Geographical Distribution of Various Crops like Cereals, Legumes, Oilseed, Vegetables, Fodder and Forages, Commercial Crop, Condiments and Species, Medical and Aromatic Plant: An Overview

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Abstract

Different kinds of crops have been grown since ancient times. Initially, when the cultivation of crops started at that time, the production is limited to a specific location. As time passes and countries start trading with each other, the seeds of the crops are distributed from their primary centre of origin to another secondary centre of origin. It is very important to know the geographical distribution of the particular crop species to other countries. Various scientists give their opinion on the geographical distribution of a particular crop. However, we only follow that view by having the data authenticated along with their view. The geographical distribution also helps to understand the origin of a particular plant species. It also helps to understand the pattern of farming around the world and the diversification of crops. From this, we can also estimate how crops are grown around the world to form major crop belts.

Keywords: Ancient, Cultivation, Diversification, Farming, Geographical .

Introduction

Country political unit and lower to that unit as a province are the main units that decide on the geographical distribution of the species and the genera. The maximum time of natural geographical distribution is naturally described, but in certain cases where there is no natural geographical distribution, the distribution of the species shall be decided based on the pattern of cultivation of the crops. To interpret the geographical situation, the relevant classification of the crop must be taken into consideration and, in the case of the genera, important. Whenever any of the genes and species are defined shortly, the classification must be taken into account. There is always a slight difference in the pattern of distribution of the species and the genera because various scientists and authors delimit these species and the genera. According to some scientists, such as **Klein Goldewijik, 2001; Ramankutty, and Foley. 1998: Turner et al., 1993;** all together stated that one-third of the world's surface is occupied by three anthropogenic ecosystems, such as cropland (18 million sq. km), pasture land (34 million sq. km, and the urban area (2.5 million square kilometers). Food for the population is provided by the cropland and the pastureland only, on the other hand, the land surface used by the human population exhibit various types of negative effects on the land surface as well as on the climatic conditions. Global warming is the main risk to the world; it takes an increase in speed due to human activities, both directly and

indirectly. In the current scenario, the forest area is declining day by day, mainly due to an increase in population daily. Forest areas are cut and the area is cleared for agricultural activities **(Goudie 2000)** for food production to feed the world's growing population. According to Meyer and Turner; (1994), many lands are also degraded by human land-use practices, which leads to an increase in the problem of erosion infertile land. Human land-use practices also change the water, carbon, and nitrogen cycles initiated by **Houghton et al. (1999); Vitousek et al. (1997); Postel et al. (1996)** and, according to some scientists, the change in these cycles leads to a change and loss of biodiversity **(Dale et al. (2000); Pearce et al. (2001); McNeeely. (1992)**. Data and information on the geographic distribution are also collected from ground-based census data. This type of data is routinely collected from nations, states, and across countries. For the characterization of the global land cover of agriculture, a technique called data fusion is used to gather information for the calibration of the land cover identified by various scientists such as **Ramankutty and Foley (1998).** This type of data is visible on a continuous scale and represents a percentage of cropland coverage. However, this data is not sufficient to define the area under the crop system and the specific crop type. To understand the environmental impact on the cultivated ecosystem, it is necessary to have detailed information on land-use practices. The estimation of the distribution of methane emissions is well identified using the spatial pattern of rice cultivation data set out in **Cao et al. (1996); Matthews and Fung (1987).** To derive the spatial distribution of different crops throughout the world, **Ramankutty and Foley (1998)** combine the national and sub-national census data with the land cover data. According to the definition the Food and Agriculture Organization, only permanently cultivated arable land is considered to be agriculturally cultivated, while, on the other hand, land under shifting cultivation and pastureland is not classified as arable land. The term distribution is applicable in all fields that exist on earth generally encompass such as the distribution of man-made structures, infection of the disease, distribution of plant and animal species, etc. The word "distribution" is used to say how a certain thing is spread out in a certain way with time on the surface of the earth. The reorganization distribution of the map is the starting point for many geographic studies. Some distributors take the visual pattern of the crop as a reference for an explanation of the geographical distribution, but the visual information is not always correct or accurate because the size of the area is too large, so that the visibility of all areas under the crop may be problematic. When estimating the spread of the world population, it is very important to understand the variation of climatic factors such as vegetation, landform, and climate, etc. Depending on the climatic conditions, there are huge variations in the world population, for example in the arid and temperate zones, with a low population percentage compared to other places where the climatic conditions are not too harsh.

Geographical distribution of cereals

Cereal grains play a major role in human civilization as they have been and continue to be an important component of the human diet for thousands of years. Billions of people in the world depend on Rice, Maize, and Wheat for their staple food among these three main crops, other crops such as Millets and sorghum also play an important role. Globally, cereal crops alone meet 50 percent of the calorie requirement. The pattern of consumption of the main cereals varies from country to country and from region to region. Mainly there are three main types of cereal crops, Rice, Maize, and Wheat, most of which are consumed.

1) Rice

The cultivation of rice in India begins in ancient times. There is a variety of evidence that supports the cultivation of rice in ancient times, such as in Hindu literature, and many references are made to the Scriptures, showing and verifying the cultivation of rice in ancient times. Between 1000-750 B.C. During the excavation, evidence of carbonized paddy grains is found at Hasthinapur of Uttar Pradesh. In all the world, this evidence of rice is considered to be the oldest evidence of rice. According to various scientists, such **as De candole (1886) and Watt (1892),** rice originated in the southern part of India. Whereas another scientist named **Vavilov (1926)** stated that the primary centre of origin of rice is considered to be India and Burma.

Geographical Distribution of Rice

This crop is considered the world's leading crop with a production potential of 596 million tonnes out of 155 million hectares. This amount of production has the potential to meet the world's 22 percent calorie and 17 percent protein requirements. Asia holds the maximum for rice cultivation. India occupies the highest rice-growing area among all rice-growing countries, followed by other countries such as China, Indonesia, etc. In the case of rice production, China is the leading country, and India is second to China. In the case of productivity among all the countries named as Egypt, holds first place and the USA hold second place. In India, the average yield of rice is estimated at 2929 kg/ha. There have been many countries involved in rice cultivation viz., Japan, Brazil, China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, and the Philippines (Table 1).

Rice Production (Million tonnes)

Table 1: Top 10 States of India having the highest production and area under cultivation (2015-2016).

Sr. No.	State	Area (Million hectares)	Rice Production (Million tonnes)
1	West Bengal	**5.46**	**15.75**
2	Uttar Pradesh	**5.86**	**12.5**
3	Punjab	**2.97**	**11.82**
4	Tamil Nadu	**2.04**	**7.89**
5	Andhra Pradesh	**2.16**	**7.49**
6	Bihar	**3.21**	**6.5**

7	Chhattisgarh	**3.82**	**6.09**
8	Odisha	**3.94**	**5.84**
9	Assam	**2.46**	**5.14**
10	Haryana	**1.35**	**4.14**

Source: https://www.indiatoday.in

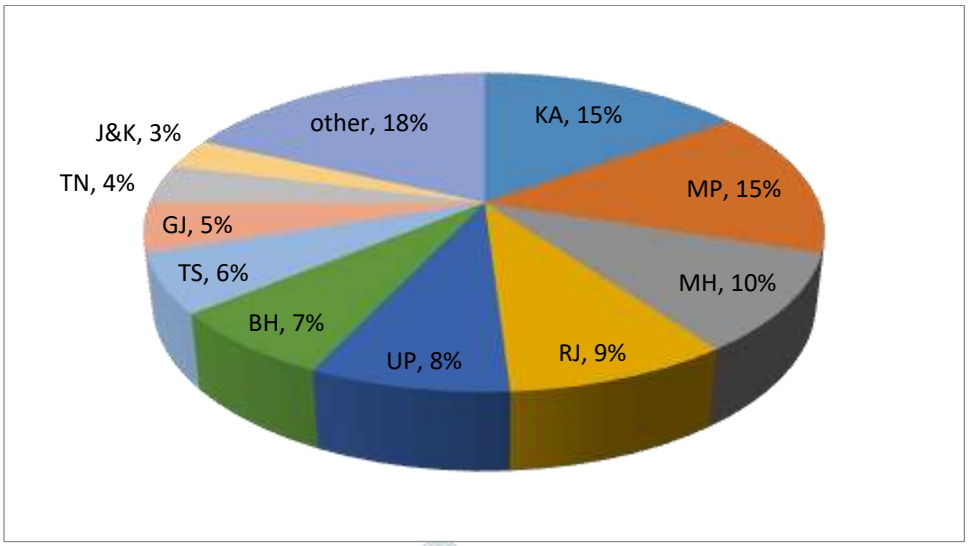
2) Maize

Mexico is considered the centre of origin of the maize crop. The diversity of the maize crop is present in many parts of the country. The geographical distribution, as well as the diversity of the maize crop, is described using the observed database of the maize races. High diversity of the area is present in the mountainous regions of the south, northwest, central and southern regions of Mexico, in the states of Oaxaca, Jalisco, Michoacan, and Chiapas. Using the hierarchical clustering system, six contiguous maize regions were defined. To improve the diversity of several races in a particular region, the main practice is to repeat further sampling and increase the number of samples.

Geographical Distribution of Maize

To identify the area of origin of a particular crop, it is important, first of all, to understand the pattern of geographical distribution for the diversity of crop species and also their shift from one area to another, as stated by various scientists such as **De Candole (1892); Vavilov (1951); Harlan (1975); Brush (2004); Van Etten and Hijmas (2010); Kraft et al. (2014).** This pattern of distribution contributes to the role of particular crop biodiversity in sustaining agricultural production in the Past, Current, and Future Times **Hawkes (1983); Bellon (1996); Brush (2000); Jarvis et al., 2008**). Small and unbiased sampling is very important to know the comprehensive geographical distribution of a particular crop, but often small and unbiased sampling is generally not available. According to **Hijmas and Spooner (2001); Jarvis et al. (2003)** the study of intra-specific crop diversity is important for understanding the relationship between the crop and its wild relatives. Mexico is considered the place of origin of maize (*Zea mays L.)* and, in Mexico, a diverse set of maize; Mexican farmers cultivate the genotype. Several features, such as taxonomy, genetics, morphological, agronomic variations, are important to express the various dimensions of the crop. Maize races are distinguished between the 25 different races based on the morphological and agronomic characteristics indicated by **Sanchez et al. (2000).** Sometimes genetic criteria are considered the basis for the definition of certain maize breeds. Some races are also described by **Perales et al. (2005), Brush and Perales (2007)** on the cultural importance of the race in the particular region. The maize crop is a crossbreeding crop (cross-pollination) because of which the traits may be shared between two or more breeds in a farmer's field (figure 1).

Figure 1: State wise area under production of Maize



Source: https://iimr.icar.gov.in/india-maze-scenario/

3) Wheat

According to Scientists like **Harlan (1992), Zohary and Hopf (2000)** have stated that Wheat is one of the founding crops of ancient times and is considered a staple food for around 40 countries around the world. According to **Gill et al.,(2004)** this crop yields approximately 60 percentages of calories through the human diet, there is also some input from other crops such as Rice and Maize. During the period between 12000 and 10000 years ago, it was the first crop to be domesticated by our ancestors. In general, wheat growers are divided into two groups: 1) Tetraploid (2n=28), 2) Hexaploid (2n=42). In the Rabi season, Wheat is usually grown in different parts of the country between September and October and harvested between March and April. The area under wheat cultivation is increasing, as there are generally 29.04 million hectares of the area under wheat cultivation in the past and this is increased to 30.54 million hectares. The largest share of the area under wheat cultivation is held by Uttar Pradesh 9.75 million hectares, representing 32 percent of the total area, followed by other states such as Madhya Pradesh (18.75), Pb (11.48 percent), RJ (9.74 percent), HR (8.36 percent) and Bihar (6.82 percent). As the area under wheat cultivation increases, this leads to increased production and productivity plays an important role in increasing the production of the wheat crop.

Geographical Distribution of wheat

Cultivation of crops began in ancient times when the population began to shift from hunting and gathering to domestication and cultivation and to build up permanent civilizations near the valleys of the river. As time passes, humans start a selective gathering and domesticate the various wild varieties of crops. A scientist named **N.I. Vavilov** (Russian botanist) studied and stated that the diversity of wheat varieties is present in South East Asia. From this study, the scientist considered this region to be the homeland of the varieties of wheat. One scientist named **Robert Braidwood** (An Archaeological) contradicts the fact that the birthplace of wheat varieties is close to the east of the Mediterranean Sea. The main basis of his study is the distribution of wild wheat varieties. The value of the wheat seeds was determined by the color of the seeds. Mainly at that

time, there are only two heat seeds, one white and the other black. White and fine wheat hold a good and prestigious position. The higher-class people of society consume this type of wheat seed. As time goes on and as far as time is concerned, both types of wheat seeds have been eaten to the maximum of all classes of society. In some places, wheat is considered a sign of successful farming, because the availability of this crop is also possible for the poor people of society, not regularly, but on several occasions indicated by scientists such as **Kipel and Kriemhild (table 2).**

Table 2: Production of Wheat in India

Sr. No.	Name of the State	Wheat Procure up to 24.05.2020 (Lakh Metric Tonnes)
1.	Punjab	125.84
2.	Andhra Pradesh	113.38
3..	Haryana	70.65
4.	Uttar Pradesh	20.39
5.	Rajasthan	10.63
6.	Uttarakhand	0.31
7.	Gujarat	0.21
8.	Chandigarh	0.12
9.	Himachal Pradesh	0.03
	Total	341.56

Source: Ministry of consumer Affairs Food & Public Distribution (25 May 2020)

Geographical distribution of Legumes

According to Tubiello et al., (2008); Fedoroff et al., (2010) climate change is a major concern for agricultural production and development. In recent times, there has been a huge increase in the prices of agricultural commodities, mainly staple food items, so that it is not possible to meet the basic food requirements to increase the population daily. Major problems in the current situation are:1) the arable land is shrinking, the adverse climatic conditions are being adversely affected, and the heavy use of chemical arable land is being converted into degraded land. 2) In the most recent scenario of the maximum population, food habits have changed and shifted from plant-based food to animal-based food. 3) To grow a successful crop, there are two main important attributes that we need as much as water and nutrients for the plants, both of these nutrients are becoming scarce day by day due to climate change. 4) According to a scientist such as **Cooper et al. (2009),** in the current situation, the climate is not good for producing crops because, instead of favoring food production,

it hinders food production and this happens in areas where food needs are increasing daily. From the above, we can say that climate is a major factor affecting food production. According to Agriculture and Processed Food Products Export Development Authority **(APEDA; 2019-2020)** the total amount of pluses exported from India is 2, 35699.04 MT (table 3)(figure 2).

Table 3: Area, and Percent Production of Various States

Sr. No.	States	Area (lakh ha.)	% Contribution
1	Madhya Pradesh	53.64	23.20
2	Rajasthan	33.62	14.60
3	Maharashtra	31.39	13.60
4	Uttar Pradesh	23.41	10.10
5	Karnataka	23.09	10.00
6	Andhra Pradesh	14.50	6.30
7	Tamil Nadu	9.40	4.10
8	Odisha	8.35	3.615
9	Chhattisgarh	7.85	3.40
10	Others	25.73	11.09
11	All India	230.98	100

Source: Directorate of economics & Statistics, Ministry of Agriculture 7 F W Govt. Of India

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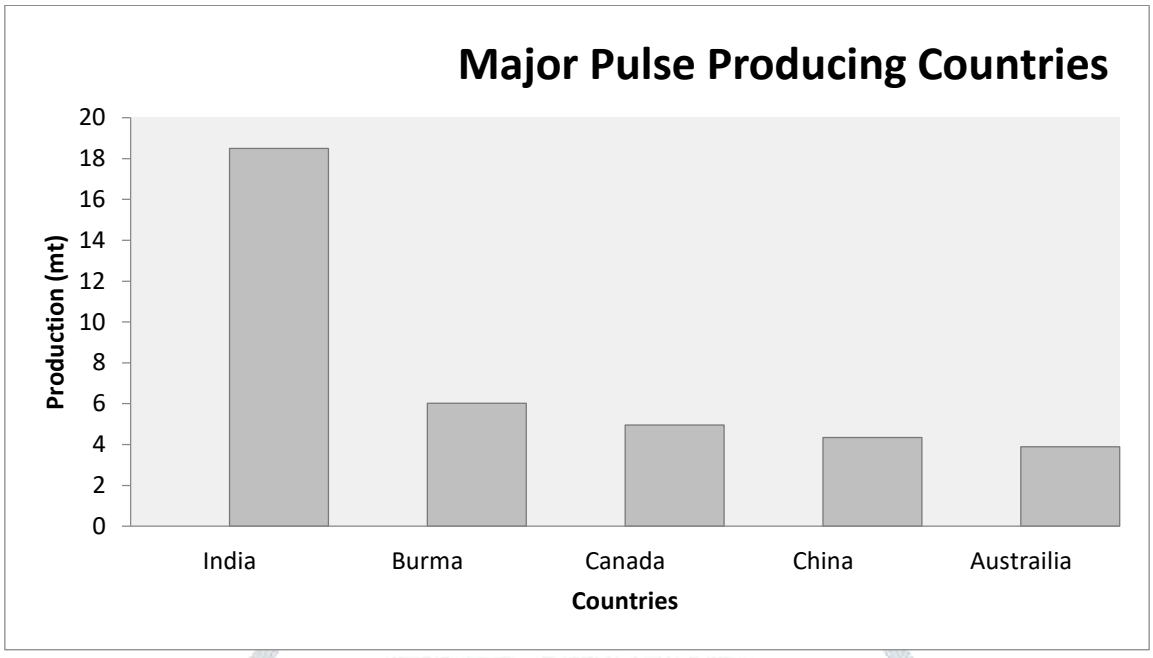
Figure 2: Major Pulse Producing Countries



Source: www.factfish.com (2013-2014)

The most important legumes are as followed; 1) Soybean, 2) Chickpea, 3) Lentil, etc. Next, we are going to discuss the distribution of these crops.

