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Impact of split application of nitrogen and harvesting schedule on yield and quality of sweet corn (*Zea mays* var. *saccharata* L.) under South Saurashtra condition

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Abstract

A field experiment was conducted during the *rabi* season of 2019-20 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The experimental site had clayey soil, which was slightly alkaline in reaction (pH 7.7), rich in organic carbon and medium in available nitrogen, phosphorus (P_2O_5), and potassium (K_2O). The study comprised eighteen treatment combinations arranged in a split-plot design with three replications. The main plots included two sweet corn varieties (V₁: Sugar-75 and V₂: Sweet-16) along with three nitrogen application schedules—N₁ (50% as basal + 50% at knee-height stage), N₂ (25% as basal + 50% at knee-height stage + 25% at tasseling stage) and N₃ (33.3% as basal + 33.3% at knee-height stage + 33.3% at tasseling stage). The subplots consisted of three harvesting times, viz., T₁: 20 days after silking, T₂: 30 days after silking, and T₃: 40 days after silking.

The findings revealed that the sweet corn variety Sugar-75 produced significantly higher values of green cob yield, fresh kernel yield, green fodder yield, protein yield, sugar yield, as well as nitrogen and phosphorus uptake by both dry kernel and dry fodder. Among nitrogen management practices, the schedule of 25% applied as basal, 50% at the knee-height stage, and 25% at tasseling resulted in maximum green cob yield, fresh kernel yield, fodder yield, kernel protein content, protein yield, sugar yield, kernel nitrogen content, uptake of phosphorus and potassium by dry kernel and improvement in soil nitrogen status after harvest. Harvesting at 30 days after silking significantly enhanced green cob, kernel and fodder yield, protein yield and uptake of nitrogen and phosphorus by dry kernel and fodder, along with potassium uptake by dry kernel and fodder, followed by harvesting at 40 days after silking. The highest sugar yield was observed when the crop was harvested 40 days after silking, which was statistically at par with 30 days after silking. Significant interactions between variety and harvesting time were observed for harvest index and nitrogen uptake in dry fodder. Moreover, the combined influence of variety, nitrogen split application and harvesting schedule was significant for protein yield, kernel sugar content and nutrient uptake (N and P) by dry kernel and fodder. Based on the overall results, it may be concluded that under the clayey soils of South Saurashtra, *rabi* sweet corn variety Sugar-75, when supplied with nitrogen in the proportion of 25% basal + 50% at knee-height + 25% at tasseling and harvested 30 days after silking, achieved superior cob, kernel, fodder and protein yields.

Keywords: Sweet corn, *rabi*, variety, nitrogen split, harvesting

Introduction

Maize (*Zea mays* L.) ranks as the third most important cereal crop globally, following rice and wheat, yet it surpasses them in terms of overall production and productivity. Owing to its remarkable genetic yield potential, it is popularly referred to as the “Queen of cereals.” Currently, maize is cultivated on about 150 million hectares across nearly 160 countries, covering a wide range of soils, climatic conditions, biodiversity, and management systems (Meena *et al.*, 2019) [26]. In India, maize contributes approximately 9% to the national food basket and around 5% to the world’s dietary energy intake as a staple food (Kumar *et al.*, 2012) [12]. The crop’s production in the country has grown over twelvefold, from just 1.73 million

tonnes in 1950-51 to 21.73 million tonnes by 2010-11, and it now covers 9.22 million hectares with an average productivity of 2.92 t/ha (ASG, 2011). At present, India produces 21.81 million tonnes of maize from 8.69 million hectares, achieving an average yield of 2509 kg/ha. Looking ahead, the demand for maize in India by 2050 is projected to rise sharply to nearly 121 million tonnes (Amarasinghe and Singh, 2008) [5]. Sweet corn is a distinct type of maize grown primarily for table consumption. It is widely recognized as one of the most popular vegetable crops in developed nations such as the USA and countries in Europe. Nearly 40% of the produce is frozen while the remaining portion is processed and canned. In recent years, sweet corn has gained increasing popularity in India, especially in regions where maize is already cultivated. As a high-value crop, its demand is expanding in star hotels for culinary uses, particularly in soup preparation. Farmers located near urban areas can grow sweet corn as a profitable enterprise (Wahidullah *et al.*, 2022). An additional advantage of sweet corn is that after harvesting the green ears, the crop biomass remains in a succulent stage and serves as nutritious green fodder for livestock. Its short crop duration makes it suitable for integration into diverse cropping systems. Studies have shown that it performs well when intercropped with low-canopy species such as groundnut, green gram, and black gram, as well as with long-duration, high-canopy crops like red gram. The adoption of improved cultivars, proper plant stand and balanced nutrient management significantly influence yield, nutrient uptake and quality traits of maize (Massey and Gaur, 2013) [25]. Efficient fertilizer use is also closely linked with irrigation management (Malam and Solanki, 2022). Given India's favourable climatic conditions across most states, emphasis should be placed on developing and promoting early-maturing varieties, which allow cultivation during *kharif*, *rabi* and spring seasons not only for field maize but also for sweet corn. Harvest timing is equally critical; delayed harvest may lead to both quantitative and qualitative yield losses due to physiological and morphological changes in the grain. Maximum grain yield and seed quality are achieved when harvest is carried out soon after physiological maturity. Conversely, leaving grains in the field until moisture content drops below 20% results in weight loss from respiration and increases the risk of mechanical injury during harvest (Lauren *et al.*, 2007) [21]. With these considerations, the present investigation was undertaken to evaluate the performance of sweet corn (*Zea mays* var. *saccharata* L.) varieties under different nitrogen split-application schedules and harvesting times at the Instructional Farm, Junagadh Agricultural University (JAU), Junagadh, under the South Saurashtra agro-climatic conditions.

