Empowering Rural Women - Drudgery Reduction Through Mechanized Weed Management in Guntur District

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ABSTRACT

Background: Rural women play a critical role in agricultural operations, often engaging in labor-intensive tasks like weed control, which imposes significant physical strain and limits their participation in other productive activities. The lack of access to mechanized tools exacerbates this drudgery, impacting both productivity and well-being. This study focuses on evaluating the efficacy of mechanized weed management tools, particularly cycle weeders developed by TNAU and CRIDA, in reducing the physical burden of weeding for women in Guntur District, Andhra Pradesh. By addressing drudgery through improved technologies, the study aims to promote sustainable and gender-inclusive agricultural practices.

Methods: The study employed a quasi-experimental design to compare the drudgery levels associated with traditional weeding methods and mechanized alternatives, such as the TNAU and CRIDA cycle weeders. A sample of 30 rural women, randomly selected from villages adopted by the KVK, participated in the study. The Drudgery Index was utilized as the primary assessment tool to quantify the physical strain experienced during weeding activities. Data collection included both pre- and post-intervention assessments, with observations and feedback gathered to evaluate changes in perceived drudgery and productivity levels.

Result: The findings revealed that both the TNAU and CRIDA cycle weeders significantly reduced the drudgery levels compared to traditional weeding methods. Participants reported improved efficiency, lower physical strain and enhanced productivity after adopting the mechanized tools. Despite the limitations of a small sample size and restricted geographical scope, the results highlight the potential of these interventions to alleviate the physical burden on rural women. The study emphasizes the importance of integrating mechanized tools in agricultural practices to enhance sustainability and support gender-inclusive development.

Key words: Cycle weeders, Drudgery reduction, Gender inclusive technology, Mechanised weed management, Rural women.

INTRODUCTION

In rural agricultural settings, particularly in developing regions, women often bear a significant portion of the cultivation. The arduous and time-consuming nature of traditional weeding methods not only imposes physical strain but also limits women's participation in other productive activities and opportunities for socioeconomic advancement. Therefore, there is a pressing need to explore and implement technologies that alleviate the drudgery of weed management while promoting gender equality and empowering rural women. In response to this imperative, the adoption of cycle weeders represents a promising solution. Cycle weeders are mechanical devices or implements designed for weed management in agriculture, typically consisting of rotating blades or brushes mounted on a wheeled frame. These devices are manually operated. Cycle weeders, such as those developed by the Tamil Nadu Agricultural University (TNAU) and the Central Research Institute for Dryland Agriculture (CRIDA), offer a mechanized alternative to manual weeding, significantly reducing the physical exertion required for weed control tasks. Drudgery reduction refers to the systematic alleviation or mitigation of physically demanding, repetitive, or strenuous tasks associated with agricultural activities, particularly those performed by rural women. By leveraging human-powered mechanisms, these wheel hoes harness the energy of the operator while minimizing reliance on fossil fuels, making them both environmentally sustainable and cost-effective. The focus of this research article is to investigate the efficacy of TNAU and CRIDA cycle weeders in reducing drudgery associated with weed management, particularly for rural women engaged in agricultural activities. Through a comprehensive examination of these innovative technologies, we aim to evaluate their impact on labor efficiency, productivity and overall well-being of women farmers. By elucidating the benefits and challenges of adopting cycle weeders in rural farming communities, this study seeks to contribute to the ongoing discourse on sustainable agricultural practices and gender-inclusive technology interventions, these technologies aim to promote gender equality by addressing specific challenges and constraints faced by women, enhancing their access to and utilization of agricultural resources, knowledge and

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opportunities. By reducing drudgery and improving labor efficiency, the adoption of cycle weeders has the potential to enhance the overall productivity and livelihoods of rural communities. By reducing drudgery and improving labor efficiency, the adoption of cycle weeders has the potential to enhance the overall productivity and livelihoods of rural communities. This study could provide insights into how such technologies can contribute to poverty alleviation and economic empowerment, especially among women farmers.

Furthermore, by highlighting the specific merits of TNAU and CRIDA wheel hoes, we aim to inform policymakers, agricultural extension workers and development practitioners about viable options for promoting mechanization and gender equity in smallholder farming contexts. Ultimately, our research endeavors to catalyze positive change by advocating for the widespread adoption of cycle weeders as a means to alleviate the drudgery of rural women and foster sustainable agricultural development.

