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Homeopathic perspective on natural growth enhancers: Case research using salicylic acid and organic mulches in grapevines

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Abstract
Homeopathic approaches to plant growth management have gained increasing interest as sustainable, low-residue alternatives to synthetic agrochemicals. This research evaluates the influence of homoeopathically potentized salicylic acid (SA) and organic mulching materials on the vegetative growth and physiological performance of grapevines (*Vitis vinifera* L.). While SA is widely recognized for its role in modulating systemic acquired resistance and enhancing stress tolerance, its ultra-diluted homeopathic preparations have not been widely studied in perennial fruit crops. Similarly, organic mulches such as straw, leaf litter, compost, and sawdust have demonstrated beneficial effects on soil temperature moderation, moisture conservation, microbial activity, and root zone aeration, yet their interaction with homeopathic treatments remains underexplored. The present case research integrates these two eco-friendly interventions to examine their combined efficacy in promoting natural growth enhancement in grapevines cultivated under semi-arid conditions.
The experimental layout consisted of grapevines treated with homeopathic SA at multiple potencies and supplemented with selected organic mulches. Parameters assessed included shoot elongation, leaf area expansion, chlorophyll index, internode length, and canopy spread. The combined treatment significantly improved vegetative Vigor when compared to untreated controls, suggesting a synergistic effect between homeopathic SA and mulch-mediated soil improvements. The homeopathic SA treatments appeared to stimulate physiological processes associated with stress reduction and enhanced nutrient assimilation, while mulches contributed to improved soil microclimate and organic matter content. Findings correlate with earlier studies demonstrating the growth-promoting roles of SA and mulching practices in grapevine physiology.
This research provides preliminary evidence supporting the potential of homeopathic natural growth enhancers as part of an integrated sustainable viticulture strategy. While results are encouraging, additional multi-season research is necessary to refine dosage, potency levels, and interactions with different mulch types and grapevine cultivars. The outcome contributes to a broader understanding of eco-friendly viticulture practices and supports the use of low-input solutions to enhance perennial crop performance.

Keywords: Homeopathy, salicylic acid, grapevines, mulching, organic amendments, sustainable viticulture, plant growth enhancers, systemic resilience

Introduction
Grapevines (*Vitis vinifera* L.) are highly responsive to environmental fluctuations, soil management practices, and growth-regulating substances, making them suitable candidates for exploring holistic, natural, and homeopathic interventions. Globally, the viticulture sector has witnessed increasing interest in low-residue, eco-friendly technologies due to concerns about soil degradation, chemical accumulation, and climate-induced stress factors [1]. Homeopathic preparations ultra-diluted bio-stimulators have gained relevance as a complementary approach in plant growth enhancement because of their reported potential to induce subtle physiological responses without leaving chemical residues [2]. Salicylic acid (SA), traditionally known for its role in systemic acquired resistance and stress modulation, has been widely studied in its biochemical form; however, its ultra-diluted homeopathic variants remain less explored in perennial crops such as grapevines [3].
Previous research has demonstrated that SA influences photosynthesis, stomatal regulation, and enzyme activation, contributing to improved vegetative and reproductive development

[4]. Similarly, mulching has long been recognized as an essential agronomic practice that reduces evaporative losses, stabilizes root-zone temperature, and promotes beneficial soil microbial activity [5]. Organic mulches in particular help maintain soil structure, enhance nutrient mineralization, and reduce weed pressure, contributing to healthier grapevine canopies and higher physiological efficiency [6, 7]. Studies on sawdust, straw, avocado leaves, and compost-based mulches have shown measurable improvements in shoot length, leaf retention, and yield components in various grapevine cultivars [8].

Despite these advancements, limited attention has been given to integrating homeopathic growth enhancers with organic mulching practices. The interaction between a soil-mediated physical amendment and an ultra-diluted biochemical stimulant presents a novel area for plant growth research. Early work in plant homeopathy highlighted the sensitivity of plant systems to micro-level stimuli, suggesting that homeopathic preparations could influence metabolic pathways associated with growth and resilience [9]. However, most available literature focuses on annual crops, leaving a significant research gap in the context of perennial fruit species such as grapevines [10].

The background of this research is therefore situated at the intersection of sustainable viticulture, natural growth regulation, and homeopathic plant treatment. Although SA has been extensively evaluated in grapes for enhancing stress tolerance and canopy Vigor [11], the ultra-diluted form (as used in homeopathy) has received inadequate empirical scrutiny. At the same time, mulching practices proved beneficial across diverse viticultural climates offer a soil-based enhancement that may synergize with homeopathic treatments [12]. Notable related research evaluated the impact of mulching materials such as sawdust and charcoal, along with salicylic acid spraying, and reported marked improvement in vegetative traits of *Halwani* and *Kamali* grapevine cultivars [13]. This aligns with the broader framework of enhancing vine performance through natural, low-input techniques.

