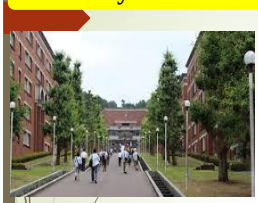
Advance of mechanization in Japanese tea and contribution of cultivar

Yoriyuki NAKAMURA
Tea Scinence center
University of Shizuoka

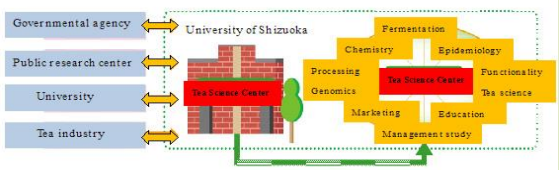
University of Shizuoka : Past & Present



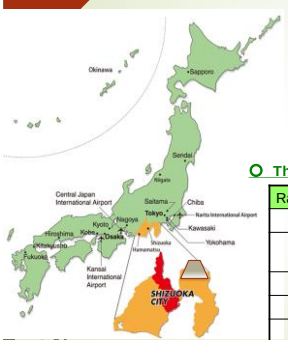
The University of Shizuoka, by absorbing various prefectural universities established in Shizuoka, came into being in 1987. It combined the Shizuoka College of Pharmacology, originally founded in 1916 as Shizuoka Women's Pharmacology School, along with Shizuoka Women's University and Shizuoka Women's Junior College.
Currently, there are about 3000 students in 5 faculties.

Tea Science Center

At the Tea Science Center, we teach about the health benefits of tea and pass on our knowledge about the best methods of cultivation, processing and marketing the various types of teas. The Center also collaborates extensively with other laboratories and organizations related to the tea industry



General Information of SHIZUOKA



Geographical Information

Population	3,765,007 (2010)
Area	7,780.42 ㎢
Ave. Temp.	16.5℃
Prefectural Capital	Shizuoka city

The Top 5 Main Agricultural Products(2015)

Rank	Products	Amount (mil JPY)
1	Tea	37,300
2	Tangerine (Mandarin Orange)	23,600
3	Rice	20,000
4	Hen's egg	13,800
5	Strawberry	10,800

Source: Ministry of Agriculture, Forestry and Fisheries

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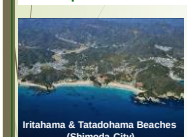
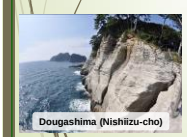
Shizuoka meeting global standards

● Izu Peninsula Geopark to join the Global Geoparks Network





● The Southern Alps as a UNESCO Eco Park

● Chagusaba as a Globally Important Agricultural Heritage System (GIAHS)

