/////////// Azienda Agricola Moranda



One Step Ahead with Sustainable Agriculture

Recommendations, actions and tools, rooted in practical experience





Bayer ForwardFarming: One Step Ahead with Sustainable Agriculture

Useful recommendations, actions and tools, rooted in practical experience

The first Italian Bayer ForwardFarm was established in 2016. Azienda Agricola Moranda became part of a global Bayer initiative to help agricultural businesses produce in an economically, environmentally and socially sustainable manner.

Over the years, the distinguished quality of the farm's wines has grown, as well as the confidence and knowledge in safety and crop protection through the implementation of specific actions and tools. The farm has experienced, first-hand, the effects of activities implemented with initiative partners, on its agroecosystem and biodiversity. This publication documents the practical experiences of the Italian Bayer ForwardFarm and functions as a guide for agricultural technicians and entrepreneurs. It focuses on the actions, practices and tools available to achieve the expected production results through an increasingly knowledgeable use of crop protection products, which forms the first step towards the best technical outcome, the right degree of safety and appropriate care of the production area.



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One Step Ahead with Sustainable Agriculture

What is Bayer ForwardFarming and why do we believe in it?

Sustainability is a highly interesting and increasingly topical concept: everyone talks about it and tries to implement it in their field of expertise, with farmers in the primary sector being no exception. Implementing and measuring sustainability is a challenge for modern agriculture, which is continuously having to address climate, agricultural and yield changes as well as preserving biodiversity. The Bayer ForwardFarming initiative stems from the commitment to prove that sustainable farming is possible, by building effective partnerships with innovative suppliers and facilitating farmers' external communications to legitimize their role and their products to the public.

Bayer ForwardFarming is a knowledge platform that allows the farmer, in collaboration with Bayer experts and other specialized partners, to make the best use of the most advanced integrated protection tools. It also enables farmers to proactively adopt the most up-to-date practices to protect themselves and their surrounding environment in all agronomic operations, thereby achieving all-round economic, social and environmental sustainability. Farmers participating in **Bayer ForwardFarming** are open to sharing experiences and continuous improvements with other operators in the sector and interested visitors, in the spirit of increasing the exchange of knowledge between professionals and promoting dialog with the supply chain and the public.

The Bayer ForwardFarming initiative:

- // Tailored Solutions Innovative products and services tailored to customer needs, including high quality seeds and traits, biological and chemical crop protection products and digital solutions. These solutions are backed by tailored services ranging from agronomic support in field, to innovative digital farming tools.
- Proactive Stewardship to ensure safe use (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.
- // Partnership to enhance the quality of life for farmers, communities, and society. Mutually beneficial partnerships that include all players in the value chain and help to leverage the potential for collaboration in modern agriculture.

Château Lamothe



Bayer ForwardFarming is a global initiative present in most major agricultural regions



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Bayer ForwardFarming in Italy

Sustainability is not an individual pursuit

Bayer ForwardFarming in Italy

In Italy, Bayer ForwardFarming was implemented at Azienda Agricola Moranda thanks to the trust and collaboration between Bayer technicians and the vineyard's owner Nunzio Giovanni Capurso, proving that sustainable grape production is not only a necessity for responsible farming but also feasible and advantageous for the farmer. In joining the Bayer initiative, Azienda Agricola Moranda began a process of continuous improvement, based on Giovanni's desire to produce wine conscientiously, use natural resources efficiently and maintain economic and social well-being for his family and his region.

The collaboration with the farmer began with an analysis of his vineyard's needs and requirements by all involved stakeholders: the vineyard, Bayer experts and qualified partners. The initiative includes an improvement process aimed at optimizing some of the aspects and needs identified together with the farmer. The agreed activities address safety in the countryside, optimization of certain agronomic management aspects, and monitoring biodiversity as a way to measure the quality of the activities implemented.



All activities implemented at the Bayer ForwardFarm, Azienda Agricola Moranda, were developed together with specialist partners, who brought their experiences and skills to the initiative.

// Braglia

specializes in the production of crop spraying components and is the Italian dealer for Agrotop and Albuz. Braglia supplied this Bayer ForwardFarm with technologies to reduce environmental impact, such as drift reduction nozzles and the easyFlow system.

// Bulzoni Meccanica

specializes in functional checks, testing and calibration of sprayers on herbaceous and arboreal plants. At this Bayer ForwardFarm, Bulzoni oversees the correct operation of the equipment, such as functional control, calibration and tests for reducing the drift effect of the sprayers.

// Graper

agricultural services company and specialist in the wine sector offers farms a consultancy service for sustainable and rational water management. Graper supplied this Bayer ForwardFarm with BluGrape®, a decision support system for irrigation management.

// Mybatec

develops and markets products and services for the sustainable and rational use of crop protection products and fertilizers. At this Bayer ForwardFarm, Mybatec installed and tested the innovative Bayer Phytobac® biodegradation system for crop protection products.

// Pessl Instruments

produces instruments for agrometeorological and soil moisture monitoring with high tech IT hardware and software solutions. At this Bayer ForwardFarm, Pessl Instruments installed the iMetos® 300 weather station and TrapV (pheromone traps with a digital camera).

// World Biodiversity Association

a non-profit association comprising naturalists, botanists, zoologists and enthusiasts, long dedicated to the knowledge and conservation of the species present on our planet. At this Bayer ForwardFarm, the association has begun an environmental analysis for certification and is mentoring the vineyard towards ever greater preservation of biodiversity.

Azienda Agricola Moranda

The Capurso family's life, vines, wines

Life

Family-owned vineyard Azienda Agricola Moranda is located in Nesente, in the heart of Valpantena, just six kilometers from the historic center of Verona. The vineyard has been in the Capurso family since 1896. Giovanni and his two daughters, Camilla and Selene, are the fourth and fifth generation owners, maintaining the family line. They run a wine-making business with a complete production cycle, from grapevine to glass. In a region with particularly favorable soil for vine cultivation, Azienda Agricola Moranda covers about 17 hectares, 15 of which are vineyards and the remaining two olive and cherry trees. Thanks to the daughters' passion for hospitality and their desire to breathe new life into the historic home, the "Agriturismo Corte Moranda" also offers farm-stay holidays. The seven rooms each have a unique charm linked to their history, the nature that surrounds them and the region's hospitality. www.cortemoranda.it



Vines

The vineyard exclusively cultivates native varieties such as Corvina, Corvinone, Rondinella, Molinara and Croatina, all irrigated with a drip system. The microclimate of Valpantena virtually guarantees high quality wine production - significant temperature changes between day and night, prolonged daily exposure to the sun, light and continuous ventilation, as well as alluvial, calcareous, clay-like soil. Integrated crop protection, preservation of biodiversity, advanced agronomic techniques, cutting-edge technologies and innovative crop protection products are at the heart of all decisions made by the vineyard to protect its vines.



