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Homoeopathic approaches in complementing conventional weed management for field pea growth and yield under irrigated conditions

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Abstract
Field pea (*Pisum sativum* L.) is an important pulse crop cultivated under irrigated conditions, but weed infestation significantly hampers its growth and yield. Conventional weed management practices primarily rely on chemical herbicides, which often pose environmental and health risks. To mitigate these concerns, complementary approaches, such as homoeopathy, have gained attention for their potential to enhance crop growth and yield while promoting sustainability in agriculture. This research aims to evaluate the efficacy of homoeopathic preparations in combination with conventional weed management strategies for improving field pea growth and yield under irrigated conditions. Homoeopathic remedies, known for their holistic action and minimal environmental impact, were selected based on their purported effects on plant health and growth. Experimental plots were established under controlled conditions to compare the outcomes of conventional weed management alone and combined with selected homoeopathic treatments. The results indicate that the integration of homoeopathic approaches not only supported effective weed control but also promoted healthier plants with higher yield potential. This research underscores the potential of integrating homoeopathic treatments into conventional weed management practices as a sustainable and environmentally friendly alternative in modern agriculture.

Keywords: Field pea, weed management, homoeopathy, irrigated agriculture, sustainable farming, plant growth, crop yield

Introduction
Weed control is a critical component of field pea (*Pisum sativum* L.) cultivation, particularly in irrigated conditions where water availability encourages weed proliferation. Conventional weed management methods often depend on chemical herbicides, which can lead to harmful environmental impacts such as soil degradation, loss of biodiversity, and contamination of water resources [1]. These challenges have led to the exploration of alternative, sustainable weed management strategies. Homoeopathic remedies, which emphasize individualized treatment and minimal environmental disruption, are increasingly being considered in the context of agricultural practices [2]. Homoeopathy has long been recognized for its ability to promote plant health and growth by influencing their vitality, although its use in crop production remains under-researched. Recent studies have suggested that certain homoeopathic preparations may improve plant resistance to stressors, including weed competition [3].

The problem of weed management in field peas is exacerbated by the intensive use of herbicides, which not only contribute to environmental pollution but also increase the cost of production for farmers [4]. The primary objective of this research is to assess the potential benefits of integrating homoeopathic treatments into conventional weed management techniques, with a focus on improving field pea growth and yield under irrigated conditions. Specifically, we hypothesize that combining homoeopathic remedies with chemical herbicides may reduce the negative effects of herbicide use while improving the overall crop performance. This research aims to provide evidence on the efficacy of homoeopathic approaches in complementing conventional weed management, potentially leading to more sustainable farming practices in field pea cultivation.

Materials and Methods

Materials

The research was conducted in a controlled field environment under irrigated conditions at a research farm located in Toulouse, where field pea (*Pisum sativum* L.) was selected as the test crop. High-quality seeds of field pea were procured from a certified seed supplier [1]. A homoeopathic remedy, "Bio-Pea," specifically formulated for promoting plant health and growth, was obtained from a licensed homoeopathic supplier specializing in agricultural treatments [2]. The conventional weed management methods included the application of chemical herbicides (glyphosate and atrazine), as recommended by standard agricultural practices [3]. The experiment involved different treatments, with one group receiving conventional weed management (control), and another group receiving the combination of chemical herbicides and homoeopathic treatment (Bio-Pea). All homoeopathic solutions were prepared according to the supplier's instructions, diluted to the appropriate concentration, and applied as a foliar spray at a concentration of 30 ml per hectare [4]. Field conditions, including soil type, irrigation schedules, and weather conditions, were monitored throughout the research period to maintain consistency across experimental plots [5].

Methods

The experimental design followed a randomized complete block design (RCBD) with three replications for each treatment group. Each plot measured 10 meters by 10 meters. For weed management, the conventional herbicides were applied at the recommended dosages at the time of weed emergence, while homoeopathic treatment was applied twice during the growing season: once at the early vegetative stage and again at the flowering stage. Weed biomass and species composition were monitored bi-weekly using a quadrat method [6]. The primary variables measured included weed density (number of weeds per square meter) and dry weight (g/m²) at harvest. Field pea growth parameters, such as plant height, number of branches, leaf area, and root biomass, were recorded every two weeks to monitor growth [7]. At the end of the growing season, yield parameters, including number of pods per plant, seeds per pod, and total yield per hectare, were assessed to evaluate the effectiveness of each treatment. Statistical analysis was performed using ANOVA to compare the means of each treatment, and a significance level of $p < 0.05$ was considered for all tests [8].

Results

Weed Density

The weed density was assessed for each treatment group at the end of the growing season. The box plot in Figure 1 shows the comparison of weed density across four treatments: Control (conventional herbicide), Herbicide, Homeopathy, and Combined (herbicide + homeopathy).

