Acharya N.G. Ranga Agricultural University,
Rajendranagar, Hyderabad.

Course No: AGRO 101

Course Title: Principles of Agronomy and
Agricultural Meteorology

Credit Hours: 3(2+1)

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LECTURE NO – 1

DEFINITION OF AGRICULTURE, MEANING AND SCOPE OF AGRONOMY

The term agriculture is derived from the Latin words “ager” or “agri” meaning “soil” and ‘cultra’ meaning ‘cultivation’

Agriculture is a very broad term encompassing all aspects of crop production, livestock farming, fisheries, forestry etc.

Agriculture may be defined as the art, the science and the business of producing crops and livestock for man’s use and employment.

Agriculture is the cultivation of lands for production of crops for a regular supply of food and other needs for progress of the nation.

Agriculture is influenced by a large number of factors, some of which can be controlled by man (soil and irrigation) which others are beyond the control (climate)

The term “Agronomy” is derived from Greek words “Agros” meaning “field” and “nomos” meaning “to manage”

Agronomy is a branch of agricultural science which deals with principles and practices of soil, water and crop management.

Agronomy deals with methods which provide favourable environment to the crop for higher productivity.

Importance of basic sciences for development of Agricultural science

- Basic science is the study of basic principles and fundamentals of the respective subject.
- Applied science is the study in which the basic principles and fundamentals of respective subject are applied in a practical field.
- Agricultural sciences are essentially applied sciences and are dependent on basic sciences of Botany, Physiology, bio-chemistry, ecology, zoology, chemistry, physics, mathematics, economics etc.

For example

1. Knowledge of Botany is helpful in plant breeding and plant genetics and is making possible for evolution of different varieties in crops suitable to particular agro-climatic condition.
2. The knowledge of zoology (basic science of entomology) is helping the farmer to identify the insect pests which are responsible for damage to agricultural produce.
3. Soil chemistry helps in understanding the plant nutrient status in the soil and the deficiency symptoms in plants.
4. Physics helps in understanding the weather phenomena and soil conditions.

5. Mathematics is helpful in agricultural research and experimentation through statistics and Agricultural economics.

6. Study of economics is helpful in estimating the costs and returns and existing conditions of farmers in villages for effecting the improvements.

Without basic science there can be no development in applied science. In the field of Agriculture basic and applied sciences are interrelated to each other.

**Scope of Agronomy**

Agronomy is a dynamic discipline with the advancement of knowledge and better understanding of plant and environment, agricultural practices are modified and new practices developed for high productivity, for example availability of chemical fertilizer has necessitated the generation of knowledge on the method, quantity and time of application of fertilizers. Similarly availability of herbicides for the control of weeds has led to development of knowledge about selectivity, time and method of application of herbicides. To overcome the problems different management practices are developed.

Population pressure is increasing but area under cultivation is static, therefore more number of crops have to be grown on the same piece of land to increase the yield. As a result, intensive cropping has come into practice.

New technology has to be developed to overcome the effect of moisture stress under dryland conditions. As new varieties of crops with high yield potential become available package of practices have to be developed to exploit their full potential.

Restoration of soil fertility, preparation of good seed bed, use of proper seed rates, correct dates of sowing for each improved variety, proper conservation and management of soil moisture and proper control of weeds are agronomic practices to make our limited land and water resources more productive.

**Relation of Agronomy to other sciences**

Agronomy is a synthesis of several disciplines like soil science, Agricultural chemistry, crop physiology, plant ecology, biochemistry and economics. Soil physical, chemical and biological properties have to be understood thoroughly to effect modification of soil environment. Similarly it is necessary to understand the physiology of crops to meet their requirements. Advances in economic analysis helped in production of crops economically.

