Enhancing Rapeseed-Mustard Production and Productivity

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RM Crop Profile

- Globally , India ranks 3rd in area (contributing 20.2%)
- 3rd in production after Canada and China (contributing 10.7%)
- In India, contribute 22.4 % to acreage and 22.6 % to oilseeds production.

Indian Agriculture Industry

Growing Population

Expected to grow from 1.1 bn in 2009 to 1.9 bn by 2050

Source: UN Population Division (2005)

Rapid Industrialisation

0.33 ha	0.14 ha	0.05 ha
1951	2001	2035

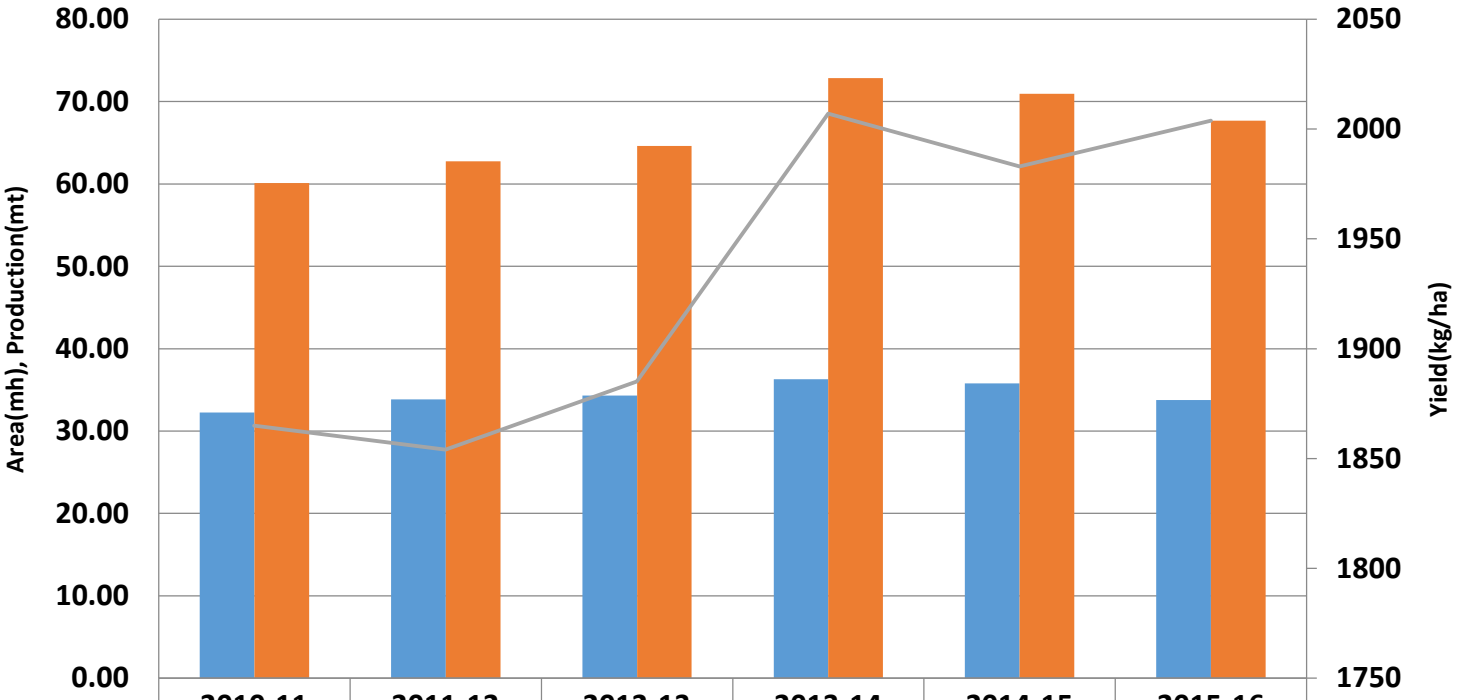
Source: Union Agriculture Ministry (2006)

Fuels

Oilseed Scenario: Future Projection

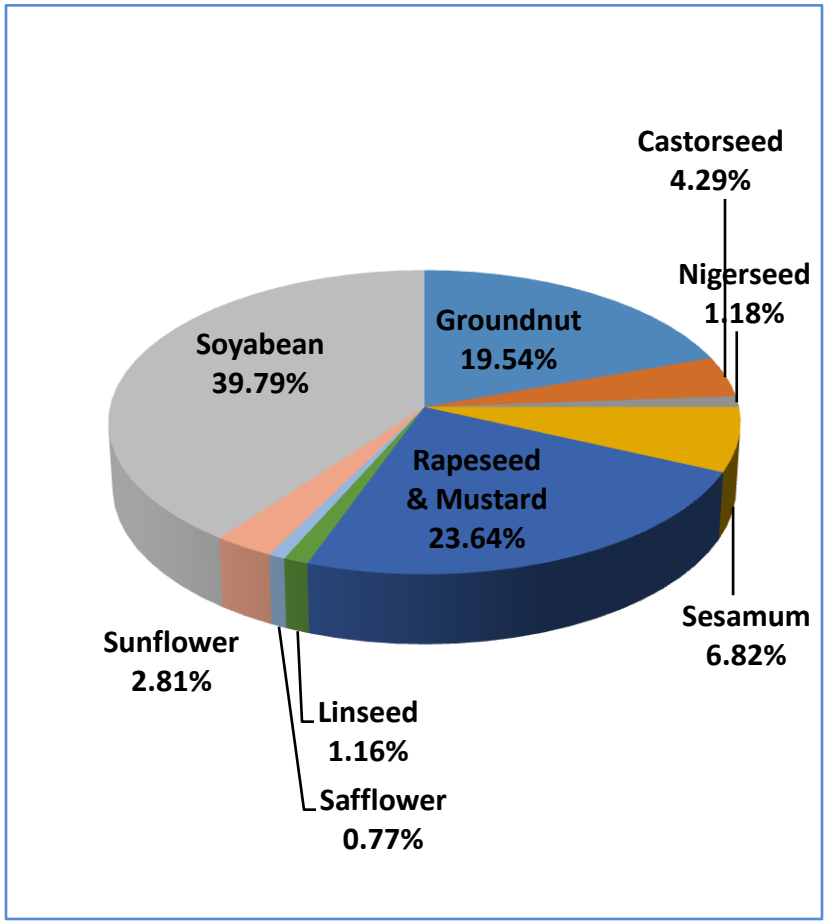
	2015	2020
Per capita consumption (kg/per annum)	14.57	16.38
Vegetable oils (mt)	18.3	21.8
Oilseeds (mt)	55.5	66.0
Annual oilseeds (mt)	44.4	55.0
Rapeseed- Mustard (20%) mt	8.88	11.0
(25%) mt	11.1	13.8
Expected area (m ha)	7.0	7.5
Productivity (kg/ha)	1270-1570	1470-1840

