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# Effect of Edaphic Factors on the Phenotypic Characteristics of *Cicer Arinetinum* (Chickpea) Plant of Two Different Regions of the District Prayagraj (U.P) India

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***Abstract:*** ***In the Present study Based on Prayagraj District area which can Bifurcated by the river Ganga, Yamuna and Vindhyan Hills into three natural subdivisions are active Flood Pains, older Alluvial Plain and Rock surface, Denudation hills. Here soil used in the Alluvial Plains(shringverpur) and Denudation hills (Karchanna). As we all know Legume Cropping Systems are More sensitive toward Abiotic conditions. They increase soil fertility and concurrently enhance Plant productivity and prevent erosion and desertification. The Growth development and yield of Cicer arietinum (chickpea) is strongly influence Abiotic factors. In this present study we will conclude that different level of Ph, Ec Organic Carbon and N, P, K of soil cause variation in the Phenotypic characteristics of the chickpea plant. The difference can be seen at the selected Phenotypic characters of plants like- Height of plant, diameter of plant, Number of nodules, shape of nodule, fruiting, plant health, Identified species etc. The duration of study is September 2018-May 2019.Phenotypic Result- shringverpur region have moderate tall height and medium diameter, good number nodules present, Shape of the nodule found is filiform shaped and having moderate kind of plant health. Karchanna region have short height and small diameter, very less or absence of nodule, blunt shaped (Y) nodules and having good plant health. Chemical Analysis soil - PH is 6.4-6.7 between 0-20cm of depth of shringverpur means soil is Slightly acidic character and 0-20 cm depth of Karchanna soil is between 6.8-7.0, it means neutral in nature these depths are having high amount of exchangeable sodium ions. EC of this region soils 0-20cm depth is various in between 0.10-0.16dS m -1 mean value is 0.16.it means slightly saline characters are present and most sensitive crops are restricted and 0.21-0.24dS m-1 mean value is 0.22. Organic carbon of 0-20cm depth is between 1.0-1.4 g/kg soil of shringverpur and 0-20cm depth is between 1.5-2.6 g/kg soil of Karchanna. At 0-20 cm depth amount of nitrogen of shringverpur is 6.3-10.3% and 0-20 cm depth amount of nitrogen of Karchanna is between 14-19% of soil. At 0-20 cm depth of shringverpur soil amount of phosphorus is various between 9.43-25.56 kg/ha-$^{1}$ and 0-20cm of Karchanna soil amount of phosphorus is 17.20-22.63 kg/ha-$^{1}$ .At 0-20 cm depth of shringverpur soil Potassium various in between 30.1- 40.6 kg/ha-$^{1}$ and 0-20 cm depth of Karchanna the amount of potassium various 35.7-57.3 kg/ha-$^{1}$ .***

***Keywords: chemical properties of soil, Sangam-Prayagraj, Edaphic factors, Phenotypic characters.***

## I. INTRODUCTION

A very famous quote – "***Land is not merely soil, it is fountain of energy flowing through the circuit of soil, plant and animal***". Soil is one of the most important natural resources for existence of living creatures. Yet it is most renewable and finite natural resources over use of the soil coupled with lack of proper management has led to its degradation echoing the concerns of the planners, researches and farmers (sharma,2006). Edaphic factors concluded as the important abiotic factor. An abiotic factor relating to the physical or chemical composition of the soil found in a Area. The influence of edaphic factors on the plant distribution is essential to community ecology and important for vegetation Restoration and Management. As well as variation at different levels edaphic factor led to the variation Taxonomic characteristics of Plant. The major landforms in the central parts Allahabad district, Uttar Pradesh which lie close to Triveni.

Sangam "three river confluence" named Ganga, Yamuna, Sarasvati River. It lies in the southern part of Uttar Pradesh. Basically, district is divided into the three main category of alluvial plain, denudation hill and rock surface. The soil and water are primarily Alluvial.

