It is a well accepted fact that feeding dairy animals is incomplete without including green fodder in their diet.

Green fodders are staple feed for dairy animals. Dairy animals producing up to 12-15 liters milk per day can be maintained by feeding green fodders. Inclusion of green fodders in ration of dairy animals decreases amount of concentrate feeding and thus increases profit. Therefore, for economical and sustainable dairy farming, fodder production round the year is highly essential.

Advantages of Feeding Green Fodder
- Fulfills bulk of animal easily and quickly.
- Major source of vegetable protein.
- Good source of soluble & Fibrous carbohydrate
- Good source of minerals.
- Rich source of vitamins.
- Good source of water (approx. 15-25% water).

Green fodders produced by growing seeds without soil but in water or nutrients rich solutions are known as hydroponics green fodder.

In comparison to conventional green fodders, hydroponics green fodders contain more protein, fat (ether extract) and soluble carbohydrates (nitrogen free extract); but less fiber, total ash and acid insoluble ash.

Hydroponic fodder is much more easily digestible, full of nutrients and enzymes that the energy spent on this digestion process would be far less with the resultant extra energy being diverted to milk production and growth.

Compared to conventional methods of growing fodder, hydroponic fodder requires lesser space and produces highly nutritious fodder than soil farming.

All About Fodder Growing Technology
For Commercial Production of Hydroponic Green Fodder

HiTech Power Systems
5th Floor, Ajya Complex,
Satadhar Cross Road,
Ghatlodiya, Ahmedabad,
Gujarat, INDIA
Phone: +91 7622062206,
+91-79-32503029,
contact@foddermachine.com
www.foddermachine.com
Now a days with googling we can have knowledge about hydroponically green fodder.

Hydroponic fodder production involves supplying cereal grain with necessary moisture and nutrients, to enable germination and plant growth in the absence of a solid growing medium. The resulting green shoots and root mat are harvested and fed to livestock. The grain responds to the supply of moisture and nutrients by germinating, sprouting and then producing a 200 – 250mm long vegetative green shoot with interwoven roots within 7 to 8 days.

The fodder is grown on trays in a growing unit under controlled environment and only supplied with water at predetermined times during the day.

Commonly grown fodder crops under this method are Maize, barley, wheat and sorghum. Hydroponic fodders is ready for feeding in 7 days. The end result is a network of roots and a green mat of green sprouts which is fed wholesome and provides high nutritional content.

**Characteristics of hydroponic grown fodder**

- Highly rich in vitamins, minerals, enzymes.
- Hydroponic fodder is 85% to 90% digestible.
- Hydroponic fodder contains high quality protein.
- High energy content.
- High in moisture content that prevents colic.

**Hydroponic Fodder Growing Technology Features**

**Fodder Alternative** – A highly nutritious and digestible fodder is provided daily on your property to be used in conjunction with other feed or as an alternative to them. The cost per kilogram is very competitive – depending largely upon the current prices of the seed grain.

**Drought Proofing** – The conversion of seed grain into succulent fodder by a factor of six to one has much appeal during drought or normal dry summer periods.

**Management Tool** – To have such a fodder available 365 days of the year allows farm managers to drop lambs, calves, etc at an optimal time to meet market peaks, as well as having the comfort of being able to produce fat stock that has a consistent quality.

**Productivity in a Shed** – Owners of small properties now have the means to economically increase their stock numbers without having to lot feed or the need to purchase additional land.
Constant Feed Supply: Hydroponic Fodder technology will remove the need for long term storage of grass. A consistent supply of green grass is guaranteed 365 days of the year.

Enhancement of Nutritional Value: Fodder green grass is a highly effective particularly nutritious feed, which produce 3 times more than protein as compared to conventional green feed. Feeding livestock fodder produced feed may increase the milk production and improve upon the general health & fertility.

Completely Natural: An important factor about growing green grass in fodder machine is that completely natural product. Therefore, there are no pesticides or fungicides used that could alternatively contaminate the milk or meat that are being produced.

