Conservation Agriculture/No till

A Climate Smart Agriculture Solution: the Kazakhstan and Ukraine experiences

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Rome

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investment days
invest in sharing

Conservation Agriculture Definition

FAO definition:

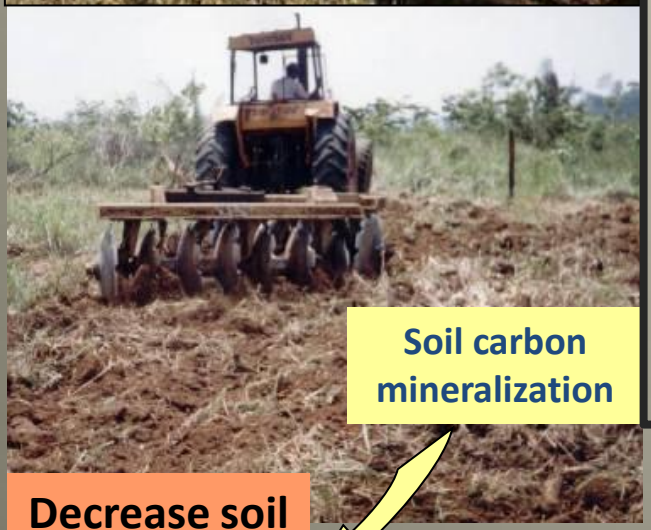
1. **Minimal Soil Disturbance/No Till:** the tilled area must be less than 15 cm wide or 25% of the cropped area (whichever is lower)

2. **Soil permanent cover:** Ground cover must be more than 30%

3. **Crop rotation:** Rotation should ideally involve at least 3 different crops. However, monocropping is not an exclusion factor

CA/No till: a paradigm shift

Ploughing used to be essential to control weeds, but it causes soil erosion and consequent loss of fertility (with variations according to local conditions)



Soil carbon mineralization

Decrease soil carbon stock

CA/NT increases soil organic matter with the following benefits:

- reduced soil erosion;
- improved soil structure;
- reduced leaching;
- Increased water infiltration;
- earthworms proliferation which creates channels that foster root growth

Residues

Increase soil carbon stock

From Martial Bernoux, Institut de Recherche pour le Développement (IRD)

Technologies at comparison

Tillage	No tillage
Soil de-structured ⇓ High erosion	Improved soil structure ⇓ Less erosion
Low water holding capacity ⇓ High yields variability	Increased water holding capacity ⇓ High yields stability
Higher tillage costs and time ⇓ Low competitiveness	Decreased seed bed preparation costs and time ⇓ Improved competitiveness
Low C sequestration ⇓ High environmental impact	Moderate C sequestration ⇓ Decreasing environmental impact

CA Triple Win-Win

Economic/Financial benefits

- Increased profitability by reducing soil preparation costs
- Possibility to have two crops/catch crops (in warmer climates)

- Reduced soil erosion and its related costs

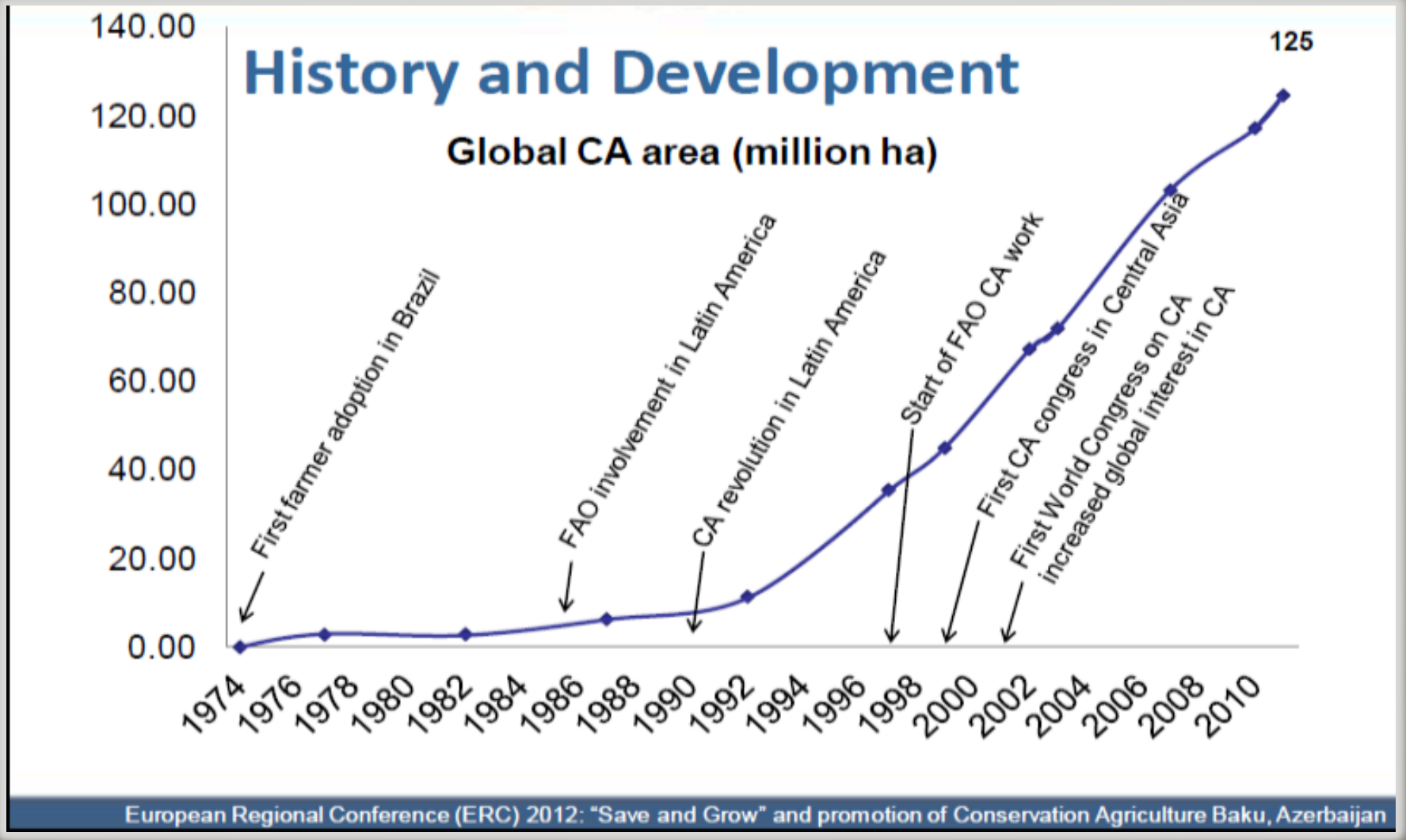
Climate Change Adaptation

- Improving rainfall efficiency and soil moisture storing
- Increased soil organic matter, biodiversity and fertility

