Evaluation of wheat grain yield and soil organic carbon change under various agricultural management practices

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Background and objectives

Introduction

- Providing energy for word growing population have been an overarching issue (Lal, 2006). To fill the gap between population food demand and supply, pressure on agricultural lands through intensive farming activities e.g., fertilizer application, mono-cropping, crop residues removal and deep tillage has been increasing (Hammad et al., 2020). Although these practices lead to improve yield quantity due to easily-accessible chemical elements and ease of cultivation, they have been reducing soil organic carbon (SOC). Depletion of SOC as a result of conventional agriculture system (CON) is one of the main concerns that threatens soil quality and developing a sustainable agriculture (maltas et al., 2018).

Problem statment

- Khuzestan province, located in the southwestern part of Iran (Fig. 1) is the main center to produce high quality and quantity grain wheat in the country.

- In this semi- arid region:

➢ Lack of proper wheat cropping system and agricultural management has been endangered sustainable wheat production through the reduction of SOC pools.

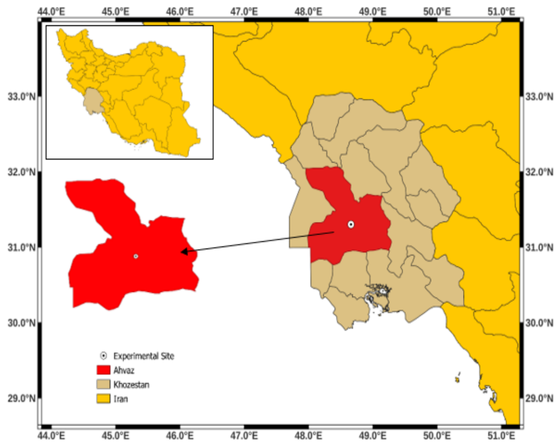

Figure 1. Location of the experimental site in Iran.

Objectives

- **To investigate**

➢ **(i)** The impact of three agricultural strategies combined with four crop rotation systems on wheat grain yield.

➢ **(ii)** Seasonal monitoring of SOC dynamics under mentioned treatments on two years of experiment.

Material and methods

- **Experimental design**
- Three combinations of fertilizer and crop residues management as agricultural strategies (CON, ORG and IAS) and four types of crop rotation system i.e. fallow-wheat (F-W), corn-wheat (C-W), sesame-wheat (S-W), and mung bean-wheat (B-W) in Khuzetan province in Iran (Fig. 2).

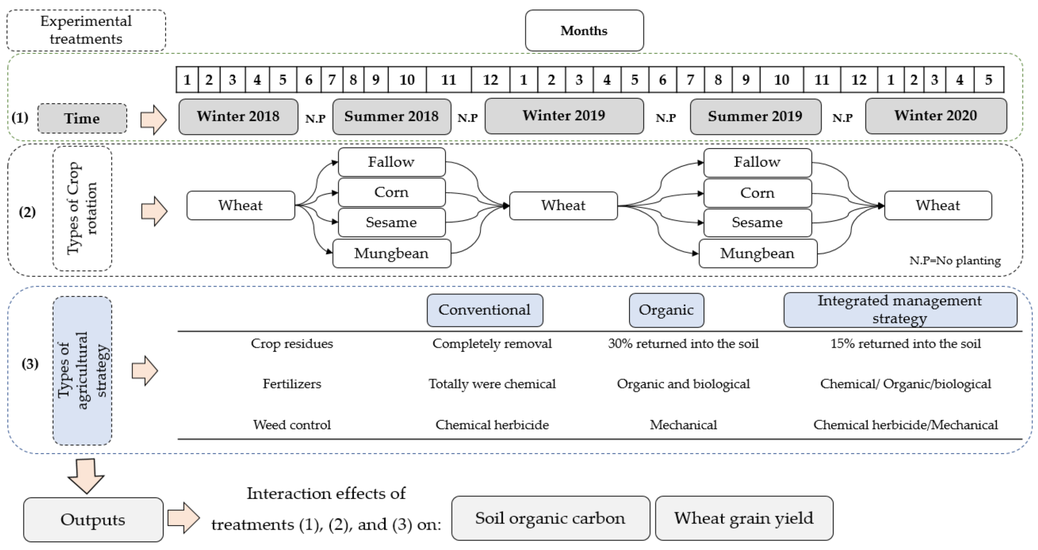

Figure 2. Schematic diagram of material and method.

Figure 3. A: summer experimental plots including corn, sesame, and mung bean crops as well as fallow. B: winter wheat in rotate with summer experimental plots. C: soil sampling through auger

Conclusion and outlook

- The agricultural strategies based on crop residue management and organic fertilizer were more effective for C-sequestration.
- The comparison of various summer crops in rotation with wheat revealed a positive effect of B-W followed by C-W and S-W on SOC.
- The presence of mung bean and sesame in rotation with wheat under IAS not only improved wheat grain yield but also increased SOC pools in the region.
- This study present a promising results in terms of implementing B-W and S-W cropping systems under IAS in the region.

Results

Interaction effect of experimental treatments on wheat grain yield

- The grain yield in IAS and ORG were following the descending order of B-W>S-W>C-W>F-W.
- Grain yield in CON followed the order of B-W>C-W>S-W>F-W .
- There was no statistically notable difference in grain yield of S-W and B-W under IAS in the second experimental year (Fig. 4).