Grain legumes play an important nutritional role in the diet of millions of people in the developing countries and are thus sometimes referred to as the poor man's meat. Since legumes are vital sources of protein, calcium, iron, phosphorus, and other minerals, they form a significant part of the diet of vegetarians since the other food items they consume do not contain much protein (Latham, ).Legumes are multipurpose crops and are consumed either directly as food or in various processed forms or as feed in many farming systems (Kumara Charyulu & Deb,2014). The legume crops are often grown as rotation crops with cereals because of their role in nitrogen fixation. However, over the past few decades, the yields and production of legume crops have been stagnant in the developing countries. Agricultural research and development efforts in many of these countries have concentrated on increasing cereal yields and production and lowering crop losses in order to achieve food security. Due to the diverse roles played by grain legume crops in farming systems and nutritional security, the research on legume crops will have significant impacts on nutritional security and soil fertility. (Merga&Haji,2019).

As we all know leguminous crops have tendency of nodulation. Cicer arietinum the chickpea, is the world's third pulse crop. Yet its products play a very small part in world trade. They are, however, very important for local consumption. Cicer arietinum has been cultivated since antiquity, mainly in the semi-arid, temperate to warm regions of the Old World. Because of its insignificance to world trade, little fundamental research has been carried out on this crop. (Veenam&ZonenN.V-Wageningen,1972). It is an annual legume of the family Fabaceae, subfamily Faboideae. Chickpea seeds are high in protein. It is one of the earliest cultivated legumes, and 7500-year-old remains have been found.

The chickpea is important in Indian, Mediterranean and Middle Eastern cuisine. In recent, world production of chickpea 14.8 million tonnes increased, by India 67% -72% of the world total contributed. (FAOSTAT-United nation ,2017). Chickpea is Rabi crop; cultivation occurs in winter between October-April. Chickpea Plant have Normal growth Rate of 14% this year in India. Chick pea is the important pulse crop and mostly growth with rainy condition -65% remaining 35% with critical irrigation support. Straw of grains an excellent fodder while both husk and bits of "Dal" are valuable cattle feed. Leaves consist of Mallic acid and Citric acid, useful for stomach ailment and blood purifier. It have protein ,18-22%, carbohydrates 61-62%,Fat-4-5%,Fibre-22%-23%,Calcium 280mg/100g,Iron-12.3 mg/100g.Phosphorus,Calorific value-369-396 Kcal/100g.Taxonomical characteristics of *cicer arietinum* having small herbaceous branched Plant with maximum height of 45-60cm .Roots include strong central tap root with extensive lateral branches spread out it all direction in upper soil layers .There are numerous bacterial nodules found on Primary and secondary roots ,used as a site of atmosphere Nitrogen fixation. Stem is branched with numerous consisting of five sepals, five petals (consists of one standard, 2 wings, two keels) ten stamens (Nine fused to form one staminal column and one free) and a carpel with the style borne laterally on the ovary. They are single, axillary, Racemes usually solitary having pink or white colour with pink or blue shades. Pods are rectangular, swollen structure about 2 cm long and usually contain 2 seed in them. Single plant produces 50 -159 pods, seeds are spherical in shape, wrinkled or smooth with a pointed beak. Its head is like called chicken's head with a characteristics "beak" hence known as chicken pea.

Traditional soil management in agriculture is based on temperate crop rotations with grass crops for livestock production, improving soil structure and increasing fertility, with an important role of animals and natural fertilizers. After the Second World War, this traditional system was reduced, increasingly separating livestock from arable land, which lead to the elimination of grass and animal manure application in many arable crop systems. (Martinez- Salgado et al.2010)

Hence, it is important to study the ecological-edaphic factors of this crop to understand how changing environment led change plant morphology ultimately it will hamper the yielding capacity of plant. In view of above facts present study is entitled-"Effect of edaphic factors on Taxonomical characteristics of *Cicer arinetinum* (chickpea) plant of two different zones of Prayagraj" was design to analyse the soil estimation chemical level and their effect on taxonomic characteristic of plant at two opposite zone of Prayagraj - Shringverpur (Soraon) and Karchanna both areas located near Gangetic plains.

## II. MATERIALS AND METHODS

The study was designed to analyze the Chemical level of soil and their effect on taxonomical Characteristics of Chickpea plant of different regions of city of Prayagraj in order to check variation in both aspects. Accurate and reliable laboratory methods and analysis are a perquisite to ensure portable soil sample characteristics and thereby following experimental plan was taken.

