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Science for Better Livelihoods in Dry Areas

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Conservation agriculture in irrigated areas

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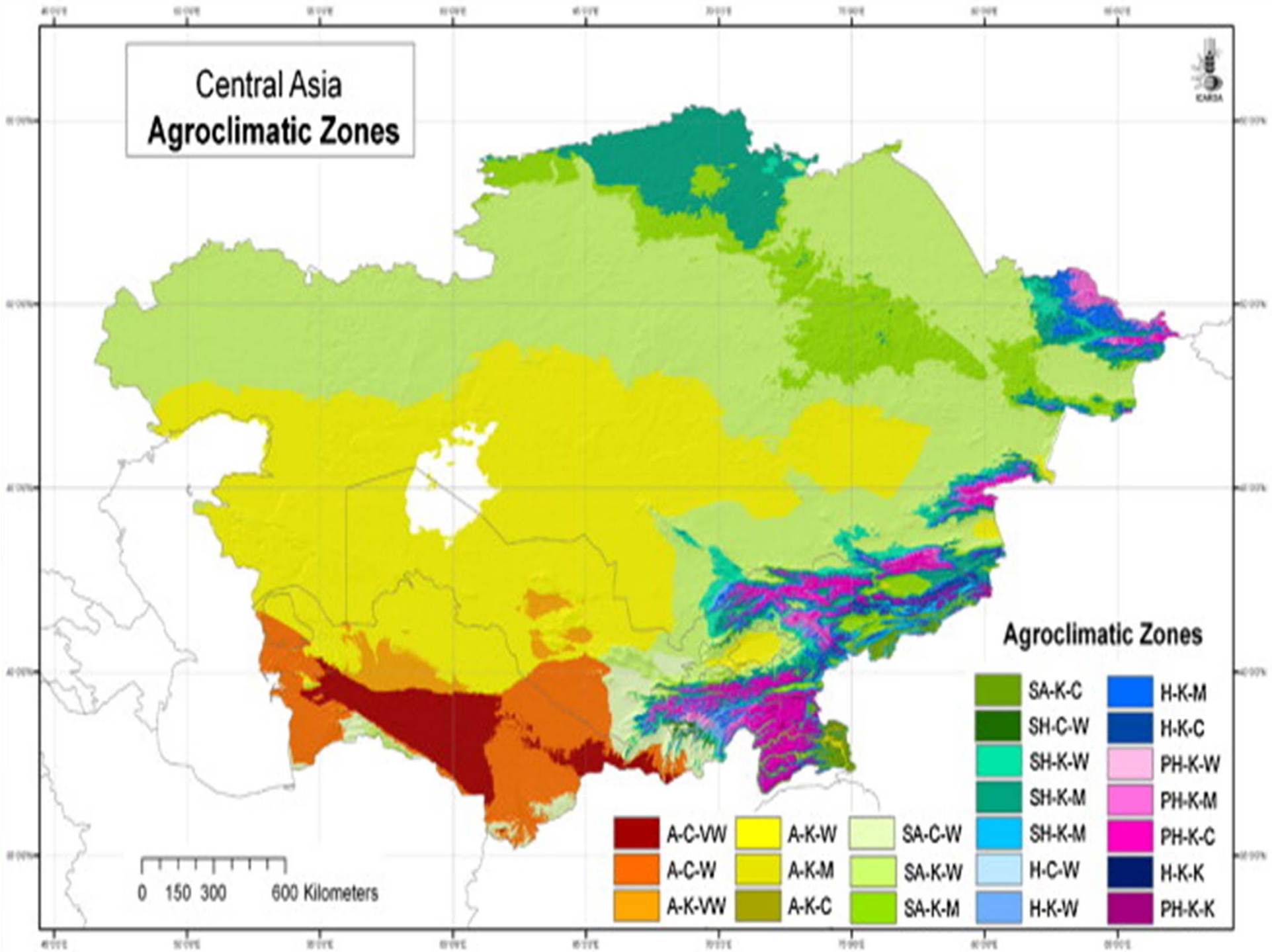
Central Asia
Agroclimatic Zones
Agroclimatic Zones
SA-K-C
SH-C-W
SH-K-W
SH-K-M
SH-K-M
H-C-W
H-K-W
H-K-M
H-K-C
PH-K-W
PH-K-M
PH-K-C
H-K-K
PH-K-K
A-C-VW
A-C-W
A-K-VW
A-K-W
A-K-M
A-K-C
SA-C-W
SA-K-W
SA-K-M
0 150 300 600 Kilometers

