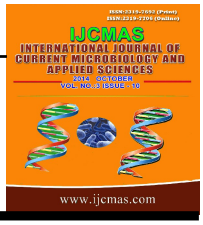
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 10 (2014) pp. 1008-1014**
http://www.ijcmas.com



Original Research Article

Profiling Enzymes involved in Nitrogen transformation in semi arid soil

R. G.Chaudhari* and S.A.Bhatt

Department of Life Sciences, Hngu, Patan, Gujarat, India

**Corresponding author*

Keywords

Profiling Enzymes, Nitrogen transformation, semi arid soil

A B S T R A C T

All the nutrients requirement of microorganisms are satisfied by soil enzymes which degrade soil organic matter added through dead plant tissue. These enzymes are produced and released in soil by number of organisms including bacteria, fungi, Actinomycetes, Protozoa, Algae, etc. *(Pancholey and rice 1982)*. Free enzymes in soil remain active for long period however; the activity may be affected by soil conditions *(Kiss et al 1986)*Enzymes in soil are significant as they are involved in cycling of elements and also influence availability of these nutrients to plants. Enzymes of nitrogen transformations are of special significance as they are directly related to plant – available nutrient. Therefore, this study has been carried to work out the status of this important element which also indicates microbial activity in soil involved in nitrogen transformation. Results of the activities of Urease, Amidase, L-asparginase and effect of soil temperature and pH have been discussed.

Introduction

The microbial biomass is a small but comparatively labile fraction of soil organic matter and is important as a source and sink of plant available nutrients. Thus microbial biomass act as a pool for release of otherwise locked nutrients into the soil and thus control the turnover of nutrient elements in soil. The activity of microorganisms is a result of intra and/or extra-cellular enzymes produced by them. Urease and Amidase are important in transformation of nitrogen. The activity of an enzyme is campsite of activities associated with different biotic and abiotic factors.

Materials and Methods

A network of total 7 locations was selected in some parts of Patan region comprising semi-arid condition.

Climate

The entire Patan experiences semi-arid climate. Aridity increased from East to West in Semi-arid region. Rainfall decreased from East to West creating clearly define climatic zone with respect rain fall. Temperature varies from 2-50 to 45-47 ºC. Annual rainfall ranges between 200mm and 400mm. Samples were collected from the Upper 0-

10cm and lower 20-30cm in a gunny bag and brought to the label and analyzed immediately at 4ºC.

Sampling and Analysis

Soil samples were collected from the 7 different locations at two-depth viz., 0-10 cm (rhizosphereic) and 20-30 cm (non-rhizosphereic). Collected soil sample description is given in table no. 1. Soil was sieved and analyzed for the physical characters like color, temperature, texture, water holding capacity, soil P^H was measure. Organic carbon was determined by modified walkley and black method. Available phosphorous were recorded. Total nitrogen is determined by Kjeldahl method.

