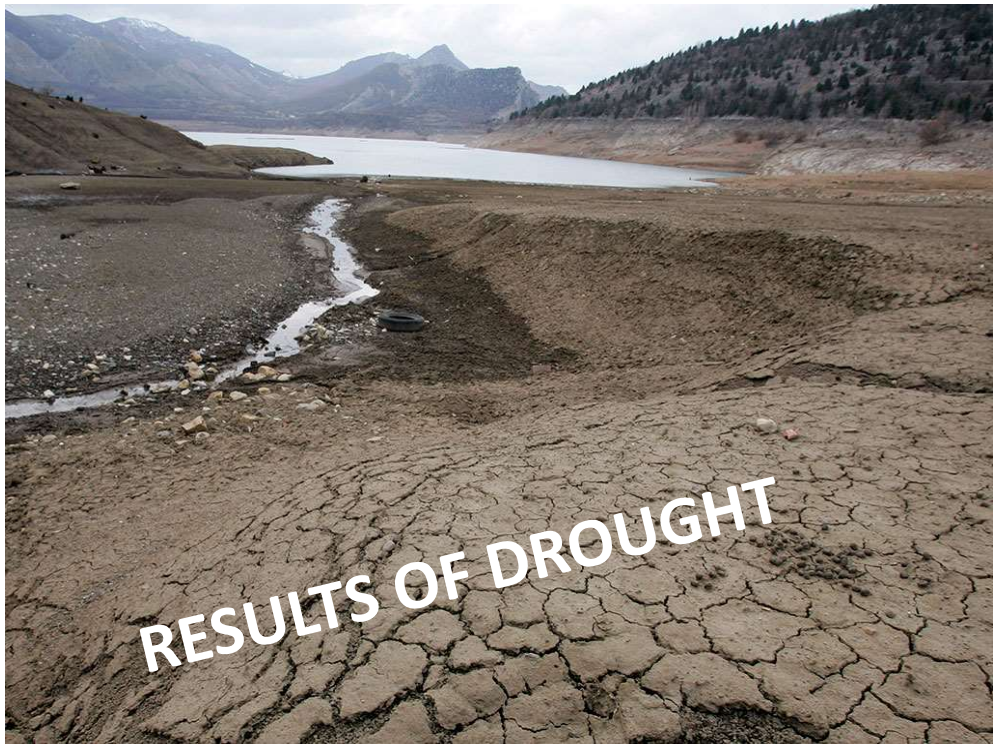
THE 9TH REGIONAL FORUM ON SUSTAINABLE AGRICULTURAL MECHANIZATION IN ASIA AND THE PACIFIC

26 NOV. 2021, BEIJING, 14:30-16:30



KANAT AKSHALOV

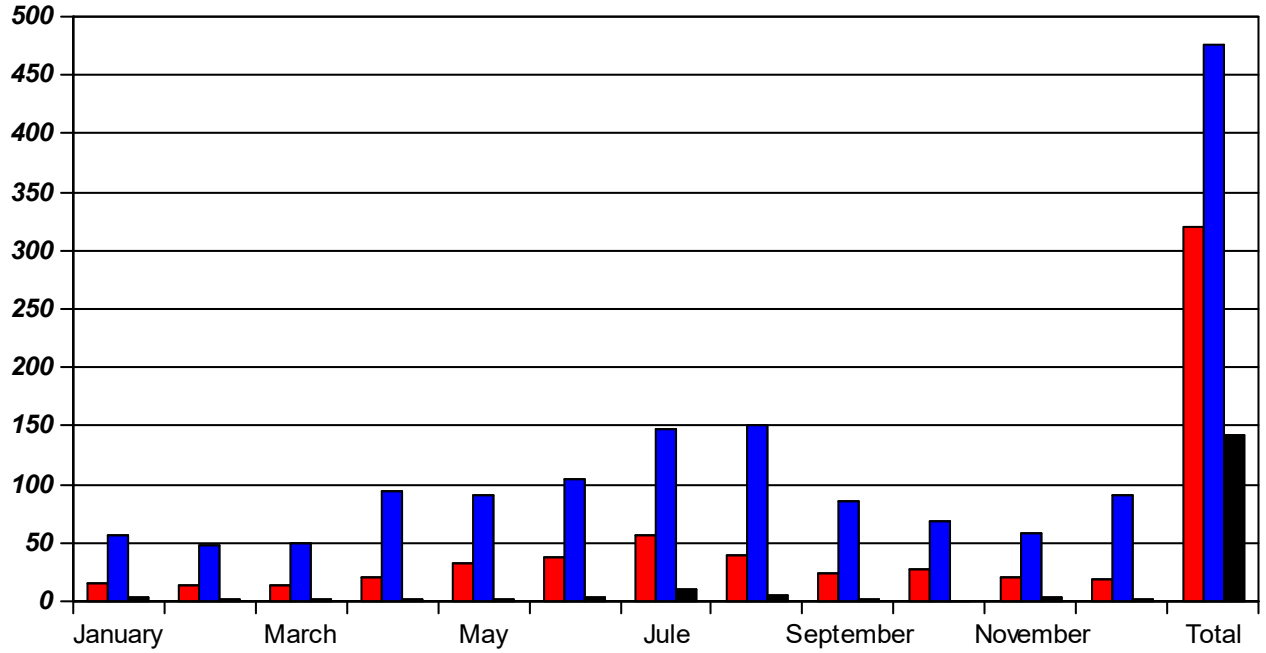
TITLE "INTENSIFICATION OF TILLAGE SYSTEM IN DRYLAND CONDITIONS OF KAZAKHSTAN: CHALLENGES, SOLUTIONS"

RESEARCH & PRODUCTION CENTER OF GRAIN FARMING NAMED AFTER A. BARAYEV

SHORTANDY, KAZAKHSTAN, 2021

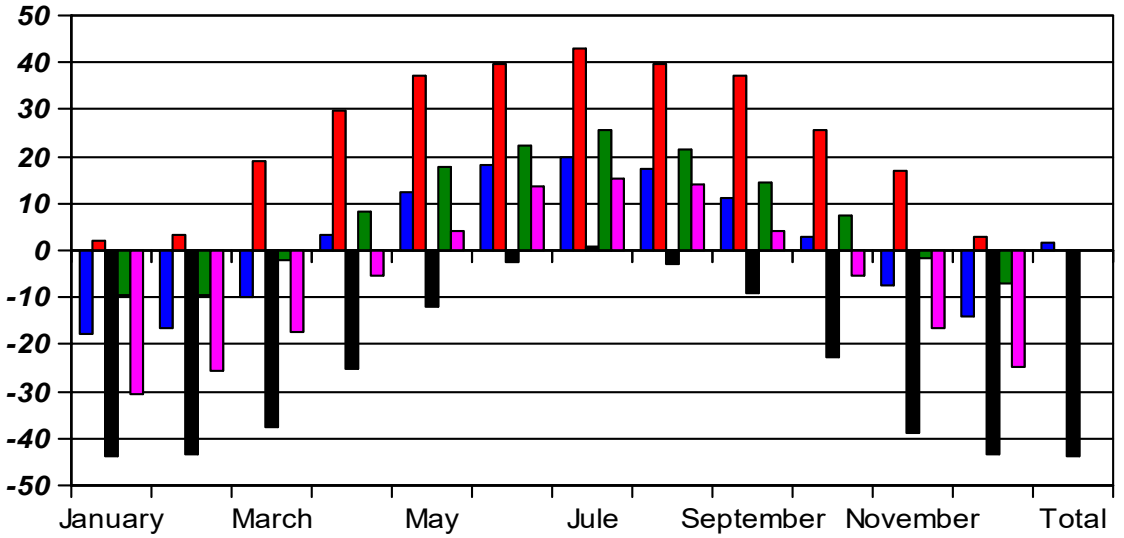
WHAT IS THE SOIL - CLIMATIC CONDITIONS OF NORTH PART OF KAZAKHSTAN?

