

Effect of nutrient management on growth and grain yield of pearl millet (*Pennisetum glaucum*) in pearl millet–wheat (*Triticum aestivum*) cropping system

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A field experiment was conducted during the rainy (*kharif*) season of 1991 at Agronomy Research Farm, Hisar. The group of soil was sierozem having sand 58.95%, silt 24.01%, clay 17.04%, electrical conductivity 0.14 dS/m at 25°C, with pH 8.1. Available N, P and K were 130 kg/ha, 10.8 kg/ha and 510 kg/ha respectively. The experiment was laid out in randomized block design with 4 replications. There were 12 treatments, viz. T₁, no fertilizer and no organic manure (control) to *kharif* crop of pearl millet (L.) R. Br. emend. Stuntz] and no fertilizer and no organic manure (control) to winter (*rabi*) crop of wheat L. emend. Thell. Fiori & Paol.); T₂, 50% recommended NP dose through fertilizers only to *kharif* crop and 50% recommended NP dose through fertilizers only to winter crop; T₃, 50% recommended NP dose through fertilizers to *kharif* crop and 100% recommended NP dose through fertilizers to winter crop; T₄, 75% recommended NP dose through fertilizers to *kharif* crop and 75% recommended NP dose through fertilizers to winter crop; T₅, 100% recommended NP dose through fertilizers to *kharif* crop and 100% recommended NP dose through fertilizers to winter crop; T₆, 50% recommended NP dose through fertilizers + 50% N through farmyard manure (FYM) to *kharif*

crop and 100% recommended NP dose through fertilizers to winter crop; T₇, 75% recommended NP dose through fertilizers + 25% N through FYM to *kharif* crop and 75% recommended NP dose through fertilizers to winter crop; T₈, 50% recommended NP dose through fertilizers + 50% N through wheat straw to *kharif* crop and 100% recommended NP dose through fertilizers to winter crop; T₉, 75% recommended NP dose through fertilizers + 25% N through wheat straw to *kharif* crop and 75% recommended NP dose through fertilizers to winter crop; T₁₀, 50% recommended NP dose through fertilizers + 50% N through green-manure to *kharif* crop and 100% recommended NP dose through fertilizers to winter crop; T₁₁, 75% recommended NP dose through fertilizers + 25% N through green-manure to *kharif* crop and 75% recommended NP dose through fertilizers to winter crop; and T₁₂, conventional farmer's practice (1 bag DAP + 1 bag urea/ha, given in 2 splits) to rainy-season crop. The recommended dose of N, P₂O₅ and K₂O was 120, 60 and 60 kg/ha respectively. 'HHB 60' pearl millet was drilled on 19 July 1991 @ 5 kg seed/ha, keeping intraline distance of 45 cm. As per treatments, the entire dose of P in the form of single superphosphate and half the quantity of N in the form of urea were

Table 1. Growth parameters and grain yield of pearl millet as influenced by fertilizer treatments

Treatment	Plant= height (cm)	Tillers/m at harvest	Dry matter/ plant (g) at harvest	Leaf area/ plant (cm ²) at 75 DAS	Grain yield (kg/ha)
T ₁	167.0	12.33	48.97	807	723
T ₂	194.9	18.83	84.79	1,369	1,554
T ₃	200.0	19.75	88.03	1,397	1,777
T ₄	201.2	19.58	90.82	1,443	1,789
T ₅	225.1	24.83	109.00	1,770	2,527
T ₆	204.8	20.15	97.38	1,483	1,937
T ₇	216.7	25.42	108.25	1,796	2,696
T ₈	189.0	18.00	83.79	1,331	1,433
T ₉	202.0	19.78	93.51	1,403	1,914
T ₁₀	211.2	22.33	98.74	1,658	2,099
T ₁₁	218.6	23.78	106.32	1,733	2,326
T ₁₂	287.0	17.92	83.52	1,335	1,486
CD (P = 0.05)	13.9	3.59	10.81	283	568

Treatments detail are given in text

= At harvest; DAS, days after sowing

applied before sowing and the remaining N was top-dressed in the form of urea 33 days after sowing. Farmyard manure, wheat straw and green-manure (*dhaincha*) @ 60, 96 and 33 kg/plot (10 m x 8 m) on dry-weight basis were applied respectively 22 days before pearl millet sowing, where 25% of inorganic N was substituted. Double dose of these organic manures, i.e. 120, 192 and 66 kg plot of farmyard manure, wheat straw and green-manure, were applied respectively where 50% substitution of inorganic N was made.

All the treatments resulted in significantly better growth parameters (plant height, number of tillers, dry-matter production and leaf area) and grain yield compared with the control (Table 1). The successive increase in NP application showed beneficial effect on growth parameters and grain yield. Application of 100% NP dose showed significant influence on growth and yield compared with 50 or 75% NP dose through

fertilizer. But the differences amongst T₂, T₃, T₄ and T₁₂ were found non-significant.

The growth parameters and grain yield varied in different treatments, depending on the source of nutrients and proportionate replacement (%). Substitution of chemical fertilizer either through farmyard manure or green-manure up to 25% resulted in equal growth and yield as obtained with 100% recommended dose (T₅). However, 25% substitution through wheat straw recorded significantly poor growth and yield compared with to T₅ and 50% substitution through green-manure recorded growth parameters and yield at par to that of recommended dose (T₅). These findings are in agreement with those of Singh (1985), Sharma and Mittra (1990) and Pandey and Dwivedi (1992).

It was concluded that 25% nutrient requirement of pearl millet can be replaced through farmyard manure or green-manure at 25 or 50% level for obtaining the yield at par with treatment receiving 100% recom-

mended dose through chemical fertilizers. Inclusion of wheat straw for substitution as N source is not comparable due to poor yields.

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Growth, yield and yield attributes of sunflower (*Helianthus annuus*) and greengram (*Phaseolus radiatus*) and blackgram (*P. mungo*) intercropping in different planting patterns

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The possibility of intercropping of short-duration varieties of pulses, viz. greengram (*Phaseolus radiatus* L.) and blackgram (*P. mungo* L.) in spring-planted sunflower (*Helianthus annuus* L.) under irrigated conditions of northern plains was studied during 1992 at Kanpur. The soil was sandy loam with pH 7.0, low in organic carbon (0.30%) and available N (170.50 kg/ha), medium in P (14.30 kg/ha) and high in exchangeable K (545.00 kg/ha). Nine treatments were replicated thrice in randomized block design. The sowing was done on 14 March 1992 keeping spacing of 45 cm x 20 cm for sole crop of 'EC 68414' sunflower and 25 cm x 6 cm for sole crops of 'PDM

11' greengram and 'Pant U 19' blackgram. In 2 : 1 planting pattern, the sunflower rows were paired at 30/60 cm and 1 row of greengram or blackgram was taken in the inter-pair space (additive system), whereas in 2 : 2 and 2 : 3 planting patterns, the third row of sunflower was replaced by 2 and 3 rows of intercrops respectively in replacement series. A basal dose of 20 kg N + 40 kg P₂O₅/ha was applied uniformly at planting and remaining 40 kg N/ha for sunflower was given in 2 splits on area basis as top-dressing.

Leaf-area index (LAI) in greengram and blackgram under sole and that in intercropping was almost identical till 20 days after

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