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Chemical Pesticides in Vegetable Farming Hampers Health of Farmers And Biodiversity Canvas of The Region.

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Abstract: ***A huge part of Indian populations are engaged in agriculture. This paper trying to recognize the farmers' awareness and perceptions of pests and pesticide use mostly in few winter vegetable farming and judge the pesticide use practices and the intensity of pesticide use in some selected winter vegetable cultivation. The farmers who farm cabbage, cauliflower, Tomato in the survey area use a huge number of pesticides to defend the crop and also good yield. They are basically exposed to a outsized number of health problems directly and indirectly. The result indicates that on an average only 14 per cent of the farmers were aware about pesticide exposures. Most of the farmers suspected that frequency of insects (86.5%) and disease (85.5%) infestation has increased over the past 20 years. Our study shows that farmers have not followed adequate safety measures at the time of pesticide application. The high pesticide use cost was observed in vegetables especially in tomato and it is a great anxiety that most of the pesticides are noticeable to high and moderate risk chemicals. This paper targets to study the health problems faced by the farmers and to provide proper advice so that minimum loss is caused to the farmers, environment, Biodiversity canvas of the region and maximum sizeable yield is obtained. Increasing farmers' consciousness of pesticide hazards to the environment and use of alternative pest management technique such as use of bio-pesticides and IPM is necessary on an vital basis for dropping unnecessary outcome on environment and Biodiversity scenario of the locality.***
Keywords: ***Pesticides, pesticide risk, health hazards, IPM, environment, biodiversity***

I. INTRODUCTION

There is no doubt that pesticides have a foremost contribution for controlling of pests and at the same time increasing good crop yields. But over the years there is an upsetting anxiety about offensive and unsystematic use of pesticides in agriculture land [1]. Pesticide use has resulted in a diversity of socioeconomic and environmental hazards. The farming of lofty yielding varieties, overlapping of cropping seasons and pointless disproportionate submission of agro-chemicals, monoculture of commercially very important crops have aggravated the incidence of diseases and pests. The Coochbehar district of West Bengal in the North-eastern part of India is also fairly well-known for vegetable farming mostly in the winter season (Nov-Dec) from the Mathabhanga and Mekhliganj subdivision. The course of using fertilizers and pesticides begins about a month before the sowing of seeds. The majority of the farmers are careless as a result they hardly know the proper way of using the pesticides. They obtain the information from older farmers and pesticide sellers. Subsequently most of the farmers are ignorant of the health hazards they are facing day by day [2]. This study is mainly purposeful to study the hazardous effects of pesticides used in the field during the entire process of cultivation of winter vegetables. There are about 1200 farmers in this two subdivision, who are totally dependent on the winter vegetable farming. To get a considerable high-quality crop yield, the farmers have to use a huge quantity of pesticides and fungicides [3]. This study attempts to examine the management of pesticides and health related problems arising in the farmers in Mathabhanga block I and Mekhliganj Block in the jurisdiction of Mathabhanga subdivision under Coochbehar district. It is a universal fact that like other parts of our country, the vegetable cultivated here also suffers from fairly a bundle of diseases and pests. The most frequent pests are the Stem and Fruit Borer Worms (SFBW) along with fungal and viral diseases.

II. METHODOLOGY

Cooch Behar lies between $25^0$57'47" to $26^0$36'2" North latitude and between $89^0$54'35" to $88^0$47'44" East longitude. Total area of the district is 3387 sq. km. It is located in the north-eastern part of the state and surrounded by the district of Jalpaiguri in the north, state of Assam in the east and the international border in the form of Indo-Bangladesh boundary in the south as well as in the west.

