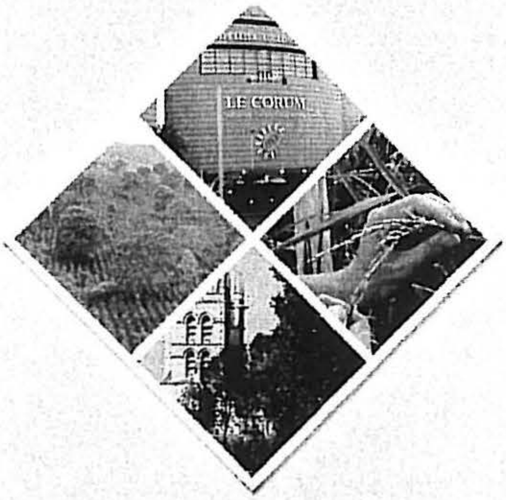
AGRO 2010
29 AUGUST - 3 SEPTEMBER
MONTPELLIER

ESA
European Society for Agronomy

PROCEEDINGS OF
Agro2010
the XIth ESA Congress



August 29th - September 3rd, 2010
Montpellier, France

Chair

- J. Wery, Montpellier SupAgro, France
  ESA President

Scientific Committee

- S. Asseng, CSIRO, Australia
- J.M. Barbier, INRA Montpellier, UMR Innovation, France
- M. Benoit, INRA Mirecourt, dpt SAD, France
- J.E Bergez, INRA Toulouse, UMR Agir, France
- J. Boiffin, INRA Angers, AFA, France
- P. Carberry, CSIRO, Australia
- J.L. Chotte, IRD Montpellier, UMR EcoSol, France
- O. Christen, Martin Luther University, Halle-Wittenberg, Germany
- M. Donatelli, ESA secretary, JRC and CRA, Italy
- T. Dore, AgroParisTech-INRA/EA, France
- C. Gary, INRA Montpellier, UMR System, France
- M. Genard, INRA Avignon, UR PSH, France
- P. Gregory, SCRI, United Kingdom
- D. Habash, Rothamsted Research, United Kingdom
- G. Hammer, APSRU, Australia
- P. Hinsinger, INRA Montpellier, UMR EcoSol, France
- B.Hubert, Agropolis International, France
- J. Jones, University of Florida,USA
- J.D. Lebreton, CNRS Montpellier, IFR MEB, France
- F. Lescouret, INRA Avignon, UR PSH, France
- R. Lifran, INRA Montpellier, UMR Lameta, France
- E. Malezieux, CIRAD Montpellier, France
- F. Maraux, CIRAD Montpellier, France
- M. Morison, INRA Grignon, France
- N. Munier-Jollain, INRA Dijon-INRA/EA, France
- M.L. Navas, Montpellier SupAgro, UMR CEFE, France
- B. Ney, AgroParisTech & Académie de l'Agriculture, Paris, France
- J. Porter, University of Copenhagen, Denmark
- F. Tardieu, INRA Montpellier, IFR Daphne, France
- M. Van Ittersum, WUR and Seamless, The Netherlands

Organizing Committee

- I. Bastie, Montpellier SupAgro
- B. Cabantous, Agropolis International
- C. Jacquet, CIRAD
- F. Lavat, Montpellier SupAgro
- E. Mignard, INRA
- A. Perrin, Montpellier SupAgro
- C. Picard, INRA
- P. Prevost, Montpellier SupAgro - AFA
- S. Renoir, CIRAD
- M. Salas, Agropolis International
- I. Shili-Touzi , Montpellier SupAgro
- N. Villemejeanne, Agropolis International

Proceedings of 'Agro2010 the XIth ESA Congress', Montpellier, August 29th - September 3rd, 2010
J. Wery, I. Shili-Touzi, A. Perrin (eds), Agropolis International Editions, Montpellier, France
ISBN: 978-2-909613-01-7 • Printed by *Pure Impression* (Montpellier, France) • August 2010

Effect of sampling date on chemical indices of the mineralizable nitrogen in soil

Fonseca T., Arrobas M., João Parada M., Ângelo Rodrigues M.

