

**A survey of worldwide agriculture systems in the 21st century  
utilizing negative ion technology**

## 1. What is negative ion agriculture?

Negative ion technology holds enormous potentialities not only with respect to health, but also in the industries of agriculture and stockbreeding. In the agriculture field, negative ion technology has been utilized for a long time in electric agriculture and other cultivation methods.

There is a saying "The year with much thunder means a good harvest". There are various scientific theories on this, but generally you can see this phenomenon as an example of the influence that negative ions have over plant growth.

Our earth touches the atmosphere with the surface of the earth as a border. Both the surface of the earth and the air covering it form an electric potential difference of positive and negative. The atmosphere with this potential difference from the electric field influenced by atmospheric pressure, temperature, humidity, and wind. It changes its figure by various conditions.

It was thought that a potential difference in this electric field was exerting a powerful influence to agricultural growth. There was an agriculture method called "electricity cultivation" used to control the growth of plants by controlling this potential difference, and it had been practiced for more than 200 years mainly in Europe. Approximately 100 years ago, "the air ions", the ions in the atmosphere, was discovered. Since then, there has been detailed attention on the correlations among positive and negative ions in the atmosphere with electricity cultivation effect.

There have been various experiments performed by universities and institutions through out the world about how potential difference and electric field could affect plants. For instance, changing potential difference in the atmosphere near plants by discharging electricity, or passing electricity directly through electrical stimulation.

As result, it was starting to be understood that many types of plants are affected on their growth by changing the balance between positive and negative ions.

In Japan, a method called electronic agricultural farming is being practiced. This method is to accelerate the growth of plants by charcoal buried underneath the soil of the field, adjusting the negative ion balance in the atmosphere, and water with strong anti-oxidizing power called electric water. With this method, there were reports on the increase of the crop when conditions were appropriate.

Nowadays, with the expansion of circulation management, the limit of organic or no pesticide farming does not seem too far. There are also harmful effects by dissemination of various pieces

Applying negative ion technology to agriculture has a great potential to support our healthy diet in the 21st century.

Also, considering the current organic and pesticide-free cultivation techniques are risky and not suitable for mass production, there is a reality of not being able to adequately supply the demand for natural produce.

I believe that new agricultural technology suitable for the 21st century is necessary to provide farm products or processed food with anti-oxidizing power and vital energy. The closest way to get there, is with technology utilizing negative ions.

I would be more than happy if the practice of this method backed up with the knowledge produces minimum profit and this system gives people a better quality of life and fulfillment.

## **2 Mechanisms of agriculture using negative ions**

Dr. Kruger P.H.D. is the foremost expert on negative ion research and development in University of California. He practiced experimentation and study for fundamental research on negative ions in various field. That was almost 50 years ago. He made fundamental reports on the negative ion effects on organisms in many studies he has done on plants, bacterial micro organisms, and physiological history of ions in the atmosphere. In his experiments, he found that there were different phenomena in the growth of plants such as barley, lettuce, and peas, depending on the type of ionized atmosphere.

In an experiment with wheat, significant differences appears in the length of the leaves or the height of the stems under the circumstance of normal air with negative ions (10000 /cc) positive ions(10000 /cc) the pneumatic cause ionized by the cause under pneumatic each condition usually.

He found that production of an enzyme called cytochrome C had become almost 1.5 times more than usual. Cytochrome C is a kind of enzyme that gives significant influence to the oxidation-reduction in a circuit of electronic transmission system.

After this experiment, There have been many reports on different experiments about accelerating the effect of plant growth under a negative ion environment.

In view of the experimental result of accelerating ATP metabolism in chlorophyll, it is thought that the excessively negative ionized atmosphere environment excites energy metabolism and greatly impacts acceleration of plant growth.

Generally, in a indoor environment like a greenhouse, it is said that there is a considerable

practical experiments done to watch plant growth and crop with atmosphere ion balance adjusted into negative using negative ion generator, and more results came out to show better growth of both leaves and blanches when negative ionized.

