



IFA
CROSSROADS
ASIA-PACIFIC 2014

 Singapore
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Micronutrient markets evolution (or revolution?) in Asia-Pacific

Kevin Moran
Kingenta International, China



IFA Crossroads Asia-Pacific 2014

In the beginning.....



IFA CROSSROADS ASIA - PACIFIC 2007, BALI
Agronomic Workshop "Balanced fertilization in Asia: where are we?"

Micronutrients: Beyond Crossroads On the Highway!

Dr Kevin Moran
Director of Micronutrient Competence Centre
Yara International





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Topics

- 1 Importance of balanced fertilization including micronutrients
- 2 Micronutrient fertilization for nutrient and water use efficiency
- 3 Evolution (revolution?) of Asia-Pacific micronutrient markets

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Essential growth factors for all crops

Primary nutrients

Secondary nutrients

Micro-nutrients

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Essential Fertilizer Nutrients for Crops

PRIMARY NUTRIENTS	SECONDARY NUTRIENTS	MICRONUTRIENTS
Nitrogen (N) Phosphorus (P) Potassium (K)	Calcium (Ca) Magnesium (Mg) Sulphur (S)	Boron (B) Copper (Cu) Iron (Fe) Manganese (Mn) Molybdenum (Mo) Zinc (Zn)
100' s kg/ha	10' s kg/ha	1' s kg/ha

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Adequate supplies of ALL nutrients are essential to achieve maximum yield and top crop quality

Justus von Liebig's "Law of the Minimum" published in 1843

'If one plant nutrient is deficient, plant growth is limited, even if all other vital nutrients are adequate... plant growth is improved by increasing the amounts of deficient nutrients'

Although the 'Law of the Minimum' was already defined in 1843, shortfalls of specific nutrients are still the major reason, **with limited WATER supply**, for low crop yields and poor quality throughout World Agriculture

The Classic Nutrient Response Curve

"Hidden Hunger" is where micronutrient deficiencies will most commonly reduce crop yield, quality...and human health!

Soil and crop tissue analysis enable accurate diagnosis of nutrient deficiencies...

Analysis Results (SOIL)

Customer: EXAMPLE COPY
THE FARM
TOWN STREET
VILLAGE
COUNTRY

Distributor:

Sample Ref: 22222
Sample No: 22222
Crop: WHEAT

Date Received: 07/01/2008

Analysis	Result	Guideline	Interpretation	Comments
pH	6.5	6.5	Normal	Adequate level.
Phosphorus (ppm)	15	15	Normal	(Index 24) 65 (light) PDS (2) adequate; Winter crop straw removed; Maintenance.
Potassium (ppm)	180	121	Normal	(Index 24) 65 (light) KDS (30) adequate; Winter crop straw removed.
Magnesium (ppm)	22	30	Very Low	(Index 44) PRIORITY FOR TREATMENT.
Calcium (ppm)	4482	1650	Normal	Adequate level.
Sulfur (ppm)	19	15	Normal	Adequate level.
Manganese (ppm)	21.0	40.0	Very Low	PRIORITY FOR TREATMENT.
Copper (ppm)	0.7	4.1	Very Low	PRIORITY FOR TREATMENT.
Boron (ppm)	0.10	0.50	Very Low	Consider treatment with boron.
Zinc (ppm)	> 30	4.1	High	Possible interference with the availability of iron.
Micronutrient (ppm)	0.01	0.05	Very Low	Low priority for this crop. Other crops may be affected.
Iron (ppm)	34	30	Normal	Adequate level.
Sodium (ppm)	20	90	Very Low	Not a problem for this crop.
C.E.C. (cmv/100g)	15.0	15.0	Normal	Cation Exchange Capacity indicates a soil with a good nutrient holding ability.