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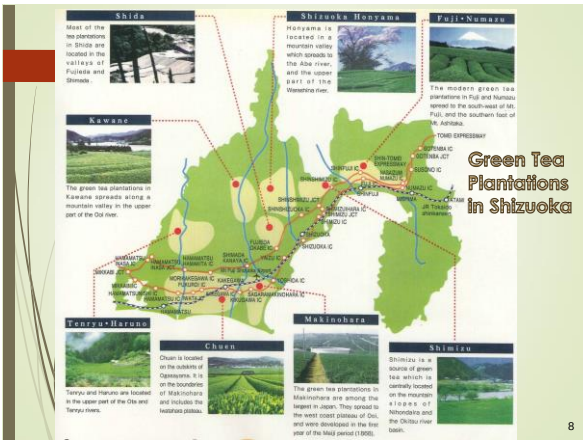
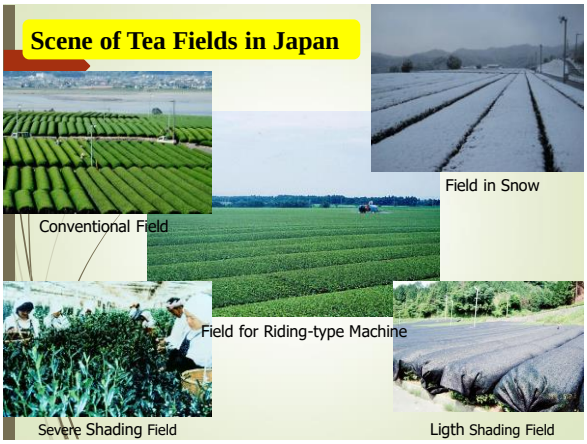
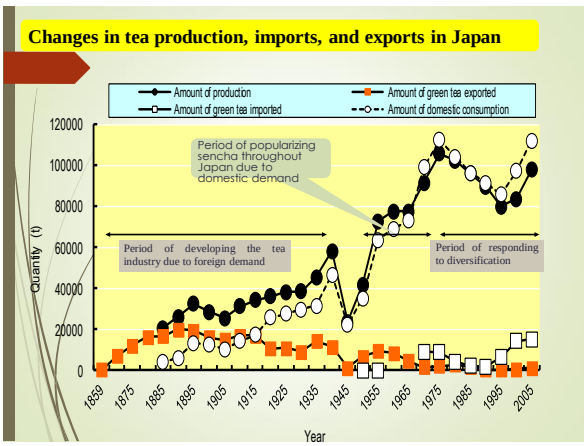
Japanese Green Tea Production

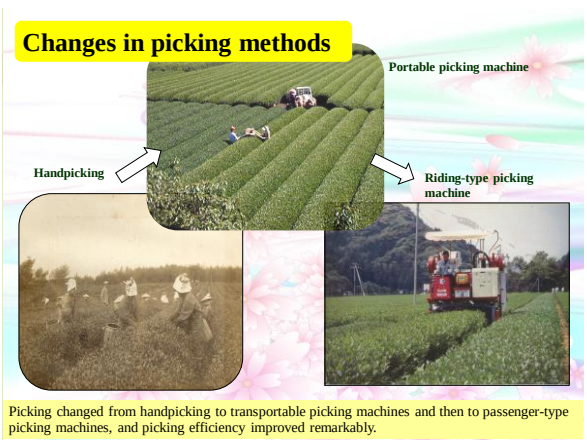
Area and production of tea (2020)

Prefecture	Area (ha)	Production (1000t)
Shizuoka	15,200	25,200
Kagoshima	8,360	23,900
Mie	2,710	4,696
Kumamoto	1,180	1,084
Kyoto	1,556	2,208
Fukuoka	1,510	1,664
Miyazaki	1,330	1,999
Saitama	825	884
Saga	705	1,137
Others	4,293	5,349
Total	37,669	68,121

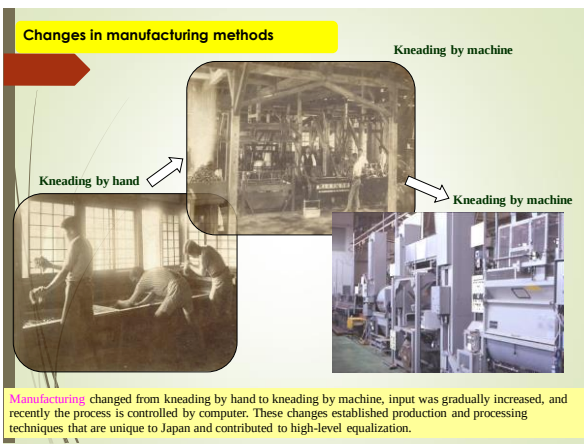






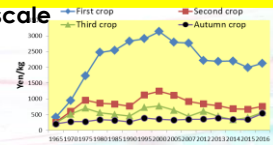


Picking changed from handpicking to transportable picking machines and then to passenger-type picking machines, and picking efficiency improved remarkably.

