Comparative Test of Xinjiang Turnip Cultivars

Zhengying Xuan

College of plant science, Tarim University, Alar Xinjiang 843300

Keywords: Turnip; Varieties; Biological characteristics

Abstract: In order to evaluation of source in turnip varieties in different regions of Xinjiang, and screened suitable for planting in Alar area of high-quality high-yielding varieties, this experiment selected Xinjiang 13 different varieties of turnip as experimental material, under the same experimental conditions were planted, and on their phenology and on their biological characteristics such as plant height, stem diameter, leaf area and yield were measured, research and analysis, and by means of statistical analysis in the software of Excel and DPS analysis. Experimental results show that: number of W7 turnip (cultivars from Xinjiang Jifeng seedling Co., Ltd.) the highest yield, the average yield per plot for 39kg, equivalent to (667m Yield of 2) 11416.82 Kg, good quality, good growth, is currently the most ideal suitable for the cultivation of local varieties, numbered W1 turnip (Cultivars from Xinjiang Changji Xinke Seed Co., Ltd.) numbering W8 turnip cultivars (Cultivars from sunset red Agricultural Technology Co., Ltd.) performance is also good, but also suitable for the cultivation of local varieties.

1. Introduction

Xinjiang turnip (*Brassica campestris* L.ssp.*rapifera* Sinsk,syn.B.*rapa* L.ssp.r*apifera*), also known as brassica campestris, belongs to Brassica subspecies of Cruciferae and is a 2-year-old herb that can form fleshy roots. Turnips originated from Mediterranean coast, Afghanistan, Pakistan and Transcaucasia, and evolved from subspecies of oil. Chinese turnips came from Siberia and were later introduced into Japan. Turnips have a long history of cultivation in China and were widely cultivated in the Eastern Han Dynasty. North China, Northwest China, Yunnan, Guizhou, Jiangsu, Zhejiang and other places have a long history of cultivation. However, with the introduction of new vegetable species and varieties and the reform of the cultivation system, the planting area of turnip has been significantly reduced, and it has changed from common vegetables to rare vegetables[1]-[2]. At present, the main varieties in our country are Wenzhou turnip and Xinjiang brassica campestris etc. Turnips can be cultivated in Xinjiang in spring, summer and autumn because of their strong adaptability, easy cultivation and storage. Especially in the arid and water-deficient south of Xinjiang, turnips are widely planted and are one of several traditional vegetables that are loved by Uygur residents and have a long history of use. Brassica campestris is a kind of unique plant in Xinjiang. Xinjiang brassica campestris and inland turnips belong to the same variety, but they differ greatly in form and flavor.[3]

Based on the investigation and collection of the local variety resources of Xinjiang turnips, the paper conducts field observation of the phenophase period, main plant characters and output of turnip materials, in order to screen out the excellent varieties suitable for local cultivation and lay the foundation for high-output cultivation of local turnip.

2. Materials and Methods

Thirteen varieties (see Table 1) of the tested materials were tested in the open field of the Horticultural Test Station of Tarim University in 2014. The soil quality is sandy loam with medium fertility, and the previous crop is sorghum. Sow and drill in the open field on July 30, 2014 with row spacing of 0.4m, repeat for 3 times. The experiment adopts random block arrangement with an area of 2.4m^2. Thin out seedlings when cotyledons are expanded and 2 true leaves appear, final seedling will be done when 4-5 true leaves appear. The plant spacing is 0.1m. The comparison is made with

  DOI: 10.25236/isafb.2019.038

the local main W5 brassica campestris (from Changji City Yahua Seed Co., Ltd.).

When the leaves stop growing and new leaves do not appear, the fleshy roots are harvested, measure the output amount at one time. 10 plants are randomly selected at fixed points in each area to measure the botanical characteristics of each variety respectively. Meanwhile, the appearance, quality and rotting rate of fleshy roots of each variety are investigated. The test data were statistically analyzed by Excel and DPS data analysis software.

