Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2636

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 476-479 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Incubation Study of Major Nutrients as Influenced by Different Slow Releasing Fertilizers in Coastal Karnataka

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Received: 26.02.2017 | Revised: 8.03.2017 | Accepted: 10.03.2017

ABSTRACT

The steady increase in population growth and food demand and the continuous reduction in per capita cultivated land and increase in fertilizer application worldwide. Fertilizers in general and nitrogenous fertilizers in particular have made a major contribution towards agricultural productivity. Recovery per cent of applied nitrogen is only less than thirty to forty per cent. The factors that contribute to the poor recovery of nitrogen by plants are as a result of rapid dissolution of the applied fertilizer materials and release of more mineral nitrogen than what is used by the plant or conserved by the soil in the available forms. Urea is the least efficient among the nitrogen sources. High loss and low nitrogen use efficiency demand and the factors responsible for such wastage of expensive input has to be studied. The dynamics of release of N from these fertilizers is likely to be studied. The dynamics of release of N from these fertilizers is likely to be influenced by soil characteristics as well as moisture condition. Hence, an attempt was made to know the releasing pattern of coated urea fertilizers. An incubation experiment was conducted with neem oil coated urea, mud coated urea, cashew nut shell liquid coated urea and pongamia oil coated urea. Thus, use of neem oil coated urea prolonged the nitrogen availability for the crop growth thereby minimized the losses of nitrogen and improved the nitrogen use efficiency.

Key words: *neem oil coated urea, mud coated urea, cashew nut shell liquid coated urea, pongamia oil coated urea and nitrogen use efficiency.*

INTRODUCTION

The efficiency of urea is a serious problem especially in coastal area of rice. The 50 to 70 per cent of the nitrogen applied as prilled urea is lost through various mechanisms such as volatilization, denitrification and leaching. However, split application of urea is reduced these losses upto certain extent and favoured the grain yield and N· use efficiency in rice, prilled urea treated with neem oil improve the grain yield and N use efficiency due to minimising the release rate and available for longer period in soil.

Cite this article: Bhanuprakash, H.R., Hanumanthappa, M., Athaulla, P., Kamath, K.V.S. and Jayaprakash, S.M., Incubation Study of Major Nutrients as Influenced by Different Slow Releasing Fertilizers in Coastal Karnataka , *Int. J. Pure App. Biosci.* **5(4):** 476-479 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2636

This technique of urea application is appeared to be more effective for increasing use efficiency in rice. Recovery per cent of applied nitrogen is only less than thirty to forty per cent. The factors that contribute to the poor recovery of nitrogen by plants are as a result of rapid dissolution of the applied fertilizer materials and release of more mineral nitrogen than what is used by the plant or conserved by the soil in the available forms. Urea is the least efficient among the nitrogen sources. High loss and low nitrogen use efficiency demand and the factors responsible for such wastage of expensive input has to be studied. The dynamics of release of N from these fertilizers is likely to be studied. The dynamics of release of N from these fertilizers is likely to be influenced by soil characteristics as well as moisture condition. Hence, an attempt was made to compare the releasing pattern of newly developed coated fertilizers.

MATERIALS AND METHODS

A Field experiment was conducted at Zonal Agricultural and Horticultural Research Station, Brahmavar, University of Agricultural and Horticultural Sciences, Shivamogga during kharif 2015 coming under Coastal zone of Karnataka (Zone- 10). The experimental site is situated between 130 24' North latitude and 740 45' East longitude and an altitude of 10 meters above mean sea level. The soil was sandy loam in texture and acidic in nature (pH= 5.18). It has medium organic carbon content (0.60 %) and EC 0.048 dSm^{-1}. A pot culture experiment (Incubation study) was conducted to study the nutrient release pattern of different slow releasing nitrogenous fertilizers, they are neem oil coated urea, mud coated urea, pongamia oil coated urea and cashew nut shell liquid coated urea. These four slow releasing fertilizers were replicated five times and kept in open field conditions.

Treatment details

T_1= 100 % RDN through neem oil coated urea
T_2= 100 % RDN through mud coated urea
T_3= 100 % RDN through pongamia oil coated urea
T_4= 100 % RDN through cashew nut shell liquid coated urea

Note: a. RDF (60:30:60 NPK Kg ha^{-1})
b. Phosphorus and potassium is common to all treatments through rock phosphate and muriate of potash.
c. RDN: Recommended Dose of Nitrogen

Procedure followed

The sandy loam soil of the experimental area was filled in 20 bags, each having an average weight of 10 kg and analysed for initial NPK status (305.24, 54.62 and 207 NPK kg ha^{-1}). It was kept for 5 days for settlement with frequent watering. The neem oil coated urea, mud coated urea, pongamia oil coated urea and cashew nut shell liquid coated urea were placed 10 cm below the surface and watered regularly to maintain saturated condition. The soil samples were drawn at 0-30 cm depth below placement of slow release source in different intervals at 2 days, 4 days, 8 days, 15 days, 30 days, 45 days and 60 days. These samples were taken to laboratory and analysed for its available NPK status.

