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Research Article

SPECTROPHOTOMETRIC ESTIMATION OF PIGMENT CONTENT IN PGRs APPLIED PLANTS OF *CUCUMIS SATIVUS* L.

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Abstract: A field experiment was carried out to determine the effect of Plant Growth Regulators on pigment content in *Cucumis sativus* L. Foliar spray of ethrel, CCC and GA_3 at 50, 100, 250 and 1000 µg/ml were applied to the seedlings of *C. sativus* L. which were grown in a separate experimental plot. Pigment content was estimated by UV spectrophotometric method. GA_3 250µg/ml, Ethrel 100µg/ml and CCC 250 µg/ml were recorded as optimum for production of maximum pigment contents in *Cucumis sativus* L. The experiment established that application of Plant Growth Regulators has an immense influence on *C. sativus* L to boost up pigment contents which is correlated with enhanced fruit production.

Keywords: *CCC, Ethrel, GA3, Cucumis sativus L*

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Introduction

In the magnificent process photosynthesis, the chlorophyll of green plants can harvest solar radiation and converted it into chemical energy. The process, thus, depends upon harvesting of the solar energy by these green pigments. Chlorophyll 'a' plays an important primary role in the photosynthetic process. The status of chlorophyll pigments in the leaf tissue is thus determining the overall photosynthetic efficiency of the plants. The photosynthetic efficiency directly influences on growth, development and yield of crops. The carotenoids, are organic pigments and act as passive light filters that would reduce light intercepted by chlorophyll [1] and the protection from reactive oxygen species [2]. Some carotenoids serve as precursor for vitamin A, which plays an essential role in human and animal diets and as antioxidants and also in reducing the risk of certain forms of cancer. Increase in productivity of agricultural as well as horticultural crops is the main objective of plant breeders. During the last four decades many scientists have been concentrating their works in this field by applying Plant Growth Regulators on different plants. There are a lot of reports on extensive works done with conventional retardants like CCC, SADH, AMO 1618, 2, 4-DNC, Phosphone-D *etc.* Growth retardants have been shown to increase femaleness in many cases [3]. Early flowering due to growth retardants was also reported by Stuart [4] and [5]. Several workers have reported that Plant Growth Regulators imparts a favourable effect on chlorophyll content. It was reported [6] that, GA, CCC, methionine and cysteine applications can significantly increase chlorophyll content in onion varieties. Plant Growth Regulators have an immense influence in the enhancement of pigment contents in Squash [7]. The chief objective of the present work was to study the effects of different plant growth regulators GA_3, Ethrel and CCC on the pigment contents of *Cucumis sativus* L.

Materials and Method

The field experiment was conducted at Bongaigaon, Assam, to find out the effect of PGRs on pigment contents of Cucumber (*Cucumis sativus* L.). The crop is very popular not only in northeast but also in all parts of the country.

Experimental plots were well prepared by mixing organic manure before sowing of seeds. The experimental sites received free sunshine. The soil of the field is sandy loam with pH value 5.10.

The healthy seeds of cucumber were collected from the Assam Seed Corporation, Guwahati. Two experimental plots were got ready with six treatments of PGRs including an untreated control. The PGRs selected for experimentation were growth promoter GA_3, and growth retardant Ethrel and CCC. GA_3 prepared in four concentrations namely 50 µg/ml, 100 µg/ml, 250 µg/ml and 1000 µg/ml and one control (distl.water treatment). The same range of concentration was prepared for Ethrel and CCC. The different concentrations of PGRs were applied to the seedlings grown in separate field by foliar spraying of the solutions. The foliar application was carried out with a hand sprayer fitted with a fine nozzle so as to facilitate uniform wetting of leaves with about 20 ml/plant. Each treatment was replicated three times. The leaves from each replication were collected and subjected to estimation of pigments by UV Spectrophotometric method.

Chlorophyll is extracted in 80% acetone and the absorbance is measured at 645 and 663 nm against the solvent blank in a spectrophotometer. The amount of chlorophyll (mg/g) is calculated out by using absorption coefficients. The concentrations of the different chlorophylls were calculated as per Parkin's method as elucidated by Nayek *et al.* (2014).

To determine the carotenoids 100 mg leaf tissue is extracted in 80% acetone and the absorbance is measured at 480 nm in UV spectrophotometer.

The concentrations of the carotenoids were calculated as follows:

Amount of carotenoids in 100 mg plant tissue = 4×OD value × Total volume of sample / weight of fresh plant tissue

The data recorded was statistically analysed and presented in a tabular form.

Results and Discussion

The data revealed that, application of PGRs exhibited a considerable variation in pigment content of cucumber.

