

# QuantiFarm Toolkit – Directions for using the "Cost & Benefit Calculator tool"

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# Table of Contents

Overview	2
Description	3
DAT Search and Selection Process	3
DAT Evaluation process	3
Entering DATA	4
System Analysis	4
Presentation of the Results	4
Guiding steps for each functionality	5
DAT Search and Selection Process	5
DAT Evaluation Process	8
Entering DATA & System Analysis	9
Presentation of the Results1	0
Crop Farming Example1	1
Livestock Farming Example1	3

#### Overview

With the Cost & Benefit Calculator tool, a user can:

- 1. Evaluate the financial implications of implementing Digital Agricultural Technologies (DATs),
- 2. Calculate potential returns on investment (ROI) for various DATs, and
- 3. Assess the cost-effectiveness of DATs for specific agricultural scenarios.

For example, a user operating a crop farm could select a crop-oriented DAT from the tool and enter information such as current yield, water usage, fertilizer costs, and crop market prices. The Cost & Benefit Calculator will then process this data to estimate the costs involved in adopting the DAT, as well as the potential financial gains from improvements in yield, resource efficiency, or product quality. Similarly, a livestock farmer can choose a livestock DAT and provide details on animal numbers, feed costs, veterinary expenses, and current production metrics. The tool will calculate the estimated costs of implementation and potential benefits, which may include enhanced animal health, increased milk or meat production, and better feed-to-growth ratios. Users can therefore leverage the Cost & Benefit Calculator tool to conduct a thorough financial analysis before committing to a new DAT. The tool's ability to customize calculations based on user-provided farm-specific data ensures that the insights are relevant and actionable.

The Cost & Benefit Calculator tool (Figure 1) is available here: QuantiFarm Toolkit

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FARMER TOOLKIT	Cost and Benefit Calculators		
E Recommendations Tool	Description	DATs for Crop Farming Systems	DATs for Livestock Farming Systems
Cost and Benefit Calculators	The 'Cost & Benefit Calculators' tool is designed to as operations. This integrated tool adeptly meets the div	ist farmers and agricultural advisors in analysing the financial implicati erse requirements of both crop and livestock farming systems, featurir	ions and potential benefits of integrating various DATs into their farming ng specific calculator modules tailored for each.
Benchmarking Tool	Within the tool, users can explore a comprehensive re Investment (ROI) and Net Benefit.	pository of DATs, select one, and upon completing the necessary input	ts for the calculator modules, the tool provides vital information such as Return on
	This aids end-users in gaining a realistic understandir	g of their potential investment in a DAT.	
	As a crucial component of the QuantiFarm Toolkit, the potential profitability of DATs throughout their opera	'Cost & Benefit Calculators' serves as an essential, indicative guide for ional lifecycle.	farmers and advisors, aiding them in understanding the economic feasibility and
	To use the tool, the user must register and log in.		
	Considerations and Disclaimers for the Cost & Ber	efit Calculator Tool Usage	
	Average Prices: The purchase costs presented are av	erage prices and should not be considered fixed or guaranteed. End-us	sers should seek actual quotations from DAT providers or retailers.
	Source of Benefit Data: Economic and environmenta actual benefits can vary.	l benefits are based on scientific publications or assertions by provider	rs from specific conditions and locations. They may not apply universally, and
	Exclusion of Taxes/Fees: The calculator does not inc	ude taxes or other specific fees that may be applicable to the end-user	r's location.
	Tool's Purpose: The calculator is an indicative tool th	at provides insights into potential costs and benefits, complementing th	he main recommender tool based on the QuantiFarm Assessment Framework.
	Decision-Making: This tool offers valuable information	n to support decision-making in the adoption of DATs, helping stakeho	olders to identify options that best fit their specific needs.
	The Smart Farming Technologies Group of the Agricultur platform is objectively formulated scientific data, which express any personal assessments or opinions of the res entitled to a claim for detrimental reliance on any advice	al University of Athens maintains this platform to inform the public approp ave been extracted from several sources (such as scientific articles, researc archers. Any member of the research team does not carry any responsibili or information provided or expressed.	vriately and propose technological solutions. The information provided on this online ch results, products, and services of companies and/or organizations), and do not ity for the acts or omissions of those who visit this platform, and no one shall be

Figure 1 – Cost & Benefit Calculator Tool

### Description

The description of the tool (Figure 2) can be found under the "Description" tab in the top navigation bar.

⇔QuantiFarm  Toolkit	≡			¢
FARMER TOOLKIT	Cost and Benefit Calculators			
E Recommendations Tool	Description	DATs for Crop Farming Systems	DATs for Livestock Farming Systems	
		Figure 2 – Tool Description		

The tool currently requires no registration and/or logins. Currently, the tool holds five main functionalities:

- (1) DAT Search and Selection Process
- (2) DAT Evaluation process
- (3) Entering DATA

(4) **System Analysis** to perform the evaluation of the selected DAT through the calculator modules based on the end-user inputs

(5)Presentation of the Results

#### DAT Search and Selection Process

The "DAT Search and Selection Process" within the Cost & Benefit Calculator tool is designed to systematically guide users in identifying the DATs that best suit their farming needs. This process involves four key steps, each requiring specific inputs from the user to refine the search and evaluation of DATs.

**1. Select Farming System:** Users start by choosing their primary farming system type from a dropdown menu, with options for 'Crop' or 'Livestock'. This selection is crucial as it tailors the subsequent options to be relevant to the user's farming context.

