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Effect of Seaweed Extract on different Vegetables as a Bio Fertilizer in Farming

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Abstract: ***The effect of green marine algae Ulva lactuca was evaluated as Biofertilizer to improve growth of Corinderum sativum, Trigonella foenum graecum, Spinacia oleracea. Seeds were treated with different concentration seaweed extract of Ulva lactuca such as 2%, 4%, 6%, 8%, 10% and control (without treatment). After 15, 30, 45 and 60 days relevance of green algae certain plant growth parameter of root length, shoot length, seedling length ,seed vigour index, seed stamina index. The Bio-chemical parameter of chlorophyll-a, chlorophyll-b and total chlorophyll, carotenoid, protein measured in a plant material. Better result of seed vigour index and seed stamina index was showed in Corinderum sativum and in Trigonella foenum graecum and Spinacia oleracea in treatment of 6% and 8% concentration of seaweed extract, respectively.***
Keywords: Ulva lactuca, Seed vigour index, seed stamina index, vegetable plant, biofertilizer

I. INTRODUCTION

Farmers are used chemical fertilizer in the field directly. This chemical fertilizer are directly or indirectly harmful to air, soil, water and living organism. The utilize of seaweed as a fertilizer in crop production has long time belief in coastal areas in the world [1]. Marine algae extract is new generation of natural organic fertilizers highly nutritive and improve growth, germination of seeds and improve yield of many crops [2].

Seaweed is valuably use for plant germination and their growth; thereby recover the yield and resistance ability of many crops [3][4]. Seaweed is effect on plant growth hormones. Seaweed is biodegradable, non-hazardous, harmless, none polluting to human. The SLF (seaweed liquid fertilizer) is use as an organic fertilizer which is more useful to human health and environment. Seaweeds are excellent sources of many essential micro and macronutrients, vitamins, minerals, fatty acids and due to them higher polysaccharides content which could also imply high level of soluble and insoluble dietary fiber [5][6]. The seaweed extract carried out from seaweed or sprayed on crops for better seed germination percentage, growth, nutrient uptake and yield of plants [7][8]. The SLF obtained from seaweed to use as foliar spray for inducing better and faster growth, yield in leafy -green vegetables, fruits and also horticultural plants. During this study, the effect on the germination process to in bio-material of seaweed extract different concentration 2%, 4%, 6%, 8% and 10% percentage germination of three plants of *Corinderum sativum, Trigonella foenum graecum, Spinacia oleracea* seeds treatment respectively and untreated seed used as a control. Treated seed to show improved germination and growth.

II. MATERIALS AND METHOD

A. Collection of Seaweed

In the present study fresh seaweed was collected from Veraval sea site Gujarat, India in December 2018. The handpicked seaweed washed with the help of sea water to remove all the discarded impurities and sand particles etc. After washed, it was packed in to plastic bag and moved to the lab. The collected marine algae were again washed in fresh water to remove the surface salt and stored in to bottle, and filled it with fresh water.

B. Preparation of Seaweed Liquid Fertilizer (SLF)

Fresh marine algae were washed thoroughly to remove all epiphytes & sand particles with tap water. The seaweeds are dried for 3-5 days after dried seaweed to convert in to powder form. The powder was mixed with distilled water in ratio of 1:20 (w/v). Boiled for 45 to 60 minutes and filter by the muslin cloth [9]. The extract was 100% concentration and this experiment take five different concentration of extract such as 2%, 4%, 6%, 8% & 10% was used.

C. Selection Of Test Plants

In the present study, *Corinderum sativum, Trigonella foenum graecum, Spinacia oleracea* seeds were selected for the examination these were collected from Anand Agriculture University, Anand.

D. Seed Soaking

The seaweed extract was prepared with different concentration viz., 2%, 4%, 6%, 8%, 10%.The seeds surface was sterilized with 0.1% $Hgcl_2$ up to 1-2 minutes and washed help of distilled water. Then seeds were soaked in particular and individual doses of seaweed liquid fertilizer up to 24-48 hours at room temperature for better germination and early growth.

