Future Prospects for Sorghum and Pearl millet in Asia-Pacific Region

The Global Scenario

- World population expected to reach 9 billion by 2050
- > 1 billion poor and hungry people (~65% of poor and 70% of hungry people) live in rural areas
- Food and nutrition security will be critical, with certainty of climate change
- > 85% of smallholder farms are in Asia and sub-Saharan Africa
- **Food production should increase by 70-100%**
- **Agriculture productivity is declining in many countries**
- **Decreasing global food stocks in last 5 years**

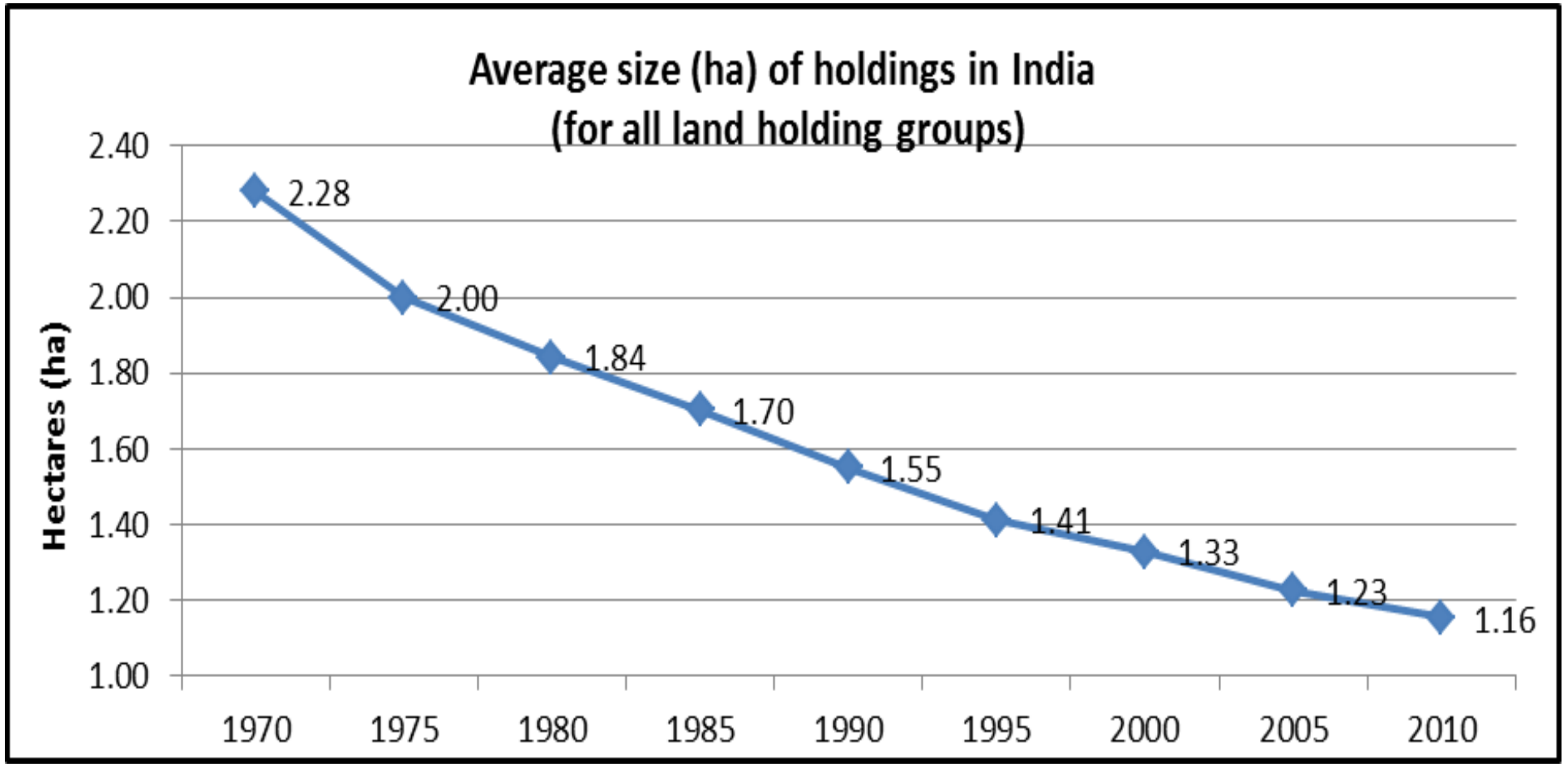
Role of Seed Industry in agricultural research for development

