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Performance of different percentage of urea as foliar fertilizer on growth and development of rice (Rabi dhan1)

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1. Abstract:

Nitrogen can dramatically stimulate plant productivity as well as yield potential of intensified agriculture system. The unavailability of Nitrogen fertilizer specially urea during critical period (sowing season, drought, flood.) hamper the rice production. It is noticed in literature that the effectiveness of nitrogen fertilizer increased if it is applied in plants through foliage along with soil application. Present research work was planned to evaluate this theme so that the loss of yield due to unavailability of urea can be reduced by foliar application at various growth stagesof rice. A research work was conducted to examine the "Performance of different percentage of urea as foliar fertilizer on growth and development of rice (Rabi dhan 1)." at the Agronomy and Agricultural extension Department Field, University of Rajshahi, Bangladesh from December 2022-May 2023. Rabi Dhan-1 rice variety with six different percentage of urea as foliar application were used for this experiment. 1. T_1= N0% Control, 2. T_2= 65% of recommended dose (N 50% as SA + 15% as FA), 3. T_3= 70% of recommended dose (N50% as SA + 20% as FA), 4. T_4= 75% of recommended dose (N50 % as SA + 25 % as FA), 5. T_5= 80% ofrecommended dose (N60% as SA + 20% as FA) , 6. T_6= N100% Soil application (Traditional practice). The experiment was laid out in a randomized complete block design with threereplications. The significant effect of liquid fertilizer was found on almost all the parameters under studied. All the phenological and growth parameters showed the highest performance in T_4
= 75% of recommended dose (N50 % as SA+ 25 % as FA) and lowest in T_1= N0% Control. The result showed that the phenological characters like plant height, total number of tiller hill-^{1} was highest inT_4 while the lowest was in T_1. Plant height was increased with the increase of the age of plants. Chlorophyll content increased slowly at the early stage of crop growth and later declined. All the yield contributing characters like plant height, total number of tiller hill-^{1}, effective tiller hill-^{1}, panicle length, number of grains panicle-^{1} , number of filled grain panicle-^{1}
,1000 grain weight and grain yield were varied significantly due to different doses of fertilizer

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application.

Keywords: Nitrogen, Urea, Foliage, Phenological, Replication, Soil application.

2. Introduction:

Rice (Oryza sativa L.) is a vital cereal crop and the staple food for the population of Asia (Lin *et al*, 2022). It is the important food for four hundred millions of people in Africa and Latin America (IRRI 2010). Agriculture is one of the dominant sectors in Bangladesh measuring in terms of employment of resources and of income generation. About 80% peoples of this country depend on agriculture directly or indirectly, especially on rice cultivation. In Bangladesh, population is increasing at an alarming rate while the agricultural land is decreasing day by day. Hence, it's high time to take attempts for increasing productivity of rice. Without fertilizer, rice plant cannot produce much yield. Among different nutrients, Nitrogen is the most important key input for crop growth and development. Applied nitrogen fertilizer in agricultural field is notused 100%. Some portion of the N is wasted – lost through leaching, run-off, volatilization (atmospheric evaporation) and de-nitrification (Belal *et al*, 2020). Excessive use of N fertilizer is one of the major concerns in sustainable agriculture for its decreased N-utilization efficiency by crops and increased N release to the environment, resulting atmosphere and water systems pollution (Zhu et al. 1997). Researchers have tried many ways to evaluate the fertilizer use by improving fertilizer nutrient use efficiency and minimizing environmental impacts. It has been observed that foliage along with soil application of urea (Nitrogenous fertilizer) is more efficient than only in soil application (Mosluh et al, 1978) as just 20-50% of the soil applied nitrogen can be used by annual crops (Bajwa 1992). Even several researchers have noticed that foliar application of nitrogen has much recovery than soil application (Shim et al. 1972, Klein and Weinbaum 1985). This study attempts to evaluate the effective percentage of urea fertilizer application for growth and development of rice plant.

3. Methods and Materials

3.1 Ethical approval:

The experiment was conducted at the Agronomy and Agricultural extension Department Field, University of Rajshahi, Bangladesh during the period from December 2022-May 2023.

3.2 Location:

The experimental field was situated at the western side of the Department of Agronomy and Agricultural Extension, University of Rajshahi. Geographically the experimental field was located at 24°22′36″ N latitude and 88°38′27″ E longitude at an elevation of 20m above the sea level to High Ganges River Flood Plain AEZ-11. The land was medium high, flat, well drained.

