SUSTAINABLE VINING PEAS

GOOD AGRICULTURAL PRACTICE GUIDELINES

Unilever

CONTENTS

This document has been discussed with the members of the Unilever Sustainable Agriculture Advisory Board (SAAB). The SAAB is a group of individuals, specialists in agricultural practices or representatives of non-governmental organisations (NGOs), who have expertise in different aspects of sustainability. They have agreed to critically assist Unilever in the evolution of Sustainable Agriculture Indicators and good practices for a range of raw material crops. The contents of this document and the choices made therein are, however, the responsibility of Unilever only.

INTRODUCTION

These guidelines have been developed under the Unilever Sustainable Agriculture Initiative to support sustainable management practices for vining pea production.

Ten indicators of sustainability have been identified:

1. **Soil Health**
2. **Soil Loss**
3. **Nutrients**
4. **Pest Management**
5. **Biodiversity**
6. **Product Value**
7. **Energy**
8. **Water**
9. **Social and Human Capital**
10. **Local Economy**

Within Unilever Frozen Foods, the Lead Agriculture Programme team in the United Kingdom (Birds Eye) has worked closely with local farmers, organisations and communities to benchmark their agricultural operations against the indicators of sustainability.

For each indicator specific good agricultural practices are described, which are either already in place or will be implemented in the near future.

In addition, potential areas for improvement are listed, which will require further investigation.

The development of these good agricultural practice guidelines has been based upon a thorough evaluation of potential agronomic practices and associated inputs and follows the principles of Integrated Farm Management (IFM). These guidelines have been produced in consultation with relevant scientists and specialists, including members of a Unilever Sustainable Agriculture Advisory Board (SAAB).

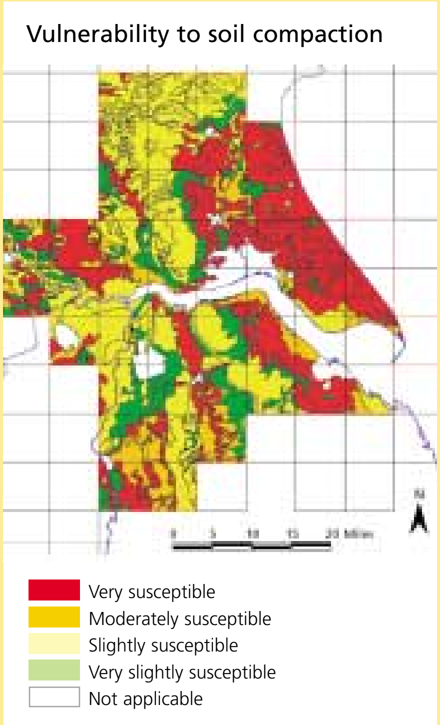
This guide is primarily intended for use by the agricultural development teams in the processing factories and for communication with other vining peas processors and suppliers, but it also provides the basis for development and implementation of good practices in consultation with farmers growing peas. We value our relationships with the contract farmers, their knowledge base and capacity to innovate, which are all key to a successful development and implementation of the good agricultural practice guidelines.

The guidelines are implemented through local agricultural management systems which contain detailed good agricultural practice standards and procedures aimed at both farmers and company agronomists. This document forms the basis for continuous improvement and development of good agricultural practices, which includes aspects of product safety and quality as well as the environmental impact and sustainability of the entire agricultural production process.

Contributions to the continuous improvement of these good agricultural practice guidelines are welcome, and may be sent to:

sustainable.agriculture@unilever.com

Soil is fundamental to agriculture. A rich soil ecosystem improves performance of crops and livestock. Sustainable agriculture practices can improve the quality of the soil's ecosystem.



Soil health has been defined as 'the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation'. **Soil organic matter** is important for maintaining soil health and soil structure, reducing soil loss and increasing nutrient and water use efficiency. It also provides a carbon (energy) source for soil micro-organisms and sequesters carbon from the air playing a critical role in the global carbon balance and the greenhouse effect. Organic matter levels should be maintained at, or improved to, a satisfactory equilibrium level for the particular soil type. The organic matter will derive from organic manures and compost, and incorporation of crop residues and/or cover crops in the rotation. Long term deterioration in soil structure and fertility may result from **soil compaction**, particularly under mechanisation, from changes in **soil pH** and **soil nutrient status**, or from build-up of **salinity**, a possible side effect of irrigation.

Various **soil fauna** species are excellent indicators of soil health. Earthworms are important in maintaining soil structure, aeration, nutrient cycling, drainage and by breaking down organic matter for incorporation into the soil profile. Carabid beetles are intra- and supra-soil dwellers and are important predators of insect pests. Soil micro-organisms are also important in the context of soil health, and in particular for legumes such as peas, the association of nodule-forming micro-organisms (*Rhizobium* spp.) results in biological nitrogen fixation. This is one of the most commercially important microbial relationships, with a large impact on agricultural systems. *Rhizobium* numbers are therefore good as indicators of the innate fertility of the soil and its suitability for growing peas.

The soil nutrient status is improved for the crop following peas by the crop residues left on the field during the pea harvest (main picture), and the residual nitrogen fixed by the pea plants as they are legumes.

A soil compaction risk map of part of Humberside (top) helps to identify potential problem areas. Soil compaction (above) can lead to long term deterioration in soil structure and fertility. Good drainage, well adjusted tyre pressures, wide machinery and minimising the number of field passes are some of the measures that help prevent the problem.

