農研機構
NARO 国立研究開発法人 農業・食品産業技術総合研究機構

Colors, elegance, relaxation, and health to your life through fruits and tea

NARO Institute of Fruit Tree and Tea Science (NIFTS)




Our mission is to bring a cultivar of fresh, tasty fruits and tea to your table and to support agricultural development and a bountiful food culture by creating new cultivars and technologies to realize efficient and stable production and distribution.

Creation of new cultivars

We are creating many new cultivars by crossbreeding.

Examples of cultivars developed by NIFTS

Apple cultivar 'Fuji'
One of the world's most widely grown apple cultivars, known for its good taste and storability

Citrus cultivars 'Kiyomi,' 'Setoka,' and 'Shiranuhi (Dekopon)'
'Kiyomi' is a first cultivated tangor (mandarin-orange hybrid) in Japan.
'Setoka' and 'Shiranuhi' (descendants of 'Kiyomi') whose growing area increasing due to their good taste.

Japanese pear cultivars 'Kosui,' 'Hosui,' and 'Akizuki'
'Kosui' and 'Hosui' account for approximately 65% of the pear-growing area in Japan. 'Akizuki' is popular for its juicy texture, and its cultivation has been increasing in recent years.

Tea cultivars 'Saemidori' and 'Benifuki'
'Saemidori' is a high-quality cultivar with an excellent savor.
'Benifuki' is suitable for full and semi fermentation. Green tea brewed from this cultivar contains anti-allergic substances.

Cultivars in recent years

Division of Fruit Breeding and Genetics

We have created a high sugar content, tasty, easy-to-grow, and high-yielding Japanese pear; an easy-to-peel tasty chestnut; a peach with stable quality that does not require fruit bagging; a large-fruit Japanese apricot with vivid red flesh and skin; and disease-resistant, high-quality cultivars of Japanese plum and apricot.

Japanese pear cultivar 'Kanta'
A high sugar content, high-yielding cultivar with soft texture

Chestnut cultivar 'Porotan'
An innovative Japanese chestnut cultivar with easy-to-peeled pellicles

Japanese apricot cultivar 'Tsuyuakane'
Suitable for making beautiful red umeshu (plum liqueur)

Peach cultivar 'Tsukiakari'
A tasty, yellow-flesh peach cultivar that does not require fruit bagging

Division of Citrus Research

We have bred citrus cultivars showing various harvesting schedules (from early- to late-ripening traits) with characteristics for facilitating both cultivation (e.g., disease resistance) and consumption (good taste, seedlessness, and ease of peeling)

Citrus cultivar 'Mihaya'
The vermillion skin cultivar with an early-ripening and high sugar content

Lemon cultivar 'Rinoka'
The mildly tart cultivar with a large-fruit and canker-resistance

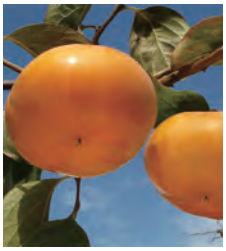
Mandarin cultivar 'Seinannohikari'
A tasty cultivar with high β-cryptoxanthin, a well-known functional substance

Division of Grape and Persimmon Research

We have developed grape and persimmon cultivars that are superior in quality, labor-saving, and resistant to pests and diseases.

Grape cultivar 'Shine Muscat'
A large-berry cultivar with a Muscat flavor and edible skin

Grape cultivar 'Queen Nina'
A large-berry cultivar with a foxy flavor and good pulp texture



Persimmon cultivar 'Taiten'
A large-fruit, tasty, late-ripening, and pollination variant astringent type persimmon

Division of Apple Research

We have developed high-quality apple cultivars with a long shelf life for fresh consumption and apple cultivars with red flesh for both fresh consumption and processing

Apple cultivar 'Morinokagayaki'
A juicy, very sweet, and aromatic cultivar

Apple cultivar 'Ruby Sweet'
A mildly tart, sweet cultivar with red flesh

Apple cultivar 'Rose Pearl'
A tart cultivar with pink flesh that is also suitable for processing

Division of Tea Research

We have developed diverse tea cultivars with traits including pest and disease resistance, high quality and yield, and health-benefit components with the goals of expanding consumption, protecting the environment, and stimulating demand

Tea cultivar 'Sofu'
A cultivar with jasmine-like scent that contains high levels of quercetin glycosides, which have known health benefits

