEX had spent 25 years convincing the American black powder shooters that GOEX black powder was the best and fastest black powder the world has ever seen. In essence, they had a vested interest in burying the Swiss powder as far as the U.S. market goes.

By mid-summer of 1999, the Swiss became disenchanted with Goex and terminated their agreement.

The Swiss then signed an agreement making the Elephant Black Powder Company the U.S. importer and distributor for their powder. The Elephant Black Powder Company then began to market the Swiss sporting powder aggressively.

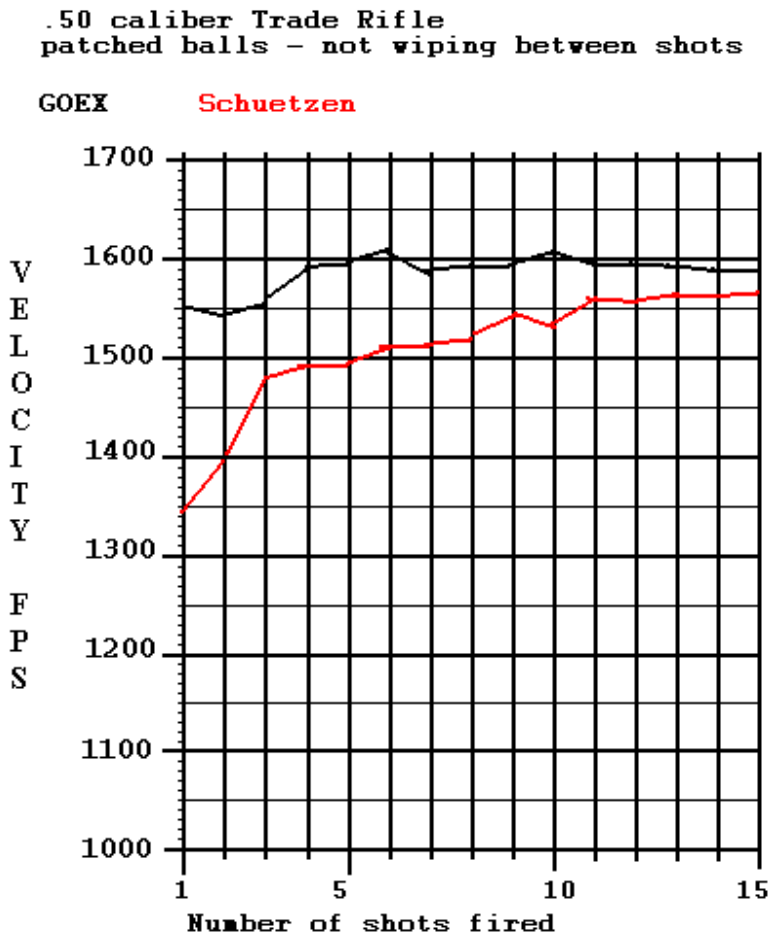
The Swiss sporting powder then began to bite into Goex sales to a good portion of the competition shooters. While the Swiss sporting powder is rather expensive you use less of it so the over the counter price per pound is mitigated.

When the GOEX velocity data is viewed in chronological order it appears as if GOEX was slowly increasing the velocities in their powders to better compete with the Swiss black powder.

When Goex learned that the S/A Pernambuco Powder Factory (Elephant) had ceased operations it appeared to them that their only competition would be the Swiss powder. While the Swiss sporting burn rate powder is far faster than a rifle burn rate powder in patched ball guns the difference in velocities between the Swiss and GOEX diminishes with increasing projectile weights. A few .45-70 shooters had commented that the post-Feb. 2002 Goex gave slightly higher velocities compared to Swiss 1&1/2Fg in .45-70 cartridges with heavy bullets.

Microscopic examination of various lots of 2002 production Goex showed that Goex was doing a better job of polishing their powder when compared to previous lots dating to 1999, 2000 and 2001.

Bore fouling, Schuetzen versus GOEX.



This work looks at the accumulation of powder residue in the bore of the rifle when the rifle's bore is not wiped between shots.

