Amino acids are known as the source of all life. Over the past 100 years the Ajinomoto Group has provided all sorts of amino acid-related products including umami seasoning AJI-NO-MOTO\textsuperscript{®}, the product that forms the foundation of the Group’s business, as well as health, pharmaceutical and feed-use products.

As the Group thought about how to jointly progress with the bounty of the fields providing the raw materials and the regions that nurture them, in order to continue making these products on a permanent basis, we arrived at a recycling-oriented manufacturing model that makes the most efficient use of the raw materials and helps to create a cycle in which they continue, without any waste, to be used for the benefit of both the human and natural environment.

This sustainable mechanism is now the keystone of the Ajinomoto Group’s varied and diverse worldwide businesses.
Functional foods

25 million tons

Sweeteners

200 million tons

NO-MOTO®, using the power of organic fertilizers and feeds.

The mechanism has now been in production region in the form of organic fertilizers and feeds. It is also part of the precious bounty of the fields, and created acid from the fermentation liquors left over after extracting amino acids are produced, such as umami seasoning AJI-NO-MOTO®, using the power of microbes to ferment easily obtained local vegetative materials including sugar cane, cassava, corn and wheat.

In order to produce amino acid the crops providing the raw materials have to be procured on a continuous basis. The Ajinomoto Group realized that the nutrient-rich liquid (by-product) left over after extracting amino acid from the fermentation liquors is also part of the precious bounty of the fields, and created a mechanism for continuous creation by returning it to the production region in the form of organic fertilizers and feeds. The mechanism has now been in practice for over thirty years.

In order to always provide good taste and healthy lifestyles

The Bio-cycle—A recycling-oriented framework for amino acid production

At the Ajinomoto Group’s amino acid production plants, which are being spread all over Asia, America, Europe and the rest of the world, many different amino acids are produced, such as umami seasoning AJI-NO-MOTO®, using the power of microbes to ferment easily obtained local vegetative materials including sugar cane, cassava, corn and wheat.

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The chart assumes worldwide annual production of approximately 500,000 tons of AJI-NO-MOTO® seasoning produced by the Ajinomoto Group using only sugar cane. The values for sugar cane grown and sugar production represent average global use, while the values for resources used for producing AJI-NO-MOTO® and values for by-products are based on actual Ajinomoto Group statistics.

What’s the demand for plant resources?

In recent years there has been a growing demand for plant resources as carbon-neutral materials in many fields, such as bioenergy. Considering the limitations of the spaces available for crop cultivation, and the fact that the local farmers have carefully cultivated all the crops, it is vital that the raw materials are used efficiently and without any waste. And it is even more important than before that we do not just take the rich bounty of local regions for the sake of our production, but run our businesses with an awareness that we have to give something back to both the local communities and the ecosystem.

Recent world trends in grain production volume by crop, and consumption level by use

<table>
<thead>
<tr>
<th>Crop</th>
<th>Production (Million tons)</th>
<th>Consumption (Million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>2,099</td>
<td>2,019</td>
</tr>
<tr>
<td>Wheat</td>
<td>1,088</td>
<td>1,019</td>
</tr>
<tr>
<td>Coarse grains except corn</td>
<td>1,355</td>
<td>1,278</td>
</tr>
<tr>
<td>Corn</td>
<td>421</td>
<td>412</td>
</tr>
</tbody>
</table>

NB: Of the production volumes, coarse grains, with the exception of corn, include barley, rye and sorghum etc. Of the consumption volumes, industrial use includes raw materials for the brewing of ethanol, starch and beer etc.

This table provides a summary of recent world trends in grain production volumes by crop and consumption levels. It covers key crops such as rice, wheat, and corn, and includes information on coarse grains, excluding corn. The production and consumption values provided are based on actual production and consumption data from recent years and are intended to reflect global trends in these important agricultural commodities.

Source: Compiled from the USDA’s Grain World Market and Trade (August 2007), the IGC’s Grain Market Report (June 2007), and other data. Parts of the data are estimates.

What if we made seasoning ingredients from kelp and tomatoes?

Each year 30,000 tons of dried kelp is produced in Japan and 125 million tons of tomatoes are being spread all over Asia, America, Europe and the rest of the world, so these resources could be exhausted at any time.

Ajinomoto Group Environmental Report 2010

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The Ajinomoto Group returns nearly 100% of the nutrient-rich by-products arising from its amino acid fermentation process to agriculture, livestock and fisheries to use for fertilizers and feeds, ensuring that these by-products play a role in a seamless cycle of production.

The Group sees these by-products as valuable “Co-Products,” which can be used to ensure continuous procurement from local agriculture and the abundant production of other crops, and continues to practice the recycling-oriented amino acid production that is rooted in the local area.

**Major amino acid production plants and uses of co-products**

In the Fields

**Co-products, making the most efficient use of the bounty of the fields and**

- **France**
  - Used for cattle feed etc.
- **Thailand**
  - Used for rice and sugar cane, and as a source of nutrition for the cultivation of fish such as tilapia.
- **Indonesia**
  - Used for sugar cane, corn, pineapple, rice etc.

**Amino acid**

- Glutamate
- Feed-use amino acid (lysine, threonine etc.)
- Other amino acids

**Co-Products (Examples of types and transformation to resources)**

- By-products
  - Fermented with power of microbes
  - Concentrated fermentation liquor

- Uses
  - Liquid fertilizer (Asia, North & South Americas), field crops, industrial crops, fruit (Thailand), marine cultivation (to increase plankton)
  - Liquid feeds (nitrogen additives) (Europe, North America)
  - Raw material for solid fertilizers (Japan)
  - Silage enhancers
  - Cell protein
  - Protein feeds (Europe) cattle, pig
  - Solid by-products
    - Raw material for solid fertilizers
    - Waste activated carbon, excess sludge
    - Salt by-products, waste filter aids etc.
  - Raw material for cement
  - Fuels etc.