Wines

Since 2015, a carefully selected portion of the vineyard's wine production has been dedicated to wines such as Valpolicella DOC, Valpolicella DOC Superiore, Amarone della Valpolicella DOCG and a red Verona IGT, called 'Diavolo Rosso', their flagship product, dedicated to their beloved Irish Setters. The grapes are harvested strictly by hand. The carefully selected bunches must be blemish-free and must not be laid together too densely in the winery's drying room, in order to allow ventilation in 'Fruttaio' during the predominantly natural drying process. All the wines are born from an irrepressible desire to represent some of the many nuances that this terroir offers, exclusively from this vineyard. All of the wines can be purchased directly, in the Wine Shop at the winery, or ordered by sending an email to azienda@capursowine.com.



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//////Safety first

Crop protection products are essential to protect crops from harmful insects, fungi and weeds, which can seriously compromise the quality of the crop. The correct use of crop protection products is the first step towards achieving the best technical result, the right degree of safety for all users and responsibility towards the environment. Safe conditions for all phases of the use of crop protection products is in the interest of all farms, in addition to the requirement to protect employees during all phases of work. The improvement measures to be adopted on a farm include: staff training, secure infrastructure (e.g. storage), Personal Protective Equipment (PPE) and calibration of equipment. Together, these elements help reduce or prevent accidents and ensure safe working conditions.

In practice at the Bayer ForwardFarm

Reading the label carefully, choosing the right protective equipment and innovative tools, following good agricultural practices and implementing regular updates are fundamental measures to protect yourself and work safely.

Azienda Agricola Moranda seized the opportunity to broaden its knowledge of safe and sustainable use of crop protection products and to adopt new improvement tools. As part of the Bayer ForwardFarming initiative, with the collaboration of experts from Bayer and its partners, a practical training plan was implemented and more sustainable tools and techniques were increasingly employed. These actions included reorganization of crop protection product storage, instructions on the correct protective equipment and their use and maintenance methods, consulting the DressCode online platform and using easyFlow.



Safety First

How to protect your-self while using crop protection products

To operate safely, the first step is to read the label carefully. The label of a crop protection product provides all necessary information to use it correctly: dosage, application time, safety interval, etc., as well as essential information on what to do to protect yourself and the surrounding environment.







DressCode is available for free online Scan the QR code to download.

Dress appropriately and safely with DressCode

Direct contact with crop protection products should always be avoided - Personal Protective Equipment (PPE) exists for this purpose and must be worn.

In addition to the label, which is the first guide to choosing PPE, there are two general rules to follow in order to minimize the risk of contact:

1 In all phases of handling crop protection products, i.e. weighing, dosing, transferring, it is essential to wear the right PPE such as gloves, overalls, boots, masks, visors and protective glasses.

2 Carefully check that PPE is undamaged and effective before putting it on.

The level of exposure to a crop protection product is not always the same in the 3 main phases of use (preparation of the solution, application, washing of the equipment). It is significantly greater in the first phase, when working with the concentrate, compared to the other two phases where the risk of contact is with the diluted solution.

How do you dress properly for each phase, in a safe and practical way? To find out which PPE to use in each phase, use **DressCode**, an application that details the safety equipment to be used in the three different phases of use of a Bayer product. DressCode is quick, simple and intuitive to use: answer 3 guestions about the product you intend to use, the conditions of use and the type of equipment and it will display the most suitable clothing to use in the three phases, as well as some useful tips on maintenance.

Always adhere to PPE removal methods

The removal of PPE can be another critical contact point and therefore must be done carefully, in the washing area if possible. The following sequence should be adhered to:

- 1 Wash your hands without removing your gloves.
- 2 Remove and wash visor/protective glasses and leave to dry.
- **3** Wash boots while still wearing them.
- 4 Remove overall and place in container for disposal (if disposable).
- 5 Wash boots again before taking them off.
- 6 Wash gloves and remove the mask and visor/protective glasses.
- 7 Wash gloves again before taking them off.
- 8 Put on a new pair of gloves and clean the visor/protective glasses.

All reusable PPE must be cleaned and dried (not in direct sunlight) and placed in the appropriate locker. Disposable PPE must always be placed in the appropriate disposal container and disposed of, without ever reusing them. Always check for breakages or wear and don't hesitate to replace PPE.



Your hands are the most exposed part of your body. Protect them. Download a poster to hang where you prepare your mixtures Scan the QR code to

download.



SPRAYER

Safety First

How to protect yourself while using crop protection products

Organize the storage area of the crop protection products correctly

Proper storage of crop protection products is essential to maintain product quality, to protect people and animals from accidental exposure and to prevent contamination of the surrounding environment.





To make sure that everything is in order in your crop protection product storage, download the illustrative reference card by using the QR code.







The storage area must be:

- // a designated, well-ventilated room, or a specific area enclosed by walls or mesh, or a closet in the case of small quantities.
- // fitted with a lock.
- // separate from the locker rooms/toilets, possibly adjacent to the latter.

The storage area must also be equipped with the following:

- // clearly visible warning signs and emergency telephone numbers.
- // waterproof flooring and shelves made of non-absorbent material.
- // products stored in original containers and arranged by type.
- containers with liquid crop protection products must be stored on the bottom shelf, and below containers with powdered crop protection products; with a retention basin below the shelves.
- // at least one bag of an absorbent substance (e.g. sand) and airtight containers (plastic bags, bins) for placing empty containers and any spills or broken packages.
- // firefighting equipment.
- // a folder containing the safety sheets of the crop protection products purchased.
- // tools for weighing and measuring crop protection products.
- // PPE required for handling.

