Effect of Burger dirt on the enzymatic activities of the soil planted with Bok Choy (*Brassica ruba* subsp. *Chinensis*)

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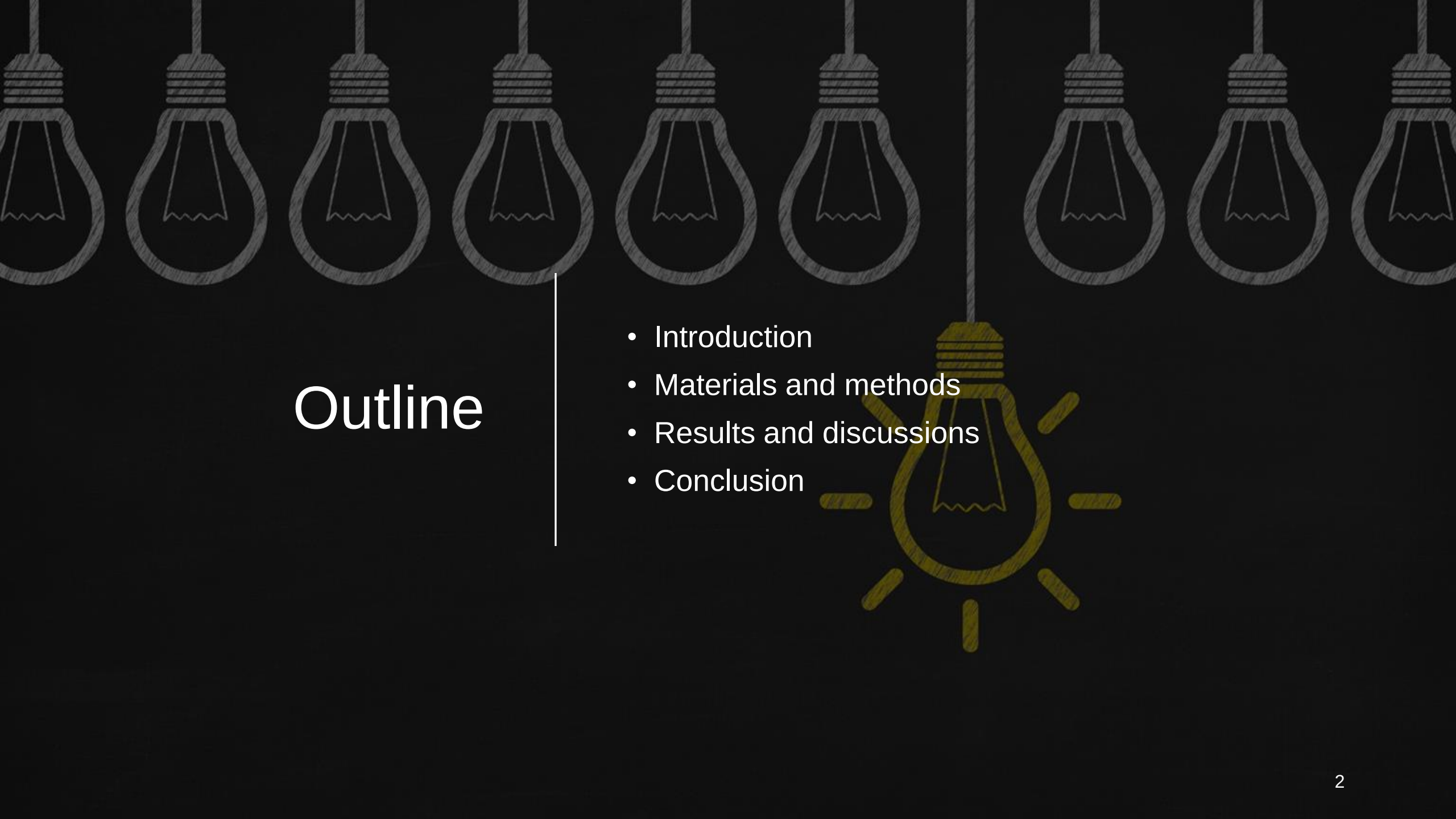


Outline

- Introduction
- Materials and methods
- Results and discussions
- Conclusion

Introduction

Soil enzyme

Support food security

Complete nutrient cycle

Depend on

The amount of organic matter

Plant

Soil

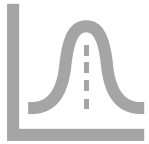
Root

Microbial biomass

(Shaw & Burns, 2005)

