PRODUCT KNOWLEDGE · MICRONUTRIENTS

VL-Boron

Boron 5% w/v · 50 g per litre

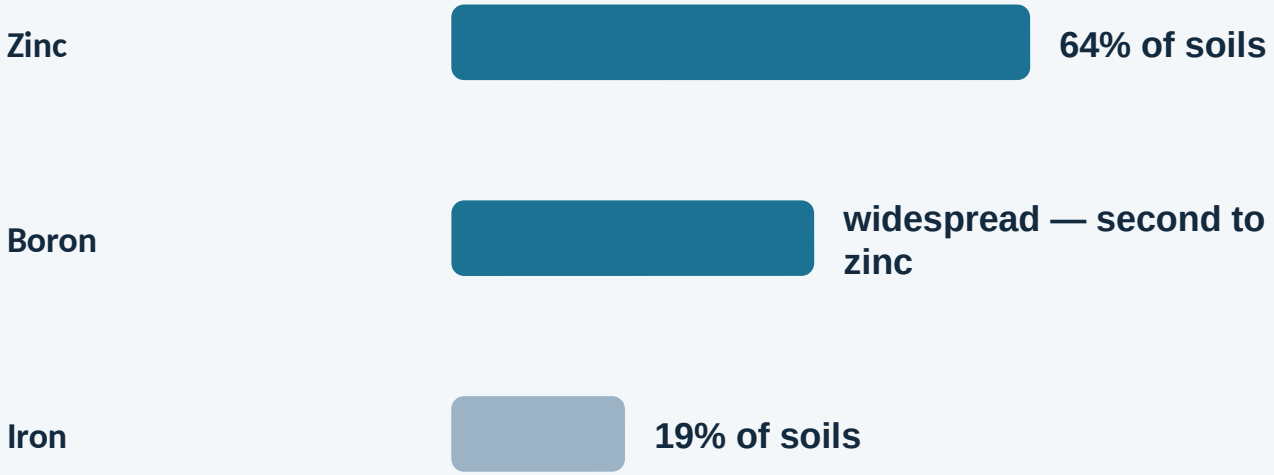
Boron has the narrowest safe window of any nutrient a crop needs. Too little costs the flower; too much costs the plant. This is the product for getting it exact.

PS 5469-2020 | Licence CM/L-3159/2024 | 1 L | Foliar & fertigation

THE PROBLEM

Boron is Pakistan’s second-most-widespread micronutrient shortage.

After zinc, boron is the deficiency most often limiting a Pakistani crop.



Zinc and iron figures are the national survey. The boron bar is indicative of rank, not a measured percentage.

grams

per acre — that is the whole requirement

and the difference between deficient, adequate and toxic is measured in the same units

No other nutrient asks to be applied this precisely. That is what makes a formulated liquid worth more than a bag of borax.

! Boron is also immobile in most crops: what the flower did not receive while it was forming, it will never receive.

THE CASE, IN FOUR NUMBERS

Boron is not a minor nutrient here. It is a national shortage nobody is filling.

Published Pakistani survey and use figures.

40–78%

of field-crop area is boron deficient

50%

of Punjab soils, on the province's own figure

92 t

of boron used in Pakistan in a year

2,245 t

of boron the crop actually needs

i

The country is supplying about four per cent of its own boron requirement. That is the gap VAN built a boron range to close — and it is why boron sits at the centre of VAN's micronutrient strategy rather than at the edge of it.

WHERE THE SHORTAGE IS WORST

Deficiency is not spread evenly. It tracks rainfed ground and heavy feeders.

Share of surveyed fields testing boron deficient, by crop and system.

1	**Mustard, rainfed — 78%**	Rainfed soils run consistently shorter than irrigated ones. The Pothohar plateau tests 55% deficient across all cultivated fields.
2	**Sugarcane, Punjab — 69%**	The single worst irrigated figure in the survey, and sugarcane is a long-season crop with a long boron demand.
3	**Wheat — 48% irrigated, 64% rainfed**	Half the wheat area, on the country's largest crop.
4	**Cotton and maize — 50% each; rice — 40%**	About 0.91 million hectares of the rice area, on a separate estimate by the same research group.

WHAT CORRECTION IS WORTH

Boron is the cheapest yield in the programme, and it is not close.

Pakistani field trials — yield increase and value-to-cost ratio at a fraction of a kilogram of boron per hectare.

1. **Rice — 18–30%, value:cost up to 38:1**

   Basmati +21%, IR-6 +30% across multi-location trials in Punjab and Sindh. The mechanism is measured: reduced panicle sterility and more productive tillers. Milling and cooking quality improved as well.

