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Effect of sulphur on growth and development in sunflower

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Abstract

Sunflower is an essential oil seed crop for human consumption. One of the main causes of low sunflower yield is unbalanced nutrient utilization. The utilization of macro and micronutrient in the proportions and in the proper amount is the important component in boosting growth and productivity. Sulphur (S) plays a vital influence in its growth, yield and oil content. Sulphur's role in sunflower growth and development. After nitrogen, phosphorus, and potassium, sulphur (S) is the fourth and most crucial nutrient for plants. Overall, sulphur (S) application improves sunflower growth, oil, as well as output percent. It has many benefits for sunflower regarding growth parameters and yield quality.

Keywords: Sulphur, sunflower growth

Introduction

Oilseeds have become an important component of human nutrition and a source of valuable raw resources for agricultural enterprises. India's vegetable oil economy is the world's fourth largest in terms of both region and output, accounting for roughly 14.5 percent of global oil seed area and 6.65 percent of production. Vegetable oils play the second most important position in the agriculture economy, second only to food grains. Oil seed crops cover 27.86 million hectares and produce 27.98 million tonnes, yielding a productivity of 1004 kilogrammes per hectare. This is owing to the rapid expansion of the human population and the reduced production of these crops. Sunflower has large acreage covering 14.5 million ha in different agro-climatic zones of this country.

Because of its short period of time, photo-insensitivity, and tolerance to several agro-climatic zones and soil types, sunflower (*Helianthus annuus*) has considerable potential as an oilseed crop. Sunflower oil is an excellent source of linoleic acid (64%) is beneficial to heart patients. It's also possible to manufacture hydrogenated oil from the oil. It's a good catch crop for when the field is otherwise fallow because it can be planted at any time of year. Sunflower is ideally suited to, with the potential to certain circumstances for area expansion and horizontal intensification in India to boost oil seed production. Sunflowers may also be able to aid with the country's edible oil scarcity. Approximately 36.36 million tonnes of sunflower seeds were produced globally in 2012-2013. (40.29 million Tonnes in the 2011-2012 period). In India, it covers 2.34 million hectares and produces 1.44 million tonnes. Total productions with an average productivity of 615 kg ha⁻¹ (Anonymous, 2007). After N, P, and K, S is the fourth nutrient with widespread deficiency in India. (Yadav *et al.*, 2000; Sakal *et al.*, 2001).

Sulphur

Sulphur is regarded as a quality nutrient because it affects not only crop yield but also crop quality through its effects on protein metabolism, oil synthesis, and amino acid formation (Krishnamoorthy, 1989). The average increase in oil content due to sulphur application in major oilseeds is 11.3 percent in groundnut, 9.6% in mustard, 6.0% in linseed and 3.8% in sunflower (Sharma *et al.* 1991 and Tandon, 1991) Sulphur is a mobile element that is quickly lost from the soil. The level of available sulphur reaches below the critical limit and sunflower is bound to suffer sulphur deficiency. Sulphur-deficient soils are unable to provide enough sulphur to satisfy crop demand, resulting in crop sulphur deficiency and suboptimal yield.

In soils, sulphur is found in both organic and inorganic forms. The sulphate form of sulphur is absorbed by plant roots. Chlorophyll, as well as other biologically important chemicals including thiourea, plant hormones, thiamine, biotin, and glutathione, require sulphur to be formed. Sulphur use for sunflower provides many advantages in terms of growth parameters and production. Per unit of sulphur fertiliser produces 3-5 units of edible oil, a product that every family requires. Seeds with high levels of sulphur have more protein and oil. Sulphur has a big impact on soil resources; thus, it's employed as a soil amendment to boost the supply of other nutrients. It is essential for the growth and development of all crops. The most important of the 16 basic elements for increasing sunflower grain quality is sulphur. Crop yields and efficiency are both affected by increased production of sulphur-containing amino acids like cystine and methionine.

Sources of sulphur

Sulphur is present in a variety of forms, including sulphides, sulphates, and organic fractions related to N and C. Sulphur is mainly found in sulphide-bearing plutonic rocks, where it weathers into sulphates, that dissolve, precipitate, and actually reduce to elemental sulphur depending on the weather. Sulphur is also found in organic fertilisers, which provide a considerable amount of sulphur to the soil. Sulphur is applied

to soil in many forms, such as ammonium sulphate (24% S), single super phosphate (12% S), gypsum (13-18% S), elemental sulphur (100% S), pyrites (24%), ammonium phosphate sulphate (15% S), zinc sulphate (11% S), copper sulphate (13% S), magnesium sulphate (14% S), etc. Gypsum, SSP, and ammonium sulphates are the most expensive when compared to ammonium phosphate sulphate, zinc sulphate, magnesium sulphate, copper sulphate, and elemental sulphur.

