Applications of *Stevia rebaudiana* in Agriculture and Stockbreeding

JBB STEVIA LABORATORY/B&L corporation
Shintaro Kimura

Overview of Stevia Applications in Japan

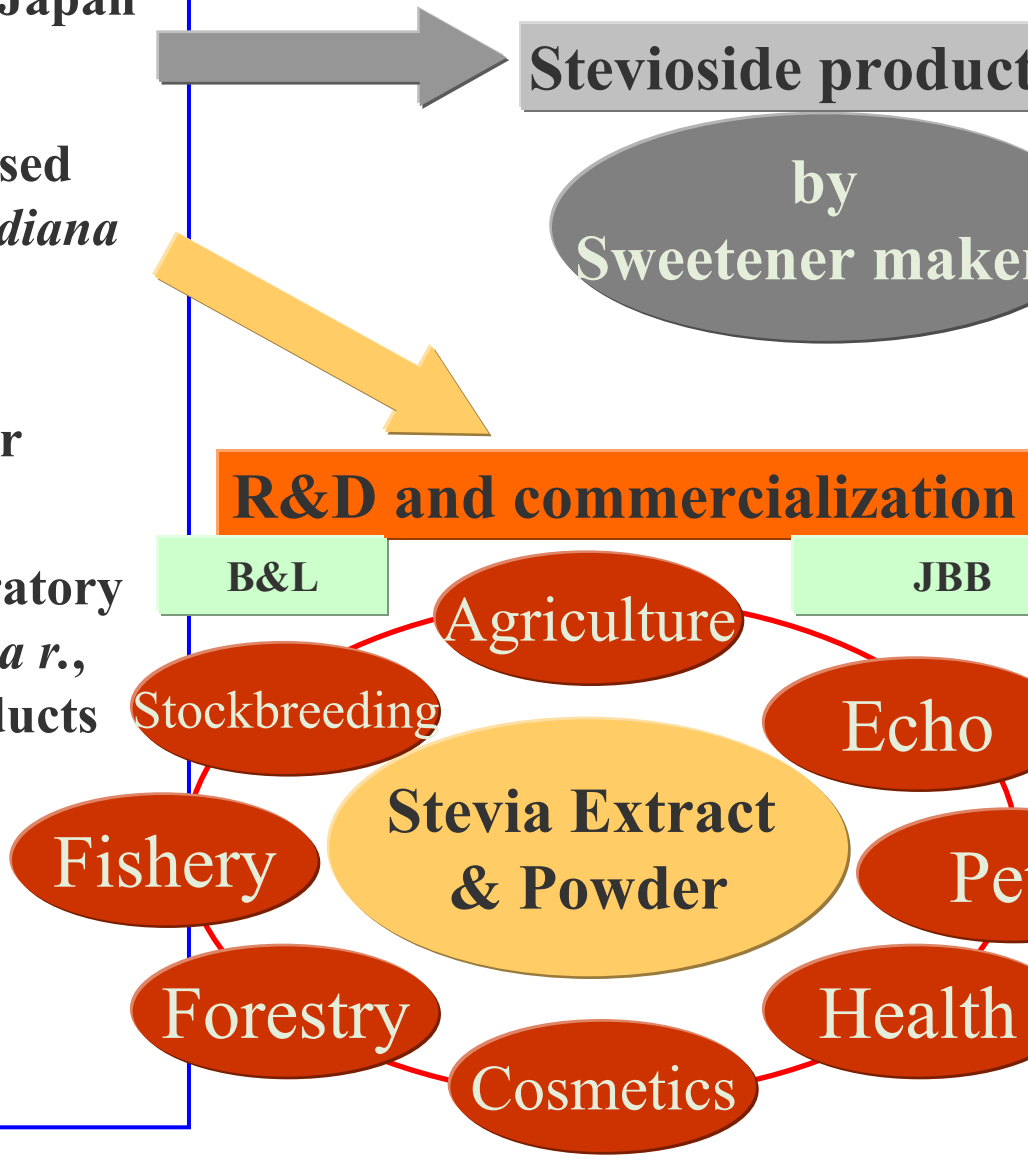
1970 : *Stevia rebaudiana* introduced to Japan
→ Trial cultivation started

1975 : Mr. N. Sato, JBB President, focused on big potentials of *Stevia rebaudiana* for non-sweetener applications

