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Evaluation Of Sweet Sorghum Genotypes For Plant Height, Chlorophyll And Nitrogen Content Under Late Sown Conditions

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ABSTRACT: An experiment was carried out to analyze the effect of sowing dates and genotypic response of sweet sorghum (Sorghum bicolar L.) in relation to plant height, total chlorophyll and nitrogen content in the flag leave at regular intervals i.e. 30, 60, 90 and 120 DAS at the research farm of Lovely Professional University, Punjab. As per the sowing dates is concern, plant height (cm) and amount of chlorophyll (mg g^{-1} of fresh leaf) and nitrogen content (%) was gradually decreased up to the last sowing dates (D_1 to D_3). While among the DAS is concern, the amount of chlorophyll content was gradually increased up to 75 DAS and decline thereafter in all the tested genotypes in each dates of sowing. However, the amount of nitrogen (%) was marginally leads by 120 DAS plant as compare to 90 DAS plant. The maximum amount of chlorophyll content was recorded in V_1 (SSV 74) followed by V_3 (CSV 24 SS) and V_2 (SSV 84). While the variety V_3 recorded maximum height as well as highest amount of nitrogen content followed by V_1 and V_2.

Key words: Chlorophyll, Days after sowing, Dates of sowing, Nitrogen, Sweet Sorghum,

1. INTRODUCTION:

Sorghum is a one of the most important and multipurpose cereal crop ranked 5th after wheat, rice, maize and barley. Being a multipurpose crop, it represents various types like grain, forage and sweet sorghum (Berenji *et al.*, 2011). Sweet sorghum grains and leaves is a good source of vitamins and minerals, mainly vitamin B which include- thiamin, riboflavin, pyridoxine and phosphorus, potassium, zinc and iron (**Rao *et al.*, 2012;** ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Naik, M., & Kumar, P. (2020); Kumar, P., & Naik, M. (2020); Kumar, P., & Dwivedi, P. (2020); Devi, P., & Kumar, P. (2020); Kumari, P., & Kumar, P. (2020); Kaur, S., & Kumar, P. (2020); Devi, P., & Kumar, P. (2020); Sharma, K., & Kumar, P. (2020); Kumar, S. B. P. (2020); Devi, P., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020). It requires fewer amounts of fertilizers, water and labour as compare to other crops like sugarcane, rice and maize. The optimum requirement of temperature, annual rainfall and relative humidity for the healthy growth and development of sweet sorghum crop is ranged between 32 ^{0}C to 34 ^{0}C, 550 to 800 mm and 15-50% while the day length ranged between 10 to 14 hours. It has a powerful ability to overcome the effect of adverse climatic condition during its vegetative stage and can resume their reproductive stage thereafter (**Nguyen, 2013**). The harvesting of sweet sorghum crop can be done as per the focused objectives because it accumulates sugar in the stem and bears grain in ear head (Siddique *et al.*, 2011). Most of the soluble sugars especially sucrose are present in the central part of the stalk while the lower and upper part of the stem are rich in glucose and starch (Bihmidine *et al.*, 2015). Being a C_4 plant, sweet sorghum has high photosynthetic efficiency as well as high carbohydrate production efficiency as compare to C_3 plant. Hence it is very advantageous in respect of many ways because its leaves and stem can be utilized as fodder of animal, its juice and their sugar as a source of bioethanol production and their bagasse can be utilized as a source of raw material for paper making industry (Guigou *et al.,* 2011 and Rohowsky *et al.,* 2012). The ethanol which produces from the sweet sorghum has burning quality with high rating of octane and less emission of sulphur (Mathur *et al.*, 2017; Kumar, P. (2019); Kumar, D., Rameshwar, S. D., & Kumar, P. (2019); Dey, S. R., & Kumar, P. (2019); Kumar et al. (2019); Dey, S. R., & Kumar, P. (2019); Kumar, P., & Pathak, S. (2018); Kumar, P., & Dwivedi, P. (2018); Kumar, P., & Pathak, S. (2018); Kumar et al.,2018; Kumar, P., & Hemantaranjan, A. (2017); Dwivedi, P., & Prasann, K. (2016). Kumar, P. (2014); Kumar, P. (2013); Kumar et al. (2013); Prasann, K. (2012); Kumar et al. (2011); Kumar et al. (2014).

