



ZIPGROW™

VERTICAL, EASY, EFFICIENT



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REFARMERS © 2015



Using ZipGrow towers vertically increases production 2, 3 even 4 times compared to traditional methods. They are the most researched hydroponic tower on the market, designed for maximal yields:

Their single sided design and the reflective, white colour maximize light, allowing high density production.

Their unique Matrix Media has a 960 m²/m³ biological surface area – much larger than any other media and filtration system – and limits root zone temperature fluctuations.

ZipGrow makes vertical farming commercially possible today, whether aquaponics or hydroponic.

No complex parts or set up, ZipGrow is simple. By combining a growing media, with a mechanical and a biological filter, Matrix Media makes your whole system even simpler.

The towers can be hung, strapped, or set onto any surface. At only 4 kg each, they are easy to move and handle. Maintenance, pest control, harvest and transport: it's all a breeze!

**MUCH MORE
PRODUCTIVE
x 2, x 3, x 4**

**SIMPLE
DESIGN,
EASY-TO-USE**



Made to be arranged hundreds of different ways, ZipGrow allows farmers to build operations anywhere and any size: small-scale high-density farms with 500 towers, green walls in restaurants or on buildings, with 4, 50 or ...3,000 towers like the the U.S. Pavilion at Expo Milano 2015 (see photo

below). Mature ZipGrow towers can even be brought to the (super)market for live sales! (see photo on the left)

ZipGrow also works great at home: on a balcony, in a kitchen or backyard, with just a few towers.



A long-lasting tool that provides ultra high-yield, the ZipGrow tower will save your time and give you reliable production for years to come. Matrix Media is reusable, and will last several years, depending on crops. Like the rigid housing, it is made of high-quality plastics safe for all food applications.



**SAFE
&
LONG-
LASTING**

**ENDLESS
POSSIBILITIES**
Can be installed
anywhere,
any number



Dr Nate Storey

Zipgrow is a vertical hydroponic technology, designed for high-density vertical crop production in either a hydroponics or aquaponics system. It is the patented result of seven years of research by Dr. Nate Storey.

Information in this document is based on his research work, and on Bright Agrotech's experience - the company he co-founded in 2010. Dr. Nate Storey and his team have been farming aquaponically using ZipGrow towers for seven years, and follow many other farmers using them both in hydroponic and aquaponic setups.

This document was put together by Refarmers, a young company based in Lyon, France, which was recently granted the ZipGrow license for Europe. Refarmers imports ZipGrow towers and will start manufacturing locally in 2016.

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1. WHAT IS THE ZIPGROW TECHNOLOGY?

1.1. TECHNICAL SPECIFICATIONS

ZipGrow towers are made of a rigid housing that holds the multi-functional Matrix Media. It is a growing media, as well as a mechanical and biological filter.



Housing is made of virgin rigid PVC. This high quality plastics is safe for all food applications and does not contain softening chemicals like phthalates or Bisphenol A (BPA), used to make soft PVC (used in raincoats for example). It is a an extremely stable plastic used in a wide variety of applications from drinking water pipes to heart bypass tubing, and ZipGrow towers. Our PVC housings are UV-resistant.

Matrix Media : it is made from recycled PET-1 (a type of polyester made from recycled plastic water bottles) and is coated with a silicone oxide binder to prevent degradation. Matrix Media is also easy to use, with 5 foot media coming in two pieces for ease of loading & removal. It is reusable and designed to last a long time while effectively



harbouring a multitude of beneficial microbial communities. Matrix Media is 93% air space which allows for good water movement and high biological surface area (BSA). The dark colour provides some algae control. Initially, Matrix Media is a bit stiff, but softens up with time. Eventually, it becomes too soft and starts degrading. It then needs to be replaced. You can fold your inserts in the opposite direction every time you use them so that they age evenly. Coming with a 1 year warranty, an insert typically lasts 2-3 years, but this may vary depending on crop type. (Lettuce roots are very easy on the media, whereas mint roots are harsh!). Bright Agrotech have been using some of their Matrix Media up to seven years.