**Crops used as raw materials**

- Sugar cane, cassava, corn, beets, wheat etc.
Rubber cultivation is widespread in Vietnam, and co-products created at the Ajinomoto Vietnam Co., Ltd’s amino acid fermentation plants are also used as fertilizer. Resin from rubber trees is used as a raw material for rubber, while the wood from those trees that grow to a particularly large size are used to make luxury furniture.

In addition to the widely cultivated rubber trees, it is also used in various vegetables and fruits such as sugar cane, pineapple and coffee.
Towards the development of high-value-added co-products

Although about 90% of co-products are turned into fertilizer mainly in the agricultural industry, the effects and application vary depending on the regions and agricultural product. Further research on the agricultural practice and method applied for crops met in each region and verification are underway. In addition, using the concept of returning the bounty of nature to the agricultural industry of each region that helps provide the amino acid fermentation material, the Group is working on research into further high-value-added by-products and application development for contributing not only to agriculture but also to livestock and fisheries.

Launch of high-value-added project

In order to accumulate more knowledge and expertise to strengthen the Ajinomoto Group’s co-product business, including data on the effective use of co-products on local crops, which had been promoted at the Group’s amino acid manufacturing plants across the globe, we launched the “A-Link” project in 2009. Under this project, we develop higher-valued added and in-demand co-products through collaboration between the Group’s production sites and regional technology centers around the world and the research institutions of Ajinomoto Co., Inc.

We have developed foliar spray fertilizers that contain amino acids and minerals derived from fermentation by-product liquid to make crops healthy and increase harvests, as well as other unique ingredients to make crops resistant to diseases. We have also developed amino acid fermentation by-product feed that is rich in protein and can be used in place of fish meal, for which there is a concern over imminent resource depletion. We will continue to develop and commercialize products like these, which offer added value to customers and are useful for ecological conservation and resource protection. AJIFOL®, which is a spray fertilizer for use on the leaves of plants to help them absorb nutrients, is an example of the Group’s high-value-added co-products.

Demonstration experiments on the AJIFOL® foliar spray are conducted

AJIFOL®, a spray fertilizer that helps the leaves of plants to effectively absorb nutrients, is typical of the high-value-added co-products. Originating in Brazil, the AJIFOL® project has been underway since 1988, and the product is currently used on soybeans, corn, fruit trees, cotton and so on. Since 2007 operations have spread to Peru, Thailand, China, Indonesia, Vietnam and the United States. It is reported that the product enables effective provision of nutrition with small amounts, and improves immunity to diseases. Examinations are being conducted into different ingredients and spraying techniques according to the region where it is used.

Comparative cultivation of soybeans (Bolivia)

The soybeans grow better in the fields using AJIFOL®

Comparative cultivation of rice (Japan)

The liquid and solid fertilizers produced at the Kyushu Plant of Ajinomoto Co., Inc. are used in the cultivation of rice, vegetables and fruit. Cultivation experiments are underway using a combination of AmiHeart™ and AJIFOL®.

The business of Ajinomoto Fine-Techno Co., Inc. includes activated carbon. Activated carbon features tiny pores known as micropores in much larger quantities than ordinary carbon, and is characterized by its absorption of chemical substances. It is used in food manufacturing, water cleansing and for the absorption of harmful chemical substances. Research is underway on its use as a soil cleanser on agricultural land.
The Ajinomoto Group companies’ various initiatives to make the most efficient use of the riches of the land

Making the most of unused biomass in producing the energy required for amino acid fermentation
(Ajinomoto Co., (Thailand) Ltd. Kamphaeng Phet Factory)

Ajinomoto Co., (Thailand) Ltd. produces amino acids using sugar cane and cassava as raw materials. The Kamphaeng Phet Factory, located four hours’ drive north of Bangkok in a busy agricultural district full of rice paddies and sugar cane fields, is aiming to become a “Green Factory.” In December 2008 the factory installed a biomass boiler, to utilize not only the raw materials used in amino acid fermentation but also the region’s unused biomass as an energy source.

The fuel they use instead of heavy oil is the husks resulting from local rice production. Three rice crops are harvested in a year in Thailand, so rice husks are available on a stable basis throughout the year. The husks are a hitherto untapped agricultural resource and a carbon-neutral fuel. The installation of the boiler has helped the factory to reduce its CO₂ emissions by around 50%, or 100,000 tons per year. The Ajinomoto Group has, for the first time, applied to and received approval from the Japanese and Thai governments for this CDM Project. The Group also plans to apply to the United Nations to register it as a CDM project.

Aiming to become a resource recycling-oriented plant that nurtures raw materials for products by turning residue into fertilizer
(Ajinomoto Frozen Foods Co., Inc., Shikoku Plant)

The Shikoku Plant of Ajinomoto Frozen Foods Co., Inc. produces a range of over 100 household and business-use food products, including stuffed dumplings and hamburgers. It is situated in an area that grows plenty of the ingredients of the products, such as cabbages and onions.

The production process results in large amounts of animal and vegetable residue, including inedible cabbage stalks and outer leaves, and other material that cannot be used in products. In order to use these without any waste as parts of nature’s benefits, a fertilizer conversion facility was opened in the latter half of fiscal 2006, and sales of fertilizer launched. The residue can be turned into fertilizer by fermentation and drying.

Since the second half of fiscal 2008, the fertilizer has been gradually sold to contracted local farmers, and the resource recycling areas have been expanding. The company intends to steadily continue with its efforts to promote resource recycling and the efficient use of nature’s bounty through its frozen foods business.