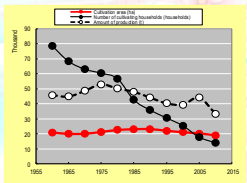


Manufacturing changed from kneading by hand to kneading by machine, input was gradually increased, and recently the process is controlled by computer. These changes established production and processing techniques that are unique to Japan and contributed to high-level equalization.

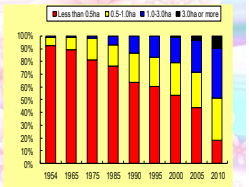
Drastic reduction of farmers and expansion of scale



Changes in the price of the each crop season



Changes in the number of households that cultivate tea in Shizuoka Prefecture



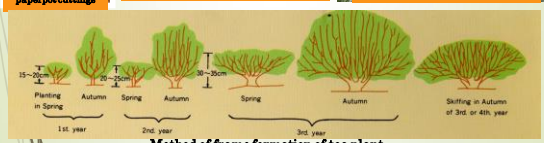
Changes in the number of households that cultivate tea in Shizuoka Prefecture

Cultivation of Japanese Green Tea

Zigzag Planting of paperpot cuttings

Young tea field (First year after planting)

Tea field（Three year after planting)



Method of frame formation of tea plant

To make it the tea field which suited mechanization for plucking, the frame formation after transplanting is most important

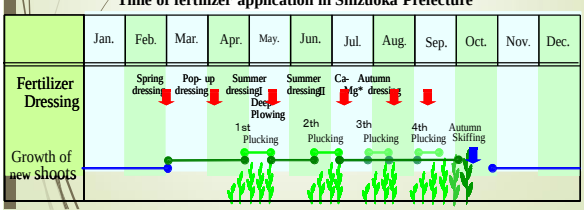
Cultivation of Japanese Green Tea

Fertilizer application

Deep plow subsoiler

Plucking of new shoots

Time of fertilizer application in Shizuoka Prefecture



Plucking Methods of New Shoots

Hand plucking

Plucking efficiency

Methods	The amount of new shoots per day per person
Hand plucking	10 ～ 15 kg
Hand-shear plucking	100 ～ 200
Mechanical plucking	
Portable machine for two persons	700 ～ 1,000
Riding machine	4,000 ～ 5,000
Self-rail-tracking machine	2,000 ～ 3,000

Hand-shear plucking

Portable machine for two persons

Riding-type plucking machine

Methods of Trimming and Pruning

Methods of trimming and pruning

A: light trimming of canopy
B: deep trimming of canopy
C: medium pruning

Tea field after pruning

Riding pruning machine

Deep Trimming of Canopy

Rail-tracking and riding-type plucking machine

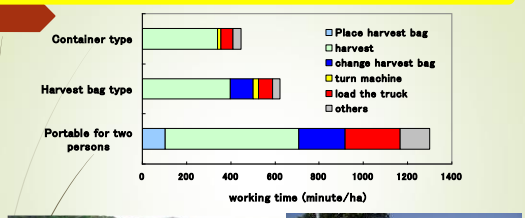
Rale-tracking plucking machine

Harvest bag Type

Harvest small bag Type

Riding Container Type

Operating Efficiency of Riding-type Machine



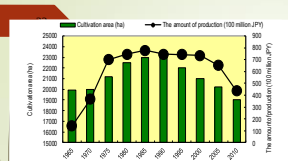
Container type

Harvest bag Type

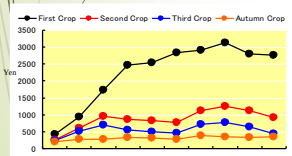
5. High-yield and Quality Tea Field by High Technology

Recently tea is plucked by machine

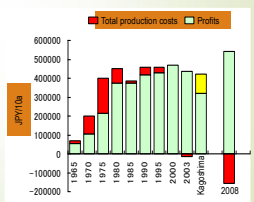
Changes in amounts of tea production and tea value according to tea period



