

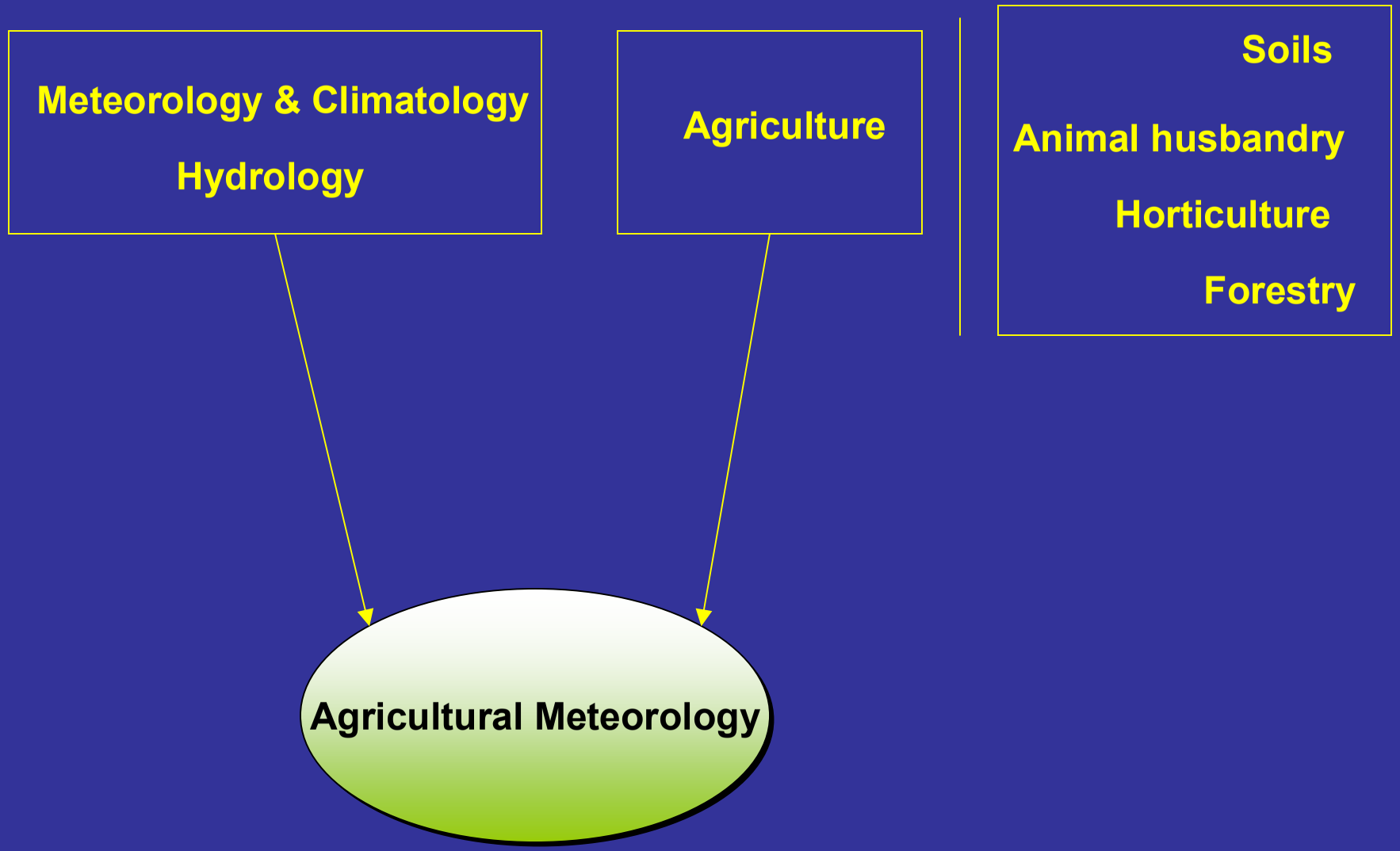
AGROMETEOROLOGY RESEARCH PRIORITIES FOR BETTER PLANNING

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