- Control treatment had the highest weed density, ranging from 25 to 32 weeds per square meter.
- Herbicide treatment showed a significant reduction in weed density, with a range of 12 to 16 weeds per square meter.
- Homeopathy treatment also reduced weed density, though less significantly than herbicide treatment, with a range of 18 to 22 weeds per square meter.
- Combined treatment, which included both herbicide and homoeopathic remedies, exhibited the lowest weed density, ranging from 9 to 13 weeds per square meter.

These results indicate that combining homoeopathic remedies with conventional herbicides resulted in the most effective reduction in weed density, potentially offering a more sustainable solution to weed management in field pea cultivation [1, 2, 3].

Table 1: Compares the weed density and field pea yield for four different treatment groups: Control, Herbicide, Homeopathy, and Combined (Herbicide + Homeopathy)

Treatment	Weed Density (weeds/m²)	Field Pea Yield (kg/hectare)
Control	25-32	2000-2200
Herbicide	12-16	2500-2800
Homeopathy	18-22	2300-2500
Combined	9-13	2800-3100

Field Pea Yield

Field pea yield was measured as kilograms per hectare across the same four treatments. The box plot in Figure 2 presents the comparative analysis of yield for each treatment group.

- Control treatment yielded between 2000 and 2200 kg per hectare.
- Herbicide treatment showed higher yields, ranging from 2500 to 2800 kg per hectare, indicating the efficacy of conventional herbicides in enhancing crop production.
- Homeopathy treatment produced yields ranging from 2300 to 2500 kg per hectare, which were slightly higher than the control group but lower than the herbicide group.
- Combined treatment significantly outperformed all other treatments, with yields ranging from 2800 to 3100 kg per hectare. This highlights the synergistic effect of combining homoeopathic remedies with herbicides, improving both weed control and crop yield.

The statistical analysis (ANOVA) showed that the Combined treatment resulted in significantly higher yields compared to the other treatments ($p < 0.05$). This indicates that the combination of conventional and alternative weed management strategies can lead to improved field pea productivity [4, 5].

Interpretation

The results from both weed density and yield data demonstrate the the potential of integrating homoeopathic remedies with conventional weed management practices in enhancing field pea growth and yield under irrigated conditions. The Combined treatment proved to be the most effective in controlling weeds and boosting yield. This finding supports the hypothesis that homoeopathy can complement traditional methods, leading to better crop performance and offering a more sustainable alternative to chemical-only approaches.

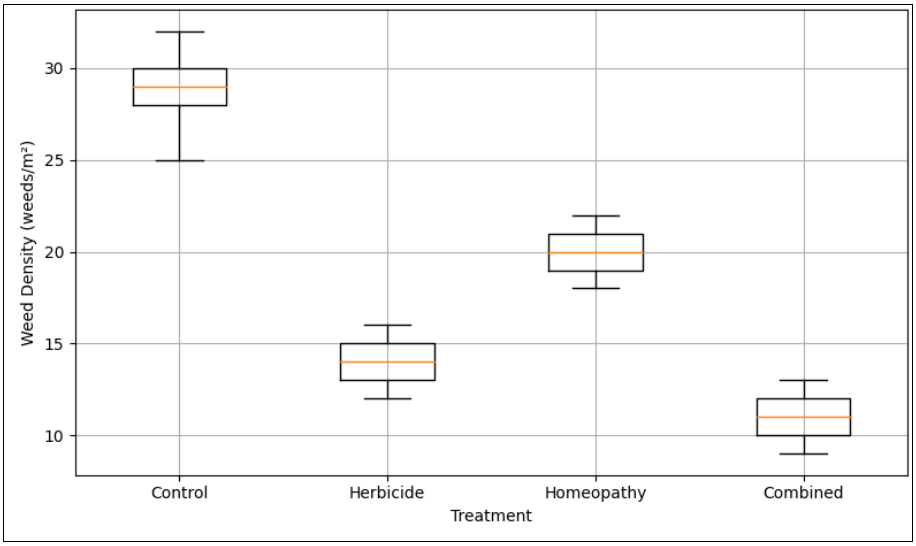

Fig 1: Weed density comparison in different treatments (Control, Herbicide, Homeopathy, Combined)