Size & weight

- Standard height : 1,5 m (custom heights on demand)
- Section : 10 cm x 10 cm
- Weight (empty) : about 4.3 kg



1.2. HOW IT WORKS

3-in-1 Media

Matrix Media is at the heart of the ZipGrow technology. It combines 3 functions: growing media, mechanical filter and biological filter.

Growing media : plants take roots and colonize the Matrix Media, which provides excellent support.



Matrix Media cut lengthways to show how the root system gets established.



Matrix Media rinsed after harvest

Biological filter: BSA, or Biological Surface Area is the heart of a healthy aquaponic system. The more BSA, the more microbes. And microbes are the engine of a healthy aquaponic system. By increasing your BSA, you're increasing microbial oxidation of ammonia, assisting in nitrification, and even increasing the mineralization process of material like iron which helps foster better plant growth. The main advantage of Matrix Media is its huge BSA: 960 m²/m³ ! A 5 ft ZipGrow towers provides 14 m² BSA.

Comparison between Matrix Media and other common growing media and biofiltration:

	BSA (m ² /m ³)	void %	weight	plant support
Large rock (102 mm)	39	48	heavy	<i>d. n. a.</i>
Rock (25 mm)	69	40	heavy	<i>d. n. a.</i>
Plastic biofilter media (large, 89 mm)	125	95	medium	<i>n/a</i>
Plastic biofilter media (medium, 50 mm)	157	93	medium	<i>n/a</i>
Limestone gravel	150 - 200	<i>d. n. a.</i>	heavy	excellent
Volcanic gravel (pumice)	200 - 300	<i>d. n. a.</i>	light	medium - weak
Clay pebbles (Light expanded clay aggregate)	250 - 300	<i>d. n. a.</i>	light	medium
Pea gravel	280	28	heavy	<i>d. n. a.</i>
Plastic biofilter media (small, 25 mm)	280	90	medium	<i>n/a</i>
Coconut fiber	200 - 400	<i>d. n. a.</i>	light	medium
Volcanic gravel (tuff)	300 - 400	<i>d. n. a.</i>	medium	excellent
Medium sand	886	40	heavy	<i>d. n. a.</i>
Matrix Media	960	93	light	excellent

BSA: biological surface area, *d. n. a.*: data not available, *n/a* : not applicable

Sources : Bright Agrotech (based on Storey, 2012 and Crites et al., 2006) and Somerville et al., 2014

Mechanical filter : Matrix Media has a nonwoven fiber structure that captures solids, which decompose and in turn contribute to feed plants.

Abolish Anaerobic Zones and stabilize temperature

Matrix Media is 93% air. This open space allows for high percolation: water goes through Matrix Media quicker than with other media. This boosts dissolved oxygen level, and abolishes anaerobic zones around plant roots. Anaerobic zones cause the roots to starve and die, causing decomposition which produces nasty compounds like hydrogen sulphide, as well allowing a number of pathogens. Altogether, anaerobic conditions are detrimental to most plants.

More open space and higher percolation also mean more stable root zone temperatures, which is key to healthy plants.

And again, at 93% air, Matrix Media inserts are light and flexible. No heavy gravel or sand. They make ZipGrow towers easily transported to stores or moved for maintenance.

Redworms

Filtration can be improved by using redworms, who do great in Matrix Media. They help breaking down solids and making nutrients more bioavailable in aquaponics systems. You can introduce redworms in your system by using vermicompost to plant seeds. When seedlings are transplanted in the ZipGrow tower, redworms juveniles will colonize Matrix Media.

Light optimization

ZipGrow towers are white and single-sided to optimize lighting. Multi-sided towers result in stunted plant growth on sides not facing the light source. That's not a problem with ZipGrow. Towers are single sided, allowing growers to stack them in tight configurations while optimizing light use by the plants and decreasing light depletion. The white tower colour maximizes its reflection around the greenhouse. This unique design allows high density with no artificial lighting: see section 2.3 "High-density configuration".



