

**Cho's Natural Farming: Recipes
and Instructions for Use**

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1. Indigenous Microorganisms (IMO)

1. The necessity of indigenous microorganisms

Indigenous microorganisms (IMO) are organisms that have lived in harmony with the soil in a particular region, who have contributed to establishing the environment that they live in. IMO are the main protagonists that have brought vigor to the land in the region, and the inhabitants that have through time proliferated in diversity. IMO have the ability to withstand any weather conditions, and given the right environment, will perform their function with great vitality. They are also easily adaptable to various changes in their living conditions.

In order to practically apply natural farming, it is most important to achieve the right soil conditions, i.e. invigorating the life of the soil. For this, the optimal living environment for microbes and other small animals must be provided to live and prosper. It is the goal of natural farming to revitalize the earth that is growing increasingly desolate by reinstating these organisms back to their original design.

2. Characteristics of Indigenous microorganisms

IMO purify the soil water and provide various nutrients. IMO have the following characteristics:

(1) Ability to decompose

When complex organic materials such as plants, animals, excrements, and organic fertilizers enter the soil, IMO break these down into simpler compounds or elements that can undergo ionic interactions. Even the diverse inorganic matters decomposed by IMO increase in their effectiveness, and are converted to a form readily absorbable by plants.

(2) Catalysis of chemical processes in the soil

Microorganisms produce numerous enzymes, antibiotics, organic acids and various complexes. The majority of chemical reactions in the soil and plants are reliant on the enzymes which are catalysts.

(3) Revitalization of the ecosystem

When the soil environment is revitalized through the use of IMO, various bacteria and fungi appear first, followed by nematodes, earthworms, mole crickets, moles, etc. The use of IMO brings the ecosystem back to life in this manner.

(4) Suppression of diseases by circulating naturally active materials

IMO have the ability to convert weak soil into healthy soil by solubilizing trace minerals and enhancing the circulation of nutrients. IMO bring diversity back to soil in which the balance among the microbial population has been broken due to the abuse of chemicals. IMO are strong survivors that cannot be languid even in extreme conditions. The recovered diversity of microbes can, then, reduce the occurrence of diseases rapidly.

3. Collecting indigenous microorganisms (IMO #1)

It is important to collect IMO in a place that has characteristics most similar to the land one is working on. On a mountain, vegetation differs depending on the altitude. This is because microorganisms, and the environment that sustains them, differ as altitude changes.

One cannot plant the grass from the top of a mountain on the valley below and expect it to grow. One cannot expect the grass from the crevice of rocks to grow in the field soil, either. Each has its own appropriate habitat, so it follows that one must collect microorganisms in the farming region. Because microorganisms are used that are well acquainted with the character of the soil in a particular region, they are called indigenous microorganisms.

(1) Time of collection

IMO can be collected at any time, and from several sites (e.g. slopes facing the north and south)

(2) Period of collection

In the spring and fall: 7~10 days; in the summer: 4~5 days

(3) Materials

"Lunch box" (translator's note: A square or rectangular box made of natural materials such as Japanese cedar or bamboo.)

Hard-cooked rice (less moisture to collect aerobic microbes)

Porous paper ('Korean paper' or paper towel)

Rubber band or straw for covering

Container box (to protect the wooden lunch box from animals and to mark the location)

(4) Collection site

A. It is preferable to pick a site around plants whose roots contain sugar.

Near the roots of bamboo or broadleaf trees, leaf moulds from the hill near the

working field, or near the roots of lawn grass.

Rice stump

After harvesting rice plants, the sap of the plant rises to the top of the stump. Fungi or bacteria, such as *Aspergillus oryzae*, or *Bacillus subtilis*

rubber band)

IMO#1, brown sugar

B. Methods

Mix IMO #1 with brown sugar in 1:1 ratio (weight) and then put it in the jar. (The weight of IMO #1 is that of the content within the lunch box right after harvesting the microbes.) Fill 2/3 of the clay jar with the mixture. This creates the most favorable environment for fermentation. Cover the clay jar with paper and tie it with a rubber band or straws.

Keep the temperature at 23-25°C for optimum fermentation of the IMO. In early spring or late fall, the optimum temperature cannot be well maintained, so it may take more time for fermentation and cultivation. Be careful to maintain the temperature. During fermentation, the temperature rises above 40°C inside the jar, and the consistency of the IMO becomes like gruel. This process takes over 7 days. In the spring and fall, it is beneficial to stir the jar in the early morning. The product of this process is called foundation stock, or IMO #2

C. How to keep IMO #2

Keep the temperature at 1~15°C, and make sure that air well circulated. Cover the clay jar with its lid after putting rice straws over the paper which covers the clay jar. Maintain this state of dormancy during storage.

The thing to consider: Examine well whether the bubbles are generated in the IMO or not. The appearance of bubbles means that IMO are losing their effectiveness. Watch carefully in order to avoid this situation.

(2) How to make IMO #3

A. Tools and Materials

A shade that shields the working area from direct light, a thermometer, rice straws, rice straw mats, and fallen leaves.

IMO #2, rice bran, nutrient liquid [OHN ($\times 1/1,000$), FPJ of Japanese mugwort and dropwort ($\times 1/500$), BRV ($\times 1/500$), Mineral A ($\times 1/1,000$), 'Makgeolli' (Korean rice wine).

Nutrient liquid is a supplementary material for activating IMO.

B. Methods

Dilute IMO #2 by 500 to 1,000 times with water and mix with rice bran. The moisture level of this mixture should be 65~70% to make IMO very active. Use diluted IMO #2 and nutrient liquids (OHN, FPJ, BRV, and Mineral A) to control moisture. It is possible to add a little amount of 'Makgeolli' in order to raise the temperature. The effect of 'Makgeolli', although small in volume, may vary depending on the regions, where the

damage from cold weather differs. Use 'Makgeolli' without diluting it.

The moisture level can be measured by forming a rice bran ball and twisting it: if the moisture level is around 65~70%, the ball can be easily divided into two halves. However, it is better to use the moisture meter to get accurate data.

Stack rice bran mixed with diluted IMO #2 evenly 35~40cm high, and cover it over with straws, straw mats, or fallen leaves to prevent moisture evaporation and to provide shading from direct sunlight. 70% shade and 30% light is recommended, since it creates favorable conditions for useful microbes in rice straws, e.g., *Aspergillus oryzae*, *Bacillus subtilis*, etc. Be sure to press several spots with weights or soils over the straws, because straws are too light to be fixed on the top of rice bran mixture. It is the best to use straw mats or straw bags for covering.

This process is very important for massive cultivation of IMO. This must be done on soil floor, not on concrete, and in a place with good ventilation. As time passes, the temperature rises within the pile of rice bran mixture, because the IMO undergo fermentation. When the temperature reaches 40~50°C, overturn the rice bran mixture evenly so that it does not rise further and also in order to prevent moist clusters. If the temperature is below 40°C, the mixture may be in an anaerobic condition due to the excessive moisture. If the temperature rises up above 70°C, proteins may be broken down by thermophilic bacteria and nutrients released into the air resulting in loss the fertilizing effect. Therefore, it is necessary to overturn the rice ban mixture in order to control temperature. It takes about 7 days for this process.

When IMO #3 is completely cultivated, they become a lump White colonies of IMO are visible over the top when the straws are uncovered. In the beginning of the fermentation, the IMO emit similar smell to those of *Absida*, *Aspergillus*, *Mucor*, or *Rhizopus* during their fermentation, and give out a fragrance when the fermentation process is completed. The moisture level drops to around 40% from 65~70% of the initial stage. It is called pure stock, or IMO #3.

C. How to keep IMO #3

Keep the temperature at 1~15°C. Make sure that the air is well circulated. Keep IMO #3 in the container ventilated: First, spread rice straws or fallen leaves at the bottom of the container, and put in IMO #3. During storage, the IMO become dry (moisture level is 20~30%) as the moisture is evaporated. It means that the IMO have entered the state of dormancy. Pile up containers into 3 layers and shield them from direct sunlight and

rain. At this point, it is good enough not to overturn, because of the convection currents that are created through the gap of containers

(3) Cultivation of IMO #4

A. Tools and Materials

Materials: IMO #3, oriental herb nutrient (OHN, x1/1,000), fermented plant juice of Japanese mugwort and dropwort (FPJ, x1/500), brown rice vinegar (BRV, x1/500), mineral A (x1/1,000, sea water (x1/30).

Sea water (x1/30) means the dilution of 1 part sea water to 30 part fresh water.

B. Methods

Mix the IMO #3 with soil (field soil 50%, mountain soil and loess 50%, or field soil 50%, fresh soil 50% ratio (bulk) in a 1: 1 ratio. Use OHN, FPJ, BRV, mineral A and sea water in order to adjust the moisture content to 65-70%. It is necessary to add sea water to the IMO, building their ability to cope with the adverse weather.

The process of fermentation is similar to that of IMO #3 (Moisture 65~70%, 35~40cm high, temperature 40~50°C). It takes 4~5days for the whole process. IMO work best, when they are inoculated to the soil. The end product is called IMO #4, the IMO in natural farming.

C. How to keep IMO #4

Refer to the part C of IMO #3. The moisture may be evaporated during storage, so adjust the moisture content to 65~70% by adding nutrient liquids just before using IMO #4.

6. How to utilize IMO

(1) Making the soil foundation

When using IMO #4, scatter them over the field, so that the top soil is barely covered (minimum 150kg/ha). The deeper the soil is, the richer it is, so do not bury the IMO

Soil applied with IMO #4 will get warm and have soft surface, and maintain the balanced microbial community. It is recommended that IMO #4 be applied to the field in small lumps. This form helps the field soil build up the aggregated structure rapidly. Soil treatment may be done 7 days before seeding or transplanting. In case the field has repeated cultivation disorder, soil treatment should be done 14 days before seeding. Apply IMO #4 2~3 hours before sunset and make the soil foundation right after that.

	Filed without successive cropping disorder	Field with Successive cropping disorder
IMO #4	One week before seeding and planting	Two weeks before seeding and planting
Making soil foundation	Right after applying IMO #4	One time after applying IMO #4 One time 1 week before seeding and planting

(2) Using with fermented mixed compost

Mix IMO #4 with mixed fermented compost materials (oil cake, fowl droppings, pig manure, cow manure, fish meal, commercial organic fertilizer) with a 1:10 ratio, and use after fermenting for 7~14 days.

It is more effective to add cow bone powder, shrimp shell, or crab shell to the mixture, and ferment for more than a week. The result is IMO #5.

(3) Using IMO in liquid form

For a liquid fertilizer, it is necessary to use IMO #4. Fusarium wilt and damping-off can be prevented. IMO #4 collected from rice stumps are diluted by 1,000 times with water. Apply it to seedlings in the nursery. Abnormal weather conditions, such as tropical nights, weaken plants, so that they become susceptible to diseases. By applying liquidized IMO #4 together with other natural farming materials on leaves, plants grow more resistant against diseases.

How to liquidize IMO #4

Put IMO #4 into a hemp cloth bag or nylon stocking and soak in the water. The dilution ratio is 1/500~1/1,000. For example, when liquidizing IMO #4 in 1,000l of water, 1~2kg of IMO #4 is needed.

(4) Other cases

IMO #4 are the basic materials widely used in natural farming for making the soil foundation, fermented mixed compost, fermented feed, managing pigen floors, henhouses, etc.

