

# The Effect of Rotation on Alfalfa Autotoxicity in Hexi Corridor of China

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**Introduction:** Alfalfa autotoxicity is quite common on continuous cropping land in Hexi Corridor of China, rotation is an effective way to reduce continuous cropping barrier. But the related information is limited in this area. So the objective of this paper is to rotate wheat and corn in 5-year old alfalfa land and study their effects on autotoxin content and alfalfa seed germination.

**Material and methods.** A complete random block design was conducted in 5-year old alfalfa land in Huangyang Township, Wuwei city of Gansu province with 3 treatments, i.e. rotate wheat (AW), corn (AC) and continuous cropping (CK) in Spring of 2018 with 3 replicates. Wheat and corn were seeded in 48m<sup>2</sup>(6 m×8 m) plot by drill (20cm row space and 150 kg·hm<sup>-2</sup> seeding rate) and bunch planting (20cm plant space) on April 15th, respectively. Rhizosphere soil samples in 0-30cm were taken before plowing and after wheat and corn harvest. The autotoxin in the soil was determined by HPLC. Air dried soil from each treatment was used to make 10, 50, 160 g·L<sup>-1</sup> soil extract. Alfalfa seeds were disinfected and set on 9cm petri dish, 5 mL soil extract of each concentration was added for germination. Seed germination rate was determine after 7 days and plumule and radicle length were measured. Allelopathy index (RI) was calculated according to Williamson and Richardson (1988).

**Results.** The total autotoxin content of rotation treatments was significantly lower than that of the control (Figure 1). As much as 17.49% and 10.76% reduction were observed for AC and AW treatment. After rotated to corn and wheat, the content of p-hydroxybenzoic acid and coumarin were lower ( $P<0.05$ ) than that of the control. No remarkable differences among treatments were obtained in terms of caffeic acid, ferulic acid and chlorogenic acid content.

Figure 1. Rotation affects soil autotoxin.

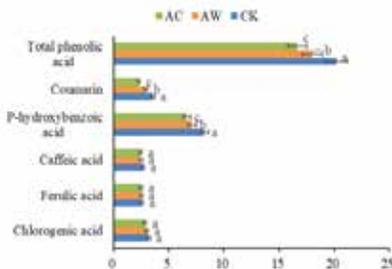


Figure 2. RI of germination rate.

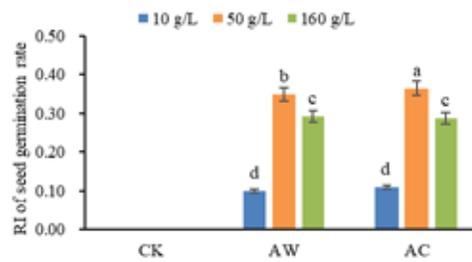
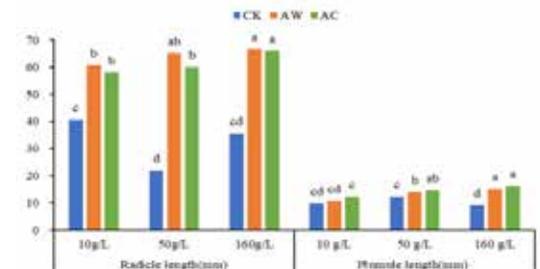


Figure 3. Rotation influences radicle/plumule length.



Soil extracts from corn and wheat improved alfalfa seed germination (Figure 2), and higher concentration also increased radicle and plumule length (Figure 3). The significant correlation was observed between germination and autotoxin (Table 1).

Table 1. Correlation between alfalfa seed germination and autotoxin.

	Chlorogenic acid	Ferulic acid	Coffee acid	Para-hydroxybenzoic acid	Coumarin	Total inductive substances
Germination rate	-0.893**	-0.402	0.808**	-0.935**	0.864**	-0.920**
Radicle length	-0.826**	-0.191	-0.525	-0.652	-0.696*	-0.690*
Plumule length	-0.958**	-0.459	0.827**	-0.966**	0.957**	-0.979**

**Conclusion.** Continuous cropping can cause alfalfa auto-toxicity, and rotation to annual cereal is very effective to reduce autotoxin content and improve alfalfa seed germination.

## References

Williamson B and Richardson D. Bioassays for allelopathy: Measuring treatment response with independent controls. Journal of Chemical Ecology. 1988.14:181-187.

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