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EFFECT OF SALICYLIC ACID (SA) ON DORMANT COLEUS TUBER AND ITS BIOCHEMICAL ANALAYSIS BEFORE AND AFTER THE TUBER GERMINATION

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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 different concentration of Salicylic acid(SA) solution and germination(No.of sprouts),Length of seedlings, number of leaves and Biochemical content like sugar, starch and protein were observed in both SA treated and controlled tubers.The result showed that maximun number of sprouts in SA treated tubers ,i.e, SA break dormancy of tubers. Again length of seedlings, no.of leaves were more in SA treated tubers than that of controlled one. Sugar content and protein content were also more in SA treated tubers.

Keywords: Coleus,Dormancy, Growth regulators, Salicylic acid, Biochemical content

INTRODUCTION

Coleus is a seasonal crop cultivated for its edible tubers in Kerala and Tamil nadu. Tubers which resemble miniature potato have a characteristic flavour and are used as vegetables after cooking. Plant is a bushy herbaceous annual with succulent stem and round ovate petiolate leaves. Plant is completely sterile and produces a cluster of dark brown tubers with round to oblong shape at the base of lower nodes of stem below soil. Coleus is originated in Africa and is grown in india, Sri Lanka, South East Asia and parts of Africa.

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 SA) , 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.

Salicylic Acid(SA) is one of the potential plant growth regulators that regulate plant growth and development by triggering many physiological and metabolic processes. It is known to be crucial component of plant defense mechanism against environmental stimuli.

The aim of this study was to investigate the effect of different concentration of Salicylic Acid(SA) on dormancy of Coleus tuber and effect on its biochemical content such as sugar, starch and protein content.

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.

One gram of each of active substance of salicylic acid was dissolved in 10 ml of alcohol and final volume was made upto 1000ml by adding distilled water and thus stock solution of 1000 ppm salicylic acid was prepared. 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 SA.One set was placed in distilled water which served as the control.Then the tubers are transfered to the field after 24 hours.

RESULTS AND DISCUSSION

1. NUMBER OF SPROUTS:

Dormant coleus tubers were soaked with salicylic acid (SA) at the concentrations of 10, 50, 100, 250, 500 and 1000 ppm. One set of tuber was placed in sterile distilled water which constituted the control. Then the tubers were transferred to the small earthen tubs filled with sterile garden soil. Sprouting of tubers after few days indicated the breaking of dormancy. The number of sprouts on each tuber was counted after 15, 22, 29 and 36 days. The mean number of sprouts per

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tuber was worked out (Table 1). The data were analyzed statistically. From the means action-curves (Fig 1) were drawn.

The magnitude of stimulation increased from 10 to 500 ppm, 500 ppm being the optimal concentration. At the optimal concentration of 500 ppm the mean number of sprouts was as 4.6, 5.0, 5.9 and 6.6 against 0.6, 1.0, 1.6 and 2.0 at control after 15, 22, 29 and 36 days of treatment. At the concentrations of 10, 50, 100, 250, 500 and 1000 ppm after 36 days the mean number of sprouts was as 3.3, 4.0, 4.9, 5.6, 6.6 and 4.6 against 2.0 at control respectively. The mean table (Table1) and the statistical analysis (Table2) reveal the effect of salicylic acid to be highly stimulatory in breaking dormancy of tubers.

Table 1. Mean number of sprouts with salicylic acid (SA) treatments

Conc. of SA in ppm	Time in days				Total for conc.	Mean
	15	22	29	36		
0	0.6	1.0	1.6	2.0	5.2	1.3
10	1.6	2.0	2.6	3.3	9.5	2.3
50	2.0	3.3	3.6	4.0	12.9	3.2
100	3.6	3.9	4.3	4.9	16.7	4.1
250	4.0	4.6	5.3	5.6	19.5	4.8
500	4.6	5.0	5.9	6.6	22.1	4.4
1000	3.9	4.0	4.3	4.6	16.8	4.2
Total for time	20.3	23.8	27.6	31		
Mean	2.9	3.4	3.94	4.4		

