

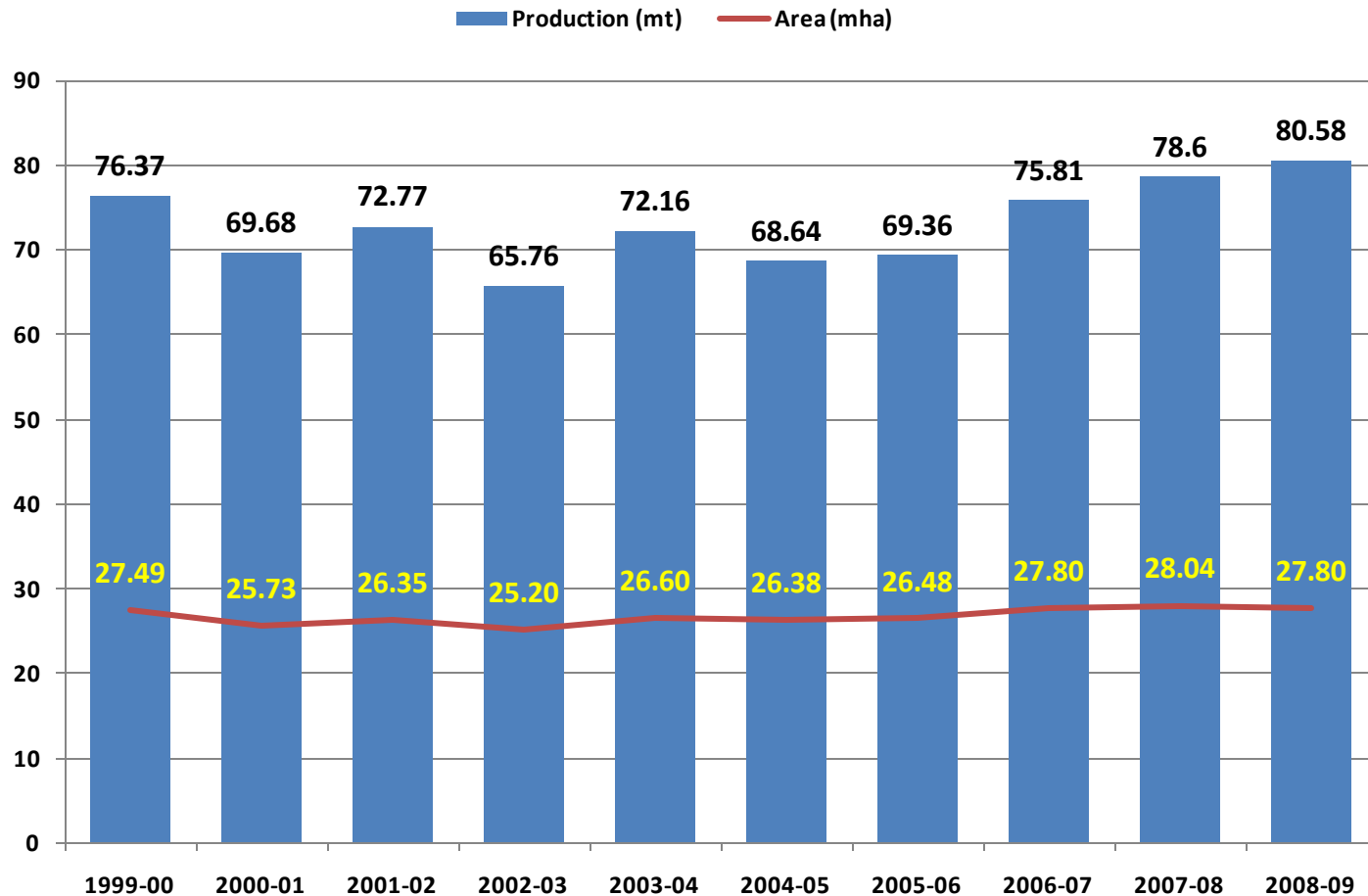
Effect of climate change: Indian perspective

