Bulletin of Kyusyu Regional Breeding Office





Kyushu Regional Breeding Office, Forest Tree Breeding Center, Forestry and Forest Products Research Institute

The activities of the Kyushu Regional Breeding Office

Trees planted in a forest require many years for growth under severe, natural conditions. To create an ecologically diverse forest, it is important to select genetically superior seeds and seedlings for adapting to harsh natural environment.

To develop and conserve superior seeds and seedlings, the Kyushu Regional Breeding Office, Forest Tree Breeding Center, Forestry and Forest Products Research Institute (affiliated with the National Research and Development Agency) is engaged in the following activities in the Kyushu Breeding Region:

- (1) Developing superior varieties for growth, wood quality and resistance against damages;
- (2) Extension of superior varieties;
- (3) Collection, conservation, and evaluation of tree genetic resources.

Breeding zones

In Japan, the climate and distribution of tree species vary by location. To implement forest tree breeding reflecting the unique characteristics of trees in different geographical regions, there are five breeding zones in Japan. Based on a close working relationship with prefectural and other government related agencies, efforts are being made to develop new varieties suitable for different environments in various regions of Japan.



① Developing superior varieties

(Development of superior varieties with excellent growth)

The project in the Kyushu Breeding Region, which was established in 1957 for the selection and breeding of superior trees, has selected 1,290 plus tree individuals including Japanese cedar and cypress based on data of superior growth and other characteristics. Approximately 345 geographic areas (total: approximately 428 ha) have been established as "progeny test sites" by which it verifies that these trees should possess the desired genetic characteristics.

Number of plus trees selected in the Kyushu Breeding Region						
Cedar (<i>Cyptomeria Japonica</i>)	Cypress (<i>Chamae</i> -cyparis obtusa)	Red Pine (<i>Pinus</i> densiflora)	Black Pine (<i>Pinus</i> thunbergii)	Ryukyu Pine (<i>Pinus</i> <i>luchuensis</i>)	Other spp.	Total
633	188	113	214	95	47	1, 290

Progeny test sites are periodically assessed for the growth, curvature, quality of wood and other characteristics and the analytic results are published in a "characteristics table of plus trees".

<Selection of the next generation>

Artificial crossing between superior varieties of plus trees is made and evaluation of the varieties of seedlings from the selected varieties is implemented (clone validation). Based on superior growth characteristics, the second generation plus tree is selected.

As of the end of 2016, 156 varieties of cedar and 98 varieties of cypress have been designated as the second generation plus tree or "Elite Tree".



① Developing superior varieties

[Less-pollen Japanese cedar and cypress varieties]

The allergy associated with pollen of Japanese cedar and cypress has become an increasingly important socio-medical issue in Japan. In collaboration with 7 prefectures, the Kyushu Regional Breeding Office has developed 39 cedar varieties (total in Japan: 156 varieties) and 17 cypress varieties (total in Japan: 55 varieties) that produce less pollen.

Prefecture	Cedar				Cypress		
Fukuoka	Ukiha4	Ukiha5	Yame10	Tagawa3	Ukiha14	Onga1	
g	Saga3	Fujitsu14	Fujitsu25	Karatsu5	Fujitsu3	Fujitsu4	Karatsu1
Daga	Karatsu6	Karatsu7	Karatsu8	Kishima1			
Nagasaki	Minamitakaki12	Nagasaki1			Minamitakaki2	Minamitakaki10	
Kumamoto	Aso1	Aso2			Aso3	Aso6	Aso11
0.1	Saiki6	Saiki13	Taketa5	Hita20	Nakatsu10		
Olta	Hiji3						
Miyazaki	Higashiusuki5	Higashiusuki8	Higashiusuki12	Higashiusuki15	Higashiusuki3	Kitamorokata2	
	Nishiusuki3	Takaokasyo1	Ayasyo1	Ayasyo2			
	Nichinan2	Nichinan3	Kakutosyo1	Kakutosyo10			
Kahoshima	Kagoshima1	Kagoshima3	Aira20	Kimotsuki3	Aira4	Aira21	Aira29
	Satsuma5	Satsuma14			Aira45		



<Development of pollen free cedar varieties suitable for the Kyushu Breeding Region>

The Kyushu Regional Breeding Office conducts artificial crossing between plus trees native to Kyusyu area and a pollen free variety developed in Forest Tree Breeding Center to create pollen free cedar variety with superior growth and lumber quality suitable for the Kyushu area.

