Acta Botanica Neerlandica **8** (1959)

BRIEF REPORTS

WENT, Johanna C.: Cellophane as a Medium to study the Cellulose Decomposition in Forest Soils

RICHARD (1945) described a method to test the cellulose and protein breakdown in the soil. He placed viscose and silk threads in the soil sometimes for more than one year and measured their tensile strength after removal from the soil.

This method was used by VAN GOOR (1952) for forests soils in the Netherlands. He measured the tensile strength of rayoncord A U, a twisted cellulose thread, while Hueck (verbal information) measured the tensile strength of a cylindrical non twisted cellulose thread. Measuring the tensile strength has to be done under constant temperature and humidity and it is not easy to get reproducible results.

I have tried therefore to use the non twisted thread [1]) (a cylindrical isotropic regenerated cellulose thread), which can be cleaned better after removal from the soil than the twisted one. The threads are weighed before and after their treatment. Results, however, were confusing as many threads were partly eaten by soil animals and often it was impossible to recover the entire length from the soil. Since the cellulose threads did not give reproducible results the time necessary for the disappearance of the cellophane in the soil is now used as a criterion for the decomposition of cellulose in the soil.

Accidentely cellophane was used in this way when the method of TRIBE (1957) to study the invasion of cellophane by soil organisms was repeated. The cellophane is folded around a microscope slide and kept around this slide with a second slide, fastened together on one end with adhesive tape. The unvarnished cellophane is boiled before use to get rid of the plasticizers in this material. The slides were placed vertically in the soil and the development of fungi and bacteria was followed at intervals of one to two weeks. Already after one week the cellophane is invaded by fungi and bacteria. After two weeks an etching of the cellophane underneath the fungi and bacteria could be seen. Many fungi formed a fanshaped growth on the cellophane. Especially under the fanshaped growth the cellophane was attacked and small holes appeared. When all the cellophane is invaded by fungi, mites and springtails will start to eat holes in the moldy cellophane until it has disappeared entirely. The only animals attacking the cellophane before it is invaded by fungi and bacteria are snails or slugs. It may be mentioned that these animals have cellulase in their digestive tract.

It is not possible to recognize the fungi when they are growing on cellophane. Therefore isolates were made from the newly invaded cellophane and pure cultures of the isolated organisms were grown on cellophane placed on an agar layer with only inorganic salts as nutrients. In this way it was found that *Staphylotrichum*, described by NICOT and MEYER (1956) from a tropical soil, formed a fanshaped growth which was very similar to a chytridiacea, *Rhyzophlictis*. This shows how confusing the growth on cellophane can be. *Staphylotrichum* digests the cellophane at a temperature of 10° C in 3.5 weeks. *Myrothecium*, a well known cellulose attacking fungus digests the cellophane in less than 7.5 weeks. Both *Myrothecium* and *Staphylotrichum* were isolated from the Hackfort oakforest soil.

---

[1]) The non twisted cellulose thread was obtained from the Centraal Laboratorium, Delft and from the AKU, Arnhem. The last also procured the cellophane.

As the disappearance of the cellophane is much slower in forest soils than when used for the growth of pure fungus cultures at the same temperatures, it is evident that antagonistic action of different organisms or other influences of the environment slows down the digestion of the cellophane.

In 4 different forest soils, calcareous mull, acid mull, and mor from Hackfort oakforest and acid mull from Middachten oakforest, the rate of decomposition of cellophane was investigated (table I). The Hackfort soil is a sandy soil mixed

TABLE I

Number of weeks necessary for the disappearance of cellophane in different forestsoil types

Oakforest	Condition of the soil	pH (KCL)	pH (water)	Weeks
Hackfort	calcareous mull	5.2	5.9	12–23
Hackfort	acid mull	3.4	4.3	26–39
Hackfort	mor	3.0	4.1	20–45
Middachten	acid mull	2.8	4.1	7–10

with loam, the Middachten soil is a clay soil. Not the pH, but probably the moisture content is one of the most important factors for the breakdown of the cellophane in these different forest types. The Middachten acid mull which decomposes quickly is very wet, the Hackfort mor which has the same acidity is a much drier soil with much slower decomposition.

As temperature and moisture condition of the soil are important factors in the decomposition it is obvious that the time of disappearance will show great variation in different periods of the year.

In 1953, squares in a pine forest on sandy soil, were treated in 3 different ways. One part was dug to a depth of 20 cm. The other two parts were dug in the same way but one part was treated with ground lime marl (2000 kg pro ha) and the other part with hydrated lime (1950 kg pro ha). Now after 6 years the cellophane shows a marked difference in disappearing. Little or no disappearence could be found in the parts that were dug and treated with hydrated lime after 18.5 weeks. The untreated part showed some breakdown after 11 weeks and an appreciable breakdown after 14.5 weeks. The part treated with ground lime marl showed even more breakdown after 14.5 weeks than the untreated part. It might be possible that an initial heavy breakdown in the part that is dug or treated with hydrated lime may have caused the absence of breakdown later on. The experiment will have to be repeated with freshly treated soil.

These experiments show the possibilities of cellophane as an indicator of cellulose decomposition in the soil.

REFERENCES

GOOR, C. P. VAN. 1952. T.N.O. Nieuws **7**: 11.
NICOT, Mrs J. and J. MEYER. 1956. Bull. Soc. Myc. France **72**: 4.
RICHARD, F. 1945. Mitt. Schweiz. Anst. Forstl. Versuchsw. **24**: 297.
TRIBE, H. T. 1957. Microbial Ecology, 7th Symp. Soc. Gen. Microb.: 287.