On a whole, plants are organisms like us, and it is said that in environment with more ionized air, the metabolism circuit of the energy goes to a better direction.

When practicing agricultural experiments by ionizing atmosphere, the management of humidity is thought to be essential.

Review and future prospect of negative ion agricultural method

Negative ion agricultural method

- Carbon immersed in soil → soil improvement. Nourishing, beneficial microorganisms and agricultural method utilizing potential difference
- Ionized water (electronic water) dispersal → reduction power, anti oxidizing power, ion balance adjustment, photosynthesis a promotion
- Negative ion sprayed on → reduction power, ion balance adjustment, oxygen carbon dioxide regulation, photosynthesis promotion

→cost down, crop increase, agricultural work simplification ( compiled in a manual)

→crop with improved sweetness and flavor, longer lasting, enhanced vitality

1/ soil improvement in the greenhouses

Promotion of soil with anti oxidizing power and strong vitality (two to three months)

- Plowing in powdered charcoal ( 1m underneath the surface, whole area)
- Dispersal of diluted fermented extract (once a week)

2/Type of fruits

- mango
- Papaya

- Strawberries, Melon

### 3/Cultivation

- Dispersal of diluted fermented extract by sprinkler
- Installation of negative-ion plate
- Installation of negative-ion generator
- Stable supply of minerals and diluted fermented extract by piping in the soil.
- Negative ion multi sheet
- ※ Establishment of atmospheric ion counter
- ※ Temperature and humidity management

After a few years of system know-how built up, this method will have an aspect as content business when starting agriculture business.

- Providing practical know-how of negative ion agriculture (simple, low-cost, no pesticide)
- Providing diet education system after retirement
- Franchise practical and self sustainable negative ion agricultural methods

**Report on negative ion cultivation experiment with strawberries**  
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**Purpose:**

Modern agriculture is still troubled with pesticide use. Problems such as soil aggravation, residue and prohibitive costs are commonly associated with chemical use.

This experiment attempts to work around these problems with negative ion technology and develop the method for future use.

In addition to dealing with pest problems, this experiment aims to improve the quality and quantity of the yield. Specifically, leaf and stem thickness will be measured as well as sugar content and overall plant development rate.

**2. Methods and materials**

Experiment location

A strawberry farm in Utsunomiya, Tochigi prefecture in Japan

Sample:

- Type of strawberry: Tochi-otome

◎ Preparation:

- Prevent mildew
- Maintain humidity at 40~50%

◎ Tasks for cultivation

- Decrease temperature during daytime → enhance sourness of the fruit
- Growing speed difference in north and south side

◎ Experimental facility

1. Experimental area A : Mr. Yoichiro Nozawa

- Note: First half of the experiment→base fertilizer (rice chaff, chicken manure, oil meal)

(promotes development)

- Second half of the experiment( April) →liquid fertilizer

Divide the greenhouse into halves with curtains

- Double-ply green house (approx. 90m)
- Install PVC dispersal pipes in each aisle (tie in the middle to keep the liquid fertilizer away from the control area)

the control area)

- Fully install water curtains: Maintain around 7°C in winter and set up the system for ground water flow to the inside surface of the green house
- Line in-between the aisles with aluminum foil  
→advantage: sunbeam increasing effect by diffuse reflection  
prevents aphids  
→disadvantage : Prevents the ground temperature from rising