Enzyme Assays

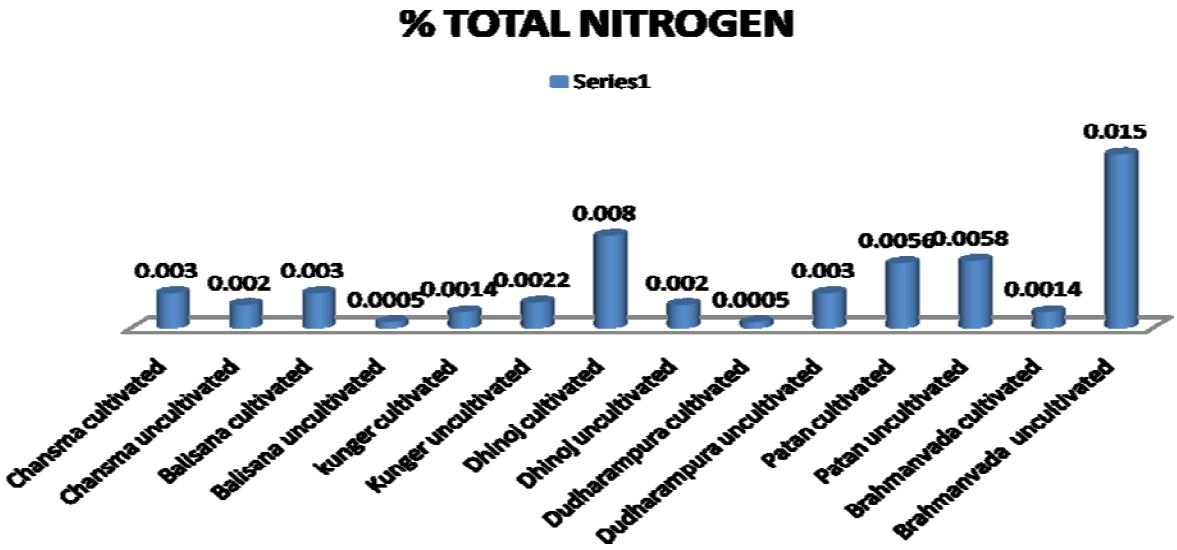
Urease, Amidase and asparginase were studied at cultivated and uncultivated soil in total 7 sites and every season at two-depth viz., 0-10 cm (rhizosphereic) and 20-30 cm (non-rhizosphereic). Soil Urease activity was determine by non-buffered method as described by Dalal and Amidase activity was determined by the method described by Frankenberger and Tabatabi. Urease activity reaction mixtures for urea hydrolysis consisted of 05ml extract, 0.5ml of 0.1M Phosphate buffer, And 0.5ml of 1.067M urea. After 2 Hour at 37 C, 2.5ml 2M kcl was added to the mixture. Ammonium was determined by the colorimetric method by Nannipieri et al. In the control, urea solution was added to the mixture after addition of kcl. Amidase activity in a sample was assayed using formamide as the substrate. Activity of Amidase is expressed as microgram of ammonia released per gram of soil per 2 hours. All enzyme activity values, organic carbon, total nitrogen are average of two replicate and on and oven dry weight basis.

