

## High-yield cultivation techniques of Huangyuan carrot

He Bing<sup>1</sup>, Li Yongshun<sup>2</sup>, Huang Ying<sup>2</sup>, Li Jilian<sup>2</sup>

<sup>1</sup>Xining Agricultural Product Quality and Safety Inspection Center, Xining, Qinghai 810000, China

<sup>2</sup>Huangyuan Agricultural Technology Extension Center, Xining, Qinghai 812100, China

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**Abstract:** Huangyuan Carrot is a product of geographical indications of agricultural products in Huangyuan County, Xining City, Qinghai Province, it comprehensively summarizes the high-yield cultivation techniques of Huangyuan carrots as the standardize planting techniques and improve in the cultivation level of Huangyuan carrots.

### 1. Introduction

Huangyuan carrot refers to the carrots produced in Huangyuan County, Xining City, Qinghai Province, the cultivation of the carrots in Huangyuan County has a long history as in 2018, it obtain it certification of geographical indication of the agricultural product, Huangyuan carrot has good color and smooth skin because of the large temperature difference between day and night, the sugar content is high and the taste is also very good and it has a good market in the domestic market. However, the traditional planting methods have its shortcomings such as low yield and poor commercial quality because in recent years, through trials it has improved in its planting methods and enhanced the water and fertilizer management and through this the quality of carrots has been continuously improved making Huangyuan carrots to have a good market at home and abroad and has also become its local people as an important path to getting rid of poverty.

### 2. The location of Huangyuan County

#### 2.1 The geographical environment

Huangyuan County is located in the transition zone between the Loess Plateau and the Qinghai-Tibet Plateau, it is the westernmost county in the eastern agricultural region of Qinghai Province and the geographical coordinations are 36°20'~36°53' north latitude and 100°54'~101°25' east longitude, the county is about 62 kilometers long from north to south and 41 kilometers wide from east to west. The total area of the county is 1509 square kilometers and there are 24,000 mu of carrot production area, the Hunagyuan County is located inland with a continental monsoon climate long sunshine hours, strong solar radiation, poor daily temperature, windy in spring, cool in summer, rainy in autumn, dry in winter, and short frost-free period.

#### 2.2 The natural environment

Huangyuan County also belongs to the Qilian Mountains. The mountains and rivers overlap and the river gullies are horizontal and vertical, the elevation of the whole river is between 2470 and 4888 meters and the vertical height difference is about 2,428 meters. The terrain in the county is high in the west and low in the east which is surrounded by the mountains and is a small basin, the soil in the territory is mainly black earth, chestnut soil, fluvo-aquic soil, new soil and other types.

### 3. The quality and quality characteristics of the Huangyuan carrot

#### 3.1 The external quality characteristics

The product characteristics: The carrots produced in Huangyuan County are smooth in skin, reddish-brown and bright in color, the fleshy roots are cylindrical, 20±5 cm long, 4.5-5.5 cm in

diameter and 150±50 g in single root.

The characteristics of plant species: The leaves of the plant are erect and the plant height is about 40 cm, the leaves are green and the basal leaves are thin, elliptic, two to three pinnately lobed, and the distal lobes are linear or lanceolate, generally long 5 -15 mm, width 0.5-4 mm, sharp tip, small leaf sheath, terminal lobes

β-carotene content of Huangyuan carrot  $\geq 1.34\text{mg}/100\text{g}$ , protein  $\geq 0.3\text{g}/100\text{g}$ , vitamin C  $\geq 5.2\text{mg}/100\text{g}$ , total amino acid  $\geq 0.26\text{g}/100\text{g}$ , calcium 25.6 mg/100g, phosphorus  $\geq 20.4\text{mg}/100\text{g}$ .

## **4. Huangyuan carrot high-yield cultivation techniques**

### **4.1 Select good varieties**

To choose varieties suitable for planting in the north, such as “Xining Red”, “Newton” and the “Black Five Village”.

### **4.2 Seed treatment**

The use of dry seed live, squid on the seeds before sowing, cleaned, slightly drying and sowing.