Rapeseed-Mustard area and production trends in world

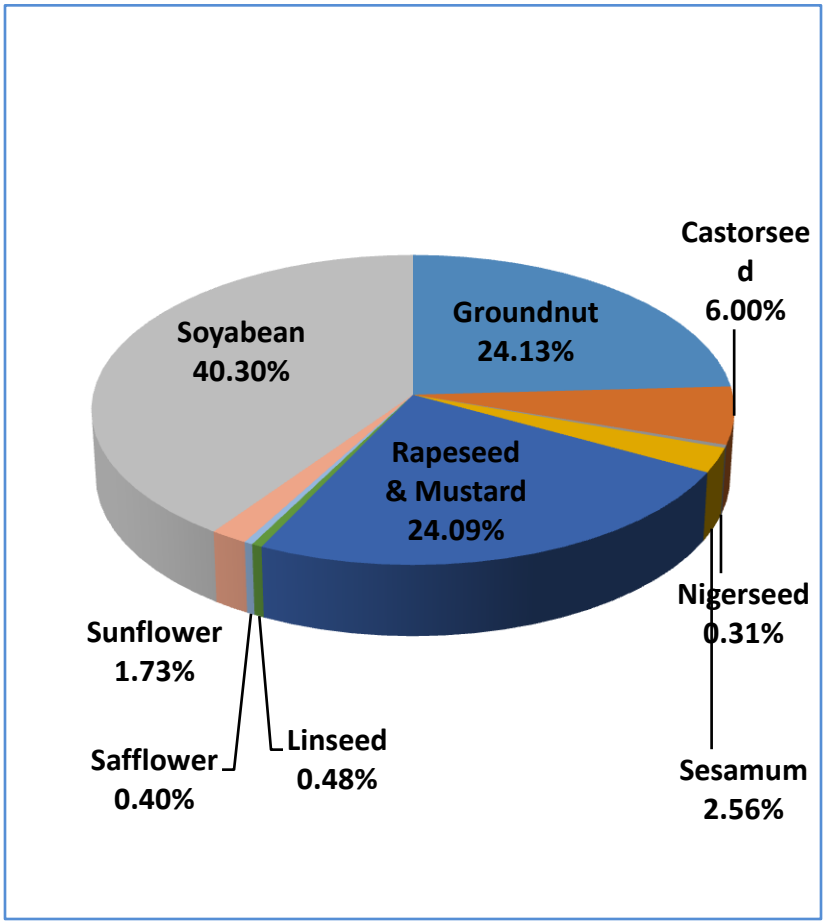


	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Area(mha)	32.23	33.84	34.29	36.30	35.79	33.78
Production (mt)	60.09	62.73	64.63	72.84	70.95	67.678
Yield(kg/ha)	1865	1854	1885	2007	1983	2004

Contribution of rapeseed-mustard to India's total oilseed (2014-15)

