



# Wheat production in India and future prospects

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# Wheat In India

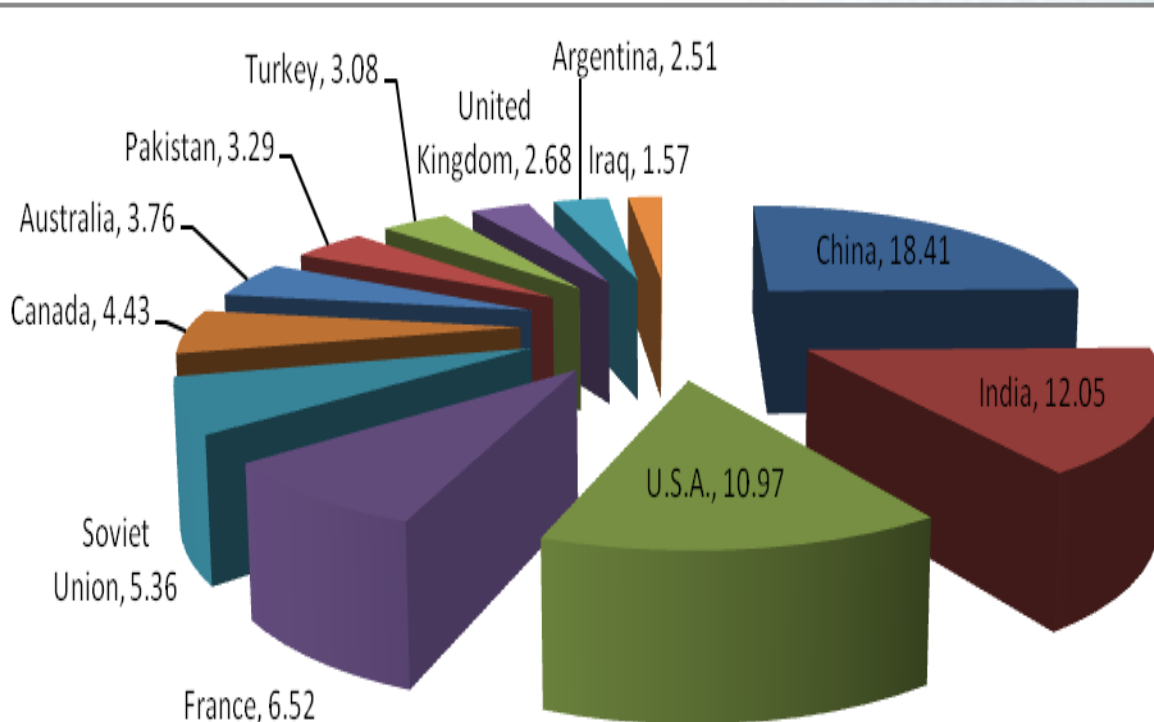
- Wheat (*Triticum* spp.) is the second most important winter cereal in India after rice.
- Bread wheat contributes approximately 95% to total production while another 4% comes from durum wheat and Dicoccum share in wheat production remains only 1%.
- Wheat crop contributes substantially to the national food security by providing more than 50% of the calories to the people who mainly depend on it.





# Global wheat scenario

## Top 10 wheat producers (2009)



Exporting	Quantity (tons)
China 	114.5
India 	80.6
USA 	59.4
Russia 	56.5
France 	39.4
Pakistan 	24.0
Germany 	25.1
Australia 	23.0
Canada 	22.5
Ukraine 	20.0
Turkey 	17.8

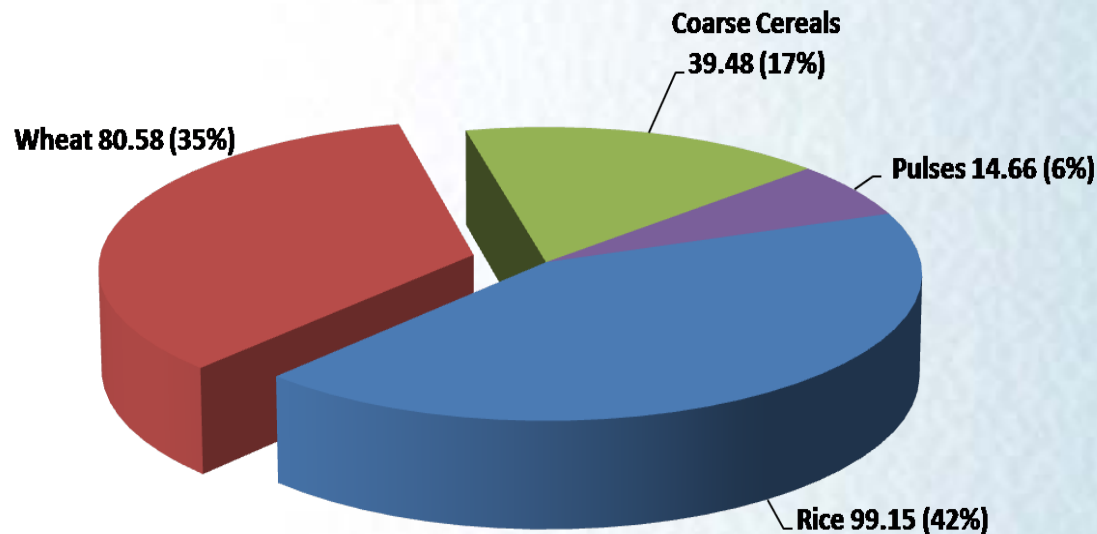
**2<sup>nd</sup> largest producer in the world next to China**





India has witnessed a significant increase in total food grain production to the tune of 233.88 m tons with a major contribution of wheat with 80.58 m tons (34.5%) during 2008-09 and is expected to touch 81 m tons in 2009-10.