1) Geographic distribution of the soybean

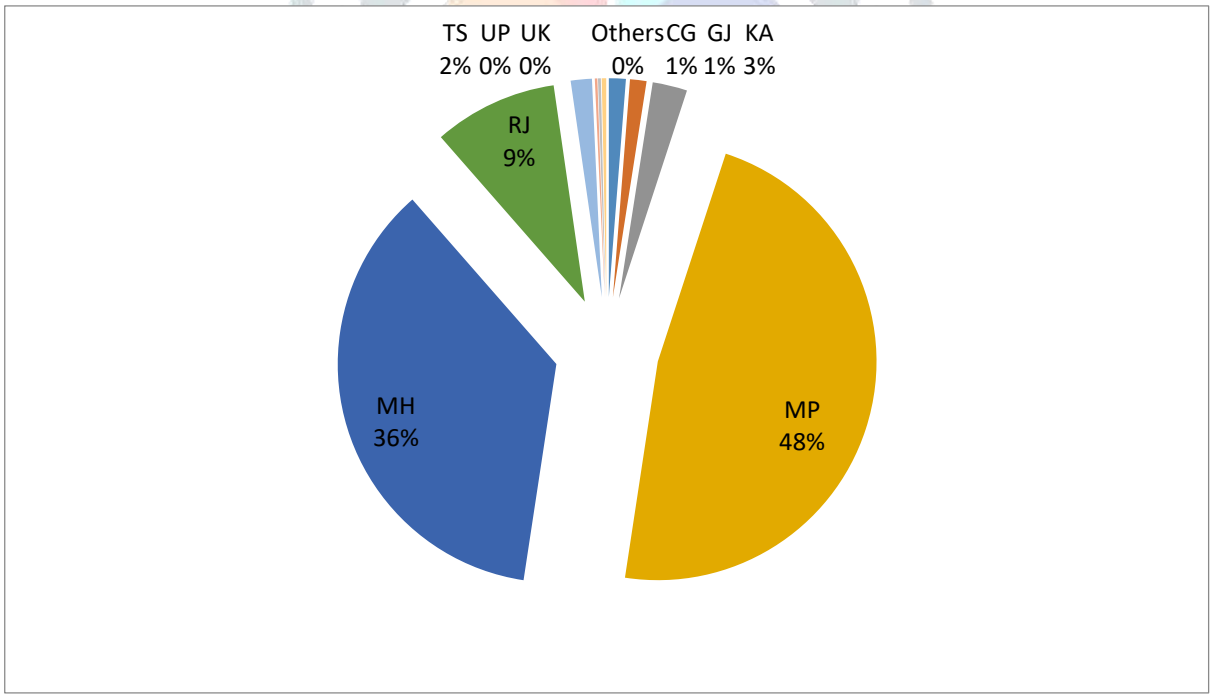
The scientific name of the soybean is (*Glycine max* L). This crop is considered the most important vegetable crop in the world and is used by the world's population in several ways, such as Fuel, Food, and various industries as biofuel. Now that per capita food production is increasing day by day, but in line with this increasing demand for food, the land area and other factors needed for crop production are being exhausted day by day. Due to the increasing population, food consumption is increasing concerning the quantity of food we have produced, this situation is particularly noticeable in Asia. With the change in the environmental condition, the fewest new varieties of different crops have also included soybean. With the advancement of crop varieties, we can grow crops in a changing environment to help improve yields to meet the needs of the population. Soybean crops perform a symbiotic fixation process where the roots of this crop are infected with rhizobia and help fix the atmospheric nitrogen as ammonia. This fixed nitrogen is used for the next crop. There are many types of rhizobia that we can use according to the type of crop and in the soybean crop; three types of rhizobia are called *Bradyrhizobium japonicum*, *B. Elkanii*, *Sinorhizobium xinjiangense*, and so on. When these rhizobia are inoculated with the soybean crop, it helps to increase the finality of the soybean by fixing the atmospheric nitrogen. Sometimes there is a huge problem in understanding the symbiotic association between the crop and

the rhizobia. To solve this type of problem, we need to understand some factors, such as environmental factors, geographical distribution, genetic diversity of the crop, and some time adjustability of the host plant with a specific microbial population. Researchers in Japan's five different sites (Hokkaido, Fukushima, Kyoto, Miyazaki, and Okinawa) investigate the genetic diversity and geographic distribution of many indigenous soybeans – nodulating rhizobia. These reports concluded that the geographic distribution of soybean has spread from southern Japan to northern Japan. According to a scientist named **Saeki et al.,** there is a strong correlation between latitude and soybean-nodulating rhizobia in Japan.

Geographical distribution of wild soybean

The cultivation of wild soybean is widely spread from 0-2,650 meters above average sea level and cultivation of this crop is restricted to East Asia. The wild soybean population is sometimes found in both the dry and salt-affected areas. In the peninsular region of Korea, on the other hand, there is a wide distribution of wild soybean populations in the mainland and close to the island. Recent studies have found that the population of wild soya beans is scattered across many of Korea's regions, including farmland, riverbanks, and roadside, and a deep valley to the top of the mountains. In Korea, some 400 islands are inhabited from the 3000 islands off the coast of the Korean Peninsula. The wild soya bean population is also found to be scattered in the few inhabited islands (figure 3).

Figure 3: Area occupied by different states of India for Soybean Production



Source: MOA&FW, GOI

2) Chickpea

The scientific name of the chickpea *(Cicer arietinum* L.) is commonly known as the Bengal Gram, and in some places, it is known as the Garbanzo. In South Asia, it is the largest producing food legumes crop and globally it occupies third place in the case of the product first and the two other legumes named as *Phaseolus*

vulagris L. and *Piston sativum* L. hold second places. Chickpea has grown in almost 50 countries, out of these 50 countries about 90 percent of production is held by Asia, 4.7 percent of production in Africa, 3.1 percent of production in Oceania, and 1.6 percent and 0.5 percent of production in America and Europe, respectively. According to the **(FAO 2011),** developing countries hold more than 95 percent of production. India is the largest producer country in the world, accounting for more than 67% of production worldwide. Approximately 75% of production comes from South Asia alone. **FAO (2011)** published data indicated that during the period 2006-2009, chickpea had approximately 11,1 m ha of production area, with production accounting for approximately 9,3 m tonnes, with the highest productivity recorded being 838 kg/ha. Chickpea is the main source of protein for millions of people, particularly in South Asia. The main consumers of chickpea in South Asia are mainly two kinds of people, including some vegetarians and other poor people who are unable to buy other expensive food products for their consumption. Protein content in chickpea ranges from 20 to 22 percent, these values indicate good protein content in addition to protein content, it is also a good source of fiber minerals that include (Ca, P, Mg, Fe, and Zn as well) along with these fiber minerals, it is also a good source of fi-carotene. It also improves soil health by correcting atmospheric nitrogen. According **to Saraf et al., (1998)**, more than 80 percent of soil nitrogen requirements are mediated with the aid of chickpea cultivation, and up to 140 kg/ha of atmospheric nitrogen is fixed by symbiotic nitrogen fixation.

Geographical distribution of chickpea

The contribution of various scientists is to explain the origin and geographical distribution of chickpeas. First In **1882, De Candole** makes it possible to consider that the probable origin of the chickpea was between the Himalayas and Greece. Another scientist named **N.I. Vavilov stated in 1926** that the primary centre of origin of chickpea is in the Mediterranean and Southwest Asia and that the secondary centre of origin is in Ethiopia. During his study, he found that all the large seed cultivars of the chickpea were found in the Mediterranean region; on the other hand, all the small seed cultivars were spread eastward. Another scientist named **Harlan (1969)** suggested that the chickpea diversity center in Ethiopia is due to the maximum variability in chickpea variety found in Ethiopia. The most likely center of origin of chickpea in northern Syria and Turkey (South-Eastern) is currently considered. The main facts behind this center of origin, according to **Van der Maesen (1987),** are the progenitors of cultivated chickpea (*Cicer reticulatum*) and other wild species of chickpea in the northern regions of Syria and Turkey (South-Eastern). Chickpea is also divided into two types, Desi Chickpea and Kabul Chickpea. In both species, the distribution of genotypes and the architecture of plants are different. In the western Mediterranean region, Kabul's chickpea type is mostly found on the other hand, the desi type of chickpea is found in the eastern Mediterranean region of central Asia of the Indian subcontinent. Some of the specific characteristics of the Kabul type of chickpea possesses as the seeds appear as the head of the Ram, the white colour of the flowers, the plant is usually taller than the desi type of the chickpea, the colour of the seed is as creamy or beige, and this Kabul type of chickpea is also known as the Macrosperma. Desi type of chickpea also has some specific type of characteristics that this type of chickpea is also known as Microsperma. It also has a small plant size compared to the Kabul chickpea type, seeds, leaflets, pods are also small. Desi type of chickpea flower color is predominantly pink in color. According to a scientist

named **Moreno and Cubero in 1978,** the evolution of the Kabul type of chickpea is a desi type of chickpea (table 4).

Table 4: State Wise Area Production and Yield of Chickpea in India

Sr. No.	State	Area (Mha)	% to All-India	Production (M Tonnes)	% to All-India	Yield (Kg/ha)
1	Madhya Pradesh	3.11	33.84	2.69	32.73	865
2	Rajasthan	1.78	19.37	1.60	19.46	899
3	Maharashtra	1.44	15.67	1.30	15.82	903
4	Uttar Pradesh	0.57	6.20	0.53	6.45	930
5	Andhra Pradesh	0.58	6.31	0.72	8.76	1241
6	Karnataka	0.96	10.45	0.63	7.66	656
7	Gujarat	0.18	1.96	0.20	2.43	1111
8	Chhattisgarh	0.25	2.72	0.24	2.92	960
9	Haryana	0.11	1.20	0.11	1.34	1000
10	Bihar	0.05	0.54	0.06	0.73	1200
11	Odisha	0.04	0.44	0.03	0.36	750
12	West Bengal	0.02	0.22	0.02	0.24	1000
13	Others	0.10	1.09	0.09	1.09	@
14	All India	9.19	1000.00	8.22	100.00	895

Source: Agriculture Statistics at a glance, GOI, (2012)

3) Lentil

Geographic distribution of Lentil

The collection of information from a variety of geographical origins is one of the most important approaches to gene pool assembly. According to some scientists such as **Frankel, (1984); Frankel et al. (1995); Brown (1978); Beuselinck and Steiner, (1992),** the conservation of co-adapted gene complexes requires a complete geographical range of the crop species. According to a scientist like **Harlan (1992)** as old

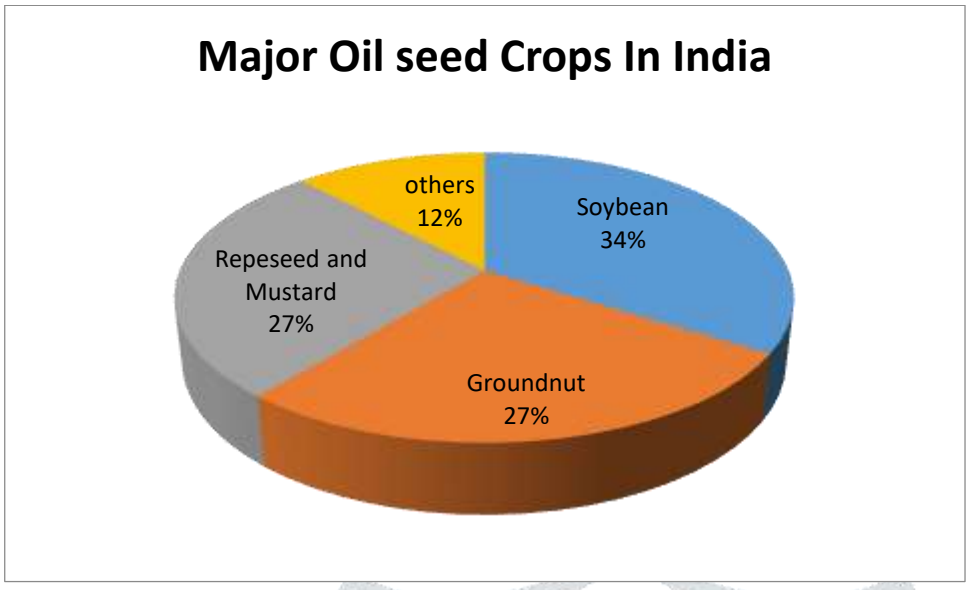
as any other plant variety, such as einkorn wheat, emmer wheat, barley, and pea lentil, is also one crop domesticated at that time. **Medicus 1787** (German botanist and physician) provides a scientific name for lentils as Lens culinaris. **Cubero (1981)** gave the synonyms and the morphological characteristics of the species of Lentil. **Barulina (1930)** gave the most detailed and comprehensive study of the cultivated lentil species. Chickpea (Kabuli channa) has 12 species and Desi chickpea has 46 varieties. Taxonomic classification of chickpea consists of Kingdom, Sub-Kingdom, Superdivision, Division, Class, Subclass, Family, Genus, Species as follows: Plantae-plant, Tracheobionta-Vascular plant, Spermatophyta seed plant, Magnoliophyta-Flowering plant, Magnoliopsida-Dicotyledon, Rosidae, Fabales, Fabaceae, Lens, culinary. According to **(Muehlbauer, 1991)**, lentil is a diploid plant species with a chromosome number (2n=14). **Arumuganathan & Earle (1991)** reported that lentil is an annual self-pollinating species with an estimated haploid genomic size of 4063 Mbq. According to scientists, **Bahl et al. (1993), Rehman et al. (1994)** stated that lentil is the oldest cultivated legume.

Geographical distribution of oilseeds

In India, oilseed crops have an important place among all commercial crops. In our diet we use daily oil extracted from the oilseed crop, as well as oil extracted from the oilseed crop is also used as raw material for the production of various types of products such as paints, varnishes, hydrogenated oils, soaps, perfumes, lubricants, etc. After extracting oil from oilseed crops, the remaining residue is known as an oilseed cake, which is used in two ways, one as a feed for cattle and the other as manure and provides nutrients to the soil. In the world, India holds the highest position in the production and area of oilseed crops. Groundnut, sesame, rapeseed & mustard, linseed, and castor are the main five oilseed crops grown in India. All five-oilseed crops account for 15 percent of the total net seed area and this 15 percent of the net seed area must be 20 percent if other minor oilseed crops such as Cotton, Soybean, Sunflower, and Nigerseed are also included. In the current situation, we do not have enough production potential for oilseed crops to meet the growing population requirements. To meet the requirements of oilseeds and their other by-products, we must depend on imports from other countries.

The scope of the more cultivated area to be included in the production of oilseeds is limited, with the increase in the production of oilseeds; we need only focus on the development of high oilseed varieties as well as on advanced management technologies to enhance the production of oilseed crops. The trend in the production of oilseed crops varies from state to state, named HR, MP, RJ, and WB, there is an increasing trend in production with increased productivity as well as some area expansion. In some states, the increase in the production of oilseed crops will only help to increase the overall output of oilseed crops. On the other hand, there is a sharp decline in the production and productivity of oilseed crops in some states (figure 4).