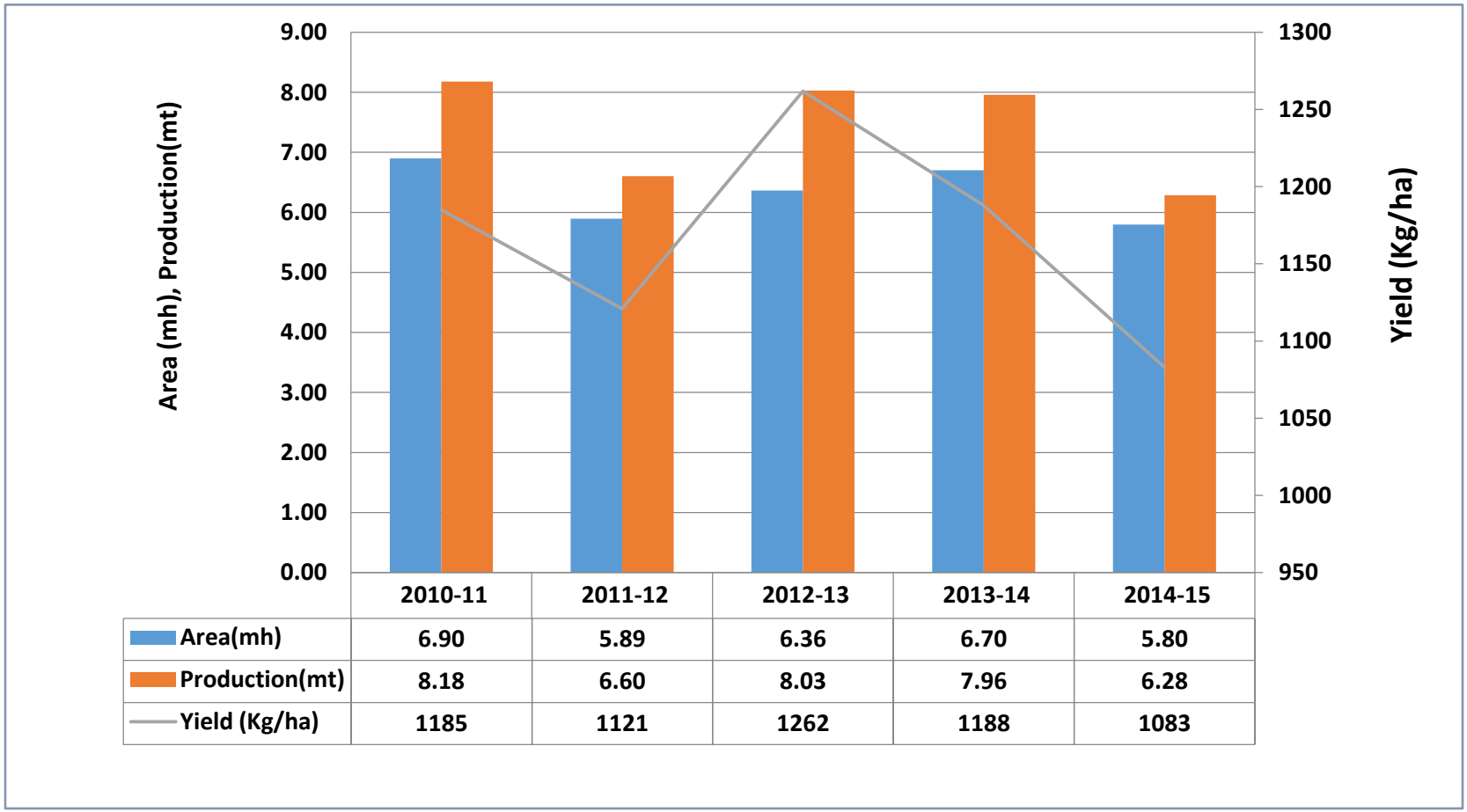


Area



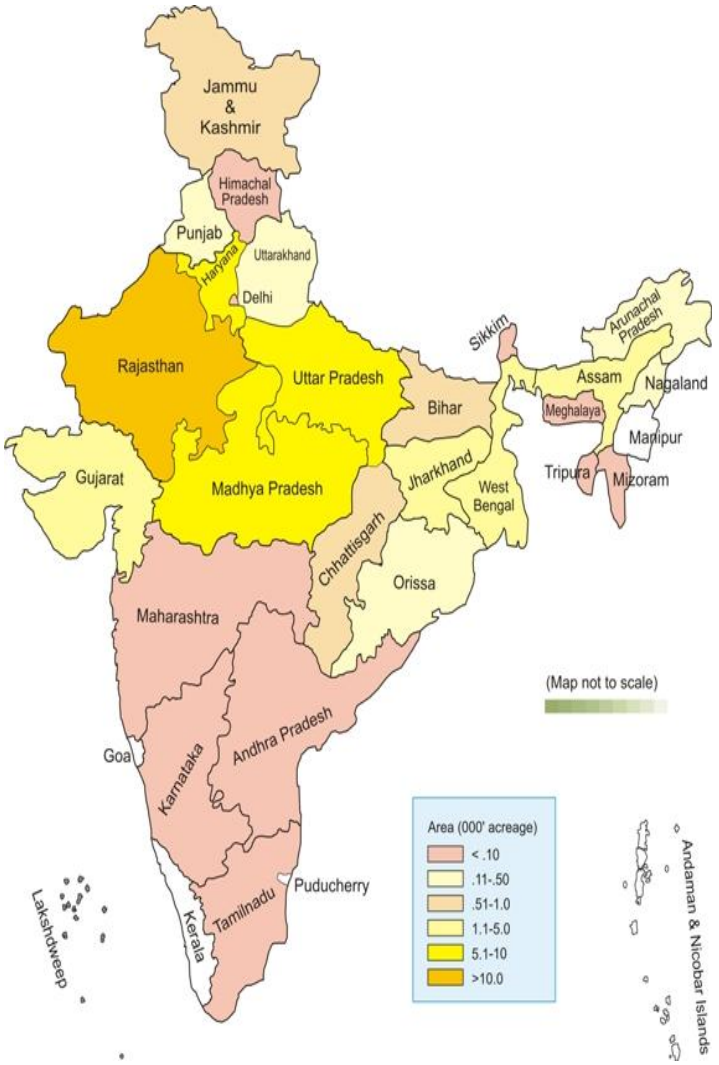
Production

Rapeseed-Mustard production trends in India



	2010-11	2011-12	2012-13	2013-14	2014-15
Area(mh)	6.90	5.89	6.36	6.70	5.80
Production(mt)	8.18	6.60	8.03	7.96	6.28
Yield (Kg/ha)	1185	1121	1262	1188	1083

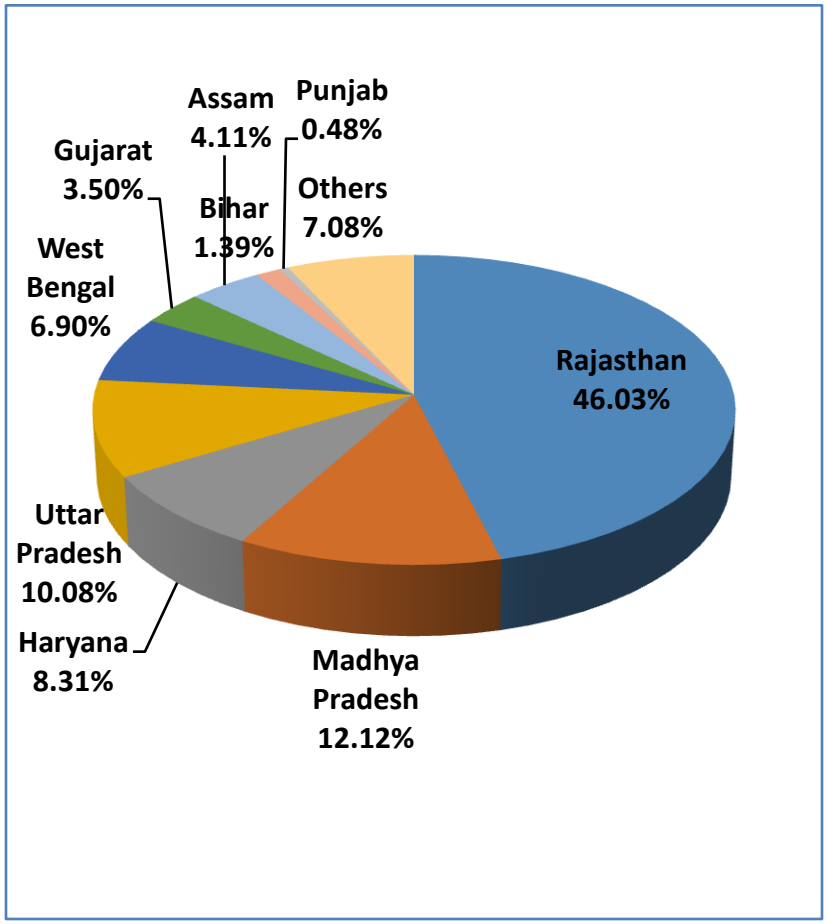
Major States and their contribution in RM area and production in India 2013-14