GOOD PRACTICE

Organic Matter

Conduct regular soil testing for organic matter

Compensate organic matter losses throughout the rotation through

– Encouraging the use of organic fertilisers (manure, compost) at the appropriate time in the rotation, with management practices aimed at minimising nitrogen leaching losses to watercourses

– Incorporating previous crop residue (e.g. cereal straw) into soil and promote straw chopping

– Encouraging improved crop rotation strategies and green manuring through introduction of cover crops before and/or following the pea crop

Promote appropriate soil cultivation techniques to conserve soil health, build organic matter and reduce tillage-induced losses to the atmosphere

Soil Compaction

Stipulate regular visual, qualitative soil structure assessments (i.e. ‘spade test’) through training seminars for farmers aimed at alleviating soil compaction

Avoid soil compaction through:

– Minimising the number of in-field machine passes and using wide machinery where possible to minimise the impact of a single operation

– Ensuring land is adequately drained

– Using sub-soiling in appropriate conditions where compaction appears to be a problem

– Using tracked vehicles or low ground pressure tyres and adjust tyre pressures for all field operations to field conditions

– Avoiding lorries entering the field during the harvesting operation where possible and where it does not conflict with possible health and safety considerations

– Drilling field margins (headlands) last and cultivate before drilling

– Peas are sensitive to poorly structured soils or where previous cropping has damaged the structure. For this reason peas should preferably not follow: sugar beet, potatoes, brussels sprouts, stubble turnips or any other root crop

Soil pH, Nutrient Status and Salinity

Peas require a pH between 6.5 and 8 for good growth

Encourage soil testing to determine:

– Macro- (nitrogen, phosphorus, potassium and magnesium) and micro-nutrient (copper, boron, etc.) status

– Optimum fertilisation rate

– Need for application of lime to shift pH to (soil type specific) optimum value.

– Need for adjustment of nitrogen top-dressing to follow on crops after peas

If irrigation is required (see also water indicator), the following important variables should be monitored regularly:

– Water table level

– Total rainfall, irrigation and evapotransporation to ensure a net downward movement of water over the full year

– Quality of irrigation water to avoid situations of high sodium build-up which might adversely affect crop growth

Soil Fauna

Retain previous crop residue before peas in the field

Use organic fertilisers and soil improvers (i.e. farm manure and/or compost) at appropriate points in the rotation

Use pest action thresholds to reduce number of pesticide sprays

Avoid the use of broad-spectrum insecticides wherever possible

Use cultural methods of pest control wherever possible, e.g. eliminate weeds (especially large overwintered weeds) and/or trash before May to reduce risk of bean seed fly attack

POTENTIAL AREAS FOR IMPROVEMENT

Investigate further the relationship between organic matter and cultivation (and linking to possible impact on leaching potential in the nutrient indicator)

Investigate ways of fine tuning operations to speed up organic carbon accumulation trends

Further investigate possible ways to improve carabid diversity and numbers, e.g. through headland management (see also biodiversity indicator)

Investigate the possibility of developing a Rhizobium toolkit for measuring Rhizobium numbers and their health status as part of a programme to develop methods of measuring and monitoring soil health through genetic fingerprinting of soil micro-organisms and fungi

Develop a soil compaction risk model which incorporates predictions for potential for reversibility of compaction

Disseminate advice on avoiding or mitigating compaction where it is predicted to be a high risk

Investigate the potential of a flexible optimal tillage regime where appropriate, which does not exclude possible use of ploughing

Counting earthworms: a large earthworm population [illegible] to maintain soil structure and aeration, nutrient cycling and drainage. It is also important in breaking down organic matter which is then included into the soil profile. Other beneficial soil fauna include carabid beetles which are useful predators of insect pests as well as indicators of the efficiency and accuracy of insecticide inputs.

SOIL LOSS

Erosion by wind and water can lead to soil losing its structure and organic matter, so reducing the main asset of the agricultural system. Sustainable practices can reduce soil erosion.

Soil erosion is a natural process, but agricultural activity, soil type, slope, crop, wind and amount of rainfall can all affect the amount of soil lost. Erosion removes topsoil, reduces levels of soil organic matter, and contributes to the breakdown of soil structure, creating a less favourable environment for plant growth. In soils that have restrictions to root growth, erosion decreases rooting depth, which decreases the amount of water, air, and nutrients available to plants. Erosion removes surface soil, which often has the highest biological activity and greatest amount of soil organic matter. This causes a loss in nutrients which once removed are no longer available to support plant growth onsite, but can cause nutrient rich (eutrophic) water to the detriment of the aquatic ecosystem.

Soil erosion in pea growing areas is a factor not only on light soils on sloping land but on some land previously classified in the 'negligible' erosion category. There is a linear relationship between the relative amount of exposed soil and the soil lost in a given rainfall event or over a season. **Soil cover index** (the mean soil cover over the life of the crop including any fallow period before plants start to grow) is therefore an extremely useful indicator of erosion potential.

A field margin (main picture) can play an important role in helping to reduce soil erosion, especially on sloping land or very large fields. Keeping soil covered as much as possible - for example, sowing winter wheat (above) as part of the rotation - also helps protect the soil from wind, rain and other pressures associated with soil loss.

GOOD PRACTICE

Soil Erosion

Avoid steeply sloping fields for cultivation

On sloping fields follow contours with operations for soil preparation where possible

Soil Cover Index

Keep the soil covered as long as possible using an economically viable crop rotation

Management systems should aim to achieve a greater crop cover as early as possible in the life of the crop

POTENTIAL AREAS FOR IMPROVEMENT

Further work on soil erosion risk on a wider sample of farms and possible links with risk of compaction

Create higher awareness of how to identify soil erosion and its causes (i.e. poor structure, bare soils, long slopes) with the farming community

Development of simple farm tools to identify erosion types and possible off-site damage

Investigation into possible erosion losses at catchment scale

Investigation into current practices regarding soil cover in relation to peas across all growing areas

Identification of potential for practices to increase soil cover (and therefore reduce water erosion) including:

– Forage crops in the rotation or as permanent cover

– Winter cover crops (i.e. mustard, barley)

Vulnerability to soil erosion

A computer-generated erosion risk map developed using Geographic Information System (GIS) technology. This links farm data on soil types and textures with other parameters such as the field gradient. This exercise has been carried out for all 19 farms associated with the UK Sustainable Agriculture initiative, with the aim of identifying any potential high risk areas for pea growing, and understanding where sediment losses might be large enough to have significant impacts in terms of in-field soil degradation and off-field impacts on surface water quality.