Dosing crop protection products safely: use easyFlow

To prevent possible accidental user contact during the treatment preparation phases, Bayer recommends installing easyFlow on the sprayer - a revolutionary system for the safe transfer of liquid crop protection products to the sprayer during the preparation phases.

Advantages of easyFlow for user and environmental preservation:

- // No contamination: the system is completely sealed and prevents any accidental contact, splashes, dripping and unwanted spills when transferring the product into the sprayer.
- // Calibrated: allows partial use of the contents of a package by visually monitoring the quantity of liquid product transferred (using graduated containers).
- // Self-cleaning: allows empty containers to be washed quickly and efficiently, optimizing management and decontamination before disposal. All system and container inner surfaces can be cleaned by connecting a hose delivering clean water.
- // Easy-to-use: suitable for all sprayer equipment tanks and pre-mixers and is compatible with all 63 mm diameter packs (3 to 10 liter containers). The system is quick and easy to install and requires no special installation tools.



For more details on easyFlow, use the QR code.



/////Tools to optimize treatments

To produce quality food, a distinguishing factor of the 'Made in Italy' food industry, it is essential to protect crops from diseases and pests that would otherwise compromise production. Integrated crop protection is at the heart of every business decision the farmer has to make to protect his/her harvest - and therefore his/her income - in order to produce and bring to market healthy and high quality products and to manage production in full respect of the consumer, the environment and the farm's own agroecosystem.

> Knowledgeable use of crop protection products benefits the farmer, who, by applying them correctly and solely when necessary, protects his/her own health, saves on costs and obtains excellent yields. It also helps protect the environment as unnecessary applications are avoided.

In practice at the Bayer ForwardFarm

Azienda Agricola Moranda has increased its knowledge of new vine protection tools with the aim of optimizing the number and type of treatments, making use of agronomic techniques, cutting-edge technologies and increasingly safe and effective synthetic or natural crop protection products. As part of the Bayer ForwardFarming initiative, certain priority needs and related improvement solutions were identified:

- guantity through the selection and correct application of the products. Solution introduced: Bayer Movida.
- Receiving weather data in advance and in real time, for the planning of farming operations, including plant health management. Solution introduced: Bayer MeteoBase and iMETOS® IMT300 by Pessl Instruments.
- Monitoring of vine moth flights, to verify the effectiveness of the mating disruption technique and to check the uniformity of diffuser coverage during the whole season. Solution introduced: iMETOS iSCOUT® by Pessl Instruments.



// Rationalization of treatments, eliminating those not strictly necessary - without jeopardizing quality and

Tools to Optimize Treatments

The value of knowing the variables on the field

A good harvest is based on the combination of countless uncontrollable, but predictable, factors including environmental factors. In modern agriculture the farmer's work is also based on the management of endless data transmitted by sensors positioned in the field. These technologies help to capture and transmit incredible amounts of information in real time and at a low cost, generating meteorological data, monitoring results and more, which increase the success and efficiency of farming decisions.

To find out what the weather will be like, access the Meteobase service free of charge

using the QR code.







Access weather forecasts to aid farming decisions

The science of agrometeorology is of great help for farmers who need to know the weather in advance to make the right choices at the right time. In fact, climate influences the main parameters that a farmer must consider for successful agricultural production: from planning farming operations (sowing, pruning, processing etc.) to crop protection (against diseases, insects and weeds), water and nutrition management, harvesting time, etc. All farmers consult weather forecasts, often several times a day. Bayer offers its own weather service, **Meteobase**. By simply entering the municipality or zip code, the online tool gives you the main meteorological variables, with a forecast of up to four days, for all areas of Italy.

As well as consulting national weather services, more and more farmers are equipping themselves with weather stations to receive even more precise and customizable data. As part of the Bayer ForwardFarming initiative, **iMETOS® IMT300** was installed at the vineyard. This is a solar powered weather station that sends weather data in real time to the **FieldClimate** online platform (accessible via PC or mobile device). This system provides the user with climate and hydrological parameters to correctly assess whether to apply a crop protection product and/or irrigation, thereby preventing unnecessary treatments, product drift and water waste.

Early monitoring of harmful insects' flights

Monitoring the flights of harmful insects that attack key crops such as fruit, grapes, corn and vegetables is of fundamental importance. This is vital for integrated crop protection strategies because it allows you to monitor the development of populations and to plan targeted measures according to the phenological stages of insects and the type of insecticide (ovicide, larvicide and adulticide). This monitoring involves the use of traps equipped with adhesive media and special attractive pheromones (volatile substances emitted by females to attract males). There are various types of traps on the market, primarily for monitoring moths, scale insects and flies. **iMETOS iSCOUT**[®] was installed at the vineyard as part of the Bayer ForwardFarming initiative. The system forms a trap that attracts and captures insects using a pheromone placed on an adhesive card and sends the image of the catch (via an internal digital camera) to the **FieldClimate** platform (accessible via PC or dedicated app). The use of images allows the farmer to monitor the earliest infestations of the season, to count catches daily, to time crop protection product application and to monitor the success of the mating disruption technique in the field.



Tools to Optimize Treatments

The use of decision support systems

Innovation in agriculture has always been essential, as in all production sectors, to respond to continuous changes. Agriculture has made great strides in recent years: from agricultural mechanization to the most modern digital technologies, including decision support systems (DSS).

A DSS automatically collects, organizes, interprets and integrates multiple data from multiple sources to respond to the growing complexity required for crop system management.

These systems offer support on the most appropriate actions to take, whether strategic long-term decisions or tactical short-term decisions. Decision support systems do not replace the farmer's experience, but support him/her in making the important decisions, by linking and simplifying all the data available from the technologies in the field.



In modern sustainable agriculture, DSS can facilitate optimization of the use of chemical products (fertilizers and crop protection products in particular) and the consumption of natural resources (water, soil, energy, etc.), ensure the achievement of high production standards (both in qualitative and quantitative terms), and maintain or increase the profitability of farms.

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Monitor vine downy mildew and powdery mildew with Bayer Movida

Movida was developed by Bayer to help vine growers to manage the most severe vine diseases and optimize the application of crop protection products throughout the growing season.

