Lecture Note

Course Title : **Agricultural Research, Research Ethics and Rural Development Programmes**

Course No. : **PGS 505**

Credit Hours : **1 + 0 = 1**

Department of Agricultural Extension & Communication
B. A. College of Agriculture
Anand Agricultural University, Anand, Gujarat

Lecture Note of Course on "Agricultural Research, Research Ethics and Rural Development Programmes" (PGS-505)

Compiled by

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DEPARTMENT OF EXTENSION EDUCATION

COURSE CUM LECTURE OUT LINE

Course Particulars

1.	Course	:	M. Sc. (Ag.)
2.	Course No	:	PGS 505
3.	Course Title	:	Agricultural Research, Research Ethics and Rural Development Programmes
4.	Credit Hours	:	1 (1 + 0)
5.	Semester	:	Even Semester (2nd Semester)
6.	Academic Year	:	2021-22
7.	Entry Level Qualification of Learners	:	B. Sc. (Ag.)
8.	Year of Standing	:	First Year M. Sc. (Ag.)
9.	Course Teacher	:	Dr. Vinaya Kumar, H. M.
10.	Fundamental Objective:		
	To provide **Knowledge and Skills** in **agricultural research and research ethics and current development in agricultural research and rural development through different government programmes.**		

11.	**General objectives:** The course intends to sensitize the scholars about the basic issues related with agricultural research, ethics in research as well as rural development. The scholars will be also educated about principles and philosophy of rural development and motivated towards practicing and promoting ethics in research and developmental endeavors.

THEORY

SI. No.	Lesson / Topic of Lecture	Lecture Duration (in Hours)	Teaching Methods	Teaching Aids
UNIT – I				
1.	History of agriculture in brief; Ancient agriculture, Historical stages of development of agriculture.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
2.	Development of scientific agriculture in world and India. Green revolution in India. Revolutions related to agriculture and allied activities.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
3.	National Agricultural Research Systems (NARS): ICAR- mandate, research institutions their mandate.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
4.	Regional Agricultural Research institutions of ICAR. State Agricultural Universities.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
5.	Consultative Group on international Agricultural Research (CGIAR)	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
6.	International Agricultural Research Centers (IARC) their mandate and achievements.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
7.	Global agricultural research system: need, scope, opportunities.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
8.	Role promoting food security, reducing poverty and protecting the environment;	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
9.	Partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels;	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
10.	International fellowships for scientific mobility. NAAS rating journals.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation

UNIT – II				
11.	Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics and standards land problems in research ethics.	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
UNIT – III				
12.	Definition, Meaning and Connotations of Rural Development	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
13.	Rural Development Policies and Strategies	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
14.	Rural Development Programmes -CDP and IADP	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
15.	Drought Prone Area Programme and Swarnajayanti Gram Swa rojagar Yojana	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
16.	Sampoorna Grameena Rojagar Yojana and National Rural Employment Guaranty Act	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
17.	Panchayat Raj Institutions in implementation of Rural Development Programmes	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
18.	NGOs/Voluntary Organizations in Rural Development	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
19.	Evaluation of Rural Development Policies and Programmes	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation
20.	Constraints in implementation of Rural Development Programmes	1	Lecture cum Discussion/ Forum	Chalk Board/ Power Point Presentation

RECOMMENDED REFERENCES IN COURSE CATALOGUE (4th Dean's ICAR Syllabus)

1. Ableman, M. 2005. Fields of plenty: A farmer's journey in search of real food and the people who produce it. San Francisco: Chronicle Books.
2. Agarwal, A. 2005. Environmentality: Technologies of government and the making of subjects. Durham, NC: Duke University Press.

3. Gadgil, M. and Guha, R. 1995. Ecology and equity. The use and abuse of nature in contemporary India. New Delhi: Penguin Books.
4. Jain, L.C., Krishnamurthy, B.V. and Tripathi,P.M. 1986. Grass without roots under Government Auspices. Sage Publications, New Delhi.
5. Punia M. S. Manual on international Research and Research ethics. CCS, Hayana Agricultural University, Hisar.
6. RAO, B.S.V., 2007, Rural Development strategies and Role of Institutions-Issues, Innovations and Initiatives Mittal Publishers, New Delhi.
7. Rivera, Roberto and David Borasky 2009. Research Ethics Training Curriculum, Family Health International. P.O. Box 13950 Research Triangle Park, NC27709. USA.
8. Singh, K., 1998, rural Development Principles, Policies and Management Sage Publications, New Delhi.
9. Singh, Kartar 2001. Rural Development – Principles, Policies and Management.Sage Publications, New Delhi.
10. Thompson, P. 1997. The spirit of the soil: Agriculture and environmental ethics. New York: Routledge Press.

Scheme of Evaluation

THEORY:

Name of the Examination	Marks	Weightage of Marks
Internal Examination	50	50
Semester Final Examination (External)	50	50
Total Marks:	100	100

Marks obtained for total 100 Marks will be converted to 10 Point Scale for obtaining Grade Point (GP), (‹6.0 =not satisfactory, 6.0 or ›6.0=satisfactory)

UNIT – I

Chapter-1.1: History of agriculture in brief; Ancient agriculture, Historical stages of development of agriculture.

There are grounds to believe that prehistoric man gave some attention to the cultivation of crops 10,000 to 12,000 years ago or possibly earlier. But improvement in the methods of growing food crops was doubtless very slow until about the time of Abraham about 2000 B.C. (4009 years ago).

The investigations of ancient caves at Palestine indicate that plowing was practiced between 2500 to 3000 B. C. and ancient drawings depict Egyptian plowing scenes in the 14^{th} and 15^{th} centuries B.C.

1. The earliest authenticated writings discussing farming practice are those of **Greeks** more than 50 of whom gave some attention to agriculture in their manuscripts.

2. Among the most noted to pay considerable attention to farming was the poet **Hesiod** who set down some rules for crop production before 776 B.C.

3. Historian **Xenophon** (430 to 355 BC) mentions plowing under of green plants as a means of soil enrichment.

4. Mago from Carthage was a voluminous writer on agriculture who compiled 28 books on agriculture (These were translated into Greek and condensed into 20 volumes by Cassius Dionysius. When Carthage was conquered in 146 B.C. Mago's books were taken back to Rome and were translated into Latin by order of the Roman senate. These books were read extensively by Roman writers.)

ROMAN AGRICULTURE

Agriculture was held in high esteem by the early Romans and Farm Work was the only manual labor deemed honorable for free men. Other manual labor was considered to be the job of only slaves. (Farming methods were very primitive. Gradually the land passed more and more into the large estates of influential men to be worked under by the slaves).

Number of Romans wrote extensively about farming. Most important were:

1.**Cato** (234-139 B.C) was the earliest Roman agriculture writer. He drew much information from Greek literature.

- Good ploughing is more important than even manuring.

- But urged careful conservation of manure.
- Gave directions for care of livestock and cultivation of soil.

2. **Varrow** (116-27 BC). Was a traveler soldier, farmer, statesman and a scholar? His writing on agriculture may be divided into 3 parts.

- Cultivation of fruits, grains and legume.
- Raising of large animals like cows, sheep, goats, pigs etc.
- Raising of small animals, poultry, bees etc.

Also wrote on the selection and operation of farm.

3. **Columella** (First century AD). Wrote 13 short books and are more readable than those of Cato or Varrow

His first 12 books cover every phase of agriculture.

a. Selection of land and arrangement of buildings.
b. Tillage, Soil improvement.
c. Production of various field crops.
d. The propagation of and care of fruit trees and of vines.
e. Selection, breeding and general care of farm animals both small and big.
f. Methods of treating diseases of animals.
g. Management of poultry, bees and fish ponds.
h. Duties of an overseer or manager.
i. Receipt for wine making and preservation of fruits and vegetables/
j. Last book elaborates the discussion of the care of trees and wines.
k. The tenth book is in verse.

Among the practices advocated in these Roman books the following may be listed.

1. Thorough tillage
2. Green manuring
3. Crop rotation
4. Use of lime
5. Application of manure
6. Growth of legumes for soil improvement

(There is some reason to believe that many of the desirable practices listed were discussed by writers to a greater extent than they were actually utilized by most farmers).

Farming after the fall of Rome

With the conquer of Italy by the Barbarians around 410 a long period without progress set in following the actual deposing of the Roman emperor by the Barbarian Odoacer in 476 A.D. Agriculture as well as other forms of civilization lost grounds for many years. In fact the knowledge accumulated would have been lost had it not been preserved by the monks.

During the middle ages, the system of land ownership was not conducive to progress. The fields were divided into a number of small strips often an acre or less. Each tenant worked several such strips which were scattered over the field or farm. A 3-Years system of cropping was followed (a) A winter grain (b) A spring crop of oats, barley, peas, beans or a crop mixture (c) Year of fallow.

Thus there was an extensive literature in Roman times which maintained a pre-eminent position until comparatively recently. The Roman literature was collected and condensed into one volume about the year 1240 by a senator **Petrus de Crescent**, whose book was one of the most popular treatises on agriculture of any time, and it passed through many editions. Many other agriculture books appeared in the 15^{th} and 16^{th} centuries notably in Italy and later in France. In some of these books are, found certain ingenious speculations that have been justified by later work.

For Example:

i) If you bring dung to the field it is to return to the soil something that has been taken away.

ii) Every sort of plant without exception contains some kind of salt - when a plant is burnt it is reduced to a salty ash called alkali.

iii) The farmers burn the unused straw of wheat in the field. In the ashes are found the salts that the straw took out of the field. If this is put back the field is improved.

But for every speculation that has been confirmed will be found many that have not. The beginning of scientific agriculture must be sought later when men realized the necessity of carrying on experiments.

Beginning of Scientific Agriculture

The Search for the 'Principle of Vegetation'

It was probably very early discovered that manures, composts, dead animal bodies and parts of animals such as blood all increased the fertility of the land and there by increased the plant

growth. Yet the early investigations consistently ignored this ancient wisdom when they sought for the 'Principle of Vegetation' to account for plant growth.

1. Francis Bacon (1561-1624) believed that water formed the 'Principle nourishment of plants'. The soil only keeps the plants in position and protects them from excessive cold or heat.

2. Van Helmont (1577-1644) A physician and Chemist regarded water as the sole nutrient for plants.

Experiment:

Earthen vessel + 200 pounds oven dry soil + rainwater+ planted willow shoot weighing 5 lbs.

After 5 years the plants weighed 169 lbs + 3 ounces. It received only rainwater or distilled water.

The soil was covered with iron sheet to prevent the contamination from dust. The soil was dried and weighed 200 lbs less about 2 ounces. Therefore the plant arose from water alone.

The experiment was simple and convincing and satisfied **Robert Boyle** who repeated it with squash and obtained similar results. Boyle further distilled the plant and concluded the products obtained. 'Salt, Spirit, Earth and Oil' may be produced from water. But two things were overlooked part played by air and the missing 2 ounces of soil. From a good experiment a conclusion was drawn that appeared to be absolutely sound but is in reality entirely wrong.

3. Glauber (1604-1668) a German Scientist set up the hypothesis that soil peter (KNO_3) is the principle of vegetation and not water. He found the earth cleared out from cattle sheds contained salt peter. He considered that this salt peter must have come from urine and excreta and must therefore be contained in the plants eaten by the animals. He also found that addition of salt peter to the soil produced enormous increase of crop. He connected these two observations and suggested that the salt petre is the principle of vegetation.

4. This view was supported by **John Mayow**, an English Chemist. He estimated the amount of nitre in soil at different times of the year and showed that it occurs in greatest quantity in spring when plants are just beginning to grow, but is not to be found in soil in which plants grow abundantly since the nitre is sucked by the plants.

5.The most accurate work was done by **John Woodward** around 1700. Setting out from the experiments of Van Helmont and Boyle but apparently knowing nothing of the work of Glauber and Mayow he grew Spearmint in Rain water, Water from Thames river Hyde park conduit (London) and Hyde park conduit + 1.1/2 oz garden mould.

All these plants had abundance of water and therefore should have made equal growth. The amount of growth, however, increased with the impurity of water. He concluded that vegetables are not formed of water but of certain terrestrial matter.

Peter Descresenzi (1230-1307 A.D.) collected many literature related to Agronomy in his book "**Opus Ruralium Kamo Daram**" for the first time. That is why he is called the **Father of Agronomy**.

Soil Particles as the Principle

For many years no such outstanding work as that of Glauber and Woodward was carried out. Advances were however being made in agricultural practice. One of the most important was the **introduction of the seed drill and the horse hoe** by **Jethro Tull**,(1674-1741) an oxford man of a strongly practical turn of mind. He wrote a book "**Horse Hoeing Husbandry".** According to him

1. The minute particles of soil loosened by the action of moisture constituted the food of plants.
2. The pressure caused by the swelling of the growing roots forced these particles into the "Lacteal (conducting) mouths of the roots" where they entered the circulatory system.
3. All plants lived on these particles i.e. on the same kind of food.
4. Plants take in anything that comes their way, good or bad.
5. Rotation of crops is not a necessity but a convenience
6. Any soil will nourish any plant if temperature and water supply is properly regulated.
7. Hoeing increased the surface of the soil and also enabled the soil better to absorb the nutritious vapors condensed from the air.
8. Dung acted in the same way but was more costly and less efficient.

The words **weed** and **zero tillage** were also used first by him.

Humus Theory

Scientists like **Kulbel and Boer** have believed that there is some living juice in humus which is used by the plants.

SEARCH FOR PLANT NUTRIENTS

The Edinburgh Society established in 1775 induced **Francis Home** to try chemistry in settling principles of agriculture. Homemade pot experiments to ascertain the effect of various substances on plant growth. It was clear that plant food was not one thing only but several. He

enumerated six: air, water, earth, salts of different kinds, oil and fire. The work of Home indicated that two methods to be followed in studying the plant growth are: Pot culture and Pot analysis.

Joseph Priestly (1775): showed that the plants (mint) purify the air whereas breathing of animals make it impure. But he had not discovered oxygen. But when he discovered oxygen he failed to confirm his earlier results because he overlooked the importance of light. It was **Jan Ingen-Housz** (1779) a Dutch scientist who showed that purification goes on in light only while vitiation of air takes place during darkness.

Senebier at Geneva also obtained similar results. He also studied the effect of air on plants and argued that the increased weight of willow tree in van Helmonts experiment came from the fixed air.

A new method was wanted for further progress or before the new idea introduced by Senebier could be development. In 1804 **Theodore de Saussure** introduced the quantitative experimental method which formed the basis of subsequent work of Boussingault, Liebig, Lawes and Gilbert and indeed still remains our safest method of investigation. He was thus able to demonstrate the central facts of respiration – the absorption of Oxygen and evolution of CO_2 and decomposition of CO_2 and evolution of O_2 in light. He therefore showed that.

a. Air was the main source of Carbon to plants.

b. Soil furnished only a very small part of the plant food but it is indispensable.

c. Soil supplies nitrogen and not the air

d. Root exerts certain action on the absorption of mineral matter. Water can be taken by the plants without the dissolved salts in it and thus increases the concentration of salts in soil water.

Different salts are also absorbed to a different extent

The composition of the plant ash varies depending upon the nature of the soil and age of the plants.

A plant grown in water from seed contains no more ash than the seed itself. Thus he dispelled the idea of ash from water.

Arthur Young (1741-1820) conducted pot culture experiments to increase the yield of crops by applying several materials like poultry dung, nitre, gun powder, etc. He published his work in 46 volumesas 'Annals of Agriculture" Till 1834 experiments were being conducted either in the Laboratory or in small pots. During this year **J.B. Boussingault** began a series of field experiments on his farm at Bechelbronn in Alsace, France. These were the first of their kind. To Boussingault goes the honour of introducing the method by which the new agriculture science was to be developed. He is therefore referred to as the **Father of Field Plot Method of Experimentation.** He reintroduced the quantitative method of de Saussure, weighed and analyzed the manures used and the crop obtained at the end of the rotation, drew up a balance sheet showing how far the manures had satisfied the needs of the crop and how far other sources of supply- air, rain and soil had been drawn upon.

Boussingault's work covered the whole range of agriculture and dealt with the composition of crops at different stages of their growth with soils and with problems in animal nutrition. Unfortunately the classic farm of Bechelbronn did not remain a centre of agricultural research and the experiments came to an end after the war of 1870.

For some years no important discoveries were being made, no controversies were going on and no great amount of interest was taken in the subject but all this changed in 1840 when **Liebig's** famous report to the British Association published as '**Chemistry in its application to agriculture and physiology**' came like thunder bolt upon the world of science. With his sarcasm he ridiculed the plant physiologists of his day for their continued adhesion to the wrong notion that plants derive their C from soil and not from CO_2 of the air.

"All explanations of chemists must remain without fruit and useless because even to the great leader of physiology carbonic acid, ammonia, acids and bases are sounds without meaning, words without sense, terms of unknown language which awake no thoughts and no associations".

