

PRODUCT KNOWLEDGE · NITROGEN EFFICIENCY

# Vital Urea

Sulfur Coated Urea · N 32% min · S 13% min

Nitrogen that feeds the crop instead of the air. A sulfur coating slows dissolution on alkaline ground, and the sulfur itself is a second nutrient that unlocks a third.

PS 217-2023

Licence CM/L-4126/2025

25 kg

Patent 144684



## THE PROBLEM

# Pakistan applies nitrogen. It does not apply much else.

Fertilizer nutrient applied, 2023 — as published on [van.com.pk](https://van.com.pk).



Bar length is to scale. Eighty-three parts of nitrogen for every one of potash.

# pH 8+

is where most of it lands

and above pH 8 surface-applied urea converts rapidly to ammonia gas

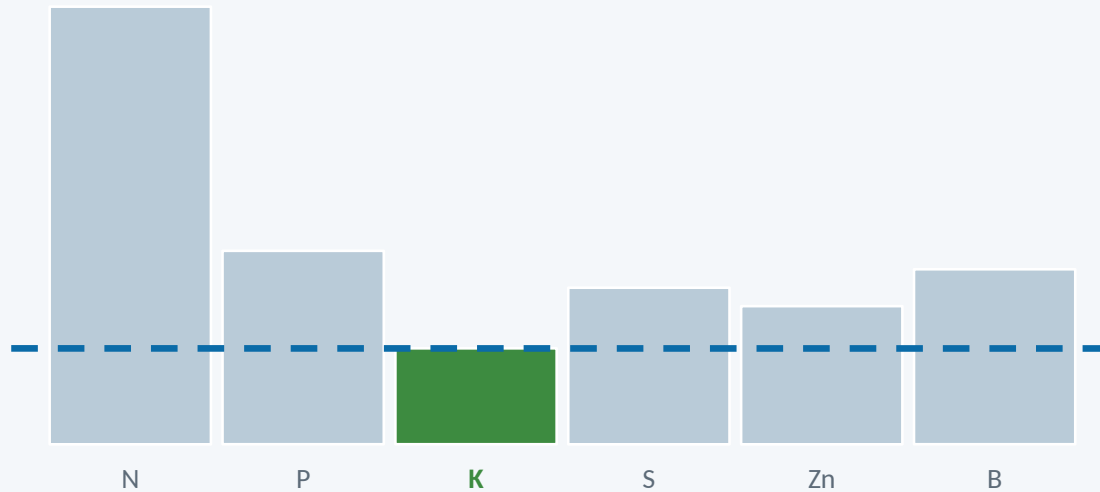
The nitrogen is bought, carried, spread and paid for. A share of it never reaches the crop at all — it leaves as gas within hours of touching the soil.



More nitrogen is not the answer to nitrogen that never arrives. Losing less of it is.

# The barrel holds what the shortest stave allows.

Carl Sprengel set it out in 1840; Justus von Liebig made it famous. Yield is set by the nutrient in shortest supply — not by the one you applied most of.



— the water line — what the crop actually yields

## Adding N to a sulfur-short soil

raises the tallest stave and changes nothing. This is the Pakistani pattern: nitrogen applied heavily, sulfur and the rest barely applied at all. A coated urea that carries sulfur raises two staves at once — and the oxidising sulfur reaches down and raises phosphorus and zinc as well.

The staves above show the shape of the problem, not measured soil values. Your own shortest stave is a soil test away — VAN Lab publishes its prices.

# Raw urea on alkaline ground has somewhere else to be.

What happens in the hours and days after the granule lands.

## Uncoated urea

Dissolves on contact with moisture. On soils above pH 8 the hydrolysis product is ammonia, and ammonia is a gas.

- Converts rapidly to ammonia at the soil surface
- What survives is soluble and moves with water, below the root zone
- Delivers its whole load at once, whether or not the crop is ready for it

## Vital Urea

A sulfur coating stands between the granule and the soil water, so dissolution is gradual rather than immediate.