Johnson (2023) study revealed that wheel hoes offer promising benefits in reducing drudgery for women by mechanizing and streamlining the weeding process. Garcia (2022). The review synthesizes empirical evidence on the adoption and impact of wheel hoes on women's workloads. Findings indicate that wheel hoes offer significant benefits in terms of labor-saving, time efficiency and ergonomic design, thereby alleviating the physical strain associated with manual weeding tasks. Moreover, the adoption of wheel hoes has been linked to increased decision-making autonomy, income generation and social recognition for women farmers. Ahmed (2023). The review highlights the multifaceted impacts of wheel hoe interventions on women's empowerment and agricultural productivity. Key findings suggest that wheel hoes contribute to labor efficiency, income generation and women's participation in decision-making processes within farming households. Furthermore, the adoption of gender-responsive agricultural technologies, such as wheel hoes, has the potential to promote social inclusion, poverty alleviation and sustainable development outcomes. However, contextual factors such as socio-cultural norms, access to resources and extension services influence the effectiveness and sustainability of wheel hoe interventions. Kumar (2023). Studies indicate that the adoption of the TNAU wheel hoe results in labor savings, time efficiency and improved crop yields, thereby enhancing the livelihoods and well-being of women in rural communities. Findings suggest that the CRIDA wheel hoe offers several advantages, including lightweight construction, adjustable handlebars and compatibility with various crop types, making it well-suited for women farmers working in dryland and rainfed areas. Sharma (2022) studies indicate that the adoption of the CRIDA wheel hoe results in increased weeding efficiency, reduced physical strain and enhanced productivity, leading to improvements in household food security and income generation.

Materials and Methods

This research employed a quasi-experimental design to assess the effectiveness of CRIDA and TNAU wheel hoes in reducing drudgery associated with weed management among rural women in selected villages of Guntur district Andhra Pradesh, India.

Sample size and selection

A sample size of 30 rural women engaged in agricultural activities was selected for this study. The study participants were from adopted villages of Krishi Vigyan Kendra (KVK) in Guntur district, specifically from the villages of Jonnalagadda, Kolakalur, Vallabhapuram and Lam. The intervention involved the use of CRIDA and TNAU wheel hoes as alternative tools for weed management in agricultural fields. CRIDA and TNAU wheel hoes were provided to the participants and they received training on the proper use and maintenance of the implements.

Data collection

Drudgery was assessed using the drudgery Index, a validated tool for measuring the physical and physiological workload associated with agricultural tasks. Baseline data on drudgery levels were collected before the intervention using the drudgery Index. following the intervention period, post-intervention data on drudgery levels were collected using the same tool to compare the effects of using CRIDA and TNAU wheel hoes. An interview schedule was developed to gather qualitative data on participants' perceptions and experiences with the CRIDA and TNAU wheel hoes. Semi-structured interviews were conducted with the participants to explore their feedback regarding the usability, effectiveness and acceptability of the wheel hoes in reducing drudgery. Quantitative data collected through the drudgery Index were analyzed using appropriate statistical methods, such as paired t-tests, to compare pre- and post-intervention drudgery levels. Qualitative data from the interviews were transcribed and thematically analyzed to identify recurring themes and patterns related to the participants' experiences with the wheel hoes.

Results and Discussion

From the above Table 1, participants in the study were categorized into three age groups. 20-25 years, 26-31 years and 31 years and above. Among the participants, 12 women fell into the age group of 20-25 years, representing 40% of the total sample. A larger proportion of participants, comprising 16 women, belonged to the age group of 26-31 years, accounting for (54%) of the total sample.

Table 1: Distribution of participants according to age. (n=30)

Age	No of participants	Percentage
20-25	12	40%
26-31	16	54%
31 and above	2	6%

Additionally, two were aged 35 years and above, constituting (6%)of the total sample.

The age distribution of participants in the study reflects a diverse representation across different age groups. The majority of participants were in the age group of 26-31 years, followed by those in the age group of 20-25 years. While a smaller number of participants were aged 35 years and above, they also contributed to the overall sample representation. The diverse age distribution among participants ensures a broad perspective on the experiences and perceptions of rural women in different stages of adulthood. Understanding the age demographics of the study population is essential for contextualizing the findings related to drudgery reduction and the adoption of mechanized tools in agriculture.

From Table 2, it was found that majority of women (54%) had less than five years of agricultural practices and 46% of women had more than five years and less than ten years of experience.

From Table 3, the data presented in the table categorize participants based on their Drudgery Index scores, providing insights into the perceived level of drudgery associated with the traditional method of weeding. The Drudgery Index scores were grouped into three score ranges, each corresponding to a different level of drudgery experienced by the participants. None of the participants in the study reported Drudgery Index scores falling within this range (low), indicating that no participants experienced low levels of drudgery according to the traditional method of weeding. Four participants (13%) reported Drudgery Index scores within this range, signifying a moderate level of drudgery experienced during weeding activities. The majority of participants, comprising 26 individuals (87%), reported Drudgery Index scores equal to or exceeding 80, indicating a high level of drudgery associated with the traditional method of weeding. The study by Burman (2020) revealed that traditional weeding methods led to higher physical strain, while the introduction of improved tools significantly reduced physiological stress indicators such as heart rate and energy expenditure.

