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# Economics and energetics of rice (*Oryza sativa*) as influenced by neem coated urea fertilizer

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**Abstract**
Rice is the world's single most important food crop, being the primary food source for more than a third of the world's population and grown on 11% of the world's cultivated area. Agronomical trial on Paddy and Wheat crops with Neem coated Urea as source of Nitrogen has produced significantly higher yield. The experiment was laid out in randomized block design with ten treatments in three replications. Among different treatments, the maximum cost of cultivation was involved under the application of NCU based on LCC followed by PU based on LCC. The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation resulted the highest gross income and highest net return recorded under the application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation). The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) recorded higher B: C ratio followed by the application of 100% RDN as NCU in 2 splits (Basal + Max Tillering). The maximum energy input was taken under the application of 100% RDN as PU in 3 splits (Basal + Max Tillering + Panicle Initiation) and 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation). The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) resulted the highest energy output and highest energy output:input recorded under the application of control.

**Keywords:** Economics, energetics of rice, *Oryza sativa*, influenced, urea fertilizer

## Introduction
Rice is the world's single most important food crop, being the primary food source for more than a third of the world's population and grown on 11% of the world's cultivated area. Specially, it is important in case of Asians, Africans, and Latin Americans living in the tropics and subtropics. In these areas, population growth is high and will likely remain high at least for the next few decades and rice will continue to be their primary source of food. For India, it is estimated that the rice consumption in 2015-16 was 99.5 million tonnes and in 2025, the demand will be around 140 million tonnes and the world demand for rice is projected to increase by as much as 70% over the next 30 years. The International Rice Research Institute (IRRI, 2000) studied the food problem in relation to world population, and they predict that 800 million tons of rice will be required in 2025.

With consumption of fertilizer-nitrogen increasing from 0.6 million tonnes in 1965-66 to 16.95 million tonnes in 2014-15, India has emerged as the second largest consumer of N in the world. Since 1970s, urea is the major source of fertilizer-N; 83.1 % fertilizer-N was consumed as urea in 2014-15 (Anonymous, 2015) [1]. With record urea production of 24.5 million tonnes in 2015-16, its dominance as source of fertilizer N in India is likely to continue. While urea provides the most N at the lowest cost, has no storage risks and can be used for all types of crops and soils with little or no harm to the soil, use efficiency of urea-N by different crops can be as low as 20% and it rarely exceeds 50%.

## Material and Method
The study was under taken with a view to find out the Evaluation of neem coated urea fertilizer for their efficiency and its effect on increase in grain yield of rice (*Oryza sativa*)'' was conducted at the ICAR-Indian Institute of Rice Research (IIRR) Farm, Rajendranagar, Hyderabad during kharif season (2016-17). The experiment was laid out in randomized block design with ten treatments in three replications. The treatments comprised of $T_1$: 100% RDN as PU in 3 Splits (Basal + Max Tillering + Panicle Initiation); $T_2$:100% RDN as NCU in 3 Splits (Basal + Max Tillering + Panicle Initiation); $T_3$: 100% RDN as NCU in 2 Splits (Basal +

Max Tillering); $T_4$: 100% RDN as NCU as Basal; $T_5$: 75% RDN as NCU in 3 Splits (Basal + Max Tillering + Panicle Initiation); $T_6$: 75% RDN as NCU in 2 Splits (Basal + Max Tillering); $T_7$: 75% RDN as NCU as Basal; $T_8$: NCU application based LCC readings; $T_9$: PU application based LCC readings and $T_{10}$: Control. While computing the economics, different variable costs of items were considered. The cost includes expenditure on seeds, manures, fertilizers, plant protection chemicals and labour charges and were considered at the prevailing market price and presented in rupees $ha^{-1}$. Gross returns were calculated by multiplying the grain and straw yield with their respective prevailing market prices (Perin *et al*. 1979) [5]. Gross returns are presented as $ha^{-1}$. The net returns $hectare^{-1}$ was calculated by subtracting the cost of cultivation from the gross returns and presented as $ha^{-1}$. The benefit cost ratio was calculated by formula gross income divided by cost of cultivation. The energy input was calculated as the summation of energy requirement for labour, farm machineries, seed, fertilizers and irrigation used in system and expressed in (GJ $ha^{-1}$).

