



Whole-Process Mechanized Production and Social Service of Chinese Scallion

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Chinese Scallion

In 2016

- **Cultivated area:** 571,800 hectares
- **Percentage:** 2.56% of the total Chinese vegetables area
- **Total output:** 21.724 million tons (comparing to 17.628 million tons in 2003)

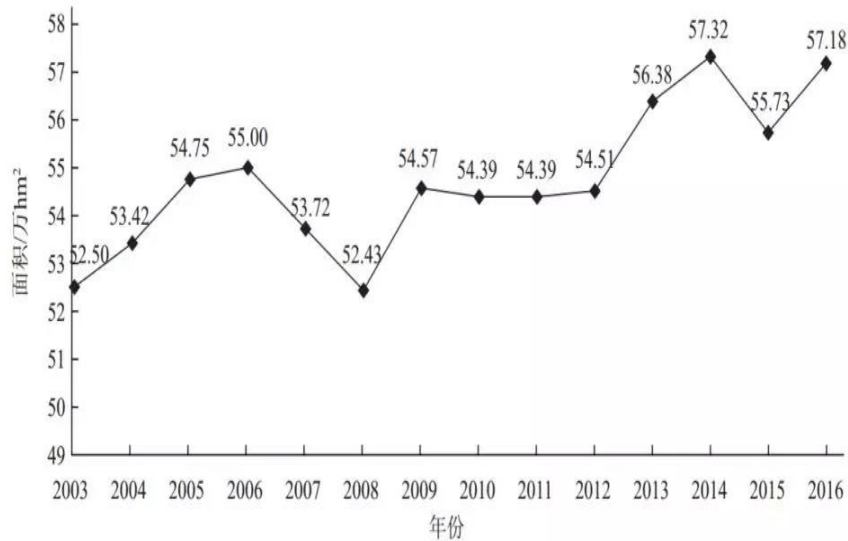


图1 2003~2016年我国大葱种植面积的变化趋势

数据来源于农业农村部种植业管理司, <http://zzys.agri.gov.cn/moazzys/shucaicx.aspx>; 下图同。

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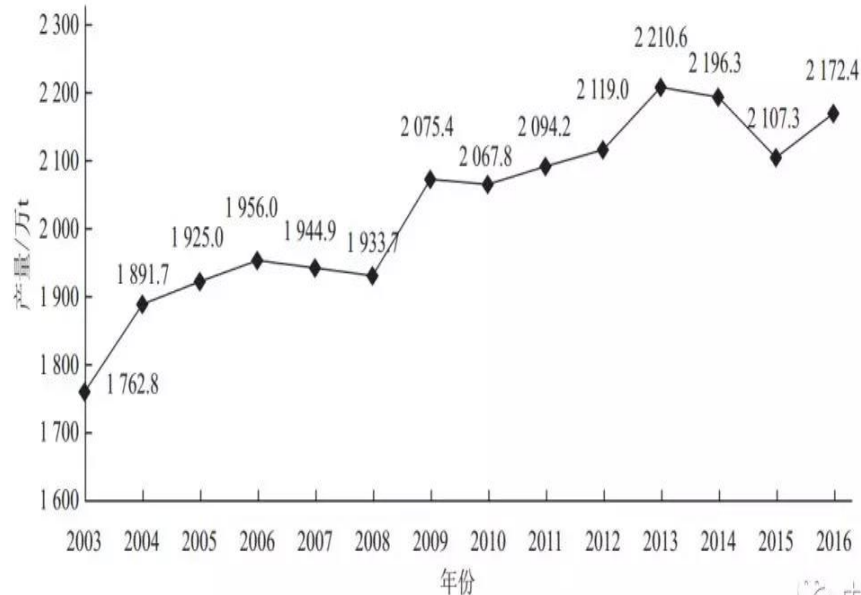
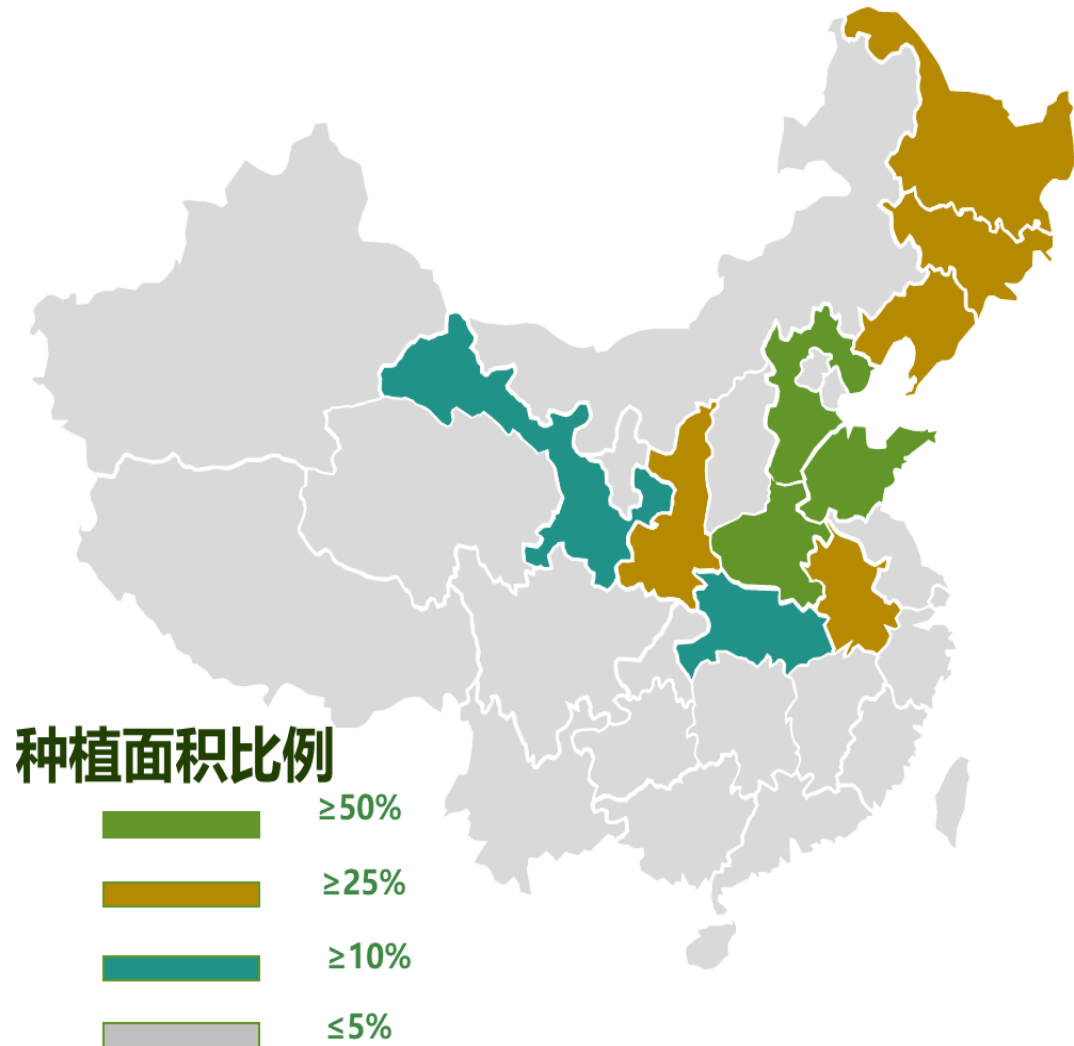


图2 2003~2016年我国大葱总产量的变化趋势

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Distribution Map & Main Production Area Of Chinese Scallion



The North Temperate Zone of Shandong Province is the most suitable area for Chinese Scallion. Liaoning, Hebei, and Henan provinces all have large Chinese Scallion cultivation area.

Chinese Scallion in Pingdu

- **Cultivated Area:** 6,000 hectares
- **Yield:** 400kg-500kg/ha (max 667kg/ha at some region)
- **Whole sales volume in 2017:** 289,500 tons
- **Average sales price:** 1.92 RMB/kg
- **Sales volume:** 556 million RMB = 80 million USD
- Pingdu scallion accounts for 45% of the sales volume of scallion in the wholesale market



The whole-process mechanized production technology of scallion

catalogue

1 Technical Background

2 Technical Content

3 Main Benefit Analysis

4 Social Service Mode

5 Current Difficulties and Directions





1

**Whole-process
Mechanized Technology**



**Production
Background**

1、 Technical Background

In Reality: 4 Obstacles of Traditional Planting

➤ Hard to hire labor

Shortage of labor due to heavy workload

“Planting in the hottest weather &
Harvesting in the coldest weather”



1、 Technical Background

In Reality: 4 Obstacles of Traditional Planting

- Extensive management of production & low quality

“Too much fertilizer residue & pesticide residue due to the pursuit of economic benefits”

- Limited planting mode, no agricultural machinery

“Individual farmers, single combat with fixed mode”



1、 Technical Background

In Reality: 4 Obstacles of Traditional Planting

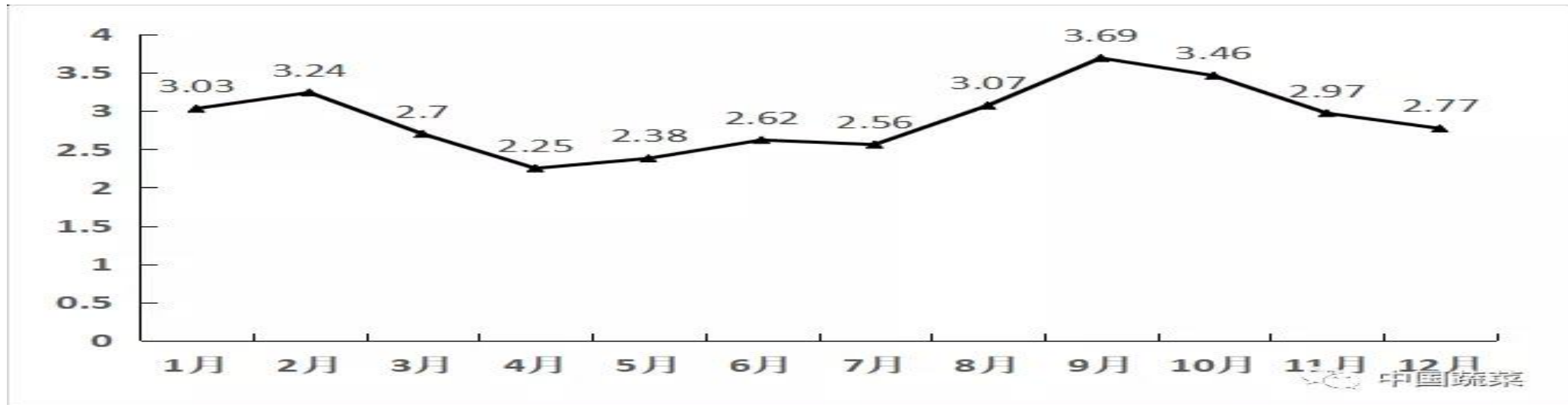
- Increasing cost of agricultural materials
- Price advantage not sustainable
- Weather condition fluctuates

In 2008: price of scallion ranged from RMB 0.10 – 1.44 / kg



1、 Technical Background

Annual price trend of scallion in 2018:

