CIMMYT Achievements and Challenges in a Changing Climate with focus on Central Asia

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14th Meeting of the Steering Committee of the CGIAR Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus
Tashkent, 20 Sept 2011

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Importance of wheat

- Globally the most important food crop
- Second most important food crop in the developing world after rice
- Food to 2.5 billion poor people (< 2 USD) in 89 countries
- Provides calories (20%) and protein (20%) in LDC
- Most traded food crop (20%)

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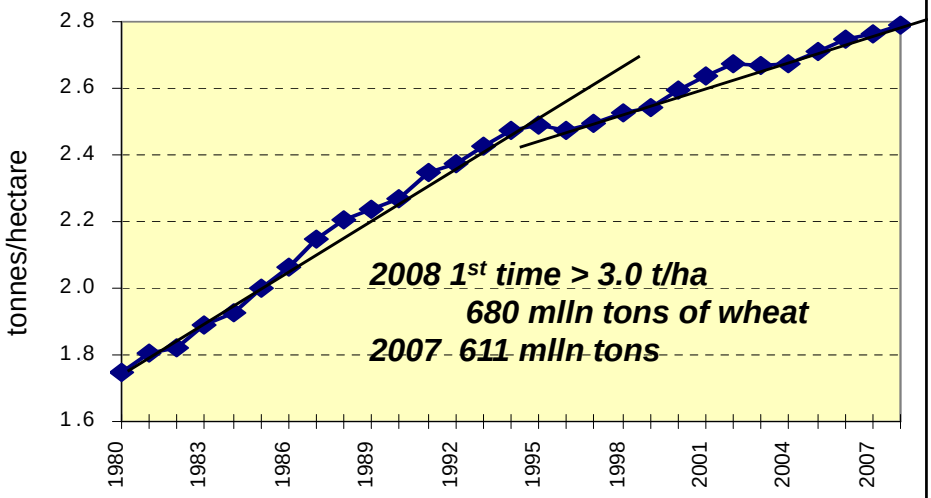
WORLD WHEAT YIELD TRENDS

(5 Year Moving Average - ton/ha)



Source: Chudleigh, 2008

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Extreme climatic events in 2010...

New record high in Food Price Index in December 2010 (FAO/GIEWS)

- Floods in Pakistan in July 2010

- Fires and drought in Russia in summer
- Floods in Queensland, in December

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Expected Climate Change Effects in Kazakhstan

- Rise in the seasonal and annual surface air temperature
- Almost constant or increase in winter precipitation
- Decline in summer precipitation
- 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

North and Central Kazakhstan. Summer, 2010

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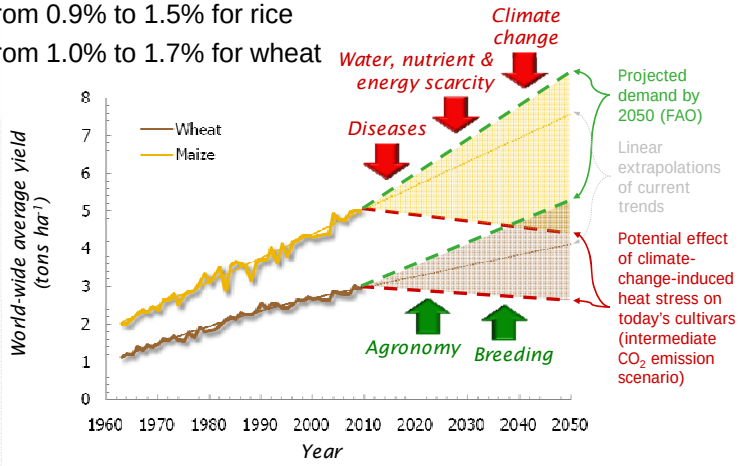
For food prices to remain constant, annual yield gains would have to increase

- From 1.6% to 2.4% for maize
- From 0.9% to 1.5% for rice
- From 1.0% to 1.7% for wheat



