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Effect of site-specific nitrogen management on growth and yield attributes of *kharif* maize (*Zea mays* L.) under central plain zone of U.P.

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Abstract
The experiment was conducted at Student Instructional Farm, C. S. Azad University of Agriculture and Technology, Kanpur during *kharif* and *rabi* seasons of 2018-19 and 2019-20. There were eight treatments combinations *i.e.*, T_1: LCC 3, T_2: LCC 4, T_3: LCC 5, T_4: CCM 30, T_5: CCM 35, T_6: CCM 40, T_7:100% RDN as 3 splits (2:1:1) at basal, knee height and tasseling stage and T_8: 75% RDN as 3 equal splits at basal, knee height and tasseling stage. The experiment was laid out in RBD with four replication on silt loam soil with low organic carbon (0.43%) available nitrogen (161.43 kg ha^{-1}) and available phosphorus (14.71 kg ha^{-1}) while medium in potassium (240.33 kg ha^{-1}), respectively. The growth characters like plant height (cm), number of functional leaves per plant, crop growth rate (CGR), dry matter production (g), leaf area index, days to 50% silking, days to 50% tasseling were significantly higher with the treatment T_3 (LCC 5, i.e. application of 30 kg N ha^{-1} based on LCC critical value 5) and found to be superior over rest of the treatments during the years 2019, 2020 and on pooled basis. The yield components like number of cobs plant^{-1}, length of cob (cm), number of grains cob^{-1}, grain weight cob^{-1} (g), weight of 1000 grains (g), shelling percent were maximum with the T_3 (LCC 5, i.e. application of 30 kg N ha^{-1} based on LCC critical value 5) and found to be greater over rest of the treatments during the years 2019, 2020 and on pooled basis. Thus, it may be concluded T_3 (LCC 5, i.e. application of 30 kg N ha^{-1} based on LCC critical value 5) found to be most suitable practice to get more growth and yield attributes.

Keywords: Site-specific, nitrogen, management, *kharif*, *Zea mays* L.

Introduction
Maize (*Zea mays* L.) is one of the most versatile crops grown throughout the tropical as well as temperate regions of the world. A crop of maize is sown and harvested somewhere in the world in every month of the year. Greatest genetic diversity of maize is available in South American continent, and the centre of origin are Peru, Bolivia and Equador (De Wilt *et al.*, 1972). Native Americons classified the major lineages of maize, *viz.*, dent, flint, flour, pop, and sweet corn. The name corn is derived from Indo-European word, which means 'small nugget'. It is third most important cereal crop in India after rice and wheat. Globally, maize is cultivated on 180.63 million ha in more than 150 countries, having wide variations in soil, climate, biodiversity and management practices.
The total production of maize in the world is about 1133 million metric tonnes with a productivity of 5.75 tonnes ha^{-1} during 2020-21 (USDA Special report: January 2021). In India, maize is cultivated on 9.2 million hectare area with production and productivity of 27.8 million tonnes and 2706 kg ha^{-1}, respectively (Agricultural statistical a glance, 2018-19).
It is a crop of worldwide economic importance, provides approximately 30 per cent of the food calories to more than 4.5 billion people in 94 developing countries. The demand for maize is expected to be doubled worldwide by 2050. Maize is used as a staple human food, livestock and poultry feed, fermentation and many industrial purposes. About 85 per cent of the maize produced is consumed as human food and animal feed including poultry. However, there exists a scope for using maize as basic raw material to several industrial products, such as starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries. In India, greater increase in food and feed production is expected to come from coarse cereals, primarily from maize, which has a comparative advantage in assured rainfall areas. The future of maize is now brighter, than in the past. Today, increasing the maize productivity, production and utilization are not a matter of choice but a necessity due to high population pressure.

Nitrogen being the most yield-limiting factor in maize, its stress reduces growth and yield and considered as a most crucial nutrient. Poor nitrogen utilization in maize crop is due to inclusion of excessive nitrogenous fertilizers by farmers in the absence of nutrient recommendations as well as without assessing the crop-N demand and crop stage. Furthermore, problem associated with this nutrient is the high mobility in soil, causing loss by heavy rainfall. Many research reports indicated loss of fertilizer N in cereal production from 20 to 50 per cent. Fertilizer N losses in surface runoff range between 1 and 13% of the total N applied. Application of urea to the surface without incorporation, the losses of fertilizer N as NH_3 can be as high as 60 per cent (Rochette *et al*., 2013) [10], and generally greater with increasing temperature. Therefore, N management poses a serious challenge in addition to loss of N in such area having high rainfall and temperature. Hence higher yield of maize on sustainable basis are of paramount importance in this region.