2. MATERIALS AND METHODS

A field experiment was conducted at the research farm of Lovely Professional University, Punjab to know the effect of dates of sowing and genotypes of sweet sorghum in relation to plant height, chlorophyll and nitrogen content. The experiment was comprises in Randomized Block Design using three genotypes and three dates of sowing. The popular sweet sorghum varieties namely SSV 74, SSV 84 and CSV 24 SS were received from AICSP, Andhra Pradesh, while the intervals among the each sowing date were kept for ten days i.e. D_1, D_2 and D_3. To grow the crop, all the recommended agronomic practices were followed along with healthy and surface sterilized seeds grow the crop under all sowing dates. The observation regarding the plant height was recorded by using meter scale. The flag leaves of the sweet sorghum plants were used for the analysis of biochemical parameters from each and every research plot.

Determination of chlorophyll and Nitrogen content

The chlorophyll content from the flag leaves of sweet sorghum were estimated by using the method given by (Arnon, 1949). While the nitrogen content of sweet sorghum leaf was estimated by using the KEL PLUS instrument.

$$\text{Total chlorophyll (mg g}^{-1}) = 20.2\,(A645) + 8.02\,(A663) \times \frac{V}{1000 \times W}$$

$$\text{Nitrogen \%} = \frac{14.01 \times 0.1N \times (TV-BV) \times 100}{W \times 10000}$$

Whereas, 14.01 = molecular weight of Ammonia, 0.1 N= Normality of titration solution, TV= Titration value, BV= Blank value, W= Sample weight. The statistical analysis of data generated in present piece of research work was carried out with the help SPSS V. 23 software.

3. RESULTS AND DISCUSSION:

Data depicted from (Fig-1 and 2) shows the effect of sowing dates and genotypes on plant height (cm) and chlorophyll content (mg g^{-1}) of sweet sorghum plant (*Sorghum bicolor* L.).

Both the observations regarding the plant height and chlorophyll content (mg g^{-1}) was observed every 30 days intervals up to 120 DAS. The maximum plant height and chlorophyll content was recorded at first date of sowing (D_1) at every DAS (i.e. 60.22, 132.61, 169.91 and 235.11 cm and 0.63, 1.66, 2.49 and 2.31 mg g^{-1}) and it started to decline gradually up to third date of sowing (D_3) (i.e. 0.44, 1.44, 2.01 and 1.88 mg g^{-1}). Among the tested genotype i.e. SSV74, CSV 24 SS and SSV84, the maximum Chlorophyll content (mg g^{-1}) was observed in V_1 (i.e. SSV74) followed by V_3 and V_2. As per the DAS is concern, the maximum Chlorophyll content (mg g^{-1}) was recorded at 90 DAS and then declined at 120 DAS. The statistical analysis regarding the dates of sowing shows that all the dates of are highly significant among them. While the varietal response shows that V_1 and V_3 at 30 DAS, V_2 and V_1 at 60, 90 and 120 are significant in between while other combination of varieties are showing non-significant difference at every DAS (Fig-2). Data of pertaining in (Fig-3) shows the effect of different dates of sowing and varieties on Nitrogen content (%) of sweet sorghum (*Sorghum bicolor* L.) leaf. The observation regarding the Nitrogen content (%) was recorded at certain intervals viz. 90 and 120 DAS (Days after sowing). The maximum Nitrogen content (%) of sweet sorghum leaf was recorded at first date of sowing (i.e. 1.81 and 2.12 %) while it gradually decreased up to last date of sowing i.e. D_3 (1.48 and 1.69 %) at both the time of observations (90 and 120 DAS). However, among the tested genotypes, the Nitrogen content (%) of sweet sorghum leaf was recorded maximum in V_3 (1.75 and 2.21 %) and followed by V_1 and V_2 (1.66 and 1.77, 1.54 and 1.75 %) at both the time of observation (Fig-3). Statistical analysis of data regarding the dates of sowing reveals that all the dates of sowing from D_1 to D_3 are significantly differing with each other at both the DAS (i.e. 90 and 120 DAS). While the varietal response shows that all the tested genotypes i.e. SSV74, SSV84 and CSV 24 SS are significant at 90 DAS while at 120 DAS, V_3 is significant with V_2 and V_1 but showing non-significant between V_2 and V1. The quantification of chlorophyll content in the leaf of plant reflects the photosynthetic efficiency of particular plant while at certain stage it also reflects the maturity stage of plant. It was reported by the worker that under adverse environmental condition, chlorophyll content of sweet sorghum plant decreased including other parameters viz. plant height, leaf number (Oyier *et al.*, 2017 and Kapanigowda *et al.*, 2013). Maulana and Tesso (2013) was also reported that late planting may inhibit chlorophyll biosynthesis and rate of photosynthesis therefore; the negative impact appears on growth and development that lead to reduce the ultimate production efficiency of sweet sorghum plant. The low content of nitrogen in the leaf of sweet sorghum plant may reduce the performance of photosystem second hence the efficiency of CO_2 assimilation in dark reaction would be affected. So up to somehow, the reduction of chlorophyll content may link with the reduction of nitrogen content in the leaf because of late planting of crop. Therefore, the biomass production including other dependent parameters may decrease (Walker *et al.*, 2018).