2. HOW TO USE ZIPGROW TOWERS?

2.1. FROM PLANTING TO HARVEST

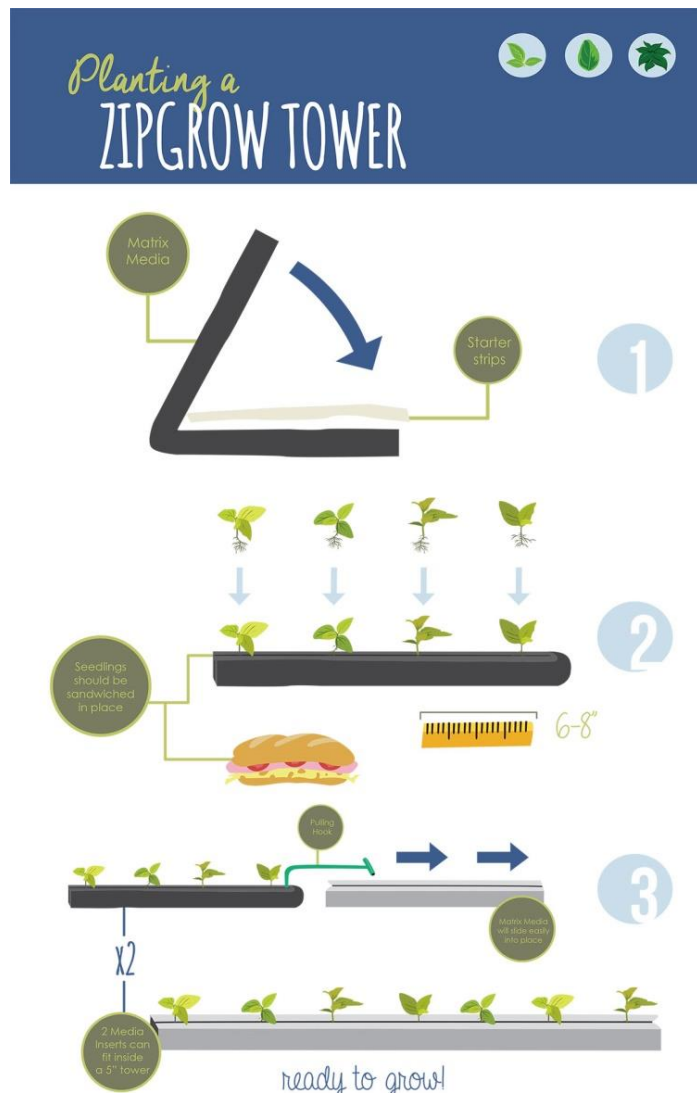
Planting : we recommend planting young seedlings (first set of true leaves) with small earth balls. Gently sandwich your seedlings inside the media. Use your pulling hook to zip the media back into the tower and voila! Your tower is planted.

Although we don't recommend it, you can also sow seeds directly in Matrix Media: If you decide to plant seeds, however, be sure to use a seed tape or direct seed on the media once it's broken in.

If you are growing in aquaponics, let your tower hang under your drip for a while before planting- this will allow microbes coat the media surface and aid in the health of your plants.

Irrigation & fertilization: a drip nozzle is directed to the top of the tower and into the Matrix Media where plants' roots are being held. Plants are able to uptake the nutrients from the water as it trickles down. You can then channel the water to a tank and recycle it with a pump.

Harvest, clean up & replant: some crops can be harvested several times, some need to be replanted after harvest. To replant, remove the Media from the tower, open it and remove the "root balls". There will always be remnants of roots left in the medium after harvesting, and this is totally fine. We actually recommend aquaponic producers in particular (but hydroponic ones as well) leave the majority of root matter in the tower for increasing biological surface area and contributing to a healthier system – although it wouldn't hurt to clean media every few growth cycles. With aquaponics and vermiponics, growers can use redworms to aid in the breakdown of this root matter and other solids. Cleaning the Matrix Media is quick and easy. Start by removing the "root ball" that should be stuck to one side of the medium insert. After that, hang your medium on a clothesline or some other place to dry. Once dried, flex it to break up any organic matter inside of it, spray it with a hose, and replant.