• Input Fields: Dropdown: Crop, Livestock

**2. Select Crop or Livestock Type:** Depending on the farming system selected, users will specify the type of crop or livestock they manage. This step further narrows down the DATs to those that are specifically designed for the selected type of agriculture, whether it be arable farming, fruit cultivation, dairy cattle management, etc.

• Input Fields: For Crop: Dropdown (Arable, Fruits, Vineyards, Vegetables, Orchards); For Livestock: Dropdown (Cattle/Dairy Cattle, Pigs, Poultry, Small Ruminants)

**3. Select DAT Category:** After defining the farming system, users select a category of DAT that aligns with their operational goals or the challenges they aim to address. The dropdown provides a list of DAT categories to choose from.

• Input Fields: Dropdown: List of DAT Categories

**4. Select Farming Practice (Purpose):** After selecting the DAT category, users are prompted to choose the specific farming practice or purpose for which they are considering a DAT.

• Input Fields: Dropdown: List of Farming Practices

**5. Select Specific DAT:** In the final step of the selection process, users choose a specific DAT from a curated list that matches their farming system, DAT category, and crop or livestock type. This chosen DAT will then be the focus for indepth cost-benefit analysis and evaluation.

• Input Fields: Dropdown: List of DATs

#### DAT Evaluation process

The "DAT Evaluation Process" is a streamlined component of the Cost & Benefit Calculator tool, enabling users to select and evaluate the suitability of DATs for their specific farming needs.

**DAT Evaluation Process:** This function allows users to choose the most relevant DATs for further analysis. After users have navigated the selection process by specifying their farming system (crop or livestock), DAT category, and the type of crop or livestock they manage, they can then pick a specific DAT from the list. Each DAT in the list comes with essential details such as the DAT name, provider, web links, purpose, and a description, aiding users in making an informed selection.

Once a DAT is selected, users are prepared to move to the next functionality of entering data into the system, which will utilize the provided information to conduct a thorough cost-benefit analysis.

#### Entering DATA

The "Entering Data" functionality is a crucial step in the Cost & Benefit Calculator tool that involves the detailed input of farming operation data by the end-user. This data is essential to perform a tailored evaluation of the selected DATs for either crop or livestock farming. Below is a description suitable for inclusion in the manual:

**For Crop Farming DATs:** Users are required to enter specific information about their crop farming operations. This includes the expected duration of DAT utilization (Years of Usage of DAT), the quantity of DAT units needed (Number of Units), the size of the land area where the DAT will be deployed (Total Area in hectares), and the current agricultural yields and costs associated with production inputs such as fertilizer, water, pesticides, labor, and fuel. Each data point entered will help in determining the potential improvements and cost savings that could be achieved by implementing the DAT in question.

**For Livestock Farming DATs:** Livestock farmers will input data related to the number of animals, the expected duration of DAT usage, and the number of DAT units required. Additionally, they will provide financial figures such as the market price of milk, average milk production per animal, and annual costs for labor, energy, water, feed, antibiotics, and losses due to mortality. These inputs help calculate the expected changes in profitability and efficiency from using the DAT.

In both cases, the data entered must meet certain validation criteria to ensure accuracy in the subsequent analysis. For example, numerical inputs such as area, yields, and costs must be zero or positive, while the number of years and units must be greater than zero.

This data-gathering phase is pivotal, as it feeds directly into the system analysis component where the cost-benefit evaluation is performed. By carefully entering accurate and comprehensive data, users can expect to receive a detailed analysis of the potential financial and operational impacts of adopting the selected DATs.

#### System Analysis

The "System Analysis" functionality within the Cost and Benefit Calculator tool is designed to harness user-provided data alongside specialized calculation modules to deliver comprehensive financial evaluations of DATs for different farming systems. This dual approach ensures a tailored analysis that reflects the unique conditions and requirements of each user's agricultural operation. Here's how it works:

- User Data Integration: The tool begins by collecting specific data from the user regarding their current farming operations, including details on crop types, livestock, and existing costs and yields. This data serves as the foundation for all subsequent analyses.
- Farming System-Specific Modules: Based on the type of farming operation (crop or livestock), the tool selects from a set of predefined calculator modules designed to evaluate various aspects of the farming operation. Each module focuses on a particular area of cost or benefit, such as yield increases, input cost reductions (fertilizer, water, pesticide, feed, etc.), labor savings, and more.
- **Customized Calculations**: For each module, the tool applies user data to farming system-specific formulas to compute potential costs, savings, and revenue enhancements. This approach allows for a highly personalized analysis that reflects the potential impact of DATs on the user's unique operation.
- **Comprehensive Financial Evaluation**: By aggregating the outcomes from all relevant modules, the tool provides a holistic view of the financial implications of adopting DATs, including total investment costs, projected benefits, cost savings, and key financial indicators like Return on Investment (ROI) and Net Benefit.

This systematic use of user data and targeted calculation modules enables the "System Analysis" functionality to offer precise and actionable financial insights. It empowers users to make informed decisions about integrating DATs into their farming operations by providing a clear, customized evaluation of the economic outcomes.

#### Presentation of the Results

The "Presentation of Results" functionality in the Cost and Benefit Calculator tool is a critical component designed to synthesize and display the outcomes of the analysis conducted through various calculator modules. This feature ensures that users can easily understand the financial implications of adopting DATs for their specific farming operations.