**Total Foodgrains (233.88)**

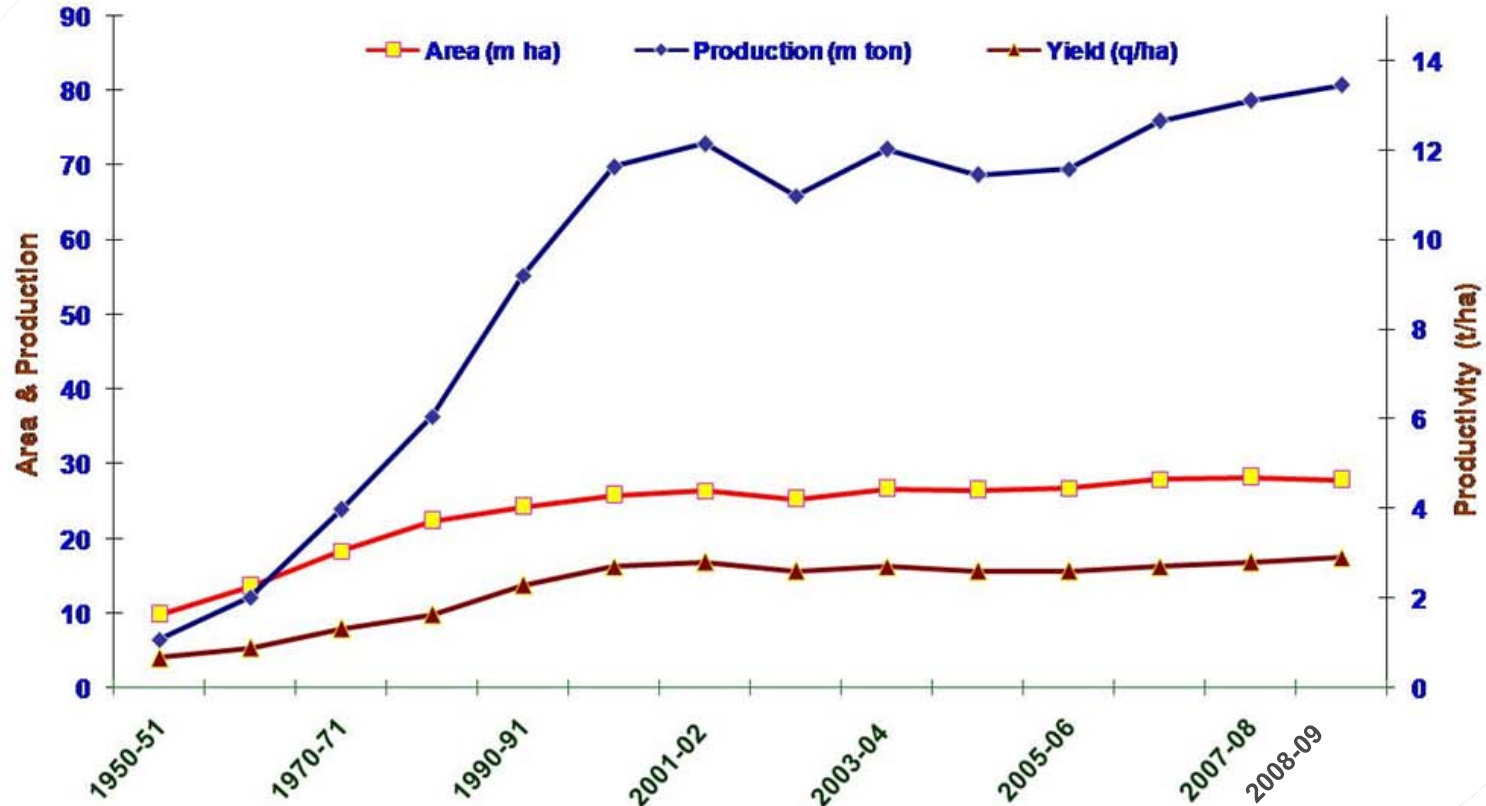


■ Rice ■ Wheat ■ Coarse Cereals ■ Pulses





# Wheat production statistics



Area - more than two fold increase (from 13.4 m ha in 1965)

Production - more than six times increase (from 12.3 mt in 1965)

Productivity - over three times increase (from 0.9 t/ha in 1965)

**From last eight years, India is maintaining its 2nd position in world**

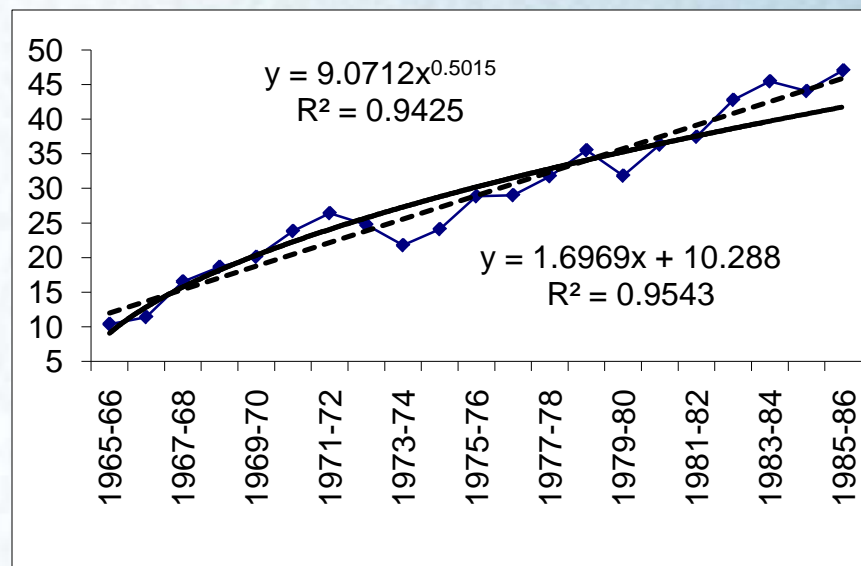
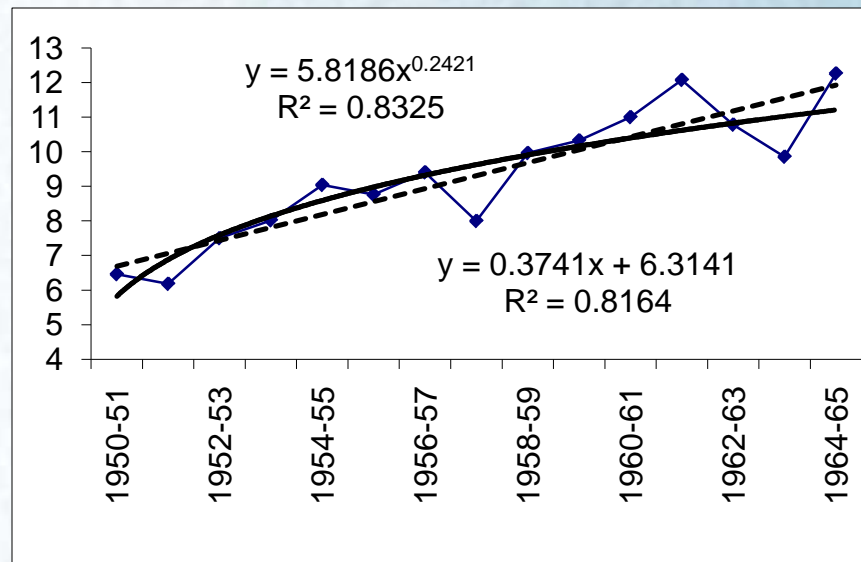




## The production growth

In **1947-48**, total wheat production was just **5.6 mt** with an **average yield of 0.8 t/ha** and despite all possible efforts, India could not harvest beyond **12.3 mt** of wheat till **1964-65** crop season. The **compound growth rate was 4.26**. It was then in 1965 that the introduction of **dwarf wheats from Mexico** ushered in the **green revolution**

During next twenty years, total wheat production increased from **12.3 mt** to **47.5 mt** with highest **growth rate of 6.68**. This period reflected the fruits of green revolution in the country.

