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Effect of Farm Pond Algae on Productivity in *Cucumis Sativus* L. Using Aqueous and Cow Urine Extracts

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ABSTRACT
The emergence of biofertilizer as a potential environmentally friendly inputs for supplementing the plant growth has been incredible and found supporting agricultural sustainability. Hence, in present study an attempt was made to assess the efficacy of fresh water algae from the farm ponds on the yield parameters in Cucumis sativus L. The field trial was conducted with RBD design and seven treatments were used with control, algal aqueous and algal cow urine extract by using algae from two farm ponds. Different concentrations of algae were applied through foliar application as per the standard methods. The results revealed that farm pond algae has promotive role in the yield of Cucumis Sativus L. The farm pond algae in 15 % cow urine extract had shown prominent result in the form of increased fruit length, diameter, total fruits per plant and total yield over the control which is almost close to the yield using commercial nutrients.
Keywords: RBD design, Cucumis Sativus, Cow Urine Extracts

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INTRODUCTION

The introduction of green revolution technologies in the agriculture marked striking quantitative increase in food production which was the welcoming sign, and it was hailed as one of the most significant matters of pride for a country like India in its long struggle for a better life. In the 1960s and the 70s, it was impressive progress made by India in food production as it was a significant achievement for any third world country. However, the journey of Indian agriculture since the green revolution has always raised the doubts about the quality of food it is serving. Although use of fertilizers and pesticides is inevitable, its entry in the food chain has questioned the intention and people across the world have started asking for the alternative sources for nutrients and pesticides [11-18].

It is believed that, as long as the agriculture system continues to use large scale chemical fertilizers, sustainability cannot be achieved [14]. The consumers and farmers share a strong desire for agricultural sustainability, increasing anxiety about pollution, and damage to the environment. They also have a strong desire and willingness to engage with new farming technology that can produce more nutritious and pollutants free food [4-7].

The emergence of biofertilizer as a potential environmentally friendly inputs for supplementing the plant growth has been incredible and found supporting agricultural sustainability. They meet the plant nutrient requirement as well as minimize the use of chemical fertilizers. [20, 19]. Freshwater algae have a high percentage of nutrients incorporated into their major biochemical properties and metabolites such as carbohydrates and protein [24]. The variety of substances excreted by blue-green algal extract influences plant growth and development in a variety of ways [18]. Algal microorganisms are found benefiting the plants by the synthesizing growth enhancing hormones. With this background, the study was conducted to assess the efficacy of fresh water algae from the farm ponds on the yield parameters in *Cucumis sativus* L.

MATERIAL AND METHODS

The farm ponds for collection of algal samples were identified from village Wakadi (19.6697° N, 74.5730° E) in RahataTaluka and village Sawargaontal (19.4863° N, 74.1651° E) in Sangamner Taluka of Ahmednagar district, Maharashtra, India. The algal material was handpicked from the pond and washed

with water and brought to the laboratory in polythene bags. The collected samples were labelled as Sample 1 – Algae from farm pond of village Wakadi and Sample 2 - Algae from farm pod of village Sawargaontal. The dried algal mixture was used for the preparation of algal aqueous extract. 100 gm material of algal mixture was taken and boiled in 1000 ml distilled water to make final volume up to 100 ml. This process was repeated for obtaining the required amount of algal extract to be used for experimental trials. Using this standard algal extract 15 % algal extracts were prepared separately for both samples [9]. Cow urine extract was prepared for both samples using cow urine instead of distilled water.

The field trial was conducted to study the effect of algal extracts on the growth of *Cucumis sativus* L. The field was selected as per the recommendations for the farming practices. The field experiment was carried out from February 2019 to May 2020.The land for the field trial was prepared by ploughing, and the debris was collected by hand. After ploughing the land was thrown into ridges and furrows of 100 cm. The ridges and furrows were prepared with the raidger as per the standard method recommended for the plant. The farmyard manure was applied to the field in the proportion as recommended. Seven treatment sets were designed andthe seeds were treated by soaking them overnight into various concentrations as mentioned in table 1.

Table 1 -Treatment Symbols and treatments.

Treatment Symbol	Concentration
T_1	Control with water
T_2	Control with Cow Urine
T_3	15 % algal aqueous extract of sample 1.
T_4	15 % algal cow urine extract of sample 1.
T_5	15 % algal aqueous extract of sample 2.
T_6	15 % algal cow urine extract of sample 2.
T_7	Commercial Nutrient

The plantation of *Cucumis sativus* L. seeds in the field plot was carried out as per the Randomized Block Design (RBD). The irrigation was done as per the requirement of the plants at approximately weekly intervals. After one month, the irrigation interval was maintained, depending on the water requirement of the soil and plant.