E. Preparation Field For Seed Germination

All healthy selected vegetable seeds primed in each concentration of seaweed extract and sawing in enough space in each field. Water is sprinkle after sawing seed for maintaining the moisture content. Seaweed extract applied by soil drench method with selected duration time. Measurement of growth parameter like root length, shoot length, seedling length, seed viguor index, seed stamina index and biochemical parameter of chlorophyll-a, chlorophyll-b, total chlorophyll, carotenoid. Protein was determined by Lowry method. Total carbohydrate was determined Anthrone method.

III. RESULTS AND DISCUSSION

In the world, the use of seaweed extract should be urged to avoid environment pollution by heavy dose of chemical fertilizer soil. The growth increasing probable of seaweed might be qualified to the presence of carbohydrates, protein, macro and micro elements [10]. In a maximum results of occurrence of 6% concentration of Sargassum wightii & Sargassum johnstonii on plant of Corinderum sativum, Trigonella foenum graecum, Spinacia oleracea [11]. The seaweed extract is different type concentration treatment expanded. The seed growth and germination significantly when compared to the control and developed of organic vegetable transplants has been achieved the utilize of both liquid and soil property of organic fertilizers [12]. Organic improvement such as compact and manure had been also proven to be a very superior source of fertilizer in container growth of organic plant production [13]. The results are presented in Table 1, 2 and 3 of plants Corinderum sativum, Trigonella foenum graecum and Spinacia oleracea, respectively of germination.

A. Trigonella Foenum Graecum

Present study of 15 days, 30days, 45days and 60 days plant on Trigonella foenum graecum in 8% concentration higher growth are observed. Root length; shoot length, seedling length 8% concentration is given a good result compare of other percentage concentration and control. Day by day good improvement observed in this 8% concentration. 2.17±0.091, 3.7± 0.158, 10.57±0.158, 13.97±0.133 growth are occurrence in root length of 15days,30days, 45day, 60 days on plant of Trigonella foenum graecum. Shoot length growth are observed 13.53±0.141, 30.5±0.158, 45.02±0.158 and 54.07±0.202 respectively. in a seedling length of this plant was marking 15.7±0.197, 34.2±0.493,55.59±0.235 and 68.04±25.963. In a SVI give a good performance of the germination. Root length was observed highest 15.26±0.60cm in 20% concentration of seaweed extract with optional level of control and where as 14.83±0.15cm in plants that was received from 20% seaweed extract alone[14].

TABLE I. Effect of seaweed extract of Ulva lactuca on the growth of Trigonella foenum graecum

