

## A STUDY OF SOIL TYPES AND AGRICULTURAL PRACTICES IN HARYANA

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### **Abstract**

*The soil landscape of Haryana is dominated by alluvial types brought by Ganges and Indus rivers, which have developed a remarkable number of soils affecting agriculture, land utilization, and productivity of the soils. Old alluvial soil prevails and is one of the most fertile and extensive groups of soil comprising sand, clay, silt and Kankar (calcareous concentration), predominant in the state. These soil types that may not be as fertile as those depicted above may be used in farming. Although old alluvial formations predominate in the area surrounding the modern course of the Yamuna and in the Ghaggar culinary, the Khaddar area is formed by younger bodies of alluvial deposits of coarse sand and silt which are generally more fertile and capable of supporting intensive cultivation. The last part of the Haryana state is characterized by large sand dunes caused by the installation of sand by winds thus the area is sandy and less fertile. As indicated, however, where these depressions are referred to as Tals and in which sand do not settle, the ground is more suitable for cultivation though these areas are restricted. Physiographic and climatic factors influence soil fertility production across districts since they are not the same. Other districts of the northeastern region such as Panipat and Sonipat have average fecundity soils for a variety of crops grown there. Thus, some districts like Rohtak and Jhajjar have low birth rates and would need to tap and nourish their soils in order to support significant yields in food production. Areas of Rewari, Mewat, and parts of southern Gurgaon suffer from low soil quality and desert climate thus restraining the growth of agriculture. Depending on their location, the soils of Haryana can be divided into Typic Ustochrepts in old alluvial plain, Typic Ustipsammets in the Aravali plain and Typic Ustifluvents in a flood plain. These soil types determine the kind of use of the land and the crops to be grown in various areas. Crop production which is the most dominant land use activity culture in Haryana relies on soil productivity and water availability. The Kharif crops include paddy, wheat, bajra, and mustard while Rabi crops include paddy, wheat, bajra, and mustard. The north fruitful tracts have better scores in soil and irrigation, multiple cropping are also possible there but the south unfertile tracts and water scarcity give low-yielding tracts.*

**Keywords:** Soil fertility, Alluvial plains, Agriculture productivity, Irrigation, Management, Kharif crops, Rabi crops, Southern Haryana, Soil types

### Introduction

Haryana's soil system is largely influenced by the alluvial deposits from two major river systems the Ganges and the Indus. The state is mostly a flat plain located close to the line of water divide of these two basins. The has been described to contain a large portion of old alluvium in several areas, sand, clay, silts, and kankar – which are hard calcium nodules that are embedded in the soil. More of this old alluvial soil is developed on the land, you find young and nutrient-rich soils in the Yamuna and Ghaggar flood plains which experience frequent deposition of course sand and silt by river systems. Due to the geographical variation, the soil of this state is also varied. The southwestern region is characterized by sand dunes, which are formed by sand blown about by the wind, and as a result, the place is less fertile for crop growing. While the northern and the eastern part of the state has comparatively fertile soil that supports better yield of crops. The Midland tracts such as Panipat and Sonipat are rated with moderate fertility. The Arid zones of Gurgaon and Rewari are rated low fertility due to poor and sandy soils. They have also focused on case study areas related to reclaimed wasteland development in areas containing a good number of farmer households of district Rohtak in Haryana with special reference to Kharif and Rabi crops. The fertility of the land especially the nutrient value of the soil especially nitrogen, phosphorus and potash when it comes to crops.. The distributorship affects the type and fertility of the land in the state, with fertile areas having better ways to manage water or and irrigation systems than arid areas that have a difficult time supporting agricultural productivity.(Singh, 2005)

### Objective of paper

1. Analyze soil characteristics across Haryana's districts.
2. Assess impact of soil types on agriculture.
3. Evaluate irrigation needs based on soil fertility.
4. Identify challenges in agriculture in southern Haryana.
5. Recommend soil management strategies for crop productivity.
6. Compare Kharif and Rabi crop suitability by region.
7. Examine soil variation's influence on land use.
8. Explore sustainable practices for less fertile areas.