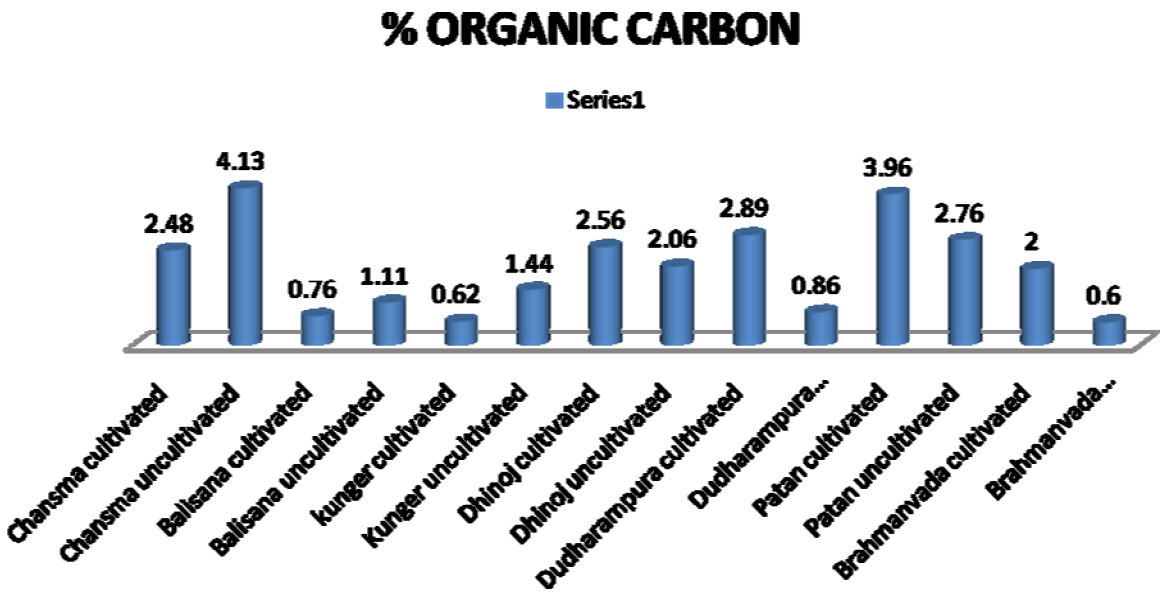
Results and Discussion

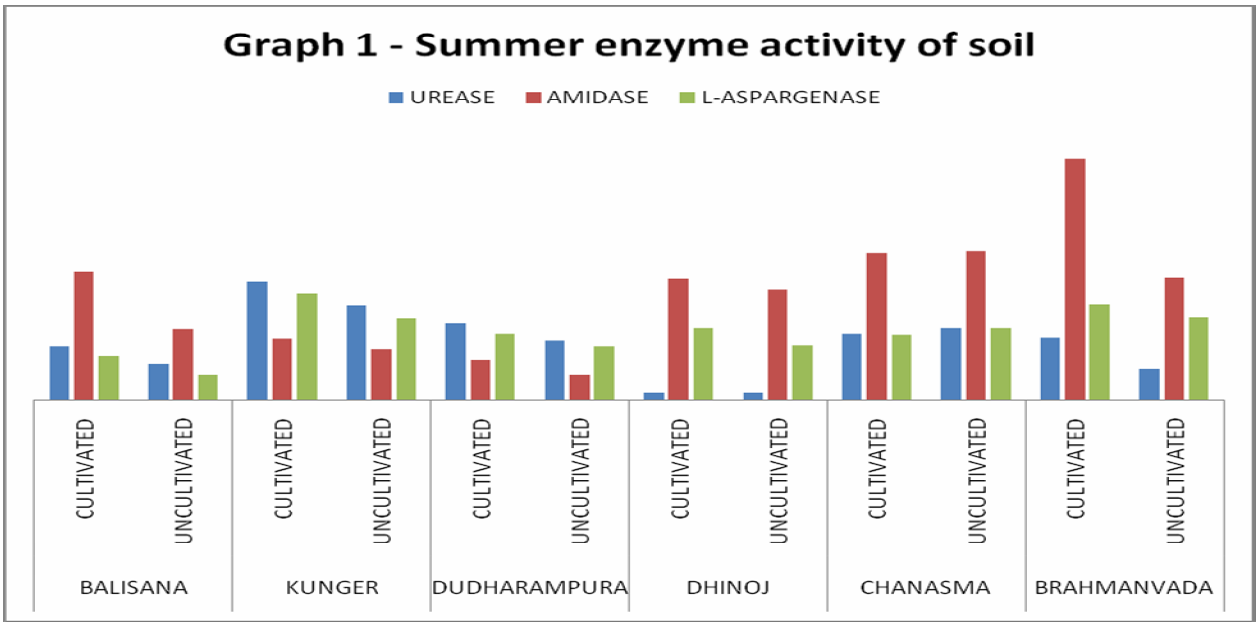
Soil in most locations show sandy loamy nature except one location in semi-arid.SoilMoisture content was 16.27%. Organic carbon recorded was maximum 4.13%, and Maximum total nitrogen 0.015, soil pH in most locations was either or slightly alkaline. The C/N ratio in most soil was higher except one location in semi-arid Soil (Table 2). Graph show variation in activities of Urease, Amidase, & asparginase in different season. Among them Amidase recorded highest activity was recorded at Dudharampura (75.84 μg g^{-1}) where soil showed very high C: N ratio which favors microbial activity and development of microbial biomass. High C: N ratio also favours growh of nitrogen transforming organisms which contribute to the higher enzyme activites. According to the result most of the location enzyme activity is higher in premonsoon season and lowest in summer and winter. Cultivated soil reported higher enzyme activity except few locations.Amidase activity was mostly reported high in all the season and the entire sites which show that the soil type may have influence on the activities of enzymes in these soils. Amidase and asparginase activity is 70.3 and 47.24 μg respectively and minimum activity is 4.43 and 2.25 μg respectively. However, urease activity in all the samples was found to have least variation. This suggests that the urease activity was not much affected by soil properties as inferred from table 3. The activity of L-asparginaseand Amidase was high in almost all soil samples which imply that organisms secreting this enzyme have large population in all the sample.