Table 1 Names and sources of 13 varieties of brassica campestris

No.	Name	Company	Source
W1	Brassica napobrasslc	Xinjiang Changji Xinke Seed Co., Ltd.	Kashi
W2	Brassica napobrasslc	Pishan Farm (White)	Pishan Farm
W3	Brassica campestris	Xinjiang Guoyin Seed Industry Co., Ltd.	Urumqi
W4	Brassica campestris	Changji City Lianchuang Seed Co., Ltd.	Urumqi
W5(ck)	Brassica campestris	Changji City Yahua Seed Co., Ltd.	Aksu
W6	Brassica napobrasslc	Xinjiang Lvkun Fruit and Vegetable Science and Technology Development Co., Ltd.	Urumqi
W7	Brassica campestris	Xinjiang Jifeng Seed Co., Ltd.	Urumqi
W8	Brassica napobrasslca	Xiyanghong Agricultural Technology Co., Ltd.	Urumqi
W9	Brassica napobrasslc	Baza variety	Kashi
W10	Brassica napobrasslc	Local Variety in Yanji County	Yanji County
W11	Brassica napobrasslc	Wu Jia Qu, Yanji County	Yanji County
W12	Brassica napobrasslc	Pishan Farm (Red)	Pishan Farm
W13	Brassica napobrasslc	Kalpin County	Kalpin County

3. Results and Analysis

3.1 Comparative Analysis of Phenophase Observation.

It can be seen from Table 2 that the phenophase observation results show that the seedling speed and growth of the tested varieties are basically the same. The varieties with the earliest seedling time are W7, W1 and W8, and the seedling date is 2nd, August, the variety with the latest seedling time is W12, and the seedling date is 4th, August. The variety with the earliest breakdown time is W7, the breakdown date is 16th, August, the variety with the latest breakdown time is W12, and the breakdown date is 23rd, August. The variety with the earliest rhizome expanding time is W7 and the rhizome expanding date is 17th, August, the variety with latest rhizome expanding time is W12 and the rhizome expanding date is 26th, August. In this experiment, 13 varieties were sown and harvested at the same time, and the whole growth period was 81 days.

Table 2 Comparative table of phenophase observation

No.	Sowing time	Seedling time	Breakdown time	Rhizome expanding time	Harvest time	The whole growth period(d)
W1	30th, July	2nd, August	17th, August	18th, August	19th, October	81
W2	30th, July	3rd, August	18th, August	20th, August	19th, October	81
W3	30th, July	3rd, August	18th, August	20th, August	19th, October	81
W4	30th, July	3rd, August	19th, August	21st, August	19th, October	81
W5(ck)	30th, July	3rd, August	19th, August	22nd, August	19th, October	81
W6	30th, July	3rd, August	19th, August	22nd, August	19th, October	81
W7	30th, July	2nd, August	16th, August	17th, August	19th, October	81
W8	30th, July	2nd, August	17th, August	19th, August	19th, October	81
W9	30th, July	4th, August	19th, August	23rd, August	19th, October	81
W10	30th, July	4th, August	20th, August	23rd, August	19th, October	81
W11	30th, July	4th, August	21st, August	24th, August	19th, October	81
W12	30th, July	4th, August	23rd, August	26th, August	19th, October	81
W13	30th, July	4th, August	22nd, August	25th, August	19th, October	81

3.2 Comparative Analysis of Botanical Characters of Overground Parts.

The height and the degree of development of plants. It can be seen from Table 3 that the variety with the largest plant height is W1, which is 81.2cm, and the variety with the smallest plant height is W13, which is 54.7cm, with a difference of 26.5cm. The variety with the highest degree of plant development is W1, which is 72.2cm, while the variety with the lowest degree of plant development is W12, which is only 42.3cm.

Color and number of leaves. The leaf color of W7 is dark green, and that of the other 12 varieties is green. The variety with the largest number of leaves is W13, with an average of 42.6 leaves per plant, and the variety with the smallest number of leaves is W10, with an average of only 13.4 leaves per plant.

Characters of leaves. W7 leaves surfaces have wax and no fuzz, while the other 12 varieties have no wax and no fuzz.

The largest length and width of leaves. The variety with the longest and largest leaf is W1, the average largest leaf length per plant is 78.8cm, the variety with the shortest and largest leaf is W12, and the average largest leaf length per plant is only 52.4cm, with a difference of 26.4cm. The variety with the widest and largest leaf is W7, with an average leaf width of 23.2cm per plant, and the variety with the narrowest and largest leaf is W12, with an average leaf width of 13.8cm per plant, with a difference of 9.4cm.

Area of leaves. The area of leaves is calculated by the transparent checkerboard method[4]. The variety with the largest leaf area is W1, with a leaf area of 265.29cm^2, followed by W7. The variety with the smallest leaf area index is W12, with a leaf area of only 120.52cm^2. The difference between the two varieties with the largest leaf area and the smallest leaf area is 144.87cm^2.

Plant growth. Area of leaves is an important index of plant growth potential. The larger the leaf area is, the better the growth potential will be. The results show that the variety with the strongest overground growth is W1, followed by W7, and the variety with the weakest overground growth is W12.

