The great Indian fertilizer bazaar

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What will we cover today?

Drivers of nutrient use
- Population & growth
- What do Indians eat
- What does India grow

Inside the bazaar
- Scale, growth & susbidy
- Drivers of use
- Journey to the farm
- The supply side
- Outcomes of big demand & small domestic resource
- How India buys fertilisers
- Three headaches – the new frontiers

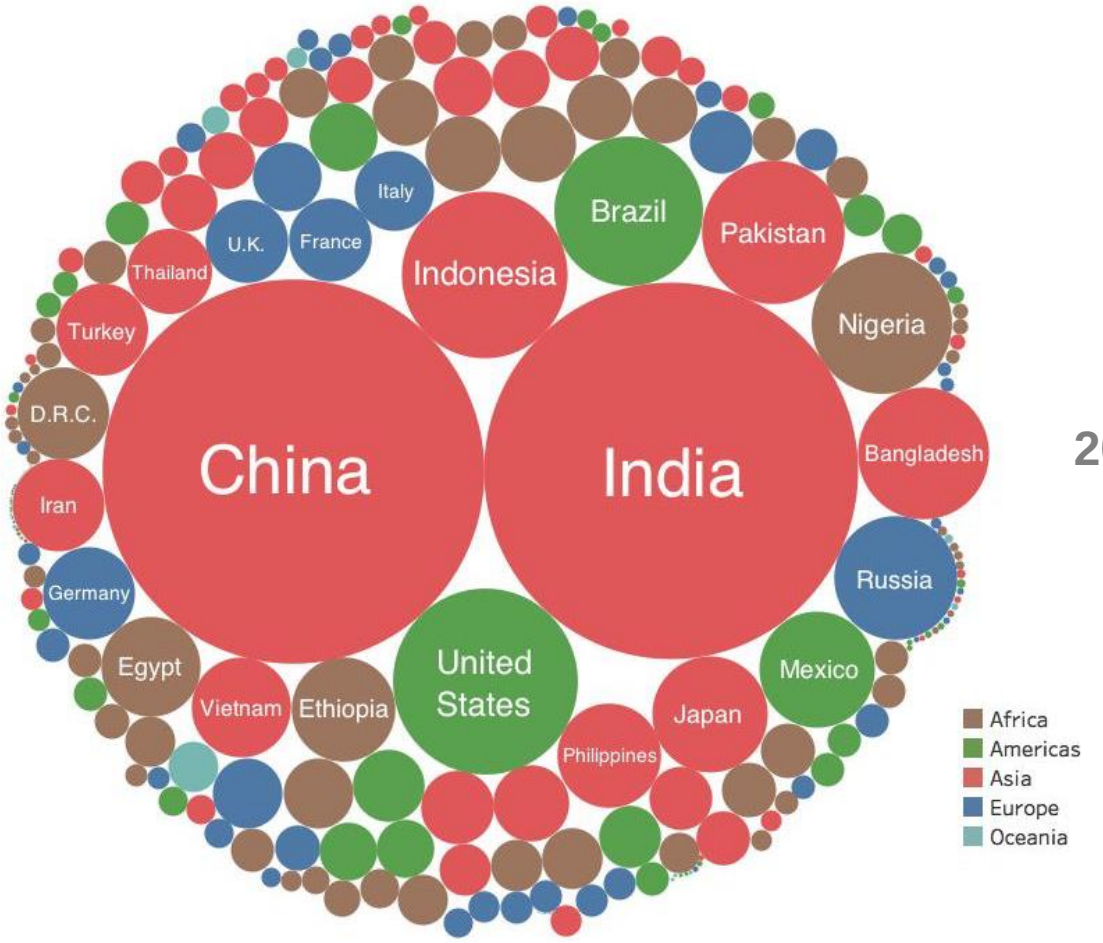
Beyond traditional fertilisers
- Soil, water and yields
- The case for soil health
- Micronutrients
- Organic Carbon

Takeaways
What does it take?

Author's assertion - This presentation is based on the author's insights and analysis of data available in public. Data and image sources have been cited where ever practicable.

Drivers of nutrient use

How many Indians are there?



Now - 1.36 b
1.19% Growth
2025 = China
2060 Peak - 1.65 b

Data: UN projections. Image from social media

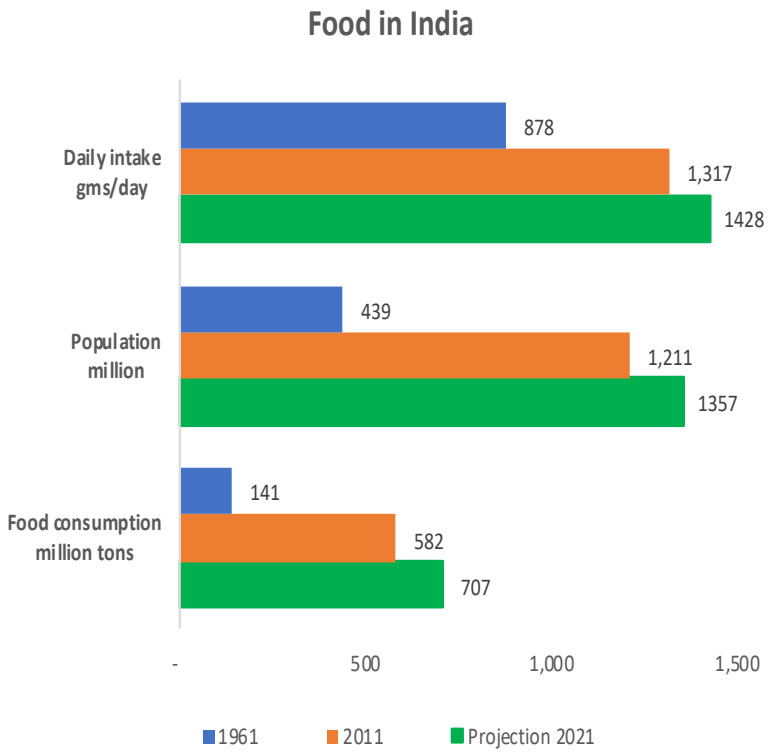
Do Indians eat differently?

