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Short Communication

Effect of Integrated Nutrient Management under Varying Levels of Zinc on Pearl Millet Yield

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Pearl millet is a short-duration crop and is well adapted to low and erratic rainfall due to its drought-escaping mechanism and low water requirement as compared to other cereals like sorghum and maize. Nutrient requirement of the crop is mainly met through fertilizer but use of chemical fertilizer is a costly proposition. Moreover, continuous use of chemical fertilizer deteriorates the soil health and crop productivity. In the modern system of agriculture, conjunctive use of manures and fertilizers maintains long-term soil fertility and sustains crop productivity (Van Dijk and Van Dijk, 1995). FYM is the major source of organic manure. Poultry manure is also gaining importance among farmers as it is rich source of major nutrients along with various micro-nutrients. Zinc (Zn) deficiency is widespread in field crops grown on light textured soils that are low in organic matter. The present investigation was undertaken to find the impact of integrated nutrient management on the crop.

The treatments comprising seven combinations of fertilizers and manures (RDF, poultry manure @ 4 t ha^{-1}, poultry manure @ 2 t ha^{-1} + 50% RDF, poultry manure @ 1 t ha^{-1} + 75% RDF, FYM @ 10 t ha^{-1}, FYM @ 5 t ha^{-1} + 50% RDF and FYM @ 2.5 t ha^{-1} + 75% RDF) in main plots and four levels of zinc (control, 2.5 kg Zn, 5 kg Zn and 7.5 kg Zn ha^{-1}) in sub-plots were tried in a split-plot design with three replications at Agricultural Research Station Farm, Fatehpur (Sikar) during kharif 2004 and 2005. The composition of poultry manures was 1.5% N, 0.76% P_2O_5, 1.26% K_2O and 48.9 ppm Zn. The FYM had 0.55% N, 0.28% P_2O_5, 0.51% K_2O and 25.7 ppm Zn. Recommended dose of 60 kg N and 30 kg P_2O_5 ha^{-1} was applied through different combinations of fertilizes/ manures or both sources. The soil of the experimental field was loamy sand in texture, alkaline in reaction (pH 8.3), poor in organic carbon (0.17%), low in available nitrogen (128 kg ha^{-1}) and available zinc (0.41 ppm), and medium in available phosphorus (18.1 kg ha^{-1}) and potassium (224 kg ha^{-1}). Pearl millet variety Raj. 171 was sown on 8th July 2004 and 7th July 2005 using 4 kg seed ha^{-1} in rows 45 cm apart. Besides treatments, the packages of practices were followed as per recommendation to raise a crop.

Application of FYM @ 5 t ha^{-1}+50% RDF significantly increased the number of effective tillers over RDF, poultry manure @ 4 t ha^{-1} and FYM @ 10 t ha^{-1} but

Table 1. Effect of integrated use of fertilizers and manures under varying levels of zinc on pearl millet yield and its attributes (pooled over 2 seasons)

Treatment	Effective tillers per meter row length	Length of ear head (cm)	Grain wt. per ear head (g)	Test weight (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Biological yield (kg ha^{-1})
Fertilizers and manures							
T1	14.28	22.00	11.09	7.81	2025	5061	7086
T2	14.73	22.33	10.35	7.80	1967	5078	7046
T3	14.66	25.28	12.65	8.04	2531	5915	8446
T4	16.52	26.59	12.62	8.05	2395	5834	8229
T5	14.26	22.18	9.99	7.79	1876	5194	7070
T6	17.87	24.16	11.74	7.84	2456	5893	8349
T7	16.00	26.27	10.31	7.81	2331	5770	8102
CD (P=0.05)	2.02	1.97	0.72	NS	173	427	510
Zinc levels (kg ha^{-1})							
0	14.25	23.67	9.96	7.62	1987	5043	7030
2.5	15.57	24.07	11.09	7.82	2201	5455	7656
5.0	16.54	24.33	11.97	7.99	2340	5798	8138
7.5	17.24	24.39	12.00	8.09	2376	5845	8220
CD (P=0.05)	1.37	NS	0.54	0.23	107	258	379

T1: RDF (60 kg N + 30 kg P_2O_5 ha^{-1}), T2: Poultry manure @ 4.0 t ha^{-1}, T3: Poultry manure @ 2.0 t ha^{-1} + 50% RDF, T4: Poultry manure @ 1.0 t ha^{-1} + 75% RDF, T5: FYM @ 10.0 t ha^{-1}, T6: FYM @ 5.0 t ha^{-1} + 50% RDF, T7: FYM @ 2.5 t ha^{-1} + 75% RDF, NS: Non-significant.

was par with poultry manure @ 2 t ka^{-1} + 50% RDF, poultry manure @ 1 t ha^{-1} + 75% RDF, and FYM @ 2.5 t ha^{-1} + 75% RDF (Table 1). Significant increase was noticed under application of poultry manure @ 1 t ha^{-1} + 75% RDF, which proved superior to RDF, poultry manure @ 4 t ha^{-1} and FYM @ 10 t ha^{-1} and FYM @ 5 t ha^{-1} + 50% RDF in pooled analysis. Application of poultry manure @ 2 t ha^{-1} + 50% RDF showed the maximum weight of grains per earhead and proved significantly superior to rest of the treatments except poultry manure @ 1 t ha^{-1} + 75% RDF. This could be due to the supply of nutrients in balanced amount and in available form, which might have increased growth in terms of plant height, tillers per plant, expansion of leaf lamina and chlorophyll content that ultimately provided greater sites for photosynthesis and diversion of photosynthates towards sink. The beneficial effect on yield attributes might also be due to increased supply of all the essential nutrients by poultry manure and FYM , which might have resulted in more synthesis of food and its subsequent partitioning to sink. The finding of present investigation were also supported by those of Channabasavanna *et al.* (2001).

Application of 7.5 kg Zn ha^{-1} significantly increased the number of effective tillers per meter row length and test weight over 2.5 kg Zn ha^{-1} and control, but it was at par with 5 kg Zn ha^{-1} (Table

1). Increasing levels of zinc upto 5 kg ha^{-1} significantly increased the weight of grains per earhead over 2.5 kg Zn ha^{-1} and control. The increase in yield attributes might be due to role of Zn in biosynthesis of indole acetic acid (IAA) and especially due to its role in initiation of primordial for reproductive parts and partitioning of photosynthates towards them. The finding are in close agreement with those of Dewal and Pareek (2004).

The combined use of fertilizers and manures had remarkable effects on grain, stover and biological yield. application of poultry manure @ 2 t ha^{-1} + 50% RDF was at par with FYM @ 5 t ha^{-1} + 50% RDF, poultry manure @ 1 t ha^{-1} + 75% RDF and FYM @ 2.5 t ha^{-1} + 75% RDF but produced significantly higher grain, stover and biological yield of pearl millet over rest of the treatments (Table 1). This could be attributed to the sustained availability of nutrients throughout the growing season. The efficacy of inorganic fertilizer was much pronounced when it was combined with organic manures. The increased vegetative growth and the balanced C:N ratio might have increased the synthesis of carbohydrates, which ultimately promoted the yield. The higher grain yield of pearl millet seemed to be the cumulative effect of yield attributes such as effective tillers per metre row length, length of earhead and weight of grains per earhead, which were significantly enhanced due to application of combined use of poultry manure + RDF and FYM + RDF. These findings are in close agreement with that of Jain and Tiwari (2001).

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