Welcome to Shizuoka
All about Japanese green tea

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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.

The University of Shizuoka's Aims

Aims

The University of Shizuoka has the following aims for education, research, contributing to the community and international relations.

Education

Putting students first, we will improve their quality of life and provide fine-tuned, high-level, excellent education, developing human resources who contribute to society.

Research

Aware of being the highest educational institution in Shizuoka Prefecture, we will gather high-level, original academics and promote research that gets international recognition.

Contributions to the Community

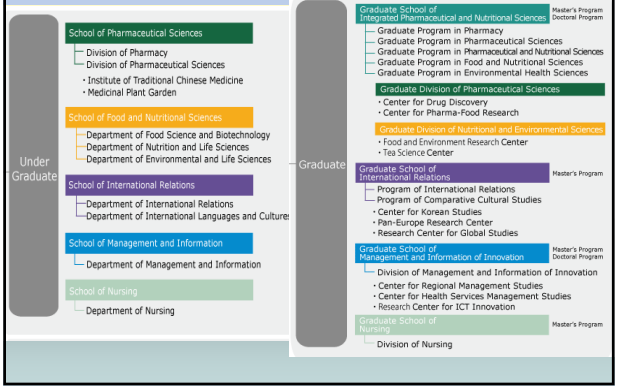
In response to citizen mandates, we will promote ties with the prefectural government and local industry, providing results to the community through research made possible by excellent education and academics.

International Exchange

We will actively take in students and researchers from foreign countries, and by spreading information across the world, strongly promote international relations in Shizuoka Prefecture.

The University of Shizuoka aims to utilize academic and personnel resources to their maximum levels in order to achieve these goals.

Organization of University of Shizuoka



Research activities

Education and research leading to longer, healthier lives

Japan now faces a crisis in the form of a globally unprecedented super-aged society. This has necessitated a nationwide shift to a society in which healthy living is maintained even during old age. Shizuoka Prefecture ranks second among Japan's prefectures for "healthy life expectancy". As an educational and research institution of Shizuoka Prefecture, the University aims to establish a new academic discipline that spans preventative and therapeutic fields.

The University of Shizuoka was selected for the Global Centers of Excellence Program administered by the Japanese Ministry of Education, Culture, Sports, Science and Technology. As a result, the Graduate School of Nutritional and Environmental Sciences and the Graduate School of Pharmaceutical Sciences are working collaboratively on the development of functional health foods and pharmaceuticals for maintenance of health, improving nutrition, and increasing usage rates of efficient pharmaceuticals. The goal of this endeavor is to develop the framework for a new "science of health and longevity," a systematic academic discipline that integrates the nutritional and pharmaceutical sciences.

After the achievements earned over a decade of the COE program, in 2012 the University brought together the Graduate School of Nutritional and Environmental Sciences and the Graduate School of Pharmaceutical Sciences to form the Graduate School of Integrated Pharmaceutical and Nutritional Sciences. This key institution for "science of health and longevity" is currently fostering professionals who possess knowledge in both of the aforementioned fields.

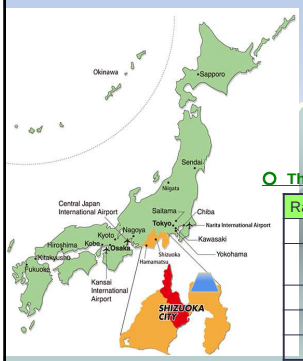
Research into tea

Agriculture and fisheries developed early on in Shizuoka as a result of its temperate climate and rich natural surroundings. Tea cultivation is particularly worth nothing in that crude tea grown in Shizuoka accounts for about 40 percent of all tea produced in japan. Refined tea also accounts for about 60 percent. In an effort to contribute to one of Shizuoka's best known industries, the University of Shizuoka continues to conduct a university-wide range of studies on tea, covering such topics as the functional properties of tea, its potential to slow aging and prevent illness, and topics such as sales strategies and product development.

