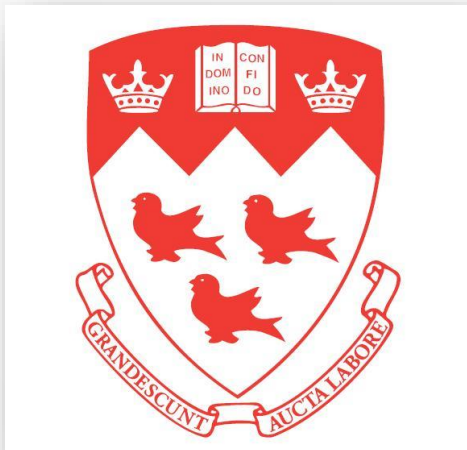


Millets – Shrouded gold

Vijaya Raghavan



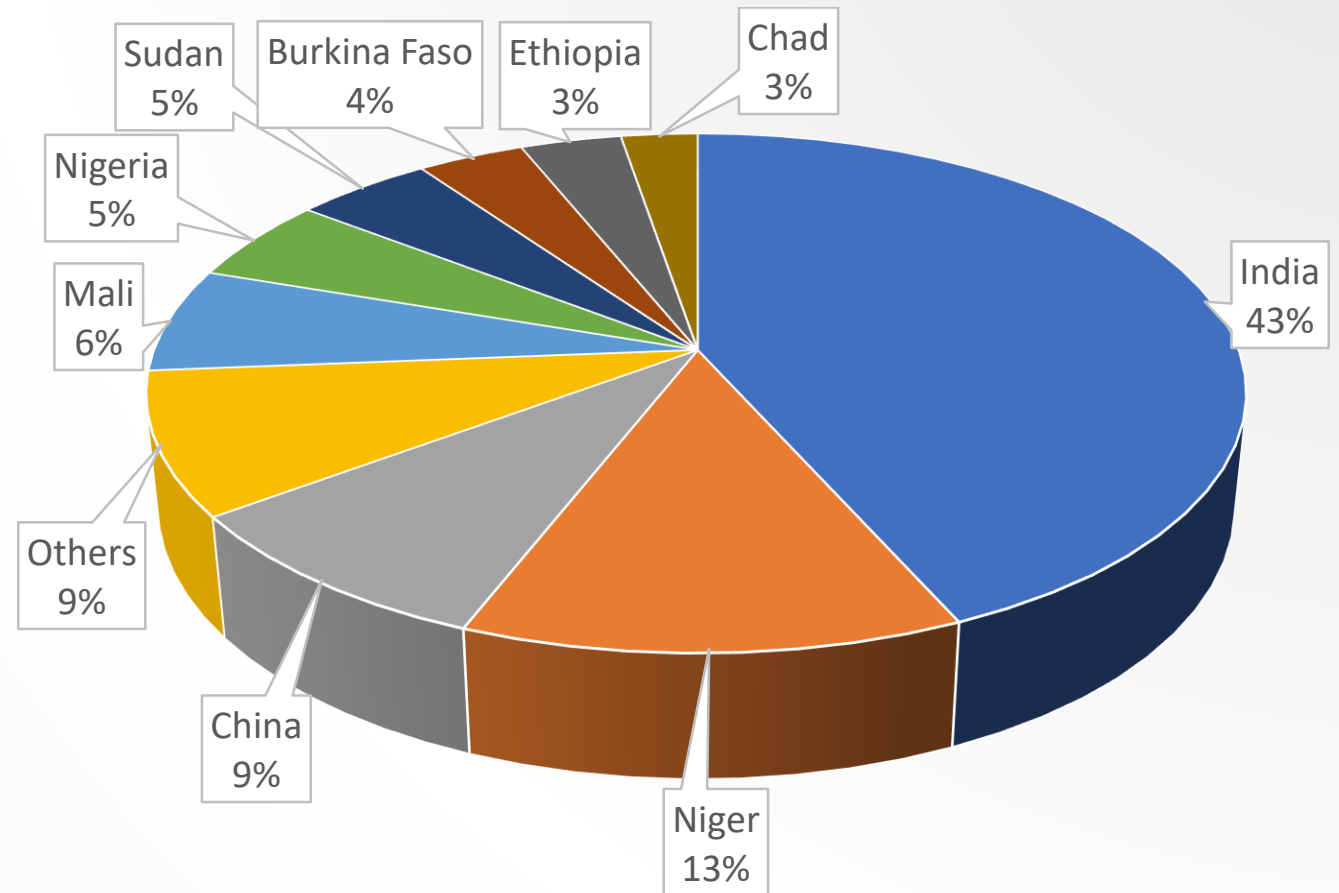
Bioresource Engineering
McGill University