Long-tern Annual PRCP, mm (1936-2016), Shortandy, Kazakhstan



	January	February	March	April	May	June	Jule	August	September	October	November	December	Total
Mean annual	16,2	13,3	12,9	20,2	32	38,4	56,8	39,4	24,4	28	20,6	19,1	319,7
Mean max.	56,5	48,5	49,3	94,5	90,9	104,9	147,1	150	86,1	68,4	58,3	90,5	476,5
Mean min.	2,6	2,2	2,4	2,4	1,5	3	9,9	5	1,7	0,4	4,2	0,9	141,8

Long-tern Annual T, c (1936-2016 гг.). *Shortandy, Kazakhstan*



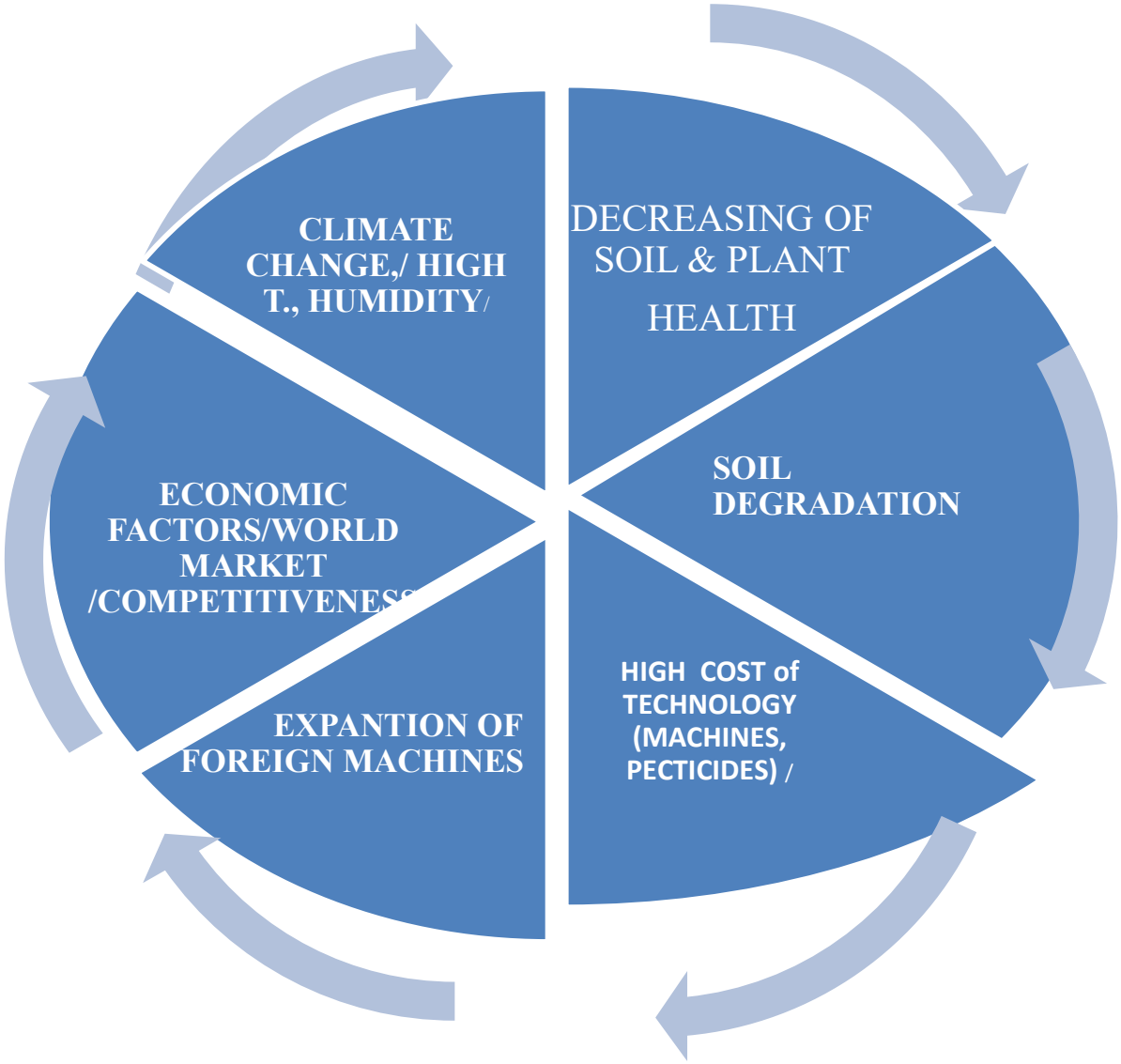
	January	February	March	April	May	June	Jule	August	September	October	November	December	Total
Mean	-17,7	-16,4	-9,9	3,4	12,5	18,3	19,9	17,4	11,2	2,9	-7,4	-14,1	1,8
Absolute max.	2	3,5	19	29,8	37	39,5	43	39,5	37	25,5	16,8	3,1	
Absolute min.	-44	-43,4	-37,6	-25,4	-11,8	-2,4	1	-3	-9	-22,7	-39	-43,5	-44
Mean high	-9,5	-9,5	-1,9	8,3	17,8	22,3	25,7	21,3	14,5	7,3	-1,7	-7	
Mean low	-30,7	-25,6	-17,4	-5,4	4,2	13,8	15,2	14	4	-5,3	-16,6	-24,7	

EXPECTED WEATHER CHANGE IN KAZAKHSTAN BY 2030 AND 2050

ITEM	2030 YEAR	2050 YEAR
TEMPERATURE	+ 2-9%	+ 4-15%
SUM PRECIPITATION IN VEGETATION TIME	MINUS 1-10%	MINUS 2-14%
SUM OF PRCP PER YEAR	ДО + 12%	ДО + 21%

