FarmBot

HUMANITY'S FIRST OPEN-SOURCE
CNC FARMING MACHINE

Locations of every FarmBot on Earth as of November 2017

100% Open-Source

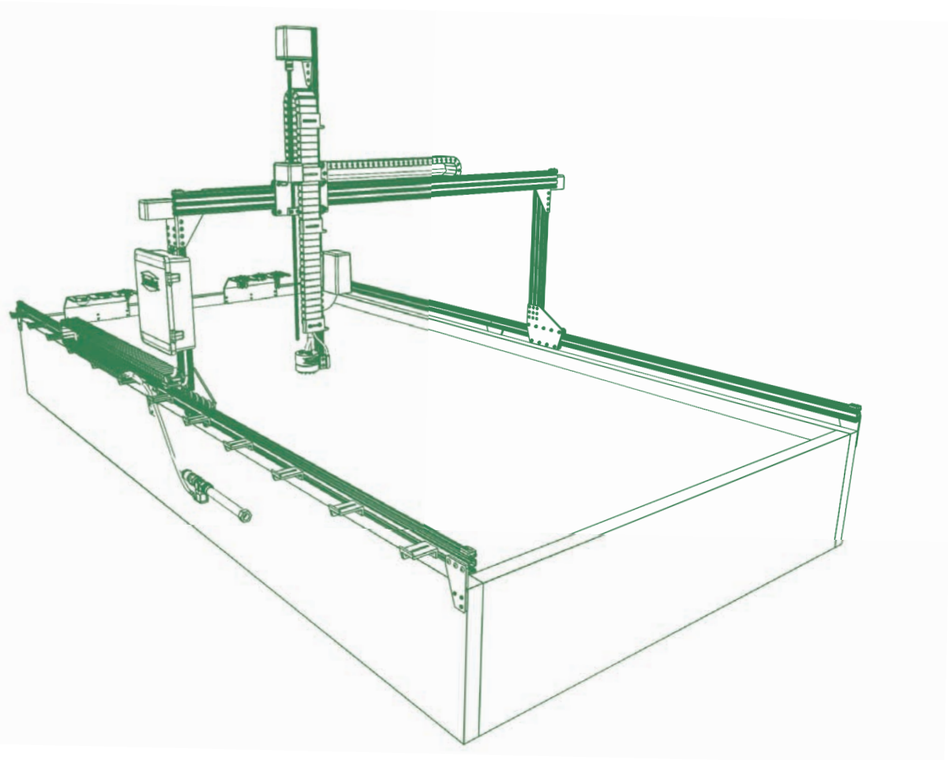
FarmBot is yours. through & through

Design Files

We've published all of the CAD and manufacturing files used to make FarmBot so you can make and modify your own parts. All CAD files are in the public domain under CC0.

Software Source Code

Help us build new features, fork the code for your own custom mods, or host the web app locally for true off-grid independence. All software is under the MIT license.



Documentation

Know FarmBot inside and out with our step-by-step assembly instructions, bill of materials, and tech specs of every part. All documentation is in the public domain under CC0.

Community

FarmBot is powered by a global community of makers and hackers, students and educators, professional farmers, and DIY food enthusiasts who are all passionate about bringing control of the food production system back into the hands of end-eaters.

In addition to our documentation hubs, we've set up online community spaces including a forum and wiki for collaboration, troubleshooting, and sharing. Join us!

Farm from Anywhere

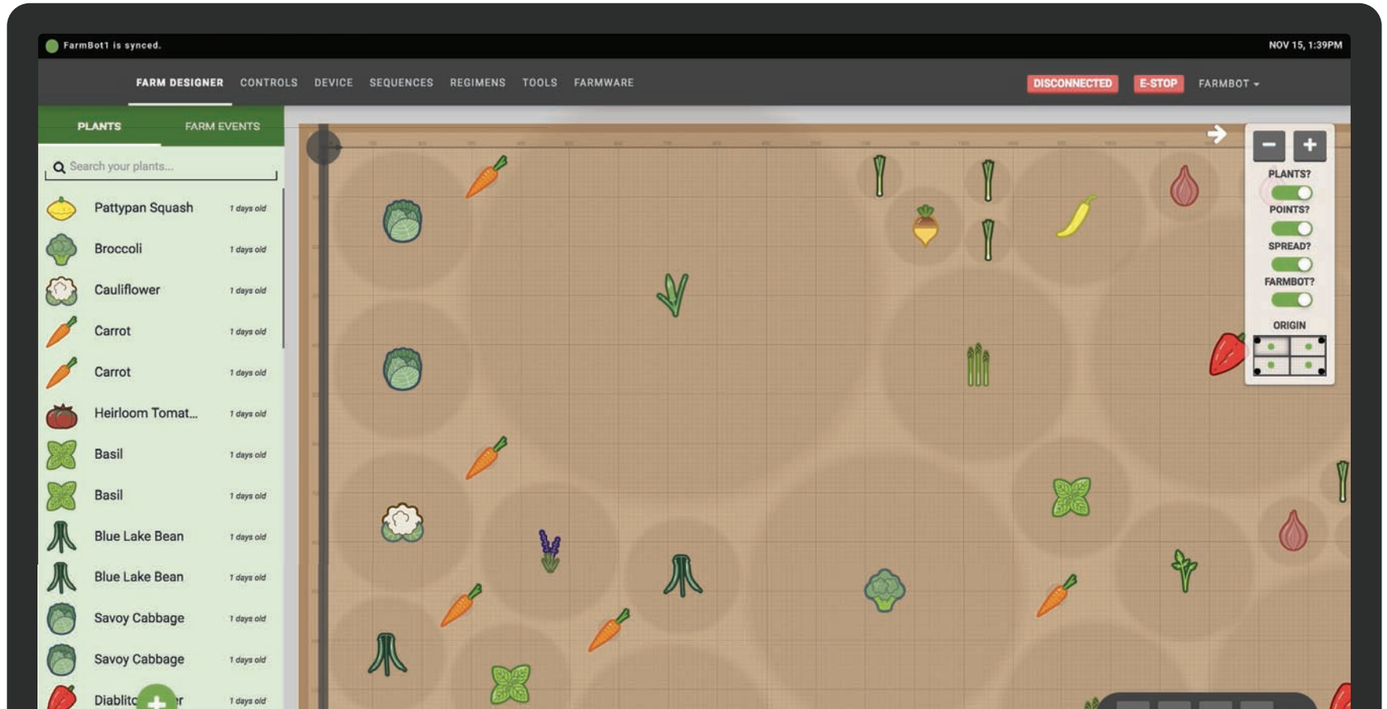
Control and configure FarmBot with any device

Drag & Drop Farming

Visually design your farm by dragging and dropping plants into the map. The game-like interface is learned in just a few minutes so you'll be growing in no time. Plants are automatically spaced and growing regimens can be applied upon planting.

