Against common belief !

Changing ”Regular water” into ”Ultra water”

Introducing the technology

MARUYAMA ”UFB Ultra Pump” Introduction

【Aquaculture／Agriculture】

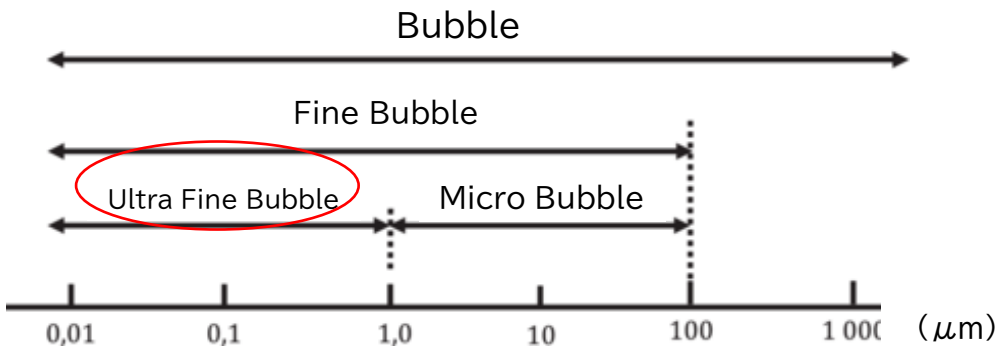
Ultra Fine Bubble（UFB）is:

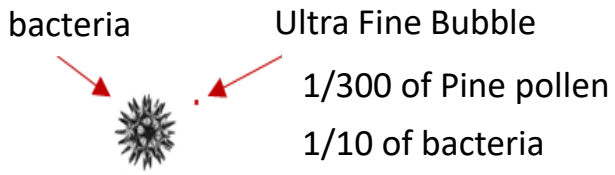
UFB=

Micro sized tiny bubble same size as flu virus

(diameter less than1μm)

The bubble is invisible and does not burst





Name of the bubble changes accordingly to its size
But it also has different characteristics accordingly to the size

UFB characteristics changes water performance and function

- ✓ High wash power
- ✓ Destroy virus & bacteria
- ✓ It penetrate deep into the smallest of spaces
- ✓ Activates physiology
- ✓ **It can contain various gas**
- ✓ **Proven safety for humans**

～Already at work!～

Medical

Periodontal treatment, body cavity wash in surgery, and others

Life

Increased wash power in wash machine and 洗toilet. Adding flavor to food

Agri/Aqua culture

Increased harvest volume and sweetness in tomato field. Water quality and mortality rate improved in aquaculture

Beauty

Used in Showerhead, UFB contained lotion that have high absorption

UFB is Awesome !
But, the problem was the size of UFB machine and its cost

Ultra Fine Bubble Pump

MARUYAMA's leading technology made it possible
For the machine to be **small, low cost,** and **high performance** !

Other company

Image	
Power	Triple 200V
UFB Qty.	One pass 0.46mil 30min. Circulation 4 mil.
Type	Set
Output	20ℓ/30 min

MARUYAMA UFB pump line up

MARUYAMA

Product						
Power	Battery	Battery	Single 100V	Single 100V	Triple 200V	Gasoline engine
UFB Qty.	2 mil./1ml	2 mil./1ml	2 mil. /1ml	2 mil./1ml	4 mil./1ml	4 mil./1ml
UFB gen. Method	One pass method, generates bubbles at the same time as output					
Type	Back Pack	Hand Held	Hand Held	Set/Movable	Set/Movable	Movable (Outdoor)
MPa	2	2	2	2	3	3
Output/ min	1. 4	1.4	1.4	1.4	20	20
吐出口径	G1／4	G1/4	G1/4	G1/4	G1／2	G1/2

The size small enough to be parts and its low cost
Maruyama pump can generate a few million bubbles in 1cc water in just seconds

UFB Case Study in Aquaculture

Preventing “death” in the culture tank by UFB

Case Study① mortality test in Red Snapper tank for Market

Circulating UFB water by Ultra Pump in culture fish tank,
improved water quality & mortality rate (“0” death)