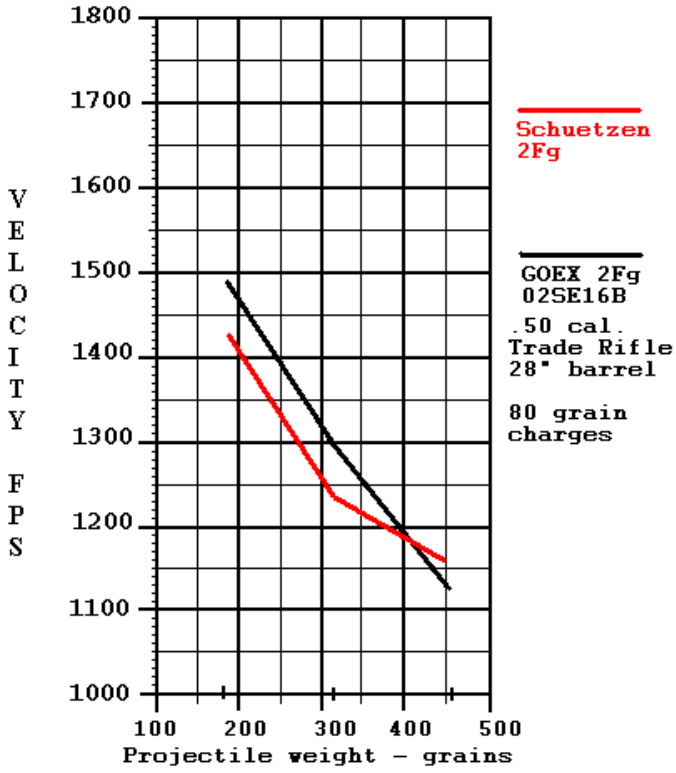
The weather at the time of shooting was 70 to 75 degrees F and the Relative Humidity at 35%. Bore fouling was somewhat dry in nature.

This particular rifle has very shallow rifling grooves and is rather sensitive to bore fouling when the bore is not wiped between shots.

In doing the velocity testing previously listed it was noted that when changing brands or grain sizes there would be a difference in how many shots were required to reach an equilibrium state where the data would level off.

The amount and consistency of the fouling produced by the powder regulates this. The number of shots that are required to reach an equilibrium state is a good indicator of how a particular powder fouls the bore. The 200 fps rise in the Schuetzen data shows that on a per shot basis it will foul less than GOEX.

Schuetzen 2Fg, velocities with increasing bullet weight.



Going back to a comment on Page 9. That being the reports that post-Feb. 2002 gave higher velocities than Swiss 1&1/2 Fg in .45-70 cartridges with heavy bullets.

With black powder, there are times when a slow powder may look "fast" and times when a "fast" powder looks slow.

This relates to the respective powder's burn rate and the ability to convert rising pressures to projectile velocity.

The graph represents some exploratory work in this area of interest.

Additional work to be carried out using Schuetzen and Swiss powders with .50 caliber bullets of varying weights.

This graph was prepared using three different bullet weights. The future work will use 6 different bullet weights.

The weather here in southeastern Pennsylvania, at this time of year, is a period where we will have rain at least 3 or 4 days a week. Accuracy work will begin next week as the weather permits. At this point in time there is nothing to suggest that the Schuetzen powder cannot match or beat Goex for accuracy.

At 61, all of my rifles are able to shoot better than I am able to sight them. I don't consider myself to be expert in accurate shooting.

Summary.

The concept behind this Schuetzen powder was to produce a rifle burn rate powder that would match GOEX velocity/ballistic strength with improved bore fouling characteristics through the use of an alder wood charcoal.

Testing of the full-scale production Schuetzen powder shows that the project has been successful.

The future and reputation of this Schuetzen powder will depend on the ability to produce the powder with a lot to lot consistency better than that seen in GOEX production. Lot to lot consistency is one of the hallmarks of the Swiss black powder and one of the main reasons why black powder cartridge shooters prefer it over GOEX powders. It is important that WANO show good control over lot to lot consistency. Beating GOEX in the velocity department is not as important as lot to lot consistency as long as there is no major velocity deficiency in velocity with Schuetzen powder.

William A. Knight
April 5, 2003

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William A. Knight
541&1/2 Moss Street
Reading, PA 19604-2708
June 9, 2004

2004 Schuetzen shipment

The goal in this work was to compare the 2004 shipment of Schuetzen brand black powder to the 2003 shipment to look at production run consistency in powder properties and to see how this powder compares to the most recently available GOEX Rifle powder production.