- Nitrogen stays in the soil solution longer instead of leaving as gas
- Release is spread across the crop's demand curve
- One basal application covers what would otherwise need split doses

*This is the mechanism as VAN states it on [van.com.pk](http://van.com.pk). No loss percentage is claimed for it here, because VAN has not measured one.*

# The same nitrogen. A different week.

Nitrogen in the soil solution after one application. Both strips are drawn to one scale and carry the same area — the same nitrogen in the bag, at least 8.0 kg either way.



## WHERE THE SPIKE GOES

$\text{NH}_3 \uparrow$

ammonia, straight to the air

$\text{NO}_3^- \downarrow$

nitrate, past the root zone

$\text{N}_2\text{O} / \text{N}_2 \uparrow$

denitrified in wet ground

Plain urea puts almost all of its nitrogen into the soil in the first days, when the crop is barely taking any up, and what is not taken up has three ways to leave. Vital Urea meters the same nitrogen out across roughly 7 to 18 days, into the part of the season the crop is actually asking for it.

Schematic, not a measurement. The demand window is drawn for shape, not for scale, and no axis here carries a figure VAN has not published. VAN publishes stage-by-stage programmes for 28 crops at [van.com.pk/crops/](https://van.com.pk/crops/).

# What is actually in the bag.

One 25 kg bag, and what it carries onto the field.



Vital Urea — 25 kg

## NITROGEN

N 32% minimum — at least 8.0 kg of nitrogen per 25 kg bag

## SULFUR

S 13% minimum — at least 3.25 kg of sulfur, from about 4.06 kg of 80% pure sulfur material

## STANDARD

PS 217-2023, the Pakistan Standard for sulfur and neem coated urea

## LICENCE

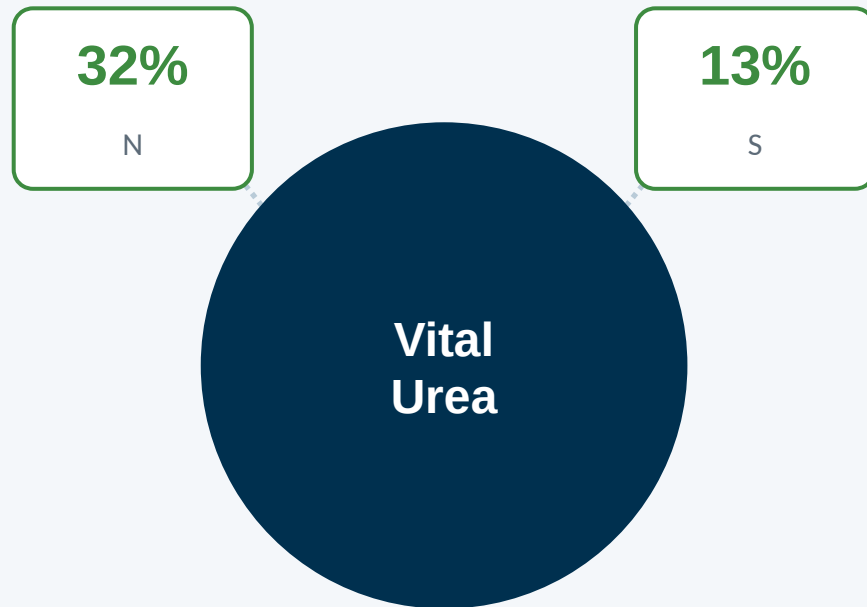
PSQCA marks licence CM/L-4126/2025

## RELEASED BY

VAN's own PNAC-accredited laboratory — ISO/IEC 17025:2017, LAB-336

# Two nutrients, declared.

As registered under PS 217-2023 and as published on [van.com.pk](http://van.com.pk).



## RELEASE PROFILE

**7 – 18 days**

depending on climate and application method

## FORM

**Coated granule**

sulfur coated onto the urea prill, not blended beside it

## PACK

**25 kg**

carrying at least 8.0 kg N and 3.25 kg S

# The coating is the product. The urea underneath is a commodity.

What VAN engineers into the granule.

## 1 Sulfur, coated on

Sulfur is applied as a coating onto the urea granule. It is a physical barrier that slows the water reaching the nitrogen, and it dissolves away progressively rather than all at once.

