

3 Analysis of the shortcomings in current vegetable production

J.J. de Haan

Applied Plant Research (PPO), Lelystad, The Netherlands

V. Tisseli

Centre for Plant Production Research (CRPV), Cesena, Italy

A. Garcia Diaz

Institute for Agricultural Research (IAIA), Valencia, Spain

C. Hippe

Swiss Federal Research Station for Fruit Growing, Viticulture and Horticulture (FAW), Wädenswil, Switzerland

3.1 Introduction

In this chapter, the analysis and diagnosis as carried out in the VEGINECO project are summarised to present the problems and the environment in which the farming systems were designed. In Chapter 2.2, a framework was presented for the analysis and diagnosis. This framework is used to present the results. However, not all of the points were treated at this point. In each method manual, a short analysis and diagnosis is presented related to the method. As it can be seen in this chapter, there is overlap between the subjects treated in relation to their place in the framework.

From the analysis and diagnosis as carried out in the VEGINECO project, some general developments are summarised:

- Changes in farming practices:
 - scale enlargement,
 - specialisation to a few crops,
 - better mechanisation for weed control, planting and harvesting,
 - inclusion of vegetables by larger arable farms,
 - a decrease in the number of small specialised farms.

- Changes forced by social demands:
 - rise in control systems for quality production chains,
 - more integrated production labels and increasing importance of organic production,
 - attention to other functions in the rural areas and farming.

- Changes in eco-environmental effects:
 - innovative environmental compatible farming methods.

The speed of development in the different practices is different for different countries, however, the general picture remains the same over all of Europe. As the length of the project was limited, it was not possible to finish the analysis and diagnosis before designing and testing the farming systems. Therefore, some important conclusions about the analysis and diagnosis were not accounted for in the design of the farming systems. In the following paragraphs, these main points will be examined in more detail.

3.2 Farming practice

3.2.1 Farm structure

Farm structure is specific for each region. A statistical analysis was made several factors including: the total surface area, the chosen crops, the area per crop, the trade value per crop, the involved channels for trade and the import/export flows for vegetables in the country and, when possible, in the region in which the partners are working.

Figure 3.1 shows the area for field-grown vegetables in every region and the number of farms involved. Figure 3.2 focuses on the 10 major crops per region. The field-

grown vegetables account for only a small surface area (between 1-4%) of the total agricultural land in the regions. The surface area of field-grown vegetables is about 3-4 hectare on average per farm. The surface area per farm is larger in the Netherlands than in other countries. The crops grown in vegetable farming are diverse. The surface area of the largest crop is in all cases less than 20% of the total cultivated area in the region. Especially in Italy and Switzerland, there are no typical crops.

Southwest region in the Netherlands

The Southwest region, the area in which the experimental farm is located, is relatively important with more than 7 000 hectare of field-grown vegetable (3.7% of the total

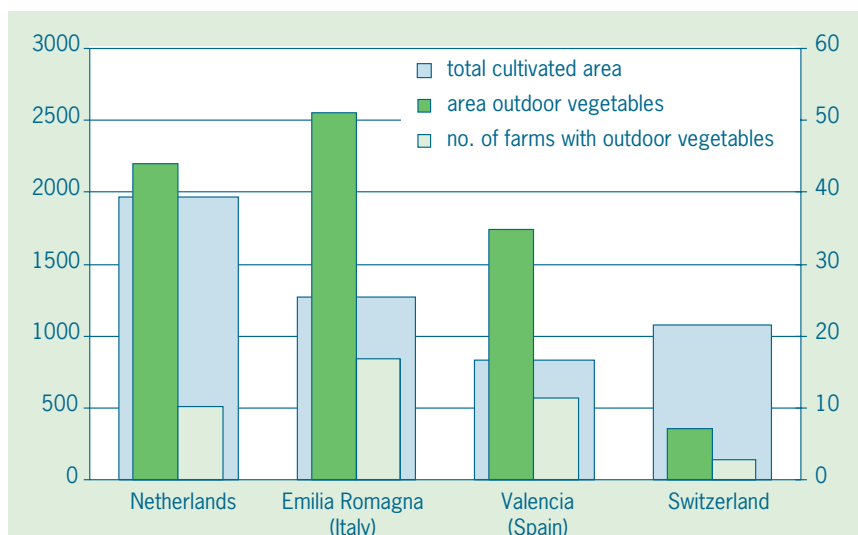


Figure 3.1 Total agricultural cultivated area (left axis in 1 000 hectare), area for field-grown vegetable (right axis in 1 000 hectare) and number of farms with field-grown vegetable (right axis, x 1 000).

farmland area compared to an average of 2.2 hectare per country). In the Netherlands, onions, processed peas and potatoes are considered to be arable crops and as such, they are not taken in to account in Figure 3.2.

Italy (Emilia-Romagna)

In Italy, more than 15 million hectares are cultivated, of which 3.7% is used for field-grown vegetables. Vegetable production in Italy stays almost unchanged in importance with 15% of the total agricultural market value.

Vegetable production areas are located in Southern Italy as well as in Emilia-Romagna and Veneto (north-eastern Italy). From the beginning of the 90's, there has been a great increase in integrated and organic production.

Mechanisation is spreading in industrial vegetable crops such as onion and potato, partly because of labour shortage. This has caused a decrease in production costs and in some areas, an increase of leased land.