Powder samples used in this work:

Schuetzen 2Fg, 2003 shipment, no lot number identification.
Schuetzen 3Fg, 2003 shipment, no lot number identification.
Schuetzen 2Fg, 08.01.2004, WP-04A0002
Schuetzen 3Fg, 15.01.2004, WP-04A0003
GOEX 2Fg, 02-95, Date Code 03AU18B
GOEX 3Fg, 03-10, Date Code 03MY01B

Screens.

Schuetzen 2Fg.
41% on 20 mesh, 59% thru 20 mesh - 2003 shipment.
40% on 20 mesh, 60% thru 20 mesh - 2004 shipment

Schuetzen 3Fg.
52% on 30 mesh, 48% thru 30 mesh - 2003 shipment.
54% on 30 mesh, 46% thru 30 mesh - 2004 shipment.

Excellent control of grain sizing!

The 2004 powders did however have a bit of polishing barrel debris/dust that should have been removed prior to packaging.

Loading Density.

Using a Treso adjustable powder measure that is calibrated to throw 100 grains weight of water at the 100 setting on the sliding stem with a volume of 6.4 cc at this setting.

3Fg powders.

First shipment, 2003.

As poured.
100.8 grains weight average of 5 throws from the measure, or 6.53 grams.
1.02 g/cc
1.5 grains weight variation in 5 throws from the measure.
Settled.
105.6 grains weight average of 5 throws from the measure, or 6.84 grams.
1.07 g/cc
2.7 grains weight variation in 5 throws from the measure.

0.31 grams increase, or 5% increase in weight, as poured versus settled.

Most recent shipment, 2004. 15.01.2004, WP-04A0003

As poured.
96.66 grains weight average of 5 throws from the measure, or 6.26 grams.
0.98 g/cc
2.0 grains weight variation in 5 throws from the measure.
Settled.
102.2 grains weight average of 5 throws from the measure, or 6.62 grams.
1.03 g/cc
1.6 grains weight variation in 5 throws from the measure.

0.36 grams increase, or 6% increase in weight, as poured versus settled.

2Fg powders.

First shipment, 2003.

As poured.
101.4 grains weight average of 5 throws from the measure, or 6.57 grams.
1.03 g/cc
5.2 grains weight variation in 5 throws from the measure.
Settled.
105.7 grains weight average of 5 throws from the measure, or 6.85 grams.
1.07 g/cc
1.3 grains weight variation in 5 throws from the measure.

0.28 grams increase, or 4% increase in weight, as poured versus settled.

Most recent shipment, 2004. 08.01.2004, WP-04A0002

As poured.
99.2 grains weight average of 5 throws from the measure, or 6.43 grams.
1.00 g/cc
1.0 grains weight variation in 5 throws from the measure.
Settled.
103.7 grains weight average of 5 throws from the measure, or 6.72 grams.
1.05 g/cc
2.0 grains weight variation in 5 throws from the measure.

0.29 grams increase, or 5% increase in weight, as poured versus settled.

Most recent GOEX samples.

3Fg powder, packing date code 03AP22B
Settled.
100.26 grains weight average of 5 throws from the measure, or 6.50 grams.
1.02 g/cc
0.7 grains weight variation in 5 throws from the measure.

2Fg powder, packing date code 03MA12B
Settled.
100.9 grains average weight of 5 throws from the measure, or 6.54 grams.
1.02 g/cc
2.2 grains weight variation in 5 throws from the measure.

Summary.

1.07 g/cc, Schuetzen 3Fg, 2003 shipment.
1.03 g/cc, Schuetzen 3Fg, 2004 shipment.

1.07 g/cc, Schuetzen 2Fg, 2003 shipment.
1.05 g/cc, Schuetzen 2Fg, 2004 shipment.

1.02 g/cc, GOEX 3Fg, 03AP22B.
1.02 g/cc, GOEX 2Fg, 03MA12B

Observed loading density variation range over the last two years of Goex production shows a range from 1.00 g/cc up to 1.07 g/cc.

The data for the Schuetzen 2Fg would make a bp cartridge shooter happy.

Hygroscopic behavior.

100 grain samples of powder were placed in shallow aluminum foil pans about 2" by 3" in size.

These pans were placed in a box out on the roofed over backyard deck. One open side of the box gives the test samples ample access to the air.

As the relative humidity changes the samples are periodically weighed to look at weight gain or weigh loss as the respective powders attempt to reach an equilibrium condition with the air passing over them.