2. **Cotton — 14% soil, 13% foliar, value:cost 16:1 and 25:1**

   Boron deficiency during flowering and fruit formation increases square and boll shedding, because pollen germination and pollen-tube growth fail without it.

3. **Wheat 14%, maize 12%, peanut 23%**

   At 0.75–1.0 kg of boron per hectare. Peanut is rainfed, which is where deficiency is deepest.

4. **Citrus — Kinnow +14% yield at 0.2% foliar boric acid**

   University of Agriculture Faisalabad, applied at fruit set: more fruit per tree, less fruit drop, higher total sugars.

LAW OF THE MINIMUM

The barrel does not care that the short stave is a small one.

Carl Sprengel set the law out in 1840; Justus von Liebig made it famous. A nutrient needed in grams limits yield exactly as hard as one needed in kilograms.

Set, not size

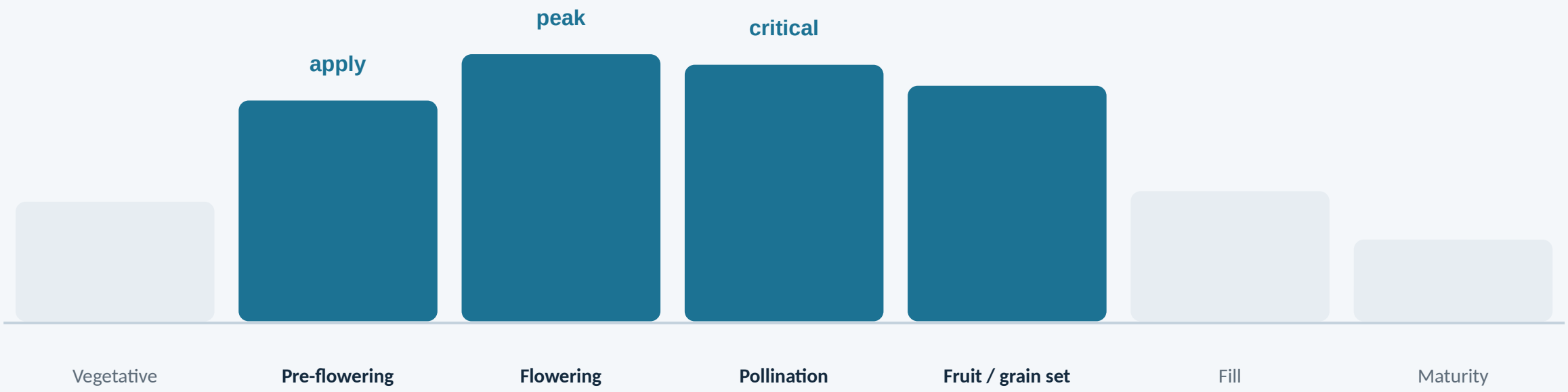
Boron shortage rarely shows as a small plant. It shows as a plant that grew perfectly and then failed to set — hollow stems, poor pollination, aborted flowers, cracked fruit. The yield was lost at flowering, not at growth.

The staves show the shape of the problem, not measured soil values. A soil or leaf test is what tells you your own — VAN Lab publishes its prices.

THE DEMAND WINDOW

Boron is needed at flowering, and it does not redistribute.

Relative boron demand across a season. In most crops boron is immobile in the phloem, so the window is narrow and it does not reopen.



Applied before and during flowering, foliar or through fertigation. Applied after fruit set, it is arriving for a job that has already been done.

The band shows the shape of demand, not measured uptake for a named crop.

THE PACK

What is actually in the bottle.

One litre, one nutrient, formulated for a narrow window.