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



O Geographical Information

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

O 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's Natural and Cultural Gallery of Landscapes

Total of 1,143 agriculture, forestry, and fisheries products

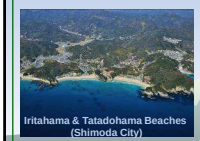
439 food items produced in Shizuoka

● Fujisan as a World Cultural Heritage (June 2013)

2

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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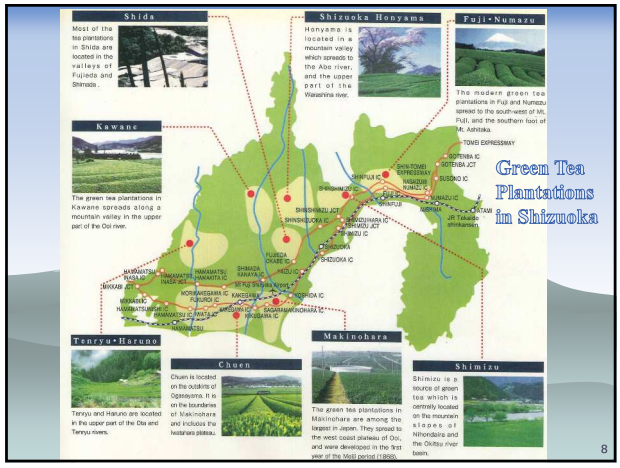

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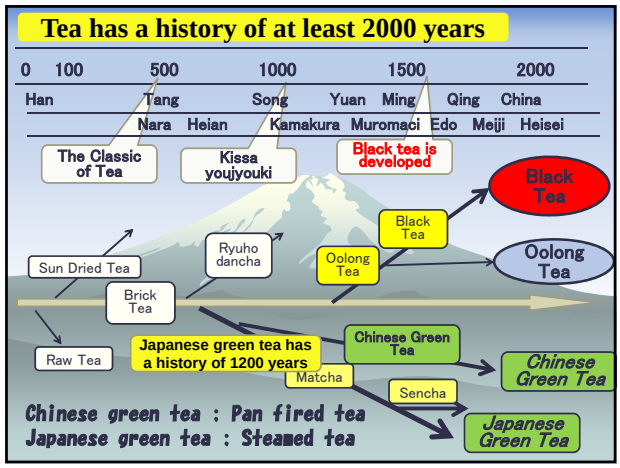
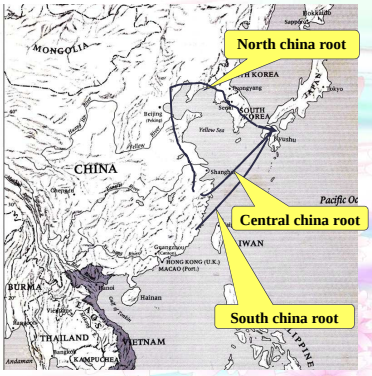
3. All about Japanese green tea

Tea has a history of at least 2000 years



The Introduction of Tea into Japan



North-china root

North china⇒ Korea⇒ Japan
Oldest root (about A.D.600)

Central china root

Introduction of the cake tea, powder tea (About A.D.1100)

South china root

Introduce of pour tea (About A.D.1600)

Changes of green tea production etc. in Japan

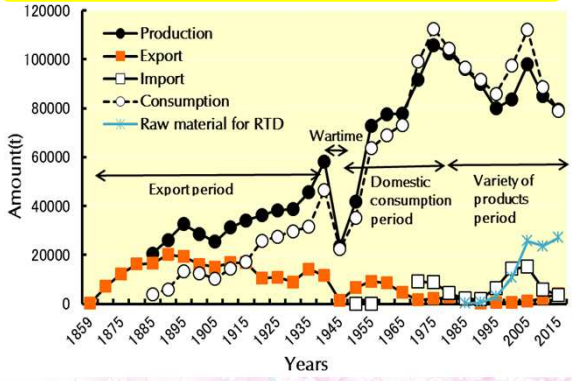
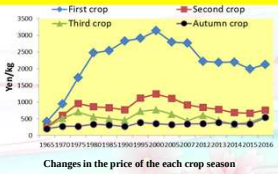


Figure 1: Changes of green tea production, export, import and consumption in Japan

