

# Improve Water Productivity and Climatic Resilience for Agriculture: Chinese Lessons and Outlook

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## Climate, water and food in China



% of the world

Arable Land Irrigation Ratio (%)

Cereal Production (MMT) Water Consumption (BCM) Water Productivity (CM/MT)





2017/9/22



## Climate, water and food in China

 Climate Change in North China Plain, Northeast China Plain and Loess Plateau suggested a negative impacts on food production, vulnerability and resilience of agro-ecosystem

**Changes of temperature 1951~2004** 

#### **Spatial changes of drought severity**





## Climate, water and food in China

By 2030, plant production may reduce 5%-10%, cereal crops are mainly loss yield due to high temperature, frequent drought and flood, and water scarcity





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## Climate, water and food in China





Drought



Flooding

#### Caused by extreme climatic events in 2009

- grain losses reached 55 million tones
- 10% of total grain production







- Increase water availability
- Reduce non-productive water use
- Improve crop yield under water limitation

$$WP = \frac{Crop Yield (kg)}{Water Consumption (m^3)}$$

 $\frac{Biomass \times Harvest \ Index}{Evaporation + Transpiration}$ 





Increase water availability – water harvesting





#### Increase water availability – water harvesting & irrigation

Cistern water harvesting combine with gravity drip irrigation system becomes a good solution small-scaled greenhouse





#### • Increase water availability – irrigation

Irrigation methods	Water Use
Surface, Flood	40%~60%
Furrow	50%~70%
Sprinkler	70%~80%
Trickle, drip	90%~95%







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#### Reduce non-productive water use – minimize soil evaporation



Partitioning Es from ET by using isotope techniques to maximize the plant Transpiration



Alternative furrow irrigation -20%~30% irrigation water



Full plastic film mulching -90% Es & WP 4.2 kg/m<sup>3</sup> (240m<sup>3</sup>/t)

Straw mulching -50% Es and -200 m<sup>3</sup>/t



#### Improve WUE/WP – genetic explore and W-F integration







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#### • Improve WUE/WP – Fertigation





 Enhance climatic resilience - Optimize cropping system and biodiversity
WUR 60% 1 70%, WUE 0.60 1 1.20



Potato II canola



#### Alfalfa II foliar maize



Grazing



Contour planting



Stubble mulching



Hedgerow



## **Climate Smart Agriculture Approach**

#### Climate Smart Agriculture(FAO)

It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars:

- sustainably increasing agricultural productivity and incomes;
- adapting and building resilience to climate change;
- reducing and/or removing **GHGs** emissions, where possible.
- Ecological Intensification(CGIAR, 2011)

Meet food demand under acceptable environmental standards

Increase Productivity and Light capture
N use efficiency
Water use efficiency
Land use efficiency
Reduce GHGs emissions
Maintain agro-biodiversity



## **Climate Smart Agriculture Approach**

- Improve crop productivity for food supply
  - Genetic exploring and climate change ready varieties
  - Enhance soil organic carbon and fertility
  - Irrigation technical Integration and intensification
- Enhance *biodiversity & climatic resilience* for ecosystem healthy
  - Multi- and/or Inter-cropping system to improve profit and reduce environmental and natural disaster risks
  - Crop-based livestock (dry subhumid)
  - Grassland-based livestock (arid and semiarid)
- Develop *horticulture/food processing* for poverty reduction & livelihood
- Intensify Carbon management for C sequestration & GHGs reduction
  - Soil water reservoir enrichment
  - Biological fertility enrichment and chemical fertilizer (NPS) reduction
  - GHGs emission Reduction



### **Climate Smart Agriculture Approach**



## CDCC: Common Duties for Common Challenge!!

# Theme You!