"A review on using Elemental Sulphur in Crop Yield Optimization by synchronising sulphur uptake and uptake of other nutrients with crop nutrient demand"

An emerging trend in Horticulture and Broad Acre Farming

SulSync®

(Polymer Sulphur Coated Slow Release Fertilisers)

Nursery & Garden Industry Western Australia

Langley Fertilizers

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Introduction

Sulphur is an essential element for plants and is required for synthesis of essential amino acids (Cysteine & methionine) and proteins. It has been empirically established that for healthy crops, the sulphur to nitrogen ratio in the plant should be approximately 1:15. A lack of sulphur can reduce the amount of protein synthesized (crop yield), even if plenty of nitrogen is available for the plant.

Since the uptake and assimilation of sulphur and nitrogen by plants are strongly interrelated and also dependent on each other, sulphur has emerged as the fourth major nutrient in the recent years. Both sulphur and nitrogen are constituents of protein, and are necessary for the development of chloroplasts and in photosynthesis, .

Manufacturers have tried to increase the N, P, and K contents of fertilisers over the last four decades and gradually squeezed out most of the S in the major N, P and K fertilisers in order to achieve a high analysis. Continuous and indiscriminate use of these high analysis fertilisers devoid of sulphur have reduced soil sulphur content to the levels where sulphur is increasingly becoming a limiting factor to higher crop yields and production. The deficiency of sulphur is emerging fast in areas where continuously sulphur free fertilisers like DAP, MAP, Urea, Potassium Nitrate, Calcium Ammonium Nitrate etc are being used. Sulphur deficiency is also found more in soils with high pH, coarse textured, low organic matter soils and also due to higher removal of sulphur by crops. Over the last few decades, due to environmental regulations to reduce pollution, high S containing fuels have been replaced by low S containing fuels and this has led to decreased deposition of sulphur on agricultural land.

The use of elemental sulphur as a fertiliser is increasing and is projected to continue to increase due to the reasons mentioned above and also due to the declining levels of soil organic matter, a significant potential source of sulphur. Organic matter in the soil contains nearly 70 % to 80% sulphur. Sulphur is taken up by plants in the form of sulphate and it is absorbed by plant roots. However, sulphate due to its anionic nature is not absorbed strongly by soil or organic matter and this feature of sulphate gives rise to the possibilities of potential leaching losses in the areas under heavy rain fall and irrigation. Elemental sulphur goes through a mineralization process as soil bacteria converts elemental sulphur slowly or is oxidized into sulphate form to make it plant available. This slow release feature of elemental sulphur offers reserve availability in the soil and is a means to correct sulphur deficiencies.

Langley Fertilizers have developed and are involved in the manufacture of the SulSync® range of slow release fertilisers using their own proprietary technology specifically developed for elemental sulphur coating (using polymer stabilizers to stabilize the crystal structure of sulphur for the desired performance).

These fertilisers offer a valid combination for variety of situations requiring high-analysis fertilisers and the need to synchronize the supply of sulphur in a slow release pattern to economically and effectively match the availability and supply of other nutrients with crop nutrient demand. Langley Fertilizers, a Strategic Business Unit of Sunpalm Australia in pursuance to its innovation policy, remains at the forefront to ensure that these products are affordable to Australian farmers for the use in horticulture and broad acre situations for various crops.

Mode of Action

The sulphur coating in SulSync® is a slow- release source of plant nutrient. SulSync® range of fertilisers contains 10 to 22% of sulphur in its coating as elemental S which can fulfill the sulphur demand of most of the crops throughout the crop cycle. The SulSync® range of fertilisers contains three types of coated granules and the release of nutrients is determined by coating thickness, temperature, soil moisture and also the quantity proportion of these three types of granules:

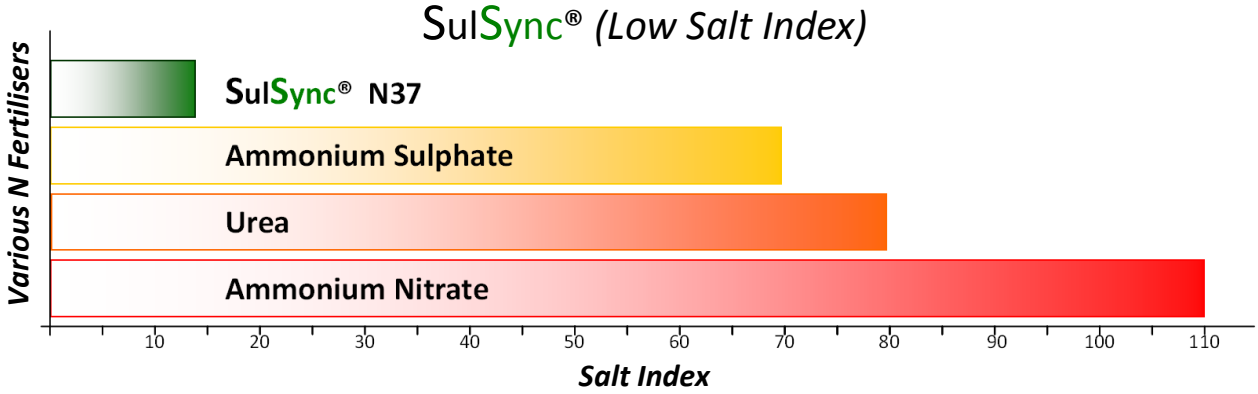
- Granules with pores/cracks/pin holes on sulphur coating- Release of nutrients starts immediately after coming into the contact of water.
- Granules with pores but pores are tightly sealed up with modified polymeric wax- Release of nutrients starts only after biodegradation of modified polymeric wax.
- Granules with no pores on sulphur coating- Release of nutrients starts when elemental sulphur is oxidized or mineralized through microbial action of soil bacteria belonging to genus thiobacillus, generally found in most soil types.

SulSync® range of fertilisers thus releases nutrients gradually to satisfy the nutrient demand of crops in different growing stages. Longevity of these fertilisers can be tailor designed by changing the thickness of sulfur coating and the amount of modified polymeric wax. Its coating is biodegradable and the release rate can be adjusted according to each crop's specific requirements.

Salient features and agronomical advantages of SulSync® Range of Fertilisers

- By slowing down the rate of dissolution of nutrients and therefore controlling the nutrient release rate, SulSync® maintains the availability of nutrients throughout the crop cycle and enhances the Nutrient Use Efficiency "NUE". It reduces pollution due to leaching, volatilization and fixing of nutrients. SulSync® range of fertilisers can therefore eliminate/minimize the need for split applications and hence can save you in labour costs.
- Slow release feature of elemental sulphur coating on SulSync® achieved by its oxidation or degradation by soil microbes into sulphate offers reserve availability and can be of agronomical benefit in correcting the sulphur deficiency by supplementing sulphur to crops when they need it.

- Nitrogen and sulphur complement each other to improve yield and enhance the fertiliser use efficiency. Various researches and trials have suggested that the effect of 1 kg sulphur equals to that of 1 kg Nitrogen, for example, SulSync® fertiliser with 34% N and 20% S analysis can give the same effect as of straight fertiliser with 54% N. Research data suggests that application of sulphur alone increased the sugar cane yield by 16.2% compared to control and uptake of sulphur by sugar cane ranged from 25 to 48 kg per Ha in Australia.
- Reduce Nitrogen accumulation and/or phosphorous fixing/ leaching in the soil, reduce soil salinity due to its low salt index (for example Salt Index of SulSync® Urea is approx. 14 against 80 of straight Urea and 70 of ammonium sulphate), and assists in balancing the C: N ratio. Higher levels of salts in the soil can give injury to the roots of young crop plant and also can dehydrate the beneficial soil microbes and can kill them. SulSync® range of fertilisers therefore assists in ensuring crop safety and in improving beneficial soil micro-organism population in the soil.



- Offers the opportunity for efficient and compatible bulk blending option due to greatly reduced hygroscopic properties, reduced caking and absolutely no or reduced reaction possibilities with other fertilisers. Essentially this feature of SulSync® offers the opportunity to agronomists and farmers to formulate their own efficient and economical bulk blends to suit the crop nutrient demand based on their specific needs, soil nutrient status and climatic conditions

SulSync® Range of Fertilisers

Fertiliser	Brand	Analysis N—P—K—S	Longevity
Coated Urea	SulSync® N32 SulSync® N34 SulSync® N37 SulSync® N39	32— 0 — 0 — 22 34— 0 — 0 — 20 37— 0 — 0 — 15 39— 0 — 0 — 10	6 Months 4 Months 3 Months 2 Months
Coated DAP *(Di Ammonium Phosphate)*	SulSync® P15	13— 15 — 0 — 22	3 Months
Coated MAP *(Mono Ammonium Phosphate)*	SulSync® P17	8— 17 — 0 — 22	3 Months
Coated SOP *(Sulphate of Potash)*	SulSync® K31	0— 0 — 31 — 34 *22% S in Elemental* *12% S in Sulphate*	3 Months
Coated MOP *(Muriate of Potash)*	SulSync® K39	0— 0 — 39 — 21	1 Month

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Cost Saving
"Lower Cost of Application"

Increased Crop Yields
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SulSync®

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Crop Safety
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