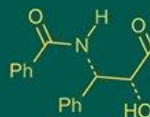


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Effect of cytokinin and different nitrogen sources on growth and yield of sweet corn (*Zea mays* L.)

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Abstract

The field experiment was conducted on Effect of Cytokinin and Different Nitrogen Sources on Growth and Yield of Sweet Corn (*Zea mays* L.) during Kharif season, 2025 at the Crop Research Farm, Department of Agronomy, NAI, SHUATS, Prayagraj, U.P. The soil of the experimental plot was sandy loam in texture, had a pH of 7.8, contained 0.72 per cent organic carbon, and had 178.48 kg of nitrogen, 27.80 kg of phosphorus, and 233.24 kg of potassium available per hectare. The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice. Viz., T₁: 100% Nitrogen through Urea + 25 ppm Cytokinin, T₂: 100% Nitrogen through Urea + 50 ppm Cytokinin, T₃: 100% Nitrogen through Urea + 75 ppm Cytokinin, T₄: 50% Nitrogen through Urea + 50% Nitrogen through Poultry Manure + 25 ppm Cytokinin, T₅: 50% Nitrogen through Urea + 50% Nitrogen through Poultry Manure + 50 ppm Cytokinin, T₆: 50% Nitrogen through Urea + 50% Nitrogen through Poultry Manure + 75 ppm Cytokinin, T₇: 100% Nitrogen through Poultry Manure + 25 ppm Cytokinin, T₈: 100% Nitrogen through Poultry Manure + 50 ppm Cytokinin, T₉: 100% Nitrogen through Poultry Manure + 75 ppm Cytokinin, T₁₀: N:P:K-120:60:40 kg/ha (Control). The result obtained that highest Plant height (190.17cm), highest Plant dry weight (152.38 g), and the yield attributes namely more cobs per plant (1.66), number of grain rows per cob (17.20), number of grains per row (36.20), cob length (18.10 cm), cob yield (8.76 t/ha) and stover yield (16.50 t/ha) was recorded in treatment - 5 with application of 50 % Nitrogen through Urea along with 50% Nitrogen through Poultry Manure and 50 ppm Cytokinin.

Keywords: Cytokinin, nitrogen, poultry manure, growth & yield, sweet corn

Introduction

Sweet corn (*Zea mays* L.), belongs to member of *Poaceae* family originating in Central America, it is basically valued for its high sugar content, tender kernels, and robust green fodder yield, sweet corn offers exceptional economic returns per unit area for Indian small holders. However, the production of sweet corn in modern Indian agriculture faces significant bottlenecks due to intensive multi cropping patterns, depleting micronutrient profiles in local soils, and unpredictable abiotic stressors that frequently limit the crop from reaching its true genetic potential (Islam *et al.*, 2024; Shankar *et al.*, 2013) [7, 22]. To maximize both quantitative yield attributes and qualitative economic traits, agronomic interventions using specific Plant Growth Regulators (PGRs) and Different nitrogen sources have become vital focal points in localized field research.

Despite its excellent commercial potential, maximizing the productivity per unit area of sweet corn in India remains bounded by several crop specific biological limitations and systemic soil nutrient degradations. Because sweet corn is harvested at the immature milk stage (typically 18 to 22 days post silking), the crop demands highly aggressive and uninhibited early stage vegetative growth, rapid leaf area expansion for optimum canopy light interception, and an uninterrupted source to sink photo assimilate translocation path. However, intensive cultivation sequences across major Indian farming belts have resulted in widespread exhaustion of critical primary, secondary, and micronutrient reserves in the soil profile. The continuous removal of nutrients without balanced replenishment has created widespread sub surface nutrient limitations, severely weakened cellular expansion and reduced maize crop vigor (Kumar *et al.*, 2020). Nutrient management critically influences Sweet corn productivity; Nitrogen (N) is especially vital as a constituent of chlorophyll, amino acids, proteins, nucleic acids, enzymes, and vitamins and is central to photosynthesis and biomass accumulation (Marschner, 2012; Fageria and Baligar, 2005) [4, 13].