**Table 1: Soil Types and Distribution in Haryana**

Sr. No.	Soil Type	Area (%)	Districts
1	Inceptisols	58.0	All districts
2	Entisols	29.0	All districts
3	Aridisols	9.0	Sirsa, Fatehabad, Hisar, Bhiwani

Sr. No.	Soil Type	Area (%)	Districts
4	Alfisols	2.0	Karnal, Kurukshetra
5	Hills and Rock Outcrops	2.0	Mahendergarh, Rewari, Gurgaon, Panchkula

Source: Soil Types and Distribution in Haryana

**Table 2: Physiographic Zones and Soil Taxonomic Associations in Haryana**

Sr. No.	Physiography	Soil Taxonomic Associations
1	H - Hills	Udorthents/Eutrochrepts
2	P - Piedmonts Plain	
	P1 - Upper	Ustorthents/Ustifluvents
	P2 - Lower	Ustipsamments/Ustorthents
3	Y - Yamuna Flood Plain	
	Y1 - Recent	Psammaquents/Haplaquents
	Y2 - Old	Ustipsamments/Ustifluvents, Haplustepts
4	G - Ghagger Flood Plain	
	G1 - Recent	Ustorthents/Ustifluvents
	G2 - Old	Haplustepts/Ustorthents
5	Sb - Sahibi Flood Plain	Ustipsamments/Ustorthents/Ustifluvents, Haplustepts
6	C - Chautang (Relict) Flood Plain	
	C1 - Recent	Haplaquents
	C2 - Old	Haplustepts (Aquic), Haplustepts (Saline/alkali), Haplustepts
7	Older Alluvial Plain	
	O - Normal	Haplustepts
	S - Salt affected	
	S1 - Saline	Haplustepts (saline)
	S2 - Alkali	NatrustalFs/NatricHaplustepts
	W - Lowlands	Haplaquepts/Haplustepts (Aquic)
8	Pd - Pediments with Aravalli Hills	

Sr. No.	Physiography	Soil Taxonomic Associations
	Hills	Ustorthents
	Pediments	Ustipsamments
	Plain	Haplustepts/Ustipsamments, Udorthents/Eutrochrepts
9	A - Aeolian Plain with Sand Dunes	
	A1 - Plain	Ustipsamments/Haplustepts, Calciorthids
	A2 - Moderately eroded	Ustipsamments
	A3 - Severely eroded	Ustipsamments

Source :Physiographic Zones and Soil Taxonomic Associations in Haryana

### District-Wise Soil Analysis in Haryana

Haryana has relied on soil as a natural resource in framing its agricultural output and physical land use plan. Geographical factors of Haryana. Due to variations in soils, climate, water resources, and altitude, the physiographic regions of Haryana can be divided in several distinct zones of which each have differing quality of agricultural land across the thirteen districts of this region. The fertility of soil ranges from low to medium fertility districts including Panipat, Sonipat, Palwal, the northeastern part of Jhajjar, and a few areas of Faridabad. These regions have soils of moderate fertility on which a variety of crops could be grown, though with the aid of irrigation. On the other hand, fall in the L/MFZ, where less favorable environmental conditions for agriculture make it necessary to apply extra efforts to sustain yields. Moreover, Rohtak, Jhajjar some parts of Gurgaon is on a low fertility zone hence the land isn't suited for farming due to poor soil quality. These regions use irrigation and fertilization to enhance the productivity of crops that are grown in the area.(Kumar, 2005)

The desert tract of Mewat, parts of Gurgaon, Rewari, the south and west of Palwal, and Faridabad are characterized by low fertility, a ragged prospect zone. These areas are made of dry sandy soils that are less fertile and stick more in these areas requiring huge irrigation and fertilization. The two regions are unable to support large-scale farming, and it is always challenging for producers to produce steady yields because the of the poor physical properties of the soils i.e., lacking in organic matter.(Singh, 2008)

The Haryana soils can broadly be categorized into five major classes. Typic Ustochrepts are predominant in old alluvium, particularly in the northern and central regions of the state. While these soils may be slightly low in fertility, when adequately managed, they continue to yield reasonably well. Typic Ustipsamments are located in the Aravali plain with reference to the southern area where alluvial soils are mostly sandy and infertile in comparison with the northern areas. Typic Ustifluvents are found in the recent alluvial plains and flood plains of the Yamuna and Ghaggar rivers. These soils are relatively

younger also more fertile and which is suitable to come under the category of agricultural land because these have regular siltation and nutrients from the rivers. It is typical that the Typic Torripsamments occupy the aeofluvial plains, which have seen wind to affect the accumulation of sand and affect its fertility hence not suitable for farming. Finally, the rocky outcropping is observed in Aravali hills where the soil is shallow and rocky and hence not suitable for agriculture.(Yadav, 2010)

Soils of this state are dissimilar in their fertility and structure, this due to the differing physiography of Haryana. This variation defines the productivity of a given area in farming and the level of a given area farming productivity depending on how productive the soil is in that given area.(Patel, 2009)

### **Soil Characteristics and Mineral Resources in Haryana Districts**

The study covers the composition of soil types in the districts that make up this state called Haryana located in northern India and, variations in geographical and climatic conditions. One can observe that all the districts under study have peculiarities in the distribution of soil types that shape their agriculture and mineralogy.(Gupta, 2007)