Liebig's ridicule did what neither de Sausser nor Boussingault's logic had done. It finally killed the humus theory. It was considered that.

a. CO_2 in the air was considered to be the sole source of Carbon to plants.
b. H_2 and O_2 came from water and N_2 from ammonia.
c. Certain mineral substances were essential for plant growth.
d. Alkalis were needed to neutralize acid, made by plants in their vital process.
e. Phosphate was necessary for seed formation.
f. Potassium silicate for development of grasses and cereals.

The evidence lay in the composition of ash: plants may absorb anything but they excreted from their roots whatever was non-essential. The fact that a substance being present was therefore sufficient proof of its necessity.

Liebig stated that nitrogen is taken up as ammonia which may come from the soil, from added manure or from the air. When sufficient crop analysis is made it will be possible to draw up tables showing the farmer precisely what he must add in a particular case.

An artificial manure known as **Liebig's Patent manure** was made up on these lines and placed on the market. As time went by Liebig developed his thesis and gave it a quantitative form.

"The crops on a field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manure". He further adds what after words become known as the **Law of the minimum.**

Law of the minimum

"By the deficiency or absence of one necessary constituent, all the others being present' the soil is rendered barren for all those crops to the life of which that one constituent is indispensable"

These and other amplifications of the ideas gave rise to controversies. So much did Lie big insist on the necessity for alkalis and phosphates and so impressed he was for big the gain in N in meadow that he began to record atmosphere as the source of N to plants.

Based on plant analysis he said turnip crop requires smallest quantity of P for their development. These and other practical deductions were tested by Lawes and Gilbert and showed that they are erroneous. Further when the patent manure was tried in practice it failed. There was nothing wrong in the theory in which it was based and the manure was sound. It contained compounds of N, P and K but he fused with lime and Calcium Phosphate so the nutrients were made insoluble.

Meanwhile the great field experiments at **Rothamsted** were started by **Sir John Bennet Lawes** and **Sir Joseph Henry Gilbert** during 1843. These experiments were conducted on the same site even today and many valuable informations have accumulated. This is the **oldest Experimental Station in the world**. It is situated at the village Harpendon about 24 miles from London. In 1842 Lawes patented a process of treating rock phosphate to produce super phosphate and thus initiate the synthetic fertilizer industry.

By 1855 (By 12 Years) the following points were established.

1. Crops require phosphates and salts of alkalis but the composition of the ash does not afford reliable information as to the amounts of each constituent needed e.g. turnips require large amounts of phosphates although little is present in their ash.

2. Non-leguminous crop require a supply of some N-compounds, Nitrate and ammonium salts being almost equally good. Without an adequate supply of N, no increases of growth are obtained, even when ash constituents are added. The amount of N obtainable from atmosphere is insufficient for the needs of crops. Leguminous crops behave abnormally.

3. Soil fertility may be maintained for some years at least by means of artificial manures.

4. The beneficial effect of following lies in the increase brought about in the available nitrogenous compounds in the soil.

   The list of nutrients required started by Liebig included C, H, O, N, P, K, Ca, Mg, S, Silicon.

   The water culture work of **Knop** and other physiologists put down a similar list with the modification that Fe was added and Si was deleted.

   However controversies continued in 2 directions.

1. Farmers believed that chemical manure can only stimulate the crop growth and cannot replace organic manures and they will ultimately exhaust the ground.

2. But the results of experiments at Rothamsted have shown this to be untrue. Even after more than 100 years the chemical manure continued to produce good crops, though the growth of crops might have been affected due to side effect.

   In France **Georges Ville** (During 1867 and 1874-75) pleaded that artificial manures are more remunerative than dung and the addition was the only way of maintaining soil fertility. He considered that one of the four elements viz., lime, N, P, and K is more wanted and hence he called that "dominant". He obtained following results.

Wheat yield/ acre

1. Normal manure 43
2. Manure without lime 41
3. Manure without potash 31
4. Manure without phosphorus 26
5. Manure without Nitrogen 14
6. Soil without manure 12

1. Production of various fields crops

2. It was a mystery how leguminous plants obtained nitrogen from.

Liebig believed that plants take N as NH_4 and not as nitrates. But the French Scientists established the importance of NO_3 to the plants and nitrification to soil fertility.

Soil Bacteriology

During 1860s and 1870s it was shown that the process of decomposition of organic matter and conversion of NH4 to NO3 was not chemical as supposed by Liebig but is microbiological

1. **Schloesing and Montz,** Bacteriologists showed that formation NO_3 in sewage water could be stopped by addition of cholorform and adding little turbid extract of dry soil. So they said that nitrification was due to microbes.

2. Warrington: Working in Rothamsted soils applied this to soils and showed that nitrification in the soil could be stopped by the addition of chloroform or carbon disulphide and started by the addition of trace of soil. He showed that there are two stages and two sets of organisms. First NH_3 to NO_2 and then to NO_3. But he could not isolate the organisms.

3. **Winogradsky** isolated these organisms and found that they are bacteria. He isolated them on silica gel plates free from organic matter.

Thus the problem of nitrogen nutrition of non-leguminous plants was solved.

But the behavior of leguminous plants still baffled the scientists.

a) **Berthelot** had shown by experimentation that certain micro-organisms in the soil can assimilate gaseous nitrogen.

b) **Hellriegel and Wilfarth** supposed that the bacteria in the nodules of leguminous plants assimilated gaseous N and handed over part of it to the plant.

c) The organism was isolated by **M.W.Beijerinck** who called Bacillus radicicola. But now it is known as Rhizobium.

Thus the controversy and problem of leguminous crops ended.

In 1857 Michigan State University was established to provide agricultural education at College level

Systematic selection of cereal varieties according to predicted yield was commenced in the 18th century. The discovery of **Laws of Heredity** and the ways to cause mutations by **Gregory Johann Mendel in 1866** led to modern plant breeding.

In **1876 Charles Darwin** published the results of experiments on cross and self-fertilization in plants.

Thomas Malthus in 1898 proposed Malthusian Theory.- Humans would run out of food for everyone in spite of advance in agriculture due to limited land and yield potential of crops (ie food may not be sufficient in future for the growing population at this current rate of growth in agriculture)

Blackman in 1905 proposed theory of "Optima and Limiting factors"- When a process is conditioned as to its rapidity by a number of separate factors, the rate of the process is limtited by the pace of the slowest factor.

Mitscherlich in 1909 proposed the theory of "Law of Diminishing Returns" – Increase in growth with each successive addition of the limiting element is progressively smaller and the response is curvilinear.

Wilcox in 1929 proposed "Inverse Yield Law". – Growth or the yielding ability of any plant is inversely proportional to the mean N content in the dry matter.

Since 1920 the application of genetics to developed new strains of plants and animals, brought major changes in agriculture.

Agri Engineering was mainly concerned with improving farm machinery and implements originally improvised by farmers. Mechanization took hold in Western Europe and the newly settled countries only after 1850.Robert Ransome patented a cast iron share in 1785 and self-sharpening share in 1803. An efficient seed drill was devised in 1830s. First successful tractor was built in US in 1892. And DDT was synthesized by Dr Paul Muller in 1874.

Chapter-1.2: Development of scientific agriculture in world and India. Green revolution in India. Revolutions related to agriculture and allied activities.

It began in India when sugarcane, cotton and tobacco were grown for export purpose.

1970 – Joint department of Agriculture, revenue and commerce were established

1877 and 1978 – Famine

1880 – Famine Commission appointed and recommended for separate DOA and DOA was established

It got the momentum in the 19th century. Indian land tax was levied in the middle of the 19th century. In 1887, 1878, 1889, 1892, 1897, 1900 population decreased due to continuous famines. Due ot these famines Britishers started various development programmes like railways, telegraph and postal departments (1848-1856 during Lord Dalhousie) He constructed "Upper Bari Doab Canal" in Punjab; laid roads and established PWD. Improvement of Agriculture started in his period. Lord Curzon's period (1898-1905) the "Great Canal System" of Western Punjab was constructed. During his period Imperial Agricultural Research Institute was started at Pusa, Samstipur district in Bihar in 1903. His period is called as golden period in Agriculture. During his period Department of Agriculture and Agricultural Colleges for provinces were started at Coimbatore, Poona, Kanpur, Nagpur, Lylipur in 1906. Sugarcane Breeding Institute established in 1912 at Coimbatore.

Due to earthquake IARI was shifted to New Delhi in 1936. In 1926 Royal Commission on Agriculture was setup and was responsible for giving recommendation to dug canal, lay roads etc. Based on the recommendation of Royal Commission, ICAR-Imperial Council of Agricultural Research was started in 1929 with objective to conduct Agriculture Research. Later it was named as Indian Council of Agriculture after Independence. State Agriculture Universities were started after 1960s. ICAR had also started research institutes of its own in different centers in India for various crops.

1942- Department of Food was created to cope up with the difficult food situation

1945- Indian Meteorological Department was established for weather services for agriculture

1950- Planning commission was set up

1951- First V year plan implemented

After 1947, ICAR totally adapted to Land Grant Colleges. In 1962 a Land Grant College was started at Pantnagar (UP). It is the first University with 16,000 acres.

1965-67- Green Revolution due to introduction of HYV in wheat, rice, use of fertilizers, construction of dams and use of pesticides.

Important events in the history of Agriculture

Period	**Event**
10,000B.C.	-Hunting,gathering
8700 B.C.	-Domestication of sheep
7700 B.C.	-Domestication if goat
7500 B.C.	-Cultivation of crops (Wheat and barley)
6000 B.C.	-Domestication of cattle and pigs
4400 B.C.	-Cultivation of maize
3500 B.C.	-cultivation of potato
3400 B.C.	-Wheel was invented
3000 B.C.	-Bronze was used to make tools
2900 B.C.	-Plough was invented. Irrigated farming started.
2700 B.C.	-Silk moth domesticated in China
2300 B.C.	-Cultivation of chickpea, pear, sarson and cotton
2200 B.C.	-Domesticated of fowl, buffalo, and elephant. Cultivation of rice
1800 B.C.	-Cultivation of finger millet (Ragi)
1725 B.C.	-Cultivation of sorghum
1700 B.C	-Taming if horses

1500 B.C.	-Cultivation of sugarcane. Irrigation from wells.
1400 B.C.	-Use if iron
15 Century A.D.	-Cultivation of Sweet orange, sour orange, wild brinjal, pomegranate
16 Century A.D.	-Introduction of several crops into India by Portuguese. They are potato, sweet potato, arrow root, cassava, tomato chilies, pumpkin, papaya, pineapple, guava, custard apple, groundnut, cashewnut, tobacco, American cotton, rubber.

Some of the ancient literature that explain about the agriculture are

1. Brahat Samhita (500 AD) by Varahamihira

2. Agnipurana (500-700 AD)

3. Krishi Sangraha of Parashara (500-1000 AD)

4. Shukraniti

5. Upavana-vinod (1220-1330)

6. Artha-shastra (Koutilya)

7. Krishi sukti by Kashyapa

8. Vishava vallabha by Chakrapani

9. Mahabharata

10. Rigveda

11. Atharva Veda.

Agriculture in Ancient India

Land and Soil

Agriculturists in ancient India were quite conscious of the soil and its relation to the production of a specific crop of economic importance. The vast knowledge acquired by experience has been handed over from generation to generation. The information is very intelligently and ably moulded in the form of maxims, proverbs etc.

Soil:

According to fertility, soil is mainly divided into **Urvara (fertile)** and **Anurvara (sterile)**. Further, **Urvara mruttike** is divided into different kinds according to their peculiar fitness for cultivation of different kinds of crops. Yavya (barley), til (sesamun), vrihi (rice) etc.

Anurvara mruttike: **Usara (salt ground)** and **maru (desert)**.The exact chemical composition of different kinds of soils might not have been known but by observations the ancient Indians had gathered knowledge eg.

- Clayey soils are suitable for jute, potato, thrives well if cultivated by the side of a bamboo grove.
- Lands that are beaten by foam ie river banks are suitable for pumpkin, gourd etc lands frequently overflown with water for long pepper, grapes and sugarcane

In **Krishi Sukti**: a comprehensive book on agriculture (attributed to Kasyapa) classified the land into

a. Wet lands for paddy fields named **shuli bhumi, Jala Bhumi or Sasya Bhumi**

b. Dry lands called **Adhaka Bhumi**

In **Upavana Vinod**: The land is described as of 3 kinds ie arid, wet and moderate. Each of these is divided further depending upon the.

Colour: Black, pale, dark red, white and yellow.

Taste: Sweet, sour, salt, pungent, bitter, astringent.

It was specified which type of crop or tree was suitable to which type of soil. Citron, Punnaga, Champaka, Amra, pomegranate grown on moderate land which is neither too wet nor too dry.

Irrigation and Drainage

Reference to irrigation are numerous and scattered in the whole of the ancient literature of India. In the Rigveda we find many references to irrigation. The word well occurs many times. Water was raised from the wells by means of a wheel, a strap and water pails. Also by buckets tied by rope to one end of a long wooden pole working about a fulcrum near the other end that carried a heavy weight. It is still in use in parts of India. Another method was by a small canoe (sanna doni) tied by four strings and worked between two men standing on a wooden platform. The canoe is swung to and fro.

In AtharvaVeda also, such references are common. In Mahabharata also in 'Sabhaparva' mention is made of irrigation.

In historical period- Megasthenes wrote 'Greater part of the soil is under irrigation and consequently grows two crops in a year'.

In Gupta dynasty Lake Sudarsana was excavated during the regime of Chandra Gupta whose canals of irrigation was completed by Ashoka shows the importance attached to irrigation. Ruins of many reservoirs in West Bengal also point to the importance to irrigation. Remains of canals are also seen in Hampi.

Location of water table for wells is described for normal condition, in arid areas, in marshy lands, in mountaneous country etc. by Chakrapani from Mathura. He further describes construction of reservoirs also in his book "Vishva Vallabha".

Chapter-1.3: National Agricultural Research Systems (NARS): ICAR- mandate, research institutions their mandate.

ICAR

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. Formerly known as Imperial Council of Agricultural Research, it was **established on 16 July 1929** as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. The ICAR has its headquarters at New Delhi.

The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR institutes and **78 agricultural universities** spread across the country this is one of the largest national agricultural systems in the world.

he ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has **enabled the country to increase the production of food grains by 5 times**, **horticultural crops by 9.5 times**, **fish by 12.5 times** , **milk 7.8 times** and **eggs 39 times** since 1951 to 2014, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

The Mandate

1. Plan, Undertake, Coordinate and Promote Research and Technology Development for Sustainable Agriculture.
2. Aid, Impart and Coordinate Agricultural Education to enable Quality Human Resource Development.
3. Frontline Extension for technology application, adoption, knowledge management and capacity development for agri-based rural development.
4. Policy, Cooperation and Consultancy in Agricultural Research, Education & Extension.

Organization

Union Minister of Agriculture is the ex-officio President of the ICAR Society. Secretary, Department of Agricultural Research & Education Ministry of Agriculture, Govt. of India & Director-General, ICAR – the Principal Executive Officer of the Council. Governing Body is the policy-making authority.

Chapter-1.4: Regional Agricultural Research institutions of ICAR. State Agricultural Universities.

