

then decreased, but they were not evident compared with the control. The root activity and chlorophyll content were sensitive to the allelopathy of Eucalyptus, and was first obviously increased and then significantly decreased with the increase of the concentration. The MDA content of Vetiver in different treatments was higher than that in control, and it was no obvious difference in low concentration (under equal or lower concentration of 40%). But it was obvious difference in high concentration (the treatment concentration was equal to or above 60%). Results indicated that *Vetiveria zizanioides* had more strong viability to the effect of allelochemicals of Eucalyptus and had application foreground of developing agro-forestry management Eucalyptus plantation.

Key words Eucalyptus; *Vetiveria zizanioides*; Allelopathy; Water extract

04 CO₂ and N₂O Emissions in The Red Soils of Agro-Forestry (Grass) Systems Converted From Cropland in Subtropical Hilly Region of China

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Abstract Not much information exists on soil respiration and nitrous oxide emissions in soils under different terrestrial ecosystems in subtropical China. Field experiments were conducted in static chambers to investigate the effects of soil environmental conditions on CO₂ and N₂O fluxes from red soils under six different land use types. The investigated land use types included maize land, *Amorpha fruticosa* plantation, *Vetiveria zizanioides* plantation, *A. fruticosa* + maize and *V. zizanioides* + maize agro-forestry (grass) systems, and wasteland. Also variations in soil greenhouse gases, water, nitrogen, organic carbon, microbial biomass carbon and net nitrogen mineralization were determined. The results were as follows: 1) during maize growth season, CO₂ flux in wasteland was lower than that in *A. fruticosa* + maize agro-forestry system, sole maize, *V. zizanioides* + maize agro-grass system, *A. fruticosa* plantation and *V. zizanioides* plantation, in that order. However, no significant differences in CO₂ flux were noted among five land use types. 2) N₂O fluxes were 508 g·hm⁻²·a⁻¹, 470 g·hm⁻²·a⁻¹, 390 g·hm⁻²·a⁻¹, 373 g·hm⁻²·a⁻¹, 372 g·hm⁻²·a⁻¹ and 285 g·hm⁻²·a⁻¹ for *A. fruticosa* + maize agro-forestry system, *A. fruticosa* plantation, wasteland, *V. zizanioides* + maize agro-grass system, *V. zizanioides* plantation and sole maize, respectively. 3) No significant relationships existed between CO₂ fluxes and soil organic carbon, microbial biomass carbon or water content. Significant positive linear relationship was, however, observed between N₂O flux and soil mineralization. The study suggested that land conversion from cropland to agro-forestry potentially increased soil CO₂ and N₂O release. While land conversion from cropland to forestland and/or grassland potentially decreased soil CO₂ emission, it increased N₂O emission.

Key words Returning farmland to forest or grass, Agro-forestry (grass) system, Land use change, Red soil, CO₂ and N₂O emission

05 Photosynthesis Response to Cadmium in *Vetiveria Zizanioides*(L.)Nash.

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Abstract: *Vetiveria zizanioides*(L.)Nash are subjected to different kinds of Cadmium treatment (0 mg/kg, 2 mg/kg, 20 mg/kg and 80 mg/kg), and their biomass, pigment content, net photosynthesis rate (P_n) and chlorophyll fluorescence parameters are investigated at 0d, 50d and 100d. The results show in the following. At 50 d, Cadmium conditions have facilitation on net photosynthetic rate (P_n), PS II photochemistry (ΦPSII), the electron transfer rate of PSII (ETR) and photochemical quenching coefficient (qP) of *Vetiveria zizanioides*(L.)Nash especially

under 20 mg/kg. Cadmium conditions could not effectively influence the biomass, photosynthetic pigment, the potential efficiency of primary conversion flight energy of PSII (Fv/Fm) of *Vetiveria zizanioides*(L.)Nash. At 100d, net photosynthetic rate(Pn) goes up significantly under 2 mg/kg and 20 mg/kg but decline significantly under 80 mg/kg, PS II photochemistry (Φ PSII), the electron transfer rate of PS PSII (ETR) and photochemical quenching coefficient(qP) all decrease but it drops significantly only under 80 mg/kg. The above results prove that *Vetiveria zizanioides* (L.)Nash could not only tolerate Cadmium stresses with low concentration for a long time, but also endure Cadmium stresses with high concentration for a short time.