Changes in tea production



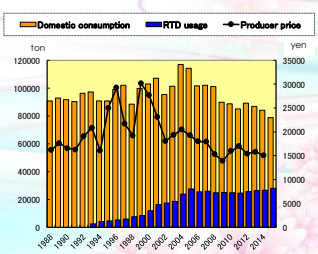
Changes in the price (yen/kg) of dried tea leaves by tea periods



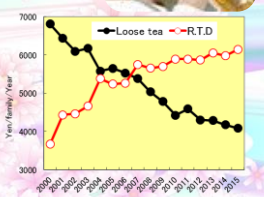
Changes in profit compared to production cost

Present state of tea consumption in Japan

The way of drinking tea changes greatly with the change of lifestyle

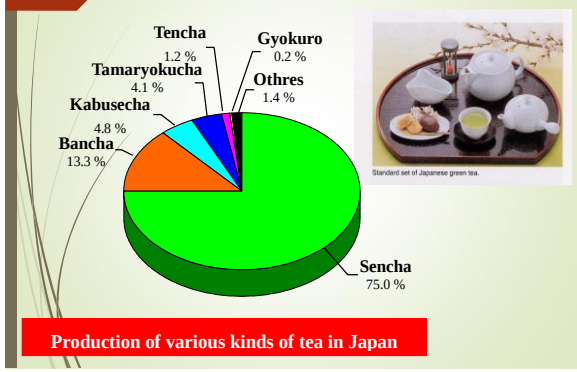


Changes in domestic consumption and producer price



Changes in purchase price of loose tea and RTD

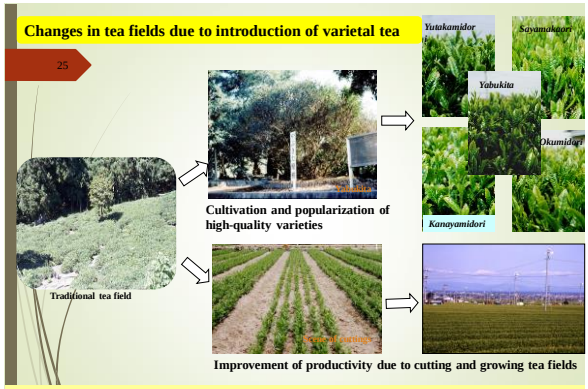
Production of Various Kinds of Japanese Green Tea



Standard set of Japanese green tea.

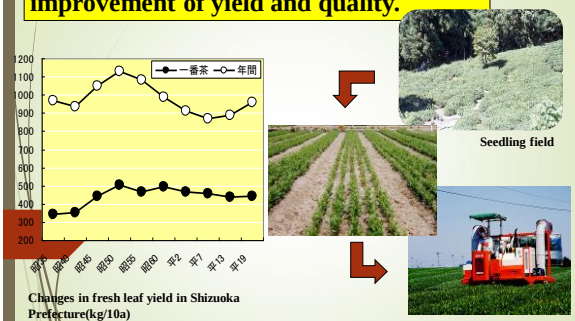
Production of various kinds of tea in Japan

Changes in tea fields due to introduction of varietal tea



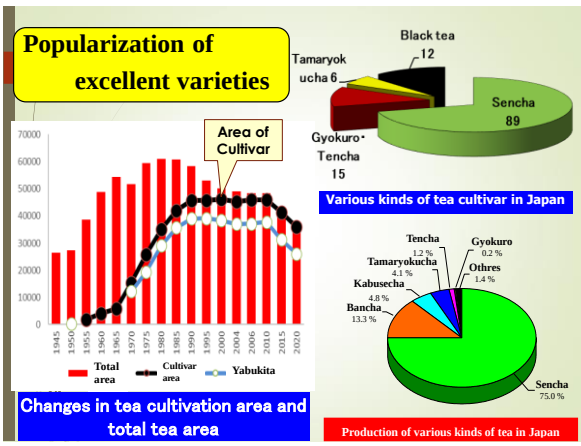
Improvement of crop yields and quality was achieved by making vegetative propagation tea fields through cultivation and cutting of high-quality varieties instead of the traditional tea fields that used seedlings.