Study

Subject: Culture fish tank/Red Snapper

Content: Check for improved mortality rate while cultured

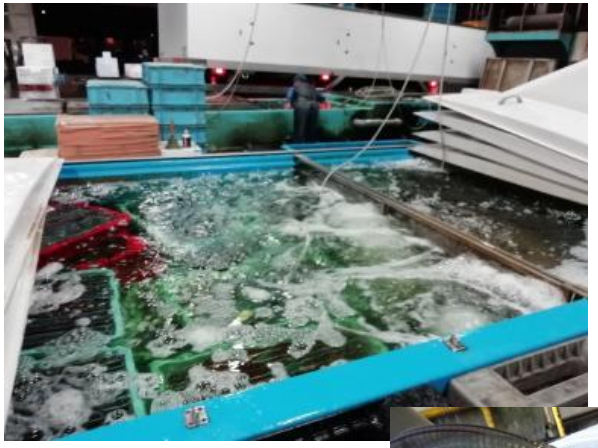
Method: Circulate culture water by Ultra Pump
Continuous run 8 hrs./day avg.

Evaluation: Death count with/without UFB

Period: December, 2018 - April, 2019

Result: Without UFB - “2” deaths

With UFB - “0” death



By improving water quality and stabilizing dissolved oxygen level, “death” was prevented

Thawing Tuna with UFB water

Case Study② Thawing frozen tuna in the Fish Market

Able to keep its bright color and freshness by thawing Tina with UFB water

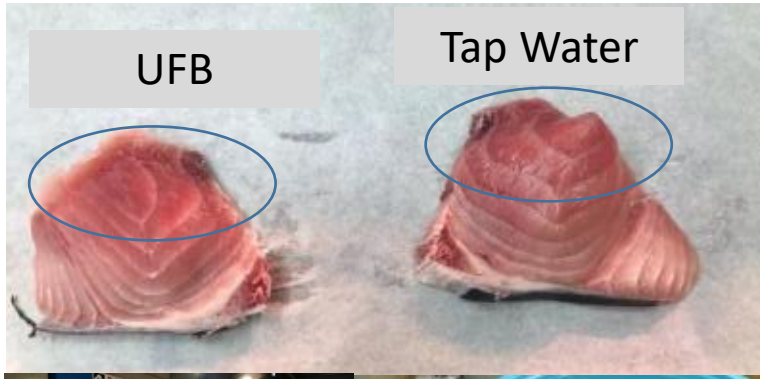
Study

Subject: Frozen tuna

Method: Quality check after thawing tuna with nitrogen UFB added tap water

Evaluation: Comparing freshness of thawed tuna by tap water and tap water with added nitrogen UFB

Result: Oxidation controlled by UFB
- Improved brightness in red color
- Chefs evaluated that the freshness lasts longer
- No change in taste or smell with UFB



No negative effect on taste or smell, but keeps freshness and bright red color in Tuna

Improving mortality rate in young shrimp culture tank by UFB

Case Study③　Culturing young shrimp（Inland aquaculturing）

Reduced mortality rate of shrimp in half by setting a UFB pump in the tank

Study

Subject: Young Shrimp

Method:　setting UFB pump in circulating system

Evaluation:　1 tank out of 6 is setup with UFB (5 tanks with　regular system). Comparing mortality rate and dissolved oxygen level

Period:　about 2 months. (spawn　season early Oct. – Dec.)

Back　　Depth of the tank：35cm
Water vol. of the tank ：11.55㎥
Shrimp qty. per tank: about 500 (male165, female 335)

Shrimp culturing process

Baby shrimp(0.8mm)

↓

Young Shrimp(20cm) → Test Period (2 mon.) → Moved to another tank Until fully grown

Spawn twice

↓

Ship to another culture supplier

Improving mortality rate in young shrimp culture tank by UFB

Case Study③ Culturing young shrimp（Inland aqua culturing）Result

Result 1
Reduced young shrimp mortality rate

Regular tank:
10death/mon./tank
↓
UFB tank: **4～5 death**

Result 2
Increased dissolved oxygen level

Regular tank: 4～5ppm
↓
UFB tank: 8ppm
※Oxygen level went up in UFB tank, despite water being replaced once a week in regular tanks

Result 3
Eats better

Cause of eating better is thought to be the high oxygen level. Time was not available to measure the difference in the growth speed.