3.3 Soil:

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The experimental plot was poorly drained soil with moderately slow permeability. The top soil was silty loam and slightly alkaline in reaction.

3.4 Climate:

The experimental area was under subtropical climate characterized by heavy rainfall during kharif season (April to September) and low temperature and scanty rainfall during the rabi season (October to March).

3.5 Variety and treatment:

One rice variety (Rabi dhan 1) was used for this experiment. Rabi dhan 1 was collected from Agronomy and Agricultural Extension Department, Rajshahi University, Bangladesh. This variety is popular and widely cultivated in our country.

Rabi Dhan-1 rice variety with six different levels of urea as foliar application were used:

1. T_1= N0% Control
2. T_2= 65% of recommended dose (N 50% as SA + 15% as FA)
3. T_3= 70% of recommended dose (N50% as SA + 20% as FA)
4. T_4= 75% of recommended dose (N50 % as SA + 25 % as FA)
5. T_5= 80% of recommended dose (N60% as SA + 20% as FA)
6. T_6= N100% Soil application (Traditional practice)

*SA=Soil Application *FA=Foliar Application

3.6 Experimental design and field management:

The experiment was laid out in a Randomized Completely Block Design (RCBD) with three replications. Firstly, the entire field was divided into three blocks. Each of the replications represented a block in the experiment. Then each block was divided into six units. Total numbers of unit plot were 18 and each plot size was 10 m^2 (4m×2.5m). The distance maintained between the unit plots and replications were 0.5m and 1.0m respectively. The sprouted seeds were sown uniformly in a well-prepared seedbed on 5 December 2022. The experimental plot was finally made ready for transplantation on 20 January 2023. The layout of the experimental field was done on 24 January, 2023.

3.7 Fertilizer management:

The experimental field was fertilized with TSP, MoP, Gypsum and ZnS04 at the rate of 90 kg ha^{-1}, 112 kg ha^{-1}, 75kg ha^{-1} and 7.5kgha^{-1} respectively (Source: Soil Resources Development Institute Regional Laboratory, Rajshahi. SRDI, Rajshahi). Urea fertilizer was applied as per experimentation. Whole TSP, MoP and Gypsum were applied during the final land preparation and were thoroughly mixed to the soil. At all the plots except control plots urea was applied as foliar application, at three splits at different (20 DAT, 45DAT and 60 DAT) days after transplant (DAT).

3.8 Seedbed preparation:

Healthy seeds were collected maintaining standard method. Then seeds were soaked in water in bucket for 24 hours. Seeds were taken out of water and spread thickly on polythene sheet. A

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covering was done with wet gunny bags under dark condition for sprouting. The seeds were started sprouting after 48 hours and seeds were sown in the seedbed after 72 hours.

3.9 Raising of Seedling:

A piece of medium high land was puddle perfectly with country plough followed by cleaning and leveling with a ladder. Weeds were removed well. Irrigation was given in it as and when necessary. Pest and disease infestation were prevented carefully.

3.10 Transplanting of seedling:

Forty-six days old seedling was transplanted in the well-puddled plots. One seedling was planted hill $^{-1}$. Hill to hill distance was 20cm and plant to plant was 20cm.The plot size was 10m ^{2}.

3.11 General observation:

Regular observations were done to observe the growth stages of the crops. In general, the field looked nice with normal green plants. They were vigorous and fresh. Tiller growth of all treatment was satisfactory. The plant did not lodge in any of the plot. 3.5 Sampling, harvesting, threshing, cleaning and processing Maturity of crops was determined when about 80-85 percent grains becomes golden yellow.

3.12 Harvest:

Ten hills (excluding border hill) were randomly selected from each plot and tagged carefully for recording necessary data. Then whole plot was harvested at full maturity on 10 May 2023. The harvested crop of each plot was bundled, tagged and brought to the threshing floor. The harvested crop was threshed, cleaned and sun dried to record the yields of grain and straw plot wise and converted into tha^{-1}.

3.13 Recording of data at harvest:

The harvested crop of each plot was bundled, tagged and then brought to the threshing floor was threshed, cleaned and sun dried to record the yields of grain and straw plot wise and converted into t ha^{-1}. Three plants plot-1 were randomly taken from any side of the plot for measuring the total dry matter. Then the samples (with an envelope) were dried in an oven at 60^{0}C for 72 hours,were weighed separately by using an electric balance for leaf, stem, root dry weight as well as panicle dry weight.

