Original Research Article
Effect of foliar application of GA_3, on biochemical changes of Indian mustard [*Brassica Juncea* (L.) Czern. & Coss.] under sodic soil

Abstract

The investigation on effect of foliar application of GA_3, 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 GA_3 (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 GA_3 increased all characters of the crop. All the parameters viz. To the studies of biochemical parameters were high recorded with foliar spray of GA_3 125ppm followed by foliar spray with GA_3 90ppm over rest of the treatments together with control, during the analysis.

Key Words: GA_3, 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 State, 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. The share of oilseeds is 14.1 percent out of the total cropped area, in India, mustard accounts for 3percent 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) (Anonymous, 2016).

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 (GA_3) on biochemical contributing traits of mustard. In randomized block design (RBD) with 8th treatments, 3rd replications & variety Narendra rai (NDR-8501). Different concentrations of GA_3 (15ppm, 30ppm, 45ppm, 60ppm, 75ppm, 90ppm, 125ppm) were taken along with Disttel 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 GA_3 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 GA_3 125ppm followed by GA_3 90ppm -and minimum increase in GA_3 15ppm at 40 and 60 DAS over control. Ramesh, R. E. *et al.* (2014) & Sharma *et. al*. (2005)

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 GA_3 90ppm at 80 DAS, but is higher in respect to control 15ppm. Shairy, *et al.* (2009)

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

GA_3 90ppm at 80 DAS but is was higher in respect to control 15ppm. Dashora, L.D. *et al.* (1994) & Martin, G. C. (1983).

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 GA_3 90ppm at 80 DAS. but is was higher in respect to control 15ppm. Das, R. *et al.* (2001) Deotale, R. D. *et al.* (1998)

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 ultimately determine growth, development and final yield, productivity. GA_3 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. In the present study, it was observed that GA_3 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 GA_3 Shari and Hegazzi (2009). 10 and 20ppm), IBA (50 and 100ppm) and GA_3 (50 and 100ppm) foliar sprays at different growth stages on peas significantly increase the total chlorophyll content in the leaves. 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 GA_3. Analysis of maximum nitrate reductase, peroxidase activity, catalase activities with GA_3 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 GA_3.

5. Conclusions:

Increased chlorophyll content in almost all treatments was estimated at all stages of growth, but maximum chlorophyll content was recorded with GA_3 spraying at 125ppm (10.22, 11.82,10.39 SPAD values) at 40, 60 and 80 DAS, respectively was followed by perfusion with GA_3 90ppm (10.14, 11.20, 10.37) including control and all other treatments. Maximum nitrate activity in leaves was estimated with GA_3 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 GA_3 90ppm was sprayed. Maximum peroxidase activity was recorded with GA_3 125ppm (408.04, 524.75, 522.67, g fresh weight/min) at 40, 60 and 80 DAS, respectively, followed by 90ppm perfusion of GA_3 on control . Catalase activity in leaves was analyzed by spraying GA_3 125ppm (79.16, 188.16, 184.89 g fresh weight/min) at 40, 60 and 80 DAS, respectively, followed by foliar spray of GA_3 90ppm on control and mature seed oil. An increase in the quantity was recorded. Foliar spray GA_3 90ppm (39.44%) followed by foliar GA_3 125ppm (38.90%).

Reference:

Abrol, L.P. and Bhambla, D.R. (1971). Start with dhaincha on saline- sodic soil Indian Fmg. 21: 41-42.

Anonymous (2015-16). Agronomy project coordinators report mung bean and Urd bean (2015-16). All India coordinated research project on Mullar ICAR-Indian Institute of pulse research Kanpur-208024.

Anonymous (2015-16). USDA Foreigen Agriculture Service oilseed report, (New Delhi).

Bora, R. K. and Sarma, C. M. (2006). Effect of Gibberellic Acid and Cycocel on Growth, Yield and Protein Content of Pea. *Asian J. Plant Sc.*, 5 (2): 324-330.

Das, R.; Rabha; B.K. and Dey, S.C. (2001). Effect of growth regulators on sex expression on fruit yield in cucumber (*Cucumis sativus* L.) under plastic green house. *Ann. Agric. Res. New Series*, 22 (3): 312-317.

Dashora, L.D. and Jain, P.M., (1994). Effect of growth regulators and phosphorus levels on growth and yield of soybean. *Madras Agricultural Journal*, 81:235-237.

Deotale, R. D.; Mask V.G.; Sorte, N. V.; Chimurkar, B. S. and Yerne, A. Z. (1998). Effect of GA_3 and IAA on morpho-physiological parameters of soybean. *J. Soils & Crops*., 8: 91-94.

Deotale, R. D.; Mask V.G.; Sorte, N. V.; Chimurkar, B. S. and Yerne, A. Z. (1998). Effect of GA3 and IAA on morpho-physiological parameters of soybean. *J. Soils & Crops*., 8: 91-94.

Lee, H. S. (1990). Effect of pre-sowing seed treatments with GA_3 and IAA on flowering and yield components in groundnuts. Korean *J. Crop Sci.*, 35: 1-9.

Martin, G. C. (1983). Commercial uses of gibberellins. In The Biochemistry and Physiology of Gibberellins (ed. Crozier, A.), Praeger, New York, 395-444 pp.

Rahman, M. S.; Islam, M. N.; Tahar, A. and Karim, M. A. (2004). Influence GA, and MH and their time of spray on morphology, yield contributing characters and yield of Soybean. *Asian J. plant Sc.*,3: 602-609.

Ramesh, R. E. and Ramprasad (2014). Effect of Plant Growth Regulators on Morphological, Physiological and Biochemical Parameters of Soybean (*Glycine max* L. Merrill). *Springer briefs in applied sciences and technology* pp 61-71.

Shairy, A. M. E. l. and Amira, H. M. (2009). Effect of acetylsalicylic acid, Indole-3-Bytric acid and Gibberellic Acid on plant growth and yield of pea (*Pisum sativum L.*). *Australian J. Basic and App. Sc.,* 3(4): 3514-3523.

Shairy, A. M. E. l. and Amira, H. M. (2009). Effect of acetylsalicylic acid, Indole-3-Bytric acid and Gibberellic Acid on plant growth and yield of pea (*Pisum sativum L.*). *Australian J. Basic and App. Sc.*, 3(4): 3514-3523.

Sharma, K.; Kaur, J. and Thind, S. K. (2005). Biochemical parameters, pod setting percentage and yield of soyabean (*Glycine max* (L.) Merill) as influenced by foliar application of indole-acetic-acid and maleic hydrazide under low leight intensity. *Environ. Ecology,* 23 (spl.2): 225-229.

Table-1: Effect of GA_3 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 GA_3 on Nitrate reductase of mustard at different growth stages.

Table-3: Effect of GA_3 on peroxidase activity of mustard.

Table-4: Effect of GA_3 on Catalase activity of mustard

Treatments	Nitrate reductase activity (µ g 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±	**2.12**	**3.97**	**3.24**
CD at 5%	**6.23**	**11.66**	**9.53**

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±	**24.00**	**47.56**	**19.70**
CD at 5%	**71.93**	**52.58**	**59.06**

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±	**5.16**	**6.71**	**5.79**
CD at 5%	**15.46**	**20.12**	**17.35**