

2: PROTECTION OF NATURAL RESOURCES – ENVIRONMENT – CODES OF GOOD AGRICULTURAL PRACTICE

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INTRODUCTION

As part of this unit, the negative impacts of "classic" (chemical) agriculture on the environment will be examined, along with methods of environmental protection using environmentally friendly farming techniques. The codes of good agricultural practice, which are a number of practices that help the environment, contribute to the protection of healthy products, bolster sustainability and reduce farming costs, will also be reviewed. Particular emphasis will be placed on the implementation and monitoring of compliance with the codes in farming activities.

EXPECTED RESULTS

When you have finished this chapter, you will be able to:

Better understand the negative impacts of traditional farming on the environment within your own area.

Better manage consumable inputs, such as fertilisers, pesticides and others.

Know and implement certain practical methods of farming with respect for the environment.

KEY CONCEPTS

Codes of good agricultural practice, Natural environment, Sustainable development, Climate, Biodiversity, Inputs.

2.1. Impact of agricultural activity on the natural environment

The Common Agricultural Policy was designed to increase agricultural production and to improve the standard of living of those involved in farming. Initially, the policy did not take into consideration the impacts of intensive agricultural production on the natural environment. In general, CAP had a negative impact on the quantity and quality of water resources, on soil quality and on biodiversity.

The CAP has known, over time, five major reforms, the most recent of them in 2003 (mid-term), in 2009 ("assessment of the state of health") and in 2013 (for the financial period 2014-2020)¹.

In the case of water, increased agricultural production requires **extensive extraction of surface and groundwater for irrigation**, reducing the surface water level and the quantity of water flowing into rivers. In turn, these impacts may contribute to the reduction of soils with high moisture content, the reduction of oxygen in rivers and to the flow of salt water into the groundwater of coastal areas. There are also areas where the substitution of crops with others requiring more water results in a drop in the water table by hundreds of metres.

Example:

The waters of Lake Doirani, in Kilis Prefecture, have been greatly reduced in recent years.

The reason for this is that there has been an increase in crops with high water consumption around the lake. Producers are not drawing water from the lake, but from boreholes they have made around the lake. How is it possible, though, to draw water from boreholes which are

¹ www.europarl.europa.eu

sometimes kilometres away from the lake and reduce the water level? This happens because the lake water is connected with underground water reservoirs deep in the earth. As soon as these ground reservoirs empty, water from the lake flows into them (according to the principle of communicating vessels) and fills them while the water level in the lake drops.

The same phenomenon is observed in coastal holiday resorts where overdrawn of water through boreholes results in the inflow of seawater into underground natural reservoirs. It then becomes apparent that brackish water is being drawn from boreholes which may be kilometres away from the sea.

In any case, **when the water becomes contaminated, wildlife that lives in the area is disturbed.** When the nitrogen in fertilisers ends up in lakes and rivers through leaching, it becomes poisonous for living organisms. Similarly, phosphorus causes phytoplankton to flourish (eutrophication) and leads to asphyxiation of fish.

Example:

Fish need the oxygen dissolved in the water to breathe. A great increase in phytoplankton limits the availability of oxygen for fish and causes them to asphyxiate.

Farming activities also diminish the soil through erosion, depleting the nutrients in the soil and causing pollution through the improper use of fertilisers based on inorganic nitrogen, phosphorus or potassium. It is estimated that about 50 million hectares, which amount to 16% of the EU's land, has depleted soil. The Commission has launched an effort to elevate soil protection to the same level as air and water quality.

Example:

The burning of stubble that is left after threshing results in the arable land becoming poorer in organic substances. What is left behind after threshing should remain on the field and be incorporated into the soil. This example illustrates one of the many mistakes made in farming which result in reducing soil fertility and increasing the level of pollution in soils and groundwater.

Biodiversity – which refers to the number and variety of living species in a particular area – has cooperated with farmers for thousands of years to improve agricultural production. In traditional farming systems, farmers relied on local populations of plants, animals and insects. The areas planted with crops were distributed among forested areas, soils with high moisture content, grassy meadows, rows of hedges and other natural areas which provided a living environment for numerous species and which supported the farming process. In modern farming systems, natural areas have been cleared and levelled so as to plant as many crops as possible. Many of the organic functions provided by biodiversity were replaced by artificial substitutes, like **fertilisers and herbicides. These harm the environment by polluting surface water and groundwater and indirectly destroying beneficial insects.**



In Europe, natural vegetation and many species of wildlife have been significantly impacted by the changing agricultural models. In the past, traditional forms of agriculture supported the greater part of biodiversity. The European landscape nowadays has few extensive, uncultivated areas which could support biodiversity. By emphasising production, the EU's agricultural policy promoted **monoculture**, which is the cultivation of just one crop in a large area. This type of farming has harmed many plant and animal species and agriculture is no longer in harmony with its environment. In the United Kingdom, for example, most of the meadows which are rich in flowers and about half of the ancient lowland forests and open fields have disappeared. As agricultural production intensifies, the number and health of species traditionally associated with farmland are decreasing. Farm crops at one time constituted the natural habitat of many species of birds; but these are disappearing. In Germany, one study showed that agriculture is responsible for the 72% reduction in plant and animal species which have been evaluated.

Agriculture also negatively impacts species of trees that are in danger of extinction.

The EU addressed the environmental impacts of its agricultural policy in reforming the Common Agricultural Policy (CAP) in 1992 and 2003. Among other measures, the increased **set-aside** (laying fallow) of arable land is expected to have a positive impact on the environment by providing habitat for plants, insects and animals (particularly birds), by reducing soil erosion, by providing pasture land and by restoring the landscape.

Example:

In order to understand the contribution of biodiversity (the existence of many and varied organisms) to balance in nature, consider the following example. Tomatoes and peppers are grown in one part of a garden where there are still some trees around and there are some hedges growing along the fence. The appearance of tomatoes and peppers attracts aphids from the surrounding area, as they like to eat vegetables. Aphids, however, are food for ladybugs, which eat dozens of them a day and keep their numbers down. The ladybug nests are in the hedges and trees near the crop. In this way, there is a dynamic balance between the insects in the vegetable garden. If the number of aphids increases, so does the number of ladybugs because they find more food and therefore multiply more quickly.

