Export Potential of Millet crop improvement research - current status & opportunities

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EAT MILLETS - STAY HEALTHY

Millets for Nutrition Security

पोषण सुरक्षा हेतु पोशक अनाज

स्वाद भी और स्वास्थ्य भी

Definition of MILLETS - THE NUTRICEREALS

Millets are collective group of small seeded annual grasses that are grown as grain crops, pr
marginal land in dry areas of temperate, sub tropical and tropical regions.

(http://www.fao.org/3/w1808e/w1808e0c.htm)

Climate Resilient Millets grown in 131 countries. Ancient food grains first plants domesticated for food - Earliest evidence found in Indus civilization dates back to 3000 BC : Millets traditional food for 59 crore people in Asia & Africa.

Pearl Millet
(Bajra)

Sorghum
(Jowar)

Finger Millet
(Ragi)

Foxtail Millet
(Kangni)

Kodo millet

Little Millet
(Kutki)

Proso Millet
(Cheena)

Barnyard Millet
(Sawan)

Browntop millet

Teff millet

Fonio millet

GLOBAL SCENARIO OF MILLETS

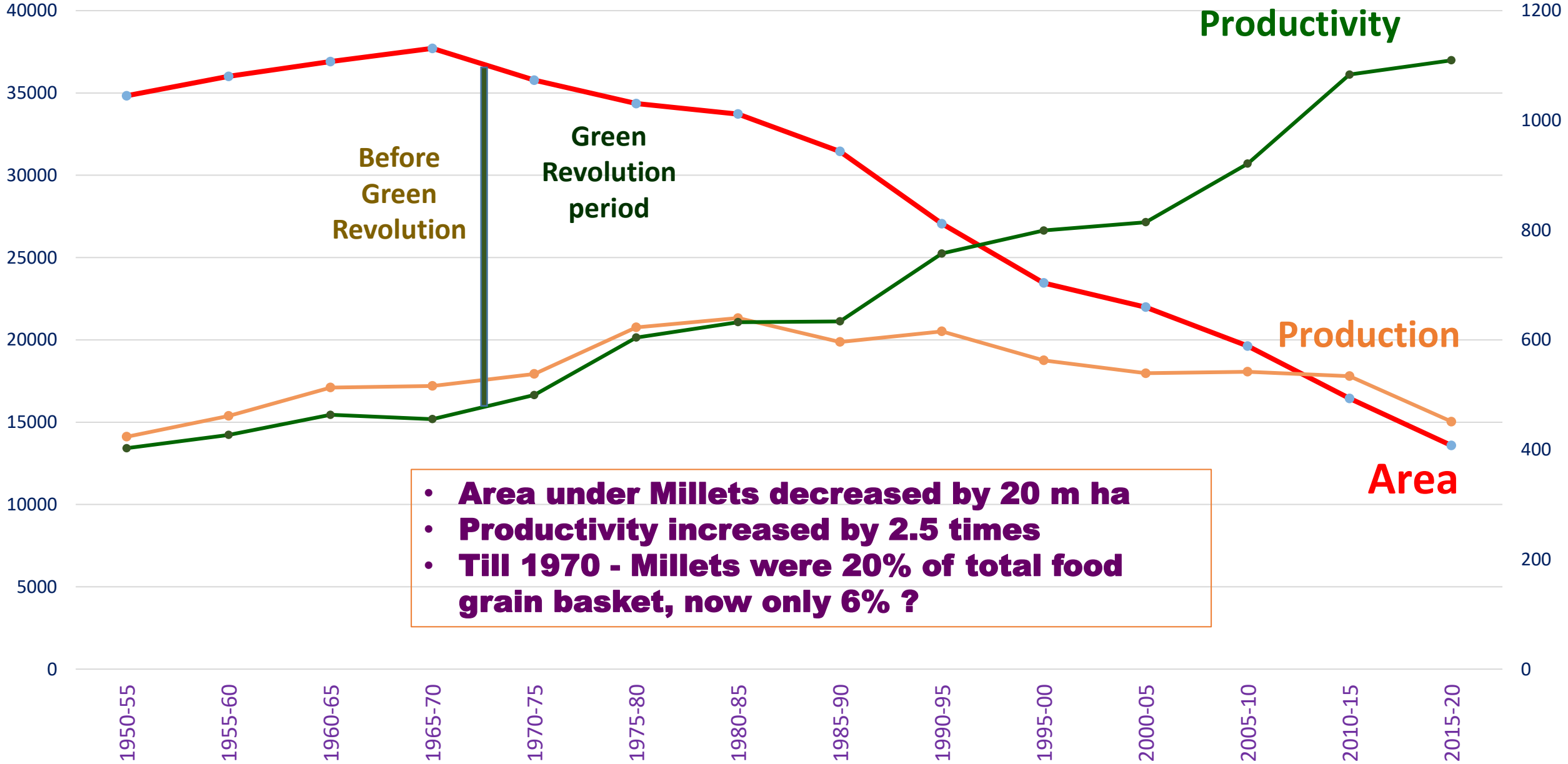
Millets area and production region wise (2019)

(Source: FAO Stat 2021)

Regions	AREA (lakh ha)	Production (lakh ton)
Africa	488.9	423.1
Americas	53.2	192.5
Asia	161.7	214.8
Europe	7.7	19.9
Australia & New Zealand	5.9	12.0
India	138.2	172. 5
WORLD	**717.2**	**862.6**

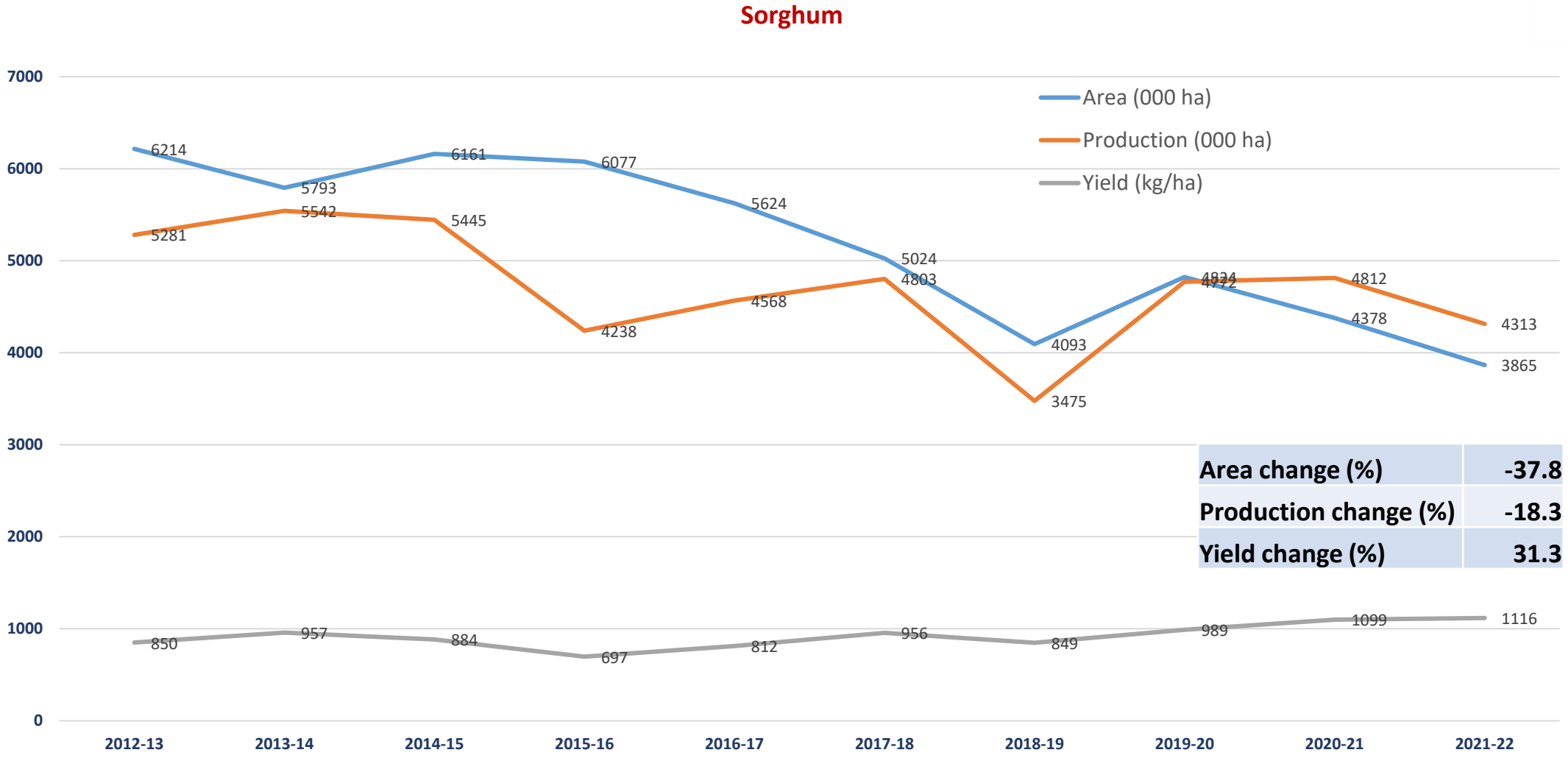
- India produces >170 lakh ton millets (80% of Asia's & 20% of global production)
- Global average yield: 1229 kg/ha whereas India (1239 kg/ha)

QUINQUENNIAL MEAN AREA, PRODUCTION & YIELD OF MILLETS IN INDIA



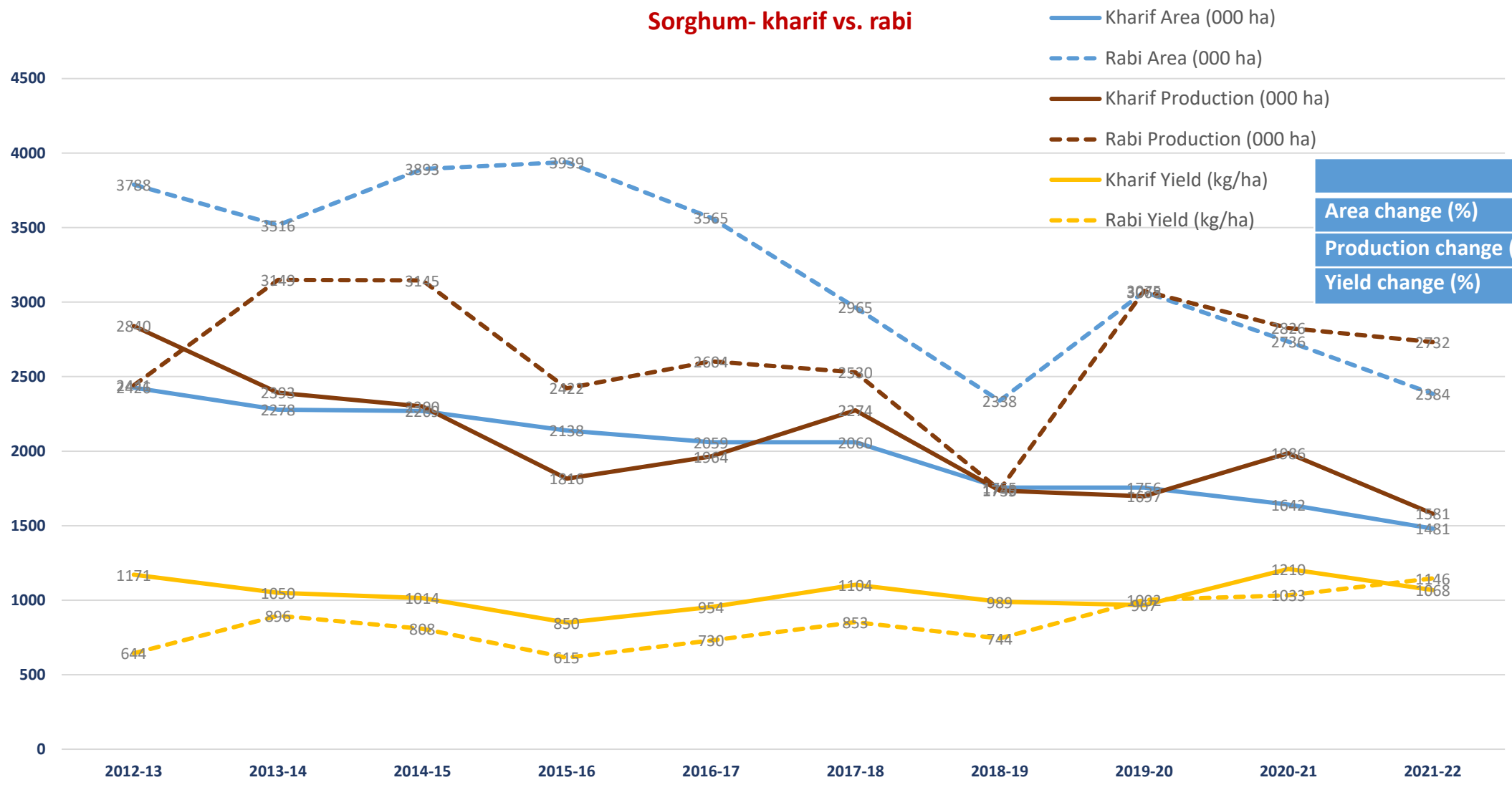
- **Area under Millets decreased by 20 m ha**
- **Productivity increased by 2.5 times**
- **Till 1970 - Millets were 20% of total food grain basket, now only 6% ?**