- **Consolidated Results Dashboard**: Once the analysis through the System Analysis functionality is complete, the tool aggregates the results from all calculator modules into a user-friendly dashboard. This dashboard provides a comprehensive overview of the calculated financial metrics, such as initial and ongoing investment costs, yield increases, revenue enhancements, cost savings, and more.
- **ROI and Net Benefit Highlighting**: Central to the dashboard are the Return on Investment (ROI) and Net Benefit figures. These key indicators are prominently displayed to give users immediate insight into the financial feasibility and profitability of implementing DATs. ROI offers a percentage-based look at the returns compared to the investment, while Net Benefit provides a dollar figure representing the total financial gain after subtracting costs.

The "Presentation of Results" functionality is designed to demystify the complex financial calculations and present them in a clear, actionable manner. By doing so, it empowers users to make informed decisions about integrating technology into their farming practices, backed by a solid understanding of the expected financial outcomes.

# Guiding steps for each functionality

#### DAT Search and Selection Process

At the top of the screen (Figure 3), the user can select the Farming System that he wants to explore and search for DATs (A) for Crop and (B) for Livestock.

FARMER TOOLKIT     Cost and Benefit Calculators     A     B       Image: Recommendations Tool     Description     DATs for Crop Farming Systems     DATs for Livestock Farming Systems	e®QuantiFarmer Toolkit Ξ					
E Recommendations Tool Description DATs for Crop Farming Systems DATs for Livestock Farming Systems	FARMER TOOLKIT	Cost and Benefit Calculators	Α	В		
	E Recommendations Tool	Description	DATs for Crop Farming Systems	DATs for Livestock Farming Systems		

Figure 3 – Farming System selection

Once the user selects the farming system then a drop down menu with a list of Crop or Livestock types appears at the Left side of the screen. **Figure 4** shows the list of Crop types included in the tool and **Figure 5** the Livestock types.

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FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming System	ns	DATs f	or Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Crop Arable	~		Crop Calcul	ator Modules	
Benchmarking Tool	Arable Fruits Vineyards Vegetables Orchards		€ INVESTMENT Paramet	Cost Calculator Mode	ule Result	Recalculate

Figure 4 - List of Crop types included in the tool

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FARMER TOOLKIT	Cost and Benefit Calculators					
Recommendations Tool	Description	DATs for Crop Farming Systems	DATs	for Livestock Farming Systems		
Cost and Benefit	DATs for Livestock Cattle	~	Livestock Cal	lculator Modules		
Benchmarking Tool	Cattle Pigs Poultry Small Ruminants	€ INVESTM	ENT Cost Calculator Mod	<b>dule</b> Result	Recalculate	



After the user selects the Crop or Livestock Type then a drop down menu with a list of DAT categories appears at the Left side of the screen. **Figure 6** shows the DAT categories for Crop and **Figure 7** the DAT categories for Livestock.

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FARMER TOOLKIT	Cost and Benefit Calculators				
E Recommendations Tool	Description	DATs for Crop Farming Syste	ems	DATs for Livestock Farmi	ng Systems
Cost and Benefit Calculators	DATs for Crop Arable	~		Crop Calculator Modules	
Benchmarking Tool	Farm Management Information Systems (FMI: Systems (DSS). Quality Management Systems	S) and applications (inc. Decision Support (QMS))	€ INVESTMENT	Cost Calculator Module	Recalculate
	Guidance / Controlled Traffic Farming (CTF) te	chnologies	Years of usage	0.00 Total cost of pu	irchase (€)
	Reacting or Variable Rate Technologies (VRT)			0.00 Costs saving (€)	)
	<ul> <li>Recording or Mapping technologies (inc. moni (RTLS))</li> </ul>	itoring systems. real-time location systems	Total area (ha)	Return on inves	stment (%)
	B Robotic Systems or Smart Machines (inc. Artif	icial Intelligence (AI))	Number of units se	nsors Net benefit (€)	()



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FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming Systems	Г		DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle	~		Livestoc	k Calculator Modules	
Benchmarking Tool	Automatic Milking Systems	€		Cost Calculato	r Module	Recalculate
	Automatic Oestrus Detection     Automatic Feeding Systems	Y	Years of usage	215	Initial cost of Investment (€)	
	Animal Behaviour. Monitoring. Health. Welfare & Disease	e Detection			Startup fee per animal (€)	

Figure 7 - DAT categories for Livestock Farming Systems

In each DAT category there are specific sub categories regarding the Farming practices (purpose) that each DAT carries out. The user needs to select the Farming Practice he wants to execute with a DAT. Examples are shown in **Figure 8** for Crop Farming Practices under the 'FMIS' DAT category and in **Figure 9** for Livestock Farming Practices under the 'Automatic Oestrus Detection' DAT category.