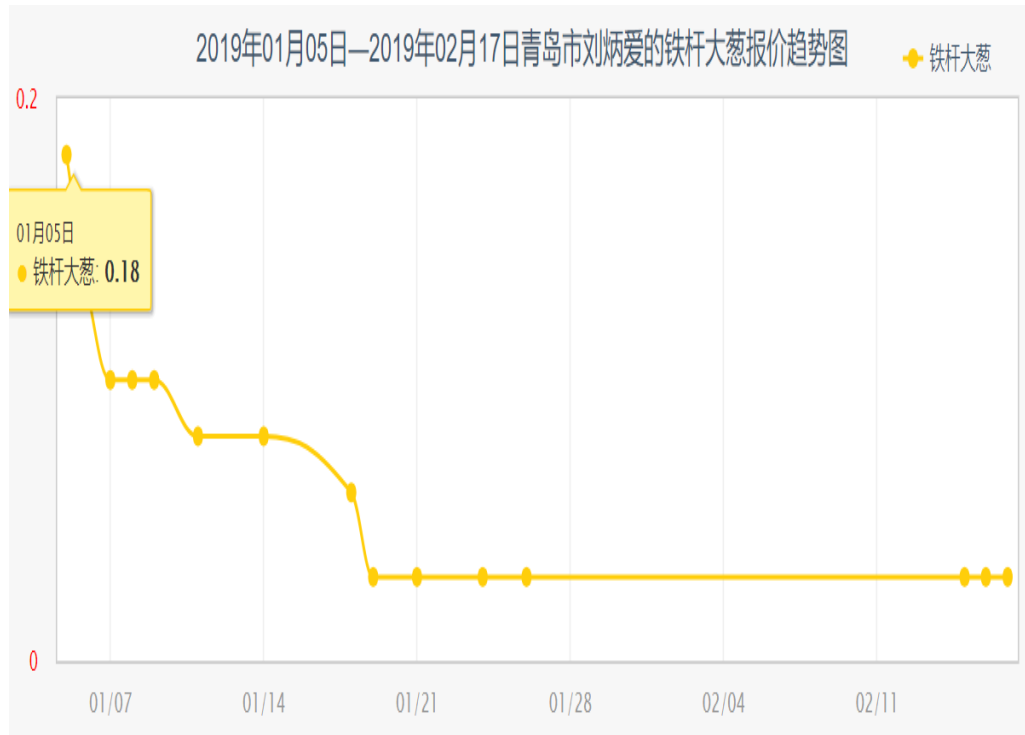


In 2018, the price fluctuation shows a “M” type:

- January: 3.03 RMB/kg
- February: 3.24 RMB/kg
- March: 2.25 RMB/kg
- September: 3.69 RMB/kg (64% increase)
- December: 2.77 RMB/kg

1、 Technical Background

Annual price trend of scallion in 2019:



Jan&Feb 2019:

Purchase price: 0.18 RMB/500 g



June 2019

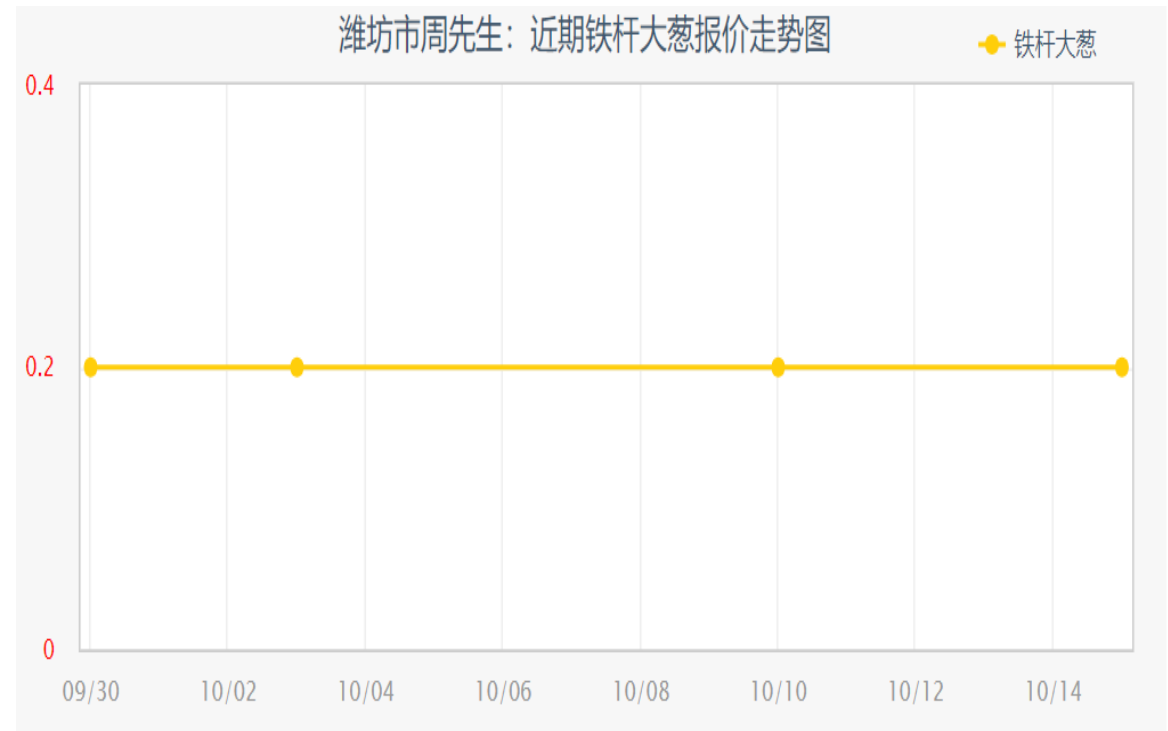
Land Price: 0.85 RMB/500g

1、 Technical Background

Annual price trend of scallion in 2019:



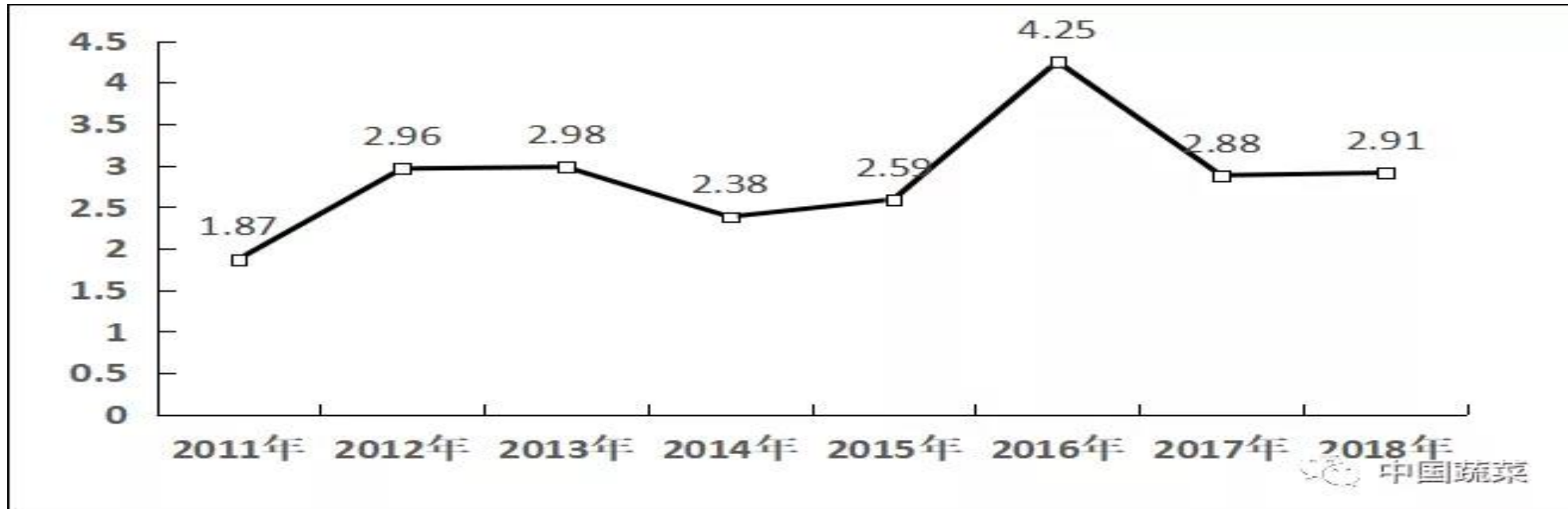
On July 29, 2019, the price in the supermarket: 2.98 RMB/500g



In October 2019, the price is 0.2 RMB/500g

1、 Technical Background

Price Trend from 2011 to 2018



The annual average price trend from 2011-2018 indicates:

Annual fluctuation characteristics are obvious: If "peak-valley-peak" is taken as a cycle, the price fluctuation cycle is generally around 4 years. And the two cycles of 2011-2014 & 2015-2018 are obvious.

1、 Technical Background



“在一切能够使用播
器操作的部门和地方，
统统使用播器操作”

毛泽东

Policy Level:

According to the 19th National Congress of the Communist Party of China and the No. 1 Document of the Central Committee, it is important to:

- Realize the connection between the development of small farmers and modern agriculture
- take targeted measures to promote the whole process of agricultural production socialized services
- help small farmers to save costs and increase efficiency
- Improve the ability of small farmers to resist risks

1、 Technical Background



“在一切能够使用机械操作的部门和地方，统统使用机械操作”

毛泽东

The guiding opinions on accelerating the transformation and upgrading of agricultural mechanization and agricultural machinery equipment industry issued by the State Council proposed:

- Speed up the completion of the whole-process of mechanized production
- Focus on the weak links and coordinate to build an efficient mechanized production system
- Promote the matching of improved varieties (good laws, good land, and good opportunities)
- Create conditions for the whole-process of mechanized operation and large-scale production



