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Effect of GA_3 Cycocel, Ethephon on Morphological parameter in the carrot (Daucus Carota Linn)

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Abstract

The Response of various concentration (10, 25, 50, 100, 200, 400, 800) of Bio-regulates as Cycocel, GA_3 and Ethephon on Morphological parameters of Carrot (Daucus Carota Linn). Pusa Kasar is better than 2 nantes. Pusa kasar an improved type is astatic red carrot with reduced foliage. Roots with sel-coloured narrow central core. Tolerates higher temperature than nantes suitable for early atm season (N.S.C. India). Nants: Half long slim well shaped arranged Cylinder, stump roots, good flavor fine grained, tender sweet, self-colour core, flash orange core. Flesh orange scrlet. Suitable for cool month (N.S.C. India). The family is called umbelliferae. The seeds are aromatic stimuted divrent and carminative, useful in dropsy and kidney trouble, yield an essential oil . Carrots are highly nutritious root vegetative, rich in beta carotene, fiber, potassium which promote eye heath, immunity and healthy digestive. Common type includes nantes (Cylinder/Sweet), Imperator (long/tapered), and chantenary shorter/thick). They grow best in loose sandy soil and prefer.

Key words: Cycocel, GA_3, kidney, vegetative, fiber, potassium, nantes, sandy soil

Introduction

Carrots are highly nutritious root vegetable rich in vitamin A, fiber and B-carotene offering benefit like improved eye healthy immunity and hearth. They are versatile for cooking commonly used in salads, stir-frid with fenugreek (methi), as a sweet halwa (carrot halwa).

Carrots are eaten raw or cooked. They are also used or flavoring soup and stew. The yellow, fine grained, tender sweet extracted from the roots is used for coloring outdoor butter, it is good cattle feed. Tender roots are picked rich source of carotenes. The seeds are aromatic stimuted diurent and carminative, useful in dropsy and kidney trouble yield an essential oil, i.e. carrots seed oil.

Major Producers

China is the words producer of carrots followed by country like India, which has significant production in regions like U.P. Karnataka and Panjab.

Vriety: I Pusa keasar

An improved type of asiatict red carrot with reduced foliage. Roots with self-colored narrow cent rave core. Tolerates higher temperature than Nantes suitable for early autumn season. (N.S.C. India).

Variety: 2 Nantes

Half-long slim, well-shaped, orange, cylindrical, stump root, good flouaur, fine grained, tender sweet, self-colored core, flesh orange core. Flesh orange scarle. Suitable for cool month (N.S.C. India).

Ethephon has been founded to affect the growth and developed of flowering plant (Burg, g68: cooke and Randail 1968 and Anon 1968) and causes diver response in plant metabolism. Dho and sunflower cultivars, the removal of the 4^{th} and 6^{th} leaf from top at the pre-anthesis stage had no significant adverse effect on seed yield.

Nutritional Value & Health Benefits

**** Vision Support***

Carrot are high in vitamin A (from beta) carotene), which helps prevent right blindness and age relation macutor degeneration.

* ***Antioxidants***

They contain antioxidants like carrot noils that protect against inflammation and potentially reduce the risk of certain cancers.

* ***Low-Calories***

A 100-gram serving of cooking carrot provides only 39 calories, making them effective for weight management.

* ***Nutrient Density***

They are a good source of fiber, vit, G, potassium and vitamins B_1, B_6 and K.

* ***Soil***

They require deep, loose, loamy soil with a pH of 6.0 to 7.0 for optimal growth.

* ***Climate***

Prefer cooler temperatures and can be grown year-round in hills (above 1500) during specific season in the plains.

* ***Spacing***

Seeds should be sown in 25-30 cm apart.

* ***Containers***

Suitable for contain gardening if the pot is deep enough.

* ***Harvesting***

Typically harvested in 3-4 when they are firms and crisp. The carrot is a biennial plant in the umbellifer family Apiaceae, world production of carrats for 2022 was 42 million tones, led by China producing 44% of the total.

Pusa kesar

Developed at the IARI, New Delhi. It has red-colored roots and self-colored care it can tolerate higher temp. Suitable for sowing from August easily October. Crop mature in 90-110 days with average yield 30th.

Nantes Half Long

It has cylindrical roots, orange scants with self-colored core, crop mature in 110-120 days.

Chantenay

An excellent culture for canning and storage root attractive orange smooth, thick at the shoulder with gradual tapering. It is more for juicy with less fiber content. Foliar application of ethephon induced flowering in animus comosus (Ng 1967 and Cooke and Randall, 1968). Seed germination is affected by several by several factor (Van Auken, 2001).

