Fiber hemp as a feasible crop for enhancing carbon sequestration and cultivation under water scarcity in sandy agricultural soils

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1. Introduction

■ Industrial hemp *Cannabis sativa* L. (THC < 0.2 %) is a multi-purpose crop, which is known for its large biomass, fibers and seeds.

■ A monoecious hemp spiecies Santhica 27 was cultivated for the fiber production.

■ The project aim was to analyse 1) the industrial hemp cultivation in high and low densities under the water scarce condition in sandy agricultural soil, and 2) the feasibility of industrial hemp for the carbon sequestration.

2. Methodology

- The total of 20 pots divided into the low density (10 pots) with max. 5 plants and the high density (10 pots) with max. 10 plants, respectively, representing 71 plants/m^2 and 142 plants/m^2;

- The water scarcity with the total of 12 litres, representing the sum of precipitation 168.9 mm from May to August (2018–2020), was simulated for 5 pots with low density and 5 pots with high density. The control pots received the total of 17 litres representing the average sum of precipitation 242 mm in 1981-2010. The illumination and ventilation of 17/24 h were set;

- The total 0.063 kg of N/ha was applied of the Planto-Pure organic fertilizer;

- The cultivation period of 96 days from sowing to harvest;

- Hemp root dry mass (DM) was determined;

- The C/N analysis with an ELEMENTAR Vario Max Cube.
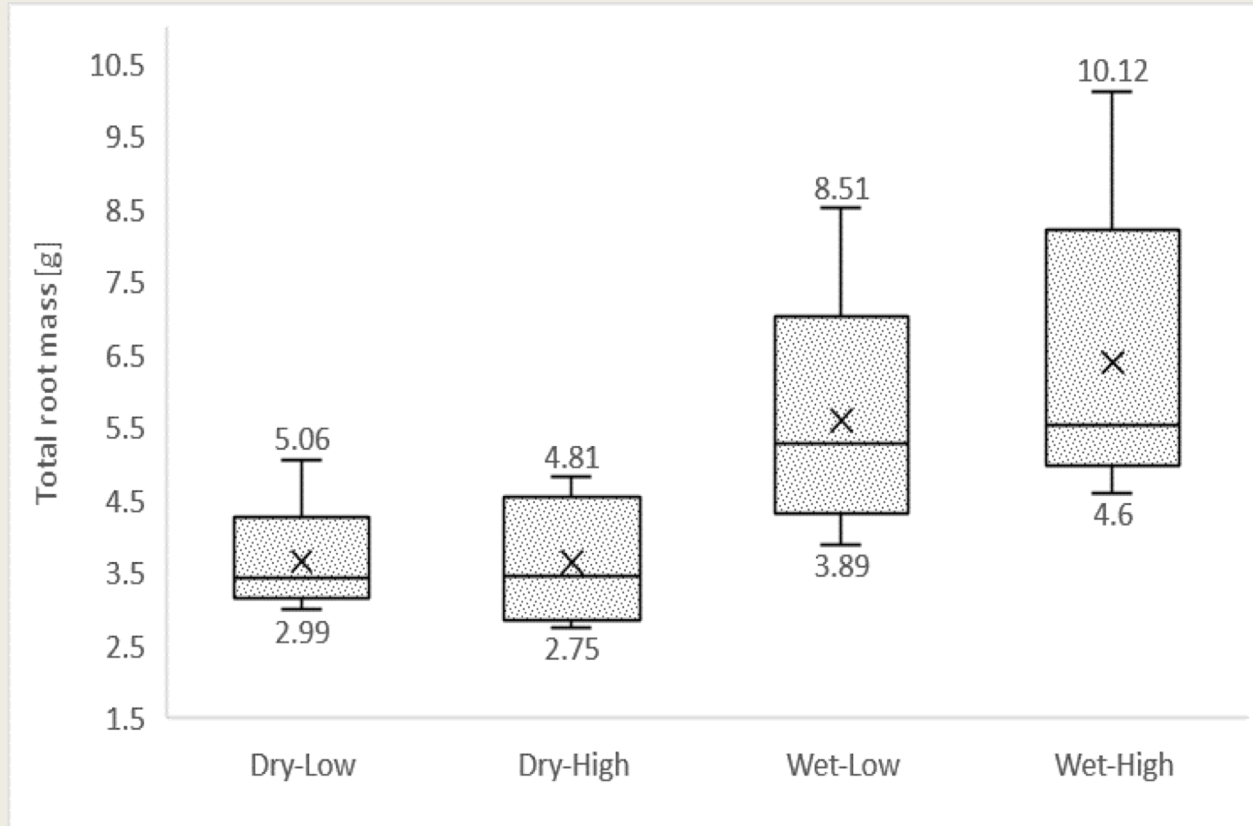
3. Results