## 2 Biodegradable adhesive

The coating is bonded with a biodegradable adhesive system. This is the subject of the patent VAN holds — Patent No. 144684, Government of Pakistan Patent Office.

## 3 Sulfur is also a nutrient

Unlike an inert polymer, the coating is itself a nutrient the crop needs. Nothing is carried onto the field that does not do work.

## 4 A microsite, not a field

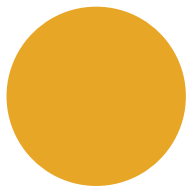
As the sulfur oxidises in the soil it releases acid into the few centimetres around each granule, where phosphorus and zinc held by alkalinity can come back into solution. It will not move a soil test, and VAN does not claim it does.

*Uniformity of coating is what separates a coated urea from a urea with sulfur mixed into the bag. A blend segregates; a coating cannot.*



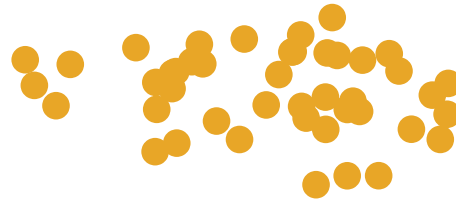
# Oxidation is a surface reaction. Where the sulfur sits decides everything.

The same mass of elemental sulfur, three ways. Sulfur only becomes a nutrient once the soil oxidises it to sulfate, and that can only happen on the surface it reaches.



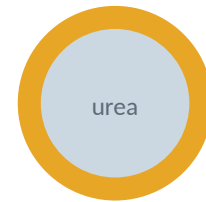
**one lump**

almost no surface



**fine, dispersed**

all surface, goes everywhere



**fine, on the granule**

all surface, stays with the N

90% S pastille  0.0006 / day

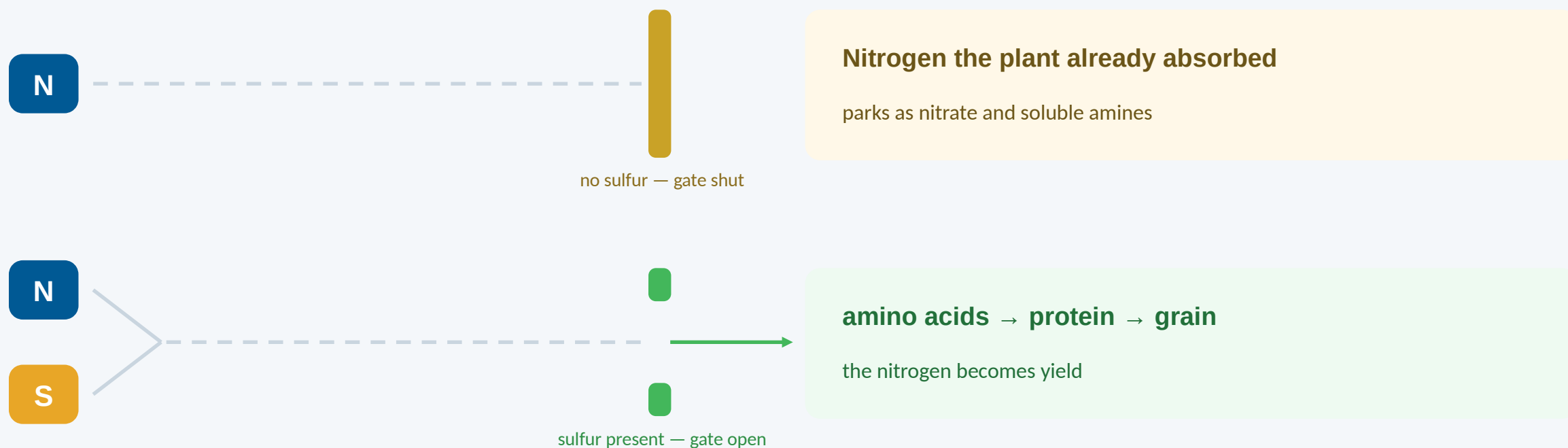
fine S in soil  0.02 / day — about 33× faster

*Measured oxidation rate of elemental sulfur, per day, at the same mass (Degryse et al., 2016). Neither figure is a measurement of Vital Urea.*

This is why the sulfur is milled fine and put ON the granule rather than mixed into the bag as a lump: all of the surface, in the same place as the nitrogen.

