

A Friendly Pastures Publication

# FODDER

From one pound of seed to ten pounds of feed



by Andrew Siemer

# Fodder

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Andrew Siemer

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# Dedication

To my loving family. You are the ever driving purpose in my life. I have enjoyed every minute with you all and look forward to many more.



# Preface



Todo: need to write the preface

# Acknowledgments

To all the great folks in the fodder group on Facebook, thank you for all your help with the creation of this book. To my wife, thank you for putting up with me while I write yet another book!

## **David Capocci - Pacca Pride Guest Ranch**

David Capocci is one of the first to pioneer a large fodder system for daily use on a small scale farm. But that is not what makes David great. His willingness to share all that he has learned during the creation of his system has helped a great number of folks in their fodder endeavors. Thank you David.

## **Randy Coleman - Wings and A Prayer Alpacas**

Randy Coleman is another great resource willing to help anyone with their fodder system issues. He has been a great resource to turn to for fodder system questions and is always there with an answer on the Facebook Fodder group. Thank you Randy.

# About this book

This is a book about hydroponically sprouted micro-greens also known as **FODDER**. Specifically it is about growing micro-greens as a form of feed for your farm animals. I will show you how to grow fodder from all sorts of seeds that are easily acquirable by most farmers.

I will cover the basics of what fodder is including the different types of seeds that work well in a fodder system. This book will also explain the various types of fodder systems and how to create a few of them in your garage.

Knowing how to sprout fodder is only half the battle. For that reason we will also take a look at the different dietary needs for each type of farm animal with a focus on fodder mixing and matching to get us as close to a complete diet as possible. We will then look into how to fill the gaps with proper supplementation for each animal.

## Who should read this book

If you are a farmer, large or small, or if you maintain livestock in some form or fashion, you might want to think very hard about getting into fodder to increase the nutritional value you are feeding to your animals and increase the amount of money that stays in your wallet!

Getting into fodder doesn't necessarily mean purchasing this book. There is a great deal of fodder information out on the web. And you, like me, can get very deep into this topic very quickly without this book. But if you are looking for a manual that details the types of fodder, how to grow it successfully, and how to eek out that last extra pound of fodder from your seeds - you might consider picking up a copy of this book.

## Roadmap



TODO: Brief explanation of each chapter and what it addresses

## Developed in the open

This book has been developed in the open. Each chapter has been submitted for free to the public for a review. With this quick feedback we have been able to produce great information on this somewhat new topic.

We will continue to follow this open concept even after publishing the book. If you purchase this book on [leanpub.com/fodder](https://leanpub.com/fodder) you will gain access to content updates as they become available. These updates come with the book for free.

## About the author

You might think that an author on fodder should be a grass growing king of farmlands on high with a list of spectacular achievements that can be listed here. Nope - that's not me!



**Andrew Siemer of Friendly Pastures**

I went from high school, to Ranger Battalion in the army, to building big systems on the internet. I have worked since 1998 as a software engineer. I currently work for one of the largest ecommerce company's in the world as an architect. And I only just recently got started with farming and ranching 3 years ago.

After watching movies such as Food Inc. I quickly started thinking that I needed to feed my family healthy hyper local non-industrially produced food. We were living in CA at the time. We spent a couple years looking for a small farm property there but quickly learned that that was never going to be in our cards. So we moved to Austin Texas and bought a small 15 acre hay farm.

The hay farm quickly changed into a chicken and egg producing, produce growing, hog raising operation. I got involved with the

Aquaponics Association where I took over as the Regional Director to help grow their membership and spread the word of all things aquaponics. I stood up a few aquaponic green houses. And quickly found that maintaining hundreds of animals was not a cheap task. As droughts hit us, and our animals started to reproduce I found myself in need of a better, cheaper, more consistent way to feed my animals.

Fodder! I started doing the research. Built my first system. And, like every other system I have come in contact with, got hooked on growing fodder in a more and more efficient manner. I have since built myself several ever-expanding fodder systems. I have also built fodder systems for others in addition to training other farmers about all things fodder.

This book is a summary of all the information I have learned while tinkering on fodder systems for my farm and friend's farms.

# Introduction



- todo: A quick blurb on what fodder is and how it can help the average livestock owner.

Some facts about the cost savings that can be achieved.

Introduce the math behind fodder.

Show some photos of fodder days 1 - 7.

Show some happy animals on fodder.

# 1 What is fodder?

According to many sources ***fodder*** is simply any agricultural foodstuff used to feed domesticated animals, such as goats, cattle, sheep, horses, donkeys, chickens, ducks, geese, rabbits, and pigs. In the case of this book though we are specifically referring to the growth of “micro greens” in a hydroponic <sup>1</sup> system over the course of roughly 7 days. You will see that you can take just about any grain bought at a local feed store, grain mill, or grocery store, and through proper care grow roughly 1 pound of grain into 5-10 pounds of fresh nutritious greens. We have found that these greens are readily consumed by every non-carnivore found on the farm.

Just to be clear, while fodder is indeed truly amazing and can certainly cut your feed bill in half, fodder is not a magic bullet for all animals. Many animals can largely consume fodder as their primary dietary input. But they may also require other supplemental feeds such as dry hay for cows and horses and possibly corn for your pigs. We will cover a proper diet including fodder for the majority of your livestock critters.