Climate Change Mitigation

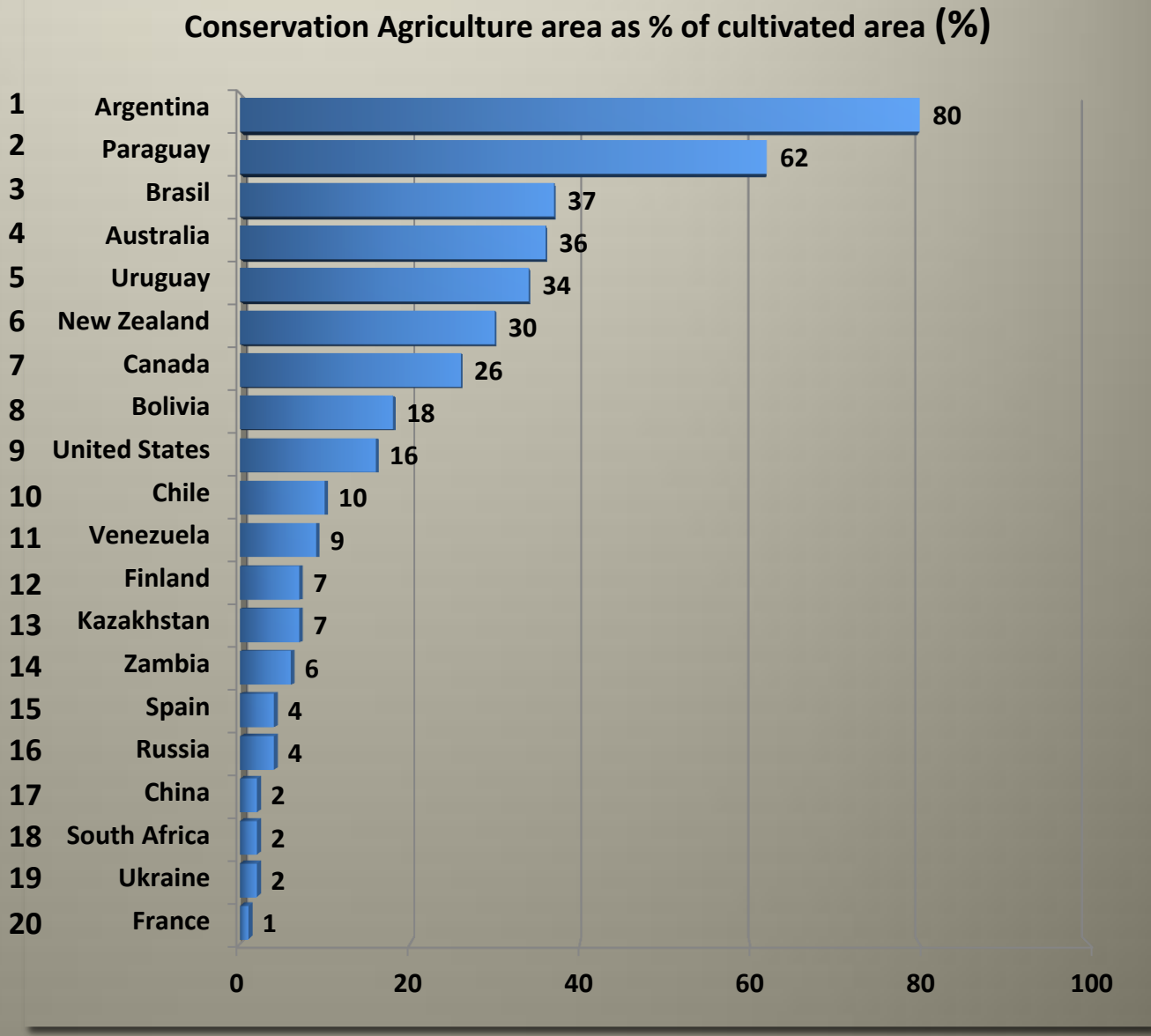
- Reduced green house gas emissions

CA/NT History



Global Adoption of CA/No Till

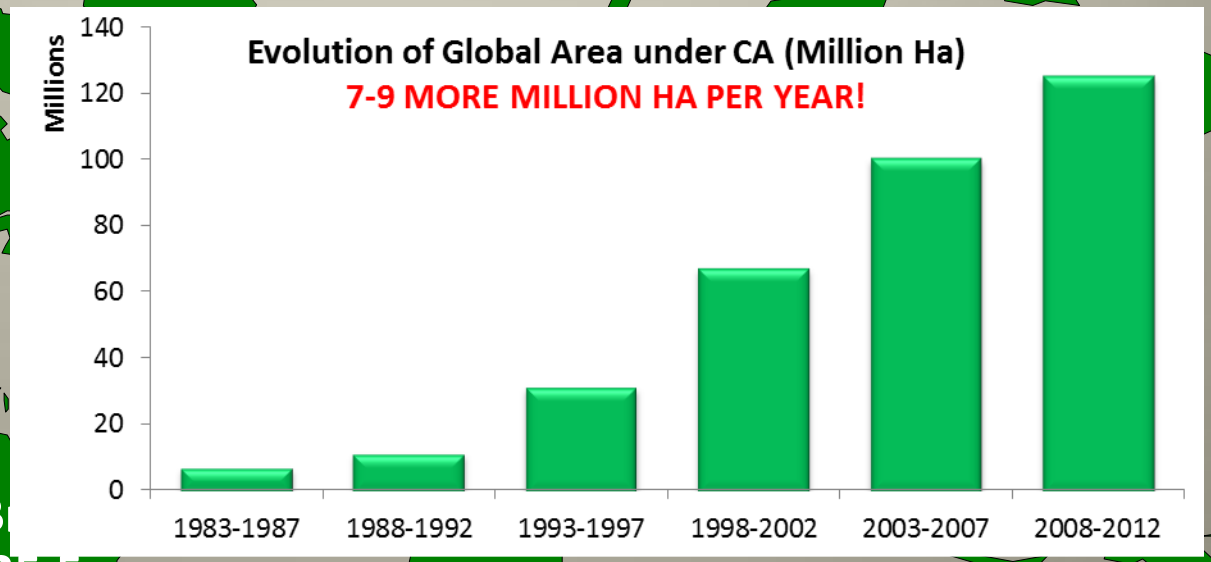
	Country	Conservation Agriculture area (1000 ha)
1	United States of America	26,500
2	Argentina	25,553
3	Brazil	25,502
4	Australia	17,000
5	Canada	13,481
6	Russia	4,500
7	China	3,100
8	Paraguay	2,400
9	Kazakhstan	1,850
10	Bolivia	706
11	Uruguay	655
12	Spain	650
13	Ukraine	600
14	South Africa	368
15	Venezuela	300
16	France	200
17	Zambia	200
18	Chile	180
19	New Zealand	162
20	Finland	160
	TOTAL	124,067
	Others	1,000



Global Adoption of CA/No Till

Latest database update

Global adoption in 2010: ~125 Million ha (9% of arable land)



Canada 13.5

USA 26.6

B… 25.5

Paraguay 2.4

Other South America 2.0

Argentina 19.7

Australia 12.0

From Martial Bernoux (IRD) on data from Derpsch and Friedrich (FAO), and *Roberts and Johnston, 2009.


Produção de grãos no Brasil
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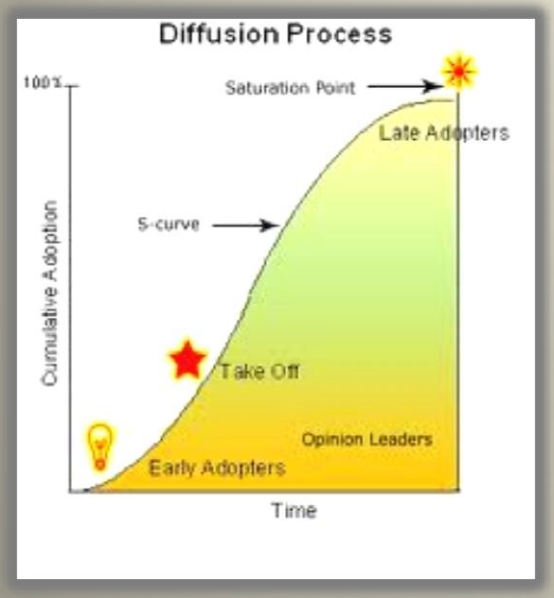
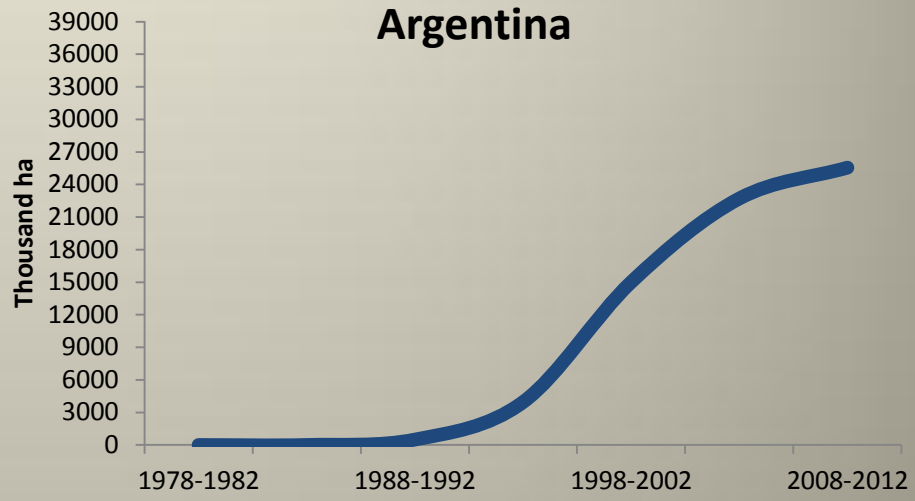
Obstacles to Adoption

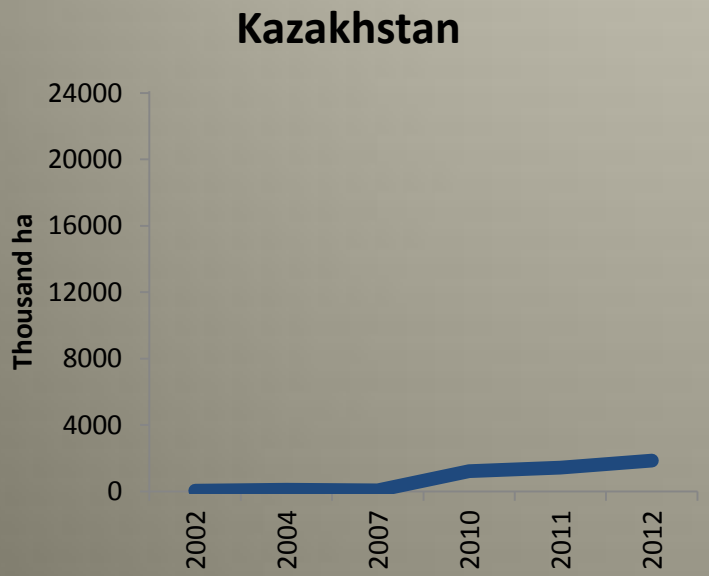
- Significant investments required to update farm machinery
- More evident and durable benefits when technology is applied for several continued years (issue when land tenure is insecure)
- Challenging technological changes & steep learning curve
- New weed management approach & increased herbicides cost (at least initially)
- Difficulty to handle crop residues, which cannot be used for animal feed or fuel
- Psychological and cultural bias

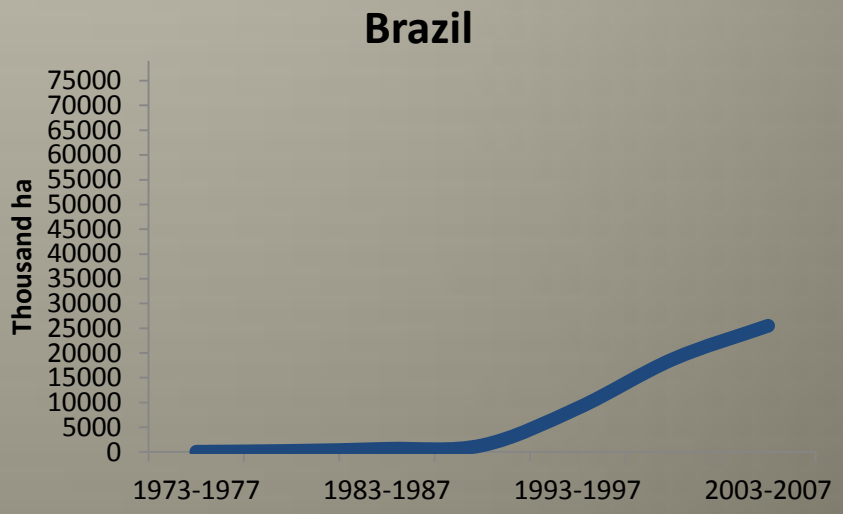
Adoption is easier in larger farms, and more challenging (but not impossible nor less beneficial) in smaller farms. That is why adoption takes time

The “S” curve of Technology Adoption









"Adoption is easier in larger farms, and more challenging (but not impossible nor less beneficial) in smaller farms. That is why adoption takes time "

What about China?