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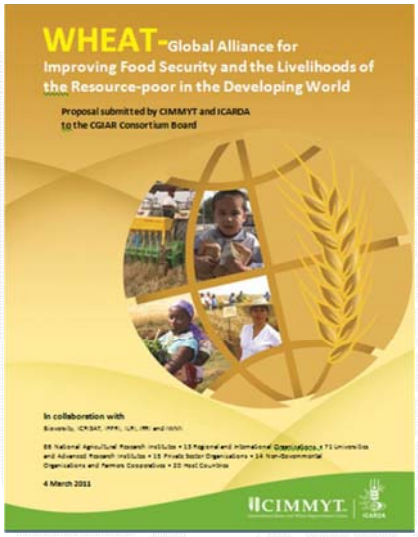
Ten Strategic Initiatives for WHEAT



1. Technology targeting for impact
2. Sustainable wheat-based systems
3. Fertilizer and water-use efficiency
4. High yield wheat varieties
5. Durable disease and pest resistance
6. Enhanced heat and drought tolerance
7. Breaking the wheat yield barrier
8. More and better seed
9. *Seeds of Discovery* – open the black box of genetic diversity
10. Strengthening R&D capacities

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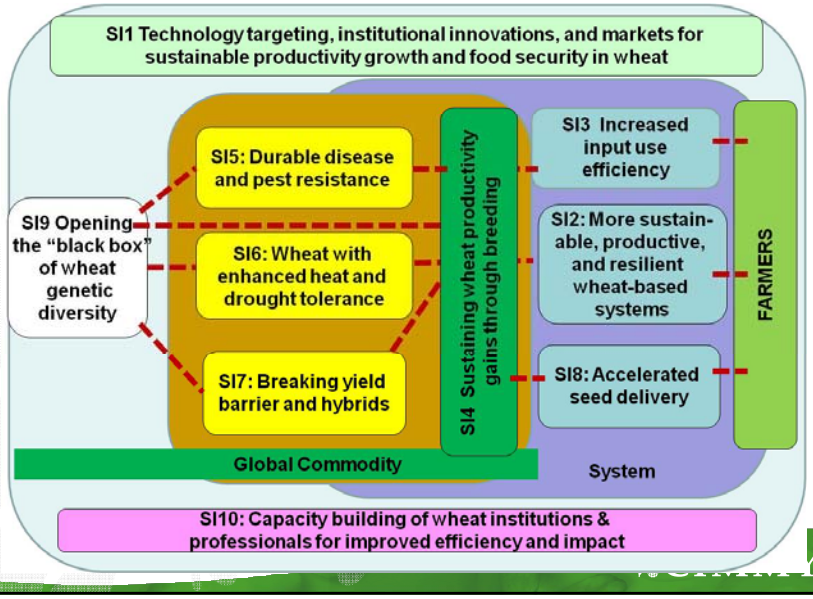
10 Wheat Strategic Initiatives to Address the Threats to Global Food Security and Poor People



Core breeding priorities

- Grain yield potential and yield stability
- Durable resistance to rusts (including Ug99) and other diseases
- Water and nutrient use efficiency
- Heat tolerance
- End use quality
- Adaptation to conservation agriculture
- High Zn and Fe concentration

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Kazakhstan

	Rainfed	Irrigated
Wheat area, ha	14.1 mln	0.8 mln
Yield, t/ha	1.2	2.2
Major diseases	Leaf rust, Stem rust, Septoria	Yellow rust, Leaf rust
Major abiotic stresses	Drought	Low temperatures, Drought
Major varieties	Omskaya 18, Pamyati Aziyeva, Akmola 2	Steklovidnaya 24, Almaly, Progress

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CIMMYT-Kazakhstan Program on Wheat Improvement

- Wheat germplasm enhancement: spring wheat high latitude and winter wheat breeding
- Efficient soil and water management : Conservation Agriculture for wheat production and crop diversification
- Capacity Building and NARS strengthening

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Wheat Germplasm Enhancement

1. **Kazakhstan-Siberia Network on Spring Wheat Improvement (KASIB)**
2. **Shuttle Breeding "Mexico-Kazakhstan/Siberia" for Spring Wheat**
3. **Winter Wheat Breeding**
4. **Biofortification on Iron & Zinc Content in Wheat**

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Kazakhstan-Siberia Network on Wheat Improvement (KASIB)

Objectives:

- Spring wheat germplasm exchange within 17 Northern Kazakhstan and Siberian (Russia) programs which grow more than 20 mln ha of spring wheat
- Evaluation of the germplasm; promotion of the best varieties into farmers fields; involving the best germplasm in breeding programs
- Communication through annual meetings, traveling seminars, visits and publications

Presently KASIB Network includes all breeding programs of the region – 17 institutions, i.e. 100% coverage!!!