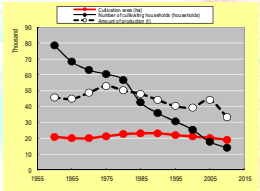
Changes in picking methods

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

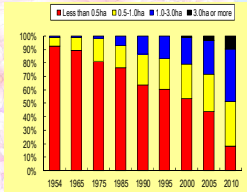
Drastic reduction of farmers and expansion of scale



Changes in the price of the each crop season



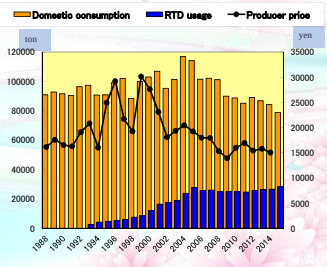
Changes in the number of households that cultivate tea in Shizuoka Prefecture



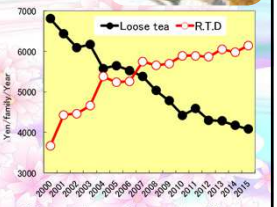
Changes in the number of households that cultivate tea in Shizuoka Prefecture

Present state of tea consumption in Japan

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



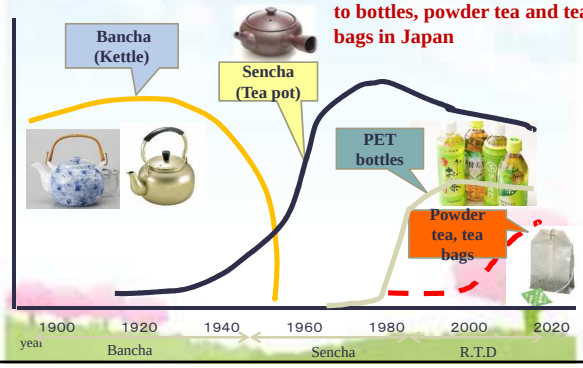
Changes in domestic consumption and producer price



Changes in purchase price of loose tea and RTD

Changes in tea to be drunk

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

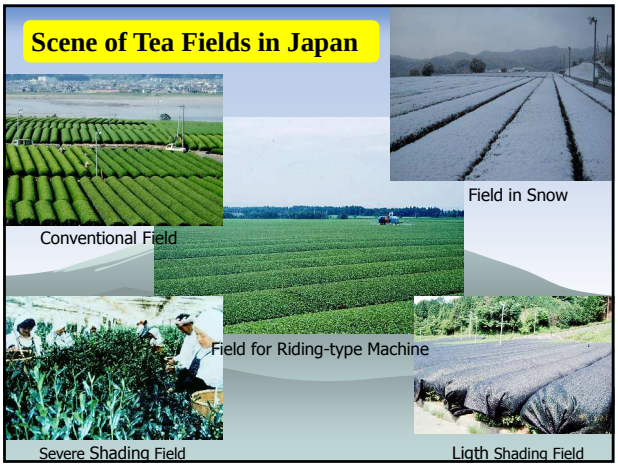


Japanese Green Tea Production

Area and production of tea (2014)

Prefecture	Area (ha)	Production (1000t)
Shizuoka	18,100	33,100
Kagoshima	8,670	24,600
Mie	3,110	6,770
Kumamoto	1,500	1,300
Kyoto	1,580	2,920
Fukuoka	1,560	2,160
Miyazaki	1,510	3,870
Saitama	899	560
Saga	891	1,350
Others	6,980	6,870
Total	44,800	83,500

