



Science For A Better Life

CHÂTEAU LAMOTHE DE HAUX

FRANCE



ONE STEP
AHEAD WITH
SUSTAINABLE
AGRICULTURE

Bayer  ForwardFarming



CONTENTS

Page

BAYER FORWARD FARMING

Introduction

4

THE FARM

Château Lamothe de Haux

6

INTEGRATED CROP SOLUTIONS

Vineyard management,
Crop protection products and services

8

PROACTIVE STEWARDSHIP

Product Integrity, Human Protection
and Environmental Preservation

14

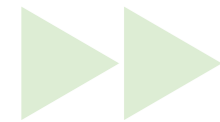
PARTNERSHIPS

Working together for Sustainable Agriculture

18

HOW TO TACKLE THE CHALLENGES OF MODERN AGRICULTURE AND SOCIETY'S EXPECTATIONS

The simple answer is through innovative solutions for sustainable agriculture. In cooperation with farmers, Bayer CropScience demonstrates these through Bayer ForwardFarming, the knowledge platform for sustainable agricultural practice.



Selected farms share their expertise and on-going improvements as they combine the economic success of their farm business with responsibility towards the environment and society.

Population growth, the increasing demand for more and better food, decreasing arable land per capita, limited natural resources, and climate change – the world of farming faces numerous challenges. At Bayer we believe that sustainable agriculture is the best way to overcome these challenges and raise both productivity and environmental compatibility. Our experts help to address agriculture's top challenges and work on innovative solutions to sustainably secure global food supplies.

Bayer CropScience is one of the world's leading innovative crop science companies in the fields of seeds, crop protection, and non-agricultural pest control. We support farmers around the world with innovative solutions designed to meet the growing demand for high-quality food and animal feed, fiber, and renewable raw materials.

Bayer CropScience's core competency is in developing tailored solutions focused on improving crop productivity and quality. Bayer CropScience supplies farmers with the tools, technology, and training they need to prosper in the long term. To help ensure safe use of Bayer CropScience's products we have defined a global Product Stewardship policy covering the entire life cycle of a product. Together with external stakeholders along the value chain, Bayer CropScience is working for sustainable agriculture.

With Bayer ForwardFarming, the knowledge platform for sustainable agricultural practices, we are expanding the exchange of knowledge between farmers, Bayer CropScience, and other stakeholders (consumers, politicians, academics, etc.) in order to continuously improve the state of knowledge concerning sustainable agricultural practices, and to promote the benefits farmers bring to consumers and society through sustainable farming.

The farms involved in Bayer ForwardFarming – the Bayer ForwardFarms – make use of three basic mechanisms:

- **Integrated Crop Solutions** with high-quality seeds and crop protection products (chemicals and biologicals) to protect the yield and quality of agricultural commodities. These solutions are backed by tailored services ranging from agronomic support, field demonstrations, diagnosis and prediction tools to documentation.
- **Proactive Stewardship** to ensure product integrity (for seeds and crop protection products), protect human health, and preserve the environment. We offer training to raise standards of handling and usage, as well as to minimize any possible risks to human health and the environment.
- **Partnerships** to enhance the quality of life for farmers, communities, and society. Mutually beneficial partnerships that include all the players in the value chain and help to leverage the potential for collaboration in modern agriculture.

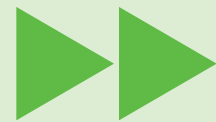


BAYER FORWARD FARMING – DEMONSTRATING SUSTAINABLE AGRICULTURE IN PRACTICE

Many skills are needed to grow an agricultural business in a sustainable way, but normally they exist separately with little integration between them. Bayer ForwardFarming is an advanced farming concept that unites all these competencies into a single holistic system.