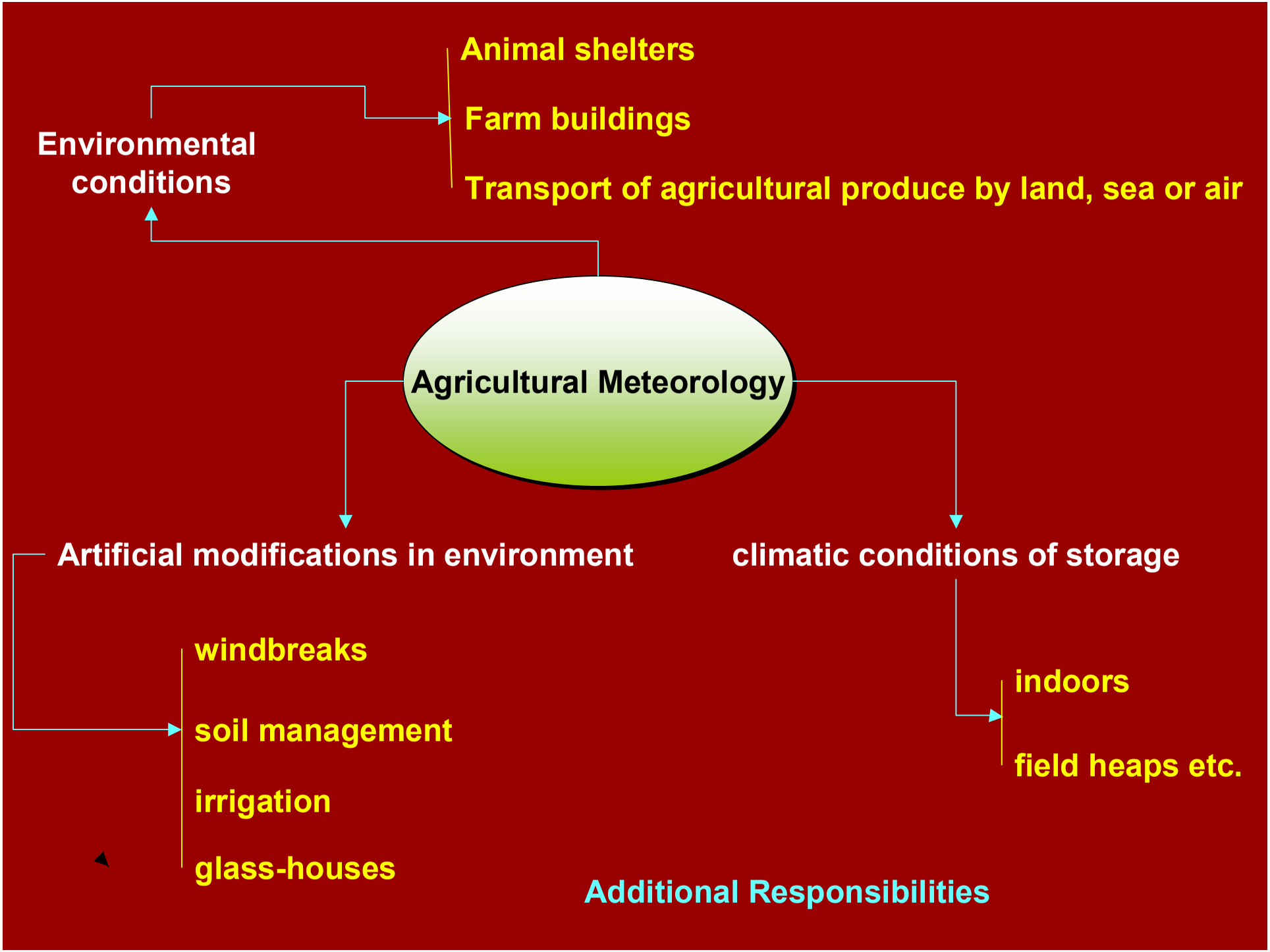
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Guide to Agricultural Meteorological Practices (WMO - No. 134) 1981


