

Comparative Test on Spring Medium-sized Watermelon Varieties in Beijing

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Abstract [**Objectives**] This study was conducted to select suitable medium-sized watermelon varieties for early spring cultivation in Beijing. [**Methods**] Seven watermelon varieties were collected, including Beinong Tianjiao 2, Beinong Tianjiao, Hongfuji, Yongfeng 1, Beinong Futian, Beinong Shijia, and Beinong Jinxiu, and Jingxin 2 was used as the control check (CK). The growth period, morphological traits, yield traits and fruit quality of the tested varieties were investigated. [**Results**] Beinong Tianjiao 2 had an earlier maturation stage, a fruit development period of 38 d and a total growth period of 118 d. It showed stable growth, with a single fruit weight of 7.56 kg, a fruit setting rate of 0.99 per plant, and a yield of 83 076.9 kg/hm², which ranked, respectively, second, first, and second among all tested varieties, and were significantly superior to the CK. Furthermore, this variety had thin and tough peel, a bright red flesh color, high central sugar content, loose and crisp flesh, and a good taste. [**Conclusions**] It is preliminarily believed that it is suitable for early spring watermelon production in Beijing area.

Key words Medium-sized watermelon; Variety comparison; Beijing area; High yield; High quality

Watermelon originated in Africa, and the fruit has the effects of clearing heat, relieving heat, cooling thirst, and is truly the king of summer fruits, widely cultivated worldwide^[1–2]. China is an important producer and consumer of watermelons in the world. According to statistics, the harvested area and yield of watermelon in China in 2018 were 1.499 1 million hm² and 62.803 8 million t, respectively, accounting for 46.25% and 60.43% of the world's total, ranking first in the world^[3]. Watermelon is also a kind of cash crop with short planting cycle, quick yield and high output value, which plays a major role in rural revitalization and farmers' income increase in China^[4–6]. Currently, the main medium-sized watermelon variety cultivated in facilities in Beijing is Jingxin 2, but it has problems such as low yield and poor stress tolerance^[7–9], making it difficult to meet the needs of growers and the market. Based on this, Beijing Agricultural Technology Promotion Station conducted a spring medium-sized watermelon variety screening test, aiming to select excellent watermelon varieties suitable for early spring production in the Beijing area.

Materials and Methods

Test materials

Eight watermelon varieties were tested, among which the control variety Jingxin 2 was introduced from National Vegetable Engineering and Technology Research Center, and Beinong Tianjiao 2, Beinong Tianjiao, Hongfushi, Yongfeng 1, Beinong Futian, Beinong Shijia, and Beinong Jinxiu were all from Beijing Agricultural Technology Promotion Station.

Test design

The test was carried out in the test greenhouses in Houluma

Village, Dasungezhuang, Shunyi District, Beijing City in the spring of 2019. The soil was sandy. The test field was a winter fallow land with moderate fertility. The test adopted randomized block design, and was done in three replicates. Each plot had an area of 28.8 m² with guard rows around. The test materials were grafted and raised in trays in a solar greenhouse in the early stage, and planted at the stage of 3 leaves and 1 heart in single rows. Ground-climbing cultivation was adopted with 3-vine pruning (in addition to the main vine, two well-growing side vines were selected while removing other side vines). The plant spacing was 1.2 m × 0.75 m, and each plot was planted with 32 plants, equivalent to 11 100 plant/hm². Pollination was performed manually, and the fruit was kept on the third female flower, according to one piece of fruit per plant. The base fertilizer should be applied with 45 m³/hm² of decomposed chicken manure, 450 kg/hm² of ternary compound fertilizer (15 : 15 : 15), and 22.5 kg/hm² of carbendazim. When the size of fruit was in the size of an egg, topdressing should be performed with water, using 105 kg/hm² of high-potassium water-soluble fertilizer.