HOW TO RECONCILE PRODUCTION WITH SUSTAINABILITY

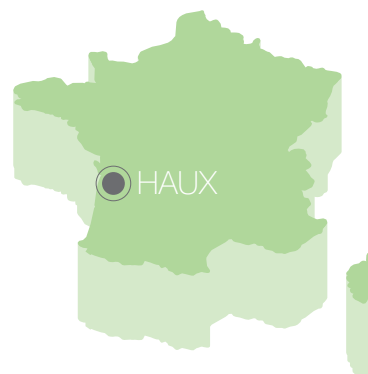
Château Lamothe: Connecting to a knowledge platform like Bayer ForwardFarming provides innovative solutions for sustainable agriculture.



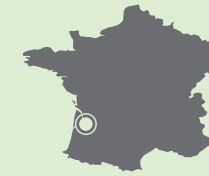
“At Château Lamothe in the commune of Haux in the heart of the Bordeaux vineyard, we cultivate 75 ha of vineyards on limestone-clay slopes. These grapes are directly processed on our estate where we produce 500,000 bottles a year. Our family has stewarded this estate for four generations, and sustainability has always been key. Our mother still welcomes guests and oversees the Château, while our daughter is the one who drew the logo for the bottle labels when she was five. We also named our main wine brand after her: Valentine.

As a Bayer ForwardFarm, we have the opportunity to work with leading experts who help us to improve our farming practice in order to better protect the environment and increase our productivity. Another objective was for us to start a dialog with the local community about the benefits of modern agriculture and how to work better together. Over the last three years we have met with the mayor of our village, direct neighbors and beekeepers, and were astonished how much an open dialog helped to increase the appreciation for our farming business.

Moreover, we not only sell our wine in Europe but we also export almost 90 % of our production to North America and Asia. Our customers in these regions appreciate knowing where our wine is from and how it has been crafted. Bayer ForwardFarming helps us to build and maintain this trust, as we have a shared belief: “Sustainable agriculture is about continuous improvements in farm practices that lay the foundations for the next generation.”



DAMIEN CHOMBART



REGION, COUNTRY

Haux, near Bordeaux, France



HISTORY

Château Lamothe’s foundations date back to the 16th century. Since 1956, four generations of the same family have managed Château Lamothe: the Perriquets, then the Néels, and now the Chombarts.

CROPS

Wine Grapes



SOIL

Limestone-clay on slopes in the heart of the Bordeaux wine region.



PARTNERS

Berthoud, French Vine and Wine Institute, Vitinnov, bee keeper



CUSTOMERS

Export 90 % to North America and Asia

Working with a sustainable business model:

“I committed to cooperating with Bayer to move forward towards a truly sustainable agriculture. Combining their expertise and our experience has allowed me to progress and evolve towards this agriculture of the future. Talking to the other farms in the Bayer ForwardFarming network also nourishes my thinking and actions.

This initiative allows me to show that viable viticulture and winemaking can advance side by side with respect for the environment and people.”