2

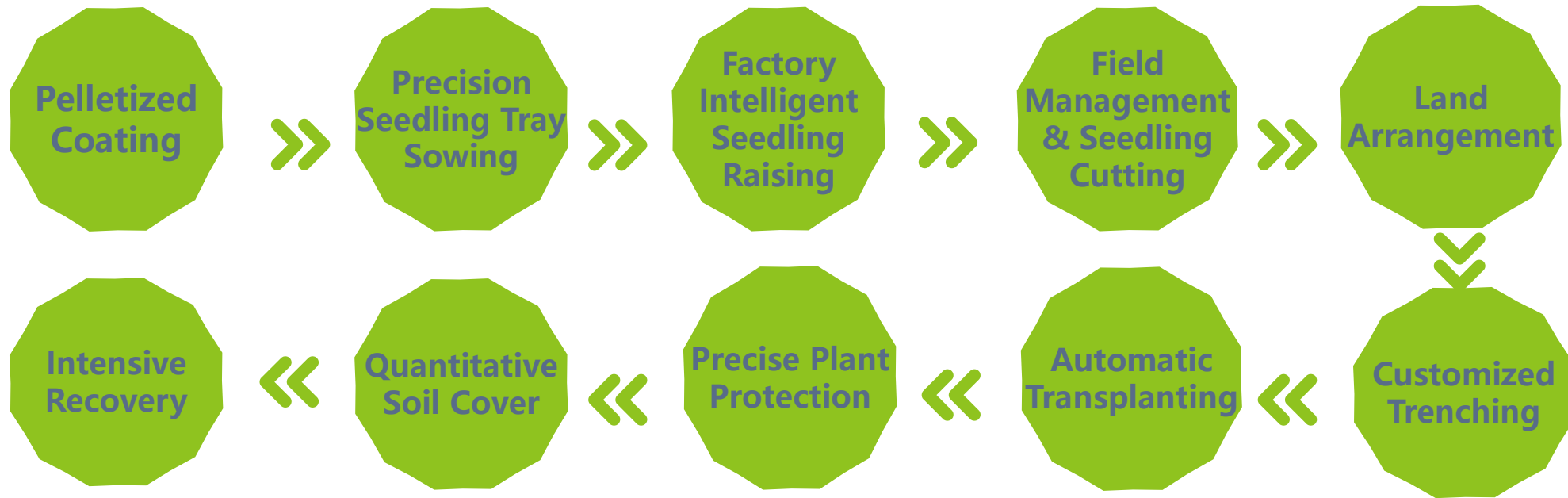
Chinese Scallion



**Whole-process
Mechanization
Technology**

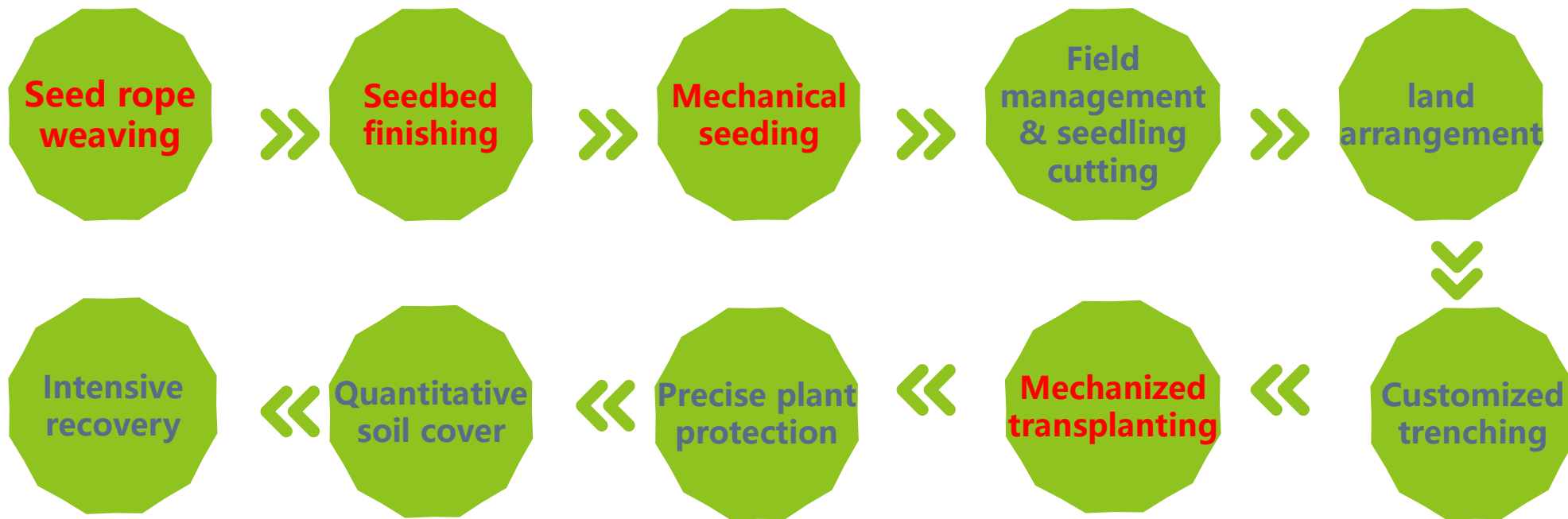
2、 Whole-process mechanization Technology

Mode 1: Whole process automatic mode of seedling raising with disk



2、 Whole-process mechanization Technology

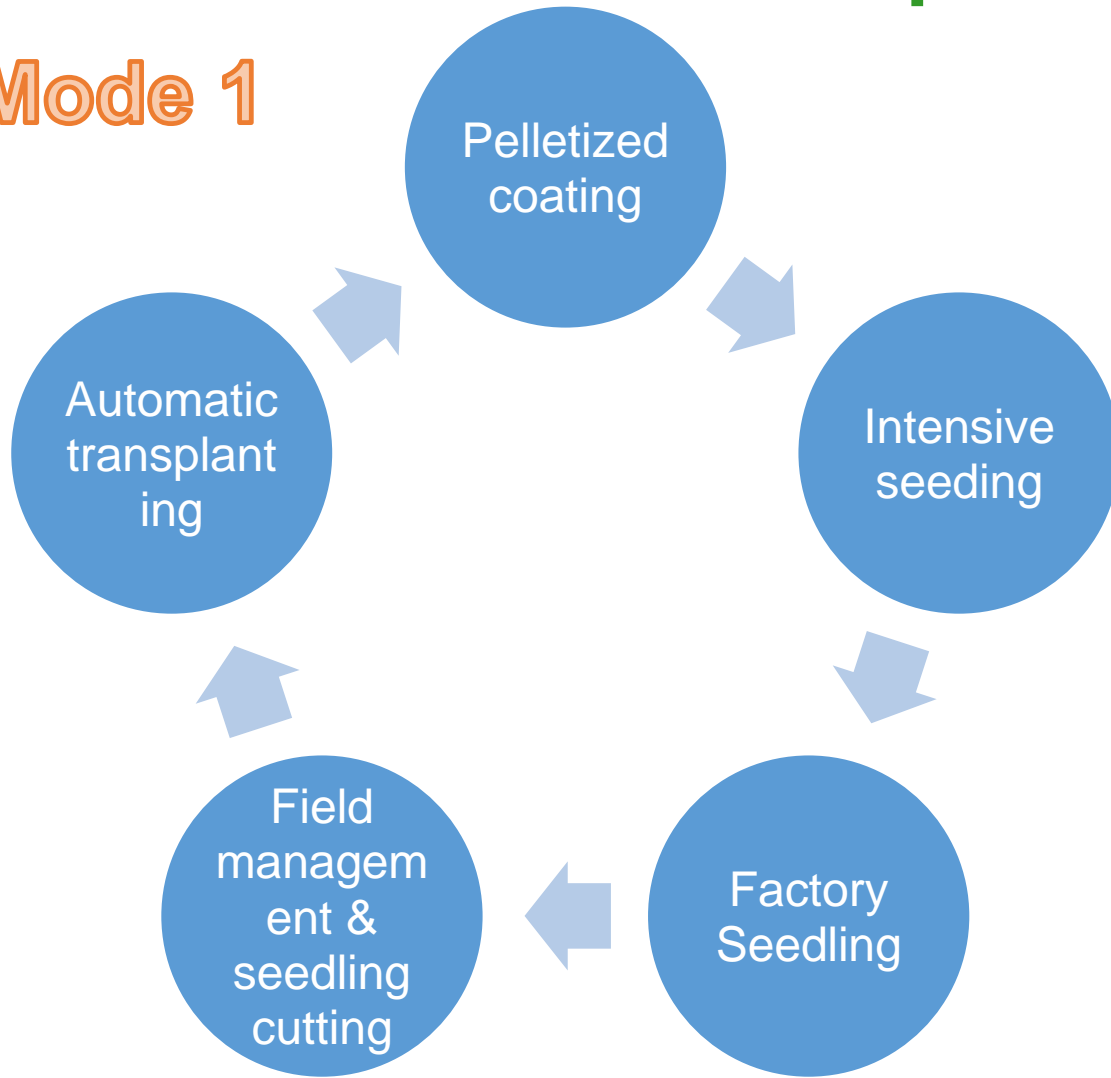
Mode 2: the whole process mechanization mode of rope seedling



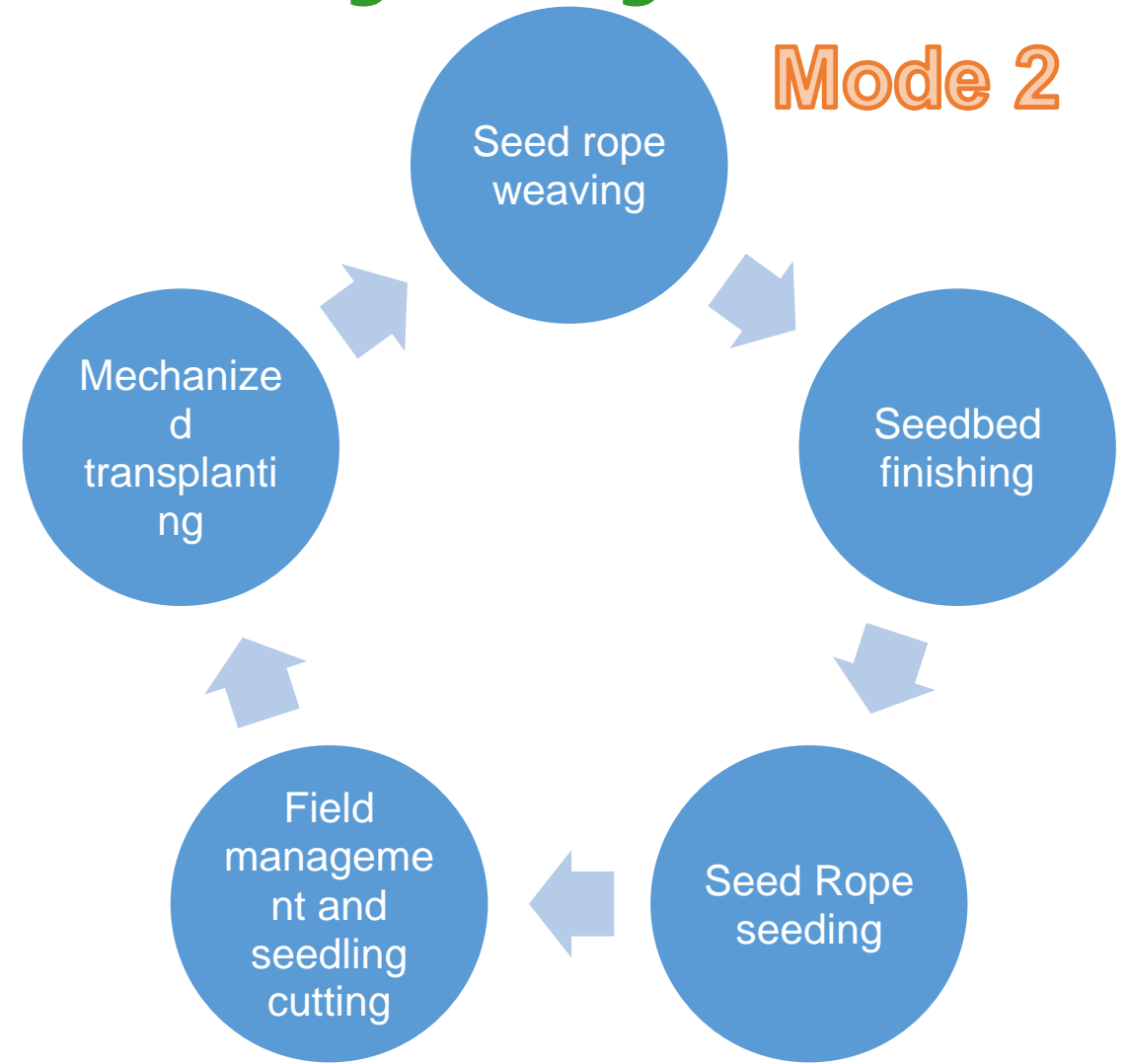
2、 Whole-process mechanization Technology

