

INFLUENCE OF COMPOSTS OF SEMICOKE, OIL SHALE, PEAT AND LIQUID MANURE ON SOIL BIOTA

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Material and Methods

Five kinds of composts and the preparation Medina Soil Activator (Medina Agriculture Products Inc., Hondo, Texas, USA) (MSA) were studied.

Compost "Virus 1" was prepared with 48 % semicoke, 32 % peat and 20 % liquid poultry manure to which 0.01 % MSA was added.

Compost "Virus 2" was prepared with 75 % semicoke and 25 % peat to which 0.02 % MSA was added.

Compost "Virus 3" was prepared with 40 % oil shale and 60 % peat to which 0.02 % MSA was added.

Compost "Virus 4" was prepared with 60 % semicoke, 20 % peat and 20 % liquid pig manure to 0.01 % which MSA was added.

Compost "Virus 5" was prepared with 45 % semicoke, 25 % peat and 30 % liquid pig manure to which 0.01 % MSA was added.

Composts "Virus 1", "Virus 2" and "Virus 3" were prepared in summer 1993 and were added to the soil two months later.

Composts "Virus 4" and "Virus 5" were prepared in summer 1994 and were added to the soil two months later.

Investigations were conducted in biometers, i.e. 5m² bottomless concrete boxes containing a 50 cm layer of sifted and well-mixed field soil isolated from the ground by a 10 cm layer of stone chips (in case of soddy calcareous soils) or by a 20 cm layer of sand (in case of soddy podzolic soils).

Investigations of composts "Virus 1", "Virus 2" and "Virus 3" were carried out simultaneously on soddy calcareous (SC) and soddy podzolic (SP) field soils. Investigations of composts "Virus 4" and "Virus 5" were carried out on soddy calcareous soils only.

The influence of composts (4 kg/m²) on soil biota was studied by complex microbiological, biochemical and agrochemical analyses. The number of ammonifiers, nitrifiers, denitrifiers, aerobic cellulose decomposers, Azotobacter, actinomycetes, fungi, algae, floral composition of soil fungi, soil enzymatic activity (catalase, urease, nitrate reductase and nitrite reductase), as well as the content of nitrogen compounds (both available and fixed ammonia, nitrates and nitrites) and pH were estimated.

Analyses of composts and soil samples from biometers were carried out from September to November 1993 and from April to December 1994 (composts 1, 2 and 3) and from September to December 1994 (composts 4 and 5).

Results

Compost "Virus 1"

Acid soil reaction of SP soil turned alkaline. In autumn 1993 the influence of the compost on soil biota was comparatively weak. Nitrate reductase and nitrite reductase activities increased. It was noticed that hard fragments of semicoke were partially decomposed and in a porous state after staying in the soil for two months. Earth-worms were discovered in the biometers. In spring 1994 the number of ammonifiers, nitrifiers, aerobic cellulose decomposers, Azotobacter and soil fungi increased markedly. Nitrate reductase, nitrite reductase, urease and catalase activities and the content of nitrates increased. A favourable microbiological regime in the soil was discovered during the whole year of 1994 except for December.

Compost "Virus 2"

Acid soil reaction of SP soil turned neutral. In autumn 1993 the number of nitrifiers, aerobic cellulose decomposers, Azotobacter and algae decreased almost by half and the number of denitrifiers – about a quarter, but urease and nitrate reductase activities increased. At the same time changes in

the frequency of occurrence of families of soil fungi were small indicating that the toxic influence on soil biota was not strong. In April 1994 this toxic influence disappeared, and stimulation was observed. The number of ammonifiers, aerobic cellulose decomposers and soil fungi and nitrate reductase activity was higher than in the control soil. A favourable microbiological regime in soil was discovered during the whole year 1994.

Compost “Virus 3”

Acid soil reaction of SP soil turned slightly alkaline. In autumn 1993 the number of Azotobacter decreased almost by half and the number of soil algae – almost by third. The number of actinomycetes, soil fungi and aerobic cellulose decomposers, nitrate reductase, nitrite reductase and urease activities decreased slightly. In April 1994 the toxic influence of compost disappeared, and stimulation was observed. The number of ammonifiers, nitrifiers and soil fungi, nitrite reductase and urease activities were higher than in the control soil. In May 1994 the number of Azotobacter and aerobic cellulose decomposers also increased.

Compost “Virus 4”

A month after adding compost into the soil the number of nitrifiers, denitrifiers and aerobic cellulose decomposers increased by a factor of 2...3, nitrate reductase and nitrite reductase activities and the content of ammonia also rose significantly. At the same time the number of ammonifiers, Azotobacter and fungi decreased slightly (25...40 %). After four months the unfavourable influence on some groups of soil microflora disappeared.