NUTRIENTS

Crops need a balance of nutrients. Some, such as nitrogen, can be created locally. Others must be imported. Nutrients are lost through cropping, erosion and emissions to air. Sustainable practices can enhance locally produced nutrients and reduce losses.

Nutrient inputs are vital for most agricultural systems. Rock weathering and nitrogen fixation by legumes and free-living bacteria rarely provide enough to compensate fully for the amounts of nutrients removed with crops, even in mixed farming systems. As a consequence, agricultural systems depend on use of fertilisers on most soils.

Sustainable farming systems should maximise the nutrients that are recycled within the system and thereby minimise the quantities of imported nutrients that are necessary. Ideally, total nutrient inputs (including soil mineralisation) should be similar to nutrients exported in the harvested product plus that stored in ground vegetation, soil and pea biomass. To achieve this, the **ratio of nutrient exports to inputs (nutrient balance)** should be carefully balanced. Nitrogen applications are not made to peas, because of the potential of the crop to fix nitrogen. However phosphorus and potassium are required and would normally be applied as maintenance dressings for the benefit of the whole rotation.

Nitrate and phosphate losses by surface run-off, soil erosion and to ground water are key parameters for measurement at field level, since, for example more than 70% of nitrates and 40% of phosphates in English waters originate from agricultural land. Phosphate pollution can lead to the eutrophication of inland water bodies. Nitrate pollution, despite the Drinking Water Directive limit of 50 mg/litre, causes off-shore eutrophication.

A balanced nutrient management strategy is based on a good understanding of what is available in the soil. Here in an experimental pea field a researcher is using a remote sunshine sensor linked to a data logger to record the leaf area index. By measuring the difference between light below and above the crop canopy he will gain a better understanding of the link between the pea plants' green leaf area and the amount of residual nitrogen left by the pea crop. This in turn enables the farmer to fine-tune nitrogen requirements for the following crop – in this case, wheat.

GOOD PRACTICE

Ratio of Exports to Inputs (nutrient balance)

It is important to check levels of soil phosphorus and potassium using soil analysis every 5 years and adjust inputs accordingly. National guidelines or recommendations should be used to calculate optimum phosphorus and potassium levels for peas, for example index 3 for phosphate and index 2 for potassium are given in the UK in DEFRA's RB209 recommendations [1]

Reduce nitrogen inputs to first crop following peas to allow for nitrogen fixed by pea crop, using appropriate estimates (e.g. RB209 recommendations) or measurements (e.g. mineral-nitrogen)

Loss of Nitrate and Phosphate by Surface Run Off, Soil Erosion and to Ground Water

Ensure that any legislation relating to fertiliser use is strictly followed (e.g. Nitrate Vulnerable Zones (NVZ) legislation in the UK)

Follow any national guidelines where available for water protection e.g. the Code of Good Agricultural Practice for the Protection of Water (DEFRA PB0587) [2]

Before peas, restrict manure applications and delay cultivation where possible

After peas, delay cultivation, and reduce cultivation on soils with high organic matter

Use national recommendations (e.g. RB209) to determine optimum phosphorus rates

Do not apply slurries to cracked soils

POTENTIAL AREAS FOR IMPROVEMENT

Measurement of soil mineral nitrogen and plant nitrogen in relation to the potential to reduce synthetic fertiliser input to first cereal crop after peas

Investigate nitrate and phosphate leaching at catchment level to get a better idea of overall impact

Further work to investigate how management factors contribute to nitrate and phosphate leaching, e.g. potential for catch crops, effect of efficient drainage on heavy soils

Investigate potential of using reedbeds to filter nitrate in appropriate areas e.g. the Broads – East Anglia, UK

During a workshop (above left) an automatic sampling system is demonstrated in one of the experimental fields.Triggered by rainfall, this system allows soil water samples to be taken as water moves down through the soil profile. The samples are analysed for nitrate, phosphate and pesticide content.

An equivalent of the above system (top right) relies on manual application of a vacuum to pots buried below the rooting depth of the crop to draw surrounding soil water through the pot and up to the surface for collection.

Yet another automatic sampling system allows drainage water to be continuously recorded as it leaves the field using a flume and an ultrasonic probe (above) linked to an electronic data capture system. This system also provides a sensitive method of monitoring leaching losses.

1 Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209) 7th Edn. DEFRA 2000.

2 Code of Good Agricultural Practice for the Protection of Water. DEFRA (MAFF) 1998. PB0587.

PEST MANAGEMENT

When pesticides are applied to crops or livestock, a small but significant proportion can escape to water and air, or accumulate in foods, affecting ecosystems and human health. Sustainable practices can substitute natural controls for some pesticides, reducing dependence on synthetic substances.

Integrated Pest Management (IPM) is key to sustainable pest control. The objective is to adopt cultural, biological, mechanical, physical or other less-hazardous strategies to minimise the use of pesticides (including fungicides, herbicides & insecticides).

IPM is therefore the careful consideration of all these available pest control techniques and their subsequent integrated use to improve biological balance. This should discourage the development of pest populations whilst keeping pesticide use and other interventions to economic levels, and will also minimise risks to health and the environment.

The total amount of pesticides applied per hectare in vining peas indicates a reduction as a result of IPM, but this does not take into account the hazard potential of the products used. Therefore, a pesticide profiling system has been developed that enables a preferred list of pesticides to be drawn up on the basis of efficacy in peas, human and environmental hazard, residue risk and consumer perception. In practice this is a mandatory list, as products not appearing on the list are not permitted for use in peas. The aim is for downward trends in the mean pesticide profile scores as older products are gradually replaced with less harmful ones.

Birds Eye routinely sources from between seven and ten pea varieties to fill some 40 million packs of frozen peas every year. Unilever Colworth R&D is the centre of pea research into existing and future pea varieties. Here in the experimental greenhouses a scientist is explaining on-going research programmes to farmers. The breeding of disease resistant varieties is an essential part of the Birds Eye strategy to reduce dependence on chemical inputs.

