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Influence of briquettes and nano urea formulations on growth, yield and physiological growth indices of sweet corn (*Zea mays saccharata* L.)

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Abstract
The field experiment was carried out to study the influence of briquettes and nano urea formulations on growth, yield and physiological growth indices of sweet corn (*Zea mays saccharata* L.) during *rabi*, 2023-24 at Instructional Farm, Department of Agronomy, College of Agriculture, Dapoli, Ratnagiri, Maharashtra. The experiment was laid out in randomized block design comprising of eleven treatments replicated thrice on sweet corn var. Sweet-70. The experimental results indicated a significant impact of chitosan fortified briquettes and nano urea formulations on growth and yield of sweet corn. The result of experiment indicated that significantly higher plant height, dry matter production plant^{-1}, leaf area plant^{-1} was observed periodically i.e. 30, 60 DAS and at harvest with application of 75% RDF through chitosan fortified briquette (CFB) + Foliar application of synthesized nano urea conjugate @ 30 ppm (T_9). Significantly higher green cob yield (219.72 q ha^{-1}), green stover yield (255.64 q ha^{-1}) and total biomass yield (475.36 q ha^{-1}) was observed with 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm (T_9). Plant growth indices like Absolute growth rate (AGR), Crop growth rate (CGR), Relative growth rate (RGR), Net assimilation rate (NAR), Leaf area ratio (LAR) and Leaf area index (LAI) were estimated periodically. AGR (cm day^{-1}) for plant height of sweet corn was numerically higher at 60 DAS to at harvest stage in treatment 75% RDF (CFB) + Foliar application of synthesized Nano urea conjugate @ 90 ppm (T_{11}). AGR (g day^{-1}) for dry matter production was numerically higher at 30 to 60 DAS in treatment 75% RDF (CFB) + Foliar application of synthesized nano urea conjugate @ 30 ppm (T_9). CGR (g m^{-2} day^{-1}) for dry matter production was numerically higher at 30 to 60 DAS in treatment 75% RDF (CFB) + Foliar application of synthesized nano urea conjugate @ 30 ppm (T_9). RGR (g g^{-1} day^{-1}) for dry matter production was numerically higher at 30 to 60 DAS in treatment 100% (T_2). NAR (g m^{-2} day^{-1}) for dry matter production was numerically higher at 30 to 60 DAS in treatment control (T_1). LAR (cm^2 g^{-1}) was numerically higher at 30 to 60 DAS in treatment 75% RDF (CFB) + Foliar application of synthesized Nano urea @ 60 ppm (T_7). LAI was numerically higher at 60 DAS to harvest stage in treatment 75% RDF (CFB) + Foliar application of synthesized nano urea conjugate @ 30 ppm (T_9).

Keywords: Sweet corn, chitosan fortified briquette, nano urea, growth, yield, plant growth indices

Introduction
Sweet corn is a popular vegetable that comes in second place for farm values and fourth place for commercial values. Sweet corn can boost farm profits because of its increasing demand. Sweet corn is more productive than wheat and has a greater nutritional value than rice; as a result, it is no longer referred to as a "coarse grain" but rather as a “nutritious grain” (Batra, 2002) [4]. Sweet corn is highly nutritious food as it contains 5-6% sugar, 10- 11% starch, 3% water soluble polysaccharides, 70% water and also contains moderate levels of protein and vitamin (yellow varieties) and potassium (Oktem and Oktem, 2005) [14]. According to study per 100 g of sweet corn contains 19.02 g carbohydrates, 2.70 g dietary fiber, 1.18 g fat and 3.2 g proteins. Plant growth indices are quantitative tools used to measure and analyse different aspects of plant growth over time. These indices are vital in understanding how plants respond to environmental factors, management practices, and genetic traits. By assessing these indices, researchers can gain insights into plant performance, productivity, and resource use efficiency.

Plant growth indices provide a structured approach to understanding plant performance and productivity, which is crucial for advancing agricultural science and sustainable farming practices. Briquettes technology play an important role to increase fertilizer use efficiency. Application of briquettes improving soil structure, moisture retention and nutrient content. This enhance soil fertility and promote healthy plant growth. In order to address the growing issues, certain new products are in research and development that will lead to sustainable agriculture. Chitosan-fortified briquettes are a relatively new technology that will be examined in this study. As compared to conventional fertilizers, nano-fertilizers release their nutrients gradually, providing sustained supply to plants over time. Nano-sized particles have higher surface area, allowing better absorption of nutrient by plant cell. This increased efficiency can lead to improved plant growth, higher yield and ultimately increased productivity.