3.1. Hemp total biomass and height
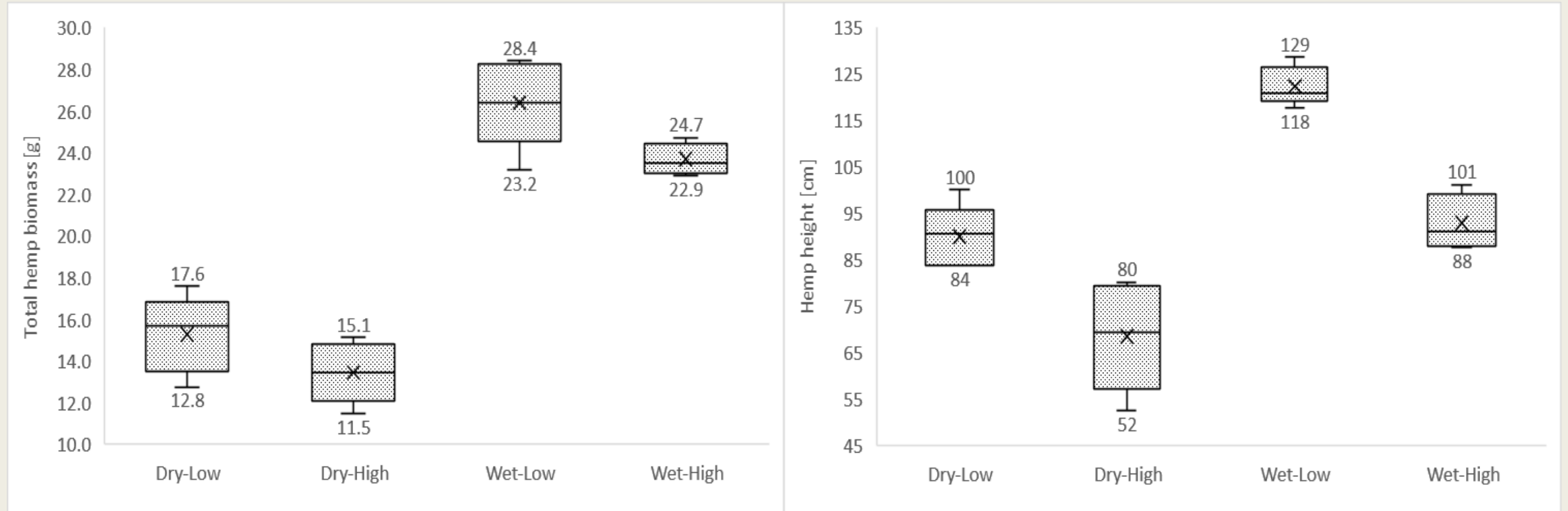
3.2. Hemp DM yields

Treatments	Dry – Low	Dry – High	Wet – Low	Wet – High
Total DM yield [t/ha]	2.16	1.91	3.74	3.35
Stem DM yield [t/ha]	1.3	1.17	2.33	2.05
Fibre yield [t/ha]	0.5	0.48	0.82	0.77

3.3. Hemp roots

3.4. Carbon sequestration

Treatments	Dry – Low	Dry – High	Wet – Low	Wet – High
Hemp biomass C [%]	41.13	41.05	38.92	39.91
Hemp main roots C [%]	41.47	41.73	42.94	43.19
Hemp fine roots C [%]	32.86	35.09	33.98	32.17

- Initial soil N % of 0.088 and C % of 1.21
- Main roots average N % of 1.20 and C % of 42.33
- Fine roots average N % of 1.67 and C % of 33.53

