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Effect of a new urease inhibitor on NH_3 volatilization and N utilization in maize in NCP

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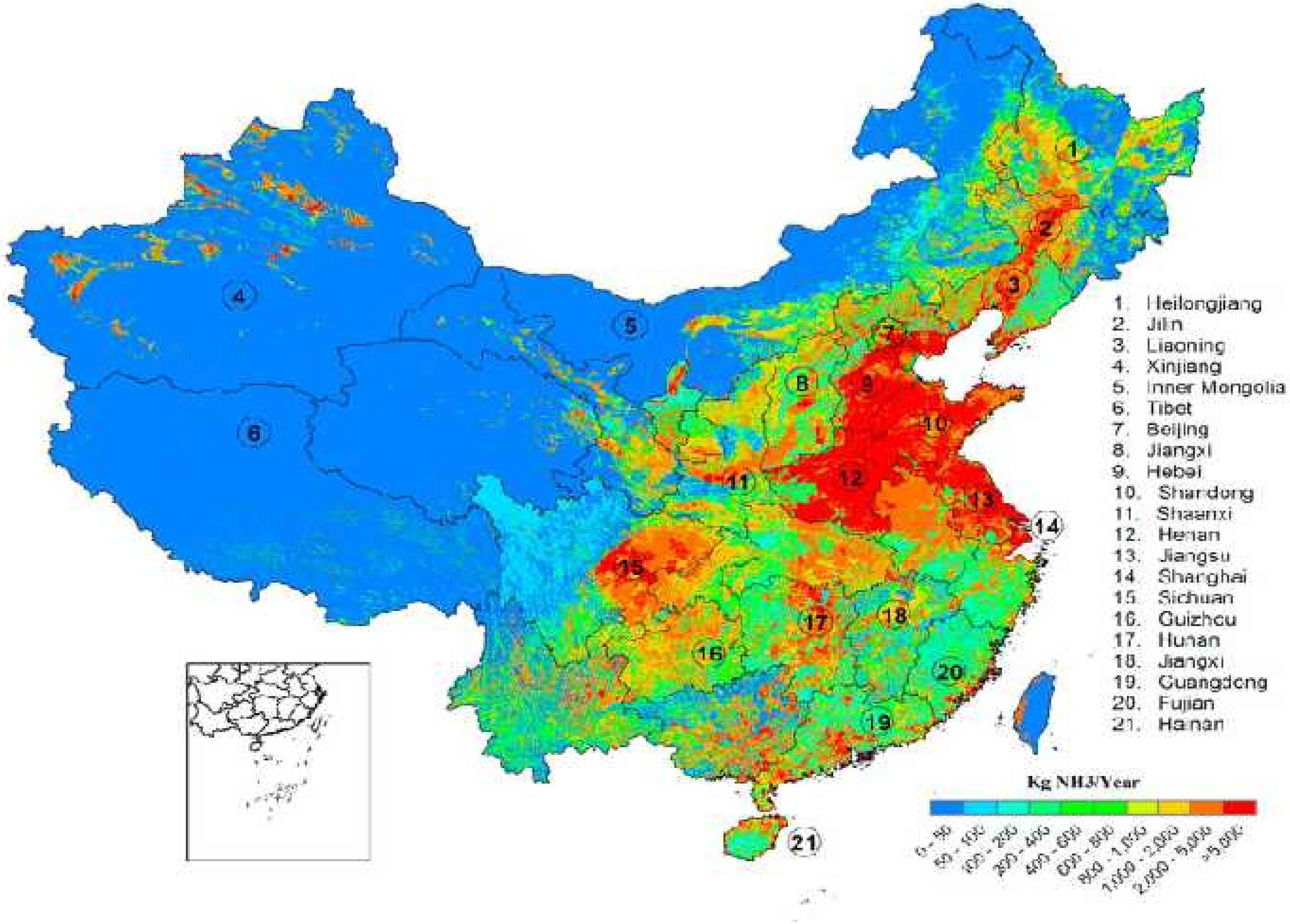
Map of NH_3 emission in China