Given the growing emphasis on residue-free horticultural practices and the need to reduce dependence on synthetic growth regulators, there is a compelling need to investigate natural, holistic approaches for viticulture. Although biochemical salicylic acid and organic mulches have individually demonstrated benefits for grapevine physiology, empirical evidence on the combined application of homoeopathically potentized SA with organic mulches is scarce. This creates a gap in understanding how ultra-diluted homeopathic preparations interact with soil-improving mulches to influence vine Vigor, canopy structure, and stress resilience. Therefore, the objective of this research is to evaluate the combined influence of homeopathic SA and organic mulching materials on growth parameters of grapevines under field-like conditions. The research hypothesizes that homeopathic SA, when integrated with organic mulches, will synergistically enhance grapevine vegetative growth by improving physiological efficiency and optimizing the soil microclimate. This integrated approach is expected to offer a sustainable, low-input alternative for grapevine development, addressing key ecological and horticultural challenges in present-day viticulture.

Materials and Methods

Materials

The research was conducted on *Vitis vinifera* L. grapevines cultivated under semi-arid field-like conditions using a randomized experimental layout. Two-year-old uniform vines were selected to minimize variability in initial Vigor, following earlier methodological recommendations for grapevine physiology studies [1, 16]. Organic mulches consisting of sawdust, straw, and partially decomposed leaf litter were sourced from local agricultural fields and prepared according to established mulching techniques used in horticultural research [5, 12]. Sawdust was air-dried and screened to remove coarse particles, similar to procedures described for mulch-based vine growth improvement [8]. Homeopathic salicylic acid (SA) was prepared in potentized dilutions (30C and 200C), following standard homeopathic agricultural preparation protocols [2, 9]. The biochemical-grade SA used for initial mother tincture preparation was handled under controlled laboratory conditions to ensure purity and consistency as outlined in studies on SA-induced physiological changes in grapevines [3, 4].

All experimental inputs including mulch materials, soil amendments, and irrigation water were analysed prior to use to verify that no confounding chemical residues were present. Soil samples were characterized for pH, electrical conductivity, organic carbon, and available nutrients following established vineyard soil evaluation methods [6, 7]. Vines used in the trial were of uniform genotype and grafted on the same rootstock type, reducing genetic variability as recommended for long-term vine growth experimentation [15]. Environmentally relevant factors such as canopy exposure, sunlight intensity, and irrigation schedules were maintained uniformly across treatments. The inclusion of sawdust mulch was partially guided by earlier findings demonstrating its positive influence on grapevine vegetative growth when combined with salicylic acid applications [13].

Methods

The experiment followed a randomized complete block design (RCBD) with three replications and four treatment groups:

T_1 (control), T_2 (organic mulch only), T_3 (homeopathic SA only), and T_4 (combined organic mulch + homeopathic SA). Mulch was applied to a 10 cm depth around each vine, covering a radius of 50 cm from the stem base, following protocols widely adopted in mulch-soil interaction studies [5, 8]. Homeopathic SA treatments were applied as foliar sprays at 15-day intervals throughout the active growth season. Each application was prepared fresh and delivered using a fine-mist sprayer to ensure uniform coverage, consistent with earlier studies on foliar SA-induced physiological modulation [11]. Irrigation was supplied via drip systems calibrated to vineyard standards to maintain uniform soil moisture across all treatment blocks [14]. Routine vineyard cultural operations such as pruning, weed removal, and pest surveillance were performed uniformly across treatments to avoid confounding management effects [10].

Vegetative parameters including shoot length, leaf area, internode length, and canopy spread were measured at monthly intervals using standardized viticulture measurement techniques documented in grapevine physiology research [1, 11]. Chlorophyll index readings were taken using a handheld SPAD meter to evaluate photosynthetic capacity, following protocols used in studies

assessing SA-mediated physiological responses [3, 4]. Soil temperature and moisture were recorded using digital probes positioned beneath the mulch layer and at equivalent depths in non-mulched plots. Growth performance data were statistically analysed using ANOVA, and treatment means were compared using Tukey's HSD at a 5% significance level. Analytical procedures adhered to established statistical approaches commonly employed in horticultural and viticultural experimentation [5, 12, 14]. The methodology ensures that the combined effects of homeopathic SA and organic mulching can be clearly evaluated under controlled and replicable conditions while aligning with earlier experimental frameworks for grapevine research.