Note: As the non-pollen producing gene is recessive, the non-pollen cedar tree of F2 (second filial generation) is produced by crossing F1 (first filial generation) cedar trees which have non-pollen gene.

① Developing superior varieties

(Pine wilt nematode-resistant varieties)

Forest damage due to the pine wilt nematode is spreading throughout Japan expect Hokkaido. The Kyushu Regional Breeding Office developed 120 resistant varieties (total in Japan: 429 varieties) that are resistant to the disease by 2016.

The Kyushu Regional Breeding Office has developed 30 second generation resistant varieties through controlled crossing experiments between resistant varieties considered to have superior resistance. More resistant varieties will be developed by the Kyushu Regional Breeding Office in the medium-term.





Longhorn beetle vector



(0.6 - 1.0 mm in length)

Pine wilt nematodes invade the xylem tissue of pine tree through damage caused to young needles by longhorn beetles. The nematodes propagated in this way cause pine wilt in a short space of time.



<Promoting the use of tolerant varieties against pine will nematode>

In creating a second generation of more tolerant varieties against pine wilt nematode, an evaluation of flowering characteristics as well as the tolerance of the seedling will be undertaken, followed by public release of the results.

Furthermore, in order to maximize the pine wilt tolerance of the seedlings produced in the seed orchard, consideration is given to selection of trees and placement of trees within the seed orchard considering the flower season.



Clonal seed orchard of Pine wilt nematode-resistant varieties

Developing superior varieties 1

(Pine wilt nematode-resistant varieties) First generation resistant varieties

Tree species	Black pine			Red pine					
Prefecture	Name of varieties		ies	Development year	Name of varieties		es	Development year	
	Shima64	Tsuyazaki50		1985	Dazaifu4	Kurume18	Kurume29		
Fukuoka	Okagaki1	0kagaki5	Okagaki6		Kurume78	Kurume79	Kurume118	1985	
	Okagaki8	0kagaki25	0kagaki29		Kurume142	Kurume144			
	Okagaki31	0kagaki32	0kagaki35	2006					
	Munakata2	Munakata4	Munakata12						
	Munakata19	Shingu2	Shingu5						
	Shingu11	Shingu14	Shingu17						
	Fukuoka (Okagaki) 20			2010					
	Karatsu1	Karatsu4	Karatsu7		Arita49	Tara122		1985	
Saga	Karatsu9	Karatsu11	Karatsu16	2003					
	Karatsu17								
Nereeki	0bama30	Oseto12		1985	Kunimi17	Kunimi31	Kunimi53	1005	
Nagasaki					Obama24			1985	
Kumomoto	Kawaura8	Kawaura13	Amakusa20	2003	Kumamoto16	Kumamoto63	Hondo1	1005	
	Kumamoto (Minamata) 5			2015	Matsushima58	Matsushima70	Ariake7	1985	
	0ita8			1985	0ita111	0ita137	Oita142		
					Oita166	0ita167	Oita168		
					Oita173	0ita186	Oita198		
Oita					Oita203	0ita204	Oita269	1985	
					Saganoseki84	Saganoseki90	Saganoseki93		
					Saganoseki108	Saganoseki113	Saganoseki117		
					Saganoseki118	Saganoseki126	Saganoseki132		
					Saganoseki134	Saganoseki162	Saganoseki165		
					Saganoseki170				
Miyazaki	Sadowara8	Sadowara14	Sadowara15	0000	Nobeoka219			1985	
	Miyazaki20			2003					
Kagoshima	Senda i 290	Ei 425		1985					
	Hiyoshi1	Hiyoshi5	Fukiage25	2003					