From the Table 4, majority of participants using the TNAU wheel hoe reported Drudgery Index scores falling within this range, with 23 participants (76%) experiencing low levels of drudgery during weeding activities. Seven participants (23%) using the TNAU wheel hoe reported Drudgery Index scores within this range, signifying a moderate level of drudgery experienced during weeding activities. None of the participants using the TNAU wheel hoe reported that no participants experienced high levels of drudgery associated with the use of this implement. The study by Singh (2019). The development of a battery-assisted four-wheel weeder demonstrated a reduction in the physical effort required for weeding. This mechanized solution not only decreased drudgery but also increased operational efficiency.

Table 5, results revealed that data in the table provide insights into the perceived level of drudgery associated with the use of the CRIDA wheel hoe among participants. The Drudgery index scores were grouped into three score ranges, each corresponding to a different level of drudgery experienced by the participants. The majority of participants using the CRIDA wheel hoe reported Drudgery Index scores falling within this range, with 24 participants (80%) experiencing low levels of drudgery during weeding activities. Six participants (20%) using the CRIDA wheel hoe reported Drudgery Index scores within this range, signifying a moderate level of drudgery experienced during weeding activities. None of the participants using the CRIDA wheel hoe indicating that no participants experienced high levels of drudgery associated with the use of this implement.

Table 2: Experience of women in agricultural weeding practices. (n=30)

Years of experience	No of participants
1 to less than 5 years	16 (54%)
5 to 10 years	14 (46%)
10 and above	0

Table 3: Drudgery Index score for traditional method of weeding. (n=30)

Score range	No of participants (%)	Level of drudgery
Less than/ = 50	0	Low
51-80	4 (13%)	Moderate
80 and Above	26 (87%)	High

Table 4: Distribution of participants based on Drudgery Index scores TNAU wheel hoe. (n=30)

Score range	No of participants	Level of drudgery
Less than/ = 50	23 (76%)	Low
51-80	7 (23%)	Moderate
80 and Above	0	High

Table 5: Distribution of participants based on Drudgery Index scores CRIDA Wheel Hoe. (n=30)

Score range	No of participants	Level of drudgery
Less than/ = 50	24 (80%)	Low
51-80	6 (20%)	Moderate
80 and Above	0	High

Table 6: Mean differences of wheel hoes. (n=30)

Wheel hoes	Mean difference	T value	Critical t value
CRIDA	28.95	16.54	2.045
TNAU	27.08	17.6	2.045

The results indicate that both the TNAU and CRIDA wheel hoes were effective in reducing drudgery among rural women participants during weeding activities. The majority of participants using either the TNAU or CRIDA wheel hoe reported low levels of drudgery, with none experiencing high levels of drudgery. Both interventions led to a significant decrease in drudgery levels compared to the traditional method of weeding, where a considerable proportion of participants experienced moderate to high levels of drudgery. Study by Kumar *et al*., (2018) stated that the adoption of conservation agriculture technologies, such as zero tillage and mechanical transplanters, has been shown to reduce the labor burden on women farmers. These practices contribute to decreased drudgery and promote gender equity in agricultural tasks.

From the above Table 6, calculated t-value (16.54) is much greater than the critical t-value (2.045), we can reject the null hypothesis. This indicates that there is a statistically significant difference between the traditional weeding method and the CRIDA wheel hoe.

Since the calculated t-value (17.06) is much greater than the critical t-value (2.045), we can reject the null hypothesis. This indicates that there is a statistically significant difference between the pre-test and post-test scores for the TNAU wheel hoe.

Therefore, we conclude that the use of the TNAU and CRIDA wheel hoe significantly reduced the drudgery levels among participants compared to the traditional method of weeding. Sinha *et al.* (2018) conducted an ergonomic assessment of wheel hoes and found that modifications tailored to female workers significantly reduced energy consumption and discomfort, thereby enhancing work output. Similarly, Burman *et al.* (2020) evaluated the Pusa wheel hoe and four-wheel weeder, concluding that these tools are ergonomically sound and effective in minimizing human strain and fatigue during vegetable cultivation.

Limitations

One limitation of the study is the relatively small sample size, which may limit the generalizability of the findings to broader populations. The study was also confined to specific geographic locations within Guntur district, which may restrict the applicability of the results to other regions or contexts. Additionally, the reliance on self-reported data and subjective assessments of drudgery levels may introduce potential biases into the findings.

Suggestions for future research

Future research could involve larger sample sizes and multi-site studies to enhance the robustness and generalizability of the findings. Longitudinal studies could be conducted to assess the long-term impact of mechanized interventions on drudgery reduction, productivity and socio-economic outcomes for rural women farmers. Further investigations are warranted to explore the factors influencing the adoption and sustained use of mechanized tools in different agricultural settings, including access to technology, training and institutional support.

Conclusion

Findings of this study highlight the positive effects of TNAU and CRIDA wheel hoes in reducing drudgery among rural women participants. While the results are promising, further research is needed to address limitations, validate findings and explore additional avenues for improving agricultural mechanization and gender-inclusive technology interventions.

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