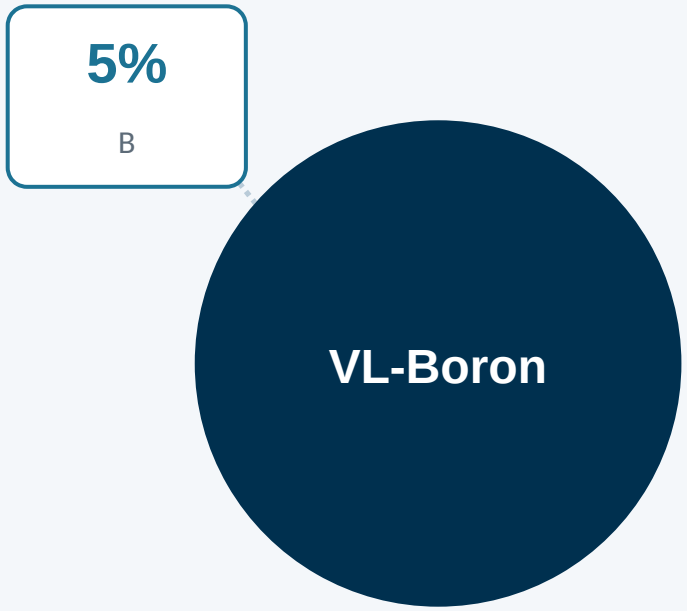
VL-Boron — 1 L

BORON	B 5% w/v — 50 grams per litre
FORM	Liquid, fully soluble — no undissolved residue in the tank
ROUTE	Foliar spray and fertigation
WHY LIQUID	Because the dose is grams per acre, and a liquid can be metered to grams
STANDARD & LICENCE	PS 5469-2020 · PSQCA marks licence CM/L-3159/2024

THE REGISTERED ANALYSIS

What the label declares.

As registered under PS 5469-2020 and as published on van.com.pk.



CONCENTRATION

50 g / L

weight per volume — the number that matters when dosing

SOLUBILITY

100% soluble

liquid; foliar or fertigation

PACK

1 litre

sized to the per-acre requirement rather than to a pallet

THE MECHANISM

What boron is actually doing in there.

Six functions, and every one of them is structural or reproductive.

1 Cell walls

Cross-links pectin in the cell wall — boron is what holds the wall together

2 Pollen

Essential to pollen viability and to pollen tube growth. No boron, no fertilisation

3 Flower retention

Reduces flower and fruit abortion — the commonest visible symptom of shortage

4 Sugar transport

Involved in moving sugars across membranes to where they are stored

5 Calcium partner

Helps calcium reach and fix into new tissue; the two work together

6 Root tips

Required at every growing point, above and below ground

IN THE FIELD

What boron shortage looks like.

General agronomy, not a VAN measurement. It shows in the newest tissue and in the crop, not in the old leaves.

1 Growing points die

Terminal buds and root tips die back — boron is immobile, so new tissue starves first

2 Hollow stem

Hollow or brown heart in brassicas, stems and roots

3 Poor set

Flowers abort; fruit and grain set badly despite a healthy-looking plant

4 Cracked fruit

Corking and cracking in fruit; internal browning

5 Brittle tissue

Leaves and stems become thick, brittle and distorted

6 ⚠️ Toxicity

Too much boron scorches leaf margins and tips. The safe range is narrow — this is the one nutrient where over-application is a real risk

THE TECHNOLOGY

Fast boron and slow boron are two different jobs, not two price points.

The choice is set by the soil and the crop, and getting it wrong wastes the application either way.

Fast — fully soluble borate

Boric acid and the sodium borates. In solution the moment they meet water.

- The only option for a foliar spray or a rescue treatment on a crop already short
- Reaches the crop in the season it is applied, at the stage you choose
- On a light, freely draining soil it can leach — one column study lost up to 80% of applied boron
- The narrowest safety margin: released fast, it can concentrate near a seed

Slow — sparingly soluble borate

Calcium and calcium-sodium borates. Dissolve over weeks to months.

- Holds boron in the root zone through a long season and across rainfall
- Far safer beside a seed — coated and co-granulated forms cut leachate losses from 24–37% down to 1–2%
- Right for perennials, orchards and coarse soils
- Particle size matters as much as mineralogy: a coarse granule of the same mineral may supply almost nothing

⚠️ *And the honest finding: on non-leaching, finer-textured irrigated soil, a finely ground slow source and a soluble one are agronomically equivalent. Slow release earns its price where water moves through the profile — not everywhere. Combining the two gives an initial fast release followed by a steady one, which is where the category is heading.*

THE CHEMISTRY

Why boron behaves unlike every other nutrient you apply.

Four properties that between them explain the timing, the rate and the risk.

1 It is taken up as an uncharged molecule

Boron enters as boric acid, with no charge. It moves largely with the transpiration stream rather than being actively pulled in, so anything that slows transpiration slows boron supply.

2 In most crops it does not move again

Boron is phloem-immobile in the majority of species. It cannot be pulled out of an old leaf and sent to a flower. Deficiency shows first at growing points and in reproductive tissue — and a spray after the damage is too late.

3 It builds the cell wall

Boron cross-links the pectin network in the wall. Without it the wall is weak, and tissue that should be expanding fastest fails first.

4 It decides whether pollen works

Pollen germination and pollen-tube growth both fail under boron shortage. That is the whole of the rice sterility story and the whole of the cotton shedding story, in one sentence.

Immobility plus flowering-stage demand is the reason boron is applied at the stage the crop sets, and not once at land preparation and forgotten.

THE NARROWEST WINDOW OF ANY NUTRIENT

The difference between not enough and too much is smaller than a bad measure.