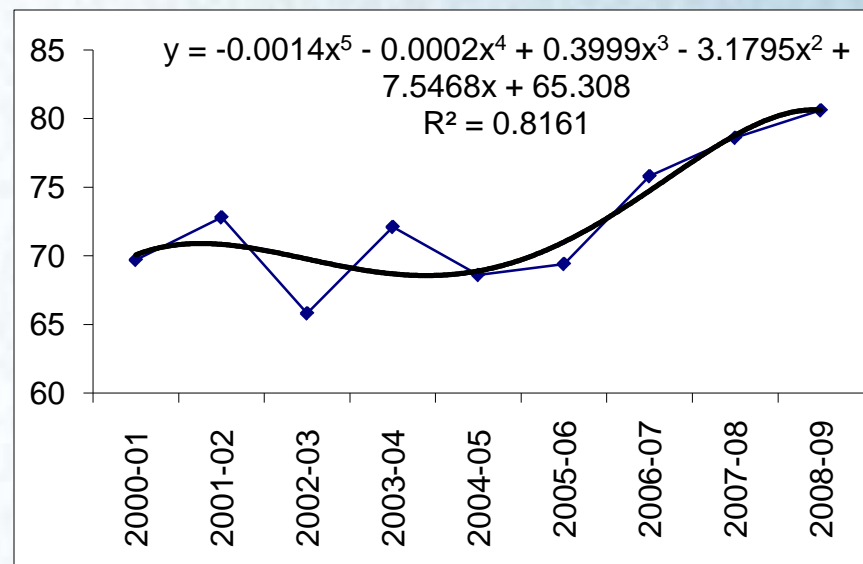
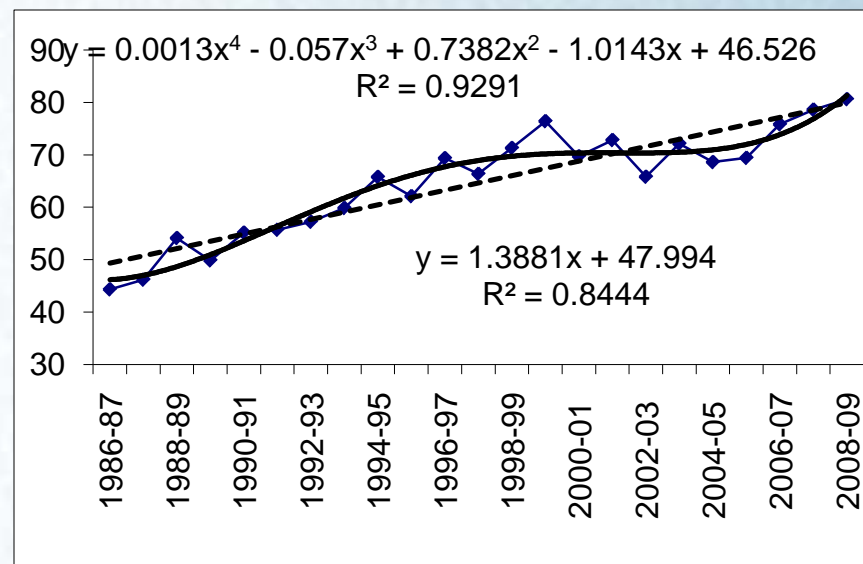




## The production growth

From 1986-87 to 2008-09 the production figures increase in linear fashion from 44.3 mt to 80.6 mt with moderate growth rate of 2.27.

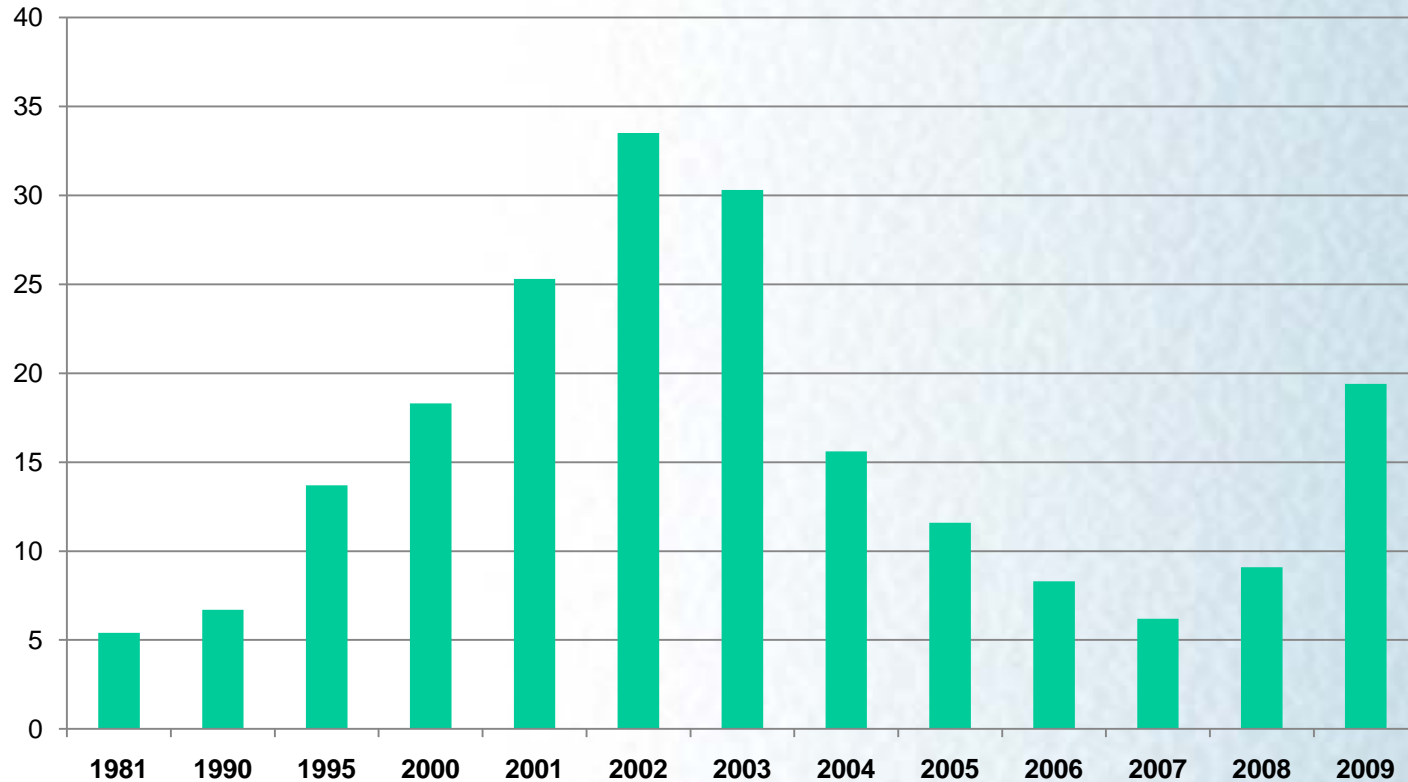
The ups and down of wheat production during 2000-01 to 2008-09 depicted growth rate of 1.77. There were significant dips due to unfavourable weather conditions. However from 2006-07 there has been a steady rise in wheat production.