Model comparison of seedling raising

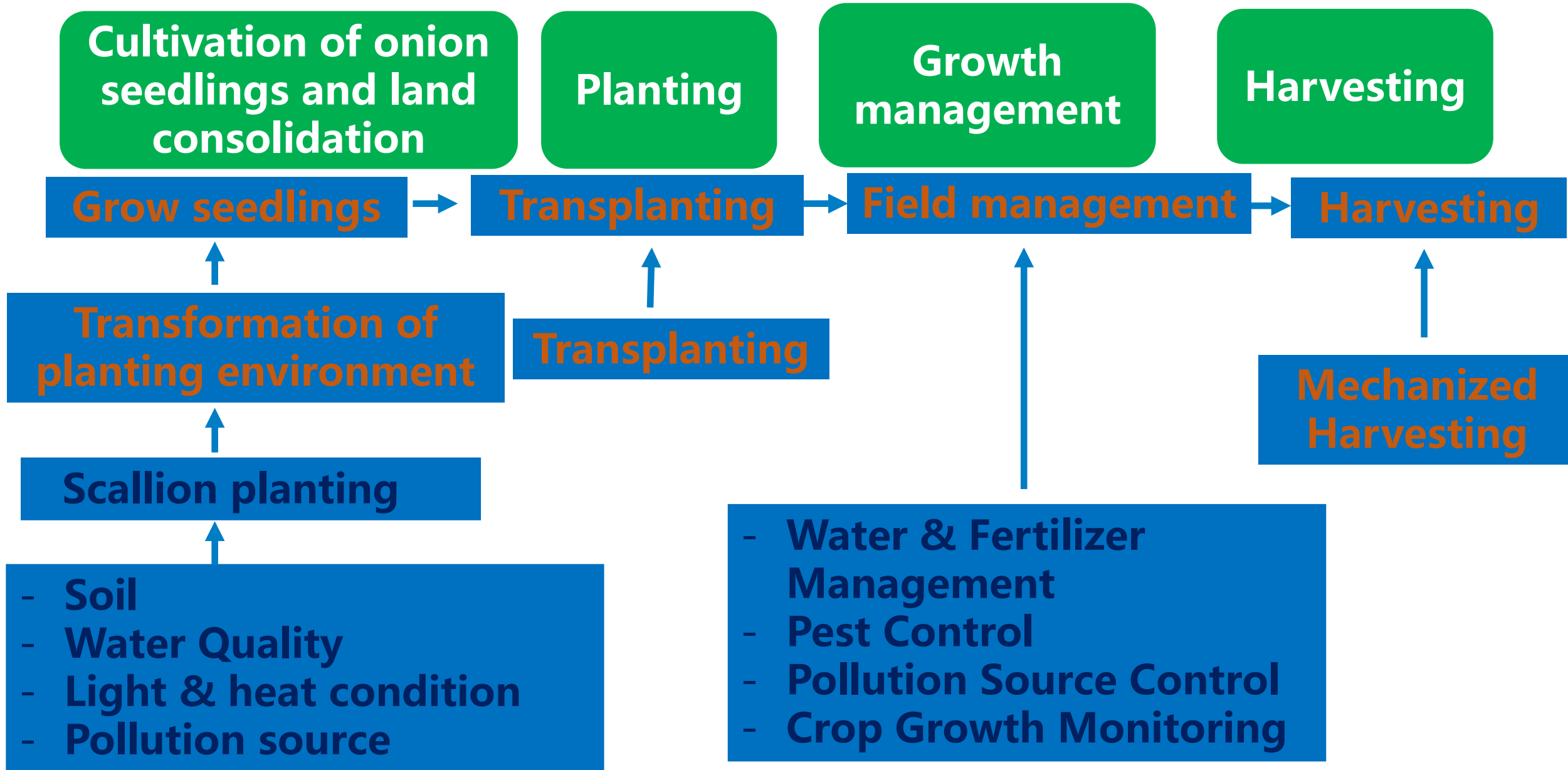
Mode 1



Mode 2



2、 Whole-process mechanization Technology



2、 Whole-process mechanization Technology

1. Seed pelletizing and coating technology

A layer of water containing agent and seed coating agent promoting growth are coated on the outside of the seed. The seed coating agent forms a curing film on the seed, which is divided into five layers, namely, the sterilization layer, the coating layer, the nutrition layer, the insecticidal layer and the color layer. With the seed germination and emergence, the curing film is fully absorbed by the root system. After pelletizing, the seed volume will increase about 20 times, which is easy to sow.



2、 Whole-process mechanization Technology

1. Seed pelletizing and coating technology

Advantages:

- Prevent diseases and insects, reduce the use of drugs
- Save seed and reduce cost
- Drought and cold resistance, labor and time saving
- The whole seedling is strong, and the yield is increased



2、 Whole-process mechanization Technology

2. Seeding technology of precision seedling tray

Through the intelligent precision seeder, the pills are seeded to the seedling tray, and through digital preset, the precise control of the seeding quantity is realized. The seeding speed of the seedling tray is 4000-6600 seeds / min, that is, 25-30 seedling trays.

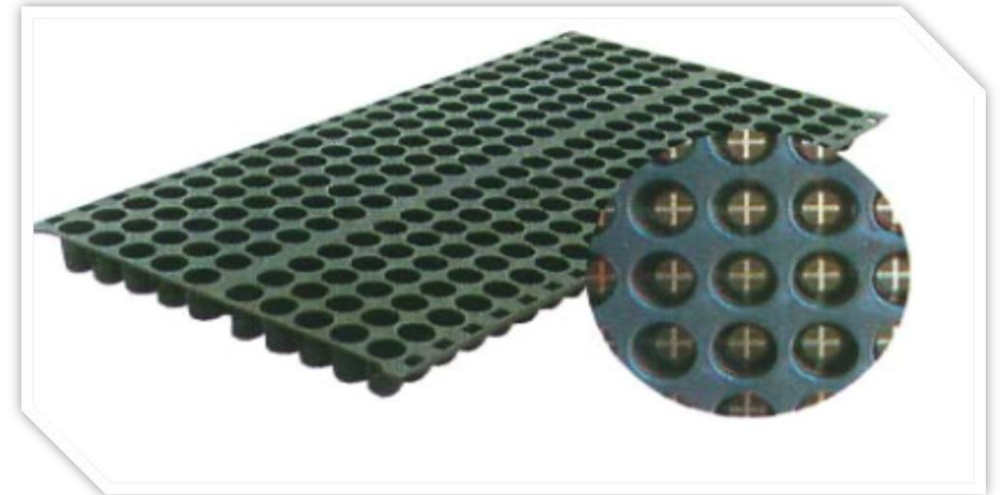


2、 Whole-process mechanization Technology

2. Seeding technology of precision seedling tray

Seedling raising :

The tray is made of special resin by injection molding, the bottom of which is equipped with automatic switch cross hole bowl, automatic drainage and nutrient absorption, so that the seedling with complete bowl-shaped nutrient soil block at the root can be raised. The seedlings were raised with 220-hole suction tray.



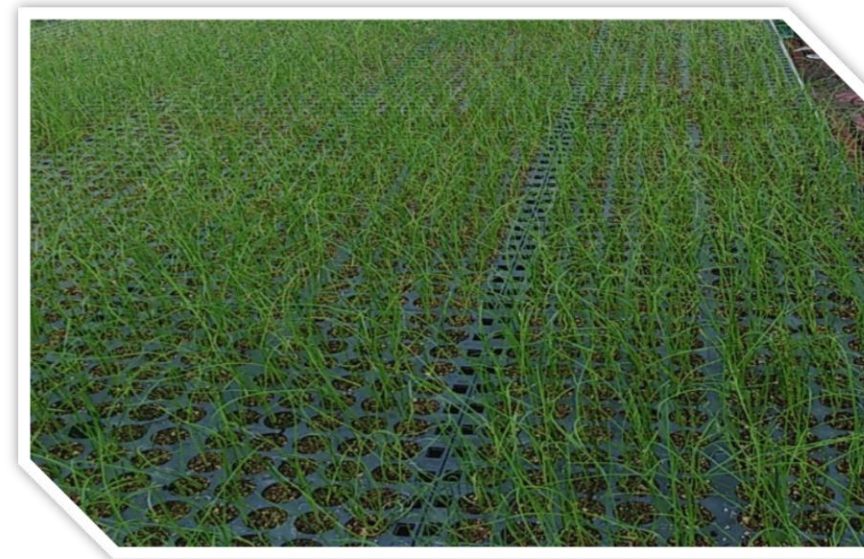
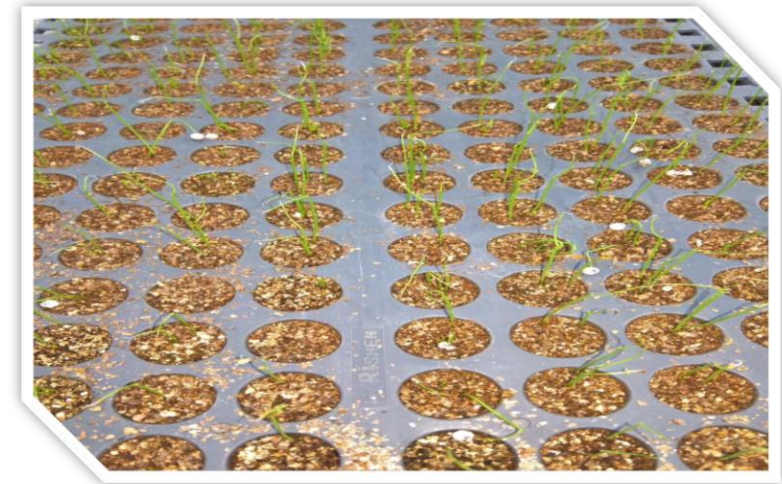
2、 Whole-process mechanization Technology

2. Seeding technology of precision seedling tray

Light matrix soil :

The substrate of seedling is made of peat or coconut bran. Coconut bran with fine grains should be used for seedling raising in summer, and coconut bran with coarse grains should be used in winter. At the same time, water containing agent should be added to improve seed germination speed. In order to improve the purity, imported matrix soil is used.

- loose aeration, strong seedling, 40-50 days shorter than that of normal nutrient soil.
- No bacteria and eggs, save medicine, reduce drug residue, no need for artificial weeding.
- The root system is developed, which is good for later growth.

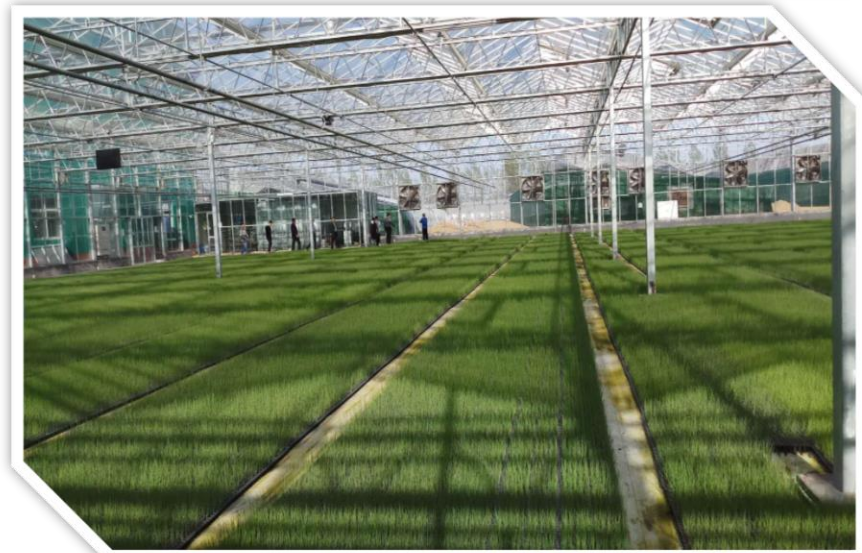


2、 Whole-process mechanization Technology

3. Industrial intelligent seedling raising technology

Standardized seedling raising shed

- Short growth period: the germination growth period of seedling tray in greenhouse is 50-60 days shorter than that in field.
- Intensive seedling bed: the seedling land required for every 1000 mu of planting is reduced from 170 Mu to 25 mu.
- Good controllability: temperature, moisture, light and nutrition can be controlled.