Cotton leaf tissue, published ranges — and they are typical.

1	**Deficient below 11 ppm**	The crop is already losing squares and bolls before anything visible appears on a leaf.
2	**Sufficient from 16 to 80 ppm**	A wide-looking band, but the gap to the floor is only a few parts per million.
3	**Toxic above 100 ppm**	And severe toxicity is a real, documented outcome, not a theoretical one. Necrotic tissue has been measured at thousands of ppm.
4	**⚠️ Which is why VAN does not print a universal rate**	Boron is the one nutrient where the crop plan figure is not a starting point to be adjusted upward. Weigh it. Re-test soil boron every three to four years on fields that receive it.

NUTRIENT INTERACTIONS

Boron works with calcium and fights potassium.

Established interactions between soil nutrients — after Mulder. These describe how nutrients behave with one another, not how VL-Boron performs.

+ Works with

Boron and calcium work together in cell-wall construction — boron helps calcium reach and fix into new tissue

Balanced boron supports flowering and set, which is where the calcium work becomes visible

An acidic, fully soluble delivery keeps boron available to the leaf

VAN carries two boron chemistries on its coated potash products for the same reason

– Competes with

Excess boron reduces nitrogen, potassium and calcium uptake — and damages the crop directly. This is the nutrient where more is genuinely worse

Excess potassium suppresses boron — a heavy potash programme creates a boron shortage

Excess calcium suppresses boron as well, which is the standing condition of calcareous soil

Excess nitrogen also suppresses boron uptake

Read the right-hand column together: a Pakistani programme heavy in nitrogen, on calcareous ground, with potash applied at the mid-life stage, suppresses boron three separate ways.

WHERE IT IS USED

In 24 of VAN’s 28 published crop programmes.

These are the programmes VAN publishes on van.com.pk, with a dose and a growth stage for each.

Wheat · Maize · Cotton · Sugarcane · Ratoon Sugarcane · Hybrid Rice · Potato · Garlic

Tomato · Chili · Canola · Sunflower · Soybean · Lentil · Chickpea · Sesame

Mungbean & Mash · Turmeric · Watermelon · Strawberry · Guava · Citrus — 5 years and over

Banana — 1st year · Banana — 2nd year

24 of 28 crop programmes, published in full and free at van.com.pk/crops/.

i Canola, sunflower and the brassicas are the highest-response crops. Cotton, citrus and the fruiting vegetables follow.

THE VAN BORON RANGE

One nutrient, three specifications — because one form cannot do three jobs.

What is in market, and what is coming.

1 VL-Boron 5% liquid

Boron 5% w/v — 50 g per litre. Foliar and fertigation. In market, PS 5469-2020, licence CM/L-3159/2024.

2 Boron 19.5% solid

A high-analysis soluble solid for foliar use, where the tank has to carry more boron in less volume.

3 ⚠️ VAN Boron 19.5% — Tier 2

Under registration. Say “in registration”, never “registered”, until the licence issues.

4 Why a liquid at all

It measures accurately at low rates, mixes without a dissolving step, and on the narrowest window of any nutrient that matters.

5 Why a solid at 19.5%

Freight and storage per unit of boron, and headroom in a tank that is already carrying something else.

6 Both are foliar-first

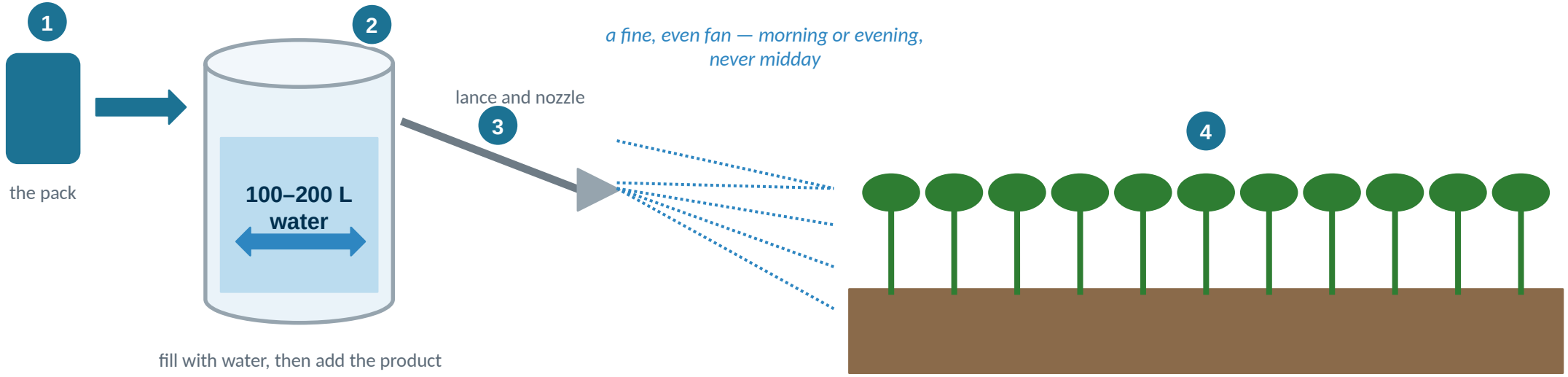
Because boron does not move once it is in the plant, and the stage it is needed at is the stage that sets the crop.

