

UNIT - I

1.

OUTLINE OF AGRICULTURAL GEOGRAPHY BY PROF. A. BALASUBRAMANIAN

INTRODUCTION:

Human civilization began to grow with agriculture, adventure, sports, exploration and entertainment.

People relied on hunting and gathering to obtain food supplies.

When our nomadic ancestors began to settle and grow their own food, human society got changed forever. In the entire human history, agriculture played a very vital role in the economy of all nations. Around ten to twelve thousand years ago, human beings began to domesticate plants and animals for food.

The beginnings of agriculture did not just occur in one place but appeared almost simultaneously all over the world. It happened possibly through trial and error methods with different plants and animals or by long term experimentation.

Agriculture is a major science and farming is an art. It is the production of foods and grains through farming. All of us know that farmers spend their whole day in the agricultural fields looking and nurturing the fields. Agriculture is a vital source of income for every nation that exists on this globe. About 45% of the world's population makes their living through agriculture. Agriculture in India has a long history. It dates back to several centuries. Indian agriculture began by 9000 BCE as a result of early cultivation of plants, and domestication of crops and animals.

Today, India ranks second worldwide in farm output. India has made impressive strides on the agricultural front during the last six decades. Much of the credit for this success should go to the several million small farming families that form the backbone of Indian agriculture and economy. India is basically an agricultural country. About 62% of its population is engaged in agricultural activities.

On the one hand, agriculture provides food security to the people and on the other hand it provides raw materials to various agro-based industries.

India has been divided into many agro-climatic regions on the basis of geographical features and agricultural practices employed.

India has high population pressure on land and other resources to meet its food, and raw material requirement. The natural resource base of land, water availability and bio-diversity are all under severe pressure.

The massive increase in population and substantial growth in income, demand an extra food grain of about 2.5 mt annually.

In addition, there is also a significant demand to increase the supply of livestock, fish and horticultural products.

Agriculture sector is a vital sector for the food and nutritional security of any nation.

Similarly, irrigation which was originally developed since the Indus Valley Civilization by around 4500 BC, has helped the Indian agriculture to be the best in the world and is fully recognized and respected.

Agriculture is a vast science and spread across different parts of the world. Agricultural production is not uniformly distributed.

It depends on various factors which also vary from place to place and from one geographic zone to the other.

It is under these contexts the subject of Agricultural Geography came in.

It is an inter-disciplinary branch of geography that deals with the areas of land cultivation and the effect of such cultivation on the physical landscape.

Agricultural Geography is the study of spatial patterns in agricultural activity.

The major themes include, variations in agricultural activity within the main biomes, the delimitation of agricultural regions, the study of agriculture as a system, and the classification of agricultural systems.

There are so many aspects included in agriculture as intensive/extensive; commercial/subsistence; shifting/sedentary and pastoral/arable/mixed.

Agricultural Geography is a vast subject covering a very wide range of topics.

These topics are very interesting to every citizen of a country, when studied with a strong desire to develop the nation.

Some agricultural geographers are concerned with the way in which agricultural systems change within the levels of development.

All these aspects are Essential aspects under Agricultural Geography.

Let us see the Topics Included under the Origin of Agriculture.

The origin of Agriculture includes the Human history the hunting and gathering of Activity for food in ancient days and also the role of civilization in the growth of agriculture. It also deals with diffusion of crops, spread of crops, and genes centers. Even today, lot of gene centers exists all through the world. The spread of pastoralism is also important aspect in origin of agriculture. The dispersion of crops and the domestication of animals are all essential aspects under origin of agriculture.

The 2nd aspect is related to the physical factors of agriculture.

The role of physical factors is essential for the development of agriculture. It includes terrain characteristics, Terrain evaluation is important of aspect for agriculture development. It is to related terrain topography and slope of the environment. Topography from coastal zones to mountain ranges, snow fields, and ice caps are to be analyzed for the development of agriculture. Agriculture geography deals with the physiographic condition in which to topography plays in important role. The next aspect

is altitude. Altitude variation also impact much on the agriculture growth. Altitude also changes the atmospheric pressure condition and also accordingly the variation of agriculture happen in different parts of the world.

The next aspect is the temperature

Temperature varies from coastal regions to the Polar Regions. It also got lots of impact on the growth of vegetation. Wind, temperature, rain fall, frost, moisture and water availability all are essential factors to be considered agriculture. The distribution of these factors varies from place to place geographically. We have to analyze these physical factors which are impacting on agriculture.