Additional Comments
Soil analysed P and K, recommendations are taken from MAFF RB209 for an 8 t/ha winter wheat crop with straw removed. Additional technical details are available at www.kingsenta.com

Please Note
It is very important to ensure that the Results from Analysis are as accurate as possible. It is important to note that the analysis refers to the sample received by the laboratory, and is representative only of that sample. No warranty is given by the laboratory that the Results from Analysis refer to any part of a field or growing area not covered by the sample received. It is important to ensure that the soil has changed under the sample set for analysis is representative of the area requiring analysis and that samples are obtained in accordance with standard sampling techniques. A field's consistency in structure on how to take soil test, heritage, slope and soil samples for analysis is available from the laboratory on request.

Analysis Results (LEAF)

Customer: A FARMER
TOP FARM

Distributor:

Sample Ref: EXAMPLE FIELD
Sample No: 22222
Crop: WHEAT (WINTER)

Date Received: 30/04/2008

Analysis	Result	Guideline	Interpretation	Comments
Nitrogen (%)	1.68	3.00	Low	PRIORITY FOR TREATMENT.
Phosphorus (%)	0.49	0.50	Normal	Adequate level.
Potassium (%)	1.75	3.00	Low	PRIORITY FOR TREATMENT.
Calcium (%)	0.14	0.07	High	Low priority; See comments below.
Magnesium (%)	0.15	0.10	Normal	Adequate level.
Manganese (ppm)	12.0	35.0	Very Low	PRIORITY FOR TREATMENT.
Boron (ppm)	0.7	0.5	Normal	Adequate level.
Zinc (ppm)	250.0	25.0	High	Above normal range.
Iron (ppm)	355	55	Normal	Adequate level.
Sulfur (ppm)	1.4	0.5	Normal	PRIORITY FOR TREATMENT.
Micronutrient (ppm)	0.44	0.10	Normal	Adequate level.
Sulfate (ppm)	0.18	0.25	Low	PRIORITY FOR TREATMENT.

Additional Comments
Low level nutrients should be treated as a priority. However where these are adequate, treatment of deficient low priority nutrients may be beneficial. For any product applied, always refer to manufacturers advice for rates and timing of application. PLEASE NOTE: The guideline levels quoted should be regarded as the absolute minimum at which crop yield or quality may be affected. Treatment of deficient low priority nutrients may be beneficial if all sensitive nutrients are adequate.

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(Courtesy of Yara Analytical Services)

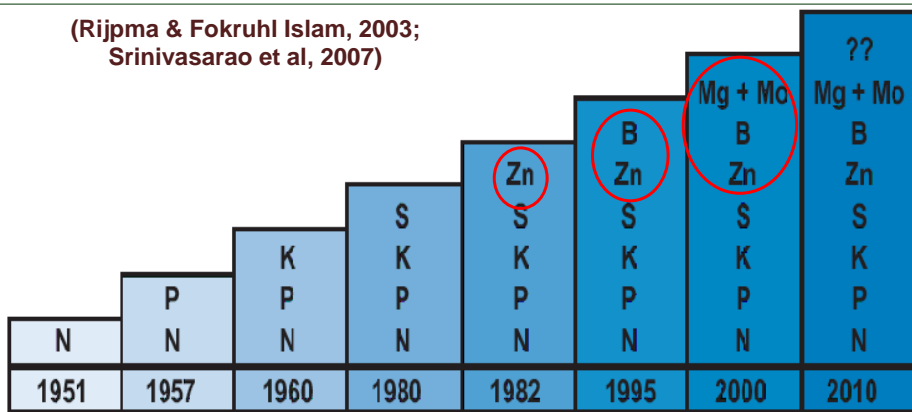
...including identification of micronutrient 'Hidden Hunger'

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Soil & tissue analysis have revolutionised identification of micronutrient markets

(Rijpma & Fokruhl Islam, 2003; Srinivasarao et al, 2007)



Progressive micronutrient depletion and deficiency in India & Bangladesh

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Evolution of micronutrient deficiencies in China

Percentage of soils with micronutrient deficiency in 1980s and recent in China (%)