2.2. WATER & FLOW RATE

Flow rate, or the specific rate or velocity at which the volume of your aquaponic or hydroponic system solution drains through the ZipGrow tower media, depends on whether you are using an aquaponics or hydroponics setup:

- For aquaponics, a higher flow rate is necessary to promote good nitrification as well as good bio-filtration and mechanical filtration. We recommend a flow rate of 27 to 37 litres (7-10 gallons) per tower per hour. When sizing your pump: since you've got the fish tanks as well, you also need to factor in the fish tank water volume, which you want to be turning twice every hour. Fish water volume depends on fish stock density.
- For hydroponics, a slower flow rate of 4 to 12 litres (1-3 gallons) per tower per hour is fine. In terms of total water volume, 4 litres (1 gallon) per tower, plus 200 litres (50 gallons) for the sump should work well.

Where conventional agriculture loses up to 50% of their water (using flood irrigation), ZipGrow systems lose only 1.5%. Constant recirculation maximizes water use.

2.3. AQUAPONICS : FISH / TOWER RATIO

A standard 5 ft ZipGrow tower provides mechanical and biological filtration for 0,7 to 1,1 kg of mature fish.

To keep your system simple, we recommend stocking fish at a density between 12kg and 15 kg per m³. For most species, this density will help keep you fish healthy and doesn't require extra oxygenation.

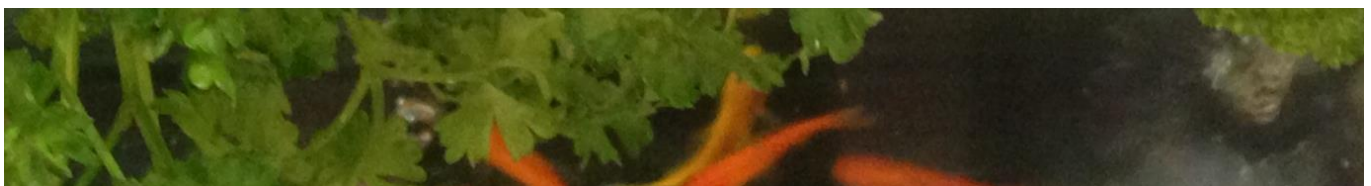
Average ratio: one 5 ft ZipGrow → 0,9 kg fish → 67,5 litres of water

2.4. HIGH DENSITY CONFIGURATION

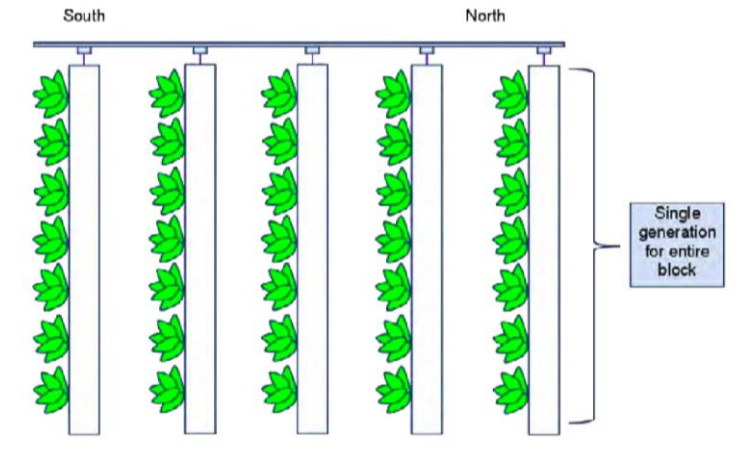
Density & spacing

In high density , we recommend spacing towers by 53 cm in width and 46 cm in depth, which is just above 4 towers per m². With this density, you can still move between towers for maintenance or checking your crops.

For a quick estimate of how many ZipGrow Towers will fit in your total greenhouse or growing space: use 3 towers /m², which accounts for the non-directly productive space (central alley way, planting space...).