Field margins (left) are important to encourage pests' natural enemies. Pheromone traps (above) provide effective control of insect pests and are a helpful decisional aid in IPM strategies for monitoring insect flight peaks.

GOOD PRACTICE

Arthropod Pests and Fungal Diseases

Field manuals must include detailed methodologies for management of the pests and diseases in the area with emphasis on cultural controls

Key elements of the IPM system in vining peas include:

– Consideration of all possible pests and whether any control is necessary or justifiable

– Disease tolerant and resistant crop varieties should be used where possible

– Use of routine cultural and physical controls such as rotational aspects, manual weeding etc

– Life history, action thresholds and appropriate monitoring systems should be established for all the key pests on the basis of economic damage levels and taking into account natural controls

– Where cultural or physical control is not possible, pesticide application decisions must be made on the basis of economic justification and action thresholds for pests, which are likely to impact on yield or quality

– Regular monitoring, either by field walking or the use of pheromone traps should be used for key insect pests to allow informed decision making

– Broad-spectrum insecticides such as synthetic pyrethroids should only be used where there is no selective alternative and only when economically justifiable

– Seed treatments are used to avoid the need for foliar fungicides, which should only be used in exceptional circumstances

Weed control

Consider the rotation carefully, as inclusion of crops such as potatoes (particularly certain varieties) and seed rape can lead to potentially serious volunteer weed and contaminant problems

Prepare the seed bed as early as possible in order to germinate the weeds and then selectively remove them before drilling preferably using a stale seed bed approach with minimal cultivation

Where contaminant weeds are present, roguing (selective, manual removal) should be considered as first option for control

Product choice should be made on the basis of weed species, timing, soil type, weather conditions, crop health and previous application history

If vigorous varieties are being grown and weed pressure is low, consider using reduced rates of certain herbicides

An extreme experiment (top) where no herbicides were used, resulting in a severe infestation of weeds in a pea crop which in this case would have a negative effect on yield and quality. This field experiment is designed to establish an acceptable level of weed tolerance that will not compromise yield and quality.

When farmers spray adjacent to a natural field margin (above) it is important to avoid spraying onto the margins, and to take care to prevent spray drift reaching them. This is achieved by using the correct spray equipment and spray procedures, taking into account the weather conditions and product requirements.

Pesticide use

Issue a list of permitted pesticides:

– Based on their efficacy and hazard (human and environmental) profile in relation to the field and weather conditions in which they are to be used (soil type, drainage, leaching potential, rainfall etc.)

– To be reviewed on an annual basis to include any newly registered products or new information relating to older products

– Pesticides used are restricted to those on the permitted list

Accurate records must be kept of pesticide use, including any legislative requirements e.g. Local Environmental Risk Assessments for Pesticides (LERAPs)[3] and Control of Substances Hazardous to Health (COSHH)[4] risk assessments where required

Pesticides should be selected from the permitted list with regard to their efficacy and hazard (human and environmental) profile in relation to the field and weather conditions in which they are to be used (soil type, drainage, leaching potential, rainfall etc.). Company agronomists and farm managers must be able to justify the use of each pesticide

Ensure pesticide harvest intervals (time between application and harvest) are strictly adhered to – failure to do so will lead to crop rejection

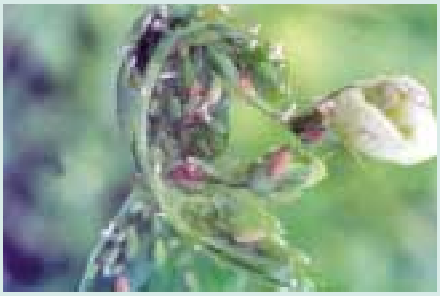
Spray applications must comply with the statutory conditions of use on the label

Ensure safety measures are followed with respect to pesticide handling and use, including appropriate storage, mixing, cleaning and waste handling facilities, and the correct use of appropriate personal protective equipment (PPE)

Label nozzle recommendations in relation to spray quality should be followed. Consider using low drift spray equipment wherever possible.

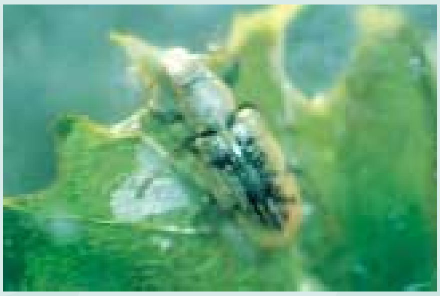
All applications must be made by a suitably qualified operator

HOWARD SOOLEY



PGRO

PGRO



PGRO

A perfect, disease-free pea plant (left). Research continues to evaluate new exclusive pea varieties. Key elements of such programmes include pea breeding and variety evaluation, supported by consumer science expertise. Peas are susceptible to a number of problems including pea aphid (top), downy mildew (middle), and pea weevil (above), all of which have to be controlled to achieve a quality final product.

Spray equipment used should be well maintained and accurately calibrated

Consider the protection of appropriate buffer zones around water bodies, habitats of particular wildlife importance and buildings, especially dwellings and places of work, schools etc

POTENTIAL AREAS FOR IMPROVEMENT

Promote research on bio-control agents (predators, parasites, bio-fungicides etc.) as IPM tools. Where research findings are encouraging, incorporate their systems into management practices and evaluate their effectiveness and consequences for pest management and the wider environment (e.g. introduction of flower margins to control pea aphid)

Research alternative products such as semio-chemicals (behaviour disrupters), natural chemicals, which might provide economically justifiable alternatives to synthetic pesticides, including further development of pheromone traps for pea midge control

Investigate and test use of precision farming tools as part of a decision support system (e.g. early warning for aphid infestation in pea growing areas)

Research into better ways to assess pesticide risk for use in profiling system

Reducing rates or number of pesticides applications and using low drift nozzles

Investigate weed-mapping techniques to target herbicides more efficiently

Research where in rotation best weed control might be obtained

Define weed tolerance levels to allow selective weeding

Investigate the potential of mechanical weeding (e.g. guided inter-row weeding) as an option for weed control, to replace and/or complement the use of pre- and post-emergence herbicides

Investigate pesticide leaching at catchment level to get a better idea of overall impact – development of risk prediction models based on different scenarios/seasons

More work on pesticide leaching to understand the factors affecting leaching potential – development of leaching probability models

3 Horizontal Boom Sprayers – A step by step guide to reducing aquatic buffer zones in the arable sector. DEFRA, PSD (2001).