Role of sulphur in plant growth and development in sunflower

One of 17 important plant nutrients is sulphur. It is critically necessary for all crop growth and development. Sulphur, like any other essential nutrient, serves a variety of important roles in sunflower:

- Sulphur is an essential component of Chlorophyll formation allows plants to generate starch, carbohydrates, oils, fats, vitamins, and other compounds via photosynthesis.
- Sulphur is contained in three amino acids: cystine, cysteine, and methionine, which are the building blocks of proteins and constitute 90% of the plant S.
- Oilseeds need a high level of sulphur for oil synthesis.
- The sulphur cycle's procedure is described below fig 1.

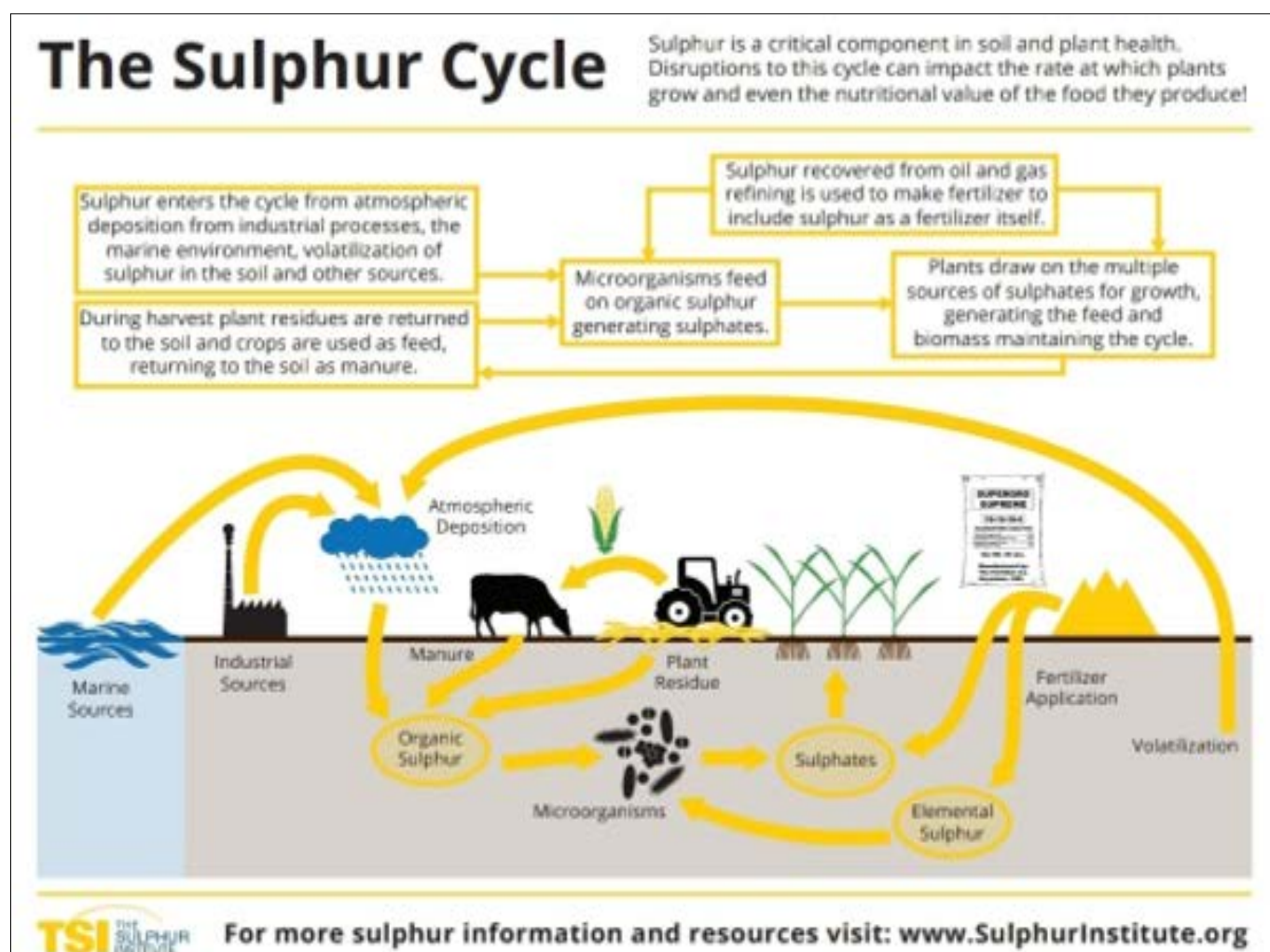


Fig 1: SulphurInstitute.org/pub/?id=30177057-bc30-5bd9-0719-6380f37c76f9

Effect of sulphur in soil and in the plant

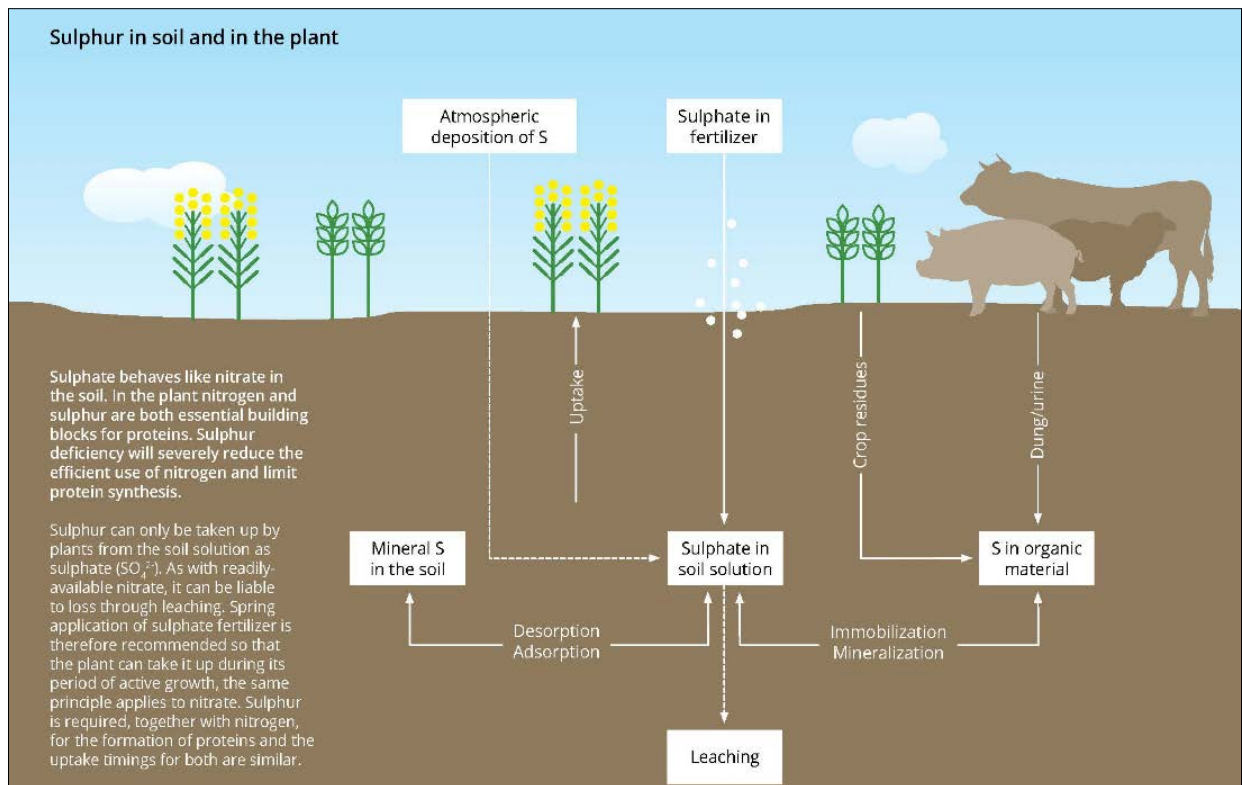


Fig 2: Idfertilizers.com/sulphur

Role of sulphur in crop production

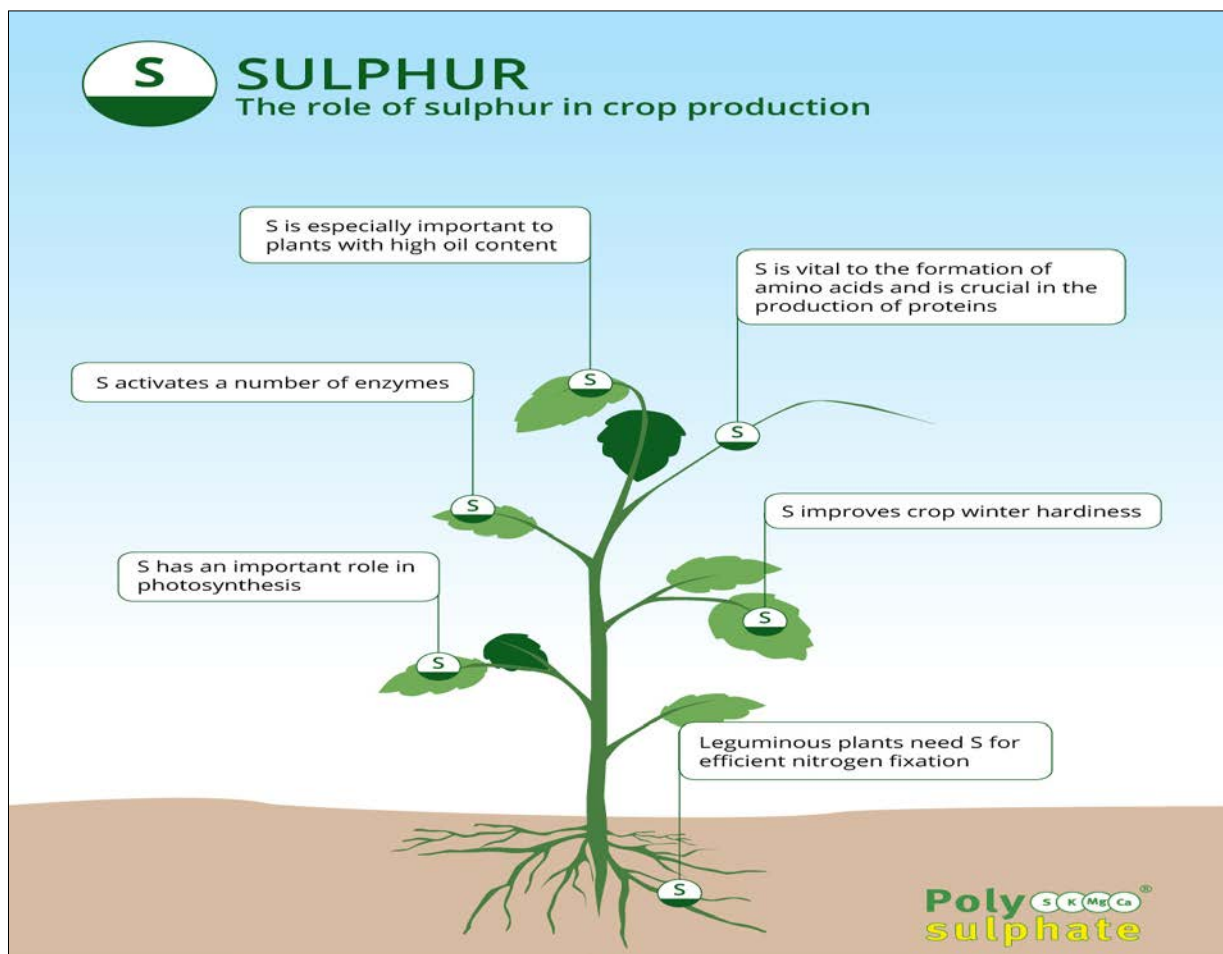


Fig 3: Idfertilizers.com/sulphur

Sulphur (S) is required by plants for the production of proteins, enzymes, vitamins, and chlorophyll. It's essential for legume nodule production and nitrogen fixation performance. Sulphur also plays a crucial role in photosynthesis and helps

crops survive the winter. Sulphur is a component of various amino acids and vitamins present in plants and animals, and it is essential for protein synthesis, particularly in the creation of oils within the seed.