Tea cultivar 'Saeakari'
A high-yielding, easy-to-grow cultivar that retains high quality in the first and second harvest

Tea cultivar 'Sunrouge'
A cultivar rich in anthocyanin, which is expected to reduce fatigue

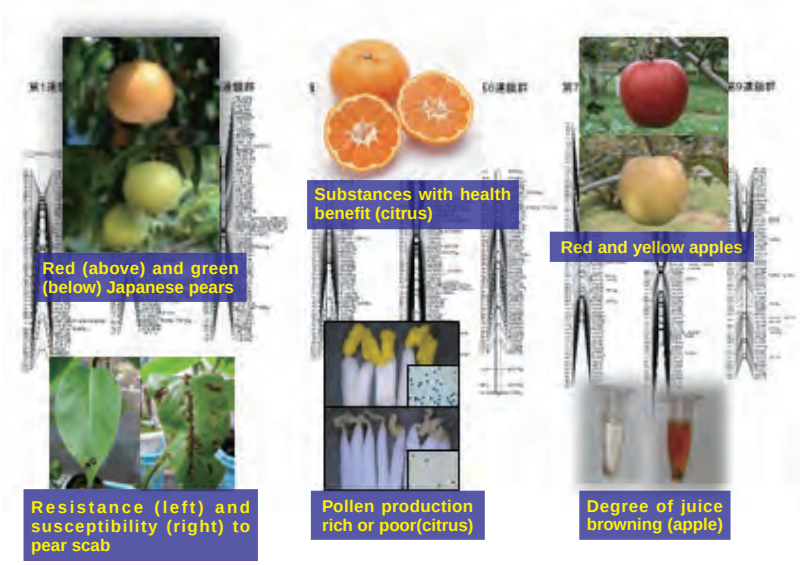
Tea cultivar 'Nanmei'
A cultivar with multiple resistance to white peach scale, gray blight, and anthracnose

Use of genetic information and genetic resources

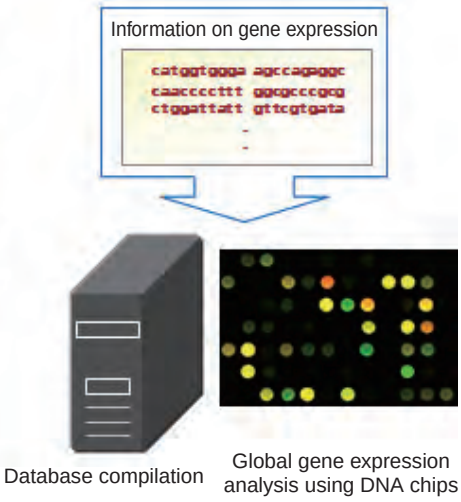
We are developing efficient breeding techniques by using information from genetic analyses and genetic resources introduced from abroad. We have also identified genes for pest and disease resistance, which are used in breeding new cultivars.

Analysis and use of genetic information to increase the efficiency of fruit breeding

Construction of linkage maps and development of DNA markers linked to beneficial traits

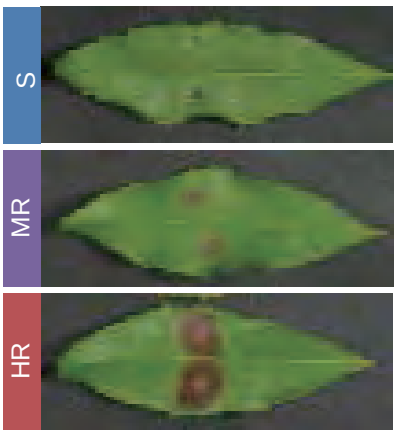


Collection of genes expressed in citrus, Japanese pear etc., and their compilation into a genetic database



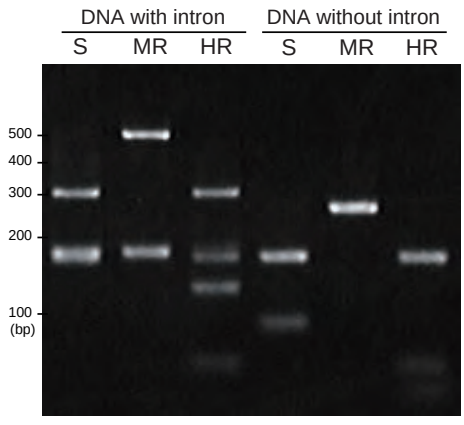
Upgrading of cultivation management system based on genetic information

There are two types of the QoI fungicides-resistance in tea gray blight fungus: high resistance (HR) and moderate resistance (MR).