- Generate and share information and technologies as public goods
- Facilitate growth and development especially in rural, marginalized and resource-poor areas
- Catalyze strategic partnerships with both public and private sector agencies
- Build research-for-development (R4D) capacities in the state and national level
- Emphasize on R4D for creating impacts

Why Smallholder & Marginal Farmers

- 85% of Indian farmers are smallholders (<2 ha)
- Sustainability of Indian agriculture pivots on the performance of SH farmers
- Share of agriculture GDP declining due to raise in the service and manufacturing sector
- 56% of population largely dependent on agriculture
- Average size of holding declining: 2.3 ha in 1970 to 1.16 ha in 2010
- Shift from smallholder to marginal farmers

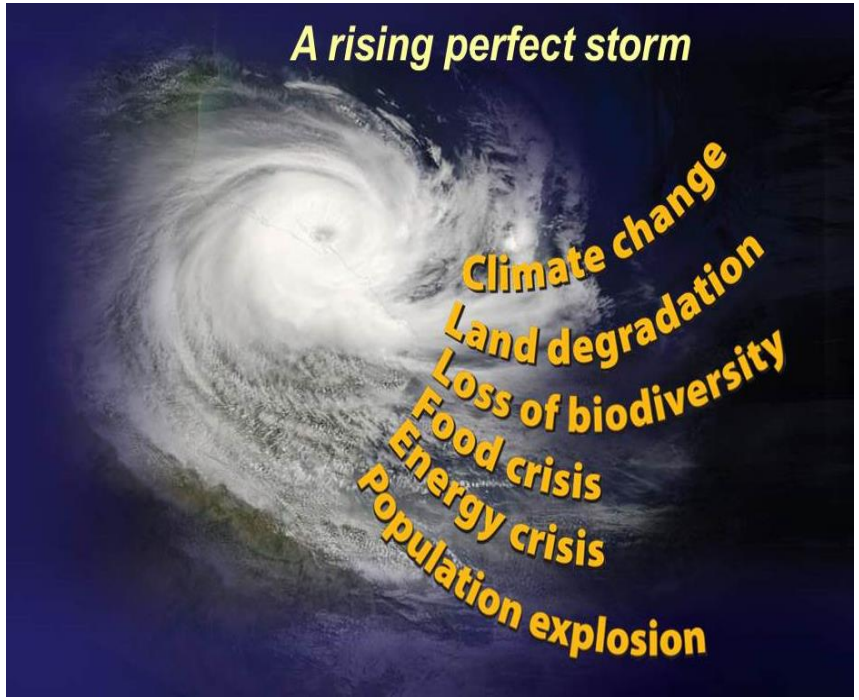
Trends in farm size in India (1970-2010)



Demand and Growth drivers

- Rapid growth in urbanisation and middle class population
- Growing urban markets, income rise, and changing consumption patterns
- Role of smallholder & marginal farmers is highly relevant
- Sustaining agriculture productivity and incomes of SH farmers is crucial
- Cost of inputs increasing and labor becoming scarce and unaffordable
- Need to make smallholder agriculture profitable and sustainable—through appropriate R4D