In Emilia-Romagna, the surface area of field-grown vegetables is about 51 000 hectares. Some of the crops in Figure 3.2 have a small surface area in Emilia-Romagna (cauliflower, fennel). Nevertheless, these crops are very interesting for small farms that are typical of the Cesena area in Emilia-Romagna.

Spain (Valencian community)

In Spain, the farming area for field-grown vegetables is about 539 000 hectares (2.9% of the total cultivated surface area). In the Valencian community, the surface area for field-grown vegetables is 34 600 hectares. The average size of the vegetable farms is about 13.6 hectares in Spain, and 4.5 in Valencia. The surface area with integrated vegetable cropping in Valencia is still small, but these farming systems are well accepted among the farmers. A rapid increase is expected in the coming years, mainly due to the pressure from the market. Organic farming was introduced in Spain in the eighties; at present, the surface area for this production system is about 152 000 hectare, of which 1 044 hectare are used for producing vegetables. The surface area and production of organic vegetables shows a progressive increase. Nevertheless, some of its characteristics such as a higher labour costs represent a serious limitation to expanding organic farming.

Switzerland

The cantons of Zurich and Bern are very important for producing vegetable in fields in Switzerland. Zurich is

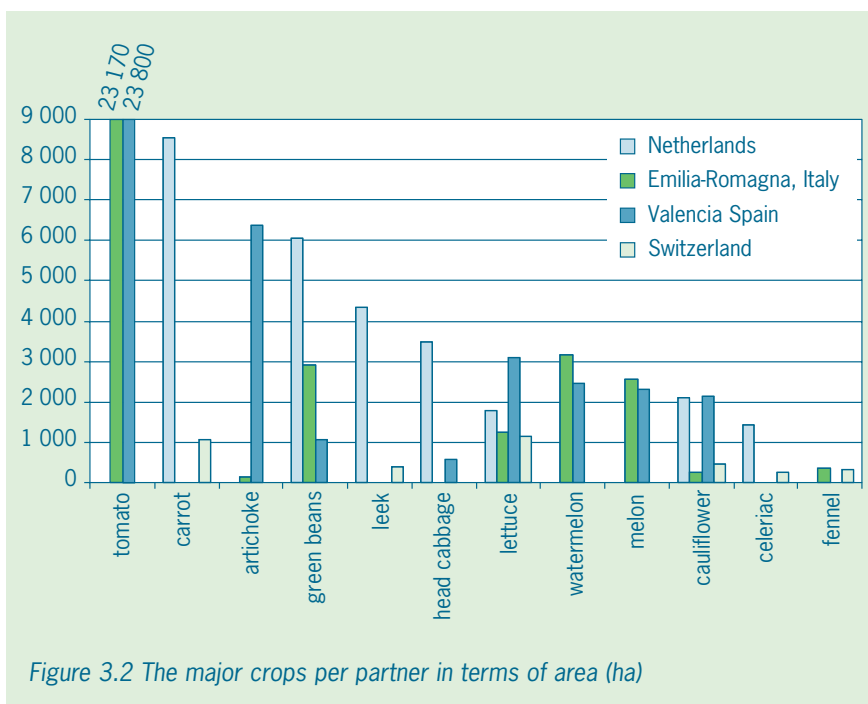


Figure 3.2 The major crops per partner in terms of area (ha)

very important in greenhouse vegetable production as well. Other Cantons such as Tessin or Genf are important in greenhouse vegetable production, but less important in field production. Carrot, lettuce and onion are the most important vegetables based on total area. Corn is very popular in Switzerland, which is indicated by its monetary value (domestic and import) more than by its surface area. Over the last 20 years, the total number of vegetable farms and the total manpower has decreased greatly by about 40%. The average farm size in the same period has more than doubled, while the number of workers per farm has increased only by about 15%.

3.2.2 Major farm types with field-grown vegetable

In general, there are three types of farms:

1. Specialised field-grown vegetable farms that are small in size (less than ten hectare) and have a large number of crops (labour intensive), fresh market-oriented, family run and very intensive in terms of land use, labour use and use of inputs (fertilisers and pesticides). A small group of these farms is specialised in one or two crops and has a high level of mechanisation (for example, Brussels sprouts in the Netherlands and tomatoes in the Valencia region).
2. Arable farms in the Netherlands, Italy and Switzerland and citrus and fruit tree farms in Valencia with vegetables fields and low labour costs: relatively large farms (10 to 50 hectare) with well mechanised vegetable crops.
3. Remaining farms: farms that combine greenhouse and field-grown vegetables (Switzerland, Valencia and the Netherlands) or combine labour intensive, fresh market crops with arable farming (Emilia-Romagna and Netherlands).

Below, the specific situation for the countries and regions of the partners is explained:

Southwest region in the Netherlands

There are three types of farms producing vegetables in the Southwest of the Netherlands. These types differ from the types described above.