S S Singh

Project Director

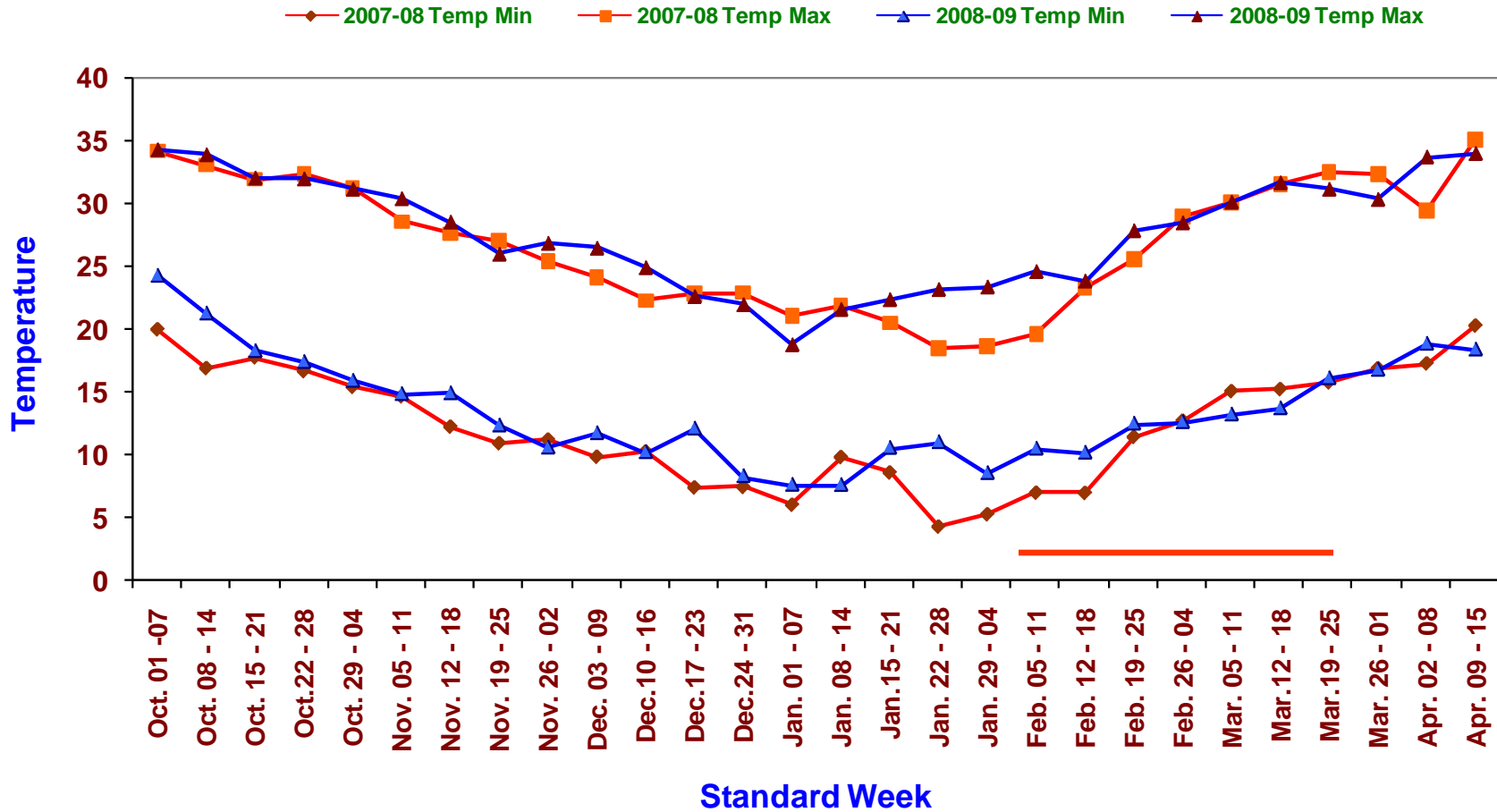
Directorate of Wheat Research, Karnal, India