3.14 Statistical analysis:

The compilation and tabulation of recorded data of different parameters was done for statistical analysis. The “Analysis of variance” (ANOVA) was done with the help of computer package program “Statview”. The mean differences were adjudged by Duncan’s Multiple Range Test. Simple correlation coefficient was done to determine the relationship between grain yield and its components with the help of computer package SPSS.

4. Results:

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4.1 Effect of nitrogen (liquid) treatments on plant height at different days after transplanting:

The effect of liquid fertilizer on plant height was significant at different DAT (Table 1). Plant height was increased progressively with the advancement of time. The increase of plant height was slow at initial stages, but it accelerated on later DAT. From the results it was noticed that, treatment T_4 showed the highest plant height (61.03a) and the lowest

Table 1. Effectivity of urea fertilizer as foliar application on plant height:

PLANT HEIGHT (cm)				
Treatment	**30DAT**	**60DAT**	**90DAT**	**120DAT**
T_1	33.63c	55.89c	68.79e	72.13d
T_2	55.59b	60.82a	75.35d	100.99b
T_3	56.42b	71.00a	89.00b	97.99c
T_4	61.03a	72.50a	94.87a	105.37a
T_5	57.14b	70.46a	85.66c	98.75bc
T_6	56.01	68.83a	85.81c	99.36bc
LSD	0.05	0.05	0.05	0.05
CV	2.68	3.57	2.02	1.59

plant height (33.63c) was observed in T_0 (control) treatment at 30 DAT. The plant height was significantly highest (105.37a) in T_4 treatment and the plant height was significantly lowest (72.13d) in T_0 treatment at 120 DAT. Besides, Kenbaev & Sade (2002), reported these similar results, Soylu et al. (2005) and Arif et al. (2006), recorded that the increase with foliar application of different nutrients individually or in combination in plant height of cereal crop.

Table 2. Effectivity of urea fertilizer as foliar application on number of Leaf:

Treatment	30DAT	60DAT	90DAT
T_1	5.65d	10.83c	14.54d
T_2	7.54ab	14.01ab	18.39b
T_3	7.23abc	13.17ab	17.41b
T_4	8.13a	15.23a	22.44a
T_5	6.36cd	12.18bc	16.01c
T_6	6.93bc	13.01b	14.66d

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LSD		0.05	0.05	0.05
CV		7.57	8.56	3.79

The effect of liquid fertilizer on number of leaf was significant at different DAT (Table 2). With the advancement of time, number of leaf was increased progressively. The increase of number of leaf was slow at initial stages, but it accelerated on later DAT. From the results it was observed that, treatment T_4 showed the highest number of leaf (6.36a) and the lowest (5.65d) was observed in T_0 (control) treatment at 30 DAT. The number of leaf was significantly highest (22.44a) in T_4 treatment and the significantly lowest (14.54d) in T_0 treatment at 90 DAT.

Table 3. Effectivity of urea as Foliar-fertilizer on number of tiller:

Treatment		30DAT	60DAT	90DAT	120DAT
T_1		4.96c	6.03d	6.13d	6.74d
T_2		6.49b	8.72c	13.73c	15.10c
T_3		6.49b	11.78b	14.99ab	17.09ab
T_4		7.62a	13.36a	15.88a	18.98a
T_5		6.87ab	13.57ab	14.16bc	17.09ab
T_6		6.49b	13.39ab	13.58c	16.44c
LSD		0.05	0.05	0.05	0.05
CV		8.32	8.75	4.99	6.79

The liquid fertilizer had significant effect on total number of tillers hill-1 at the observation of 30 DAT (Table 3). Results revealed that, total number of tillers hill-^{1} was increased progressively with the advancement of time. The treatment T_4 showed the highest total number of tillers hill-1 (7.62a) and the lowest (4.96c) was found in the treatment T_1 at 30 DAT. At 90 DAT, the treatment T_4 showed the highest total number of tillers (15.88a) and the lowest (6.13) was found in the treatment T_1. At 120 DAT, the treatment T_4 showed the highest total number of tillers hill-^{1} (18.98a). Whereas, lowest total number of tillers hill-^{1} (6.74d) was observed in the treatment T_1. . H. Ferdous (2013) recorded the highest number of total tillers hill-1 on Boro rice cv. BRRI dhan29 from foliar application of 3% urea solution.