1. *Specialised vegetable farms*
These farms specialise in growing mainly one fresh market vegetable crop (Brussels sprouts, iceberg lettuce or cauliflower). This vegetable crop generates their main income. Crop rotations are short. The farms are highly mechanised, are relatively large (less than ten hectare) and often lease extra land from arable farms. Most of the production is sold at auctions. However, the production is sold more and more to individual clients.
2. *Arable farms with vegetable fields*
The farms main source of income is from arable crops (potatoes, sugar beets and cereals). Depending on the size, these can be divided into three subtypes:
 - Small arable farms (smaller than 30 hectare). A surplus of labour on these farms is used to cultivate fresh market vegetable crops (Brussels sprouts, celeriac and carrot).
 - Middle size arable farms (30 to 50 hectare) that often lease land to specialised vegetable farms (iceberg lettuce, Brussels sprouts).
 - Large arable farms (larger than 50 hectare) that concentrate mainly on arable crops, but sometimes cultivate industrial crops (peas, phaseolus beans) on a contract basis or lease some land to cultivate highly mechanised, labour extensive crops such as chicory roots.
3. *Combination of greenhouse and field-grown vegetable fields*
These farms are usually quite small (smaller than five hectare). The crops grown are mostly labour intensive (parsley, celery, endive and several types of lettuce). These farms grow a variety of vegetable crops (less than five crops) and have a low level of mechanisation. The number of this type of vegetable farms is decreasing rapidly through urbanisation, specialisation and scale enlargement.

Emilia-Romagna (Italy)

In Emilia-Romagna, there are three types of vegetable farms:

1. *Specialised vegetable farms for fresh market (specialised farms)*
Specialised farms are located mainly in the districts of Bologna, Forlì and Rimini (Central and South-eastern part of the region). These family farms are small (2.5 to three hectare), specialised in four to five profitable, labour intensive crops. Levels of mechanisation are very low. Products are sold through co-operatives that directly supply to supermarket chains, to the wholesale market or directly to private traders. More than

2. *Farms growing vegetables for industrial and arable crops (commercial farms)*

Commercial farms are usually situated in the districts of Modena, Parma, Piacenza and Ravenna (Western and North-eastern parts of the region). The average surface area is 15 to 20 hectare. Levels of mechanisation are high. Products are sold directly on contract basis for industrial processing. More than two-third of the income comes from vegetable crops.

3. *Farms growing vegetables for fresh market and arable crops (mixed farms)*
Mixed farms are usually situated in the districts of Ferrara and Modena (Northern part of the region). The average surface area is eight to ten hectare. The main crops are melon, watermelon, onions and green beans (fresh market). The income is medium-high and labour input is lower compared to farms growing more intensive crops such as lettuce, celery, strawberries. Co-operatives or private traders sell the products. More than 50% of revenues comes from vegetable crops.

Valencian community (Spain)

In the Valencian community, there are three types of field-grown vegetable farms:

1. *Specialised farms*
This group is divided into two subgroups:
 - a. A small group of specialised farms growing one vegetable crop for fresh market, mainly tomatoes. These farms are highly mechanised and their surface area is relatively large. Privately owned companies/farms usually trade their own production.
 - b. A large group with low acreage (less than ten hectare), few crops (less than five) and with a low level of mechanisation. The crops are labour intensive.
2. *Citrus and fruit tree farms with vegetable crops*
These farms' main source of income comes from growing citrus and fruit trees. This type of farms has a wide range of surface area. Only a small number of vegetable crops are grown with low labour needs.
3. *Combination greenhouse and field-grown vegetable*
Small farms with a combination of greenhouse and field-grown vegetables (less than five hectare). A few labour intensive crops are grown. The mechanisation level is low.

Switzerland

The local markets in Switzerland are traditional, which means the Swiss farms grow a very large number of crops and are in a different position than the farms in the other partner countries. In Switzerland, vegetable farms with both protected and field-grown vegetables are widespread. Specialisation in greenhouse production is an exception (Tessin and Genf). On the other hand, the two large trade chains Migros and Coop, prefer large specialised farms. These farms are able to guarantee large quantities with standardised quality of production.

- *Vegetable farming in “Seeland” (Canton Bern, Freiburg, Neuenburg)*
The main vegetable production area in Switzerland is the “Seeland” area, which is located between three lakes (Bielersee, Neuenburgersee, Murtensee) at an average altitude of about 450 meter above sea level. The region “Grosses Moos” is a part of Seeland with about 600 vegetable farms producing 25% of the vegetables in Switzerland (Hormes, 1996). The very intensive production is mainly destined for fresh market, only a small part goes to industrial processing. Small family farms produce a broad diversity of different crops. Specialisation is not very advanced. Nevertheless, some farmers have started to reduce their assortment. An interesting characteristic of Seeland is the importance of vegetable trading companies that sell directly to supermarket chains.

- *Vegetable farming in Zürich*
In the Zürich area, vegetable farms are not as concentrated as in Seeland. This is why crop rotations with arable crops are much more widespread and consequently, the pressure from some pests and diseases is lower. There is production for the canning industry, and rationalisation and specialisation is more advanced as well. There are some large farms (> 50 ha). Often, production goes to supermarket chains (Migros, Coop) or directly to consumers.

Severe and rapid changes must be expected in Swiss vegetable farming in the coming years. Specialisation (fewer crops) will continue as well as mechanisation and average farm size will increase (fewer farms). Structural changes in vegetable farming were first seen in the price of field-grown vegetables in 1996. The prices were sometimes 50% lower than in the previous year (Hurni, 1996; 1997). Depending on certain conditions such as direct selling or cheap family labour, a higher diversity of crops and smaller farm areas will still be possible.