September 2017, Madurai, India



INTRODUCTION

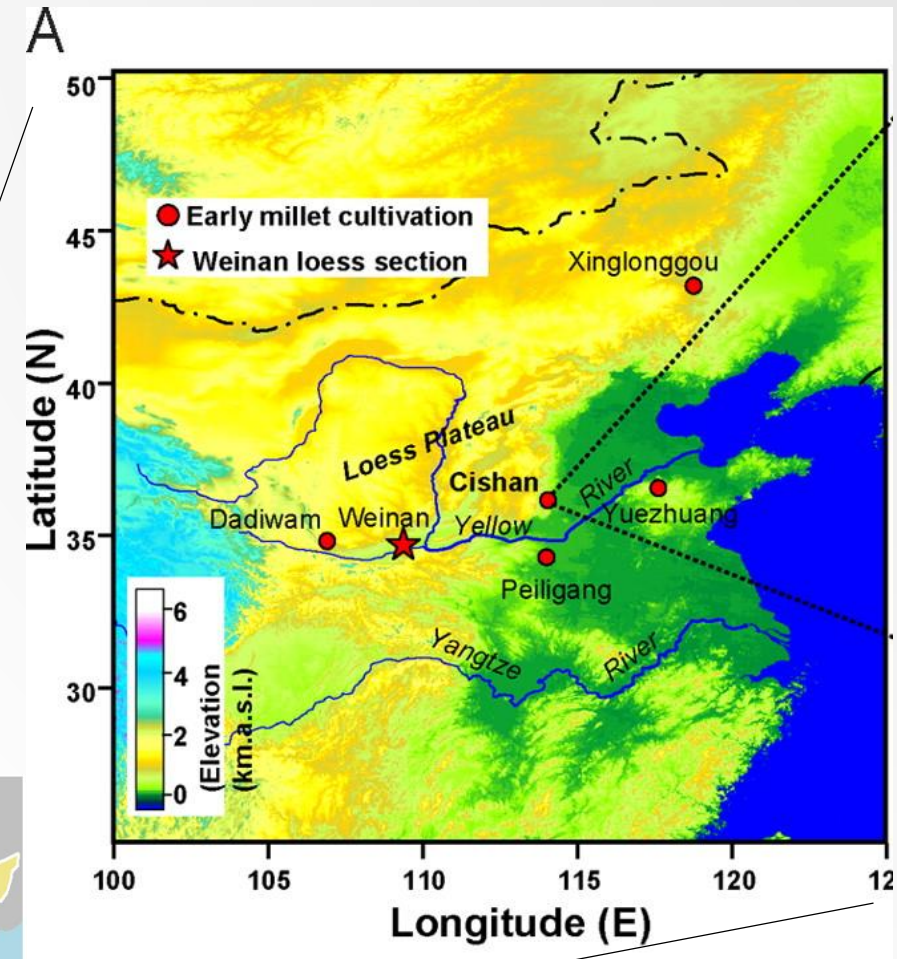
- Millets also called 'minor cereals'
- Rice, wheat and corn are 'major cereals'
- Nutritional and energy source in arid and semi-arid regions of Africa and Asia



Top ten Millet producers of World - 2014

HISTORY

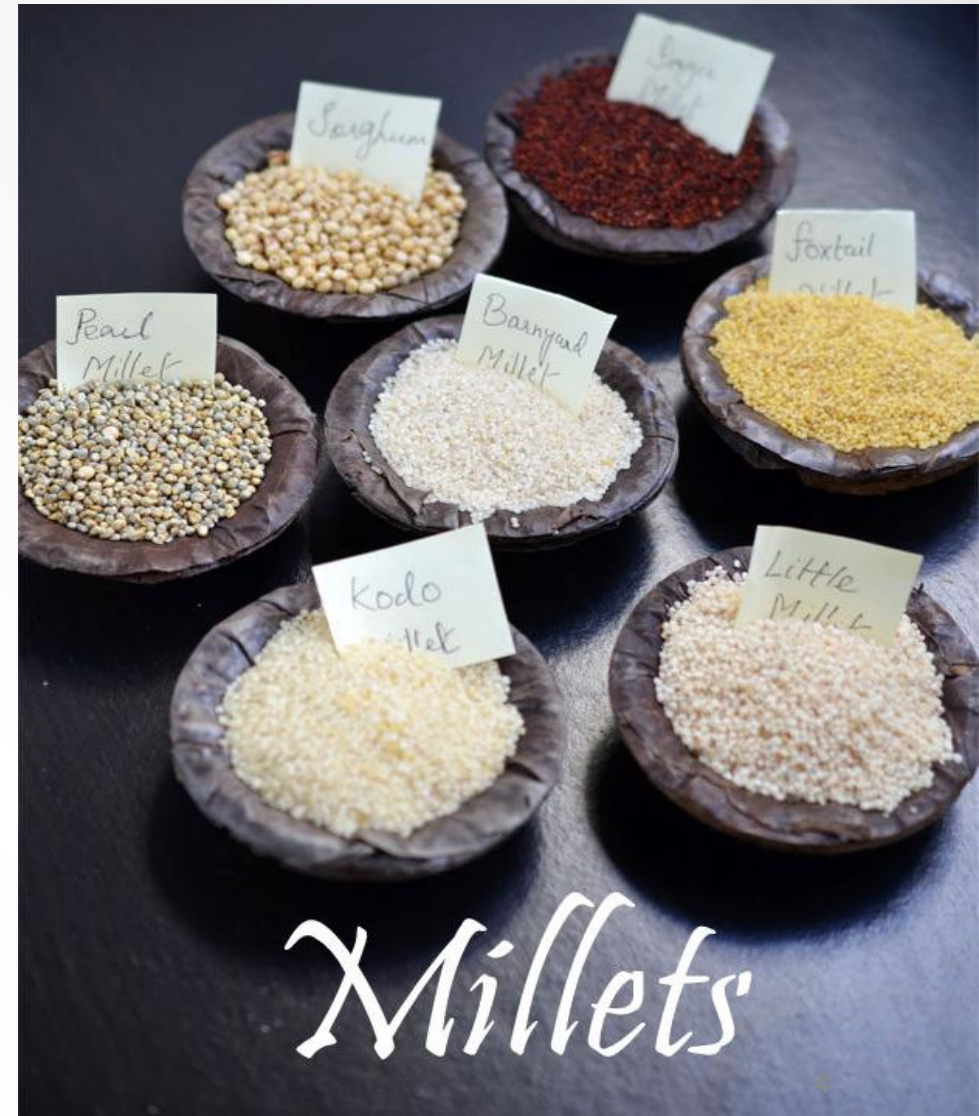
- Earliest millet cultivation – Northern China
- 8500 – 10000 years ago
- Foxtail millet and common millet
- Spread to India and other parts of Asia



Millets in India

- Inception of cultivation in India – 3500 years ago
- Staple crop in South India at the time of independence
- Health benefits include
 - Lowering blood pressure, risk of cancer, diabetes and cholesterol levels
 - Prevents gastric ulcers, constipation and other gastrointestinal conditions

