The GrowKit 3.0

The Future Of Farming lies in an empty corner of your home.

INDOOR METAL HYDROPONIC UNIT | 6 PLANTS

SPECTRUM CONTROLLED GROWLIGHT

DEEP WATER CULTURE TECHNIQUE

If you want to have a successful harvest please read the manual.

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LNO AgriTech

THE GROWKIT INSTRUCTION MANUAL

Index

Technical Specifications:

Part	Specification
Grow Channel	• 600mm x 150mm x 70mm • Made from Powder Coated Marine grade steel has a rated usage of 15 years
LED Growlight	• 2ft Batten 10W Batten light • Spectrum range 440-760nm • PPFD 85 µmol/m^2/s • Aluminium Body
Water Pump	• 9 watt pump with 1 year warranty • Submersible
Cocopeat	• pH buffered and sterilized Agri Grade • pulverized coconut husk.
Clayballs	• Light Expanded Clay Aggregate balls • Approx dia 8-15 mm • Interstitial gap holds air and keeps roots oxygenated

Part	Specification
TDS Meter	• 1-9999ppm range
Macro and Micro Nurients	• 100 ml Liquid Concentrate • Complete & Balanced Primary Macros, Secondary Macros & Micro-nutrients
Seeds	• 100+ Lettuce Seeds • 100+ Basil Seeds
pH Paper	• 40 Sheets of high precision pH paper- 5-7.5
pH Down	• Buffered horticultural grade H_3PO_4

What is Hydroponics?

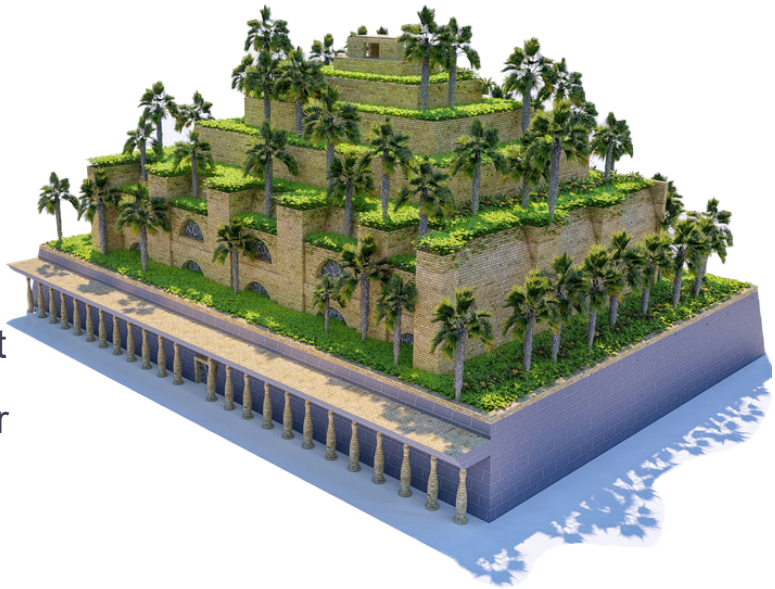
Hydroponics is the technique of growing food without soil in Nutrient rich water. This allows us to indefinitely circulate the water in the root zone of the plant until it is harvested. So the only water that escapes the setup is through transpiration and the mass of the plant. This technique of giving nutrients and water at the same time is known as Fertigation.

It takes about 200 Liters of water to grow a plant of lettuce in 2 months in soil. In hydroponics you can grow 304 plants of lettuce in 220 liters of water in about 25 days! This is something that we have personally grown in our R&D setups and locally sold that produce.

Because the plants do not have to compete for nutrient hot zones like there are in soil, we can grow plants much closer to each other. On top of that(literally) We can grow plants in multiple layers which increases the efficiency further. So with the increased speed of growth and density, Hydroponics can be up to 250x more efficient than conventional farming methods.

A little history

Hydroponics is a technique of farming that dates back to the Ancient Babylonian Times where the Hanging Gardens of Babylon were the first ever Hydroponic Farm that grew fig and plum trees. These trees grew hydroponically in huge reservoirs carved out of stone, without any fancy automation equipment and sensors, the garden was the most beautiful man made garden to have ever existed. It was Irrigated by the Euphrates now in present day Iraq.



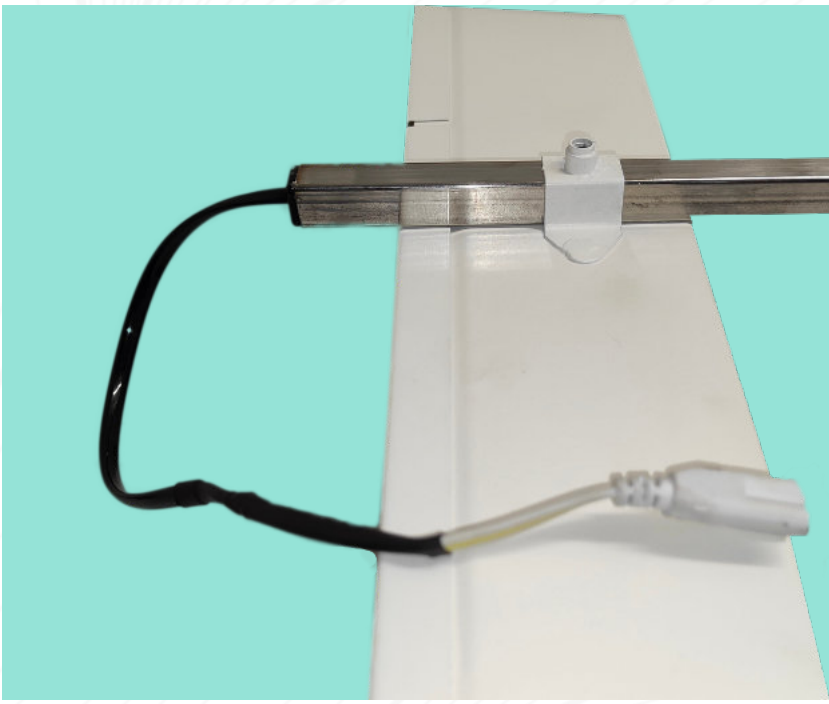
How to assemble :