Area, production and yield of sorghum during 2012-2021



Despite 38% decrease in area, the yield increase of 31% reduced the production deficit

Area, production and yield of kharif and rabi sorghum during 2012-2021

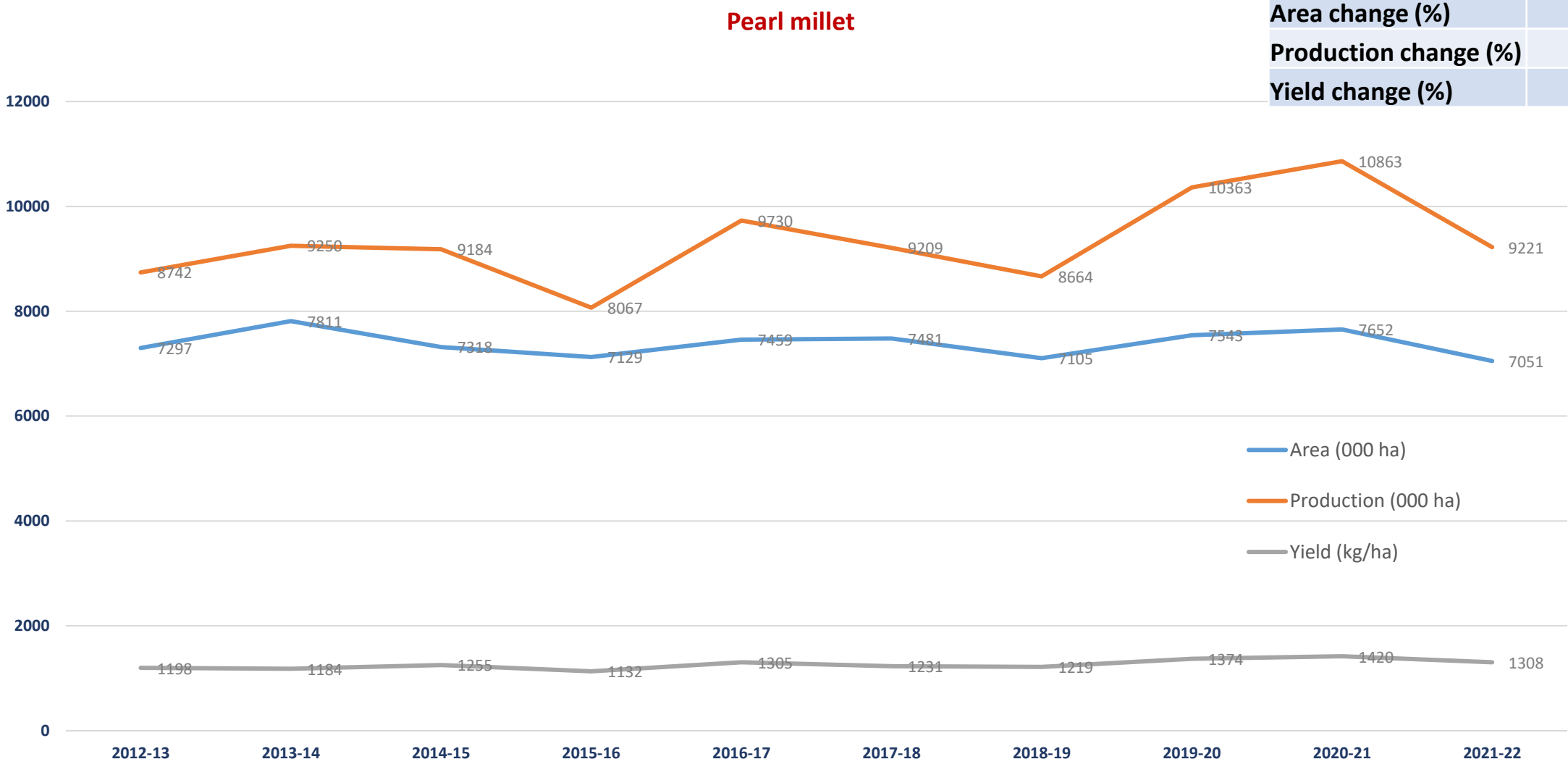


	Kharif	Rabi
Area change (%)	-39.0	-37.1
Production change (%)	-44.4	11.9
Yield change (%)	-8.8	77.8

Though both kharif and rabi area reduced by 37-39%, 77% enhancement of rabi yield boosted rabi production by 12%

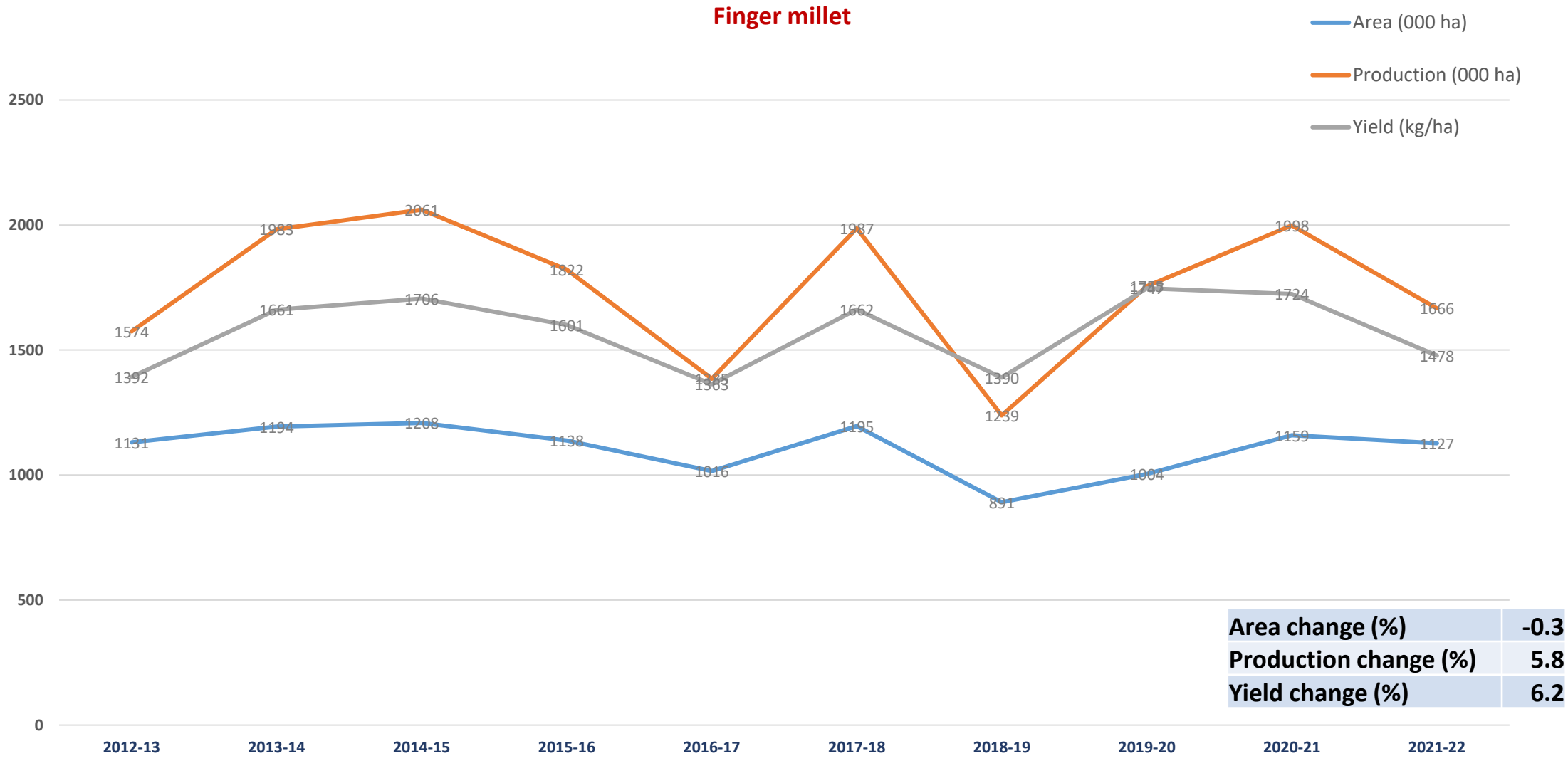
Area, production and yield of pearl millet during 2012-2021

Area change (%)	-3.4
Production change (%)	5.5
Yield change (%)	9.2



Area under pearl millet has not changed much, 9% yield increase across 10 years led to 6% more production

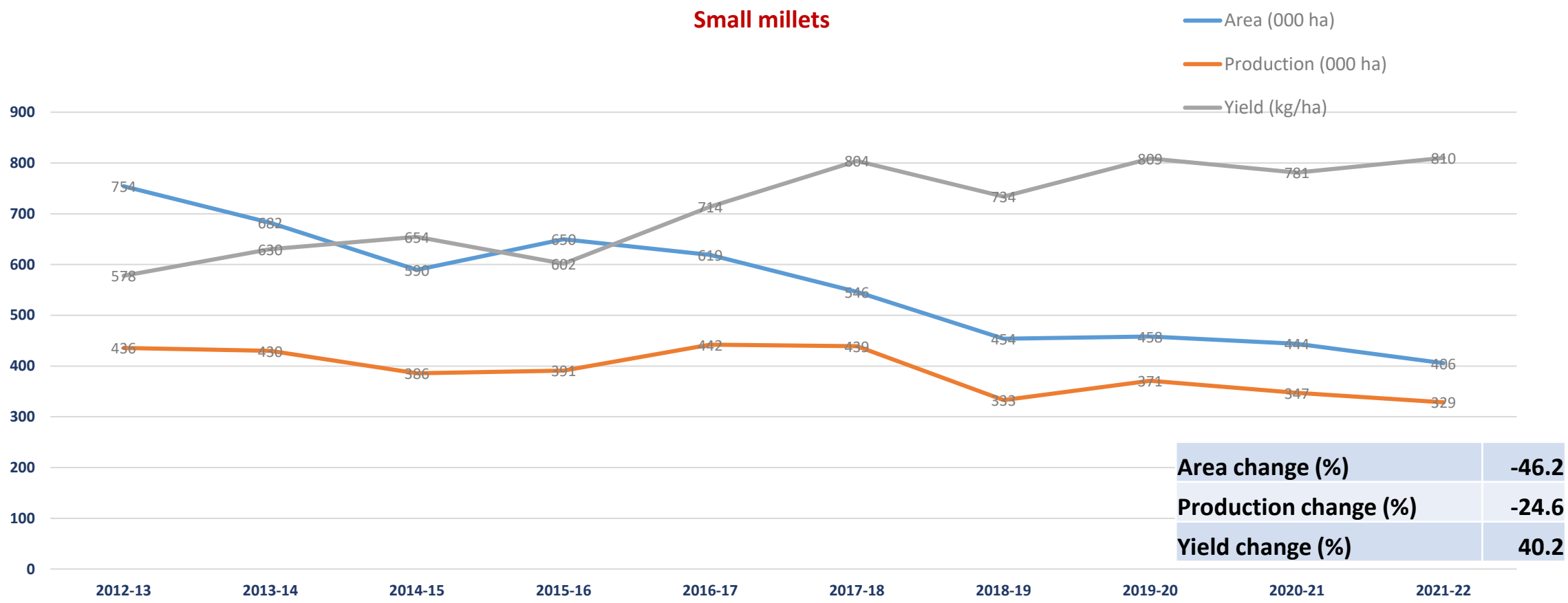
Area, production and yield of finger millet during 2012-2021



Area change (%)	-0.3
Production change (%)	5.8
Yield change (%)	6.2

Area under finger millet also has not changed much, 6% yield increase across 10 years led to 6% more production