Source: Sarkar et al., 2015; Rajagopalan 2017; Saleh et al., 2013



Traditional Indian millet dishes



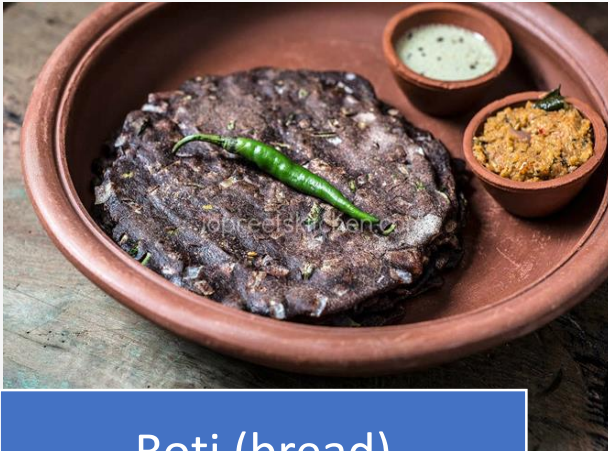
Ambali



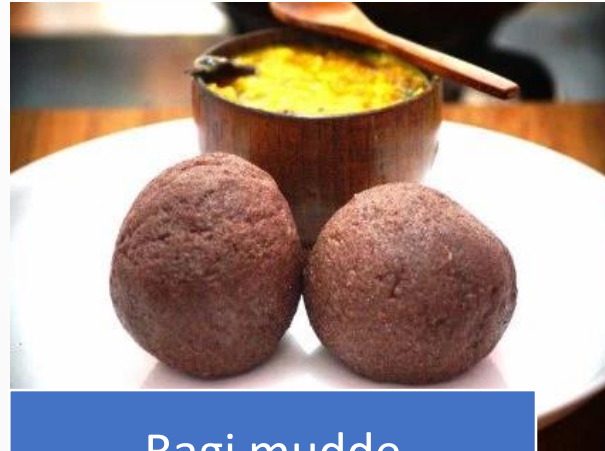
Ragi harihittu (popped)



Millet Pongal/Upma



Roti (bread)



Ragi mudde



Millet Dosa

Food Security - India

1945

- India was founding member of Food and Agriculture Organization (FAO)
- India was classified as low-income food-deficient country
- Rampant starvation and malnutrition

1960 - 70s

- Green revolution in India
- Government policy to provide subsidies for growing rice and wheat
- Promote chemical pesticides, High yield varieties (HYV) and irrigation



Food Security - India

- Rice and wheat doubled in 20 years between 1950 - 1970
- Grain imports dropped drastically
- Millets production rate was almost constant



Growth in food grain production between 1950 – 2000 India

	1950	1960	1970	1980	1990	2000
Food grain production (MT)	50.8	82.0	108.4	129.6	176.4	201.6
Food grain imports (MT)	4.8	10.4	7.5	0.8	0.3	-
Millet production (MT)		7.7	12.3	9.3	10.4	10.0
Population (million)	361	439	548	683	846	1000

Source: Production estimates & Crop Assessment Division, Foreign Agriculture Service, USDA

Indian Government Policy changes

- Indian Government started subsidies as part of **five-year plans** after independence
- National Development Council (NDC) adopted Food Security Mission in 2007
- Targets to increase production under 11th Five-year plan (2007-08 to 2011-12)
 - Rice (10 million tons)
 - Wheat (8 million tons)
 - Pulses (2 million tons)

Indian Government Policy – Cont'd

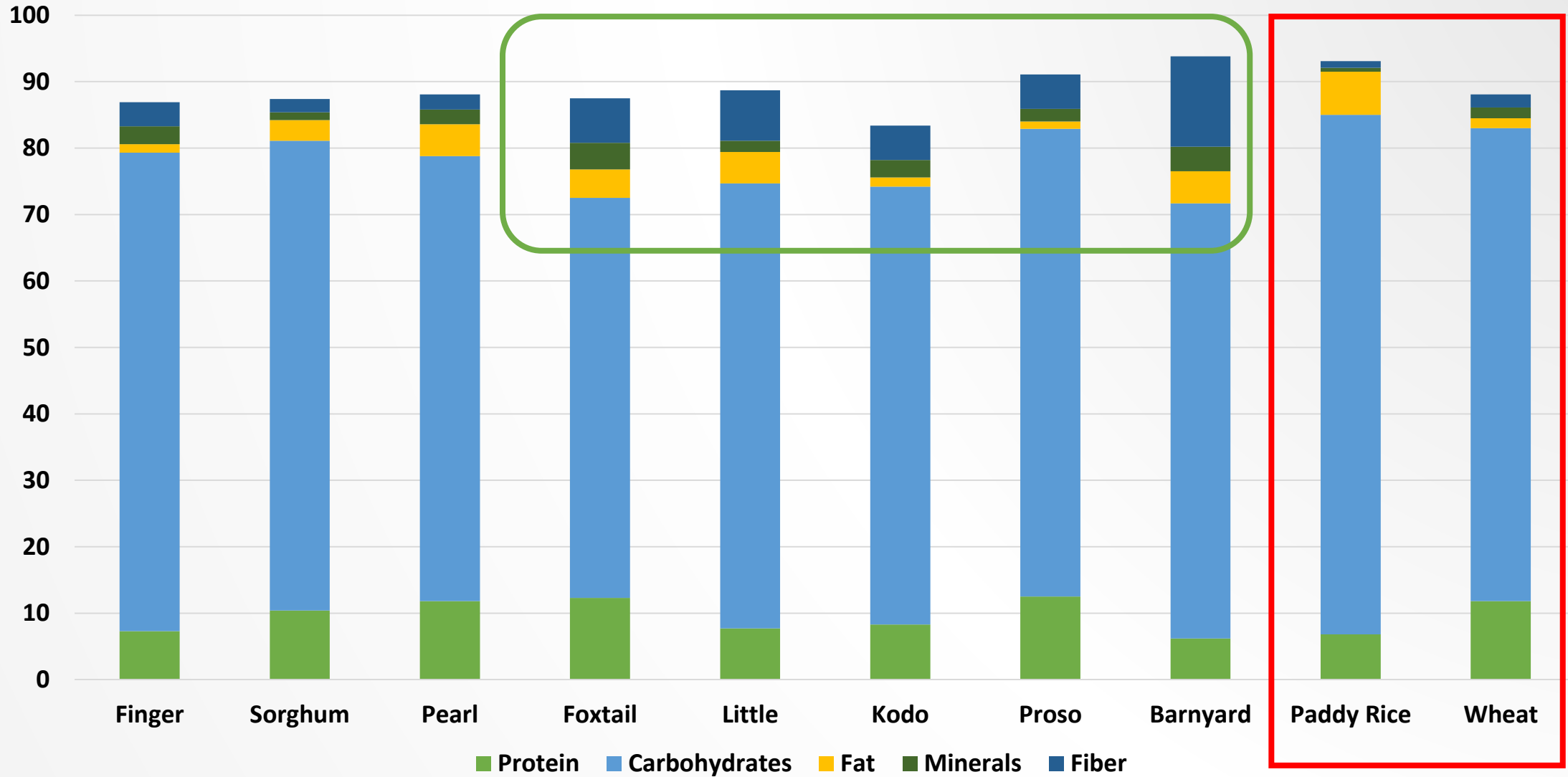
- However, 12th Five-year plan included millets as part of 'National Food Security Mission (NFSM)' (launched 2007)
- 12th five-year plan targets
 - Rice (10 million tons)
 - Wheat (8 million tons)
 - Pulses (4 million tons)
 - **Coarse cereals (3 million tons)**
- Coarse cereals: Corn, Sorghum, barley, pearl millet, finger millet, small millets, etc.,