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FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming Systems		DATs for Livestock Farming Systems
Cost and Benefit Calculators	DATs for Crop Arable	~	с	rop Calculator Modules
Benchmarking Tool	Farm Management Information Systems (FMIS) an Systems (DSS). Quality Management Systems (QM:	nd applications (inc. Decision Support S))	€ INVESTMENT Cost Calcu Parameters	lator Module Recalculate
	Irrigation-DSS		Years of usage	0.00 Total cost of purchase (€)
	Monitoring- FMIS		Total area (ba)	0.00 Costs saving (€)
	Monitoring-FMIS		0	Return on investment (%) (i)
	Monitoring-FMIS		Number of units sensors 0	Net benefit (€) (i)
	Multipurpose-FMIS			
	Guidance / Controlled Traffic Farming (CTF) techno	ologies	Parameters	Result
	Reacting or Variable Rate Technologies (VRT)		Current yield (tons/ha)	6.00 Yield increase (%)
	Recording or Mapping technologies (inc. monitorin	ng systems. real-time location systems	0	0.00 Current revenue (€ in 1 year)
	(RTLS))		Market price (€/ton) 0	0.00 Increased yield (tons/ha)
	Robotic Systems or Smart Machines (inc. Artificial I	Intelligence (AI))		0.00 Price of increased vield (€/ha)

Figure 8 - Crop Farming Practices under the 'FMIS'

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FARMER TOOLKIT	Cost and Benefit Calculators				
Ecommendations Tool	Description DATs for Crop Farming Syst	ems		DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle		Livestoo	ck Calculator Modules	
-	Automatic Milking Systems	€ INVESTME	NT Cost Calculato	r Module	Recalculate
Benchmarking Tool	Automatic Oestrus Detection	Para	ameters	Result	
	monitoring and warning	Years of usage		Initial cost of Investment (€)	
	heat detection			Startup fee per animal (€)	
	heat and movement patterns detection and warning	Number of anim	nals	Monthly cost per animal (€)	
	Automatic Feeding Systems	Number of units	s sensors	Total cost of purchase (€)	
	Animal Behaviour. Monitoring, Health. Welfare & Disease Detection			Total Savings in years of usage (€)	

Figure 9 - Livestock Farming Practices under the 'Automatic Oestrus Detection'

After the user selects the Farming Practice then a list of DAT related to the selected Farming Practice appears. Examples are shown in **Figure 10** for Crop DATs under the 'Irrigation DSS' Crop Farming Practice in the 'FMIS' DAT category and in **Figure 11** for Livestock DATs under the 'Heat Detection' Livestock Farming Practice in the 'Automatic Oestrus Detection' DAT category.

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FARMER TOOLKIT	Cost and Benefit Calculators Description DATs f	or Crop Farming Systems	DATs for Livestock Farming Systems
Cost and Benefit Calculators	DATs for Crop Arable	~	Crop Calculator Modules
Benchmarking Tool	Farm Management Information Systems (FMIS) and applications (inc. Decisi Systems (DSS). Quality Management Systems (QMS))     Firigation-DSS     Plantae manager         ② Zen Agro         ③ CropX App     Monitoring-FMIS     Monitoring-FMIS     Monitoring-FMIS     Multipurpose-FMIS     Multipurpose-FMIS     Guidance / Controlled Traffic Farming (CTF) technologies     Reacting or Variable Rate Technologies (VRT)	on Support ● INVESTMENT Cost Calc Parameters Vears of usage 1 Total area (fra) 0 Number of units sensors 0 P YIELD Increase Calculat Parameters Current yield (tons/ha) 0 Market price (C/ton) 0	Result     Recalculate       0.00     Total cost of purchase (€)       0.00     Costs saving (€)        Return on investment (%)        Net benefit (€)        Result
	Recording or Mapping technologies (inc. monitoring systems. real-time loca (RTL5))     Robotic Systems or Smart Machines (inc. Artificial Intelligence (AI))	tion systems	0.00 Increased revenue (€ in 1 year)

Figure 10 - Crop DATs under the 'Irrigation DSS' Crop Farming Practice in the 'FMIS' DAT category

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FARMER TOOLKIT	Cost and Benefit Calculators		-		
Recommendations Tool	Description	DATs for Crop Farming Systems		DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle	~]	Live	stock Calculator Modules	
Benchmarking Tool	Automatic Milking Systems	€ IN	VESTMENT Cost Calcul	ator Module	Recalculate
	Automatic Oestrus Detection		Parameters	Result	
	monitoring and warning	Years	s of usage	Initial cost of Investment (€)	
	heat detection			Startup fee per animal (€)	
	③ AfiAct II	() Num	ber of animals	Monthly cost per animal (€)	
	Ovalert	(i) Num	ber of units sensors	Total cost of purchase (€)	
	heat and movement patterns detection and warning			Total Savings in years of usage (€	)
	Automatic Feeding Systems			Return on investment (%)	(1)
	Animal Behaviour. Monitoring. Health. Welfare & Disease Det	ection		Net benefit (€)	()

Figure 11 - Livestock DATs under the 'Heat Detection' Livestock Farming Practice in the 'Automatic Oestrus Detection' DAT category

#### **DAT Evaluation Process**

At this stage the user will select one DAT (by clicking in on it) from the list that matches their farming system, DAT category, and crop or livestock type and the evaluation process will begin moving to the next functionality for user's data entering. Next to each DAT there is an (i) icon which includes specific information for the selected DAT. Examples can be found in **Figure 12** for 'Plantae Manager' in Crop DATs and in **Figure 13** for 'Ovalert' in Livestock DATs.

