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EFFECT OF GROWTH REGULATORS ON CLUSTERBEAN [*CYAMOPSIS TETRAGONOLOBA* (L.)] GROWTH UNDER ARAVALI HILLS ENVIRONMENT IN RAJASTHAN

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ABSTRACT

A field experiment was conducted during the season *kharif* 2008 and 2009 to find out response of clusterbean to growth regulators. Twenty eight treatment combinations *i.e.* four varieties (RGC-936, RGC-1002, RGC-1003 and RGC-1017) as main plot treatment and seven growth substances (control, seed treatment with thiourea 500 ppm, foliar application of thiourea 500 ppm, seed + foliar application of thiourea 500 ppm, seed treatment with TGA 100 ppm, foliar application of TGA 100 ppm and seed + foliar application of TGA 100 ppm) as sub-plot treatment was laid out in split-plot design with three replications. The results of the experiment showed that variety RGC-936 gave significantly higher plant height at harvest, dry matter accumulation at 30 DAS, 45 DAS and 60 DAS and at harvest. The application of seed + foliar application of thiourea 500 ppm show significant improvement on growth parameters *viz.*, plant height at harvest, days to maturity, dry matter accumulation at 30 DAS, 45 DAS, 60 DAS and at harvest than the other treatments.

INTRODUCTION

Guar (*Cyamopsis tetragonoloba* L.) member of the family fabaeace, is a drought-tolerant legume requiring 400-500 mm annual rainfall. Being a deep rooted and drought hardy, clusterbean has occupied large areas in arid and semiarid tracts. This crop is mainly grown in Rajasthan, Gujarat, Haryana, Punjab and Uttar Pradesh. Rajasthan ranks first in respect of both area and production, occupying an area of 30.94 lakh ha and production of 18.47 lakh ton with a productivity of 597 kg/ ha during 2011-12 (ASDA, 2013).Unlike the seeds of other legumes, guar seeds contains sufficient amount of galactomannan gum, which form a viscous gel in cold water. Guar gum has 5-8 times the thickening power of starch. It is used in textile, paper manufacture, stamps, cosmetics, pharmaceuticals, food products, *e.g.* bakery products, ice cream, stabilizer for cheeses and meat binder. Also it is used recently in oil wells, mining industries, explosives, and other industrial applications (Undersander *et al.,* 2006). Application of growth regulator also increase flower, fruit setting, grain filling and test weight in different crops (Patel and Singh, 1980). Among agro- chemicals, Thiourea plays vital role in physiological process of plants and modifying the growth, yield and quality of clusterbean crop. Thiourea is easily available and cost wise cheaper compound as compare to other agro-chemicals. Thiourea is a sulphydryl compound, containing one - SH group (Jocelyn, 1972). Thiourea and thioglycolic acid are such sulphydryl bio regulator. Thiourea contains one SH group besides containing N in the form of NH_2. It contains 42.1 per cent sulphur and 36.8 per cent nitrogen. Thus, it behaves in the physiology of the plant both as sulphydryl compound and as amino compound like urea. The stimulatory action of thiourea in various physiological processes of plant is well known. Evidences are also available that loss of reactive sulphydryl group of the membrane protein is the under lying mechanism for drought injury. Foliar application of sulphydryl compounds should therefore improve drought tolerance of plants, because of the unique role of sulphydryl group in photosynthesis and dry matter partitioning. Keeping in view and the paucity of information available on these aspects, a study was conducted on Clusterbean.

MATERIALS AND METHODS

An experiment was conducted during *kharif* seasons of 2008 and 2009 at the Department of Agronomy, Rajasthan College Agriculture, Udaipur. Twenty eight treatment combinations *i.e.* four varieties (RGC-936, RGC-1002, RGC-1003 and RGC-1017) in main plot and seven growth substances (control, Seed treatment with thiourea 500ppm, Foliar application of thiourea 500 ppm, Seed + foliar application of thiourea 500 ppm, Seed treatment with TGA 100 ppm, Foliar application of TGA 100 ppm and Seed + foliar application of TGA 100

Table 1: Effect of growth regulators on dry matter accumulation at different stages of clusterbean