## 1.1 The general process for growing fodder

Sprouted fodder is an amazingly easy way of maximizing the nutrition you feed to your animals while minimizing the cost of your feed bill. We will get into great detail about sprouting fodder later in the book but I felt it was of great importance that we tackle the general principles of how to grow fodder early on. For that reason we will take a high level look into each step found in most fodder operations.

---

<sup>1</sup>**Hydroponics** - Hydroponics is a subset of hydroculture and is a method of growing plants using mineral nutrient solutions, in water, without soil. The definition for the term hydroponics was sourced from Wikipedia at <http://en.wikipedia.org/wiki/Hydroponics>.



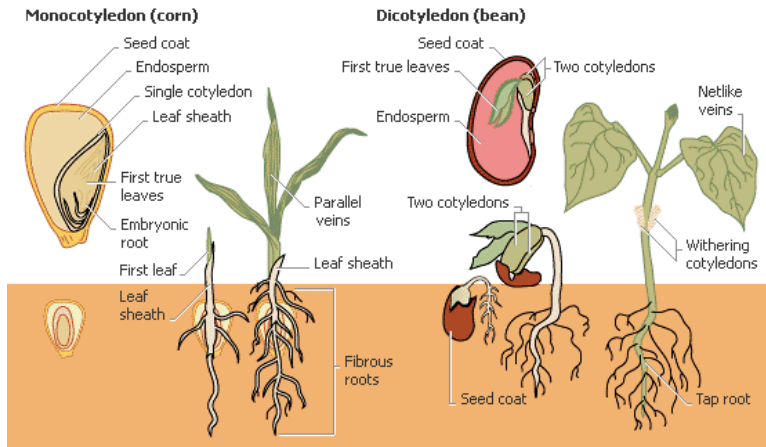
## The seed

There are several types of seed that are appropriate for growing fodder. Some are higher in protein or energy than others. So mixing and matching them to build up the appropriate nutritional balance is important. But the thing to know about all seeds is that they have everything in them that is needed to start the plants life in the first few days.



Seed growth chart

Some plants such as grass variants start life with one leaf (monocots). While other plants like beans start their life with two leaves (dicots). The seed is wrapped in a protective covering called the seed coat which protects the embryo of the plant. The seed also contains endosperm which is a food supply for the initial days of the seed until the plant can generate its own food.



Seed anatomy

In a fodder system, most (but not all) people tend to pre-soak their seeds prior to spreading them out. The duration of this soak ranges from 4-12 hours. Soaking is thought to help weaken the seed coat to help the plant get started with life.



TODO: thoughts on an air stone in the soak bucket



TODO: thoughts on H<sub>2</sub>O<sub>2</sub> or bleach in soak bucket



### Over-soaking

Soaking seeds for too long will effectively stop the seed from being able to grow thereby diminishing the number of seeds that will sprout. Each seeds soak rates are different.

## The growing container

There are various containers that you can sprout your fodder in. I will mostly discuss growing in trays as most systems use some form of tray. But any container that you can put your seeds in, fill with water, and drain efficiently can be used.

Trays can be bought from any hydroponics store, home supply stores, online. But you can also use Tupperware containers, cookie sheets, cat litter containers, pvc rain gutters, custom bent steel sheeting, etc.

One thing to keep in mind is that you will be interacting with these trays daily by way of removing fodder and spreading new seeds. For this reason you generally don't want a tray that is overly flimsy. I built my first system with standard 10x20 plant trays. The plastic is too thin on these for long term use.



10x20 tray

## Water

Once you have your seeds and a container chosen you need to think about how to get water to the seeds. Like all the other aspects of fodder, conveying water to the seeds can be done in many different ways.

Some folks just pour water from their sink faucet directly into their small systems.



[peakprosperity.com](http://peakprosperity.com) watering a tray of fodder

A few folks water their fodder like you would water your normal plants - with a hose and a soft shower wand. This is a great idea if you have the time as each tray of fodder will get a nice even soak and no more water than it needs.



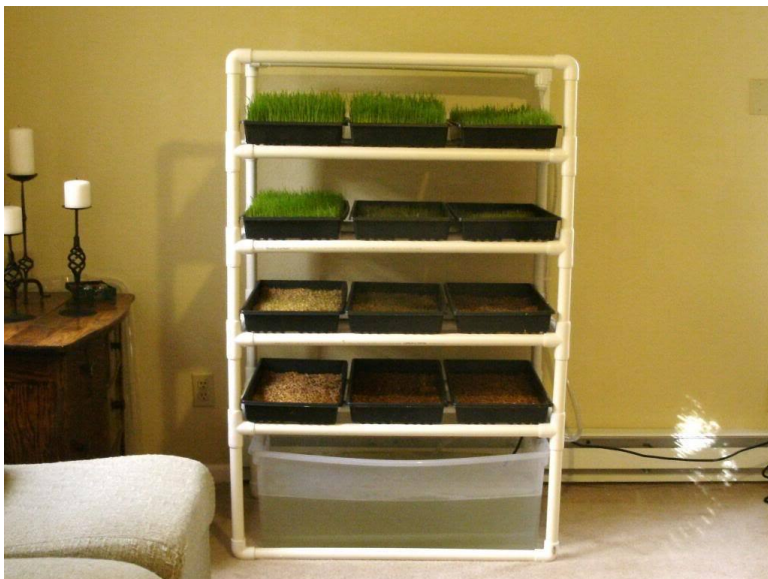
Quartz Ridge Ranch water with a soft shower hose wand

Others keep a large container at the bottom of their fodder system, called a sump tank, at the bottom of the system and pump the water up to their seed containers. You have to be careful with reusing the water from a fodder system. Similar to brewing beer, the longer you soak your seeds the more the starch levels build up in your water. Putting that on your fodder over and over again is a sure way to invite mold and other funky issues into your system.



