Responses to comments of Referee no. 2

General comments:

Does the paper address relevant scientific questions within the scope of SE?

The MS takes two winter crops, after pH and Al correction, the benefits of this correction are prolonged in soil (residual effects). In the sense, the better Al and pH levels in a soil should be reasoned considering a crop rotation and not only one crop. Thus, a better Al and pH levels will be defined for the more sensitive crop in the crop rotation adopted. This must be also addresses in the discussion.

Reply: This issue has been addressed in the discussion.

In present study, the critical soil pH and Al levels for wheat and canola were obtained with pot experiments in only one crop season. A better Al and pH levels in a soil should be reasoned considering a crop rotation and not only one crop. Thus, a better Al and pH levels will be defined for the more sensitive crop in the crop rotation adopted in future.

Specific comments

Comment 1:

Reply: Thanks for positive comments.

Comment 2: Are substantial conclusions reached?

Yes, see the comments below. ¨We hope these findings also help to protect the soils from degradation by reducing the excess use of lime in the studied location. ¨this statement is not
well worked in the discussion section.

Reply: This statement has been removed from the section of Conclusions.

Comment 3:

Reply: Thanks for positive comments.

Comment 4: Are the results sufficient to support the interpretations and conclusions?
Yes, in part.

Question: Commonly, Al^{3+} is missing in soils with pH 5.3 or upper. Al^{3+} pass toward $Al(OH)^{2+}$ or completely to $Al(OH)_3$ with zero free charge. Can the authors explain how Al was found in pH condition higher than 5.3?

Reply: We agree with the suggestion of the referee. The interpretation has been added in revised version: "Commonly, Al^{3+} is missing in soils with pH5.3 or upper. However, the exchangeable Al^{3+} was still detected above pH5.3 in present study. This may be due to the indirect method used, in which the exchangeable Al^{3+} was the difference between exchangeable acidity and exchangeable H^+ (Bertsch et al., 1996)."

Question: Explain what is causing the differences in the two locations (Hunan and Anhui). The difference found in Al exchangeable for wheat varied from 0.56 to 2.36, and such difference can represent 4.2 % and 15.22% in the Al CEC.

Reply: The differences of critical values between two locations were mainly due to the difference in soil CEC. The CEC of the Ultisol from Anhui was greater than that from Hunan (Table 1). Thus, at the same exchangeable Al level, the Al saturation (percentage of exchangeable Al in CEC) was lower at the Ultisol from Anhui than that at the Ultisol from Hunan; while the base cation saturation (percentage of exchangeable base cation in CEC) was higher at the Ultisol from Anhui than that at the Ultisol from Hunan. Base cations can alleviate Al toxicity to plants (Liu and Xu, 215). Therefore, the higher CEC and greater base cation saturation of the Ultisol from Anhui led to the lower critical values of soil pH and exchangeable Al in the Ultisol from Anhui compared with that from Hunan. This paragraph has been added in revised version of my manuscript.

Question: Explain why is not possible to determinate the critical soil Al contents for canola. In the introduction section Lollato et al. (2013) has an important result to your consideration (Line 7 and 8 page 3).

Reply: Canola was more sensitive to soil acidity than wheat, and thus has higher critical soil pH in both locations than wheat. Canola was also more sensitive to Al toxicity and less tolerance to toxic Al. This may be the main reason that the critical soil Al contents were not obtained canola in present study. These sentences have been added in revised version of my manuscript.

Question: Are there morphological effects on roots in the crops due to Al?

Reply: Yes. There was adverse effect on root of both crops at low soil pH with high Al concentration. Stunt, thick, bend, brownish root, deformed root tip and no or very few lateral roots were observed. The related information has been added in the revised version.

Question: Can we extend the critical pH and Al values, obtained in this study, for another crops or the same crops for other soil types?

Reply: The critical soil pH and Al values varied with soil types and crop species and thus the two parameters obtained in this study cannot be extended for other crops or the same crops for other soil types. These obtained critical values are only for specific soil types and crops. It is suggested that liming should be done according to the critical values for the growth of same species in different soil types. Hence, site-specific agricultural management practices including liming can apply judiciously with proper crop selection which are economically as well as environmentally sound. These sentences have been added in revised version of my manuscript.