NH_3 emission in China were approximately 9.8 Tg/Year

Huang et al., 2012

Impact of NH_3 volatilization

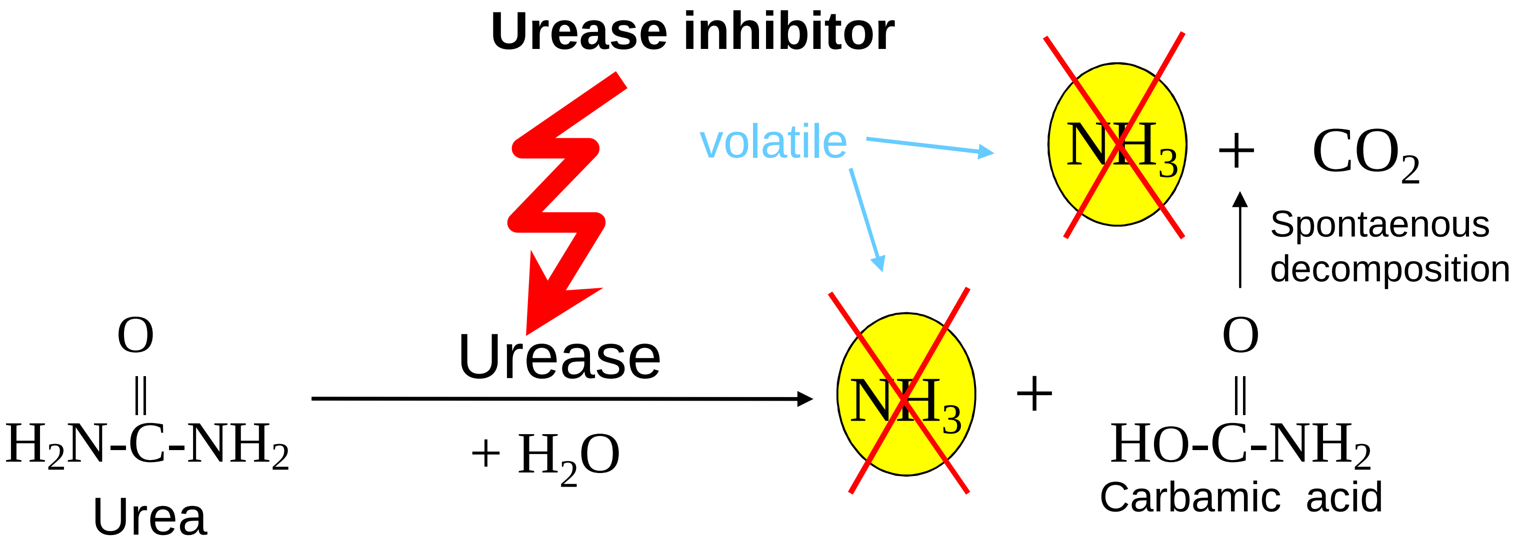
- Financial losses for the farmer.

- Ecological effects include acidification of soil, reduced biodiversity, and eutrophication of aquatic ecosystems.

- Effects on human health include negative impacts of air pollution and smog (e.g., $PM_{2.5}$).




mode of action of urease inhibitors



Urease inhibitors inhibit the activity of enzyme urease for a certain period of time and so can reduce NH_3 emissions

LIMburgerhof Urea Stabilizer (Limus®)