## Result and Discussion

Among different treatments, the maximum cost of cultivation was involved under the application of NCU based on LCC ($T_8$) (32956) followed by PU based on LCC ($T_9$) (32872). The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_2$) resulted the highest gross income (Rs. $ha^{-1}$ 93721) followed by application of 100% RDN as NCU in 2 splits (Basal + Max Tillering) ($T_3$) (Rs. $ha^{-1}$ 90218). The highest net return (Rs. $ha^{-1}$ 60944) recorded under the application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_2$) followed by application of 100% RDN as NCU in 2 splits (basal + Max Tillering) ($T_3$) (Rs. $ha^{-1}$ 57781). The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_2$) recorded higher B: C ratio (Rs. 2.86) followed by the application of 100% RDN as NCU in 2 splits (Basal + Max Tillering) ($T_3$) (Rs. 2.78). Whereas lowest gross, net profit and B: C ratio was observed under the treatment control ($T_{10}$). This result was supported by Gupta *et al.* (2016) [2], Koppad and Chandrashekaraiah (1999) [3] and Nachimuthu (2007) [4]. The maximum energy input (14.24 GJ $ha^{-1}$) was taken under the application of 100% RDN as PU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_1$) and 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_2$) followed by 100% RDN as NCU in 2 splits (Basal + Max Tillering) ($T_3$) (14.21 GJ $ha^{-1}$). The application of 100% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) (T2) resulted the highest energy output (184.34 GJ $ha^{-1}$) followed by application of 100% RDN as NCU in 2 splits (Basal + Max Tillering) ($T_3$) (176.76 GJ $ha^{-1}$). The highest energy output: input (17.75) recorded under the application of control ($T_{10}$) followed by application of 75% RDN as NCU in 3 splits (Basal + Max Tillering + Panicle Initiation) ($T_5$) (14.04). The application of control ($T_{10}$) recorded higher energy use efficiency (5.92) followed by the application of 75% RDN as NCU in 2 splits (Basal + Max Tillering) ($T_5$) (4.73 q MJ $ha^{-1}$). Whereas lowest energy input and energy output was observed under the treatment control ($T_{10}$) and energy output: input and energy use efficiency was observed under 100% RDN as NCU as Basal ($T_4$).

**Table 1:** Cost of cultivation, gross income, net income and B:C ratio of rice as influenced by neem coated urea fertilizer

| Treatments | Cost of cultivation (Rs. $ha^{-1}$) | Gross income (Rs. $ha^{-1}$) | Net income ( Rs. $ha^{-1}$) | B:C ratio |
|---|---|---|---|---|
| $T_1$: 100% PU-(Basal+ Max. till.+PI) | 32679 | 83855 | 51176 | 2.57 |
| $T_2$: 100% NCU-(Basal+ Max. till.+PI) | 32776 | 93721 | 60944 | 2.86 |
| $T_3$: 100% NCU-(Basal+ Max. till.) | 32436 | 90218 | 57781 | 2.78 |
| $T_4$: 100% NCU-Basal | 32096 | 67447 | 35350 | 2.10 |
| $T_5$: 75%NCU-(Basal+ Max. till.+PI | 32289 | 85416 | 53127 | 2.65 |
| $T_6$: 75%NCU-(Basal+ Max. till.) | 31949 | 73990 | 42041 | 2.32 |
| $T_7$: 75% NCU-Basal | 31609 | 63521 | 31912 | 2.01 |
| $T_8$: NCU-Basal on LCC | 32956 | 88184 | 55228 | 2.68 |
| $T_9$: PU-Basal on LCC | 32572 | 82647 | 49775 | 2.51 |
| $T_{10}$: Control | 29806 | 45282 | 15475 | 1.52 |

**Table 2:** Energy input, energy output, energy outout: input ratio and energy use efficiency of rice as influenced by neem coated urea fertilizer

| Treatments | Energy input (GJ $ha^{-1}$) | Energy output (GJ $ha^{-1}$) | Energy output: input ratio | Energy use efficiency (MJ $ha^{-1}$) |
|---|---|---|---|---|
| $T_1$: 100% PU-(Basal+ Max. till.+PI) | 14.24 | 164.93 | 11.58 | 3.90 |
| $T_2$: 100% NCU-(Basal+ Max. till.+PI) | 14.24 | 184.34 | 12.94 | 4.36 |
| $T_3$: 100% NCU-(Basal+ Max. till.) | 14.21 | 176.76 | 12.44 | 4.21 |
| $T_4$: 100% NCU-Basal | 14.18 | 132.66 | 9.36 | 3.15 |
| $T_5$: 75%NCU-(Basal+ Max. till.+PI | 11.97 | 168.00 | 14.04 | 4.73 |
| $T_6$: 75%NCU-(Basal+ Max. till.) | 11.94 | 145.53 | 12.19 | 4.10 |
| $T_7$: 75% NCU-Basal | 11.91 | 124.94 | 10.49 | 3.53 |
| $T_8$: NCU-Basal on LCC | 13.06 | 173.45 | 13.28 | 4.47 |
| $T_9$: PU-Basal on LCC | 13.06 | 162.56 | 12.45 | 4.19 |
| $T_{10}$: Control | 5.06 | 89.80 | 17.75 | 5.92 |

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