

Study on Irrigation Pattern in Conservation

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ABSTRACT

Conservation tillage (CT) is a dryland agriculture technique.

In Xinjiang Province, irrigation is a big problem. This research aims to study CT and determine the patterns of the technology.

Various countries have used the technology of CT. In China, practices related to CT have been implemented by farmers such as straw stalk cover, plowing and seed sowing, and deep soil planting to save on irrigation water.

CT technology protects and saves the land resource and increases agricultural productivity, Thus, policy support is needed to promote the technology.

In recent years, the Ministry of Agriculture is promoting CT, resulting in coverage of more than 20 million acres.

In Xinjiang, the annual mean rainfall amount is only 145mm, and 80 per cent of the cultivated land depends on surface irrigation. As a result of traditional irrigation, Xinjiang has developed a conservation tillage system as a way of irrigation farming conservation. This has further led to the development and promotion of an irrigation protection cultivation technique and pattern in Xinjiang which has a certain typical nature and representation.

In 2005, the Ministry of Agriculture embarked on a conservation tillage technique project which was implemented for two years. Under the project, the ministry studied in depth the Xinjiang dryland agriculture conservation tillage.

1. XINJIANG DRYLAND AGRICULTURE CONSERVATION TILLAGE

Xinjiang has 700 million mu of dryland farm. Generally, yields are poor and unstable. As a result of regular plowing, the area experiences soil erosion and desertification, the situation has continued to deteriorate.

In the 1990s, CT was promoted as a water saving technology in the northern region of Changji, the Tacheng, the Yili area, and other places along the Tianshan large dry areas. The use of ordinary drilling machine tillage planting was also promoted. No-tillage operations not

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only reduced costs, but resulted in higher yields. It also curbed soil erosion and desertification, and had become increasingly accepted by the farmers.

Dry farming areas implementing no-tillage planting has reached 40 million mu, of which more than 20 million mu were devoted to grain, soybean, sunflower, and other crops to achieve the zero tillage conservation tillage practice. The no-tillage/tillage sowing forage technology was promoted for natural grassland restoration and improved grass production. In conjunction with the state's project to protect natural grassland, a grassland-tillage sowing machine and conventional drilling machines were promoted. With the technology, nearly 80 million mu was covered.

2. XINJIANG CONSERVATION TILLAGE AND SURFACE IRRIGATION PROBLEMS

There are more than 5,000 hectares of farmland under irrigation in Xinjiang since the 1990s. As crop stalks are mainly used for livestock, the implementation of no-tillage sowing technology is not popular in the area. No-tillage sowing, however, is practiced as a dry water-saving technique at the Xinjiang Agricultural University irrigation district. Specifically, the practice was implemented at the southern border of Kashgar, Aksu, and along the northern Tianshan area, including the Ili Valley.

Currently, the Kashi region promotes small wheat stubble and no-tillage planting maize covering 50 million mu. This cropping pattern is being supported by state policies which farmers welcomed. The technology of CT has focused on the problem of maize crop to the ground in no-tillage sowing.

The inland introduction of large-scale machinery into a small land parcel is unsuitable. Simultaneously, Xinjiang's irrigated soil generally hardens quickly. Therefore, many areas are using the rotary cultivator. At present, the Chinese farm machinery courtyard production is large and middle-scale. Another difficulty is the need to solve the irrigation problem. After the implementation of conservation technology, the boundary ridge between fields and the ditch ridge are unable to maintain the traditional small furrow view fills. So, the irrigation pattern has not been suitable.

3. EXPLORATION AND REALIZATION OF IRRIGATION FARMING AND PROTECTION CULTIVATION TECHNIQUE UNION

Many have discovered from the massive experimental study that the wheat-corn crop rotation carries on seeds on the plough causing uneven ground surface. This affects work quality.

In the corn planter, they must carry on the ploughs earth, with the ridge apart from between 45-50 centimeters.

3.1 Explorations under Existing Surface Irrigation Condition Protection Cultivation

Technique Pattern

Since agriculture utilizes a major part of surface irrigation, crops' irrigation system and planter patterns are different.