Second generation resistant varieties

Tree species	Black pine						
Prefecture		Name of	varieties		Development year		
	Kumamoto (Goshi) 1	Kumamoto (Goshi) 2			2010		
	Kumamoto (Goshi) 3	Kumamoto (Goshi) 4	Kumamoto (Goshi) 5	Kumamoto (Goshi) 6	0010		
	Kumamoto (Goshi) 7	2012					
	Kumamoto (Goshi) 8	Kumamoto (Goshi) 9	Kumamoto (Goshi) 10	Kumamoto (Goshi) 11			
Kyushu RBO	Kumamoto (Goshi) 12	Kumamoto (Goshi) 13	Kumamoto (Goshi) 14	Kumamoto (Goshi) 15	2015		
	Kumamoto (Goshi) 16	Kumamoto (Goshi) 17	Kumamoto (Goshi) 18				
	Kumamoto (Goshi) 19	Kumamoto (Goshi) 20	Kumamoto (Goshi) 21	Kumamoto (Goshi) 22			
	Kumamoto (Goshi) 23	Kumamoto (Goshi) 24	Kumamoto (Goshi) 25	Kumamoto (Goshi) 26	2016		
	Kumamoto (Goshi) 27	Kumamoto (Goshi) 28	Kumamoto (Goshi) 29	Kumamoto (Goshi) 30			

② Extension of superior varieties

Superior varieties developed by the Kyushu Regional Breeding Office can be propagated from cuttings and grafts. Seedlings and scions will be made available to prefectures or prefecture-authorized propagation companies (that authorize "Specified Mother Tree").

What is a "Specified Mother Tree"?

- This labeling is applicable to those trees that have been designated by the Minister of Agriculture, Forestry and Fisheries based on the criteria of superior growth and male flower production reduced by one half or lower. This became law with the 2013 amendment of the Act on Special Measures concerning Advancement of Implementation of Forest Thinning, etc.
- To promote extension of the specified mother tree, private enterprises (authorized by the prefecture to propagate Specified Mother Trees) were designated as producers of seedlings from foundation stock whose seedlings were distributed from the Forest Tree Breeding Center.
- •As of the end of 2016, the Kyushu Breeding Region had 31 cedar trees and 1 cypress tree designated as "Specified Mother Trees"

At the Kyushu Regional Breeding Office, Elite Trees that are candidates for "Specified Mother Trees" are evaluated in the light of male flowering production, etc. Concurrently, preparation is undertaken for filing an application in cooperation with each prefecture.

Strengthening the supply system for "Specified Mother Trees"

• To increase the supply of seedlings, the Kyushu Regional Breeding Office has created seed orchards and scion gardens where "Specified Mother Trees" and Elite Trees that would be candidates of Specified Mother Trees are planted.

• To increase earlier scion harvesting and efficient seedling production, studies on earlier trunk cutting and rooting facilitation have been started.



Scion garden of Cedar Specified Mother



Studies on earlier fusion

Dissemination of the variety management system

To avoid mix-ups during production of seedlings from "Specified Mother Trees", every step in the process of collecting of scions, cuttings and nursery transplanting is traced and labeled. In parallel, DNA analysis is introduced to trace the variety prior to distribution of seedling.



Distributed seedlings labeled with the name of the variety



«Providing information about new developed varieties»

- Information highlighting the superior characteristics of newly developed varieties will be made public through our homepage, pamphlets, etc.
- Information on propagation of varieties from cuttings, growing rootstock and other details related to efficient seedling production, as well as distribution capacity, will be made available at various meetings and via the forest tree breeding network.

<Studies involving joint research on the planted newly developed variety and usefulness of such data at exhibitions>

- The prefecture, the Regional Forest Office, and the Forest Management Center have established joint study sites for planting newly developed varieties.
- These study sites are utilized as sites with an environment different from other geographical areas and as exhibition forests to realize the degree of growth.