The looming threat of Global Warming

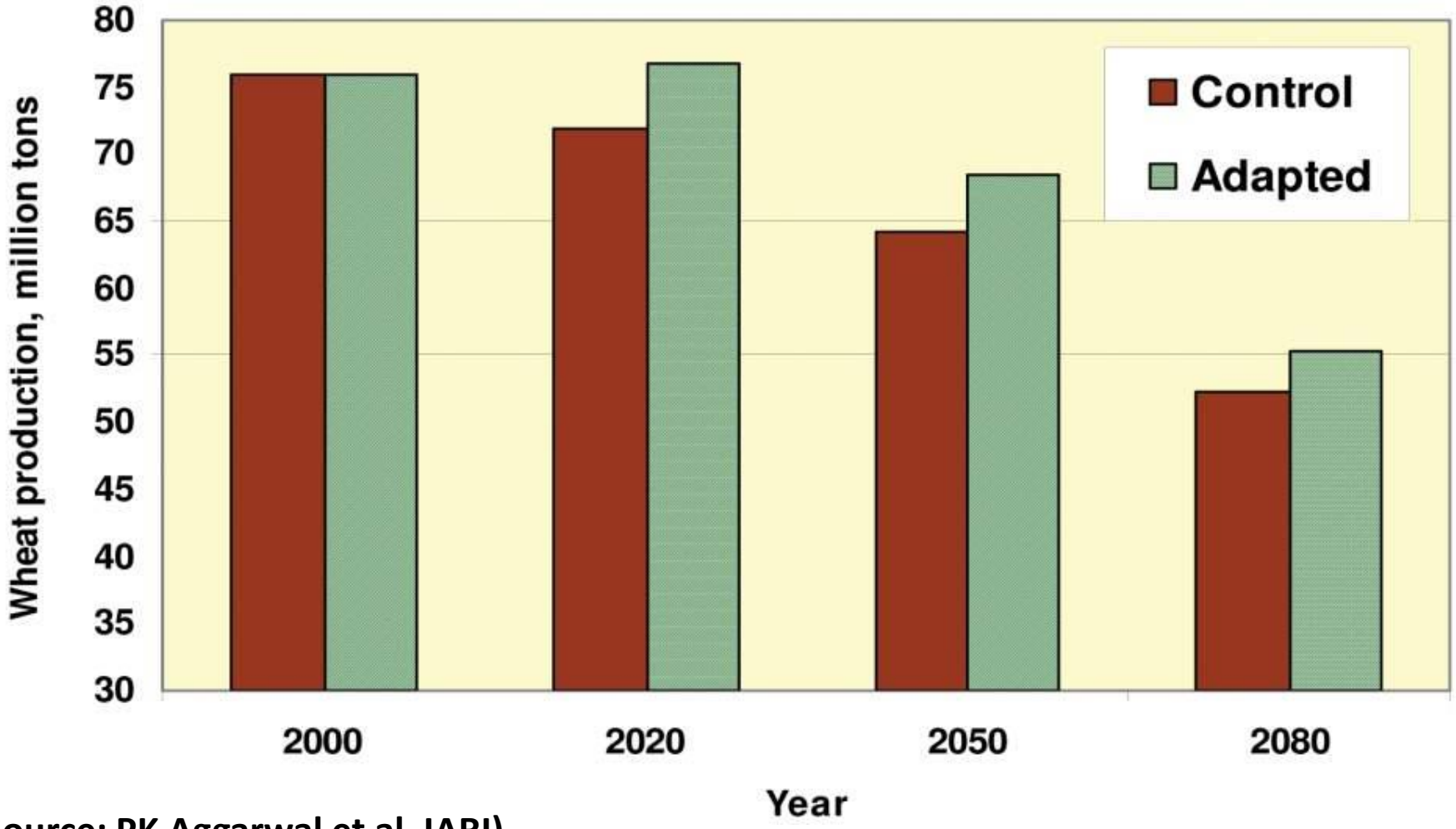


- **South Asia and Sub-Saharan Africa: likely to be adversely affected due to global warming**
- **Crop breeding for adaptation to abiotic stress-prone environments is a sustainable approach to minimize adverse impact of abiotic stress**

(Photo credit: ICRISAT)

Impact on wheat yields

Adapted varieties will reduce yield losses over the years



(Source: PK Aggarwal et al, IARI)

Simulated effect of climate change on selected crops

Crop	% change in grain yield		
	+ temp.	+ CO_2*	Net change
Sorghum	-(27 to 55%)	+(0 to 10%)	-(22 to 50%)
Pearl millet	-(38 to 56%)	+(0 to 10%)	-(33 to 51%)
Groundnut	-(38 to 44%)	+(10 to 20%)	-(23 to 29%)
Pigeonpea	-(23 to 26%)	+(10 to 20%)	-(8 to 11%)
Chickpea	-(22 to 24%)	+(10 to 20%)	-(7 to 9%)