#### Stinky sump tank?

If you can smell your sump tank or notice that your water is not clear - change your water. Foul water will certainly impact your ability to grow good fodder. It can also invite mold and root gnats.



**Half Pint Homestead 18 tray system**

And some systems have fresh water piped directly in and distributed through irrigation controllers or similar flow controls.



FarmTek Fodder Pro

## Drainage

Once you get water into your system you next have to worry about getting all of the water back out. This can be done with a bunch of holes in the bottom of your trays. Or you can accomplish drainage with hydroponic drains. However you tackle this problem it is important that your seeds aren't left to sit in water for long periods of time.



**10x20 trays come in perforated and non-perforated**

You can also put a commercial drain fitting into just about any format of tray you might have. This can be done by drilling a hole through the bottom of your tray and screwing in this water tight drain fitting. These are the ones first used in David Capocci's Paca Pride fodder system.



**MPT Drain Fitting Kit**



## **Build types**

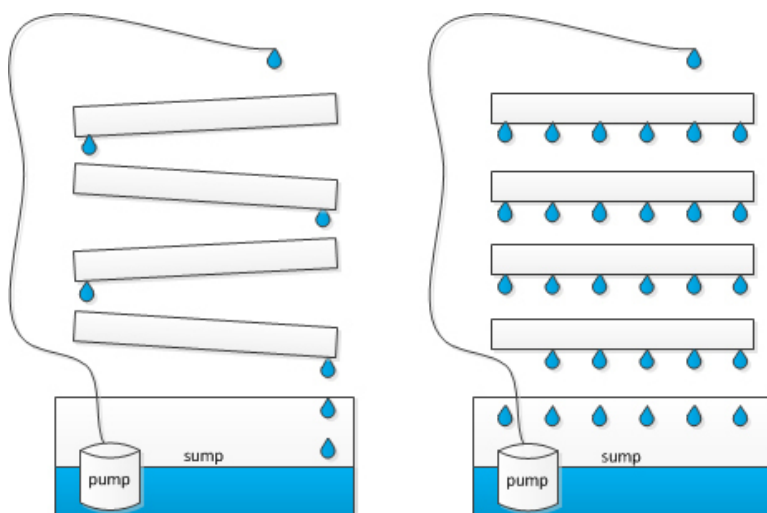
The best thing about growing fodder is that it is amazingly easy to set up a fodder system for yourself in numerous ways based on the amount of fodder you would like to grow each day and the budget that you have available. In this section we will take a quick look at a bunch of different types of fodder systems. In a later chapter we will look deeper into how each works.

### **Flood and Drain**

Flood and drain is a hydroponic/aquaponic growing method where you fill a reservoir with nutrient rich water to feed and water the roots of a plant or plants. Once the water level gets to a predetermined point in the reservoir a drain mechanism kicks in and quickly removes all of the water from the container. This process can either be continuous, on a timer, or manual. In the realm of fodder, the water can be just water, and the drain mechanism might be as simple as holes in the bottom of the container.

### **Trickle Down**

In a trickle down style system water is put into the top tray of a set of trays. From there one of two things can occur. The water then flows from one end of the tray to the other end of the tray where drain holes are located and drains out into the tray below it. Or there are a series of holes throughout the tray and the water just “rains” down on the next tray. This repeats until the water has passed through all the trays and ends in the holding tank or sump.



Trickle down fodder trays

There is no scientific evidence to say that one style is better than the other. As long as your water is evenly spread across your seeds for an appropriate amount of time you should be ok.



### Over-soaking

Do keep in mind that in both of these systems the time it takes to drain out the top tray all the way down to the bottom tray might take longer than you want your seeds to be under water. Over soaking can occur. And this will potentially kill your seeds. Time the complete cycle to ensure that the water is evacuated fairly quickly.

### Misting vs. Soaking

There are also systems out there that using misting heads at the end of their irrigation lines to thoroughly douse their fodder rather than filling the fodder tray with water. This is an unsolved controversy. However, here are my thoughts.

The seeds roots are what needs the water. Applying a thorough supply of water to the fodder leaves and not as much to the roots doesn't quite make sense. That is sort of like washing my hair every day without drinking. I wouldn't last very long with that approach!

Bathing the seed roots also aides in washing any built up impurities around the root system. The starches that slowly build up from soaking the seeds are around the seed husks, not the green leaves. When the seeds are soaked and then drained most of those fly attracting and mold feeding starches are washed away. Of course this only matters if you aren't utilizing a sump in your system!

## **1.2 The math behind fodder**

To me there are two interesting factoids about fodder. 1 - It costs me less to feed my animals a more nutritious diet. 2 - The price of fodder doesn't fluctuate like the cost of hay in times of drought, extreme cold, or extreme heat. And like most things in life, the more you buy up front the cheaper it is on the back end.

