Techniques to reduce N_2O emissions derived from farmers' efforts to preserve water quality in tea fields

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The beginning of tea, “Omi's Tea”

The history of tea in Shiga Prefecture is the oldest in Japan. It is said that in 805 about 1200 years ago, Dengyo Daishi Saicho brought back seeds from Tang (china) and planted it at the foot of Mt. Hiei. This tea garden still remains near the Hiyoshi Taisha Shrine (Sakamoto Otsu City).


Sencha


Plucked new shoots


Matcha

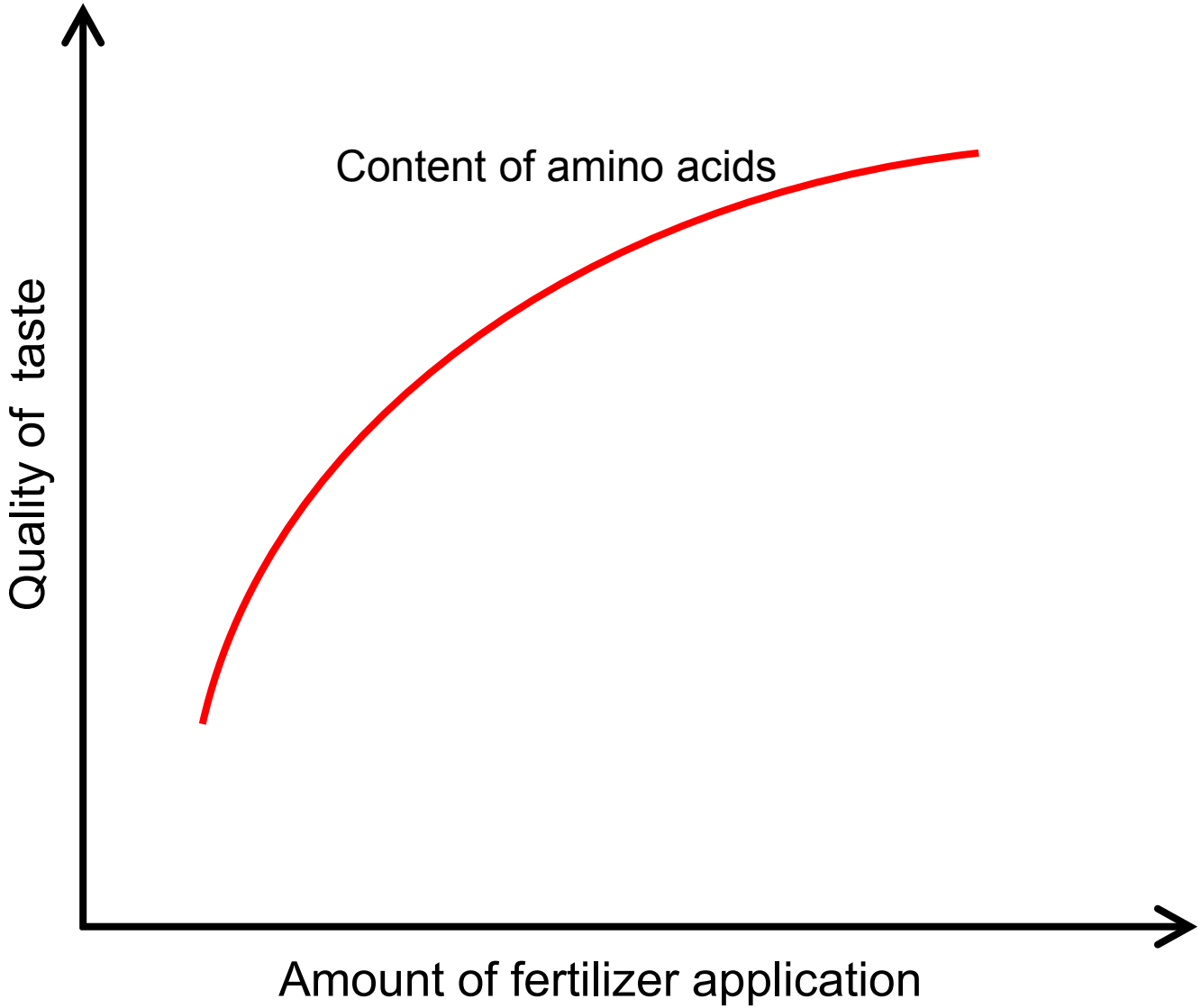

Fig. Relationship between the amount of fertilizer application and content of amino acids

Protecting Lake Biwa as it is the source of drinking water for 14 million people in the Kinki region

→ Studied on saving the nitrogen load caused by fertilizer application in tea fields

Effort to preserve water quality in tea fields
Developed fertilizer application techniques for environmental conservation
→The water quality was improved by this effort

However

Comparison between farmers' tea fields and tea field of Tea Research Institute in developed fertilizer application technique

Annual	Tea field of Tea Research Institute		Farmers' tea fields	
	Yield	Quality	Yield	Quality
1 year	○	○	○	○
2 year	○	○	○	○
3 year	Why did we get different results ?			
4 year	○	○	△	△
5 year	○	○	△	×

○ : equal to or greater than conventional farmers' cultivation

△ : less than or equal to conventional farmers' cultivation

× : less than conventional farmers' cultivation

Tea culture management has been mechanized in Japan.