Figure 4: Major oilseed crops in India



Source: https://www.nfsm.gov.in/StatusPaper/NMOOP2018.pdf

(1) Groundnut

In India, groundnuts are the main and most important oilseed crops, accounting for half or less than half of the oilseed producers in the country. It has good nutritional values and a very rich source of various vitamins, proteins, and high calorific value. The oil content in groundnuts is about 40-50 percent. This oil is used as an edible oil (pure form) or as a form of vanaspati (hydrogenated). Groundnut is used as raw material for many types of industrial products, such as wool and silk, artificial leather, soap and toiletries, margarine, and medical emulsions. Groundnut kernels are also eaten in a sweetened or salted form, both raw and roasted. Apart from all these important points, it also plays an important role in improving soil health, as this crop is used as a good and ideal rotational crop with cereals, fixes the atmospheric nitrogen for the next crop, and helps soil to restore nutrient status at a rapid rate. The best environmental and soil conditions for good soil growth are as follows: tropical climate with a temperature range of 20-30 degrees Celsius, optimum rainfall is between 50-75 percent. Conditions that hinder the growth of groundnuts are as follows: continuous rainfall and water stagnation are not good for growth, are also susceptible to frost and prolonged drought.

Geographical distribution of groundnut

Groundnut production depends on the amount of rainfall distribution. Groundnut is considered a rainfed crop by nature. The production pattern for groundnuts in 2001-2002 was 70, 28 lakh tonnes. However, between 2002 and 2003, production decreased from 70.28 lakh to 43.63 lakh tones due to failure in rainfall.

The three main groundnut-producing states include Gujarat, Tamil Nadu, and Andhra Pradesh. In India, more than 65 percent of production is held by these three states. Out of these three states, Gujarat contributes more than 25 percent of India's total groundnut production. Over 22 percent of the production of groundnuts comes from Tamil Nadu. 18 percent of the production comes from a state named Andhra Pradesh. There are

also other land-producing states named M.P., Orissa, RJ, UP, W.B. Kerala, Pb, HR, and Bihar, which contribute a small amount of groundnut.

2) Sesamum (Til)

The world's largest producer and consumer of sesame in India. On average, India contributes one-third of the world's sesame production. It contains about 45-50 percent of the oil content, which is the way it was used in important oilseed crops. Sesame oil is used for the manufacture of medicines, perfumes, and cooking purposes. It is important to have rainfall of about 45-40 cm for good sesame production and the temperature should be between 21-23 degrees Celsius. Conditions such as heavy rainfall for longer periods and long-term drought conditions are not suitable for the production of sesame. Therefore, we need to avoid these conditions to have sesame food production. It is grown as a Rabi crop in the southern region of India and is grown as a Kharif crop in the northern regions.

Production and Geographic Distribution

The trend in the production of sesame cops is always fluctuating because it is grown as a grain crop in a maximum part of the region. We know that there are huge variations in the rainfall region to region due to global warming. Sesame production potential increased to 8.4 lakh tonnes (1990-1991) from 4.5 lakh tonnes (1950-1951). Sesamum is imported from Africa to India and the western part of Asia. It is assumed that sesame originates in Africa. Tropical and subtropical regions are good for sesame production. India's share of production in the world is about 39 percent, 27 percent of production and India also contributes about 40 percent to exports to other countries. Sesamum is also divided into two types based on their col, i.e. it’s white, red, and black. Red and black sesame are mainly grown in the eastern regions of India (West Bengal, Orissa, Assam, and Andhra Pradesh). Besides, the white color of sesame is grown in the western part of the country, i.e. Gujarat (table 5).

Table 5: Production and geographic distribution

Country	Area (m/ha)	Production (m t)	Productivity (kg/ ha)
India	1.85	0.63	368
Sudan	1.66	0.30	181
Myanmar	1.37	0.55	402
China	0.65	0.78	1083
Uganda	0.21	0.11	521
Nigeria	0.16	0.08	450
Tanzania	0.11	0.04	390
World	**7.43**	**3.28**	**441**

Source: FAO Year Book, 2004

3) Rapeseed and Mustard

Rapeseed and mustard belong to the genus *Brassica* and the family Cruciferae, and these are two important oilseed crops next to groundnuts in India. Seeds of these crops contain an average oil content of between 25 and 45 percent. Oil extracted from rapeseed and mustard has been used in many ways, including: for the preservation of pickles, for cooking purposes, for lubricants, etc. After extraction of the oil, the remaining residue is used as an oil cake. These oil cakes are mainly used in two ways, 1) used as feed material for cattle. 2) It is also used as a source of manure and provides a diversity of nutrients to the soil and helps to maintain soil nutrient status and soil health because the nutrient source is purely organic.

Production and Geographic Distribution

In the world, India is the largest country in the area and the production of Rapeseed and Mustard. There has been an approximately four-fold increase in the production of rapeseed and mustard since the last three decades (i.e. 1960-1991). After 1991, the production trend of rapeseed and mustard is very uneven, or we can say that it shows a very fluctuating pattern of production. In-between (1996-1997) the maximum production of rapeseed and mustard is recorded as 6,658 thousand tonnes, but after that, there is a significant decrease in crop production, as in the years 2002-2003, the average production is estimated to be only 3,918 thousand tonnes in all of India.

It has historically been estimated that, in the first place, Asian countries cultivate brassica species under cultivation, with India and the sub continental region of India taking the lead in the production of rapeseed and mustard. Some Russian scientists consider the origin of the Brown Sarson, estimate that the adjacent area of northwest India and the eastern region of the country Afghanistan should be the independent origin of the brown sarson. On the other hand, yellow sarson has the greatest diversity in Bengal but is mostly grown in the eastern part of India. According to a scientist named **Prain (1898),** China is the passing country of *Brassica juncea* to India. It is estimated that this origin is likely to be in Africa. Another type of mustard called *Brassica nigra*, also known as black mustard, is considered native to Eurasia. In India, the recently introduced Brassica variety is considered to be *Eruca sativa* (Taramira). Countries such as India, China, Canada, Europe, Australia, the USA, East Africa, Russia, and South America are considered to have a good production potential for various types of Brassica.

4) Linseed

The oil content of linseed is between 47 to 65 %. Linseed oil has some special characteristics, such as drying properties, which is why this oil is used in the manufacture of paints, and other products include varnishes, printing inks, and waterproof fabrics. It is also used as an edible oil in some parts of the country because it is also considered to be good for health. This crop may be grown in a variety of geographical conditions, but for its good and high production, it is advisable to select cool and humid weather conditions with a temperature of up to 20 degrees Celsius and an annual rainfall of between 75 and 80 cm. Soil that is considered to be good for the production of linseed is clay loam, deep black soil, and alluvial soil.

Production and Geographic Distribution

After Russia and Canada, India holds the third position in production and supplies 10% of linseed production worldwide. The main linseed production states in India are as follows: M.P., U.P., Bihar, Chhattisgarh, and Maharashtra. From these producing states, Madhya Pradesh holds the highest production position and produces about 45 thousand tonnes (approximately 26% of total production). The second position in the production of linseed is that Uttar Pradesh has 37 thousand tonnes of linseed produced (21.4% of total production).

The cultivation of linseed (flax) is considered to have begun over a long early period, i.e. 500 years ago. The main reason for the cultivation of linseed by ancient Greeks and Romans is mainly for the production of fiber and seed (flax) and sometimes it is used as raw material for the production of linseed. As far as the origin of the linseed is concerned, there are many disputes. Well, according to the **N. I. Vavilov**, the probable origin of annual linseed is considered in India, Ethiopia, and Iran. Once an estimate of the origin of the linseed has been made, it should be from the Asian center to India. Nevertheless, this estimate is no longer the most logical and accurate estimate of the origin of linseed in India.

5) Castor Seed

Castor seeds contain about 50 percent of the oil content. This oil has very beneficial uses such as used as a lubricant to reduce friction in machines, also used as hair oil, used for the production of soap and leather tanning. After oil extraction, the remaining material is used as an oil cake, and these oil cakes are used as a source of manure, provide the soil with a wide range of nutrients, and help to maintain soil nutrient status and soil health since this source of nutrients is purely organic in nature. We can use the leaves of the castor plant as a feed material for the silkworms. In the tropical and subtropical regions, we can grow castor plants like small trees. This crop is mainly grown as a mixed crop in maximum time. For best castor production, this crop should be grown in climatic conditions with a temperature range of between 20-20 degrees Celsius and a rainfall of between 50-75 degrees Celsius. The crop is grown in the peninsular region of India. In this region, mainly sandy loam soil and light alluvial soil are present. By nature, these soils are considered good for the cultivation of the beaver. This crop is taken in both the *Kharif* and *Rabi* seasons. It is grown as a *Kharif* crop in the northern part of the country and as a *Rabi* crop in the southern part of the country.

Production and Geographic Distribution

After Brazil's second-largest producing county of castor is India. In the production status of castor in the back time i.e. (1950-1951) one lakh tonnes of castor, production takes place, then there is a sudden increase in castor production i.e. in (1996-1997) the maximum production recorded is approximately nine lakh tonnes per year.

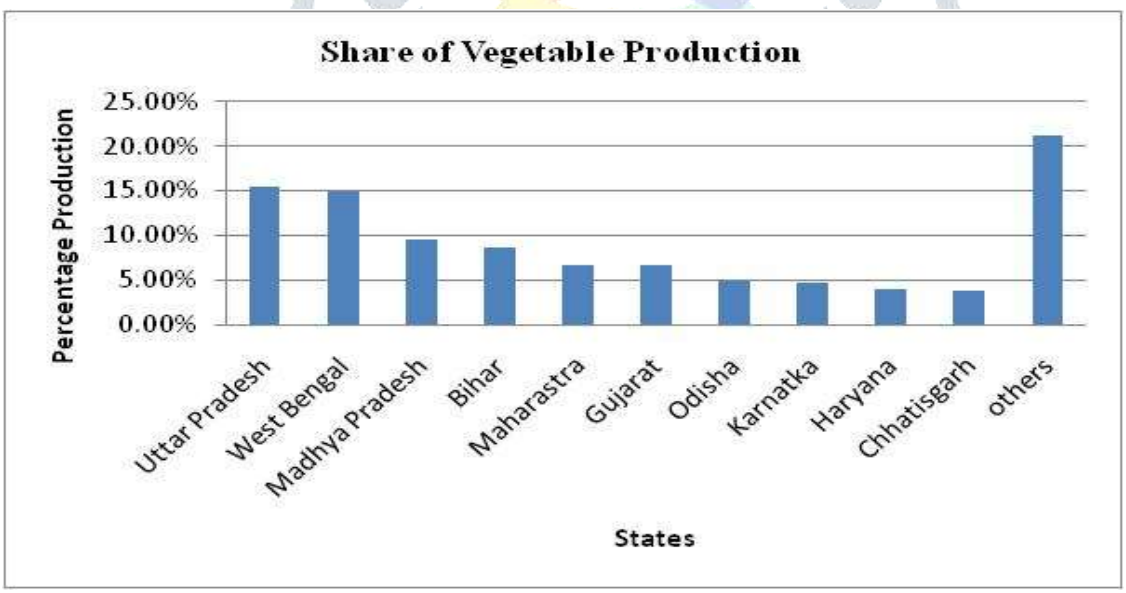
As the year passes, besides the increase in the production of the castor, there is a sharp decrease in production. The lowest castor production is recorded in the year (2002-2003) i.e. 4.3 lakh tonnes. Castor crop has been grown for oil in Egypt for as long as six thousand years. According to a scientist named **(Deacon**

1986), he stated that the number of archaeological records dating back to the Stone Age and the summarization of the evidence for the very early introduction of this species to South Africa. *Ricinus communis* was first recorded in the Martinique West Indies (1822) as well as recorded in the Virgin Island of the United States in 1833. According to **Buurt (1999)** from the old world, it is noted that Curacao & Bermuda has been introduced, but along with this statement, Bruut cannot explains and set the time and dates for the introduction of this crop from that island.

Geographic distribution of vegetables

Humans and animals use vegetables as their food material, animals can take vegetables as raw, but humans eat vegetables after cooking. There are different kinds of parts in vegetable plants that we can use in our diets, such as flowers, fruits, stems, leaves, roots, and seeds. During the year of 10,000 B.C to 7,000 B.C., vegetables are grown in several parts of the world. Initially, vegetables are grown in very specific locations, but time passes through the seed materials of these vegetables spread all over the world. In the current situation, these vegetables are grown in many parts of the world under appropriate environmental conditions. Vegetables are also cultivated during the off-season in protected cultivation, i.e. in Green Houses. China has the highest position in the production of vegetables all over the world. These vegetables are distributed all over the world from China. Vegetables have an important role to play in human nutrition and we can consume vegetables as raw and cooked forms (figure 5).

Figure 5: Vegetable production of India



Source:https://www.statista.com/statistics/1036898/india-leading-vegetable-producing.

1) Tomato

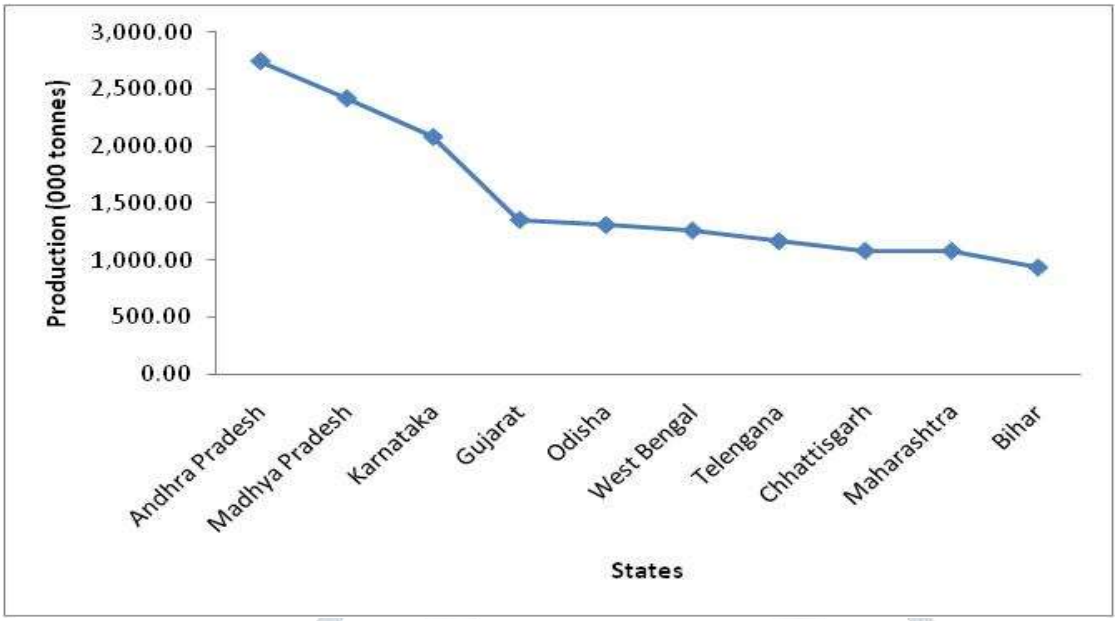
Scientifically, tomatoes are known as *Solanum lycopersicon* L. and it belongs to the Solanaceae family. In Tanzania, it is the most widely grown crop and accounts for about 51 % of total vegetable and fruit production. The tomato crop is grown as a famous vegetable worldwide. The evolution of the tomato crop is considered by wild progenitors named *S. Lycopersicon*. The cultivated spies of the tomato consist of eight

different wild species and these wild species probably belong to two complexes named *esculentum* and *Peruvianum*. In the case of nutrition, it has a good status as minerals, vitamins, and water in large quantities, which is also good in taste. According to the report **(FAOSTAT, 2017)** in 2014, more than 5 million hectares of land are under tomato cultivation with an estimated production potential of 171 million hectares, according to a scientist named **Geisenberg and Stewart (1986)** who stated that under certain environmental conditions the tomato plant has perennial and semi-perennial behaviour, but commercially this crop is considered to be an annual crop. Tomato plant fruit cab is distinguished based on its colour, shape, and size, as stated by **Vaughan and Geissler (1997).**

Geographical distribution of tomatoes

According to the **WWF and IUCN (1997)**, the geographical distribution and the center of origin of the *Solanumlycopersicon* L.are situated between the narrow landscapes of the Pacific coast of western South America and the Andes mountain ranges. According to various scientists named **Peralta, Spooner and Knapp, (2008); Nuez et al., (1996); Jenkins, (1948),** the center of origin and distribution is extended to northern Chile, including the Galapagos Islands from southern Ecuador. Scientists named **Taylor (1986)** have studied that the distribution of native wild tomato ancestry is limited between the (0°-20^oS & 64°-81° W) co-ordinated. The most likely domestication center in Mexico in the case of wild relatives Peru is considered to be a center of diversity mainly for wild relatives according to **Larry and Joanne (2007)**. The tomato plant is considered to have been migrated from Canary Island to Andalusia, and then spread throughout the whole of Spain. It is assumed that the fruit of the tomato is consumed with oil, pepper, and salt, as stated by a scientist named **Nuezwt al., 1996; Rick, 1978)**. In some countries, the fruit of tomatoes is very easily accepted for consumption, as in Spain, and the Italians were the first to accept this fruit. On the other hand, European countries have shown no interest in accepting this fruit because they have assumed that the possibility of poisoning may be due to the consumption of tomatoes, and according to **Long Towell (2001),** the curse of the dulcamarais considered to have been caused by the consumption of tomatoes. However, as time passes and the cultivation of tomatoes spreads throughout the world, as well as consumption increases at a very rapid rate. In India, the leading tomato states in the area followed by Uttar Pradesh and next to the U.P. In the case of the area under production, Orissa is the third Indian state. In terms of productivity and production, the leading state in Uttar Pradesh and next to the U.P., Karnataka takes second place, followed by Punjab, West Bengal, and Assam (figure 6).