The cultivars greatly contributed to the improvement of yield and quality.



Trend of Japanese Green Tea Production Area with Superior Cultivars

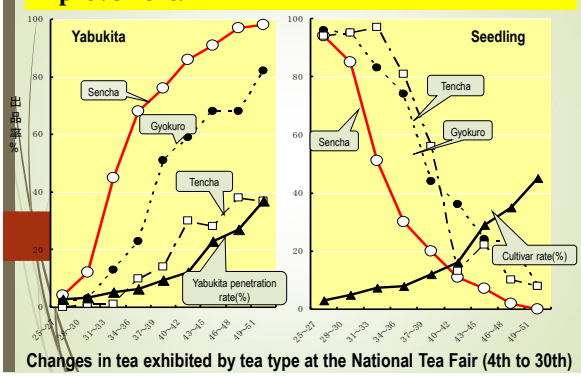
Popularization of excellent varieties



The cultivars have been breeded according to the demands of the times

Period	Historical context	Purpose of selection	Selected cultivars
1930S	Expansion and strengthening of exports	Higher yield and higher quality by breeding vegetative cultivars	Yabukita, Koyanishi, Rokutrou etc.
1950s	Shift to domestic demand due to economic improvement	Proliferation of black tea products, adoption of cultivars suitable for Western food	Benihomare, Karabeni, Tadanishiki, Fujimidori etc.
1960s	Rapid increase in domestic demand, upsizing of tea making machines	High yield, early and late cultivars, high quality	Kurasawa, Kanayamidori, Ooiwase etc.
1970s	Frequent weather disasters	Adoption of cold-resistant cultivars	Sayamakaori, Okuhikari etc.
1990s～	Bubble burst and diversification	Adoption of cultivars with distinctive aroma and taste	kousyun, Tuyuhikari etc.

The cultivars have greatly contributed to quality improvement!



Recommended cultivars in Shizuoka Prefecture and strategic cultivars of each city

Recommended cultivars in Shizuoka Prefecture

Early Ooiwase, Yamanoibuki

Slightly early Sayamakaori, Tuyuhikari, Shizukaori

Intermediate Yabukita, Kousyun

Slightly late Yumesuruga, Kanayamidori

Late Okuhikari, Sawamizuka

Strategic cultivars of each city

Cultivars that seek to promote the region by recommending cultivars suitable for the region in each city

"Okuhikari" with a soft taste and rich aroma ～Kawanehoncyo～

品種を活用して山間地を天空の郷に！

「天空の茶産地「奥光」」として川根茶全体のマーケッティング戦略の機軸として位置付け、川根茶産地の振興と活性化を図る。

"Tsuyu Hikari" with emerald green light blue and strong umami ～Omaezaki city～

ドリップ式　つゆひかり

市茶商、JA、行政が一体となり、つゆひかりを普及

"Machiko" with a rich scent of cherry blossom leaves ～Shizuoka city, Shimizu～

桜葉の香りを前面に出し、清水みんなのお茶を創る会。まちこクラブで消費者の取り込み

"Fuji Kaori" with the scent of jasmine ～Fujieda city～

菱凋により花葉の香りを強化

RTDも女性に人気

花葉の香りを前面に出し、香りの藤枝茶をPRするためにブランド化。RTDも人気商品

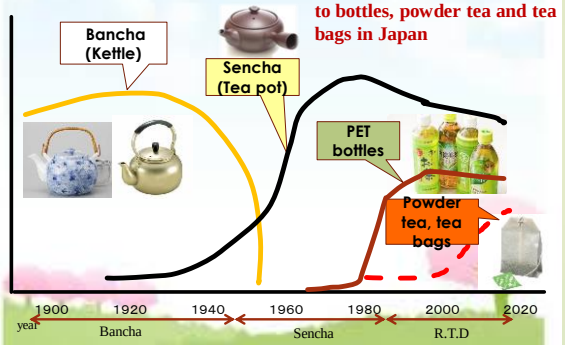
Factors that change cultivars

① Changes in socio-economic needs
②Changes in demand needs
③Introducing new cultivars
④Changes in production style
⑤Changes in the production environment