If the carrot enzyme is used together with IMO #4 as top soil, healthy seedlings can grow. Even if the carrot enzyme soil is not prepared in a

which ferment the soybean, gather at once on the stump. When sap is visible on the stump, it is time to collect the microbes. It is easy to miss the time of collection due to the short-period in which the sap is produced. If the collection time is missed, the sprouts growing out of the stumps may be cut in order to collect the microbes.

Another way is, to spread straws thinly between rice stumps. Place the hard-cooked rice over the straws and then cover them with more straws. This method is less effective than the first one explained above. The hay bacillus (*Bacillus subtilis*) collected from rice stumps may prevent damping-off (*Pythium sp.*, *Rhizoctonia sp.*, *Fusarium sp.*, etc.) and Fusarium wilt, if the hay bacillus is applied on rice seedlings as a form of liquid fertilizer.

The hay bacillus (*Bacillus subtilis*) is helpful in overcoming damage by successive cropping, when it is used with IMO collected from environments other than rice paddies.

Also, the hay bacillus breaks down proteins quickly, and promotes soil joining effectively.

B. It is better to collect in a slightly barren area rather than in a nutrient-rich area. It is recommended to seek a place of collection located 150~200m higher than the altitude of the field.

C. It is effective if directional difference is used in collection

South: effective for summer crops because they receive a lot of sunshine

North: effective for winter crops because they receive small amount of sunshine.

It is more effective to cultivate various microbes together, because they are very adaptable to the environment.

D. Things to consider

Do not collect IMO in the rainy season.

Avoid moist areas for collecting, where anaerobic microorganisms (red mold, blue mold, etc.) can occur easily.

This does not mean that anaerobic microorganisms cannot be used: Anaerobic microorganisms are indigenous, too. But, if the anaerobic microbes are in the majority, it is better to try again to collect IMO in areas with less moisture.

(5) How to collect IMO

A. Prepare the "lunch box"

Fill the wooden box (preferably made of Japanese cedar 10cm in height) with hard-cooked rice up to 7cm (2/3 of the box height). Cover the lunch

box with paper and tie it with rubber band. It is better to tie with rice straws, if available.

Bury the lunch box in the local bamboo field or leaf moulds nearest the working field. Select an area where no human disturbs and where the soil under the leaf moulds are loose and soft for burying the lunch box. After burying it, cover it up with more leaf moulds, and then cover it with the container box (it is best if air can flow through it) against wild animals.

The leaf moulds contain more moisture, when they are dug deeper. It is good to mix moist leaf moulds and dry fallen leaves together to cover the lunch box. If leaf moulds contain too much moisture, an anaerobic condition is formed, and if there is not enough moisture, IMO will be hardly collected.

- In dry weather, water the leaf moulds around the lunch box. Spray the mixture of oriental herb nutrient (OHN, x1/1,000), fermented plant juice of Japanese mugwort and dropwort (FPJ, x1/500), brown rice vinegar (BRV, x1/500), and mineral A (x1/1,000) instead of water for better IMO collection.

- In the winter the rice freezes. To prevent freezing, bring the leaf moulds into the green house and install the lunch box there. Care should be taken that it is warm inside the house during the daytime, but temperature drops quickly after sunset. Put bottles of warm water into the leaf moulds in order to keep warm inside. It takes more than 10 days to collect IMO in winter.

B. Period of collection

The temperature varies depending on the season. Collection takes 7~10 days in the spring and fall, 4~5 days in the summer, and more than 10days in the winter. It is good to collect IMO every year.

C. Condition of IMO when collected

If a collection is successful, the empty space of the lunch box (1/3 of its volume) is fully covered by white microorganisms (aerobic). Red and blue molds may occur in several spots: it means that anaerobic microbes are collected also. It is acceptable if there are a few spots of the red and blue mold, but if the whole box is covered by them, collect again.

4. Cultivation of IMO

(1) How to make IMO #2

A. Materials

Clay jar, porous paper ('Korean paper' or paper towel), rice straw (or

timely manner, good results may be obtained by only spraying IMO #4 on the top soil.

Making agricultural mineral water with IMO #4 and providing to the livestock will enable the healthy growth of pigs and chickens.

Mix mold with 3 parts water

Let sit for few days

Pour off liquid

2. Oriental Herbal Nutrient (OHN)

The Oriental Herbal Nutrient (OHN) is made from herbs which are full of energy and function to increase plant robustness, to sterilize, and to keep plants warm. OHN revitalizes crops and activates their growth.

- Optimum season for preparation: spring or fall
- Temperature for preparation: 23-25°C
- Temperature for storage: 1-15°C
- Ingredients: gigantic angelica root (*Angelica gigans*), cinnamon bark, licorice root (*Glycyrrhiza glabra*), garlic, ginger, 'Makgeolli' (Korean rice wine), brown sugar, 'Soju' (Korean distilled liquor) (30-35% alcohol)
- Tools: 20l jars (for each herb), porous paper ('Korean paper' of paper towel), vinyl film, wooden sticks for stirring, rubber bands.

1. How to make OHN

The ingredients may be classified as being in a dry state (gigantic angelica root, cinnamon bark, Licorice root, or a raw state (Garlic, Ginger).

(1) Dry state: gigantic angelica root (*Angelica gigans*), cinnamon bark, licorice root (*Glycyrrhiza glabra*), are usually sold in the dry state. Put these three main herbs in three separate jars and fill it up with 'Makgeolli' so that the herbs are completely soaked. Here is an example of making cinnamon OHN.

- 1 Put 2kg cinnamon bark into a 20l jar with 6-8l of rice wine. Fill the jar with raw rice wine 2/3 full. The amount of 'Makgeolli' should be such that it fully wets cinnamon bark but not too much. Cover the jar with porous paper, and tie it with a rubber band. Let the cinnamon bark absorb moisture for 1 or 2 days.
- 2 Add brown sugar equivalent to the weight of the ingredients (cinnamon bark 2kg + 'Makgeolli' 6l to the jar. Cover the jar with porous paper and tie it with a rubber band after stirring. Leave it for 4-5days. (It is very important that all the contents of cinnamon bark, 'Makgeolli', and brown sugar occupy 2/3 of the jar. As it is the optimum environment for fermentation.)
- 3 After the fermenting process of step 2, pour about 11-12l 'Soju' (Korean distilled liquor) into the remaining 1/3 of the jar and cover it with vinyl film. Diligently stir the mixture clockwise every day for two weeks in the early morning.
- 4 Filter the contents and keep it in another jar (a colored glass bottle or a PE container) for long-term storage.

use Turmeric in ¹¹ place of ginger

use 1/3 sugar

soak in already fermented stuff to start

□ The herbs may be reused up to 4-5 times. The recipe for reusing the ingredient follows.

- After filtration, put the remnant of the cinnamon bark into a jar again. Pour 1/3 (5ℓ) of the extracted liquid into the jar. Do not add 'Makgeolli' this time. Brown sugar is not needed, either. But, should brown sugar be used, add only 1/10 of the original amount (800g). Divide the amount of brown sugar into 4~5parts and separate them. Leave it for 1day. Again, let the contents occupy 2/3 the space of the jar.
- Fill the remaining space of the jar (1/3) with 'Soju', The next process is exactly same as the first extraction. It can be extracted a maximum 5 times this way. Pour all the extracted liquid into a jar.

Likewise, the extracted liquid of gigantic angelica and licorice should be kept in their own jars.

(2) Raw state: Garlic and Ginger can be used in its raw state.

- Garlic: When using the whole bulb of garlic (6~6.5kg), select freshly harvested garlic and crush everything including the skins and the roots, which contain moisture. For peeled garlic, crush 8kg of the garlic (Remember, it is the same weight as the cinnamon bark plus 'Makgeolli'). If garlic has sprouts, use 8kg of garlic with a small amount of 'Makgeolli'. Because the spouted garlic contains little moisture.

- Ginger: Crush after shaking the soil off. Do not crush too finely.

□ The thing to consider: Do not wash either garlic or ginger with water.

Garlic is given as an example for making OHN in its raw state here.

- 1 Put 8kg of garlic in the jar. As mentioned above, the amount of garlic is equivalent to the weight of the dry ingredient plus 'Makgeolli'.
- 2 Add the same amount of brown sugar (8kg) and cover it with porous paper. The amount of mixture should occupy 2/3 of the space of the jar. It is very important to fill only 2/3 of the jar in order for good fermentation. Leave it for 4-6 days.
- 3 After the fermenting process of step □, pour 11-12ℓ of 'Soju' into the remaining 1/3 of the jar and cover it with vinyl film. Diligently stir the mixture clockwise every early morning for 2 weeks.
- 4 Filter the content and keep the extraction in another jar for long-term storage

□ Both the garlic and ginger can also be rebrewed 4~5 times.

■ What amount of OHN can be extracted after 5 extractions?

For cinnamon bark, 15ℓ of OHN can be extracted from the first brew. However, 5ℓ is used for the second brew. 10ℓ of OHN can be obtained from the first brew. 10ℓ can be extracted from the second through the 4th brew, and 15ℓ from the 5th brew. Therefore, the total amount of OHN is 55ℓ. Other herbs produce 55ℓ of OHN each, except the gigantic angelica which produces 110ℓ (because gigantic angelica is used twice as much as other kinds). Therefore, 110ℓ of gigantic angelica, 55ℓ of cinnamon, 55ℓ of licorice, 55ℓ of garlic and 55ℓ of ginger are extracted: a total of 330ℓ.

2. How to keep OHN

It is very important to have an appropriate environment for long-term storage by using jars, glass bottles, or PE containers through which light cannot penetrate. The temperature should range from 1 to 15°C, with no direct sunlight, enough ventilation, and airtight. The longer the storage period is, the thicker the concentration of OHN becomes. The particles of OHN also become smaller. As a result, the higher rate of absorption. The better and the longer the OHN is preserved. When using OHN that is years-old should be diluted.

3. How to dilute OHN

The dilution ratio of OHN to water is 1:1,000. The ratio can be changed depending on the weather or the condition of the plant. The six kinds of OHNs are mixed just before using in the following ratio: 2(*Angelica*):1(licorice):1(cinnamon):1(garlic):1(ginger). For example, dilute OHNs 1,000 times with 18ℓ of water, then mix 6cc (*Angelica*), 3cc (licorice), 3cc (cinnamon), 3cc (garlic), 3cc (ginger), which results in an OHN mixture (x1/1,000).

4. How to use OHN

OHN is used for making IMO #2, IMO #4, the soil treatment solution, and the seed treatment solution. OHN is also good for all of the growth periods of crops, which are: vegetative, cross-over, and reproductive. OHN is always used in natural farming.

3. Fermented Plant Juice (FPJ)

The Fermented Plant Juice (FPJ) is a fermented extract of the plants, which helps crops to absorb nutrients directly for growing healthy and enabling their potentiality.

1. Origin of FPJ

The 'Kimchi' (translator's note: Korean pickled dish made of vegetables with various seasonings) soup in which lactic acid bacteria grow in abundance enhances appetite and facilitates digestion. 'Kimchi' soup is also applied in farming to help crops grow healthy and strong. (For example, some farmers mix 'Kimchi' soup with human feces, add water and apply it to the field after the mixture is fermented).