Consider, however, what happens if the garden is sprayed with insecticide. The insecticide kills the aphids, but it causes more damage to the ladybugs, which are larger in size and more sensitive. As a result, the aphids remain without natural enemies and proliferate uncontrollably, causing damage to the crops. To combat the growth of harmful insects, spray applications with pesticides have to be increased, further burdening the environment.

The same thing will happen if there are no hedges or if there are some but they have been removed, as beneficial insects will have nowhere to nest. It can be concluded, then, that the use of pesticides upsets the balance present in nature and creates a vicious cycle in which farmers use

increasingly greater quantities of pesticides. Chemical fertilisers work in a similar way, whereby their use destroys the microorganisms present in soil which help recycle crop residues.

2.2. Codes of Good Agriculture Practice

2.2.1 Introduction

The countryside in each area is different, depending on the type of farming done there, the way the fields are divided, the way the trees are trimmed, the species and varieties grown, ground inclination, the presence or absence of water and other factors. The types of landscapes formed by agriculture and animal husbandry are called **rural landscapes**. Apart for its own particular landscapes, agriculture maintains and provides food and shelter to many wild animals and plants.

Farming and animal husbandry have changed significantly over time, solving many problems, but creating others. The changes brought by the large-scale use of fertilisers, agricultural machinery, new irrigation systems and the abandonment of traditional methods of farming and breeding animals gave agriculture a boost and helped increase income. At the same time, they created problems both for farms and for the environment in general and therefore for society.

The role of farmers, all aspects of which are acknowledged, is not limited to production, but extends to protecting the environment, cultural heritage and the countryside as a whole. Farmers and their actions should aim to reduce problems created by farming and animal husbandry, but also to maintain good farming services to society in general. In addressing problems created by agricultural activity and the continuation of its positive functions, farmers should enforce certain practices, which are known as **Codes of Good Agricultural Practice (CoGAP)**.

These practices, almost all of which were used in the past and which were shown to be effective, were enriched with new ones where necessary and **aim at:**

- >the **sustainable management of farm lands** and natural resources;
- >the **protection and preservation of the rural landscape** and its characteristics;
- >the **protection of health** of farmers and consumers.

To achieve the abovementioned goals, the codes address the following agricultural activities:

1.	Soil cultivation
2.	Crop rotation
3.	Fertilisation
4.	Management of water resources
5.	Plant Protection
6.	Wild plant management
7.	Harvest
8.	Management of crop residues
9.	Waste management

The practice of crop rotation is applicable only to annual crops, arable crops and market produce. All other activities apply to all types of crops.

The Codes of Good Agricultural Practice also apply to the following animal husbandry activities:

1. Pasture management

In other words, the same field should not be used as pasture for so long that the grass is destroyed.

2. Animal health and welfare

Animals should live in good conditions, with adequate ventilation of their housing and stabling space, among other things.

3. Waste management in animal husbandry

Waste should be managed in such a way that the stock breeder does not pollute the environment. For example, liquid waste in an appropriate vat can be spread onto fields as fertiliser and there should be a biological treatment system where required, etc. Dumping waste into rivers, irrigation canals or streams is prohibited.

Additional codes may apply in certain areas or zones.

Farmers who are inducted into a farming programme in compliance with the CoGAP receive special subsidies, bonuses for new farmers and generally receive various **financial incentives** adapted from country to country. At the same time, their activities are supervised by competent agencies and in the event that the CoGAP is violated, there are **economic sanctions**.

Later and in the following units, the CoGAP applied to each agricultural activity will be cited, as well as how each is applied and its related sanctions.

2.2.2 Input management

The term **inputs** refers to the sum total of consumable products used in agricultural production, such as **fuels, energy, fertilisers, pesticides, agricultural tools and water**.

The total intermediate consumption (agricultural consumable inputs) comes to about 40-45% of the gross value of agricultural production in the EU-15.

A significant consumable input is **livestock feed**, which comes to about 20% of the total inputs.

Another major input is **energy consumption**, which is responsible for about 7-8% of the total inputs. This high proportion reflects an increase in the use of mechanised and modernised production methods.

Fertiliser consumption came to 8% of total consumable inputs for the year 2000 in the EU-15. It should be noted, however, that during the 1990s, there was a notable decrease in fertiliser use, in comparison to previous decades. Related to this, research findings indicated that the average use of nitrogen (which is directly related to water pollution) was about 100kg per hectare in the mid-1990s, but groundwater (due to its relatively greater depth) was less affected.

Finally, **plant protection products** contribute about 6-7% to consumable inputs. It should be noted that total sales in chemicals represent 3 kg per hectare of total utilised agricultural area (UAA) in the EU. Although there is a risk of increased chemical use aimed at achieving higher crop yields (cotton, corn, tobacco, etc.), chemical consumption remains at low levels for the time being.

On the other hand, a significant increase in **irrigated holdings** was noted during the last two decades, indicating the importance of irrigation in the notable improvement of total productivity in the sector. This was the result of irrigation not only in growing market produce, but also in extensive farming (corn, sugar beets, cotton).

The Codes of Good Agricultural Practice require farmers to keep **records of used inputs** along with associated documents for the purchase of these inputs. Farmers should retain these input recording forms, as well as other documents, for at least two years after the year they were completed. The safekeeping of these recording forms aims to improve the use of inputs on the one hand and to document the prerequisites for certification of products on the other.

Example:

A typical conversation between producers as they prepare to spray their fields with insecticide is presented as an example. "The instructions say to put two parts chemical in the sprayer. What do you say?" "Better to put in four. It will have better results. Let's not be stingy about it." The non-compliance with instructions for pesticide use, but also of all other inputs, is a common phenomenon in farming.