Movida is an advanced decision support system in viticulture:

- // An online platform that can work with or without a connected weather station, as meteorological data is available directly from Bayer's free Meteobase online platform.
- // An epidemiological model based on the integration of 4 modules (plant, pathogen, product and program), which identifies the current and expected sensitivity level of the plot to downy mildew and powdery mildew.

Movida provides information on the maturation of oospores and the evolution of infections, developing and interpolating the automated climate-related data (temperature) to the disease development cycle (downy and powdery mildew) and to the vegetative stage of development of the vines with the defense program via user input.

The results are easy to understand with a "traffic light" indication of the plant's sensitivity, the risk of contamination and coverage (in terms of crop protection), with a forecast of up to 6 days. This allows **Movida** to offer recommendations that support farming decisions for optimal crop protection.



Movida helps winemakers save time and resources by providing tailored advice for sustainable disease management. For more information italy.cropscience@bayer.com

to optimize water management

Water is an increasingly limited and irreplaceable asset essential for life. Agriculture may consume more water than any other industry, which is why farming operations such as irrigation are of vital importance. Calculating the amount of irrigation water is one of the most complicated aspects for an agricultural business. This is particularly critical in arboreal plants, because it must be analyzed and adapted according to a multiplicity of factors, including: rainfall, seasonal temperatures, soil characteristics, productions, varieties, rootstock, crop density, vine row management, etc. To adopt rational irrigation in vineyards, the water availability offered by the climate-soil system must be considered, based on the rainfall and the evaporative demand of the particular area.

Water stress management: BluGrape[®]

Research into irrigation planning methodologies is ongoing, in particular to improve the practical interpretation of data provided by measurement instruments, such as agrometeorological sensors. The BluGrape® decision support system used in the Bayer ForwardFarming initiative to facilitate the farm's irrigation and water stress management, provides precise and real-time information about the soil's water status and the plant's water stress condition. The system considers all the factors of the vineyard system that affect the irrigation management of the crop (soil climatic characteristics, crop needs, meteorological conditions and water availability). The grower sees simple and clear indications, both on PC and on the dedicated mobile app, for rational and sustainable irrigation management, without overdosing or underestimating the volumes. The grower can also calculate, effective nutrient plans.



In light of climate change causing rising temperatures and water scarcity, it will be increasingly necessary to optimize water use. In agriculture, it is essential to know how to calculate the actual irrigation requirement in order to use water more efficiently and avoid unnecessary waste.

In practice at the Bayer ForwardFarm

Azienda Agricola Moranda has enhanced its knowledge of water stress management practices and how to improve interpretation of the environmental parameters provided by the vineyard sensors. Mild water stress, in some physiological phases, is desirable in modern viticulture as it limits vegetative growth and favors the qualitative development of the grapes. However, excessive water stress causes a reduction in photosynthesis and delays ripening with a decrease in quality. Therefore, as part of the Bayer ForwardFarming initiative, the vineyard began to use a decision support system, BluGrape®, which provides guidance for the correct management of irrigation schedules and water stress.



/////Practices to improve application

Correct application of crop protection products, to protect crops from harmful insects and fungal diseases or weeds, is as important as the choice of the product in order to achieve the expected results from a treatment. The effectiveness of a treatment also depends on its correct application: a malfunctioning machine distributes unevenly, resulting in ineffective crop protection, potential phytotoxicity problems or the presence of residues exceeding the permitted limits for the harvest. Furthermore, environmental risks increase due to drift or machine leaks that can cause point source pollution.

> Farming with correct agricultural practices and suitable equipment starts you off on the right foot. Avoiding waste in the field allows you to save, optimize your yield and protect the environment, as well as the people and animals that live close to the fields.

In practice at the Bayer ForwardFarm

and for specific technical support.



Azienda Agricola Moranda seized the opportunity to improve internal skills and optimize management practices of the equipment used in the vineyard. As part of the Bayer ForwardFarming initiative, two complementary paths were followed: the first was the training of users in basic principles for correct application, and the second was involving the partner Bulzoni Meccanica S.a.s. in machine checks (functional checks and calibration)

This enabled the business to optimize its interventions in the vineyard thanks to the use of certified, regularly checked and calibrated machines, specifically for the cultivation phase and the treatment type. The vineyard adopted the use of anti-drift nozzles that produce larger drops than conventional nozzles and are less sensitive to the effect of air currents, thereby reducing dispersion of the sprayed solution into the environment.

Practices to Improve Application

How to prepare the solution and optimize application

Here are some practical tips to adequately and safely organize two essential treatment steps: preparation and application. First, assess whether treatment is necessary. Second, choose the product or products for the mixture and evaluate the knowledge and adjustment of the equipment settings.



Correctly prepare the solution to be applied

This operation must always be carried out carefully and accurately to obtain the best technical results, and to ensure user safety and environmental preservation.

The main steps to follow are:

- // Carefully read the product label: it contains all the information necessary to use the product correctly and includes the warning symbols and instructions on how to protect yourself.
- // Wear the specified Personal Protective Equipment (PPE) during the mixing and filling phases.
- // Weigh the right dose in a waterproof area to prevent the crop protection product seeping into the ground in the event of accidental spillage.
- // Check the correct operation and adjustment of the sprayer. For calibration, also see the specific section.
- // If possible, prepare the solution in a waterproof area; if you do it in the field, stay away from permeable waterways or wells/spring.
- // Pour the products into the pre-mixer or, if not available, into the tank filled with half of the volume to be applied. Follow the stirring instructions on the label.
- // Do not leave the sprayer unattended during mixing and filling.

Follow these recommendations to optimize application

The main steps to follow are:

- // Adjust the equipment to prevent the solution reaching surfaces not to be sprayed or being dispersed by drift and seeping into the ground.
- // Wear the required PPE.
- // Having defined the spraying volume/ha, you should be familiar enough with your equipment to choose the appropriate configuration. For example, if you use a boom sprayer, choose the: machine speed, type of nozzles used and their flow rate, operating pressure, boom height; in the case of tree sprayers, choose the: fan flow rate, feed speed, type of nozzle, total sprayer flow rate and distribution profile.
- // Maintain safe distances from sensitive crops, waterways, urban areas, etc.
- // Close the nozzles when turning and when driving along the edges of the field.
- // Once the treatment has been completed, wash the empty containers and equipment. Also see the specific section.