### **Soil in Panipat District**

Reservation is immensely significant in Panipat District because soil type contributes significantly towards determining the areas of agriculture and the economy. Soils are well-drained, and while their bearing capacity is fairly good, there exists considerable variation in the texture of the soils. Soils in the plains include the sandy loam, the clay loam, and the silty clay loam. These variations afford the requisite conditions of diverse agriculture practices that are important to the sustainability of the agriculture sector in the region. Sandy loam, in particular, has good drainage and aeration, hence favoured for the production of pulse, maize and cotton. On the contrary, the characteristics of the clay loam and silty clay loam are slightly more suitable for holding moisture which is important in water-dependent crop growing.(Mehta, 2006)

In relic channels, depressions or basins soil texture becomes loam, clay loam or siltyloose clay loam. Specifically, this kind of soils are preferred for use in farming since they usually have better structures for holding nutrients as well as supporting plant growth. The presence of both good drainage and water conservation soils increases the arable intensity of the area and allows farmers to set various cropping systems.(Sharma, 2005)

Among the soil types of Panipat, the alluvial soil is rich and most suitable for intensive farming because of the deposit of nutrient loams brought by the rivers. These alluvial soils are yearly replenished to make it fertile and can produce high-yield crops all year round. The important crops sown in the district are wheat, rice, cotton, sugarcane, and mustard in which rice and wheat are leading crops. Another important aspect of farm activity is irrigation whereby Panipat enjoys an impressive system of canals as well as tube well points. Irrigation increases the number of cropping cycles that are feasible, ensuring the best yields possible.(Kumar S. , 2016)

The other major resource in the district is minerals apart from agriculture which results to the improvement of the income of Panipat District. The two of the most abundant minerals

on the area include limestone and sandstone. Limestone is widely used as construction material where it is applied in producing cement and other construction matrix. Availability of good quality limestone has favoured numerous cement factories in the district and thus opened job market for the locals and contributed in the growth of the economy.(Desai, 2016)

Sandstone of course is hard-wearing and very visually striking, this particular type of rock is used frequently in structures and building projects. Panipat sandstone has enormously felicitous characteristics such as diversification in colors and many types of surfaces in this beauty makes it useful for the cladding of buildings, floorings, and decorative purposes. The district has therefore developed into a major supplier of minerals to the growing construction market in Haryana, as well as in other adjacent areas.(Singh R. , 2015)

But the land use system for agriculture having is some problems in Panipat city especially the erosion and degrading problem of soil. The mechanized methods of farming, and especially low crop rotation, have raised questions about the fertility of the soil. Water-born soil erosion particularly in regions with significant steep gradients can mainly help to remove the nutrient content layer, hence making the area in one way or less productive agriculturally in the long run. To cope with these threats, there has been increased practice of conservation agriculture techniques including use of legume cover, minimum tillage, and organic production.(Gupta A. , 2009)

Moreover, the impact of climatic conditions presents threat in the overall agricultural production of Panipat. Variations in the rainfall, higher temperatures and storm frequency are likely to harm the crops, and presidential soil moisture content. Farmers in the region are gradually learning to change by adopting climate-smart production technology, including choosing crops with drought tolerance and proper water management.(Gupta L. , 2007)

The characteristics of the soils of Panipat District are of great importance to the District's agricultural production and economic progress. The type of soil is suitable for various crops, the growing of crops in the region can be done in Kharif and Rabi seasons. With the mineral deposits of the district especially the Limestone and sandstone, Panipat has emerged as one of the principal agricultural and economical towns in Haryana. Nonetheless, the threats of managing the challenges of soil erosion, degradation, and climate change will be essential in fostering the agricultural potential of the district and consequently the future economic growth. Panipat's constant endeavors echoing it as a key driver of sustainable Agriculture practice & productive soil management in Haryana can bring out its further strength.(Desai A. , 2007)

### **Soil in Sonipat District**

Sonipat District boasts a diverse soil profile that significantly influences its agricultural landscape and productivity. The district is predominantly characterized by recent flood plains, young meander plains, old meander plains, and old alluvial plains. These varying geological formations contribute to the intricate tapestry of soil textures found throughout the area. The surface soils primarily consist of loamy sand to sandy loam, which are known

for their excellent drainage properties and ability to retain moisture while allowing excess water to percolate through. This feature is essential for supporting crops that require well-drained conditions, enabling farmers to cultivate a variety of staple and cash crops.(Chauhan, 2008)

