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ASSESSMENT OF SOWING ENVIRONMENTS AND BIO-REGULATORS AS ADAPTATION CHOICE FOR CLUSTERBEAN PRODUCTIVITY IN RESPONSE TO CURRENT CLIMATIC SCENARIO

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Abstract

In present climatic scenario several factors are expected to affect clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) yield parameters, yield and gum content. This is also likely to change crop production practices, especially those related to crop sowing environment and stress management. An experiment was conducted during *kharif* season of 2014-15 with objectives of this study were to: (*a*) investigate the impact of changing sowing environments, as an adaptation strategy to current climatic scenarios and (*b*) simulate the effect of bio-regulators on crop productivity. This paper investigates normal (15 July) and late (30 July) sowing environments and foliar spray of thiourea (500, 1000 ppm) and salicylic acid (50, 100 ppm) at 45 and 60 days after sowing. Amongst foliar spray, significantly higher yield parameters, yield and gum content were recorded in foliar spray of thiourea 500 ppm as compared to all other bio-regulators spray level. Similarly, salicylic acid 100 ppm found statistically at par with thiourea 500 ppm foliar spray at 45 and 60 DAS.

Presently, due to climate change plant stresses are often interrelated, either individually or in combination, they cause morphological, physiological, biochemical, and molecular changes that adversely affect plant growth and productivity, and ultimately yield (Christensen and Christensen 2007). The most often recommended practices include some familiar strategies and some not so familiar. Environmental factors greatly affected plant growth and yield. Sowing environment in an important determinate of crop yield, it depends on the onset of significant rainfall, temperature and humidity of a region. Crop yield decrease in delay sowing has been reported by several workers (Meena and Yadav 2014, Meena *et al.* 2015). Determining suitable planting date plays an important role in conformation of plant growth stage with desirable environmental condition which results in maximum crop yield. The lower productivity in most of the cases is attributed to various abiotic stresses. Curtailing crop losses due to various environmental stresses are major area of concern to cope with the increasing crop productivity (Shanker and Venkateswarlu 2011). The major biotic and abiotic stresses like drought, high salinity and heat negatively influence the survival, biomass production and yield of food crops up to 70% (Vorasoot *et al.* 2003, Mantri *et al.* 2012) hence, threaten the crop productivity. Drought is a world-spread problem seriously reducing the yield and quality of crop plants (Hongbo *et al.* 2005). Plant growth regulators like thiourea and salicylic acid amend the plant responses towards biotic and abiotic stresses (Farooq *et al.* 2009). Thiourea application has been identified as a novel bio-regulator technology, for imparting stress tolerance in crop plants (Meena *et al.* 2014, Dadhich *et al.* 2015). Salicylic acid plays diverse physiological roles in plants which include plant growth, thermogenesis, flower induction, nutrient uptake, ethylene biosynthesis, stomatal movements, photosynthesis and enzyme activities (Hayat and Ahmed 2007). This paper examines the role of foliar application of bio-regulators to mitigate the environmental stress in crop production. Farmers may be use the bio-regulators t o mitigate the different stress like drought stress, saline stress and temperature stress *etc.* that come due to adverse environment.

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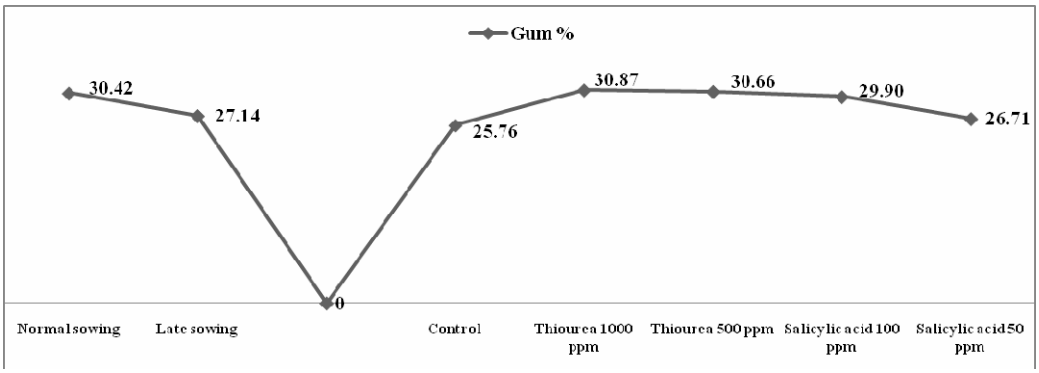

Fig. 1. Effect of sowing environments and bio-regulators on gum content of clusterbean.

Table 1. Effect of sowing environments and bio-regulators on yield attributes and grain yield of clusterbean.