3.2 Different Crop Rotations, the Irrigated Way which Unifies the Conservation Condition

3.2.1 Broadcasts or Broadcast Irrigation

After implementing the protection cultivation technique, the winter wheat fills the soil with moisture. The summer corn technology pattern cannot use this technology.

3.2.2 Ridge Irrigation

Through protection irrigation, the wheat and corn crops may adopt the water. The expanded soil crops planter raises the soil, reduces the labor requirement in irrigation, saves time, and enhances the soil to conserve moisture resulting in production efficiency.

4. XINJIANG CONSERVATION IRRIGATION PATTERNS

For two years, Xinjiang depended on the Ministry of Agriculture and the autonomous region in Qitai and the two counties to send a committee to serve nearly 100,000 Chinese acres on protection cultivation. The model has established different irrigation patterns for protection cultivation techniques and conducted experimental demonstrations..

4.1 Spray Irrigation Patterns

The spray irrigation effect approximates the nature rain which is good. In drip irrigation, the water pulls the drip irrigation belt after sowing seeds, which causes the tube belt to drop the hydrosphere aimed at the crops, which in effect saves water. However, this system is expensive and therefore, depends on a national project and policy support.

4.2 The Ditch Fills Pattern

Using wheat seedlings, this pattern involves a revolving farming machine which completes the gutter, sows seeds, applies fertilizer, covers it, and results in compaction. Through suppression, the pouring drainage of 10-15cm is formed; and after sowing the seeds, a forming seeding region of 3-5cm in the pouring drainage is formed. Water savings is remarkable. This pattern may continuously avoid sowing seeds of low pole crops (e.g., wheat and legumes) and high pole crops (e.g., corn and oil sunflower).

4.3 The Furrow Fills Pattern

The technology of furrow fills defines the width according to seeder work scope furrow. Employing human power or the machinery builds the boundary ridge between fields and a land parcel unified plan is 7.2 or 10.8, which is the multiple of 1.8 and 2.4 with the width of 0.3-0.4m. The altitude is 0.3-0.4m. Using machines and tools and power, wheel distance can unify and realize the fixed road work. With this pattern, surface irrigation is realized and irrigation water is saved to a certain degree.

5. TECHNICAL ROUTE AND SPECIFICATIONS

5.1 Overall Specifications

5.1.1 Surface Processing

The stubbles may block water soil moisture. With the first stubble corn, avoid the cultivation or sowing of wheat seeds as mechanical devices artificially builds the boundary ridge between fields after shallow rake process.

5.1.2 Sowing Seeds Turns the Soil

It is important that the suppression of the soil is not solid to enable the seeds to emerge and grow.

5.1.3 Keeps the Stubble Altitude

The wheat should be bigger than 20 cm; corn and safflower bigger than 30 cm; and the oil sunflower straw may completely keep the stubble, in order to guarantee straw the cover quantity.

5.1.4 Mechanical Surface Soil Processing is not Bigger than 5 cm

5.1.5 Winter Wheat Extinguishes the Grass Seedling Stage

Artificial weeding and chemical weed control during the spring extinguishes the grass before the seeds are sown. Chemical weed control should be carried out.

5.1.6 Need for Applying Fertilizers

Making organic fertilizer the foundation, inorganic fertilizers should be applied to enhance moisture content efficiency.

5.2 Irrigation Pattern's Technical Route and Request

5.2.1 Sprinkler Technique

Technical route: Combine or artificial returning the high stubble (20-30cm) harvesting-deep loosening (23-30cm, each time three to four years) -no-tillage seeding and fertilization-field management during crop growing period-combine or artificial returning the high stubble (20-30cm) harvesting.