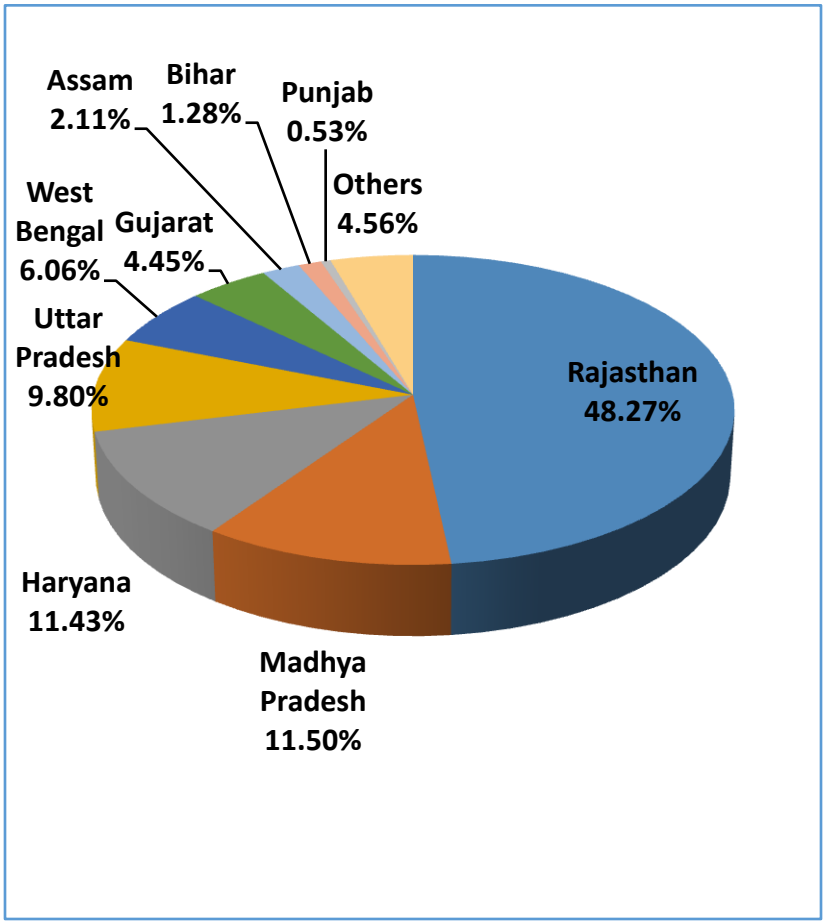
	Area ('000 Ha)	Prod ('000T)	Yield (kg/Ha	%of All India Area	%of All India Prod
Rajasthan	3080	3830	1244	46.0	48.1
Madhya Pradesh	810	900	1111	12.1	11.3
Haryana	540	880	1630	8.1	11.1
Uttar Pradesh	660	770	1167	9.9	9.7
West Bengal	459.5	489.9	1066	6.9	6.2
Gujarat	279.6	349.8	1251	4.2	4.4
Assam	260	150	577	3.9	1.9
Bihar	89.9	100.4	1117	1.3	1.3
Punjab	30	40	1333	0.4	0.5
Others	491	449.9	916	7.3	5.7
All India	6700	7960	1188		

Contribution of major states

average (2009-10 to 2015-16)



Area



Production

Rapeseed-mustard ???

- Adaptability to irrigated and rainfed areas
- Suitability for sole and mixed cropping
- Relatively salt tolerant
- Higher return with low cost of production
- Low water requirement
- About 35-46 % oil in the seed
- Saturated fatty acid lowest