ICAR Institutions, Deemed Universities, National Research Centres, National Bureaux & Directorate/Project Directorates

Deemed Universities - 4

1. ICAR-Indian Agricultural Research Institute, New Delhi
2. ICAR-National Dairy Research Institute, Karnal
3. ICAR-Indian Veterinary Research Institute, Izatnagar
4. ICAR-Central Institute on Fisheries Education, Mumbai

Institutions - 64

1. ICAR-Central Island Agricultural Research Institute , Port Blair
2. ICAR-Central Arid Zone Research Institute, Jodhpur
3. ICAR-Central Avian Research Institute, Izatnagar
4. ICAR-Central Inland Fisheries Research Institute, Barrackpore
5. ICAR-Central Institute Brackishwater Aquaculture, Chennai
6. ICAR-Central Institute for Research on Buffaloes, Hissar
7. ICAR-Central Institute for Research on Goats, Makhdoom
8. ICAR-Central Institute of Agricultural Engineering, Bhopal
9. ICAR-Central Institute for Arid Horticulture, Bikaner
10. ICAR-Central Institute of Cotton Research, Nagpur
11. ICAR-Central Institute of Fisheries Technology, Cochin
12. ICAR-Central Institute of Freshwater Aquaculture, Bhubneshwar
13. ICAR-Central Institute of Research on Cotton Technology, Mumbai
14. ICAR-Central Institute of Sub Tropical Horticulture, Lucknow
15. ICAR-Central Institute of Temperate Horticulture, Srinagar
16. ICAR-Central Institute on Post harvest Engineering and Technology, Ludhiana
17. ICAR-Central Marine Fisheries Research Institute, Kochi
18. ICAR-Central Plantation Crops Research Institute, Kasargod
19. ICAR-Central Potato Research Institute, Shimla
20. ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore
21. ICAR-Central Research Institute of Dryland Agriculture, Hyderabad
22. ICAR-National Rice Research Institute, Cuttack
23. ICAR-Central Sheep and Wool Research Institute, Avikanagar, Rajasthan

24. ICAR- Indian Institute of Soil and Water Conservation, Dehradun
25. ICAR-Central Soil Salinity Research Institute, Karnal
26. ICAR-Central Tobacco Research Institute, Rajahmundry
27. ICAR-Central Tuber Crops Research Institute, Trivandrum
28. ICAR-ICAR Research Complex for Eastern Region, Patna
29. ICAR-ICAR Research Complex for NEH Region, Barapani
30. ICAR-Central Coastal Agricultural Research Institute, Ela, Old Goa, Goa
31. ICAR-Indian Agricultural Statistics Research Institute, New Delhi
32. ICAR-Indian Grassland and Fodder Research Institute, Jhansi
33. ICAR-Indian Institute of Agricultural Biotechnology, Ranchi
34. ICAR-Indian Institute of Horticultural Research, Bengaluru
35. ICAR-Indian Institute of Natural Resins and Gums, Ranchi
36. ICAR-Indian Institute of Pulses Research, Kanpur
37. ICAR-Indian Institute of Soil Sciences, Bhopal
38. ICAR-Indian Institute of Spices Research, Calicut
39. ICAR-Indian Institute of Sugarcane Research, Lucknow
40. ICAR-Indian Institute of Vegetable Research, Varanasi
41. ICAR-National Academy of Agricultural Research & Management, Hyderabad
42. ICAR-National Institute of Biotic Stresses Management, Raipur
43. ICAR-National Institue of Abiotic Stress Management, Malegaon, Maharashtra
44. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru
45. ICAR-National Institute of Research on Jute & Allied Fibre Technology, Kolkata
46. ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Hebbal, Bengaluru
47. ICAR-Sugarcane Breeding Institute, Coimbatore
48. ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora
49. ICAR-Central Institute for Research on Cattle, Meerut, Uttar Pradesh
50. ICAR-National Institute of High Security Animal Diseases, Bhopal
51. ICAR-Indian Institute of Maize Research,New Delhi
52. ICAR- Central Agroforestry Research Institute , Jhansi
53. ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi
54. ICAR- Indian Institute of Wheat and Barley Research, Karnal
55. ICAR- Indian Institute of Farming Systems Research, Modipuram
56. ICAR- Indian Institute of Millets Research, Hyderabad
57. ICAR- Indian Institute of Oilseeds Research, Hyderabad
58. ICAR- Indian Institute of Oil Palm Research, Pedavegi, West Godawari

59. ICAR- Indian Institute of Water Management, Bhubaneshwar
60. ICAR-Indian Institute of Rice Research, Hyderabad
61. ICAR- Central Institute for Women in Agriculture, Bhubaneshwar
62. ICAR-Central Citrus Research Institute, Nagpur
63. ICAR-Indian Institute of Seed Research, Mau
64. ICAR-Indian Agricultural Research Institute, Post Box No. 48, Hazaribag 825 301, Jharkhand

National Research Centres - 15

1. ICAR-National Research Centre for Banana, Trichi
2. ICAR-National Research Centre for Grapes, Pune
3. ICAR-National Research Centre for Litchi, Muzaffarpur
4. ICAR-National Research Centre for Pomegranate, Solapur
5. ICAR-National Research Centre on Camel, Bikaner
6. ICAR-National Research Centre on Equines, Hisar
7. ICAR-National Research Centre on Meat, Hyderabad
8.. ICAR-National Research Centre on Mithun, Medziphema, Nagaland
9. ICAR-National Research Centre on Orchids, Pakyong, Sikkim
10. ICAR-National Research Centre on Pig, Guwahati
11. ICAR-National Research Centre on Plant Biotechnology, New Delhi
12. ICAR-National Research Centre on Seed Spices, Ajmer
13. ICAR-National Research Centre on Yak, West Kemang
14. ICAR-National Centre for Integrated Pest Management, New Delhi
15. National Research Centre on Integrated Farming (ICAR-NRCIF),Motihari

National Bureaux - 6

1. ICAR-National Bureau of Plant Genetics Resources, New Delhi
2. ICAR-National Bureau of Agriculturally Important Micro-organisms, Mau, Uttar Pradesh
3. ICAR-National Bureau of Agricultural Insect Resources, Bengaluru
4. ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur
5. ICAR-National Bureau of Animal Genetic Resources, Karnal
6. ICAR-National Bureau of Fish Genetic Resources, Lucknow

Directorates/Project Directorates - 13

1. ICAR-Directorate of Groundnut Research, Junagarh
2. ICAR-Directorate of Soybean Research, Indore
3. ICAR-Directorate of Rapeseed & Mustard Research, Bharatpur

4. ICAR-Directorate of Mushroom Research, Solan
5. ICAR-Directorate on Onion and Garlic Research, Pune
6. ICAR-Directorate of Cashew Research, Puttur
7.. ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand
8. ICAR-Directorate of Floricultural Research, Pune, Maharashtra
9. ICAR-Directorate of Weed Research, Jabalpur
10. ICAR-Project Directorate on Foot & Mouth Disease, Mukteshwar
11. ICAR-Directorate of Poultry Research, Hyderabad
12. ICAR-Directorate of Knowledge Management in Agriculture (DKMA), New Delhi
13. ICAR-Directorate of Cold Water Fisheries Research, Bhimtal, Nainital

List of Agricultural Universities in India: 78

Sr. No.	Name of Agricultural University	Year of Establishment
	Andhra Pradesh	
1.	The Acharya N. G. Ranga Agricultural University (ANGRAU, Guntur Rajendra Nagar, Hyderabad	12th June, 1964
2.	Dr. Y.S.R. Horticultural University, Venkataramannagudem, Tadepalli Gudem Mandal, West Godavari District	26th June, 2007
3.	Sri Venkateswara Veterinary University, Tirupati,	30th March, 2005
	Assam	
4.	Assam Agricultural University (AAU), Jorhat	1969
	Bihar	
5.	Bihar Agricultural University (BAU), Bhagalpur	2010
6.	Dr. Rajendra Prasad Central Agriculture University, Samastipur (previously, Rajendra Agricultural University)	11th May, 2016
	Chhattisgarh:	
7.	Indira Gandhi Agricultural University (IGAU) Raipur	20th January, 1987
	Gujarat	
8.	Anand Agricultural University (AAU), Anand	1st May, 2004
9.	Junagadh Agricultural University (JAU), Junagadh	1st May, 2004
10.	Navsari Agricultural University(NAU), Navsari	1st May, 2004
11.	Sardarkrushinagar Dantiwada Agricultural University (SDAU), Sardarkrushinagar	1st May, 2004
12.	**Kamdhenu University,** Karmayogi Bhavan, Block-1, B1-wing,4th	7th July, 2009

	Floor,Room No.414, Sector-10-A, Gandhinagar	
	Haryana	
13.	Chaudhary Charan Singh Haryana Agricultural University Hisar	2nd February, 1970
14.	Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar	2010
15.	National Dairy Research Institute (NDRI), Karnal	1923
	Himachal Pradesh	
16.	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur	1978
17.	Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan	1985
	Jammu & Kashmir	
18.	Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shrinagar	1982
	Jharkhand	
19.	Birsa Agricultural University, Kanke, Ranchi	1981
20.	Sai Nath University, Ormanjhi (Private University)	2012
21.	Jharkhand Rai University, Ranchi (Private University)	2011
	Karnataka	
22.	University of Agricultural and Horticultural Sciences, Shivamogga (UAHS), Bangalore	2012
23.	University of Agricultural Sciences, Dharwad (UASD)	1st October, 1986
24.	University of Agricultural Sciences (UAS), Raichur	2009
25.	University of Horticultural Sciences, Bagalkote	22nd November, 2008
26.	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar	28th February, 2005
27.	University of Agricultural and Horticultural Sciences, Shivamogga (UAHS)	21st September, 2012
	Kerala	
28.	Kerala Agricultural University (KAU), Vellanikkara, Thrissur	1971
29.	Kerala University of Fisheries and Ocean Studies(KUFOS), Kochi	2010
30.	Kerala Veterinary and Animal Sciences University (KVASU), Wayanad	12th June, 2010
	Madhya Pradesh	

31.	Jawaharlal Nehru Agricultural University, Jabalpur	1964
32.	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior	2009
	Maharashtra	
33.	Central Institute of Fisheries Education(CIFE), Mumbai (Deemed university)	1989
34.	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	18th May, 1972
35.	Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV**)** , Akola	20th October, 1969
36.	Maharashtra Animal and Fishery Sciences University(MAFSU), Nagpur	17th November, 2000
37.	Mahatma Phule Krishi Vidyapeeth, Rahuri	29th March, 1968
38.	National Backward Krushi Vidyapeet, Solapur	2014
39.	Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani	1972
	Manipur	
40.	Central Agricultural University, Iroisemba, Imphal	26th January, 1993
	Nagaland	
41.	Nagaland University (Central University)	1994
	New Delhi	
42.	Indian Agricultural Research Institute (IARI), Pusa, Delhi	1st April, 1905
	Orissa	
43.	Orissa University of Agriculture and Technology, Bhubaneswar	1962
	Punjab	
44.	Desh Bhagat University of Agriculture Sciences, Almoh,Fategarh, Sahib District, Punjab	1996
45.	Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana	9th August, 2005
46.	Punjab Agricultural University (PAU), Ludhiana	1962
	Rajasthan	
47.	Agriculture University, Jodhpur	14th September, 2013
48.	Agriculture University, Kota	14th September, 2013
49.	Maharana Pratap University of Agriculture and Technology, Udaipur	1st November, 1999
50.	Shri Karan Narendra Agriculture University, Jobner	September, 2013
51.	Swami Keshwanand Rajasthan Agricultural University, Bikaner	1st August, 1987
53.	Suresh Gyan Vihar University, Jaipur	2008

54.	Rajasthan University of Veterinary and Animal Sciences, Bikaner	13th day of May, 2010
	Tamil Nadu	
55.	Annamalai University, Chidambaram	1929
56.	Tamil Nadu Agricultural University, Coimbatore	1971
57.	Tamil Nadu Fisheries University, Nagapattinam	2012
58.	Tamil Nadu Veterinary and Animal Sciences University, Madhavaram, Chennai	1989
	Telangana	
59.	Professor Jayashankar Telangana State Agricultural University, Hyderabad	2014
60.	Sri Konda Laxman Telangana State Horticultural University, Hyderabad	**23rd December,2014**
	Uttar Pradwsh	
61.	Aligarh Muslim University, Aligarh	1920
62.	Banaras Hindu University, Varanasi	1916
63.	Banda University of Agriculture and Technology, Banda	2010
64.	Chandra Shekhar Azad University of Agriculture and Technology, Kanpur	1975
65.	Chaudhary Charan Singh University, Meerut	1965
66.	Indian Veterinary Research Institute, Bareilly	1889
67.	Integral Institute of Agricultural Science and Technology (IIAST), Integral University, Lucknow	**9th May,2014**
68.	Narendra Dev University of Agriculture and Technology, Faizabad	10th October, 1975
69.	Sardar Vallabhbhai Patel University of Agriculture and Technology, Meeruth	2010
70.	Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad	1910
71.	Rani Lakshmi Bai Central Agriculture University, Near Pahuj Dam, ,Near IGFRI, Gwalior Road, Jhansi	2014
	Uttarakhand	
72.	G. B. Pant University of Agriculture and Technology, Pantnagar	17th November, 1960
73.	Hemwati Nandan Bahuguna Garhwal University, Shrinagar (Garhwal), Uttrakhand	1973

74.	Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri garhwal	2011
	West Bengal	
75.	Bidhan Chandra Krishi Viswavidyalaya, Mohanpur	1974
76.	Uttar Banga Krishi Viswavidyalaya, Cooch Behar	1st February, 2001
77.	Visva-Bharati University, Santiniketan	1921
78.	West Bengal University of Animal and Fishery Sciences, Kolkata	1995

https://en.wikipedia.org/wiki/List_of_agricultural_universities_in_India and
http://www.icar.org.in/en/universities.htm

Chapter-1.5: Consultative Group on international Agricultural Research (CGIAR)

Mandate: To achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment.

Why agricultural research matters?

Rising food prices, concern over global climate change, the energy crisis and new interest in the potential of biofuels have ushered in a new era of challenge and opportunity for agriculture and natural resource management.

These global trends, while affecting people everywhere, have particularly high risks and consequences for the approximately 2.1 billion people who live on less than US $2 a day. About three-fourths of these people live in rural areas and depend directly or indirectly on agriculture for their livelihoods.

Furthermore, higher food and energy prices will force poor consumers to make tradeoffs in their spending, drastically reducing their possibilities for improved wellbeing.

Climate change, by worsening growing conditions for crops, will further strain the capacity of agricultural land and threaten the productivity growth vital for reducing poverty. Scientists estimate that rising temperatures and changing rainfall patterns could cause agriculture production to drop by as much as 50 percent in may African countries and by 30 percent in Central and South Asia.

Strengthened investment in agricultural science at national and international levels is essential to meet these new and multi-faceted challenges. Moreover, there is a need to scale up such research to foster innovations for increased agriculture productivity to benefit the rural poor while conserving natural resources such as water, forests and fisheries.

According to the World Development Report 2008, investment in agriculture research has “paid off handsomely,” delivering an average rate of return of 43 percent in 700 development projects evaluated in developing countries. Clearly, strong programs of relevant and effective research must be at the top of the international development agenda, if the Millennium Development Goals of halving hunger and poverty by 2015 are to be met and if these gains are to be expanded in the decades to come.

An evolving strategic partnership

The Consultative Group on International Agricultural Research (CGIAR), established in 1971, is a strategic partnership, whose 64 Members support 15 international Centers, working in collaboration with many hundreds of government and civil society organizations as well as private businesses around the world. CGIAR Members include 21 developing and 26 industrialized countries, four co-sponsors as well as 13 other international organizations. Today, more than 8,000 CGIAR scientists and staff are active in over 100 countries throughout the world.

The CGIAR generates cutting-edge science to foster sustainable agricultural growth that benefits the poor through stronger food security, better human nutrition and health, higher incomes and improved management of natural resources. The new crop varieties, knowledge and other products resulting from the CGIAR's collaborative research are made widely available to individuals and organizations working for sustainable agricultural development throughout the world.

The priorities of CGIAR research are:

- Reducing hunger and malnutrition by producing more and better food through genetic improvement
- Sustaining agriculture biodiversity both in situ and ex situ
- Promoting opportunities for economic development and through agricultural diversification and high-value commodities and products
- Ensuring sustainable management and conservation of water, land and forests
- Improving policies and facilitating institutional innovation

A critical task for 11 of the CGIAR Centers is to maintain international genebanks, which preserve and make readily available the plant genetic resources that form the basis of food security worldwide.

In addition, the CGIAR implements several innovative "Challenge Program" designed to confront global or regional issues of vital importance. Implemented through broad-based research partnerships, Challenge Programs mobilize knowledge, technology and resources to solve those and other problems such as micronutrient deficiencies, which afflict more than three billion people; water scarcity, which already affects a third of the world's population; and climate change, which poses a dire threat to rural livelihoods across the developing world.

The CGIAR is constantly striving for excellence. During 2008 a Change Management Initiative is in progress designed to ensure that in this rapidly changing external environment described earlier, the CGIAR is positioned to deliver new technologies and new knowledge which will deliver the best possible results. The Initiative will culminate in a forward looking strategy for the CGIAR.

The CGIAR is open to all countries and organizations that share a commitment to achieving sustainable agricultural development and are willing to invest financial, human and technical resources toward this end. Membership has expanded and diversified over the years, and the CGIAR is poised for further growth. CGIAR expenditures amounted to US$506 million in 2007, the single largest investment made to mobilize science for the benefit of the rural poor worldwide.

Without public investment in international agricultural research through the CGIAR,

- world production would be 4-5 percent lower
- developing countries would produce 7-8 percent less food
- world food and feed grain prices would be 18-21 percent higher
- 13-15 million more children would be malnourished

For every $1 invested in CGIAR research, $9 worth of additional food is produced in developing countries, where it is needed most. The evidence is clear: agricultural growth alleviates poverty and hunger.

Benefits for the poor and the planet

International agricultural research has a strong record of delivering results that help confront the central development and environmental challenges of our time.

The science developed by the CGIAR-supported Centers and their partners has delivered significant gains in terms of reduced hunger and improved incomes for small farmers throughout much of the developing world. CGIAR research is much broader than agricultural productivity alone, encompassing a range of initiatives related to water, biodiversity, forests, fisheries and land conservation. It has advanced sustainable management and conservation practices in these sectors, therefore protecting millions of hectares of forest and grasslands, safeguarding biodiversity, and preventing land degradation.

Among the outcomes of that research are the following:

- Successful biological control of the cassava mealybug and green mite, both devastating pests of a root crop that is vital for food security in sub-Saharan Africa. The economic benefits of this work alone, estimated at more than $4 billion, are sufficient to cover almost the entire costs of CGIAR research conducted so far for Africa.

- New Rices for Africa, or NERICAs, which combine the high yields of Asian rice with African rice's resistance to local pests and diseases. Currently sown on 200,000 hectares in upland areas, NERICAs are helping reduce national rice import bills and generating higher incomes in rural communities.

