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Performance of CR DHAN 805 with different dose of nano urea under upland condition at Lawngtlai district Mizoram

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Abstract

During Kharif 2023-24, field experiment had been conducted with rice cv CR Dhan 805 cultivated in upland condition at Lawngtlai district Mizoram to determine the effect of different application of nano urea on length of the root, plant height, number of tiller per plant and seed yield. The study was conducted at research farm of KVK, Chawnhu, Lawngtlai, Mizoram. The height of the plant was found to be significantly high at 30, 45, 60 Days after sowing and at harvest at treatment -T₃ where nano urea was sprayed 3 times at 30, 50 and 70 DAS along with urea (100% RDN) application to the soil and bears reading of 72.6, 112.3, 145.6 and 144.6 cm respectively. The number of tillers per hill also increased from control (T₁) where no fertilizer was applied to T₃ significantly. Similarly the length of the root increased with increasing dose of nano urea application (T₁ < T₂ < T₃). Highest yield was recorded at 4.9 ton per hectare against T₃ which was 64 and 27 per cent higher than T₁ and T₂ urea (50% RDN + nano urea spray at 30 and 50 DAS). It is evident from these data that application of urea (100% RDN) to soil and spraying of nano urea at 30, 50 and 70 DAS showed superior result in the yield of upland rice and therefore could be suggested to be practiced by farmers to elevate the yield of upland rice in Lawngtlai district.

Keywords: Height, nano urea, rice, tillers

Introduction

Rice (*Oryza sativa* L.) is a primary food for around half of the world's population. In India, it occupies nearly 51.4 Mha with a total production of 149.07 MMT (Vinod *et al* 2025) ^[14]. Nutrient management in rice production is crucial as it directly affect crop growth, yield, quality and sustainability. Proper nutrient management strategies like using nano urea at critical growth stages ensures the rice receives the required nutrient in the right quantity at the right time as nitrogen is a major essential nutrient element required for plant's growth and development (Anushka *et al* 2024) ^[1]. Nanotechnology is the science of operating matter at nano scale to create new and exclusive materials and products. It has the ability to release nutrients according to crop demand promoting productivity while ensuring environmental safety. Nano urea fertilizer- an alternative to conventional fertilizer can be used as soil and foliar spray to supplement soil nitrogen reducing the requirement of nitrogen through conventional means. The efficacy of 500ml nano urea is equivalent to 45 kg of urea. Therefore use of nano urea will reduce input cost, improve the productivity, health of soil and nutrient content of produce (Sandeep *et al* 2024) ^[11]. Rice is the principal staple crop for Mizoram where more than 90 per cent of the population consumes rice on an everyday basis. The minimum rice requirement of the state per month is estimated to be about 15,000 Metric tonnes with present rice population of only 59,605 MT, producing 1.68MT/ha per year meeting only 33.11 per cent of rice requirement (Economic Survey Mizoram 2019-20). The production and productivity if rice needs to be increased dramatically, keeping this in perspective, the present study was taken up aiming to increase the yield of rice through use of nano urea.

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Materials and Methods

The experiment was conducted at KVK Chawnhu, Research Farm, Lawngtlai district, Mizoram in the kharif season of 2023-24 in upland condition under direct seeding. The variety of rice cultivated is CR Dhan 805. The nano urea used in this experiment is IFFCO nano urea (liquid) under the Fertilizer Control Order (FCO). Nano nitrogen particles size range from 20 to 50 nm and contains 4.0 per cent total nitrogen (w/v) which can be easily assimilated by plant cell through stomata. The treatment consist of T₁: control where no chemicals are applied. T₂: where nano urea is applied through spraying at 4ml/L at 30 and 50 days after sowing along with 50% RDN applied through urea in two split doses and T₃: where Nitrogen is applied to the soil through urea 100% RDN in two split doses with 4ml/L nano urea applied through spraying at 30, 50 and 70 days after sowing. The plant height and tiller are recorded at 30, 45, 60 days after sowing and during harvesting. The root length was also recorded at 30 and 45 days after sowing with yield recorded during harvest. This study has Randomized Block Design having three treatments replicated thrice. The statistical analytic study was carried out through one-way ANOVA by OPSTAT software developed at CCS HAU, Hisar (Sheoran *et al*, 1998) ^[13] and critical differences with Statistical Error Mean (SEM±) were computed.

Results

Length of the root

The root length was recorded at 30 days after sowing. The length of the root at T₃ was 16 cm which was significantly higher as compared to T₁ and T₂ which were 11.6 and 13cm. Likewise the root’s length recorded at 45 DAS has also show increasing trend from T₁ to T₃ where the lengthiest root was recorded at T₃ (31.6cm) which was 14.6% and 8.6% higher than T₁ and T₂ respectively. This could be attributed to better root proliferation due to application of urea and higher application of nano urea in the standing crop which improves crop metabolism, modulation and regulation of photosynthesis, growth and reproduction. Similar findings were reported by Mangena (2025) ^[9] and Behera *et al* (2025) ^[2].