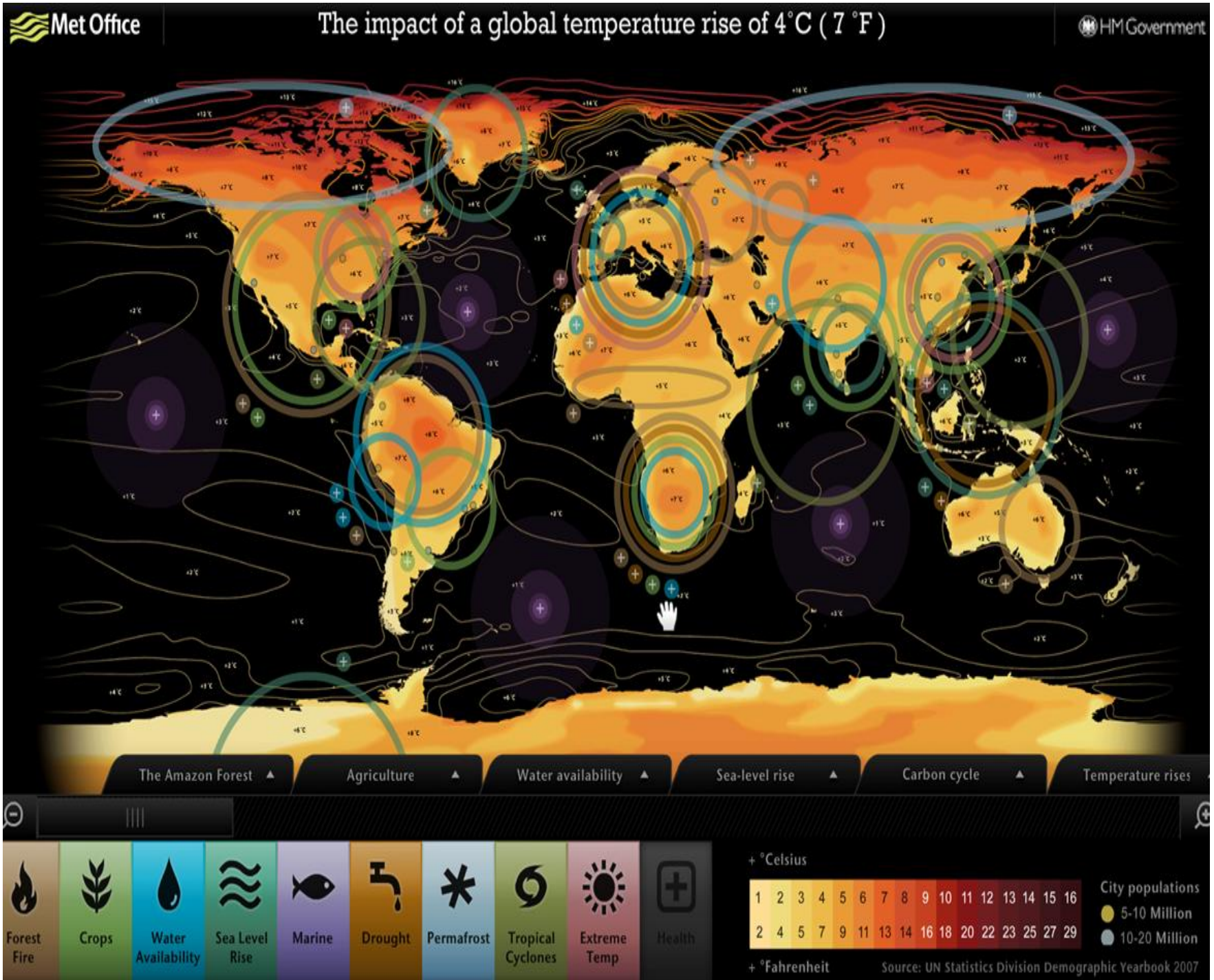
1. Seed meal has high content (36-38%) & quality of protein

Constraints in Mustard Production

- Complex existing and emerging disease and pest scenario
- Soil deficiency for nutrients and built-up of soil borne pathogens, abiotic stresses and *Orobanche* inscidence.
- Large cultivation under resource constrained conditions
- Climate change (high temperature) Uncertainty of acreage due to climatic, biological, natural resources, policy decisions (MSP)
- Erratic rainfall in September
- Poor quality of ground water in major growing tracts
- Insufficient networking among various stakeholders and multiplicities in technology dissemination
- Real term stagnation in support price in comparison to competing wheat crop.

Future challenges

- Increase in R-M production among resource-poor farmers without exacerbating environmental problems
- and simultaneously coping with climate change (adaptation).


Met Office
The impact of a global temperature rise of 4°C (7 °F)
HM Government
The Amazon Forest
Agriculture
Water availability
Sea-level rise
Carbon cycle
Temperature rises
Forest Fire
Crops
Water Availability
Sea Level Rise
Marine
Drought
Permafrost
Tropical Cyclones
Extreme Temp
Health
+ °Celsius
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
2 4 5 7 9 11 13 14 16 18 20 22 23 25 27 29
+ °Fahrenheit
City populations
5-10 Million
10-20 Million
Source: UN Statistics Division Demographic Yearbook 2007

Climate-smart Agriculture

Agriculture that sustainably:

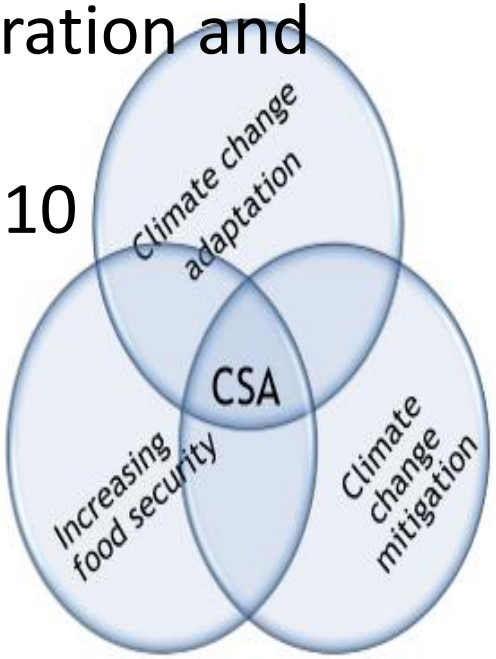
- increases productivity
- increases resilience (adaptation
- reduces/removes GHGs

AND

- enhances achievement of national food security and development goals

Climate Smart Agriculture-Concept

Climate smart agriculture is defined as an approach that " Sustainably increase productivity, enhance resilience (adaptation), reduces GHGs (mitigation), carbon sequestration and increases food security and development goals" FAO, 2010



Contribution to productivity

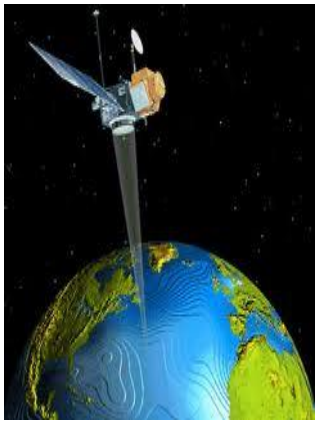
CSA technologies should improve resource use efficiency/ and higher productivity and yields.

Crop varieties that are drought tolerant, improved cropping systems.

Contributing to adaptation

Any agricultural practice that reduces exposure, sensitivity or vulnerability to climate variability or change in climate.
These practices enhance farmer's ability to cope with extreme weather events
Example: Shifting showing window, zero tillage, residue retention, weather forecasting.