Pattern of Assistance (2015-16)

	Rice	Wheat	Pulses	Millets
Interventions	Rs.20000/ha	Rs.20000/ha	Rs.20000/ha	Rs.5000/ha
Seed – High yielding varieties	Rs.10/kg	Rs.10/kg	Rs.25/kg	Rs.15/kg
Seed – Hybrid	Rs.50/kg	-	-	Rs.50/kg
Farm Machineries	Rs.225700	Rs.171600	Rs.171600	-
Pesticides, etc.,	Rs.1000/ha	Rs.1000/ha	Rs.1000/ha	-
Nutrients/fertilizers	Rs.1500/ha	-	Rs.2550/ha	-

All values are estimated approximates (2015 – 2016)

Nutritive value of Different cereals



Source: EARTH 360 (India) & ICRISAT

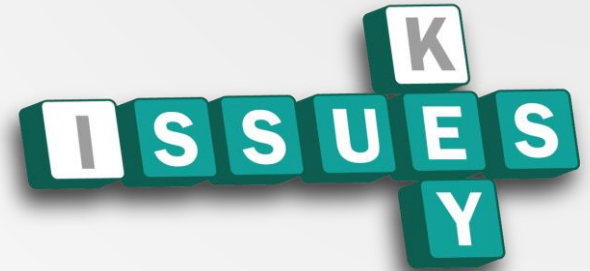
Health concerns – rice and wheat

- Research raised various health concerns with consumption of excess rice and wheat.
- Consumption of excess white rice increases the risk of type 2 diabetes
- Gluten in wheat – risk of celiac disease and food allergy
- However, Indians are used to carbohydrate-rich diet traditionally, hence millets can be a sustainable alternative



Issues – Millet diet

- Various problems associated with re-incorporating millets into our regular diets
 - Government support & policy changes
 - Innovations – Farm machinery and Processing
 - Research & Product development
 - Consumer awareness (Nutritional and marketing)



GOI – policy changes

- Government should actively promote consumption of millets as an alternative to rice and wheat
- Subsidies to farmers for cultivating millets
- Indian Institute of Millets Research (IIMR) Scenarios for 2050
 - **Scenario I** – Current areas of production & productivity
 - **Scenario II** – Optimistic estimates with increased productivity & HYV seeds
 - **Scenario III** – Optimistic estimates with favourable government policies and HYV seeds.



	Scenario I			Scenario II			Scenario III		
<i>Crop</i>	<i>Area (m ha)</i>	<i>Yield (kg/ha)</i>	<i>Prod (m t)</i>	<i>Area (m ha)</i>	<i>Yield (kg/ha)</i>	<i>Prod (m t)</i>	<i>Area (m ha)</i>	<i>Yield (kg/ha)</i>	<i>Prod (m t)</i>
Pearl	9.0	1214	10.9	9.0	2500	22.5	15.0	2500	37.5
Finger	1.1	1428	1.59	1.1	2500	2.78	4.0	2500	10.0
Others	18.6	1117	20.2	18.6	2400	42.11	35.0	2400	85.5

Area: Production area in million hectares;

Yield: Crop yield in kilograms per hectare;

Prod: Total Production in metric ton

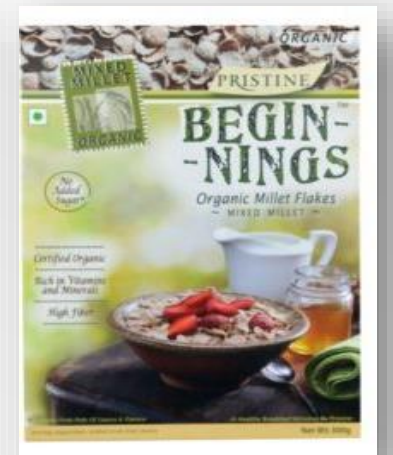
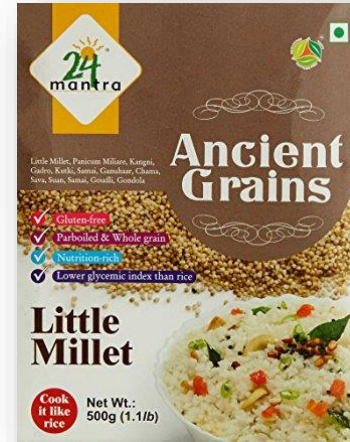
Innovations – Machinery & Processing tools

- Need to develop novel machinery to help farmers
- Processing tool innovations are required to reduce drudgery and labour
- Innovations will reduce the overall time spend on processing the crop



Research and Product development

- Products that appeal to the mass market
- Speciality products promoting various health benefits.
- Small and medium scale food industries – contribution to the market through R&D



Consumer awareness

- Promote millets as healthy alternatives for rice and wheat
- Market as 'superfoods'
- Superfoods - a nutrient-rich food considered to be especially beneficial for health and well-being
- Would this actually work?