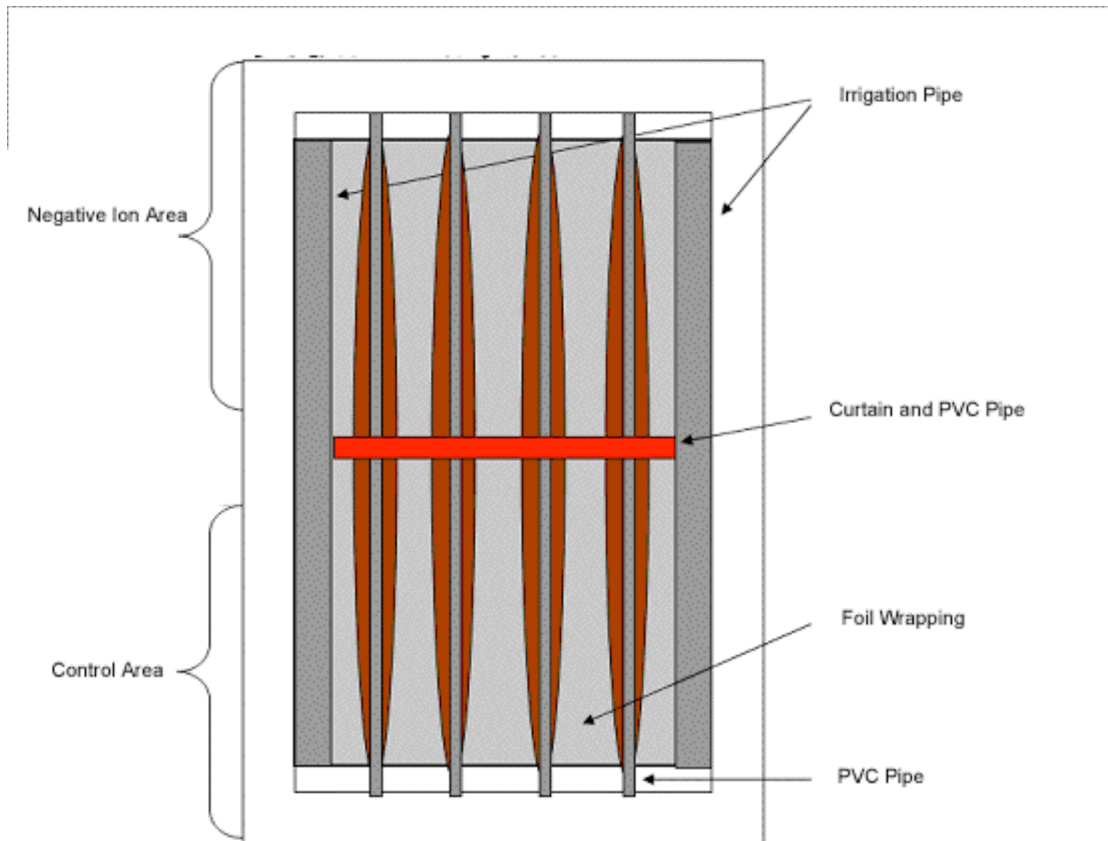






photo1. The Water garden system (90 meters long)  
vinyl



photo2. A double ply



photo3. A 区の各畝の散水塩ビパイプ



photo4. B 区 (奥行き約 90m)

Cultivation Environment	Control Area	Negative Ion Area	
Negative Ion Method	None	Negative Ion Multi-Sheet <ul style="list-style-type: none"> <li>Multi-Sheet with Negative Ion Coating developed by Shinto-Toryo Ltd.</li> <li>The sheet was placed between the aisles</li> </ul>	
Humidity	Not Set	Maintained at 40~50%	
Applying mineral water	N/A	Mineral water diluted to 1/1000 concentration of Rock and Sulfuric Acid Mineral water dispersed by sprinkler on both sides of the greenhouse once a week.	
Recorded Measurements	Temperature	Temperature	Daily
	Humidity	Humidity	
	Crop Yield	Crop Yield	Each Crop
	Size	Size	
	Interior/Exterior Ion measurements	Interior/Exterior Ion Measurements	Every 2 weeks
	Gamma Radiation	Gamma Radiation	
	Particulate Matter	Particulate Matter	
	Sugar level	Sugar Level (sweetness)	
	Scent	Scent	
	Cultivators Questionnaire	Cultivators Questionnaire	Every 3 days

## Results:

### Review

The damage caused by mildew was less in the negative ion area, and in proportion, the plants showed rapid growth after the 21<sup>st</sup>.

Disease damage was in proportion to the growth of the plants body.

