Breeding for Cold-Tolerant Lines of *Stylosanthes guianensis* in Southern China

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Stylosanthes guianensis is an important forage legume with high yield and quality , acidity tolerance , and excellent adaptation to low fertility soil in tropical and subtropical areas worldwide . It has also been used as a cover crop in agricultural farming , grown as green manure , cut for either fresh fodder or hay , and sown to rehabilitate the soil fertility of mine site . The low temperature in winter is a key factor limiting its growth and production in the subtropical regions . In order to induce and select chilly-tolerant mutants of *S . guianensis* , a total of fifty-eight thousands seeds of CIANT 184 were irradiated with gamma-ray at dosage of 400 , 420 , 440 , 460 , 500 , 600 , 700 Gy , respectively , in 2003 . The seedlings were exposed to 2-3 ℃ in growth chambers for 3 days as chilling treatment . The surviving plants were maintained and subjected to a second round of selection after 3 months . M2 and M3 plants were selected in 2004 and 2005 , respectively , like the M1 plants . Five mutants with increased chilly tolerance and ten dwarf mutants were selected .

M4 and M5 plants of mutants were evaluated in greenhouse and fields in 2006 and 2007 . The result indicate that in terms of chilly-tolerant mutants , M4 plants (lines 4-13 , 4 .2-14 , 4 .4-3 , 6-2 , and 7-1) showed lower ion leakage and higher Fv/Fm than the wild type control under chilling stress in growth chamber . In field tests , the mutants had the similar yield to the wild type control in the first year (2006) , but four lines (4-1-3-8 , 4 .4-3 , 6-2 , and 7-1) had significant higher yield in the second year (2007) . Lines 6-2 and 7-1 showed early recovery growth in spring , and had better survival after over-winter .

In terms of the dwarf mutants in greenhouse , the two-month-old M5 plants (lines 4 .2-2 , 4 .2-3 , 4 .2-4 , 4 .2-6 , 4 .2-11 and 7-2) were 31-34% shorter than the wild type (the control) , however , the dry weights of shoots and roots of the mutant lines were similar to those of the wild type , and the dry weight of the shoot of line 4 .2-3 was even higher . Growth of the dwarf mutants was promoted by treatment with 50 mg/L and 100 mg/L gibberellin (GA_3) , while CIANT 184 was not affected , indicating that GA_3 biosynthesis might be blocked in the mutants . All the mutant lines increased drought resistance , and the lines 4 .2-4 , 4 .2-6 , and 4 .2-11 increased chilly resistance . In field study , the tested mutant lines (4 .2-3 , 4 .2-4 , 4 .2-6 , 4 .2-11 , 7-2) were approximately 30% shorter than their parent cultivar , CIANT 184 in 2006 and 2007 , respectively . The chlorophyll contents in leaves were also higher in the mutant lines than CIANT 184 . In spring of 2007 , M4 plants of dwarf mutants showed early recovery growth and significantly increased yields .