- More than 50 varieties of recently developed drought-tolerant maize varieties being grown on a total of about one million hectares across eastern and southern Africa.

- A flood-tolerant version of a rice variety grown on six million hectares in Bangladesh. The new variety enables farmers to obtain yields two to three times those of the non-tolerant version under prolonged submergence of rice crops, a situation that will become more common as a result of climate change.

- Widespread adoption of resource-conserving "zero-till" technology in the vital rice-wheat systems of South Asia. Employed by close to a half million farmers on more than 3.2 million hectares, this technology has generated benefits estimated at US$147 million through higher crop yields, lower production costs and savings in water and energy.

- An agroforestry system called "fertilizer tree fallows," which renews soil fertility in Southern Africa, using on-farm resources. More than 66,000 farmers have adopted this technology in Zambia, where it has strengthened food security and reduced environmental damage, and the system is spreading in four neighboring countries.

- Information and tools used by conservationists to monitor some 37 million hectares of forest, resulting in better management of this diminishing resource and contributing to more sustainable livelihoods for forest dwellers.

- A new method for detecting aflatoxin, a deadly poison that infects crops, making them unfit for local consumption or export benefiting farmers throughout sub-Saharan Africa. This technology, together with a novel biological control method that has proved able to reduce

aflatoxin by nearly 100 percent, is helping to curb this major threat to human health, especially in children, and to save millions of dollars in lost sales of food for export.

- A simple methodology for integrating agriculture with aquaculture to bolster income and food supplies in areas of southern Africa where the agricultural labor force has been devastated by HIV/AIDS. Under large-scale testing in Malawi, the method doubled the income of 1,200 households and dramatically increased fish consumption.

- A new approach to predicting the likely impact of climate change on major crops' wild relatives, which are a key source of genes needed to enhance climate resilience, as well as valuable findings on the likely consequences of biofuels development in China and India for increasingly scarce water supplies.

- Increasing smallholder dairy production in Kenya improving childhood nutrition while generating jobs. This award-winning project with smallholder dairies has contributed up to 80 percent of the milk products sold in the country and strengthened local capacity to market milk products.

Reference: www.cgiar.org

Chapter-1. 6: International Agricultural Research Centers (IARC) their mandate and achievements.

INTERNATIONAL INSTITUTES

Sl No	Institutes		Location
1	CIAT*	Centro Internacional de Agricultura Tropical (International Centre for Tropical Agriculture)	Palmira, Colombia
2	CIDA	Canadian International Development Agency	Cubac, Canada
3	CIFOR*	Center for International Forestry Research	Bogor, Indonesia
4	CIMMYT*	Centro Internacional de Mejoramiento de Maizy Trigo (International Center for the Improvement of Maize and Wheat	Mexico city, Mexico
5	CIP*	Centro Internacional de la Papa (International Potato Center)	Lima, Peru, South America
6	FAO	Food and Agriculture Organisation of the United Nations	Rome, Italy
7	IBPGR*	International Board for Plant Genetic Resources	Rome, Italy
8	ICRAF*	International Council for Research in Agro Forestry	Nairobi, Kenya
9	ICARDA*	International Center for Agricultural Research in the Dry Areas	Aleppo, Syria
10	ICRISAT*	International Crops Research Institute for the Semi-Arid Tropics	Patancheru, Hyderabad, India
11	IFPRI*	International Food Policy Research Institute	Washington DC, USA
12	IITA*	International Institute of Tropical Agriculture	Ibadan, Nigeria

13	ILCA*	International Livestock Center for Africa	Addis Ababa, Ethiopia
14	ILRAD*	International Laboratory for Research on Animal Diseases	Nairobi, Kenya
15	ILRI*	International Livestock Research Institute	Nairobi, Kenya
16	IRRI*	International Rice Research Institute	Manila, Philippines
17	INSAR	International Service for National Research	The Hague, Netherlands
18	INSFFER	International Network on Soil Fertility and Fertilizer Evaluation on Rice (IRRI)	Manila, Philippines
19	IWMI*	International Water Management Institute	Colombo, Sri Lanka
20	WARDA*	West African Rice Development Association	Monrovia, Liberia
21*		World Fish Center	Penang, Malaysia

*Established under CGIAR

Note: Refer the website of each institute for its mandate, achievements etc.

Chapter-1.7: Global agricultural research system: need, scope, opportunities.

Chapter-1.8: Role promoting food security, reducing poverty and protecting the environment;

Chapter-1.9: Partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels;

Building the global agricultural research system

Agricultural research is conducted throughout the world by a diverse array of organizations and institutions. Each has developed special capabilities and has advantages in addressing different aspects of the constraints to sustainable agricultural production. These institutions have often worked through partnerships to capitalize on the advantages of their specialization. However, major changes in science, in farmers' awareness and degree of collective organization, in the involvement of the private sector and in priorities within aid agencies have profoundly affected the face of international agricultural research in recent years and will continue to do so in the foreseeable future. Research organizations and institutions must now redefine their roles and responsibilities to adapt to reduced resources and to rapidly changing developments in agricultural research. These varied institutions are becoming more and more linked into an informal global agricultural research system.

Within this evolving system, each component will have to determine its comparative advantage, to find to its niche and to develop the necessary partnerships with other components to maximize synergies, to reduce overlap and redundancy and to respond appropriately to beneficiaries in a demand-driven system. This may occur as a deliberate process from within the institution or through management mechanisms as stakeholders and clients demand more efficient and effective technology generation and transfer. This section outlines the developing institutional structure for research and technology development in the global system and its role in improving food security and alleviating poverty.

The major components of the global agricultural research system are the national agricultural research systems (NARS) of developing and developed countries, including private and other non-governmental research establishments, and the international agricultural research centres (IARC). In 1995, developed country NARS accounted for about 48 percent of global research expenditures with one-third of scientists, while developing-country NARS

accounted for about the same proportion of expenditures but with nearly two-thirds of scientists. The IARC accounted for the balance of about 4 percent of global research expenditures.

National agricultural research systems of developing countries

The NARS are, and will continue to be, the cornerstone of the global agricultural research system as they work to increase agricultural productivity and profitability in their own countries. NARS are made up of various national agricultural research institutes (NARI), agricultural universities, private-sector firms, NGOs and farmers' organizations. Although some have long histories, many NARS in developing countries are composed of fairly young institutions and all have changed over the past few decades. Given the diverse nature of agro-ecological conditions and the location-specificity of small-farm production and natural-resource management problems, NARS of developing countries must play an even larger role in increasing food production and contributing to economic growth. They face a major challenge to be responsive to the needs of their clientele.

The NARS in developing countries vary greatly in numbers of researchers and funding resources available to them. The significantly increased number of well-trained scientists working in these NARS has been a very positive development of the past decades. Unfortunately many of these scientists are underfunded and thus much less productive than they could be. Yet, in all cases, the NARS have a key role to play in providing the critical link between the global research system and research users, particularly farmers.

Following a CGIAR meeting for political leaders in February 1995 in Lucerne, Switzerland, a number of multilateral organizations, concerned about the effectiveness of the NARS in developing countries, encouraged regional discussions of the future of agricultural research in the region in general and the role that the CGIAR system could play in particular. All regional meetings conducted in 1996 (for sub-Saharan Africa, the Near East and North Africa, Asia and the Pacific and Latin America and the Caribbean) stressed the need to involve both the existing regional agricultural research organizations and their national constituencies more closely in the setting of the international agricultural research agenda. The regional meetings also suggested possible closer collaboration between NARS, and between NARS and the CGIAR system, to exploit more fully research synergies and to reach a higher level of resource-use efficiency.

National agricultural research institutes

Developing-country NARS have in the past been dominated by the public-sector NARI. These institutions suffer from the weaknesses common to public institutions, including lack of flexibility, susceptibility to political interference, lack of responsiveness to client demand, limitations on funding and lack of infrastructure. It is imperative that these institutional weaknesses be addressed; the global research system will not be effective without strong NARI. NARI can and should establish strong partnerships with universities and the private sector (within and outside the country). They also need to take more responsibility for generating technologies needed in their respective countries. They are well placed to carry out applied and adaptive research; to work with farming communities in identifying research needs for the future; to provide support to other institutions within the NARS; and to provide feedback and support to national development plans and policies.

NARI in general are faced with several challenges. They need a strong and effective extension mechanism to transfer their technology to users and to provide feedback to scientists and research administrators. NARI should provide better support to private-sector technology needs and rely to a greater extent on private input distributors for a more efficient transfer of results to farmers' fields. In general NARI have completed a period of rapid growth, but must now consolidate programmes, improve management systems and focus on producing results.

Universities

In today's global economy the competitiveness of a country's agricultural sector is increasingly dependent on the quality and technical skills of its human resources in agricultural research, extension and agribusiness systems. Higher education facilitates technology development and transfer and improves a nation's ability to absorb improved technologies from outside. Universities provide the technical training and develop future researchers. Yet agricultural education at the tertiary level has tended to be neglected in recent years as the attention of education professionals focused on the primary level.

Undoubtedly a strong primary education system is important for developing countries to address food-security and poverty issues. Primary education provides a good return on investment. But agricultural universities have a special role to play in addressing a society's food-security needs because of their advantage in basic and adaptive research and integrating

research, education and extension for efficient transfer of research results. Universities should strengthen their linkages with NARI as well as with the private sector. Universities can take an independent approach to research topics and, in some cases, challenge conventional wisdom. They need to coordinate their research agenda with NARI to increase their contribution to the growth of food production and to the sustainability of natural resources and the environment.

The private sector

The importance of private-sector agricultural research in developing countries has grown in recent years but varies with the level of each country's economic development, policy environment, patents and plant-breeder rights legislation and various market factors. Private-sector research in germplasm improvements for food and non-food crops has been significant. Private-sector involvement in natural-resource management research, however, has been very limited, constrained by high risk and non-exclusiveness of the research results (products cannot be restricted to those who pay). However, because of the funding problem facing public-sector research in developing countries, the private sector will have to play an increasingly important role in applied and adaptive research in the future. As economies are transformed and agriculture becomes more commercialized and dependent on purchased inputs, the scope for private-sector research will increase.

Non-governmental organizations

Numerous types of NGOs have proved effective in working at the farmer and community levels. These organizations serve as intermediaries between disadvantaged rural households and research, donor, financial and other organizations. Their flexibility, informality, social commitment and participatory style are especially suited to the complex task of rural development aimed at alleviating poverty, particularly in countries where special interests or political instability may render governments and bureaucracies unresponsive to the needs of the poor (Carroll, 1992). A few international NGOs have also become an important force in adaptive research and development at the global level, whereas local NGOs are becoming strong voices for rural people. In countries with severe political instability, NGOs may have a much stronger presence than other actors and are a valuable link in the research/technology-transfer continuum. They also have an increasingly important role in implementation of new technologies.

NGOs will continue to play an important part in the global agricultural research system, although they will be more a stakeholder than a research implementor. In an era of shrinking government budgets and capacities, NGOs may become more important in extending and adapting technologies for less-commercialized farmers. They will also serve as a voice for clients of the research system and for expressing environmental concerns that need to be addressed in the research agenda.

Farmers' organizations

The long-term sustainability of agricultural research in developing countries will depend upon the extent of public support for it. To this end, NARS will need to increase the participation of farmers and their organizations in setting research priorities and in the transfer of research results to farmers' fields. Commodity groups and farm organizations are potentially an important force in setting research priorities relevant to their needs. In Chile, Kenya, Senegal and some parts of India, for example, farmers have played an important role in articulating their demands on research systems and in directly or indirectly contributing funds for research. An analysis of such experiences in generating and sustaining farmers' involvement would provide insights into the measures needed to replicate the situation in the same countries for different commodities, and in other countries and regions. The future research agenda must respond to farmers in setting priorities and appropriate institutional arrangements, to ensure that the voice of the farmers continues to be heard.

National Agricultural Research Systems of developed countries

The NARS of developed countries have made significant contributions towards improving the welfare of the poor both in their own countries and in developing countries. They have an important role to play in the global research system and in the quest for global food security and environmental and resource sustainability. Even though their first priority is to seek solutions to the problems faced by agriculture in their own country, it is important to their own self-interest and to the productivity of the global research system that they continue to collaborate with other NARS and with international research centres. Developed countries and international organizations must recognize the value of agricultural research and continue to support and encourage basic and strategic research.

Many developed-country research organizations have strong capacity in basic and applied research. Universities and private industry have become increasingly important components

of the research systems of industrialized countries, particularly in high-cost biotechnology research. It is clearly in the best interests of developing countries to find ways to mobilize such competencies to work on problems of agricultural development in poor countries.

Universities

Universities in developed countries have long had a significant role in fostering the emergence of the global research system not only through their research efforts but also through training agricultural researchers in science and technology. Universities in developed countries have expertise in applied research as well, with a long tradition of integrating research over the entire continuum from basic to adaptive. In some countries, they effectively integrate research with education and extension. And many have been an important source of training for many scientists from developing countries. They can provide substantial scientific stimuli to research, education and extension in developing countries through greater interaction with research organizations, including universities in developing countries. Many universities have recognized that, as the world progresses towards a truly global economy, it is in their interests to build global programmes and provide their students with a global perspective.

An opposing factor is that because of reduced public funding, universities in developed countries conduct more of their research under contract to private firms. This is typically accompanied by a reduction in their interest and expertise in tropical agriculture and, sometimes, by severe restrictions on the information they can exchange with researchers from different institutions. This is likely to slow the transfer of science and technology to developing-country NARS and reduce the attention given to larger global problems.

The private sector

One of the most significant developments in agricultural research in recent years has been the increased role of the private sector in the developed and more advanced developing countries. Its role in biotechnology research and application on farmers' fields has been very promising. The private sector, however, only conducts research on technologies and products (for example, pesticides or hybrid varieties which cannot be replicated by farmers) that can be protected through intellectual property rights (IPR). Strengthening the laws relating to IPR has encouraged investment by the private sector. Market reforms and more open policies to attract private investment have also encouraged the private sector to invest more in research

and to develop technologies suitable for different agro-ecological markets. For example, in Mexico, with the opening of the seed market in the early 1990s the sale of hybrid maize seed by private companies more than doubled (Lopez-Pereira and Garcia, 1994)

International agricultural research centers

The IARC of the CGIAR and other associated centres have particular advantages in strategic and applied research. Their regional or global mandates allow them to do research on problems of interest over broad areas (strategic research) and their locations (mostly in developing countries) give them the added advantage of being able to conduct research on site.

Because their research objectives transcend national and regional interests, IARC are uniquely positioned to conduct activities of an international public-goods nature. In addition, they are well placed to act as convenors of other partners in the global system, playing a valuable catalytic role in the establishment of new partnerships and new ways of operating. Given the relatively small investments in IARC, they must continue to focus their activities and set their priorities on those areas where they have a distinct advantage over national systems.

The CGIAR system

Since its establishment in 1971, the leadership role of the CGIAR in international research has grown. The CGIAR system consists of 16 IARC spread throughout the world. Although it accounts for only 4 percent of global agricultural research expenditures, its impact has been significant.

The initial emphasis of CGIAR research was on increasing the productivity of major food grains (wheat, maize and rice) to decrease food insecurity and poverty. The focus of the CGIAR was subsequently extended to include other food and non-food crops, livestock, fisheries, forestry, genetic resources and natural-resource management and environmental sustainability issues. This involved an expansion of emphasis beyond germplasm conservation and improvement. The CGIAR centres together house the largest collection of plant germplasm in existence.

The CGIAR centres have dual responsibilities. On the one hand, they need to produce high-quality research output in large quantities to solve problems and to provide credible leadership in the global research system. On the other hand, they need to help NARS to build their capacity through collaborative research and training of scientists and research managers. CGIAR centres have done a commendable job in fulfilling both responsibilities and need to continue these efforts into the future if solutions to the problems of food insecurity, poverty and resource and environmental degradation are to be pursued seriously.

The lack of sufficient economic incentives for private-sector research to develop technologies in developing countries, coupled with a decline in international involvement of developed-country universities and NARI, has increased the role of CGIAR research to support technology generation to meet the needs of developing countries. While the system has been involved in training scientists and research administrators from developing countries, it is clear that the CGIAR's role in NARS capacity building can only be catalytic and achieved mainly through collaboration in conducting research programmes. Yet such collaboration has a crucial role in increasing food production and safeguarding natural resources and the environment through provision of advanced technologies for the poor whose needs are not met by the market.

Linking global research partners

Institutions comprising the global agricultural research system need to find new and innovative ways of working together in order to increase the efficiency and effectiveness of scarce financial resources. The emphasis of NARS should now be on developing new partnerships to capitalize on shared resources in regional arrangements; to access advanced research methodologies such as biotechnology from the private sector; and to improve the efficiency of research efforts in natural-resource management, which falls outside the scope of traditional agricultural research and has international implications. In short, partnerships need to be more numerous, diverse, innovative and substantive (Lele and Coffman, 1995).