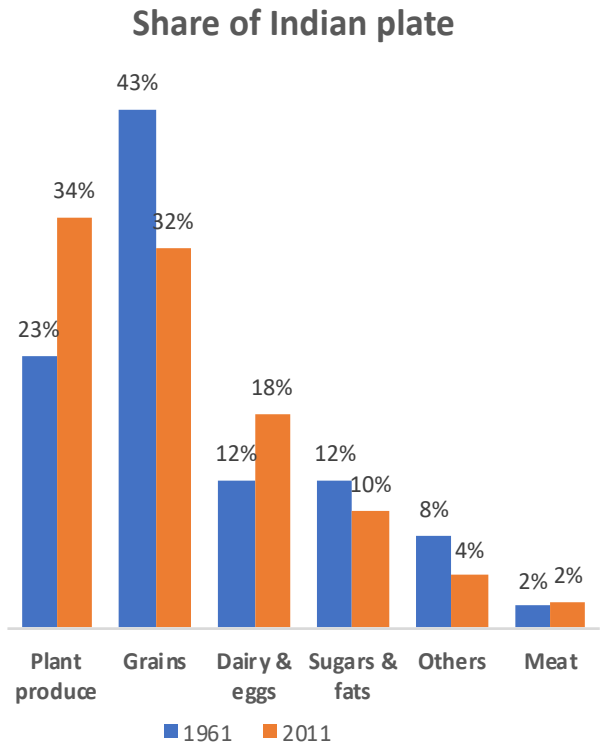
Image & views credit - 50 Years of Food in India by Lucy Plummer (2017)

- Traditionally, Indian families sit together for a meal and love eating with their fingers!
- Generally food is well cooked, less processed with more natural ingredients
- Its common to be asked whether you're "…Veg or Non-Veg?..."

How much do Indians eat? Are diets changing?

- India's growing population is eating better, food intake will be over 700 million tons by 2021
- The Indian plate has a larger share of Fruit & vegetables (↑11% points) + Dairy & eggs(↑6% points) edging out Cereals (↓11% points). Share of Meat is unchanged. Poultry growth is impressive & holds promise
- India's dietary shifts are significant though less dramatic than in China. Ending malnourishment is a key goal for India.





Indian agriculture - big and small?

Image credit: Shutterstock

- 140 million ha or 43% of India's total land is farmed. Its gross cropped area is nearly 200 million ha. More than 70% of holdings are smaller than 4 ha.
- Over 100 million Indian households are engaged in Agriculture and get nearly ½ their income from farming. Average holding size is just over 1 ha.
- Agriculture is about 17% of India's GDP or about US$ 350 billion. Its growth rate is low and erratic compared to manufacturing & services sectors so that agriculture's share of the economy is declining.

Source: GOI's MAFW 2017-18 Annual. NABARD 2015-16 Survey. OECD July 2018.

What does India grow?

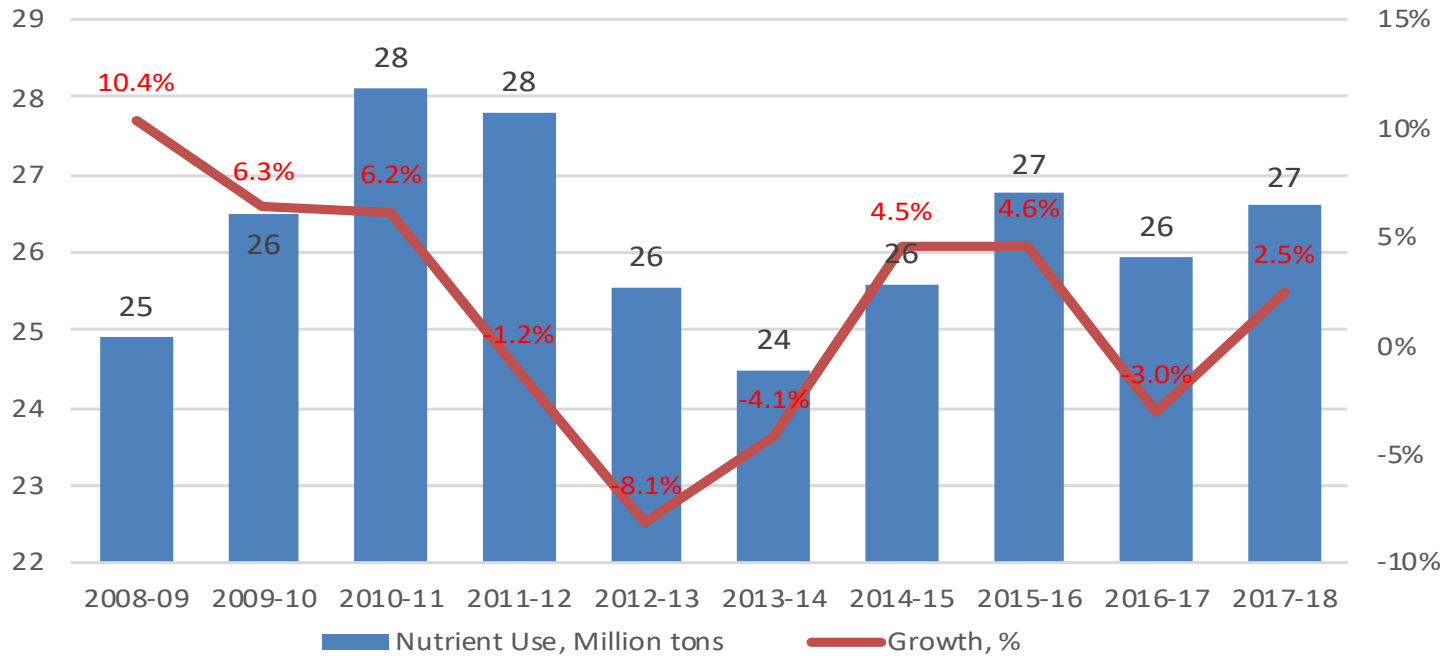
- Cereals make up 50% of India's sown area. Rice is the biggest and is also exported. Together with wheat it tops 200 million tons in annual production. Maize is small – barely 4-4.5% of sown area.
- India struggles with poor yields of its oilseeds and pulses crops. Both are important food groups in the Indian diet and India is the world's largest importer of both.
- Cotton and fruit & vegetables are by far the outstanding performers in terms of output growth over the last two decades.
  - The expansion of cotton was driven by the 2002 introduction and rapid adoption of GM (Bt) technology. Production tripled by 2015. India now has the largest area under Bt cotton (greater than China).
  - India is the world's 2nd largest producer of fruits and vegetables after China. Despite a rickety supply chain, fruit and vegetables are now bigger in volume and value than cereals! Together they take up only 8% of India's sown area.
  - Ranks & numbers - No.1 producer of mango, banana, papaya, or pomegranate & No.2 (after China) - potato, tomato, onion, eggplant, cabbage, or cauliflower. 41% of world's mangoes, 23% of bananas, and 10% of onions.

Milk & meat

- India's 'white revolution' continues and is an important supplement for farmer incomes.
- India has the world's largest population of cows and buffalos (300 million!) producing 50-60 million tons of milk each year. Half of that is buffalo milk!
- Meat production has been gradually increasing at 2.5% per year since 2000. Bovine meats (mainly Buffalo) is exported.
- Poultry has a large and growing local demand for eggs and broilers – rising 6-10% each year since 2000.

Inside the bazaar

The Indian fertilizer bazaar – scale, growth & subsidy



- India is the world's 2nd largest N, P & K nutrient market after China (48 million). It accounts for 14-15% of world use. However, per hectare use at 135 – 140 kilogram is low compared to neighbouring China & Bangladesh.
- After many years of consistent growth, nutrient use shrank in 4 of the past 10 years. Growth 'hiccups' have been caused by subsidy reform and course correction by farmers facing declining response ratios.
- Will Indian nutrient demand continue to grow?