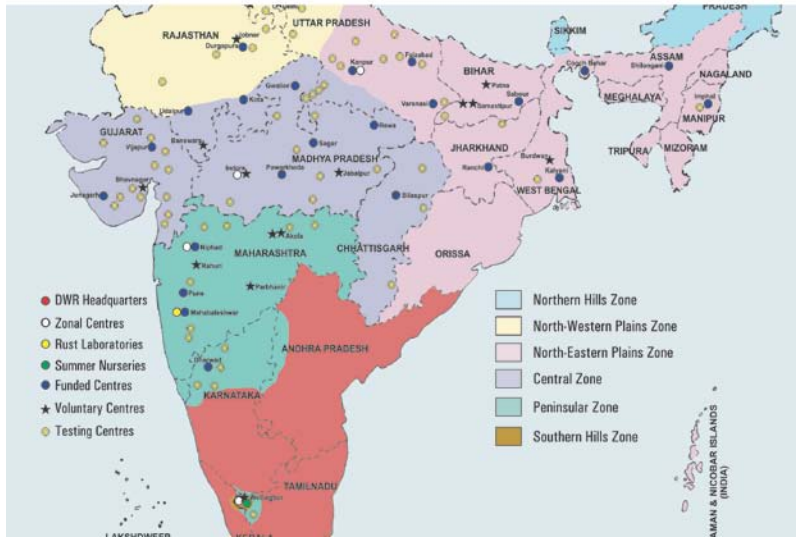
# Wheat buffer stocks

Buffer Stock (mt)





# Wheat growing zones of India

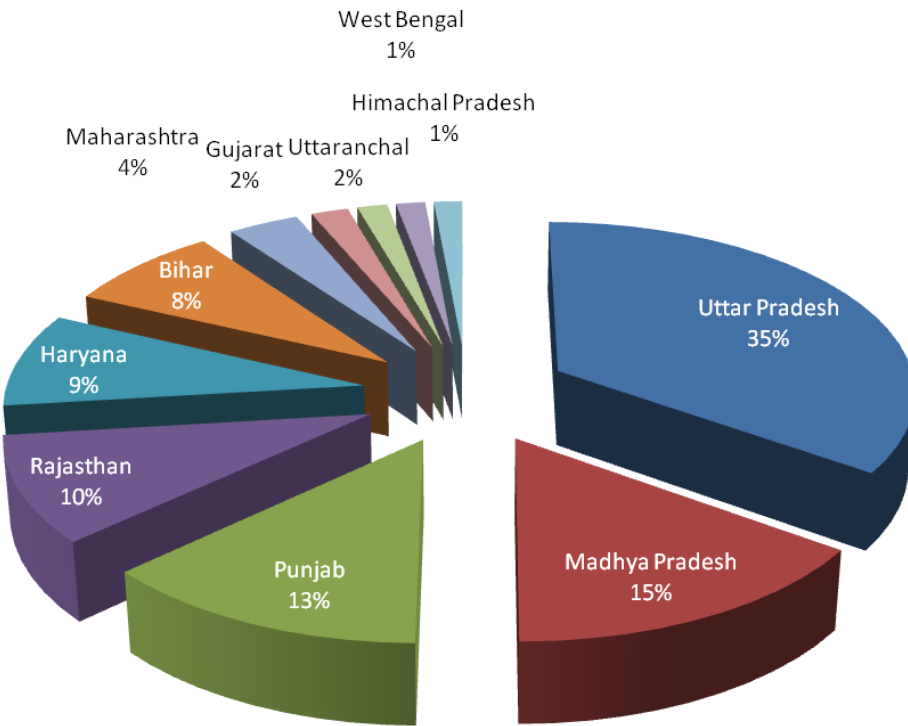


Zone	Approximate Area (2007-08)	
	(mha)	%
Northern Hills Zone (NHZ)	0.8	2.9
North Western Plains Zone (NWPZ)	11.1	40.1
North Eastern Plains Zone (NEPZ)	9.2	33.2
Central Zone (CZ)	5.0	18.1
Peninsular Zone (PZ)	1.5	5.4
Southern Hills Zone (SHZ)	0.1	0.4
	<b>27.7</b>	