At the same time, it must be recognized that partnerships, linkages and collaboration have their costs. These costs need to be minimized and roles defined so that attempts at collaboration do not reduce efficiency and place even greater strain on declining budgets.

The privatization of research and IPR points to a far larger role for the private sector. Strengthened partnerships are needed between private- and public-sector research

institutions, particularly in developing countries that must keep pace with advances in new technologies and fully capture the benefits of their utilization. Such partnerships will speed up the commercialization of public research results and products, thereby reducing the time lag between the development and adoption of new technologies. No one yet knows exactly what form these partnerships will or should be taking, given the challenge of reconciling a range of different, sometimes apparently conflicting, objectives. In particular, private-sector entities are legitimately seeking higher profits for themselves, whereas the legitimacy of public research institutions rests on the pursuit of public goods and social benefits (e.g. poverty alleviation, conservation of natural resources, public education, etc.). Fortunately there are already many diverse examples of successful public-private partnerships in agricultural research. These examples provide hope that collaboration is indeed possible and can provide lessons on how such collaboration can be achieved.

While private research focuses on high-value crops and patentable technologies, international public-sector research continues to focus on technologies that are national or international public goods. The major challenges of food security, poverty alleviation and resource and environmental sustainability are not restricted to one country or one region of the world. In an increasingly interdependent world, there will be greater opportunities for bilateral and multilateral collaboration to address these national and regional problems. Such collaborations offer significant economies of scale and scope, greater accountability for both negative and positive externalities and greater opportunities to exploit recent advances in biotechnology, geographic information systems and communication technologies.

Finally, beneficiaries of technologies must be included as full partners in the system. A demand-driven system implies that the ultimate users of technologies have a strong voice in setting priorities, evaluating the technology and validating the results. The global research system should be at its full efficiency to feed a population that is not only growing in number but also consuming more higher quality and higher value products.

Conclusion

Investments in national and international agricultural research should increase in the future. There is a continuous need for new technologies and techniques to be developed to keep pace with the growing demand for food (crops, livestock, fish and forest products) without price increases or deteriorating natural resources and environment. Investments in agricultural

research have been, and will continue to be, highly beneficial to society in solving problems of food insecurity and poverty. Research and technology generation are central to achieving the structural transformation of the agricultural sector. Agricultural and rural development in turn is crucial to the overall economic, social, political and cultural progress of humanity.

There is little doubt that the necessary increase in total resources devoted to agricultural research globally will not come about unless researchers and research institutions demonstrate that they can increase the productivity and effectiveness of the resources already devoted to agricultural research. Such improvements will require major institutional reforms, including:

- correcting major flaws in public agricultural research institutions in developing countries;
- meaningfully involving the clients of research, i.e. farmers and other natural-resource users, individually and collectively, in the selection of research priorities, the conduct and continuing evaluation of research programmes and the validation of research results;
- forging effective partnerships, domestically, with universities, NGOs, private firms and other entities involved in the technology development and implementation process;
- forging effective partnerships with international research institutions such as the CGIAR centres and other advanced research organizations (ARO), as well as strong collaboration among NARS within a region through collaboration in the various regional agricultural research associations.

The current development of regional organizations of NARS and their more active role on the international scene are positive signs. Such regional organizations have three main advantages. First, they enhance regional collaboration. They permit small NARS to take advantage of economies of scale and scope, and in the case of large NARS they can be a very useful instrument in overcoming the stifling bureaucratic constraints restricting them from focusing their efforts on specific development objectives. The second potential advantage of regional organizations is to help organize and coordinate the numerous initiatives of outside actors such as the IARC, the ARO and individual donors. The third advantage is to address issues and constraints that can only be effectively addressed through regional collaborative efforts, for example the management of natural resources that transcend national boundaries.

There is also scope for increasing the efficiency and impact of donor funding by improving and consolidating donor support to developing-country NARS. As partners in the system, donors must find ways to collaborate and support agricultural research with less overlap and inefficiency. Funding reform will require the investment of strong political capital and support. The development of national commitment at both the highest political and financial levels, and not simply at the levels of NARS directors and donors, is essential.

The role of agricultural research in achieving sustainable food security and contributing to agricultural development is clear: productivity must increase and must do so in an environmentally sustainable manner. Economic reforms including policy changes and trade liberalization will provide a favourable environment for future production increases. However, technology and management innovations are still needed to sustain and increase food production in both high- and low-potential areas, often where natural resources are already under considerable pressure. Science-based agricultural technology, developed through agricultural research, can accomplish these goals provided that:

- Substantial investments continue to be made in the agricultural and rural sectors of developing countries generally, and in their knowledge systems specifically, i.e. in agricultural research, education, extension, information and communications systems;
- Institutions and organizations concerned with the knowledge system are reformed, so that information is widely shared, research priorities reflect the genuine needs of stakeholders, responsibilities for generating and disseminating technologies rest at the level most appropriate to achieve results, and existing resources are used more effectively.

Investments and institutional changes are needed first and foremost in NARS. This is true both for developed countries, which generally have a good record in this regard, and for developing countries, some of which have a dismal record in consistency of support to agricultural knowledge systems. No blanket funding recommendation is possible, but significantly increased financial support is needed in many countries. To improve food security in a sustainable manner, developing countries will often require an investment in their agricultural research system at a level of 1 percent of the value of agricultural output over the short term and 2 percent in the long term (Pinstrup-Andersen, 1995b).

Continued and increased donor support to national programmes is critical, although this might be conditional on adequate country commitment. Greater synergy among donors' efforts is also critical. Financial support for the international agricultural research system must be strengthened to provide the support needed by developing-country NARS. Investments in CGIAR research should increase to facilitate its mission of promoting sustainable and efficient agriculture for food security, poverty alleviation and environmental protection.

Increased funding, while necessary, will not suffice. Investments and changes are also needed concurrently in relevant institutions at the regional, international and global levels. All partners at all levels must seek and develop new relationships and new modalities of collaboration, bringing modern science to bear on problems in poor countries especially. The beneficiaries of research technology must have a strong voice and must be part of the collaborative effort. Taken together, these changes will enable a rapid evolution of an existing, but often nascent, global agricultural research system.

For these changes to occur, political commitment at all levels is essential, in both developing and developed countries, for the support of agricultural research. The consequences of failure to transform and invest sufficiently in agricultural research will be greater food insecurity, especially among those with little or no purchasing power, a greater incidence of poverty and increased degradation of resources and the environment. A thriving agricultural sector is a necessary condition for economic growth, for providing food, income and employment to the poor and for improving resource conservation and environmental protection.

Chapter-1.10: International fellowships for scientific mobility, NAAS rating journals.

Scholarships and Fellowships by ICAR

Post Matric Scholarship for SC/ST - 240 number per year

Eligibility : For SC/ST Undergraduate degree program students studying in Agricultural Universities (State Agricultural Universities, Allhabad Agricultural Institute Deemed University, Central Agricultural University, Central Universities having Agriculture faculty and ICAR Institute based Deemed to be Universities). **Amount** : Rs. 300/- pm + Rs. 750/- annual grant for the duration of the program.

Merit cum Means (MCM) Scholarships

Eligibility : For Undergraduate degree program students having Parents Annual Income below Rs. 1 Lakh and studying in Agricultural Universities. **Amount** : Rs. 500/- pm for the duration of the program

National Talent Scholarships (NTS)

Eligibility : For Undergraduate degree program students studying in Agricultural Universities not located in the domicile State of the student and selected through ICAR/VCI All India Entrance Examination for admission to UG programs and award of NTS in agriculture and allied subjects. **Amount:** Rs. 1000/- pm for the duration of the program

Internships for Veterinary students

Eligibility : For B.V.Sc & AH and equivalent degree program students studying in Agricultural Universities. **Amount** : Rs. 400/- pm for 6 months + travel grant of Rs. 200/- for the duration of internship

ICAR Junior Research Fellowships for pursuing Master's degree - 475 number

Eligibility : For Master's students studying in Agricultural Universities **Amount** : Rs. 8640/- pm + Contingency grant of Rs. 6000/- per year for other than Veterinary Science students Rs. 12000/- pm + Contingency grant of Rs. 6000/- per year for Veterinary Science students

ICAR Senior Research Fellowships for pursuing Ph. D. degree - 202 number

Eligibility : For Ph.D. students studying in Agricultural Universities **Amount** : Rs. 12000/- pm for 1 st and 2 nd year and Rs. 14000/- pm for 3 rd year + Contingency grant of Rs. 10000/- per year for other than Veterinary Science students Rs. 14000/- pm for 1 st and 2 nd year and Rs. 15000/- pm for 3 rd year + Contingency grant of Rs. 10000/- per year for Veterinary Science students

Other International fellowships are

1. Bayer Foundations Jeff Schell Scholarship
2. Food and Agriculture Organization of the United Nations Hungarian Government Scholarship
3. Cattolica Africa Scholarships
4. Swedish University of Agricultural Sciences
5. University of East Anglia Lord Walston Scholarship
6. NFU Mutual Charitable Trust Centenary Award
7. Royal Agricultural University Africa's Land and Food Fellowship
8. Agriculture Future of America Scholarships
9. United States Department of Agriculture William F. Helms Internship Program
10. Purdue University College of Agriculture
11. Utah State University College of Agriculture and Applied Sciences
12. ExtremeTerrain's Student Scholarships
13. Dalhousie University Faculty of Agriculture Graduate Scholarships
14. University of Guelph Undergraduate Scholarships
15. Chinese Government Scholarships
16. Obihiro University of Agriculture and Veterinary Medicine (OUAVM)
17. ASEAN International Student Scholarship at Kasetsart University
18. Australian Agriculture Scholarship
19. Flowers Across Melbourne Scholarship
20. University of Queensland School of Agriculture and Food Sciences
21. Australian Centre for International Agricultural Research (ACIAR)
22. Dairy Farm Business Management Scholarship
23. Lincoln University Faculty of Agriculture and Life Sciences Postgraduate Scholarships

NAAS rating journals 0f 2017: http://naasindia.org/documents/journals2017.pdf

UNIT – II

Chapter-2.1: Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics and standards land problems in research ethics.

Research ethics involves the application of fundamental ethical principles to a variety of topics involving research, including scientific research. These include the design and implementation of research involving human experimentation, animal experimentation, various aspects of academic scandal, including scientific misconduct (such as fraud, fabrication of data and plagiarism), whistleblowing; regulation of research, etc. Research ethics is most developed as a concept in medical research. The key agreement here is the 1964 Declaration of Helsinki. The Nuremberg Code is a former agreement, but with many still important notes. Research in the social sciences presents a different set of issues than those in medical research.

The academic research enterprise is built on a foundation of trust. Researchers trust that the results reported by others are sound. Society trusts that the results of research reflect an honest attempt by scientists and other researchers to describe the world accurately and without bias. But this trust will endure only if the scientific community devotes itself to exemplifying and transmitting the values associated with ethical research conduct.

There are many ethical issues to be taken into serious consideration for research. Sociologists need to be aware of having the responsibility to secure the actual permission and interests of all those involved in the study. They should not misuse any of the information discovered, and there should be a certain moral responsibility maintained towards the participants. There is a duty to protect the rights of people in the study as well as their privacy and sensitivity. The confidentiality of those involved in the observation must be carried out, keeping their anonymity and privacy secure. All of these ethics must be honoured unless there are other overriding reasons to do so - for example, any illegal or terrorist activity.

Research ethics in a medical context is dominated by principlism. Medical research involving human experimentation is overseen by an ethics committee, in most countries working under legislation based on the Declaration of Helsinki and its later revisions.

Research ethics is different throughout different types of educational communities. Every community has its own set of morals. In Anthropology [3] research ethics were formed to protect those who are being researched and to protect the researcher from topics or events that may be

unsafe or may make either party feel uncomfortable. It is a widely observed guideline that anthropologists use especially when doing ethnographic fieldwork

Ethics: moral principles of right and wrong

Research ethics: incorporating ethical principles into research practice

All stages, all those involved, from inception of research through to completion and publication of results and beyond.

Definition: "research ethics" refers to a diverse set of values, norms and institutional regulations that help constitute and regulate scientific activity.

History

- 1947- Noremberg Code
- 1968- Helsinki Declaration
- 1979- Belmont Report
- 1993- CIOMS
- 2005- UNESCO

Objectives of Research Ethics

- To protect human participants
- To ensure that research is conducted in a way that serves interests of individuals, groups and/or society as a whole
- To examine specific research activities and projects for their ethical soundness, protection of confidentiality and the process of informed consent

Issues related to Ethical concern in Research

- Plagiarism
- Misuse of Privileged Information
- Data
- Authorship and Other Publication Issues
- Interference

- Research with Animals
- Research with Human
- Subjects

Areas of Academic misconduct

- Plagiarism
- Fabrication and falsification
- Non-publication of data
- Faulty data-gathering procedures
- Poor data storage and retention
- Misleading authorship
- Sneaky publication practices

Codes and policies for research ethics

Given the importance of ethics for the conduct of research, it should come as no surprise that many different professional associations, government agencies, and universities have adopted specific codes, rules, and policies relating to research ethics. Many government agencies, such as the National Institutes of Health (NIH), the National Science Foundation (NSF), the Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), and the Department of Agriculture (USDA) have ethics rules for funded researchers. Other influential research ethics policies include the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (International Committee of Medical Journal Editors), the Chemist's Code of Conduct (American Chemical Society), Code of Ethics (American Society for Clinical Laboratory Science) Ethical Principles of Psychologists (American Psychological Association), Statements on Ethics and Professional Responsibility (American Anthropological Association), Statement on Professional Ethics (American Association of University Professors), the Nuremberg Code and the Declaration of Helsinki (World Medical Association).

The following is a rough and general summary of some ethical principles that various codes address*:

1. **Honesty**: Strive for honesty in all scientific communications. Honestly report data, results, methods and procedures, and publication status. Do not fabricate, falsify, or misrepresent data. Do not deceive colleagues, granting agencies, or the public.

2. **Objectivity**: Strive to avoid bias in experimental design, data analysis, data interpretation, peer review, personnel decisions, grant writing, expert testimony, and other aspects of research where objectivity is expected or required. Avoid or minimize bias or self-deception. Disclose personal or financial interests that may affect research.
3. **Integrity**: Keep your promises and agreements; act with sincerity; strive for consistency of thought and action.
4. **Carefulness**: Avoid careless errors and negligence; carefully and critically examine your own work and the work of your peers. Keep good records of research activities, such as data collection, research design, and correspondence with agencies or journals.
5. **Openness**: Share data, results, ideas, tools, resources. Be open to criticism and new ideas.
6. **Respect for Intellectual Property**: Honor patents, copyrights, and other forms of intellectual property. Do not use unpublished data, methods, or results without permission. Give credit where credit is due. Give proper acknowledgement or credit for all contributions to research. Never plagiarize.
7. **Confidentiality**: Protect confidential communications, such as papers or grants submitted for publication, personnel records, trade or military secrets, and patient records.
8. **Responsible Publication**: Publish in order to advance research and scholarship, not to advance just your own career. Avoid wasteful and duplicative publication.
9. **Responsible Mentoring**: Help to educate, mentor, and advise students. Promote their welfare and allow them to make their own decisions.
10. **Respect for colleagues**: Respect your colleagues and treat them fairly.
11. **Social Responsibility**: Strive to promote social good and prevent or mitigate social harms through research, public education, and advocacy.
12. **Non-Discrimination**: Avoid discrimination against colleagues or students on the basis of sex, race, ethnicity, or other factors that are not related to their scientific competence and integrity.
13. **Competence**: Maintain and improve your own professional competence and expertise through lifelong education and learning; take steps to promote competence in science as a whole.
14. **Legality**: Know and obey relevant laws and institutional and governmental policies.
15. **Animal Care**: Show proper respect and care for animals when using them in research. Do not conduct unnecessary or poorly designed animal experiments.
16. **Human Subjects Protection**: When conducting research on human subjects minimize harms and risks and maximize benefits; respect human dignity, privacy, and autonomy;

take special precautions with vulnerable populations; and strive to distribute the benefits and burdens of research fairly.

There are many other activities that do not define as "misconduct" but which are still regarded by most researchers as unethical. These are called "other deviations" from acceptable research practices and include:

1. Publishing the same paper in two different journals without telling the editors
2. Submitting the same paper to different journals without telling the editors
3. Not informing a collaborator of your intent to file a patent in order to make sure that you are the sole inventor
4. Including a colleague as an author on a paper in return for a favor even though the colleague did not make a serious contribution to the paper
5. Discussing with your colleagues confidential data from a paper that you are reviewing for a journal
6. Trimming outliers from a data set without discussing your reasons in paper
7. Using an inappropriate statistical technique in order to enhance the significance of your research
8. Bypassing the peer review process and announcing your results through a press conference without giving peers adequate information to review your work
9. Conducting a review of the literature that fails to acknowledge the contributions of other people in the field or relevant prior work
10. Stretching the truth on a grant application in order to convince reviewers that your project will make a significant contribution to the field
11. Stretching the truth on a job application or curriculum vita
12. Giving the same research project to two graduate students in order to see who can do it the fastest
13. Overworking, neglecting, or exploiting graduate or post-doctoral students
14. Failing to keep good research records
15. Failing to maintain research data for a reasonable period of time
16. Making derogatory comments and personal attacks in your review of author's submission
17. Promising a student a better grade for sexual favors
18. Using a racist epithet in the laboratory

19. Making significant deviations from the research protocol approved by your institution's Animal Care and Use Committee or Institutional Review Board for Human Subjects Research without telling the committee or the board
20. Not reporting an adverse event in a human research experiment
21. Wasting animals in research
22. Exposing students and staff to biological risks in violation of your institution's biosafety rules
23. Rejecting a manuscript for publication without even reading it
24. Sabotaging someone's work
25. Stealing supplies, books, or data
26. Rigging an experiment so you know how it will turn out
27. Making unauthorized copies of data, papers, or computer programs
28. Deliberately overestimating the clinical significance of a new drug in order to obtain economic benefits

These actions would be regarded as unethical by most scientists and some might even be illegal. Most of these would also violate different professional ethics codes or institutional policies.

