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Mineral Profile of Hybrid Napier Grass Under Slurry Irrigation

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Abstract

The present study was conducted Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy and at University Livestock Farm and Fodder Research and Development Scheme, Mannuthy of Kerala Veterinary and Animal Sciences University. The study was for a period of one year and divided to summer, monsoon and post monsoon seasons. The objective of the research was to estimate the minerals in soil, slurry, feed, fodder, dung and vermicompost. The representative sample of green grass from the treatment plots fed to the experimental animals were collected from the animal sheds during feeding. Fodder samples were collected once in every two months corresponding to each harvesting cycle of green grass at the fodder plots. The nitrogen element of fodder samples was estimated using Macro Kjeldhal method from fresh samples (AOAC. 1990). The minerals phosphorous, potassium, sodium, calcium, magnesium, manganese, iron, copper, zinc, cadmium and chromium and lead were estimated using Inductively Coupled Plasma Optical Emission Spectrometer (ICPOES) Perkin Elmer Model Optima 8000.

Keywords: hybrid Napier, fodder, mineral profile

Introduction

The application of organic manures including farmyard manure, compost or liquid slurry from animal farms can improve the macro and micro mineral content of soil in which it is applied. The mineral estimation of manures and slurry can be of great use to ensure that correct mineral content and to ensure mineral balancing in the cultivating soil. The mineral content in these farm wastes may be adequate to meet the growth and production of crops. The overuse of waste materials or the accumulation of

heavy metals in soil and plants can become a threat to the livestock or human beings.

The estimation of mineral contents in the livestock farm waste is necessary to decide the supplementation of inorganic fertilizers in case of any deficiencies or withdrawal of the farm waste application in fields, in case of excess content of any minerals or heavy metals. There is need to quantify the minerals contained in fodder to assess the manurial value of livestock farm waste.

Materials and Methods

The present study was conducted at Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy and at University Livestock Farm and Fodder Research and Development Scheme, Mannuthy of Kerala Veterinary and Animal Sciences University. The study was conducted for a period of one year and the study period was divided into three seasons as categorised by Joseph (2011) namely (i) Summer months (February-May), (ii) Monsoon months (June-September) and (iii) Post-monsoon months (October-January).

Three different treatments were applied to the fodder plots selected for the study. The fodder plots at ULF & FRDS, Mannuthy with CO3 variety of hybrid Napier grass was utilized for the study. Fodder plot of six acres area was divided into 12 subplots and the following three treatments were applied to the subplots randomly with four replicates. Treatment – I The fodder plots in this group was irrigated by pig slurry alone for the study period. Treatment – II The fodder plots in this group was irrigated by cattle slurry alone for the study period. Treatment – III The fodder plots in this group was irrigated by water and cultivated as per Package of Practice of Kerala Agricultural University.

The representative sample of green grass from the treatment plots fed to the experimental animals were collected from the animal sheds during feeding. Fodder samples were collected once in every two months corresponding to each harvesting cycle of green grass at the fodder plots.

The nitrogen element of fodder was estimated using Macro Kjeldhal method. (AOAC. 1990). The fodder samples were processed oven dried and representative samples were digested using Perkin Elmer Titan MPS model microwave sample preparation system.

The minerals phosphorous, potassium, sodium, calcium, magnesium, manganese, iron, copper, lead, zinc, cadmium and chromium were estimated using Inductively Coupled Plasma Optical Emission Spectrometer (ICPOES) Perkin Elmer Model Optima 8000.

The data obtained were analyzed statistically based on the methods described by Snedecor and Cochran, 1994 and utilising the IBM SPSS version 24 software.

Results and Discussion

Nitrogen Content of Fodder

The results obtained are shown in Table 1. In the first treatment there was no significant difference between seasons. In the second treatment the post monsoon means was significantly different from summer and monsoon. In the third treatment all the three season means did not have any significant difference between each other. The values ranged from 1.29 ± 0.07 to 2.14 ± 0.07per cent. This was similar to values reported by Savitha and George (2014) 1.533 to 2.250per cent and Senthil *et al.* (106) 1.61per cent and Jadhav (2001) 1.16 to 1.81 per cent.

Table 1. Nitrogen content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	1.64 ± 0.11^{Ab}	1.37 ± 0.09^{Ab}	2.14 ± 0.07^{Aa}
T2	1.37 ± 0.11^{ABb}	1.38 ± 0.09^{Ab}	1.78 ± 0.07^{Ba}
T3	1.33 ± 0.11^{Ba}	1.34 ± 0.09^{Aa}	1.29 ± 0.07^{Ca}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Phosphorus Content of Fodder

The results obtained are shown in Table 2. In the first treatment there was no significant difference between the three seasons means. In the second treatment post monsoon means showed significant difference with monsoon means. In the third treatment, the post monsoon means showed significant difference with both summer and monsoon means. In the present study values obtained were 1670.51 ± 67.09 to 3197.36 ± 172.02 ppm, This was similar to values reported by Jena *et al.* (2012) 3000 ± 10 ppm, Ramana *et al.* (2000) 2200 ppm, Garg *et al.* (2014) 1500 to 4500 ppm, Savitha and George (2014) 2200 to 2340 ppm and lower than those reported by Garg *et al.* (2008) 3800 ± 670 ppm, Sharma *et al.* (2009) 3200 ± 290 ppm and Sushama *et al.* (2015) 7700 ± 1100 ppm.