There are tremendous populations of microbes such as lactic acid bacteria and yeast on leaves of plants. Similar to making 'Kimchi', the essence of the plant can be extracted by using brown sugar (instead of salt) through osmotic pressure. During the process of fermentation, FPJ produces weak alcohols which dissolve chlorophylls. FPJ is the fertilizer that helps plants enhance their own vitality and induce their potentials, and, consequently, let them grow robustly.

2. Principles of FJP

There are about 100,000~150,000 microbes per 1cm² of a leaf. Most of the microbes are lactic bacteria and yeast that are very useful for plant growth. Chlorophylls are dissolved by weak alcohols through osmotic pressure. The essence of the plant, chlorophylls, lactic acid bacteria, and yeast, which are in or on the leaves and stems of the plant, can be extracted by using brown sugar. The lactic acid and yeast promote fermentation in which brown sugar is broken down into simple sugars and the weak alcohol is produced by enzymes.

The extracted essence and chlorophylls make FPJ while reacting to 3 'chi' (translator's note: the natural energy of the universe) in the jar, namely, water, air, and heat. The process of fermentation happens in 5 steps: 1) the recognition of 'each other' (translator's note: between microbes and ingredients); 2) harmony; 3) fermentation; 4) affection (stabilization); and 5) producing natural farming materials. Fill up 2/3 of the jar with materials, and leave 1/3 of the space for that 3 'chi' (water, air, and heat)

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Mugwort: after pour of FPJ
pour in vodka 1 week
use for fungicide

3. What to collect

(1) Plants with 'chi'

Choose plants that have 'chi' for the ingredients of FPJ. Japanese mugwort (*Artemisia princeps*) and dropwort (*Oenanthe javanica*) are good examples.

- Japanese mugwort is strong against both cold and heat, has good vitality, and a good amount of iron. The FPJ of Japanese mugwort is used for giving vitality to the crops when they sprout buds at the end of the dormant period in the spring. Japanese mugwort revitalize plants in this way.
- Dropwort is full of iron and manganese, which are good for blood circulation, stimulating the peripheral nervous system, and recovery from injury.

(2) Fast-growing and vigorous plants

When making FPJ, it important to use plants that grow fast. The fast developing plants have growth hormones that are very active, which means that the plants have a lot of energy. This characteristic can improve any weaknesses and recover from health problems.

1 Bamboo shoots are a typical example. Bamboo shoots grow after raining.

Because they grow very fast, they must be collected in a timely manner. Remove the soil but not the outer skin. Bamboo shoot FPJ along with Japanese mugwort and dropwort FPJ can be used to increase the effect of vegetative growth when diseases weaken crops.

2 Lateral buds of all kinds of plants have abundant growth hormone and vitality.

3 Japanese arrowroot or kudzu vine (*Pueraria lobata*)

4 Fruiting vegetables (strawberry, kiwi)

5 Thinned-out fruits have a lot of gibberellins which makes plants healthy with thicker

foliage and enhances the thickness of fruit

(3) Materials should be in season

1 Wild plants have strength which is key to a good FPJ. Fermentation occurs smoothly with wild plants.

2 Seaweeds

3 Indigenous plants can adjust themselves well to the weather and climate of the region.

(4) FPJ from the same crop

- 1 Tomato: lateral buds stems and leaves
- 2 Squash and sweet potato: vines
- 3 Crops eaten by insects: unmarketable products
- 4 Pinched shoots: not contaminated by chemicals
- 5 Cabbage, broccoli, or kale: outer leaves

4. When to collect materials

(1) Just before sunrise

- 1 Plants have the most nutrients.
- 2 The most powerful period of plant vitality ('chi')
- 3 Ingredients with dew on them creates a higher volume of FPJ.
 - When the sun is up, photosynthesis is active; therefore, energy is consumed and partially stored in stems and leaves.
 - From 3 pm to the following day's sunrise, catabolism is active; hence the energy is stored intensively. That is why the plants must be collected just before sunrise.

(2) Quickly snap the growing points

Growing points should be picked for making FPJ. If it takes too much time to collect, slightly dip the picked materials in the same kind of FPJ(x1/500). A film is then formed outside the materials, preventing the escape of nutrients and energy.

(3) Special attention

- 1 Avoid excessive sunshine (drought)

Avoid sunlight for picking plants. If the hot weather continues, but FPJ production must continue, then water the plant one day before picking.
- 2 Avoid excessive rainfall (rainy season)

Avoid picking plants during or after rainfall because rain washes away lactic acid bacteria and yeast on the leaves. If FPJ is made during this time, the juice can become sticky and thick, and won't ferment well. This is the same reason why the ingredients should not be washed before fermentation. It is advised to pick plants 2~3 days after rain.
- 3 Do not pick too many kinds of plants at a time
- 4 Avoid picking plants near the road.

5. Characteristics of each material

(1) Japanese mugwort (*Artemisia princeps*)

- Even though there is a slight difference between the regions, it is the best to pick from the end of March to April, when Japanese mugwort is full of energy

- Snap the tender parts which contain the growing point.
- Pick parts wet with dew.
- The amount of extracted juice is slightly different depending on the seasons (spring>fall> summer)
- Avoid yellowish growth points.
- It is possible to make enough FPJ for a whole year in the spring. Consider the environmental conditions for long-term storage, if this is the case.
- In general, Japanese mugwort produces little juice.

(2) Dropwort (*Oenanthe javanica*)

- FPJ is more effective when created from dropwort that are harvested from the winter to May.
- Spring is the best season for making dropwort FPJ.
- Cut dropwort in pieces of about 5cm in length.
- Dropwort has plenty of juice, which accelerates the process of fermentation.

- Because dropwort produces a lot of juice, add more brown sugar when keeping dropwort FPJ in storage,

(3) Bamboo shoot (*Phyllostachys spp.*)

- May is the best time for harvesting bamboo shoots. (slightly different in regions)
- Pick thick and short shoots.
- Cut shoots into small pieces without peeling off skin (Do peel off the skin, when it becomes brownish)
- Ferments fast due to the plentiful juice. (About 5 days)
- When bamboo shoots are soaked too long, white molds may occur due to the abnormally fast fermentation.

(4) Japanese arrowroot or kudzu vine (*Pueraria lobata*)

- Pick about 15cm-long vines which sprout newly in the spring.
- In the summer, collect the soft part of the vine and the light-colored leaves from the upper part of the vine.
- Ferments fast due to the plentiful juice. (About 5 days)
- When bamboo shoots are soaked too long, white molds may occur through the abnormally fast fermentation.

(5) Fruit of the Japanese cedar (*Cryptomeria japonica*)

- Japanese cedar is often used as windbreakers in 'Jeju Island' (translator's note: the biggest island in Korea). A flow of sap oozes out

from the tree in the end of June. This is the time optimal time for harvesting its fruits.

- Japanese cedar has 'chi', so when a small amount of the FPJ made from the cedar is mixed with other FPJs, it will become a very effective reinforcing agent.

(6) Fruit of the chocolate vine (five-leave Akebia) (*Akebia quinata*)

- Pick immature fruits of the chocolate vine in September [before 'Chuseok' (translator's note: a Korean harvest festival on August 15 of the lunar calendar)]. It is good to collect when the fruit is immature, because matured fruits only have a small amount of juice.
- Fruits from the chocolate vine entwining a lacquer tree (*Toxicodendron vernicifluum*) are even better.

(7) Seaweeds

- Effective for a plant's growth.
- Reinforces the color of fruit
- Use a light stone weight to press down on brown seaweed (*Undaria pinnatifida*), because the juice of brown seaweed can be extracted faster than others.

(8) ripe fruits with no commercial value.

- FPJ of ripe fruits is called fruit enzyme
- Divide a fruit into four parts (don't use as a whole)
- It is good to use FPJ which has matured for 1 year. Apply this FPJ to the plant in its late reproductive period.

(9) Flower of the false acacia (black locust) (*Robinia pseudoacacia*)

- It promotes flower bud formation after the cross-over period, and increases sugar content of fruits.
- The best time for collecting flowers is when they begin to bloom, just before bees visit to pick honey.
- Use the same amount of brown sugar as the amount of flowers, because they have a lot of moisture.
- Flowers which smell strong are more effective.
- It is much better when the FPJ has matured for 6 months to 1 year after fermentation.

(10) 'Child liquid'

- Use thinned-out fruit (young fruit) and the auxiliary bud of general crops

6. How to make FPJ

(1) Materials and Brown sugar

1 Materials

- Do not wash in water and use with their own skin.
- Only one kind per container
- Shake off the dirt from the ingredient (Again, do not wash in water.)
- If the ingredient is an irregular size, cut it into an adequate size in order to broaden the surface area.
- Use material with dew on it.

□ Brown sugar

- Brown sugar has the effective components of sugar cane, and contains a lot of minerals, such as iron, calcium, and sodium. Sugar cane contains 293mg of calcium per 100g. Brown sugar is effective for feeling control of the cerebrum, and providing emotional stability due to the fact that it contains a lot of calcium.
- The more moisture the material contains, the more brown sugar it needs
- The mixing ratio between the ingredient and brown sugar is on the basis of weight.

- It is not recommendable to use molasses. It contains too much moisture to raise the osmotic pressure as high as brown sugar does for good fermentation.

(2) Containers

1 A clay jar or wooden container made with Japanese cedar

- A clay jar is good because it is not prone to temperature changes, and because it lets air to circulate. Choose a jar that is suitable for the amount of ingredients.)
- A small opening is recommended. If the opening is small, then less air will be in contact with the juice, thus promoting the fermentation process. When the liquid rises to the top and all ingredients are fully soaked, it is best to have a small opening. If the opening wide, the liquid will not rise above the ingredients, the surface will become dry and fungi may appear.
- Avoid using stainless steel, iron and plastics.

2 Stone weight: A stone is needed to extract air from the container. After putting all ingredients in a container, place a board on top of the ingredients and then press with the stone weight over the board for even pressure.

3 Cover lid: Porous paper ('Korean paper' or paper towel) and rubber bands

(3) Methods

- 1 Shake off the dirt from the ingredients. Do not wash them in water and use with their own skin.
- 2 Measure the weight of the ingredients and the brown sugar. Usually, as much as 1/2 to 2/3 the weight of the ingredient is needed of the brown sugar. Add more brown sugar for fruits and flowers, which have a high moisture level. Mix the ingredients with brown sugar in a 1:1 ratio for storage.
- 3 Pile up the ingredient and brown sugar layer by layer or mix them together. The more brown sugar added, the higher the materials are piled up. At the top of the jar, put enough brown sugar to cover materials. Fill the mixture of ingredient and brown sugar to the rim of the jar for green vegetables so that air can still remain in the space between materials.
- 4 Press the materials with a stone weight to extract air, and cover the top of the jar with paper.
- 5 When uncovering the jar half a day later, the air will be extracted. At this time, the materials should fill up to 2/3 of the jar. (When the container is filled 2/3 with materials and 1/3 with air, optimum fermentation will occur.) Remove the stone weight from the jar.
- 6 Keep the jar in the shade (at the temperature of 23~25°C) for 7 days, and let it under the process of fermentation.
- 7 If a good result is obtained after 7 days, there will be a fragrance, and clean juice will be visible when the content is filtered. Sometimes, small bubbles or fungi will be present in the jar. They result from lacking brown sugar or from an unbalanced volume between the empty space and the ingredient. In this case, add a little brown sugar, stir, and preserve after filtering.
- 8 Do not give any pressure when filtering the juice.
 - Remember to store the juice only after the fermentation process is completed.