As one delves deeper into the soil profile, the texture transitions to sandy loam and clay loam in the subsurface. This transition is crucial, as it enhances the soil's nutrient-holding capacity and improves its overall fertility. Sandy loam, being more porous, facilitates root growth and encourages better aeration, while clay loam contributes to water retention and nutrient availability. Together, these soil types create an optimal growing environment for many crops, including wheat, rice, and pulses, which are staples in the region's agriculture. The combination of well-drained surface soils and nutrient-rich subsurface layers fosters a productive agricultural ecosystem, allowing for multiple cropping cycles throughout the year. The Sonipat district's proximity to the Yamuna River further enriches its soil by depositing nutrient-laden sediments during seasonal floods. These alluvial deposits are vital for maintaining soil fertility, making it an attractive region for agriculture. The annual replenishment of nutrients ensures that the soil remains fertile, supporting high crop yields and encouraging sustainable farming practices. Farmers in Sonipat benefit from this natural irrigation system, which reduces their dependency on artificial irrigation methods and helps maintain a consistent water supply for their crops.(Patel K. , 2008)

The agricultural landscape of Sonipat is not only defined by its soil characteristics but also by the adoption of modern agricultural practices. The availability of irrigation facilities, combined with the favorable soil conditions, has led to the cultivation of a diverse range of crops. Farmers are increasingly employing advanced techniques such as drip irrigation and precision farming to maximize productivity and minimize water usage. These methods, along with the nutrient-rich soils, contribute to the district's reputation as a significant agricultural hub in Haryana. However, like many other agricultural regions, Sonipat faces challenges related to soil health and sustainability. Issues such as soil erosion, nutrient depletion, and the impact of climate change can affect the long-term viability of agriculture in the area. To combat these challenges, there is a growing emphasis on implementing sustainable farming practices that prioritize soil conservation and restoration. Techniques such as cover cropping, crop rotation, and the use of organic fertilizers are gaining traction among local farmers as they seek to maintain soil health and productivity.(Bhatia, 2009)

The soils of Sonipat District, characterized by their diverse textures and proximity to the nutrient-rich Yamuna River, play a pivotal role in supporting the region's agricultural activities. The favorable conditions promote a wide range of crops, contributing to the district's economic vitality. As farmers continue to adopt sustainable practices to address the challenges of soil degradation and climate change, Sonipat is poised to maintain its agricultural productivity and secure its position as a crucial player in Haryana's agricultural landscape. With ongoing efforts to enhance soil health and promote sustainable farming practices, the future of agriculture in Sonipat looks promising.(Yadav N. , 2009)

### **Soil in Rohtak District**

Rohtak district's soil profile is primarily composed of old alluvial plains, which provide a fertile foundation for agricultural activities. The soils in these plains are generally characterized by loamy sand to sandy loam on the surface, transitioning to sandy loam and clay loam in the subsurface. This progression in texture from the surface to deeper layers ensures a balance between drainage and water retention, crucial for supporting crops that require well-drained yet moisture-retentive soils. The loamy sand at the surface allows for good aeration and easy root penetration, while the clay loam in the subsurface helps retain water and nutrients, making it favorable for crop growth.(Verma, 2010)

In addition to the old alluvial plains, the district also features old meander plains, which are predominantly flat and have soils ranging from loamy sand to silty clay loam. These meander plains are remnants of ancient river systems and exhibit a more fine-textured soil, particularly in the silty clay loam areas, which is ideal for cultivating crops that thrive in nutrient-rich environments. The varied texture of soils across the district ensures that farmers can grow a wide range of crops, including staple grains like wheat and rice, as well as cash crops such as cotton and sugarcane.(Singh P. , 2010)

The extensive spread of old alluvial plains across Rohtak makes it one of the prime agricultural areas in Haryana. These soils are enriched by the alluvial deposits left by ancient river systems, which have imparted natural fertility to the land over millennia. Despite being somewhat sandy, the soils are highly productive, especially when supplemented with modern irrigation techniques. The district benefits from a well-developed irrigation network, including canals and tube wells, which ensures a steady water supply, further enhancing agricultural productivity. One of the key advantages of Rohtak's soil composition is its versatility. The combination of loamy sand and clay loam makes it possible to cultivate a variety of crops throughout the year. During the Rabi season, crops like wheat, barley, and mustard thrive, while in the Kharif season, crops like rice, maize, and bajra are widely grown. The ability of the soil to support multiple cropping cycles, along with its natural fertility, makes Rohtak a significant contributor to Haryana's agricultural output.(Malik, 2011)

However, like many agricultural regions, Rohtak faces challenges related to soil health. Continuous farming, particularly in the more intensively cultivated areas, has led to issues such as nutrient depletion and soil compaction. Farmers are increasingly adopting practices such as crop rotation and the use of organic fertilizers to address these challenges and maintain soil fertility over the long term. In addition, there is a growing awareness of the need to implement soil conservation techniques, particularly in areas prone to erosion due to the sandy nature of the topsoil. Another challenge for Rohtak's soils is water management. While the district benefits from irrigation infrastructure, over-reliance on groundwater and surface water can lead to issues such as waterlogging and salinity, especially in clay-rich soils. Proper water management practices, such as efficient irrigation systems and drainage improvement, are essential to ensuring the long-term sustainability of agriculture in the district.(Joshi, 2011)