The 3 Rs: Replacement, Reduction and Refinement

Encapsulated in the code of practice for the care and use of animals for scientific purposes is the requirement for scientific and teaching activities to consider the 3Rs.

1. **Replacement**: Techniques that totally or partially replace the use of animals for scientific purposes must be sought and used wherever possible.

2. **Reduction**: Each project must use no more than the minimum number of animals necessary to ensure scientific and statistical validity. The principle of reducing the number of animals used should not be implemented at the expense of greater suffering of individual animals. Scientific and teaching activities involving the use of animals must not be repeated unless essential for the purpose or design of the project. Teaching activities must involve no more than the minimum number of animals required to reach the educational objectives. Overproduction of animals bred for scientific purposes should be avoided so that the need to kill healthy animals is minimized.

3. **Refinement**: Animals must be suitable for the scientific purpose taking into account their biological characteristics including behaviour, genetic attributes and nutritional, microbiological and general health status. The design and management of animal accommodation should meet

with species-specific needs. Special consideration is required where this is precluded by the requirements of the project. Animals should be transported, housed, fed, watered, handled and used under conditions that meet species-specific needs

Ethical issues in agricultural research

1. **Sustainability**: The ethical dilemmas arise when short term problems are preferred over long term ones. Institutional capacities to address long term problems require different kinds of reinforcement than otherwise. Ethical dilemma also arises when certain sectors, segments, social classes and seasons are preferred over others while choosing problems, or locating them, solving them or diffusing the solutions obtained. Inter species and inter sectorial concerns also influence the sustainability of the outcomes. Not all local practices need to be sustained. Sustainability is as much about continuity as about discontinuity (that is innovations or fundamental change in values).

2. **Eco system health**: When scientists know about the concomitants of the eco system health and yet develop technologies which impair the health, they are not only making a tradeoff but also passing a value judgment. Transferring costs of near term tradeoffs over the longer term stakeholders may neither be ethical nor economically very judicious. Eco system health is also affected when long term consequences of certain chemical inputs are known or anticipatable, and yet these are continued to be used. Judgments are involved when chemicals banned in western countries are allowed to be used in developing countries, when the precautionary principle is applied or not applied, and while technologies are transferred to countries which may or may not have capacity to assess the consequences.

3. **Responsiveness**: In any context, not everybody‟s problem is equally important. Michael Lipton once drew attention to the biases that existed in favour of interesting pests‟ vis-à-vis the relevant ones. When certain problems remain unsolved or unaddressed for centuries, surely it says something about the dominant ethics in the society which does not generate a dilemma or a discomfort despite sustained inertia and indifference. A good example is the cooking stove used by millions of women or carrying water pots on the head for long distance, transporting grass or twigs on head on the hill slopes by women or transplanting paddy by keeping feet under water and thus getting fungal infections, etc.

4. **Accountability**: Researchers seldom share their findings with the people from whom they collect the data. Not only that. They often do not even calibrate their criteria of relevant or not so relevant research by involving the users of research in calibration. Ethical dilemma also arise

when a large multinational corporations inform the consumers of its chemical inputs about a desirable resource use practice in west but which they do not share in the developing countries. The community of corporations has to evolve its own code of conduct censoring such behaviour.

5. **Capacity building**: Any society which has to grapple with risk and uncertainty inherent in agricultural resource management has to learn to create capacity not only to anticipate but also address the future problems. The education and training of young minds thus becomes a very important determinant of the capacity to face emerging challenges in future. When the education system does or does not include content or pedagogical means which make a potential leader aware of the challenges, an ethical judgment has been made. When certain crops and/or other agricultural products are deliberately portrayed as inferior in the educational curriculum, on cultural grounds rather on nutritional or other scientific grounds, values have already been expressed. Lack of periodic review of the skills that are being developed to address such concerns about externality, diversity, inter sectorial linkages, etc., invariably involve making tradeoffs about what should be told and what should young people learn on their own.

6. **Location specificity**: It is well known that agro ecological environment in rainfed regions is much more heterogeneous. Developing technologies which would diffuse only in a small region poses an institutional challenge apart from technological challenge. Organization incentives are often provided, commensurate with the diffusion or potential reach of a solution. If a technology is addressing problems of small community, it may not invoke a significant encouragement or incentive. Consequently, either such problems don‟t get addressed or the people who address such problems become marginalized. In either case ethical judgments have to be made by the decision makers. When research infrastructure, allocation of human resources and priority in research are biased in favour of better endowed regions and communities, the ethics of neglecting the bypassed communities and regions has to be made explicit. When hand tools receive less attention than energy intensive technologies, judgments have been made.

7. **Asymmetry in rights of and responsibilities towards knowledge holders**: No agricultural research council in developed or developing countries ever requires the asymmetry between rights and responsibilities towards the knowledge holders of informal sectors be deliberately overcome. The respondents in research with communities are not acknowledged, do not receive the findings of the research for which they provide data and do not receive any share in the benefits that are generated from the application or commercialization of the knowledge provided by the respondents/knowledge providers.

8. **Empowerment of informal innovators and knowledge holders**: It is obvious that creativity exists in formal as well as informal sectors. Just as the scientists can generate a creative and innovative solution to a problem, a farmer or an artisan can too1. The global bias against innovations in informal sector is very obvious. Inability of formal research system to listen to and learn from informal innovators not only deprives the organized sector of agricultural research and technology of the insights from the margin but also prevents it from being inspired by the values of many of the grassroots innovators.

The ethical tradeoffs in such matters invariably affect the efficiency, equity, excellence and environmental consequences of resource and institutional management.

UNESCO: **Ethical Guidelines**

1. Principal investigators
2. Integrity of the research enterprise is maintained
3. Potential benefit / harmful effects to the participants and society
4. Consider the effects of his/her work, including the consequences or misuse
5. Competent fashion
6. Awareness of, local customs, standards, laws and regulations
7. Informed consent
8. Potential participants should be informed about potentially harmful effects
9. Full confidentiality
10. Participants should be offered access to research results
11. Reported widely
12. Acknowledged
13. Preserved

Economic and Social Research Council, UK – Guidelines

1. Research should be designed, reviewed and undertaken to ensure integrity and quality
2. Research staff and subjects must be informed fully about the purpose, methods and intended possible uses of the research, what their participation in the research entails and what risks if any, are involved.
    a. Exceptionally, some variation may be acceptable
3. The confidentiality of information supplied by research subjects and the anonymity of respondents must be respected.
4. Research participants must participate in a voluntary way, free from any coercion.

Exceptionally, covert research and deception may be acceptable.

5. Harm to participants must be avoided.
    - avoidance of harm extends to family, kin, community
    - groups should not be unreasonably excluded from research
    - *exceptionally, some limited short term and minimal harm may be acceptable*
6. The independence of the research must be clear; any conflicts of interest or partiality must be explicit.

Ethical Principles in Research

1. Voluntary Participation (Informed consent- Components, deception – procedures)
2. No harm to the subjects - Non-maleficence - Do no harm (commission or omission) minimize harm
3. PAC: PRIVACY, ANONYMITY AND CONFIDENTIALITY
4. Beneficence - promotion of wellbeing (maximize benefit)
5. Autonomy - make own decisions
6. Integrity

APA Ethics Code Standard 8: Research & Publication

- 8.01 Institutional Approval
- 8.02 Informed Consent to Research
- 8.03 Informed Consent for Recording Voices & Images
- 8.04 Client/Patient, Student, & Subordinate Research Participants
- 8.05 Dispensing with Informed Consent
- 8.06 Offering Inducements for Research Participation
- 8.07 Deception in Research
- 8.08 Debriefing
- 8.09 Humane Care & Use of Animals in Research
- 8.10 Reporting Research Results
- 8.11 Plagiarism

- 8.12 Publication Credit
- 8.13 Duplicate Publication of Data
- 8.14 Sharing Research for Verification
- 8.15 Reviewers

Benchmarks for ethical research are

- Collaborative partnership
- Social value
- Scientific validity
- Fair participant selection
- Favorable risk-benefit ratio
- Independent review
- Informed consent
- Ongoing respect

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UNIT – III

Chapter-3.1: MEANING, DEFINITION AND CONNOTATIONS OF RURAL DEVELOPMENT

Meaning of Rural Development

Rural development in general is used to denote the actions and initiatives taken to improve the standard of living in non-Urban neighborhoods, countryside, and remote villages. These communities can be exemplified with a low ratio of inhabitants to open space. Agricultural activities may be prominent in this case whereas economic activities would relate to the primary sector, production of foodstuffs and raw materials.

Rural development actions mostly aim at the social and economic development of the areas. These programs are usually top-down from the local or regional authorities, regional development agencies, NGOs, national governments or international development organizations. But then, local populations can also bring about endogenous initiatives for development. The term is not limited to the issues for developing countries. In fact many of the developed countries have very active rural development programs. The main aim of the rural government policy is to develop the undeveloped villages. To develop a country not only industrialization is sufficient but also the every common man has to survive.

Rural Development is defined as improving the living standards of the masses of the low income population residing in rural areas.

Definition of Rural Development

According to World Bank rural development is a strategy designed to improve the economic and social life of a specific group of people by extending the benefits of development to the poorest among those who seek livelihood in the rural areas.

According to Finance Ministry rural development is systematic and integrated use of national resources enabling every person to engage himself in production and social useful occupation and earn income that will meet at least the basic needs.

According to National Commission on Agriculture rural development means development of an area and the people through optimum development and utilization of local resources by bringing about necessary institutions, structures and attitudinal changes and by delivering package of services to improve all fields of the rural poor and rural weak.

The term rural development is a subset of the broader term 'Development'. However we define it, development is a universally cherished goal of individuals, families, communities and nations all over the world. Development is also natural in the sense that all forms of life on Planet Earth have an inherent urge to survive and develop. Given these two attributes, i.e, its universal supremacy as a goal and its natural occurrence, development deserves a scientific study and analysis. Hence it is not surprising that the subject of development has been studied by scholars of all faiths, ideologies and disciplines.

Connotation of Rural Development:

The term rural development connotes overall development of rural areas with a view to improve the quality of life of rural people. In this sense, it is a comprehensive and multidimensional concept, and encompasses the development of agriculture and allied activities, village and cottage industries and crafts, socio-economic infrastructure, community services and facilities, and, above all, the human resources in rural areas. As a phenomenon, rural development is the end-result of interactions between various physical, technological, economic, socio-cultural and institutional factors. As a strategy, it is designed to improve the economic and social well-being of a specific group of people – the rural poor. As a discipline, it is multi-disciplinary in nature, representing an intersection of agricultural, social, behavioural, engineering and management sciences.

Rural development is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of rural development. The group includes small scale farmers, tenants, and the landless.

Thus the term rural development may be used to imply any one of the above-mentioned connotations. To avoid ineffective floundering among the myriad definitions, we shall define rural development as; 'A process leading to sustainable improvement in the quality of life of rural people, especially the poor.'

Basic elements of rural development:

Whatever the geographic location, culture and historical stage of development of a society, there are at least three basic elements which are considered to constitute the 'true' meaning of rural development.

1. **Basic necessities of life**: People have certain basic needs, without which it would be impossible (or very difficult) for them to survive. The basic necessities include food, cloths, shelter, basic literacy, primary health care and security of life and property. When any one or all of them are absent or in critically short supply, we may state that a condition of 'absolute underdevelopment' exists. Provision of the basic necessities of life to everybody is the primary responsibility of all economics, whether they are capitalist, socialist, or mixed. In this sense, we may claim that economic growth (increased per capita availability of basic necessities) is a necessary condition for improvement of the 'quality of life' of rural people, which is rural development.
2. **Self-respect**: Every person and every nation seeks some sort of self-respect, dignity, or honour. Absence or denial of self-respect indicates lack of development.
3. **Freedom:** In this context, freedom refers to political or ideological freedom, economic freedom and freedom from social servitude. As long as a society is bound by the servitude of men to nature, ignorance, other men, institutions, and dogmatic beliefs, it cannot claim to have achieved the goal of 'development'. Servitude in any form reflects a state of underdevelopment.

Rural Development in India – The Concept:

The development of rural areas in India is a multi-dimensional problem, which has been so far viewed by the policy makers and academicians mainly from the economic aspect only. In India rural development is not only an economic problem but also a more social problem. Michael P. Todaro views rural development most suitable, in Indian Context, in following manner:

i. Improvement in the level of living standard including employment, education, health nutrition, housing and a variety of social services.
ii. Decreasing in equality in distribution of rural incomes and in the rural urban imbalances in incomes and economic opportunities.

iii. To sustain the capacity of rural sector.

It seems that in Indian Centex rural development is a more sociological problem rather than an economic problem. With the process of economic development and growing awareness, the social system in the country is becoming more complicated and unfavourable to economic conditions. The caste system continues to be a strong moral phenomenon of social structure in India, which undoubtedly is an ordering system in marriage, basis of communal participation, a social control agency, and a political instrument affecting the rural development process adversely. So the policies of rural development may so designed to crack down the prevalent social structure in the country.

Chapter-3.2: Rural Development Policies and Strategies

Rural development programmes and polices followed in India after independence reveal four strategies of development.

1. Growth Oriented Strategy:

This is based on the philosophy that rural people, like any other people, are rational decision makers. Who when given adequate opportunity and a proper environment, will try to maximise their incomes the role of the state in this strategy is to build infrastructure, and maintain a favourable climate to stimulate the growth of rural of rural enterprises. The critical assumption of this strategy is that the benefits of increased production will gradually 'trickle down' to the poor. The regulation and coordination of the activities of private and public agencies is primarily through market mechanisms. This paradigm formed the basis of the predominant agricultural development strategy of the 1960s, when programmes like the Intensive Agriculture District a programme (IADP), the Intensive Cattle Development Programme (CIDP), the High yielding varieties Programme (HYVP), were launched. But this paradigm failed to make any dent on the basic problems of poverty, unemployment and inequality, and had to be abandoned.

2. Welfare Oriented Strategy:

This seeks to promote the well-being of the rural population in general, and the rural poor in particular, through large – scale social programmes like the Minimum Needs Programme, Applied Nutrition Programme, Mid-day Meals programme, etc. the primary means used in this strategy are free provisions / distribution of goods, services and civic amenities in rural areas.

The critical assumption of this strategy are that people are not competent to identify and resolve their problems, and that government specialists can identify their needs and meet them with the financial and administrative resource available with the government. The role of villagers id that of passive receptors of services. This strategy has paternalistic orientation. The performance of the programme is judge by the orientated programmes present a mixed picture: the rural poor have benefited significantly through some programme in a few areas, but not in others There are two major criticism of this strategy, namely,(a) it has created dependence: and (b) it require resources that are beyond the means of governments.

3. Responsive Strategy:

This is aimed at helping rural people help themselves through their own organizations and other support systems. Its concern is with responding to the felt needs of the rural people, as defined by them. The role of the government is to facilate the self-help efforts of villagers by providing technologies and resources that are not locally available. The critical assumption of this strategy is that the rural poor will identify and resolve their problems if provided with minimal support, and otherwise left to their own devices and initiatives. Community participation in , and control pf, project activities is the primary performance indicator of this strategy. India's Operation Flood, which was launched in 1970 in 18 milksheds in 10 states, is a good example of this strategy. Operation Flood aimed at modernising and developing India's dairy industry through a three –tire structure of Anand pattern dairy cooperatives. Many voluntary agencies are also following this paradigm of development.

4. Integrated or Holistic Strategy:

This combines all the positive features of the earlier three strategies, and is designed to simultaneously achieve the goals of growth, welfare, equity and community participation. This paradigm takes a very comprehensive but integrated view of the basic problems of poverty, unemployment and inequality, and seeks to address the physical, economic, technological, social, motivational, organisational and political bases of these problems.

The multiple goals of this strategy are sought to be achieved by building the capacity of the community to involve itself in development in partnership with the government. The critical assumption underlying this approach is that the government can restructure societal power relationship, and centralised bureaucracies can learn to share power with community groups. Successful implementation for vertical and lateral integration, a combination of specialist and generalist skills, institutional leadership, social intervention capability and systems management. of this strategy requires complex decentralised matrix structure, with permanent mechanism.