(4) How to keep FPJ

- 1 Add more brown sugar if the FPJ is not used immediately.
- 2 PE or glass products may be used as a container, the clay jar, or the Japanese cedar tree. When using glass bottles, brown glass that blocks sunlight must be used.
- 3 Bury the container or keep it in a cool storehouse. Select a shaded area where there is no direct sunlight and where the temperature does not fluctuate.

- 4 Cover the container with a lid made of rice straws. This prevents unhelpful micro-organisms from entering, and provides a favorable environment for ventilation.
- 5 The container may be kept for 2~3 years for ripe FPJ.
- 6 The optimum temperature range is 1~15°C for storage. A convection current of air is needed, and direct sunlight should be avoided.

7. How to use FPJ

- (1) From germination to early growth
 - Choose an ingredient that has good vitality, strong to cold weather and that grows well in its early stages.
 - Reduce the expected damage from cold weather
 - Use Japanese mugwort, dropwort, bamboo shot, etc. (x1/500)
- (2) In the period of vegetative growth
 - The crops develop their volume in this period.
 - The crops absorb chiefly nitrogen-rich nutrients
 - Use the FPJ of Japanese mugwort, dropwort, bamboo shot, reed, the vines of Japanese arrowroot, etc. (x1/500)
- (3) In the cross-over period
 - It is a period for flower formation, ovary formation, and qualitative maturity
 - Absorption of phosphoric acid-rich nutrients.
 - Use the FPJ from the flower of the false acacia (black locust), "child liquid", mulberry, grape, raspberry, etc., which are more acidic because they are less ripe (x1/500)
- (4) In the period of reproductive growth
 - The flowers fall from crops and reach the fruit-bearing stage in this period.
 - Absorption of calcium-rich nutrients
 - Use the fruit enzymes made from ripe fruits, e.g., chocolate vine, apple, peach, grape, etc. (less than x1/2,000).
- (5) In the maturity period
 - Use the matured FPJ of purslane (*Portulaca oleracea*) during the harvest time (less than x1/5,000).
 - Add luster and prevent evaporation.
- (6) Use FPJs to IMO #3 and IMO #4.
- (7) Do not use FPJs when fungal diseases appear in the vinyl house. More fungi will spread with FPJs are used under poor ventilation.
- (8) Use well-ripened FPJ after diluting it to less than 1/2,000 in the period of reproductive growth, when the fruits become large enough. This is

because the sugar content in the FPJ functions as a spreader and leave spots on the fruit. FPJs improve the taste of fruits very much, but also decrease commercial value (the outer appearance)

4. Brown Rice Vinegar (BRV)

1. Characteristics of Brown Rice Vinegar

- (1) The acetic acid bacteria of brown rice vinegar (BRV) affect liver cells and support them for sterilization, neutralization, diuresis, synthesis, and work to prevent and cure various diseases.
- (2) BRV is weakly acidic and alkali (basic) as well. BRV is an acid, but when it is decomposed in the body, the remnant becomes alkali. Therefore, it is called alkali food. As the BRV shows, acid material and acid foods are different. Cereals and fruits, which produce vinegars, are typical alkali foods.
- (3) BRV itself is an acid, but it changes into a base when it is absorbed by humans, livestock, or crops. So BRV functions to change the physical constitution from acidic to alkali, which means it renews the body into a pure and healthy condition.
- (4) Because BRV contains phytic acid, it helps to neutralize poisons, to sterilize, and to improve physical constitution. It is effective in preventing and curing various diseases.
- (5) BRV has more amino acids and organic acids, which are antidotal, than any other food. Therefore, it has an excellent for decomposing lactic acid, which prevents aging.
- (6) BRV raises the calcium absorption ratio. If body fluid tends to be acidic, the body tries to neutralize it, and when this happens, the body needs calcium. It is difficult for calcium to be absorbed in an acidic condition. But combined with the citric acid in BRV, calcium can be easily absorbed.

2. Functions of BRV

- (1) BRV in low concentrations facilitates vegetative growth and affects the initial growth of leaves greatly. If BRV is applied on the leaves, it helps them form the wax layer, which creates thicker leaves, fastens foliation, and increases resistance to diseases and insects.
- (2) BRV improves the flexibility of the tree and increases absorption ability when natural farming materials are sprayed.
- (3) Due to the activity of the acetic acid bacteria, BRV has an ability to sterilize and restrain bacterial growth.
- (4) Because it is used with water-soluble calcium, BRV maximizes the effect of calcium.
- (5) BRV of high concentration accelerates reproductive growth.

2. How to make BRV

- (1) Same method as 'Makgeolli' (Korean rice wine).
- (2) It is possible to collect yeast from the content that has been in the fermentation process for 2~3 days.
- (3) If ripe 'Makgeolli' is left as it is, BRV is produced due to the acetic acid bacteria.

3. Practical usage of BRV

- (1) Put the eggshells or oyster shells in BRV and make water-soluble calcium.
- (2) Dissolve the bones of pig or cow in BRV and make water-soluble calcium phosphate.
- (3) For the purpose of sterilizing, use BRV with a dilution ratio of 1/500 at the juvenile leaf stage and a ratio of 1/200~1/300 at the adult leaf stage.
- (4) BRV is used for making soil foundation, seed/seedling treatment, treatments of vegetative growth period, cross-over period, and reproductive growth period.
- (5) BRV is used for making IMO #3, IMO #4 and mixed compost.
- (6) When BRV is used for the matured plant, BRV decreases sugar content of the fruit or the hot taste, in case of pepper.

5. Fish Amino Acid (FAA)

1. Characteristics of Fish Amino Acid

The Fish amino acid (FAA) is a liquid made from fish waste. FAA is of great value to both plants and microorganisms in their growth, because it contains an abundant amount of nutrients and various types of amino acids. Blue-back fishes may be used as well.

□ Blue-back Fish

The blue-back fish is the common name for blue-colored fishes, for example, mackerel (*Scomber sp.*), Spanish mackerel (*Scomberomorus sp.*), horse mackerel (*Trachurus sp.*), saury (*Cololabis sp.*), garfish (*Hemiramphus sp.*), herring, yellow tail (*Seriola sp.*), sardine, salmon, sweet fish (*Plecoglossus sp.*), bluefin tuna (*Thunnus sp.*), skipjack tuna (*Euthynus sp.*), anchovy, etc. Blue-back fishes have good proteins, amino acids, and fatty acids. They contain a lot of DHA and EPA which are well known unsaturated fatty acids that are recognized as healthy food. Both DHA and EPA function to lower the cholesterol level and prevent adult diseases, such as arteriosclerosis and high blood pressure.

Blue-back fish help children to be bright by supplying oxygen to their brain

cells. Blue-back fishes also prevent Alzheimer's disease in elderly people by preventing aging and death of brain cells.

Blue-back fish contain various and abundant vitamins. Vitamin A prevents night-blindness and strengthens the immune system, increasing resistance to diseases, such as the common cold; vitamin B complex prevents anemia and beriberi, and helps cells to regenerate; vitamin E functions to slow down the aging process by blocking peroxidized lipids in the cell. Such effects are also excellent in plants as well.

2. How to make FAA

(1) Tools

- 1 Clay jar, Japanese cedar box, PE container
- 2 Mosquito net, rubber band

(2) Materials

- 1 blue-back fish waste (Use fresh waste only; do not use salted fishes)
- 2 Brown sugar
- 3 IMO #4, OHN, Mineral A, rice straw

(3) Environments

- The optimum temperature ranges 23~25°C.
- A cool and shaded area with no direct sunlight.
- Little to no changes in the environmental conditions is recommended

(4) Methods

- 1 Put fish waste (head, bone, intestines) and brown sugar in the clay jar with a 1:1 weight ratio. Fill the jar up to 2/3 of its volume.
- 2 Pile up the fish waste and brown sugar alternating layer by layer, and fill the jar with enough brown sugar to cover the top. It is recommendable to add a little amount of IMO #4 together with brown sugar in order to decompose the fish oil and the meat. The closer to the top fish waste is piled up, the more sugar should be added. Then cover the jar with rice straws after scattering IMO #4 on top. It is more effective if to add a little amount of OHN and mineral A.
- 3 Cover the opening of jar with a mosquito net, lay a couple of sticks on the rim, and cover it again with its own lid. Now there is a space between jar and its lid.
- 4 In 3 to 4 days, the fish waste starts becoming liquidized through the osmotic pressure generated by the brown sugar, and is undergoing the process of fermentation.
- 5 It takes long time to liquidize all the fish trash. (At least 6 months are needed to get well-fermented FAA.)

6 Matured FAA has a smell. Extract the FAA and use only the liquid.

Hints for installing a container

- (1) Put various stones 10cm high on the bottom of the container.
- (2) Put ingredients into the container.
- (3) Cover the opening with mosquito net.
- (4) When covering, not sealing, the container with a lid, make sure that air can flow through it. Only then will the FAA contain mineral A, and the FAA will be convenient for fertilizing since it is already filtered.

3. How to use FAA

- (1) FAA is used after it is diluted with water. The basic dilution ratio is 1:1,000.
- (2) FAA is rich with nitrogen. It is a good fertilizer for applying both to soil and foliage since it enhances the growth of crops during their vegetative growth period when used with other natural farming materials.
- (3) When making IMO or mixed compost, apply the FAA after diluting it with water. Then the FAA will help activate the microorganisms.
- (4) For leafy vegetables, it is possible to use FAA continuously to increase yield and improve taste and fragrance.
- (5) It is not recommendable to use FAA during the period of reproductive growth, because it may induce overgrowth.
- (6) Some kinds of FAA have distinctive odors. The fish oil produced during fermentation may be used as the insect repellents. (For example, army worm moths (*Mythimna separala*) become helpless even at the slightest brush with the fish oil.)
- (7) Mackerel FAA is very effective in getting rid of mites and the greenhouse whitefly (*Trialeurodes vaporariorum*). Dilute FAA with water and spray it on both sides of the leaf.
- (8) Put the bones left over from creating FAA into the brown rice vinegar (BRV), which has a volume 10 times larger than the bones. The bones will decompose and produce good quality water-soluble calcium phosphate.

High in N: spray on new plants, early stage

6. Lactic Acid Bacteria (LAB) AKA GOD

1. Characteristics of Lactic Acid Bacteria

- (1) The Lactic Acid Bacteria (LAB) are very effective for improving soil ventilation and for growing fruits and leaf vegetables.
- (2) LAB are conditionally anaerobic, so they can also survive with oxygen.
- (3) LAB are resistant to high temperatures.
- (4) LAB are the strong sterilizer.
- (5) LAB are used to cultivate IMO #3.
- (6) LAB accelerate root growth during transplanting, and effectively enhance the initial growth of the plant.
- (7) LAB increase the solubility of the fertilizer.
- (8) When LAB is used during the vegetative growth period of fruiting vegetables, higher quality plants will result, and may be kept for longer periods in storage.
- (9) When spraying LAB on a rice paddy field, more weeds will appear.
- (10) LAB solubilize phosphate in 100~200ppm. Using LAB in phosphate-accumulated soil will increase its capacity to absorb the insoluble form of phosphates, and help overcome the saline disorder as a result of decomposition of the phosphates.
- (11) Lactic acid (LAB) can reduce damage from gas through neutralizing ammonia gas produced where the immature compost is applied.
- (12) LAB have an about a week-long resistance to some fungi
- (13) There is no significant effect of LAB on damage done by diseases and insects
- (14) LAB can adjust the fluids within plants, which may increase disease tolerance or harden their bodies even during rainy season.