Responses of gray blight to QoI fungicide

Development of genetic diagnosis technology for detection of QoI resistant fungi/bacteria based on multiplex polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) analysis



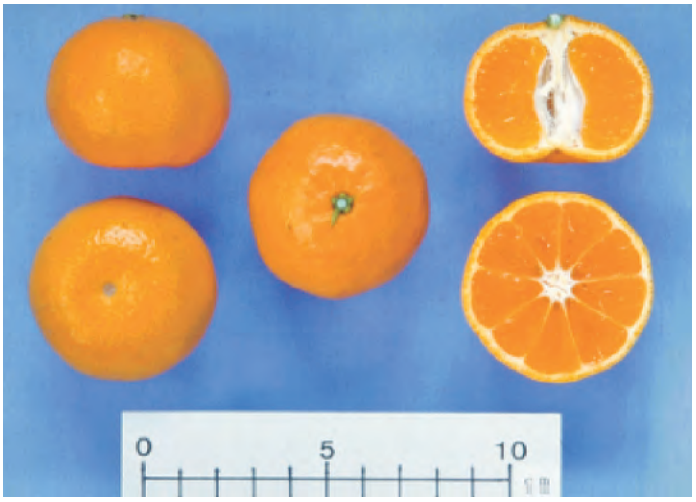
Genetic diagnosis of QoI-resistant strains

HR: highly resistant; MR: moderately resistant; S: susceptible

Collection, preservation, and use of genetic resources in fruit breeding

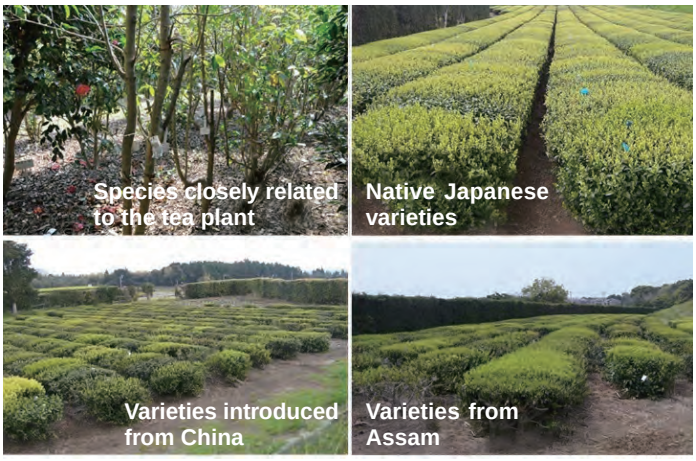
Exploration of fruit genetic resources on the island Hachijō-jima

Citrus parental line Norin No. 5, a breeding material developed using female sterile trait derived from 'Mukaku Kishu'



Survey of tea genetic resources in Vietnam

Field gene bank for tea



We evaluate the diversity of genetic resources in wild fruit species, including many endangered species, and also study rare fruit species grown as regional specialties.

Berries of the wild Japanese grape *Kumagawa budou* (*Vitis kiusiana* Momiyama)
A rare wild grapevine species (a Class IA endangered species) distributed in southern Kyushu of Japan

Fruit of natsume (*Zizyphus jujuba*)

Creation of tasty, health-promoting fruit and tea cultivars

Our research and development activities cover a wide range of areas to provide the market with high-quality fruits and tea. Our efforts include the development of farm management technologies to reduce and lighten work load, technologies to preserve product freshness, and investigation and evaluation of health-benefit substances.

Improvement of efficiency; labor-saving

The use of dwarf rootstocks to reduce tree size to decrease labor requirements in orchard management.

