

## 高供氮水平下不同硅肥对水稻茎秆特征的影响

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**摘要:** 【目的】倒伏是水稻生长的主要限制因子, 不仅降低稻谷的产量, 而且还影响其品质。因此, 通过在两种氮水平条件下, 研究硅肥对水稻茎秆特征及其抗倒伏的影响。【方法】以唐粳 2 号水稻品种为材料, 在田间试验条件下, 设不施硅 (-Si)、硅酸钠 (Si1) 和硅钙肥 (Si2) 三个硅处理 (SiO<sub>2</sub> 用量 70 kg/hm<sup>2</sup>), 每个硅处理含正常和过量两个氮水平 (分别为 N 180 和 450 kg/hm<sup>2</sup>)。水稻成熟期, 测量株高、第 1 节和第 2 节长度、茎粗、旗叶和倒 2 片叶夹角、茎秆厚度和茎秆抗折力, 分析水稻植株中硅和钾的含量, 并观测了水稻茎秆的解剖显微结构。

【结果】正常供氮水平 (180kg/hm<sup>2</sup>) 下, 施硅对水稻株高、节间长度、茎粗、旗叶和倒 2 片叶夹角均无显著影响。过量供氮条件下, 施硅显著降低水稻基部第 1 节和第 2 节长度, 倒 2 片叶夹角显著降低了 20% ( $P < 0.05$ ), 显著增加了水稻基部第 1 节和第 2 节壁厚度和茎粗, 增加了茎的细胞层数和紧实度, 促进维管束的发育。过量供氮水平下, 与不施硅相比, 施用硅酸钠的植株硅含量在水稻拔节期和成熟期分别显著提高了 14.2% 和 11.3% ( $P < 0.05$ ), 施用硅钙肥处理的均显著提高了 14.9% ( $P < 0.05$ ); 成熟期各处理水稻植株抗折力从大到小表现为 Si2 > Si1 > -Si, 施硅的水稻茎秆倒伏指数均显著低于不施硅处理, 且过量供氮水平, 施硅钙肥的倒伏指数比施硅酸钠的处理显著降低了 6.2% ( $P < 0.05$ ); 施用硅酸钠和硅钙肥的水稻产量分别显著增加 12.3% 和 12.5% ( $P < 0.05$ )。【结论】过量施用氮肥条件下, 可增加水稻基部第 1 节和第 2 节壁厚度和茎粗, 增加茎细胞层数和紧实度, 从而提高茎秆的抗倒伏指数, 显著提高水稻产量。供试土壤上硅钙肥效果好于硅酸钠。

**关键词:** 硅; 氮; 水稻; 茎秆; 倒伏; 抗性; 产量

## Characteristics of rice stem in response to different silicon fertilizers under high nitrogen supply level

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**Abstract:** 【Objectives】Lodging is a major limiting factor in rice production, which not only reduces rice yields but also affects the grain quality and production costs. Silicon usually plays an important role in alleviating rice lodging. The response of rice stems to silicon fertilizer application was thus investigated under two levels of nitrogen supply. 【Methods】A field experiment of rice (*Oryza sativa* japonica cv. Tang No.2) was conducted using sodium silicate (Si1) and calcium silicon fertilizer (Si2) as Si sources. The Si supply level was setup as SiO<sub>2</sub> 70 kg/hm<sup>2</sup>, with no Si supply as control (-Si). All the Si treatments were under two nitrogen supply levels of normal N (180 kg/hm<sup>2</sup>, N1) and high N (450 kg/hm<sup>2</sup>, N2). The rice height, internode length, stem diameter, the leaf angles of the flag and the second leaves, stem wall thickness, and stem bending force were measured, respectively. The contents of silicon and potassium in the stalk of rice were analyzed. The anatomic structure of rice stem was also surveyed. 【Results】Under normal N supply level, applying Si did not show significant

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