Next comes the role of floods and droughts.

Severe floods will damage agriculture and recurring droughts will also have an effect on the food production. The next aspect is soil condition. Fertility of the soil, soil types, soil textures profile, microbiology of soil and nutrients availability in soils, all have a great role to play in the growth of agriculture in any region since soil condition is varying from place to place, agriculture development also varies from place to place. Understanding of soil condition is an essential requirement for agriculture productivity.

Next comes the surface drainage patterns. Drainage patterns vary from place to place and also with reference to topographic condition. We do have man-made drainage networks like dams and reservoirs canals and other irrigation systems these factors play a wide role in the development of agriculture. In a place, the ground water table may be at shallow level or deeper level, which also has got a major role to play in the growth of vegetation and the crops. The study of these physical factors is very essential for the distribution analysis of agriculture and the crop production.

Next come, the 3rd important aspect, the socio economic factors and agriculture.

Land tenancy, the duration of the land tenure and also land availability for agriculture plays a significant role in this. The size of land holding and fragmentation of places are very essential to be studied. The next aspect is the labor. Labor is used for various activities of agriculture, location and availability. Next comes capital-investment. Investment is required for irrigation machineries than regular equipment for agriculture and also to spend for wages to labors and also to meet the requirement of fertilizers.

The next aspect is the mechanization aspect. Agriculture geography also deals with the role of mechanization and equipment. The tools and consumable which are use for production. In this, another important factor is the energy requirement. The energy

availability is variable from place to places. Different energy requirement is also to be studied under agriculture geography. The next aspect is transportation network. Agriculture requires a very good transportation network. The next aspect is the marketing factor. Agriculture marketing is an important area which is also specially distributed differently in different parts of world. The role of government policy and also the various schemes which are enacted in the government and buy the government are having very severe impact on the production of agriculture. So the government policy is studied under agriculture geography. Religion It is playing a significant role in agricultural production.

Fourth important area of geography is the role of irrigation. The irrigation network is distributed differently. Irrigation is a basic requirement for agriculture. It is very important in agriculture production. The means of irrigation are to be studied carefully under agriculture geography. The distribution of networks, canals, wells & tanks coming under means of irrigation. The methods of irrigation also various from place to place. They are flood of irrigation, ring and basin irrigation, ridge irrigation, furrow irrigation, drip irrigation and sprinkler irrigation, which are practice in different places for different crops.

The fifth important aspect is related to agricultural systems of the world.

The agricultural system of the world varies from country to country. It includes several commodities. The following are the important aspects coming under agricultural systems of the world. Nomadic herding, live stock, ranching, commercial grazing, shifting cultivation-cropping pattern and rotation of crops, problems and prosperity of different crops of agriculture practices and farming practices. Intensity of cropping, degree of commercialization, diversification in agriculture, efficiency and productivity in agriculture, sedentary agriculture, intensive subsistence agriculture, intensive agriculture, Extensive agriculture, Plantation Agriculture, Mixed Farming, Commercial crops and Livestock production, Horticulture, Collective farms-State farms, are all coming under the common heading-agriculture systems of the world.

The sixth important area of agricultural Geography is related to agricultural statistics and modeling. There are two important aspects which are covered under agricultural modeling & statistical analyses one is Geographical statistics and another one is agricultural statistics. This include land utilization statistics, agricultural Land area not available for cultivation and fallow land in agricultural area statics. crops statistics with reference to food crops, non food crops, and area under mixed crops. Various irrigation statistics and also agricultural prices are analyzed in this subject.

The seventh important aspect coming under agricultural geography is the agricultural regionalization de-limitation of agriculture regionalization is an important aspect. Regionalization concept is adapted in this methodology of agriculture regionalization included classification with reference to cropping pattern and crop concentration. It also includes the crop combination regions. There are some regions which come under 1st crop only zones, first 2 crops only zones, first 3 crop only zones. Crop diversification analysis is also attempted in this. There are lot of food crops which are studied under this. They are rice, wheat, bajra, maize, barley, ragi, pulses. We do a lots of study in India with reference to sugar-cane cotton, jute, tobacco, oil seed, ground nuts, rape seeds, mustards, in seed in addition to that of castor seeds under the plantation crop analysis. We analyze the growth of tea, coffee, rubber, spices, banana, and other fruits. In addition to that vegetables like potatoes, onions and other crops are studied under this. Animal husbandry is also included under agricultural geography. It deals with the cattle, distribution of buffaloes, the growth of dairying, goat and sheep rearing, poultry, sericulture, pisciculture, floriculture and other activity under the agricultural growth. We do discuss all aspects of agricultural productivity. The agricultural productivity is related to pattern of agriculture production which is also related to land availability the surveys. Surveys of land which is of land which is suitable for irrigation and the land capability analysis are attempted in this.