Mountain Research Center - ESA, Instituto Politécnico de Bragança
Campus de Sta Apolónia, ap. 1172, 5301-855 Bragança, Portugal; *email: marrobas@sipb.pt

In the 1960s and 1970s there was great emphasis on selecting simple laboratory methods to estimate the potentially available soil N that could be routinely used as a method for the N recommendations systems (Keeney and Bremner, 1966; Stanford and Smith, 1976). Many chemical extractants were investigated (acids, alkali, salts, water, ...) as possible tools for assessing how much N may be mineralized, varying the concentration of the extractant, temperature and time of extractions. The results were usually related to N mineralized in laboratory incubations or with N recovered in field crops. Similar methodologies were also used to predict the N mineralized from organic substrates (manures, sewage sludge, ...). In the following 1980s and 1990s, the published work was still dominated by optimism, with the researchers finding good relationships between chemical indices and plant available N (Gianello and Bremner, 1986). However, after decades of searching for a rapid method to estimate the N mineralization capacity of soil there are still no consistent recommendations. Many conflicting results have been appearing in the literature after a general inability of the following researchers to replicate the positive results however found (Wang et al., 2001). One possible source of error could be the time of soil sampling. It would be expected that the most labile fraction of organic N, which plays a prominent role as a source of substrate for N mineralization, varies over the year due to debris deposition and root death. In this work the effect of sampling date on N extracted by several chemical methods was investigated in three different agrosystems: an intensive grazed pasture rich in legs; a rainfed olive orchard, the ground of which was managed by a simple application of glyphosate in April; and an intensive cropping system based on two silage crops per year (small grains from October to May, and maize from May to October).

Materials and Methods

The chemical extraction methods used in this work were essentially the same as reported by Sharifi et al. (2007) and Soon et al. (2007). Extractable NH_4-N and NO_3-N (KClNmin) were determined from 10 g of soil and 40 mL 2*M* KCl shaken for 1 hour. The suspension was thereafter filtered through a Whatman #42 filter paper. The concentrations of NH_4-N and NO_3-N in the extracts were determined by UV–vis. spectrophotometry. Hot KCl extractable NH_4-N (HKClNH$_4^+$) was determined by heating (100 °C) 5 g of soil and 20 mL of 2*M* KCl for 4 hours in a digestion block. Thereafter the tubes were removed and allowed to cool and the extract filtered through a Whatman #42. Hydrolysable NH_4-N (HydNH$_4^+$) was obtained by subtracting initial NH_4-N from hot KCl extractable NH_4-N. The ultraviolet absorbance of $NaHCO_3$ extracts were prepared by shaking 2.5 g soil with 0.01 mol L^{-1} $NaHCO_3$ for 15 min. The suspension was filtered through a Whatman #42. The ultraviolet absorbance of the extracts was measured at 205 (Abs205) and 260 (Abs260) nm. Kjeldahl N (Kjel-N) was determined after the digestion of 1 g of soil with H_2SO_4 and selenium as the catalytic agent in a heated (400°C) aluminium digestion block. After cooling, the suspension was distilled with alkali and the $NH4^+$-N in the digest was titrated with HCl in a Kjeltec Auto 1030 Analyzer. Soil samples were provided from an intensive grazed pasture (sampled 10 times throughout the year); a rainfed olive orchard (sampled in October and May); and an intensive cropping system based on small grains and maize (sampled in October and May) grown for silage.

Results and discussions

The indices based on the UV absorbance at 205 and 260 nm appear very stable over time in all the agrosystems, without significant differences between sampling dates (table 1). Mineral-N released by cold KCl was significantly different between dates of sampling in the winter cereals-maize system and in the grazed pasture. The instability of the inorganic N fraction in soils is well-known and it may decrease quickly due to plant uptake, biological immobilization or by being lost from the soil. A rapid increase of the mineral N in the soil is also possible when a net N mineralization occurs and there are no favorable conditions for crop uptake or N lost from the soil. NH_4^+ released by hot KCl was significantly different among sampling dates in the olive orchard and also in the pasture. The $HydNH_4^+$ followed the same pattern. In spite of there being no clear reference in the literature as to which organic fraction is preferentially released by saline KCl solutions, it seems that $HydNH_4^+$ is readily dependent on soil conditions at the time of sampling. In the pasture the higher values seem to be found in the autumn and early spring. Probably root activity together with microbial activity, which are dependent of environmental variables, were the main factors influencing the NH_4^+ hydrolyzed by saline KCl solutions. The same seems to be true for the olive orchard, with the root activity in May (olive and weeds) promoting the presence of easily hydrolysable organic compounds.

