

Genotypic differences in maize phenology, growth and biomass “hybrid” vs. “local cultivars” applied with variable rates of different n-fertilizer sources

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Introduction Maize (*Zea mays* L.) is the second most important crop after wheat in the North West Frontier Province (Khyber Pakhtunkhwa) of Pakistan but its yield per unit area is very low (Amanullah et al., 2009). Nitrogen is one of the most important factors affecting maize growth, phenology and grain yield (Amanullah et al., 2009), leaf area and biomass, grain quality (Amanullah and Shah, 2011) and net returns (Amanullah et al., 2010) in Northwest Pakistan.

Materials and Methods The objective of this experiment was to investigate the response of different maize genotypes [local high yielding cultivars (Azam and Jalal) vs. hybrid (Pioneer-3025)] to variable rates (50, 100, 150 and 200 kg N ha⁻¹) and sources [urea, calcium ammonium nitrate (CAN) and ammonium sulphate (AS)] of N in comparison to control (N not applied) on calcareous soils having wheat-maize cropping system for long time. A field study was conducted at the Agriculture Research Farm of Agricultural University, Peshawar, during summer 2008-2010.

Results and Discussion Nitrogen applied plots delayed physiological maturity by three and half days, produced 19 cm taller plants, 3.29 more leaves plant⁻¹, 81.17 cm² (21 %) higher leaf area, and 3,533 kg ha⁻¹ (35 %) higher biomass than the plots where N was not applied (control). Days to physiological maturity was delayed significantly with each increment in N rate, and enhanced with application of AS compared to urea and CAN. Application of CAN produced taller plants, more leaves plant⁻¹, leaf area and so higher biomass than urea and AS. Although, there was no significant difference in the biomass of CAN (10,352 kg ha⁻¹) and AS (10,062 kg ha⁻¹) applied plots, but was significantly higher than the biomass of the plots applied with urea (9,472 kg ha⁻¹). Plant height ranked first with 150 kg N ha⁻¹. Number of leaves plant⁻¹, leaf area and biomass were statistically among the two higher N rates (150 and 200 kg N ha⁻¹) and were significantly higher than the two lower rates of N (50 and 100 kg N ha⁻¹). The Pioneer-3025 hybrid was 13 days late maturing, produced 36.25 cm (20 %) taller plants, 3.2 (21 %) more leaves plant⁻¹, 88 cm² (20 %) higher leaf area, and 1,939 kg ha⁻¹ (17 %) higher biomass than the average of the two local cultivars.

Conclusion It is concluded from the study that growing maize hybrid Pioneer-3025 applied with 150 or 200 kg N ha⁻¹ either as CAN or urea could result in higher maize productivity and profitability in the studied area.

References

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- Amanullah, L.K. Almas and P. Shah. 2010. Timing and rate of nitrogen application influence profitability of maize planted at low and high densities in Northwest Pakistan. *Agronomy Journal*: 102(2): 575-579.

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Table 1. Preplanned comparison in physiological maturity (PM), plant height (PH), number of leaves plant⁻¹ (LPP), mean single leaf area (MSLA) and biomass of maize as influenced by control (N not applied) vs. rest (N applied)

Control vs. Rest	PM (days)	PH (cm)	LPP	MSLA (cm ²)	Biomass (kg ha ⁻¹)
Control	87.67	146.11	10.11	298.89	6,429
Rest	91.14	164.97	13.40	380.06	9,962
Difference	3.47	18.86	3.29	81.17	3,533

Table 2. Days to physiological maturity (PM), plant height (PH), number of leaves plant⁻¹ (LPP), mean single leaf area (MSLA) and biomass of maize as influenced by different sources of nitrogen

N Sources	PM (days)	PH (cm)	LPP	MSLA (cm ²)	Biomass (kg ha ⁻¹)
Urea	91.61	162.28	13.11	375.33	9,472
CAN	91.78	167.89	13.89	400.56	10,352
AS	90.03	164.75	13.19	364.28	10,062
LSD _{0.05}	0.44	2.60	0.37	20.34	395

Table 3. Days to physiological maturity (PM), plant height (PH), number of leaves plant⁻¹ (LPP), mean single leaf area (MSLA) and biomass of maize as influenced by variable rates of nitrogen

N rates (kg ha ⁻¹)	PM (days)	PH (cm)	LPP	MSLA (cm ²)	Biomass (kg ha ⁻¹)
50	88.37	158.81	11.78	353.15	8,575
100	90.37	162.33	13.00	335.11	9,883
150	92.07	171.96	14.48	418.37	10,543
200	93.74	166.78	14.33	413.59	10,846
LSD _{0.05}	0.51	3.00	0.43	23.48	456

Table 4. Differences in days to physiological maturity (PM), plant height (PH), number of leaves plant⁻¹ (LPP), mean single leaf area (MSLA) and biomass of maize genotypes

Genotypes	PM (days)	PH (cm)	LPP	MSLA (cm ²)	Biomass (kg ha ⁻¹)
Azam	85.86	153.56	12.31	349.03	8,980
Jalal	87.83	152.22	12.36	352.42	9,651
Pioneer-3025	99.72	189.14	15.53	438.72	11,254
LSD _{0.05}	0.51	3.59	0.38	24.18	237