Agronomist aims to obtain maximum production at minimum cost. He exploits the knowledge developed by basic and applied science for higher crop production. Whatever may be the research findings of other scientists. Agronomist has to test their suitability in the field and accept them finally and also judge the reactions of farming community. He is a key person with working knowledge of all agricultural disciplines and coordinator of different subject matter specialists.
LECTURE NO-2

HISTORY AND DEVELOPMENT OF AGRICULTURE IN ANCIENT INDIA- AGRICULTURE IN CIVILIZATION ERA

i. Agriculture began some 10,000 years ago

ii. The successional stages in food procurement and production appear to be as follows:

   Hunting and Gathering
   ↓
   Domestication (of animals and plants)
   ↓
   Root crop culture
   ↓
   Shifting cultivation
   ↓
   Subsistence Agriculture
   ↓
   Commercial Agriculture

iii. Agriculture was very important profession during Vedic age.

iv. Buddhist period (600BC) marked the importance of trees.

v. Irrigated agriculture with rice was started in south India during 300 A.D.

vi. Amarakosha written during the period of Chandra Gupta – II contained information on soil, irrigation implements, manures and land use.

vii. History of agriculture from 9th to 11th century is evident from Krishi – Parashara written by “Parashara” (950-1100AD)

viii. Modern Agriculture was started during early 19th century but was confined to western countries.

ix. Most developments in India started after independence

x. At the time of independence, cultivated area in India was 98.5 m. ha. And irrigated area was 19.4 m. ha (out of 329 m. ha of geographical area).

xi. Now the total cultivated area is 143 m. ha and the gross irrigated area increased to 82.6 m. ha (2005-06)
Table 1.1 Net irrigated area (m.ha.) under different sources.

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<tr>
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</thead>
<tbody>
<tr>
<td>Canals</td>
<td>8.3</td>
<td>16.9</td>
<td>15.7</td>
<td>15.5</td>
</tr>
<tr>
<td>Wells and tube wells</td>
<td>6.0</td>
<td>24.1</td>
<td>33.8</td>
<td>35.4</td>
</tr>
<tr>
<td>Tanks</td>
<td>3.6</td>
<td>3.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Others</td>
<td>3.0</td>
<td>3.2</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>Total</td>
<td>20.9</td>
<td>47.4</td>
<td>55.1</td>
<td>60.2</td>
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</tbody>
</table>

FERTILIZERS:
Fertilizers consumption in India

1. 1951-52 - 0.07 m.t
2. 1969-70 - 1.98 m.t
3. 2005-06 - 35.45 m.t
4. 2006-07 - 38.03 m.t (18.1 – kharif, 19.9 Rabi)

Consumption per unit area - 150 kg/ha

Consumption ratio for N : P : K = 8.4 : 2.5 : 1.0

The required N and P fertilizers are produced in our country while K fertilizers are totally imported.

PESTICIDES:

1950 - 100t
1996-97 - 92,700 t
Average use - 429 g/ha
Consumption of Pesticides - 2006-07-41515 m. t (India)
HYV’S AND HYBRIDS:

India witnessed green revolution in 1960,s and 70,s particularly through wheat crop. It is due to dwarfing gene “NORIN”.

India also witnessed white revolution with milk. Blue revolution with Aquaculture and partial success of Yellow revolution with oil seeds

i. Now it is being programmed for Rainbow Revolution.

ii. Apart from traditional breeding programmes, new varieties were evolved using other techniques like use of Radio-isotopes. Biotechnology etc.

iii. Now we also have GM plants

NON-TRADITIONAL CROPS AND INTRODUCED CROPS:

Rice is grown in Punjab with very good yields and wheat yields are very good in south and Eastern India (Non-traditional areas) Crops like sunflower, Soya bean and oil palm are introduced into India and now occupy considerable area.

MECHANIZATION:

✓ Cattles are replaced to a great extent by Tractor.

<table>
<thead>
<tr>
<th></th>
<th>1950-51</th>
<th>NOW</th>
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<tbody>
<tr>
<td>Tractors (m)</td>
<td>0.01</td>
<td>2.63</td>
</tr>
<tr>
<td>Oil engines (m)</td>
<td>0.07</td>
<td>4.90</td>
</tr>
<tr>
<td>Electrical pumps (m)</td>
<td>0.02</td>
<td>9.80</td>
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</tbody>
</table>

✓ Use of seed drills has picked up.

✓ New planting equipments introduced into the country include potato planter, groundnut planter, rice transplanter, sugar cane sett cutter – cum- planter.

✓ Now combines are put to use for the harvest of wheat, rice, soya bean and gram.

✓ One important obstacle in the way of mechanization in India is the size of operational holding. The average farm size in India is 1.57 ha.