Mix the products in the correct order

For mixtures of multiple crop protection products, first check the labels for any incompatibilities and then follow the correct mixing sequence of the formulations:

1 pH regulators

- 2 Water-soluble bags (WSB)
- 3 Micro-granular products (WG-SG)
- **4** Wettable powders (WP)
- **5** Suspension concentrates and oil dispersions (SC-OD)
- 6 Suspo-emulsions (SE)
- 7 Aqueous emulsions (EW/ME)
- 8 Emulsifiable concentrates (EC)
- 9 Water-soluble concentrates (SL)
- 10 Wetting agents, oils, fertilizers, anti-drift products



To always have the correct formula mixing sequence with you, download the illustrated reference card using the **QR** Code

Practices to Improve Application

Machine checks

Using sprayers that are not functioning perfectly poses a number of risks such as drift, point source pollution, ineffective crop protection, phytotoxicity on crops and residues exceeding the permitted limits for the harvest.

Functional (mandatory) and calibration (optional) checks are two fundamental forms of inspection to ensure well-maintained and calibrated machines.





Performing functional checks

A certificate is issued for these inspections, which must be carried out exclusively by authorized centers. Users who do not comply with these legal requirements may be penalized.

The main inspections of the different parts of the equipment include:

- // Main tank: seal and stirring/shaking potential of the crop protection product mixture.
- // Main pump: functionality and absence of leaks.
- // Fluid level scale: presence and readability.
- // Pressure gauge: presence, functionality and
- adequacy of the reading scale at operating pressure.
- // Spray pressure adjustment system: functionality and efficiency.
- // Filtration system: presence of at least 1 filter and functionality.
- // Hoses: check seals and connections at maximum operating pressure.
- // Nozzles/diffusers: check flow rate and wear.
- // Anti-drip system: check functionality.
- // Uniformity of distribution: check against distribution diagram.

Performing equipment calibration

Calibration consists of a series of voluntary checks and ad enable optimal machine performance according to specific (Current Italian legislation does not yet mandate instrumen on sprayers).

The procedure is not standardized but is customized base specific crop characteristics.

The main adjustments that are made to the application equ shown below.

Some (marked*) can also be conducted periodically to che uniformity of application (using just water) before preparin mixture:

- // Identify the direction of the jet delivered by each nozzle*
- // Adjust the jets for the targeted crop to be treated*.
- // Check positioning of air deflectors/diffusers or, for pnet machines, the guns/blowers/cannon.
- // Check the quality and uniformity of the application and whether nozzles need to be replaced (always use gloves because clogged nozzles do not get rinsed)*.
- // Change dusting level (for pneumatic machines).
- // Adjust nozzle flow rate.
- // Adjust air flow rate and speed.
- // Verify forward speed.
- // Calculate the distributed volume.



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Practices to Improve Application

A nighttime test in the vineyard

The success of treatments and the effectiveness of the products applied are directly linked to the application methods. Using equipment that is not in perfect working order, uncalibrated nozzles or excessively high flow rates can lead to incorrect application of the crop protection product, with negative effects on production and the environment (drift).

Let's provide a little clarity

What is drift?

Drift of a crop protection product occurs when some of the spray dispensed by the sprayer misses the treated area, due to environmental air currents present when the crop protection product is sprayed on the crop. Spray falling in areas adjacent to the field being treated may represent a risk of pollution of the surrounding environment.

In practice at the Bayer ForwardFarm

The issue of correct application of crop protection products and consequent management of drift was the focus of a field test conducted at Azienda Agricola Moranda.

In line with the philosophy of sharing experience and improving knowledge among experts and farmers, an application test was implemented at the Bayer ForwardFarm in collaboration with the project partner Bulzoni Meccanica S.a.s. The test was conducted with a single, previously calibrated, machine with the intention of further understanding the effects of different types of nozzles on the application of products. In this case there was a particular interest in the performance of anti-drift nozzles, which are increasingly popular for reducing drift. Three different types of nozzle were compared: two anti-drift nozzles - air induction fan nozzle (CVI), air induction cone nozzle (TVI) - and a traditional empty cone nozzle (ATR).

To highlight the differences between the tested nozzles in application to the crop, two techniques were adopted:

- // Water-sensitive paper positioned at different heights of the crop, to identify the degree of uniformity and the average size of the drops on the leaves depending on the height of the row.
- // An innovative, completely natural fluorescent substance that allows you to see the vegetation coverage using a UV lamp in the dark.

The equipment settings for the distribution of the water-fluorescent substance solution were the same as those normally used by the farmer for the application of crop protection products. The settings were kept the same for all 3 trial groups.

The in-field observations demonstrated that the traditional nozzle provided the most uniform coverage. This was true for both the water-sensitive paper and the leaves under a UV lamp. However, the coverage provided by the fan nozzle was also very efficient and associated with less drift.

The level of coverage ensured by the air cone nozzle, under trial conditions, was found to be coarser and not suitable for full coverage spraying with contact products.

While we know that these findings require additional and more in-depth investigation, it remains clear that



a key determining factor is selecting the correct nozzle and equipment settings (e.g. speed and pressure) to achieve the right compromise between treatment efficacy and drift management, distribution technique and cost reduction.

By applying crop protection products correctly, the first to gain is the farmer who has well-protected crops and significant cost savings. The use of perfectly functioning and correctly calibrated equipment not only contributes to attaining the expected technical result, but also leads to a reduction in waste and therefore to cost savings.

for environmental preservation

Once the crop protection treatment has been completed, how do you correctly and safely clean the equipment and manage the rinse water or any excess mixtures? Washing sprayers at the end of the treatment is a regular maintenance task that helps ensure the effectiveness and optimal working condition of the equipment. But this task requires a lot of care and it is important to make sure that no crop protection product residue comes into contact with surface water or ends up in ground water. For this reason, the water used for washing the equipment and the remaining mixture in the tank must be disposed of properly, relying on specialist companies or using

biodegradation systems.