Wheat production – last 10 years



Area and production of wheat for last 10 years
Estimates for 2009-10 – 81.0 + mt

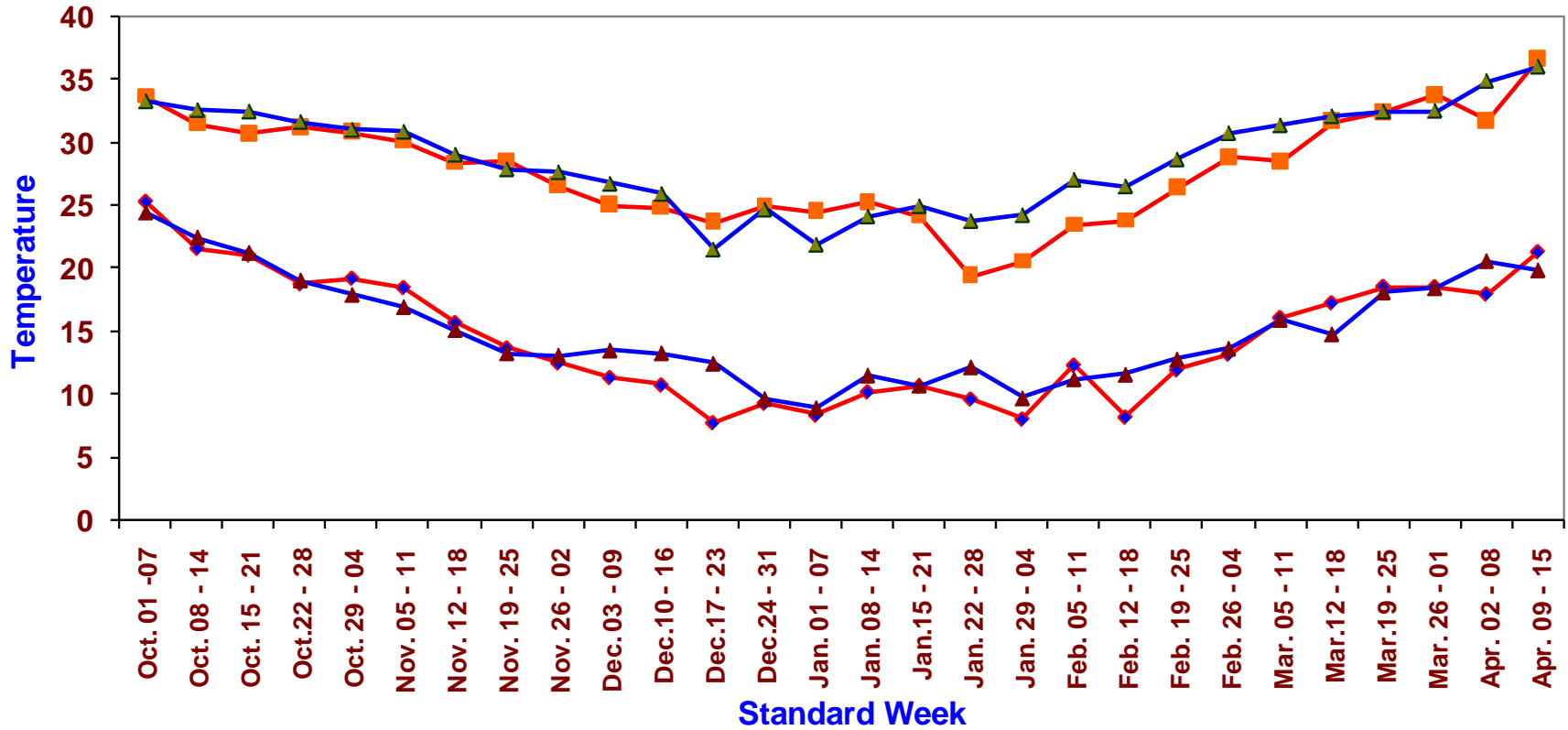
North Western Plains Zone



Sudden rise in minimum temperatures during grain growth phase in previous crop season where as in 2008-09 the temperatures were higher but increase in temperature was little and gradual.