4 COSHH A brief guide to the regulations. Health and Safety Executive (1999). INDG 136.

BIODIVERSITY

The diversity of biological systems (biodiversity) can be improved or reduced by agricultural practices. Sustainable agricultural practices can help improve biodiversity – e.g. by 'greening the middle' of fields as well as 'greening the edge'.

Certain **plant and animal species**, which form a natural part of the arable ecosystem, are important indicators of the health of that ecosystem and of changes occurring within it. These indicators show the total impact of a range of factors in that environment. It is important to understand what flora and fauna species are present, at what densities and how management practices might affect these species, especially in relation to whole farm habitat quality and management. The areas on a farm managed as 'natural' habitat include field margins, uncultivated areas, hedges and waterways. These habitats provide a diverse and stable environment to a range of both beneficial (i.e. predators and parasitoids) and pest species.

In the United Kingdom (UK) certain species showing declines in numbers in recent years have been targeted for conservation action under the UK Biodiversity Action Plan (UK-BAP). Some of these species occur in pea fields including plants such as Cornflower *(Centaurea cyanis)* and Field Gromwell *(Lithospermum arvense)* as well as farmland birds including Skylark *(Alauda arvensis)*, Song Thrush *(Turdus philomelos)* and Grey Partridge *(Perdix perdix)*.

Well maintained field margins (top) promote biodiversity including legumes such as clovers, vetches and trefoils. Insects including bumble bees and meadow brown butterflies (above) are attracted to such a managed 'natural' habitat.

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Yellow Wagtails (top), Lapwings (middle) and Skylarks (above) find it increasingly difficult to find suitable habitats for nesting sites when so much farmland is given over to cereals and rape, both of which have tall and dense vegetation.

The birds' difficulties are further accentuated when there is insufficient suitable grassland in their territory. Thus these three species are particularly attracted to pea vegetation as a surrogate habitat because it is low-growing, so providing important access to the ground. It also offers a relatively protected habitat for their young. Skylarks, especially, often have second broods in pea fields in June and July when they would otherwise fail to do so in winter cereals.

Studies are underway to understand to what extent pea fields benefit bird populations, for example, whether birds such as Lapwing breed more successfully in peas compared with other crops.

GOOD PRACTICE

Plant and Animal Species Diversity

Environmental audits (LEAF[5] audits) for the whole farm must be completed by all growers on an annual basis and targets for improvement agreed

Enhance the farm environment for locally important, rare or endangered species by providing appropriate habitats and adopting the right cultural practices, including avoiding pesticide damage to beneficial flora and fauna

Consider creating suitable biodiversity habitat as permanent features in areas of low productivity

Ensure that field margins and buffer zones are maintained and dominated by native species

Link wildlife habitats wherever possible through corridors and field margins. Native tree species can be planted more widely through estates and farms without adverse impacts on other agricultural activities

Adhere to Integrated Pest Management principles

Do not spray chemicals into waterbodies. Carry out LERAPs assessments where necessary and ensure that any resulting buffer zone is protected. Consider using a buffer zone even where it is not a statutory requirement

Minimise losses of nutrients to the environment

POTENTIAL AREAS FOR IMPROVEMENT

Further work to clarify the role of the pea crop in enhancing biodiversity in rotations dominated by cereals. Peas add to the rotational diversity of most farms by creating a landscape mosaic, which is attractive for particular species such as skylark

Further research to define the pesticide management of crop margins in order to enhance the presence of beneficial flora and fauna, with minimum impact on yield

Promote research & provide training (on request) on the establishment and management of permanent grass and wildflower margins and communicate results to farmer network

Link with government to consider how pea crop management strategies can be brought into the subsidy/support schemes currently under development for environmental management

Work with local initiatives to encourage biodiversity

Adopt conservation measures for rare or endangered species that use farmland as a habitat

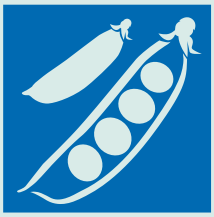
Further develop Integrated Pest Management procedures

Encourage biodiversity census activity and monitoring on a wider scale

Develop awareness and consensus on the biodiversity issue within the farmer community through the farmers' forum and other communication channels

5 LEAF – Linking Environment and Farming, National Agricultural Centre, Stoneleigh, Warwickshire, CV8 2LZ.

PRODUCT VALUE



Product value is a measure of the desired outputs of an agricultural system. Sustainable practices should maintain or improve product value.

Frozen peas (left) must achieve the high quality standards demanded by the consumer. Improvements in harvester technology (top) contribute greatly to pea quality: the harvester automatically removes peas from pods (middle), and sorts waste material. But increasingly it is clear that consumers not only demand frozen peas of perfect flavour and appearance, but they also wish to know the product has been grown in a sustainable way.

Sustainable pea production must be productive, competitive and efficient. Product value is determined by the combination of pea **product quality** and **yield per hectare**.

Quality of the final product includes both tangible (taste, colour, appearance etc.) and perceived quality of the final product. The latter refers to consumer concerns about food safety, environmental performance and social responsibility, which must be satisfied. This is related to measures such as the number of consumer complaints, which are directly linked to the number of contaminants in the final product. Pesticide residues in the finished product must conform to Maximum Residue Level (MRL) regulations as a legislative requirement as well as an indicator of good agronomic practice.