The 8th important aspect covered under agricultural geography is related to the agro climatic regions of the country, particularly in India.

This particular aspect is related to the land use and shifting cropping pattern. Improved seeds, the crop insurance, the agricultural credits, the eco-farming and the zero farming, the dry zone agriculture, the medicinal plant cultivation, and also the new trend in agriculture, are discussed.

The subject also concentrates on the Indian agriculture and its characteristics. Indian agriculture mainly depends upon the 5 years plans. We are aware that green revolution in India has given a long push towards the economic development in addition to that of white revolution which happened in India which has also given a very good economy for our development.

The merits of high yielding varieties are studied under this. The subject also deals with the agricultural development in various aspects and dimensions.

The growth of bio-technology, organic farming, the poly house, tissue culture and all other related aspects of research done in agricultural extensional research activities are coming under this subject.

We also deal with sustainable agricultural programmes under this agricultural development. In addition to that agricultural geography also deals with the problems of Indian agriculture. There are so many problems which are trusting upon the agricultural growth and patterns. Some of them are listed here

- The chemical fertilizer which we use
- The plant protection which we take care off
- The regional inequalities which we have
- The inter crop disparities which we see
- The farm size variation which we are seeing
- The problem of salinisation of soils
- The water logging problems is some of the command area in India
- The soil erosion problems which are degrading the agricultural lands
- The pollution of soil and also water which are disturbing the agricultural environment.
- The lowering of ground water table is also severely affecting the crop production
- The food nutrition and hunger problems which are also seen in different places.
- The drought and food security issues related to agricultural productivity.

In addition to that we also have to study the food aid programmes and food and nutrition programmes.

The employment in agricultural sector is a major sector, but gradually due to urbanization. People are moving towards urban environment for different other jobs. We have to develop a lot of employment activities in the agricultural sector. So the agricultural geography also studies the distribution pattern of employment opportunities available in agricultural sector.

The role of insecticide and pesticide usage in agriculture is to be carefully studied in order to protect the grains which we produce. Agricultural geography also deals with the land reform issues.

We have to develop a lot of land use policies and plan the land use category for proper production and for proper use of agricultural land. So the land use policy and planning are important issues related to the agricultural geography. Without agriculture nothing will work in the world studying the geography of agriculture will certainly help understanding the various factors involved in agricultural production and also the locational and regional imbalance. The study of agricultural geography also helps to understand the problems of agriculture in a region. It also helps to overcome the problems as well let us see all these in the series on agricultural geography.

UNIT - I

1. Approaches to agricultural geography

Introduction

Plants and animals produce a wide range of products. Consequently, cultivation of crops and rearing or grazing of livestock involve several methods which vary from region to region. Scientific investigation of the resultant forms of agricultural activity may be carried out by statistical, ecological, and physiognomic or land utilization techniques. However, the statistical approach must be complemented by ecological one which concentrates on study of the different ways in which man produces crops in a given environment. Since modern agriculture is a complex phenomenon, it is essential to make use of these scientific techniques in geographical investigation of agriculture. It is very useful for planning and policy making.

While looking into the works done in the field of agricultural geography, one comes across four distinct approaches which adopt scientific methods of investigation. These are the commodity, regional, environmental and systematic approaches.

These approaches are important for the geographical investigation of subsistence or commercial agricultural systems. Let us explore these sections from the following:

1. Commodity Approach
2. Regional approach
3. Systematic Approach
4. Recent Approaches
5. Study of Indian agricultural geography

1. Commodity Approach

This approach aims at studying commodity as a unified whole or as an unbreakable unit. It focuses attention on the detailed spatial analysis of a particular commodity such as the geography of sugarcane, wheat

or cotton cultivation. This deals with a single commodity and considers all aspects of its growth requirements, distribution, concentration, production, processing marketing and consumption. It is often set in the various regions of the world which produce the total supply of the commodity under study ie., commodity and regional, for studying a commodity in detail.