North Eastern Plains Zone

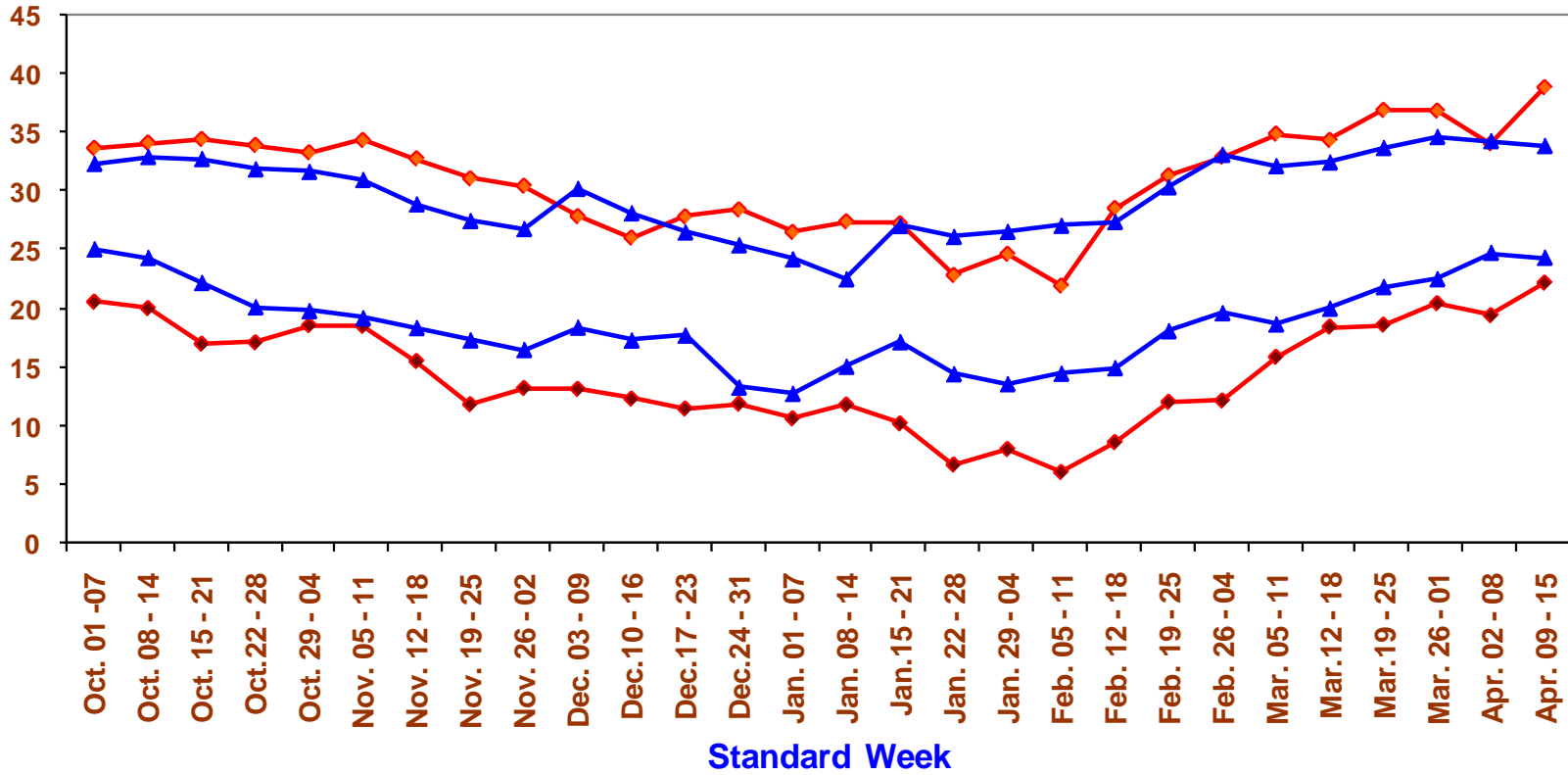
◆ 2007-08 Temp Min ■ 2007-08 Temp Max ▲ 2008-09 Temp Min ▲ 2008-09 Temp Max



Maximum and minimum temperatures were higher during grain growth phase.