Trait investigation

The first female flower node was investigated in the early stage of fruit setting. During the middle stage of fruit setting, the botanical traits such as leaf length, width and internode length were investigated at the fruit setting node. After the fruit ripened, yield testing should be conducted in a timely manner. In specific, 15 pieces of fruit should be randomly selected from each plot to investigate single melon weight, fruit setting rate, skin color, flesh color, peel thickness, peel hardness, central sugar content, texture, taste, and other indexes (the results were all averaged).

Data statistics

The experimental data were processed and analyzed using Excel sheet and DPS 3.01 software.

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Results and Analysis

Comparison of main field traits

The experimental results are shown in Table 1. Varieties Beinong Tianjiao 2, Beinong Tianjiao, Hongfushi, and Jingxin 2 belonged to early-maturing varieties, and had a fruit development period of 36–39 d and a whole growth period of 117–120 d. Among them, varieties Beinong Tianjiao 2 and Hongfushi had a slightly earlier maturity stage than the control check (CK), with a total growth period of 1 and 2 d shorter, respectively. Varieties Yongfeng 1, Beinong Futian, Beinong Shijia, and Beinong Jinxiu had a late maturity stage, with a fruit development period of 40–42 d and a whole growth period of 122–125 d, both of which were longer than the CK. The fruiting nodes of varieties Beinong

Tianjiao 2, Hongfushi and Jingxin 2 were relatively low, at 14.63, 13.91, and 15.4 nodes, respectively. The fruit setting nodes of varieties Beinong Tianjiao, Yongfeng 1, Beinong Futian, Beinong Shijia and Beinong Jinxiu were relatively high, ranging from 16.3 to 17.45 nodes. There were greater differences in growth among different watermelon varieties. The growth of varieties Yongfeng 1, Beinong Futian, Beinong Jinxiu, and Jingxin 2 was relatively weak, with leaf areas of 290.61, 296.38, 289.93, and 281.90 cm², respectively, and internode lengths of 21.25–24.09 cm. The growth of varieties Beinong Tianjiao 2, Beinong Tianjiao, Hongfushi and Beinong Shijia was relatively stable, with a leaf area in the range of 312.84–335.56 cm² and an internode length in the range of 20.42–25.33 cm.

Table 1 Comparison of main field traits of different watermelon varieties tested

Variety	Fruit development period//d	Whole growth period//d	First female flower node	Fruiting node	Leaf length//cm	Leaf width//cm	Leaf area//cm ²	Internode length//cm
Beinong Tianjiao 2	36	118	9.67	14.63	33.17	28.83	312.84	20.42
Beinong Tianjiao	39	120	10.0	16.30	33.05	29.50	335.56	23.05
Hongfushi	37	117	8.67	13.91	33.15	29.95	324.96	21.06
Yongfeng 1	42	125	12.5	17.45	30.56	27.64	290.61	24.09
Beinong Futian	40	123	11.8	16.50	26.91	29.20	296.38	23.90
Beinong Shijia	41	122	11.5	17.13	33.50	29.50	328.68	25.33
Beinong Jinxiu	41	124	12.0	16.38	31.44	28.81	289.93	23.13
Jingxin 2 (CK)	38	119	10.5	15.40	29.81	24.50	281.90	21.25

Leaf area = Leaf length × Leaf width × 0.7.

Comparison of yield-related traits

From Table 2, it can be seen that there were significant differences in yield and correlation among different watermelon varieties tested. Except for Hongfushi, other variety all showed a weight of single melon higher than the CK, with Yongfeng 1 having the largest single melon weight of 8.25 kg, which was 24.43% higher than the CK. The fruit setting rates per plant of the seven varieties ranged from 0.91 to 0.99, and the fruit setting rates of varieties Beinong Tianjiao 2, Hongfushi, and Beinong Jinxiu were

better than the CK. Among them, Beinong Tianjiao 2 had the highest fruit setting rate of 0.99, which was 6.45% higher than the CK (0.93). There were five varieties with yields higher than the CK, by 0.45%–23.1%, respectively. Among them, Beinong Tianjiao 2 and Yongfeng 1 had the best yield performance, with yields of 83 076.90 and 84 249.00 kg/hm², respectively. The yield differences between them and other varieties were extremely significant, 21.38% and 23.1% higher than the CK, respectively.