Persimmon trees grafted on dwarf rootstock (right)

'New Jonagold' apple trees grafted on JM7

Labor-saving for grape flower thinning

Grape flower clusters trimmer tool

Post-harvest quality management for added value and long shelf life

Tea dispenser optimized for efficient extraction from tea leaves of catechin and other health-benefit substances

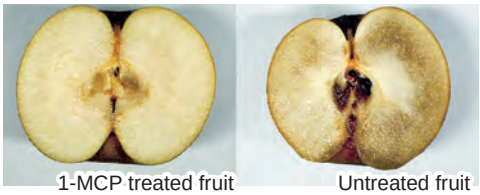
	Cultivar		
	'Benifuki'	'Saemidori'	'Yutakamidori'
Dry leaf weight (g)	1.9	1.7	1.5
Water temperature (ºC)	94	65	10
Stirring time (s)	20	20	30
Amount per cup (mg/120 mL)			
Caffeine	46	47	15
Total catechin	205	116	67
methylated epigallocatechin gallate (EGCG3"Me)	15.4	0.2	0.4
methylated epicatechin gallate (ECG3"Me)	3.2	0.4	0.2
theanine	1.9	20.4	4.2
epigallocatechin (EGC)	54.4	41.5	39.1
epigallocatechin gallate (EGCG)	92.6	52.5	15.7
EGC/EGCG	0.6	0.8	2.5

'Benifuki': Green tea brewed from leaves of the third harvest in Kagoshima;
'Saemidori': Green tea brewed from leaves of the second harvest in Kagoshima;
'Yutakamidori': Green tea brewed from leaves of the third harvest in Kagoshima;
The amount of each component per cup (120 mL) is the mean of three brews extracted using RICH+.

RICH+
(https://www.jstage.jst.go.jp/article/nskkk/61/12/61_586/_pdf)

Proposal of a new consumption style based on enzymatic peeling of citrus fruit, persimmon, and other fruits

Development of an effective treatment with a freshness keeping agent (1-methylcyclopropene, 1-MCP) to keep fruit fresh



1-MCP treated fruit　　Untreated fruit

Shelf life of Japanese pear (2 weeks at 25ºC)

Investigation of health benefits

We have found that the serum β-cryptoxanthin level increases extremely according to an increase of Japanese mandarin intake. Our longitudinal cohort study among middle-aged and older Japanese subjects showed that the risk of developing type 2 diabetes, liver disease, osteoporosis, dyslipidemia, arteriosclerosis was inversely associated with the baseline serum β-cryptoxanthin concentration. We are conducting research that will contribute to increase Japanese mandarin consumption and health promotion.

Citrus cultivars containing high levels of β-cryptoxanthin

'Mihaya'

'Seinannohikari'

Citrus parental line 'Norin No. 6'

Liver dysfunction

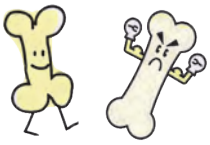
Results of an epidemiologic study conducted in citrus-growing regions

Beta-Cryptoxanthin rich in satsuma mandarin has the potential to reduce the risk of lifestyle diseases

Arteriosclerosis

Oxidative stress due to smoking and drinking

Insulin resistance



Decrease bone mineral density

Metabolic syndrome

Various risk factors associated with lifestyle diseases

We demonstrated that two tea cultivars, 'Sofu' and 'Saemidori,' contain higher levels of quercetin glycosides than the leading cultivar, 'Yabukita.' In recent years, quercetin, a member of the flavonoid family, has been shown to be a potent antioxidant and to offer various health benefits (prevention of arteriosclerosis, obesity, and inflammation).

Tea cultivars containing high levels of quercetin

'Sofu'

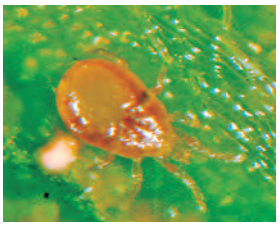
'Saemidori'

Crop protection

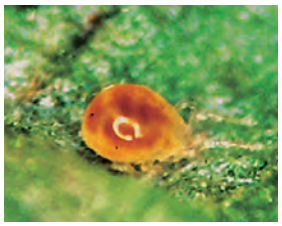
We have improved the integrated pest management system to ensure stable fruit and tea production. We have developed classification and identification methods for key and exotic pests. We are also developing environment-friendly crop protection technologies using biological agents such as natural enemies, hot water, and pheromones.