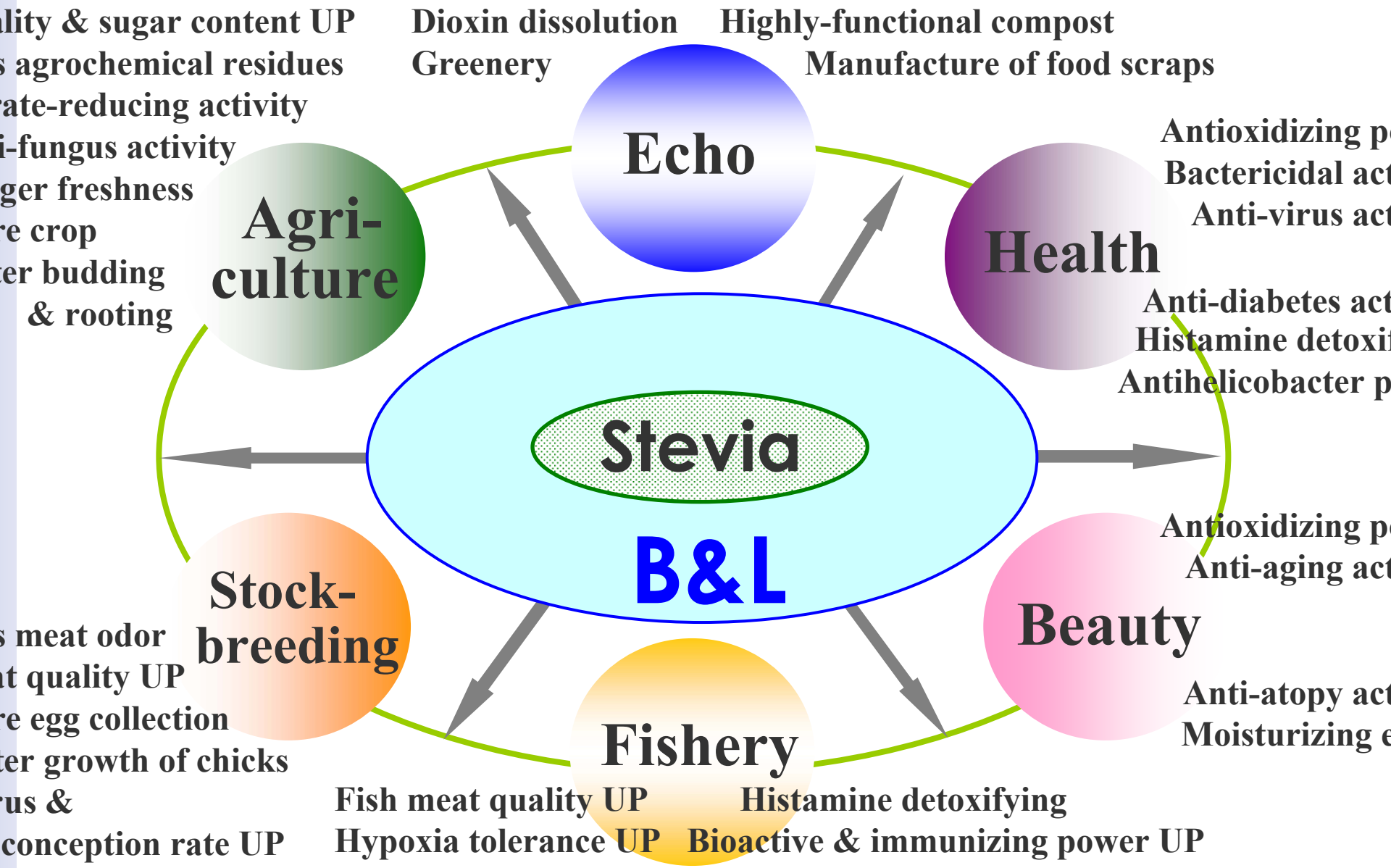
1982 : He started research on *Stevia r.*
→ production of Stevia hot-water fermented extract

1988 : He established JBB Stevia Laboratory
→ studied effect-efficacy of *Stevia r.*, and commercialized Stevia products for many applications

2005 : B&L Corporation was incorporated for further expansion of Stevia potentialities.



Applications & Effect-efficacy of Stevia



Agro. I Products & effects - Stevia farming

Stevia agro-products

❖ Liquid fertilizer

A hot-water fermented extract from Stevia stems & leaves

- Foliar spray in dilution
- Aspersion into farm soil

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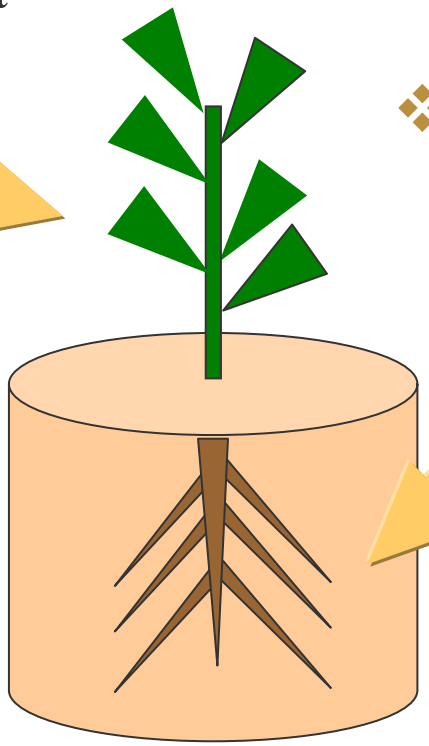
◇Anti-oxidizing products
◇Less agro-chemical residues
◇Less nitrate content
◇Better taste
◇More nutrition