Greek yogurt



Quinoa



Blueberries



Kale

Superfoods

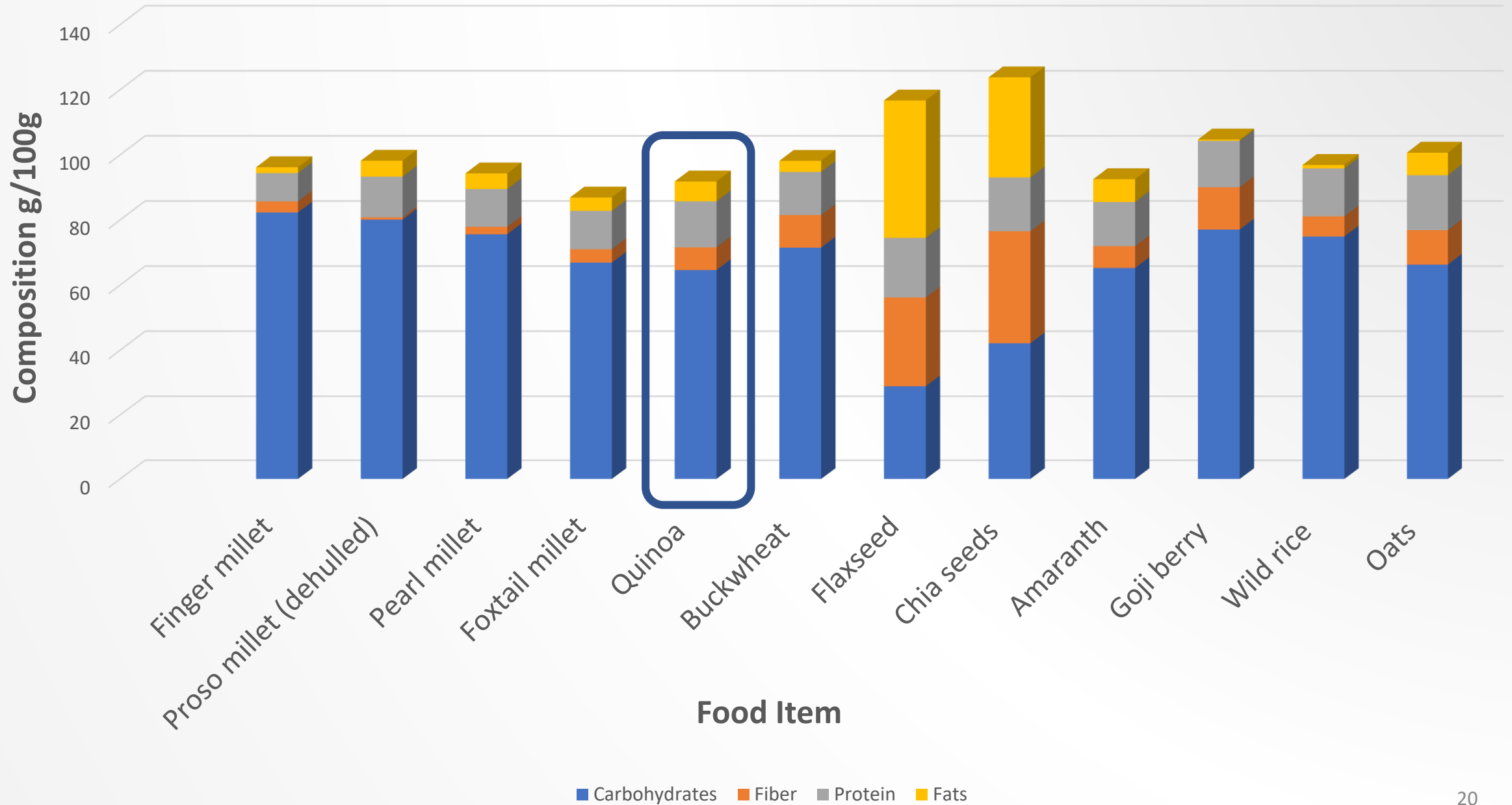


Chia seeds



Oatmeal

Nutritive value of few Millets and different superfoods

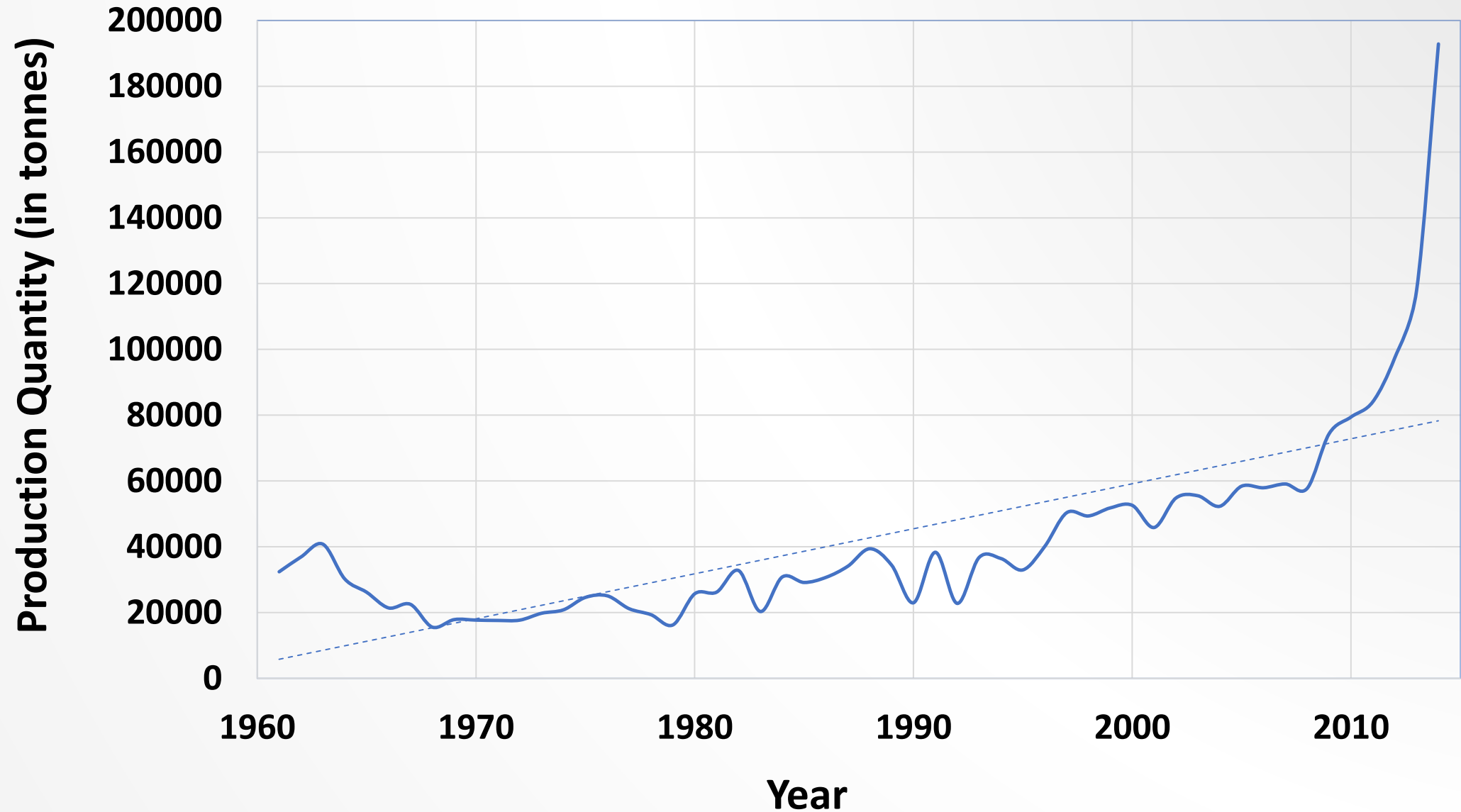


QUINOA