Technical requirement: To complete several operations at one time including ditching, seeding, fertilizing, earthing, crackdown, seed and fertilizer application to stratified sowing (depth of seeding is 3-4cm, depth of fertilizing is 7-8cm), the array pitch is 19-20cm. The atmospheric sprinkler technique which has been used in this model (self-pressure sprinkler irrigation), does not need any turbocharged equipment; makes use of the pressures produced by the natural gradient (gradient $>3\text{m}/1000\text{m}$) to sprinkler irrigation; the sprinkler pipeline has the reticular formation of stem and branch pipe, with the main pipe fixed in the soil perennially, its length according to the land's length, each 8-10m has an attachment; the length is 50-100m transportable branch pipeline when the spraying of water receives the main pipeline in the attachment, each 8-10m at pipe installs one sprinkler.

Before the crops are harvested, there should be total irrigation water annually from May to July. This can be done using sprinkler irrigation facilities. It may also use the surface fluctuation to be bigger, resulting in higher yields in the mountain arid land.

5.2.2 Furrow Irrigation Technology

Technical route: Combine or artificial returning of the high stubble (20-30cm) harvesting-deep loosening (23-30cm, each time three to four years) – the land parcel builds the boundary ridge between fields-surface processing-no-tillage seeding and fertilization-field management during crop growing period (irrigation and chemical control to the weeds) -combine or artificially returning the high stubble (20-30cm) harvesting.

Technical requirement: Several operations can be completed at one time including ditching, seeding, fertilizing, earthing, crackdown, and forming 10-15cm deep pouring drainage through the suppression by the roller. After sowing seeds, the narrow line (each line is the width which is 2-4cm seedling belt), with the wide wend width is 25cm, the narrow wend width is 15cm; Seed and fertilizer have been sown by a subsidiary bank; the chemical fertilizer is broadcast among the narrow line; first stubble for corn's land parcel when abolishing must enlarge the agricultural chemicals dosage. Its characteristic is that rotary tillage for the seedling belt has certain comminuted earth function, thus sowing seeds quality is good, production efficiency higher, is easy to irrigate, the compatibility is strong, and suits the big area promotion. Its shortcoming is the straw stalk where 80 per cent of all concentrates in the ridge.

The seeding machine number is 2BMFS-5/10, 6 /12, 7 /14 wheat and corn with a rotary planter and fertilizer application applied.

5.2.3 Small Furrow Irrigation Technology

Avoid ploughing and fertilizing during the second spring - field management in crop growth stages which is a combined harvest or artificial (20-30cm) - deep loading tillage (every 3-4 years), then no-tillage can be applied continuously in these fields.

Technical requirements. 2BMC-18 no-till seeder 3.6 meters、 2BY-6 – this machine avoids ploughing corn seeder 3.6 meter (row-spacing is 60cm), 2BY-4 avoids ploughing corn seeder 1.8 meter (row-spacing is 45cm) , 2BMFS-6 avoids ploughing wheat seeder 1.2 meter (row-spacing is 20cm), 2BMFS-12 rotary tillage planter 2.4 meter (average row-spacing is 19cm)。

According to the machines' width, it adopts artificially. The unified plan will be 7.2 meter or 10.8 meters (Integral multiple of single machine's working width), when the length of stripe field is longer than 200 meters and slope of land smaller than 3per cent, the banking specification will be 30cm width and 30cm height; when the length of stripe field is longer than 200 meter and slope of land between 3 and 5 percent, the banking specification will be 40cm width and 30cm height. If the bank of field is formed and kept great, the contradiction between protected cultivation and irrigation will be resolved.

According to the China Machine Academy, the number of 2MBG-18 No-Till Seeder's operating width is 3.6 meter design banking of plots. Take it as suitable the normal irrigation smallest furrow of width as the principle, when the land parcel slope is higher than 5 per cent, suitable irrigation uses 7.2 meters plot patterns; when the land parcel slope is lower than 5 percent, the irrigation may use 10.8 or 14.4 meters plots pattern. In the irrigation quantity aspect, rotary tillage with the sowing of seeds irrigation pattern and the conventional ditch fill without the difference, the stub land exempts ploughs. In most recent years to have an increase, the Shan Ciguan water volume reduces, along with the passage of time; the transpiration rate reduces year by year, and always fills the water volume to enable for a normal reduction, in the Xinjiang arid area. The stub land exempts ploughs and this is advantageous to raise the moisture content use factor.