Primary drivers of nutrient use are intact

- India's growing demand for food, feed, fibre and fuel drives agriculture production
- Fertilizer use continues to be a key strategy for improving India's agriculture productivity.
- Need to increase nutrient application rate (Kgs per Ha) especially in the east
- Urgent need to correct application ratio of P&K relative to N

But hang on tight – the subsidy program is changing…

- India's US$ 11 billion FY20 fertilizer subsidy budget enables cheap fertilizers for farmers. At 26% of all subsidies – fertilizer subsidy is unaffordable.
- Reforms to 'target' subsidy better have begun. Direct money transfers to selected farmers is the big milestone.
- Direct transfer eco-system is ready and being tested but change is gradual. Reforms have progressed for P&K but there is hardly any change for Urea.

And there are new frontiers…

- Agribusiness can shape solutions in three areas - improved yields, better soil health and increased water productivity.

Journey to the farm

- Fertilizers are sold in 50 kg bags bags. All bagging is done at factory or at import ports. Smaller bags & pouches are used for newer specialty products.
- Freight trains carry bagged fertilizers to upcountry warehouses. Inventory at these warehouses builds up to several months during off-season. Closer to the season, sales are made to wholesalers and retailers.
- Smaller shipments are trucked to retail shops in towns and villages. Retail storage is limited – typically 2-5 days inventory.
- Farmers pay cash or get some credit from their market-yard agents who also buy their produce. They use bicycles to carry a bag, or two, and trolleys for larger loads of fertilizers.
- Application is by simple seed– fertilizer drills or even manual on small sized lots.

The flip side – a tough supply situation

- Every other bag of fertilizer used in India is Urea - its India's most popular fertilizer and makes up 80% of India's Nitrogen use.
- India is also the world's 2nd largest producer of Urea (FY18 ~ 22 million tons & 8-9 million new capacity by FY25).
- But India is short of Hydrocarbon feedstock to make Urea and despite high energy efficiency of most gas based plants it is not cost competitive.

- India has insignificant Phosphate resources. Only about 6-8% of Phosphate used in India comes from domestic rock. It is mainly used to produce SSP.
- India diversifies its Phosphate origination risk by importing from various origins and in different forms – 45% as fertilizer (mainly DAP), 30% as Phosphoric acid and the balance 25% as rock phosphate.
- Ammonia and Sulfuric used in production of ammonium-phosphates is also mainly imported.

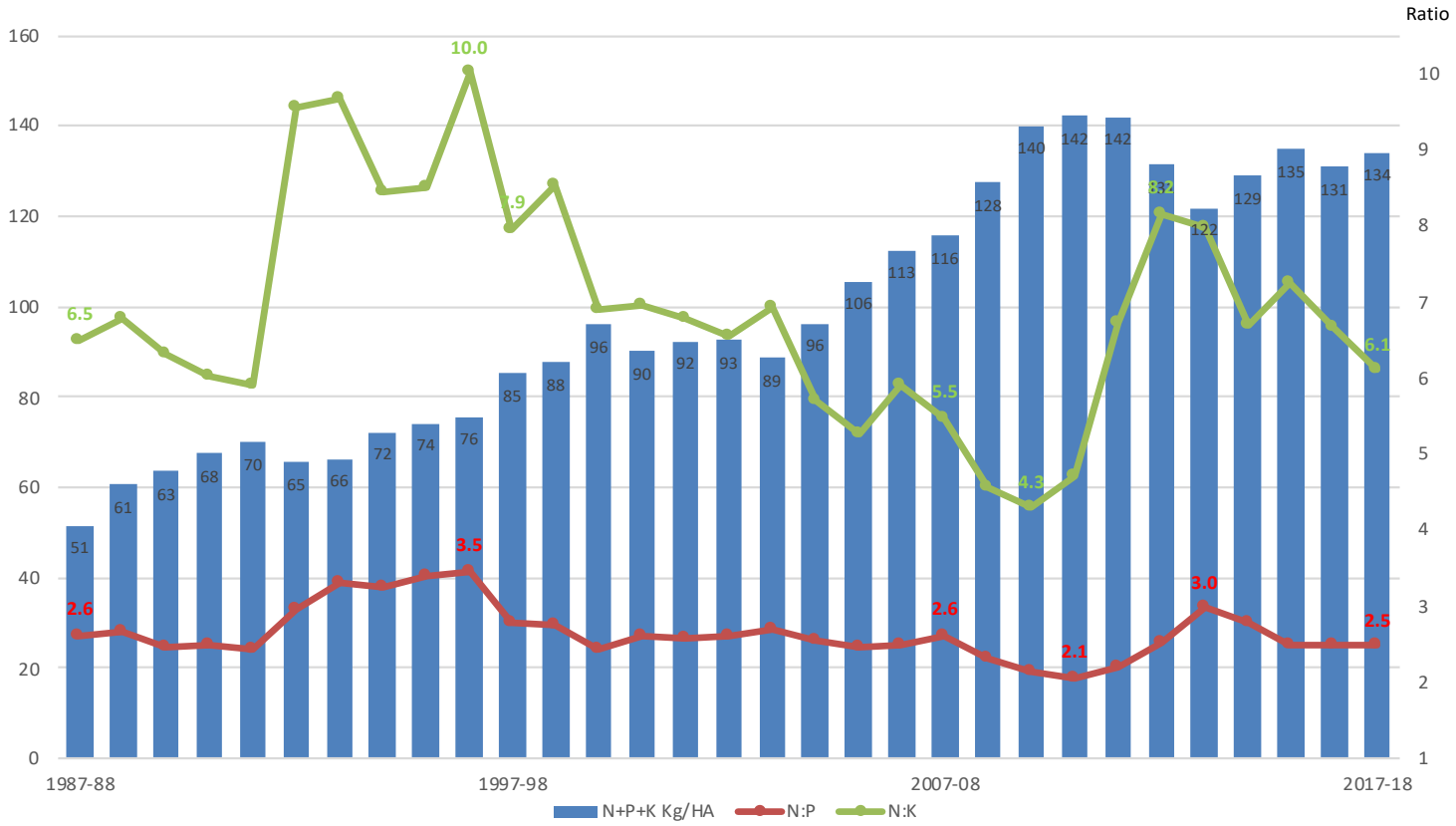
- India's Potash use is relatively small but growing fast.
- India doesn't have any Potassium and imports all its requirements.

