



Effect of Foliar Application of GA₃, on Biochemical Changes of Indian Mustard [*Brassica juncea* (L.) Czern. & Coss.] under Sodic Soil

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The investigation on effect of foliar application of GA₃, on biochemical changes of Indian mustard under sodic soil, was conducted during the rabi season, at the Main Experiment Station Farm of ANDUAT, Kumarganj, Ayodhya-224229 (UP) in randomized block design with 8th treatments, three replications & variety Narendra rai (NDR-8501). Different concentrations of GA₃ (15ppm, 30ppm, 45ppm, 60ppm, 75ppm, 90ppm, 125ppm) were taken along with Distilled water control. Foliar spray was done at 30 Days after sowing. Observations to be recorded at 40, 60, 80 days after sowing of biochemical parameters like chlorophyll content, nitrate reductase, peroxidase, and catalase activities in green leaves were taken. Sprayed of different concentrations of GA₃ increased all characters of the crop. All the parameters viz. To the studies of biochemical parameters were high recorded with foliar spray of GA₃ 125ppm followed by foliar spray with GA₃ 90ppm over rest of the treatments together with control, during the analysis.

Keywords: GA₃; mustard; peroxidase.

1. INTRODUCTION

Indian mustard is an most important oilseed crop that related to the family cruciferae, oilseed crop plays an most important role in the agriculture economy of India. Our country is the highest oil economy in the world after the United States, China, and Brazil in terms of vegetable oil. In India occupies the 2nd position in the area after China and the 3rd position in production in the world after China and Canada. In India, it is the 2nd important edible oilseed crop after groundnut sharing something 25 to 30% Indian oilseed economy [1,2]. The share of oilseeds is 14.1 percent out of the total cropped area, in India, mustard accounts for 3 percent of it. Mustard is the 2nd largest produced oilseed in the world with an area of 37.0 mha, with the production of 63.09 m tones and productivity of 11.90q/hac. India contributes 28.3 percent and 19.8 percent in world acreage and production. India produced around 7.4 mt of mustard next to China (11-12 mt) & EU (10-13 mt) with a significant contribution to the world rapeseed industry. Among the overall oilseed crops producing states in India, in Uttar Pradesh the area under cultivation was 6.39 lakh ha with a production of 7.9 lakh metric tonnes & productivity of 12.36 q/hac (2015-2016) [3].

2. MATERIALS AND METHODS

The experimental site is situated at the main Experiment Farm of the university on the Ayodhya to Raibareli road, at a distance of 42 km from Ayodhya city and 23 km away from Jagdishpur. In the present work, Variety Narendra rai (NDR-8501) was taken as experimental materials to find out the response of plant growth regulators (GA₃) on biochemical contributing traits of mustard. In randomized block design (RBD) with 8th treatments, 3rd

replications & variety Narendra rai (NDR-8501). Different concentrations of GA₃ (15ppm, 30ppm, 45ppm, 60ppm, 75ppm, 90ppm, 125ppm) were taken along with Distal water control. Foliar sprayed was done at 30 Days after Sowing. Biochemical parameters like chlorophyll content, nitrate reductase, peroxidase and catalase activities in green leaves were taken. The investigation of variance for the design of experiment was carried out ethically, to the procedure outlined by Fisher and Yates (1949).

3. RESULTS

3.1 Chlorophyll Content

The data presented in Table 1. Clearly indicate that all the foliar application of GA₃ significantly improved the chlorophyll contents in leaf up to 60 DAS and after 80 DAS the decline trend was recorded in chlorophyll content in leaf. The maximum increase in chlorophyll contents and in leaf was registered in GA₃@ 125ppm followed by GA₃ 90ppm -and minimum increase in GA₃ 15ppm at 40 and 60 DAS over control. Ramesh, R. E. et al. [4] & Sharma et al. [5].