Continuous use of chemical fertilizer causes soil degradation, environmental pollution also causes harm to soil microorganism. Therefore, modern ideas of nano fertilizers and briquette technology are the most advanced technology in the way of supplying mineral nutrients for plant need crops. Compared to conventional fertilizers their supplemental pattern of nutrients of nutrients for plant needs minimizes leaching and improves fertilizer use efficiency. With this background, the current experiment was carried out to study "Influence of briquettes and nano urea formulations on growth, yield and physiological growth indices of sweet corn (*Zea mays saccharata* L.)"

Materials and Methods

The field experiment was conducted at Instructional Farm, Department of Agronomy, College of Agriculture, Dapoli, Ratnagiri during *rabi*, 2023-24. Sweet corn var. Sweet-70 was tested for this study. The field experiment was laid out in randomized block design comprising of eleven treatments replicated thrice. The treatments of the experimental trial were T_1 : Control, T_2 : 100% RDF through straight fertilizer (SF), T_3 : 100% RDF through Konkan Annapurna Briquettes (KAB), T_4 : 100% RDF through Chitosan fortified briquettes (CFB), T_5 : 75% RDF through CFB, T_6 : 75% RDF (CFB) + Foliar application of synthesized Nano urea @ 30 ppm, T_7 : 75% RDF (CFB) + Foliar application of synthesized Nano urea @ 60 ppm, T_8 : 75% RDF (CFB) + Foliar application of synthesized Nano urea @ 90 ppm, T_9 : 75% RDF (CFB) + Foliar application of synthesized Nano urea conjugate @ 30 ppm, T_{10} : 75% RDF (CFB) + Foliar application of synthesized Nano urea conjugate @ 60 ppm, T_{11} : 75% RDF (CFB) + Foliar application of synthesized Nano urea conjugate @ 90 ppm. Seeds were sown on 25th October 2023 at spacing of 60 cm X 20 cm. The experimental plot was sandy clay loam in texture, medium in available nitrogen (314.38 kg ha^{-1}), low in available phosphorus (11.50 kg ha^{-1}), high in available potassium (268.00 kg ha^{-1}), high in organic carbon (0.98 g kg^{-1}) and acidic in reaction (5.49). Briquette application was done at 15 and 40 DAS and foliar application of nano urea was done at 25 and 50 DAS. Regular irrigation was given, along with necessary cultural operations i.e., weeding and crop protection methods were adopted. Different growth and yield attributes such as plant height, dry matter production, leaf area, green cob yield, green stover yield and biological yield were recorded. Plant growth indices i.e., absolute growth rate, crop growth rate, relative growth rate, net assimilation rate, leaf area ratio and leaf area index were calculated. Five plants were randomly selected and tagged for recording observations. The data recorded for various parameters were analysed further for statistical analysis.

The formula for the growth analysis on the plants observed is as follows.

a) Absolute growth rate (AGR)

For height (cm day^{-1}) $\text{AGR} = \frac{H2 - H1}{t2 - t1}$

For dry matter accumulation (g day^{-1}) $\text{AGR} = \frac{W2 - W1}{t2 - t1}$

b) **Crop growth rate (CGR) (g m^{-2} day^{-1})**

$$\text{Crop growth rate (CGR)} = \frac{1}{P}\,\frac{W2 - W1}{t2 - t1}$$

c) **Relative growth rate (RGR)** (g g^{-1} day^{-1})

$$\text{Relative growth rate} = \frac{\text{Loge } W2 - \text{Loge } W1}{t2 - t1}$$

d) **Net assimilation rate (NAR) (g m^{-2} day^{-1})**

$$\text{Net assimilation rate} = \frac{W2 - W1}{t2 - t1} \times \frac{\text{Loge } A2 - \text{Loge } A1}{A2 - A1}$$

e) **Leaf area ratio (LAR) (cm^2 g^{-1})**

$$\text{Leaf area ratio} = \frac{A2 - A1}{\text{Loge } A2 - \text{Loge } A1} \times \frac{\text{Loge } W2 - \text{Loge } W1}{W2 - W1}$$

f) **Leaf area index (LAI)**

$$\text{Leaf area index} = \frac{\text{Leaf area per plant}}{\text{Ground area per plant}}$$