Yield per hectare is used as a measure of the economic sustainability of peas, since yield should be maintained or improved where possible. Yield also provides an important measure of impact for other sustainability indicators when expressed as per tonne of finished product.

GOOD PRACTICE

Product Quality

Use only pesticides on the preferred list. Pre-harvest intervals must be strictly followed

Set targets for pesticide residues below legal Maximum Residue Levels (MRLs) with the aim to achieve zero detectable residues in the final product in the long term

Inspect fields carefully before harvest to check for potential contaminants

Ensure quality control both in the field and factory

Replace pea harvesters on a routine basis to ensure that equipment is up-to-date and contaminants are removed efficiently. Ensure harvesters are well maintained

Ensure rotational control of weeds e.g. thistles and disease such as *Sclerotinia*

Yield per Hectare

Select growers for their ability to produce good yields and high quality crops, and support the 'growers group' approach in this process

Encourage precision drilling wherever possible and ensure suitable cultivation for this, i.e. well ploughed, furrow pressed land, avoiding a loose seedbed

Provide good up-to-date technical advice to enable growers to get the best from the crop

Follow closely any available good practice guidelines e.g. *Commitment to Quality* document

HOWARD SOOLEY

Pea perfection: a young pea pod which is developing under ideal conditions and has benefited from appropriately fertile soil, optimum inputs and sufficient rainfall.

POTENTIAL AREAS FOR IMPROVEMENT

Further develop automatic detection and cleaning systems for foreign body detection on harvesting machines

Balance contaminant control in field (especially weeds) with acceptable levels in factory in relation to performance of cleaning equipment in factory

Continue with exclusive pea breeding programme to develop better varieties

Maximise benefits offered by genetic marker research to the pea-breeding programme. Extend the pea variety DNA database

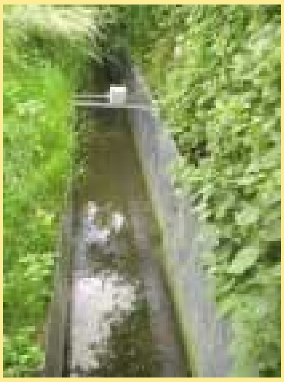
Better understanding of consumer purchase choice drivers in relation to sustainability issues

Further refine acceptable parameters for product value based on both tangible and perceived product quality

Although energy from sunlight is essential for growth, the energy balance of agricultural systems depends on additional energy, from non-renewable sources to power machinery. Sustainable practices can improve the balance of energy, ensuring there is more coming out than going in.

The **efficient use of renewable resources** should be targeted since the use of non-renewable sources, such as fossil fuel, is not sustainable in the long term. Energy use is a measure of resource consumption and is related to environmental impacts such as **greenhouse gas emissions** and acidification.

A Life Cycle Assessment (LCA) of peas quantifies the contribution of agricultural activities to total energy used and emission levels of the total life cycle – from 'field to fork'. The dominant indirect energy input in peas is related to seed and pesticide production, while a major component of direct energy use is the harvesting operation. The energy balance is a key measure relating metabolisable energy with energy inputs to produce the crop. Agriculture also generates waste. The 'farm waste ratio' looks at the amount of waste used, recycled and/or disposed of safely in relation to total farm waste.



Looking to future energy savings: an experiment using wind and solar energy (above) to power an automatic water sampling system. The three pictures below show how the system works. Drainage flow is continuously recorded in the water flume (right) using an electronic sensor to measure water depth. The probe is linked to a data capture system (middle) which transfers information daily to ADAS scientists via a telephone link. Water samples are automatically collected for analysis (far right). Sampling is controlled by a programmed data logger and triggered when drainage flow parameters reach certain levels.

Precision drilling (left and top) has contributed to energy savings, both in seed costs and harvesting. A joint project between pea harvester manufacturer (PMC) and pea processors (Birds Eye, EQT and Marollo) has been instigated to investigate potential energy savings in relation to design and development of harvesting equipment (middle). Recent developments in lorry transport from field to factory (above) have also contributed to energy savings.

GOOD PRACTICE

Efficiency and the Use of Renewable Resources

Minimise use of fossil fuel for power generation i.e:

– Optimise field operations

– Careful selection of equipment

– Ensuring good maintenance practices

– Meter all power outlets to minimise power misuse/wastage

Minimise the input of synthetic fertilisers

Investigate and test alternative practices for re-use, recycling and/or safe disposal of waste incurred as a result of growing peas

Review practicality of best current waste re-use, recycling and disposal technologies available

Greenhouse Gas Emissions

Optimise nitrogen balance (nitrogen input minus output) to reduce nitrous oxide losses

Ensure sufficiently aerated soil to minimise denitrification through application of a soil compaction alleviation strategy

Minimise tillage intensity and depth to maintain and/or improve level of soil organic carbon

Optimise fossil fuel consumption during field operations through reduction of tillage depth, choice of machinery and driving technique

POTENTIAL AREAS FOR IMPROVEMENT

Further work on more detailed energy audits to review the baseline

Investigate energy requirements in relation to harvest strategies and energy efficiency of harvesters

Investigate link between field yield and harvesting efficiency

Investigate alternative practices for recycling and waste disposal, especially for plastics

Review the possibility of using alternative energy sources such as bio-fuels

Irrigation and other practices can lead to pollution of ground and surface water with pesticides, nutrients or soil. Sustainable practices target inputs and reduce losses.

PGRO

All aspects of 'water' are important in that water itself is a critical renewable resource for all agricultural production. Responsible use and management of water (i.e. irrigation) supplies is fundamental to the sustainability of not only agriculture, but also human health and social development.

Water plays an important role in the environment's ability to 'self-purify'. The quantity of water used for irrigation is a useful direct measure to assess water consumption. However, **irrigation** is not common practice on vining peas except on very light soils.

A field of healthy vining peas just before harvesting. In England irrigation is not usually necessary on pea fields, and quality therefore depends on sufficient rainfall throughout the short growing season.