### **Simple math with 50# bags**

Let's take a look at purchasing feed for pigs. If you are interested in feeding your animals a quality food then you are probably buying pig & sow blends or high quality cotton cake or similar. You might also be mixing in some whole corn.

Say a bag of pig and sow costs you \$20 for 50 pounds at the local TSC. That works out to \$0.40 cents per pound. Not horrible. Unless you are buying 30 bags every two weeks! That quickly becomes \$600 every two weeks and only gives me 1500 pounds of feed.

Now lets look at a bag of seed for the purposes of sprouting. I buy a 50 pound bag of organic (no less) seed for \$30 per bag. Wow that already sounds expensive. But using simple math and knowing that I can always get at least 5 pounds of fodder out of every 1 pound of seed (we will learn how to get a 10:1 conversion in later chapters)

I know that the 50 pounds of seed becomes 250 pounds of feed. That is \$0.12 cents per pound! Working backwards to see how many bags of seed I need to generate the same 1500 pounds of feed in the end: 6 bags of organic seed. Cost? \$180 My pigs can eat all they want at that rate.

## **Better math when buying in bulk**

Now we all know that anyone feeding large quantities of feed to a large herd doesn't buy in the smallest quantities sold. We want to buy in bulk. I have land and I can store seed so I will buy as much as possible to get the price as low as possible.



**This next paragraph contains heart throbbing information**

After reading this next paragraph, please take a couple breaths and count to 10. Then continue reading the rest of the book prior to running out and spending money on a new fodder system!

So let's talk in terms of bulk. Go buy 2,000 lbs of all organic seed at 37¢/lb (or \$18.50 per 50lbs) and you are down to 7.4¢/lb! 7.4¢ for organic, non-gmo, no animal byproducts, feed me as much as I want fodder! The higher your yield the lower your cost.

## 2 Fodder System Types

Fodder systems come in all shapes and sizes. If you are just feeding a couple bunnies or chickens you can grow in something as simple as muffin pans, glass jars, or small Tupperware containers. If you need to grow enough feed for a couple of cows you might look at a small shelf based system with a series of trays on each shelf. And if you have a full blown operation feeding a bunch of pigs, horses, or alpacas, then a dedicated fodder room with large trays on large shelves might be just the ticket.

Keep in mind when designing your system that the more manual steps there are in your system, the more likely it is to be a non-scale-able system from the start. Meaning expanding the system as your needs grow will exponentially add time to the care and maintenance required by the system. Washing a bunch of small trays, re-seeding all those trays, pulling small chunks of fodder, all takes time.

On the flip side though, the more automation a system has in it, the more scale-able it likely is. But keep in mind that automation adds to the complexity of the system. Which also adds to the cost of the system. And when you have a problem in your fully automated system (like a pump going out), the manual processes required to keep the fodder growing may be even more time consuming or worse, not possible.

### 2.1 Flood and Drain Systems

Flood and drain is a hydroponic/aquaponic growing method where you fill a reservoir with nutrient rich water to feed and water the roots of a plant or plants. Once the water level gets to a predetermined point in the reservoir a drain mechanism kicks in and quickly removes all of the water from the container. This process can either be continuous, on a timer, or manual. In the realm

of fodder, the water can be just water, and the drain mechanism might be as simple as holes in the bottom of the container.

## Muffin Trays

Growing small serving size fodder bits can be achieved in just about any container. But this method was especially clever. You can use any muffin tray that you have available. Foil trays like the one in the picture are especially cheap and semi-durable.



**photo by Robin S Stoy**

**Fodder grown in a muffin pan by Robin S Stoy**

Poke a couple of holes in the bottom of the tray. Line each cup with 1/2" of pre-soaked seed. Water once in the morning and once in the evening. And you have little fodder fragments which is perfect for a bunny or chicken.

This style of system is what is referred to as a flood and drain system. You fill the cups up with water. And the water slowly drains out of the bottom of the muffin cups. Simple.

## In a Jar

As long as the basic requirements are met, you can grow fodder anywhere. In this case an experiment was being done to see if fodder could be grown in a jar. By placing the seeds in the jar, and tying a piece of cheese cloth over the top, the jar can easily be filled with water and then drained out. This method is also using the flood and drain method.



Fodder grown in a jar by Backyard Chicken Lady - <http://backyardchickenlady.blogspot.com/>

## On a larger scale

All of these flood and drain systems work on the same premise which is what allows us to create small or large scale systems with similar understanding. The proper initial system allows you to quickly scale up to a point where you are producing 100's of pounds of fodder each day. In this system you can see a copy of the fodder system first pioneered by David Capocci, owner of Paca Pride Guest Ranch. It uses a 13" x 40" tray (which David distributes for AmHydro) with a simple drain and overflow set up. In this system fresh water is pumped to each tray individually and then

drains each tray individually. This sort of system is in use on a great many farms and reliably produces fodder day after day.





Fodder grown David Capocci style (of Paca Pride Guest Ranch)

## 2.2 Trickle Down Systems

In a trickle down system water is put into the top tray of a set of trays. From there one of two things can occur. In one system the water flows from one end of the tray to the other end of the tray where drain holes are located and drains out into the tray below it. On another style there are a series of holes throughout the bottom of the tray and the water just “rains” down on the next tray. This repeats in each tray until the water has passed through all the trays and ends in the holding tank or sump tank.