Area, production and yield of small millets during 2012-2021



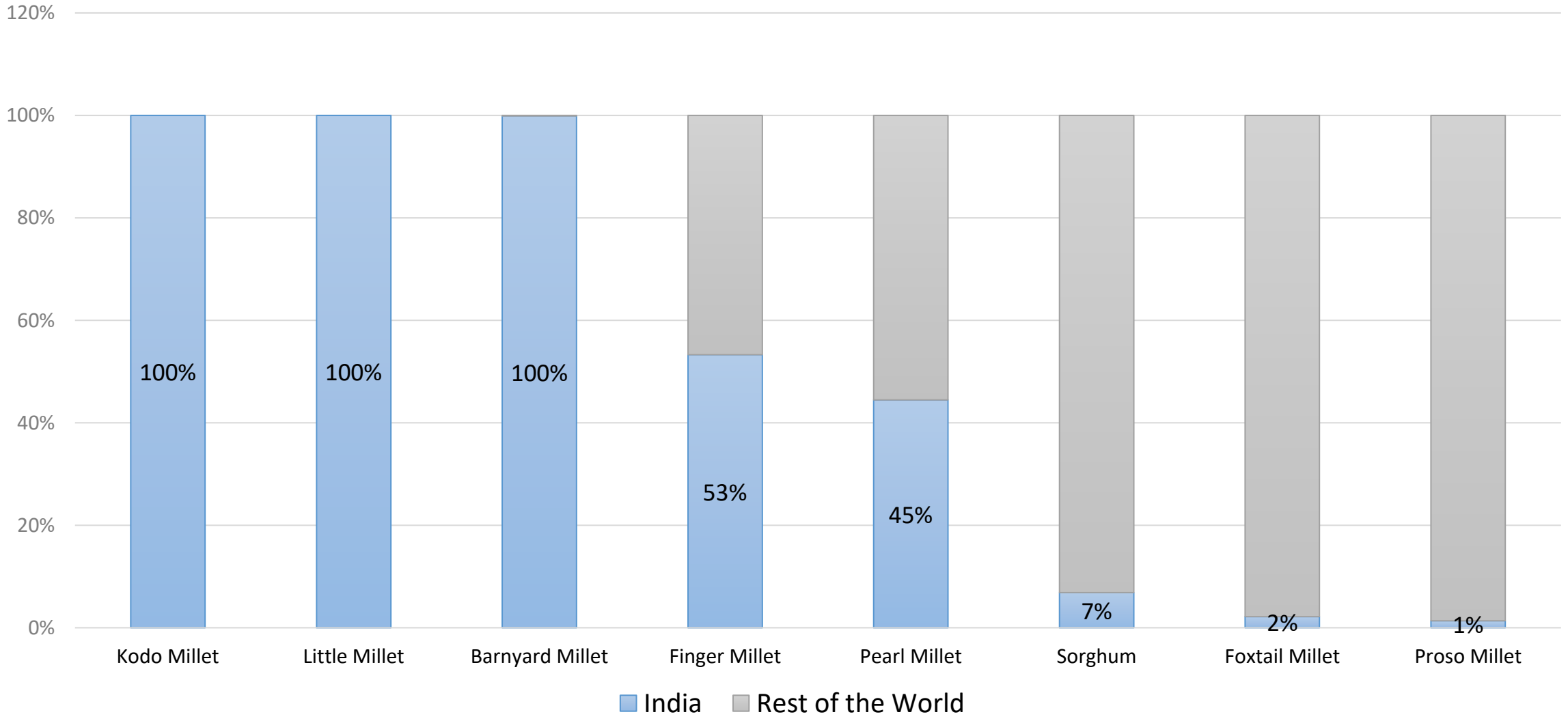
Area change (%)	**-46.2**
Production change (%)	**-24.6**
Yield change (%)	**40.2**

Despite steep decrease of 46% in area under small millets, due to 40% increase in yield, reduction in production was only 25%

MILLET CULTIVATION DIVERSITY MAP OF INDIA

States	Millets
Andhra Pradesh	Jowar/Foxtail
Chhattisgarh	Kodo Millet/Kutki
Gujarat	Bajra
Haryana	Bajra
Jharkhand	Jowar/Ragi
Karnataka	Jowar/Ragi
Kerala	Ragi/Little Millet
Madhya Pradesh	Kodo Millet/Kutki
Maharashtra	Ragi/Jowar
North Eastern States	Small Millets
Odisha	Ragi/Little Millet
Punjab	Little Millet/Foxtail Millet
Rajasthan	Bajra/Sorghum
Tamil Nadu	Bajra/Small Millets
Telangana	Jowar/Foxtail Millet
Uttarakhand	Ragi/Barnyard Millet
Uttar Pradesh	Bajra
West Bengal	Foxtail Millet/Jowar

Percent Contribution of India to World Millet Production

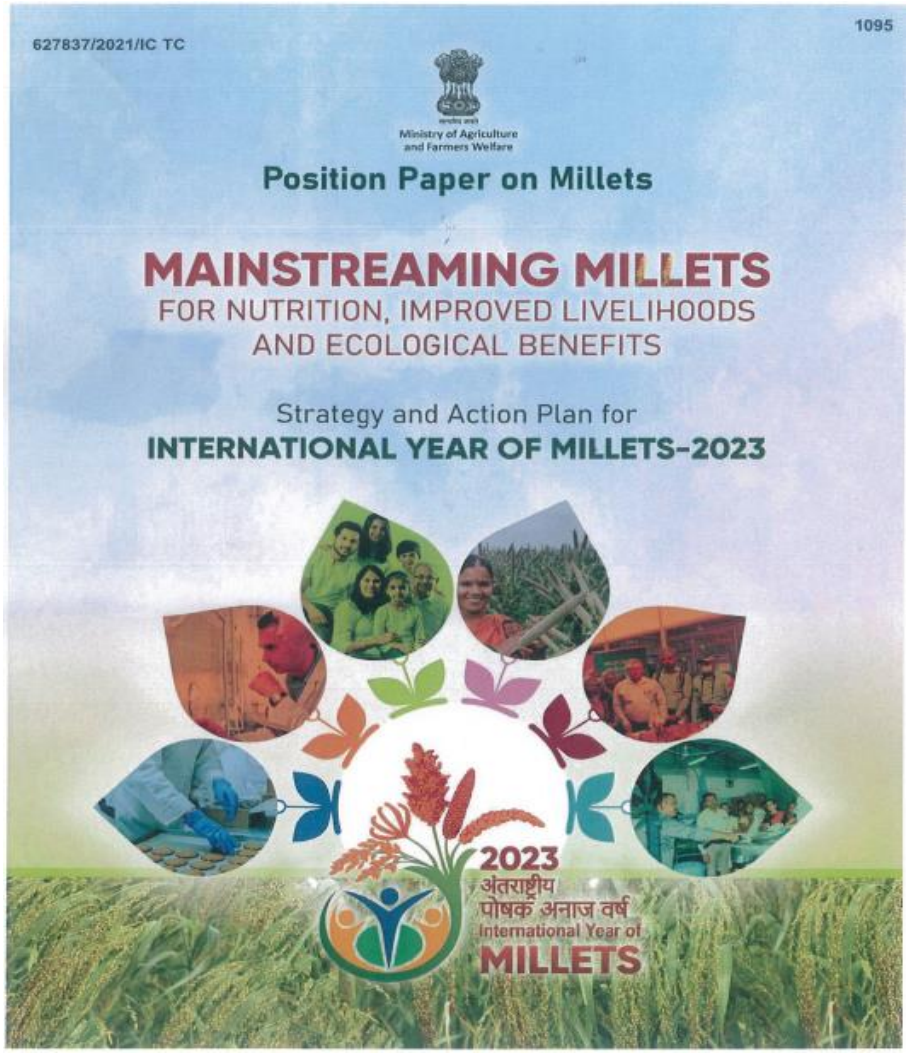


Source: IIMR estimate based on FAO/DES-GOI data

POSITION PAPER ON MILLETS BASED ON THEME AREAS

Outline of position paper

- Geographical mapping of millets growing areas
- Examine possibilities of wider use of millet in food items
- Examine introduction of millets as part of POSHAN Abhiyaan
- Study possibilities of millets in the global market
- Gaps in studies on nutrition of millets
- Look at linkages of markets and promotion as healthy food
- Recent initiatives in Millets promotion in the country
- Summary of Recommendations



Millets and the 2030 Agenda

The International Year of Millets 2023 contributes to the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs)

INTERNATIONAL YEAR OF
MILLETS
2023

SEVEN SUTRAs : THEMES

Enhancement of **production/ productivity.**

Nutrition & health benefits.

Value-addition, Processing & Recipe Development.

Entrepreneurship / Startup / Collective Development.

Awareness creation – Branding, Labelling & Promotion.

International outreach of millets.

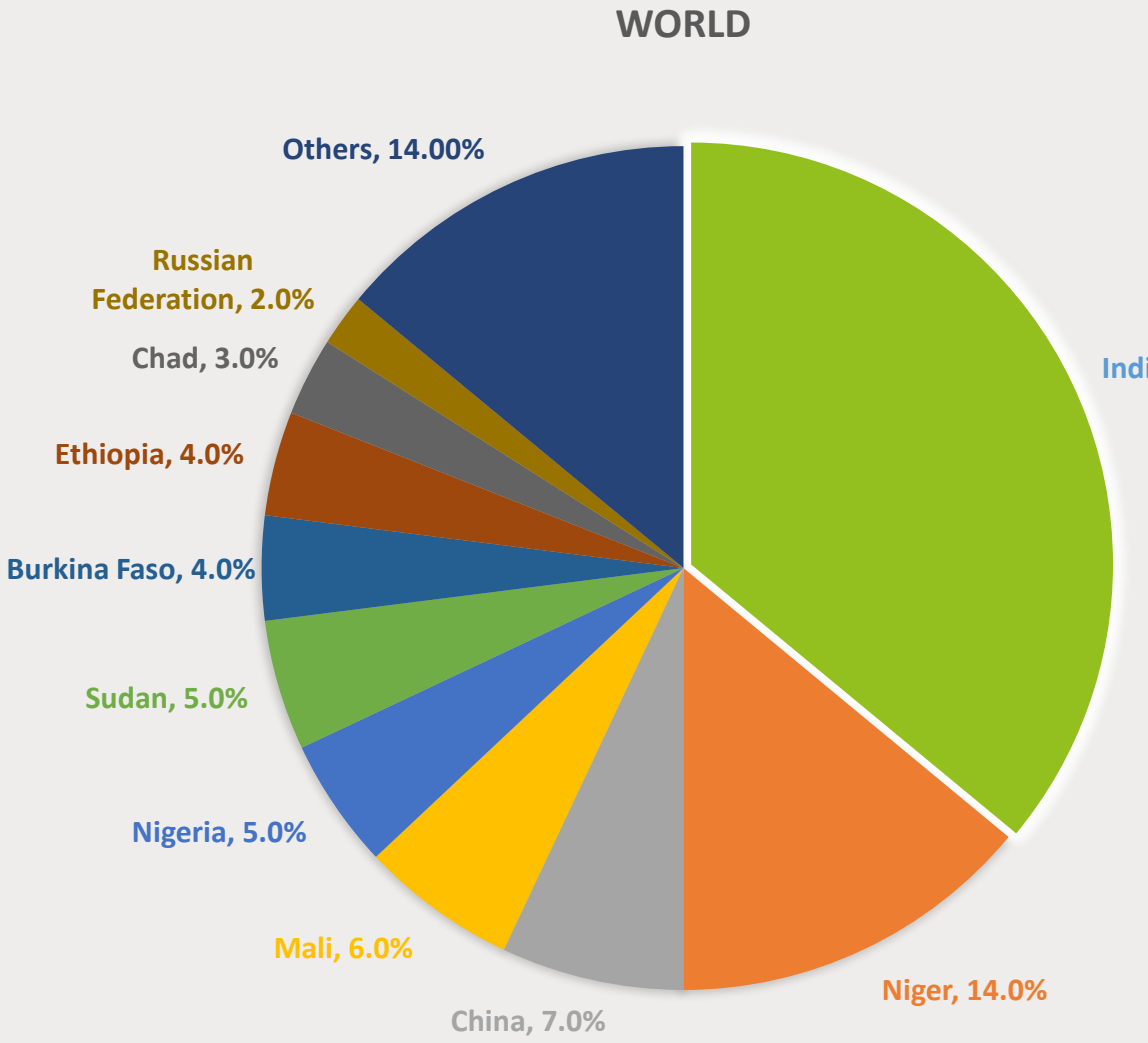
Policy interventions for mainstreaming of millets.