Nutrition Report by Animal Nutrition Research Station

![Nutrition Report](image)

Table 1: Chemical composition (on % DM basis) of fodder maize

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Seed (0 day)</th>
<th>Days of spraying under hydroponics system</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein*</td>
<td>8.60%</td>
<td>8.88%</td>
<td>9.14%</td>
<td>9.65%</td>
<td>11.29%</td>
<td>11.58%</td>
<td>12.89%</td>
<td>13.57%</td>
<td></td>
</tr>
<tr>
<td>Ether Extract*</td>
<td>2.56%</td>
<td>2.49%</td>
<td>2.57%</td>
<td>2.88%</td>
<td>3.08%</td>
<td>3.06%e</td>
<td>3.21%</td>
<td>3.49%</td>
<td></td>
</tr>
<tr>
<td>Crude Fiber*</td>
<td>2.55%</td>
<td>3.07%</td>
<td>3.07%</td>
<td>4.72%</td>
<td>5.51%</td>
<td>7.56%d</td>
<td>10.67%</td>
<td>14.07%</td>
<td></td>
</tr>
<tr>
<td>Nitrogen Free Extract*</td>
<td>84.49%</td>
<td>84.15%</td>
<td>82.82%</td>
<td>79.26%</td>
<td>77.65%</td>
<td>74.04%e</td>
<td>69.21%</td>
<td>66.72%</td>
<td></td>
</tr>
<tr>
<td>Total Ash*</td>
<td>1.57%</td>
<td>1.67%</td>
<td>1.84%</td>
<td>1.92%</td>
<td>2.19%</td>
<td>2.44%</td>
<td>3.34%</td>
<td>3.84%</td>
<td></td>
</tr>
<tr>
<td>Acid Insoluble Ash*</td>
<td>0.02%</td>
<td>0.03%</td>
<td>0.08%</td>
<td>0.09%</td>
<td>0.13%</td>
<td>0.14a</td>
<td>0.24%</td>
<td>0.33%</td>
<td></td>
</tr>
</tbody>
</table>

No Fertilizer or Hormones Just Water and Seed

Nutrition Rich Green Fodder, 365 Days, Year Around
Daywise Fodder Growing Status

Day 0 – 1 of cycle - Pre-soaked swollen grains evenly spreading in the plastic tray, trays stacked on shelves

Day 2 of cycle - Seeds have begun to sprout roots and head after being soaked for 24 hours before planting.

Day 4 of Cycle - Tremendous growth in root bed occurs before growth of shoots/heads. Healthy root beds will create a mass that resembles that of a tight knit carpet lifting the seed and shoot from the tray.

Day 6 of Cycle - Root bed is almost fully developed and growth transfers to shoots that have grown to 1”-2” in overall height.

Day 7 of Cycle - Feeding Day - Growth so fast you can nearly see it! Fully developed shoots and root bed ready for feeding. Healthy root beds are hard to separate and shoots are 8”-10” in overall height. From simple seed and water comes healthy natural feed with no fertilizer and hormones added.

After the mat is removed from the tray, it can go into a feed mixer or be hand-fed to livestock. Livestock will eat the whole thing: seeds, roots, and grass. There is minimal waste. Livestock may not eat the fodder initially because it is novel, but should soon learn to eat it with relish.
Housing Structure (Outer Structure)

Housing structure can be made from many materials like, RCC, PUF panel, Roofing Sheets, Polycarbonate Sheets etc. We preferred to be build by PUF panels for its very good insulation properties and long life.

Environmental conditions inside the room should be controlled by use of 5 Star rated Air Conditioner. To do that the equipment capacity needs to be considered according to Production / Day.

Tray Holding Shelves structure

It will be necessary to build a special shelves structure that allows to keep the HDPE Trays with grains are stacked, such frame can be made with aluminum to give longer life. These shelves will have a light slope needed in order to have a good running off excess water. Besides, the shelves should be spaced enough to allow building the irrigation system in it.

Climate control - The chamber temperature

Temperature control inside the chamber is extremely important to get an optimal result. The working temperature averagely 25°C (77°F) according with the type of grain selected and its variety to avoid problems from moulds, yeasts, and bacteria, all of them highly detrimental for green fodder production and its quality.
Maize, barley, oats are a very interesting forage to produce by green fodder. It requires a temperature 25ºC. To support a correct temperature all year round heating in Winter and cooling in Summer are required in most places around the world unless in some zones having very special microclimates.