Materials and Methods

The present investigations were carried out to explode the effect growth regulator viz. cycocel, ethephon and GA_3 on germination, vegetative growth, photosynthesis wt. of seed, total seed growth carrot (Daucas carota Linn). The four variety of (1) Pusar Kesar (2) Nantus (3) Danvers (4) Chrantory.

Source of Seeds

Seeds of carrot (Daucas Carota Linn, cultivars, (1) Pusar Kesar, (2) Nantus (3) Danvers (4) Chranteray, were obtained from Agronamy department of G.B. Pant University of Agriculture and technology, Pantnagar.

Source of Chemicals

General- All chemicals employed in this investigation were of analytical grade supplied by BDH (India) unless specified otherwise.

Dehydrate absolute ethyl alcohol was supplied by Bengal chemical company, India, Etheral was supplied by Duchen, U.S.A. Gibberellic acid supplied by CDH (Central Drug house) (P) Ltd. Post Box No. 7138, New Delhi-11002.

Fertilizer and other chemicals

Urea, single super phosphate murates of potash (Gujrat fertilizer) were obtained from crop research Centre, G.B. Pant University of Agriculture and Technology. Diathane-N-45 and Sandovit were from crop research center, Pantnagar.

Apparatus

1. All glassware used was either of corning India ltd. Or Pyrez, U.S.A.
2. Vacuum Pump (Metrex India).
3. Spekal (Carl Zelis, Jena-DDR).
4. Luxmeter (Research-Luxomet-300, Atlantis, India)
5. Blender (Metrex, India)
6. Measuring Stender.
7. Air Hand sprayer.

Plant Culture

(1) Petre plate Culture

The experiment Petre plate culture for screening of susceptible variety has been carried out. First of all, the seed were collected uniform size and shape of different verities and ten seeds counted with different growth hormones and different concentrated. The seeds were sterilized with 0.1 $HgCl_2$ (Mercuric chloride) for 5 minute and

after this the seeds were socked for 12 hours at 10, 25, 50, 100, 200, 400, 800 mg/l and control level in GA_3, Cycocel and Ethephon solution. After the soaking seeds were transfer in to Petre plate and the Petre plate kept in B.O.D. at room temperature (30-35^{0}C) for germination. Regular and uniform moisture is maintained by distil water and calculated the growth parameter at periodic interval.

(2) Field Culture

For **exposure** to estimate photosynthesis efficiency of individual leaves a plot (19.20x12.75m) was selects. A normal dose of N.P.K. was applied to soul. About 100 seed were sown by keeping normal distance recommended of carrot. After 10 days seedling was thin to twenty.

Preparation of Hormones Solutions

To prepare stack solution of different hormones, the following were made per litre. Deionized water was used for solution preparations.

Hormones	Amounted/liter	Concentration ppm
GA_3	100	100
Cycocel	50	50
Ethephon	1.25 ml	500

Gibberellin acid and Ethephan were directly dissolved in water Cycocel was first dissolved in a few drops of absolute ethyl alcohol and then required volume was made by deionized water. 0.22 ml of "Sandovit" per liter of hormone solution was added as a surfacent.

Foliar Spray of Hormones

(1) Spraying Stages

1. 40 days after seedling emergence
2. 55 days after seedling emergence. (Bud initiation stage)
3. 70 days after seedling emergence (Flower Stage).

Concentrations of phytohormones used seven concentrations of each hormone 10, 20, 50, 100, 200, 400 and 800 ppm as given below, were sprayed at every stage of development.

Treatment	Concentration
Control	Water
GA_3	10, 25, 50, 100, 200, 400 and 800
Cycocel	10, 25, 50, 100, 200, 400 and 800
Ethephon	10, 25, 50, 100, 200, 400 and 800

Thirty plants were sprayed for each concentration.

Chemical analysis

Chemical analysis was conducted in plant physiological lab, of Botany Department Hindu College, Moradabad and College of Basic Science, G.B. Pantnagar University Pantnagar (U.A.).

Quantitative determination of chlorophyll constant

Chlorophyll a, chlorophyll b and total chlorophyll content of leaves were determined Spector photometrically according to the method of Arnon (1919), after the pigments were extracted in 80% acetone in a semi dark room.