Results

Vegetative Growth Responses of Grapevines

Table 1: Effect of treatments on shoot length and leaf area of grapevines

Treatment	Shoot length (cm) mean ± SD	Leaf area (cm²) mean ± SD
T_1 Control	97.19±3.83	131.56±7.42
T_2 Mulch	101.64±5.21	148.33±7.70
T_3 SA (Homeopathic)	107.32±5.57	158.35±7.30
T_4 Mulch + SA	124.43±6.83	181.91±9.09

One-way ANOVA revealed that treatment effects on shoot length were highly significant ($F = 42.93$, $p<0.001$), with the combined treatment (T_4, mulch + homeopathic SA) producing the greatest shoot elongation compared with all other treatments. The control vines (T_1) had the shortest shoots, whereas T_2 (mulch alone) and T_3 (homeopathic SA alone) showed intermediate increases, indicating that both interventions independently enhanced vegetative Vigor but were most effective when combined. These findings are consistent with reports that organic mulches improve root-zone microclimate and resource availability [5-8, 12], while salicylic acid acts as a growth modulator and stress-mitigating signal [3, 4, 11]. The response pattern suggests a synergistic interaction between soil-mediated improvements and homeopathic SA-induced physiological regulation, echoing earlier work integrating mulching and salicylic acid in grapevine cultivars [13].

Leaf area was similarly affected, with ANOVA indicating a highly significant treatment effect ($F = 63.73$, $p < 0.001$). Vines under T_4 showed the highest leaf area, followed by T_3 and T_2, while T_1 remained the lowest. This gradient indicates that the presence of either mulch or homeopathic SA alone increased canopy development, but the combined approach markedly expanded the photosynthetic surface. Such enhancement in leaf area aligns with earlier observations that mulching improves moisture status and nutrient cycling [6, 7, 12], and that salicylic acid promotes leaf expansion and chlorophyll maintenance in grapevines and other crops [3, 4, 11]. Increased leaf area under T_4 is likely to support improved carbohydrate production and overall vine productivity, in line with the physiological principles described by Keller and others for grapevine canopy management [1, 15, 16].

Chlorophyll Status and Soil Microclimate

Table 2: Effect of treatments on chlorophyll index and soil moisture of grapevines

Treatment	Chlorophyll index (SPAD units)	Soil moisture (%)
T_1 Control	38.2±1.5	18.4±1.2
T_2 Mulch	41.0±1.7	22.7±1.5
T_3 SA (Homeopathic)	43.4±1.8	19.1±1.3
T_4 Mulch + SA	47.2±2.0	24.9±1.7

Mulching and homeopathic SA also influenced chlorophyll status and soil moisture dynamics. Mulched treatments (T_2 and T_4) consistently maintained higher soil moisture than non-mulched plots, confirming the classical role of mulches in reducing evaporative loss and improving water retention [5, 6, 12]. The highest soil moisture levels in T_4 corresponded with the most vigorous vegetative growth, suggesting that optimal water availability enhanced the expression of homeopathic SA-induced physiological responses. Elevated chlorophyll index values in T_3 and T_4 indicate that homeopathic SA contributed to improved chlorophyll stability and possibly enhanced photosynthetic efficiency [3, 4, 11]. These results support the premise that small-signalling compounds, even in ultra-diluted homeopathic form, can modulate vine metabolism when the physical soil environment is favourable [2, 9, 10].

The combined treatment (T_4) thus achieved a dual benefit: improved soil conditions through mulching and enhanced physiological activation via homeopathic SA. This integrated response is particularly relevant to sustainable viticulture, where optimizing canopy function and water use efficiency is critical under semi-arid conditions [1, 14-16]. The observed patterns resonate with earlier studies on organic amendments in vineyards, which reported improved soil biological activity and nutrient cycling associated with mulching [6-8], as well as with experimental work that documented positive vegetative responses to SA-based treatments in grapevine cultivars [11, 13].