2. How to make LAB

(1) Tools

- Clay jar (a big and a small one)
- Porous paper ('Korean paper or paper towel), rubber band

(2) Materials

- Rice-washed water
- Obtain strong indigenous pure stocks of lactic acid bacteria in a given region by using rice-washed water. By cultivating massive amounts of bacteria, they can continually be applied to the soil.
- Milk (unprocessed, if possible)

(3) Environments

- Optimum temperature is 23~25°C

- A cool and shaded area with no sunlight
- Little change in the environment.

(4) Methods

- 1 Pour rice-washed water up to 15~20cm deep in a jar and cover the mouth of the jar with porous paper. that the rice-washed water must occupy 2/3 the volume of the jar.
- 2 Lactic acid bacteria populate at 23~25°C. Three to four days later, the jar will have 3 divided layers: floating matter, clear liquid, and dregs. It starts to emit a sour smell unique to lactic acid bacteria. The separated layer of clear liquid contains the lactic acid bacteria (called LAB pure stock). This liquid is used.
- 3 Pour milk in the big jar. The ideal ratio of milk and rice water is 10:1.
- 4 Since milk has more nutrients than rice-washed water, the lactic acid bacteria grow vigorously. In 5~7 days at 23~25°C, starch, protein, and fat float on the surface (called cheese) and light yellow liquid (LAB serum) remains below the cheese.
- 5 When LAB are produced after 7 days, remove the cheese, which is separated from LAB. If the cheese is left as is, the cheese melts and undergoes a secondary reaction. This cannot be used as LAB.
- 6 The LAB serum can be kept after filtering and refining.

(5) How to keep LAB

- 1 Keep the refined LAB serum where there is little temperature change (1~15°C) and no sunlight.
- 2 In order to keep LAB at a normal temperature it must be mixed with the same amount of brown sugar and stirred with a wooden stick.

3. How to use LAB

- (1) The basic dilution ratio is 1/1,000.
- (2) If the LAB is used together with mixed compost or IMO, the fermentation process occurs fast, leading to very effective results. LAB function to prevent the fermented mixed compost from decaying.
- (3) LAB reinforces the ability of anabolism of microbes living on the plant stem and leaf, a condition that arose from the abuse of insecticides and fungicides.
- (4) When using LAB alone, it is more effective to use it with FPJs
- (5) Fields will recover fertility and the soil will become soft and fluffy if IMO mixed with LAB is sprayed on the field.
- (6) Use LAB (x1/500) with FPJ (x1/300) as drinking water for livestock, to recover their digestive function.

- (7) Using LAB too much will decrease the sweetness.
- (8) LAB are extremely effective in making fruits and leaves large, but the amount of LAB used should be reduced approaching the later stages.

Drink to cure food poisoning

7. Water-soluble Calcium (WCA)

Calcium is one of the most common substances in the world next to oxygen and silicon, and the majority of calcium exists in the form of calcium carbonate (CaCO₃). In natural farming, calcium carbonate is extracted from eggshells in which calcium carbonate is the main component by using brown rice vinegar. Through this process, calcium carbonate is changed to water-soluble calcium, which can be quickly absorbed by the crop.

1. Characteristics of Calcium

- (1) Calcium contributes to better utilization of carbohydrates and protein. It is the major component in forming cell membranes, and enables smooth cell division.
- (2) Calcium functions to remove harmful substances in the body by binding with organic acids.
- (3) Calcium prevents crops from overgrowing.
- (4) Calcium makes fruits firm and prolongs the storage period.
- (5) Calcium promotes absorption of phosphoric acid and is responsible for nutrient accumulation in the crop.
- (6) Calcium plays a very important role in maintaining the health of the plant.
- (7) Calcium functions to carry and accumulate nutrients (e.g., carbohydrate), which are temporarily stored in branches or leaves to the final storage organ (e.g., ovary) through physiological activity.

2. Symptoms of Calcium Deficiency

- (1) Underdeveloped roots and feeble root hairs: It is because that the normal protoplasm of the cell is not formed due to calcium deficiency.
- (2) The leaves discolor to a brownish color and then dry out.
- (3) Appearance of empty bean pods.
- (4) Poor ripening of the fruit and vegetable, excessive moisture and organic acid, lack of sugar content, softening of the fruit flesh, insufficient fragrance.
- (5) Leafy vegetables contract *Rhizoctonia* disease and the poor heading phenomenon.

- (6) Root vegetables become pithy and hollow, lack of sugar content and fragrance, and lasts a short time in storage.
- (7) Both rice plants and barley plants suffer from problems such as excessive moisture, low accumulation of starch, lack of luster and fragrance, and low resistance to insects and diseases.

3. How to make WCA

(1) Tools

- 1 Clay jar , Japanese cedar bucket, or PE container
- 2 Porous paper ('Korean paper' or paper towel), rubber band

(2) Materials

- 1 Eggshell or oyster shell which contains an abundant amount of calcium
- 2 Fermented brown rice vinegar
 - Calcium carbonate is the main component of eggshells and oyster shells. When calcium carbonate acts with any kind of acid, it produces carbon dioxide (CO₂). But acetic acid, the major component of vinegar, is a weak acid, so it reacts very slowly and emits an imperceptible amount of CO₂. A fluffy eggshell means that CO₂ is melting into vinegar.

(3) Environmental conditions

- The optimum temperature ranges from 23° to 25°C.
- It is good to have cool and shaded place where no direct sunlight can penetrate.
- It is desirable that there is little change in the environment.

(4) Methods

- 1 It is proper to use eggshells after removing shell membranes. However, it is not easy to remove them. Try not to smash too many of the eggshells and roast them in the frying pan with a light fire.
- 2 This process must happen in order to burn out the organic substances that the eggshell contains. The organic substances can be burned out, but calcium remains because calcium is an inorganic substance.
- 3 Lightly roasted shells show a brighter color than the original, and become very light in weight. It takes about 30~40 minutes to roast, even though it varies depending upon the seasons.
- 4 Fill the brown rice vinegar (BRV) into the container first and then put the roasted eggshells (The ratio of eggshells and BRV is 1:10). The eggshells may move up and down continuously emitting bubbles, and calcium carbonate melts.(ca. pH4)
- 5 When there is no more movement of eggshells and no more formation

of bubbles, the process of solubilization of calcium carbonate is completed (about 7 days).

- The eggshells that still have calcium carbonate may sink and remain at the bottom. This is because there are too many materials for the BRV to melt and the solubilization process reaches the saturation point. In this case, take out the solution and add more BRV.
- (5) Something to consider
 - Put the roasted eggshells or oyster shells little by little and slowly into the container with BRV. If not, the bubbles can overflow by the reaction between the materials and the BRV.

4. How to use WCA

- (1) Use after diluting with water. The basic dilution ratio is 1/1,000.
- (2) Several WCA completed separately may be mixed in order to enhance the effect of calcium.
- (3) WCA is very effective in the cross-over period when the growth of crop changes from vegetative to reproductive growth.
- (4) Spray WCA on the leaves several times after the fruits have become large to some degree. Spraying WCA prevents overgrowing and yields solid fruits.
- (5) WCA leads nutrients to be accumulated in flower buds and fruits. As a result, the flower buds become strong, can prepare for high yields the following year, and harvest solid and substantial fruits that year as well.
- (6) WCA has an effect of improving the taste and fragrance of the fruit when it is used with water-soluble calcium phosphate, oriental herb nutrient, fermented plant juice (false acacia), and seawater.
- (7) Use WCA when the weather is not favorable.
- (8) Use WCA when the plants overgrow.
- (9) Use WCA when the initial growth of the crop is poor.
- (10) Use WCA when the leaves discolor and lack luster.
- (11) Use WCA when the flower buds have poor differentiation.
- (12) Use WCA when the physiological drop is severe.
- (13) Use WCA when fruit enlargement is slow.
- (14) Use WCA when the sugar content decreases.

Chitosan

- Materials: crab shell, shrimp shell, BRV
- How to make chitosan

The ratio of crab shell (or shrimp shell) and brown rice vinegar (BRV) is 1

to 10. It is necessary to roast the shells. The method is the same as that of WCA.

- It takes more time to roast crab shells than to roast eggshells, and roasting emits a pungent scent. When the process is completed, the smell is gone and the color becomes brighter than original as the eggshell does.
- How to use
 - Dilute with water in the ratio of 1/1,000 and mix with other natural farming materials during the whole period of cultivation.

8. Water-soluble Calcium Phosphate (WCP)

The water-soluble calcium phosphate (WCP) is extracted from the bone of vertebrate animals. WCP is an essential substance for plant growth, and is widely distributed in the soil. Calcium phosphate is insoluble in water, but soluble in acids: this property is used in Natural Farming. Calcium phosphate can dissolve slightly in the water containing CO₂.

1. How to make WCP

(1) Tools

- clay jar, Japanese cedar bucket
- porous paper ('Korean paper or paper towel), rubber band

(2) Materials

- Bones of vertebrates (pig, cow), fish bones
- Fermented BRV

(3) Environmental conditions

- The optimum temperature ranges from 23° to 25°C .
- It is good to select a cool and shaded area with no direct sunlight
- It is desirable that there is little change in the exterior surroundings.

(4) Methods

- 1 Use boiled bones, not raw bones, on which no meat and fat is attached. Turn the bones into a charcoal state by burning them at a low temperature. This process is necessary to burn organic and fatty substances.
- 2 Use the charcoal of the bones as they are, or pound them (Do not pound too much, as it will become powder). Put the bones in the jar with BRV (charcoal: BRV= 1:10).
- 3 Calcium phosphate is dissolved from the bones.
- 4 Small bubbles will appear. If there is no movement, it means that the process of solution is completed (about 7 days).

2. How to use WCP

- (1) Use as drinking water (x1/500) for the livestock that are pregnant or ovulating.
- (2) Use after diluting with water. The basic dilution ratio is 1/1,000.
- (3) Spray WCP on leaves during the periods of cross-over and vegetative growth.
- (4) Use WCP when the crop overgrows.
- (5) Use WCP when the weather condition is bad.

- (6) Use WCP when the initial growth is poor.
- (7) Use WCP when the flower buds have weak differentiation.

9. Water-soluble Phosphoric Acid (WPA)

1. Function of WPA

- (1) Phosphoric acid is an important element for the life of crops, because the acid contained in every plant. Phosphoric acid is a substance that composes the cell nucleus.
- (2) Absorbed phosphoric acid is used for increasing cells when it moves to the vigorous bud, root tip, or seed fruit.
- (3) The stem of sesame contains large amounts of phosphoric acid, and is used in Natural Farming. Burn sesame stems into charcoal, and percolate the charcoal to extract WPA.
- (4) Phytic acid, a storage form of phosphoric acid, is the major substance in the seed. Phosphoric acid is involved in photophosphorylation and electron transport in photosynthesis. Also, phosphoric acid affects transporting anabolites and protein synthesis.