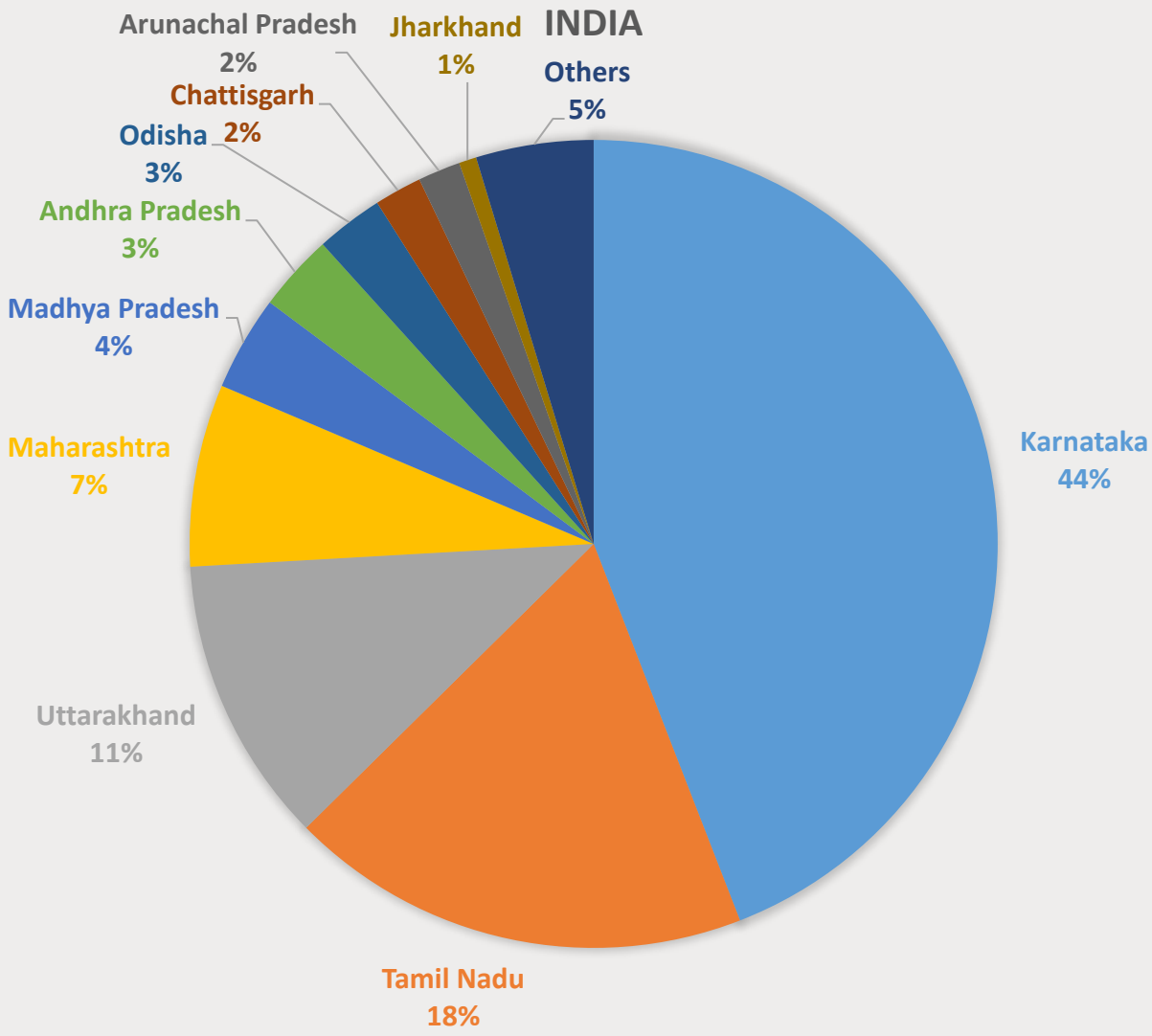
Consumption Trends

- Per capita consumption of millets - in rural Areas - has decreased from 3.2 kg to 0.53 during 1977 - 2011 i.e. 83% drop, and in urban areas, it has decreased from 1.15 kg to 0.27 kg during the same period i.e. 77% drop.

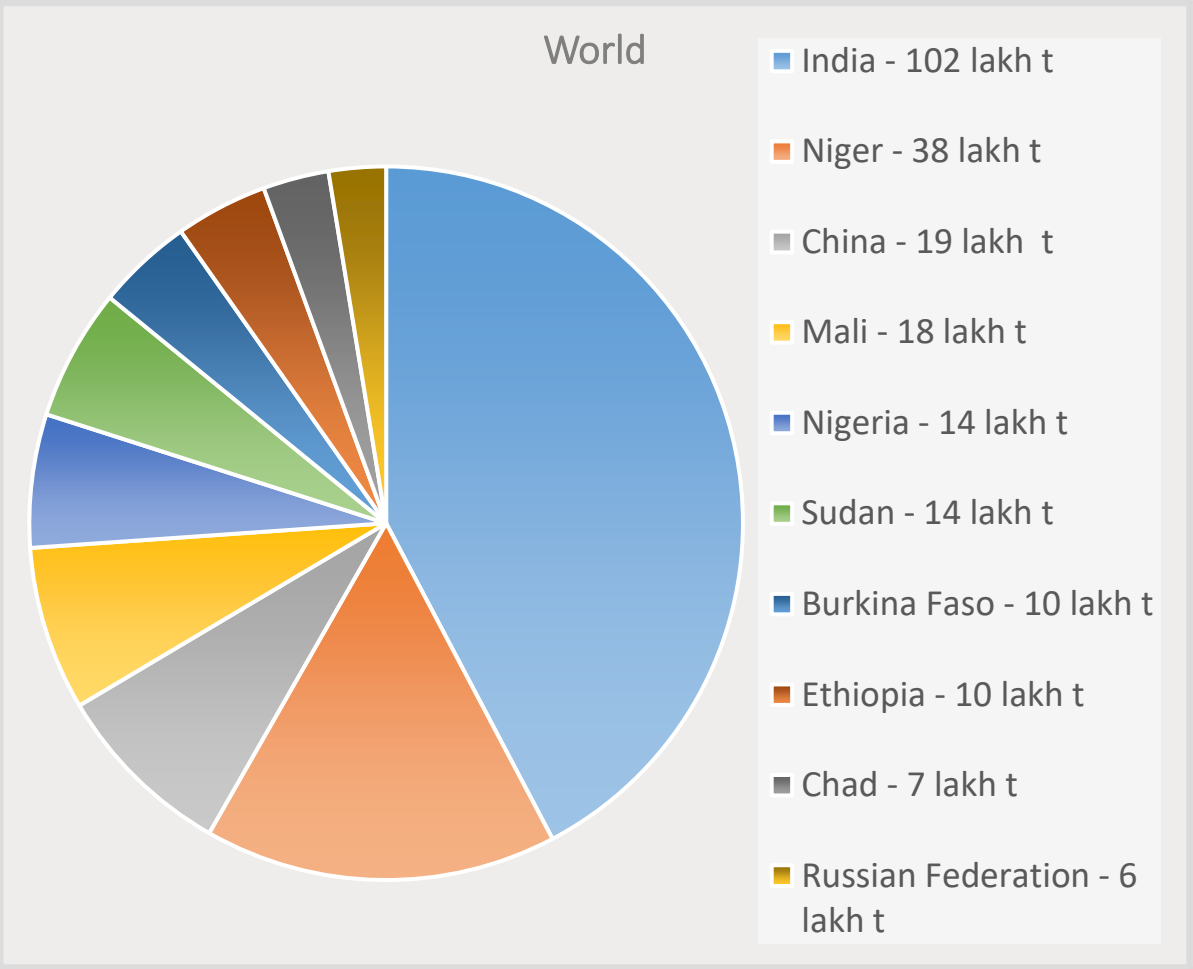
- As per a recent study by ICAR-IIMR, only less than 42% of the produce is available as marketable surplus and the remaining is dominantly consumed for household purpose, followed by feed to cattle, seed and others.

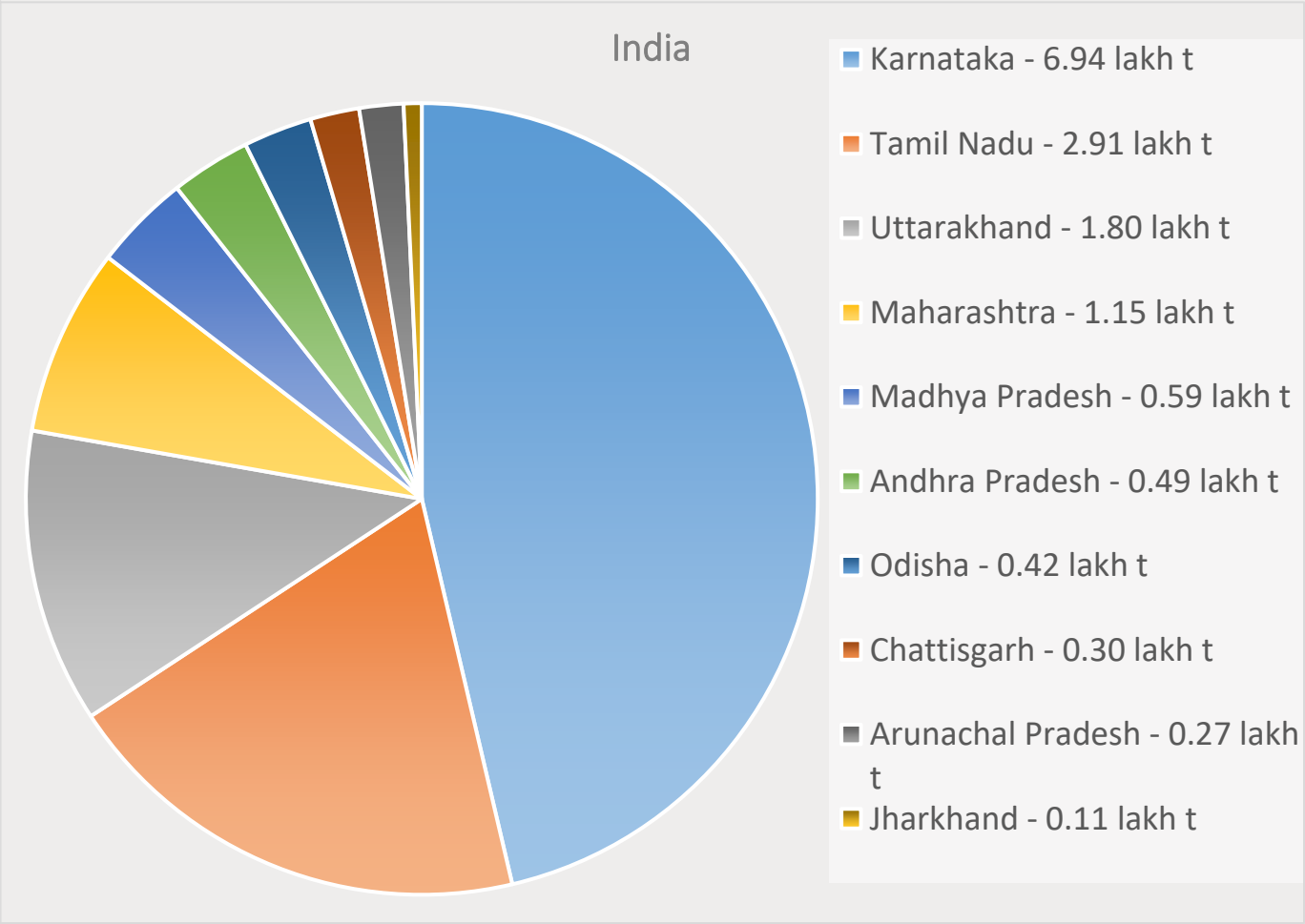
Production and Consumption status





Top 10 countries Production and Consumption status (in lakh tons)





Super Foods – The Driving Force

- Superfoods are foods that have a very high nutritional density. This means that they provide a substantial amount of nutrients and very few calories.

- They contain a high volume of minerals, vitamins, and antioxidants.

- Antioxidants are natural molecules that occur in certain foods. They help neutralize free radicals in our bodies. Free radicals are natural byproducts of energy production that can wreak havoc on the body.