3.5. Hemp litter
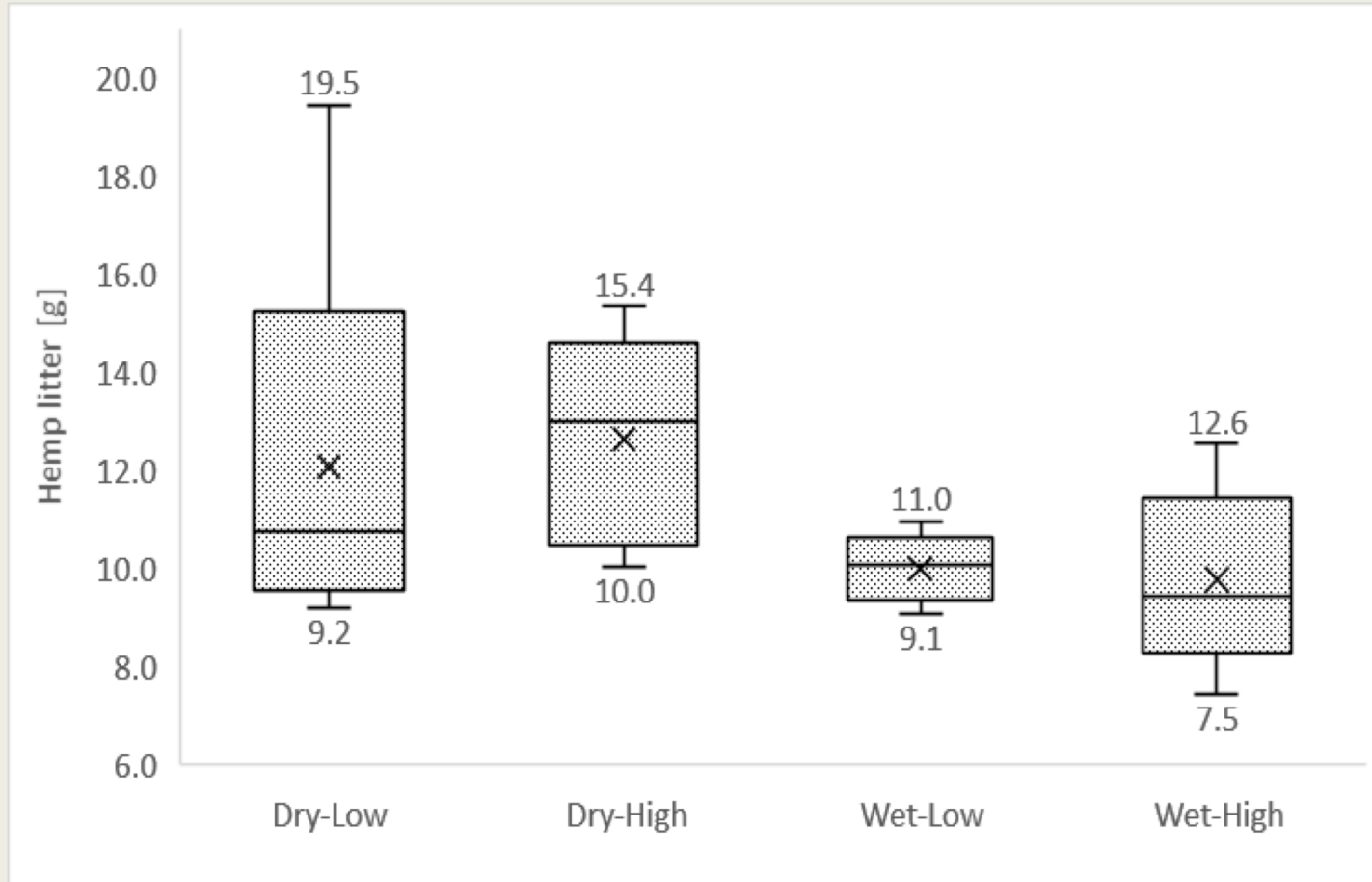
	Hemp Litter C%	Hemp Litter N%
Dry-Low	18.82	1.38
Dry-High	19.75	1.57
Wet-Low	19.43	0.90
Wet-High	21.86	1.08

4. Conclusions

■ Industrial hemp showed the lowest yields in the presence of water-stress environment, especially when planted in high densities.

■ Lower hemp planting densities generated greater yields.

■ Fibre hemp as an atmospheric carbon sink and a source of soil organic carbon.

■ Sustainable hemp agriculture with low-input practices.

■ New market opportunities.