Note

H_1= plant height at time t_1,
H_2= plant height at time t_2
W_1= plant dry matter weight at time t_1,
W_2= plant dry matter weight at time t_2
P= land area,
A_1= leaf area at time t_1 and
A_1= leaf area at time t_1

Results and Discussion

Effect on growth and yield parameters of sweet corn

Plant height (cm)

Data pertaining to the mean plant height of sweet corn as influenced by different treatments at various crop growth stages are presented in Table 1. Data clearly revealed that the plant height went on increasing with the increase in the age of the crop and it was higher at harvest. It was evident from the data that, the plant height progressively increased with the advancement in the age of the crop. The mean height of the sweet corn recorded at 30, 60 and at harvest was 25.18, 75.20 and 162.62 cm respectively.

At 30, 60 DAS and at harvest maximum value of plant height was recorded when crop was grown with 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm (T_9), which was significantly superior over rest of the treatments. The next best treatment was 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 60 ppm (T_{10}) which remained statistically at par with T_{11} and T_8.

Treatment 75% RDF (CFB) + foliar application of synthesized nano urea @ 30 ppm (T_6) was found statistically identical with T_4 and treatment 75% RDF through CFB (T_5) was found statistically identical with T_3. The rest of the treatments (T_7, T_2 and T_1) showed the level of significance in descending manner with respect to the plant height at all stages of crop growth. The lowest plant height was observed in the control i.e., T_1. This increase in values of growth attributes might be due slow release of nutrient through briquette and synthesized nano urea conjugate. Also the placing of fertilizer close to seed gives the better response to applied nutrients. Kaviyazhagan *et al.* (2022) [11] in sweet corn reported that foliar application of nano fertilizer is a beneficial method as it is easily penetrated through stomata, hydathodes and trichomes and then transported to all parts of the plant *via* phloem pathway. Nano fertilizers increases the duration of nutrient release to the plant, boosts the absorption of nutrients, rises to the accumulation of nitrogen in the plant, also balances the nutrient losses results in maximum plant height. The above results are also in conformity with the findings of Khedekar *et al.* (2022) [12], Srivastava and Singh (2023) [16], Owusu and Adu-Gyamfi (2024) [15] in maize.

Dry matter production plant^{-1} (g)

Data related to dry matter production plant^{-1} as influenced periodically by various treatments are presented in Table 1. The scrutiny of the data presented in Table 1 implies that, the treatments differed significantly in dry matter production plant^{-1}. There was progressive increase in dry matter production throughout the growth period of sweet corn. The mean dry matter production plant^{-1} was 4.51, 98.59 and 167.68 g at 30, 60 DAS and at harvest respectively.

At 30, 60 DAS and at harvest, treatment T_9 (75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm) recorded significantly higher dry matter production over remaining treatments. The next best treatment was 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 60 ppm (T_{10}) which remained statistically at par with T_{11} and T_8. Treatment 75% RDF (CFB) + foliar application of synthesized nano urea @ 30 ppm was found statistically identical with T_4 also treatment 75% RDF through CFB was found statistically similar with treatment T_3. The remaining treatments (T_7, T_2 and T_1) showed the level of significance in descending manner with respect to the dry matter production plant^{-1} at all stages of crop growth. Significantly lowest dry matter production plant^{-1} was observed in the control treatment i.e, T_1. Chinnappa *et al.* (2023) [5] observed that tiny size of nano fertilizers results in better absorption of nano nutrients which affects plant growth mechanism. Nano urea has potential to improve nutrient use efficiency compared to convential urea. It can improve the uptake and utilization of nutrient, including availability and utilization results in higher plant dry weight. Similar, findings were also reported by Srivastava and Singh (2023) [16] and Khedekar *et al.* (2022) [12].