Question: In general, MS have a week point concerning the discussion of the data. It must be deeper in two aspects: Exchangeable Al versus soil pH. There is less exploration about the relationship soil pH and plant response. Thus, the discussion can be improved.

Reply: A sub-section of General discussion has been added under Results and discussion (3.5) to improve discussion in revised version of my manuscript.

Comment 5: Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Question: Provide more information about soil profile (soil profile descriptions, such as granulometry, colors; A horizon deep, Bt horizon characteristics etc…).

Reply: The soil samples were collected from crop lands, only surface soil was collected. But we provide more information on both soils and sampling sites in revised version of my manuscript.

Both Ultisols were derived from quaternary red earth. The Ultisols derived from quaternary red earth were widely distributed in subtropical regions of southern China. The profile depth of this type of soils was normally more than 2 meters or even reached ten meters (Hseung and Li, 1990). The clay content in the soils was more than 40%. Langxi, Anhui province located in the northern part of subtropical region in China. The average annual rainfall and temperature are 1300 mm and 15.5°C at this sampling site. Qiyang, Hunan province located in the middle part of subtropical region in China. The average annual rainfall and temperature are 1431 mm and 18°C at this sampling site. The greater precipitation and higher temperature at Qiyang led to higher weathering extent of the Ultisol from this site than that from Langxi. Therefore, the cation exchange capacity (CEC) of the Ultisol from Langxi is greater than that of the Ultisol from Qiyang (Table 1).

Question: How the pH and Al critical values were found?

Reply: The critical values of soil pH and Al were obtained through piecewise models by using a nonlinear curve fitting procedure. The critical values were obtained by two intersected linear lines.

Comment 6: Do the authors give proper credit to related work and clearly indicate their own new/original contribution? In this sense the MS can be improved.

Reply: Thanks for comments. Manuscript has improved as suggestions.

Comment 7: Does the title clearly reflect the contents of the paper? Yes!

Reply: Thanks for positive comments.

Comment 8: Does the abstract provide a concise and complete summary? Yes, but it can be shorter.

Reply: Thanks for positive comments. The abstract has been shortened.

Comment 9: Is the overall presentation well structured and clear?

I consider the MS strong point: the methodology is clear and well building.

Reply: Thanks for positive comments.

Comment 10: Is the language fluent and precise? Yes.

Reply: Thanks for positive comments.

Comment 11: Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Reply: The related issues have been examined in revised version.

Comment 12: Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
The figures must be reviewed, provide a better presentation in the figure size, figures alignments and figure statements (equation, soil types, any other informations). Pay special attention on all y axes of the figure 5, in the wheat root dry weight. Inside the figure 5 both soils are Hunan soil, and the equations are the same. Figure 4 there is no identification about what crop is it.

In the figures, provide the real curves on the observed points. Besides, the equation resulting of these curves should be presented in the figures (with R2 and P values).
Reply: Figures have been corrected as suggestions.

In the table 1. What means CEC?

Reply: In Table 1. CEC is the abbreviation of Cation Exchange Capacity. The information has been provided in revised version.

Comment 13:

We suggest a review of literature used. There are few papers quoted in the MS originated from the last 5 years. Please recheck this section. By references sampling, I found inconsistences in Bertsch and Bloom, 1996 is not in the references.
Reply: References have updated as suggestions.
Following reference should be added in reference section.

Bertsch, P. M., and Bloom, P. R.: Aluminum, in: Methods of Soil Analysis. Part 3-Chemical Methods, Soil Sci. Soc. Am. Book Ser. 5, edtied byb Sparks, D. L., Am. Soc. Agron. and Soil Sci. Soc. Am., Madison, WI, USA, 1996.

References:

Brevik, E. C. and Sauer, T. J.: The past, present, and future of soils and human health studies, SOIL, 1, 35-46, doi:10.5194/soil-1-35-2015, 2015.

Zornoza, R., Acosta, J. A., Bastida, F., Dom ńguez, S.G., Toledo, D.M. and Faz, A.: Identification of sensitive indicators to assess the interrelationship between soil quality, management practices and human health, SOIL, 1, 173-185, doi:10.5194/soil-1-173-2015, 2015.