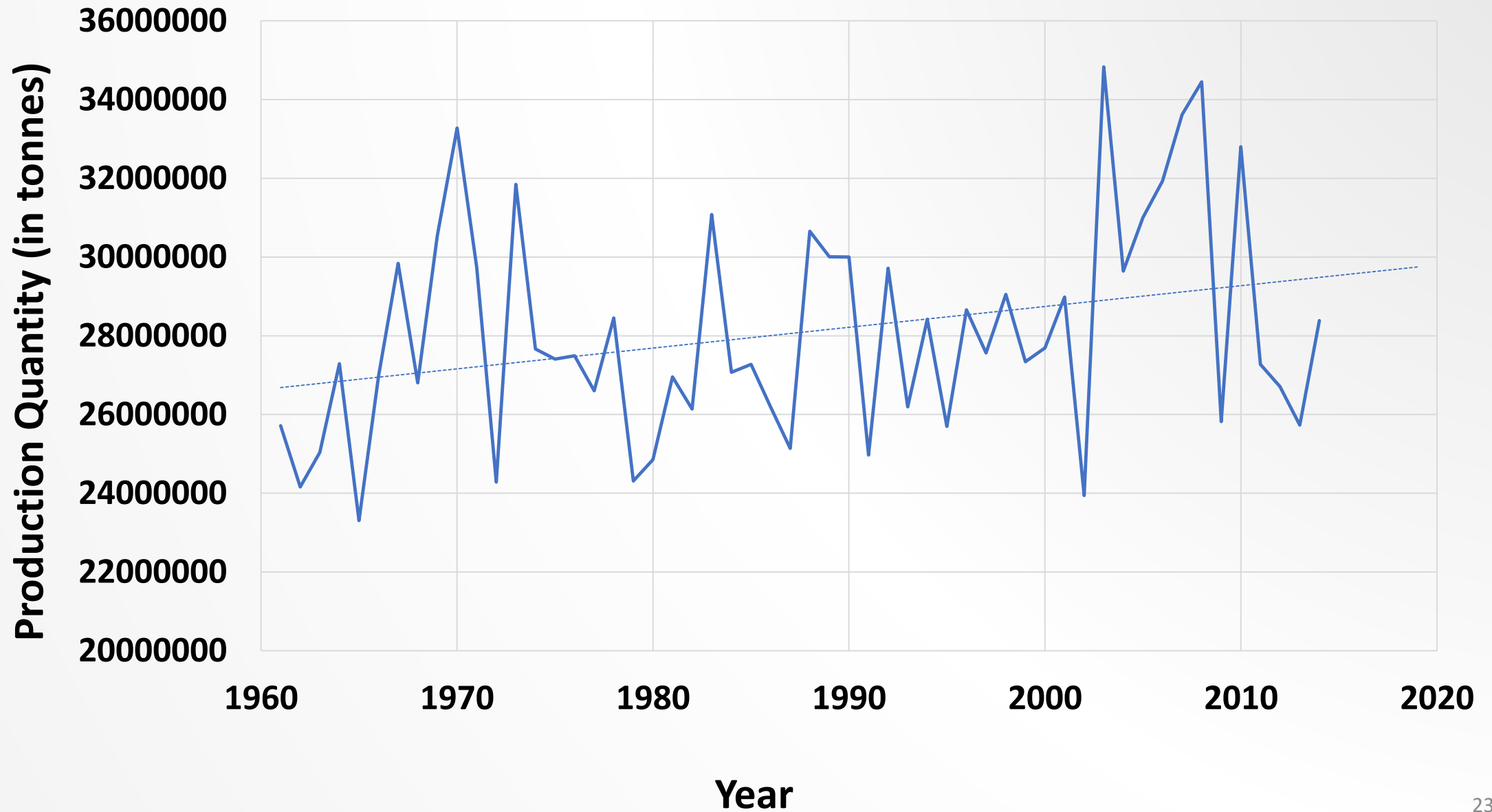
- Domesticated 4000 years ago by Andean population in South America
- Popularity spread across Japan, China, US, Canada and Europe in the last 10 years
- Termed as “mother of all grains”
- Alternative to rice and wheat