Nutrient	1980s	Recent
Zn	51.1	60.7
B	34.5	25.3 *
Mn	21.3	20.1
Cu	6.9	10.6
Fe	5.0	20.5

Source: 2nd national soil survey and PPI/PPIC cooperative network

* Decrease resulting from promotion of boron applications in China



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Improvement in N uptake and use efficiency using Mo applications

Mo application (g ha ⁻¹)	dry matter (kg ha ⁻¹)	N uptake (kg ha ⁻¹)	Mo content ($\mu\text{g g}^{-1}$ dry wt)		
			shoots	nodules	seeds
0	2685	70	0.02	0.4	0.02
200 (soil)	3413	90	0.02	1.5	0.20
200 (foliar)	3737	101	0.05	3.7	0.53

(Pulschen, 2004)



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Boron application increases NPK uptake and use efficiency

Treatment	Concentration in seed cotton		
	N (%)	P (%)	K (%)
Control (Recommended NPK)	3.00	0.69	1.11
169 gm B/ha-1	3.33	0.74	1.16
225 gm B/ha-1	3.40	0.80	1.21
281 gm B/ha-1	3.35	0.75	1.17
Average increase	+12	+10	+6.3

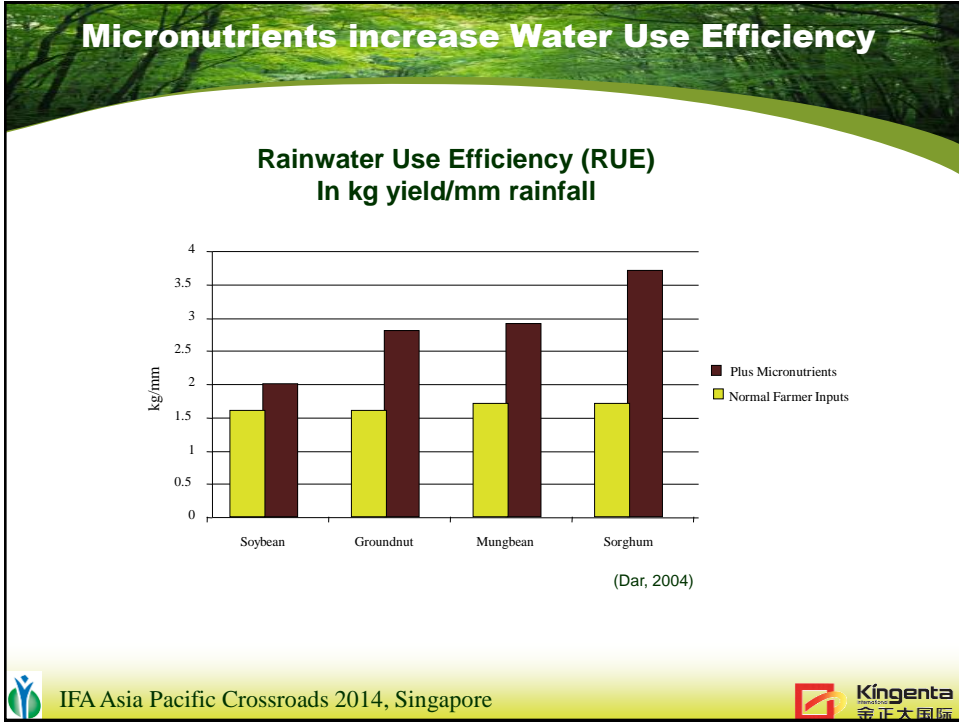
(Phillips, 2004)



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- ## Topics
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Distribution of micronutrient deficiencies in Asia-Pacific

		B	Cu	Fe	Mn	Mo	Zn
Asia	China	●●	N	●●	●●	●●	●●
	India	●●	na	●●	N	N	●●
	Iran	●	N	●●	●●	N	●●
	Philippines	●	na	na	na	na	●●
	Saudi Arabia	na	na	●	na	na	na
	Turkey	●	na	N	●●	N	●●
	Vietnam	●	na	N	●●	N	●●
Oceania	Australia	●●	●●	●	●●	●●	●●
	New Zealand	●	●●	N	N	●●	na