Earlier studies in agricultural geography dealt largely with the production and exchange of agricultural commodities. The main emphasis of study is on the production, particularly on determining the nature of conditions that make for a good produce of commodities in specific areas, or stress on the conditions favourable for undertaking production of crops hitherto not grown there.

This approach provides a systematic description and interpretation of the world distribution pattern of a commodity (wheat), or an industry (cotton textile industry), or a human occupation (fishing).

The commodity approach is a colonial legacy. The commodity approach was important in the Western European countries seeking to produce different types of food and raw materials from areas lying outside Europe. It was generally adopted by the British geographers, who produced comprehensive studies of agricultural products produced in tropical areas. In fact they had a great need to identify food producing regions in the world and agro based raw materials for use in developing their economic system at home in view of the limited resources within their territory.

During the second half of the 19th century and up to the first world war a number of monographs were produced in Europe about the geography of rubber, tea, coffee, cotton, jute hemp, sugarcane and spices. In India, D.S Sandhu (1977), produced a monumental work based on the commodity approach in the form of geography of sugarcane cultivation in eastern Haryana. The area under sugarcane,

its yield per unit area, total production, marketing and processing, have also been systematically examined.

Though commodity approach provides useful information about the geo-climatic requirements of individual crops, does not take into consideration the behavioral aspects of the farmers in their decision making process. The normative questions such as values, motives, attitudes and beliefs of the farmers are ignored. Any study made with this approach, gives only a narrow picture of geographical reality of an agricultural phenomenon.

The approach may be explained with a help of an example. Suppose the geography of tea is to be discussed with commodity approach. In such study an attempt will be made to examine the environmental conditions. (temperature, moisture, soil, tillage etc.,) required for its cultivation. Subsequently, the areal distribution concentration, production, productivity, marketing, processing, distribution and consumption have to be discussed and explained.

2. Regional approach

In the past, the commodity approach has been dominating the agricultural scene. Later the emphasis shifted to the regional approach and soon it gained significance making regional studies more sought for. Regional studies were perhaps essential as these identify regional distinctions or disparities. Such studies bring to the fore internal conditions as well as regional imbalances and measure geographic relations concerning other regions. The regional approach to a study therefore starts with a geographic investigation of the regional differences in agricultural features. The majority of regional studies remain confined to a single region. It can thus be said that its main interest is in the area or a region concerned. It is perhaps the result of a particular agricultural pattern or characteristics in a given

region. In other words, in a regional approach a certain selected area is chosen for intensive study.

This approach involves the study of composite agricultural characteristics in different regions of the world along with locating agricultural problems and finding pragmatic solutions. Of all the approaches used by agricultural geographers, this one has been very satisfying. Whittlesey (1936) strongly recommended the regional approach while discussing the major agricultural regions of the world.

With this approach, the agricultural geographer hopes to analyze and synthesize agricultural phenomena in a particular area into an integrated whole. Therefore it is also known as the integrating approach. Even in the smallest unit of area, one commonly comes across a marked degree of variation in agricultural phenomena. This may perhaps be the result of interrelated factors of a complex nature that can be independent, semi-independent, partly dependent and interdependent, all of which vary from location to location in the area. Thus the study is concerned with the kind of agricultural phenomena present in agricultural regions, the manner in which these are present and the nature of their relationship both within each unit of area and across the unit of division. An agricultural geographer also seeks to understand the arrangement of agriculture in a unit area and the relationship of agricultural regions to one another.

In a regional approach the size of the area under study is immaterial. What matters is the manner in which smaller areas are grouped into larger areas, the manner in which large areas are related to areas of greater scale and so on till one reaches a national or universal level. The purpose of agricultural geography is to gain knowledge of global agriculture in terms of regional characteristic and variations.

The regional approach was widely used in the European countries. Here geographers were responding in part at least, to demand for

better utilization of agricultural resource within their own national limits. However, in the United States both the commodity and regional approaches have been used till the early 1920s the commodity approach was almost used everywhere.

Although studies of individual commodities are still being undertaken in large number, research workers appeared to be preferring the area approach. Yet this does not mean the commodity and regional approaches are mutually exclusive. An experienced scholar studying a region may make use of both approaches.