Disposing of rinse water and treatment residues incorrectly is not only a criminal offense but is also poor practice and can harm the environment and health of people living around farms.

In practice at the Bayer ForwardFarm

Phytobac[®], at the winery. similar systems.



Azienda Agricola Moranda has an area equipped for mixing, filling and washing sprayers. As part of the Bayer ForwardFarming initiative, Bayer ran training sessions on how to correctly clean and wash equipment, both during the treatment phase and at the end of the season. In addition, the partner Mybatec installed a technologically advanced Biobed system,

This system collects the wastewater produced from washing the equipment and/or any spills, in a special closed-loop microbial biodegradation system that does not require annual disposal in specialist centers, unlike other

Tools for Environmental Preservation

How to clean equipment safely

After each treatment, the machines used must be washed internally and externally to maintain their working condition over time. Empty crop protection product containers must also be washed on site, collected and disposed of correctly. Sprayers must be repaired in a safe place, out of reach of animals and unauthorized persons.

In the absence of a collection system such as the Biobed, the water contaminated by washing and the residual, non-used crop protection product mixture must be stored and disposed of annually by specialist companies General equipment cleaning must be carried out at the end of the season, to avoid problems caused by cold and frost.

Here are some simple tips:

- // In the equipped area, empty and completely wash the main tank and any other additional tanks (washbasins, pre-mixing, etc.).
- // Unload the compensator so the membranes are not kept under pressure unnecessarily.
- // Loosen the pressure regulator.
- // Clean the filters, nozzles and anti-drip systems.
- // Loosen the nozzle rings.



The main steps to follow for cleaning the equipment properly are:

- // Wear the required PPE.
- // If you do not have an area set up on the farm, you can wash the equipment on the field, switching the washing area from time to time, and always staying away from water sources. However, it is preferable to use a prepared, impermeable area equipped for collecting the rinse water.
- // If possible, wash the outside of the sprayer immediately after application, before the deposits are dry.
- // If possible, use a high pressure cleaner, to save water.
- // Wash the internal parts of the sprayer by circulating clean water inside the tank multiple times.
- // Use specific (biodegradable) products to clean the inside and the outside of the sprayer.







Tools for Environmental Preservation

Microbial system or Biobed

Unused crop protection mixture from the tank and rinsing water from cleaning the sprayer is collected in a container, to be picked up by third parties for disposal. An alternative is biodegradation, an example of which is the microbial system known as the Biobed.

The Biobed is a biological degradation system consisting of organic material of various origins, which reduces the potential pollutant load using particular physical, chemical-physical and biological processes. Systems adapted to the farm's needs have been developed based on Biobed principles.



Manage wastewater carefully: install Phytobac®

The crop protection product biodegradation principle is put into practice by Phytobac®, a safe and effective system that allows wastewater to be disposed of directly on the farm.

It is an excellent tool to protect ground and surface water by preventing point source pollution. **Phytobac®** is a simple and natural system: contaminated water is stored in a tank, after being channeled from the washing site, through a pump, to the tanks containing the biomix, a natural substrate consisting of farm soil and straw, which already contain biodegrading microorganisms. The remaining water evaporates naturally, aided by the sun and wind, without water entering into the soil.

A control panel autonomously manages the correct moisture level of the **biomix** and regulates the programming of accurate daily irrigation cycles to optimize biodegradation and disposal. The system does not require special maintenance, except for cutting the grass that grows on the substrate when it gets too tall, and aerating the soil once a year.

Installation of the Phytobac[®] system allows the farm to:

- // Dispose of wastewater independently without contracting external companies, thereby saving important resources.
- // Prevent contamination, protect the integrity of the environment and employee health.
- // Receive funding for installation costs from the regions and autonomous provinces that offer it, under rural development plan grants.
- // Demonstrate its commitment to sustainable agriculture through employing technical advancements.



Bayer ForwardFarming,

Coexistence of Agriculture and Biodiversity is Essential

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/////Agriculture and Biodiversity

Biodiversity is the basis of life on our planet for humans, animals and plants. Biological diversity is a fundamental resource for humans and its preservation represents an important goal for production activities, especially for the agricultural sector. We must try to preserve biodiversity everywhere, not only in places at risk or parks and nature reserves, but also in environments in which we live every day, e.g. agricultural settings, that cover a significant surface area. Every farm must try to promote biodiversity and manage the risks of potential biodiversity loss, because an environment rich in biodiversity is a healthier environment that offers quality products.

Let's provide a little clarity

What does biodiversity mean?

Biodiversity is all the different kinds of life you'll find in one area - the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life (source: WWF).

What does ecosystem mean?

An ecosystem is a fundamental functional unit in ecology. It is a group of living organisms and non-living substances with which the organisms exchange matter and energy, in a particular area, e.g. a lake, a meadow, a forest, etc. (translated from Italian source: Treccani).

What is an agroecosystem?

In agricultural sciences, an agroecosystem is defined as a secondary ecosystem characterized by human intervention and designed for agricultural and livestock production. Compared to the natural ecosystem, in the agroecosystem the flows of energy and matter are modified by external production factors (fertilizers, machines, irrigation etc.), that are intended to enhance the productivity of the cultivated crops by eliminating those natural factors (other plant species, insects, microorganisms) that can be harmful or compete with the agricultural crop to the detriment of its productivity (translated from Italian source: Treccani).

In practice at the Bayer ForwardFarm

The owners of Azienda Agricola Moranda agreed to commission an objective assessment of the impacts of the activities carried out in the field towards the goal of biodiversity conservation. The Capurso family has always expressed and demonstrated an interest in protecting the species present on their own farm and in the region in which they live. A more biodiverse environment is a more sustainable environment, which offers the opportunity to produce high-quality crops for a long time. The assessment was coordinated by non-profit World Biodiversity Association (WBA).

The WBA proposed a series of activities aimed at harmonizing crop production with the conservation of biodiversity. The interventions helped Azienda Agricola Moranda to monitor its operations, introduce some improvements and to produce concrete evidence demonstrating the preservation of biodiversity in its agroecosystem. The main activities carried out by WBA at this Bayer ForwardFarm were:

- // Preparation of the farm for a potential "Biodiversity Friend[®]" certification pathway, according to a protocol that assesses conservation of biodiversity in agriculture.
- // Evaluation of soil fauna as an index of the biological quality of soils and qualitative surveys on some invertebrates.
- // The placement of equipment to promote biodiversity on the farm.
- // Beekeeping as an additional indicator in monitoring the agroecosystem.