Animal shelters
Farm buildings
Transport of agricultural produce by land, sea or air
Environmental conditions
Agricultural Meteorology
Artificial modifications in environment
climatic conditions of storage
windbreaks
soil management
irrigation
glass-houses
indoors
field heaps etc.
Additional Responsibilities

- The primary mandate of agricultural meteorology is to extend and fully utilize our knowledge of atmospheric and related processes to optimizing agricultural production with maximal use of weather resources and with minimal damage to the environment

- A secondary mandate concerns the conservation of natural resources and protection of the environment from detrimental usage.

Hence,

Sustainable human activity is dependent on climatic conditions and variable

Some Facts About Indian Agriculture

- India sustains 16% of the world's population on 2.4% of land resource
- Present Agriculture contributes 2-6% of the Indian GDP
- Livelihood support to two-thirds of the population
- Employment to 57% of work force
- Single largest private sector occupation
- Small farm size: Average of 1.4 ha
- Large number of farm holdings



Some Facts About Indian Agriculture

- Predominantly Rain-fed Agriculture
- Largely Subsistence Farming
- Less than 40% of net sown area irrigated.
- Most Irrigation from non-perennial sources.
- High risk / low margin production inhibits improvement of crop production techniques

Some Facts About Indian Agriculture

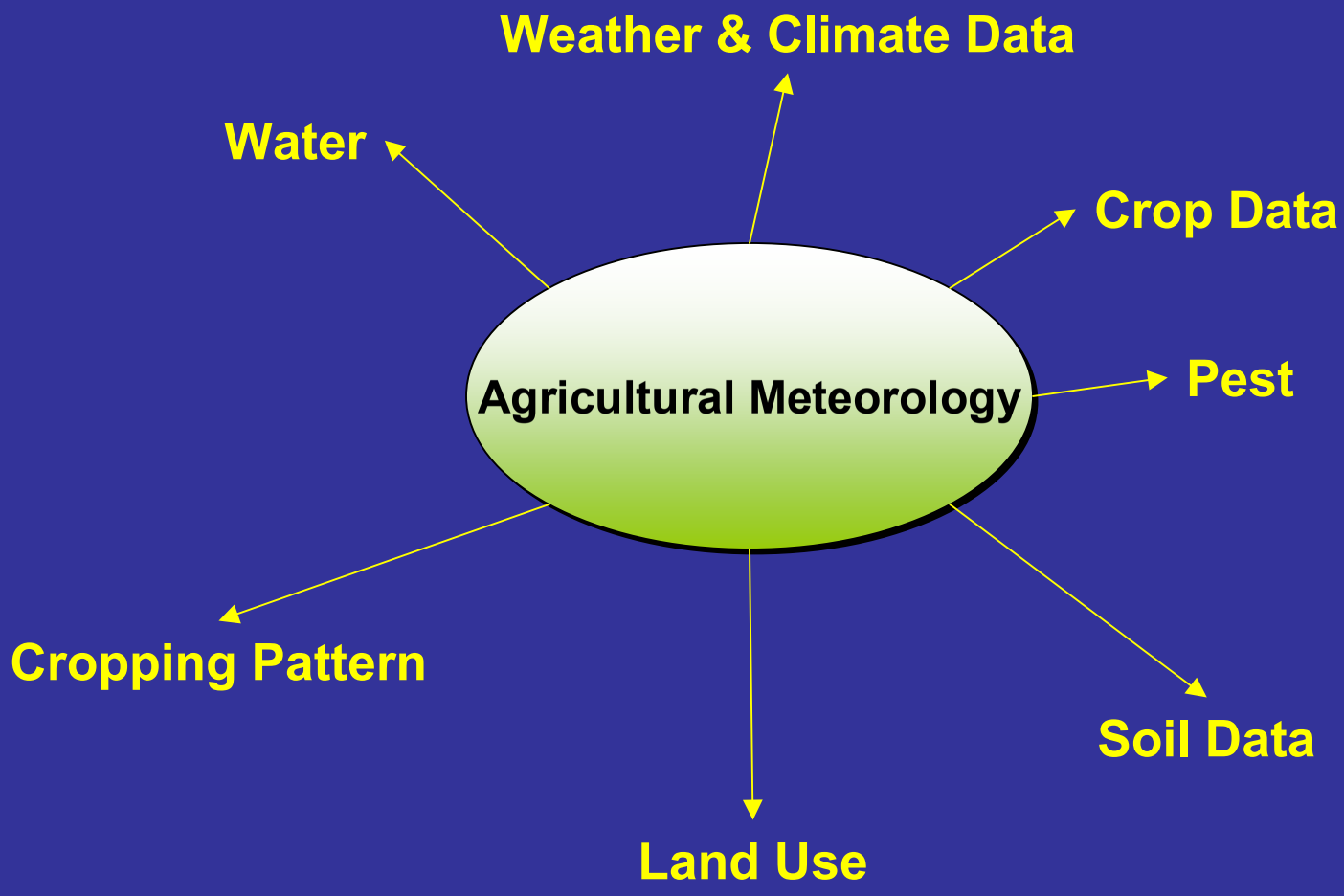
- Indian Agriculture is predominantly controlled by monsoon
- Up to 80% of variability in crop yields is attributable to weather.
- Many areas prone to extremes: Flood and Drought

