Int.J.Curr.Microbiol.App.Sci (2019) *8*(1): 2950-2955

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 01 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.801.313

Study of Nitrogen Release Potential of *Entisol* and *Vertisol* as Influenced by Various Sources of Nitrogenous Fertilizers

N.B. More, S.S. Sadafule*, V.R. Gaikwad, B.D. Tamboli and G.D. Patil

Division of Soil Science and Agriculture Chemistry, College of Agriculture, Pune, Maharashtra, India

**Corresponding author*

Keywords

Nitrogen release potential, *Entisol*, *Vertisol*, Nitrogenous fertilizers

Article Info

Accepted:
20 December 2018
Available Online:
10 January 2019

A B S T R A C T

The experiment was conducted to study the nitrogen release potential of *Entisol* and *Vertisol*as influenced by the treatments of neem coated urea (NCU), DAP, NPK briquette, NP briquette, urea briquette and crotonylidene diurea (CDU). The application of all the sources of nitrogenous fertilizers increased the N release potential by 336.78 % to 411.49 % over the control in *Entisol* and by 342.59 % to 470.98 % over the control in *Vertisol*. The application of NCU in *Entisol*(7.16 mg kg^{-1} day^{-1}) and the application of NPK briquette in *Vertisol* (7.63 mg kg^{-1} day^{-1}) showed the highest N release potential. The NPK briquette and NP briquette are identified as the best slow nitrogen releasing fertilizers followed by the neem coated urea and urea briquette.

Introduction

The improved understanding of N mineralization and N immobilization, along with their continuous changing dynamics may improve our ability to manage N cycling and increase nitrogen use efficiency (NUE) by minimizing N losses whatever the form (Cabrera *et al*., 2005). The use of slow N releasing fertilizers having higher nitrogen release potential is new development in this direction of improving NUE of fertilizers. To minimize nutrient losses and increase the use efficiency of N fertilizer, the placement of fertilizer or spot application of fertilizer, use of slow release fertilizer and nitrification inhibitors are recommended. The use of urea super granules, urea briquette and urea DAP briquette are another development in this direction (Daftardar and Savant, 1995). Placement of NPK briquette at 10 cm deep maintained higher level of NH_4^+-N and NO_3^--N in soil (More, 1999). However, the information regarding a comparative performance of neem coated urea, DAP, NPK briquette, NP briquette, urea briquette and crotonylidene diurea with respect to nitrogen release pattern and availability of NH_4^+-N and NO_3^--N from these sources is limited. Therefore, the present study was undertaken

to study the nitrogen release potential of *Entisol* and *Vertisol* as affected by these various sources of nitrogenous fertilizers.

Materials and Methods

The present laboratory experiment was conducted at Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Maharashtra during 2017-18 to study the release pattern of nitrogen in *Entisol* and *Vertisol* due to effect of various inorganic nitrogenous fertilizers at field capacity moisture regime (0.33 bar).The various physico-chemical properties of soils are analyzed by using various standard methods, the soil properties are given in given in table 1.

There were fourteen treatments in experiment viz. combination of six nitrogenous fertilizers viz. F_1-neem coated urea (NCU), F_2-DAP, F_3-NPK briquette, F_4-NP briquette, F_5-urea briquette and F_6-Crotonylidene diurea (CDU) and F_0-control with two soils viz. *Entisol*(S_1) and *Vertisol*(S_2). For maintaining moisture at field capacity level, double distilled water was used throughout the experiment. The amount of N fertilizers to be added is calculated on the basis of recommended dose of rice crop i.e. 100 kg N per hectare. As 1 ha of soil weight is 2.24×10^6 kg so further calculations were made to determine the quantity of N fertilizers for 1 kg of soil and 200 mg of N was added per kg of soil (Table 2).

Incubation study for 0, 15, 30, 45, 60, 75 and 90 days of incubation (DOI) after addition of nitrogenous fertilizers into soils was carried out at ambient condition. The NH_4^+-N and NO_3^--N in *Entisol* and *Vertisol* are evaluated by method described by Kenney and Nelson (1982). It is determined immediately after sampling at each interval day by taking 5 gm of soil from each incubated bowl. At the same time same weight of soil sample was kept for determining the moisture content for further calculations.