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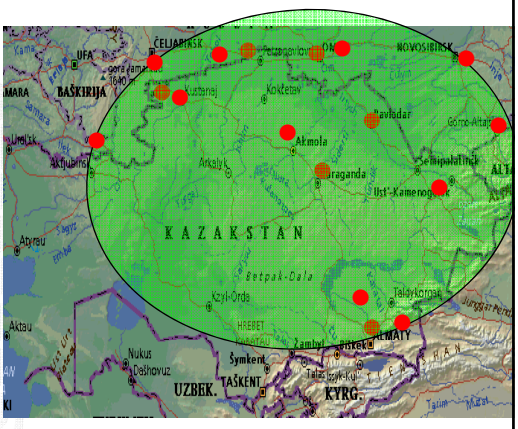
KASIB Network Activities

2000: KASIB establishing
2010: 12th KASIB SBW
12th KASIB SDW

For the period 2000-2010:
505 varieties studied
370 BW varieties
135 DW varieties

The main breeding traits:
- *Yield potential*
- *Drought resistance*
- *Cold resistance*
- *Disease resistance*
  (LR, SR, Septoria etc.)
- *Grain quality*



Up to 40% of KASIB material are involved in breeding programs

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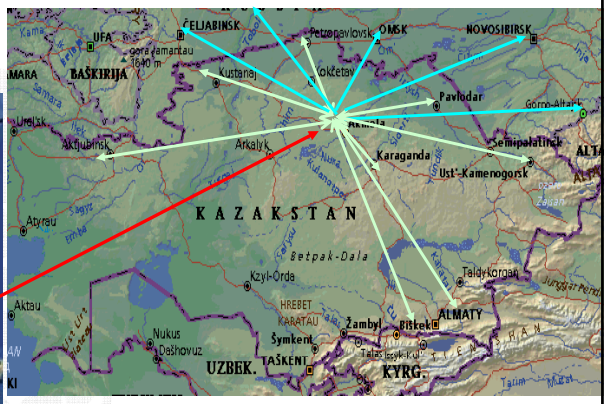
Wheat germplasm enhancement

SHUTTLE BREEDING



Mexico - Kazakhstan/Siberia

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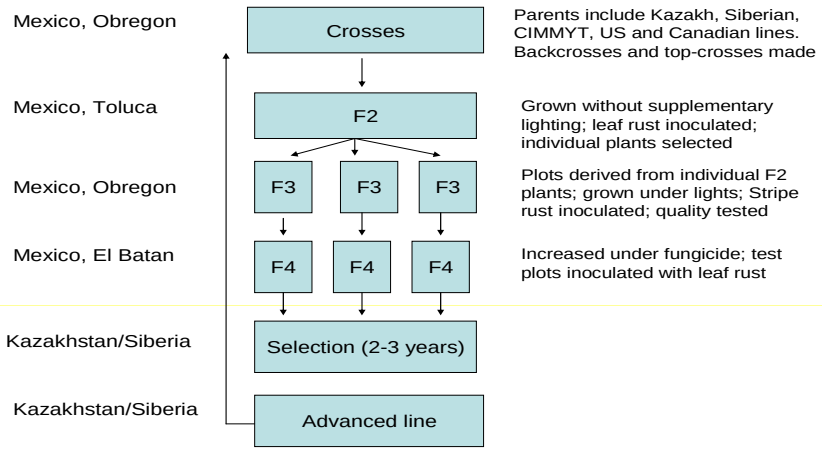
Wheat germplasm enhancement

SHUTTLE BREEDING: Mexico – Kazakhstan/Siberia



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Shuttle Breeding Mexico-Kazakhstan/Siberia.
Efficiency of F7 selection (9th KSBN) in the different locations (2010)