Synergistic action of 75%NBPT with 25%NPPT

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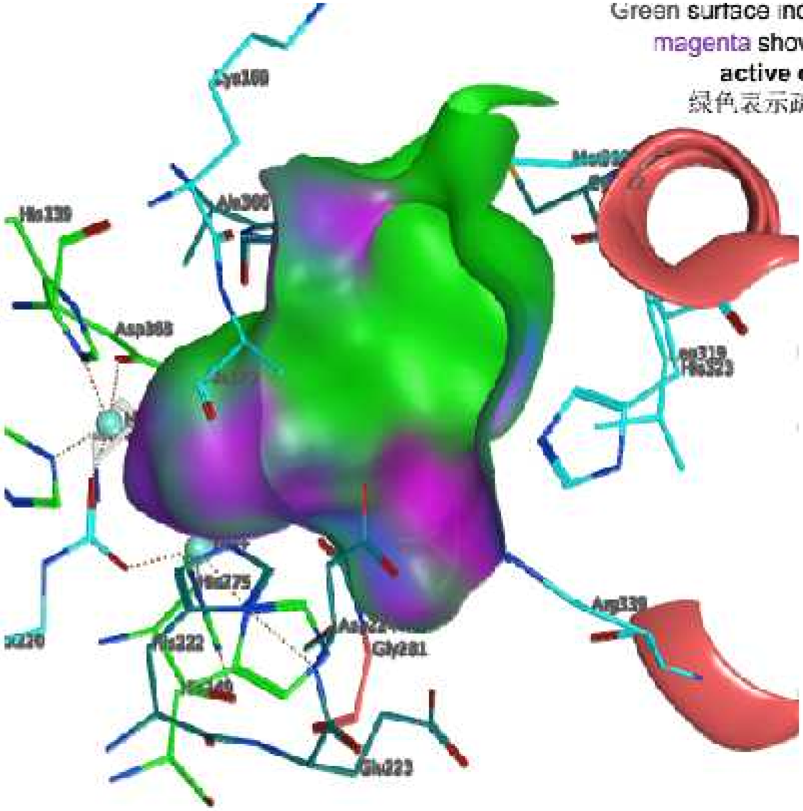
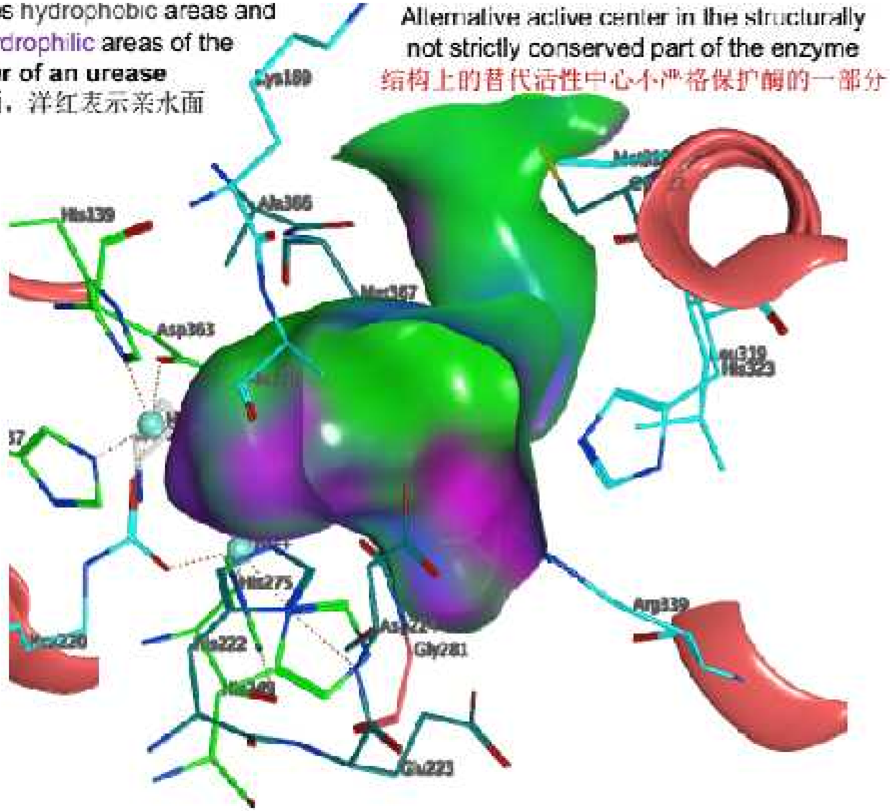
Ureases in soils differ and require different inhibitors



Experimental 3D structure of the active center of urease from *Bacillus pasteurii*