Compost “Virus 5”

A month after adding compost into the soil the number of nitrifiers and aerobic cellulose decomposers increased by a factor of 2.5...3. Nitrate reductase and nitrite reductase activities and the content of ammonia and nitrates also rose. The number of actinomycetes, fungi and algae decreased slightly (25...50 %). After four months the unfavourable influence on some groups of soil microflora disappeared.

General conclusions

Compost “Virus 1” prepared of semicoke, peat and liquid poultry manure, to which the preparation Medina Soil Activator was added, has a favourable influence on soil biota and microbiological and biochemical processes in soil. The number of ammonifiers, nitrifiers, aerobic cellulose decomposers, Azotobacter and soil fungi increased significantly. Nitrate reductase, nitrite reductase, urease and catalase activities and the content of nitrates also increased. Earth-worms were discovered in the soil. There was no unfavourable influence of composts on soil biota during the whole period of investigation.

Compost “Virus 2” with a very high concentration of semicoke and compost “Virus 3” with a very high concentration of oil shale have an unfavourable influence on some groups of soil biota and soil enzymatic activity immediately after supplementation. However this influence of the composts was comparatively weak, without changing the composition of soil mycoflora. After the winter period the toxic influence of the composts disappeared, and stimulation was observed.

After adding the composts “Virus 1”, “Virus 2” and “Virus 3” into the soil, acid reaction of soddy podzolic soil turned alkaline.

Composts “Virus 4” and “Virus 5” prepared of semicoke, peat and liquid pig manure to which the preparation Medina Soil Activator was added have a favourable influence on several groups of soil microflora, soil enzymatic activity and the nitrogen regime in the soil. The unfavourable influence of composts on certain groups of soil microflora was comparatively weak and of short duration (up to four months).

Poolkoksist, põlevkivist, turbast ja vedelsõnnikust valmistatud kompostide mõju mulla elustikule

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Resümee

Uuriti poolkoksist, põlevkivist, turbast, vedelast linnu- ja seasõnnikust ning preparaadist Medina Soil Activator (MSA) valmistatud viie eri koostisega komposti mõju mulla elustikule ja bioloogilisele aktiivsusele. Uuringud viidi läbi homogeniseeritud mullaga täidetud biomeetris. Analüüsidel määrati ammonifitseerivate, nitrifitseerivate, denitrifitseerivate ja aeroobsete tselluloosi lagundavate bakterite, asotobakterite, seente ja vetikate arvukus, seente floristiline koosseis, mulla katalaasne, ureaasne, nitraat- ja nitritreduktaasne aktiivsus, asendusneeldunud ja fikseeritud ammoniumlämmastiku, nitraatide ja nitritite sisaldus ning mulla pH. Uuringud viidi läbi 1993. a. septembrist 1994. a. detsembrini.

Poolkoksist (48 %), turbast (32 %), vedelast linnusõnnikust (20 %) ja preparaadist MSA (0.01 %) valmistatud kompost "Virus 1" avaldas märkimisväärselt soodsat mõju mulla elustikule ning mikrobioloogilistele ja biokeemilistele protsessidele mullas. Oluliselt suurenes ammonifitseerivate, denitrifitseerivate, nitrifitseerivate ja aeroobsete tselluloosi lagundavate bakterite, asotobakterite ja seente arvukus. Samuti tõusis mulla nitraat- ja nitritreduktaasne, ureaasne ja katalaasne aktiivsus ning nitraatide sisaldus. Mulda ilmusid vihmaussid.

Väga kõrge poolkoksi kontsentratsiooniga (75 %) komposti "Virus 2" ja väga kõrge põlevkivi kontsentratsiooniga (40 %) komposti "Virus 3" muldaviiamise järel täheldati suhteliselt nõrka ebasoodsat toimet mõningatele mikroobigruppidele ja mulla ensümaatilisele aktiivsusele. Talveperioodi järel kompostide toksiline toime kadus ning muutus stimulaatoriks.

Poolkoksist, turbast, vedelast seasõnnikust ja preparaadist MSA valmistatud kompostid "Virus 4" ja "Virus 5" avaldasid märkimisväärselt soodsat mõju mitmetele mulla mikrofloora gruppidele, mulla ensümaatilisele aktiivsusele ja lämmastikureguleerimisele. Kompostide mõningane ebasoodne toime üksikutele mulla mikrofloora gruppidele oli suhteliselt nõrk ning lühiajaline, kadudes nelja kuu jooksul.