Figure 6: India Production of Tomato



Source: National Horticulture Board (NHB 2017-2018)

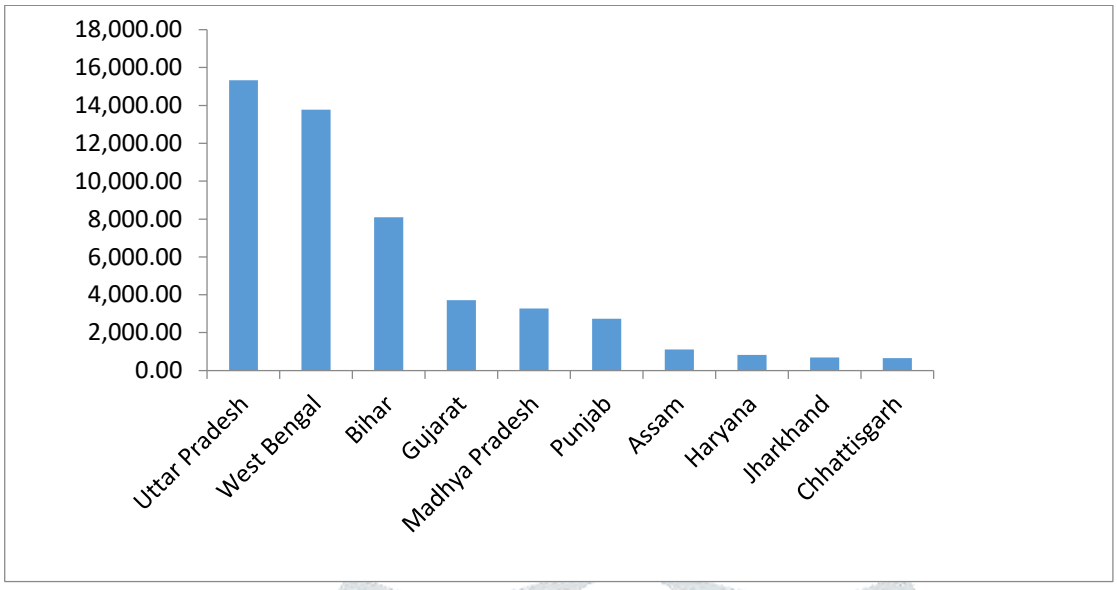
(2) Potato

Scientifically, potatoes are known as *Solanum tuberosum* and belong to the Solanaceae family. At present Potatoes are known to be cultivated around the world under climatic conditions. Worldwide, the consumption of potatoes will increase daily. Initially, in ancient times, the people of America were known as the original domesticators of potatoes. The potato crop is considered a modified stem. At present, potatoes are being consumed as a staple food all over the world and are an integral part of the world's food supply. One estimate for 2014 was that Potato, after the three main crops such as Rice, Maize, and Wheat, holds fourth place in the case of consumption.

Geographical distribution of potatoes

We know that potatoes are served as a staple food in many countries today. But the first domestication of the potato is considered between 8000 and 5000 B.C. In the south of Peru and the northwest of Bolivia. It was concluded from the estimation of the various scientists that, during the 16th century, the Spanish people spread or introduced potatoes from America throughout Europe. It was estimated in France that the potato crop was introduced at the end of the 16th century. The potato crop of the 19th century, introduced in many countries, is shifted to the consumption of potatoes instead of other vegetables due to its low prices. Widely potatoes are also called poor man food. In India, it was estimated that the Portuguese introduced potatoes in India, first cultivated in the vegetable gardens of Surat and Karnataka in 1675. Initially, potatoes are known as "Batata" in India. British traders are known as the originator of potatoes as a root crop in the Bengal region. It was cultivated throughout the northern part of India by the end of the 18th century. By the end of the 19 century, potatoes were introduced into Tibet by the Indian route trade (figure 7).

Figure 7: Top 10 Potato Producing states in India (2018-2019)



Source: https://www.mapsofindia.com/top-ten/india-crops/potato.html

(3) Onion

Scientifically, onion is named *Allium cepa* L. It belongs to the Alliaceae family. Onion has other vernacular names, such as bulb, shallot, Charlotte, Kitunguu, etc. In all parts of the world, onions are eaten as vegetables. Onion is consumed by humans in a variety of ways, such as boiled with other vegetables, in fried form, as raw as seasonal salads. Onion also has some medicinal values, such as helping to heal stings and wounds, asthma, gastrointestinal disorder, and headache.

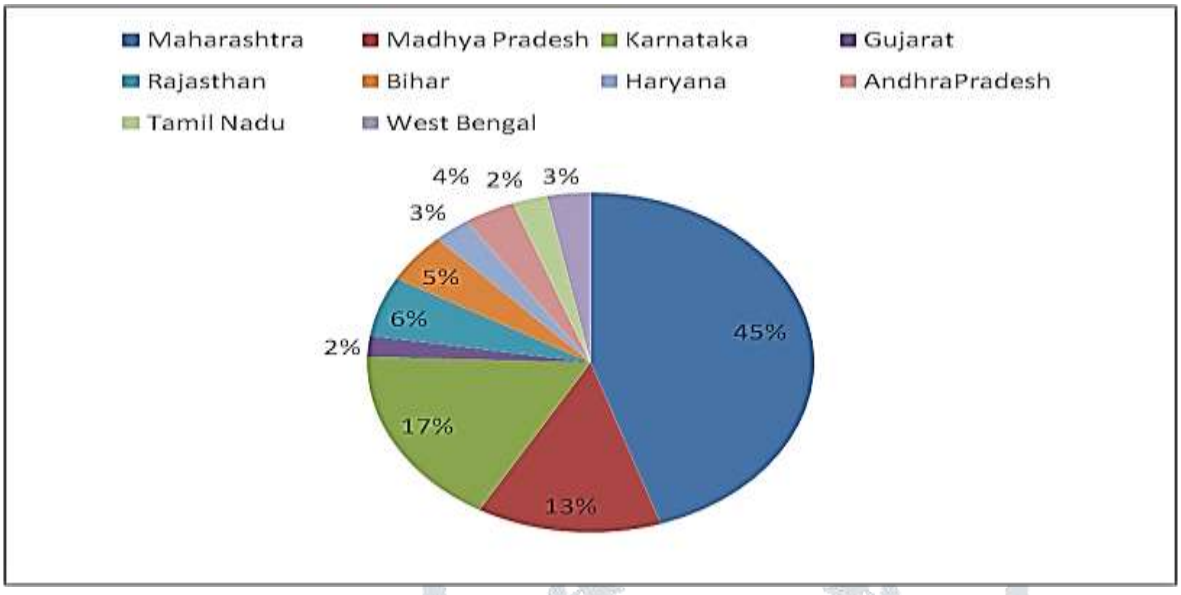
Onion Geographical Distribution

The place in Central Asia (between Turkmenistan and Afghanistan) is considered to be the place of origin. *Allium cepa* is cultivated as the bulb onion or shallot in tropical African countries. The main producing countries of Onion are Nigeria, Sudan, Ethiopia, Kenya, Zimbabwe, and Zambia, etc. An estimate of the origin and where its distribution begins. Two statements about the origin of the onion are quite popular. In the first statement, as we know, Central Asia is considered to be of origin. The second declaration in the Middle East of Iran and western Pakistan contains the locations considered the centre of origin of Onion. Some of the old Indian Vedic literature shows that in 5000 years, onion is grown in China as a kitchen garden crop. In 3500 B.C year back onion, cultivation and consumption are traced in Egypt. According to Rogers, (1995) out of all vegetables, only onion is a single crop made of gold by Egyptian artists. Gold onion paintings are not found everywhere in Egypt, but there are some major sites, such as the inner walls of the pyramids and the tombs only. According to Platt (2003), onion is a staple food for all workers who work for the construction of tombs and pyramids because of its cheap prices.

The family of onions has been established in Europe by the Roman peoples. The main reason for the transport is that the onion is probably the main vegetable for the Roman people so that they can carry it along with their journey. As time passes in the Roman Empire, onion, cabbage, and beans are the main sources of

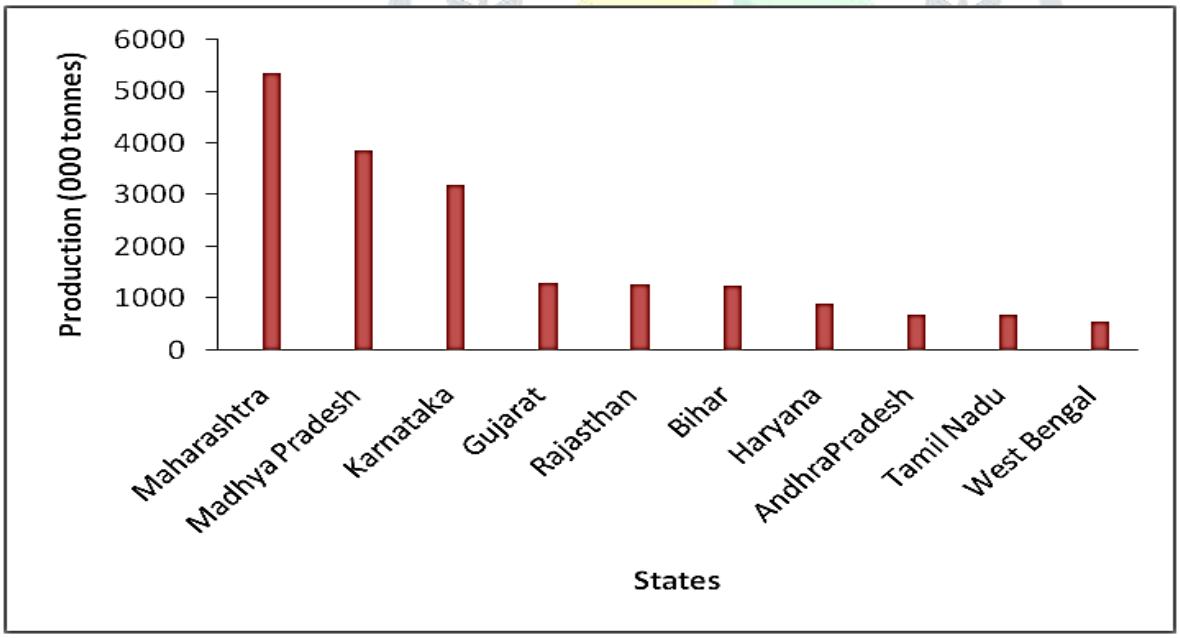
food for the people in that dark period of Europe. At that time, Onion serves both purposes like food and another as a medicine. After that, onion is spread all over the world along with traders because Europe holds the center position for trade. Nowadays, different varieties of onions and hybrids are available on the market and grown worldwide according to their need for special shape, color, and size (figure 8, 9).

Figure 8: Area Wise Contribution of Different States (2017-2018)



Source: https://www.mapsofindia.com/top-ten/india-crops/onion.html

Figure 9: Top 10 Onion Producing States in India (2017-2018)



Source: https://www.mapsofindia.com/top-ten/india-crops/onion.html

4) Cabbage

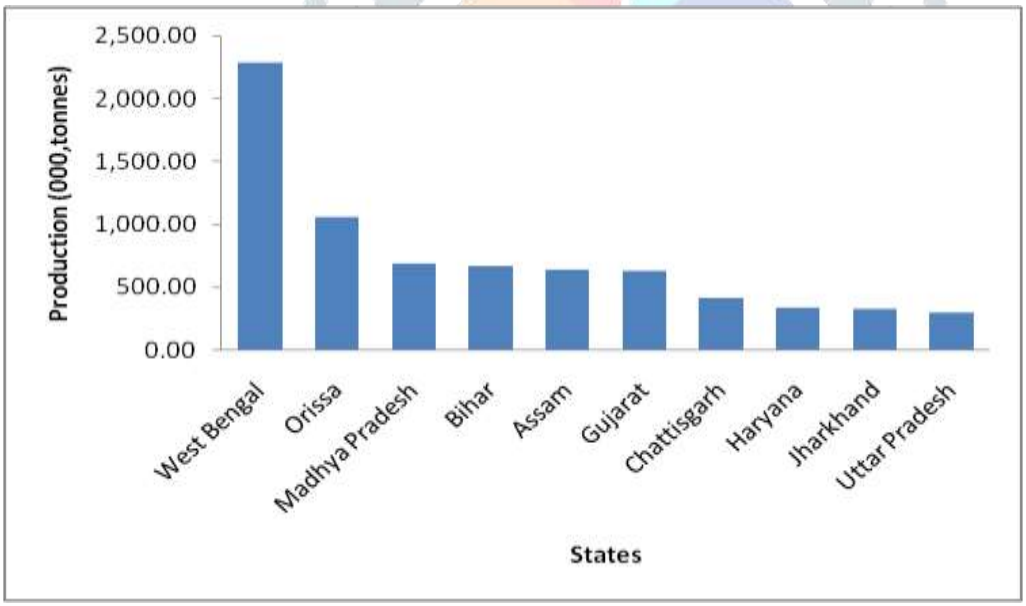
Scientifically, cabbage is called *Brassica oleracea* L. It belongs to the Brassicaceae family. Botrytis is a sub-variety of cabbage. In general, the average weight of the cabbage is between 500 and 1000 g. It was estimated that the domestication of cabbage started around 1000 B.C. It is somewhere in Europe. In many parts

of the world, cabbage is in many ways, e.g. as a pickle, raw, cooked, etc. It holds good nutritional values such as good in the type of vitamins, e.g. Vitamin K and C, as well as good in dietary fibers. The inflorescence of the Cabbage is named indeterminate and unbanked. The economic part or parts we consume appear at the top of the plant so that its growth is defined as an indeterminate type of growth.

Geographical distribution of cabbage

Continental Europe and Britain are potential locations that are considered possible original locations where it originates. One concept/theory named as a triangle of U theory, given by a scientist named **Woo Jang Choon in 1935,** makes it easy to understand the origin of the Cabbage. According to this theory, three main ancestral lines are solely responsible for the origin of the cabbage. According to Theophrastus, ancient Greek peoples cultivate some varieties of cabbage, but on the other hand, there is no sign that the Egyptian people used to cultivate the cabbage. During the sixteenth century, a certain variety of Savoy cabbage is introduced by the German Gardeners. Cabbage has become a staple food for many countries, such as England, Ireland, Russia, and Germany, during the 17th and 18th centuries. In 1788, along the First Fleet (a set of 11 ships) the seed of the cabbage was transported to Australia. These seeds are planted in Norfolk Island in the same year. By the end of the 1830s, this vegetable is likely to be grown throughout Australia, becoming a favorite vegetable for the Australian people (figure 10).