Growing Regimens

Build complete regimens for taking care of a plant throughout its lifetime by scheduling sequences to run when a plant is a certain age. Regimens can be reused, saving you time and effort during replanting.



Sequence Building

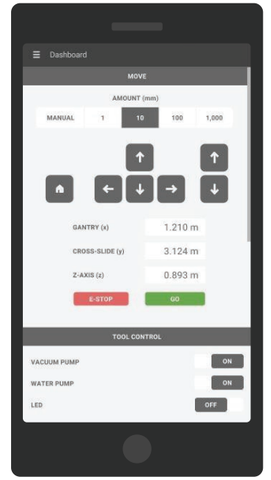
Quickly and easily create custom sequences of operations to take full advantage of your hardware – no programming is required. Simply drag and drop basic operations and other sequences together, adjust the parameters to your liking, and save.

Built-in Farming Knowledge

FarmBot uses public-domain crop information from OpenFarm.cc, allowing you to grow a wide variety of common vegetables, flowers, mushrooms, and more without any prior experience.

Real-Time Control

Move FarmBot and operate its tools in real-time with the manual controls. Remotely scare birds away or next time friends are over, pull out your phone for a quick and impressive demo.



Premium Hardware

We've gone through great lengths to design, manufacture, and source only the highest quality components for our kits

Plates & Brackets

Our plates and brackets are stamped and machined out of high grade aluminum alloys. Then they are tumble polished to remove burrs, sandblasted to remove surface defects, and anodized to achieve a premium quality aesthetic and feel.

"They don't only look good. They feel really solid, like they will last a century."

— Tim Evers, FarmBot Core Contributor

Motors, Electronics, & Wiring

An Arduino MEGA and four NEMA 17 stepper motors with rotary encoders power FarmBot's movements, while the Raspberry Pi 3 serves as the web-connected brain.

"It was important for us to integrate rotary encoders into the FarmBot design so that its movements are reliable, even in an unpredictable garden environment."

— Rory Aronson, Founder of The FarmBot Project

Fasteners & Hardware

All fasteners are made of stainless steel, allowing them to stand up to the outdoor environment without rusting or corroding.

Plastic Parts

The plastic components have been injection molded with ABS or precision machined from Delrin. They are both tough and able to withstand UV rays.

Aluminum Extrusions

These black anodized beams serve as both the primary structural element of FarmBot and its linear guide system, allowing precise movements in the X, Y, and Z directions.

"I wasn't expecting the extrusions to be black, but man they look incredible!"

— Garrett, 1st production run backer

Know the Weather

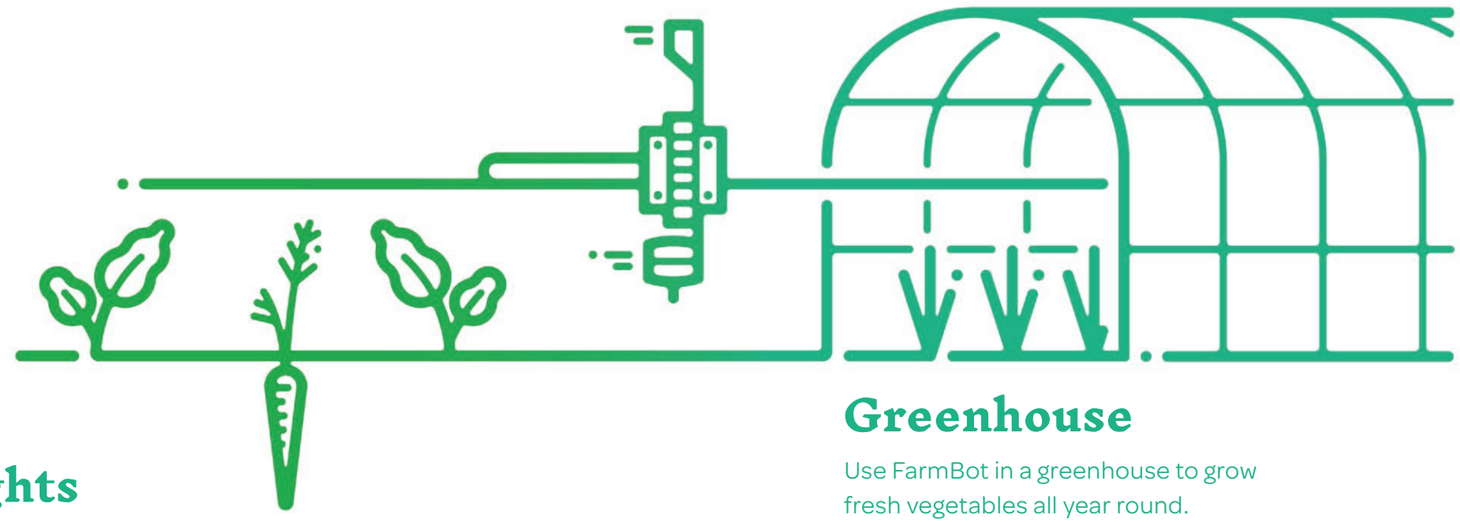
Gather and use real-time weather data to allow FarmBot to farm smarter.

Go Off-Grid

Take FarmBot off-grid with small solar power and rain collection systems.