As soon as the leaves were developed, the foliar application of algal aqueous extract, algal cow urine extract, and nutritional supplement was started. The foliar application of algal extract and commercial nutritional supplement was repeated after every 10 days of the first application. The parameters M:F ratio, Fruit set, fruit retention, fruit length (cm), Fruit diameter (cm), fruits per plant, fruit yield (gms) were recorded.

RESULTS AND DISCUSSION

Female to male flower ratio (Table 2) was maximum in T_2 i.e. 1:2.36 however it was minimum at T_1 i.e. 1:1.80.

Table 2 Effect of algal extract on Male and Female flower ratio, Fruit set and retention in *Cucumis sativus* L.

Treatment / Parameter	M:F Ratio		Fruit Set		Fruit Retention	
	Mean	SD	Mean	SD	Mean	SD
T_1	1:1.80	0.15	20.14	1.77	11.14	1.77
T_2	1:2.36	0.22	21.00	2.45	13.00	2.45
T_3	1:1.86	0.15	34.57	2.07	25.57	2.07
T_4	1:2.00	0.18	36.57	2.57	28.57	2.57
T_5	1:1.86	0.14	35.43	3.21	26.43	3.21
T_6	1:1.94	0.21	36.43	2.07	28.43	2.07
T_7	1:1.99	0.22	38.43	2.94	30.43	2.94
Total	1:1.97	0.24	31.80	7.62	23.37	7.74
	$F_{(6, 48)} = 7.09$, $p<0.01$		$F_{(6, 48)} = 68.28$, $p< 0.01$		$F_{(6, 48)} = 70.58$, $p< 0.01$	

T_1 showed minimum fruit set and fruit retention with 20.14 and 11.14 per plant respectively. However, T_7 showed maximum fruit set and fruit retention with 38.43 and 30.43 respectively. Commercial nutrient had shown 90.81 % more fruit set over the control, however the algal cow urine extract of sample 1 (T_4)and algal cow urine extract of sample 2 (T_6) have also shown prominent fruit set i.e. 81.58 % and 80.88 % more than control. Commercial nutrient (T_7) had shown 173.16 % more fruit retention over the control, however the algal cow urine extract of sample 1 (T_4)and algal cow urine extract of sample 2 (T6)

have also shown maximum fruit retention i.e. 156.46 % and 155.21 % more than control. The ANOVA examined the effect of treatment on M:F flower ratio of *Cucumis sativus* L. which shows that there was a statistically significant effect within the treatment with $F_{(6, 48)} = 7.09$, $p<0.01$. The ANOVA shows that there was a statistically significant effect within the treatment for fruit set with $F_{(6, 48)} = 68.28$, $p< 0.01$, for fruit retention with $F_{(6, 48)} = 70.58$, $p< 0.01$. The algal extract is beneficial in stimulating the fruit setting in the cucumber [7]. The seedlings treated with the algal extracts set more flowers than the control. [11]. The results are in line with those reported by Taha *et al* [22]. The mentioned the female flowers between 39.42 to 46.34 in cucumber followed by application of sea weed extract. The results are similar to Dinesh *et .al.,* [12] who mentioned the sex ratio between 1.40-2.32. Taha *et. al*,[21] also reported the fruit setting in between 77.18-82.76 % which is similar to present study. Ajay *et. al*., [4] reported the fruit set percentage between 71 -81.90 % and fruit retention percentage between 77.23-84.84 % in *Cucumis sativus* L.). The study outcome is in line with the results of studies conducted by Ansari and Chowdhary [6] in bottle gourd, Mir [17] in cucumber and Mehdi *et al.,* [17] in cucumber.

Table 3 -Effect of algal extract on fruit length, diameter, fruits per plant and total yield in *Cucumis sativus* L.

Treatment/ Parameter	Fruit Length (cm)		Fruit Diameter (cm)		Fruits per plant		Fruit Yield (gms)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
T_1	12.43	1.72	11.57	2.88	11.14	1.77	1894.29	301.38
T_2	13.43	1.81	12.14	2.73	13.00	2.45	2275.00	428.66
T_3	14.14	1.07	13.57	2.44	25.57	2.07	4730.71	382.99
T_4	14.86	1.35	15.43	1.81	28.57	2.57	5714.29	514.55
T_5	14.57	1.40	14.57	1.51	26.43	3.21	5021.43	609.36
T_6	15.29	1.50	15.14	1.68	28.43	2.07	5827.86	424.39
T_7	15.43	0.79	15.43	1.51	30.43	2.94	6177.00	595.97
Total	14.31	1.66	13.98	2.50	23.37	7.74	4520.08	1685.38
	$F_{(6, 48)} = 4.03$, $p<0.01$		$F_{(6, 48)} = 3.84$, $p<0.01$		$F_{(6, 48)} = 70.58$, $p<0.01$		$F_{(6, 48)} = 92.88$, $p<0.01$	