Material and Methods

A field experiment was conducted during the *rabi* season of 2019-20 at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). The study site is located in the southern part of the state, within the South Saurashtra agro-climatic zone. Geographically, it lies at 20°51' N latitude and 70°31' E longitude with an average altitude of 83 meters above mean sea level. The investigation aimed to assess the performance of sweet corn (*Zea mays* var. *saccharata* L.) varieties under different nitrogen split-application schedules and harvesting times in this region. The experimental soil was medium black in texture, moderately supplied with available nitrogen, phosphorus, potassium and

slightly alkaline in reaction, with a pH of 7.7. The net experimental plot measured 4.00 m × 3.60 m and included a total of eighteen treatment combinations. The main plot treatments comprised two sweet corn varieties (V₁: Sugar-75 and V₂: Sweet-16) along with three nitrogen split application schedules: N₁ - 50% as basal + 50% at knee-height stage; N₂ - 25% as basal + 50% at knee-height + 25% at tasseling stage; and N₃ - 33.3% as basal + 33.3% at knee-height + 33.3% at tasseling stage. The sub-plot treatments included three harvesting times: T₁ - 20 days after silking, T₂ - 30 days after silking and T₃ - 40 days after silking. The study followed a split-plot design with three replications. Both varieties (Sugar-75 and Sweet-16) were cultivated according to the recommended package of practices. No major incidence of insect pests or diseases occurred during the experiment. The recommended fertilizer dose (RDF) for sweet corn was 120:60:00 kg NPK per hectare. A uniform dose of 60 kg P₂O₅ per hectare was applied, while nitrogen was supplied in splits as per the treatments. Urea (46% N) and Di-Ammonium Phosphate (46% P₂O₅) served as the nutrient sources. Nitrogen application was distributed in three phases—basal, knee-height, and tasseling stage.

Effect of varieties

Yield attributes and yield

A noticeable improvement in yield components of Sugar-75 was reflected in higher productivity, particularly in terms of green cob, fresh kernel, and green fodder yields (Table 1). The superior performance of Sugar-75 compared to Sweet-16 can be attributed to better reproductive growth of the crop. Enhanced accumulation of photosynthates, as indicated by greater biomass production, together with efficient uptake of key nutrients such as N, P and K, likely contributed to higher biomass build-up. This, in turn, improved yield attributes, leading to increased green cob and green fodder yields in Sugar-75. The results of the present investigation are in close accordance with the findings of Wang (1995) [57], O'Neill *et al.*, (2004) [35], Saleem *et al.*, (2009) [41], Erdal *et al.*, (2011) [13], Zamir (2011) [59], Suthar *et al.*, (2012) [49], Opsi *et al.*, (2013) [36], Tadesse *et al.*, (2013) [51], Barary *et al.*, (2014) [10], Dhaka *et al.*, (2014) [12], Modhej *et al.*, (2014) [28], Om *et al.*, (2014), Nand (2015) [30], Szymanek *et al.*, (2015) [50], Panison *et al.*, (2016) [27], Banotra *et al.*, (2017) [9], Majid *et al.*, (2017) [23], Mehta *et al.*, (2017) [36], Riliang Gu *et al.*, (2017) [38], Ahmad *et al.*, (2018) [3], Muhammad *et al.*, (2018) [29], Nawaz *et al.*, (2019) [31], Olaiya *et al.*, (2020) [32] and Adhikari *et al.*, (2021) [2].

Quality

Quality parameters *viz.*, protein content in kernel, protein yield, sugar content in kernel and sugar yield (Table 2) were significantly affected by sweet corn variety, Sugar-75 recorded numerically higher protein content in kernel than variety Sweet-16. Significantly maximum protein yield was recorded by sweet corn variety Sugar-75. Sweet corn variety Sugar-75 also exhibited numerically higher sugar content in kernels and a significantly greater sugar yield. The enhancement in kernel protein content, protein yield and sugar accumulation in Sugar-75 can be attributed to its higher nitrogen concentration in both kernels and fodder. Since nitrogen is a fundamental component of proteins, enzymes, chlorophyll and plays a central role in carbohydrate and protein metabolism, the superior protein levels in Sugar-75 are most likely due to its greater nitrogen uptake compared with Sweet-16. These findings are complete agreement with the finding of Wang (1995) [57], Erdal *et al.*, (2011) [13], Suthar *et al.*, (2012) [49], Om *et al.*, (2014), Nand (2015) [30], Szymanek *et al.*, (2015) [50] and Panison *et al.*, (2016) [37].

Nutrient content and uptake

The data presented in Table 5, Table 9, and Table 11 indicated that variety Sugar-75 consistently recorded numerically higher concentrations of nitrogen, phosphorus and potassium in both kernels and fodder at harvest compared to Sweet-16. Likewise, the uptake of N, P and K by kernels and fodder was significantly greater in Sugar-75. This superiority may be attributed to its enhanced efficiency in nutrient absorption, translocation and utilization. The higher dry matter accumulation in Sugar-75 further supports the hypothesis that adequate metabolites were supplied from shoots to roots, promoting better root development and thereby improving nutrient extraction from the soil. Since nutrients stored in vegetative tissues are largely remobilized towards kernels and fodder during reproductive stages, the observed increase in nutrient concentration in Sugar-75 was expected. Ultimately, the combined effects of greater dry matter accumulation and nutrient content contributed to higher total NPK uptake by kernels and fodder in Sugar-75. The results are in close conformity with the findings of Suthar *et al.*, (2012) [49], Massey and Gaur (2013) [25], Dhaka *et al.*, (2014) [12] and Banotra *et al.*, (2017) [9].