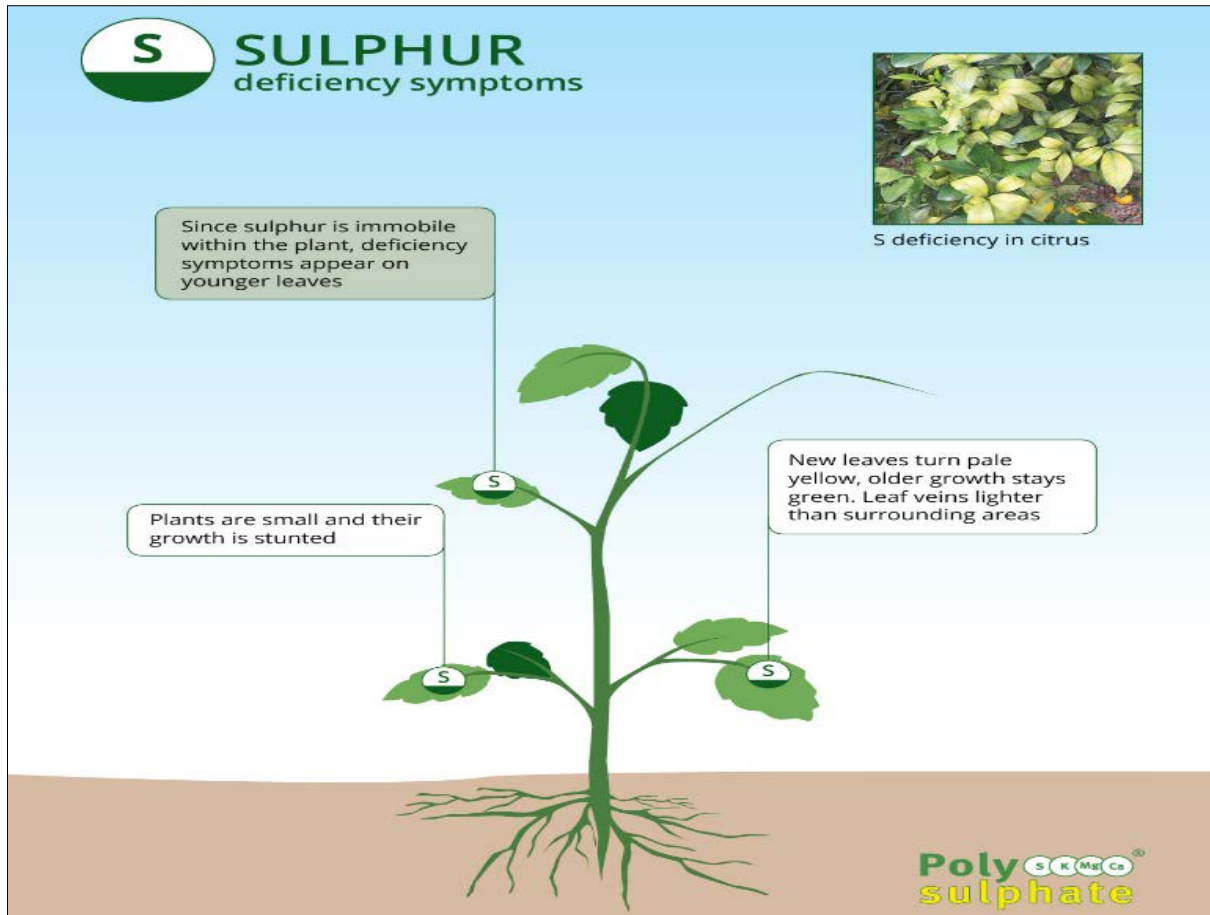


Fig 4: idfertilizers.com/sulphur

Deficiency Symptoms in sunflower

Sulphur deficiency symptoms

Pale/yellowing leaves on plants. The yellowing progresses from the base to the top. Plant development is delayed. Capitulum size is extremely limited. The inflorescence can be hidden within the bracts. Crop maturation is delayed. (fig 4.)



Fig 5: Agritech.Tanu.ac.in

Control measures

- Apply 25 kg S/ha or 80 kg N+25 kg S.
- Other deficiency symptoms in sunflower:

Nitrogen (N) deficiency symptoms

New and old leaves also suffer from chlorosis (early stages), Marginal Chlorosis is a form of chlorosis that affects only a small Leaf in its entirety Chlorosis Yellow-Pale Green Chlorosis Yellow-Pale Green Chlorosis Yellow- Death of the whole leaf, accompanied by chlorosis and death. stems that are thin and spindly There are fewer or smaller mature heads of light green stems. Depending on the soil moisture level, sunflower responds to 30-80 kg N/ha. (Fig 6)



Fig 6: https://agritech.tanu.ac.in/agriculture/plant-nutri/sun_nitro.html

Control measures

Foliar spray of 1% urea at weekly interval.