It has been noticed that GA_3 application at 250 µg/ml recorded as optimum for production of chlorophyll 'a', 'b' and total chlorophyll pigments estimated as 6.81, 3.32 and 5.41 mg/g respectively against control recorded as 3.31, 2.06 and 4.61 mg/g respectively. It shows that chlorophyll 'a 'content is higher than chlorophyll 'b'. The higher concentration of GA_3 (1000 µg/ml) shows a remarkable decrease in pigment content recorded as 3.61, 2.82 and 3.21 mg/g in chlorophyll 'a', 'b' and total chlorophyll respectively which is a little bit higher than the value of control [Table-1) and [Fig-1].

Table-1 *Effect of GA_3 on Pigment content in Cucumis sativus L*

Control	3.31	2.06	4.61	0.2
Ethrel 50	4.46	2.06	3.95	0.32
Ethrel 100	5.96	2.91	5.27	0.37
Ethrel 250	5.8	2.88	5.14	0.266
Ethrel 1000	3.81	1.78	4.9	0.28
Average	4.67	2.34	4.77	0.29
STDEV	1.18	0.52	0.52	0.06
VAR	1.39	0.271	0.275	0.004
SE	0.52	0.23	0.23	0.028
CD 5%	1.5S	0.67S	0.67S	0.081S

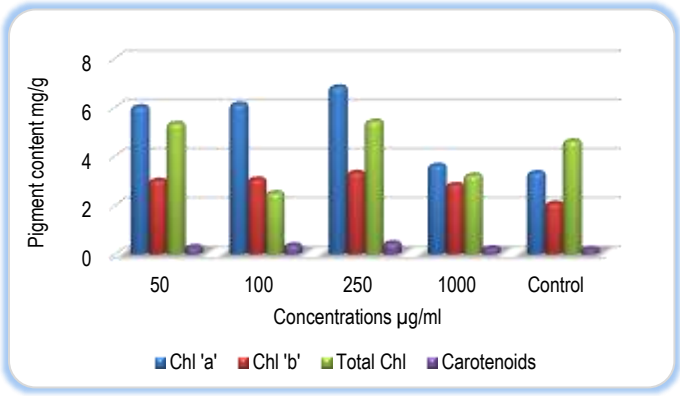

Fig-1 Effect of GA_3 on Pigment content in *Cucumis sativus* L

The total chlorophyll content shows variable values at different concentration. The same range of concentration of ethrel were applied to the seedlings of cucumber grown in a separate experimental plot. Ethrel at 100 µg/ml emerged as optimum for chlorophyll production which is recorded as 5.96 mg/g, 2.91 mg/g and 5.27 for chlorophyll 'a', 'b' and Total chlorophyll pigment respectively. Carotenoids also recorded as maximum at 100 µg/ml of ethrel [Table-2] and [Fig-2].

Table-2 *Effect of Ethrel on pigment content in Cucumis sativus L*

Concentration (µg/Ml)	Chl a	Chl b	Total Chl	Carotenoids
Control	3.31	2.06	4.61	0.2
GA_3 50	6	3	5.32	0.29
GA_3 100	6.11	3.05	2.49	0.36
GA_3 250	6.81	3.32	5.41	0.45
GA_3 1000	3.61	2.82	3.21	0.24
Average	5.168	2.85	4.2	0.3
Variance	2.53	0.22	1.69	0.0098
STDEV	1.59	0.47	1.3	0.099
SE	0.35	0.21	0.58	0.044
CD 5%	1.04S	0.62S	1.70S	0.12S

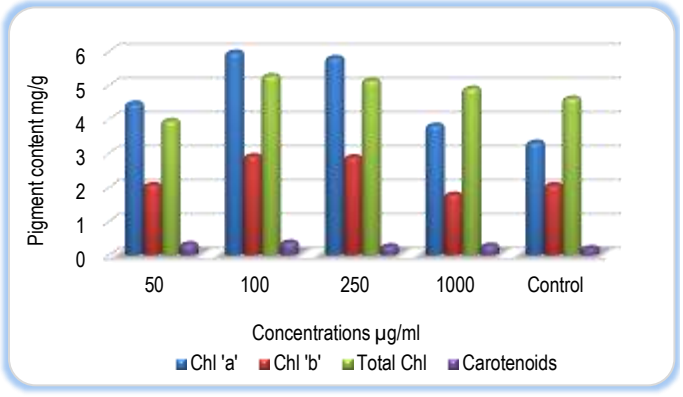

Fig-2 Effect of Ethrel on Pigment content in *Cucumis sativus* L

The application of CCC shows a different result. CCC at 250 µg/ml recorded 12.15 mg/g, 10.07 mg/g, 10.8 mg/g and 0.54 mg/g of chlorophyll 'a', chlorophyll 'b', Total chlorophyll and carotenoids respectively [Table-3] and [Fig-3].