Table 2. Phosphorus content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	3010.35±144.74 ^{Aa}	3037.32±172.02 ^{Aa}	2945.14±67.09 ^{Aa}
T2	2684.18±144.74 ^{ABab}	3197.36±172.02 ^{Aa}	2458.12±67.09 ^{Bb}
T3	2376.11±144.74 ^{Ba}	2280.68±172.02 ^{Ba}	1670.51±67.09 ^{Cb}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Potassium Content of Fodder

The results obtained are shown in Table 3. In the first treatment the summer means showed significant difference from both monsoon and post monsoon. In the second treatment all three seasons means showed significant difference with each other. In the third treatment summer means showed significant difference with both summer and post monsoon. In summer the second treatment showed significant difference with both first and third treatment. In monsoon there was no significant difference between the treatments. In post monsoon the second treatment means showed significant difference with both first and third treatment. The values obtained were 7019.53 ± 390.59 to 35202.98 ± 963.42 ppm. This was similar to values reported by Varghese (1998) 5300 to 12600 ppm, Garg *et al.* (2008) 30400 ± 2500 ppm, Buragohain *et al.* (2006) 14900 ± 2300 ppm, Savitha and George (2014) 17000 to 19000 ppm.

Table 3. Potassium content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	7019.53±390.59 ^{Bb}	23225.66±2035.31 ^{Aa}	22987.84±963.42 ^{Ba}
T2	8295.69±390.59 ^{Ac}	26787.88±2035.31 ^{Ab}	35202.98±963.42 ^{Aa}
T3	7134.37±390.59 ^{Bb}	23713.51±2035.31 ^{Aa}	23017.83±963.42 ^{Ba}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Sodium Content of Fodder

The results obtained are shown in Table 4. There was significant difference between all the three seasons in all the three treatments. In summer all the three treatments showed significant difference between each other. In monsoon and post monsoon the second treatment means was significant different from both first and third treatment. The values obtained were 3546.51 ± 260.92 to 27627.49 ± 1685.77 ppm. This was similar to values reported by Garg *et al.* (2014) 2000 to 12000 ppm. But higher than those reported by Garg *et al.* (2008) 370 ± 25 ppm, Varghese (1998) 500 to 1100 ppm.

Table 4. Sodium content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	4531.66±260.9 ^{Bc}	22021.55±1685.77 ^{Ba}	17878.21±923.06 ^{Bb}
T2	6415.60±260.9 ^{Ac}	27627.49±1685.77 ^{Aa}	23088.13±923.06 ^{Ab}
T3	3546.51±260.9 ^{Cc}	21942.09±1685.77 ^{Ba}	16389.34±923.06 ^{Bb}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Calcium Content of Fodder

The results obtained are shown in Table 5. All the three treatments showed significant difference with each other in all the three seasons. In summer and post monsoon the three treatment means differed significantly with each other. In monsoon the first treatment means showed significant difference with both second and third treatment. The present values obtained were from 575.06 ± 46.31 to 5305.00 ± 145.29 ppm. This was similar to values reported by Varghese (1998) 2200 to 5800 ppm, Ramana *et al.* (2000) 5100 ppm, Garg *et al.* (2008) 4300 ± 330 ppm, Garg *et al.* (2014) 2000 to 2500 ppm. These values were lower than those reported by Buragohain *et al.* (2006) 8900 ± 500 ppm and Jena *et al.* (2012) 6800 ± 100 ppm.

Table 5. Calcium content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	1027.26±46.31 ^{Ac}	4145.85±171.54 ^{Aa}	3349.12±145.29 ^{Cb}
T2	758.72±46.31 ^{Bc}	3131.35±171.54 ^{Bb}	4511.39±145.29 ^{Ba}
T3	575.06±46.31 ^{Cc}	2684.39±171.54 ^{Bb}	5305.00±145.29 ^{Aa}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Magnesium Content of Fodder

The results obtained are shown in Table 6. In the second and third treatment there was significant difference between each other for all the three seasons. In the first treatment the summer means showed significant difference with both monsoon and post monsoon means. In summer the second treatment means showed significant difference with both first and third treatments. In monsoon and post monsoon the first treatment showed significant difference with both second and third treatment. The present values obtained were from 261.59 ± 36.94 to 3267.34 ± 152.08 ppm. This was similar to values reported by Varghese (1998) 1000 to 2700 ppm, Buragohain *et al.* (2006) 900 ± 300 ppm, Garg *et al.* (2008) 2500 ± 520 ppm, Ramana *et al.* (2000) 3300 ppm and Savitha and George (2014) 2130 to 2600 ppm.