*Tubiello et al. 2007

Public-Private Partnerships (PPP)

- PPP enable pooling of resources and minimize risks in R&D investments for mutual benefit
- Synergy between the social equity of public institutions and efficiency of delivery of the private sector
- PPP can create linkage in the supply chain to deliver inputs (hybrid seed) to small-holder farmers at reasonable costs
- Investment costs are shared leading to lower product costs (= benefit to consumer)
- Builds on the strengths of both public and private sector

ICRISAT-Private Sector Hybrid Parents Research Consortium

- Three consortia operating since 2000
  - ❖Sorghum, pearl millet and pigeonpea (2003)
- PS can join one or more consortia paying membership fees
- Funds from consortia augment ICRISAT core resources for hybrid parents research
- Members have access to breeding materials developed at ICRISAT
- No exclusivity to any consortium partner
- Unrestricted access to materials by public sector institutions

Indian Seed Industry

- Indian economy: >7% growth last decade
- Indian Seed Market: > 2.5 billion US$
- CAGR: >15% v/s 5% Global average
- Private Sector dominates hybrid seed trade

Crop	Area under hybrids
Cotton	>90%
Maize	>60%
Pearl millet	>60%
Kharif sorghum	>80%
Rabi Sorghum	<5%

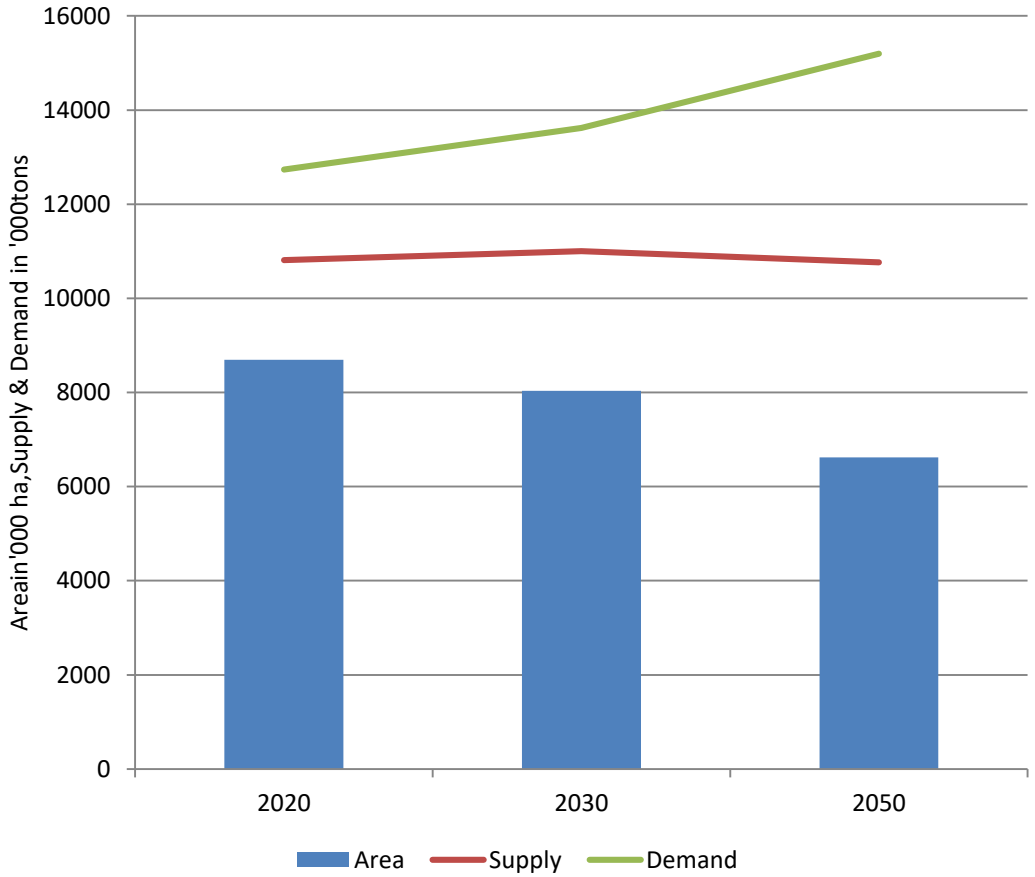
Uses of sorghum and millets

- **Food use: decreasing in Asia and ESA, increasing in West Africa**
- **Feed: Both as poultry and animal feed: demand increasing**
- **Fodder: Both green and dry fodder: increasing demand**
- **Fuel: Sweet sorghum for ethanol: increasing demand**
- **Beverages: Demand likely to increase significantly (suitable cultivars for malting and brewing needed)**
- **Novel and Health Foods: Huge potential to be exploited**