# Nitrogen the plant has absorbed is not yet nitrogen the plant can use.

Two of the twenty amino acids — cysteine and methionine — carry sulfur, and protein cannot be finished without them.

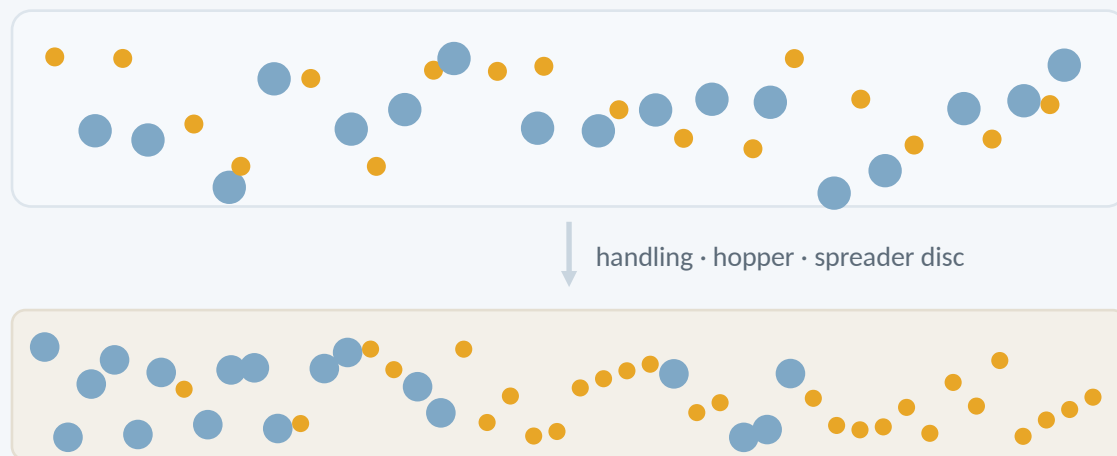


Where sulfur is short, nitrogen the plant has already absorbed accumulates as nitrate and soluble amines, and nitrogen use efficiency falls with it (Grzebisz et al., 2022; Elbasyoni et al., 2026). Wheat builds protein at about 15 parts nitrogen to one part sulfur, and above 17:1 yield falls away — so each kilogram of sulfur the crop is short of is roughly 10–15 kg of nitrogen that cannot be finished into protein. A cereal ratio; the brassicas run far lower.

# A mixture cannot promise that the two arrive together.

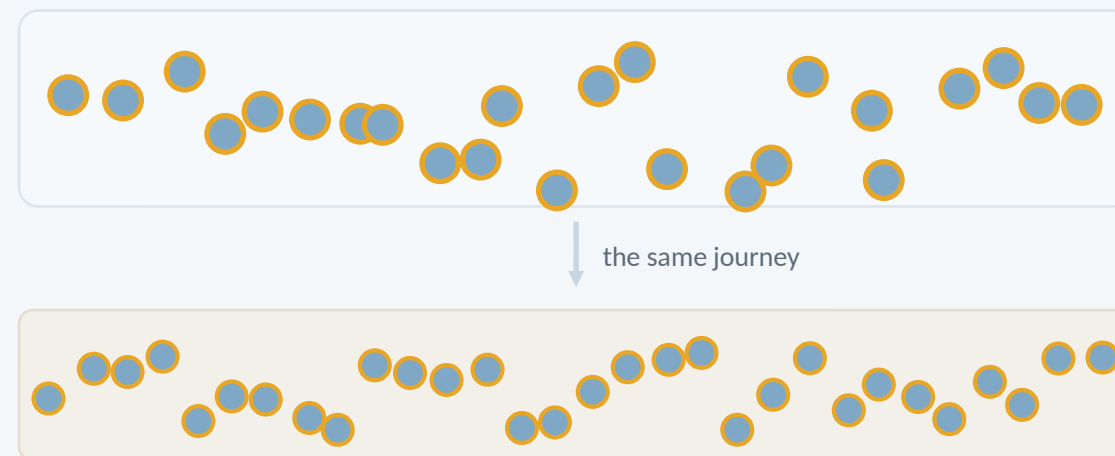
Two materials in one bag separate by size and by density through handling and the spreader disc. A coated granule cannot separate from itself.

