



## Characteristics of Eight Japanese Tea Cultivars

Chika Yagi, Namiko Ikeda, and Dwight Sato\*

In the 1970s, consumption of green tea (*Camellia sinensis*) in Japan increased, following the high rate of economic growth occurring in the country at the time. Because domestic tea production was not meeting consumer demand, tea was imported from Taiwan, and many tea farmers started to open new fields. At the same time, labor shortages in the tea-growing areas were severe as a result of workers migrating to urban districts. To meet this challenge, mechanization of tea cultivation and harvesting was developed and introduced to the growers. The new mechanization demanded clonally propagated cultivars that were high yielding and uniform in bud initiation and development.

'Yabukita' proved to be the most suitable variety, with its vigorous upright branching and intense green-tea flavor. The new and improved clonal tea propagation technology expanded the planting of 'Yabukita' tremendously over seed-produced plants, starting in Shizuoka and then spreading to all of Japan's tea-growing regions, eventually accounting for three-quarters of all the tea cultivated in Japan. 'Yabukita' was high yielding and had



quality attributes that Japanese tea drinkers favored, including a novel green-tea taste characteristic known as "umami." Earlier or later harvests of all other tea cultivars in Japan became based on the harvest period of 'Yabukita'.

Farmers increased field plantings of 'Yabukita', creating a single-cultivar monoculture and, as a consequence, a marketing problem. Acceptable farm-gate tea pricing could be maintained for only a short period because of sharp seasonal over-production in the domestic market. This one-cultivar industry also led to prevalent and frequent outbreaks of tea plant pest and diseases. In addition, the new tea cultivar required excessive amounts of fertilizer for optimal growth and brew quality, which increased farm management and production costs. This high productivity also contributed to delay of shoot maturation. Therefore, growing too much 'Yabukita' was viewed as a detriment to market stability, and an interest in tea cultivar diversification emerged.

In the 1980s, many excellent cultivars were developed and registered in Japan. Past selection criteria to screen tea cultivars included characteristics such as early harvest season, good taste quality, and high yield. The tea cultivar development program aimed to extend the harvest season by cultivar diversification and by incorporating resistance to anthracnose (*Colletotrichum* sp.), gray blight (*Pestalotiopsis* sp.), and a plant pest called the mulberry scale (*Pseudaulacaspis pentagona*). It was perceived that if Japanese tea farmers grew a variety of cultivars, this

\*Chika Yagi is a graduate of the College of Agriculture, Forestry and Natural Resource Management, University of Hawai'i at Hilo, residing in Shizuoka, Japan; Namiko Ikeda is with the National Institute of Vegetable and Tea Science, Shizuoka, Japan; Dwight Sato is with the CTAHR Department of Plant and Environmental Protection Sciences at the Komohana Agricultural Research and Extension Complex, Hilo.

would increase and improve market stability, increase tea beverage product lines, and increase use of tea in food, health, and cosmetic products. Currently, 52 cultivars are registered with the Japan Ministry of Agriculture and Forestry. ‘Yabukita’ is still the dominant cultivar grown and sold in Japan, but farmers are beginning to better select, utilize, and manage cultivar diversity based on their specific regional environments and market conditions.

The purpose of this publication is to provide background information on selected tea cultivars from Japan and to explore some of the concepts of assessment and evaluation that Japanese researchers have employed in characterizing tea cultivars. A simple hand-processing and brew-quality evaluation method was adopted as a working protocol for preliminary screening of tea selections. We advocate that the tea industry in Hawai‘i should develop a tea variety improvement program to select appropriate tea cultivars in order to gain sustainability and diversification.

### ‘Yabukita’

‘Yabukita’ was selected by Hikosaburo Sugiyama, a grower in Abe County, Shizuoka, in 1908. ‘Yabukita’ has been popular and widely adaptable throughout Japan

### General types of Japanese tea

#### **Sencha**

The most popular green tea consumed in Japan. It is typically grown in full sun and is harvested in the spring. It is steam-processed and is prized for its intense green color and ‘umami’ flavor. Sencha is made from 78 percent of the tea grown in Japan.