3. Systematic Approach

In agricultural geography two different lines of study are adopted to understanding the regional differentials of world agriculture. These are

- (i) the study of regional differences in any particular agricultural phenomenon in relation to that of its influence and
- (ii) the study of total character of the agricultural elements within a specific area.

The former constitutes a systematic approach, while the latter is a regional approach. A systematic approach, therefore, deals with the regional differences of a particular or a specific agricultural phenomenon conditioned by the interaction between the physical and the non-physical environment. In a systematic approach the simplest form of study is that of the various agricultural aspects of the surface of the earth, generally on a global scale, in terms of any single, specific agricultural element. Therefore, it may also be designated as a 'specific approach'. Systematic approach is also known as the 'general' or 'universal' approach. On the whole, this approach deals with the systematic study of each element of agriculture, which is investigated individually for a detailed regional analysis.

Ideally, the first step in a systematic approach would be to find out

- whether a single or a specific element or a complex element, or an inter related association of various elements, regardless of their kind, plays any role
- the second is to classify the agricultural phenomena into types to study their distribution, such as the classification of cultivated plants into different kinds of crops, namely, food grain, fodder, fiber, oilseed crops, etc. and
- the third is to formulate principles on the basis of the relationship of the agricultural features.

If a systematic study follows these steps, it is clear that the interest of an agricultural geographer is not only confined to specific phenomena, their classification, their origin and evolution, but also, includes the relationship which these have with the other geographic features. Such an approach is of great significance in the study of regional differentiation.

The systematic approach in agricultural geography focuses its attention on a particular agricultural phenomenon which is studied in the terms of distribution of regional differences. Through this approach it is possible to conduct a series of studies with their account of character, distribution and relations of different agricultural phenomenon in a spatial perspective.

However, a systematic approach fails to yield a composite picture of agriculture in an area. All the factors of agriculture, even if investigated individually, fail to present a complete picture of the area's agriculture.

The basic difference between a regional and a systematic approach is, in fact, not of content or subject manner, but of scale and style. A systematic approach provides material, while a commodity approach provides guidelines to a regional approach which, in turn, gets direction for its own organised and systematic investigation. ~~How~~

UNIT - I

2. Origin and Dispersal of Agriculture

Introduction

Agriculture was not a dramatic overnight explosion that appeared all at once, fully-fledged, in one place. It took place over several hundred years, against a background of ecological and environmental changes, and social innovations. Understanding how agriculture evolved in the Near East, and how it spread into neighboring areas, or was adopted independently, has been one of the enduring investigations of archaeology in the Near East and nearby areas.

This objective is to provide an introduction to the origins, development and spread of agriculture, with a view to providing a foundation for understanding the evolution of the world after the Neolithic – a world which saw the establishment of "civilization".

Agricultural origins cannot at present be conclusively proven to have begun close to 10,000 years ago when additional evidence for agriculture extends further back in prehistory. What can be unequivocally stated is that agriculture had already emerged several times in numerous parts of the world in the last 12,000 to 20,000 years, and possibly as early as 50,000 years ago, with the last 6,000 years producing the most evidence for this cultural phenomenon. Let us explore the evolution of agriculture and how it spread across the globe from the following topics:

1. szghkjsg
2. The Origin of Agriculture
3. Understanding Dispersal
4. Nature, Mechanisms and Speed of Dispersal
5. Dispersal of agriculture out of Asia
6. Origin and dispersal of Indian agriculture

1. The Origin of Agriculture

Agriculture was developed at least 10,000 years ago, and it has undergone significant developments since the time of the earliest cultivation. Independent development of agriculture occurred in northern and southern China, Africa's Sahel, New Guinea and several regions of the Americas.

Agricultural practices such as irrigation, crop rotation, fertilizers, and pesticides were developed long ago but have made great strides in the past century. The Haber-Bosch method for synthesizing ammonium nitrate represented a major breakthrough and allowed crop yields to overcome previous constraints.

In the past century agriculture has been characterized by enhanced productivity, the substitution of labor for synthetic fertilizers and pesticides, selective breeding, mechanization, water pollution, and farm subsidies. In recent years there has been a backlash against the external environmental effects of conventional agriculture, resulting in the organic movement.

Identifying the exact origin of agriculture remains problematic because the transition from hunter-gatherer societies began thousands of years before the invention of writing. Nonetheless, archaeobotanists/paleoethnobotanists have traced the selection and cultivation of specific food plant characteristics, such as a semi-tough rachis and larger seeds, to just after the Younger Dryas (about 9,500 BC) in the early Holocene in the Levant region of the Fertile Crescent.