Effect of split application of nitrogen

Yield attributes and yield

The findings (Table 1) demonstrated that applying nitrogen in the sequence of 25% as basal, 50% at the knee-height stage and 25% at the tasseling stage significantly enhanced yield attributes, particularly green cob yield, fresh kernel yield and green fodder yield. The improvement in cob and fodder yields under this nitrogen management practice can be attributed to its integrated effect on growth and yield components, underscoring the importance of these traits in determining overall productivity. Split application of nitrogen ensures a steady nutrient supply throughout the crop growth cycle, thereby promoting sustained vegetative development, efficient photosynthesis and effective partitioning of assimilates towards economic sinks. This strategy maintains a balanced source-sink relationship by strengthening both the nutrient-absorbing vegetative organs and the assimilate-storing reproductive structures. As a result, the cumulative effect of these processes led to significant improvements in green cob and fodder yields. The outcomes of the present investigation are in close agreement with the findings of Krishnamoorthy *et al.*, (1974) [19], Sanjeev *et al.*, (1997) [42], Fedotkin and Kravtsov (2001) [14], Gokmen *et al.*, (2001) [15], Mkhabela *et al.*, (2001), Torbert *et al.*, (2001), Akbar *et al.*, (2002) [4], Waqas (2002), Younas *et al.*, (2002) [58], Gungula *et al.*, (2003) [16], Rizwan *et al.*, (2003) [39], Sharar *et al.*, (2003) [44], Derby *et al.*, (2004) [11], Zeidan *et al.*, (2006) [60], Mollah *et al.*, (2007), Ullah *et al.*, (2007) [53], Wajid *et al.*, (2007) [56], Onasanya *et al.*, (2009) [34], Saleem *et al.*, (2009) [41], Tadesse *et al.*, (2013) [51], Hejazi and Soleymani (2014) [17], Adhikari *et al.*, (2016) [2], Sharifi and Namvar (2016) [45], Singh *et al.*, (2016), Anwar *et al.*, (2017) [7], Majid *et al.*, (2017) [23], Zerihun and Feyisa Hailu (2017) [61], Anjum *et al.*, (2018) [6], Shrestha *et al.*, (2018) [48], Umesh *et al.*, (2018) [54], Olaiya *et al.*, (2020) [32] and Adhikari *et al.*, (2021) [1].

Quality

The enhancement in kernel protein content, sugar content, protein yield, and sugar yield (Table 2) under the nitrogen schedule of 25% as basal, 50% at knee-height stage, and 25% at tasseling stage appears to be associated with higher nitrogen accumulation in the kernels. Nitrogen plays a crucial role in carbohydrate utilization and protein synthesis, as an adequate supply creates favourable conditions for converting

carbohydrates stored in vegetative tissues into proteins. Sweet corn receiving this split application of nitrogen exhibited significantly higher protein content and yield compared to other nitrogen application schedules. The results of present research experiment indicated higher protein content in kernel under the influence of time of split application of nitrogen to sweet corn is in close conformity with findings of Jena *et al.*, (2013) [18], Zerihun and Feyisa Hailu (2017) [61], and Umesh *et al.*, (2018) [54].

Nutrient content and uptake

The plant analysis results (Tables 5, 9 and 11) demonstrated that applying nitrogen as 25% basal, 50% at the knee-height stage and 25% at tasseling slightly increased the concentrations of N, P and K in both kernels and fodder. Similarly, the uptake of these nutrients was positively influenced under this split application compared to other nitrogen schedules. The observed improvement in nutrient content can be attributed to enhanced soil nutrient availability along with more efficient absorption, translocation and assimilation within the plant. In crop systems, absorbed nutrients are maintained at critical levels to support metabolic processes and the growth of developing organs. Therefore, a well-timed split application of nitrogen ensured a continuous supply of nutrients, maintained cellular nutrient balance, promoted robust vegetative growth, and facilitated efficient translocation toward economic sinks such as green cobs and fodder. The combined effect of improved nutrient accumulation and concentration ultimately resulted in higher NPK uptake under this nitrogen management practice. The results are in close vicinity with the findings of Shivay and Singh (2000) [47], Shrestha *et al.*, (2018) [48], Umesh *et al.*, (2018) [54].

Effect of harvesting schedule

Yield attributes and yield

The harvesting schedule of sweet corn significantly influenced yield attributes and overall productivity. Among the different harvesting times, harvesting green cobs 30 days after silking resulted in the highest green cob yield, fresh kernel yield and green fodder yield (Table 1). A delayed harvest allows the crop more time for photosynthesis, leading to greater accumulation of assimilates in the plant system and consequently higher yields of both green cob and fodder. Daynard *et al.* (1969) also reported a linear relationship between kernel yield and the duration of the grain-filling period. In the present study, green cob and green fodder yields followed a similar trend, reaching their optimum levels when harvested 30 days after silking. Harvesting beyond this stage did not lead to significant yield increases, likely due to the onset of senescence in the lower leaves. The more or less similar results were also reported by Shaheb *et al.*, (2009) [43], Barary *et al.*, (2014) [10], Panison *et al.*, (2016) [37], Riliang *et al.*, (2017) and Sahu (2018) [40].

Quality

The protein content and yield as well as sugar content and sugar yield plays an important role in deciding the quality of sweet corn. The protein and sugar content in kernel were not affected significantly due to harvesting schedule of sweet corn green cob, but protein yield and sugar yield (Table 2) were recorded significantly maximum when sweet corn green cobs were harvested 30 days after silking. At the early phase of grain formation, there is less protein and sugar in kernel, which enhanced progressively with time. The low protein and sugar content in kernel at early harvesting of sweet corn green cob (20 days after silking) which was increased to the maximum values

when sweet corn green cob harvested at 30 days after silking in case of protein content and harvesting of sweet corn green cob 40 days after silking in case of sugar content. Protein yield increased with delay in harvesting of sweet corn green cob and reach to peak when green cob of sweet corn harvested 30 days after silking. Whereas, sugar yield increased with delayed in harvesting. Similar results were also reported by Mahemoud *et al.*, (2007) [22], Shehzad *et al.*, (2012) [46], Szymanek *et al.*, (2015) [50] and Panison *et al.*, (2016) [37].

