TECHNICAL REFERENCE

Compatibility with Seed Treatments, Inoculants and Fertilizers

Orvan™ microbial inoculant

Document	ORVAN-COMPAT-2026-01 · Version 2.1 · August 2026
Supersedes	Version 2.0 (2026) — Section 1.2 clarified; positions unchanged
Applies to	Orvan™ seed-applied formats. The consortium is common to all Orvan™ formats and the positions are governed by the organisms rather than the carrier; extension to the granule and in-furrow formats is confirmed on request.
Does not apply to	Nodu™ and Vigor™ — see Section 1.2
Issued by	Huasheng Bio Limited — technical affairs

1 Scope

1.1 What this document covers

This document states the compatibility position of the Orvan™ microbial inoculant with seed-treatment fungicides and insecticides, rhizobial and other microbial inoculants, seed-coating systems, fertilizers and water quality. It addresses use on leguminous crops, principally peanut and soybean. It is intended for agronomists, seed-treatment operators and technical staff evaluating Orvan™ for use within an existing input programme.

Definition. In this document, **compatible** means that the two products may be applied to the same seed, or into the same furrow, within a single operation and in the sequence set out in Section 9, without material loss of Orvan™ viability. It does not mean the products may be premixed and held, nor that they are chemically inert to one another, nor that they may be co-stored.

1.2 Products this document does not cover

The positions in this document derive from the composition of the Orvan™ consortium, whose strains are endospore-forming bacteria of the Bacillus group. They must not be applied to the other products in the Huasheng range:

- **Nodu™** supplies Rhizobium and Bradyrhizobium — Gram-negative organisms that do not form endospores.
- **Vigor™** contains Pseudomonas fluorescens and Azospirillum brasilense, also Gram-negative and non-spore-forming.

Both are appreciably more sensitive to seed-treatment chemistry than Orvan™. The positions in this document are specific to the Orvan™ consortium and must not be applied to either product.

2 Basis of Assessment

Two properties of the Orvan™ consortium determine its compatibility behaviour.

2.1 Target specificity

Fungicides used in seed treatment act on targets specific to fungi — sterol biosynthesis, β-tubulin assembly, mitochondrial respiration at the Qo site, succinate dehydrogenase, and comparable sites. These targets are absent or materially different in bacteria. The Orvan™ consortium is bacterial. Consequently the great majority of seed-treatment fungicides have no appreciable inhibitory activity against it.

The converse defines the exclusion in Section 8: products formulated to control bacterial plant pathogens act on bacterial targets, and therefore act on the Orvan™ organisms as well.

2.2 Endospore formation

All strains in the consortium form endospores. This confers substantially greater resistance to chemical, thermal and desiccation stress than that of vegetative bacteria such as rhizobia, and is the reason Orvan™ tolerates seed-treatment conditions that a rhizobial inoculant would not.

2.3 Evidence and its limits

- Laboratory compatibility work on the fludioxonil + metalaxyl-M combination (FRAC 12 + FRAC 4), the most widely used seed-treatment pairing in the target crops.
- Mode-of-action assessment across the FRAC and IRAC groups listed in Sections 4 and 5.
- Field experience from the multi-site demonstration programme in China.

Classification source. Group numbers follow the FRAC Code List (Fungicide Resistance Action Committee) and the IRAC Mode of Action Classification (Insecticide Resistance Action Committee). Both committees review their numbering periodically; where classification is material to a decision, confirm against the current edition.

Limits. Not every commercial formulation has been tested. Co-formulants, solvents, adjuvants and colourants differ between products and between markets, and any of these may affect the result independently of the declared active ingredient. Positions marked “By mode of action” in Sections 4 and 5 are assessments, not test results. Section 10 sets out how to obtain a position on a product not listed here.