RESULT AND DISSCUSSION

Coated urea fertilizers were used for determining release pattern of nitrogen. In general with increase in incubation days the release of N form significantly increased up to 60 days then after it decreased probably due to loss of nitrogen by volatilization and denitrification. In this study moisture status was maintained at field capacity so that inorganic fertilizers easily dissolved and released the nutrient. Among the treatments, application of 100 per cent RDN through mud coated urea recorded highest available nitrogen (341.81 kg ha^{-1}) around 30 days. For 45 and 60 days after incubation higher value of available nitrogen (352.13 and 381.32 kg ha^{-1} available nitrogen at 45 and 60 days after incubation respectively) (Table 1) was obtained by the treatment, 100 per cent RDN through neem oil coated urea. Neem oil coated urea recorded highest value of available nitrogen due to slow releasing property and also reduced different losses of nitrogen.

The above results are in agreement with the findings of Suganya *et al.*[4] and Mubarak *et al*[2].

The same coated urea fertilizers were also influenced the releasing pattern of phosphorus and potassium (Table 2 & 3). In general with increase in incubation days the release of phosphorus and potassium were also increased up to 60 days then after it decreased probably due to losses. In this study moisture status was maintained at field capacity so that inorganic fertilizers easily dissolved and released the nutrient. Among the treatments, application of 100 per cent RDN through neem oil coated urea recorded highest available phosphorus and potassium (83.81 and 262.69 kg ha^{-1} respectively.) upto 60 days, because of interaction effects of these coated fertilizers which is followed 100 per cent through cashew nut shell liquid coated urea applied treatment plots recorded highest amount of phosphorus and potassium at different stages of incubation. The results were also confirmed by Kumar *et al.*[1] and Sanjay Kumar *et al*[1].

Table 1: Nitrogen releasing pattern of major nutrients as influenced by different slow releasing nitrogenous fertilizers

Treatments	2 DAI	4 DAI	8 DAI	15 DAI	30 DAI	45 DAI	60 DAI
T_1= 100 % RDN through neem coated urea	305.42	305.80	306.64	308.60	322.46	353.84	363.14
T_2= 100 % RDN through mud coated urea	307.08	309.60	313.45	325.56	342.59	344.60	347.43
T_3= 100 % RDN through pongamia oil coated urea	306.95	308.08	309.68	314.76	338.82	347.35	353.39
T_4= 100 % RDN through cashew nut shell liquid coated urea	305.97	306.54	307.74	311.17	326.96	351.21	359.43
S.Em.±	11.64	11.36	10.70	7.60	6.65	4.11	5.05
C.D. at 5%	NS	NS	NS	NS	19.94	12.32	15.14

Table 2: Phosphorus releasing pattern of major nutrients as influenced by different slow releasing nitrogenous fertilizers

Treatments	2 DAI	4 DAI	8 DAI	15 DAI	30 DAI	45 DAI	60 DAI
T_1= 100 % RDN through neem coated urea	56.27	56.47	57.29	60.74	78.53	80.02	83.81
T_2= 100 % RDN through mud coated urea	55.26	55.39	55.62	56.31	65.04	68.53	70.77
T_3= 100 % RDN through pongamia oil coated urea	55.91	56.08	56.54	59.13	68.60	71.89	76.00
T_4= 100 % RDN through cashew nut shell liquid coated urea	56.06	56.19	56.99	57.20	76.84	79.32	80.22
S.Em.±	3.19	3.16	3.70	3.63	3.55	2.99	3.24
C.D. at 5%	NS	NS	NS	NS	10.23	8.96	9.73

Table 3: Potassium releasing pattern of major nutrients as influenced by different slow releasing nitrogenous fertilizers

Treatments	2 DAI	4 DAI	8 DAI	15 DAI	30 DAI	45 DAI	60 DAI
T_1= 100 % RDN through neem coated urea	211.53	218.69	226.68	239.89	255.54	259.64	262.69
T_2= 100 % RDN through mud coated urea	208.40	211.86	214.73	221.53	234.13	236.73	240.03
T_3= 100 % RDN through pongamia oil coated urea	210.03	214.29	219.95	227.42	240.35	243.87	247.96
T_4= 100 % RDN through cashew nut shell liquid coated urea	211.10	216.15	224.30	235.89	246.49	251.91	256.83
S.Em.±	7.81	7.40	6.24	5.87	6.45	6.93	7.06
C.D. at 5%	NS	NS	NS	17.61	19.35	20.77	21.18

CONCLUSION

Coating urea with neem for 100 per cent recommended dose of fertilizers application was found best followed by cashew nut shell liquid coated urea, pongamia oil coated urea and mud coated urea in that order.

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