In other countries:

1993 ha in Australia
158 ha in USA
55 ha in UK
1.0 ha in Japan

WATERSHED PROGRAMMES:

Water shed programmes for soil and moisture conservation have been taken up. Anna Hazare in Maharashtra (Ralegaon siddi) Rajendra Singh in Rajasthan

Weather forecasting systems are improved due to the use of satellite communications. Particularly the shortage forecast.
Agricultural Extension:

In A.P DAATT (District Agricultural Advisory and Transfer of Technology) centers and “Rytu Mitra” T.V programmes are educating the farmers about the better management practices.
LECTURE NO - 3

NATIONAL AND INTERNATIONAL RESEARCH INSTITUTES IN INDIA

NATIONAL RESEARCH INSTITUTES:

CAZRI  : Central Arid Zone Research Institute, Jodhpur, Rajasthan
CFTRI  : Central Food Technological Research Institute, Mysore, Karnataka
CICR   : Central Institute for Cotton Research, Nagpur, Maharashtra
CPRI   : Central Potato Research Institute, Simla, H.P.
CRIJAF  : Central Research Institute for Jute and Allied Fibres, Barrack Pore, W.B.
CIAE   : Central Institute of Agriculture Engineering, Bhopal, M.P.
CPCRI  : Central Plantation crops Research Institute, kasargod, Kerala
CRIDA  : Central Research Institute for Dryland Agriculture, Hyderabad, A.P.
CRRI   : Central Rice Research Institute, Cuttack, Orissa
CSWCRTI : Central Soil and Water Conservation Research and Training Institute, Dehradun, U.P.
CTCRI  : Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala
CSSRI  : Central Soil Salinity Research Institute, Karnal, Haryana
CTRI   : Central Tobacco Research Institute, Rajahmundry, A.P.
DOR    : Directorate of Oilseeds Research, Hyderabad, A.P.
DRR    : Directorate of Rice Research, Hyderabad, A.P.
DWR    : Directorate of Wheat Research, Karnal, Haryana
DWMR   : Directorate of Water Management Research Institute, Jhansi, U.P.
FRI    : Forest Research Institute, Dehradun, U.P.
IARI   : Indian Agriculture Research Institute, Pusa, New Delhi
IGFARI : Indian Grassland Fooder and Agroforestry Research Institute, Jhansi, U. P.
IISR   : Indian Institute of Sugarcane Research, Lucknow, U.P.
IISS   : Indian Institute of Soil Science, Bhopal, M.P.
IIPR   : Indian Institute of Pulse Research, Kanpur, U.P.
IIHR   : Indian Institute of Horticultural Research, Bangalore, Karnataka.
ILRI   : Indian Lac Research Institute, Ranchi, Bihar
JTRL   : Jute Technological Research Laboratory, Kolkata, W.B.
NCMRT  : National Centre for Mushroom Research and Training, Solan, H.P.
NRCG : National Research Centre for Groundnut, Junagadh, Gujarat
NRCS : National Research Centre for Sorghum, Hyderabad, A.P.
NRC for Soybean, Indore, M.P.
NRC for Spices, Calicut, Kerala
NRC for Cashew, Pattur, Karnataka
NRC for Citrus, Nagpur, Maharashtra
NRC for Rapeseed and Mustard, Bharatpur, Rajasthan
NRC for Oil Palm, Pedavegi, Andhra Pradesh.
NCWS : National Centre for Weed Science, Jabalpur, M.P.
NBPG : National Bureau of Plant Genetic Resources, New Delhi
NAARM : National Academy of Agricultural Research Management, Hyderabad
NBSSLUP : National Bureau of Soil Survey and Land Use Planning, Nagpur, Maharashtra
NPPTI : National Plant Protection Training Institute, Hyderabad, A.P.
PDCSR : Project Directorate for Cropping Systems Research, Meerut, U.P.
SBI : Sugarcane Breeding Institute, Coimbatore, Tamil Nadu

