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Project Title: CROSSING DATA BOOK: AN OPEN SOURCE ANDROID APPLICATION FOR REAL-TIME SUCCOUR

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ABSTRACT

Crop improvement is the genetic alteration of plants to satisfy human needs. It is done in three vital phases – Selection, Plant hybridization, and Evaluation. Plant hybridization is the process of crossbreeding between genetically dissimilar parents to produce a hybrid. At this crucial stage of crop improvement; maintenance of crossing data under tradition book scribing doesn't provide real-time progress data. Crossing data book-android application has been specially designed as succour to the plant breeders at the decisive time of plant hybridization. As per the assigned input data, it is programmed to analysis and assists the breeder; by prioritizing female for emasculation, male for pollination, and crosses (female × male). For females, it provides information on selection of female line for emasculation based on the average number of successful crossings completed in that female and also on the basis of priority of the female parents if assigned by the breeder. For males, it provides information on the selection of male parents for pollination on the basis of a total number of successful pollinations done using that male irrespective of female pollinated and also provides the list of emasculated female parents which need to be pollinated with the selected male. For specific cross, ranking among the different crosses with the same female, prudence breeder whether to pollinate or not. This real-time handy information to the breeder during the crucial stage of plant hybridization assists in generating more number of consistent crosses, large F_1 population and ultimately increasing the probability of recovering the superior high yielding varieties to meet the domestic and global food security and prosperity.

INTRODUCTION

Artificial hybridization has been studied and utilized since the beginning of the plant breeding and until now its corner stone in crop improvement efforts. This stage remains a very crucial stage as well as decides the final straw of crop improvement programme. Further, the maintenance of crossing records under tradition book scribing doesn't provide real-time progressive data leading to production of larger F_1 hybrid seeds increasing the probability of recuperating to high yield varieties

METHOD AND IMPLEMENTATION

We have designed and programmed Crossing data Book, an open-source application that runs on Android. The application is available at the Google Play Store (https://play.google.com/store/apps/details?id=com.db.crossingdata&hl=en_IN) and its runs on plant breeders' android based mobile phones, thus easily accessible for every breeder during crossing phase. The application is developed specially to address the real-time, progressive, judgemental data by prioritizing female for emasculation, male for pollination and crosses (female × male) for the breeder during *crossing*.

Crossing data book is designed as per the standard artificial hybridization protocols. It begin with the creating a new crossing project in the project homepage by incorporating the basic information on – *project name* and *crop name*. After creating crossing project, in project page – using the *add male* and *add female* options the breeder will now add the male and female parents selected for the crossing respectively, then using the *assign* operative the breeder now assign the crosses among the added female and male parents. (**Figure 1**).

During the crossing time, *emasculation* tool in project page will list out the added female parents in ascending order based on the average number of successful crossing completed in that particular female parent. This information assists the breeder in selecting the female parent for emasculation. After selection, the breeder will manually add the total number of emasculation done in the respective female. This emasculation count will be valid until 11AM of the upcoming day. Based on the flowering time, importance of particular female in crossing programme can be marked priority using the star symbol in the female parent list (**Figure 2**).

Pollination tool in project page will list out the added male parents in ascending order on the basic of total number of successful pollination done irrespective of female parents, thus providing the breeder with the information about male parents to be selected for pollination. Upon selecting the male parents, it would list out only the emasculated female parents assigned to be crossed with the selected male. Application is programmed specially to provide ranks in the decreasing order of total number of crosses done in different crosses of the same female. This system provides decision of whether or not to pollinate among the selected male and female parent. Upon deciding and

selecting the male and female crosses, it would display the number of emasculation buds available for pollination in the selected female. After selection of cross, breeder will manually add the total number of pollination done. This completes one crossing cycle. This input data will automatically get updated in real-time in the female parents list for emasculation, male selection for pollination and ranking of the crosses (**Figure 2)**.

Seed Set tool in the project homepage will list out all the assigned crosses according the female parents. It is used to input the data on the number of successful hybrid seed sets. *Summary tool* in the project homepage give the overall summary of the crossing project. It provides summarized information about crosses, hybrid seed set and total number of successful crosses in tabular format for further analysis (**Figure 3**).