3.2 Nitrate Reductase

The mean data of nitrate reductase under (μ g nitrite produced g⁻¹ fresh weight h⁻¹) various treatments have been presented in Table 2. All the treatments show a non-significant increase in nitrate reductase activity at 40 DAS of observations with respect to control. Significant increase in nitrate reductase activity at 125 DAS was recorded maximum in NR. However the minimum increase in nitrate reductase activity was recorded in foliar application of GA₃ 90ppm at 80 DAS, but is higher in respect to control 15ppm. Shairy, et al. [6].

Table 1. Effect of GA₃ on chlorophyll content of mustard at different growth stages

Treatments	Chlorophyll content (SPAD value)		
	40 DAS	60 DAS	80 DAS
T ₁ : Control	8.65	9.65	7.92
T ₂ : GA ₃ (15ppm)	9.73	10.36	9.60
T ₃ : GA ₃ (30ppm)	9.88	10.50	9.97
T ₄ : GA ₃ (45ppm)	9.77	10.14	9.69
T ₅ : GA ₃ (60ppm)	10.10	10.14	9.70
T ₆ : GA ₃ (75ppm)	10.05	11.10	10.04
T ₇ : GA ₃ (90ppm)	10.22	11.20	10.37
T ₈ : GA ₃ (125ppm)	10.14	11.82	10.39
SEm±	0.28	0.24	0.29
CD at 5%	0.86	0.72	0.88

Table 2. Effect of GA₃ on Nitrate reductase of mustard at different growth stages.

Treatments	Nitrate reductase activity (μg nitrite produced g^{-1} fresh weight h^{-1})		
	40 DAS	60 DAS	80 DAS
T ₁ : Control	17.33	30.66	63.99
T ₂ : GA ₃ (15ppm)	18.78	34.11	67.44
T ₃ : GA ₃ (30ppm)	20.12	40.12	70.12
T ₄ : GA ₃ (45ppm)	23.12	42.79	72.79
T ₅ : GA ₃ (60ppm)	19.57	46.23	76.23
T ₆ : GA ₃ (75ppm)	18.63	55.30	79.26
T ₇ : GA ₃ (90ppm)	22.14	57.44	81.44
T ₈ : GA ₃ (125ppm)	23.11	62.14	86.14
SE m \pm	2.12	3.97	3.24
CD at 5%	6.23	11.66	9.53

Table 3. Effect of GA₃ on peroxidase activity of mustard.

Treatment	Peroxidase activity		
	40 DAS	60 DAS	80 DAS
T ₁ : Control	316.08	423.42	418.25
T ₂ : GA ₃ (15ppm)	320.08	437.75	431.83
T ₃ : GA ₃ (30ppm)	326.50	503.75	497.75
T ₄ : GA ₃ (45ppm)	331.67	507.42	504.67
T ₅ : GA ₃ (60ppm)	354.92	517.67	513.42
T ₆ : GA ₃ (75 ppm)	357.08	520.00	517.75
T ₇ : GA ₃ (90 ppm)	401.58	526.17	522.67
T ₈ : GA ₃ (125 ppm)	408.04	524.75	520.92
SE m \pm	24.00	47.56	19.70
CD at 5%	71.93	52.58	59.06

Table 4. Effect of GA₃ on Catalase activity of mustard

Treatment	Catalase activity (g fresh weight/ min.)		
	40 DAS	60 DAS	80 DAS
T ₁ : Control	52.77	156.11	152.72
T ₂ : GA ₃ (15 ppm)	63.22	161.11	159.45
T ₃ : GA ₃ (30 ppm)	66.27	167.77	165.83
T ₄ : GA ₃ (45 ppm)	64.54	171.94	167.74
T ₅ : GA ₃ (60 ppm)	67.28	177.49	173.05
T ₆ : GA ₃ (75 ppm)	68.18	179.88	175.39
T ₇ : GA ₃ (90 ppm)	71.44	185.00	183.88
T ₈ : GA ₃ (125 ppm)	79.16	188.16	184.89
SE m \pm	5.16	6.71	5.79
CD at 5%	15.46	20.12	17.35

3.3 Peroxidase Activity

The mean data of Peroxidase activity under (g fresh weight/ min.) various treatments have been presented in Table 3. All the treatments show a non-significant increase in Peroxidase activity at 40 DAS of observations with respect to control. Significant increase in Peroxidase activity at 125 DAS was recorded maximum in Peroxidase activity. However the minimum increase in

Peroxidase activity was recorded in foliar application of GA₃ 90ppm at 80 DAS but is was higher in respect to control 15ppm. Dashora, L.D. et al. [7] & Martin, G. C. [8].