Scene of Tea Fields in Japan



Main Tea Production Areas in Shizuoka

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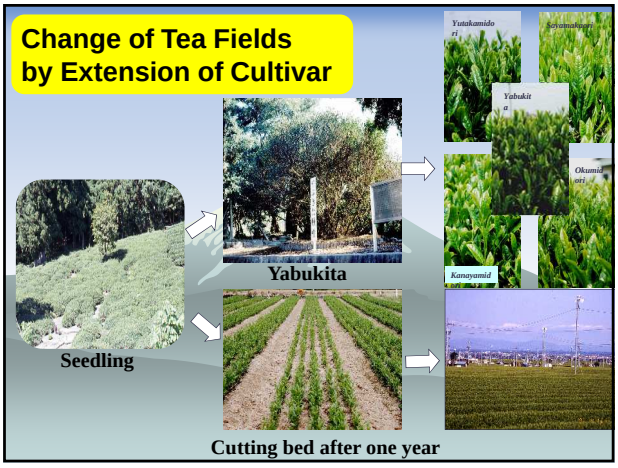
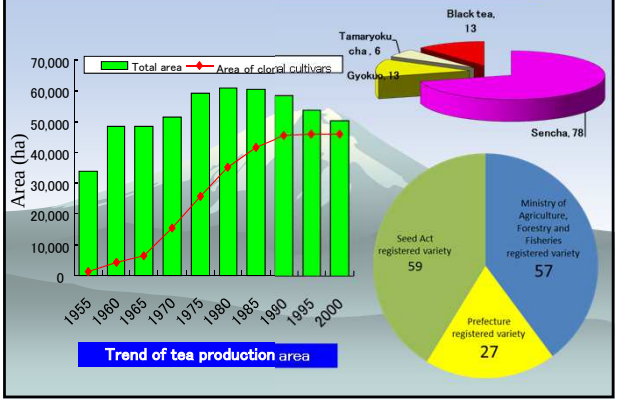
Change of Tea Fields by Extension of Cultivar



Trend of Japanese Green Tea Production Area with Superior Cultivars

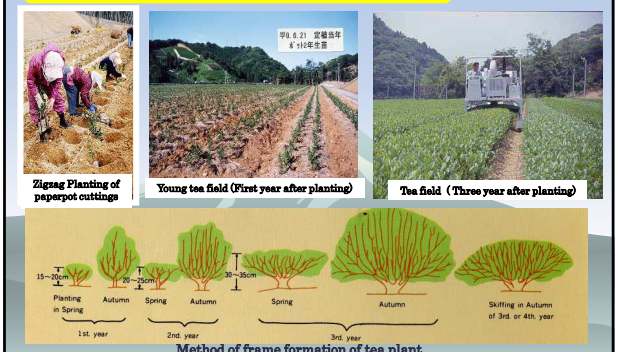
Spread of superior cultivars by cutting



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

Cultivation of Japanese Green Tea

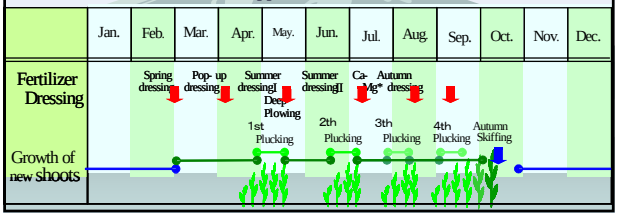


Method of frame formation of tea plant

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

Cultivation of Japanese Green Tea

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

Difference between the hand plucking and the mechanical plucking tea fields


Hand plucking

★A new shoot is chosen and it plucking
★The amount of plucked shoot is 10 -15kg/day
★Plucking method for high grade tea


Mechanical plucking

★All the new shoots are plucked in fixed height
★The amount of plucked shoot is 700 – 1000kg/day using portable machine for two person
★Plucking method for midle grade tea

Rail-tracking and riding-type plucking machine


Rale-tracking plucking machine


Harvest bag Type


Harvest small bag Type


Riding Container Type

Methods of Trimming and Pruning


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


Riding pruning machine


Tea field after pruning


Deep Trimming of Canopy

Frost Protection


Damaged shoot


Anti-frost fan


First crop injured by frost


Sprinkler

The Principle of Air Stirring Method (Anti-frost fan)

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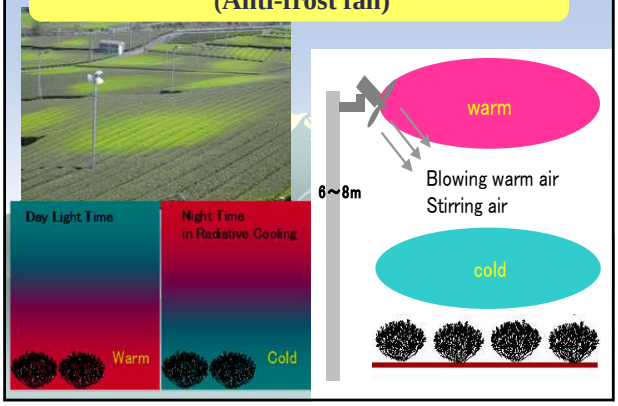