Agrometeorological Research in India

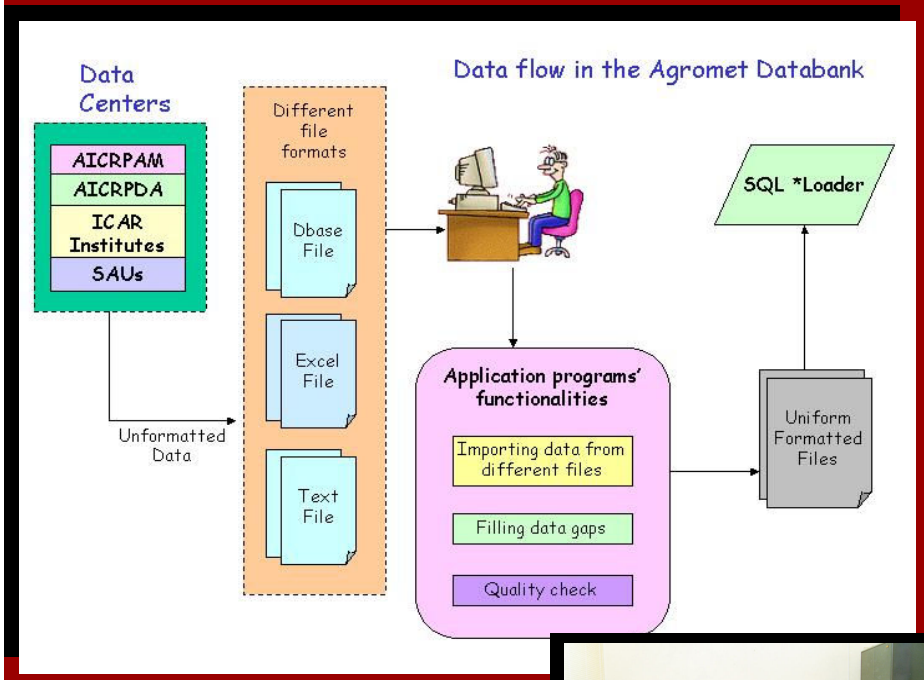
Major Research Activities Undertaken in Agrometeorolgy