However, the result of incorrect use of pesticides is extremely negative. Some of the negative impacts include:

- The presence of chemical residues after harvest

- The pollution of the environment (soil, groundwater)

The destruction of fauna. Chemicals in large doses are toxic even to larger animals, such as hares, foxes and various birds, as they enter the food chain and become poisonous.

The application of CoGAP ensures control and documentation of all inputs and chemicals, making it difficult for anyone who uses them to deviate. Inspections can easily verify possible deviations through the following simple procedure.

- Asks the producer to submit invoices for the purchase of supplies (including the chemical itself).

- Checks the number of hectares in cultivation, as well as crops (integrated administration and control system).

- Checks that the chemicals are in storage.

- Calculates the quantity of pesticide used on each hectare.

By cross-referencing the above data, it is possible to quickly and accurately verify if the instructions were followed, and by extension, that CoGAP were complied with.

2.2.3 Soil cultivation

The soil is cultivated to prepare the field for the next crop, to prepare it for sowing, to destroy and bury undesirable plants and to ensure good drainage and soil aeration. This cultivating action on the soil upsets its structure, while extreme or unsuitable interventions can destroy it. The cultivated bare soil is vulnerable to erosion from wind and water. Therefore, any cultivation of the soil should be limited to the absolutely essential interventions as much as possible. Excessive soil cultivation requires increased energy, leads to greater and needless fuel consumption and at the same time has a negative impact on the soil.

The CoGAP main direction with regard to soil cultivation recommend the following:

- Work tasks related to the soil should be undertaken in the appropriate season using farming machinery suited to the soil and the task. It is preferable to make as few interventions as possible.
- Work on the soil should be done when it is somewhat moist, in other words, after the first autumn rains. It is preferable to avoid summer tillage if it is not considered necessary in combating perennial weeds.
- Avoid deep tillage greater than 40cm, if there is no need to uproot deep-rooted weeds or to break through the impenetrable soil layer. - If there is deep tillage and the impenetrable layer is broken, the soil should not be turned over.
- In cases where there is a flood risk, tillage should be done using a method that ensures the smoothing of fields using a reversible plough.

Additional requirements based on CoGAP:

- On fields with an inclination gradient greater than 10%, tillage is done along the contours, or diagonally, or natural ridges are created along the contours and tillage is done diagonally (uncultivated zones with plant coverage) at a width of 1-2m.

- Agricultural machinery should be used in such a way as to avoid damaging rural roadways.
- The uncultivated boundaries between fields, hedges, natural vegetation in ravines and any neighbouring forests should not be destroyed.
- Natural streams should be maintained. Interventions which result in changing the course of streams with heavy machinery should only be undertaken by permission by the competent authorities.

As an example, the importance of not damaging the uncultivated borders between fields or hedges or vegetations in ravines will be examined. Inspections made to ensure compliance with the CoGAP include, apart from the administrative control (of paperwork), onsite checks (in the fields). In this way, compliance with all of the above can be verified.

The importance of uncultivated boundaries between fields was emphasised above in referring to biodiversity, given that these boundaries serve as nesting areas for beneficial insects.

2.2.4 Crop rotation

Crop rotation (which means alternating crops), in both arable crops and market produce, is one of the most important factors in maintaining soil fertility. Crop rotation was essential and irreplaceable before the introduction of agricultural machinery and chemical fertilisers. The introduction of new farming methods made it possible to grow the same crop continually in the same field. This practice, however, exhausts the fields, which lose fertility, present increased weed- and disease-related problems and lead to increased production costs, as there is greater need for fertilisers and pesticides, while yield decreases over time. The most important thing is that the fields themselves lose their fertility while increased use of pesticides and fertilisers could have a negative impact on the environment and on human health.

Crop rotation is a practice that should start being used again, wherever it is not being used. Care should also be taken so that the fields do not remain bare during the winter when they are more vulnerable to erosion caused by rain. On light soils with a sand content greater than 50% (sandy, loamy sand, sandy loam), it is imperative to provide mulching in winter. This can be achieved through an appropriate crop rotation programme that includes a crop of green manure or correct use of the residues of previous crops or wild flora. Crop rotation achieves the following **goals**:

- Increase in soil fertility
- Improved soil structure
- Reduction in weed problems
- Reduction in disease problems.

To achieve the above goals, there will have to be alternating crops and depending on the problems being faced, a variety of crops should be alternated as part of a crop rotation scheme. The particular conditions in the fields, the preceding crops and the climatic conditions should all be taken into account in formulating the crop rotation programme. Crop rotation should ensure that the same crop is not grown continuously on the same field. Specifically with regard to arable crops (meaning those which require tillage of the field) and market produce, except cotton, sugar beet and industrial tomatoes, the same field cannot be planted with the same crop for more than four years. In cotton farming, the administrative measures in effect for cotton will apply. Sugar beet and industrial tomatoes should not be grown on the same field for more than two seasons in five years. These growing seasons should not be contiguous, and should be at least three years apart.

To achieve this goal of alternating crops, the following crop rotation methods may be applied:

- Method A Over a five-year period, the field is allowed to lie fallow or be rotated for an

entire year.

-Method B Over a five-year period, at least 20% of the field (main crop) is allowed to lie fallow or be rotated.

-Method C Over a five-year period, Method A is applied on some fields, while Method B is applied to others. The same field cannot be farmed using both methods over a period of less than five years. A change in the crop rotation method on a specific field can only be made when adequate rotation (not less than 20%) has been achieved.

In order that crop rotation achieves its goals, the crop rotation programme being applied should be appropriate to the local conditions. For this reason, the competent authorities post a compulsory crop rotation programme suitably adjusted to farm conditions and their economic budget.

Example

The cyclical change of crops on a specific field each year, as described above, is called crop rotation. There are many crop rotation systems which are implemented depending on whether the field is irrigated or non-irrigated. A common crop rotation system used is the five-year rotation. To illustrate, here is a plan using crops that are common.