- **Industrial use: alcohol, starch, pigments, nutraceuticals, etc**

Sorghum (*Sorghum bicolor)*

- **Fifth most important cereal, important for food security**
- **Global area: 41 m ha; India: ????**
- **Global Production: 64.2 m t; India: ???**
- **Av Yield: 1.6 t/ ha; India: ???**
- **Major growing areas:**
  - **India, China, Australia,**
  - **Brazil, USA;**
  - **West and Central Africa; and**
  - **Eastern and Southern Africa**

Projected food and feed demand for Sorghum globally



- Global area projected to decrease 20% betwn 2020-50
- Production to increase by 66%
- Demand increases by 68%
  - Food demand by 59%
  - Feed demand by 50%
- Developed countries:
  - Both food (20%) and feed (31%) demand will increase

Sorghum demand-supply projections in Asia

- Area projected to decline by 24% by 2050, leading to marginal decline in production
- Demand projected to increase by 20% by 2050
- Thus, gap between demand and supply will widen further
- Majority of demand for feed from China (29%) and India (98%) between 2020 and 2050

Sorghum demand-supply projections in Africa

- Sorghum area projected to expand by 34%
- Sorghum production will increase by 96%
- However, demand for sorghum will be high (109%)
  - Demand for food to increase by 79%
  - Demand for feed to increase by 169%
- Thus, a huge demand-supply gap will be evident

Pearl millet

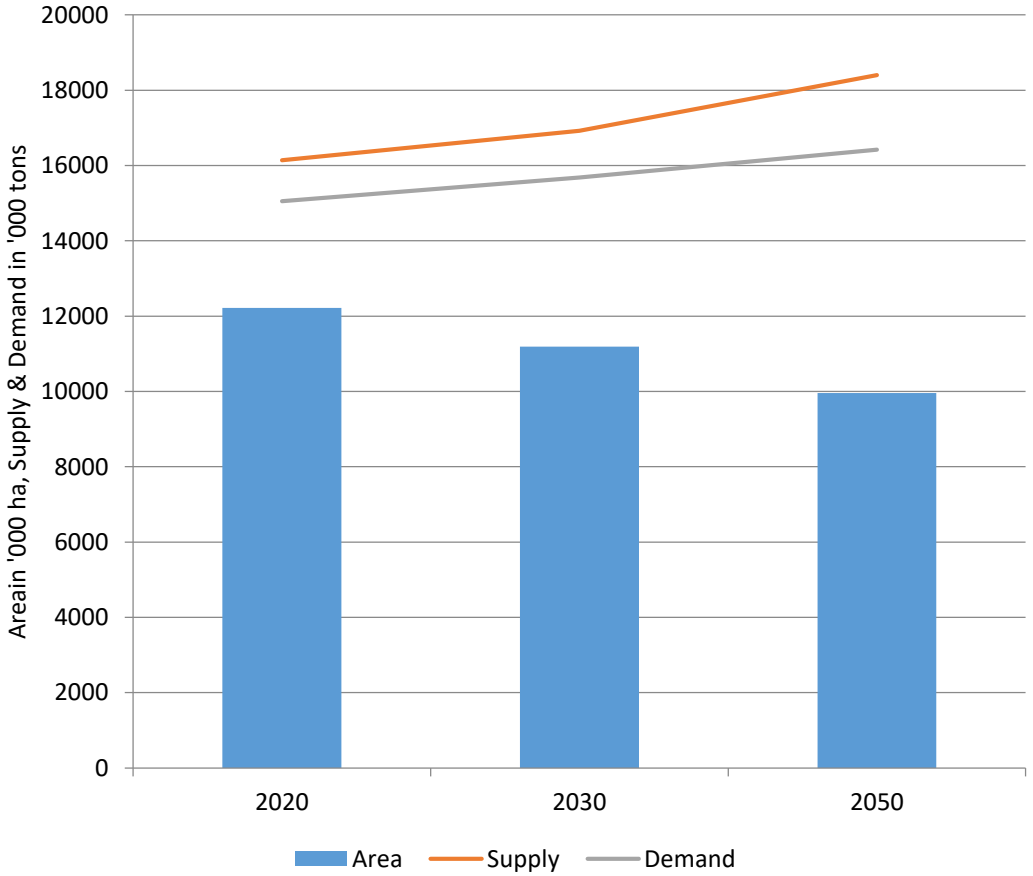
- Sixth most important cereal globally
- Main source of food and nutrition in arid and semi-arid areas
- Drought and heat tolerant
- Performs well in poor spoils and harsh conditions
- High tolerance to salinity and low pH soils
- Grown where maize and sorghum cannot survive
- Responds well to irrigation and good management
- Valued for both grain and fodder