Chapter-3.3: Rural Development Programmes: Community Development Programme and Intensive Agricultural District Programme

Community Development Programme

The Community Development Programme was launched in India on 2nd October, 1952 with 55 Community Development Projects (CDPs0. Each project had an operational area of about 400 to 500 square miles, comprising 300 villages and a population of about 2 lakhs. The project area was divided into 3 development blocks, each consisting of about 100 villages and a population of 60 to 70 thousand. The project was headed by a Project officer, and a number of subject matter Extension Officers in the disciplines of agriculture, animal husbandry, cooperation, industries, rural engineering, social education etc. each project had about 60 multi-purpose. Village Level Workers (VLWs), one for each group of 5 to 10 villages. They were government appointed extension functionary at the lowest level. Who were nearest to the people. The multipurpose VLWs were common to the development departments engaged in rural work.

The people in all the project areas responded enthusiastically and the need for a rapid expansion of the programme to other parts of the country was urgently felt. Limited resources, however, did not permit a rapid expansion of the CD projects. A year later, in 1953, the National Extension Service (NES) programme was launched with the idea of having wider coverage at less cost and more peoples' participation. Each NES block had about 100 villages and about 65 thousand population. The NES block was headed by a Block Development Officer (BDO) and had a number of Extension Officers (EOs). For the NES blocks funds were drastically reduced and the number of multipurpose of VLWs was brought down to 10. NES was through of as the agency and CD as the method to bring about socio-economic transformation of the rural people.

The momentum gained by the NES programme was intensified by converting some selected NES blocks to Community Development Blocks (CDB). The programme was initiated in 1954. The NES blocks which produced good results and where peoples' participation had been in abundance, were selected for the purpose. In these blocks funds were increased and some additional staff was provided.

Concepts of Community Development;

The term Community Development appears to have originated from Cambridge in England. In 1948, the Cambridge Summer Conference on African Administration recommended this term defining it as a movement designed to promote better living for the whole community with the

active participation, if possible on the initiative of the community, but if this initiative is not forthcoming spontaneously, by the use of techniques for arousing and stimulating it in order to secure its action and enthusiastic response to the movement.

The United Nations (1956) defined Community Development as the process by which the efforts of the people themselves are united with those of the governmental authorities to improve the economic, social and cultural conditions of the communities, to integrate these communities into the life of the nation and to enable them to contribute fully to national progress.

The International Cooperation Administration (1957) in its guidelines stated that Community Development is a process of social action in which the people of a community organize themselves for planning and action, define their common and individual needs and problems, make group and individual plans to meet their needs and solve their problems, execute these plans with a maximum of reliance upon community resources, and supplement these resources when necessary, with services and materials from governmental and non-governmental agencies outside the community.

Taylor and others (1965) conceived Community Development as the method by which people who live in local villages or communities are involved in helping to improve their own economic and social conditions and thereby become effective working groups in programmes of national development. The adoption of this method is based upon a knowledge that villages who in past have seemed to be lethargic and not interested in change, will become dynamic if they are permitted to take decisions concerning, exercise responsibility for, and are helped to carry out projects and programmes for improvements in their own villages.

Community Development has also been defined as a balanced programme for stimulating the local potential for growth in every direction. Its promise is of reciprocal advance in both wealth and welfare, not on the basis of outside charity but by building on the latent vitality of the beneficiaries themselves with the minimum of outside aid.

Mukherji (1967) summed up these concepts by stating that Community Development is a process of changing from the traditional way of living of rural comities to progressive ways of living, as a method by which people can be assisted to develop themselves on their own capacity and resources, as a progress for accomplishing certain activities in fields concerning the welfare of the rural people, and as a movement for progress with a certain ideological content.

Objectives of Community Development Programme in India:

The community development programme was outlined by the Planning Commission in the first three Five Year Plans as essential for the improvement of all phases of village life. The Ministry of Community Development and Cooperation, Government of India (1962) stated the specific objectives of the community development programme as follows :

1. To assist each village in having effective panchayats, cooperatives and schools; and
2. Through these village institutions plan and carry out integrated, multi-phased family, village, block and district plans for :
    a. Increasing agricultural production
    b. Improving existing village crafts and industries and organizing new ones,
    c. Providing minimum essential health services and improving health practices,
    d. Providing recreational facilities and programmes,
    e. Improving housing and family living conditions, and
    f. Providing programmes for village women and youth.

Basic Assumptions in Community Development:

Ross (1967) made some basic assumptions in community organization, which appear to hold good for community development as well. They are :

1. Communities of people can develop capacity to deal with their own problems
2. People want change and can change
3. People should participate in making, adjusting, or controlling the major changes taking place in their communities.
4. Changes in community living that are self-imposed or self-developed have a meaning and a permanence that imposed changes do not have.
5. A holistic approach can deal successfully with problems with which a fragmented approach can not cope.
6. Democracy requires cooperative participation and action in the affairs of the community, and that people must learn the skills which make this possible.
7. Frequently communities of people need help in organizing to deal with their needs, just as many individuals require help in coping with their individual problems.

Guiding Principles of Community Development:

In a report of the United Nations Economic and Social Council, the guiding principles of community development were summarized as follows :

1. Activities undertaken must correspond to the basic needs of community; the first project should be initiated in response to the expressed needs of the people.
2. Full and balanced community development requires concerted action and the establishment of multipurpose programmes. Changed attitudes in people are as important as the material achievements of community projects during the initial stages of development.
3. Changing attitudes in people are as important as the material achievement of community projects during the initial stages of development.
4. Community development aims at increased and better participation of the people in community affairs, revitalization of existing forms of local government and transition towards effective local administration where it is not yet functioning.
5. The identification, encouragement and training of local leadership should be a basic objective in any programme.
6. Greater reliance on the participation of women and youth in community projects invigorates development programmes, establishes them on a wide basis and secures long range expansion.
7. To be fully effective, self-help projects for communities requires both intensive and extensive assistance by the government.
8. Implementation of community development programme on a national scale requires adoption of consistent policies, specific administrative arrangements, recruitment and training of personal mobilization of local and national resources and organization of research, experimentation and evaluation.
9. The resources of voluntary and non-governmental organizations should be fully utilized in community development programmes at the local, national and international levels.
10. Economic and social progress at the local level necessitates parallel development on a wider national scale.

Activities of Community Development Programme

The following rural community development activities are undertaken in such varying degrees (within the limits of the available funds), as are advisable under the circumstances peculiar to each block (Ensminger 1972-105-07):

Agricultural and related matters:

1. Reclamation of available virgin and waste land.
2. Provision of water for agriculture through irrigation canals, tube wells, surface wells, tanks, lift irrigation from rivers, lakes and pools etc.
3. Development of rural electrification.
4. Provision of commercial fertilisers.
5. Provision of quality seeds.
6. Promotion of improved agricultural techniques and land utilisation.
7. Provision of veterinary aid.
8. Provision of technical information, materials and bulletins on agriculture.
9. Provision for the dissemination of information through slides, films, radio broadcast and lectures.
10. Provision of improved agricultural implements.
11. Provision of marketing and credit facilities.
12. Provision breeding centres for animal husbandry.
13. Development of inland fisheries.
14. Promotion of home economics.
15. Development of fruit and vegetable cultivation.
16. Provision of soil survey and information.
17. Encouragement of the use of natural and compost manures.
18. Provision of arboriculture, including plantation of forests.

Communications:

1. Provision of roads.
2. Encouragement of mechanical road transport services.
3. Development of animal transport facilities.

Education:

1. Provision of compulsory and free education, preferably basic education, at the elementary stage.

2. Provision of high and middle schools.
3. Provision of adult and library services.

Health:

1. Provision of sanitation (including drainage and disposal of wastes) and public health measures.
2. Provision for the control of malaria and other diseases.
3. Provision of improved drinking water supplies.
4. Provision of medical aid for the ailing.
5. Antenatal care of expectant mothers and midwifery services.
6. Provision of generalised of public health services and education.

Training:

1. Refresher courses to improve the existing standard of artisans.
2. Training of agriculturists
3. Training of extension assistants.
4. Training of artisans.
5. Training of supervisors, managerial personnel, health workers and excutive officers for project.

Social welfare:

1. Organisation of community entertainment.
2. Provision of audio-visual aids for instruction and recreation.
3. Organisation of sports activities.
4. Organisation of melas (village fairs)
5. Organisation of the cooperative and self-help movement.

Supplementary Employment:

1. Encouragement of cottage industries and craft as the main or subsidiary occupation.
2. Encouragement of medium and small-scale industries to employ surplus hands for local needs, or for export outside project areas.
3. Encouragement of employment through trade, auxiliary and welfare services.
4. Construction of brick kilns and sawmills to provide building materials for local needs.

Housing:

1. Demonstration and training in improved techniques and designs for rural housing.
2. Encouragement of improved rural housing on a self –help basis.

Intensive Agricultural District Programme (IADP):

Intensive Agricultural District Programme popularly known as Package Programme "Was thus launched in the country from Kharif 1960. On a pilot basis in seven selected districts. The Central idea behind the IADP was that increased agricultural productivity shall lead to economic growth, which shall bring welfare to the society.

The programme aims at combining technical know-how, credit and production supplies for stepping up agricultural production.

The method adopted in IADP was to demonstrate the feasibility of increased agricultural production rapidly by concentrating all factors of production at the same time in an integrated action programme in selected areas fulfilling optimum conditions. Agriculture, like all other industry needs high degree of investment before it can be self-generating and self-financing. There was a deviation from the multi propose approach in community development to single purpose approach in increasing agricultural production through IADP.

The preparatory stage in IADP consisted of the following steps :

i. Selection of district. Criteria for selection were –
    a. Assured water supply
    b. Not exposed to natural hazards
    c. Should have well developed cooperative credit structure.
    d. Should have maximum potential to show increased production within the shortest possible time.
ii. Strengthening of the cooperative institutions
iii. Creating general awareness amongst the people
iv. Selection, appointment and posting of staff
v. Training of staff
vi. Organizational and resources bench mark survey
vii. Assessing the needs for supplies
viii. Construction and/or hire of godowns
ix. Strengthening of transport arrangements
x. Establishment of agricultural implements workshop, seed and soil testing laboratories and implementation of local works programme having a direct bearing on production increase.

Implementation of the programme is to be done to a phased way. In the first year 20 percent and by the end of 5 years, 65 percent area is to be covered. The programme is to be implemented slowly, taking into consideration whether people have understood the basic philosophy. The essential features of the implementation stage were –

i. Presentation of individual farm and village production plans. Simple plan for majority and more comprehensive plan for a few progressive cultivators.
ii. Adequate and timely supply of credit and inputs based on production plans.
iii. Organizing cooperative marketing societies.
iv. Strengthening transport
v. Analysis and evaluation of the programme
vi. Intensification of information and extension education activities, such as demonstrations and use of information media.

The distinctive features of IADP were as follows:

i. Through factors of production were known earlier, they were not provided simultaneously, timely and adequately.
ii. Essential input like fertilizers etc. to be made available 100 percent of the requirement.
iii. Previously credit was available only to the credit-worthy farmers. In this programme, any farmer who joins the programme has a farm production plan and has the potential to get increased yield, will be given credit.
iv. In selected areas more agricultural and cooperative staff will be posted.
v. Composite demonstrations instead of single factor demonstrations. Economics of the demonstrations will be worked out.
vi. Periodical training of staff
vii. Analysis and evaluation.

The shortcoming of the IADP were as follows:

i. Educational approach to reach the cultivators was lacking. Emphasis was anyhow to make the cultivators join the programme.
ii. Training programme of staff was not clear. In many cases, the VLWs were found below standard and were not able to impress the farmers.
iii. Staffs were not clear about the methods to reach the cultivators. The staffs were target minded even in filling up agricultural production plans.

iv. Posting of staff was not adequate and timely.

v. Workshop, seed testing and soil testing laboratories were not functioning to the required level.

vi. Transport and land development programmes were not progressing satisfactorily

vii. Cultivators were not using insecticides, fungicides and seed treatment of their own.

viii. There was problem of communication.

ix. Cooperatives were not functioning well.

x. There was lack of action research.

xi. There was very little programme in animal husbandry, fisheries etc.

xii. Stereotyped farm production plans

xiii. Very little participation by women in the programme.

Chapter-3.4: Drought Prone Areas Programme (DPAP) and Swarnjayanti Gram Swarozgar Yojana (SGSY)

Drought Prone Areas Programme

The Drought Prone Areas Programme, formerly known as Rural Works Programme, was initiated in 1970-71 as a Non-Central Sector Scheme. Seventy –four districts have been identified as drought prone and they have been grouped under 54 units. The programme aimed at mitigating the severity of scarcity conditions by executing rural works to generate employment.

The programme was sought to be reoriented on the basis of an area development approach, and was redesigned as the Drought Prone Area Programme (DPAP) at the time of the mid-term appraisal of the Fourth Five Year Plan. The programme was confined to that area which was originally taken up under the Rural Works Programme.

The basis objectives of the programme are as follows;

1. Reducing the severity of the impact of drought
2. Stabilising the income of the people, particularly weaker sections of the society
3. Restoring the ecological balance.

In the fifth plan, the main thrust is to restore the proper ecological balance in the drought prone areas. Some of the important elements envisaged in this integrated approach are

a) Development and management of water resources
b) Soil and moisture conservation
c) Afforestation
d) Restructuring the cropping pattern and pasture development
e) Changes in agronomic practices
f) Livestock and dairy development and
g) Development of small farmers, marginal farmers and agricultural labourers.

During the Fourth Plan, DPAP was a central sector scheme with 100 per cent financial assistance from the centre. From the Fifth Plan onwards, this scheme has been operating with funds being shared between the centre and the states on a 50 : 50 ration.

Under the new strategy of rural development adopted in the Sixth Plan, DPAP was merged with the Integrated Rural Development Programme (IRDP). Considering the innovativeness and utility of DPAP, the World Bank provided 35 million US dollars under an agreement for six projects in the states of Rajasthan, Maharastra, Andhra Pradesh and Karnataka. An

interdisciplinary task force was set up by the GOI in June 1980 to review the scope and coverage of the programme. The task force submitted its report in July 1982. The report stressed the importance of interlinkages between various rural development programmes, and made many useful recommendations to enhance the effectiveness of the programme. The programme continued during the Eighth Plan, and is likely to continue in the Ninth Plan also. As of 1996-97, the programme was in operation in 947 blocks of 155 districts in 13 states. An expenditure of Rs. 1,742 crores has been incurred under the programme since its inception in 1973-74 to 1994-95, and 57.29 lakh ha of land had been covered under the three core activities of land development, water resources development, and afforestation over the same period of time(GOI1997 b:41-45).

Swarnjayanti Gram Swarozgar Yojana (SGSY)

- Launched on 1-4-1999
- Largest self employment programme for rural poor
- SGSY was introduced after restructuring and merging the following programmes
    a) Development of Women and Children in Rural Area (DWCRA)
    b) Million Well Scheme (MWS)
    c) Training Rural Youth for Self Employment (TRYSEM)
    d) Supply of Improved Toolkits to Rural Artisans (SITRA)
    e) Ganga Kalyan Yojana (GKY)

Aims: 1.To bring the assisted families above poverty line in rural area

2.To establish a large number of micro-enterprises in the rural area and building upon the potential of the rural people.

Target beneficiaries are BPL family members and SHG consisting of 10-20. BPL family members in rural area

Salient Features:

- It is a holistic programme covering all aspects of self-employment, i.e. organization of the rural poor into SHG, training and capacity building activity, credit, technology, infrastructure and marketing.
- It is a credit - cum subsidy programme, in which credit is critical component, subsidy being only a minor and enabling element.
- It support for individual and group projects.

Individual Projects:

Subsidy; 30% or Rs.7500/- for general category and 50% or Rs.10, 000/- for SC/ST

Margin Money Contribution by Beneficiary: No margin money upto Rs.50, 000/-and 15-25% **margin** money (including subsidy) for Rs.50, 000/- and above

Group Project:

Subsidy: 50% or Rs.1.25 Lakhs or Rs.10, 000/- per member for group schemes consisting 10-20 BPL family members in rural area.

Margin Money Contribution by Beneficiary: No margin money upto Rs.3.00 Lakhs and 15-25% margin money (including subsidy) For Rs. 3 Lakhs and above

Implementing Agency: Zilla Panchayat / Taluk Panchayat

Chapter-3.5: NATIONAL RURAL EMPLOYMENT GUARANTEE ACT AND SAMPOORNA GRAMEEN ROZGAR YOJANA

National Rural Employment Guarantee Act

The National Rural Employment Guarantee Act (NREGA) was enacted in September 2005 and brought into force w.e.f February 2006 in 200 most backward districts.

Objective:

To providing 100 days of guaranteed unskilled wage employment to each rural household opting for it.

The NREGA marks a paradigm shift and stands out among the plethora of wage employment programmes, as it bestows a legal right and guarantee to the rural population through an Act of Parliament and is not a scheme unlike the other wage employment programmes.

