The story of wheat....

The Beginnings

Wheat is a grass widely cultivated for its seed, a cereal grain which is a staple food worldwide. Wheat was first grown by people who lived nearby the place where it grew naturally. Wheat and other cereals belong to the grass family Poaceane with about 10,000 species and represents one of the largest families of flowering plants.

Poaceane grass



FIRST EVIDENCE: FERTILE CRESCENT

The archaeological record suggests that wheat was first cultivated in the regions of the Fertile Crescent around 9600 BCE.

Wheat cultivated in the region of Fertile Crescent.



EINKORN : THE FIRST WHEAT

Einkorn was the first wheat grown. Impressions of Einkorn was as far north as the Great Britain and Ireland. All plants are grown from chromosomes. Einkorn once combined with 14 other chromosomes can make a 28-chromosome wheat which is also termed as wild Emmer which is the only surviving combination.

> Einkorn filed in Germany



THE EVOLUTION OF WHEAT : THE CHANGES IN THE CHROMOSOME.

Einkorn once combined with 14 other chromosomes can make a 28chromosome wheat which is also termed as wild Emmer which is the only surviving combination



Evolution of Domesticated Wheat

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THE EVOLUTION OF WHEAT

Einkorn is genetically described as a diploid containing 2 sets of chromosomes This was a further genetic development as Emmer was a natural hybridization between 2 wild grasses *Triticum* and *Aegilops* species. Both were diploid which meant that this new wheat was now a tetraploid which meant 4 chromosomes. Durum wheat is also a tetraploid and developed through a process of natural hybridization.



The evolution of wheat.

WHEAT IN THE ANCIENT PERIOD.....

GREECE (6500BC)

The Greeks planted naked wheat an evolving range whose grain might be easily separated from the hulls when threshed. John Diamond in his book "Weapons, bacteria and steel" traces the spread of cultivated Emmer wheat starting from the Fertile Crescent in 8500 BC reaching Greece in 6500 BC and to Egypt quickly thereafter and further introduction in Germany and Spain by 5000 BC.

> An illustration on an attic red figure vase describing the Demeter and Triptolemos examining a wheatgrass.



ROME: THE EARLY REPUBLIC (450BC)

According to the Roman scholar Varro, common wheat and durum wheat were introduced to Italy as crops in about 450 BC. Durum wheat became the preferred grain of urban Romans, because it could be baked and it was easier to grow in the Mediterranean region than the soft wheat.

Wheat cultivation in Rome.



ROME : THE LATER REPUBLIC (140-130BC)

Scientists deduced this by examining the DNA of modern stains of Einkorn wheat grown in the mountains. Wheat was immensely important for the Roman Empire because it was staple.

> Roman relief showing man intent on husking wheat in tent.



INDIA (130BC)

According to Hosno, it followed 3 routes.

The first one is called the silk route, running from Turkenistan, through Sinkiang (Xinjiang), skirting Mongolia to reach China.



INDIA

The second route started from Afghanistan, through the Khyber Pass to cross the plains of Punjab, and basin of Ganga and Yamuna, skirting the Himalayas to enter Upper Burma, crossing the Yunnan and the Yangtse valley.



INDIA: THE WHEAT BOWL OF INDIA

In the Northern plains of the country majorly in Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh and Bihar wheat is the dominant crop. The vast Indo-Gangetic plains offer the most suitable climate for wheat culture. This region, which gives the highest amount of wheat is termed as the "Wheat Bowl of India".



DWARF WHEAT: ORIGINS IN INDIA

From the Indus basins wheat moved towards Gangetic plains along with migrating caravans. From Mehergarh according to the evidence collected so far, it travelled at an average speed of one km/year so it took 1800 years to reach Chirand(Bihar).

DWARF WHEAT IN INDIA



WHEAT IN THE MEDIEVAL ERA.....

PREFERANCE FOR WHEAT IN MEDIEVAL ERA

By the middle ages the preference was to eat white bread made from wheat- medieval physicians also recommended it as being the healthiest, but poor people used to bake dark bread with oats or rye. If needed people could also add rice, peas, lentils, chestnuts, acorns or other foods into the mixture. In medieval France, most people would eat a type of bread *Meslin* which was made from a mixture of wheat and rye.

Bread baking in the medieval era



INDIA (5th TO 15th CENTURY)

Wheat has been one of the primary crops grown during medieval India. Wheat was mainly grown in the region of Agra, Allahabad, Oudh, Lahore, Multan, Malwa, Ajmer, Kabul and Qandahar Sarkar. Wheat in those days was also the spring crop. Wheat had the greatest comparative value amongst the food grains similar to that of present day.

Wheat in the Mughal Era



WHEAT IN THE MODERN ERA.....

WHEAT IN MODERN ERA: INTRODUCTION (1950s)

Modern wheat refers to varieties that developed after the use of dwarfing genes in 1950s these are the highest yielding varieties. After World War II, a dwarfing gene was added to wheat to help the crops grow shorter. This helps them better stand up to harsh weather conditions this meant that wheat competed with weeds for the nutrients in the soil, so herbicides, fertilizers, and insecticides were added to the fields so that wheat would outcompete the weeds and pests.