Varieties that contribute to production promotion → Cultivars that can meet demand → Cultivars that can open up a new era

Changes in tea to be drunk

Tea is changing progressively toward simplicity from kettle to bottles, powder tea and tea bags in Japan



Outline of characteristics of main cultivars

	Saemidori	Tuyuhikari	Yabukita	Kanayamidori	Okumidori
Plucking time	Early	Slightly early	Intermediate	Slightly late	Late
Yield	High	Very high	High	High	Very high
Quality	Very good	Very good	Very good	Good	Very good
Cold injury	Severe	Fairly light	Light	Light	Fairly light
Pest injury	Weak	Strong	Weak	Strong	Slighly weak

品種活用の今後の展開 ②これからの品種に求められる形質は？

構造の変化に対応して

Keyword;

- ◎ グローバル化、
- ◎ 少子高齢化、
- ◎ サービス産業社会化、
- ◎ 自然健康志向化、
- ◎ 価値観・生活様式の多様化、
- ◎ 女性の社会進出化、
- ◎ 温暖化、
- ◎ 低炭素社会化、
- ◎ 自然循環機能重視化
- ◎ その他

需要ニーズに応えられる品種

- ★ 世界に通用する香味を持つ品種
- ★ 刺激の少ない低カフェイン品種
- ★ 機能性が強化された品種
- ★ 低コスト対応型超多収品種
- ★ 個性的な香味特性を持つ品種
- ★ 各種需要対応型（茶種、飲食品素材など）品種
- ★ 安定生産可能な品種
- ★ ストレス耐性品種
- ★ 少肥適応型品種
- ★ その他

Production Process of Matcha

Processing stages

Tea leaf cooling spreader

Tencha dryer ('Tencha-ro')

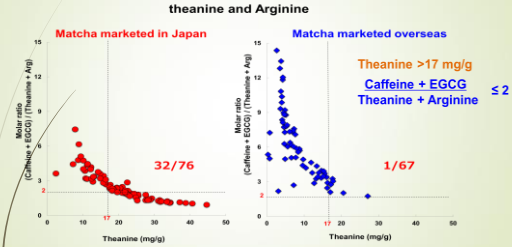
Grinding stages

Tea grinder (special stone mill designed for matcha grinding)

Stress-Reducing Effect of Matcha

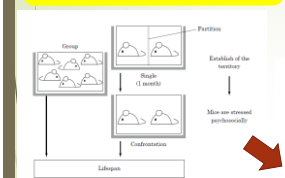
Matcha of poor quality has no Stress-reducing effect

The amount of theanine and the molar ratio of caffeine and EGCG to theanine and Arginine



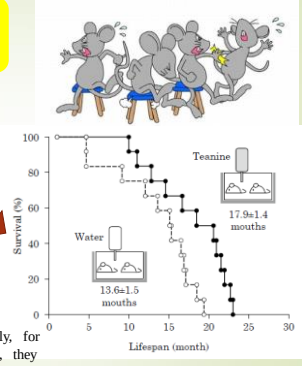
1.To predict mental function of each matcha, both the quantity of theanine and the ratios of caffeine, EGCG, and arginine against theanine need to be verified.
2.As a result of assessment of the stress-reducing effect of matcha, 42% of matcha samples marketed in Japan, and only one sample marketed abroad, were expected to have a stress-reducing effect.

Effect of Theanine on Psychosocial Stress



Group and confrontational housing

After the two mice were housed separately, for one month, in a cage with a partition, they were housed confrontationally by removing the partition. Generally, group housing mice have long lifespan more than the stressed mice.



Prolonged lifespan of mice by theanine intake