Height of the plant

The plant height was recorded at 30, 45, 60 DAS and during harvest time. The height of the plant recorded at 30 DAS ranged from 54.6 to 74.6 cm where the highest was recorded at T₃ (72.6cm) and the lowest at control T₁. The data of plant height recorded at 45 DAS showed significant difference which was statistically comparable (*p*>0.05, 1-way ANOVA). Also the height of the plant gradually and significantly increased from T₁

to T₃ at 60 DAS (94.6, 105.6, 145.6 cm) and at harvest (95,108.3, 144.6 cm). This could be the result of higher nitrogen availability to the crop due to adequate supply through nano urea spray and uptake from urea applied to the soil at T₃. These research result were in line with Vinod *et al* (2025) ^[14], Behera *et al* (2025) ^[2]. Sehgal *et al* (2024) ^[12] also reported highest plant height against 100% RDF applied through nano urea in direct seeded rice.

Number of tillers/hill

The data showed in Table 2 depicted the number of tillers per hill which gradually increased at 30 DAS from 10.3 at control T₁ to 12.3 at T₃. Whereas the number of tillers were at par at 45 DAS. The highest tiller number were recorded against T₃ at 60 DAS and during harvest and were 22 and 17 percent higher at 60 DAS and 45 and 38 percent magnitude increase at harvest. This increase in tiller per hill could be the result of better supply of nutrients with spray of nano urea as well as better stomatal influx of nutrients to the plant. Similar findings were reported by Sandeep *et al* (2024) ^[11] in rice where the number of tillers increased in treatment with RDF and 0.4% nano urea application at tillering and panicle initiation stage. Similar findings were reported on rice cultivar Bg 250 by Rathnayaka *et al* (2018) ^[7].

Seed yield

The highest seed yield (Table 2) was recorded in T₃ where urea was applied 25 DAS with spraying nano urea at 30, 50 and 90 DAS which was 4.9 t/ha and was significantly higher over the yield of control (2.5 tha⁻¹) and T₂ (3.3 tha⁻¹). This can be imputed to higher photosynthetical activity arising from higher number of tillers which are effective and area of leaf which resulted in larger dry matter yield leading to better grain yield over other treatments. Similar opinions were asserted by Behera *et al* (2025) ^[2] in study of rice cultivated under nano urea and 75% RDF application. Rathnayaka *et al* (2018) ^[7] also reported highest yield in nano urea treated rice as compared to combination of fertilizers and nano urea at different compositions. Whereas Namasharma *et al* (2023) ^[10] reported integration of 100% RDF along with two spray of nano urea at panicle initiation and tillering stage yield higher profit and productivity in hybrid rice cultivation.

Conclusion

We may conclude from this investigation that integrating nitrogen in the form of urea at 100% RDN and spraying of nano urea at 30,50,70 days after sowing resulted in better grain yield in upland rice in Lawngtlai district, Mizoram and could be recommended for farmers practice.

Table 1: Data of Plant height and Number of tillers hill⁻¹ at 30, 45, 60 days after sowing and at harvest in paddy under different treatments

Treatment	Plant height(cm)				Number of tillers hill ⁻¹			
	30DAS	45DAS	60DAS	Harvest	30DAS	45DAS	60DAS	Harvest
T ₁	54.6	76	94.6	95	10.3	14.3	11.6	16.3
T ₂	60.3	82.6	105.6	108.3	11	14.6	12.3	17.6
T ₃	72.6	112.3	145.6	144.6	12.3	16.3	14.6	26
SEm±	2.06	3.92	3.13	2.95	0.30	0.60	0.45	1.65
CD@5%	8.32	15.81	12.64	11.9	1.25	NS	1.82	6.65

Table 2: Data of Length of Root at 30 and 45 days after Sowing and Yield at harvest

Treatment	Length of Root (cm)		Yield (t/ha)
	30 DAS	45 DAS	Harvest
T ₁	11.6	27.3	2.5
T ₂	13	29	3.3
T ₃	16	31.6	4.9
SEm±	0.60	0.94	0.17
CD@5%	2.45	NS	0.72

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Finding

The research finding suggests application of nitrogen to the soil through urea @ 100% RDN in two split doses along with 3 spray of nana urea at 30,50 and 70 Days after direct sowing showed best result in grain yield in paddy cv CR Dhan 805.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Author Contribution

Data curation, Formal analysis, Methodology, Validation, and Writing, Supervision and Writing - review and editing. - original draft.

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