Reduction of Internal Parasites Through Improved Feeder Design

Matthias Hefty

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Abstract

I raise commercial boer goats that consist of a 30 doe herd bred year-round for both market and 4-H. The last two years I have had to worm my herd twice as much as normal which has become expensive, time consuming, and has an impact on overall herd health. This led to the **purpose** of my experiment which is to design a goat feeder that can easily remove the manure from the feed tray. By doing this it can reduce the reoccurring worm problems that are caused from the goats digesting the manure that contains worms and their eggs.

The **method** of this project starts with my existing self made feeder already on my farm. I removed multiple pieces of the feeder to get to the base where the tray lays. I reconfigured the tray so that it could slide easily in and out of the feeder to remove the waste. This involved cutting and drilling the tray and also adding other pieces of wood to the feeder to make this possible

The **results** showed that through my improved feeder design of my initial feeder, I could save 23 seconds of cleaning per 8 linear feet. By using the retractable tray in the feeder it only took 2 seconds while the original feeder took 25 seconds to clean. Then determining that 442,500 8 feet feeders would be needed to feed all the goats in America, it showed that it would cost $13,841,099.30 to clean all the feeders. If the retractable tray feeder design is used it would only cost $1,108,008.60 to clean all the feeders. By preventing the reoccurring worm problem it saves $5.28 per goat by not having to treat them four extra times a year.

In **conclusion,** the retractable tray feeder design is a huge advantage for goat farmers in America. It can save $12,733,090.70 in one year by reducing the time to clean which reduces reoccurring worm problems. Also, with all the millions of pounds of goat meat that is imported into the United State this is a great opportunity for goat farmers to commercialize their herds through the huge savings in cleaning the goat feeders.

INTRODUCTION

My FFA Supervised Agricultural Experience project is breeding commercial boer goats for market and 4-H. My herd consists of 30 boer does that are bred year-round. As a boer goat farmer I have always struggled with **the problem** of my goats getting worms 8-10 times a year. Normally farmers would only need to worm their goat 4-6 times a year (Animal Mom) which means I have doubled the work and cost of deworming my herd. Through extensive **research,** I learned that one reason goats get reoccurring worms is from eating their stool in their feeders which contain a high amount of worms.

An **earlier working design** that I used to build my feeders was from Premier1. However, the feeder had no way of quickly removing the stools in it other than getting in with all of the goats and sweeping the feeder daily with a small hand broom. Unfortunately, with all the other extracurriculars that I am in, I never have had time to clean out all my feeders in my barn every day. That is why the **engineering problem** with these feeders is that there is no way to quickly clean them.

Last summer I placed second in the Indiana statewide Innovate WithIN entrepreneurship competition with my Acacia Ranch Show Goat business. This 8-week process taught me how to solve real problems to improve an existing businesses for a profit. It **justified conducting this research,** because it will improve the overall health of my goat herd and increase my profits.

The **project goal** is to improve my existing goat feeders with the **objectives** of being easy, quick, and clean. The **general approach** is to improve the feeders by modifying the stationary feed tray to become retractable. This can have a huge **financial impact on agriculture** because farmers do not want to have reoccurring parasitic problems within their

goat herds nor do they want to pay $12.34 an hour (Indeed) to farmhands to clean their feeders every day.

Literature Review

Parasitic Studies

A reason for reoccurring worm problems in goat herds are through the goats digesting their stools. According to PSU (2017), “the adult worm lives in the host's gastrointestinal tract and lays large numbers of eggs that the goat excretes in the manure.” As well as, according to OSU (2012), “The adult worms expel eggs that pass out of the sheep in the manure.” Through the two research studies done by each college it shows that goat stools can be infested with parasites. According to Critter Ridge (2021), “When feeding goats it is very important to protect the feed from contamination with goat manure to avoid internal parasites.” This leads back to making sure that the feeders are always clean to prevent the goats from digesting their own parasitic stool.

Competitive Review

The fenceline feeders that I use are from the design plan from Premier1. These are 8 feet long feeders that can feed 6 goats at once. However, this feeder is time tasking to clean. Tarter (2021) came out with a V-shaped feeder trough that prevents goats from standing in it. However, if a goat dropped some stool in it the trough has no way of being cleaned. D-S Livestock (2021) created a metal powder coated fenceline feeder that is a similar design to Premier1’s design, but it has an opening on each end so you can easily brush all the stool that is on the tray out of the feeder. However, you would still have to brush the feeder out and get in with the goats which is very time consuming. Lastly, Lakeland Farm & Ranch (2021) has a fenceline feeder with adjustable legs to raise the feeding tray higher off the ground. This can

help reduce goats dropping stool into the feeder, but it doesn't prevent them from stepping in it. This feeder as well has no easy way of being cleaned.