Key words: Cadmium stresses; *Vetiveria zizanioides*(L.)Nash; photosynthesis; chlorophyll fluorescence

06 Vetiver Nitrogen-Fixing Bacteria on Some Biochemical Properties

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Abstract On Vetiver Grass nitrogen-fixing bacteria on some biochemical nature of the study, these findings for further research on biological nitrogen fixation has laid the foundation of vetiveria

Keywords azotobacter; vetiver; symbiotic nitrogen fixation

07 Research on MF Impregnation Resin Modified By *Vetiveria Zizanioides* Micro/Nano Fibrils

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Abstract: The *Vetiveria zizanioides* micro /nano fibrils (VFs) were prepared by high intensity ultrasonication (HIUS) . The relative crystallinity and morphologies of VFs were investigated by wide angle X ray (WAXD) and optical microscopy and scanning electron microscopy.(SEM) , respectively. The micro /nano fibrils were used to modify melamine formaldehyde resin (MF) impregnation resin and the property of abrasion resistance of MF before and after modification were evaluated. It showed that when filling with 15% of VFs, the abrasion got the minimum value, i. e. the abrasion resistant was best.

Key words: *Vetiveria zizanioides*; Cellulose; Micro /nano fibrils; Modification; Melamine formaldehyde impregnation resin

08 Establishment of Agrobacterium-mediated At CBF3 Transformation and its Effect on Cold Tolerance in Vetiver (*Vetiveria zizanioides*)

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Abstract: Temperature is the main restricted factor for distribution and application of vetiver (*Vetiveria zizanioides*) in Temperate and Frigid Zone. To improve its chilling resistance, we established an Agrobacterium mediated gene transfer system, in which a gene encoding transcriptional activator CBF3 extracted from *Arabidopsis* was transferred into the vetiver calli. The research results showed that the transgenic vetiver seedlings which overexpressed CBF3 were more tolerant to low temperature stress.

Key words: Agrobacterium-mediated genetic transformation; AtCBF3; cold resistance; *Vetiveria zizanioides*

09 Transferability of Wheat (*Triticum aestivum*) EST-derived SSR

Markers to Several Potential Energy Plants in Gramineae

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Abstract: To select some useful and reliable molecular markers for genetic and evolutionary study and germplasm evaluation of potential energy grass plants, the transferability of 48 wheat EST-SSR markers to seven grass species, *Saccharum arundinaceum*, *Miscanthus sinensis*, *Miscanthus floridulus*, *Saccharum arundinaceum*, *Triarrhena lutarioriparia*, *Themeda villosa*, and *Vetiveria zizanioides* were assessed. The results showed that 36 of 48 wheat EST-SSR markers could be transferred to the potential energy plants, with a transferability rate of 75.0%. Two hundred and forty loci were detected in the seven species, and the polymorphic loci were 184, with the polymorphic rate as 76.67%. The polymorphism information content (PIC) ranged from 0 to 0.370, and 0.220 was the average. A dendrogram was constructed based on genetic distance generated by the transferable EST-SSR markers. The *S. arundinaceum*, *N. porphyrocoma*, *M. floridulus* and *T. villosa* were classified into group A, *M. sinensis* and *M. floridulus* were assigned to group B, and *V. zizanioides* belonged to group C. This result is consistent with classical classification based on morphological traits. Therefore, wheat EST-SSR markers had high transferability to the Gramineae species, and will be useful in genetic and breeding research on potential Gramineae energy plants.

Key words: Wheat; EST-SSR molecular markers; Transferability; Gramineae energy plant

10 Effect of Different Plant Densities On Tiller and Axillary Dynamic of *Vetiveria Zizanioides*

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Abstract: The experiment studied the effect of planting densities on tillering dynamics and axillary dynamic of *Vetiveria zizanioides*. The results showed that planting density had little influence on the plant height and tillering number in the prophase. In the anaphase, planting density had a great effect on the plant height and tillering number. Smaller planting density could raise the tiller number in individual plant. Besides, axillary dynamics, the vitality of axillary buds, axillary space and the transformation of axillary different age were also influenced by planting density. As it grew, smaller planting density increased in the vitality of axillary buds and enlarged in its axillary spacing variations and thus, the old age axillary buds would grow well. Conversely, when planting density was big, the vitality of axillary buds decreased gradually, and axillary spacing variations became small and thus, the young age axillary buds would grow well.

