THE INFLUENCE OF CITY SLUDGE FERTILIZATION UPON THE SYMBIOTIC FIXATION AT ALFALFA

Roxana VIDICAN[1], Ioan ROTAR, Iancu PINTEA, Florin PĂCURAR
E-mail: roxanavidican@yahoo.com

Abstract

Neutralization of the city sludge with the help of soil considered a cleaning biological station is one of perspective, the most important upon the environment with the increase of the agricol production. In the new socio economic conditions from Romania, manure is to found less and less due to the decreasingof the animal number, and the way they are exploited, replacing manure with the sludge from the treatment of used waters is an alternative due to the sure advantages of using sludge as fertilizer. The aim of this present paper is represented by the determination of the nitrogen symbiotically fixed at the alfalfa culture fertilized with sludge from the station of cleaning water at Tetarom Cluj with manure, within an experiment with eight variants. Following the appliance of city sludge there was noticed an increase of the nitrogen quantity symbiotically fixed at the fertilized variants with sludge from the cleaning water stations, and in direct corelation with it, a significant increase of the dry matter quantitaty /ha.

Key words: city sludge, alfalfa, nitrogen symbiotically fixed NFB

The more and more quantity of sludge produced in the city cleaning water stations rises more and more the problem for their re integration in the environment. Taking into account the importance of the sludge regarding the organic material, one of the possibilities to achieve this goal is to administrate it on the agricol fields (Davies, 1980, Dragomir, N., 1982). Storage, recycling or usage of several residual materials represents one of the the most dificil especially for the urban agglomerations, but not with no importance in the rural community. One of the possible solutions to eliminate from the areas and to give a useful destination is to introduce as component in the technological systems for soil cultivation in different agricultural areas, in the conditions of the environment, and maintaining some reasonable costs. The valorization in agriculture for the residual products is determined also by the more and more lack of chemical fertilizers and the continuous increase of their cost, in the conditions in which soil requires more quantities of fertilizers in order to obtain high, stable and efficient productions (Guidi, 1983, Moisuc et al. 2002, Rotar et al. 2005, Vintu et al 2004). Results of fermented and dehydrated city sludge from the station for cleaning water Tetarom III in Cluj-Napoca highlighted the fact that these sludges may offer to the agriculture important sources of organic material, and significant quantities of micro and macro elements. The present paper has as a goal to follow the influence of the city sludge upon the capacity to fix the biologic nitrogen at alfalfa. Generally, estimating the quantities of NFB at alfalfa varies a lot, depending on the local ecological conditions, technology of applied cultivation, used method of quantification. Alfalfa is considered one of the vegetables that fix a significant quantity of symbiotic nitrogen, on average 229-290 kg/ha/year. Other authors consider that alfalfa fix between 44-308 kg/ha or on average, 208 kg/ha/an. In condition of irrigation, in Australia, during the three years of expetimental, in condition of bacterial inoculation and fertilizer appliance with nitrogen, Gault et al. (1995) estimated a quantity of NFB at alfalfa of 640 kg/ha.

MATERIAL AND METHOD

Exeprience took place during two years, 2010-2011, being placed on a faeoziom cambic soil from Bolduţ, Cluj County, belonging to the SCDA Turda. The soil is alkalin with a pH of 8,07 in Ao horizon and 8,39 in Bt horizon, with a content of 0,24% N, 41 ppm P and 342 ppm K. The experiences were placed after the method of latin angle in 4 repetitions with 8 variants as follows: V1- control, V2 - 20 t/ha sludge, V3 - 30 t/ha sludge, V4 - 40 t/ha sludge, V5 - 60 t/ha sludge, V6 - 20 t/ha manure, V7 - 40 t/ha manure and V8 - 60 t/ha manure. The biologic material was represented by alfalfa belonging to Madalina cultivar. Sludge used was from the station for cleaning water in Cluj-Napoca, fermented in big

[1] University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca

tanks and dry on beds for 8 months with the following characteristics: 3,56% N, 2330 ppm P, 816 ppm K and a pH of 7,06. Chemical sludge analysis and soil profile were made at OSPA Cluj-Napoca. The determination of the nitrogen quantity symbiotically fixed are made, presently using different methods, for example: the method of nitrogen difference - NFB is the difference between the quantity of Nt from a vegetable and quantity of Nt from other not leguminous specie, a simple method, cheap, that can be applied easily. The methods of nitrogen difference has more variants, taking into consideration, not only the quantity of Nt aerial vegetal bio weight, but also the quantity of Nt in roots and soil (rhyzosfere);NFB can be determined by ureidae determination -ureidele are substances found in the composition of the solution from xilem of the plants an stem cells, as allantoin and alantoin; they form during the period of nitrogen fixation by the vegetable species, especially from the tropical and subtropical area.The most precise method is to calculate NFB by applying techniques with isotope ^{15}N (that takes into account the isotope ^{15}N, expressed from the proportion of the quantity Nt (atom% ^{15}N), and the izotop ^{15}N of the atmospheric nitrogen has the following value: 0,3663 atom%; at these methods it is added the reduction method for acetylene (the principle of the method is given by the nitrogenase enzyme, which in the period of N_2 reduction to NH_3, is achieved also a decrease for the acetilen formed quantity (C_2H_2) at etilen) and the evolution of hydrogen (it is an indirect method to determine the activity of nitrogenase and it is achieved quantifying the concentration of H_2 in the roots nodosities, with the gas – chromatography method). Carlsson and Huss Danell (2003) established several liniar equations in order to determine the nitrogen symbiotically fixed in the conditions of mowing depending on the production of dry substance achieved.