### **4.3 The preparation of the plot**

The carrots belongs to the root vegetables, so you will have to choose the deep soil layer, soil fertile that is well-drained, water-permeable and good permeability in order to facilitate the root expansion, coloring, quality for commercial, to also choose the leguminous or gramineous crops as the former plot and carry out deep ploughing and drying in time.

### **4.4 The use of base fertilizer**

Before the sowing, the application of organic fertilizer of about 3000kg-4000kg or the commercial organic fertilizer of about 200kg, vegetable special fertilizer 75kg, evenly applied and then fully plowed the fertilizer into the soil and the depth of the ploughing layer is about 25cm, and then flattened.

### **4.5 Sowing period**

5cm below the surface temperature is stable at 8-10 °C, according to which to determine the appropriate sowing period in general and from mid-May to late May, the high water area and which is from early May to mid-May.

### **4.6 Seeding method**

The artificial sowing low waters is from mid-May to late May and the high waters are planted from early May to mid-May, the sowing method is striping or spreading and the seeding is about 200-250 grams per acre. 250-300 grams, and the line spacing is 15-20 cm, the depth is 2-3 cm; and also the seed is first spread on the flat surface and then the soil is covered to repressed and watered.

The mechanical sowing: Carrots are mechanically sown, and the labor efficiency is greatly improved because at present, the multi-purpose planter and supporting equipment of Huangyuan County are mostly designed by the local technicians or is improved according to the actual production and four-wheel tractors are used to plant the carrots when planting. The ridges, sowing and suppression are completed in one time. The ridge method is divided into two types, one is double ridges and 4 rows, the ridge surface is 45 cm wide, the groove width is 50 cm, and each ridge is 2 rows, and the row spacing is 15 cm. 6 rows of single ridge, 90cm wide ridge surface, 50cm wide, 50 rows of carrots per ridge, 15cm line spacing, 2-3cm plant spacing, 0.35-0.5kg per mu, to make the ridge surface smooth, the topsoil is finely divided, loose and breathable to facilitate the sowing and germination.

Kind of rope broadcast: This is a reformed sowing technique from Japan, it has been promoted and used in carrot cultivation in Huangyuan County since 2017. It is planted with “skin rope”, which has labor saving which reduced the seed amount and sowing and the high quality emergence and other advantages, the seeds are equally spaced into the seeding rope by the computer, and the

tractor is used to ditch the seed rope into the soil and when the seed rope is wet and dissolved then, the seeding process is completed.

#### **4.7 The irrigation equipment installation:**

Watering in the seedling stage: watering the head water 7-10 days after sowing and then pouring it every 7 days (to ensure that the soil is damp and to prevent surface layering), which is conducive to emergence because the emergence period is the critical period of the water demand in order to ensure sufficient water content, and the sprinkler irrigation (fast evaporation, large water volume, seedlings), micro-spraying and drip irrigation has a (better effect and high cost) can be used.

The annual rainfall in Huangyuan County is little especially in the carrot growing season because the precipitation is also little which affects the emergence of the seedlings, in order to ensure the emergence and later sensation, the drip irrigation and sprinkler irrigation equipment are installed in the carrot production in recent years and to install the drip irrigation pipe in the middle of the carrot ridge, and the drip that the water needed to replenish the carrot in time.

#### **4.8 Field management**

The first seedling were carried out at 1 leaf - 2 leaves, with a seedling distance of about 3 cm, when combined with weeding and shallow tillage; the second seedlings were 4 leaves and 5 leaves, and the seedlings were about 6 cm - 7 cm, while cultivating and weeding once. The density is also guaranteed to be 35,000 to 40,000 plants/mu, and at least 20,000 plants/mu are guaranteed. It is required that it should be continuously watered 2 times to 3 times from sowing to the emergence and the soil moisture should be kept at 70%-80%, and when the carrot grows to 50d, it will be topdressed with the second irrigation combine with the seedlings to carry out the cultivating and weeding also to remove the weeds in the field.