Common Wheat



THE UNITED STATES OF AMERICA: INTRODUCTION

The US ranked 3rd in production and volume of wheat with about 58 million tons produced in 2012-2013 growing season, behind only China and India. During the colonial period wheat was grown by broadcasting, reaped by sickles, and threshed by flails (a threshing tool consisting of a wooden staff with a short heavy stick swinging from it).

Wheat in US



THE UNITED STATES OF AMERICA:19th CEN

New technology substantially enhanced productivity in the 19th century as sowing with drills replaced broadcasting and cradles took place of sickles and the cradles in turn were replaced by reapers and binders. Steam-powered threshing machines superseded flails.

> The horse-powered thresher it removes the inedible shaft from the edible kernels.



THE UNITED STATES OF AMERICA:20th CEN

The annual wheat production of the United States more than tripled in the fifty years between 1871 and 1921; it increased from about 250 million bushels during the period of 1869–1871 to over 750 million during the period of 1919–1921.

Boise valley, Idaho wheat field



INDIA (1960s)

The Green Revolution within India commenced in the early 1960s that led to an increase in food grain production, especially in Punjab, Haryana, and Uttar Pradesh. Major milestones in this undertaking were the development of high-yielding varieties of wheat, and rust resistant strains of wheat. The introduction of high-yielding varieties(HYV) of seeds and the increased quality of fertilizers and irrigation technique led to the increase in production to make the country self-sufficient in food grains, thus improving agriculture in India.

Use of fertilizers



AUSTRALIA (1788)

The first crop of Australian wheat was sown at the Botanic Gardens in Sydney shortly after the arrival of the colonists in January 1788. The first harvests were disappointing. The harsh climate, poor soils and the lack of farming knowledge shown by the convicts meant that the young colony almost starved in the first few years.



EUROPE (1860s)

Due to the political unrest in the country the timing was right for farmers in America to exploit vast areas of virgin soil to produce wheat to feed Europe and at the same time create millionaires in the young nation. By about 1860 America was exporting millions of tons of wheat to much of Europe and had built a vast, lucrative railway system

towards its ports.

Wheat filed in Europe



USE OF MORDERN TECHNOLOGY

The history of commercially produced bread in factory bakeries includes feats of mechanical and chemical engineering that are breath taking in their sheer contempt for the art of traditional food preparation. The boast of "never touched by human hands" has become the new mark of pride in food science, hygiene and modernity.

> Machines being used after the green revolution.



IMPORTANT CHARACTERISTICS OF MODERN WHEAT

Three of wheat's fundamentally important characteristics are the moisture and protein content, and the falling numbers which are used in the baking industry to describe how well it rises. As for storing wheat, know that if it is stored properly, it can last a very long time. It is hard to get an exact number of years but around 30 years maximum to a "lifetime."

Wheat field



DIFFERENCE BETWEEN THE EUROPEAN WHEAT AND THE AMERICAN WHEAT

Due to soil and growing conditions, the differences between American and European wheat extend further than gluten content. Hard wheat has more gluten than soft wheat, and the gluten it contains is stronger than gluten found in soft wheat. Europe has soft wheat while America has hard wheat.

Hard and soft wheat.



DIFFERENCE BETWEEN ANCIENT AND MODERN WHEAT

Modern wheat is lower in minerals like zinc, magnesium, iron, copper, and selenium than its ancient ancestor. When compared with strains of wheat that are centuries old, modern wheat has many more gluten proteins because of all the hybridization that has taken place. Many of these brand-new gluten proteins are associated with today's gluten sensitivities, such as celiac disease.



Table depicting difference between Einkorn and modern wheat.

EINKORN COMPARED TO MODERN WHEAT

* NEVER hybridized

*NEVER had chemical or genetic technologies used to produce.

 A Genome for gluten - a different type of gluten that does not even register on the Eksa Test for gluten.

Diploid - Only 2 simple sets of chromosumes

"High in vitamins and low in dangerous" heavy metals.



* Hybridized naturally and commercially multiple times.

 Genetic and chemical technologies used to raise production.

* D genome of gluten which is the main contributor of gluten sensitivities.

* Tetraploid - 6 sets of chromosomes



DIFFERENCE BETWEEN EINKORN AND MODERN WHEAT

Modern wheat grows on a shorter plant, has a stronger gluten and five times the yield of einkorn plants. Einkorn wheat is low-yielding but can survive on poor, dry, marginal soils where other varieties of wheat will not. It is primarily eaten boiled in whole grains or in porridge. Its flour lacks the rising characteristics desirable for bread.

> Pictorial representation showing the difference between ancient and modern wheat.



SNO	PROPERTIES	ANCIENT	MODERN
1.	CHROMOSOMES	DIPLOID (14CHROMOSOMES)	HEXAPLOID (42CHROMOSOMES)
2.	WHEATGRASS	TALL	DWARF
3.	YIELD	LOW YIELD	HIGH YIELD
4.	PEST	PRONE	RESISTANT
5.	PESTICIDE	SENSITIVE	RESISTANT
6.	GLUTEN	LOW	HIGH
7.	NUTRIENT VALUES MAGNISIUM CALCIUM IRON COPPER	HIGH HIGH HIGH HIGH	LOW LOW LOW LOW
8.	VARIETY	SOFT	HARD

GLUTEN

Gluten is a group of proteins which occur with starch in the endosperm pf various cereal grain. The protein complex comprises 75-80% of the total protein the wheat contains.