- Resource characterization of Production Systems
- Climate characterization
- Microclimate and its modification
- Agromet Instrumentation
- Agrometeorology and Remote Sensing
- Climate change, variations and its impact on agriculture
- Agro advisory services to agriculture
- Agromet training and capacity building
- Agromet Database management
- Linkages with national and international institutions

Agromet Database management



Agromet Database management



Databank-CRIDA



Databank collects, quality controls and Stores the data on:

- 8 weather parameters such as
- Temp,RH,WS,BSH,E, Rainfall
- Derived parameters
- Crop morphology & Phenology
- Yield characters
- Information on pest and disease etc.

Developed website for faster communication and data transfer to the research Scientists

Deficiencies

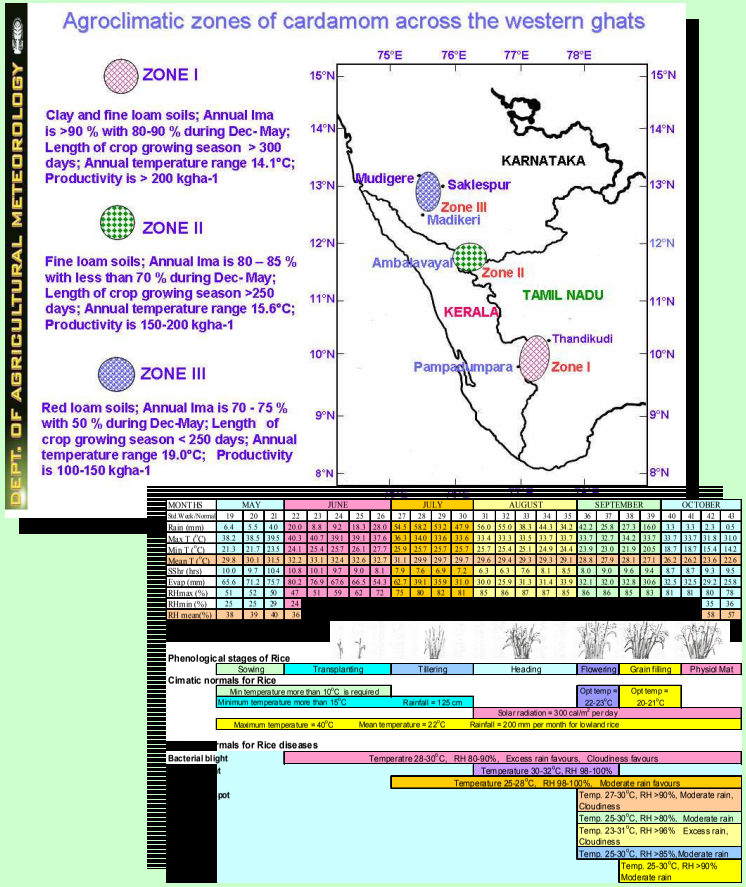
Lot of gaps in meteorological data
Lack of real-time data

Agromet Database management

Research Priorities

- Bringing all ICAR Institutes and SAUs to develop a 'Real-time Weather Communication Network' for Agro met research.
- Development of advanced Statistical, artificial intelligence and neural network Procedures for filling the missing meteorological data
- Development of new sources of data for operational agro-meteorology and Improved understanding of natural climate variability