CD for SA (n=12)

At 5% level of probability = 0.22

At 1% level of probability = 0.31

CD for Time (n=21)

At 5% level of probability = 0.14

At 1% level of probability = 0.19

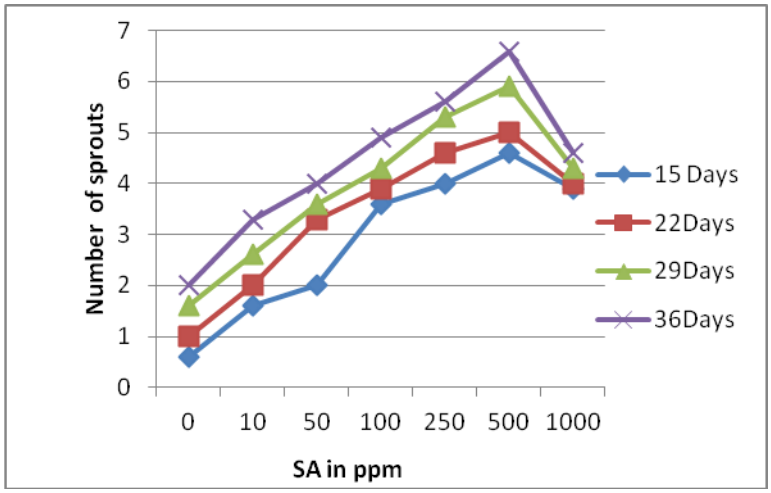

Fig 1. Action-curves on number of sprouts with SA treatments

Table 2. Analysis of variance

Source of variance	SS	DF	MSS	F-Value
SA	51.68	7-1=6	8.61	143.50**
Time	9.21	4-3=1	3.07	51.16**
Error	1.08	6x3=18	0.06	
Total	61.97	83		

**Significance at 1% level of probability

2. Length (cm) of seedling

The length of the seedlings was recorded after 15, 22, 29 and 36 days. From this data means were calculated out (Table 3). At the optimal concentration of 500 ppm after 36 days the mean length was as 4.6 cm against 2.0 at control. The collected data were subjected to statistical analysis and the analysis of variance is presented in another table (Table 4). From the means action-curves were drawn (Fig 2).

Table 3. Mean length (cm) of seedlings with SA treatments

SA in conc.	Time in days				Total for conc.	Mean
	15	22	29	36		

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0	0.6	0.6	1.0	2.0	4.2	1.05
10	0.6	0.6	2.0	2.6	5.8	1.45
50	1.6	1.9	2.6	3.0	9.1	2.27
100	2.3	2.3	3.0	3.6	11.2	2.80
250	2.3	2.6	3.3	4.0	12.2	3.05
500	3.0	3.3	3.6	4.6	14.5	3.62
1000	2.0	2.3	3.0	3.6	10.9	2.72
Total for time	12.4	13.6	18.5	23.4		
Mean	1.77	1.94	2.64	3.34		

CD for SA (n=12)

At 5% level of probability = 0.15

At 1% level of probability = 0.21,

CD for Time (n=21)

At 5% level of probability = 0.10

At 1% level of probability = 0.14

Table 4. Analysis of variance

Source of variance	SS	DF	MSS	F-Value
SA	19.7	7-1=6	3.28	109.33**
Time	10.84	4-3=1	3.61	120.33**
Error	0.68	6x3=18	0.03	
Total	31.22	83		

