Climate change in the Loess Plateau of China and its affection to apple suitable region

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ABSTRACT
Using temperature, cloud amount and apple planting condition data, we find the suitable region for apple planting extending to north because of the climate change in the Loess Plateau of China in recent 50 years. The main changes are following. One is the increasing temperature, the other is decreasing cloud amount, which will result in longer sunshine hours. By comprehensive analysis of the change in climate resource, a conclusion about apple suitable region extending to northward can be drawn out.

Keywords
The Loess Plateau; Apple; Cloud; Temperature

1. INTRODUCTION
The impacts of climate change are associated with the climate-related parameters of sea level rise, changes in the intensity, timing and spatial distribution of precipitation, changes in temperature (variation and mean values), cloud amount changes which will affect the sunrise hours, and so on. Recent studies show negative impacts because of climate change, such as global warming, flooding, draught, and other severe weather event. But, as the two sides of a coin, climate change will bring some positive impact on biological and human systems, such as agriculture and forest planting, especially in middle-high latitude region. Here, we suggest, for the first time, the potential for global climate change, and, in particular, increased CO2 and temperature, to have an impact on apple planting in North of China. Such impacts could have significant benefit to such developing regions. There is an urgent need for research on the impacts of climate change on apple planting.

2. The fact of climate change in the Loess Plateau of China
In recent 50 years, the major trend of temperature in the Loess Plateau is increasing. The abrupt climate change event occurred in the middle of 1980. Before this event, the temperature decreased slowly and the lowest temperature appeared in 1984. After this event, the temperature increased obviously and the highest temperature appeared in 1998(Fig. 1).

3. Affection of climate change to apple growth
For the Loess Plateau region, the main characters of climate change is increasing temperature, especially in winter and spring. The flowering stage of apple is ahead of 20d since 1990 because of warm winter and spring[2]. Through further analysis, warm winter often accompanies strong temperature drop in following spring. During 2001-2007, there are 6 warm winters in the apple suitable region in the Loess Plateau, which occurred 33 strong temperature drops in 5 years and the flowering stage met strong temperature drop in 4 years. So, although on the background of global warming, the freezing injury events by strong temperature drop in flowering stage increase obviously.

4. Affection of climate change to apple suitable region
Apple production needs suitable ecological and climatic condition. At present, apple suitable region in Shannxi province is
In general, suitable growth conditions for apple production are following: annual mean temperature is 8.0～14.0℃; minimum temperature under -20℃ in winter is less than 22d; mean temperature in apple growing period is 13.4～18.5℃; daily mean temperature above 10.0℃ is more than 140d; precipitation in apple growing period is more than 450mm～500mm; relative humidity is 60～70%; sunshine hours is more than 1200h. Based on above conditions, the ecological and climatic conditions in other regions become better for apple growth with the global warming. By comprehensive analysis of the change in climate resource, a conclusion about apple suitable region extending to northward can be drawn out(Fig 3).

5. REFERENCES