(Bell and Dell, 2008)



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More 'traditional' micronutrient applications incorporated into 'blended' or 'compound' N, NP and NPK fertilizers



Broadcasting



Drilling

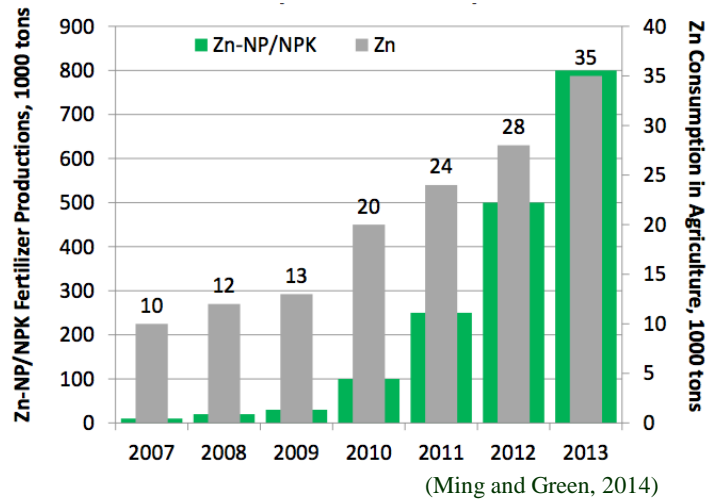


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Growth demand for micronutrients in Asia-Pacific exemplified by production of zinc-enriched N/NP/NPK's in China



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Revolutionary NPK's + micronutrients

Controlled Release Fertilizer

The Release Mechanism of CRF



Structure of CRF



Soil water penetrates into the granule through the CRF coating pores



The solid nutrients inside are gradually dissolved into easily absorbed liquid form



The liquid nutrients are released into the soil slowly and continuously.

- **Nutrients released as growing crop needs increase – reduced volatilisation**
- **Environmentally friendly – reduced leaching**
- **Improved nutrient use and application efficiencies**
- **Rapidly evolving relevance to Asia-Pacific agricultural challenges**



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Increasingly innovative 'alternative' micronutrient applications are being adopted

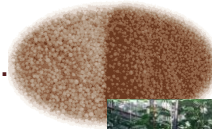
◆ Foliar application.....



◆ Seed treatment / coating.....



◆ Fertilizer impregnation.....



◆ Fertigation.....



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Fertigation requires chelated micronutrients



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The Future: Linking Nutrient and Water Use Efficiency

Top 5 Countries: Irrigated Land, NPK Use

Top 5 Irrigated	Hectares Irrigated	Top 5 NPK Users	2002 Million metric tons
India	54,800,000	China	39.5
China	54,402,000	USA	19.6
USA	22,400,000	India	16.0
Pakistan	18,090,000	Brazil	7.5
Iran	7,500,000	France	4.0

Source-UN Food & Agriculture Organization, IFA

Micronutrients are key to the fertigation revolution sweeping Asia-Pacific



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Other main market drivers in Asia-Pacific

(Adapted from Argus FMB Micronutrients Report 2014)

- ◆ **Normal food supply issues always apply**
- ◆ **Crop response to NPK's is stagnating – improving NUE and WUE**
- ◆ **In last 20 years K (and S) have underpinned some yield growth**
- ◆ **Limitations are now due to soil depletion of micronutrients (and other secondaries)**
- ◆ **Growing awareness of impact of micronutrient deficiencies on human (and animal) health**



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Revolution in crop bio-fortification with micronutrients

Fertilizer nutrients applied	Rice		Wheat	
	Yield (t/ha)	Grain Zn content (ppm)	Yield (t/ha)	Grain Zn content (ppm)
Urea (N)	4.0	30	3.7	40
Urea plus 1% Zn	4.7	39	4.3	49
% increase	17%	30%	14%	23%