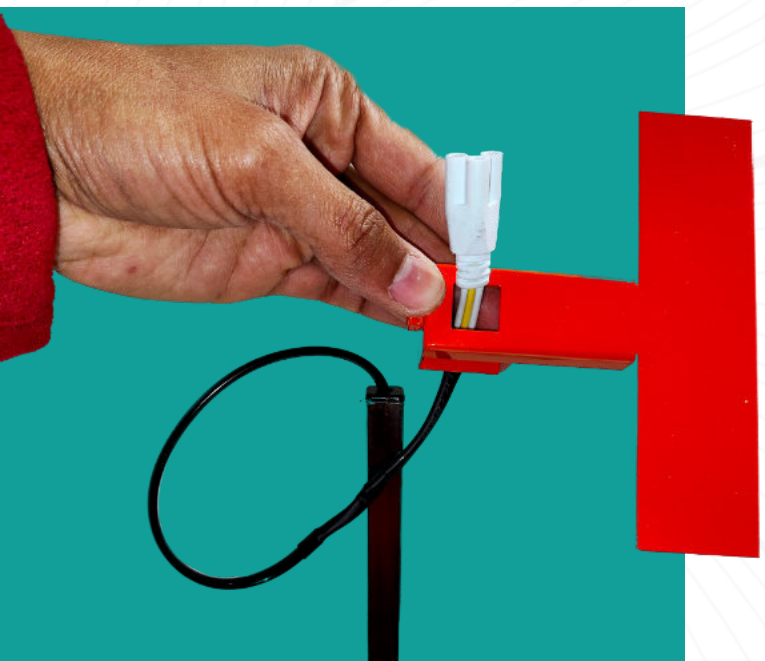
- Place the kit in a cool area make sure the ambient temperature is lesser than 28°C or at least 28°C. Make sure the area is somewhere indoors.

- Take out everything from the kit and lay it down. There should be two plug points nearby, 1 for the water pump and 1 for the grow light.

Assembling the GrowLight Manifold

- Place the rod through the **Clamp** behind the kit. (remove the lid before pushing the rod through)





- Pass the rod through the light bracket. (don't worry if the bracket is a little tight)

- Screw into place with the 2 knob screws provided with the kit

Assembling the Water Pump

- Attach the re-circulation manifold to the pump.

- Place the pump on the right hand side of the Grow Kit. The pump should be placed close to the slot for the wire, on the lid.

- Place the lid on top of the Grow Kit, pass the wire through the slot.

- Place the fertigation lid on top of the fertigation well.

Watch the kit installation video here

What Is What ?

TDS METER :

Total Dissolved Solids, it is the measure of all the inorganic and organic substance dissolved in water

EC vs TDS

●TDS and EC are ways to measure how many nutrients are in the water that plants drink. Think of it like checking how much sugar is in a cup of lemonade.

●TDS is like counting how many grains of salt is in the nimbu soda. The more the grains, the saltier the soda. TDS is measured in parts per million (**Parts per million** can be expressed as milligrams per litre. This measurement is the mass of a chemical or contaminate per unit volume of water.)

●EC is like checking how well the nimbu soda can conduct electricity. The more salt grains in the soda, the better it can conduct electricity, just like the more the nutrient in the water, the better it conducts electricity. EC is measured in millisiemens per centimeter

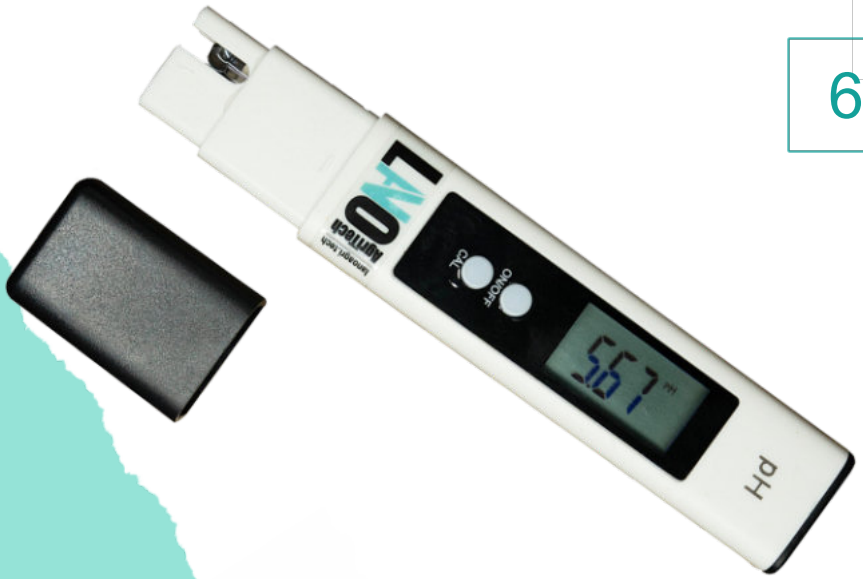
●TDS is only an estimation whereas EC is a precise measurement hence, more commonly used by experienced growers.