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The regional challenges

- *Land degradation (salinization, soil erosion, waterlogging, overstocking and soil fertility decrease)*
- *Arable land per capita is decreasing*
- *Agricultural input prices increasing (fuel, fertilizer, seed, pesticides, etc.)*

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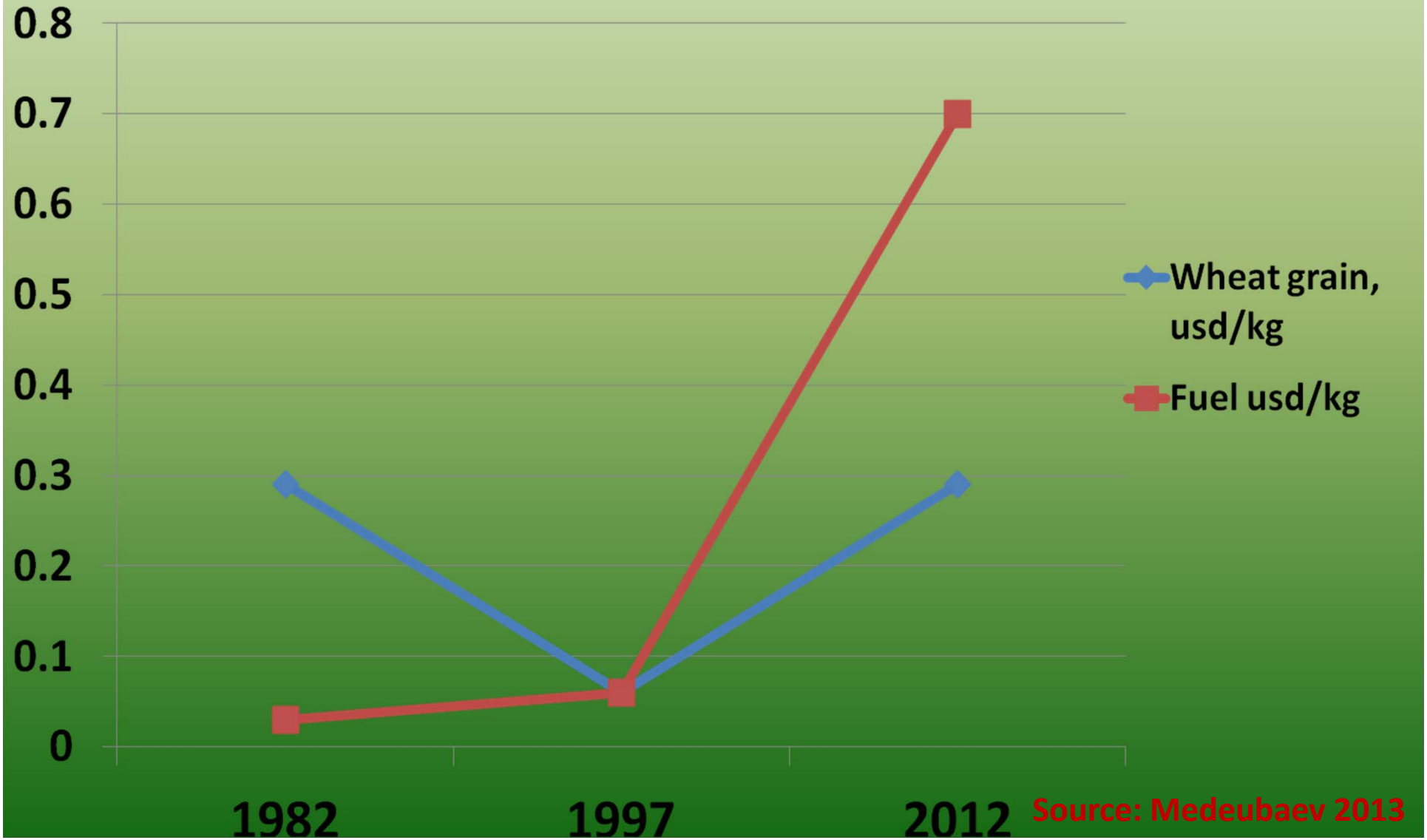
Comparison wheat and fuel prices in Kazakhstan (1982-2012)



Source: Medeubaev 2013

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Conservation agriculture can address these challenges

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What is Conservation Agriculture?

