ISSN 1808-8546 (ONLINE) 1808-3765 (CD-ROM)

APPLICATION FOR MANAGING DRIP IRRIGATION: CHICO D'ÁGUA

RAÍ LIMA FERREIRA[1]; ALLAN CUNHA BARROS[1] AND TÉRCIO DE MORAES[1]

1- Federal University of Alagoas, Arapiraca Campus. Av. Manoel Severino Barbosa - Bom Sucesso, 57309-005, Arapiraca - AL, Brazil. E-mail: rai.ferreira@arapiraca.ufal.br , tercio@arapiraca.ufal.br , allan.cunha@arapiraca.ufal.br

1 RESUMO

A falta de dados, conhecimento e acesso às tecnologias sobre o uso racional da água pode levar o pequeno produtor a diversos erros no manejo da água na sua propriedade agrícola. Assim, o objetivo do trabalho foi desenvolver um aplicativo para o manejo diário da irrigação utilizando a menor quantidade de dados disponíveis e com facilidade de acesso. O aplicativo Chico D'água, nome inspirado no rio São Francisco, foi desenvolvido pela Universidade Federal de Alagoas, em framework Flutter dentro de uma linguagem de programação DART (DART, 2020). Utiliza dados de cultura como: Espaçamento e Kc; do sistema de gotejamento: vazão (Lh^{-1}), espaçamento entre emissores e linhas (m) e Temperatura do ar °C (máxima e mínima) para determinar o tempo de irrigação. Sua simplicidade é confirmada através do seu uso, demonstrando potencial para utilização por pequenos produtores. Sua limitação está relacionada a não possibilidade de se utilizar outras metodologias de cálculo e inserção de fatores como Eficiência e Kl. No entanto, o aplicativo pode ser utilizado para o manejo da irrigação utilizando poucos dados de entrada.

Palavras-Chave: Android, Pequenos produtores, Evapotranspiração diária..

FERREIRA, RL; BARROS, AC; MORAES, T.
DRIP IRRIGATION MANAGEMENT APPLICATION: CHICO D'ÁGUA

2 ABSTRACT

The lack of data, knowledge and access to technologies on the rational use of water can lead small producers to several errors in the management of water on their agricultural property. Thus, the objective of the work was to develop an application for the daily management of irrigation using the smallest amount of data available and with easy access. The Chico Dágua application, named after the São Francisco River, was developed by the Federal University of Alagoas in a flutter framework within the DART programming language (DART, 2020). Culture data such as spacing and Kc were used for the dripping system, and the flow rate ($L\ h^{-1}$), spacing between emitters and lines (m) and air temperature (°C (maximum and minimum) were used to determine the irrigation duration. Its simplicity is confirmed by its use, demonstrating its potential for use by small producers. Its limitation is related to the impossibility of using other methodologies for calculating and inserting factors such as efficiency and Kl. It can be concluded that the application can be used for irrigation management using only a small amount of input data.

Recebido em 05/09/2023 e aprovado para publicação em 11/09/2023
DOI: http://dx.doi.org/10.15809/irriga.2023v28n3p491-495

Keywords: Android, Small farmers, Daily evapotranspiration.

3 INTRODUCTION

According to Barros *et al*. (2017), the Penman–Montetih (PM) model requires a meteorological station so that reference evapotranspiration (ETo) can be estimated with a large amount of equipment, increasing the cost of acquisition and making its use unfeasible for some producers, especially small and medium producers. The authors also state that ETo can be estimated with simpler, lower-cost equipment, but to do so, the equation developed by Hargreaves and Samani (1985) must be adopted, whose necessary variables are only the maximum and minimum air temperature. .

The development of an application aimed at irrigation management, using little data and with reduced estimation error, appears to be an alternative for small and medium-sized producers. Furthermore, because they are in the "palm of your hand", they can be used daily.

According to Ribeiro, Coimbra and Bazzi (2020), some programmers end up ignoring the user experience in the creation process, preventing applications from fulfilling their role. Therefore, the development of an app for simple access to and insertion of information could be useful for small producers or in regions with low data availability.

Therefore, the objective of this work was to develop an application for managing drip irrigation using only air temperature data based on daily ETo estimates.

4 MATERIALS AND METHODS

The flutter framework is available within the DART programming language (DART, 2020), which allows it to be run on multiple platforms (Android and iOS).

The application has two main stages: the initial stage, in which the user is introduced upon first access and in the event of the addition of new crops at a later time; and the main stage, in which the application plays its main role and estimates irrigation time.

Initially, data on crop spacing, flow rate and spacing between drippers were registered, and access to the cell phone's geographic coordinates was requested to calculate the radiation at the top of the atmosphere.