IT IS EXPECTED INCREASING SUM OF PRCP PER YEAR DUE TO OF INCREASING PRCP DURING WINTER TIME

CHALLENGES/ LIMITING FACTORS

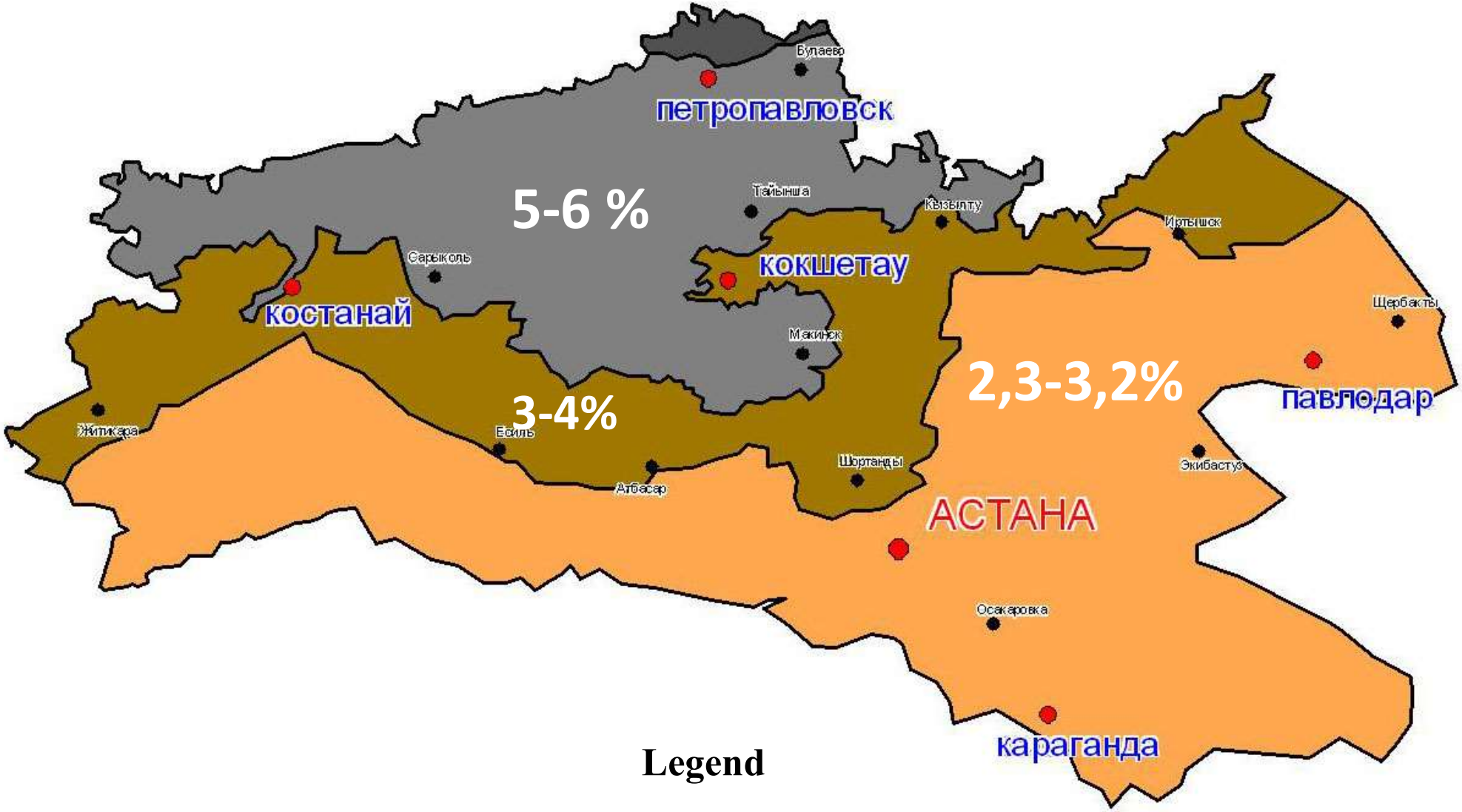


CLIMATE CHANGE IS THE MAIN CHALLENGES IN KAZAKHSTAN

Expected climate change in Kazakhstan: Key Findings

- **Rise in** the seasonal and annual surface air temperature
- **Increase in** winter precipitation
- **Redisyribution of** summer precipitation (more in late summer)
- An increase of precipitation **will not compensate for** increase in air temperature
- **Increased irregularity** of rainfall in time
- For all scenarios, the change trends towards **increased aridity/drought & erosion**