Enzyme activity

Temperature



pH

Moisture content

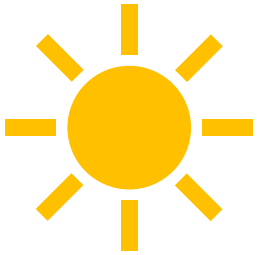
Soil management

(Guan, 1986; Olkova & Tovstik, 2022; Sinsabaugh, 1994; Štursová & Baldrian, 2011)

Catalase

Hydrogen peroxide oxidoreductase

To protect the cells from oxidative damage (Chelikani et al., 2004)



Found in aerobic bacteria and most facultative anaerobes

Urease

An extracellular enzyme

Responsible for the N and C cycles

High ammonium = high urease

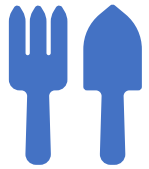
(Makoi & Ndakidemi, 2008)

Burger dirt

- Short production time
- Improved soil enzyme activity (Bautista-Cruz et al., 2014; Gómez-Velasco et al., 2014)
- Improved soil aggregate stability (Cosentino et al., 2006; Sodhi et al., 2009)

Objective

- To determine the effect and relationship between soil enzyme activity, pH, cation exchange capacity, moisture content and aggregate stability under Burger dirt treatment with bok choy



Materials and Methods

Burger dirt substrate and leachate treatments

Treatment	Burger dirt substrate [1]	Burger dirt leachate [2]	Burger dirt leachate [3]
T000	0	0	0
T001	0	0	1
T009 [4]	0	0	9
T010	0	1	0
T011	0	1	1
T100	1	0	0
T101	1	0	1
T110	1	1	0
T111	1	1	1

[1] soil incorporation.
[2] seed priming agent.
[3] liquid fertilizer.
[4] commercial fertilization.

Soil physiochemistry

- Soil pH
  - 1:2.5 (w/v) soil-water extract (Xu et al., 2020)
- Soil moisture content
  - Gravimetrically (Xu et al., 2020)
- Aggregate stability %
  - Wet sieving (Teh & Talib, 2006)
- Cation exchange capacity
  - Leaching method

Soil enzyme activity

- Catalase activity
  - Back-titrating residual H_2O_2 with $KMnO_4$ (Guan, 1986, p. 323; Johnson & Temple, 1964; Stepniewska et al., 2009)
- Urease activity
  - Spectrophotometrically (urea as the substrate) (Guan, 1986, p. 296; Van Slyke & Archibald, 1944)

Statistical analysis

- Two-way Analysis of Variance (ANOVA)
- R-program statistic software
- Duncan Mean Range Test (DMRT)
- Pearson's correlation
- Package “corrplot” (T. Wei & Simko, 2021)

Results and discussions

Burger dirt substrate increased the soil pH

- Soil amendments like biochar stabilize the soil pH under drought conditions (Mansoor et al., 2021)

