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Effect of fertility levels and nano-nitrogen on growth and yield of pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz]

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Abstract

Background: Pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz] is fourth most important cereal after rice, wheat and maize in India. Nitrogen increases process of photosynthesis, leaf area duration, leaf area production, net assimilation rate, food quality and crop yield. Phosphorus is essential for cell enlargement, cell division, energy storage and transfer, enhancing seed maturity, seed development and photosynthetic activity. Potassium is an activator of enzymes which are involved in plant growth. It plays important role in stomata activity, transport of sugars, water and nutrient, synthesis of protein and starch. Nano fertilizers are the most important field of agriculture has been giving the attention of the soil scientists as well as the environmentalists due to its capability to increase yield and improve soil fertility. Nanotechnology can reduce the rate of fertilizer nutrients loss through leaching and increase their availability to plants which ultimately leads to reduced water and soil pollution.

Methods: In the present work, the experiment was laid out in factorial randomized block design with fertility levels and nano-nitrogen on Productivity of Pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz]. The experiment consisted sixteen treatments viz., two factors with where four fertility levels and four levels of nano-nitrogen foliar spray.

Result: The experimental results showed that application of 75% RDF produced significantly higher plant height, dry matter accumulation at 60 DAS and at harvest, leaf area index, chlorophyll content, number of effective tiller meter per row length, ear length, grain yield, stover yield and biological yield, protein content in grain, net returns B: C ratio over control and 50% RDF also remained at par with application of 100% RDF. Results further showed that application of Nano- N foliar spray @ 3.0 ml l⁻¹ significantly increased the plant height, dry matter accumulation at 60 DAS and at harvest, leaf area index, chlorophyll content, number of effective tiller meter per plant, ear length, grain yield, stover yield, biological yield, net returns and B: C ratio over control and Nano- N foliar spray @ 1.5 ml l⁻¹ and remained at par with Nano- N foliar spray @ 4.5 ml l⁻¹.

Keywords: Pearl millet, nano, RDF, growth, yield, economics

1. Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz] is the most important staple food of majority of poor and small land holders in Asia and Africa. It is consumed as feed and fodder for livestock. It produces nearly half of all millets on the planet. Behind wheat, rice, corn, barley and sorghum, it is the world's sixth most valuable cereal crop. After rice, wheat and maize, pearl millet is India's fourth most widely cultivated food crop. It occupies an area of 6.93 million ha with an average production of 8.61 million tonnes and productivity of 1243 kg ha⁻¹. In rajasthan pearl millet occupies area of 4.54 m ha⁻¹ with annual production of 5.89 m t⁻¹ and productivity of 1296 kg ha⁻¹ (Anonymous, 2022-23) ^[1]. Rajasthan, Maharashtra, Uttar Pradesh, Gujarat and Haryana are the main pearl millet producing states.

Nitrogen increases process of photosynthesis, leaf area duration, leaf area production, net assimilation rate, food quality and crop yield.

Phosphorus plays a vital role in increasing crop yield because it improves crop quality and provides resistance against diseases.

Potassium plays important role in stomata activity, transport of sugars, water and nutrient, synthesis of protein and starch. Nano fertilizers are the most important field of agriculture has been giving the attention of the soil scientists as well as the environmentalists due to its capability to increase yield and improve soil fertility. Nanotechnology can reduce the rate of fertilizer nutrients loss through leaching and increase their availability to plants which ultimately leads to reduced water and soil pollution. Nowadays, nano fertilizers are emerging as an alternative to conventional fertilizers (Veronia *et al.*, 2014). Nano materials are defined as materials with a single unit between 1 and 100 nm in size in atleast one dimension (Liu and Lal, 2015) [2] and having a both positive and negative charge on same particle that led to improve uptake of other nutrients by holding those nutrients in soil against different losses.

2. Materials and Methods

The experiment was conducted during *kharif* 2023-25 at Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan). Geographically, the study area is located at 75° 51'44" E longitude and 26°48'35" N latitude and altitude of 427 m mean sea level.

This region experiences subtropical climatic conditions, with mild winter and summer temperatures and high relative humidity from July to September. The present experiment consisting of 16 treatment combinations was laid out in Factorial Randomized Block Design. The experiment consisted sixteen treatments viz., two factors with where four fertility levels are (Control, 50%, 75% and 100% RDF) and four levels of nano-nitrogen foliar spray are (Control, 1.5 ml l⁻¹, 3.0 ml l⁻¹ and 4.5 ml l⁻¹). Seeds of Pearl millet variety 'RHB-233' were sown manually by 'Kera' method at rate of 4 kg ha⁻¹ maintaining row distance of 45 cm and plant to plant distance 15 cm placed at depth of 5 cm and sowing was done at 11th July 2024. Fertilizers were placed beneath the seed, after placing the seed in furrows it was covered with soil for uniform germination and to protect from bird damage.