Central Zone

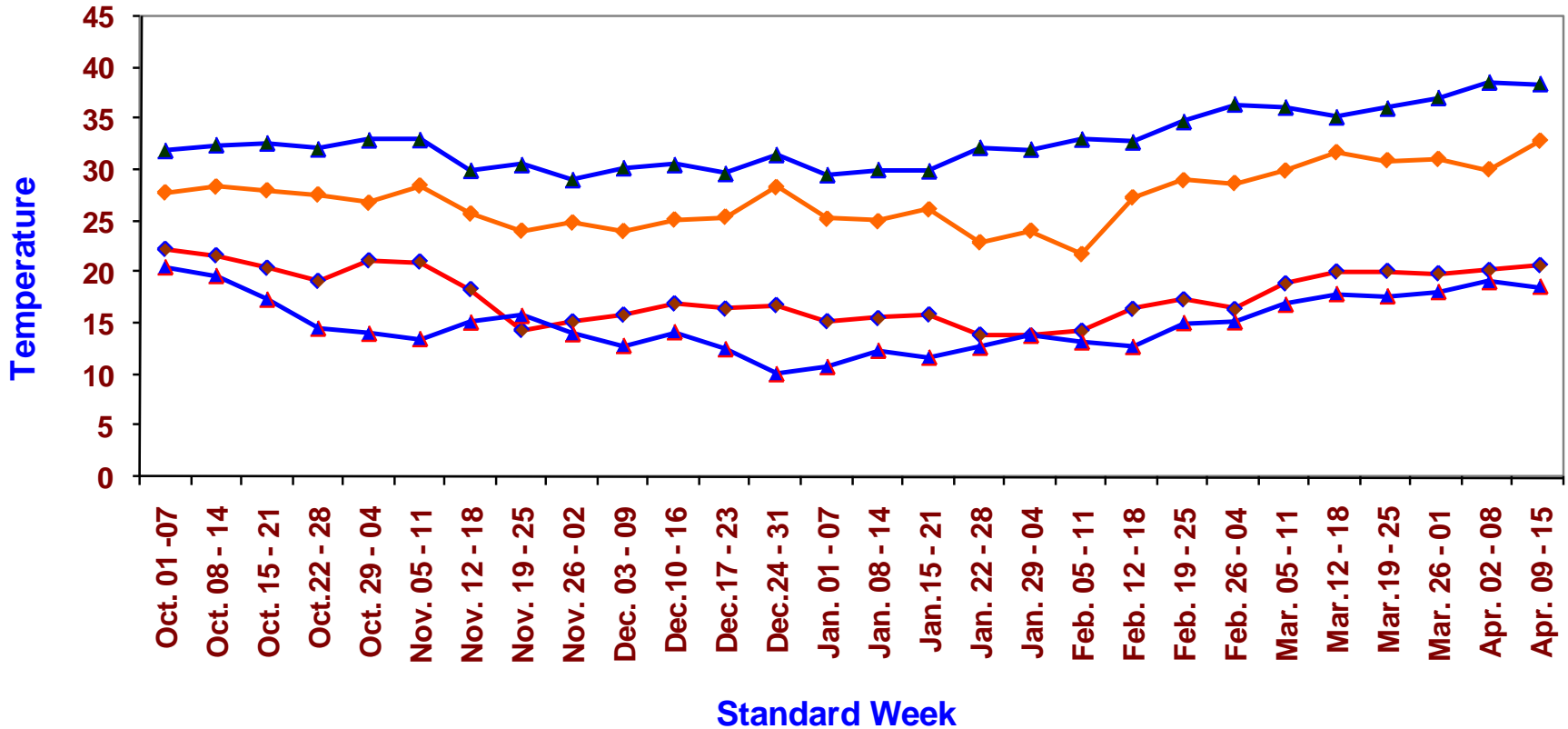
2007-08 Temp Min 2007-08 Temp Max 2008-09 Temp Min 2008-09 Temp Max



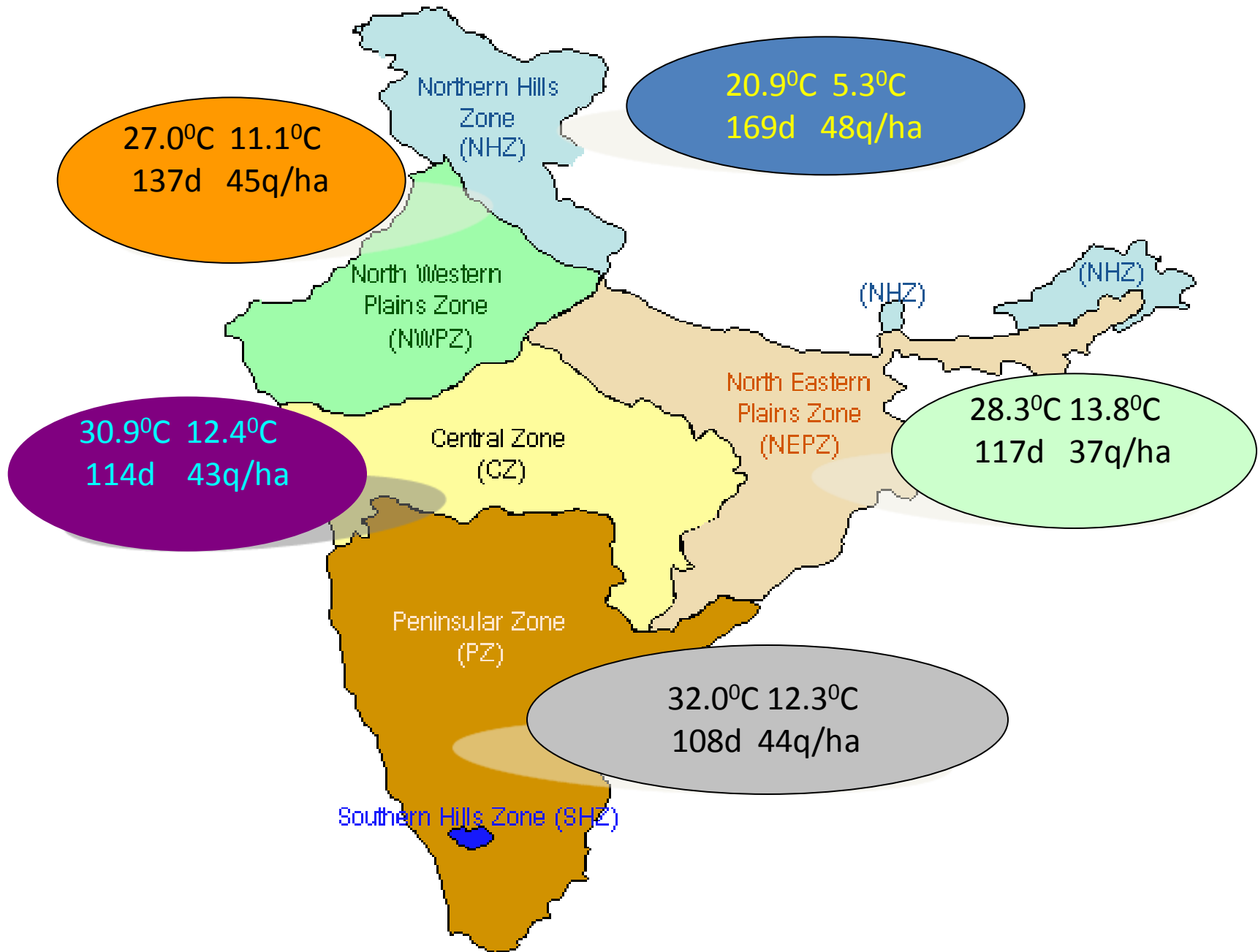
Minimum temperatures were higher through out the crop season