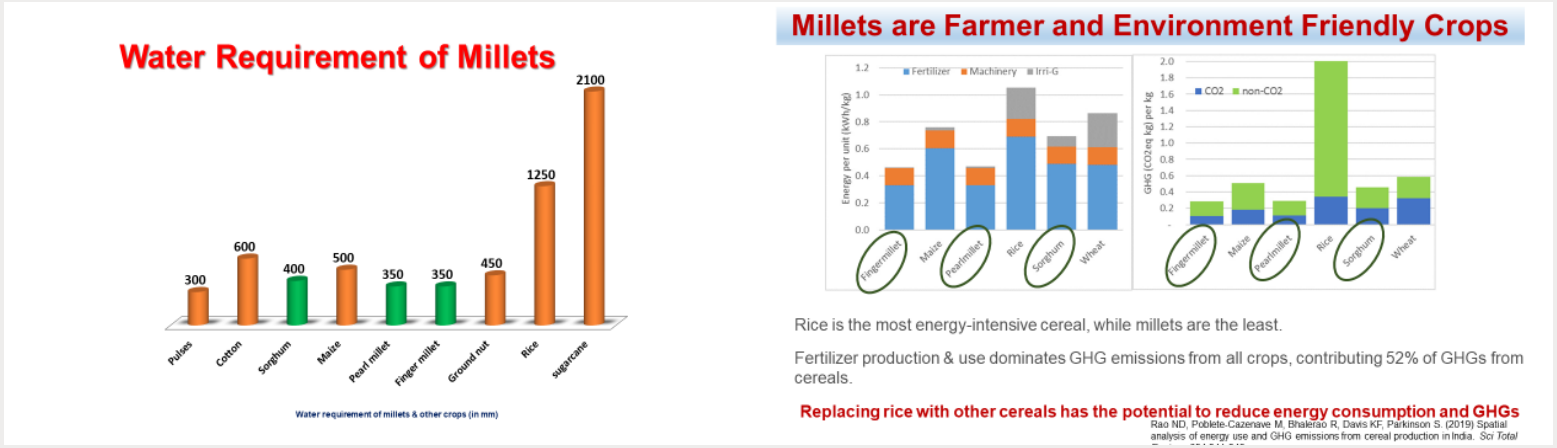
- Antioxidant molecules decrease or reverse the effects of free radicals that have close links with the following health problems:

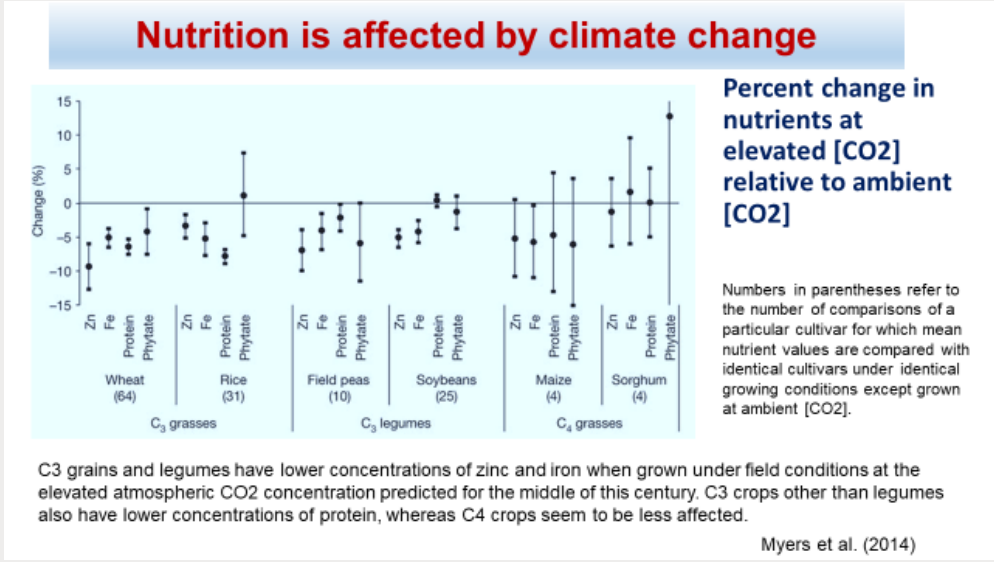
  - heart disease
  - cancer
  - arthritis
  - stroke
  - respiratory diseases
  - immune deficiency
  - emphysema
  - Parkinson's disease

Climate Resilience of millet crops

Small millets received less priority in the agricultural development in the past both at National and International level

- Grown in marginal and low soil fertility
- Drought tolerant
- Photo-insensitivity
- Short duration
- Multiple security of food grains
- Storehouses of nutrition
- Long storability





Minor millets - Key information

Small millet species	Finger millet	Foxtail millet	Kodo millet
Botanical name	*Eleusine Coracana*	*Setaria italica*	*Paspalum scrobiculatum*
Origin	East Africa	China	India
Area of adaptation and crop worldwide	Well adapted to heat and drought conditions	Well adapted to heat and drought conditions	Well adapted to heat and drought conditions
Yield determining factors	1. Productive tillers 2. Finger branching 3. Finger length 4. Number of grains per spikelet 5. Green fodder yield 6. 1000 grain weight [g] 7. Grain yield (per/plant)	1. Productive tillers 2. Finger length 3. Number of grains per spikelet 4. Green fodder yield 5. 1000 grain weight [g] 6. Grain yield (per/plant)	1. Plant height 2. Tillers per plant 3. Panicles per plant 4. Panicle length 5. Grain yield (per plant) 6. 1000 grain weight (g)
Biotic stress	Blast, Brown spot, Foot rot, Leaf spot, Downy mildew, Smut, Damping off	Blast, Rust, Smut, Downy mildew	Head smut, Rust, Ergot, Udbatta disease, Bacterial leaf streak, Phanerogamic partial root parasite

Contd..

Minor millets - Key information

Small millet species	Finger millet	Foxtail millet	Kodo millet
Abiotic stress	Climate change, heat and drought	Climate change, heat and drought	Climate change, heat and drought
Duration (days)	80-100	70-95	75-95
Management practices (N:P:K)	40-20-20	40-30-0	20-20-0
Yield levels (Grain - q/ha)	25-30	15-18	15-18
Yield levels (Straw - q/ha)	60-70	20-40	30-40
Reproduction aspects	Self pollination	Self pollination	Self pollination
Seed production (Isolation distance)	3m	3m	3m
Public varieties/Hybrids	lC33PR202, PS110, RAU8, KM13, PES400, VL149, VL146, GPU28, GPU45, GPU26, GPU66, GPU67, VR708, BM9-1, AKP2, Ratnagiri	SiA3085, SiA3088, SiA3156, SiA326, Lepakshi, Krishnadevaraya, PS-4, HMT100-1, Co1, Co 2, Co (1943), H1, H2 (1948), T4 (1949)	GPUK 3, RBK 155, RK 390, JK 106, JK 65, JK 98, DPS 9-1, TNAU 86, RK 390-25, PLR 1(1942), T 2 (1949), Co 1 (1953)

Minor millets - Key information

Small millet species	Proso millet	Barnyard millet	Little millet
Botanical name	*Panicum miliaceum*	*Echinochloa colona*	*Panicum Sumatrense*
Origin	Manchuria	Japan	India
Area of adaptation and crop worldwide	Well adapted to heat and drought conditions	Well adapted to heat and drought conditions	Well adapted to heat and drought conditions
Yield determining factors	1. Plant height (cm) 2. Tillers per plant 3. Seed yield per plant (g) 4. Grain yield (per plant) 5. 1000 seed weight (g)	1. Plant height (cm) 2. Tillers per plant 3. Seed yield per plant (g) 4. Grain yield (per plant) 5. 1000 seed weight (g)	1. Plant height (cm) 2. Tillers per plant 3. Seed yield per plant (g) 4. Grain yield (per plant) 5. 1000 seed weight (g)
Biotic stress	Head smut, grain smut, leaf spot	Head smut, Grain smut, Kernel smut, Leaf spot, leaf blast	Grain smut, Rust, Downy mildew, Blast

Contd..

Minor millets - Key information

Small millet species	Proso millet	Barnyard millet	Little millet
Abiotic stress	Climate change, heat and drought	Climate change, heat and drought	Climate change, heat and drought
Duration (days)	60-80	45-60	70-110
Management practices (N:P:K)	20-20-0	40-20-0	20-20-0
Yield levels (Grain - q/ha)	20-23	12-15	12-15
Yield levels (Straw - q/ha)	50-60	20-25	20-25
Reproduction aspects	Self pollination	Self pollination	Self pollination
Seed production (Isolation distance)	3m	3m	3m
Public varieties/Hybrids	TNAU 151, TNAU 164, TNAU 202, TNAU 145, CO 4 K 2, CO3, CO2, CO 1 (1954), BHAWNA, GPUP8, GPUP 21, DHP-2769	CO2, VL207, VL172, PRJ 1, VL 29, PRS 1, DHBM 93-3, T 46, T 25 (1949)	OLM 203, OLM 208, OLM 217, JK 36, DHLM 36-3, DHLM 14-1, JK 8, BL 6, BL 4, JK 36, JK 137, Phule Ekadashi

Breeding: Strategies in minor millet

Crop	Breeding methods	No. of germplasm accessions	Germplasm availability
Finger millet	Pure line selection, Bulk method, Pedigree method, Mutation breeding, Recombinant breeding, MAS	34160	▪ National Bureau of Plant Genetic Resources (NBPGR) ▪ International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) ▪ All India Coordinated Minor Millet Project (AICMMP) ▪ Kenya Agricultural Research Institute (KARI) ▪ Institute of Biodiversity Conservation (IBC) ▪ USDA Agricultural Research Service (USDA-ARS) ▪ All India Coordinated Minor Millet Project (AICMMP)-Bangalore
Foxtail millet	Pure line selection, Bulk method, Pedigree method, Mutation breeding	43580	
Kodo millet	Pure line selection, Bulk method, Pedigree method, Mutation breeding	4273	
Proso millet	Pure line selection, Pedigree method, Recombinant breeding, Mutation breeding	24014	
Barnyard millet	Pure line selection, Bulk method, Pedigree method, Mutation breeding	1134	
Little millet	Pure line selection, Bulk method, Pedigree method, Mutation breeding	1222	

Exploit Crops and Target traits for Productivity increase

Crops	Traits of focus
Kharif Sorghum	Wider adaptation, industrial end-uses, biofortification, grain mold and shoot fly resistance
Rabi sorghum	Genetic diversification, Hybrids, Terminal drought, charcoal rot resistance
Sweet and High biomass sorghum	Biofuel and forage, stem borer resistance, brown-mid rib and juice quality
Forage sorghum	High per day productivity, forage quality, shoot fly and foliar diseases
Pearl millet	Drought and heat tolerance, downy mildew and blast resistance, forage pearl millet
Small millets	• Floral biology and crossing techniques (all small millets) • Recombination and mutation breeding (all small millets) • Male sterility system (all small millets) • Blast and heat tolerance (Finger millet) • Shoot fly (Little, Proso and foxtail millet)

Future Research Thrusts

Sorghum

- Drought tolerance & resistance to grain molds and shoot fly, stay green character
- Enhancing industrial utilization for starch, feed, grain-based spirits
- Higher juice recovery, brix, longer keeping quality and fermentation to high grade ethanol
- Brown mid-rib lines with low lignin and high digestible quality
- Semi processed and ready to eat foods for urban demand and value addition
- High biomass sorghum (90 t/ha) types for paper and pulp industry

Pearl millet

- Downy mildew resistance; tolerance to drought and heat; and micronutrients (iron and zinc)
- Emphasis on dual-purpose hybrids, greater attention on hybrid development for the driest A_1 zone
- Development and promotion of green forage hybrids
- Application of biotechnology in breeding for downy mildew resistance; tolerance to drought and heat

Future Research Thrusts

Small millets

- Improvement of yield potential in finger millet
  - ✓ Hybrid technology
  - ✓ Improve biomass production and harvest index
- Development of genomic resources
  - ✓ Employ tools of comparative genomics
- Gene discovery & allele mining from Small Millet genetic Resource
  - ✓ Water and nutrients use efficiency
  - ✓ Nutritional quality
- Improvement of nutritional quality (Grain and Fodder) and bio-fortification
  - ✓ Exploit with in species variability for nutrients
  - ✓ Improve bio-availability
- Crop improvement for resistance to biotic and abiotic stresses
  - ✓ Blast disease in finger millet
  - ✓ Shoot fly in little, proso and foxtail millets
  - ✓ Tolerance to drought, temperature and salinity

Breeding : Varietal improvement of Minor millets

- Small millets are **highly self-fertilized** crops and **Pure line selection** has been primarily used to improve the performance of land races
- Contact, hot water and gametocide methods have been used in hybridization
- The smallness of the spikelets and their delicate nature have been hindering hand emasculation
- The discovery of male sterility in foxtail millet in China for the improvement of this crop

Objectives

- The goal is to improve the grain yield including maximization of biomass and the harvest index
- Genotypes need to be tailored for maturity-early, mid-late and late, depending on the location
- Exploit the rich source of minerals available in different minor millets

Breeding methods

- **Intravarietal improvement:** Mass selection, Pure line selection, Pedigree method
- **Intervarietal improvement:** Natural hybridization
- **Mutation breeding** – For selection of desirable plants

