

Requirements for Double-Cropping in the South-Eastern Region of Kazakhstan

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Abstract: In this article discusses the ways of intensive using of irrigated lands on the basis of no-tillage and direct seeding of main and catch crops on the ridges to produce two crops harvests per year. The object of research as the main crop is winter wheat, as catch crops-corn and rape. Introduction of new technology into irrigation conditions of the south and south-east of Kazakhstan will increase the productivity of irrigated lands and give the opportunity for receiving competitive and ecologically pure agricultural products.

Key words: Ridge sowing • Winter wheat • Catch crop culture • Two crops harvests

INTRODUCTION

The aim of the development of the agrarian complex in the Republic of Kazakhstan for the nearest future is increasing the productivity and sustainability of agriculture [1].

To enhance productivity especially the effective use of irrigated arable land is important. Scientifically sound management of these lands guarantees high and stable yields, conservation and increase of soil fertility. It can be achieved by intensive use of irrigated land during the whole vegetation period, using catch crops, water-and resource-saving tillage systems, creating a dense stand of the crop, using more organic and mineral fertilizers and implementing irrigation regarding the biological characteristics of crops [2].

Research conducted earlier, revealed the possibility of a guaranteed yield of intercrop culture after winter wheat grown on ridges. So in this way immediately after winter wheat harvesting and irrigation in the existing furrows the intercrop culture has been sown directly on the ridges. As result we achieved a significant reduction of the sowing date (30 days or more) and obtained simultaneous shoots of intercrop culture [3, 4].

These results raise a need of comprehensive testing of unconventional production methods with the development of radical new catch crop cultivation technology that provides a full second harvest. Development and implementation of this technology

could be the most effective method of crop diversification in the south and south-east of Kazakhstan and boosting productivity of irrigated arable land [5, 6].

Additional oilseeds and forage crops production without increasing of sowing area can be an important source of a sustainable food supply and biofuel production.

The purpose of our research is the development of an effective technology for two crops harvests per year based on the use of ridge sowing of the main and catch crop culture, providing a sharp increase in the productivity of irrigated arable land, management of water resources, soil fertility conservation and environmental protection with the diversification of irrigated agriculture

MATERIAL AND METHODS

The experimental field has been placed on light-brown soil containing 2.1% of humus in the plow layer, 0.203% of total nitrogen, 0.211% of total phosphorus, 23.4 mg/kg of mobile phosphorus and 512 mg/kg exchangeable potassium.

The climate is continental. Long-term data on the average annual temperature is 8.3° C, it reaches a minimum of -40° C, a maximum of 42° C. The amount of positive temperatures during the active growing season (April-September) for the average long-term data up to 3429° C, which is sufficient to form high yields of crops.

The total area under the main crop of winter wheat is 24 hectares, the area of the single plots-2 hectares and the record plot is 200 m². Object of study, as main crop was Uzynagashskaya variety. As catch crops corn and rapeseed have been chosen.

RESULTS

Surveillance to the growth and development of studied varieties of winter wheat showed that more early-maturing varieties were Svetlaya and Uzynagashskaya, selected by Breeding Institute of Plant Biology and Bioengineering and "Agrosemkonsalt." These varieties are ripe 3-5 days before Almaly state permitted cultivar (Table 1).

Accounting the harvest of winter wheat productivity shows that the cultivation on the ridges formed sufficiently high yield of Uzynagashskaya variety-4800 kilo per 1 hectare (kg/ha) [7].

This high yield of winter wheat achieved due the high productive tillering on the ridges. The day after winter wheat harvest (July 19) we sowed on the ridges catch crops-rape and in another field a corn. Two days later we conducted humidifying irrigation with amount of 350 m³/ha [8].

Rape-oilseed and fodder culture of the cabbage family. Introduction of rape in the rotation has a positive effect on the yield of grain crops. Good precursor crops for rapeseed are grain crops, corn, perennial grass, potatoes, leguminous crops. In the south-east of Kazakhstan, rape as a long-day plant, showing photoperiodism has an increasing growing period.

Results of observation of the growth and development of rape plants during the vegetation period showed that rape shoots appeared on the sixth day after sowing and total shoots we received on July 29. Stem elongation of rape plants follows 20-25 days after germination. The phase of rape budding was marked on 7-10 September and the week later flowering started. This period is the most suitable for cutting rape as green fodder or silage supplemented with straw (Table 2)[9].