Boron deficiency symptoms

Boron deficiency symptoms appear first on the youngest leaves, which become smaller and much more deformed over

time. The stem will be short because the cells in the internode do not expand. The seed set on the flower heads is uneven, with some portions of the head showing no seed set at all. The pollen tube's boron requirements are associated to this condition. When the shortage is severe, the growth point dies, and no flowers are formed.



Fig 7: Agriculture.borax.com

Sulphur fertilization

Apply sulphur at a rate of 20 kg/ha via SSP or ammonium sulphate or use gypsum at a rate of 200 kg/ha as a basal.

- Foliar application for high seed set
Spray 0.5 percent borax on the stage of button opening for better seed establishment.

How does sulphur affect sunflower growth?

Sulphur is crucial for the growth of chlorophyll as well as legume nitrogen-fixing nodules. Sulphur can be used in sunflower to produce proteins, amino acids, enzymes, and vitamins. Sulphur helps sunflowers resist disease, grow faster,

and produce more seeds.

Growth stages of sunflower

List of stages

1. Planting the seed.
2. Germination (2 to 10 DAS).
3. The seedling, leaf and plant development (10-35 DAS).
4. Growing a bud (35 to 65 DAS)
5. Flowering (65 to 85 DAS).
6. Pollination (65 to 85 DAS).
7. Seed development (85 to 105 DAS).
8. Harvesting (105 to 125 DAS).

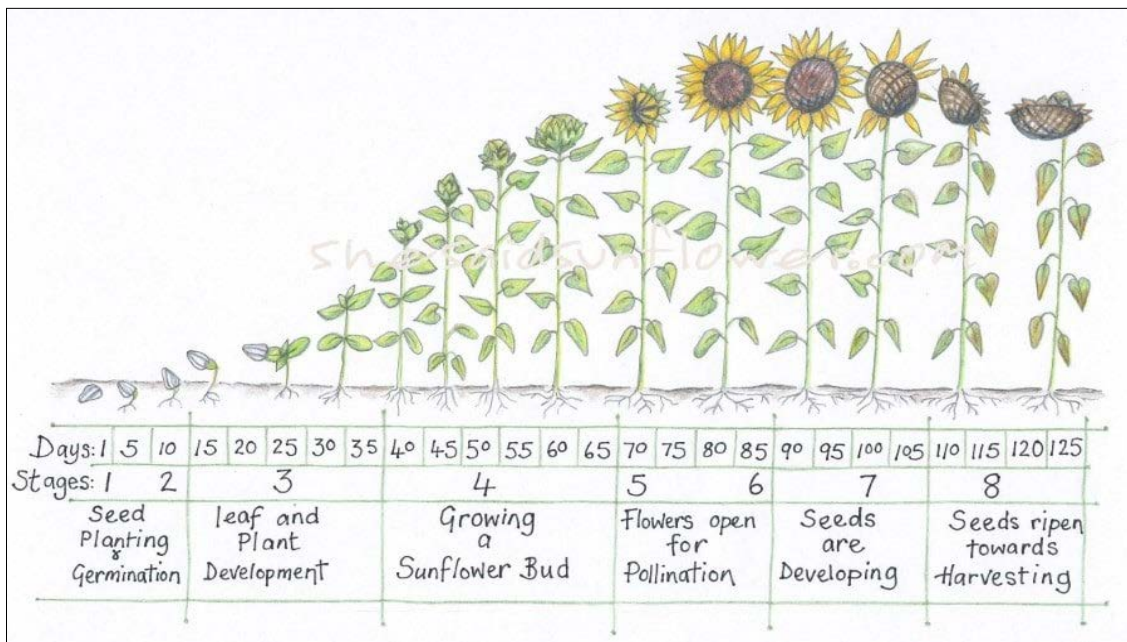


Fig 8: <https://shesaidsinflower.com/sunflower-growth-timeline-life-cycle-8-stages/>

A sunflower seedling emerges from its seed. The seedling grows into a strong plant. Flowers appear in the shape of buds on mature sunflowers. Pollinators are attracted to the bloom, and seed is created. As the seeds ripen, sunflowers begin to droop. The cycle is restarted when some seeds fall from the blossom and drop on the grass.

Conclusion

Based on the data, it is reasonable to conclude that applying sulphur at a rate of 20 kg/ha via SSP or ammonium sulphate or applying gypsum at a rate of 200 kg/ha, is helpful to the plant's growth and oil yield. S will have a positive impact on growth and yield factors. Controlling and balancing the crop's

resource demands with the environmental and supplemental supply at various phases of the crop's growth and development cycle is crucial for full production.

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