Empirical and scientific evidence internationally shows ....

- **No or minimum mechanical soil disturbance by** – seeding or planting directly into untilled soil
- **Enhance and maintain organic matter cover on the soil surface** – using crop residues and cover crops to protect & feed soil life
- **Diversification of species** -- both annuals and perennials - in associations, sequences and rotations

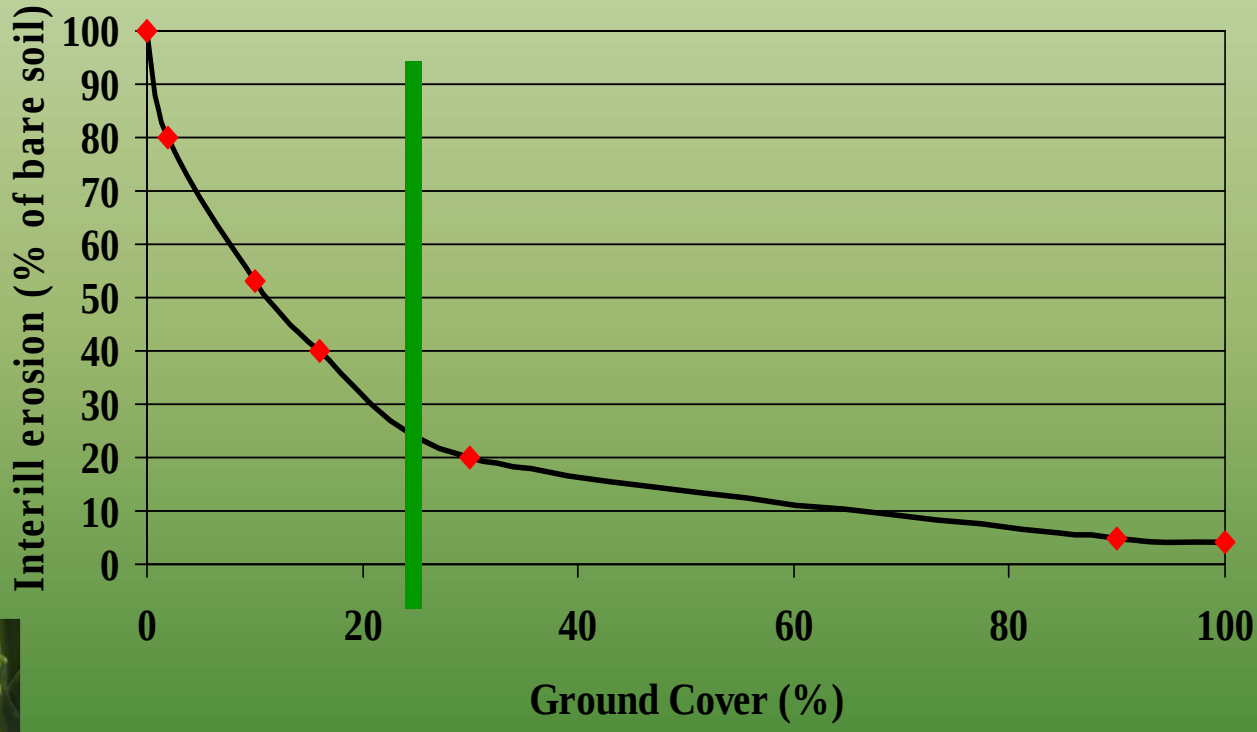
Conservation Agriculture,
together with other good practices

CA impact on soil fertility and environment

Type of degradation	Conservation Agriculture impact
Soil salinity	❑ Reduced soil salinity was reported by Devkota (2011) ❑ The differences in soil salinity at the end between conventional practices (0.52%) and NT (0.39%) were significant. After 4 years, NT system had the lowest soil salinity level (Nurbekov 2008 and Pulatov et al., 2012).
Soil organic matter	❑ Numerous results from the irrigated areas showed that crop residue retention improves SOM and soil N content (e.g. Egamberdiev, 2007; Nurbekov et al., 2012; Pulatov et al., 2012) ❑ In comparison, a wealth of information on CA practices worldwide shows an increase in SOM (e.g. West and Post, 2002; Sanchez et al., 2004; Govaerts et al., 2006; Corsi et al., 2012) and these results were also confirmed by selected studies in the irrigated areas in Central Asia
Soil Biodiversity & Biological activities	❑ CA positive effect on earthworm populations, with earthworm biomasses up to 80% higher
Soil Physico-chemical properties	❑ CA positive effect on soil aggregation + 60% (F. Tivet, Laos 2008) ❑ Under CA total exchange capacity + 50% (P. Lienhard, Laos 2013)

Soil Cover and Erosion

80% reduction with 30% cover!!