According to the above analysis, W1 is the variety with the best botanical characters of overground parts, followed by W7. The variety with the worst botanical characters of overground parts is W12.

Table 3 Comparative table of botanical characters of overground parts

No.	Height of plant (cm)	Degree of development	Color of leaves	Number of leaves (piece)	Characters of leaves	The largest length of leaves (cm)	The largest width of leaves (cm)	Area of leaves(cm^2)
W1	81.2	72.2	Green	22.8	No wax, no fuzz	78.8	20.2	265.29
W2	77.6	58.2	Green	23.0	No wax, no fuzz	74.8	17.8	221.91
W3	78.8	64.6	Green	26.0	No wax, no fuzz	75.3	18.4	230.92
W4	75.4	51.1	Green	14.0	No wax, no fuzz	73.8	13.8	169.74
W5(ck)	66.0	49.2	Green	18.0	No wax, no fuzz	64.5	15.6	167.70
W6	75.0	61.8	Green	27.4	No wax, no fuzz	70.8	18.2	214.76
W7	70.9	71.3	Dark green	14.4	No wax, no fuzz	66.7	23.2	257.91
W8	72.5	62.8	Green	19.0	No wax, no fuzz	68.6	17.9	204.66
W9	73.5	57.5	Green	16.8	No wax, no fuzz	70.0	18.3	213.50
W10	65.4	55.2	Green	13.4	No wax, no fuzz	62.9	15.7	164.59
W11	73.6	46.0	Green	27.2	No wax, no fuzz	68.4	17.3	197.22
W12	56.4	42.3	Green	15.0	No wax, no fuzz	52.4	13.8	120.52
W13	54.7	42.9	Green	42.6	No wax, no fuzz	52.9	18.3	161.35

3.3 Comparative Analysis of Botanical Characters of Underground Parts.

Color of fleshy root and the shape of root. It can be seen from Table 4 that W3 fleshy root is green in its entirety, the overground part of W5 fleshy root is purple and its underground part is white, the overground part of W7 fleshy root is purple and its underground part is yellow, W12

fleshy root is purple in its entirety, and the overground parts of other 8 varieties are green and the underground parts are white. W3 and W9 are oblate round and the other 11 varieties are round.

Spherical index. The variety with the largest spherical index is W5, the average spherical index is 1.57, and the variety with the smallest spherical index is W1, the average spherical index is only 0.95, with a difference of 0.65.

Length and thickness of root. The variety with the longest fleshy root is W8, with an average root length of 14.7cm, followed by W5. The variety with the shortest fleshy root is W12, with an average root length of only 9.6cm. The difference between the two varieties with the longest fleshy root and the shortest fleshy root is 5.1cm. The variety with the thickest fleshy root is W8, with an average root thickness of 12.087cm, followed by W1. The variety with the thinnest fleshy root is W13, with an average root thickness of only 7.449cm. The difference between the two varieties with the thickest and thinnest fleshy root is 4.638cm.

Full weight per plant, weight of single root. The variety with the heaviest full weight per plant is W1, the average full weight per plant is 1.192kg, followed by W8. The variety with the lightest full weight per plant is W13, the average full weight per plant is only 0.352kg. The difference between the two varieties with the lightest and heaviest full weight per plant is 0.84cm. The variety with the heaviest single root weight is W1, the average single root weight is 0.69kg, followed by W8. The variety with the lightest single root weight is W13, the average single root weight is only 0.206kg, and the difference between the two varieties with the heaviest single root weight and the lightest single root weight is 0.484kg.

Root-shoot ratio. The root-shoot ratio of W8 is the largest, the average root-shoot ratio is 3.48, and the root-shoot ratio of W7 is the smallest, the average root-shoot ratio is only 1.10, the difference between the two is 2.38.

According to the above analysis, W1, W7 and W8 are the varieties with good botanical characters in underground part.