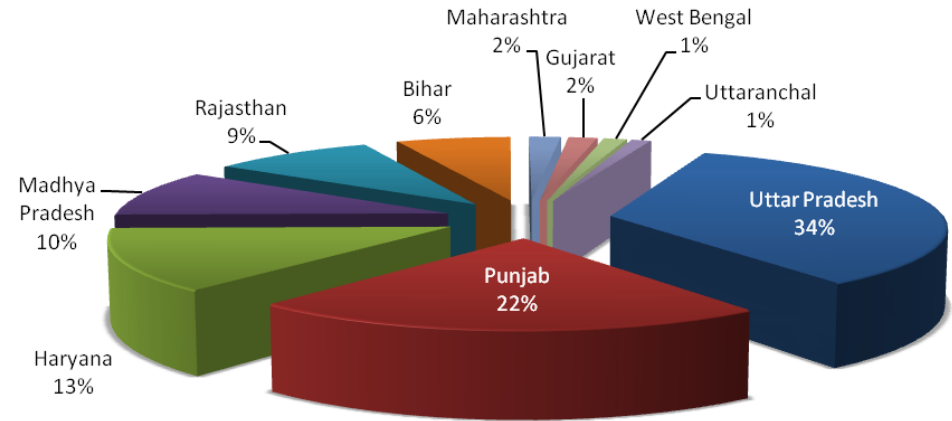




# State wise contributions to wheat area and production



% share in area



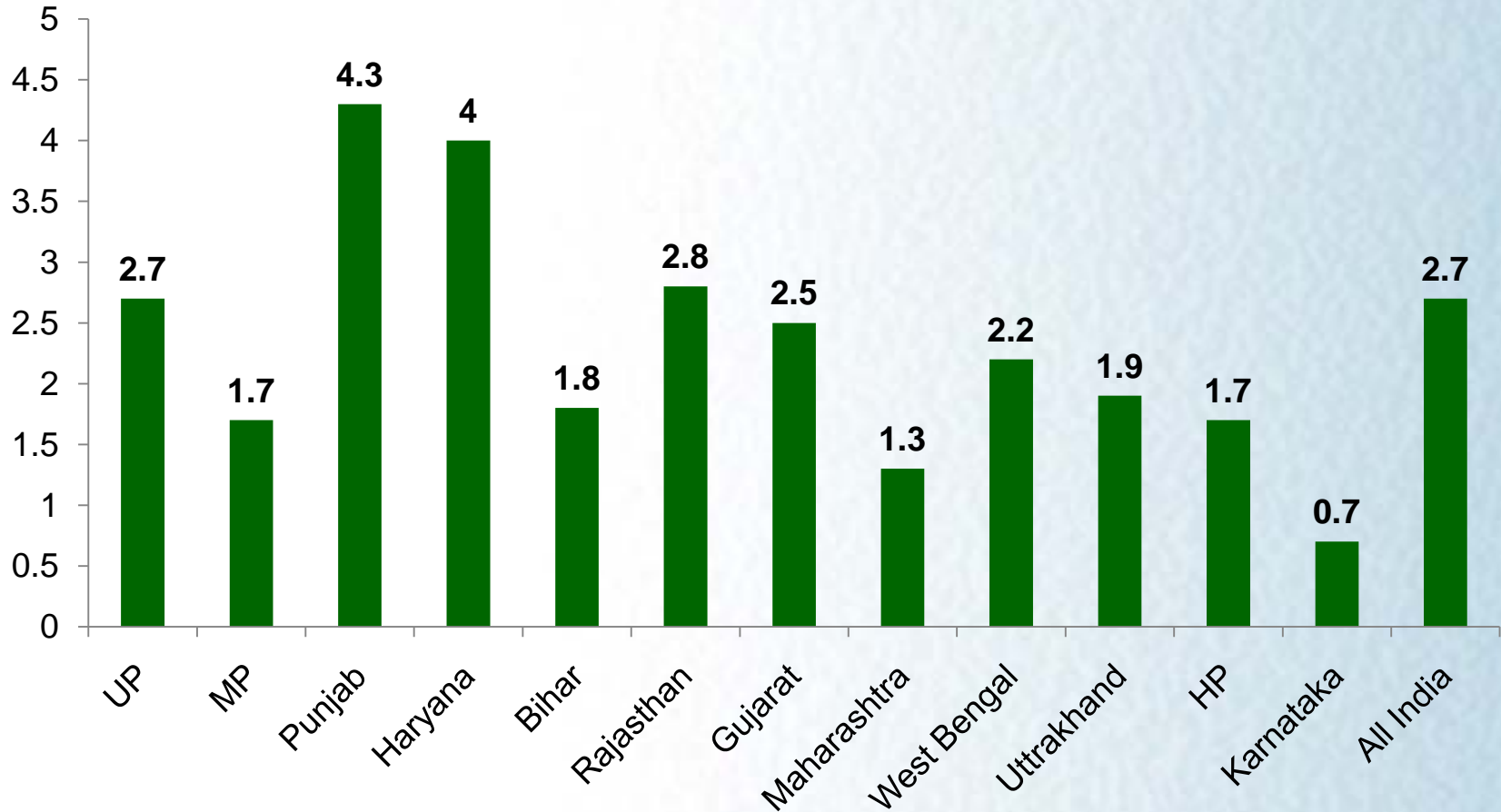
% share in production





# Productivity of wheat growing states in India

Productivity (t/ha)





# Where are we getting our wheat from?

About 91.5% of the wheat produced in six states viz. Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar.

Uttar Pradesh with 24.3 million tons (mt) is the highest producer of wheat followed by Punjab (14.7 mt) and Haryana(9.1 mt).

Contribution from Haryana and Punjab is due to high productivity (4.0 to 4.3 tons/ha).

Contribution of Uttar Pradesh and Madhya Pradesh is due to relatively large area (50% of the total area) sown to wheat.

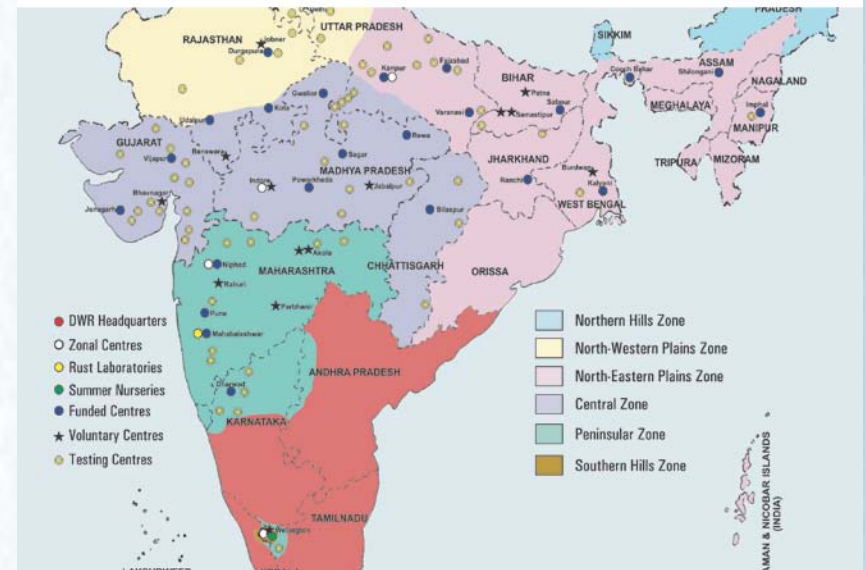




# National Wheat Programme

## DWR and AICW&BIP

- DWR – nodal centre of wheat & barley research
- Regional Stations
  - Flowerdale, Shimla
  - Dalang Maidan (>10,000')
- 49 Scientists (56– sanctioned strength) presently at DWR
  - Breeding - 12
  - Biotechnology – 5
  - Crop Protection – 11
  - Quality – 3
  - Plant Physiology-1
  - Resource Mgmt – 7
  - Social Sc. – 4
  - Statistics - 1
  - Barley - 5
- 107 scientists from 31 funded centres
- 115 non-funded cooperating centres
- National coordination: rice-wheat cropping system