**Significance at 1% level of probability

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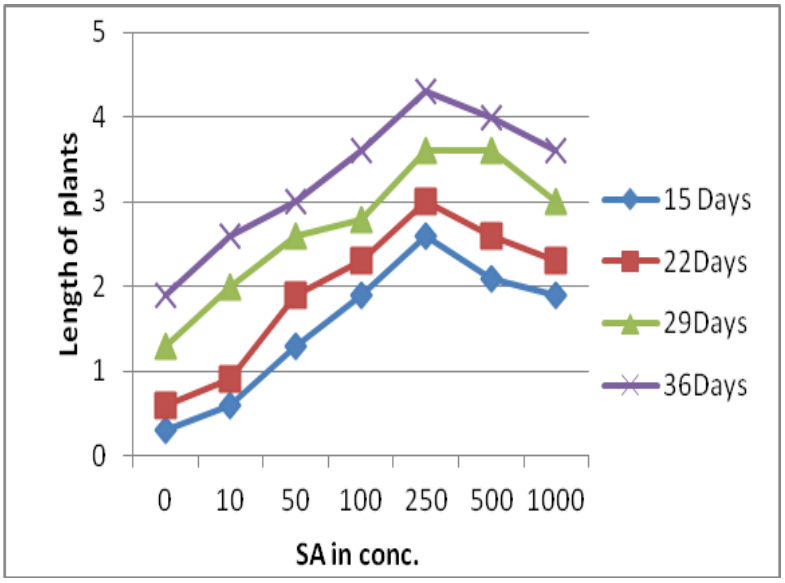

Fig 2. Action-curves on length of plants treated with SA

The statistical analysis reveals the effect of salicylic acid to be highly significant on the length of shoot establishing the observed stimulatory effect. The effect of time was also found to be highly significant.

3 .Number of leaves:

Number of leaves of the seedlings was recorded after 15, 22, 29 and 36 days of treatment and means were calculated out (Table 5). The obtained data were subjected to statistical analysis and analysis of variance is represented in a table (Table 6). After 36 days at 10, 50, 100, 250, 500 and 1000 ppm, the mean number of leaves was as 7.6, 8.3, 10.3, 12.3, 13.6 and 12.0 against 6.3 at control. At the optimal concentration of 500 ppm the number of leaves was as 4.6, 8.0, 11.6 and 13.6 against 0.6, 2.3, 4.6 and 6.3 at control after 15, 22, 29 and 36 days. From the means action-curves (Fig 3) were drawn.

Table 5. Mean number of leaves treated with SA

SA in ppm	Time in days				Total for conc.	Mean
	15	22	29	36		
0	0.6	2.3	4.6	6.3	13.8	3.4
10	1.6	3.0	5.3	7.6	17.5	4.3
50	2.0	4.3	7.0	8.3	21.6	5.4
100	3.3	5.6	8.6	10.3	27.8	6.9
250	4.0	6.6	10.6	12.3	33.5	8.3

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500	4.6	8.0	11.6	13.6	37.8	9.4
1000	3.6	6.6	9.6	12.0	31.8	7.9
Total for time	19.7	36.4	57.3	70.4		
Mean	2.8	5.2	8.1	10.0		

CD for SA (n=12)

At 5% level of probability = 0.56

At 1% level of probability = 0.77

CD for Time (n=21)

At 5% level of probability = 0.40

At 1% level of probability = 0.54

Table 6. Analysis of variance

Source of variance	SS	DF	MSS	F-Ratio
SA	118.09	7-1=6	19.68	49.20**
Time	215.27	4-3=1	71.75	179.37**
Error	7.29	6x3=18	0.40	
Total	340.65	83		

**Significance at 1% level of probability

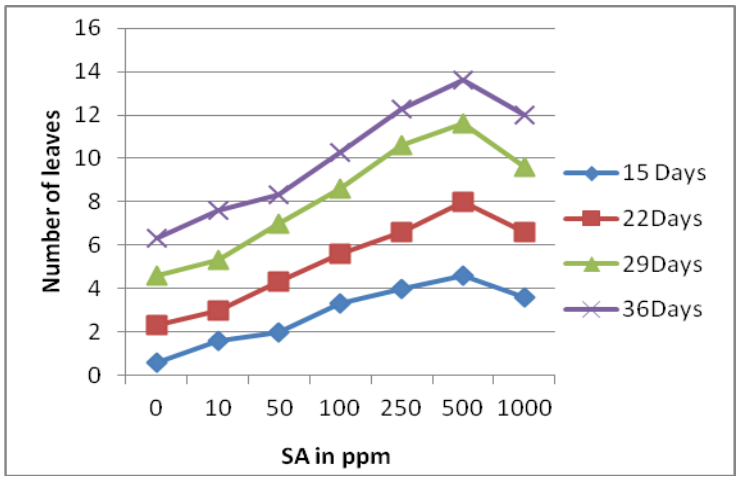

Fig 3. Action-curves on number of leaves with SA treatments

From the table it was found that the effect of salicylic acid was highly significant on number of leaves per plant. The time effect was also highly significant.