Environment-friendly pest control methods with the use of indigenous natural enemies and pheromone traps

Biological control of serious fruit pests, using indigenous natural enemies, such as predatory mites *N. californicus* against citrus red mites and *G. liturivorus* against thrips pest



Predatory mites, *Neoseiulus californicus* (McGregor)



Thrips predator, *Gynaeseius liturivorus* (Ehara)

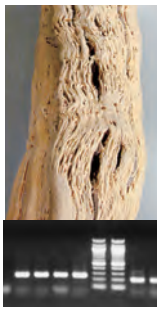
Accurate monitoring using pheromone traps leads us to control stinkbugs efficiently

Brown-winged green bug *Plautia crossota stali* (Scott)

Pheromone trap

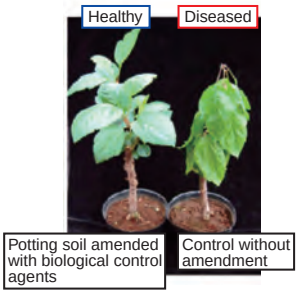
Rapid diagnosis of pathogens

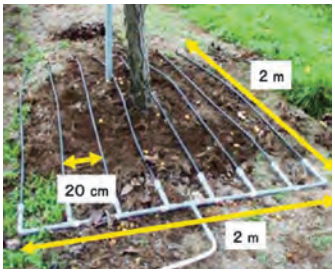
A diagnostic kit to detect the satsuma dwarf virus (left) and a technique to detect viruses from grapevine (right)



Management and treatment of difficult-to-control diseases

Use of biological control agents (left) and hot-water treatment (right) to control white root rot disease, which causes the eventual death of fruit trees including Japanese pear and apple.





Protection of domestic fruit trees from new pests and diseases

We are committed to the development of techniques for rapid diagnosis of new pests and diseases invaded from abroad and techniques to control pests and diseases that are spreading in response to environmental changes.

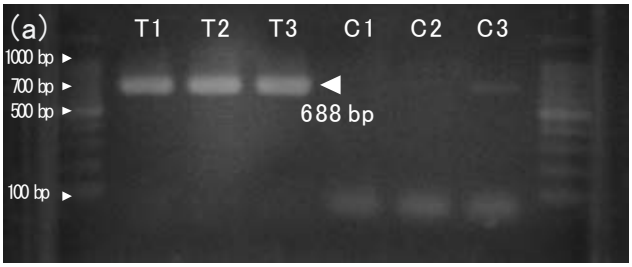
Symptoms of kiwifruit bacterial canker: spots on an infected leaf (left) and exudate from twigs (right).

An adult (left) and a larva feeding on fruit pulp (right) of Japanese orange fly. The expansion of their distribution is concerned as the poorly controlled citrus groves increase.

Integrated pest management strategy of new invasive tea pest

We clarified the ecology and lifecycle of tea spiny whitefly, a new invasive tea pest, and established an integrated management system depending on the pest invasion stage

Tea spiny whiteflies swarming on a new tea shoot



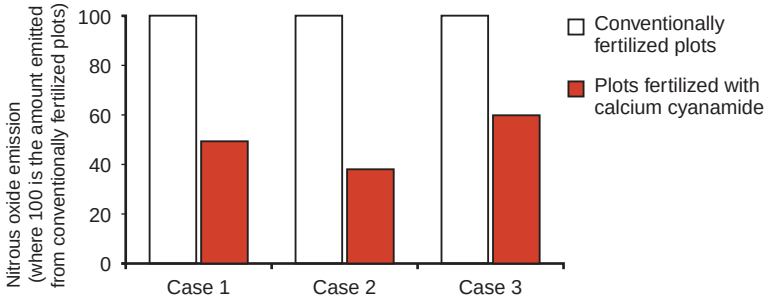
Tea spiny whitefly can be distinguished from the closely related orange spiny whitefly by using species-specific primers. This technique is used in invasion monitoring.

Countermeasures to global warming

We evaluate and predict the effects of global warming on fruit and tea production. We are also developing technologies to adapt the effects and to reduce the generation of greenhouse gases.

Reduction of greenhouse gas emission

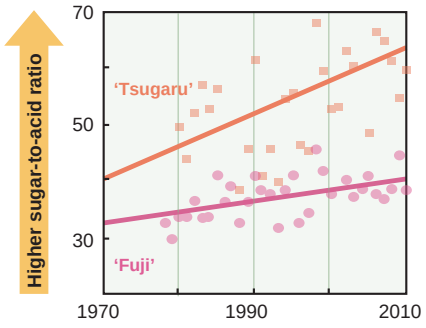
We have developed a technique to reduce nitrous oxide (greenhouse gas) emission from the soil between rows of tea plants by 40% to 60% by replacing the part of annual nitrogen fertilizer input in tea fields with calcium cyanamide.