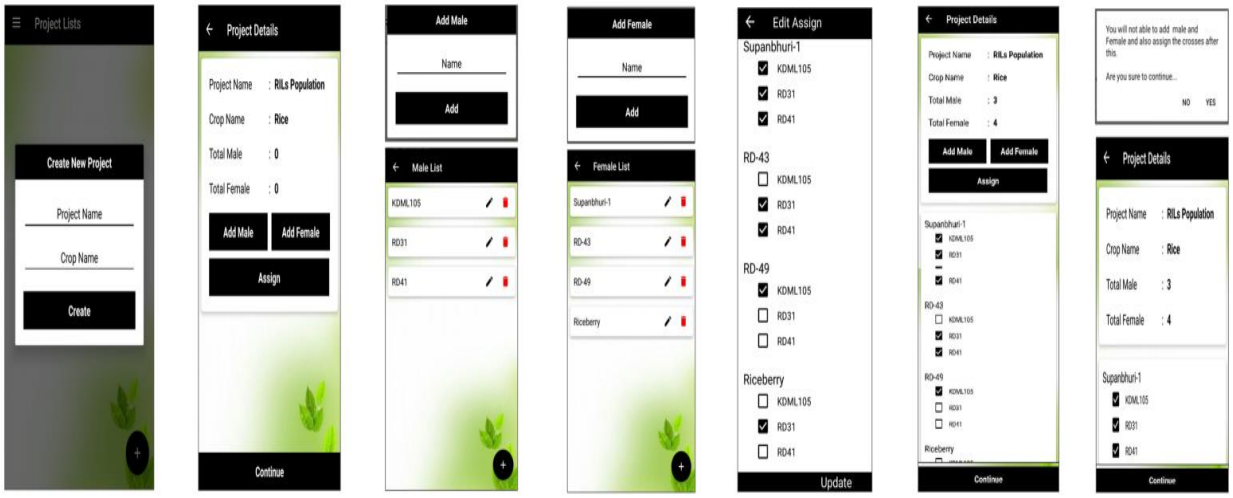

Figure 1 Main layout of Crossing Data Book on Android phone. From left to right – Screen 1: Creating new crossing project; Screen 2: Project home page; Screen 3: Add male list; Screen 4: Add female lis Screen 5: Assigning male parent for each female parent; Screen 6 & 7: Final steps in creating the crossing project.

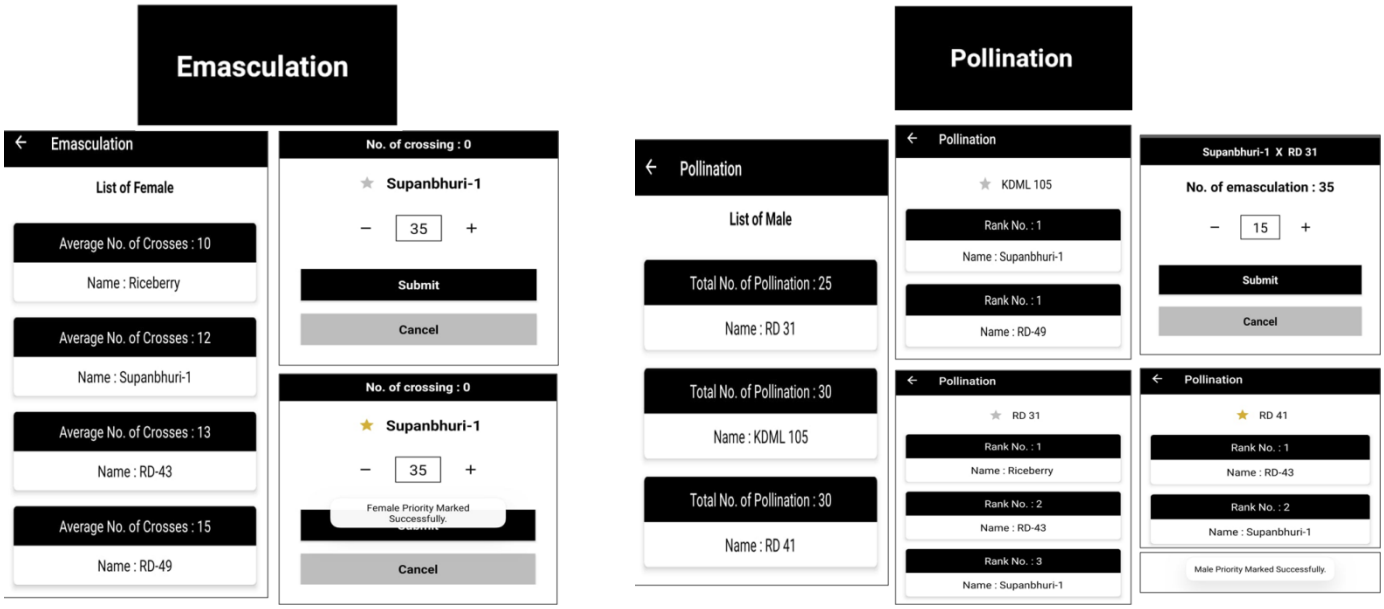

Figure 2 Main layout and input tools of Emasculation (Left) and Pollination page (Right)

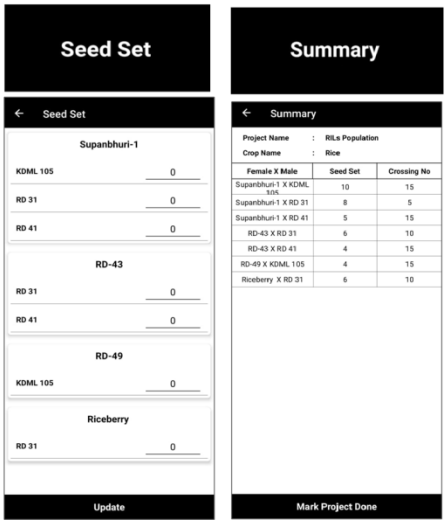

Figure 3 Main layout and input tools of Seed Set (left) and Summary (Right)