Isolation of the growing chamber is the first consideration to take into account before starting to design this room. Every effort made in order to keep isolation high inside the cabinet will help in big savings in energy needed in conditioning the full equipment.

Irrigation System

Production of green fodder is a very short process. Most of the necessary energy is provided by its own seeds. That is why nutrients requirement is minimum or not require.

Irrigation is necessary from the very beginning. It should be done since grains are put in trays. Irrigation should be carried out several times during the day. There are different ways to do it but it is always required to keep the plant roots humid mainly when germination is vigorous.

For irrigation purposes it is possible to employ a simple sprayer or a manual pumping sprayer for small green fodder chambers with only few trays but automatic micro aspersers should be used in bigger facilities.

The irrigation method is keeping relationship with production equipment design. we uses Spray irrigation system to supply water for moisture by using mini sprinklers, fodders, misters etc.

Irrigation can be regulated. That will save water, scarce in some places. To regulate it a sprayer driven by a timer can be employed. It is suggested to spray each half an hour period during daily hours only for 20 to 30 seconds each time. This regime will keep constant humidity during time of higher plants activity. Irrigation time depends on working conditions, available equipment, size of installations, type of seeds and quality, and management.
Seed Selection

The grain to be used (mainly cereals and some leguminous seeds) is the main point of this technology. Grain is not important only as a productive raw material but also its cost is the main controlling factor on the final production cost.

Essentially grains used to produce green fodder are: wheat, barley, sorghum and maize. Fundamentally the selected type shall be a good quality grain.

A good quality grain for green fodder production follows the next pattern of conditions:

1. Not to be impaired during its handling. Broken grains allow starch freedom and illness possibilities increases.

2. To be dust clean. Dusts are yeast, bacteria, micro-fungus and other microorganism bearers.

These are two main conditions that a good grain for green fodder should comply. They are very important by themselves and they could be the cause of success or failure in producing green fodder.

The first points mentioned on the grain selection criterion can be searched by visual observation on grains. Besides careful observation, counting should be used to know the percentage on broken and bad grains. Of course, a third condition is also highly important: A grain having at least 90% of germinative power should be selected. Being easy to do, it is highly advisable to make a grain germination power test before buying it.

The second point, clean grains as much as possible without dust, should deserve a major discussion. Presence of dust, many times slanted, is a clue matter when somebody wants to obtain a healthy green fodder.

Another very important point to consider by the producer when he is ready to select a grain is its local availability. Since cost of grain is the main factor on green fodder production, it is necessary to avoid long transportation distances. As it was expressed it is highly important to give special attention to seed selection. Also, a good treatment of grains previous to germination, is essential.

Seeds Cleaning & Washing

We had found that a good previous washing of seeds is one of the main factors to get green fodder without problems. The main object of this washing is to eliminate most superficial dust.

This washing should be done adding to water a small amount of a good inert nonionic detergent, similar to those used in the kitchen to clean dishes and cooking equipment.

After washing, several rinses to eliminate detergent and dirt traces will complete this part of the procedure. Good cleaning of seeds is also excellent and very important to reduce or eliminate chemicals from fumigation residuals if any are there.
Disinfection

Having grains clean, after washing and rinsing of seeds was done, next step correspond to disinfect them. We use a bleach pre-soak process for our grains and consider pre-sanitization of grains a necessity for the fodder growing.

Grains should be immersed in this water and kept there for 1 hours. Seeds shall be drained and later they will be rinsed several times. It should be remembered that many rinses with little water in each one is much more effective than few of them with a lot of water. Grain that is stored in any fashion is prone to storage mold spores, like Aspergillus.

This is a very common mold that will look like fluffy white cotton (not to be confused with root hairs) if there’s an outbreak. By pre-sanitizing the seed, prior to introducing it to a grow tray within the grow system, we reduce the vector of contamination not only of this type of mold spore, but also of any other fungal spores that might be present, along with cleaning the seed of dirt and debris.