Using air temperature data provided by the user, which can be collected from simple equipment, such as a thermohygrometer, the ETo is estimated on a daily scale using the Hargreaves and Samani equation (1985). The equation can be applied in any region of Brazil; for the Alagoas region, the equation adjustments found by Barros, Oliveira and Netto (2019) were used.

The user is provided with a list of some crops and Kc values, or the user can enter the desired value. From there, the equation for calculating irrigation time was developed using equation 1:

$$((\frac{ET_c * (E_l * E_p)}{q * (E_p * E_{em})}) * 1.10) * 60 \quad (1)$$

Where Etc is the crop evapotranspiration (mm day $^{-1}$); El is the spacing between plant rows (m); Ep is the spacing between plants in the rows (m); q is the emitter flow (L h $^{-1}$); and Eem is the spacing between emitters (m).

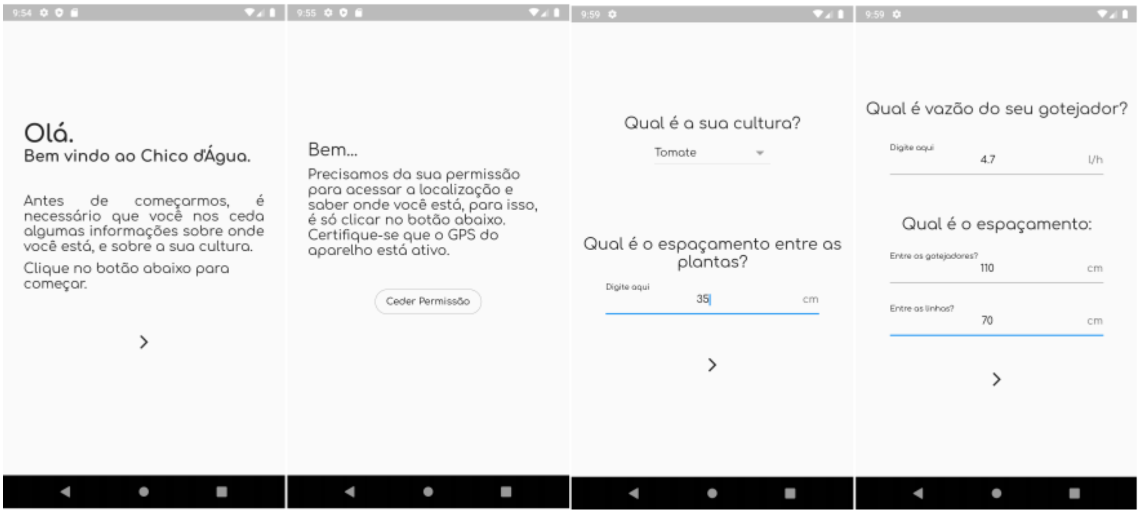
To simplify the input data, information on the efficiency factor was omitted, and the system was considered to be 90% efficient, justifying the 10% increase in the formula.

The final result is provided to the user in minutes. For the test, a simulation was carried out for tomato cultivation, with a spacing between plants of 35 cm, dripper flow of 4.7 L h $^{-1}$, spacing between emitters of 110 cm and spacing between planting lines of 70 cm. The maximum and minimum air temperatures were 36 and 27°C, respectively, and a Kc of 0.86 was adopted.

5 RESULTS AND DISCUSSION

Figure 1 shows the steps after starting the program. The program does not require any need for updates, and there is no difficulty in releasing the use of your location. The data were easily entered, and the culture records were saved on the home screen.