Nutrient content and uptake

Availability of nutrients in soil solution and absorption capacity of the plant determine the nutrient content in plant. N content (Table 5), phosphorus content (Table 9) and potassium content (Table 11) showed the non-significant effect of harvesting schedule of green cob of sweet corn. Uptake of NPK by plants largely depends on the yield and nutrient content of produce. NPK uptake by kernel and fodder increased with delayed in harvesting and maximum removal of NPK by kernel and fodder were recorded when crop was harvested 30 days after silking. Results of present investigation confirms the findings of Sahu (2018) [40].

Interaction effect

The interaction effect among sweet corn varieties, nitrogen split application and harvesting schedule was found to be significant for protein yield (Table 3). The highest protein yield of 871 kg ha⁻¹ was recorded for Sugar-75 fertilized with 33.3% N as basal, 33.3% N at knee-height and 33.3% N at tasseling with green cob harvested 30 days after silking (V₁N₃T₂). This was statistically comparable to the treatment combinations V₁N₂T₁, V₁N₂T₃, V₁N₂T₂ and V₂N₂T₂. Similarly, the interaction among varieties, nitrogen application and harvesting schedule was significant for kernel sugar content (Table 4). The maximum sugar content of 4.36% was observed in Sugar-75 fertilized with 25% N as basal, 50% N at knee-height, and 25% N at tasseling, with green cobs harvested 20 days after silking (V₁N₂T₁). This was closely followed by the treatment combination V₁N₁T₃.

Interaction effect of sweet corn varieties, split application of nitrogen and harvesting schedules of green cob was found significant for nitrogen uptake by dry kernel (Table 6). Significantly maximum nitrogen removal by dry kernel of 34.86 kg ha⁻¹ was recorded when sweet corn variety Sugar-75 (V₁) was fertilized with 33.3% N as basal + 33.3% N at knee height stage

+ 33.3% N at tasseling stage (N₃) and green cob of sweet corn harvested 30 days after silking (V₁N₃T₂) and it was found at par with treatment combinations V₁N₂T₁, V₁N₂T₃ and V₂N₂T₂. Interaction effect between sweet corn varieties and harvesting schedule also found significant for nitrogen removal by dry fodder (Table 7). Significantly higher removal of nitrogen by dry fodder of 42.76 kg ha⁻¹ was observed when sweet corn variety Sugar-75 was harvested 40 days after silking and it was found statistically on par with treatment combination V₁T₁, V₁T₂, and V₂T₂. Similarly, interaction effect of sweet corn varieties, split application of nitrogen and harvesting schedules of green cob found significant for nitrogen uptake by dry fodder (Table 8). Significantly higher removal of nitrogen by dry fodder of 49.01 kg ha⁻¹ was observed when sweet corn variety Sugar-75 (V₁) was fertilized with 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage (N₂) and green cob of sweet corn harvested 30 days after silking (T₂) and it was found statistically on same bar with treatment combinations V₁N₁T₁, V₁N₂T₁, V₁N₂T₃, and V₁N₃T₃.

Among various split application of nitrogen levels effect on sweet corn produce their significant influence on phosphorus removal by dry kernel of sweet corn. Significantly maximum phosphorus removal by dry kernel (5.27 kg ha⁻¹) when sweet corn was fertilized with 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage (N₂) and it was closely followed by N₃. Interaction effect among sweet corn varieties, split application of nitrogen and harvesting schedules of green cobs found significant for phosphorus uptake by dry kernel (Table 10). Significantly maximum phosphorus uptake of 6.49 kg ha⁻¹ was observed when sweet corn variety Sugar-75 was fertilized with 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage (N₃) and harvesting of green cob 30 days after silking and it was found comparable with treatment combinations V₁N₂T₂ and V₁N₂T₃.

Conclusion

Based on the findings of this one-year field study, it can be concluded that under the clayey soils of the South Saurashtra agro-climatic zone, sweet corn variety Sugar-75 achieves higher fresh kernel and green fodder yields when fertilized with nitrogen in three splits—25% as basal, 50% at knee-height, and 25% at tasseling—and harvested 30 days after silking, along with the adoption of other recommended package of practices.

Table 1: Green cob yield, fresh kernel yield and green fodder yield as influenced by varieties, split application of nitrogen and harvesting schedule

Treatments	Green cob Yield (kg ha ⁻¹)	Fresh kernel yield (kg ha ⁻¹)	Green fodder yield (kg ha ⁻¹)
Varieties -(V)			
V ₁ - Sugar-75	12080	6547	24448.8
V ₂ - Sweet-16	11100	6014	22114.5
S.Em.±	307	165	512
C.D. at 5 %	968	519	1615
Split application of nitrogen - (N)			
N ₁ - 50.0% N as basal + 50.0% N at knee height stage	10755	5880	22290
N ₂ - 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage	12275	6782	24737
N ₃ - 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage	11741	6180	22818
S.Em.±	376	202	628
C.D. at 5 %	1185	635	1977
C.V. %	13.77	13.62	11.44
Harvesting schedule - (T)			
T ₁ - 20 days after silking (DAS)	11066	5996	21720.5
T ₂ - 30 days after silking (DAS)	12289	6665	24084.4
T ₃ - 40 days after silking (DAS)	11416	6181	24040.0
S.Em. ±	333	179	495

C.D. at 5 %	974	522	1446
C.V. %	12.22	12.09	9.03
Significant interaction	NS	NS	NS

Table 2: Protein content in kernel, protein yield, sugar content in kernel (%) and sugar yield as influenced by varieties, split application of nitrogen and harvesting schedule