Coverage:

It covers all the districts of the country within five years. The focus of the act is on works relating to water conservation, drought proofing (including afforastation / tree plantation), land development, flood control/ protection (including drainage in waterlogged areas) and rural connectivity in terms of all-weather roads. Each district has to prepare perspective plan of 5 years with a bottom up approach deriving from the needs of the local community. The said plan should have the approval of the community and the PRIs.

Implementation:

Panchayats have a key role in planning, implementation and monitoring of the Act through preparation of perspective plan, approval of projects, execution of works at least to the extent of 50 per cent in terms of costs. The Act envisages strict vigilance and monitoring. Gram Sabha has the power of social audit. Local Vigilance and Monitoring Committees are to be set up to ensure the quality of works. Provision for due representation in such communities for SC/STs, women has also been made. At least 1/3rd of the beneficiaries are to be women. Key records such as muster rolls, asset registers and employment registers are to be maintained and public access to them ensured. The Act also envisages a grievance redressal mechanism and helpline. A comprehensive MIS, has been developed to capture work wise and household –wise data and track the progress of resources invested.

Sampoorna Grameen Rozgar Yojana

Pursuant to the announcement made by the Hon'ble Prime Minister in his Independence Day speech, a new Centrally Sponsored Scheme, namely, Sampoorna Grameen Rozgar Yojana (SGRY) was launched on 251h September, 2001 by merging the on-going schemes of EAS and the JGSY.

Objectives:

The objective of the programme is to provide additional wage employment in the rural areas as also food security alongside the creation of durable community, social and economic infrastructure in the rural areas. The programme is self-targeting in nature with special emphasis to provide wage employment to women, scheduled castes, scheduled tribes and parents of children withdrawn from hazardous occupations.

Strategy: The Programme is being implemented in two streams:

The First Stream of the Programme is implemented at the District and Intermediate level. Panchayats. Fifty per cent of the funds available under the SGRY are earmarked for First Stream, these are distributed between the Zilla Parisad and the Intermediate Panchayats in the ratio of 40:60.

The Second Stream of the Progarmme will be implemented at the Village Panchayat level. Fifty per cent of the SGRY funds are earmarked for this Stream. The entire funds are released to the Village Panchayats through the DRDAs/Zilia Parishads.

Salient features of SGRY

The salient features of the proposed Scheme are as under:-

- The Sampoorna Grameen RozgarYojana (SGRY) is a Centrally Sponsored Scheme (CSS) being implemented with a total outlay of Rs.10,000 crores.
- Under the Scheme, 50 lakh tonnes of food grains amounting to Rs.5,000 crores (at economic cost) is provided every year, free of cost to the State Governments and Union Territory Administrations.
- The remaining funds (Rs.5,000 crores) is utilized, to meet the cost component of wages and material cost.
- The cost of the cash component of the Programme is shared by the Centre and States in the ratio of 75:25.

- The payment for food grains is made by the Ministry of Rural Development to the Food Corporation of India (FCI) directly.
- About 100 crore mandals of employment are envisaged to be generated every year in the rural areas through the SGRY.
- Fifty per cent of the total available funds under the SGRY are provided to each stream.
- Every worker seeking employment under the SGRY are provided 5 kg. of food grains (in kind) per mandal as part of wages.
- The balance of wages are paid in cash so that they are assured of the notified minimum wages.
- The State Governments and UT Administrations are free to calculate the cost of food grains (paid as part of wages) at either BPL rates or APL rates or anywhere between these two rates.
- The SGRY has been in operation from the financial year 2002-2003. Since the Scheme was launched in the middle of 2001-02, the ongoing schemes of the EAS and the JGSY were merged with the new Scheme.

The Programme permits works which lead to the creation of additional wage employment, durable assets and infrastructure, particularly those which assist in drought proofing such as soil and moisture conservation works, watershed development, promotion of traditional water resources, afforestation and construction of rural infrastructure and link roads, primary school buildings, dispensaries, veterinary hospitals, marketing infrastructure and Panchayat Ghars in rural areas.

Monitoring and evaluation

The overall supervision of the programme rests with the Zilia Parisad. The programme will be regularly monitored by the Department of Rural Development in accordance with the in-built monitoring mechanisms, including periodical reports and returns, Vigilance and Monitoring Committees, visits by officers of the Central and State Governments and by the Area officers of the Ministry of Rural Development. The programme would also be evaluated through the studies conducted by reputed institutions, organizations and sponsored by the Central/State Governments.

Chapter-3.6: Panchayat Raj Institutions in implementation of Rural Development Programmes

The passage of the Constitution (7311 Amendment) Act, 1992 marks a new era in the federal democratic set up of the country and provides Constitutional status to the Panchayati Raj Institutions . The Act which came into force on 24 April, 1993 stipulates that Panchayats shall be given powers and authority to function as institutions of self-government.

Salient features of the Act:

- A 3-tier system of Panchayati Raj for all States having a population of over 20 lakhs
- Regular Panchayat elections every 5 years
- Reservation of seats for Scheduled Castes, Scheduled Tribes in proportion to their population and not less than 113 seats for women
- State Finance Commission to make recommendations on financial powers of the Panchayats
- Independent State Election Commissions

Powers and responsibilities of Panchayats:

- Preparation of plan for economic development and social justice.
- Implementation of schemes and rural development programmes for economic development and social justice in relation to 29 subjects given in Eleventh Schedule of the Constitution.
- To levy, collect and appropriate taxes, duties, tolls and fees.

The panchayats receive funds from three sources – (i) local body grants, as recommended by the Central Finance Commission, (ii) funds for implementation of centrally-sponsored schemes, and (iii) funds released by the state governments on the recommendations of the State Finance Commissions.

Panchayati Raj is a system of governance in which gram panchayats are the basic units of administration. It has 3 levels: village, block and district. At the village level, it is called a Panchayat, at the taluk level it is Taluk Panchayat and at district level it is Zilla Panchayat.

Village Panchayat

It is a local body working for the good of the village. The number of members usually ranges from 7 to 31; occasionally, groups are larger, but they never have fewer than 7 members.

Gram sabha

Gram sabha is constituted by all members of a village over the age of 18 years.The Gram Sabha elects the Gram Panchayat a council of elected members taking decisions on issues key to a village's social, cultural and economic life: thus, a Gram Panchayat is also a village's body of elected representatives. The council leader is named Sarpanch in Hindi, and each member is a Gram Panchayat Sadasya or Panch. The panchayat acts as a conduit between the local government and the people. Decisions are taken by a majority vote (Bahumat). It is said that in such a system, each villager can voice his opinion in the governance of his village. Decisions are taken without lengthy legal procedures and the process remains for the most part transparent. Panchayat is an ancient Indian word that means Five Persons (Headman).

Taluk Panchayat

Taluk Panchayat is a local government body at the tehsil or Taluka level in India. It works for the villages of the Tehsil or Taluka that together are called a Development Block. Itis the link between the Gram Panchayat and the district administration. There are a number of variations of this institution in various states. It is known as Mandal Praja Parishad in Andhra Pradesh, Taluka panchayat in Gujarat.

Constitution

It is composed of ex-officio members (all sarpanchas of the area, the MPs and MLAs of the area and the SDO of the subdivision), coopted members (representatives of SC/ST and women), associate members (a farmer of the area, a representative of the cooperative societies and one of the marketing services) and some elected members.

The Taluk Panchayat is elected for 5 years and is headed by the chairman and the deputy chairman. The common departments in the General administration are: Finance, Public works, Agriculture, Health, Education, Social welfare, Information Technology and others. A government appointed officer is the executive officer to the taluk panchayat and the chief of its administration.

Functions

- Implement schemes for the development of agriculture.

- Establishment of primary health centres and primary schools.
- Supply of drinking water, drainage, construction/repair of roads.
- Development of cottage and small-scale industries and opening of cooperative societies.
- Establishment of youth organisations.

Sources of income

The main sources of income of the Taluk panchayat are grants-in-aid and loans from the State Government.

Zilla Panchayat

Zilla Panchayat looks after the administration of the rural area of the district and its office is located at the district headquarters. It is headed by the "District Collector" or the "District Magistrate" or the "Deputy Commissioner". It is the link between the state government and the taluk panchayats.

Constitution

Members of the Zilla Panchayat are elected from the district on the basis of adult franchise for a term of five years. Zilla Panchayat has minimum of 50 and maximum of 75 members. There are seats reserved for Scheduled Castes, Scheduled Tribes, backward classes and women. The Chairmen of all the Taluk Panchayat form the members of Zilla Panchayat. It is headed by a President and a Vice-President.

Functions

1. Provide essential services and facilities to the rural population and the planning and execution of he development programmes for the district.
2. Supply improved seeds to farmers. Inform them of new techniques of training. Undertake construction of small-scale irrigation projects and percolation tanks. Maintain pastures and grazing lands.
3. Set up and run schools in villages. Execute programmes for adult literacy. Run libraries.
4. Start Primary Health Centers and hospitals in villages. Start mobile hospitals for hamlets, vaccination drives against epidemics and family welfare campaigns.
5. Construct bridges and roads.
6. Execute plans for the development of the scheduled castes and tribes. Run ashramshalas for adivasi children. Set up free hostels for scheduled caste students.

7. Encourage entrepreneurs to start small-scale industries like cottage industries, handicraft, agriculture produce processing mills, dairy farms, etc. implement rural employment schemes.
8. They construct roads, schools, & public properties. And they take care of the public properties.

9. They even supply work for the poor people.(tribes, scheduled caste, lower caste)

Chapter-3.7: NGOs/ VOLUNTARY ORGANIZATIONS IN RURAL DEVELOPMENT

The world conference on agrarian reform and world development convened by U.N in 1979 in Rome made certain observations with regard to rural development which were of far reaching in nature. It felt that high percentage of failure of R.D. programmes in many of the developing countries was mainly due to lack of peoples' participation in the development programmes. It also felt that peoples participation was most essential for the success of development programme and this could be brought about only by voluntary organizations which work closely with the people and therefore know their pulse.

Voluntary organization is an agency, organized or unorganized, structured or unstructured which work for the welfare of a community in any given area of its volition (willingness). So it can be said that it is a non-political, secular, non-profit making, non-governmental and philanthropic (urge to serve people) organization which operates through programmes and projects to eradicate poverty.

"The greatest experiences in reaching disadvantage groups through innovative participatory methods are found in voluntary organization methods".

Special features of Voluntary Organizations:

1. Voluntary action
2. Innovativeness (newness of idea)
3. Commitment and dedication among workers for effective implementation.
4. Flexibility in approach to suit local conditions
5. High level of motivation
6. Minimum procedural practices
7. Natural capabilities
8. Better grasp of needs and problems of people

Intermediately functions of NGOs (Voluntary Organization):

1. Facilitating communication between people and government
2. Helping to identify and voice community needs
3. Supporting, participation and group formulation
4. Training and building the capacity of community groups
5. Channelising resources at the community level

Effective NGO's:

BAIF – Bharatiya Agro Industries Foundation

IDS – India Development Service

ISARD - Institute for Studies on Agriculture and Rural Development

MYRADA – Mysore Resettlement and Development Agency

CAPART – Council for Advancement of Peoples Action and Rural Technologies

Funding of Voluntary Organizations:

Government, non-government, foreign agencies, donations

Weakness:

1. Many of the agencies are headed by strong and dominant personality without much devolution of power and authority to the lower section thereby giving an impression of are one man show.
2. Recruitment of personnel is generally done on the basis of personal consideration
3. Overdependence on funding agencies and government rather than mobilizing local resources and funds
4. A general tendency to blame other agencies and authorities in case of failure without accepting their responsibilities.

Chapter-3.8: Evaluation of Rural Development Programmes

The Ministry of Rural Development lays great emphasis on monitoring and evaluation of all rural development programmes in general and poverty alleviation and employment generation schemes in particular, being implemented in various States/UTs. It is well recognized that the success of the programmes largely depends on the effective delivery system and efficient implementation at the grass-roots level so that the programme benefits reach the rural poor in full measures. In order to ensure this, the Ministry has evolved a comprehensive multi-level and multi tool system of Monitoring and Evaluation for the implementation of its programmes.

The Monitoring mechanism includes, inter-alia, the Performance Review Committee, Review meetings by the Minister of Rural Development and Ministers of State with the Chief Ministers/ Ministers of Rural development and Officers of the States, the Area Officer Scheme, periodic progress reports, audit and utilization certificates, video conferencing and field visits. The Ministry conducts quick evaluation/concurrent evaluation of all major programmes. Impact assessment studies to asses the overall impact of programmes of village-level is also conducted in selected district. The Vigilance and Monitoring Committees at State and District Levels in all States/UTs monitor the implementation of Programmes and introduce greater transparency in the process. These Committees inter-alia include MPs/ MLAs representatives of Panchayti Raj Institutions and NGOs. The Members of Parliament both Lok Sabha and Rajya Sabha have been assigned a Central role in the reconstituted V&M Committees and they have been nominated Chairman/Co-Chairman of the district level V&M Committees.

The Ministry has also taken initiatives to strengthen the monitoring mechanism and quality of implementation of programmes by introducing District Level Monitoring (DLM) System in 130 district of 27 States through external agencies which include monthly reporting of physical and financial performance, qualitative reporting about policy and implementation environments in the district and physical verification of the assets crated under various programmes of the Ministry. Similarly DLM of Total Sanitation Campaign (TSC) and Swajaldhara is implemented in 398 districts of the country w.e.f. 1 July 2005 This system aims at providing continuous, transparent and accountable monitoring inputs in reporting format with the objectives of reporting of the process and progress of the programmes covering different components of the programmes. It also aims at identification of gaps in the implementation at the village, block, district and state level. The monitoring system also elicits the stakeholders' views; assesses the institutional issues and document case studies and success stories on best practices, innovations and lesson learned.

In order to strengthen the monitoring mechanism, the Ministry has a panel of about 300 National Level Monitors comprising retired servicemen and Retired Civil Servants to monitor and furnish periodic reports to the Ministry on the implementation of programmes in selected districts including verifying facts of the cases and complaints if any, which may be referred to them.

The Union Government in recent years has given emphasis to e-governance in all possible areas. Accordingly, the Ministry of Rural Development has also initiated action with the state Governments and UTs to ensure that information and progress reports completed by Districts Rural Development Agencies (DRDAs) are sent through the electronic medium. About 400 (DRDAs) have started sending their reports through online. Efforts are being made in this direction to obtain online progress reports from all the remaining DRDAs, all the remaining DRDAs.

Chapter-3.9: Problems / Constraints in Implementation of Rural Development Programmes

Inadequate Coordination

As per the Guidelines all the developmental programmes in the rural areas are to be planned / formulated by DRDA in corporation and coordination of other departments and financial institution, agencies of peoples representatives etc. It is often observed that these agencies, organization failed to maintain proper coordination among each other. All the agencies / organizations are trying their best to stick to their own principles and ideologies. In the process cooperation and coordination are not maintained. The Agencies responsible for the formulation, implementation and evaluation of the Rural Development Programme are required to maintain good coordination among them.

Inadequate funds:

The rural development programmes require more capital investment. The Economic Sectors of rural areas remain more or less traditional. These sectors also adopt traditional methods of production. In order to attain rural development the transformation of technologies is required. The conditions of weaker section people are not improved even after 50 years of planned economic development. The upliftment of their socio-economic condition also require high dose of investment. In our country, a fixed amount of funds are allocated for a particular rural development programme. These are distributed among States/Districts as per the importance, such as geography, concentration of weaker section population etc. The share of the Fund to cope with the local problems seems to be inadequate.

Leakage of benefits:

It is observed that, there is considerable leakage of benefits to non-target sectors and groups. Most of the rural development programmes are conceived to improve the Socio-economic condition of the weaker section like small, marginal farmers, agricultural and nonagricultural labourers, rural artisans, scheduled castes, scheduled tribes and deprived women etc. It is observed that benefits are not properly reaching to these classes.

Low Sustaining Impact

It is observed that a considerable number of rural developments programmes/schemes having no or little sustaining impact for changing the socio-economic status of the beneficiaries. The assets created from the credit assistance of financial institutions and subsidies of the development / administrative agencies are short lived (Particularly incase of livestock assets) failed to push the

beneficiaries up on the scale of production and productivity. This is perhaps due to the existence of low or no development approach / thoughts. This factor again dominated by the lack of awareness about the programmes.

Dominance of welfare over productivity

In India, most of the rural development programmes are based on the basic welfare principles. These schemes are backed by both credit and subsidy components. Besides, development of infrastructure facilities is also emphasized under these programmes. It is also evident that provision of long term credit and based on the principle of write off by political parties also have adverse effect on the productivity of economic sectors. It is observed that the subsidy component is often extending up to 100 percent in some selected schemes and class of beneficiaries. This reduces the productivity motive and attitude of the beneficiaries.

More Generalized Programme

Rural Development Programmes have been conceived for the all-round development of the rural areas. However, the rural development Programmes are launched in the context of general problems of the rural areas. It fails to give importance to some particular and area issues. The rural development programmers should be micro in nature and growth oriented based on real values.