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FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming System	IS	D	ATs for Livestock Farming Systems					
Cost and Benefit Calculators	DATs for Crop Arable	~		Crop C	alculator Modules					
Benchmarking Tool	Farm Management Information Systems (FMIS Systems (DSS). Quality Management Systems ( Irrigation-DSS Plantae manager Click me! Click me! Click me! Click me! Monitoring-FMIS	5) and applications (inc. Decision Support (QMS))	€ INVESTMENT ( Parametr Years of usage d Total area (ha) y Number of units sensor 0	s	Module         Result           0.00         Total cost of purchase (€)           0.00         Costs saving (€)            Return on investment (%)            Net benefit (€)	Recalculate				
	Monitoring-FMIS Monitoring-FMIS Multipurpose - DSS/ FMIS		YIELD Increase Paramete Current yield (tons/ha)	e Calculator Moc	Iule Result 11.00 Yield increase (%)					
	Multipurpose-FMIS		0		0.00 Current revenue (€ in 1 vear	1				

Figure 12 - 'Plantae Manager' in Crop DATs

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ARMER TOOLKIT	Cost and Benefit Calculators				
Recommendations Tool	Description	DATs for Crop Farming Systems		DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle	~	Live	stock Calculator Modules	
	Automatic Milking Systems	€	INVESTMENT Cost Calcu	lator Module	Recalculate
Benchmarking Tool	Automatic Oestrus Detection		Parameters	Result	
	monitoring and warning	· · · · · · · · · · · · · · · · · · ·	/ears of usage	Initial cost of Investment (€)	
	heat detection			Startup fee per animal (€)	
	AfiAct II	0	Number of animals	Monthly cost per animal (€)	
	Ovalert     Click me!		Number of units sensors	Total cost of purchase (€)	
	heat and movement patterns detection and warning	Click mol		Total Savings in years of usage (€)	
	Automatic Feeding Systems	Click me!		Return on investment (%)	()
	Animal Behaviour. Monitoring, Health. Welfare & Disease Detectio	n		Net benefit (€)	(i)

Figure 13 - 'Ovalert' in Livestock DATs

The following figures showing the information provided for 'Plantae Manager' in Crop DATs (**Figure 14**) and for 'Ovalert' in Livestock DATs (**Figure 15**) after the user click on the (i) icon.

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		Plantae manage	2r			цэ 1
FARMER TOOLKIT	Cost a	Plantae Manager is use efficiency. The s growth stage. and m	an irrigation decision support system (DSS) designed to help farmers optimize their irrigation practices and improve water oftware collects data on a range of factors that can impact irrigation. Including soil moisture. weather conditions. crop orce. Based on this data. Planta e Manager provides recommendations on when and how much to irrigate, as well as tools	estock Fari	ning Systems	
Cost and Benefit Calculators	DATs for Arable	for creating irrigatio irrigation. sprinkler i equipment to provid	n schedules and monitoring water use. The software is designed to work with a range of irrigation systems. Including drip irrigation, and pivot systems. It can also integrate with weather stations. soil moisture sensors, and other monitoring le real-time data and insights. Overall. Plantae Manager is a comprehensive irrigation DSS that can help farmers save	Modules	Modules	
Benchmarking Tool	Fa Su	water. reduce costs.	and improve crop yields.			Recalculate
-		DAT Category Farm Management Information Systems (FMIS) and applications (inc. Decision Su Management Systems (OMS))	Farm Management Information Systems (FMIS) and applications (inc. Decision Support Systems (DSS). Quality Management Systems (QMS))	atal cost of	Result	
	¢	Purpose for	Irrigation-DSS	Juli Cost of	purchase (e)	
	fe.	Livestock / Crop ty	Livestock / Crop type arable.vegetables.orchards		(€)	
	4	Cost info	700euro/year	eturn on in	/estment (%)	
	45	Provider	Plantae	et benefit (	ε)	()
		Platform				
					Result	
			Close	ield increa	se (%)	
	-	a to the second				•

Figure 14 - Information provided for 'Plantae Manager' in Crop DATs

o SquantiFarm Scolkit	≡	A Qualant			ර
	Cost	😒 Ovalert	,	< compared with the second sec	
Recommendations Tool	COSU	Ovalert is a reprodu behavior and physic	ctive management system developed by SCR Dairy for dairy farms. It uses sensors and data analysis to monitor cow logical indicators related to reproduction. By analyzing cow activity and other factors. Ovalert helps farmers detect optimal	astock Farming Systems	
Cost and Benefit	DATs for Cattle	and data analysis fe	tes and improve reproductive endency in den rends, it provides near detection, near intensity scoring, nearth monitoring, atures to assist farmers in making informed decisions for better herd fertility.	or Modules	
Culculators		DAT Category	Automatic Oestrus Detection		
Benchmarking Tool	Au	Purpose for	heat detection	Recalcula	ate
	🗁 Au	Livestock / Crop ty	pe Dairy cows	Result	_
		Cost info	€2.925	cost of Investment (€)	
		Provider	CRV	ıp fee per animal (€)	
	¢	Platform		nly cost per animal (€)	
	¢			cost of purchase (€)	
			Close	Savings in years of usage (€)	
	🖿 Au	tomatic recurry systems	Kt	turn on investment (%)	(i)

Figure 15 - Information provided for 'Ovalert' in Livestock DATs

#### Entering DATA & System Analysis.

After the user has select a DAT he can start using the calculator modules at the right side of the screen by entering the requested data in the 'Parameters' section in each module. When the user starts putting data then each calculator module starts the system analysis by calculating and providing results. Examples for Livestock and Crop calculator modules highlighting the 'Parameters' sections are shown in **Figure 16** and **Figure 17** respectively.