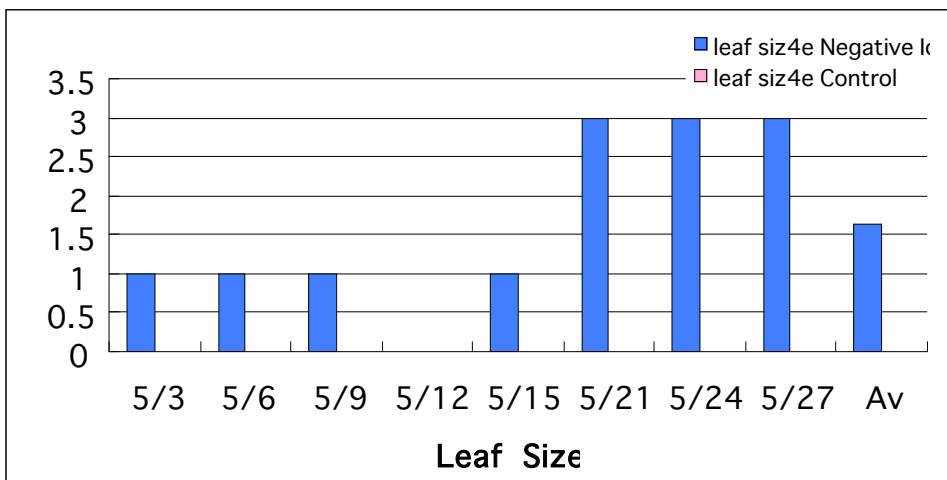
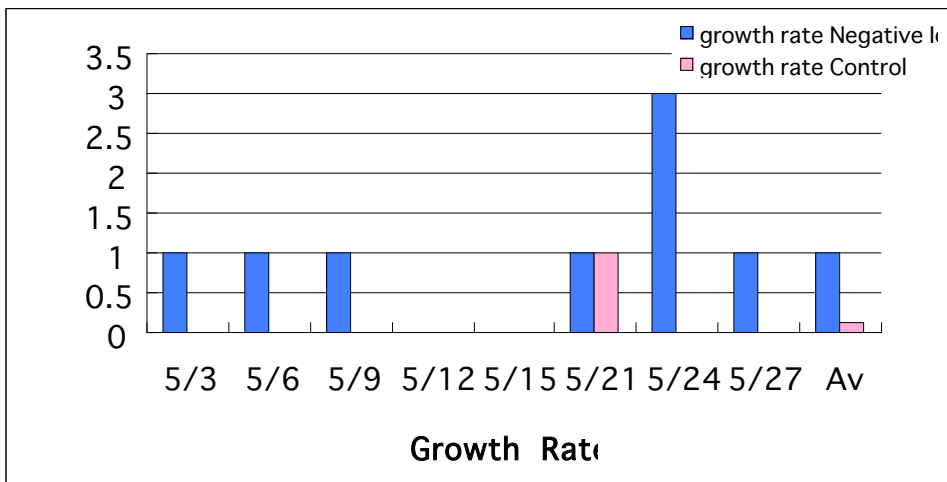
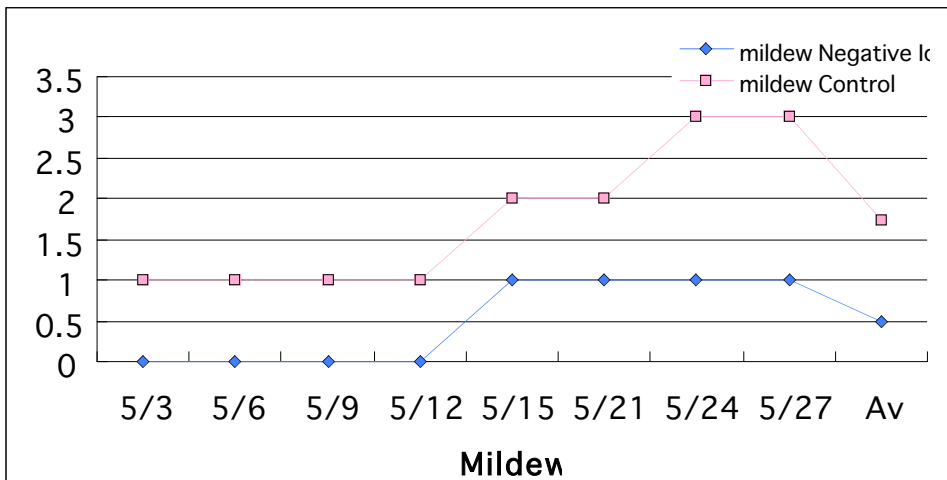
It is possible to frame a hypothesis that control of the disease was due to masking and disease resistance improving effect caused by the negative ions.