Resource characterization of Production Systems



MONTHS	MAY			JUNE				JULY				AUGUST					SEPTEMBER					OCTOBER			
Std Week/Normal	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Rain (mm)	6.4	5.5	4.0	20.0	8.8	9.2	18.3	28.0	54.5	54.0	53.2	47.9	56.0	55.0	38.1	44.3	34.2	42.2	25.8	27.2	16.0	3.3	3.3	2.3	0.5
Max.T (°C)	39.2	38.5	39.5	40.3	40.7	39.1	39.1	37.6	36.3	34.0	33.6	33.6	33.4	33.3	33.5	33.7	33.7	33.7	32.7	34.2	33.7	33.7	33.7	31.8	31.0
Min.T (°C)	21.3	21.7	23.5	24.1	25.4	25.7	26.1	27.7	25.9	25.7	25.7	25.7	25.7	25.4	25.1	24.9	24.4	23.9	23.0	21.9	20.5	18.7	18.7	15.4	14.2
Mean T (°C)	29.8	30.1	31.5	32.2	33.1	32.4	32.6	32.7	31.1	29.9	29.7	29.7	29.6	29.4	29.3	29.3	29.1	28.8	27.9	28.1	27.1	26.2	26.2	23.6	23.6
SShr (hrs)	10.0	9.7	10.4	10.8	10.1	9.7	9.0	8.1	7.9	7.6	6.9	7.2	6.3	6.3	7.6	8.1	8.5	8.0	9.0	9.6	9.4	8.7	8.7	9.3	9.5
Evap (mm)	63.6	71.2	75.7	90.2	76.9	67.6	66.5	54.1	62.7	59.1	55.9	51.0	50.0	45.9	41.3	41.4	41.9	42.1	42.0	42.5	40.6	42.5	42.5	29.2	25.8
RH1max (%)	81	82	80	87	81	89	92	92	95	90	92	91	95	96	97	97	98	96	96	95	93	91	91	89	78
RH1min (%)	35	35	29	24																				35	36
RH mean(%)	58	59	55	56																				63	57

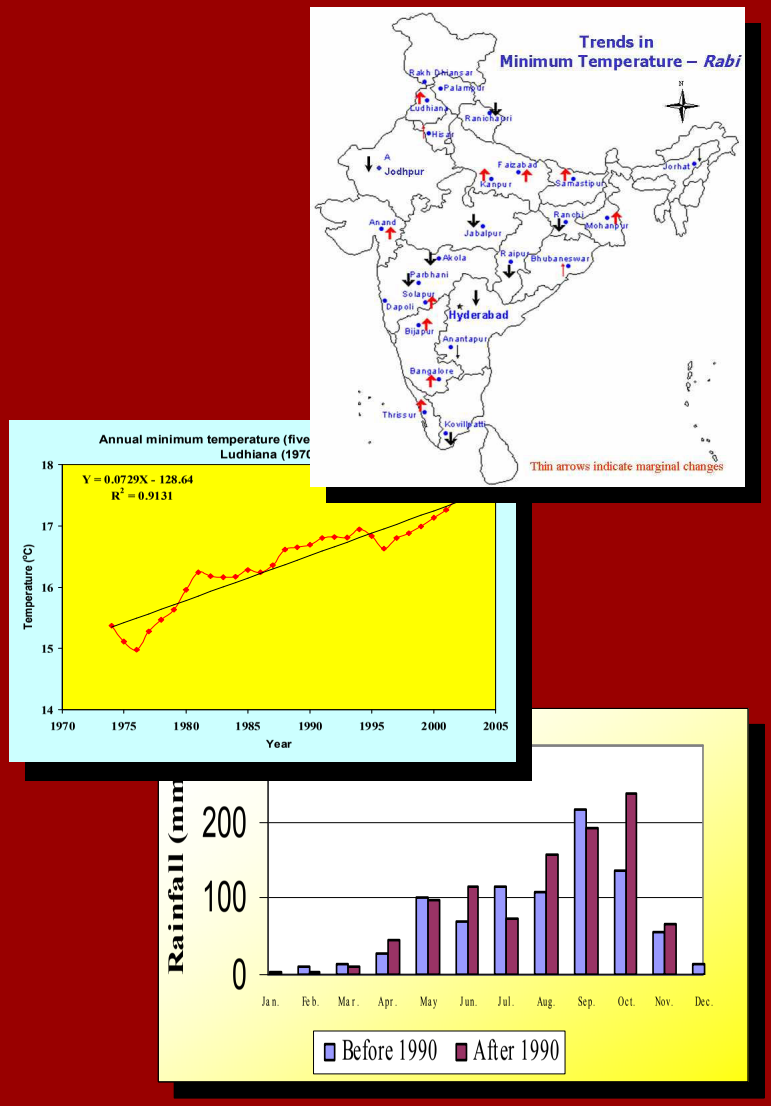
- **Resource characterization for individual crops were done at many places.**
- **But this characterization has done at Macro level and more generalized.**
- **Characterization for certain crops at micro level were done but scanty**
- **Further, this may not help in providing measures of Operational meteorology / agro advisories at micro level or block level**