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FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming S	ystems	_		DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Crop Arable		•		Crop (	Calculator Modules	
Benchmarking Tool	<ul> <li>Farm Management Information Systems (FMIS) and application Management Systems (QMS))</li> <li>Irrigation-DSS</li> </ul>	ns (inc. Decision Support Systems (DSS). Quality	€	INVESTMENT Cost Calo Parameters	culator Module	Result	Recalculate
	<ul> <li>Plantae manager</li> <li>Zen Agro</li> </ul>	(		otal area (ha)		0.00 Total cost of purchase (€) 0.00 Costs saving (€) 	0
	<ul> <li>CropX App</li> <li>Monitoring- FMIS</li> </ul>	(		umber of units sensors		Net benefit (€)	0
	Monitoring-FMIS Monitoring-FMIS		YIELD Increase Calculator Module     Parameters     Result				
	Multipurpose - DSS/ FMIS Multipurpose-FMIS	TF) technologies VRT)	0 M	urrent yield (tons/ha) arket price (€/ton)		<ul><li>11.00 Yield increase (%)</li><li>0.00 Current revenue (€ in 1 year)</li></ul>	
	Guidance / Controlled Traffic Farming (CTF) technologies     Reacting or Variable Rate Technologies (VRT)		ame (PTI S))			0.00 Increased yield (tons/ha) 0.00 Price of increased yield (€/ha)	
	Robotic Systems or Smart Machines (inc. Artificial Intelligence (	ear-ume location systems (ki LS)) Al))	ě	FERTILIZER Use Reduct	tion Calculator M	lodule	
			Fe	Parameters ertilizer usage (kg/ha)		Result 16.40 Fertilization saving (%)	
			Fe	ertilizer cost (€/kg)		<ul><li>55.00 Current fertilization (€/ha)</li><li>9.20 Reduced fertilizer usage (kg/ha)</li></ul>	

Figure 16 - Crop calculator modules Parameters' sections

≪QuantiFarme Toolkit	≡		Ę	3
FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming Systems	DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle	× .	Livestock Calculator Modules	
Benchmarking Tool	Automatic Milking Systems Automatic Oestrus Detection monitoring and warning heat detection Affact II Ovalert heat and movement patterns detection and warning heat and movement patterns detection and warning Automatic Feeding Systems Animal Behaviour. Monitoring. Health. Welfare & Disease Detection	€ INVESTMENT Cos Parame Years of usage Number of animals Number of units sensors	Act Calculator Module     Recalculate       ters     Result        Initial cost of Investment (€)        Startup fee per animal (€)        Total cost of purchase (€)        Total Savings in years of usage (€)        Return on investment (%)        Return on investment (%)	
		MILK YIELD Incre Parame Average milk price per lit Average liters of milk pro LABOR Cost Redu Parame Current Labor Cost (€ in	Ase Calculator Module	

Figure 17 - Livestock calculator modules Parameters' sections

#### Presentation of the Results

When the user has completed the data entering process he needs to press the 'Recalculate' blue button (in Green circle) to see the results of all the calculator modules which is presented in the 'Results' section. Examples for Livestock and Crop calculator modules highlighting the 'Results' sections are shown in **Figure 18** and **Figure 19** respectively.

%QuantiFarm <sup>€</sup> Toolki	t≡				\$
FARMER TOOLKIT	Cost and Benefit Calculators Description	DATs for Crop Farming Syste	ems	DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Crop Arable	~		Crop Calculator Modules	Click me!
Benchmarking Tool	Farm Management Information Systems (FMIS) and applicatio Management Systems (QMS))	ons (inc. Decision Support Systems (DSS). Quality	€ INVESTMENT Cost Calco Parameters	ulator Module	Recalculate
	<ul> <li>Irrigation-DSS</li> <li>Plantae manager</li> </ul>	Û	Years of usage	0.00 Total cost of purchase (€)	
	<ul> <li>Zen Agro</li> <li>CropX App</li> </ul>	0	Total area (ha)	Return on investment (%)	()
	Monitoring- FMIS	U	Number of units sensors	Net benefit (€)	(i)
	Monitoring-FMIS Monitoring-FMIS		YIELD Increase Calculate		
	Multipurpose - DSS/ FMIS		Current yield (tons/ha)	11.00 Yield increase (%)	
	Multipurpose-FMIS     Guidance / Controlled Traffic Farming (CTF) technologies		Market price (€/ton)	0.00 Current revenue (c in 1 year)	
	<ul> <li>Reacting or Variable Rate Technologies (VRT)</li> <li>Recording or Mapping technologies (inc. monitoring systems.)</li> </ul>	real-time location systems (RTLS))		0.00 Price of increased yield (€/ha) 0.00 Increased revenue (€ in 1 year)	
	Robotic Systems or Smart Machines (inc. Artificial Intelligence)	(AI))	E FERTILIZER Use Reducti	on Calculator Module	
			Parameters	16.40 Fertilization saving (%)	
			Fertilizer cost (£/kg)	55.00 Current fertilization (€/ha)	
			renditzer cost (erkg)	9.20 Reduced fertilizer usage (kg/ha)	