Lack of nutrient resources in India have meant…

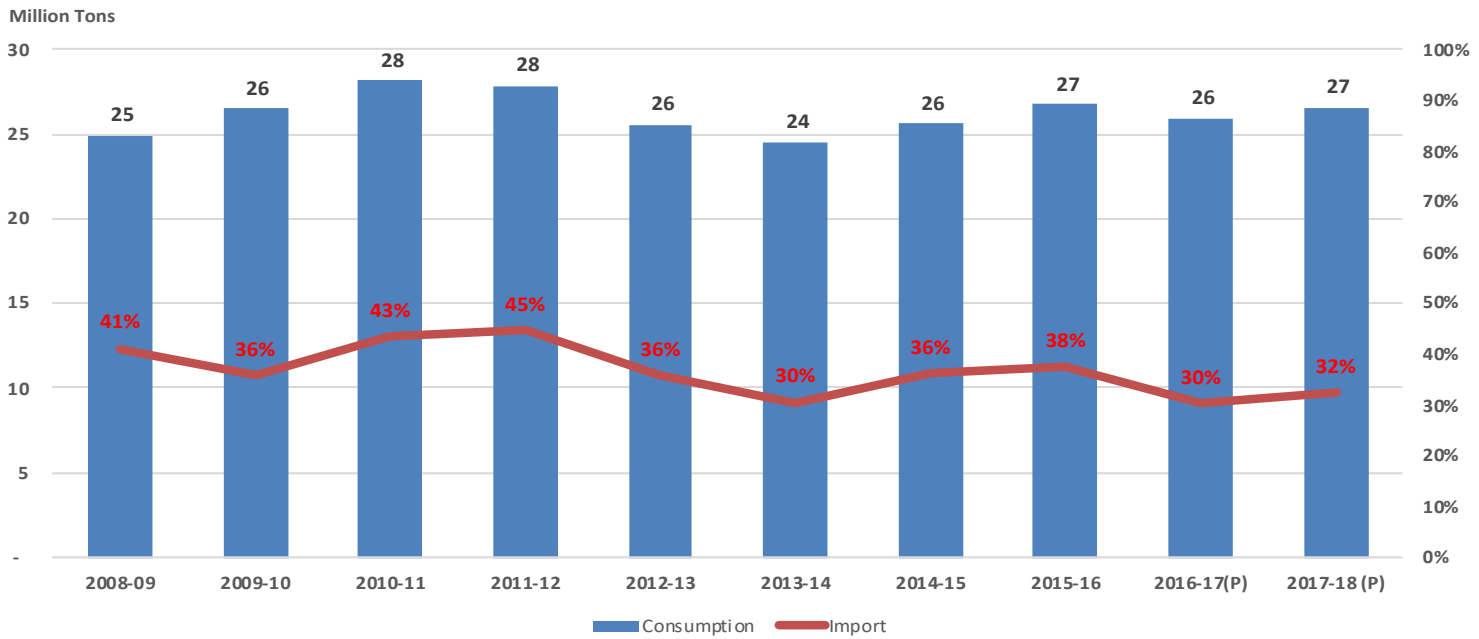
- Large scale & continuous imports
- Heavy Government involvement – regulator as well as a participant (producer, importer & marketeer). The subsidy program props up Government's role.

Government regulation - usage rate & ratio

- The skew towards Nitrogen use is India's biggest challenge – 2/3rd of nutrient use is Nitrogen. Government's 'cheap Urea policy" means farmer pay only around 80$/ton for Urea.
- In 2008, pricing policy for P&K fertilizers changed – cost increases and exchange rate changes are now passed through to farmers. Farmer price of DAP and MOP is up 300 – 350% since 2008. But only 11% for Urea
- Improvements achieved in N:P & N:K use ratio have been lost after 2008.