Materials and Methods

The experiment was conducted during two consecutive *Kharif* seasons of 2019 and 2020 at Student's Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur.

Geographically experimental site is situated situated in subtropical and semi-arid zone and lies between the parallel of 25°26'and 26°58'north latitude and 79°31' and 80°34' East longitude with an elevation of 125.9 m from sea level in the alluvial belt of Indo-gangetic plains of central Uttar Pradesh. the soil of experimental field was alkaline in reaction (8.41 pH), low in organic carbon (0.43%) available nitrogen (190.20 kg ha^{-1}) and available phosphorus (11.80 kg ha^{-1}) while medium in potassium (170.76 kg ha^{-1}), respectively. The experiment consists of 8 treatments T_1 (LCC 3), T_2 (LCC 4), T_3 (LCC 5), T_4 (CCM 30), T_5 (CCM 35), T_6 (CCM 40), T_7 (100% RDN as 3 splits at basal, knee height and tasseling stage) and T_8 (75% RDN as 3 equal splits at basal, knee height and tasseling stage). Which were laid out in Randomized Block Design with four replications. The crop was fertilized as per the treatment.

Application of fertilizers

A basal dose of 30 kg N ha^{-1} (common to all treatments except treatment T_7) was applied in the form of urea in all the plots. For the treatment T_7 a basal dose of 60 kg N ha^{-1} was applied. Full dose of phosphorus was commonly applied as basal dressing in the form of single super phosphate. After fertilizer application, the furrows were covered with soil in such a way that the furrows remained partly opened for seed sowing. The top dressing of nitrogen was done based on LCC or CCM readings whenever the average readings of LCC or CCM were found equal or less than the critical value as per the treatments except the treatments T_7 and T_8 in which 30 kg N ha^{-1} was applied as top dressing at knee high and tasseling stages. The total quantity and the time of N applied in different treatments during 2019 and 2020 is given in Table-8.

Leaf Color Chart (LCC) Readings

The LCC data was recorded from the middle portion of the topmost fully expanded first leaf using leaf color chart developed by Punjab Agricultural University, Ludhiana. The LCC readings were recorded at middle lamina of the third leaf from the top of maize at weekly interval from 21 days after sowing (DAS) and at weekly interval from until the tasseling stage. The third fully expanded leaf from top of maize was selected for leaf color measurement. Five youngest fully expanded and healthy leaves (third leaf from the top) were selected from 5 randomly selected maize plants in an area of uniform population for leaf color measurement.

Chlorophyll meter measurements (SPAD-502)

The SPAD meter readings were recorded with Minolta SPAD 502 (soil and plant analysis division (SPAD) for measuring leaf N by inserting the middle portion of the topmost fully expanded first leaf (index leaf) in the slit of the SPAD meter. The SPAD meter was calibrated before collecting data. SPAD readings from randomly selected five plants (each plot) was taken and the average value is recorded as SPAD value for the plot. Whenever the average of leaf color readings fell below the pre-set critical value, N fertilizer was top dressed immediately to correct N deficiency.

Result and Discussion

Growth Characters

Plant population

The plant count at initial stage could not differ significantly with the application of different treatments as depicted in table-7. The maximum plant stand at initial and recorded with treatment T_7 (100% RDN as 3 splits at basal, knee height and tasseling stage). The higher plant population in treatment T_7 (100% RDN as 3 splits 2:1:1 at basal, knee height and tasseling stage).

Plant Height (cm)

The mean data of periodical plant height was recorded at 30, 60, 90 DAS and at harvest during the years 2019-2020 and on pooled basis. The relevant data pertaining to plant height recorded at various growth stages are presented in Table- 1.

At 30 DAS, significantly the higher plant height (46.95, 48.56 and 47.75 cm during 2019, 2020 and on pooled basis, respectively) was recorded under the treatment T_7 (100% RDN as 3 splits (2:1:1) at basal, knee height and tasseling stage) and it remained at par with treatments T_6 (CCM 40, i.e. application of 30 kg N ha^{-1} based on CCM critical value 40) and T_3 (LCC 5) during both the years as well as on pooled basis (Table 1).