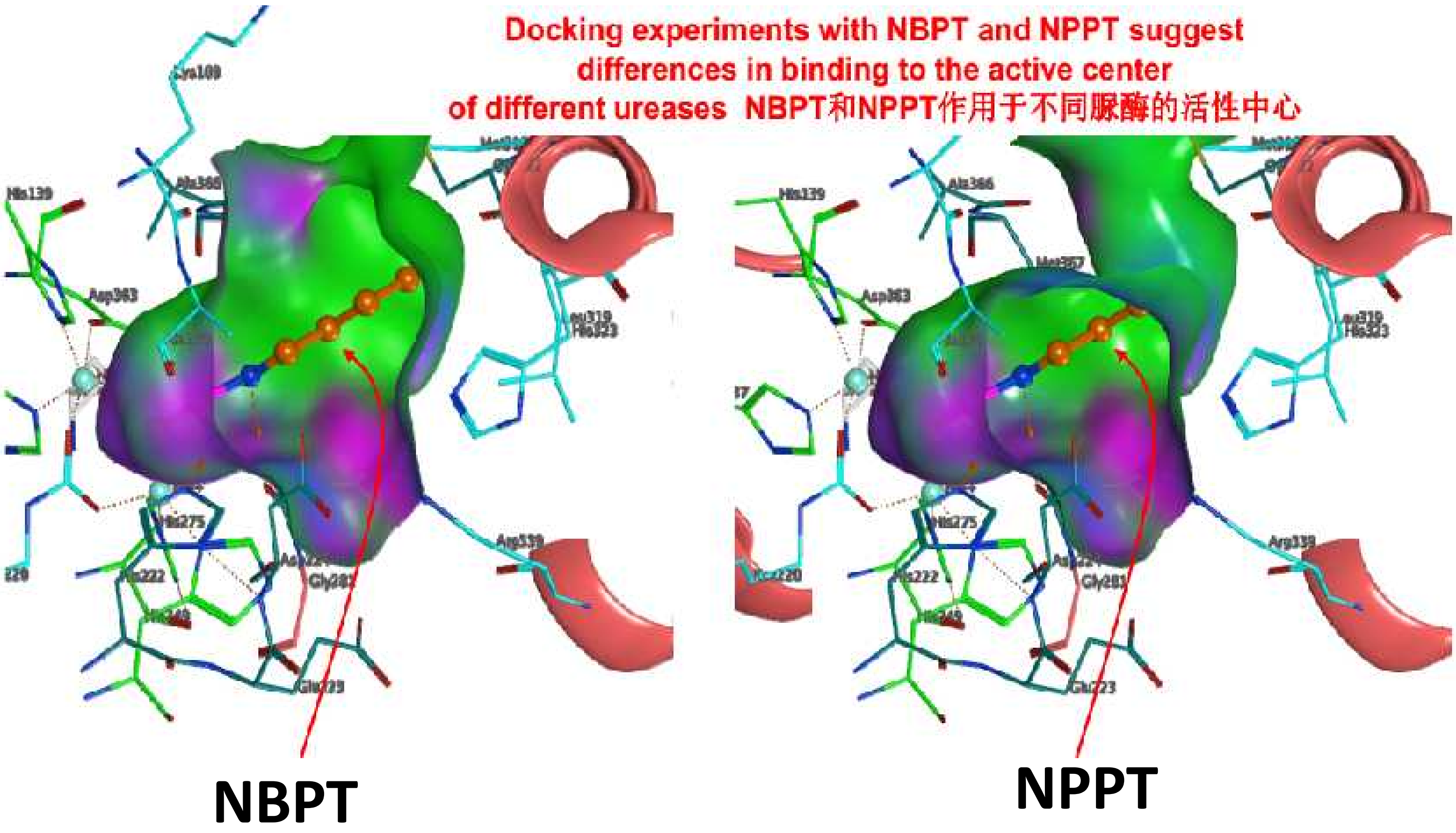


Experimental 3D structure of the active center of urease after a *in silico* point mutation (Pearson *et al.* (1997) Biochem. 36, 8164)