Treatment	Dry matter accumulation (g/plant)											
	30 DAS			45 DAS			60 DAS			At harvest		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
Varieties												
RGC 936	3.79	3.30	3.55	11.06	10.41	10.74	50.83	46.56	48.69	65.59	62.97	64.28
RGC 1002	2.96	2.62	2.79	9.11	8.40	8.76	41.04	37.07	39.05	57.51	55.79	56.65
RGC 1003	3.15	2.76	2.96	9.45	9.08	9.26	43.26	39.79	41.53	59.45	56.96	58.20
RGC 1017	3.65	3.28	3.46	10.85	10.26	10.56	49.60	45.30	47.45	63.68	61.25	62.47
CD (P=0.05)	0.26	0.13	0.12	0.56	1.20	0.55	2.87	4.92	2.37	3.83	4.00	2.31
Growth substances												
Control (Water spray)	2.34	2.10	2.22	7.08	6.87	6.97	31.76	29.93	30.84	50.90	48.49	49.70
Seed treatment thiourea 500 ppm	2.83	2.45	2.64	8.69	7.83	8.26	38.79	35.15	36.97	55.86	54.94	55.40
Foliar application of thiourea 500ppm	3.52	3.16	3.34	10.62	10.25	10.43	47.97	45.13	46.55	62.67	60.62	61.64
Seed + foliar application of thiourea (500ppm each)	4.28	3.87	4.07	12.56	12.35	12.45	58.50	53.48	55.99	69.56	65.97	67.76
Seed treatment TGA 100ppm	3.35	2.88	3.12	9.91	9.28	9.60	45.71	40.75	43.23	62.05	60.26	61.16
Foliar application of TGA 100ppm	3.23	2.75	2.99	9.46	8.63	9.04	43.93	38.46	41.19	61.26	59.37	60.32
Seed + foliar application of TGA (100ppm each)	4.17	3.72	3.94	12.53	11.56	12.05	56.63	52.36	54.50	68.58	65.05	66.81
CD (P=0.05)	0.21	0.14	0.11	0.70	0.74	0.44	2.48	3.07	1.69	3.67	3.70	2.23

ppm) as sub-plot treatment was laid out in split-plot design with three replications. The soil of the experimental site was clay loam in texture and having 250.12 kg/ha alkaline permanganate oxidizable N (Subbiah and Asija 1956), 17.04 kg/ha available P (Olsen *et al*., 1954), 340.24 kg/ha 1 *N* ammonium acetate exchangeable K (Stanford and English 1949) and 1.17% organic carbon (Jackson 1973). The pH of soil was 7.6 (1:2.5 soil and water ratio) and bulk density recorded 1.46 Mg/m^3 in 0-30 cm soil depth.

RESULTS AND DISCUSSION

Weather conditions

Experimental region has a typical semi-arid and sub-tropical climate characterized by mild winter and moderate summers, associated with high relative humidity especially during the months of July to September. A critical resume of meteorological data shows that a total rainfall of received during the crop season of the *kharif* 2008 and 2009 was 527.70 and 425.2 mm, respectively. The maximum and minimum temperature during the crop growth period ranged between 28.3ºC to 34.7ºC and 19.8ºC to 24.7ºC, respectively during *kharif* season 2008. The corresponding ranges of temperature during the *kharif* season 2009 were 28.1º C to 36.3ºC and 19.1ºC to 26.6ºC.The temperature play important role in crop germination. Growth and development of clusterbean was affected by different uncontrollable environmental conditions. Temperature play important role in thermal requirement growing degree days Nuttonson (1955). The heat unit efficiency went on increasing from vegetative growth to pod filling and physiological maturity of the crop. These results are also in close agreement with the findings of Meena. (2013).

Effect of cultivars

Plant height/plant are the genetic characters and hence, different cultivars varied with respect to these characters which ultimately brought about variation in dry matter accumulation. Variety RGC-936 recorded significantly higher plant height at harvest and dry matter accumulation at all the growth stages as compared to other varieties exceppt RGC-1017, which was at statistically at par with RGC-936. This might be due to fast growth habit of variety RGC-936 and RGC-1017 which continuously increased in height, dry matter accumulation and also take less time taken by RGC-936 to mature than RGC-1017, RGC-1003 and RGC-1002 (Table 1 and 2). Further the differential behaviour among the varieties could be explained solely by the variation in their genetic make up and their differential behaviour under different conditions. This may because of the long duration and fast later growth of these cultivars and it was also evident by significantly higher crop growth rate at later stages of growth. Similar results were also reported Meena *et al,* (2013). In days to maturity observed significant differences among varieties in both the years of experimentation as well as in pooled analysis (Table 2). The variety RGC-936 recorded the earliest maturity (83.57, 85.14 and 84.36 days) among four varieties tried during 2008, 2009 and on pooled basis. The per cent decrease days to maturity in RGC-936 was 10.51, 12.34 and 12.73% during 2008, 12.40, 13.91 and 15.30% during 2009 and 11.47, 13.14 and 14.04% on pooled basis over RGC-1017, RGC-1003 and