3 Summary of Positions

Input	Position	Governing section
Rhizobial inoculants (Rhizobium, Bradyrhizobium)	**Compatible**	§6, §9
Other beneficial microbial inputs	**Compatible with conditions**	§6
Fungicide seed treatments — FRAC 1, 3, 4, 7, 11, 12, 29, 32	**Compatible**	§4, §9
Insecticide seed treatments — IRAC 4A, 28	**Compatible**	§5, §9
Seed-coating polymers and colourants	**Compatible with conditions**	§7
Neutral-pH fertilizers, including starter fertilizer	**Compatible**	§7
Strongly alkaline products, pH above 9	**Not compatible**	§7

Input	Position	Governing section
Chlorinated water above 2 ppm free chlorine	**Not compatible**	§7
Copper compounds	**Not compatible**	§8
Agricultural antibiotics	**Not compatible**	§8
Synthetic bactericides and strong oxidizers	**Not compatible**	§8

4 Fungicide Seed Treatments

Compatible under the sequence and conditions of Section 9. Orvan™ is applied after the fungicide has dried and is not premixed with it.

FRAC	Group	Representative active ingredients	Basis
FRAC 1	Benzimidazoles (MBC)	Carbendazim, thiophanate-methyl	Named in assessment
FRAC 3	DMI — triazoles and imidazoles	Tebuconazole, difenoconazole, triadimefon, prochloraz, prothioconazole	Named in assessment
FRAC 4	Phenylamides (PA)	Metalaxyl-M (mefenoxam), metalaxyl	Named in assessment
FRAC 7	SDHI carboxamides	Penflufen	By mode of action
FRAC 11	QoI — strobilurins	Azoxystrobin	Named in assessment
FRAC 12	Phenylpyrroles (PP)	Fludioxonil	Named in assessment
FRAC 29	Uncouplers of oxidative phosphorylation	Fluazinam	Named in assessment
FRAC 32	Heteroaromatics — isoxazoles	Hymexazol	Named in assessment

A fungicide outside these groups is not, for that reason alone, incompatible. The governing question is whether the product carries antibacterial activity — some formulations combine a fungicide with an antibacterial component, and those are excluded under Section 8. Section 10 applies.

5 Insecticide Seed Treatments

IRAC	Group	Representative active ingredients	Basis
IRAC 4A	Neonicotinoids	Thiamethoxam, clothianidin, imidacloprid	Named in assessment
IRAC 28	Diamides	Chlorantraniliprole	Named in assessment

Applied sequentially, not premixed. Confirm any product carrying an antibacterial co-formulant or preservative.

6 Microbial Inoculants

Orvan™ contains no Rhizobium or Bradyrhizobium. It is formulated to act alongside a rhizobial inoculant, not in place of one, and no treatment programme should substitute Orvan™ for an existing rhizobial product.

- **Rhizobial seed inoculants:** compatible. Apply as separate layers rather than in a single slurry. Where a fungicide is also present, the rhizobial product occupies the outermost layer (Section 9.2).
- **Other beneficial microbial inputs:** generally compatible. Confirm any product declaring biocontrol activity against bacteria.

7 Fertilizers, Coatings and Water

- **Neutral-pH fertilizers, including starter fertilizers:** compatible. Where tank-mixed, apply within four hours of mixing.
- **Seed-coating polymers and colourants:** compatible with common commercial systems. Confirm the specific polymer and colourant before committing a seed lot.
- **Strongly alkaline products, pH above 9:** not compatible. Viability declines irrespective of biological activity.
- **Chlorinated water:** not compatible above 2 ppm free chlorine. Use clean, non-chlorinated water for all dilution.
- **Total liquid load:** where several liquid inputs are applied to seed, keep the combined load within approximately 12–15 mL per kg of seed. Above this the seed clumps and loses flowability, irrespective of compatibility.

8 Not Compatible — Antibacterial Products

Products formulated to control bacterial plant diseases — bacterial wilt, canker, soft rot, bacterial angular leaf spot and related conditions — act on bacterial targets. They inactivate the Orvan™ consortium. These must not be combined with Orvan™ on seed, in a tank, or in the furrow.

