

An Approach on the Practice and Development of Conservation Tillage in Ningxia Hui Autonomous Region

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ABSTRACT

Key words: Ningxia, conservation tillage, practice, development

The technology of conservation tillage has been introduced into Ningxia for the past five years. The technology has been extended in 15 demonstration counties which extends to an area of 70,000 hm² characterized with three different ecological blocks. The following cropping patterns are practiced in the area: spring-wheat, winter-wheat, spring-maize, summer-maize, beans and grass. This paper analyzes the trend and development of technology on conservation tillage in Ningxia.

1. INTRODUCTION

Ningxia Hui autonomous region is located at the east part of northwest China, the middle-upper reaches of the Yellow River. The region has 22 counties with a population of 6.03 million. Ningxia is one of the five regions inhabited by minority nationalities in China. The total land area is 66,400. km², of which 1.1 million hm² is cultivated land; and 2.33 million hm² is grassland. It is one of the ten big grasslands of China. The average size of cultivated land is 0.2 hm². It is divided into three different kinds of ecological blocks: southern mountainous area, arid area in the middle, and the Yellow River irrigated area from the south to the north. Annual precipitation ranges from 183.4 to 677 mm, while annual evaporation is from 1500 to 2300 mm. Rainfall is reduced gradually from the south to the north. The main restraints for Ningxia's agricultural development are the arid climate condition, fragile ecology, and shortage of irrigation water.

The technology of conservation tillage was started in 2003 in Ningxia to test and demonstrate the technology in three different kinds of ecological areas covering 15 demonstration counties with an extension area of 70,000 hm². Therefore, the extension of suitable conservation tillage in Ningxia, has a profound significance in improving the crop yields and farmers' income, saving water resources, and conserving and improving environment.

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2. THE CONSERVATION TILLAGE MODELS IN DIFFERENT AGRICULTURAL DISTRICTS IN NINGXIA

2.1 Conservation tillage has achieved remarkable savings in costs in the Yellow River irrigated area, but still, it is not sufficient.

The annual average temperature is 7.6 in this area. The soil type is irrigated wrapped soil and flow soil. The main crops are wheat, maize and paddy. There are three significant factors affecting the implementation of conservation tillage in this area. Firstly, crop straw being returned to the fields is helpful in preventing the dust storm and improving land fertility. Secondly, little or no ploughing is helpful for water saving. Thirdly, simplifying the tillage links is helpful in increasing agricultural efficiency. It is difficult to extend the conservation tillage technology on the condition of sowing spring-wheat when the freezing of the land is not yet over.

Four models of the technology of conservation tillage have been tested and demonstrated in six counties from the Yellow River irrigated area, which are spring-wheat seeding with no-till (less-till) in single cropping system, spring-maize seeding with no-till (less-till) in single cropping system, spring-wheat and summer-maize/beans seeding with no-till (less-till) in double cropping system, and winter-wheat and summer-maize/beans seeding with no-till (less-till) in double cropping system.

Results of the above practices showed the following:

- (1) The effect of output savings and income increases is not remarkable in spring-wheat seeding with no-till (less-till) since the quality of planting is difficult to guarantee. The soil is still frozen during the planting period.
- (2) The crop yield may increase from 3 to 5 per cent in spring-maize seeding with no-till (less-till). Meanwhile, spring-maize seeding with no-till (less-till) can also result in savings in labor, working time, money and irrigation water.
- (3) Crop yield may increase from 5 to 10 per cent in winter-wheat seeding with no-till (less-till).
- (4) Crop yield may increase from 10 to 20 per cent in summer-maize or beans seeding with no-till (less-till) after harvesting wheat.

2.2 The technology of conservation tillage has an important action on improving ecological environment in the mid-arid zone. Crop planting can only be successful with additional water in the irrigated area.

The annual average temperature in the mid-arid zone is 8.1. The annual precipitation is about 220mm, while annual evaporation is about 2200mm. The main crops are wheat,

maize, potato and some coarse cereals. The effect of conservation tillage on the crop planted is unfavorable if there is no additional irrigation water.

Three models of the technology of conservation tillage have been tested and demonstrated in two counties in the mid-arid zone, with the following cropping pattern: spring-maize seeding with no-till (less-till) in single cropping system in arid area, spring-maize seeding with no-till (less-till) in single cropping system in additional water irrigated area and grass seeding with no-till (less-till) after raining. With the practice, the following were observed:

- (1) Compared with traditional maize planting with plastic, spring-maize seeding with no-till (less-till) has lower outcome in arid areas.
- (2) Crop yield may increase from 5 to 10 per cent in spring-maize seeding with no-till (less-till) if additional water is provided in the irrigated area.
- (3) Seeding grass with no-till (less-till) after raining in desert area brings about good results. Compared to manual work and air seeding, grass seeding with no-till (less-till) increases grass cover from 30 to 68 per cent. Grass production increased to 2250kg/hm² from 675kg/hm². It improves the ecological environment and provides forage grass for the animal industry.

2.3. The yield increase is obvious in southern mountainous area.

The average temperature in the southern mountainous area of Ningxia is 5.6 with an average precipitation of 580 mm yearly, but the evaporation average is 1550 mm. The main crops are winter-wheat, maize, potato and buckwheat. The crop yield is low and unstable. The ecological environment is rather fragile having experienced nine droughts in ten years. Farmers' income is very low and agricultural development foundation very poor.

Winter-wheat seeding with no-till (less-till) is the main model in this area. Compared with traditional planting method, the crop yield of seedbed tripe rotation seeding may increase from 10 to 30 per cent. This year is the driest year in the recent 50 years, but the wheat with seedbed tripe rotation seeding has advantages in fighting drought. The technology of wheat with seedbed tripe rotation seeding will be the main agricultural technology of fighting against drought since the farmers and experts are satisfied with technology.

