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(5) Improve the drought resistance of wheat cultivations in the Shandong Province, China

<i>Hazard</i>	Drought
<i>Hazard Impact</i>	Reduction of yield or crop loss
<i>Strategy</i>	New varieties of wheat with drought resilience and anti- drought cultivation techniques
<i>Agrovoc Terms</i>	drought; wheat; cotton; double cropping; cultivars; training
<i>Categories</i>	Climate Change Adaptation and Disaster Risk Reduction
<i>Global Farming System</i>	Wetland Rice Based

Synopsis

The county of Juye is an area located in a depression zone which receives an average of 500mm of annual rainfall. During the past few decades, the unpredictability of a changing climate has exposed this area to serious drought, almost every year for the past few years, especially in the winter and spring. China is the largest wheat producer in the world, thus it is very important to increase the agricultural resilience to drought by introducing practical and advanced agricultural technologies.

These new technologies consist of new, more drought resistant, wheat cultivars to promote water-saving agricultural production technology, and the introduction of soil improvement practices with the application and extension of 3-D cultivation technologies.

Introduction

The introduction of new drought resistant wheat cultivars, and new soil improvement practices constitutes an efficient way to enhance the resilience of local farming systems to drought events. Wheat experts were invited to provide technical guidance for field demonstrations to explain, among other things, disaster prevention and reduction cultivation techniques, such as delayed planting and N fertilization, and reduced seeding rate. It is important to complement the introduction of new cultivars with training to provide farmers with management skills on soil improvement.

Objective

To mitigate the impacts of drought spells on wheat crops through the introduction of more hazard resilient varieties and cultivation technologies.

Detailed description of the Technologie

Introduce disaster-resilient crop varieties

The two wheat varieties, namely Jimai 21 and Jimai 22 (the latter created by SAAS, the Shandong Academy for Agricultural Sciences and approved in China in 2007) are noted for their vigorous roots and resistance to drought and disease. They have strong tillering ability, and many ears with strong stems. In general, these cultivars have high ratios of productive tillers and optimum ratio of yield components, as well as good resistance to powdery mildew and strip rust. (See Table 1)

Table 1: Comparison of Jimai 21 and 22 values

Characteristic	Values for Jimai 21	Values for Jimai 22
Maturity rate of leaves	0,65 million ears per mu ¹⁴	0.4-0.45 million ears per mu
	35 seeds per ear	36 seeds per ear
1000 seed weight	38-48g	43.6 g
Test weight	778-783g/l	807 g/l
Protein content	15.15% and 15.04%	12.2%
Wet gluten content	almost 33%	31.4%
Sedimentation value	30.7-32.5 ml	--
Water absorption	58.1-60.3%	57.8%
Developing time	3.6-4.4 min	3 min
Stability time	3.8-5.4 min	--
Extorsograph area	32-42 cm ²	--
Maximum Resistency	226 EU	--

Cropping pattern*Wheat-cotton double cropping:*

Three lines of wheat were planted in a 1.5m width area in early October with an in-row spacing of 20 cm. The following year, another two lines of cotton were planted in late April or transplanted in mid-May alongside the wheat with an in-row spacing of 50 cm. The row spacing between the wheat and cotton was 30 cm.

Before planting, a 10cm high ridge was built up. Wheat was planted at the bottom of the ridge, and cotton on the ridge. Wheat can be easily watered and make full use of rainwater. It can improve the germination of cotton and alleviate the controversy between wheat and cotton. During rainy season in summer, rainwater can be drained out in time.

The optimum management procedures have been established based on the field trials for sowing time, seeding rate, irrigating, fertilizing, controlling of pests and diseases. The optimum planting temperature was 16-18C and the optimum seeding rate was 80,000-120,000 seeds per mu.

Disaster-relief measures

- **Irrigation:** Wheat should be fully irrigated during the turn-green stage and in winter. If it is not watered in winter, lower soil moisture prevents the growth of the lateral roots. If the wheat does not grow well irrigation of 75-150 kg urea per hectare is necessary. If the wheat has been watered well in winter, then the soil should be loose retain moisture in the early spring.