2、 Whole-process mechanization Technology

3. Industrial intelligent seedling raising technology

Automatic irrigation

The quality of single hole base is less, and the ability of water and fertilizer retention is poor, so it should be watered frequently with little water. An automatic irrigation system should be used. The water can be magnetized and then irrigated. The magnetized water can promote the growth and development of *Allium mongolicum*. The irrigation device is used to supplement fertilizer in seedling stage. Two technologies of spray and spray belt for automatic irrigation



A magnetized water generator for Scallion Seedlings

2、 Whole-process mechanization Technology

3. Intelligent seedling raising technology -- automatic irrigation



Sprinkler system



Spray belt system

2、 Whole-process mechanization Technology

4. Standardized seedling cutting technology

Before lodging, cut the leaves to ensure that the seedlings stand upright, reduce the evaporation of leaf water, reduce the burden of root system, and keep the seedlings strong. Mechanical cutting of seedlings can be standardized, completed in one time, saving labor and time.



2、 Whole-process mechanization Technology

4. Standardized seedling cutting technology



2、 Whole-process mechanization Technology

The technique of raising seedlings with rope

Mode 2



(Seed weaving)



(Seed Rope seeder)

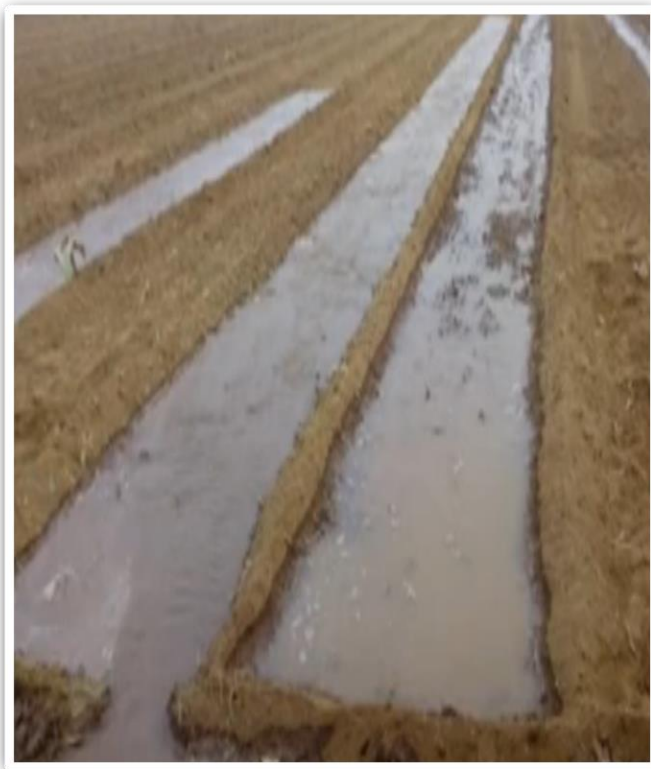


(Seed Rope seeding)

2、 Whole-process mechanization Technology

The technique of raising seedlings with rope

Mode 2



Seedbed irrigation



Seedling raising arch shed



Seedling effect

2、 Whole-process mechanization Technology

5. Land consolidation and laser land preparation technology

Land Consolidation - soil hardening

Soil hardening refers to the lack of organic matter on the surface due to unreasonable cultivation, irrigation and fertilization methods, the reduction of microbial activity, the formation of soil aggregates, the structural damage caused by external factors such as irrigation or rainfall, and the hardening of soil surface caused by cohesion after drying.



2、 Whole-process mechanization Technology

5. Land consolidation and laser land preparation technology

Land Consolidation - soil hardening

1. Farming methods (rotary farming, deep farming, suppression, etc.);
2. Excessive and wrong use of chemical fertilizer (n, P, K);
3. Use of plastic products (plastic bags, mulch film);
4. Unreasonable irrigation mode (flood irrigation);
5. Accumulation of harmful substances in soil (groundwater pollution);
6. Rainstorm and soil erosion.



2、 Whole-process mechanization Technology

5. Land consolidation and laser land preparation technology

Land consolidation -- hardening hazards

1. The root respiration of the plant is blocked
2. The root system of the plant could not develop normally
3. Plant deficiency

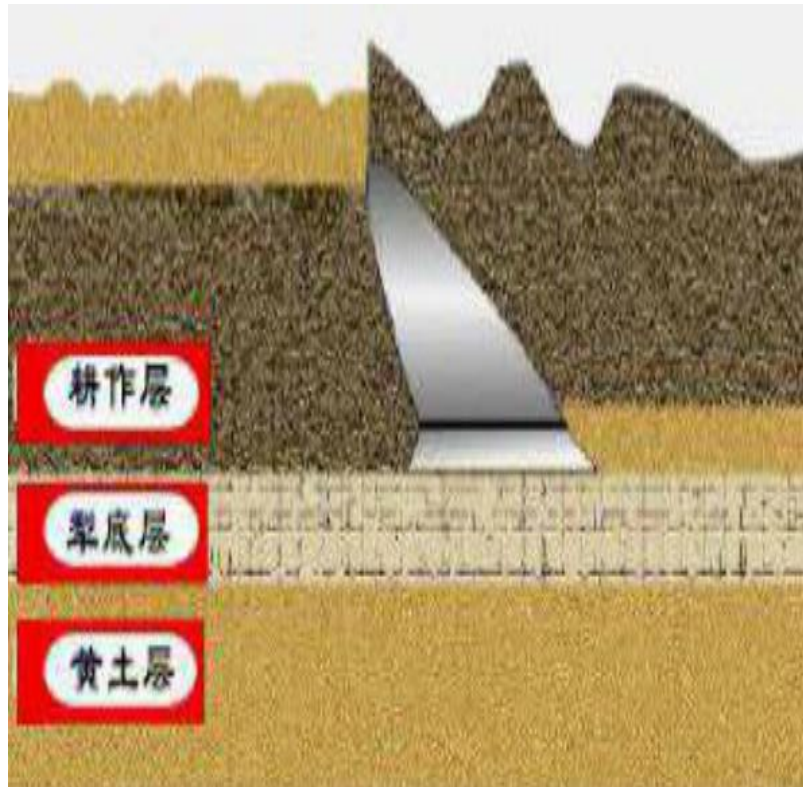
Land consolidation – solution

1. Combination of deep ploughing and deep loosening;
2. Effectively promote straw returning to the field
3. The technique of soil testing and fertilization was used

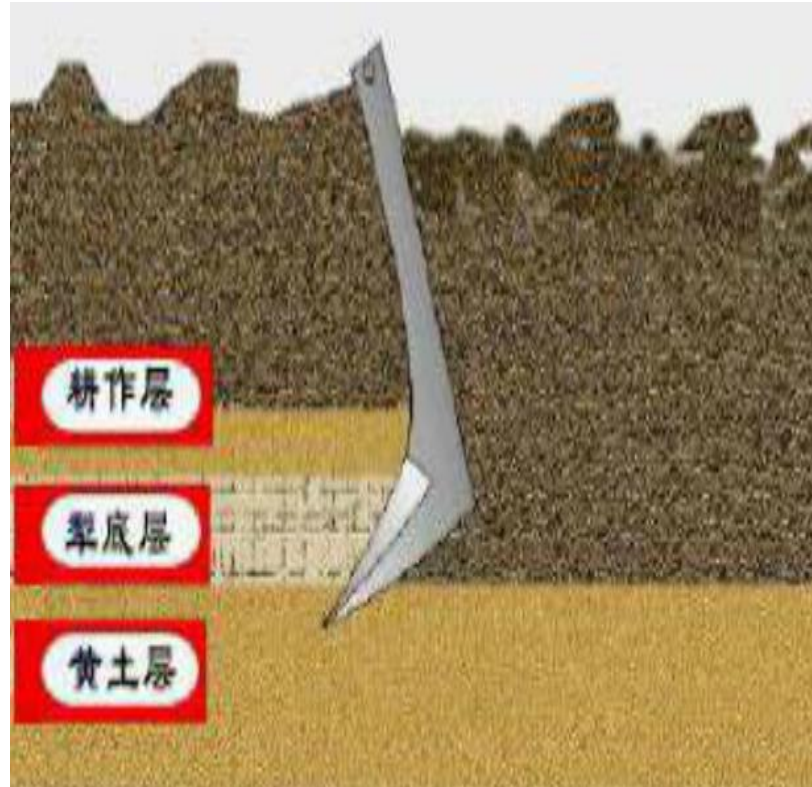
2、 Whole-process mechanization Technology

5. Land consolidation and laser land preparation technology

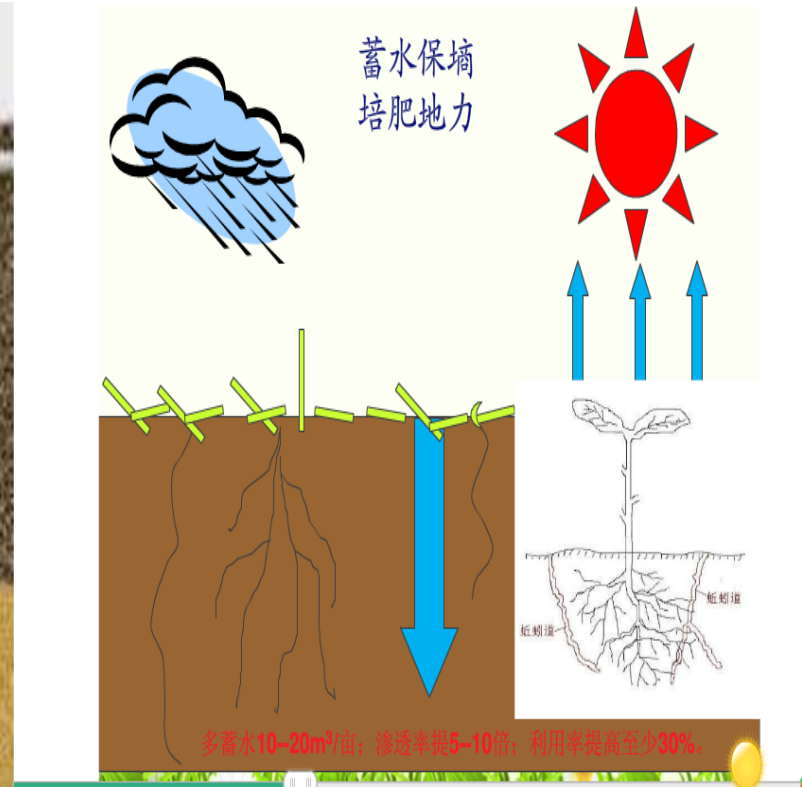
Land consolidation -- subsoiling Technology



Plough



Subsoiling



2、 Whole-process mechanization Technology

5. Land consolidation and laser land preparation technology

Land consolidation -- deep loosening and land preparation machinery



Double wing chisel type
deep loosening machine



Power driven rake



Disc harrow

2、 Whole-process mechanization Technology

5. Laser land preparation technology for land consolidation

The laser transmitter sends out a rotating beam to form a reference light plane with a diameter of 800 meters on the working site. After receiving the laser signal, the laser receiver transmits the signal to the hydraulic system, which automatically corrects and controls the lifting height of the scraper according to the command.



2、 Whole-process mechanization Technology

5. Laser land preparation technology for land consolidation

Advantage:

- The speed of land preparation is fast, 5 mu per hour, saving 70% of labor
- The ground flatness error is less than 5cm, saving 30% water
- Sorted out stones and other sundries in the land, and increased production by 30%.