The "Decalogue of Biodiversity in Agriculture" according to the "Biodiversity Friend[®]" protocol

The "Biodiversity Friend[®]" protocol is a certification for farms that want to engage in biodiversity conservation. The aim of the "Biodiversity Friend®" protocol is to harmonize production and conservation. As well as verifying a farm's commitment to a significant reduction in biodiversity loss in the region due to human activity, it also represents a stimulus for the farm itself to progressively increase biological diversity.





The "Decalogue of Biodiversity in Agriculture" consists of the analysis of 10 parameters or actions:

- 1 Agricultural model: verifies the pest control methods.
- 2 Soil fertility reconstitution: verifies the methods of reconstituting the fertility of agricultural soils.
- 3 Hydric resource management: verifies water resource management methods.
- 4 Hedges, woods, meadows and nectariferous species: verifies the presence and distribution of permanent areas of hedges and/or woods.
- 5 Agricultural and structural biodiversity: verifies the presence of crop or animal breed diversification.
- 6 Soil quality: verifies the presence of fauna in the soil, using the Soil Biodiversity Index (IBS-bf).
- 7 Water quality: verifies the quality of surface water present on the farm or in the surrounding areas, using the Aquatic Biodiversity Index (IBA-bf).
- 8 Air quality: verifies the quality characteristics of the air, using the Lichen Biodiversity Index (IBL-bf).
- 9 Renewable energy: monitors the use of energy from renewable sources and the adoption of energy-saving measures.
- 10 Environmental responsibility: verifies the adoption of tools to increase the presence of wild animal or plant species on the farm.

Evaluation of the quality of the environment through biodiversity indices

There are several ways to assess the quality of water, soil and air in a specific environment. The World Biodiversity Association uses key indices, which are based on the evaluation of organisms. These organisms are defined as biological indicators.

These organisms can be used to assess soil, air and water quality, as they are highly sensitive to potential pollutants and can perform the role of 'sentinels' very well.

The biodiversity indices used in the Bayer ForwardFarming initiative were:

- 1 Soil Biodiversity Index (IBS-bf)
- 2 Aquatic Biodiversity Index (IBA-bf)
- 3 Lichen Biodiversity Index (IBL-bf)



For more information, visit the World Biodiversity Association website: https://biodiversityassociation.org/it

Bayer Forward Farming – Coexistence of Agriculture and Biodiversity is Essential 46–47

Soil, water and air quality measured by the biodiversity indices

Soil quality

The Soil Biodiversity Index (IBS-bf) is based on the analysis of soil samples in which the presence of different animal taxa (e.g. invertebrates, mollusks and annelids) is measured.



Water quality

On the Bayer ForwardFarm, 2 surveys were carried out each year, each of which involved three samples from different places on the farm. The average values were found to be acceptable by the assessors; the most common groups found in the samples were earthworms, spiders, ants, mollusks and beetles. To further expand the assessment and provide the farm with further evidence of the good level of biodiversity in the vineyard, the Shannon diversity index (H) was also measured.

For the calculation, additional samples of invertebrate fauna were taken, using fall traps, both within the vineyard and behind a hedge, to evaluate the distribution between cultivated and natural area. The results were positive and encouraging for the farm: in the two year evaluation period, approximately 9,000 samples were taken and about 7,000 specimens of invertebrates were found in the examined areas, with a greater presence of invertebrates in the non-cultivated areas.

The quality of surface water can be tested by examining the aquatic invertebrate communities. Many aquatic organisms (stoneflies, mayflies [Ephemeroptera], caddisflies [Trichoptera], crustaceans and mollusks, etc.) can serve as biological indicators to determine the health of surface waters in agroecosystems. The protocol involves the use of the IBA-bf water biodiversity index, which considers taxonomic diversity and also detects the main chemical-physical parameters (pH, temperature, electrical conductivity and dissolved oxygen). On the Bayer ForwardFarm, given the lack of surface water both inside and near the farm, chemical-physical and bacteriological analyses were carried out on water from the groundwater well located on the farm, in order to assess the quality of the water used for irrigation. The results of the analyses indicate that the quality of the groundwater used for irrigation purposes is excellent; none of the parameters considered was above the defined limits.

Air quality

The Lichen Biodiversity Index (IBL-bf), calculated by the protocol, represents an indirect method for assessing air quality in environments with trees. It evaluates the state of the epiphytic lichen community present on the bark of trees located on the farm and is based on the quantification of the presence and frequency of different lichen species. Lichens (organisms forming a symbiosis between a fungus and an alga) are in fact extremely sensitive to air pollution, as they do not have an excretion system. Therefore, they can be considered valid biological indicators for the biomonitoring of air quality, both in urban and rural environments.

On the Bayer ForwardFarm, lichen biodiversity was detected on a sample of three trees located along the perimeter. A total of 14 species of epiphytic lichens were identified and confirmed. The biodiversity index based on the average frequency of the individual species reported an average value which, when compared with the biodiversity scale proposed by the Italian National Agency for Environmental Protection (ANPA, 2001), falls within the maximum band, indicating a very high naturalness of the lichen communities and very good air quality.



Surveys of fauna and non-terrestrial invertebrates

To further investigate the fauna present in an agroecosystem, it is necessary to observe two important orders of insects that act as bioindicators: Lepidoptera and Hymenoptera.



On the Bayer ForwardFarm, the lepidopteran fauna appears uniform in its biodiversity. As a short-term, general, gualitative judgment, the population of the vineyard includes rather common species, widely found both in natural and man-made environments. To get an idea of the extent this covers, the province of Verona (where Azienda Agricola Moranda is located) in its various natural and man-made environments has an average of 153 species.

Lepidoptera

Lepidoptera Lepidoptera (better known as butterflies) have a high number of easily sampled and recognizable species. This order has a close link with plants, both at the larval stage and at the adult stage; these communities are therefore connected to the vegetation and to the various designations of use (such as agriculture and/or grazing).