Table 4 Comparative table of botanical characters of underground parts

No.	Color of fleshy root		Shape of root	Spherical index	Length of root (cm)	Thickness of root (cm)	Full weight per plant (kg)	Weight of single root (kg)	Root-shoot ratio
	External	Internal							
W1	Green on top and white on bottom	White	Round	0.95	11.1	11.689	1.192	0.690	2.50
W2	Green on top and white on bottom	White	Round	0.96	10.2	10.593	0.792	0.508	2.06
W3	Green	White	Oblate round	0.96	10.6	11.013	0.714	0.492	2.36
W4	Green on top and white on bottom	White	Round	1.19	11.0	9.245	0.528	0.328	1.90
W5(ck)	Purple on top and white on bottom	White	Round	1.57	13.4	8.558	0.502	0.350	2.49
W6	Green on top and white on bottom	White	Round	1.20	12.5	10.460	0.814	0.534	2.27
W7	Purple on top and yellow on bottom	Yellow	Round	1.37	11.4	8.317	0.672	0.332	1.10
W8	Green on top and white on bottom	White	Round	1.22	14.7	12.087	0.87	0.662	3.48
W9	Green on top and white on bottom	White	Oblate round	1.23	12.6	10.222	0.592	0.388	2.18
W10	Green on top and white on bottom	White	Round	1.36	13.0	9.564	0.498	0.360	3.13
W11	Green on top and white on bottom	White	Round	1.13	11.7	10.340	0.626	0.452	2.57
W12	Purple	White	Round	1.12	9.6	8.567	0.402	0.266	2.21
W13	Green on top and white on bottom	White	Round	1.38	10.3	7.449	0.352	0.206	1.74

3.4 Comparative Analysis on Quality, Appearance and Rotting Rate of Fleshy Root.

Quality and appearance. It can be seen from Table 5 that W2, W5, W6, W11, W12 and W13 all

have bran cores, in which W13 has the most serious bran core, W11 has the lightest bran core, and the other 6 varieties all have no bran core. From the appearance, W2 and W11 have slight sheath cracking cork on their outer skins, while the other 11 varieties have no sheath cracked cork.

Cracking rate. The variety with the most serious cracking rate is W5, with a cracking rate of 21%, followed by W1 and W9. The variety with the lightest cracking rate is W11, with a cracking rate of 0%. According to the cracking rate, the best quality is W11, followed by W6, while the worst quality variety is W5, and the other 10 varieties are in the middle.

Rotting rate. The most rotten variety is W8, with a rotting rate of 18%, followed by W10. The lightest variety is W4, with a rotting rate of 4%. According to the rotting rate, W4 has the best quality, followed by W9, while W8 has the worst quality, and the other 10 varieties are in the middle.

According to the above analysis, W11 has a light cracking rate but slight sheath cracked cork on its outer skin, W6 has a light cracking rate but has a bran core, and W2 has a slight sheath cracked cork on its outer skin. It is concluded that the variety with the best appearance quality of fleshy root is W10, W4 has no bran core and has the lowest rotting rate, and the variety with the best internal state is W4. However, W10 has a serious rotting rate and W4 has a serious cracking rate. The cracking rate and rotting rate of W7 are in the middle, with no bran core or sheath cracking cork. To sum up, W7 is the best in the appearance quality and internal state of fleshy root.

Table 5 Table of comparing quality, appearance and rotting rate of fleshy root

No.	Cracking rate	Rotting rate	Whether there is bran core of cross section of fleshy root	Degree of sheath cracking cork
W1	0.20	0.12	No bran core	No sheath cracking cork
W2	0.09	0.09	Slight bran core	Slight sheath cracking cork
W3	0.17	0.10	No bran core	No sheath cracking cork
W4	0.15	0.03	No bran core	No sheath cracking cork
W5(ck)	0.21	0.10	Light bran core	No sheath cracking cork
W6	0.05	0.08	Slight bran core	No sheath cracking cork
W7	0.11	0.07	No bran core	No sheath cracking cork
W8	0.14	0.18	No bran core	No sheath cracking cork
W9	0.20	0.04	No bran core	No sheath cracking cork
W10	0.06	0.15	No bran core	No sheath cracking cork
W11	0	0.14	Low bran core	Slight sheath cracking cork
W12	0.10	0.06	Slight bran core	No sheath cracking cork
W13	0.12	0.08	Moderate bran core	No sheath cracking cork

3.5 Comparative Analysis of Output.

It can be seen from Table 6 that at the significance level of 0.05, W7 and W1 are significantly different, W1 and W8 are significantly different, W8 and W2 are significantly different, W2 and W3 are not different, W3 and W4 are significantly different, W4 and W5 are not different, W5 and W6 are significantly different, W6 and W9 are significantly different, W9 and W10 are significantly different, W10 and W13 are significantly different, W13 and W11 are significantly different, and W11 and W12 are significantly different. At the significance level of 0.01, W7 and W1 are significantly different, W1 and W8 are significantly different, W2 is not different from W3 and W4, W4 and W5 are significantly different, W5 and W6 are significantly different, W6 and W9 are significantly different, W9 and W10 are significantly different, W10 and W13 are significantly different, W13 and W11 are not different, and W11 and W12 are significantly different.