Adjust the height of tea plants according the machine

Pruning of canopy after the second crop in each year

Conventional space between the hedges

Space between the hedges after mechanization

There was a large difference in the state of accumulated litter in space between the hedges, which was where fertilizer was applied.

Space between the hedges after mechanization

N_2O emission potential in the litter, surface soil, and soil below 10 cm

Incubation experiment

(According to the method of Tokuda and Hayatsu)

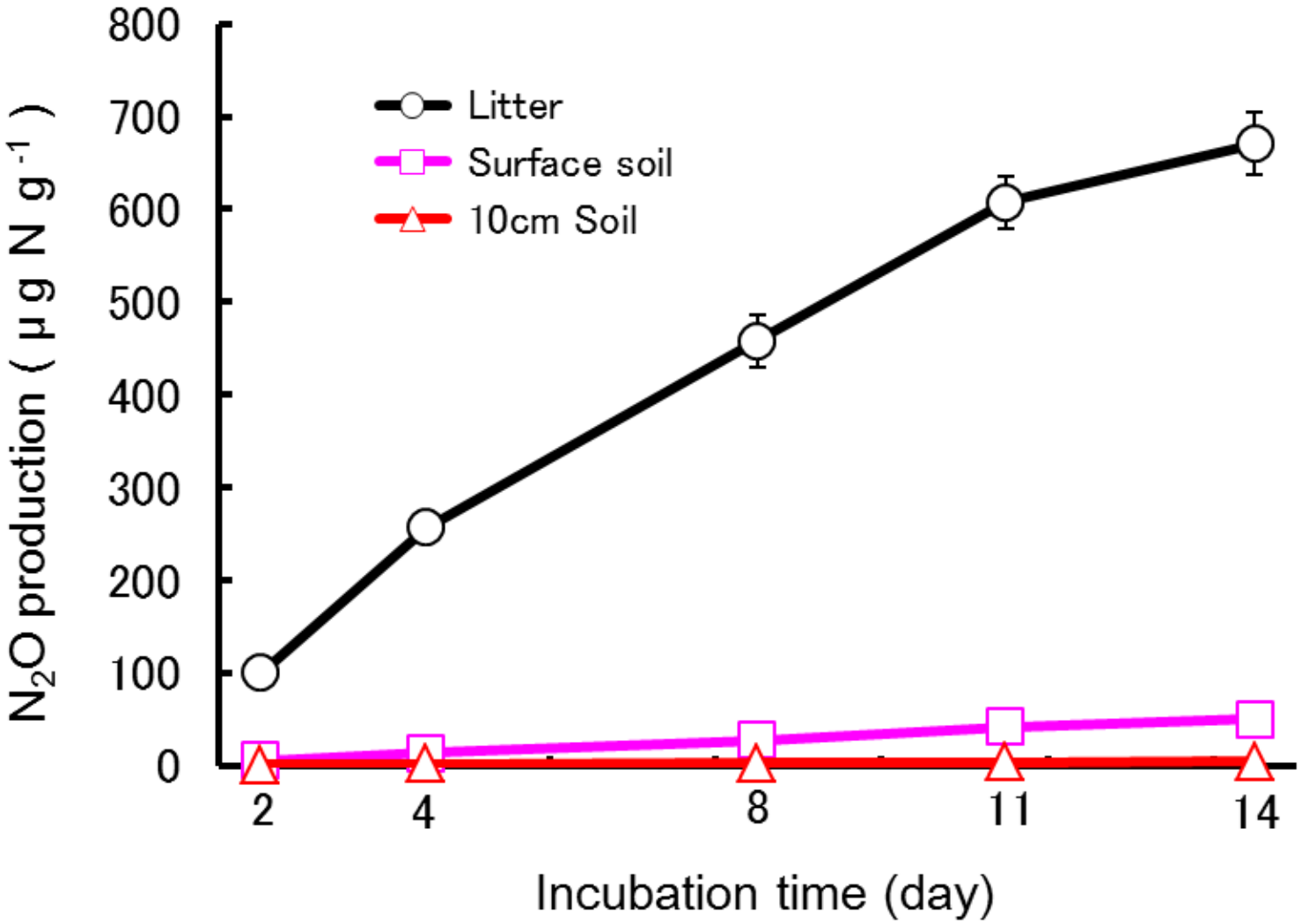

Fig. N_2O emission potential in the litter, surface soil, and soil below 10 cm

Table. N_2O emission potential per surface area

Incubation time (14 day)			
	Per weight	Per surface area	
	$\mu g\ N\ g^{-1}$	$g\ N\ m^{-2}$	
Litter	671	12.9	16 cm in depth
surface soil	50	0.3	1 cm in depth
Soil	5	0.5	16 cm in depth