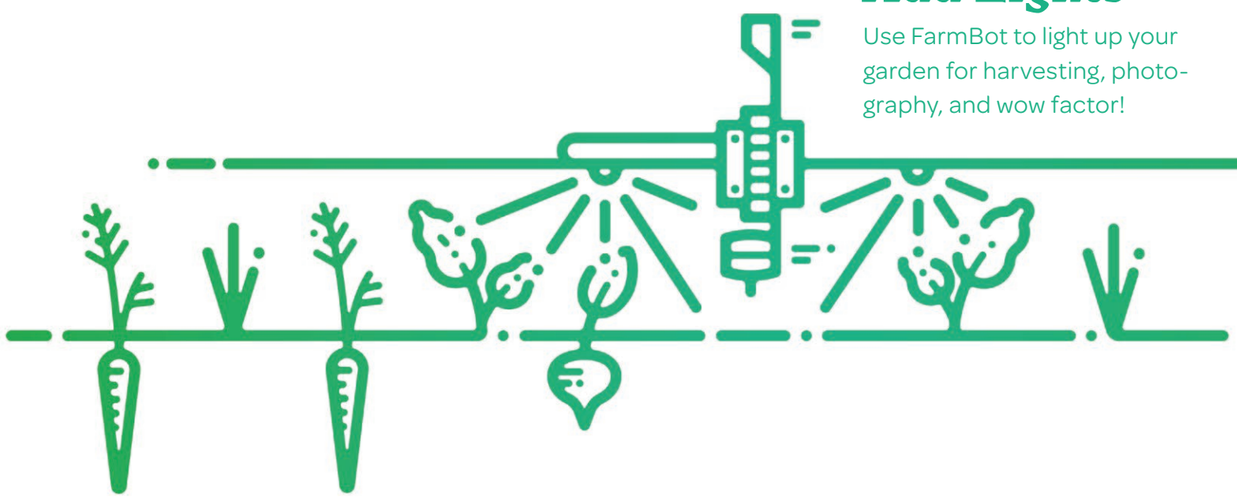
Ready for Expansion?

Modify and augment FarmBot for your unique growing style & needs



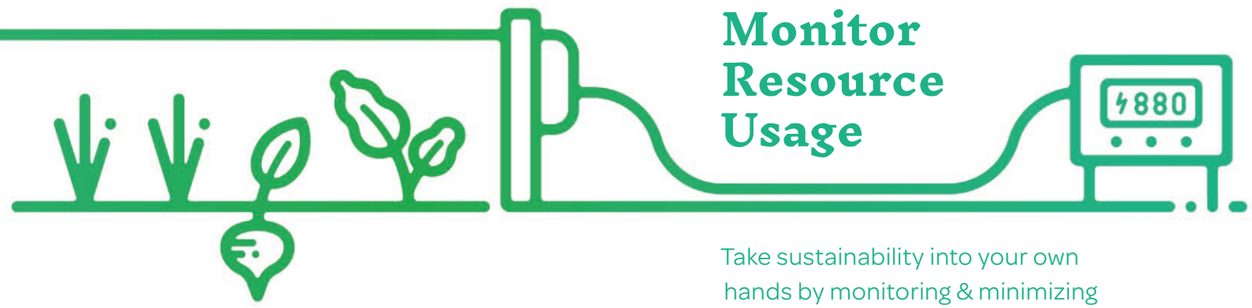
Greenhouse

Use FarmBot in a greenhouse to grow fresh vegetables all year round.



Add Lights

Use FarmBot to light up your garden for harvesting, photography, and wow factor!



Monitor Resource Usage

Take sustainability into your own hands by monitoring & minimizing resource usage.

Interchangeable Tooling

These ones come standard. What will you create?

Weed Suppression

Stomp out weeds before they become a problem with this customizable weed suppression tool. The blades and spikes come standard, though you can add corkscrews and other shapes depending on your environment.

Soil Sensor

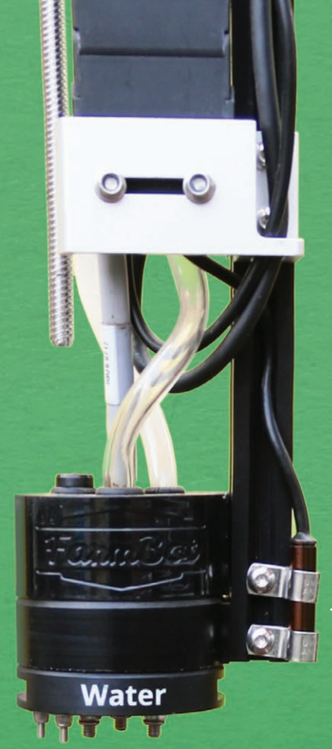
By measuring the moisture content of the soil, FarmBot can be configured to take care of your crops in more water-efficient ways. For example: it can avoid watering after a rain.

Universal Tool Mount

Featuring 12 electrical connections, three liquid/gas lines, and magnetic coupling, the UTM can support any tool you can imagine.

Watering

Coupled with a 12 volt solenoid valve, this tool allows you to precision water your plants with a gentle shower. The two-piece design allows you to customize the spray pattern by 3D printing your own alternative.



Camera

FarmBot's camera takes photos of your plants and soil in order to detect weeds, track plant growth, and one day identify pests and disease.

Seed Injection

Powered by a 12 volt vacuum pump, the seed injector can precisely position seeds in the ground with millimeter accuracy. Interchangeable luer lock needles allow you to work with both small and large seeds.

Seed Trays

The seed trays have 16 small areas for holding seeds. They are best used when planting many different crops, and when the number of seeds per hole needs to be strictly controlled.

Seed Bins

Seed bins are for holding large amounts of one type of seed. They are best used when planting many plants of the same crop, for example: when growing microgreens.

Infinite Possibilities

How will you use FarmBot?

For Research

Use FarmBot in the lab for precise growing experiments. A/B testing with hundreds of variations has never been easier.

For Food Sovereignty

Use FarmBot on a raised bed, urban rooftop, or in a greenhouse to grow your food exactly the way you want it to be grown.

Commercially

Use FarmBot for your small commercial farming business to save labor costs and improve efficiency.

How much food can FarmBot grow?

An in-depth analysis based on crop needs & performance

We are often asked questions relating to FarmBot's yield. "How big of a FarmBot do I need to grow all of my food?" is a common one. While we don't yet have comprehensive empirical data to share with you, we have done an analysis answering this very question. Let's dive in to see the results.

Gathering Data

We compiled a set of 33 common crops (seen in the table below) that could be compatible with FarmBot in the near future. You'll notice that we did not include tall crops such as sunflowers and corn, and there are no fruit trees or berry bushes (with the exception of strawberries). Additionally, there are no grain crops included because it is unlikely that growing grains would be efficient with FarmBot hardware in comparison to larger scale specialized equipment.

After choosing the crops, we needed to find three pieces of data for each: average yield per harvest (kg/m²/harvest), average days till harvest (days/harvest), and caloric density (calories/kg). We found this information from the USDA and a wide range of other sources online (see below for resources list).