Treatment	Number of cluster/plant	Number of pod/plant	Length of pod (cm)	Number of seed/pod	Test weight (g)	Seed yield (q/ha)
Sowing date						
Normal sowing	9.98	37.54	7.71	7.88	30.08	9.12
Late sowing	9.24	34.68	6.90	7.06	26.92	8.17
SEm±	0.09	0.33	0.10	0.09	0.46	0.11
CD (p = 0.05)	0.57	2.01	0.60	0.57	2.80	0.67
Foliar spray of bio-regulators						
Water spray	8.86	33.32	6.53	6.67	25.54	7.72
Thiourea 1000 ppm	10.09	37.95	7.82	7.99	30.61	9.26
Thiourea 500 "	10.04	37.75	7.77	7.94	30.21	9.19
Salicylic acid 100 "	9.86	37.07	7.58	7.74	29.64	8.96
Salicylic acid 50 "	9.20	34.44	6.82	6.99	26.52	8.09
SEm±	0.09	0.35	0.09	0.10	0.35	0.12
CD (p = 0.05)	0.28	1.06	0.28	0.30	1.05	0.35

Table 2. Interaction effect of sowing environments and bio-regulators on seed yield of clusterbean.

Treatment	Normal sowing	Late sowing	Mean
Water spray	7.75	7.69	7.72
Thiourea 1000 ppm	9.91	8.60	9.26
Thiourea 500 "	9.93	8.45	9.19
Salicylic acid 100 "	9.40	8.53	8.96
Salicylic acid 50 "	8.60	7.59	8.09
Mean	9.12	8.17	
CD (p = 0.05)	0.49	SEm±	0.16

A field experiment was conducted during *kharif* season of 2014 - 2015 at Agronomy farm of Rajiv Gandhi South Campus Banaras Hindu University, Barkachha, Mirzapur, Uttar Pradesh. Crop sowing as agro-horti based system between row of guvava tree spacing of 7 × 7 meter, guava trees were 9 year old planted in august 2007. The soil of the experimental site was sandy loam and having 186 kg/ha alkaline permanganate oxidizable N 20.97 kg/ha available P (Vanado-molybdo-phosphoric acid yellow colour method). Available K 243.38 kg/ha analyze with flame photometer method and 0.35% organic carbon as per chromic acid rapid titration method. The pH of soil was 5.8 analyzed with glass electrode pH meter. Experiments were carried out on clusterbean in the alleys of guava trees. The experiment was laid out in split-plot design with three replications, assigning 10 treatments combinations, consisting of two date of sowing as normal sowing 15 July and late sowing 30 July in main-plots and water spray as control, foliar spray of thiourea (500, 1000 ppm) and salicylic acid (50, 100 ppm) in sub-plots at 45 and 60 DAS. Clusterbean cultivar RGC-936 was sown at a spacing of 30 cm × 15 cm in normal sowing and late sowing. Data on various growth and yield attributes grain and straw yield of clusterbean was calculated as per the standard procedures.

Results showed that on tested crop in the study, higher yield parameters and gum content were observed in normal sowing than late sowing (Table 1, Fig. 1), primarily due to the differences in the environmental constitutions and growth habit of the crop as evidenced from the variation in crop yield parameters with sowing environments. The variable behavior of crop could be explained in sowing. Normal crop sown was exposed to longer duration for maturity and perform better than late sowing, similar results was observed by (Meena *et al.* 2015, Subrahmaniyan *et al.* 2008). Thus, the variation in yield parameters with sowing environments, resulted yield and gum content also affected with sowing due to the variation in moisture availability *vis-a-vis* environmental factor like temperature, day length, relative humidity, rainfall, wind velocity and biotic and abiotic factors, which have a considerable bearing on important plant functions such as photosynthesis, respiration, transpiration, nutrient and water absorption *etc.* These results were also in close agreement with the findings (Leong and Ong 1983). Amongst foliar spray treatments, significantly higher yield parameters were recorded in thiourea 500 ppm as compared to all other bio-regulators spray level. Similarly, foliar spray of salicylic acid 100 ppm found statistically at par with thiourea 500 ppm at 45 and 60 DAS. Foliar spray of thiourea and salicylic acid applied at initiation of branches and flowering stages brought about significant improvement in crop yield parameters (Table 1). It may also be noted that gum content increased due to the effects of thiourea and salicylic acid spray (Fig.1). This may be due to metabolic reaction in the plant systems both water as well as environmental stress conditions. The increase in the yield recorded in this investigation could be a reflection of the effect of bio-regulators on growth and development; it might be due to marked increase in the number of branches per plant, which gave a chance to the plant to carry more flowers, pods and hence more seeds. Similar results were reported by Meena *et al.* (2015), Attaaly *et al.* (2000).

The interaction effect was recorded significant on sowing dates and bio-regulators on seed yield. The maximum seed yield was observed (9.93 q/ha) with normal sowing and foliar spray of thiourea 500 ppm than all other treatments (Table 2). However, foliar spray of salicylic acid 100 ppm found statistically at par with thiourea 500 ppm. Thus, results of photosynthesis, which mainly depends upon the utilization of solar energy through crop canopy along with other essentials. The increase in crop yield parameters with thiourea and salicylic acid might be attributed due to considerable increase in number of branches and effective utilization of nutrient, moisture light and mitigate stresses. Similar results by various workers were reported at different places Dadhich *et al.* (2015), Meena *et al*. (2014).

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