The classic entomological net was used for the Lepidoptera survey. The survey had a taxonomic focus on diurnal butterflies (Macrolepidoptera, Rhopalocera), but during the course of the research it was also possible to quantify and qualify all the diurnal lepidopterans of the Macroheterocera and Microheterocera groups. Identification took place directly in the field, except for some species that can only be definitively identified in the laboratory.

Apoidea Hymenoptera

The solitary Apoidea Hymenoptera (bumblebees, wild bees and mason bees), besides being excellent indicators of environmental quality, have the function of pollinators as much as social, honey bees, but do not live in colonies. They are particularly sensitive and their presence in cultivated areas is a good indicator of agroecosystem quality. To identify these insects, three colored traps - white, yellow and blue - (pan-traps) were used. The traps consist of saucers that contain water and a surfactant; they are left in the field for two days and then taken to the laboratory for identification.



The same considerations also apply to the population of Apoidea Hymenoptera. In recent seasons the vineyard has followed the advice of the WBA to mow between rows after the spring flowering phase has completed. This improves the availability of nectar for Lepidoptera and Apoidea Hymenoptera.



Human interventions to promote biodiversity on the farm

Any farmer who manages his/her farm and the associated agricultural activities well can further increase biodiversity by following some simple tricks. Easy-to-position equipment is available for monitoring and improving their 'own' ecosystem. This equipment can be managed independently, even by non-professionally trained but dedicated and interested operators. The examples below outline the actions taken by Azienda Agricola Moranda as part of the Bayer ForwardFarming initiative, to promote biodiversity and to contribute to the integrated management of insect pests.



- // Artificial bird nests, to increase the number of potentially nesting species, with holes of various diameters to allow different types of birds to nest. Birds feed their offspring with insects, hunting for the most abundant species and limiting the presence of insects that damage crops.
- // Bat-boxes for pipistrelles, to increase numbers that control insect pests, recognized as being among the most useful species for maintaining ecological balance in agroecosystems.
- // Insect houses or hotels, to offer wild bees a comfortable place to nest, raise their offspring and shelter in winter, and for many other useful insects (ladybugs, mantis, bumblebees, etc.).
- // Flower beds, to promote plant biodiversity and improve the reproduction conditions of some insects, offering them food and places to shelter.
- // Hedges, tree-lined avenues and wooded areas to create important reserves of biodiversity for the fauna.
- // Mowing between rows after spring flowering, to promote the presence of Lepidopterans and Apoidea Hymenoptera that feed on flower nectar.

In practice at the Bayer ForwardFarm

On the Bayer ForwardFarm, 32 artificial bird nests, 3 bat-boxes for pipistrelles and 5 insect hotels were installed early, in the first year of the initiative. The insect hotels have been gradually colonized over the years; in general, they are well used. This proves their usefulness as refuges. The bird nests are still sparsely nested as this is a longer process and it is difficult to observe impacts in the short term. In the third year of the initiative, flower beds were created using a mix of 35 varieties of seeds, supplied directly by the Bayer Bee Care Center in Germany, which offer superior shelter and nourishment to local pollinators, as well as prolonged flowering and a blaze of colors: blue and pink in spring; a sea of shades in summer: warm yellow; and mauve tones in the fall.





Bees for safeguarding and monitoring biodiversity

Bees and agriculture form an unbreakable bond: Bees play a major role in the pollination of flowers and consequently in the quality of the fruit; their presence is an indicator for good health of the environment.







About 70% of the fruits of the earth depend at least in part on insect pollination. Honey bees are social insects that live in permanent colonies of several tens of thousands of individuals and feed mainly on nectar and pollen. This means that honey bees, much more so than other pollinating insects, are crucial organisms for the conservation of plant biodiversity and therefore for the maintenance of numerous ecosystems. Several studies conducted on these animals indicate that their health can be affected by many different factors, including pathogens and parasites, microbial diseases, malnourishment, certain agricultural methods, breeding errors or poor living conditions and adverse climate.

As a company with decades of valuable experience in animal health and crop protection, Bayer is committed to the protection of bees. To investigate bee health and the factors that could influence it, Bayer has created the 'Bee Care Program', which includes two Bee Care Centers - one in Germany and one in the United States. In these centers, researchers work on numerous initiatives aimed at helping beekeepers maintain healthy and viable colonies, and fight the Varroa mite.

Varroa is the main enemy of the honey bee, to which it transmits lethal viral diseases. Today there are no longer any colonies of honey bees that aren't affected by this mite.

In practice at the Bayer ForwardFarm

On the Bayer ForwardFarm, some beehives have been installed to obtain additional insights into the environmental quality of the agroecosystem, in addition to the monitoring activities of the "Biodiversity Friend®" protocol. Initially, two colonies of bees were placed in top-bar hives. This type of hive was chosen as it was considered more suitable for the purpose of the study. In top-bar hives, bees are not supplied with artificial waxy sheets but only bars on which the colony must build virgin wax combs, arranged according to their needs. This solution offers a great opportunity in terms of environmental monitoring, because much more reliable information on the environmental quality of the areas surrounding the hives can be obtained compared to traditional bee-hives. In the second year, two colonies hosted in Arnia Dadant hives were added, in order to monitor the beehive with a computerized monitoring system called Melixa, developed by a group of researchers from the Edmund Mach Foundation.

Melixa is a beekeeping monitoring system equipped with precision scales, bee monitoring sensors and climate sensors, which can be used to evaluate the weight variation of the bee colony, to count the number of daily flights and to provide data on the weather and internal temperatures of the hive. The system allows the beekeeper to continuously and remotely monitor the beehive by viewing data on the web portal.

The hive was managed completely by WBA professional beekeepers, who monitored the health of the colonies twice a month and fed them if necessary, depending on the weather conditions of the seasons. In general, no particular problems were identified in the colonies in terms of mortality or serious disease.

The findings highlighted small anomalies primarily attributable to the adverse climatic conditions and to the scarce natural presence of food. To solve the latter, flowers were planted on the farm.



Azienda Agricola Moranda

Sustainability in numbers



Crop protection products authorized by the Ministry of Health. Use crop protection products with caution. Always read the label before use, heading hazard warnings and symbols and product information.

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