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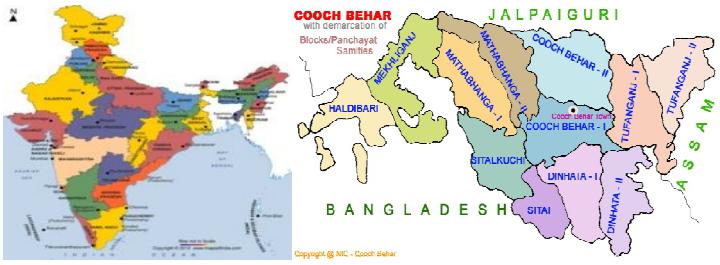


Fig.1.Map of India and Coochbehar district (Not to scale)

The community development block Mathabhanga block-I(26°17′28″N 89°13′53″E.) of Mathabhanga sadar subdivision and and Mekhliganj (26°21′N 88°55′E.)Block of Mekhliganj sadar subdivision is situated in the Coochbehar district. Due to high rainfall and high humidity, there is diseased trouble of vegetable cultivation. Total cultivated area is 2, 58,296 ha. Net cultivated area is 2, 48,144 ha and gross cultivated area is 5, 47,108 ha in Coochbehar district. The cropping intensity for the district is 204%. Total no. of farmers are occupied in cultivation is approx 3, 70,000 in the district. The geological formation is the alluvium of recent times deposited by Tista and Mahananda rivers. The Climate is humid to sub-humid. The length of moisture availability (LGP) ranges between 270-300 days in a year[4] The principal crops are Paddy, Jute, Tobacco and Vegetables. The two blocks Mathabhanga block-I and Mekhliganj block plays a vital role as winter vegetable producing area.

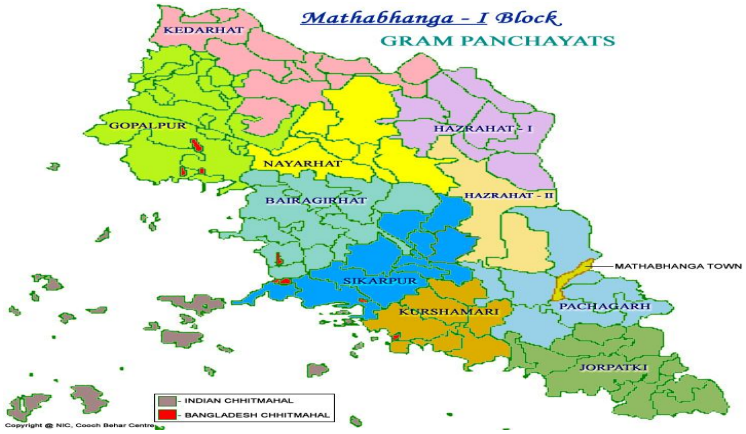


Fig.2.Map of Mathabhanga Block I(Not to scale)

The Mathabhanga block I and Mekhliganj Block of Mathabhanga subdivision of Coochbehar district were purposively selected for the study area because of commercial cultivation of vegetables and nearness to main markets.



Fig.3.Map of Mekhliganj Block (Not to scale)

Three leading vegetables of winter like tomato, cabbage, cauliflower were selected for detailed investigation. The other reason to choose sample blocks from Mathabhanga subdivision and Mekhliganj subdivision as the selected vegetables are extensively grown in this region. In the Second stage, from each selected block, hundred farmers from each block were selected randomly making a total sample size of 200 for the study. The entire survey work was carried out from Sept, 2016 to December, 2017

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Mathabhanga blockI		Mekhliganj Block	
Characteristics	Frequency (Σn = 100)	Characteristics	Frequency (Σn = 100)
Age		Age	
21 and below	10	20 and below	10
22-38	43	22-38	40
38-40	11	38-40	14
41-50	12	41-50	16
51-60	15	51-60	12
61-70	9	61-70	8
Race		Race	
SC	50	SC	37
ST	22	ST	33
Other	28	Other	30
Gender		Gender	
Male	73	Male	74
Female	27	Female	26
Education level		Education level	
Primary school	68	Primary school	68
Secondary School(Lower)	20	Secondary	22
Secondary School(Upper)	11	School(Lower)	8
College/University	1	Secondary	2
	0	School(Upper)	0
	0	College/University	0
Farming Experiences (years)		Farming	
1 - 5 years	20	Experiences	22
6 - 10 years	6	(years)	3
11 - 15 years	6	1 - 5 years	6
16 – 20 years	15	6 - 10 years	15
21 – 25 years	29	11 - 15 years	29
26 – 30 years	5	16 – 20 years	5
More than 30 years	19	21 – 25 years	20
	0	26 – 30 years	0
		More than 30 years	
Work		Work	
Full time applicator	88	Full time	85
Part Time applicator	12	applicator	15
		Part Time applicator	
Suffering from any severe illness		Suffering from	
Yes	10	any severe illness	14
No	90	Yes	86
		No	
Smoking tendency		Smoking habit	
Smoker	77	Smoker	81
Non- smoker	23	Non- smoker	19
Farming Area (ha)		Farming Area (	