1) *Duration of Work:* September 2018 and May 2019
2) *Site Visit:* last week of October 2018(3 times)
3) *Sampling Month:* mid week February 2019

*A. Place of Work*

The present study entitled, "Effect of edaphic factors on Taxonomic Characteristics of plant at two different regions of Prayagraj City "was carried out at 2 place-

1) *Chemical Estimation of Soil:* Department of Soil science and Agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj, Uttar Pradesh
2) *Taxonomical Analysis*: Post Graduate Department of Botany, Ewing Christian College, Prayagraj, Uttar Pradesh

*B. Study Sampling Site*

1) The chickpea field was located at Prayagraj district, Uttar Pradesh, India. The selected area is located near Tamas river (Tributary of Ganga) and Gaura river (Tributary of Ganga).
2) The area of latitude 25035'55" N and longitude 81037'50" E -Karchanna and 25016'55" N and longitude 81056'09" N Shringverpur, kaudihar (Soraon). Distance between both river land site is 46.3 km. Temperature Ranges from 240-70 C. wind speed 8 km/ha Pressure.
3) Source of irrigation is Tamas river (Tributary of Ganga), borewell, water shed rainfall - Karchanna and Gaura river (Tributary of Ganga) borewell, water shed rainfall, borewell-Shringverpur

*C. Study Sample*

A total of 6 samples soil were collected 3 samples from different crop field by homogenous method of soil sampling with "V" Slit method. So, total one site 3 sampling points were chosen for this study with 1 depth -from 0-20 cm. Soil sample was collected 0-20cm from soil surface. For taxonomical analysis standard Randomized block design method used for which total 10 samples were collected 5 each from different region of city.

*D. Collection and Transportation of Samples*

Soil samples were collected into different and labelled yellow pocket patch, for plant samples they were collected into plastic bags with pores. Then both samples carried to laboratory vey carefully. For sampling, we use drying sample and post sampling care.

*E. Chemical Analysis of soil Samples*

Table 1- Procedure used chemical analysis of soil: -

| Particulars | Methods (Scientist) |
|---|---|
| Soil Ph | Digital pH meter (Jackson 1958) |
| EC (dSm-1) | Digital conductivity meter (Wilcox 1950) |
| Organic carbon (%) | Rapid titration method (Walkley and Black 1947) |
| Available Nitrogen (kg ha-1) | Available Nitrogen (Subbiah and Asija 1956) |
| Available Phosphorus (kg ha-1) | Colorimetric method (Olsen *et al*. 1954) |
| Available Potassium (kg ha 1) | Flame photometer method (Toth and prince 1949) |

*F. Taxonomical Analysis of Plant*

For this study we chosen the 7 specific character which directly influence by soil variation in soil. Analysis of plant is done by natural system of classification.

Those characters are-

1) Height of plant
2) Width of plant
3) Number of nodules
4) Shape of nodules
5) Fruiting body
6) Plant health
7) Identified species