Pearl millet crop was harvested from net plot of 3.0m x 2.7 cm = 8.1 m² separately, and taken from the particular plot when it reached physiological maturity. The plants from net plot were cut close to the ground, Cut the ear from plant, and spread out on the threshing floor to dry in the sun.

3. Results and Discussion

Effect of fertility levels and nano-nitrogen

The application of different fertility levels and nano-nitrogen has a considerable impact on the growth parameters of pearl millet as demonstrated by clear data, The application of 75% RDF and nano- N foliar spray @ 3.0 ml-l significantly increased the plant height at 60 days after sowing and at harvest dry matter accumulation at 60 DAS and at harvest, leaf area index and chlorophyll contain over control (Table 1). Pandit *et al.*, (2020) [3] assessed the influence of fertility levels, plant density, and seedling age on transplanted pearl millet (*Pennisetum glaucum*

L.) and they recorded that significantly higher plant height (236.9 cm), leaf area index (3.9), dry matter accumulation (1235.6 g/m²), tillers/hill (4.2) at harvest under the fertility levels of F3 (150:75:75 kg NPK/ha), but being statistically at par with F2 but superior. Fertility level of F3(150:75:75 kg/ha) gave higher tillers/plant at all the crop growth stages i.e. at 30 DAT (7.09), 60 DAT (6.79) and harvest (4.21), which was statistically at par with F2(120:60:60 kg/ha) but superior over F1(90:45:45 kg/ha).

Parihar *et al.*, (2012) [4] at IARI, New Delhi reported that all the growth attributes of pearl millet, namely, plant height, LAI, total number of tillers and dry matter accumulation were significantly higher with 30 kg N + 20 kg P₂O₅/ha and 6 t/ha FYM over control, 30 kg N + 20 kg P₂O₅/ha and sole application of 6 t/ha FYM but remained at par with 60 kg N + 40 kg P₂O₅/ha.

It is probable to correlate the overall increase in crop growth caused by nano-nitrogen application to improved root development of plant in the soil. The plant height varied from 128.5 to 151.4 cm among all the treatments. Highest plant height (151.4 cm) was recorded with application of 100% RDF and Nano- N foliar spray @ 4.5 ml l⁻¹ (148.5 cm) which was superior over other treatments. The Highest dry matter accumulation in pearl millets plant (118.96 g plant⁻¹) was registered with application of 100% RDF and Nano- N foliar spray @ 4.5 ml l⁻¹ (118.35 g plant⁻¹) which was significantly superior over all treatments. The leaf area index was found highest (3.21) in Nano- N foliar spray @ 4.5 ml l⁻¹ and 100% RDF (3.13) treatment which was significantly superior over all treatments. The chlorophyll content was found highest (2.84) in Nano- N foliar spray @ 4.5 ml l⁻¹ and 100% RDF (2.89) which was significantly superior over all treatments. The number of effective tillers/plant were significantly increased under treatment 100% RDF which was superior over all treatments. The effective tillers range 2.49 to 2.87. The ear head length of pearl millet was significantly increased under 100% RDF and Nano- N foliar spray @ 4.5 ml l⁻¹ as compared to other treatments. The ear length range registered between 18.60 and 22.41. The grain weight earhead⁻¹ of pearl millet was significantly influenced by different treatments. Planting of pearl millet with 100% RDF and Nano- N foliar spray @ 4.5 ml l⁻¹ recorded significantly higher grain weight earhead⁻¹ (7.77 g). The different fertility application practices had significant effect on grain yield. Significantly higher grain yield of 2273 kg/ha was recorded under Nano- N foliar spray @ 4.5 ml l⁻¹ with 100% RDF. The Stover yield recorded after harvest of the pearl millet crop as influenced by fertilization. The stover yield is highest 4596 kg/ha was recorded under Nano- N foliar spray @ 4.5 ml l⁻¹. The biological yield of pearl millet was increased due to 100% RDF over control. Significantly superior biological yield was obtained 100% RDF over control. The harvest index of pearl millet was not influenced significantly due to fertilization. However, higher and lowest harvest index was recorded under 100% RDF and control respectively.

Table 1: Effect of fertility levels and nano-nitrogen on growth attributes of pearl millet.