It is seen from the table 3 that minimum fruit length was reported in T_1 with 12.5 cm and maximum fruit length was reported at T_7 with 15.5 cm. The variation in the fruit diameter was from 11.6 cm at T_1 to 15.5 cm at T_7. At the same time the number of fruits per plants varied from 11.1 cm at T_1 to 30.4 cm at T_7. The minimum yield of the fruits was reported at T_1 with 1894.3 gms and maximum yield was reported at T_7 with 6177 gms followed by T_6 with a yield of 5827.9 gms and T_4 with a yield of 5714.3. When the data of all parameters was compared with the control treatment, it was observed that T7 had shown 24.14 % more length as compare to control, however T4 and T6 had also shown 19.55 % and 23.01 % more growth compared to control. Similarly, T7 had shown 33.36 % more fruit diameter compare to control, whereas T4 and T6 also had shown 33.36 % and 30.86 % more growth compare to control. T7 reported 173.16 % more fruits as compare to control and it was 156.46 % and 155.21 % more in T4 and T6. T7 reported 226.09 % more fruit yield compare to control and again T4 and T6 had shown prominent yield with 201.66 % and 207.65 % more than control.

The ANOVA examined the effect of treatment on the Fruit Length, Fruit Diameter, Fruits per plant and fruit yield in of *Cucumis sativus* L. It shows that there was a statistically significant effect within the treatment for Fruit Length, Fruit Diameter, Fruits per plant and fruit yield with $F_{(6, 48)} = 4.03$, $p<0.01$, $F_{(6, 48)} = 3.84$, $p<0.01$, $F_{(6, 48)} = 70.58$, $p<0.01$, $F_{(6, 48)} = 92.88$, $p<0.01$ respectively.

The increases in overall weight of the fruit as well as total yield in cucumber treated with algal extract can be linked to the increasing fruit numbers, leaf area and dry weight as a result of enhanced physiological activities, photosynthesis and plant nutrition. The yield in cucumber could have been attributed due to an increases in distillate flowers which in increases the fruit number which is reflected in the total yield [5]. High level of cytokinin improve the nutrient mobilization and the algal extract increase the movement of cytokinin from the roots to the fruits. [13]. The increased cytokinin availability results into increased supply to the maturing fruits. In addition to the growth hormones, increased yield in cucumber could be due to the additional elements in the algae like macro, micronutrients and organic matters like, amino acids that improve nutritional status, vegetative growth and yield quality [1-3]. Bajpai, [8] also indicated about presence of active organic compounds in algae which acts a growth regulators. Metting *et al*., [16] have responded that nutrient mobilization, root development, improvement in chlorophyll content and leaf area are the physiological responses of crops after algal application.

The results are in agreement with that of Crouch and Van-Staden [10] who reported increases in fruit number by 10% and fruit weight by 15% followed by application of seaweed extract. Saravanan *et al*., [21] mentioned a significant increase in number of fruits and fruit yield per plant after application of sea weed extract. Zodape *et al*., [25] applied 2.5 % sea weed extract and reported better improvement in the length, diameter and number of fruit. Abdel-Mawgoud *et al.,* [3], were of the same opinion that the fruit weight and diameter in cucumber were enhanced as a result of increased vegetative growth after application of algal extract. The results are also similar to Taha, *et al*., [22] where they reported the fruit length between 13.36 cm -16.76 cm, fruit diameter between 3.38 cm - 4.85 cm and fruit weight between 154.3 gms. - 282.6 gms. Taha *et.al*., [21] reported the fruit weight between 112.31 -126.55 gms in cucumber treated with sea weed extract. They reported number of fruit between 14.89-21.73, fruit length between 17.32-18.20 cm, fruit diameter between 2.37-2.50 cm and the yield per fruit between 7.35-10.96 kg. Radameset.al., 2018 compared the benefits of the total yield of cucumber from chemical fertilization and algae and stated that algae is greater as it is friendly to the environment.

CONCLUSION

It is concluded from the study that, farm pond algae has promotive role in the yield of *Cucumis Sativus* L. The less expensive farm pond algae in 15 % cow urine extract had shown prominent result in the form of fruit length, diameter, total fruits per plant and total yield which is almost close to the yield using commercial nutrients. Hence, using algae as a source of nutrient can protect the yield as well as help to achieve the sustainability in agriculture.

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