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0.3 – 0.4 0.4-0.5 0.5-1	30 61 9	ha) 0.3 – 0.4 0.4-0.5 0.5-1	35 53 12

Table-1. Socio-demographic data from the survey work and dialogue of vegetable farmers in Mathabhanga blockI and Mekhliganj Block

III. RESULTS AND DISCUSSION

A. Survey On vegetable Farmers' Socio-Economic Background

The study was involving a sample population of 100 active vegetable farmers from Mathabhanga blockI and 100 active vegetable farmers from Mekhliganj Block. Farmers were selected at random basis according to active vegetable farmers in the area as well as based on residence area neighbouring to the cultivated land and directly or indirectly get in touch with vulnerable effects of pesticide use. Survey and formal interview which were comprised of varied questions were carried out to get information on pesticide use in vegetable farming techniques from the farmers. The survey containing various types of primary as well as secondary data involving to various angles linked with pesticide usage in vegetable cultivation in the study area. The primary data relating to various issues involved in pesticide use .The interview was carried out in an local language (Bengali) for 30-45 minutes for each session. Farmers were questioned about their socio-demographic data such as age, work experience, sex, education level and size of vegetable farm. They were also asked about pesticide use and types of pesticide to prevent pests and disease, formulation or commercial name, major pests in vegetable farming, pesticide practices and occurrence of spraying in one vegetable farming season, awareness of farmers with regard to degree of toxicity of pesticide, safety methods followed during pesticide use, quantity and frequency of pesticides used in cultivation. The knowledge of farmers about pest management, awareness of the kind and information associated to various inputs used, vegetable of inputs and outputs were collected. The vegetable farming system sampled in Mathabhanga and Mekhliganj usually consists of smallholder vegetable farmers planting vegetable plants in areas with average farm size ranging from 0.3 to 1 ha as shown in Table 1. It is obvious from the table that the size of vegetable farm showed that most farmers had less than 0.5 ha. A very minimum percentage of farmers have higher education level at college or university. From the interview it was exposed that few of the farmers agreed training from the Department of Agriculture and obtained vegetable cultivation procedure mostly from skill with their parents; work on other farmers' cultivation field or by knowing from other vegetable farmers. From the interviews, it was established that most of the farmers were scheduled caste (SC) in both the study area. The average ages of farmers varied from 22 to 38 years. Therefore it is evident that there is relatively small new entry to vegetable farming in the area for the past 10 years. Most of the farmers questioned were males and only few were females. The highest education level was primary school, followed by secondary school (lower) and secondary school (Upper).Farming understanding is not much different between generations because they gained from their friends and parents through working experience [5]. The sizeable portions of the farmers involved in the interviews were smoking practice and only few were non-smokers. Most of the farmers were not suffering any severe illness. Most of the farmers were full-time pesticide applicators and a low percentage of farmers were involved as part-time applicators.

B. Pesticides Used by Farmers During Farming of Some Selected Winter-Vegetable

The name of the pesticides used by farmers during the farming of tomato, cabbage, cauliflower, brinjal, potato and their manner of use were collected from the farmers through personal interview with them. Based on the information gained (Table 2), from the farmers it was obvious that they use mixture of harmful pesticides in their grounds for improving the yield. To prove this information a feedback form was ready and all 200 farmers were asked to answer. The responses were recorded in a tabular form and given in table2.