Measuring the N_2O emissions in the space between hedges in a tea field

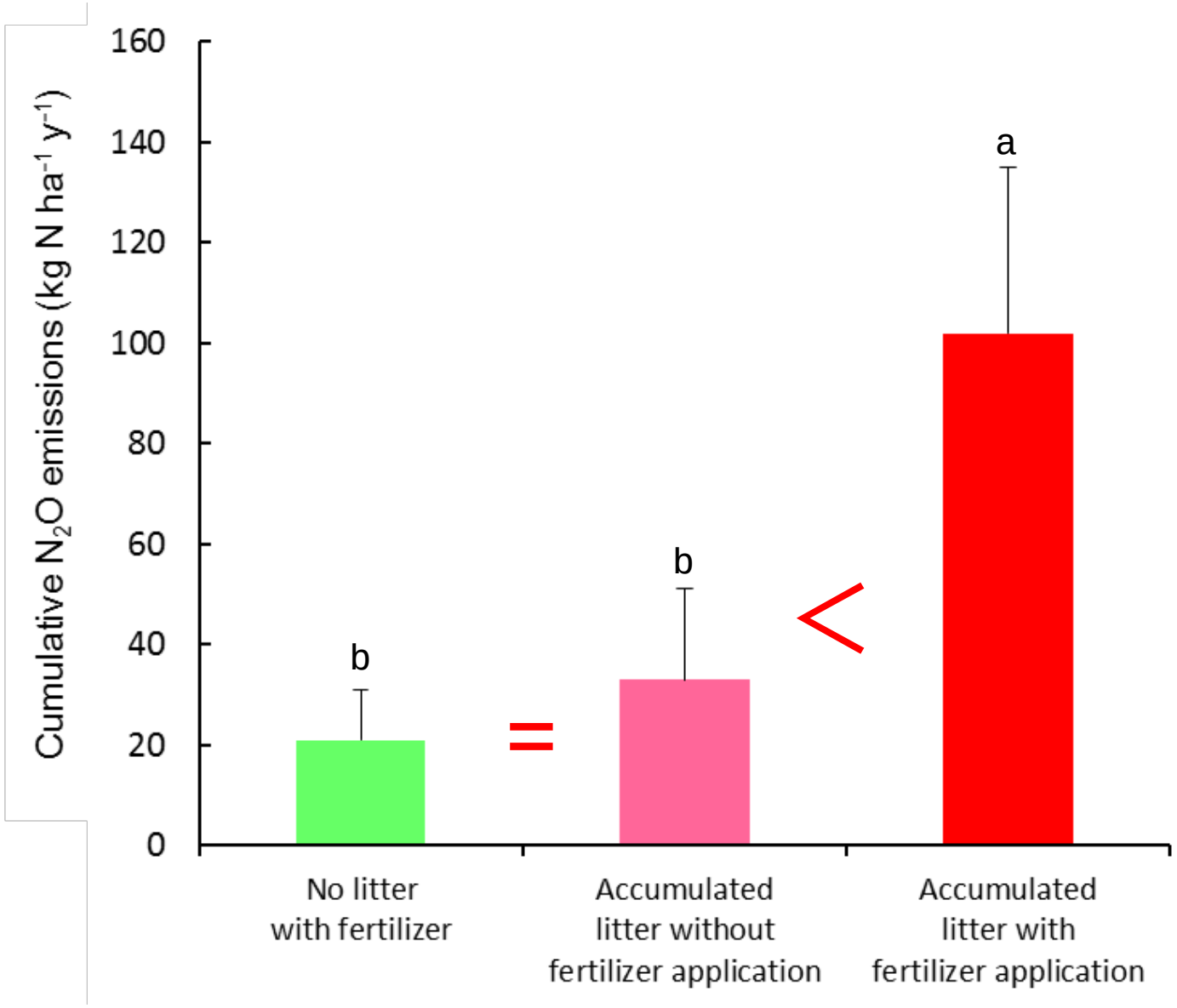

Fig. Cumulative N_2O emissions in different soil environments

$p < 0.05$ according to REGWQ method

Incorporation of litter with soil by deep plowing can reduce N_2O emission

Cultivator for deep plowing

Before deep plowing

After deep plowing

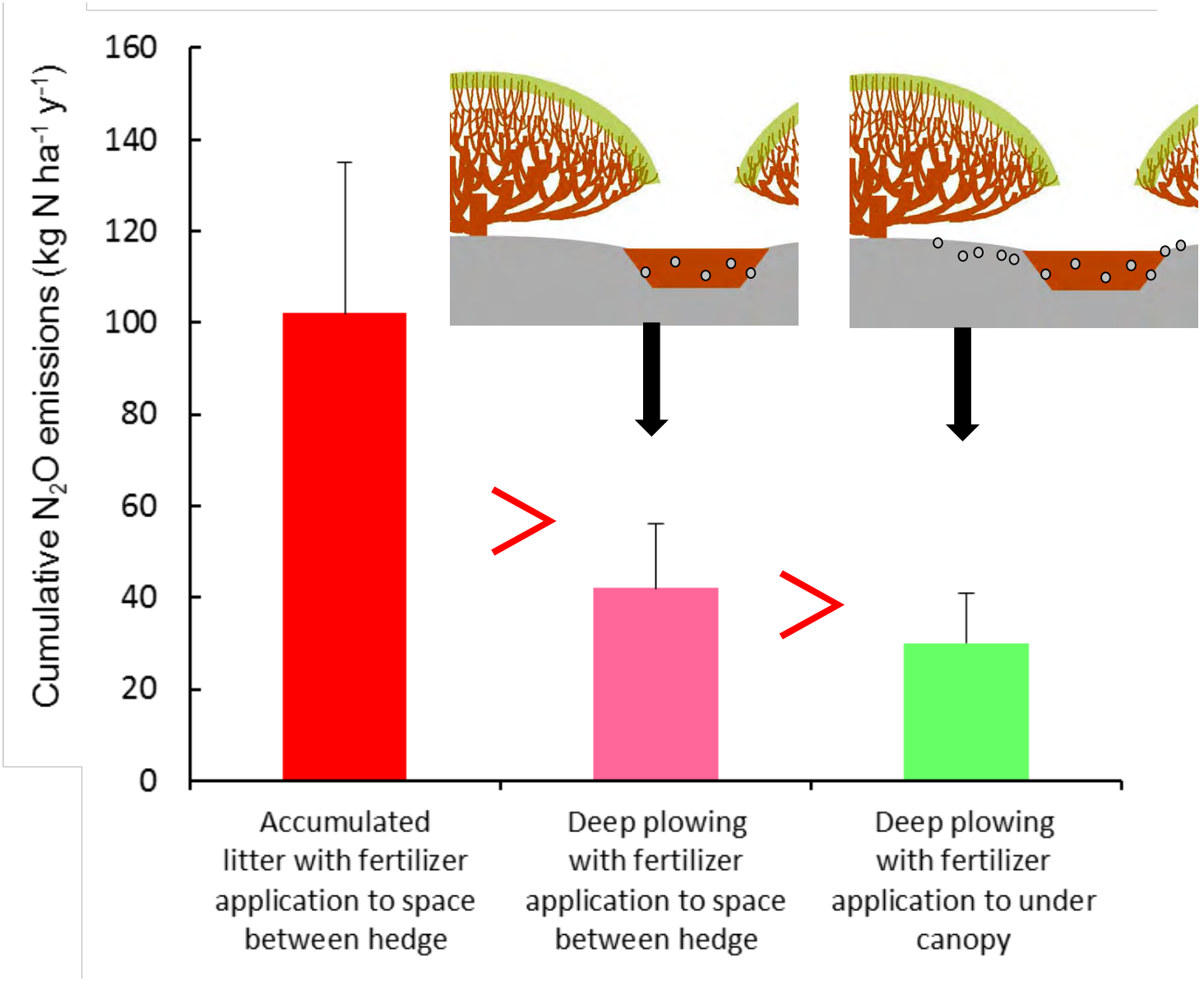

Fig. Cumulative N_2O emission in deep plowing

Developed techniques (Deep plowing + Fertilizer application to under canopy)		
Yield	Quality	Production cost
○	○	◎

◎ : greater than conventional farmers' cultivation

○ : equal to or greater than conventional farmers' cultivation

Farmers' efforts to preserve water quality in Lake Biwa led to techniques to reduce N_2O emissions in tea fields.

These techniques are now being used in 50-70% of the areas in Shiga Prefecture in Japan.

Thank you for your attention !