Table 4. Effectivity of urea fertilizer as foliar application on chlorophyll content (Spadmeter check):

Treatment		70DAT	90DAT
T_1		25.53d	25.04c

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T_2		41.13bc	45.78a
T_3		40.90c	40.87b
T_4		43.37ab	45.30a
T_5		43.47ab	41.47b
T_6		43.71a	41.51b
LSD		0.05	0.05
CV		3.27	4.96

The liquid fertilizer had significant effect on chlorophyll content at the observation (Table 4). Results revealed that, chlorophyll content was increased progressively with the application of liquid fertilizer whereas the control showed 25.53d. Chlorophyll content was counted two times. Chlorophyll content plays an important role in photosynthesis and production. Leaf N content increases with the application of N fertilizer. Higher N content in leaves increases chloroplast activity as well as photosynthetic productivity (Amin Fathi, 2022).

Table 5. Effectivity of urea fertilizer as foliar application on effective tiller number:

Treatment		90DAT	120DAT
T_1		5.52c	4.77e
T_2		12.72b	10.97d
T_3		11.81b	15.68ab
T_4		14.92a	17.01a
T_5		12.96ab	15.26bc
T_6		12.32b	13.41c
LSD		0.05	0.05
CV		10.08	6.79

The liquid fertilizer had significant effect on total number of tillers hill-^{1} at the observation (Table 5). Results revealed that, total number of effective tillers hill-1 was increased progressively with the advancement of time. Effective tiller counted two times. The treatment T_4showed the highest number of effective tillers hill-^{1} (14.92a) and the lowest (5.52c) was found in the treatment T_1 at 90 DAT. At 120 DAT, the treatment T_4 showed the highest total number of effective tillers (17.01a) and the lowest (4.77e) was found in the treatment T_1.

Table 6. Effectivity of urea as foliar application on panicle length:

Treatment	90DAT	120DAT

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T_1		11.49d	12.59c
T_2		15.20ab	23.16a
T_3		15.00ab	21.31b
T_4		15.75a	21.77ab
T_5		13.74c	20.85b
T_6		14.33bc	21.84ab
LSD		0.05	0.05
CV		4.66	6.85

Liquid fertilizer as a plant nutrient contributes in panicle formation as well as panicle elongation and as a result panicle length was increased by spraying liquid fertilizer. Nitrogen and liquid fertilizer had significant influence on panicle length (Table 6). The highest panicle length (15.75a) was observed in T_4 and the lowest panicle length (11.49d) was found in control liquid fertilizer at 90 DAT. At 120 DAT, the highest panicle length (21.77ab) was observed in T_4 and the lowest panicle length (12.59c) was found in control liquid fertilizer. The similar result was consistent with Patrick and Hoskins (1974).

Table 7. Effectivity of urea as of foliar application on grain number per plant, 1000 grain weight and yield:

Treatment		Filled grain no./panicle	1000grain weight	Yield(to/ha)
T_1		56.78d	18.04d	4.2c
T_2		107.92c	20.90c	5.03b
T_3		120.45b	23.76ab	5.57a
T_4		156.71a	24.37a	5.77a
T_5		118.27b	22.78b	5.53a
T_6		120.24b	23.12ab	5.63a
LSD		0.05	0.05	0.05
CV		3.95	3.71	4.27

Nitrogen and liquid fertilizer showed significant variation in term of number of filled grain. Highest number of filled grain panicle-^{1} (156.71a) was obtained from T_4, while the lowest (56.78d) was produced at control treatment (Table 7).

The effect of Nitrogen liquid fertilizer showed a significant influence on 1000 grain weight. Results presented (Table 7) that the highest 1000 grains weight (24.37a) was obtained from T_4 whereas, the lowest one (18.04d) was obtained from control treatment.

There was a significant variation in respect of grain yield due to nitrogen liquid fertilizer. Highest grain yield was showed in T_4 (5.77a tha-^{1}) whereas, the lowest grain yield (4.2c tha-^{1})

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was obtained from control (Table-7). Alston (1979), Strong (1982) and Gooding and Devies (1992) also reported increased grain yield from foliar application of N and P, individually or in combination.

Table 8. Effectivity of urea as of foliar application on Straw yield, Biological yield and Harvest index.