***in silico* modelling**

Source from Agricultural Center, BASF SE

Ureases in soils differ and require different inhibitors



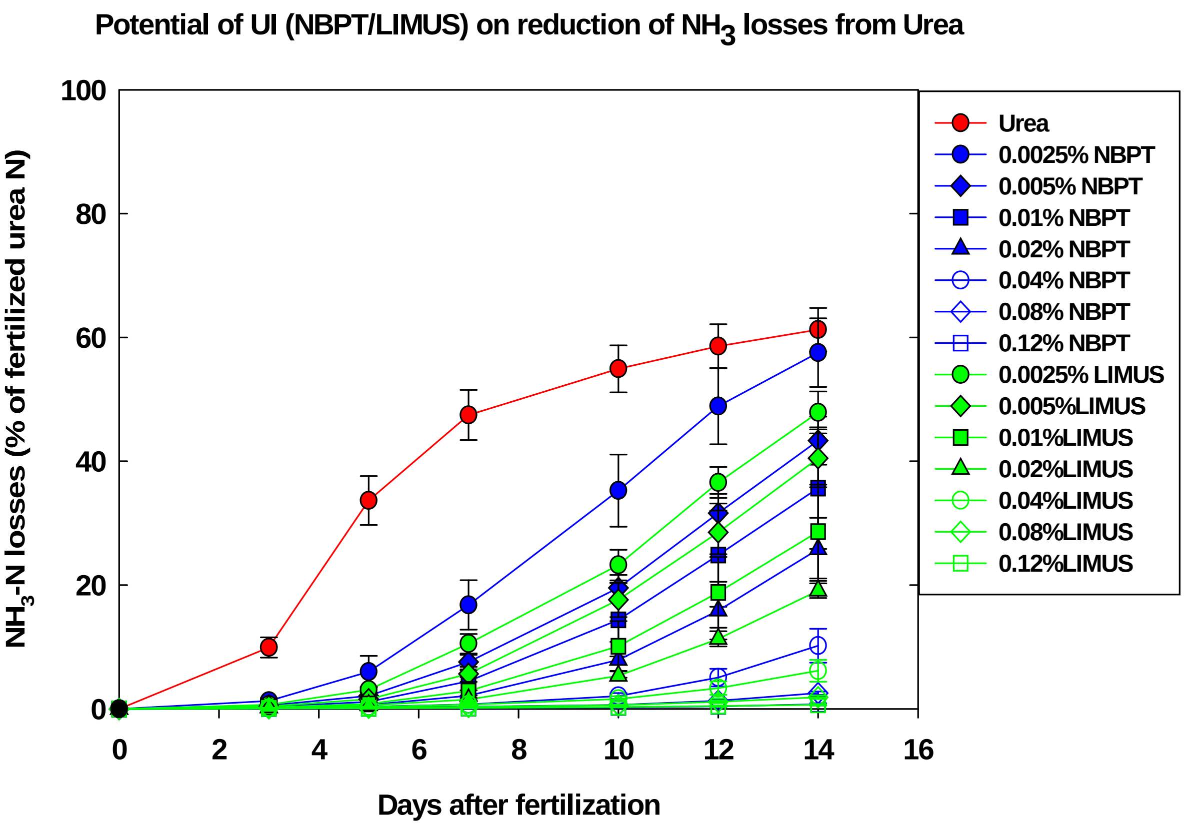
in silico **modelling**

Source from Agricultural Center, BASF SE

- **Effect on NH_3 loss under fully controlled environmental conditions without plants (incubation experiments)**

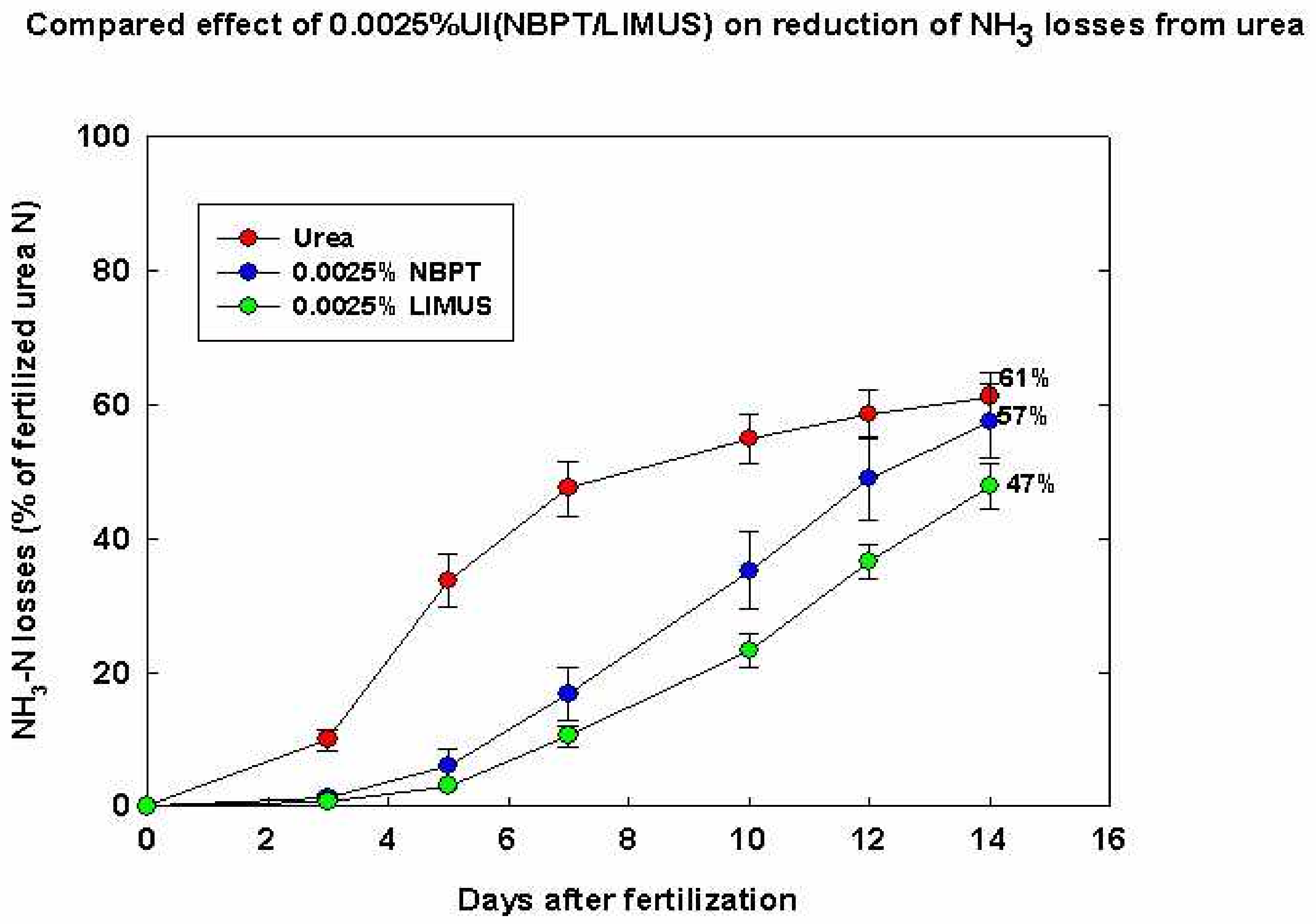
- **Effect on corn yield, RE_N and NH_3 loss (field trials)**