Peninsular Zone

2007-08 Temp Min 2007-08 Temp Max 2008-09 Temp Min 2008-09 Temp Max



Minimum temperatures were lower than previous season whereas maximum temperatures were significantly higher during vegetative as well as grain growth phase.



Effect of climate change

- **Abiotic stresses**

- Heat
- Drought
- Waterlogging
- Salinity & alkalinity
- Frost damage

- **Biotic stresses**

- Rust race evolution
- New diseases –head scab, leaf blight in northwest
- Changes in insect pest dynamics

Mitigating the effects of climate change

- Focus on heat stress and genotypes are being regularly screened for high temperature tolerance under natural as well as under controlled environment.
- Methods have been developed for screening genotypes for thermal tolerance.
- Superior genotypes possessing high temperature tolerance have been identified and are being used in breeding programme for high temperature environments
 - *WH 730* has been registered as heat tolerant genetic stock.
 - *DBW 14, NIAW 34, RAJ 3765 and RAJ 4037, CBW 12, NIAW 845 and HD 2808* have also been found to have thermal tolerance and are being used in breeding programmes
- Adopting resource conservation technologies like zero tillage and bed planting.

Genetic variation for heat tolerance

- Identified sources of heat tolerance such as **WH 730, CBW 12, NIAW 34, NIAW 845, RAJ 4037** and **HD 2808** are being used in breeding programme
- Genotypes such as AKAW 3717, HI 1564, KLP 787, K 0623, K 0624 and AKAW 4630 were found to be superior among DHTSN.
- HW 2045, RAJ 3765, RAJ 4101, WH 1021, Lok 54 and HW 2004, were found to have least heat sensitivity index for consecutive three years under Multilocation Heat Tolerance Trial

Biotechnological Interventions

Disease resistance:

(Rusts, Foliar blight, Powdery mildew, FHB)

- Characterization of genes that confer resistance
 - Identifying over-expressed tag sequences with SAGE tag or EST datasets
 - CC-NBS-LRR studies
- Precise manipulation and deployment of resistance genes
 - Marker assisted selection
 - Gene Pyramiding
- Genomic studies on pathogens
 - Understanding molecular basis of specificity
 - Opportunity to select targets for more durable resistance.
 - Transfer of rust immunity from rice to wheat



Yield/ Adaptability:

- C3 to C4 transition
- TILLING for novel alleles
- Chromosomal translocation from other species/ genera

Quality:

- Low Phytate activities
- Increased Gpc
- HMW Glutenins
- Gliadins/LMW Glu
- Grain softness Protein (Pina, Pinb)
- Waxy gene (Starch synthase)

Physiological Traits:

- Vernalization gene(s)
- Rht genes
- Q genes

Tolerance to drought, thermal stress:

- Root characteristics, stay green
- Dehydrin, DREB, Trehalose gene

Thanks