Product Demand

Knowing that this design is both unique and needed within goat meat production in the United States today I wanted to determine the potential demand for my design. I know that one eight foot feeder can accommodate six goats. The initial inventory of goats in the United States today according to the USDA (2021); stated that there are 2,655,000 million goats as of 2020. This would require 3,540,000 linear feet of retractable feed trays, or **442,500 eight feet fenceline feeders**. However, that is not the full potential for this design. The USDA (2022) reported that in 2020, 87,916,000 million pounds of goat meat/mutton was imported into the United Sates. To find the head count of that much meat I had to find the average carcass weight of a goat. According to Goats (2019), "an average carcass weight imported into the United States was 32 pounds each." This can help decipher 87,916,000 million pounds of goat meat into a head count by diving it by 32 pounds. This determined that 2,747,375 million processed goats are imported into the United States. As America tries to fill this gap by producing it's own food source domestically, that would equal **an additional 457,896 eight feet fenceline feeders** in America if all mutton was domestically produced.

Vertebrate Animal Research

I used my goats in this project because they are what cause manure within the feeder. They do this by primarily stepping in the feeder and they can do it by pooping in it as well. This contributed to the research because I was able to show how effectively my retractable tray was able to remove the manure from the feeder. To minimize all discomfort the goats were able to freely walk around their pen and there were no parts of the feeder that could injure them. I used 3 female goats in my study and their ages ranged from 2-4 years old. To take care of the goats

they received the adequate amount of water, grain, and hay that they needed inside the pen in the barn. They were also bedded with clean straw throughout the time they were in with the redesigned goat feeder. At the end of the study the disposition of the goats didn't change. They stayed in the same pen and got all the same food and water.

Materials

One of the most important materials that I obtained was the Premier1 Single Sided Feeder. I used the Premier1 instructions to build the feeder which is what I use in my barn and what I will improve in this project. In order to improve the Premier1 feeder a Jigsaw is needed to cut the back leg in order to let the tray slide in and out from the position in the feeder. The saw is also necessary to cut the tray to shorten its length and to cut out two boards from the 2"x4"x8" that also needs to be obtained. A drill with a tri point bit and a one inch spade bit is needed to unscrew or screw in 1½ screws that are needed or to drill holes into the tray. A hammer will be needed to remove the fencing panel on the feeder and to put the fencing panel back into place by using U-Nails that are also needed. Lastly, the tape measurer will be needed to measure out the length of holes that will be drilled out in the back of the tray to be used as a grip to pull the tray in and out.

Methods

To begin the process of modifying the Premier1 feeder first obtain all the materials listed. Remove the feeder fencing panel labeled with a 1 with a hammer by removing the U-Nails and then take the fencing panel out and lay it to the side. Then use the drill with the tri point bit and remove the screws at the bottom and top of the 16"x96"x ½" plywood board labeled as a 2 that rests diagonally on the backside of the feeder and set the plywood board to the side. Then sitting on the tray of the feeder are two 2"x4" boards labeled both as 3 that need to be removed

with the drill and tri point bit and set to the side. Unscrew all the screws that are connecting the tray that is labeled as 4 to the floor support boards.

Saw eight inches in length off the wooden tray board labeled 4 so that it can slide past the end legs of the feeder. Then take the saw and the 2”x4”x8’ wooden board and measure and cut two 2”x4”x16” wooden boards. Use the drill and tri point bit, to screw each 2”x4”x16” wooden board a ½” higher than the top of each floor support boards on either end that are circled and labeled with a 5. Then place both 2”x4” wooden boards labeled as a 3 that were taken out earlier and put them back into place on top of the two new 2”x4”x16” wooden boards labeled as 5.

Then use the 1 ½ inch screws and the drill with the tri point bit and screw the 2”x4” wooden board at the front end of the feeder as it was before. Then with the other 2”x4” wooden board place it back into its original place but only drill two screws on each end of the board that screws into the 2”x4”x16” wooden boards labeled as a 5. Then taking the tape measurer, measure 24.5 inches across the backside of the tray labeled as 4 and drill a one inch hole with the drill and the one inch spade bit. Then measure one inch over from the center of the hole and drill another one inch hole with the same bit. Then from the edge of the second hole that is 25 inches across from the tray measure 37 inches farther down the tray and drill a one inch hole with the same bit to make your third hole. Then from the center of the third hole measure one inch over and drill another one inch hole into the tray to have four holes on the tray.

Then place the 16”x96”x ½” plywood board labeled as 2 that rests diagonally on the backside of the feeder back into place by using the drill with the tri point bit and screw one screw in each corner, at the middle top, and the middle bottom of the board to keep it in place. Then place the feeder fencing panel labeled as 1 back into place by hammering a U-Nail into each corner, the bottom middle, and the top middle of the feeder fencing panel. Then with the

jigsaw cut the middle back leg labeled as 6 down to the floor support board that is connected to complete the revised feeder.