Key words: *Vetiveria zizanioides*; planting density; tillering dynamics; axillary dynamic

11 Germination Dynamics and Effects of Different Soaking Treatments on Seed Germination of *Vetiveria zizanioides* in Western Guangdong Province

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Abstract: Dynamics of germination rate of *Vetiveria zizanioides* seed in western Guangdong Province were studied by the experiments of germination on paper seven years after the introduction. On this basis, the different concentrations of polyethylene glycol (PEG), calcium chloride (CaCl₂), gibberellin (GA₃) solution and water processing were used to determine the optimal conditions for improving the germination rate of *V. zizanioides* seed. The results showed that: 1) The germination rate of *V. zizanioides* seed was increased from July to October, and the germination rate reached the maximum 3.00% in October. However, they showed downward trend from November to December. So the optimal time for harvest of *V. zizanioides* seed was in October. 2) The germination rates were 14.00% and 11.33% in the 0.1 g/L GA₃ treatment group and the water treatment group after 6 hours, respectively, whose germination rates were about 4-5 times than those in the natural conditions. Those conditions

were fit for germination of *V. zizanioides* seed, but the overall germination rate was still low. The seedlings grew sturdily after being treated by PEU solution and water, while the transplanting survival rates were 74% and 73%, respectively.

Key words: *Vetiveria zizanioides*; osmotic regulating agents; seed; germination rate; seed germination dynamics

12 Preliminary Study on *Vetiveria Zizanioides* Using As A Potential Lignocellulosic Energy Plant

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Abstract: The photosynthetic characteristics and main mineral elements content in leaf and height growth rate of *Vetiveria zizanioides* (L.) Nash cultivated in experimental field in Nanjing were determined, and contents of chemical components related to fiber property and of hydrolysis products in leaf of *V. zizanioides* cultivated in experimental field in Nanjing and beach in Dongtai were analyzed and compared. The results show that response curve of net photosynthetic rate (Pn) with photon flux density of leaf is a single peak curve with a max Pn of 15.3 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ and light saturation point of 1528.6 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. And daily change curve of Pn is an obvious double peak curve with the two peaks appearing respectively at 10:00 and 15:00. The contents of K, N, Ca, P, Mg and S in leaf are 11.2, 7.6, 4.3, 2.7, 2.8 and 1.5 $\text{mg}\cdot\text{g}^{-1}$, respectively. The rapid growth period of the species is from May to October and height growth rate in July is the highest with 42.1 cm per month. Contents of cellulose, hemicellulose and lignin in leaf of *V. zizanioides* cultivated in experimental field and beach are 326.1 and 321.7 $\text{mg}\cdot\text{g}^{-1}$, 380.2 and 369.5 $\text{mg}\cdot\text{g}^{-1}$, 147.8 and 154.0 $\text{mg}\cdot\text{g}^{-1}$, respectively, without significant difference between different locations ($P > 0.05$). While contents of benzene-ethanol extractives and ash are 59.5 and 54.1 $\text{mg}\cdot\text{g}^{-1}$, 81.7 and 71.7 $\text{mg}\cdot\text{g}^{-1}$, respectively, with significant difference between different locations ($P < 0.05$). Among hydrolysis products in leaf of *V. zizanioides* cultivated in experimental field and beach, contents of glucose and xylose all are higher with 368.3 and 359.9 $\text{mg}\cdot\text{g}^{-1}$, 245.7 and 204.3 $\text{mg}\cdot\text{g}^{-1}$, respectively, and contents of arabinose, galactose and mannose are lower with total contents of 58.6 and 55.8 $\text{mg}\cdot\text{g}^{-1}$, respectively. In which, only xylose content has the significant difference between different locations ($P < 0.05$). It is concluded that *V. zizanioides* has a very high photosynthetic capacity, fast growth rate, relative high contents of cellulose and hemicellulose in leaf. And it can grow well in the marginal land and be considered as a potential lignocellulosic energy plant.

Key words: *Vetiveria zizanioides* (L.) Nash; lignocellulose; energy plant; photosynthetic characteristics; hydrolysis products; growth rate