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On 4 May 2025, in an auditorium named after the architect of Indiaâ??s Green Revolution, Union Agriculture Minister Shivraj Singh Chouhan unveiled two unremarkable-looking bags of rice seed. The varieties â?? DRR Dhan 100, branded â??Kamala,â?• and Pusa DST Rice 1 â?? looked like any other improved line a public-sector institute might release. They were not. Both had been built using CRISPR-Cas9, and with their release India became the first country in the world to commercialise genome-edited rice developed with its own institutions.

For an industry that spent two decades watching transgenic crops collide with courts, street protests and moratoria, the moment was loaded. The same Indian state that imposed an indefinite moratorium on Bt brinjal in 2010, and whose Supreme Court has kept GM mustard in regulatory limbo, had just walked a gene-edited staple onto the market in a single afternoon â?? no Genetic Engineering Appraisal Committee (GEAC) clearance, no multi-year biosafety dossier, no environmental release hearing.

The question for anyone running a seed company, writing farm policy or backing an agri-tech venture in Asia is no longer whether gene editing is coming. It is whether the region has genuinely leapfrogged the Westâ??s GM gridlock â?? or whether the opposition that defeated transgenics is simply re-forming around CRISPR, one allegation and one writ at a time.

What the rules actually permit

The pivot rests on a regulatory distinction that is easy to state and hard to police: did you add foreign DNA, or not?

Indiaâ??s framework, set out in a March 2022 Office Memorandum from the Ministry of Environment, Forest and Climate Change, exempts two categories of genome-edited plants â?? known as SDN-1 and SDN-2 â?? from the biosafety rules that govern genetically modified organisms, provided the final plant carries no exogenous introduced DNA. SDN, or site-directed nuclease, refers to the cutting tools (CRISPR-Cas9 being the best known) that make a precise break at a chosen spot in the genome. An SDN-1 edit lets the plantâ??s own repair machinery knock a gene out; SDN-2 uses a short template to make a small, defined tweak. Crucially, neither inserts a gene from another organism. SDN-3 â?? which does insert foreign genes â?? remains fully regulated as GM under GEAC.

The practical effect is large. Because most plant-breeding applications envisaged today produce SDN-1 or SDN-2 outcomes, the bulk of the gene-editing pipeline falls outside Indiaâ??s GMO regime. Oversight shifts to Institutional Biosafety Committees, which certify the absence of foreign DNA, and the resulting varieties are released through the ordinary Seeds Act channel rather than the Environment Protection Act. Kamala, for instance, was created by editing the CKX2 (Gn1a) gene in the popular Samba Mahsuri background to lift grain number per panicle; Pusa DST Rice 1 edited a drought-and-salt-tolerance gene in the MTU1010 background. No bacterial gene, no viral promoter â?? and, in the governmentâ??s reading, no GMO.

China has built a parallel but more centralised pathway. Its Ministry of Agriculture and Rural Affairs (MARA) issued safety-evaluation guidelines for gene-edited plants in January 2022 and follow-up review rules in 2023, sorting edits into four risk tiers and reserving the lightest touch for changes that introduce no foreign sequence. Where India deregulates a whole class, China keeps a government-led, case-by-case review â?? but one designed to move quickly. It approved its first CRISPR crop, a high-oleic soybean from Shandong Shunfeng Biotechnology, in 2023, and on 25 December 2024 issued a tranche of certificates that included five new gene-edited events â?? two soybeans and one each of wheat, maize and rice â?? alongside a batch of transgenic approvals. Recipients included feed group Dabeinong and China National Seed Group, now part of Syngenta Group. The 2024 rice event was Chinaâ??s first gene-edited rice cleared for cultivation.

The contrast with transgenic GM matters commercially, not just scientifically. A Bt cotton or GM mustard event in India can take a decade and tens of crores to shepherd through field trials, environmental assessment and a politically exposed GEAC vote. An SDN-1 rice line can follow the same release calendar as a conventionally bred variety. For breeders, that compresses the distance between a benchtop idea and a farmerâ??s field from a generation to a few seasons â?? and changes the economics of who can afford to play.