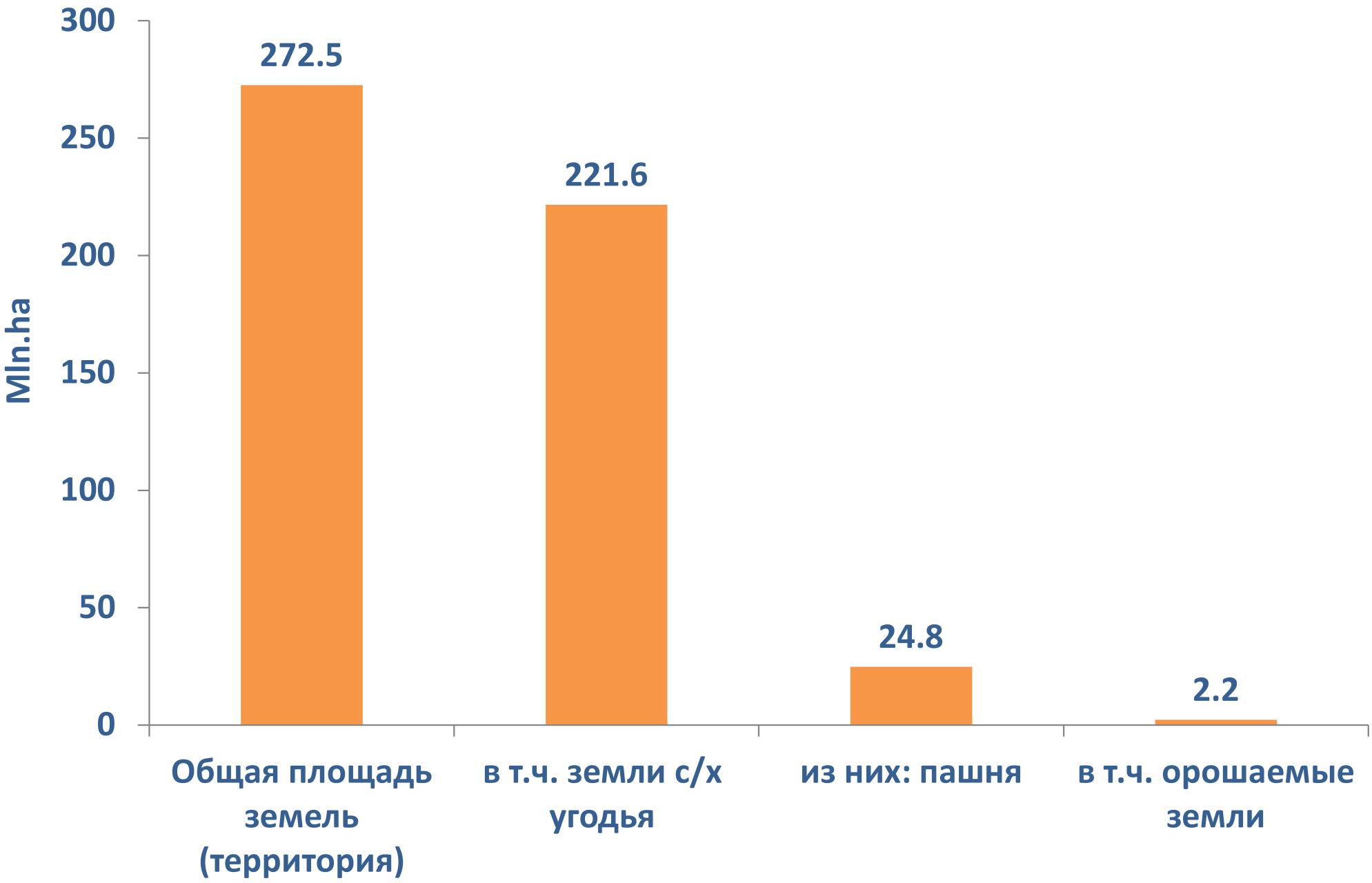
SOIL ZONES OF NORTH KAZAKHSTAN



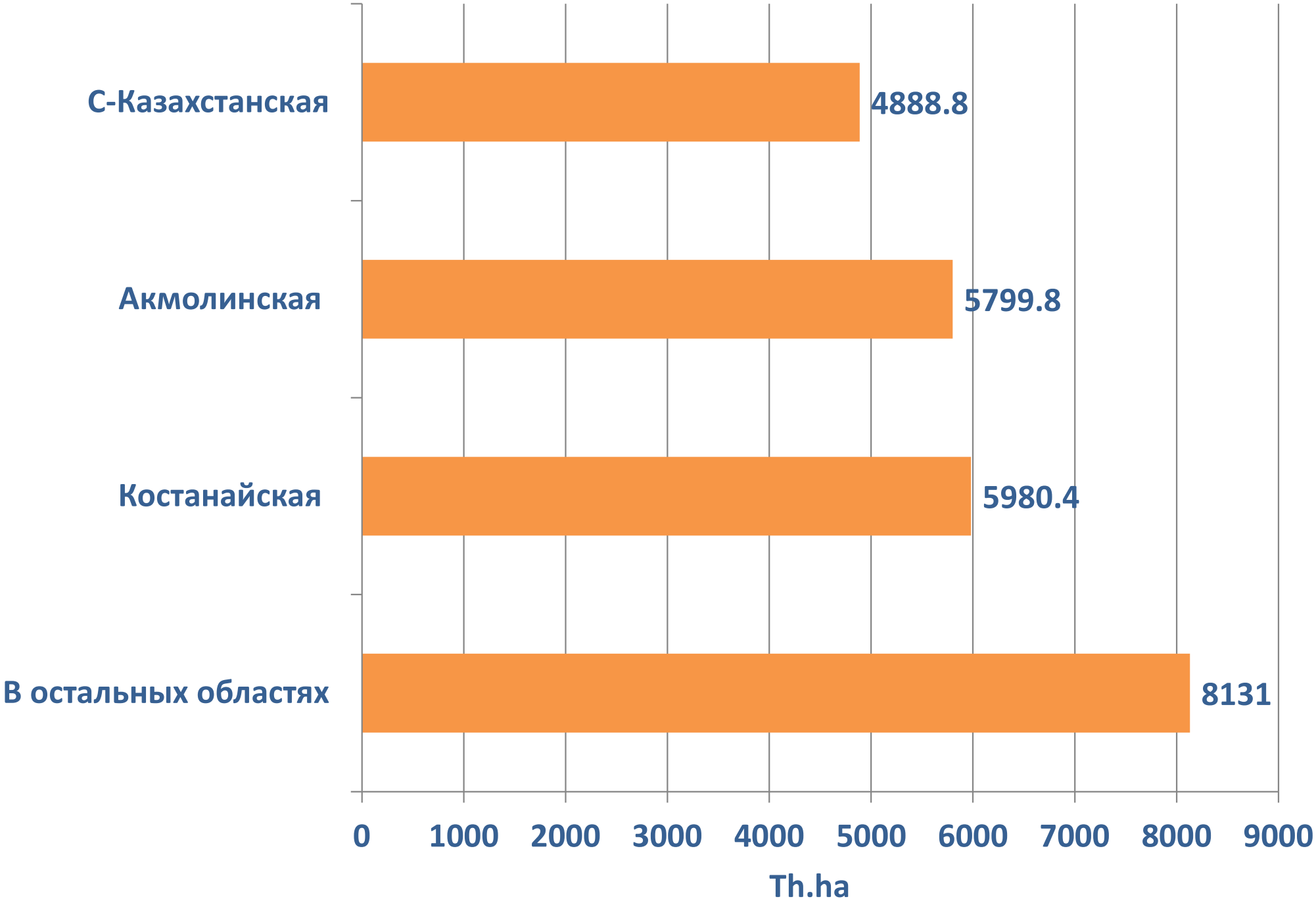
Legend

- Leached fertile chernozem and meadow chernozem
- Ordinary Chernozem (Pachic Haplustolls)
- Southern chernozem (Typic Haplustolls
- Dark Chestnut (Typic Haplustolls)