Adequate N promotes vegetative growth, leaf area, chlorophyll formation, and photosynthetic efficiency, improving grain yield and quality; deficiency causes chlorosis, poor roots, premature senescence, and yield loss. Plant growth regulators, notably cytokinins, further enhance crop performance by stimulating cell division, chloroplast development, nutrient mobilization, and delaying leaf senescence (Letham, 1973; Taiz and Zeiger, 2015) ^[11, 12]. Synthesized mainly in root tips and transported via xylem, cytokinins regulate cytokinesis, DNA and chlorophyll biosynthesis, protein synthesis, and sink source relations (Sakakibara, 2006) ^[21]. They maintain chloroplast integrity, sustain photosynthetic activity, and improve grain filling; exogenous cytokinin application can increase stress tolerance, nutrient uptake, and productivity. Interactions between Nitrogen nutrition and cytokinins are significant; Nitrogen availability affects endogenous cytokinin biosynthesis in roots, while cytokinins regulates N uptake, assimilation, and translocation with plants (Mi *et al.*, 2008) ^[14]. Adequate N stimulates cytokinin production, promoting shoot growth and leaf expansion; exogenous cytokinins may enhance Nitrogen use efficiency via improved root activity, nutrient absorption, and photosynthesis.

Sweet corn, a short-duration, high value crop, responds well to scientific management, yet studies combining cytokinin application with different nitrogen sources evaluating growth, yield, quality, and economics across agro climatic conditions are limited. Most research treats Nitrogen management and growth regulators separately; integrated evaluation is needed to identify optimal treatment combinations for improved growth, yield, quality, and profitability.

This investigation, “Effect of Cytokinin and Different Nitrogen Sources on Growth and Yield of Sweet Corn (*Zea mays* L.),” conducted during Kharif 2025 at the Crop Research Farm, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.), examined how various Nitrogen sources and cytokinin influence growth parameters, yield attributes, yield, and quality, with the aim of informing efficient nutrient and growth regulator management for sustainable, profitable sweet corn production.

Materials and Methods

The field experiment was conducted on “Effect of Cytokinin and Different Nitrogen Sources on Growth and Yield of Sweet Corn (*Zea mays* L.)” during kharif season, 2025 at the Crop Research Farm, Department of Agronomy, NAI, SHUATS, Prayagraj, U.P. The soil of the experimental plot was sandy loam in texture, had a pH of 7.8, contained 0.72 per cent organic carbon, and had 178.48 kg of nitrogen, 27.80 kg of phosphorus, and 233.24 kg of potassium available per hectare. The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice. Viz., T₁: 100% Nitrogen through Urea along with 25 ppm Cytokinin, T₂: 100% Nitrogen through Urea along with 50 ppm Cytokinin, T₃: 100% Nitrogen through Urea along with 75 ppm Cytokinin, T₄: 50% Nitrogen through Urea along with 50% Nitrogen through Poultry Manure along with 25 ppm Cytokinin, T₅: 50% Nitrogen through Urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin, T₆: 50% Nitrogen through Urea along with 50% Nitrogen through Poultry Manure along with 75 ppm Cytokinin, T₇: 100%

Nitrogen through Poultry Manure along with 25 ppm Cytokinin, T₈: 100% Nitrogen through Poultry Manure along with 50 ppm Cytokinin, T₉: 100% Nitrogen through Poultry Manure along with 75 ppm Cytokinin, T₁₀: N:P:K-120:60:40 kg/ha (Control). Here, Sweet corn variety *Sugar* 75 the spacing adopted was plant to plant 45 cm and row to row 15 cm according to the treatment details and the seeds were drilled at 4-5 cm depth in the net plot area 3m x 3m on 01st Aug, 2025.

The observation on growth parameters i.e. Plant height (cm), Plant dry weight (g), were recorder whereas yield attributing parameters i.e. Number of cobs/plant, Number of grains/row, Number of grain rows/cob, Cob length (cm), Cob yield (kg/ha), Grain yield (kg/ha) and Harvest Index (%) from the net plot area these observation were recorded. The cob and stover yield were taken for the net plot of 1 m². Harvest Index (%) was calculated by using this formula (Economic yield /Biological yield) x 100 and extrapolated to a per hectare basis. The recorded data were analysed statically by ANOVA technique.