3. MAIN MEASURES TAKEN IN NINGXIA

As conservation tillage extension progressed in Ningxia, different measures were undertaken such as government support, technical training, demonstration and propagation, and etc. A main principle in the implementation of the technology was "setting up one consciousness" involving one principal, signing a series of responsibility contracts, and using well one policy.

3.1 Develop an opinion that the farmers are the main bodies of the conservation tillage technology.

The farmers are the land users and they decide how to use the land and what to plant on it. They are eager to attain practical profit, and expect a technique for improving yield and income. The trials showed that technicians were made to understand and regard the farmers as the main consideration in implementing the conservation tillage technology. Demonstration plots were selected where project trials were carried out towards achieving the purpose of improving the environment, promoting yields and sustainable agricultural development, and increasing farmers' income. By doing things in this manner, demonstration trials achieved good results and social benefits creating a favorable environment for conservation tillage technological extension.

3.2 Stress the principle of doing things in the light of the local condition; extend the technology only when it could be extended.

The field trials were carried out considering local conditions. After many trials, three kinds of ecological blocks are described below:

- (1) Winter-wheat and summer-maize/beans seeding with no-till (less-till) in double cropping system and spring-maize seeding with no-till (less-till) in single cropping system are the well-considered models for the Yellow River irrigated area.
- (2) Spring-maize seeding with no-till (less-till) in single cropping system in additional water irrigated area and grass seeding with no-till (less-till) after raining are the well-considered models for the mid-arid zone.
- (3) Winter-wheat planting with seedbed tripe rotation seeding is the well-considered model for the southern mountain area.

There are conservation tillage practices for different kinds of ecological blocks according to the local conditions. Grass seeding could be extended with no-till (less-till) after raining for 35,000 hm² in Yanchi county. The extended subsoil technology was promoted in 20,000 hm² out of the project area.

3.3 To guarantee the effect of project implementation, the demonstration area was selected after competition.

The national project county for the technology of conservation tillage was selected from Ningxia regional project county with experts giving marks to project counties. As a result, every manager and working staff did their best for the project of conservation tillage.

3.4 The allowance policy for agricultural machinery purchasing, complemented the demonstration action of agricultural machinery farmers.

It is quite difficult for farmers to purchase agricultural machineries for the technology of conservation tillage because these are too expensive. Therefore, farmers were encouraged to purchase agricultural machineries for conservation tillage by using the allowance policy of agricultural machinery purchasing. After purchasing the

machineries, the farmers start to use the technology of conservation. The conservation tillage technology becomes the behavior between and among farmers. It reduces the burden of concerned government authorities. In some counties, the system has encouraged the lowering of the operation fee for conservation tillage machinery and instruments purchased through the government agricultural machinery purchasing scheme. This system has built the foundation for the extension of conservation tillage among the farmers.

4. TOWARD SUSTAINABLE DEVELOPMENT AND THE CONSERVATION TILLAGE TECHNOLOGY IN NINGXIA

There is still a long way for the complete adoption of conservation tillage technology in China. For Ningxia, the adoption of conservation tillage technology may proceed in the following way:

4.1 Develop a scientific development programme and steadily push for the conservation tillage technology in Ningxia.

Learning from international and domestic experiences and achievements, Ningxia could develop a scientific and practical programme for the extension of the local conservation tillage technology. It is important the Ningxia would solicit the strong support from all sectors by making a rational plan with wide media support. In this way, conservation tillage could move forward quickly and smoothly in Ningxia.

4.2 In line with the development trends, expand the content of the conservation tillage technology, and extend it in different areas.

It would be beneficial for the farmers if the concept of conservation tillage could be expanded to cover grain crops, economic crops, and forage plants. The technology not only protects the environment but improves the farmers' income.

4.3 Make a decision in the light of the local conditions and doing some but not doing all things.

For the Yellow River irrigated area – The plan of the Ningxia regional government indicates that the winter-wheat planting area will be expanded in the future. Maize planting area will also be increased since irrigation water from the Yellow River is limited. The winter-wheat planting with seedbed tripe rotation seeding, summer-maize or beans seeding with no-till (less-till) after harvesting wheat and spring-maize seeding with no-till (less-till) in single cropping system. The farmers will obtain more income by using the technology of conservation tillage.

For the mid-arid zone - More attention should be paid to grass seeding with no-till (less-till) after raining in order to develop the animal husbandry industry and increase farmers' income. Spring-maize seeding with no-till (less-till) in additional water irrigated area should also be extended in this area. There are more areas with gravel covering for

planting water melon and jujube trees. There is a potential to use conservation tillage in this planting pattern.

For the southern mountain area- The technology of winter-wheat with seedbed tripe rotation seeding should be extended. Meanwhile, the technology of conservation tillage should be used for grass, buckwheat, and beans in order to expand its benefits.

4.4 Expanding the utilization of the single technology of conservation tillage to develop local agriculture.

Subsoiling and summer-maize/beans seeding with no-till (less-till) is a good technology for three different kinds of ecological blocks.

4.5 Increasing the number of machinery for conservation tillage by using the allowance policy of agricultural machinery purchasing and increasing the rates of machinery utilization.

The government should support farmers and service organizations of agricultural machinery to purchase special equipment for conservation tillage through the allowance policy of the government. Meanwhile, the managing and extending organizations of agricultural machinery may build working associations and service teams of conservation tillage in order to increase the rates of machinery utilization. These groups should also supply information about the machinery's performance in various counties so that the farmers can get more service income.

5. REFERENCES

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