#### **Gyokuro**

Known as the finest Japanese green tea, having a unique and sweet flavor. It is shaded for about 20 days before harvest, which contributes to its deep green color and sweetness. Only 0.3 percent of tea produced in Japan is processed as gyokuro.

#### **Tencha**

Shade-grown tea similar to gyokuro but processed without rolling prior to drying. Tencha is the precursor to matcha. It represents 1.1 percent of total tea production in Japan.

#### **Matcha**

The powdered green tea used in tea ceremonies.

### Summary: Japanese tea cultivar backgrounds and characteristics

<b>Cultivar:</b>	<b>Yabukita</b>	<b>Yutakamidori</b>	<b>Benihikari</b>	<b>Benihomare</b>
Year registered	1953	1966	1969	1953
Original cross location <sup>1</sup>	Abe, Shizuoka	NIVTS	NIVTS	NIVTS
Parents	Seedling of native Shizuoka species	Asatsuyu seedling	Benikaori x Cn 1	Seedling from India variety
Spring harvest	April–mid-May	Early	Late	Late
Branching type	Upright	Intermediate	Intermediate	Intermediate
Vigor	Medium	High	High	Medium
Yield	High	Medium-high	Medium-high	Low
Brew quality				
Color	High	Medium	Medium	High
Aroma	High	Medium	High	High
Taste	High	Medium	High	High
Cold resistance	High	Low	Med (green tea), high (black tea)	Medium
Disease resistance	Susceptible to anthracnose and gray blight	High resistance to anthracnose	High resistance to anthracnose and gray blight	High resistance to anthracnose and gray blight

<sup>1</sup>NIVTS = National Institute of Vegetable and Tea Science

because it proved to be have high yield and exceptional quality. It has an elegant aroma and a strong “umami” taste. Its major disadvantages are its susceptibility to the fungal diseases anthracnose and gray blight. ‘Yabukita’ is cultivated on 90,400 acres, which is 77 percent of the total tea cultivation area in Japan. The major ‘Yabukita’ production regions (with the percentage of dominance by this cultivar) are Shizuoka (93%), Mie (84%), Fukuoka (77%), Saitama (72%), Kyoto (62%), and Kagoshima (40%).

### ‘Yutakamidori’

‘Yutakamidori’ was selected from a population of ‘Asatsuyu’ (gyokuro flavor) seedlings at the National Institute of Vegetable and Tea Science in Kanaya and later registered in Kagoshima in 1966. This cultivar is second to ‘Yabukita’ in total field production area in Japan, with 6148 acres. It is mainly grown in the Kagoshima and Miyazaki regions. Harvest is 5 days earlier than ‘Yabukita’; it has good yields and high resistance to anthracnose. ‘Yutakamidori’ is shaded at 60 percent of full sun for a week prior to harvest to soften its shoots, intensify its green tea color, and reduce bitterness. It can also be grown like gyokuro, but longer steaming is recommended during the first processing step.

### ‘Benihikari’

‘Benihikari’ was developed in 1952 from a cross between ‘Benikaori’ and Cn1 (a Chinese variety) at the Makurazaki Black Tea Experiment Station (Kagoshima), now known as the National Research Institute of Vegetables, Ornamental Plants and Tea. It was registered in 1969 as a tea variety with parentage from India, Japan, and China. Seasonal yields are good and disease resistance is high, but recovering for the next tea flush is longer. ‘Benihikari’ makes a high-quality black tea with a strong incense-like aroma. It is much too bitter to make it into green tea.

### ‘Benihomare’

‘Benihomare’ was selected in 1953 from a seedling population derived from a native India variety grown at the National Institute of Vegetable and Tea Science in Kanaya. It is usually harvested 2 weeks after ‘Yabukita’; it has an intermediate branching pattern and strong resistance to anthracnose and gray blight. ‘Benihomare’ is the best black tea cultivar in Japan, but yields are typically low. It produces a tea with a brilliant red color and strong astringency. Excessive nitrogen fertilizer application is known to reduce its taste quality.