Crunching Numbers

Right off the bat, we made an assumption that FarmBot can increase yield per harvest by about 12% by packing plants in a denser hexagonal packing structure instead of a traditional cubic packing structure. Using this new yield data and the days/harvest values, we calculated daily yield values for each crop in kg/m²/day. Multiplying this figure with the caloric density provided a daily caloric yield for each crop in calories/m²/day.

crop	kg/m²/harvest (cubic packing)	kg/m²/harvest (hexagonal packing)	days/harvest	kg/m²/day	calories/kg	calories/m²/day
arugula	0.79	0.91	35.00	0.0259	250	6.47
broccoli	1.18	1.36	65.00	0.0209	340	7.11
carrots	3.36	3.88	70.00	0.0555	410	22.74
tomato	1.23	1.42	85.00	0.0167	180	3.01

Find the full chart at farmbot.io/yield

From here, we found out how many calories/day could be produced with a FarmBot Genesis (4.5 m² in size) and a FarmBot Genesis XL (18 m²). We calculated these values twice: once by using an average caloric yield of all 33 crops to represent growing them all using an equal amount of area; and once by using an average of the best 10 performing crops as ranked by the calories/m²/day benchmark. The results are in the table below:

	calories / m²/day	calories / day with FB Genesis	calories / day with FB Genesis XL
all crops average	9.74	44	175
best 10 average	18.21	82	328

As you know, 328 calories/day with a Genesis XL growing the best 10 performing crops is not very many calories. Most people eat at least 2,000 calories/day. By this analysis, one would need a huge FarmBot to grow all of their caloric needs. We calculated just how big in the table below, revealing a minimum size of 110 square meters (the size of a small house) in order to provide all 2,000 calories/day.

	calories/ m²/ day	size of FB needed for a 2,000 calorie diet (m²)	size of FB needed for a 2,500 calorie diet (m²)
all crops average	9.74	205	257
best 10 average	18.21	110	137

Cups. Not Calories

But this isn't a very useful calculation because most people don't get 100% of their calories from vegetables. Not even close to it, actually. Most people also eat grains, dairy, meats, oils, fruits, etc – all of which are much more calorie dense than veggies. According to My Plate (previously the food pyramid), we're supposed to eat about 3 cups of veggies a day, and there is no mention of calories of veggies at all.

This means that the question we are asking and answering should instead be: "How big of a FarmBot would I need to grow the recommended cups/day of veggies I need?" Let's see how this changes things.

If you chose to eat 3 cups of black beans every day, that would be over 1,500 calories, and require about 250 square meters to grow. This is a huge amount of area needed to satisfy our 3 cups goal. If you chose to eat 3 cups of arugula every day (a crop with similar calorie/kg value to black beans), that would be less than 20 calories, and only require about 3 square meters to grow. This is a much smaller amount of area needed because our new goal is cups, not calories. So while both crops perform similarly according to the calorie benchmark, they perform extremely differently under the cups benchmark.

Promising Results

Looking back out our table of 33 crops, with new columns for cups/m²/day, FarmBot is looking quite a bit more feasible for satisfying our needs.

crop	kg/m²/harvest (cubic packing)	kg/m²/harvest (hexagonal packing)	days/ harvest	kg/m²/day	calories/kg	calories/m²/day
arugula	0.79	0.91	35.00	0.0259	50	1.29
broccoli	1.18	1.36	65.00	0.0209	10.99	0.23
carrots	3.36	3.88	70.00	0.0555	8.70	0.48
tomato	1.23	1.42	85.00	0.0167	5.56	0.09

Find the full chart at farmbot.io/yield

Using the average yield for our 33 crops, and an assumption that they will all be grown in equal quantities, one only needs about 7 square meters of space to grow the daily recommended veggies for one person. If one decides to grow only the top 10 performers (by the cups/m²/day benchmark), then they will only need 3 square meters to grow all of their daily veggies.

This indicates that FarmBot Genesis could produce all of the veggies needed for one person every day.

Meanwhile, a Genesis XL could produce enough veggies for a family of four every day. See the table below for the numbers:

	cups / m²/ day	cups / day with FB Genesis	cups / day with FB Genesis XL
all crops average	0.42	1.88	7.51
best 10 average	1.00	4.51	18.02

We think that this data is quite promising for the FarmBot Project because it shows the capabilities of FarmBot in a clear and transparent light. Your FarmBot (unless it is very large) will not be able to produce all of your calories. However, it will be able to produce enough cups of vegetables to satisfy your daily needs.

Sources can be found at farmbot.io/yield/ .

Exploring the Carbon Footprint of FarmBot

A life-cycle analysis of FarmBot's CO2 emissions vs food from the grocery store

People often want to know how much electricity FarmBot uses. Sometimes they're wondering if FarmBot can be run on solar power (it can). More often, they are actually searching for an answer to this (slightly more complicated) question: "What is the carbon footprint of owning and operating a FarmBot to produce vegetables compared to buying an equal amount of vegetables from the store?" In this section we'll look in depth at this question from a theoretical perspective.

The Two Types of Emissions

First let's talk about carbon footprint calculations. In general, there are two types of carbon emissions associated with a product:

1. The emissions generated from producing the product. These emissions come from mining, processing raw materials, manufacturing the components/product, and shipping it all to the consumer. These emissions are usually directly related to the embodied energy of the product, though depending on the source of the energy used in production, the total emissions can vary widely. For example: the aluminum used in FarmBot might be from Factory A which uses solar energy (zero emissions), or from Factory B which uses energy from coal. Because we don't know every detail of the FarmBot supply chain, we don't know exactly what sources of energy are used to produce a FarmBot. Instead, we will be using published averages for the calculation of these emissions.

2. The emissions generated from using the product. FarmBot uses electricity to operate. The source of that electricity will determine how much CO2 is emitted to operate FarmBot. Because we don't know if the consumer will be using coal based energy, that from natural gas, wind, solar, or some combination thereof, we will again be using published averages for electricity usage emissions.

Sometimes a third emission is included which accounts for emissions generated after a product's lifespan. For example, a building might cause more emissions if it needs to be demolished and taken to a landfill when it is time to be replaced. For this analysis, we are not going to be considering these post-lifespan emissions as FarmBot is a physically small device (compared to a building) and any emissions generated from recycling materials would be attributed to the new product, not FarmBot.

Embodied Energy

In the table on the next page, we list the most prevalent materials used in FarmBot, their cumulative weight, and the expected kg of CO2 emitted due to their production. Keep in mind that these are only estimations meant to provide us with a ballpark idea of the emissions generated to produce a FarmBot.