Table-3 *Effect of CCC on pigment content in Cucumis sativus L*

Concentration (µg/ml)	Chl a	Chl b	TOTAL Chl	Carotenoids
Control	3.31	2.06	4.61	0.2
CCC 50	3.75	2.7	3.33	0.48
CCC 100	7.98	6.24	5.9	0.51
CCC 250	12.15	10.07	10.8	0.54
CCC 1000	3.1	2.05	2.58	0.25
Average	6.058	4.62	5.44	0.39
STDEV	3.95	3.5	3.25	0.16
VAR	15.6	12.29	10.57	0.025
SE	1.77	1.57	1.45	0.07
CD5%	NS	NS	4.2S	0.2S

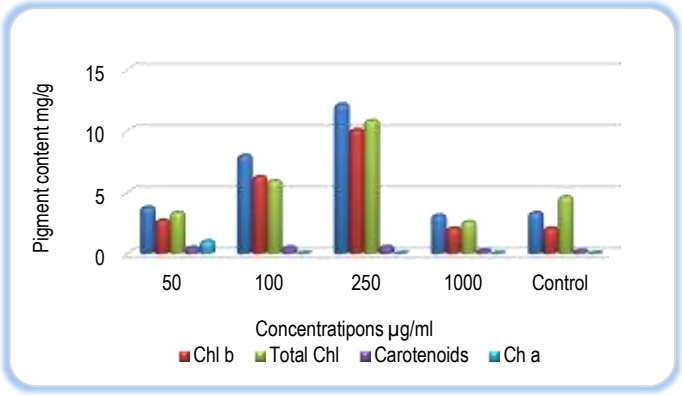

Fig-3 Effect of CCC on Pigment content in *Cucumis sativus* L

The Carotenoid pigments are at par in all the concentrations applied. A number of workers confirmed the effect of PGRs on increase of pigment content in plants. It was [8] who proved that application of CCC recorded increase in chlorophyll content in *Lolium temulentum*. Increased chlorophyll content of leaves is related to increased rate of photosynthesis. Application of GA_3 increased the chlorophyll content of leaves which may be indication of increased rate of photosynthesis [9]. It was reported that cycocel at 250 and 500ppm significantly improved the chlorophyll contents in leaves of Brassica napus [10]. Plant Growth retardant application increases the number of leaves per plant [11-18]. The application of CCC increased the number of leaves per plant over control in Catheranthus roseus L [19]. Increase in number of leaves per plant facilitate to increase in the photosynthesis rate. This was observed in different plant species after the application of plant growth regulators [20,21]. It was reported by [22] that foliar spray of CCC increased the photosynthesis rate in pigeon pea. Positive effect of CCC on photosynthesis and chlorophyll content have also been reported by many workers [23-24]. Worked on mango plant and studied the influence of growth retardants on respiration, chlorophyll and carotenoid pigments in mango leaves in relation to flowering [25]. The retardants improved the flowering potential of mango trees by providing a more efficient photosynthetic apparatus and by moderating the respiratory catabolism. It was established by [26] that application of higher doses of both ethrel and CCC had significantly enhanced most of the yield characters of cucumber. The application of Plant Growth Regulators, both promoter and retardant are beneficial for regulating pigments in *Cucumis sativus* L. which can be utilized for regulation of the number of fruits per plant.

Conclusion

It is now evident from the present study that application of Plant Growth Regulators improved the pigment contents in cucumber. Increase of pigments is correlated with photosynthetic efficiency of plants, therefore PGRs' application have an immense influence on growth and development of plants. It is, thus, beneficial to utilize Plant Growth Promoter and retardant to raise pigment content in cucumber which facilitates crop improvement.

Application of research: Plant Growth Regulators, both Promoter and Retadant are equally beneficial for application in the crop fields.

They can help to enhance productivity of cucumber and solve the problem of farmer to a great extent.

Research Category: Plant Growth Regulators

Abbreviations:
Ethrel: 2-Chloroethyl phophonic acid
CCC: 2-Chloroethyl trimethyl ammonium chloride
GA_3: Gibberellic acid

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University: Gauhati University, Guwahati, 781014, Assam
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Author Contributions: All authors equally contributed

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Study area / Sample Collection: Bongaigaon, Assam

Cultivar / Variety / Breed name: *Cucumis sativus* L

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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