

Wettability is a property of materials affecting their behaviour in contact with liquids. When water is the analysed liquid, the material has a hydrophilic (easily wettable material) or hydrophobic (hardly wettable material) nature. This can be illustrated by the statement that, depending on the features of the surface of the material, a water drop will spread over the surface or remain in an unchanged shape, i.e. maintaining its sphericity.

In the case of soil, wettability is one of the most important characteristics, since it determines soil physical, chemical, and biological properties and its agricultural usefulness. It is also important for environmental processes associated with water management in both forest and agricultural areas. It has an influence on the distribution of soil moisture and water accumulation in the soil profile. More precisely, water infiltration into the soil is a beneficial phenomenon, which is the case of soils with a hydrophilic character and, by analogy, unfavourable in hydrophobic soils, where a water layer is formed on such soils during heavy rainfall and subsequent raindrops cause surface runoff and, consequently, soil water erosion.

Erosion is highly detrimental for the natural and economic (agricultural) environment. Generally, this process consists in degradation of the soil surface and translocation of loose soil material by water, wind, or gravity. Protection of soils against this harmful process is the subject of many research programs and is one of the priorities of soil sciences.

As mentioned earlier, when water is the destructive force, water erosion of soil occurs. The negative consequences of this process include e.g. leaching of nutrients from the soil, destruction of crops, reduction of the area of arable land, changes in river courses, and flood risk.

Water erosion consists of several stages. The first one is the splash phenomenon, which is the subject of the proposed project. This stage is associated with the direct contact of a raindrop with the soil surface, which can even refer to a single drop.

The course of the direct contact largely depends on soil wettability, which is influenced by factors such as the content of organic matter or clay minerals in the soil, the type of vegetation, and chemical properties of soil. An effect on changes in surface soil properties, including wettability, is also exerted by thermal conditions, e.g. forest fires, grass burning, and prolonged drought. Another adverse factor that increases soil hydrophobicity is contact with a substance built of non-polar molecules. Hydrocarbons, i.e. petroleum substances, are a typical example of hydrophobic compounds; soil is exposed to these substances during environmental disasters or even small fuel leakage from the tanks of agricultural machinery.

In hardly wettable soils, water flows via certain privileged routes, which limits soil ability retain fertilisers to and pesticides, which may result in increased contamination of ground water. Furthermore, seed germination and plant growth is impaired in hydrophobic soils, which in turn can lead to lower yields.

An assumption of the proposed project is that wettability directly affects the course of the splash phenomenon. Investigations of wettability and the effect of its changes on the phenomena occurring on the soil surface seem to be important, as soil hydrophobisation is becoming an increasingly discernible problem.

The aim of the project is to determine the effect of soil wettability on the first phase of water erosion (the so-called splash). The investigations will be carried out on soil material sampled from soils with natural diversity of wettability and soil material that will have been modified a) thermally and b) by contact with a petroleum substance. We will take into account the initial moisture content and different conditions of the soil sample surface, i.e. a flat and smooth surface and a loosened surface with visible depressions and elevations. The research results will greatly contribute to expansion of basic knowledge of the phenomenon of soil water erosion, which will potentially be practically applied in prevention of this phenomenon.