Figure 10: Top 10 Cabbage Producing States in India (2017-2018)



Source: National Horticulture Board (2017-2018)

Geographic Distribution of Fodder and Forage Crop

India's livestock production sector plays a key role in agriculture by contributing almost 32%. Out of the total contribution of the Geographical Area India to the Geographical Area, about 2.4%. India contributes more than 15% of the world's livestock production from this 2.4% share of the geographical area. Of this 15%, there is a variation in the type of livestock as follows: Cattle (16 percent), Buffalo (55 percent), Goat (20 percent), and Sheep (5 percent). Because of GDP growth, about 4% of its growth depends on the livestock population.

Green, dry feed as well as types of concentrates are needed for the rearing of livestock production. But we have only 4 per cent of the total crop area under cultivation. Because of this less cultivated forage, we are deficient in about 36%, 40%, and 54% of green forage, dry forage as well as concentrate. This deficiency in the production of feed is mitigated due to less under-growing of feed as well as a lack of good varieties of feed crops. Other factors are also responsible for this lower productivity of feed crops such as; Farmers are focused only on the cultivation of cereals, not on feed crops, Post-harvest management of feed material is also lacking, while grazing is also lacking in proper grazing, etc. The recent year's scientists aim to develop new varieties of feed crops with varying degrees of climatic conditions to obtain higher quantities of feed material for livestock. Nowadays, barley, pearl millet, sorghum, maize forage, and oat are the main feed crops.

1) The Barley

Scientifically, Barley is known as (*Hordeum vulgare* L.) and belongs to the grassy Poaceae family. The cultivation of barley is considered very old as the word agriculture of ancient times. According to a scientist named **(Zahary and Hopf 1993; Diamond 1998),** the Barley crop was domesticated back in 8000 B.C. The well-known wild relatives of this cultivated barley are (*Hordeum spontaneum* c) According to **Harlan and Zohar, 1996; Nevo (1992)** claimed that the colonization of the wild relative of the barley Hordeum spontaneum C. It is still in its primary habitats, such as Israel, Jordan, and southern Turkey, as well as in Iran.

Barley Geographical Distribution

The cultivation practices of the barley crop are similar to that of wheat. In the case of barley production, Europe holds the first position and Asia holds the second position. Russia, China, Canada, the United States, Spain, France, Australia, the United Kingdom, and India are the main producing countries for barley. In India, several states hold quite a good position in the production of barley named Uttar Pradesh, Rajasthan, M.P., Haryana, Punjab, and Himachal Pradesh. According to some researchers, early evidence of the cultivation of wild barley is found at the southern end of the Sea of Galilee. As per the carbon technique dating back to the barley age, it is expected to exist at the time of 8500 B.C. Some other scientists estimate that evidence of barley cultivation can be found in Mesopotamia. It is now located in the Jarmo region of modern-day Iraq. Barley is a type of crop that can grow in a wide range of climates. According to some researchers, domestication in Central Asia and Central Asia is believed to have spread throughout India. Many Indian Scriptures and Rig-Veda barley are considered the principal grain of ancient India. The traces of cultivation are to be seen in the Harappan civilization during the period from 5700 to 3300 years ago. Neolithic peoples were considered the first people to develop barley as their first alcoholic drink.

(2) Sorghum

Scientifically speaking, sorghum is known as *Sorghum bicolor L*. and it belongs to the Poaceae family. There are many other vernacular names of sorghum according to the regional languages its name may vary, such as in Bengali, Gujarati, Hindi it is known as Jwar, in Kannada, it is known as Jola, in Malayalam and known as Cholam, in Jwari and Marathi it is known as Janha, in Telugu, it is known as Jonnalu. There are many

views which, according to their findings, show the origin of sorghum. According to **Warth (1937),** the origin of Sorghum is confined to India and Africa alone. However, another scientist named De Candolle said that sorghum originated only from Africa. Some other researchers find that sorghum is considered to originate in Africa (Abyssinia) and the northeast of Africa. From that location, sorghum is considered to have been distributed to other countries named the United States of America and other European countries through slaves at that time.

Sorghum Geographical Distribution

Except for some of the cooler parts of Europe, sorghum is grown in all parts of the world. Mainly sorghum growing areas are subject to rainfall of between 400 and 1000 mm. Africa is considered the main continent for sorghum cultivation, and North America is also well positioned in sorghum cultivation. Other continents named Asia and South America are also good for the production of sorghum. Sorghum is resistant to growing in harsh climatic conditions so that it is considered a good crop to grow in arid and semi-arid conditions. This crop is considered the fifth-largest crop in the world, and it occupies second place in Africa. In terms of the conservation of solar energy and the efficient use of water. This crop is known to be good for grains, forage, and sugar. This crop is also referred to as a drought tolerance crop. It is one of the good indispensable crops due to the high adaptation in a wide range of climatic conditions. Sorghum is used as a feed crop in various ways for the livestock, poultry, beef, and pork industries, etc. According to **FAOSTAT (2007),** sorghum and other millet are approximately 11.4 percent of all cereal crops, and sorghum and other millet are approximately 4.1 percent of the total cereal output. All the millets, along with the sorghum crop, provide a good source of forage. For millions of the poorest people, the sorghum crop is a good contributor to meeting the energy, vitamins, proteins, and other mineral requirements. In addition to Sorghum, India is also considered to be a good source of forage. Scientifically, pearl millet is known as Pennisetum typhoid and is commonly referred to as Bajra. It is also an important crop in the millet field. In India, the secondary centre of origin of pearl millet is considered. Pearl millet is grown in India throughout the country. In India, mainly in the western part of Rajasthan and Gujarat, pearl millet is a good source of forage. According to the **FAO (1995),** the main pearl millet, the growing countries are Africa, Asia, China, and Russia, where it is grown for dual purposes, such as forage and grain.

Geographical Distribution of Forage Crops

It was believed that during 8000, 11000, and 9000 years ago, animals like Cattle, sheep, and goats respectively are considered as important grazing animals to be domesticated. Likewise, about 5000 years ago, other animals like horses, asses, camels, and buffaloes are considered to be domesticated. At that, these animals are considered good friends of peoples because they provide the main source of livelihood for humans. They provide various kinds of things like Source of food, Fuel, act as a draft animal for the transformation of heavy goods, as well as they act as a good source of manure (Source of nutrients), etc. From the ancestors and till now the main practice that should utilize by humans to feed the animals is “Grazing” in the open area. However, as time passes to the 20th century this practice is minimized to the location of the world. This is due to the more

and more industrialization and transformation of the rural areas into urban areas and the area under the grazing is shrinking. As we know the contribution of the forage crop is very acknowledgeable in the domestication of the animals. Nowadays the number of forage crops is going to increase day by day until now more than 200 species of forage crop are consider to be developed. Along with proving food for animals these crops also help us in other like; 1) Helps in the conservation of the soil; 2) Conservation of the wildlife animals. 3) Helps in the protection of the environmental conditions from the main problem of now a day is i.e. "Pollution". The main forage crops are Alfalfa, legumes crops, Forage maize, clover is also we can used as a forage crop. Forage crops are cultivated mainly to provide the feeding materials for the livestock.

Geographical Distribution of Commercial Crops

Commercial crops are those that are grown on a large scale in a large area. The main objective behind the cultivation of commercial crops such as cotton, sugar cane, jute, and tea, is because the main product of these crops is only available after processing of the raw material. Every country has a good production capacity of at least one commercial crop.

(1) Tea

Scientifically, tea is known as *Camellia sinensis* and belongs to the Theaceae family. The tea plant has the character of a bushy type of plant, which is why it is also known as a tea bush in all parts of the world. Indigenous tea was supposed to originate from China. But according to one scientist, Major Robert Bruce (1823) said that wild tea bushes were grown on the hillsides of Upper Assam. Tea seed was imported from China in the year 1840 and the commercial tea plantation was located in the valley of Brahmaputra. Initially, the tea plantation is confined to the upper valley of Assam, but as time passes in the year 1859, the tea plantation spreads to the other lower valleys of Assam and the Darjeeling area. Only 30 tea plantations have been set up in the Assam Valley. Later, the tea plantation is also established in the other part of the country, i.e. Nilgiri Hills is located in South India, in the foothills of the Himalayas, and other parts of Himachal Pradesh. Well, the right climate for tea growth is the warm and humid climate. The soil for tea growth is likely to have a good water drainage capacity, somewhat acidic.

Geographical Tea Distribution

In India, tea seeds were imported from China, and back in the 1830s, British rulers began planting them on the foothills of the Himalayas. Nowadays, India is considered the largest exporter of tea to other countries on the international market. In 1996, India was ranked first in the world in terms of tea production. Overall, about 28 per cent of tea production in the world comes from India. With the production of tea India also good in terms of productivity (kg/ha) of tea. In India, the major tea-producing countries are Assam, W.B., T.N. Kerala, Tripura, Arunachal Pradesh, Himachal Pradesh, Karnataka, Sikkim, Nagaland, Manipur, Mizoram, Meghalaya, Bihar, Orissa, and other Indian tea industries. All south-eastern countries contribute about 80 per cent of the world's total production. A group of Russian peoples in the sixteenth century, e.g. Cossack Atamans Petrov and Yaishev. By the way, after visiting China, they introduced tea. In 1638, the Mongolian Khan to Tsar Michael 1

donated a pack of four pods. According to Jeremiah Curtin in 1636, a sender named Vassili Starkov was sent with a gift of 250 pounds of tea to the ruler of the north eastern Altan Khan. This is a reason for the spread of tea in Russia. Russian people like tea too much because of the reason that Russia made a treaty with China to export tea regularly through Camels (Table 11).

Table 11: Area under Tea Cultivation and Production (2015-2016)

Sr.No.	State	Area (Th. Ha.)	Production (Million Tonnes)
1	Assam	307.08	652.95
2	West Bengal	140.44	329.70
3	Tamil Nadu	69.62	161.46
4	Kerala	35.01	56.63
5	Karnataka	2.22	6.46
6	Other	12.29	25.91
	Total	566.66	1233.14

Source: https://teacoffeespiceofindia.com/tea/tea-statistics

2) Cotton

Scientifically, Cotton is named *Gossypium arboretum* L. and it belongs to the Malvaceae family. It is the largest genus in the Gosspieae tribe because it consists of about 50 Gossypium species. In terms of area and production, India has the largest area under cotton cultivation. In terms of production after China and the USA, India holds the third position. The main growing season for cotton is Kharif and it is necessary for the growing season for cotton to mature between 6-8 months. Depending on the climate, the growing season, as well as the harvesting time of the cotton, varies from region to region. Deep black soils are best suited for the cultivation of cotton. Deep black soils are mainly found in the Deccan and Malwa Plateaus regions of Gujarat. The area under cotton cultivation increased very slowly from 1950 to 1961, and there was a record increase in the area under cotton cultivation in 1998-99, i.e. 7.6 million hectares to 9.3 million hectares. However, in the years 2001-2002, there was a sudden decrease in the area under cotton cultivation, i.e. from 9.1 million hectares to 7.6 million hectares. Cotton is a crop grown all over the world, not in India, but throughout the world. For the cotton textile industry, cotton produces raw materials such as cotton fiber.

Cotton Geographical Distribution

Cotton is the most important crop traded from ancient times to modern India. The cotton textile industry originated in the year 1818 A.D. Cotton textile industries are divided into four regions in India; the western, southern, northern, and eastern regions. The places named Arabia, Persia, and Baluchistan are the places from which cotton is extorted to India. One species of Cotton, called *Gossypium barbadense*, was initially known as wild, but after that, it evolved into a cultivated species. Cotton is also known as the King of Fibres and is a major industrial commodity in the world. Through the cultivation, trade, and processing of cotton, more than 60 million people earn their income as a source of livelihood. Due to various reasons, the cotton production system is in crisis. The main problems affecting the production of cotton are: 1) the price of the inputs used for the cultivation of cotton will increase daily; to make the cotton production system more cost-oriented. 2) Nowadays, the problem of insect pests and diseases is increased at a very high speed, so that the various kinds of insecticides, pesticides, and other chemicals are used to control the attacks of these farmers; while using this chemical farmer, the proper safety measures are not followed and the dose of the chemicals is also higher than the recommended dose. 3) There is also a problem with the deterioration of the genetic purity of the cotton cultivar.

Status of cotton production in the countries of India

All four cotton cultivars and their hybrids are grown in India alone. Three agro-ecological zones, known as the Northern Region (Punjab, Haryana, and Rajasthan), the Central Zone (Gujarat, Maharashtra, and Madhya Pradesh), and the Southern Region (Andhra Pradesh, Tamil Nadu, and Karnataka).

(1) Maharashtra

Out of the total production of Maharashtra, about 29.78 percent of cotton is produced. By producing that percentage of cotton, it is the highest cotton-producing country in India. Cotton production in Maharashtra is a traditional practice. Out of the total cotton production, some 80 percent of cotton is produced in the Yavatmal, Nanded, Amravati, Parbhani, Wardha, Jalgaon, Ahola, Buldhana, Nagpur, Dule district of Khandesh, Vidarbha, and Marathwada regions.

(2) Gujarat

In India, the second-largest cotton producer in Gujarat. Out of the total cotton production area, some 21.33% of the cotton-producing area is in Gujarat with a production potential of around 19.33%. The average cotton yield is approximately 1.8 quintals per hectare, which is almost equal to the average national yield. For cotton cultivation, the annual rainfall must be between 80-100 cm and the soil must be black. Of the total production in Gujarat, about two-thirds of the production comes from the plains of Gujarat. The plains of Gujarat are located in the districts of Bharuch, Surendemagar, Vadodra, and Ahmedabad, etc.

(3) Andhra Pradesh

With a production potential of 12.46 per cent of cotton in India as a whole, Andhra Pradesh is the third largest cotton-producing state in India. The area under Cotton production in Andhra Pradesh is approximately 10.47% of the total area in India. Guntur and Prakasam are the main cotton producers in Gujarat.

(4) Punjab

In 1991-1991, Punjab was the leading producer of cotton, but some years later, i.e. in 2012-03, the production of cotton in Punjab decreased from the first position to the fourth. Out of 5.86 per cent of the cotton area in Punjab, this state produces about 12.42% of the cotton yield in India. The best quality of cotton is known to be produced in Punjab for various reasons, i.e. soil is very fertile e.g. alluvial soils, Punjab has a proper irrigation channel network, and the Punjab farmer has used various kinds of chemicals in the production of cotton against insects, pests, and diseases.

In earlier times, only hybrid seeds are grown, but after the introduction of BT cottonseed, the production of cotton is enhanced because the BT cotton seed plant possesses the good quality to fight against various kinds of things, such as insect pest attacks. Bt cotton seeds did not require as much use of the chemical (mainly insecticides) as hybrids. It has been estimated that about 2,500-3,000 rupees per acre of money will be saved in cotton production when we choose BT cottonseed for production. Punjab produces about 10.83 lakh bales; one bale is about 170 kg of cotton. Approximately 95 per cent of the production in Punjab comes from the Malwa region of the state. Cotton is known as "White Gold" in this region.

5) Haryana

As regards the position based on cultivation, Haryana holds the fifth place in production by producing approximately 11.91 per cent of cotton from the area around 6.77 per cent of the total area under cotton cultivation in India. The major cotton-producing states in the Haryana are Hissar, Sirsa, and Fatehabad. These districts contribute about 80 per cent of the production of cotton in all the states of Haryana.

(6) Karnataka

The area under cotton cultivation in the state of Karnataka contributes to approximately 5.13 per cent of the total area of India where cotton cultivation is practised. Out of this 5.13 per cent of the area, it contributes to some 4.22% of the yield. The main area under cotton cultivation in the northern plateau of Karnataka. The districts responsible for the production of the main cotton-producing districts in Karnataka are Dharwad, Raichur, Bellary, and Gulberg, etc.

7) Rajasthan

Rajasthan is home to about 5 per cent of the country's cotton-grown area. It produces about 2.9% of the country's yield from that cultivated area. One district, called Ganganagar, produces about 80 per cent of the total state production.

8) Tamil Nadu

Tamil Nadu contributes 1.11 per cent of India's total cotton-producing area. That is 1.11 per cent of the area in which it produces about 1.55 per cent of the total production of the country. The main cotton-producing countries in Tamil Nadu are the following areas: Coimbatore, Salem, Madurai, Tiruchirapalli, Ramnthapuram, South Arcot, Chengalpattu, and Tirunelveli K. Bomman, etc.

(9) Madhya Pradesh

The average yield in the state of Madhya Pradesh is only 1.2-quintal hectares, i.e. very low in cotton production. In this state, more than 80 per cent of production comes from areas where lava soils are found. The main cotton-producing districts of Madhya Pradesh are East Nimar, West Nimar, Ujjain, Shajapur, Dewas, Dhar, Ratlam, Indore, and Bhopal, etc.