India is a structural importer of fertilizers

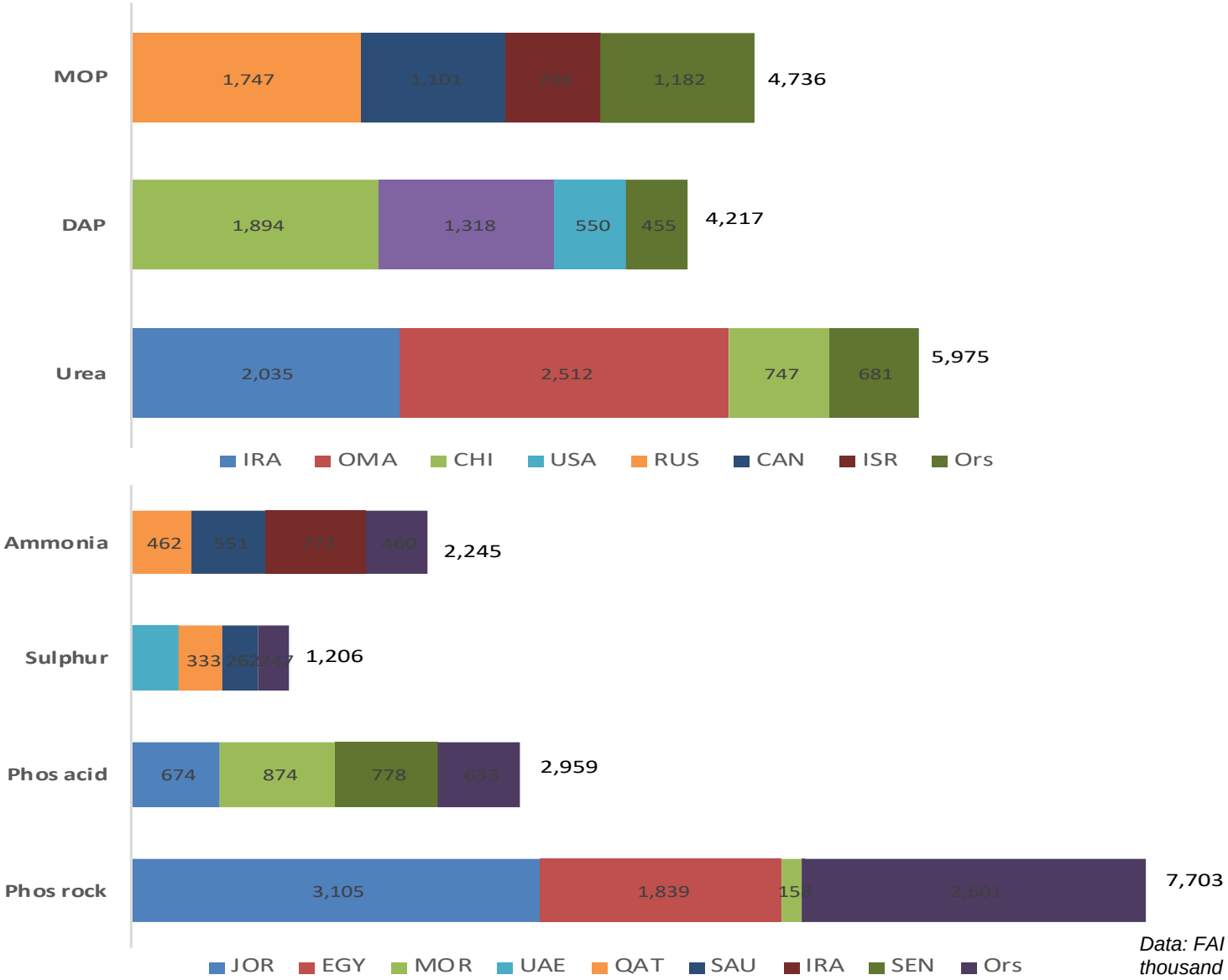


- In the past decade imports supplied 30-45% of nutrient use. India also imports large quantities of intermediates and raw materials phosphate rock (7.7), sulphur(1.2), phosphoric acid (2.9) and ammonia(2.4).
- About 15.7 million tons of fertilizers were imported in 2017-18. Urea imports range 5.5 – 8.5 million tons. DAP is 4 – 6 million and Potash 3.5 – 4.5 million. About 0.5 million tons of NPKs are also imported.
- Urea imports are undertaken by 3 SOEs on behalf of the Government. In-country distribution of imported Urea is auctioned out to fertiliser companies. Import of all other fertilizers is open for private companies.

Figures in ( ) are 2017-18 imports in million tons

From where? Top 3

- 8 countries supply most of India's Urea, DAP & MOP. China is among top 3 suppliers of both Urea & DAP. Raw materials originate in another 6 countries.



Data: FAI for FY18
thousand tons

How India buys fertilizer

Urea

- MMTC, STC and IPL periodically tender on behalf of the Government.
- Strict tender terms – QQ final at discharge. Performance bond(1% for producers) required.
- Arrivals tuned to seasonal peak use in July-August and November - January.
- Import is in bulk. Onus for neem-oil (Azadirachta indica) coating is with importer NOT with supplier.
- Payment by LC. Suppliers are paid full FOB or CFR price. Supplier has NO involvement with Government subsidy program.

Everything else!

- All other grades, whether included in the Government's subsidy program or not, are open for import by anyone. Caveat – grade but be registered in India (FCO).
- Import duty structure is stable and clear eg 5% for DAP
- Typically, Indian fertiliser producers and distributors are importers
- Contract terms and pricing is negotiated. Good alignment with international trade practices. SOEs go the tender route.
- Spot or short duration pricing. Long term pricing is uncommon
- Contracting is usually CFR. Shipments are in Bulk. Payment is by LC.

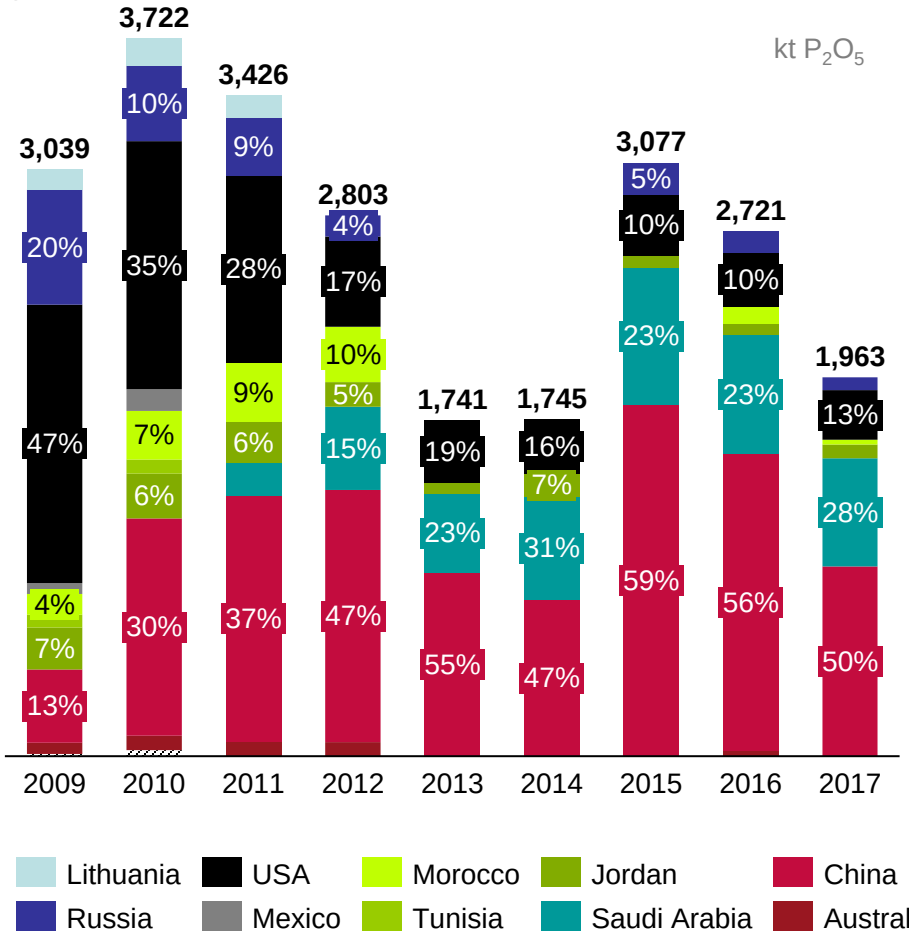
- *Government's NBS program subsidizes 21 grades of NP, NP-S, NPK and SSP. Grades not in NBS are not paid subsidy.*