Name of the vegetable	Brand name /Common Name	Chemical composition /Identity	Class
Tomatto	Sevin	1-naphthyl methylcarbamate)	Carbamate
Tomatto	Eight	(±)-3-Phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate	Pyrethroid
Cabbage	Oxydemeton methyl 0.02%	S-[2-(ethylsulfinyl)ethyl] O,O-dimethyl phosphorothioate (56)	Organophosphate

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Cauliflower	acetamiprid	*N*-[(6-chloro-3-pyridyl)methyl]-*N'*-cyano-*N*-methyl-acetamidine	Organochlorine

Table-2- The list of few pesticides used by farmers

The table no.2 markedly shows that pesticides and insecticides usually categorised into four categories, namely, Organochlorines, Organophosphates, Carbaryl and Pyrethroids. All the chemicals are extremely harmful chemicals and are used all over our country to manage pests and insects [6]. These chemicals are used by the farmers to defend their crops in a large scale and in turn they are uncovered to various health hazards. carbamate pesticide inhibit acetyl cholinesterase, an enzyme critical to the control of nerve impulse transmission from one cell to another. When the enzyme is inhibited, there is overstimulation and then paralysis of the secondary cell. The character, duration, and degree of the resulting physiologic effect are straight related to the amount and rate of enzyme inhibition at certain receptor sites in the central and peripheral nervous systems. Agricultural contact is the mainly common site of organophosphate and carbamate poisoning. Most carbamate insecticides are used for crop spraying in commercial agriculture [7]. The symptoms of poisoning by Pyrethroid class of pesticides are dizziness, headache, nausea, muscle twitching, reduced energy, changes in awareness, convulsions and also loss of consciousness [8-9].Organophosphates are insecticides containing esters of phosphoric acids. These pesticides are extremely strong neurotoxins [10] and directly harass the nervous system of man. Organochlorines are chemicals like DDT, polychlorinated biphenyls, Hexachlorocyclohexanes, etc. On usual contact to these chemicals diverse types of health risks has been observed among the farmers and their family members. These take account of decreased sperm-count in males, birth defects, chromosome deformities in blood cells, leukaemia among children [11]. Farmers who are in direct contact to this chemical may demonstrate symptoms like headache, tiredness, general weakness and excessive salivation [12]. This may be included with vomiting and diarrhoea, stomach cramps, muscle twitch, shaking of hands and in acute poisoning the affected person may also lose consciousness [13].The indications of Organophosphates poisoning is known as Cholinergic Syndrome [14-15].

C. Resources of Information On Pest Management System

Farmers obtained the useful information on pesticide use from multiple sources (Table 3). The inter comparison of the two block shows, Mathabhanga block I had enhanced access to genuine information, such as State department of agriculture (14 per cent) compare to Mekhliganj Block (10 per cent), viewing the originality as well as higher educational level of farmers in that block (Table 3).

It was confirmed from the survey that about 15 per cent of farmers were exclusively dependent on the suggestion of pesticide sellers, followed by public annexe system or state department of agriculture staff (12per cent) as well as information from fellow farmer and friends (9 per cent).

Sources of information	Mathabhanga blockI	Mekhliganj Block	Overall (%farmers)
colleague farmer/friends/ relatives	10	8	9
company representatives /Pesticide sellers	16	14	15
State Agriculture Department	14	10	12

Table 3. Basis of information on pest management

D. Farmers' Knowledge On Ipm System

Winter vegetable cultivator in the study area was not aware of various issues connected to pest management. On an average 13.5 per cent of the farmers were conscious about pesticide hazards in vegetable farming. In case of Mathabhanga block I, about 15 per cent and in case of Mekhliganj block about 12 per cent of the farmers know about hazards of pesticide use. The information about pest

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enemies, IPM practices, bio pesticides and awareness about suggested level of pesticide use was also examined. Almost 6 and 8 per cent of sampled respondents were aware of IPM practices and use of bio-pesticides respectively in case of Mathabhanga block I and Mekhliganj block advise their motivation to accept safer pest control techniques, which is a good signal for environmental friendly cultivation. Only few farmers (7 per cent) know about the suggested level of pesticide use in vegetable cultivation, representing their need of knowledge regarding approved amount and unawareness about excess use of pesticides. (Table 4).