Reduction of nitrous oxide generation by substitution with calcium cyanamide

Evaluation of the effects of global warming and development of countermeasures

We have shown that apple sweetness increases as global warming progresses due to the reduction of acid levels in apple fruit.



Changes in the sugar-to-acid ratio of apple fruit due to global warming

We have developed a technique to prevent dead flower buds in Japanese pear, a problem that frequently occurs in warm winters.

Dead flower bud on Japanese pear trees

Efficient progress of researches and rapid spread of the productions

We organize a variety of research conferences, symposia, workshops, and seminars to facilitate communication among researchers and to share our achievements with growers, processors, distributors, and consumers in a timely manner. We also publish technical manuals and other references and provide information on our website for public access.

Growers, processors, distributors, wholesalers, and retailers are introduced to new cultivars in 'Fruit Seminar'

A NARO Symposium

Examples of cultivar catalogs, technical manuals, and brochures in which our research achievements are introduced.

History

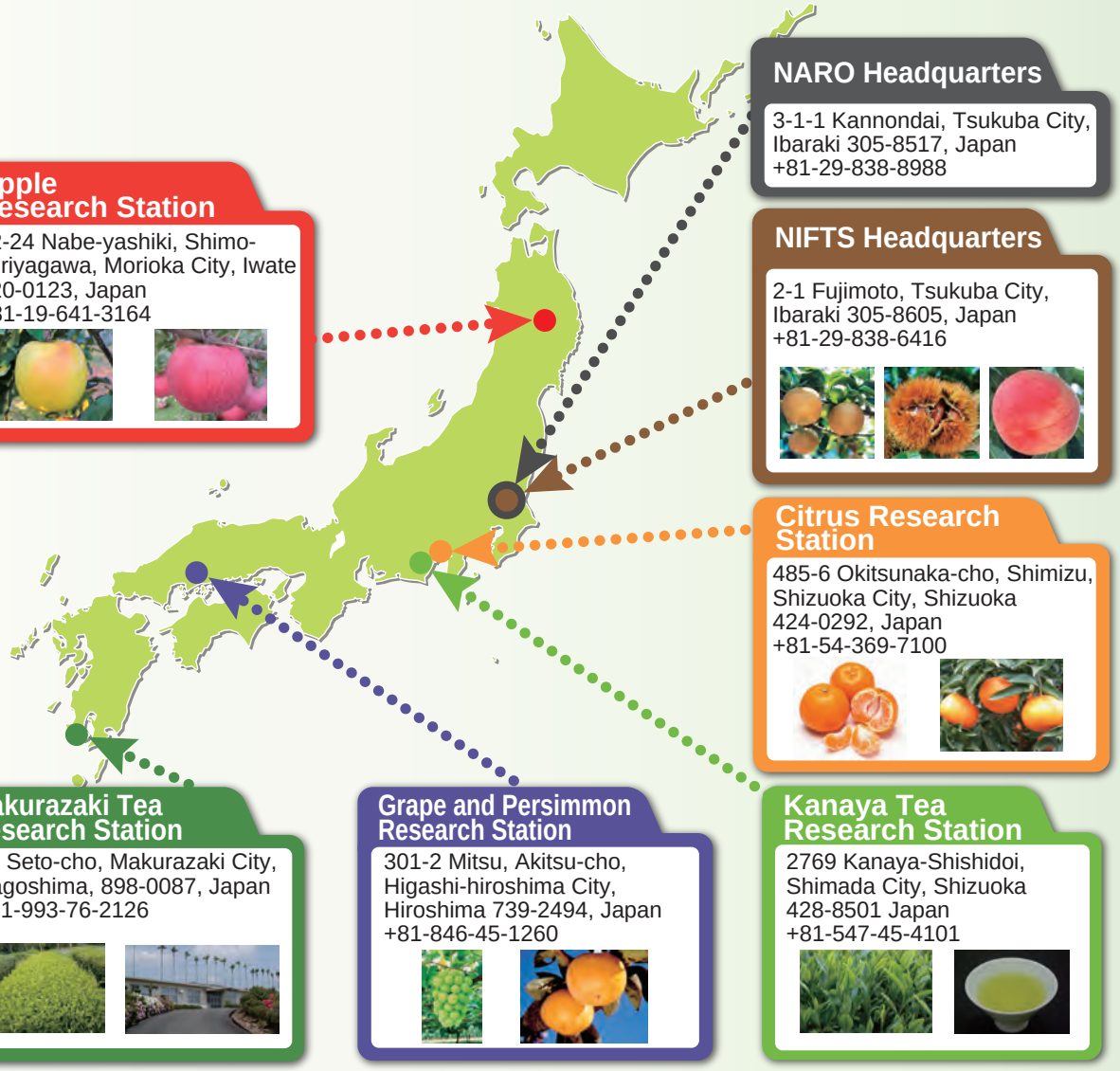
History

	-History of Fruit Tree Research-		-History of Tea Research -
1902	The Horticultural Division of the Agricultural Research Station was established as an agency of the Ministry of Agriculture and Commerce (MAC) in Okitsu Town (a sector of present-day Shizuoka City), Ihara District, Shizuoka Prefecture.	1896	The Tea Research Station was established as an agency of the Ministry of Agriculture and Commerce (MAC) in Nishigahara (a sector of present-day Kita Ward), Tokyo Prefecture.
1906	The Apprentice System was started (succeeded by the Agricultural Technical Training System in 1959)	1905	Reorganized as the Tea Division of the Agricultural Research Station under MAC.
1921	Reestablished as the Horticultural Research Station under MAC.	1919	Reorganized as the Tea Research Station under MAC and relocated to Kanaya Town, Haibara District, Shizuoka Prefecture.
1947	Relocated to Ono Town (a sector of present-day Hiratsuka City), Naka District, Kanagawa Prefecture.	1920	The Tea Industry Trainee System was started (succeeded by the Agricultural Technical Training System in 1959)
1950	Reorganized as the Horticultural Division of the National Institute of Agricultural Sciences under the Ministry of Agriculture and Forestry (MAF)	1950	Reorganized as the Tea Division of the Tokai-Kinki Agricultural Experiment Station under the Ministry of Agriculture and Forestry (MAF).