Treatments	Plant height (cm)		Dry matter accumulation (g)		Leaf Area Index	Chlorophyll Content
	60 DAS	At Harvest	60 DAS	At Harvest		
Fertility levels (kg ha ⁻¹) Control	76.5	128.5	20.64	100.55	2.49	2.71
50% RDF	85.4	137.4	31.74	110.74	2.87	2.80
75% RDF	93.3	145.3	37.54	114.21	3.08	2.86
100% RDF	99.4	151.4	38.96	118.96	3.13	2.84
S.Em ±	3.0	3.0	1.17	1.99	0.05	0.03
CD (p = 0.05)	8.7	8.7	3.36	5.76	0.15	0.09

Nano- nitrogen Control	77.7	129.7	23.36	100.69	2.38	2.69
Nano- N foliar spray @ 1.5 ml l ⁻¹	85.9	137.9	29.98	109.98	2.84	2.79
Nano- N foliar spray @ 3.0 ml l ⁻¹	94.4	146.4	35.52	115.44	3.14	2.85
Nano- N foliar spray @ 4.5 ml l ⁻¹	96.5	148.5	40.01	118.35	3.21	2.89
S.Em ±	3.0	3.0	1.17	1.99	0.05	0.03
CD (p = 0.05)	8.7	8.7	3.36	5.76	0.15	0.09

Table 2: Effect of fertility levels and nano-nitrogen on Yield attributes of pearl millet.

Treatments	Yield Attributes		
	Number of effective tillers plant ⁻¹	Ear length (cm)	Test weight (g)
Fertility levels (kg ha ⁻¹) Control	2.49	18.60	5.03
50% RDF	2.77	20.48	6.51
75% RDF	2.82	21.08	7.59
100% RDF	2.87	22.41	7.77
S.Em ±	0.09	0.54	0.22
CD (p = 0.05)	0.25	1.56	NS
Nano- nitrogen Control	2.23	18.16	5.00
Nano- N foliar spray @ 1.5 ml l ⁻¹	2.74	20.20	6.46
Nano- N foliar spray @ 3.0 ml l ⁻¹	2.95	21.61	7.62
Nano- N foliar spray @ 4.5 ml l ⁻¹	3.03	22.59	7.82
S.Em ±	0.09	0.54	0.22
CD (p = 0.05)	0.25	1.56	NS

Table 3: Effect of fertility levels and Nano-nitrogen on Yield of pearl millet.

Treatments	Grain yield	Stover yield	Biological yield	HI (%)
Fertility levels (kg ha ⁻¹) Control	1638	3813	5451	30.21
50% RDF	2020	4303	6322	31.79
75% RDF	2248	4548	6796	33.01
100% RDF	2273	4589	6862	33.08
S.Em ±	55	93	128	0.59
CD (p = 0.05)	159	268	370	NS
Nano- nitrogen Control	1799	4083	5882	30.47
Nano- N foliar spray @ 1.5 ml l ⁻¹	2006	4214	6221	32.17
Nano- N foliar spray @ 3.0 ml l ⁻¹	2144	4361	6505	32.91
Nano- N foliar spray @ 4.5 ml l ⁻¹	2229	4596	6825	32.53
S.Em ±	55	93	128	0.59
CD (p = 0.05)	159	268	370	NS

4. Conclusion

Based on results of one year experiment, it may be concluded that application of RDF and nano-nitrogen produced significantly higher seed, straw and biological yield and net returns as compared to other treatments.

Therefore, application of 100% RDF may be recommended for higher production and profitability of pearl millet under semi-arid condition of Rajasthan.

management with nano-fertilizers. International Journal of Environmental Science and Technology. 2014;1(1):4-6.

References

1. Anonymous. Annual report: All India Coordinated Research Project on pearl millet. Jodhpur; 2023.
2. Liu R, Lal R. Potentials of engineered nanoparticles as fertilizers for increasing agronomic productions: A review. Science of the Total Environment. 2015;514:131-139.
3. Pandit SK, Prasad S, Singh MK, Singh YK, Niranjana IK, Kumar R. Effect of fertility level, plant density and age of seedling on transplanted pearl millet (*Pennisetum glaucum*). International Journal of Current Microbiology and Applied Sciences. 2020;9(6):1124-1131.
4. Parihar CM, Rana KS, Jat ML, Jat SL, Parihar MD, Kantwa SR, et al. Carbon footprint and economic sustainability of pearl millet-mustard system under different tillage and nutrient management practices in moisture stress conditions. African Journal of Microbiology Research. 2012;6(23):5052-5061.
5. Veronica N, Thatikunta R, Reddy NS. Crop nutrition