Fig-1 Sample preparation in the laboratory

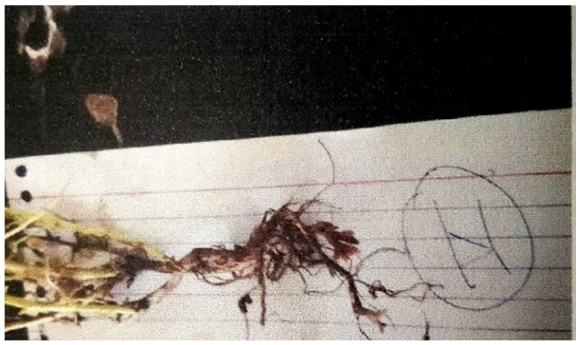


Fig-2 Filliform shaped node structure

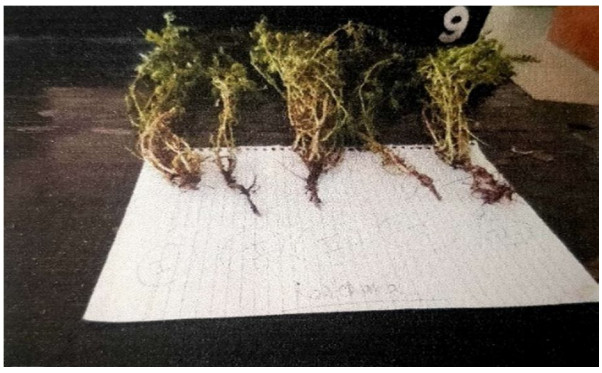
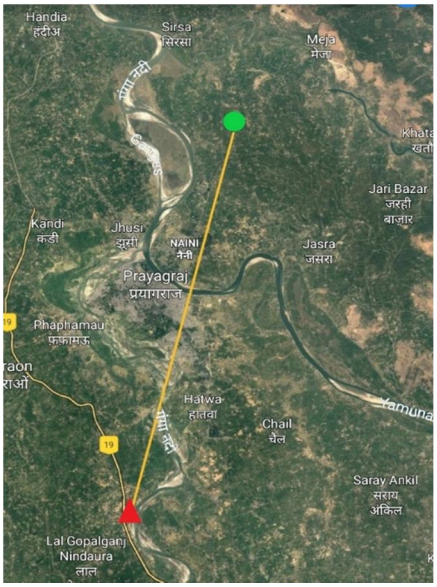


Fig-3 5 Plant sample of Karchanna without nodule

Fig-4 5 Plant sample of shringverpur with nodule found *Cicer arinetinum* of shringverpur






Karchanna site

Shringverpur, kaudihar (Soraon)

## III. RESULT AND DISCUSSION

Table 2- Morphological Taxonomical characteristics used for analysis –

| Characters | Shringverpur | | | | | Karchanna | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Plant No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Height of plant | 36cm | 39cm | 40cm | 36cm | 38cm | 18cm | 21cm | 25cm | 24cm | 16cm |
| daimeter of plant | 12cm | 18cm | 08cm | 15cm | 15cm | 14cm | 16cm | 11cm | 09cm | 13cm |
| Number of nodules | 2 | 6 | 5 | 4 | 3 | 0 | 0 | 2 | 0 | 5 |
| Shape of nodules | F | F | F | F | F | Y | Y | Y | Y | Y |
| Fruiting | AB | P | AB | AB | P | HP | P | P | HP | P |
| Plant health | M | M | G | M | M | G | G | G | G | M |
| Identified species | 1 type | 1 type | 1 type | 1 type | 1 type | 1 type | 1 type | 1 type | 1 type | 1 type |

F-filiform Shape, Y- Y shaped, Ab-Absent-P-Present HP-highly present M-moderate- Good,1 type- Cicer arietinum sp.

1) *Height of Plant and Diameter of Plant:* In Shringverpur region plant sample have Height is various between 36-40 cm and in Karchanna region plant sample have 16cm-25cm. In shringverpur, diameter of the plant is various between 18-8cm and Karchanna region it is between 16-18. In comparison between both regions, shringverpur have long height and bigger in diameter of chick pea plant. Reason behind these result – primary, the secretion of plant growth hormone auxin and by the reference Table no.2 due presence of good numbers of chick pea because of their weight plant must be bend down little bit.
2) *Number of Nodules:* In shringverpur, numbers of nodule present is good but in Karchanna region have very less or absent. The reason is that shringverpur have low amount of nitrogen in soil because of which to fulfill their requirement roots do symbiotic association with rhizobium bacteria and in Karchanna region have good amount of nitrogen, no such needs are require.
3) *Fruiting:* The shringverpur region have bad fruiting in comparison with Karchanna region have good fruiting. The reason can be many -Bad soil quality, disturbed pollination, location lies near to the industrial area. Karchanna region is benefited with located as outskirts of Prayagraj, Undisturbed pollination, Good soil quality which favor good yielding of chick peas, favored traditional practices of cultivation.
4) *Plant Health and Identified Species:* In shringverpur region have mostly moderate kind of plant health but Karchanna region have mostly good plant health. The reason behind this shringverpur soil getting eroded because of high use of fertilizers.