Particulars	Mathabhanga blockI	Mekhliganj Block	Overall (%farmers)
About pesticide hazards Understanding	15	12	13.5
Know the suggested level of pesticide use	8	6	7
Knowledge on bio-pesticides	5	7	6
Awareness about the pest enemies	14	12	13
Familiarity with the term IPM practice	6	8	7

Table 4: Farmers knowledge about pest management

E. Farmers' Option criteria For Pesticide Application In Winter Vegetable Farming

Farmers' option criteria for pesticide spray in winter vegetable farming depend on individual choice of the pest invasion levels (67.5 per cent) in all the selected vegetables (Table 5). About 16.5 per cent of farmers use pesticide application as regular practice or as calendar basis. Farmers in Mathabhanga block I (32 per cent) were more consulted extension employees compare to farmers of Mekhliganj block (18 per cent), reflecting their awareness and right to use consistent source of information. The farmers were also trusted upon extension employees (25 per cent) to know about degree of infestation level before going for pesticide application in vegetables. Only 12.5 per cent of total farmers were also took choice based on colleague farmers and media resources.

Basis of application	Mathabhanga blockI	Mekhliganj Block	Overall (%farmers)
Pest influx level determined by individual farmer	65	70	67.5
Information from other farmers, radio, TV etc.	12	13	12.5
Model practice and history of insect problems	16	17	16.5
Annexe guidelines of information for invasion thresholds	32	18	25

Table 5. Basis of submission of chemical pesticides by farmers

F. Farmers' Awareness Of The Diversity And occurrence of pests In Vegetables Over The Precedent Fifteen Years

In our survey area, farmers' perception about the diversity and uniformity of diseases and insect over the past 20 years was examined. The major portion of the farmers in both Mathabhanga blockI and Mekhliganj Block were supposed that frequency of disease (85.5 per cent) and insects (86.5 per cent) attack had increased over the past 20 years in vegetable farming. This redundant state of affairs undoubtedly ascertain the fact that the growth of resistance in insects and diseases, due to surplus and insentient application of pesticides in vegetables causing economic losses to the farmers as well as harm to the environment and consequently Biodiversity profile of the region.

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Fig.4.Invasion of insect in the cabbage

Particulars	Mathabhanga blockI	Mekhliganj Block	Overall (%farmers)
Disease			
No Changes	12	8	10
Declining	5	4	4.5
Increasing	83	88	85.5
Insect			
No Changes	7	10	8.5
Declining	9	1	5
Increasing	84	89	86.5

Table 6. Farmers perception of the kind and frequency of insect and diseases over the past 20 years

G. Farmers' Awareness on Harshness Of Pests in Vegetable Farming During Entire Study Period

Different insects and diseases occur in the particular three vegetables in the study area. The farmers vigilance on thoroughness of insects and disease in the vegetables was judged on three criteria namely minor, intermediate and heavy (Table 7).

Crops	Pest	Harshness of insect and diseases (%farmers)		
		Minor	Intermediate	Heavy
Tomatto	Insect	5	67	28
	Disease	7	10	83
Cabbage				
	Insect	7	13	80
	Disease	52	37	11
Cauliflower				
	Insect	6	15	79
	Disease	59	35	6

Table 7. Farmers perception on severity of insects and diseases in vegetables during the study period.

In case of Tomatto, cauliflower and cabbage farmers believed that heavy severity of insects (83 per cent, 80per cent and 79 per cent respectively) as the diamond back moth in cabbage was rigorous in the study area. In case of tomato, most farmers supposed the severity of insect as intermediate (67 per cent) and disease severity as heavy (83 per cent) as both insect and disease harshness is present in tomato.