HOW TO CONTINUOUSLY IMPROVE SUSTAINABILITY AT A SUCCESSFUL FARMING BUSINESS

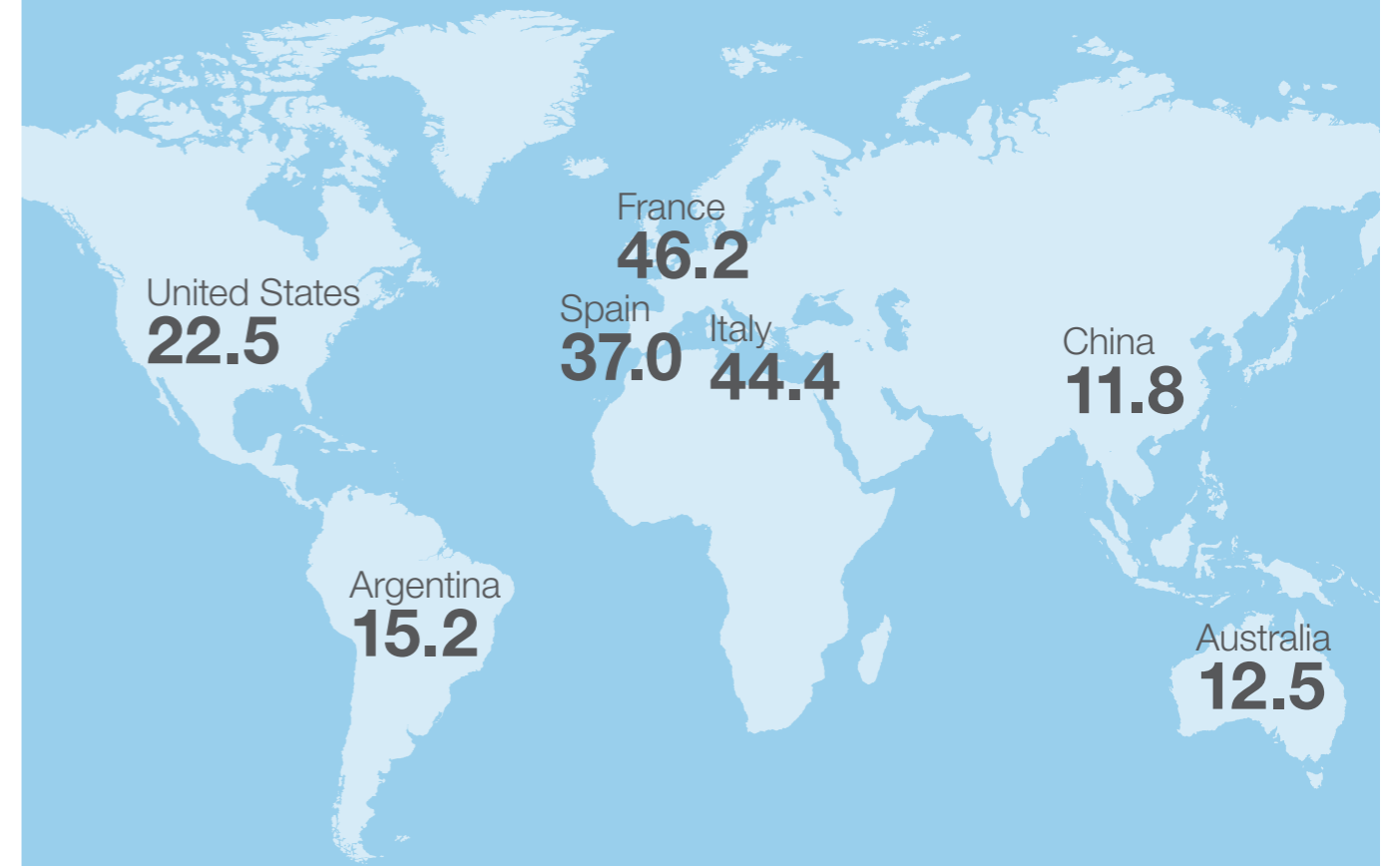
This is made possible through integrated crop solutions that include crop protection products and customer-tailored services. An example of an integrated solution for wine grape production is described on the following pages.



GLOBAL WINE GRAPE PRODUCTION

MAIN COUNTRIES OF PRODUCTION

For some countries, like France, vine-growing is a major agricultural activity. As shown by the OIV (International Organisation of Vine and Wine) 2014 statistics, the three main players are France, Italy and Spain, covering nearly half of world wine production. However, other countries, including the United States, Argentina and China, are continuing to increase production.



Vine production (Mhl)
Global production: 271 Mhl
Source: International Organisation of Vine and Wine

INTEGRATED CROP SOLUTION FOR WINE GRAPES

PRODUCTIVE, PROFITABLE, AND ENVIRONMENTALLY FRIENDLY

Château Lamothe produces premium grapes for great wines with focus on:

- Choice of grape varieties and rootstock
- Soil and fertilization
- Soil maintenance
- Protection from disease
- Harvesting quality yield

CHOICE OF GRAPE VARIETIES AND ROOTSTOCK

The choices a winegrower has to make from planting to harvesting are many and fundamental. The first choice is the grape variety and rootstock, as they need to be adapted to the terroir. The minimum lifespan of a vine is 30 years.