Due to almost same kind of climatic zone and geographical area have same kind of species found type -*Cicer arinetinum*

Table 3- Chemical property analysis-

| S.no | Region | $P^H$ | EC (dS m-1) | OC (%) | N (%) | P (kg ha-1) | K (kg ha-1) |
|---|---|---|---|---|---|---|---|
| | | 0-20 cm | 0-20 cm | 0-20cm | 0-20 cm | 0-20cm | 0-20 cm |
| 1 | Shringverpur | 6.45 | 0.10 | 1.4 | 6.3 | 9.43 | 30.1 |
| 2 | | 6.59 | 0.14 | 1.4 | 10.3 | 8.22 | 34.6 |
| 3 | | 6.75 | 0.16 | 1.0 | 6.92 | 25.56 | 40.6 |
| Mean | | 6.59 | 0.13 | 1.2 | 7.84 | 14.40 | 35.1 |
| 4 | Karchanna | 6.90 | 0.23 | 1.5 | 14.02 | error | 35.7 |
| 5 | | 6.82 | 0.24 | 2.6 | 19.0 | 17.20 | 42.8 |
| 6 | | 6.96 | 0.21 | 1.8 | 15.0 | 22.63 | 57.3 |
| Mean | | 6.89 | 0.22 | 1.9 | 16.0 | 13.37 | 45.2 |
| Standard dev. | Shringverpur | 0.150332 | 0.030822 | 0.244948 | 2.152858 | 9.680392 | 5.267826 |
| | Karchanna | 0.070356 | 0.017320 | 0.181659 | 2.638219 | 7.176606 | 7.771965 |

1-Plot 1, 2- Plot 2 ,3- Plot 3 (1,2,3 of Shringverpur) and 4-Plot 1,5-Plot 2,6- Plot 2(4,5,6 of Karchanna)

*A. $P^H$ and Soil Salinity (EC)*

PH is 6.4-6.7 between 0-20cm of depth of shringverpur means soil is Slightly acidic character and 0-20 cm depth of Karchanna soil is between 6.8-7.0, it means neutral in nature these depths are having high amount of exchangeable sodium ions. Mean value of 0-20cm depth is 6.6 in shringverpur and mean value of 0-20cm depth is 6.9 in Karchanna. It shows that pH slightly acid nature is shown by the shringverpur and neutral to alkaline conditions for Karchanna soil. Chick pea crops are best suited to well drained loam and clay loam soil that neutral to alkaline (pH 6.0-9.0) and have good water holding capacity. It occurs because of downward movement of water accumulation of cations in the Karchanna region. Anova is showing significant. Plot 3 is showing highest mean value in shringverpur and Plot 3 showing highest mean value in Karchanna is also showing the same.

EC of this region soils 0-20cm depth is various in between 0.10-0.16dS m -1 mean value is 0.16.it means slightly saline characters are present and most sensitive crops are restricted and 0.21-0.24dS m-1 mean value is 0.22 .At the depth of 20-40cm of soils showing 0.26-0.29dS m -1 and mean value is 0.28 moderately saline, yield of most crops gets affected. Karchanna region is showing high EC. Result of Anova is showing significant.

*B. Organic Carbon*

Organic carbon of 0-20cm depth is between 1.0-1.4 g/kg soil of shringverpur and 0-20cm depth is between 1.5-2.6 g/kg soil of Karchanna. Highest amount of organic carbon present in surface soils of Karchanna compared to shringverpur. The reason is soil compactness will be more at high depth or may be high bulk density. High mean value is showing plot-5 Karchanna region. Anova table is showing significant.

