



Products Information

Bison Soil Organic Biochar and Soil Water Retention



Biochar Improves the Water Retention of Soils

Biochar improves the water retention of soils. A number of studies have investigated the relationship between biochar and water retention in soils. The results are soil and crop dependent, but studies indicate increased water retention as a function of biochar addition to soils. For example, Glaser et al. (2002) reported that anthrosols rich in biochar with surface areas three times higher than those of surrounding soils had an increased field capacity of 18%. Novak et al. (2009) found that increases from 6.7% to 15.9% in soil moisture retention occurred relative to controls in a southeastern coastal soil. Brockhoff et al. (2010) examined biochar (10% v/v) as a replacement for peat in sand-based turfgrass ecosystems and found that biochar improved water storage (170% compared to sand), reduced overall water use, and decreased N fertilizer applications.

Additionally, water retention studies have been conducted with biochar on soils negatively affected by human activities. On mine impacted soils in Colorado, Peltz et al. (2011) concluded the following:

1. The addition of a 30% by volume amount of biochar increases soil water holding capacity in field settings by >100% relative to no biochar.
2. Biochar treatments increased water holding capacity in all soils by 90% - 180%.
3. The soil moisture content measurements strongly suggest that biochar improves the water holding capacity of degraded mine soils.
4. In container trials, biochar additions to soil increased both the soil moisture content and above ground biomass by >100% and >66%, respectively.

Water retention is improved directly and indirectly when biochar is added to the soil. The direct effect of biochar applications is related to the large inner surface area of biochar which ranges from 200 to 400 m²/g (Kishimoto and Sugiura 1985). The addition of the highly porous material holds more water than the soils to which it was added.

The indirect effects of biochar application on water retention relate to improved soil structure (see below). Water retention of soil is determined by the distribution and connectivity of pores in the soil matrix, which is largely affected by soil texture, aggregation, and soil organic matter content (Brady and Weil, 2004). Biochar has a higher surface area and greater porosity relative to other types of soil organic matter, and can therefore improve soil texture and aggregation, which improves water retention in soil.

Factors such as soil temperature, soil cover, evaporation, and evapotranspiration affect soil water availability as well as the addition of biochar (Sohi et al 2010). The agronomic water-storage benefit of biochar application is dependent on the relative modification of the proportion of soil pore size in the plant root zone (that is, the relative distribution of micro, meso and macro pores in the root zone). In sandy soils, the additional volume of water and soluble nutrients stored in the biochar micropores may become available even as the soil dries. This may lead to increased plant water availability during dry periods (Verheij et al 2009).

Biochar Improves Soil Quality

Soil quality directly affects water retention in soils. Therefore any improvement in soil quality results in better water retention by the soil and improved availability of water and soluble nutrients by plants. Biochar improves soil quality and



general soil improvements are summarized below. These are taken from Glaser et al. 2002; Rondon et al. 2007; Laird 2008; Lehmann and Joseph 2009; Sohi et al. 2010, and Steiner 2010.

1. Biochar is effective in significantly enhancing soil carbon, organic matter, available and exchangeable potassium, cation exchange capacity (CEC), and pH on a relatively short timescale.
2. Biochar is a relatively low density material that helps to lower the bulk density of soils, increasing drainage, aeration, and root penetration,
3. Biochar increases the ability of soils (especially sandy or poor soils) to retain water and nutrients.
4. Biochar is a liming agent that will help offset the acidifying effects of N fertilizers, thereby reducing the need for liming.
5. Biochar is an excellent adsorbent and when present in soils it increases the soil's capacity to adsorb plant nutrients and agricultural chemicals and thereby reduces leaching of those chemicals to surface and ground water.

Description of Bison Soil Organic Biochar

Bison Soil Organic Biochar is sold by Bison Soil and optimized for superior performance to enhance plant growth by retaining nutrients and water; improving soil physical, chemical and biological properties; enhancing crop growth with less agronomic inputs; increasing beneficial microbial colonization; and suppressing disease. This Bison Soil Organic Biochar is manufactured from clean wood biomass to maximize its ability to improve soils, plant growth and suppress disease.

Bison Soil Organic Biochar lasts for hundreds of years, so it stays in the soil providing benefits for soils and plants for years. Bison Soil Organic Biochar is not only good for improving water retention, but it is also good for the planet because it is a natural, USDA Certified Biobased soil amendment that is derived from 100% renewable plant-based feedstock including landfill-derived material.

References

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