India DAP imports and main suppliers

For 'commodity' DAP – shift dictated by scale and cost leadership

US share declines as China and Saudi grow share

Strategic value of India market – Scale & counter cyclical



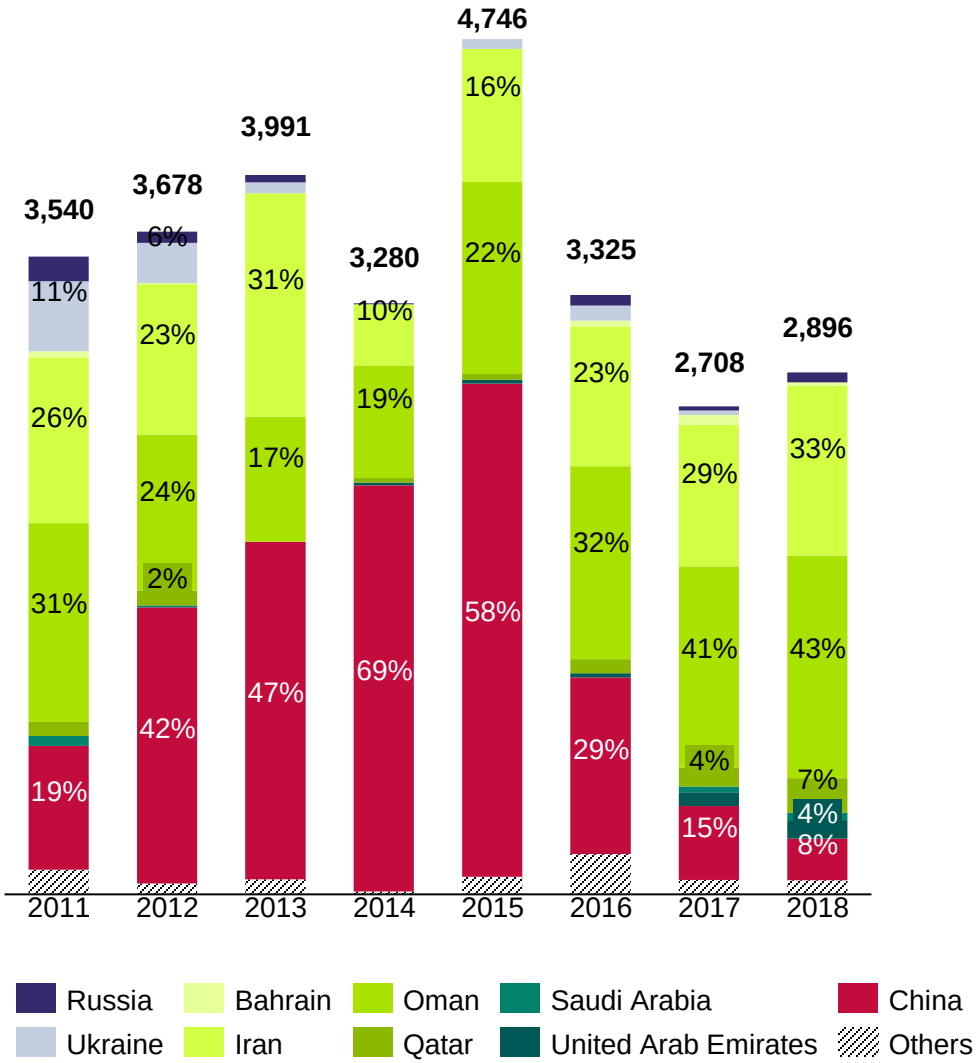
- India diversifies origin for risk management. But already top 3 account for over 90% share since 2013 (up from 75% in 2010)
- Opportunistic market for suppliers like Australia seeking home in a lean patch. There are always bottom feeders.
- Limited scope for differentiation via NP/NPK grades (Russia). Lead-in for domestic capacity.
- Higher value capture & assured access for downstream players like Mosaic or Yara. Origin un-important.

How might India's Urea imports change?

AFCOME
RENCONTRES INTERNATIONALES
Nantes 2019

Fundamental shifts

- Capacity ramp up
- Demand moderation



Key insights

- Urea is the "holy cow". No politician will mess with it. <u>All demand must be met</u>.
- Source of frustration – agri impact, economics & politics
- Import base-load is Oman (Omifco) & Iran consistently supply 1.8-2 million tons. Remainder is price & timing driven.
- Neem coated urea
- Talking down demand (Prime Minister)
- 1 brownfield, 5 revival and 1 conversion projects could add 4,100 kt Nitrogen by 2023 (3,500 kt by late FY21)
- India could do a China on Urea

Indian fertilizer regulation

- Fertilizer Control Order (FCO) – the law governing registration, quality, handling & sale or purchase of all fertilizer. Administered by the Ministry of Agriculture.
- Subsidy program administration and pay out managed by the Department of Fertilizer.
- Soil testing and soil health awareness program led by Ministry of Agriculture.
- Subsidy policy & road map engaging top country leadership.

Beyond India's traditional nutrient markets

The Sultan & the skies

- An Indian fable tells that farmers problems are from two sources – either *Sultani* meaning policies of the sultan/rulers, or, *Asmaani meaning* vagaries of the sky (asmaan).
- In modern times things have gotten more complicated for Indian agriculture. Business-as-usual will not work.

In the 1960s & 70s…

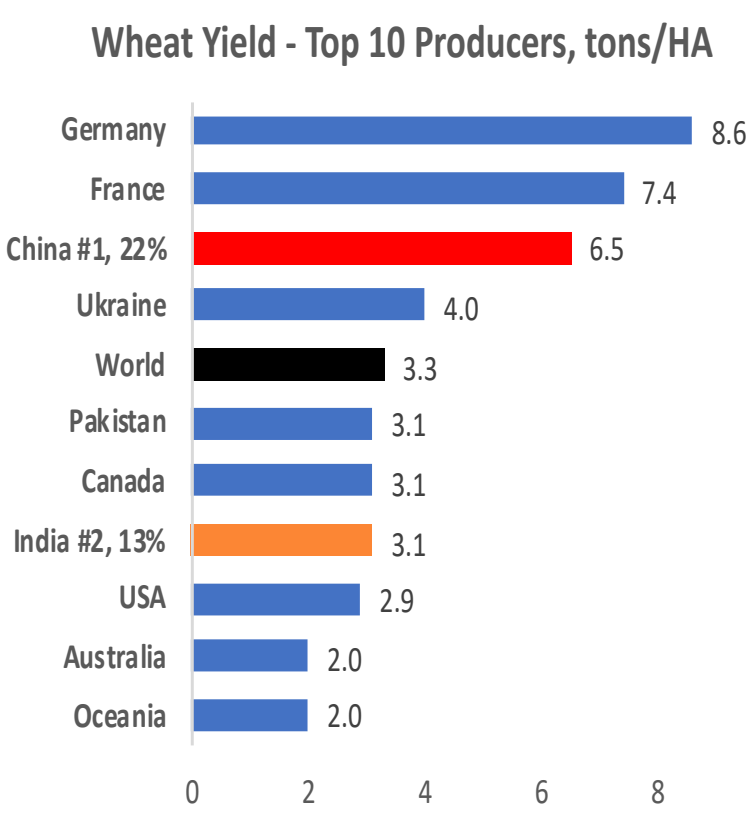
- Food self sufficiency

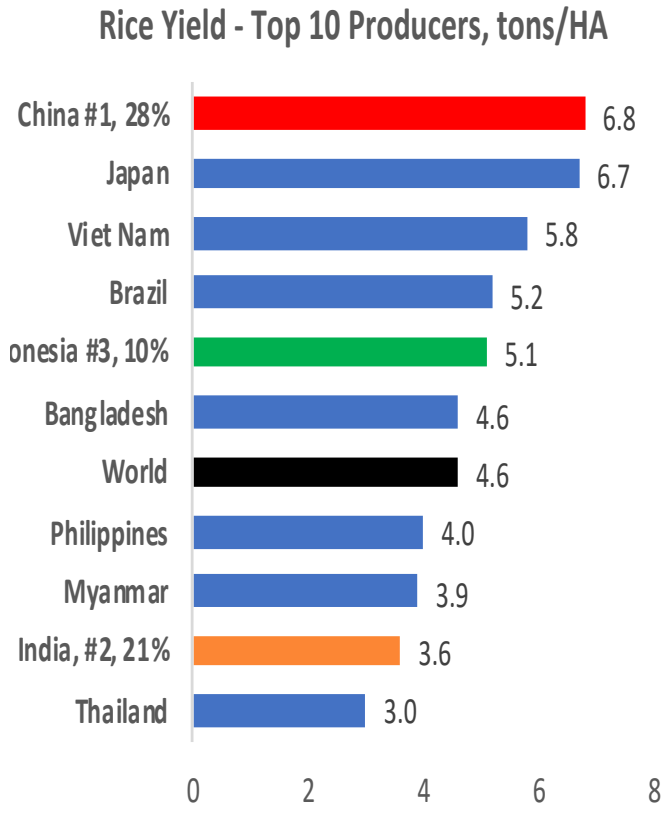
Lately…

- Farm profitability and farmer incomes
- Changing diets
- Rickety supply chains & access to market
- Food processing
- Sustainability
- Organic farming
- **Yield**
- **Soil health**
- **Water**