	Field No.	Area	Type of crop
1st YEAR	101	15	Patatoes
	102	30	Wheat
	103	20	Wheat
	107	15	Chickpeas
	110	20	Maize
	Field No.	Area	Type of crop
2nd YEAR	101	15	Maize
	102	25	Patatoes
	103	20	Wheat
	107	15	Wheat
	110	20	Chickpeas

	Field No.	Area	Type of crop
3rd YEAR	101	15	Chickpeas
	102	25	Maize
	103	20	Patatoes
	107	15	Wheat
	110	20	Wheat

	Field No.	Area	Type of crop
4th YEAR	101	15	Wheat
	102	25	Chickpeas
	103	20	Maize
	107	15	Patatoes

	110	20	Wheat
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	Field No.	Area	Type of crop
5th YEAR	101	15	Wheat
	102	25	Wheat
	103	20	Chickpeas
	107	15	Maize
	110	20	Patatoes

In the example, Method A is used and the following apply:

During the five-year period, the field is allowed to lie fallow or be rotated for an entire year. In the example above, the field undergoes crop rotation.

A legume must participate in the crop rotation at a rate of 15% of the total area. Maize cannot be grown more than once in two years and pulses not more than once in three years. Sugar beet should not be grown on the same field more than one growing season.

2.2.5 Fertilisation

Fertilisation is essential for plant growth and the qualitative and quantitative improvement in yield, as well as for the maintenance of soil fertility. To achieve these goals through fertilisation, the fertiliser should be appropriate to the soil and the crop and the quantity should be controlled each time it is applied, along with the way and the time it is applied. The use of improperly selected fertilisers applied in incorrect amounts and at the wrong time increases production costs, as there is fertiliser overuse. In addition to increased costs, problems are created in the soil and groundwater and surface water is polluted. With the correct use of fertilisers as their aim, according to the CoGAP, producers should:

Apply the most appropriate quantity and type of fertiliser according to the crop and type of soil to meet the nutritional needs of the plants, as listed in the "fertilisation practices" issued by local Rural Development and Agriculture administrations. ☑Apply nitrate fertiliser in amounts suited to the stage of germination.

The maximum amount of 160kg N/Ha is applied on winter wheat and in at least two doses. The main fertilisation should not exceed 50kg N/Ha.

- Fertilisers should not be applied at a distance of less than 5m from the edges of rivers and lakes and 0.5m from irrigation canals, drainage channels, wells and boreholes.
- Apply naturally alkaline fertilisers on acidic soils (with pH <6.5) and avoid the use of fertilisers that lower the pH further (increase acidity), such as ammonia fertilisers, with the exception of calcium ammonium nitrate. Conversely, sulphur fertilisers are preferred for alkaline soils.
- During the application of nitrate fertilisers, the instructions on the fertiliser container must be carefully followed and particular attention should be paid to avoiding the use or drift of fertilisers in locations where the risk of surface runoff is great, particularly in waterretaining soils and/or inclines.
- Fertilisers should not be applied in strong winds and the spreaders should be used and maintained properly.
- During packaging, transport and storage, measures should be taken (particularly with liquid fertilisers) to ensure there is no risk of leaks. Sacks of fertiliser should not be placed within 5m from any bodies of water, streams, boreholes or wells.

- In using liquid fertilisers in particular, tanks, pipes and valves should be meticulously maintained to avoid any leaks.
- Fertiliser packaging materials should not be left at the site of application or any other place other than that intended for this purpose.

2.2.6 Protection of water resources

Successful irrigation should provide the soil with as much as water as necessary to help the crop grow correctly on the one hand, and on the other hand, should ensure that the application of water is such that there is the least possible waste of water and nutrients through deep percolation or surface runoff. During every irrigation, enough water should be applied so as to saturate the soil to a depth equal to that of the root system. Deep percolation and surface runoff can be minimised with the proper control of a number of factors which affect irrigation:

a. irrigation water supply (leaks in the supply system should be avoided or repaired)
b. duration of irrigation
c. ground inclination
d. the distance water travels to the field
e. soil infiltration rate
f. the irrigation method

Additional requirements based on CoGAP state:

- Care should be taken to minimise water loss during irrigation by avoiding surface runoff or deep percolation. An exception is made in cases where deep percolation is necessary to treat salinity.
- Fields with an inclination gradient greater than 3% should not be irrigated by flooding (in ditches) except for the irrigation of perennial crops with ditches around the plant stalk.
- Irrigation practices for each crop should be observed (total quantity, number of applications, amount per application), as determined by local authorities.
- Regulations of organisations operating collective projects should be observed.
- Measures limiting the use of water, where required by competent bodies, should be observed.

Example:

there is a summary of some of the parameters that should be taken into account to achieve the best possible result in irrigation. (Water conservation, best use of water by plants)

- Installing a drip irrigation system
- Suitable water pressure in the system
- Compliance with instructions from manufacturer and advising agronomist regarding number and duration of irrigation.
- Selection of the most suitable time (it should not be very hot or very windy)
- Correct levelling of the field

By adhering to the above, a reduction in water consumption of up to 70% may be achieved with good results in crop yield.

2.2.7 Plant protection

The use of plant protection products should be justified by the presence of disease, the extent of invasion or the presence of weeds. In addition to the presence of the problem, this should be defined and assessed in terms of whether the loss it would cause in production or plant health would have a significant economic impact.

An attempt should be made to prevent and impede the establishment of harmful organisms in crops, which, according to CoGAP, **must** be done:

- by resorting to organic remedies before chemical means are used;
- by using propagation material that is disease-resistant or disease-free;
- by managing wild plants in order to avoid seed production of undesirable types while allowing desirable types to germinate in suitable locations;
- by destroying wintering forms of enemies and diseases in winter;
- by implementing suitable crop rotation;
- by monitoring the emergence of enemies, weeds and diseases in the area so that timely measures may be taken to suppress them;
- by managing sowing density.