At 60, 90 DAS and harvest, treatment T_3 (LCC 5) recorded significantly higher plant height during 2019, 2020 and on pooled basis, respectively and superior with other treatments during the investigation (Table 1). This might have happened due to favorable effect of nitrogen on cell division and tissue organization that ultimately led to significant improvement in plant height. Similar results were also reported by Singh and Sharma (2016) [11] and Reena *et al.* (2017) [9].

Number of functional leaves plant^{-1}

At 30 DAS, the treatment T_7 (100% RDN) produced maximum number of functional leaves $plant^{-1}$ 7.62, 8.02, 7.82 but did not differ significantly with treatment T_3 (LCC 5, i.e. application of 30 kg N ha^{-1} based on LCC critical value 5) and T_6 (CCM 40) during the year 2019. While, during the year 2020 and on pooled basis treatment T_7 again recorded the significantly higher number of functional leaves $plant^{-1}$ (8.020 & 7.82 during 2020 and on pooled basis, respectively) however, it was at par with treatments T_3 (LCC 5) and T_6 (CCM 40) (Table 2)

Data shown that at 60, 90 DAS and harvest, treatment T_3 (LCC 5) recorded significantly higher number of functional leaves plant^{-1} and superior over treatment T_6 (CCM 40), T_7 (100% RDN) and T_5 (CCM 40) during the year 2019-20 and on pooled basis. These results are in close conformity with those reported by Duttarganvi *et al.* (2014) [2] and Mathukia *et al.* (2014) [7].

Dry Matter Production Plant^{-1} (g)

At 30 DAS, treatment T_7 (100% RDN) recorded significantly higher dry matter production of 12.36, 13.15 and 12.75 g plant^{-1} during 2019, 2020 and in the pooled analysis, respectively but did not differ significantly with the treatments T_3 (LCC 5) and T_6 (CCM 40) during both the years as well as in pooled analysis (Table 3).

Data further revealed that after 60, 90 DAS and harvest, treatment T_3 (LCC 5) noted significantly higher values for dry matter production which remained statistically at par with the treatments T_6 (CCM 40) and T_7 (100% RDN) during the year 2019-20 and in pooled analysis. This could be attributed to better synchronization of nitrogen supply with crop nitrogen demand which led to higher dry matter accumulation and increased crop growth rate. These results are in close conformity with findings of Lal (2013) [6] and Barad *et al.* (2018) [1].

Leaf area index

A perusal of data given in Table-5 indicated that the different treatments significantly influenced on leaf area index at 30, 60, 90 DAS as well as at harvest during the years 2019, 2020 and on pooled basis. At 30 DAS, significantly higher leaf area index (2.13, 2.18 and 2.15 during 2019, 2020 and on pooled basis, respectively) was recorded under the treatment T_7 (100% RDN) which did not differ significantly with the treatments T_3 (LCC 5) and T_6 (CCM 40) during both the years as well as in pooled analysis.

At 60, 90 DAS and harvest, significantly higher leaf area index recorded under the treatment T_3 (LCC 5) during the years 2019, 2020 and on pooled basis and found best results over rest of the treatments. This might be attributed to increased leaf area of maize crop due to increased number of functional leaves plant^{-1} of maize. Similar findings were also reported by Kumar (2011) [5].

Crop Growth Rate (gm^{-2} day^{-1})

At 30-60 DAS, among various treatments, treatment T_3 (LCC 5) recorded crop growth rate of 21.18, 21.36 and 21.27 g m^{-2} day^{-1} respectively during 2019, 2020 and in pooled analysis (Table 5) and found to be significant over all other treatments except the treatments T_6 (CCM 40) during 2019-2020 and in pooled analysis.

It is further evident from data presented in Table-4 that different treatments to maize were found to encourage the significant difference on crop growth rate at 60-90 DAS during the both years and in pooled analysis. At 60-90 DAS significantly higher crop growth rate of 27.80, 28.01 and 27.90 g m^{-2} day^{-1} respectively during the year 2019, 2020 and in pooled analysis was observed under the treatment T_3 (LCC 5). Kibe *et al.* (2006) explained the fact that crop growth rate (CGR) increased with rate of N fertilizer because of accelerating the activities of meristem and increasing the function of protoplasm. This view of results was also supported by Sarnaik (2010) [3] in maize and Hasan *et al.* (2016) in wheat.