The pipeline behind the headlines

The two rice varieties are the visible tip of a deep regional pipeline. Indiaâ??s public laboratories have been editing toward drought- and salinity-tolerant rice and maize, blast-resistant and low-phytate rice, high-oleic groundnut, beta-carotene-enriched banana, disease-resistant pepper and stress-tolerant tomato. Edited oilseeds â?? including mustard, the crop whose transgenic version remains stuck in the courts â?? sit in the queue, offering proponents a politically tantalising prospect: delivering the yield and oil-content gains of GM mustard through a route that sidesteps the GEAC fight entirely.

Chinaâ??s published approvals already span soybean, maize, wheat and rice, with traits running from oil quality to yield and disease resistance â?? explicitly framed by Beijing as a food-security and import-substitution play. The country planted an estimated three million hectares of biotech maize and soybean in 2025, more than four times the 2024 area, signalling how fast a cautious system can scale once the politics are settled internally.

Elsewhere in the region the map is uneven but moving in one direction. Japan was first to market: Tokyoâ??s Sanatech Seed has sold a CRISPR-edited high-GABA tomato, â??Sicilian Rouge,â?• directly to consumers since September 2021 under guidelines that treat foreign-DNA-free edits as outside GMO rules, requiring only notification. Japan has also cleared gene-edited tiger puffer and red sea bream. Australia excluded SDN-1 organisms from its GMO definition back in 2019. The Philippines built a science-based â??plant breeding innovationâ?• process in 2022 and has since ruled a reduced-browning banana and the GABA tomato to be non-GMO. New Zealand, long the regional hold-out, is now drafting a Gene Technology Bill that edges toward a risk-tiered model. Across Southeast Asia, Vietnam, Indonesia and the Philippines already grow biotech maize, and Bangladesh remains the regional exception that proves a different rule â?? its publicly bred Bt brinjal is one of the few transgenic food crops in commercial cultivation anywhere in the region.

For seed-industry strategists, the takeaway is that Asia is assembling a patchwork of fast lanes for edited crops at the very moment the technology is maturing. The breederâ??s case, made by the public scientists who built Kamala and echoed across MARA and Japanâ??s agriculture ministry, is straightforward: a CRISPR knockout that deletes a few base pairs is indistinguishable in its end product from a spontaneous or radiation-induced mutation â?? the kind of mutation breeding that

has produced hundreds of crop varieties eaten safely for decades. Regulating the process rather than the product, they argue, taxes precision and rewards the bluntness of older techniques.

The opposition re-forms

That argument has not gone unanswered â?? and the speed of Indiaâ??s release has, if anything, sharpened the resistance rather than dissolved it.

The Coalition for a GM-Free India, the network that helped block Bt brinjal and contest GM mustard, condemned the rice release within a day, calling the governmentâ??s conduct devious and irresponsible and accusing it of acting under corporate pressure. Its core legal claim is that gene editing falls squarely within Indiaâ??s statutory definition of genetic engineering, and that the 2022 exemption therefore deregulated GM crops by administrative sleight of hand rather than law. By that reading, Kamala and Pusa DST Rice 1 are GMOs released without the confined field trials and high-level clearance the rules require.

The scientific objection runs alongside the legal one. Coalition convenor Kavitha Kuruganti and allied scientists point to published work â?? including studies on CRISPR in rice â?? arguing that SDN-1 editing is not as precise as marketers claim, and can produce unintended insertions, deletions and rearrangements both at the target site and elsewhere in the genome, with unknown consequences for the proteins a plant produces and for the people who eat it. The precaution they urge is not a permanent ban but mandatory, transparent biosafety testing and labelling before any edited staple reaches a plate.

The dispute turned concrete and bitter in October 2025, when the Coalition wrote to Minister Chouhan alleging that ICARâ??s own multi-location trial data did not support its yield claims. Kamala, the group said, underperformed at eight of nineteen trial sites in 2023 and showed a flowering-time advantage of about three days rather than the headline twenty. ICAR rejected the allegations as baseless and motivated, and its communications office has defended gene editing as a straightforward extension of mutation breeding, noting that more than ninety percent of Indian cotton farmers adopted Bt cotton within a few years â?? its evidence that farmers embrace a technology that works.

