Effects of balanced fertilization on bamboo's quality

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Abstract
Moso bamboo forest is an important forest resource in southern China. The results of balanced fertilizing in Jiangxi and Hubei bamboo forests showed that: balanced fertilization can increase the bamboo diameter, improve the quality of bamboo shoots and increase economic efficiency and yields. The influence on mechanical properties of bamboo is not obvious. Balanced fertilization can also reduce fertilizer waste and pollution. Balanced fertilization of bamboo forest and good management guarantees of improved productivity and quality, increased economic and ecological benefits in South China.

Key Words
Moso bamboo, balance fertilization, quality.

Introduction
Moso bamboo is the most widely distributed species occupying the largest area of cultivation, the largest reserves, has the highest economic value wood and bamboo shoots in China's bamboo forests. It occupies a very important position in forestry production in China. Bamboo with its fast growth, early useful wood, the wide use, the wide receipts, and other major characteristics are an important forest resource of the South in China. The recent 10 years, the area of bamboo increased at a rate of 51,000 hm^2 each year in China. Among them, *Moso* bamboo increased 76,000 hm^2 within the recent 5 years. Bamboo plays an important role in human life and production. It receives wide attention in world forest production. It not only provides industrial and agricultural production and people's lives are affected by the bamboo through bamboo shoots and bamboo by-products of raw materials, but bamboo also affects water and soil and water conservation, regulation of climate, landscape environment and other effects. *Moso* bamboo will have an irreplaceable role to meet the country's "bamboo instead of wood" and "bamboo instead of plastic".

Methods
The main producing areas are in Fengxin, Jing'an, Chibi, and other cities and counties in Jiangxi Province, Hubei Province. South Bamboo main production types and site conditions, the same basic rotation of bamboo-bamboo with balanced fertilization of pilot sites are represented by Fengxin, Jing'an and Chibi in the humid subtropical monsoon climate. The mean annual temperature is 17.4 ℃ with a frost-free period of 280 d, a mean annual rainfall ranging from 1612.5 to 1955.7 mm, the sunshine hours 1802.5 h, the total radiation is 106 kcal/cm^2.
Fengxin, Jing'an District uses on completely randomized design group designed trial, Hubei Chibi a incompletely random group. Analyses include bamboo shoot nutritional quality (protein hydrolysis amino acid method, Kjeldahl, residual method, detergent, anthrone color, burning method, atomic absorption spectrophotometry, sodium tungstate colorimetric method, 2,4-Dinitrophenylhydrazine Colorimetry)

Results
Fertilization on the impact of bamboo DBH
Fertilization and reclamation measures improve the average diameter at breast high (DBH). In the data about the average DBH in Fertilization, 1-3 year new bamboo, the average annual increase is 2.46 percent. The average fertilized DBH, 3-5 year new bamboo, the average increase is 7.93 percent. With fertilizer increasing, average DBH between fertilization treatment and CK (reclamation tending) has significant differences. It indicates that it is very important of fertilizer inputs to the maintenance of average diameter.

Balanced fertilization on the impact the nutritional quality of bamboo shoots
The difference N, P, K ratio in six treatments for the six treatments. But compared to CK (reclamation), the nutritional content of bamboo shoots improves with respect to protein, sugar, fat, VC, fibre etc., which show

higher values than those in non-fertilized treatments. In particular, the sugar content increases 38.7 percent.

Balanced fertilization impacts on Moso bamboo wood properties
To test *Moso* bamboo wood properties after four years continuous fertilization wiyh different N and P rates in Hubei Chibi. In general, string bending strength was slightly lower than the control, radial bending strength, along the grain compressive strength and tensile strength of slightly higher than those in control.

Conclusion
The DBH increment relationship with fertilization treatment is larger than for CK (reclamation). The largest growth reached 11.2 percent in $N_2P_2K_2$, followed by $N_1P_1K_2$, relatively increment 10.3 percent. The next highest growth response is 9.9% in $N_2P_1K_2$ treatment, which is more than four-fold that for CK (reclamation). It is very important that fertilizer inputs improve the quality of bamboo.
Fertilization improve the protein, sugar, fat, VC, fibre and nutrient contents of bamboo shoots, in particular, the sugar content increased 38.7 percent. From the perspective of using bamboo shoots, the highest yield of bamboo shoots with $N_2P_1K_1$ reached 4363 kg/hm^2, an increase of 90.72 percent over Control. The other treatments in order of the relative production of bamboo shoots: $N_1P_1K_2$ (162.7%)> $N_2P_2K_2$ (160.6%)> $N_2P_1K_2$ (159.4%)> $N_1P_1K_1$ (135.5%)> N_1P_1 (126.0%)> CK (reclamation) (100%). Fertilizers N, P and K nutrients play a vital role in the growth of bamboo shoots. Fertilization has a certain impact on bamboo culm properties. Different fertilizer ratios have different impacts on bamboo mechanical properties. Their mutual relations are more complicated. At the same low-N, P level, more K fertilization can improve bamboo mechanical properties. Excessive fertilization may decrease timber. Based on the utilities of the *Moso* bamboo, we need to choose suitable fertilizer ratios to maximize economic efficiency.

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