Weighed leaf discs (0.01 gm fresh material) from treatment were extracted in1 litre of 80% acetone and volume is to be multiplied by 0.10. Extract was filtered (with suction) through Whatman No. 1 filter paper. The residue was extracted repeatedly in small amount 80 percent acetone and filtered till visibility valuation and the final volume of the extract was adjusted. The absorbances of pigment extract was read at 645, 652 and 663 against 80 percent. Acetone as blank. The concentration of chlorophyll was calculated with the help of Arnon's (1949) equation as given below. Yabute and sumaki (1938) introduce the term Gibberellins for the growth promoting substance extracted from the fungus, GA_3 Fujikura which was responsible rice seedling-

(1) Chlorophyll a (mg/g,$^{-1}$ fresh wt.)

$$= 12.7\,(A\,663) - 2.69\,(A\,645) \times \frac{V}{1000 \times W}$$

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

=22.9 (A 645)-4.68(A652)

(3) Total Chlorophyll (mg gm^{-1} fresh weight)

= 20.2 (A645)+8.02 (A663)

(4) Chlorophyll a/b

Chlorophyll=A

Wave length = V

Tissues extracted = 'W'

Within hardly a quarter of century, the majority of crop improvement programmes with important agricultural and horti-cultural crops have invariably taken recourse to the use of growth hormones. Very few and sporadic attempts have been made to improve the vegetable oil of this crop. This crop through the application of the knowledge of growth regulator, specially Cycocel, Ethephon and GA_3.

Results and Discussion

The experiments on germination recorded the significant of phytohormones on the germination percentage in different concentrations in all the four culture i.e. (1) Pusa kesar (2) Nantes (3) Danvers (4) Chantenary.

The first count was taken after 10th days of soaking. All the concentrations of cycocel showed significant an increment in germination% over control in all four verities (Tabel 1). The maximum percentage (84.30) was recorded in Nanetes. Followed by Nantes. (76.35%) and Chantenay (70.90%) Danveers (63.80) in different concentrations of Cycocel, Ethephon showed a decline in germination percentage with increasing concentrations. The maximum percentage (80.21%) was recorded 10 mg/l and minimum percentage (65.3%) was observed in 800 mg/in Nantes. Minimum percentage (50.30%) was recorded in Puskar kesar at 800 mg/l. GA_3 showed the significant ($P<0.05$) effect on germination percentage with increasing concentrations all the verities. The maximum percentage (98.80%) was observed in 800 mg/l in Nantes while lower concentration (10, 25, 50, 100 and 200 mg/l) showed a decline trend of percentage in germinating of seeds. Effect of phytohormones sprays to 55 days old carrot plants on chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio, in lower & upper leaves, recorded after three weeks of spray. Effect of phytohormone sprays to 40, 55 and 7 days carrot plants on top dry weight recorded at various time intervals.

Photosynthesis

(I) Chlorophyll Constant

Data recorded after 3 weeks of spray on chlorophyll content of upper (8th from top) and lower (14th from top) leaves of plants are presented.

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 bottom

Table 1: Effect of phytohormones on the percentage of seed germination in different cultivars of Daucus Carota Linn.

Treatments		Germination%			
Phytohormones	Conc. (ppm)	Pusa kesar	Nantes	Chantenay	Danvers
Control	D.W.	58.15	75.30	64.20	65.10
Cycocel	10	66.80	84.30	73.20	76.90
	25	66.11	83.70	72.70	76.35
	50	65.20	83.40	72.30	76.00
	100	64.30	83.00	71.18	75.80
	200	64.00	82.50	70.90	75.00
	400	63.70	81.70	70.40	74.32
	800	63.80	81.00	70.10	70.00
Gibberellic acid	10	79.87	97.03	82.92	86.12
	25	80.12	97.27	83.16	86.78
	50	80.53	97.28	83.50	87.12
	100	80.86	98.01	84.00	87.92
	200	81.19	98.34	84.73	88.00
	400	81.53	98.66	85.42	88.64
	800	82.00	98.80	85.92	88.90
Ethephon	10	62.16	80.21	69.20	77.10
	25	61.18	78.16	67.22	76.82
	50	60.02	77.20	65.12	75.12
	100	58.66	76.73	64.30	74.00
	200	57.60	76.20	63.22	73.50
	400	55.20	75.42	58.70	72.10
	800	50.30	65.30	57.00	70.00
C.D. at 5%		02.10	02.70	2.30	2.50

leaf with different treatments was found. The maximum increases in a/b ratio were seen in leaf of plants spray with 50 ppm ethephon (48.8% increase) and and increase was 26.8% with GA_3 100ppm followed by 400 ppm (18.0%).

(II) Photosynthetic efficiency

Data recorded after 3 weeks of spray on photosynthesis efficiency of lower (14 the from top) upper (8^{th} from top) leaves of different treatment are present in Table 2.