We want leverage over mold control from the very start of the growing cycle. However, the best pre-sanitized seed does not mean that molds cannot occur or will be prevented during the growing cycle. Upon germination, the seed hull is discarded by the newly emerging plant sprout. This seed hull immediately starts to decay. The style of irrigation can encourage or accelerate the rate of decay. Sprouting is a delicate dance between creating a live plant and controlling the decay rate of those discarded seed hulls where molds gain a toehold. During a grow cycle, many other factors can cause molds to occur within the seed bed: climate control, air circulation and evaporative rates, cleanliness, and mixed use applications.

Seeds Soaking

After cleaning and disinfecting soaking of seeds is next. Water temperature higher than 15ºC (59ºF) is convenient, but 20º to 25ºC is much better, to accelerate imbibitions. Seeds should be immersed during 12 hours well covered in this water.

After that period, water will be discarded and changed once for another 12 hours to complete their swelling. due to soaking weight of the grains will be increase by around 30%. After the soaking is done, drain all the water from the bucket.

Ensure you drain all of it as some water is usually observed to stagnate at the bottom of the bucket.

Seeds Sowing

Sowing in trays can be done immediately after soaking and draining, but it also can be done after being one whole day in buckets mass germination.

In case the last method is used, many seeds are going to trays with incipient germination. They should be put in the trays with great care in order to avoid breaking small sprouts.

Now transfer the seeds to a clean plastic tray. The tray should be cleaned first, using soap or bleach at best. Clean it well. Transfer the seeds to the tray and ensure that you spread them into an even mat with your hands.

Be gentle. The trays should be placed on a slope, with the perforated end of the trays on the lower side of the slope.
Fodder Growth - day wise No Fertilizer or Hormones Just Water and Seed

Day 0 - 1 of cycle - Pre-soaked swollen grains evenly spreading in the plastic tray, trays stacked on shelves

Day 2 of cycle - Seeds have begun to sprout roots and head after being soaked for 24 hours before planting.

Day 4 of Cycle - Tremendous growth in root bed occurs before growth of shoots/heads. Healthy root beds will create a mass that resembles that of a tight knit carpet lifting the seed and shoot from the tray.

Day 6 of Cycle - Root bed is almost fully developed and growth transfers to shoots that have grown to 1"-2" in overall height.

Day 7 of Cycle - Feeding Day - Growth so fast you can nearly see it! Fully developed shoots and root bed ready for feeding. Healthy root beds are hard to separate and shoots are 8"-10" in overall height. From simple seed and water comes healthy natural feed with no fertilizer and hormones added.

The daily operation of the fodder growing revolves around 6 main tasks:

1. Harvesting mature fodder mature fodder is pulled out of the trays as a complete single mat. feeding them to animals

2. Cleaning Trays It is critical that the trays and all equipment are thoroughly cleaned to reduce the risk of mould and other infections. A soapy water or water with bleach is commonly used to achieve this.

3. Sowing New grain, which has been soaked for 24 hours, is sown into the trays. This grain is sown in an even layer 2cm deep.

4. Cleaning & washing the grains for soaking

5. Disinfecting and soaking grains for next day sowing
There are several different “mold” and fungal issues. Spider-webby / Cotton mold, Blue-Green fuzz forms, Brown mold on the root system. Clean the planting tray with bleach (grapefruit seed extract, hydrogen peroxide, whatever you feel safe with using.) and water and let dry out in the sun. not too long as the sun will dry out the fodder.

Hydroponic fodder grows really fast. Atleast 6kg of fodder in 7 days from 1kg of seed. The problem is, fungus on the roots of the fodder may grow and spread just as fast. So how do you get it under control? The following are step on how a you can use simple, inexpensive, and very effective tricks to get rid of the mold and fungus.

1. Tray Slope
This by far, is the most important measure one can take to control fungus. The trays on which the fodder grows must be put on a gentle slope so as to ensure water keeps moving when they are watered. The functionality of this is simple. Think of fungus as mosquitoes, and your trays as a water body e.g. a river or a swamp. In the event that your trays are on a flat surface, they will act as a swamp, and mosquitoes love to breed in stagnant water. And so does fungus. One way to keep the mosquitoes at bay is to get rid of any stagnant water or ensure good drainage. This almost always works in controlling mosquitoes and it is also effective in controlling fungus. This is why rivers are clean, but swamps are filthy. Turn your trays into a ‘river’. Make sure they are on a gentle slope, and the water is always in constant motion. But this does not mean you turn your system into a waterfall. Make the slope gentle, not steep. This simple trick does wonders. And the avoidance of this trick is the main reason many farmers experience fungus in their hydroponic shelters. Ensure a good slope.