Material	Weight (kg)	kg of CO_2 / kg of material	kg of CO_2
Rubber (belts, wiring, gaskets)	0.2	3.18	0.60
Copper (electronics, wiring, motor windings)	0.3	2.60	0.80
Plastic (drag chain, 3D prints, wheels, electronics housings, tubing, circuit boards)	2.8	2.53	7.10
Stainless Steel (hardware, bearings, driveshaft, leadscrew)	1.4	6.15	8.60
Aluminum (extrusions, plates)	9.5	8.24	78.3

It is important to note that the numbers in the table above are calculating the CO2 emitted for the production of enough raw materials for a FarmBot (raw aluminum billets, raw plastic pellets, etc). Obviously FarmBot is not constructed from raw aluminum or raw plastic – it is constructed from aluminum extrusions and plates, 3D printed plastic parts, screws, wheels, belts, motors, and other non-raw components. In reality, the actual CO2 emitted to produce a FarmBot may be closer to **150kg** (330lbs) than 100kg, though we can't truly know without exhaustive research and due diligence.

Emissions from Using FarmBot

In the table on the facing page, we look at the emissions attributed to using FarmBot. While we could consider the emissions associated with the delivery of municipal water, acquiring seeds, and more, we are going to limit our scope to the most obvious emission source: electricity usage. Because we don't know how a specific consumer's electricity is produced (coal vs solar vs whatever) we're going to use the US average for CO2 emissions per kWh of electricity: **0.554 kg CO2/kWh.**

Note: *Duty cycle refers to the estimated average percentage of time that the component is being used. For example, the computer and microcontroller are always on (100% duty cycle), while the motors are only being used sometimes (estimated at 5% for each motor). As a point of reference, if you have your TV on for 4 hours per day, that is a 16.6% duty cycle. Also keep in mind that we're including usage of high power 12V tools utilizing the maximum deliverable power and an always-on webcam. At the end of the day, these are very rough estimations and the power usage may change considerably depending on how you program and use your FarmBot.*

component	power (watts)	duty cycle (%)	use in 1 day (hours)	kWh / day	kWh / year	kg CO_2 / day	kg of CO_2 / year
Web App Server / User	20.0	1%	0.24	0.005	1.8	0.003	0.97
Solenoid Valve	30.0	2%	0.48	0.014	5.3	0.008	2.91
User's Device (laptop)	60.0	1%	0.24	0.014	5.3	0.008	2.91
Vacuum Pump	186.0	0.5%	0.12	0.022	8.1	0.012	4.51
Arduino Mega 2560	1.0	100%	24.00	0.024	8.8	0.013	4.85
Raspberry Pi Camera	1.5	100%	24.00	0.036	13.1	0.020	7.28
3x NEMA 17 Stepper Motors	30.0	5%	1.20	0.036	13.1	0.020	7.28
12V tools	132.0	2%	0.48	0.063	23.1	0.035	12.81
Raspberry Pi 2	3.0	100%	24.00	0.072	26.3	0.040	14.56
			total	**0.287**	**104.9**	**0.159**	**58.09**

Using these estimations, operating a FarmBot will emit approximately **60kg of CO2/year, or 130lbs**. As points of reference, this is equivalent to burning 6.5 gallons of gasoline in your car, and the energy used each day by FarmBot is close to what a desktop computer would use in about an hour and a half. Fun fact: at the average US electricity cost of $0.15/kWh, operating FarmBot for a year will cost about $16.

FarmBot Veggies vs Store-Bought

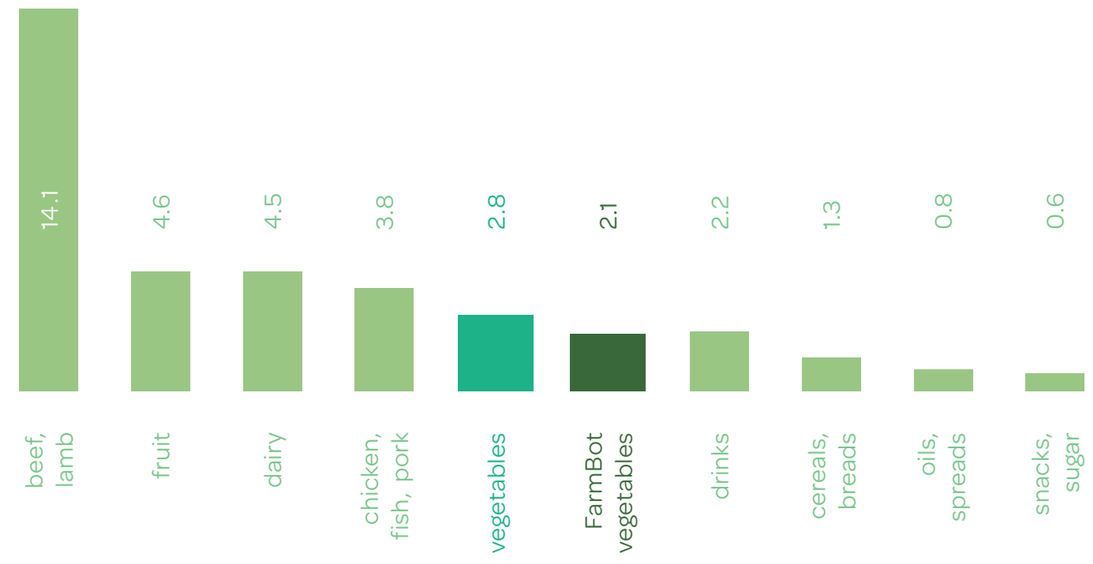
Now that we have a ballpark estimation for the CO2 emissions of FarmBot, let's see how using FarmBot to grow vegetables compares to buying the same quantity from the store. From our analysis of how much food FarmBot can grow, let's assume we're fully utilizing our FamBot and growing 80 calories of vegetables per day. This means that over one year, FarmBot will produce 29,200 calories of vegetables at a cost of 60kg of CO2. This means that the carbon intensity of FarmBot grown vegetables is **2.05 g CO2/calorie.**

Therefore, FarmBot grown vegetables emit 25-30% less CO2 than vegetables bought at the store.

According to ERS/USDA data seen in the figure below, the average carbon intensity of vegetables grown in the US is **2.8 g CO2/calorie.**

Keep in mind that this is not taking into account the CO2 emitted for the production of FarmBot itself (150kg), but the CO2 emitted from the production of industrial tractors, transportation trucks, highways, and grocery store buildings is not included in the 2.8 g CO2/calorie number either. Considering the difference in materials used in the US food supply chain vs the materials used in a FarmBot, we can only imagine that taking all that into account with an exhaustive study would only prove FarmBot to be an even more attractive food production system from a CO2 emissions standpoint. So let's add FarmBot into the plot! Fits in nicely, huh?