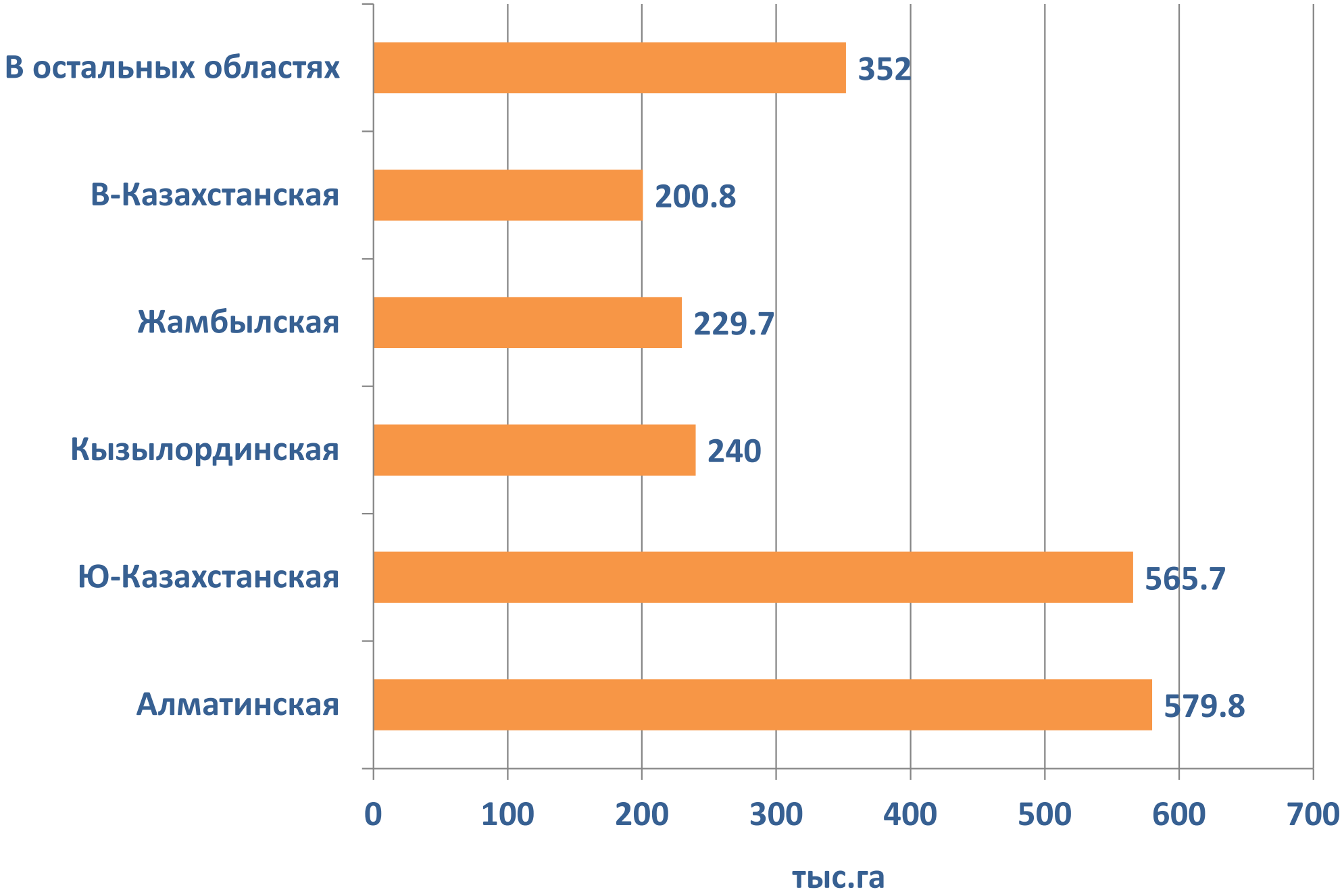
TOTAL & AGRICULTURAL AREA



DISTRIBUTION OF ARABLE LANDS



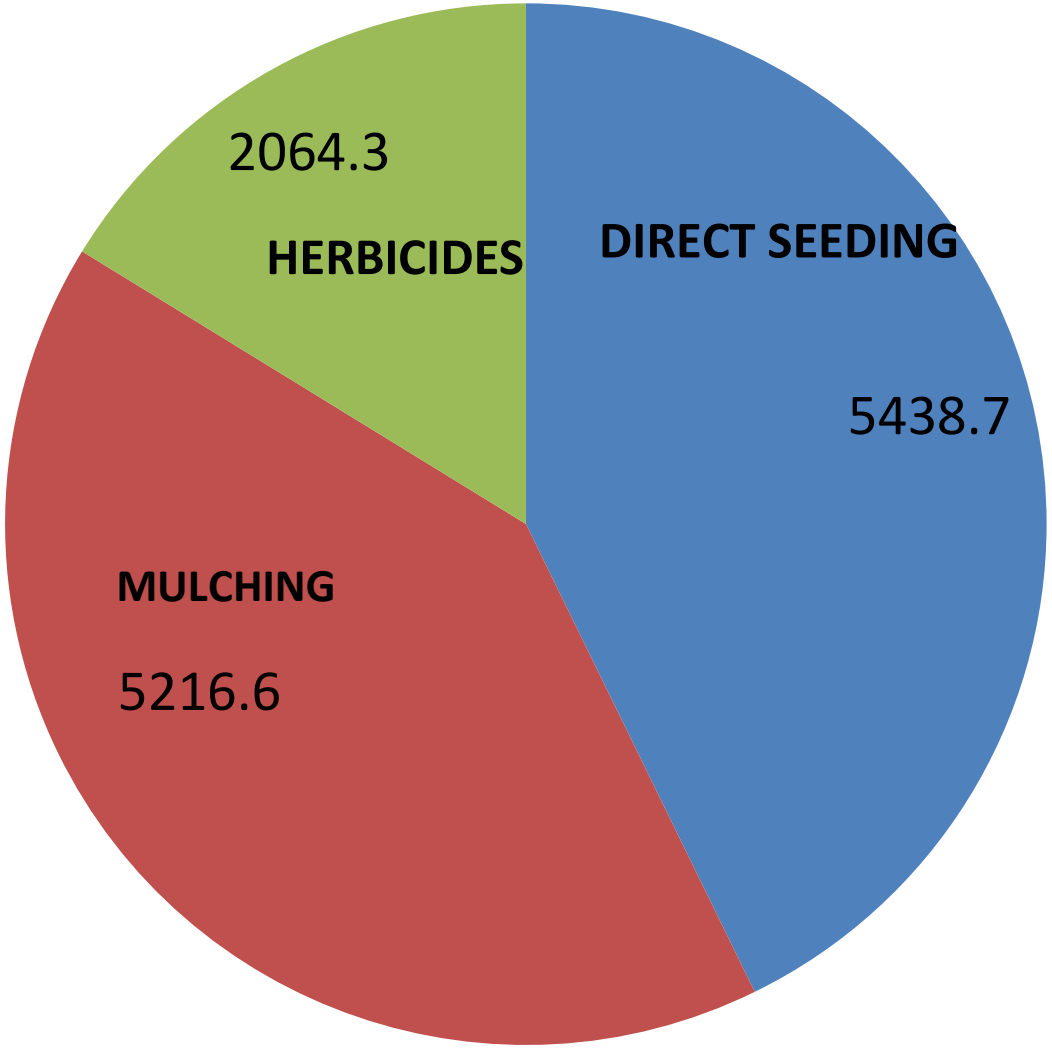
DISTRIBUTION OF IRRIGATED AREA



Area under CA., th.ha.

Total; 5438,7 тыс. га

(21,9% от общей площади пашни)

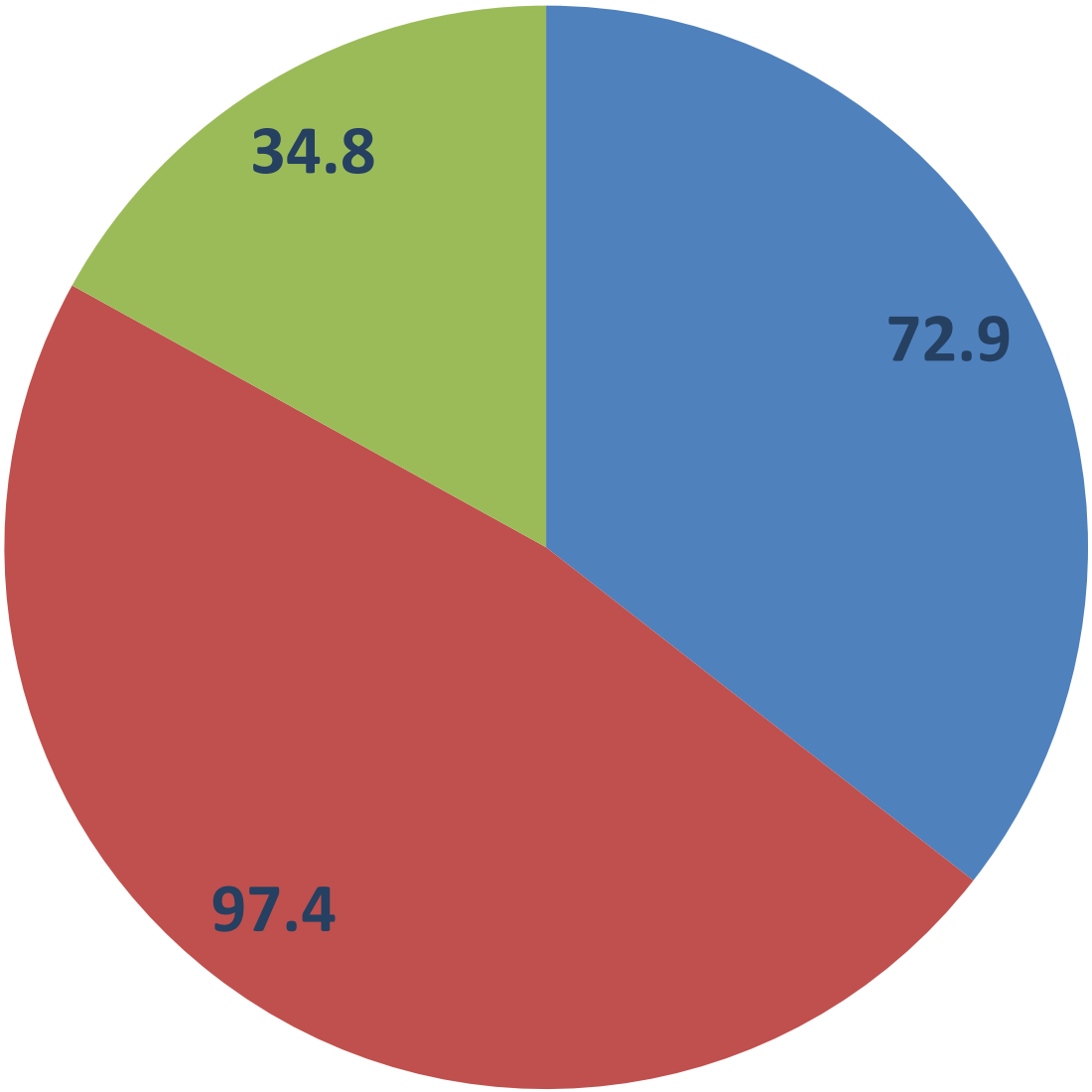


- Посев зерновых культур стерневыми сеялками

в том числе:

- Уборка зерновых культур с измельчением и срабрасыванием соломы
- Посев зерновых культур с обработкой глифосатодержащими гербицидами

Area under water saving technology, th. hectares



Total area is 205,1тыс. га (0,8% from arable land)

- Капельное орошение
  DRIP IRRIGATION
- Дождевание
  SPRINKLING
- Мульчирование, дискретный, подпочвенные, через борозду
  MULCHING, SUBSOIL, IRRIGATION FARROW