Concertation of seaweed extract	Root length				Shoot length				Seedling length				Seedling vigour index				Seed stamina index			
	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days
2%	1.94 ± 0.079	3.7± 0.247	9.07± 0.237	11.68± 0.233	11.35± 0.205	28.06± 0.247	44.06± 0.237	51.56± 0.243	13.29± 0.218	31.76± 0.965	53.13± 0.480	63.24± 0.398	1329± 21.834	3176± 96.542	5313± 48.036	6324± 39.800	13.29± 0.218	31.76± 0.965	31.76± 0.965	63.24± 0.480
4%	1.92± 0.097	3.65± 0.201	9.78± 0.175	12.3± 0.161	12.49± 0.171	27.39± 0.201	44.27± 0.175	52.70± 0.159	14.41± 0.165	31.04± 0.656	54.05± 0.390	65.08± 0.184	1441± 16.572	3104± 65.601	5405± 39.020	6508± 18.456	14.41± 0.165	31.04± 0.656	31.04± 0.656	65.08± 0.390
6%	1.96± 0.046	3.69± 0.115	9.90± 0.135	12.42± 0.124	13.06± 0.200	29.77± 0.115	43.95± 0.135	51.82± 0.42	15.02± 0.172	33.46± 0.358	53.05± 0.435	65.24± 0.151	1502± 17.277	3346± 35.841	5385± 43.534	6524± 15.662	15.02± 0.172	33.46± 0.358	33.46± 0.358	65.24± 0.435
8%	2.17± 0.091	3.7± 0.158	10.57± 0.158	13.97± 0.133	13.53± 0.141	30.5± 0.158	45.02± 0.158	54.07± 0.202	15.7± 0.197	34.2± 0.493	55.59± 0.235	68.04± 0.259	1570± 19.788	3420± 49.396	5559± 23.595	6804± 25.963	15.7± 0.197	34.2± 0.493	34.2± 0.493	68.04± 0.235
10%	1.96± 0.095	3.67± 0.142	9.99± 0.58	13.24± 0.091	12.47± 0.180	28.16± 0.142	44± 0.058	52.89± 0.236	13.93± 0.428	31.83± 0.639	53.99± 0.404	66.13± 0.301	1393± 42.894	3183± 63.991	5399± 40.456	6613± 30.154	13.93± 0.428	31.83± 0.639	31.83± 0.639	66.13± 0.404
control	1.78± 0.113	3.29± 0.163	9.69± 0.113	11.49± 0.257	8.92± 0.459	22.57± 0.666	41.42± 0.384	51.11± 0.330	10.7± 0.225	25.86± 0.447	51.11± 0.300	63.11± 0.257	1225± 50.388	2586± 44.700	5111± 30	6311± 50.999	10.7± 0.503	25.86± 0.687	51.11± 0.396	63.11± 0.509

(Results=Mean±std)

B. Spinacia Oleracea

The plant of *Spinacia oleracea* increase a highest growth of 8% to compare of other concentration and control. Plant growth germination parameter like root length, shoot length, seedling length, SVI, SSI. In a root length 3.08±0.118, 9.75±0.179, 14.27±0.135 and 16.75±0.172 respectly. 5.34±0.181, 22.1±0.568,32.54±0.276, 37.39±0.202 are occurrence a this type of shoot length growth on a *Spinacia oleracea.* in a Seedling vigour index growth are observed 839±21.297, 318±66.082, 4681±32.400,3992±25.900 respectively. Good performance of SSI is on plant of *Spinacia oleracea.* SVI (seed vigour index) of germinating seeds have profound impact on the establishment and crop yield [15].

TABLE II. Effect of sea weed extract *Ulva lactuca* on the growth of *Spinacia oleracea*

Concertation of seaweed extract	Root length				Shoot length				Seedling length				Seedling vigour index				Seed stamina index			
	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days
2%	2.03± 0.112	8.2± 0.282	13.68± 0.131	16.2± 0.150	5.07± 0.190	21.57± 0.519	32.4± 0.333	35.54± 0.137	7.1± 0.269	29.77± 0.654	46.08± 0.378	40± 0.098	710± 26.950	297± 65.470	4608± 37.800	4000± 98.00	7.1± 0.269	29.77± 0.654	46.08± 0.378	40± 0.098
4%	2.76± 0.231	7.76± 0.196	13.99± 0.094	16.48± 0.150	4.97± 0.138	19.07± 0.509	31.93± 0.194	35.53± 0.137	7.93± 0.321	26.83± 0.543	45.92± 0.242	39.94± 0.184	793± 32.119	268± 54.343	4592± 24.200	3994± 18.840	7.93± 0.321	26.83± 0.543	45.92± 0.242	39.94± 0.184
6%	3.09± 0.142	7.45± 0.745	13.97± 0.173	16.01± 0.068	4.05± 0.161	21.47± 0.350	31.57± 0.252	35.84± 0.291	6.77± 0.392	28.92± 0.743	45.54± 0.222	41.74± 0.151	677± 39.257	289± 74.928	4554± 22.200	4174± 15.100	6.77± 0.392	28.92± 0.743	45.54± 0.222	41.74± 0.151
8%	3.08± 0.118	9.75± 0.179	14.27± 0.135	16.95± 0.05	5.34± 0.181	22.1± 0.568	32.54± 0.276	37.39± 0.202	8.39± 0.212	31.88± 0.660	46.81± 0.324	39.92± 0.259	839± 21.297	318± 66.082	4681± 32.400	3992± 25.900	8.39± 0.212	31.88± 0.660	46.81± 0.324	39.92± 0.259
10%	2.53± 0.158	6.69± 0.361	14.06± 0.063	16.75± 0.172	5.08± 0.144	20.99± 0.545	32.15± 0.372	36.7± 0.214	7.61± 0.130	27.68± 0.583	46.21± 0.382	39.87± 0.301	761± 13.014	276± 58.342	4621± 38.200	3987± 30.100	7.61± 0.130	27.68± 0.583	46.21± 0.382	39.87± 0.301
control	2.29± 0.113	5.35± 0.163	12.66± 0.110	11.49± 0.257	4.06± 0.273	17.31± 0.667	30.83± 0.358	34.27± 0.604	6.35± 0.188	22.66± 0.545	44.78± 0.358	35.51± 0.604	635± 18.800	226± 54.500	4478± 35.800	3551± 60.400	6.35± 0.188	22.66± 0.545	44.78± 0.358	35.51± 0.604