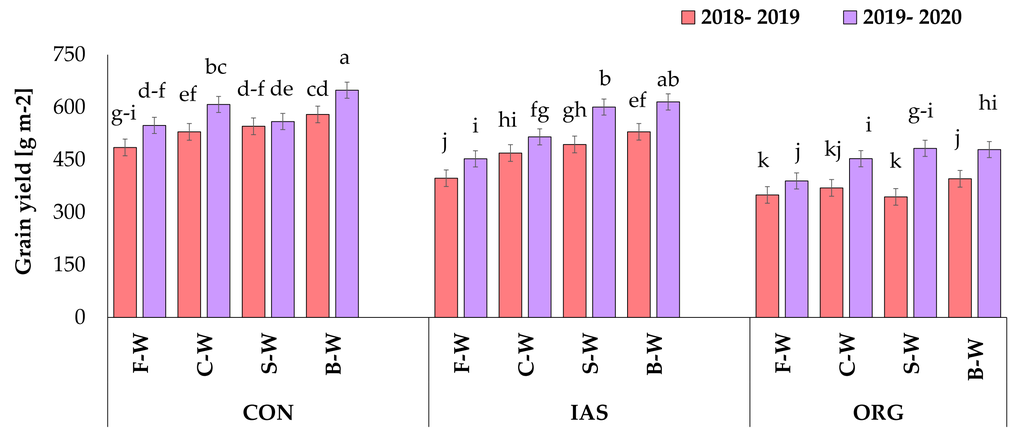

Figure 4. The effect of two experimental years (2018-2020), four crop rotation systems: F-W: fallow-wheat; C-W: corn-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat, and three agricultural strategies: conventional, CON; organic, ORG; and integrated agricultural strategy, IAS on wheat grain yield.

interaction effect of experimental treatments on soil organic carbon

- Increasing trend in the content of SOC over time (relative to the initial SOC) in ORG and IAS under all crop rotation systems except F-W.
- In CON, no significant differences in terms of SOC content compared to the initial value ($p \leq 0.05$) were observed, except for the B-W.

- The highest amount of SOC was observed in:
- ORG: 0.66%, 0.57%, and 0.57% for B-W, C-W, and S-W, respectively
- IAS: 0.55%, 0.55%, and 0.53%, for B-W, C-W, and S-W, respectively
- CON: 0.51%, 0.47%, and 0.5% for B-W, C-W, and S-W, respectively; (Fig. 5)

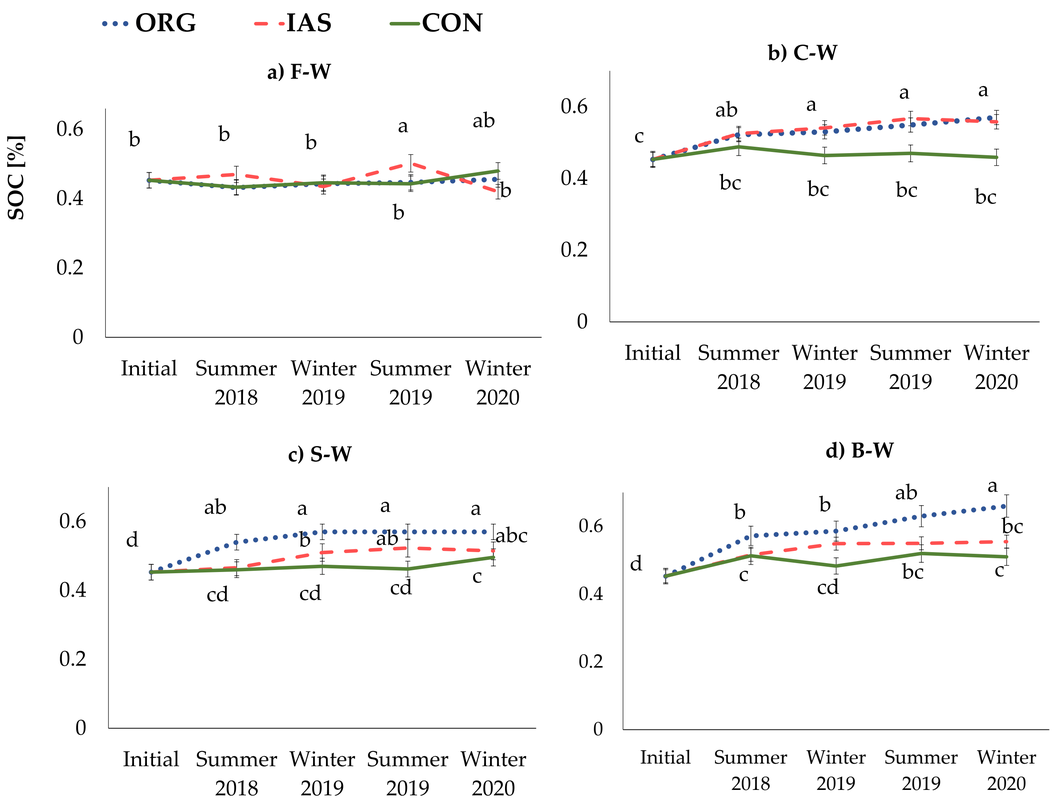

Figure 5. The effect of four seasonal weather variations: two summer and two winter, three agricultural strategies: conventional, CON; organic, ORG; and integrated management strategy, IAS) and four crop rotation systems: (a) F-W: fallow-wheat, (b) C-W: corn-wheat, (c) S-W: sesame-wheat, and (d) B-W: mung bean-wheat on SOC change.

References

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