3.2.3 Economic analysis

An analysis was made of the developments in the last decade in order to put the present situation into perspective. This analysis examined farm size, specialisation, mechanisation, market developments, and labour demand and availability. In all countries, some general trends can be seen:

- The number of farms is dramatically decreasing, partially due to lower average income.
- Agricultural employment is greatly reduced, partially due to high labour costs.
- Farms are specialising more and more in order to reduce costs with better mechanisation.
- Arable farms are gradually integrating the better mechanised vegetables in their crop rotation.
- Prices are under pressure, especially when there is open competition in the international markets (Netherlands and Italy).
- Leasing land is expensive (Netherlands and Spain).

Farmers are looking for possibilities to reduce the costs, on one hand, by increasing efficiency (specialisation and scale enlargement). On the other hand, they try to add value to their produce with post harvest processes (sorting, packing), focusing on special products or finding new niches in the market.

Netherlands

In the Netherlands, the average income is € 30 000 per person. The average income for a farmer with field-grown vegetables is € 16 000 (excluding interest on private capital). The Dutch vegetable growers are trying to increase their income by reducing costs, improving production per hectare or improving the added value of their produce. Product prices are world market prices and as such the individual grower has little influence on the price. The consumers demand produce with a very high “cosmetic quality”. Vegetable production in the Netherlands is a free market economic occupation and there are no subsidies. However, farmers that change from traditional to organic farming are subsidised during a transitional period.

As most of vegetable production is exported, the production is sold against world market prices. Prices are constantly under pressure. Farmers have to work efficiently and keep their production costs as low as possible. The major costs are labour and land and to a smaller extent trade (auction). Costs for fertilisation and crop protection are very low compared to the major costs. In order to reduce the labour costs, farmers try to improve their mechanisation and labour organisation. This causes specialisation on one or two vegetable crops.

Land is a limited resource and therefore land is relatively expensive in the Netherlands. Improvement in yield makes these costs relatively lower. In addition, the land in the arable farming regions is less expensive than the land in the traditional areas for cultivation of intensive vegetables, which are often located close to the cities. For efficient use of land, labour and mechanisation, vegetable farming needs to have larger acreages. This makes vegetable farming more and more suitable for arable farms.

For these reasons, there is movement to specialisation, higher mechanisation and scale enlargement. For example, improved mechanisation allows arable farms to include vegetable crops in their rotation, which improves their profitability or makes use of their surplus of labour. Specialising in a limited number of crops leads to very intensive cultivation of crops such as Brussels sprouts and iceberg lettuce in the Southwest. In order to expand the rotation, these crops will be grown more on leased or exchanged arable land. These developments allow more vegetable crops to be cultivated on arable farms, either privately or as land leased to specialised vegetable farms.

The organic farmers’ incomes are equal to or slightly bet-

ter than the income of traditional farmers, which increases the attractiveness of organic farming.

Italy

In Italy, vegetable farms can be divided into two groups by level of income: unspecialised farms with an average income of € 8 110, and the specialised farms with an average income of € 19 560. In 1994 in Italy, the income for every agricultural worker was about € 11 900 on average. In Emilia-Romagna, it was € 15 140 in 1994. From 1980 to 1994, the Italian average income increased by 2.5%, while in Emilia-Romagna, there was a decrease of 23.1% (at constant prices). The net profit for each worker was about € 800 in 1995. The dependent worker in agriculture receives a gross income that is equal to 62.5% of workers in other categories (data: INEA/National Institute Agricultural Economics, 1994).

In Italy, 1 574 000 men work in agriculture, 575 000 men are employees and 999 000 are self-employed. In 1994 in Italy, the average financial contribution to agricultural production was about 13.2% of the total income in Italy, while in Emilia-Romagna it was about 8.6%.

The main costs are mechanisation and labour. In fresh market vegetable production, the main costs are labour (55-70%), technical means (20-25%) and mechanisation (15-20%). In the vegetable production for industry, the main costs are technical means (55-60%), mechanisation (35-40%) and the remainder for labour. Tomatoes are an exception as labour costs account for only about 2.5% of the total. Generally, incomes for farms producing vegetables for industrial processing are guaranteed with contracts. Supply and demand of fresh market vegetables are changing and this causes dramatic fluctuations in market trends and farmers' incomes.

Farms must reduce production costs and must improve food quality. To reduce the labour needs, it is necessary to increase levels of mechanisation. The main problem is that farms are too small for large investments and suitable use of machinery.

The main changes that will have to be made by the farms are:

- increased use of mechanisation,
- specialising in a group of crops that assures suitable crop rotation,
- increasing the surface areas of farms through land lease and exchange.

Spain

Vegetable production in Spain is very important in the agricultural sector, making up of 23% of the total agricultural production. Vegetable production is concentrated in the Mediterranean regions: Valencia, Murcia, Andalucía and Cataluña. In the Valencia region, vegetable production makes up about 12% of the total agricultural produc-

tion and 16% of the exported agricultural production.

On a regional level, the vegetable sector shows a general trend of a decrease in both surface area and production. The following are the main reasons:

- vegetable growers' low incomes,
- high labour costs,
- changing land used to grow vegetables to other crops with lower of labour needs such as citrus or fruit trees,
- high demand for land to used for urban and industrial activities.

Costs for labour and land are the highest production costs, each being about 40% of the total costs. To increase income in vegetable farming, a high level of mechanisation is imperative. However, increasing mechanisation is difficult to implement in many cases because of the small size of the farms. Fertilisation and crop protection costs are very low. These low costs frequently cause fertilisers and pesticides to be overused to lower production risks. However, in at the same time, environmental and ecological risks are increased and food quality is threatened.