❖ Powder & pellet fertilize

powdered & pelletized from Stevia stems & leaves

❖ Stevia compost

made of Stevia powder & anim dung

- Mixed into farm s

↓

◇Activates microbes in soil
◇Activates budding & rooti
◇Less agro-chemical & nitr
◇More crop

Delicious, safe & secure, stay-fresh-longer farm products

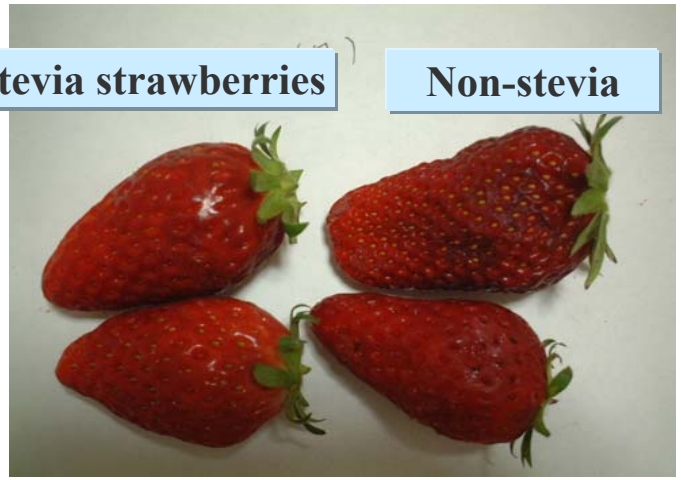
Agro. II Effect I - Better product quality

Stays fresh longer

< Shelf life test on strawberries > Test in Ibaragi

From Jan. 11 ~ 17, 2000

○Edible, △Not edible, ×Unusable



	Test items	Elapsed number of days					
		1	2	3	4	5	6
Stevia-applied	Color	○	○	○	○	○	○
	Damage	○	○	○	○	△	△
	Turn moldy (%)	0	0	0	0	0	0
Non-Stevia	Color	○	○	○	○	△	×
	Damage	○	○	△	×	×	×
	Turn moldy (%)	0	0	0	10	10	30

Higher sugar content

Comparison in sugar content between Stevia-applied & non-S

Samples	Sugar Content (°Brix)		
	Stevia-applied	Non-Stevia	Differe
Strawberry	12.9	9.5	+3.4
Tomato	6.8	5.9	+0.9
Peach	13.7	12.9	+0.8
Grape	18.2	16.6	+1.6

Shelf life test (by NHK Broadcasting)

Test on pears：Image extracted from NHK TV aired on Sep. 29, 20

Much less change in color for Stevia-cultivated pear

which has more resistance against oxidization

Agro. III　Effect II - Higher safety

No agro-chem. residues

Comparison test on lemons in agro-chem residue

Examination on pesticide performed by Tokyo Metropolitan Clinical Laboratory
Detection limit: 0.01 ppm
Test samples: Stevia-cultivated lemons

Stevia products & agro-chem. Applied	
Dec. 2000	Stevia compost
	Agro-chemicals
Mar. 2001	Farm A application
April	Agro-chemicals
May	Agro-chemicals
July	Agro-chemicals
	Farm A application
August	Harvest start
September	Farm A application

Agro-chemicals	Resu
Organochlorine pesticide	ND
Organophosphorous pesticide	ND
Carbamate pesticide	ND
Captan pesticide	ND
Ortho phenyl phenol	ND
Diphenyl	ND
Thiabendazole	ND
Imazalyl	ND