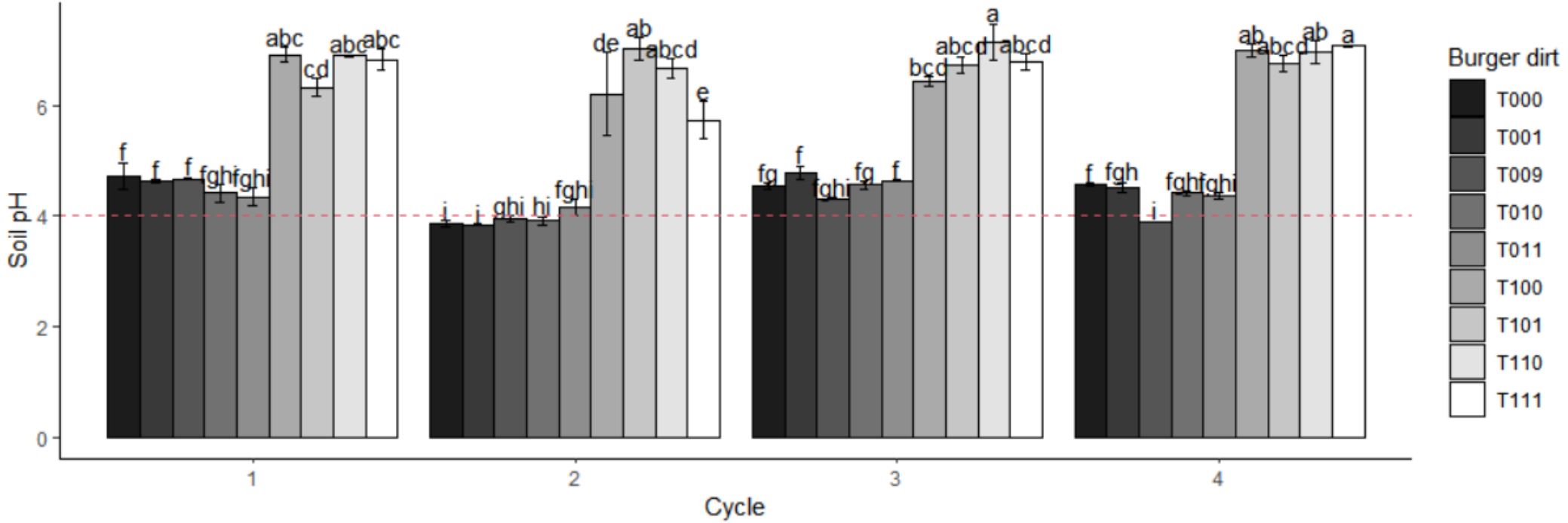


Figure Interaction effect of growing cycle (1, 2, 3 and 4) and Burger dirt treatments on soil pH. Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to as original soil pH 4.00±0.0473.

Cation exchange capacity improved 65% with Burger dirt substrate

- Organic matter contribute to more negative sites (Lyu et al., 2021)
- Organic matter may be degraded by the microbes after 3 growing cycles