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H. Pesticide Safety And Storage Practices By The Farmers

From the study it was found that most of the farmers (57 per cent) situated the pesticide containers in a particular safe location inside their own houses (Table 8). The remaining 43 per cent placed the containers in insecure spaces such as mixed with other kinds of bottles without any proper gentle method. Compare to the farmers of Mekhliganj Block (50 per cent), the Mathabhanga block I farmers took additional safety measures (62 per cent) regarding protective and safe storage of pesticide after purchase, due to their more consciousness of health protection. It was found that, 33 per cent of the sample farmers sold or uses again the pesticide containers. It was found that 23 per cent of the farmers had used facemasks or hand gloves and rest of the farmers are not aware to use any kind of protective measures like face-masks or hand gloves. The applicator farmer who did not use face masks reported the problem to wear as it results in sweating, and breathing problem Only 17 per cent farmers took secure disposal procedure like crushing or burying in the soil (Table 8). However, 42 per cent of sampled farmers destroy the vacant bottles in the field and outside the house. But bulk of the farmers (65 per cent) had washed their hands with soap after use of pesticide. It can be concluded that still farmers has to take more protective and safety measures without any wait to keep their health as well as environment in good condition and finally to maintain a good Biodiversity canvas of the region



Fig.5. Unsafe application of pesticide.

Particulars	Mathabhanga blockI	Mekhliganj Block	Overall (%farmers)
Pesticide storage by the farmers			
secure storage	62	52	57
Unsecure storage	40	52	46
Dumping of pesticide containers			
In the cultivated land	40	44	42
Sell and recycling	30	36	33
Crushed/buried in soil	20	14	17
Safety measures taken by applicants			
Use of face masks or hand gloves	25	21	23
Wash hands with soap	70	60	65
Sprayer use practices by the applicator			
Use after wash	72	68	70
Wash rarely or never wash	38	35	36.5

Table8. Pesticide storage, disposal and application practices by farmers

I.The Loss of Biodiversity Scenario in The Study Area.

We have identified two rivers which are polluted by the used chemical fertilizers and pesticides. Actually many cultivated lands are very close to the river Shutunga and Giria in the study area. Chemical pesticides pollute the ground water and river water also in polluting the primary source of drinking water and thus creating many water borne diseases[16]. Living organism is also reducing gradually due to uncontrolled and unspecified use of chemical pesticides and as a result the biodiversity scenario of the region is

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worsening day by day. In the study area, numbers of trees, animals, birds, and reptiles, insect like: butterfly etc. reducing day by day and it was observed by the farmers that some species have already being extinguished due course of time. Variety of fish found in between ten years ago and present days, there is a huge difference. Most of the common fish of this region are rare now and this clearly shows that there is a changing picture of biodiversity scenario around the locality Few unknown wild flower and the indigenous fruits, trees and medicinal plants are gradually shrinking day by day, because of clearing of vegetation for small tea gardens. Some of them had already extinct and others are threatened of extinction. Different type of birds and animals had already extinct and some of them are becoming rare day by day.

V. CONCLUSION

The present work strongly on firms that farmers of Mathabhanga block I and Mekhliganj Block and their family members were highly exposed to extremely harmful, constrained and also some banned pesticides, without sufficient protective measure. In this highly upsetting situation, immediate educational and practical training intrusion on pesticide handling and safety measures are very much needed in order to alter the existing present situation to protect farmers, environment and healthy Biodiversity scenario of the region. Farmers alleged that over the years the vulnerabilities of pests is increasing and greater quantities of pesticides required for controlling pests. Governmental involvements and efforts, such as controls on use of hazardous poisonous pesticides, scrutinizing of labels and strict enforcement of good agricultural practices are really required to diminish pesticide exposure of farmers and the general population. Farmers have not followed sufficient safety measures regarding pesticide application which is well documented. Most of the family members of the farmers suffer from general ill health due to the harmful side effects caused by the handling of these poisonous chemicals. Farmers had inadequate knowledge of integrated pest management as well as the consequences of pesticide use in vegetable cultivation. Increasing farmers' awareness of pesticide harshness to the environment and endorsement of alternative pest management strategies such as use of bio-pesticides and IPM, initiative of NGOs is immediately needed for decreasing objectionable effect on environment and protect the Biodiversity scenario of the region.