From Brady and Weil, 2002

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Challenge - Arable land per capita is decreasing

Double crops will be essential to improve sustainability of farming and land use efficiency

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Challenge - Arable land per capita is decreasing

Effect of no till succeeding maize in Azerbaijan (2011-2012)

Crops	Crop yield, t/ha			+-, t ha -1
	Winter wheat	Maize	Winter wheat+maize	
Winter wheat, control	**5.17**	**-**	**5.17**	**-**
Winter wheat + maize	**5.17**	**5.21**	**10.38**	**5.21**

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Challenge - Arable land per capita is decreasing

Land use efficiency with different crop rotations

	Farm 1																																
	2011										2012										2013												
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	Corn (*Zea Mays*)							Winter wheat (*Triticum aestivum*)							Mung bean (*Vigna radiata*)				Field pea (*Pisum sativum*)				Corn (*Zea Mays)*				Winter wheat (*Triticum aestivum*)							
	Farm 2 farmers' practice																																
	2011										**2012**										**2013**												
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
2		Soy bean (Glycine max.)						**winter wheat (*Triticum aestivum*)**							**Fallow**								**Sorghum (*Sorghum bicolor*)**				**Fallow**							
	Farm 3																																
	2011										2012										2013												
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
3	Sorghum (*Sorghum bicolor*)							Winter wheat (*Triticum aestivum*)							Bersim (*Trifolium*)				Winter barley (*Hordeum vulgare L.*)				Soy bean (*Glycine max*)				Field pea (*Pisum sativum*)							

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Challenge - Agricultural input prices increasing

Traditional agriculture – wheat







Conservation agriculture – wheat




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Challenge - Agricultural input prices increasing

No-till Mungbean grown in Karshi (2011-2013)

Planting method	Spent fuel for planting, l ha-1	Yield, t ha-1
Conventional	53.6	1.61
No-till with 1 cultivation	13.6	1.77
No-till	5.9	1.94

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Challenge - Agricultural input prices increasing

Economics of planting methods on maize green mass yield in Kazakhstan (2012-2013)

Tillage method	Yield, t ha-1	Production cost, USD t ha -1	Production value USD	Net benefits, USD	Profitability rate %
No-till	47.5	81.2	190.2	109.0	134.8
Conventional till	47.9	103.	191.9	88.1	83.5

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If CA is so good,
why CA is it not spreading?

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Adoption – Regionally

- Kazakhstan 2.1 M ha
- Uzbekistan 0.6 M ha minimum till wheat (only one year), including 2450 ha in rainfed area
- Tajikistan 25,000-50,000 ha minimum till wheat
- Kyrgyzstan 700 ha
- Turkmenistan no data

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Why has there been so little adoption of Conservation Agriculture outside the Kazakhstan?

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Constraints - adoption of conservation agriculture

- Mind set
- Lack of extension services throughout the region
- Training needs larger than perceived
- Lack of local manufacturers
- Limited number of publications CA
- Little or no mainstreaming of CA in National Programs
- Policy makers unaware of CA

No-till drill - 24 rows , 15 cm, 3.6 m

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Conclusions

- CA practices are suitable for the existing major cropping systems.
- CA also can combat land degradation in the region through application of no-till, crop residue retention and crop diversification;
- CA can provide similar or higher crop yields while saving considerable production resources, including fuel, seeds, water and labour.

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Discussion

- Further research in Central Asia across agro-ecological zones is necessary:
  - on weed, nutrient, pest and water management;
  - on sowing depth, dates, density;
  - on fertilizer and irrigation rates;
  - on the impact to livelihoods and environment.
- Where necessary, livestock should be integrated with Conservation agriculture systems;
- To make results applicable on a wider scale, state programmes should become more active in conducting research, training and extension on CA.

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Thank you