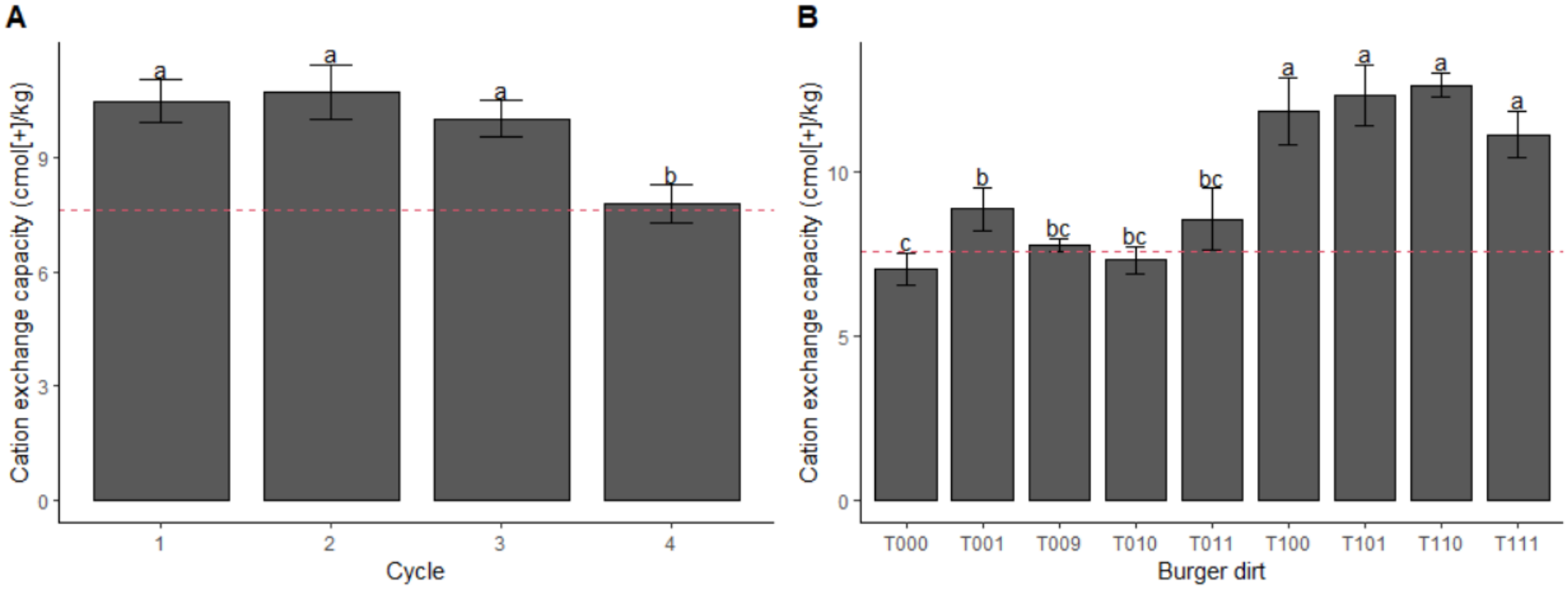


Figure Effect of growing cycle (A) and Burger dirt treatments (B) on cation exchange capacity ($cmol_+ kg^{-1}$). Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to as original cation exchange capacity (7.60±0.216 $cmol_+ kg_{-1}$).

Soil moisture content increased with Burger dirt substrate

- Organic matter hold water

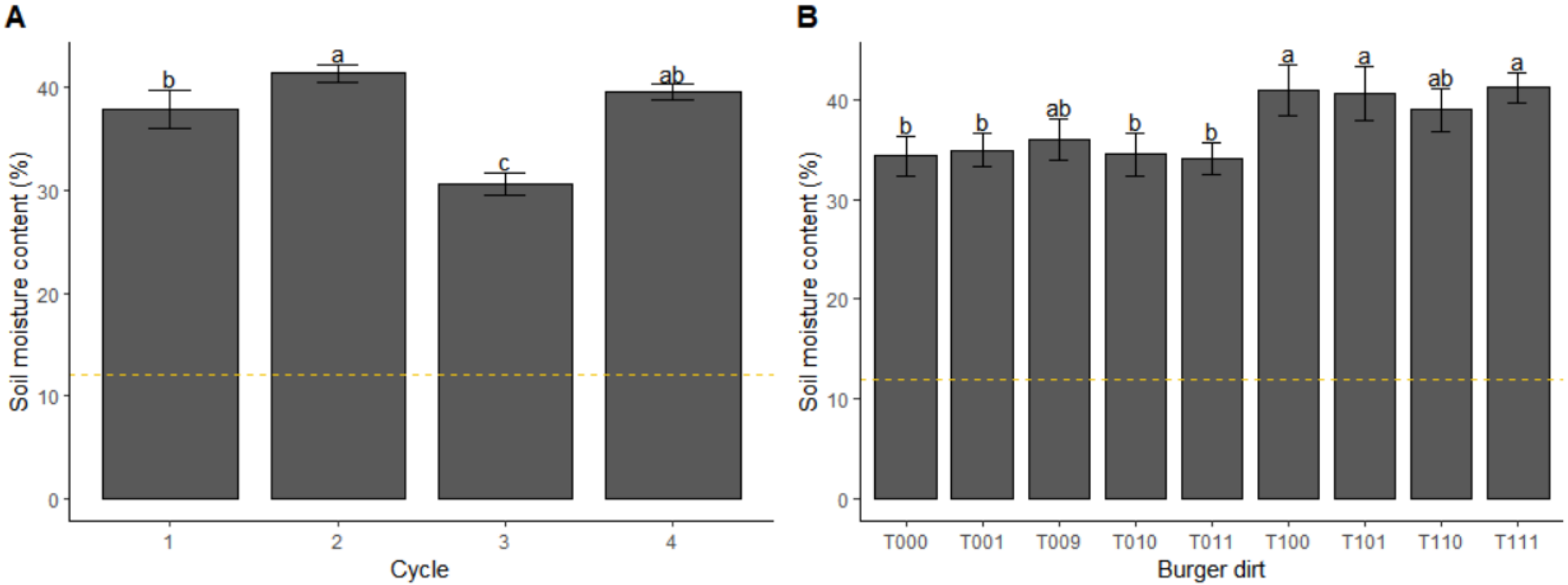


Figure Effect of growing cycle (A) and Burger dirt treatments (B) on soil moisture content (%). Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to original soil moisture content (12.00±0.286 %).