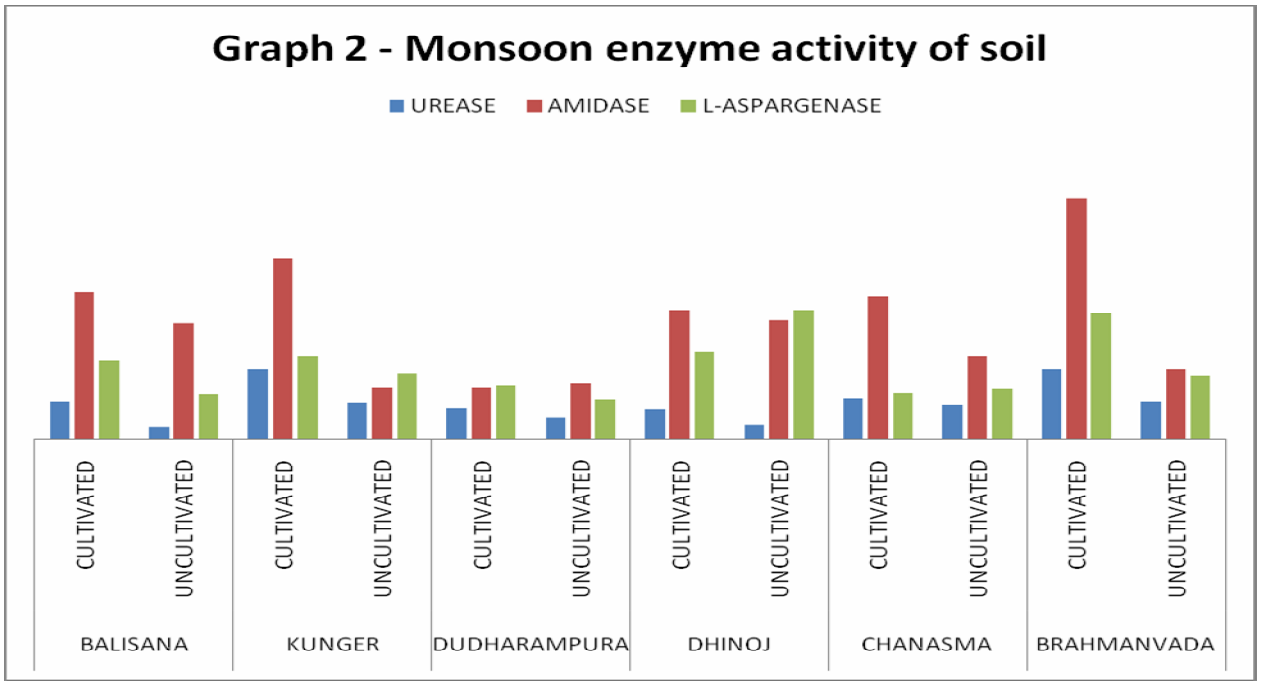
Table.1 Soil moisture content and major soil type

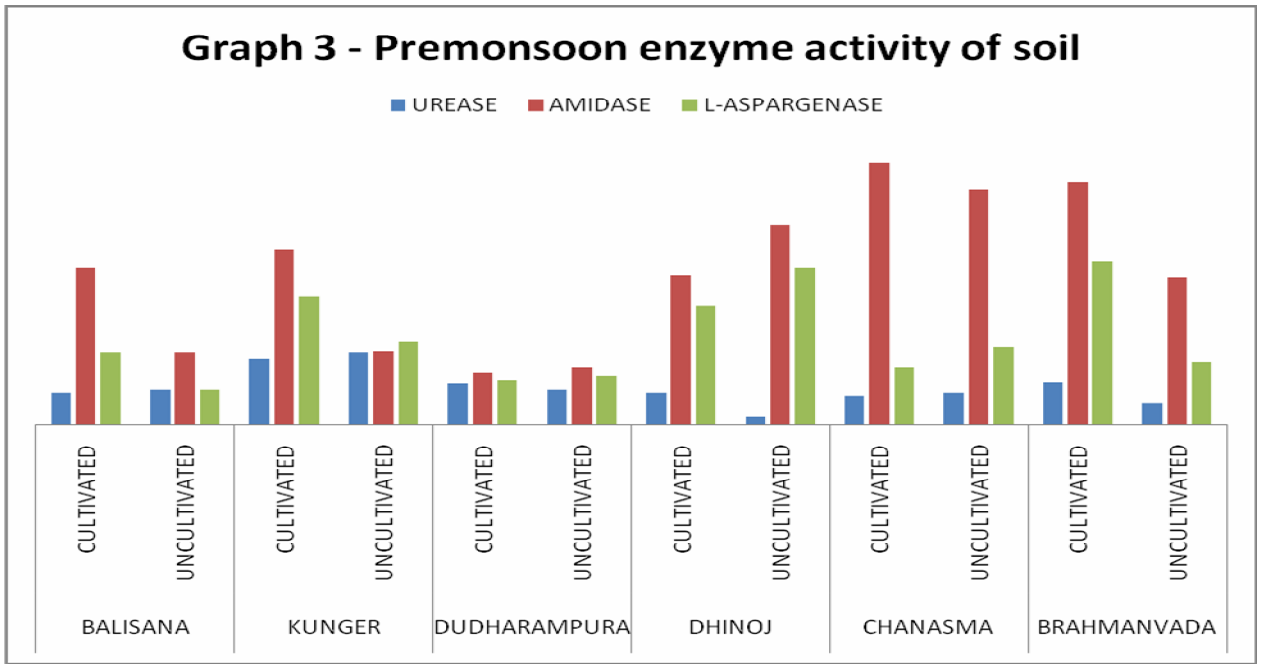
ZONE	LOCATION	SOIL TYPE	MOISTURE CONTENT
Semiarid	Chansma cultivated	Loam	13.26
	Chansma uncultivated	Loam	16.27
	Balisana cultivated	Loam	11.11
	Balisana uncultivated	Loam	12.35
	kunger cultivated	Loam	6.38
	Kunger uncultivated	Loam	9.89
	Dhinoj cultivated	Loam	8.69
	Dhinoj uncultivated	Loam	5.26
	Dudharampura cultivated	Loam	8.69
	Dudharampura uncultivated	Loam	6.38
	Patan cultivated	Loam	12.35
	Patan uncultivated	Loam	11.0
	Brahmanvada cultivated	Loam	1.41
	Brahmanvada uncultivated	Loam	11.1