The soils of Rohtak district, primarily consisting of loamy sand and clay loam, provide a strong foundation for agricultural productivity. The district's extensive old alluvial plains and flat meander plains support a diverse range of crops, benefitting from the fertile soils and well-established irrigation facilities. Despite challenges related to soil degradation and water management, the adoption of sustainable agricultural practices can help preserve soil health and ensure continued productivity. Rohtak's soils, enriched by their alluvial origins, remain a valuable asset to the region's agricultural economy.(Kaur, 2012)

### **Soil in Jhajjar District**

Soil of Jhajjar District is gently sloping old alluvial plain mixed with the patches of Aravali plain, suitable for agricultural purposes. A large portion of the District is occupied by the old alluvial plains, though the soils are vary between loamy sand or sandy loam on the surface, though more mature subsoil soils include sandy loam to clay loam. They are alluvial formed from ancient river channel deposits, and thus are charged with favorable nutrients for growth of different horticultural crops. The productivity of these plains favors the growth of staple crops and cash crops including wheat, rice and barley, mustard, cotton and sugarcane.(Sharma A. , 2012)

Even the Aravali plains are found in some parts of the district contributes to the variation of soil types among the areas of Jhajjar. These areas have sandy and loamy soils which even though not as fertile as the alluvial plain can produce crops once the right approach to irrigation and use of fertilizers has been acknowledged. The soils in the Aravali plain areas are mostly sandy and this is favorable for the growth of plants which require well drained soils but the problem that is normally encountered in such areas is that of requirement of frequent irrigation and nutrition as the nutrient holding capacity of the soil is low being derived from dilute Lateritic influence is also indicated by the high pH of the Aravali plain's soil which varies from 7.3 to 7.5.(Khanna, 2006)

In addition, the existence of a network of first order dams and the location of the district in close vicinity to the large river systems like Yamuna make it all the more richer trough agricultural base. The river systems guarantee that the alluvial plains get sufficient water, be it for irrigation purposes, or to recharge the water table to support agriculture in an area that doesn't receive much rainfall annually. Due to the proximity to the rivers farmers of Jhajjar can practice intensive farming, especially during Rabi and Kharif crops.(Bhardwaj, 2009)Moreover, Jhajjar's farmers have also introduced various modernisms and have experienced rich and favorable fertile grounds. High yielding seeds, chemical fertilizers and pesticides have assisted in increasing yield, this may have been made necessary by the fact that soil productivity in the region may have declined over time because of several farming cycles. Crop rotation is still in practice to avoid depletion of the soil nutrients – and the use of organic fertilizers.

However, the analysis of Jhajjar reveals several problems associated with the management of soil in this region despite its first-rate agricultural potential. Even in the low coarser textured arid plains of aravali, the problem of soil erosion is more acute especially during the dry season in which the wind erosion remove the nutrient content of the top soil. To

mitigate for this, farmers in these areas are putting soil conservation measures like planting cover crops, construction of wind breaks to shield the soil. Furthermore, the use of groundwater for irrigation also comes with a problem of surface water resulting in salinity which is a big threat to soil if well controlled.(Jain, 2009)

Irrigation infrastructure within the district comprises both canal networks as well as tube well. The latter is highly associated with the district's agricultural breakthroughs. Nevertheless, some of the regions heavily dependent on the source have been confronted with issues relating to sustainable water supply. Adequate use of water conserving technologies like drip irrigation and rain water harvesting is being encouraged to preserve water and make farming in Jhajjar techno-economically feasible in the future. Jhajjar district enjoys an antecedent of quality soil right from alluvial lands to sophisticated Aravali soil which is best suited for efficient agriculture and grow variety of crops. The later makes the growing of crops all year round possible while its position in the map close to the River systems were extension of area increase the farming capabilities of the district. But problems like erosion and water use have remained a challenge the use of sustainable farming practices is however maintaining the fertility of the soil for future and sustainable production.(Singh R. , 2009)

#### **Soil in Rewari District**

Measurement of agricultural productivity and burden of farming inside and outside Gurgaon dist would involve Accepting the facts and scenarios that the district is geo-agro-morphographically and agriculturally possible as well as feasible and possibly supra-viable and heterogeneous. Some of these are sand dune, sand plain, alluvial plain, salt lands, lowland, fringe of lakes, hills and pediments on many and various soils of the district many varieties are established. It is justified so, with respect to the typology of the soils that prevail on these forms as far as the compatibility of the agriculture potential of the district is concerned.(Kapoor, 2009)