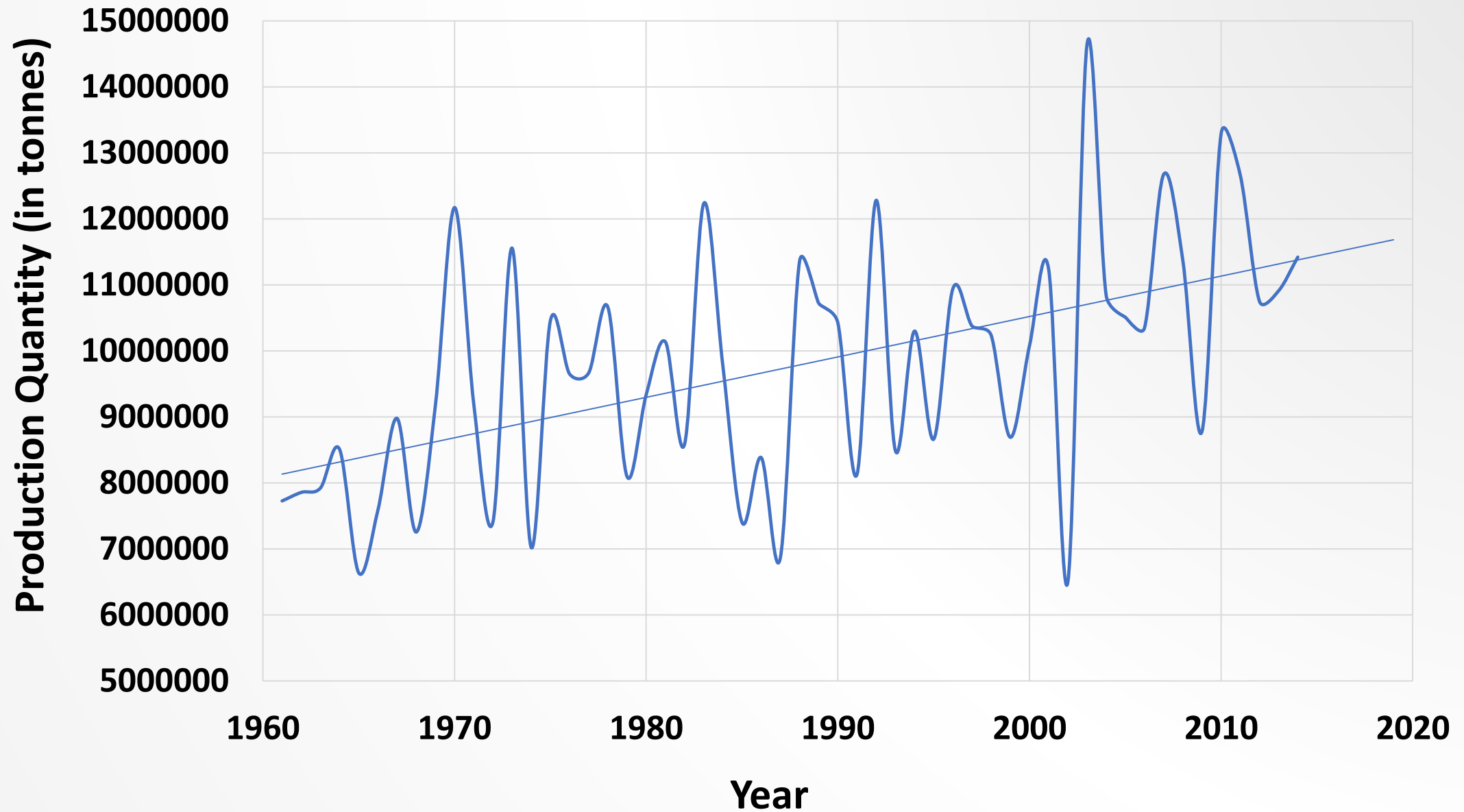
Total World Production of Quinoa between 1961-2014



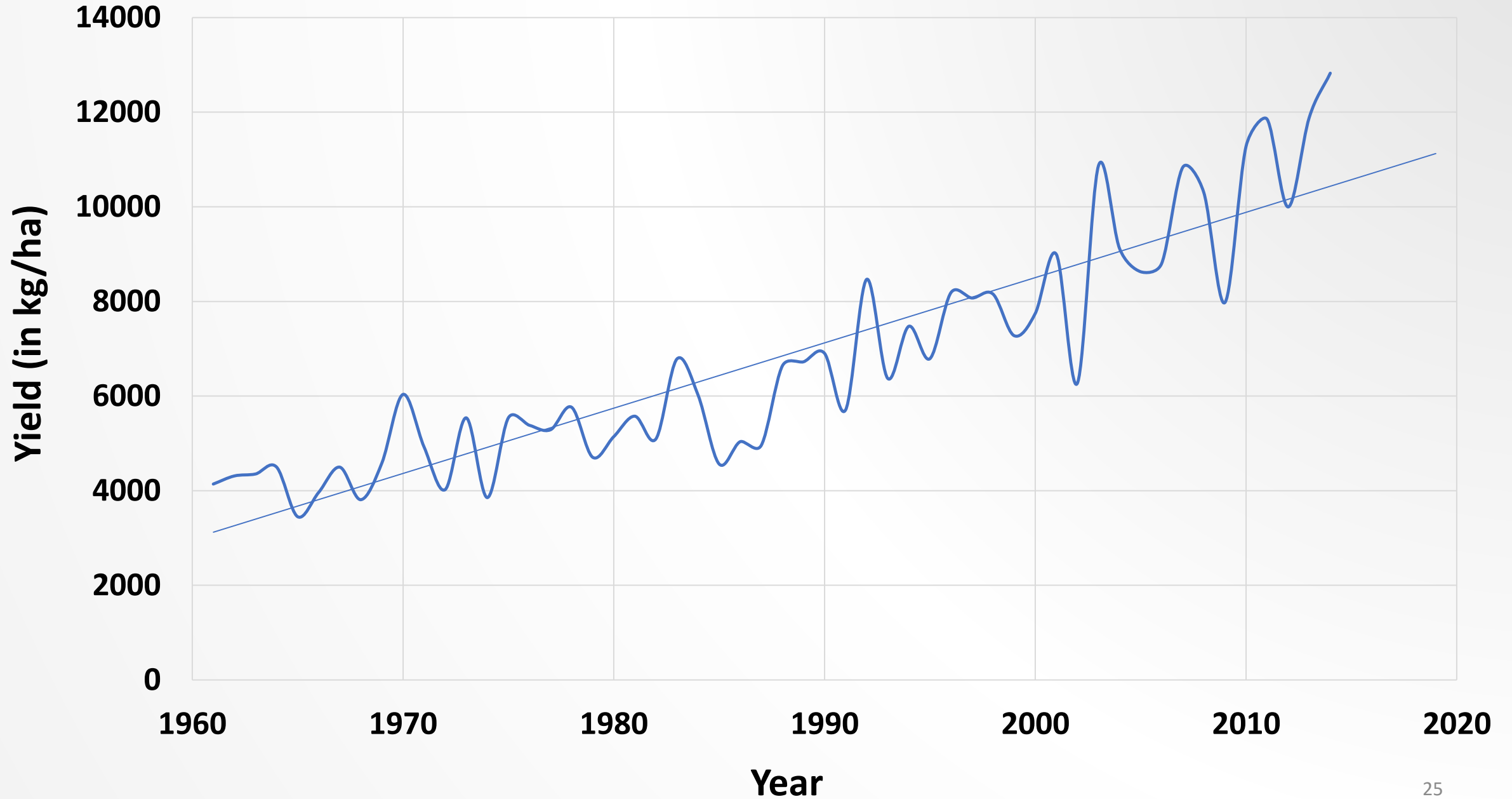
Total World Production of Millet between 1961-2014