Crop yields

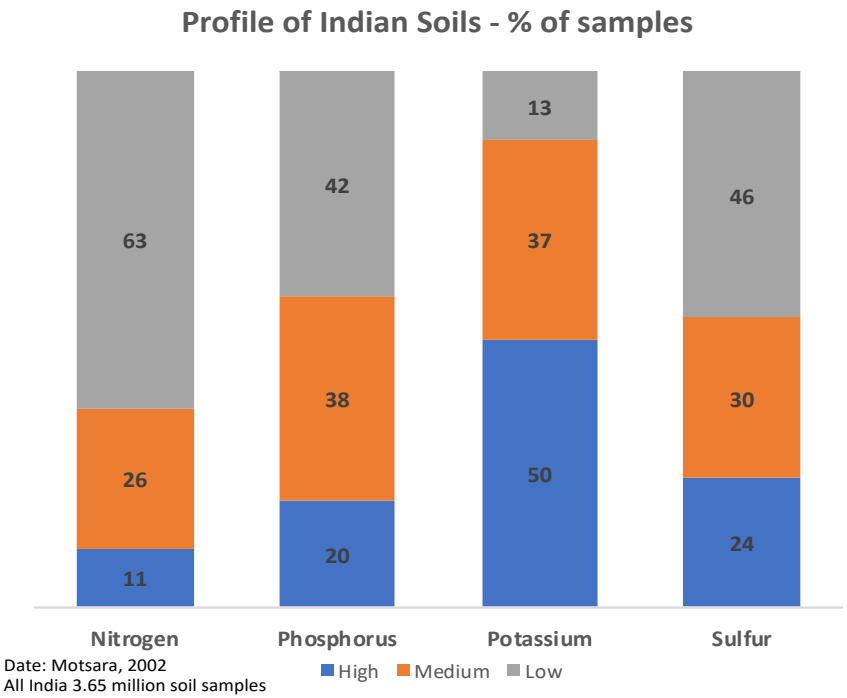
- Indian agriculture has scale but is not efficient – rice and wheat yields are both below world average
- Low yields imply inefficient land and resource use and lousy farm economics and competitiveness. They are dragging down India's economic growth.
- Regional variation in yields prove that improvement is possible.





India's soil are getting tired

- Most of India's agriculture is on alluvial soils found in its river valleys and deltas & in its flood plains that cover over 40-45% of India
- 5 decades of intensive agriculture with farmers taking 2-3 crops each year and imbalanced fertilisation is catching up.
- Indian soil scientists estimate that over 120 million ha or 85% of farmland could already be problematic.
- Indian soils today have major physical and chemical challenges - depleted organic content at 0.3 – 0.5% together with compaction and multiple secondary and micro deficiencies are manifesting.
- Not enough is know of the biological status of Indian soils.



Date: Motsara, 2002
All India 3.65 million soil samples

Water use in Indian Agriculture is unsustainable

- India has 4% of the world's freshwater and 16-17% of its population. Current practice and quantity of water use is unsustainable and 54% of the country is already 'water stressed' (WRI).
- Paddy & sugarcane cover less than 30% of sown area but use 60% of irrigation water. It doesn't help that average Indian rice yields (land productivity) at 3.4 tons/HA are half of that in China.
- Competing demand will push down availability for agriculture from the current 78% to 65% by 2050.
- A 2018 mapping of the water productivity[#] of (10) major Indian crops has set the ball rolling.

Water productivity mapping of major Indian crops 2018 – NABARD & ICRIER

The case for soil health#

- Competing priorities from domestic, industry and energy will reduce the amount of land and water available for agriculture.
- Current and future food requirements will have to come from better productivity of land and smarter use of water.
- Declining response to applied N, P & K result from decades of imbalanced nutrient application and neglect of organic compost.
- Intensive farming and insufficient replacement leaves a net nutrient deficit of 10 million metric tons each year.
- Poor field water management (flood irrigation) has led to reduction in water and nutrient use efficiency.

Progress?

- Raise awareness & metrics – Soil Health Card for all farmers. 45 million soil samples tested since FY16.
- Re-balancing N:P:K needs big push on pricing policy. So far …only deck chairs re-arranged (neem coated).
- Agribusinesses have increased product options and availability. Improved field marketing. Initial work on – secondary & micronutrients, water soluble & fortified fertilisers.
- Organic carbon yet to get traction.

Soil Sample Details

Date of Sample Collection	10/09/2017
Survey No., Khasra No./ Dag No.	88
Farm Size, Irrigation Status	2.16 Acre Irrigated (Bore well)
Geo Position (GPS)	Latitude 16.117223°N Longitude 75.800556°E

Soil Test Results

Soil Health Centre, Bagalkote

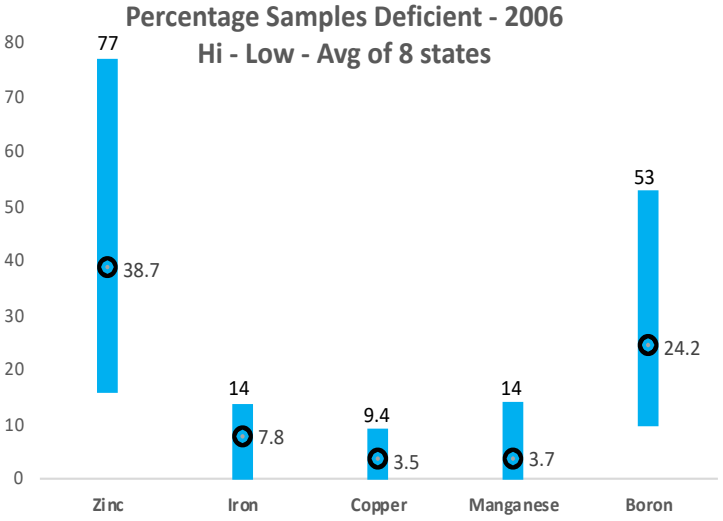
Soil Type: Black Soil

Parameter	Test Value	Unit	Rating	Normal Level
1 pH	7.70		Moderately alkaline	7, Neutral
2 EC	0.04	dS/m	Normal	0 - 1 dS/m
3 Organic Carbon (OC)	0.35	%	Low	0.51 - 0.75%
4 Available Nitrogen (N)	200.63	kg/ha	Low	280 - 560 kg/ha
5 Available Phosphorus (P)	4.19	kg/ha	Very Low	23 - 57 kg/ha
6 Available Potassium (K)	122.85	kg/ha	Low	145 - 337 kg/ha
7 Available Sulphur (S)	26.50	ppm	Sufficient	> 10 ppm
8 Available Zinc (Zn)	0.27	ppm	Deficient	> 0.6 ppm
9 Available Boron (B)	0.63	ppm	Sufficient	> 0.5 ppm
10 Available Iron (Fe)	0.71	ppm	Deficient	> 4.5 ppm
11 Available Manganese (Mn)	6.41	ppm	Sufficient	> 2.0 ppm
12 Available Copper (Cu)	1.65	ppm	Sufficient	> 0.2 ppm