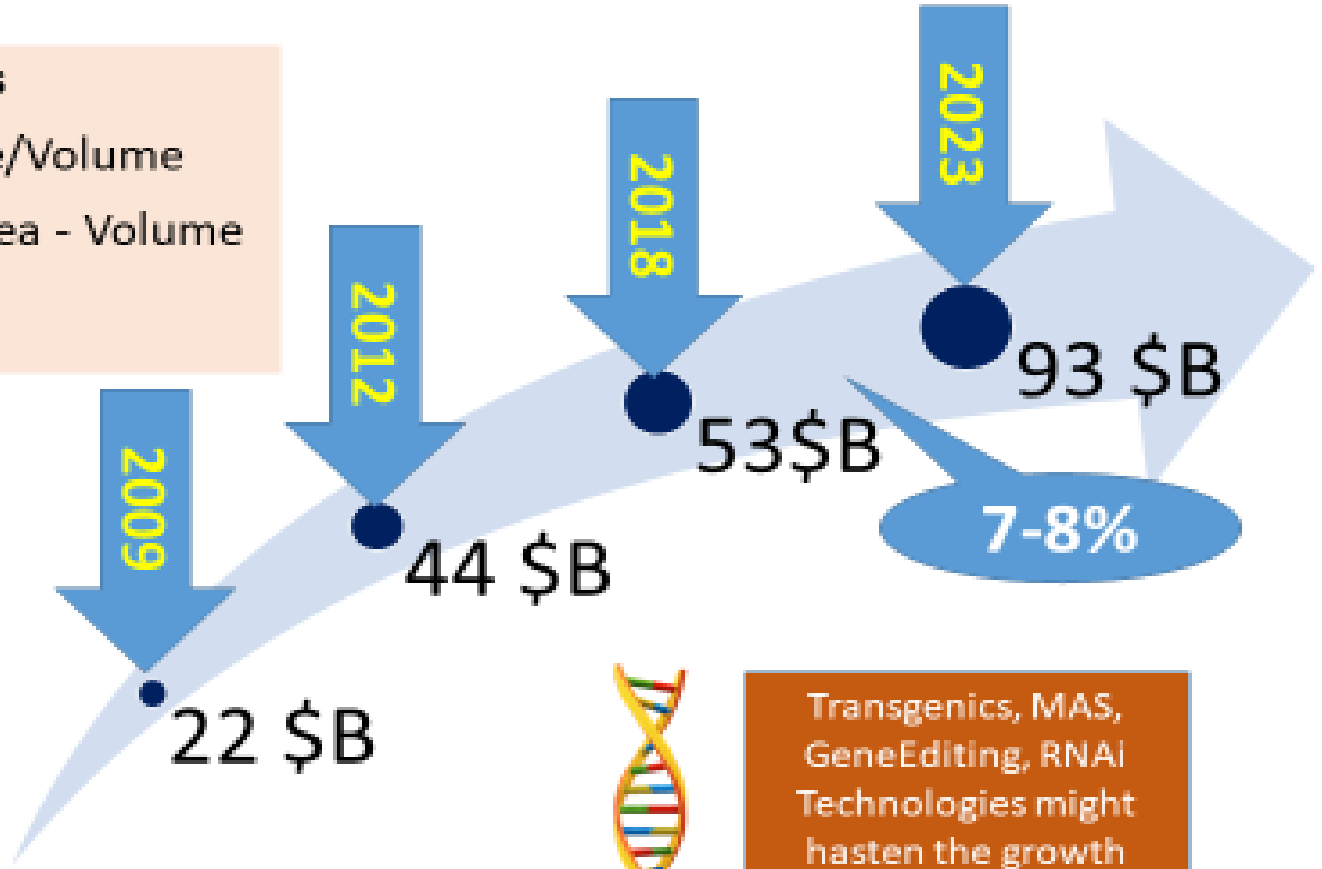
Global Seed market Growth – 7-8%

Growth - Territories

Indo- Pacific – Value/Volume

Africa- Increased area - Volume

USA/China- Value



Transgenics, MAS, GeneEditing, RNAi Technologies might hasten the growth much faster than expected by value

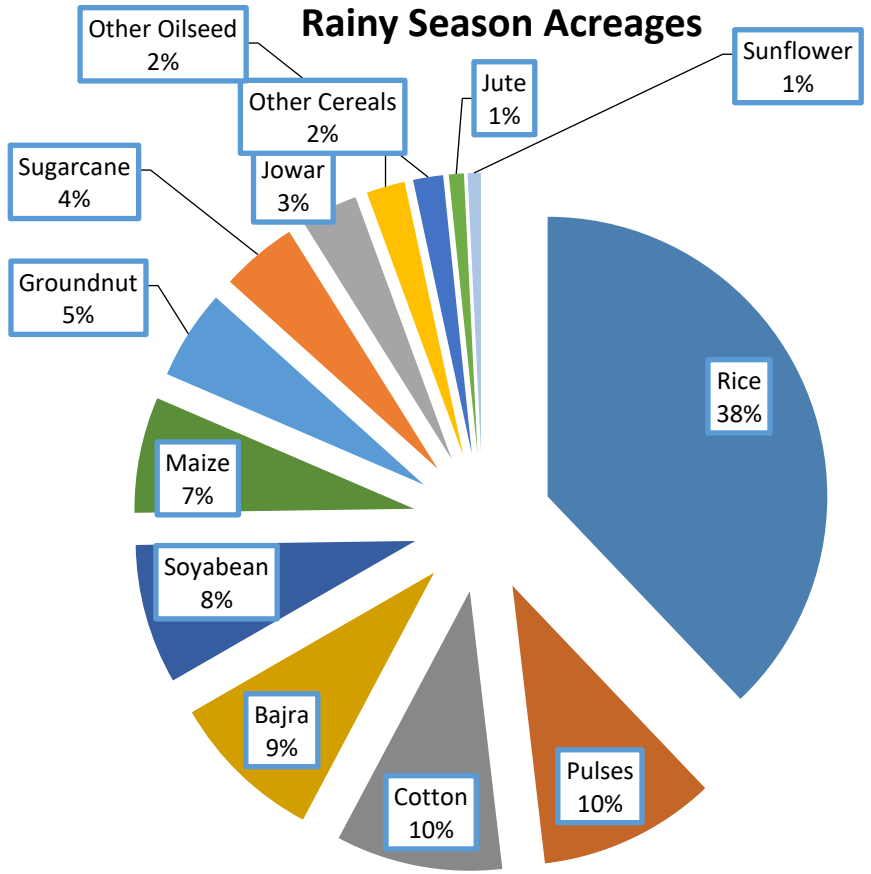
USA
China
=50%

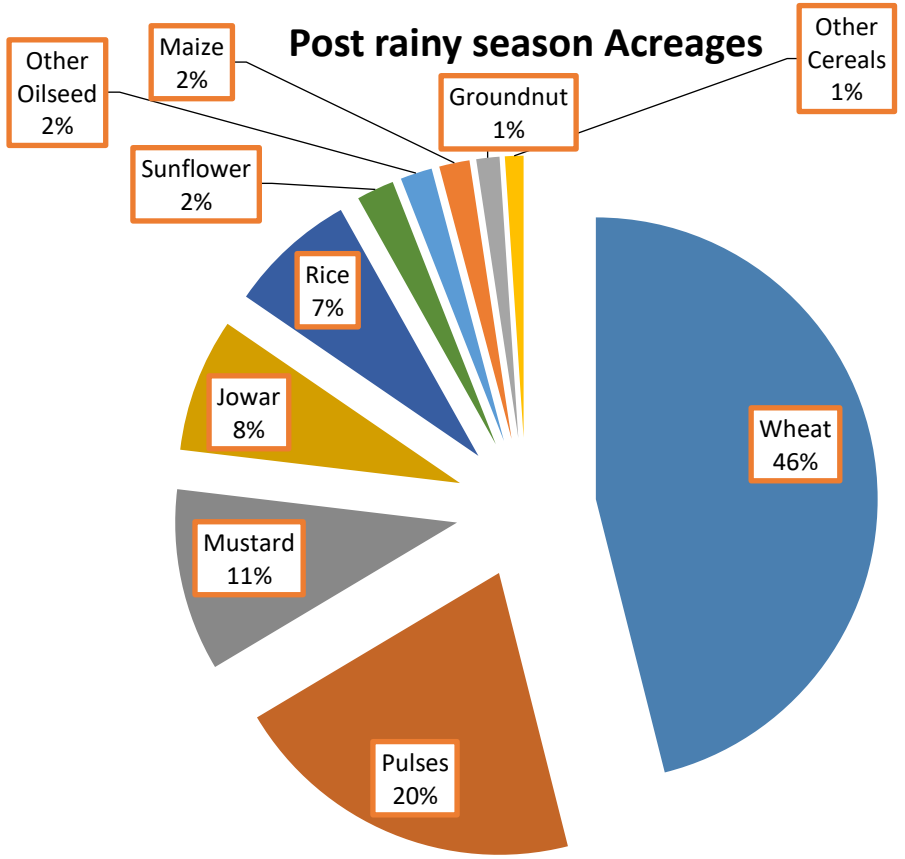
France
Brazil
India
Canada
25%

Others
25%

INDIA RABI & KHARIF ACREAGES

(Except 8 Million hectare area under vegetables)

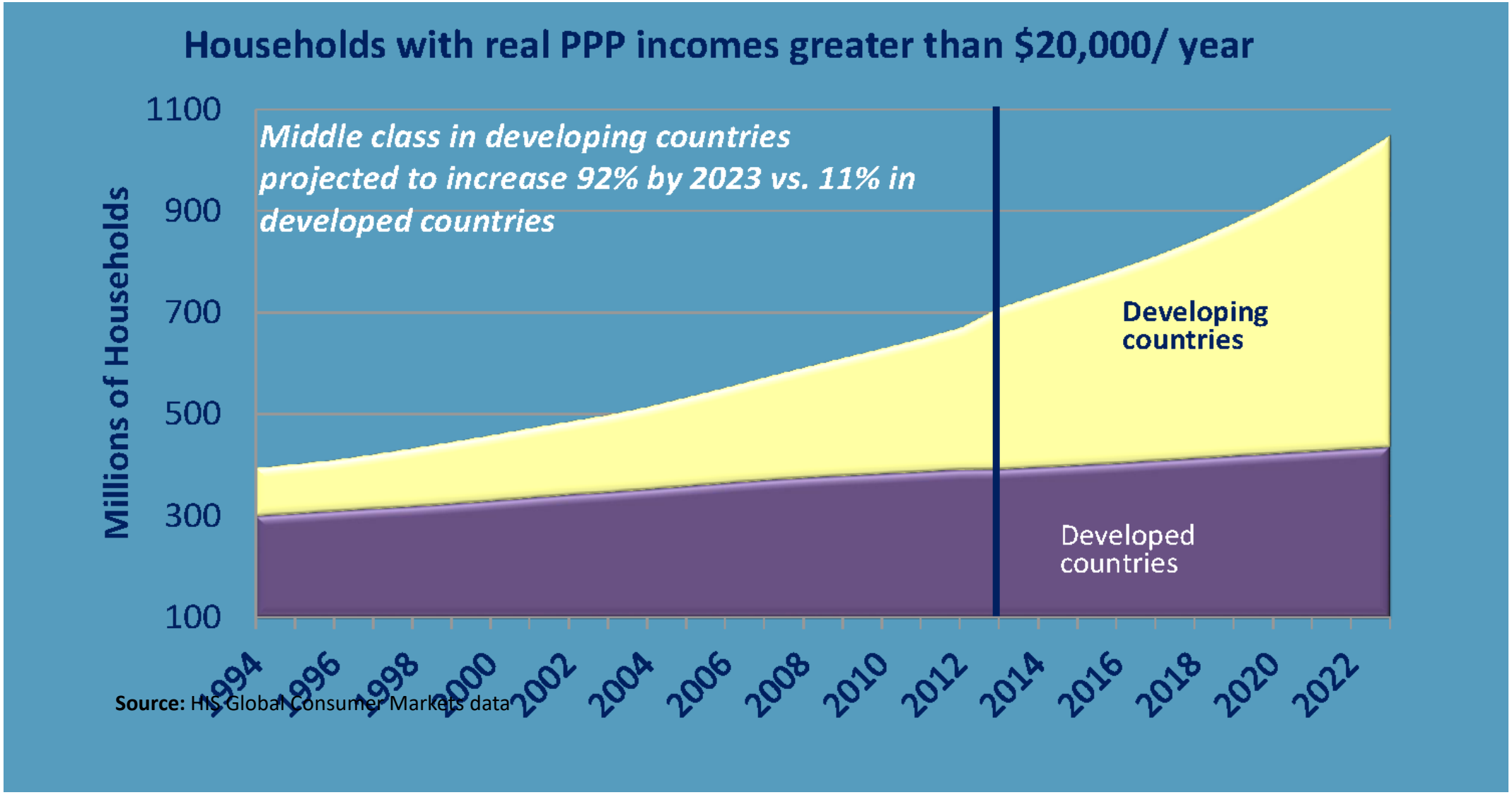




Total Acreages 106 Million Hectare
Food Grain accounts for 61% Area,
OPVs are dominating in this area.