'China must be in the forefront of promoting intensified sustainable agricultural practices since it only has 7% of global arable land but 22% of the global population. Conservation agriculture is an opportunity to increase sustainable development of agriculture in China now and in the future'

Professor Li Hongwen, lead CA expert in China Agriculture University

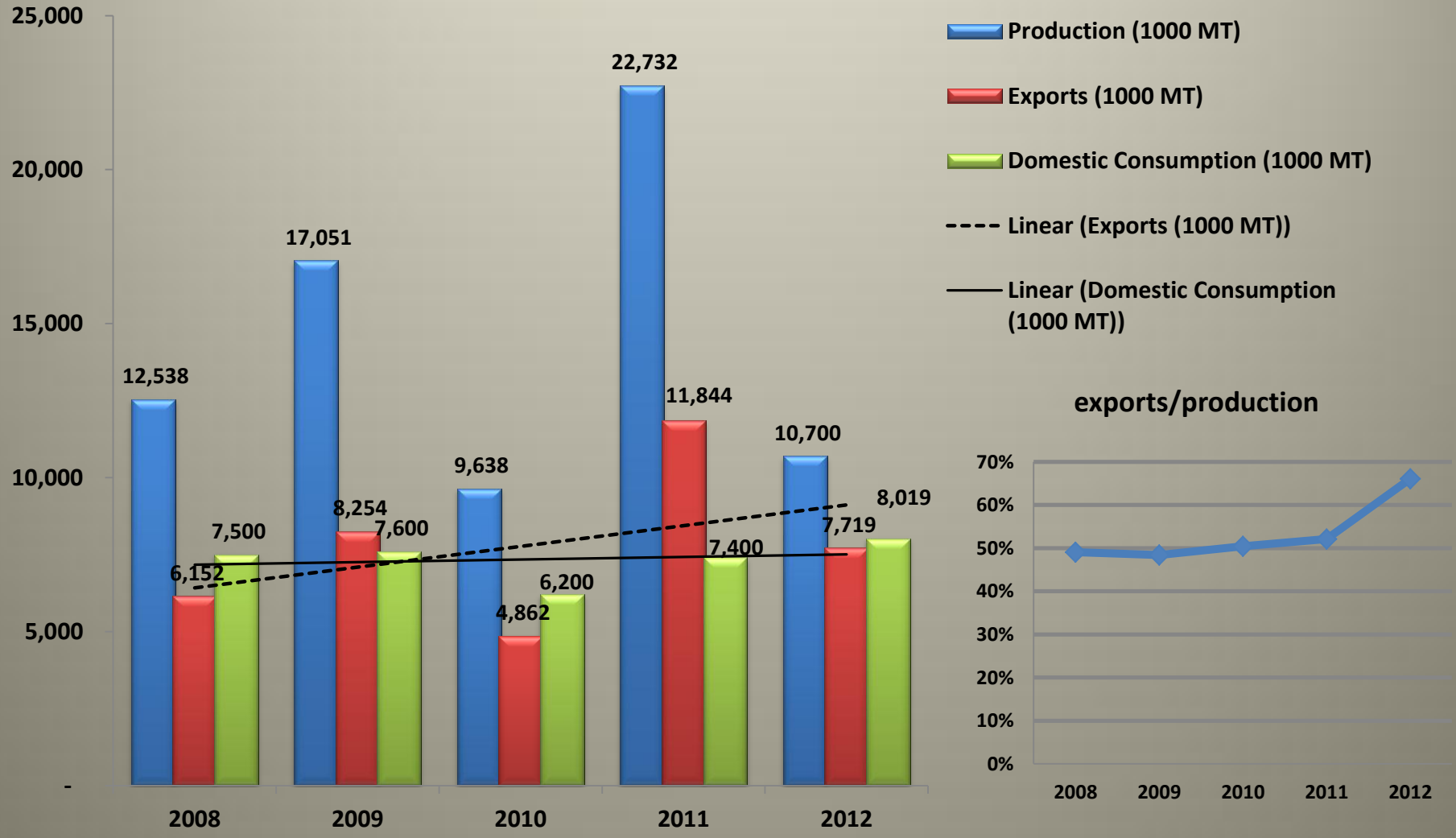
China's recipe:

- High-level championship and ownership
- R&D (on machinery, cropping patterns, etc.)
- Widespread demonstrations/awareness raising
- Enabling policies and targeted subsidies
- Good governance

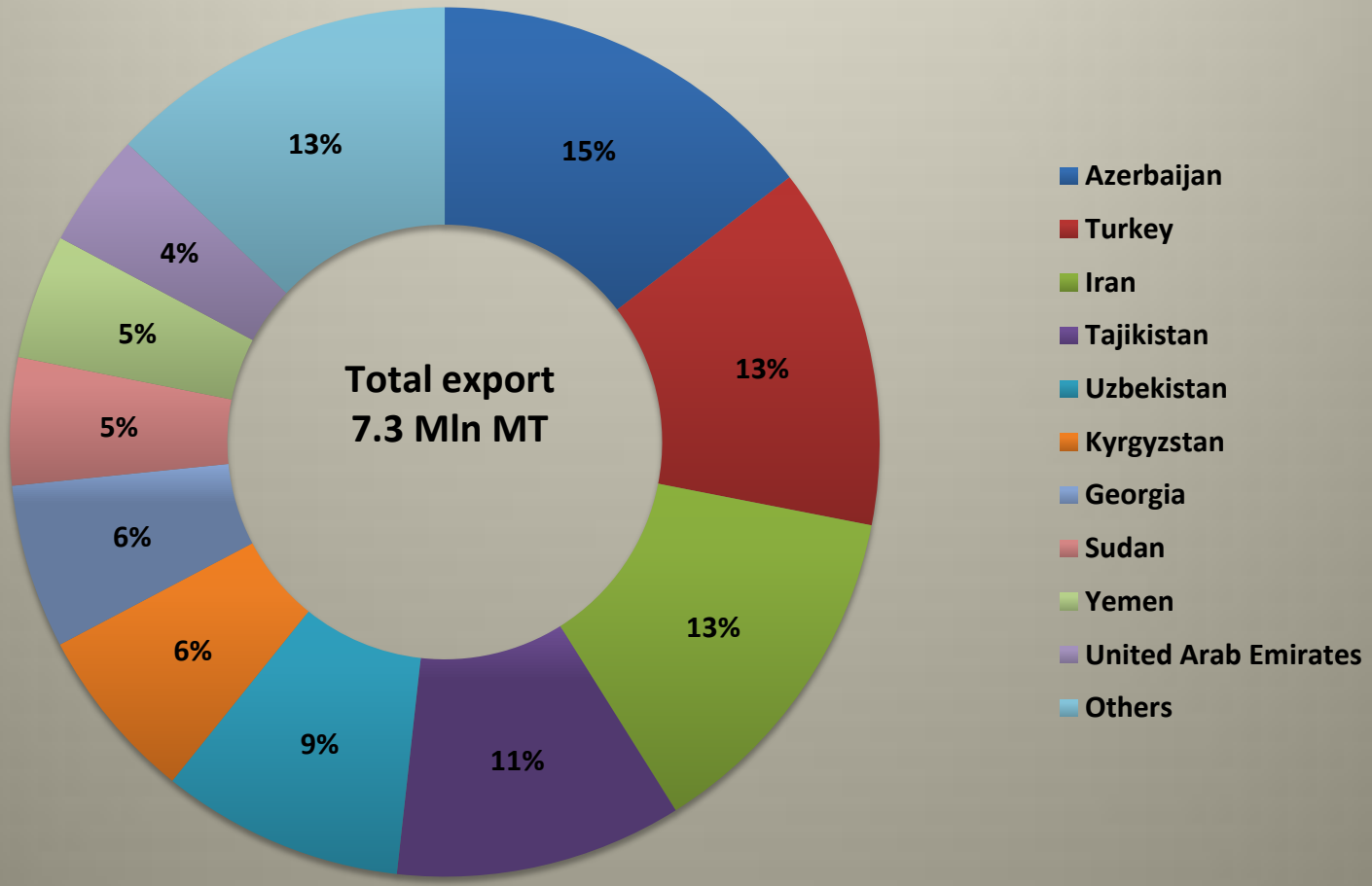
The Kazakhstan Experience:

TCI Implementation Support to the WB-ACP

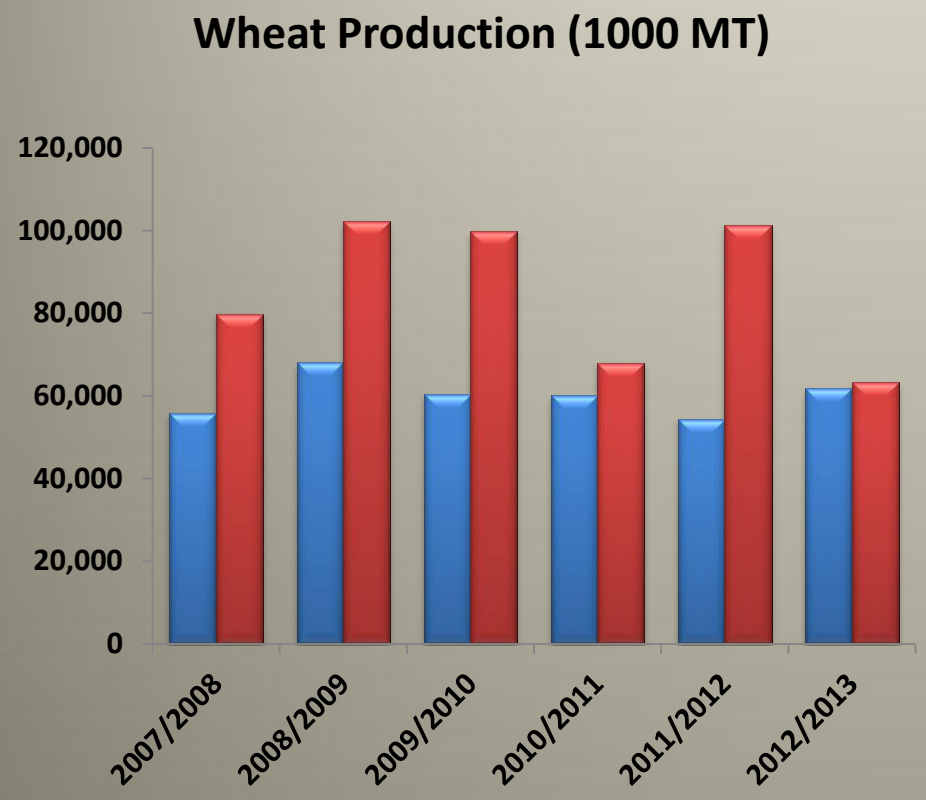
Kazakhstan is a major wheat exporter

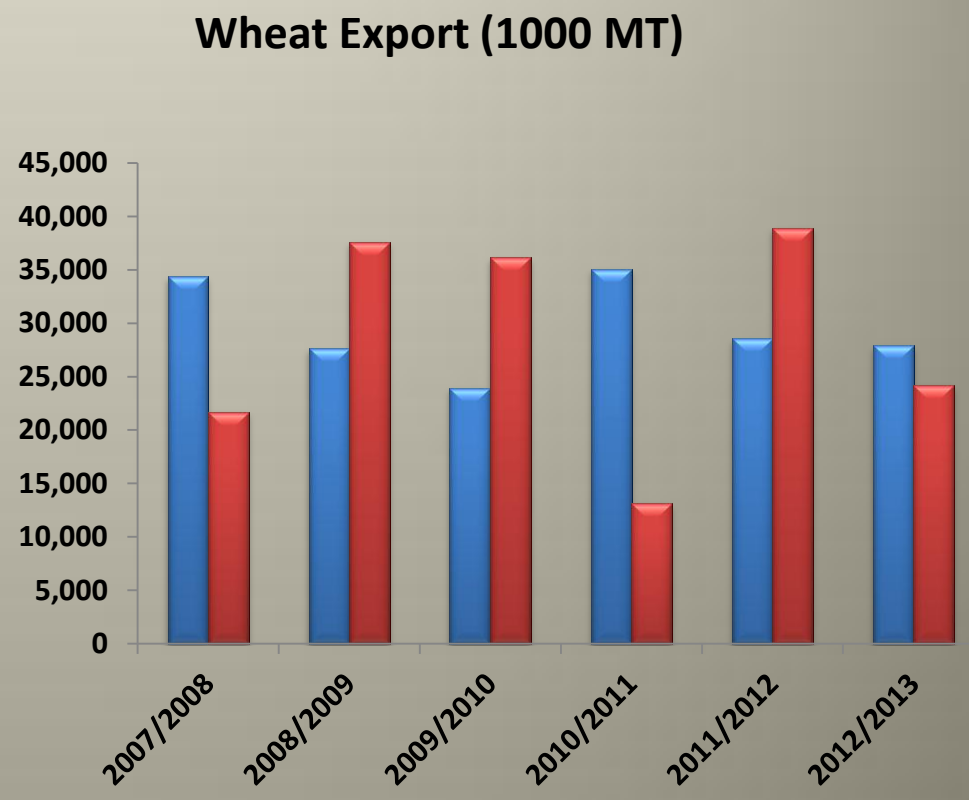


Kazakhstan cereals exports and their destinations (2012)



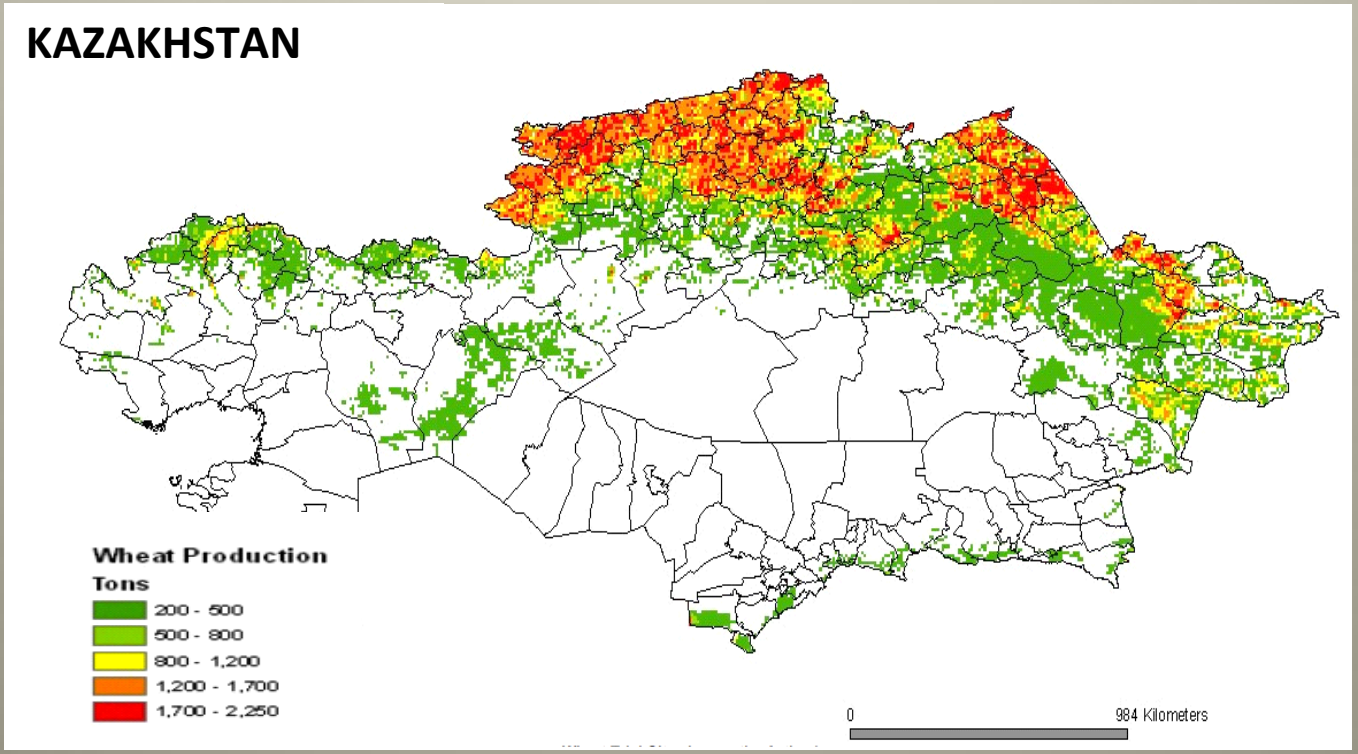
RUK is challenging the US as the largest wheat exporter in the world (global food security factor)





United States
RUK

Wheat is produced mostly in the northern part of Kazakhstan

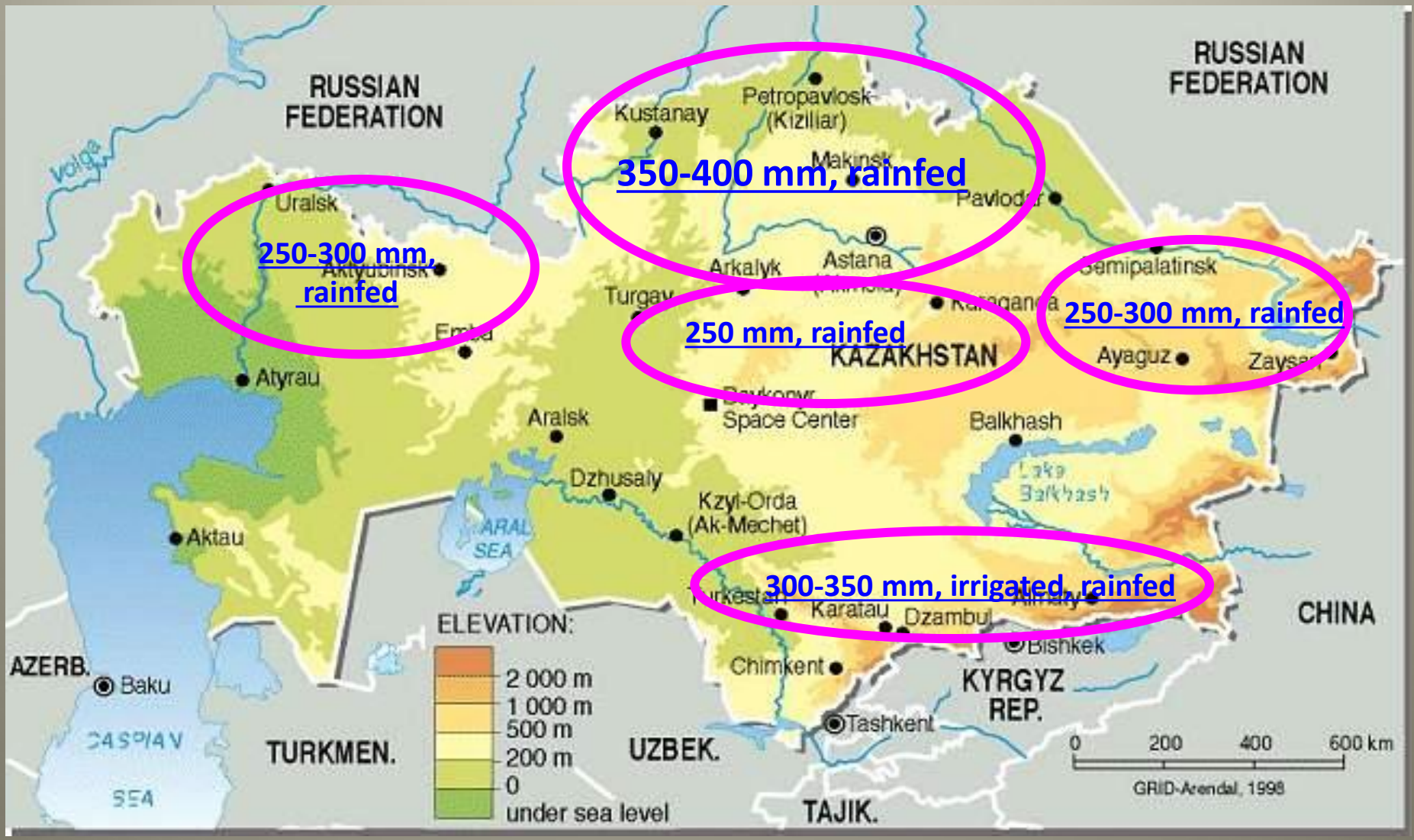


Ranks the 9th place in the area extent.