Resource Characterization of Production Systems

Research Priorities

- Data warehouse on all natural and crop resource information at block level need to be developed
- 'Real time Agro-Weather Maps' of different crops for different areas should be prepared at block level using near-real time weather data and corresponding crop phenological data.

Climate characterization



- Agro climatic characterization is the main research area where lot of work has been carried out to find the suitable climates for different crops
- Further the short term as well as long-term variability in climate was also characterized
- Again the problem arising with the spatial scale of analysis which is at macro level. This hinders the decision making mechanism at micro level

Research Priorities

- Agro-climatic atlas
- Uniformity and standardization of procedures
- Analysis of agro climatic output

Microclimate Studies



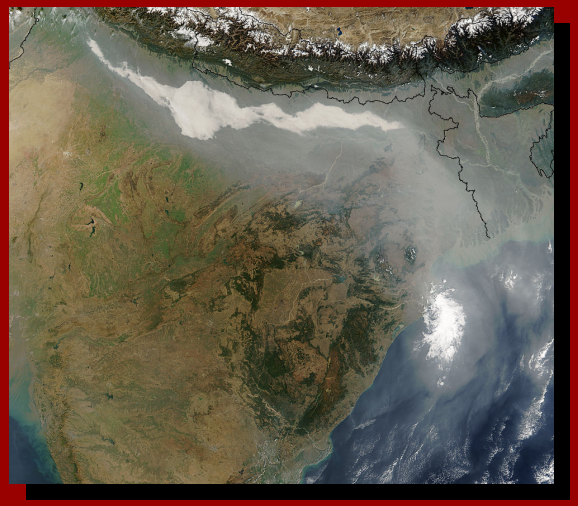
- Study on PAR
- Bowen's ratio and ET studies
- Lysimetric studies
- Crop Model Studies like DSSAT, BRASSICA, INFO-CROP and crop syst.

Microclimate and its modification

Research Priorities

- Microclimate modification optimization and improvement for agricultural production
- Operational agro-advisories through DSS models for yield enhancement
- Weather impacts on the performance and productivity of livestock / poultry and fisheries under heat / cold stress, along with possible changes under climate change scenarios may be studied.

AGROMETEOROLOGY AND REMOTE SENSING



- RS techniques for crop acreage and , production estimation
- Assessment of crop health
- Identifying the areas of incidence and spread of drought,
- flood zones and their recession
- other extreme weather events
- Measuring rainfall, radiation, surface temperature, soil moisture, LAI and crop phenology at limited locations

Research Priorities

- Development of minimum data sets for several locations
- Remote sensing based agromet research
- Capacity building in Remote sensing and agrometeorological applications are required.

CLIMATE CHANGE, VARIATIONS AND ITS IMPACT ON AGRICULTURE

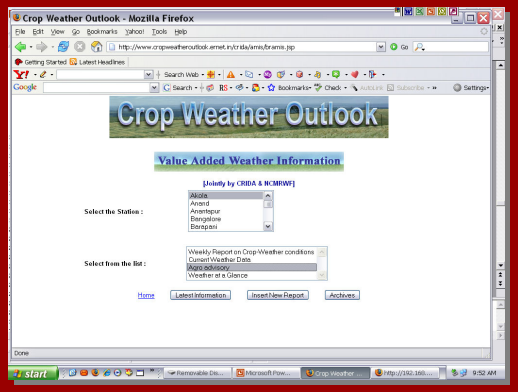
- Climate change studies have been take-up in India
- Hot spots, vulnerability zones were identified
- Impact studies on agriculture are progress in different parts of the country