The low level of mechanisation is the main problem in organic farming. The weeding must be done manually and this adds to labour costs. In addition, the lack of adequate outlets for sales can be a limitation for this type of production.

Many vegetable farmers are part-time farmers; most of their income comes from other activities. About 57% of the farms use only family members as sources of labour.

3.3 Social demands

3.3.1 Policy and legislation

An analysis was carried out on all of the policies and legislation that influence farming methods. In general terms, this analysis revealed that farmers must deal with the following topics:

- Pesticides and fertilisers: legislation to reduce the input and emissions (Netherlands and Spain government policy), legislation to counteract the undesired negative side effects (Italy) and restrictions built in the production guidelines for "integrated" production (all partners).
- Conversion to organic farming is encouraged with funding policies (all partners).
- Funding is coupled to restrictions in the production methods and the management of farms (Switzerland).
- Subsidies are given to co-operatives to employ technicians for transfer of expertise concerning integrated farming practices (Spain).
- Switzerland is gradually becoming more open to competition by gradually lowering import taxes.

European Union

In the EU, specific regulations have been set up for organic production (EC 91/2092, and revised in EC 01/426), with regulations on input use (seeds and plants, fertilisers and pesticides). For integrated production, no regulations at the EU level exist.

To protect environmental and ecological quality, direct regulations have been set up for the quality of surface water and drinking water (EC 98/83, EC 91/676 and EC 75/440). In these directives, maximum levels for pesticides and nutrients have been set. Also, additional measures were set to reach the objectives as codes for Good Agricultural Practice within the nitrate directive (EC 91/676). To ensure food quality, EC 90/642, EC 86/362 and EC 97/194 regulate the maximum residue levels of pesticides and nitrate in food products. In the EU, Uniform principles have been set for the admission of pesticides. Requirements for quality and application of pesticides are being harmonised.

The EU is making more and more policies on rural development (EC 99/1257). To protect the environment, agri-environmental procedures have been set up, which provide funding for commitment to Good Agricultural Practices. Also, member states must link funding for farmers partially to meeting environmental requirements (cross compliance).

There are two other important directives for agriculture that help to protect natural resources and landscape. These are the directive for protecting wild birds, and the directive for habitats that establishes a network of protected areas throughout the EU.

Netherlands

In the Netherlands, policies have been set up in response to the environmental damage caused by agronomic activities and there is national legislation to minimise the environmental effects of agriculture:

- Legislation concerning the input of nutrients to reduce the volatilisation of ammonia and the pollution of surface water and shallow groundwater with nutrients.
 - MINAS: requiring registration of nutrient use and maximum surplus for nitrogen and phosphate at a farm level. There is a penalty if the allowed surplus is exceeded.
 - Restrictions on the method of application and the time of application of manure in the winter period on sandy soils (September until January). Restrictions on working after the manure have been applied.
- Legislation for the reduction of pesticide pollution.
 - MJPG legislation (until 2000) to reduce the volume of pesticide use. Average targets were set for the field-grown vegetable sector. There were no penalties for individual farmers.
 - Chemical policy: pesticides are examined for

emission and toxicity for the environment; the most environmentally damaging applications are forbidden.

- Legislation for decreasing drift of pesticides to surface water by requiring cropping free zones, prohibiting spraying in strong winds, regular examination of spraying equipment, spraying licences and special equipment for spraying edges of fields bordering a waterway.
- New policy (“Zicht op gezonde teelt”) aimed at integrated production for certified farms to improve environmental quality, labour conditions and food safety.
- Policy to stimulate organic farming (entering the organic market) includes:
 - the aim to make organic farming up to ten per cent of all farming in 2010,
 - provision of funding for changing from traditional farming to organic farming,
 - improving the chain of organic food production,
 - provision of funding to stimulate research and expansion in organic farming.

Italy

In Italy, for the past 20 years, several regions started the “guided control of pest and disease”. Up to now, there has been no specific legislation to limit the use of pesticides or nutrients in Italian agriculture. Nevertheless, with the “financial law of 2001”, there is a specific regulation (art.123, rule 388/2000) that fixes taxes (2% of the sale price) on the most dangerous pesticides. The law requires to use the money from this tax for the development of sustainable agriculture.

Spain

In Spain, in addition to the EU and state policies, legislation is different per region. At the state level, the promotion of integrated production started in 1983 through the creation of the ATRiAs (Associations for the Application of Integrated Protection). They are regulated by regulations set up by the Ministry of Agriculture on 26 July 1983 and 17 November 1989 (BOE 22-XI-89). The salaries for specialised technicians in integrated production are partly subsidised by this regulation. In Valencia, these subsidies are complemented with the ADVs (Asociaciones de Defensa de los Vegetales) with regulations from the Agriculture Regional Council of 19 April and 23 May 1990 (DOGV 15/5/90 and 18/6/90). Legislation in different regions has recently regulated integrated production for specific field-grown vegetables:

- Murcia: celery, lettuce, melon, broccoli, cauliflower and tomato (1998),
- Navarra: broccoli, white asparagus and cauliflower (1998),
- Andalusia: strawberry (1996),
- Catalonia: tomato (1996).

In the Valencian community, legislation for integrated

production of citrus and grapes (1997 and 1999) was set up. Also, a Code for Good Agricultural Practices was published in April 2000, with the main objective of avoiding the pollution of groundwater through reduction of nitrogen input.