Pearl millet (*Pennisetum glaucum*)

- India: Area cultivated: 8 m ha

States	Area (%)	Average yield (Kg/ha)
Rajasthan	56	760
Uttar Pradesh	11	1950
Maharashtra	10	950
Gujarat	9	1550
Haryana	5	2000
Rest	9	

Projected food and feed demand for Millets globally



- Global millets area reduces by 15% between 2020-2050
- Global production increases by 85%
- Global demand to increase by 86%
  - Food demand—83%
  - Feed demand --69%
- Demand for millets for food in developed countries decreases (17%), but feed demand increases slightly (5%)

Millets demand-supply projections in Asia

- Millets area likely to decline by 18% between 2020-2050
- However, production increases by 14% to meet demand
- High productivity in China responsible for increased production trends
- Demand for food (7%) and feed (23%) likely to increase
  - Feed demand in India will likely DOUBLE
  - Feed demand in Pakistan likely to increase by 70%

Millets demand-supply projections in Africa

- Millets area in Africa projected to increase by 32% by 2050
- Total production projected to increase by 130%
- Demand (132%) is likely to be met by increased production
- Africa will experience highest demand for food (130%) and feed (112%)

Future needs for pearl millet

- **Mid-tall, non-lodging, synchronous maturity of tillers for mechanical harvest**
- **Drought and heat tolerance and responsive to high plant population**
- **Continued emphasis on DM, but also on leaf blast, stem borer and head pests**
- **Grain quality suitable for food processing and feed industry**
- **High Fe and Zn density grain types for human nutrition**
- **Single-cut, high foliage and sweet stalk hybrids for fodder**
- **Multi-cut forage hybrids for drylands**

Future needs for sorghum

Kharif (Rainy-season)

- **Resistance to grain mold, shoot fly and anthracnose**
- **Grain quality suitable for feed and beverage industry**
- **Sweet stalk sorghums for ethanol production**
- **Multi-cut forage types for dairy industry**

Rabi (Postrainy season)

- **Resistance to shoot fly and charcoal rot**
- **Thermo-insensitivity and match maturity with available moisture**
- **Maintain grain quality (seed size, color and chapatti quality)**
- **Maintain and Enhance fodder (dry) quality for dairy industry**

The Way Forward

- Seed industry should be more proactive and create demand for the nutricereals (eg. Quinoa)
- Private-Public partnerships to develop designer cultivars for different market niches and agroecologies (eg. ICRISAT-PS Hybrids Consortium)
- Private-Private Partnerships with other industries:
  - Processed Foods, Ready-to-eat Foods, Nutri-ceuticals, Health Foods
  - Animal feed industry (piggery, poultry, goat and sheep)
  - Dairy industry for fodder and feeds
  - Petroleum corporations for ethanol production
- Lead the joint campaigns to popularize smart and healthy foods
- Link-up strongly with Pan-Africa Seed Companies (WCA and ESA)

Thanks for Your Attention