Data

Current Market Potential

Additional Worming Expenses

- Average goat weight is 225lbs
- Safegaurd = $132/bottle
- 10ml of Safegaurd per 225lbs
- A $132 safegaurd bottle can treat on average 100 goats
- Usually worm 5 times a year but reoccurring parasites cause 9 times a year which is 4 extra times in a year
- 2,655,000 inventory of goats today in America
- 2,655,000/100 = 26,550 safeguard bottles to treat one dose of America
- 26,550 x 4 extra doses = 106,200 safegaurd bottles for all extra treatments
- 106,200 x $132 = $14,018,400 to treat reoccurring worm problems in all goats

Cost to Clean Non Retractable Feeders

- $12.34 farmhand per hour
- 8ft = 25 seconds to clean
- 442,500 8ft feeders
- 442,500 x 25 seconds = 11,062,500 seconds a day = 184,375 minutes a day = 3,073 hours a day to clean all feeders
- 3,073 hours x 365 days = 1,121,645 hours in a year to clean all feeders
- 1,121,645 hours x $12.34 = $13,841,099.30 spent on cleaning feeders

Cost to Clean with Retractable Feeders

- 8ft retractable tray feeder = 2 seconds to clean
- $12.34 farmhand wage
- 442,500 8ft feeders
- 442,500 x 2 seconds = 885,000 seconds a day = 14,750 minutes a day = 246 hours a day to clean all feeders
- 246 hours x 365 days = 89,790 hours to clean all feeders in a year
- 89,790 hours x $12.34 = $1,108,008.60 spent on cleaning feeders

Future Market Potential

Additional Worming Expenses

- Average goat weight is 225lbs
- Safegaurd = $132/bottle
- 10ml of Safegaurd per 225lbs
- A $132 safegaurd bottle can treat on average 100 goats
- Usually worm 5 times a year but reoccurring parasites cause 9 times a year which is 4 extra times in a year
- 5,402,375 goats to meet total domestic demand
- 5,402,375/100 = 54,023.75 safegaurd bottles to treat one dose of America
- 54,023.75 x 4 extra doses =216,095 safegaurd bottles for all extra treatments
- 216,095 x $132 = $28,524,540 to treat reoccurring worm problems in all goats

Cost to Clean Non Retractable Feeders

- $12.34 farmhand per hour
- 8ft = 25 seconds to clean

- 900,396 8ft feeders
- 900,396 x 25 seconds = 22,509,900 seconds a day = 375,165 minutes a day = 6,252.75 hours a day to clean all feeders
- 6,252.75 hours x 365 days = 2,282,253.75 hours in a year to clean all feeders
- 2,282,253.75 hours x $12.34 = $28,163,011.28 spent on cleaning feeders

Cost to Clean with Retractable Feeders

- 8ft retractable tray feeder = 2 seconds to clean
- $12.34 farmhand wage
- 900,396 8ft feeders
- 900,396 x 2 seconds = 1,800,792 seconds a day to clean all feeder = 30,013.2 minutes a day = 500.22 hours a day to clean all feeders
- 500.22 hours x 365 days = 182,580.3 hours to clean all feeders in a year
- 182,580.3 hours x $12.34 = $2,253,040.90 spent on cleaning feeders

Results

In the current market potential there are 2,655,000 goats in America today. With reoccurring parasitic problems, goat farmers would need to worm their goats an extra 4 times a year. Based off the price of dewormer, extra worming, and total goat population in America, $14,018,400 would be spent on dewormer to treat all the parasitic problems in the goat population by not cleaning out their feeders.

To meet the demand of enough feeders to feed all the goats in America, 442,500 8 feet feeders would have to be assembled. In order to not have reoccurring parasitic problems, farmers would have to pay $12.34 an hour to have the feeders cleaned. It takes 25 seconds per

8 linear feet to clean each feeder per day, so in a year $13,841,099.30 would be spent to pay farmhands to clean the feeders that feed all the goats in America.

However, by using my retractable feeder tray design, it only takes 2 seconds to clean 8 linear feet of feeder. Based off the hourly wage of $12.34 this would mean only $1,108,008.60 will be spent on cleaning all feeders in a year.

In the future market potential there will need to 5,402,375 goats in America. With reoccurring parasitic problems, goat farmers would need to worm their goats an extra 4 times a year. Based off the price of dewormer, extra worming, and total goat population in America, $28,524,540 would be spent on dewormer to treat all the parasitic problems in the goat population by not cleaning out their feeders.

To meet the demand of enough feeders to feed all the goats in America, 900,396 8 feet feeders would have to be assembled. In order to not have reoccurring parasitic problems, farmers would have to pay $12.34 an hour to have the feeders cleaned. It takes 25 seconds per 8 linear feet to clean each feeder per day, so in a year $28,163,011.28 would be spent to pay farmhands to clean the feeders that feed all the goats in America.