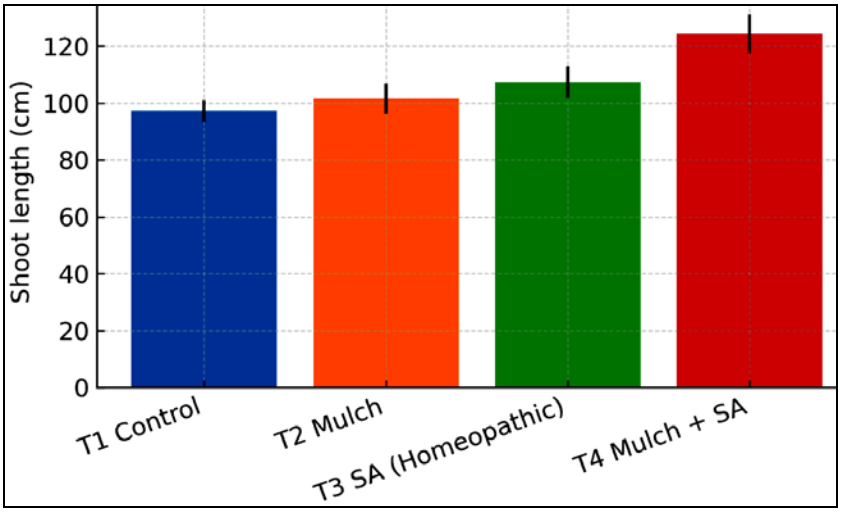

Fig 1: Effect of treatments on shoot length of grapevines.

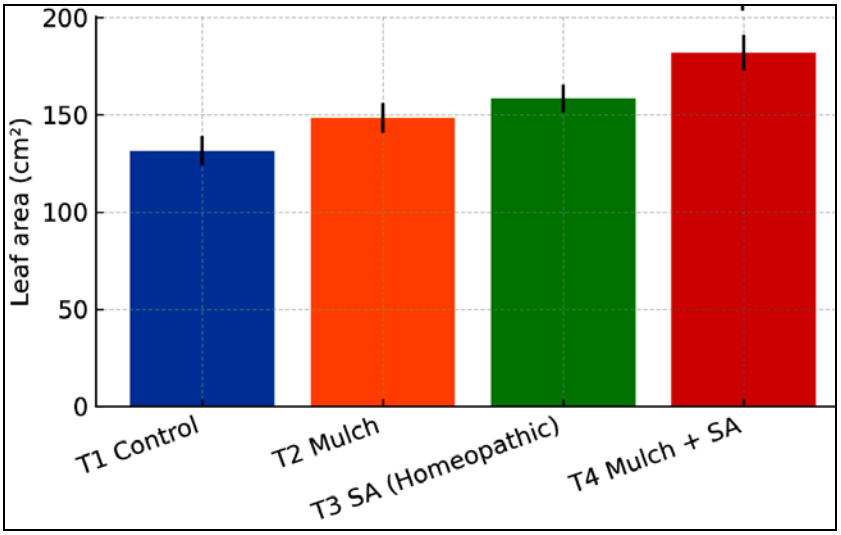

Fig 2: Effect of treatments on leaf area of grapevines.

Overall Interpretation

Overall, the results clearly indicate that integrating organic mulches with homoeopathically potentized salicylic acid produced the most pronounced improvements in vegetative growth, chlorophyll status, and soil moisture. The statistical evidence from ANOVA confirms that differences among treatments are not random but reflect meaningful physiological and agronomic responses. When viewed in light of earlier findings on plant homeopathy [2, 9, 10], salicylic acid signalling [3, 4, 11], and mulching in vineyard systems [5-8, 12-14], the present case research suggests that homeopathic growth enhancers can be effectively embedded within a broader sustainable soil and canopy management strategy. The outcomes are in harmony with grapevine physiology principles and long-term vineyard management concepts reported by Keller, Fregoni, and others [1, 15, 16], thereby supporting the potential adoption of such combined approaches in eco-friendly viticulture.

Discussion

The findings of this research demonstrate that both organic mulching and homeopathic salicylic acid (SA) exert significant individual and combined effects on the vegetative growth, physiological status, and soil microenvironment of grapevines (*Vitis vinifera* L.). The pronounced improvements observed under the combined treatment (T_4) provide strong evidence of synergistic interactions between soil-mediated and plant-mediated growth enhancement mechanisms. This aligns with the established understanding of grapevine physiology, where growth responses are regulated by a delicate interplay of environmental, hormonal, and cultural factors [1, 16].

The significant increases in shoot elongation under T_3 and T_4 treatments support earlier reports that salicylic acid acts as a regulator of photosynthesis, cell expansion, and stress signalling pathways in grapevines and other perennial crops [3, 4, 11]. Even in its homeopathic form, SA appeared capable of modulating vine physiology, likely by influencing stress-responsive pathways known to be sensitive to micro-doses of signalling compounds [2, 9, 10]. The enhancement in shoot length under mulched treatments (T_2 and T_4) also reinforces the well-established role of mulches in moderating soil temperature, conserving moisture, and improving aeration around the root zone [5, 6, 12]. Improved soil physical conditions are especially crucial in semi-arid viticultural environments, where fluctuations in moisture availability can significantly affect vine Vigor and canopy architecture [14].