The problems stated on sandy plain and sand dunes soils in Gurgaon made this region become fall under Coarse textured soil whereby sandy to loamy sand is prevalent. These are well drained but they have very low water holding capacity. As a result, the farmers are always under a lot of hardship, particularly in the arid region. The crops that can be grown in these sand dune are crops that can be grown in dry climates because most plants here lack water some of the crops include bajra, mustard and gram etc. One has been used successfully only in those areas under condition that irrigation is needed because of low moisture content of the soil for mass production.(Raina, 2008)

However it found in the alluvial plain of Gurgaon, it was partly supplemented more fertile type of soil such as sandy loam, clay loam and silty clay loam. There is riverine alluvial soils, which is usually deposited down by stream silt and which is usually brought in to the area by other surrounding rivers, can be used for almost any type of crop production, wheat, rice and vegetables inclusive. Because of these plain are considered to be most productive agricultural land in the district due to high fertile nature and also good for the irrigation facility. Since alluvial plain has got well drainage and nutrient enriched agri

growth structure, multiple cropping and thus high agricultural production is made possible in the district.(Sharma A. , 2009)

But there is one problem in Gurgaon which has regions where saline and the land might be calcareous and can be vary from Loamy sand to Loam. Some of such soils are found in soils with slow internal drainage, and for growers who rely on bore hole water to cultivate their crops Such signs are positive indication of high salinity in the growth media sodium encroaches in the root zone affecting water implication which shrinks the size of the produce to make it leak proof. Here, some of measures of almost a special management systems have to be applied such as application of gypsum, reduction in the salinity of the soil and application of the salt tolerance crops. Further, it is connected with such factors as the salinity of irrigation water and the question of the proper drainage as the main factors in the further degradation of such soils in areas such as.Lesser elevations and the earth surrounding the lake, at the pediments it is chiefly silty loam to loam. They areas are flooded often and hence are prone to calamities more so in the rainy season as well as when bringing periods of moisture that are essential for crop production. Crop production is always difficult due to the frequent floods. Due to their nature of being swampy they are mostly used to grow crops that do well in water logged soils such as rice, though if the waterlogged state is maintained for so many years it will pollute the building and richness of the soil.(Gupta H. , 2009)

### **Soil in Gurgaon District**

Gauging agricultural productivity and farming burden inside/outside Gurgaon dist would require taking into consideration the fact that the district is geo-agro-orophographically as well as agricultural practicably and feasibly and potentially supra-viably heterogeneous. These are sand dune, sand plane, alluvial plain, saltlands, lowland, lake fringes, hill and pediment which are the foundation of the many and varied soils of the district . It is justified so, depending on the typology of the soils found on these forms that defines the consonance of the agriculture potential of the district.Sandy plain and sand dunes soils issues in Gurgaon categorized it under Coarse textured soils in which sand to loamly sand dominates. These are well drained but they have a poor water holding capacity therefore the farmers are always in lot of trouble especial so in the arid region. The kinds of crops grown in these sand dune are crops which can be grown in dry areas as most of these plants are short of water and such crops include bajra, mustard, and gram, etc. However one has been applied successfully only in those areas, under condition if irrigation is needed because of low moisture content of the soil for the mass production.(Vohra, 2009)

But the alluvial plains of Gurgaon have partly more fertile type of soils that ranged from sandy loam, clay loam and silty clay loam. These are alluvial soils which is normally deposited down by stream silt frequently conveyed into the area by neighbouring rivers, ideal for the growth of almost any type of produces including wheat, rice or vegetables. Due to these plain are considered most fruitful agricultural lands in the district by the reason of fertility and those are also better in facility of irrigation. The nature of different

alluvial plain which possess well drained and nutrient rich soils leads to multiple cropping and accordingly significant agricultural output in the district.(Singh K. , 2013)

However there is one issue in Gurgaon which consists areas where saline and the soil can be calcareous and may vary from loamy sand to loam. Soils of such types are found in areas with low levels of soil drainage and where growers rely heavily on ground water in raising their crops Such indicators are signs of high salinity in the growth media. Salt accumulates in the root zone compromises the ability of the plant to absorb water and reduces the size of the produce making it leak proof. Here, some measures of almost a special management systems have to be applied, such as the application of gypsum to reduce the salinity of soil and the application of salt tolerance crops. Furthermore, in conjunction with water salinity the problem of irrigation water quality and proper drainage as primary causes of continued soil decline in such regions as well.(Malhotra, 2011)