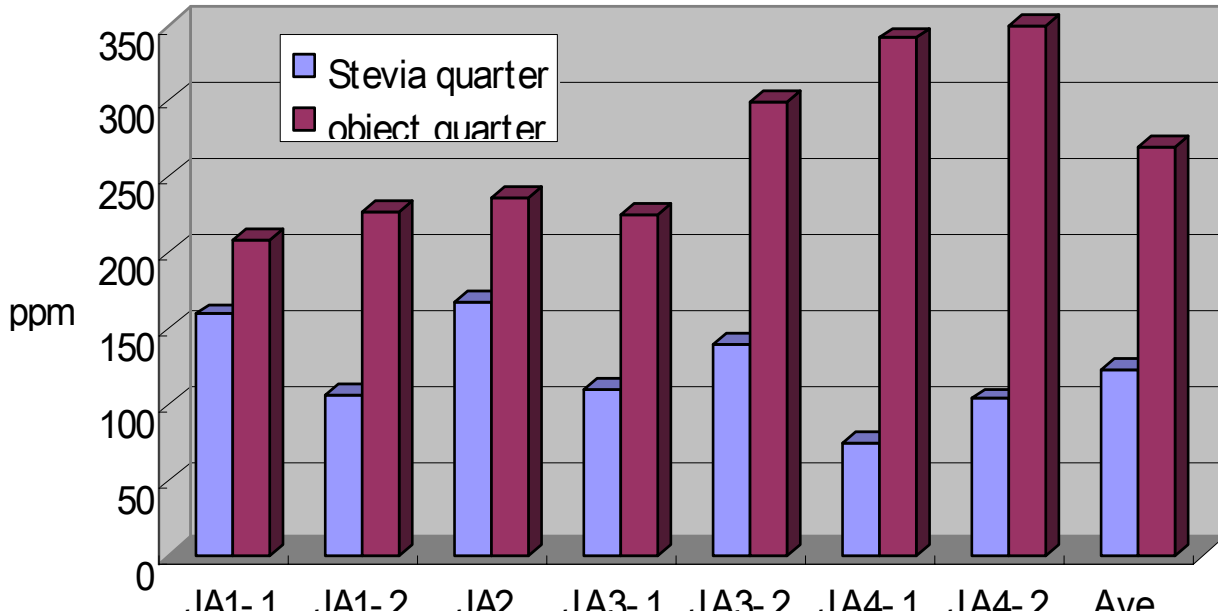
Reduction in nitrate

Comparison test on carrots in nitrate content

Test performed in 2005
JA1-1 etc. show test sections.