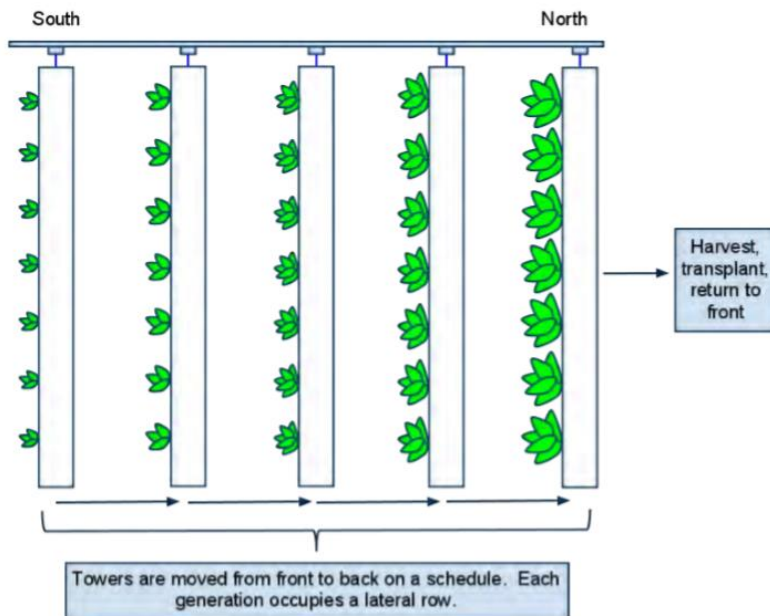


Batch cropping production



With this technique, there is some slight light depletion in the back rows as plants mature.

Conveyor production



Towers are arranged in rows, each corresponding with a seedling generation. This technique optimizes light reflection allowed by



Hydroponic experimentation by French National Horticulture Institute Astredhor.

3. CROPS, HARVEST & YIELDS

3.1. WHAT TO GROW IN ZIPGROW TOWERS?

Bright Agrotech have tried just about everything in their own towers and confidently know that almost anything will grow! However, due to the structure of the media, root crops, such as carrots and beets, will not perform well. For vining crops, conventional methods like trellis or stakes work just fine and you don't need a ZipGrow tower to go vertical.

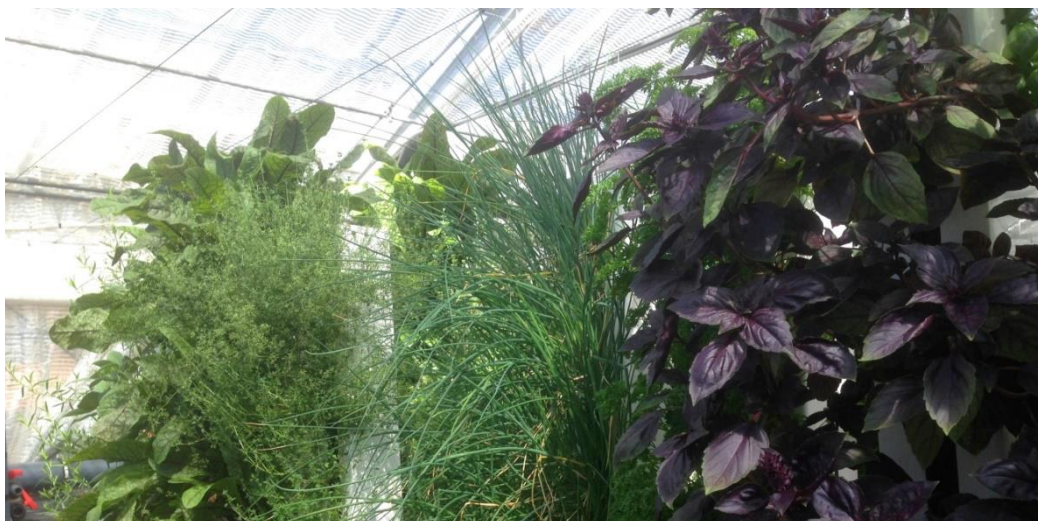
Here is Bright Agrotech list of recommended crops for commercial farms. So it is not only based on what grows well in ZipGrow towers, but also on what sells well in the US. This list is definitely not comprehensive!