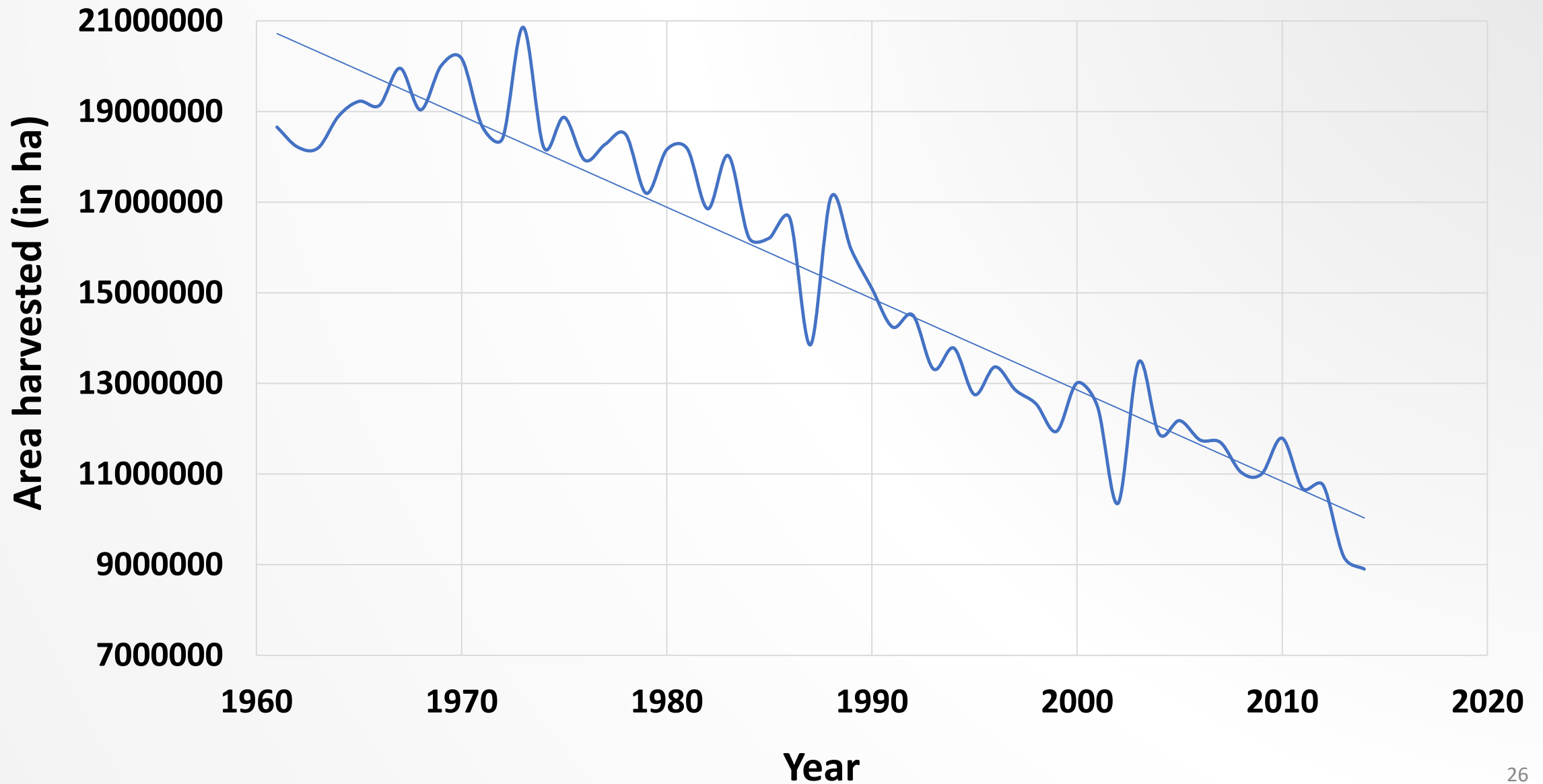
Total Production of Millet in India between 1961-2014



Total Yield of Millet in India between 1961-2014



Total Area of Millet harvested in India between 1961-2014



Millets - India

- Millet production in India increased marginally
- Still considered a marginal crop
- Yields – 3-fold increase
- Land use – reduced by 50%



Can be reversed!!!

Conclusion

- Government intervention with policy changes is vital
- Farmers & consumer education programs
- Development of new products to increase the market size
- Promoting millets as 'superfoods'

Acknowledgement



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Sai Kranthi Vanga, Rachit Saxena and
all the other graduate students!!!

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