Two further strands give the opposition durability beyond the laboratory. The first is corporate control. Even where edits are public-sector, the underlying CRISPR tools and many enabling patents are held by a handful of firms and universities, mostly Western; farmer movements warn that a deregulated fast lane could entrench seed-industry dominance and erode the right to save and exchange seed â?? the same anxiety that animated the GM fights, now attached to a technology that is harder to detect. The second is detectability itself: an SDN-1 edit that leaves no foreign DNA can be impossible to distinguish from natural variation, which means labelling and traceability regimes built for transgenics may simply not work. In Japan, that gap has spawned a consumer-led â??OK Seedâ?• project that voluntarily labels produce as not gene-edited â?? a market signal that the absence of mandatory labels does not equal the presence of public trust.

The trust question is not confined to democracies with active farmer movements. In China, where civil-society pushback is muted, the pressure point has shifted to transparency: USDA analysts noted that from 2025 MARA stopped publishing its newly approved biosafety certificates, a move that obscures exactly which edited events are entering cultivation and which firms hold them. For a system selling gene editing partly on the promise of rigorous, science-led oversight, that opacity is its own reputational risk â?? and precisely the kind of governance gap advocacy networks elsewhere seize on.

And the courts remain a live venue. The Philippines offers the cautionary case study: in April 2024 the Court of Appeals, acting on a writ of kalikasan sought by Greenpeace Southeast Asia and the farmer-scientist network MASIPAG, ordered a halt to the commercial propagation of Golden Rice and Bt eggplant, citing the constitutional right to a healthful ecology and the lack of full scientific certainty on safety. Greenpeace called the ruling a monumental win; biosafety proponents called it a step backward for a country with real vitamin-A deficiency. The crops at issue were transgenic, not edited â?? but the judgment demonstrated that a determined coalition can stop an approved GM food crop in its tracks years after regulators signed off, on precautionary and procedural grounds that would transfer cleanly to a CRISPR product.

The West as context, not template

For Asian adopters weighing all this, Western developments matter less as a model than as a verdict on market access.

The headline shift is in Brussels. After the European Court of Justice ruled in 2018 that gene-edited crops must be regulated as GMOs â?? effectively freezing them out of the EU â?? the bloc spent years deadlocked. In December 2025, Council and Parliament negotiators struck a provisional deal on a New Genomic Techniques (NGT) regulation that creates a two-tier system: NGT1 plants, those judged equivalent to what conventional breeding could achieve, would be exempt from GMO rules with only a verification step and seed-level identification; NGT2 plants would stay under the full GMO regime. Member states endorsed the compromise in December and the relevant parliamentary committee in January 2026, with a final plenary vote expected around mid-2026 and the rules likely to apply from 2028. The European Parliamentâ??s earlier push for a

blanket ban on patenting NGT plants â?? a sticking point for years â?? was softened after the Commissionâ??s own analysis warned it would gut research investment. England has already moved faster, with its Precision Breeding regulations entering force in November 2025.

The direction of travel in the West therefore now broadly converges with Asiaâ??s: separate the foreign-DNA question from the breeding-method question, and treat the lightest edits as conventional. But two cautions are buried in the detail. First, the EU framework is slower and more conditional than Indiaâ??s blanket exemption â?? labelling of seed, exclusions, and a monitoring programme all survive â?? which means â??Europe is opening upâ?• should not be read as â??Europe will wave through Asian edited grain.â?• Second, the patent fight that nearly sank the EU deal is the same corporate-control anxiety driving Asian opposition; it has not been resolved so much as deferred.

For export-oriented producers, that ambiguity carries real money. India ships basmati and non-basmati rice into price-sensitive and label-sensitive markets; Vietnam and Thailand are among the worldâ??s largest rice exporters; Japan guards a premium domestic market with strong consumer scepticism. If an importing market â?? or a single influential retailer â?? decides an edited variety is a GMO requiring authorisation and labelling, the absence of a detectable DNA signature becomes a compliance nightmare rather than a marketing advantage. The very feature that makes SDN-1 edits regulatorily light at home makes them legally ambiguous at the border.

Has the science outpaced the politics?

The honest answer is that Asia has won the first round and not the fight.

On the proponentsâ?? side, the structural advantages are real and probably durable. The regulatory architecture is built and functioning in India, China, Japan, Australia and the Philippines. The pipeline is broad and aimed at exactly the traits the region needs â?? drought and salinity tolerance, water and nitrogen efficiency, lower methane from shorter-duration rice. The economic logic is compelling: editing collapses development timelines and lets cash-strapped public institutes, not just multinationals, bring improved staples to market. And the political framing â?? precision, food security, climate resilience, no foreign genes â?? is far more defensible than the one transgenics carried.