3. Technical training

A series of technical training sessions were conducted in this project including: in-door workshops, technical guidance in farmers' fields and field demonstrations. Knowledge about the characteristics and the cultivation technologies of the newly introduced cotton varieties benefits farmers considerably.

¹⁴ The mu is a traditional unit of land area in China equivalent to 667m². It is often reckoned to be 1/15 hectare

3.1 *In-door workshop*: Before planting, farmers and field-level technicians were invited to a technical training in-door workshop on disaster prevention and reduction given by experts on cotton from universities and research institutes. The techniques of the local bureaus were shared with agronomists, field-level technicians and farmer representatives, who also attended the training workshop. The workshop was based on lectures and informal discussions.

3.2 *On-spot technical guidance*: Cotton experts were invited to Juye to provide technical guidance on site during the critical growing stages of cotton, such as the planting, germination, seeding, squaring, and boll-setting stage. Experts also went to the field to give farmers assistance and guidelines in case of disasters.

3.3 *Field demonstrations*: High-standard demonstration fields were built using disaster prevention and reduction cultivation technologies in the project area. Farmers attended these field demonstrations to learn about the technologies. Farmers who attended technical training could skilfully apply the techniques in production practices.

Impact and results

In pre-tests of the new varieties, the yield of the Jimai 21 cultivar was 19% greater than that of Lumai 14, in the advanced yield trials in 1999 and 2000. In 2000-2001, the yield of Jimai 21 was 5.2% greater than that of Lumai 14 (also as control crop for 2009), averaging 538.1kg per mu. In the following season, the yield of Jimai 21 averaged 494.47kg per mu, 6.1% greater than control in regional trials.

The yield of Jimai 22 averaged 530.94 kg per mu, the equivalent to 8.98% more than that of the Lumai 14 in regional trials during 2004. The following year, the yield averaged 542.68 kg per mu, 12.59% greater than the control in regional trials. In the Huanghuai growth area, the yield of Jimai 22 averaged 517.06 kg per mu, 5.03% greater than Shi 4185 in regional trials in 2005. The same year, the yield of Jimai 22 averaged 542.68 kg per mu, equal to 4.05% greater than control in Shandong province. The highest yield of Jimai 22 was 727.43 kg per mu.

In 2009, a year with serious drought spells in the early spring, the yield of wheat increased in the studied area when compared to the yield in 2008 (see table 2).

Table 2: Wheat yields in 2008 and 2009 for Jimai 21, Jimai 22 and Control

Yield (kg/mu) in 2008	Yield (kg/mu) in 2009		
497.5	Jimai 21	Jimai 22	Control
		536.7	543.6

In a cost-benefit analysis carried out to evaluate the new cultivars, the results demonstrated that although more money (about 31 RMB15/mu) is required to plant Jimai 21 and Jimai 22 than the control variety, earnings equalled 51.4 RMB/mu in the case of Jimai 21 and 65.4 RMB/mu for Jimai 22.

¹⁵ China's currency, Yuan Renminbi (1 CNY = 0,146 USD)

Table 3: Cost and benefit analysis of wheat planting in 2009¹⁶.

Variety	Input (RMB/mu)				Outcome (RMB/mu)	Net income (RMB/mu) (Outcome - Input)
	Seed	Water	Fertilizer	Labour		
Jimai 21	50	60	160	180	1073.4	623.4
Jimai 22	50	60	160	180	1087.2	637.2
Control	44	45	150	170	981	572

Monitoring of the Demonstration

Cultivars were monitored and compared with control plots with control varieties.

Source of testing adaptation option

This adaptation practice has been successfully tested in Juye in the context of the Strengthening Disaster Preparedness in the Agricultural Sector (TCP/CPR/3105).

Reference

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¹⁶ Wheat price was 2 RMB/kg