Principles of Conservation Agriculture in Kazakhstan

No-till – no mechanical tillage, just direct seeding

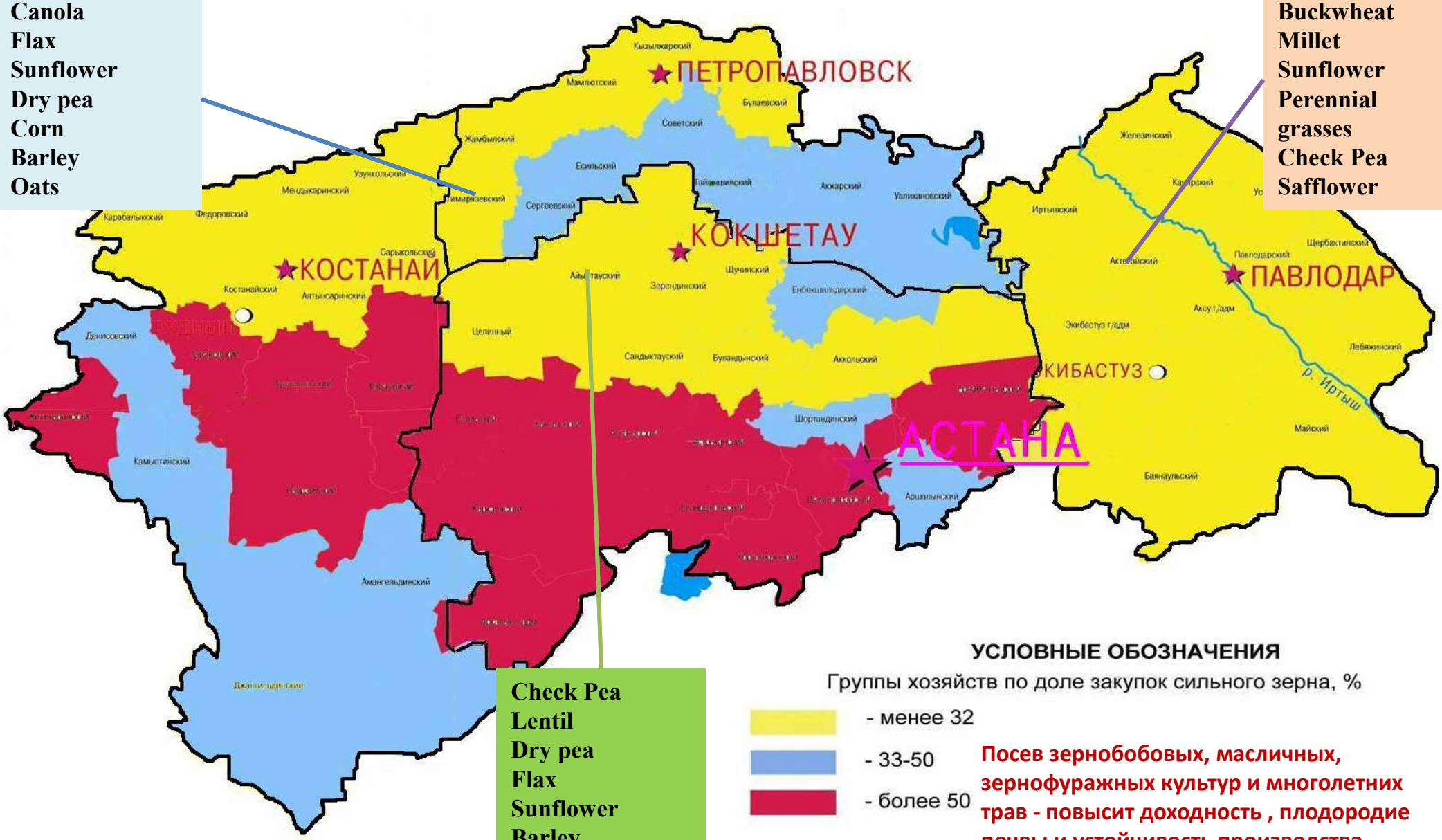
Minimum tillage (Zero-till, reduced tillage (minimum) – combination of mechanical & chemical treatments

DIVERSIFICATION – CEREALS, CASH CROPS (OIL, LEGUMES, FORAGE … CROPS

GRAIN PRODUCTION IN NORTH KAZAKHSTAN

Canola
Flax
Sunflower
Dry pea
Corn
Barley
Oats

Buckwheat
Millet
Sunflower
Perennial grasses
Check Pea
Safflower



Check Pea
Lentil
Dry pea
Flax
Sunflower
Barley
Oats
Perennial grasses

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ

Группы хозяйств по доле закупок сильного зерна, %

- менее 32
- 33-50
- более 50

Посев зернобобовых, масличных, зернофуражных культур и многолетних трав - повысит доходность , плодородие почвы и устойчивость производства растениеводства и животноводства

Area under S. Fallow in Kazakhstan & Canada

Country	Area, mln. hectares			
	2001	2009	2010	2014
North Kazakhstan	3.0	3.5	3,0	3,0
Saskatchewan, Canada	4.7	1,6	2,4	1,4

WIND EROSION


TRANSFER OF SOIL FROM SUMMER FALLOW
WIND EROSION
SHORTANDY,KAZ.
MAY 23, 2017
PHOTO BY KANAT AKSHALOV

WATER & SOIL RUNOFF IN SPRING TIME

Photo: by Kanat Akshalov


Summer Fallow
(prepared dy conventional tillage)
Summer Fallow
(prepared dy No - Till)
PHOTO: BY KANAT AKSHALOV