Statistical analysis

The experimental data gathered underwent a statistical Analysis Of Variance (ANOVA) as described by Gamez and Gomez (2010). Critical Difference (CD) values were computed, and the 'F' test was significant at the 5% level.

Result and discussion

1. Plant height (cm)

Maximum plant height (190.17 cm) at 80 DAS was recorded in T₅ with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. Treatments T₆ with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm Cytokinin and T₈ with application of 100% Nitrogen through poultry manure along with 50 ppm Cytokinin were statistically at par with T₅ with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. The pronounced height in T₅ with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin likely results from the rapid availability of nitrogen from urea and adequate plant growth regulator (PGR), which accelerates vegetative growth by stimulating cell division, chlorophyll synthesis, and overall metabolic activity. Nitrogen, an essential component of amino acids, proteins, and nucleic acids, reliably enhances plant vigor and stature when supplied adequately (Marschner, 2012; Taiz *et al.*, 2015) ^[12, 13]. Supplementary cytokinin in T₅ with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin, intensified these effects by promoting cell division, delaying leaf senescence, and improving nutrient mobilization. Together, readily available Nitrogen and exogenous cytokinin likely optimized sink source relationships, fostering greater biomass accumulation and stem elongation (Davies, 2010) ^[2].

2. Plant dry weight (g)

Application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin, i.e Treatment 5, produced the highest plant dry weight (152.38g) at 80 Days after Sowing (DAS).

Treatments 6 with application of 50% Nitrogen from urea along with 50% Nitrogen from poultry manure along with 75 ppm Cytokinin yielded dry weights that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. Nitrogen is a key constituent of amino acids, proteins, nucleic acids, and chlorophyll, and thus exerts a direct influence on photosynthetic efficiency and biomass accumulation. The provision of nitrogen as urea, a rapidly available source, likely promoted vigorous vegetative growth and greater dry matter production (Marschner, 2012) ^[13]. Moreover, cytokinin enhances cell division, delays leaf senescence, and facilitates nutrient mobilization toward actively growing sinks, collectively contributing to increased biomass accumulation.

3. Number of cobs/plants

The statistical analysis reveals that the varying treatment combinations exerted a highly significant influence on this specific prolificacy trait. Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin produced the highest and a significantly greater number of cobs per plant (1.66) at harvest. Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm cytokinin exhibited cob counts per plant that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. These results concur with Pandey *et al.*, (2000) ^[18], who reported that increasing nitrogen levels significantly improved yield attributes, including the number of cobs per plant in sweet corn. Sahoo and Mahapatra (2007) ^[20] similarly noted that optimal nitrogen nutrition enhanced growth and reproductive efficiency, thereby increasing cob production in sweet corn. The positive role of cytokinin in reproductive development and assimilate partitioning is supported by Taiz and Zeiger (2015) ^[12], who described how cytokinins delay senescence and strengthen source sink relationships, contributing to improved reproductive development and yield.

4. Number of row/cobs

Maximum number of grain row/cobs (17.20) was recorded in Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm cytokinin produced the highest and significantly greater number of rows per cob (17.20) at harvest. Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen from poultry manure along with 75 ppm Cytokinin produced values that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. The number of rows per cob in sweet corn was markedly affected by the combined application of nitrogen and cytokinin. Adequate nitrogen enhanced vegetative vigor, chlorophyll concentration, and photosynthetic efficiency, thereby promoting the development of reproductive structures and increasing the number of rows per cob. Nitrogen's central role in protein synthesis, enzyme function, and cell division supports proper cob morphogenesis and kernel arrangement.

The role of cytokinin in maintaining sink activity and delaying senescence further facilitates cob growth and orderly kernel development (Taiz and Zeiger, 2015) ^[12].