2.2.8 Useful CoGAP for irrigation and plant protection

CoGAP include a series of instructions for more efficient and economical irrigation, plant protection and personal protection during its application. **For irrigation:** the main types are:

- Surface irrigation
- Surface irrigation with ditches or parallel strips. This method is used to irrigate leguminous crops, such as cotton, maize, vegetables and others.

To ensure success of this method, the field should be tilled and the crops should be sown linearly.

Surface irrigation is not the preferred system of irrigation because it involves:

- great water consumption;
- leaching of nutrients;
- uneven irrigation; the above is more apparent in sandy soils.
- in cases where the field inclination gradient is greater than 2-3%, there is greater loss of water from surface runoff.

It should be noted, however, that surface irrigation may be necessary if the type of crop or soil demands it, such as soils which exhibit problems with salt deposits or crops like rice.

Surface irrigation is the most wasteful method of irrigating fields. In the event that the above method of irrigation is deemed necessary, the most effective measure to reduce water consumption is to level the field as much as possible so as to restrict water loss.

The negative impacts of surface irrigation are evident in fields where water collects in certain spots, while others which are on a slope have leached and appear lighter in colour (indicating the drainage of organic substance, which is dark).

Sprinkler irrigation

With this system, water is uniformly applied to the entire field. The rate at which the irrigation takes place should be the same as the rate of absorbency in the soil so that there is no surface runoff. To achieve this balance, the selection of nozzles and the arrangement of sprinklers should be made in such a way that the intensity of the spray is equal to the base soil percolation rate and the average hourly spray height should be appropriate to type of soil in the field. The duration of irrigation should be such that water percolation to the deeper soil layers is avoided.

There is often loss of irrigation water with this method when irrigation is done at the wrong time (at midday - 11 am-3 pm) due to evaporation. It is also possible that irrigation will not be uniform when weather conditions are unsuitable (wind speeds higher than 5 Beaufort/21 mph). Irrigation should be avoided in the above conditions. The water drops break up the texture of the topsoil when water is released at high pressure during sprinkler irrigation. This system should be avoided when the quality of irrigation water is not good, as the salts from irrigation remain on the leaves and stems of plants.

This method of irrigation is considered somewhat outdated due to the water loss it involves. For this and other reasons, this system's replacement is being promoted.

Drip irrigation

Drip irrigation is applied to part of the soil and specifically around the plant root system. The water supply from the drippers is very slight, about 2-3 litres an hour, which results in the water percolating into the soil rather than running off the surface. Given that irrigation is repeated daily for 2-3 hours to replenish the water that has evaporated, there is no water loss due to deep percolation.

This system ensures: complete control of irrigation, almost zero leaching of nutrients, effective operation on sloping surfaces and where water quality may be marginal and reduced labour costs. Finally, it facilitates the gradual application of liquid fertilisers and fertilisation in doses. The only disadvantages are the high initial cost to purchase the system and the high level of expertise required to operate and maintain it (e.g. care to avoid blockages in drippers).

It is the most preferred method of irrigation and is being promoted through investment programmes with subsidies to replace other systems of irrigation with drip systems.

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Surface irrigation is the most wasteful method of irrigating fields. In the event that the above method of irrigation is deemed necessary, the most effective measure to reduce water consumption is to level the field as much as possible so as to restrict water loss. The negative impacts of surface irrigation are evident in fields where water collects in certain spots, while others which are on a slope have leached and appear lighter in colour (indicating the drainage of organic substance, which is dark).

Sprinkler irrigation

With this system, water is uniformly applied to the entire field. The rate at which the irrigation takes place should be the same as the rate of absorbency in the soil so that there is no surface runoff. To achieve this balance, the selection of nozzles and the arrangement of sprinklers should be made in such a way that the intensity of the spray is equal to the base soil percolation rate and the average hourly spray height should be appropriate to type of soil in the field. The duration of irrigation should be such that water percolation to the deeper soil layers is avoided. There is often loss of irrigation water with this method when irrigation is done at the wrong time (at midday - 11 am-3 pm) due to evaporation. It is also possible that irrigation will not be uniform when weather conditions are unsuitable (wind speeds higher than 5 Beaufort/21 mph). Irrigation should be avoided in the above conditions. The water drops break up the texture of the topsoil when water is released at high pressure during sprinkler irrigation. This system should be avoided when the quality of irrigation water is not good, as the salts from irrigation remain on the leaves and stems of plants. This method of irrigation is considered somewhat outdated due to the water loss it involves. For this and other reasons, this system's replacement is being promoted.

Drip irrigation

Drip irrigation is applied to part of the soil and specifically around the plant root system. The water supply from the drippers is very slight, about 2-3 litres an hour, which results in the water percolating into the soil rather than running off the surface. Given that irrigation is repeated daily for 2-3 hours to replenish the water that has evaporated, there is no water loss due to deep percolation. This system ensures: complete control of irrigation, almost zero leaching of nutrients, effective operation on sloping surfaces and where water quality may be marginal and reduced labour costs. Finally, it facilitates the gradual application of liquid fertilisers and fertilisation in doses. The only disadvantages are the high initial cost to purchase the system and the high level of expertise required to operate and maintain it (e.g. care to avoid blockages in drippers). It is the most preferred method of irrigation and is being promoted through investment programmes with subsidies to replace other systems of irrigation with drip systems.

For plant protection:

For the protection of the environment, as well as farmers, during plant protection activities, the main instructions are:

Recommended

- The application of plant protection products should ensure uniform distribution of the spray liquid and precision in application.
- Plant protection interventions should be designed to avoid the development of increased resistance. For this reason, plant protection products should be alternated to include different active ingredients and having different action.
- There should be meticulous compliance with measures recommended by regional plant protection and quality control administrations and by research institutions wherever resistance is apparent. Where resistance is apparent, the Plant Protection Bureau of the Rural Development and Agricultural Administration should be notified.