Days to 50% tasseling

As it is evident from the data given in Table-7 that various treatments influenced days to 50% tasseling in maize during both the years as well as in pooled analysis. Treatment T_3 (LCC 5) recorded significantly the maximum tasseling 49.50, 50.10 and 49.80 during the years 2019, 2020 and on pooled basis, respectively which was remained at par with treatments T_6 (CCM 40) and T_7 (100% RDN) during the years 2019 and 2020 as well as in the pooled analysis.

Days to 50% silking

As it is evident from Table-7 that various treatments influenced days to 50% silking in maize during both the years as well as in pooled analysis. Treatment T_3 (LCC 5) showed significantly the maximum tasseling 53.30, 54.40 and 53.85 during the years 2019, 2020 and on pooled basis, respectively which was remained found at par with treatments T_6 (CCM 40) and T_7 (100% RDN) during the years 2019 and 2020 as well as in the pooled analysis. These results are in line with findings of Jayanti *et al*. (2007) and Satpute *et al*. (2015) in rice, Sarnaik (2010) [3] and Mathukia *et al*. (2014) [7] in maize.

Yield attributes

The data pertaining to number of cobs plant^{-1}, length of cob (cm), number of grains cob^{-1}, grain weight cob^{-1} (g), weight of 1000 grains (g), shelling percent which was found statistically at par with 100% recommended dose of nitrogen and CCM 40 in both years. This might be due to slow and steadily available of nitrogen as per crop need during different stages of maize which was resulted in significant increase in yield attributes of maize crop. These results corroborate with the findings of Nayak and Patra (2000) [8] and Krishnakumar and Haefele (2017) [4].

Number of Cobs Plant^{-1}

As it is evident from the data given in Table-6 that various treatments influenced the number of cobs plant^{-1} in maize during both the years as well as in pooled analysis. Treatment T_3 (LCC 5) recorded significantly the maximum number of cobs plant^{-1} 1.48, 1.61 and 1.54 during the years 2019, 2020 and on pooled basis, respectively which was remained at par with treatments T_6 (CCM 40) and T_7 (100% RDN) during the years 2019 and 2020 as well as in the pooled analysis.

Length of Cob (cm)

It is apparent from the data presented in Table-6 that length of cob (cm) significantly influenced due to various treatments during both the years (2019 and 2020) as well as in their combined results. Treatment T_3 (LCC 5) produced significantly the higher length of cob 22.45, 23.19 and 22.82 cm during experimental years 2019 and 2020 as well as in pooled results, respectively and superior over rest of the treatment.

Number of Grains Cob^{-1}

It is clear from the data given in Table-6 that numerous treatments exerted significant influence on number of grains cob^{-1} during both the years as well as in the pooled analysis. Significantly maximum number of grains cob^{-1} 438.30, 515.46 and 476.88 was recorded under the treatment of T_3 (LCC 5) during both the years and on pooled basis which is at par with the treatment T_6 (CCM 40) during the experimental years 2019 and 2020 as well as in pooled analysis.

Grain Weight Cob^{-1} (g)

As it is apparent from Table-6, various treatments significantly influenced the grain weight cob^{-1} during both the years as well as in pooled analysis. Among all the treatment tested, treatment T_3 (LCC 5) recorded significantly higher grain weight cob^{-1} 99.50, 103.27 and 101.38 g during the years 2019, 2020 and on pooled basis. Treatment T_3 (LCC 5) found to be superior with respect to grain weight cob^{-1} over rest of the treatments except the treatment T_6 (CCM 40) which remained statistically at par with treatment T_3 during both the year as well as in pooled analysis.

Weight of 1000 Grains (g)

It is clear from the data given in Table-7 that numerous treatments bring to bear significant influence on weight of 1000 grains during both the years as well as in the pooled analysis. Significantly higher weight of 1000 grains 222.50, 223.75 and 223.12 g was observed under the treatment T_3 (LCC 5) but did not differ significantly with the treatments T_6 (CCM 40) and T_7 (100% RDN) during both the years as well as in pooled analysis.