In the present paper for the determination of the quantity of nitrogen biologically fixed it was used the regression method based on the production of dry matter, using the calculation formula established in 2003 by Carlsson and Huss Danell:

NFBc = 0,013 x SU+12,3,

where NFBc represents the quantity of nitrogen fixed in conditions of mowing usage.

RESULTS AND DISCUSSIONS

Studying the effects of the fertilization with city sludge, that is manure, regarding the nitrogen quantity fixed on the biological way and used in the mowing conditions, in the two experimental years (2010 and 2011) it is noticed that (table 1): in the first experimental year 2010, at all fertilized variants with city sludge with manure there were obtained very significant differences compared to the control variant regarding the quantity NFB. The higher quantity of nitrogen fixed biologically there were registered in the variant treated with 40 t/ha city sludge, and 131.24 kg/ha, this being superior to the variant fertilized with the same quantity of manure (NFB 127.61 kg/ha). Between the fertilized variant with the balanced dose of sludge and manure it is registered a difference by 3.64 kg/ha nitrogen in favor of the treated variant with sludge, without the fertilization of any nature (control variant) it was registered a decreased quantity of nitrogen biologically fixed, 109.41 ka/ha N. The appliance of the significant quantities of manure (60 t/ha) determine only the obtaining several significant differences compared to the control variant, other way not justified from the economical point of view.

Table 1

Capacity to fic biologic nitrate (NFB) at alfalfa 2010

Variant		NFB	%	Diferences	Significant
V1- control		107.24	100	0	Mt.
V2 - 20 t/ha sludge		127.71	119.1	20.47	***
V3 - 30 t/ha sludge		122.09	113.8	14.84	**
V4 - 40 t/ha sludge		131.35	122.5	24.11	***
V5 - 60 t/ha sludge		130.57	121.7	23.33	***
V6 - 20 t/ha manure		127.25	118.7	20.01	***
V7 - 40 t/ha manure		127.71	119.1	20.47	***
V8 - 60 t/ha manure		117.02	109.1	9.77	*
	LSD 5%			9.24	
	LSD 1%			12.58	
	LSD 0.1%			16.98	

Table 2

Capacity of nitrogen biologic fixation (NFB) at alfalfa 2011

Variant		NFB	%	Diferences	Significant
V1- control		121.08	100	0	Mt.
V2 - 20 t/ha sludge		157.46	130.1	36.38	***
V3 - 30 t/ha sludge		149.35	123.4	28.28	***
V4 - 40 t/ha sludge		163.59	135.1	42.51	***
V5 - 60 t/ha sludge		152.54	126.0	31.46	***
V6 - 20 t/ha manure		151.56	125.2	30.49	***
V7 - 40 t/ha manure		159.53	131.8	38.45	***
V8 - 60 t/ha manure		153.74	127.0	32.66	***
	LSD 5%			2.18	
	LSD 1%			2.97	
	LSD 0.1%			4.00	

Table 3

Capacity to fix biologic nitrogen (NFB) at alfalfa 2011-2010

Variant		NFB	%	Diferences	Semnificaţia
V1- control		13.84	100	0	Mt.
V2 - 20 t/ha sludge		29.75	215	15.91	***
V3 - 30 t/ha sludge		27.26	197	13.42	***
V4 - 40 t/ha sludge		32.04	237.3	18.20	**
V5 - 60 t/ha sludge		21.97	158.7	8.13	***
V6 - 20 t/ha manure		24.31	175.7	10.47	***
V7 - 40 t/ha manure		31.82	229.9	17.98	***
V8 - 60 t/ha manure		36.72	265.3	22.88	***
	LSD 5%			2.18	
	LSD 1%			2.97	
	LSD 0.1%)			4.00	

As in the year 2010, in the second year of the experiment 2011 the superiority of the variant is maintained at 40 t/ha city sludge (V4) where NFB is 163.49 ka/ha, superiority that manifest towards the other experimental variants. Obviously the lack of fertilization of any nature determine the obtaining of 120.98 kg/ha N. Taking the year as experimental factor the year, it can be noticed that for all the fertilized variants with city sludge and manure are obtained higher quantities of NFB compared to the firs year, in another words, the effect of the fertilization determine the increase of NFB (table 3). Calculating the average quantity of NFB in each experimental years, it can be noticed that theproduction is of 117.02 Kg/ha in the first year (2010) and of 153.74 Kg/year in the second experimental year (2011).Appliance of 40 t/ha city sludge from the station for cleaningt water Cluj Napoca determine to over due this value with 12.24 % in 2010 and of 6.40 %in 2011.

CONCLUSIONS

Research made demionstrated that the species of vegetable, among which is also alfalfa that has the ability to fic lartge quantities of nitrogen, depending on the technology applied, by the type and quantity of the fertilizers used.

Introducing n the culture the species of vegetables, that supply soil with nitrogen fixed biologically, lead to the maintaince of a balanced proportion between the nitrogen forms of the nitrogen cycle, achieved in frame of the relation soil – plant – air. In the case of the experinece at alfalfa cultureit was achieved a significant increase of the the quantity of NFB.

Fertilizing with city sludge, due to its high content in P and k determines an increase of the intensity of symbiotic fixation for nitrogen. So, the highet quantity of NFB it is obtained in the case of the fertilization with 40 t/ha sludge, superiot to all the experimental variants, including manure fertilization.

In the second experimental year the quantity of NFB increases compared to the the firs year, in all variants due to the mineralization and dispose the micro organisms indispensable for symbiotic fixation: P, K, Mg etc.

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