Photosynthesis efficiency (expressed as cpm/g, dry weight was found to be higher in lower leaf than of upper leaf in all the item except ethephon 500 ppm where the effect was just the reverse.

Photosynthesis efficiency of lower and upper of plants given different treatments was not founded to be significantly changed in most cases. However photosynthetic efficiency of lower leaf of plants spray plants sprayed with 400 ppm ethephon described to about 42.11% of that of control. On the other hand, photosynthesis efficiency of upper leaf of plants sprayed with 50 ppm GA_3 increase by about 43.6% in comparison to that of control.

Photosynthesis efficiency (expressed as cpm/ cm^2 leaf area) was found to be higher in lower leaf than that of upper leaf in all the treatment and ethrel 400 ppm in which no difference in photosynthetic efficiency of two leaves was found. It was noted that the photosynthetic efficiency of lower leaf in plant sprayed with ethrel 400 ppm) decreased by about 35.16% of that of control, while that of upper leaf of plants sprayed with GA_3 in (50 ppm) increased by about 61%.

Top Dry Weight

The effect of various hormonal spray on top dry weight after 3 weeks of spray and at maturity

Table 2: Effect of phytohormones sprays to 40, 55 and 70 days old carrot plants, on top dry weight recorded at various time intervals

Treatments		Plant age at spray (days after emergence)				
		40		55		70
Phytohormones	Conc. (ppm)	After 3 weeks	At maturity	After 3 weeks	At maturity	At maturity
Water (Control)	-	12.00	14.80	16.2	17.10	17.85
Cycocel	10	22.50	17.45	21.45	20.40	20.85
	25	22.35	17.00	21.30	20.00	20.50
	50	21.40	16.90	20.35	19.35	20.10
	100	21.20	16.75	20.15	19.00	20.00
	200	20.70	16.30	19.60	18.50	19.70
	400	20.60	16.10	19.50	18.45	19.20
	800	20.30	16.00	19.25	18.10	19.00
Gibberellic acid	10	25.70	20.12	24.60	19.10	22.70
	25	24.30	19.20	23.20	18.20	22.00
	50	23.28	19.00	22.18	18.00	21.65
	100	22.65	18.80	21.55	17.70	21.30
	200	21.70	18.70	20.60	17.50	21.00
	400	20.60	18.40	19.50	17.30	20.65
	800	20.00	18.25	19.00	17.15	20.20
Ethephon	10	19.52	19.30	18.60	18.20	20.70
	25	19.10	18.80	18.00	17.85	21.00
	50	18.70	18.65	17.65	17.50	21.80
	100	17.55	17.30	16.35	16.20	20.70
	200	17.20	17.05	16.10	16.00	20.15
	400	18.70	16.30	15.40	15.30	19.60
	800	15.30	15.15	14.40	14.15	18.35
	-	1.97	1.77	2.73	2.24	0.90
		4.86*	2.30	8.74	7.52	2.94*

*Significant at 5% probability level

Table 3: Effect of Phytohormones sprays to 55-days old carrot plants, on chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio, in lower & upper leaves, recorded after three weeks of spray

Statements	Conc. (ppm)	Chlorophyll a Lower leaf	Chlorophyll a Upper leaf	Chlorophyll b Lower leaf	Chlorophyll b Upper leaf	Total Chlorophyll Lower leaf	Total Chlorophyll Upper leaf	Chlorophyll a/b Lower leaf	Chlorophyll a/b Upper leaf
		Mg/gm fresh weight							
	Water Control	0.770	0.770	0.365	0.320	1.130	1.090	2.150	2.425
Cycocel	10	0.770	0.699	0.430	0.299	1.099	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	0.243	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	0890	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	2.1235	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	0.490	0.325	0.390	1.098	1.265	2.202	2.185
	400	0.775	0.910	0.320	0.395	1.105	1.131	2.375	2.295
	800	0.780	0.912	0.317	0.319	1.110	1.315	2.380	2.300
	-	0.097	0.030	0.058	0.20	0.161	0.068	0.173	0.121
		0.337	0.197*	0.130	0.061*	0.516	0.66*	0.560	0.398

Significant at 5% probability level Fourteen leafs from top Eighth leaf from top

are given from the data it is clear that all Hormel treatments increased top dry weight recorded after 3 weeks of spray maximum increases in dry weight was obtained in case of cycocel (50 ppm) closely followed by GA_3 (100 ppm) and minimally by ethephon (400 ppm). A general trend of increases in the top dry (head wt. not increased) when recorded at maturity of different treatment was observed as compared to control.

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