## blended in the bag



one end of the field gets the nitrogen,  
the other gets the sulfur

## coated on the granule



every granule carries both,  
to the same spot

What is claimed here and what is not. Uniformity is a batch record, not a slogan. What VAN publishes is the declared analysis — 32% N and 13% S, registered against PS 217-2023 and released through VAN's PNAC-accredited laboratory. Coating weight IS measured per batch — VAN does not publish the figure and will provide it against a batch number. No granule-to-granule figure is claimed because none is published, not because none is measured.

*Segregation of blended fertilisers by particle size and density — Antille et al. (2013), reporting the thresholds of Miserque and Pirard.*

# The finding that cuts against the simple version of this story.

- 1 What the simple version says**

Alkaline soil is warm, moist and biologically active, so elemental sulfur oxidises readily and acidifies its surroundings.
- 2 What was actually measured**

In a controlled comparison, elemental sulfur oxidised FASTER in acid soil than in a slightly alkaline one — 20.9% against 12% — and lowered the pH of the alkaline soil only where a sulfur-oxidising inoculant was added with it (Mattiello, da Silva, Degryse et al., 2017).
- 3 Why it is on this slide**

It is published on van.com.pk next to the claim it qualifies. A deck that dropped it would be making a stronger claim than the website, and the website is the weaker of the two on purpose.
- 4 What VAN does about it**

Inoculating the coating so that it oxidises faster is a live VAN research track. It is not a product claim and there is nothing in the bag today that does it.

# One coating moves three nutrients.

Established interactions between soil nutrients — after Mulder. These describe how nutrients behave with one another, not how Vital Urea performs.



## Works with

Sulfur oxidising around the granule lowers local pH — phosphorus that was fixed as calcium phosphate becomes available again

The same local acidification improves zinc availability, the most widespread micronutrient deficiency in Pakistani soils

Balanced sulfur supports nitrogen: the two are taken up and used together in protein synthesis

Balanced nitrogen in turn supports sulfur, magnesium and molybdenum uptake



## Competes with

Excess nitrogen reduces uptake of potassium, copper and boron — which is exactly the Pakistani pattern of heavy N and almost no K

Excess calcium, abundant in calcareous soils, suppresses magnesium, zinc, iron, manganese, boron, phosphorus and potassium

Excess phosphorus reduces zinc and iron uptake — over-applying DAP can create a micronutrient problem

Excess potassium suppresses calcium, magnesium and boron, so potash also has to be balanced rather than maximised

Mulder's chart is a map of these relationships and is not specific to any manufacturer. It is on this slide because it explains why a sulfur coating is worth more than the sulfur in it.

# Four figures, and what each one rests on.

These are the figures VAN locked for this product on 3 August 2026. Everything else in the older deck was an estimate and is not reproduced.

**up to 30%**

reduction in nitrogen losses against  
plain urea

**7–18 days**

release profile, by climate and  
application method

**500,000+**

acres reached

**18%+**

yield improvement in oil crops —  
field data on request



The 18%+ figure carries a condition. Trial results on maize, sugarcane and oil crops exist and are available on request; they are not published, so the figure is shown with that stated rather than presented as a settled number.

## 25 kg against 50 kg. The comparison was deliberately uneven.

Five grower sites, in collaboration with Rafhan Maize Products, from application in August 2023 to harvest in October, with assessments at 12 and 24 days.

### One 50 kg bag, conventional urea

The standard grower practice the trial was measured against.

- 50 kg of product
- About 23 kg of nitrogen applied
- No sulfur

### One 25 kg bag, Vital Urea

Half the weight, roughly a third of the nitrogen, and sulfur included.

