

Establishing a Lasting Effect Mechanism for Conservation Tillage

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ABSTRACT

The establishment of conservation tillage (CT) lasting effect mechanism is a long process and needs four conditions. The key factors affecting this mechanism are the awareness and recognition by farmers. The project demonstration, the lasting effect of CT mechanism can be established in project areas where it has been carried out for seven years.

CT is an advanced agricultural tillage technology which can promote sustainable agricultural development.

This paper will provide some insights on establishing the lasting effect of CT in a province in China.

Key words: Conservation tillage, lasting effect mechanism, and practice.

1. WHAT IS THE LASTING EFFECT CT MECHANISM?

The final aim of promoting the standards and application of CT technology by the Chinese government and extension departments is to establish the lasting effect CT mechanism. The lasting effect CT mechanism is the permanent mechanism for applying CT technology. This implies the establishment of a healthy social marketing mechanism under government supervision and guidance, with capital and technological support from the technology extension departments. Farmers and machine drivers themselves can permanently use the CT technologies after the project.

2. NECESSARY CONDITIONS FOR CT MECHANISM ESTABLISHMENT

The five-year long practice through experiment and demonstration of the CT technology in the Henan Province indicates that the establishment of the technology requires the presence of the following conditions at the same time:

2.1 Mature Technology and Proper Working Process

Henan is the main province for producing agricultural products in China. Agricultural production plays an important role in the development of the Chinese economy with wheat and corn as the chief crops. There are 76 million mu for wheat plantation and 39 million mu for corn. The province ranks first in wheat production in the whole country. Wheat and corn are grown in two crops rotation in a year, with high yields and producing large amounts of straw.

The two crops rotation CT model is applied following a no-till corn in the wheat straw retention fields and the no-till wheat in the corn straw retention fields. Many experimental sites

have been set up in the cities of Anyang, Zhengzhou, Shangqiu, Luoyang, and Sanmenxia in Henan province since 2002. Results of comparative studies have shown that economic benefits have been achieved. Farmers employed the following practices: harvesting corn using the combine harvester (or through manual harvesting by hand) and returning the chopped residues to the fields simultaneously →fertilizing and sowing wheat by no-till retention planters →mechanical plant protection →wheat harvesting by the harvester →mechanical deep tillage (once every three to five years) →fertilizing and sowing corn by no-till retention planters →mechanical plant protection →corn harvest and returning straw to fields by chopping simultaneously.

Research and application of CT technological system of wheat and corn in two crops rotation was done in five years, covering 702.5 thousand mu .An average of 30.8 kg per mu increase has been attained for wheat with a savings of 35.7 yuan per mu. An average of 30.9 kg per mu increase was attained for corn and a savings of 22.7 Yuan per mu.

2.2 High Quality CT Machineries

CT machines are efficient vehicles of CT technology which can be used in the no-till fertilizing and corn sowing in wheat straw retention field and no-till fertilizing and wheat sowing in corn straw retention field (standing). After field experiments and research, solutions to the following problems were found:

2.2.1 No-Till Fertilizing and Sowing Corn in the Wheat Straw Retention Field

In recent years, with the extension and popularization of wheat combine harvester, much wheat stubble is left in the field and straws are piled in rows. These problems result in straw blocking, resistance increasing and poor working effect in no-till corn sowing. In response to these problems, the technological theories of “chopping straws + chisel ditching + compulsory drilling + adjustable seedling spacing and rows spacing”, etc. were improved through the following: adding a chopping residue equipment at the back of the combine harvester and spreading evenly the wheat residue; changing the spade ditching machine to chisel ditching machine to reduce machinery resistance and improve sowing stability; adding the compulsory drilling equipment and getting rid of the jam and press; changing the fixed seedling and rows adjustments to improve machine suitability. The improved machines completely meet the CT technical requirements after five years of experimentation and application.

2.2.2 No-Till Fertilizing and Sowing Wheat in the Corn Residue Retention (Standing) Field

No-till fertilizing and sowing wheat in the corn residue retention (standing) field have technical problems such as large amount of corn residues, straw blocking, and the difficulty in the management of corn stubble. For these problems, solutions were based on the technical theory of “band spinning + sowing in wide and narrow rows + preventing block by supervision automatically”. These were done through the following: adding rotary slash in front of the wheat-sowing ditcher to finish the spinning band of 12 cm in width and 10 cm in depth and solving the problem of ditching by straw blocking and corn stubble; finishing the six working procedures of chopping parts of straws, spinning, ditching, sowing, fertilizing and pressing; two rows of wheat are sown in the shallow band of 12 cm width; one row of chemical fertilizer is used between

two rows of wheat.