	78 degrees F - 41% R.H.
Schuetzen 2Fg	+ 0.2%
GOEX 2Fg	+0.2%
	59 degrees F - 80% R.H.
Schuetzen 2Fg	+0.7%
GOEX 2Fg	+0.7%
	59 degrees F - 94% R.H.
Schuetzen 2Fg	+1.0%
GOEX 2Fg	+1.0%

In terms of how the powder behaves when exposed to air the Schuetzen powder behaves well.

Brass corrosion testing.

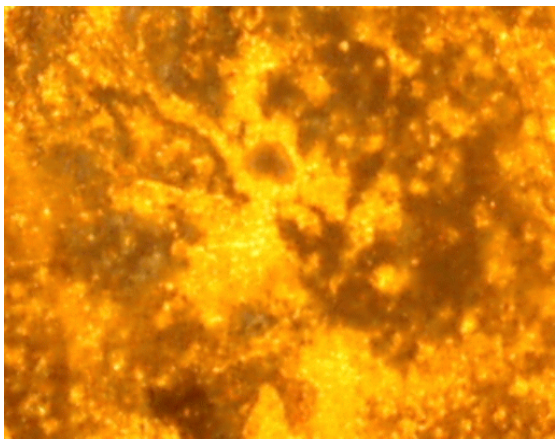
Shallow pans 2" by 3" were prepared using .015" brass obtained from the local hobby shop.

60 grams of powder was flashed in the respective pan in 20 grain increments using a heated wire to ignite the powder in the pan.

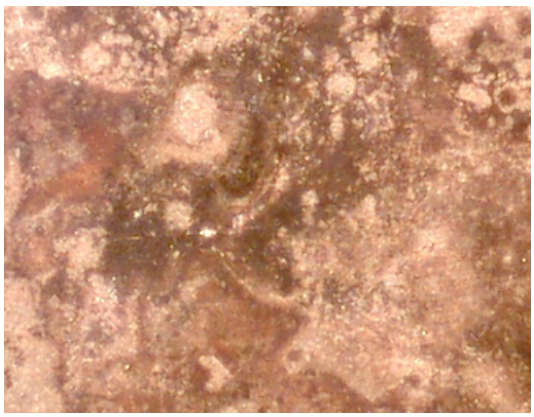
The pans were then left overnight on the roofed over backyard deck. After 24 hours exposure with the Relative Humidity ranging from 35% on up to 90% the pans were brought inside and washed free of powder residue. After drying with a soft cloth the brass sheets were examined under a microscope.

Schuetzen powder was compared to Goex powder in this test.

Both the Goex and the Schuetzen showed no pitting of the surfaces of the brass sheets. Both showed the usual surface leaching of copper from the brass alloy and splotches of discoloration of the brass.

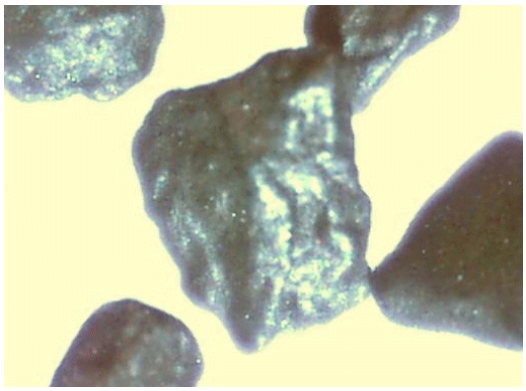


GOEX plate at 60X.



Schuetzen plate at 60X.

Microscopic view of powder grains.



2004 2Fg at 60X.

2004 3Fg at 60X.

Nothing out of the ordinary seen in the microscope views.

Velocities.

Shooting on June 7, 2004
80 to 85 degrees F, 40 - 50% R.H.

.50 caliber Lyman Trade Rifle, 28" barrel, 1 turn in 48" twist.
Speer balls, all weighing between 176 and 177 grains in weight.
.018" #40 cotton drill ball patching.
Lehigh Valley Shooting Patch Lubricant.
CCI #11 Magnum percussion caps.
CED Millennium Chronograph, 15 feet from muzzle, using sunlight.

Rifle was wiped with a damp patch between each shot.

Charges by volume measure from a Treso adjustable powder measure calibrated to throw 100 grains weigh of water at the 100 setting on the stem. Keep in mind that grains is a measure of weight and not volume.