### **RabbitTalk.com slanted trays**

In this system you can see that a baking rack has been utilized as the frame for their fodder system. A series of used baking trays were then used to hold the seeds. The water flows from one tray to the next using a simple overflow approach (no holes). The water slowly makes it's way from tray to tray until it finds itself in a sump tank.



RabbitTalk.com slanted trays

### **Half-Pint Homestead 6 Tray Kit**

This system is built out of parts that can mostly be sourced from a big box store like Home Depot. It is made from PVC for the frame and utilizes common 10x20 trays for the growing container. The big tank on the bottom is a sump tank which is used to capture and re-use the same water each time you cycle the system.

You will notice in the image below that the water is rained from one shelf to the next. This provides great coverage to all of the fodder below the top shelf. This is done with a series of holes poked in the trays. As water enters the top shelf it immediately drips down onto the trays below it. And ultimately collects in the sump tank.



The Half-Pint Homestead 6 Tray Kit

## Quartz Ridge Ranch

In this system water is sprayed in with a hose wand (similar to what you would use to water your plants). All the water then pools at the front of the tray and drain down to the next tray. Eventually the water gets to a gutter system below the bottom tray and is collected into a sump tank (which is then wisely pumped out with a pond pump to a near by garden).



Quartz Ridge Ranch fodder system



**Be careful when using a sump tank!**

When using a sump tank be sure to check the water quality. If the water smells or is visibly yellow, change it immediately.

## 2.3 Commercial Systems

There are several commercial systems now available. These range in size from something you build and install into a pre-built fodder room to a full turn key system that is delivered to you ready to go. Some of these systems can be contained in a shipping container or semi trailer. May of these utilize computerized systems for monitoring and controlling the water flow and timing, temperature, humidity, and lighting.

### **Fodder King by Crop King**

The Fodder King system is a very hydroponically inspired system. The trays used are common to growing in an NFT style hydroponic system for growing all sorts of plants. The plumbing is a PVC collector pipe that gathers all the water to a sump or other capture vessel. They provide a pump and everything you need to get fodder going very quickly. You just need to provide a temperature controlled room to house it in.



Fodder King by Crop King - 12x24 system - \$2,950

### **Fodder Pro 3.0 by FarmTek**

The Fodder Pro 3.0 is the latest from FarmTek. This is an industrial size system that is capable of producing “tons” of feed each day. If you run a dairy operation, organic farm, large cattle



operation, have a large scale pig operation, or commercial size poultry operation then this is one of the systems you should be looking at. I have also heard stories from other fodder fanatics that they have been able to call FarmTek for help on non-FarmTek systems. Great company.



FodderPro 3.0 by FarmTek

### **Automatic Paddock by Fodder Solutions**

If you are near a computer navigate over to youtube.com via this url: <http://goo.gl/OMb4NU> or search for “United Fodder Solutions automatic paddock”. Simply amazing.

This is a fully automated fodder generating system. It automates the seeding of trays, watering of trays, delivery out of the building into the back of your truck, washing the trays, and reseeded them.

It is capable of producing 4 tons of fodder daily!

## 2.4 Fixed or removable trays?



TODO: fill in this section

## 2.5 Understand the daily rituals prior to picking a system type

### Cleaning fixed trays can be hard



EXPAND

Expand on the concept of cleaning fixed trays. Fixed trays at the top of a fixed tray system or in the middle of a fixed tray system may prove to be hard, require a ladder, etc.



TODO: fill in this section



## 2.6 Consider the systems scalability



TODO: fill in this section

- small vs large trays
- fodder weight per tray (size matters)
- how much weight do you want to produce now vs later
- tedious tasks only get more tedious as you expand

## 3 Creating a good fodder growing environment

I have to start this chapter by declaring that you can actually be somewhat careless in how you grow your fodder. If you don't have time, a big budget, the engineering know how, or just don't want to put much into creating your fodder system prior to seeing it in action - no worries! As long as you aren't overly careless and pay attention to a few rules, you can easily convert 1 pound of seed into 5 pounds of feed over and over again.



### 1 pound of seed into 10 pounds of feed

Now, if you really want to dial in your system and convert 1 pound of seed into 10 pounds of feed, keep reading.

### 3.1 Just give me the details so I can skip this chapter

In order to grow fodder you only need to be mindful of a few things:

1. **temperature:** 65 degrees or a tad higher is best but I have seen 80 degrees work.
2. **humidity:** Shoot for around 60% on average
3. **clean water:** If your systems uses fresh water with each cycle great! If you use a sump tank, flush it out often.
4. **excellent drainage:** Regardless of style (flood and drain, trickle, misting) be sure you get all the water out of your trays.

5. **air circulation:** If your system is in a closet, add a fan to move the air around. Don't dry out the seeds, just keep the air flowing.
6. **high germination rate:** None of the other points are important if you buy seeds that just won't sprout!

## 3.2 Humidity

Humidity is a tricky subject. In most seed growing operations you might shoot for a 90% humidity level. This is where your seed will be most efficient at sprouting and turning itself into a full fledged seedling.

Unfortunately the same rules don't quite apply in a fodder system. While a 90% humidity rate will indeed produce a fast growing sprout, it will also encourage mold growth.

