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The Effect of Cycocel, Ethephon, GA_3 on Brinjal Plants on chlorophyll a, b, total chlorophyll and chlorophyll Ratio a/b

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Abstract

Brinjal is one of the most common and popular vegetable crops grown in Northeast. Brinjal or Eggplant is an important crop of subtropics and tropics. Effect of phytohormones sprays to 10, 40, 55 days old Brinjal plants, on Chlorophyll a, b and total Chlorophyll and chlorophyll a/b ratio, in lower & Upper leaves recorded after three weeks of spray. Chlorophyll content was inhibited by most of the treatment when applied to 10 or 55 days old plants. Maximum inhibition product by GA_3 application while inhibited chlorophyll content at call the three growth status (10, 40 and 55 days) and the inhibition was greater at higher GA_3, concentrations. The total chlorophyll content was increased by cycocel when applied to 10 or 40 days old plants but slightly decreased when he applied to 55 days old plants, through the difference were not significant in most cases.

Key words: Brinjal, phytohormones, Chlorophyll, cycocel,

Introduction

Brinjal is a warm season crop and requires a long warm growing season. It is very susceptible to frost. A daily mean temperate of 13-21^{0}c is most favorable for its successful production. The growth of the crop is severely affected when temperate falls below 17^{0}c. It can be successfully grown in a rainy and summer season crop and can grow at an elevation of 1200m above the sea level.

It is cultivation west Bengal, Orissa, Karnataka, Bihar Maharashtra, Uttar Pradesh, and Andhra Pradesh. Fruits are the common source of Vitamins and minerals like calcium and phosphorus and nutritive values differs from Variety. It grows in plain over the year but it is best grown in Rabi season. In rainy season it is grown in the month of June-July. In winter season it is grown in the month of October- November. In summer season it is growth in the month of February-March.

It can be favourably grown as a summer or rainy Season crop and can grow at and a height of 1200m above the sea level. Certified Seeds of Brinjal pusa purple long (PH_4, Pusa, Bhairar, Pant smart) cultivar have been obtained from Agronomy Department of G.B Pantnagar University Pant Nagar (U.A). Varying from light sandy to heave clay brinjial plants can be grown in all types of soil. pH rang of 6.5-7.5 with well drained soil and rich in organic matter is favorable for early yield light soils are preferred But, for highly yield clay loam and Silt loam soils are best suited for early, sight soils are preferred.

*for one hectare of land on a required ha average 370-500gm seed is required for seedlings Varieties - 400 gms/ha & hybrids 200 gm/ha.

Materials and Methods

Certified Seeds of Brinjal Cultivar have been obtained from Agronomy Department of G.B. Pantnagar University Pant Nagar (U.A.). All chemicals and instrument provide in plant Physiology lab in Hindu College Moradabad U.P. India and chemical analysis was conduct college of Basic Sciences, G.B. P. U.A. &T Pantnagar U.S. Nagar U.K. Seven concentrations of each hormone 10, 25, 50, 100, 200, 400, 800 ppm as given below were sprayed at every stage of development.

Treatments	Concentration (ppm)
Control	water
GA_3	10, 25, 20, 100, 200, 400, 800
Cycocel	10, 25, 20, 100, 200, 400, 800
Ethephon	10, 25, 20, 100, 200, 400, 800

Thirty plants were sprayed for each concentration

Quantitative determination of chlorophyll content:

Chlorophyll a, chlorophyll b, and total chlorophyll Content of leaves were determined spectro photo metrically, according to the method of Arnon (1949), after the pigments were extracted in 80% acetone in Semi dark room.

Weighed leaf discs (0.01 gm fresh material) from each treatment were extracted in 1 liter of 80% acetone and volume is to be multiplied by 0.1. Extract was filtered (with suction) through what man No. 1 filter paper. The residue was extracted repeatedly in small amounts of 80% acetone and filtered till visibly colorless and the final volume of the extract was adjusted. The absorbance of pigment extract was read at 645, 652 and 663 against 80% acetone as blank. The concentration of chlorophylls was calculated with the help of "Arnon's (1949) equations as given below:

1. Chlorophyll a (mg/gm^{-1} fresh weight)

$$= 12.7\,(A663) - 2.69\,(A\,645) \times \frac{V}{1000 \times W}$$

2. Chlorophyll b (mg/gm^{-1} fresh weight)

$$= 22.9\,(A645) - 4.68\,(A652) \times \frac{V}{100 \times W}$$

3. Total chlorophyll (mg/gm^{-1} fresh weight)

$$= -20.2\,(A645) + 8.02\,(A\,663) \times \frac{V}{100 \times W}$$

4. Chlorophyll a/b

$$= \frac{\text{mg/chlorophyli a/gm tissue}}{\text{mg/chlorophyli b/gm tissue}}$$

In the above equation 'A' represents the absorbance of chlorophyll extract at the specific indicated wave-length, 'v' the final volume of solution and 'w' gms. of tissue extracted.