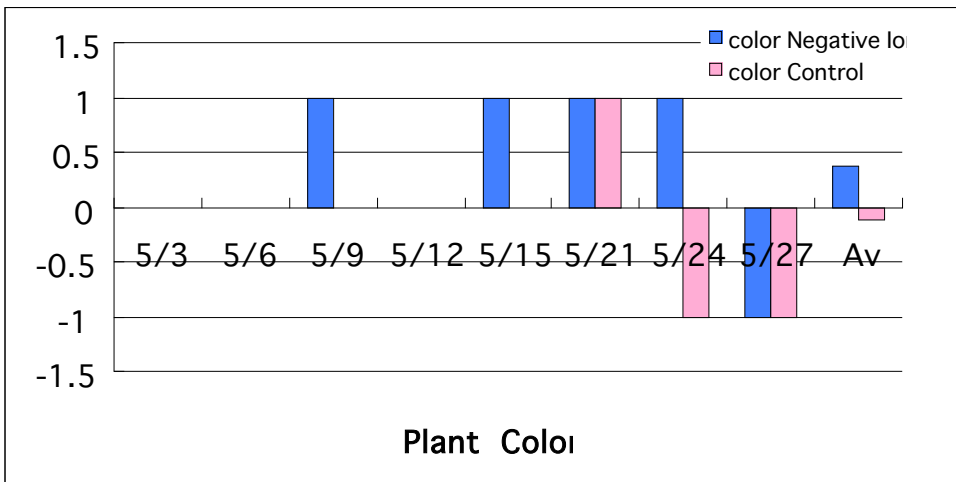
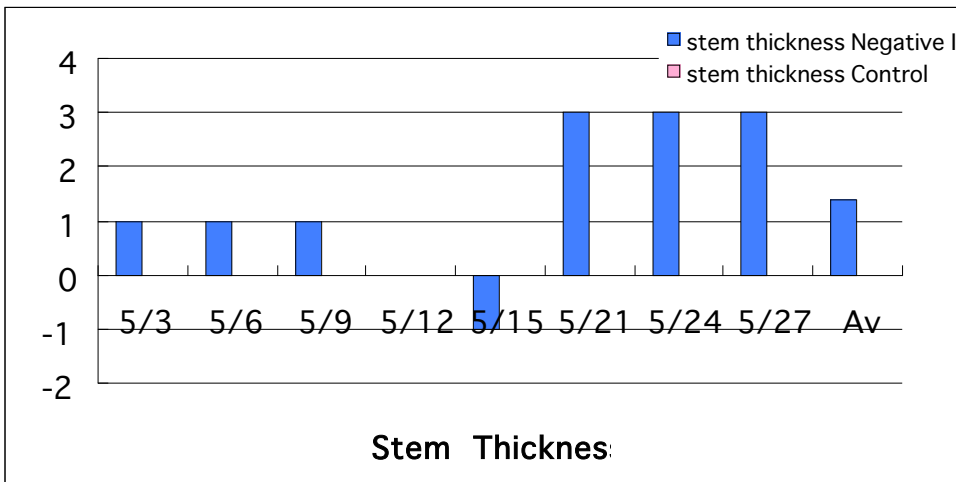
The plants growth had tendency to be accelerated as time progressed, and we were able to see the result of stem and leaves thickened and enlarged.