Date of Sowing	Yield (kg/ha)	% decrease over 15th October sown Crop
15th October	2127	-
30th October	1775	16.6
15th November	1267	40.4
30th November	980	53.9



Contributing to mitigation

CSA technologies have a greater capacity to sequester carbon from atmosphere

Examples- Improved soil management, green manuring, land leveling, improved machines

Climate-resilient technologies

Varieties suited to different agro-climatic zones
Resistant to drought, salinity, waterlogged conditions
Farmer participatory research/field trials
Training and out scaling technologies
Investment and policy support.

Intensification of Brassica production system

More crops per year suitable to agro-climatic situations
Incorporation of legumes in the cropping systems
More time soil surface covering

Benefits for food production, adaptation and mitigation

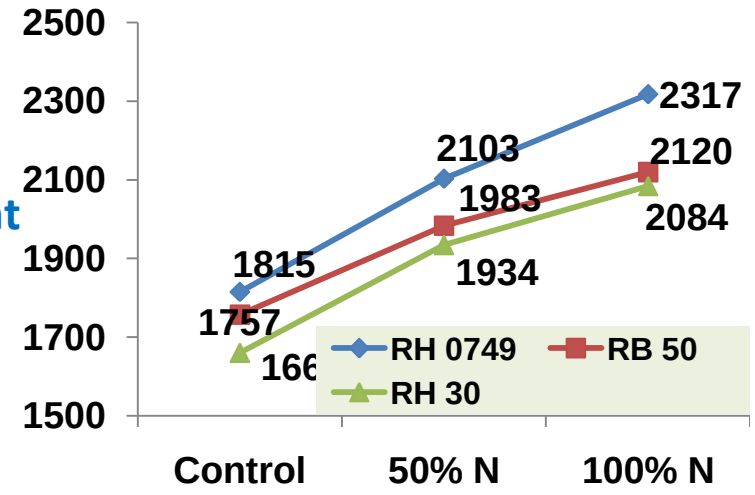
- **Food production:**
  - ✓ additional two million tonnes of R-M per year.
  - ✓ improved food security of 1.5 million people.
  - ✓ yields of R-M from 1200 kg/ha to 1800 kg/ha.
- **Adaptation :**
  - ✓ improved structure and fertility of the soil.
  - ✓ water more accessible.
- **Mitigation:**
  - ✓ sequestration of carbon in soil.

Efficient N management

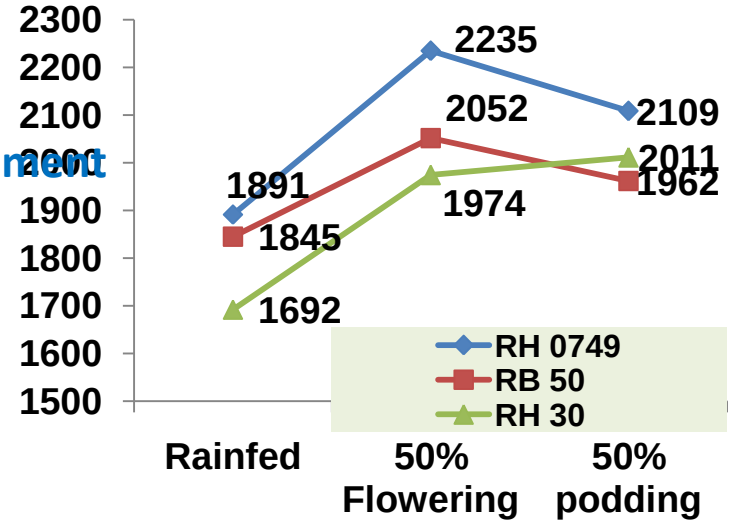
Nitrogen application	Seed yield (kg/ha)
1/2 as basal + 1/2 at pre-flowering stage	1817
1/3 as basal + 2/3 at pre-flowering stage	1511
2/3 as basal + 1/3 at pre-flowering stage	1766
1/3 as basal + 1/3 at pre-flowering stage + 1/3 at 75% flowering	1601
C.D. (p=0.05)	93