Research Priorities

- Monitoring of effects of climatic variations/change on Agriculture
- Integration of
- Drought monitoring cells may be established at each district capital for coping up with contingency measures
- Indian agriculture is 5000 years old. There are many ITK s that are inherited by the present day farmer from his ancestors. These ITK s may be identified through Survey and recorded for further strengthening of agricultural management to adopt the current climate change by improving them with the existing knowledge and applications

- Differences in CO2 uptake when forests are replaced by other forms of agriculture.
- Dynamics of GHG in relation to rice paddies and ruminant cattle (as major source of methane) and the use of fertilizers (as source of nitrous oxide).
- Combined GCM and crop simulation models provide a good scientific approach to study the impact of climate variability and/or change on agricultural production and on the world food supply.
- Better understanding of the climate (variability) of the major eco-systems of India where bio-diversity is at risk could help develop *in-situ* conservation strategies.
- This requires knowledge of weather around ITCZ, ENSO phenomenon, and variability in rainfall and other extreme events.

AGROMETEOROLOGICAL SERVICES TO AGRICULTURE



- weather based agro-advisories for crop operation
- Early drought warning modules and their management strategies for better control measures against pest incidence, soil frost and extreme weather events
- Research on the consequences of modifications of the micro climatic environment

AGROMET RESEARCH AND INSTRUMENTSTION

- Facilities need to be created to develop technologies for manufacturing of sensors for use in Agrometeorological research.
- Testing and calibration centres to be established across the country.
- AWS network may be established at all locations covering even inaccessible and remote areas for improving the weather based agro-advisories.
- Local talent may be developed for maintenance of AWS.
- Development of Nanotechnology based agromet instrumentation

Crop weather Modeling

- **Conventional empirical approaches are considered inadequate for addressing the complexity of the interaction between global climates, regional weather variability, decision making, agricultural productivity and economic responses.**

- **Crop weather modeling must be further developed for solving complex agricultural problems.**

- **Modeling in the field of phenology, yield forecasting and related subjects are considered priority area.**

- **Development and validation of models for crop-pest management is another priority area.**

Training and capacity building

- To enhance capabilities of agromet personnel working at SAU's and other Institution,
- Open fulfledged Department of Agrometeorology at each SAU
- Response farming on specific effects of various weather/climatic factors on crop growth and performance
- GIS tools for spatial and temporal analysis of the climatic resources in combination with conventional methods, with priority for rainfall and temperature

Policy Issues

- **Protection, sustainable management and conservation of our resources, greening of degraded lands**
- **Changes in cropping pattern for high WUE**
- **Reduce Over-exploitation of ground water**
- **Development on watershed basis**

Policy Issues

- **Assessment of Rainwater harvesting potentials and conservation**
- **Irrigation scheduling as per meteorological requirements**
- **Environmental and economic evaluation of water use in Agriculture**

National and International Linkages

- Research programmes should be developed in Collaboration with international organizations to enhance the standard of research work
- Sharing of Real time weather and crop data among several research, training and services
- Organizations should be encouraged

Projections

- Micro level agro-climatic analysis for better crop planning
- Analysis of weather hazards (floods, droughts, heat and cold waves, hailstorms, un-seasonal rainfall events) for agricultural crop production
- Characterization of agro-climatic resources and identification of efficient crop growing environments for high productivity of major crops and cropping systems using GIS
- Influence of weather on dynamics of pests and diseases

Projections - Contd

- Agro-ecological regions - cropping patterns and agricultural productivity
- Modeling crop-weather relationships to enhance production
- Development of weather-based operational models for use in agro-advisories


Thank you