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

HOW IT IS APPLIED

Water first, product second — never the other way round.

Boron has the narrowest safe window of any nutrient. The rate is not a suggestion.



1 Water first
100–200 L of clean water in the tank. Always water first, product second — never the other way round.

2 Add and keep agitating
Per the published crop plan — weigh it, never estimate. A tank that settles sprays the last acre at a different rate from the first.

3 A fine, even fan
Cover the leaf without running off it. Morning or evening — midday is the wrong half of the day.

4 At the right stage
At flowering, when set is decided.

Doses are per acre, from VAN agronomy. The dilution is part of the rate: cutting the water to save a pass doubles the concentration on the leaf.

GETTING IT RIGHT

Four things that decide whether it works.

1	**Do not guess the rate**	Boron is the one nutrient where over-application damages the crop. Follow the published rate or test first — do not round up.
2	**Timing is before flowering**	It is immobile. Applied after set, it has arrived for a job that is finished.
3	**Foliar beats soil on calcareous ground**	Free calcium suppresses boron in the soil. The leaf route bypasses the problem.
4	**Watch it if you push potash**	Potassium, calcium and nitrogen all suppress boron. A heavy programme in any of them raises the boron requirement.

SOURCES

Where every figure in this deck came from.

Pakistan deficiency	Rashid, A. & Rafique, E. (2017), Journal of Boron 2(3):142–152 — B deficiency in 40–78% of field-crop area; use 92 t/yr against a 2,245 t requirement. ⚠ Review in a low-profile journal; the underlying primary work is the authors' own
Punjab figure	Soil Fertility Research Institute, Government of the Punjab — 50% of Punjab soils boron deficient. ⚠ Undated web page, no sample size published
Crop responses	Rashid & Rafique (2017) Table 4, from Rashid et al. (2007) Springer; Rashid & Rafique (2002) Kluwer; Rashid et al. (2011) J. Plant Nutr. 34:600–613
Rice sterility	Rashid, A. et al. (2009), in Salinity and Water Stress, Springer — Super Basmati +21%, IR-6 +30%; reduced panicle sterility
Citrus	Ullah, S. et al. (2012), J. Plant Nutr. 35(13):2067–2079 — Kinnow, UAF Faisalabad
Cotton physiology	Rosolem, C.A. & Bogiani, J.C., Physiology of Boron Stress in Cotton, in Stress Physiology in Cotton, The Cotton Foundation
Fast vs slow release	da Silva, R.C. et al. (2018), SSSAJ 82(6):1437–1448 — borax >93% released in 2.5 pore volumes vs colemanite <20% after 20; up to 80% B lost in leached soil, NO difference in non-leached soil
Coated boron	Samreen, T. et al. (2021), J. Soil Sci. Plant Nutr. 21(2):1134–1143 — leachate losses 24–37% uncoated against 1–2% coated
Particle size	Saleem, M. et al. (2011), Soil Sci. Plant Nutr. 57(3):403–410 — powdered colemanite effective, granular colemanite not; Shorrocks (1997) Plant and Soil 193:121–148
Source analyses	IPNI Nutri-Facts No. 7; U.S. Borax product data sheets, 2024
⚠ Excluded deliberately	A 2020 PLOS ONE Pakistani cotton boron paper reporting +52% yield was RETRACTED in November 2022 and is not used here, although it still circulates
Analysis, standard, licence	van.com.pk — VL-Boron, B 5% w/v (50 g/L), PS 5469-2020, CM/L-3159/2024
Deficiency rank	van.com.pk — boron described as Pakistan's second-most-widespread micronutrient deficiency
Boron physiology	Standard plant physiology — cell wall, pollen viability, immobility in the phloem. Not manufacturer-specific
Nutrient interactions	After Mulder's chart — established relationships
Law of the minimum	Carl Sprengel (1840), popularised by Justus von Liebig
Crop programmes	van.com.pk/crops/ — 24 of the 28 published programmes name VL-Boron

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