1961	Reorganized as the Horticultural Experiment Station under MAF	1961	Reorganized as the Tea Research Station under MAF.
1973	The Fruit Tree Research Station (under MAF) was established after separation from the vegetable and floriculture divisions.		
1977	Relocated to Yatabe Town (a sector of present-day Tsukuba City), Tsukuba District, Ibaraki Prefecture.	1986	Integrated with the Vegetable and Ornamental Crops Research Station into the National Research Institute of Vegetables, Ornamental Plants and Tea under MAFF.
2001	Establishment of the National Institute of Fruit Tree Science (NIFTS) as one of the Institute of National Agricultural Research Organization (NARO) independent administrative institution.	2001	Transition to the National Institute of Vegetable and Tea Science (NIVTS) of the National Agricultural Research Organization (NARO) independent administrative institution.
2006	NARO was renamed the National Agriculture and Food Research Organization.	2006	NARO was renamed as the National Agriculture and Food Research Organization.
2016	Reorganized as the Institute of Fruit Tree and Tea Science of NARO (NIFTS).		

Research Divisions

- Division of Fruit Breeding and Genetics (Tsukuba)
  - Pear and Chestnut Breeding Unit
  - Stone Fruit Breeding Unit
  - Genome Research Unit
  - Fruit Genetic Resources Research Unit
- Division of Fruit Production and Postharvest Science (Tsukuba)
  - Cultivation and Physiology Unit
  - Meteorology and Soil Unit
  - Postharvest Physiology and Health Benefits Unit
  - Plant Pathology Unit
  - Entomology Unit
- Division of Citrus Research (Okitsu)
  - Breeding Unit
  - Genome Research Unit
  - Cultivation and Physiology Unit
  - Postharvest Physiology and Health Benefits Unit
  - Pest Management Unit
- Division of Apple Research (Morioka)
  - Breeding Unit
  - Cultivation and Physiology Unit
  - Pest Management Unit
- Division of Grape and Persimmon Research (Akitsu)
  - Breeding Unit
  - Cultivation and Physiology Unit
  - Pest Management Unit
- Division of Tea Research
  - Tea Breeding Unit (Makurazaki)
  - Tea Cultivation Unit (Kanaya)
  - Tea Chemistry and Health Benefits Unit (Kanaya)
  - Tea Manufacturing and Soil Management Unit (Kanaya)
  - Tea Pest Management Unit (Kanaya)

Contact information National Agriculture and Food Research Organization (NARO) headquarters and Institute of Fruit Tree and Tea Science (NIFTS)



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