The rootstock is an essential contributor to successful planting. It needs to be chosen to suit the soil so that its vigor can be controlled as this plays an important role in the quality of the yield.

The rootstock used is mainly Fercal because it is resistant to ferric chlorosis induced by very calcareous soils; other rootstocks, including 101-14 MG and 3309 C, are also used for their grape quality attributes.

In Bordeaux, the appellation wines are a blend of several grape varieties. That is why at Château Lamothe you will find Merlot, Cabernet Sauvignon and Cabernet Franc for the reds and Sauvignon Blanc, Sémillon and Muscadelle for the whites.

Planting density varies from 5,000 vines/ha for the red varieties to 4,500 vines/ha for the whites. This allows for quality wines to be crafted at a production cost according to the Cadillac Côtes de Bordeaux appellation.

SOIL AND FERTILISATION

At Château Lamothe the soil is mainly limestone-clay with some clay-gravel to gravelly soil. A soil analysis is carried out before planting a new plot to determine the most suitable rootstock and fertilization. Other soil or leaf analyses are carried out once the vineyards are established.

The soil type and its composition vary from one plot to another. Fertilization has to be adapted to these circumstances. Fertilization is mainly done in organic form, which preserves the soil's characteristics and agronomic properties and maintains the macrobiotic biomass (the soil's biological functioning). In autumn the organic matter is incorporated in every two rows of vines after having de-compacted the soil. Depending on specific occasional needs, there may be some mineral input – phosphate, magnesium and potassium – applied either to the soil or onto the leaves.

SOIL MAINTENANCE

At Château Lamothe, the entire vineyard has been grassed between the rows of vines since the 1980s. This limits erosion and improves wine quality, but as grass competes for nutrients and could reduce yield, we need to manage competition. Therefore, the bottom of the vines are weeded; weeding is done by chemical means in spring and by mechanical means throughout the summer. The grass between the rows of vines is mowed.

PROTECTION FROM DISEASES

Mildew, powdery mildew and botrytis are the main vine diseases. The possible harm to both the quality and quantity of the yield can be very significant if the weather conditions are unfavorable. These fungi are present in all French vineyards.

At Château Lamothe, vine pruning in winter, fertilization management, soil maintenance and work during the growing season (suckering, training, thinning, etc.) are prophylactic means of fighting fungal infection and producing quality grapes. These are complemented by an integrated crop protection solution consisting of innovative products such as Profiler®, Luna Sensation® and Corail®. This solution is based on a professional resistance management strategy to ensure the long-term availability of different modes of action. They are chosen to alternate the modes of action of the products to avoid disease resistance. They are applied, if necessary and at the right time, with backup from the Movida® decision making tool. In French viticulture, the only disease that is mandatory to treat is flavescence dorée. At Château Lamothe two treatments are necessary to combat this disease.

Vine wood diseases, which are present in all French vineyards, include a number of diseases under the same name: Esca, BDA (Black Dead Arm) and grape canker, which may cause the infected vine to wither. The harm caused by these diseases is significant and increasing throughout Europe. 40-50% of French vineyards are infected and two out of three winegrowers are affected. Protection against vine wood diseases is carried out as a precautionary measure, depending on the characteristics of each plot (grape variety, age, vigor, etc.).

In order to help winegrowers combat these vine wood diseases, Bayer has developed Esquive®WP, a bio-control solution that is effective against the ESCA/BDA/grape canker complex. The strategy at Château Lamothe is to pull up and burn any infected vines and protect young plots with Esquive®WP.

HARVESTING QUALITY YIELD

Getting a quality grape yield requires yearlong preparation using different vine tending techniques (from pruning, via fertilization and suckering, to leaf and grape thinning), a disease combat strategy and the ripeness of the grapes at harvest. Harvesting is mixed – mostly mechanical, but also manual for some plots of liqueureux (sweet) white and for the top-quality red wine sold as Valentine.