Results and Discussion

Nitrogen release potential of *Entisol*

Among the different nitrogenous fertilizers, the highest amount of cumulative NH_4^+-N (153.03mg kg^{-1}) found in DAP whereas the highest amount of NO_3^-N (596.59mg kg^{-1}) found in NPK briquette fertilizer (Table 3). In case of N release potential, thehighest nitrogen release rate was observed in case of fertilizer F_1 (NCU) @ 7.16 mg kg^{-1} day^{-1} followed by fertilizer F_3 (NPK briquette) @ 6.98 mg kg^{-1} day and fertilizer F_4 @ 6.94 mg $kg^{-1}day^{-1}$ in *Entisol*. Similarly Suganya *et al.*, (2009) observed that the lowest nitrate nitrogen content was under NCU products which show the higher N release potential with respect to time. Thus, use of neem coated urea products prolonged the nitrogen availability for the crop growth thereby minimized the losses of nitrogen and improved the nitrogen use efficiency.

The lowest nitrogen release rate found to be in control fertilizer @ 1.74 mg kg^{-1} day^{-1}.It is observed that nitrogen release potential was highest in all fertilizer soils than control. Further it was also found that at the end of incubation period NO_3^--N was at higher levels than NH_4^+-N in all treatments which might be due to activities of nitrifying microbes which oxidize the NH_4^+-N to NO_3^--N. Similar results were observed by Singh (2017) while studying mineralization kinetics of organic manures (Table 4 and 5).

During study the application of all the sources of nitrogenous fertilizers increased the N release potential by 336.78 % to 411.49 % over the control.The nitrogen release potential in *Entisol*was in order; NCU >NPK briquette >NP briquette >DAP >UB >CDU >Control.

Nitrogen release potential of *Vertisol*

Among the different nitrogenous fertilizers, the highest amount of cumulative NH_4^+-N (154.10mg kg^{-1}) found in DAP whereas the highest amount of NO_3^-N (643.83mg kg^{-1}) found in NPK briquette fertilizer.

The highest quantity of nitrogen release potential was observed in NPK briquette @ 7.63 mg kg^{-1} day^{-1}followed by NP briquette @ 7.57 mg kg^{-1} day^{-1} and Urea briquette @ 7.31 mg kg^{-1} day throughout the incubation study. As that of *Entisol*, the quantity of NO_3^- -N found to be very high than that of NH_4^+-N at the end of incubation study.

The order of nitrogen release potential was found to be; NPK briquette >NP briquette >UB >DAP >NCU >CDU >Control. Also in *Vertisol*, CDU showed the lowest nitrogen release potential as that of *Entisol*. From the results, it is revealed that neem coated urea (F_1) in *Entisol* while NPK briquette (F_3) in *Vertisol* performed better nitrogen release potential than other fertilizers in same soils. This proves the superiority of briquette fertilizers as reported by More and Shinde (2001), Durgude *et al.*, (2008) and Singh (2012). The application of all the sources of nitrogenous fertilizers increased the N release potential by 342.59 per cent to 470.98 per cent over the control in *Vertisol* (Table 6–8).

Table.1 Physico-chemical properties of *Entisol* and *Vertisol*

Sr. No.	Soil properties	*Entisol*	*Vertisol*
A.	**Physical properties**		
1.	Sand (%)	52.50	20.35
2.	Silt (%)	31.75	28.05
3.	Clay (%)	15.75	51.60
4.	Textural class	Sandy loam	Clay
5.	Bulk density (g cm^{-3})	1.45	1.27
6.	Field capacity (%)	29.02	37.60
7.	Permanent wilting point (%)	15.54	20.60
B.	**Chemical properties**		
8.	pH (1:2.5; soil:water)	7.31	8.14
9.	EC (dSm^{-1})	0.12	0.23
10.	Organic carbon (%)	0.28	0.54
11.	$CaCO_3$ equivalent (%)	1.75	8.01
12.	Available nitrogen (kg ha^{-1})	213.24	288.51
13.	Available phosphorous (kg ha^{-1})	34.50	24.38
14.	Available potassium (kg ha^{-1})	329.28	499.52
15.	Ammonical nitrogen (mg kg^{-1})	13.05	19.60
16.	Nitrate nitrogen (mg kg^{-1})	22.60	31.20
17.	Exchangeable cations (meq. 100 g^{-1})		
	Ca^{2+}	26.29	61.30
	Mg^{2+}	13.80	26.10
	Na^+	21.35	29.84
	k^+	23.40	21.09