Leaf area plant^{-1} (cm)

Data computed for leaf area plant^{-1} at 30, 60 DAS and at harvest was presented in Table 1. An assessment of data indicates that the leaf area went on increasing with the increase in the age of the crop and it was higher at harvest. The mean leaf area plant^{-1} of sweet corn recorded at 30, 60 and at harvest was 696.64, 2260.03 and 3823.71 cm^2 respectively. Among the different treatments, 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm (T_9) was found significantly superior over rest of treatments. The next best treatment was 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 60 ppm (T_{10}) which found statistically identical with T_{11} and T_8. Treatment 75% RDF (CFB) + foliar application of synthesized nano urea @ 30 ppm (T_6) was found at par with T_4 and treatment 75% RDF through CFB (T_5) was found at par with T_3. The rest of the treatments (T_7, T_2 and T_1) showed the level of significance in descending manner with respect to the leaf area plant^{-1} at all stages of crop growth. The minimum leaf area plant^{-1} was observed in the control treatment i.e., T_1.

Table 1: Plant height (cm), dry matter production (g) plant^{-1} and leaf area (cm^2) plant^{-1} of sweet corn as under different treatments.

Treatments		Plant height (cm)			Dry matter production (g)			Leaf area (cm^2)		
		30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
T_1	Control	16.20	50.67	135.53	2.92	66.29	94.47	415.35	1415.37	2702.59
T_2	100% RDF through straight fertilizer (SF)	18.27	57.33	145.93	3.21	75.04	116.61	493.07	1755.60	2934.72
T_3	100% RDF through Konkan Annapurna Briquette (KAB)	20.73	63.60	152.13	3.78	82.96	148.20	560.27	1943.00	3377.79
T_4	100% RDF through Chitosan fortified briquettes (CFB)	24.27	70.57	160.40	4.53	93.87	158.37	645.91	2230.87	3783.78
T_5	75% RDF through Chitosan fortified briquettes (CFB)	21.90	64.33	153.60	3.96	85.73	150.99	580.96	2058.22	3438.76
T_6	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 30 ppm	25.33	70.60	160.47	4.59	95.39	160.80	658.68	2300.03	3841.96
T_7	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 60 ppm	27.47	80.13	167.07	4.84	100.57	187.63	727.51	2436.87	4084.76
T_8	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 90 ppm	29.73	86.37	173.53	5.29	117.87	202.86	866.21	2576.51	4315.24
T_9	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 30 ppm	32.70	105.07	187.93	5.81	127.68	214.52	949.65	2824.56	4753.80
T_{10}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 60 ppm	30.53	91.47	176.67	5.40	120.99	206.02	890.30	2684.37	4426.10
T_{11}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 90 ppm	29.83	87.07	174.53	5.33	118.13	204.01	875.14	2634.98	4401.26
S.Em. (±)		0.40	2.05	2.13	0.07	1.10	1.23	9.63	41.55	41.13
C.D. at 5%		1.19	6.06	6.28	0.21	3.26	3.62	28.42	122.56	121.33
General Mean		25.18	75.20	162.62	4.51	98.59	167.68	696.64	2260.03	3823.71

This might be due to increased plant height, resulted by an increased number of internodes, consequently resulting in a more number of functional leaves which results in an expanded leaf area. These results corroborate the findings of Gowtham *et al.* (2023) [8] and Kumar *et al.* (2024) [13].

Yield (q ha^{-1})

An examination of data in Table 2 revealed that the green cob, green stover and total biological yield of sweet corn was influenced significantly due to different treatments.

Significantly higher yield was recorded by 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm (T_9) which was found significantly superior over rest of the treatments. The next treatment to this was 75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 60 ppm (T_{10}) which was statistically at par with T_{11} and T_8. Treatment 75% RDF (CFB) + foliar application of synthesized nano urea @ 30 ppm (T_6) was statistically identical with T_4 and treatment 75% RDF through CFB (T_5) was statistically at par with T_3. The remaining treatments (T_7, T_2 and T_1) showed the level of significance in descending manner with respect to the green cob, green stover and total biological yield. The lowest cob, stover and biological yield was found in the control (T_1) treatment. This might be due to slow release of nutrients from briquettes and effective absorption of nano urea conjugate which prevent the losses of nutrient from leaching, volatization and runoff followed by better rentention of nutrients. Nano fertilizers promotes the plants to absorb more nutrients and water from the soil. Also, it increases the plant metabolic process like photosynthesis leads to accumulation of higher photosynthates which then translocate to economic part of the plant. These results are in close conformity with Abdel- Aziz *et al.* (2018) [1], Kalia *et al.* (2019) [10], Elshayb *et al.* (2022) [7].