- 25 kg of product
- at least 8.0 kg of nitrogen applied
- at least 3.25 kg of sulfur included

*Across the growth parameters assessed — shoot length, colour, leaf number and vigour — the 25 kg bag produced comparable crop growth to the 50 kg bag.*

# What that trial does and does not show.

1

## What was measured

Shoot length, colour, leaf number and vigour, at 12 and 24 days after application, across five grower sites identified by Rafhan's agronomy team.

2

## What was found

Comparable crop growth from roughly a third of the applied nitrogen, with sulfur included. Observers additionally recorded better uniformity of plant height.

3

## What it is not

It is not a replicated yield trial and VAN does not present it as one. No yield percentage is claimed from it.

4

## The honest conclusion

On alkaline ground, nitrogen released gradually and held in the root zone does more work than a larger quantity that volatilises. That is the whole argument for a coating, stated without a percentage.



## WHERE IT IS USED

# In 27 of VAN's 28 published crop programmes.

These are the programmes VAN publishes on [van.com.pk](http://van.com.pk), with a dose and a growth stage for each.

Wheat

Maize

Cotton

Sugarcane

Ratoon Sugarcane

Basmati Rice

Hybrid Rice

Potato

Onion

Garlic

Tomato

Chili

Canola

Sunflower

Soybean

Lentil

Chickpea

Sesame

Mungbean & Mash

Turmeric

Watermelon

Strawberry

Mango

Date Palm

Citrus — 5 years and over

Banana — 1st year

Banana — 2nd year

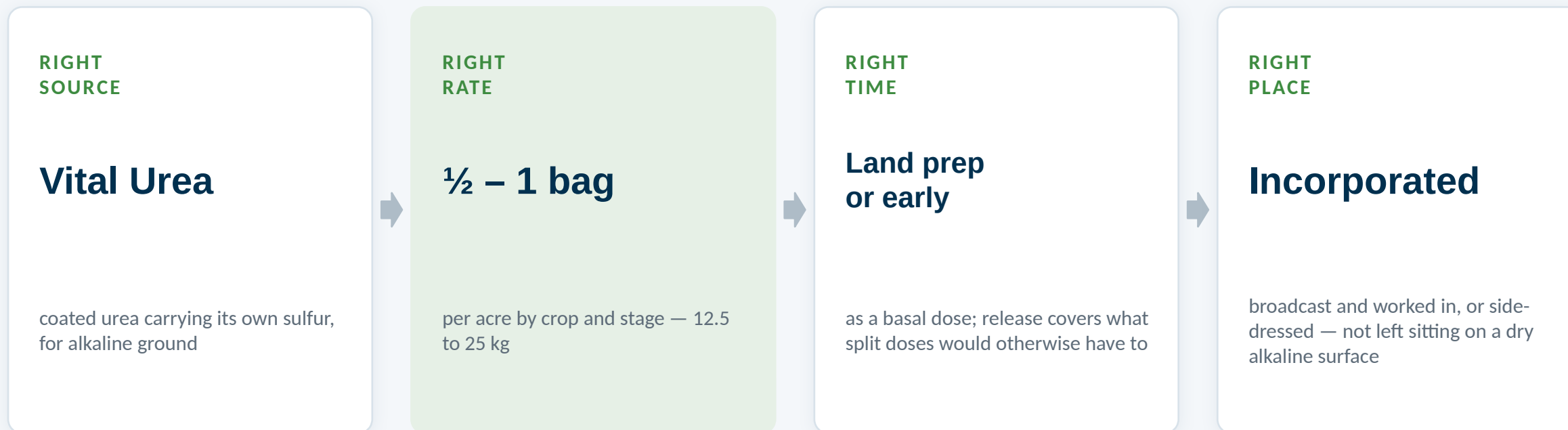
*27 of 28 crop programmes, every one published in full and free at [van.com.pk/crops/](http://van.com.pk/crops/).*

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Typical basal rates run from half a bag to one bag per acre by crop and stage. The programme is the starting point; a soil test is the finishing point.

