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Induction and breaking of *Coleus* tuber Dormancy by the application of 6-benzyladenine (BA)

[1]Dr. Suresh Bharali[*], [2]Narayan Sarkar, Dr. Gunajit Kalita

[1]Associate Professor, Dept of Botany, Tihu college
(sureshbharali@gmail.com)
[2]Phd Research scholar , Dept of Botany, Gauhati University
(sarkarnarayn8@gmail.com)
[3]Assistant Professor, Dept of Botany, Nalbari College
(gunajitkal@gmail.com)
*Corresponding author's email id: (sureshbharali@gmail.com)

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ABSTRACT

The plant Coleus parviflorus is an annual herb with opposite dentate or serrate and dark green leaves. The stems are quadrangular and light green in colour. Coleus attains a height of 30-60 cm and produces clusters of dark brown root tubers. Flowers are light pink colour and the inflorescence is verticillaster. Coleus tubers are two types , viz- Those having small sized tubers with good flavour and others with large sized tubers and higher yield. An improved variety of Coleus is Sree-Dhara, which yields about 20-25 tones/ha over a period of 6 month. Coleus tuber shows periods of dormancy from September-October to March –April. If this dormancy can be broken by treatment with plant growth regulators then it can be cultivated throughout the year and used as vegetables for all in North –East India.In this study, Coleus tubers were treated with 6-benzyladenine at different concentration. The result showed that lower concentration of BA can break the dormancy of the tubers and induce germination. It also promote leave formation, branch formation and length of the seedlings.

INTRODUCTION

coleus (*Coleus parviflorus*) belongs to the family Labiatae is one of the important tuber crops grown particularly in south India for its edible tubers which have special flavour and taste and use as vegetables.It is also known as Chinese potato , country potato or coleus potato in english.A fresh coleus tuber contains carbohydrates 20% ,Fat 0.1%, Protein 1.4%, Starch 2%, Sugar 0.54%, to 0.96%, moisture 77%, calcium 60.4% and energy 392 K cal. Plant growth regulators are considered to be the primary germination controlling agents. Tuber sprouting may be regarded as the resumption of active growth by the tuber.Plant hormone may induce the synthesis of certain specific enzymes which cause germination.

Coleus tuber shows periods of dormancy from september – october to March –April.The regulation of dormancy release has an academic values. It may be possible regulating by artificial manipulation of the environment by the use of active compounds. By indicious manipulation of plant growth regulators (such as BA) , THe dormancy of coleus tubers can be removed and growth and yields of crops can be modified considerably.

Phytohormones are the group of organic substances other than the nutrients provided by the plant which in minute concentration increases, decreases or modifies growth and developments of plant and generally their sites of action and biosynthesis are different.

6-benzyladenine(BA) is the first synthetic cytokinin which appeared to be very active in some assays, germination of non dormant , after ripened seeds was markedly protected by application of BA.The true dormancy of freshly harvested seeds of tubers effectively broken by treatment of BA. The relative effectiveness of the germination promotion was better in BA than GA3.Dormancy can be broken pre sowing seed treatment in BA in combination with GA_{4+7}.

The main aim of this experiment was to investigate the effects of BA on dormant coleus tubers for the growth and developments.If this dormancy can be broken by treatment with BA then it can be cultivated throughout the year and used as vegetables for all in North East India.

MATERIALS AND METHODS

The fresh coleus parviflorus were collected and soaked with $HgCl_2$(0.1%) solution for 15 minutes for surface sterilization and dried for 24 hours.

1gm of Benzyladanine was weighted and dissolved in about 5ml of NaOH(0.05%) and slightly heated. Then the volume was made upto 1 liter . This gives 1000 ppm stock solution and from this different grades(10,50,100,250,500 and 1000ppm) were prepared and distilled water used in case of control.These numbers of tubers constituted a set for one replication. Each was placed in respective concentration of BA.One set was placed in distilled water which served as the control.Then the tubers are transfered to the field after 24 hours. The experiment was started by the first week of March.