A rough formula used to convert EC to TDS in hydroponics is:

EC (ms/cm) = TDS (ppm) / 0.64

TDS to EC

TDS (ppm) = EC (ms/cm) x 0.64



pH :

It stands for potential of hydrogen, it is the indicator of acidity or basicity of a solution. the pH of a solution has a range from 0 to 14. Solutions with pH value varying from 0 to 7are called acidic solutions. Solutions with pH value ranging from 7 to 14 are basic solutions. Value equal to 7 are known as neutral solutions.

- **Plants pH requirment**

Most plants prefer a slightly acidic to neutral pH range of around 6.0 to 7.0, which allows the plant to take up the essential nutrients it needs for growth. However, some plants can tolerate a pH range outside of this range depending on the species.

Water Pump :

- The Water pump helps to increase the dissolved oxygen content in water & helps to cool the water a little. The provided pump is a 9 watt water pump designed to run continuously 24x7.

Cocopeat :

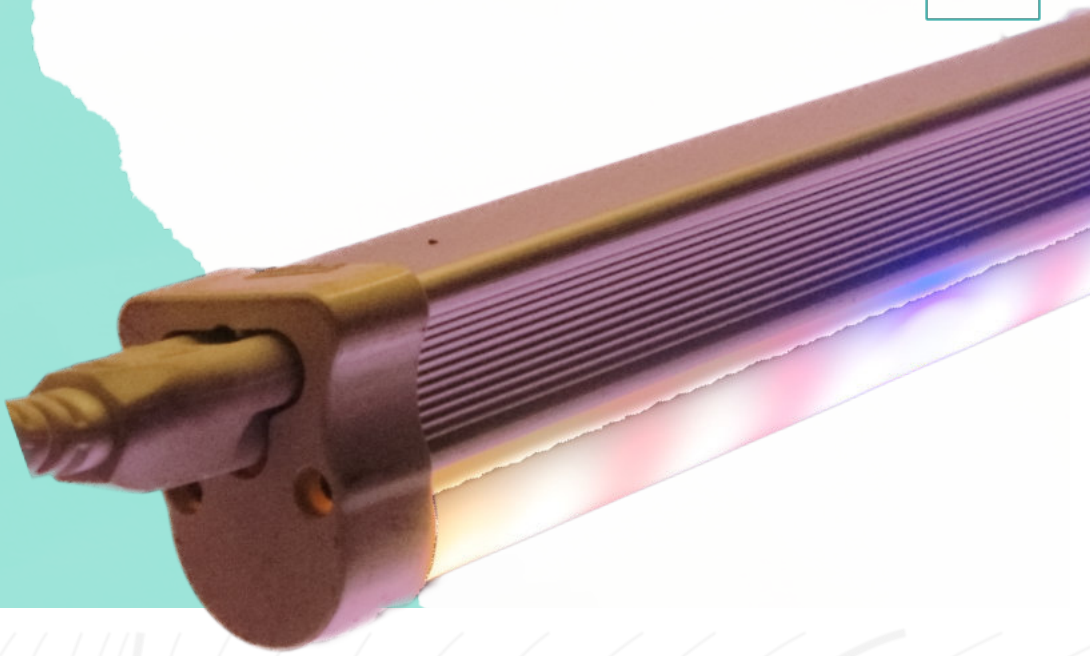
- It is a non fibrous, spongy, lightweight, corky material that holds together the coir fiber in coconut husk, it is a 100% organic, natural and biodegradable substance which was the by-product of coconut fiber extraction process but now is a coproduct of coconut fiber extraction process.

- It is an excellent material for seed germination, as it has high porosity and high water holding capacity.

Clay Balls (Fly Ash Pebbles) :

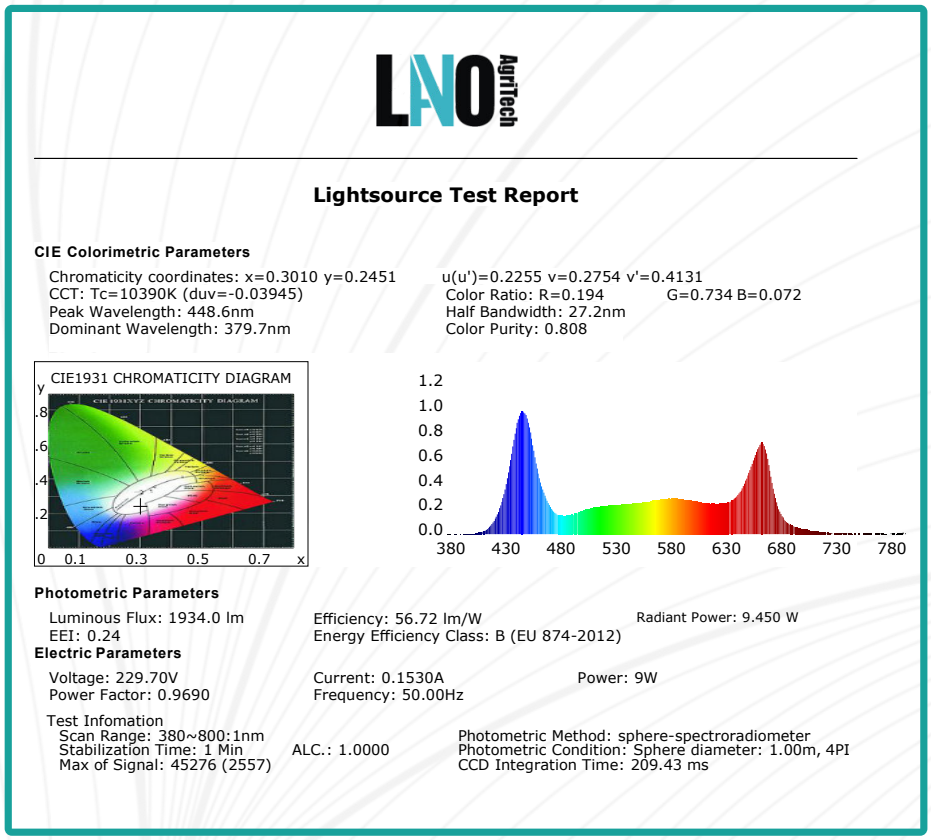
- They are a highly economical substitute for LECA balls, instead of clay they are formed using fly ash. This fly ash comes from the chimneys of coal fired power plants. They are much lighter than clay pebbles and serve as an excellent growing medium in hydroponics and soil-less gardening.