- In combating weeds that create particular problems for crops on inclined surfaces (inclination gradient greater than 10%), the selection of herbicide should be made with the provision that some mulch will be maintained during the rainy season.
- The application of granular preparations should be carried out by incorporating the granules into the soil so as to prevent birds from ingesting them, unless their incorporation reduces their effectiveness.
- During herbicide application, a safety zone should be maintained from adjacent crops, from hedges, bird nests, aquatic flora, surface water and other important environmental elements.
- Packaging materials from plant protection products should not be left at the site of application or any other place other than that intended for this purpose.

Required

- The use of plant protection products should be made at the appropriate time so as not to affect beneficial insects.
- The use of substances toxic to bees is forbidden when plants are flowering.
- In combating weeds that create particular problems for crops on inclined surfaces, the selection of herbicide should be made with the provision that some mulch will be maintained during the rainy season.
- Spray equipment in use should be well maintained and regulated and be inspected at regular time intervals.

For personal protection

Recommended

Those using plant protection products should follow the safety instruction listed on package labels by the manufacturer, e.g. special protective clothing, goggles, masks, gloves, etc.

2.2.10 Harvest

In the event plant protection products have been used, harvest must be carried out after the period of time listed on the product label has passed.

2.2.11 Wild flora management

Wild plants play an important role in the function of the soil and the farm environment in general. Their presence in some area of the field is sometimes undesirable and at other times desirable. It is important that producers know when and from where these should be removed and in what way and where they should be kept.

Wild plants at the boundaries of the farm (particularly if they are hedges or tree lines) are desirable because they protect the field and various insects, reptiles, birds and small mammals which may be natural enemies of crop pests find refuge in them, while they serve as a valuable part of the country's natural environment.

For the abovementioned reasons, it is essential to maintain an 0.5 metre uncultivated space between fields.

Hedges and flora along the borders of the farm in general are an element of the agricultural landscape and beyond their value in preserving the natural environment, they have an aesthetic value which should also be preserved and emphasised.

Wild plants, the stubble of previous crops or the cultivation of green manure are useful in covering the fields in the winter months, particularly on sloping ground with an inclination gradient greater than 10%. The practice of mulching the soil, mainly during the winter months, offers significant benefits listed below:

- It lessens the degradation of soil fertility because it protects the structure from the fragmentation caused by rain.
- It increases the ability of soils to absorb rainwater and reduces surface runoff.
- It functions as a thermal insulator in extreme temperatures.
- It helps retain moisture because it prevents evaporation.
- It reduces soil erosion and loss of nutrients.
- It aids the development of microorganisms in the soil which contribute to soil fertility.

It is recommended that wild plants be removed from the soil during summer months in areas and crops, such as olive trees, where there is increased risk of fire.

2.2.12 Management of crop residues

With correct management, the residues of arable crops can provide protection against erosion in the field and can enrich the soil with organic substances. The convenient practice of burning stubble deprives the soil of organic substances and of other advantages described in the section on managing wild plants. The benefit to the soil of retaining more rainwater and lessening evaporation from the crop residues is directly related to good seed germination. Moisture retention is also better if there is better mulching with plant residues. For these reasons, stubble burning should be avoided.

The burning of stubble is often the cause of fire. For these reasons:

- The burning of stubble is prohibited in environmentally sensitive areas, on sloping ground (greater than 10% inclination) and in areas with organic soils (organic substances greater than 4%). The following management practices may be undertaken, depending on local conditions:
 - Grazing on stubble and incorporation of grazing residues into the soil.
 - Immediate incorporation into the soil.
 - Cutting, mulching with residues and incorporating them into the soil the following spring.

The clippings from perennial crops:

- It is forbidden to burn cuttings on areas that are within a 500m radius from forests or are environmentally sensitive, unless permission has been obtained from the fire service.
- Burning should take place during the winter months.
- It is recommended that clippings be used as renewable energy sources in the home (fireplaces, wood stoves) or incorporated into compost piles after they have been shredded.
- When burning, measures to prevent the spread of fire should be taken, as described below.

When stubble is burned, the following measures **should be taken**:

1. Request permission from the competent authorities where required.
2. Notify the fire service before burning takes place.
3. Burn control measures should be in place before burning begins, such as the creation of fire-safety ditches.
4. In the location where burning is to take place, there should be 200 litres of water available, along with shovels and at least two people to supervise.
5. The burn materials should be at a distance from electricity or telephone poles, from any natural gas or oil facilities, etc.

Also recommended:

1. Burning should take place against the wind where possible.
2. Wherever possible, the ashes should be incorporated into the soil within two days of the burn.

2.2.13 Waste management

Crop waste, plastic mulches, fertiliser packaging materials, pesticides, irrigation materials no longer being used or agricultural machinery parts should not be left on the fields or in common areas, but should be collected and disposed of in specially designated areas.

Plastics from packaging or mulches and paper supply wrapping can be recycled, as now there are recycling bins available in every municipality. Old machinery can be turned over for dismantling or recycling by arrangement with the municipality or the manufacturing company. Great attention must be given to any types of chemicals whose expiration date has passed. In no event should they or their empty containers be thrown into rivers, streams or irrigation canals.

2.3 IMPLEMENTATION - CoGAP COMPLIANCE REVIEW - PENALTIES

2.3.1 Implementation

The implementation of all the codes is compulsory and non-compliance carries penalties as outlined below. Acceptance of the commitment to comply is indicated by the signature of an agreement by the participant in the corresponding programme.

2.3.2 Review

Review of compliance with the commitment is carried out on at least 5% of participants annually. Reviews are carried out, where possible, concurrently with reviews to verify farmers' obligations resulting from the requirements of subsidy programmes.

Reviews may be:

- on site;
- on site, in combination with review of documents related to the purchase of fertilisers and pesticides;
- computerised cross-referencing of collected data, where possible, particularly to certify compliance with compulsory fallow-period and crop rotation or grazing density;
- laboratory testing, where deemed necessary (e.g. to check for pesticide residues, heavy metals, etc.)

The selection of review samples is done on the basis of risk analysis and random sampling with the aim of ensuring representation. To determine the criteria for risk analysis, the applicable contents are reviewed as per Regulation 2419/2001.