RESULT AND DISCUSSION

Effect of 6-Benzyladenine on Coleus tuber:

Dormancy of coleus tubers was effectively broken with different concentration and the effect gradually diminished at higher cocentration . Lower cocentration were moreeffective than higher concentration.Tubers were soaked with BA at the concentration of 10, 50, 100, 250,500 and 1000 ppm. The number of sprouts on each tuber was counted after 15 days treatment and it was repeated after 22, 29 and 36 days.i.e after 7 days respectively. The means are presented in a table and from the means action-curves were drawn.

statistical analysis and the mean table reveal the effect of BA to be highly stimulatory in breaking tuber dormancy.The intensity of stimulation increased from 0 to 100 ppm as the letter one being the maximum concentration for breaking dormancy .At the optimal concentration of 100 ppm after 36 days , the mean number was 2.9 and 1.3 at control. The time effect was also found to be highly significant.

Table1. Mean no. of sprouts on coleus tuber treated with BA at different concentration

conc. of BA in ppm	time in days				total for conc.	mean
	15 days	22days	29 days	36 days		
0(control)	0.3	0.6	1.0	1.3	3.2	0.8
10	0.3	1.0	1.3	1.6	4.2	1.0
50	0.6	1.3	1.9	2.0	5.8	1.41
100	1.0	1.6	2.3	2.9	7.8	1.9

250	0.6	1.0	2.0	1.6	5.2	1.3
500	0.3	0.6	1.0	1.3	3.2	0.8
1000	0.3	0.3	0.6	1.0	1.4	0.4
mean	0.4	0.91	10.1	1.67		

CD for BA(n=12)

At 5% level of probability=0.18

At 1% level of probability=0.25

CD for time (n=21)

At 5% level of probability=0.13

At 1% level of probability=0.17

table2: Analysis of variance

source of variance	SS	DF	MSS	F-value
BA	5.83	7-1=6	0.97	24.25**
time	6.36	4-3=1	2.12	53.00**
Error	0.74	6x3=18	0.04	
Total	12.93	83		

*Significant at 1% level of probability.

BA treated sprouted tubers were planted in the field in random block design. Then the length of seedlings , branch numbers and leaves were measured after 40, 55 days and 70 days of planting.

Length of seedlings:

6-benzyladenine(BA) also proved to be highly stimulatory for the elongation of shoots of *Coleus parviflorus*. Increase in length of shoot was measured separately for each interval of time and the means are presented in the table.The data thus obtained were subjected to statistical analysis. The mean table reveals that BA stimulated length of shoot at lower concentrations. The intensity of stimulation increased from 10 to 250 ppm and then gradually decreased . After 40 days at the concentration of 10,50, 100, 250 ,500 and 1000 ppm,the shoot length was recorded as 16.8, 17.5, 18.9, 19.7, 17.8, 16.1 cm against 15.4 cm at control.Again the same concentrations after 70 days it was 27.1, 29.6, 37.3 , 33.5,

30.2, and 28.7 cm against 26.2 cm at control. The highest stimulation (250 ppm) of length was as 13.7, 25.3, and 33.5 after 40, 55 and 70 days against 15.4, 20.1 and 26.2 cm at control.

Table3: Mean length of plants treated with BA

conc. of BA in ppm	time in days			total for conc.	mean
	40 days	55days	70days		
0(control)	15.4	20.1	26.2	61.7	20.5
10	16.8	21.5	27.1	65.4	21.8
50	17.5	22.2	29.6	69.3	23.1
100	18.9	23.6	31.3	73.8	24.6
250	19.7	25.3	33.5	78.5	26.1
500	17.8	22.7	30.2	70.7	23.5
1000	16.1	21.2	28.7	66.0	22.0
total for time	122.2	156.6	206.6		
mean	17.4	22.3	29.5		

CD for BA(n=9)

At 5% level of probability=0.67

At 1% level of probability=0.97

CD for time (n=21)

At 5% level of probability=0.40

At 1% level of probability=0.54

Table 4: Analysis of variance

source of variance	SS	DF	MSS	F-value
BA	63.56	7-1=6	10.59	27.15**
time	514.60	3-1=2	257.30	659.74**
Error	4.73	6x2=12	0.39	

Total	582.89	63		

*Significant at 1% level of probability.