There are also other countries producing cotton, but the amount of production is very small. These states are as follows: Uttar Pradesh, Kerala, Orissa, Meghalaya, Mizoram, etc.

(3) Tobacco

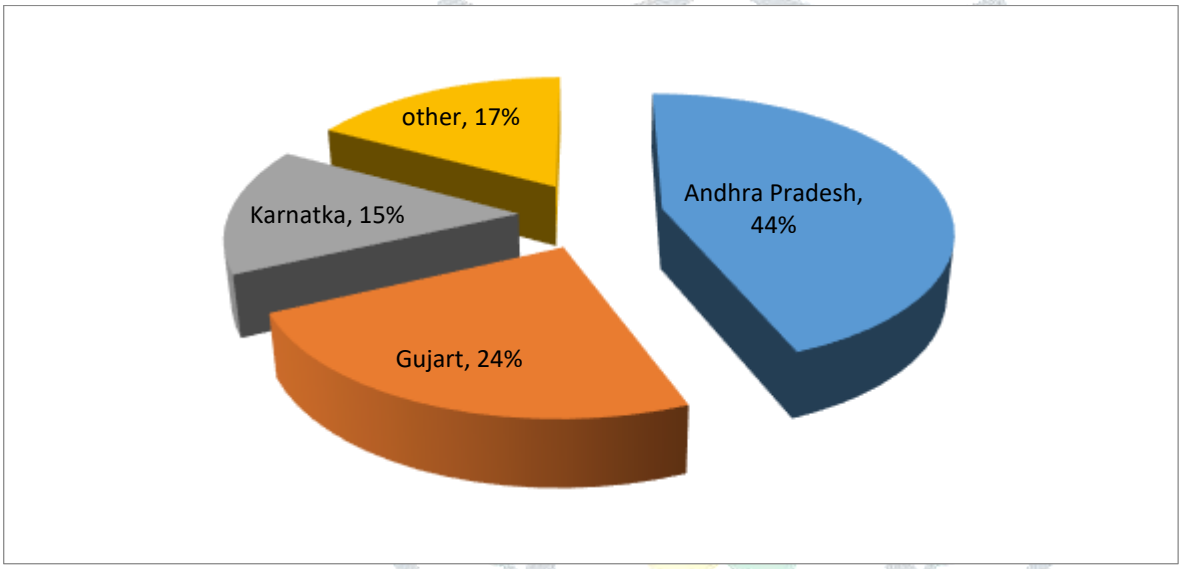
Scientifically, tobacco is known as *Nicotiana tabacum* and belongs to the Solanaceae family. Other than Nicotiana tabacum, there are more than 70 tobacco varieties grown worldwide. According to one survey conducted by GATS (Global Adult Tobacco Survey, 2016-2017), at least 30% of the Indian population uses tobacco. In the years 2013-2014, a national ban on the use of tobacco has been introduced because of this ban helping to reduce tobacco consumption by at least 20%. Tobacco is cultivated in India with an area of 0.45 m hectares. This area is equal to 0.31% of the net cultivated area of the country. Total tobacco production in the world is 7 billion kg, of which about 2.35 billion kg of tobacco is produced in China alone. Out of this amount of production, China is the world's leading producer of tobacco. After China, India holds the second position in terms of tobacco production and exports to other countries. Tobacco is considered the top crop in terms of revenue generation, i.e. it generates revenue of 13.853 corers. It also generates a good amount of annual foreign exchange revenue, i.e. 4,402 crores. In combination, it contributes to national income with a contribution of 18,255 crores. Apart from having all the negative effects of tobacco products, it contributes directly or indirectly to the generation of employment. About 36 million people are engaged or likely to be employed in tobacco production, processing, marketing, and exports. Thus, we can say that, directly or indirectly, tobacco helps to provide livelihoods for large sections of the population, mainly rural women, tribal women, and other vulnerable sections of society.

Tobacco Geographical Distribution

It was assumed that Columbus discovered tobacco in 1492. Tobacco is considered a crop native to America. Nowadays, this crop is grown all over the world. According to a scientist named **Killebrew and Myrick in 1897**, the first country to consume and grow tobacco in China, but to authorize this statement, they allow this statement to be authenticated. In other countries named the Caribbean, Mexico, and South America,

some evidence has also been found that convinces and encourages the use and production of tobacco in these countries. For the first time in the year, 1612 tobacco crops were grown for export in Jamestown, Virginia. By the year 1631, this activity of growing tobacco for export was extended to other places named Maryland. In 1605, the Portuguese are the first people to introduce tobacco to India. The introduction of tobacco by the Portuguese made it a success because tobacco production in India later takes a good speed. After that, India became a major tobacco-producing country and played a significant role in the export of tobacco to other countries. Nowadays, major tobacco-producing countries in India are Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttar Pradesh, and West Bengal. We can therefore recognize the Spaniards and the Portuguese for the spread of tobacco to other countries (figure 12).

Figure 12: Percentage Area occupied by different states of India



Source:https://www.who.int/tobacco/framework/cop/events/2007/india_case_study.pdf

(4) Sugarcane

Scientifically, sugar cane is known as *Saccharum officinarum*, is a perennial grass, and belongs to the Poaceae family. In 1912, the Sugarcane Breeding Institute was established in Coimbatore, India. The main objective of this sugarcane-breeding institute is to develop new sugarcane varieties that are good for producing higher yields in the different agro-climatic zones. There are three regional central sugarcane breeding institutes in different locations named Karnal (Haryana), Kannur, and Agali (Kerala). In the year 2017, sugar cane is the world's largest producing crop with a production potential of 1.8 billion tonnes. According to the Food and Agriculture Organization 2012, sugar cane is produced in more than 90 countries with a production area of approximately 26 million hectares. *Saccharum officinarum* is the main sugarcane variety responsible for the production of 70% of sugar worldwide.

Geographical distribution of the cane

Climate conditions such as tropical and subtropical regions are suitable for the production of sugar cane. Warm and humid climatic conditions are the main climatic factors suitable for the production of sugar cane. 30°N and south latitudes confined to sugar cane production. Mainly there are two centres for the domestication of the sugar cane; 1) one center for the domestication of the Peoples of New Guinea (Papuans) is for the sugar cane variety *Saccharum officinarum*. Another type of domestication is the *Saccharum sinense* variety produced by the people known as the Austronesia's, which belongs to Taiwan and southern China. Some of the major cotton-producing countries are Brazil, India, Thailand, China, Mexico, Cuba, etc.

1) Brazil

Brazil holds the first position in sugar cane production. In the year 1966-1997, Brazil alone accounted for about 324 million tonnes of sugar cane, which is equal to 27 percent of the world's production. By taking into account, an area of approximately 4.8 million hectares dedicated to sugar cane in Brazil. In Brazil, sugar cane is cultivated across the country, but most of the production comes from the three main regions of Brazil named as 1) Minas Gerais; 2) the coastal regions of Pernambuco, Alagoas, Paraiba, and Bahicaa; 3) the coastal regions of Rio de Janeiro. The area under cultivation of sugar cane in Brazil continues to grow day by day.

(2) India

In terms of sugar cane production, India holds the second position. The area under the production of sugar cane is 3.9 million hectares. Out of this area, India produces around 255 million tonnes, accounting for 21 percent of global production.

3) China

China is the fourth largest sugar cane-producing country in the world. In 1996, China produced about 55.6 million tonnes of sugarcane, which accounts for almost 5 % of the world's production. The cultivation of sugar cane is well known in the south-eastern part of China. The main districts producing sugar cane in China are Fukien, Humans, Kiangsu, etc.

(4) Cuba

Cuba holds good status for the export and import of sugar cane. Some studies have shown that the economy of the whole country depends largely on the production of sugar cane. In Cuba, the area under cultivation accounts for almost 3.4% of the total global area. Of this amount, Cuba contributes some 40 million tonnes of sugar cane production. In 1996, it was observed that Cuba held the sixth position in the sugarcane production sector.

(5) Rubber

Scientifically, rubber is known as *Hevea brasiliensis* and belongs to the Euphorbiaceae family. It is considered to be the most important and economical crop in the Hevea genus. Rubber is used as a raw material

to make a variety of things, i.e. Tires and tubes, also used in an electrical wire as an insulator, for the manufacture of erasers and gum, used in eater-proof materials help in the manufacture of shoes as well as in the manufacture of sports goods, etc.

The Geographic Distribution of Rubber

Initially, the rubber plantation is started or the native rubber plantation is planted in the Amazon rainforest in South America. However, by the end of the 20th century, the Rubber Plantation in the region of South America is ending due to the attack on the disease called Blight caused by the host named Ascomycetes microcycles. However, at that time the cultivation of rubber has spread to many parts of the world. However, native rubber cultivation is not practiced in other parts of the world. Now, most of the rubber requirements of the day are being met by the South and South Asia parts of the world. Other countries producing rubber are:

1) Brazil:

Brazil has a leading position in the production of Rubber all over the world. Initially, we know that the native Rubber plantation occurred only in the Amazon basin. Nevertheless, in the year 1910, the country named Brazil took full control of the production of rubber. However, after a few years later, the rubber seed was transported to Malaysia. So, after Malaysia starts taking the lead in cotton production that is the main reason why Brazil's rubber market is declining. There are also several reasons to disturb Brazil's Rubber market, i.e. The location of the rubber plantation is very scattered, some forest areas are inaccessible, in the forest.

2) Thailand:

The cultivation of Rubber in Thailand has recently begun. However, in the 1990s Thailand produced a very high amount of rubber in the years 1996-1997 Thailand produced about 1.75 million tonnes of rubber. The main growing area of rubber is the southern part of the country. This amount of production is equal to 28% of global production.

3) Indonesia:

Thailand holds the second position in terms of production. It contributes to around 28 percent of global production by producing approximately 1.33 million tonnes of rubber. In Indonesia, Dutch planters are the people that started the production of Rubber. In the year 1990, Indonesia took second place in terms of production by suppressing the production of Malaysia. Java, Sumatra, and Borneo Island of Indonesia are the main regions producing the most Rubber.

(4) Malaysia:

In the twentieth century, Malaysia was considered a global leader in rubber production. In recent years, however, two countries named Thailand and Indonesia have produced a very high level of production, which has dropped Malaysia's first position to third. Nowadays, Malaysia is contributing about 16 percent of the total

geographical production to purchase 1.01 million tonnes of Rubber per year. Despite the decline in rubber production, the rubber plantation in Malaysia is well-coordinated and organized.

Geographical distribution of medicinal products and aromatics

Medicinal plants are those plants that are used for the preparation of medicinal products of a kind. Various plants, such as plant leaves, plant bark, seeds, and flowers, as well as plant roots, are used in the preparation of the medicinal product. The forest area is the main source of the medicinal plant. Among all the civilizations of ancient India, it is a country known as rich in medicinal plants. WHO has stated that around 21,000 plant species are found worldwide and have the potential to be used as medicinal plants. The WHO also notes that around 80 percent of the world's population depends on medicinal herbal medicines. The use of a medicinal plant in the manufacture of medicinal products is higher in developing countries than in developed countries. The use of medicinal pant base medicines is considered safe for both humans and animals without negative effects. The main crop used as the main source for the production of medicinal products is as follows (table 12)

Table 12: State wise area and production of Aromatic and medicinal plant in India

Sr. No.	States	Area(000'ha)	Production(000't)
1	Andhra Pradesh	2.47	1.18
2	Arunachal Pradesh	0.46	0.99
3	Assam	4.43	0.17
4	Bihar	4.5	0.6
5	Chhattisgarh	8.54	60.39
6	Karnataka	2.38	16.56
7	Madhya Pradesh	72.9	502.07
8	Mizoram	0.93	0.9
9	Odisha	1.92	0.+61
10	Punjab	12.52	2.43
11	Rajasthan	401.10	195.2
12	Tamil Nadu	11.92	175.15
13	Uttar Pradesh	135.04	13.53

14	Others	1.87	1.87
	Total	664.16	971.65

Source: Source:https://www.who.int/tobacco/framework/cop/events/2007/india_case_study.pdf

(1) Mint:

The scientific classification of Mint, the genus of men, is made up of many species. These cultivars are more efficiently cultivated, such as spearmint, Menthaspicata, menthe x Piperita and peppermint. Peppermint is a cross between spearmint and water mint, water mint. However, the first introduced peppermint was distinguished as a species, but still most commonly known as a hybrid. It is usually referred to as the mint family. The family consists of 260 genera and 3200 species of global distribution. However, there are 400 mentha species in India.

Description of the Mint

Mint plants usually grow 1-2 feet long and emit a fresh aroma. The leaves and stem of the mint seem to be slightly hairy. The leaves are usually one-and-a-half to three-and-a-half inches long and one-and-a-half inches wide. In its appearance, the peppermint has purple flowers. This mint is best suited for oil extraction and can be extracted from various plants. The oil is also used for medicinal and other culinary purposes. However, when placed over the tongue, it seems to produce a hot tingly sensation that gives a cooling feeling later on. This cooling feeling is due only to menthol, which makes up the majority of the chemical composition of the essential oil extracted from the plant. Peppermint oil was reported to have been made up of 59.17% of menthol. The essential oil content can also be obtained from spearmint. It is therefore low potent than the essential oil of the peppermint and is mainly used for cooking purposes.

Geographic Distribution

Peppermint and spearmint are the most common type of mint. They are mostly growing commercially in many countries, such as Southern California, Michigan, Northern Indiana, the Pacific Northwest, as well as in Europe and other areas, usually along with a bank or in waste areas with a damp soil surface. The most famous location in Michigan, USA, for the production of peppermint oil. Mint history is introduced in the Mediterranean Sea and later originated in Britain and the Americas of ancient times. Eventually, the Greeks used this peeled aroma as a perfume by rubbing it on their arms. The Romans and the Greeks used peppermint in their meals and used it as a flavoring in sauces, as a perfume in wine, and as a decoration for tables. Besides, it has been cultivated in the American Garden for many years and is so universally valued that it appears to be found in the wild in almost all the countries by which the use is extended.

(2) Celery

This review focuses mainly on the origin, geographical distribution, physiological and morphological characteristics, and on the cultivation of different crops such as celery (*Apium graveolens*) and medicinal plants

in India. Information on post-harvest handling and processing, as well as different uses of celery in the pharmaceutical and food industries.

The pharmacological properties of medicinal plants and their different chemical nature, as well as the different products of plant origin, are found in the chemical constituents of which they are made up. However, in many cases, the main objective of the phytochemical determination of plants and natural products is to determine the isolation of the products, the characteristics of those products, and to identify which family they belong to. The celery plant belongs to the family of the Apiaceae. *Apium graveolens* (Celery plant) is an indigenous plant used for aphrodisiac, antispasmodic, carminative, diuretic, emmenagogue, laxative, sedative, stimulant, and toxic purposes. Celery is also known as a mild diuretic and urinary antiseptic, as well as relief and some pain. In the present review, the data shows that *A. Gravilins* have many pharmacological properties as an antifungal, antihypertensive and also hypolipidemic, diuretic, anticancer and have more medicinal plants defined as medicinal products that are widely used in traditional cultures all over the world and are now increasingly popular in modern society as an alternative to synthetic chemicals.

The four widely known celery type of horticulture:-

Apiumgraveolens, Apiumrapaceum, Apiumsecalinum, Apium

Commercial celery is found as celery seed, celery flakes, vegetables, celery seed, and celery oleoresin seed. Celery seed is one of the least known herbs in western herbal medicine in India. It has been used for several years. Celery is a highly nutritious drink from celery. The celery plant consists of being more nutritious with beneficial acids, vitamins, and nutrients that are beneficial to the human diet. However, celery juice provides more nutritional value and is a highly preferred health-conscious patient in both developed and developing countries. However, celery juices offer many health benefits, such as improving blood pressure, fighting cancer, neutralizing acidity, and treating inflammation. Celery juices, when added with other types of juices, could be a beneficial health drink due to their different health benefits.