Covering Culture in Shizuoka

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Ceiling-shelf covering


Simple tunnel covering

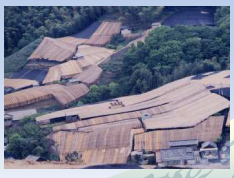

Direct covering

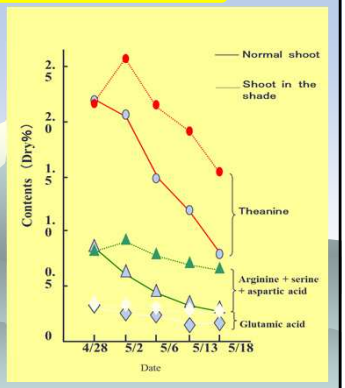
<Aim>
1. to protect the new shoots against frost
2. to prolong the plucking time
3. to produce high-grade tea

Culture of Gyokuro or Tencha

to produce high-grade tea, Gyokuro and Tencha, which are known as the finest tea in Japan, is made from the leaves grown under the ceiling-shelf covering.

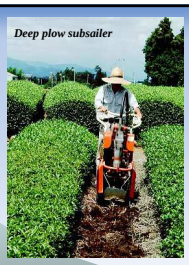
Umami increases by Covering Culture

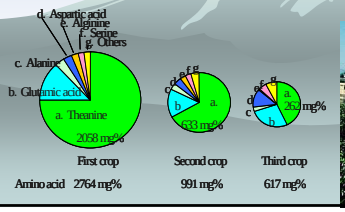




Fertilizer Application

Fertilizer	Nutrients (kg per hectare) Nitrogen (N)	Phosphate (P_2O_5)	Potassium (K_2O)
Spring dressing	100	90	130
Pop-up dressing	60		
Summer dressing Ⅰ	110		
Summer dressing Ⅱ	110		
Autumn dressing	160	90	140
Sum	540	180	270

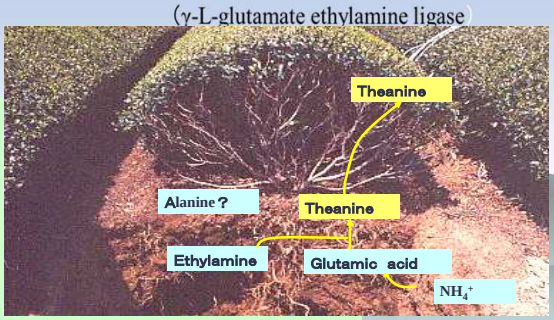




Biosynthesis of Theanine (Umami)

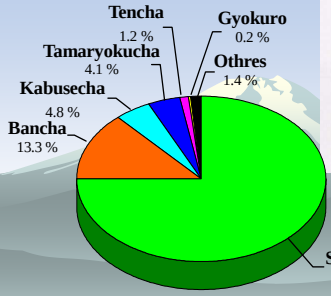
Glutamic acid + ethylamine + ATP $\xrightleftharpoons{Mg^{2+}}$ Theanine + ADP + Pi

(γ-L-glutamate ethylamine ligase)



Theanine is composed in the root, and shifts to a new shoot.

Production of Various Kinds of Japanese Green Tea



Production of various kinds of tea in Japan

The only steaming process in the world

The oxidizing enzymes contained in the fresh leaves are stopped by the steam-heat. By steaming the leaves it becomes the aroma and taste exceptional to Japanese tea.

Steaming is an important process in making of Japanese green tea

Japanese green tea is a sharp tea like a needle

Needle type tea can only be done by steaming

Different Kinds of Japanese Green Tea

Sencha
This is the most popular type of tea in Japan.

Gyokuro
This is the finest tea in Japan, and its taste is a tender sweet astringency and special flavor.

Tencha
This is ground in a stone mortar into Matcha (Powdered Tea) and used in a tea ceremony.