Around 20 mln ha is used for crop production, mainly for wheat – 14 mln ha

Mostly spring wheat, planted in spring and harvested in autumn because winters are too cold

Rainfed wheat with limited precipitation



The importance of stubble

- 50% of yield depends on soil moisture
- Snow 30-40 % of all precipitations
- Snow is taken away by the strong wind of the steppe or through runoff (causing erosion)
- Stubbles of preceding crop trap snow
- Snow melts more gradually and more water becomes available to growing crop
- The higher the stubble the better (35 to 40-45 cm for best results)

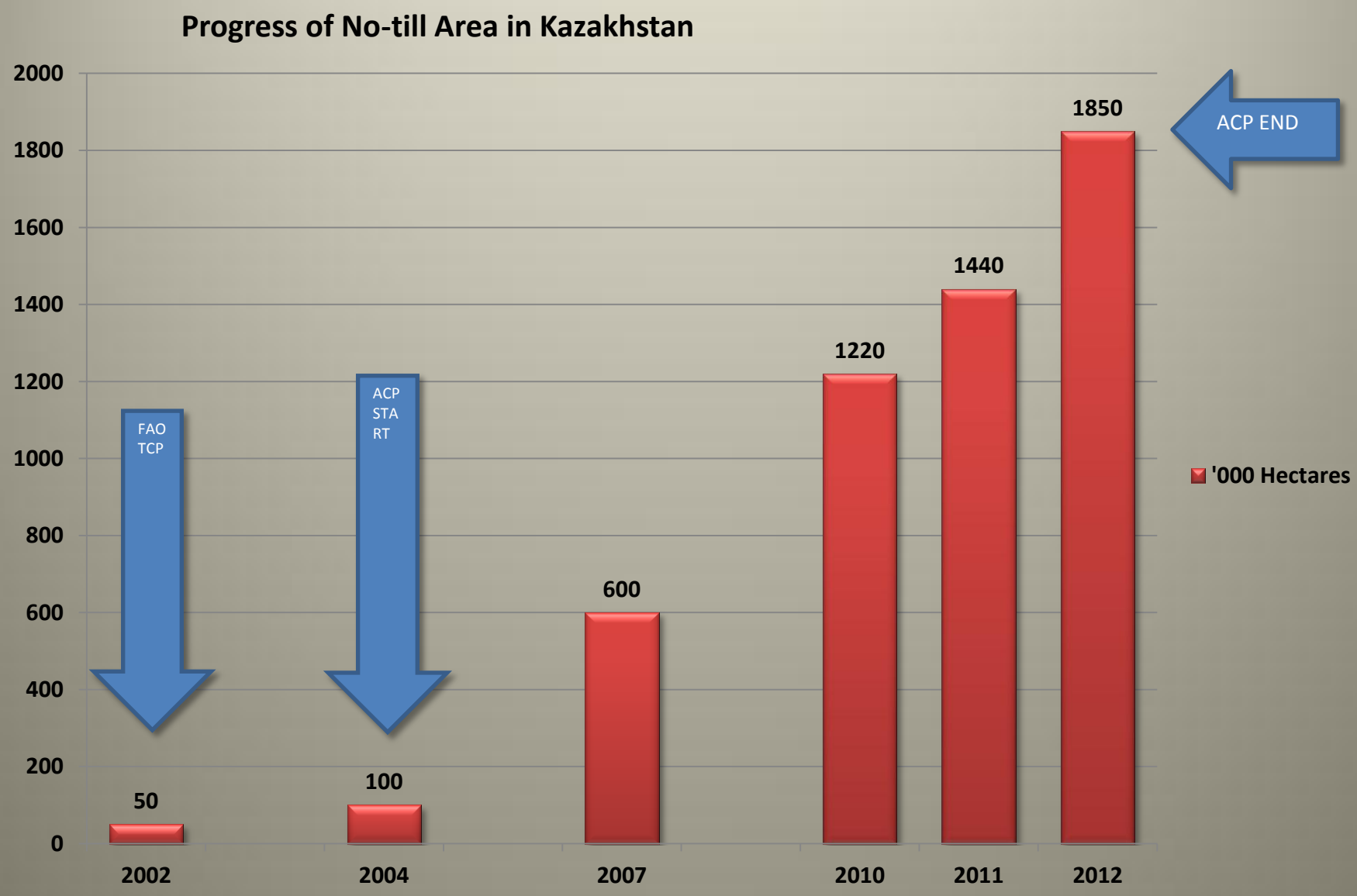
(LL from Saskatchewan, Canada)

Snow trapping

CA/NT Adoption in Kazakhstan

- Kazakhstan together with Russia has the highest adoption in ECA
- The area has grown more than 200% during the last 5 years
- Now it is practiced on at least 1.85 million ha (CIMMYT, 2012 based on rigorous latest assessment)
- The country is ranked 9th in the world for adoption

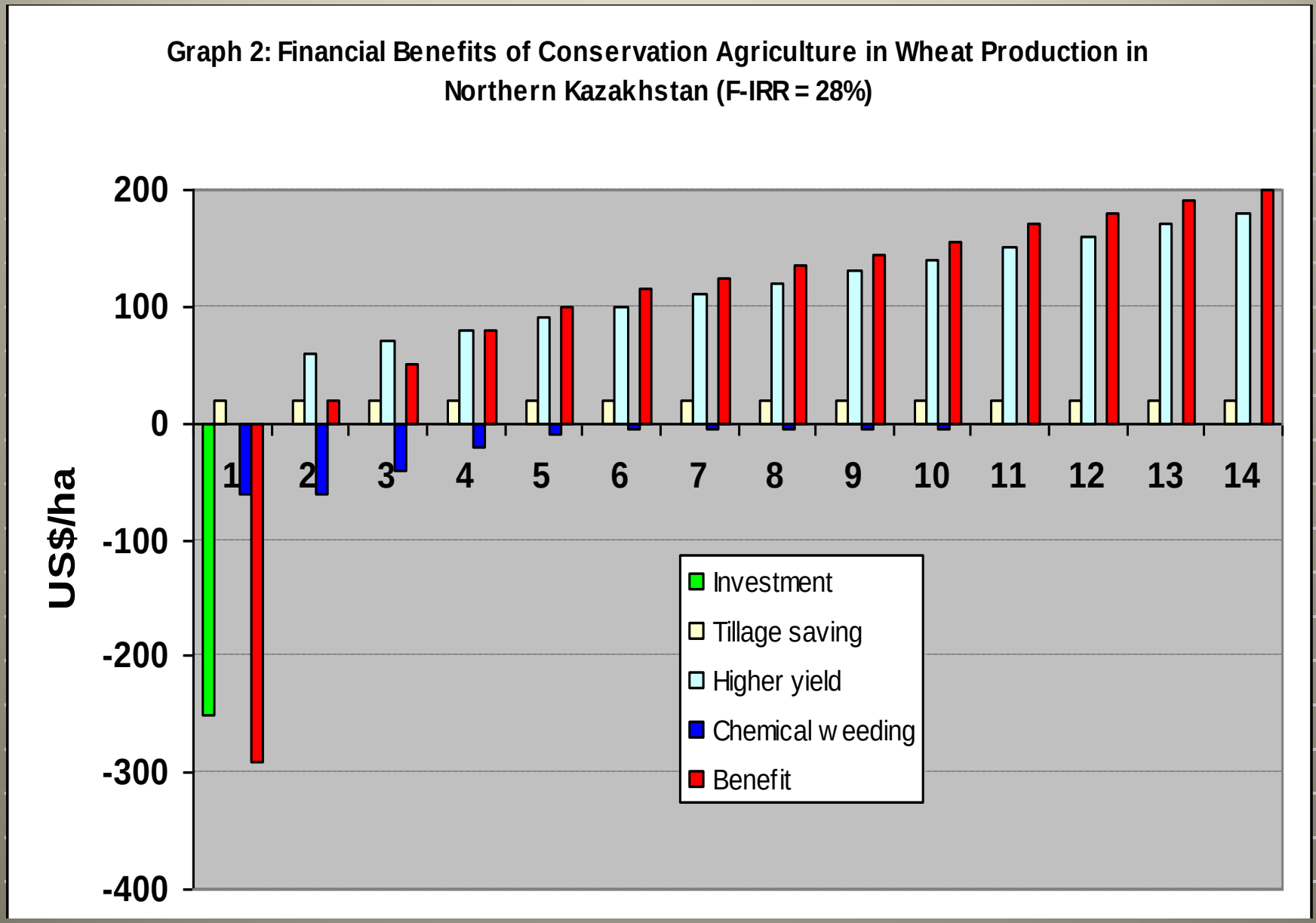
CA/NT area in Kazakhstan



Speed of adoption

In terms of speed of adoption, during the last three years, Kazakhstan shares the 1st position with China