Leafy greens	Herbs	Fruits
All sorts of lettuce salads	Mint	Strawberries
All sorts of leafy cabbage like Kale	Basil	Cucumbers
Arugula	Rosemary	Peppers (bell, tabasco, habanero...)
Chard	Thyme	
Spinach	Parsley	
Bok choy	Fenel	
Tat Soi	Chive	
Mustard greens	Coriander	
	Oregano	

A few Bright Agrotech videos on this topic :

- Mint in commercial hydroponics
- Best crops for aquaponics & hydroponics
- Parsley in commercial hydroponics
- Harvesting basil

<https://www.brightagrotech.com/what-grows-in-a-zipgrow/#>



3.2. HARVEST & YIELDS

ZipGrow towers offer much higher yields than any other technologies on the market today, mainly because of their high-performance Matrix Media, which gives roots an excellent environment and boosts beneficial bacterial communities, and because they optimize space.

Of course, yields will depend on many other factors: crop varieties, quantity and quality of fertilization, lighting, potential threats (diseases, pest...), grower's skills etc.

The data below gives yields for one 5 ft ZipGrow tower based on:

- Aquaponics
- Fall & Spring harvests (which reflect a yearly average)
- No artificial lighting or CO₂ addition
- Mass configuration
- Grower with average experience

Leafy greens

Most greens are cultured on a 5 week turn at 10.4 turns per year. However, an additional week increases productivity dramatically for some crops. These values are for complete harvests although gradual harvests are possible for many of these crops. With a 5-row conveyor production, you can harvest every week.



Transplant size is typically 2-3 inches in size with one to two sets of true leaves.

Crop	Estimated harvest per turn and per 5 ft ZipGrow tower		Yearly yield by m ² (10.4 x 5 week turns)	
	5 week turn	6 week turn	Gross yield (based on space occupied by towers, 4 per m ²)	Net yield (based on total space, 3 towers per m ²)
Lettuce	1.8 to 2.7 kg 4-6 lbs	2.7 to 3.6 kg 6-8 lbs	94 kg / 208 lbs	71 kg / 156 lbs
Chard	1.8 kg / 4 lbs	2.5kg / 5.5 lbs	75 kg / 166 lbs	57 kg / 125 lbs
Cress	1.4 kg / 3 lbs	2.3 kg / 5 lbs	57 kg / 125 lbs	42 kg / 94 lbs
Kale	1.4 kg / 3 lbs	1.8 kg / 4 lbs	57 kg / 125 lbs	42 kg / 94 lbs
Bok Choi	2.7 to 3.2 kg 6-7 lbs	3.6 to 4.1 kg 8-9 lbs	57 kg / 125 lbs	42 kg / 94 lbs
Tatsoi	1.4 kg	1.8 kg	57 kg / 125 lbs	42 kg / 94 lbs
Mustard greens	1.4 kg	1.8 kg	57 kg / 125 lbs	42 kg / 94 lbs

Herbs

Herbs cultured in towers have longer, gradual harvest schedules. Basil is typically cut three times before towers are replanted. Each cutting (at three week intervals) yields slightly more than the last. Slow growing crops like oregano, rosemary and sage often are cultured for 9-12 months with consistently increasing harvests. When weights begin to taper off the tower is torn out and replanted.



Yield per 5 ft ZipGrow tower								
Semaine	5	8	11	14	17	20	23	26
Sweet basil (3 cuts)	1.4 to 1.8 kg 3-4 lbs	1.8 to 2.3 kg 4-5 lbs	2.3 to 2.7 kg 5-6 lbs	New cycle				
Oregano (Spanish)	0.4 kg 1 lb	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs	1.1 kg 2.5 lbs
Chives	-	-	0.9 kg 2 lbs	1.8 kg 4 lbs	1.8 kg 4 lbs	1.8 kg 4 lbs	1.8 kg 4 lbs	1.8 kg 4 lbs
Rosemary	-	-	-	0.2 kg 0.5 lb	0.4 kg 1 lb	0.4 kg 1 lb	0.4 kg 1 lb	0.9 kg 2 lbs
Sage	-	-	-	0.2 kg 0.5 lb	0.4 kg 1 lb	0.4 kg 1 lb	0.9 kg 2 lbs	0.9 kg 2 lbs
Fennel	-	2.3 to 3.2 kg 5-7 lbs	New cycle					
Parsley	1.4 to 1.8 kg 3-4 lbs	1.4 to 1.8 kg 3-4 lbs	New cycle					
Coriander (Cilantro)	1.4 to 1.8 kg 3-4 lbs	0.9 to 1.4 kg 2-3 lbs	New cycle					