(Results=Mean±std)

C. Corinderum Sativum

Root length, shoot length and seedling length the 6% are higher and better growth occurrence plant on Corinderum sativum. Compare of other concentration 6% is give high germination of plant Corinderum sativum. maximum growth of 15days, 30days, 45days and 60days in a 6% in this plant. 2.78±0.115, 7.35±0.153, 7.24±0.137, 8.52 ±1.694 this types growth are occurrence in root length. Shoot length in a giving of performance of 5.27± 0.219, 18.47± 0.209, 27.84± 0.194, and 33.22± 10.505 respectively. Corinderum sativum giving best results of SVI& SSI. The effect of SLF (seaweed liquid fertilizer) on vegetables plants achieving the quality of the soil and increase the plants germination growth and crop production yield. Improve of early germination by priming treatment compared to untreated unprimed seeds [16]. Seed vigour can be defined as the seed which define uniform emergence, potential for faster, normally development seed under a full range of fill condition. It's important to vigour, test the quality performance of ability of seed compared to the untreated seeds know its true ability [17].

TABLE III: Effect of seaweed extract Ulva lactuca on the growth of Corinderum sativum

Concertation of seaweed extract	Root length				Shoot length				Seedling length				Seedling vigour index				seed stamina index			
	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days	15days	30days	45days	60days
2%	1.96± 0.119	7.11± 0.385	7.05± 0.083	8.11± 2.564	5.01± 0.237	17.41± 0.352	27.21± 0.173	31.89± 10.084	6.97 ± 0.280	29.77± 0.654	34.26± 0.480	40± 0.098	697± 28.062	245± 45.924	3426± 48.00	6324± 98.00	6.97 ± 0.280	29.77± 0.654	34.26± 0.480	40± 0.098
4%	2.27± 0.156	'4.79± 0.296	7.05± 0.068	8.9± 2.558	4.79± 0.201	17.31± 0.312	26.76± 0.284	31.85± 10.671	7.16± 0.246	26.83± 0.543	33.81± 0.390	39.94± 0.184	716± 24.632	221± 50.241	3381± 39.00	6508± 318.40	7.16± 0.246	26.83± 0.543	33.81± 0.390	39.94± 0.184
6%	2.78± 0.115	7.35± 0.153	7.24± 0.137	8.52± 1.694	5.27± 0.219	18.47± 0.209	27.84± 0.194	33.22± 10.505	8.05± 0.169	28.92± 0.743	34.88± 0.435	41.74± 0.151	805± 16.936	258± 26.785	3488± 43.50	6524± 415.10	8.05± 0.169	28.92± 0.743	34.88± 0.435	41.74± 0.151
8%	2.73± 0.191	7.33± 0.216	7.2± 0.069	8.02± 2.536	4.88± 0.283	18.45± 0.335	27.54± 0.181	31.9± 10.807	7.61± 0.348	31.88± 0.660	34.74± 0.235	39.92± 0.259	761± 34.836	257± 42.619	3474± 23.50	6804± 25.90	7.61± 0.348	31.88± 0.660	34.74± 0.235	39.92± 0.259
10%	2.41± 0.117	5.52± 0.206	7.08± 0.057	7.89± 2.495	4.29± 0.243	16.66± 0.661	27.35± 0.130	31.98± 10.112	6.7± 0.248	27.68± 0.583	34.43± 0.404	39.87± 0.301	670± 28.432	221± 78.630	3443± 40.40	6613± 40.40	6.7± 0.248	27.68± 0.583	34.43± 0.404	39.87± 0.301
control	2.66± 0.139	4.66± 0.205	6.57± 0.156	7.74± 2.289	3.78± 0.178	15.45± 0.295	25.28± 0.192	31.18± 9.859	6.38± 0.266	20.11± 0.447	31.58± 0.474	38.42± 0.201	695± 23.896	215± 22.580	3383± 30.00	6642± 3000	6.38± 0.266	20.11± 0.447	31.58± 0.474	38.42± 0.201