Soil aggregate stability maintained over growing cycle

- Continuous harvesting may be affecting the soil aggregate (Fokom et al., 2012)
- Soil aggregate form, high soil organic matter stored (Rabot et al., 2018; Yu et al., 2020)

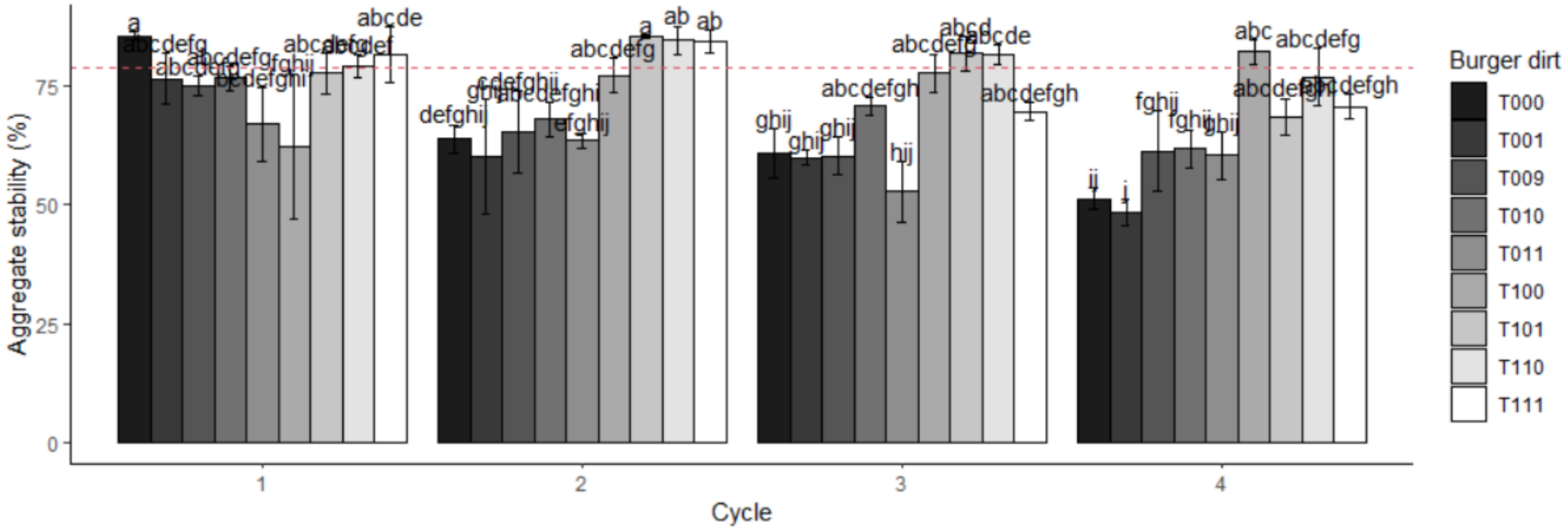


Figure Interaction effect of growing cycle and Burger dirt treatments on soil aggregate stability (%). Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to original soil aggregate stability (78.73±0.5679 %).

Catalase activity decreased 125-400% with Burger dirt substrate and increased with cycle

- Burger dirt produced anaerobically and thus anaerobes were predominant in the soil
- Soil air increased over the growing cycle and thus high catalase activity (Glinski et al., 1986, 2000)