2. Symptoms of WPA Deficiency

- (1) WPA can easily travel within the plant and move to the vigorous new leaves first. As a result, symptoms of deficiency appear mainly on the petiole and veins of the old leaf.
- (2) The new leaf does not grow well, and it becomes smaller and dark green in color.
- (3) The growth of flowers is noticeably suppressed, naturally bearing fewer fruits.
- (4) Usually the symptoms are dormant within the body. It is therefore difficult to recover, even considering the ability to cope with the disease when the symptoms appear on the exterior.
- (5) The fruit skin becomes thick and the acid content increases.

3. How to make WPA

(1) Tools

- 1 Clay jar, Japanese cedar bucket
- 2 Porous paper ('Korean paper' or paper towel), rubber band

(2) Materials

- 1 Charcoals made from sesame stems
- 2 Water

(3) Environmental conditions

- The optimum temperature ranges from 23° to 25°C.
- It is good to select a cool and shaded place with no direct sunlight.

- It is desirable that there is little change in the exterior surroundings.

(4) Methods

- 1 To make charcoal, burn the sesame stems and put out the fire when large flames appear
- 2 Put 1~2kg of sesame stem charcoal in the hemp cloth bag, and dip it in 100ℓ of water in order to dissolve phosphoric acid in water (crude liquid of natural phosphoric acid). It takes about 7 days, although the time varies depending on the temperature of the surroundings.

(5) How to use WPA

- 1 Dilute 0.7ℓ of the crude WPA liquid with 20ℓ of water when WPA is used alone.
- 2 Dilute WPA with water in the ratio of 1/1,000, when it is used together with water-soluble calcium (WCA).

4. Utilization of WPA

- (1) Apply WPA during the cross-over period. It promotes the differentiation of flower buds resulting in high fertility and yield.
- (2) WPA improves the sugar content of fruits.
- (3) Apply WPA when the color of leaves is dark green.
- (4) Apply WPA when the color of leaves is light green.

10. Water-soluble Potassium (WP)

1 Functions of Water-soluble Potassium (WP)

- (1) Potassium activates the starch-synthesizing enzyme, facilitates the translocation of photosynthate, and helps to relocate the storage substances in the starch crop.
- (2) Potassium deficiency symptoms occur first on older leaves, because potassium is a highly mobile element in the plant. The potassium content in the leaf decreases rapidly in the fruit enlargement period because a lot of potassium is translocated to the fruit.
- (3) The principal function of potassium is to grow meristematic tissues.
- (4) Potassium regulates water use and the plant stomata. At low concentrations, potassium decreases the growth rate, the size of the fruit, and the moisture content in the tissues. Therefore, potassium plays a vital role in cell enlargement. When the stomata are opened, the potassium content in guard cells is high; when the stomata are closed, the potassium content in guard cells is low. In the light, guard cells produce ATP through photosynthesis and absorb potassium by using energy from ATP. Consequently, when potassium is accumulated in the guard cells, the turgor pressure rises resulting in the opening of the stomata.
- (5) Potassium promotes synthesis of the carbon dioxide-fixing enzyme, decreases the diffusive resistance of CO₂ in the leaf, and activates various enzyme reaction systems.
- (6) The absorption of potassium is metabolic and its rate is high and fluid. The main route of translocation is bound for meristematic tissues. Sometimes, potassium is translocated again from old tissues to young tissues.
- (7) Potassium functions to regulate the absorption of moisture, to enhance the translocation of photosynthate, and to activate enzymes.
- (8) Potassium is abundant in leaves, the stem and the root tip as almost a form of salt. Potassium is very mobile in the plant, because it always exists as an ion or an easily ionizable form.
- (9) Potassium functions to help transport carbohydrates, to vitalize carbon assimilation, to control the turgidity of protoplasm, and to improve resistance to drought and freezing of plant tissues.
 - (10) Potassium reduces lodging problems, increases yield, and improves the quality of crops.

The bean plant requires a comparatively high amount of potassium

2. Symptoms of WP Deficiency

Potassium Nitrate induces Flowering

- (1) WP deficiency occurs in plants that lack potassium in the plant or soil. The lack of potassium leads to an abnormal enzyme system and restrains various metabolisms. Consequently, the plant is disturbed in its growth.
- (2) When WP is deficient, the branch shows growth deterioration, maturity is stunted, and yield/quality is deteriorated.
- (3) It is rare to have WP deficiency in early stages of growth. In general, the symptoms of deficiency appear after the plant grows up to a certain point.
- (4) Chlorosis starts from the old leaves whose edges become yellowish brown. Chlorosis appears as a spot in the middle of leaves in some plants.
- (5) When roots and stems are getting thin, especially when lignifications of vascular bundles in the stem suppressed consequently becoming less resistant to coldness.
- (6) The seed of fruits becomes small and matures late.
- (7) Chlorosis usually starts from the old leaf, but the tip of the leaf in the middle may discolor and dry out even at the peak of growth.

□ Potassium deficiency occurs when the soil is lacking potassium. Even though enough potassium exists, if the soil contains a lot of lime and magnesium, the plant still suffers from potassium deficiency, because the absorption of potassium is suppressed due to those trace elements. Potassium deficiency can also easily occur in sandy soil which has less humus, because potassium is easily lost in soil like nitrogen.

3. Symptoms of Excessive WP

- (1) Magnesium deficiency occurs if the potassium level is excessive.
- (2) It is similar to gas disorder and occurs in the middle part of leaves.

4. How to make WP

- (1) Tools
 - 1 Clay jar, Japanese cedar bucket
 - 2 Porous paper ('Korean paper of paper towel), rubber band
- (2) Materials
 - Tobacco stems
 - Water
- (3) Environmental conditions
 - Optimum temperature range is 23~25°C.
 - It is good to a select cool and shaded area with no direct sunlight
 - It is desirable that there is little change in the exterior surroundings.

(4) Methods

- 1 Dry tobacco stems and ground them (Do not ground too finely to avoid making powder)
- 2 Put 1~2kg of tobacco stem in the hemp cloth bag, and dip it in 100ℓ of water in order to dissolve potassium in water (crude liquid of natural potassium). It takes about 7 days.

(5) How to use

It is necessary to use water-soluble potassium alone. Dilute 0.7ℓ of the crude potassium liquid with 20ℓ of water.

(6) Attention

Weather conditions should be taken into consideration when WP is used. If WP is applied with nitrogen in a hot and humid condition, or WP is applied on a rainy day, WP may bring about the synergy effect, which helps the plant to absorb nitrogen resulting in overgrowth.

11. Yeast

1. Functions of Yeast

- (1) Yeast is a microorganism which is in charge of the last step of fermentation. Yeast breaks sugars down into alcohol and carbon dioxide (translator's note: ethanol fermentation), which is necessary in the process of fermentation.
- (2) Yeast enhances metabolism and expands capillary vessels.
- (3) Yeast functions to resynthesize organic substances decomposed by various microbes into amino acids, hormones, vitamins, etc., which are beneficial to the crop
- (4) Yeast produces various substances, e.g., vitamins, nucleic acids, minerals, hormones, and fatty acids in the body. Yeast also produces 8 essential amino acids that humans cannot synthesize. It is healthy to eat many fermented foods containing yeast.
- (5) Yeast has the excellent ability to decompose chemical fertilizers.
- (6) Yeast usually sticks onto the fruit surface. Many yeast exist specifically on the grape.

- Attention on using grape or strawberry as a culture medium
 - Do not wash in water, and use as it is.
 - Tools must always be sterilized before use.
 - Do not seal the container. Cover the container by its lid loosely.
 - Keep the container in a separate place in order to prevent unwanted microbes and odors from permeating it.
 - Maintain the optimum temperature (23~25°C) and humidity (65~70%).
 - Shake 1~2 times a day to protect from fungi during the cultivation of yeast.
- Keep the cultivated yeast in the refrigerator (1~15°C)
 - Yeast can be kept for a maximum 1 month, but it is recommended to use all of it within a week.

2. How to use Yeast

Dilute yeast with water in the ratio of 1/1,000.

- (1) Use yeast when the plant becomes weak.
- (2) Use yeast when viral or bacterial disease occurs.
- (3) Use yeast when branches or stems are heavily damaged by strong

wind

(4) Use yeast when the amount of photosynthate is low during the rainy or high-humidity seasons.

(5) Use yeast when the livestock lose appetite or vigor.

- It is effective to spray yeast on the leaves with other natural farming materials.

12. Maltose

Traditionally, Korean people have made maltose by using barley. The maltose is used for producing 'Shikhye' (translator's note: A traditional sweet Korean rice dessert drink made of malt and rice. Also called dansul or gamju) or glutinous rice jelly. The maltose is also used for farming. The maltose made from hulled barley is tastiest, but it is possible to use sweet potato, potato, or taro for making maltose. For farming purposes it is unnecessary to use hulled barley. However, the following are the materials and methods for producing maltose with hulled barley.

1. How to Make Maltose

(1) Materials

Hulled barley, thin cloth, water

(2) Methods

- 1 Put the hulled barley in a bowl and cover with cloth. Water it for 1 week as when growing bean sprouts.
- 2 When barley sprouts and grows to 1cm long, and the tip turns to a light green, then dry the barley.
- 3 Pound the dry barley.
- 4 Pour water, then rub and soak the pounded barley. Save the suspension after soaking.
- 5 Add the suspension into 2~3 bowls of rice cooked hard, and keep them warm in the electrical rice cooker (50°C for 5~6 hours; do not keep it too long to prevent sourness)
- 6 Filter rice through the sieve and use the liquid only.

2. How to Use Maltose

- (1) Dilute maltose with water in the ratio of 1/500. Use it with other natural farming materials.
- (2) If maltose is applied in the paddy field, rice straw can be decomposed rapidly by the action of enzymes. Also, maltose helps to make the soil foundation.
- (3) Maltose is used for seedling treatment.
- (4) Use maltose for treating damping-off, root rot, soft rot, etc.
- (5) Use maltose when the crop is severely affected by physiological or environmental damage (low or high temperatures) in the early growth stage.
- (6) Use maltose when the livestock suffers from dyspepsia or loses

appetite.

13. Seawater and Fermented Seawater

Fish live off of seawater microbes. Seawater 3cm in depth from the surface of the water is an area swarming with microbes. The deeper the seawater is, the higher the salt content is. Therefore, it is desirable to use the surface seawater. For storage, pour seawater in a large bowl and leave it for a day to let airborne microbes go in it. Fermented seawater is developed from this way of storage.

Fermented seawater can be prepared by adding rice-washed water(x1/200), FPJ of pear, Japanese mugwort, and dropwort (x1/500) into diluted seawater (x1/30). This is the same as putting organic matters in seawater. Organic matter in seawater produces an excellent effect when the microbes of land and the minerals and microbes of seawater are combined. This combination has a similar effect to that of a confluent point where freshwater and seawater meet. Brackish provides a favorable condition for microbes, which in turn helps support many plankton, and many fish that eat the plankton. In other words, fermented seawater provides abundant energy to the crops and the livestock.

It is effective to fertilize fermented seawater when the weather is hot and during tropical nights. Fermented seawater also functions to control fungal diseases such as scab, rust, and anthracnose.

Skin disease occurs because of viruses. When skin loses fat, the number of microbes decrease, and even such a small change can induce outbreaks of disease. Seawater can solve this problem. Adding rice-washed water and fermented plant juice (FPJ) to seawater brings out its best properties. Rice-washed water has an effect like that of yeast. It is more effective when oriental herb nutrient (OHN) is mixed.