There is earlier evidence for use of wild cereals; anthropological and archaeological evidence from sites across Southwest Asia and North Africa indicate use of wild grain (e.g., from the ca. 20,000 BC site of Ohalo II in Israel, many Natufian sites in the Levant and from sites along the Nile in the 10th millennium BC). There is even evidence of planned cultivation and trait selection: grains of rye with domestic traits have been recovered from Epi-Palaeolithic (10,000+ BC) contexts at Abu Hureyra in Syria, but this appears to be a localised phenomenon resulting from cultivation of stands of wild rye, rather than a definitive step towards domestication. It isn't until after 9,500 BC that the eight so-called founder crops of agriculture appear: first emmer and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax. These eight crops occur more or less simultaneously on PPNB sites in the Levant, although the consensus is that wheat was the first to be sown and harvested on a significant scale.

There was a gradual transition from hunter-gatherer to agricultural economies after a lengthy period during which some crops were deliberately planted and other foods were gathered in the wild. Although localised climate change is the favoured explanation for the origins of agriculture in the Levant, the fact that farming was 'invented' at least three times elsewhere, and possibly more, suggests that social reasons may have been instrumental.

When major climate change took place after the last ice age c.11,000 BC much of the earth became subject to long dry seasons. These conditions favoured annual plants which die off in the long dry season, leaving a dormant seed or tuber. These plants tended to put more energy into producing seeds than into woody growth. An abundance of readily storable wild grains and pulses enabled hunter-gatherers in some areas to form the first settled villages at this time.

The significance of agriculture cannot be elucidated in terms of its origins alone, but involves a more detailed understanding of the emergent structure of its continuing spread.

2. Understanding Dispersal

The adoption of agriculture took place independently in a number of different geographical regions and environmental zones around the world, all at much the same time, but it is clear that the processes that drove and characterized these changes and their spread from the core areas where they were first innovated were different in each of these areas.

There are a number of ways of trying to track the dispersal of agriculture in geographical, social and interactive terms:

The archaeological record - Establishing a balance between these perspectives is necessary to get a clear picture of what happened. The presence of desert on the east and the Mediterranean on the west helps to concentrate populations within the Levantine area, preventing straightforward expansion and forcing dispersal channels.

Genetics (human and plant populations) - Genetic studies can be used in two ways in this context – extrapolating backwards from modern genetic data or to use ancient genetic data to attempt to make contemporary comparisons with a view understanding population spread.

Comparative linguistics - Explanations for language ancestry may give indications about shared language origins. Some linguists believe that recognizable traits of an evolved language can only be traced back as far as between 10,000 and 7,000 years, and that beyond this time language would not be identifiable as a member of an ancestral group. If a language type appears 100s or 1000s of miles from its source, it is necessary to find a mechanism to account for it. This may include only few processes:

- Language mixing
- Population mixing e.g.
- Via settlement (major presence)
- Via trade (minor presence)

Once agriculture was established in the Near East, it dispersed into Europe, towards southeast Asia and into northern Africa by any one or a combination of a number of possible mechanisms:

- The grasslands and forests of temperate Europe and Eurasia contrast sharply with the steppes and arid plains of the Fertile Crescent, and the spread of agriculture northward and eastward required new strains of plants and animals and different social and technological adaptation.
- Environmentally favourable situation for animals to be successfully adapted
- Knowledge and experience of plant cultivation activities and animal husbandry and maintenance
- Cultural disposition

If the physical dispersal model is favoured then following needs to be applied:

- Increased population
- Sufficient plant/fauna to enable surplus to be released
- Social acceptance/inability to challenge

If the ideas dispersal model is favoured, the following also need to apply:

- Communication between different subsistence groups
- Some degree of synergy and agreement involving knowledge and communication between groups

3. Nature, Mechanisms and Speed of Dispersal

Dispersals from southwest Asia went in three directions – Europe, southeast Asia and northern Africa. They were not the only unique inventions of agriculture to be dispersed, by different mechanisms, but they are the only ones examined here. In each case, dispersals may have been physical (by migration), conceptual (ideas and technologies being adopted by indigenous groups) or admixture (a combination of both). They took place in different geomorphologies and climatic conditions.

The reasons for dispersal, whether by physical movement or indigenous adoption, could have been many and varied, but suggested reasons are for the adoption of pristine agriculture.