Table 6. Magnesium content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	597.81±36.94 ^{Ab}	2464.25±99.83 ^{Aa}	2404.91±152.08 ^{Ba}
T2	261.59±36.94 ^{Bc}	1941.08±99.83 ^{Bb}	2935.94±152.08 ^{Aa}
T3	690.60±36.94 ^{Ac}	1908.65±99.83 ^{Bb}	3267.34±152.08 ^{Aa}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Manganese Content of Fodder

The results obtained are shown in Table 7. All the three treatments showed significant difference with each other in all the three seasons. In summer and post monsoon there was no significant difference between the treatment means. In monsoon the third treatment means showed significant difference with both first and third treatment. The present values obtained were from 13.39 ± 0.54 to 70.17 ± 3.1 ppm. This was similar to values reported by Varghese (1998) 9.71 to 56.10 ppm, Garg *et al.* (2008) 73.35 ± 4.6 ppm, Jena *et al.* (2012) 32.54 ± 0.74ppm, Sushama *et al.* (2015) 19.25 ± 1.19 ppm, Garg *et al.* (2014) 27 to 170 ppm. Lower than those reported by Buragohian *et al.* (2006) 158.24 ± 1.32 ppm.

Table 7. Manganese content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	13.64±0.54 ^{Ac}	55.72±1.24 ^{Ab}	66.08±3.1 ^{Aa}
T2	14.75±0.54 ^{Ac}	56.90±1.24 ^{Ab}	67.05±3.1 ^{Aa}
T3	13.39±0.54 ^{Ac}	51.57±1.24 ^{Bb}	70.17±3.1 ^{Aa}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Iron Content of Fodder

The results obtained are shown in Table 8. In the first and third treatment the summer means showed significant difference with both monsoon and post monsoon means. In the second treatment there was significant difference between all the three season means. In summer, the second treatment means showed significant difference with both first and third treatment. In monsoon all the three treatment means showed significant difference between each other. In post monsoon the first treatment means showed significant difference with both second and third treatment means. The present values obtained were from 11.94 ± 0.54 to 176.88 ± 3.40 ppm. This was similar to values reported by Buragohian *et al.* (2006) 165.27 ± 5.33 ppm and the values were lower than those reported by Varghese (1998) 336.09 to 917.94 ppm, Ramana *et al.* (2000) 771 ppm, Garg *et al.* (2008) 1537.5 ± 152.0 ppm, Jena *et al.* (2012) 219.95 ± 0.85 ppm and Garg *et al.* (2014) 237 to 1500 ppm.

Table 8. Iron content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	13.34±0.54 ^{Bb}	138.20±3.40 ^{Ba}	140.68±2.79 ^{Aa}
T2	15.68±0.54 ^{Ac}	176.88±3.40 ^{Aa}	108.19±2.79 ^{Bb}
T3	11.94±0.54 ^{Bb}	103.60±3.40 ^{Ca}	104.03±2.79 ^{Ba}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Copper Content of Fodder

The results obtained are shown in Table 9. In all the three treatments there was significant difference between each other in all the three seasons. In summer, there was significant difference between all the three treatment means. In monsoon there was no significant difference between any of the treatment means. In post monsoon the first treatment means showed significant difference from both second and third treatment means. The present values obtained were from 0.98 ± 0.07 to 10.13 ± 0.44. This was similar to values reported by Varghese (1998) 4.19 to 23.95 ppm, Ramana *et al.* (2000) 8 ppm Buragohian *et al.* (2006) 7.02 ± 0.34 ppm and Sushama *et al.* (2015) 3.03 ± 0.17 to 3.83 ± 0.29 ppm. Values were lower than those reported by Syam Mohan (2003) 11.91 to 12.91 ppm, Garg *et al.* (2008) 12.74 ± 2.72 ppm and Jena *et al.* (2012) 29.24 ± 0.79 ppm.