SOIL RUNOFF FROM FALLOW FIELD
SHORTANDY
KAZAKHSTAN
11.04.2014
PHOTO: BY KANAT AKSHALOV


SUMMER FALLOW
Stubble
PHOTO BY KANAT AKSHALOV

SOIL RUNOFF: FALLOW FIELD


CONVENTIONAL TILLAGE
(SPRING TIME)
PHOTO BY KANAT
AKSHALOV

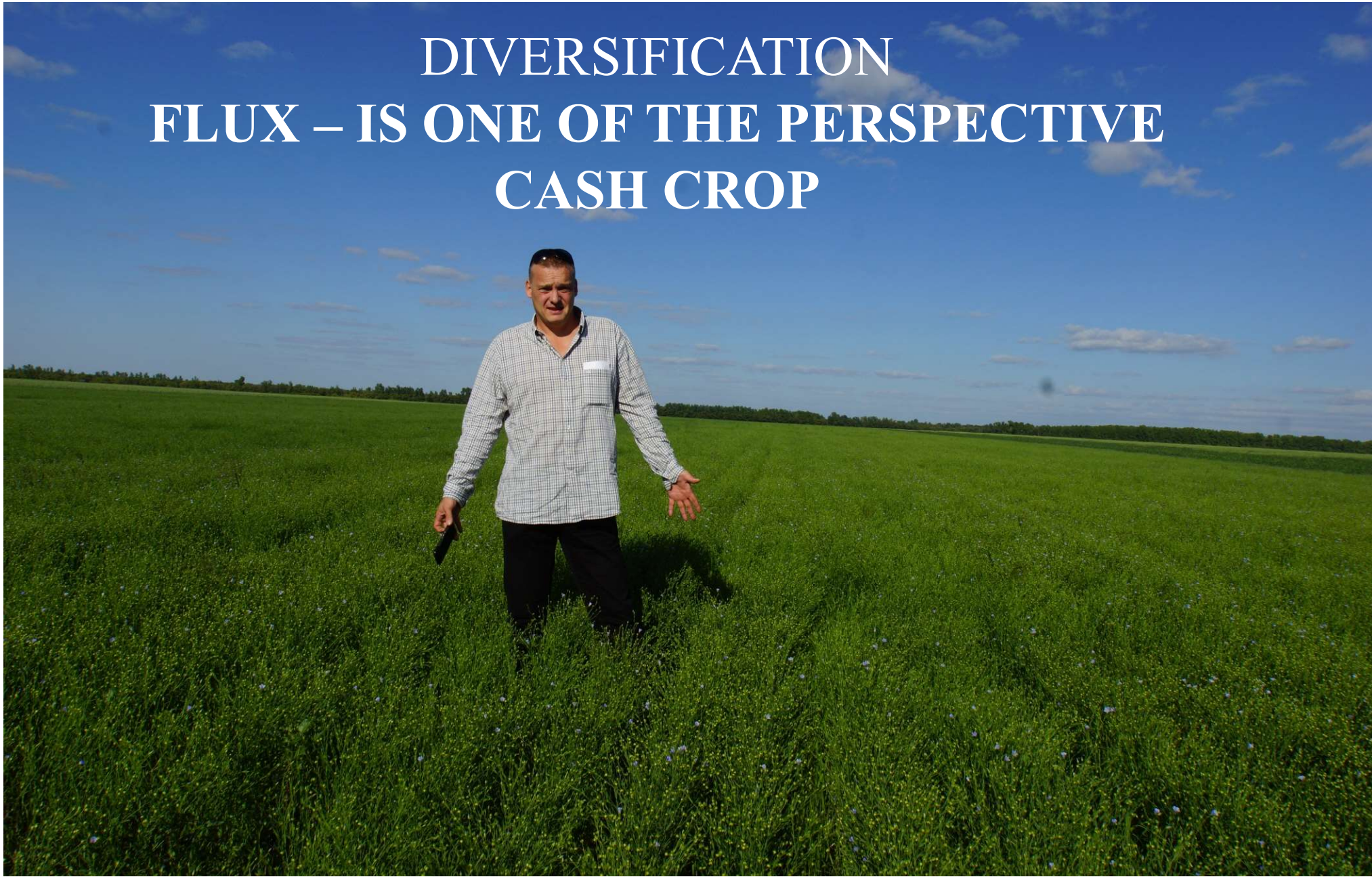

NO-TILLAGE
PHOTO BY KANAT AKSHALOV


NO-TILLAGE, MULCHING
PHOTO BY KANAT AKSHALOV

ENTAL TRIALS AT THE BARAYEV RESEARCH & PRODUCTION OF GRAIN FARMING


DIRECT SEEDING
by “Condor 12001”


DIVERSIFICATION


DIVERSIFICATION
FLUX – IS ONE OF THE PERSPECTIVE
CASH CROP

EFFECTS OF TILLAGE SYSTEM ON BULK DENSITY, G/CM³

TILLAGE SYSTEM	Wheat after Fallow		Continious Wheat	
	Spring time	FALL	Spring time	FALL
Conventional	1.09	1.19	1.12	1.24
No-Till	1.14	1.25	1.14	1.25

TILLAGE SYSTEM	Wheat after dry pea		Continious Wheat	
	Spring time	FALL	Spring time	FALL
Conventional	1.06	1.20	1.12	1.25
No-Till	1.13	1.24	1.15	1.27

SOIL WATER CONTENT AS EFFECTED BY TILLAGE & CROPPING SYSTEM , MM

SUBSEQUENT CROP	TILLAGE SYSTEM	SOIL DEPTH, CM		
		0-30	0-50	0-100
SUMMER FALLOW	NO-TILL	42,7	77,1	153,1
	MINIMUM TILL	54,1	92,4	162,6
CONTINUOUS CROPPING (STUBBLE)	NO-TILL	33.2	66,6	137,9
	MINIMUM TILL	35,5	69,6	146,8

PRCP USE EFFICIENCY UNDER DIFFERENT CROPPING SYSTEM

CROPPING SYSTEM	TILLAGE SYSTEM	Amount of PRCP, mm	PRCP Use Efficiency, %
CONTINUOUS CROPPING	NO-TILL	170-180	50 AND ≥
	MINIMUM		50 AND ≥
SUMMER FALLOW	NO-TILL	400-500	18-20
	MINIMUM		22-25

WATER AND SOIL RUNOFF FROM DIFFERENT CROPPING SYSTEMS

CULTURAL PRACTICE (CROPPING SYSTEM)	TILLAGE SYSTEM	RUNOFF	
		WATER, M^3	SOIL, TONS\HA
SUMMER FALLOW	CONVENTIONAL	500-600	6-7
	NO-TILL	500-600	-
CONTINUOUS CROPPING	CONVENTIONAL	150-200	1-2
	NO-TILL	180-250	-