The highest temperature exceeded 20 degrees C on May 3<sup>rd</sup>, 6<sup>th</sup>, 21<sup>st</sup>, and 24<sup>th</sup>

Plants in the negative ion area had a tendency to show remarkable growth on the days when the highest temperature exceeds 20 degrees C, and the plants in the area with negative ion sheets presumably grew along with internal factor such as temperature which they have high sensitivity to.

Date	5/3	5/6	5/9	5/12	5/15	5/21	5/24	5/27
High Temp.	26_	24_	18_	18_	17_	23_	22_	—
Low Temp	11_	10_	8_	13_	14_	14_	12_	—





## ② Yields and Sizes

With regard to the yields, the decreased fruit number could show that more nutrients were absorbed to plants body more than to fruits, however, considering the shape of strawberry fruits generally being unstable, the fact plant growth turned positive in the end of May and tendency of widening gap in crop yields can presumably show that in negative ion area where more positive growth stood out, plants bodies were revitalized by negative ion effect.

However, on the 24<sup>th</sup>, contrary to previous behavior, the crop yields in the negative ion area dropped below the yields in the control area.

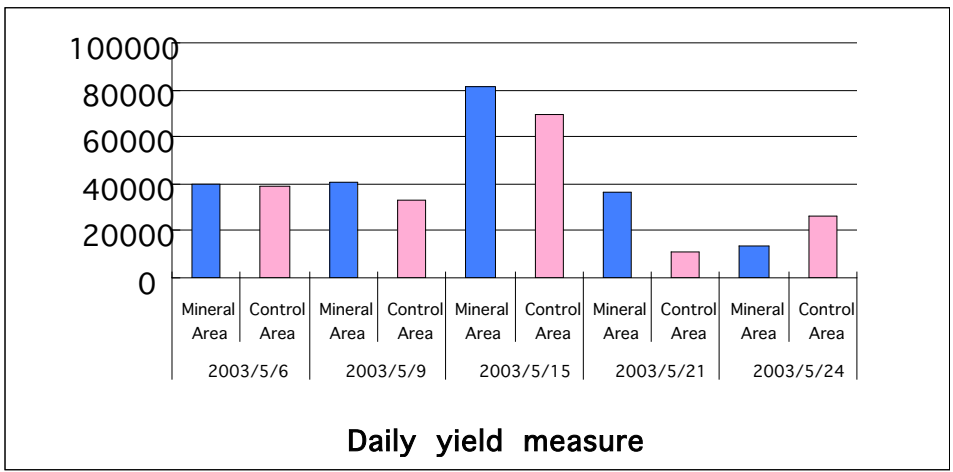
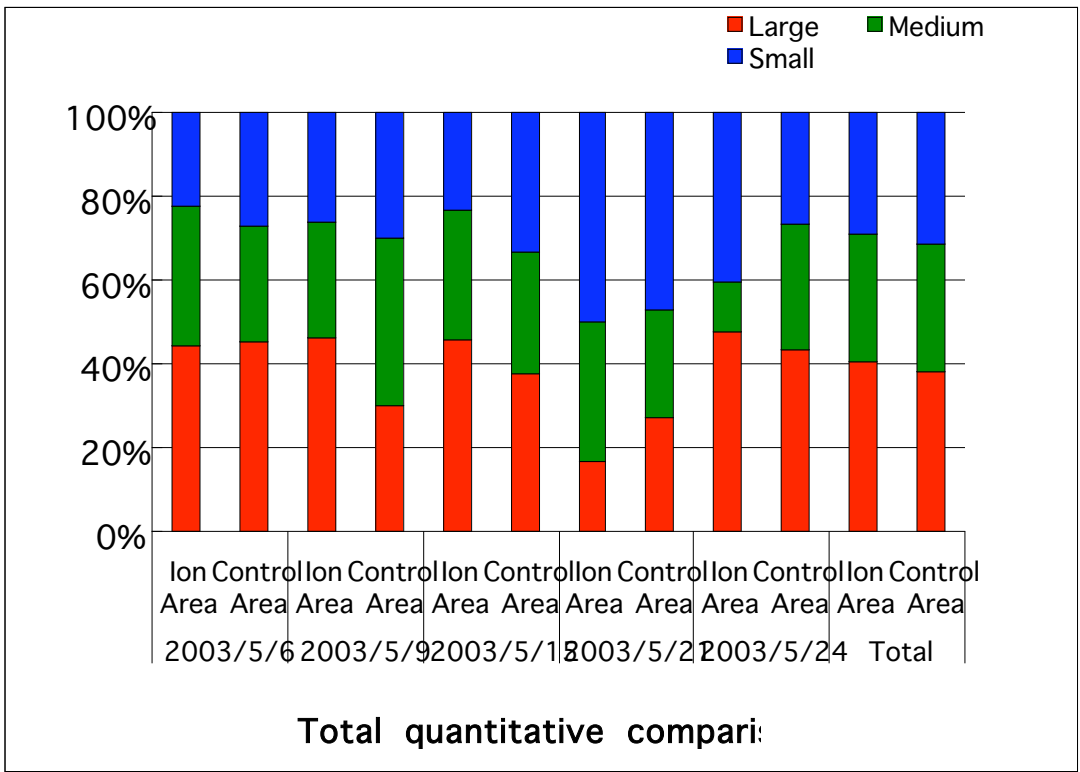
What caused the drop is irrelevant, as the growth rate for each particular item had increased.