A good business for farmers

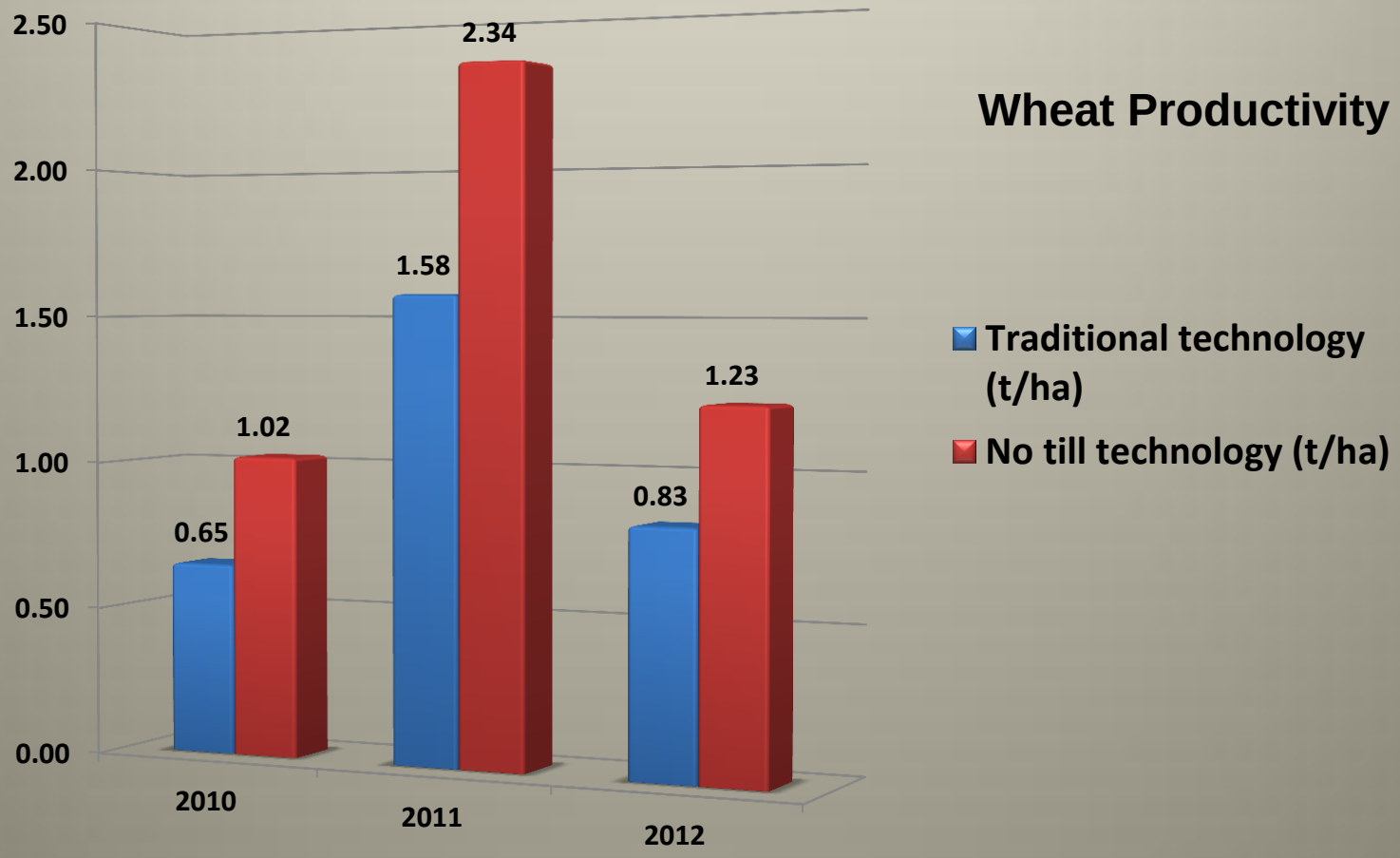


Kazakhstan - 2012 Incremental Estimates

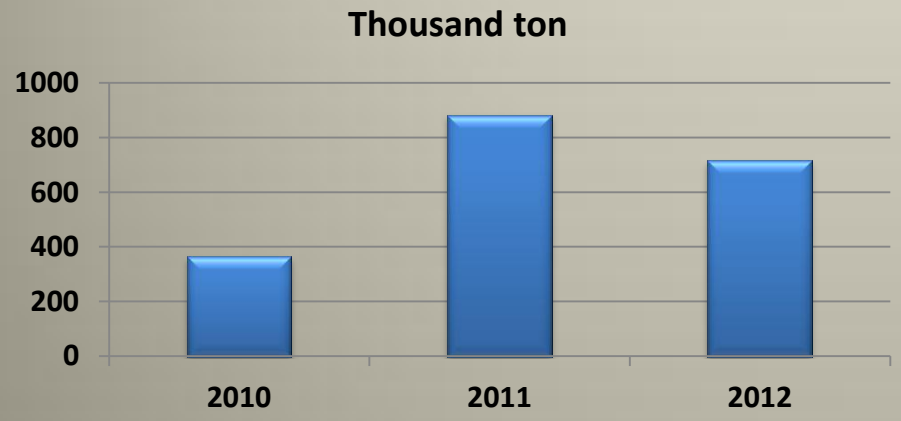
- Wheat production was **10.7 million tons**
- **Wheat no-till area** has produced an estimated **1.8 million tons of wheat**
- **Incremental** wheat production only because of no-till area is about **0.7 million tons, equivalent to around 220 million dollars**

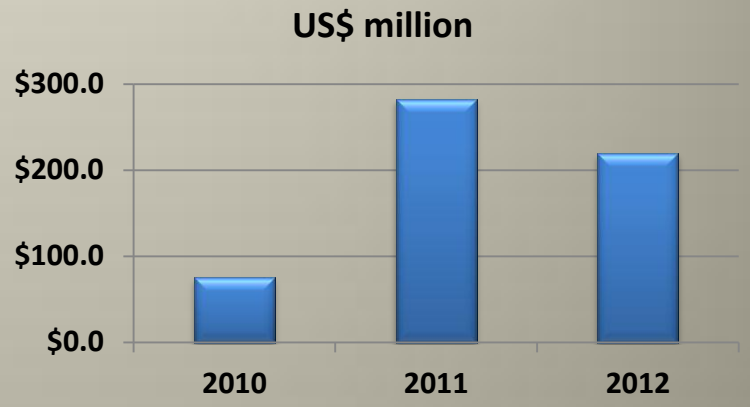
See report at http://www.eastagri.org/publications/pub_docs/Info%20note_Print.pdf

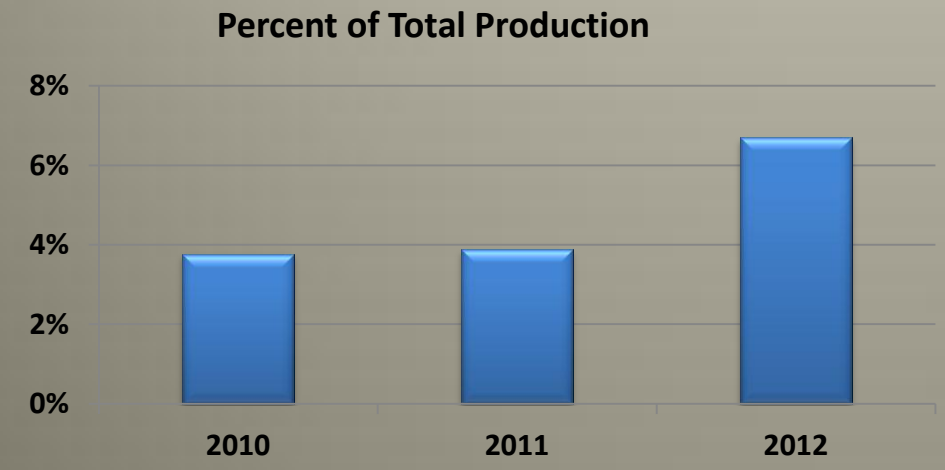
Kazakhstan - Yield Increases

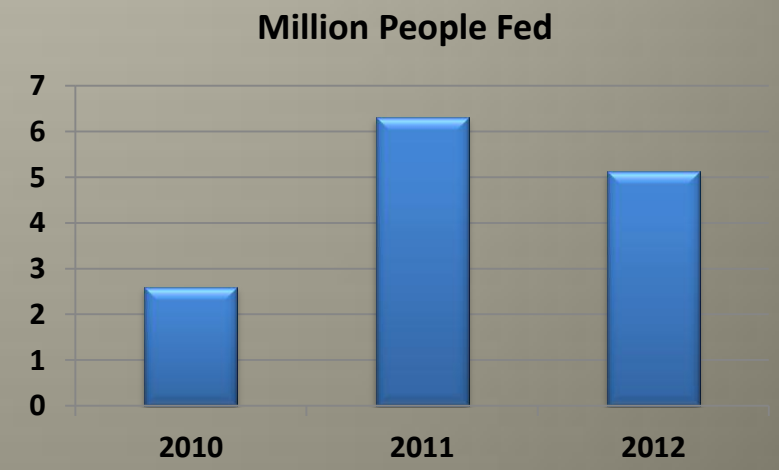


National Benefits from CA/NT Adoption - Wheat only









Kazakhstan - Impact of CA/NT

- **Increased income and food security during the last three years:**
  - **An estimated 580 million dollars incremental income;**
  - **satisfied cereals requirements of about 5 million people annually**
- **Climate Change mitigation:** Kazakhstan contributes to the annual sequestration of about **1.3 million tons of CO_2** equivalent to the emissions of 270,000 cars

The Agricultural Competitiveness Project (ACP)

- **42 out of 585 Competitive Grants awarded for no-till/minimum tillage activities.**
- **Beneficiary farmers have expanded the technology to the rest of their farm areas (about 45,000 ha)**
- **Extension activities of KazAgroInnovation contributed to further expansion through seminars in knowledge centers, direct consultancies and call centers. High demand topic**

ACP Contribution

- **Due to replication effect,** extrapolation can be made for the entire country which would allow the assumption that some **350,000-400,000 ha of NT area have been promoted thanks to ACP**
- Strengthened links between research centers and farmers reduced failures
- ACP **supported the CIMMYT assessment**

Kazakhstan – CA/NT State of art and needs

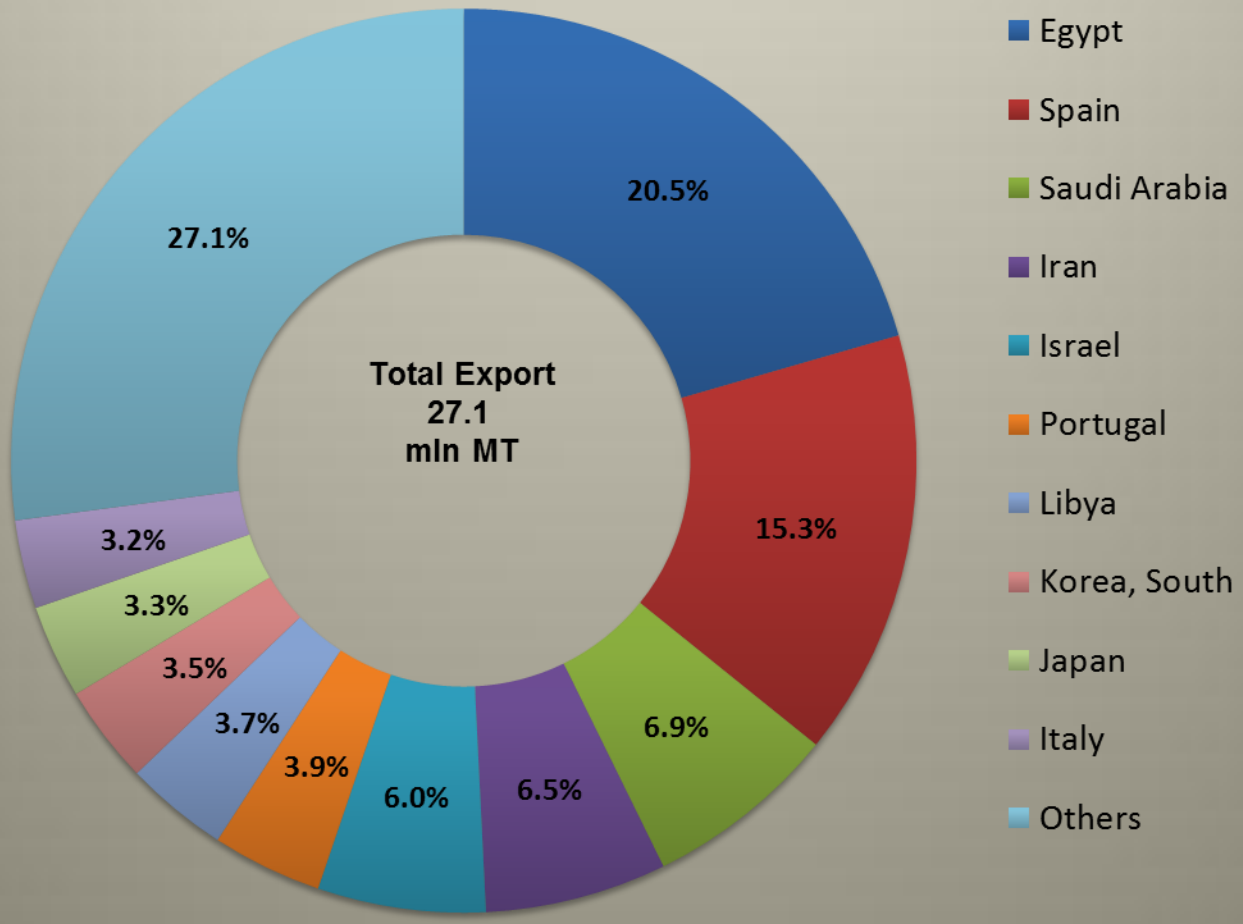
- **GOK** and the national research system have done a lot: **policy, incentives, investment, R&D**
- **The private sector** has invested (specifically) over **200 million dollars**
- CA/NT specialized **machinery companies are** expanding, but farmers depend excessively on machinery suppliers
- Some farmers **reversed adoption** because of organizational challenges
- To enable further expansion and avoid reversals **more investment is required**
- More farm/business specific **R&D, Knowledge Dissemination, and expert advice**