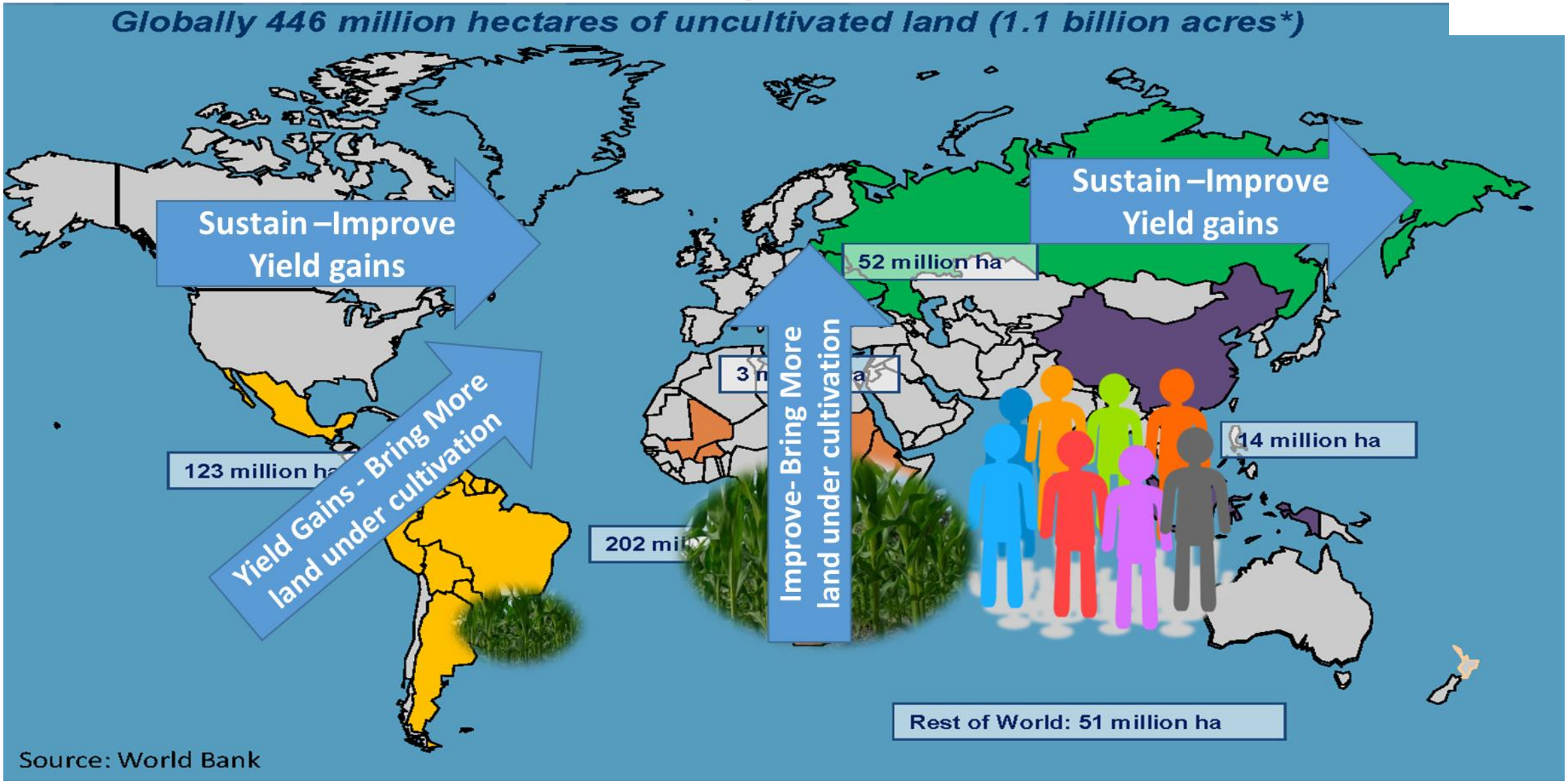
Total Acreages 60 Million Hectare
Food Grain accounts for 58% Area
40 Mn Hectare = No irrigation.

Global 'Middle Class' is Expected to Exceed 1 Billion Households by 2025



Source: HIS Global Consumer Markets data

Potential Availability of Uncultivated Land



Global Seed Market - Growing Demand

- Increased food demand in Indo-Pacific nations
- Increased income to be spent on more protein and fat foods
- Developing countries noticing rapid increase in middle income groups demand agriculture products more than their production
- Per capita consumption of vegetables will increase with enhanced middle income group population
- Growth in India, China and Indonesia are going to be significant
- Hybrid corn, soybean, rice, cotton, canola, soybean, vegetable seeds demand will see spurge in the demand
- Addressing biotic and abiotic stresses with modern technologies will bring new dimensions

Millet grain commodities- Production and Estimated trade value (Mean of 2020-21 & 21-22)

Commodity	Avg price Rs. per Kg (current procurement price)	India mean production 2020-21 & 2021-22 ('000 ton)	Total value Rs. In crores	Price source
Pearl Millet grain	28.49	10042	286097	Selina Wamucii , 2023
Sorghum grain	33.17	4578	151852	Selina Wamucii , 2023
Ragi grain	25.07	1832	45928	Commodity insights
Small millets grain	37.00	338	12506	Commodity insights
Total		16790	496383	

World area, production and seed production requirements of millet crops

Millet crop	No. of countries growing millets	Mean of 5 years (2016-2020)			seed required ('000 ton)*	Area required for seed production ('000 ha)*
		World area (million ha)	World production (million ton)	Yield (kg/ha)		
Sorghum	102	41.842	62.319	1489	334.739	167.369
Pearl millet	32	28.537	24.049	843	142.687	71.343
Proso millet	28	0.745	1.076	1444	3.725	2.483
Finger millet	7	0.932	1.636	1755	4.659	3.106
Foxtail millet	3	0.987	2.361	2393	4.933	3.289
Barnyard millet	1	0.0003	0.0002	839	0.001	0.001
Countries with more than one millet (other than sorghum)						
Pearl +finger millet	4	0.263	0.111	423	1.315	0.877
Pearl + Proso millet	2	0.037	0.041	1107	0.183	0.122
Proso + Foxtail millet	1	0.011	0.011	1009	0.053	0.035
Total	117	73.354	91.603	1249	492.296	248.626

* As per recommended rates in India

** Assuming seed yield of 2 ton/ha in sorghum and pearl millet; 1.5 ton/ha in other millets

Millet Exports

- India traditionally export millets in commodity form
- World over sorghum and other millets are used for feed purposes except in India, SE Asia, and Africa.
- However, in the changed context, the millets exports are emerging in terms of diversified food uses.
- India is the largest research hub of Millets in the world with extensive product diversification
- India is the world's leader in the production of millets with a share of around 15% of the world total production i. e around 15 Million tonnes annually. India is the second-largest exporter of millets.

Millet Exports

1. As per the Market Intelligence report (Global Millets Market, 2027), millets market is expected to grow over $14 Bn at a CAGR of 4.6% during 2019-2027.
2. It was revealed that increasing demand for Organic foods and Gluten-free foods are the two main pushing factors for the global millets market.
3. Besides, the consumers are becoming more conscious of the chemicals used in farming and thus the share of Organic millets is expected to grow over 29.7% at a CAGR of 5.6%.
4. With regard to the markets, **Asia Pacific is the dominant market with 40.9% market share followed by the Middle East and Europe with 32.0% and 14.1% market share respectively.**

- **Asia Pacific Markets (APAC):**

  Millets market is expected to grow from US$ 3851 Mn in 2018 to US$ 5653 Mn by 2027 at a CAGR of 4.4%, while organic market (CAGR of 3.9%) is expected to grow faster than the regular market (CAGR 3.0%). India is the dominant market with 41.0% market share in Asia Pacific Markets, and holding the biggest market share with 16% of total world market. In APAC, China 21.1%, Japan 11.0%, South Korea 6.9%, Australia 5.9% and Others 14% are following the India.

- **Middle East and Africa Markets:**

  Millets market is expected to grow from US$ 3015 Mn in 2018 to US$ 4559 Mn by 2027 at a CAGR of 4.7% while, the organic foods market is expected to grow at a CAGR of 5.3% and regular market at 4.5%. Niger is the single most dominant market with 45.1% market share followed by UAE 14.0%, Saudi Arabia 9.9% and Others 31.1%. Unlike APCA markets, other parts of MEA are also expected to grow at higher CAGR.

- **European Markets:** The western part of Europe is known for its better standards of living, with people displaying a higher income level, growing urbanization, and rising demand for health beneficiary products. Millets market is expected to grow from US$ 1323 Mn in 2018 to US$ 2132 Mn by 2027 at a CAGR of 5.4%. In the Europe markets, the Organic food are expected to grow at a CAGR of 6.1% which is higher than other markets, while the regular market also expected to grow at 5.2%. Alike APAC market, Europe market is well distributed over 5 countries such as Russia (26.1%), Germany (18.2%, France (14.9%), UK (11.0%), Italy (8.8%) and others (21%0.). Europe markets have shown strong growth projections compared to both APAC and MEA markets. Unlike APCA markets, all other parts of Europe are also expected to grow at higher CAGR.

- **North American Markets:** Several domestic and multinational companies already have a strong foothold in the North American countries like the U.S. and Canada. Millets market is expected to grow from US$ 842 Mn in 2018 to US$ 1192 Mn by 2027 at a CAGR of 4.0%. USA is the single most dominant market with 81.0% followed by Mexico (12.1%) and Canada (7.0%). Markets have shown strong growth projections, while the bakery, breakfast and infant food markets are expected to grow at a higher CAGR.

- **South and Central American Region Markets:** Millets market is expected to grow from US$ 371 Mn in 2018 to US$ 491 Mn by 2027 at a CAGR of 3.2%. In this market, the Organic food are expected to grow at a CAGR of 3.8% which is lower than APAC, MEA, Europe and North America markets, while the regular market also expected to grow at 2.9%. Argentina is dominant market with 19.1% followed by Brazil (8.9%) and others (71.9%). Markets have shown poor growth projections compared other markets.

Existing Market

Country	2017-18		2018-19		2019-20		Market
	Qty in MT	US$ Mill	Qty in MT	US$ Mill	Qty in MT	US$ Mill	
Nepal	12836.1	3.6	15580.5	4.0	15936.4	4.3	Asia
Saudi Arabia	9045.1	2.4	7689.0	2.0	10554.5	3.7	Asia
Pakistan	3979.2	2.5	6942.3	4.7	4320.4	3.5	Asia
U Arab Emeritus	14898.3	4.0	13990.6	3.9	8407.7	3.1	Asia
Tunisia	5552.0	1.7	6618.0	2.1	5216.0	1.8	Africa
Sri Lanka	3540.1	1.7	3580.2	1.5	3971.0	1.6	Asia
Yemen	8688.0	2.2	7053.0	1.9	4301.0	1.4	Asia
Libya	3347.0	1.0	4246.0	1.5	3283.0	1.3	Africa
Namibia	3850.0	1.0	1156.0	0.3	3952.6	1.3	Africa
Morocco	3329.0	0.8	1759.0	0.5	2652.0	0.9	Africa
Top 10 Total	69064.9	20.9	68614.6	22.3	62594.6	22.9	
Other Countries	12370.6	4.2	14045.3	5.3	12406.2	5.6	
World	81435.5	25.1	82659.9	27.5	75000.8	28.5	
Source: DGCIS							

Potential Countries

Top Importing Countries in the World (Value in US Dollar millions)				
Importers	Year- 2017	Year- 2018	Year- 2019	Market
Japan	39.37	38.28	35.31	Asia
Indonesia	13.47	18.61	34.12	Asia
Germany	16.02	16.48	17.17	Europe
Belgium	11.27	11.26	14.87	Europe
Netherlands	9.57	11.99	14.24	Europe
Italy	11.67	9.93	11.76	Europe
United Kingdom	7.73	9.28	10.12	Europe
Poland	5.1	8.47	9.90	Europe
China	.03	6.96	9.86	Asia
Korea, Republic of	9.40	9.60	9.34	Asia
Top 10 Total	123.63	140.87	166.68	
Other Countries	96.18	71.88	95.50	
World	219.81	212.75	262.19	
Source: ITC Trade Map				

Export Market Trends

- As in the Indian scenario, there are potential emerging trends such as gluten-free, weight management, health and wellness foods, etc.
- There are around 14 emerging food trends, and to capture these opportunities, export markets can be mapped in relevance to those food trends and a strategic export promotion can be undertaken to link with startups domestically.
- Besides the trends related to food forms, the market share of organic millets grown naturally without any chemical is US$ 2644 Mn in 2018 i.e. 28.1% of total millets market, and expected to grow to US$ 4160 Mn by 2027 at a CAGR of 5.2% compared to 4.3% that of regular millets (GMM, 2027).
- The global millets market by application is segmented into infant food, bakery food, breakfast food, beverages, livestock feed, biofuel, syrup, fodder, starch, potable alchohol etc.. The breakfast foods is dominant trend with 32.1% market share followed by bakery foods (16.9%), beverages (16.9%), fodder (14%), infant foods (11.1%) and other (9.0%).