Table 2: Green cob yield, green stover yield and total biomass yield (q ha^{-1}) of sweet corn under different treatments

Treatments		Green cob yield (q ha^{-1})	Green stover yield (q ha^{-1})	Total biomass yield (q ha^{-1})
T_1	Control	86.87	103.93	190.80
T_2	100% RDF through straight fertilizer (SF)	126.86	150.22	277.08
T_3	100% RDF through Konkan Annapurna Briquette (KAB)	142.72	170.35	313.07
T_4	100% RDF through Chitosan fortified briquettes (CFB)	160.93	190.37	351.31
T_5	75% RDF through Chitosan fortified briquettes (CFB)	144.10	173.57	317.67
T_6	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 30 ppm	162.62	196.39	359.02
T_7	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 60 ppm	178.56	213.45	392.01
T_8	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 90 ppm	194.29	231.11	425.40
T_9	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 30 ppm	219.72	255.64	475.36
T_{10}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 60 ppm	201.22	238.03	439.24
T_{11}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 90 ppm	195.73	233.88	429.61
S.Em. (±)		5.32	4.51	9.48
C.D. at 5%		15.69	13.30	27.97
General Mean		164.87	196.09	360.96

Effect on plant growth indices

Absolute growth rate (AGR) for plant height (cm day^{-1})

The values regarding absolute growth rate for plant height (cm day^{-1}) at periodical interval of sweet corn under different treatments are shown in Table 3. Mean AGR for plant height recorded at 0-30 DAS, 30-60 DAS and 60 DAS- at harvest were 0.839, 1.807 and 2.781cm day^{-1} plant^{-1} respectively. It was observed that treatment T_9 [75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm] showed highest AGR for plant height at 0-30 and 30-60 DAS. At 60 DAS to harvest treatment T_{11} [75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 90 ppm] recorded highest AGR for plant height.

Absolute growth rate (AGR) for dry matter production (g day^{-1})

The values regarding absolute growth rate for dry matter production (g day^{-1}) at periodical interval of sweet corn under different treatments are shown in Table 3. AGR for dry matter production increases rapidly from 30 to 60 DAS and then declines at harvest. Mean AGR for dry matter production recorded at 0-30 DAS, 30-60 DAS and 60 DAS- at harvest were 0.150, 3.133 and 2.306 g day^{-1} plant^{-1}respectively. It was observed that treatment T_9 [75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm] showed numerically higher AGR for dry matter production at 0-30 and 30-60 DAS. At 60 DAS to harvest treatment T_7 [75% RDF (CFB) + foliar application of synthesized nano urea @ 60 ppm] recorded highest AGR for dry matter production.

Crop growth rate (CGR) for dry matter production (g m^{-2} day^{-1})

The values regarding crop growth rate for dry matter production (g m^{-2}day^{-1}) at periodical interval of sweet corn under different treatments are shown in Table 3. CGR for dry matter production increases rapidly from 30 to 60 DAS and then declines at harvest. Mean CGR for dry matter production recorded at 0-30 DAS, 30-60 DAS and 60 DAS- at harvest were 1.25, 26.11 and 19.21 g m^{-2} day^{-1} plant^{-1}respectively. It was observed that treatment T_9 [75% RDF (CFB) + foliar application of synthesized nano urea conjugate @ 30 ppm] showed numerically higher CGR for dry matter production at 0-30 and 30-60 DAS. At 60 DAS to harvest treatment T_7 [75% RDF (CFB) + foliar application of synthesized nano urea @ 60 ppm] recorded highest CGR for dry matter production.

Relative growth rate (RGR) for dry matter production (g g^{-1}day^{-1})

The values regarding crop growth rate for dry matter production (g g^{-1}day^{-1}) at periodical interval of sweet corn under different treatments are shown in Table 3. Mean RGR for dry matter production recorded at 30-60 DAS and 60 DAS- at harvest were 0.1028 and 0.0175 g g^{-1}day^{-1} plant^{-1} respectively. Among the different treatments, 100% RDF through straight fertilizer (T_2) showed numerically higher RGR for dry matter production 30-60 DAS and treatment T_7 [75% RDF (CFB) + foliar application of synthesized nano urea @ 60 ppm] recorded highest RGR for dry matter production at 60 DAS- at harvest.