SERVICES

APPLICATION TECHNOLOGY

IMPORTANCE

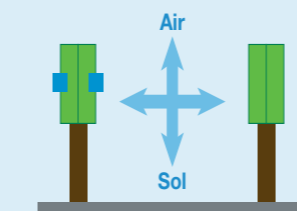
Spraying accuracy is the major factor determining the efficacy of crop protection products, influencing environmental protection and user safety, as well as showing consideration for the neighborhood.

MEASUREMENT OF OUTPUT FACTORS

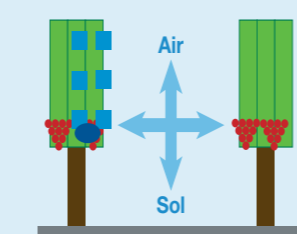
This study measures the amount of the product deposited on the vegetation, on the ground and in the air. Therefore double-sided sensors positioned at different heights and depths of the vegetation, plus a tracer to quantify deposits by spectrophotometric means were used.

Measure of fuel consumption

Measure of the noise level in the cabin and at different distances (25 m, 50 m and over).



1st growing stage
At the 1st growth stage (5-6 leaves): the amount covering the upper and lower leaf surfaces is homogeneous.



2nd growing stage
At the 2nd growth stage (lead shot) with denser vegetation: the deposited amount is greater on the upper leaf surface.

IMPLEMENTED ACTIONS

- To improve the accuracy of the sprayer used in Château Lamothe a study was carried out together with a technician from BERTHOUD® and in close cooperation with IFV (French Institute of Vine and Wine).
- This study covered two growth stages of the vine.

RESULTS

- Pneumatic sprayer (one side at a time) ensures good coverage with over 70% reaching the target.
- Coverage can be improved by positioning the inter-line sprayer closer to the vegetation.
- Development of the vineyard: the sprayer is suitable for vineyard spacing at 2m instead of 2.50m.
- Compliance gained with the with the ear protection 77/311 standard (86 dB) in the working phase
- As a result of non-compliance in the standard idling phase, corrective measures were introduced to limit vibrations and the noise pollution in the cabin.

With the help of specialists like the IFV and BERTHOUD®, it has been possible to improve spraying quality and accuracy through better knowledge of spraying practices and equipment capabilities, which has also resulted in energy savings and noise reduction.

NEXT STEPS

Following on from the measures relating to the quantities of products deposited on the vines, the main lever identified is the replacement of 'old generation' AB MOST booms with 'new generation' AB MOST booms, which are better adapted to the distance between rows of vines here (2.5 m). New appraisals will be carried out in 2015 with the results being compared to the first figures from 2013.

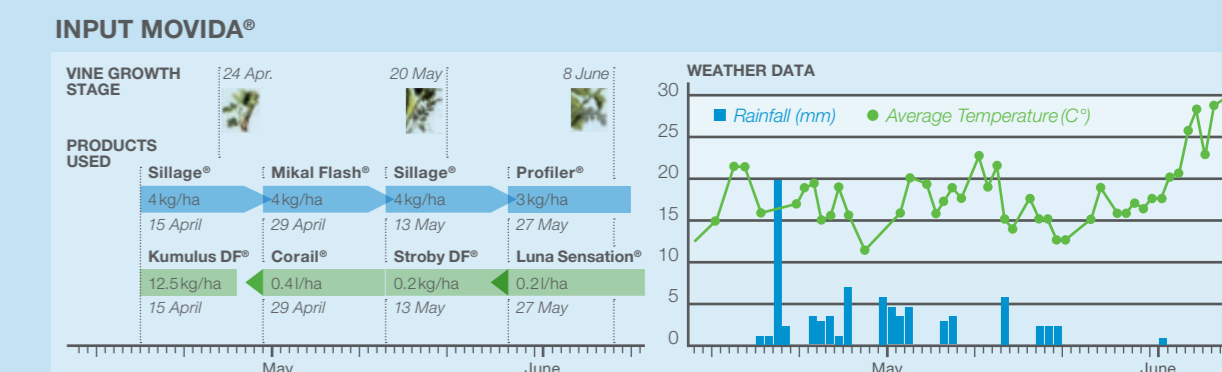
SERVICES

DECISION SUPPORT TOOL

To optimize crop protection decision support tools are well established at Château Lamothe, i.e. monitoring of weather through the weather stations and particularly by using Bay+ Movida®, a mildew control tool for vineyards. By being linked to local weather stations, Movida® develops an epidemiological model for downy mildew and powdery mildew as well as a growth model for the vine-