Soil is different on the lowland and around the lakes, pediments and silty loam to loam. They continue to be prone to flooding hence have Frequent calamities especially during rainy seasons while bringing periods of moisture that are essential for the growing of crops the growing of crops is always complicated due to frequent floods. Due to their swampy nature, they are mostly settled with crops that favor water logged soils such as rice, so long as the water logged state is not maintained for so many years as it pollutes the structure and soil fertility.The hilly areas of Gurgaon, particularly those associated with the Aravali range, have rocky and shallow soils, limiting their agricultural potential. These soils are often composed of a mix of loamy sand and calcareous material, with low fertility and poor water retention capacity. While some areas may support limited grazing or the cultivation of hardy crops like pulses and oilseeds, the steep terrain and rocky nature of the soil make intensive agriculture difficult. As a result, these hilly areas are typically used for non-agricultural purposes, such as mining or construction.(Chopra, 2011)

Overall, the diverse soil types in Gurgaon allow for a variety of agricultural practices, though the challenges posed by sandy and salt-affected soils require careful management to ensure sustainable farming. The district's combination of fertile alluvial plains and more challenging sandy and saline soils makes it a region of both high agricultural potential and significant environmental management needs. Through the use of modern irrigation techniques, soil conservation practices, and the cultivation of salt-tolerant crops, Gurgaon's farmers can continue to maximize the productivity of the district's varied landscapes.(Jain A. , 2015)

### **Soil in Mewat District**

Regarding to the soils distribution in the region of Mewat district which is situated in the southern part of Haryana almost all of its soils are ranged from sandy loam to loam whereas in the lower tracts the soils are clayey and saline. This distribution of the soils implies that the agricultural potential and problems of the region depend on the type of soil. Most of the soil types are sandy loams, which being well drained lack water holding capacity that is a disadvantage for crop production especially during the dry season. hence

to encourage high production in Mewat region, irrigation is commonly used to provide moisture for the crops.(Bansal, 2012)

The loam type of soils found in Mewat has better drainage as well as water holding capacity than the former hence more favorable for cultivation. Nevertheless, it is necessary to do it cautiously because these areas are already providing comparatively high yields and compared to other soil types the soils of the Central Black Soil Zone are sandy and regarding the climate of the region it is not very rich in rainfall rather it is semi arid. Pump irrigation and especially the tube wells and the canal irrigation are important in the development of agriculture in the mentioned regions. These soils are moderately fertile, therefore crops like wheat, mustard, and millet are often grown on these soils as they lock the nutrients supplied.(Verma R. , 2014)

However, food production in Mewat is even more complicated when the soil turns into clayey and saline in the low lying areas. Saline efflorescence is injurious to the growth and productivity of crops since the nature of the soil affects process of water uptake hence stunting the growth of the plant. Due to high salinity of soil it's also not suitable for most of the standard crop plants and therefore one has to cultivate salt-tolerant crop varieties together with practicing methods of combating salinity in soils. People who own such farms tend to apply chemical such as gypsum or use good drainage system to reduce the effects of salinity level with the aim of making the land arable again.The upper hills in Mewat are almost unfit for cultivation because of the poor and shallow nature of the soils which is contributed by the rocks. Such areas are not suitable for conventional farming practices because the soil is too light, containing little nutrient matter and it is also too shallow for most root systems to develop properly into. Hence, the majority of farming is exclusive to the lower plateaus and valley floors where soil is most preferred.(Desai N. , 2012)

The soils in Mewat though containing features that are anticipatable and favorable for agriculture have to be monitored and managed for maintaining the arable productivity. The conditions of the sandy loam and loam throughout the plains provide for crops growth though encouragement of irrigation and efficient use of soil conservation practices. However, low lands with saline and clayey soils requires focused and rigorous interventions on working on reduced soil salinities and enhancement of the soil. Nonetheless, it has been ascertained that agriculture in Mewat can be practised and also can help in giving livelihood support to the farmers of Mewat region, if and only if issues right from the irrigation to the management of the soil, everything is done in proper manner.(Sood, 2013)

### **Soil in Faridabad and Palwal Districts**

This paper focuses on two districts Faridabad and Palwal, which have a variety of soils that determine soil suitability for agriculture across the two areas. The two districts comprises recently formed flood plain of Yamuna, low land, low lying plain, depression, sand dunes and hills which have contributed towards the difference in geographical structure and type and nature of soil. The flood plains of the Yamuna are located in both districts and these

have sandy to Loamy sand soils. These soils are also rich due to flooding and can grow a variety of crops but because the soils are well-drained they water intake is very good and crops will require water during the dry season.(Gupta N. , 2015)