Shelling Percent

It was apparent from the data presented in Table-7 that the shelling percent differed significantly due to the influence of various treatments in both the years as well as their pooled analysis. Application of LCC 5 (T_3) recorded significantly higher shelling percent 76.52, 78.20 and 77.36% during experimental years 2019 and 2020 as well as in pooled results. However, it's fallowed by treatments T_6 (CCM 40) and T_7 (100% RDN) during both the experimental years 2019, 2020 as well as on pooled basis.

Table 1: Plant Height (cm) influenced by different treatments at 30, 60, 90 days and harvest

S.N.	Treatments combination	30 DAS			60 DAS			90 DAS			At harvest		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	35.10	36.95	36.02	117.50	118.85	118.17	165.0	166.97	166.0	170.83	171.98	171.40
T_2	LCC 4	36.66	37.99	37.32	123.20	125.55	124.37	173.5	176.15	174.83	183.52	186.85	185.18
T_3	LCC 5	43.88	45.65	44.75	135.46	137.95	136.70	178.21	180.65	179.43	190.21	192.75	191.48
T_4	CCM 30	38.30	39.87	39.08	113.36	114.95	114.15	160.3	163.85	162.10	164.36	165.98	165.17
T_5	CCM 35	40.85	41.65	41.25	126.75	129.90	128.32	174.5	175.88	175.22	184.56	186.95	185.75
T_6	CCM 40	45.51	47.55	46.53	132.50	135.24	133.87	176.50	177.97	177.23	187.90	190.05	188.97
T_7	100% RDN as 3 equal splits (2:1:1)	46.95	48.56	47.75	129.56	131.97	130.76	175.73	179.11	177.42	185.73	186.99	186.36
T_8	75% RDN as 3 equal splits (2:1:1)	42.98	43.75	43.36	120.56	122.62	121.95	169.83	171.35	170.59	175.84	177.15	176.49
S.E(m)		0.73	0.91	0.58	2.71	3.03	2.08	3.07	3.15	2.20	3.28	3.57	2.43
C.D. (P=0.05)		2.17	2.68	1.67	7.98	9.27	5.93	9.05	9.27	6.28	9.67	10.52	6.92

Table 2: No. of functional as influenced by different treatments at 30, 60, 90 days and harvest (per running m)

S.N.	Treatments combination	30 DAS			60 DAS			90 DAS			At harvest		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	7.09	7.25	7.17	12.72	13.35	13.03	13.28	13.95	13.61	4.85	5.05	4.95
T_2	LCC 4	7.28	7.49	7.38	14.12	14.98	14.55	14.32	15.35	14.83	6.10	7.45	6.77
T_3	LCC 5	7.57	7.80	7.68	14.91	15.15	15.03	15.75	18.25	17.00	7.35	9.05	8.20
T_4	CCM 30	7.12	7.20	7.16	13.58	14.90	14.24	13.34	14.45	13.89	4.13	5.19	4.66
T_5	CCM 35	7.18	7.36	7.27	14.30	14.55	14.42	14.58	15.97	15.27	5.95	6.98	6.46
T_6	CCM 40	7.36	7.55	7.45	14.48	14.75	14.61	14.90	16.10	15.50	7.10	8.35	7.72
T_7	100% RDN as 3 equal splits (2:1:1)	7.62	8.02	7.82	14.34	14.41	14.37	14.76	15.75	15.25	6.85	7.97	7.41
T_8	75% RDN as 3 equal splits (2:1:1)	7.23	7.39	7.31	13.92	14.05	13.98	13.56	14.65	14.10	5.51	6.61	6.06
S.E(m)		0.05	0.07	0.04	0.35	0.28	0.22	0.28	0.42	0.25	0.33	0.32	0.23
C.D. (P=0.05)		0.16	0.20	0.12	1.05	0.84	0.65	0.84	1.26	0.73	0.99	0.94	0.66

Table 3: Dry matter production plant-1 as influenced by different treatments at 30, 60, 90 day and harvest