In the seedling stage and the vigorous growth of the leaves, it is necessary to control the water and also pay attention to the drainage and to combine the cultivating loose soil in order to maintain the growth balance between the upper and lower parts of the plant, when the carrot grows to about 2cm, and entering the fleshy root, the expansion period is the period when the water and nutrients are most needed, it be should be watered in time to keep the soil moist and the watering should be uniform to prevent the water from being drenched in the case of drought, and the roots of the fleshy roots are severely expanded to form cracked roots and the water should not be watered for 7 days before harvesting.

#### **4.9 Pest control**

Spot disease, gray mold, sclerotinia, bacterial disease, carrot microtubules.

Principles of prevention and control in accordance with the plant protection policy of "prevention first, comprehensive prevention", adhere to the principle of "agricultural prevention, physical control, biological control, supplemented by chemical control".

The control method

Agricultural control uses high-quality varieties to avoid disease and avoids heavy cropping and rational rotation, after harvesting, the diseased plants are removed and the soil is deepened and the seriously ill plants are removed in time, the diseased leaves are removed, burned or buried deeply and also the organic fertilizer replaces the fertilizer dosage.

Physical control use warm soup soaking; color plate trapping, hanging 20 to 30 yellow sticky insect boards per 667m<sup>2</sup>.

Biological control use biological pesticides; use natural enemies, sexual attractants, etc. to control the pests and diseases.

The chemical control black spot disease is controlled by 50% mancozeb 500 times liquid wetTable powder and 75% chlorothalonil wetTable powder 800 times liquid. Gray mold and sclerotinia sclerotiorum are treated with 50% keeling WP and 50% metalaxyl WP 800-1000 times as the bacterial disease was sprayed with 72% agricultural streptomycin 4000 times solution, the aphids were controlled with 10% imidacloprid wetTable powder 2000-3000 times, carrot microtubules were treated with 50% anti-Polycarb 2000 solution, the chemical control should

strictly implement the safe interval of the harvesting period.

#### Physiological diseases and prevention

(1) Root abnormalities: abnormal roots of fleshy roots are mostly the roots and bifurcation roots, roots mean curved roots of fleshy roots, and bifurcations are short roots, which are bifurcated in the lower part to form bifurcated carrots, roots and the fork roots seriously affect the commercial value and uses the value of carrots.

The control method: try to sow fresh seeds as much as possible. The soil must be deep-rooted, do not use organic fertilizer that is not fully decomposed, and time seedlings, promote root development, and timely control when soil pests occur.

(2) Cracked roots: Due to the uniformity of the soil water supply during the growth process, especially in the early stage of growth, the epidermis gradually hardens the internal cells and divide slowly and during the second growth period, due to rainfall or irrigation, water supply increases and the internal cell division will then accelerate and hardened and as a result the epidermis no longer grow correspondingly and thus cracks.

Control method: During the growth process, water is supplied according to the growth law in order to maintain a balanced supply of water and fertilizer.

### 4.10 Harvesting

When the fleshy roots are fully expanded and mature, the fleshy roots are rounded and the leaves are light and yellowish green and the commercial roots are 11-13cm long, and the roots can be harvested when the roots are up to 4-5cm thick then the premature fleshy roots have not yet grown and the rate of cracking and hollowness of fleshy roots is then too late, it will generally be harvested from the end of September to the beginning of October and when the fleshy roots are fully expanded and mature, the base of the fleshy roots is rounded and the leaves are light and yellowish green as the commercial roots are about 20 cm long, and the roots can be harvested when the roots are 4-5 cm thick. Generally low water is at the end of September and the high water is harvested in mid-October then the yield of mandarin carrots can reach kg per mu.

### 4.11 Packaging, transportation and storage

The packaging and unit net content used in each batch of products should be the same, the transportation process is to maintain the proper temperature and humidity. When storing, store them separately according to the variety and specifications when storing the stack, ensure that the airflow is evenly circulated.

### 4.12 The production record

Complete production files must be established during the production process, and production files should be properly preserved in order to establish a complete traceability system.

## References

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