*C. NPK*

At 0-20 cm depth amount of nitrogen of shringverpur is 6.3-10.3% and 0-20 cm depth amount of nitrogen of Karchanna is between 14-19% of soil. Compared to shringverpur soil, Karchanna soil is containing highest amount of nitrogen. High amount of nitrogen available in Karchanna soil. Mean value of shringverpur is 7.3 % and Karchanna have 16%. Plot 5 have the highest nitrogen percentage. It shows that medium of nitrogen content in soil. At 0-20 cm depth of shringverpur soil amount of phosphorus is various between 9.43-25.56 kg/ha-$^1$ and 0-20cm of Karchanna soil amount of phosphorus is 17.20-22.63 kg/ha-$^1$. Plot 4 results error because of may be high use of pesticides. It shows high amount of phosphorus at shringverpur soil compared to Karchanna soil. Mean of shringverpur is 14.40 kg/ha-$^1$ and mean of Karchanna is 13.37 kg/ha-$^1$ Plot 3 of Karchanna have the highest phosphorus value 25.56 kg/ha-$^1$ .Anova is showing significant. At 0-20 cm depth of shringverpur soil Potassium various in between 30.1- 40.6 kg/ha-$^1$ and 0-20 cm depth of Karchanna the amount of potassium various 35.7-57.3 kg/ha-$^1$ . Presence of potassium is high at Karchanna. Potassium fixation is high in Karchanna compared to shringverpur soil. Anova is significant. High mean value present in Plot 6.

## IV. CONCLUSION

In the conclusion, by the means of various significant parameter it is evident that soil and plant quality of Karchanna is better than shringverpur (Soraon). Amount of macro and micro nutrients prese Soil pH is considered the 'master variable' in soil fertility for several reasons. Soil pH often has a large impact on precipitation and dissolution of primary minerals, the degree of CEC(cation exchange capacity) and AEC(Anion exchange capacity) on variable-charge minerals, the degree of ion-exchange, ligand exchange, and chemisorption reactions, microbial activity that impacts nutrient cycling, and the solubility of Al. Based on this analysis soil from nearby riverbank area soils was good for cultivation and soil is having Medium fertility and productivity. Wheat, Rice, Paddy, Arhar, Gram, Lentil, Line seed and vegetables like Tomato, Brinjal, Chilli, Broad beans can grow. By the means of study, it finds out that shringverpur (Soraon) region is exhibiting little bit degradation of soil due to over use of pesticides and fertilizer. Nitrogen is present in plant tissue at the highest relative abundance of the essential mineral nutrients that comprise from 1% to 5% of plant dry matter. Plants use N to form amino acids, which are subsequently incorporated into proteins and nucleic acids (DNA and RNA). Nitrogen is also an integral component of chlorophyll, the light-absorbing pigment needed for photosynthesis. Because of the high N requirement of most crops and its mobility in the environment, it is also commonly the most limiting nutrient in both managed and natural ecosystems. As a result, N is typically the nutrient that receives the most attention. As per optimum productivity of yielding crop records, yielding capacity of field of shringverpur also decrease. As per need of the crop sometimes farmer doesn't know exact amount of particular variety of crop in that case the amount of fertilizers may increase cause harm to it.The chemical composition of soil and components of the agricultural land is very important because it affects the distribution of micro flora and micro fauna ,which is very essential for it. The farmer should stop the use urea based fertilizers. In the case of leguminous plant, they have capability to show microbial association takes place through which biological nitrogen fixation is done it ensure the nitrogen content in soil macronutrient, playing important role in optimum productivity of the yielding crop.

It has been overserved that present modern practices disturbed the soil compositions to the extent not facilitating nature symbiotic association due to which nutrient balance in soil would not bring up in soil. On that sake the presently study is important that give us conclusion through which we can reduce agarose impact of all agricultural practices. Several plants could be used as biofertilizers *Crotoloria juncia, Glycine max*(soybean), *Vigna radiate* (mung). Other several methods also can be used to increase soil fertility and ecology of field like-crop ploughing, use of traditional practices of farming, Crop rotation, inter cropping- relay intercropping and strip intercropping. The plant selected for the current study belongs to the family Fabaceae which includes comparatively a primitive group. It is during a long course of evolution; the plants have developed an ability to establish a symbiotic relationship with other primitive and simple unicellular plant having capability to be free atmospheric nitrogen. It is through this mutual benefit both of them managed to survive in different hostile condition. Nitrogen is an essential part of each and every type of protein. These protein act as building blocks as well as biocatalyst of different biochemical taking place in a living cell. The protein synthesis is also mediated by a number of $P^H$ and variable temperature sensitive enzymes, as result of which we notice change in the phenotype of the plant. In long course of evolution these changes get genetically fixed resulting evolution of the new strain or species or a ecotype able to grow successfully in a given habitat. In the present study the changes in the morphology and physiology of the concerned plant. These finding will be helpful to decipher the intricate evolution of the plants of this group as well as other plants interacting with the different type of habitat and according bringing about charges in their genome.