The work today centered on comparing the velocities produced by the 2004 shipment of Schuetzen powder to the 2003 shipment and against the latest samples of GOEX black powder.

2003 Schuetzen shipment.

2Fg
80 gr. Volume 1435, 1435, 1429, 1415, 1420 - 1427 fps ave., ES 20
80 gr. Weight 1483, 1462, 1467, 1462, 1478 - 1470 fps ave., ES 21

3Fg
80 gr. Volume 1648, 1632, 1632, 1619, 1680 - 1642 fps ave., ES 61
80 gr. Weight 1579, 1632, 1624, 1577, 1623 - 1607 fps ave., ES 55

2004 Schuetzen shipment.

2Fg, 08.01.2004, WP-04A0002
80 gr. Volume 1498, 1480, 1451, 1526, 1582 - 1507 fps ave., ES 131
80 gr. Weight 1571, 1601, 1570, 1566, 1612 - 1584 fps ave., ES 46

3Fg, 15.01.2004, WP-04A0003
80 gr. Volume 1666, 1650, 1661, 1660, 1658 - 1659 fps ave., ES 16
80 gr. Weight 1597, 1634, 1604, 1670, 1572 - 1615 fps ave., ES 98

Goex 2Fg, 02-95, 03AU18B
80 gr. Volume 1484, 1503, 1504, 1529, 1537 - 1511 fps ave., ES 53
80 gr. Weight 1516, 1514, 1493, 1529, 1512 - 1513 fps ave., ES 36

Goex 3Fg, 03-10, 03MY01B
80 gr. Volume 1633, 1597, 1529, 1596, 1606 - 1592 fps ave., ES 104
80 gr. Weight 1713, 1707, 1668, 1698, 1695 - 1696 fps ave., ES 45

Schuetzen powder gave the appearance of burning cleaner in this rifle under today's weather conditions. Less discoloration of damp cleaning patches with the Schuetzen powder. Most likely due to the bore fouling with the Schuetzen powder giving more readily soluble in the water contained in the damp cleaning patches.

None of these powders gave any problems with bore fouling or misfires due to flash channel powder residue buildup. All of the powders gave rapid ignition.

In this data I would ignore the ES data. This .50 caliber Lyman Trade Rifle has a 28" barrel, shallow rifling grooves and has never been known for uniform ballistics. It is good for comparative velocities and little else.

Comparing the data by volume measure as in shooting ML rifles.

1427 fps ave., Schuetzen 2Fg, 2003 shipment. (81.1 grs acutal weight)
1507 fps ave., Schuetzen 2Fg, 2004 shipment. (83.0 grs actual weight)
1511 fps ave., GOEX 2Fg, 03AU18B (79.2 grs actual weight)

You may recall that when the 2003 shipment of 2Fg was checked in 2003 it was found to be slower than the then current GOEX 2Fg by about 50 to 75 fps. In this data we see that the 2004 Schuetzen closely matches GOEX 2Fg velocities. Which is what we had hoped for.

1642 fps ave., Schuetzen 3Fg, 2003 shipment. (84.5 grs actual weight)
1659 fps ave., Schuetzen 3Fg, 2004 shipment. (81.8 grs actual weight)
1592 fps ave., GOEX 3Fg, 03MY01B (82.0 grs actual weight)

When the 2003 shipment had first been tested it was found that the Schuetzen 3Fg was faster than the then most recent GOEX 3Fg. In viewing the data from the 2003 and 2004 shipments of Schuetzen you could not ask for better reproducibility.

Comparing the data using 80 grain by weight charges.

1470 fps ave., Schuetzen 2Fg, 2003 shipment.
1584 fps ave., Schuetzen 2Fg, 2004 shipment.
1513 fps ave., GOEX 2Fg, 03AU18B

1607 fps ave., Schuetzen 3Fg, 2003 shipment.
1615 fps ave., Schuetzen 3Fg, 2004 shipment.
1696 fps ave., GOEX 3Fg, 03MY01B

I have no idea why the Goex 3Fg gave such widely differing velocities in the volume versus weight comparison.

In closing.

With the 2004 shipment of Schuetzen powder the 2Fg Schuetzen now matches Goex 2Fg. Other than the increase in velocity with the 2Fg Schuetzen the powder exhibits a good degree of consistency from one production run to the next.

William A. Knight