Female spawn 600 eggs (9,000 Yen) twice a year

Omits **18,000 yen loss per female shrimp**

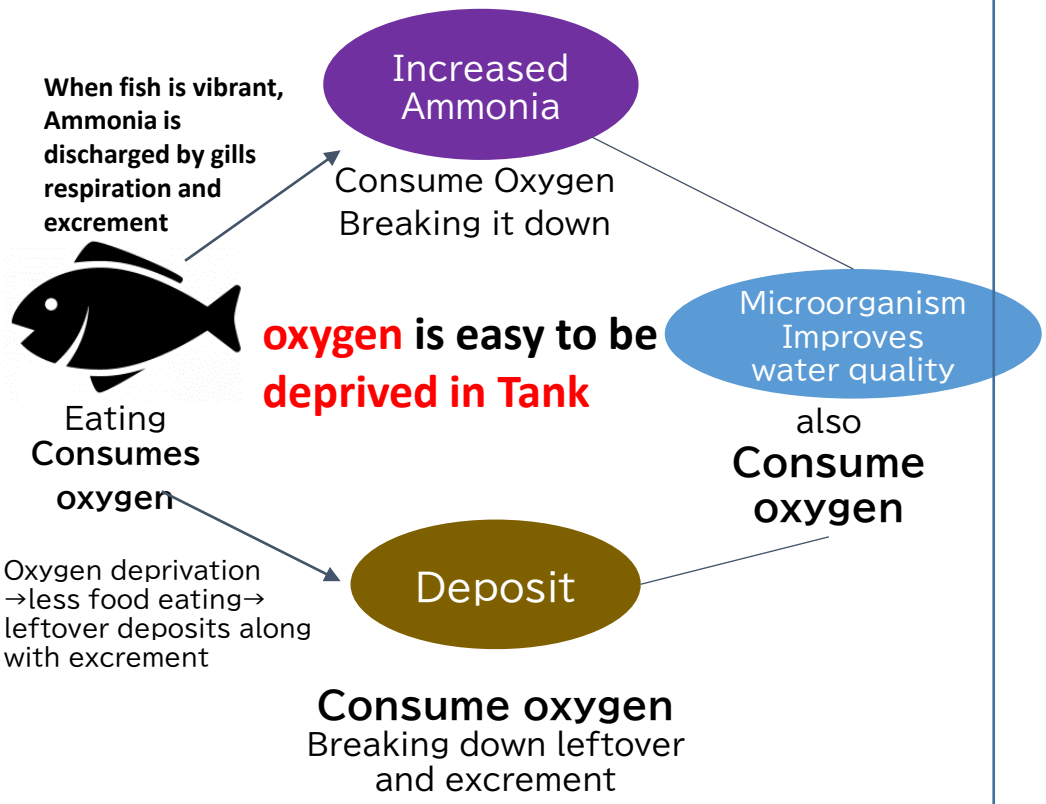
Already existing synergy effect with aeration

2MPa 2l pump (about 11t and only 2 l/min.) Can improve culturing environment of 11.55㎥ tank

Mechanism of faster growth in aquaculture by UFB①

UFB enables sea water to dissolve oxygen **5 times** the saturated amount, improving issues with deprived oxygen

Easy to deprive oxygen in the tank



When deprived of Oxygen:

- Fish do not eat
- Leftover deposit and rot
- Slow Ammonia decomposition
- Low water quality makes fish sick

→ Administrate Antibiotic
→ Cost increase
→ gives bad impression with drug

Increased oxygen 5 times the saturated amount

Increase appetite, promotes growth, and improved water quality reduces death in the tank

Mechanism of faster growth in aquaculture by UFB②

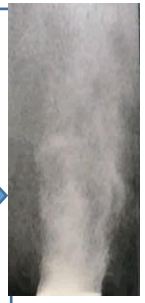
Nano mm UFB, can void cap phenomenon situation by its small size

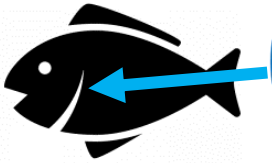
Aeration ＝Common process to increasing oxygen in tank

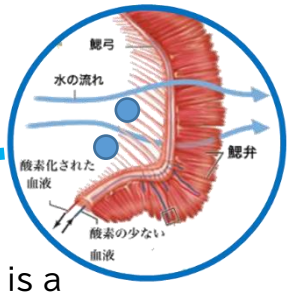
Problem with aerating With micro bubble

- **Micro sized** bubble
  (white in appearance)
- Fish swallows the bubble that stays in water for a few min. and spread
- Gill's **cilia spacing is a few hundred nano**
  1 micro =1,000 nano
  the bubble clogs up the gill
  (cap phenomenon)

Fish normally avoids being in bubble curtain







The bubble bigger than the space between cilia, covers the gill up ＝cap phenomenon

Cilia spacing is a few hundred nano

Cap phenomenon prevent fish from gill breathing to weaken !

