

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.910.419>

Physiological Modification of Patharchur *Coleus forskohlii* (Willd) Briq as Impact of Plant Growth Hormones

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ABSTRACT

A field experiment was carried out in the farmer field adjoining, RAK College of Agriculture, Sehore (Madhya Pradesh) during 2015 and 2016 to find out Physiological modification of Patharchur *Coleus forskohlii* (Willd) Briq as impact of Plant Growth Hormones. Field experiment consisting of Plant Growth Hormones MH @ (100 and 150 ppm), Cycocel @ (500 and 1000 ppm), NAA @ (50 and 100 ppm), GA₃ @ (150 and 200 ppm) and water spray as control. Bjective of the study is to study the impact of plant growth Hormones on physiology of *Coleus forskohlii* (Willd) Briq. Physiological parameters like, Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$), Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), CO₂ utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$) and H₂O utilization (Kpa) by using IRGA and observations were recorded at 150 day after transplanting. Pooled data (2015 and 2016), 150 day after transplanting (DAT) revealed that application of Cycocel @ 1000 ppm resulted in increased Physiological parameters like, Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$), Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), CO₂ utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$) and H₂O utilization (Kpa), respectively (13.14, 14.56, 3.64, 13.53 and 0.458) followed by Cycocel @ 500 ppm (12.68, 13.64, 3.19, 13.38 and 0.447) as compare to control (10.63, 9.90, 2.22, 9.99 and 0.349).

Keywords

Coleus, Cycocel, ppm, Patharchur, Hormones

Article Info

Accepted:

26 September 2020

Available Online:

10 October 2020

Introduction

Coleus forskohlii (Willd) Briq. [syn. *C. barbatus* (Andr.) Benth] is a plant in Indian origin (Valdes *et al.*, 1987) belonging to mint family and grows in the subtropical temperate climates of India, Nepal, Thailand and Sri Lanka. Coleus is an aromatic perennial, with an erect stem and tuberous roots, reaching 30

to 60cm tall having teardrop leaves (Prajapati *et al.*, 2003). The tuberous root of coleus is rapidly spreading and typically golden brown (Thorne Research, 2006). Coleus has been used since ancient times in Hindu and Ayurvedic medicine. *Coleus forskohlii* (Willd) Briq. [syn. *C. barbatus* (Andr.) Benth] (Patharchur) is an exclusive source of a labdane diterpene forskolin along with

diversified chemical contents. The crop has a great potential in future due to respected increase in demand for forskolin widely used in glaucoma, cardiac problem and also used in treatment of certain type of cancer (Shah *et al.*, 1980). Plant growth regulators are group of naturally occurring, organic substances which effect growth processes at minute concentration, synthesized at one plant part and are capable of translocation to site of its action and regulating one or more physiological activity like Photosynthesis rate, Stomatal conductance, CO₂ utilization (ppm) and H₂O utilization.

Materials and Methods

This study was conducted at A field experiment was carried out farmer field adjoining RAK College of Agriculture, Sehore (Madhya Pradesh) during the year 2015 and 2016. The experiment will be conduct under Randomized Block Design (R.B.D.) with nine treatments in three replication. There were eight treatments MH (100 and 150 ppm), Cycocel (500 and 1000 ppm), NAA (50 and 100 ppm), GA3 (150 and 200 ppm) and the water being the control. The plant growth regulators were sprayed in three stages viz cutting stage, vegetative stages and reproductive stage. The k8 variety cutting were transplanted in main field. The whole plot was divided into 3 block each representing the replication. Each block was then divided into unit plot of 3 x 3 m size. Well rooted cuttings were transplanted at 60 x 30 cm spacing. The experiment plot fertilized with NPK 40 kg, 60 kg and 50 kg ha⁻¹ respectively. All the operations done regularly during growing season. Physiological parameters like, Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$), Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), CO₂ utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$) and H₂O utilization (Kpa) by using IRGA and observations were recorded at 150 day after

transplanting. The IRGA working on the principle of heteroatomic gas molecules absorb infra red radiation in specific infra-red wavebands. Finally mean data of the all characters were computed for statistical analysis as per standard procedure given by (Panse and Sukhtme, 1989).

Results and Discussion

Physiological observation

The Impact of plant growth hormones on the physiological parameters of *Coleus forskohlii* like, Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$), Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), CO₂ utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$) and H₂O utilization (Kpa) were judged at 150 DAT of crop. It was observed that all the physiological parameters of crop were noticed to be significantly influenced at by all treatments at 150 DAT.

Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$)

Pooled data at 150 DAT was observed to be in the range 13.14 - 10.19 as compared to control. The highest Photosynthesis rate 13.14 was recorded treatment with Cycocel (CCC) 1000 as compared to lowest Photosynthesis rate 10.19. NAA 50 ppm. Photosynthesis rate 3524.23 was found in control as compared to other treatment.

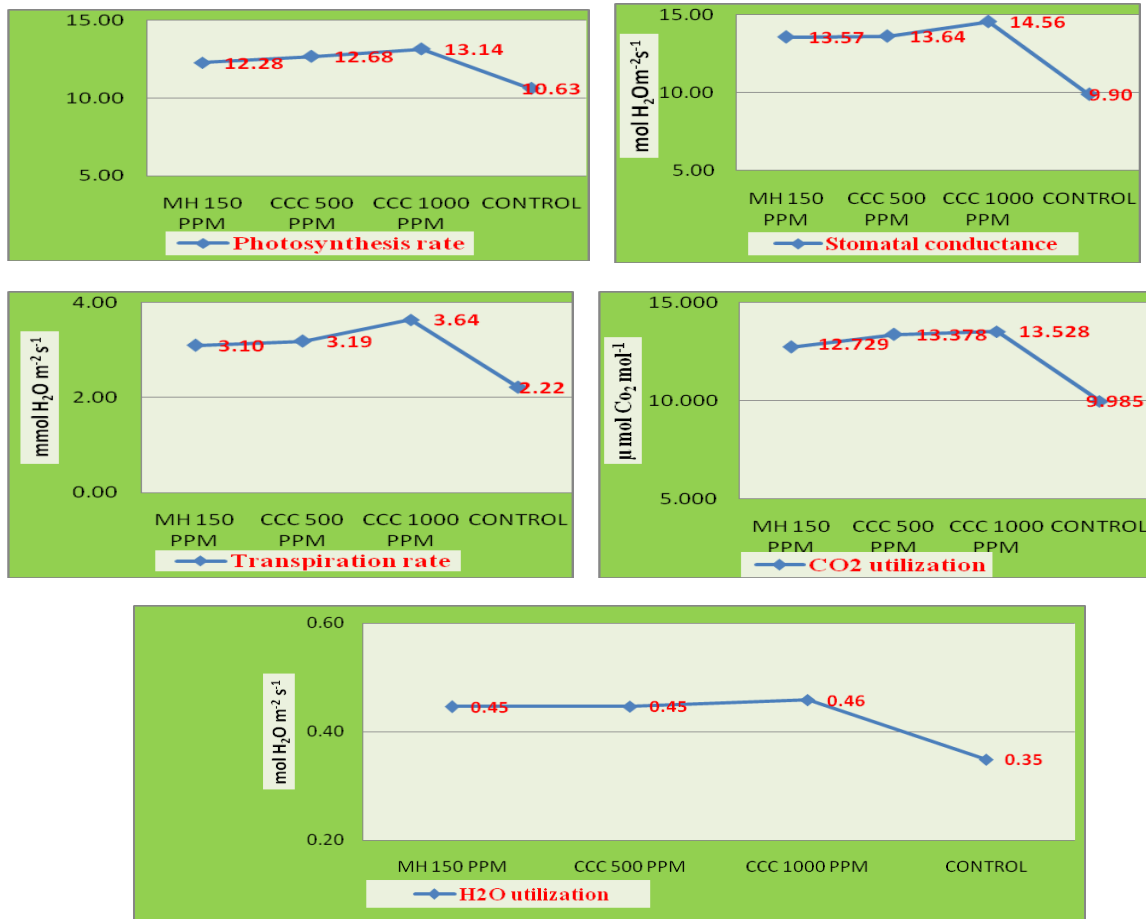
Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$)

Pooled data 150DAT was observed to be in the range 14.56 - 11.40 as compared to control. The highest Stomatal conductance 14.56 was recorded treatment with Cycocel (CCC) 1000 as compared to lowest Stomatal conductance 11.40 NAA 50 ppm. Stomatal conductance 9.90 was found in control as compared to other treatment (Table 1 and Fig. 1).