Treatments	Protein content (%)	Protein yield (kg ha ⁻¹)	Sugar content in kernel (%)	Sugar Yield (kg ha ⁻¹)
Varieties -(V)				
V ₁ - Sugar-75	6.85	705	3.88	257
V ₂ - Sweet-16	6.55	608	3.85	226
S.Em.±	0.10	16.03	0.05	7.80
C.D. at 5 %	NS	50.51	NS	24.58
Split application of nitrogen - (N)				
N ₁ - 50.0% N as basal + 50.0% N at knee height stage	6.42	564	3.80	211
N ₂ - 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage	7.15	756	3.95	273
N ₃ - 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage	6.53	649	3.84	240
S.Em.±	0.12	19.63	0.06	9.55
C.D. at 5 %	0.37	61.87	NS	30.10
C.V. %	7.42	12.69	6.58	16.77
Harvesting schedule - (T)				
T ₁ - 20 days after silking (DAS)	6.63	583	3.82	214
T ₂ - 30 days after silking (DAS)	6.77	704	3.81	252
T ₃ - 40 days after silking (DAS)	6.70	683	3.96	258
S.Em. ±	0.10	20.08	0.05	7.17
C.D. at 5 %	NS	58.60	NS	20.93
C.V. %	6.47	12.97	5.04	12.58
Significant interaction	NS	VxNxT	VxNxT	NS

Table 3: Interaction effect of varieties, split application of nitrogen and harvesting schedule on protein yield (kg ha⁻¹)

Harvesting schedule Varieties x Split application of nitrogen	T ₁	T ₂	T ₃
V ₁ N ₁	505	580	698
V ₁ N ₂	759	827	840
V ₁ N ₃	592	871	677
V ₂ N ₁	488	592	522
V ₂ N ₂	605	806	698
V ₂ N ₃	550	545	662
S.Em. ±			49.18
C.D. at 5 %			143.55
C.V. %			12.97

Table 4: Interaction effect of varieties, split application of nitrogen and harvesting schedule on sugar content in kernel (%)

Harvesting schedule Varieties x Split application of nitrogen	T ₁	T ₂	T ₃
V ₁ N ₁	3.50	4.00	4.03
V ₁ N ₂	4.36	3.87	4.00
V ₁ N ₃	3.80	3.53	3.87
V ₂ N ₁	3.74	3.68	3.87
V ₂ N ₂	3.54	3.93	4.00
V ₂ N ₃	4.00	3.85	4.00
S.Em. ±			0.11
C.D. at 5 %			0.33
C.V. %			5.04

Table 5: Nitrogen content and uptake by kernel and fodder as influenced by varieties, split application of nitrogen and harvesting schedule

Treatments	Nitrogen content (%)		Nitrogen uptake (kg ha ⁻¹)	
	Kernel	Fodder	Dry Kernel	Dry Fodder
Varieties -(V)				
V ₁ - Sugar-75	1.70	0.683	28.22	41.81
V ₂ - Sweet-16	1.65	0.674	24.30	37.26
S.Em.±	0.01	0.003	0.64	0.91
C.D. at 5 %	NS	NS	2.02	2.88
Split application of nitrogen - (N)				
N ₁ - 50.0% N as basal + 50.0% N at knee height stage	1.63	0.683	22.58	38.08

N ₂ - 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage	1.74	0.675	30.23	41.80
N ₃ - 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage	1.64	0.678	25.98	38.72
S.Em.±	0.01	0.004	0.79	1.12
C.D. at 5 %	0.05	NS	2.47	NS
C.V. %	4.74	2.29	12.69	12.01
Harvesting schedule - (T)				
T ₁ - 20 days after silking (DAS)	1.66	0.680	23.33	36.98
T ₂ - 30 days after silking (DAS)	1.68	0.680	28.14	40.96
T ₃ - 40 days after silking (DAS)	1.67	0.676	27.31	40.66
S.Em. ±	0.01	0.003	0.80	0.90
C.D. at 5 %	NS	NS	2.34	2.64
C.V. %	4.13	1.92	12.97	9.69
Significant interaction	NS	NS	VxNxT	VxT, VxNxT

Table 6: Interaction effect of varieties, split application of nitrogen and harvesting schedule on nitrogen uptake by dry kernel (kg ha⁻¹)

Harvesting schedule Varieties x Split application of nitrogen	T ₁	T ₂	T ₃
V ₁ N ₁	20.20	23.22	27.92
V ₁ N ₂	30.35	33.08	33.60
V ₁ N ₃	23.68	34.86	27.08
V ₂ N ₁	19.54	23.68	20.90
V ₂ N ₂	24.20	32.23	27.92
V ₂ N ₃	22.00	21.80	26.47
S.Em. ±	1.97		
C.D. at 5 %	5.74		
C.V. %	12.97		

Table 7: Interaction effect of varieties and harvesting schedule on nitrogen uptake by dry fodder (kg ha⁻¹)

Varieties Harvesting schedule	V ₁	V ₂
T ₁	41.28	32.67
T ₂	41.40	40.52
T ₃	42.76	38.57
S.Em. ±	1.28	
C.D. at 5 %	3.73	
C.V. %	9.69	

Table 8: Interaction effect of varieties, split application of nitrogen and harvesting schedule on nitrogen uptake by dry fodder (kg ha⁻¹)

Harvesting schedule Varieties x Split application of nitrogen	T ₁	T ₂	T ₃
V ₁ N ₁	43.64	33.79	40.49
V ₁ N ₂	43.22	49.01	44.97
V ₁ N ₃	36.96	41.41	42.81
V ₂ N ₁	31.18	39.49	39.89
V ₂ N ₂	35.82	39.49	38.32
V ₂ N ₃	31.02	42.60	37.50
S.Em. ±	2.21		
C.D. at 5 %	6.46		
C.V. %	9.69		

Table 9: Phosphorus content and uptake by kernel and fodder as influenced by varieties, split application of nitrogen and harvesting schedule