Over the period of only a few thousand years, farming reached far west to Britain, far east to southeast Asia and far south to Egypt (beyond which the Levantine domestic package was not ecologically suitable). The establishment of agriculture outside its original area of establishment is usually referred to as "secondary" establishment (as opposed to "pristine" or "primary" establishment in the Levant).

The spread of agriculture in the Near East, that between hunter-gatherer and agricultural communities, differing mechanisms of physical migration of agriculturalists into new areas, cultural and conceptual adoption by local populations, and interaction between different populations are all factors that need to be considered.

How agriculture spread is in part is how agricultural communities impacted the landscape and the much wider territories of hunter-gatherer communities. The sedentism of one group could impact a neighbour's activities. Similarly, the nature of existing hunter-gatherer communities would impact the possibility of change of use of territories and the likelihood of adoption of new methods by the indigenous communities. Hunter-gatherer societies did not adopt farming indiscriminately, but selectively, to fit the local needs. These needs varied from region to region, and so did the factors which combined to bring about the shift to food production. It follows, therefore, that there is no single cause for the transition which would fit all situations.

Zvelebil (1986) describes three main paradigms for the transition to agriculture by hunter-gatherer populations who are exposed to it:

- Diffusion by colonization and/or adoption
- Population-Resource Imbalance
- Social Competition

Rindos (1984) believes that changes to plant morphologies and behaviours were caused by human alterations to their environments, and that human exploitation of plants within these environments caused these changes to be enhanced over the centuries.

He offers yet another view of the way in which agriculture disperses, but with an emphasis on indigenous adoption rather than colonization.

First

- Early Holocene conditions favoured plant growth
- Grasses become increasingly abundant, including wild einkorn and barley
- Locally dense stands appear
- Harvest periods are short and unpredictable

Second

- Trees colonized areas previously occupied by grasses leading to a concentration of grasses at their margins
- Grasses were then worth maintaining "as a seasonally important food source"

Third

- Establishment of permanent agricultural settlements were enabled by the arrival of grasses with domesticated features,
- The more labour intensive character of the new cereals meant that land had to be prepared and maintained, leading to permanent settlement
- Settlement locations had to be determined partially by the type of soils (light enough to till and organic enough to feed crops)

4. Dispersal of agriculture out of Asia

Around 10,000 years ago on the fertile crescent - the foothill regions of modern Iran and Iraq, as well as Syria and the Levant - the shift from hunting and gathering to agricultural production marked a key moment in human history.

Prehistoric archaeologists have long recognised the importance of this transition, and its subsequent spread into Europe, and have sought to understand the processes involved.

The actual product of agriculture - indicates that cereal cultivation spread rapidly along the Mediterranean coast to Italy and into Iberia, and was certainly established by about 7750 BP (before present).

But these cereal grains show that the much-debated spread inland occurred in fits and starts. It seems agriculture arrived in the Balkans around 7950 BP then halted for approximately 800 years before spreading rapidly to north-west Europe, arriving with near synchronous dates in the Czech Republic and the Netherlands.

The shift from hunting and gathering to agricultural production marked a key moment in human history. The events surrounding the spread of domesticated crops from Asia, the spread of agriculture south-west Asia across the diverse landscapes and societies of early Europe, from the arid Mediterranean to the temperate shores of north-west Europe, involved a complex set of interconnected changes in lifestyle but in virtually all cases ended with land coming under the plough.

Archaeologists don't fully understand the nature of the transition in the disparate regions, but if we did, it may well offer clues to the reasons why farming based on the cultivation of a handful of plant species became the dominant way of life across Europe and the rest of the world.

Possible explanations for the delays in agricultural spread could be a slow uptake of agriculture by existing human populations due to the relative success of the hunter-gatherer lifestyle; or a reflection of the time taken for crops to adapt to alien climatic conditions.

The spread of agriculture in Europe are largely based on wood charcoal, collected from sites classified as Neolithic (the period associated with early farming) on the basis of artefacts such as pottery or other cultural evidence found at the sites rather than on the products of agriculture itself. These are poor measures of agricultural spread. The earliest appearance of cereals at sites throughout Europe provides a better marker to chart agricultural progression.

In some respects, these results support previous work indicating that cereal cultivation arrived in Greece from the fertile crescent region of south-west Asia, and then spread rapidly into the Balkans by around 7950 BP. Subsequent movement across Europe followed two major routes.

