



preventing risks such as Bovine Spongiform Encephalopathy (BSE) and ensuring safety. The Cosmo Oil Group continued to develop high-purity refining techniques and succeeded in extracting ALA crystals with over 99% purity. The Group was first in the world to succeed in using fermentation in its industrial production technique for ALA, and was recognized with the Technical Award of the Society for Biotechnology, Japan, in 1999.



ALA crystals with 99% purity

## Extraordinary Effect on Plants Harnessed for Use as Fertilizer

Along with its development of mass-production methods, the Cosmo Oil Group conducted research into ALA applications, which demonstrated particularly notable effects on plants.

- **Increase in chlorophyll**

Chlorophyll increases when administering moderate amounts of ALA to plants, enhancing photosynthetic capacity and CO<sub>2</sub> sequestration.

- **Produce is large and sweet**

Increasing photosynthetic capacity results in larger and sweeter fruits and vegetables.

- **Plants strengthen in low-sunlight environments**

Plants prosper even in environments with little sunlight.

- **Improved resistance to cold and salinity tolerance**

The large amount of sugar produced through photonic synthesis makes plants resistant to cold and tolerant to soil with high salinity, even alkaline soil.

- **More efficient nutrient absorption**

ALA accelerates the speed at which nutrients are absorbed from the roots.

To take advantage of the unique properties of ALA, the Cosmo Oil Group joined with Seiwa Co., Ltd. to commercialize the Pentakeep series of liquid fertilizer. Currently, Seiwa is selling the fertilizer to domestic agricultural producers, and Cosmo Oil's subsidiary Cosmo Seiwa Agriculture Co., Ltd. is selling the home gardening variety to general consumers.

The Cosmo Oil Group is particularly focused on marketing Pentakeep outside Japan to fulfill its role in raising global

agricultural production. Tests conducted in the Netherlands, Poland, the Czech Republic, and Hungary demonstrated increased yields and higher quality in many plants, garnering high praise from agricultural producers. The product is now widely sold in Italy, Germany, Greece and Spain. In 2003, Pentakeep was demonstrated at Horti Fair in the Netherlands, the world's largest agricultural exhibit. Cosmo Oil's fertilizer won the theme prize, and attracted a stream of business inquiries from agricultural companies from all over the world. Looking ahead, the Cosmo Oil Group plans to expand into the U.S. and Chinese markets.



Horti Fair agricultural exhibit in the Netherlands

## Pursuing ALA's Potential to Contribute to a More Prosperous Life

ALA is demonstrating impressive results in raising crop yields and inducing growth, thereby contributing to agricultural production without harming living organisms or contaminating soil. ALA is currently marketed as the liquid fertilizer Pentakeep, but in a solid form it could be applied to larger land areas and be effective in grain production and other agricultural pursuits. Moreover, as land areas of many regions in the world have been damaged by salt and alkali, making desertification a major problem, ALA's effectiveness in improving the salinity tolerance and alkalinity tolerance of plants makes it a landmark substance that could herald a turning point for the environment in these areas. Cosmo Oil is also moving ahead with research into afforestation and agriculture using ALA.

In addition, the Company expects ALA to have applications in animal feed, hair growth formulas, and tumor diagnosis and treatment. The Cosmo Oil Group will continue to commercialize ALA for applications that can contribute to a wide variety of fields, such as agriculture, the environment and health. As with petroleum, ALA takes its origins from the earth's riches that have been with us since time immemorial. The Cosmo Oil Group will continue to take up the challenge of seeking ALA's potential to pursue better lives for humankind.

### ◆ Effects of Pentakeep

Example with vegetable cultivation in Italy

Crop: Lettuce (grown in tunnels)

Application method:

500g/ha of Pentakeep Super was applied to leaves one time every eight days for a total of four applications.

Effect:

The mass of lettuce above the ground increased significantly in proportion to the roots, resulting in increased yield.



### ◆ Fields where Cosmo Oil Applies ALA

	Microorganisms and fermentation fields	Animal and medical fields	Plant and agriculture fields
Exposure to light	Anti-infective drugs	ALA derivatives	
	Disinfection	Rheumatism treatments	Cancer treatments
	Hemophilia diagnosis	Blood clot treatments	Cancer intraoperative diagnosis and treatment
Addition of elevated concentration	Heme enzyme production	Animal cell culture	UV cut
	VB12 production	Heme metabolic research	Diagnosis of heavy-metal poisoning in porphyrin cases
	Microbial culture	Hair growth	Prevention of severe anemia
	Porphyrin production		
Addition of low concentration			Improved yields
			Enhanced photonic synthesis
			Improved resistance to cold
		Improved tolerance to salinity	