Treatments	Phosphorus content (%)		Phosphorus uptake (kg ha ⁻¹)	
	Kernel	Fodder	Dry Kernel	Dry Fodder
Varieties -(V)				
V ₁ - Sugar-75	0.313	0.208	5.18	12.78
V ₂ - Sweet-16	0.304	0.199	4.45	10.99
S.Em.±	0.003	0.003	0.13	0.34
C.D. at 5 %	NS	NS	0.40	1.06
Split application of nitrogen - (N)				
N ₁ - 50.0% N as basal + 50.0% N at knee height stage	0.313	0.208	4.33	11.61
N ₂ - 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage	0.305	0.200	5.27	12.43
N ₃ - 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage	0.308	0.203	4.85	11.62
S.Em.±	0.004	0.004	0.16	0.41
C.D. at 5 %	NS	NS	0.49	NS
C.V. %	5.028	7.618	13.78	14.70
Harvesting schedule - (T)				
T ₁ - 20 days after silking (DAS)	0.310	0.205	4.32	11.18

T ₂ - 30 days after silking (DAS)	0.310	0.205	5.16	12.36
T ₃ - 40 days after silking (DAS)	0.306	0.201	4.97	12.11
S.Em. ±	0.003	0.003	0.13	0.35
C.D. at 5 %	NS	NS	0.39	NS
C.V. %	4.227	6.404	11.67	12.34
Significant interaction	NS	NS	VxNxT	NS

Table 10: Interaction effect of varieties, split application of nitrogen and harvesting schedule on phosphorus uptake by dry kernel (kg ha⁻¹)

Harvesting schedule Varieties x Split Application of nitrogen	T ₁	T ₂	T ₃
V ₁ N ₁	3.89	4.28	5.13
V ₁ N ₂	5.40	6.17	5.64
V ₁ N ₃	4.53	6.49	5.10
V ₂ N ₁	4.00	4.56	4.10
V ₂ N ₂	4.08	5.53	4.82
V ₂ N ₃	4.03	3.96	5.01
S.Em. ±	0.32		
C.D. at 5 %	0.95		
C.V. %	11.67		

Table 11: Potassium content and uptake by kernel and fodder as influenced by varieties, split application of nitrogen and harvesting schedule

Treatments	Potassium content (%)		Potassium uptake (kg ha ⁻¹)	
	Kernel	Fodder	Dry Kernel	Dry Fodder
Varieties -(V)				
V ₁ - Sugar-75	0.563	1.118	9.32	68.40
V ₂ - Sweet-16	0.554	1.109	8.12	61.30
S.Em.±	0.003	0.003	0.23	1.46
C.D. at 5 %	NS	NS	0.72	4.62
Split application of nitrogen - (N)				
N ₁ - 50.0% N as basal + 50.0% N at knee height stage	0.563	1.118	7.78	62.32
N ₂ - 25.0% N as basal + 50.0% N at knee height stage + 25.0% N at tasseling stage	0.555	1.110	9.59	68.71
N ₃ - 33.3% N as basal + 33.3% N at knee height stage + 33.3% N at tasseling stage	0.558	1.113	8.79	63.53
S.Em.±	0.004	0.004	0.28	1.79
C.D. at 5 %	NS	NS	0.88	NS
C.V. %	2.779	1.394	13.53	11.74
Harvesting schedule - (T)				
T ₁ - 20 days after silking (DAS)	0.560	1.115	7.81	60.60
T ₂ - 30 days after silking (DAS)	0.560	1.115	9.32	67.16
T ₃ - 40 days after silking (DAS)	0.556	1.111	9.03	66.81
S.Em. ±	0.003	0.003	0.24	1.44
C.D. at 5 %	NS	NS	0.69	4.19
C.V. %	2.336	1.172	11.52	9.39
Significant interaction	NS	NS	NS	NS

Reference

- Adhikari K, Bhandari S, Aryal K, Mahato M, Shrestha J. Effect of different levels of nitrogen on growth and yield of hybrid maize (*Zea mays* L.) varieties. *J Agric Nat Resour.* 2021;4(2):48-62.
- Adhikari P, Baral BR, Shrestha J. Maize response to time of nitrogen application and planting seasons. *J Maize Res Dev.* 2016;2(1):83-93.
- Ahmad S, Khan AA, Kamran M, Ahmad I, Ali S, Fahad S. Response of maize cultivars to various nitrogen levels. *Eur J Exp Biol.* 2018;8:1-4.
- Akbar H, Miftahullah J, Jan MT, Ihsanullah. Yield potential of sweet corn as influenced by different level of nitrogen and plant population. *Asian J Plant Sci.* 2002;6:631-633.
- Amarasinghe UA, Singh OP. Changing consumption patterns of India: implications on future food demand. In: Amarasinghe UA, Shah T, Malik RPS, editors. *India's Water Future: Scenarios and Issues.* International Water Management Institute; 2008. p. 131-146.
- Anjum MM, Shafi M, Ahmad H, Ali N, Iqbal MO, Ullah S, *et al.* Influence of split nitrogen application on yield and yield components of various maize varieties. *Pure Appl Biol.* 2018;7(2):721-726.
- Anwar S, Ullah W, Islam M, Shafi M, Iqbal A, Alamzeb M. Effect of nitrogen rates and application times on growth and yield of maize (*Zea mays* L.). *Pure Appl Biol.* 2017. <http://dx.doi.org/10.19045/bspab.2017.60096>
- ASG. Agricultural Statistics at a Glance 2011. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India; 2011.
- Banotra M, Sharma BC, Nandan B, Verma A, Shah IA, Kumar R, *et al.* Growth, phenology, yield and nutrient uptake of sweet corn as influenced by cultivars and planting times under irrigated subtropics of Shiwalik Foot Hills. *Int J Curr Microbiol Appl Sci.* 2017;6(10):2971-2985.
- Barary M, Kordi S, Rafie M, Mehrabi AA. Effect of harvesting time on grain yield, yield components, and some qualitative properties of four maize hybrids. *Int J Agric Food Res.* 2014;3(4):1-7.
- Derby NE, Casey FX, Knighton RE, Steele DD. Midseason nitrogen fertility management for corn based on weather and yield potential. *Agron J.* 2004;96(2):494-501.