5. Number of grains/rows

Statistical analysis revealed a significant effect of treatments on grains per cob. Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin produced the highest and significantly greater number of grains per rows (36.20). Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm Cytokinin yielded grain counts that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin.

6. Cob length (cm)

Application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin, i.e Treatment 5, produced the longest cobs (18.10 cm), a value that was significantly greater than most treatments. Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm Cytokinin produced cob lengths that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin.

Cob length and grain yield in sweet corn were markedly influenced by the combined application of nitrogen and cytokinin. Elevated nitrogen availability enhanced vegetative growth, chlorophyll synthesis, photosynthetic activity, and nutrient uptake, thereby promoting superior cob development and grain formation. Adequate nitrogen supports cell elongation, protein synthesis, and assimilate production, resulting in increased cob length and higher grain yield (Mahapatra *et al.*, 2007). Nitrogen's central role in kernel development and grain filling further contributes to improved productivity in sweet corn.

7. Cob yield (t/ha)

The statistical variance highlights that the integration of growth regulators and secondary macronutrients profoundly influenced final harvest weight. Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin produced the highest grain yield (8.76 t/ha), and this value was significantly greater than most treatments. Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm Cytokinin yielded cob outputs that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. The application of cytokinin likely contributed to the yield increase by promoting cell division, delaying leaf senescence, and strengthening source sink relationships; these effects prolong the activity of photosynthetic tissues and enhance translocation of photosynthates to reproductive organs, thereby improving kernel development and grain filling (Nayak *et al.*, 2019) ^[16]. Concurrently, supplying nitrogen as urea a readily available nitrogen source and

ensuring adequate nitrogen status enhanced vegetative growth, chlorophyll synthesis, photosynthetic efficiency, and nutrient uptake, all of which support greater dry matter accumulation and assimilate translocation toward developing grains (Midde *et al.*, 2022) [15]. The synergistic application of optimal nitrogen and cytokinin levels thus promoted crop growth and reproductive development, resulting in the observed increases in cob yield.

8. Stover yield (t/ha)

The analysis of variance reveals that the vegetative structural development responded significantly to the distinct treatment combinations. Treatment 5 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin produced the highest stover yield (16.50 t/ha), and this value was significantly greater than most treatments. Treatments 6 with application of 50% Nitrogen through urea along with 50% Nitrogen through Poultry Manure along with 75 ppm cytokinin recorded highest stover yields that were statistically at par with Treatment 5 with application of 50% Nitrogen through urea along with

50% Nitrogen through Poultry Manure along with 50 ppm Cytokinin. Stover yield in sweet corn was markedly influenced by the combined application of nitrogen and cytokinin. Elevated nitrogen availability promoted vegetative growth, leaf area expansion, chlorophyll synthesis, and photosynthetic activity, resulting in greater biomass accumulation and higher stover yield. Nitrogen, being a fundamental component of proteins, enzymes, and chlorophyll, supports vigorous plant growth and enhanced dry matter production; increases in plant height, stem girth, and leaf number under higher nitrogen regimes contributed to the observed rise in stover yield. Cytokinin further augmented these effects by stimulating cell division, delaying leaf senescence, and sustaining photosynthetic activity for an extended period, thereby improving nutrient mobilization and assimilate translocation to vegetative tissues. The combined application of optimal nitrogen and cytokinin levels produced synergistic effects on plant growth and dry matter production, culminating in significantly higher stover yields, as reported by Sahoo *et al.*, (2007) [20]; Dragana *et al.*, (2015) [3].