Table.2 Quantity of nitrogenous fertilizers used for incubation studies

Sources of N fertilizers	Estimated Total N content (%)	Amount of N fertilizers (mg) added to maintain 200 mg N kg^{-1} soil
Neem coated urea	43.05	193.80
DAP	16.10	496.00
NPK briquette	25.66	327.60
NP briquette	32.66	256.00
Urea briquette	42.00	193.80
Crotonylidene diurea	32.50	226.00 (micro ml)

Table.3 Effect of nitrogenous fertilizers on cumulative NH_4^+-N content of Entisol (mg kg^{-1})

Nitrogenous fertilizers	Incubation periods (Days)							Cumulative total
	0	15	30	45	60	75	90	
NCU	30.80	26.73	25.50	11.19	7.94	7.30	5.15	114.60
DAP	75.00	24.10	22.73	11.55	8.31	7.22	4.12	153.03
NPK briquette	31.03	20.80	11.80	10.97	8.40	8.67	7.30	98.97
NP briquette	33.83	24.30	12.15	11.35	9.48	8.62	7.03	106.76
UB	29.13	25.20	13.03	9.59	7.04	7.18	3.99	95.16
CDU	44.87	25.50	20.74	12.16	6.14	6.33	5.29	121.04
Control	14.97	13.30	12.98	8.59	7.23	6.95	3.20	67.22

Table.4 Effect of nitrogenous fertilizers on cumulative NO_3^--N content of Entisol (mg kg^{-1})

Nitrogenous fertilizers	Incubation periods (Days)							Cumulative total
	0	15	30	45	60	75	90	
NCU	14.57	39.51	85.80	86.26	97.42	125.45	126.0	575.01
DAP	15.63	42.86	73.21	76.62	84.67	114.44	115.00	522.43
NPK briquette	36.00	55.87	57.93	76.55	94.97	136.50	138.77	596.59
NP briquette	30.76	53.50	55.73	75.50	94.33	135.10	137.33	582.26
UB	23.33	52.89	53.92	72.83	88.33	129.83	120.77	541.91
CDU	13.47	42.12	55.19	62.17	81.40	106.22	104.53	465.09
Control	8.30	14.52	20.59	18.60	17.34	16.87	16.67	112.89

Table.5 Nitrogen release potential of Entisol due to effect of nitrogenous fertilizers

Nitrogenous fertilizers	Incubation periods (Days)							Cumulative total
	0	15	30	45	60	75	90	
NCU	29.43	25.88	23.72	10.85	6.84	6.69	5.88	109.29
DAP	78.43	26.47	21.55	9.05	7.37	5.96	5.27	154.10
NPK briquette	31.64	23.93	15.03	15.03	9.60	8.72	7.83	111.79
NP briquette	32.00	27.08	15.58	13.74	8.23	7.60	7.60	111.83
UB	31.13	26.99	18.82	12.50	7.23	6.64	5.94	109.25
CDU	32.80	22.00	19.65	11.66	6.13	5.83	6.02	104.10
Control	14.77	13.39	10.31	8.29	6.30	6.55	3.98	63.58

Table.6 Effect of nitrogenous fertilizers on cumulative NH_4^+-N content of *Vertisol* (mg kg^{-1})

Nitrogenous fertilizers	Mineral N at 0 days		Mineral N after 90 days		N Mineralization Potential mg kg^{-1} e= (c-a)+(d-b)	N Mineralization Potential mg kg^{-1} day^{-1} f=e/90
	NH_4^+-N (mg kg^{-1}) (a)	NO_3^--N (mg kg^{-1}) (b)	NH_4^+-N (mg kg^{-1}) (c)	NO_3^--N (mg kg^{-1}) (d)		
NCU	30.80	14.57	114.60	575.01	644.24	7.16
DAP	75.00	15.63	153.03	522.43	584.82	6.50
NPK briquette	31.03	36.00	98.97	596.59	628.53	6.98
NP briquette	33.83	30.76	106.76	582.26	624.43	6.94
UB	29.13	23.33	95.16	541.91	584.60	6.50
CDU	44.87	13.47	121.04	465.09	527.79	5.86
Control	14.97	8.30	67.22	112.89	156.84	1.74

Table.7 Effect of nitrogenous fertilizers on cumulative NO_3^--N content of *Vertisol* (mg kg^{-1})