12. Dhaka SK, Singh D, Nepalia V, Sulochana, Dhewa J. Performance of sweet corn (*Zea mays* L. Ssp. *Saccharata*) varieties at varying fertility levels. *Forage Res.* 2014;40(3):195-198.
13. Erdal S, Pamukcu M, Savur O, Tezel M. Evaluation of developed standard sweet corn (*Zea mays saccharata* L.) hybrids for fresh yield, yield components and quality parameters. *Turk J Field Crops.* 2011;16(2):153-156.
14. Fedotkin IV, Kravtsov IA. Production of grain maize under irrigated conditions. *Kukuruz-I Sorgo.* 2001;3:5-8.
15. Gokmen S, Sencar O, Sakin MA. Response of popcorn (*Zea mays*) to nitrogen rates and plant densities. *Turk J Agric For.* 2001;25(1):15-23.
16. Gungula DT, Kling JG, Togun AO. CERES-Maize predictions of maize phenology under nitrogen-stressed conditions in Nigeria. *Agron J.* 2003;95(4):892-899.
17. Hejazi L, Soleymani A. Effect of different amounts of nitrogen fertilizer on grain yield of forage corn cultivars in Isfahan. *Int J Adv Biol Biomed Res.* 2014;2(3):608-614.
18. Jena N, Vani KP, Rao P, Srinivas A, Sankar S. Performance of quality protein maize (QPM) on quality, yield and yield components as influenced by nutrient management. *J Prog Agric.* 2013;4(2):72-74.
19. Krishnamoorthy K, Bommegowda A, Jagannath MK, Nenugopal N, Ramchandra Prasad TV, Raghunatha G, *et al.* Relative production of yield in hybrid, composite and local maize as influenced by nitrogen and population levels I. Grain yield and its components. *Indian J Agron.* 1974;19:263-266.
20. Kumar RS, Kumar B, Kaul J, Karjagi CG, Jat SL, Parihar CM, *et al.* Maize research in India - historical prospective and future challenges. *Maize J.* 2012;1(1):1-6.
21. Lauren DR, Smith WA, Di Menna ME. Influence of harvest date and hybrid on the mycotoxin content of maize (*Zea mays*) grain grown in New Zealand. *N Z J Crop Hortic Sci.* 2007;35(2):331-340.
22. Mahemoud MR, Solieman THI. Influence of sweet corn cultivars and plant spacing on vegetative growth, yield, quality and chemical composition characteristics in newly reclaimed soils. *J Agric Environ Sci Alex Univ.* 2007;6(2):90-115.
23. Majid MA, Islam MS, Sabagh AEL, Hasan MK, Saddam MO, Barutcular C, *et al.* Influence of varying nitrogen levels on growth, yield and nitrogen use efficiency of hybrid maize (*Zea mays*). *J Exp Biol Agric Sci.* 2017;5(2):134-142.
24. Malam KV, Solanki RM. Growth, Yield and Water Use Efficiency of Sweet Sorghum [*Sorghum bicolor* (L.) Moench] Affected by Drip Irrigation and Nitrogen Levels through Fertigation. *Int J Environ Clim Change.* 2022;12(11):2407-2424.
25. Massey JX, Gaur BL. Response of sweet corn cultivars to plant population and fertility levels on yield, NPK uptake and quality characters. *Int J Agric Sci.* 2013;9(2):713-715.
26. Meena A, Solanki RM, Malam KV, Palanjiya RR. Effect of spacing and nitrogen levels on quality parameters and nitrogen uptake of fodder maize (*Zea mays* L.). *Int J Chem Stud.* 2019;7(5):2355-2357.
27. Mehta BK, Hossain F, Muthusamy V, Zunjare RU, Sekhar JC, Gupta HS. Analysis of responses of novel double mutant (sh2sh2/su1su1) sweet corn hybrids for kernel sweetness under different sowing and harvest time. *Indian J Agric Sci.* 2017;87(11):1543-1548.
28. Modhej A, Kaihani A, Lack S. Effect of nitrogen fertilizer on grain yield and nitrogen use efficiency in corn (*Zea mays* L.) hybrids under irrigated conditions. *Proc Natl Acad Sci India Sect B Biol Sci.* 2014;84(3):531-536.
29. Muhammad MA, Muhammad S, Ahmad H, Nawab A, Muhammad OI, Saif U, *et al.* Influence of split nitrogen application on yield and yield components of various maize varieties. *Pure Appl Biol.* 2018;7(2):721-726.
30. Nand V. Effect of spacing and fertility levels on protein content and yield of hybrid and composite maize (*Zea mays* L.) grown in rabi season. *J Agric Vet Sci.* 2015;8(9):26-31.
31. Nawaz I, Anwar S, Ahmad J, Mehboob M, Ullah I, Ullah A, *et al.* Phonological traits and yield of different maize genotypes as influenced by nitrogen application methods. *Int J Biosci.* 2019;15(4):303-311.
32. Olaiya AO, Oyafajo AT, Atayese MO. Nitrogen use efficiency of extra early maize varieties as affected by split nitrogen application in two agro ecologies of Nigeria. *MOJ Food Process Technol.* 2020;8(1):5-11.
33. Om H, Singh SP, Singh JK, Ansari MA, Meena RL, Yadav B. Productivity, nitrogen balance and economics of winter maize (*Zea mays* L.) as influenced by QPM cultivars and nitrogen levels. *Indian J Agric Sci.* 2014;84(2):306-308.
34. Onasanya RO, Aiyelari OP, Onasanya A, Oikeh S, Nwile FE, Oyelakin OO. Growth and yield response of maize (*Zea mays* L.) to different rates of nitrogen and phosphorus fertilizers in southern Nigeria. *World J Agric Sci.* 2009;5(4):400-407.
35. O'Neill PM, Shanahan JF, Schepers JS, Caldwell B. Agronomic response of corn hybrids from different areas to deficit and adequate levels of water and nitrogen. *Agron J.* 2004;96:1660-1667.
36. Opsi F, Fortina R, Borreani G, Tabacco E, Lopez S. Influence of cultivar, sowing date and maturity at harvest on yield, digestibility, rumen fermentation kinetics and estimated feeding value of maize silage. *J Agric Sci.* 2013;151:740-753.
37. Panison F, Sangoi L, Kolling DF, Coelho CMM, Durli MD. Study the harvest time and agronomic performance of maize hybrids with contrasting growth cycles. *Maringa.* 2016;38(2):219-226.
38. Gu R, Li L, Liang X, Wang Y, Fan T, Wang Y, *et al.* The ideal harvest time for seeds of hybrid maize (*Zea mays* L.) XY335 and ZD958 produced in multiple environments. *Sci Rep.* 2017;7:17537. <https://www.nature.com/articles/s41598-017-16071-4>
39. Rizwan M, Maqsood M, Rafiq M, Saeed M, Ali Z. Maize (*Zea mays* L.) response to Split application of Nitrogen. *Int J Agric Biol.* 2003;5(1):19-21.
40. Sahu C. Nitrogen splitting and harvesting schedule on yield and quality of sweet corn [M.Sc. Agronomy thesis]. Orissa University of Agriculture and Technology; 2018.
41. Saleem MF, Randhawa MS, Husain S, Wahid MA, Anjum SA. Nitrogen management studies in autumn planted maize (*Zea mays* L.) hybrids. *J Anim Plant Sci.* 2009;19(3):140-143.
42. Sanjeev K, Bangarwa AS, Kumar S. Yield and yield components of winter maize (*Zea mays* L.) as influenced by plant density and nitrogen levels. *Agric Sci Dig.* 1997;17:181-184.
43. Shaheb MR, Nessa A, Alom MS, Islam MN, Islam MA. Effect of harvesting time on the yield and quality of sweet corn seed. *J Bangladesh Soc Agric Sci Technol.* 2009;6(3&4):209-212.