1. Seawater

- (1) Seawater: Diluted with fresh water in the ratio of 1/30.
 - (2) Fermented seawater: Mix seawater (x1/30), rice-washed water (x1/200), and FPJ (Japanese mugwort + dropwort, x1/500) together and keep the mixture for a half day in the summer (for 2~3 days if cloudy). Use the mixture when it becomes whitish like haze.
- Fermented seawater becomes easily unusable because of its abundant nutrients. When fermented seawater goes bad, the haze gathers like a cotton ball. Use fermented seawater right away when it becomes whitish. It cannot be stored.

2. How to use seawater and fermented seawater

- (1) For increasing the sugar content of the fruit: apply seawater with water-soluble calcium 15~20 days before harvest.
- (2) For seedling treatment of onions, big leeks, or garlic, apply seawater (x1/20) with FPJ and BRV. If salt water is used, dilute to 0.2%.
- (3) To prevent feather-loss in chickens during the summer, provide the chicken with seawater (x1/10~1/15 or salt water 0.1%), BRV (x1/200), and water-soluble calcium (x1/500) every other day.
- (4) Fermented seawater prevents and controls anthracnose. Add liquid IMO #4, OHN, and water-soluble calcium phosphate to the fermented seawater for increased microbial activity.
- (5) Use seawater (x1/30, 1/25, 1/20) to enhance ripening.

14. Mineral Liquid

What is Mineral Liquid?

1. Mineral liquid contains a lot of elements, especially Ca, Mg, and Fe.
2. The name mineral liquid implies that it is derived from rocks.
3. Mineral liquid is a solution that reflects the structural characteristics of rocks.

Effects of Mineral Liquid

1. Mineral liquid is effective for balancing the soil ecosystem.
 - (1) It suppresses disorders by successive cropping and soil diseases.
 - (2) It controls diseases and insects.
 - (3) It activates microorganisms and promotes the breakdown of organic matters
2. Mineral liquid is effective for accelerating the ionization of soil
 - (1) It improves plants' ability to absorb trace elements.
 - (2) It accelerates the ionization of soil. An electrical repulsion generates due to the ionization of metal elements. Consequently, soil becomes swollen. (when mineral A is used)
 - (3) In general, there is a hardpan located 20~30cm under the soil surface. It is too hard for plant roots to pierce the hardpan, even if organic matters are added. This is the reason why stakes cannot be buried deeply. The more the soil is plowed by a tillage machine, the harder the hardpan becomes. If mineral A is applied, the hardpan layer can be

broken. The stake can be buried below the hardpan layer. It is more effective for softening the soil, if organic matters are added at this time.

3. Mineral liquid changes water through interaction

Mineral liquid makes water particles smaller.

- (1) Mineral liquid contains minerals dispersed in the water as regular-tetrahedron-shaped ultrafine particles with electrons on the surface. There are two types of the dispersed substance coexisting in the water: the ion and the ultrafine particle. The ultrafine particle has electrons, so they combine with the ion. The mineral liquid increases the amount of ultrafine particles in the water, and induces the combination between ultrafine particles and ions.
- (2) Water has a hierarchical structure. If mineral liquid is added to the water, the water particle gets smaller (1,000 Angstroms to 800 Angstroms, 20% smaller than before). This means that the water can be absorbed into plants and the soil as an ultrafine-particle form.
- (3) Mineral liquid controls root rot disease.
- (4) Seeds germinate successfully if seeds are treated with mineral liquid.
- (5) Mineral liquid makes plants resistant to cold damage, or low/high temperature disorder.

4. Mineral liquid softens the soil

Mineral liquid helps soil to ionize and so improves water penetration, soil aeration, water-holding capacity, drainage, and fertility.

5. Mineral liquid changes microflora in soil.

- (1) There are general microorganisms, Actinobacteria, fungi, etc. in soil. When mineral liquid A is applied to the soil, general bacteria and fungi disappear, but Actinobacteria, yeast, and lactic acid bacteria remain. Consequently, soil can recover.
- (2) Microorganisms live in a better habitat, because mineral liquid makes the soil surface broader than before.
- (3) When there is a frost, most of the soil is covered by frost, but soil treated with mineral liquid A has no frost. Soil treated with mineral liquid A has an excellent capacity for aeration, water-holding, and drainage. As a result, there is abundant water and air in the soil resulting in the low thermal conductivity. It is possible for plants to take nutrients even in cold weather and to recover rapidly from cold damage, because water reacts slowly to the thermal changes outside.

6. Mineral liquid helps various enzymes activate.

- (1) For example, the acetic acid reductase with mineral liquid catalyzes over 30 times as fast as it does without mineral liquid. Today the soil has a problem of excessive nitrogen. Mineral liquid can solve this problem by promoting acetic acid reductase to reduce excessive NO_3 to the state utilized by the soil and the crop.
- (2) Mineral liquid enhances plant growth and controls lodging problems.
- (3) Mineral liquid facilitates the differentiation of flower buds and helps ovules mature.

7. Effects of mineral liquid on photosynthesis

Mineral liquid promotes the maturation of leaves and rhizomes, and improves taste, quality and quantity.

8. Mineral liquid enhances quality, increases quantity, homogenizes products, overcomes imitated products promotes maturity, enlarges fruits, increases sugar content, and improves fruit fragrance.
9. Mineral liquid expands the harvest period of fruiting vegetables.
10. Mineral liquid develops rhizomes remarkably, strengthens stems and leaves, overcomes lodging, reduces viral infection, and consequently enhances the storability of ripe fruits.

■ Types and usage of mineral liquid

1. Mineral Liquid A (M-A)

- (1) Effects: M-A is effective on soil treatment, seed/seedling treatment, disease control, and coping with abnormal weather conditions.
- (2) Characteristics: It restores and activates soil microflora, softening the soil; it boosts enzyme activities to minimize damage from soil diseases and continuous cultivation disorder.
- (3) How to use: Diluted M-A with water in the ratio of 1/1,000
- (4) When to use
 - 1 When IMO are cultivated massively (IMO #3 and #4)
 - 2 When the soil foundation treatment is needed
 - Standard field: Apply 1~2 tons of M-A (x1/1,000) per 100a before plowing and then sow or transplant in the field one week later.
 - If the soil is very degraded or suffers from serious continuous cultivation damage, apply 3~4 tons of M-A (x1/1,000) per 100a in two applications. Make the soil foundation 2 weeks before sowing or transplanting (before plowing), and apply M-A one time. Apply once

again 1 week later (after plowing). Sow or transplant 1 week later.

3 When seed/seedling treatment is needed: M-A activates enzymes in the seed and vitalizes germination and root generation. It also equalizes growth, and has antibiotic effects by controlling the growth of unwanted microbes.

- How to use: Soak the seeds in warm water and take off the coating, and then do seed treatment. The time for the treatment varies depending on the degree of germination.

Seeds with very fast germination (potato, taro, ginger, garlic, etc.):

1/2~1 hour

Seeds with fast germination (Chinese cabbage, radish, bean, etc.): 2 hours

Seeds with an average speed of germination (cucumber, melon, squash, etc.): 4~5 hours

Seeds with slow germination (rice, barely, tomato, etc.): 7~8 hours

- Transplant seedlings after soaking them in the seedling treatment liquid for 10 minutes. Water the same liquid used for treatment after transplanting the seedlings for better results.

- Seed/seedling treatment leads to uniform germination and vigorous root generation, and a good establishment of the root, letting the plants grow evenly.

4 If the disease occurs while the plant grows, apply 1~2 tons of M-A (x1/1,000) per 100a with other natural farming materials.

5 Use M-A as an emergency response plan against low temperatures or abnormal weather conditions during the harvest time.

6 Use M-A to control fruit tree diseases, for example, canker of apple trees

7 Use M-A to control *Fusarium* wilt of melon or watermelon.

8 For fruit trees, apply 2 tons of M-A (x1/1,000) per 100a right after harvest (making the soil foundation).

2. Mineral Liquid B (M-B) and Mineral Liquid C (M-C)

(1) Effects: M-B helps root vegetables grow, and M-C helps general crops besides root vegetables grow (fruit tree, rice plant, flowering plant, leaf/fruit vegetable, etc.)

(2) Characteristics: Both of M-B and M-C contain abundant minerals because both are made from several kinds of rocks with various elements. Both mineral liquids activate enzymes at each step of development of the particular crop, and facilitate photosynthesis. With

M-B and M-C, root systems and foliage become vigorous. Both M-B and M-C also keep the balance of minerals in intracellular/extracellular fluids. Consequently, both can improve taste and maintain freshness.

(3) How to use: Dilute in the ratio of 1/1,000. Both M-B and M-C are used for enhancing growth. Apply them after germination or 1 week after root establishment.

1 Soil irrigation: Dilute M-B or M-C in the ratio of 1/1,000. Water 1~2 tons of M-B or M-C per 100a.

2 Leaf spraying: Dilute M-B or M-C in the ratio of 1/1,000. Spray 200~300 l per 100a on the leaves.

3 Deep-soil injection: use this method with leaf spraying for fruit trees. Inject 2 tons of M-C deep into the soil.

3. Mineral Liquid D (M-D)

(1) Effects: M-D promotes flower bud differentiation, reproductive growth, and ovule maturation.

(2) Characteristics: M-D promotes flower bud differentiation and the flowering of plants. It also induces fertilization and fruiting even in low or high temperatures.

1 For rice plants: Spray M-D at the panicle formation stage and the flowering stage.

2 For fruiting vegetables from which repetitious harvests are possible: Spray M-D at the adequate time every other week.

3 For fruit trees: Spray M-D at the stage of flower bud differentiation and flowering.

(3) How to use: Dilute M-D with water in the ratio of 1/1,000.

1 When irrigating: Dilute M-D (x1/1,000) and apply 1~2 tons per 100a.

2 When spraying leaves: Dilute M-D (x1/1,000) and spray 200~300l per 100a. 3

4. Mineral Liquid E (M-E)

(1) Effect: M-E improves the sugar content and acidity.

(2) How to use: Dilute with water in the ratio of 1/1,000

1 For crops that need to be ripe, use M-E 2 weeks before harvest.

2 For fruit trees, use it 2 weeks before harvest.

15. Loess Powder

(1) The reason for using loess powder

Loess powder is full of soil vitality, and is the foundation for all life. Loess powder is uncontaminated soil containing various trace elements, and even some growth factors that are yet undefined.

Loess powder possesses a natural healing power that has not yet been explained by scientific analysis. Natural farming uses this ability of loess.

(2) How to make loess powder

- Materials: loess, water, containers

- How to choose loess

Take the loess and put it into water. There are two kinds of loess: one that submerges in a lump, and the other that scatters in all directions. Choose the latter.

- Methods

- Put 2~3kg of loess into 20ℓ of water and stir well. Thick particles will sink and fine particles will float.
- Collect the floating particles into a separate container. As time passes, the floating particles will precipitate.
- When the precipitation is completed, drain the surface water, called 'Jijangsu' (translator's note: the water filtered through loess) into another container.
- Dry the precipitated loess in a cool and shaded place. Be careful that, if the loess is dried under the sunlight, it does not disperse in the water.

(3) How to use loess powder

- Put 20~30g of loess powder into 20ℓ of water.
- Mix the loess powder suspension with the seedling treatment liquid for preventing diseases such as canker.