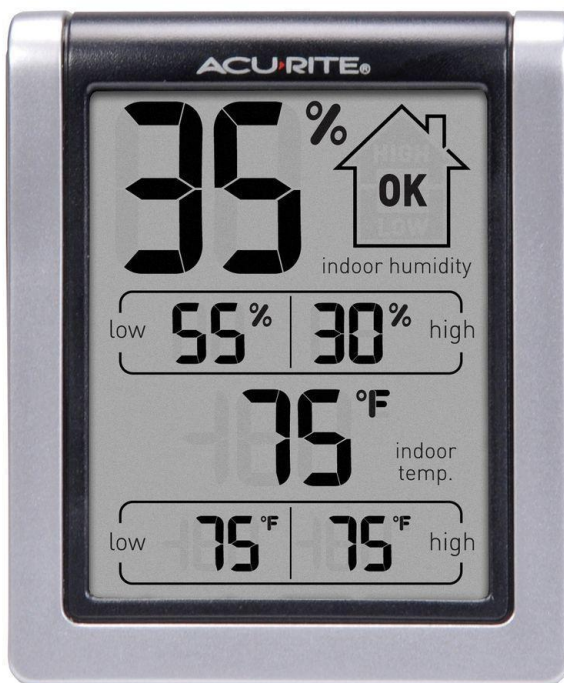
For that reason you should shoot for a 60%-80% humidity level. Each growing environment is slightly different. It depends upon where you are growing your fodder. The insulation you have in your building. And the climate your are living in. All of these factors will push you in one direction or another. But stay away from the 90% level as you will be swallowed up by mold outbreaks.

You would be wise to get a temperature and humidity monitor. These are generally sold in a big box home store like HomeDepot or similar and are used in a persons home to monitor for "comfortable" levels in the home. They can also be used in your fodder enclosure or near your fodder system.

[AcuRite digital humidity and temperature comfort monitor<sup>1</sup>](http://www.homedepot.com/p/AcuRite-Digital-Humidity-and-Temperature-Comfort-Monitor-00613/204350179)

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<sup>1</sup><http://www.homedepot.com/p/AcuRite-Digital-Humidity-and-Temperature-Comfort-Monitor-00613/204350179>



AcuRite digital humidity and temperature comfort monitor

## Humidifiers

What happens if I live in a location where the humidity is just not high enough? In that case you need to raise your humidity levels. There are several ways to do this.

The obvious way is to buy a humidifier. However, that will add to the expense of running your fodder system. Instead you can simply take a towel and wet it. Then hang it to dry in your fodder room or the area in which your fodder lives. As the towel dries, the water it contains will evaporate into the air. This should serve to raise your humidity levels in smaller systems.



#### **Rock salt dehumidifier**

For larger systems you might add a couple spray nozzles to your fodder system. The mist can quickly increase your humidity levels. Just make sure you monitor this spraying activity!

If you do need to purchase a humidifier though, there are many options. A dedicated humidifier can be picked up for around \$300 and will monitor for your desired levels and turn on as it is needed. This does add some complexity to your system as an automated humidifier needs a dedicated water source piped to it.

If either of these solutions don't work quick enough for your needs you can also look into purchasing a commercial de-humidifier. They can be acquired at any big box store such as HomeDepot or similar.



Herrmidifier Humidifier

## De-Humidifiers

When ever we are monitoring for a specific numeric value in nature and trying to control it at all times we almost always have to have two devices to help us. In the case of controlling humidity we will need a humidifier and a de-humidifier. A de-humidifier lowers the volume of moisture in the air.

We have a few more options available in the DIY world of de-humidifiers. We can either use a bag of bbq charcoal. Or we can use some rock salt. In both cases, simply dump a bunch of charcoal or rock salt into a plastic or water tight container. Then place that container near your fodder system or in your fodder room. Watch as your humidity starts to drop. Do monitor the container though as it will slowly (or quickly) collect the moisture from the air and needs to be dumped out. In both cases you may need to replace the media every few months.



TODO: need an image

# 4 Temperature

In general we try to seek the 65 degree mark. This seems to be where most people report having the best results. Having said that I have heard of people growing at the 55 degree mark. And I have personally grown at the 80 degree mark.

Growing at lower temperatures is totally possible. But the lower temperatures mean that the fodder grows slower. If you have an eight tray system this may be acceptable for you as you will still get a daily supply of fodder. But if you only have 4 or 5 trays in your system you will either have to skip a day or two or just feed sprouts instead of grass mats.

Growing at higher temperatures is also totally possible. Just know that the higher the temperature is the more likely you are to sustain mold damage. Keeping your humidity and temp in check is largely a method of keeping mold in check. Try to keep it close to 65 to be safe.

## 4.1 Heaters

As with most of these fixes to common problem, it really depends on the size of your fodder system and the size of the room the fodder system lives in. For example, if you have a small fodder system in a big room and you are trying to raise the temperature a couple of degrees, you will have to heat the entire room to get the air around your fodder system to raise in temperature. The size amount of air you are trying to raise the temperature on is the key.

Another factor is the insulation level in the space that your fodder system lives in. As an example, if you built your fodder system in a room wrapped in screen, you need to heat the world. This is a farce of course, but you get the idea. If the room has no insulation you will be fighting the cold. If you have good insulation and sprayed foam in the cracks to insure zero air loss or entry, then

you will not need as much power to raise the temperature.