S.N.	Treatments combination	30 DAS			60 DAS			90 DAS			At harvest		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	10.60	10.95	10.77	125.30	128.15	126.72	154.40	157.15	155.77	195.41	197.15	196.28
T_2	LCC 4	11.13	11.79	11.46	132.86	134.91	133.88	177.95	181.17	179.56	215.30	217.45	216.37
T_3	LCC 5	11.71	12.05	11.88	145.31	148.46	146.88	201.50	206.35	203.92	241.30	245.75	243.52
T_4	CCM 30	10.76	11.12	10.94	129.61	131.35	130.48	156.87	160.04	158.45	198.32	201.25	199.78
T_5	CCM 35	11.19	11.34	11.26	130.35	133.25	131.80	177.60	181.45	179.52	214.20	216.15	215.17
T_6	CCM 40	11.88	12.35	12.11	144.65	148.35	146.50	198.43	202.10	200.26	240.46	243.35	241.90
T_7	100% RDN as 3 equal splits (2:1:1)	12.36	13.15	12.75	142.32	144.65	143.48	193.01	195.35	194.18	233.51	235.30	234.405
T_8	75% RDN as 3 equal splits (2:1:1)	11.33	11.63	11.48	128.75	130.80	129.77	170.54	173.34	171.94	210.11	212.35	211.23
S.E(m)		0.22	0.27	0.17	1.72	2.00	1.27	2.85	3.28	2.10	5.01	5.29	3.64
C.D. (P=0.05)		0.67	0.81	0.49	5.07	5.89	3.64	8.40	9.67	5.99	14.74	15.56	10.39

Table 4: Crop growth rate (gm^{-2}day^{-1}) influenced by different treatments at 30-60 and 60- 90 DAS

S.N.	Treatments combination	30 -60 DAS			60-90 DAS		
		2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	16.06	16.25	16.15	21.50	21.68	21.59
T_2	LCC 4	17.41	17.55	17.48	26.12	26.45	26.28
T_3	LCC 5	21.18	21.36	21.27	27.80	28.01	27.90
T_4	CCM 30	16.38	16.47	16.42	21.72	21.95	21.83
T_5	CCM 35	16.58	16.68	16.63	26.21	26.39	26.30
T_6	CCM 40	20.84	20.97	20.90	27.46	27.77	27.61
T_7	100% RDN as 3 equal splits	17.80	17.95	17.87	27.13	27.31	27.22
T_8	75% RDN as 3 equal splits	16.45	16.67	16.56	24.69	24.83	24.76
S.E(m)		0.29	0.32	0.21	0.42	0.49	0.31
C.D. (P=0.05)		0.86	0.94	0.60	1.26	1.45	0.90

Table 5: Leaf area index influenced by different treatments at 30, 60, 90 days and harvest

S.N.	Treatments combination	30 DAS			60 DAS			90 DAS			At harvest		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	0.970	0.990	0.980	2.280	2.330	2.305	2.230	2.330	2.280	0.630	0.810	0.720
T_2	LCC 4	1.480	1.540	1.510	3.410	2.480	2.945	3.180	3.470	3.325	0.940	1.070	1.005
T_3	LCC 5	1.980	2.060	2.020	4.770	4.990	4.880	4.520	4.790	4.655	1.130	1.280	1.205
T_4	CCM 30	1.230	1.250	1.240	2.370	2.470	2.420	2.040	2.270	2.155	0.760	0.910	0.835
T_5	CCM 35	1.460	1.490	1.475	3.380	3.480	3.430	3.160	3.450	3.305	0.910	1.030	0.970
T_6	CCM 40	1.970	2.040	2.005	4.460	4.610	4.535	4.250	4.620	4.435	1.090	1.240	1.165
T_7	100% RDN as 3 equal splits (2:1:1)	2.130	2.180	2.155	4.170	4.310	4.240	4.010	4.510	4.260	1.050	1.170	1.110
T_8	75% RDN as 3 equal splits (2:1:1)	1.390	1.430	1.410	3.200	3.320	3.260	3.060	3.250	3.155	0.860	1.020	0.940
S.E(m)		0.06	0.07	0.04	0.11	0.14	0.09	0.07	0.11	0.06	0.04	0.05	0.03
C.D. (P=0.05)		0.17	0.21	0.13	0.32	0.41	0.25	0.21	0.33	0.19	0.12	0.16	0.09

Table 6: Number of Cobs Plant^{-1}, Cob length (cm), No. of grains cob^{-1} and Grain weight cob^{-1} influenced by different treatments