More specifically, on site inspections may, depending on the season they are being conducted, involve:

Example

- on site, in combination with review of documents related to the purchase of fertilisers and pesticides;

During this combined review, compliance with CoGAP is verified with regard to:

The quantity and type of fertiliser and pesticides used. The review is conducted through documents related to the purchase of fertilisers and pesticides, while at the same time, there is an on-site inspection of residual chemicals in storage so they may be taken into account.

- On site inspection

An on-site inspection is carried out during tillage to check compliance with regulations requiring the maintenance of uncultivated zones around the fields and the protection of rural roadways. In addition, crops are inspected in the final stages of growth to determine the type of crop and the percentage surface area of the field it occupies. Finally, the management of crop residues is the object of inspection, as part of the regulations imposed by CoGAP (burning or incorporation of stubble in grain crops).

- Laboratory inspection

Samples are taken from the final products (e.g. tomato) and sent to certified laboratories to ascertain whether there are pesticide residues above allowable limits. The presence of residues indicates non-compliance with CoGAP (non-compliance with spraying times or use of amounts that are greater than specified).

2.3.2.1. Soil cultivation

Review of tillage to determine whether it is being done along contours or diagonally, where the inclination gradient is greater than 10% or, in the event tillage is done against contour lines, that there are barrier zones or diagonal tillage.

2.3.2.2. Crop rotation

Review of crop rotation programme implementation

2.3.2.3. Fertilisation

1. Review (based on documents) of quantity and type of fertiliser used
2. Review of compliance with fertiliser storage regulations

2.3.2.4. Irrigation

1. Check for surface runoff
2. Check for deep percolation
3. Review of compliance with Land Reclamation Organisations (OEB) regulations
4. In areas where the water table has been depleted, the application of an irrigation water use reduction programme should be reviewed. For example, the cultivation of non-irrigated crops in the appropriate area or the control of underground irrigation through supply meters.

2.3.2.5. Plant protection

1. Review (through documents and/or on-site visits) of the suitability of preparations in use for crops relative to the indications of the preparation being used.
2. Review of herbicide use on hedges or uncultivated zones.

2.3.2.6. Wild flora management

In ecologically sensitive areas, the presence of hedges 1.5m wide or uncultivated boundaries should be checked.

2.3.2.7. Management of crop residues

Review of burn applications on sloping areas or in areas within the Natura 2000 network or on organic soils.

2.3.2.8. Waste

Inspection for the presence on the fields of waste resulting from packaging of fertilisers, pesticides, plastic mulches and other discarded materials.

In addition to the above, which may be verified by on-site inspections, if it is found that water is being polluted by fertilisers or pesticides, the applicable penalties will be enforced.

2.3.3 Sanctions - penalties

According to EC regulations, farmers are required to adhere to CoGAP. In the event that during an inspection it is apparent that the farmer being inspected is not adhering to one or more of the Codes of Good Agricultural Practice,

the following penalties must be imposed, along with a proportional reduction in support.

TABLE of Inspections and Sanctions

No.	Goal	Inspection by Competent Authority	Sanction
1.	Prevention of soil erosion	<ul style="list-style-type: none"> Tillage perpendicular to contours or diagonally on inclines >10% without barrier zones 	<ul style="list-style-type: none"> 10%
2.	Protection of soil fertility	<ul style="list-style-type: none"> Non-compliance with crop rotation programme 	<ul style="list-style-type: none"> 10%
3.	Correct use of fertilisers	<ul style="list-style-type: none"> Non-compliance with fertiliser record-keeping Warning for first violation; 10% penalty for recurrence Exceeding amounts of fertiliser per hectare Non-observance of minimum distance from surface water in fertiliser application 10% Non-observance of minimum distance from surface water in fertiliser storage 	<ul style="list-style-type: none"> Warning for first violation; 10% penalty for recurrence 10% 10%

4.	Protection of water table – Irrigation	<ul style="list-style-type: none"> • Crops planted in dry lake beds • 100% • surface runoff or sprinkler irrigation of fields or 10% • 10% roadways • Warning for first • deep percolation • Irrigation by flooding on slope with gradient greater than 3% • Non-compliance with OEB regulations 	<ul style="list-style-type: none"> • 100% • Warning for first violation 10% penalty for recurrence • Warning for first violation 10% penalty for recurrence • 10%
5.	Correct use of plant protection products	<ul style="list-style-type: none"> • Non-compliance with plant protection product • Correct use of plant record-keeping • Use of unapproved or banned preparation • Use not made in approved way and/or made at wrong time • Use of herbicide on uncultivated boundaries or hedges • Dumping of packaging materials from plant protection products, fertilisers and plastic mulches in fields or public spaces • Dumping of plant protection product residues in streams, rivers, lakes, irrigation or drainage channels, wells and boreholes • Use of preparations toxic to bees during flowering season 	<ul style="list-style-type: none"> • Warning for first violation 10% penalty for recurrence • 10% • 100% • 10% • 10% • 30% • 20%
6.	Correct management of crop residues and protection of fauna	<ul style="list-style-type: none"> • burning stubble on sloping fields, orgeologically sensitive areas • burning plant clippings without perone is required • absence of uncultivated boundary 	<ul style="list-style-type: none"> • 20% • 20% • 10%
7.	Protection of livestock	<ul style="list-style-type: none"> • Absence of branding 	<ul style="list-style-type: none"> • 20%
8.	Protection of pastureland	<ul style="list-style-type: none"> • Compliance with start and/or end dates for use of pastureland • Non-compliance with grazing density • Grazing in areas where it is prohibited (burned, designated for reforestation, inducted into grazing ban programme, etc.) • Use of burning in revegetation of pasturelandwithout permit 	<ul style="list-style-type: none"> • 10% • 20% • 30% • 10%
9.	Correct waste	<ul style="list-style-type: none"> • Dumping waste from animal husbandry 	<ul style="list-style-type: none"> • 30%

	management in animal husbandry	activities into streams, rivers, lakes, irrigation or drainage channels, wells and boreholes <ul style="list-style-type: none"> • Disposal of wastes at a distance <50m from surface water and without taking measures to prevent surface runoff and leakage into groundwater 	<ul style="list-style-type: none"> • 10%
10.	Protection of environmental waste	<ul style="list-style-type: none"> • Presence of waste (packaging material, old irrigation equipment of agricultural machinery, in the fields or in public spaces) 	<ul style="list-style-type: none"> • 10%

2.3.3.1. Calculating Penalties

The penalties listed in the table below are expressed as a percentage of the annual payment farmers receive for each assistance programme they have submitted an application for.