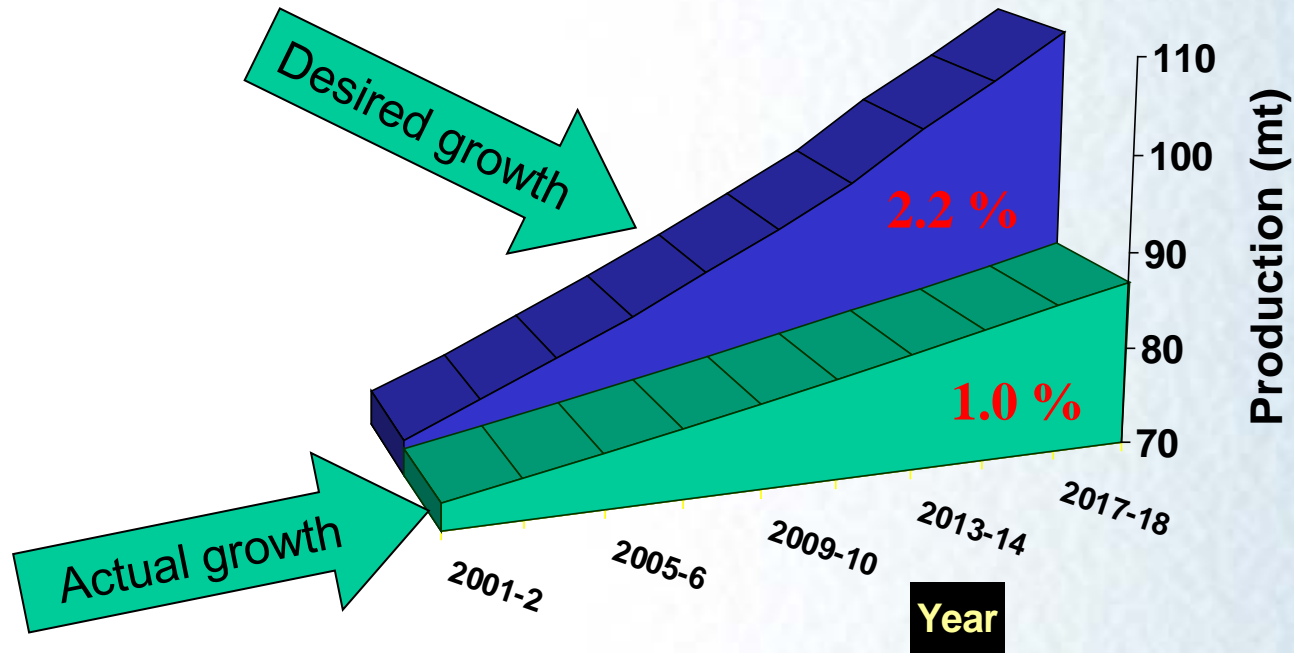
## **Achievements of Indian wheat programme**

- **372 wheat varieties released in the country since 1965**
- **119 genetic stocks for various traits**
- **Advanced production technologies with eco-sustainability through resource conservation**
- **The crop protection strategies acted as barrier to disease havoc since last 4 decades**
- **Germplasm enrichment and sharing across the country**
- **Infrastructure created to produce more around 30,000q of breeder seed**
- **Quality parameters standardized for specific products**
- **Strengthening the wheat research to partner countries for global food security**
- **Sound international linkages**





# Wheat Targets - 2020 AD



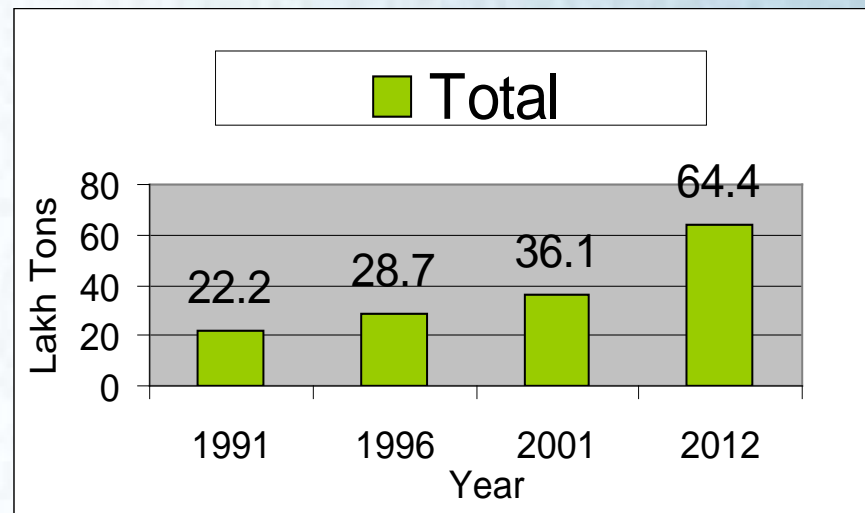
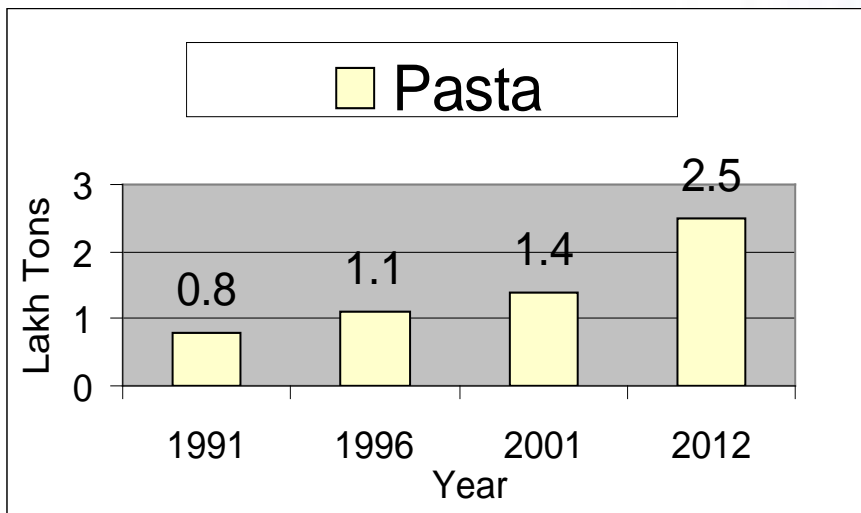
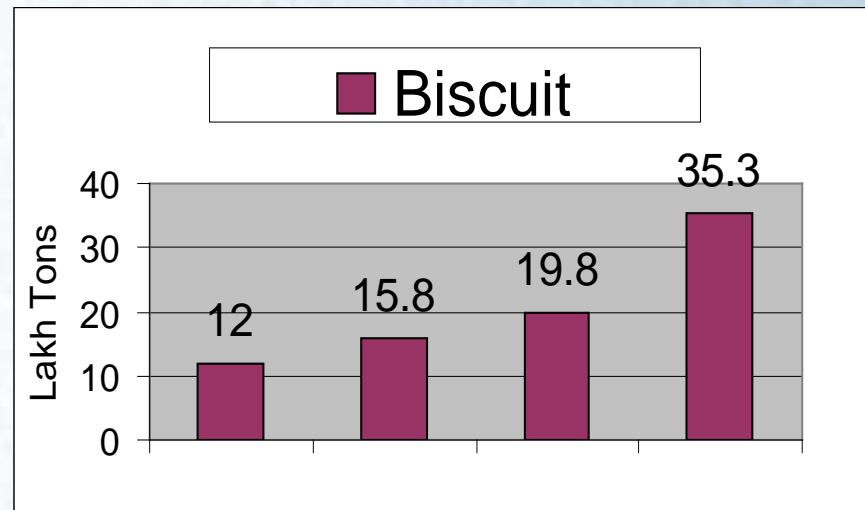
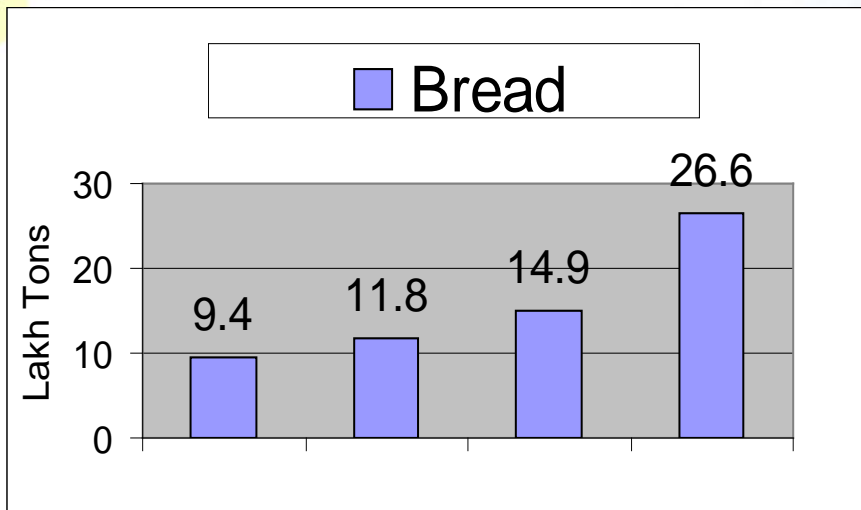
It is estimated that India will require 109 m tons of wheat to feed the population of about 1.25 billion by the year 2020 A.D.