16. Agricultural Mineral Water (AMW)

It is not too much to say that farming is a job that relies thoroughly on water. Water is composed not only of H₂O but various minerals affecting the crop's ecology significantly. The contaminated water negatively affects crop cultivation. One of the conditions for good farming is preparing good, clear water.

Recently, in some countries such as Japan, agricultural water or water for livestock has been sold commercially. The fact that water is sold indicates the importance of water. There is a significant difference in a crop's yield and quality depending upon the quality of water. It is necessary to build an energetic body fluid circulation within healthy crops.

(1) Principles

All water manufacturers give sophisticated explanations of their product. But the basic principle is to strengthen absorption ability by making water particles smaller. Fortunately, farmers can prepare Agricultural mineral water (AMW) by themselves. The following method reveals how to make vital water containing abundant minerals and dissolved oxygen by using the waterfall principle and various rocks.

Put various rocks and IMO #4 in a bag and hang it. Let the water and minerals from the rocks and IMO flow out of the bag to produce the vital water abundant in oxygen, minerals, and microorganisms.

(2) How to make AMW

- Dig a pond 120cm deep and cover the bottom with vinyl film to prevent water to permeate.
- Make an artificial waterfall above the pond: Pump up water with an electrical motor and let water fall through the pipe.
- When natural topography is used, dig a pool in a low area to let water flow downward naturally. On the flat ground, install the pipe or hose at a high level to make an artificial fall.
- Put various rocks such as granite into a sack made of rust-free gauze (Break rocks into pieces with sharp edges). Fix the sack with rocks to a level at which only the bottom of the sack dips in the water (Don't let the bag submerge).
- Alternate methods may be applicable depending on the farmer's situation. For example, the sack can be fixed on a wooden stick laid across the pool.
- Put IMO #4 in a bag and hang it together with the sack of rocks. The

appropriate location for the IMO #4 is where the fallen water flows through the sack of rocks and creates a whirlpool. The bag of IMO #4 floats first and then sinks slowly. The bag floats again after time passes. When the bag floats again, it is the time to refill IMO #4.

(3) Usage and effects

There is no special way of using AMW. Simply use it like regular water. AMW is good for plants and livestock. When pigs or chicken have diarrhea, provide them with this vital water.

- Use as drinking water for livestock.
- AMW deodorizes manure.
- AMW promotes plant growth.
- AMW produces mineral-rich crops and improves storability.
- It is more effective to water once with AMW than to water 5 times with regular water.
- Install the circulation pump to increase the AMW concentration.

Figure. 농업용 약수

17. Green Grass Liquid Fertilizer (GGLF)

1. What is the Green Grass Liquid Fertilizer (GGLF)?

- (1) GGLF is the solubilized and extracted essence, nutrients, and chlorophylls from the plants.
- (2) It is enough to apply little GGLF, because it permeates well into the soil. GGLF is effective for forming the aggregated structure of the soil.
- (3) GGLF improves soil ventilation, facilitates the decomposition of organic matter, and increases CO₂ emission into the air, so activates photosynthesis.
- (4) GGLF decreases electrical conductivity (EC) and pH levels, increases the soil temperature, resulting in enhanced root development.
- (5) GGLF can supply water without increasing humidity in the greenhouse.
- (6) GGLF has an excellent effect at fertilizing. Only a little GGLF makes cultivation possible and reduces damage by diseases and insects.
- (7) It is difficult to keep GGLF long. Make GGLF whenever it is needed and use it immediately.

2. How to Make GGLF

Chlorophylls are not soluble in water. Use IMO #4, which break down sugars in rice bran, to weaken alcohol. This weak alcohol extracts and solubilizes chlorophyll and other nutrients in the plant.

(1) Materials

Various weeds (cut into small pieces 10cm long)

- 1 Organic fertilizers such as oil cake, fowl droppings, fish meal (5~10kg)
- 2 IMO #4 (500g in summer, 1 kg in winter)
- 3 Rice bran (1.5kg)
- 4 Container (200ℓ)
- 5 Vinyl film for covering (for preventing insects in summer, for warming in winter)
- 6 Rubber band

(2) Environmental conditions

- 1 Little temperature change (23~25°C)
- 2 A cool and shaded place with no direct sunlight

(3) Methods

- 1 Put the materials in 2/3 of the container.
- 2 Fill water to the rim of the container.
- 3 Cover the container with vinyl film.

- 4 Leave it to ferment (4~5 days in summer, 7~10 days in winter)
- 5 There are bubbles on the surface when the liquid fertilizer is completed. It has a bad smell because of anaerobic fermentation.

3. How to Use GGLF

- (1) Dilute with water in the ratio of 1/500~1/1,000 and use 40~60ℓ per 100a.
- (2) The electrical conductivity (EC) increases 1~2 months after fermentation of GGLF, so dilute it with more water.

4. Something to consider

The fertilizing schedule should be readjusted when GGLF is used, because GGLF fertilizes fast and causes the nitrogen-excessive growth easily.

18. Soap water and Hot-pepper water

Soap water and hot-pepper water are used for controlling aphids and mites in natural farming. When soap water is sprayed to the plant, water is evaporated by the sunlight. Due to evaporation, heat loss and condensation, aphids burst and die.

It is effective to spray the soap water when sunlight is the strongest in a day, from 1~2pm. Spray the soap water on the back of the leaf where aphids are. Note that it can be harmful to spray on a cloudy day.

1. How to make and use soap water

- (1) Cut 200g of laundry soap into small pieces.
- (2) Boil 20ℓ of water with soap pieces, until it becomes like a thick soup.
- (3) Cool and mix it with 200ℓ of water (it is called 'turbid water').
- (4) For aphid control, mix 0.7ℓ of turbid water with 20ℓ of water. For mite control, mix 0.5ℓ of turbid water with 20ℓ of water.

2. How to use hot-pepper water

Repel the aphids with the hot taste of pepper. Cut 10~12 hot peppers into pieces and put them in 1ℓ of water. Boil the water until when the content reduces to 1/2 of the original volume. Cool and mix it with 20ℓ of water for spraying.

3. Things to consider

It is apt to focus on controlling aphids and mites, but it is more important to grow plants with no aphids and mites in the first place.

The reason why aphids and mites appear is that the plant becomes unhealthy due to excessive nitrogen and an imbalance of nutrients. In other words, the body constitution of the plant changes to a condition favorable to aphids and mites. It is more important to manage plants without damage from aphid and mite from the start than to control the insects after they appear.

19. Fermented Mixed Compost (FMC)

1. Time for Making FMC

It is better to start making the fermented mixed compost (FMC) in the fall rather than in the summer. This is because FMC made through low-temperature fermentation is good for fertilizing. For the best quality FMC, for minimal decay issues, and for the easiest temperature control, the ideal time for fermentation is between November and March, the months with the lowest temperatures.

During the time between the end of November and the beginning of December in Korea, the average temperature drops below 10°C and a cold wind blows. Microbes favoring high-temperatures languish, but fermenting microbes, such as *Aspergillus oryzae*, *Absida sp.*, *Mucor sp.*, *Rhizopus sp.* etc. can multiply themselves steadily in this condition. Hot and humid weather in the summer is favorable for bacteria to multiply, and the cool and dry weather between late fall and winter is favorable for those fermenting microbes to multiply.

The first stage of making FMC is the saccharification. The fermenting microbes are adept at making sugars. They can be active without hindrance from bacteria in the season between late fall and winter. This is the reason why FMC should be made in the late fall

2. Place for making FMC

The appropriate place for making FMC is somewhere with little wind and good drainage. Water availability is important. For green houses, transparent vinyl film should not be used. Install the shade over the green house in order to shield plants from direct sunlight. The floor must be soil. If the floor is made of concrete, cover the floor with soil 20cm high. When FMC becomes hot it starts to emit moisture in all directions. The concrete floor gets wet, and causes FMC to decay. Consequently, the fertilizing effect of FMC is decreased.

The ways to prevent possible problems are as follows:

- (1) Cover the floor with the loess and leaf molds.
- (2) Do not pile ingredients too high. The higher the ingredients are piled, the easier the lower part decays.
- (3) Mix ingredients well in order to prevent moisture from accumulating.

Mixing provides a favorable condition for aerobic fermentation.

- (4) Do not step on the pile, if possible.

3. Materials

FMC is hardly made from only one kind of material. Using several kinds of materials has a greater effect beyond simply using various nutrients that are supplementary to each other. In the mixing principle, all the possible materials from the mountain, the paddy, the field, and the sea are included as fermentative materials.

- (1) Include at least one item from each category: the mountain (fallen leaf or fruit); the paddy (rice bran or straw); the field (oil dreg, bean dreg or bush clover); and the sea (fish waste or seaweed).
- (2) Include as many kinds as possible, but the major ingredients are animal materials with abundant proteins (bone meal or fish meal) and plant materials.
- (3) As a rule, do not use agricultural by-products.
- (4) Food for microbes is food for humans, animals and plants as well.

Establish the four principles described above and choose materials freely within the limit of the principles. The best way is to use the natural materials that are available in the surroundings. For example, when bush clover is used, collect an armful of bush clover branches with its flowers, and put them in FMC. Then, well fermented and good qualified FMC will be made.

In addition to bush clover, there are many examples of FMC materials: bean (immature), clover (around the time of flowering), tea (especially green tea powder), citron, fruits from the mountain, flower pollen, seaweed, broccoli, spinach, Japanese mugwort, etc.

These materials contain various vitamins, functioning as supportive enzymes, and abundant minerals combining proteins for the connecting body. High-quality FMC made from such methods will enhance resistance to diseases and insects, and improve growth, yield, and quality by facilitating crop maturation.

4. How to make FMC

- (1) Prepare IMO #4.
- (2) Mix rapeseed oil cake, fish waste, bone meal, bean oil cake, and crab shell. Spray them with water and add IMO #4. The amount of IMO #4 is 10% of the materials. Adjust the moisture content of the mixture to 65~70%.
- (3) Pile up the mixture 35~40cm high.

5. How to use FMC

- (1) Apply FMC to the field 2~3 hours before sunset or on a cloudy day, in order not to prevent strong UV radiation.
- (2) It is important to cover FMC with soil right after applying, or to put FMC into the soil by lightly plowing with a 3cm rotary hoe.
- (3) For the surface application, spread FMC under vinyl mulch or rice straws.
- (4) For a field covered with vinyl mulch, FMC can decay when water drops form under the vinyl, because soil adheres to the vinyl film and air cannot flow. In this case, spread several layers of rice straws or leaf molds in order to prevent the vinyl film and the soil from sticking together. Take care that the vinyl film and soil do not stick together by making holes using a fork or a similar tool on the top of the mulching where FMC is applied.
- (5) Avoid the daytime and spray 2~3 hours before sunset when FMC is sprayed on the leaves as a liquid fertilizer. Dilute it with water in the ratio of 1/1,000.
- (6) It is better and more sustainable to apply FMC in the small-lump form than in the smashed form.

Compost Tea air makes aerobic beneficial
bacteria

- ① compost
- ② water
- ③ O₂
- ④ sugar

carbohydrates make fungal

Nitrogen Juice

1. Take rhizobial plant, scrape roots
2. add sugar
3. ferment

Neem Plus

1. Neem leaves + 2 mango leaves
- for insecticide