Limus® effect on reduction of NH_3 loss compared with NBPT



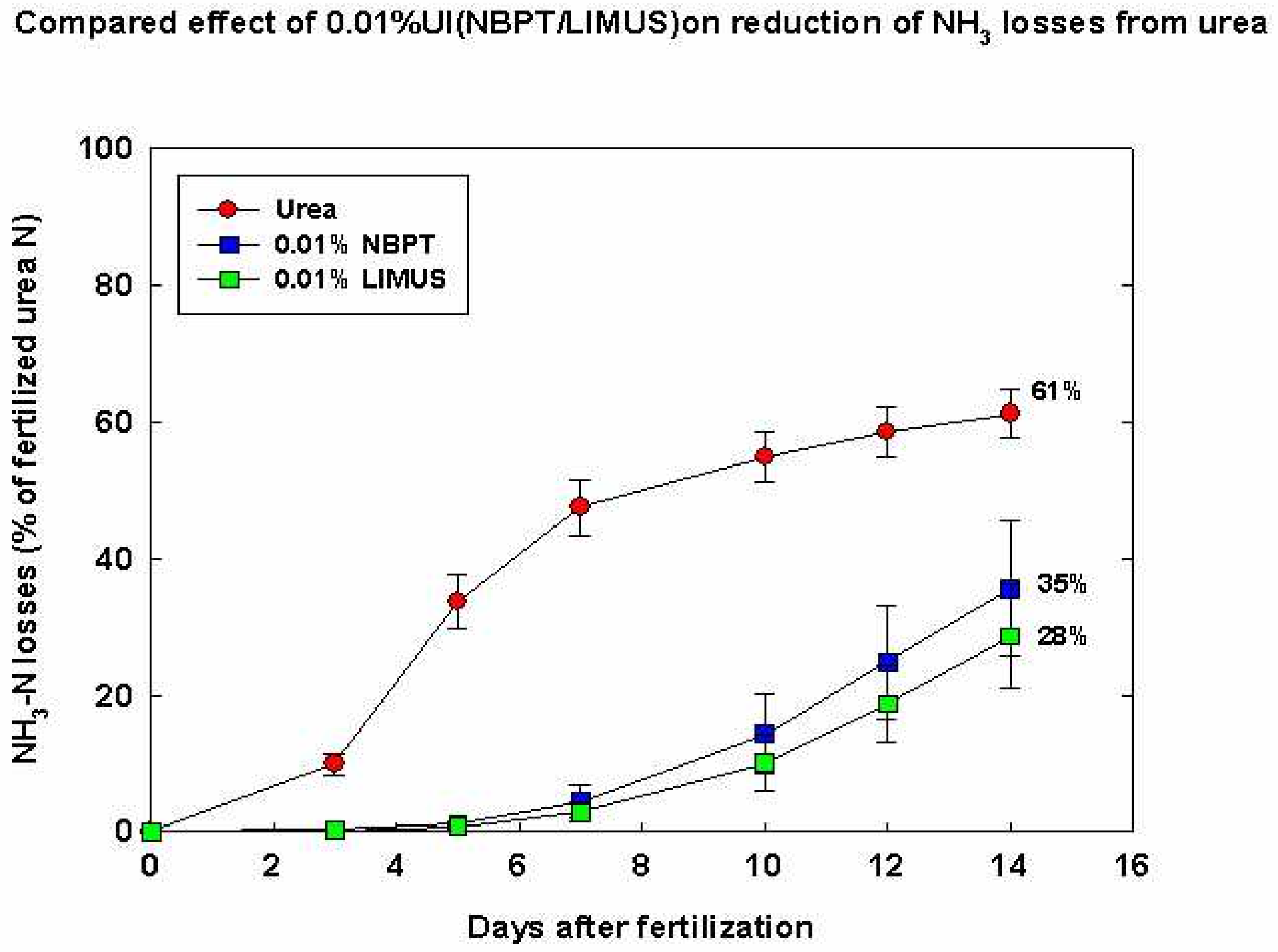
Li et al., unpublished data

Limus® effect on reduction of