Table.1 Impact of growth hormones on physiological parameters of Patharchur *Coleus forskohlii* (Willd) Briq

Treatments	Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$)			Stomatal conductance ($\text{mmol}^{-1}\text{m}^2\text{s}^{-1}$)			Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$)			CO ₂ utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$)			H ₂ O utilization (Kpa)		
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled
MH @100 ppm	12.07	11.78	11.92	13.69	13.28	13.48	2.84	2.73	2.79	12.99	12.37	12.68	0.427	0.399	0.413
MH @150 ppm	12.53	12.03	12.28	13.78	13.36	13.57	3.13	3.06	3.10	13.10	12.36	12.73	0.456	0.437	0.446
CCC @500 ppm	12.77	12.60	12.68	13.91	13.37	13.64	3.29	3.09	3.19	3.70	13.05	13.38	0.453	0.440	0.447
CCC @1000 ppm	13.27	13.02	13.14	14.73	14.39	14.56	3.76	3.52	3.64	13.96	13.10	13.53	0.468	0.449	0.458
NAA @50 ppm	10.28	10.10	10.19	11.50	11.29	11.40	2.32	2.21	2.26	10.92	10.37	10.64	0.380	0.369	0.374
NAA @100 ppm	11.24	10.72	10.98	12.05	11.64	11.85	2.47	2.27	2.37	12.41	11.64	12.03	0.379	0.347	0.363
GA3 @150 ppm	11.53	11.35	11.44	12.41	11.83	12.12	2.51	2.23	2.37	12.82	11.91	12.36	0.398	0.386	0.392
GA ₃ @200 ppm	11.94	11.42	11.68	12.36	11.95	12.16	2.59	2.30	2.44	12.97	11.91	12.44	0.422	0.396	0.409
CONTROL	10.78	10.47	10.63	10.15	9.66	9.90	2.31	2.12	2.22	10.24	9.73	9.99	0.357	0.341	0.349
Mean	5.20	14.78	14.99	16.37	15.82	16.10	3.60	3.36	3.48	16.16	15.20	15.68	0.534	0.509	0.522
SEm ±	0.53	0.51	0.52	0.77	0.81	0.79	0.21	0.22	0.21	0.54	0.49	0.51	0.020	0.022	0.021
CD at 5%	1.59	1.54	1.56	2.31	2.43	2.37	0.63	0.66	0.64	1.62	1.46	1.54	0.061	0.064	0.063

Fig.1 Impact of growth hormones on physiological parameters of Patharchur *Coleus forskohlii* (Willd) Briq



Transpiration rate (mmol H₂O m⁻² s⁻¹)

Pooled data 150DAT was observed to be in the range 3.64-2.26 as compared to control. The highest Transpiration rate 3.64 was recorded treatment with Cycocel (CCC) 1000 as compared to lowest Transpiration rate 2.26 NAA 100 ppm. Transpiration rate 2.22 was found in control as compared to other treatment.

CO₂ utilization (μmol CO₂ mol⁻¹)

Pooled data 150DAT was observed to be in the range 13.53 - 10.64 as compared to control. The highest CO₂ utilization 13.53

was recorded treatment with Cycocel (CCC) 1000 as compared to lowest CO₂ utilization 10.64 NAA 50 ppm. CO₂ utilization 9.99 was found in control as compared to other treatment.

H₂O utilization (Kpa)

Pooled data 150DAT was observed to be in the range 0.46 - 0.37 as compared to control. The highest H₂O utilization 0.46 was recorded treatment with Cycocel (CCC) 1000 as compared to lowest H₂O utilization 0.37 NAA 100 ppm. H₂O utilization 0.35 was found in control as compared to other treatment.

The studies on physiological parameters, pooled data (2015 and 2016), 150 day after transplanting (DAT) revealed that application of Cycocel @1000 ppm resulted in increased Physiological parameters like, Photosynthesis rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), Stomatal conductance ($\text{mmol}^{-1} \text{ m}^2 \text{ s}^{-1}$), Transpiration rate ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), CO_2 utilization ($\mu\text{mol CO}_2 \text{ mol}^{-1}$) and H_2O utilization (Kpa) respectively (13.14, 14.56, 3.64, 13.53 and 0.458) followed by Cycocel @ 500 ppm (12.68, 13.64, 3.19, 13.38 and 0.447) as compare to control (10.63, 9.90, 2.22, 9.99 and 0.349).

Acknowledgments

We are thankful to the Department of Plant Physiology, College of Agriculture, Jabalpur (JNKVV), Department of Biological Science, RDVV, Jabalpur for providing lab facilities for the analysis. and with thanks for the farmer for conducted of experiment

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How to cite this article:

Choudhary, A. K., S. D. Upadhyaya and Sharma, A. 2020. Physiological Modification of Patharchur *Coleus forskohlii* (Willd) Briq as Impact of Plant Growth Hormones. *Int.J.Curr.Microbiol.App.Sci*. 9(10): 3622-3626. doi: <https://doi.org/10.20546/ijcmas.2020.910.419>