Reg. No: B 3763 Act No. 36 of 1947

Fertilizer Group 2

A COMPLEXED LIQUID POTASSIUM SILICATE FERTILIZER FOR FOLIAR FEEDING AND FERTIGATION.

Active Ingredient: Potassium, Silicon, Nitrogen

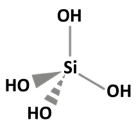
WHAT IS MAXSIL?

Maxsil is a stabilized potassium silicate solution. Polymerisation of Si in solution can be prevented by reacting soluble potassium silicate with certain osmoticants. Osmoticants are molecules that attract water, and in the process, the silicic acid molecules are kept apart even in a tank mix with a pH as low as 5.

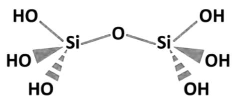
The osmoticants chosen to stabilise the potassium silicate in Maxsil also promote plant growth. The availability of Si in Maxsil as mono-silicic acid and di-silicic acid effectively alleviate effects caused by abiotic stresses e.g. salt stress, drought, heavy metals. It ameliorates the vigour of plants and improves their resistance to exogenous stresses. Maxsil fortifies the cell interior and affects plant metabolism which attributes to a physical barrier.

NOT ALL SILICONE PRODUCTS ARE EQUAL?

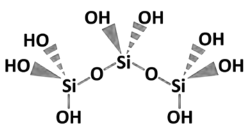
Most silicon containing agricultural products in the market are in the form of simple potassium silicate. Silicon is absorbed by the plant in its ortho-silicic form (H_4SiO_4). Silicon is pH (and EH) sensitive, which means that it readily forms insoluble forms such as SiO_2 or polymerised Si at a pH ≤ 11. A normal spray mixture pH is much lower than 11, making the effective use of Si very difficult, because of its instability. MBFi has formulated a proprietary complexed Si product, that remains stable over a wide pH range. Figure 1 shows microscope images of dilute solutions of Maxsil and normal potassium silicate at different pH values.



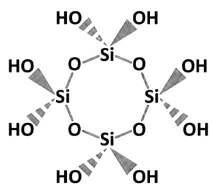
Silicic acid in this form will only exist at a high pH (above 13). This is known as mono-silicic acid. This small molecule can easily be taken up by the plant.



At high concentration or lower pH, di-silicic acid will form. The molecule is bigger but can still be taken up by the plant.



Over time, the chain of silicic acid will lengthen and the molecules will not allow it to be taken up.

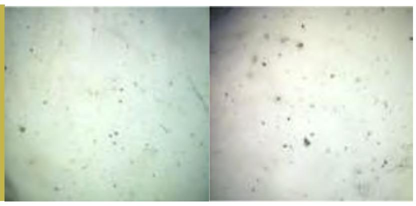


Polymerization will continue until rings and eventually amorphous silicate will precipitate.

ADVANTAGES OF MAXSIL

- **Supply concentrated formulation of silicon, in a highly absorbable and mobile form.**
- **Silicon improves resistance against several biotic and abiotic stresses.**
- **Particularly effective against drought and salinity stress as well as fungal disease resistance.**
- **Improves stomatal regulation and water use efficiency of crops.**
- **Alleviates heavy metal (such as aluminium, Al^{3+}) toxicity.**
- **Improves cell structure by reinforcing cell walls.**
- **Improves plant productivity.**

MAXSIL POTASSIUM SILICATE



CONVENTIONAL POTASSIUM SILICATE

Figure 1: Visual difference of polymerization of potassium silicate of Maxsil vs. conventional potassium silicate diluted at 200ml/100L water and magnified at 60x under microscope

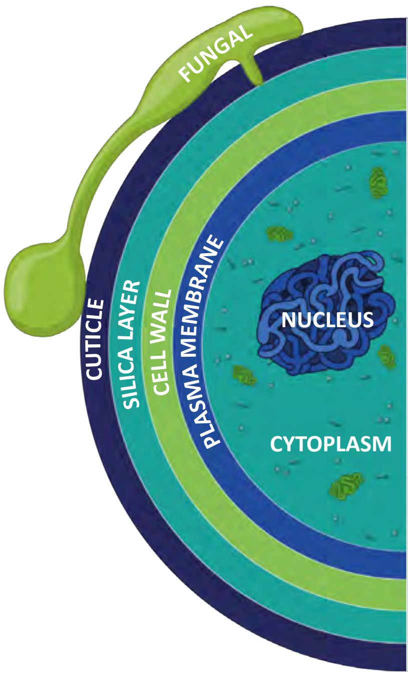
SILICON AND PLANTS

All plants contain Si at different concentrations according to species, ranging from <0.1 to >10% in dry weight . Based on the Si content, plant species are classified as:

1. Si accumulators, with a Si content above 1.0%
2. Intermediate types, with a Si content between 0.5% and 1.0%
3. Si excluder types, with a Si content lower than 0.5%

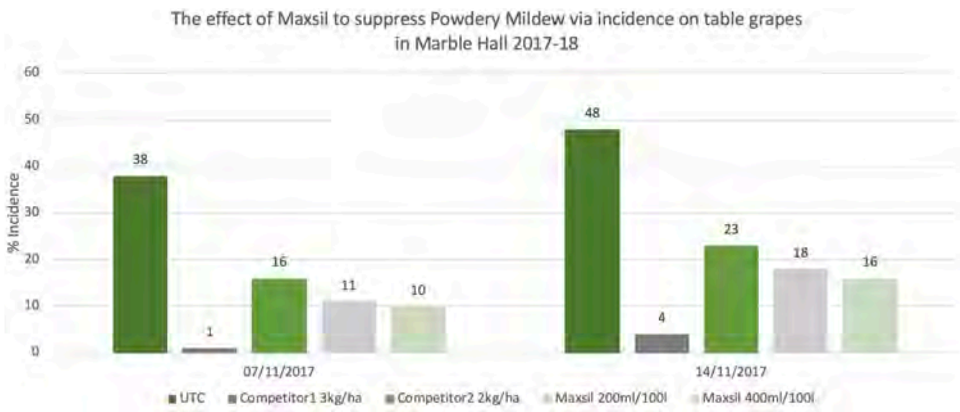
These differences are the result of the capacity of the roots of different plant species to absorb mono silicilic acid (MSA), but within the same plant species there are also genotypic differences in Si uptake. The uptake of MSA in monocotyledonous plants is an active process. Kinetic studies in rice show that the xylem loading of Si is mediated by Si transporters in the root wall. In dicotyledonous plants, the uptake of MSA is mediated by a process of diffusion resulting in significantly lower MSA concentrations in the xylem compared to monocots. After uptake in the xylem, the (soluble) MSA follows the transpiration stream to be finally deposited in any part of the plant, within or between cells or as part of the cell wall in the case of the leaf epidermis, as silica (biogenic opal, phytoliths). Sufficient uptake of MSA by the plant is important because silicon exerts many beneficial effects on plants.

Figure 2: The role of silicon (Si) on plant–pathogen interactions. Si mediated plant defence responses were classified as physical, biochemical and molecular mechanisms. Physical mechanisms involved in cell wall reinforcement and papillae deposition, biochemical mechanisms were attributed to activating defence-related enzymes, stimulating antimicrobial compounds production as well as regulating the complex network of signals pathways, and the molecular mechanisms mainly contained the regulation of genes and protein related to defence responses.