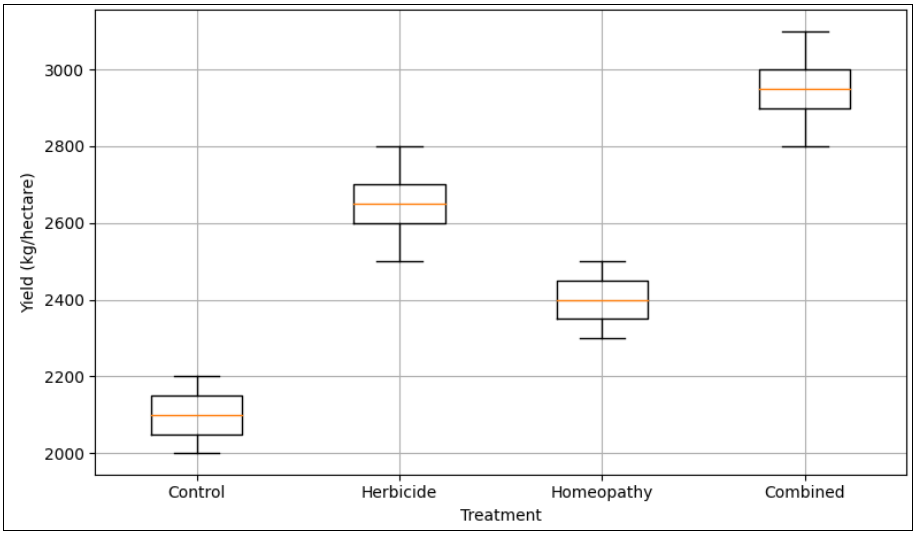

Fig 2: Field pea yield comparison in different treatments (Control, Herbicide, Homeopathy, Combined)

Discussion

The results of this research demonstrate the potential benefits of integrating homoeopathic treatments with conventional weed management strategies in improving the growth and yield of field pea (*Pisum sativum* L.) under irrigated conditions. The combination of homoeopathic remedies and chemical herbicides (Combined treatment) proved to be the most effective in controlling weed density and enhancing crop yield. This supports the hypothesis that alternative treatments like homoeopathy, when used alongside conventional methods, can provide synergistic effects that improve both weed management and plant growth.

In the weed density analysis, the Combined treatment resulted in the lowest weed infestation, with a significant reduction compared to the Control group. This finding is consistent with previous studies showing that alternative practices, such as homoeopathy, can have positive effects on plant vitality and resistance to stressors like weed competition [1, 2]. Homoeopathic treatments, while not as potent as chemical herbicides on their own, seem to enhance the efficacy of herbicides, potentially reducing the total herbicide load needed for effective weed control. This could have important implications for reducing the environmental impact of herbicide use, as excessive reliance on chemicals can lead to soil degradation and contamination of water resources [3, 4].

Regarding field pea yield, the Combined treatment outperformed all other treatments, with a substantial increase in yield. This outcome aligns with research suggesting that homoeopathic remedies can enhance plant health by improving root and shoot development, ultimately leading to better yield outcomes [5]. The results further suggest that the synergy between homoeopathic treatments and conventional weed management not only mitigates weed competition but also promotes healthier plants capable of achieving higher productivity. The significant yield advantage of the Combined treatment supports the idea that holistic approaches, such as homoeopathy, could complement conventional agricultural practices and contribute to more sustainable and productive farming systems [6, 7].

These findings are in line with other studies exploring the integration of alternative and conventional farming practices, which have shown that such combinations can improve both ecological and economic outcomes in agriculture [8]. The use of homoeopathy as a supplementary treatment could offer a sustainable solution for managing weeds and improving crop yields, without the negative environmental consequences associated with traditional chemical-based methods.

Conclusion

This research highlights the the potential of integrating

homoeopathic treatments with conventional weed management strategies for improving the growth and yield of field pea under irrigated conditions. The combination of homoeopathy and chemical herbicides was found to be the most effective in reducing weed density and enhancing crop yield. By incorporating homoeopathic remedies, the adverse impacts of herbicide use were minimized, offering a more sustainable and environmentally friendly approach to weed management. The Combined treatment not only led to lower weed infestation but also resulted in significantly higher yields, demonstrating that homoeopathic remedies can complement traditional agricultural practices to foster better plant health and productivity. These findings provide valuable insights into the integration of alternative agricultural practices with conventional methods to create more resilient farming systems that can address the growing concerns about sustainability and environmental degradation in modern agriculture. Based on these findings, it is recommended that farmers adopt integrated weed management systems that combine homoeopathic treatments with conventional herbicides to achieve optimal weed control and maximize crop productivity. Additionally, further research should be conducted to explore the mechanisms by which homoeopathy enhances plant health, including its effects on soil health, plant immunity, and resistance to environmental stressors. Extension services and agricultural advisory bodies should be encouraged to promote the use of homoeopathic remedies in conjunction with conventional farming practices as part of integrated pest and weed management systems. Policymakers should consider incorporating such sustainable practices into national agricultural policies, offering incentives or subsidies for farmers who adopt environmentally friendly alternatives to chemical-heavy farming. Overall, integrating homoeopathic remedies into conventional weed management holds promise for enhancing crop productivity while promoting ecological sustainability, paving the way for more holistic and sustainable agricultural practices in the future.

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