3.4 Catalase Activity

The mean data of catalase activity under (g fresh weight/ min.) various treatments have been presented in Table 4. All the treatments show a

non-significant increase in catalase activity at 40 DAS of observations with respect to control. Significant increase in catalase activity at 125 DAS was recorded maximum in catalase activity. However the minimum increase in catalase activity was recorded in foliar application of GA₃ 90ppm at 80 DAS. but is was higher in respect to control 15ppm. Das, R. et al. [9] Deotale, R. D. et al. [10].

4. DISCUSSION

As plant performance is believed to be attributed to genetic factors, differences in biochemical parameters are significant as plant metabolism depends on different biochemical components. It is known that thousands of reactions take place in plants which ultimately determine growth, development and final yield, productivity. GA₃ has shown its influence on all these processes in one way or another. As you know, chlorophyll is named as the "pigment of life" because of their central importance in the living systems responsible for harvesting sunlight and converting its energy into the biochemical energy required for life on Earth is due to [11-13]. In the present study, it was observed that GA₃ had a profound effect on chlorophyll content and the pot experiment conducted to investigate the effect of acetylsalicylic acid resulted in a significant good increase in chlorophyll content with GA₃ Shari and Hegazzi [14]. 10 and 20ppm, IBA (50 and 100ppm) and GA₃ (50 and 100ppm) foliar sprays at different growth stages on peas significantly increase the total chlorophyll content in the leaves [15]. Sherry and Hegazi (2009) Biochemical parameters of any crop have been enhanced to improve the quality of any product/product with better yield. Maximum profit in the form of monetary value to the producers. Biochemical parameters such as nitrate, peroxidase, catalase in green leaves have been significantly affected by foliar spray of various concentrations of GA₃. Analysis of maximum nitrate reductase, peroxidase activity, catalase activities with GA₃ perfusion of 125ppm at 40, 60, and 80 DAS. , respectively, compared to the control. This increase may be due to higher RNA induced and protein synthesis. This site appears to be membrane permeable due to increased nitrate reductase, peroxidase activity, catalase activity in plants by GA₃.

5. CONCLUSIONS

Increased chlorophyll content in almost all treatments was estimated at all stages of growth,

but maximum chlorophyll content was recorded with GA₃ spraying at 125ppm (10.22, 11.82,10.39 SPAD values) at 40, 60 and 80 DAS, respectively was followed by perfusion with GA₃ 90ppm (10.14, 11.20, 10.37) including control and all other treatments. Maximum nitrate activity in leaves was estimated with GA₃ 125ppm (23.11, 62.14, 86.14, µg nitrite produced g⁻¹ fresh weight h⁻¹) sprayed with 40, 60 and 80 DAS, respectively, followed by control GA₃ 90ppm was sprayed. Maximum peroxidase activity was recorded with GA₃ 125ppm (408.04, 524.75, 522.67, g fresh weight/min) at 40, 60 and 80 DAS, respectively, followed by 90ppm perfusion of GA₃ on control . Catalase activity in leaves was analyzed by spraying GA₃ 125ppm (79.16, 188.16, 184.89 g fresh weight/min) at 40, 60 and 80 DAS, respectively, followed by foliar spray of GA₃ 90ppm on control and mature seed oil. An increase in the quantity was recorded. Foliar spray GA₃ 90ppm (39.44%) followed by foliar GA₃ 125ppm (38.90%).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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