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International Section

SOUTHEAST CHINA

Diversifying Lowland Production with Water Bamboo

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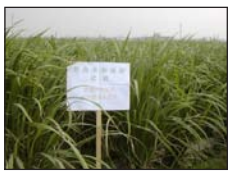
The incorporation of water bamboo into lowland production systems is becoming an increasingly popular practice. Farmers recognize advantages over strict rice production. However, research indicates much more may be gained by implementing proper nutrient management.

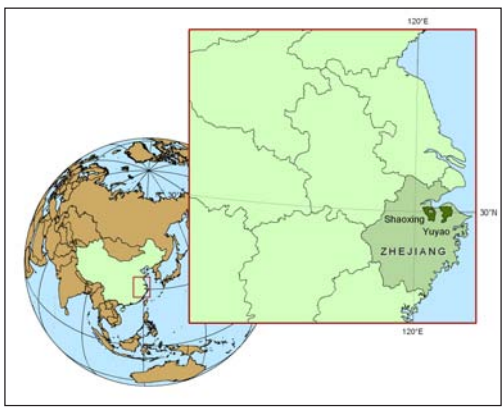


A network of research and public demonstration plots is showing advantages of proper fertilization for water bamboo.

Water bamboo (*Zizania caduciflora*) continues as a popular vegetable in south China. The crop is a water-loving rhizocarpic grass. Its edible part is the succulent stem created by fungal (*Ustilago esculenta*) infection and subsequent release of the plant growth hormone indole acetic acid (IAA).

The growing habitat of water bamboo is rather similar to rice, so a water bamboo-rice crop rotation is a natural fit. The selected water bamboo cultivar should be adapted to local rice soil conditions (high soil water table) and cause no negative effects in rice. Where implemented, the prevailing practice is a double-crop system wherein water bamboo is first transplanted in March to April and harvested in autumn. During winter, above-ground plant parts die off and new sprouts are generated the following spring, and the second harvest occurs in summer. The rotation is completed by transplanting late rice immediately after this second water bamboo harvest.

Recently, a rapid increase in planted area has been observed in Zhejiang, Jiangsu, and Shanghai Provinces. The shift is primarily a result of the system's highly efficient use of lowland soil environments. Thus, planting index can be increased from a one-crop system (late rice-fallow) to a three-crop system (autumn water bamboo-late rice-summer water bamboo). Damage from insects and plant disease is reduced with the three-crop system and income per unit area is greatly enhanced (more than US$11,100 higher than a single rice cropping system).



In Zhejiang Province and adjoining areas, water bamboo can be part of a lowland rice production system.

Water bamboo requires a good nutrient supply in order for its roots to flourish and support its large above-ground biomass, which extends 1 to 2 meters. At present, local farmers usually use high rates of nitrogen (N) and phosphorus (P) fertilizers for water bamboo,

Water bamboo stems from balanced fertilization plots are shown at left, compared to stems from plots with common fertilizer practice at right.

Table 1. Autumn water bamboo response to balanced fertilization, Zhejiang.

N-P_2O_5-K_2O, kg/ha	Yield, kg/ha	Yield, %
375-180-225 (OPT)	21,912 A[1]	—
375-180-338 (+K)	21,201 A	-3.35
375-0-225 (-P)	19,137 B	-14.50
375-180-0 (-K)	19,232 B	-13.93

[1]Yield values followed by the same letter are not significantly different.

but largely ignore potassium (K) and micronutrient fertilization. The Soil and Fertilizer Institute of Zhejiang Province initiated a network of research and public demonstration fertilization trials in 2002 on water bamboo in Yuyao County and Shaoxing County in the province. A summary of the results to date indicates the following.

1) Improved treatments promoted overall plant growth, while increasing plant height, leaf length, leaf width, and numbers of tillers. Yield was highest with application of 375-180-225 kg N-P_2O_5-K_2O/ha…N:P_2O_5:K_2O ratio of 1: 0.48: 0.6 (**Table 1**). Additional K application provided no yield advantage at this site. Treatments omitting P and K produced significantly less.
2) Higher produce quality was achieved with either the OPT or +K treatments (**Table 2**). Both of these treatments had elevated vitamin C (Vc) contents. The +K treatment had noticeable higher protein and lower nitrate (NO_3-N) contents in harvested product. Again, the -P and -K treatments had a negative impact on quality.

Table 2. Treatment effects on water bamboo stem quality, Zhejiang.

Treatment	Length, cm	Width, cm	Net weight, g	Vc, mg/kg	Sugar, %	Protein, %	NO_3-N, mg/kg
OPT	18.16	2.96	50.1	85.4	2.4	14.81	35.1
+K	18.39	3.13	51.2	100.8	2.6	17.19	29.7
-P	19.15	2.87	43.8	70.6	2.4	14.75	34.5
-K	17.55	2.59	36.3	75.6	2.6	14.00	34.8

3) Economic analysis found the highest yielding treatment to be the most profitable (**Table 3**). Treatments omitting P and K were half as profitable as the OPT treatment.

The incorporation of water bamboo into the lowland rice production system has greatly increased potential productivity for local farmers. Balanced fertilization is one of the key practices needed to sustain yields, quality, and economic benefit of water bamboo production. BC

Table 3. Economic impact (US$/ha) of balanced fertilization, Zhejiang.

Treatment	Input	Output	Profit	Value-to-cost
OPT	976	3,513	2,537	2.60
+K	1,011	3,399	2,388	2.36
-P	914	2,124	1,210	1.32
-K	907	2,135	1,228	1.35

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