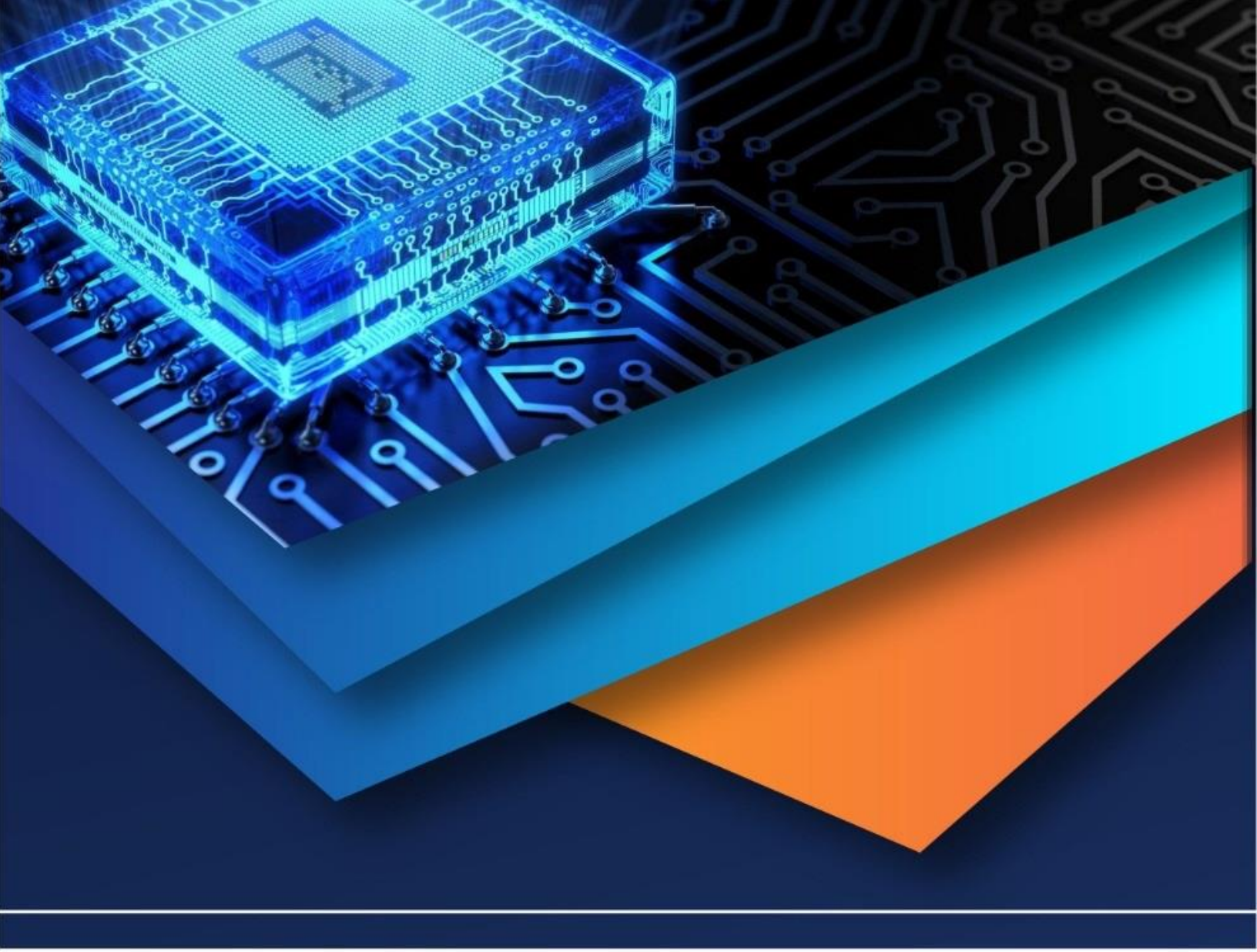
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