YIELD OF OIL CROPS AS EFFECTED BY SEEDING TECHNOLOGY

CROP	TECHNOLOGY	YIELD, T/HA
CANOLA	MINIMUM	0.81
	DIRECT SEEDING	1.0
FLAX	MINIMUM	1.28
	DIRECT SEEDING	1.53

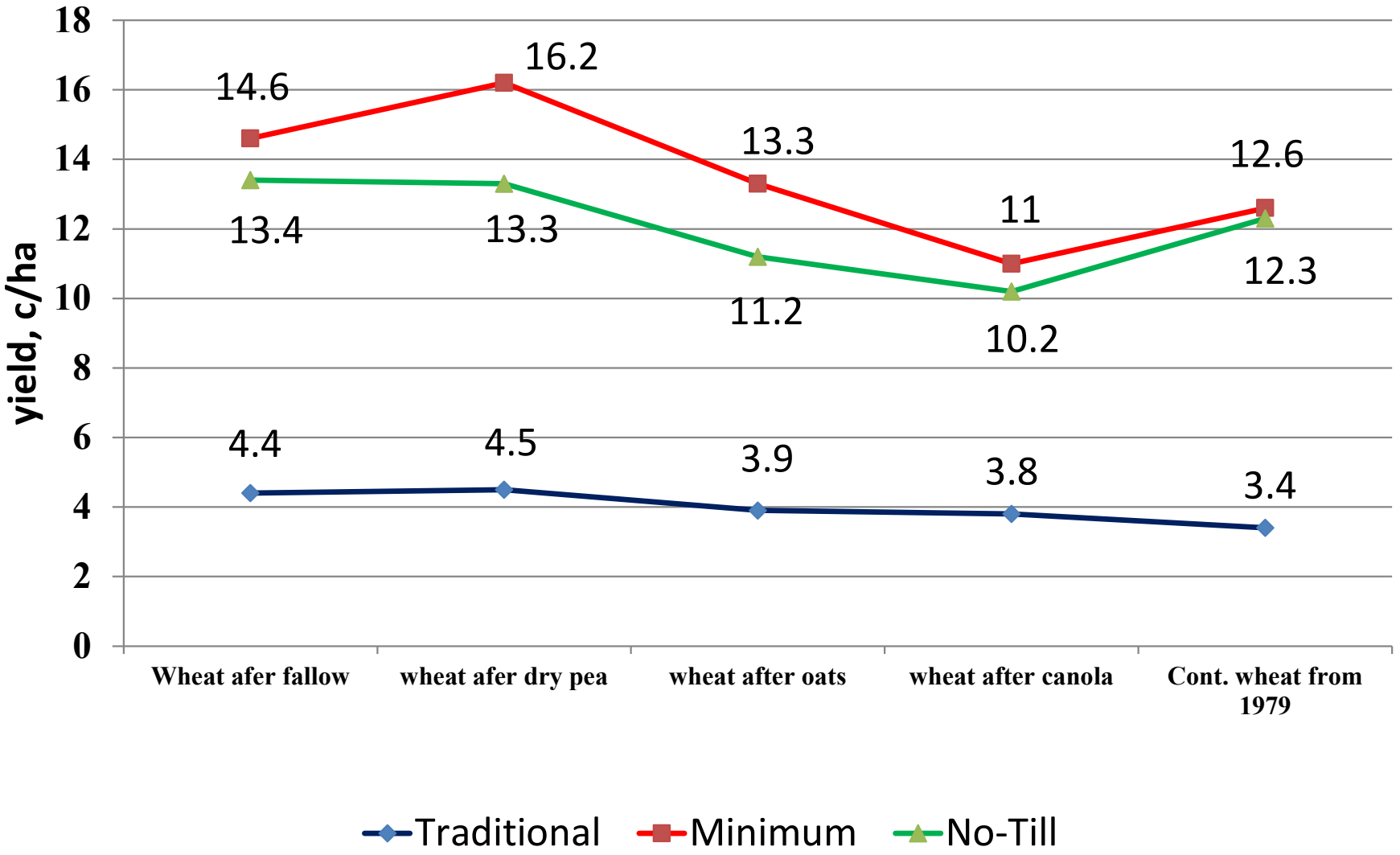
ECONOMIC EVALUATION OF SEEDING TECHNOLOGY

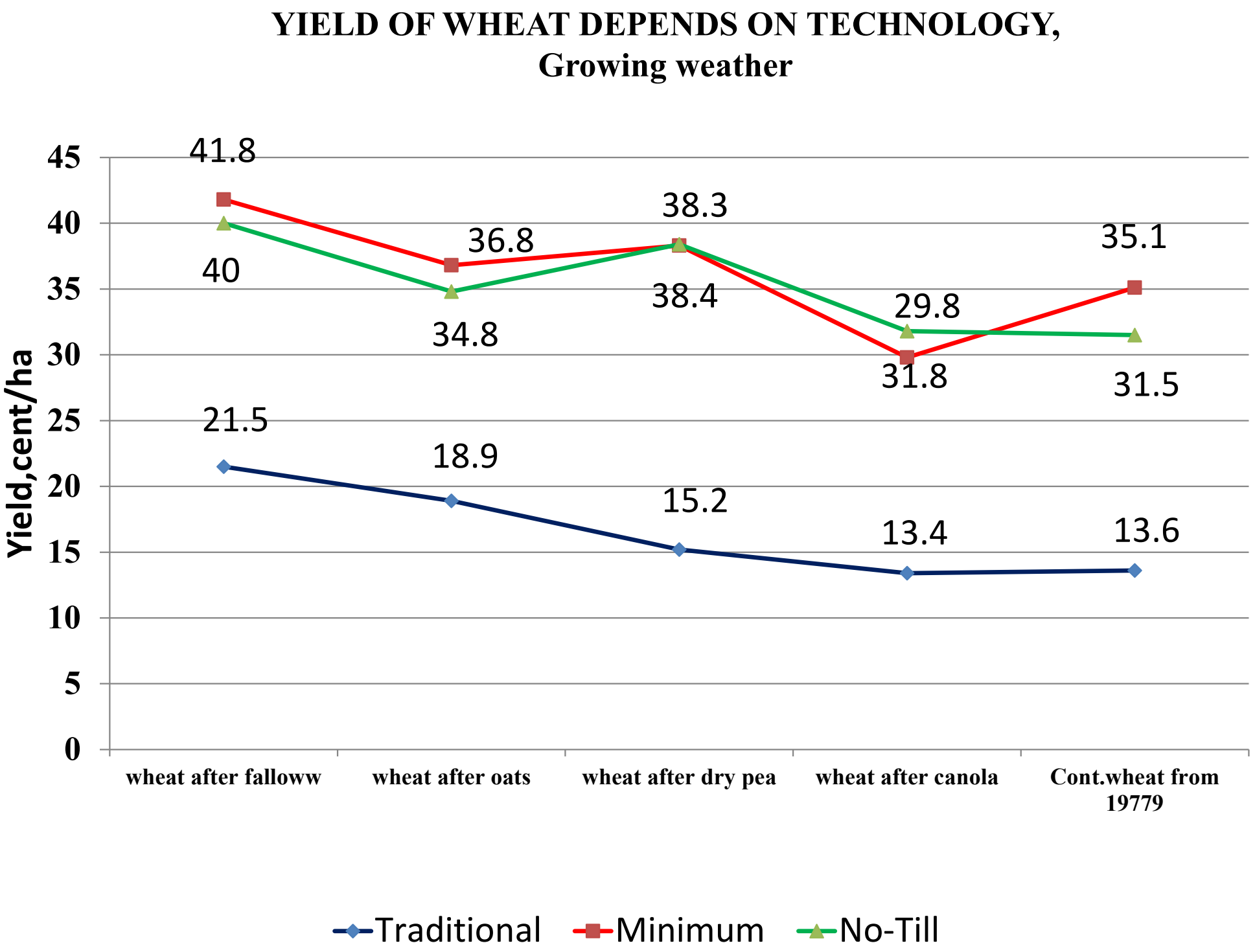
Seeding technology	Gazoline expense (liter per hectare)	Save, L/ra	Cut cost of gasoline expenses (cost of gasoline – 120 тg/L - $ 0.34)	
			Per hectare	1000 ha
V-type drill coulter	5,0	-	-	-
Direct seeding – hoe boot «Condor 12001» - Amazone	3,0	2,0	$0.57	$570.00

EFFICIENCY OF DIVERSIFICATION (EXAMPLE)

CROP	YIELD, T/НГА	CULTIVATION COST (TECHNOLOGY), $/ГА	COST OF PRODUCTION, $/T	MARKET PRICE, $/1 T	STORAGE	FARM PROFIT, $/ГА
WHEAT	0,8-1,0	150-200	150-200	250		50.00
FLAX	1,0	200-250	200-250	500		250-300

YIELD OF WHEAT DEPENDS ON TECHNOLOGY, SEVERE DRY YEAR




YIELD OF WHEAT DEPENDS ON TECHNOLOGY,
Growing weather
Yield,cent/ha
45
40
35
30
25
20
15
10
5
0
41.8
36.8
38.3
35.1
40
34.8
38.4
29.8
31.8
31.5
21.5
18.9
15.2
13.4
13.6
wheat after falloww
wheat after oats
wheat after dry pea
wheat after canola
Cont.wheat from 19779
Traditional
Minimum
No-Till

Based on our research & farm experience, the principle steps are needed:

- ***Government strategy***
- ***Long-term research on CA***
- **currently use farming system with right – angled fields and straight-lined roads on slopes doesn`t meet soil conservation requirements**
- ***It is critical to develop cropping system with soil cover crop rotations and diversify root system rotation to avoid soil compaction***
- ***On – farm research on the farm level***
- ***Activate extension service***
- ***Use of modern technology like remote sensing and GIS technology to develop CA system with full retention of crop residues.***
- ***Smart Agriculture (precision farming, remote sensing, electronic maps, etc.)***


DIRECT SEEDING of FLUX
Photo: by Kanat Akshalov

DIRECT SEEDING OF FLUX
BY «CONDOR 12001» DRILL, AMAZONE

DIRECT SEEDING OF DRY PEA

Photo: by Kanat Akshalov

DIRECT SEEDING of SPRING WHEAT

Photo: by Kanat Akshalov

FIELD DAYS

DRIP IRRIGATION of COTTON

DRIP IRRIGATION


THANKS
FOR
YOUR
ATTENTION
AND
FOR
YOUR
TIME
Photo: by Kanat Akshalov