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Fig-1: Effect of dates of sowing and varieties on the growth of Plant height (cm)

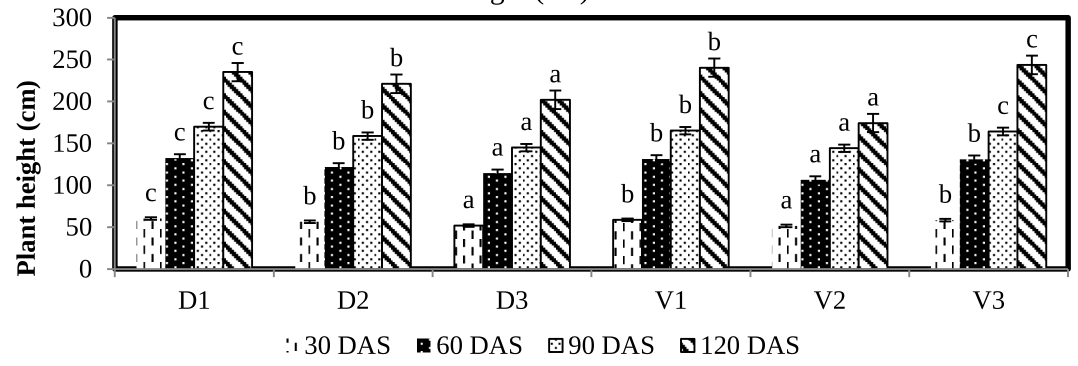


Fig-2: Effect of dates of sowing and varieties on the Chlorophyll content (mg g-1)

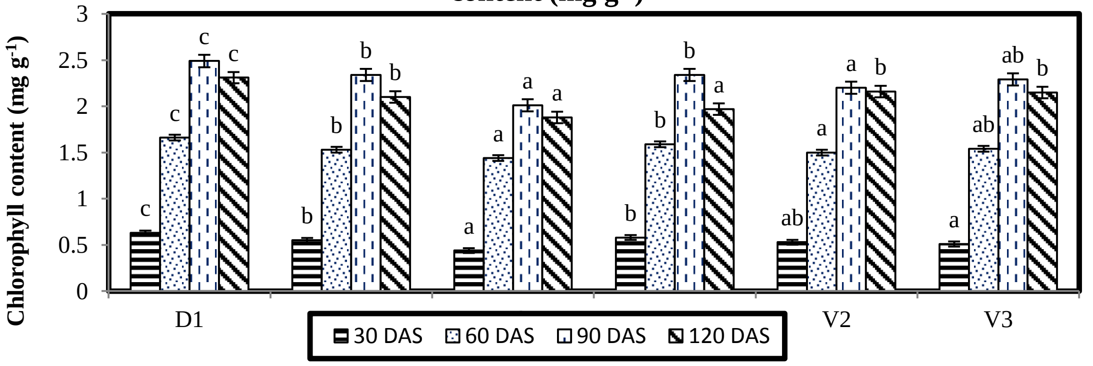
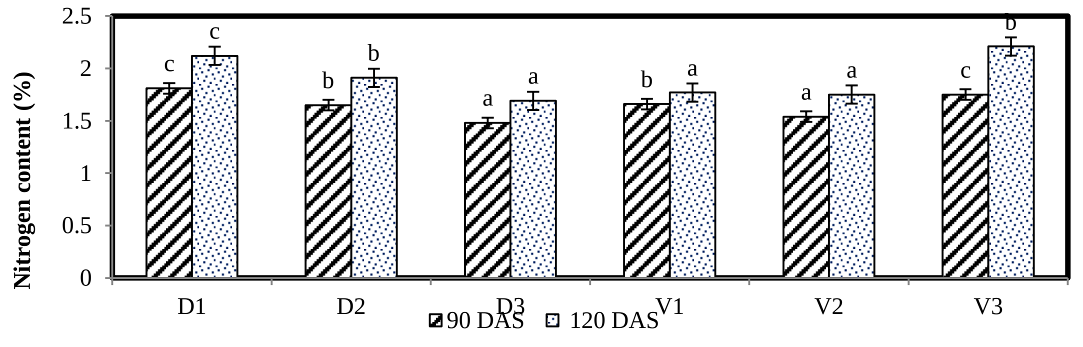


Fig-3: Effect of dates of sowing and varieties on Nitrogen content (%)



Note: D_1= First date of sowing, D_2= Second date of sowing, D_3= Third date of sowing, V1= Variety 1, V_2= Variety 2, V_3= Variety 3

Data is significant at $p<0.05$