Different Kinds of Japanese Green Tea

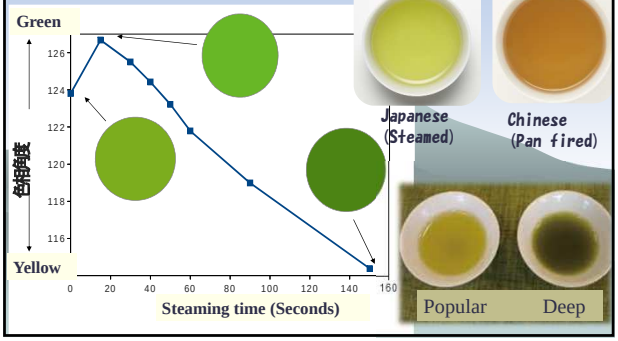
Bancha
This is lower grade of tea, made from mature leaves and stalks.

Hojicha
This is lower grade tea, made from Bancha by roasting at about 200℃ for a few minutes.

Genmaicha
This is Bancha, in which poprice and Genmai are added, having good flavor.

Japanese green tea infusion is green color

Color changes depending on steaming time



Difference in color between Japanese and Chinese green tea

Japanese green tea has a green note

Withering Oxidizationing

Steamed tea

Pan fired tea

Japanese green tea
Refreshing and greenish aroma

Chinese green tea
A little roasted aroma with floral and sweet note

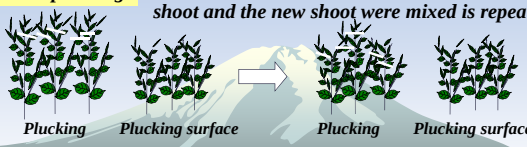
Oolong tea Black tea
Floral and fruity aroma

4. For mechanized plucking

Difference between the hand plucking and the mechanical plucking

Hand plucking

The plucking of the shoot in which the delayed shoot and the new shoot were mixed is repeated

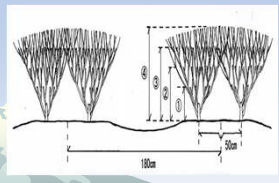


Mechanical plucking

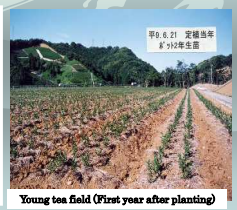
The plucking of the only new shoot by skiffing

To use a mechanical plucking machines

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



Zigzag Planting of paperpot cuttings



Young tea field (First year after planting)

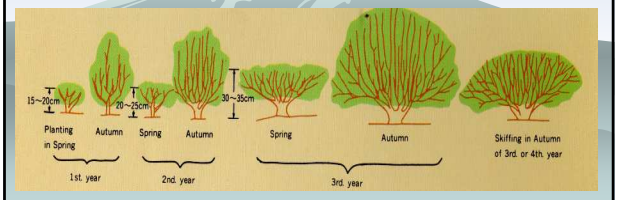
Tea field (Three year after planting)

The point of tea field for the use of plucking machine

- ☆*The plucking surface of tea is uniform*
- ☆*The growth of new shoot is uniform*

To make a tea field into the uniform

- ☆ *Thickness of branches are made uniform by the frame formation*
- ☆*The plucking surface of tea is united with a machine*



To Uniform Growth of New Shoots

The point for making a plucking surface of tea uniform

1)Thickness of the branch which constitutes leaf layer is made uniform.
2)The size of a leaf is made uniform.
3)The aging of stem (branch) is made uniform.
4)From the same position to a new shoot coming out.