Stevia-cultivated

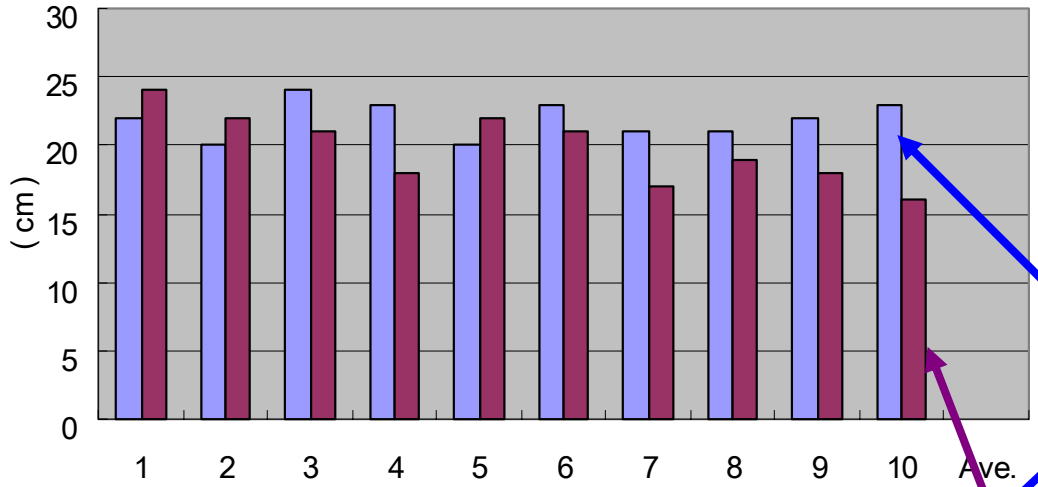
Non-Stevia



Agro. IV Effect III-Faster growth · more crop

Growth promoting effect

< Comparison in growth of carrots



Comparison in length of carrot roo

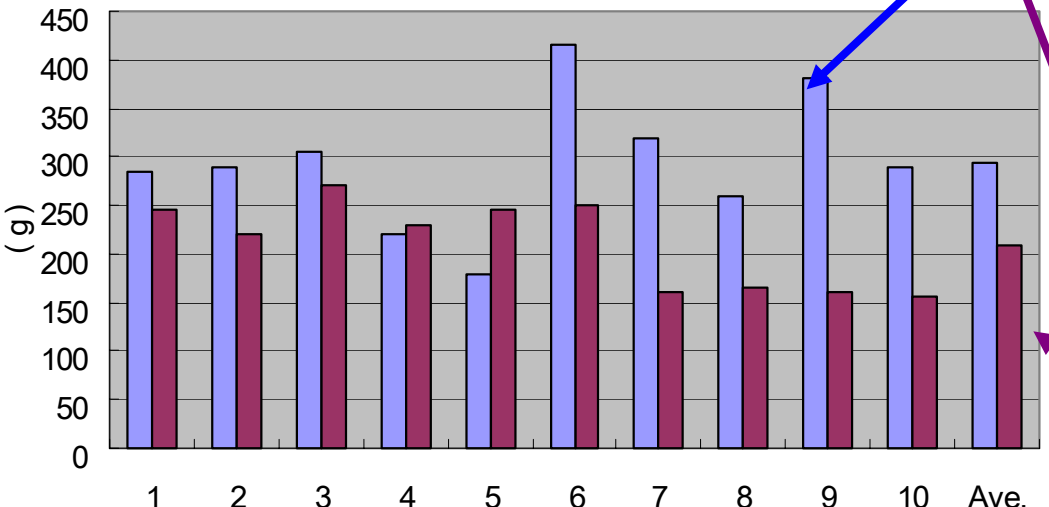
Cultivated in 2005 at Miyazaki

N.B. 1 ~ 10 : Test section number

Stevia-cultivated carrot

More crop

< Comparison in weight of carrot



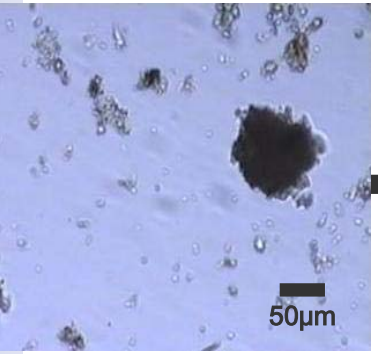
Cultivated in 2005 at Miyazaki

N.B. 1 ~ 10 : Test section numbe

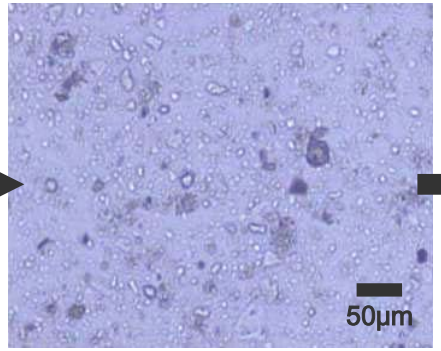
Non-Stevia carrot

Agro. V Effect IV- Soil improvement / Promotion of budding & rooting

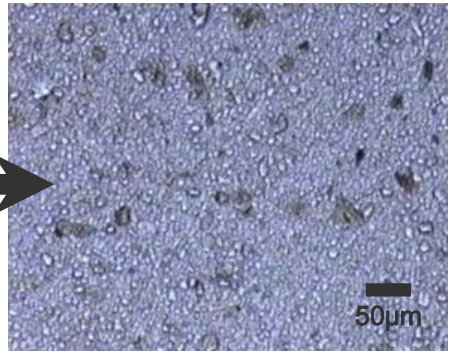
Activates useful microbes in farm soil



Exhausted soil



Stevia application →Bacterial growth



Multiplied useful microbes make soil into aggregate structure

Use of too much agro-chemical & chemical fertilizer exhausts farm soil.

Dissolve organic minerals

Increase water-retaining & manure-retaining capacity

Increase mineral absorption

More & longer roots

Promotes rooting

Rice plants

Non-Stevia | Stevia-appl

- Germination rate
- Uniform growth
- Growth promotion
- Nutrient absorptio ability UP
- More resistant to disease

Farm plants full of nutrients & resistant to diseases

Agro. VI Stevia farm products -Markets in Japan

Market size for Stevia farm products

US$100 ~ 200 Mil/year

Sales channels of high-end farm products

- Marketed at high prices in high-end fruit specialty stores
- Stores specializing in Stevia farm products are prevailing.

Super-deluxe fruit store

Stevia product specialty st

Highly-acclaimed in fruit & vegetable markets

- High evaluation with certification marks in the 2 biggest markets in Japan
- Permanent corner in the market specializing in sales of Stevia farm products

Stevia farm product corner in a fruit & vegetable market

JBB BRAND
ステビア農法

Certificatio mark

Agro. VII Achievements of research & development

1998・ Published a paper on anti-oxidizing activity of Stevia & its utilization

2002・ B&L Stevia agricultural products were certified as a farming material conforming to organic cultivation.

・ Presented in a congress a paper on the effect of Stevia on germination & rooting

2003・ Presented in a congress papers on identification of high-temperature bacteria & lactic acid bacteria in Stevia powder

2004・ Presented in a congress a paper on the the effect of Stevia compost for rooting

2006・ Presented in a congress a paper on nitrate-decreasing power & agro-chemical dissolution by Stevia

2007・ A paper on antifungal activity of Stevia

Joint research institutes in agriculture

◇ Department of Applied Microbiology, Fukuoka Junior College of Agricultu

Research on agro-chem. residues, nitra content, more crop, etc.

