Effect of Silicon on Early Growth and Yields of Alfalfa (*Medicago sativa*)

Fuping Tian
Lanzhou Institute of Animal Science and Veterinary Pharmaceutics Science, China

The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Effect of silicon on early growth and yields of alfalfa *(Medicago sativa)*

TIAN Fu-ping
[1] *Lanzhou Institute of Animal and Veterinary Pharmaceutics Science , The lanzhou Scientific Observation and Experiment Field Station of Ministry of Agriculture for Ecological System in Loess Plateau Areas ,Lanzhou 730050 China .*
[2] *Corresponding author . E-mail : tianfp@163 .com*

Key words : alfalfa ,yields ,silicon ,pot experiment ,nutrients

Introduction Silicon is the second most abundant element in soils , the mineral substrate for most of the world' s plant life (Epstein , 1994) . Since Sommer (1926) demonstrated the favorable effect of Si on rice growth , intensive studies on the essentiality of Si for plants have been undertaken throughout the world . Although the essentiality of Si for plant growth has not yet been established (Epstein , 1994) , there is sufficient evidence to suggest that it is an agronomically essential nutrient for achieving and maintaining high yields of rice (Lian , 1976 ;Liang et al . , 1994) . Silicon enhances the growth of various (mostly monocotyledonous) plants by providing rigidity to plant tissues and promoting photosynthesis (Cheng , 1982 ; Epstein , 1994) . Si has recently aroused interest in crop research because of yield responses to Si in rice , spring wheat (Nowakowski and Nowakowska 1997 ; Rafi and Epstein 1999) , sugarcane (Savant *et al* . 1999) , and barley (Liang 1999) . Some experiments indicated that it could promote growth of legumes ,such as soybeans and alfalfa(Tian 2006) .

Materials and methods A Si-deficient top soil (about 0-20 cm) was collected in September 2002 from the Dingxi county of Gansu province , China (104°35'E ,35°28'N , 1970 m a .s .l .) . Fifty plots of 50 by 50 by 15 cm were randomly selected to collect experimental soil . Five replicates of each soil sample were analysed for organic matter .The experiment was conducted in a greenhouse with opening windows at the Dingxi experimental site of the Gansu Academy of Agricultural Science during the growing season of 2003 . The average temperatures for day and night were 25 and 14°C , respectively , and the light and dark periods were 15 and 9 h each day , respectively . The equivalent of 27 .5 kg of oven-dried soil and 0 .1 kg $CO(NH_2)$ (46 .7% N) were put into 36 plastic pots , each with a saucer to prevent drainage loss of nutrients . Treatments consisted of 6 rates of Si application : 0 , 0 .025 , 0 .050 , 0 .100 , 0 .200 , 0 .300 g/kg of soil , and each treatment was replicated 6 times . Silicon was applied as H_4SiO_4 and was mixed through the soil .

Results First , the effect of Si fertilization on early growth and development of alfalfa . Si increased the vigour of seed germination and the germination capacity . It enhanced seedling development-low Si fertilization treatments increased fresh weight of single seedlings of alfalfa . Treatments of Si fertilization shortened the growth duration by about three to six days . Si fertilizations increased ramification numbers during the ramification stage , but without significant differences during the blooming period . Si treatments increased the height , number of inflorescences and cod numbers of alfalfa , and high Si fertilization treatments reduced leaf inclination angle . Si did not affect the leaf area of alfalfa during the ramification stage , but increased it during the blooming period .
Second , the effect of Silicon on alfalfa yields . Silicon increased yields of alfalfa green grass[anon .1] , dry matter and single dry weight . It increased leaf fresh weight , leaf dry weight and inflorescence weight . Silicon did not affect stem weight during the ramification growth stage , but it did increase the stem weight in the reproductive period . The pot trial showed that Silicon fertilization did not affect yields of seeds in the first year , but did have a significant effect on one thousand-seed weight which increased twenty-nine percent compared with the control . Silicon fertilization increased root nodules of alfalfa by about fifty percent compared with the control .

Discussion
The effect of Si on vegetative growth and yields has been debated for different plants . Lux et al . (2003) indicated that silicate application increased the vegetative growth of Phyllostachys heterocycla .