GOOD PRACTICE

Irrigation

Only use irrigation where absolutely necessary and when it can be economically justified. If so, these guidelines should be followed:

– Ensure the amount of water applied does not exceed the remaining water capacity of soils at the moisture level triggering irrigation

– Regular maintenance of the irrigation equipment

– Ensure that refuelling and lubrication operations for pumping equipment do not pollute watercourses

– Where necessary, monitor the quality of irrigation water. Water harvested from agricultural or industrial areas may have effects on soil nutrient retention and release equilibrium, and there may also be toxicity effects from pollutants

– Keep irrigation records of water usage and timing, and measure water consumption

– Irrigation should preferably be done at night wherever practical and dry or windy days should be avoided

– Where appropriate, support farmers' irrigation knowledge and practices with a modelling system to assist in optimising the use of irrigation water

POTENTIAL AREAS FOR IMPROVEMENT

Regular checks on irrigation performance in pea growing areas

Base land selection for pea growing on areas where irrigation is not needed

SOCIAL AND HUMAN CAPITAL

The challenge of using natural resources sustainably is fundamentally a social one, requiring collective action, the sharing of new knowledge and continuous innovation. Sustainable practices can improve social and human capital. The prime responsibility should remain with the local community.

Good **relationships** with the workforce, local community, suppliers, customers and Government are vital for the long-term sustainability of any business. These relationships reflect the degree of trust within and between social units (individuals and/or groups) and are often referred to as **social capital**.

Human capital entails the capacity of people to earn and sustain a livelihood (including health, nutrition, education and training). Well-trained, knowledgeable, and responsible farmers now and in future form the most important asset for the pea business. Social and human capital forms the basis for innovation, building confidence and creating trust.

Farmers who grow peas for Birds Eye on a visit to the farm project (top) which is part of the sustainable agriculture research programme managed at Unilever Colworth R&D where the long-term impact of current farm practice is compared to extreme, and potentially more sustainable, alternatives. A wide range of stakeholders participate in a workshop to discuss the progress and opportunities of this extensive research programme (above). Regular meetings and brain-storming sessions produce a wealth of ideas (opposite).

GOOD PRACTICE

Relationships (social capital)

Continue to build trust and confidence between the company and the farmers through:

– Use of long term contracts which offer financial security to growers

– Striving to be a good customer, citizen and supplier – pay and supply on time and at the agreed price

– Company agronomists (fieldsmen) ensuring close contact between the factory and the individual farmers

– Stimulate and provide assistance to farmers to group together to obtain bulk discounts for inputs such as fertiliser or equipment. Farmer groups will also find it easier than individuals to gather and share information on subsidies, tax and agronomic benefits

Stimulate farmers' participation in the Sustainable Agriculture initiative; and make joint decisions with the farmers' organisations whenever possible, such as discussing good practice guidelines

Provide further structure and facilities for farmer participation through:

– Negotiation of prices and contract conditions between a farmer' group representative (i.e. board of farmers' organisation) and the company

– Providing farmers with the ability to secure their production sites based on a profitable and mutually beneficial relationship with the operating company

– Establishing communication links through periodical farmer meetings and factory/research site visits

Link with other stakeholders by:

– Maintaining good relationships with local government and others in the local community

– Develop links with schools and school programmes to educate through visits, talks, and literature

– Facilitate interaction between consumers and producers

Human capital

Provide educational/training opportunities for farmer and other interested groups in key aspects of sustainable pea production

POTENTIAL AREAS FOR IMPROVEMENT

Continue to develop useful and appropriate parameters for social and human capital

Further work on interactions and relationships requiring socio-economic auditing

Development of a 'Farmers' Forum' with representation from all growing areas to enable and stimulate grower empowerment in decision making about the sustainability of the pea business

Farmer groups may consider, and be supported in, developing partnerships with government to address commonly shared threats and opportunities, and to support public services

Stimulate and improve relationships between farmers and consumers, and between farmers and local communities

LOCAL ECONOMY

Sourcing agricultural inputs locally helps sustain businesses, livelihoods and communities. Sustainable practices maximise use of local resources to increase efficiency.

Rural communities are dependent on sustainable local agriculture. Farming and other businesses can help build and sustain these communities by buying and **resourcing locally**.

The production of peas provides farmers with an additional income source, and it also provides work and income to the local community. This is reflected by the amount of money spent to source goods (including raw materials) and services.

GOOD PRACTICE

Local resourcing

- Use local suppliers wherever practical (based on availability, reliability and cost)
- Use local farmers as much as possible (based on reliability and consistency in performance – yield and quality of pea crop)

POTENTIAL AREAS FOR IMPROVEMENT

- Continue to develop useful and appropriate measurements for local economy
- Consider working with local communities to develop businesses that reduce the need to import goods and services (for the farm) from further afield

Birds Eye produces over 35,000 tonnes of peas annually, mainly for the British and Italian market, and sells them with a promise on the packet (top): "Birds Eye peas are frozen for a good reason – it is the most natural way to preserve them. We do it within two and a half hours of picking so that we can guarantee you locked-in vitamin goodness. From field to fork our farmers are committed to quality, caring for their pea crop and the long term health of the environment. What is more – we are working to make our peas, and farming practices, even better in the future".

The state-of-the-art pea harvesting machines (above) used for Birds Eye crops in eastern England are made locally in Fakenham, Norfolk. Birds Eye, based in Lowestoft, Suffolk and Hull, Humberside, sources locally whenever possible and encourages its suppliers to do the same.

THE FARMERS' VIEW

Robert Middleditch (below right, with Colin Wright, Birds Eye agricultural general manager) grows peas in Suffolk as part of his rotation which includes cereals, sugar beet and potatoes. Robert comments: "As a grower of crops for Birds Eye since 1972, I welcome their sustainability project, particularly since the market increasingly demands products produced in a sustainable manner. If that is the market requirement then I as a farmer must provide it. Being a project partner has involved me with many different organisations and individuals with whom I have enjoyed a good exchange of views, including the practicalities of implementing some of these views on the farm. I have gained new insights into the impact of various crops, and farming practices, in areas such as leaching and biodiversity."

