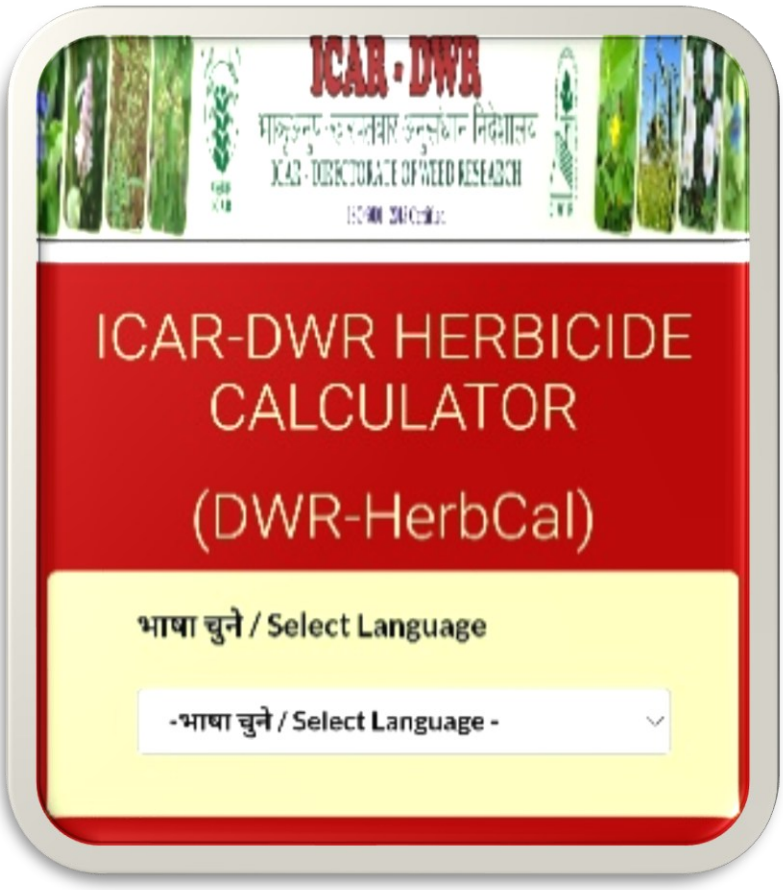
DWR HerbCal: A mobile app for herbicide calculation



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Introduction

Weeds pose a major threat to agricultural productivity by competing with crops for nutrients, water, light, and space, ultimately reducing yield and profitability. While herbicide-based weed control remains one of the most effective and economical solutions, many farmers struggle with the technicalities of calculating the correct herbicide dose and spray volume for their specific field conditions. Errors in calculation often lead to under- or over-application, resulting in poor weed control, crop damage, or environmental hazards.

To address this critical gap, the ICAR-Directorate of Weed Research, Jabalpur, has developed a user-friendly mobile application 'DWR HerbCal' specifically designed to simplify herbicide and water volume calculations. Available in 11 regional languages, this Android-based app enables farmers and other agricultural stakeholders to obtain accurate, crop-wise, season-wise herbicide recommendations by simply entering the area of their field and herbicide formulation. The app's intuitive interface, multilingual support, and extensive database make it an efficient digital tool for enhancing the precision and timeliness of herbicide applications.

By promoting correct dosing, the DWR HerbCal not only improves weed management efficacy but also contributes to higher yields, resource conservation, and cost savings. Its unique features and scalability make it a significant advancement toward digital and precision agriculture in India.

Methodology

1. Data Collection and Database Development

Comprehensive data on crops (Kharif, Rabi, Zaid), recommended herbicides (formulation, concentration, active ingredient), and standard spray volumes were compiled from ICAR-DWR repositories, AICRP–Weed Management centers, and published agronomic guidelines. These data formed the backbone of a season-wise, crop-wise database, supported in eleven Indian languages.

2. App Design and Programming

Using standard Android development frameworks, a user interface was created with cascading drop-down menus. Users first select their preferred language, then the cropping season, followed by crop and herbicide. Upon entering field size (with optional adjustment of formulation and water rate), the app automatically computes the precise herbicide quantity and water volume required for that area. Emphasis was placed on a clean, intuitive design to minimize user input and errors.

3. Multi-site Validation

The app underwent a multi-user, multi-site validation across diverse agro-ecologies. Farmers, extension officers, and researchers installed DWR HerbCal on their devices, entered real field scenarios, and compared the app's recommendations against manual calculations and standard recommendations. Feedback on accuracy, usability, and language clarity was collected.

4. Refinement and Deployment

Based on validation feedback, minor tweaks were made to menu labels, language translations, and calculation logic. The final version was released on the Google Play Store. User analytics (3,690 downloads, 4.3-star rating, 31 reviews) and follow-up surveys confirmed the app's reliability and ease of use. By integrating a robust database with a simple, multilingual interface, DWR HerbCal ensures that farmers of all scales can accurately calculate herbicide doses and spray volumes—leading to better weed control and resource conservation.