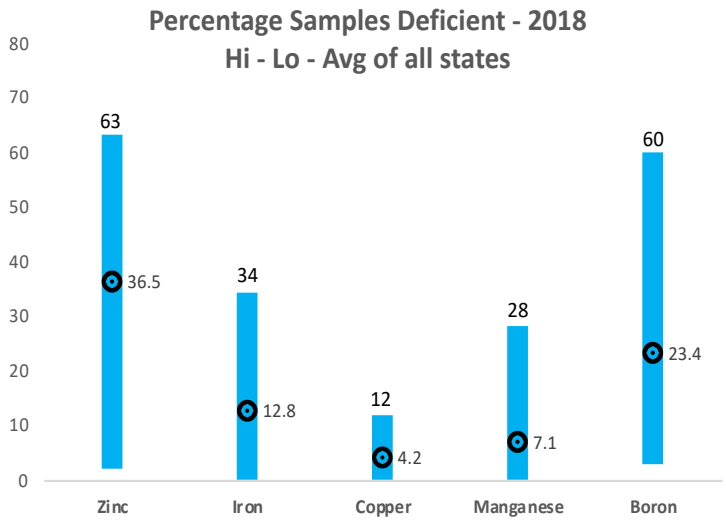
#National Academy of Agriculture Sciences, May 2008

Micronutrients

- Zinc and Boron are India's most widely deficient micronutrients. While average PSD# for both has changed little since 2006, high end of PSD for Boron has moved up. For Zinc the high end of PSD has reduced likely due to good awareness, availability and use of Zinc Sulphate.
- Average PSD for Iron, Copper and Manganese are small but have trended up since 2008. Importantly, the high end of PSD increased significantly for all three – 2.4X for Iron & 2X for Manganese - implying continued mining.
- Micronutrient awareness programs are starting make and impact but availability of quality options and farmer action are still patchy.
- Options to provide micronutrients to farmers include - Micronutrient fertilisers (like Manganese Sulfate or Borax), fortified grades of fertilisers (like Boronated Urea) and inclusion of micronutrients in water soluble and customized fertilisers (steam granulated mixtures)



Data: Singh, IISS, 2006. 8 States 2857-4082 Samples



Data: Shukla, 2018. All states

Percentage Samples Deficient

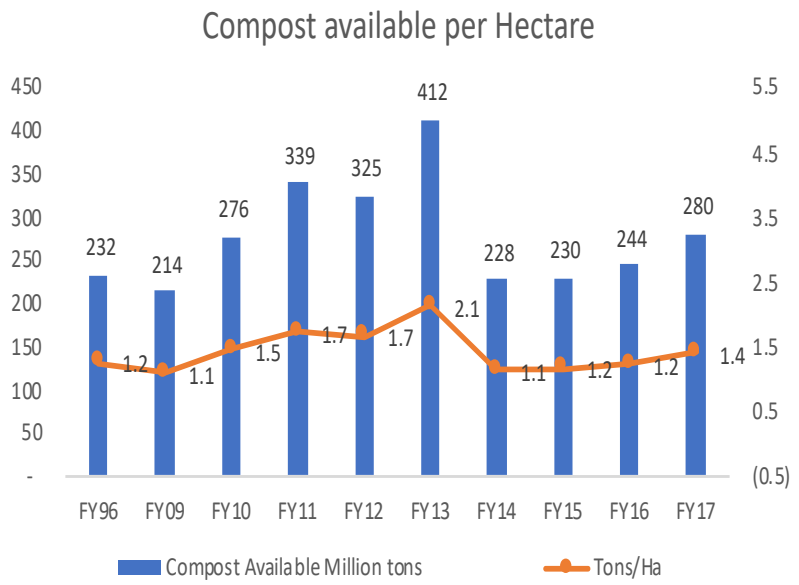
Carbon debits

- The Government's Soil Health Card program shows that 85% of 45 million soil samples tested since FY16 are organic carbon deficit.
- The low organic carbon content of Indian soils at 0.3-0.5% are well below the required 1.5%.
- Traditional cycles that rejuvenated soils have fallen away –
  - Intensive cultivation means farmers don't rest their fields.
  - Plant residue is often burnt in the rush to catch the next planting.
  - Cow dung and other manure have become scarce as mechanization and lack of grazing grounds means fewer farm animals.
- Against a recommended application of 5-10 tons per hectare of compost, actual availability is well below 2 tons. The cumulative impact of this deficit is now telling on soil health

What are the options?

Still grappling with the situation…

- Conservation tillage and incentives or carbon credit for carbon sequestration.
- Smarter practices and course correction for handling available compost and organic manure.
- Best practices from the '4 per 1,000'
- Biofertilizers (BF)



Takeaways

- Increasing food demand and improving diets provide a strong pull + soil and water challenges make India an attractive market.
- India's primary nutrients market is large and still has headroom.
- However, in the near to medium term it will go through a period of change (reform). Fearless forecast –
  - Changes will include direct cash transfer to farmers (begun in 2018) and phase out of P&K fertilizer subsidy
  - Urea subsidy reform is less likely but increase in Urea price is possible.
- Other challenges in traditional primary nutrient market are lack of innovation opportunities, limited freedom to operate and slim margins.
- There are promising growth and profit opportunities in improving yields, soil health and water use to capture market and build a profitable business.
- It is possible to grow and profit by participating in solving India's agriculture challenges.

What does it take to play in India

- The new frontier of Indian ag market is already open.

- Choose where to play – simple market expansion that takes best available opportunity OR strategic investor that owns & shapes market
- Segment and select - crop & farmer.

- Value conscious market. Seeks high benefit/cost ratio.
- Show-me. Demonstration very effective. Generate word-of-mouth.
- Brand is trust

- Strong local talent pool – eager to learn and contribute.
- Good payback from talent development.

- Safety & operational excellence can be done. If one cares enough.

- Patience & persistence pays.

- The new tools…
  - Mobile connectivity
  - eCommerce (…but last mile delivery)
  - Application services

Merci
Thank you