Treatment	Straw yield (ton/ha)	Biological yield(ton/ha)	Harvest index (%)
T_1	5.4d	9.6d	43.57a
T_2	7.2c	12.23c	41.44b
T_3	7.5bc	13.30b	43.36ab
T_4	8.6a	14.16a	39.30c
T_5	7.6b	13.13b	42.13ab
T_6	7.6b	13.26b	42.44ab
LSD	0.05	0.05	0.05
CV	2.89	2.61	2.58

Straw yield of rice differed significantly due to nitrogen and liquid fertilizer. Nitrogen liquid fertilizer gave significantly different straw yields (Table-8). Highest straw yield was showed in T_4 (8.6a) whereas, the lowest one (5.4d) was obtained from control treatment. Similar result was presented by Subhendu et al. (2003). This result was also in agreement with the findings of Patrick and Hoskins (1980).

The nitrogen liquid fertilizer had significant effect on biological yield. Results presented (Table 8) that numerically the highest biological yield was found in T_4 (14.16a) and the lowest was obtained at control (9.6d) treatment. Gooding and Devies (1992) noticed similar result.

Harvest index is the ratio of grain yield and biological yield. Nitrogen liquid fertilizer had influenced the harvest index non-significantly. Highest harvest index was recorded in T_1 (43.57%) while the lowest harvest index in T_4 (39.30c).

5. Conclusion:

The liquid fertilizer had significant effect on almost all the parameters under studied with a few exceptions. In most cases, the highest value for plant phenological characteristics like plant height, total number of tiller hill-^{1} was observed from the treatment T_4 (liquid fertilizer) and the lowest value was found in the treatment T_1 (control or non- nitrogenous fertilizer) at different days after transplanting with some exception.

Based on the results of this study, it can be concluded that liquid fertilizer performed the best for almost all the plant, growth, yield and yield components and consequently it produced the highest grain yield. Among six treatments T_4 performed the best for almost all the plant, growth,

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yield and yield components and consequently it produced the highest grain yield and showed the highest growth and yield performance.

The farmers can be recommended to use liquid fertilizer for obtaining the highest growth and yield performance in rice cultivation than by applying nitrogen fertilizer only in soil. Further studies are necessary to draw a definite conclusion.

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6. References

Fathi, A. (2022). Role of nitrogen (N) in plant growth, photosynthesis pigments, and N use efficiency: A review. Agrisost, 28, 1-8. https://doi.org/10.5281/zenodo.7143588

Arif, M., Chohan, M.A., Ali, S., Gul, R. and Khan, S.2006. Response of rice to foliar application of nutrients. J. Agric. Bio. Sci., 1(4):30-34. https://www.researchgate.net/publication/236620915_Response_of_wheat_to_foliar_application_of_nutrients

Alston, A.M.1979. Effects of soil water content and foliar fertilization with nitrogen phosphorous in late seasons on yield and composition of rice. Aus. J. Exp. Agric.,30(4):577-585. http://dx.doi.org/10.1071/AR9790577

Belal H. M 1, a,* Sarker R.R. 1,b (2020) Effect of Different Forms and Levels of Urea Fertilizer on Rice (Oryza sativa L) and Mineral Nitrogen Status in Soil. Turkish Journal of Agriculture - Food Science and Technology, 8(6): 1315-1319, 2020 DOI: https://doi.org/10.24925/turjaf.v8i6.1315-1319.3326

Bajwa, M.I. 1992. Soil fertility management for sustainable agriculture. p. 7-25. In: Proceeding 3rd National Congress of Soil Science, March 20-22, 1990, Lahore, Pakistan =Bajwa%2C+M.I.+1992.+Soil+fertility+management+for+sustainable+agriculture.+p.+7-25.+In%3A+Proceeding+3rd+National+Congress+of+Soil+Science%2C+March+20-22%2C+1990%2C+Lahore%2C+Pakistan+&qs=n&form=QBRE&sp=-1&lq=0&pq=bajwa%2C+m.i.+1992.+soil+fertility+management+for+sustainable+agriculture.