# Right source, right rate, right time, right place.

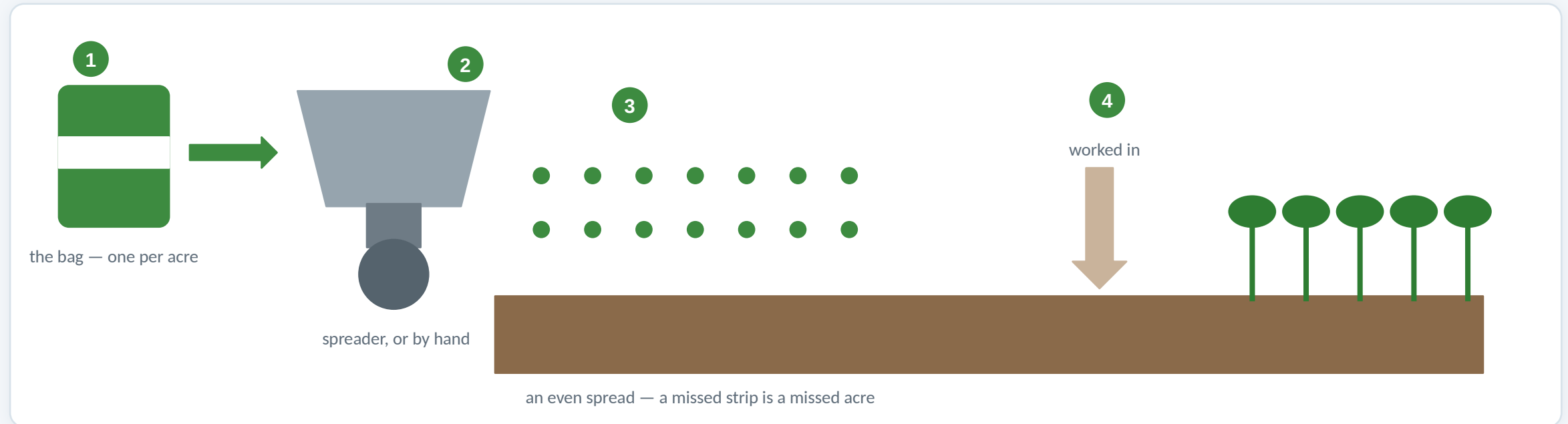
VAN publishes a rate and a stage. It does not publish a yield promise.



Surface-applied urea on dry alkaline ground is the worst case for volatilisation. Incorporation, or an irrigation soon after, is worth more than any additive.

# An even spread, then worked in.

The sulfur coating only works if the granule ends up in the soil, not on it.



**1 Measure it**  
Half a bag to one bag per acre.

**2 Spread evenly**  
Spreader or by hand. A missed strip is a missed acre and it shows at harvest, not on the day.

**3 Work it in**  
Incorporate into the root zone. Material left on the surface is not where the roots are.

**4 At the right stage**  
At land preparation or early growth.

Doses are per acre, from VAN agronomy. Incorporation is not optional — it is the difference between feeding the crop and feeding the surface.

# The timing error that costs the most.

1

## Applying too early

Nitrogen put out well before the crop can use it is nitrogen exposed to loss for no return. A controlled release narrows that window but does not abolish it.

2

## Leaving it on the surface

On dry, alkaline ground surface urea is the fastest route to ammonia. Incorporate it, or time it to an irrigation.

3

## Substituting weight for nitrogen

A 50 kg bag is not twice a 25 kg bag if the nitrogen in the larger one leaves as gas. Compare nitrogen delivered, not weight bought.

4

## Ignoring the sulfur

The sulfur is not packaging. About 4.06 kg of 80% pure sulfur material goes into every 25 kg bag — a sixth of the weight — to deliver at least 3.25 kg of a nutrient most Pakistani soils are short of, and it is what frees the phosphorus and zinc.

# What is behind the bag.

1

## Patent 144684

VAN holds a patent covering sulfur coating of urea granules with biodegradable adhesives — Government of Pakistan Patent Office.

2

## PS 217-2023

Registered against the Pakistan Standard for sulfur and neem coated urea.

3

## Licence CM/L-4126/2025

PSQCA marks licence, current, printed on the pack.

4

## Tested before it ships

Released through VAN's own PNAC-accredited laboratory, ISO/IEC 17025:2017, LAB-336. Send the batch number and VAN sends the certificate.