UFB bubble is smaller than the space between cilia, avoids cap phenomenon and provide oxygen.

Mechanism of faster growth in aquaculture by UFB summary

UFB enables sea water to dissolve oxygen **5 times** the saturated amount, improving issues with deprived oxygen

(UFB's gas solubility effect)

Ultra fine bubble is small enough that do not allow cap phenomenon

(UFB's characteristics)

Biofilm(slime=germs nest)is destroyed by UFB bubble bursting to keep the high quality water

(UFB's power to physical destroy)

Activating the fish's physiology and promotes its growth

(UFB's physiology vibrant effect)

All of these mechanism, made it possible for UFB to

Reduce culture time by half and enlarge the size by 1.5 times

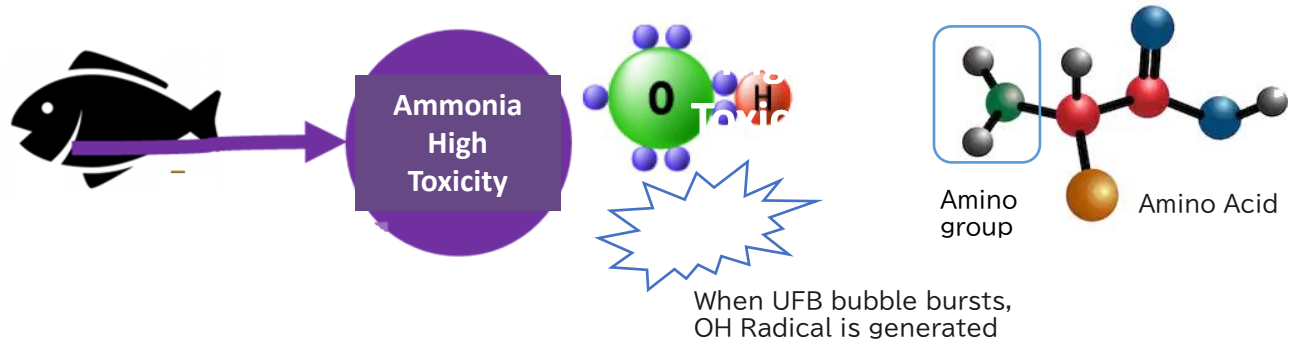
And The taste!

UFB ion decomposes ammonia in sea water to change it into amino group

When UFB bursts, OH radical is generated.
The chemical reaction between ammonia and OH radical creates amino group which is base of amino acid.

Ammonia　OH radical　Amino group　Water

$$NH_3 + OH \rightarrow NH_2 + H_2O$$



Amino acid is need nutrients that the body needs to function

Amino acid increases muscle in culture fish, and adds flavor when deposits in the muscle

4 Merits by aqua culturing with UFB

Culturing time reduced by promoted growth

Improved quality by increased dissolved oxygen level

Improved water quality by UFB's traits to able to physically destroy

Better flavor with added amino acid

Just by adding UFB function to the water,
Reduce cost & Increase profit

UFB Case Study in Agriculture

Case Study① Tomato in Green house（soil culture）

Just by irrigating with UFB water, Increase harvest and quality

Study

Subject: Tomato

Content: Compare the tomato growth with “regular water” and “UFB water”

Method: Irrigating with UFB water (1,000L/10a)

UFB Irrigation: once per 10-14 days Diluted UFB water is irrigated at the root

Evaluation: Comparing the harvest in 1 test area to other normally operated 2 areas . (12.5kg/container)

Period: Nov. 2018～Apr. 2019

*The firm purchased 5 ultra pumps after the experiment period

irrigating

Farm Kumamoto 30a		
Test Area 10 a	Normal Area 10 a	Normal Area 10 a

UFB Case Study in Agriculture

Case Study① Tomato in Green house（Result）

- ✓ 165% increase in 8 times harvesting (avg.), during the test period
- ✓ Ave. size of tomato is bigger and more uniformed in appearance
- ✓ The red color is bright and taste well. The rate of clearing the standard to be sold is increased.