- Fly ash clay balls are made by mixing fly ash, a byproduct of coal combustion, with clay and water to form a wet mixture. The mixture is then shaped into balls by a machine. The balls are then dried in the sun or in a kiln to remove any remaining moisture.



GrowLight :

- 9W light
- Well distributed spectrum including IR
- High PPFD value
- Diffuser to avoid light burn



Lightsource Test Report

CIE Colorimetric Parameters

Chromaticity coordinates: x=0.3010 y=0.2451 u(u')=0.2255 v=0.2754 v'=0.4131
CCT: Tc=10390K (duv=-0.03945) Color Ratio: R=0.194 G=0.734 B=0.072
Peak Wavelength: 448.6nm Half Bandwidth: 27.2nm
Dominant Wavelength: 379.7nm Color Purity: 0.808

CIE1931 CHROMATICITY DIAGRAM

y .8 .6 .4 .2
0 0.1 0.3 0.5 0.7 x

1.2 1.0 0.8 0.6 0.4 0.2 0.0
380 430 480 530 580 630 680 730 780

Photometric Parameters

Luminous Flux: 1934.0 lm Efficiency: 56.72 lm/W Radiant Power: 9.450 W
EEI: 0.24 Energy Efficiency Class: B (EU 874-2012)

Electric Parameters

Voltage: 229.70V Current: 0.1530A Power: 9W
Power Factor: 0.9690 Frequency: 50.00Hz

Test Infomation
Scan Range: 380~800:1nm
Stabilization Time: 1 Min ALC.: 1.0000 Photometric Method: sphere-spectroradiometer
Max of Signal: 45276 (2557) Photometric Condition: Sphere diameter: 1.00m, 4PI
CCD Integration Time: 209.43 ms

Grow Light Test Report

Photosynthetic Active Radiation (PAR) is the measure of the amount of light (of the total light source) that a plant will utilise from a source for photosynthesis. Simply put, it is the amount of light that is usable to plants.

Photosynthetic Photon Flux (PPF) is the way to measure PAR, it calculates the intensity of light being emitted from the light source that is used by plants to photosynthesize. It basically calculates the number of photons of light that hit the sensor per second.

Photosynthetic Photon Flux Density (PPFD) is the measure of light density in a given area.

Daily Light Integral (DLI), is the total amount of photosynthetic light delivered to plants in a 24 hour day. Technically, it is the integrated photon flux density between 400 and 700 nm received in 1 square meter (m2) per day (d).

Unit of measurement: moles per day or mol/day

DLI and plant growth are directly proportional where plant growth increases fairly linearly with increases in DLI.

How to measure?

Calculating the PPFD value helps derive the DLI value for plants. This requires the purchase of expensive and sensitive PPFD meters.

For meters where DLI calculation is not an option, you can calculate DLI, with PPFD value:

PPFD = The reading on the PPFD meter

PHOTOPERIOD = How long the lights will be on each day

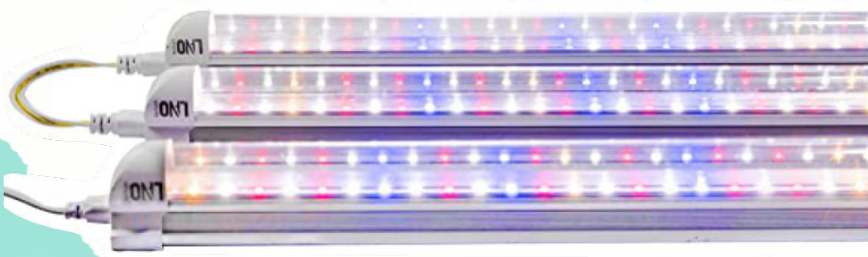
3600 = The number of seconds in an hour

1,000,000 = Converts micromoles (PPFD) to moles (DLI)

$$DLI = \frac{(PPFD) \times (3600 \times photoperiod)}{1{,}000{,}000}$$

PPFD values to calculate DLI:

- When light is at full height from GrowChannel = 85
- When light is at 3/4th height from GrowChannel = 100
- When light is at 1/2 height from GrowChannel = 140