Net assimilation rate (NAR) for dry matter production (g m^{-2} day^{-1})

The values regarding net assimilation rate for dry matter production (g m^{-2} day^{-1}) at periodical interval of sweet corn under different treatments are shown in Table 4. Mean NAR for dry matter production recorded at 30-60 DAS and 60 DAS- at harvest were 0.00237 and 0.000761g m^{-2} day^{-1} plant^{-1}respectively. The results showed that NAR for dry matter production decreases with increasing the nitrogen supply. Among the different treatments, control (T_1) showed numerically higher NAR for dry matter production 30-60 DAS and treatment T_7 [75% RDF (CFB) + foliar application of synthesized nano urea @ 60 ppm] recorded highest NAR for dry matter production at 60 DAS- at harvest.

Leaf area ratio (LAR) (cm^2 g^{-1})

The values regarding leaf area ratio at periodical interval of sweet corn under different treatments are shown in Table 4. Mean LAR recorded at 30-60 DAS and 60 DAS- at harvest were

43.45 and 23.08 cm^2 g^{-1} $plant^{-1}$ respectively. It was observed that treatment with T_7 [75% RDF (CFB) + foliar application of synthesized nano urea @ 60 ppm] showed numerically higher LAR at 0-30 and 30-60 DAS. At 60 DAS to harvest treatment T_1 (control) recorded highest LAR.

Leaf area index (LAI)

The values regarding leaf area index at periodical interval of sweet corn under different treatments is shown in Table 4. It was observed that LAR went on increasing with the increase in the age of the crop and it was higher at harvest. Mean LAI at 30, 60 DAS and at harvest were 0.58, 1.88 and 3.19 respectively. Among the different treatments, 75% RDF (CFB) + foliar application of synthesized Nano urea conjugate @ 30 ppm (T_9) showed numerically higher LAI at 30, 60 DAS and at harvest. Joshi *et al.* (2018) [9] stated that, nitrogen is the primary component of chlorophyll that makes leaves greener for longer periods of time. It also enhances photosynthesis, which in turn leads to better leaf growth and development. Valadabadi and Parahani (2010) [17] reported that presence of nitrogen helps in developing leaf area and lateral stem as a result of the increase in the physiological growth indices. The amount of dry matter and leaf development considered as two major component of physiological growth indices, therefore values of the growth indices increased under the application of nitrogenous fertilizer. This could also be might due to the foliar application of nano sources of nutrient considerably improved the leaf nutrient content and consequently increased the meristematic activities and cell elongation associated with protein synthesis of leaves make a pathway to produce more functional leaves and photosynthetic activity for a longer period of time and thereby contributing higher LAI [Alyasari *et al.* (2019)] [3]. The improved crop growth rate, relative growth rate and net assimilation rate was owing to the fact that nano nutrient given by foliage has mobilized more efficiently and ultimately boost the crop growth rate, relative growth rate and net assimilation rate. Furthermore, increase in dry matter production with foliar application of nano N nutrient resulted in the ready availability of nutrients at critical period of crop demand. Similar, results were also reported by Egli (2019) [6] and Alimany *et al.* (2022) [2].

Table 3: AGR for plant height (cm day^{-1}) and dry matter production (g day^{-1}), CGR (g m^{-2} day^{-1}) and RGR (g g^{-1} day^{-1}) for dry matter production at periodical interval in sweet corn