yard. This enables Movida® to provide recommendations for treatment connected with a database offering suitable crop protection products. This system saves time and money. Even more importantly, it supports the estate's sustainability targets by providing tailored advice for effective disease control with minimum environmental impact, which brings the best results at harvest time.

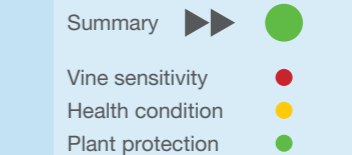
BAY+ MOVIDA® - MILDEW CONTROL TOOL FOR VINEYARDS



OUTPUT MOVIDA®

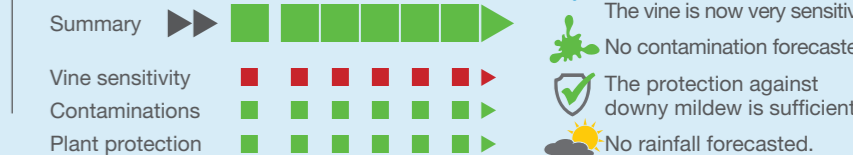
DOWNY MILDEW RISK

Current situation



DOWNY MILDEW

Forecast mildew risk



The bud break state has been reached on May 20th. The vine is now very sensitive. No contamination forecasted. The protection against downy mildew is sufficient. No rainfall forecasted.

Note: This is a simplified model of the Bay+Movida® service tool and does not reflect the actual outcome.



In this brochure you will find only a fraction of the measures with which Bayer ForwardFarming supports the Chombart family in their sustainable farm/estate management goal.

For more information please visit: http://www.forwardfarming.com/forwardfarms/chateau_lamothe



HOW TO SAFEGUARD FARMERS' HEALTH AND THE ENVIRONMENT

This goal can be achieved through stewardship measures to ensure responsible use of crop protection products, and thus protect the health of farmers and consumers, maintain biodiversity on the farm, and protect the environment.

PRODUCT INTEGRITY

CROP PROTECTION PRODUCTS

Only registered crop protection products should be used in farming. By crop protection products we refer to the group of products that includes insecticides, acaricides, nematicides, fungicides, herbicides, and plant growth regulators.

Only registered products have been thoroughly tested for their efficacy against plant pests, diseases, or weeds, and their safety for humans and the environment before they receive official approval and are registered for agricultural use. For safe and effective usage crop protection products must be handled and used in accordance with the manufacturers' instructions, which are printed on the product label. Basic usage instructions always have to be in the local language on the label of each pack. Prior to application of a crop protection product, the farmer must check if the crop protection product is the most suitable for the intended purpose and what safety precautions need to be observed.

Crop protection products should only be purchased from certified dealers in order to avoid illegal counterfeit products being traded or used. Counterfeit products can harm a farmer's health, the crop that should actually be protected, and the environment.



HUMAN PROTECTION PROTECT YOURSELF

It is mandatory for any French farmer who employs workers to undertake an assessment of the potential risks of the activities on that farm (Article L.421-2 French labour code). Once this is done safety measures must be implemented to reduce these risks (machinery, chemical, slurry tanks etc). The first level of measures is undertaken by improving infrastructures and layout, the second looks at how work is organized, the third relates to the provision of common collective protection measures such as fitting devices to machinery, and the last but not least is the provision of individual personal protective equipment for each worker. Together, these four elements help to reduce or prevent accidents and ensure safe working conditions.