TOTAL VALUE OF MILLETS IN INDIA

- Total Production 16.00 MT
- Total Value of Exports - Rs 228 Millions
- Total Value of Domestic Consumption-Rs 88140 Cr
- Total Value of Value addition of Millets Rs 3966.3 Cr
- Total Value Rs 127826 Cr

Projected increase in production of millets

Area in '000 Ha Production in '000 tonnes		2022	2030	2040	2050
Component					
Waste Lands (Projected)		12111.28	12051.14	11991.31	11931.77
Total Fallows (Projected)		24391.35	24270.25	24149.74	24029.84
Total of Waste and Fallow lands		36502.63	36321.39	36141.05	35961.61
Total addition under millets		5% of total lands	10% of total lands	20% of total lands	30% of total lands
		1825.132	3632.139	7228.21	10788.48
Millets wise share	Sorghum	739.7276	1472.109	2929.601	4372.582
	Pearl Millet	867.7317	1726.847	3436.545	5129.224
	Finger Millet	138.5573	275.7387	548.7392	819.022
	Small Millets	79.11494	157.4443	313.325	467.654
Target Yield level (Kg. / Ha)	Sorghum	900	950	1000	1050
	Pearl Millet	1275	1300	1350	1400
	Finger Millet	1750	1775	1800	1850
	Small Millets	750	775	800	820
Additional output	Sorghum	665.7548	1398.504	2929.601	4591.211
	Pearl Millet	1106.358	2244.901	4639.336	7180.913
	Finger Millet	242.4753	489.4362	987.7306	1515.191
	Small Millets	59.3362	122.0193	250.66	383.4763
	Total	2073.924	4254.86	8807.327	13670.79

Sorghum- Great Millet (*Sorghum bicolor*)

Pearl Millet *(Pennisetum typhoides)*

Finger Millet *(Eleusine coracana)*

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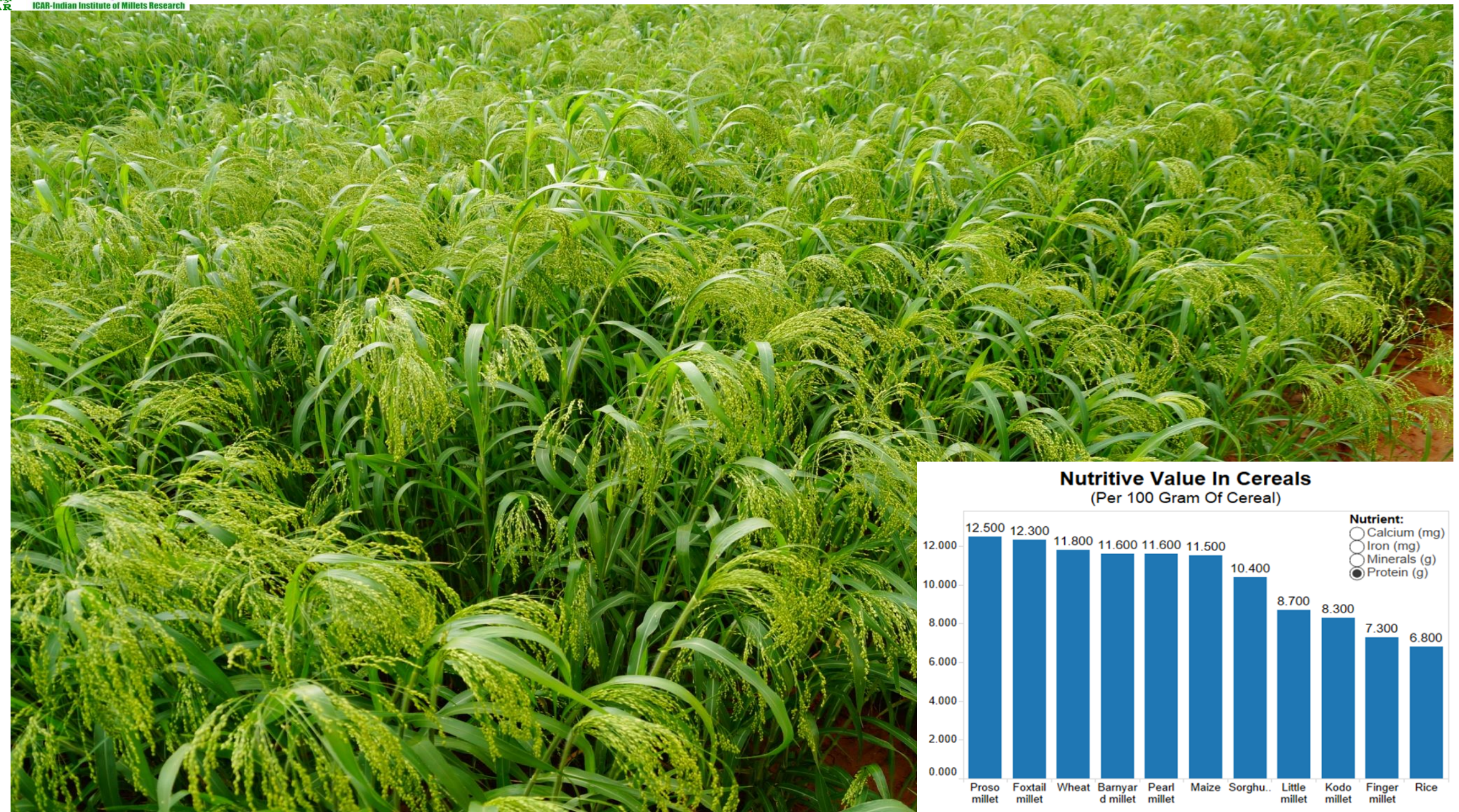
Barnyard Millet *(Echinochloa frumentacea)*

Proso Millet



Foxtail Millet *(Setaria italica)*

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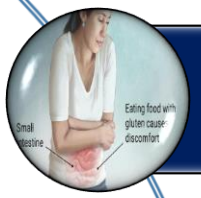
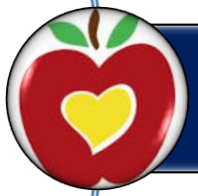
Health benefits of Millets



Celiac disease: Millets are gluten free grains hence, used for celiac disease patients.

Anti-diabetic properties: Millets consumption lowers blood glucose response and glycosilated hemoglobin thus, rendering low glycaemic index; helps in reducing the risk of *diabetes mellitus*



Reduction of oxidative stress: Free radicals, are removed by the phenolic compounds present in millet grains which reduces oxidative stress.

Anti-cancer properties: Millet extracts have anti-prolific effects on cancer cell line, inhibit DNA damage and induce the production of phase-2 detoxifying enzymes.

Anti-hypertensive: Millets prevent the oxidation of low density lipoproteins reducing lipase activity which reduces the occurrence of hypertension.

Health benefits of Millets contd..

Obesity: Intake of high dietary fibre (present in millets),hunger satisfaction and increases satiety decreases incidence of obesity.

Coronary Heart Disease (CHD): Regular consumption of whole millet grains (40 g/day) reduces the risk of CVD and thus reduces the risk of CHD by 20%.

Beneficial in treating stomach ulcers and gall stones: Millet consumption turns the stomach alkaline and prevents the formation of stomach ulcers or reduces the effect of ulcers.

For Anemia control: Finger millet is a very good source of natural Iron. Its consumption helps in conditions of anemia. It helps in keeping malnutrition, degenerative diseases, liver disorders and asthma at bay.

Beneficial in preventing allergic reactions: Pearl millet especially has a very low probability of causing allergic reactions, due to the hypo-allergic property;

Nutritional composition in comparison to rice and wheat

Grain (Millet /Cereal)	Carbo-hydrates (g)	Protein (g)	Fat (g)	Energy (Kcal)	Dietary Fibre (g)	Ca (mg)	Mg (mg)	Zn (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Folic acid (µg)
Sorghum	67.7	10.0	1.7	334.1	10.2	27.6	133.0	2.0	4.0	0.4	0.1	2.1	39.4
Pearl Millet	61.8	11.0	5.4	348.0	11.5	27.4	124.0	2.8	6.4	0.3	0.2	0.9	36.1
Finger millet	66.8	7.2	1.9	320.7	11.2	364.0	146.0	2.5	4.6	0.4	0.2	1.3	34.7
Kodo millet	66.2	8.9	2.6	331.7	6.4	15.3	122.0	1.7	2.3	0.3	0.2	1.5	39.5
Proso millet*	70.4	12.5	1.1	341.1	-	14.0	153.0	1.4	0.8	0.4	0.3	4.5	-
Foxtail millet*	60.1	12.3	4.3	331.0	-	31.0	81.0	2.4	2.8	0.6	0.1	3.2	15.0
Little millet	65.6	10.1	3.9	346.3	7.7	16.1	91.4	1.8	1.3	0.3	0.1	1.3	36.2
Barnyard millet*	65.6	6.2	2.2	307.1	-	20.0	82.0	3.0	5.0	0.3	0.1	4.2	-
Wheat	64.7	10.6	1.5	321.9	11.2	39.4	125.0	2.9	4.0	0.5	0.2	2.7	30.1
Rice	78.2	7.9	0.5	356.4	2.8	7.5	19.3	1.2	0.7	0.1	0.1	1.7	9.3

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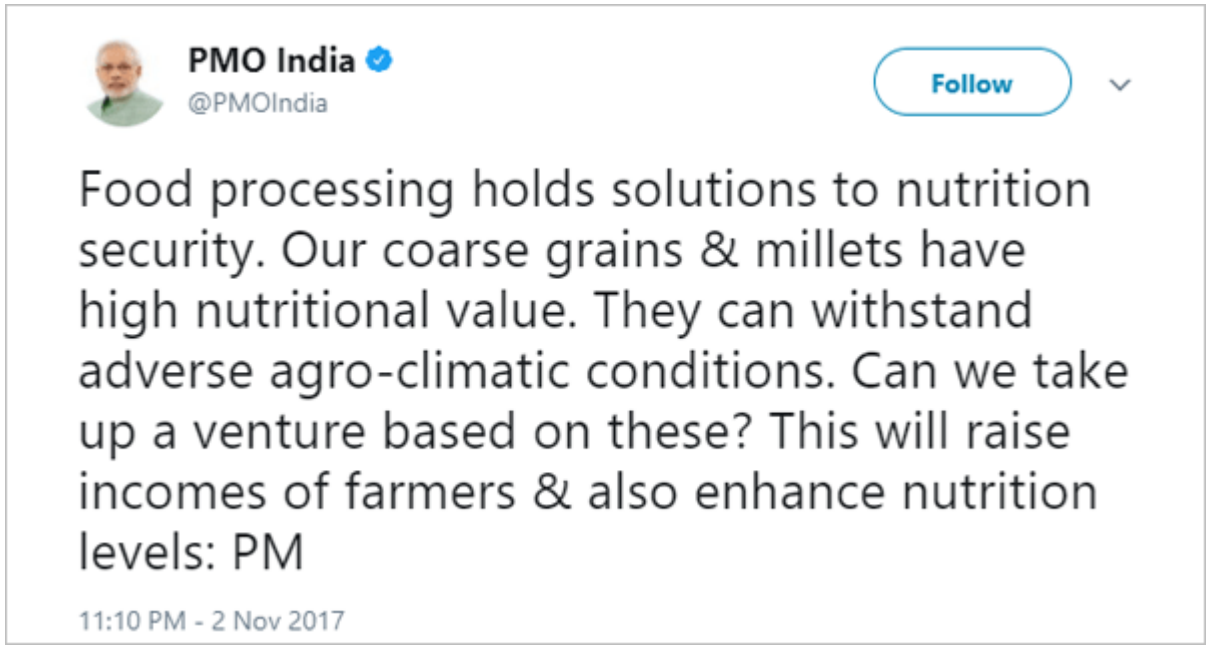
COVER STORY

MAKING THE MILLET MIGHTY

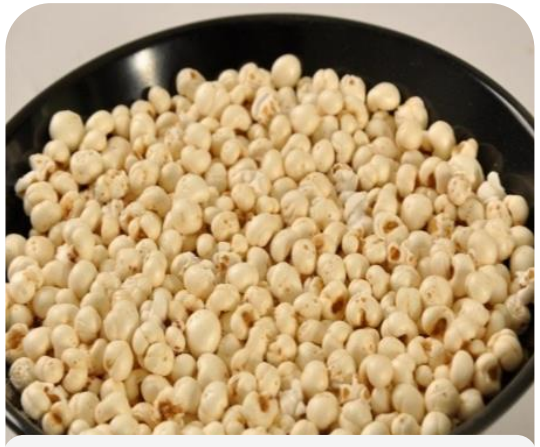
This is a gadhe, a traditional storage unit for grains that ensured food security even during the worst calamities. Now, you'll find very few of them. To bring back the culture and knowledge associated with growing such grains, Millet Bank is open and functional now

P8-9

Hon'ble Prime Minister highlights the importance of millets



Millet Processing Technologies



Puffing Technology

Flaking Technology

Baking Technology

Cold Extrusion Technology

Hot Extrusion Technology

Fortified Foods Technology

Instant Mixes Technology

Recipes

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EAT MILLETS- STAY HEALTHY

Millets for Food & Nutrition Security

पोषण सुरक्षा हेतु पोशक अनाज
स्वाद भी और स्वास्थ्य भी

THANK YOU

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