Through the above analysis, the significant difference of W7 is significantly higher than that of W12.

Table 6 Output comparison table

No.	Area output(kg)			Average output(kg)	Convert into output of 667m^2(kg)	Significant difference	
	I	II	III			0.05	0.01
W7	40.44	43.2	39.6	41.08	11416.82	a	A
W1	39	38.64	39.36	39	10838.75	ab	AB
W8	31.44	34.44	40.56	35.48	9860.48	b	B
W2	24.96	24.96	25.8	25.24	7014.62	c	C
W3	24.6	24.96	26.04	25.2	7003.50	c	C
W4	22.8	24.36	23.4	23.52	6536.60	cd	C
W5(ck)	22.56	18.96	24.24	21.92	6091.93	cd	CD
W6	20.16	18.24	23.16	20.52	5702.85	de	CDE
W9	19.44	16.56	14.64	16.88	4691.23	ef	DEF
W10	13.8	17.04	17.04	15.96	4435.55	fg	EFG
W13	14.64	15.96	13.2	14.6	4057.58	fgh	FG
W11	15.24	10.8	10.56	12.2	3390.58	gh	FG
W12	8.4	12.84	11.64	10.96	3045.97	h	G

4. Summary and Conclusion

Summary. Field experiments show that W1, W7 and W8 varieties perform well in the field. Among them, W7 and W8 have good adaptability, are not easy to crack, have good disease resistance. W7 and W1 have high output and low rotting rate, and have good botanical properties in aerial parts. According to the above comparison, W7 is currently the most ideal variety suitable for local planting, W1 and W8 also perform well and are also suitable for local planting.

4.1 Correlation between the Output of the Underground Fleshy Root and the Growth of the Overground Stem and Leaf.

Root system is an organ that absorbs water and nutrients, and leaf is an organ that uses light energy for photosynthesis. The two are closely related to each other.

The fleshy root development of Xinjiang turnips requires a large amount of nutrients, all of which come from leaves. Without strong stem and leaf columns, large fleshy roots will not grow, and the output of fleshy roots will not be high if they are small. However, when leaves supply light and products to fleshy roots, they also need to save some nutrients for their own growth and development. When stems and leaves are too luxuriant, the nutrients supplied to fleshy roots will be greatly reduced, resulting in fleshy roots slow developing or not developing. In this experiment, the overground stem and leaf of W7 has good growth potential, strong stress resistance and the highest output.[5]-[9]

4.2 Correlation between Fleshy Root Output and Fleshy Root Quality.

The bran core, sheath cracking cork, cracking or rotting of the fleshy root will not only reduce its commercial value, but also reduce its output. In this experiment, the output of varieties with fleshy roots and bran cores is not very high, and cracking or rotting is easy to affect fleshy roots by diseases and insect pests.[10]

References

[1] Wan Wentao. Turnip[J]. Food and Life, 2005(5):46

[2] Chen Qiufang, Jia Hongru. Research Value and Development Prospect of Cruciferae Plants[J]. Anhui Agricultural Science, 2007,35(34):11183~11185

[3] Li Qiaojuan, Xiao Chunxia, Zhang Hongliang. Research Status of Uighur Medicine Qiamagu[J]. Xinjiang Traditional Chinese Medicine, 2010,28(6):81~82

[4] Wang Erhu, Ye Linmao, Qiao Changcheng. Comparative Analysis of Experimental Data of Leaf Area Measurement [J]. Meteorology and Environmental Science, 2011(04):45~48

[5] Zhao Baofu, Jia Lanying, Li Shuhe. Comparative Test of Green Radish Varieties [J]. Tianjin Agriculture, 2010(6):14~17

[6] Zhang Li. Comparative Test of Spring White Radish Varieties [J]. Chinese Vegetables, 2003(5):37~38

[7] Mou Qiong, Wu Jiahai, Yang Yicheng, Wang Yingfen, Yang Fei. Comparative Experiment on Varieties of Huaxi Grey Radish[J]. Seeds, 2011,30(2):80~82

[8] Chen Wensheng, Zheng Min. Comparative Test of Spring Radish Varieties [J]. Shanghai Vegetables, 2005(2):15~16

[9] Jin Mingdi. Comparative Test of Early Mature Summer Cabbage [J]. Shanghai Vegetables, 2005(2):16

[10] Liu Xiuyin. Source Activity and Fleshy Root Quality of Turnip in Spring and Autumn [D]. Xinjiang: Tarim University, 2012