In the plains, the soil becomes a sandy loam one slightly better in the capacity of holding water and nutrients, hence, suitable for paddy, wheat and sugarcane. The nature of soils are sandy loam in Faridabad and Palwal includes black soil which is good for crop growing because they are easy to tilt and are moderately fertile. But these soils require proportional watering and feeding as they get so quick dry and wash away the nutrients in the farmers' field. While in the low areas and depressions of the area, soil has sandy loam at the upper part and clay loam to silty clay in the lower part. These areas being low lying are more susceptible to flooding particularly during the rainy season and come with their benefits as well as demerits as concerning the improvement of agriculture. The clay-rich are good for holding water and providing nutrients and inputs for crops production, water logging for long time harms crops and affects the yields. To avoid this, farmers use draining systems or uptake plants varieties that will thrive well with high water conditions. Some of these crops include rice that grow well in area with wet soil conditions.(Singh V. , 2013)

In some areas of both districts hills and sand dunes further complicate the soil regimen as mentioned earlier. The vegetation in the sand dunes is located in sandy substrates that have low water retention capacity and nutrient solutions. This renders these areas as unsuitable for conventional farming if the soil is not irrigated. Due to poor and sandy soils farmers in these areas have to practice water conservation especially on the nutrient part of the soils this results to cultivation of crops such as millet and bajra. The hills as mentioned before are not very fertile for agriculture the presence of soil is from sandy loam to loam. These are light textured soils with hardpans and stone lines which restrict their use in intensive agriculture. Nevertheless, the lower lands, including the valleys in the hilly districts, can produce limited extent of crops, provided that irrigation facilities are available. The flood continues to be significant in the recent flood plains and other low land areas of Faridabad and Palwal. The Yamuna River's floods periodically enrich the fertile loamy silt creating growth conditions heavy floods also harm plants and wash out the top fertile soil eroding the ground. In these areas farmers struggle with precise control of when to harness flood benefits and when to harness floods to prevent crop loss. Furthermore, the occurrence of water in the low lying planes during the monsoon season leads to stagnancy that is not beneficial to agriculture unless there is good drainage needed.(Kumar R. , 2014)

The opportunity and constraint of agriculture in Faridabad and Palwal districts of Haryana – The reported feature of the soil of the two districts shows that while the district contain a variety of appropriate condition for the cultivation of crop, they are also riddled with some rather unfavourable condition. The flood plain and the other areas with a relatively low elevation bear the nutrient-rich, loamy soils favorable for crop productions provided the appropriate water control system is in place. However, the soils in the dunes and hills are sandy making cultivation more difficult concerning the choice of crops to be cultivated and the management practices that are needed. In general, the component of the variety of soil

texture in these districts enable differentiated agricultural production with prospects at flood hazard being the key determinant of crop yields.(Thakur, 2013)

### **Agriculture in Haryana Based on Soil Types**

Haryana's soil system is largely influenced by the alluvial deposits from two major river systems the Ganges and the Indus. The state is the mostly a flat plain located close to the line of water divide of these two basins. The has been described to contain a large portion of old alluvium in several areas, sand, clay, silts and kankar – which are hard calcium nodules that are embedded on the soil. More of this old alluvial soil is developed on the high land, you find young and nutrient rich soils in the Yamuna and Ghaggar flood plains which experience frequent deposition of coarse sand and silt by river systems. Due to the geographical variation, the soil of this state is also varied. The southwestern region is characterized by sand dunes, which are formed by sand blown about by the wind, and as a result, the place is less fertile for crop growing. While, the northern and the eastern part of the state has comparatively fertile soil that supports better yield of crops. The Midland tracts such as Panipat and Sonapat are rated moderate fertility. The Arid zones of Gurgaon and Rewari are rated low fertility due to poor and sandy soils.(Reddy, 2011)

They have also focused on case study areas related to reclaimed wasteland development on areas containing a good number of farmer households of district Rohtak in Haryana with special reference to Kharif and Rabi crops. The fertility of the land especially the nutrient value of the soil especially nitrogen, and phosphorus and potash when it comes to crops.. The distributorship affects the type and fertility of the land in the state, fertile areas having better ways to manage water or and irrigation systems than arid areas that have a difficult time supporting agricultural productivity.(Mathur, 2001)

### **Conclusion**

Finally, it is established that below the surface of Haryana, the play of the soil forming factors is controlled by the alluvial forms formed by the debris of the Ganges and Indus etc rivers. These are alluvial to the south and more or less productive depending on the quality of the soil which varies between the black cotton soils of the north, to sand in the south, affecting the agricultural potential of the state's districts. Northern tracts like Panipat and Sonapat are blessed with profuse black soils that are highly suitable for multiple cropping and So, Rewari and Gurgaon face problems of sandy and low fertility soils which require expensive irrigation and soil use. Soil conservation is another vital practice in preventing soil erosion, while crop rotation and the use of organic fertilizers are relevant in avoiding nutrient depletion and water scarcity. Soil resources are closely associated with agricultural prosperity in Haryana, and appropriate measures are taken to use both high and low fertility lands in the state for cropping.

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