3) Amla

Species of amla: Phyllanthusemblica Linn. *Emblica officinalis*

Family: Euphorbiaceae

English name: Indian gooseberry, Embolic

Indian name: Dhatri, Amlaka, Adiphala (Sanskrit) Amla, Amlika, Aonla (Hindi) Nelli, Malanelli (Tamil) Amalakkamu, Usirikai (Telugu) Amalak, Bettadanelli (Kannada) Amali, Ambala (Guajarati) Amla, Amlaki (Bengali) Nelli (Malayalam)

Emblica Officinalis (EO) plays an important role in Ayurveda- also it is an Indian indigenous system of medical science. Eventually, it is important in ancient Indian mythology, and it is to be the first plant introduced on the earth. Amla belongs to the family Euphorbiaceae. The other name of Amla is Phyllanthus, Emblica, or

Indian gooseberry. Other names of Amla are Amaliki, Vayastha, Amalakan etc. Amla is grown in many countries tropical and subtropical regions consisting of Pakistan, Srilanka, South East Asia, China, and Malaysia. It has its more beneficial role in the treatment of cancer, diabetes, liver treatment, heart trouble, ulcer, anemia, and different other diseases. Accordingly, it is having the property of antioxidant, immune modulator, analgesic, gastro protective. All over the country, there is a huge demand to develop medicinal plants for health care and biological activity and the most common herbs is *Emblica officinalis* commonly known as amla.

Geographical Distribution

Emblica Officinalis genus. Phyllanthus (Euphorbiaceae) is normally distributed in most tropical and subtropical countries. It is normally grown in tropical and subtropical parts of China, India, Indonesia, and on the Malay Peninsula and indigenous to tropical and southeast Asia.

Medicinal Properties and uses

It an important crop in the field of Ayurveda.

The fruit has a rich source of vitamin C (700 mg per 100g of fruits)

Product preparation by using Amla: Chyawanprash, Triphalachura (Mixture of amla, Terminalia chebula, and T.bellerica) Brahma Rasayana, Madhu Megha Chura.

Medicinal properties: Ant scorbutic, diuretic, laxative, antibiotic, and anti-dysenteric. Phyllemblin, obtained from the fruit pulp.

3) *Aloe Vera*

It was considered that *Aloe Vera* originated from the Arabian Peninsula, but it has been observed that tropical, semi-tropical, and arid climates around the world are the areas from which the cultivation of Aloe Vera has been practiced. *Aloe vera* is cultivated as a medicinal crop in agriculture. *Aloe vera* extract is most commonly found in a variety of products called Skin Lotion, Ointment, or other gels used to treat burn lesions. It is also used in some of the clinical products referred to as cosmetic products.

Geographic Distribution

It was assumed that the majority of the Aloe species occurred naturally in the areas of mainland Africa as well as in the tropical and subtropical latitudes. The Genus was considered to have spread throughout the southern regions of the African continents, including the Sahara Desert. In the 17th century, the species Aloe Vera was introduced to China, South Europe, and other parts of the world. According to a scientist named **Reynolds (1966), the species named Aloe Buettner (1966)** is considered the most widespread crop, i.e. the distribution of Aloe buettneri species is 5.600 km long. The spread of other species named Aloe myriancantha is 4.800 km long, i.e. from Kenya to Uganda to the Republic of South Africa. Mainly Aloe vera contains two types of substances called yellow latex and one is a clear gel. These substances are used in the manufacture of various types of commercial products.

Geographical distribution of Condiments and Species

Species are the substances used to enhance the taste of food. We can use different parts of the plant as a species, such as the roots of the plant in a dried form, the seeds of the crushing plant as well as the whole seed as it is. We also convert the part of the plant to powder form. Condiments, on the other hand, are those substances that have been added as "extra" to food products. It also helps to add flavor to the food. Species are the substances that are used in conjunction with food preparation. However, on the other hand, condiments are the substances used as table substances to enhance the dishes according to the preference of salt.

Significance of species and Condiments

The specific flavor, taste, and aroma of the species and the condiments play an important role in human life. Various types of active ingredients are available, such as phthalides, polyacetylenes phenolic acids, flavonoids, coumarins, triterpenoids, roles, and monoterpenes, etc (table 13).

Table 13: State wise area and production of Condiments plant in India

Sr. No.	State	Production (000' metric tones)
1.	Madhya Pradesh	3010.17
2..	Rajasthan	930.86
3..	Gujarat	837.6
4.	Andhra Pradesh	765.26
5.	Karnataka	712.4
6.	Telangana	640.91
7.	West Bengal	341.61
8.	Orissa	293.85
9.	Uttar Pradesh	285.49
10	Maharashtra	211.49
11.	Kerala	191.33
12.	Tamil Nadu	172.62

Source: State wise area and production of Condiments and Species plant in India 2020

Production of species

1) Fenugreek:

Botanically, it is known as *Trigonella foenum-graecum L*. and belongs to the Fabaceae family. The main reason why this crop is cultivated is its seeds, fresh leaves, and tender shoots. In India, these annual crops are widely grown. The preferred climatic condition for the good growth of the Fenugreek is as follows; precipitation should be low or moderate, i.e. more rainfall is not good for the growth of the Fenugreek. The climate must be cool but without the presence of extreme temperatures. It is grown in countries such as India, Egypt, Spain, Turkey, Ethiopia, Kenya, Israel, Morocco, etc. The main country of Fenugreek in the world is India. Approximately 68% of production worldwide is carried out by India. According to **NBH (2009),** Fenugreek is produced in an area of approximately 68,290 kg/ha in India. Out of this area, India produces about 76,580 metric tonnes of production. According to other scientists named **Altunatas, Ozgoz and Faruk Taser (2005)** stated that some 700 hectares of fenugreek are cultivated in Turkey. It has about 670 tonnes of fenugreek seed from that area. Several studies have shown that fenugreek is grown in several countries, but the main fenugreek-producing countries are as follows: India, Ethiopia, Egypt, and Turkey.

2) Turmeric

Scientifically turmeric is known as *Curcuma longa* and belongs to the Zingiberaceae family. Turmeric has been used in a variety of beauty products, as well as in medicines. Not only has the Indian people's turmeric been used throughout the world in different parts of the world. It was considered that Buddhist monks had to wear turmeric while travelling to die their robes. The Indian Ayurvedic turmeric holds an important part because of its various advantages.

Origin and Geographic Distribution

The south or south-eastern part of Asia, mainly the Indian turmeric known to originate from that place. Turmeric is not a true wild crop because it occurred in some places in natural ways. Turmeric production is practiced in all the states of India. Mainly in India, Tamil Nadu, West Bengal, and Maharashtra are the major turmeric-producing countries. Red and light black clay loam are the most preferred soil for the cultivation of turmeric. The major producing countries are India, China, Haiti, Jamaica, Peru, Pakistan, Bangladesh, and Thailand. In the pharmaceutical industry, turmeric is used as the main colouring agent or as a dye in textiles and confectionery as a pH indicator.

3) Cumin

The scientific name for cumin is (*Cuminum cyminum*). The cumin is an annual herb and the cumin plant belongs to the Apiaceae, also known as the Umbelliferae family. The origin of cumin is from East Mediterranean to South Asia, but now cumin is growing around the world for its useful aromatic seeds. Cumin has been found to have many pharmacological properties such as anti-diabetic, immune modulatory, anti-microbial, anti-fungal, analgesic, anti-osteoporotic, hepato protective, anti-inflammatory, anti-stress, anti-

asthmatic, anti-infertility, dietary fiber, anti-cancer, blood circulation, anti-tissues, and also ophthalmic effects due to different chemical compositions. It consists of 2.5 to 4.5 percent of volatile oil content, 10 percent of oil content, and protein content. This volatile oil content consists mostly of 30-50 percent cumin aldehyde and is composed of cumin, which is best suited for medical purposes. The only species-genus, cumin, depends entirely on the source of the seed. Cumin seeds are used for a variety of purposes, such as those used in kitchens. Some aromatic constituents are present in these herbs and draw the attention of many researchers around the world to the experimental determination of the therapeutic uses of cumin seeds documented in various indigenous healing systems. A brief physical and chemical description of the cumin is provided. The chemical structure and physiological properties are also indicated.

Geographical distribution of cumin in the global scenario

Cuminum cyminum is an annual plant. World production is estimated to be around 300,000 tonnes. Nowadays, however, cumin production is mainly concentrated in Central and South Asia. In recent studies, however, India is the largest producer (70 percent of world production), as well as the exporter and consumer of cumin seeds in the world. India's scenario: India holds a leading position in the major production of Cumin. Rajasthan produces approximately 56 percent cumin seed, while Gujarat production contributes 44 percent. Cumin was native to Egypt and has been cultivated in the Middle East, India, China, and the Mediterranean for millennia. Cumin plants were mainly produced in the Mediterranean area, along with Egypt and Syria. It has recently been widely cultivated in Turkey, India, China, Iraq, Libya, and Palestine. Iran was the largest exporter of cumin to the United States in the previous study. Moreover, Turkey, India, and China have recently offered alternatives. Now the largest producer of cumin from India (States of Rajasthan and Gujarat) has been recorded.

4) Cardamom

The scientific name of Cardamom (*Elettaria cardamomum*) is also called Elaichi (Green Cardamom) and spelt Elaichi. Cardamom is beneficial for all digestive systems, cough, respiratory system, kidneys, blood, heart, and skin problems. Cardamom is commonly found as an ayurvedic medicine that is also helpful in the treatment of various organ diseases. Cardamom (*Elettaria cardamom*) is a perennial herb, pungent, aromatic, and herbaceous. The height of the cardamom plants is up to 2-4 m from which the spice is extracted.

The two main types of cardamom are:

The true and green cardamom (or white cardamom when bleached) and comes from the species (Elettaria cardamom) and is distributed from India to Malaysia. Another type of cardamom is often referred to as white cardamom, Siam cardamom, *Amomum krervanh.*

The second most important type of cardamom is the black cardamom, also known as brown, larger, longer, or Nepal cardamom, which comes from the species *Amomum subulatum* and is native to the eastern Himalayas and is mainly cultivated in eastern Nepal, Sikkim, and parts of the Darjeeling district in western Bengal India and southern Bhutan.

Geographical distribution and habitat of cardamom

Cardamom (*Elettaria cardamomum*) is an herb plant distributed throughout Iran, India, and Malaysia. We can obtain cardamom or true cardamom from this study of the plant.

Description of the cardamom plant

The cardamom plant is a perennial herb, pungent, aromatic, up to 2-4 m tall. Cardamom plants with two alternative leave in two rows, linear-lanceolate, 40-60 cm long, with a long pointed tip. The flowers of the cardamom plant are white to lilac or pale purple, with a loose end of 30-60 cm in length. The fruit, however, is a three-sided yellow-green pod, about 1-2 cm long, consisting of between 5 and 20 black and brown seeds.

These two types of cardamom differ from the father of botany, Theophrastus, in the 4th century. Theophrastus and other scientists know that these cultivars were originally and exclusively native to India.

The main symptom of the use of Elaichi is a burning sensation. However, these cardamom species can be used for several types of burning sensation diseases that present symptoms. Besides, as compared to other herbs, cardamom also relieves various diseases such as Sore Throat, Cough, Cold, Bleeding Disorder, Excessive Urination, Heart Disease, Asthma, Urinary Retention, Common Cold, Flu, Leucorrhea, Headache, Nausea, and Vomiting, Urticaria

Cardamom medicinal benefit and use

Cardamom (Elaichi) is known for its pleasant aroma and taste, medicinal properties, so it is commonly used to add flavor to food. It helps to provide relief from swelling of the mouth, bad smell of the mouth, stomach aches, and aphrodisiacs. It also provides immunity in the human body and provides lung strength; it is also used for chronic cough and cold, chest pain, purulent cough, and chronic bronchitis.

Cardamom increasing appetite, and low burning sensation, also increasing well-being. Cardamom tea is also used to boost immunity and tonic health.

(5) Black Pepper

The scientific name of black pepper (*Piper nigrum L.*) is also known as pepper, black pepper is a perennial plant with a climbing vine. Black pepper belongs to Piperaceae, and black pepper is a pungent spice made from its fruit. Black Pepper is almost native to the Malabar Coast of India, and black pepper is known as the oldest spice in the world. This spice is used worldwide, with limited use in medicine for carminative (to relieve flatulence) and gastric stimulating secretions. In the history of black pepper, it has been widely grown in the tropics of Southeast Asia, making it a condiment in spices.

Geographical distribution of black pepper chili

The main distributor of black pepper in Europe and its nominal virtual monopoly of trade, which helps to stimulate the search for the eastern route. An enormous amount of black pepper has been cultivated

throughout Indonesia and has developed into tropical areas of Africa and the entire western hemisphere. Black pepper is also known as the "King of Spices" (*Piper nigrum*) and black pepper is a perennial tropical crop. Black pepper is the most important and widely cultivated spice in the world. To know its better bioclimatic distribution, more entropy based on ecological modelling has been used to model the bioclimatic ranges of the species in its Asian range. However, based on the occurrence of bioclimatic areas with more probabilities, the majority of them are located on the eastern and western coasts of the Indian Peninsula, east of Sumatra Island, few areas in the Malaya Archipelago and south-eastern coasts of China. Few unforeseen places have also been documented as better areas.

The black pepper plant is a woody climber with an altitude of about 10 m, 33 feet using its aerial roots. The black pepper leaves are shiny green leaves, which are alternately arranged. The small black pepper flowers are dense, slender spikes of about 50 flowers per plant. The fruits of black pepper are sometimes called peppercorns, the drupes are about 5 mm (0.2 inches) in diameter. The black pepper seeds are yellowish red when ripe and bear a single seed. The shape of the black pepper seeds is round, black in color, and contains up to 3% of the essential oil, which gives the aromatic taste of Capsicum peppers but does not produce any pungency. The chemical present in black pepper is piperine, through which the seeds also contain chavicin, piperidine, and piperidine. The *Piper nigrom L.* It is the commercially and medicinally most important member of the genus Piper (Piperaceae). This species is known to be black pepper because of the color of its peppercorn, and it is known as the "King of Species" because of its large share of trade in the international market **(Mathew et al., 2006; Srinivasan, 2007).** Black pepper fruit consists of 1.0-2.5 percent of volatile oil and 5-9 percent of alkaloids.

Conclusion

From that whole literature, we can conclude that that different crop is first time domesticated in different places and afterward as time passes then according to the time these seed of planting materials are transported to other countries along with the traders. Now a day's great conflicts are going on with the origin of the particular plant species. However, on the basis, authenticated data on the geographical distribution and the regional climatic conditions these conflicts are solved.

Reference

Åberg, E. 1938. *Hordeumagriocrithon* nova sp., wild six-rowed barley.

Ahmad, F., and Slinkard, A.E. 1992. Genetic relationships in the genus Cicer L. as revealed by polyacrylamide gel electrophoresis of seed storage proteins. Theoretical and Applied Genetics, 84: 688-692.analysis of the accession of *Trigonellabalansae. New Zealand Journal of Agricultural Research* 49:55–58.*Ann. R. Agric. Col. Swed.* 6:159–216.

Bellon MR (1996) The dynamics of crop infraspecific diversity: a conceptual framework at the farmer level. Econ Bot50:26–39.

Betts, R. A. (1999), The impact of land use on the climate of present-day, in Research Activities in Atmospheric and Oceanic Modelling: CAS/JSC WGNE Report, edited by H. Richie, pp. 7.11 – 7.12, World Meteorol. Org., Geneva.

Bonnemaison L. 1957. Le charan~on des siliques (CeutorhynchusassimilisPayk.) biologieetmCthode de lutte. Annales des Epiphytes 4 : 387-543

Bothmer, R. von, and N. Jacobsen. 1985. Origin, taxonomy, and related species. Pp. 19–56 *in* D. C. Rasmusson, ed. Barley. American Society of Agronomists, Madison, Wis.

Bounoua, L., R. DeFries, G. J. Collatz, P. Sellers, and H. Khan (2002), Effects of land cover conversion on surface climate, Clim. Change, 52(1 – 2), 29 – 64.

Boutler D, Thurman DA, and Turner BL. 1966. The use of disc electrophoresis of plant proteins in systematics. Taxon 15: 135–143.

Brovkin, V., A. Ganopolski, M. Claussen, C. Kubatzki, and V. Petoukhov (1999), Modelling climate response to historical land cover change, Global Ecol. Biogeogr., 8(6), 509 – 517.

Brush SB (2004) Farmers' bounty: locating crop diversity in the contemporary world. Yale University Press, New Haven.

Buurt GV, 1999. Vijfhonderdjaarnatuur op Curacao, verleden, hedenentoekomst. In: Veranderd Curacao. Bloemendaal, Netherlands: StichtingLibriAntilliani, 87-121

Cao, M., K. Gregson, S. Marshall, J. B. Dent, and O. W. Heal (1996), Global methane emissions from rice paddies, Chemosphere, 33(5), 879 – 897.