Table 1: Response of cytokinin and different nitrogen sources on growth attributes of sweet corn

S. No.	TREATMENTS	Plant Height(cm)	Plant Dry Weight (g/plant)
1.	100% Nitrogen through Urea + 25 ppm Cytokinin	160.96	135.86
2.	100% Nitrogen through Urea + 50 ppm Cytokinin	171.88	139.48
3.	100% Nitrogen through Urea + 75 ppm Cytokinin	172.08	138.32
4.	50% Nitrogen through Urea + 50% N through PM + 25 ppm Cytokinin	174.62	137.51
5.	50% Nitrogen through Urea + 50% N through PM + 50 ppm Cytokinin	190.17	152.38
6.	50% Nitrogen through Urea + 50% N through PM + 75 ppm Cytokinin	185.06	150.44
7.	100% Nitrogen through Poultry Manure + 25 ppm Cytokinin	173.32	136.79
8.	100% Nitrogen through Poultry Manure + 50 ppm Cytokinin	182.76	140.28
9.	100% Nitrogen through Poultry Manure + 75 ppm Cytokinin	174.58	140.17
10.	N-P-K – 120-60-40 kg/ha (Control)	158.63	133.18
	F- Test	S	S
	S.Em(±)	5.11	4.01
	CD(p=0.05)	15.18	11.92

Table 2: Response of cytokinin and different nitrogen sources on yield attributes and yield attributes of sweet corn

S. No.	Treatments	Number of cobs/plant	Number of row/cob	Number of grains/row	Cob length (cm)
1.	100% Nitrogen through Urea + 25 ppm Cytokinin	1.13	14.40	32.33	16.00
2.	100% Nitrogen through Urea + 50 ppm Cytokinin	1.33	15.06	32.80	16.44
3.	100% Nitrogen through Urea + 75 ppm Cytokinin	1.40	14.93	31.93	16.42
4.	50% Nitrogen through Urea + 50% N through PM + 25 ppm Cytokinin	1.33	14.40	32.20	16.38
5.	50% Nitrogen through Urea + 50% N through PM + 50 ppm Cytokinin	1.66	17.20	36.20	18.10
6.	50% Nitrogen through Urea + 50% N through PM + 75 ppm Cytokinin	1.53	16.13	34.93	17.41
7.	100% Nitrogen through Poultry Manure + 25 ppm Cytokinin	1.26	14.53	32.26	16.25
8.	100% Nitrogen through Poultry Manure + 50 ppm Cytokinin	1.46	15.40	32.46	15.63
9.	100% Nitrogen through Poultry Manure + 75 ppm Cytokinin	1.46	15.06	33.13	16.26
10.	N-P-K – 120-60-40 kg/ha (Control)	1.06	14.06	30.20	15.50
	F test	S	S	S	S
	SEm(±)	0.05	0.44	0.97	0.48
	CD(P=0.05)	0.15	1.30	2.87	1.42

Table 3: Response of cytokinin and different nitrogen sources on yield attributes and yield of sweet corn

	Treatments	Cob yield (t/ha)	Stover yield(t/ha)	Harvest index (%)
1.	100% Nitrogen through Urea + 25 ppm Cytokinin	7.10	11.46	38.10
2.	100% Nitrogen through Urea + 50 ppm Cytokinin	7.36	12.63	37.10
3.	100% Nitrogen through Urea + 75 ppm Cytokinin	6.86	12.40	35.80
4.	50% Nitrogen through Urea + 50% N through PM + 25 ppm Cytokinin	7.33	13.19	35.70
5.	50% Nitrogen through Urea + 50% N through PM + 50 ppm Cytokinin	8.76	16.50	34.70
6.	50% Nitrogen through Urea + 50% N through PM + 75 ppm Cytokinin	7.83	14.20	35.60
7.	100% Nitrogen through Poultry Manure + 25 ppm Cytokinin	7.03	13.36	34.50
8.	100% Nitrogen through Poultry Manure + 50 ppm Cytokinin	7.40	13.53	35.40
9.	100% Nitrogen through Poultry Manure + 75 ppm Cytokinin	7.26	12.76	36.20
10.	N-P-K – 120-60-40 kg/ha (Control)	6.10	11.2	35.30
	F test	S	S	NS
	SEm(±)	0.42	0.84	1.02
	CD(P=0.05)	1.25	2.50	-

Conclusion

It is concluded that the combined application of Treatment 5 with application of 50% Nitrogen through urea and 50% Nitrogen as Poultry Manure together with 50 ppm Cytokinin resulted in the highest Cob yield, Stover yield, Gross Return, Net Return in Sweet Corn.

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