As seen from Table 3, the rape direct seeded in the ridges as intercrop after the harvest of winter wheat generates up to 23400 kg/ha of green mass. The yield value of rape green mass depends on sowing methods in ridges furrows and seeding rate. The highest yields were obtained by direct sowing on ridges in three rows with a rate of 4-6 kg/ha.

In general corn is a more productive catch crop culture in the south-east of Kazakhstan after winter wheat harvesting.

Table 1: Phenological growth stages of main crop-winter wheat

Varieties	Growths phases						
	shoots	tillering	stem extension	heading	milky ripe	mealy ripe	full ripeness
Almaly	10-13.10	2-5.04	03-06.05	23-26.05	16-18.06	04-06.07	15-17.07
Svetlaya	10-13.10	2-5.04	02-06.05	21-26.05	13-17.06	01-03.07	10-12.07
Smolina	12-15.10	2-5.04	02-05.05	21-25.05	14-17.06	03-05.07	13-17.07
Uzynagashskaya	12-15.10	2-6.04	02-06.05	22-26.05	14-17.06	03-06.07	12-15.07

Table 2: Results of phenological growth stages of rape

Culture	Growths phases				
	shoots	3-5 leaves	stem elongation	budding	flowering
Rape	24-29.07	16-18.08	28-30.08	7-10.09	15-18.09

Table 3: Yield of rape green mass depending on seeding method and seeding rate, kg/ha, 2011

Methods of sowing in ridges	Seeding rate, kg/ha		
	4	6	8
Drill	11500	16700	20100
Two rows	21200	22600	15300
Three rows	22500	23400	13300

Table 4: Results of phenological growth stages of corn

Hybrids	Growths phases				
	shoots	3-5 leaves	10-12 leaves	flowering	milk-wax maturity
Arman	25-06.07	12-15.08	27-31.08	6-10.09	5-9.10
Skiff	25-6.07	12-5.08	27-31.08	4-9.09	1-2.10

Table 5: Yield of corn green mass depending on seeding method and seeding rate kg/ha, 2011

Hybrids	Seeding rate, kg/ha		
	25	35	45
Arman	21600	32700	34400
Skiff	17400	27700	28900

Table 6: Economic efficiency of growing two harvests per year

Data	Main crop	Catch crops	
		rape	corn for the green mass
Yield, kg/ha	4800	23400	34400
Production value from 1 ha, tenge	144000	35100	56000
Expenses per 1 ha, tenge	52000	21200	24000
Net profit from 1 ha, tenge	92000	13900	32000
Profitability, %	176	66	133

In the fodder balance corn ranks first place, because of its properties of both high-calorie grain and green mass-silos. In our experience we studied the local maize hybrids Arman and Skiff [10].

Due to good moisture and normal soil temperature germination of corn hybrids have appeared after 6-7 days. Phase of milk-wax maturity of maize came in October 6-11 and it's quite relevant for forage and silage. Hybrid Skiff has matured for a few days earlier than the hybrid Arman. (Table 4).

Mid-ripeness hybrid Skiff ensured 32700 and 34400 kg/ha of green mass with seeding rates 35 and 45 kg/ha (Table 5).

Medium-late hybrid Arman has amassed the largest biomass with seeding rate of 45 kg of seeds per 1 ha. From this follows that the best intermediate crop is corn hybrid Skiff.

In the irrigated south-east of Kazakhstan after winter wheat grown on ridges inter-cropping is economically reasonable for green fodder production. Calculations of economic efficiency have shown (Table 6) that the cultivation of winter wheat on ridges provided 92 thousand tenge per hectare of net profit and profitability for the production is 176%. Corn as catch crop on ridges provided 32 thousand tenge per hectare of net profit and profitability for the production is 133%. Cultivation of rape after harvesting of winter wheat by direct seeding in ridges provides additional income in 66% profitability of cultivation.

CONCLUSIONS

- Under the conditions of the south-east of Kazakhstan direct sowing on ridges creates good facilities for the growth and development of winter wheat due to high tillering. Yield of Uzunagashskaya variety can reach 4800 kg/ha.
- In the irrigated zone of the south and south-east of Kazakhstan direct seeding on ridges is the only way to get two crops per year. As a catch crop Skiff hybrid sown with a rate of 45 kg/ha and provided 34400 kg/ha of green mass. Rape provided 23400 kg/ha with seed rate 6 kg/ha.
- Under irrigation conditions in the south-east of Kazakhstan cultivation of catch crops-maize for green fodder and rape after winter wheat is economically viable.

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