#### Summary: Japanese tea cultivar backgrounds and characteristics (continued)

<b>Cultivar:</b>	<b>Okuhikari</b>	<b>Okumidori</b>	<b>Tsuyuhikari</b>	<b>Saemidori</b>
Year registered	1985	1974	2001	1990
Original cross location <sup>1</sup>	STES	NIVTS	STES	NIVTS
Parents	Yabukita x Shizu Cy 225	Yabukita x Shizuoka native variety No. 16	Shizu 7132 x Asatsuyu	Yabukita x Asatsuyu
Spring harvest	Late	Late	Early	Early
Branching type	Upright	Spreading	Intermediate	Intermediate
Vigor	High	High	High	Medium
Yield	Med-high	High	High	Medium-high
Brew quality				
Color	Med-high	High	High	Very high
Aroma	High	High	High	High
Taste	High	High	High	Very high
Cold resistance	High	High	High	Low
Disease resistance	Resistant to anthracnose, gray blight, blister blight; susceptible to bacterial shoot blight	Slightly susceptible to anthracnose	Highly resistant to anthracnose,	Resistant to anthracnose, susceptible to gray blight

<sup>1</sup>NIVTS = National Institute of Vegetable and Tea Science; STES = Shizuoka Tea Experiment Station

**‘Okuhikari’**

‘Okuhikari’ was selected from a cross of ‘Yabukita’ and Shizuoka-Cy225 (a Chinese variety) in 1964 at the Shizuoka Tea Experiment Station. It has been cultivated mainly in the mountainous regions since 1987. ‘Okuhikari’ is a good late-harvest variety and is harvested 5–6 days later than ‘Yabukita’. It is therefore a good cultivar to grow in combination with ‘Yabukita’. Its branching is vigorous and upright. Mature leaves are oval, long, dark green, and brilliant. Tea yields are similar to ‘Yabukita’. ‘Okuhikari’ is resistant to anthracnose, blister blight, and gray blight but susceptible to bacterial shoot blight (*Pseudomonas syringae* pv. *theae*). Because ‘Okuhikari’ grows in an upright manner, pruning it increases the number of buds developed.

**‘Okumidori’**

‘Okumidori’ was developed at the National Institute of Vegetable and Tea Science at Kanaya and was registered in 1974. It originated from an F1 hybrid of ‘Yabukita’ and Shizuoka native variety No. 16. In Shizuoka, 181 acres of ‘Okumidori’ are currently under cultivation. Kyoto and Mie districts started to grow ‘Okumidori’ in 1999, along with ‘Yabukita’, to expand the harvest period for better labor distribution and management. The Miyazaki and Kagoshima areas also extended the harvesting season by including ‘Okumidori’ with ‘Yabukita’. Fuji-City started growing this variety in 2000. ‘Okumidori’ is used as a tencha in Aichi and a gyokuro in Fukuoka. In total, 2013 acres of ‘Okumidori’ are grown in Japan. It is high yielding and is harvested 8 days later than ‘Yabukita’. ‘Okumidori’ has vigorous growth, a spreading growth habit, and is slightly susceptible to anthracnose.

**‘Tsuyuhikari’**

‘Tsuyuhikari’ was selected from a cross of ‘Shizu 7132’ and ‘Asatsuyu’ in 1970 at the Shizuoka Tea Experiment Station. It is harvested earlier than ‘Yabukita’ and develops an intermediate branching pattern. It is highly resistant to anthracnose and blister blight. The quality of the first harvest is good, and yields are high if hedges are pruned properly.