The Ukraine Experience:

Study on Potential Benefits of CA/No till Adoption in Ukraine

Ukraine cereals exports and their destination (2012)

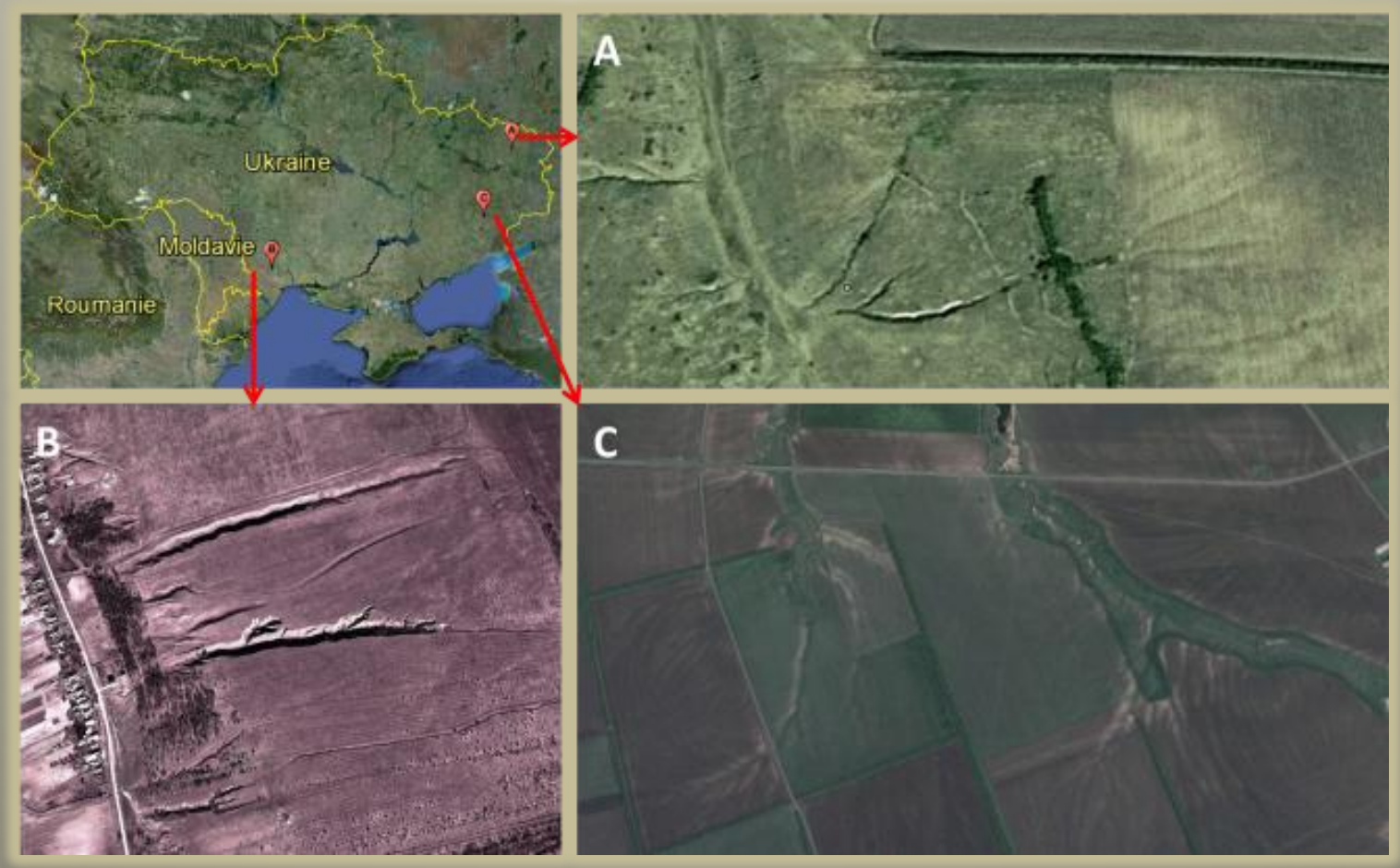
State Customs Committee of the Ukraine, Global Trade Atlas



Erosion in Ukraine is a major issue

- The country is gifted by nature with a strategic production asset: the Chernozems
- These soils over the years have been widely degraded by erosion
- Erosion is causing every year a loss of soil fertility currently valued at US$5 billion, which is 1/3 of Ag. GDP
- 10 tons of soil eroded per ton of grain produced!!

Erosion: the Steppe example



Interlinked issues

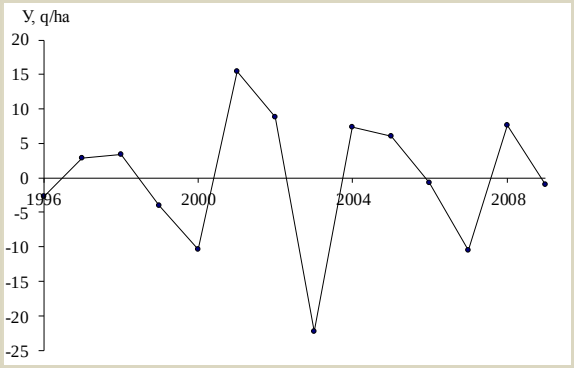
- **Comparative advantage of crop production systems in Ukraine is threatened:**
  - **Output volatility and high costs of production**

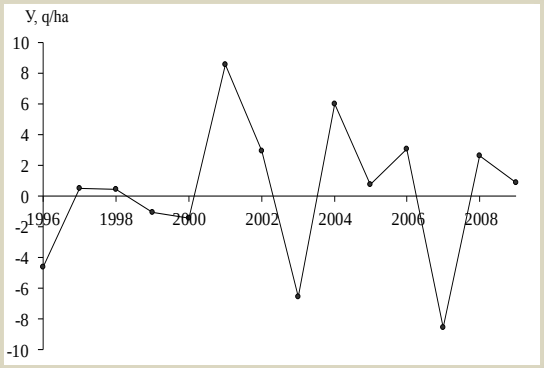
- **Competiveness is at risk (agricultural enterprises contribute over 85 percent to the agricultural GDP*)**

- **Siltation of rivers, harbors, and dams (feeding hydroelectric power stations water intakes): not quantified yet.**

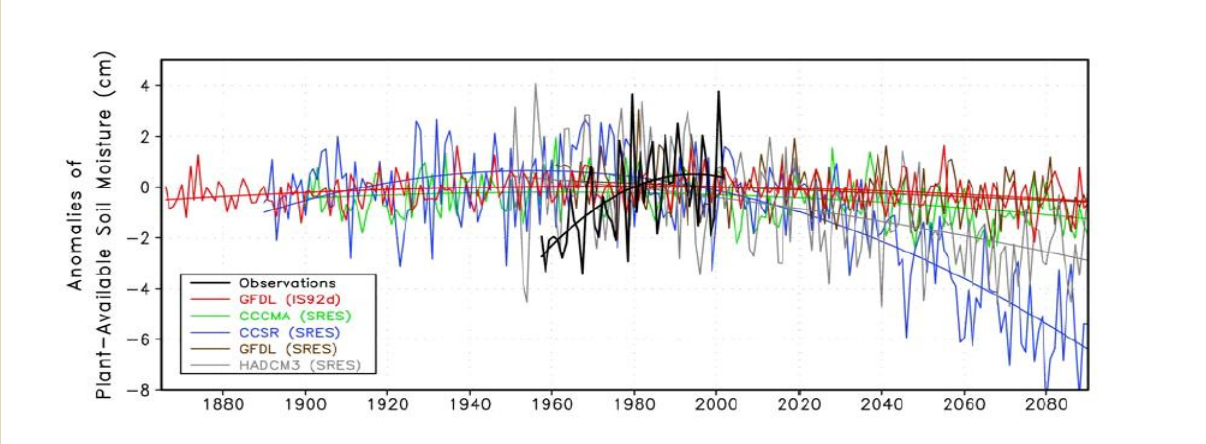
*** 13.7 billion USD**

Interlinked issues





Winter and Spring Wheat yield dynamics (Dnepropetrovsk, Steppe)



Soil Moisture in Ukraine with respect to 1971-2000 mean

Drivers and halters

- **Land tillage** is the major driver of soil erosion
- **Climate Change** will further exacerbate all phenomena (crop yield related studies are required)
- **Land tenure** insecurity
- **Biases:** soil quality, yields and knowledge (soils, CC)

Actions: current

- **MAPF advocates resource saving technologies**
- **Academics continue their analyses**
- **Farmers have moved decisively to Minimum Tillage (estimated on over 20 million ha).**

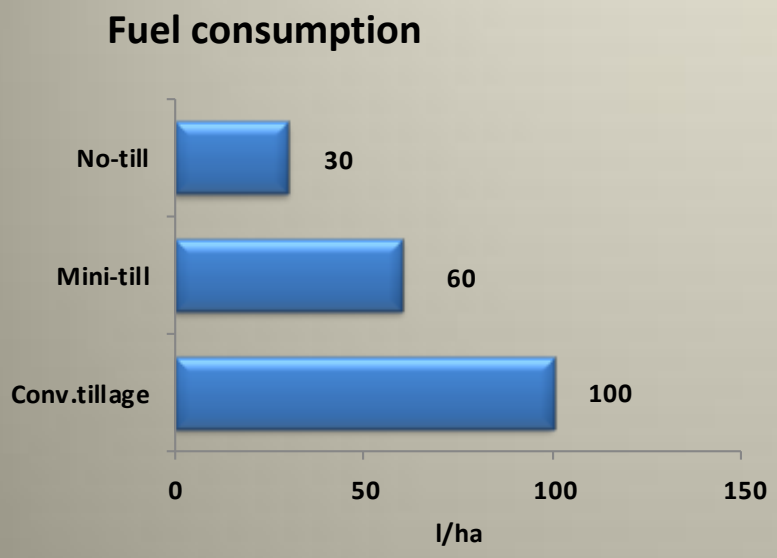
  An important step forward but not effective in a sustainable manner: soil degradation will continue