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4. BIOCHEMICAL ANALYSIS

Sugar content:

The sugar content of the tubers treated with SA at the concentrations of 10, 50, 100, 250, 500 and 1000 ppm was estimated by Nelson-Somogiyi's method. With the increasing concentration of SA the sugar content also gradually increased but declined at 1000 ppm (Table7). At the concentration of 500 ppm reducing sugar content was maximum and minimum at the control. Reducing sugar was 0.08 per cent at 500 ppm against 0.02 per cent at control. The non-reducing sugar content was 0.53 per cent against 0.33 per cent at control and total sugar content was 0.61 per cent against 0.35 per cent at control.

Table 7. Estimation of Sugar content

Treatment of SA in ppm	Reducing Sugar (%) ± SE	Non-reducing sugar (%) ± SE	Total sugar (%) ± SE
0	0.02 ± 0.002	0.33 ± 0.005	0.35 ± 0.007
10	0.04 ± 0.005	0.35 ± 0.002	0.39 ± 0.004
50	0.04 ± 0.007	0.41 ± 0.001	0.45 ± 0.008
100	0.06 ± 0.001	0.43 ± 0.008	0.49 ± 0.009
250	0.07 ± 0.004	0.49 ± 0.009	0.56 ± 0.013
500	0.08 ± 0.002	0.53 ± 0.008	0.61 ± 0.010
1000	0.07 ± 0.006	0.50 ± 0.002	0.57 ± 0.008

Starch content :

Estimation of starch from SA treated coleus tubers was done by Anthrone reagent. After 10 days of SA treatment the starch content was as 0.153, 0.145, 0.137, 0.129 and 0.117 per cent. Again after 20 days, on sprouting coleus tubers starch content decreased with the increased in all the time from lower to higher concentrations (Table8). The starch content after 20 days was 0.146, 0.131, 0.123, 0.115, 0.108 per cent.

Table 8. Estimation of starch treated with SA

Conc. of SA in ppm	Time in days	
	10 days (Dormant) %	20 days (Sprouted) %
0	0.156 ± 0.06	0.153 ± 0.06
10	0.151 ± 0.06	0.148 ± 0.06
50	0.145 ± 0.06	0.139 ± 0.05
100	0.137 ± 0.05	0.131 ± 0.05
500	0.129 ± 0.05	0.122 ± 0.05
1000	0.117 ± 0.04	0.108 ± 0.04

Starch content decreased with the increase in time at all the SA treatment from lower to higher concentrations.

Protein content:

Protein content of the SA treated tubers was estimated by the Lowry's method.

After 10 days of SA application the protein value was 0.010, 0.034, 0.056, 0.109 and 0.187 per cent. After 20 days of SA treatment at different concentrations the protein content was 0.017, 0.046, 0.084, 0.124 and 0.206 per cent. Protein content increased with the increase in time at all the SA treatment from lower to higher concentrations (Table9).

Table 9. Protein analysis from tubers treated with SA

Conc. of SA in ppm	Time in days	
	10 days (Dormant) %	20 days (Sprouted)%
0	0.001 ± 0.00	0.001 ± 0.00
10	0.010 ± 0.004	0.017 ± 0.006
50	0.034 + 0.01	0.046 ± 0.02
100	0.056 ± 0.02	0.084 ± 0.03

500	0.109 + 0.04	0.124 $\pm$ 0.05
1000	0.187 $\pm$ 0.08	0.206 $\pm$ 0.08

Protein content increased with the increase of time at all the SA treatments from lower to higher concentrations**.**

CONCLUSION

From these results it is clear that Salicylic Acid(SA) 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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