**‘Saemidori’**

‘Saemidori’ is a newly registered (1990) early tea cultivar that was selected from a cross between ‘Yabukita’ and ‘Asatsuyu’ in 1969 at the Makurazaki Branch Station of the National Research Institute of Vegetables, Orna-

mental Plants and Tea. It is harvested 2–5 days earlier than ‘Yabukita’ and develops an intermediate branching pattern. It is fairly resistant to anthracnose but very susceptible to gray blight. Yields are medium-high and taste is very good due to its low bitterness and lack of astringency. The amino acid content is higher than ‘Yabukita’. ‘Saemidori’, which means “clear green,” has a brilliant green liquor. ‘Saemidori’ is gaining in popularity in Japan, and it is suitable to be grown in warmer areas such as Kyushu, Shikoku, Kinki, and Tokai districts. It is also being processed into gyokuro in Fukuoka. Co-author Ikeda was part of the tea-improvement team that bred and studied this cultivar.

**Method for establishing and pruning tea fields used in Japan**

- Use well-established 1–2-year-old rooted cuttings and plant to fields in cooler regions during March–April. In warmer regions, plants can also be planted in the autumn season.
- Decide whether you will use single- or double-row (zigzag) spacing. For both double and single rows, spacing between main hedgerows is 5–6 ft on center. For single-row, spacing between plants is 12–18 inches. For double-row, the distance between each pair of rows is 1–2 ft and within the pair is 2–3 ft.
- Dig planting holes 12–16 inches deep and mix in a general fertilizer formulation 1 month prior to planting.
- Plant and then mulch with organic material or cover with weed mat.
- Cut shoot tops 6–8 inches from ground level. The newly planted tea should have approximately 10 leaves remaining on its branches. By autumn, root and shoot growth should have progressed and be well established.
- Prune back new growth next spring to a height of 8–10 inches from ground level. Root and shoot growth should increase in height and girth by autumn.
- Prune back growth the subsequent spring to a height of 12–14 inches from ground level. By the autumn of the third year, light harvesting can be started.
- Prune back the third year’s growth in the autumn or spring to a height of 16–18 inches.
- Lightly prune tea hedgerows in the autumn or after a few harvests to remove late-emerging shoot growth, thereby maintaining a fairly uniform harvest surface.
- Proper pruning at an early phase increases optimal branching between rows and therefore maximizing yields in tea production fields.



### Method for predicting tea harvest time used in Japan

- Take a frame (8 x 8 inches) and randomly place it on a harvestable surface. Count all the newly emerging buds inside the frame and designate this as total buds.
- Count the number of leaves on each bud. Designate this as total leaves.
- Calculate opened leaves: total leaves / total buds.  
For example, If total leaves is 145 and total buds is 48,  $145 \div 48 = 3.02$  leaves per bud.
- Apply the number to the table below. If the current date is April 15 with three open leaves, bud initiation occurred 23 days before, which is March 24. The predicted harvesting time is in 11 days, which is April 26.

Opened leaves	Bud initiation occurred (days prior)	Estimated days to harvest
0.5	7	27
1	14	20
2	19	15
3	23	11
4	28	6
5	33	0

### Simple tea processing and quality evaluation for preliminary screening

1. Harvest 1 lb fresh shoot tips with at least 2–3 leaves during a sunny period between 9 a.m. and 2 p.m.
2. Sun-wilt harvested shoot tips on a wide flat tray for at least 20 minutes.
3. Wither tea indoors for 5–6 hours, turning shoot tips after 60–90 minutes.
4. Roast outdoors in a large steel wok set at 225–250°C for 2–3 minutes, using cotton gloves to turn the tea. At the onset, use an infrared thermometer to measure temperature at the center of the wok.
5. Turn off stove.
6. Ball and roll cooked tea in a muslin cloth on a wooden washboard.
7. Air-dry at 80°C or microwave until tea is crisp to touch.
8. Set your tea evaluation bench-top against a window with diffused morning sunlight.
9. Weight out 2 or 3 g of tea and add 150 ml of hot water (90°C) in a ceramic tea cupping set for 3 or 5 minutes.
10. Rate tea as high, medium, or low in regard to dry leaf color and dry leaf aroma, liquor color, wet leaf aroma, and flavor and aroma of tea brew.



Wok and propane tank; burner with small orifices, low flames; turning tea in wok with gloved hands.

11. Give tea an overall rating in regard to potential for further evaluation as green or oolong type tea.

**Further information**

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