Cooper P, Rao KPC, Singh P, Dimes J, Traore PS, Rao K, Dixit P, Twomlow SJ (2009) Farming with current and future climate risk: Advancing a "Hypothesis of hope" for rainfed agriculture in the semi-arid tropics. Journal of SAT Agriculture Research #7 Coviella CE, Trumble JT (1999) Effects of elevated atmospheric carbon dioxide on insect-plant interactions. conservation 13:700–712

CUBERO JI. 1981. Origin, taxonomy, and domestication. In: Webb C, Hawtin G [eds.], Lentil, 15–38. C.A.B., Landon, UK.

De Candolle A (1892) Origin of cultivated plants. D.A. Appleton & Co., New York

Deacon J, 1986. Human settlement in South Africa and archaeological evidence for alien plants and animals. In: Macdonald IAW, Kruger FJ, Ferrar AA, eds. The Ecology and Management of Biological Invasions in Southern Africa. Cape Town, South Africa: Oxford University Press, 3-19

Dmoch J. 1965. The dynamics of a population of the cabbage seedpod weevil (CeutorhynchusassimilisPayk.) and the development of winter rape. Part I. EkologiaPolskaSeriaA 13: 249-87

Dmoch J. 1965. The dynamics of a population of the cabbage seedpod weevil (CeutorhynchusassimilisPayk.) and the development of winter rape. Part I. EkologiaPolskaSeriaA 13: 249-87

Dosdall LM, Dolinski MG. 2001. Biology and control of the cabbage seedpod weevil, a new pest of canola in Alberta. Alberta Agriculture, Food and Rural Development Technical Report

Dosdall LM, Moisey D, Circamo H, Dunn R. 2001. Cabbage seedpod weevil factsheet. Alberta Agriculture, Food and Rural Development Agdex 622-21

Duke, A. J. 1986. *Handbook of legumes of world economic importance.* New York: Plenum Press.

Dundas, I.S., R. M. Nair, and D.C. Verlin. 2006. First report of meiotic chromosome number and karyotype

FAO (Food and Agriculture Organization of the United Nations). 1995. Sorghum and millets in human nutrition. FAO Food and Nutrition Series No. 27. Rome: FAO.

FAO. 2011. Statistical database. Available at: http://www.fao.org

Fedoroff NV, Battisti DS, Beachy RN, Cooper PJM, Fischhoff DA, Hodges CN, Knauf VC, Lobell D, Mazur BJ, Molden D, Reynolds MP, Ronald PC, Rosegrant MW, Sanchez PA, Vonshak A, Zhu JK (2010) Radically rethinking agriculture for the 21st century. Sci 327:833–834

Fedoroff NV, Battisti DS, Beachy RN, Cooper PJM, Fischhoff DA, Hodges CN, Knauf VC, Lobell D, Mazur BJ, Molden D, Reynolds MP, Ronald PC, Rosegrant MW, Sanchez PA, Vonshak A, Zhu JK (2010) Radically rethinking agriculture for the 21st century. Sci 327:833–834

*foenum-graecum*L. from various production locations. *Journal of Plant Research & Environment* 9(4): 53–54.

for southeastern Australia. Biennial Report 1998–99. Joint Center for Crop Improvement, Private Bag260, Horsham, Victoria, 3401, Australia, p. 15.

Frankel OH, Brown AHD, and Burdon JJ. 1995. The conservation of plant biodiversity. Cambridge University Press, Cambridge.

Frankel OH. 1984. Genetic perspectives of germplasm conservation. In: Arber W, Licensee K, Peacock WJ, Starlinger P [eds.], Genetic manipulation: impact on man and society, 161–170. Cambridge Univ. Press, Cambridge.

Freier B, Triltsch H (1996) Climate chamber experiments and computer simulations on the influence of increasing temperature on wheat-aphid-predator interactions. Aspects of Applied Biology 45:293–298

Geisenberg, C. and K. Stewart (1986), "Field crop management", in Atherton, J.G. and J. Rudich (eds.), The Tomato Crop: A Scientific Basis for Improvement, Chapman & Hall, London, pp. 511-557.

Goudie, A. (2000), The Human Impact on the Natural Environment, 5th ed., MIT Press, Cambridge, Mass.

Harlan J (1975) Crops and man. American Society of Agronomy Madison, Wisconsin

Harlan, H. V. 1931The origin of hooded barley. *J. Hered.* 22:265–272.

Hawkes JG (1983) The diversity of crop plants. Harvard University Press, Cambridge.

Heun, M., R. Schäfer-Pregl, D. Klawan, R. Castagna, M. Accerbi, B. Borghi, and F. Salamini. 1997. Site of einkorn wheat domestication identified by DNA fingerprinting. Science **278**:1312–1314.

Howard, M. 1987. *Traditional folk remedies. A comprehensive herbal.* London: Century Hutchinson Ltd.

Huang, W. Z., and X. Liang. 2000. Determination of two flavone glycosides in the seeds of *Trigonella*

ICAR (Indian Council of Agricultural Research). 2006. Annual report. New Delhi, India: Krishi Bhavan.

ICRISAT (International Crops Research Institute for Semi-Arid Tropics). 1998. Annual report. Patancheru, Andhra Pradesh, India: ICRISAT.

ICRISAT. 1994. Cold-tolerant chickpea varieties ICCV 88503, ICCV 88506, and IC.CV 88510. Plant Material Description no. 53. ICRISAT, Hyderabad, India.

ICRISAT. 1994. Cold-tolerant chickpea varieties ICCV 88503, ICCV 88506, and IC.CV 88510. Plant Material Description no. 53. ICRISAT, Hyderabad, India.

In *Proceedings of 9th Australian Agro Conference*, 1998. Wagga Wagga, Australia. 2006. Fenugreek has a role in southeastern Australian farming systems. *Proceedings "Groundbreaking*

J.B. Killebrew and H. Myrick Tobacco Leaf, Its culture endure, Marketing and Manufacture, P. 506, Orange Judd, New York,1897.

Jarvis D, Brown A, Cuong P, Collado-Panduro L, Latournerie-Moreno L, Gyawali S, Tanto T et al (2008) A global perspective of the richness and evenness of traditional crop variety diversity maintained by farming communities. ProcNatlAcadSci USA 105:5326

Katz, Solomon H. Encyclopedia of Food and Culture. New York: Charles Scribner, 2003.

Kholová J, Hash CT, Kakkera A, Kocová M, Vadez V (2010a) Constitutive water-conserving mechanisms are correlated with the terminal drought tolerance of pearl millet (Pennisetumamericanum L.). J Exp Bot 61:369–377

Kiple, Kenneth F. and KriemhildConee Ornelas. The Cambridge World History of Food. New York: Cambridge University Press, 2000.

Klein Goldewijk, K. (2001), Estimating global land-use change over the past 300 years: The HYDE Database, Global Biogeochem. Cycles, 15(2), 417 – 433.Reference

Kozlowski MW, Lux S, Dmoch J. 1983. Oviposition behavior and pod marking in the cabbage seed weevil, Ceutorhynchusassimilis. EntomologiaExperimentalisetApplicata 34: 277-82

Kraft KH, Brown CH, Nabhan GP, Luedeling E, Luna Ruı´zJ, Coppensd'Eeckenbrugge G, Hijmans RJ, Gepts P (2014)Multiple lines of evidence for the origin of domesticated chili pepper, Capsicum annuum, in Mexico. Proc Natl AcadSci USA 111:6165–6170.

Ladizinsky G. 1979. The origin of lentil and wild gene pool. Euphytica 28: 179–187.

Laghetti G, Pienaar BL, Pasdulosi S, and Perrino P. 1998. Ecogeographical distribution of Vignasavi in southern Africa and some areas of the Mediterranean basin. Plant Genetic Resources Newsletter 115: 6–12.

Larry, R. and L. Joanne (2007), "Genetic resources of tomato", in: Razdan, M.K. and A.K. Mattoo (eds.), Genetic Improvement of Solanaceous Crops, Vol. 2. Tomato, Science Publishers, Enfield, New Hampshire.

Lloyd, J., and G. D. Farquhar (1994), 13C discrimination during CO2 assimilation by the terrestrial biosphere, Oecologia, 99, 201 – 215.

McCaffrey JP. 1992. Review of US canola pest complex: cabbage seedpod weevil. pp 140-3 in Proceedings of the 1992 US Canola Conference, Washington, DC, 5-6 March 1992. Memphis, Tennessee: American Pedigree Seed Co.

McCormick, K. M., R. M. Norton, and H. A. Eagles. 1998. Evaluation of a germplasm collection of fenugreek.

McCormick, K. M., R. M. Norton, H. A. Eagles, and J. F. Kollmorgen. 2000. Fenugreek studies on a new crop

McLeod JH. 1962. Cabbage seedpod weevil-Ceutorhynchusassimilis (Payk.) Curculionidae. pp 5-6 in JH McLeod, BM McGugan, HC Coppel (Eds), A review of the biological control attempts against insects and weeds in Canada. Farnham Royal, Bucks, England: Commonwealth Agricultural Bureaux (CAB) Moss EH. 1959. Flora of Alberta. Toronto, Ontario: University of Toronto Press

Meyer, W. B., and B. L. Turner II (Eds.) (1994), Changes in Land Use and Land Cover: A Global Perspective, Cambridge Univ. Press, New York

Mudd A, Ferguson AW, Blight MM, Williams IH, Scuba P, Solinas M. 1997. Extraction, isolation, and composition of oviposition-deterring secretion of cabbage seed weevil Ceutorhynchusassimilis. Journal of Chemical Ecology 23: 222740

Natural Database. 2010. Natural medicines comprehensive database of fenugreek. http://www.naturaldatabase.com/(S(we44ty55dms1i0552j50us2h))/nd/Search.aspx?cs=&s=ND&pt=9&Product=fenugreek&btnSearch.x=10&btnSearch.y=6 (24.05.2010)

Nesbitt, M., and D. Samuel. 1996. From staple crop to extinction? The archaeology and history of the hulled wheat. Pp. 41–100 *in* S. Padulosi, K. Hammer, and J. Heller, eds. Hulled wheat (Proceedings of the First International Workshop on Hulled Wheat). International Plant Genetic Resources Institute, Rome, Italy.

Nevo, E. 1992. Origin, evolution, population genetics and resources for breeding of wild barley, *Hordeumspontaneum*, in the Fertile Crescent. Pp. 19–43 *in* P. R. Shewry, ed. Barley: genetics, biochemistry, molecular biology, and biotechnology. C.A.B. International, The Alden Press, Oxford.

Pande, S. Sharma, M. Gaur, P.M. and Gowda, C.L.L. 2010. Host Plant Resistance to Ascochyta Blight of Chickpea. Information Bulletin No. 82. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics, pp. 1-40.

Peralta, I.E., D.M. Spooner and S. Knapp (2008), Taxonomy of Wild Tomatoes and Their Relatives (Solanum sect. Lycopersicoides, sect. Juglandifolia, sect. Lycopersicon; Solanaceae), Systematic Botany Monographs, The American Society of Plant Taxonomists, Vol. 84, pp. 186.

Pielke, R. A., G. Marland, R. A. Betts, T. N. Chase, J. L. Eastman, J. O. Niles, D. D. S. Niyogi, and S. W. Running (2002), The influence of land-use change and landscape dynamics on the climate system: Relevance to climate-change policy beyond the radiative effect of greenhouse gases, Philos. Trans. R. Soc. London, Ser. A, 360(1797), 1705 – 1719.

Platt, Ellen Spector, (2003), Garlic Onion & other. Alliums, Mechanicsburg, PA: Stackpole Books.

Ramankutty, N., and J. Foley (1998) Characterizing patterns of global land use: An analysis of global croplands data, Global Biogeochem. Cycles, 12(4), 667 – 685.

Ramankutty, N., and J. Foley (1998) Characterizing patterns of global land use: An analysis of global croplands data, Global Biogeochem. Cycles, 12(4), 667 – 685.

Ratnakumar P, Vadez V, Nigam SN, Krishnamurthy L (2009) Assessment of transpiration efficiency in peanut (Arachis hypogaea L.) under drought by the lysimetric system. Plant Biol 11:124–130

Reserve Bank of India (RBI). 2005. Economic Survey of India. Mumbai, India: RBI. 2006. Annual report 2005–06. Mumbai, India: RBI.

Rogers, Mara Reid, (1995), Onions: A celebration of the onion through Recipe, Lore, and History, Addison – Wesley Publishing Co., P. 6.

Rosengarten, F. 1969. *The book of spices.* Wynnewood, PA: Livingston.

Rosser, A. 1985. The day of the yam. *Nursing Times* 81 (18): 47.

Rouk, H. F., and H. Mangesha. 1963. Fenugreek (*Trigonellafoenum-graecum*L.)—Its relationship, geography, and economic importance. Experimental Station Bulletin no. 20. Imper. Ethiopian College of Agric. &Mech. Arts.

Sammour R.H. 1994. Species relationships in Genus Lens as indicated by electrophoresis – A reappraisal. Lens Newsletter 21: 1–4.

Savage GP. 1988. The composition and nutritive value of lentils. Nature Abstract Review 58: 319–343.

Sendhil R, Singh R, Sharma I.Exploring the performance of wheat production in India. Journal of WheatResearch. 2012;4:37-44.

Stuff" 13th Annual Agronomy Conference, Perth, Australia.

Tadross M, Suarez P, Lotsch A, Hachigonta S, Mdoka M, Unganai L, Lucio F, Kamdonyo D, Muchinda M (2007) Changes in growing season rainfall characteristics and downscaled scenarios of change over southern Africa: implications for growing maize. In: IPCC Regional Expert Meeting on Regional Impacts, Adaptation, Vulnerability, and Mitigation, Nadi, Fiji, June 20-22, 2007. pp. 193–204

Tubiello F, Schmidhuber J, Howden M, Neofotis PG, Park S, Fernandes E, Thapa D (2008) Climate change response strategies for agriculture: challenges and opportunities for the 21st Century Agriculture and development discussion paper No 42. The World Bank

Turner NC, Nicolas ME (1998) Early vigor: a yield-positive characteristic for wheat in drought-prone Mediterranean-type environments. In: Behl RK, Singh DP, Lodhi GP (eds) Crop improvement for stress tolerance. CCS Haryana Agricultural University, Hisar and Max Mueller Bhawan, pp 47–62

Vadez V, Krishnamurthy L, Kashiwagi JW, Kholova J, Devi JM, Sharma KK, Bhatnagar-Mathur P, Hoisington DA, Hash CT, Bidinger FR, Keatinge JDH (2007) Exploiting the functionality of root systems for dry, saline, and nutrient-deficient environments in a changing climate. J. SAT Agric Res Volume 4 (Special Symposium edition) http://www.icrisat.org/journal/specialproject.htm

Vadez, V. Krishnamurthy, L. Serraj, R. Gaur, P.M. Upadhyaya, H.D. Hoisington, D.A. Varshney, R.K. Turner, N.C. and Siddique, K.H.M. 2007. Large variation in chickpea is explained by differences in sensitivity at the reproductive stage. Field Crops Research, 104: 123-129.

vanEtten J, Fuentes Lo´pez M, Molina Monterroso L, PoncianoSamayoa K (2008) Genetic diversity of maize (Zea mays L.ssp. mays) in communities of the western highlands of Guatemala: geographical patterns and processes. Genet Res Crop Evol 55:303–317.

van Etten J, Hijmans RJ (2010) A geospatial modeling approach integrating archaeobotany and genetics to trace the origin and dispersal of domesticated plants. PLoS ONE5:e12060.

Vaughan, J.G. and C.A. Geissler (1997), The New Oxford Book of Food Plants, Oxford University Press.

Vavilov NI (1951) Estuiossobre el origen de las plantascultivadas. ACME, Buenos Aires

Vavilov, N. I. 1926. Centers of origin of cultivated plants. *Trends in Practical Botany & General Selection*16:3–24.

WWF and IUCN (1997), Centres of Plant Diversity: Vol. 3, The Americas, IUCN Publications Unit, Cambridge, England.

Zabeau, M., and P. Vos. 1993. Selective restriction fragment amplification: a general method for DNA fingerprinting. European patent application number 92402629.7; publication number 0534858 Al.

Zohary, D., and M. Hopf. 1993. Domestication of plants in the Old World. The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley. Clarendon Press, Oxford, England.