Advances in radiocarbon dating and, though it has been suggested that here too agricultural spread was an interrupted process, there is no evidence for this. The second route through the interior of Europe is hotly contested with some researchers seeing the spread of agriculture slowing when it reached central Hungary, before again moving rapidly through the Danube and Rhine valleys, while others assert a more uniform rate of spread from the Balkans to north-west Europe.

5. Origin and dispersal of Indian agriculture

Agriculture was well established throughout most of the subcontinent by 6000–5000 bp.

Evidence of the presence of wheat and some legumes in the 6th millennium BC have been found in the Indus Valley. Oranges were cultivated in the same millennium. The crops grown in the valley around 4000 BC were typically wheat, peas, sesame seed, barley, dates and mangoes. By 3500 BC cotton growing and cotton textiles were quite advanced in the valley. By 3000 BC farming of rice had started. Other monsoon crops of importance of the time was cane sugar. By 2500 BC, rice was an important component of the staple diet in Mohenjodaro near the Arabian Sea.

The Indus Plain had rich alluvial deposits which came down the Indus River in annual floods. This helped sustain farming that formed basis of the Indus Valley Civilization at Harappa. The people built dams and drainage systems for the crops.

South India, centre of the later distinctive Tamil culture, constituted a second, initially independent agricultural region. Crops were being raised there during the first half of the 4th millennium bp. Two varieties of pulses (legumes) and finger millet (also called raggee) were cultivated there.

To the north and west of the Deccan plateau lay a third, intermediate area. There, at Lothal and Rangpur, has been found the earliest South Asian evidence of rice cultivation, in the later Harappan period. Subsequently, wheat, cotton, flax, and lentils spread into the region from the Indus valley, and pulses and millets from the south. In all three regions the basic cropping pattern of the 4th millennium bp, except the pattern for rice, continued into the 21st century.

By 2000 BC tea, bananas and apples were being cultivated in India. There was coconut trade with East Africa in 200 BC. By 500 AD, eggplants were being cultivated.

A fourth South Asian agricultural region, the Ganges River valley, became increasingly developed after about 3000 bp. Although it is clear that some of these changes arose from contact with Indo-European speaking peoples known as Aryans, notions of a devastating Aryan invasion are mistaken and in the past tended to obscure objective research on the region's history.

Apparently, rice played an important role in the growth of population and the founding of new settlements. These had spread eastward to the Ganges delta by about 2600 bp.

In the later Vedic texts (c. 3000–2500 bp) there are repeated references to agricultural technology and practices, including iron implements; the cultivation of a wide range of cereals, vegetables, and fruits; the use of meat and milk products; and animal husbandry. Farmers plowed the soil several times, broadcast seeds, and used a certain sequence of cropping and fallowing. Cow dung provided fertilizer, and irrigation was practiced where necessary.

Rice predominated in the eastern states, on the southwest coast, and in Kashmir. Aside from its original home in Gujarat, it had spread also to the Punjab and Sindh with the aid of irrigation. Wheat grew throughout its "natural" region in north and central India. Millets were cultivated in the wheat areas and in the drier districts of Gujarat and Khandesh as well.

Cultivation of tobacco, introduced by the Portuguese, spread rapidly. The Malabar Coast was the home of spices, especially black pepper (*Piper nigrum*), that had stimulated the first European adventures in the East.

Conclusions

Agricultural origins cannot at present be conclusively proven to have begun close to 10,000 years ago when additional evidence for agriculture extends further back in prehistory. What can be unequivocally stated is that agriculture had already emerged several times in numerous parts of the world in the last 12,000 to 20,000 years, and possibly as early as 50,000 years ago, with the last 6,000 years producing the most evidence for this cultural phenomenon.

Genetic manipulation of plants, particularly cereal grains, occurred at some point in prehistory by people who already had the knowledge to do so. Evidence points to the Fertile Crescent of the Middle East as the site of the earliest planned sowing and harvesting of plants, that had previously been gathered in the

wild. Independent development of agriculture occurred in northern and southern China, Africa's Sahel, New Guinea and several regions of the Americas.

The dispersal of farming was clearly not a straightforward process. The transition to farming must be seen as a complex process resulting from several forces operating simultaneously at different chronological and spatial scales of resolution. This is reflected in all the literature, not just archaeological but linguistic and genetic as well.