David Rush (above left, with fellow farmer Mike Porter) who farms in Suffolk, England, has supplied Birds Eye for eight years, and thus has just completed his first Birds Eye pea rotation. This rotation includes oilseed rape, malting barley and wheat. "For me, sustainable farming is responsible farming, and it is important that any improvements in our practices are willingly accepted and implemented. Farmers are cynics at heart but what attracted me to the sustainable agriculture project was that it is based on growers' farms, with active involvement of the growers themselves, which must lend credibility when any changes to our practices are suggested. Our aim is optimum inputs and diversity over the wider landscape."

Mike Porter is a third generation farmer who devotes some 35ha of his 320ha Suffolk farm to peas in a rotation that includes winter wheat and oil seed rape, plus linseed, oats and amenity rye grass for seed production. "My personal passion is birds, and I welcome this initiative because it is helping us to be more aware of what we do, why we do it, and what the implications are for birds and other wildlife. Also consumers are increasingly concerned about how their food is produced, and the implications of production methods, all of which means that we must constantly scrutinise our operations in the smallest ways. Focusing on small improvements in all areas helps to increase sustainability," Mike says.

Giuseppe Zagaglia in Italy, and his brothers Renato and Marco, run a 50ha farm at Casenuove di Osimo, a small village in the Marche region which is Italy's most important growing area for vining peas. Their farm is one of the pilot farms chosen by Marollo, the Unilever frozen pea supplier in Italy, to develop sustainable pea growing. Giuseppe says, "I am happy to be a special part of this project. We believe that this new way of growing will create new opportunities for our local agriculture and will also bring recognition for the value of our work".

GLOSSARY OF TERMS

Biodiversity – There are two aspects to biodiversity: the first is the diversity of wild floral and faunal species on and around a pea field and up to landscape scale. The second is the genetic diversity in the pea crop grown on a world scale

Carbon sequestration – The process by which atmospheric carbon dioxide is converted to organic carbon by vegetation or soil micro-organisms

Greenhouse effect – The rise in global temperature caused by certain gases in the atmosphere (e.g. carbon dioxide) trapping energy from the sun

Integrated Farm Management (IFM) – A whole farm policy encompassing crop and animal husbandry, which provides the basis for efficient and profitable production which is economically viable and environmentally responsible. IFM integrates beneficial natural processes into modern farming practices using advanced technology. It aims to minimise environmental risks while conserving, enhancing and recreating that which is of environmental importance

Integrated Pest Management (IPM) – A sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimises economic, health and environmental risks

Pesticide – A chemical used to control invertebrates such as insects, mites, slugs and snails, nematodes etc., weeds, plant diseases and vertebrate pests

Soil organic carbon – The carbon content as a proportion of organic matter in the soil; % organic carbon x 1.7 indicates the % of total organic matter

CREDITS

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FURTHER READING

UNILEVER SUSTAINABILITY INITIATIVES

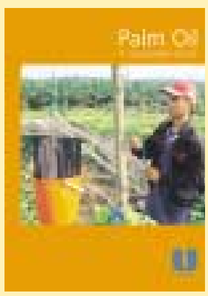
Growing for the Future II
Unilever and Sustainable Agriculture (2002)

Fishing for the Future
Unilever's Sustainable Fisheries Initiative (2002)

Our Everyday Needs
Unilever's Water Care Initiative (2001)

UNILEVER SUSTAINABLE AGRICULTURE INITIATIVES

Tea – A Popular Beverage
Journey to a Sustainable Future (2002)



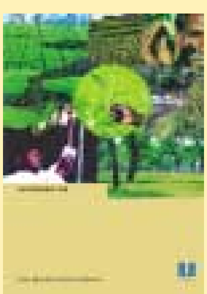
Palm Oil
A Sustainable Future (2001)

In Pursuit of the Sustainable Pea
Forum for the Future in collaboration with Birds Eye (2002)

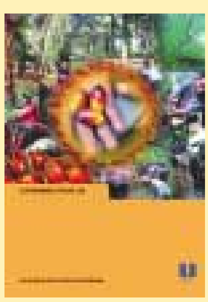
***Growing for the Future**
Spinach: For A Sustainable Future (2003)

• Growing for the Future
Tomatoes: For A Sustainable Future (2003)

GOOD AGRICULTURAL PRACTICE GUIDELINES



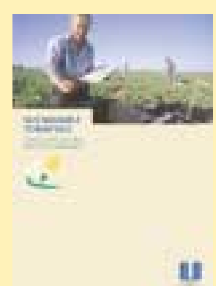
Sustainable Tea
Good Agricultural Practice Guidelines (2002)



Sustainable Palm Oil
Good Agricultural Practice Guidelines (2003)

***Sustainable Vining Peas**
Good Agricultural Practice Guidelines (2003)

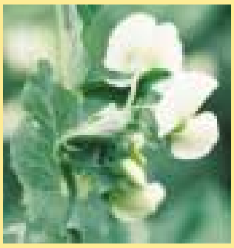
***Sustainable Spinach**
Good Agricultural Practice Guidelines (2003)



• Sustainable Tomatoes
Good Agricultural Practice Guidelines (2003)

Copies of these publications and further background on Unilever and sustainability, the environment and social responsibility can be obtained from **www.unilever.com** (click link for environment & society) or can be requested by email on **sustainable.agriculture@unilever.com**. For specific information on the Unilever Sustainable Agriculture Initiative visit **www.growingforthefuture.com**.

*Available in English, German and Italian •Available in Portuguese (2004)



"Unilever is committed to making continuous improvements in the management of our environmental impact and to the longer-term goal of developing a sustainable business. Unilever will work in partnership with others to promote environmental care, increase understanding of environmental issues and disseminate good practice."

Antony Burgmans and Niall FitzGerald, Chairmen of Unilever.

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