MEASURES IMPLEMENTED

Based on a risk assessment evaluating all potential risks related to working activities on Château Lamothe, the following measures have been implemented:

- Regular equipment maintenance checks
- Replacement of goggles with face shields, as they cover the entire face and are more comfortable to wear
- Wearing of chemical protection apron for slurry preparation and filling and cleaning of sprayers
- Installation of a new storage room for crop protection products
- Set-up of separate cloakroom for the storage of clean personal protective equipment and clothing.
- In cooperation with the MSA (Mutualité Sociale Agricole) a risk awareness campaign and risk training have been carried out among the workforce.

Raising the awareness of potential risks in the workplace and these implemented measures have improved work organization and helped to optimize risk management. In addition, some of the actions have shown that safety and comfort can be combined and that training contributes to a good working relationship between employer and employee.



ENVIRONMENTAL PROTECTION

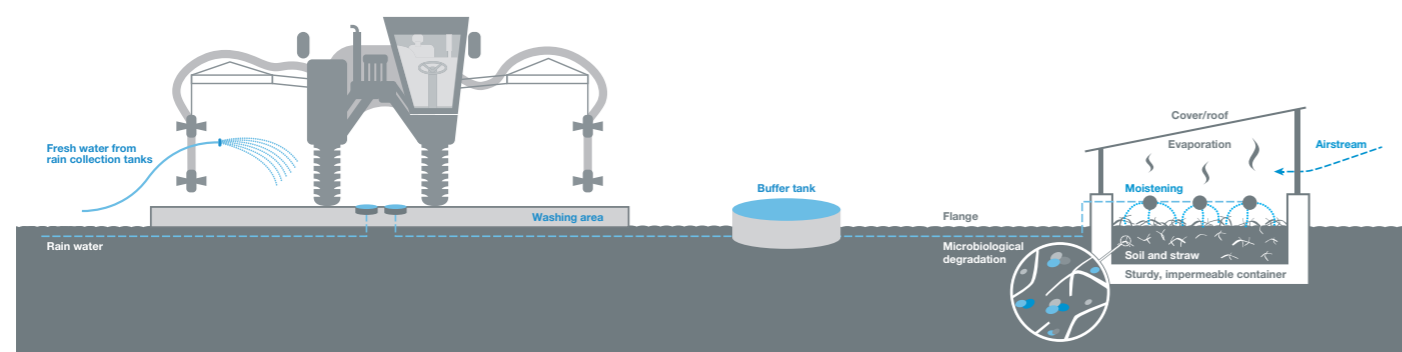
MANAGEMENT OF PLANT PROTECTION PRODUCTS' EFFLUENT

There are several potential sources of risk for the aquatic environment due to the use of crop protection products. Crop protection products may pollute surface water due to drainage, run-off or drift. This depends, among other things, on the soil type of the field, weather conditions and the treatment technique used. In order to reduce these risks, the user of crop protection products is required to take measures to prevent pollution from both: point and diffuse sources.

Diffuse source pollution generally happens on the field and risk mitigating measures include the use of spray drift reducing techniques during application. Point source pollution that happens on the farmyard premises is predominantly related to handling issues during sprayer filling and washing operations.

In order to reduce this risk a specific mixing, loading and washing area is designated, as well as effective sprayer maintenance and effluent management. Since 2012, Château Lamothe is using an effluent management protocol and therefore installed the officially recognized Phytobac® system. The system was approved by French authorities in 2006 and more than 3,000 systems are installed in France today. Phytobac® is a bio-bed that uses the natural purifying elements present in cultivated soil to purify waste water. All the water used for rinsing and washing is collected and spread on a substrate made up of earth (70 %) and straw (30 %). The straw in the Phytobac® system provides the microorganisms (fungi, bacteria, etc.) with the energy they need to biologically break down the plant protection products.

How the Phytobac® system works:



NEIGHBORHOOD RELATIONS

In order to limit any disturbance to the local neighborhood from farm operations, Chateau Lamothe has set up a good neighbor charter (*Viticulteur et Riverains*). This is a great example of how to improve and safeguard good relations.