2. Temperature of Growing Space
Another condition that favors the growth and spread of fungus, is high temperatures. Just like mosquitoes, fungus prefers warm temperatures. One way to make your hydroponic shelter cool is to use fans, thermostats and thermometers to keep the temperatures at an average of 25 to 26 degrees centigrade.

Another way to control the temperature is to align the structure lengthwise east to west. This ensures minimal direct sunlight enters the structure thus reducing the temperature. Do this, and you are a step closer to a clean hydroponic system.

3. Soilless floor
A lot of fungus comes from the soil. If you get rid of soil, you get rid of the source. One way is to make a concrete floor in the structure. This is expensive but very effective. It not only reduces the chances of fungal infestation but it also prevents the formation of mud and growth other plants on the floor of the structure.

4. Hygiene
This cannot be stressed enough. The farmer has to take responsibility over the hygiene of the structure. The following are the hygiene measure he has to take.
   a) Do NOT lift the fodder mat to inspect the roots. This exposes the roots to air and may lead to fungal infestation. Only lift the mat during harvesting.
   b) Not Recycle the irrigating water, use fresh water every time.
   c) Do NOT irrigate your fodder with water used to soak your seeds. Farmers who have problems with water availability tend to use the water used for soaking to irrigate the hydroponic system. Although this is very water economical, it does aid in the spread of fungus. Cut it out.
   d) Always clean the trays before planting the seeds on them. The best way to do this is to use a bleach solution. This will disinfect the trays. If bleach is not available, soap may be used. Be thorough, like you are washing a plate for human use.
   e) Keep the door closed whenever possible. Insects that fly in will aid in the spread of fungus. Whenever not in use, keep the door of the structure closed at all times.
   f) Clean all the buckets and gutters with soap, on a daily basis.

5. Create Air Circulation
Air circulation blowing around the grass, especially if the temp. starts to get above 26 degrees. (ceiling fan, oscillating fan, air condition, exhaust fan, in front of an open window, etc...) Air movement will prevent 90% of all mold issues.

6. Change your seed
If you have good air flow, and you are still getting mold, it is time to change your variety of seed you are using.

7. Spraying
Spraying the grass with Hydrogen Peroxide, grapefruit seed extract, acid base water, etc... These are all nice ideas to get rid of MOLD, but they are not quick fixes. There is no quick fix to get rid of the mold. Once you get it, don’t let it get you down. Just rinse it off.

These are the measures we have taken ourselves in running a clean structure. And it has worked wonders for us. One thing the you should note, is that you cannot completely get rid of fungus, but you can keep it at a minimum, at which it has no effect on the system of your livestock.
Get Rid of Uneven Growth of Fodder

It’s always very odd when we plant all seed sprouts all at the same time, and some appear to be growing faster than others. It happens that there are patches that have not grown, or some parts are growing extremely long and the other parts pretty short. It is possible to get evenly growing fodder. To do this we have to go all the way to the beginning.

1. Bottom of the plastic tray must be even or flat, if bottom is uneven than it holds the water in uneven space.

2. Another important step we should take is how we place the sprouted seeds on the tray. Once we have place them on the tray, use hands to level the seeds. If we leave them in heaps on the tray, they will grow unevenly and only the seeds at the top of the tray will grow. This is bad news and can be avoided by simply leveling the seeds on the tray.

3. Another measure we should take is mostly one based on technique. When running the structure it is good to sprinkle the entire tray with water. Makes sure the trays are on a gentle gradient. If it too steep, the fodder at the end of the slop will grow tall, but the ones at the start of the slope will be considerably shorter. Again do not make it flat, as water will well up, creating a swamp like environment and result in the death of the seeds.

Healthy Hydroponic Fodder