



QUICK GUIDE TO FARM NITROGEN SOURCES

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Nitrogen inputs in farming systems come from a variety of sources, including soil bacteria, legumes, manures, composts, fertilisers and inputs directly from the atmosphere. Nitrogen is released by soil organic matter, but also bound up in new organic matter.

Carbon-rich inputs like manures, composts and crop wastes have low nitrogen concentrations (2-5%), so are usually applied in large volumes. The N contained in them needs to be included in nutrient budgets.

Legumes build soil nitrogen in varying amounts, depending on dry matter production and existing soil nitrogen levels. In the best cases they can provide large (>300kg/ha) nitrogen inputs in a year.

Free-living soil bacteria and atmospheric deposition deliver modest inputs, around 10-40kg/ha per year.

Fertilisers have the highest concentration of nitrogen, and come in different chemical formulations.

These fertilisers react with soils and plants in different ways, and understanding this is key to achieving the most profitable use of nitrogen fertilisers.

Some fertilisers have more than one source of N, including products like UAN.

	UREA $\text{CO}(\text{NH}_2)_2$	AMMONIUM NH_4	NITRATE NO_3
Common sources (many others including in blends)	Urea (46% N) (also livestock urine)	MAP (12% N) DAP (18% N) Ammonium sulphate (21% N)	Calcium nitrate (15.5% N) Potassium nitrate (13% N) Magnesium nitrate (11% N)
Uptake by plants	Minor foliar uptake if applied as foliar No uptake by roots until conversion to ammonium and then nitrate	Minor foliar uptake as gaseous ammonia following ammonia gas loss Major plant root uptake but many crops prefer nitrate	Minor foliar uptake Major plant root uptake
Movement in soil	No charge, highly soluble, moves with soil water until conversion to ammonium, but less mobile than nitrate	Positive charge, held relatively strongly by soil but can compete with other cations like Ca, K, Mg	Negative charge, poor bond with soil, moves with soil water
Speed of plant availability	Not available to plant roots	Available for direct uptake	Available for direct uptake
Plant uptake efficiency	N/A	Medium – ammonia is the form used by plants to create proteins	High – but plants must expend energy converting nitrate to ammonia
Transformation in soil	Soil enzymes convert urea into ammonium, losing carbon dioxide Conversion fastest in warm, moist topsoil	Soil bacteria convert ammonium into nitrate Occurs fastest in good growing conditions	Nitrate rapidly converted to gasses in wet soil conditions
Acidifying potential	Yes, loss of hydrogen lowers soil pH	Yes, loss of hydrogen lowers soil pH	Minor acidification during nitrate leaching
Loss potential	Moderate – High Large amounts can be lost as ammonia gas following surface application Ammonium remaining is again subject to losses after conversion to nitrate	Moderate Ammonia can be lost as gas following surface application Ammonium remaining is again subject to losses after conversion to nitrate	High Nitrate is easily lost to drainage, runoff or gaseous emissions under moist and waterlogged conditions
Ways to reduce losses	Use controlled-release formula or use urease inhibitor Cultivate into soil If surface applied, ensure sufficient rain or irrigation to quickly wash fertiliser into the soil	Use controlled-release formula or use nitrification inhibitor Cultivate into soil If surface applied, ensure sufficient rain or irrigation to quickly wash fertiliser into the soil Avoid applying with lime or on recently limed soils	Apply in small amounts more often to match plant uptake Avoid applying during or shortly before soil becomes very moist Good irrigation scheduling