NITROGEN TRANSFORMATION IN SOIL DURING HUMIFICATION OF STRAW LABELLED WITH $^{15}$N

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SUMMARY

The decomposition and humification of oat straw labelled with $^{15}$N were followed in the soil during 80 days. The influence of NaNO₃ and (NH₄)₂SO₄ on these processes were also investigated. It was ascertained that addition of NH₄-N acted more efficiently than NO₃-N on both the decomposition of straw and the mineralization of the organic nitrogen compounds of the soil. In the presence of NH₄-N, straw $^{15}$N predominated in humic acids, while in the presence of NO₃-N it predominated in fulvic acids.

The incorporation of straw $^{15}$N into the humic compounds occurred in proportion to the progressing decomposition of straw. The greatest similarity in the proportions of soil-N and straw-$^{15}$N in isolated fractions was ascertained after 80 days of incubation in the presence of NH₄-N.

INTRODUCTION

The decomposition of straw, especially in the presence of inorganic-N, is accompanied by an intensive synthesis of humic compounds. Straw introduced into the soil, although it sometimes fails to cause an increase in the humic contents, leads to renewing their humic reserves at the cost of newly formed compounds. For the synthesis of humic compounds straw constitutes not only the source of carbon but also of nitrogen. This has been indicated in the preceding paper. The present research continues and complements it. However, as opposed to the preceding research, in the present one the straw dose has been lowered to 1%, adjusting its contents to the amount that is usually introduced into the soil by fertilization. In these conditions, the influence of NH₄-N and NO₃-N on the rate of
straw decomposition and on the incorporation of straw-\(^{15}\)N into the arising humic compounds was investigated.

**MATERIAL AND METHODS**

250 g of podsolic soil (pH 6.1; 30.9 ppm \(\text{NH}_4\)–N; 16.2 ppm \(\text{NO}_3\)–N; 0.09% of total-N and 0.64% of total-C) was mixed with 2.5 g of ground oat straw and with 25 mg of inorganic-N in the form of \(\text{NaNO}_3\) or \((\text{NH}_4)_2\text{SO}_4\). The straw was labelled with \(^{15}\)N, 6.37% excess. To each sample of all the combinations 2.5 mg \(\text{P}_2\text{O}_5\) as \(\text{NaH}_2\text{PO}_4\) and \(\text{K}_2\text{O}\) as \(\text{KCl}\) were added and for the stabilization of pH, \(\text{CaCO}_3\) in threefold excess in relation to the potential acidity of \((\text{NH}_4)_2\text{SO}_4\) was added. The mixture was incubated for 80 days at a constant temperature (27°C) and humidity (60% of full water capacity of the soil and straw), which made optimum conditions for the development of microflora.\(^8\)

In periodical tests, according to the procedure described in the previous paper\(^8\), pH, total N, inorganic-N, and the nitrogen contents in individual fractions of humic compounds were estimated. The isotopic analyses were made on the spectral analyser \(^{15}\)N \(\text{LGU-CYNAO}\) in the Central Institute of Agricultural Services in Moscow.

Because of applied \(\text{CaCO}_3\), the changes of pH during the incubation were only slight (6.7–7.2). Therefore, the results of the measured changes of pH and their discussion have been omitted in the text.

**RESULTS AND DISCUSSION**

During incubation, a gradual decomposition of the straw took place, which was accompanied by changes in the distribution between various nitrogenous fractions (Table 1). The intensity of the mineralization of straw-\(^{15}\)N is presented in Table 2. The addition to the soil of inorganic-N speeded up the decomposition of the straw to a significant degree. Of the two forms compared, as was also ascertained in the previous study\(^8\), \(\text{NH}_4\)–N proved to be more effective. It is true that till the 39th day of incubation a larger amount of inorganic \(^{15}\)N compounds accumulated in the soil to which \(\text{NO}_3\)–N had been added (Table 2). However, this does not prove that a quicker decomposition of straw takes place in the presence of this form of nitrogen. It is possible to assume that, because of the preference of microorganisms, there was a quick multiplication of microflora in the soil to which \(\text{NH}_4\)–N had been added, and that not only the ni-