＝>The firm purchased 5 pumps after the experiment

Result

First UFB Irrigation on 11/15, started 3 weeks before the harvesting

	Test Area(10a)		Reg. Area(20a avg.)		
Date	container qty.	weight(kg)	container qty.	weight(kg)	Test/Reg. area Rate of increase (%)
12/9	19.3	241	8	100	241%
12/12	15.3	191	12.8	160	120%
12/15	14.6	183	9.6	120	152%
12/18	7.3	91	4.8	60	152%
1/2	32.6	408	16.6	208	196%
1/4	20	250	10	125	200%
1/7	29.3	366	20	250	147%
1/13	24	300	16.6	208	145%
Period Avg.	**162.4**	**2,030**	**98.4**	**1,230**	**165%**

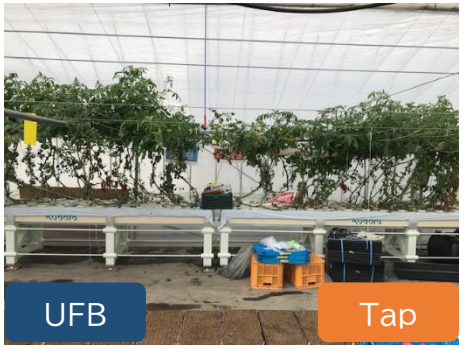
UFB Case Study in Agriculture

Case Study② Cherry Tomato in Green house（Hydroponic/Result）

- ✓ Able to harvest one week early
- ✓ Increased harvest by 31% avg.
- ✓ Result varied by the brand.
  But most increased in harvest

品種	UFB有	慣行	増減
Pomodoro	7,710	7,600	101%
Collet Long	20,220	20,580	98%
Hana Seven	11,540	8,210	141%
Black Cherry	22,940	8,710	263%
Green Zebra	26,000	22,300	117%
Total(kg)	88,410	67,400	131%

Feb. 25th



Mar. 25th

Mechanism of increased harvest in agriculture by UFB①

Irrigating with UFB water, provides enough oxygen to the roots in growth suitable temperature

Suitable temperature and dissolved oxygen for tomato growth

水温と飽和酸素濃度の関係

℃	mg/L	℃	mg/L
11	10.67	21	8.68
12	10.43	22	8.53
13	10.20	23	8.38
14	9.98	24	8.25
15	9.76	25	8.11
16	9.56	26	7.99
17	9.37	27	7.86
18	9.18	28	7.75
19	9.01	29	7.64
20	8.84	30	7.53

Best suitable temp. for growth

Day : 25 ~ 30 ℃

Night : 10~ 15 ℃

Crucial to have correct temp. and enough oxygen supplied to the roots

Higher temp. reduces amt. of dissolved oxygen

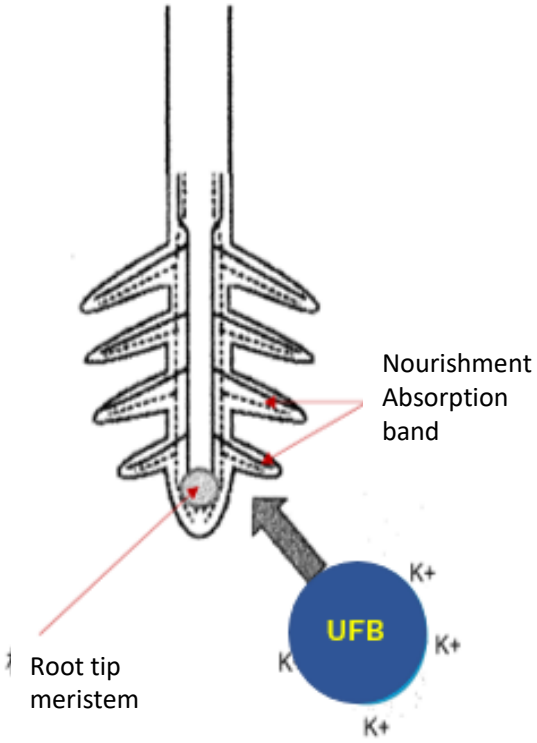
At 25℃, 1g of tomato root takes in oxygen 0.35mg per 1hr.