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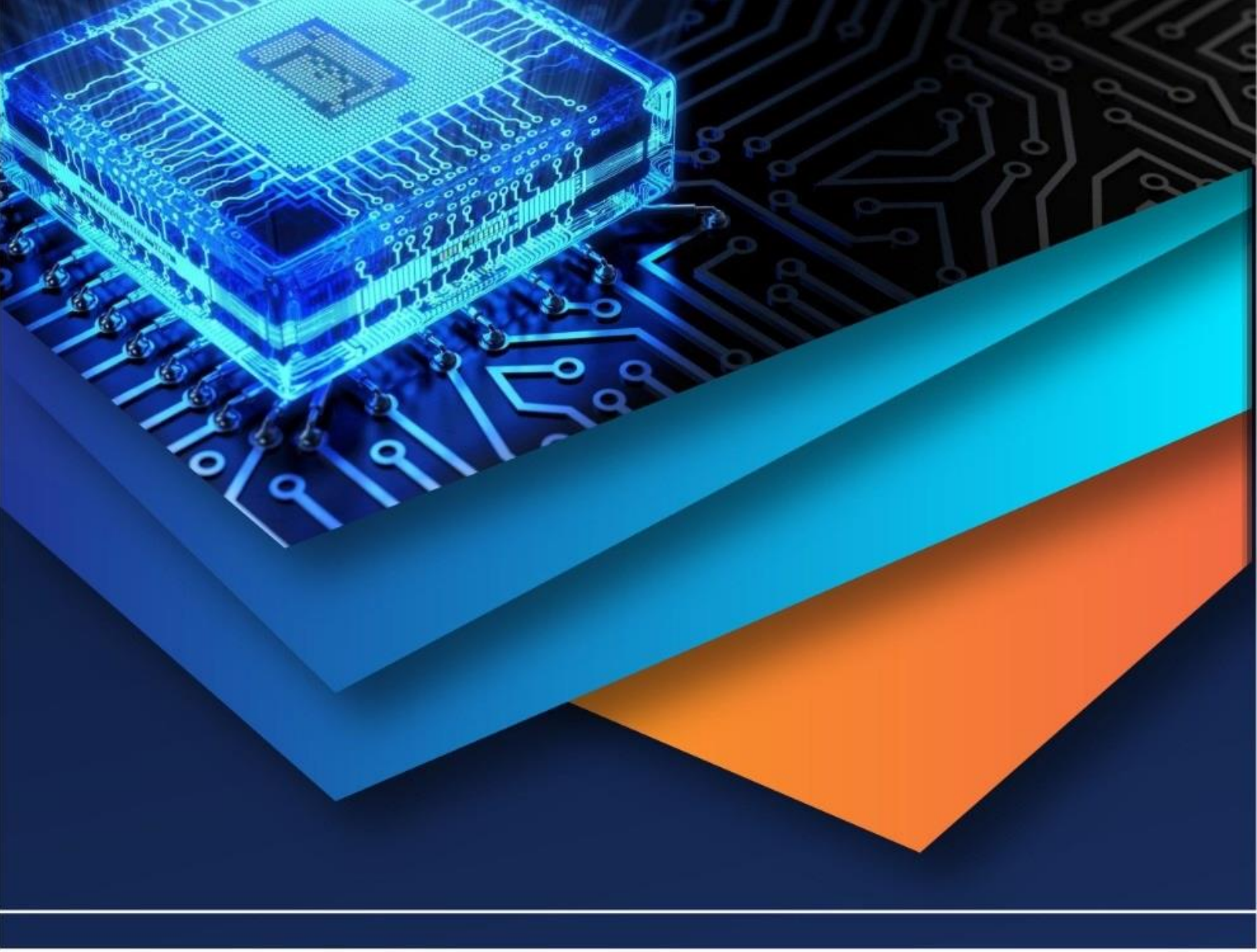

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