Gooding, M.J. and Davies, W.P.1992. Foliar urea fertilization of cereals: A review. Fert.Res.32:209-222. Gooding%2C+M.J.+and+Davies%2C+W.P.1992.+Foliar+urea+fertilization+of+cereals%3A+A+review.+Fert.Res.32%3A209-222&qs=n&form=QBRE&sp=-1&lq=0&pq=gooding%2C+m.j.+and+davies%2C+w.p.1992.+foliar+urea+fertiliz

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ation+of+cereals%3A+a+review.+fert.res.32%3A209-222&sc=0-103&sk=&cvid=68478E85C1C24FC88269D91E0CE057BF&ghsh=0&ghacc=0&ghpl=

Ferdous, H., 2013. Effect of soil and foliar application of urea on BRRI dhan29 .M.S. Thesis, Department of Agronomy, Bangladesh Agricultural University Mymemsingh. pp. 19-39.FAO (Food and Agriculture organization).2000. Ferdous%2C+H.%2C+2013.+Effect+of+soil+and+foliar+application+of+urea+on+BRRI+dhan29+.M.S.+Thesis%2C+Department+of+Agronomy%2C+Bangladesh+Agricultural+University+Mymemsingh.+pp.+19-39.FAO+%28Food+and+Agriculture+organization%29.2000.&qs=n&form=QBRE&sp=-1&lq=0&pq=ferdous%2C+h.%2C+2013.+effect+of+soil+and+foliar+application+of+urea+on+brri+dhan29+.m.s.+thesis%2C+department+of+agronomy%2C+bangladesh+agricultural+university+mymemsingh.+pp.+19-39.fao+%28food+and+agriculture+organization%29.2000.&sc=0-220

Klein, I. and S.A. Weinbaum.1985. Foliar application of urea to olive: Translocation of urea nitrogen as influenced by sink demand and nitrogen deficiency. Journal of American Society for Horticultural Sci., 109: 356–360. DOI:10.21273/jashs.109.3.356

Kenbaev, B. and Sade, B. 2002. Response of rice cultivars grown on zincdeficient soil to zinc application. Comm. Soil Sci. Plant Anal., 33(3-4): 533-544 Kenbaev%2C+B.+and+Sade%2C+B.+2002.+Response+of+rice+cultivars+grown+on+zinc+deficient+soil+to+zinc+application.+Comm.+Soil+Sci.+Plant+Anal.%2C+33%283-4%29%3A+533-544&qs=n&form=QBRE&sp=-1&lq=0&pq=+kenbaev%2C+b.+and+sade%2C+b.+2002.+response+of+rice+cultivars+grown+on+zinc+deficient+soil+to+zinc+application.+comm.+soil+sci.+plant+anal.%2C+33%283-4%29%3A+533-544&sc=0-154&sk=&cvid=ED521DA2010E4C9FA56CA8BAF7C1A2A3&ghsh=0&ghacc=0&ghpl=

Mosluh, K.I., J. Seth and A.K.K. Rashid. 1978. Efficiency of urea spray for wheat crop under irrigated conditions in Iraq. Plant and Soil. 49(1): 175-178. https://link.springer.com/article/10.1007/BF02149918

Lin. L 1, 2, Zheng Z. 1,2, Hua T. 1,2, ASHRAF U. 1,3, HAMOUD Y.A. 4, ALAA A.A. 5, Xiangru T. 1,2, Meiyang D. 1,2, Zaiman W.6, Shenggang P. 1,2 (2022) Nitrogen Deep Placement Combined with Straw Mulch Cultivation Enhances Physiological Traits, Grain Yield and Nitrogen Use Efficiency in Mechanical Pot-Seedling

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Transplanting Rice. Rice Science, 29(1): 89□100 Lin.+L+1%2C+2%2C+Zheng+Z.+1%2C2%2C+Hua+T.+1%2C2%2C+ASHRAF+U.+1%2C3%2C+HAMOUD+Y.A.+4%2C+ALAA+A.A.+5%2C+Xiangru+T.+1%2C2%2C+Meiyang+D.+1%2C2%2C+Zaiman+W.6%2C+Shenggang+P.+1%2C2+%282022%29+Nitrogen+Deep+Placement+Combined+with+Straw+Mulch+Cultivation+Enhances+Physiological+Traits%2C+Grain+Yield+and+Nitrogen+Use+Efficiency+in+Mechanical+Pot-Seedling+Transplanting+Rice.+Rice+Science%2C+29%281%29%3A+89□100&qs=n&form=QBRE&sp=-1&lq=0&pq=lin.+l+1%2C+2%2C+zheng+z.+1%2C2%2C+hua+t.+1%2C2%2C+ashraf+u.+1%2C3%2C+hamoud+y.a.+4%2C+alaa+a.a.+5%2C+xiangru+t.+1%2C2%2C+meiyang+d.+1%2C2%2C+zaiman+w.6%2C+shenggang+p.+1%2C2+%282022%29+nitrogen+deep+placement+combined+with+straw+mulch+cultivation+enhances+physiological+traits%2C+grain+yield+and+nitrogen+use+efficiency+in+mechanical+pot-seedling+transplanting+rice.+rice+science%2C+29%281%29%3A+89□100&sc=0-357&sk=&cvid=0DF721A5ED3B40BDB91EF6FE10F15FB6&ghsh=0&ghacc=0&ghpl=