Figure 18 - Crop calculator modules 'Results' sections

≪QuantiFarm  Toolkit	: =					Ô
FARMER TOOLIGT	Cost and Benefit Calculators Description	DATs for Crop Farming Systems			DATs for Livestock Farming Systems	
Cost and Benefit Calculators	DATs for Livestock Cattle	~		Livestoc	k Calculator Modules	Click me!
Benchmarking Tool	Automatic Milking Systems  Automatic Oestrus Detection  monitoring and warning  heat detection  AffAct II  Automatic Feeding Systems  Automatic Feeding Systems  Animal Behaviour. Monitoring. Health. Welfare & Disease Detection	€ IN Year O Nurr	INVESTMENT Cost Calculator Module Parameters Years of usage Number of animals Number of units sensors Number of units sensors			Recalculate
		Aver Aver 22 L	MILK YIELD Increas Paramete rage milk price per liter rage liters of milk prod ABOR Cost Reduce Paramete rent Labor Cost (€ in 1	se Calculator Module ers rr (CI) duced per cow per ttion Calculator Modu ers year)	Result     Result     Milk Yield increase (%)     Price of Milk Yield in one year (€)     Price of Increased Milk Yield in one year     Increased Revenue (€ in 1 year)     Result     Labor saving (%)     Labor saving (€ in 1 year)	6

Figure 19 - Livestock calculator modules 'Results' sections

Specifically in the 'Investment Cost Calculator Module' regarding the 'Return on Investment (ROI)' and the 'Net benefit' result the user can press the (i) icons next to them to read some information for these values. Example for the ROI result information is shown in **Figure 20**.

⇔QuantiFarme Toolki	t≣		×	1	@
FARMER TOOLKIT	Cost and Benefit Calcu	Return on Investment (ROI) is a financial metric used to evaluate the efficiency and profitability Technologies (DATs). Expressed as a percentage, the ROI figure indicates the return you can ex- concenting for the perce of the investment	DATs for Livestock Farming Systems		
Cost and Benefit Calculators	DATs for Crop Arable	A positive ROI means you are gaining more value from the DAT than it costs to implement. For invested, you're getting \$1.20 back in returns. On the other hand, a negative ROI indicates a loc	ry \$1 • benefits		
Benchmarking Tool	Farm Management Informa Management Systems (QMS	it provides to your farming operations. Understanding the ROI of a DAT can help you make informed decisions about which technolog	Result	Recalculate	
	Plantae manager     Close		Close	0.00 Total cost of purchase (€) 0.00 Costs saving (€)	Click me!
	Zen Agro     Croox Ann	U	Total area (ha)	Return on investment (%)	
Monitoring-FMIS		•	Number of units sensors	Net benefit (€)	Ū

Figure 20 - Example for the ROI result information

## Crop Farming Example

The following **Figure 21** provides an example with a cotton farmer and the data that needs to enter in the crop calculator modules to estimate the potential benefits of the DAT he/ she selected will provide specifically for his/ her farm.

### Crop Farming Example - A Cotton Farmer in Greece

Meet Yiannis, a dedicated cotton farmer in in the rural plains of Greece. Overseeing 10 hectares of fertile land, he is keen on embracing technology to boost his farm's productivity.

Adopting New Technologies:

- Yiannis eyes the future, considering the integration of a DAT (<u>AutoTrac Controller</u>) for the next 3 years.
- Years of Usage of DAT: 3 years
- Number of Units: 1 unit for his field operations
- Farm's Snapshot:
  - Total Area (ha): 10 hectares
  - Current Yield (tons/ha): 2 tons
  - Market Price (€/ton): €600
  - Fertilizer: Uses 600 kg/ha at €1.5/kg
  - Water Usage: 800 m³/ha at €0.8/m³
  - Pesticide: 2 kg or I/ha at €24/kg or I
  - Labour Cost: €15,000/year
  - Fuel Cost: €5,000/year



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Figure 21 - Example with a cotton farmer

The following Figure 22 presents the results from the Crop Calculator modules after entering Yiannis' farm data.

ာာား Toolkit	: =							Ø
FARMER TOOLKIT	Cost and Benefit Calculators							
Recommendations Tool	Description		DATs for Crop Farmin	ng Syster	ns	DATs for Livesto	ck Farming Systems	
Cost and Benefit Calculators	DATs for Crop Arable			*		Crop Calculator Module	5	
Benchmarking Tool	Farm Management Information Systems (FMIS)	and applications	(inc. Decision Support Systems (DSS). Quality		€ INVESTMENT Cost Calcu	lator Module		Recalculate
-	management systems (QmS))	hand had here			Parameters		Result	
	Guidance / Controlled Traffic Farming (CTF) teo	nnoiogies			Years of usage 3	12500.00 Tot	al cost of purchase (€)	
	Autosteering				Total area (ha)	27927.00 Cos	ts saving (€)	
	GPS Guidance System	Q.			10	74.47 Ret	urn on investment (%)	0
	JY100 Tractor GNSS Guidance System			()	Number of units sensors	15427.00 Net	benefit (€)	()
	S AutoTrac Controller			0				
	Autosteering-FMIS				YIELD Increase Calculato	r Module		
	GPS GPS				Parameters		Result	
	Autosteering - VRA seed and fertilizer				Current yield (tons/ha) 2	12.50 Yield	l increase (%)	
	Reacting or Variable Rate Technologies (VRT)				Market price (€/ton)	12000.00 Curr	ent revenue (€ in 1 year)	
	Recording or Mapping technologies (inc. monit	oring systems. rea	al-time location systems (RTLS))	600	2.25 Incre	eased yield (tons/ha)		
	Robotic Systems or Smart Machines (inc. Artific	cial Intelligence (AI))			1350.00 Price	e of increased yield (€/ha)		
						1500.00 Incre	eased revenue (€ in 1 year)	
	FERTILIZER Use Reduction Calculator	Module		PESTICIDE Use Reduction Calculator Module				
	Parameters		Result		Parameters		Result	
	Fertilizer usage (kg/ha)	12.50	Fertilization saving (%)		Pesticide usage (kg or lt/ha) 2	5.00 Pesticide s	aving (%)	
	800	900.00	Current fertilization (€/ha)		Pesticide cost (€/kg or It)	48.00 Current pe	sticide cost (€/ha)	
	Fertilizer cost (€/kg) 1.5	525.00	Reduced fertilizer usage (kg/ha)		24	1.90 Reduced p	esticide usage (kg or lt/ha)	
		112.50	Fertilizer cost saving (€/ha)			2.40 Pesticide co	ost saving (€/ha)	
		1125.00	Fertilization cost saving (€ in 1 year)			24.00 Pesticide co	ost saving (€ in 1 year)	
					** I AROR Cost Poduction C	algulator Mogulo		
		ule			Parameters		Result	
	Parameters		Result		Labor cost (€/year)	8.00 Labor	saving (%)	
	Water usage (m3/ha)	65.00	Water saving (%)		15000	1200.00 Labor	cost saving (€ in 1 year)	
	800	640.00	Current irrigation cost (€/ha)					
	Water cost (€/m3) 0.8	280.00	Reduced water usage (m3/ha)		FUEL Cost Reduction Cale	culator Module	Desult	
		416.00	Water cost saving (€/ha)		Fuel cost (Øyear)	26.00 Fuels	saving (%)	
		4160.00	Water cost saving (€ in 1 year)		5000	1300.00 Fuel	cost saving (€ in 1 year)	