Irrigation x N levels x Genotype interaction: Mustard

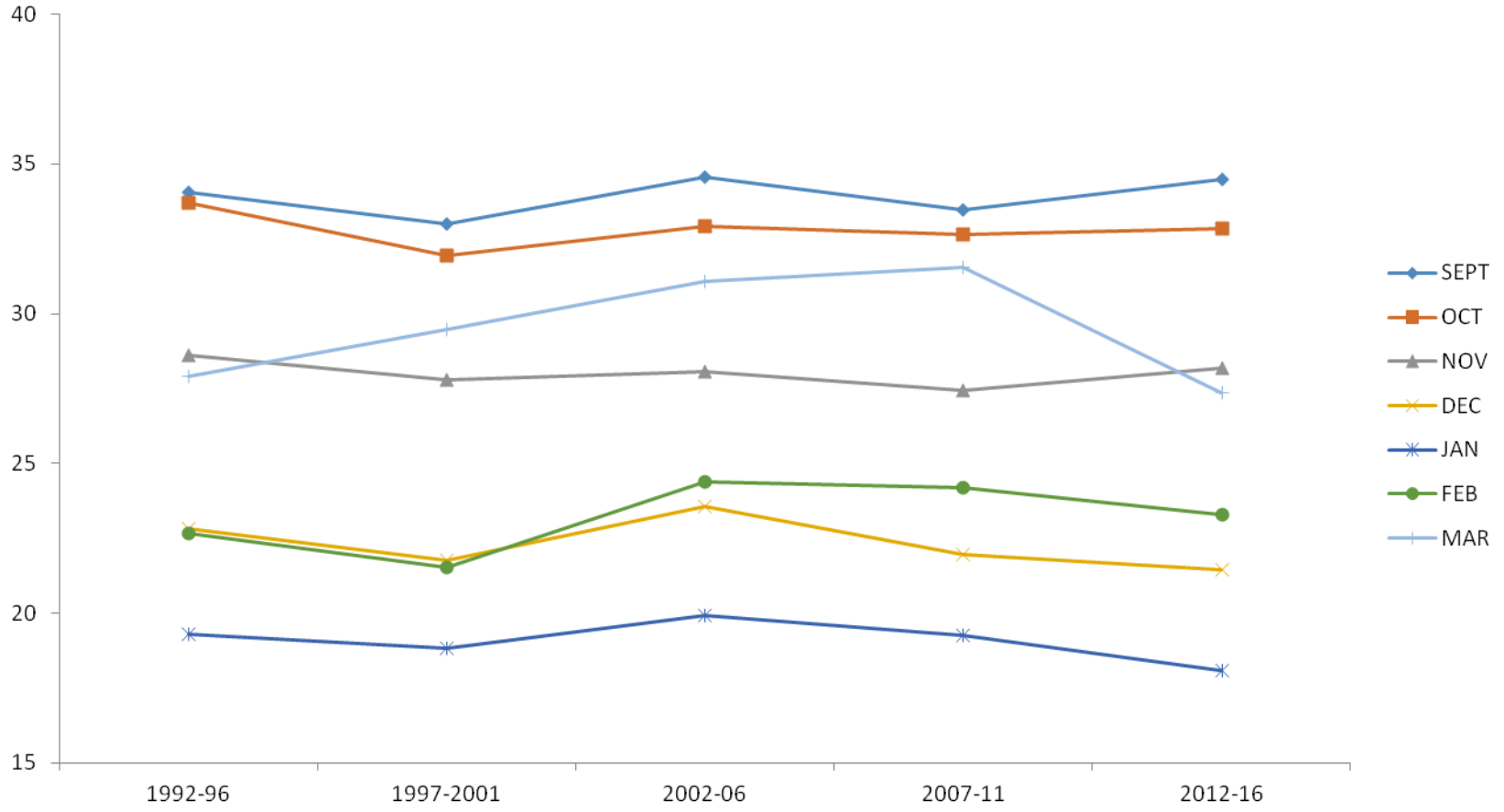
Variety x N management



Variety x Irrigation management

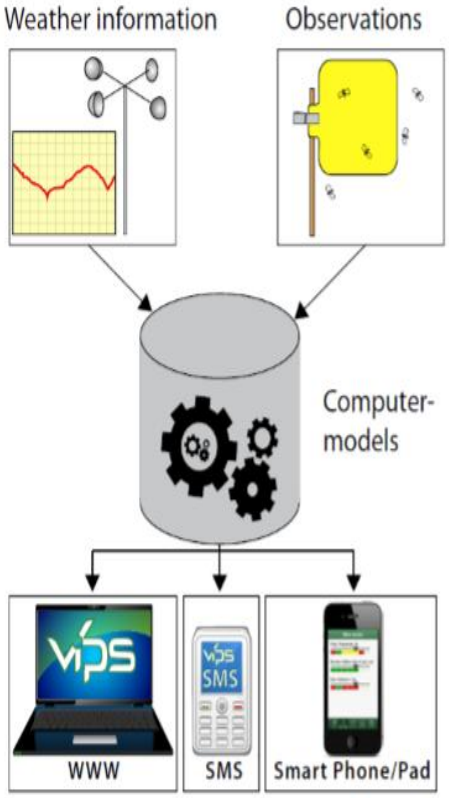


Maximum temperature variation in mustard growing season in India



Crop pest and disease risk assessment and management

Weather data, numerical weather forecasts
Biological knowledge and observations from field
Forecasting model for plant pests/diseases
Early warning based on damage threshold and recommendation to farmers



Recent threats in India on Brassica

Bacterial rot caused by
Erwinia carotivora

Root rot caused by
Sclerotium rolfsii

Wilt caused by
Fusarium spp.

Stem blight by
Nigrospora oryzae

Occurrence of disease in different temperature and moisture conditions

Disease	Temperature (°C)	% RH
Alternaria blight	15-30	65
White rust	12–24	> 97
Downy mildew	15-25	95
Powdery mildew	24–30	< 90
Clubroot	18-23	70
BlackLeg	14-18	100
Damping off	16-25	90-95

Sclerotinia rot management

- ✓ Seed treatment with Carbendazim (2g/kg seed),
- ✓ no crop irrigation during 25 Dec to 15 Jan and foliar spray of carbendazim (0.2%) during first week of January with spray gun.

Comparison among maximum yield level of IP and FP in FLDs during 2012-13 to 2015-16

State	No. of FLDs	FLDs Mean yield (kg /ha)		Yield gap- I (%)	Triennium State average yield (Kg/ha)*	Yield gap- II (%)	State average production (000 tonnes)	Expected production (000 tonnes)	
		IP	FP					EP-I	EP-II
RAJ	174	1843	1593	15.7	1256	46.7	3513	4065	5154
UP	40	1830	1576	16.1	1123	63	729	846	1188
HAR	40	2076	1762	17.8	1601	29.7	849	1000	1101
GUJ	15	2163	1857	16.5	1437	50.5	324	377	488
MP	20	2245	1583	41.8	1099	104.3	845	1191	1726
BIH	20	2096	1637	28.1	1117	87.6	97	124	182
PUN	35	1930	1794	7.6	1287	49.9	40	43	100
ASM	10	1107	732	47.2	619	78.8	169	248	302
All India	**354**	**1911**	**1567**	**22.0**	**1181**	**61.8**	**7423**	**9056**	**13643**

These yield gaps indicate the presence of significant yield reservoir which can be exploited through spread of appropriate technology among the farmers.