Group	Representative active ingredients
Copper compounds	Thiodiazole-copper, copper hydroxide, kasugamycin + copper, cuprous oxide
Thiazoles	Zinc thiazole, benziothiazolinone
Quinolines	Oxine-copper
Agricultural antibiotics	Zhongshengmycin, kasugamycin
Synthetic bactericides and strong oxidizers	Bismerthiazol, octylamine acetate, chlorobromoisocyanuric acid

8.1 Copper — further restrictions

- Copper products must not be mixed with strong acids or with phosphate-based fertilizers.
- Excessive copper concentration in a seed coating inhibits germination. This effect is independent of any interaction with Orvan™ and applies whether or not Orvan™ is used.

8.2 Where a bactericide is required in the programme

Separate the two in time rather than reconciling them in a single application: treat the seed with Orvan™ and schedule the bactericide as a later foliar or soil intervention, allowing the Orvan™ population to establish first. Programme design of this kind should be reviewed with Huasheng in advance.

9 Application Sequence and Conditions

9.1 Sequence

Orvan™ is applied last among the chemical inputs and is never premixed with a fungicide or insecticide.

Step	Operation	Condition
1	Fungicide and insecticide seed treatment	Applied first, directly on the seed. Allow to dry until the seed is free-flowing.
2	Orvan™	Applied over the dried chemical film. Allow 2–5 minutes for surface moisture to be taken up.
3	Rhizobial inoculant, where used	Applied last, so that the rhizobia are positioned furthest from the fungicide.
4	Final drying	Tumble to an even film and dry until free-flowing before bagging.

9.2 Why the rhizobial inoculant goes outermost

Orvan™ tolerates contact with a dried fungicide film; a rhizobial inoculant does not. Placing Orvan™ between the chemical layer and the rhizobial layer keeps the more sensitive organism furthest from the chemistry. This is a positional recommendation and does not imply that Orvan™ acts as an engineered barrier.

9.3 Conditions

- Where a tank-mix cannot be avoided, prepare it immediately before use and apply within 30 minutes. Do not hold or store a prepared mixture.
- Run a germination check on a small seed sample before treating a full lot with an unfamiliar variety or a new treatment package.
- Record the interval between treatment and sowing. Where a rhizobial inoculant is included, that product's on-seed window normally governs the interval.

10 Products Not Listed in This Document

For a product that does not appear above, send the product name, registration number, full declared composition and label rate to contact@huasheng.bio. Huasheng will issue a written position for that specific product and, where the result cannot be determined from composition alone, will advise on a compatibility test.

A written position issued for a named product takes precedence over the general classification in this document.

11 Limitations

The positions in this document describe short-window operational co-application under normal seed-treatment practice. They do not constitute a warranty of compatibility with any particular commercial formulation, and they do not extend to co-storage of mixed products. Products named in this document are identified for classification purposes only; their availability, registration status and approved uses differ between countries, and their appearance here is neither a recommendation to use them nor a statement that they are approved in any particular market. Products named in this document are identified for classification purposes only; their availability, registration status and approved uses differ between countries, and their appearance here is neither a recommendation to use them nor a statement that they are approved in any particular market. Users remain responsible for observing the label of every co-applied product and for

compliance with the regulations in force in the country of use. Where a position is material to a commercial decision, obtain written confirmation for the specific products concerned.

12 Revision History

Version	Date	Change
1.0	2026	First issue.
2.1	2026	Section 1.2 reworded: the document now states only that its positions do not extend to Nodu™ and Vigor™, without implying that separate positions exist for them. No compatibility position changed.
2.0	2026	Restructured as a technical reference. FRAC and IRAC classification added; basis of each position distinguished between named and mode-of-action assessment; scope, definitions, evidence limits and revision control added. Compatibility positions themselves unchanged.

Contact

Technical questions on this document, and requests for a position on a product not listed in it, should be sent to the address below.

Enquiries	contact@huasheng.bio
Website	huasheng.bio

Trademarks & Copyright

Orvan™, Nodu™ and Vigor™ are trademarks of Huasheng Bio Limited. FRAC and IRAC classifications are those of the Fungicide Resistance Action Committee and the Insecticide Resistance Action Committee respectively. All other product and active-ingredient names are used for identification only and are the property of their respective owners.