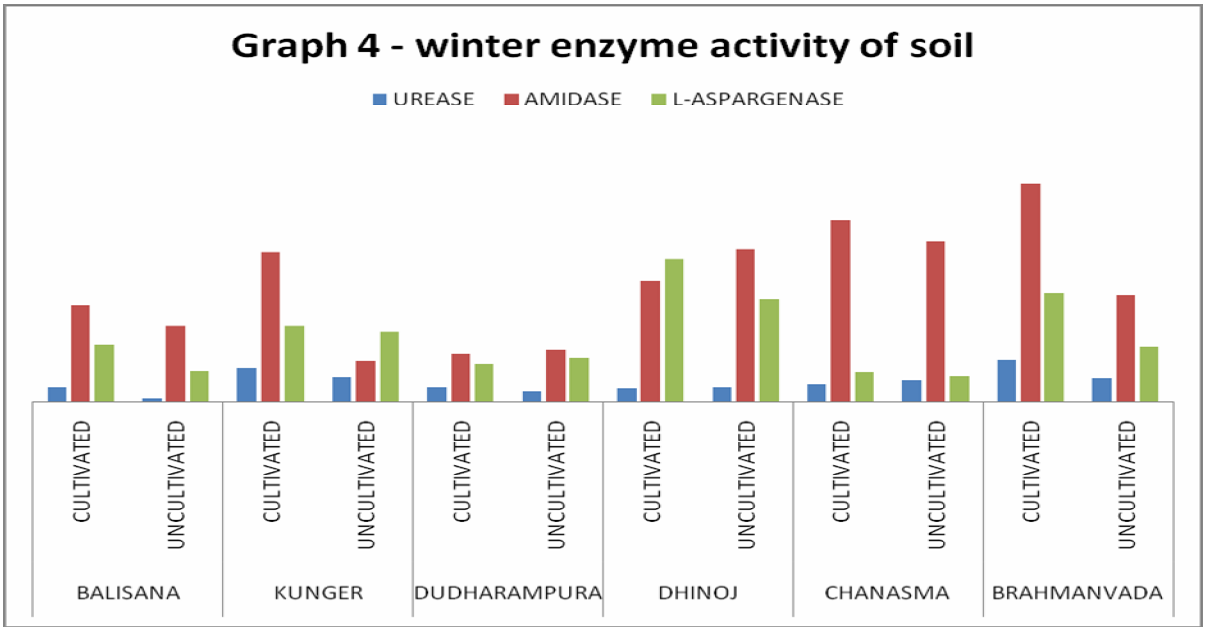



% ORGANIC CARBON
Series1
2.48
4.13
0.76
1.11
0.62
1.44
2.56
2.06
2.89
0.86
3.96
2.76
2
0.6
Chansma cultivated
Chansma uncultivated
Balisana cultivated
Balisana uncultivated
kunger cultivated
Kunger uncultivated
Dhinoj cultivated
Dhinoj uncultivated
Dudharampura cultivated
Dudharampura...
Patan cultivated
Patan uncultivated
Brahmanvada cultivated
Brahmanvada...