2、 Whole-process mechanization Technology

5. Laser land preparation technology for land consolidation

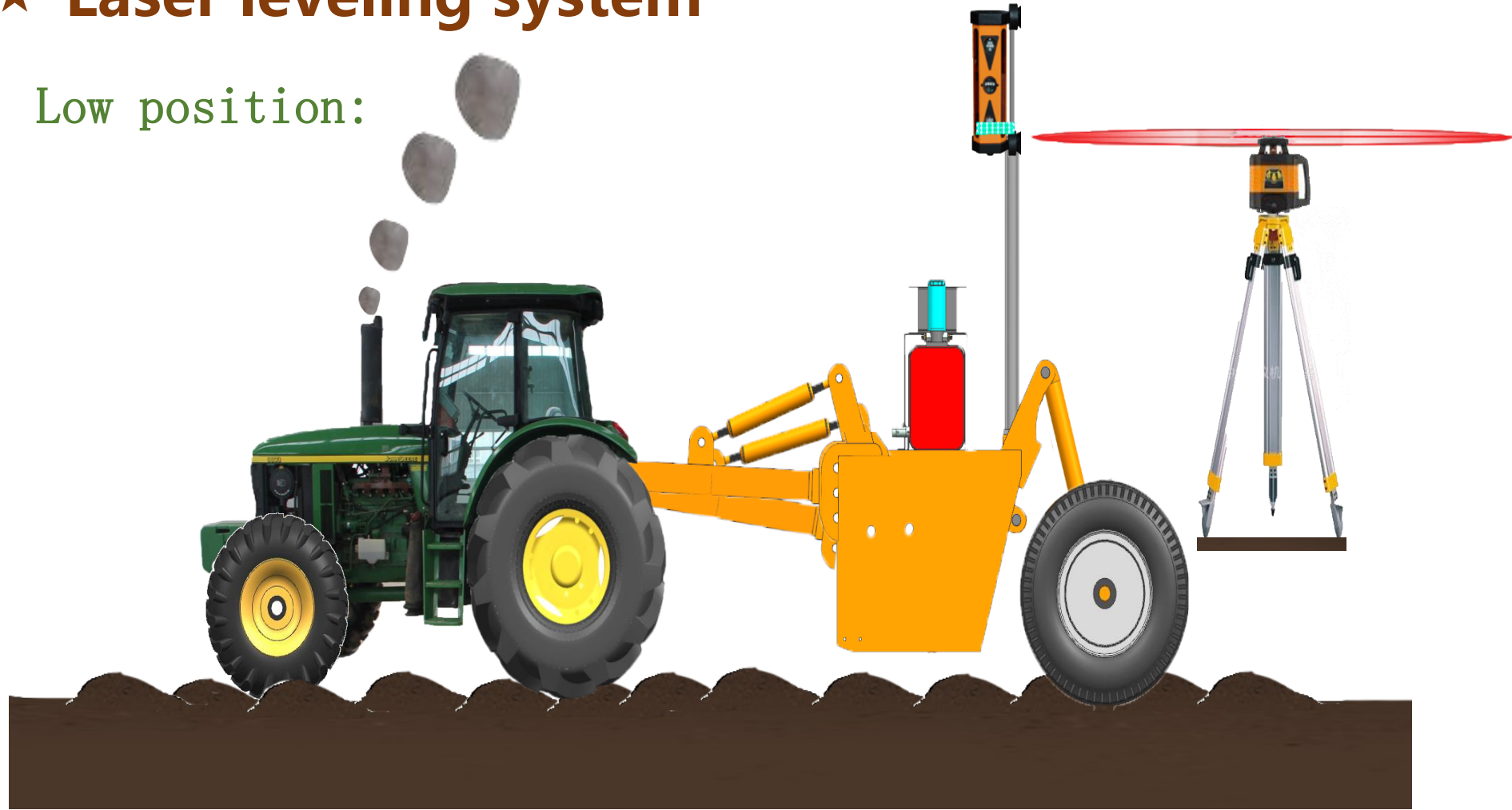


2、 Whole-process mechanization Technology

5. Laser land preparation technology for land consolidation

★ Laser leveling system

Low position:

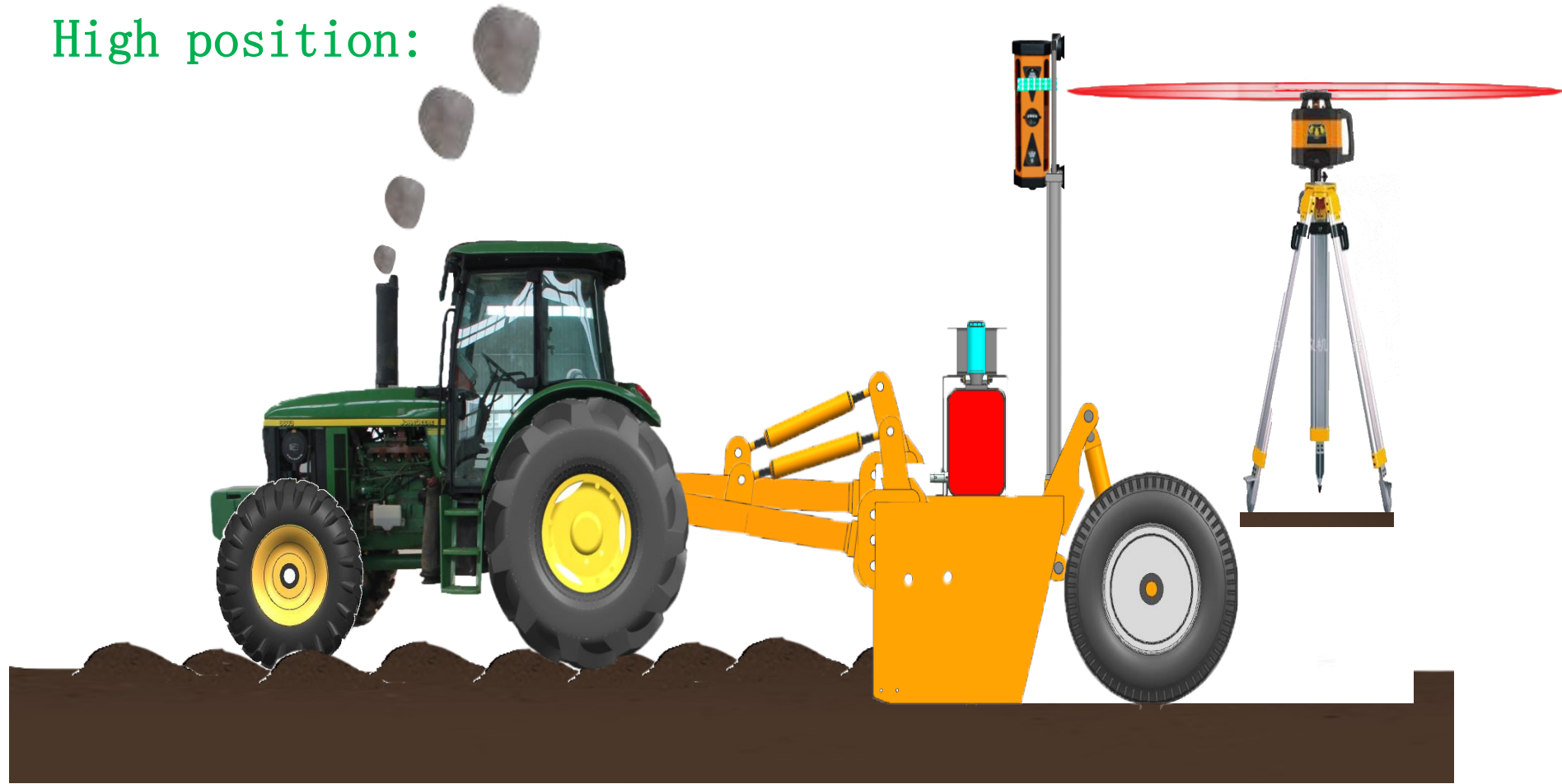


2、 Whole-process mechanization Technology

5. Laser land preparation technology for land consolidation

★ Laser leveling system

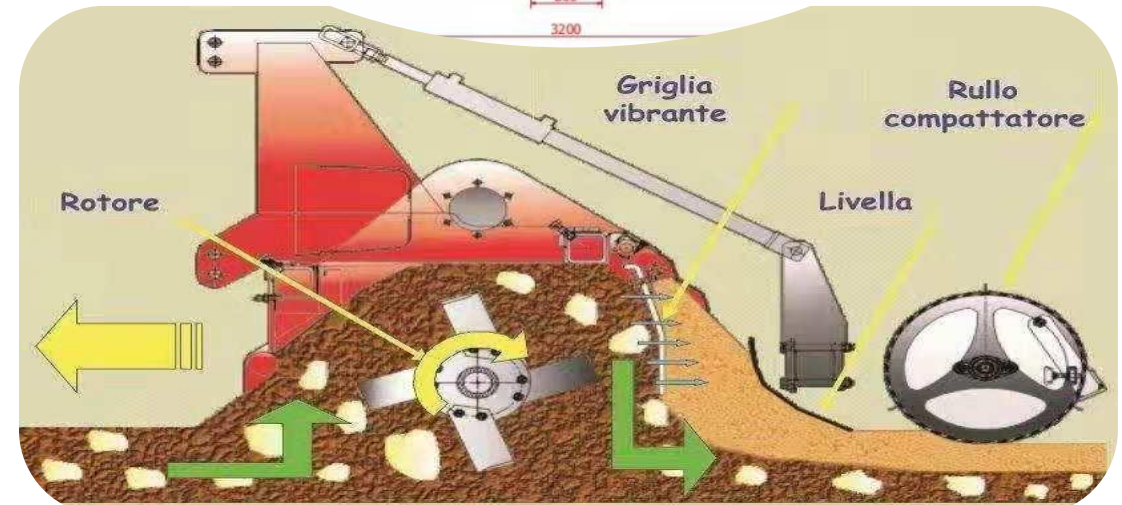
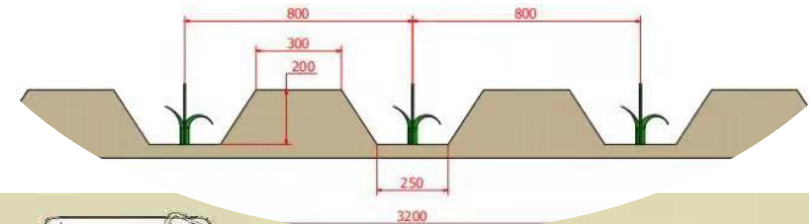
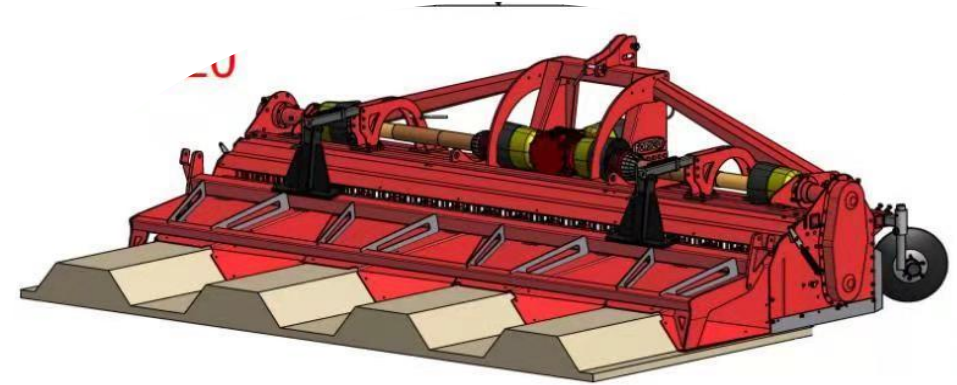
High position:



2、 Whole-process mechanization Technology

6. Customized trenching Technology

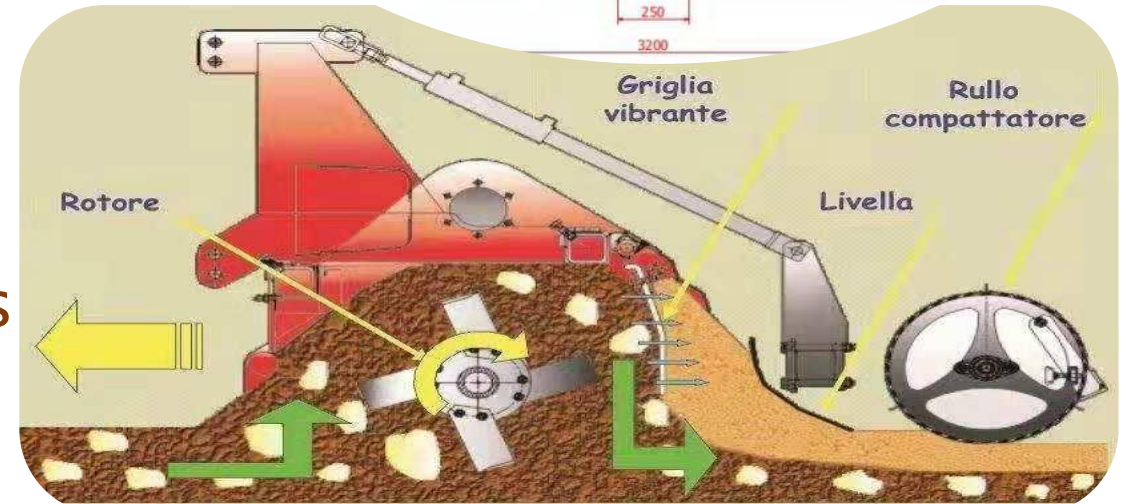
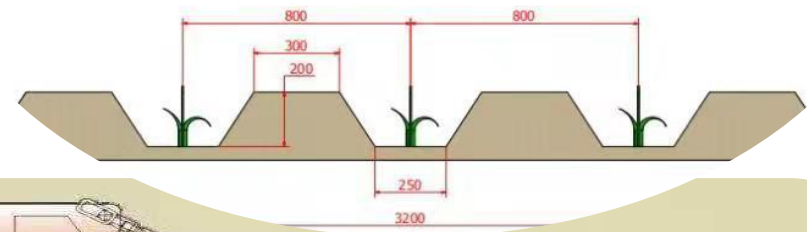
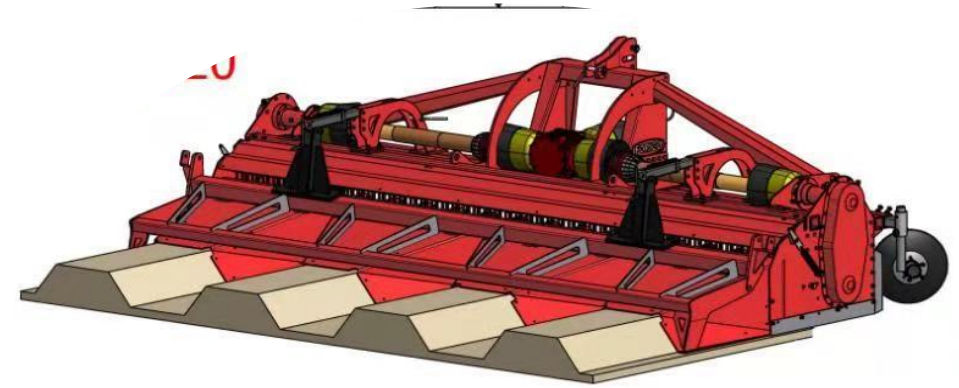
The quality of trenching affects the growth and yield of onion, and the quality of trenching affects the use of covering soil and harvesting machinery. It is recommended to use tractor with automatic driving navigation system for trenching.



2、 Whole-process mechanization Technology

6. Customized trenching Technology

In different seasons, there are different ways of trenching with scallion, and the depth is different. Different soils and plots have different requirements for trenching. For example, in rainy season, the trenching should not be too deep, and the covered plot should not be too deep. Mechanized transplanting is different from artificial cutting.



2、 Whole-process mechanization Technology

6、 Customized trenching Technology



Features: the front rotary blade breaks the soil block, and the back grinding blade smashes the surface soil evenly, sprinkles and flattens the surface soil, which will not form a hard bottom layer in the soil, resulting in impermeability and air permeability, providing the most suitable soil structure for crop landing.

2、 Whole-process mechanization Technology

6、 Customized trenching Technology - Data acquisition of automatic driving

Automatic driving of agricultural machinery is the function of using navigation satellite to realize the straight-line operation of agricultural machinery. It mainly uses angle sensor to obtain the offset data of agricultural machinery, camera to obtain the growth data of surrounding crops, navigation satellite to locate and track the vehicle information data in real time, and transmits the data acquired by the three to the control end through wireless network. After analyzing the data, it uses the on-board computer display to analyse operation status and progress.

2、 Whole-process mechanization Technology

6、 Customized trenching Technology



2、 Whole-process mechanization Technology

7、 Mechanized transplanting technology

Each transplanter can place more than 7 potholes, and each pothole can plant 660 plants.

- No automatic alarm for seedlings, and the plant spacing and depth can be adjusted and controlled in the whole process
- High degree of standardization, complete, uniform, strong onion seedlings
- Only takes 60-90 minutes to complete the planting of 30000 Welsh onion seedlings per mu, and one set = 30 labor.



2、 Whole-process mechanization Technology

7、 Mechanized transplanting technology



Yakemei Transplanting



Jingguan Transplanting

2、 Whole-process mechanization Technology

7、 Mechanized transplanting technology



Traditional seedling bed

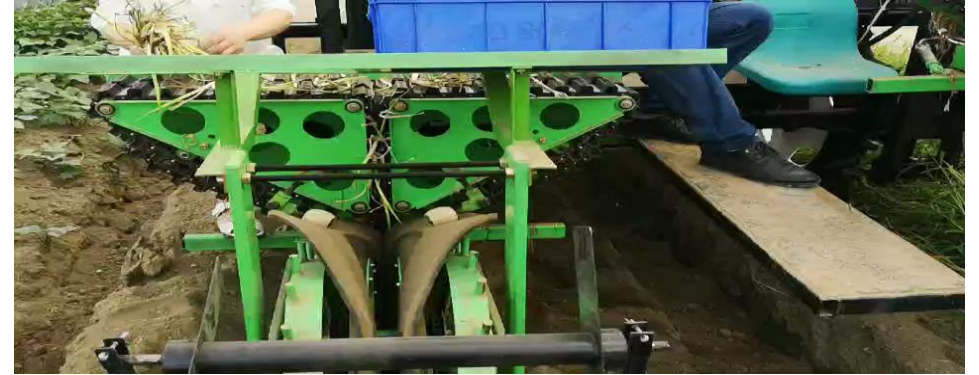


2、 Whole-process mechanization Technology

7、 Characteristics of Different Transplanting Techniques:

Semi automatic planting:

The advantages of scallion are large seedling, short seedling slowing time, strong disease resistance, suitable for large-scale operation. But it takes a lot of labor. Slow operation speed.



2、 Whole-process mechanization Technology

7、 Characteristics of Different Transplanting Techniques:



Transplanting with drip irrigation



Transplanting in dry area



Transplanting of shallot in Guangxi

2、 Whole-process mechanization Technology

7、 Characteristics of Different Transplanting Techniques:



Mechanical transplanting 27 / M



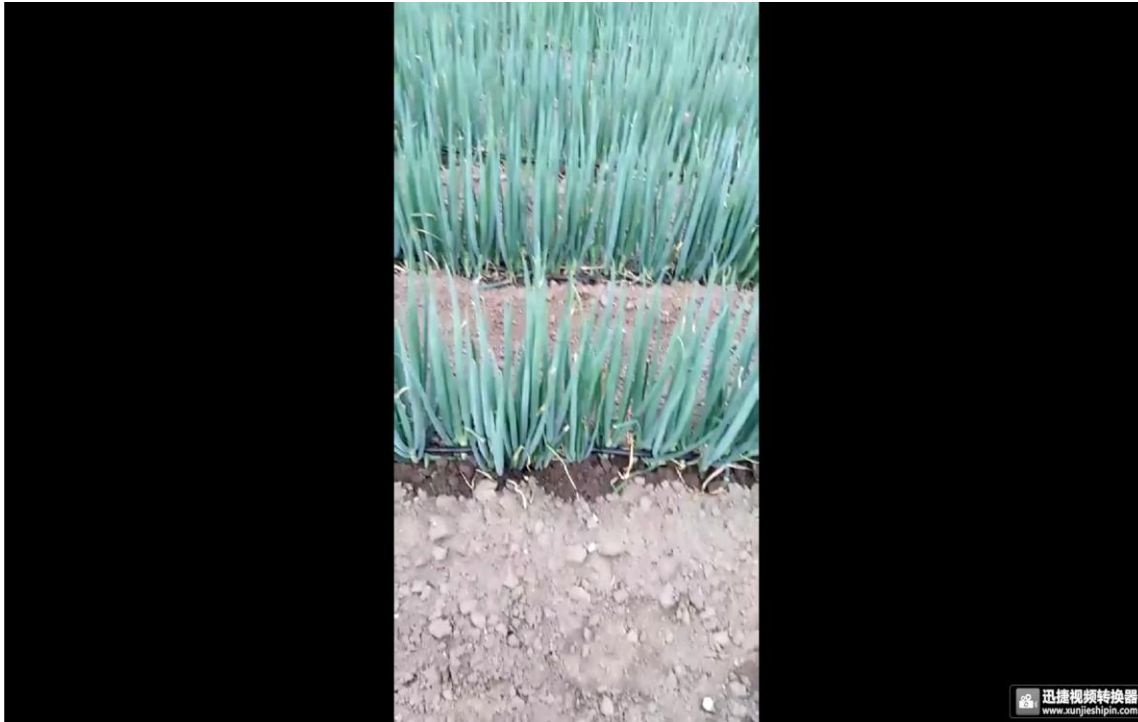
Artificial planting 22 / M

2、 Whole-process mechanization Technology

8、 Precise plant protection technology

Integration of water and fertilizer

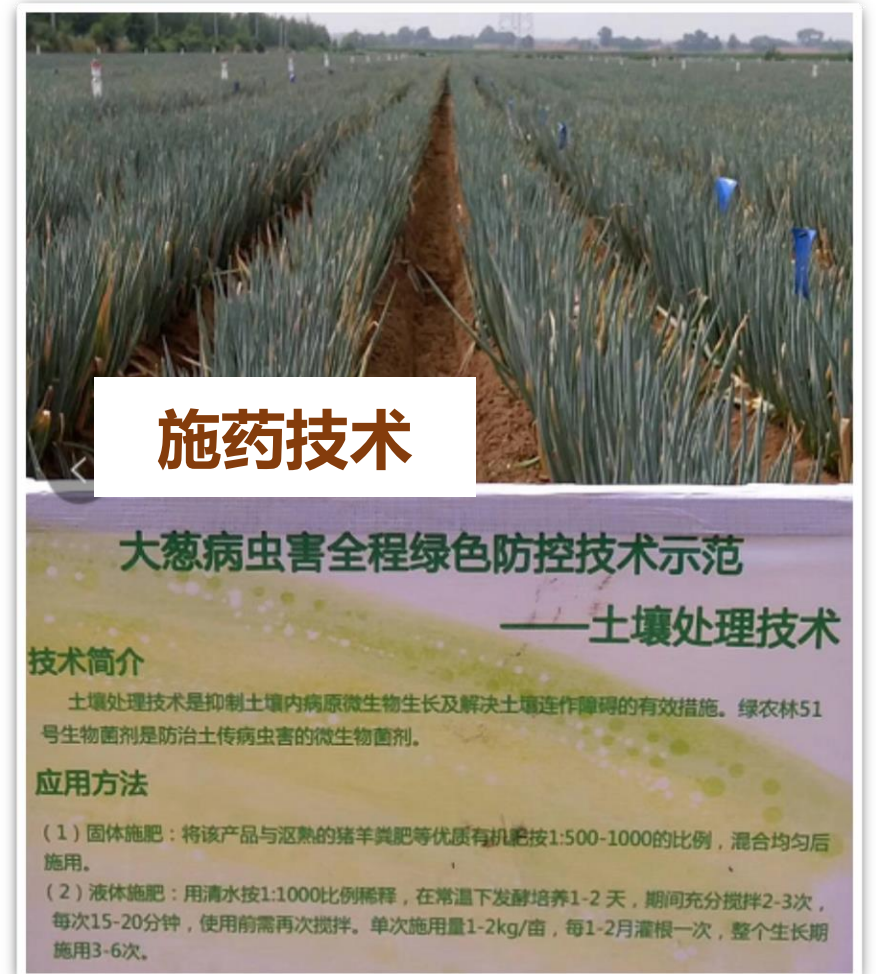
Mechanized plant protection



2、 Whole-process mechanization Technology

8、 Precise plant protection technology

Pest control



Insecticidal lamp (using beet armyworm, cotton bollworm, tiger and trips to trap and kill pests)

2、 Whole-process mechanization Technology

8、 Precise plant protection technology



Multifunctional machine for plant protection, fertilization and transplanting

2、 Whole-process mechanization Technology

9、 Quantitative soil covering technology

Scallion, also known as pseudo stem or bulb, is the main factor affecting the price of scallion. The length of scallion restricts the quality of scallion. Covering function: anti lodging, soft false neck, increasing green and white, anti bending. The higher the soil is, the longer the scallion is, the whiter and fuller the scallion tissue is, the higher the price is. Fertilization in the process of soil covering is also one of the important factors affecting the verdant.