Yearly yield m ²		
	Gross yield (based on space occupied by towers, 4 per m ²)	Net yield (based on total space, 3 towers per m ²)
Sweet basil	116 kg / 255 lbs	87 kg / 191 lbs
Oregano (Spanish)	67 kg / 148 lbs	50 kg / 111 lbs
Chives	80 kg / 176 lbs	59 kg / 132 lbs
Rosemary	20 kg / 44 lbs	15 kg / 33 lbs
Sage	24 kg / 52 lbs	18 kg / 39 lbs
Fennel	71 kg / 156 lbs	53 kg / 117 lbs
Parsley	83 kg / 182 lbs	62 kg / 137 lbs
Coriander (Cilantro)	71 kg / 156 lbs	53 kg / 117 lbs

Comparing ZipGrow yields with other growing techniques

BASIL (Genovese)

Technique	Growing time	Production (kg/m ²)	Production/week (kg/m ²)	Reference (see appendix)
ZipGrow aquaponics	5 weeks post-transplant	9.4 kg	1.88 kg	Storey, 2012
Raft aquaponics	52 weeks post-transplant	13 to 42 kg	0.25 to 0.81 kg	Savidov et al., 2007
Raft aquaponics	52 weeks post-transplant	23.4 to 25 kg	0.45 to 0.48 kg	Rakocy et al., 2007
Hydroponic media bed	5.7 weeks post-transplant	6.26 kg	1.1 kg	Bradley & Marulanda, 2001
Raft hydroponics	6.5 weeks from seed (1.5 weeks post 5 week establishment period)	2.6 to 3.6 kg	0.4 to 0.55 kg	Micheli et al., 2003
Vertigro Greenhouse Hydroponic	48 weeks post-transplant	16.6 kg	0.35 kg	Stapleton et Hochmuth, 2001
Vertigro Field Hydroponic	15 weeks post-transplant	6.2 à 7.1 kg	0.41 to 0.47 kg	Hochmuth et Leon, 1999
Field Production	52 weeks post-transplant	7.8 kg	0.15 kg	Rakocy et al., 2004
Intensive Field Production	7 weeks post-transplant	2.5 kg	0.36 kg	Sifola & Barbieri, 2006

ZipGrow aquaponics offers yields 1.7 to 7.5 higher than industry standards (aquaponics, hydroponics, field).



STRAWBERRY

Variety	Technique	Plant density per m ²	Prod° per plant (kg)	Prod° per m ² (kg)	Growing period	Prod° per month and m ²	Reference (see appendix)
Seascape	ZipGrow aquaponics	35.3	-	6.9 kg	1,4 month	4.9 kg	Storey, 2012 (total prod°)
Seascape	ZipGrow aquaponics	35.3	-	6.9 kg	1,4 month	4.3 kg	Storey, 2012 (group B)
Chandler	NFT	10.8	0.6 to 0.9 kg	6.5 to 9.7 kg	6 month	1.1 to 1.6 kg	Takeda & Hokanson, 2002
Sweet Charlie	Hydroponic tower	32	0.23 to 0.37 kg	4.5 to 7.8 kg	4,5 month	1 to 1.7 kg	Dummer, 1999
Elsanta	Hydroponic peat bag	8.5	-	8 kg	12 months	0.7 kg	Leiten & Baets, 1991
Chandler	Aquaponic Stacked Pot Tower	28	0.195 kg	5.4 kg	5 months	1.1 kg	Takeda et al., 1999a Takeda et al., 1997
Sweet Charlie		28	0.167 kg	4.7 kg	5 months	0.9 kg	
Oso Grand		28	0.138 kg	3.9 kg	5 months	0.8 kg	
Chandler	Hydroponic NFT	14	0.370 kg	5.2 kg	5 months	1 kg	Takeda et al., 1997
Sweet Charlie		14	0.261 kg	3.7 kg	5 months	0.7 kg	
Oso Grand		14	0.253 kg	3.5 kg	5 months	0.7 kg	
Chandler	Hydroponic tower	40	0.5 kg	20 kg	12 months	1.7 kg	Resh, 2004

ZipGrow aquaponics offers yields 2.5 to 7 higher than industry standards (aquaponics, hydroponics).



