CLIMATE REANALYSIS TO SUPPORT SUSTAINABLE AGRICULTURE: BIOSUCCESS

The key objective for **BioSuccess** is to assist the agriculture industry in moving away from the use of synthetic chemical pest control to the use of more sustainable biopesticide products.

Research has shown that, **pest and diseases are responsible for up to 40% of small-holder crop losses worldwide.** To date, synthetic chemical pesticides are the primary means of pest / disease control, but concern regarding over-reliance on these products is increasing due to issues such as environment toxicity, worker and consumer exposure, and insect resistance.

Biopesticides are emerging as safer, effective alternatives to chemical pesticides. As a living organism, the efficacy of a biopesticide is controlled in part by environmental conditions such as temperature. In addition, biopestcides require time to take effect and hence users need guidance on when to expect results from their spraying campaign. BioSuccess assists users make better use of their biopesticide by addressing;

• When should I spray to achieve maximum effectiveness?
• If I spray on this day, when will the pest population be controlled/killed?
• When should I spray to achieve control aims by a certain date?
• Where in the country/world will a biopesticide effective?

BioSuccess allows users, manufacturers and governments to estimate the time it would take for a biopesticide to control insect populations in specific scenarios, and the latest date that a biopesticide could be applied whilst still being effective.

The tool combines temperature data from Copernicus Climate Change Service (C3S) climate reanalysis (ERA5), delivered via the Copernicus Climate Data Store, with biological models of insect development (initially locusts) and biopesticide efficacy.

Biosuccess predicts the 'time-to-kill' based upon location and time of application, using reanalysis derived climatologies and data from individual years to show where applications will be most reliable.

The algorithm uses global reanalysis data to estimate the temperature of the habitat favoured by the locusts. This is important in calculating the hourly rate of development of the biopesticide working within the pest, where parameters used here were derived from a combination of biopesticide efficacy data and fieldwork investigating local environmental temperature trends. The final output given to the user is the number of days calculated to reach 90% mortality within the pest population after the given spray date.

To date, the focus of **BioSuccess** has been on locust management and control. Future development will broaden the range of pest targets and applicability to a range of biopesticide products.

The **BioSuccess** tool is an interactive web-based application providing:

1. Historical Analysis: a map where the user can access required products for the whole area of study or a specific province and based on 20 years of data, storing all the datasets needed to derive the climatology

2. Current Analysis: a display depicting results of biopesticide efficacy in combination with locust development over time for a single location. Thus allowing users to plan best utilization of their biopesticide product

3. Last chance to kill' mode offers the user the ability to determine the latest date by which to apply the biopesticide to prevent the insect reaching a selected locust development stage

4. User feedback utility enables biopesticide suppliers to gain a measure of the efficacy of their products in the field.