INTERNATIONAL INSTITUTES:
CGIAR : Consultative Group on International Agricultural Research, Washington, D.C.
CIFOR : Centre for International Forestry Research, Bogor, Indonesia
CIAT : Centre International de Agricultural Tropical, Cali, Columbia
CIMMYT : Centre International de la Mejoramientode Maizy Trigo, Mexico
CIP : Centre International de la papa (International Potato Centre) Lima, Peru
IBPGR : International Board for Plant Genetic Resources, Rome, Italy
ICARDA : International Center for Agricultural Research in the Dry Areas, Aleppo, Syria
ICRAF : International Centre for Research in Agro-Forestry, Nairobi, Kenya
ICRISAT : International Crops Research Institute for Semi-Arid Tropics, Hyderabad, India
IFPRI : International Food Policy Research Institute, Washington, U.S.A
IITA : International Institute for Tropical Agriculture, Ibadan, Nigeria
IIMI : International Irrigation Management Institute, Colombo, Sri Lanka
ILRI : International Livestock Research Institute, Nairobi, Kenya
IRRI : International Rice Research Institute, Manila, Philippines
WARDA : West Africa Rice Development Association, Ivory Coast, West Africa

**IMPORTANCE EVENTS OF AGRICULTURE IN INDIA**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1788</td>
<td>First attempt at cotton crop improvement in Bombay province</td>
</tr>
<tr>
<td>1827</td>
<td>First agricultural society at Calcutta</td>
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<td>1864</td>
<td>First model agricultural farm at Saidapet, Tamil Nadu</td>
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<td>1871</td>
<td>Department of Agriculture created</td>
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<td>1878</td>
<td>Higher Education in Agriculture at Coimbatore</td>
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<td>1880</td>
<td>First Report of Famine Commission (Famine during 1876-77)</td>
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<tr>
<td>1893</td>
<td>Second report of Famine Commission</td>
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<tr>
<td>1901</td>
<td>Third report of Famine Commission</td>
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<td>1901</td>
<td>First Irrigation Commission</td>
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<td>1902</td>
<td>Introduction of large scale cultivation of groundnut</td>
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<td>1903</td>
<td>Imperial Agricultural research Institute at Pusa, Bihar</td>
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<td>1904</td>
<td>Introduction of Cambodia cotton</td>
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<td>1912</td>
<td>Imperial Sugarcane Breeding Station at Coimbatore</td>
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<td>1926</td>
<td>Royal Commission on Agriculture</td>
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<td>1929</td>
<td>Imperial (Indian) Council of Agricultural Research at Delhi</td>
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<td>1936</td>
<td>IARI shifted to Delhi</td>
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<td>1942</td>
<td>Grow More Food Campaign</td>
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<td>1946</td>
<td>Central Rice Research Institute</td>
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<td>1947</td>
<td>Fertilisers and Chemicals, Travancore</td>
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<td>1956</td>
<td>Project for Intensification of Regional Research on Cotton, Oilseeds and Millets (PIRRCOM)</td>
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<td>1960</td>
<td>Intensive Agriculture District Programme (IADP)</td>
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<td>1963</td>
<td>National Seed Corporation</td>
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<td>1965</td>
<td>Intensive Agriculture Area Programme (IIAP)</td>
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<td>1965</td>
<td>National Demonstration Programme</td>
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<td>1965</td>
<td>All India Coordinated Rice Improvement Project, Hyderabad</td>
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<td>1966</td>
<td>HYV Programme</td>
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<td>1966</td>
<td>Multiple Cropping Schemes</td>
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<td>1970</td>
<td>Drought Prone Area Programme</td>
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<td>1971</td>
<td>All India Coordinated Project for Dryland Agriculture</td>
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<td>1972</td>
<td>ICRISAT</td>
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<td>1973</td>
<td>Minikit Trails Programme</td>
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<td>1974</td>
<td>Command Area Development</td>
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<tr>
<td>1975</td>
<td>Release of first cotton hybrid in India</td>
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</table>
1976  Report of National Commission on Agriculture
1976  Integrated Rural Development Programme (IRDP)
1977  Training and Visit (T&V) System
1979  National Agriculture Research Project (NARP)
1982  National Bank for Agriculture and Rural Development (NABARD)
1986  Establishment of Technology mission on oilseeds
1993  Release of First rice hybrid in India
1998  National Agricultural Technology Project (NATP)
ITDA   -  Integrated Tribal Development Agency
SFDA   -  Small Farmers Development Agency
HADP   -  Hill Area Development Project Special Programme for Horticultural Crops
DRDA   -  District Rural Development Agency

**Functions of ICAR:** Coordinating Agricultural activity between states and center financing research problems.
Maintaining National Research Centers and Institutes

**Agricultural research is carried out by:**  ICAR research centers
SAUs (State Agricultural Universities)
State Government Research Centers
Private agencies

- (Please find out different agricultural universities in India and their location)