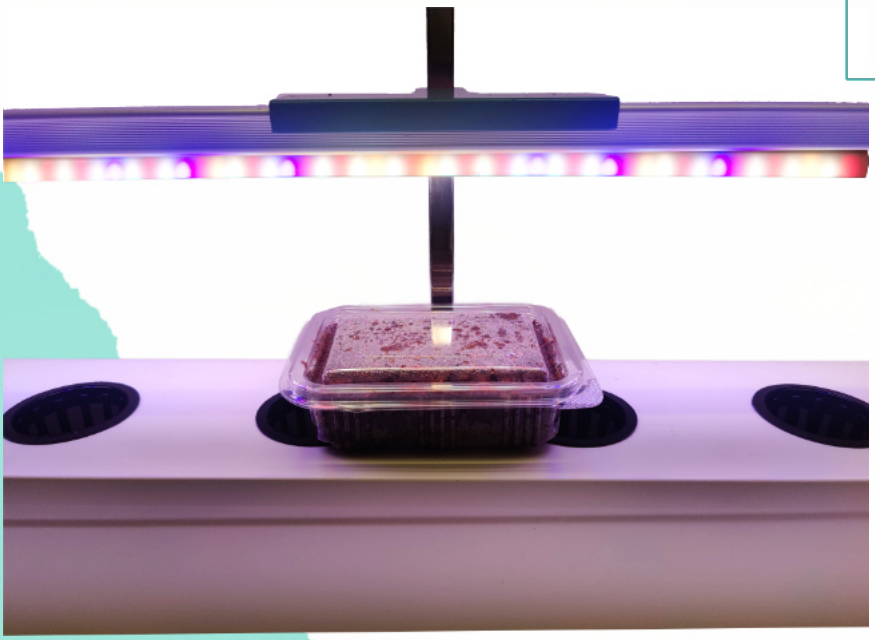
PLANT LIGHT REQUIREMENT CHART

The following values are ranges that are to be followed from minimum to maximum. Start from the smallest value and Incrementally increase every week.

If leaf tips start burning or the leafs are pointing up increase ppm by 50 every day.

PLANT	DLI	LIGHT ON (Hrs)
ARUGULA	10-15	12-18
BASIL	12-16	10-18
BOK CHOY	10-12	8-14
BROCCOLI	15-25	10-20
LETTUCE	8-12	8-14
CAPSICUM	15-25	12-20
CAULIFLOWER	9-15	10-18
CHIVES	12-18	10-16
CILANTRO	9-14	10-14
CORIANDER	6-11	8-12
CUCUMBER	11-22	10-18
CUTTINGS (HERBS)	8-10	8-10
DILL	10-20	12-16
EGGPLANT	12-30	12-20
KALE	12-16	10-16
LEAFY GREENS	8-14	10-16
MINT	8-16	8-16

PLANT	DLI	LIGHT ON (Hrs)
PARSLEY	8-16	8-16
PEA	9-11	8-18
PEPPERS	15-40	12-20
PUMPKIN	25-35	14-22
ROSEMARY	10-16	8-12
SAGE	10-16	8-12
SEEDLINGS(MATURE)	9	8-12
SEEDLINGS(NEW)	5	6-8
SEEDLINGS(TOMATO)	9	14-18
SPEARMINT	10-20	8-14
SPINACH	7-15	12-14
SQUASH	15-30	14-18
THYME	10-20	12-14
TOMATO	22-30	14-22
WATERMELON	25-30	14-24
ZUCCINI	25-30	14-22
OREGANO	8-16	10-14



How to Start ?

- Open the germination kit, remove the seeds. Fill the kit with water till the top & close the lid. Let the cocopeat soak for 30 mins.
- Mix the cocopeat by hand, sprinkle the seeds on it and cover the seeds with a thin layer of cocopeat about 1 cm and make sure no seed is exposed to light.
  watch the video here
- Close the lid and place the germination kit on the Grow Channel lid, water sparingly, the cocopeat should be moist but not wet.
- Open the lid after 2 days, and switch the GrowLight on, sprinkle little water.
- Wait for seeds to germinate, It could take upto 10 days so be patient. Keep watering sparingly.
- Once the plant has grown True leaves. Transplant the plants into the Netpots watch the video

"When seeds germinate the first leaves that come out are seed leaves. These do not perform photosynthesis but are capable of photo-tropism. They signal to the plant to either grow True leaves which have the capability of photosynthesis Or grow the root zone until lighting is optimal."

How to Fertigate ?

- Add R.O water into the Grow Channel. Use the water level stick to measure the level of water in the Grow Kit.
- Using the TDS meter, add both Macro and Micro nutrients in equal quantities drop-wise, until the TDS reaches 300 ppm. (DONT EVER MIX THEM TOGETHER IN CONCENTRATED FORM) (make sure the re-circulation pump is ON whenever adding nutrients)
- Increase the TDS by 100 ppm every week. Refer to the TDS Chart on page 13-14 for the range of Maximum values.

Why R.O Water ?

We recommend adding R.O water to your hydroponic setup as the water in every place has a different mineral profile which could affect the pH hence the rate of nutrient absorption.
Commercial growers that use fresh water in their reservoir, get their water tested periodically so they can add pH down and nutrients accordingly.

Lighting Schedule & Water Pump

- Turn the GrowLight ON and adjust the height as the plant grows.
- As the plant increases in size it will require more light hence you need to place the GrowLight nearer to it with its increasing size.
- Keep light on for the day when you wake up to when you go to sleep, younger plants may need less light so 08 hrs for the first week and increase 1-2 hours every week up-to 18 hours.
- Water Pump should be kept on until lights are ON.