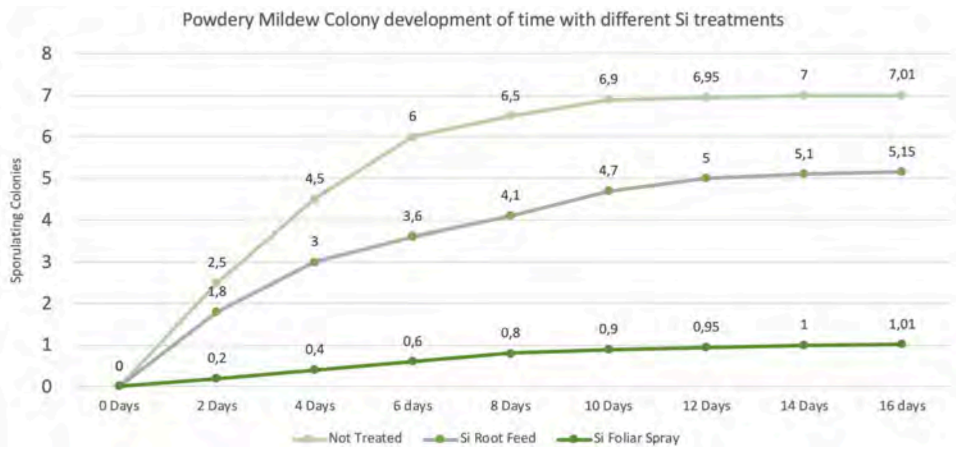


THE ROLE OF SILICON ON PLANT-PATHOGEN INTERACTIONS	
Physical Mechanisms	Cuticle Si double layer formation Cell wall rigidity and reinforcement Papillae formation
Biochemical Mechanisms	Defense-related enzymes activation Antimicrobial compounds production Systemic signalling regulation
Molecular Mechanisms	Transcriptomic regulation Proteomic regulation

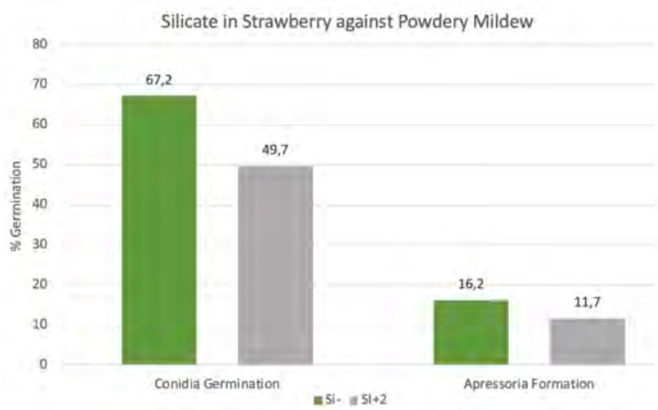
Graph 1: Application of Maxsil to Table Grapes increased the Systemic Acquired resistance response towards pathogen infection. This priming of natural host defenses reduced powdery mildew incidence with 73% at the 400ml/100L dosage 7 days after application and by 67% 14 days after application compared to the untreated control. Competitor 1 which is a traditional chemical fungicide gave the best level of control, but the suppression of disease from Maxsil was significant.

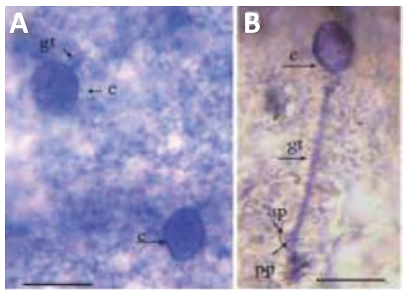


Graph 2: Powdery mildew colony development over tine with different Si treatments, each point represent mean colonies per leaf from nine plants on grapes. The Si Foliar Spray and root feed reduces sporulating colonies with 85.6% and 26.5% respectively compared the untreated control.



Graph 3: The conidial germination rate was 49.7% in Si+, and 67.2% in the control, indicating that silicate soil drenching significantly reduced conidial germination. Appressorial formation of germinating conidia was 11.7% in Si+ and 16.2% in the control.





A, B. Light micrographs of strawberry powdery mildew conidia on strawberry leaves 1 day after inoculation. A.) Tissues were fixed, cleared, and stained with aniline blue. A detached silicon-treated (Si+) leaf (upper) is just starting to germinate, but the other (lower) is not. B.) Germ tube with appressorium and penetration peg on control (Si) leaf. c, Conidium; gt, germ tube; ap, appressorium; pp, penetration peg.

THE PURPOSE OF THE TRIAL WAS TO EVALUATE THE EFFICACY OF AMINEX + MAXSIL ON NECTARINES FOR CHILLING INJURY

- This over a period of 5 days with temperatures dropping below the norm in conjunction with wind and rain.
- This is backed up by canopy cover measurement using iPAR developed by the UC-Davis in the measurements. This determined that there was an average increase of 9.4% in canopy cover over three replicates.
- It can also be seen in the figures that there is an increase in Leaf area index LAI of the shoots and that the leaves are more uniform.
- The data in the leaf analysis shows that there is higher N levels in the treatments than in control. This is unique as normally an increase in LAI will lead to reduced levels on N in the leaves. This is due to the dilution effect of an increased LAI.