# Four reasons, and the fourth is the one that matters.

1

## Nitrogen that stays

The coating slows dissolution on the soils where uncoated urea is least likely to survive.

2

## Sulfur included

About 4.06 kg of 80% pure sulfur material per bag, delivering at least 3.25 kg of a nutrient the soil is short of, carried at no extra operation.

3

## Phosphorus and zinc unlocked

Oxidising sulfur acidifies the few centimetres around each granule and frees nutrients the soil had already been given and locked away.

4

## One pass, not three

Release across the demand curve does the job split applications were invented to do — at a point in the season the grower is already in the field.

## PUBLISHED RESEARCH

# The literature behind the four figures.

### Surface area governs it

Degryse, Ajiboye, Baird et al. (2016). Oxidation of elemental sulfur in granular fertilizers depends on the soil-exposed surface area. SSSAJ 80(2), 294–305. doi:10.2136/sssaj2015.06.0237

### Elemental S in practice

Bremer (2022). Efficacy of elemental sulfur fertilizers. Crops & Soils 56(1), 34–37. doi:10.1002/crso.20241

### Field oxidation rates

Janzen & Bettany (1987). Oxidation of elemental sulfur under field conditions in central Saskatchewan. Can. J. Soil Sci. 67(3), 609–618. doi:10.4141/cjss87-057

### N cannot finish without S

Grzebisz, Zielewicz & Przygocka-Cyna (2022). Deficiencies of secondary nutrients in crop plants. Agronomy 13(1), 66. doi:10.3390/agronomy13010066

### N × S in wheat

Elbasyoni, Al-Otayk, Ghonimy et al. (2026). Advancing wheat productivity through nutrient interactions. Life 16(5), 795. doi:10.3390/life16050795

### Acid frees locked P

Khoshru, Fallah Nosratabad, Mitra et al. (2023). Rock phosphate solubilizing potential of soil microorganisms. Bacteria 2(2), 98–115. doi:10.3390/bacteria2020008

### The counter-evidence

Mattiello, da Silva, Degryse et al. (2017). Sulfur and zinc availability from co-granulated Zn-enriched elemental sulfur fertilizers. J. Agric. Food Chem. 65(6), 1108–1115. doi:10.1021/acs.jafc.6b04586

### Blends segregate

Antille, Sakrabani & Tyrrel (2013). Characterisation of organomineral fertilisers derived from nutrient-enriched biosolids granules. Appl. Environ. Soil Sci. 2013, 694597. doi:10.1155/2013/694597

### What none of them is

None of the eight is a measurement of Vital Urea. They describe elemental sulfur, coated urea and blended fertilisers as technologies, under the conditions each study states.



## SOURCES

# Where every figure in this deck came from.

|                                |                                                                                                                                  |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Analysis, standard, licence    | van.com.pk — Vital Urea: N 32% min, S 13% min, PS 217-2023, CM/L-4126/2025                                                       |
| The four published figures     | Locked for this product by VAN, 3 August 2026                                                                                    |
| The 4.06 kg of sulfur material | 3.25 kg registered ÷ 80% purity. The purity is VAN's, confirmed 22 August 2026; the 4.06 kg is arithmetic, not a batch assay     |
| Field trial                    | Rafhan Maize Products collaboration, five sites, Aug–Oct 2023 — as published on van.com.pk                                       |
| Volatilisation mechanism       | van.com.pk — stated qualitatively; VAN publishes no loss percentage of its own                                                   |
| Release chart                  | Schematic. The two curves are the same functions the product page draws, and the build fails if they stop carrying the same area |
| Nutrient interactions          | After Mulder's chart — established relationships, not manufacturer-specific                                                      |
| Law of the minimum             | Carl Sprengel (1840), popularised by Justus von Liebig; the barrel image is von Dobeneck's                                       |
| Patent                         | Patent No. 144684, Government of Pakistan Patent Office                                                                          |
| Crop programmes                | van.com.pk/crops/ — 27 of the 28 published programmes name Vital Urea                                                            |

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*For information only. VAN may change a product's composition at any stage for agronomic, efficiency or upgrade reasons.*