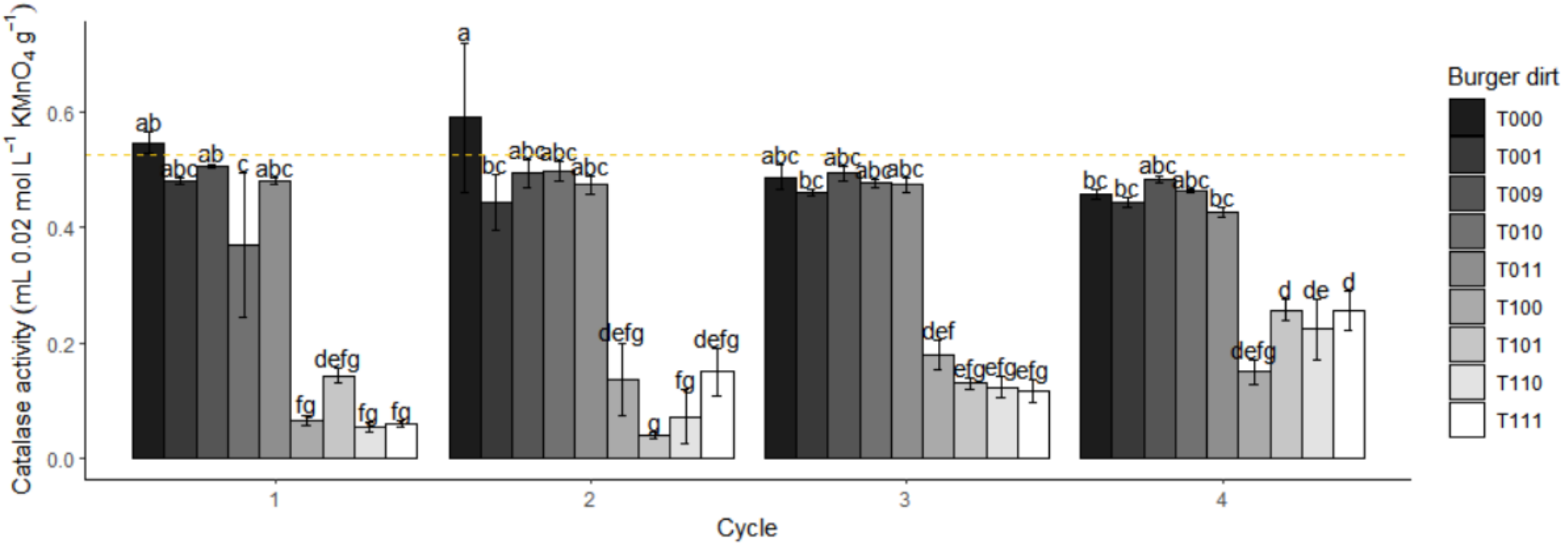


Figure Interaction effect of growing cycle and Burger dirt treatments on catalase activity (mL 0.02 mol L^{-1} $KMnO_4$ g^{-1}). Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to as original soil catalase activity (0.525±0.0104 mL 0.02 mol L^{-1} $KMnO_4g^{-1}$).

Urease activity increased 88-600% with Burger dirt

- Urease activity improved by organic matter content and microbial biomass (Guangming et al., 2017; Kumar & Wagenet, 1984; Roscoe et al., 2000; Sahrawat, 1983; Zantua et al., 1977)