Table 1. N mineralization indices for different soil sampling dates of the agrosystems maize/winter cereals for silage, olive orchard and grazed pasture.

Crop	Date	Abs205	Abs260	Kjel-N ($g\ kg^{-1}$)	KClNmin	$HKClNH_4^+$	$HydNH_4^+$
					------------- ($mg\ NH_4\text{-}N\ kg^{-1}$) -------------		
Maize	15-Oct-08	1.52 a	0.41 a	0.75 a	22.52 a	11.25 a	6.15 a
	22-May-09	1.62 a	0.51 a	0.73 a	18.38 b	10.70 a	4.20 a
Olive	26-Sep-08	1.76 a	0.41 a	0.70 a	27.74 a	8.67 b	3.60 b
	15-May-08	1.48 a	0.47 a	0.62 a	28.51 a	17.00 a	7.73 a
	08-Oct-07	1.56 a	0.51 a	0.39 a	15.57 abc	10.10 ab	3.70 a
	08-Nov-07	1.56 a	0.60 a	0.45 a	13.63 c	10.40 ab	3.50 a
	17-Dez-07	1.39 a	0.47 a	0.42 a	17.88 abc	12.38 ab	1.65 abc
	23-Jan-08	1.78 a	0.64 a	0.42 a	18.78 ab	12.20 ab	1.10 bc
Pasture	17-Mar-08	1.43 a	0.53 a	0.38 a	16.93 abc	13.80 a	2.95 ab
	18-Abr-08	1.38 a	0.49 a	0.38 a	15.29 bc	10.70 ab	1.30 bc
	04-Jun-08	1.54 a	0.63 a	0.42 a	16.98 abc	11.65 ab	0.55 c
	26-Jun-08	1.82 a	0.62 a	0.37 a	18.85 ab	10.40 ab	0.60 c
	19-Ago-08	1.74 a	0.56 a	0.40 a	17.62 abc	9.00 b	2.60 abc
	01-Oct-08	1.57 a	0.48 a	0.42 a	21.24 a	10.78 ab	1.28 bc

Within each agrosystem means followed by the same letter in the columns are not statistically different by Tukey-Kramer HSD test ($\alpha < 0.05$).

Conclusion

The results showed that the sampling date may influence the N mineralization indices obtained by chemical extractions, at least when KCl was used as the extracting agent. Thus, it seems that the soil sampling date should be specified in the standard procedures of each method that presents promising results to be adopted in a Lab as a routine procedure.

References

Gianello, C., and Bremner, J.M. 1986. A simple chemical method of assessing potentially available organic nitrogen in soil. Commun. Soil Sci. Plant Anal. 17: 195-214.

Keeney, D.R., and Bremner, J.M. 1966. Comparison and evaluation of laboratory methods of obtaining an index of soil nitrogen availability. Agron. J. 58: 498-503.

Sharifi, M., Zebarth, B.J., Burton, D.L., Grant C.A., Cooper J.M. 2007. Evaluation of some indices of potentially mineralizable nitrogen in soil. Soil Sci. Soc. Am. J. 71, 1233-1239.

Soon, Y.K., Haq, A., Arshad, M.A. 2007. Sensitivity of nitrogen mineralization indicators to crop and soil management. Commun Soil Sci Plant Anal 38, 2029-2043.

Stanford, G., and Smith, S.J. 1976. Estimating potentially mineralizable soil nitrogen from a chemical index of soil nitrogen availability. Soil Sci. 122: 71-76.

Wang, W., Smith, C.J., Chalk, P.M., and Chen, D. 2001. Evaluating chemical and physical indices of nitrogen mineralization capacity with an unequivocal reference. Soil Sci. Soc. Am. J. 65: 368-376.