India's per capita wheat production is 67kg against per-capita consumption of 73kg, which is also on upswing





# Growing demands for wheat based product

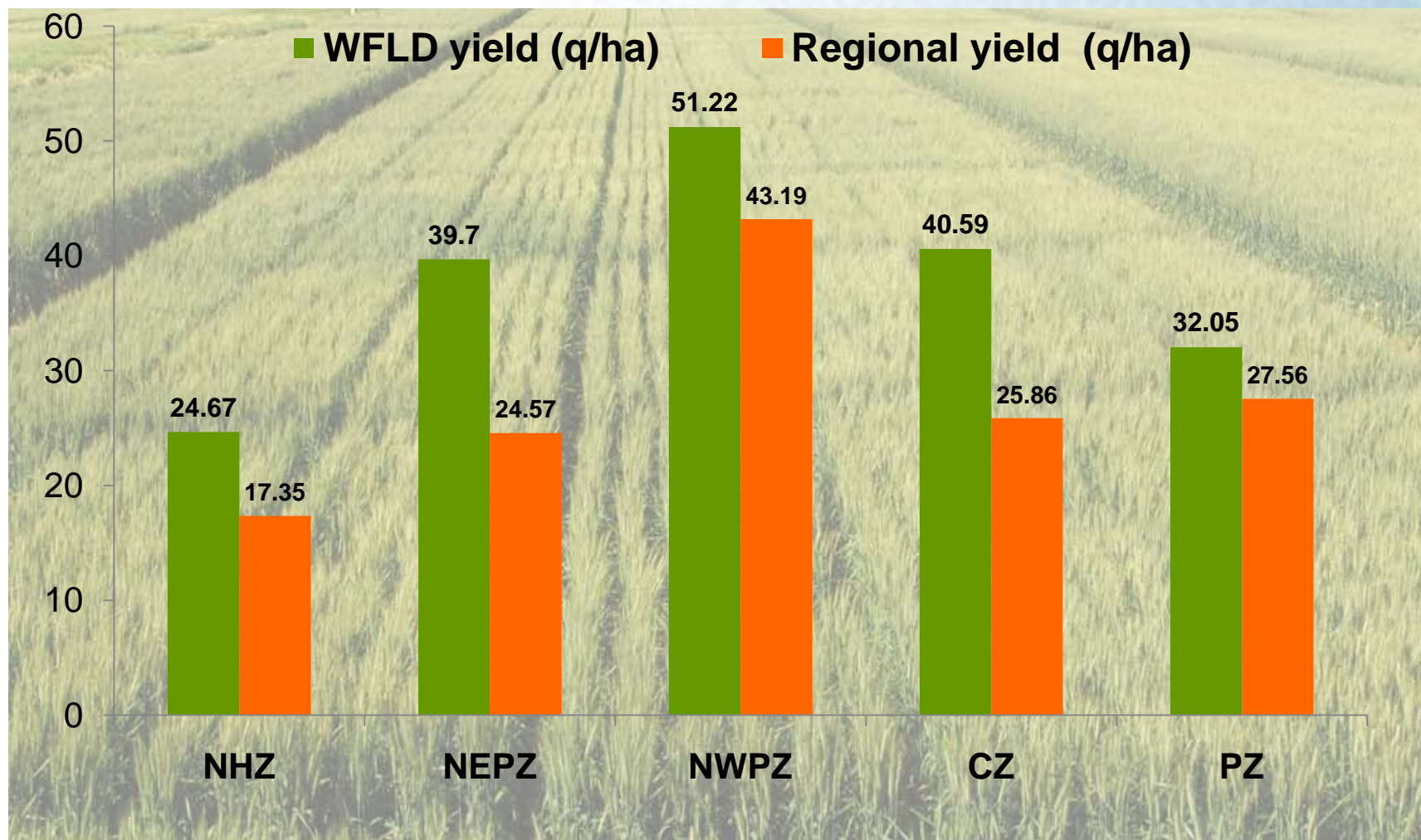


Source: Future perspective for wheat and wheat based products, 1992:  
Figures in year 2012 are based on 5% growth rate assumptions





## Potential productivity of wheat zones in India (2008-09)





# Constraints in wheat production

## Biotic stresses

- **Rusts**
  - **Stripe**- More prevalent on north western parts and hills.
  - **Leaf** – All parts of the country
  - **Stem** – Central & Peninsular parts however infestation not observed or under control
- **Leaf Blight** - More prevalent in north eastern plains followed by peninsular, central and low in north western parts (15 mha)
- **Karnal bunt** – More problem in northwestern plains
- **Powdery mildew** – Emerging problem in northwestern plains
- **Aphids and termites** - observed in pockets