There are many options in the heating world. You can purchase a simple floor heater if you have access to electricity. If you are off grid you might consider a propane powered heater. And if you need a lot of heat for extreme cold then you might want to look at a rocket mass heater like the one Rob Torcellini built.

## **4.2 Air Conditioners**

We all know about using an air conditioner. We turn it on in our home and glorious cold air comes out. However, most people don't think they need an industrial size air conditioning unit on their fodder systems. And if you did you wouldn't want the expense of the added AC bill.

Thankfully air conditioners come in all sorts of shapes and sizes. Generally, a window AC unit will work for our application. Just know that if you need to run that window AC for extended period of times it will likely generate an ice build up on the radiator and freeze over. Enter the CoolBot.

### **CoolBot**

With the CoolBot, you can easily run a small window AC unit continuously. It claims that it can run an appropriately sized AC efficiently enough to get the room down to 32 degrees. As we only need the room to get down to 65 degrees this will work out perfectly for us!

The CoolBot closely monitors the environment of your fodder room. And if it senses anything that will cause the air conditioner to freeze up (literally, ice forms on the fins of the AC), it will shut the AC down. It continues to poke and prod the AC to get it to perform like a champ and cool your room to the appropriate temperature. And at \$300, this is a must have for any medium to large size installation.





CoolBot

### **4.3 Drainage**

### **4.4 Air flow**

### **4.5 Light**

## **4.6 Signs that something isn't quite right**

**Spotty growth**

**Stink**

### **4.7 Watch out for**

**Fungal Spore**

**Yeast**

**Mold**

**Aspergillus**

# 5 Nutritional numbers around fodder

In this chapter we will take a look at the numbers around fodder. This will include how much fodder should be targeted for feeding your animals. The break down of each type of seed from a protein, energy, and other chemical break down of fodder. From this chapter you will have all the raw data you need so that we can enter the next chapter ready to discuss the dietary needs of each animal around fodder.

## 5.1 How much fodder should I plan to produce

A simple equation for calculating how much you want to feed your animals is to feed roughly 3-5% of the animals body weight in fodder. People often ask “why so much”. Remember that you are feeding wet food with fodder where as you were likely feeding dry food before.



### **Fast and loose calculations for where to start**

You will have to validate the following calculations and the numbers used to ensure that they match your environmental capabilities. Your birds may average more or less weight per bird. Your fodder growing capabilities may produce more or less fodder per inch. Etc. Read this equation and then tweak it to fit your input values.

An average back yard chicken might weigh in at the 6 pound mark. If we target 4% of a 6 pound bird we would need to provide

roughly .25 pounds of fodder to each bird per day. On average you can convert one pound of seed to 5 pounds of feed. And we can grow about 25 pounds of fodder from a 10” x 20” tray. This means you can get about 1/8 lb of fodder per square inch of growing surface. For a chicken you would need at least 2 square inches in each days container. If you were using a 5x8” tray it would provide feed for roughly 20 chickens.

Terms	Numbers
Average chicken weight (ACW):	6lbs
Feed ratio (FR):	4%
Feed per animal (FPR):	.25lbs
Seed conversion ratio (SCR):	1:5
Seed weight per sq/inch (SWPSI):	.025lbs
Feed weight per sq/inch (FWPSI):	.125lbs
Number of birds to feed (NBF)	
Inches of daily grow surface (DGS)	

Calculate feed needs in pounds per animal:

$ACW * FR = FPR$

Calculate inches needed for daily grow surface:

$(FPR / FWPSI) * NBF = DGS$

## 5.2 Types of seeds used in fodder



great read: <http://www.ksre.ksu.edu/bookstore/pubs/MF2298.pdf>

There is a multitude of seeds that can be used for growing fodder. Some work really well while others don’t work at all. And seeds that by name should work really well for fodder may not work at all due to the facility you have purchased them from. For these reasons you will have to see what works for you based on the resources available to you but start with the well known seeds first.

And to add to this seed conundrum, also understand that while a certain type of seed may be easy to grow, it won't necessarily be the appropriate seed for your type of animal's diet. We will get into more detail about appropriate diets in a later chapter.

There are a multitude of different types of seeds that can be used in fodder. Some better than others. But the few that are most commonly used are wheat, barley, clover, and sunflower (BOSS - black oil sunflower seeds). Some are higher in protein than others. Some grow faster than others.

## **5.3 Cereal Grains**

**Maize (aka Corn)**

**Wheat (triticum)**

**Barley (hordeum)**

## **5.4 Legumes**

**Alfalfa (lucerne) - perennial flowering plant in the pea family**

**Clover (trifolium)**

**Soy Bean**

Of the proteins available in Soy Bean in the sprouted form, 5.74% of the protein is **lysine**.

**Pea Nut**

**Green Peas**

**Chickpeas**

6.69% of the protein is **lysine**

# 5.5 Nuts

## Sunflower (helianthus annuus)



TODO: Need a grid for which plant has which thing in it.



Soak and sprout chart

## Know your germination rate

Before we take a look at seeds, lets talk about something that applies to all seeds. Germination rate. The *germination rate* (GR)

is a way of telling the quality of the seed that you purchased from a given source. It helps you determine what the percentage of sproutable seed is.