44. Sharar MS, Ayub M, Nadeem MA, Ahmad N. Effect of different rates of nitrogen and phosphorus on growth and yield of maize. *Asian J Plant Sci.* 2003;2:347-349.
45. Sharifi RS, Namvar A. Effects of time nitrogen application on phenology and some agronomical traits of maize (*Zea mays* L.). *Biologija.* 2016;62(1):35-45.
46. Shehzad MA, Maqsood M, Bhatti MA, Ahmad W, Shahid MR. Effects of nitrogen fertilization rate and harvest time on maize (*Zea mays* L.) fodder yield and its quality attributes. *Asian J Pharm Biol Res.* 2012;2(1):19-26.
47. Shivay YS, Singh RP. Growth, yield attributes, yields and nitrogen uptake of maize as influenced by cropping systems and nitrogen levels. *Ann Agric Res.* 2000;21(4):494-498.
48. Shrestha J, Chaudhary A, Pokhrel D. Application of nitrogen fertilizer in maize in Southern Asia. *Peru J Agron.* 2018;2(2):22-26.
49. Suthar M, Singh D, Nepalia V. Green fodder and cob yield of sweet corn (*Zea mays* L. Ssp. *Saccharata*) Varieties at varying fertility levels. *Forage Res.* 2012;38(2):115-118.
50. Szymanek M, Tanas W, Kassar FH. Kernel carbohydrates concentration in sugary-1, sugary enhanced and shrunken sweet corn kernels. *Agric Agric Sci Procedia.* 2015;7:260-264.
51. Tadesse T, Assefa A, Liben M, Tadesse Z. Effects of nitrogen split-application on productivity, nitrogen use efficiency and economic benefits of maize production in Ethiopia. *Int J Agric Policy Res.* 2013;1(4):109-115.
52. Torbert HA, Potter KN, Morrison JE. Tillage system, fertilizer nitrogen rate and timing effect on corn yields in the Texas Black land prairie. *Agron J.* 2001;93:1119-1124.
53. Ullah A, Bhatti MA, Gurmani ZA, Imran M. Studies on planting patterns of maize (*Zea mays* L.) facilitating legumes intercropping. *J Agric Res.* 2007;45(2):113-118.
54. Umesh MR, Mallikarjun Swamy TS, Ananda N, Shawad UK, Chittapur BM, Desai BK, *et al.* Nitrogen application based on decision support tools to enhance productivity, nutrient use efficiency and quality of sweet corn (*Zea mays*). *Indian J Agron.* 2018;63(3):331-336.
55. Wahidullah, Solanki RM, Malam KV. Response of sweet corn (*Zea mays* var. *saccharata* L.) to split application of nitrogen and harvesting schedule under South Saurashtra condition. *Pharma Innov J.* 2022;11(5):2174-2180.
56. Wajid A, Ghaffar A, Maqsood M, Hussain K, Nasim W. Yield response of maize hybrids to varying nitrogen rates. *Pak J Agric Sci.* 2007;44(2):217-220.
57. Wang AD, Swiader JM, Juvic JA. Nitrogen and sulfur fertilization influences aromatic flavor components in shrunken2 sweet corn kernels. *Am Soc Hortic Sci.* 1995;120(5):771-777.
58. Younas M, Rehman H, Hyder G. Magnitude of variability for yield and yield associated traits in maize hybrids. *Asian J Plant Sci.* 2002;1:694-696.
59. Zamir MSI, Ahmad AH, Javeed HMR, Latif T. Growth and yield behaviour of two maize hybrids (*Zea mays* L.) towards different plant spacing. *Cercet Agron Mold.* 2011;XLIV(2):33-40.
60. Zeidan MS, Amany A, El-Kramany MF. Effect of N-fertilizer and plant density on yield and quality of maize in sandy soil. *Res J Agric Biol Sci.* 2006;2(4):156-161.
61. Zerihun A, Feyisa Hailu. Effects of nitrogen rates and time of application on yield of maize: rainfall variability influenced time of N application. *Int J Agron.* 2017. <https://doi.org/10.1155/2017/5467325>