The gap in the shallow sown band is 26 cm, namely the band of 26 cm in width is no-till area. In this way, ditch sowing in wide and narrow rows and residue retention technologies can be achieved. No-till fertilizing and sowing conditions in corn retention field are poor. Fertilizer blocking still happens through the above two methods and are taken to solve the blocking problem. To remedy the situation, an infrared rays sensor beneath the sowing and fertilizing ditch machine can be installed so that it can timely report through an alarm when sowing and fertilizing block happens. In this way, the problem can be remedied immediately. The improved machine fully meets the technical requirements of no-till fertilizing and sowing wheat in corn retention (standing) field.

2.3 Adequate Awareness and Recognition of No-Till Technology by the Farmers

Farmers are the characters in applying the no-till technology. Their recognition and acceptance to the technology is the key to establishing a lasting effect of the CT mechanism.

In recent years, publicity efforts to promote the no-till technology were strengthened through the news media. In this way, all sectors were made aware of the significance of the technology and improved the level of farmers' recognition to it; and eventually made them change their concept of traditional tillage. This was replaced with an awareness of scientific farming, eliminating their feeling of insecurity to the new technology, and forming good social environment.

However, due to the deeply rooted concept of traditional tillage, there is still a long way to go for the government to convince farmers to apply CT. There is also a need for enhanced publicity, training, demonstrations, and guidance to the farmers.

Based on results of the three-year research and field trials, one third of the farmers can adopt the CT technology, one third can accept it passively, and one third cannot accept it.

2.4 Economic Profit for Machine Drivers

The machinery drivers or operators are the main performers in implementing the CT technology. The establishment of a lasting effect of the CT mechanism is influenced by the economic profit the machine driver can obtain. If a machine driver can have the returns of his investments in two years, he would be interested to buy the machines.

Based on the current market prices, a no-till wheat sowing machine costs about 9000 Yuan. The machine can service over 500 mu every season, through normal working efficiency. The driver can obtain 8450 Yuan of net income annually based on a rate of 35 Yuan per mu as working fee. Operational costs would include 18.1 Yuan per mu for miscellaneous costs consisting of 10 Yuan for oil, 3.6 Yuan as depreciation charge, and 1.5 Yuan for repairs, and 3.0 Yuan for salary per mu.

In less than 18 months, one can obtain back the investment on the machinery.

Despite this economic benefit, farmers are reluctant to use the CT technology, resulting in the absence of work for machine drivers. Usually, a driver can finish about 200 mu every season. Thus, it takes more than two years to get back the investments made on the machine. In return, the driver's purchasing power is affected.

In practice, one machine driver in Henan Province can finish 500 mu annually; another finishes 200 to 300 mu annually; while another one can finish less than 200 mu annually.

3. HOW TO ESTABLISH THE LASTING EFFECT OF CT MECHANISM

The CT lasting effect mechanism will develop smoothly if the farmers take the initiative to actively use CT technology. The following should be done to establish the CT mechanism:

3.1 Strengthening the Government Guidance

The government and its technology extending departments with public welfare should play the active role through their special positions and promote actively the tillage system reform through administration, law, and economy.

3.2 Implementing the Project

The present achievements of CT should be attributed to the effect of the site's leading every programme. Thus, further investments should be made and the areas expanded for more demonstrations.

3.3 Doing Well in Publicity and Training

Doing well in publicity is an important way to expand the CT effect and improve social awareness. During these years, publicity efforts and reports on the CT technology were made known by the media, resulting in increased public understanding of the significance of the technology. Training can improve the farmers' recognition and acceptance of the technology, changing their traditional tillage ideas and setting up a positive thinking towards scientific farming.

The CT implementing effect depends on the technical experience by the farmers and machine drivers. More attention should be paid to farmers' training so that they can build their skills. Extension persons should go to the fields more often to provide technical instructions and services. The machinery administrative offices and technology extending departments in all levels should also do publicity and training in the programme sites as well as new sites.

3.4 Standardizing and Regulating Programme Management

Working experiences on the CT technology must be shared and CT management should be enhanced scientifically, regularly and systematically. Provincial level demonstration sites at the counties should be set up on the bases of self-experimentation/demonstration for more than one year. Ministry-level counties should be set up on the bases of popularizing the province-level programme for three years. When the ministry programme ends, the county will constantly practice or apply the technology for more than seven years. With popular recognition and

acceptance among the users and implementers of the technology, the conditions of establishing the lasting effect mechanism will mature.

4. CONCLUSION

Establishing a lasting effect of the CT mechanism is a long process requiring the presence of four conditions at the same time. These conditions are mature technological modes, proper working process, high quality of CT machineries, enough recognition and acceptance to CT technology by farmers and good economic benefits earned by the drivers. At present, the key factor affecting the establishment of the lasting effect mechanism is the farmers' recognition and acceptance. Therefore, administrative behavior should still play a dominant role. Through programme demonstration, the lasting effect of CT mechanism can be set up in areas where programme implementation could run for more than seven years.

5. REFERENCES

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