Figure 22 - Results from the Crop Calculator modules

### Livestock Farming Example

The following **Figure 23** provides an example with a livestock farmer and the data that needs to enter in the livestock calculator modules to estimate the potential benefits of the DAT he/ she selected will provide specifically for his/ her farm.



Figure 23 - Example with a cattle farmer

The following Figure 24 presents the results from the Livestock Calculator modules after entering Maria's farm data.

≪QuantiFarm  Toolkit	: =			©
FARMER TOOLKIT	Cost and Benefit Calculators			
Recommendations Tool	Description	DATs for Crop Farming Syste	ems	DATs for Livestock Farming Systems
-	DATs for Livestock		Livert	tock Calculator Modulos
Cost and Benefit Calculators	Cattle	~	Livest	our calculator moutles
	Automatic Milking Systems		€ INVESTMENT Cost Calculator Module	e Recalculate
Benchmarking Tool	Automatic Oestrus Detection		Parameters	Result
	Automatic Feeding Systems		Years of usage 5	180000.00 Initial cost of Investment (€)
	Automatic Feeding		Number of samely	0.00 Startup fee per animal (€)
	Pitstop BASIS mineral feeder	0	100	0.00 Monthly cost per animal (€)
	② Lely Vector	0	Number of units sensors	180000.00 Total cost of purchase (€)
	Triomatic T30 feed kitchen		·	400375.00 Total Savings in years of usage (€)
	② Lely Calm automatic calf feeder	0		44.49 Return on investment (%)
	Jeantil Automatic Feeding	0		220375.00 Net benefit (€) ①
	Feeding Robot			
	FEED Use Reduction Calculator Modu	ıle	MILK YIELD Increase Calculator Mode	le
	Parameters	Result	Parameters	Result
	Current Feed Cost (€ in 1 year) 40000	33.00 Feed saving (%)	Average milk price per liter (€/l) 0.60	10.00 Milk Yield increase (%)
	Current Feed Waste Cost (€ in 1 year)	13200.00 Feed Cost Saving (€ in 1 year)	Average liters of milk produced per cow per	438000.00 Price of Milk Yield in one year (€)
	3000	0.00 Feed Waste Saving (%)	20	481800.00 Price of Increased Milk Yield in one year (€)
		0.00 Feed Waste Cost Saving (€ in 1 year)		43800.00 Increased Revenue (€ in 1 year)
			Parameters	Result
	ANTIBIOTICS Use Reduction Calculate	pr Module	20000	79.00 Labor saving (%)
	Parameters	Result		15800.00 Labor cost saving (€ in 1 year)
	Current Antibiotics Cost (€ in 1 year) 7000	0.00 Antibiotics Saving (%)	ENERGY Cost Reduction Calculator M	hdule
		0.00 Antibiotics Cost Saving (€ in 1 year)	Parameters	Result
	* NORTHITY D + D		Current Energy Consumption (kWh)	97.00 Energy saving (%)
	MORIALITY Rate Decrease Calculato Parameters	Result	Cost of Energy per Wh (E)	7500.00 Current Cost of Energy (€ in 1 year)
	Current Mortality Cost (€ in 1 year)	0.00 Mortality Rate Decrease (%)	0.15	7275.00 Energy Cost Savings (€ in 1 year)
	2000	0.00 Mortality Cost Saving (€ in 1 year)		
			WATER Use Reduction Calculator Mod	cule
	📸 PROFITABILITY Increase Calculator N	odule	Parameters	Kesuit
	Parameters	Result	5000	0.00 water saving (%)
	Current Profitability (€ in 1 year)	0.00 Profitability Increase (%)		0.00 Water Cost Saving (€ in 1 year)
	5000	0.00 Profit Increase in 1 year (€)		0.00 Profit per animal per year (€)
				0.00 From per animal increase in Fyear (e)

# End of the

# 'Cost & Benefit Calculators' Tool

Manual