**Calculate your germination rate**

You can quickly calculate the GR of your seed by counting out 100 seeds (random sample). Place those 100 seeds on a wet paper towel. Keep the towel wet at all times. Over the course of 3-4 days you should see some seed begin life. Count how many out of the 100 seeds started. If 70 out of the 100 sprouted then your seed has a 70% germination rate.

Why is this important? Let’s take a look at some simple numbers real quick. In each scenario we will start with a 50lb bag of seed of any type. Each bag of seed will cost us a specified amount. And the GR will be defined. From there we can do quick math to determine the cost of grown feed per pound. This table assumes that we will be able to convert one pound of seed to 5 pounds of feed.

Cost	GR	Viable Weight	Grown Weight	Cost Per Pound
\$30	70%	35#	175#	\$0.17
\$38	85%	42.5#	212.5#	\$0.17
\$40	90%	45#	225#	\$0.17

Eh? I don’t understand! In each example the grown feed costs me a mere 17 cents per pound. This is already vastly cheaper than hay.

The key here is that you can’t pick out the seeds that won’t germinate prior to soaking them and spreading them out in your tray. If they don’t germinate then they just sit among your viable growing seeds souring. They are like the seed casing that is left there to rot. The funk that non-viable seed adds to your system is a key attractant to root gnats and mold. They put starch into your system

which can thicken your water (in a sump based system) and slowly clog up the working parts of your pump.



### **Knowing your germination rate helps you before you start**

The importance to knowing your germination rate is that the more seeds that sprout the less seeds there are to turn to trash and work against you.

## **5.6 The nutritional building blocks required**

### **Lysine**

Lysine is one of the nine essential amino acids. This means that your critter cannot produce this amino acid on its own, and you must include it in their diet. Lysine is important for the production of carnitine, which is essential for helping turn fat into energy. Lysine also helps your body absorb calcium, and when combined with vitamin C, lysine aids in the production of collagen.

### **Digestable energy**

### **Crude protein**

### **Calcium**

### **Phosphorus**

# 6 Formulating the proper diet for your animal

In the previous chapter we took a look at the raw numbers required to build a proper diet for an animal. In this chapter we will dive into each animal type that we might consider feeding fodder too and formulate some options around the right diet for that animal. We will also look at why fodder isn't always the only food required for a proper nutritional plan for all animals.

## 6.1 Why does this matter?

Barley, Wheat, Oats, Sunflower, Pea, Milo.

1) Rabbits: Wheat, barley, BOSS, radish, millet, lentil

2) Pigs: 50% Barley, 30% Rye, 20% yellow/winter peas, alfalfa, clover

3) Chickens: Barley, BOSS, Wheat, Oats,

4) Cows:

5) Horses:

6) Goats: Barley, Wheat, Cow Peas, Millet, Sunflower, Oats, Corn, (Barley, Wheat, Cow Peas, and Sunflowers is my main mix) I'll use Millet, Corn and Oats if one or more of the others are not available but you could feed just one or two of these and the animal would do fine. Mine can be somewhat picky sometimes so I offer a mix, gives them a little variety and I'll change it up a little every so often but Barley is always my first choice and usually the main percentage of grain in mix 35%

7) Alpacas: Barley, Wheat, Oats

8) Sheep: Barley, Wheat, Oats, Annual Rye, BOSS

<http://abclocal.go.com/kgovideo?id=9385462>



## 7 How do I feed fodder

- story about first time feeding fodder
- types of racks to feed fodder in – hay rack mounted on wall – hay box, fodder on top, ladder on top of that Randy Coleman



“Fodder Brothers” style

# 8 DIY - Building a small system for chickens and rabbits

Some families keep a couple chickens for egg laying reasons. Or perhaps they keep some rabbits as pets. Either way, these animals can benefit from small scale fodder production too. In this chapter we will explore all sorts of ideas around small scale fodder production. And then we will walk through the steps on how to produce a small fodder system for our in home use.

## 8.1 Who would this type of system be right for?

Let's take a quick look at a few scenarios that generally applies to many home or small farm operations. We will use chickens in the examples but each scenario is applicable to chickens, rabbits, guinea pigs, pot bellies, etc.

**Confined animals:** If you have chickens that are kept in a coop and never allowed to free range, fodder is a perfect way to get a more natural diet into your birds.

**Free range:** If however you do allow your birds to forage then fodder will make a great supplemental feed for your birds. The difference that you need to think about is how much food the birds are getting on their own vs. how much the animals are dependent on you for its food.

**Severe climates:** If you raise your animals in areas that have severe winter or summer weather where freezing temperatures impact the grazing ability of your animals (dormant grasses) or really hot temperatures that kill off your grasses, then fodder should be considered as a cheap reliable source of high value nutrition to

supplement these weather driven issues.

## **8.2 Some example systems**

### **8.3 The build**

#### **Making the trays**

Storage bins with holes stacked

#### **Seeding the trays**

Cut a lid to the shape that allows you to fill the tray 1/2 deep

#### **Stacking the trays**

Stack trays on a plate drying mat so that the water drains into your sink

#### **Soaking the seeds**

## **9 A medium sized system for a family farm**

## **10 A large scale-able system for a working farm**

# **11 Questions and Answers**

# Resources

Here are the links I found useful while researching this book.