(Results=Mean±std)

D. Bio-Chemical Parameters

The biochemical parameters of chlorophyll-a, chlorophyll-b and total chlorophyll, Carotenoid , Protein content of Trigonella foenum graecum, Spinacia oleracea, Corinderum sativum of plant presented in the following figures-1,2,3,4,5&6 Respectively which was treated by Trigonella foenumgraecum, Spinacia oleracea 8% concentration and Corinderum sativum 6% concentration of seaweed extract of Ulva lactuca on 60 days. In seedling of wheat, highest total chlorophyll (20.62 µg/g fr. Wt) was recorded at 20% liquid fertilizer concentration of S. vulgare followed by result obtained at 20% liquid fertilizer of C.tementosum (18.186 and 3.952 µg/g fr. Wt) acompared with the parallel control (13.883 and 2.404 µg/g fr. Wt) for total chlorophyll [18].

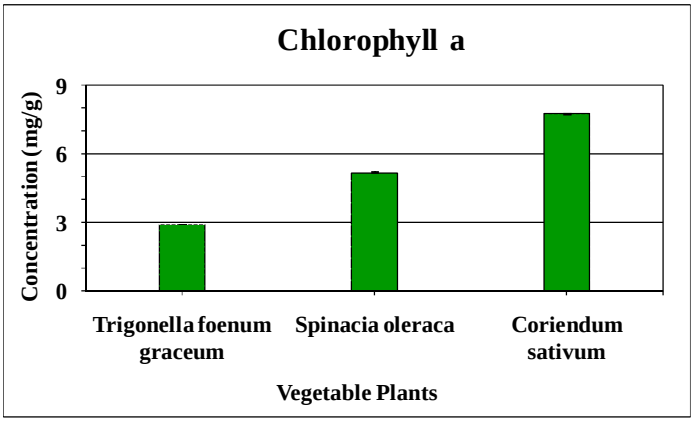

Figure-1. Chlorophyll a content of vegetables plants.

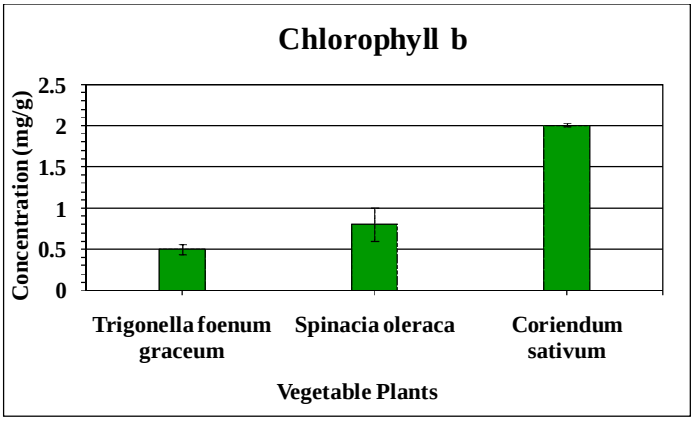

Figure-2. Chlorophyll b content of vegetables plants.