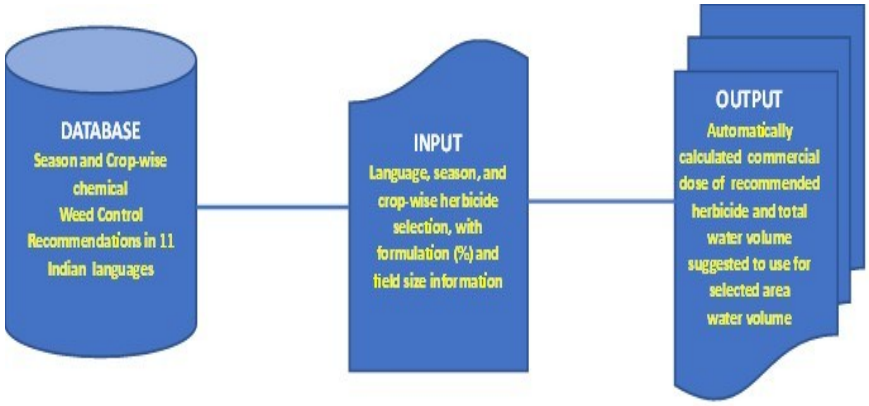

Fig. Data Flow diagram of DWR HerbCal

Results

The DWR HerbCal app offers a user-friendly mobile solution for herbicide and water volume calculations, aimed at enhancing weed management efficiency in agriculture. This Android-based app simplifies the often complex process of determining the correct amount of herbicide and water for specific areas, helping farmers achieve optimal weed control regardless of field size.

The app features a multi-language interface (11 languages) and is designed to be intuitive, allowing users to select the season, crop, and herbicide type from dropdown menus. It then automatically calculates the required herbicide and water volume based on the farm size entered by the user. The app's accuracy helps farmers avoid both under- and over-application, leading to better weed management, reduced wastage, and higher productivity. Key outcomes of the app include accurate herbicide application leading to increase in crop yield; reduction in spray water, labour, time, energy and optimized herbicide use lowering the cost of weed control.

Benefits

- **Comprehensive database:** The app is having an option to select the menu in 11 different language and comprises a comprehensive database of different cropping seasons (i.e. *Kharif*, *Rabi* and *Zaid*).
- **User-friendly interface:** The app has a user-friendly interface that allows users to easily select the crop, recommendation, dose, formulation and area. It automatically calculates and recommend the herbicide and water quantity according to the input area in the app.
- **Targeted audience:** The app is specifically designed for farmers, Agriculture officer, KVK personnel, students and scientists seeking to manage weed infestations in their fields effectively. This focus on the target audience allows the app to provide information that is more relevant and useful to its users.
- **Increased Crop Yield:** Accurate herbicide application leads to a 15-20% increase in crop yield.
- **Resource Savings:** 12-13% reduction in spray water and 3-4% in labor, time, and energy.
- **Cost Effectiveness:** Optimized herbicide use lowers the cost of weed control, improving the economic efficiency of farming.

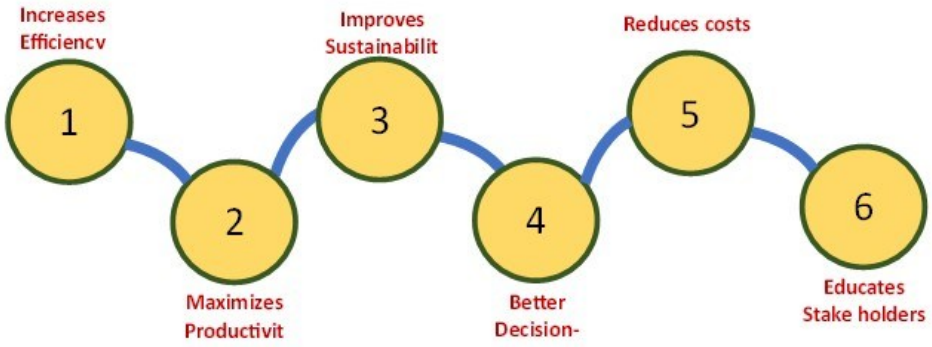

Fig. Benefits of DWR HerbCal App

Upscaling

The DWR HerbCal mobile app has proven to be an effective tool in optimizing herbicide application, reducing wastage, and improving productivity. To further enhance its impact and broaden its reach, several upscaling strategies are proposed. These include expanding its adoption through awareness campaigns, leveraging agricultural extension services, KVKs, government agricultural departments, and community organizations to promote the app among farmers, alongside organizing training workshops and field demonstrations. At present the android application has been downloaded by 5,940 stakeholders belonging to various categories. Additionally, collaborating with other agricultural platforms or farm management apps would offer synergistic benefits, providing farmers with comprehensive services for precise crop management. The app can also be enhanced with multi-language support and regional customization, further localizing it to cater to specific areas and agricultural seasons. Forming partnerships with agri-tech companies could improve its commercial viability by offering subscriptions for advanced features or personalized recommendations. The app's potential can

also be amplified by collecting anonymized data to provide insights for AI-driven predictive analytics, improving weed management. Collaborating with NGOs and rural development programs will increase accessibility in underserved regions. By focusing on these strategies, the DWR HerbCal app can become an indispensable tool for farmers worldwide, driving more efficient weed control, boosting productivity, and fostering environmental sustainability.

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