Table 2: Effect of growth regulators on plant height and days to maturity of clusterbean

Treatment	Plant height (cm) at harvest			Days to maturity at harvest		
	2008	2009	Pooled	2008	2009	Pooled
Varieties						
RGC 936	94.16	93.21	93.69	83.57	85.14	84.36
RGC 1002	87.09	84.41	85.75	95.76	100.52	98.14
RGC 1003	88.06	84.90	86.48	95.33	98.90	97.12
RGC 1017	91.87	89.69	90.78	93.38	97.19	95.29
CD ($P=0.05$)	4.86	4.52	2.76	1.16	1.10	0.67
Growth substances						
Control (Water spray)	81.63	77.95	79.79	97.00	101.50	99.25
Seed treatment thiourea 500 ppm	86.04	81.40	83.72	93.58	97.83	95.71
Foliar application of thiourea 500ppm	92.71	90.87	91.79	91.25	94.58	92.92
Seed + foliar application of thiourea (500ppm each)	97.02	96.63	96.83	89.17	91.92	90.54
Seed treatment TGA 100ppm	90.45	88.53	89.49	91.50	94.92	93.21
Foliar application of TGA 100ppm	88.31	85.32	86.82	92.08	95.08	93.58
Seed + foliar application of TGA (100ppm each)	95.91	95.66	95.78	89.50	92.25	90.88
CD ($P=0.05$)	2.91	3.74	2.03	0.99	1.09	0.63

RGC-1002, respectively. Growth and development of clusterbean was affected by different uncontrollable environmental conditions. Temperature play important role in thermal requirement growing degree days Nuttonson (1955). The heat unit efficiency went on increasing from vegetative growth to pod filling and physiological maturity of the crop. These results are also in close agreement with the findings of Gouri *et al*. (2005).

Effect of growth Regulators

Seed treatment + foliar spray of thiourea and thioglycolic acid applied at initiation of branches and flowering stages brought about significant improvement in growth parameters in both years of experimentation. Seed treatment + foliar spray of 500 ppm of thiourea recorded higher value of growth attributes of clusterbean crop but this treatment was statistically at par with 100 ppm thioglycolic acid. It may also be noted that not only accumulation of dry matter was increased due to the effects of thiourea and thioglycolic acid spray, but translocation of dry matter as well as its efficiency were also found to be higher in crop plants sprayed with thiourea and thioglycolic acid as compared to unsprayed crop. Growth regulators brought significant improvement in days to maturity. The earliest maturity was recorded in treatment seed + foliar application with thiourea 500ppm. However, it was found at par with treatment seed + foliar application with TGA 100ppm. The treatments seed + foliar application with thiourea 500ppm and seed + foliar application with TGA 100ppm were significantly superior over all other treatments. The magnitude of decrease in maturity due to seed + foliar application with thiourea 500ppm was 0.37, 2.28, 2.55, 3.16, 4.71 and 8.07% during 2008, 0.36, 2.81, 3.16, 3.32, 6.04 and 9.44% during 2009 and 0.37, 2.56, 2.86, 3.25, 5.40 and 8.78% on pooled basis over seed + foliar application with TGA 100ppm, foliar application with thiourea 500ppm, seed treatment with TGA 100ppm, foliar application with TGA 100ppm, seed treatment with thiourea 500ppm and control, respectively. These effects on days to maturity found consistent in the entire all the varieties due to growth substances. The growth attributes increased under foliar as well as thiourea and thioglycolic acid may be attributed to the better availability of nutrients. In light of these observation it is fairly conceivable that thiourea might have stimulating the photosynthetic carbon fixation mechanism and hence might have increased canopy photosynthesis (Sahu *et al.,* 1993). Significant increase in dry matter accumulation obtained with thiourea treatment provide ample support to such effects. Since thiourea exhibits cytokinin like activity and cytokinins are well known for delaying leaf senescence (Woolhouse, 1974). Because of this reason it improved plant height, number of branches/plant, delayed leaves ageing, prolonged photosynthetic activity, all account for better total dry matter accumulation/ plant at each successive growth stages (Chavan *et al.,* 2014).

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