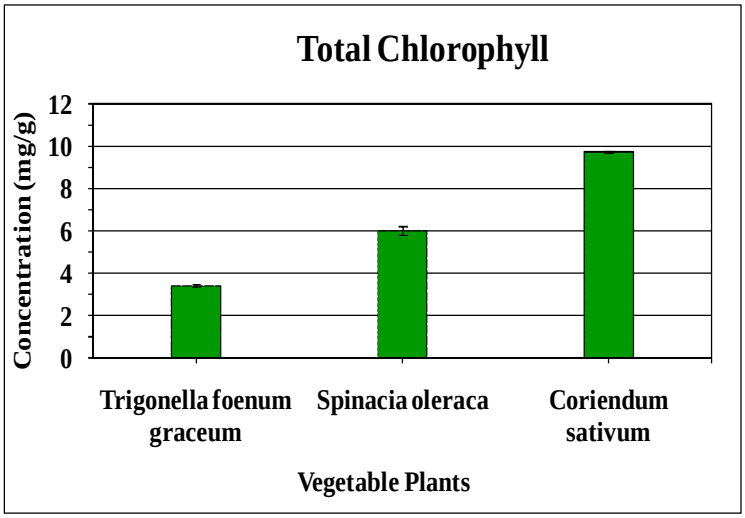

Figure-3. Total chlorophyll content of vegetables plants.

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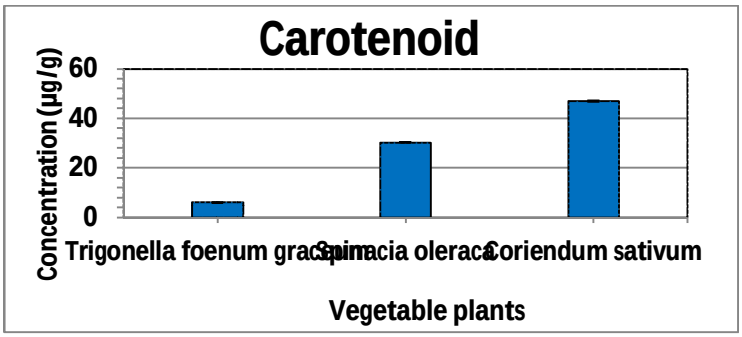

