# MAP and DAP

**FACT SHEET**
**April 2017**

## Analyses and Use

| Product | % Nitrogen (N) | % Phosphorus (P) |
|---|---|---|
| MAP | 10 | 21.9 |
| DAP | 17.7 | 20 |

DAP is the most economical, and therefore the world's most commonly traded and used phosphorus fertiliser. Its high analysis minimises freight, handling and storage. It is used both on its own and in combination with other fertilisers in blends. Both DAP and MAP are compatible in blends with urea, the world's most commonly used nitrogen fertiliser, whereas superphosphate is not.

MAP is preferred to DAP at planting in those situations where too much nitrogen may affect germination, emergence and early seedling root development. MAP is commonly used where the planting fertiliser is placed in direct contact with the seed of winter cereals sown at narrow row spacings, e.g. wheat and barley, and in cotton.

MAP is also less hygroscopic than DAP, on account of its lower nitrogen content, making it less prone to setting in storage. This makes it more suitable to place in silos for on farm storage, though the time that it is stored in this way (in silos) should be kept to a minimum.

MAP and DAP are ideal planting fertilisers, their attributes including:

- Concentrated high analysis - minimising delays and stoppages to fill equipment;
- Fully granulated – suiting today's modern precision application equipment;
- Phosphorus in forms readily available for plant uptake, stimulating root development and early growth;
- They supply starter nitrogen as well as phosphorus. Furthermore, the combination of positively charged ammonium ions (NH4+) with negatively charged phosphate ions ($H_2PO_4^-$ and $HPO_4^{2-}$) promotes uptake of both nitrogen and phosphorus.

## Manufacture

MAP and DAP are made by ammoniating phosphoric acid. The ratio of ammonia ($NH_3$) to phosphoric acid ($H_3PO_4$) determines which product, monoammonium phosphate (MAP) or diammonium phosphate (DAP), is produced.

- MAP $NH_3 + H_3PO_4 \rightarrow NH_4H_2PO_4$
- DAP $2NH_3 + H_3PO_4 \rightarrow (NH4)_2HPO4$

Incitec Pivot manufactures up to one million tonne per annum of these products at Phosphate Hill in northwest Queensland. A number of prerequisites are required in order to manufacture MAP and DAP:

Foremost is a source of phosphate rock. This is mined locally from the Duchess deposit, which was discovered in 1966. The phosphate rock is reacted with sulfuric acid to produce phosphoric acid. Gypsum ($CaSO_4.2H_2O$) is produced as a by-product. It is stockpiled on site.

Natural gas is required to manufacture ammonia, and on this site, given its remote location, generate electricity. It is piped from Ballera in south west Queensland.

Sulfuric acid ($H_2SO_4$) is obtained in various ways. It can be imported through Townsville, or manufactured at Mt Isa from sulfur bearing gases emitted from the local copper smelter or from imported elemental sulfur. The latter is obtained through the removal of sulfur compounds from natural gas and petroleum products, in the production of low sulfur fuels.

The manufacture and use of sulfuric acid in the production of fertilisers is a Win Win situation. Atmospheric emissions of sulfur dioxide ($SO_2$), which contribute to acid rain, are reduced, while the sulfuric acid is used beneficially to concentrate and improve the water solubility and availability of the phosphorus in the phosphate rock for plant uptake.

Finally, transport and export facilities are required. The finished products are railed to Townsville, from where they are despatched to Australian and overseas customers. In meeting its own farmer customers' needs in Australia, Incitec Pivot Fertilisers balances local manufacture with strategic imports of MAP and DAP into southern Ports.

## History

Superphosphate was the first manufactured phosphorus fertiliser to be used in any quantity in the world, and in Australia. It was first produced in the 19$^{th}$ century.

Ammonium phosphates were available in the USA by 1930. They have since become the world's most commonly used and traded phosphorus fertilisers.

MAP and DAP were first produced in Queensland by ACF and Shirleys, an antecedent company of Incitec Pivot, at Pinkenba (Brisbane). Ammonia was obtained from Ammonia Company of Queensland plant that was commissioned in 1966. Phosphoric Acid was manufactured on site from imported phosphate rock.

Not long afterwards in 1968, the Austral Pacific Fertilisers fertiliser plant at Gibson Island, Brisbane, came on line. Following the merger that led to the creation of Consolidated Fertilisers Limited in 1970, MAP and DAP production at Pinkenba ceased but phosphoric acid production continued. It was piped under the Brisbane River to Gibson Island to be reacted with ammonia made on that site.

MAP and DAP were also produced in New South Wales and Victoria. Production at all these sites had ceased by 1990, Gibson Island being the last to close. By this time it had become more economical to import the finished products than to manufacture them locally from imported phosphate rock.

Australian production of MAP and DAP recommenced a decade later with the commissioning of a large scale manufacturing facility at Phosphate Hill in north west Queensland in late 1999.

The phosphate rock deposit that underpins this operation was discovered near Duchess 130 km south of Mt Isa in 1966. It consists of an 11 metre thick deposit of sedimentary phosphate rock, which is close to the surface and easily extracted using open-cut mining.

Subsequent exploration discovered other deposits further north including Lady Annie and Lady Jane. The original development proposal was to move phosphate rock from Lady Annie to the Gulf of Carpentaria, approximately 250 km away, and then to a port on Sweers Island by slurry pipeline.

The Duchess deposit itself was mined in the 1970s and again in the early 1980s for export through the Port of Townsville.

It became apparent around this time that such mining and export operations were, and would remain, unprofitable. Future development was dependent on the rock being processed and concentrated locally, and the finished products being exported so as to minimise freight.