# Constraints in wheat production

## Abiotic stresses

- **Drought** – Central, peninsular and northeastern parts - 3.5 to 4 mha
- **Heat** – Central, peninsular and northeastern parts
  - 3.5 mha northeastern plains
  - 3-4 mha central and peninsular parts
- **Suppressive soils/Soil health**
  - **Salinity, alkalinity** - 2.5 -3.0 mha in Northwestern plains, northeastern plains and Central parts
  - **Nutrient deficient soils** - 46 % Zn, 17 % B, 12 % Mo, 11 % Fe and 5 % Cu. 38% S
  - **Waterlogging** - 3.2 m ha in northwestern and northeastern plains





# Constraints in wheat production

## Weeds – Broad and narrow leaved

- *Phalaris minor* and wild oats
- *Chenopodium*, *Rumex* sp., *Medicago* sp
- *Malva parviflora* –more in zero tillage

*Phalaris minor* is more prevalent in rice-wheat system as well as irrigated cotton wheat system occupying 9 mha. Other broad leaved weeds are also problem in rainfed area

## Other issues

- Availability of essential inputs for timely sowing
  - Improved seed (More problem in Eastern UP, Bihar, Jharkhand and Chatisgarh – roughly 60% wheat area)
  - Fertilizer availability (its availability in required quantity and at initial and growth stage, is critical.
  - Irrigation water (Timely availability is important)
  - Farm machinery (Mechanization is on a lower scale in northeastern, central and peninsular parts)
- Infrastructure
  - Roads
  - Storage
  - Market
- Extension facilities
  - Farmers unaware of new improved varieties and production technologies
  - Poor extension activities on part of State Department of Agriculture especially in eastern UP, Bihar and MP.

Required essentially for marketing of produce





# Major issues in wheat improvement

## Breaking yield barriers

- Exploitation of heterosis for developing hybrids
  - Based on CMS system
- Broadening of genetic base of varieties - pre-breeding
  - Through use of winter x spring hybridization
  - Use of synthetics, bultre, Chinese germplasm
  - New plant type
  - Use of alien species for biotic and abiotic stresses
- Biotechnological interventions
  - Gene pyramiding
  - Marker aided selection for biotic, abiotic and quality traits
  - Structural and functional genomics
- Abiotic Stresses –climate change
  - Heat and drought
  - Salt stress
  - Waterlogging





# Major issues in crop protection

- Survey and surveillance for monitoring diseases and insect-pest
- IPM in wheat specially to manage the diseases like KB, PM, LS and insects like foliar & root aphids, termites, root nematodes
- Managing new emerging threats
  - stem rust (Ug99),
  - leaf rust (77-5, 77-10, 104-2)
  - stripe rust (78S84, 46S119)
  - Foliar blight
  - Fusarium head blight (FHB)
- Monitoring dynamics of diseases and insect pest situation in new RCTs and in view of changing climate





# Major issues in resource management

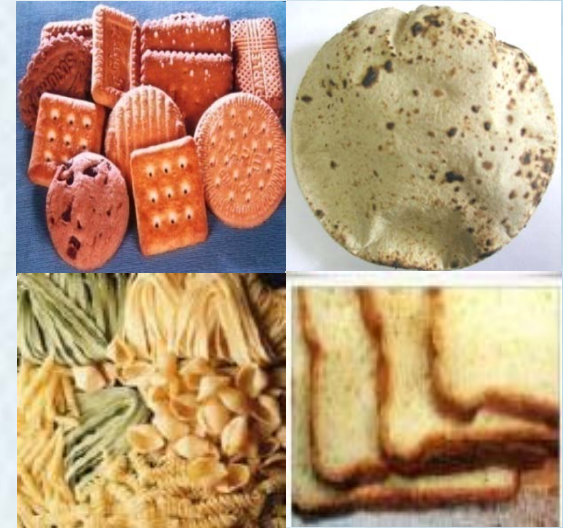
- **Resource Conservation Technologies**
  - Long term effects of new RCTs on sustaining wheat production & soil health
  - Residue management
- **Diversification of R-W System**
  - Sustaining rice-wheat system through diversification/intensification
- **Integrated Nutrient Management**
  - Balanced use of fertilizers
  - Conjunctive use of inorganic & organic fertilizers
  - Correcting micro-nutrient deficiencies & improving C/N ratio
- **Water Management for increasing WUE**
- **Integrated Weed Management**
  - Herbicide resistance
  - Weed dynamics
- **Farm Machineries** – fine tuning





# Major issues in quality improvement

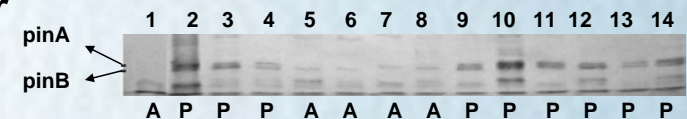
- Characterization of molecular/genetic components associated with quality parameters related to bread, biscuit, noodle and pasta products and nutritional quality.
- Improvement of nutritional quality of wheat by bio-fortification of micronutrients and beta carotene content and reducing anti-nutritional factors as phytic acid using molecular approach.
- Development of micro-level tests for use in breeding as tools to improve wheat quality.



Identification of germplasm lines with pinA; 30 lines were identified with pinA and soft grain texture



Identification of pinA and pinB using SDS-PAGE (A=pinA absent)





# Major issues – transfer of technology

- Multidimensional impact assessment of various improved technologies
- Accelerate adoption of resource conservation technologies
- Creation and updating district level data base on parameters related to area, production and input usage
- Economic analysis of latest wheat production technologies
- Analysis of returns to investment in wheat research and development.





# International linkages

- **CIMMYT**

- **More than 1500 germplasm in form of nurseries and trials received each year from CIMMYT and are being evaluated at several national centres.**
- **Many Indian wheat varieties contributed by Indian programme have been used as donor by CIMMYT.**
- **Visit to CIMMYT has been initiated again in 2006 and several Indian scientists have visited and wheat germplasm selected and brought to India.**
- **Ug99 screening in Kenya facilitated by CIMMYT – many Indian materials evaluated and found to be resistant.**
- **Zero-tillage and bed planting research conducted on partnership basis.**





# International linkages

- **ACIAR, Australia**
  - Bioinformatics
  - Abiotic stress (water logging)
  - Biotic stress (rusts)
  - Physiological: Water use efficiency (root traits)
  - Wheat grain quality
  - Enhancing farm profitability in North West India and by improving grain quality of wheat
- **ICARDA**
  - Germplasm exchange
  - Drought tolerance
  - Rusts
  - Wheat grain quality
  - Exchange of Scientists





# Acknowledgements

- Farmers of the country
- Scientists of Directorate of Wheat Research
- Cooperators of All India Coordinated Wheat and Barley Improvement Project
- International Collaborators – CIMMYT & others
- Indian Council of Agricultural Research, New Delhi





**THANK YOU**