Figure-4. Carotenoid content of vegetables plants

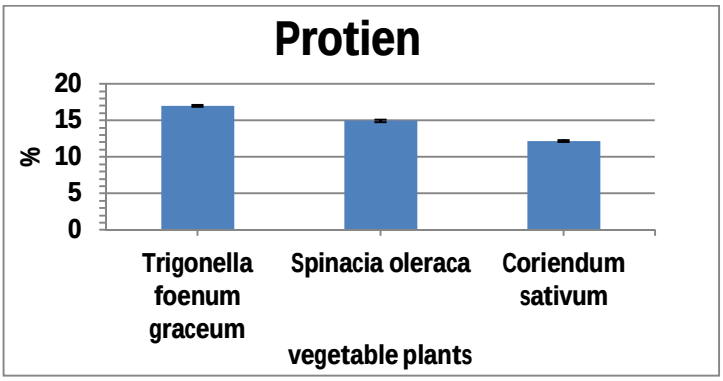

Figure-5. protien content of vegetables plants

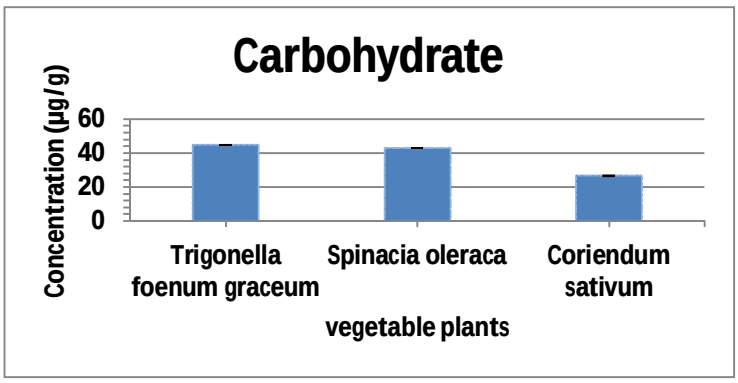

Figure 6: Carbohydrate content of vegetables plants

In Trigonella foenum graecum plants, there was a noticeable increase in bio-chemical parameters when 8% of seaweed extract of Ulva lactuca was applied as a recorded on day 60. In a Trigonella foenum graecum in a chlorophyll a, b and total content of 2.911±0.020 mg/g, 0.500±0.037mg/g , 3.411± 0.042 mg/g respectively. Carotenoid is pigment that gives a fruits, vegetables and most important role in bio-chemical parameter. In plants of Trigonella foenum graecum. The carotenoid content was available in this plants is 5.989±0.202µg/g. seaweed liquid fertilizer rich contain of carbohydrate compare to the other fertilizer.16.97±0.139 %contain of protein is present. In Trigonella foenum graecum plants, the carbohydrate present amount of 44.86±0.130µg/g. Seaweed fertilizer the treatment of 1% concentration Ulva lactuca extract mixture with 50% suggested rate of chemical fertilizers increased lipid, protein and carbohydrate content in Tagetus erecta [19].

Plant of Spinacia oleracea , there was a noticeable increase in bio-chemical parameters when 8% of seaweed extract of Ulva lactuca was applied as a recorded on day 60. In Spinacia oleracea in a chlorophyll a, b and total content of 5.174±0.025mg/g, 0.806±0.200mg/g , 5.989±0.207 mg/g respectively. Carotenoid is most important pigment in fruits, vegetables in plants of Spinacia oleracea. The carotenoid content was available in this plants is 30.266±0.207µg/g. seaweed liquid fertilizer rich contain of carbohydrate compare to the other fertilizer.14.96±0.156µg/g contain of protein present in this plant. In a Trigonella foenum graecum plants the carbohydrate present amount of43.16±0.054%.

In Corinderum sativum, concentration of 6% noticeable increase in bio- chemical parameters of seaweed extract of Ulva lactuca was applied as a recorded on day 60. Plant of Corinderum sativum in a available chlorophyll a, b and total content of 7.719±0.006mg/g, 2.00±0.020mg/g, 9.705±0.041m/g respectively. Plant of Corinderum sativum carotenoid content was available in plant is 46.933±0.202µg/g. in a SLF high contain of carbohydrate compare to the other fertilizer. In this plant carbohydrate available amount is 26.63±0.148µg/g. protein is the one of the main bio-chemical parameter of the plant of Corinderum sativum. In plant of Corinderum sativum available amount protein is 12.19±0.112%.

IV. CONCLUSION

The results obtained in this experiment showed this presoaking experiment seed with seaweed extract for improve and increase seed germination of selected plant of *Corinderum sativum*, *Trigonella foenum graecum* and *Spinacia oleracea.* the study showed that there is significant effect of treatments with seaweed extract from *Ulva lactuca* on bio-chemical parameter of chlorophyll a , b & Total , carotenoid, protein and carbohydrate. The seed priming is a new and unique method for improvement of healthy and fast seed germination. SLF as a Bio- primer material and this Bio- priming method is a organic, very easy, very cheap, easily available and eco-friendly. Now, this experiment using a green algae of *Ulva lactuca* on giving a results of in a plant of *Trigonella foenum graecum* and *Spinacia oleracea* higher growth are observed in 8% concentration when *Corinderum sativum* 6% concentration better growth are observed. Now days create a eco friendly environment and health benefits human and other living organism organic farming is a best option.