Nitrogenous fertilizers (F)	Incubation periods (Days)							Cumulative total
	0	15	30	45	60	75	90	
NCU	12.55	35.38	77.16	78.04	87.04	121.68	122.88	534.74
DAP	15.40	70.83	78.48	82.10	94.31	117.92	116.90	575.94
NPK briquette	37.67	62.25	81.63	92.89	95.55	137.01	136.83	643.83
NP briquette	36.96	61.30	80.03	92.33	94.47	136.83	136.57	638.49
UB	25.03	58.56	79.25	81.14	91.88	135.73	132.83	604.43
CDU	12.13	35.92	61.41	61.67	74.64	96.73	97.73	440.24
Control	7.39	13.07	17.88	18.00	17.62	15.10	15.01	104.07

Table.8 Nitrogen release potential of *Vertisol* due to effect of nitrogenous fertilizers

Nitrogenous fertilizers	Mineral N at 0 days		Mineral N after 90 days		N Mineralization Potential mg kg^{-1} e= (c-a)+(d-b)	N Mineralization Potential mg kg^{-1} day^{-1} f=e/90
	NH_4^+-N (mg kg^{-1}) (a)	NO_3^--N (mg kg^{-1}) (b)	NH_4^+-N (mg kg^{-1}) (c)	NO_3^--N (mg kg^{-1}) (d)		
NCU	29.43	12.55	109.29	534.74	602.04	6.69
DAP	78.43	15.40	154.10	575.94	636.21	7.07
NPK briquette	31.64	37.67	111.79	643.83	686.31	7.63
NP briquette	32.00	36.96	111.83	638.49	681.36	7.57
UB	31.13	25.03	109.25	604.43	657.52	7.31
CDU	32.80	12.13	104.10	440.24	499.40	5.55
Control	14.77	7.39	63.58	104.07	145.50	1.62

In conclusion in case of *Entisol* the highest N release potential is observed through application of neem coated urea and followed by NPK briquette whereas in case of *Vertisol* the highest N release potential is observed through application of NPK briquette and followed by NP briquette. The application of all the sources of nitrogenous fertilizers increased the N release potential by 336.78 % to 411.49 % over the control in *Entisol* and by 342.59 % to 470.98 % over the control in *Vertisol*.

References

Cabrera, M. L., Kissel, D. E. and Vigil, M. F. 2005. Nitrogen mineralization from organic residues. *Journal of Environmental Quality*, 34: 75-79.

Daftardar, S.V. and Savant, N.K. (1995) Evaluation of environmental friendly fertilizer management for rainfed Low land rice on tribal farmer's field in India. Paper presented at IRRC, 13-17 Feb., 1995. Los Banos, Laguna, Philippines.

Durgude A.G., Y.J. Patil, A.V. Bulbule and V.S. Patil (2008) Effect of fertilizer management through urea - DAP briquettes on low land rice. *Asian Journal of Soil Science*, 3: 1-3.

Keeney, D. R. and Nelson, D.W. (1982). Nitrogen-Inorganic forms. In "Methods of Soil Analysis, Part Chemical and Microbiological Properties", Page A. L. (Ed), II edition, *American Society of Agronomy, Inc. and Soil Science Society of America. Inc. Madison*, Wisconsin, USA, 643-693.

More N. B. 1999. Use of NPK briquette in Sugarcane. Ph.D. thesis submitted to M.P.K.V., Rahuri.

More N.B. and B.N. Shinde (2001) Effect of NPK briquette on Availability and Uptake of Nutrients by Sugarcane. *Journal of Maharashtra Agricultural Universities*, 27: 121-123.

Singh K. K. (2012) Use of NPK briquette for wheat, M.sc. (Agri) thesis submitted to M.P.K.V., Rahuri.

SinghSubhash (2017) Kinetics of nitrogen mineralization in Inceptisol by the use of organic manures, M.Sc. agri thesis submitted to MPKV, Rahuri.

Suganya S., K. Appavu and A. Vadivel (2009) Mineralization pattern of neem coated urea products in different soils. Research Paper. *International Journal of Agricultural Science*, 5: 175-179.

How to cite this article:

More, N.B., S.S. Sadafule, V.R. Gaikwad, B.D. Tamboli and Patil, G.D. 2019. Study of Nitrogen Release Potential of *Entisol* and *Vertisol* as Influenced by Various Sources of Nitrogenous Fertilizers. *Int.J.Curr.Microbiol.App.Sci.* 8(01): 2950-2955. doi: https://doi.org/10.20546/ijcmas.2019.801.313