INCREASING AND RESPECTING BIODIVERSITY

Château Lamothe is assessing its vineyard biodiversity, e.g. in terms of flora, birds, beetles, earthworms and pollinators, in order to understand the integrated farming context and the derived supportive measures to preserve these with Bayer CropScience:

- **Vegetative strips** the rows of vines with occasional mowing in combination with targeted chemical control along the rows maintain a balanced habitat.
- **Delaying mowing** until the end of summer on biodiversity areas surrounding plots extends the flowering period and provides beneficial insects and pollinators with flowers and pollen from January to September.
- Installation of solitary **bee hotels** provides them with shelter and nesting sites.
- Signing of an **agreement for good agricultural and beekeeping practices**: the farmer, for example, informs beekeepers about upcoming spraying activities.
- Using the **biodiversity networks** ENI and OAB to monitor progress in managing biodiversity for example trapping insects in a net.



HOW TO ACHIEVE BETTER PERFORMANCE

This is done most effectively by working together for sustainable agriculture. The partner network for Bayer ForwardFarming at Château Lamothe includes the following organizations:



For over a century Berthoud has been innovating to provide accurate and reliable high-performance crop sprayers in France (60%) and for exports (40%). The sprayers range from row crops, orchards to vines and fruit bushes.



The French Wine and Vine Institute (IFV) conducts studies for the whole French wine industry on topics of general interest, such as plant material, vine growing, sustainable vineyard management, winemaking, and marketing wine. At Château Lamothe, IFV is involved as a technical partner to evaluate the application quality.



As part of the Institute of Vine and Wine Sciences of the University of Bordeaux, Vitinnov is one of its four technology transfer and innovation units, dedicated to viticulture and merged with Bordeaux Sciences Agro (National School of Agronomy). Vitinnov's main objective is to transfer scientific knowledge on best management practices to winegrowers. Vitinnov realized a diagnosis for enhancing biodiversity-friendly practices at Château Lamothe.



Laboratoire Éco-Entomologie, a non-governmental research organization focuses on insects, conducts sampling, analysis, surveys and training.

“Working together with Damien, his team and the network of partners has been very inspiring. We have created a platform to exchange knowledge, optimize practices, and demonstrate sustainable agriculture in practice.”

Isabelle Ladeveze, Sustainable Agriculture Manager, Bayer CropScience

“My customers trust that we are doing our best to produce high-quality wine in a sustainable way. I am glad to be part of this journey so that the next generation can continue the tradition of best-in-class vine growing.”

Damien Chombart, Owner Château Lamothe





BAYER CROPSCIENCE AND SUSTAINABLE AGRICULTURE

Over 300 years ago, Hans Carl von Carlowitz, a farsighted mining inspector in Germany, recognized the importance of sustainable reforestation for ensuring a lasting supply of wood for the mining industry.

The challenge facing us now and in the future is global food security, with the world's population increasing rapidly and limited arable land available. In other words, the most pressing global challenge is to intensify agricultural productivity in a sustainable way.

Bayer CropScience approaches this challenge holistically by connecting economic success in agriculture with environmental and social responsibility for all of the partners involved. In this way, Bayer CropScience is playing its part in enhancing global food security.



Bayer CropScience

Bayer CropScience AG
Alfred-Nobel-Straße 50
40789 Monheim am Rhein
Germany

www.forwardfarming.com
www.bayercropscience.com
info@bayercropscience.com

© 2015 Bayer CropScience
SBS-15-1015

CONTACT

Audrey Ossard
Phone: +33 4 728 541 72
Fax: +33 4 728 542 85
E-mail: Audrey.ossard@bayer.com

Bayer S.A.S.
J16 rue Jean Marie Leclair –
CS 90106
69266 Lyon Cedex 9
France

FARMER

**Château Lamothe de Haux
Damien and Maria Chombart**
Les Caves du Château Lamothe
33550 HAUX
France

www.chateau-lamothe.com