TDS Chart

Refer this chart for all plants. Keep the water pump on when adding the nutrients. Let the nutrients disperse evenly throughout the water. Wait for 05 mins before taking a reading. Use TDS meter to check the ppm levels, stir the TDS meter while checking the ppm levels this will remove any air bubbles From the electrodes and will give you an accurate reading. Start from TDS of 300

PLANT	PPM / TDS
HERBS	
	Max. Range
BASIL-	700 - 1120
CORIANDER-	600 - 800
DILL-	800 - 1200
FENNEL-	700 - 980
MINT-	1400 - 1680
OREGANO-	750 - 1000
PARSLEY-	560 - 1260
ROSEMARY-	700 - 1120
THYME-	560 - 1120

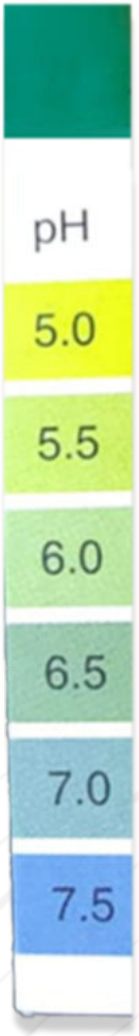
PLANT	PPM / TDS
LEAFY GREENS	
	Max. Range
CELERY-	1260 - 1400
KALE-	900 - 1500
LETTUCE-	560 - 840
PAK CHOI-	1050 - 1400
SPINACH-	1260 - 1610
BRUSSEL SPROUT-	1750 - 2100
CABBAGE-	1750 - 2100
MUSTARD GREENS--	600 - 1000

PLANT	PPM / TDS
FLOWERING PLANTS	
	Max. Range
ARTICHOKE-	560 - 1260
ASPARAGUS-	980 - 1260
BELL PEPPER-	1400 - 1750
BROCCOLI-	1960 - 2450
CAPSICUM-	1260 - 1540
CAULIFLOWER-	1280 - 1400
EGGPLANT-	1750 - 2400
OKRA-	1400 - 1680
SWEET CORN--	840 - 1680

PLANT	PPM / TDS
FRUITS	
	Max. Range
BANANA-	1260 - 1540
BLUEBERRY-	1260 - 1400
MELON-	1400 - 1750
STRAWBERRY-	1260 - 1580
WATERMELON--	1050 - 1680

PLANT	PPM / TDS
VINES	
	Max. Range
BEANS-	1400 - 2800
CUCUMBER-	1190 - 1760
PEPPER-	1400 - 3500
PEAS-	980 - 1260
PUMPKIN-	1260 - 1680
ZUCCHINI-	1260 - 1680
TOMATO-	1400 - 3500
CHERRY TOMATO--	1400 - 3500

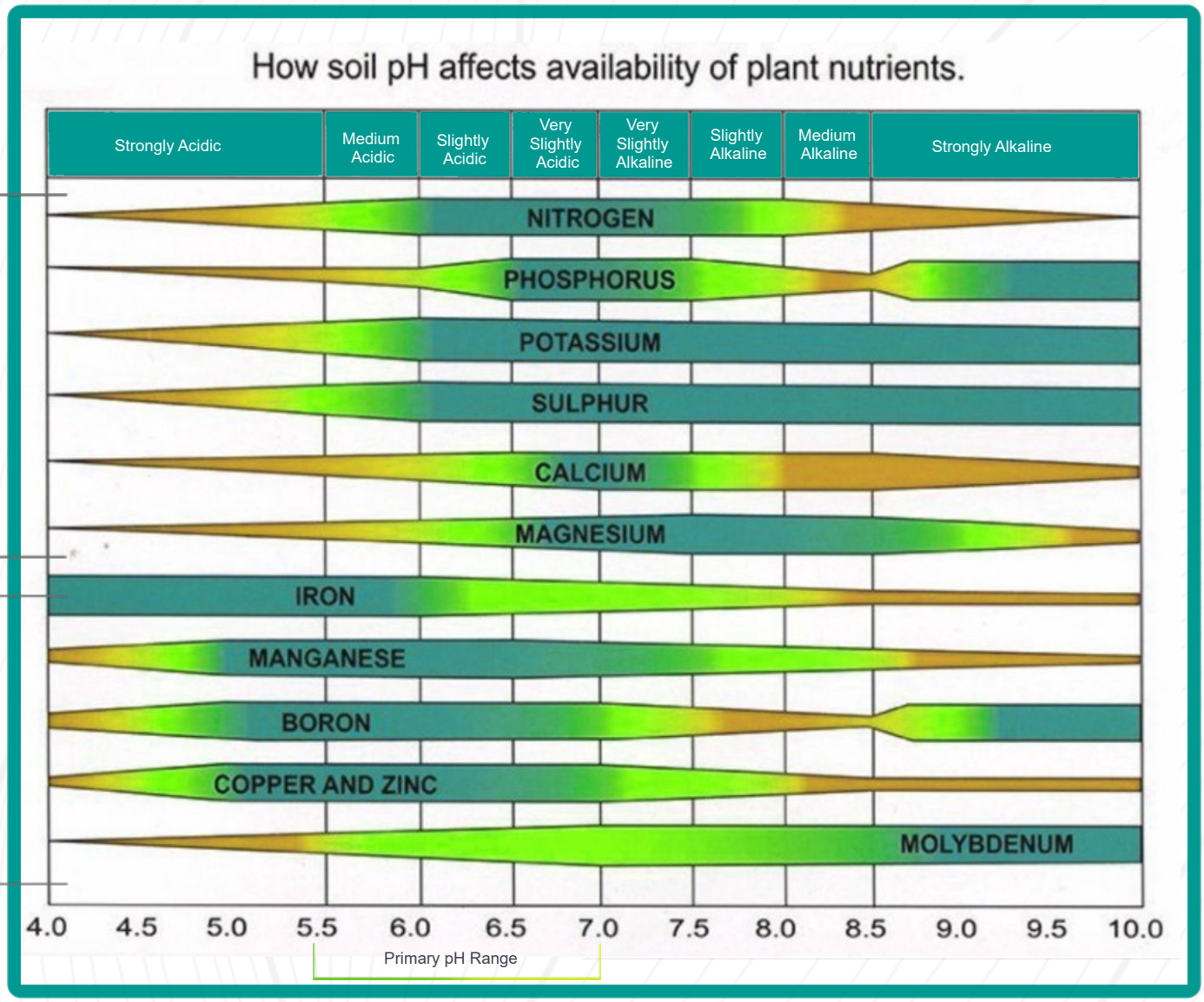
PLANT	PPM / TDS
ROOT VEGETABLES	
	Max. Range
GARLIC-	980 - 1260
ONIONS-	980 - 1260
BEETS-	1260 - 3500
CARROTS-	1120 - 1400
POTATOES-	1400 - 1750
RADISH-	840 - 1680
SWEET POTATO-	1400 - 1750
TURNIP-	1260 - 1680



