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Biogeosciences Discussions

Interactive comment on "Morphological plasticity of root growth under mild water stress increases water use efficiency without reducing yield in maize" *by* Qian Cai et al.

Qian Cai et al.

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Anonymous Referee #2 Received and published: 2 May 2017 General comments: The paper presents an interesting analysis of morphological and physiological response to water stress in a global major crop specie, maize. As water use efficiency (WUE) is a powerful indicator of tradeoff between water transport and dry matter production, understand the variance of WUE with the different degree of water stress is very valuable. The topic is suitable for the journal, and the results provide important instruction for economical irrigation schedule for maize in semi-arid region. However, a minor revision as follows is necessary before the publication: Title& abstract: what is the def-

inition for water stress levels? –no water stress, mild water stress, and severe water stress?

Response: We took the average rainfall during crop growing season (May to September) as a no water stress control. This amount equals (slight greater than) maize water requirement in this region; mild water stress is 350- 450 mm and severe is 200-300 mm than the average. The possibility of the occurrence of no stress is 69%, mild stress 28% and severe is 4%. We clarified this in the revised text (L117-118).

Introduction: I think a clear definition of growth stage in a year is necessary (with a table or figure), which would help us understand the specific means of "V16","R1",etc.

Response: We added specific growth stage in the revised text as V16 (with 16 fully expanded leaves) and R1 (silking). In M&M, we cited a reference for international standard of maize growth stages (Adendroth et al., 2011).

Response: Material and method: how does the mobile rain shelter construct and work?

The mobile rain shelter is composed of steel frame and transparent PVC. The mobile rain shelter is built on a mechanical movement track and equipped with a electricity motor to move the shelter by a remote control as shown in Fig. S1. During the time without rain, the shelter is move away from experiments plots and covered only during raining time. We clarified in the revised text (L118-121).

What height and how to prevent the possible moisture intrusion from the side?

Response: The mobile rain shelter is 9 m in width, 30 m in length and 4.5 m in height. The top and both sides of the shelter have PVC transparent board to prevent outside rainfall. There is a water gutter at out side of movement track to drain the rain water. Therefore the rain water intrusion can be avoided. We clarified this in the M&M section (L123-127).

Results: Table 1 provide the actual water supply at three growing periods, what is basis of this quantity?

Response: The actual water supply at three growing periods is based on the maize water requirements and possibility of rainfall distribution. We clarified this in the revised text.

Fig.1 why not consider the solar radiation that may be more related to transpiration and photosynthesis during the growing season?

Response: In Fig. 1, we did not include solar radiation data in two experimental years because the radiation in this region generally is not a limiting factor on maize growth and development. Also we did not use radiation data in the analysis.

Fig. 2 why selected 49,77,113 and 141 of DAS as time for comparison?

Response: Because we started water treatments after maize jointing, and then we measured crops around every 30 days. The measuring times are maize key growth and development stages, representing vegetative period (jointing, R6), tasseling (VT), milk (R3) and dent (R5). We clarified in the revised text (L148-149).

Why it is not the same period in 2015?

Response: We only measured once at final stage in 2015 for biomass of shoot and root.

Specific comments: Line 37-38, this sentence as a new point that should be discussed more detailed in Discussion;

Response: We agreed. We added more discussions.

Line 43, what is critical water sensitive period? that should be pointed out clearly;

Response: We clarified this in the revised text.

Line 78, what is V16,R1?

Response: We clarified this in the revised text.

Line 110-111, please consider how to define the water stress, soil water content or

actual water supply?

Response: Good point. We added a new figure with the anomalies of rainfall from 1965 to 2015 and the distribution of its possibility. We clarified this in the revised text.

Line 115, the word ”supplement” is not appropriate for the pot experiments;

Response: Revised.

Line 133-144, what is means of V6,VT,R3, R5?

Response: We clarified it.

Line 155, what is the number of repetitions for soil samples?

Response: We clarified in L170 (3 replicates for each treatment).

Line 212-213 I think this point is not persuasive at this time, it should discuss deeper together with morphological plasticity in Line 259.

Response: We agreed. We move this into discussion.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2017-103/bg-2017-103-AC2-supplement.pdf

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Fig. 1. Layout of mobile rain shelter in experimental site