Soylu, S., Sade, B., Topal, A., Akgun, N. and Gezgin, S. 2005. Responses of rice cultivars to boron application in low boron calcareous soil. Turk.J. Agric.,29:275-286 Soylu%2C+S.%2C+Sade%2C+B.%2C+Topal%2C+A.%2C+Akgun%2C+N.+and+Gezgin%2C+S.+2005.+Responses+of+rice+cultivars+to+boron+application+in+low+boron+calcareous+soil.+Turk.J.+Agric.%2C29%3A275-286+&form=MSNSB1&refig=f77ce9ee9f794d5193792967f17338ad&mkt=en-xl&ocid=wispr

Subhendu, M., Swamy, S.N. and Mandal, S. 2003. Effect of time of nitrogen application on yield attributes of rice (Oriza sativa L.) cultivars. Environ. Ecol. 2 (2): 411-413. Subhendu%2c+M.%2c+Swamy%2c+S.N.+and+Mandal%2c+S.+2003.+Effect+of+time+of+nitrogen+application+on+yield+attributes+of+rice+(Oriza+sativa+L.)+cultivars.+Environ.+Ecol.+2+(2)%3a+411-413.&qs=n&sp=-1&lq=0&pq=subhendu%2c+m.%2c+swamy%2c+s.n.+and+mandal%2c+s.+2003.+effect+of+time+of+nitrogen+application+on+yield+attributes+of+rice+(oriza+sativa+l.)+cultivars.+environ.+ecol.+2+(2)%3a+411-413.&sc=0-173&sk=&cvid=14AF1FDA8D244D1490ACF3FCFB489B60&ghsh=0&ghacc=0&ghpl=&FPIG=4F2E7BD3DCE14B37BD51A03DF13F869D&first=11&FORM=PERE

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

Strong, W.M.1982. Effect of late application of nitrogen on the yield and protein content of wheat. Aust .J. Exp. Agric. and Anim. Hus.,22:54-61. DOI:10.1071/EA9820054

Shim, K., J.S. Titus, and W.E. Splittstoesser. 1972. The utilization of postharvest urea sprays by senescing apple leaves. Journal of American Soc. Horticultural Sci., 97: 592–596 https://link.springer.com/article/10.1007/BF02943768

Patrick, R.M. and Hoskins, F.H.1980. Effect of foliar application of nitrogenous fertilizer on yield and yield contributing charecters of rice. Cereal Chem.51:84-95. Patrick%2c+R.M.+and+Hoskins%2c+F.H.1980.+Effect+of+foliar+application+of+nitrogenous+fertilizer+on+yield+and+yield+contributing+charecters+of+rice.+Cereal+Chem.51%3a84-95.&qs=n&sp=-1&lq=0&pq=patrick%2c+r.m.+and+hoskins%2c+f.h.1980.+effect+of+foliar+application+of+nitrogenous+fertilizer+on+yield+and+yield+contributing+charecters+of+rice.+cereal+chem.51%3a84-95.&sc=0-165&sk=&cvid=160C3395AC2F4D95B79718804350A9D5&ghsh=0&ghacc=0&ghpl=&FPIG=99956794B3234DBCA89761B692F6DE97&first=21&FORM=PERE1

Patrick, R.M. and Hoskins, F.H. 1974. Protein and amino acid content of rice as affected by application of nitrogen fertilizer. Cereal Chem. 51:84-95 https://www.cerealsgrains.org/publications/cc/backissues/1974/Documents/CC1974a09.html

Zhu ZL. 1997. Fate and management of fertilizer nitrogen in agrocosystems. In: Zhu ZL, Wen QX & Freney JR (eds) Nitrogen in Soils of China 239–279. Kluwer Academic Publishers, Dordrecht/Boston/London Zhu ZL. 1997. Fate and management of fertilizer nitrogen in agrocosystems. In: Zhu ZL, Wen QX & Freney JR (eds) Nitrogen in Soils of China 239–279. Kluwer Academic Publishers, Dordrecht/Boston/London