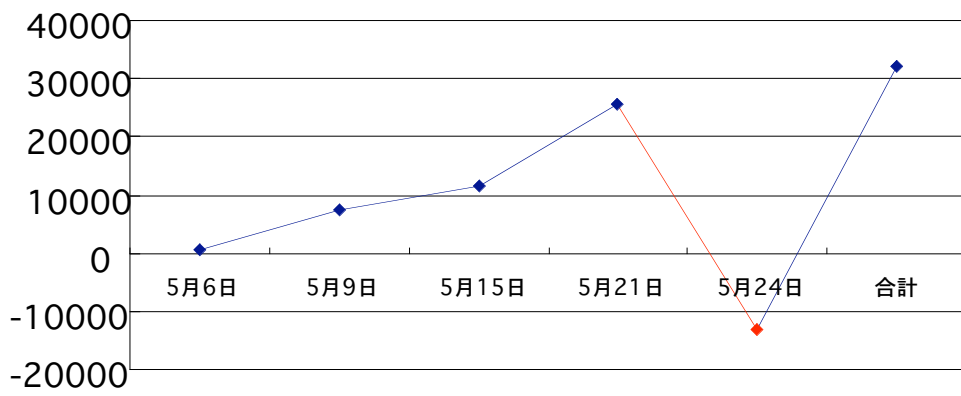
Regarding the size of fruits, there were slightly more (approximately 2.6 %) large size fruits on average in the negative ion area than in the control area, but for medium size fruit, there was 0.6% less in negative ion area, so no clear difference was shown in this experiment.

It is hard to say that negative ion effect was exerted for the size of fruits, as quantity of large fruit crop was more in control area on the 24<sup>th</sup>.

There was a difference of 32129 kg in quantity of total crop and it can be said that negative ion area is superior in producing more fruit number.