S.N.	Treatments combination	No of cobs plant^{-1}			Cob length (cm)			No. of grains cob^{-1}			Grain weight cob^{-1}		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	1.29	1.33	1.31	13.96	14.15	14.15	309.15	336.08	322.61	62.17	63.01	62.59
T_2	LCC 4	1.31	1.41	1.61	15.83	16.39	16.11	340.80	364.31	352.55	71.86	72.99	72.42
T_3	LCC 5	1.48	1.61	1.54	22.45	23.19	22.82	438.30	515.46	476.88	99.50	103.27	101.38
T_4	CCM 30	1.31	1.40	1.35	14.68	15.12	14.90	310.30	314.52	312.41	63.02	67.33	65.17
T_5	CCM 35	1.35	1.52	1.43	16.94	17.02	16.98	339.50	378.50	358.91	72.44	75.80	74.12
T_6	CCM 40	1.44	1.57	1.50	20.48	20.19	20.69	430.80	464.78	447.79	96.71	98.02	97.36
T_7	100% RDN as 3 equal splits	1.39	1.47	1.43	17.31	17.35	17.33	401.70	385.65	393.67	86.92	88.09	87.50
T_8	75% RDN as 3 equal splits	1.32	1.39	1.35	14.79	14.91	14.85	330.80	331.42	331.11	68.46	69.39	68.92
S.E(m)		0.02	0.02	0.01	0.29	0.30	0.10	4.28	5.71	3.57	1.44	1.61	1.08
C.D. (P=0.05)		0.06	0.08	0.05	0.86	0.90	0.60	12.61	16.81	10.19	4.26	4.74	3.09

Table 7: Plant population (30 DAS), days to 50% tasseling, days to 50% silking, weight of 1000 Grains (g) and shelling (%) influenced by different treatments

S.N.	Treatments combination	Plant Population (M^{-2})			50% TESSELING			50% SILKING			1000-grain weight (g)			Shelling (%)		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T_1	LCC 3	11.60	11.75	11.67	45.80	46.70	46.25	48.90	50.10	49.50	214.00	215.15	214.57	63.70	64.15	63.92
T_2	LCC 4	12.12	11.90	12.01	47.30	47.90	47.60	51.80	52.90	52.35	217.40	218.50	217.95	65.18	65.18	65.58
T_3	LCC 5	12.33	12.40	12.36	49.50	50.10	49.80	53.30	54.40	53.85	222.50	223.75	223.12	76.52	78.20	77.36
T_4	CCM 30	11.45	11.50	11.47	46.80	47.50	47.15	50.20	51.10	50.65	215.40	216.90	216.15	64.16	64.82	64.49
T_5	CCM 35	12.03	11.95	11.99	46.50	47.20	46.85	50.10	51.20	50.65	218.30	219.45	218.87	67.38	69.15	68.26
T_6	CCM 40	12.08	12.30	12.19	49.80	50.70	50.25	54.70	55.80	55.25	221.40	222.70	222.05	75.10	77.05	76.07
T_7	100% RDN as 3 equal splits	12.25	11.75	12.00	48.0	48.50	48.25	52.10	53.30	52.70	219.50	220.65	220.07	73.60	73.90	73.75
T_8	75% RDN as 3 equal splits	11.88	12.10	11.99	47.00	47.60	47.30	51.20	52.40	51.80	216.80	217.92	217.360	66.30	67.75	67.02
S.E(m)		0.31	0.39	0.24	0.43	0.52	0.33	0.60	0.73	0.46	0.285	0.43	0.27	0.45	0.59	0.37
C.D. (P=0.05)		N.S.	N.S.	N.S.	1.28	1.55	0.94	1.78	2.17	1.31	0.84	1.27	0.77	1.34	1.75	1.07

Table 8: Quantity and timing of N application in different treatments during 2019-20

Treatments	Nitrogen applied (kg ha^{-1}) on respective dates based on critical LCC and CCM values						
	Basal (16-7-2019)	21 DAS (06-8-2019)	28 DAS (13-8-2019)	35 DAS (20-8-2019)	42 DAS (27-8-2019)	49 DAS (04-9-2019)	Total
LCC 3	30			30			60
LCC 4	30		30		30		90
LCC 5	30	30		30	30		120
CCM 30	30			30			60
CCM 35	30		30		30		90
CCM 40	30	30		30		30	120
100% RDN as 3 equal splits (2:1:1)	60	Fixed time N application of 30 kg N ha-1 at knee high and tasseling stages each (25 DAS and 45 DAS)					120
75% RDN as 3 equal splits (2:1:1)	30	Fixed time N application of 30 kg N ha-1 at knee high and tasseling stages each (25 DAS and 45 DAS)					90

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