◇ Faculty of Engineering, Shizuoka Univ

Research on high-performance comp manufacture

◇ Kanagawa Pref. Agriculture Technolog Center, Research on farm plant grow

Breeding I　Products & effects

Stevia　stockbreeding　products

❖ Powder product

powdered from Stevia stems & leaves

Mixed into feedstuff

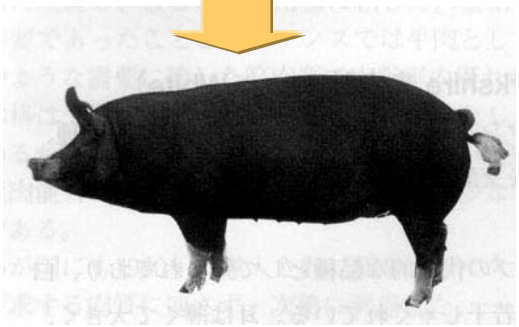
❖ Liquid extract produ

A hot-water fermented extrac from Stevia stems & leaves

Mixed into drinking water

Faster growth of chicks
Increase in immunizing power
More egg collection
Less egg breakage

- ◇ Estrus & conception rate UP
- ◇ Faster growth
- ◇ Healthy growth
- ◇ Increase in immunizing power
- ◇ Enhanced appetite

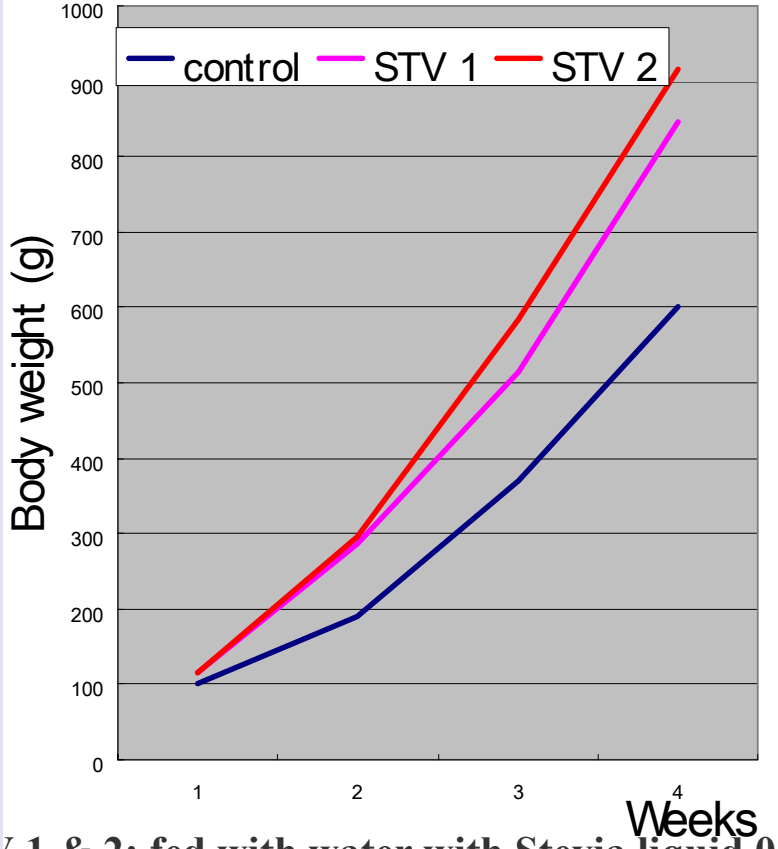


- ◇ Faster growth
- ◇ Increase in immunizing power
- ◇ Enhanced appetite
- ◇ Better meat quality (less dripping of meat ju less animal odor)

