Effective use of nitrogen fertilizers for growing garlic

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Introduction

- About 80 thousand hectares of garlic are planted in China each year.
- N fertilizers (about **480** Kg N/ha/season) are often over-applied in an attempt to achieve high garlic yields.
- A large amount of applied N has now accumulated in the soil.
- The average concentration of nitrate in groundwater is up to 34.7 mg/L in the garlic production area in Jinxiang town in China.

Objective

- to examine the effects of N fertilizer management on garlic yield, economic benefit and soil apparent nutrient balances.
- To provide evidence needed by farmers to apply N fertilizer for garlic production in an economically and environmentally rational manner.

Method

- The field experiment consisted of five treatments which included control (CK, no N fertilizer), urea at 300 kg N/ha (FP), urea at 240 kg N/ha (OPT), combined urea and commercial organic fertilizers at 120 kg N/ha each (OM-CF), and controlled-release N fertilizer at 192 kg N/ha (CRF).
- Fertilizers were applied three times in each of the FP, OPT and OM-CF treatments: 60% as a basal fertilizer, 25% as garlic bolt elongation fertilizer, and 15% as a garlic bulb expansion fertilizer. In the Treatment CRF, thermoplastic resin-coated urea, containing 4% coated material and 42% N, was applied only once as a basal fertilizer.

Results

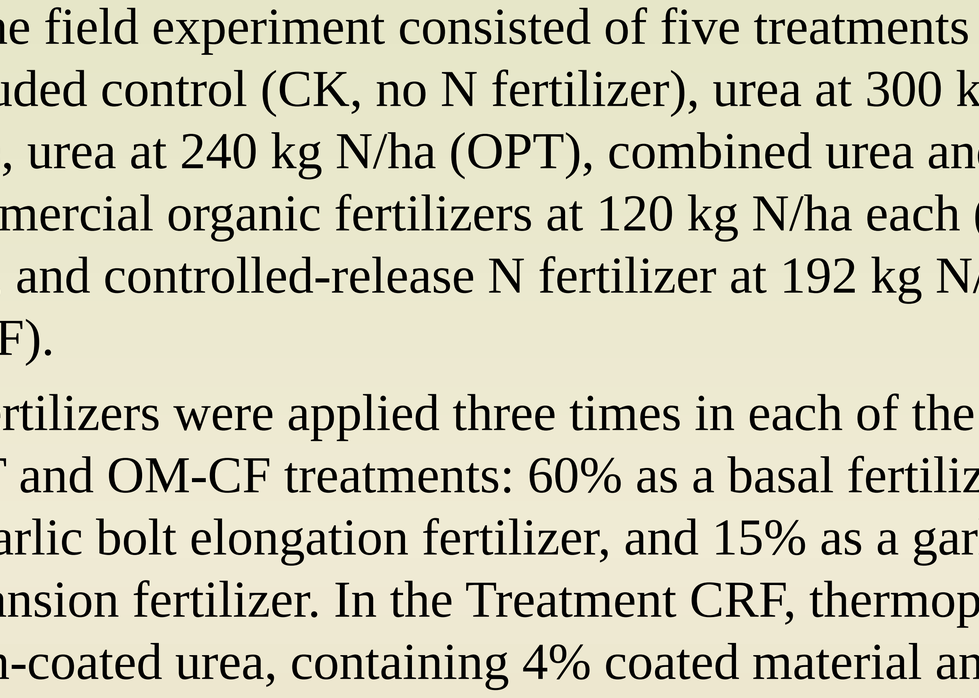

Figure 1. Garlic bulb and garlic bolt yield in different fertilization treatments. Different letters indicate significant differences ($P < 0.05$).

- Garlic bulb yields in Treatment CRF were 18%, 20%, and 30% higher than in the Treatments FP, OPT, and OM-CF, respectively.
- The garlic bolt yields in Treatment OM-CF were 15%, 22%, 16%, and 35% were higher than in Treatment CK, FP, OPT, and CRF, respectively.
- The net income of garlic in Treatment CRF was 61%, 20%, 22% and 35% higher than those in Treatment CK FP, OPT, and OM-CF, respectively.
- The N and P uptake by garlic was highest in Treatment CRF and lowest in Treatment CK. There was no significant difference for nutrient uptake between Treatment FP and OPT.

Table 1. Average annual evaluation of economic benefit of garlic in different fertilizer treatments

Treatments	cost (Yuan/ha)			Total income (Yuan/ha)	Net income (Yuan/ha)	Net income/cost
	Seed, pesticide, agricultural film	Labor cost	Fertilizer			
CK	24000	15900	2424	128384 c	94160 c	3.75 c
FP	24000	15900	3369	162296 b	127127 b	4.61 b
OPT	24000	15900	3099	160350 b	125451 b	4.59 b
OM-CF	24000	15900	5149	150563 b	113613 b	4.07 c
CRF	24000	15150	3047	186915 a	152819 a	5.48 a

Values marked with different letters in the same column are significantly different ($P < 0.05$)

Table 2. Soil nutrient balance in different fertilization treatments

Treatments	Nutrient input (kg/ha)			Nutrient output (kg/ha)			Nutrient net balance (kg/ha)		
	N	P	K	N	P	K	N	P	K
CK	0	39	224	191d	80d	165c	-191	-41	59
FP	300	52	212	250b	106ab	213b	50	-54	-1
OPT	240	39	224	240b	98bc	199b	0	-59	25
OM-CF	240	39	224	219c	89cd	214b	21	-50	10
CRF	192	39	224	278a	112a	244a	-86	-73	-20

Values marked with different letters in the same column are significantly different ($P < 0.05$)

Conclusions

- N surplus occurred in the conventional N application treatment when the N was applied at 300 kg N /ha.
- Compared with the conventional N application, a 20% reduction of N fertilizer did not significantly affect garlic yield and its economic benefits.
- A 36% reduction of N fertilizer, using controlled release N fertilizer, could increase garlic yield and its economic benefits, but would result in nutrient deficit soil which would affect long-term soil nutrient balance.

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