On the oppositionâ??s side, none of the foundations have shifted. The legal challenge that gene editing is genetic engineering under existing statutes is unresolved and could yet reach Indiaâ??s higher courts. The detectability problem makes labelling and traceability genuinely difficult, which keeps the trust deficit alive. The corporate-control critique attaches as easily to CRISPR as to Bt. And the Philippine precedent shows that an approved crop can be stopped by a precautionary judiciary long after the regulators have moved on. The October 2025 data-integrity row over Kamala is a preview of the next phase of the argument: not â??is the technology dangerousâ?• but â??can you trust the institutions that cleared it.â?•

For investors, the asymmetry is the opportunity. A transgenic trait that needs a decade of trials and a GEAC vote is a venture few funds can underwrite; an SDN-1 trait that releases on a conventional-breeding timeline turns gene editing into something closer to a software-paced business, where the bottleneck is talent and germplasm access rather than regulatory survival. That is why the names appearing on Chinaâ??s approvals â?? Dabeinong, Syngentaâ??s seed arm â?? and the licensing posture of trait developers eyeing both the EUâ??s NGT1 lane and Asian fast tracks are worth watching more closely than any single variety. The risk that prices the deals is not agronomic but political: a successful writ, a labelling mandate from a major export market, or a data-integrity scandal that hardens public opinion can strand an edited portfolio as surely as a failed field trial.

For the boardroom and the policy desk, the strategic read is therefore double-edged. The window to develop and commercialise edited staples in Asia is open wider and earlier than anywhere in the West, and first movers in seed, traits and licensing have a genuine head start. But the same forces that turned GM into a twenty-year trench war â?? litigation, labelling, corporate-control politics and the slow erosion of public trust when a release looks rushed â?? are intact and now pointed at CRISPR. The science walked through the door GM could not open. Whether it stays in the room depends on whether the breeders, regulators and seed firms now inside choose transparency over speed. The politics is not behind them. It is waiting at the next gate.

Editing versus engineering â?? why the distinction drives the policy

Transgenic GM and gene editing are routinely lumped together, but the regulatory split across Asia turns entirely on how they differ.

Transgenic GM (the old debate) – A gene from another organism is inserted into the cropâ??s genome â?? the Bacillus thuringiensis (Bt) bacterial gene in Bt cotton and Bt brinjal that makes the plant toxic to certain pests, or the genes added to Golden Rice to produce beta-carotene. The crop now contains DNA it could never have acquired by breeding. This foreign

DNA is permanent, inheritable and detectable, which is why GM crops are regulated for biosafety and environmental release, and why their critics invoke cross-species transfer.

Gene editing (the new frontier)- Tools such as CRISPR-Cas9 make a precise cut at a chosen point in the plantâ??s own genome. Regulators classify the outcomes:

- **SDN-1** â?? the cut is made and the plantâ??s repair machinery knocks the target gene out or alters it slightly. No template, no foreign DNA. (Kamalaâ??s grain-number edit and Japanâ??s GABA tomato are SDN-1.)
- **SDN-2** â?? a short DNA template guides a small, defined change, like correcting a few letters of text. Still no foreign gene retained in the final plant.
- **SDN-3** â?? a full gene from another organism is inserted. This is functionally transgenesis and stays regulated as GM in India, China and the EU alike.

Why it matters for the rulebook. Because SDN-1 and SDN-2 leave no foreign DNA, the end product can be indistinguishable from a plant produced by spontaneous or radiation-induced mutation â?? techniques used in conventional breeding for decades without GMO regulation. India, China, Japan, Australia and the Philippines have therefore drawn their regulatory line at the presence of foreign DNA rather than the use of a laboratory technique, and the EUâ??s 2025 NGT deal moves in the same direction with its NGT1/NGT2 split.

The catch. That same absence of foreign DNA means an SDN-1 edit cannot be reliably detected or traced after the fact. For proponents, this proves the edit is â??natural-equivalent.â? For critics, it means labelling, monitoring and consumer choice break down â?? and that unintended off-target changes could pass unexamined. The science of the distinction is settled; its policy consequences are not.

-- ***Ankit Kankar, Chief Operating Officer- AgroSpectrum Asia & India***