4. BRIGHT AGROTECH RESOURCES



Since they launched on 2010, Bright Agrotech have been generating a vast amount of information, empowering a new generation of small-scale farmers to start and operate their hydroponic or aquaponic farm.

- hundreds of YouTube videos
- dozens of blog articles
- podcasts, webinars, Ebooks
- the Upstart University training program

Most of this content is accessible for free. All topics are covered by Dr Nate Storey and the Bright Agrotech team : setting up a greenhouse, pumps, pipes, aquaculture, nutrients and deficiencies, crops to grow, plant health, how to use Zipgrow towers, business plan, live sales, marketing to restaurants or supermarkets, CSA, green walls...

Bright Agrotech
Grow More With Less
AQUAPONICS • VERTICAL FARMING & GARDENING

29,586 abonnés

Accueil Vidéos Playlists Chaînes Discussion À propos

Your Ideas. ZipGrow Technology. Endless Possibilities.
5 650 vues il y a 3 mois
ZipGrow towers are a flexible, adaptable solution for almost any application from greenhouse growing, to green walls, indoor warehouse production and even in the classroom. <http://brightagrotech.com/p...>

At Bright Agrotech, our core purpose is to educate, equip and empower hobbyists and commercial vertical farmers alike to be as successful as possible.

And, our elegantly simple technology is doing just that with commercial vertical farmers popping up around the world and thousands of backyard hobbyists growing more food for their friends and families.

Lire la suite

Soutenir cette chaîne
Aidez Bright Agrotech à créer plus de contenu de qualité. Toute contribution, quel que soit son montant, est utile.

Channels worth checking out!

- Bigelow Brook Far... (Abonner)
- mbogardener (Abonner)
- Tracy Holt (Abonner)
- GrowUp Urban Farms (Abonner)
- RobBobs Backyard... (Abonner)
- Barnaiser (Abonner)

Vidéos ajoutées

- Cooling a Greenhouse with a Cooling Wall (801 vues • il y a 1 jour)
- Funding Your Farm with Kiva Zip (1 613 vues • il y a 2 semaines)
- Aquaponics Academy #17: Iron In Aquaponics (763 vues • il y a 2 semaines)
- Upstart Farmers Radio Episode #8: Integrated Pest... (271 vues • il y a 2 semaines)
- Best Crops For Hydroponics: LETTUCE (1 340 vues • il y a 3 semaines)

Vidéos populaires

- Best Fish for Aquaponics (125 292 vues • il y a 2 ans)
- Redworms & Vertical Farming (91 411 vues • il y a 2 ans)
- Plumbing a Vertical Farm (62 108 vues • il y a 2 ans)
- Ammonia & Aquaponics Systems (57 192 vues • il y a 2 ans)
- What is a ZipGrow Tower? (44 648 vues • il y a 2 ans)

resources.brightagrotech.com

5. ZIP GROW & ITS MYRIAD APPLICATIONS

HIGH-DENSITY GREENHOUSE FARMING



(US commercial farm)

HIGH-DENSITY INDOOR FARMING



OUTDOOR AQUAPONIC FARM



(Aquaponic Lyinx, USA)



(Freight Farms, USA)

CONTAINER FARMING



GREEN WALL



(installation by Bright Agrotech, Laramie, USA)

SCHOOL PROJECTS



(Sallins National School, Ireland)

GASTRONOMIC WALLS IN RESTAURANTS



(installation by Refarmers, Lyon)

'LIVE' SALES



WORLD FAIRS ;)



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