Switzerland

In Switzerland, three main policies with economical consequences for vegetable farming have been formed within the past years:

On 1 July 1995, there was an important change concerning vegetable importation. Previously, a system existed with three phases of import restriction for each crop depending on the amount of domestic production (phase 1- free import, phase 2 - limited import, phase 3 - no import). After 1 July 1995, vegetables may be imported throughout the entire year because of the Gatt-treaty. During the main growing season, there is a certain amount of import with small duty taxes; the remaining part was charged a higher rate. Nevertheless, this duty tax is now reduced every year (Bourgeois et al., 1995). One consequence is an increasing number of companies importing vegetables (120 in 1992, 450 in 1998; Hurni, 1998). This puts pressure on prices (international competition).

Due to the changes in Swiss agricultural policy in recent years, prices for arable crops are decreasing and arable farmers began to produce field-grown vegetables (Hurni, 1996). This means more domestic competition, unlimited quantities of field-grown vegetable and reduced price security.

There are quite severe legal restrictions in Swiss vegetable production, such as protection of groundwater and complicated permits for buildings and greenhouses. Moreover, costs will continue to increase in the future because of required quality assurance systems (Qualitätssicherungssysteme) and a new nutrient law (Lebensmittelgesetzgebung) (Hurni, 1997).

3.3.2 Certified production

The market's demand for a controlled production chain of vegetables is growing. In addition, legislation has been and is continually being developed to reduce the negative effects of agronomic production on the environment. This creates the need for integrated and organic production labels. There is an increasing need for farmers to have some type of controlled production in order to be able to sell their products.

Governments stimulate the development of organic farming by funding the conversion (in all countries). The large retailers are also stimulating organic production by including this produce in their stock (in Switzerland and the Netherlands). The development of integrated production labels started in the early nineties in Italy and the Netherlands. This was stimulated by either the auctions or co-operatives (Netherlands and Spain) and other

groups in society (Netherlands) or the government (Italy). In Switzerland, this development has existed for a longer time and has led to the present situation that almost all vegetable growers produce under an integrated production label. They are not stimulated by the corresponding subsidies from the government. Subsidies acquired by production processes that are more or less the same as the guidelines for IP production.

Improving controlled quality and reduction of hazards can be achieved by developing the chain of quality control. It will also lead to increasing costs for the farmers.

“Integrated” labels

There are several labels for integrated production (IP) in EU countries, promoted either by the government or by supermarket chains. These labels usually have protocols for specific vegetables that include compulsory regulations at the farm and crop level, and recommended regulations. It is often required to record data concerning different farming practices.

Nevertheless, there are not specific protocols for all field-grown vegetables in every EU-country. Furthermore, the requirements change very much depending on the labels because there is no international standard for integrated production.

The new EUREP-GAP protocol concerning Good Agricultural Practises is the first attempt to establish one IP-label for all of Europe. This protocol and its label may become a standard in the near future. The protocol, set by a leading group of retailers in Europe, has been set up for the global production of horticultural products, which means the requirements are very general in many cases and different interpretations will probably develop.

Independent bodies for certification must determine which conditions must be met and monitored in the integrated production processes. Monitoring can be carried out by the staff in supermarket chains, the owners of the label, or even the government, as in the case of Italy. Certified products are usually similarly priced to conventionally produced vegetables, but it is assumed that they are sold more easily.

Netherlands

In the Netherlands, up until 1997, there was one “integrated” label for field-grown vegetables, named MBT. In 1998, the MBT label was combined with a more “strict” new label, named AMK. The AMK label already existed for arable crops. Both labels had the same basic requirements, but the AMK label had rules or levels that were more difficult to meet. The guidelines for MBT changed quite drastically in 1998 in order to make upgrading from MBT to AMK and downgrading vice versa possible.

These labels have compulsory regulations at the farm and crop levels, and recommended regulations at farm level and crop level that growers can earn points with.

A specific number of points is needed in order to fulfil the label requirements.

The compulsory rules cover:

- Registration of the purchase of, storage of and use of pesticides and nutrients.
- A restrictive list of pesticides that can be used.
- Phosphate fertilisation dependent on soil fertility and based on balanced fertilisation.
- A maximum surplus of nitrogen per crop or per farm.

The regulations for AMK are additional to (new) national legislation for pesticide and nutrient use. Monitoring and certification will be carried out by an organisation appointed by "Stichting Milieukeur". The prices for MBT products are at the same level as the prices for standard products.

Italy

No collective label that identifies the integrated productions in Italy is available, but commercial labels exist, which are managed by supermarkets and/or farmer associations of fruits and field-grown vegetables. Emilia-Romagna has been one of the firsts regions that provided Regional Integrated Production Guidelines inspired by the IOBC directives¹. These guidelines, applied since 1992, are for the major part of field-grown vegetables for the fresh market and industry, and monitor the entire production process. In 1996, Emilia-Romagna set up a QC label ("Qualità Controllata" = quality control) for vegetable production. To be able to use the label, the Regional Integrated Production Guidelines must be followed.

In Emilia-Romagna, integrated production represents about 20% of the total vegetable production. This was made possible due to the regional government that promoted the drawing up of specific "Integrated Production Guidelines". The increasing demand for quality foods produced in a healthy environment was expressed by consumers (and as a result by agro-industries and supermarket chains). This encouraged farmers to adopt integrated guidelines guaranteed by an official label. Generally, prices of integrated products are lower than of conventional products, but the sale of the produce is easier, even if market conditions are poor.