Breeding II Effect I - Growth promotion

Growth promoting effect of FSEL* on broiler chicken

Comparison in weight change trend

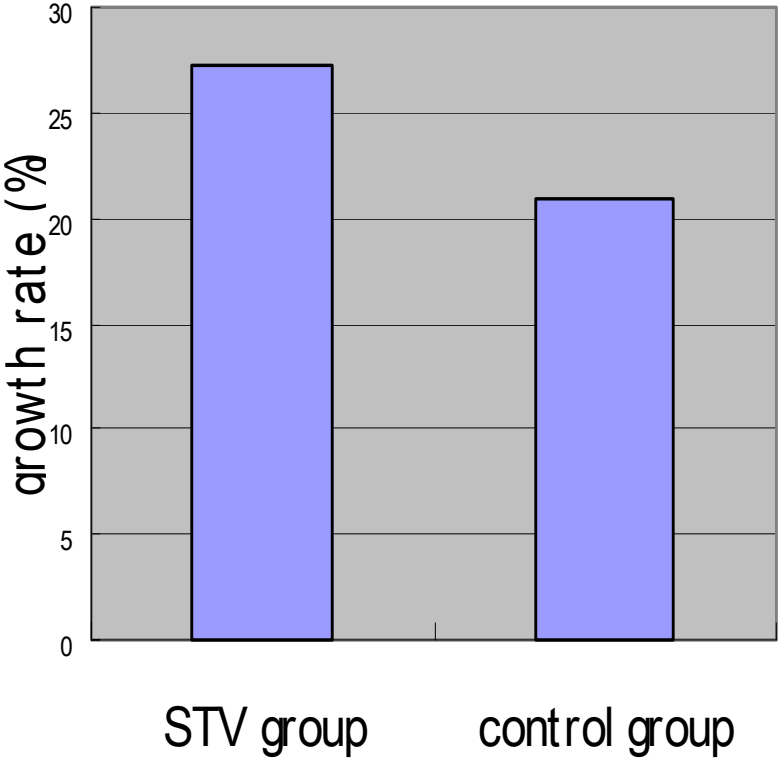


V 1 & 2: fed with water with Stevia liquid 0.2% mixed

*Fermented Stevia Extract Liquid

Growth promoting effect of FSEL* on beef cattle

Comparison in weight change



STV group: fed with feedstuff with Stevia powder 0.2% mix

Control group： fed with feedstuff only

Testing period：1 month

Breeding III Effect II - Promotion of estrus & conception

Promotion of estrus & conception of Japanese Black Cattle

Stevia powder was fed to 15 cows which showed no signs of estrus for a certain period after delivery.

How to administer: Stevia powder 30g each mixed into feedstuff every morning and evening

The cows that came into rut and became pregnant within 20 days after start of Stevia administration

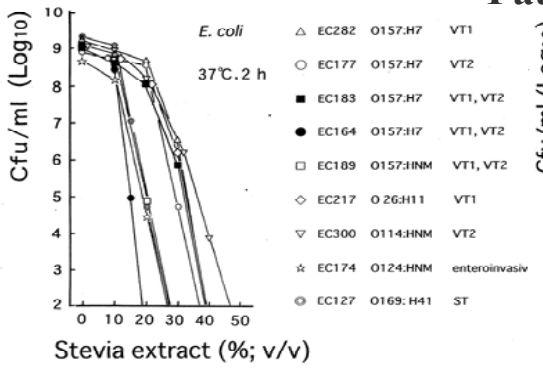
The cows that came into rut and became pregnant within 50 days after start of Stevia administration

Cow No.	Length of infecundity (days)	Days to fertilizati (days)
A	127	11
B	130	16
C	178	17
D	120	32
E	138	25
F	60	31
G	70	17
H	150	-
I	74	46
J	118	24
K	90	14
L	117	35
M	63	12
N	88	14
O	90	23

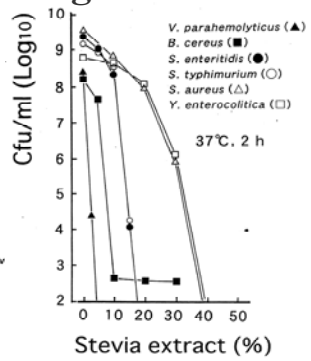
Breeding IV Effect III -Enhancement of immunizing power