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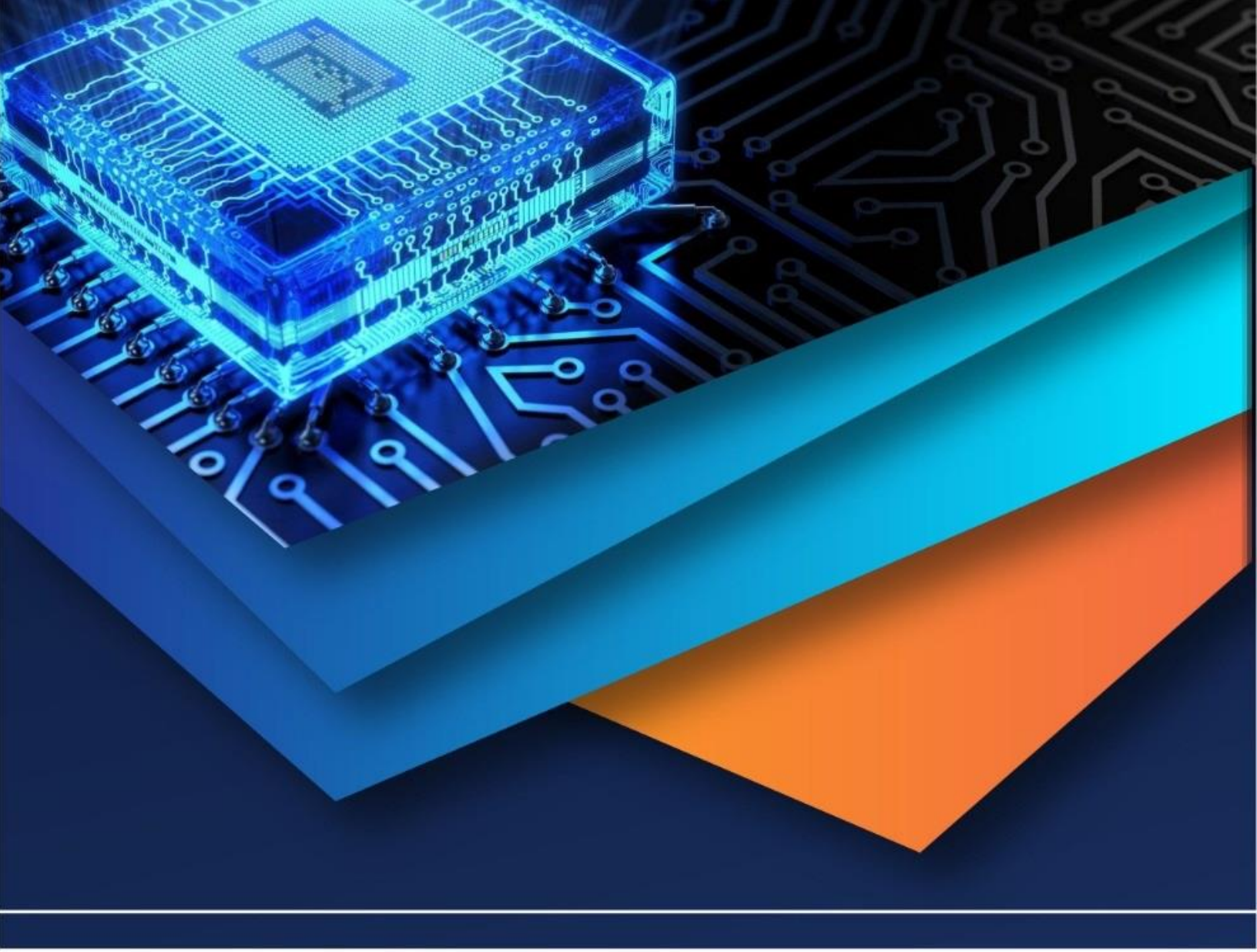

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