Number of branches:

from the three replications on number of branches the mean value were calculated as the specific interval of time(Table-5) and the data were subjected to statistical analysis.The mean table for the number of branches reveals the effect of BA to be highly stimulatory.The number of branches also increased at lower concentration . From 10-250 ppm it increased but at 500-1000 ppm it decreased. At the opyimal concentration of 250 ppm for 40,55 and 70 days and the numbers were 17.1, 23.9, and 30.3. The growth stimulation reveals that highest value on BA treated Coleus after 70 days and it was 25.2, 26.5, 28.1, 30.3, 27.6 and 25.9 against 23.8 at control. On statistical analysis , the stimulatory effects of time and BA come out at highly significant.

Table5: Mean number of branches treated with BA

conc. of BA in ppm	time in days			total for conc.	mean
	40 days	55days	70days		
0(control)	10.2	16.6	23.8	50.6	16.8
10	12.1	18.3	25.2	55.6	18.5
50	13.7	20.4	26.5	60.6	20.2
100	15.3	22.1	28.1	65.5	21.8
250	17.1	23.9	30.3	71.3	23.7
500	14.8	21.6	27.6	64.0	21.3
1000	13.2	20.7	25.9	59.8	19.9
total for time	96.4	143.6	187.4		
mean	13.7	20.5	26.7		

CD for BA(n=9) CD for time (n=21)

At 5% level of probability=1.21 At 5% level of probability=0.71

At 1% level of probability=1.74 At 1% level of probability=0.90

table6: Analysis of variance

source of variance	SS	DF	MSS	F-value
BA	77.77	7-1=6	12.96	10.36**
time	591.77	3-1=2	295.88	236.70**
Error	15.06	6x2=12	1.25	
Total	684.60	63		

*Significant at 1% level of probability.

Number of leaves:

The number of leaves were counted after 40,55 and 70 days and the means were calculated and from 3 replications. From the mean table it is evident that the number of leaves per plant increased in response to BA during all the three phases of observations. The leaves number was increased from lower concentration to higher concentrations and decreased at 500 and 1000 ppm after reaching its peak point at 250 ppm (optimum). The number of leaves at 250 ppm after 40 , 55 and 70 days was 82.4, 151.3 and 169.6 against 37.5, 83.1, and 114.5 at control. The mean number of leaves after 70 days at the concentrations of 10, 50, 100, 250, 500 and 1000 ppm recorded as 127.3, 144.7, 157.1, 169.6, 151.2, and 139.1 respectively against 114.5 at control. On statistical analysis , the stimulatory effects of BA was established by highly significant F value. The time effect also emerged as highly significant.

Table7: Mean number of leaves in response to BA treatment

conc. of BA in ppm	time in days			total for conc.	mean
	40 days	55days	70days		
0(control)	37.5	83.1	114.5	235.1	78.3
10	44.8	104.4	127.3	276.5	92.1
50	53.2	121.8	144.7	319.7	106.5
100	67.1	134.5	157.1	358.7	119.5

250	82.4	151.3	169.6	403.3	134.4
500	70.3	142.5	151.2	364.0	121.3
1000	58.6	128.6	139.1	326.3	108.7
total for time	413.9	866.2	1003.5		
mean	59.1	123.7	143.3		

table8: Analysis of variance

source of variance	SS	DF	MSS	F-value
BA	6413.67	7-1=6	1068.94	36.17**
time	27193.08	3-1=2	13596.54	460.11**
Error	354.63	6x2=12	29.55	
Total	33961.38	63		

*Significant at 1% level of probability.

CONCLUSION

From these results it is clear that BA can remove dormancy and stimulate the germination of Coleus tubers . Metabolic control during germination is required for a number of reasons.Metabolic control is needed so that reserved materials are utilized with optimal efficiency. During the early stages of germination many enzymes break down starch, proteins and other storage mterials and transported from the endosperm to the developing axis of embryo.

This result will help the farmer to cultivate the Coleus plant throughout the year making use of cultivated land of North East India.

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