NH_3 loss compared with NBPT



Li et al., unpublished data

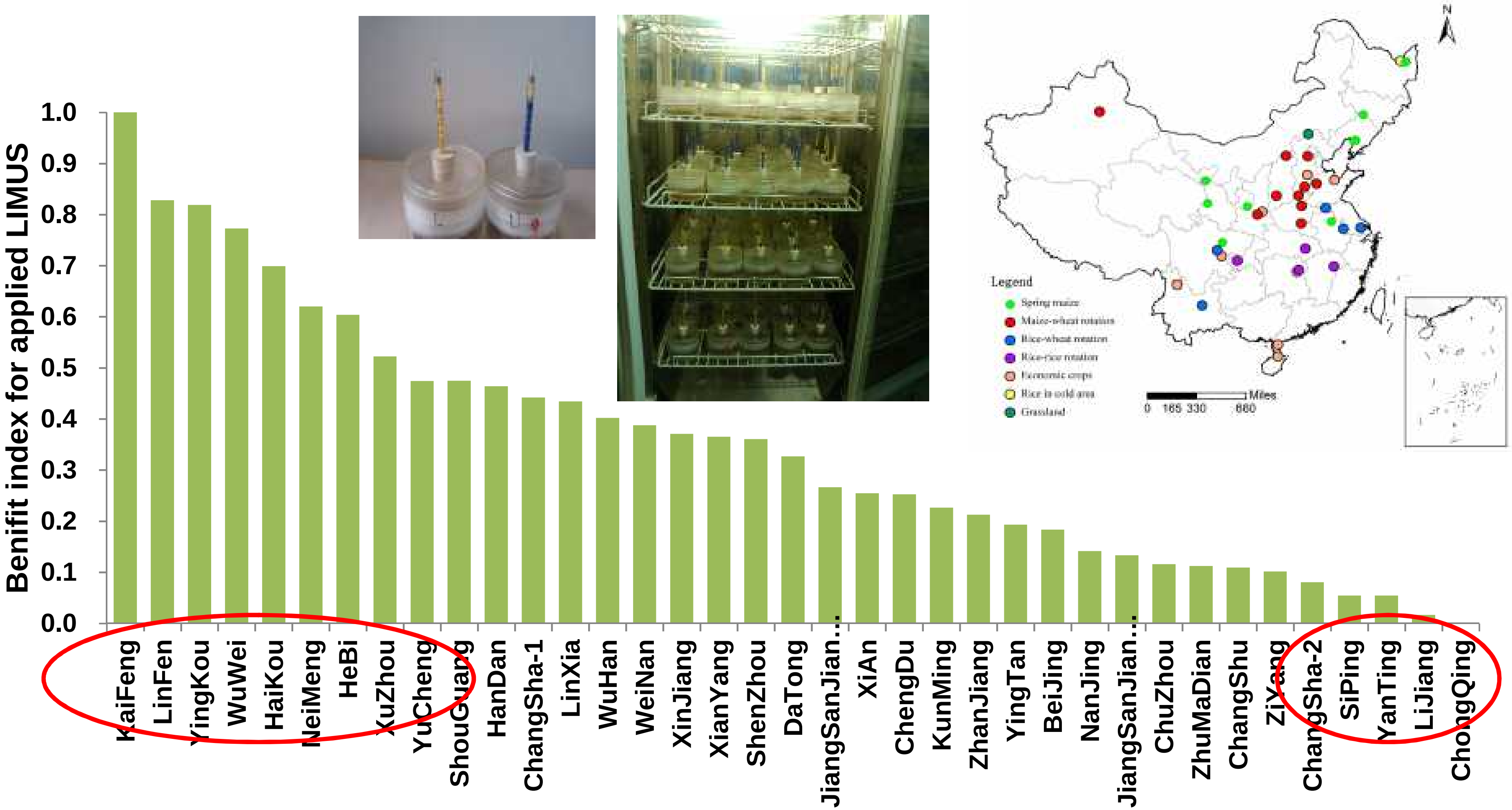
Limus® effect on reduction of NH_3 loss compared with NBPT