***3 years (2012-13 to 2014-15) state average**

Strategy

Horizontal expansion

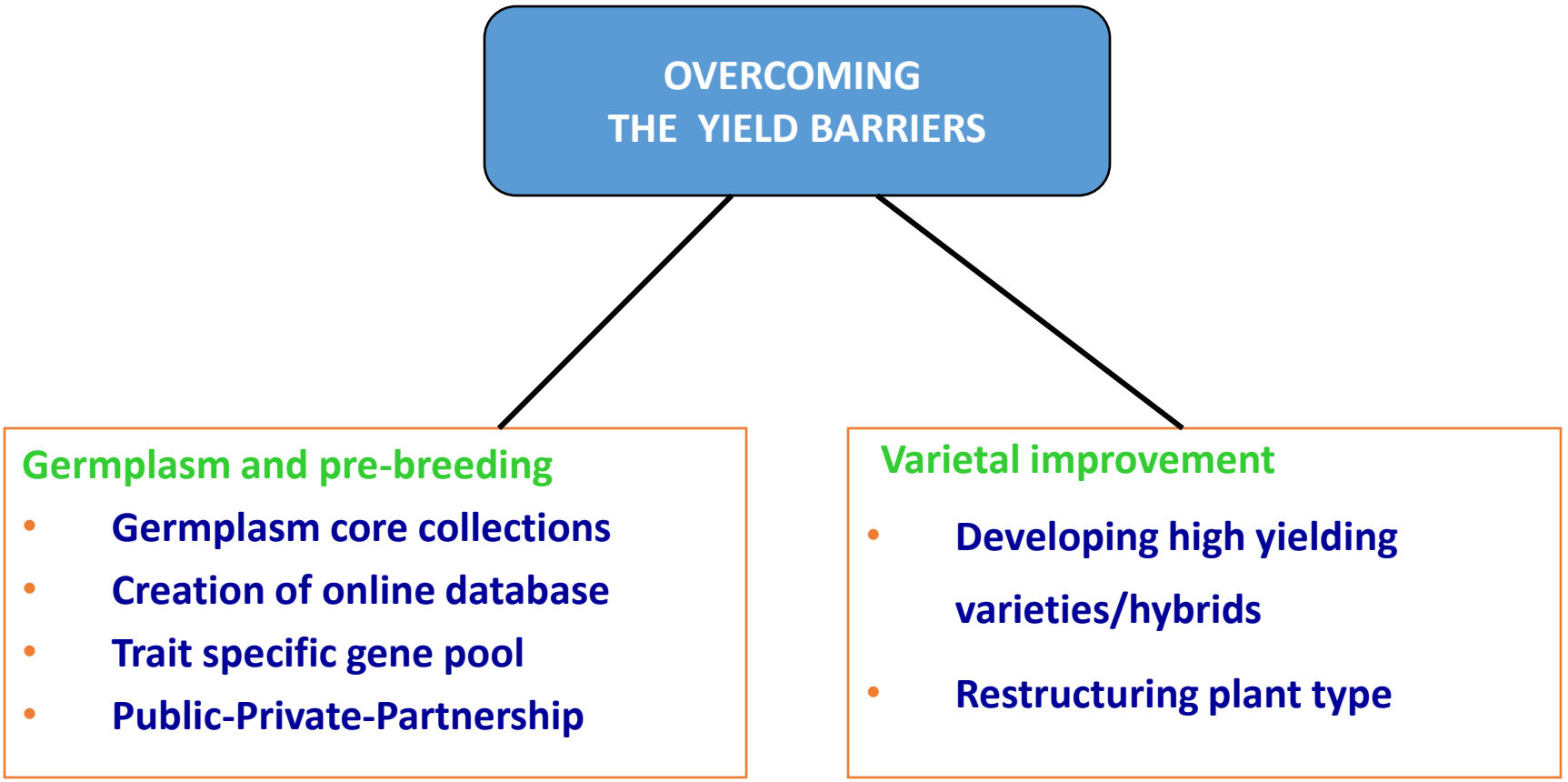
Enhanced genetic potential

Strategy

Realizing the untapped potential of the existing technologies

Policy back up

Sustainable crop resource management


OVERCOMING
THE YIELD BARRIERS
Germplasm and pre-breeding
Germplasm core collections
Creation of online database
Trait specific gene pool
Public-Private-Partnership
Varietal improvement
Developing high yielding varieties/hybrids
Restructuring plant type

Hybrid Development in Indian Mustard

- Utilization of diverse sources of CMS system
- Enhancing level of heterosis
- Improvement of parental lines for high temperature tolerance and white rust resistance.
- Introgression of oil and seed meal quality traits in parental lines.
- Conversion of restorer lines through MAS.

Realizing untapped potential of the existing technologies

Adoption of improved technologies

- Up scaling the seed replacement ratio and enhanced availability of breeder seed/certified seed of new varieties.
- Networking with state development personnel, NGOs and **processing** industries
- Linking of community based organization like self help groups (SHGs) and farmer clubs **with farm advisory services.**
- Farmer participatory technology generation and assessment
- Documentation of ITK impacting productivity and its validation
- Development of modal rapeseed-mustard production villages
- **Crop ecological zoning**

Classification of major rapeseed-mustard growing districts for strategic planning

In India the mustard crops are grown in 485 districts

Classification	Yield levels		
	Low (< 700 kg/ha)	Medium (700-1400 kg/ha)	High (>1400 kg/ha)
Low Area (<500 ha)	94	46	5
Medium Area (500- 5000 ha)	82	99	20
High Area (>5000 ha)	36	70	33

Horizontal expansion

- **Rice-fallow of eastern India and low land rice (about 15 million hectares).**
- **Non-traditional areas in Andhra Pradesh, Karnataka, South Rajasthan, Madhya Pradesh Maharashtra and Gujarat.**
- **Intercropping with wheat, lentil, chickpea, potato and sugarcane**

Challenges and future directions

Main challenges

- **Government priority?**
- **Farmers willingness to adapt new practices**
- **Low private sector investment**
- **Lack of evidence based CSA knowledge base**
- **Linkages to market**
- **Lack of innovation**

Future directions

- **Mobilize investment**
- **Share CSA knowledge between stakeholders**
- **Share genetic resources**
- **More field based trials and testing**
- **Increase capacity and awareness in stakeholders**
- **Development of region specific CSA**

Policy imperatives

- **Decontrol of traditional oilseeds from small scale sector to enhance efficiency of processing**
- **Effective market interventions**
- **Favourable trade policy**
- **Public-Private- partnership**

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