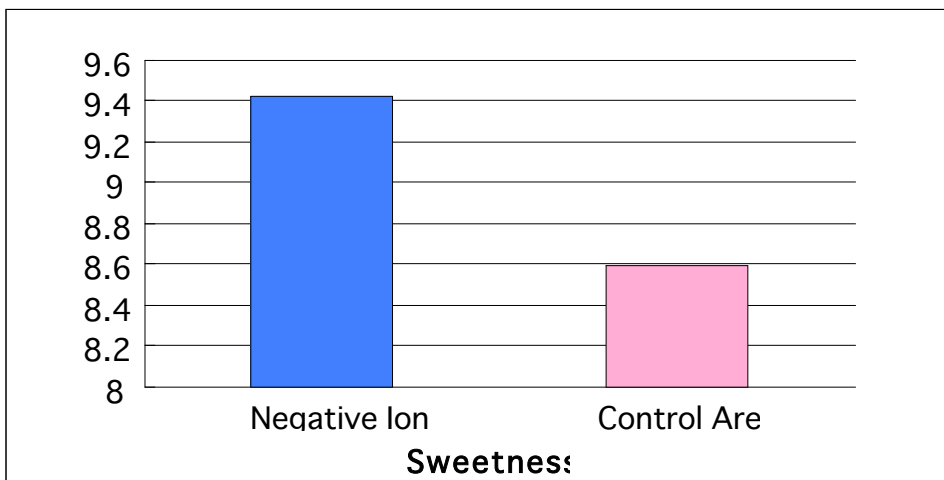
The negative ion area resulted not only in more higher crop yields, but also sugar content is 0.82 higher than that in the control area and the quality of fruit was improved.





Discrepancy ( )

### ③ Sweetness (sugar index)



Regrettably there was just one measurement of crop yields on the 14<sup>th</sup>. The crop yields showed the maximum on the 15<sup>th</sup>. If sugar content becomes higher or lower when the number of ripened fruits is higher is another issue to review in the future.

As for the number of particles, usually in the area with higher population density, there are 300,000 particles, and around 1,000 in a clean room. When the negative ion sheet was installed in the negative ion area, the number of 0.3  $\mu$  m particulate matter was reduced to 10948 (27.4% of normal count).

Later on, the number of 0.3  $\mu$  m particles was between 134,000~201,000 in both areas. It is presumably caused by the fact the sides of green houses had to be opened when the weather became warmer, as this enabled negative ions to come into the both areas. (It shows that the number of particles in control areas was reduced.) The same tendency was seen for 0.5  $\mu$  m particles.

The greenhouse environment, where there is no dense population, showed a lower particulate count in general compared to the average count. However masking effect for atmospheric particle by negative ions was the most obvious when the greenhouse was completely shut off from external environment as particle count was reduced extremely then. Since the greenhouses with the sides open were vulnerable to external impact, the effect of the negative ion sheets was not seen in this environment.

There have been some reports on negative ion for improving germination rate of agricultural crop and enlarging size of plant body.

In this experiment, there seem to have been growth promotion effect on plants body very similar to the result above, but in the final crop on the 24<sup>th</sup>, the total quantity was reduced.



premature ripening.

However, each crop yield prior to the 24<sup>th</sup> increased and additional positive growth at the end of the plants growing period indicates the possibility for agricultural applications.

If the improvement of the plants was due to the improvement of the plants photosynthesis, influenced by negative ion (or increase photosynthesized amount by negative ion effect causes the plants body to be enlarged), there is a possibility of cultivating crop plants only by thermal effect with natural light when the temperature was being controlled by the heater during the winter.

Because of this, it is expected that the costs will decrease, improving the farmers profits.

In the negative ion area, the leaves have become thicker and larger and the stems have grown to be longer and thicker. This presumably accelerated photosynthesis, leading the number and size of strawberries to be improved.

The dispersal of mineral formula was done once a week during the experiment period. This is a new method for nutritional support and growth promotion by providing minerals, electrons (anti oxidizing power) and water directly to the leaves with water negatively ionized.

In the past, organic agricultural method was focused on soil nourishment or the number of microorganisms in soil.

That was of course an important factor, but this method of enabling leaves to absorb nano-size minerals and electrons (imbuing an anti-oxidizing power) can be even more important and new agricultural method.

From this point of view, the most effective negative ion application method is necessary. We would like to propose a kind of agriculture to strengthen the primary role of plants which is turning inorganic nutrients to organic ones, by feeding organic nutrients to the roots and nano-size inorganic nutrients to the leaves.