Li et al., unpublished data

Limus® effect on reduction of NH_3 loss for different soils

Simple NH_3 test system to screen soils / to demonstrate on farmer level



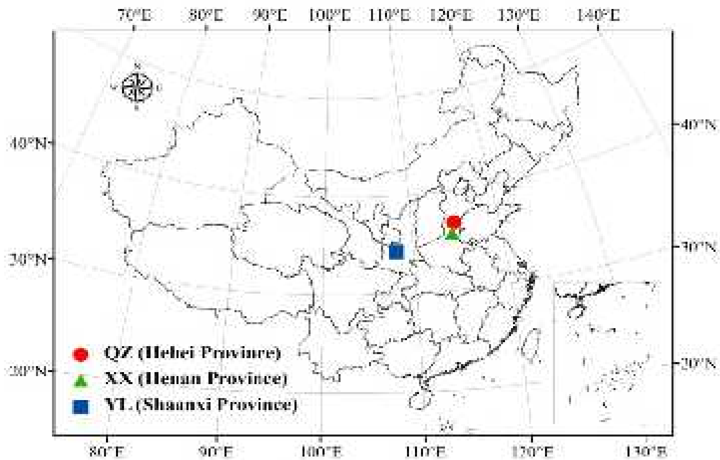
Li et al., unpublished data

- Effect on NH3 loss under fully controlled environmental conditions without plants (incubation experiments)

- **Effect on maize yield, RE_N and NH_3 loss (field trials)**

Effect of different rate of Limus® on NH_3 mitigation and maize yield

Treatment	Urea-N surface-applied at 3-leaf stage (kg N/ha)	Limus concentration (% w/w)
N0	--	--
Urea	130	0
L 0,04%	130	0,04
L 0,08%	130	0,08
L 0,12%	130	0,12



Li et al., unpublished data

Effect of different rate of Limus® on NH_3 mitigation and maize yield

NH_3-N loss (%)	Yangling	Xunxian	Quzhou	n=3	% reduction
Urea	10,4 a	7,6 a	12,6 a	10,2 a	
L 0,04%	6,6 b	3,0 b	5,7 b	5,1 b	50,0
L 0,08%	3,8 bc	2,7 b	4,9 b	3,8 c	62,7
L 0,12%	2,4 c	1,7 b	3,7 b	2,6 d	74,5

Li et al., unpublished data

Effect of different rate of Limus® on NH_3 mitigation and maize yield

Grain yield t/ha	Yangling	Xunxian	Quzhou	n=3	rel. grain yield %
no N	5,6 a	7,5 a	4,9 a	6,0 a	74,4
Urea	7,6 b	8,8 b	7,9 b	8,1 b	100
L 0,04%	8,2 b	8,9 b	9,9 c	9,0 c	111,1
L 0,08%	8,0 b	8,9 b	9,9 c	8,9 c	110,4
L 0,12%	8,4 b	8,7 b	9,3 c	8,8 c	109,0

Li et al., unpublished data

Effect of different rate of Limus® on NH_3 mitigation and maize yield

RE_N %	Yangling	Xunxian	Quzhou	n=3	RE_N response vs U %
Urea	30,8 a	20,3 a	37,5 a	29,5 a	
L 0,04%	47,2 b	24,3 a	69,0 b	46,8 b	58,6
L 0,08%	47,4 b	25,0 a	72,3 b	48,2 b	63,3
L 0,12%	52,8 b	24,3 a	72,9 b	50,0 b	69,3

RE_N = (crop N uptake in applied N plot-crop N uptake in N_0 plot)/applied fertilizer N $\times$100

Li et al., unpublished data

Conclusion

- Limus ® played better effect on reduction of NH_3 losses compared with NBPT .

- Limus ® addition (0,04-0,12 %w/w) can significantly reduce NH_3 volatilization by 50-75% compared to urea alone across three sites of NCP.

- Maize grain yield can be increased by 11% with Limus ® addition (0,04-0,12 %w/w) under cultivation practice of surface-applying at 3-leaf stage, while the RE_N can be significantly improved by 58-69% compared to urea alone.

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