Method:

The Crop begins from middle of October and continue up to the end of September. About 50 to 60 percent of the total annual rainfall occurs in this season. During these months, the mean maximum temperature ranges occurs b/w 25.5^{0}C and 30.5^{0}C and mean maxi. temperature range b/w 20.4^{0}C the seeds were soaked for 24 hours in to water and sterilized with 0.1% $HgCl_2$ (Mercuric chloride) for 5 minutes before sowing.

Foliar spray of hormones

1. 10 days after seedling emergence.
2. 40 days after seedling emergence
3. 55 days after seedling emergence (Bud initiation stage)

Design of experimental plot

Completely randomized design non used for statistical analyses of experiments. The chemical treatments, being the major importance were kept in the sub-plots. The experiment was conducted with 21 treatments and one control. All the treatments were replicated three times. Thus there were 66 sub-plots in all.

1. Total number of treatment	: 22
2. Number of replicates	: 03
3. Row to row distance	: 60 cm
4. Plant to plant distance	: 30 cm
5. Sowing distance	: 60x30 cm
6. Number of plants/treatment	: 30
7. Number of rows/treatment	: 03
8. Total number of sub plots	: 21x3=66
9. Total number of plants	: 1980
10. Plot size	: 792
11. Total experimental Area	:760.32

Results and Discussion

After 10 days:

Data recorded after two days of spray on chlorophyll content are presented table 1. None of the treatments brought about statistically significantly change in chlorophyll a, chlorophyll b or total chlorophyll content, but a trend of increase in pigment concentration, particularly by lower concentrate of hormones was observed, All the concentrations of Cycocel significantly increased the total chlorophyll Content.

Maximum chlorophyll content was reported in plants treated with 10 mg/l cycocel. Lower concentration of GA_3 (10 ppm) was the only treatment which slightly decreased chlorophyll

content of leaves. Ethephon at lower concentrations significantly increased the total chlorophyll. Similarly Chlorophyll a/b ratio was not Significantly affected by any of the treatment. The higher concentration of GA_3 400 and GA_3 800 mg/l maximum stimulatory effect on chlorophyll a/b ratio.

After 40 days:

Data recorded after 3 weeks of Spray on Chlorophyll content of upper ((8^{th} from top) and lower (14th from top) leaves of plants are presented in table 2

Non-significant changes in chlorophyll content of lower and upper leaves of plants treated with different hormones was observed. However a significant increase in chlorophyll a/b ratio of leaf with different treatments was found. The maximum increase in a/b ratio was seen in leaf of plants sprayed with 50 ppm ethephon (48.8% increase) and minimum increase was 26.8% with GA_3 100 ppm followed by 400 ppm (18.0%)

At 55 days:

Data recorded after 3 weeks of spray on chlorophyll content of lower (14^{th} from top) and upper (8^{th} from top) leaves of plants are presented in table 3. Data for chlorophyll a b and total chlorophyll of lower leaf different treatments were not significant different, however for upper leaf of different treatments significant differences in

Table 1: Effect of phytochormones sprays to 10-days old Brinjal seedling, on chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio

Treatments Phytohormones	Conc.(ppm)	Chlorophyll a	Chlorophyll b	Total Chlorophyll	Chlorophyll a/b	Dry weight ppm gm^{-1}
Control	-	0.742	0.299	1.041	2.481	975±22.3
Cycocel	10	1.017	0.380	1.397	2.676	850±21.00
	25	0.972	0.370	1.342	2.627	951±21.02
	50	0.910	0.360	1.270	2.527	985±21.10
	100	0.830	0.355	1.185	2.338	1025±21.0
	200	0.815	0.330	1.145	2.469	1050±21.0
	400	0.810	0.325	1.130	2.492	775±21.10
	800	0.805	0.315	1.120	2.555	780±22.15
GA_3	10	0.695	0.278	0.973	2.500	785±25.0
	25	0.795	0.280	1.075	2.839	800±24.0
	50	0.890	0.285	1.115	3.122	820±23.0
	100	0.900	0.290	1.190	3.103	860±22.50
	200	0.900	0.293	1.203	3.105	900±21.00
	400	0.926	0.295	1.221	3.138	905±20.60
	800	0.930	0.299	1.229	3.110	920±20.00
Ethephon	10	0.975	0.365	1.340	2.671	875±21.30
	25	0.870	0.320	1.190	2.718	895±19.20
	50	0.810	0.300	1.110	2.773	900±19.00
	100	0.800	0.288	1.088	2.776	905±19.00
	200	0.750	0.270	1.020	2.776	910±18.00
	400	0.730	0.265	0.995	2.754	925±17.30
	800	0.700	0.250	0.950	2.800	930±17.10
S.E(M)±	-	0.059	0.028	0.093	0.199	933±18.20
C.D.		0.251	0.092	0.320	0.640	935±18.00

Significant at 5 % probability level
Statistically not analyzed

chlorophyll content were recorded, chlorophyll a content of upper leaves from plants sprayed with 50 and 500 ppm ethephon increased by 4.84 and 18.18% chlorophyll b content increased by 18.75 and 24.68% and total chlorophyll content increased by 19.5 and 31.0% respectively on the other hand chlorophyll a content of plant sprayed with 10 and 100 ppm GA_3 decreased by 31.17% with both the concentrations. Chlorophyll b content decreased by 28.12 and 34.86% and total chlorophyll content by 24.0 and 26.07%, respectively. Chlorophyll a/b ratio of lower and upper leaves of plants given hormonal spray were not significantly changed by hormonal sprays.

Chlorophyll content was inhibited by most of the treatments when applied 10 or 55 days old plants. Maximum inhibition was produced by GA_3 application which inhibited chlorophyll content at all the three growth stages (10, 40 and 55days) and the inhibition was greater at higher GA_3 concentrations. The leaves of GA_3 treated plants have usually been reported to become poler (Weawer, 1972) and this has been attributed to pigment dilution i.e. failure of chlorophyll synthesis to keep pace with increased cell and organ expansion, rather than to any direct effect of GA_3 on chlorophyll metabolism, Stuart & Cathey, 1961). The application of 100 ppm GA_3

Table 2: Effect of phytochormones sprays to 40 old plants, on chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio in lower and upper leaves

Treatments		Chlorophyll a		Chlorophyll b		Total Chlorophyll		Chlorophyll a/b	
Phytoho-rmones	Conc. (ppm)	Lower leaf	Upper leaf	Lower leaf	Upper leaf	Lower leaf	Upper leaf	Lower leaf	Upper leaf
					Mg/gm fresh weight				
Control	D.W.	0.674	0.754	0.398	0.360	1.074	1.111	1.699	2.164
Cycocel	10	1.065	0.885	0.470	0.470	1.535	1.360	2.245	1.905
	25	1.140	0.895	0.500	0.400	1.600	1.300	2.242	2.220
	50	1.225	0.920	0.545	0.350	1.770	1.270	2.240	2.315
	100	1.240	0.930	0.560	0.330	1.780	1.250	2.235	2.400
	200	1.255	0.945	0.580	0.320	1.790	1.230	2.230	2.440
	400	1.266	0.950	0.585	0.315	1.800	1.215	2.228	2.465
	800	1.280	0.966	0.590	0.305	1.805	1.200	2.225	2.490
GA_3	10	0.822	0.599	0.340	0.260	1.170	0.860	2.380	2.342
	25	0.800	0.585	0.338	0.210	1.160	0.750	2.300	2.450
	50	0.770	0.560	0.337	0.220	1.155	0.700	2.220	2.550
	100	0.745	0.455	0.335	0.170	1.150	0.626	2.155	2.644
	200	0.730	0.450	0.330	0.150	1.140	0.600	2.140	2.690
	400	0.710	0.430	0.320	0.130	1.130	0.550	2.130	2.710
	800	0.700	0.420	0.310	0.120	1.120	0.510	2.110	2.730
Ethephon	10	0.840	0.885	0.336	0.330	1.155	1.220	2.570	2.880
	25	0.870	0.880	0.395	0.325	1.160	1.210	2.560	2.850
	50	0.880	0.878	0.400	0.320	1.175	1.205	2.625	2.800
	100	0.895	0.875	0.420	0.318	1.200	1.190	2.400	2.790
	200	0.900	0.870	0.430	0.315	1.250	1.180	2.200	2.765
	400	0.910	0.868	0.450	0.313	1.365	1.185	2.115	2.755
	800	0.915	0.865	0.455	0.310	1.385	1.170	2.105	2.740
SE(M)±		0.123	0.108	0.053	0.051	0.178	0.166	0.123	0.192
C.D.		0.405	0.365	0.103	0.124	0.570	0.534	0.407*	0.612