Graph 1 - Summer enzyme activity of soil
UREASE
AMIDASE
L-ASPARGENASE
CULTIVATED
UNCULTIVATED
BALISANA
KUNGER
DUDHARAMPURA
DHINOJ
CHANASMA
BRAHMANVADA


Graph 2 - Monsoon enzyme activity of soil
UREASE
AMIDASE
L-ASPARGENASE
CULTIVATED
UNCULTIVATED
BALISANA
KUNGER
DUDHARAMPURA
DHINOJ
CHANASMA
BRAHMANVADA


Graph 3 - Premonsoon enzyme activity of soil
UREASE
AMIDASE
L-ASPARGENASE
CULTIVATED
UNCULTIVATED
BALISANA
KUNGER
DUDHARAMPURA
DHINOJ
CHANASMA
BRAHMANVADA



References

Brookes, P.C.1985 Microbial Biomass and activity measurements in soil. J. sci. of Food and Agric., 36:269-270

Dala. R. 1985. Distribution, Salinity, Kinetic and thermodynamic characteristics of urease activity in a vertisol profile. Aust. J. Skoil Res., 23:49-60

Jackson, M.L. (edi.)1958. Soil Chemical analysis. Pentice Hall of India Pvt. Ltd., New delhi, India.pp.498

Nannipieri, P., B, Cechont and S. Gregorich. 1990.Ecological significance of the biological Activity in soil. Iln: J.M Bolag and G.Stotzky(edi.), Soil biochemistry, Vol, VI, Dekker, New york,: 203-355.

Aon MA, Colaneri AC (2001). Temporal and spatial evolution of enzymatic activities and physico-chemical properties in an agricultural soil. Appl. Soil Ecol. 18: 255–270.

Bandick AK, Dick RP (1999). Field management effects on soil enzyme activities. Soil Biol. Biochem. 31:1471-1479.

Baruah M, Mishra RR (1984). Dehydrogenase and urease activities in rice field soils. Soil Biol. Biochem. 16: 423-424.

Frankenberger, W.T and M.A.Tabatabai 1982. Amidase and urease activities in plants. Plant and Soil 64: 153–166.

O'Toole, P., M.A. Morgan and S.J. McGarry 1985. A comparative study of urease activities in pasture and tillage soils. Communications in Soil Science and Plant Analysis. 16: 759–773.

Saiya-Cork, K.R., R.L. Sinsabaugh, D.R.Zak. 2002. The effects of long term nitrogen deposition on extracellular enzyme activity in an Acer saccharum in forest soil. Soil Biology and Biochemistry 34: 1309-1315.

Sinsabaugh, R.L., Lauber, C.L.,Weintraub, M.N., Ahmed, B., Allison, S.D., Crenshaw, C., Contosta, A.R., Cusack, D., Frey, S., Gallo, M.E., Gartner, T.B., Hobbie, S.E., Holland, K., Keeler, B.L., Powers, J.S., Stursova, M., Takacs-Vesbach, C., Waldrop, M.P., Wallenstein, M.D.,

Zak, D.R., Zeglin, L.H., 2008. Stoichiometry of soil enzyme activity at global scale. Ecol. Lett. 11, 1252e1264.

Soil Survey Staff, Natural Resources Conservation Service, USDA, 2011. Soil Survey Geographic (SSURGO) Database for Yolo Co., California. Available at: http:// soildatamart.nrcs.usda.gov (accessed 06.03.11.).

Stursová, M., Baldrian, P., 2010. Effects of soil properties and management on the activity of soil organic matter transforming enzymes and the quantification of soil-bound and free activity. Plant and Soil 338, 99e110.

Tabatabai, M., 1994. Soil enzymes. In: Weaver, R., Angle, J., Bottomley, P. (Eds.), Methods of Soil Analysis, Part 2: Microbiological and Biochemical Properties. Soil Science Society of America, Madison, WI, pp. 775e833.

Tabatabai, M.A. and J.M. Bremner 1972. Assay of urease activity in soils. Soil Biology and Biochemistry. 4:479-487.