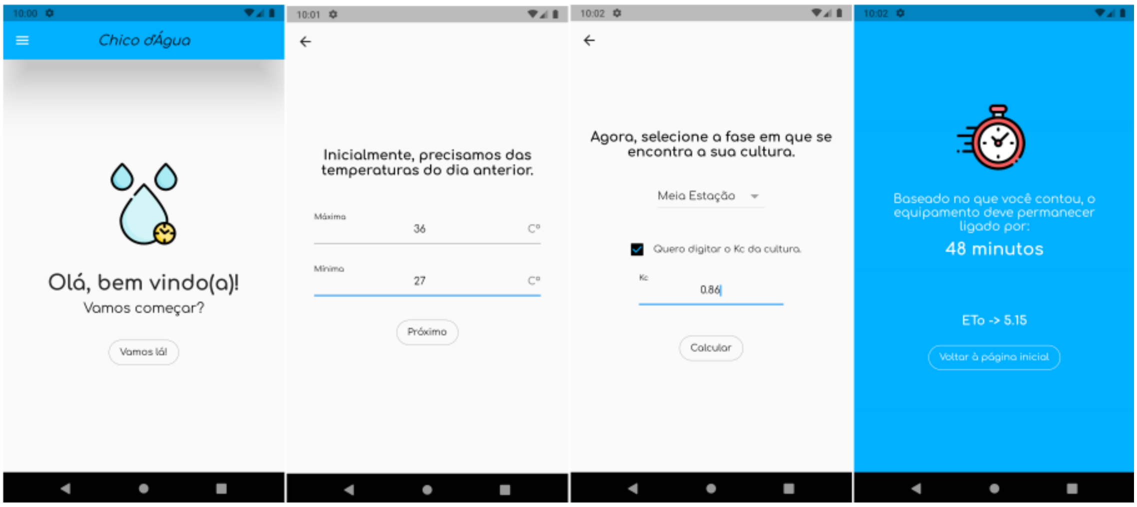
Figure 1. Initial screens for registering culture and drip system data and requesting authorization to access the location.



Source: Authors (2023)

As shown in Figure 2, in just 3 steps and 3 pieces of information (air temperature and Kc), the application provides the time needed to irrigate; in addition, it also provides the ETo (mm/day) calculated for the day in question, values these, which are stored in the application.

Figure 2. The sequence of screens for using the program after the producer registers was used to determine the irrigation time.



Source: Authors (2023)

The program is simple to use and provides the producer with irrigation time, allowing simple communication between the application and the user. By storing the data, the application also provides the irrigation history in the area, which can be used by consultants or extension agents as a verification tool.

The irrigation efficiency was a fixed factor when programming the calculations, which would be a source of error for the estimate. Other limitations of the model include the noninclusion of the correction factor for localized irrigation (Kl), the possibility of using more variables and the possibility of choosing the calculation method using another methodology, such as Penman–Monteith (ALLEN *et al.*, 1998).

However, the basic principle of the program is that it is used by professionals and producers who do not have access to reliable climatic data to calculate ETo and who use only a thermohygrometer or daily, local, temperature information. maximum and minimum values, it is possible to calculate the irrigation time.

Therefore, this approach is an alternative to irrigation management for small and medium-sized producers or an initial technique for learning about irrigation management.

6 CONCLUSIONS

The Chico D'água application is simple to use and capable of being used in irrigation management by producers who lack more precise techniques for estimating irrigation time for crops.

The application can only be used with maximum and minimum air temperature data.

7 REFERENCES

ALLEN, R. G.; PEREIRA, L. S.; RAES, D.; SMITH, M. **Crop evapotranspiration**: guidelines for computing crop water requirements. Roma: FAO, 1998. (Irrigation and Drainage Paper 56).

BARROS, AC; SILVA, CO; NETTO, AOA Adjustment of the parameters of the Hargreaves- Samani equation on a daily scale for the Jacaré- Curituba irrigated perimeter , Canindé-SE . **Brazilian Journal of Irrigated Agriculture** , Fortaleza, v. 11, no. 8, p. 2152-2161, 2017. DOI: 10.7127/rbai.v11n800704. Available at: https://www.inovagri.org.br/revista/index.php/rbai/article/view/704/pdf_428. Accessed on: 24 Oct. 2023.

BARROS, AC; SILVA, FF; ARAUJO, PHV; MEDEIROS, PRF; LELIS NETO, JA Daily estimate of reference evapotranspiration by hargreaves-samani and parameter adjustment for Alagoas. **Irriga** , Botucatu, v. 24, no. 3, p. 527-537, 2019. DOI: https://doi.org/10.15809/irriga.2019v24n3p527-537. Available at: https://irriga.fca.unesp.br/index.php/irriga/article/view/3481. Accessed on: 24 Oct. 2023.

DART. **Dart programming language** . Aarhus : Google, 2020. Available at: https://dart.dev/. Access on : 31 Nov. 2023.

HARGREAVES, G.H.; SAMANI, ZA Reference crop evapotranspiration from ambient air temperature. **Journal of Applied Engineering in Agriculture** , St Joseph, v. 1, no. 2, p. 96-99, 1985.

RIBEIRO, A.; COIMBRA, EA; BAZZI, C. Protopersonas applied to rural producers for mobile application prototyping. **Brazilian Journal of Development** , Curitiba, v. 6, no. 12, p. 96017-96039, 2020. DOI: https://doi.org/10.34117/bjdv6n12-189. Available at: https://ojs.brazilianjournals.com.br/ojs/index.php/BRJD/article/view/21258. Accessed on: 24 Oct. 2023.