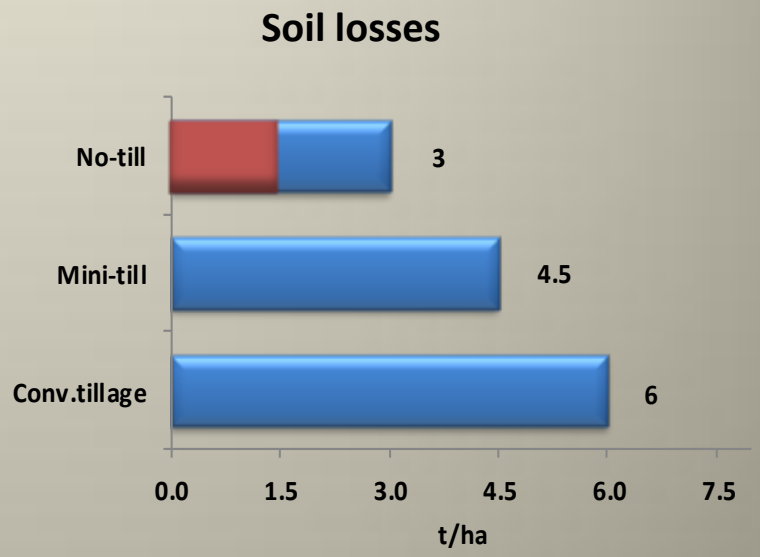
- **Few sparse progressive farmers exist: CA is applied on 600-700 thd ha, mainly in Steppe**

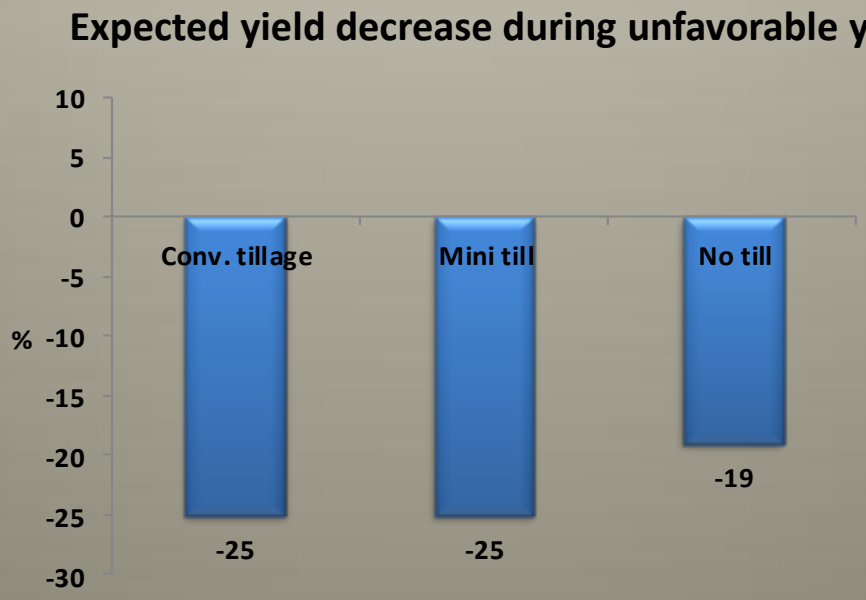
Actions: future

- **CA/ No till:**
  - **contrasts erosion, maintains soil fertility, and enhances drought resilience (evidence-based)**
  - **abates costs of production by minimizing fuel consumption (evidence-based)**
- **Growing interest among academics and enterprises in Ukraine**

Technology comparison effects







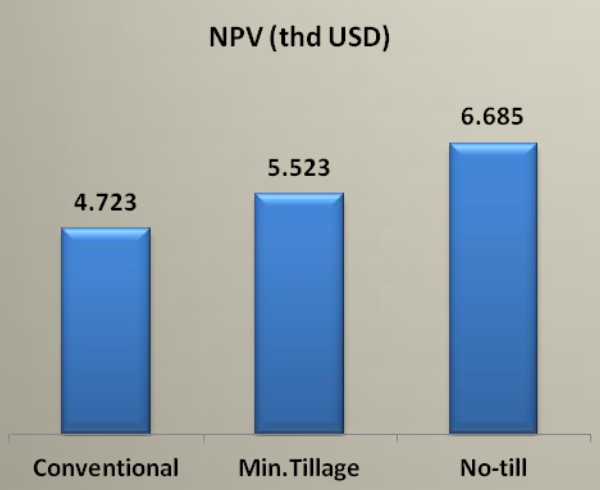
Scenarios (by priority)

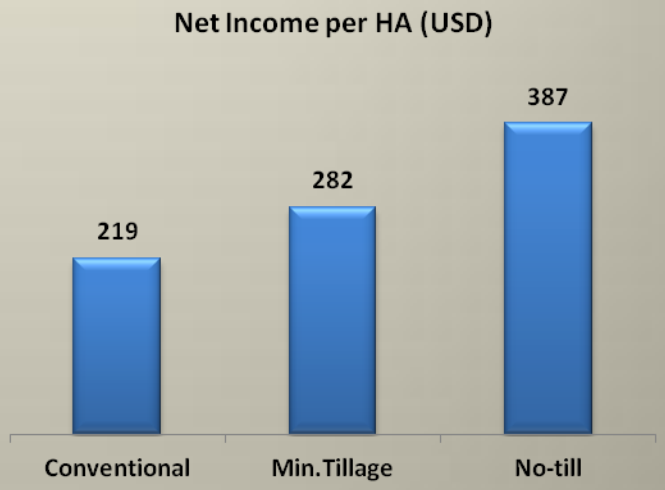
Short term (3-5y):
all larger enterprises in Steppe (> 4000 ha)
3 million ha

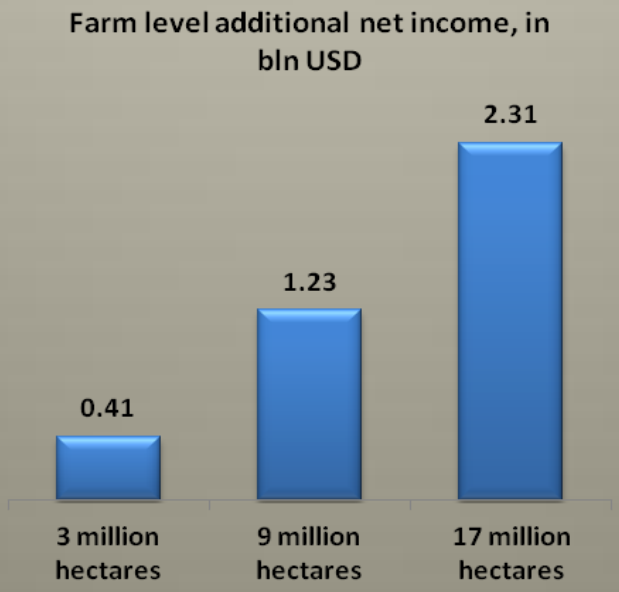
Medium term (6-10y):
all enterprise managed area in Steppe
9 million ha

Long term:
all enterprise managed area in all AEZ
17 million ha

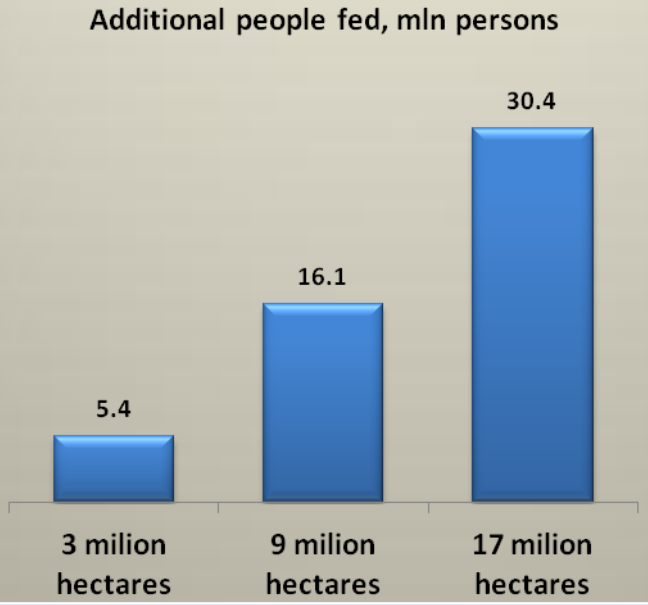
Potential benefits: farm level







Potential benefits: global level



	C sequestration in million tons CO_2 (climatic options average)				
	Past	Future			
	2000-2013	Short term	Medium term	Long term	Total
		2013-2017	2017-2023	2023-2039	2013-2039
Baseline	2.2	1.4	3.5	15	19.9
Adoption scenario	2.2	3.3	31.1	100.2	134.6
Average benefits	0	1.9	28	85.2	114.7
		Short term	Medium term	Long term	Total
		2013-2017	2017-2023	2023-2039	2013-2039
Reduced fuel burning emissions in CO_2 million tons		0.2	1.8	2.3	45.7

CA technology adoption in Ukraine would provide important benefits

Aggregated Benefits at Different Levels (monetary and non)				
Level	**Type**	**Short term (3 million ha)**	**Medium term (9 million ha)**	**Long term (17 million ha)**
Farm/Enterprise	• incremental annual net income	US$0.41 billion	US$1.23 billion	US$2.31 billion
National	• off farm additional output value (on annual basis) • additional soil fertility value (on annual basis)	US$0.37 billion	US$1.11 billion	US$2.10 billion
Total (annual)		US$0.78billion	US$2.34 billion	US$4.41 billion
Global	Improved Food Security (additional people fed during drought years)	5.4 million people	16.1 million people	30.4 million people
	reduced annual CO_2 emission	0.5 million CO_2 tons	4.6 million CO_2 tons	5.6 million CO_2 tons

Check these media

http://www.worldbank.org/en/results/2013/08/08/no-till-climate-smart-agriculture-solution-for-kazakhstan

http://www.youtube.com/watch?v=q1aR5OLgcc0

http://www.economist.com/blogs/multimedia/2011/02/future_food_production

Thank you for your attention