However, by using my retractable feeder tray design, it only takes 2 seconds to clean 8 linear feet of feeder. Based off the hourly wage of $12.34 this would mean only $2,253,040.90 will be spent on cleaning all feeders in a year.

Discussion and Conclusion

Based on the goal and results the retractable feeder tray was able to accomplish the objectives of being quick, easy, and clean. It only takes two seconds to be clean, while most fenceline feeders in the market would take an average of 25 seconds to clean per 8 linear feet which saves 23 seconds per feeder. Through the literature review 442,500 8 feet fenceline

feeders would need to be made to meet the demand of initial inventory of domestic goats. If goat farmers decided not to clean their fenceline feeders, they would spend $14,018,400 to treat their goats 4 extra times due to stool filled feeders. If American goat farmers opted to sweep their feeders every day, it would cost them $13,841,099.30 to pay farmhands to do it. However, if American goat farmers use my retractable feeder design, they would only have to pay $1,108,008.60 to farmhands to use the retractable design to clean. Through this it was determined that goat farmers can save $12,733,090.70 by reducing labor costs and having no reoccurring worm problems by using my retractable feeder tray design. With this huge amount of savings, American goat farmers can focus more on expanding their goat herds to meet the demand.

Recommendations for practice is to always remove the tray from the feeder every day to keep the stool from being digested by goats. Future research would include how to patent my design. The final design would be constructed from powdered coated steel which would be more durable and easier to clean further reducing the transmission of parasites. Since the United States imports 2,747,375 million processed goats a year. There would need to be 900,396 8 feet retractable fenceline feeders to meet that demand counting the inventory of goats we have domestically. However, by doing this it can save $25,909,970.38 compared to cleaning every feeder every day. This design can provide major savings for American goat farmers. In addition, this can help make large commercial goat farming possible due to more efficient use of labor and controlled wormer expense.

References

Adkins, F. (2020, November 19). How Often Do You Worm a Pygmy Goat? Retrieved from https://animals.mom.com/how-often-do-you-worm-a-pygmy-goat-12576740.html

Betty W from Washington State, Chris L from Tennessee, Anna M from Missouri, Daniel T from Illinois, & Zeferino J from Colorado. (2019, August 15). Double-sided or Single-sided Feeder Plan Booklet. Retrieved from https://www.premier1supplies.com/p/build-your-own-feeder-booklet?criteria=feeders

Geary, K. (2021, October 21). Goat Trough Feeder - Tarter Farm and Ranch Equipment: American Made Quality Since 1945. Retrieved from https://tarterusa.com/tarter-products/goat-trough-feeder

Goats. (2019, August 14). Goat Meat Import and Export. Retrieved from https://goats.extension.org/goat-meat-import-and-export/

Hay & Grain Fenceline Feeder. (2021, September 29). Retrieved from https://lakelandfarmandranch.com/usa/product/hay-grain-fenceline-feeder-flbf/

Nye, L. T. (2004, March 09). Meat Goat Production and Budgeting. Retrieved from https://ohioline.osu.edu/factsheet/14

OSF38. (n.d.). Retrieved from https://www.dslivestock.biz/products/category/goat-feeders/

Parasite Life Cycle (Meat Goat Home Study Course). (n.d.). Retrieved from https://extension.psu.edu/programs/courses/meat-goat/health/goat-internal-parasites/parasite-life-cycle

Safe-Guard Suspension: Free 2 Day Shipping. (n.d.). Retrieved from https://www.walmartpetrx.com/p-119-safe-guard-suspension.aspx?sku=25883-1&&adid=22222222274286745 93&wl0=&wl1=g&wl2=c&wl3=359451013598&wl4=pla-314225415742&wl5=9016290&wl6=&wl7=&wl8=&wl9=pla&wl10=136410382&wl11=online&wl12=25883-1&veh=sem&gclid=EAIaIQobChMI6qipvr229QIVgHNvBB0ssAODEAQYASABEgKuofD_BwE&gclsrc=aw.ds

Shulaw, W. P. (2012, May 04). Strategies for Coping with Parasite Larvae on Pastures in the Springtime in Ohio. Retrieved from https://ohioline.osu.edu/factsheet/VME-28

USDA (n.d) Lamb and mutton: Annual and cumulative year-to-date U.S. trade (carcass weight, 1,000 pounds). Retrieved from https://www.ers.usda.gov/webdocs/DataFiles/81475/LambMutton_YearlyFull.xlsx?v=7862.4

USDA (2021, January 29) Sheep and Goats. Retrieved from https://downloads.usda.library.cornell.edu/usda-esmis/files/000000018/41688945h/f47539332/shep0121.pdf