2、 Whole-process mechanization Technology

10、 Intensive recovery technology

Difficulties:

- No damage excavation technology, vibration shaking technology and flexible clamping and conveying technology need to be further improved
- Soil types and planting patterns affect the applicability of mechanization
- The baling technology is not mature, and the water loss is caused by untimely baling.



2、 Whole-process mechanization Technology

10、 Intensive recovery technology



Manual harvesting: in the process of centralized harvesting, a 10 persons harvesting team set up by skilled farmers can only harvest about 3 mu per day. One machine can harvest about 8 mu per day on average.

3

Whole-process Mechanization



Benefits



3、Benefits

Economic Benefits

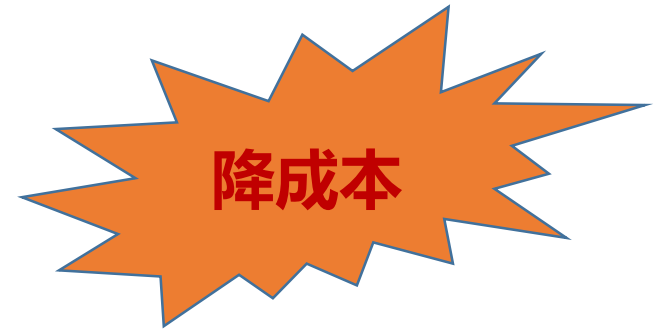


表 2 大葱种植全程机械化作业与人工作业
成本比较 元·hm⁻²

作业环节	机械化作业		人工作业	
	物质投入	操作费用	物质投入	人工费用
播种	3 375	60	1 200	—
育苗 ¹⁾	—	—	1 200	1 290
定植	—	15 600	—	4 500
采收	—	7 800	—	15 000
化肥农药费用	9 450	—	10 500	—
总成本	36 285		36 690	

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The material input and operation cost (including labor) of each link of mechanized operation is 2419 yuan / mu in total, the labor operation cost is 2446 yuan / mu in total, and the mechanized operation cost is 27 yuan / mu less than the labor operation cost. The labor cost can be saved about 1386 yuan per mu by converting the whole mechanized operation.

3、 Benefits

Social Benefits

- Carry out social services to increase the income of small farmers.
- Reduce labor intensity and save rural labor.
- Improve the operation process and promote large-scale planting.



3、 Benefits

Ecological Benefits

- Rational use of drugs, formula fertilization, soil improvement.
- Intensive management to improve resource utilization.
- Standardized planting to achieve sustainable development.





4

Whole-process Mechanization



Social Service

4、 socialized service mode

Mode 1: "order seedling, transplanting on demand, tracking management" service mode

Order seedling: the onion grower signs a seedling contract according to his planting area and can provide seeds by himself or uniformly.

Transplanting on demand: the planter shall contact the seedling raising unit for arrangement in advance according to the transplanting time

Tracking service: provide technical guidance for later field management for growers. Free technical service.



4、 socialized service mode

Mode 2: service mode of "nursery enterprise + cooperative + farmer"

The cooperative unites the growers and signs a unified contract with the seedling raising unit. The cooperative arranges personnel to be responsible for the coordination and service of seedling and transplanting contracts.

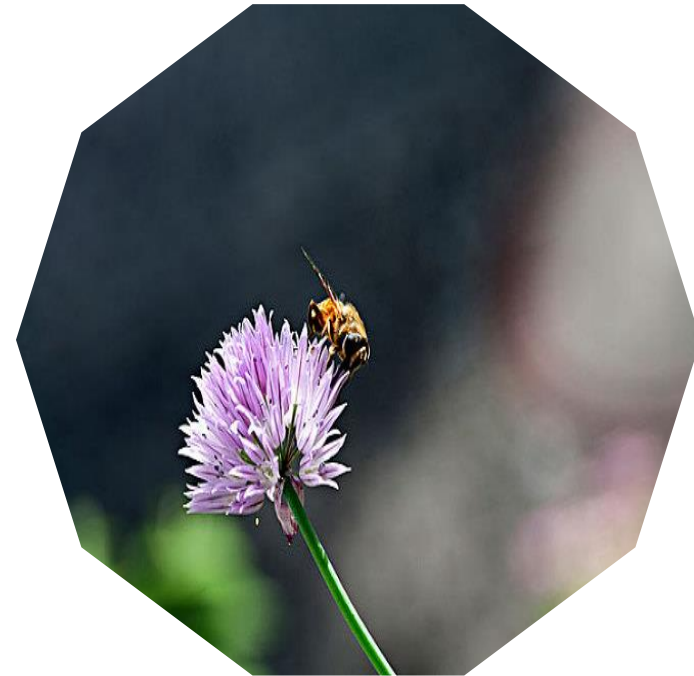
- reduce the problem of poor external contact due to the small area of farmers.
- solve the difficulties and disputes in dealing with ordinary farmers.
- cooperatives can obtain certain economic benefits by providing intermediary services.



4、 socialized service mode

Mode 3: whole process trusteeship service mode

Cultivation, planting, management and collection shall be undertaken by special service organizations. The plant protection technology team can make a professional "visit" to develop the whole process solution.



4、 Socialized Service Mode

Mode 4: production area recycling, processing and export mode

- The uniformly transplanted green onions will be harvested in a centralized way, transported back to the seedling raising institutions for further processing, such as mechanized peeling, bundling, etc., and sent to the foreign wholesale market, and the products will be embedded in the origin label
- At the same time, realize the docking of agricultural supermarkets, directly supply supermarkets, and increase the price of scallion.





5

Current Difficulties



**& Future
Directions**

5、 Current Difficulties & Future Direction

Current Difficulties

Seedling stage: Factory seedlings are greatly restricted by natural conditions. Such as: voltage, ventilation, weather, etc.

Field management stage: The traditional management is difficult to change, and the agricultural technology cannot keep up with the development of agricultural machinery.

Harvest stage: The key technical links are still not completely broken through, good opportunities, good varieties and good laws are not yet matched, and binding technology needs to be broken through.



5、 Current Difficulties & Future Direction

Future Direction

I. developing smart Agriculture:

Promote the application of Internet of things, big data, mobile Internet, intelligent control, satellite positioning and other information technologies in agricultural machinery equipment and agricultural machinery operation, and promote the integrated development of intelligent agricultural machinery, intelligent agriculture and cloud farm construction.

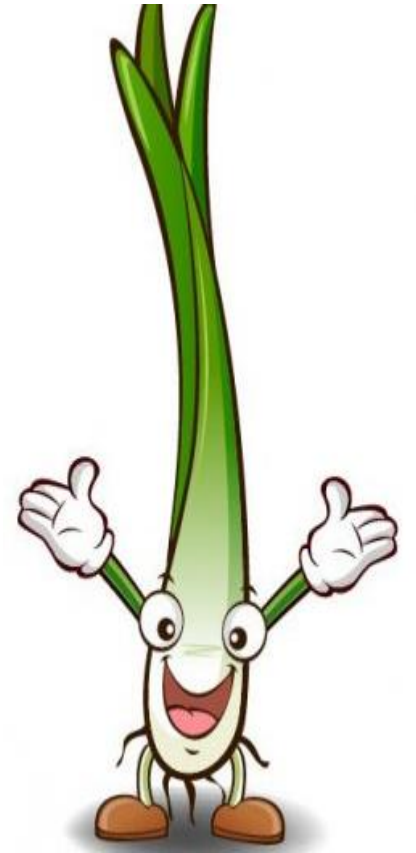


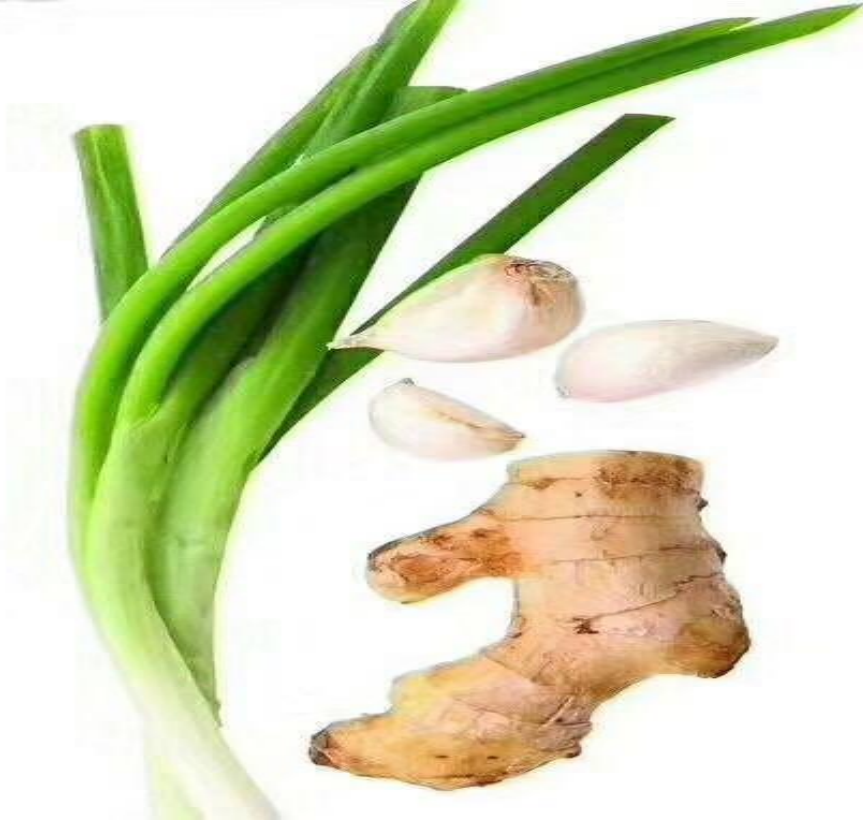
5、 Current Difficulties & Future Direction

Future Direction

II. Promote social services:

The main body of agricultural machinery service is encouraged to carry out efficient and convenient agricultural machinery operation service through order operation, agricultural production trusteeship and other forms, so as to promote the organic connection between small farmers and modern agricultural development





Thank you!