Tomato root is sensitive to having enough oxygen to absorb nitrogen

Supplying oxygen to the root is effective to increase harvest

Mechanism of increased harvest in agriculture by UFB ②

Irrigating UFB water activates the root to increase production of growth hormone



Converting Irrigation system to UFB
It increases amount of oxygen in soil by 20% without adding oxygen separately

↓ Zeta potential-100mA

Minus charged UFB attaches to the roots easily

↓

UFB bursts after attaching to the roots

↓

Oxygen supply to the roots increases
It activates roots to intake the nitrogen more

↓

It increases nourishment intake, and activates root tip meristems

↓

It increases ability of Cytokinin hormone production

↓

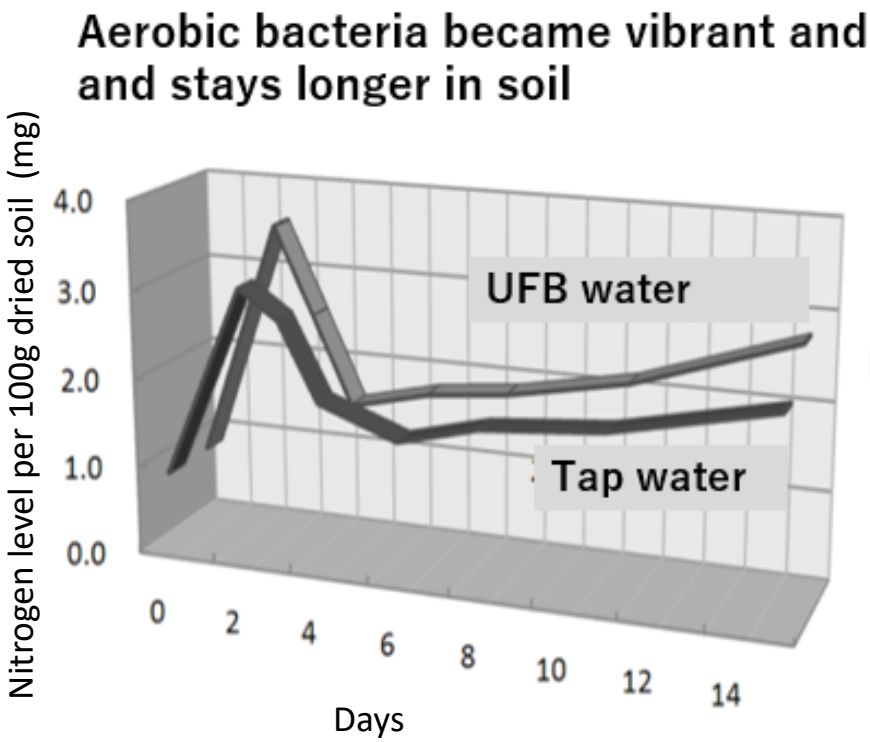
Accelerated growth

The roots do not only absorb nourishments but also supply the plant hormone to the stems. These function relays heavily on the oxygen availability

Mechanism of increased harvest in agriculture by UFB ③

Aerobic bacteria became vibrant and nitrogen became more effective and stays longer in soil when irrigating with UFB

After spraying the soil conditioner containing Azotobacter, UFB water and Tap water were sprayed to conduct the comparison test to measure the amount of Nitrogen in the soil



Aerobic bacteria becomes active by the oxygen contained in UFB

↓

Nitrogen amt. in soil is increased and stays longer

↓

Abel to keep right amount of oxygen in soil

↓

The growth of the plant is steadily promoted

**reference taken from Kochi University of Technology:
Efficient Nitrogen-Containing Fertilizer Delivery into Soils Mediated by Aqueous Solutions Containing Micro-bubble

Mechanism of increased harvest in agriculture by UFB

(Summary)

Easy to seep through

UFB's penetration makes water and nutrients easy to reach the roots

Activates aerobic bacteria

Activates fixed nitrogen

Nitrogen rate in soil is improved and stays longer

Activates plants physiology

UFB stimulates the root to promote secretion of growth hormone. The fruit permeates to absorb nutrients that increases its **sugar content**

The stem becomes sturdy by increased conduits

Number of conduits increased by absorbing more water and nutrients.

The **stem** grows **sturdy and thick** to hold many fruits

Delivers nutrients such as potassium to the roots

UFB attaches positive ion such as potassium to its bubble. Potassium a important nutrients to promote plants growth and fulfil the fruit. Delivered potassium **promotes the growth and make it fruitful**

Special mechanisms make it possible

For only **water** and **air** to **increase harvest**