Carbon Intensity of Eating: g CO_2e/kcal



Other Things to Note

This analysis is assuming you use average US electricity. If you run your FarmBot off of solar energy, then the CO2 cost of FarmBot grown veggies goes to near zero g CO2/calorie! The only emissions would come from the usage of the web app server and your laptop/phone (unless your whole home is solar powered and you run the web app locally!)

Because FarmBot grown veggies are grown in your backyard, there will be no carbon cost associated with getting the veggies from the field to your fork. With store-bought veggies, you might normally drive to the store – an emissions source not accounted for in our data from the ERS/USDA. And that source could be huge. Remember, the amount of emissions FarmBot emits in an entire year is equivalent to burning just 6.5 gallons of gas. If you drove to a grocery store or farmer's market 2.5 miles from your home once every week in a vehicle that gets 30 mpg to pick up veggies, then you would burn over 8 gallons of gas in a year, effectively doubling the carbon cost of those store-bought veggies.

Because of these reasons and the conservative numbers we've used in our calculations above, we suspect that in reality FarmBot grown veggies will outperform store-bought veggies by an even greater amount than this analysis has suggested, especially if extra steps are taken to make FarmBot less carbon intensive, such as going solar.

Sources can be found at farmbot.io/footprint/.

What is FarmBot's Return on Investment?

Dive into the economics of FarmBot and see how it stacks up against food from the average US grocery store

Many people think that having an expensive piece of farming equipment like FarmBot at your home will never pay for itself – that we would all be better off financially by simply buying fresh veggies at the grocery store. In this section we'll look at the financial costs associated with purchasing veggies at the grocery store vs owning and operating a FarmBot at your home.

There are many assumptions we'll be making in this analysis. Most assumptions are linked to a data source where applicable, while others are just realistic guesses. Guesses are marked with an asterisk. For your specific use case, you may want to adjust some of these assumptions and run the numbers yourself to gain a more accurate understanding of the economics of FarmBot and you.

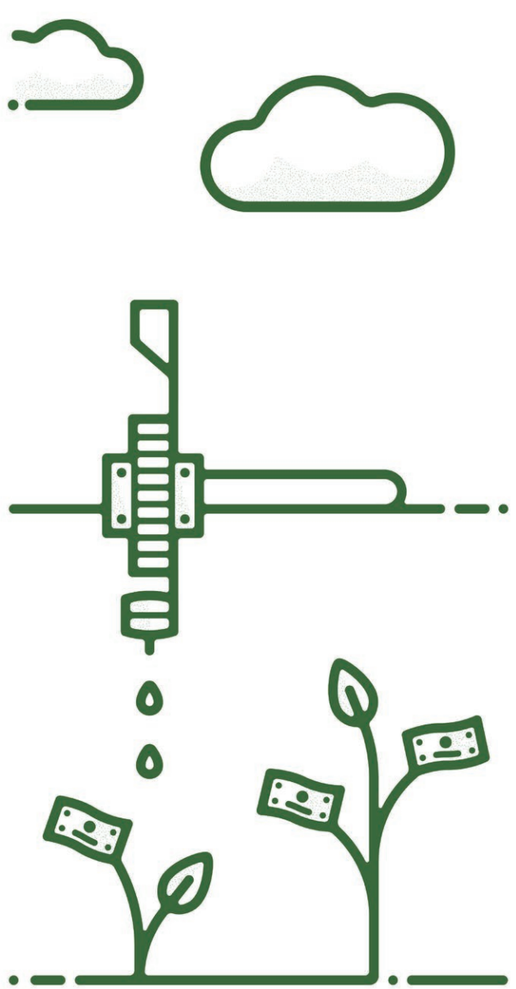
Analyzing Direct Costs

From our analysis of how much food FarmBot can grow, we're going to work with a quantity of 4.5 cups of veggies per day, or 135 cups/month. The table below shows the monthly direct costs of producing this much food with FarmBot vs buying it at the grocery store.

		FarmBot Grown Veggies		Store Bought Veggies	
factor	**cost**	**frequency / month**	**subtotal**	**frequency / month**	**subtotal**
vegetables	$0.50/cup	135	$0.00	135	$67.50
seeds	$2.00/package*	3*	$6.00	-	$0.00
water	$0.015/gallon	150*	$2.25	-	$0.00
electricity	$0.12/kWh	8.6	$1.03	-	$0.00
		total cost / month	**$9.28**	**total cost / month**	**$67.50**
		total cost / year	**$111.36**	**total cost / year**	**$810.00**

Using this data, one would save approximately $60/month, or $700/year in direct costs by growing their own veggies with FarmBot vs buying them at the store. If a FarmBot costs approximately $3,500 (kit, shipping, taxes, supporting infrastructure, soil, etc) then this would indicate a return on investment (ROI) of five years. However, this is not a complete picture because it does not take into account indirect costs such as fuel consumption when traveling to the store, the time required to shop for veggies vs harvest them from FarmBot, or the social cost of CO2 emissions. So let's look at what the cost savings and ROI of FarmBot is when taking into account indirect costs as well.

Looking at direct costs only, one might expect a return on investment period of five years.



Considering Indirect Costs

Many of the indirect costs in this calculation are based on valuing a person's time. We're going to use an hourly rate from an average middle class person making $50,000/year, or $25/hour. We're also going to go out on a limb and suggest (based on conversations with FarmBot customers) that most people will be using FarmBot to grow vegetables with organic practices. Thus, the $0.50/cup cost of veggies we used in the table above needs to be adjusted to level the playing field. Because organic food sales account for less than 5% of all food sales in the US, we can assume that the $0.50/cup price is largely reflective of conventionally grown produce. So let's tack on a reasonable premium of 30%, or $0.15/cup to account for going organic. A few other notable assumptions include using a 25 MPG vehicle for traveling to and from the store, and using a social cost of CO2 emissions of $220 per metric ton.