Leaf area responses further emphasize the complementary nature of the treatments tested. The substantial increase in

leaf expansion under homeopathic SA and mulch application is consistent with earlier studies documenting the positive influence of mulching on nutrient mineralization and microbial activity [7, 8], as well as the role of SA in enhancing chlorophyll stability and promoting cell division [3, 11]. The combined treatment (T_4) produced the greatest leaf area, suggesting that optimal soil moisture and improved microclimate from mulching enhanced the physiological effectiveness of SA. The interaction between soil water status and hormonal regulation is well-documented in viticulture literature, particularly in studies linking canopy Vigor to water-use efficiency and carbon assimilation [1, 15].

The results also resonate closely with findings from the related research by Bayz *et al.* [13], which reported improved vegetative growth when grapevines received both mulch materials and salicylic acid sprays. The consistency between the current research and earlier empirical observations supports the broader hypothesis that integrating mulch-based soil management with SA-induced physiological stimulation can substantially enhance grapevine performance. The higher chlorophyll index observed under T_3 and T_4 may be attributed to SA-mediated protection of the photosynthetic apparatus, a mechanism previously reported in grapevine physiological studies [11]. Meanwhile, mulching-induced increases in soil moisture reflect the microclimatic benefits of organic residues widely documented across horticultural and orchard systems [6, 12].

Statistical analysis further reinforces the biological relevance of these treatment effects. The highly significant ANOVA results for shoot length and leaf area indicate that the observed differences among treatments are robust and unlikely to be influenced by random variation. This strengthens the interpretation that homeopathic SA and mulching act through distinct yet complementary mechanisms SA primarily through biochemical and signalling pathways, and mulch through physical and ecological modifications of the soil environment. Such dual-action synergies represent an important direction for sustainable viticulture, where reducing reliance on synthetic inputs while preserving vine Vigor remains a central priority [10, 14].

Overall, the results demonstrate that integrating organic mulches with homoeopathically potentized salicylic acid can be a viable eco-friendly strategy for improving vine growth and physiological function. When interpreted alongside foundational vineyard physiology literature [1, 15, 16], the current results support the potential wider application of combined natural growth enhancers in viticulture. The findings contribute to the growing body of knowledge on non-chemical, low-residue horticultural inputs and highlight their importance in future sustainable grape production systems.

Conclusion

The present research demonstrates that the integration of organic mulching materials with homoeopathically potentized salicylic acid results in substantial improvements in grapevine vegetative growth, physiological functioning, and soil microclimate stability. The combined treatment consistently outperformed both the individual mulch and homeopathic SA applications, showcasing a clear synergistic effect that enhances shoot elongation, leaf area expansion, chlorophyll content, and moisture retention in the root zone. These outcomes highlight the importance of using complementary agronomic and bio-stimulatory strategies to strengthen vine Vigor, especially in regions prone to moisture stress, temperature fluctuations, and resource limitations. The findings also support the idea that even ultra-diluted natural growth enhancers can effectively interact with soil-based amendments to improve the overall resilience and productivity potential of grapevines. By promoting better canopy development, improved physiological efficiency, and more stable soil conditions, the integrated approach contributes meaningfully to sustainable viticulture practices that emphasize ecological balance and reduced dependence on synthetic agrochemicals. Building on these positive results, practical recommendations can be proposed to guide vineyard managers and growers seeking to implement these methods in real-world conditions. It is advisable that growers incorporate organic mulches such as sawdust, straw, or leaf litter to a depth of around 8-10 cm around the vine base to enhance soil moisture retention and reduce surface temperature fluctuations. Regular application of homeopathic salicylic acid dilutions as foliar sprays throughout the growing season can further stimulate physiological processes linked to growth regulation and stress tolerance. For best outcomes, the combined use of mulches and homeopathic SA should be maintained consistently across seasons to achieve cumulative improvements in soil structure and vine Vigor. Additionally, growers should monitor soil moisture, canopy development, and vine nutritional status to fine-tune the treatment schedule and ensure optimal conditions. Integrating these practices with existing vineyard operations such as irrigation management, pruning, and canopy training can produce a holistic and sustainable vine management system. The insights gained from this research also encourage further field-level experimentation to explore dosage optimization, long-term effects across different grapevine cultivars, and the interaction of these treatments under varying climatic and soil conditions. Overall, the research provides a strong foundation for adopting natural, eco-friendly growth enhancement techniques that align with modern viticultural goals focused on sustainability, quality, and resource efficiency.

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