Locations of the selection	Number of planted populations	Number of selected populations	% of selected populations
Kazakhstan			
Actobe ARS	202	138	68
East-Kazakhstan ARI	202	151	75
Karaganda ARI	202	101	50
Karabalyk ARS	202	101	50
Pavlodar ARI	202	202	100
Fiton Breeding Company	202	51	39
Russia			
Kurgan ARI	140	121	60
Kurganseed Company	140	59	25
Omsk ARI	140	22	16
Omsk ASU,	140	131	94
Novosibirsk ARI|	140	136	97
Tyumen ARU	140	136	97
Chelyabinsk ARI	140	71	51

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First "shuttle" variety "Stepnaya 60"


РЕСПУБЛИКА КАЗАХСТАН
СВИДЕТЕЛЬСТВО


Saratovskaya 29 | Stepnaya 60

New drought resistant bread spring wheat variety "STEPNAYA 60" developed by CIMMYT and Aktobe Experimental Station. Authorship Certificate No. 367 as of 2 July 2010

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Ug99 Stem Rust resistance of Kazakh/Russian wheat varieties. Kenya, 2008-2010

Variety	*2008 Main season*	*2008-2009 Off season*	*2009 Main season*	*2010 Main season*
Susceptible checks, Kenya	100S	60-70S	70-80S	80-90S
Stepnaya 62	5RMR	TR	-	20MRMS
Lutescens 12 65/93	10MR	5MR	-	15RMR
EI-4-11/7	-	-	5RMR	5R
Omskaya 37	10MR	-	-	5R
Omskaya 38	30MRMS	5MR	-	15R
Lut.242/97-2-9	-	-	5R	5R
T.t - 173	-	-	TR	TR
Lut.242-97-2-32	-	-	5MR	5R
BC2 Er.59/L.20639	-	-	10MR	5R
Niva2/Lut.22211	-	-	5RMS	5RMR
Lut. 23419	-	-	10MR	5R

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CA for wheat production and crop diversification

Adoption of Conservation Agriculture in Northern Kazakhstan

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Crop Diversification

- Canola
- Sunflowers
- Field Peas
- Lentils
- Chickpeas
- Buckwheat
- Winter Wheat
- Flax

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Conservation Agriculture for Wheat Production in Kazakhstan

- In 2000 CIMMYT initiated large-scale Conservation Agriculture activities in North Kazakhstan
  0 ha (2001), 500,000 ha (2007), 1,200,000 ha (2008), 1,500,000 ha (2009)
  with continued rapid increases in area according to a recent assessment conducted by CIMMYT
- Utilization of CA-based technologies has become an official state policy in agriculture in Kazakhstan
- Since 2008, the government of Kazakhstan has been subsidizing farmers who are adopting CA-based technologies
- Kazakhstan among the top 10 countries with the largest areas under no-tillage in the world

Source: R. Derpsch & T.Friedrich, 2009.
Global Overview of Conservation Agriculture Adoption, FAO

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III. Strengthening NARS capacity

Seminars/Workshops/Field days/Human resource development activities in 2010/11

#	Event	Status	Number of events	Number of people
1	Conference (CA)	International	1	200
2	Workshops (CA, Breeding, Biotechnology)	International, National	4	200
3	Seminars/trainings (CA, Breeding, Biotechnology)	International, National	5	220
4	Traveling seminars (Conservation Agriculture, Breeding, PGR, Biotechnology)	International, National	5	120
5	Field days (CA, breeding)	National	10	500
6	Visits/ travels /trainings of Kazakhstan scientists/specialists abroad			10
7	Bringing international scientists and specialists to Kazakhstan for providing consultations			20
	TOTAL			1270

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Conclusions

- Predictions of changes in major crops as a result of Climate Change still contain great uncertainties
- Adapting control measures to climate change is not likely to be fundamentally different from adjustment to technological innovations or changes in the economic framework
- Breeding for wide adaptation and disease resistance is paramount
- Sustainable agronomic practices are needed for the yield potential of new varieties to express
- There will be surprises: If the main prediction is surprises, the capacity to deal with these is to provide the correct scientific advise investing in a diverse scientific base to provide effective solutions.

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