How to use pH paper and pH Down?

- You have been given a high resolution pH paper specifically for horticultural use. The range in this 5- 7.5
- Plants generally need pH range from 5.5-6.5. Measure the pH once a day.
- Your pH mostly gets alkaline in hydroponics as the nutrients get absorbed.
- Always let the pH of the whole solution go up and down the whole range as certain nutrients get absorbed at certain pH levels.(refer chart on pg 16)
- If the pH goes above 6.5 let it be there for a day
- Add pH down solution only one drop at a time to decrease the pH
- Best way to keep your pH from fluctuating is to keep the setup sanitized to avoid Microbial Growth. Keep the water cool so as to have high levels of D.O. (dissolved oxygen), you can also add ice cubes if the area around the kit exceeds 30°C. Do not let any light seep into the tank so as to avoid algae growth.

Certain micronutrients have high bio availability at more acidic pH levels, but because of their lower requirement by the plant we don't need to take the pH below 5-5.5 that too only in rare specialised situtations.



FAQ's

(Frequently Asked Questions)

Basics Of Hydroponics

Q1. Plants that grow in hydroponics are healthier ?

Healthier food can be obtained through closed loop water recirculation system of hydroponics as these systems can be monitored to provide effective nutrition to the plants directly. It has been proven that plants grown hydroponically have up to 50% higher vitamin content than conventional farm produce.

Q2. Does Hydroponics system conserve water ?

Saving water through agriculture is an important method to conserve water and replenish the water table- hydroponics can save 20 times more water than organic farming methods.

Q3. Do we use pesticides in hydroponic system ?

No pesticides are used in Hydroponics. We use Hydrogen Peroxide to get rid of fungus and keep the setup clean to avoid pests.

Q4. Is hydroponics a form of organic farming ?

No, if we go by the traditional definition of organic farming, it entails the use of healthy soil and biological fertilizers and pesticides. Hydroponics on the other hand is a soil- less technique that relies on nutrient solutions to provide all of the plant nutrition and these nutrients may come from organic sources but they are usually refined mineral fertilizers (which is not a bad thing!).

Even though hydroponics is a more efficient option for growing food (vertical hydroponic systems can produce up to 240 times more food in a given area than traditional farming methods!)

The process of organic farming and hydroponics mainly differs on the basis of medium of growth and type of nutrients used. Hydroponics is described as the process of growing plants in water without the use of soil, while organic farming involves eliminating the use of inorganic/ chemical fertilizers in a conventional farming set- up.

The yield from a hydroponic setup can be 240 times greater than organic farming with vertical integration and can be attained 30- 50% faster than open field farming methods where weather and soil conditions play a major role in crop growth cycles.

FAQ's

(Frequently Asked Questions)

Questions for Nutrients

Q1. Are these nutrients made from chemicals ?

Yes, all high quality plant nutrition has been synthetic since the green revolution, the harmful chemicals that one generally associates with agriculture are pesticides, herbicides, fungicides and other hundreds of hostile chemicals that may be harmful to some form of organic life. High quality fertilizers are safe to grow with and eat through the plant, they also don't pollute the agricultural land as other hostile chemicals do. Because, we are practicing fully controlled Hydroponic farming there will be no need for hostile chemicals as mentioned.

Q2. Wouldn't mixing the Nutrients together be dangerous ?

No, mixing the nutrients together in their diluted form as instructed will not cause any unwanted reactions. Although, mixing them in a concentrated form might cause chelation which may destroy the bio availability of the nutrient.

Q3. What if I give the plants more nutrients will it grow faster ?

Giving your plant more than the desired amount of nutrients will literally cause it to burn. This phenomenon is known as Nutrient Burn and generally can be noticed by the drying leaf tips at the edges of your plant.

Q4. What all applications can the nutrients be used for ?

These nutrients work best with all soil-less growing techniques, you can also use them in conventional soil based agriculture as a soil booster.

Q5. What plants can be grown with these nutrients ?

All kinds of plants can be grown with provided balanced formulation. You might need to change the dosage of certain parts depending on the kind of plant being grown and the desired output.