Selective bactericidal activity

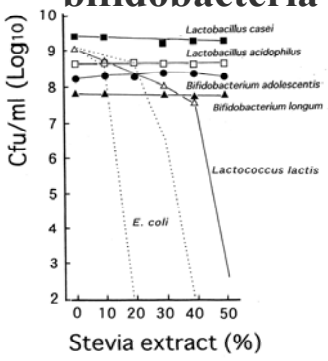
E. coli bacterium



Food-Borne Pathogenic Bacteria

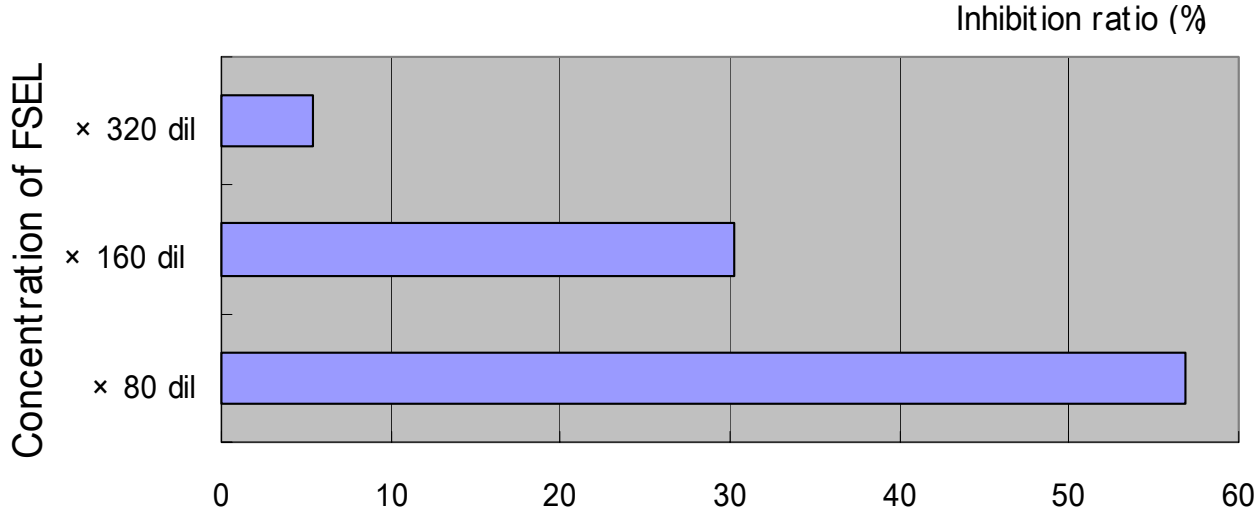


lactic bacterium, bifidobacteria



Bactericidal Activity of a Fermente Hot-Water Extract from *Stevia rebaudiana* Bertoni towards Enterohemorrhagic *Escherichia coil* O157:H7 and Other Food-Born Pathogenic Bacteria, Microbiol. Immunol., 41(12), 1005-1009, 1997, Toshio Tomita et al.

Inhibitory effect of FSEL* on avian influenza infection



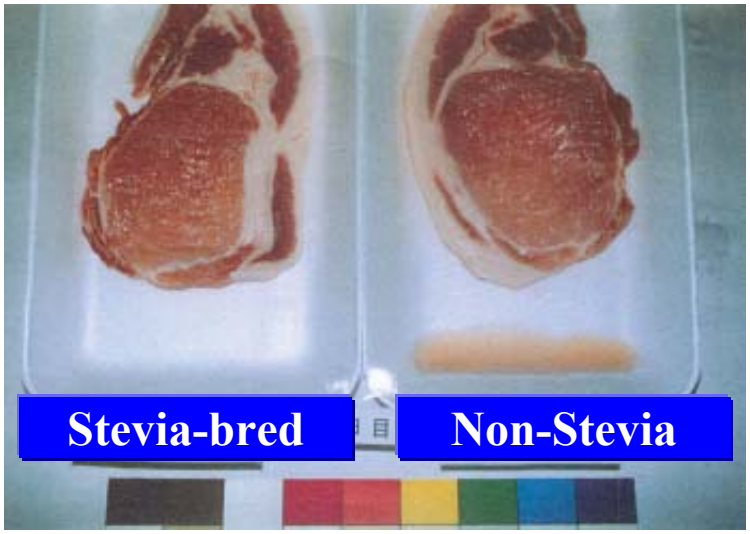
*Fermented Stevia Extract Liquid

By Kazuo Takahashi, M.D., Dr. Med. Sci., Sep. 20

Breeding V Marketing - By product branding

Features of Stevia-grown pork

- ◇ Delicious & juicy
- ◇ Refreshing & rich taste
- ◇ No unwanted odor
- ◇ Stays fresh longer
- ◇ No meat juice dripping
- ◇ Internal organs look nice & pinky.



Pork under the brand of “Momo

- ◇ Produced from Stevia-bred pigs
- ◇ Contains twice as much calcium as ordinary black pig pork.
- ◇ Contains DHA. ↓
  Differentiated marketing
- ◇ Sales channel：mass retailers

Technologies & know-how for Stevia utilization in agriculture & stockbreeding

Manufacturing technology of Stevia extract

To condense, extract, ferment and age Stevia plants into extract liquid which produces effects in human health, agriculture and stockbreeding

- Patents
- Manufacturing know-how
- Research data

Manufacturing technology of Stevia agro-materials

To mix Stevia extract and powder of Stevia stems and leaves into agricultural materials which produce remarkable effects on farm plants

- Patents
- Manufacturing know-how
- Research data

Stevia compost manufacturing technologies

To manufacture high-performance Stevia compost with Stevia manure materials mixed. Know-how accumulated on site & scientific data

- Patents
- Manufacturing know-how
- Research data

Application know-how for Stevia agro-materials

Know-how to cultivate farm plants with Stevia agro-materials, and scientific data from test institutions. High-quality certification marks.

- Cultivating manual
- Research data
- Identification system


Thank you very much.