	Treatments	AGR for plant height (cm day^{-1})			AGR for dry matter (g day^{-1})			CGR for dry matter (g m^{-2} day^{-1})			RGR for dry matter (g g^{-1} day^{-1})	
		0-30 DAS	30-60 DAS	60 DAS -At harvest	0-30 DAS	30-60 DAS	60 DAS - At harvest	0-30 DAS	30-60 DAS	60 DAS - At harvest	30-60 DAS	60 DAS - At harvest
T_1	Control	0.540	1.382	2.596	0.097	2.113	0.939	0.81	17.60	7.83	0.1041	0.0118
T_2	100% RDF through straight fertilizer (SF)	0.609	1.536	2.753	0.107	2.394	1.386	0.89	19.95	11.55	0.1050	0.0147
T_3	100% RDF through Konkan Annapurna Briquette (KAB)	0.691	1.662	2.718	0.126	2.639	2.175	1.05	21.99	18.12	0.1029	0.0193
T_4	100% RDF through Chitosan fortified briquettes (CFB)	0.809	1.776	2.762	0.151	2.945	2.183	1.26	24.54	18.19	0.1007	0.0178
T_5	75% RDF through Chitosan fortified briquettes (CFB)	0.730	1.648	2.742	0.132	2.727	2.174	1.10	22.72	18.12	0.1025	0.0189
T_6	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 30 ppm	0.844	1.742	2.816	0.153	3.027	2.180	1.27	25.22	18.17	0.1012	0.0174
T_7	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 60 ppm	0.916	1.889	2.778	0.161	3.192	2.901	1.34	26.60	24.17	0.1011	0.0208
T_8	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 90 ppm	0.991	1.889	2.905	0.176	3.752	2.831	1.47	31.27	23.59	0.1034	0.0181
T_9	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 30 ppm	1.090	2.412	2.762	0.194	4.062	2.895	1.61	33.85	24.12	0.1030	0.0173
T_{10}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 60 ppm	1.018	2.031	2.840	0.180	3.853	2.835	1.50	32.11	23.62	0.1037	0.0177
T_{11}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 90 ppm	0.994	1.908	2.916	0.178	3.760	2.862	1.48	31.34	23.85	0.1033	0.0182
	General mean	**0.839**	**1.807**	**2.781**	**0.150**	**3.133**	**2.306**	**1.25**	**26.11**	**19.21**	**0.1028**	**0.0175**

Table 4: NAR (g m^{-2} day^{-1}) for dry matter production, LAR (g m^{-2} day^{-1}) and LAI as influenced periodically by different treatments in sweet corn

	Treatments	NAR for dry matter production (g m^{-2} day^{-1})		LAR (g m^{-2} day^{-1})		Leaf area index		
		30-60 DAS	60 DAS- At harvest	30-60 DAS	60 DAS- At harvest	0-30 DAS	30-60 DAS	60 DAS-At harvest
T_1	Control	0.00259	0.000472	40.20	25.02	0.35	1.18	2.25
T_2	100% RDF through straight fertilizer (SF)	0.00241	0.000604	43.61	24.34	0.41	1.46	2.45
T_3	100% RDF through Konkan Annapurna Briquette (KAB)	0.00237	0.000838	43.36	23.07	0.47	1.62	2.81
T_4	100% RDF through Chitosan fortified briquettes (CFB)	0.00230	0.000743	43.73	23.95	0.54	1.86	3.15
T_5	75% RDF through Chitosan fortified briquettes (CFB)	0.00233	0.000808	43.89	23.32	0.48	1.72	2.87
T_6	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 30 ppm	0.00231	0.000725	43.87	23.99	0.55	1.92	3.20
T_7	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 60 ppm	0.00226	0.000909	44.81	22.85	0.61	2.03	3.40
T_8	75% RDF (CFB)+Foliar application of synthesized Nano urea @ 90 ppm	0.00239	0.000840	43.25	21.54	0.72	2.15	3.60
T_9	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 30 ppm	0.00236	0.000781	43.62	22.14	0.79	2.35	3.96
T_{10}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 60 ppm	0.00237	0.000814	43.74	21.80	0.74	2.24	3.69
T_{11}	75% RDF (CFB)+Foliar application of synthesized Nano urea conjugate @ 90 ppm	0.00236	0.000831	43.86	21.90	0.73	2.20	3.67
	General mean	0.00237	0.000761	43.45	23.08	0.58	1.88	3.19

Conclusion

It can be inferred that combined application of briquettes and lower concentration of nano urea conjugate improved photosynthesis which finally resulted into better source and thereby sink. Hence, it can be summarized that for obtaining better growth and yield of sweet corn, it should be supplied with 75% RDF through chitosan fortified briquettes (at 15 and 40 DAS) along with foliar application of synthesized nano urea conjugate @ 30 ppm with two spray at 25 and 50 DAS.

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