Spain

In Spain, there are different public regional labels as well as some private labels. The situation is different in each region. The Murcia region has integrated production labels for certain crops (see policy and legislation). The regional labels for vegetables in Andalusia are mainly intended for greenhouse crops. In the Valencian community, the IP guidelines are intended for citrus and grapes, although guidelines for vegetables and fruits are expected in the nearby future. The 2nd degree co-operative, Anecoop, in Valencia has drawn up guidelines for tomato,

pepper, watermelon and cucumber crops, both for field-grown and greenhouse crops (label Naturane). In general, the Spanish consumers usually do not demand integrated produce because they generally not familiar with this concept. Therefore, most of integrated production is produced for the export market.

Switzerland

Most vegetable farms in Switzerland have integrated production (8 348 ha in 1996) and only a very small remainder uses conventional methods. The two supermarket chains, Migros and Coop, offer products of both labels in their assortment. Migros has its own integrated production guidelines (MigrosSano) checked by its staff whereas Coop only sells already labelled products (IP SGU).

Organic labels

Most labels for organic production in EU are based on regulation EC 91/2092. The regulation treats several topics in a comprehensive way and, therefore, the regulation can be interpreted in different ways, reflecting the national guidelines.

All operators, who, as part of a business activity, produce vegetables from organic production, are subject to a special inspection scheme established by the member states. The creation of an EU-logo for organic products in March 2000 has reinforced protection against fraud. The prices of these organic products are, in the case of Italy, around 20% higher than conventional produced products. In Spain, it is very common that prices of organic products are 100% higher than conventional produced products. Nevertheless, the trend in the Northern Europe is to set the "organic prices" equal to the conventional prices, (which is already done in some supermarkets as a marketing strategy).

Netherlands

In the Netherlands, there are two labels for organic production named the EKO label for biological production and the DEMETER label for biological-dynamic production. Both regulations are based on regulation EC 91/2092. The most important guideline is ban of chemical pesticides and fertilisers.

Monitoring is carried out by SKAL, which is the inspection organisation for organic production methods. The inspection consists of an annual inspection of the registration records, production process and means of production. In addition to this annual inspection, there are random checks of organic farms.

Certified production in the Netherlands is still small, but is growing quite quickly. Table 3.1 gives an idea of the amount of the certified production in 1995.

Italy

In Italy, there is no national label for biological or biodynamic production. Organic production guidelines do not exist and the farmers operate according to the regulation EC 91/2092. The label monitoring is done by private

¹ IOBC = International Organisation for Biological Control

Table 3.1 Number of farms and surface area of certified production in field-grown vegetables (1999, MBT figures 1995)

Subject	number of farms		surface area (ha)	
total field-grown vegetables	8 695		48 195	
organic production of field-grown vegetables (EKO)	261	(3%)	1 897	(4%)
“integrated” production of field-grown vegetables (MBT)	1 655	(16%)	10 307	(23%)

organisations authorised by the Regional Government. At this time, about ten private organisations make periodic, administrative inspections of the farmers’ registration of cultivation activities.

Spain

In Spain, every region regulates the organic farming with different regional committees (CAEs). The Committee of Organic Agriculture in the Valencian community was established in 1994. It is financed with public and private money, and it is in charge of registering, monitoring and certifying the organic production in this region. In the Valencian community, the surface area of organic farming in 2000 was 18 890 hectare in total with 204 hectare planted with vegetable crops.

In addition, some farmers also use other labels such as “ECOCERT” for biological products or “DEMETER” for biological-dynamic production. The organic products are sold for higher prices than those from conventional systems. Most of the organic production (90%) goes abroad.

Switzerland

In Switzerland, the two supermarket chains, Coop and Migros, are very important in market and price-policy (together they account for 70% of all food trade in Switzerland). Coop pushed the marketing of bio-products with a program in the beginning of 1994 and Migros followed with its own bio-program in 1995 (MigrosBio).

In 1997, only 8% of domestically grown vegetables in Coop were from bio-production (Lichtenhahn, 1997). In 1996, a share of 20-30% was expected some years later (Todt, 1996; Mäder, 1996). This was perhaps a quite optimistic estimation. Currently, pressure on bio-prices is increasing, especially on storable and transportable vegetables such as carrot and red beet (for example, imported from northern Germany; Lichtenhahn, 1997).

3.4 Environmental and ecological effects

In this paragraph, the environmental problems caused by intensive agricultural production are briefly summarised. Too intensive use of land and too high inputs of nutrients and pesticides are generally considered as problematic, and cause high emissions of nutrients and pesticides. In the other manuals, this topics and policy, legislation and label guidelines are treated in more detail: problems with

nutrients in the Integrated and Ecological Nutrient Management manual (VEGINECO publication no. 3), problems with pesticides in the Integrated and Ecological Crop Protection manual (VEGINECO publication no. 4) and problems with biodiversity and landscape in the Ecological Infrastructure Management manual (VEGINECO publication no. 5).

Except for Switzerland, problems with nitrogen leaching are apparent. In the Netherlands, the emission of pesticides is well documented. In Italy and Spain, emission of pesticides is considered important, however documentation is scarce.