Table 9. Copper content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	1.51±0.07 ^{Ac}	9.44±0.44 ^{Aa}	7.60±0.35 ^{Ab}
T2	1.26±0.07 ^{Bc}	10.13±0.44 ^{Aa}	6.49±0.35 ^{Bb}
T3	0.98±0.07 ^{Cc}	9.18±0.44 ^{Aa}	6.46±0.35 ^{Bb}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Zinc Content of Fodder

The results obtained are shown in Table 10. In the first treatment the summer means showed significant difference with both monsoon and post monsoon means. In second and third treatments all the three season means showed significant difference between each other. In summer and post monsoon the first treatment mean showed significant difference with both second and third treatment means. In monsoon the third treatment means showed significant difference with both first and second treatment. The present values obtained were from 4.82 ± 0.57 to 47.22 ± 2.89 ppm. This was similar to values reported by Syam Mohan (2003) 25.51 to 28.78 ppm, Varghese (1998) 30.31 to 81.70 ppm, Ramana *et al.* (2000) 14 ppm, Buragohian *et al.* (2006) 28.49 ± 1.21 ppm, Jena *et al.* (2012) 30.50 ± 0.79 ppm, Garg *et al.* (2014) 14 to 37 ppm and Sushama *et al.* (2015) 7.93 ± 0.61 to 17.39 ± 1.77 ppm. The values were lower those reported by Garg *et al.* (2008) 50.15 ± 6.58 ppm.

Table 10. Zinc content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	11.39±0.57 ^{Ab}	44.09±1.57 ^{Aa}	47.22±2.89 ^{Aa}
T2	4.82±0.57 ^{Bc}	41.29±1.57 ^{Aa}	26.44±2.89 ^{Bb}
T3	4.88±0.57 ^{Bc}	34.02±1.57 ^{Ba}	24.36±2.89 ^{Bb}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Cadmium Content of Fodder

The cadmium concentration in fodder samples was in non-detectable levels.

Chromium Content of Fodder

The results obtained are shown in Table 11. In the first treatment all the three season means showed significant different between each other. In the second and third treatment the summer means had significant difference with both monsoon and post monsoon means.

Table 11. Chromium content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	0.18±0.05 ^{Ac}	2.04±0.23 ^{Bb}	5.12±0.26 ^{Aa}
T2	0.11±0.05 ^{Ab}	2.85±0.23 ^{Aa}	3.46±0.26 ^{Ba}
T3	0.13±0.05 ^{Ab}	1.9±0.23 ^{Ba}	2.44±0.26 ^{Ca}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

In summer there was no significant difference between any of the treatment means. In monsoon the second treatment means showed significant difference with both first and third treatment means. In post monsoon all the three treatment means had significant difference between each other. The present obtained were from 0.11 ± 0.05 ppm to 5.12 ± 0.26 ppm. The values were significantly lower during summer season for all the three treatments. Among the three treatments, the third treatment means were comparatively lower than first and second treatment values.

Lead Content of Fodder

The results obtained are shown in Table 12. In the first treatment there was significant difference between each other for all the three season means. In second and third treatment the summer means showed significant difference from both monsoon and post monsoon means. In summer the first treatment means showed significant difference with third treatment means. In monsoon the first treatment means showed significant difference with both second and third treatment. In post monsoon the second treatment means showed significant difference with both first and third treatment means. The present obtained were from 0.010 ± 0.003 to 0.930 ± 0.080 ppm. The values obtained were significantly lower in summer season for all the three treatments. Among the three treatments, the third treatment fodder values were lower compared to other two treatments.

Table 12. Lead content of fodder (ppm)

Treatment	Summer	Monsoon	Post monsoon
T1	0.09±0.03 ^{Ac}	0.93±0.08 ^{Aa}	0.31±0.04 ^{Bb}
T2	0.04±0.03 ^{ABb}	0.61±0.08 ^{Ba}	0.52±0.04 ^{Aa}
T3	0.01±0.03 ^{Bb}	0.47±0.08 ^{Ba}	0.26±0.04 ^{Ba}

Measures with different superscript (ABC with in column and abc within rows) differ significantly (P<0.05)

Summary and Conclusion

The mineral profile of hybrid Napier fodder under study was as follows. Notrogen ranged from 1.29 ± 0.07 to 2.14 ± 0.07 per cent, P from 1670.51 ± 67.09 to 3197.36 ± 172.02 ppm, K from 7019.53 ± 390.59 to 35202.98 ± 963.42 ppm, Na from 3546.51 ± 260.92 to 27627.49 ± 1685.77 ppm, Ca from 575.06 ± 46.31 to 5305.00 ± 145.29 ppm, Mg from 261.59 ± 36.94 to 3267.34 ± 152.08 ppm, Mn from 13.39 ± 0.54 to 70.17 ± 3.1 ppm, Fe from 11.94 ± 0.54 to 176.88 ± 3.40 ppm, Cu from 0.98 ± 0.07 to 10.13 ± 0.44 ppm, Zn from 4.82 ± 0.57 to 47.22 ± 2.89 ppm, Cr from 0.11 ± 0.05 ppm to 5.12 ± 0.26 ppm and Pb from 0.10 ± 0.003 to 0.930 ± 0.080 ppm.

The mineral content of fodder did not show any similar pattern for the treatments applied, however the values indicate that the slurry application in plots can give good mineral content in fodder for animals. There was also no toxic levels of minerals present.

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