Nevertheless, with regard to investments in farms and the bonus for young farmers setting up farms for the first time, the total amount is taken as the total of payments over 10 years in applying the penalties. In calculating penalties, 1/10 of the total payment is considered the annual amount.

Annex

European law for the development of agricultural activity with environmental protection.

The most important measures-directives are the following:

A.1 Laws related to chemical substances

Various directives which contribute –mainly indirectly – to the protection of the environment from certain intensive farming activities. In summary:

a. Plant protection

Directive 778/631/EEC determines packaging of dangerous preparations by category. Directive 79/117/EEC forbids the distribution of plant protection products which contain certain dangerous active ingredients, such as mercury or chlorinated organics.

A series of directives determine the maximum content with regard to plant protection product residues in various agricultural products, such as:

- 76 / 89 / EEC, market produce
- 86 / 362 / EEC, grains
- 86 / 363 / EEC, foodstuffs of animal origin
- 87 / 519 / EEC, animal feed

b. Legislation on Veterinary and Zootechnical Matters

Directive 70 / 524 / EEC determines the conditions under which additives may be used in animal feed. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31970L0524:CS:HTML>

Directive 85 / 520 / EEC establishes the maximum copper content in pig feed. This measure is particularly important in cases where waste from the pig stalls ends up in the soil as it helps avoid the build up of high concentrations of copper where it may negatively impact plant growth. (<http://eur-lex.europa.eu/Notice.do?mode=dbl?fr&ihmlang=cs&lng1=fr%2Cel&lng2=de%2Cel%2Cen%2Ces%2Cfi%2Cfr%2Cit%2Cnl%2Cpt%2Csv%2C&val=115934%3Acs&page=>)

c. Social Structure Policy

Directive 75 / 268 / EEC – Regulation (EEC) 355 / 77 – Regulation (EEC) 797 / 85 as amended by Regulation (EEC) 1760 / 87 – Regulation (EEC) 1272 / 88 – Regulation (EEC) 4115 / 88

d. Measures for Forests

There are special protective measures for EU forests:

- j) Against air pollution, mostly caused by acid rain (Regulation (EEC) 3528 / 86).
- ii) Against fires (Regulation (EEC) 3529 / 86).

A.2 Directions in research related to agriculture and the environment

Various programmes within the framework of the European Research Policy cover the activities of the agricultural sector and the environment.

The main points refer to the quality of soil with sub-programmes such as:

- Biological and chemical behaviour of plant protection products in the soil and water tables.
- Nitrates in the soil
- Study of erosion and material transport.
- Impact of fires on forests, soil erosion and the dynamics of drainage basins.
-

There are also programmes which address the use of agricultural waste and biotechnology.

- The creation of disease-resistant plants which are less reliant on chemical plant protection preparations.
- Bacterial fixation of atmospheric nitrogen.
- Improved effectiveness of fertilisers.

A.3 Measures within the Environmental Policy framework

Existing measures within the framework of the Environmental Policy are summarised as follows: Regulation 2242/87 – CORINE Programme - Directive 85/387 and 86/278. (http://aei.pitt.edu/5706/01/003102_1.pdf, <http://www.fao.org/docrep/T0551E/t0551e08.htm>)

SELF-EVALUATION TEST

Answer True (T) or False (F) to the following questions:

Agricultural activities also degrade the soil

1. For the growth of crop plants, the physical composition of the soil is not the only important factor, but also its reaction; in other words, it is important whether a soil is acidic, neutral or alkaline.

a) True

b) False

2. With the aim of correct use of fertilisers, farmers should apply the ideal quantities and types of fertilisers for each crop and type of soil to cover the nutritional needs of the plants.

a) True

b) False

Select the correct answer to the following questions:

1. Farming using environmentally friendly methods is

a) a movement – goal that is in fashion

b) a movement – goal to protect the environment

c) a movement – goal because of marketing and advertising

2. What is good agricultural practice

a) reasonable management of natural resources

b) correct use of inputs

c) economic viability of the farm and sustainability

d) all of the above

3. Crop rotation achieves the following goals:

a) An increase in soil fertility

b) Improved soil structure

c) A reduction in weed problems

d) all of the above

4. Farmers should retain input recording forms, as well as other documents,

- a) or at least two years after they were completed
- b) for one year after they were completed
- c) for three years after they were completed
- d) for as long as farmers want

ACTIVITIES:

1. Document the varieties of grapes in your country and research the type and acidity of soil each thrives in. Draw conclusions.
2. Look at a map of your country and find crops along nearby shores of lakes and rivers. Determine if there are laboratory analyses of their water.
3. List the fertiliser manufacturers in your country. Separate their products into the fertiliser categories you have learned.
4. In order to verify in practice whether the implementation of CoGAP has positive impacts on our own economy, as well as being beneficial to the environment, try to make the comparison below:
 - Choose one of your fields.
 - Calculate the expenses and revenues that were recorded from the specific field before CoGAP were applied (this can be done through the farming accounts that are kept).
 - Calculate the corresponding revenues and expenses for the same field after implementation of CoGAP.

Compare the results before and after implementation of CoGAP with regard to:

Average production of the field

Expenses for inputs related to fertilisers and pesticides

With this simple comparative study, it is possible to verify whether there is improvement or not in the economic result brought about by observing the above codes.