There is a continuous concern about the sustainability of production in terms of soil fertility (especially biological and physical soil fertility), and the long-term control options for soil-born pests and diseases. In addition, the development of resistance of pests, diseases and weeds due to a one-sided agrochemical approach raises concerns. More balanced approaches are necessary.

3.4.1 Nutrients

Nitrate in produce

Crops grown under poor lighting conditions and/or a high availability of nitrogen can result in risky, high nitrate levels in produce. For some groups in society, high nitrate levels can cause health problems.

In the Netherlands, nitrate levels higher than 2 500 mg l⁻¹ sometimes occur in leafy vegetables grown in the winter in greenhouses or in open fields in autumn. Generally, nitrate content in Italian or Spanish products are lower compared to products grown in colder climatic conditions.

High nutrient inputs

Less than half of the minerals that are brought to a farm are utilised by the products. The remainder, the mineral residue, remains behind somewhere in the environment. The main effects on this overkill of minerals are:

Nitrate in and surface water and shallow groundwater
Especially because of the abundant use of animal manure, surface water has often been polluted with high levels of nitrate and phosphate, which causes abundant growth of algae and threatens biodiversity. Leaching causes an increasing hardness of groundwater. Nitrate levels in groundwater have increased and sometimes

exceed the EU-norm of 50 mg l⁻¹, which causes high costs to purify the water. In the Valencian conditions, although the rainfall is low, irrigation water can leach a high amount of nitrates from both mineral fertilisers and organic fertilisers.

High levels of phosphate and potash in the soil

Due to high nutrient inputs, high levels of phosphate and potash have been built up in the soil. The excessive accumulation of phosphorus in the soil can give rise to nutrient unbalance in plant uptake by antagonistic effect on for example copper and zinc. The excessive accumulation of potassium has a certain risk of leaching in some light soils. In addition, nutrient unbalances can occur, as the well-known antagonism on the magnesium absorption. For instance, thirty percent of the area in the Southwest region of the Netherlands has higher levels of phosphate and potash than agronomically needed and only five percent has too low levels. In the total country, the area with too high phosphate and potash levels is with 65% much higher.

Acidification

In the conditions of the Northern Europe, the volatilisation of ammonia from liquid manure causes acid rainfall that threatened the quality of woods and nutrient enrichment of vulnerable ecosystems.

Desiccation and water irrigation

In the Netherlands, the desiccation problem manifests itself primarily in the gradual lowering of the groundwater level. Therefore, an area of about 600 000 hectare in nature reserves is affected by drought. About 60% of the water loss is caused by the agricultural sector. In particular, the accelerated removal of rainwater exacerbates the situation.

In some areas of Italy, there is competition for water resources between agricultural use (irrigation) and human use (residents and tourists).

The negative difference between rainfall and evapo-transpiration in most of the Valencian community makes water irrigation one of the most important factors to take into account in agriculture. In fact, it is subject of frequent political and social conflicts and a very important part of the budget for agriculture. At this time, the water deficit is balanced by transferring water from the Tajo River to the Segura River. A new "transferral" project (from Ebro River) is planned. On the other hand, this "transfer" between rivers is questioned because of the environmental impact. The very high costs in infrastructure projects means that the irrigation water must be used as efficiently as possible. The water used for agriculture in the Valencian community is about 72% of total water used for consumption.

3.4.2 Pesticides

The limited number of crops on a farm results in short crop rotations and host crops growing all year round.

Also large amounts of the same crops are present in a very small, geographical area. This causes high pest and disease pressures, stimulating intensive pesticide use. The high pesticide use is also "stimulated" by the need to meet ever-increasing, external "cosmetic" quality demands in the very competitive international markets. These factors lead to a high dependency on pesticides. The intensive use of pesticides is increasingly less effective because of the development of resistance against pesticides in pests and weeds.

Pesticide residues in produce

Pesticide residues on produce are not rare, although levels higher than allowed are not usually found (around 2-5% of samples).

Pesticide use

Pesticide use is high. In 1995, the annual input of pesticides per hectare was 4.5 kg of active ingredients per hectare in the Netherlands. This amount was made up of 40% fungicides, 30% herbicides and 20% insecticides. The pesticide use per hectare is higher than for other sectors as the use is 3.2% of the total and the cultivated area is only 2.2% of the total.

Pesticide levels in surface water and groundwater

Dutch surface water is highly polluted with pesticides. In a large-scale inspection in 1992 and 1993, over 66% of the inspected water contained pesticide levels that were higher than the maximum permitted level. These high pesticide levels threaten the quality of drinking water and decrease the biodiversity in aquatic ecosystems. Some pesticides (mainly herbicides) are found in concentrations over ten times higher than the normal level of 0.1 µg l⁻¹.

In the same manner, several studies in Spain show that this problem also affects the surface water and groundwater in diverse farming areas.

3.4.3 Biodiversity and landscape

Efficient large-scale agriculture has decreased the biodiversity in the main growing areas by removing the habitat and corridors for flora and fauna. The old landscapes formed by small-scale farming are rapidly disappearing, but even if small fields remain (the Valencian region in Spain), the hedges that used to separate each other can seldom be seen.

In Emilia-Romagna, too intensive use of land causes many erosion problems in hilly areas where fruit plantations and vineyards are normally located. This kind of problem is less important in vegetable production as these crops are normally grown in flat areas. These crops usually suffer from very widespread problems caused by soil-borne pathogens (soil-tiredness) and many different factors that not always well known.