

Case Study 7.3-5 Controlled release urea reduced labor cost and improved cotton nutrition in Hubei, China.

Hubei is one of the main cotton production provinces with 10% of the cotton planting area in China. Compared with other main crops, cotton has a longer growing season and has high nutrient demands. Nitrogen (N) is one of the main plant nutrients for cotton and is normally applied at high rates. At the same time, however, it can easily be over used, which can result in environmental pollution. Gains in use efficiency of applied N are likely with the adoption of enhanced efficiency fertilizers. In addition, any savings in labor time and associated costs have become important to China's cotton production.

A new polymer-coated, controlled release urea (CRU) fertilizer with an N content of 44% and N release lasting 60 to 80 days under normal conditions was tested in a cotton field experiment in Hubei Province in 2013. The field experiment was located in Qianjiang county, with 10 treatments and 3 replications. The cotton planting density was 18,000 plants/ha, and the growing season occurred between April 30 (sowing) to November 28 (harvesting). Nitrogen fertilization followed a treatment design that combined CRU and regular urea (RU) sources; P fertilizer (90 kg P₂O₅/ha) and K fertilizer (180 kg K₂O/ha). Soil testing showed that the topsoil pH (1:1 soil:water suspension) was 8.3, organic matter (modified Walkley-Black method) was 1.3%, available N (1.0 M NaOH extractable) was 69 mg/kg, available P (0.5 M NaHCO₃ extractable) was 5 mg/kg, and available K (NH₄OAc extractable) was 68 mg/kg. Results summarized in **Table 1** show:



Cotton field experiment testing CRU in Qianjiang county of Hubei Province, China.

- 1) Cotton yields fell as the rate of N fertilization decreased;
- 2) At a given N rate, CRU tended to produce better yields than regular urea (RU);
- 3) CRU significantly increased N fertilizer use efficiency compared to RU. Substituting 100% CRU for RU at the full rate of 300 kg N/ha increased cotton yield by 62% and agronomy efficiency (AE) nearly three-fold

Farmers and their advisers who have used CRU recognize not only advantages in yield and economic benefit, but also reduced labor cost by eliminating the need for fertilizer topdressing. In this region of Hubei, the average annual rainfall is about 1,100 mm, falling mainly from May to August. If urea is applied as basal fertilization for crops like cotton, the N supply from fertilizer would usually not last beyond two months and would result in N deficient crops or premature boll formation during the late growing stages. CRU showed notable advantages to solve this problem.

Table 1. Seed cotton yields in response to rates and proportions of nitrogen applied as CRU (controlled release urea) or RU (regular urea).

N Source		Yield, kg/ha	AE, kg seed/kg N
Rate, kg/ha	CRU/RU, %		
0		1,160 f	---
300	0/100	1,730 e	1.90
300	100/0	2,800 a	5.47
300	75/25	2,370 bc	4.03
300	60/40	2,390 bc	4.10
300	45/55	2,170 cd	3.37
240	100/0	2,480 b	5.50
240	75/25	2,090 d	3.88
240	60/40	2,080 d	3.83
240	45/55	2,070 d	3.79

Average yields followed by the same letter do not differ significantly ($p = 0.05$).

Submitted by Fang Chen, IPNI China, March 2014.