The control by trimming and pruning

Position of Plucking Changes the Next Shoots

Rainy season → Recovery is early
Dry season → Recovery is slow

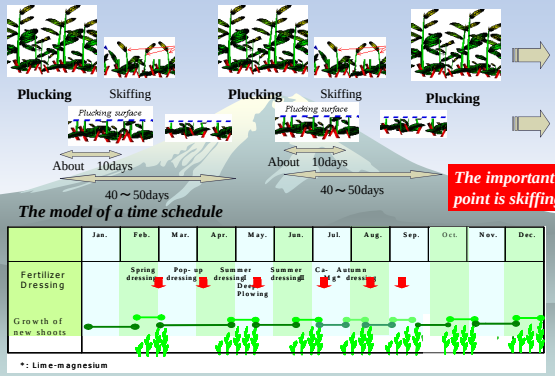
New shoot is big, however no. of shoot is few

New shoot is big, and no. of shoot is suitable

New shoot is small, and no. of shoot is many

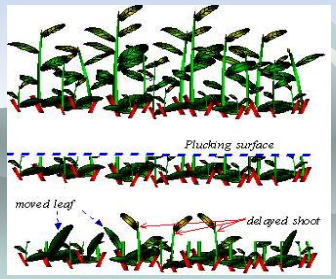
Big leaf → Big shoot
Big stem → Big shoot
Apical bud → Big shoot
First lateral bud → Big shoot
Axillary bud → Small shoot

Time schedule for mechanical plucking



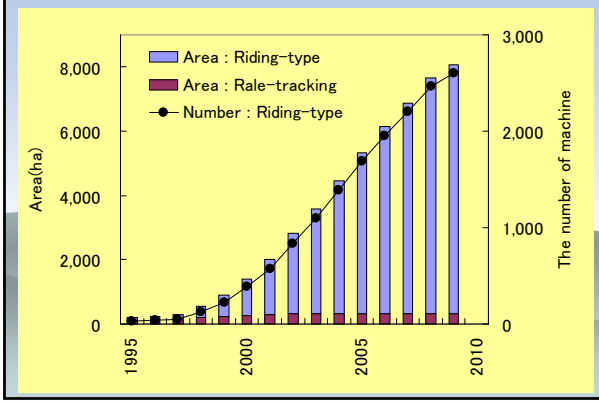
The role of skiffing

After the plucking, in order to uniform growth of the new shoot of the next plucking time, the surface of canopy is made uniform



Skiffing is done after every plucking to remove the delayed shoots and moved leaves to keep the surface uniform for mechanical plucking

The Use of Plucking Machines in Shizuoka



Riding-type Plucking Machine

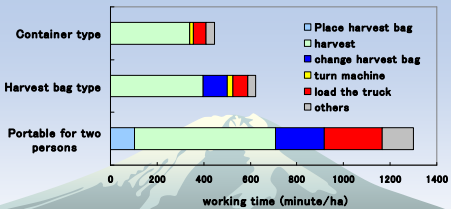

Container type


with **Container** for harvest
Large-capacity : Efficiently


Harvest bag Type

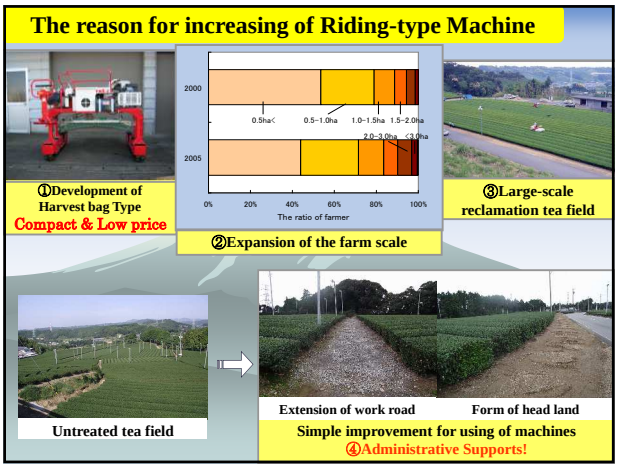

with **Harvest bag**
Compact : Light weight, turn in a small space, transport by small-scale truck
Low price relatively

Operating Efficiency of Riding-type Machine




Container type


Harvest bag Type


The reason for increasing of Riding-type Machine
①Development of Harvest bag Type
Compact & Low price
2000
2005
0.5ha<
0.5~1.0ha
1.0~1.5ha
1.5~2.0ha
2.0~3.0ha
<3.0ha
0%
20%
40%
60%
80%
100%
The ratio of farmer
②Expansion of the farm scale
③Large-scale reclamation tea field
Untreated tea field
Extension of work road
Form of head land
Simple improvement for using of machines
④Administrative Supports!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