A joint study site with Kagoshima prefecture

To generate early extension of newly developed superior varieties, a workshop/training course on establishing and improving scions (seed) gardens has been implemented in each prefecture by sending lecturers to the national and prefectural institutions as well as universities and by accepting trainees.



A training course on DNA analysis

A workshop course on improving scions gardens

A training course on test inoculated with cultured nematode

3 Collection, conservation and evaluation of tree genetic resources

(Forest tree gene bank program)

Forest tree genetic resources have to be preserved and handed to subsequent generations. In addition to the increased concerns about biodiversity conservation in forests, the expectations regarding forest genetic resources is expanding together with advances in science and technology.



(Conservation of endangered tree species) «Collection and conservation of the endangered species Pinus armandii under the category of "Endangered" on the red list»

Pinus armandii, which grows naturally on Yakushima Island and Tanegashima Island Jam, has been designated a Category B endangered species by the Ministry of the Environment. There has been a significant decline of old trees in this natural habitat where few young individuals of the next generation appear.

For this reason, an effort was launched to propagate trees. As of 2012, approximately 600 seedlings of *Pinus armandii* have been planted in a natural habitat (Kagoshima prefecture, Kumage-gun, Yakushima town).



A conifer and sprouts of Pinus amamiana

3 Collection, conservation and evaluation of tree genetic resources

(Emergency call for forest tree gene banks)

When natural treasures such as giant trees and famous trees are weakened and propagation of clones of the trees is requested to the Regional Breeding Office, cuttings and grafting are used to increase the number of trees and seedlings to return the clone seedlings to the owners or natural habitat.

The clone seedlings are reserved in the designated area and are used as research materials.

Return of "Takachiho-zinzya Sugi (Cryptomeria japonica)" As cracks and fissures were observed in the trunk of the 800-year-old cedar tree

at the Takachiho Shrine (Takachiho-cho, Nishiusuki-gun, Miyazaki prefecture), there was concern about being fallen. In response to the Shrine's request propagation efforts was initiated.

In March 2016, the clone seedlings grown at the Regional Breeding Office was returned to the Shrine with seedlings grown at the Miyazaki Prefectural Forest Technology Center and forest enterprise in Kumamoto Prefecture.



A clone seedling returned and planted at the Takachiho Shrine



Clone seedlings returned



Collection of scions

Return of "Myoken no Okeyaki (Keyaki Zelkova)

"Myoken no Okeyaki (Keyaki Zelkova)" standed 32 m high with a stem girth of 9 m. While it was classified as a national treasure, the tree toppled at the base of the roots in January 2003.

The Kyushu Regional Breeding Office propagated the tree through grafting in 1994 and conserved the seedlings in the field of the Office.

After receiving an official request from Yamato-Cho, Kamimashiki-gun, Kumamoto Prefecture to transfer the tree, "Myoken no Okeyaki (Keyaki Zelkova)", which was a symbol, for many years, that protected the town in an earthquake prone region, was returned to grounds of the Yamato town government office in December 2016.



Planting ceremony



A clone seedling planted at a parking lot of the Yamato town government office

Brief history of the Kyushu Regional Breeding Office

Apr. 1957 Inaugurated as the Kyushu Forest Tree Breeding Office. Apr. 1959 Reorganized as the Kyushu Forest Tree Breeding Office of the Forestry Agency. Apr. 1978 Established the Breeding Laboratory. Oct. 1991 Renamed the Kyushu Regional Breeding Office as part of reorganization of Forest Tree Breeding Center. Mar. 1996 Constructed the new (present) building. Apr. 2001 Reorganized as an Incorporated Administrative Agency. Apr. 2007 Integrated with FFPRI (Forestry and Forest Product Research Institute). Apr. 2007 50 years have been passed since inaugurated. Reorganized as a National Research and Development Corporation. Apr. 2015 Apr. 2017 Reorganized as a Forest Research and Management Organization.

Organization



Access



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