		FarmBot Grown Veggies		Store Bought Veggies	
factor	**cost**	**frequency / month**	**subtotal**	**frequency / month**	**subtotal**
vegetables	$0.50/cup	135	$0.00	135	$67.50
organic markup (30%)	$0.15/cup	135	$0.00	135	$20.25
seeds	$2.00/pack	3	$6.00	-	$0.00
water	$0.015/gallon	150	$2.25	-	$0.00
electricity	$0.12/kWh	8.6	$1.03	-	$0.00
transportation to & from store in vehicle (6.8 miles at $0.59 / mile)	$4.01/trip	-	$0.00	4	$16.04
CO2 emitted by vehicle transport to store (using a 25* MPG vehicle)	$0.22/kg	-	$0.00	9.7	$2.13
CO2 emitted in production of veggies	$0.22/kg	5	$1.10	6.8	$1.50
Time to purchase veggies (transport & in-store) (1 hour* at $25.00 / hr*)	$25.00/trip	-	$0.00	4	$100.00
Time to harvest veggies each day (5* minutes at $25.00/hr*)	$2.08/harvest	30	$62.40	-	$0.00
Time to maintenance FarmBot (30* minutes at $25.00 / hr*)	$12.50/session	1	$12.50	-	$0.00
		total cost / month	**$85.28**	**total cost / month**	**$207.42**
		total cost / year	**$1,023.38**	**total cost / year**	**$2,489.04**

With these numbers, one would save approximately $120/month, or over $1,400/year by growing their own veggies with FarmBot vs buying them at the store. If a FarmBot costs approximately $2,900 (kit, shipping, taxes, supporting infrastructure, soil, etc) + another $500 for installation time (20 hours at $25/hour) then we're looking at a total investment of $3,400. Thus, FarmBot will have a return on investment period that is a little less than two and a half years.

Considering both direct and indirect costs, one might expect a return on investment period of three years.

Closing Thoughts

Now some might be saying that they are not responsible for their CO2 emissions, or that they don't buy organic, or that they would go to the grocery store even if they did have a FarmBot so they could buy other goods. If any of these cases are true, then your ROI period would fall somewhere in between the three and five years we've suggested. If you value your time differently, normally ride a bike to the store, or power FarmBot with solar, then these numbers will be different for you too. To best understand the economics of owning a FarmBot, we suggest looking at these example calculations and plugging in numbers that more accurately reflect you and your lifestyle.

Something else to note is that these calculations do not account for things that have no clear dollar value. For example, what is the value you place on self-reliance and owning the food production process that sustains you? What is the value of eating fresh, local vegetables grown right in your backyard? What is the value of being more connected with your food? What is the value of having a really cool farming robot in your front yard that impresses your friends and family every time they come over? We'll let you decide!

Sources can be found at farmbot.io/roi/

Tech Specs

Everything else you need to know

FarmBot Genesis XL

Max growing area: ~2.9m x ~5.9

Max plant height: ~0.5m

Machine width: Up to 3m

Machine length: Up to 6m

Machine height: 0.5 to 1.5m

Hardware version: v1.4

FarmBot Genesis

Max growing area: ~1.4m x ~2.9m

Max plant height: ~0.5m

Machine width: Up to 1.5m

Machine length: Up to 3m

Machine height: 0.5 to 1.5m

Hardware version: v1.4

What's in the box

In short: everything you need except the raised bed, garden hose, and extension cord.

- Aluminum extrusions for the tracks, gantry, and z-axis
- 5mm anodized aluminum plates
- V-wheels with stainless steel rubber sealed ball bearings
- Injection molded UV stabilized ABS plastic components
- Stainless steel screws, tee nuts, spacers, and other hardware
- Four NEMA 17 stepper motors with rotary encoders and cables
- GT2 timing belts and aluminum pulleys
- Durable plastic cable carriers
- 8mm high tolerance stainless steel leadsrew and delrin block
- IP67 rainproof power supply with 110 and 220V AC input
- Raspberry Pi 3 and 8GB microSD card
- Farmduino microcontroller with mounted and tested stepper drivers
- Custom rainproof electronics enclosure
- Universal tool mount, cover, and 12-wire cable
- Seed injector tool with vacuum pump, tubing, seed bin, seed tray, and customizable luer lock needles (3 sizes included)
- Watering nozzle tool with solenoid valve, tubing, and adapters for a standard US garden hose
- Soil sensor tool
- Weeding tool with customizable implements
- IP67 rainproof USB Camera and mounting hardware
- Two 3-slot toolbays
- All tools needed for assembly

What you need to provide

Planter Bed: FarmBot Genesis is designed to attach to a raised bed or similar infrastructure. Materials for this are not included because every installation will be different.

Electricity: The power supply needs to be plugged into a 110 or 220V AC GFCI outlet. FarmBot ships with a 30cm (1ft) power cord with a standard US 3-prong plug. You must connect this to your own extension cord of appropriate length. Alternatively you can power FarmBot with solar.

Water: The solenoid valve that controls FarmBot's watering has a 3/4" female Garden Hose Thread (GHT) connection, meaning you can take a standard US garden hose and screw it into your FarmBot. You will need to provide a hose of the appropriate length.

Internet: FarmBot can only be programmed and controlled using the web application, meaning an active internet connection is required to send and receive data. The Raspberry Pi has built-in WiFi, though you may need to reposition your WiFi router, install a WiFi repeater, or use an ethernet cable to ensure a reliable connection. Alternatively you can run FarmBot on your local network with a local installation of the FarmBot web app.

Software

You control and configure FarmBot using the free FarmBot web application at my.farmbot.io. We expect to indefinitely offer free service adequate for home growing needs, though we may charge for commercial or industrial FarmBot usage, for FarmBots larger than 3m x 6m in area, and/or for FarmBots growing large numbers of plants concurrently. You can always host the software on your own server if you do not want to use our service.

Warranty

We're committed to providing you with the highest quality product. As we continue to develop FarmBot hardware and software, we will make changes. The final product that we ship to you may be different than the one shown in our videos, photos, documentation, and as described on our websites. If anything is damaged or defective, we will replace the parts free of charge within 30 days of delivery of the product. See our limited warranty for more information.

FAQ

What's included in the pre-order kits?

All of the hardware you see in the video except the raised bed, garden hose, and solar panels. You'll need to provide a garden hose and extension cord of the appropriate length to connect your FarmBot to municipal water and grid power. For the specifics, see the Tech Specs section above.

FarmBot is open-source. so how is it also for sale?

Being open-source means that all of the source files (CAD models, step-by-step assembly instructions, software, etc) are completely free so you can build and operate a FarmBot on your own – without our company. You can see and download all of these resources on our documentation hub.