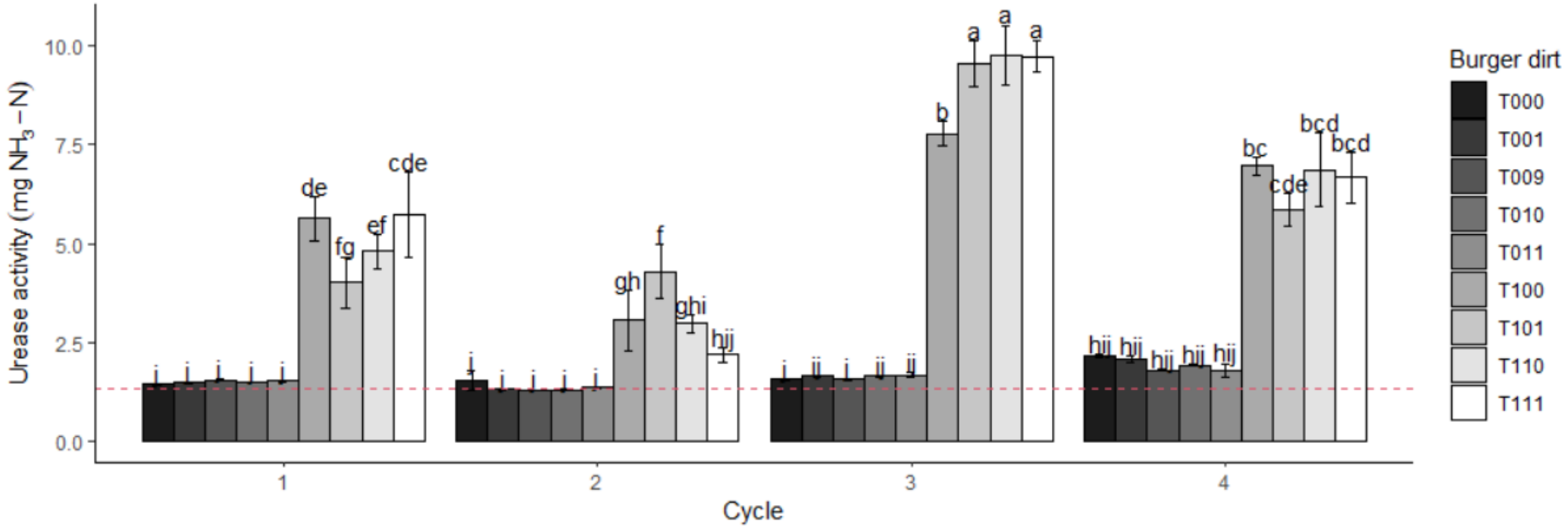


Figure Interaction effect of growing cycle and Burger dirt treatments on urease activity (mg NH_3-N). Means ± standard error with different letters is significantly different at P<0.05 using DMRT. The dotted line is referred to as original soil urease activity (1.33±0.0407 mg NH_3-N).

Correlation

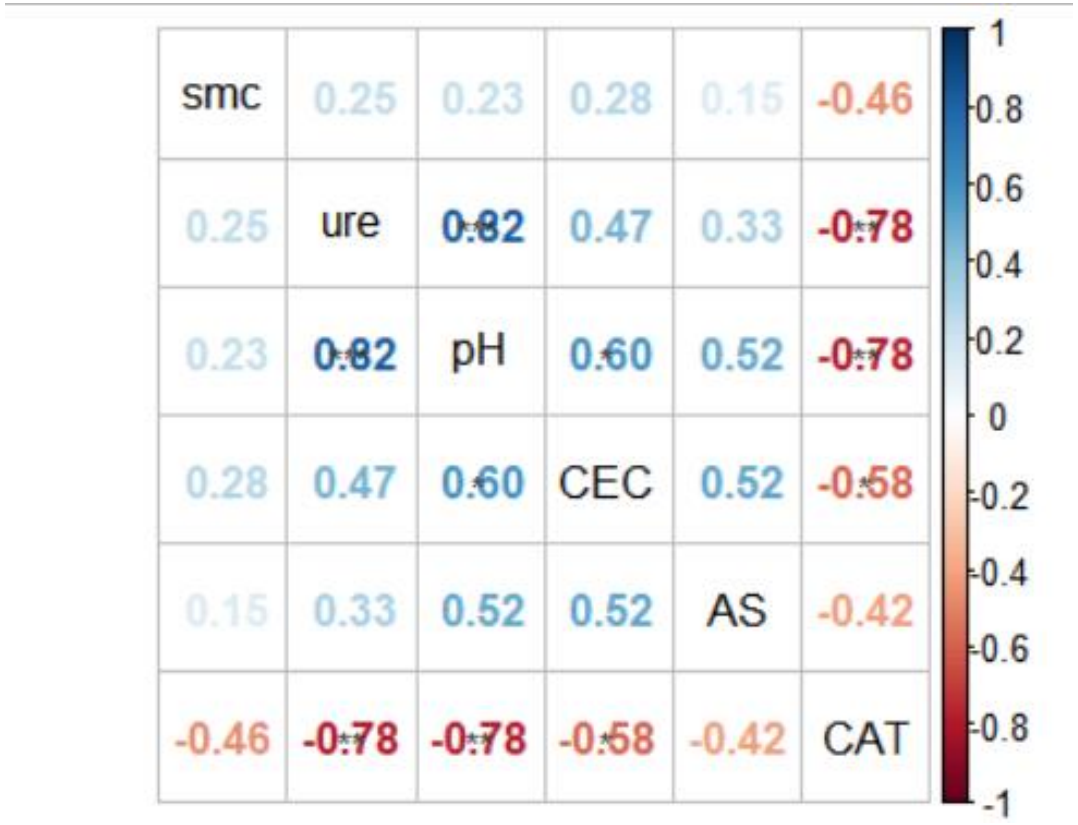


Figure Pearson's correlation for soil moisture content (smc), urease activity (ure), pH, CEC, aggregate stability (AS) and catalase activity (CAT) from bok choy treated with and without Bokashi, with 4 growth cycle. The “*” was indicated the significant level.

Conclusion

- Under bok choy growing, Burger dirt substrate improved
  - Soil urease activity
  - pH
  - CEC

Thank you