Table 2 Comparison of yield factors among different watermelon varieties tested

Variety	Weight of single melon//kg	Fruit setting rate per plant	Plot yield//kg	Yield//kg/hm ²
Beinong Tianjiao 2	7.56	0.99	239.50	83 076.90 A
Beinong Tianjiao	7.50	0.92	220.80	76 590.00 B
Hongfushi	5.82	0.96	178.79	62 017.95 D
Yongfeng 1	8.25	0.92	242.88	84 249.00 A
Beinong Futian	6.65	0.91	193.65	67 171.65 CD
Beinong Shijia	6.66	0.93	198.20	68 751.15 C
Beinong Jinxiu	6.68	0.96	205.21	71 182.05 BC
Jingxin 2 (CK)	6.63	0.93	197.31	68 441.55 C

Different capital letters following data in the same column stand for an extremely significant difference at the 0.01 level.

Comparison of fruit traits

From Table 3, it can be seen that except Hongfushi, the skin color of other varieties was darker than the CK. Varieties Beinong Tianjiao 2, Beinong Tianjiao, Hongfushi and Beinong Jinxiu had thin peel ranging from 0.95 to 1.02 cm, which were equivalent to

the CK. Varieties Yongfeng 1, Beinong Futian and Beinong Shijia had thicker peel, all exceeding 1.1 cm. There were five varieties with peel hardness higher than the CK, by 25.85–107.03%, respectively. The central sugar contents of varieties Beinong Tianjiao 2 and Hongfushi were, respectively, 11.75% and 11.33%, which

were both higher than the CK (10.96%), while other varieties were lower than the CK. Varieties Beinong Tianjiao 2, Beinong

Tianjiao, Hongfushi and Jingxin 2 had medium to little fiber, and their texture was loose and crisp or crisp, so they had good taste.

Table 3 Comparison of fruit quality among tested watermelon varieties

Variety	Skin color	Peel thickness//cm	Peel hardness kg/cm ²	central sugar content//%	Flesh color	Fiber	Texture	Taste
Beinong Tianjiao 2	Dark green	0.95	35.64	11.75	Bright red	Less	Loose and crisp	Good
Beinong Tianjiao	Dark green	1.02	42.35	10.88	Red	Moderate	Crisp	Good
Hongfushi	Green	0.96	22.32	11.33	Pink	Less	Loose and crisp	Good
Yongfeng 1	Dark green	1.35	58.63	9.8	Red	Much	Hard	Poor
Beinong Futian	Dark green	1.21	52.34	10.59	Red	Much	Hard	Poor
Beinong Shijia	Dark green	1.13	20.62	9.93	Red	Much	Hard	Ordinary
Beinong Jinxiu	Dark green	1.02	43.25	10.19	Bright red	Moderate	Hard	Ordinary
Jingxin 2 (CK)	Green	0.98	28.32	10.96	Red	Less	Loose and crisp	Good

Conclusions and Discussion

Beijing has a temperate semi-humid and semi-arid monsoon climate, with low temperatures in early spring. It has high requirements for the low temperature and weak light tolerance of watermelon varieties, and it is generally advisable to choose early- or medium-maturing varieties. Beijing area has high requirements for the quality of watermelons, and prefers watermelon varieties with thin peel, fine fiber, crisp or loose and crisp texture, high sugar content, and good taste. Among all the tested varieties, Beinong Tianjiao 2 had an earlier maturation stage, and a fruit development period of 38 d and a total growth period of 118 d, both of which were less than the CK. It showed stable growth, with a single fruit weight of 7.56 kg, a fruit setting rate of 0.99 per plant, and a yield of 83 076.9 kg/hm², which ranked, respectively, second, first, and second among all tested varieties, and were significantly superior to the CK.

Furthermore, this variety had thin and tough peel, a bright red flesh color, high central sugar content, loose and crisp flesh, and a good taste. It is preliminarily believed that it is suitable for early spring watermelon production in Beijing area.

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