At the same time, being open-source also allows anyone to sell a compiled version of FarmBot such as a complete kit or hosted software.

In fact, this is really important to do because it gives people options. The truth is that it's a lot of work to purchase all of the components from around the Internet yourself, and there is no guarantee that they would work with each other. It's also technically challenging to host and maintain the web app software on your own server.

Whereas if you buy a kit, you'll save a lot of time and get a complete product that is guaranteed to work and backed by our company. Then you get to play with designing new tools and figuring out new ways of using FarmBot, rather than struggling just to get it to work.

Long story short, being open-source and also for sale are not mutually exclusive.

So why should I pre-order a kit?

By pre-ordering a FarmBot kit you are pioneering this new technology with us. You are joining a small but growing team of people from across the globe who believe that the future of food is open, distributed, and owned by the end-eaters.

Additionally, you are supporting our company and the continuation of our work. To date, FarmBot has been a $200,000+ project over three years. This money has come from private foundations and individual contributions to pay for prototyping materials, tools, and our time. This project would not exist without this investment and it will largely stagnate if there are not dedicated people working full-time on the technology. Purchasing a kit from our company allows us to continue openly researching and developing this technology for everyone. We like to say that an investment in us is an investment in humanity.

Do you ship international?

Yes! We can ship anywhere in the world.

What are the import duties/taxes into my country?

As an importer of a good into your country, you (the customer) are responsible for all customs duties, value-added taxes, or import taxes to your country and/or state. Please check with your customs office prior to ordering so that you know what to expect ahead of time. We use the harmonization code 8432.80.0080 which classifies FarmBot as "Agricultural or horticultural machinery for soil preparation or cultivation; parts thereof".

Because there are so many different countries and tax rates, we are unable to give you specific advice. Again, please contact your customs office prior to ordering.

Can I extend the tracks or make the gantry wider/taller?

Yes! And we encourage this. While the current kits are designed to be 1.5m wide and 3m in length, there is no reason why you cannot (with additional hardware) make your gantry taller or wider and your tracks longer. We expect to offer add-on extensions in the future, as well as larger kits.

Can FarmBot be used to service multiple beds?

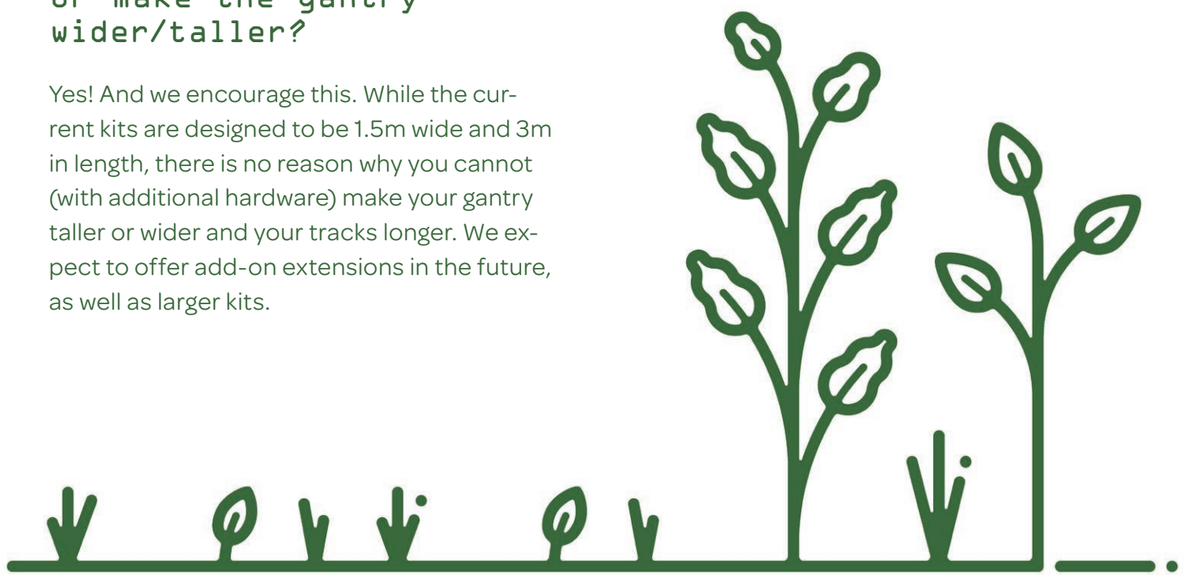
Not really. Moving FarmBot to another bed would require partial disassembly, reconnecting the power and water lines, and also a re-calibration. If you want FarmBot to tend to more plants at once you really need to have a larger device (longer tracks and/or wider gantry).

Can FarmBot do X?

Probably! While FarmBot has a limited set of things it can do right now, what we've built is a platform for you and anyone else to build upon. Want FarmBot to mist your plants? Or harvest? Or remove snails? Go ahead and design your own tools for that use case!

Do you have resellers in other countries?

At this time we do not. We are also not currently interested in partnering with resellers or doing affiliate sales.



What We're About

FarmBot Inc. is a California Benefit Corporation. Coded into our bylaws are these specific benefit purposes:

Openly share our products

Our company is founded on the belief that a more open food system is a better one. The following aspects of our products will be openly shared at the time the product is publicly released:

- Hardware designs shall be released in accordance with the Open Source Hardware Association's definition of open source hardware.
- Software source code shall be released under a permissive license approved by the Open Source Initiative.
- Documentation shall be released under a license conforming to the definition of "open" put forth by the Open Knowledge Foundation.

Openly share our business

We believe that business is a powerful agent for change, and like our products, it can be more powerful when its details are openly shared for inspection, modification, and replication by others. The following aspects of our business will be shared for the benefit of our company, our customers, aspiring entrepreneurs, and the FarmBot community at large.

- Detailed sales and financial information including, but not limited to, revenues, expenditures, profits, salaries, investments, and taxes.
- Cultural, operational, and strategic insights that we determine important to our growth and success.

We will default to transparency in all aspects of our business except when there are individual or partnership privacy concerns.

1% for the community

Each year, we shall contribute one percent (1%) of our annual net revenue towards furthering The FarmBot Project's mission to "Grow a community that produces free and open-source hardware plans, software, data, and documentation enabling everyone to build and operate a farming machine." Contributions shall consist of cash, products, and services that directly help to maintain and grow the community.

Be good people

We strive to do the right thing in every situation: for each other, our customers, the environment, and all of our stakeholders. We make ethics, integrity, transparency, and community the cornerstones of our business.