(Shivay et al, 2008)



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Global estimates of main micronutrient sectors


(Adapted from Argus FMB Micronutrients Report 2014)

Micronutrient share of global market

Micronutrient	Share (%)
Zn	35%
B	25%
Fe	15%
Mn	15%
Cu	6%
Mo	4%



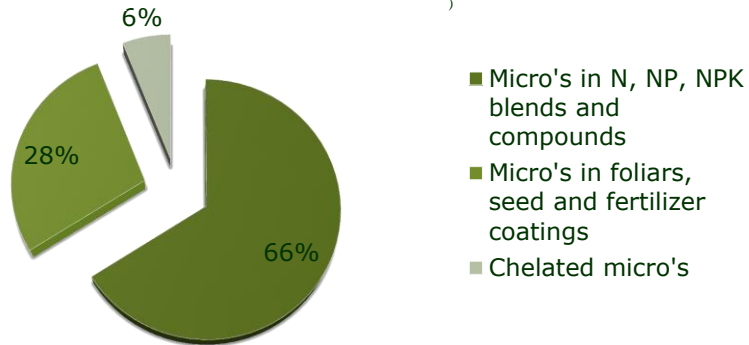
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Global estimate of micronutrient application sectors
 (Adapted from Argus FMB Micronutrients Report 2014)