*Significant at 5 % probability level
*leaf from top

Table 3: Effect of phytochormones sprays to 55 old Brinjal plants, on chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio in lower and upper leaves,

Treatments		Chlorophyll a		Chlorophyll b		Total Chlorophyll		Chlorophyll a/b	
Phytoho-rmones	Conc. (ppm)	Lower leaf	Upper leaf	Lower leaf	Upper leaf	Lower leaf	Upper leaf	Lower leaf	Upper leaf
	Mg/gm fresh weight								
Control	-	0.770	0.770	0.365	0.320	1.130	1.090	2.150	2.425
Cycocel	10	0.770	0.699	0.330	0.299	1.200	0.999	2.355	2.320
	25	0.750	0.695	0.300	0.299	1.200	0.997	2.360	2.310
	50	0.710	0.670	0.290	0.298	1.265	0.990	2.370	2.200
	100	0.640	0.665	0.270	0.295	0.710	0.975	2.395	2.290
	200	0.630	0.660	0.260	0.294	0.715	0.960	2.397	2.275
	400	0.615	0.655	0.255	.243	0.725	0.955	2.400	2.230
	800	0.605	0.640	0.250	0.240	0.735	0.945	2.408	2.200
GA_3	10	0.655	0.530	0.295	0.230	0.949	0.740	2.189	2.299
	25	0.650	0.530	0.290	0.220	0.940	0.785	2.200	2.315
	50	0.640	0.532	0.270	0.215	0.910	0.800	2.260	2.410
	100	0.625	0.535	0.265	0.210	0.890	0.830	2.365	2.525
	200	0.620	0.535	0.260	0.215	0.870	0.845	2.380	2.530
	400	0.615	0.540	0.255	0.210	0.832	0.850	2.390	2.535
	800	0.610	0.540	0.250	0.210	0.815	0.860	2.395	2.560
Ethephon	10	0.603	0.805	0.340	0.368	1.011	1.175	2.135	2.125
	25	0.600	0.810	0.335	0.370	1.022	1.180	2.140	2.130
	50	0.705	0.815	0.330	0.380	1.035	1.195	2.145	2.140
	100	0.715	0.840	0.330	0.385	1.065	1.200	2.190	2.150
	200	0.730	0.890	0.325	0.390	1.098	1.265	2.202	2.185
	400	0.775	0.910	0.320	0.395	1.105	1.310	2.375	2.295
	800	0.780	0.912	0.317	0.319	1.110	1.315	2.380	2.300
S.E(M)±	-	0.097	0.030	0.058	0.20	0.161	0.068	0.173	0.121
C.D.		0.337	0.197*	0.130	0.061*	0.516	0.66*	0.560	0.398

*Significant at 5% probability level
*Fourteenth leaf from the top
*Eight leaf from top

decreased chlorophyll content in 9 out of 12 species studied. Application of minerals along with GA_3 checked chlorophyll deficiency. It was suggested that the decrease in chlorophyll content under GA_3 application is related to mineral deficiency as plant is not able to absorb mineral at a rate commensurate with increased growth by GA_3. However, other workers have proposed a direct effect of GA_3 on chlorophyll metabolism.

The total chlorophyll content was increased by cycocel when applied 10 or 40 days old plants, but slightly decreased when applied to 55 days old plants, through the difference were not significant in most cases. Lower concentration of cycocel as foliar spray did not change the total chlorophyll content. However when concentration is too high a decreasing effect on chlorophyll content has been reported. Ethephon increased chlorophyll content when applied at 10 or 40 days and slightly inhibit when applied at 55 days. Phyto hormones are well known to delay senescence and also to effect chloroplast development. Gibberellins also act by

maintain a high level of protein synthesis, delaying degradations of protein and chlorophyll, showing down the rate of respiration and maintaining cell vigor (wittwer et. al., 1971) .

GA_3 Cycocel and Ethephon when applied to 10 or 40 days old plants slightly increased the chlorophyll content. Most of the treatments when applied to 55 days plants reduced chlorophyll contant of the leaves. The maximum decreases were caused by GA_3 Application.

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