FAQ's

(Frequently Asked Questions)

Q6. Do these nutrients require pH calibration ?

It is always recommended to calibrate your reservoir's pH accordingly, but the nutrients themselves have been designed to maintain pH around 6.5 most times.

Q7. What all hydroponic systems can you use them for ?

These nutrients work with all hydroponic and other soil-less systems due to their 100 percent water solubility rate.

Q8. Why are the nutrients provided in such small quantities ?

The nutrients provided to you have been researched on by experienced growers and are our houseblend of the most potent and bio available form of plant nutrients due to such high levels of bio availability your plants will make more with less.

Q9. After how many days are you supposed to add more nutrient ?

You can add nutrients by correlating the reading on your TDS meter to the desired nutrient required by the plant during the particular growth stage. This information is available on our blogs and in the growing section of this manual. Generally the dosing time for a hydroponic system will be between 5-10 days.

Q10. How long will these nutrients last ?

The nutrients have been formulated to have a dose 1ml/l so 100ml of concentrate solution will make a very potent 100 litre nutrient solution.

Q11. How long will these nutrients last in their concentrate form ?

These nutrients will last over two years in their concentrate form. So please don't procrastinate and leave these in your cupboard for more than two years.

FAQ's

(Frequently Asked Questions)

Q12. Will these nutrients produce organic food ?

There are a lot of other parameters one needs to take care of to grow organic foods, firstly all your produce should be seasonal and local so that they are more resistant to the environment. You will also need to grow in soil totally free from pesticides which is not possible because of ground water leeching. The produce you grow will be more dependent on your growing method than the nutrients used. Ironically, as plants DO NOT uptake organic nutrients directly, in hydroponics we provide them the most bioavailable form of the nutrients which are provided in their purest elemental form. As there are no good or bad Calcium Nitrate molecules you do not need to worry if the nutrients will harm you or the plants.

Q13. What type of nutrients are used in hydroponics ?

Only the Essential Nutrients required by the plant are used in hydroponics and given directly via a closed loop water recirculation system, these are categorised into 2 main types :

Primary Macro :

Nitrogen(N), Phosporus(P), Potassium(K).

Secondary Macro :

Calcium(Ca), Magnesium(Mg), Sulphur(S)

Micro :

Carbon(C), Hydrogen(H), Oxygen(O), Iron(Fe), Manganese(Mn), Zinc(Zn), Boron(B), Molybdenum(Mo), Chlorine(Cl), Copper(Cu) and Nickel(Ni)

FAQ's

(Frequently Asked Questions)

Questions For GrowLights

Q1. Do we use the same colour of light for both vegetative and flowering growth ?

As both the processes are part of separate growth events in a plant's life cycle, it is best to use lights with specific wavelength and colours- as suited to that particular phase, to get the best results at harvest.

Blue light stimulates vegetative growth of the plant whereas Red light stimulates flowering and fruiting.

Q2. Can we use Incandescent Bulbs in hydroponics ?

Regular incandescent bulbs are no longer used for indoor growing setups as they don't produce an ideal light spectrum required for plant growth and instead give off too much heat that can burn tender foliage.

Q3. Which type of light is most economical for hydroponics?

Given that the duration of keeping the lights on in a hydroponic setup can be anywhere between 18 to 24 hours, LED bulbs are the most economical option. Power efficient bulbs like LEDs play a very important role in cutting down the running cost of a hydroponic system. They use half the electricity and last 5 times longer even though they cost a bit more up front than fluorescent bulbs.

Fluorescent lights are relatively affordable and may be a good choice if you grow fewer plants. These comprise of a very low pressure mercury gas discharge lamp that uses fluorescence to produce visible light- creating a risk of mercury poisoning and difficult to dispose. These are better suited to grow seedlings and cuttings or plants with low light requirements, but do not help with flowering stages as they do not emit much red light.

FAQ's

(Frequently Asked Questions)

Q9. Why do we prefer GrowLights to normal sunlight ?

GrowLights are preferred over sunlight in a few scenarios such as: places with lack of extended periods of sunlight, people who do not have outdoor spaces such as gardens, lawns, etc. and for proper commercial hydroponic/ aeroponic set-ups, to name a few.

GrowLights, as the name suggests, help with the efficient growth of a plant under a controlled environment. Seedlings require lots of bright light devoid of which, they become weak and leggy, in most cases even the sunniest windows won't provide the intensity or duration of light they need- especially in winters.

Q10. What is the difference in growth rate between high output LED and sunlight ?

If done properly, there should be no difference in the growth rate of a plant. It has been seen that in case of LEDs, the optimal wavelength should be changed according to the type of plant- a combination of blue and red light works better for increase in plant height and leaf area.

Q11. What should be the duration of keeping the lights switched on ?

Commercial farmers prefer to keep the lights on for a full 24 hours for maximum output. In case this is not feasible, the most popular duration used is 18 hours on and 6 hours off- this mimics a natural day light cycle with an induced dark period which can actually trigger certain plants to flower. Turning the lights off can also help with lowering the electricity cost.

Q12. Which type of light is most environment friendly ?

LED lights are most environment friendly as they offer a long service life and high energy efficiency as compared to other lighting options currently available. These are also mercury- free and the tubes don't shatter like the fluorescent glass tubes, creating lesser toxic landfill waste.

LNO AgriTech

Congratulations

On being a part of the hydroponics family !!

Best of luck with your grow !!!
Lettuce know whenever you have any concerns