% of global market share

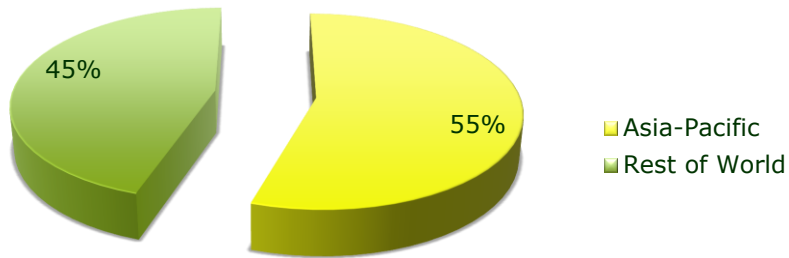


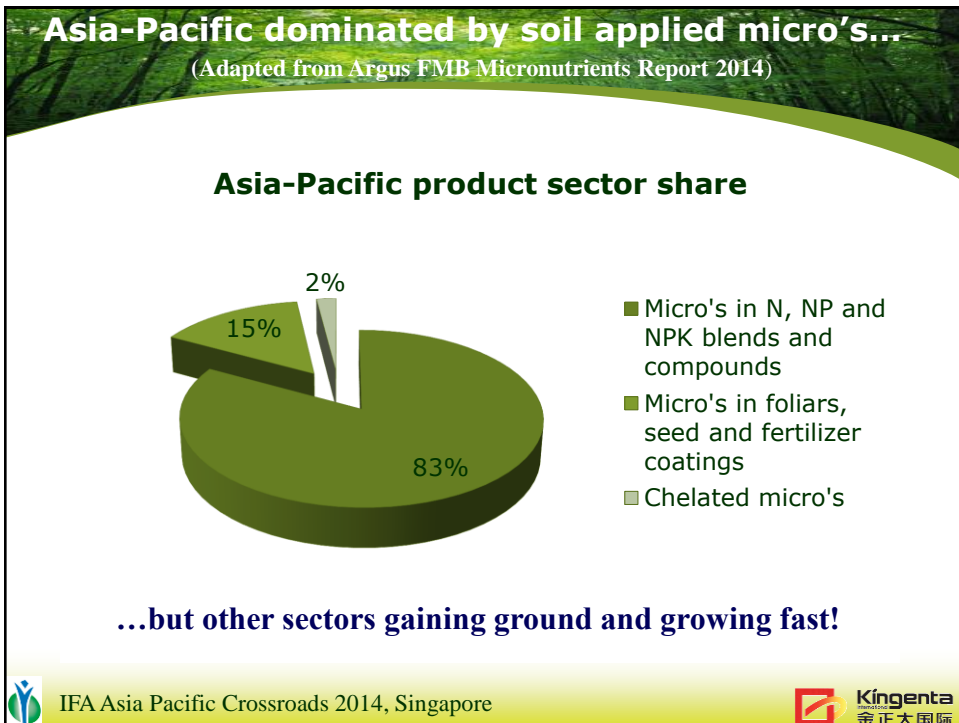
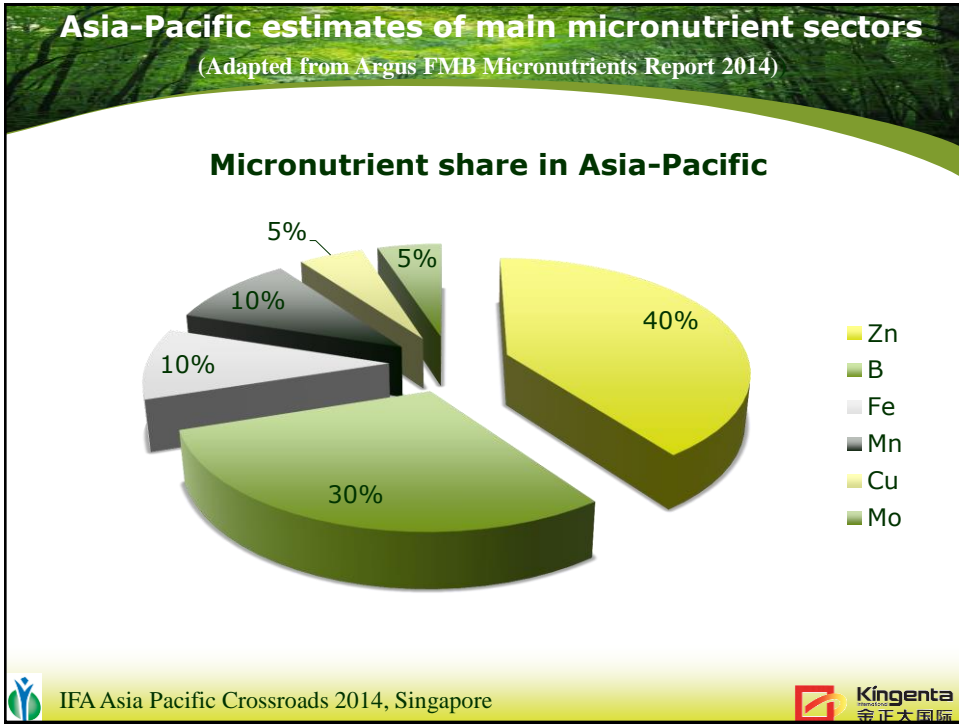
Soil-applied in blends and compound fertilizers still largest market

Asia-Pacific largest, fastest-growing market

(Adapted from Argus FMB Micronutrients Report 2014)

Asia-Pacific share of global market





A revolution in priorities!

(Adapted from Argus FMB Micronutrients Report 2014)

- ◆ The rising demand for micronutrients has reversed the gradual process of simplification in the industry
- ◆ The defining challenge is the need to include / apply micronutrients in ways to ensure even spreading
- ◆ The second challenge is the greater number of combinations and dosages to deliver micronutrients
- ◆ The third challenge is to ensure accurate and cost-effective delivery of micronutrients
- ◆ The final challenge is increasing product ranges to meet flexible demand and fluctuating markets
- ◆ All represent immense opportunities for micronutrient market growth



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Where to in next seven years?

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Micronutrients: Beyond Crossroads On the Highway!

Dr. Kevin Moran
Director of Micronutrient Collaborative Centre
Yara International

Global market = 1,100 Kt

Higher rate than 2007-2014



International
Fertilizer Industry
Association

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For up-to-date in depth analysis of micronutrient markets,
future trends and growth opportunities...



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Thank you

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